April
2021

PORT of SAN DIEGO

Wetland Mitigation Bank at Pond 20 and Port Master Plan Amendment

Final Environmental Impact Report

UPD# EIR-2019-010; SCH# 2019060167

VOLUME II of IV

HDR

Prepared For:
San Diego Unified Port District
3165 Pacific Highway
San Diego, CA 92101

Appendix A. Notice of Preparation/Initial Study and NOP Comment Letters

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San Diego Unified Port District
3165 Pacific Highway San Diego, California 92101
(619) 686-6254

NOTICE OF PREPARATION
of a
DRAFT ENVIRONMENTAL IMPACT REPORT

PROJECT TITLE: **Wetlands Mitigation Bank at Pond 20 and Port Master Plan Amendment (UPD #EIR-2019-010)**

APPLICANT: San Diego Unified Port District

LOCATION: Palm Avenue (State Route 75) between 13th Street and 16th Street, San Diego, in San Diego County, California

REFERENCE: California Code of Regulations, Title 14, Sections 15082(a), 15103, 15375

The San Diego Unified Port District (District) will be the Lead Agency in preparing an Environmental Impact Report (EIR) for the project (proposed project or project) identified above. The District is soliciting input and feedback from various agencies, stakeholders, and the public pertaining to the scope and content of the environmental information that will be included in the EIR. For certain agencies, this may be germane to statutory responsibilities in connection with the proposed project. An agency may need to use the proposed project's EIR when considering its permit or other approval for the project. The project description, location, and possible environmental effects of the proposed project are contained in the attached materials.

Due to the time limits mandated by state law, your comments must be sent at the earliest possible date but no later than 30 days after receiving this notice. **Comments regarding environmental concerns will be accepted until 5:00 p.m. on July 22, 2019** and should be mailed to Ashley Wright, San Diego Unified Port District, Planning Department, 3165 Pacific Highway, San Diego, CA 92101 or emailed to awright@portofsandiego.org.

A public scoping meeting regarding the proposed EIR will be held on Wednesday July 10, 2019 at 6:00 p.m. at the Dempsey Center at 950 Ocean Lane, Imperial Beach, CA, 91932.

For questions on this Notice of Preparation, please contact Ashley Wright, Senior Planner, Planning Department, at 619-686-6549.

6/12/2019

Signature
Lesley Nishihira
Director, Planning Department

Date:

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San Diego Unified Port District
3165 Pacific Highway
San Diego, California 92101

NOTICE OF PREPARATION
for the
WETLAND MITIGATION BANK AT POND 20 AND PORT MASTER PLAN AMENDMENT
(UPD #EIR-2019-010)

Publication of this Notice of Preparation (NOP) initiates the San Diego Unified Port District's (District's) compliance with the California Environmental Quality Act for the proposed project. The NOP is the first step in the Environmental Impact Report (EIR) process and will, in most cases, establish the baseline for the environmental setting. It describes the proposed project and is distributed to responsible agencies, trustee agencies, cooperating federal agencies, and the general public. As stated in California Environmental Quality Act Guidelines Section 15375, the purpose of the NOP is "to solicit guidance from those agencies as to the scope and content of the environmental information to be included" in the EIR. The NOP provides an opportunity for agencies and the general public to comment on the scope and content of the environmental review of a project.

Project Summary

The Wetland Mitigation Bank at Pond 20 and Port Master Plan Amendment (PMPA) includes two primary components: "project-level" and "program-level" environmental evaluation.

1. The District is proposing the creation of a wetland mitigation bank within a portion of District-owned property, which was historically used as salt evaporation pond (Bank Parcel). The project includes associated construction and long-term operation and maintenance activities of the mitigation bank. The District is proposing a PMPA to incorporate the Bank Parcel into the District's Port Master Plan (PMP), and assign a land use designation of "wetlands". The creation of the wetland mitigation bank, as well as the incorporation and land use designation of the Bank Parcel into the PMP through a PMPA, will be evaluated at a "project level" in the EIR.
2. As part of the PMPA, the District is proposing to incorporate Parcels A, B, and C into the District's PMP, and assign land use designations. Parcels A, B, and C are District-owned property; however, currently these areas are not formally incorporated into the PMP. Parcels A, B, and C would be assigned a "commercial recreation" and/or "wetlands" land use designation. Incorporation of Parcels A, B, and C into the PMP will be evaluated at a "program level" in the EIR.

Project Location

The project site consists of approximately 95 acres, which comprises a combination of District-owned and federally-managed land located in the City of San Diego, east of the City of Imperial Beach and south of the confluences of Otay River and San Diego Bay. The District- and federally-managed land is leased from the California State Lands Commission. The project site is located within the Imperial Beach United States Geological Survey 7.5-minute quadrangle and entirely within the Coastal Zone.

There is no official address for the project site; however, it is located immediately north of Palm Avenue (State Route 75), south of the San Diego Bay National Wildlife Refuge South San Diego Bay Unit managed by U.S. Fish and Wildlife Service, east of 13th Street, west of 16th Street, and southwest of Refuge's Otay Valley Regional Park. Interstate-5 (I-5) is located approximately one mile east of the project site (Figure 1). Surrounding land uses include the San Diego Bay National Wildlife Refuge and Otay River Estuary Restoration Project site to the north and commercial and residential developments to the south, east, and west.

Project Description

The project site is divided into two main areas, as shown on Figure 2: (1) the Bank Parcel and (2) Parcels A, B, and C. The Bank Parcel comprises 83.5 acres and contains the southern portion of the former salt evaporation pond, known as Pond 20. The Bank Parcel extends beyond the existing salt pond berms to also include Nestor Creek and the Otay River Tributary. The wetland mitigation bank, or Bank Site, would be developed entirely within the existing Pond 20 berms in the Bank Parcel and would be up to 80 acres. Parcels A, B, and C are located immediately adjacent to the Bank Parcel but entirely outside of the Bank Site berms. Parcels A, B, and C comprise approximately 11.7 acres of land.

Wetland Mitigation Bank at Pond 20

The proposed Bank Site (within the Bank Parcel) involves the creation, restoration, enhancement, and on-going maintenance and monitoring of tidal wetland habitat and upland buffer habitat. Project implementation would result in the creation of high marsh, mid marsh, low marsh, intertidal mudflat, transitional habitat, and subtidal eelgrass habitat mitigation credits that could compensate for future off-site impacts to marine, wetland, and transitional habitat from other public and private development projects under Section 404 of the Clean Water Act, the California Coastal Act, the Porter-Cologne Water Quality Control Act, Fish and Game Code Section 1600, and the California Eelgrass Mitigation Policy. The credits would be available to mitigate impacts within a proposed service area.

The Bank Site would be constructed entirely within the existing berms of Pond 20, which leaves the surrounding features, Nestor Creek and the Otay River Tributary, as natural buffers. The proposed Bank Site is currently isolated from tidal flow. To reconnect tidal hydrology to the Bank Site, the proposed project would require a berm breach of approximately 75 feet in the northwest corner of the project site. The berm breach would partially be located within the San Diego Bay National Wildlife Refuge. This component would be subject to a U.S. Fish and Wildlife Service Refuge Special Use Permit and would require compliance with the National Environmental Policy Act.

Bank Site construction would involve excavation, grading, and soil export activities to establish appropriate topographical conditions and tidal flows to support target marsh-plain elevations. Construction staging areas would be located in the adjacent District-owned parcels. Construction is anticipated to take approximately 17months.

Operation and maintenance of the Bank Site will be financed by the District's operational funds, a stable source of revenue for the District dedicated to specific uses for the benefit of the state tidelands under its stewardship. A functional assessment will be conducted to document the pre- and post-restoration differences for wetland site conditions. The functional assessment methodology will be reviewed by an Interagency Review Team and approved by the U.S. Army Corps of Engineers, and will be used to set the restoration goals success criteria for the proposed project. Performance standards will cover each type of credit established by the project, including establishment of subtidal eelgrass habitat, tidal and intertidal marsh wetland habitat, and upland buffer/transitional habitat. A 5-year monitoring schedule will be established, but, if all performance standards are met prior to the fifth year of monitoring, all bank credits would be released.

Once all performance standards have been met, the Bank Site is anticipated to be self-sustaining. However, because of the urban surroundings, long-term management may be needed for maintenance of invasive species monitoring and removal, trash removal, maintenance of site control measures (e.g., fencing), and restoration of any damage from human or natural phenomenon.

Establishment of the Bank Site would be completed using the process outlined by the United States Environmental Protection Agency and U.S. Army Corps of Engineers *Draft Compensatory Mitigation Rule Timeline for Bank for ILF Instrument Approval*. A bank-enabling instrument would be prepared using the appropriate template and, following the completion of the public notice comment period, the bank-enabling instrument would be submitted for review to the Interagency Review Team. Operation of the mitigation bank includes offering compensatory mitigation credits for impacts within the service area.

Port Master Plan Amendment

Bank Parcel

The PMP provides the official planning policies, consistent with a general statewide purpose, for the physical development of the tide and submerged lands conveyed and granted in trust to the District. The Bank Parcel is not currently in the PMP and, therefore, does not currently have a land use designation. As a result, a PMPA would be processed and approved by the California Coastal Commission to incorporate the Bank Parcel into the PMP that would allow for the District to issue a non-appealable Coastal Development Permit for the wetland mitigation bank. To provide long-term assurance, the District proposes to designate the proposed Bank Parcel as a "wetlands" land use in the PMP through the PMPA process.

District-Owned Parcels A, B, and C

District-owned Parcels A, B, and C are located outside the berms along the western, southern, and eastern borders of the Bank Parcel. Parcels A and C are separated from the berms by Nestor Creek and the Otay River Tributary, respectively. These three parcels are not currently in the PMP and would be incorporated and assigned a "commercial recreation" and/or "wetlands" land use designation as part of the PMPA process. No specific project-level analysis with regard to potential future uses will be analyzed on Parcels A, B, and C at this time. Development of these parcels would require preparation of a project-level California Environmental Quality Act document(s).

Environmental Considerations

Probable Environmental Effects to be addressed in the EIR

Based on the initial review of the proposed project, the EIR would address the probable project-related and cumulative effects associated with the implementation of the proposed project for the following resource areas:

- Aesthetics
- Air quality
- Biological resources
- Cultural resources
- Energy
- Geology/soils
- Greenhouse gas emissions
- Hazards and hazardous materials
- Hydrology/water quality
- Land use/planning
- Noise
- Public services
- Transportation
- Tribal cultural resources
- Utilities/service systems
- Mandatory findings of significance

Resources Eliminated From Further Discussion in the EIR

Based on the existing conditions present at the proposed project site and a review of the proposed project, it has been determined that implementation of the proposed project would not result in impacts on several resource areas and, therefore, these issues would be summarized in the Effects Found Not to Be Significant section of the EIR. Those resource areas are listed below. See the attached Initial Study/Environmental Checklist for a detailed explanation.

- Agriculture and forestry resources
- Mineral resources
- Population and housing
- Recreation
- Wildfire

Comments

The NOP is available for a 30-day public review period that **starts on Thursday, June 20, 2019 and ends at 5:00 p.m. on Monday, July 22, 2019**. Comments regarding the scope and content of the environmental information that should be included in the EIR and other environmental concerns should be mailed to:

San Diego Unified Port District

Planning Department

Attn: Ashley Wright, Senior Planner

3165 Pacific Highway

San Diego, CA 92101

or emailed to: awright@portofsandiego.org

Public Scoping Meeting

A scoping meeting to solicit comments on the scope and content of the EIR for the proposed project will be held on **Wednesday July 10, 2019, at 6:00 p.m. at the Dempsey Center at 950 Ocean Lane, Imperial Beach, CA, 91932**.

The District, as Lead Agency pursuant to the California Environmental Quality Act, will review the public comments on the NOP to determine what issues should be addressed in the EIR.

Other opportunities for the public to comment on the environmental effects of the proposed project include:

- A minimum 45-day public review and comment period for the Draft EIR
- A public heading for the Board of Port Commissioners to consider certification of the EIR

For questions regarding this NOP, please contact Ashley Wright, Senior Planner, Planning Department, at 619-686-6549.

Attachments

Figure 1. Regional Location and Project Vicinity

Figure 2. Project Site Characteristics

Initial Study/Environmental Checklist

Figure 1. Regional Location and Project Vicinity

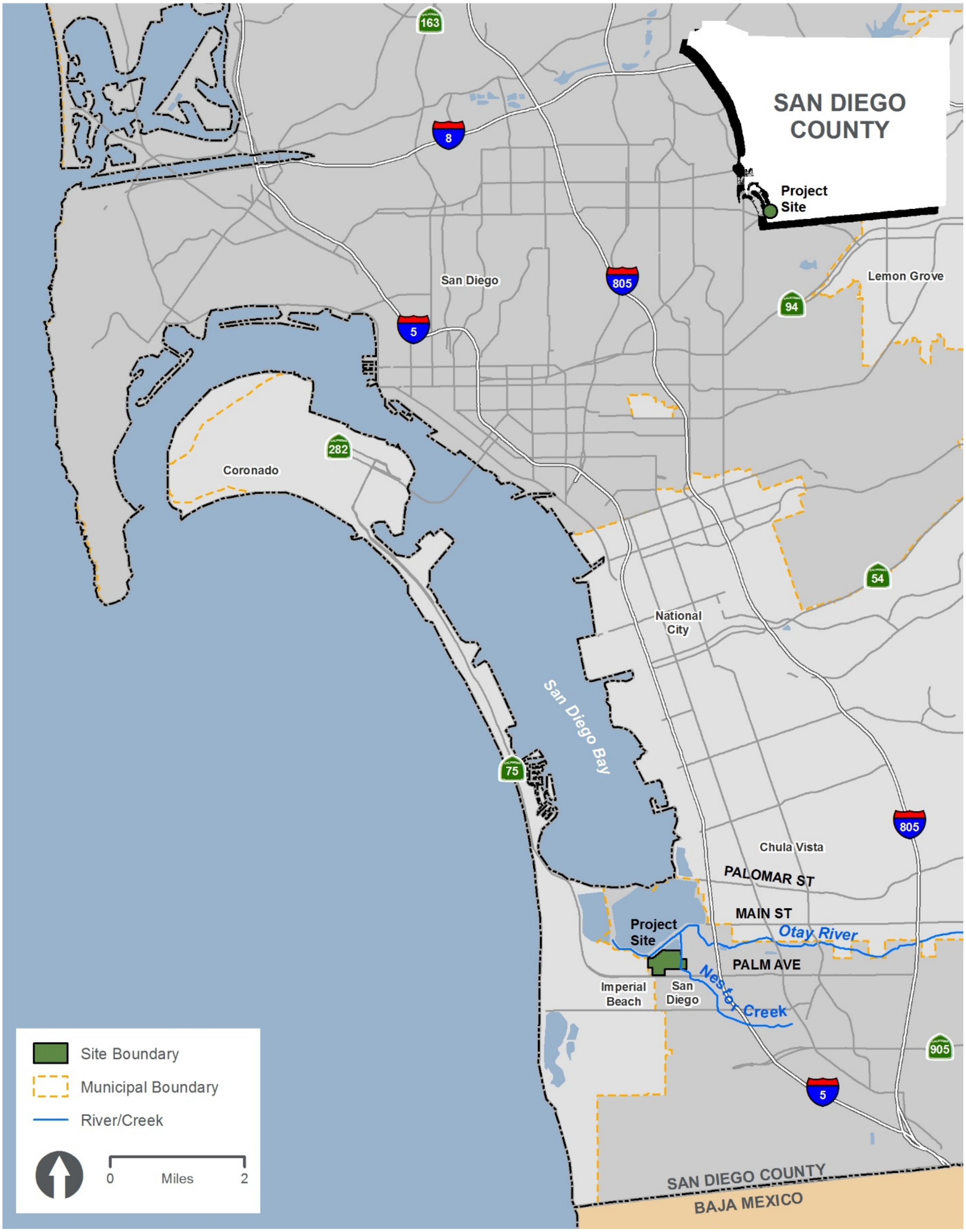

Figure 2. Project Site Characteristics

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Initial Study/ Environmental Checklist

Wetland Mitigation Bank at Pond 20 and Port Master Plan Amendment

San Diego, California

June 2019

Prepared for:

San Diego Unified Port District
3165 Pacific Highway
San Diego, CA 92101

Prepared by:

HDR Engineering, Inc.
591 Camino de la Reina,
Suite 300
San Diego, CA 92108

Contents

Acronyms and Abbreviations

CEQA	California Environmental Quality Act
District	San Diego Unified Port District
EIR	environmental impact report
GHG	greenhouse gas
PMP	Port Master Plan
PMPA	Port Master Plan Amendment
project	Wetlands Mitigation Bank at Pond 20 and Port Master Plan Amendment
SDFD	San Diego Fire-Rescue Department
Spindrift	Spindrift Archaeological Consulting, LLC

Initial Study/Environmental Checklist Form

1. Project Title:	Wetland Mitigation Bank at Pond 20 and Port Master Plan Amendment
2. Lead Agency and Address:	San Diego Unified Port District 3165 Pacific Highway San Diego, CA 92101
3. Contact Person and Phone Number:	Ashley Wright, Planning Department (619) 686-6549
4. Project Location:	The Wetland Mitigation Bank at Pond 20 and Port Master Plan Amendment Project (project) is located in the City of San Diego, east of the City of Imperial Beach and south of the confluences of Nestor Creek, the Otay River, and San Diego Bay. The project site is located immediately north of Palm Avenue (State Route 75), south of the San Diego Bay National Wildlife Refuge South San Diego Bay Unit managed by U.S. Fish and Wildlife Service, east of 13th Street, and west of Otay Valley Regional Park.
5. Project Sponsor's Name and Address:	San Diego Unified Port District 3165 Pacific Highway San Diego, CA 92101
6. Description of Project:	The Wetland Mitigation Bank at Pond 20 and Port Master Plan Amendment (PMPA) Project includes two primary components: 1) the creation of a wetland mitigation bank within a portion of a former salt pond currently known as Pond 20 (Bank Site); and, 2) a PMPA to incorporate the Bank Site and three adjacent San Diego Unified Port District- (District) owned parcels (Parcels A, B, and C) into the District's Port Master Plan (PMP). The Bank Site would be up to 80 acres and constructed within the 83.5-acre District-owned Bank Parcel. Parcels A, B, and C are outside the Bank Site and encompass 11.7 acres. The environmental impact report (EIR) will evaluate the creation and incorporation of the wetland mitigation bank into the PMP at a "project-level" and the incorporation of the District-owned parcels at a "program-level."

7. Surrounding Land Uses and Setting:	The project site is surrounded by the South San Diego Bay National Wildlife Refuge and Otay River to the north and residential, commercial, and infrastructure development to the south, west, and east.
8. Other Public Agencies whose Approval is Required (e.g., permits, financing approval, or participation agreement.):	• U.S. Fish and Wildlife Service – Special Use Permit • U.S. Army Corps of Engineers – Clean Water Act Section 404 Permit • U.S. Coast Guard – General Bridge Act of 1946 Bridge Permit • California Coastal Commission – Coastal Consistency Analysis, Port Master Plan Amendment, and Federal Coastal Consistency Certification • State Water Resources Control Board – Construction General Permit and Clean Water Act Section 401 Permit
9. Have California Native American tribes traditionally and culturally affiliated with the project area requested consultation pursuant to Public Resources Code section 21080.3.1? If so, is there a plan for consultation that includes, for example, the determination of significance of impacts to tribal cultural resources, procedures regarding confidentiality, etc.?	No tribes have contacted the District to request notification of projects under Assembly Bill 52; therefore, no tribal consultation has begun.

Note: Conducting consultation early in the California Environmental Quality Act (CEQA) process allows tribal governments, lead agencies, and project proponents to discuss the level of environmental review identify and address potential adverse impacts to tribal cultural resources, and reduce the potential for delay and conflict in the environmental review process. (See Public Resources Code section 21080.3.2.) Information may also be available from the California Native American Heritage Commission’s Sacred Lands File per Public Resources Code section 5097.96 and the California Historical Resources Information System administered by the California Office of Historic Preservation. Please also note that Public Resources Code section 21082.3(c) contains provisions specific to confidentiality.

Environmental Factors Potentially Affected

The environmental factors checked below would be potentially affected by this project, involving at least one impact that is a “potentially significant impact” as indicated by the checklist on the following pages.

☒ Aesthetics
☐ Agriculture and Forestry Resources
☒ Air Quality
☒ Biological Resources
☒ Cultural Resources
☒ Energy
☒ Geology/Soils
☒ Greenhouse Gas Emissions
☒ Hazards and Hazardous Materials
☒ Hydrology/Water Quality
☒ Land Use/Planning
☐ Mineral Resources
☒ Noise
☐ Population/Housing
☒ Public Services
☐ Recreation
☒ Transportation
☒ Tribal Cultural Resources
☒ Utilities/Service Systems
☐ Wildfire
☒ Mandatory Findings of Significance

Determination (To be completed by the Lead Agency)

On the basis of this initial evaluation:

☐ I find that the project would not have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.

☐ I find that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.

☒ I find that the proposed project may have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.

☐ I find that the proposed project may have a "Potentially Significant Impact" or "Potentially Significant Unless Mitigated" impact on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.

☐ I find that although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed project, nothing further is required.

Signature

Date: 6/12/2019

Evaluation of Environmental Impacts

1. A brief explanation is required for all answers except “No Impact” answers that are adequately supported by the information sources a lead agency cites in the parentheses following each question. A “No Impact” answer is adequately supported if the referenced information sources show that the impact simply does not apply to projects like the one involved (e.g., the project falls outside a fault rupture zone). A “No Impact” answer should be explained where it is based on project-specific factors, as well as general standards (e.g., the project will not expose sensitive receptors to pollutants, based on a project-specific screening analysis).
2. All answers must take account of the whole action involved, including off-site as well as on-site, cumulative as well as project-level, indirect as well as direct, and construction as well as operational impacts.
3. Once the lead agency has determined that a particular physical impact may occur, then the checklist answers must indicate whether the impact is potentially significant, less than significant with mitigation, or less than significant. “Potentially Significant Impact” is appropriate if there is substantial evidence that an effect may be significant. If there are one or more “Potentially Significant Impact” entries when the determination is made, an EIR is required.
4. “Negative Declaration: Less than Significant With Mitigation Incorporated” applies where the incorporation of mitigation measures has reduced an effect from “Potentially Significant Impact” to a “Less than Significant Impact.” The lead agency must describe the mitigation measures, and briefly explain how they reduce the effect to a less than significant level (mitigation measures from “Earlier Analyses,” as described in (5) below, may be cross-referenced).
5. Earlier analyses may be used where, pursuant to the tiering, program EIR, or other California Environmental Quality Act process, an effect has been adequately analyzed in an earlier EIR or negative declaration. Section 15063(c)(3)(D). In this case, a brief discussion should identify the following:
    a. Earlier Analysis Used. Identify and state where they are available for review.
    b. Impacts Adequately Addressed. Identify which effects from the above checklist were within the scope of and adequately analyzed in an earlier document pursuant to applicable legal standards, and state whether such effects were addressed by mitigation measures based on the earlier analysis.
    c. Mitigation Measures. For effects that are "Less than Significant with Mitigation Measures Incorporated," describe the mitigation measures which were incorporated or refined from the earlier document and the extent to which they address site-specific conditions for the project.
6. Lead agencies are encouraged to incorporate into the checklist references to information sources for potential impacts (e.g., general plans, zoning ordinances). Reference to a previously prepared or outside document should, where appropriate, include a reference to the page or pages where the statement is substantiated.
7. Supporting Information Sources: A source list should be attached, and other sources used or individuals contacted should be cited in the discussion.
8. This is only a suggested form, and lead agencies are free to use different formats; however, lead agencies should normally address the questions from this checklist that are relevant to a project's environmental effects in whatever format is selected.

9. The explanation of each issue should identify:
    a. The significance criteria or threshold, if any, used to evaluate each question; and
    b. The mitigation measure identified, if any, to reduce the impact to less than significance.

I. Aesthetics

Environmental Issue Area:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less than Significant Impact	No Impact
Except as provided in Public Resources Code Section 21099, would the project:				
a) Have a substantial adverse effect on a scenic vista or scenic highway?				
Wetland Mitigation Bank – Project-level Review:	☒	☐	☐	☐
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic building within a state scenic highway?				
Wetland Mitigation Bank – Project-level Review:	☒	☐	☐	☐
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐
c) In non-urbanized areas, substantially degrade the existing visual character or quality of public views of the site and its surroundings? (Public views are those that are experienced from publicly accessible vantage point). If the project is in an urbanized area, would the project conflict with applicable zoning and other regulations governing scenic quality?				
Wetland Mitigation Bank – Project-level Review:	☒	☐	☐	☐
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☐	☒
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐

Except as provided in Public Resources Code Section 21099, would the project:

a) Have a substantial adverse effect on a scenic vista or scenic highway?

Wetland Mitigation Bank – Project-level Review:

Potentially Significant Impact. The project site is located immediately adjacent to the San Diego Bay National Wildlife Refuge and Silver Strand Bikeway. Construction of the Wetland Mitigation Bank is expected to last approximately 17 months. During project construction, soil stock piles, large equipment, and general excavation activities would temporarily impact a scenic vista, which would be significant. However, once the project is complete, the project site would be visually improved. Potentially significant impacts have been identified, and the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. The parcels would be designated as commercial recreation or wetlands. If these parcels are developed, there would be a potentially significant impact on a scenic vista. Potentially significant impacts have been identified, and the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic building within a state scenic highway?

Wetland Mitigation Bank – Project-level Review:

Potentially Significant Impact. The southern boundary of the project site is Palm Avenue, which is also State Highway 75. State Highway 75 is an Officially Designated State Scenic Highway along the Silver Strand Highway and the Coronado Bridge, according to the California Scenic Highway Mapping System (California Department of Transportation 2011). While the portion of the highway that borders the project site is not officially designated, it is a main access point to the scenic highway. Additionally, construction may be visible from the state scenic highway. Potentially significant impacts have been identified, and the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. Same as above.

c) In non-urbanized areas, substantially degrade the existing visual character or quality of the site and its surroundings? (Public views are those that are experienced from publicly accessible vantage point). If the project is in an urbanized area, would the project conflict with applicable zoning and other regulations governing scenic quality?

Wetland Mitigation Bank – Project-level Review:

Potentially Significant Impact. The project is located in an urbanized area. During project construction, the existing visual character of the site would be disrupted, which would be potentially significant. However, once construction is complete, the visual character of the site would be improved. Potentially significant impacts have been identified, and the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. The parcels would be designated as commercial recreation or wetlands. If these parcels are developed, there would be a potentially significant impact on a scenic vista. Potentially significant impacts have been identified, and the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?

Wetland Mitigation Bank – Project-level Review:

No Impact. No new light sources or structures that could produce glare would be installed or used during construction. Thus, no impact is anticipated for this criterion, and no further analysis is warranted.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. The parcels would be designated as commercial recreation wetlands. If these parcels are developed, there could be a potentially significant impact due to new sources of light or glare. Potentially significant impacts have been identified, and the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

II. Agricultural Resources

Environmental Issue Area:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less than Significant Impact	No Impact
In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Department of Conservation as an optional model to use in assessing impacts on agriculture and farmland. ***Would the project:***				
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☐	☒
Parcels A, B, and C – Program-level Review:	☐	☐	☐	☒
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☐	☒
Parcels A, B, and C – Program-level Review:	☐	☐	☐	☒
c) Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)), timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104(g))?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☐	☒
Parcels A, B, and C – Program-level Review:	☐	☐	☐	☒
d) Result in the loss of forest land or conversion of forest land to non-forest use?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☐	☒
Parcels A, B, and C – Program-level Review:	☐	☐	☐	☒
e) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use or conversion of forest land to non-forest use?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☐	☒
Parcels A, B, and C – Program-level Review:	☐	☐	☐	☒

In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Department of Conservation as an optional model to use in assessing impacts on agriculture and farmland.

Would the project:

a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?

Wetland Mitigation Bank – Project-level Review:

No Impact. According to the California Department of Conservation, the project site is not designated for agriculture use. Thus, no impact is anticipated for this criterion, and no further analysis is warranted.

Parcels A, B, and C – Program-level Review:

No Impact. Same as above.

b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?

Wetland Mitigation Bank – Project-level Review:

No Impact. The project site is not zoned or designated for agriculture use and is not subject to a Williamson Act contract. Thus, no impact is anticipated for this criterion, and no further analysis is warranted.

Parcels A, B, and C – Program-level Review:

No Impact. Same as above.

c) Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)), timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104(g))?

Wetland Mitigation Bank – Project-level Review:

No Impact. There are no existing forest lands, timberlands, or timberland zoned “Timberland Production” either on site or in the immediate vicinity that would conflict with existing zoning or cause rezoning. Therefore, no impact is identified for this issue area, and no further analysis is warranted.

Parcels A, B, and C – Program-level Review:

No Impact. Same as above.

d) Result in the loss of forest land or conversion of forest land to non-forest use?

Wetland Mitigation Bank – Project-level Review:

No Impact. There are no existing forest lands either on site or in the immediate vicinity of the project site. The proposed project would not result in the loss of forest land or conversion of forest land to non-forest use. Therefore, no impact is identified for this issue area, and no further analysis is warranted.

Parcels A, B, and C – Program-level Review:

No Impact. Same as above.

e) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use or conversion of forest land to non-forest use?

Wetland Mitigation Bank – Project-level Review:

No Impact. According to the California Department of Conservation, the project site is not designated for agriculture use, and there is no forest land on the project site or in the immediate vicinity. Therefore, no impact is identified for this issue area, and no further analysis is warranted.

Parcels A, B, and C – Program-level Review:

No Impact. Same as above.

III. Air Quality

Environmental Issue Area:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less than Significant Impact	No Impact
Where available, the significance criteria established by the applicable air quality management district or air pollution control district may be relied upon to make the following determinations. ***Would the project:***				
a) Conflict with or obstruct implementation of the applicable air quality plan?				
Wetland Mitigation Bank – Project-level Review:	☒	☐	☐	☐
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐
b) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard?				
Wetland Mitigation Bank – Project-level Review:	☒	☐	☐	☐
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐
c) Expose sensitive receptors to substantial pollutant concentrations?				
Wetland Mitigation Bank – Project-level Review:	☒	☐	☐	☐
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐
d) Result in other emissions (such as those leading to odors) adversely affecting a substantial number of people?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☐	☒
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐

Where available, the significance criteria established by the applicable air quality management or air pollution control district may be relied upon to make the following determinations.

Would the project:

a) Conflict with or obstruct implementation of the applicable air quality plan?

Wetland Mitigation Bank – Project-level Review:

Potentially Significant Impact. The project site is located within the jurisdiction of the San Diego Air Pollution Control District. The project would involve excavation, grading, and soil export activities to establish appropriate topographical conditions and tidal flows to support target marsh-plain elevations. Construction of the project would create temporary emissions of dust, fumes, equipment exhaust, and other air contaminants that may conflict with the San Diego Air Pollution Control District rules and regulations or other state and local mandated plans, such as the *2009 Regional Air Quality Strategy Revision*, San Diego Air Pollution Control District's 2002 and 2012 ozone maintenance plans, and the California Air Resources Board 2017 *8-Hour Ozone*

Attainment Plan for San Diego County. No stationary source emissions would result from the project; however, temporary construction emissions have the potential to result in a significant air quality impact. Potentially significant impacts have been identified, and the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. The parcels would be designated as commercial recreation or wetlands. If these parcels are developed, construction activities could create temporary emissions of dust, fumes, equipment exhaust, and other air contaminants that may conflict with the San Diego Air Pollution Control District rules and regulations. Potentially significant impacts have been identified, and the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

b) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard?

Wetland Mitigation Bank – Project-level Review:

Potentially Significant Impact. Construction of the proposed project may result in a cumulatively considerable net increase of one or more criteria pollutants as a result of point and non-point source emissions, for which the project region is in non-attainment under applicable federal and state ambient air quality standards. Thus, a potentially significant impact is identified for this issue area. An air quality impact study that will address the proposed project's potential air quality impacts will be prepared and included in the EIR analysis. Additionally, the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. Same as above.

c) Expose sensitive receptors to substantial pollutant concentrations?

Wetland Mitigation Bank – Project-level Review:

Potentially Significant Impact. Sensitive receptors in the area are primarily the residences south and west of the project site, in the cities of Imperial Beach and San Diego. An air quality impact study that will address the proposed project's potential air quality impacts will be prepared and included in the EIR analysis. Additionally, the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. Same as above.

d) Result in other emissions (such as those leading to odors) adversely affecting a substantial number of people?

Wetland Mitigation Bank – Project-level Review:

No Impact. Land uses commonly considered to be potential sources of odorous emissions include wastewater treatment plants, sanitary landfills, food processing facilities, chemical manufacturing plants, rendering plants, paint/coating operations, and concentrated agricultural feeding operations and dairies (California Air Resources Board 2005). The construction and operation of a wetland mitigation bank is not an odor producer, and the project site is not located near an odor producer. No impact is identified for this issue area, and no further analysis is warranted.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. Land uses commonly considered to be potential sources of odorous emissions include wastewater treatment plants, sanitary landfills, food processing facilities, chemical manufacturing plants, rendering plants, paint/coating operations, and concentrated agricultural feeding operations and dairies (California Air Resources Board 2005). The proposed project would allow for Parcels A, B, and C to be assigned a commercial recreation or wetlands designation. The construction and operation of a commercial recreation or wetlands project would not likely be odor producing, and the project site is not located near an odor producer. However, if these parcels are developed as any of the identified odorous land uses, a potential impact could occur. An air quality impact study that will address the proposed project's potential air quality impacts will be prepared and included in the EIR analysis. Additionally, the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

IV. Biological Resources

Environmental Issue Area:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less than Significant Impact	No Impact
Would the project:				
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?				
Wetland Mitigation Bank – Project-level Review:	☒	☐	☐	☐
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, and regulations or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?				
Wetland Mitigation Bank – Project-level Review:	☒	☐	☐	☐
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐
c) Have a substantial adverse effect on state or federally protected wetlands (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?				
Wetland Mitigation Bank – Project-level Review:	☒	☐	☐	☐
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of wildlife nursery sites?				
Wetland Mitigation Bank – Project-level Review:	☒	☐	☐	☐
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☐	☒
Parcels A, B, and C – Program-level Review:	☐	☐	☐	☒

IV. Biological Resources

Environmental Issue Area:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less than Significant Impact	No Impact
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☐	☒
Parcels A, B, and C – Program-level Review:	☐	☐	☐	☒

Would the project:

a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?

Wetland Mitigation Bank – Project-level Review:

Potentially Significant Impact. The project site is currently disturbed and consists of relatively low-quality habitat. As a result of biological surveys conducted between 2017 and 2018, several special-status and plant species are either known to occur or have the potential to occur in the study area, including the Western snowy plover (federally threatened) and Belding's savannah sparrow (state endangered). Eight additional special-status wildlife species and one special-status plant species have also been observed (Tierra Data, Inc. 2018). The project would create estuarine wetlands, which would produce a net benefit for coastal and wetland dependent species. While impacts would occur during construction of the mitigation bank, they would be temporary; there will be an increase in functional habitat values once the project is in operation. A biological resources technical study that addresses the proposed project's potential impacts on biological resources will be prepared and included in the EIR analysis. Additionally, the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. The parcels would be designated as commercial recreation or wetlands. Preliminary findings did not identify special-status and plant species known to occur, or have the potential to occur, on Parcels A, B, and C. However, given the proximity to the proposed mitigation bank and surrounding properties that support candidates, sensitive, or special-status species, if these parcels are developed in the future, there would be a potentially significant impact. A biological resources technical study that addresses the proposed project's potential impacts on biological resources will be prepared and included in the EIR analysis. Additionally, the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, and regulations or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?

Wetland Mitigation Bank – Project-level Review:

Potentially Significant Impact. See Section IV (a) above. The 2017-2018 biological surveys indicated that previous studies of the project site have documented special-status shorebirds, colonial seabirds, and waterfowl. These species are associated with available foraging opportunities in nearby ocean, estuarine, and intertidal wetlands, and riparian vegetation at the mouth of the Otay River; as well as nesting and roosting opportunities within low-vegetation cover on site (Tierra Data, Inc. 2018). A biological resources technical study that addresses the proposed project's potential impacts on biological resources will be prepared and included in the EIR analysis. Additionally, the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. Parcel A is comprised mostly of non-native grassland, with small stands of ice plant and crown daisy. It also contains areas of pickleweed and seablite.

Parcel B is dominated by non-native grasslands. There are several desertbroom baccharis shrubs.

Parcel C is predominantly non-native grasses and forbs divided between semi-natural herbaceous stands, semi-natural herbaceous stand, and semi-natural herbaceous stands. A small area within has native saltgrass as the dominant species. The Nestor Creek stream channel along the western edge of Parcel C also contains pickleweed and alkali heath.

The parcels would be designated as commercial recreation or wetlands. Preliminary findings did not identify riparian habitat or other sensitive natural community on Parcels A, B, and C. However, given the proximity to the proposed mitigation bank and surrounding properties that support riparian habitat and sensitive natural communities, if these parcels are developed, there would be a potentially significant impact. A biological resources technical study that addresses the proposed project's potential impacts on biological resources will be prepared and included in the EIR analysis. Additionally, the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

c) Have a substantial adverse effect on state or federally protected wetlands (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?

Wetland Mitigation Bank – Project-level Review:

Potentially Significant Impact. The mitigation bank would generate subtidal and intertidal wetland credits to compensate for impacts under Section 404 of the Clean Water Act, the California Coastal Act, the Porter-Cologne Water Quality Control Act, and Section 1600 of the California Fish and Game Code; and for impacts on eelgrass habitat under the California Eelgrass Mitigation Policy Orange County and its watersheds. Although there will be an increase in functional wetland habitat values once the project is in operation, construction of the project may result in significant impacts. A biological resources technical study that addresses the proposed project's potential impacts on biological resources will be prepared and included in the EIR analysis. Additionally, the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. The parcels would be designated as commercial recreation or wetlands. If these parcels are developed, there would be a potentially significant impact on federally protected wetlands. Potentially significant impacts have been identified, and the EIR will fully evaluate the potential impact and identify mitigation. Additionally, the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of wildlife nursery sites?

Wetland Mitigation Bank – Project-level Review:

Potentially Significant Impact. The project site provides habitats for roosting, foraging, and nesting for many of the resident and migratory birds, which utilize the San Diego Bay and its surroundings. Several species were observed nesting at the project site during avian surveys conducted in 2016-2017, including black-necked stilts, western snowy plovers, burrowing owls, and killdeer (Great Ecology 2018). Additionally, the study area is proximal to San Diego Bay, including the saltworks ponds, which are part of the San Diego Bay National Wildlife Refuge immediately north and the Pacific Ocean. Additional upland habitats exist to the north and east of the project site, and the Otay River basin provides a key linkage to the inland area of southern San Diego. The Tijuana Estuary lies just 1.9 mile (3 kilometers) south. The project site's proximity to key habitats provides foraging opportunities for species that may nest or roost in the study area. Therefore, the restored areas and brine flats within the saltworks and other wetlands adjacent to the project site provide important migratory stopover value and spring/summer nesting and roosting habitats for birds. A biological resources technical study that will address the proposed project's potential impacts on biological resources will be prepared and included in the EIR analysis. Additionally, the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. Preliminary findings did not identify movement of any native resident or migratory fish or wildlife species or established native resident or migratory wildlife corridors or use of wildlife nursery sites on Parcels A, B, and C, with the exception of a snowy egret on Parcel C that was identified during the 2016-2017 avian surveys (Great Ecology 2018). However, given the proximity to the mitigation bank and surrounding properties that support habitats and corridors, if these parcels are developed, there would be a potentially significant impact. A biological resources technical study that addresses the proposed project's potential impacts on biological resources will be prepared and included in the EIR analysis. Additionally, the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?

Wetland Mitigation Bank – Project-level Review:

No Impact. Although the proposed project occurs within the boundaries of the City of San Diego Multiple Species Conservation Program and the City of San Diego Multiple Habitat Planning Area (City of San Diego 1997), the Multiple Species Conservation Program and Multiple Habitat Planning Area do not apply to projects within the jurisdiction of the District, including the project. Further, the San Diego Bay Integrated Natural Resources Management Plan is a long-term, collaborative strategy for managing the bay's natural resources and the primary means by which the U.S. Navy and District jointly plan natural resources work in San Diego Bay (Naval Facilities Engineering Command and District 2013). The project site is located within the Integrated Natural Resources Management Plan and would be consistent with its goals and strategies for ensuring the long-term heath, restoration, and protection of San Diego Bay's ecosystem. The proposed project would not be in conflict with local policies or ordinances protecting biological resources. Thus, no impact is anticipated for this criterion, and no further analysis is warranted.

Parcels A, B, and C – Program-level Review:

No Impact. Same as above.

f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?

Wetland Mitigation Bank – Project-level Review:

No Impact. See Section IV (e) above.

Parcels A, B, and C – Program-level Review:

No Impact. Same as above.

V. Cultural Resources

Environmental Issue Area:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less than Significant Impact	No Impact
Would the project:				
a) Cause a substantial adverse change in the significance of a historical resource pursuant to §15064.5?				
Wetland Mitigation Bank – Project-level Review:	☒	☐	☐	☐
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5?				
Wetland Mitigation Bank – Project-level Review:	☒	☐	☐	☐
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐
c) Disturb any human remains, including those interred outside of dedicated cemeteries?				
Wetland Mitigation Bank – Project-level Review:	☒	☐	☐	☐
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐

Would the project:

a) Cause a substantial adverse change in the significance of a historical resource as defined in §15064.5?

Wetland Mitigation Bank – Project-level Review:

Potentially Significant Impact. The project site contains the Western Company Salt Works Historic District, Pond 20A, which was recommended as significant under Criterion A of the National Register of Historic Places for its role in the solar salt industry in Southern California from 1916 to present day. It was also recommended eligible for National Register of Historic Places listing under Criterion C for embodying the distinctive characteristics of a solar salt processing facility of the era (Spindrift Archaeological Consulting, LLC [Spindrift] 2018).

Therefore, a potentially significant impact is identified for this area, and the proposed project's potential impacts on historic resources will be prepared and included in the EIR analysis and mitigation will be identified, when applicable.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. The parcels would be designated as commercial recreation or wetlands. If these parcels are developed, there would be a potentially significant impact on historical resources. Potentially significant impacts have been identified, and the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5?

Wetland Mitigation Bank – Project-level Review:

Potentially Significant Impact. A records search performed at the South Coastal Information Center of the California Historic Resource Information System at San Diego State University. The records search results indicated that two archaeological resources have been previously documented within the project area (Spindrift 2018).

The Native American Heritage Commission was contacted on April 11, 2018, to conduct a Sacred Lands File search and received a response on April 17, 2018. The Sacred Lands File Search was negative. The Native American Heritage Commission also provided a list of individuals and organizations in the Native American community that may be able to provide information about unrecorded sites in the project vicinity. No responses were received from tribes as a result of initial scoping (Spindrift 2018).

Given the results of the records search and the moderate to high sensitivity of the project area for buried prehistoric and historic-period resources, as well as the documented presence of cultural materials across most of the project area on the ground surface, archaeological resources could be discovered during ground-disturbing activity. If avoidance of impacts is not possible for previously recorded archaeological resources, further cultural work is recommended (Spindrift 2018). Therefore, a potentially significant impact is identified for this area, and the proposed project's potential impacts on archaeological resources will be evaluated in the EIR and mitigation will be identified, when applicable.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. The parcels would be designated as commercial recreation or wetlands. If these parcels are developed, there would be a potentially significant impact on archaeological resources. Potentially significant impacts have been identified, and potential impacts on archaeological resources will be evaluated in the EIR and mitigation will be identified, when applicable.

c) Disturb any human remains, including those interred outside of dedicated cemeteries?

Wetland Mitigation Bank – Project-level Review:

Potentially Significant Impact. There is a potential for unknown human remains to be unearthed during earthwork activities. Potentially significant impacts have been identified, and the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. Same as above.

VI. Energy

Environmental Issue Area:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less than Significant Impact	No Impact
Would the project:				
a) Result in potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during project construction or operation?				
Wetland Mitigation Bank – Project-level Review:	☒	☐	☐	☐
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐
b) Conflict with or obstruct a state or local plan for renewable energy or energy efficiency?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☐	☒
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐

Would the project:

a) Result in potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during project construction or operation?

Wetland Mitigation Bank – Project-level Review:

Potentially Significant Impact. Construction of the wetland mitigation bank would result in consumption of energy resources, including construction equipment, construction worker vehicle trips, truck haul, and material delivery trips. Operation of the wetland mitigation bank would not result in wasteful, inefficient, or unnecessary consumption of energy sources because no buildings would be constructed as part of the project, and no permanent sources of energy consumption would be constructed. Potentially significant construction impacts have been identified for this issue area, and the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. The parcels would be designated as commercial recreation or wetlands. If these parcels are developed, there would be a potentially significant impact due to consumption of energy resources during construction and operation. Potentially significant impacts have been identified, and the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

b) Conflict with or obstruct a state or local plan for renewable energy or energy efficiency?

Wetland Mitigation Bank – Project-level Review:

No Impact. The creation of the wetland mitigation bank would not conflict with or obstruct state or local plans for renewable energy. No new sources of energy consumption would be created and, therefore, no conflict or obstruction would occur. Thus, no impact is anticipated for this criterion, and no further analysis is warranted.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. In 2002, the State of California established its Renewables Portfolio Standard Program, of which the latest addition is Senate Bill 100, which revises the state goal to achieve 60 percent renewable energy target by December 31, 2030. Locally, the Port of San Diego *Climate Action Plan 2013* identifies strategies to reduce greenhouse gas (GHG) emissions, including on-road transportation, off-road transportation, clean and renewable energy, increased use of natural gas, and other strategies (Port of San Diego 2013). The parcels would be designated as commercial recreation or wetlands. If these parcels are developed for commercial use, there would be a potentially significant impact due to consumption of energy resources during construction and operation. Potentially significant impacts have been identified, and the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

VII. Geology and Soils

Environmental Issue Area:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less than Significant Impact	No Impact
Would the project:				
a) Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury or death involving:				
i. Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☐	☒
Parcels A, B, and C – Program-level Review:	☐	☐	☐	☒
ii. Strong seismic ground shaking?				
Wetland Mitigation Bank – Project-level Review:	☒	☐	☐	☐
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐
iii. Seismic-related ground failure, including liquefaction?				
Wetland Mitigation Bank – Project-level Review:	☒	☐	☐	☐
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐
iv. Landslides?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☐	☒
Parcels A, B, and C – Program-level Review:	☐	☐	☐	☒
b) Result in substantial soil erosion or the loss of topsoil?				
Wetland Mitigation Bank – Project-level Review:	☒	☐	☐	☐
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐

VII. Geology and Soils

Environmental Issue Area:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less than Significant Impact	No Impact
c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?				
Wetland Mitigation Bank – Project-level Review:	☒	☐	☐	☐
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial direct or indirect risk to life or property?				
Wetland Mitigation Bank – Project-level Review:	☒	☐	☐	☐
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐
e) Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☐	☒
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐
f) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?				
Wetland Mitigation Bank – Project-level Review:	☒	☐	☐	☐
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐

Would the project:

a) Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury or death involving:

i. Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42?

Wetland Mitigation Bank – Project-level Review:

No Impact. The project site is not located within a State of California Alquist-Priolo Earthquake Fault Zone (City of San Diego 2008). Therefore, no impact is identified for this issue area, and no further analysis is warranted.

Parcels A, B, and C – Program-level Review:

No Impact. Same as above.

ii. Strong seismic ground shaking?

Wetland Mitigation Bank – Project-level Review:

Potentially Significant Impact. The project site is located in the seismically active San Diego in Southern California and considered likely to be subjected to moderate to strong ground motion from earthquakes in the region. The project site could be affected by the occurrence of seismic activity to some degree. Potentially significant impacts have been identified, and the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. Same as above.

iii. Seismic-related ground failure, including liquefaction?

Wetland Mitigation Bank – Project-level Review:

Potentially Significant Impact. The area surrounding San Diego Bay has experienced moderate earthquake activity. The project site is located in an area of “High Potential” for liquefaction due to site characteristics, such as shallow groundwater, major drainages, and hydraulic fills (City of San Diego 2008). Liquefaction occurs when granular soil below the water table is subjected to vibratory motions, such as produced by earthquakes. With strong ground shaking, an increase in pore water pressure develops, as the soil tends to reduce in volume. If the increase in pore water pressure is sufficient to reduce the vertical effective stress (suspending the soil particles in water), the soil strength decreases, and the soil behaves as a liquid (similar to quicksand). Liquefaction can produce excessive settlement, ground rupture, lateral spreading, or failure of shallow bearing foundations. Potentially significant impacts have been identified, and the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. Same as above.

iv. Landslides?

Wetland Mitigation Bank – Project-level Review:

No Impact. According to the City of San Diego Seismic Safety Geologic Hazards and Faults Map (City of San Diego 2008), the project site is not located in an area prone to landslide hazards. Furthermore, the project site and surrounding area is relatively flat. Therefore, no impact is identified for this issue area, and no further analysis is warranted.

Parcels A, B, and C – Program-level Review:

No Impact. Same as above.

b) Result in substantial soil erosion or the loss of topsoil?

Wetland Mitigation Bank – Project-level Review:

Potentially Significant Impact. Soil erosion can result during construction, as grading and construction can loosen surface soils and make soils susceptible to wind and water movement across the surface. Erosion of soil or the loss of topsoil would be a significant impact. Potentially significant impacts have been identified, and the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. Same as above.

c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?

Wetland Mitigation Bank – Project-level Review:

Potentially Significant Impact. Near surface soils within the project site will need to be identified to determine if the soils are unstable. Potentially significant impacts have been identified, and the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. Same as above.

d) Be located on expansive soil, as defined in the latest Uniform Building Code, creating substantial risk to life or property?

Wetland Mitigation Bank – Project-level Review:

Potentially Significant Impact. Near surface soils within the project site will need to be identified to determine if they consist of soils having expansion potential. Potentially significant impacts have been identified, and the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. Same as above.

e) Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater?

Wetland Mitigation Bank – Project-level Review:

No Impact. The proposed project would not require any facilities that would necessitate septic tanks or wastewater disposal systems. Therefore, no impact is identified for this issue area, and no further analysis is warranted.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. The parcels would be designated as commercial recreation or wetlands. If these parcels are developed, they may require facilities that would necessitate septic tanks or wastewater disposal systems. Potentially significant impacts have been identified, and the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

f) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?

Wetland Mitigation Bank – Project-level Review:

Potentially Significant Impact. Many paleontological fossil sites are recorded by the City of San Diego and have been discovered during construction activities. Paleontological resources are typically impacted when earthwork activities, such as mass excavation, cut into geological deposits (formations) with buried fossils. It is not known if any paleontological resources are located on the project site. The project's potential to impact paleontological resources will be addressed in the EIR and mitigation will be identified, when applicable.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. Same as above.

VIII. Greenhouse Gas Emissions

Environmental Issue Area:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less than Significant Impact	No Impact
Would the project:				
a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?				
Wetland Mitigation Bank – Project-level Review:	☒	☐	☐	☐
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐
b) Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of greenhouse gases?				
Wetland Mitigation Bank – Project-level Review:	☒	☐	☐	☐
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐

Would the project:

a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?

Wetland Mitigation Bank – Project-level Review:

Potentially Significant Impact. The proposed project has the potential to generate GHG emissions during construction, in addition to construction worker trips to and from the project site. A potentially significant impact is identified and will be evaluated in the EIR. In the long term, the project is expected to provide a benefit with respect to reduction of GHG emissions by providing a restored site with native plant material. A GHG emissions/climate change technical report will be prepared for the proposed project, and this issue will be addressed in the EIR. Additionally, the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. The proposed project has the potential to generate GHG emissions during construction, in addition to construction worker trips to and from the project site. If these parcels are developed, the operation of commercial facilities may generate GHG emissions. A potentially significant impact is identified and will be evaluated in the EIR. A GHG emissions/climate change technical report will be prepared for the proposed project, and this issue will be addressed in the EIR. Additionally, the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

b) Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of greenhouse gases?

Wetland Mitigation Bank – Project-level Review:

Potentially Significant Impact. See Section VIII (a) above.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. Same as above.

IX. Hazards and Hazardous Materials

Environmental Issue Area:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less than Significant Impact	No Impact
Would the project:				
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☒	☐
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the likely release of hazardous materials into the environment?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☒	☐
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☐	☒
Parcels A, B, and C – Program-level Review:	☐	☐	☐	☒
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☐	☒
Parcels A, B, and C – Program-level Review:	☐	☐	☐	☒
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard or excessive noise for people residing or working in the project area?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☐	☒
Parcels A, B, and C – Program-level Review:	☐	☐	☐	☒

IX. Hazards and Hazardous Materials

Environmental Issue Area:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less than Significant Impact	No Impact
f) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☒	☐
Parcels A, B, and C – Program-level Review:	☐	☐	☒	☐
g) Expose people or structures, either directly or indirectly, to a significant risk of loss, injury, or death involving wildland fires?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☒	☐
Parcels A, B, and C – Program-level Review:	☐	☐	☒	☐

Would the project:

a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?

Wetland Mitigation Bank – Project-level Review:

Less than Significant Impact. Construction of the project would involve the limited use of hazardous materials, such as fuels and greases, to fuel and service construction equipment. However, no hazardous substances are anticipated to be produced, used, stored, transported, or disposed of as a result of project construction that would pose a potential impact on the environment. The applicant will be required to comply with state laws and county ordinance restrictions, which regulate and control hazardous materials handled on site. Such hazardous wastes would be transported off site for disposal according to applicable state and county restrictions and laws governing the disposal of hazardous waste during construction and operation of the project. While further discussion and justification will be provided in the EIR, impacts are anticipated to be less than significant.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. The parcels would be designated as commercial recreation or wetlands. If these parcels are developed, the construction and operation of the site could involve the use of hazardous materials. Potentially significant impacts have been identified, and the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the likely release of hazardous materials into the environment?

Wetland Mitigation Bank – Project-level Review:

Less than Significant Impact. See Section IX (a) above.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. Same as above.

c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?

Wetland Mitigation Bank – Project-level Review:

No Impact. The project site is not located within 0.25 mile of an existing or proposed school. No impact is identified for this issue area, and no further analysis is warranted.

Parcels A, B, and C – Program-level Review:

No Impact. Same as above.

d) ***Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?***

Wetland Mitigation Bank – Project-level Review:

No Impact. Based on a review of the Cortese List, conducted in September 2018, the project site is not listed as a hazardous materials site. No impact is identified for this issue area, and no further analysis is warranted.

Parcels A, B, and C – Program-level Review:

No Impact. Same as above.

e) ***For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard or excessive noise for people residing or working in the project area?***

Wetland Mitigation Bank – Project-level Review:

No Impact. The project site is not located within 2 miles of a public airport. The nearest airport to the project site is the Brown Field Municipal Airport, located approximately 6 miles east of the project site. Therefore, no impact associated with airport hazards would occur with implementation of the proposed project, and no further analysis is warranted.

Parcels A, B, and C – Program-level Review:

No Impact. Same as above.

f) ***Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?***

Wetland Mitigation Bank – Project-level Review:

Less than Significant Impact. The proposed project is not expected to impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan. The nature of the project as a wetland bank would not require emergency evacuation since it will not be occupied. The proposed project would be required to comply with applicable requirements set forth by County of San Diego Office of Emergency Services Operational Area Emergency Plan, City of San Diego Police Department, San Diego Fire-Rescue Department (SDFD), and San Diego Harbor Police Department. Therefore, the proposed project would result in a less than significant impact associated with the possible impediment to emergency plans. However, the EIR will provide a further discussion and justification.

Parcels A, B, and C – Program-level Review:

Less than Significant Impact. The parcels would be designated as commercial recreation or wetlands. If these parcels are developed, the construction and operation of the site is not expected to impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan. The proposed project would be required to comply with applicable requirements set forth by County of San Diego Office of Emergency Services Operational Area Emergency Plan, City of San Diego Police Department, SDFD, and San Diego Harbor Police Department. In addition, local building codes would be followed to minimize flood, seismic, and fire hazards. Therefore, the proposed project would result in a less than significant impact associated with the possible impediment to emergency plans. However, the EIR will provide a further discussion and justification.

g) ***Expose people or structures, either directly or indirectly, to a significant risk of loss, injury, or death involving wildland fires?***

Wetland Mitigation Bank – Project-level Review:

Less than Significant Impact. The project site is located near the San Diego Bay and comprised of disturbed upland salt flats and isolated hypersaline pools perched on fill material. The project proposes neither occupation of individuals nor structures that would place individuals near wildland fires. Therefore, the proposed project would not result in exposing people or structures to a significant risk of loss, injury, or death involving wildland fires, including those adjacent to urbanized areas and where residences are intermixed. However, the EIR will provide a further discussion and justification.

Parcels A, B, and C – Program-level Review:

Less than Significant Impact. The parcels would be designated as commercial recreation or wetlands. If these parcels are developed, the construction and operation of the site would be adjacent to already established urban areas and would not expose people or structures to wildland fires. Furthermore, project facilities would be designed, constructed, and operated in accordance with applicable fire protection and other environmental, health, and safety requirements. While further discussion and justification will be provided in the EIR, impacts are anticipated to be less than significant.

X. Hydrology and Water Quality

Environmental Issue Area:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less than Significant Impact	No Impact
Would the project:				
a) Violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or ground water quality?				
Wetland Mitigation Bank – Project-level Review:	☒	☐	☐	☐
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐
b) Substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☒	☐
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces, in a manner which would:				
i. Result in substantial erosion or siltation on- or off-site?				
Wetland Mitigation Bank – Project-level Review:	☒	☐	☐	☐
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐
ii. Substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?				
Wetland Mitigation Bank – Project-level Review:	☒	☐	☐	☐
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐
iii. Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☐	☒
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐

X. Hydrology and Water Quality

Environmental Issue Area:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less than Significant Impact	No Impact
iv. Impede or redirect flood flows?				
Wetland Mitigation Bank – Project-level Review:	☒	☐	☐	☐
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐
d) In flood hazard, tsunami, or seiche zones, risk release of pollutants due to project inundation?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☒	☐
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐
e) Conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☐	☒
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐

Would the project:

a) Violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or ground water quality?

Wetland Mitigation Bank – Project-level Review:

Potentially Significant Impact. The project would not require waste discharge and would not interfere with ground water quality (see Section X (b) below); however the project would require excavation and dredging of tidal channels during construction. This would occur prior to the site being connected to tidal flow. During construction, measures would be taken to prevent a violation of water quality standards and waste discharge requirements and to avoid or minimize degradation to surface and ground water quality; however impacts could occur. Potentially significant impacts on surface waters will be further addressed in the EIR and mitigation identified, when applicable.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. The parcels would be designated as commercial recreation or wetlands. If these parcels are developed, the proposed project has the potential to create urban non-point source discharge (e.g., synthetic/organic chemicals). Potentially significant impacts have been identified, and the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

b) Substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin?

Wetland Mitigation Bank – Project-level Review:

Less than Significant Impact. During construction, potable water would be brought to the site for drinking and domestic needs, while construction water may be brought to the site for uses such as soil conditioning and dust suppression. The majority of the groundwater below the project site is hypersaline and, therefore, not used for drinking water; subsequently, the project would not impact drinking water. Because the project would create a wetland mitigation bank, operation of the proposed project would not impede groundwater recharge or impede sustainable groundwater management of the basin. Therefore, the impact on groundwater supplies would be less than significant, and no further discussion in the EIR is warranted.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. The parcels would be designated as commercial recreation or wetlands. If these parcels are developed, and depending on the type of development, the construction and operation of the developed parcels could potentially result in interference with groundwater recharge, depending whether grading and trenching would occur and depth required, and whether dewatering activities would be necessary. However, because of the proximity to the San Diego Bay, groundwater at the project site is anticipated to be similar to the adjacent proposed mitigation bank site, which is hypersaline from saltwater intrusion, and, therefore, it is not used for drinking water. Impacts related to lowering the groundwater table and groundwater recharge could be potentially significant and will be further addressed in the EIR and identify mitigation, when applicable.

c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces, in a manner which would:

i. Result in substantial erosion or siltation on- or off-site?

Wetland Mitigation Bank – Project-level Review:

Potentially Significant Impact. No impervious surfaces would be added as part of the project. The project proposes channel modification to allow tidal flows to enter the wetland mitigation bank site. During construction, erosion prevention measures would be taken, such as providing a gently sloping transition zone around the marsh perimeter. The project site currently receives its water source solely from precipitation with limited stormwater contributions; however, during operation, the wetland mitigation bank would be exposed to tidal flow and no longer be a closed system. Potentially significant impacts on stormwater drainage systems will be further addressed in the EIR and mitigation identified, when applicable.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. The parcels would be designated as commercial recreation or wetlands. If these parcels are developed as commercial facilities, the construction and operation of the developed parcels could potentially result in an increase in the amount of runoff water due to potentially introducing an increase in impervious surfaces. Potentially significant drainage pattern impacts will be addressed in the EIR and mitigation identified, when applicable.

ii. Substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?

Wetland Mitigation Bank – Project-level Review:

Potentially Significant Impact. See Section X (c)(i) above.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. Same as above.

iii. Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?

Wetland Mitigation Bank – Project-level Review:

No Impact. The project would not create new impervious surfaces or contribute runoff water to an existing or planned stormwater drainage system. The project site currently receives stormwater runoff from Palm Avenue. The project would result in the creation of a wetland mitigation bank and would not result in a source of polluted runoff. Therefore, no impact is identified for this issue area, and no further analysis is warranted.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. See Section X (c)(i) above.

iv. Impede or redirect flood flows?

Wetland Mitigation Bank – Project-level Review:

Potentially Significant Impact. According to the Federal Emergency Management Agency Flood Insurance Rate Map for San Diego, California (Federal Emergency Management Agency 2016), the project site is located in the 100-year floodplain for the Otay River and San Diego Bay. The project has the potential to modify flood flows. Potentially significant flood impacts will be addressed in the EIR and mitigation identified, when applicable.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. The parcels would be designated as commercial recreation or wetlands. If these parcels are developed for commercial use, and depending on the location of development within the parcel, the construction and operation of the developed parcels could potentially result in the placement of structures within a 100-year flood hazard area. Potentially significant flood hazard impacts will be addressed in the EIR and mitigation identified, when applicable.

d) ***In flood hazard, tsunami, or seiche zones, risk release of pollutants due to project inundation?***

Wetland Mitigation Bank – Project-level Review:

Less than Significant Impact. The project site is not identified within a risk zone of a potential dam failure; however, the project site is within a designated high-risk zone for a tsunami (County of San Diego 2017). The likelihood that a tsunami event would occur during the 17-month construction period is low. Additionally, the project site is located near the San Diego Bay but is approximately 1.7 mile from the Pacific Ocean. Therefore, the potential for hazards associated with direct wave action in the event of a tsunami is low. Conditions under the proposed project would be similar to the existing conditions and would not increase the potential of site inundation. Although unlikely, if it were to occur during construction, people would be given sufficient warning to evacuate the project site by the West Coast and Alaska Tsunami Warning Centers, which monitor earthquakes and issue tsunami warnings when anticipated to occur. Furthermore, the project does not propose the placement of structures on the project site or pollutant sources. While further discussion and justification will be provided in the EIR, impacts are anticipated to be less than significant.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. The project site is not identified within a risk zone of a potential dam failure (County of San Diego 2017). It is highly unlikely that, if these parcels are developed, the proposed project would expose people or structures to a significant risk of loss, injury, or death involving flooding as a result of the failure of a levee or dam. The risk of pollutant release due to a tsunami is similar to that discussed above; however, if structures are placed on site, the risk is increased. Potentially significant impacts have been identified, and the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

e) ***Conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan?***

Wetland Mitigation Bank – Project-level Review:

No Impact. Creation of a wetland mitigation bank would not conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan as the project would not create a new source of pollutants or impact groundwater. Therefore, no impact is identified for this issue area, and no further analysis is warranted.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. The parcels would be designated as commercial recreation or wetlands. If these parcels are developed, and depending on the type of development, the construction and operation of the developed parcels could potentially result in a conflict with a water quality control plan. The project site is not located within one of the four San Diego County designated groundwater basins and therefore, the project is not in conflict with a sustainable groundwater management plan (County of San Diego 2018). Potentially significant impacts have been identified, and the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

XI. Land Use and Planning

Environmental Issue Area:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less than Significant Impact	No Impact
Would the project:				
a) Physically divide an established community?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☐	☒
Parcels A, B, and C – Program-level Review:	☐	☐	☐	☒
b) Cause a significant environmental impact due to a conflict with any land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect?				
Wetland Mitigation Bank – Project-level Review:	☒	☐	☐	☐
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐

Would the project:

a) Physically divide an established community?

Wetland Mitigation Bank – Project-level Review:

No Impact. The project would rehabilitate an existing vacant site, which includes a portion of a former salt pond. There are no established residential communities located within the project site. Therefore, implementation of the proposed project would not divide an established community, and no impact would occur. No further analysis is warranted.

Parcels A, B, and C – Program-level Review:

No Impact. The project could develop commercial facilities on an existing vacate site. There are no established residential communities located within the project site(s). Therefore, implementation of the proposed project would not divide an established community, and no impact would occur. No further analysis is warranted.

b) Cause a significant impact due to a conflict with any land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect?

Wetland Mitigation Bank – Project-level Review:

Potentially Significant Impact. The PMP is the guiding land use policy document for all areas under the District's jurisdiction. The PMP provides the official planning policies, consistent with a general statewide purpose, for the physical development of the tide and submerged lands conveyed and granted in trust to the District; however, the Bank Site is not currently in the PMP. As part of this project, a PMPA will be processed and approved by the California Coastal Commission to incorporate the Bank Parcel into the PMP, which will allow the District to approve a non-appealable Coastal Development Permit for the Bank Parcel. Further, the San Diego Bay Integrated Natural Resources Management Plan is a long-term collaborative strategy for managing the bay's natural resources and the primary means by which the U.S. Navy and District jointly plan natural resources work in San Diego Bay. The EIR will address whether the proposed project would conflict with the PMP, California Coastal Act, San Diego Bay Integrated Natural Resources Management Plan, or any other land use document adopted for the purpose of avoiding or mitigating an environmental effect.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. The project proposes incorporating District-owned Parcels A, B, and C into the PMP and assign land use designations to Parcels A, B, and C. Parcels A, B, and C are owned by the District; however, these areas are not currently formally incorporated into the PMP. The EIR will address whether the proposed project would conflict with the PMP or any other land use document adopted for the purpose of avoiding or mitigation an environmental effect.

XII. Mineral Resources

Environmental Issue Area:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less than Significant Impact	No Impact
Would the project:				
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☐	☒
Parcels A, B, and C – Program-level Review:	☐	☐	☐	☒
b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☐	☒
Parcels A, B, and C – Program-level Review:	☐	☐	☐	☒

Would the project:

a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?

Wetland Mitigation Bank – Project-level Review:

No Impact. The project site does not contain any known mineral resources. The project site and the surrounding area are not designated or zoned as land with the availability of mineral resources (County of San Diego 2011). Additionally, the project site is not identified on the California Department of Conservation Division of Mines and Geology as containing aggregate resources and is not in a mineral resource zone (California Department of Conservation 2015). Therefore, the proposed project would not result in a loss of mineral resources, and no further analysis is warranted.

Parcels A, B, and C – Program-level Review:

No Impact. Same as above.

b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan?

Wetland Mitigation Bank – Project-level Review:

No Impact. See Section XII (a) above.

Parcels A, B, and C – Program-level Review:

No Impact. Same as above.

XIII. Noise

Environmental Issue Area:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less than Significant Impact	No Impact
Would the project result in:				
a) Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?				
Wetland Mitigation Bank – Project-level Review:	☒	☐	☐	☐
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐
b) Generation of excessive groundborne vibration or groundborne noise levels?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☒	☐
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐
c) For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☒	☐
Parcels A, B, and C – Program-level Review:	☐	☐	☒	☐

Would the project result in:

a) Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?

Wetland Mitigation Bank – Project-level Review:

Potentially Significant Impact. The project would be required to comply with the San Diego Municipal Code Article 9.4 Noise Abatement and Control, sound level limits for construction noise (Section 59.5.0404). Nevertheless, the potential exists for construction activities at the project site to result in significant impacts. This issue will be evaluated in the EIR and mitigation identified, when applicable. No permanent increases in ambient noise are anticipated during operation of the proposed project.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. If these parcels are developed, construction activities would be required to comply with the San Diego Municipal Code Article 9.4 Noise Abatement and Control, sound level limits for construction noise (Section 59.5.0404). Nevertheless, the potential exists for construction activities at the project site to result in significant impacts. Additionally, depending on the type of development, the potential exists for operation activities to result in a permanent increase in ambient noise levels and therefore significant impacts. These issue will be evaluated in the EIR and mitigation identified, when applicable.

b) Generation of excessive groundborne vibration or groundborne noise levels?

Wetland Mitigation Bank – Project-level Review:

Less than Significant Impact. Groundborne vibration and groundborne noise could originate from earth movement during the construction phase of the proposed project; however, significant vibration is typically associated with activities such as blasting or the use of pile drivers, neither of which would be required during project construction. The project would be expected to comply with all applicable requirements for long-term operation, as well as with measures to reduce excessive groundborne vibration and noise to ensure that the project would not expose persons or structures to excessive groundborne vibration.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. The parcels would be designated as commercial recreation or wetlands. If these parcels are developed, and depending on the type of development within the parcel, the construction of the developed parcels could potentially result in groundborne vibration. Potentially significant noise impacts will be addressed in the EIR and mitigation identified, when applicable.

c) For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?

Wetland Mitigation Bank – Project-level Review:

Less than Significant Impact. The project site is located within 2 miles of the Naval Outlying Landing Field. However, the project is not expected to expose persons to excessive noise levels. While further discussion and justification will be provided in the EIR, impacts are anticipated to be less than significant.

Parcels A, B, and C – Program-level Review:

Less than Significant Impact. Same as above.

XIV. Population and Housing

Environmental Issue Area:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less than Significant Impact	No Impact
Would the project:				
a) Induce substantial unplanned population growth in an area, either directly (e.g., by proposing new homes and businesses) or indirectly (e.g., through extension of roads or other infrastructure)?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☐	☒
Parcels A, B, and C – Program-level Review:	☐	☐	☒	☐
b) Displace substantial numbers of existing people or housing, necessitating the construction of replacement housing elsewhere?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☐	☒
Parcels A, B, and C – Program-level Review:	☐	☐	☐	☒

Would the project:

a) Induce substantial unplanned population growth in an area, either directly (e.g., by proposing new homes and businesses) or indirectly (e.g., through extension of roads or other infrastructure)?

Wetland Mitigation Bank – Project-level Review:

No Impact. The project site is a former salt pond. Development of housing is not proposed as part of the project. No full-time employees are required to operate the project. Maintenance of the project would involve invasive species monitoring and removal, trash removal, maintenance of site control measures, and restoration of any damage from human or natural phenomenon. Therefore, the proposed project would not result in a substantial growth in the area, as there would not be a permanent number of new employees required to maintain the site. No impact is identified for population and housing, and no further analysis is warranted.

Parcels A, B, and C – Program-level Review:

Less than Significant Impact. The parcels would be designated as commercial recreation or wetlands. If these parcels are developed, it would be unlikely that new businesses in these locations would have a substantial impact on population growth due to the small size of the parcels. Impacts would be less than significant, and no further analysis is warranted.

b) Displace substantial numbers of existing people or housing, necessitating the construction of replacement housing elsewhere?

Wetland Mitigation Bank – Project-level Review:

No Impact. No housing exists within the project site and no people reside within the project site. Therefore, the proposed project would not displace substantial numbers of people or existing housing, necessitating the construction of replacement housing elsewhere. No impact is identified for this issue area, and no further analysis is warranted.

Parcels A, B, and C – Program-level Review:

No Impact. Same as above.

XV. Public Services

Environmental Issue Area:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less than Significant Impact	No Impact
a) Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:				
i. Fire Protection?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☒	☐
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐
ii. Police Protection?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☒	☐
Parcels A, B, and C – Program-level Review:	☐	☐	☒	☐
iii. Schools?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☐	☒
Parcels A, B, and C – Program-level Review:	☐	☐	☐	☒
iv. Parks?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☐	☒
Parcels A, B, and C – Program-level Review:	☐	☐	☒	☐
v. Other public facilities?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☐	☒
Parcels A, B, and C – Program-level Review:	☐	☐	☒	☐

a) Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:

i. Fire Protection?

Wetland Mitigation Bank – Project-level Review:

Less than Significant Impact. The project site is located in City of San Diego, and fire protection and emergency medical services in the area are provided by the SDFD. Two SDFD fire stations, including Fire Stations 30 (2265 Coronado Avenue) and 6 (693 Twining Avenue) are located southeast of the project site and could respond in the event of an emergency (City of San Diego 2018). According to the Fire Hazard Severity Zone Map, the potential for a major fire at the project site and vicinity is low (SDFD 2009). Based on these considerations, the project would not result in a need for fire facility expansion. A less than significant impact is identified for this issue area, and no further analysis is warranted.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. The parcels would be designated as commercial recreation or wetlands. If these parcels are developed, there would be a potentially significant impact on fire protection because access roads to the parcels would be required to comply with SDFD's access roadway requirements, as outlined in California Fire Code Section 503. Potentially significant impacts have been identified, and the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

ii. Police Protection?

Wetland Mitigation Bank – Project-level Review:

Less than Significant Impact. Police protection services in the project area are provided by City of San Diego Police Department and San Diego Harbor Police Department. Although the potential is low, the proposed project may attract vandals or other security risks; however, the proposed development of a wetland mitigation bank would not require an increase in police protection that would warrant new facilities. This impact would be less than significant, and no further analysis is warranted.

Parcels A, B, and C – Program-level Review:

Less than Significant Impact. As described above, the project site is near existing police protection services and would not result in the need for a new police protection facility or any other physical impacts resulting from providing services to Parcels A, B, and C. If the parcels are developed, they would be within an urban area already serviced by existing facilities. Based on these considerations, the project would not result in a need for police facility expansion. A less than significant impact is identified for this issue area, and no further analysis is warranted.

iii. Schools?

Wetland Mitigation Bank – Project-level Review:

No Impact. The proposed project does not include the development of residential land uses that would result in an increase in population or student generation. Construction of the proposed project would not result in an increase in student population within the City of San Diego's School District, as it is anticipated that construction workers would commute during construction operations. The proposed project would have no impact on City of San Diego schools. No further analysis is warranted.

Parcels A, B, and C – Program-level Review:

No Impact. Same as above.

iv. Parks?

Wetland Mitigation Bank – Project-level Review:

No Impact. The project does not propose construction of facilities that would generate the need for park use. Additionally, no full-time employees are required to operate the project. Maintenance of the project would involve invasive species monitoring and removal, trash removal, maintenance of site control measures, and restoration of any damage from human or natural phenomenon. Therefore, substantial permanent increases in population that would impact local parks are not expected. The project is not expected to have an impact on parks. Therefore, no further analysis of these issue areas is warranted.

Parcels A, B, and C – Program-level Review:

Less than Significant Impact. The parcels would be designated as commercial recreation or wetlands. If these parcels are developed, there would be negligible effect on population growth, it is unlikely that new recreational facilities would be developed due to new commercial development. The proposed project would have a less than significant impact, and no further analysis in the EIR is warranted.

v. Other public facilities?

Wetland Mitigation Bank – Project-level Review:

No Impact. The project does not propose construction of facilities that would be associated with in-migration and population growth, which typically increases the demand for public services and facilities. Additionally, no full-time employees are required to operate the project. Therefore, substantial permanent increases in population that would adversely affect other public services and facilities are not expected. The project is not expected to have an impact on other public facilities, such as post offices, and libraries. Therefore, no further analysis of these issue areas is warranted.

Parcels A, B, and C – Program-level Review:

Less than Significant Impact. The parcels would be designated as commercial recreation or wetlands. If these parcels are developed, there would be a negligible effect on population growth, it is unlikely that new public facilities would be developed due to new commercial development. The proposed project would have a less than significant impact, and no further discussion in the EIR is warranted.

XVI. Recreation

Environmental Issue Area:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less than Significant Impact	No Impact
a) Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☐	☒
Parcels A, B, and C – Program-level Review:	☐	☐	☒	☐
b) Does the project include recreational facilities or require the construction or expansion of recreational facilities, which might have an adverse physical effect on the environment?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☐	☒
Parcels A, B, and C – Program-level Review:	☐	☐	☒	☐

a) Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?

Wetland Mitigation Bank – Project-level Review:

No Impact. The proposed project would not generate new employment on a long-term basis. As such, the project would not significantly increase the use or accelerate the deterioration of regional parks or other recreational facilities. The temporary increase of population during construction that may be caused by an influx of workers would be minimal and not cause a detectable increase in the use of parks. Additionally, the project does not include or require the expansion of recreational facilities. No impact will occur, and no further analysis is warranted.

Parcels A, B, and C – Program-level Review:

Less than Significant Impact. The parcels would be designated as commercial recreation or wetlands. If these parcels are developed, commercial land uses do not typically generate an increase in the use of neighborhood and regional parks or other recreational facilities, such as community centers. This impact would be less than significant, and no further analysis in the EIR is warranted.

b) Does the project include recreational facilities or require the construction or expansion of recreational facilities, which might have an adverse physical effect on the environment?

Wetland Mitigation Bank – Project-level Review:

No Impact. See Section XVI (a) above.

Parcels A, B, and C – Program-level Review:

Less than Significant Impact. See Section XVI (a) above.

XVII. Transportation

Environmental Issue Area:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less than Significant Impact	No Impact
Would the project:				
a) Conflict with a program plan, ordinance or policy addressing the circulation system, including transit, roadway, bicycle and pedestrian facilities?				
Wetland Mitigation Bank – Project-level Review:	☒	☐	☐	☐
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐
b) Conflict or be inconsistent with CEQA Guidelines section 15064.3, subdivision (b)?				
Wetland Mitigation Bank – Project-level Review:	☒	☐	☐	☐
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐
c) Substantially increase hazards due to a geometric design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☐	☒
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐
d) Result in inadequate emergency access?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☐	☒
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐

Would the project:

a) Conflict with a program plan, ordinance or policy addressing the circulation system, including transit, roadway, bicycle, and pedestrian facilities?

Wetland Mitigation Bank – Project-level Review:

Potentially Significant Impact. Construction of the project would result in a temporary increase of traffic to the area, which may result in a potentially significant impact. While there are no public transit, bicycle, or pedestrian facilities that serve the project site, the Bayshore Bikeway path is immediately adjacent and runs along the Otay River to the west. Additionally, bus stops on Palm Avenue serve the surrounding commercial and residential facilities. The proposed project will be evaluated to determine if its implementation would result in conflicts with any adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities. This issue will be evaluated in the EIR and mitigation identified, when applicable.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. The parcels would be designated as commercial recreation or wetlands. If these parcels are developed, there would be a potentially significant impact on traffic in the area during construction and operation, and potentially conflict with adopted plans or policies relating to public transit, bicycle, or pedestrian facilities. Potentially significant impacts have been identified, and the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

b) Conflict or be inconsistent with CEQA Guidelines section 15064.3, subdivision (b)?

Wetland Mitigation Bank – Project-level Review:

Potentially Significant Impact. Construction of the project would result in vehicle miles traveled for construction worker vehicles, as well as truck haul and material delivery trips. Operation of the project would not result in an increase of decrease in vehicle miles traveled. The EIR will fully evaluate the vehicle miles traveled compared to applicable thresholds of significance and identify mitigation, when applicable.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. The parcels would be designated as commercial recreation or wetlands. If these parcels are developed, there would be a potentially significant impact from vehicle miles traveled exceeding an applicable threshold of significance for both construction and operation. Potentially significant impacts have been identified, and the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

c) Substantially increase hazards due to a geometric design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?

Wetland Mitigation Bank – Project-level Review:

No Impact. The project proposes construction of a wetland mitigation bank, which would not include design features that would increase hazards. Therefore, no impact is identified for this issue area, and no further analysis is warranted.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. The parcels would be designated as commercial recreation or wetlands. If these parcels are developed, there would be a potentially significant impact in increased hazards due to a design feature. Potentially significant impacts have been identified, and the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

d) Result in inadequate emergency access?

Wetland Mitigation Bank – Project-level Review:

No Impact. The project is not anticipated to require road improvements and/or road closures that would impact emergency access surrounding the project site. Therefore, no impact is identified for this issue area.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. The parcels would be designated as commercial recreation or wetlands. If these parcels are developed, there would be a potentially significant impact on emergency access. Potentially significant impacts have been identified, and the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

XVIII. Tribal Cultural Resources

Environmental Issue Area:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less than Significant Impact	No Impact
Would the project cause a substantial adverse change in the significance of a tribal cultural resource defined in Public Resources Code section 21074 as either a site, feature, place, cultural landscape that is geographically defined in terms of the size and scope of the landscape, sacred place, or object with cultural value to a California Native American tribe, and that is:				
a) Listed or eligible for listing in the California Register of Historical Resources, or in a local register of historical resources as defined in Public Resources Code section 5020.1(k)?				
Wetland Mitigation Bank – Project-level Review:	☒	☐	☐	☐
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐
b) A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Public Resources Code Section 5024.1. In applying the criteria set forth in subdivision (c) of Public Resources Code Section 5024.1, the lead agency shall consider the significance of the resource to a California Native American tribe?				
Wetland Mitigation Bank – Project-level Review:	☒	☐	☐	☐
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐

Would the project cause a substantial adverse change in the significance of a tribal cultural resource defined in Public Resources Code section 21074 as either a site, feature, place, cultural landscape that is geographically defined in terms of the size and scope of the landscape, sacred place, or object with cultural value to a California Native American tribe, and that is:

a) Listed or eligible for listing in the California Register of Historical Resources, or in a local register of historical resources as defined in Public Resources Code section 5020.1(k)?

Wetland Mitigation Bank – Project-level Review:

Potentially Significant Impact. A records search at the South Coastal Information Center was conducted for to determine if any resources that may qualify as a tribal cultural resources are present within the project site. While no tribal cultural resources that are listed in in the California Register of Historical Resources were identified during the records search, the records search indicated that two archaeological resources have been previously documented within the project area and have not been evaluated (Spindrift 2018). Additionally, a Sacred Lands File Search of the project area was obtained from the Native American Heritage Commission. No Sacred Lands were identified by the Native American Heritage Commission.

Given the results of the records search, tribal cultural resources could be discovered during ground-disturbing activity. If avoidance of impacts is not possible for previously recorded archaeological resources that may qualify as tribal cultural resources, further cultural work is recommended (Spindrift 2018). Potentially significant impacts have been identified, and the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. The parcels would be designated as commercial recreation or wetlands. If these parcels are developed, there would be a potentially significant impact on a tribal cultural resource defined in Public Resource Code Section 21074 that is listed or eligible for listing in the California Register of Historic Resources or in a local register of historical resources. Potentially significant impacts have been identified, and the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

b) A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Public Resources Code Section 5024.1. In applying the criteria set forth in subdivision (c) of Public Resources Code Section 5024.1, the lead agency shall consider the significance of the resource to a California Native American tribe?

Wetland Mitigation Bank – Project-level Review:

Potentially Significant Impact. A records search at the South Coastal Information Center was conducted for to determine if any resources that may qualify as a tribal cultural resources are present within the project site. While no tribal cultural resources that are listed in in the California Register of Historical Resources were identified during the records search, the records search indicated that two archaeological resources have been previously documented within the project area and have not been evaluated (Spindrift 2018). With further research, these resources may be determined by the lead agency to be significant as a tribal cultural resource. Potentially significant impacts have been identified, and the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. The parcels would be designated as commercial recreation or wetlands. If these parcels are developed, there would be a potentially significant impact on a tribal cultural resource as determined by the lead agency. Potentially significant impacts have been identified, and the EIR will fully evaluate the potential impact and identify mitigation in consultation with California Native American tribe(s).

XIX. Utilities and Service Systems

Environmental Issue Area:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less than Significant Impact	No Impact
Would the project:				
a) Require or result in the relocation or construction of new or expanded water, wastewater treatment or storm water drainage electric power, natural gas, or telecommunications facilities the construction or relocation of which could cause significant environmental effects?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☐	☒
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐
b) Have sufficient water supplies available to serve the project and reasonably foreseeable future development during normal, dry, and multiple dry years?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☐	☒
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐
c) Result in a determination by the wastewater treatment provider which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☒	☐
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐
d) Generate solid waste in excess or State or local standards, or in excess of the capacity of local infrastructure, or otherwise impair the attainment of solid waste reduction goals?				
Wetland Mitigation Bank – Project-level Review:	☒	☐	☐	☐
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐
e) Comply with federal, state, and local management and reduction statutes and regulations related to solid waste?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☒	☐
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐

Would the project:

a) Require or result in the relocation or construction of new or expanded water, wastewater treatment or stormwater drainage, electric power, natural gas, or telecommunications facilities the construction or relocation of which could cause significant environmental effects?

Wetland Mitigation Bank – Project-level Review:

No Impact. The project is a wetland mitigation bank that will not require water, wastewater treatment or stormwater drainage, electric power, natural gas, or telecommunications facilities. Therefore, no impact is identified for this issue area, and no further analysis is warranted.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. The parcels would be designated as commercial recreation or wetlands. If these parcels are developed, there would be a potentially significant impact, potentially requiring the construction of new water, stormwater drainage, electric power, natural gas, or telecommunications facilities, depending on the development. Potentially significant impacts have been identified, and the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

b) Have sufficient water supplies available to serve the project and reasonably foreseeable future development during normal, dry and multiple dry years?

Wetland Mitigation Bank – Project-level Review:

No Impact. See Section XIX (a) above.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. The parcels would be designated as commercial recreation or wetlands. If these parcels are developed, there would be a potentially significant impact, potentially requiring water supplies, depending on the development. Potentially significant impacts have been identified, and the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

c) Result in a determination by the wastewater treatment provider which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?

Wetland Mitigation Bank – Project-level Review:

Less than Significant Impact. The proposed project would generate a minimal volume of wastewater during construction. During construction activities, wastewater would be contained within portable toilet facilities and disposed of at an approved site. No habitable structures are proposed on the project site; therefore, there would be no wastewater generation from the proposed project. The proposed project would not exceed the wastewater treatment requirements. A less than significant impact is identified for this issue area, and no further analysis is warranted.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. The parcels would be designated as commercial recreation or wetlands. If these parcels are developed, there would be a potentially significant impact on the local wastewater treatment provider. Potentially significant impacts have been identified, and the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

d) Generate solid waste in excess of State or local standards, or in excess of the capacity of local infrastructure, or otherwise impair the attainment of solid waste reduction goals?

Wetland Mitigation Bank – Project-level Review:

Potentially Significant Impact. Approximately 550,000 cubic yards of soil would be excavated and disposed of off site at an appropriate facility of transported offsite for beneficial use. Per District policy and compliance with state and local requirements for waste reduction and recycling, including the 1989 California Integrated Waste Management Act and the 1991 California Solid Waste Reuse and Recycling Access Act of 1991, landfill demands would be minimized by recycling all possible materials during project construction. However, the amount of soil that would be exported to a landfill or redirected for beneficial use would be fully evaluated in the EIR.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. The parcels would be designated as commercial recreation or wetlands. If these parcels are developed, there would be a potentially significant impact on the local landfill provider or conflict with waste reduction goals. Potentially significant impacts have been identified, and the EIR will fully evaluate the potential impact and identify mitigation, when applicable.

e) Comply with federal, state, and local management and reduction statutes and regulations related to solid waste?

Wetland Mitigation Bank – Project-level Review:

Less than Significant Impact. See Section XIX (d) above.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. Same as above.

XX. Wildfire

Environmental Issue Area:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less than Significant Impact	No Impact
If located in or near state responsibility areas or lands classified as very high fire hazard severity zones, would the project:				
a) Substantially impair an adopted emergency response plan or emergency evacuation plan?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☐	☒
Parcels A, B, and C – Program-level Review:	☐	☐	☐	☒
b) Due to slope, prevailing winds, and other factors, exacerbate wildfire risks, and thereby expose project occupants to, pollutant concentrations from a wildfire or the uncontrolled spread of wildfire?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☐	☒
Parcels A, B, and C – Program-level Review:	☐	☐	☐	☒
c) Require the installation or maintenance of associated infrastructure (such as roads, fuel breaks, emergency water sources, power lines or other utilities) that may exacerbate fire risk or that may result in temporary or ongoing impacts to the environment?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☐	☒
Parcels A, B, and C – Program-level Review:	☐	☐	☐	☒
d) Expose people or structures to significant risks, including, downslope or downstream flooding or landslides, as a result of runoff, post-fire slope instability, or drainage changes?				
Wetland Mitigation Bank – Project-level Review:	☐	☐	☐	☒
Parcels A, B, and C – Program-level Review:	☐	☐	☐	☒

If located in or near state responsibility areas or lands classified as very high fire hazard severity zones, would the project:

a) Substantially impair an adopted emergency response plan or emergency evacuation plan?

Wetland Mitigation Bank – Project-level Review:

No Impact. The project is not located in or near state responsibility areas or lands classified as Very High Fire Hazard Severity Zone as recommended by the California Department of Forestry and Fire Protection (California Department of Forestry and Fire Protection 2009). Therefore, no impact is identified for this issue area, and no further analysis is warranted.

Parcels A, B, and C – Program-level Review:

No Impact. Same as above.

b) ***Due to slope, prevailing winds, and other factors, exacerbate wildfire risks, and thereby expose project occupants to, pollutant concentrations from a wildfire or the uncontrolled spread of wildfire?***

Wetland Mitigation Bank – Project-level Review:

No Impact. See Section XX (a) above.

Parcels A, B, and C – Program-level Review:

No Impact. See Section XX (a) above.

c) ***Require the installation or maintenance of associated infrastructure (such as roads, fuel breaks, emergency water sources, power lines or other utilities) that may exacerbate fire risk or that may result in temporary or ongoing impacts to the environment?***

Wetland Mitigation Bank – Project-level Review:

No Impact. See Section XX (a) above.

Parcels A, B, and C – Program-level Review:

No Impact. See Section XX (a) above.

d) ***Expose people or structures to significant risks, including, downslope or downstream flooding or landslides, as a result of runoff, post-fire slope instability, or drainage changes?***

Wetland Mitigation Bank – Project-level Review:

No Impact. See Section XX (a) above.

Parcels A, B, and C – Program-level Review:

No Impact. See Section XX (a) above.

Mandatory Findings of Significance

The following are Mandatory Findings of Significance in accordance with Section 15065 of the CEQA Guidelines.

Environmental Issue Area:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less than Significant Impact	No Impact
a) Does the project have the potential to substantially degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, substantially reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?				
Wetland Mitigation Bank – Project-level Review:	☒	☐	☐	☐
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐
b) Does the project have impacts that are individually limited, but cumulatively considerable ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)?				
Wetland Mitigation Bank – Project-level Review:	☒	☐	☐	☐
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐
c) Does the project have environmental effects, which will cause substantial adverse effects on human beings, either directly or indirectly?				
Wetland Mitigation Bank – Project-level Review:	☒	☐	☐	☐
Parcels A, B, and C – Program-level Review:	☒	☐	☐	☐

a) Does the project have the potential to substantially degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, substantially reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?

Wetland Mitigation Bank – Project-level Review:

Potentially Significant Impact. Construction of the wetland mitigation bank has the potential to temporarily impact habitat of plant and wildlife species. Further evaluation will be provided in the EIR. Additionally, there is a potential for impacts on historic and prehistoric resources, which will be further evaluated in the EIR.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. If Parcels A, B, and C are developed as commercial land use, construction and operation of commercial buildings have the potential to impact habitat of plant and wildlife species. Further evaluation will be provided in the EIR. Additionally, there is a potential for impacts on historic and prehistoric resources, which will be further evaluated in the EIR.

b) Does the project have impacts that are individually limited, but cumulatively considerable ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)?

Wetland Mitigation Bank – Project-level Review:

Potentially Significant Impact. Implementation of the proposed project has the potential to impact several resource sections. Cumulative impacts could occur for a given resource area if closely-related past, present, and reasonably foreseeable probable future projects contribute to an incremental impact. The potential for cumulative impacts from all resource issues will be evaluated in the EIR.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. Same as above.

c) Does the project have environmental effects, which will cause substantial adverse effects on human beings, either directly or indirectly?

Wetland Mitigation Bank – Project-level Review:

Potentially Significant Impact. Implementation of the proposed project has the potential to result in impacts related to: air quality, geology and soils, GHGs/climate change, noise, and transportation and traffic. These potential environmental effects could cause substantial adverse effects on human beings. These issues will be further evaluated in the EIR.

Parcels A, B, and C – Program-level Review:

Potentially Significant Impact. Implementation of the proposed project has the potential to result in impacts related to air quality, geology and soils, GHGs/climate change, hazards and hazardous materials, noise, transportation and traffic, and utilities and service systems. These potential environmental effects could cause substantial adverse effects on human beings. These issues will be further evaluated in the EIR.

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STATE OF CALIFORNIA
Governor's Office of Planning and Research
State Clearinghouse and Planning Unit

Gavin Newsom
Governor

Kate Gordon
Director

Notice of Preparation

June 19, 2019

To: Reviewing Agencies

Re: Wetland Mitigation Bank at Pond 20 and Port Master Plan Amendment
SCH# 2019060167

Attached for your review and comment is the Notice of Preparation (NOP) for the Wetland Mitigation Bank at Pond 20 and Port Master Plan Amendment draft Environmental Impact Report (EIR).

Responsible agencies must transmit their comments on the scope and content of the NOP, focusing on specific information related to their own statutory responsibility, within 30 days of receipt of the NOP from the Lead Agency. This is a courtesy notice provided by the State Clearinghouse with a reminder for you to comment in a timely manner. We encourage other agencies to also respond to this notice and express their concerns early in the environmental review process.

Please direct your comments to:

Ashley Wright
San Diego Unified Port District
3165 Pacific Hwy
San Diego, CA 92101

with a copy to the State Clearinghouse in the Office of Planning and Research at state.clearinghouse@opr.ca.gov . Please refer to the SCH number noted above in all correspondence concerning this project on our website: https://ceqanet.opr.ca.gov/2019060167/2 .

If you have any questions about the environmental document review process, please call the State Clearinghouse at (916) 445-0613.

Sincerely,

Scott Morgan
Director, State Clearinghouse

cc: Lead Agency

1400 TENTH STREET P.O. BOX 3044 SACRAMENTO, CALIFORNIA 95812-3044
TEL 1-916-445-0613 state.clearinghouse@opr.ca.gov www.opr.ca.gov

Print Form

Appendix C

Notice of Completion & Environmental Document Transmittal

Mail to: State Clearinghouse, P.O. Box 3044, Sacramento, CA 95812-3044 (916) 445-0613
For Hand Delivery/Street Address: 1400 Tenth Street, Sacramento, CA 95814

SCH# 2019060167

Project Title: Wetland Mitigation Bank at Pond 20 and Port Master Plan Amendment

Lead Agency: San Diego Unified Port District (SDUPD)
Contact Person: Ashley Wright, Senior Planner
Mailing Address: 3165 Pacific Highway
Phone: (619)686-6549
City: San Diego
Zip: 92101
County: San Diego

Project Location: County: San Diego
City/Nearest Community: San Diego
Cross Streets: Palm Ave. (State Route 75) between 13th Street and Otay Valley Regional Park
Zip Code: 92154
Longitude/Latitude (degrees, minutes and seconds): 32 ° 35 ′ 10.39 ″ N / 117 ° 6 ′ 9.67 ″ W
Total Acres: ~95 Acres
Assessor's Parcel No.: n/a
Section: ____ Twp.: ____ Range: ____ Base: ____
Within 2 Miles: State Hwy #: I-5, SR-75
Waterways: San Diego Bay; Otay River, Nestor Creek
Airports: NOLF- Imperial Beach
Railways: SD Metro Transit Sys.
Schools: St. Charles, Bayside Ele.

Document Type:

CEQA:
- ☒ NOP
- ☐ Early Cons
- ☐ Neg Dec
- ☐ Mit Neg Dec
- ☐ Draft EIR
- ☐ Supplement/Subsequent EIR
- (Prior SCH No.) ____
- Other: ____

NEPA:
- ☐ NOI
- ☐ EA
- ☐ FONSI

Other:
- ☐ Joint Document
- ☐ Final Document
- ☐ Other: ____

Governor's Office of Planning & Research

JUN 19 2019

STATE CLEARINGHOUSE

Local Action Type:
- ☐ General Plan Update
- ☐ General Plan Amendment
- ☐ General Plan Element
- ☐ Community Plan
- ☐ Specific Plan
- ☒ Master Plan
- ☐ Planned Unit Development
- ☐ Site Plan
- ☒ Rezone
- ☐ Prezone
- ☒ Use Permit
- ☐ Land Division (Subdivision, etc.)
- ☐ Annexation
- ☐ Redevelopment
- ☒ Coastal Permit
- ☒ Other: Port Master Plan

Development Type:
- ☐ Residential: Units ____ Acres ____
- ☐ Office: Sq.ft. ____ Acres ____ Employees ____
- ☐ Commercial: Sq.ft. ____ Acres ____ Employees ____
- ☐ Industrial: Sq.ft. ____ Acres ____ Employees ____
- ☐ Educational: ____
- ☐ Recreational: ____
- ☐ Water Facilities: Type ____ MGD ____
- ☐ Transportation: Type ____
- ☐ Mining: Mineral ____
- ☐ Power: Type ____ MW ____
- ☐ Waste Treatment: Type ____ MGD ____
- ☐ Hazardous Waste: Type ____
- ☒ Other: Creation of a Wetlands Mitigation Bank

Project Issues Discussed in Document:
- ☒ Aesthetic/Visual
- ☐ Agricultural Land
- ☒ Air Quality
- ☒ Archeological/Historical
- ☒ Biological Resources
- ☒ Coastal Zone
- ☒ Drainage/Absorption
- ☐ Economic/Jobs
- ☐ Fiscal
- ☒ Flood Plain/Flooding
- ☐ Forest Land/Fire Hazard
- ☒ Geologic/Seismic
- ☐ Minerals
- ☒ Noise
- ☐ Population/Housing Balance
- ☒ Public Services/Facilities
- ☐ Recreation/Parks
- ☐ Schools/Universities
- ☐ Septic Systems
- ☒ Sewer Capacity
- ☒ Soil Erosion/Compaction/Grading
- ☒ Solid Waste
- ☒ Toxic/Hazardous
- ☒ Traffic/Circulation
- ☒ Vegetation
- ☒ Water Quality
- ☒ Water Supply/Groundwater
- ☒ Wetland/Riparian
- ☐ Growth Inducement
- ☒ Land Use
- ☒ Cumulative Effects
- ☒ Other: GHG, Energy, Tribe

Present Land Use/Zoning/General Plan Designation:

City of San Diego: Park, Open Space & Recreation

Project Description: *(please use a separate page if necessary)*

The project includes two primary components: (1) project-level environmental evaluation for the creation of a wetland mitigation bank within the District-owned portion of Pond 20, which was historically used as a salt evaporation pond (Bank Parcel); and (2) program-level environmental evaluation of the incorporation of Parcels A, B, and C into the District's Port Master Plan (PMP), and assign land use designations to the project site. The District is proposing a PMP amendment to incorporate the Bank Parcel into the District's PMP, and assign a land use designation of "wetlands." Parcels A, B, and C are District-owned property; however, currently these areas are not formally incorporated into the PMP. Parcels A, B, and C are located immediately adjacent to Pond 20,and would be assigned a "commercial recreation" and/or "wetlands" land use designation.

Note: The State Clearinghouse will assign identification numbers for all new projects. If a SCH number already exists for a project (e.g. Notice of Preparation or previous draft document) please fill in.

Revised 2010

Reviewing Agencies Checklist

Lead Agencies may recommend State Clearinghouse distribution by marking agencies below with and "X".
If you have already sent your document to the agency please denote that with an "S".

X Air Resources Board
____ Boating & Waterways, Department of
____ California Emergency Management Agency
X California Highway Patrol
X Caltrans District #11
____ Caltrans Division of Aeronautics
____ Caltrans Planning
____ Central Valley Flood Protection Board
____ Coachella Valley Mtns. Conservancy
S Coastal Commission
____ Colorado River Board
X Conservation, Department of
____ Corrections, Department of
____ Delta Protection Commission
____ Education, Department of
____ Energy Commission
X Fish & Game Region #5
____ Food & Agriculture, Department of
____ Forestry and Fire Protection, Department of
____ General Services, Department of
____ Health Services, Department of
____ Housing & Community Development
X Native American Heritage Commission

X Office of Historic Preservation
____ Office of Public School Construction
X Parks & Recreation, Department of
____ Pesticide Regulation, Department of
X Public Utilities Commission
X Regional WQCB #9
X Resources Agency
____ Resources Recycling and Recovery, Department of
____ S.F. Bay Conservation & Development Comm.
____ San Gabriel & Lower L.A. Rivers & Mtns. Conservancy
____ San Joaquin River Conservancy
____ Santa Monica Mtns. Conservancy
X State Lands Commission
____ SWRCB: Clean Water Grants
____ SWRCB: Water Quality
____ SWRCB: Water Rights
____ Tahoe Regional Planning Agency
X Toxic Substances Control, Department of
X Water Resources, Department of

____ Other: ____
____ Other: ____

- -

Local Public Review Period (to be filled in by lead agency)

Starting Date June 20, 2019

Ending Date July 22, 2019

- -

Lead Agency (Complete if applicable):

Consulting Firm: HDR
Address: 591 Camino de la Reina suite 300
City/State/Zip: San Diego, CA 92108
Contact: Jenny Vick
Phone: (858) 712-8255

Applicant: Eileen Maher- Port of San Diego
Address: 3165 Pacific Highway
City/State/Zip: San Diego, CA 92101
Phone: (619) 686-6532

- -

Signature of Lead Agency Representative: ____ **Date:** 6/19/19

Authority cited: Section 21083, Public Resources Code. Reference: Section 21161, Public Resources Code.

OP Distribution List

County: San Diego or

SCH# 2019060167

sources Agency

Resources Agency
Nadell Gayou

☒ **Dept. of Boating & Waterways**
Denise Peterson

☒ **California Coastal Commission**
Allyson Hilt

☐ **Colorado River Board**
Elsa Contreras

☐ **Dept. of Conservation**
Crina Chan

☐ **Cal Fire**
Dan Foster

☐ **Central Valley Flood Protection Board**
James Herota

☒ **Office of Historic Preservation**
Ron Parsons

Dept of Parks & Recreation
Environmental Stewardship Section

☐ **S.F. Bay Conservation & Dev't. Comm.**
Steve Goldbeck

☐ **Dept. of Water Resources**
Resources Agency
Nadell Gayou

Fish and Wildlife

☐ **Depart. of Fish & Wildlife**
Scott Flint
Environmental Services Division

☐ **Fish & Wildlife Region 1**
Curt Babcock

☐ **Fish & Wildlife Region 1E**
Laurie Harnsberger

☐ **Fish & Wildlife Region 2**
Jeff Drongesen

☐ **Fish & Wildlife Region 3**
Craig Weightman

☐ **Fish & Wildlife Region 4**
Julie Vance

☒ **Fish & Wildlife Region 5**
Leslie Newton-Reed
Habitat Conservation Program

☐ **Fish & Wildlife Region 6**
Tiffany Ellis
Habitat Conservation Program

☐ **Fish & Wildlife Region 6 I/M**
Heidi Calvert
Inyo/Mono, Habitat Conservation Program

☐ **Dept. of Fish & Wildlife M**
William Paznokas
Marine Region

Other Departments

☐ **California Department of Education**
Lesley Taylor

☐ **OES (Office of Emergency Services)**
Monique Wilber

☐ **Food & Agriculture**
Sandra Schubert
Dept. of Food and Agriculture

☐ **Dept. of General Services**
Cathy Buck
Environmental Services Section

☐ **Housing & Comm. Dev.**
CEQA Coordinator
Housing Policy Division

Independent Commissions,Boards

☐ **Delta Protection Commission**
Erik Vink

☐ **Delta Stewardship Council**
Anthony Navasero

☐ **California Energy Commission**
Eric Knight

☒ **Native American Heritage Comm.**
Debbie Treadway

☒ **Public Utilities Commission**
Supervisor

☐ **Santa Monica Bay Restoration**
Guangyu Wang

☒ **State Lands Commission**
Jennifer Deleong

☐ **Tahoe Regional Planning Agency (TRPA)**
Cherry Jacques

Cal State Transportation Agency CalSTA

☒ **Caltrans - Division of Aeronautics**
Philip Crimmins

☐ **Caltrans – Planning HQ LD-IGR**
Christian Bushong

☒ **California Highway Patrol**
Suzann Ikeuchi
Office of Special Projects

Dept. of Transportation

☐ **Caltrans, District 1**
Rex Jackman

☐ **Caltrans, District 2**
Marcelino Gonzalez

☐ **Caltrans, District 3**
Susan Zanchi

☐ **Caltrans, District 4**
Patricia Maurice

☐ **Caltrans, District 5**
Larry Newland

☐ **Caltrans, District 6**
Michael Navarro

☐ **Caltrans, District 7**
Dianna Watson

☐ **Caltrans, District 8**
Mark Roberts

☐ **Caltrans, District 9**
Gayle Rosander

☐ **Caltrans, District 10**
Tom Dumas

☒ **Caltrans, District 11**
Jacob Armstrong

☐ **Caltrans, District 12**
Maureen El Harake

Cal EPA

Air Resources Board

☒ **Airport & Freight**
Jack Wursten

☐ **Transportation Projects**
Nesamani Kalandiyur

☐ **Industrial/Energy Projects**
Mike Tollstrup

☐ **California Department of Resources, Recycling & Recovery**
Kevin Taylor/Jeff Esquivel

☐ **State Water Resources Control Board**
Regional Programs Unit
Division of Financial Assistance

☐ **State Water Resources Control Board**
Cindy Forbes – Asst Deputy
Division of Drinking Water

☐ **State Water Resources Control Board**
Div. Drinking Water #________

☒ **State Water Resources Control Board**
Student Intern, 401 Water Quality Certification Unit
Division of Water Quality

☐ **State Water Resouces Control Board**
Phil Crader
Division of Water Rights

☒ **Dept. of Toxic Substances Control Reg. #**________
CEQA Tracking Center

☐ **Department of Pesticide Regulation**
CEQA Coordinator

Regional Water Quality Control Board (RWQCB)

☐ **RWQCB 1**
Cathleen Hudson
North Coast Region (1)

☐ **RWQCB 2**
Environmental Document Coordinator
San Francisco Bay Region (2)

☐ **RWQCB 3**
Central Coast Region (3)

☐ **RWQCB 4**
Teresa Rodgers
Los Angeles Region (4)

☐ **RWQCB 5S**
Central Valley Region (5)

- ☐ **RWQCB 5F**
  Central Valley Region (5)
  Fresno Branch Office

- ☐ **RWQCB 5R**
  Central Valley Region (5)
  Redding Branch Office

☐ **RWQCB 6**
Lahontan Region (6)

- ☐ **RWQCB 6V**
  Lahontan Region (6)
  Victorville Branch Office

☐ **RWQCB 7**
Colorado River Basin Region (7)

☐ **RWQCB 8**
Santa Ana Region (8)

☒ **RWQCB 9**
San Diego Region (9)

☐ **Other** ________________
____
____

☒ San Diego
Conservancy

Last Updated 5/22/18

County of San Diego

ELISE ROTHSCHILD
DIRECTOR

DEPARTMENT OF ENVIRONMENTAL HEALTH
HAZARDOUS MATERIALS DIVISION
P.O. BOX 129261, SAN DIEGO, CA 92112-9261
Phone: (858) 505-6700 or (800) 253-9933 Fax: (858) 505-6786
www.sdcdeh.org

AMY HARBERT
ASSISTANT DIRECTOR

July 1, 2019

Ashley Wright
Planning Department
San Diego Unified Port District
3165 Pacific Highway
San Diego, CA 92101-1128

Sent via e-mail to: awright@portofsandiego.org

COMMENTS: Notice of Preparation of a Draft Environmental Impact Report for the Wetland Mitigation Bank at Pond 20 and Port Master Plan Amendment (UPD #EIR-2019-010)

Dear Ms. Wright,

Thank you for the opportunity to comment on the Notice of Preparation (NOP) of a Draft Environmental Impact Report (EIR) by the San Diego Unified Port District for the Wetlands Mitigation Bank at Pond 20 and Port Master Plan Amendment (UPD #EIR-2019-010) project (Project). The Project includes:

(1) a project-level environmental evaluation of the creation of a wetland mitigation bank within the District-owned portion of Pond 20 and
(2) a program-level environmental evaluation of the incorporation of Parcels A, B. and C into the District's Port Master Plan (PMP) plus land use designations. The expected land use designations include "wetlands" for Pond 20, and "commercial recreation" and/or "wetlands" for Parcels A, B, and C which are immediately adjacent to and outside the berms of Pond 20.

Based on an initial review, the San Diego Unified Port District identified the following environmental considerations to be addressed in the EIR: Aesthetics, Air Quality, Biological Resources, Cultural Resources, Energy, Geology and Soils, Greenhouse Gas Emissions, Hazards and Hazardous Materials, Hydrology/Water Quality, Land Use/Planning, Noise, Public Services, Transportation, Tribal Cultural Resources, Utilities/Service Systems, and other Mandatory Findings of Significance. The following resources were eliminated from further discussion in the EIR: Agriculture and Forestry, Mineral, Population and Housing, Recreation, and Wildfire.

The initial review of the Project aspect pertaining to Parcels A, B, C was identified as potentially creating a significant hazard to the public or the environment through foreseeable routine activities or accidental conditions associated with the storage, transport, use, or disposal of hazardous materials; whereas, the wetland mitigation bank aspect of the Project was identified as potentially creating a less-than-significant impact.

"Environmental and public health through leadership, partnership and science"

The County of San Diego Hazardous Materials Division (HMD) is responsible for the protection of public health and the environment by ensuring hazardous materials, hazardous waste, medical waste, aboveground petroleum storage tanks, and underground storage tanks within San Diego County are properly managed. The HMD completed a review of the Project and makes the following comments pertaining to the scope and content of the environmental information to be included in the EIR:

COMMENTS:

1. Page 26-29, Table IX and associated notes: If hazardous materials will be handled or stored at the facility above Hazardous Materials Business Plan (HMBP) thresholds, an HMBP must be developed, submitted to the California Environmental Reporting System (CERS), and implemented onsite. The facility operator is also required to submit a Hazardous Materials Questionnaire to the HMD and complete an HMD Hazardous Materials Plan Check review prior to issuance of a certificate of occupancy by a Building Department. For your reference, information regarding the HMD plan check requirement can be reviewed at: https://www.sandiegocounty.gov/content/sdc/deh/hazmat/hazmat/hmd_plan_check.html

2. Pages 4, 11, 24, and 31: Please be advised a proper waste determination is required for any and all construction-related wastes including, but not limited to, scrap metal, fuels, greases, used oil, soil exports, and debris. Each waste must be classified, labeled, handled, stored, and disposed of in compliance with state and county regulations. In addition, all hazardous waste must be managed in a manner that prevents a release to the environment. Any hazardous waste generated by the Project must be properly classified, labeled, stored, and disposed of by a California registered hazardous waste hauler. A Unified Program Facility Permit may also be required for the accumulation and storage of these wastes. Additional information is available at: https://www.sandiegocounty.gov/content/sdc/deh/hazmat/hazwaste.html

3. Page 27: Be advised that a Spill Prevention Control and Countermeasures Plan (SPCC) is required if petroleum is stored onsite at 1,320 gallons or greater (shell capacity) and the SPCC Plan must demonstrate compliance with the Aboveground Petroleum Storage Act (APSA), Cal. Health and Safety Code, sections 25270 etc. The operator shall complete the SPCC plan and retain a copy readily available for onsite for inspection by the HMD. More information about APSA is available here: https://www.sandiegocounty.gov/content/sdc/deh/hazmat/hmd_apsa.html

4. Pages 4, 11, 24, and 31: If soil and/or groundwater contamination containing a hazardous substance is discovered or encountered during excavation, construction, or grading activity, The San Diego Unified Port District shall investigate the contamination and report the release to the HMD and applicable state and federal agencies. Some environmental assessment and/or remediation work may involve several regulatory oversight agencies. If a release of hazardous waste is discovered as part of this project, timely reporting of the release in writing to the County of San Diego and California oversight agencies may be required pursuant to State laws. Webpages for more information: https://www.dtsc.ca.gov/SiteCleanup/Brownfields/upload/SB-2057.pdf and https://www.waterboards.ca.gov/sandiego/water_issues/programs/smc/scp.html

5. Page 26-29, Table IX and associated notes: Be advised, any proposed activities during construction and after completion of the wharf project involving hazardous materials or generating hazardous waste will require the operator(s) to update the facility's Unified Program Facility Permit through the California Environmental Reporting System (CERS) and comply with local/state laws, and regulations. Webpage for CERS: https://cers.calepa.ca.gov

6. Please note, anytime during construction and after completion of the Project, the HMD has the authority pursuant to state law and County Code to regulate facilities that handle or store hazardous materials,

and/or generate or treat hazardous waste. The HMD will apply that authority as necessary to protect public health and the environment. Additional regulatory guidance information can be found on our website at: https://www.sandiegocounty.gov/content/sdc/deh/hazmat.html.

The HMD appreciates the opportunity to participate in the environmental review process for the Project. If you have any questions regarding the above comments, please contact Sharon Preece at (858) 495-5213 or by e-mail at sharon.preece@sdcounty.ca.gov

Sincerely,

Sharon Preece, Supervising Environmental Health Specialist
Hazardous Materials Division

Email Ecc: Mary Bennett, DEH
Sande Pence, DEH-HMD

United States Department of the Interior

FISH AND WILDLIFE SERVICE

San Diego National Wildlife Refuge Complex
1080 Gunpowder Point
Chula Vista, California 91910

July 22, 2019

Ashley Wright
San Diego Unified Port District, Planning Department
3165 Pacific Highway
San Diego, CA 92101

RE: Scoping Comments on the Notice of Preparation of an Draft Environmental Impact Report for the Wetland Mitigation Bank at Pond 20 and Port Master Plan Amendment (EIR-2019-010)

Dear Ms. Wright:

The U.S Fish and Wildlife Service, San Diego National Wildlife Refuge Complex (SDNWRC) has reviewed the above-referenced Notice of Preparation (NOP) of a Draft Environmental Impact Report (DEIR), issued by the San Diego Unified Port District (District) on June 12, 2019, for the Wetland Mitigation Bank at Pond 20 and associated Port Master Plan Amendment. The DEIR will address both project level and program level actions. At the project level, the District will evaluate the potential effects of creating a wetland mitigation bank within a portion of District-owned property, which was historically used as a salt evaporation pond (Bank Parcel). The project level evaluation will include designating the affected parcel as "wetlands" in the District's Port Master Plan (PMP), as well as evaluating the direct and indirect effects of restoring the Bank Parcel to coastal wetland habitat, including excavation to achieve required wetland elevations and facilitate tidal exchange within the restored wetland. The DEIR will also evaluate the potential effects on the environment of long-term operation and maintenance activities associated with the mitigation bank. A program level evaluation of potential effects will be conducted for the District's proposal to incorporate Parcels A, B, and C into the PMP and assign these parcels with a use designation of "commercial recreation" and/or "wetlands."

The SDNWRC has reviewed the NOP and the accompanying Initial Study and has the following recommendations related to the scope of the analysis provided within the DEIR.

Fluvial Hydrology - Flood and erosion impacts should be evaluated both up and downstream of the Otay River and Nestor Creek by comparing the hydrodynamics under existing and proposed conditions. Water levels and velocities should be assessed using a numerical model to simulate tidal and fluvial conditions in and around the project area. This evaluation should include the changes in hydrodynamics that will occur within the watershed as a result of restoration of the upper portion of Pond 20 (referred to as the Otay River Floodplain Site within the San Diego Bay National Wildlife Refuge), which is located adjacent to the District's Pond 20 restoration project. Note that mitigation was incorporated into the design for the Otay River Estuary Restoration Project (ORERP) to address increases in flood elevations downstream of the restoration project in the City of Imperial Beach. Flood impact analyses to assess the impacts of flooding associated with the 100-year flood should focus on changes to flow patterns and water elevations during flood conditions.

The hydrologic modeling should also be used to predict potential impacts related to erosion, or scour, as a result of project implementation. A comparison of maximum flood velocities downstream of the I-5 Bridge with and without the implementation of the District's Pond 20 restoration project should be conducted. The modeling should assume the implementation of the ORERP, including the restoration of the Otay River Floodplain Site and the placement of the Erosion Reduction Cover over DDT contaminated soils to the east on the Otay River floodplain, as described in the ORERP Final Environmental Impact Statement.

Tidal Hydrology - The proposed project has the potential to affect tidal velocities and the extent of scour within existing channels, on existing mudflats, and to nearby salt pond levees. Therefore, modeling should be conducted to evaluate the extent of change in tidal velocities both within and outside the boundaries of the project that would occur as a result of restoration of Pond 20. The simulations conducted for this analysis should be used to demonstrate the tidal flow velocities, along with stability and potential maintenance requirements of the Otay River channel that would connect both the Pond 20 restoration and the Otay River Floodplain Site with San Diego Bay.

Additionally, the potential for the restoration of Pond 20 to affect the tidal range within the ORERP restoration planning area should be modeled to ascertain whether there is adequate volumetric capacity within the existing Otay River flood channel to feed both sites with a full range of tidal influence once both restoration projects are completed.

(Note: If parcels A, B, and/or C are designated as "wetlands" in the PMP and the intent is to expand tidal influence to one or more of these parcels, then the additional acreage of tidal influence should be taken into account in evaluating the effects of the project on fluvial and tidal hydrology.)

Water Quality - The DEIR should evaluate the potential for short-term impacts to water quality within the Otay River and south San Diego Bay during construction. Appropriate mitigation measures should be incorporated into the scope of the project to minimize increases in sediment load and turbidity beyond the boundaries of the project.

We appreciate the opportunity to comment on this NOP. If you have questions or comments regarding this letter, please contact Brian Collins, Refuge Manager, at (619-575-2704 x 302, Brian_Collins@fws.gov).

Sincerely,

Andrew Yuen

Andrew Yuen
Project Leader

State of California – Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
South Coast Region
3883 Ruffin Road
San Diego, CA 92123
(858) 467-4201
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GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director

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Planning & Green Port

July 22, 2019

Ms. Ashley Wright, Senior Planner
San Diego Unified Port District Planning Department
3165 Pacific Highway
San Diego, CA 92101
awright@portofsandiego.com

Subject: Comments on the Notice of Preparation of a Draft Environmental Impact Report for the Wetlands Mitigation Bank at Pond 20 and Port Master Plan Amendment, San Diego, CA (SCH# 2019060167)

Dear Mr. Galvez:

The California Department of Fish and Wildlife (Department) has reviewed the above-referenced Notice of Preparation (NOP) for the Wetland Mitigation Bank at Pond 20 and Port Master Plan Amendment Draft Program Environmental Impact Report (DEIR). The following statements and comments have been prepared pursuant to the Department's authority as Trustee Agency with jurisdiction over natural resources affected by the project (California Environmental Quality Act [CEQA] Guidelines § 15386) and pursuant to our authority as a Responsible Agency under CEQA Guidelines section 15381 over those aspects of the proposed project that come under the purview of the California Endangered Species Act (CESA; Fish and Game Code § 2050 *et seq.*) and Fish and Game Code section 1600 *et seq.* The Department also administers the Natural Community Conservation Planning (NCCP) program. The City of San Diego (City) participates in the NCCP program by implementing its approved Multiple Species Conservation Program (MSCP) Subarea Plan (SAP).

The project includes two components: project-level analysis of the creation of a wetland mitigation bank within a portion of Pond 20, and program-level analysis of the incorporation of Parcels A, B, and C into the San Diego Unified Port District's (District) Port Master Plan. Land use designations of "wetlands, and "commercial recreation/wetlands" would be assigned to the two areas within project site. The District-owned portion of Pond 20 (referred to herein as the Bank Parcel; 83.5 acres) is located in the City, north of Palm Avenue, south of the San Diego Bay National Wildlife Refuge, east of the City of Imperial Beach, and southwest of Otay Valley Regional Park. Parcels A, B, and C (collectively 11.7 acres) are located immediately adjacent to the Bank Parcel outside of the Pond 20 berms. The Bank Parcel of the project is located within the existing Multiple Habitat Planning Area (MHPA), which is preserve land associated with the City's SAP.

According to the NOP, the project site is currently composed of degraded, low-quality wetland habitat. Biological surveys conducted in 2017 and 2018 resulted in the observation of Western snowy plover (*Charadrius nivosus nivosus*; Endangered Species Act-Threatened and a California Species of Special Concern) and Belding's savannah sparrow (*Passerculus sandwichensis beldingi*; CESA-listed Endangered). Eight other unnamed, "special-status wildlife species and one special-status plant species" were observed. When complete, the mitigation bank is proposed to offer high marsh, mid-marsh, low marsh, intertidal mudflat, transitional habitat, and subtidal eelgrass creation credits.

The Department offers the following comments and recommendations to assist the District in avoiding or minimizing potential project impacts on biological resources.

Specific Comments

1. Banking consultation was initiated with the Department via a preliminary Draft Prospectus (April 2017; Great Ecology Environment Design). It is our understanding that the District has opted not to continue to pursue the formal process to have the Department be a signatory agency to the Bank Enabling Instrument (BEI). Mitigation credits may not be accepted by the Department from mitigation banks where the Department is not a signatory agency to the BEI. Should the District desire to have the Department as a signatory agency to the BEI, formal consultation should be pursued. More information on our formal banking process, including templates, fee schedules, and timelines, can be found on our website at https://www.wildlife.ca.gov/Conservation/Planning/Banking.

2. The NOP only discusses two observed special status species—Western snowy plover and Belding's savannah sparrow, and refers to eight other unnamed, "special-status wildlife species and one special-status plant species". The DEIR should identify the full suite of species observed during the 2017 and 2018 biological surveys and those species with the potential to be found on site or otherwise indirectly impacted by the proposed project (see comment 6 below). If impacts to these species cannot be wholly avoided, or if impacts cannot be mitigated below a significant level, then significant impacts could possibly be mitigated through a reduction of banking credits generated at the on-site bank.

   Additionally, because of bank development, take (Fish and Game Code § 86) authorization for certain CESA-listed species may be appropriate, per Fish and Game Code section 2081(a). The Department considers adverse impacts to a species protected by the CESA, for the purposes of CEQA, to be significant without mitigation. As to CESA, take of any endangered, threatened, or candidate species that results from the project is prohibited, except as authorized by state law (Fish and Game Code, §§ 2080, 2085). Consequently, if the project, project construction, or any project-related activity during the life of the project will result in take of a species designated as endangered or threatened, or a candidate for listing under CESA, the Department recommends that the project proponent seek appropriate take authorization under CESA prior to implementing the project. Appropriate authorization from the Department may include an incidental take permit (ITP) or a consistency determination in certain circumstances, among other options (Fish and Game Code §§ 2080.1, 2081, subds. (b),(c)). Early consultation is encouraged, as significant modification to a project and mitigation measures may be required in order to obtain a CESA Permit. Revisions to the Fish and Game Code, effective January 1998, may require that the Department issue a separate CEQA document for the issuance of an ITP unless the project CEQA document addresses all project impacts to CESA-listed species and specifies a mitigation monitoring and reporting program that will meet the requirements of an ITP. For these reasons, biological mitigation monitoring and reporting proposals should be of sufficient detail and resolution to satisfy the requirements for a CESA ITP.

3. The Department has concerns about eelgrass (*Zostera marina*) due to its historical presence throughout south San Diego Bay. Eelgrass habitat is likely present within or adjacent to the project area, and this should be documented and addressed in the DEIR, in alignment with

the California Eelgrass Mitigation Policy (CEMP; NOAA 2014). As per the CEMP, the Department recommends that the DEIR contain a mitigation measure that addresses eelgrass impacts. This measure should incorporate the following elements:

a. an initial pre-construction eelgrass survey;

b. should eelgrass habitat be identified, post-construction surveys and long-term monitoring should be conducted in order to identify short- and long-term impacts such as: direct losses and indirect impacts from dredging/excavation, filling, or shading;

c. if eelgrass mitigation is necessary, mitigation should meet or exceed minimum compensation requirements and performance standards unless otherwise approved in writing by the Department's Marine Region; and,

d. a Department-issued Scientific Collecting Permit for eelgrass collection and a Letter of Authorization for eelgrass translocations are required, if eelgrass mitigation through translocation is warranted.

The Department requests any pre-project survey reports or draft mitigation and monitoring plans be sent to our Marine Region with sufficient time for review so that we may provide meaningful feedback and collaboration.

General Comments

4. The Department has responsibility for wetland and riparian habitats. It is the policy of the Department to strongly discourage development in wetlands or conversion of wetlands to uplands. We oppose any development or conversion that would result in a reduction of wetland acreage or wetland habitat values, unless, at a minimum, project mitigation assures there will be "no net loss" of either wetland habitat values or acreage. Development and conversion can include but are not limited to placement of fill or building of structures within the wetland. All wetlands and watercourses, whether ephemeral, intermittent, or perennial, should be retained and provided with substantial setbacks that preserve the riparian and aquatic values and maintain their value to on-site and off-site wildlife populations.

   a) The project area supports aquatic, and wetland habitats; therefore, a jurisdictional delineation of the creeks and their associated riparian habitats should be included in the DEIR. The delineation should be conducted pursuant to the U. S. Fish and Wildlife Service wetland definition adopted by the Department.[1] Please note that some wetland and riparian habitats subject to the Department's authority may extend beyond the jurisdictional limits of the U.S. Army Corps of Engineers.

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[1] Cowardin, Lewis M., et al. 1979. Classification of Wetlands and Deepwater Habitats of the United States. U.S. Department of the Interior, Fish and Wildlife Service.

  b) The Department also has regulatory authority over activities in streams and/or lakes that will divert or obstruct the natural flow, or change the bed, channel, or bank (which may include associated riparian resources) of any river, stream, or lake or use material from a river, stream, or lake. For any such activities, the project applicant (or "entity") must provide written notification to the Department pursuant to section 1600 et seq. of the Fish and Game Code. Based on this notification and other information, the Department determines whether a Lake and Streambed Alteration Agreement (LSAA) with the applicant is required prior to conducting the proposed activities. The Department's issuance of a LSAA for a project that is subject to CEQA will require CEQA compliance actions by the Department as a Responsible Agency. The Department as a Responsible Agency under CEQA may consider the local jurisdiction's (lead agency) Negative Declaration or Environmental Impact Report for the project. To minimize additional requirements by the Department pursuant to section 1600 *et seq.* and/or under CEQA, the document should fully identify the potential impacts to the stream or riparian resources and provide adequate avoidance, mitigation, monitoring and reporting commitments for issuance of the LSAA.[2]

5. To enable the Department to adequately review and comment on the proposed project from the standpoint of the protection of plants, fish, and wildlife, we recommend the following information be included in the draft DEIR.

  a) The document should contain a complete discussion of the purpose and need for, and description of, the proposed project, including all staging areas and access routes to the construction and staging areas.
  b) A range of feasible alternatives should be included to ensure that alternatives to the proposed project are fully considered and evaluated; the alternatives should avoid or otherwise minimize impacts to sensitive biological resources. Specific alternative locations should be evaluated in areas with lower resource sensitivity where appropriate.

<u>Biological Resources within the Project's Area of Potential Effect</u>

6. The document should provide a complete assessment of the flora and fauna within and adjacent to the project area, with particular emphasis upon identifying endangered, threatened, sensitive, and locally unique species and sensitive habitats. This should include a complete floral and faunal species compendium of the entire project site, undertaken at the appropriate time of year. The draft DEIR should include the following information.

  a) CEQA Guidelines, section 15125(c), specifies that knowledge on the regional setting is critical to an assessment of environmental impacts and that special emphasis should be placed on resources that are rare or unique to the region.

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[2] A notification package may be obtained by accessing the Department's web site at http://www.wildlife.ca.gov/Conservation/LSA.

b) A thorough, recent floristic-based assessment of special status plants and natural communities, following the Department's Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities (see https://www.wildlife.ca.gov/Conservation/Plants/Info). The Department recommends that floristic, alliance-based and/or association-based mapping and vegetation impact assessments be conducted at the Project site and neighboring vicinity. The Manual of California Vegetation, second edition, should also be used to inform this mapping and assessment (Sawyer et al. 2008[3]). Alternately, for assessing vegetation communities located in western San Diego County, the Vegetation Classification Manual for Western San Diego County (Sproul et al. 2011[4]) may be used. Adjoining habitat areas should be included in this assessment where site activities could lead to direct or indirect impacts offsite. Habitat mapping at the alliance level will help establish baseline vegetation conditions.

c) A current inventory of the biological resources associated with each habitat type on site and within the area of potential effect. The Department's California Natural Diversity Data Base in Sacramento should be contacted at http://www.wildlife.ca.gov/Data/CNDDB to obtain current information on any previously reported sensitive species and habitat, including Significant Natural Areas identified under Chapter 12 of the Fish and Game Code.

d) An inventory of rare, threatened, endangered and other sensitive species on site and within the area of potential effect. Species to be addressed should include all those which meet the CEQA definition (see CEQA Guidelines, § 15380). This should include sensitive fish, wildlife, reptile, and amphibian species. Seasonal variations in use of the project area should also be addressed. Focused species-specific surveys, conducted at the appropriate time of year and time of day when the sensitive species are active or otherwise identifiable, are required. Acceptable species-specific survey procedures should be developed in consultation with the Department and the U.S. Fish and Wildlife Service.

<u>Analyses of the Potential Project-Related Impacts on the Biological Resources</u>

7. To provide a thorough discussion of direct, indirect, and cumulative impacts expected to adversely affect biological resources, with specific measures to offset such impacts, the following should be addressed in the draft DEIR.

a) A discussion of potential adverse impacts from lighting, noise, human activity, exotic species, and drainage should also be included. The latter subject should address: project-related changes on drainage patterns on and downstream of the project site; the

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[3] Sawyer, J. O., T. Keeler-Wolf and J.M. Evens. 2009. <u>A Manual of California Vegetation, Second Edition</u>. California Native Plant Society Press, Sacramento.

[4] Sproul, F., T. Keeler-Wolf, P. Gordon-Reedy, J. Dunn, A. Klein and K. Harper. 2011. <u>Vegetation Classification Manual for Western San Diego County</u>. First Edition. Prepared by AECOM, California Department of Fish and Game Vegetation Classification and Mapping Program and Conservation Biology Institute for San Diego Association of Governments.

volume, velocity, and frequency of existing and post-project surface flows; polluted runoff; soil erosion and/or sedimentation in streams and water bodies; and post-project fate of runoff from the project site. The discussions should also address the proximity of the extraction activities to the water table, whether dewatering would be necessary, and the potential resulting impacts on the habitat, if any, supported by the groundwater. Mitigation measures proposed to alleviate such impacts should be included.

b) Discussions regarding indirect project impacts on biological resources, including resources in nearby public lands, open space, adjacent natural habitats, riparian ecosystems, and any designated and/or proposed or existing MHPA (e.g., preserve lands associated with the City's SAP). Impacts on, and maintenance of, wildlife corridor/movement areas, including access to undisturbed habitats in adjacent areas, should be fully evaluated in the draft DEIR.

c) The zoning of areas for development projects or other uses that are nearby or adjacent to natural areas may inadvertently contribute to wildlife-human interactions. A discussion of possible conflicts and mitigation measures to reduce these conflicts should be included in the environmental document.

Mitigation for the Project-related Biological Impacts

8. The draft DEIR should include measures to fully avoid and otherwise protect Rare Natural Communities from project-related impacts. The Department considers these communities as threatened habitats having both regional and local significance.

9. For proposed preservation and/or restoration, the draft DEIR should include measures to perpetually protect the targeted habitat values from direct and indirect negative impacts. Issues that should be addressed include restrictions on access, proposed land dedications, monitoring and management programs, control of illegal dumping, water pollution, increased human intrusion, etc.

10. The Department recommends that measures be taken to avoid project impacts to nesting birds. Migratory nongame native bird species are protected by international treaty under the Federal Migratory Bird Treaty Act (MBTA) of 1918 (Title 50, § 10.13, Code of Federal Regulations). Sections 3503.5 and 3513 of the California Fish and Game Code prohibit take of all raptors and other migratory nongame birds and section 3503 prohibits take of the nests and eggs of all birds. Proposed project activities (including, but not limited to, staging and disturbances to native and nonnative vegetation, structures, and substrates) should occur outside of the avian breeding season which generally runs from February 1-September 1 (as early as January 1 for some raptors) to avoid take of birds or their eggs. If avoidance of the avian breeding season is not feasible, the Department recommends surveys by a qualified biologist with experience in conducting breeding bird surveys to detect protected native birds occurring in suitable nesting habitat that is to be disturbed and (as access to adjacent areas allows) any other such habitat within 300 feet of the disturbance area (within 500 feet for raptors). Project personnel, including all contractors working on site, should be instructed on the sensitivity of the area. Reductions in the nest buffer distance may be appropriate depending on the avian species involved, ambient levels of human activity, screening vegetation, or possibly other factors.

11. The Department generally does not support the use of relocation, salvage, and/or transplantation as mitigation for impacts to rare, threatened, or endangered species. Studies have shown that these efforts are experimental in nature and largely unsuccessful.

12. Plans for restoration and revegetation should be prepared by persons with expertise in southern California ecosystems and native plant revegetation techniques. Each plan should include, at a minimum: (a) the location of the mitigation site; (b) the plant species to be used, container sizes, and seeding rates; (c) a schematic depicting the mitigation area; (d) planting schedule; (e) a description of the irrigation methodology; (f) measures to control exotic vegetation on site; (g) specific success criteria; (h) a detailed monitoring program; (i) contingency measures should the success criteria not be met; and (j) identification of the party responsible for meeting the success criteria and providing for conservation of the mitigation site in perpetuity

Sincerely,

Gail K. Sevrens
Environmental Program Manager
South Coast Region

ec: Patrick Gower (U.S. Fish and Wildlife Service)
Scott Morgan (State Clearinghouse)

The City of
SAN DIEGO
Planning Department

July 22, 2019

Ashley Wright, Senior Planner
San Diego Unified Port District
Planning Department
3165 Pacific Highway
San Diego, CA 92101

Subject: **CITY OF SAN DIEGO COMMENTS ON THE NOTICE OF PREPARATION OF A DRAFT ENVIRONMENTAL IMPACT REPORT FOR THE WETLANDS MITIGATION BANK AT POND 20 AND PORT MASTER PLAN AMENDMENT PROJECT (UPD #EIR-2019-010)**

Dear Ms. Wright:

The City of San Diego (City) Planning Department has received the Notice of Preparation (NOP) prepared by the San Diego Unified Port District (District) and distributed it to applicable City departments for review. The City, as a Responsible Agency under CEQA, has reviewed the NOP and appreciates this opportunity to provide comments to the District. The City looks forward to continued coordination with the District and other local, regional, state, and federal agencies. In response to this request for public comments, the City has the following comments on the NOP for your consideration.

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Planning Department, Multiple Species Conservation Program (MSCP) - Kristy Forburger, Senior Planner - KForburger@sandiego.gov, 619-236-6583

The proposed project site (the Bank Parcel and Parcels A and B) are located within the City of San Diego's Multi-Habitat Planning Area (MHPA) boundary of the Multiple Species Conservation Program (MSCP). The City of San Diego MHPA was developed by the City in cooperation with the Wildlife Agencies, Property Owners, Developers, and Environmental Groups. The Preserve Design Criteria contained in the MSCP Plan and the City Council adopted criteria for the creation of the MHPA were used as guides in the development of the City's MHPA. The Multi-Habitat Planning Area delineates core biological resource areas and corridors targeted for conservation.

1. The Initial Study Biological Resources IV (e) states "No Impact. Although the proposed project occurs within the boundaries of the City of San Diego Multiple Species Conservation Program and the City of San Diego Multiple Habitat Planning Area (City of San Diego 1997), the Multiple Species Conservation Program and Multiple Habitat Planning Area do not apply to projects within the jurisdiction of the District, including

the project." The DEIR should include discussion of the City's MHPA designation including the historical context of the conserved MHPA status located on the project site (The Bank Parcel). Additionally, MHPA designation and conservation status located on Parcels A and B should also be discussed and disclosed within the Land Use and Biological Resources sections of the Draft Environmental Impact Report (DEIR).

2. The City has developed the following general guideline for the Otay Mesa and Otay River Valley areas of the MHPA that should be discussed and disclosed within the DEIR as Guideline A-11 pertains to the proposed project site. The proposed wetland mitigation effort would implement Guideline A-11 of the City's MSCP Subarea Plan.

   Guideline A-11. The existing Western Salt Company salt extraction use is expected to continue for an undetermined period. The sensitive animal and plant species should continue to be managed to ensure protection. If the extraction use is terminated, the site should be converted to a use compatible with the resource goals and objectives of the MHPA and other regulations and policies applicable to the site, or enhanced/restored.

3. The DEIR should include MSCP consistency analysis against Section 1.4.2 of the MSCP Subarea Plan, General Planning Policies and Design Guidelines; Section 1.5.2, General Management Directives; and Section 1.4.3, Land Use Adjacency Guidelines. In particular, lighting, drainage, landscaping, grading, access, and noise must not adversely affect the MHPA. Please address the following applicable issues of the MHPA Land Use Adjacency Guideline's in the DEIR.

   <u>Lighting (Parcels A and B)</u>
   Lighting should be directed away from the MHPA, and shielded if necessary. Please see City of San Diego Municipal Code §142.0740 for further information if needed.

   <u>Drainage (Bank Parcel, A, and B)</u>
   Drainage should be directed away from the MHPA, or if not possible, must not drain directly into the MHPA. Instead, runoff should flow into sedimentation basins, grassy swales or mechanical trapping devices prior to draining into the MHPA.

   <u>Landscaping (Bank Parcel, A, and B)</u>
   No invasive plant species shall be planted in or adjacent to the MHPA.

   <u>Grading (Parcels A and B)</u>
   All manufactured slopes must be included within the development footprint and outside the MHPA.

   <u>Access (Bank Parcel, A, and B)</u>
   Access to the MHPA, if any, should be directed to minimize impacts and reduce impacts associated with domestic pet predation.

   <u>Noise (Bank Parcel, A, and B)</u>

Due to the site's location adjacent to and within the MHPA, construction noise will need to be avoided, if possible, during the breeding season of the least Bell's vireo (3/15-9/15) and southwestern willow flycatcher (5/1-8/30). If construction is proposed during the breeding season for these species, U.S. Fish and Wildlife Service protocol surveys will be required in order to determine species presence/absence. If the species is/are not identified within the MHPA, no additional measures will be required. If present, measures to minimize noise impacts will be required and should include temporary noise walls/berms. If a survey is not conducted and construction is proposed during the species' breeding season, presence would be assumed and a temporary wall/berm would be required. Noise levels from construction activities during the bird breeding season should not exceed 60 dBA hourly L_{EQ} at the edge of the occupied MHPA, or the ambient noise level if noise levels already exceed 60 dBA hourly L_{EQ}.

Planning Department, Long Range Planning – Elizabeth Ocampo Vivero, Senior Planner - EOcampo@sandiego.gov, 619-236-6301

The proposed project site within the City of San Diego Otay Mesa-Nestor Community Planning Area. The site is within the Special Study Area (SSA) overlay per the Otay Mesa-Nestor Community Plan (OMNCP).

1. The DEIR should include analysis of consistency between the proposed project and the Otay Mesa – Nestor Community Plan.

   Special Study Area – Intent and Criteria

   The OMNCP requires the preparation and adoption of a Special Study for properties within the SSA prior to or in conjunction with proposals for plan amendments, re-zones or other discretionary actions such as Planned Development Permits or Conditional Use Permits. The OMNCP indicates that the Special Study should comprehensively address all the property located within the designated SSA. (Refer to OMNCP pp. 90-92).

   The intent of the Special Study Area includes that the design of future development in this area shall be sensitive to, oriented towards, and enhance the adjacent open space of south San Diego Bay and the Otay River Valley. The Special Study is intended to consist of an ecological analysis of the SSA, assessing the biological, sensitive natural resources, natural habitat, and regional habitat and open space connectivity values with the SSA. The Special Study is also intended to assess the hydrological conditions and provide floodplain management recommendations to meet the needs for future development.

   Special Study Area – Supported Uses

   The OMNCP indicates that the SSA should become wholly or partially included in the future Otay Valley Regional Park (OVRP), the Multiple Species Conservation Program Preserve and/or the U.S. Fish and Wildlife Service proposed San Diego National Wildlife Refuge. The OMNCP also indicates that those areas not included should be used in ways which promote development and economic revitalization in the community, help to revitalize the Palm Avenue corridor, and improve public access and circulation in the community. (Refer to OMNCP p. 76)

2. Consider alternative use of all or portions of parcels A, B and C for passive and/or active recreation purposes which would provide greater public access and connections to and from the Otay Valley Regional Park, the Bayshore Bikeway, and/or the Palm Avenue corridor.

Police Department – Eddie Wallin, Police Officer – EWallin@pd.sandiego.gov, 619-531-2122

Area Station

Police service for the Wetlands Mitigation Bank Project will be provided by officers from the Southern Division, on beats 721, 722, and 724, located at 1120 27th Street, San Diego, CA 92154.

Current Staffing / Officer Availability

The Southern Division is currently staffed with 70 sworn personnel. The current patrol strength at the Southern Division is 56 uniformed patrol officers. Officers work ten-hour shifts. Staffing is comprised of three shifts which operate from 6:00 a.m. - 4:00 p.m. (First Watch), 2:00 p.m. - Midnight (Second Watch) and from 9:00 p.m. - 7:00 a.m. (Third Watch). Using the department's minimum staffing guidelines, the Southern Division currently deploys a minimum of 9 patrol officers on First Watch, 11 patrol officers on Second Watch and 7 patrol officers on Third Watch.

The San Diego Police Department does not staff individual stations based on ratios of sworn officers per 1,000 population ratio. The goal citywide is to maintain 1.48 officers per 1,000 population ratio.

Current Response Times

The police department currently utilizes a five level priority calls dispatch system, which includes priority E (Emergency), one, two, three and four. The calls are prioritized by the phone dispatcher and routed to the radio operator for dispatch to the field units. The priority system is designed as a guide, allowing the phone dispatcher and the radio dispatcher discretion to raise or lower the call priority as necessary based on the information received. Priority "E" and priority one calls involve serious crimes in progress or those with a potential for injury. Priority Two calls include vandalism, disturbances and property crimes. Priority Three includes calls after a crime has been committed, such as cold burglaries and loud music. Priority Four include calls include parking complaints or lost and found reports.

The Project is currently located within the boundaries of police beats 721, 722, and 724. The 2016 average response times for Beat 721 are 7.1 minutes for emergency calls, 13.8 minutes for priority one calls, 40.5 minutes for priority two calls, 91.6 minutes for priority three calls and 248.7 minutes for priority four calls. The 2016 average response times for Beat 722 are 6.3 minutes for emergency calls, 14.1 minutes for priority one calls, 35.0 minutes for priority two calls, 95.3 minutes for priority three calls and 195.8 minutes for priority four calls. The 2016 average response times for Beat 724 are 5.6 minutes for emergency calls, 13.0 minutes for priority one calls, 38.5 minutes for priority two calls, 95.4 minutes for priority three calls and 227.0 minutes for priority four calls.

The department's response time goals are 7 minutes for emergency calls, 14 minutes for priority one calls, 27 minutes for priority two calls, 80 minutes for priority three calls and 90 minutes for priority four calls. The citywide average response times, for the same period, were 7.0 minutes for emergency calls, 16.0 minutes for priority one calls, 42.5 minutes for priority two calls, 100.9 minutes for priority three calls and 150.6 minutes for priority four calls during that same time period. The department strives to maintain the response time goals as one of various other measures used to assess the level of service to the community.

Potential Mitigation Measures to Response Time

The department's current staffing ratio of 1.34 officers per 1,000 residents is based on a 2014 estimated residential population of 1,311,882. The ratio is calculated to take into account all support and investigative positions within the department. This ratio does not include the significant population increase resulting from employees who commute to work from outside of the City of San Diego or those visiting.

Long-Term (Community Plan Build-Out) Post-Project Response Time

There are no current plans for additional police sub-stations in the immediate area. Police response times in this community will continue to increase with the build-out of community plans and the increase of traffic generated by new growth. A Crime Prevention through Environmental Design Review (CPTED) is recommended by the police department to address general security concerns.

Public Utilities Department – Staci Domasco, Senior Planner – SDomasco@sandiego.gov, 858-292-6409

1. A City of San Diego Public Utilities Department (PUD) 30" trunk sewer pipeline and associated easement are located within the proposed Site Boundary per Figure 2 of the NOP. The City's PUD cannot determine if the pipeline falls entirely within "Parcel C," or if it also straddles the "Bank Parcel." The City requests that the District exclude the PUD pipeline and easement from the "Bank Parcel." In that case, the City's utility would fall entirely within "Parcel C," and the City requests the District include in the PMPA for Parcel C a description of this sewer pipe, associated easement, access needs for inspection and or sewer maintenance activities. In addition, the City requests that the pipeline and associated easement be considered when determining the land use designation of "Parcel C." Areas within pipeline easements cannot be preserved in perpetuity and are not appropriate as compensatory mitigation.
2. In addition, the City's PUD does have other pipelines and the Otay River Sewer Pump Station facility is directly adjacent to the Site Boundary. Please see the attached figure that depicts the location of the City's PUD pipelines and facilities located within and adjacent to the project boundary.

3. The City requests that the District coordinate and review project plans with the City's PUD to ensure no damage will occur to the City's utilities and that there is no operational conflict with the project and ongoing maintenance of the sewer infrastructure in the area.

Transportation & Storm Water Department – Mark Stephens, Associate Planner – MGStephens@sandiego.gov, 858-541-4361

1. The Notice of Preparation (NOP) and Initial Study/Environmental Checklist appropriately identify Hydrology and Water Quality and Utilities and Service Systems (which include storm water drainage) as areas with potentially significant environmental impacts to be addressed in the Draft Environmental Impact Report (EIR).

● ● ●

Thank you for the opportunity to provide comments on the NOP. Please contact me directly if there are any questions regarding the contents of this letter or if the District would like to meet with City staff to discuss our comments. Please feel free to contact Rebecca Malone, Senior Planner, directly via email at RMalone@sandiego.gov or by phone at 619-446-5371.

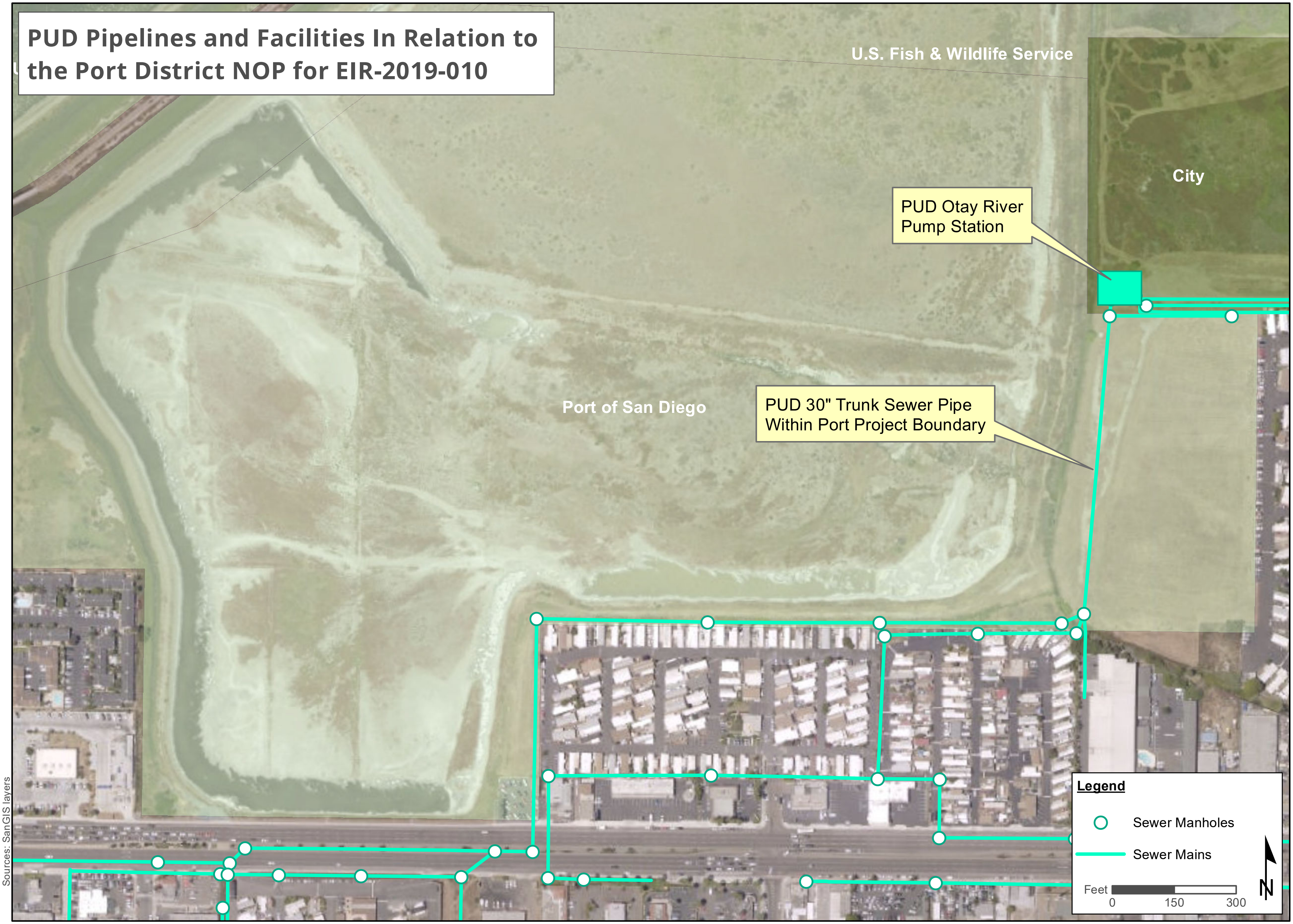
Sincerely,

Heidi Vonblum, Program Manager
Planning Department

RM/ep

cc: Reviewing Departments (via email)
Review and Comment online file

PUD Pipelines and Facilities In Relation to the Port District NOP for EIR-2019-010



Public Utilities Department

California
Department of Conservation
Division of Oil, Gas, and Geothermal Resources

Gavin Newsom, Governor
David Bunn, Director

July 22, 2019

VIA EMAIL

Ms. Ashley Wright
San Diego Unified Port District, Planning Department
3165 Pacific Highway
San Diego, CA 92101
Email: **awright@portofsandiego.org**

Dear Ms. Wright:

NOTICE OF PREPARATION OF A DRAFT ENVIRONMENTAL IMPACT REPORT
WETLANDS MITIGATION BANK AT POND 20 AND PORT MASTER PLAN AMENDMENT
(UPD #EIR-2019-010)
SAN DIEGO UNIFIED PORT DISTRICT
SCH: NO. 2019060167

The Department of Conservation's Division of Oil, Gas, and Geothermal Resources (Division) has reviewed the above-referenced project for impacts with Division jurisdictional authority. The Division supervises the drilling, maintenance, and plugging and abandonment of oil, gas, and geothermal wells in California. The Division offers the following comments for your consideration.

The project area is in San Diego County and lies outside any administrative oil field boundary. Division records indicate the presence of no active oil and gas (O&G) wells and one plugged O&G well. Division information can be found at: www.conservation.ca.gov. Individual well records are also available on the Division's web site, or by emailing dogdist1@conservation.ca.gov.

The scope and content of information that is germane to the Division's responsibility are contained in Section 3000 et seq. of the Public Resources Code, and administrative regulations under Title 14, Division 2, Chapters 2, 3 and 4 of the California Code of Regulations.

If any wells, including any plugged, abandoned or unrecorded wells, are damaged or uncovered during excavation or grading, remedial plugging operations may be required. If such damage or discovery occurs, the Division's district office must be contacted to obtain information on the requirements and approval to perform remedial operations.

The possibility for future problems from oil and gas wells that have been plugged and abandoned, or reabandoned, to the Division's current specifications are remote. However, the Division recommends that a diligent effort be made to avoid building over any plugged and abandoned well.

Questions regarding the Division's Construction Site Well Review Program can be addressed to the local Division's office in Long Beach by emailing DOGDIST1@conservation.ca.gov or by calling (562) 637-4400.

Sincerely,

Curtis M. Welty

Curtis M. Welty, PG
Associate Oil and Gas Engineer

cc: The State Clearinghouse in the Office of Planning and Research
Email: state.clearinghouse@opr.ca.gov

Christine Hansen, DOC OGER
Email: Christine.Hansen@conservation.ca.gov

Vanessa Adame, DOC OGER
Email: Vanessa.Adame@conservation.ca.gov

Naveen Habib, DOC OGER
Email: Naveen.Habib@conservation.ca.gov

Jan Perez, DOGGR CEQA Unit
Email: Jan.Perez@conservation.ca.gov

Environmental CEQA File

STATE OF CALIFORNIA—CALIFORNIA STATE TRANSPORTATION AGENCY Gavin Newsom, Governor

DEPARTMENT OF TRANSPORTATION
DISTRICT 11
4050 TAYLOR STREET, MS-240
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Making Conservation
a California Way of Life.

July 22, 2019

11-SD-75
PM 9.89
Wetland Mitigation Bank at Pond 20 and Port Master Plan Amendment
NOP/SCH#2019060167

Ms. Ashley Wright
Senior Planner
Port of San Diego
3165 Pacific Hwy
San Diego, CA 92101

Dear Ms. Wright,

Thank you for including the California Department of Transportation (Caltrans) in the environmental review process for the Notice of Preparation (NOP) for the Wetland Mitigation Bank at Pond 20 and Port Master Plan Amendment located near State Route 75 (SR-75). The mission of Caltrans is to provide a safe, sustainable, integrated and efficient transportation system to enhance California's economy and livability. The Local Development-Intergovernmental Review (LD-IGR) Program reviews land use projects and plans to ensure consistency with our mission and state planning priorities.

Caltrans has the following comments:

Traffic Impact Study

A traffic impact study (TIS) is necessary to determine this proposed project's near-term and long-term impacts to the State facilities – existing and proposed – and to propose appropriate mitigation measures.

- Palm Avenue (SR-75) and Interstate 5 (I-5). The geographic area examined in the TIS should also include, at a minimum, all regionally significant arterial system segments and intersections, including State highway facilities where the project will add over 100 peak hour trips. State highway facilities that are experiencing noticeable delays should be analyzed in the scope of the traffic study for projects that add 50 to 100 peak hour trips.

- A focused analysis may be required for project trips assigned to a State highway facility that is experiencing significant delay, such as where traffic queues exceed ramp storage capacity.
- In addition, the TIS could also consider implementing vehicles miles traveled (VMT) analysis into their modeling projections.
- Any increase in goods movement operations and its impacts to State highway facilities should be addressed in the TIS.
- The data used in the TIS should not be more than 2 years old.
- Please provide Synchro Version 10 files.
- Early coordination with Caltrans is recommended.

Hydrology and Drainage Studies

- Please provide hydraulics studies, drainage and grading plans to Caltrans for review.
- Provide a pre and post-development hydraulics and hydrology study. Show drainage configurations and patterns.
- Provide drainage plans and details. Include detention basin details of inlets/outlet.
- Provide a contour grading plan with legible callouts and minimal building data. Show drainage patterns.
- On all plans, show Caltrans' Right of Way (R/W).

Complete Streets and Mobility Network

Caltrans views all transportation improvements as opportunities to improve safety, access and mobility for all travelers in California and recognizes bicycle, pedestrian and transit modes as integral elements of the transportation system. Caltrans supports improved transit accommodation through the provision of Park and Ride facilities, improved bicycle and pedestrian access and safety improvements, signal prioritization for transit, bus on shoulders, ramp improvements, or other enhancements that promotes a complete and integrated transportation system. Early coordination with Caltrans, in locations that may affect both Caltrans and the City of San Diego, San Diego Unified Port District or other lead agency, is encouraged.

To reduce greenhouse gas emissions and achieve California's Climate Change target, Caltrans is implementing Complete Streets and Climate Change policies into State Highway Operations and Protection Program (SHOPP) projects to meet multi-modal mobility needs. Caltrans looks forward to working with the City to evaluate potential Complete Streets projects.

Traffic Control Plan/Hauling

Caltrans has discretionary authority with respect to highways under its jurisdiction and may, upon application and if good cause appears, issue a special permit to operate or move a vehicle or combination of vehicles or special mobile equipment of a size or weight of vehicle or load exceeding the maximum limitations specified in the California Vehicle Code. The Caltrans Transportation Permits Issuance Branch is responsible for the issuance of these special transportation permits for oversize/overweight vehicles on the State Highway System. Additional information is provided online at:
http://www.dot.ca.gov/trafficops/permits/index.html

A Traffic Control Plan is to be submitted to Caltrans District 11, including the interchanges at I-5/Palm Avenue, at least 30 days prior to the start of any construction. Traffic shall not be unreasonably delayed. The plan shall also outline suggested detours to use during closures, including routes and signage.

Potential impacts to the highway facilities (I-5 and Palm Avenue) and traveling public from the detour, demolition and other construction activities should be discussed and addressed before construction activity begins.

Mitigation

Caltrans endeavors that any direct and cumulative impacts to the State Highway System be eliminated or reduced to a level of insignificance pursuant to the California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA) standards.

Mitigation measures to State facilities should be included in TIS/TIA. Mitigation identified in the traffic study, subsequent environmental documents, and mitigation monitoring reports, should be coordinated with Caltrans to identify and implement the appropriate mitigation. This includes the actual implementation and collection of any "fair share" monies, as well as the appropriate timing of the mitigation. Mitigation improvements should be compatible with Caltrans concepts.

Right-of-Way

Any work performed within Caltrans' R/W will require discretionary review and approval by Caltrans and an encroachment permit will be required for any work within the Caltrans' R/W prior to construction. As part of the encroachment permit process, the applicant must provide an approved final environmental document including the CEQA determination addressing any environmental impacts within the Caltrans' R/W, and any corresponding technical studies.

If you have any questions, please contact Mark McCumsey, of the Caltrans Development Review Branch, at (619) 688-6802 or by e-mail sent to mark.mccumsey@dot.ca.gov

Sincerely,

MAURICE EATON, Branch Chief
Local Development and Intergovernmental Review Branch

STATE OF CALIFORNIA Gavin Newsom, Governor

NATIVE AMERICAN HERITAGE COMMISSION
Cultural and Environmental Department
1550 Harbor Blvd., Suite 100
West Sacramento, CA 95691 Phone (916) 373-3710
Email: nahc@nahc.ca.gov
Website: http://www.nahc.ca.gov
Twitter: @CA_NAHC

RECEIVED
JUL 05 2019
Planning & Green Port

July 1, 2019

Ashley Wright
San Diego Unified Port District
3165 Pacific Hwy
San Diego, CA 92101

RE: SCH# 2019060167 Wetland Mitigation Bank at Pond 20 and Port Master Plan Amendment, San Diego County

Dear Ms. Wright:

The Native American Heritage Commission (NAHC) has received the Notice of Preparation (NOP), Draft Environmental Impact Report (DEIR) or Early Consultation for the project referenced above. The California Environmental Quality Act (CEQA) (Pub. Resources Code §21000 et seq.), specifically Public Resources Code §21084.1, states that a project that may cause a substantial adverse change in the significance of a historical resource, is a project that may have a significant effect on the environment. (Pub. Resources Code § 21084.1; Cal. Code Regs., tit.14, §15064.5 (b) (CEQA Guidelines §15064.5 (b)). If there is substantial evidence, in light of the whole record before a lead agency, that a project may have a significant effect on the environment, an Environmental Impact Report (EIR) shall be prepared. (Pub. Resources Code §21080 (d); Cal. Code Regs., tit. 14, § 5064 subd.(a)(1) (CEQA Guidelines §15064 (a)(1)). In order to determine whether a project will cause a substantial adverse change in the significance of a historical resource, a lead agency will need to determine whether there are historical resources within the area of potential effect (APE).

CEQA was amended significantly in 2014. Assembly Bill 52 (Gatto, Chapter 532, Statutes of 2014) (AB 52) amended CEQA to create a separate category of cultural resources, "tribal cultural resources" (Pub. Resources Code §21074) and provides that a project with an effect that may cause a substantial adverse change in the significance of a tribal cultural resource is a project that may have a significant effect on the environment. (Pub. Resources Code §21084.2). Public agencies shall, when feasible, avoid damaging effects to any tribal cultural resource. (Pub. Resources Code §21084.3 (a)). **AB 52 applies to any project for which a notice of preparation, a notice of negative declaration, or a mitigated negative declaration is filed on or after July 1, 2015.** If your project involves the adoption of or amendment to a general plan or a specific plan, or the designation or proposed designation of open space, on or after March 1, 2005, it may also be subject to Senate Bill 18 (Burton, Chapter 905, Statutes of 2004) (SB 18). **Both SB 18 and AB 52 have tribal consultation requirements.** If your project is also subject to the federal National Environmental Policy Act (42 U.S.C. § 4321 et seq.) (NEPA), the tribal consultation requirements of Section 106 of the National Historic Preservation Act of 1966 (154 U.S.C. 300101, 36 C.F.R. §800 et seq.) may also apply.

The NAHC recommends consultation with California Native American tribes that are traditionally and culturally affiliated with the geographic area of your proposed project as early as possible in order to avoid inadvertent discoveries of Native American human remains and best protect tribal cultural resources. Below is a brief summary of portions of AB 52 and SB 18 as well as the NAHC's recommendations for conducting cultural resources assessments.

Consult your legal counsel about compliance with AB 52 and SB 18 as well as compliance with any other applicable laws.

AB 52

AB 52 has added to CEQA the additional requirements listed below, along with many other requirements:

1. Fourteen Day Period to Provide Notice of Completion of an Application/Decision to Undertake a Project: Within fourteen (14) days of determining that an application for a project is complete or of a decision by a public agency to undertake a project, a lead agency shall provide formal notification to a designated contact of, or tribal representative of, traditionally and culturally affiliated California Native American tribes that have requested notice, to be accomplished by at least one written notice that includes:
    a. A brief description of the project.
    b. The lead agency contact information.
    c. Notification that the California Native American tribe has 30 days to request consultation. (Pub. Resources Code §21080.3.1 (d)).
    d. A "California Native American tribe" is defined as a Native American tribe located in California that is on the contact list maintained by the NAHC for the purposes of Chapter 905 of Statutes of 2004 (SB 18). (Pub. Resources Code §21073).

2. Begin Consultation Within 30 Days of Receiving a Tribe's Request for Consultation and Before Releasing a Negative Declaration, Mitigated Negative Declaration, or Environmental Impact Report: A lead agency shall begin the consultation process within 30 days of receiving a request for consultation from a California Native American tribe that is traditionally and culturally affiliated with the geographic area of the proposed project. (Pub. Resources Code §21080.3.1, subds. (d) and (e)) and prior to the release of a negative declaration, mitigated negative declaration or Environmental Impact Report. (Pub. Resources Code §21080.3.1(b)).
    a. For purposes of AB 52, "consultation shall have the same meaning as provided in Gov. Code §65352.4 (SB 18). (Pub. Resources Code §21080.3.1 (b)).

3. Mandatory Topics of Consultation If Requested by a Tribe: The following topics of consultation, if a tribe requests to discuss them, are mandatory topics of consultation:
    a. Alternatives to the project.
    b. Recommended mitigation measures.
    c. Significant effects. (Pub. Resources Code §21080.3.2 (a)).

4. Discretionary Topics of Consultation: The following topics are discretionary topics of consultation:
    a. Type of environmental review necessary.
    b. Significance of the tribal cultural resources.
    c. Significance of the project's impacts on tribal cultural resources.
    d. If necessary, project alternatives or appropriate measures for preservation or mitigation that the tribe may recommend to the lead agency. (Pub. Resources Code §21080.3.2 (a)).

5. Confidentiality of Information Submitted by a Tribe During the Environmental Review Process: With some exceptions, any information, including but not limited to, the location, description, and use of tribal cultural resources submitted by a California Native American tribe during the environmental review process shall not be included in the environmental document or otherwise disclosed by the lead agency or any other public agency to the public, consistent with Government Code §6254 (r) and §6254.10. Any information submitted by a California Native American tribe during the consultation or environmental review process shall be published in a confidential appendix to the environmental document unless the tribe that provided the information consents, in writing, to the disclosure of some or all of the information to the public. (Pub. Resources Code §21082.3 (c)(1)).

6. Discussion of Impacts to Tribal Cultural Resources in the Environmental Document: If a project may have a significant impact on a tribal cultural resource, the lead agency's environmental document shall discuss both of the following:
    a. Whether the proposed project has a significant impact on an identified tribal cultural resource.
    b. Whether feasible alternatives or mitigation measures, including those measures that may be agreed to pursuant to Public Resources Code §21082.3, subdivision (a), avoid or substantially lessen the impact on the identified tribal cultural resource. (Pub. Resources Code §21082.3 (b)).

7. Conclusion of Consultation: Consultation with a tribe shall be considered concluded when either of the following occurs:
    - a. The parties agree to measures to mitigate or avoid a significant effect, if a significant effect exists, on a tribal cultural resource; or
    - b. A party, acting in good faith and after reasonable effort, concludes that mutual agreement cannot be reached. (Pub. Resources Code §21080.3.2 (b)).

8. Recommending Mitigation Measures Agreed Upon in Consultation in the Environmental Document: Any mitigation measures agreed upon in the consultation conducted pursuant to Public Resources Code §21080.3.2 shall be recommended for inclusion in the environmental document and in an adopted mitigation monitoring and reporting program, if determined to avoid or lessen the impact pursuant to Public Resources Code §21082.3, subdivision (b), paragraph 2, and shall be fully enforceable. (Pub. Resources Code §21082.3 (a)).

9. Required Consideration of Feasible Mitigation: If mitigation measures recommended by the staff of the lead agency as a result of the consultation process are not included in the environmental document or if there are no agreed upon mitigation measures at the conclusion of consultation, or if consultation does not occur, and if substantial evidence demonstrates that a project will cause a significant effect to a tribal cultural resource, the lead agency shall consider feasible mitigation pursuant to Public Resources Code §21084.3 (b). (Pub. Resources Code §21082.3 (e)).

10. Examples of Mitigation Measures That, If Feasible, May Be Considered to Avoid or Minimize Significant Adverse Impacts to Tribal Cultural Resources:
    - a. Avoidance and preservation of the resources in place, including, but not limited to:
        - i. Planning and construction to avoid the resources and protect the cultural and natural context.
        - ii. Planning greenspace, parks, or other open space, to incorporate the resources with culturally appropriate protection and management criteria.
    - b. Treating the resource with culturally appropriate dignity, taking into account the tribal cultural values and meaning of the resource, including, but not limited to, the following:
        - i. Protecting the cultural character and integrity of the resource.
        - ii. Protecting the traditional use of the resource.
        - iii. Protecting the confidentiality of the resource.
    - c. Permanent conservation easements or other interests in real property, with culturally appropriate management criteria for the purposes of preserving or utilizing the resources or places.
    - d. Protecting the resource. (Pub. Resource Code §21084.3 (b)).
    - e. Please note that a federally recognized California Native American tribe or a non-federally recognized California Native American tribe that is on the contact list maintained by the NAHC to protect a California prehistoric, archaeological, cultural, spiritual, or ceremonial place may acquire and hold conservation easements if the conservation easement is voluntarily conveyed. (Civ. Code §815.3 (c)).
    - f. Please note that it is the policy of the state that Native American remains and associated grave artifacts shall be repatriated. (Pub. Resources Code §5097.991).

11. Prerequisites for Certifying an Environmental Impact Report or Adopting a Mitigated Negative Declaration or Negative Declaration with a Significant Impact on an Identified Tribal Cultural Resource: An Environmental Impact Report may not be certified, nor may a mitigated negative declaration or a negative declaration be adopted unless one of the following occurs:
    - a. The consultation process between the tribes and the lead agency has occurred as provided in Public Resources Code §21080.3.1 and §21080.3.2 and concluded pursuant to Public Resources Code §21080.3.2.
    - b. The tribe that requested consultation failed to provide comments to the lead agency or otherwise failed to engage in the consultation process.
    - c. The lead agency provided notice of the project to the tribe in compliance with Public Resources Code §21080.3.1 (d) and the tribe failed to request consultation within 30 days. (Pub. Resources Code §21082.3 (d)).

The NAHC's PowerPoint presentation titled, "Tribal Consultation Under AB 52: Requirements and Best Practices" may be found online at: http://nahc.ca.gov/wp-content/uploads/2015/10/AB52TribalConsultation_CalEPAPDF.pdf

SB 18

SB 18 applies to local governments and requires local governments to contact, provide notice to, refer plans to, and consult with tribes prior to the adoption or amendment of a general plan or a specific plan, or the designation of open space. (Gov. Code §65352.3). Local governments should consult the Governor's Office of Planning and Research's "Tribal Consultation Guidelines," which can be found online at: https://www.opr.ca.gov/docs/09_14_05_Updated_Guidelines_922.pdf

Some of SB 18's provisions include:

1. Tribal Consultation: If a local government considers a proposal to adopt or amend a general plan or a specific plan, or to designate open space it is required to contact the appropriate tribes identified by the NAHC by requesting a "Tribal Consultation List." If a tribe, once contacted, requests consultation the local government must consult with the tribe on the plan proposal. **A tribe has 90 days from the date of receipt of notification to request consultation unless a shorter timeframe has been agreed to by the tribe.** (Gov. Code §65352.3 (a)(2)).
2. No Statutory Time Limit on SB 18 Tribal Consultation. There is no statutory time limit on SB 18 tribal consultation.
3. Confidentiality: Consistent with the guidelines developed and adopted by the Office of Planning and Research pursuant to Gov. Code §65040.2, the city or county shall protect the confidentiality of the information concerning the specific identity, location, character, and use of places, features and objects described in Public Resources Code §5097.9 and §5097.993 that are within the city's or county's jurisdiction. (Gov. Code §65352.3 (b)).
4. Conclusion of SB 18 Tribal Consultation: Consultation should be concluded at the point in which:
    a. The parties to the consultation come to a mutual agreement concerning the appropriate measures for preservation or mitigation; or
    b. Either the local government or the tribe, acting in good faith and after reasonable effort, concludes that mutual agreement cannot be reached concerning the appropriate measures of preservation or mitigation. (Tribal Consultation Guidelines, Governor's Office of Planning and Research (2005) at p. 18).

Agencies should be aware that neither AB 52 nor SB 18 precludes agencies from initiating tribal consultation with tribes that are traditionally and culturally affiliated with their jurisdictions before the timeframes provided in AB 52 and SB 18. For that reason, we urge you to continue to request Native American Tribal Contact Lists and "Sacred Lands File" searches from the NAHC. The request forms can be found online at: http://nahc.ca.gov/resources/forms/

NAHC Recommendations for Cultural Resources Assessments

To adequately assess the existence and significance of tribal cultural resources and plan for avoidance, preservation in place, or barring both, mitigation of project-related impacts to tribal cultural resources, the NAHC recommends the following actions:

1. Contact the appropriate regional California Historical Research Information System (CHRIS) Center (http://ohp.parks.ca.gov/?page_id=1068) for an archaeological records search. The records search will determine:
    a. If part or all of the APE has been previously surveyed for cultural resources.
    b. If any known cultural resources have already been recorded on or adjacent to the APE.
    c. If the probability is low, moderate, or high that cultural resources are located in the APE.
    d. If a survey is required to determine whether previously unrecorded cultural resources are present.

2. If an archaeological inventory survey is required, the final stage is the preparation of a professional report detailing the findings and recommendations of the records search and field survey.
    a. The final report containing site forms, site significance, and mitigation measures should be submitted immediately to the planning department. All information regarding site locations, Native American human remains, and associated funerary objects should be in a separate confidential addendum and not be made available for public disclosure.
    b. The final written report should be submitted within 3 months after work has been completed to the appropriate regional CHRIS center.

3. Contact the NAHC for:
    a. A Sacred Lands File search. Remember that tribes do not always record their sacred sites in the Sacred Lands File, nor are they required to do so. A Sacred Lands File search is not a substitute for consultation with tribes that are traditionally and culturally affiliated with the geographic area of the project's APE.
    b. A Native American Tribal Consultation List of appropriate tribes for consultation concerning the project site and to assist in planning for avoidance, preservation in place, or, failing both, mitigation measures.

4. Remember that the lack of surface evidence of archaeological resources (including tribal cultural resources) does not preclude their subsurface existence.
    a. Lead agencies should include in their mitigation and monitoring reporting program plan provisions for the identification and evaluation of inadvertently discovered archaeological resources per Cal. Code Regs., tit. 14, §15064.5(f) (CEQA Guidelines §15064.5(f)). In areas of identified archaeological sensitivity, a certified archaeologist and a culturally affiliated Native American with knowledge of cultural resources should monitor all ground-disturbing activities.
    b. Lead agencies should include in their mitigation and monitoring reporting program plans provisions for the disposition of recovered cultural items that are not burial associated in consultation with culturally affiliated Native Americans.
    c. Lead agencies should include in their mitigation and monitoring reporting program plans provisions for the treatment and disposition of inadvertently discovered Native American human remains. Health and Safety Code §7050.5, Public Resources Code §5097.98, and Cal. Code Regs., tit. 14, §15064.5, subdivisions (d) and (e) (CEQA Guidelines §15064.5, subds. (d) and (e)) address the processes to be followed in the event of an inadvertent discovery of any Native American human remains and associated grave goods in a location other than a dedicated cemetery.

If you have any questions or need additional information, please contact me at my

email address: Steven.Quinn@nahc.ca.gov.

Sincerely,

Nancy Gonzalez

for
Steven Quinn
Associate Governmental Program Analyst

cc: State Clearinghouse

STATE OF CALIFORNIA—CALIFORNIA STATE TRANSPORTATION AGENCY Gavin Newsom, Governor

DEPARTMENT OF TRANSPORTATION
DISTRICT 11
4050 TAYLOR STREET, MS-240
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www.dot.ca.gov

Making Conservation
a California Way of Life.

May 1, 2020

11-SD-75
PM 9.89
Wetland Mitigation Bank at Pond 20 and Port Master Plan Amendment
NOP/SCH#2019060167

Ms. Ashley Wright
Senior Planner
Port of San Diego
3165 Pacific Hwy
San Diego, CA 92101

Dear Ms. Wright,

Thank you for including the California Department of Transportation (Caltrans) in the environmental review process for the Notice of Preparation (NOP) of the Draft Environmental Impact Report (DEIR) for the Wetland Mitigation Bank at Pond 20 and Port Master Plan Amendment located near State Route 75 (SR-75). The mission of Caltrans is to provide a safe, sustainable, integrated and efficient transportation system to enhance California's economy and livability. The Local Development-Intergovernmental Review (LD-IGR) Program reviews land use projects and plans to ensure consistency with our mission and state planning priorities.

Caltrans welcomes the opportunity to be a Responsible Agency under the California Environmental Quality Act (CEQA), should any portion of the project require our discretionary authority through the form of an encroachment permit process. We look forward to the coordination of our efforts to ensure that Caltrans can adopt the Environmental Impact Report (EIR) for any impacts to our R/W and/or mitigation measures for our R/W. We would appreciate meeting with you to discuss the elements that Caltrans will use or review for subsequent environmental compliance.

An encroachment permit will be required for any work within the Caltrans' R/W prior to construction. As part of the encroachment permit process, the applicant must provide approved final environmental documents for this project, corresponding technical studies, and necessary regulatory and resource agency permits. Specifically, CEQA determination or exemption. The supporting documents must address all environmental impacts within the Caltrans' R/W and address any impacts from avoidance and/or mitigation measures.

Caltrans has the following additional comments:

Environmental

We recommend that this project specifically identifies and assesses potential impacts caused by the project or impacts from mitigation efforts that occur within Caltrans R/W that includes impacts to the natural environment, infrastructure (highways/roadways/on-ramps and off-ramps) and appurtenant features (including but not limited to lighting/signs/guardrail/slopes). Caltrans is interested in the analysis for resources listed in the NOP.

Traffic Impact Study

1. A Vehicle Miles of Travel (VMT) based Transportation Impact Study (TIS) should be prepared for the proposed project.

2. Caltrans references the Governor's Office of Planning and Research (OPR) Senate Bill 743 based *Technical Advisory on Evaluating Transportation Impacts in CEQA* (December 2018) for guidance on the development of VMT based Transportation Impact Studies. Caltrans recommends use of OPR's significance thresholds for determination of transportation impacts from land use projects. OPR's *Technical Advisory on Evaluating Transportation Impacts in CEQA* is available online at http://opr.ca.gov/ceqa/updates/sb-743/.

If you have any questions, please contact Mark McCumsey, of the Caltrans Development Review Branch, at (619) 688-6802 or by e-mail sent to mark.mccumsey@dot.ca.gov

Sincerely,

electronically signed by

MAURICE EATON, Branch Chief
Local Development and Intergovernmental Review Branch

Wetland Mitigation Bank at Pond 20 and Port Master Plan Amendment
Environmental Impact Report (EIR)

COMMENTS REGARDING SCOPE OF DRAFT EIR

PLEASE PRINT CLEARLY

NAME: MICHAEL WILLIAMS

ORGANIZATION: SELF

MAILING ADDRESS: 904 SEAVIEW DR. IMPERIAL BEACH, CA 91932

EMAIL ADDRESS: MICHAELWAYNE998@HOTMAIL.COM

****

COMMENTS:

THIS WILL RESULT IN A MARSH WITH LIMITED FINANCIAL BENEFIT TO THE PORT + CITIES. IT HAS LITTLE BENEFIT FOR THE CITIZENS OF THE SOUTH BAY. A MISSED OPPORTUNITY,

PLEASE SEE ATTACHED.

Written comments will be accepted until 5 p.m. on Monday, July 22, 2019.

Please submit written comments via personal delivery or mail service to:
San Diego Unified Port District
Attn: Ashley Wright, Planning Department
3165 Pacific Highway, San Diego, CA 92101

or email to: awright@portofsandiego.org

Questions? Contact Ashley Wright at (619) 686-6549

POND 20 -- CONCEPT IDEA - "THE SALT WORKS"

Such a project would be highly beneficial to Imperial Beach and the South Bay, both financially and environmentally. It would certainly be a great improvement over the current hideous empty space that collects trash. The decorative fence has improved it but the Pond is simply an eyesore.

As the climate changes with expected sea level rise, dredging Pond 20 provides another location for seawater to expand. Excavated material from the Pond could be used elsewhere in Imperial Beach to help build berms to protect the town from future flooding. If there is insufficient seawater available to keep Pond 20 filled, excess water from the South Bay Water Reclamation Plant that is currently pumped off-shore via the Ocean Outfall could be used to supply supplemental water, rich in nutrients, for possible aquaculture purposes in Pond 20.

The concept is to create a water expansion of the bay, so in fact it creates a "wetland" area, thus could still be a mitigation bank.

- Dredge the pond to increase its depth and cut a channel to the Bay to allow water to fill the pond.
- The pond could then be used for multiple purposes to include small aquaculture, eel grass cultivation, a possible habitat for sea turtles, in addition to recreational and commercial uses.
- The pond could provide a safe area for kayaking, canoeing, electric or paddle boating, types of recreational activity not readily available in the South Bay, particularly Imperial Beach and the Egger Highlands part of San Diego.
- Build a "light house" type of structure on the Bikeway, possibly with a rotating non-navigation light (blue?) to highlight the location but that could also be used as a daytime viewing platform for birdwatchers. The South Bay is a favorite destination of those looking at unique waterfowl.
- Include floating houseboats that could be used as small shops, overnight lodging, and dining. Sausalito, CA, Aberdeen Floating Village, Hong Kong, and Ha Long Bay Floating Village, Vietnam are tourist attractions with floating structures. Houseboats for actual low cost housing would also be a possibility and tied to the current trailer park.
- In Baja del Sur, Mexico is trying to reintroduce a certain species of mangrove to help restore some wetlands. Pond 20 could also include a tree restoration project, perhaps along the boundaries of the pond. Tree growth would also help mitigate CO2 as part of an overall climate change environmental program.

Such a project meets the PD 7 PMPU STANDARDS that include:

- Allow for habitat restoration, habitat replacement, and habitat enhancement to improve the quality of coastal resources and ecosystems.
- Protect coastal wetlands and marine ecosystem areas within this planning district.
- Identify and potentially establish opportunities for mitigation banking, as appropriate.

- Maintain connections between the Bayshore Bikeway and Tidelands within the planning district.
- Coordinate bayfront access and uses with resource management agencies and the adjacent jurisdictions.
- Allow aquaculture and blue technology activities where complementary to adjacent natural resources and where impacts are limited or mitigated.

Michael Williams
Imperial Beach, CA

Wetland Mitigation Bank at Pond 20 and Port Master Plan Amendment
Environmental Impact Report (EIR)

COMMENTS REGARDING SCOPE OF DRAFT EIR

PLEASE PRINT CLEARLY

NAME: JACLYN FARRINGTON "JACKI"

ORGANIZATION: BAYSIDE VILLAS HOA BOARD

MAILING ADDRESS: 627 13TH ST #20 SAN DIEGO, CA 92154

EMAIL ADDRESS: jkfsd@sbcglobal.net

****

COMMENTS: Please restore Parcel A. I have seen a red fox and heard clapper rails. ~~we~~ I suggest you increase the height of the nesting platform on the upland. The palm tree is taller, so the ospreys have not used it. They roost, but have not nested. I have seen red-tailed and red-shouldered hawks, owls, and gopher snakes on parcel A.

We are concerned with the safety of the berm on the west side, next to and adjacent to our condos. Will it affect our flood rating? Is there a plan to reinforce the berms?

What is planned for noise & dust mitigation?

Written comments will be accepted until 5 p.m. on Monday, July 22, 2019.

Please submit written comments via personal delivery or mail service to:
San Diego Unified Port District
Attn: Ashley Wright, Planning Department
3165 Pacific Highway, San Diego, CA 92101

or email to: awright@portofsandiego.org

Questions? Contact Ashley Wright at (619) 686-6549

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Appendix B. Proposed Port Master Plan Amendment

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PORT of SAN DIEGO

San Diego Unified Port District

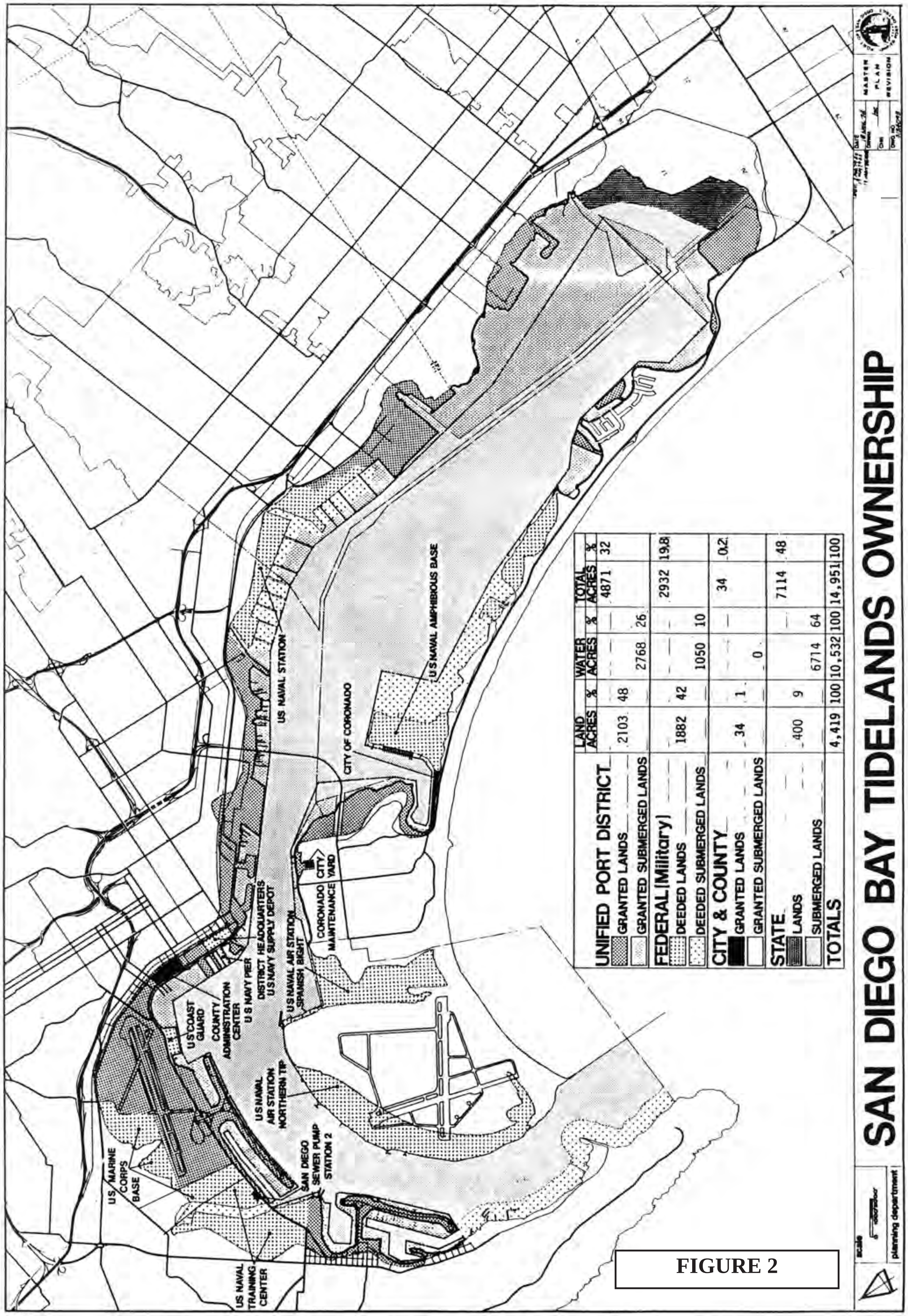
DRAFT

Wetland Mitigation Bank at Pond 20
Port Master Plan Amendment

Existing/Proposed Plan Text

March 2021

Note: Text to be deleted shown ~~stricken~~ and text to be added shown underlined.

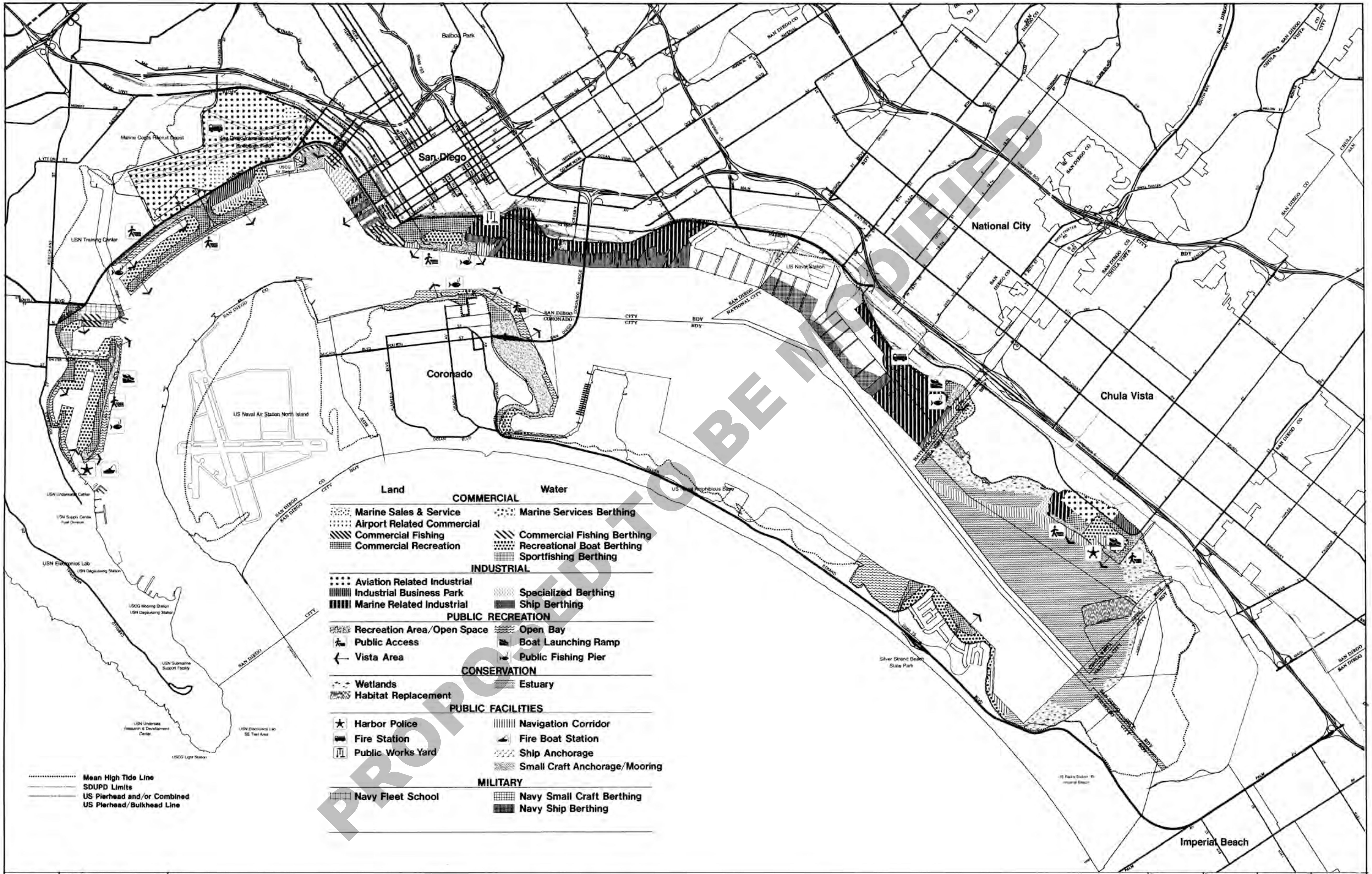


SAN DIEGO BAY TIDELANDS OWNERSHIP

	LAND ACRES	%	WATER ACRES	%	TOTAL ACRES	%
UNIFIED PORT DISTRICT					4871	32
▩ GRANTED LANDS	2103	48	—	—		
░ GRANTED SUBMERGED LANDS	—		2768	26		
FEDERAL (Military)					2932	19.8
▦ DEEDED LANDS	1882	42	—	—		
⁘ DEEDED SUBMERGED LANDS	—	—	1050	10		
CITY & COUNTY					34	0.2
■ GRANTED LANDS	34	1	—	—		
□ GRANTED SUBMERGED LANDS	—	—	0	—		
STATE					7114	48
▤ LANDS	400	9	—	—		
░ SUBMERGED LANDS	—	—	6714	64		
TOTALS	4,419	100	10,532	100	14,951	100

FIGURE 2

Note: This map and legend do not include the approximately 95-acre Pond 20 site at the southern end of San Diego Bay.



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Planning Department

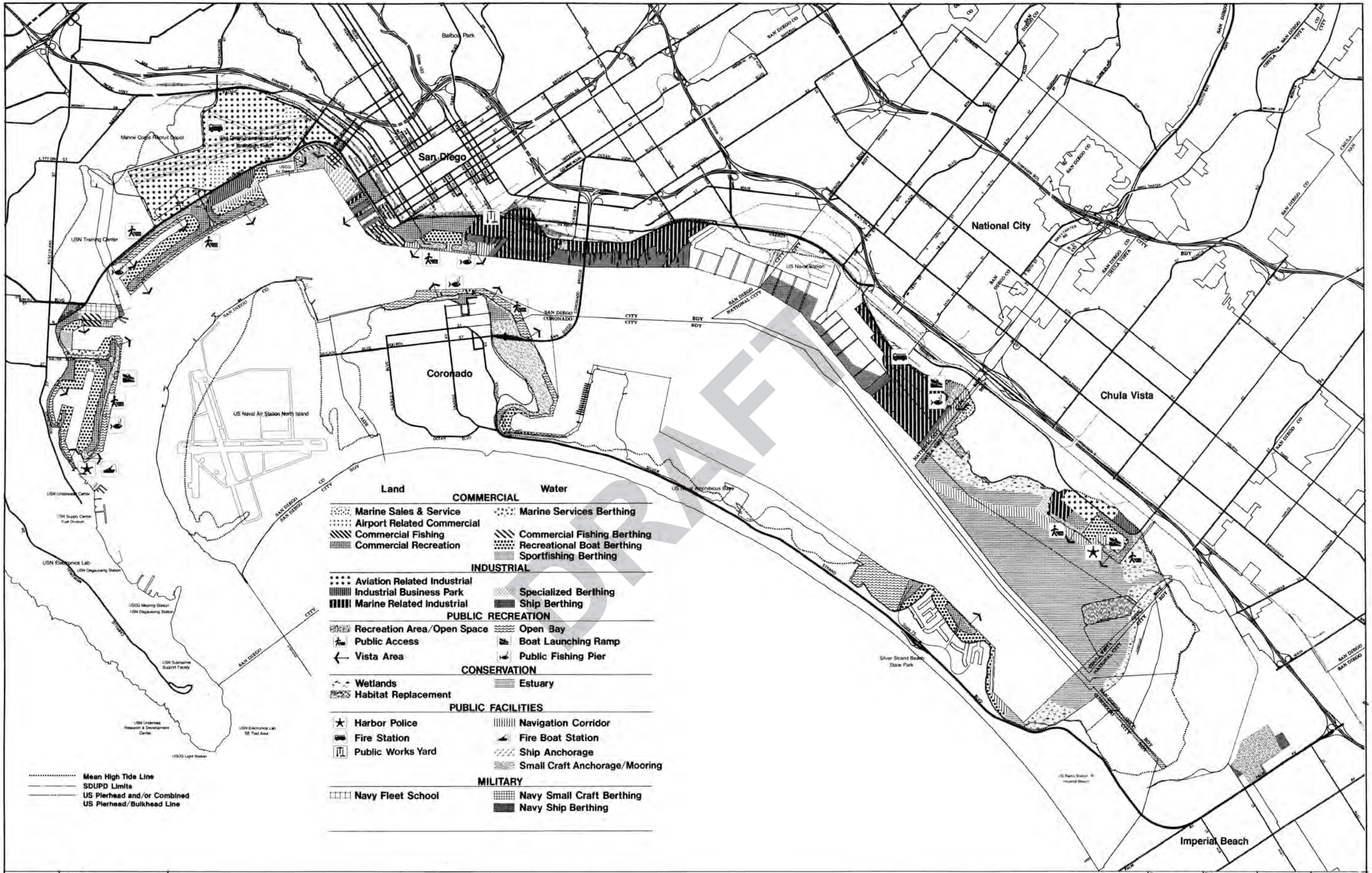
LAND AND WATER USE ELEMENT

Figure 2a

Rev
P. 18 DEC 79 KS
P. 17 July 85 KS
P. 12 AUG. 92 IMMM

Date 17 DEC 79

Master Plan



scale
0 2000 feet
0 500m 1km
Planning Department

LAND AND WATER USE ELEMENT

Figure 2a

Rev
P. 18 DEC. 79 · KS
P. 17 July 85 KS
P. 12 AUG. 92 IMWW

Date 17 DEC. 79
Drn bs
Chk
Base
No

Master Plan

TABLE 1 FROM CURRENT PMP

TABLE 1: SAN DIEGO BAY TIDELANDS BY OWNERSHIP

	LAND		*WATER*		*TOTAL*	
	Acres	***%***	***Acres***	***%***	***Acres***	***%***
Federal (military)	1,882	~~43.0~~42.0	1,050	10.0	2,932	19.8
State of California	12	0.3	6,490	61.0	6,502	43.0
County and City	34	0.7	0	0	34	0.2
Unified Port District	~~2,491~~2,586	~~56.0~~57.0	2,992	29.0	~~5,483~~5,578	37.0
Totals	**~~4,419~~4,514**	**100**	**10,532**	**100**	**~~14,951~~15,046**	**100**

TABLE 3 FROM CURRENT PMP

TABLE 3: EXISTING TIDELANDS AND SUBMERGED LANDS CONVEYED OR GRANTED TO THE SAN DIEGO UNIFIED PORT DISTRICT

	SAN DIEGO	***NATIONAL CITY***	***CHULA VISTA***	***CORONADO***	***TOTALS***
Shoreline (in miles)	16.6	2.8	4.8	8.9	33.1
Tidelands * (in acres)	~~1,550.8~~1,646	396.0	209.7	313.2	~~2,469.7~~2,564.9
Submerged Lands (in acres)	868.0	286.1	1,479.8	379.4	3,013.3
Total (in acres)	**~~2,418.8~~2,514**	**682.1**	**1,689.5**	**692.6**	**~~5,483.0~~5,578.2**

** Includes 421.3 acres of salt ponds.*

TABLE 4 FROM CURRENT PMP

TABLE 4: PORT MASTER PLAN LAND AND WATER USE ALLOCATION SUMMARY

LAND USE	*ACRES*	*WATER USE*	*TOTAL ACRES*	*ACRES*	*% of TOTAL*
COMMERCIAL	**~~457.9~~469.6**	**COMMERCIAL**	**388.6**	**~~846.5~~858.2**	**~~15~~14.9%**
Marine Sales and Services	9.1	Marine Services Berthing	17.7		
Airport Related Commercial	38.0				
Commercial Fishing	8.3	Commercial Fishing Berthing	18.8		
Commercial Recreation	~~398.2~~409.9	Recreational Boat Berthing	341.0		
Sportfishing	4.3	Sportfishing Berthing	11.1		
INDUSTRIAL	**1163.8**	**INDUSTRIAL**	**212.0**	**1375.8**	**~~24~~23.9%**
Aviation Related Industrial	152.9	Specialized Berthing	164.8		
Industrial Business Park	69.5	Terminal Berthing	47.2		
Marine Related Industrial	323.7				
Marine Terminal	149.6				
International Airport	468.1				
PUBLIC RECREATION	**407.5**	**PUBLIC RECREATION**	**681.3**	**1088.8**	**18.9~~19~~%**
	[413.7*]			**[1095.0*]**	
Open Space	66.9	Open Bay/Water	681.3		
Park/Plaza	211.0				
	[217.2*]				
Golf Course	97.8				
Promenade	31.8				
CONSERVATION	**~~485.3~~568.8**	**CONSERVATION**	**1084.6**	**~~1569.9~~1653.4**	**~~28~~28.7%**
Wetlands	~~375.8~~459.3	Estuary	1084.6		
Habitat Replacement	109.5				
PUBLIC FACILITIES	**236.3**	**PUBLIC FACILITIES**	**387.9**	**624.2**	**10.8~~1~~%**
Harbor Services	2.6	Harbor Services	10.5		
City Pump Station	0.4	Boat Navigation Corridor	274.3		
Streets	233.3	Boat Anchorage	25.0		
		Ship Navigation Corridor	53.9		
		Ship Anchorage	24.2		
MILITARY	**25.9**	**MILITARY**	**125.6**	**151.5**	**2.6~~3~~%**
Navy Fleet School	25.9	Navy Small Craft Berthing	6.2		
		Navy Ship Berthing	119.4		
TOTAL LAND AREA	**~~2776.7~~2871.9**	**TOTAL WATER AREA**	**2880.0**		
MASTER PLAN LAND AND WATER ACREAGE TOTAL				**~~5656.7~~5751.9****	**100%**

**Includes 6.3 acres of rooftop park/plaza & inclined walkway*

*** Does not include 6.3 acres of rooftop park/plaza & inclined walkway*

SOUTH BAY SALT LANDS:

PLANNING DISTRICT 9

Precise Plan Concept

Planning District 9 comprises the land and water areas at the extreme southerly end of San Diego Bay. The land is uniformly flat except for the slight elevations of the salt pond dike network. The water is very shallow. Because of an unusual annexation history, parts of three cities - San Diego, National City and Coronado - occupy this Planning District and the political boundaries of two other cities - Chula Vista and Imperial Beach - form mutual borders with the outside edges of the Planning District.

Identified concerns in land use planning include: the compatibility and routing of access corridors for pedestrian and bike path extensions around the bay; a localized desire for a public launching and marina facility, befitting the amenities and resources of a small coastal city which currently has no marina facilities; and the possible transition of land use from the industrial production of salt to mariculture, or a return of the area to a natural bay for wildlife preservation or wetland mitigation banking. The Plan Concept proposes the utilization of the area for habitat conservation, small-scale commercial recreation, and ~~to retain~~the retention of the open space character of South San Diego Bay.

Land and Water Use Allocations

A total of approximately ~~798~~ 893 acres of Port District tidelands is included in this Planning District. Use allocations proposed include wetlands, estuary and salt ponds, and commercial recreation, and follow the basic use guidelines discussed in Section III of the Master Plan under the Commercial, Public Recreation, and Conservation categories~~y~~.

South Bay Salt Lands Planning Subareas

In the following narrative, the Planning District has been divided into four subareas ***(Figure 24)***, to focus attention upon conditions and plan concepts for small areas.

Wildlife Preserve

This subarea is unleased and is proposed to be set aside and possibly enhanced for conservation purposes. The subarea is primarily shallow water, although an 8.5-acre parcel of vacant land, located at the northwest corner of the Planning District and adjacent to State Highway 75, is included. Immediately to the south of the parcel, on uplands, is an area managed by the County of San Diego as a wildlife preserve and nature interpretive area. The plan allocation would add to this conservation area.

Coronado Salt Ponds and South Bay Salt Ponds

Most of Planning District 9 was leased prior to the formulation of the Port District directly from the State of California by Western Salt Company for the production of salt through evaporation. The leased areas comprise these two planning subareas. Existing State law provides that the 612.23-acre lease of water and salt ponds will revert to State control in 1984. As was mentioned in Section I *(page 6)*, the transfer will increase State controlled tidelands in San Diego Bay to about 48 percent of the total. The Department of Fish and Game will be given management responsibility and will need to address the multiple demands in the area for a continuation of salt production, a reversion to a natural bay, the potential for mariculture, and whether marina facilities for Imperial Beach are possible. Until that time, the Master Plan recommends continuation of the current environment. When the management plan for the area is designed by the State Department of Fish and Game, the Port District should be advised so that nearby developments will be coordinated~~.~~

South Bay Salt Ponds

This subarea includes both leased and unleased areas. A parcel is leased to San Diego Gas and Electric Company for a warm water outlet and dispersal area as part of the South Bay Power Generating Plant operation. The remaining area is submerged bay tidelands, including the terminus channel of the Otay River. The water area remaining under Port District control is included in the Estuary classification.

Pond 20

This subarea is unleased and was purchased by the District in 1998 from the Western Salt Company. This was part of a larger land acquisition, the majority of which was transferred to the California State Lands Commission and includes a lease to the United States Fish & Wildlife Service to create the South San Diego Bay Unit of the National Wildlife Refuge. The District retained ownership rights to this subarea pursuant to California Senate Bill 1896 (2002), with the charge of utilizing the area for economic development, subject to the Public Trust.

This subarea is divided into two main areas, a mitigation bank parcel (83.5 acres) and three parcels (Parcel A, west of the mitigation bank parcel - 2.7 acres; Parcel B, east of the mitigation bank parcel and just north of Palm Avenue – 1 acre; and Parcel C, east of the mitigation bank parcel and just south of the Otay Valley Regional Park – 8 acres) surrounding the mitigation bank parcel. The majority of the mitigation bank parcel is proposed to be a mitigation bank, referred to as the Wetland Mitigation Bank at Pond 20, which involves the creation and the on-going maintenance and monitoring of tidal wetland habitat and upland buffer habitat. To reconnect tidal hydrology to the Wetland Mitigation Bank at Pond 20, a berm breach of approximately 75 feet in length would occur at the northwestern portion of the mitigation bank parcel and would be partially within the San Diego National Wildlife Refuge. After the berm is breached, the network of constructed tidal channels would facilitate distribution of tidal flows to the mitigation bank. Implementation of the mitigation bank would allow the District to establish a mitigation credit program that could compensate for future off-site impacts from other public and private development projects under Section 404 of the Clean Water Act, the California Coastal Act, the Porter-Cologne Water Quality Control Act, and the California Eelgrass Mitigation Policy. The Wetland Mitigation Bank at Pond 20 would complement surrounding land uses by expanding valuable wetland habitat adjacent to the San Diego Bay National Wildlife Refuge, providing essential wetland functions and services for adjacent communities, including storm surge, flood protection, and stormwater buffering.

The three parcels surrounding the mitigation bank parcel are proposed for commercial recreation uses that are compatible with the adjacent uses and character of the area and also complement the surrounding open space and natural resource areas. Any development that is proposed at a future date on the undeveloped portions of Parcels A, B, and/or C would need to comply with the proposed uses permitted under the commercial recreation designation and would be subject to a future amendment to the Port Master Plan. The southern portion of Parcel B includes an approximate 0.2 acre area that is currently paved and developed with commercial recreation uses. Additionally, uses such as a convention center, pleasure craft marina, dock and dine facilities, and sportfishing would not be allowed on Parcels A, B, and C.

TABLE 22 FROM CURRENT PMP

TABLE 22: Precise Plan Land and Water Use Allocation
SOUTH BAY SALT LANDS: PLANNING DISTRICT 9

~~This subarea is predominantly submerged bay tidelands, including the terminus channel of the Otay River. The water area remaining under Port District control is included in the Estuary classification.~~

LAND USE	ACRES	WATER USE	ACRES	TOTAL ACRES	% of TOTAL
CONSERVATION	275.5~~192.0~~	CONSERVATION	605.5	~~797.5~~881	~~100~~99%
Wetlands	~~192.0~~275.5	Estuary	185.3		
		Salt Ponds	420.2		
COMMERCIAL	11.7			**11.7**	**1%**
Commercial Recreation	11.7				
TOTAL LAND AREA	**~~192~~287.2**	**TOTAL WATER AREA**	**605.5**		

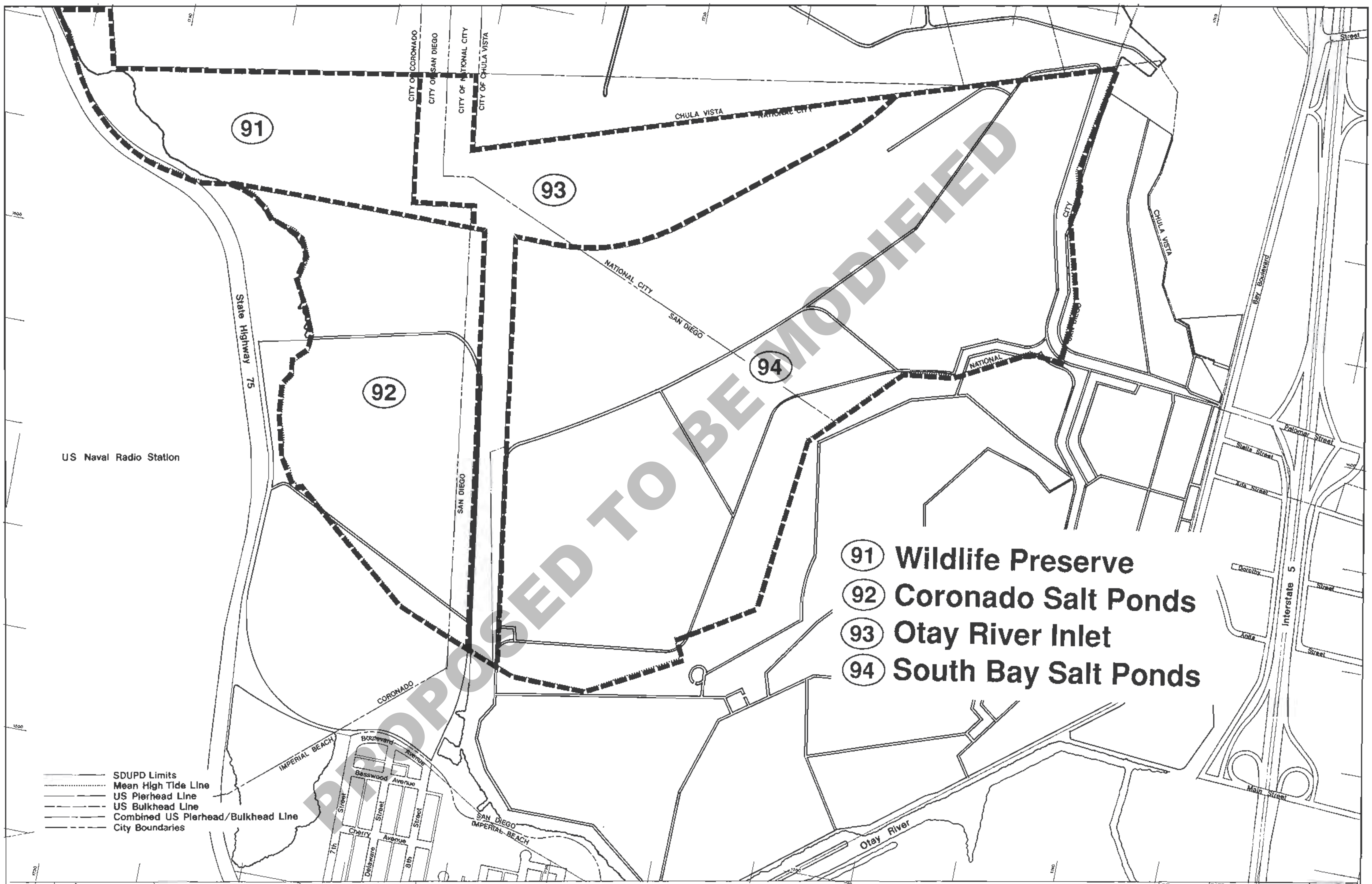
PRECISE PLAN LAND AND WATER ACREAGE TOTAL .... ~~797.5~~892.7....100%

Project List

~~No specific projects are identified, although it is anticipated that some environmental enhancement or mitigation project may be identified later as plans are implemented around the bay.~~

SOUTH BAY SALT LANDS: **PLANNING DISTRICT 9**	SUBAREA	DEVELOPER	APPEALABLE	FISCAL YEAR
1. WETLAND MITIGATION BANK: Create wetland habitat on Pond 20 Mitigation Bank Parcel to be used as a mitigation bank	94a	P	N	2022-23

P – Port District N – No



scale approx.
0 200' 400'
planning department

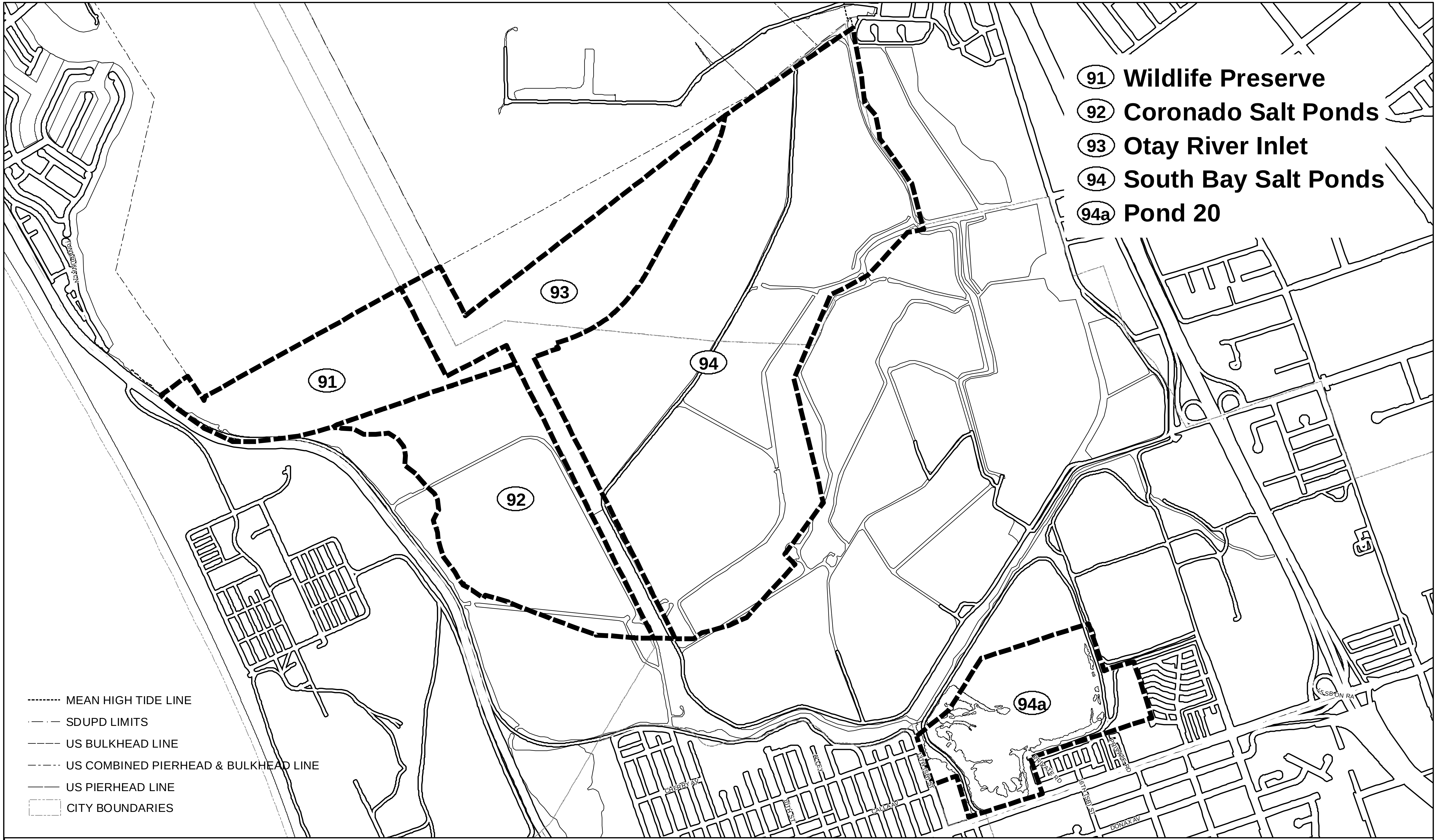
Planning District 9
SOUTH BAY SALTLANDS

Planning Subareas

FIGURE 24

DATE 5/21/93
BASE 281074
DRWG NO 9014005

Master Plan



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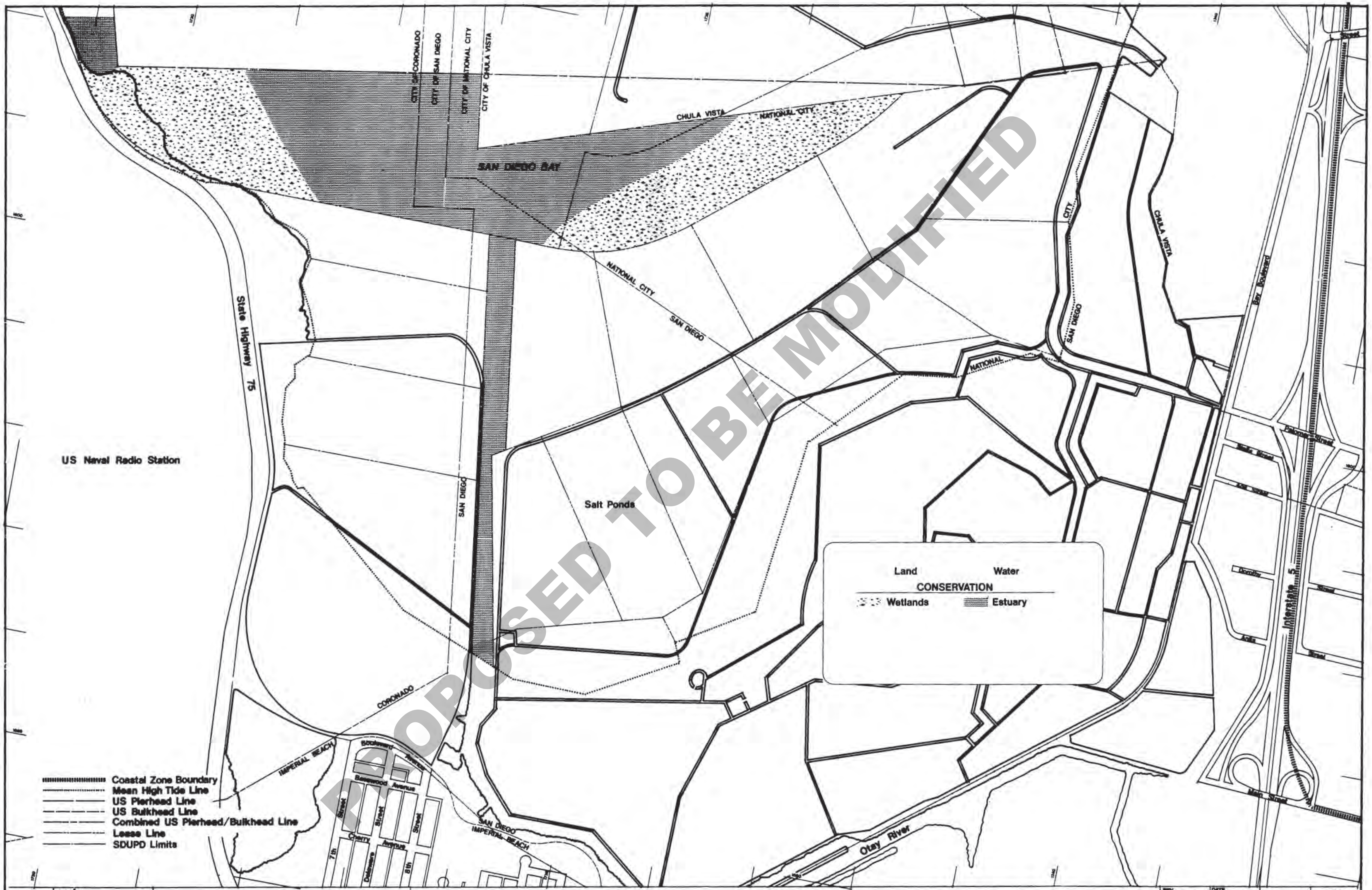
Feet

Planning District 9
SOUTH BAY SALTLANDS

Planning Subareas

Figure 24

DRAFT



scale

0 400' 800'

planning department

Planning District 9
SOUTH BAY SALTLANDS

PRECISE PLAN

FIGURE 23

REV
B - 14 DEC. 79 - KS
F - 30 MAY. 86 KS

DATE 10/26/78

DRN KS CHK

SCALE 311074

DRWG NO 9025 001

MASTER PLAN REVISION

PORT OF SAN DIEGO UNIFIED PORT DISTRICT

Planning District 9
SOUTH BAY SALTLANDS

PRECISE PLAN

Figure 23

DRAFT

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Appendix C. South San Diego Bay Wetland Mitigation Bank Prospectus

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SOUTH SAN DIEGO BAY WETLAND MITIGATION BANK

SAN DIEGO HYDROLOGIC UNIT

SAN DIEGO, SAN DIEGO COUNTY, CALIFORNIA

PROSPECTUS

Submitted to:
INTERAGENCY REVIEW TEAM
U.S. Army Corps of Engineers: Robert Smith Jr.
U.S. Environmental Protection Agency: Megan Fitzgerald, Elizabeth Goldman, Melissa Scianni
U.S. Fish and Wildlife Service: Sandy Vissman, Christine Medak
National Marine Fisheries Service: Eric Chavez
California Coastal Commission: Kate Huckelbridge, Gabriel Buhr
San Diego Regional Water Quality Control Board: Lisa Honma, Eric Becker
U.S. Department of the Navy (Guest): Mitchell Perdue, Walter Wilson

Submitted by:
PORT OF SAN DIEGO
PLANNING & GREEN PORT
3165 PACIFIC HWY.
SAN DIEGO, CA 92101
CONTACT: Eileen Maher
EMAIL: emaher@portofsandiego.org
(619) 686-6254

Great Ecology
2251 San Diego Ave, Suite A218A
San Diego, CA 92110
CONTACT: Mark S. Laska, Ph.D.
EMAIL: mlaska@greatecology.com
(858) 750-3201

April 2018

GREAT ecology
ENVIRONMENT + DESIGN

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APPENDIX B:	Photo Log: Completed Port of San Diego Restoration Projects
APPENDIX C:	Map of South San Diego Bay Mitigation Bank Property Lines and Easements
APPENDIX D:	South San Diego Bay Mitigation Bank Preliminary Title Report
APPENDIX E:	Preliminary Horticultural Soil Quality Evaluation Report
APPENDIX F:	Jurisdictional Determination Report for Waters of the U.S.
APPENDIX G:	Supplemental Jurisdictional Determination Report for Waters of the State
APPENDIX H:	Estimated Species Densities per Vegetation Alliance, November 2017
APPENDIX I:	List of Observed Plant and Wildlife Species, September 2017
APPENDIX J:	List of Observed Avian Species, 2016-2017 Season
APPENDIX K:	Evaluation of Planned Wetlands Functional Assessment Handbook (Bartoldus et al. 1994)
APPENDIX L:	South San Diego Bay Wetland Mitigation Bank Baseline Functional Assessment Results (Evaluation of Planned Wetlands)
APPENDIX M:	Wetland Restoration of Salt Pond 20: Basis of Design Report (Draft)

1 EXECUTIVE SUMMARY

The Port of San Diego (Port) seeks to create a wetland mitigation bank in South San Diego Bay. The 80-acre Bank Site is located within an 83.5-acre Bank Parcel wholly owned by the Port (FIGURE 1). This Prospectus details the components of the proposed South San Diego Bay Wetland Mitigation Bank (Bank), which includes the establishment, re-establishment, and rehabilitation of tidal wetland and upland transitional buffer habitat. The Port, as Bank Sponsor, is submitting this Prospectus for review by the Interagency Review Team (IRT). Coordination of the Prospectus review and evaluation is led by the United States Army Corps of Engineers (USACE). As such, this Prospectus has been completed in accordance with the USACE Prospectus for Mitigation Banks Checklist (APPENDIX A).

The Bank Site is within a former salt pond known as Pond 20, located in San Diego, California. It is enclosed by a berm that isolates it from tidal flows, and the interior area does not support wetlands. However, areas outside of the berm at Pond 20 currently support 1.16 acres of wetlands and 0.37 acres of non-wetland waters of the U.S.

The Port proposes to construct approximately 76.48 acres of the 80-acre Bank Site to compensate for impacts to jurisdictional wetlands and waters, and for impacts to eelgrass (*Zostera marina*). Construction would consist of approximately 59.16 acres of high, medium, and low tidal marsh habitat; 1.68 acres of subtidal eelgrass habitat; 4.00 acres of intertidal mudflat habitat; 3.81 acres of transitional zone habitat; and 7.83 acres of upland transitional habitat. Approximately 3.53 acres of perimeter berms will remain to create a hydrological buffer area within the boundaries of the Bank Site. The corresponding acreages are summarized in TABLE 1. Proposed compensatory credits would be available to mitigate for impacts to coastal areas and related watersheds within Southern California.

The proposed Bank design includes the following components:

- Re-establish tidal hydrology and improve tidal influxes by selective breaching of the perimeter berm, and excavating new channels;
- Excavate to achieve inundation frequencies required by the four tidal wetland habitat types proposed;
- Reuse excavated fill at the Chula Vista Bayfront or other upland area, or offsite disposal at an appropriate facility;
- Salvage native vegetation onsite for re-establishment, and install suitable native plant material;
- Protect, preserve, and facilitate establishment of wetland and upland habitats and species; and
- Increase habitat connectivity.

FIGURE 1: GENERAL SITE LOCATION AND EXISTING CONDITIONS OVERVIEW

SITE LOCATION AND EXISTING CONDITIONS OVERVIEW
SOUTH SAN DIEGO BAY WETLAND MITIGATION BANK
SAN DIEGO UNIFIED PORT DISTRICT
FEBRUARY 2018

1:7,500
NAD 83 CA STATE PLANE FIPS IV 0406
CENTROID: 32.5869° N, 117.1004° W

TABLE 1: SUMMARY OF ESTABLISHED HABITAT ACREAGES AND PROPOSED CREDITS

Habitat Type	Estimated Area (acres)	Proposed Credit Ratio	Proposed Credits
Within Bank Site			
Proposed Wetland Habitat			
Subtidal eelgrass habitat	1.68	1:1	1.68
Intertidal mudflat habitat	4.00		4.00
Low marsh habitat	1.43		1.43
Mid marsh habitat	37.10		37.10
High marsh habitat	20.63		20.63
Wetland Habitat Subtotals	**64.84**		**64.84**
Proposed Transition Zone			
Transition zone habitat	3.81	1:1	3.81
Transition Zone Subtotals	**3.81**		**3.81**
Proposed Upland Transitional Habitat			
Upland transitional habitat	7.83	1:1	7.83
Upland Transitional Habitat Subtotals	**7.83**		**7.83**
Perimeter Berms			
Remaining perimeter berms	3.53		
Perimeter Berm Subtotals	**3.53**		
Total Area of Mitigation Bank Site	**80**		
Outside Pond 20			
Additional Buffer Areas[1]	3.50		
Additional Buffer Subtotals	**3.50**		
Total Area of Bank Parcel	**83.5**		

[1] Additional Buffer Areas include portions of the Otay River Tributary and Nestor Creek that lie within the Port-owned Bank Parcel boundary and will remain undeveloped wetland and surface water ways.

2 BANK ESTABLISHMENT AND OPERATION

The Bank Site is situated within a parcel wholly owned by the Port (Bank Parcel; FIGURE 1). The Bank Site is located within State Tidelands which are held in trust by the Port pursuant to the San Diego Unified Port District Act (Port Act). The Bank Site has not been used as mitigation for a previous project, nor is it dedicated for purposes which are inconsistent with habitat preservation. The Port intends to conserve and protect the Bank Site and assure its long-term ecological function through a conservation land use designation. Use of the site as a mitigation bank is consistent with the Port's mission to provide economic vitality and community benefit through a balanced approach to maritime industry, tourism, water and land recreation, environmental stewardship and public safety.

The Port will be responsible for permitting and constructing wetlands habitat on the Bank Site, measuring the ecological uplift generated by wetland establishment and rehabilitation, and selling the ecological improvements to entities in need of mitigation compliance credits. Credits will be sold within a Service Area comprised of multiple watersheds that extend through portions of five Southern California counties. Operation and maintenance of the Bank Site would be financed by the Port's operational funds, a stable source of revenue for the Port dedicated to specific uses for the benefit of the State Tidelines under its stewardship.

2.1 *Responsible Parties*

2.1.1 Bank Contact Information

The Port is the Bank Sponsor and property owner. The primary point of contact for the Port is:

Eileen Maher
Planning & Green Port
Port of San Diego
3165 Pacific Highway, San Diego, CA 92101
Phone: (619) 686-6254
Email: emaher@portofsandiego.org

An additional contact for the Port is:

Brent Eastty
Planning & Green Port
Port of San Diego
3165 Pacific Highway, San Diego, CA 92101
Phone: (619) 686-6284
Email: beastty@portofsandiego.org

The Port's consultant for this project is:

Dr. Mark S. Laska
Great Ecology
2251 San Diego Ave., Suite A218
San Diego, CA 92110
Phone: (858) 750-3201
Email: mlaska@greatecology.com

2.1.2 Bank Sponsor Qualifications

The Port is a public-benefit corporation, created by the State of California Legislature in 1962 pursuant to the Harbors and Navigation Code Appendix I (herein referred to as Port Act) to manage the tidelands surrounding San Diego Bay. It is the fourth-largest of the 11 ports operating in California. The Port is governed by a seven-member Board of Port Commissioners, with one commissioner appointed by each of the city councils of Chula Vista, Coronado, Imperial Beach, and National City, and three commissioners appointed by the San Diego City Council. The Port is self-supporting and does not receive funding from taxes.

The Port manages approximately 33 miles of San Diego's shoreline, including nearly 6,000 acres of tidelands and submerged lands. The Port's lands are managed in accordance with a Port Master Plan that is certified by the California Coastal Commission (CCC). The Port Master Plan provides the official planning policies, consistent with a general statewide purpose, for the physical development of the tide and submerged lands conveyed and granted in trust to the Port (Port 2017a). The Bank Site will be incorporated into the Port Master Plan as part of the environmental review process.

The Port is a public agency and is a trustee of State Tidelands under the Public Trust Doctrine. The Port is also a significant source of economic stimulus for the San Diego region, creating jobs for the regional economy through the promotion of maritime trade, tourism, and other commercial activities. The South San Diego Bay Wetland Mitigation Bank will be funded from the Port's annual operating budget, which has the capacity to fund the development, construction, long-term management and monitoring costs of the Bank.

To protect San Diego Bay's natural resources, in 2006, the Board of Port Commissioners created an Environmental Committee. The Port's Environmental Advisory Committee Policy, BPC Policy No. 730, purpose is:

> *To review and provide input and recommendations on all Port environmental programs and initiatives, and comment on funding projects aimed at improving the condition of the Bay and surrounding Port tidelands* (BPC 2018).

BPC Policy No. 730 details management of the Environmental Fund, and provides guiding principles necessary to select and execute projects aimed at improving San Diego Bay and the surrounding tidelands, such as the South San Diego Bay Wetland Mitigation Bank. Projects sponsored by the Environmental Fund specifically address habitat restoration, environmental education, research and monitoring, air quality, conservation, water and sediment quality, and endangered species. The Environmental Fund is funded in accordance with BPC Policy No. 730, which sets aside one-half of one percent of the Port's projected gross revenues for that year to be applied to the Environmental Fund (BPC 2018).

The Port is an environmental steward of San Diego Bay and the surrounding tidelands, and has invested hundreds of millions of dollars in public improvements in its five member cities: Chula Vista, Coronado, Imperial Beach, National City, and San Diego. The Port's commitment to environmental stewardship is demonstrated by its experience in restoring environmentally-sensitive habitats and degraded wetlands, and its continued maintenance of those sites. Today, several of these mitigation sites and projects serve as educational and recreational opportunities for the public.

Some of the Port's previous mitigation and restoration projects are described in further detail in TABLE 2. These sites are similar in nature to the Bank Site as they are surrounded by urban neighborhoods and have adjacent public access. Photos of these mitigation and restored areas can be found in APPENDIX B.

TABLE 2: PORT OF SAN DIEGO COMPLETED MITIGATION AND RESTORATION PROJECTS

Project	**Location, Year Completed**	**Improvements**
South San Diego Bay Wetland Restoration Project (Southern California Wetlands Recovery Project 2017).	South San Diego Bay, 2011	• In conjunction with the U.S. Fish & Wildlife Service (USFWS) refuges • Restored approximately 257 acres of coastal wetlands • Sediment removal and redistribution to restore tidal elevations and channels • Native plant revegetation • Debris removal
D Street habitat restoration to benefit the California least tern & Western snowy plover (San Diego Audubon Society 2017a)	San Diego Bay, 2012	• Invasive plant removal • Salt grass habitat improvements • Shoreline grading and vegetation removal for improved nesting and foraging area
Telegraph Creek marsh and Chula Vista Wildlife Reserve enhancement project (Port 2008)	San Diego Bay, Chula Vista, 2008	• Debris removal • Removal of non-native vegetation • Restoration of five acres of wetland habitat, including native plant revegetation
Emory Cove Shoreline Enhancement Project (San Diego Audubon Society 2017b)	Emory's Cove San Diego Bay, 2011	• Native plan revegetation • Removal of non-native/invasive vegetation from 28 acres of wetland/upland transitional habitat
D Street Fill – five-acre mitigation for filling the L-Ditch	D Street Fill, Chula Vista, 2011	• Created five acres of intertidal habitat from uplands
D Street Fill – six-acre mitigation for construction of Berth 24-5 at the National City Marine Terminal.	D Street Fill, Chula Vista, 2003	• Created six acres of wetlands habitat from uplands

Furthermore, in 2008 the Board of Port Commissioners approved a Green Port Policy, BPC Policy No. 736, which established a set of environmental sustainability principles and initiatives the Port is required to consider when developing and conducting operations within the Port's jurisdiction (BPC 2008). This Green Port Policy specifically focuses on incorporating a balance of environmental, social, and economic concerns into operations in San Diego Bay and the tidelands. As a result, the Port's environmentally sensitive areas are continuously maintained as part of its core environmental policies.

The Port's consultant for the development of the South San Diego Bay Wetland Mitigation Bank is Great Ecology, a San Diego-based firm comprised of environmental scientists, ecologists, landscape architects, and designers specializing in the restoration, creation, and enhancement of native habitats with a focus on mitigation bank planning and entitlement. Great Ecology is supported by Environmental Science Associates (ESA), an environmental science, planning, and engineering firm, with special expertise in hydrological services, including fluvial, estuarine, and coastal processes and restoration.

2.1.3 Long-Term Conservation

Long-term conservation assurance is pursuant to the Port Act. Section 5 of the Port Act requires the Port to exercise its land management authority and power over property it acquires, and Section 19 of the Port Act which requires the Port to incorporate such lands into the Port Master Plan. Additionally, Section 56 of the Port Act gives the Port exclusive police power over property and development subject to its jurisdiction. The Port Master Plan provides the official planning policies, consistent with a general statewide purpose, for the physical development of the tide and submerged lands conveyed and granted in trust to the Port; however, the Bank Site is not currently in the Port Master Plan and therefore does not currently have a land use designation. As a result, a Port Master Plan Amendment (PMPA) will be processed and approved by the California Coastal Commission to incorporate the Bank Site into the Port Master Plan, which will allow for the Port to issue a Coastal Development Permit (CDP) for the Bank Site. In order to provide long-term assurance, the Port proposes to designate the entire 80 acres of the proposed Bank Site as "conservation/wetlands" land in the Port Master Plan through the PMPA process. The conservation/wetlands designation is reserved for habitat, wildlife conservation, and environmental protection. Further, the Port will be responsible for the long-term management and monitoring of the proposed Bank Site.

The mitigation bank will be constrained to the Bank Site boundary. Buffer areas, or land immediately adjacent to the Bank Site boundaries but not credited as part of the mitigation bank, will provide protection to the mitigation bank from outside disturbances.

The Port may ultimately apply the City of San Diego's Multiple Species Conservation Plan (MSCP) Multi-Habitat Planning Area (MHPA) overlay to the Bank Site (City of San Diego 1997), with concurrence from the MSCP Implementing Agreement signatories (i.e., City of San Diego, U.S. Fish and Wildlife Service, and California Department of Fish and Wildlife). Mitigation banking is a compatible land use subject to MHPA designation. Application of the MHPA would restrict land development on the Bank Site, but would not preclude the Port's plans to establish a formal wetland mitigation bank,

2.1.4 Long-Term Funding

Long-term management (operation and maintenance) of the South San Diego Bay Wetland Mitigation Bank will be funded through the Port's operating budget. The Port will fund development and long-term management through monies earmarked for the Bank within its operational funds, which will functionally serve as an endowment. Each year, a portion of the Port's projected annual gross revenue is budgeted and expended for specific environmental projects. The long-term management of the South San Diego Bay Wetland Mitigation Bank is designated as a specific environmental project within the Port's operational budget.

2.2 *Bank Purpose*

The purpose of the South San Diego Bay Wetland Mitigation Bank is to provide compensatory mitigation for impacts to marine subtidal, intertidal wetlands, jurisdictional resources, and transitional habitat authorized under Section 404 of the CWA, the California Coastal Act, the Porter-Cologne Water Quality Control Act, and Section 1600 of the California Fish and Game Code; and for impacts to eelgrass habitat under the California Eelgrass Mitigation Policy.

Entities with anticipated needs for compensatory mitigation include:

- The Port of San Diego;
- Port tenants;
- Transportation planning entities;
- Coastal jurisdictions charged with coastal wetland maintenance along the coast of San Diego and Orange Counties;
- The U.S. Navy and other Military installations; and
- Private entities operating within the proposed Service Area.

2.3 *Bank Establishment*

The South San Diego Bay Wetland Mitigation Bank will be established using the process outlined by the Draft Compensatory Mitigation Rule Timeline for Bank or ILF Instrument Approval (EPA and USACE 2008). A Bank Enabling Instrument (BEI) will be prepared using the 2017 BEI Template and, following the completion of the Public Notice comment period, the BEI will be submitted for review by USACE, CCC, U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service, Environmental Protection Agency (EPA), and Regional Water Quality Control Board (RWQCB) (referred to collectively as the Interagency Review Team [IRT]). As outlined in the BEI template, credit transfers may begin on the bank establishment dates, once the BEI has been fully executed by all Parties and the Bank Sponsor has furnished the necessary long-term assurances.

2.4 *Bank Long-Term Ownership and Management*

The Bank will be owned by the Port who will provide programmatic management of the Bank, including the long-term management and maintenance of the Bank. As described in Section 2.1.4, the Bank is listed as a specific project for which monies within the Port's operational budget will be annually allocated to ensure the Bank's long-term management expenses will be funded.

Long-term management maintenance activities for the Bank will include:

- Invasive species monitoring and removal;
- Periodic removal of trash blown or washed in from the adjacent areas (e.g., Palm Avenue);
- Maintenance of site control measures (e.g., fencing to keep pedestrians and vehicles from entering the Bank Site); and
- Restoration of any damage from management activities, human activities (e.g., illegal trespass), and natural phenomenon (e.g., severe storms).

2.5 *Anticipated Schedule*

The construction schedule will be dependent upon final approval of this Bank and receipt of all permits for the project. It is anticipated these will be completed by mid-2020 and that construction will begin in late-2020. With an estimated 21-month construction period, construction will be completed by mid-2022, at which time monitoring and maintenance activities will begin.

2.6 *Anticipated Permits, Agreements, and Consultations*

The District as Lead Agency, as defined under California Environmental Quality Act (CEQA) Guidelines Section 15050, has principal responsibility for carrying out and approving the proposed project. In addition, a portion of the project is located in the San Diego Bay National Wildlife Refuge, which is under the jurisdiction of the USFWS; therefore, an environmental analysis would be prepared by the Port in accordance with the National Environmental Policy Act (NEPA) and in coordination with the USFWS.

The project would require a PMPA for the assignment of land use designation(s) for the Bank Site and to incorporate it into the Port Master Plan. The project is located within the Coastal Zone and constitutes development pursuant to California Coastal Act Section 30106 as it would result in the construction of a mitigation bank. After certification of the Port Master Plan Amendment by the CCC, a non-appealable CDP pursuant to Section 30715 of the California Coastal Act would be approved by the Port. Environmental review of the project (i.e. CEQA, NEPA, and California Coastal Act review) is anticipated to be completed in late 2019.

Federal and state permits anticipated for the construction work include the following:

- USFWS Special Use Permit;
- USACE CWA Section 404 permit;
- RWQCB Section 401 Water Quality Certification;
- State Lands Commission dredging lease; and
- CCC CDP.

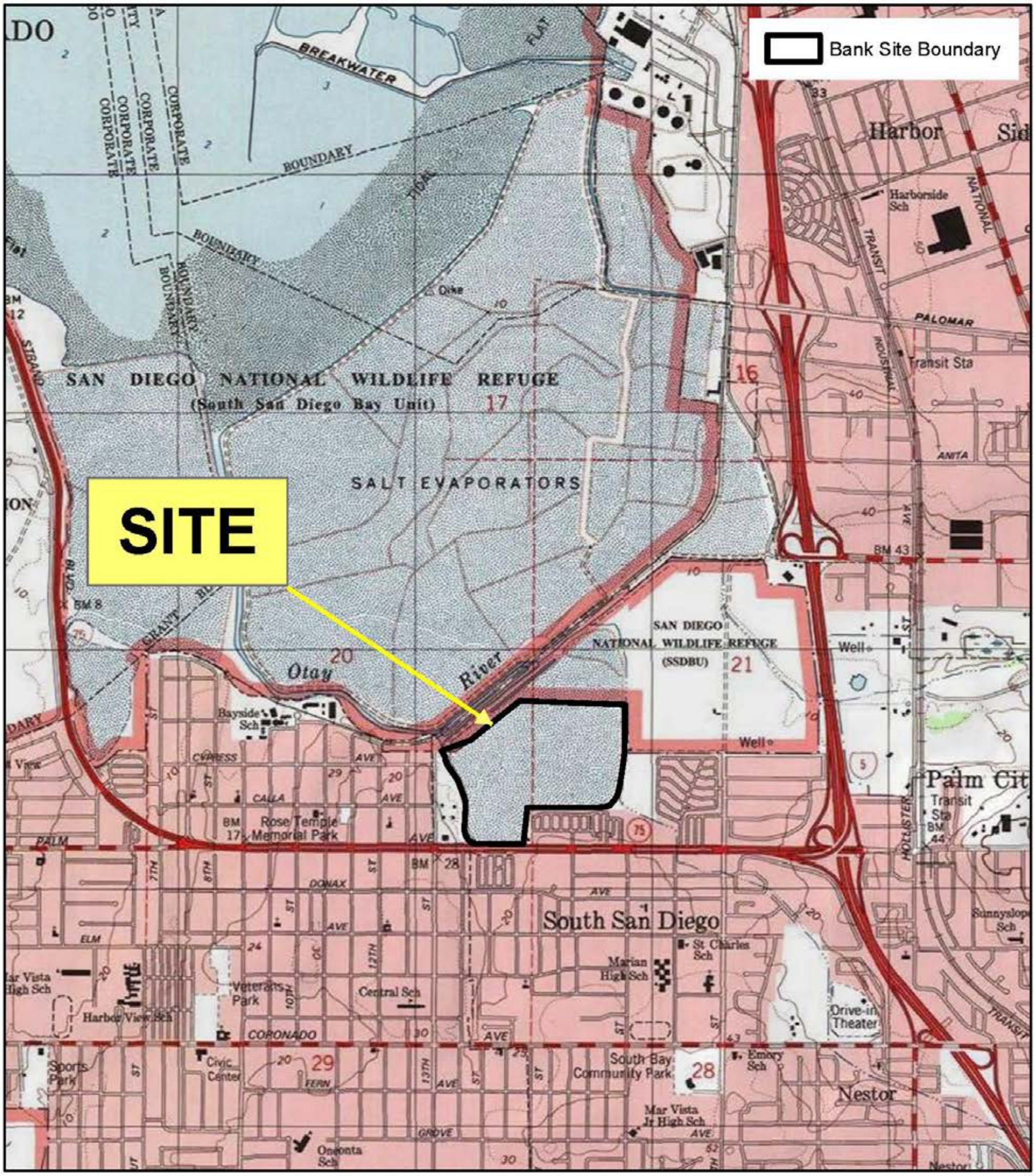
3 PROPERTY DESCRIPTION

3.1 *Location*

The Bank Site is located on the southernmost end of San Diego Bay in the City of San Diego, San Diego County, California (FIGURE 1). It is located south of the Otay River, and the South San Diego Bay National Wildlife Refuge (NWR). There is no official address for the Bank Site, but it is immediately north of Palm Avenue (State Route 75) and east of 13th Street.

The boundary of the proposed Bank Site is shown in FIGURE 1 and FIGURE 2 on aerial imagery and a United States Geological Survey (USGS) 7.5 Minute Quadrangle map, respectively. The Bank Site is located within the Imperial Beach USGS 7.5 Minute quadrangle and is entirely within the Coastal Zone. Parcel boundaries associated with the Bank are shown in APPENDIX C.

FIGURE 2: SITE AND USGS TOPOGRAPHIC MAP



TOPOGRAPHIC MAP (USGS 2002)

SOUTH SAN DIEGO BAY WETLAND MITIGATION BANK

7.5 MINUTE QUADRANGLE: IMPERIAL BEACH
SAN DIEGO UNIFIED PORT DISTRICT
NOVEMBER 2017

1:25,000
WGS 1984 WEB MERCATOR

0 0.5 1 Miles

N

The Bank Site is located on the north side of Palm Avenue, west of Saturn Boulevard, and east of 13th Street within the City of San Diego, just east of the City of Imperial Beach. The southern boundary, immediately south of Palm Avenue, is lined with residential, commercial, and infrastructure development. The northern boundary and a portion of the western boundary abut the San Diego Bay NWR. The NWR parcel comprises the northern portion of former salt evaporation Pond 20 and is under the jurisdiction of USFWS. The NWR land in the northern part of Pond 20 has similar historic uses as the Bank Site and will be used to support the Otay River Estuary Restoration Project (ORERP).

The ORERP is a mitigation project that is being developed to offset impacts to marine life caused by the Poseidon Water Resources Desalination Facility located in Carlsbad, California. The ORERP is sited on NWR land and implemented in partnership with USFWS. To the north of the ORERP site is the channelized Otay River, which flows from east to northwest where it enters San Diego Bay. Running parallel to the Otay River, north of the Bank Site, is the Silver Strand Bikeway section of the San Diego Bayshore Bikeway, which crosses the Otay River northwest of the Bank Site along an old railroad bridge. The Bikeway Village mixed-use development, located at the end of 13th Street, northwest of the Bank Site, was recently completed. Two surface water features, Nestor Creek and a tributary of the Otay River (Otay River Tributary) run north-south outside the eastern and western berms of the Bank Site, respectively. The City of San Diego's Otay River Pump Station, the Otay Valley Regional Park, and the U.S. Navy's Naval Computer and Telecommunications Station are also near the Bank Site.

The proposed Bank Site boundary lies completely within a Port-owned parcel and is marked by earthen berms along the western and eastern borders of the Bank Site. The surrounding land uses are buffered by these berms, fencing, stormwater BMPs, and the channelized, natural surface water features of Nestor Creek and the Otay River Tributary. An embankment leads up to Palm Avenue on the southern edge. Existing surface water features and wetlands are present outside of existing berms of the Bank Site and are not included in the mitigation bank. The northern edge of the bank site, a berm will be installed within USFWS jurisdiction on the ORERP site. Two Port-owned undeveloped parcels and one developed parcel are located along the eastern and western borders, but the parcels lie outside of the berms and are separated from the berms by Nestor Creek and the Otay River Tributary, respectively (FIGURE 1). The South San Diego Bay Wetland Mitigation Bank and designated buffer areas will not extend into these adjacent parcels, and the parcels will not be incorporated into the Bank Site. However, the parcels would be included as part of the PMPA process to assign land use designations to the sites. Please see **SECTION 4** for a detailed discussion of Bank design and designated buffer areas.

The Bank Site is hydrologically isolated from surface water flows from San Diego Bay, Nester Creek, and the Otay River due to the earthen berms that surround the Bank Site which were built to evaporate water and enable salts to concentrate. Some stormwater overflow runoff from Palm Avenue enters the Bank Site from the southern boundary of the property during large rain events. The surrounding surface water features—San Diego Bay, Otay River, the Otay River Tributary, and Nestor Creek—do not flow through the proposed Bank Site.

3.2 *Ownership Status*

The property owner of the South San Diego Bay Wetland Mitigation Bank is the Port of San Diego. The Port has been the legal owner of the Bank Site since 1998, when the Port purchased the Bank Parcel and three adjacent parcels from the Western Salt Company as part of a 1400-acre land acquisition. The majority of the purchased land was transferred to the State of California State Lands Commission to satisfy mitigation requirements for the Lindbergh Field Airport Terminal 2 expansion. The State Lands Commission entered into a 66 year lease with an option for an additional 66 years with the USFWS to create the South San Diego Bay Unit of the NWR.

After the San Diego County Regional Airport Authority (Airport) became a separate agency from the Port in 2003, the Port retained ownership over the Bank Site and three other parcels as provided in the California Senate Bill 1896 (2002), with the charge of utilizing them for future development, subject to the Public Trust.

The Port conducted several investigations into the feasibility and market conditions to support various developments on the site. The formal process for planning the future use of the Bank Parcel was established in a June 13, 2000 Memorandum of Understanding (MOU) between the Port and the Cities of San Diego and Imperial Beach. After numerous attempts at development, the Board of Port Commissioners determined that development of a wetland mitigation bank is the highest and best use of the property from an economic perspective, and in keeping with the Port's mission as steward of State Tidelands consistent with the Public Trust (BPC 2015).

The State of California reserves all rights on subsurface mineral deposits and soils removed from the Bank Site (California SB 860 2011). Surface water rights are not in question at the Bank Site given the tidal nature of the future established wetlands. If soils are removed from Bank Site and not deposited in the ocean, back onto State Tidelands, or at project for State wide purposes, then the State is entitled to a royalty fee of $0.25 cents per cubic yard.

The preliminary title report for the Bank Parcel is provided as APPENDIX D. There are no liens or encumbrances on the Bank property. The ALTA survey included as APPENDIX C shows the following recorded easements on the Bank Site:

- There is a San Diego Gas & Electric Company electric line easement of unknown width on the southeast portion of the Bank Site (Exception #10 in APPENDIX C);
- There is a 20-foot-wide Palm City Sanitation District easement for sewer ditches and pipelines on the southeast portion of the Bank Site (Exception #14 in APPENDIX C); and
- There is a City of San Diego sewer line easement on the southeast portion of the Bank Site (Exception #22 in APPENDIX C).

The above easements and utilities lie outside of the limits of Bank Site improvements included in the Preliminary Construction Plans within the Basis of Design Report (APPENDIX L), and the Bank is not anticipated to encroach upon or impact existing easements. As the design process advances, the Port will verify locations and extents of all easements and ensure that no conflicts with proposed improvements or construction activities exist.

3.3 *Historic Land Uses*

The Bank Site is located south of the confluence of Nestor Creek, the Otay River, and South San Diego Bay and supported wetland habitats until at least 1870 (Grossinger et al. 2011, FIGURE 3 and FIGURE 4; BLM 1987, FIGURE 5). The salt evaporation and extraction industry has operated in South San Diego Bay since the early 1870s and included the bermed portion of Pond 20 (EDAW 2001). In the 1890s, Western Salt Company acquired most of the salt producing entities and lands in South San Diego Bay, including the proposed Bank Site. The “Saltworks,” as the Western Salt Company operation was known, included a large complex of networked condensation and crystallization salt evaporator ponds in South San Diego Bay. The salt ponds were constructed to hold water, and Pond 20 is underlain by a thick impermeable clay layer to prevent the leaching of water from the pond, which remains largely intact today (APPENDIX F). When operational, water traveled through the ponds by the pull of gravity, siphons, or pumps. Salt concentrated as pond water evaporated, and the increasingly saline water was pumped from pond to pond until the salt precipitated and was harvested. Within the Bank Site, lower lying channels were created parallel to the interior berm edge that likely served as borrow areas for the reconstruction and repair of the berms, and water storage for pumped transfers within the salt pond system (Port 2008).

In 1916, the Savage Dam failed and released Lower Otay Lake to the lower watershed. The dam failure washed away several berms within the Saltworks, including those of the Bank Site, and deposited substantial volumes of sediment within the Bank Site. The Bank Site and the rest of the Saltworks were restored and operational by 1918, with water entering the Bank Site via siphons. FIGURE 6 shows the Bank Site in 1953 as a functioning salt evaporator pond with distinct standing water.

However, the high elevation of the Bank Site, along with its inland location, distance from the other ponds, and increasing costs to pump water soon made its continued use logistically and economically inefficient within the Saltworks operation. Western Salt attempted to reincorporate the Bank Site into Saltworks operations in the 1960s using a new system of electrical pumps to facilitate the movement of water from the Bank Site to the other ponds in the network. (FIGURE 7 shows the Bank Site in 1966 partially inundated within the Western Salt Company Salt Works complex). This effort ultimately failed and the Bank Site as a whole has since remained vacant. The ponded water began to slowly evaporate from the closed-system site, as shown in FIGURE 8 from 1989. Today, the Bank Site is largely upland surrounded by deep borrow pits located along the inner edge of the berms that fill with water when it rains. During the summer, the hypersaline water within these borrow pits periodically evaporates, leaving behind a thick white salt crust. This condition is shown in FIGURE 9, a 2014 aerial photograph.

The Salt Works is still in operation today as the South Bay Salt Works Company, located to the north of Pond 20 along Bay Boulevard, and does not include the Bank Site.

FIGURE 3: 1852 T-SHEET NO T-365 (GROSSINGER ET AL. 2011)

REGISTER No.:	T-365
PUBLISHED:	1852
SURVEYOR:	A. M. HARRISON
LOCALE:	TIJUANA ESTUARY, SOUTHERN PART OF SAN DIEGO BAY

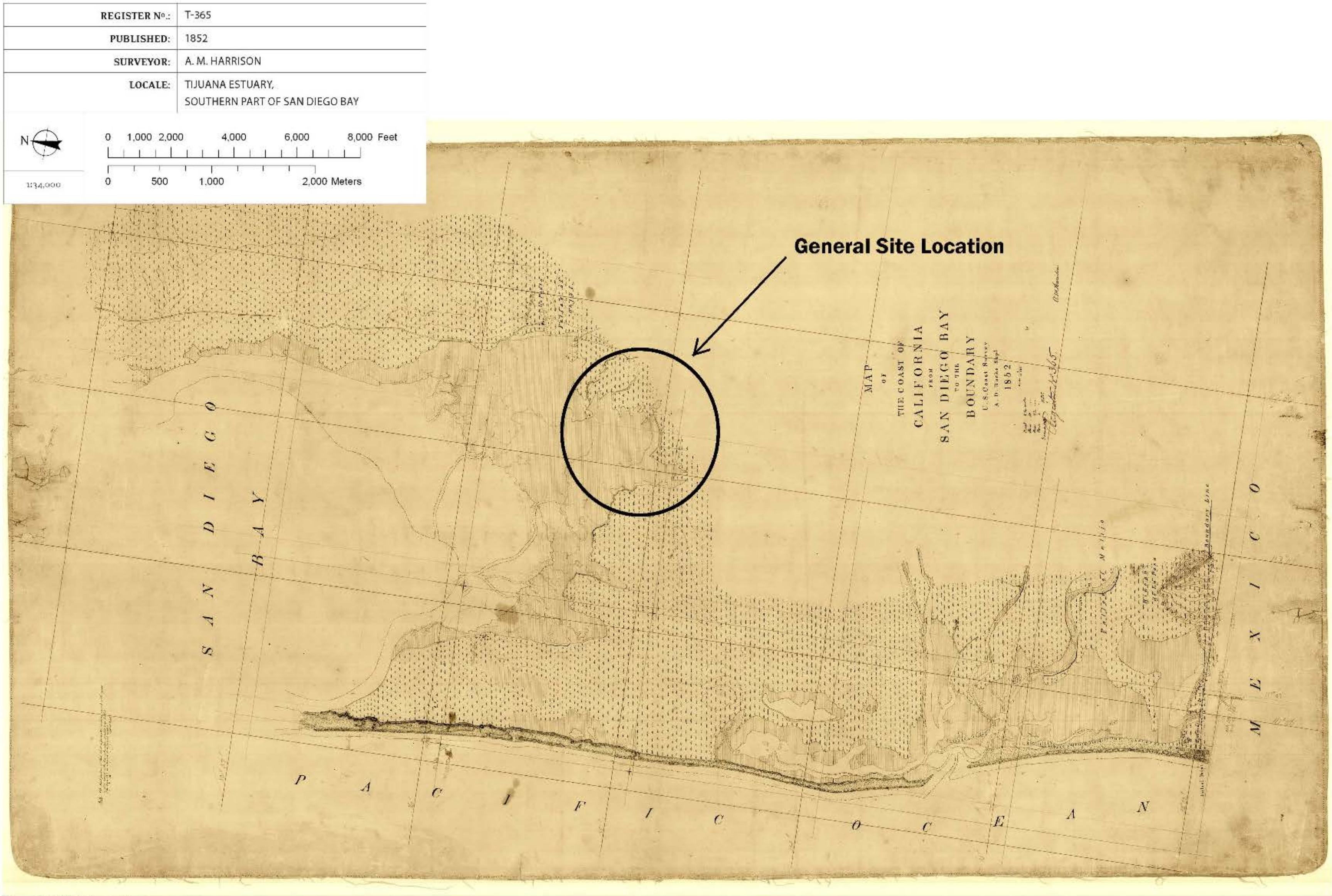


Figure 29. T-365 (full extent).

FIGURE 4: COASTAL FEATURES DIGITIZED FROM 1852 T-SHEET NO. T-365, OVERLAID ON MODERN AERIAL PHOTOGRAPHY (GROSSINGER ET AL. 2011)

Figure 30. Coastal features digitized from T-365, overlaid on modern aerial photography (USDA 2005), at same scale as facing T-sheet.

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FIGURE 5: 1870 BLM U.S. LAND OFFICE MAP

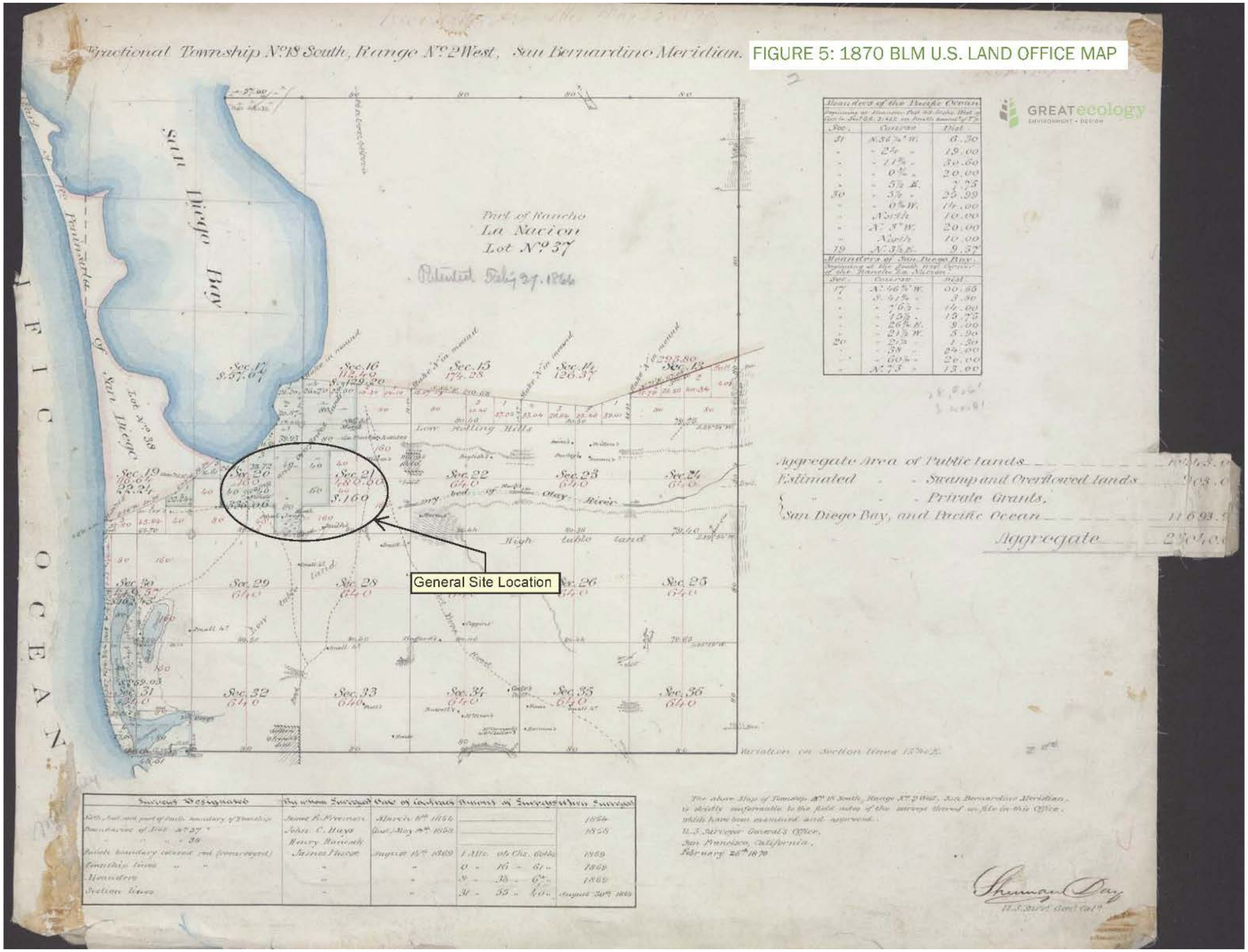


FIGURE 6: HISTORIC 1953 AERIAL PHOTOGRAPH OF THE BANK SITE

FIGURE 7: HISTORIC 1966 AERIAL PHOTOGRAPH OF THE BANK SITE

FIGURE 8: HISTORIC 1989 AERIAL PHOTOGRAPH OF THE BANK SITE

FIGURE 9: CURRENT 2014 AERIAL PHOTOGRAPH OF THE BANK SITE (BANK PARCEL BOUNDARY SHOWN)

3.4 *Current Site Conditions*

The Bank Site is surrounded by earthen berms and is comprised of disturbed upland salt flats and isolated hypersaline pools perched on fill material. The Bank Site is bermed and is isolated from surface tidal flows, and therefore only receives water inputs via precipitation and one stormwater downspout from Palm Avenue located along the southern border.

The Bank Site's historical use as a salt evaporator pond was permanently changed in the 1870s from an estuarine wetland to a biologically-unproductive, artificial upland habitat. The fill material is geologically distinct from those typical of estuarine areas and contains a small amount of anthropogenic trash and debris. Deep topographical depressions or borrow areas are located along the interior edges of the berm and support isolated, perched hypersaline pools of collected rainwater. The Bank Site's use history has rendered the fill soil at its existing grade hypersaline, and much of the Bank Site's surface supports a thick crust of salt precipitate. The hypersaline nature of the soils limits plant growth. The existing vegetation on the interior of the Bank Site is largely comprised of upland scrub and low-diversity upland herbaceous community assemblages. USACE jurisdictional wetland and non-wetland habitats are limited to the floodplain areas outside of the berms along the Otay River Tributary and Nestor Creek. These jurisdictional features are not located within the Bank Site.

The Bank Site has been hydrologically isolated from surrounding surface water features. Neither San Diego Bay, the Otay River, Nestor Creek, nor the Otay River Tributary flow into or through the Bank Site. The Bank Site has therefore been insulated from any risk associated with contaminants carried into the Bank Site by these major surface water inputs. As described in **SECTION 4**, the planned breach of the berm to restore tidal connection to the Bank Site will be located in the northwest corner of the property just south of the confluence of the Otay River and San Diego Bay.

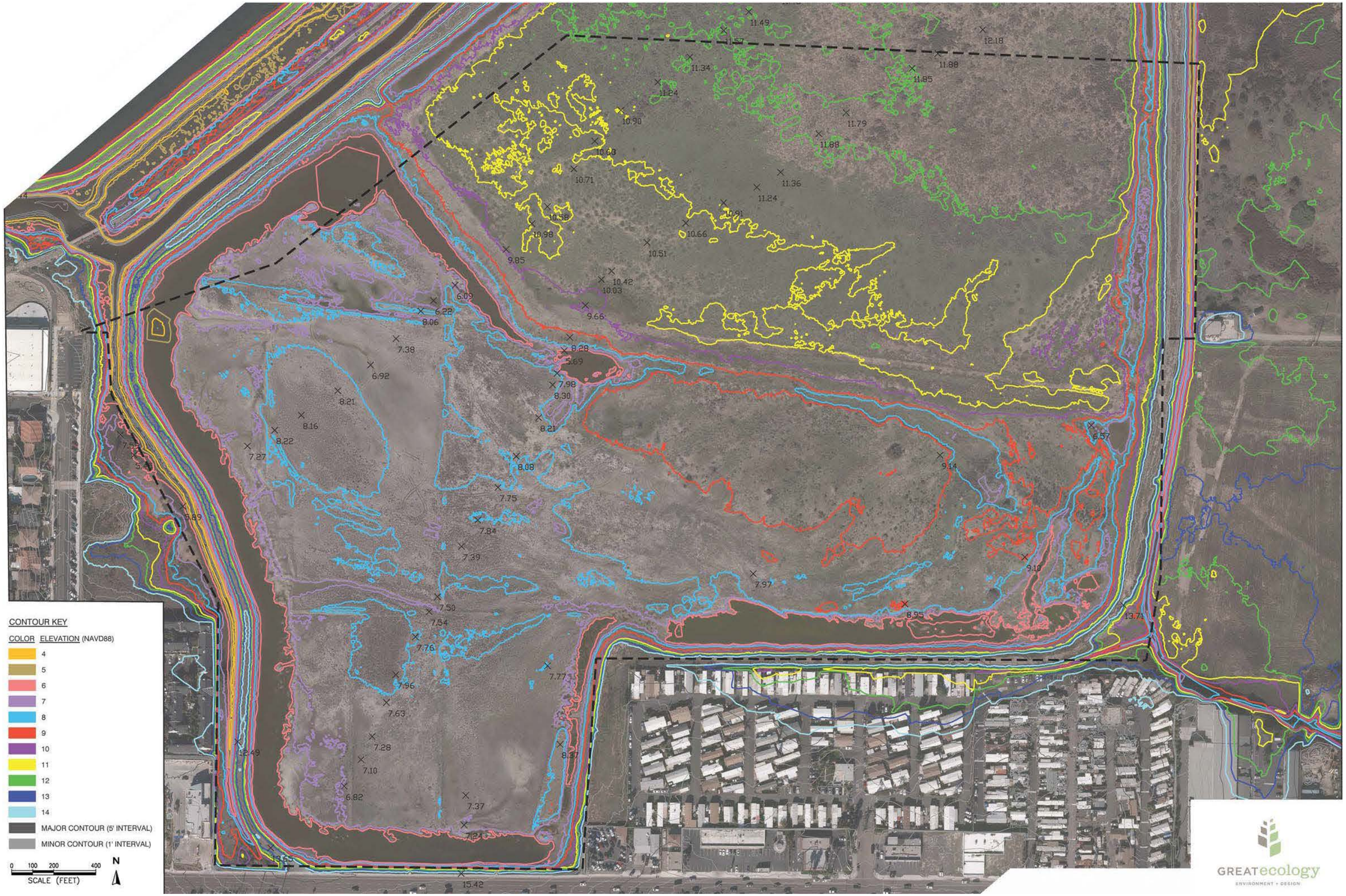
3.5 *Climate*

The City of San Diego is characterized by dry, warm summers and relatively cool and dry winters typical of a Mediterranean climate. Average annual rainfall at the Bank Site is 9.73 inches, with temperatures between 53.5 and 68.5°F on average (WRCC Station No. 041758, 1918-2016). February is the the wettest month on average.

3.6 *Topography*

Elevations within the Bank Site range from 6 to 12 feet NAVD88 between the edges of the hypersaline pools to the upland areas inside the berms. The berms range in height between 13 and 14 feet NAVD88. Palm Avenue and the surrounding commercial and residential properties lie at approximately 17 feet NAVD88 (FIGURE 10; Towill 2017).

FIGURE 10: EXISTING BANK SITE TOPOGRAPHY, 1 FOOT CONTOURS (NAVD88) (TOWILL 2017)



3.7 *Geology*

The Bank Site is located within the western Peninsular Range Geomorphic Province of Southern California, which stretches 900 miles from the Los Angeles Basin and the Transverse Ranges to the southern end of Baja California (Norris and Webb 1990). The Bank Site is located within the coastal plain section of the province, which consists, of subdued land forms underlain by Cenozoic sedimentary formations. The subject site is underlain at depth by Quaternary-age sandstone associated with the Bay Point Formation and unnamed near-shore marine sandstone, alluvium, and minor fill soils (Geotech 2000).

3.8 *Hydrology*

The Bank Site lies within the Otay Hydrologic Unit, a watershed covering 154 square miles that is drained by the Otay River and its tributaries. The existing perimeter berm hydrologically isolates the Bank Site from the surrounding landscape and waterways. Pond 20 was constructed to hold water, and the underlain impermeable clay layer remains largely intact, preventing tidal and surface water exchange. Some minor runoff from Palm Avenue enters the site from the south along Palm Avenue during large rain events. This section describes the existing hydrologic features both within and outside of the perimeter berm.

3.8.1 Hydrology of the Bank Site (within the Perimeter Berm)

The existing Bank Site contains permanent and ephemeral water features. Permanent ponds and intermittent pools are located predominately along the inside edge of the berm in the borrow pits. Water features within the Bank Site are not connected to any surface water features outside the berms via surface or groundwater.

The water source for the borrow pits identified within the berms is solely precipitation, with limited stormwater contributions. Pond 20 receives water from rain events and occasionally from stormwater entering the Bank Site via sheet water flows and from one stormwater downspout that extends from Palm Avenue into the enclosed Bank Site along its southern boundary.

Water levels in these isolated water features fluctuate seasonally and are highly dependent on closed system evaporative processes, which in addition to the Bank Site's history as a salt evaporator pond, have rendered the water within the borrow areas hypersaline. Water levels within the borrow areas and their fluctuation rates are controlled by seasonal precipitation. Standing water within the isolated borrow areas is generally found below a nearly complete salt crust, though water may sit atop the crust following sufficient cumulative precipitation.

3.8.2 Hydrology of the Otay River Tributary and Nestor Creek (Outside of the Perimeter Berm)

Two drainage features are located outside of the berms: Nestor Creek flows north along the eastern boundary to its confluence with the Otay River northeast of the Bank Site; and a tributary of the Otay River flows north along the western boundary of the Bank Site to its confluence with the Otay River (FIGURE 2). Both the Otay River Tributary and Nestor Creek receive tidal influence from San Diego Bay via the Otay River channel.

The Nestor Creek channel is lined by concrete upstream of the Bank Site and is fed by freshwater flows from the adjacent urban floodplain. Adjacent to the Bank Site and at its confluence with the Otay River, the Nestor Creek channel is unconsolidated mud bottom.

- During high stormwater flows, the Otay River Tributary conveys water from a Municipal Separate Storm Sewer System (MS4) drainage and Palm Avenue north to the Otay River. Hydrology indicators in the southern end of the Otay River Tributary indicate high water flows pass through the non-wetland area adjacent to the MS4 drainage during storm events.

Neither the Otay River Tributary, Nestor Creek, nor the Otay River Tributary enter or flow through Pond 20 (FIGURE 2). The Otay River connects to San Diego Bay northwest of the Bank Site.

3.9 *Soils*

The earthen berms forming the boundaries of the Bank Site are made of highly compacted moist gray clay with lenses of fine sand. Shell hash is present on the surface of the berm soils, indicating the berm is comprised of marine dredge material. Prior to the 1870s, the Bank Site supported wetland and estuarine habitat. Beginning in the 1870s, the Bank Site was converted into an isolated pond enclosed by high berms, purposely constructed to hold water until it evaporated to facilitate the collection of salt precipitate. The upstream failure of Savage Dam in 1918 damaged the berms and filled the impoundment with sand, sediment, and soil.

The Bank Site is currently at grades of approximately 9.05 feet NAVD88 on average and still comprised of this fill material. Soils ranging from sand to clays and construction lumber within the soil column have been observed at various locations across the Bank Site, distributed relatively randomly horizontally across the landscape and vertically down the soil profile. Near the edges of the borrow areas are hypersaline pools located along the inner edge of the berms, the soils are a coarse mix of sand and large salt precipitate fragments.

The adjacent Otay River Floodplain component of the ORERP (see FIGURE 1) has been the subject of multiple technical analysis as it moves through the environmental review process. Poseidon, the ORERP project proponent, prepared several studies that informed their initial design. A detailed soil characterization analysis for the current extent of the ORERP-Otay River Floodplain site found little to no soil contamination, and the site was determined to be a suitable location for mitigation (CCC 2013). The same study also examined a portion of the Refuge located east of Nestor Creek—outside the boundaries of both the ORERP-Otay River Floodplain site and the Bank Site, and outside the berms—and found significant soil contamination from dichlorodiphenyltrichloroethane (DDT), chlordane, and polychlorinated biphenyls (PCBs). Some of these areas east of Nestor Creek and outside of the Bank Site contained concentrations of DDT contamination high enough to be considered hazardous (CCC 2013). This contamination is likely related to historical agricultural uses, which did not occur within the ORERP-Otay River Floodplain site nor at the Bank Site.

Since the Bank Site shares its land use history with the ORERP-Otay River Estuary site, and not the agricultural uses which appear to co-occur with contamination on the Refuge land located east of Nestor Creek, the Poseidon data indicates the land uses within the salt ponds did not result in contamination. Furthermore, the data indicate that soil quality associated with historical salt production is consistent with reuse of materials as substrate for sensitive biological resources in San Diego Bay.

A screening level soil quality investigation was conducted at the Bank Site in May 2017 to inform an evaluation of placement options for upland soils and identify any potential soil contaminants at the Bank Site. Four locations on the Bank Site (one on the berm, three within the impoundment) were sampled. Bulk sediment physical characteristics and bulk sediment chemistry indicated a lack of contamination following direct testing of materials encountered during the investigation. Soil arsenic was the only analyte to exceed a screening value; additional leachability testing indicated it is tightly bound and does not present a risk to even the most susceptible aquatic receptors. As a result, data collected indicate the materials are substantially inert with regard to beneficial reuse at offsite locations. This study report (Preliminary Horticultural Soil Quality Evaluation Report) is included as APPENDIX E.

A Phase I Assessment will be completed in 2018 and the results will be submitted with the Draft BEI. Phase II soil sampling and analysis of the Bank Site will be conducted in accordance with regulatory requirements and to inform the environmental review of the South San Diego Bay Wetland Mitigation Bank project in the summer 2018.

3.10 *Jurisdictional Areas*

A survey to delineate the boundaries of potentially jurisdictional wetland and non-wetland waters of the U.S. was performed on the Bank Site in January and February 2017, and a supplementary field survey to delineate potential wetlands and non-wetland waters of the State was conducted in July 2017. No jurisdictional wetlands or waters of the U.S. or State were identified on the Bank Site within the berms.

Jurisdictional wetlands and waters of the U.S. and State features were located outside the Bank Site berms, which form the site boundary. Outside the berms, the total area of potential jurisdictional non-wetland waters of the U.S. and State was determined to be 0.37 acre, and jurisdictional wetland waters of the U.S. and State was determined to be 1.16 acres.

The jurisdictional determination report for waters of the U.S. is included in APPENDIX F, and the supplemental jurisdictional determination report for waters of the State in APPENDIX G. The extents of waters of the U.S. and State are depicted in each report, respectively.

3.11 *Biological Resources*

3.11.1 Biological Resource Studies

A comprehensive biological resources study is underway in support of this proposed Bank. The study includes literature review, database searches, and field surveys. The biological resource study will conclude with focused surveys conducted in spring 2018. A full biological resources survey report will be submitted with the Draft Bank Enabling Instrument following the completion of spring 2018 surveys. The results of the biological resources studies to-date are summarized below.

A literature review and database records search was conducted to identify the existence or potential occurrence of special interest biological resources (e.g., plant and animal species) at or within the vicinity of the Bank Parcel. The wetland features, vegetation communities, and habitat types were mapped during January and September 2017 field surveys. Aerial maps were analyzed and utilized in the field for ground-truthing. The aerial maps were modified during ground-truthing, and geographic data for habitat boundaries were recorded. Vegetation communities and habitat types were classified consistent with the California Department of Fish & Wildlife (CDFW) Vegetation Classification and Mapping Program (VegCAMP) protocols (Sawyer et al. 2009).

The Bank Site has been heavily modified, and land use history at Pond 20 has created conditions wherein ruderal habitats dominate much of the site. Vegetation consists of primarily nonnative and disturbed plant assemblages, with remnant areas of native plants. Nonnative species comprise the greatest percentage of cover within the Bank Site (i.e. inside the berms). As described in ***Section 3.10***, portions of the Bank Parcel associated with drainage channels outside of the bermed impoundment support wetland habitats. Vegetation communities within the Bank Site are comprised of Upland Mustards (*Hirschfeldia incana* Semi-Natural Herbaceous Stand), Sweetclover Fields (*Melilotus* Semi-Natural Herbaceous Stand), Ice Plant Mats (*Mesembryanthemum* Semi-Natural Herbaceous Stand), Disturbed Broom Scrub (*Baccharis sarothroides* Shrubland), a small Coastal Cholla Patch (*Cylindropuntia prolifera* Shrubland), disturbed Menzie's Golden Bush Scrub (*Isocoma menziesii* Shrubland), disturbed Seablite Scrub (*Suaeda taxifolia* Shrubland), unvegetated Salt Panne, and sparsely vegetated roads and berms. Pickleweed Mats (*Salicornia* Semi-Natural Herbaceous Stand) occur at the location of the planned berm breach in the northwest portion of the Bank Site where tidal connection will be restored. Vegetation communities mapped during the preliminary biological resources survey of the Bank Parcel are listed in TABLE 3. Detailed maps of plant communities/land cover types on orthophotos were prepared to assist in field documentation, and are included as FIGURE 11. Corresponding plant densities for each vegetation alliance are summarized in APPENDIX H.

Wildlife detected and/or expected to use the Bank Site in its current condition are adapted to disturbed landscapes. A list of plant and wildlife species observed during the preliminary biological resources survey is included as APPENDIX I. In addition, bird observations for all of Pond 20 were collected over 12 months during 2016 and 2017 focused avian surveys conducted by the Port of San Diego and U.S. Navy, and are compiled for inclusion as APPENDIX J.

3.11.2 Special Status Species

Special status species observed or with potential to occur in the vicinity of the Bank Parcel are provided in TABLE 4. This table summarizes the potential for each of these species to occur based on the Bank's existing suitable onsite habitat. While the purpose of this Bank is to create and enhance tidal wetlands, it may provide ancillary habitat services for several federal and state listed species with potential to occur onsite, including western snowy plover (*Charadrius alexandrinus nivosus*), light-footed Ridgeway's rail (*Rallus longirostris levipes*), and estuary seablite (*Suaeda esteroa*). These potential improvements to wildlife habitat are further described in Section 4.5.5.

TABLE 3: CALIFORNIA VEGCAMP PLANT COMMUNITIES AT BANK PARCEL

Alliance	Association	Acres
Herbaceous Alliances (All are disturbed due to historic soil modifications)		
Hirschfeldia incana Semi-Natural Herbaceous Stand - Upland Mustards	*Hirschfeldia incana* Semi-Natural Herbaceous Stand	9.87
Melilotus Semi-Natural Herbaceous Stand - Sweetclover Fields[1]	*Melilotus-Mesembryanthemum* sp. Semi-Natural Herbaceous Stands	1.77
Mesembryanthemum Semi-Natural Herbaceous Stand - Ice Plant Mats	*Mesembryanthemum* sp. Semi-Natural Herbaceous Stand	39.26
	Mesembryanthemum-Salicornia Semi-Natural Herbaceous Stands	3.00
Salicornia Semi-Natural Herbaceous Stand - Pickleweed Mats	*Salicornia* sp. Semi-Natural Herbaceous Stand	1.35
	Herbaceous Alliances Subtotal	**55.25**
Shrub Dominated Alliances (All are disturbed due to historic soil modifications)		
Baccharis sarothroides Shrubland - Disturbed Broom Scrub	*Baccharis sarothroides* Shrubland / *Mesembryanthemum* sp. Semi-Natural Herbaceous Stands	0.28
Cylindropuntia prolifera Shrubland - Coastal Cholla Patches	*Cylindropuntia prolifera* Shrubland/*Mesembryanthemum* sp. Semi-Natural Herbaceous Stands	0.05
Isocoma menziesii Shrubland – Menzie's Golden Bush Scrub	*Isocoma menziesii* Shrubland/*Mesembryanthemum* sp. Semi-Natural Herbaceous Stands	2.25
	Isocoma menziesii – *Baccharis sarothroides* Shrubland	6.95
Salix lasiolepis Shrubland - Arroyo Willow Thickets	*Salix lasiolepis* Shrubland/*Erigeron canadensis* Semi-Natural Herbaceous Stand	0.31
Suaeda taxifolia Shrubland – Seablite Scrub[1]	*Suaeda taxifolia* Shrubland	2.14
	Shrub Dominated Alliances Subtotal	**11.98**
Other (All are disturbed due to historic soil modifications)		
Berm/Road Vegetation	Roadway vegetation comprised of mixed non-natives and bare ground within Pond 20	3.36
	Berm vegetation – nearly bare	1.55
	Berm vegetation – comprised of mixed non-natives and bare ground surrounding Pond 20	4.37
	Berm vegetation – *Limonium* patch near culvert outfall	0.09
Salt Pond Bottom	Unvegetated	6.15
Wetland Feature[2]	Wetland Feature	0.69
	Other Subtotal	**16.21**
	Total	**83.44**

Notes

[1] Provisional mapping units

[2] See Jurisdictional Determination Report (Appendix F) for detailed delineation and characterization of this salt marsh, brackish marsh, and open water habitat.

FIGURE 11: BIOLOGICAL RESOURCES SURVEYS AT POND 20 – VEGETATION COMMUNITIES

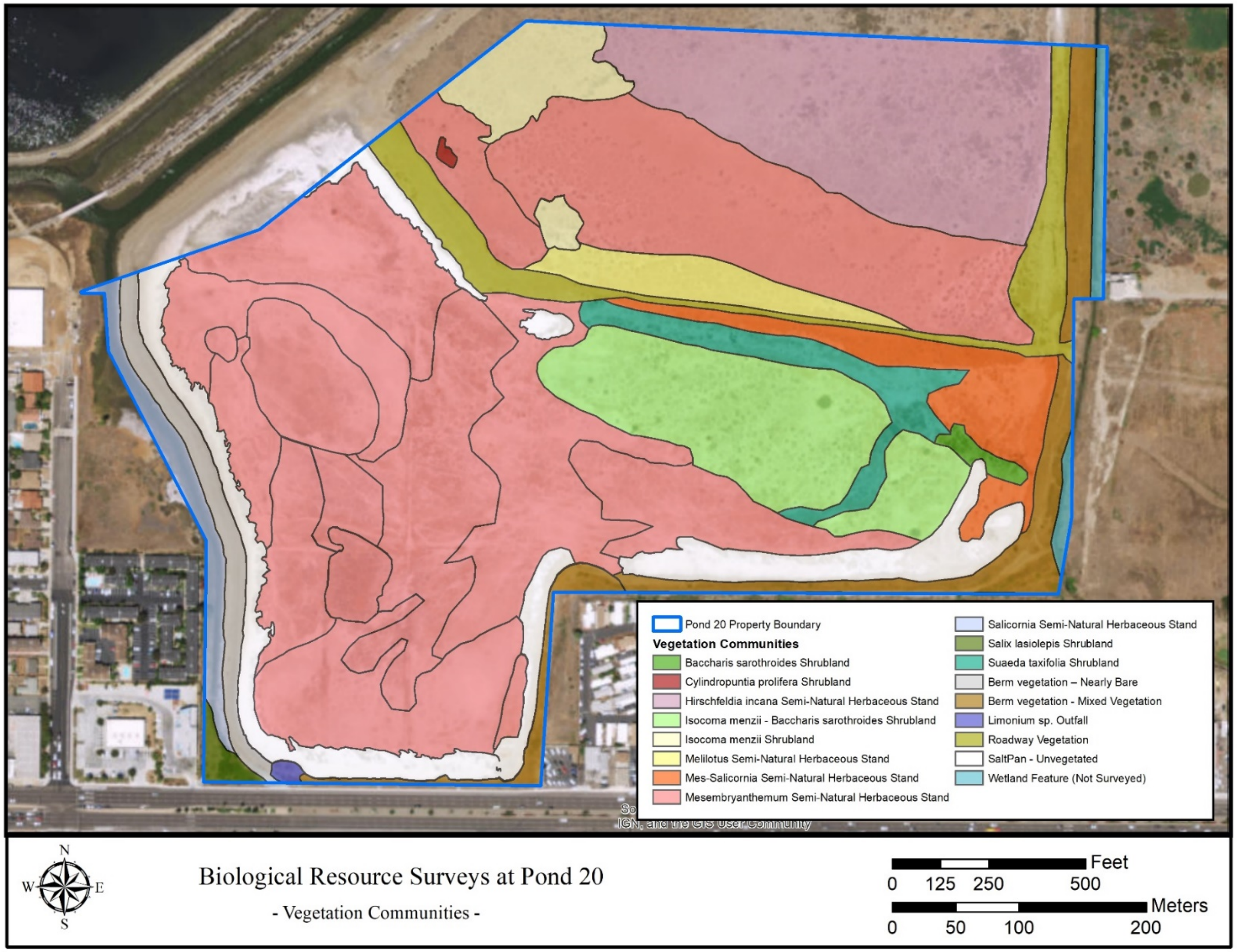


TABLE 4: SPECIAL STATUS SPECIES WITH POTENTIAL TO OCCUR IN THE VICINITY OF THE BANK SITE

Scientific Name	Common Name	Status	Potential to Occur
Plants			
Acmispon prostratus	Nuttall's Acmispon	CRPR 1B.1	Not Detected. There is potential for this species to occur within upland habitats with sandy substrates; however, there are no sand dunes onsite.
Atriplex pacifica	Pacific saltbrush	CRPR 1B.2	Not Detected. There is potential for this species to occur between the Salt Panne and upland habitats.
Lycium californicum	California boxthorn	CRPR 4.2	Occurs on site.
Suaeda esteroa	Estuary Seablite	CRPR 1B.2	Not Detected. Likely to occur. The coastal saltmarsh areas (Pickleweed Mats) within the Bank Parcel and at the northwest planned berm breach provide suitable habitat.
Birds			
Charadrius alexandrinus nivosus	Western Snowy Plover	FT, SSC	Known to occur in the vicinity. Low potential for foraging and nesting in marginally suitable habitat within the Bank Site.
Passerculus sandwichensis beldingi	Belding's Savannah Sparrow	SE	Known to occur in the vicinity. There is suitable nesting and foraging habitat for this species along the eastern edge of the Bank, but outside the Bank Site.
Rallus longirostris levipes	Light-footed Ridgway's Rail	FE, SE, FP	Known to occur in the vicinity. Low potential for foraging in marsh habitat at the northwest planned berm breach, and outside the western edge of the Bank Site.
Sternula antillarum browni	California Least Tern	FE, SE, FP	Known to forage in the vicinity. No existing forage habitat onsite. Low potential for nesting in marginally suitable habitat within the Bank Site.
Athene cunicularia hypugaea	Western Burrowing Owl	SSC	Known to occur at the Bank Site. Suitable forage and nesting habitat exists onsite.
Circus cyaneus	Northern Harrier	SSC	Known to occur at the Bank Site. Suitable forage and nesting habitat exists onsite.
Mammals			
Antrozous pallidus	Pallid Bat	SSC	Potential to occur in the vicinity. There are potential roosts in palm trees and buildings/structures adjacent to the BankSite. There is also open water which provides foraging opportunities.
Lepus californicus bennettii	San Diego black-tailed jackrabbit	SSC	Known to occur at the Bank Site.

Notes
FE – Federal Endangered
FT – Federal Threatened
SE – State Endangered
FP – Fully Protected (California)
SSC – Species of Special Concern (CDFW)
California Rare Plant Rank (CRPR) 1B – Plants Rare, Threatened, or Endangered in California and Elsewhere
CRPR 4 – Plants of Limited Distribution (watch list)

One non-listed sensitive plant species (California Rare Plant Rank 4.2) was encountered during preliminary biological surveys in 2017, California boxthorn (*Lycium californicum*). A single individual occurs near the center of the Bank Site in a slightly elevated area. Additional sensitive plant species documented within one mile of the Bank Parcel and with potential to occur onsite include Nuttall's acmispon (*Acmispon prostratus*), Pacific saltbush (*Atriplex pacifica*), and estuary seablite. No federal or state listed plant species are known or anticipated to occur onsite. Focused plant surveys of the Bank Site will be conducted during the 2018 growing season.

Federally endangered light-footed Ridgway's rail and California least tern (*Sternula antillarum browni*) are known to occur in the adjacent NWR. Federal threatened western snowy plover is also know to occur in the adjacent NWR and has been observed using Pond 20 for foraging and nesting in marginally suitable habitat. State endangered Belding's savannah sparrow (*Passerculus sandwichensis beldingi*) is known to use the salt marsh habitat associated with Nester Creek along the eastern edge of Pond 20, but outside the boundary of the Bank Site. Additionally, the following non-listed sensitive wildlife species (CDFW Species of Special Concern) are known to occur or have potential to occur onsite:

- Northern harrier (*Circus cyaneus*) and Western burrowing owl (*Athene cunicularia hypugaea*) are known to use Pond 20, and there is suitable forage and nesting habitat for these species onsite;
- San Diego black-tailed jackrabbit (*Lepus californicus bennettii*) occurs onsite; and
- Nearby there are potential roosts and foraging opportunities for pallid bat (*Antrozous pallidus*).

3.12 *Wetland Functions and Values*

Wetlands are integral components of ecosystems due to the functions they provide. For a coastal salt marsh, these general wetland functions include:

- Coastal surge, high velocity stormwater flow, and flood protection (slowing down water with vegetation and providing a basin to soak up water before it can exit to the ocean or enter adjacent coastal urban communities);
- Sediment mobilization, storage, transport, and deposition (tidal and stormwater flows carry sediment into and out of the site, providing a sink for adjacent uplands and a source of material for the tides);
- Storage and cycling of imported nutrients and organic matter (carbon sequestration, nitrogen and phosphorous removal, bacteria removal);
- Conservation of native biodiversity for plants (providing habitat for coastal species that require or tolerate regular inundation and saline environments);
- Conservation of native biodiversity for wildlife (providing feeding, breeding, and nesting grounds for coastal species);
- Marine and terrestrial wildlife corridors (providing a safe passage for species in urban areas and a resting place for migratory species); and
- Stock enhancement for recreational and commercial fisheries (wetlands act as refugia for shellfish and young fish).

Wetland values are characteristics derived from these wetland functions that humans consider beneficial or useful (e.g., carbon sequestration, aesthetic value, recreation like birdwatching and fishing, and water quality improvements--water filtration that keeps bacteria from stormwater from entering directly into the ocean).

3.13 *Baseline Wetland Functional Assessment*

The Bank Site currently has no or severely degraded wetland functions and associated values, and essentially does not function as an estuarine or intertidal saltmarsh wetland. No hydrophytic wetland communities currently exist within the proposed Bank Site, and isolation from existing neighboring water features precludes the site from any meaningful wetland functions and values to the watershed and surrounding land uses. The existing perennial borrow pits located along the inside of the berms are hypersaline and devoid of vegetation, fish, and other marine macrobiota (although the pools may occasionally support brine invertebrates, e.g., brine flies). The Bank Site currently provides minimal species habitat, and supports marginally suitable nesting habitat for migratory birds.

Historically, in this region wetland functions and values have been assessed using the California Rapid Assessment Method (CRAM). However, the California Rapid Assessment Method (CRAM) was determined to be incompatible with the unique attributes of the Bank Site. CRAM is suitable in the context of comparing existing (baseline) conditions to planned conditions if the habitat is enhanced or restored for improved function. In the case of habitat creation, which is planned for the Bank Site, CRAM would require the application of multiple separate CRAM modules that focus on different habitat attributes, because the pre- and post- habitats differ so significantly (i.e., disturbed upland fill converted to tidal wetland). This mix of different modules is problematic with regard to implementation, and for quantifying uplift. Additionally, CRAM does not currently support a module to assess subtidal or unvegetated intertidal areas, so an accurate assessment of post-restoration function would not be possible.

As an alternative to CRAM, the Evaluation for Planned Wetland (EPW) was evaluated as the project functional assessment by USACE in November 2017. The EPW is a rapid assessment procedure that documents differences between pre- and post-restoration site conditions for which a wetland is existing, planned, or both. It was designed to assess wetland function within a variety of contexts, including restoration and creation of wetlands, mitigation banking, impact analysis, and watershed planning. EPW identifies several classes of wetlands and provides a quantitative determination of the amount of uplift resulting from conversion of degraded upland to tidal wetland. The EPW Functional Assessment Handbook (Bartoldus et al. 1987), which details the full functional assessment methodology, is included as APPENDIX K and a brief summary of the methodology is provided below.

EPW builds on USACE's Hydrogeomorphic (HGM) model, which was developed in the early 1990s to evaluate the functions and values of restored wetlands. EPW was adapted specifically for management and restoration of wetland sites. EPW assesses similar wetland functions as HGM, and is typically applied when an HGM would be practicable but a regionally-calibrated HGM model does not exist for the targeted wetland subclass, such as at the Bank Site. EPW is commonly applied to projects across the U.S.

A baseline functional assessment using the EPW method was conducted at the Bank Site in March 2017 and a post-restoration EPW evaluation will be completed during the next project design phase. The results of the baseline analysis will provide the benchmark against which increases in post-restoration ecological function, or uplift, will be determined to measure post-restoration project performance.

EPW is based on six key wetland functions, or *indicators*, which are comprised of several wetland *elements*. Elements are scored individually based on field or remotely-sensed measurements taken in discrete spatial units called *wetland assessment areas* (WAAs). Element scores per WAA are then aggregated to produce a quality-based functional score for each indicator. This score is also called the Functional Capacity Index (FCI), an overall quantification of function that ranges between 0 (low level of function) and 1.0 (high level of function). FCIs can be compared between sites, or used to compare different management scenarios within a site. A Functional Capacity Unit (FCU), which scales measured function per indicator to a specific area, can also be calculated to facilitate comparisons between sites of varying size and complexity. Average FCI and FCU values may be calculated to provide a single unit to facilitate more streamlined comparisons, though this value does not represent a meaningful measure of ecological function.

EPW is typically used to guide design of wetland restoration projects. Baseline conditions are assessed, and the results of the analysis identify opportunities to improve function during the design process. After a design is completed, a post-restoration EPW model is completed to provide an estimate of the increase in function due to the restoration project. The difference in function between baseline and post-restoration is called *uplift*, and designs guided by EPW principles focus on maximizing uplift to achieve the greatest increase in ecological function that is possible for a given area. Following project implementation, EPW is periodically conducted to measure progress toward the post-restoration EPW scores that form the basis of the project success criteria.

TABLE 5 summarizes the baseline functional results of the EPW when applied to the proposed Bank Site. The Bank Site provides low overall ecological function and does not function currently as a tidal wetland system. EPW scores are limited to areas located within the boundaries of the earthen berms and these scores do not include the wetlands located along the Otay River Tributary and Nestor Creek. Due to the relatively homogenous nature of the Bank Site's existing condition, the baseline EPW was applied to the site as a whole rather than broken down by distinctive habitat assessment areas. The full table of baseline EPW scores applied to the proposed Bank Site is included as APPENDIX L.

Post-restoration projected scores will be assigned based on an analysis of the 60% level project design and submitted with the Draft BEI to quantify the projected increase in function due to the project.

TABLE 5: PRELIMINARY EPW FUNCTIONAL ASSESSMENT SCORES FOR SOUTH SAN DIEGO BAY WETLAND MITIGATION BANK EXISTING CONDITIONS

Indicator	Existing FCI	Existing FCU
Shoreline Bank Erosion Control	0.30	1.21
Sediment Stabilization	0.31	23.7
Water Quality	0.29	22.2
Wildlife	0.19	14.6
Fish (Tidal)	0.09	0.50
Fish (Non-tidal Pond/Lake)	NA	NA
Fish (Non-tidal Stream/River)	NA	NA
Uniqueness/Heritage[1]	0.24	
Average[2]	**0.24**	**12.4**

Notes
FCI = Functional Capacity Index
FCU = Functional Capacity Unit
NA = Not Applicable
[1] Uniqueness/Heritage is not evaluated across a spatial unit
[2] Average provides an overall expression of function to facilitate comparison between site conditions over time. However, unlike the individual indicator scores, the average does not express an ecologically meaningful description of function.

3.14 *Cultural Resources*

A cultural, historical, archaeological, and Native American resources evaluation will be conducted in 2018 to inform the environmental review of the South San Diego Bay Wetland Mitigation Bank project, Results of the cultural resources identification, inventory, and evaluation will be included in the Draft BEI.

3.15 *Phase I Environmental Site Assessment*

A Phase I Environmental Site Assessment is in preparation and will be included in the Draft BEI.

3.16 *Current Landscape Context*

The Bank Site is located within a landscape matrix adjacent to the preserved NWR protected habitat areas to the north, and mixed commercial and residential development to the south, east, and west (FIGURE 12). Current and historic land uses within South San Diego Bay include commercial, residential, agricultural, salt extraction, and open space uses (SANDAG 2013). The South San Diego Bay Wetland Mitigation Bank will complement surrounding land uses by expanding valuable wetland habitat of the adjacent NWR, providing essential wetland functions and services for adjacent communities, including storm surge and flood protection and stormwater buffering, which will benefit the local economy and property values. Restoration concept alternatives for Pond 20 were included in the NWR Comprehensive Conservation Plan (USFWS 2006).

The entire southern end of San Diego Bay is recognized as a Western Hemisphere Shorebird Reserve Network Site due to harboring more than 20,000 shorebirds each year (San Diego Bay INRMP 2013). The Bay's intertidal shorelines support foraging shorebirds as well as juvenile and adult fishes. The Bank Site is currently hydrologically cut off from this shoreline network and provides no marine ecological services or fish habitat, and does not function as valuable shorebird habitat due to degraded site conditions. The South San Diego Bay Wetland Mitigation Bank would establish intertidal areas that may provide habitat for migratory and resident shorebirds and fishes. Using various protection, restoration, enhancement, and management strategies, the Bank may provide ancillary habitat services that support the population of protected shorebird species and fishes in the region.

3.16.1 Adjacent Land Uses

Adjacent land uses are depicted in FIGURE 12. East of the Bank Site and north of Boundary Avenue is a large upland preserved open space area that is part of the Otay Valley Regional Park trail system and administered by the County of San Diego and the Cities of Chula Vista and San Diego, exercised through a Joint Exercise of Powers Agreement (JEPA 1997). At the western end of Boundary Avenue is the operational Otay River Pump Station, managed by the City of San Diego, which reroutes effluent to the South Bay Water Reclamation Plant. South of Boundary Avenue is an undeveloped, upland nine-acre parcel owned by the Port. This area is designated for commercial development and is not included in the mitigation bank plans or boundaries. Furthermore, the berm surrounding the Bank Site separates the mitigation site from Nestor Creek, and provides a buffer between the Bank Site and land uses to the east. The berm will likely remain in place following construction of the Bank and Nestor Creek will likely continue to be excluded from the Bank Site.

Farther north, approximately four miles along the eastern shore of San Diego Bay, is the Chula Vista Bayfront Master Plan area, which is the focus of a redevelopment effort by the Port, and the City of Chula Vista. Soil extracted from the Bank Site may be reused at the Chula Vista development and as a beneficial reuse component of the South San Diego Bay Wetland Mitigation Bank project. However, the ultimate destination of the soil to be exported from Pond 20 is currently undetermined and is the subject of active planning and negotiation based on fill quality, distance to end use site, and cost.

The southern boundary of the Bank Site is lined with residential and commercial properties. The south side of the Bank Site boundary directly abuts Palm Avenue, from which an embankment currently extends down into the Bank Site. Pedestrians will be able to view the completed Bank Site from the sidewalk and two viewing areas above the embankment along Palm Avenue. The Port installed exclusion fencing here in 2015 along with two viewing areas and associated site improvements that were designed to highlight the area's natural resources. On the east side of the southern boundary, the Bank Site abuts the Bayside Palms Mobile Home Village. The mobile home park is currently buffered by the earthen berm, and stormwater runs off the mobile home park into a ditch that parallels the Pond 20 berm and then continues east to Nestor Creek. The berm will likely remain in place following the construction of the Bank, and the stormwater ditch will likely continue to function as a conveyance to Nestor Creek, which may help support the integrity of the adjacent mobile home park infrastructure. Please see **SECTION 4** for a discussion of how sheet runoff will be addressed at the Bank Site.

The western Bank Site boundary is lined with a car wash, residential condominiums, and another Port-owned, undeveloped three-acre upland parcel designated for visitor serving commercial use. This undeveloped parcel is not included in the mitigation bank boundaries. To the northeast is the Bikeway Village, a mixed-use development located along the Silver Strand Bikeway. The earthen berm and the Otay River Tributary separates the Bank Site boundary from these adjacent uses and forms a buffer that will remain in place with the construction of the Bank.

The Bikeway Village serves recreational cyclists and pedestrians utilizing the Silver Strand Bikeway, which runs north of the Bank Site, outside the Bank Site's boundaries. Cyclists and pedestrians will be able to view the completed Bank Site during trips on the Bikeway. The Bikeway crosses the Otay River via a historical railroad bridge at the confluence of the Otay River and the Otay River Tributary, which runs north-south outside the western boundary of the Bank Site. An approximately 75 foot section of the berm along the western edge of the Bank Site (measuring from 5 feet NAVD88), along the Otay River Tributary, will be strategically breached, to serve as the major water source for the Mitigation Bank. Finally, the current bank design includes measures to reduce scour and erosion at the historical railroad bridge to ensure the integrity of the Bikeway. Please see **SECTION 4** for a detailed description of the Bank design and hydrology.

FIGURE 12: CURRENT LANDSCAPE CONTEXT

CURRENT LANDSCAPE CONTEXT
SOUTH SAN DIEGO BAY WETLAND MITIGATION BANK
SAN DIEGO UNIFIED PORT DISTRICT
NOVEMBER 2017

1:45,000
WGS 1984 WEB MERCATOR

0 0.75 1.5 Miles
N

GREATecology ENVIRONMENT + DESIGN

3.16.2 Adjacent Land & Habitat Connectivity (USFWS NWR and ORERP Site)

The 2,300-acre South San Diego Bay Unit of the NWR, established in 1999, lies north and west of the Bank Site on the north side of the Otay River. The NWR includes a large complex of restored and active salt ponds. The NWR's primary goal is to provide nesting and foraging habitat for migratory and nesting shorebirds within the largely urbanized landscape of south San Diego. The Bank Site is wholly owned by the Port and is not within the boundaries of the NWR. The projected use of the Bank Site as a wetland mitigation bank will increase tidal wetland acreage within the area just south of the NWR. The mitigation bank will provide complementary land use to support the diverse avian populations that depend on NWR-protected habitats by providing additional, contiguous forage and nesting habitat for these species.

The NWR includes the land parcel directly adjacent to the Bank Site on its northern boundary, which will be the location of the Otay River Floodplain Site of the ORERP. The ORERP design goals are the same as those of the South San Diego Bay Wetland Mitigation Bank–namely, restoration of tidal influence to re-establish wetland habitat. See **SECTION 4** for a discussion of how design components and timelines are being coordinated between the ORERP and Bank Site planning efforts.

3.16.3 Compatibility with Applicable Land Use Plans and Policies

3.16.3.1 PORT MASTER PLAN

The Port Master Plan provides the official planning policies, consistent with a general statewide purpose, for the physical development of the tide and submerged lands conveyed and granted in trust to the Port. The project would require a PMPA for the assignment of land use designations for the Pond 20 site. Consistent with the Port's mission, applying a conservation land use designation at Pond 20 and establishing wetland habitats for use as a mitigation bank will promote environmental stewardship in San Diego Bay tidelands, and at the same time facilitate regional economic growth by allowing permitted development projects with unavoidable impacts to wetlands to proceed through purchasing mitigation credits.

3.16.3.2 CITY OF SAN DIEGO OTAY MESA-NESTOR COMMUNITY PLANNING DISTRICT

As the Bank Parcel was acquired after the original granting of tidelands by the State of California to the Port, and the Port has not yet added the Bank Parcel to the Port Master Plan, the Site is identified in the City of San Diego's Otay Mesa-Nestor Community Planning District and is designated an open space Special Study Area (SSA) within the Otay River Valley Park (Otay Mesa-Nestor Planning Committee and City of San Diego 1997). Project applicant(s) within the SSA are required to initiate a special study as part of the planning process to determine if the project will enhance biological, natural resource, habitat, and open space connectivity values within the larger SSA. While the Port is not part of the City of San Diego's community planning provisions, development of the Site into a wetland mitigation bank is consistent with the goals of the SSA.

4 PROPOSED MITIGATION BANK

4.1 *Bank Objectives*

The objective of the South San Diego Bay Wetland Mitigation Bank is to establish tidal influence and create coastal wetlands, which will provide compensatory wetland mitigation credits for wetland and habitat impacts. The mitigation bank will create high marsh, mid marsh, low marsh, intertidal mudflat, and subtidal eelgrass habitat mitigation credits to satisfy mitigation requirements under CWA Section 404, the California Coastal Act, the Porter-Cologne Water Quality Control Act, and the California Eelgrass Mitigation Policy. The established and enhanced habitats will provide regional mitigation opportunities for impacts to wetland habitats stemming from public and private development. To create the tidal wetland habitat, restoration activities will reconnect the Bank Site to tidal flows from San Diego Bay, and achieve inundation frequencies necessary to support targeted habitat types.

The restored tidal marsh will enhance ecological functions by providing forage and nesting habitat for native bird species. The project will maintain or improve existing levels of flood protection, and the Bank Site perimeter will be designed to prevent erosive wave action from compromising existing berms. The Bank Site's proximity to the NWR and the ORERP site will increase habitat connectivity and contribute meaningful habitat and ecosystem services to the South San Diego Bay region.

4.2 30% Design (Preliminary Design)

4.2.1 30% Design Overview

Following conceptual design, baseline investigations, and analysis, the project design team completed 30% design documents in October 2017 (APPENDIX M). The construction drawings reflect the current design approach, which is subject to revision and refinement through subsequent design phases. The approach addresses a range of design challenges, including long-term sustainability of marsh habitat, sea level rise (SLR) considerations, and cost efficacy. The proposed habitat distribution balances near-term establishment of mitigation bank credits with long-term habitat viability and resilience to changing tidal inundation levels resulting from SLR. Please refer to Section 3.3 of APPENDIX M for a detailed discussion of SLR projections.

The design includes the establishment of tidal wetland habitat by excavating the existing site to elevations to support these habitats including constructing tidal channels, and restoring the Bank Site's hydrologic connection to San Diego Bay. The creation of wetland habitat will be achieved by excavating existing soil and sediment, and by removing approximately 75 feet of the existing berm to reconnect tidal hydrology. A single berm breach will be created near the northwest corner of the Bank Site on USFWS property, and a network of tidal channels will be dredged throughout the Bank Site to facilitate distribution of tidal flows. The Bank Site's interior will be excavated to elevations to create a self-sustaining marsh habitat matrix. The existing berms, ranging in height from 12 to 14 feet NAVD88 (FIGURE 10), will remain as a perimeter buffer around the western, eastern, and southern boundaries along with established upland and transitional habitat. The Project design will complement the ORERP and will be contiguous with that site. The northern boundary condition, which directly abuts the ORERP site, is the subject of active coordination with the Poseidon team and is discussed in ***Section 4.6***.

The restored diversity of tidal marsh habitats will provide a significant increase in native coastal San Diego bird and fish habitat and improve ecological function in South San Diego Bay (refer to ***Section 4.5*** for detailed discussion of ecological uplift). The Bank Site will support a majority of high and mid marsh habitat, and will also include low marsh, mudflat, and subtidal habitats (FIGURE 13). Preliminary estimates of acreages for each habitat type are listed in TABLE 6 and shown in FIGURE 13.

TABLE 6: PRELIMINARY ESTIMATES OF HABITAT ACREAGES GENERATED (30% DESIGN)

Habitat Type	Target Elevation Range (feet NAVD88)	Annual Inundation Frequency (% Time)	Estimated Area (acres)
Wetland Habitat			
Subtidal habitat	-3.5 to -0.4	> MLLW	1.68
Intertidal mudflat habitat	-0.4 to 2.9	51% to MLLW	4.00
Low marsh habitat	2.9 to 4.1	26% to 51 %	1.43
Mid marsh habitat	4.1 to 5.7	5% to 26%	37.10
High marsh habitat	5.7 to 6.6	1% to 5%	20.63
Wetland Habitat Area Subtotal			**64.84**
Transition Zone			
Transition zone habitat	6.6 to 7.6	1% to 3-year inundation	3.81
Transition Zone Area Subtotal			**3.81**
Upland Transitional Habitat			
Upland transitional habitat	> 7.6	< 3-year inundation	7.83
Upland Transitional Habitat Area Subtotal			**7.83**
Total Habitat Area			**76.48**

4.2.2 Proposed Hydrologic Conditions

The primary hydrologic source for the Bank Site will be unobstructed tidal inflows from San Diego Bay and the Otay River, which passes through permanently protected NWR lands before entering the Bank Site. Tidal waters of San Diego Bay and Otay River are regulated by Section 404 of the Clean Water Act. As such, the Bank Sponsor does not anticipate that water flow to the Bank Site will be impeded by any future permitted fills. The inlet below the Bayshore Bikeway bridge is approximately 70 feet wide and allows full passage of tidal flows under all tidal regimes. Additional water input to the Bank Site will come from precipitation and occasional stormwater inputs via internal loading and runoff from Palm Avenue. Nestor Creek is located outside the berms on the eastern boundary of the Bank Site. The berms separating Nestor Creek from the Bank Site will remain post-construction.

To complete 30% design, the design team utilized hydraulic geometry relationships for coastal salt marshes based on survey data collected in relatively undisturbed marshes in San Diego Bay and San Francisco Bay (ESA 2017). Hydraulic geometry relationships are empirical relationships between tidal prism or marsh area and channel geometry (e.g., channel depth, width, cross-sectional area). Using the projected tidal prism for the Bank Site, the design team calculated the channel dimensions. TABLE 7 lists preliminary tidal channel dimensions by channel order. Dimensions are based on hydraulic geometry relationships, but are adjusted for constructability.

TABLE 7: TIDAL CHANNEL DIMENSIONS BY CHANNEL ORDER (ESA 2017)

Channel Order	Top Width at marshplain (ft)	Bottom Width (ft)	Side Slope (H:V)	Invert Elevation (ft NAVD88)	Depth (ft NAVD88 below marshplain)
3	54 to 72	8	4:1	-3.3 to -1.0	6.0 to 8.3
2	30 to 40	4	3:1	-1.0 to 0	5.0 to 6.0
1	14	2	2:1	0.4	4.6

Based on proposed tidal channel and breach dimensions, the design team's preliminary assessment indicates the 30% design will provide sufficient water/tidal influence to support proposed wetland habitat, but additional modeling is required to confirm precise tidal elevations. This modeling will be conducted with the installation of tidal gauges in the Otay River to inform refinement of proposed design grades. Water level data gathered from the new tidal gauges will be combined with existing local data and results of modeling, and the grading plan will be refined to ensure appropriate hydrology for proposed habitat distribution during the 60% design.

4.3 *Design Components and Construction Sequence*

To achieve habitat restoration goals for the mitigation bank, five primary design components will be implemented:

- Site excavation to marsh elevations;
- Excavate tidal channels;
- Transition zone/upland grading;
- Berm breach construction; and
- Soil/sediment preparation and planting.

These components are divided into two broad construction phases as discussed below.

4.3.1 Bank Site Work

To create the mitigation bank, the site will be excavated to elevations to support wetlands habitat. Existing site elevations range between 6 and 12 feet NAVD88, and designed finished grades of the majority of the Bank Site fall between five and seven feet NAVD88. Therefore, some areas will be excavated to a depth of approximately six feet. Excavation equipment will include large machinery, such as scrapers and excavators. Approximately 430,000 cubic yards will be excavated and hauled offsite for disposal or reuse at the Chula Vista Bayfront redevelopment or at an undetermined location. As the *in situ* material is excavated, the design team estimates 25% expansion in volume, resulting in an estimated total haul volume of 537,500 cubic yards (430,000 x 1.25). The Port is currently identifying a suitable upland reuse or disposal location site for the surplus material based on the characterized soil conditions, local development needs, and cost. The depth of existing borrow ditches is currently unknown due to a thick salt crust within the ditches.

Existing Bank Site elevations range from two feet below to seven feet above the mean proposed elevation of 5.6 NAVD88 (excluding the berms), and will be excavated to meet target marshplain elevations. Tidal channels will be dredged within the proposed marshplain to facilitate distribution of tidal flows throughout the Bank Site. Excavation of both tidal channels and the new marsh plain elevation will be completed prior to breaching the berm and allowing tidal waters to enter the site. (For the purposes of this discussion, excavation below five feet NAVD88 is referred to as dredging.) The 30% design includes a third order channel network, which means three channel sizes will be excavated. Refer to TABLE 7 and FIGURE 13 for proposed channel geometry and planform. The finished grade elevation at the top of all channels will be 5.0 feet NAVD88 to meet the mid-marsh plain, and all channels will increase in depth toward the breach to provide positive drainage throughout the Bank Site. Please refer to Sections A, B, and C on Sheet 8 of 14 of the 30% Design Set in APPENDIX M for channel geometry details. Where channels overlap with existing borrow ditches, some fill material from site excavation will be placed to meet designed channel grades.

To prevent erosion and provide refugia and a buffer zone around the wetland habitat, a gently sloping transition zone will be established around the marsh perimeter, between 6.5 and 10 feet NAVD88 The average slope in the 30% design transition zone is approximately 20:1 (horizontal:vertical). The site will be excavated to meet elevations for each habitat. The upper limit (top of slope) will meet the perimeter berms or embankment, and the toe of slope will meet the marsh plain.

After interior site work is completed, the existing berm will be breached. The proposed berm breach is located at the northwest corner of the Bank Site, and connects to the San Diego Bay via the Otay River Tributary and Otay River (FIGURE 13). As currently designed, and subject to change during subsequent design phases, the breach will be approximately 75 feet wide at five feet NAVD88, and will have side slopes between 3:1 and 4:1. The breach bottom will be eight feet wide with an invert elevation of -3.3 feet NAVD88. Subsequent design phases will include geotechnical recommendations regarding the existing berms.

FIGURE 13: SOUTH SAN DIEGO BAY WETLAND MITIGATION BANK PRELIMINARY DESIGN PLAN

4.3.2 Revegetation

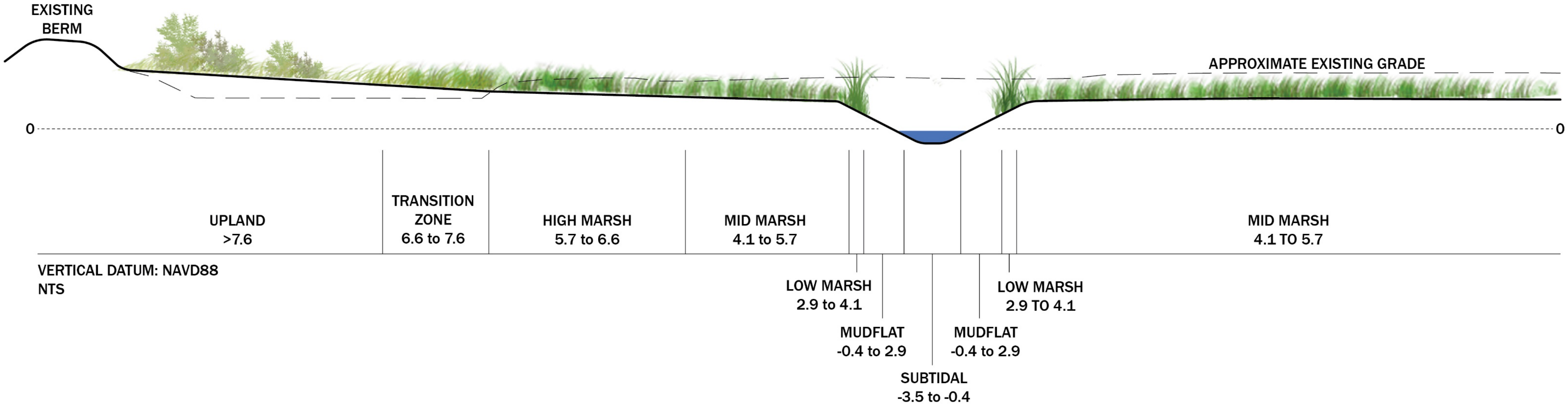
Following completion of site work, with the potential exception of the breach construction depending on phasing, soil preparation may be required to support viable plant growth. Soil compacted by construction machinery will be ripped or disked as needed to allow introduction of water, nutrients, and oxygen. Because precise elevations must be achieved for habitat establishment, and a slight expansion of material will result from ripping or disking the compacted soil, excavation depths will include over-excavation necessary to offset expansion of materials resulting from decompaction activities.

Soil/sediment sampling and testing will be conducted to determine additional soil treatment requirements prior to planting. Preliminary soil sampling from approximate future marsh planting elevations indicates high salinity and boron content, and low organic carbon. Soil conditioning, including leaching and incorporation of amendments, may be needed to provide a suitable growth medium at proposed marsh grades.

After soil decompaction and conditioning are completed, as well as any necessary weed control measures around the Bank Site perimeter, installation of the irrigation and plant materials will commence. Sheet 14 of the 30% design drawings (APPENDIX M) includes preliminary plant palettes for each proposed habitat type, and FIGURE 14, below, provides an example of a typical wetland section. Species were chosen based on nativity, habitat value, and suitability to respective habitat type and elevation range. Planting will be phased and timed to minimize site disturbance and maximize plant survivability. Plant materials will be procured from reputable, qualified native plant nurseries, and will meet quality control specifications prior to installation. Collecting stock (e.g. cordgrass and eelgrass) from adjacent tidelands or the NWR may be needed; the Port will coordinate with land managers as appropriate. Plant propagules (cuttings, seeds, and or plugs) collected in the vicinity of the Bank Site may also be used to maintain genetic integrity or to obtain source plant material for propagation. Plant material collection will be distributed over the present population to avoid overharvesting and damaging individual plants or the overall habitat. The design team anticipates installation of a combination of seed, plugs, and containerized plant stock. Subsequent design phases will determine exact sizes, distribution, spacing, and species.

The planting approach will vary depending on habitat type and desired rate of establishment. Relatively higher planting densities may be utilized at elevations that require longer periods to establish, such as mid- and high marsh. To help expedite plant establishment, the design team currently anticipates installation of a temporary or permanent irrigation system in strategic locations.

FIGURE 14: TYPICAL WETLAND SECTION



4.4 *Site Buffers*

Of the 83.5 acres of the Port-owned Bank Parcel in which the Bank Site is located, approximately 18.4 acres will function as a wetland buffer zone (FIGURE 13). This area is comprised of existing landscape features including portions of Nestor Creek, Otay River Tributary, the perimeter berm, the embankment along Palm Avenue, and proposed upland and transition habitat. (Note that a small portion of the proposed transition habitat occurs on the tops of mounds within the wetland. This 0.7 acre area has been excluded from the buffer acreage.)

The 18.4-acre buffer area is over 20% of the Bank Parcel's 83.5 acres. The buffer width varies around the perimeter of the site, and its approximate average width exceeds 100 feet. With the exception of the breach location, the proposed mitigation bank is encompassed by existing and proposed perimeter berms and embankments, which create a vertical separation from adjacent uses. The upland and transition habitat, in addition to the berm and surrounding landscape, provide a substantial buffer between wetland habitat and surrounding land uses. In addition to the 18.4-acre site buffer, the San Diego Bay NWR property and associated ORERP mitigation site along the northern boundary of the Bank Site provides an extensive external buffer zone along the length of the Bank Parcel's northern perimeter. San Diego Bay NWR land use goals for wetland habitat restoration are compatible with Bank objectives, as discussed in ***Section 4.6***.

The design team currently lacks water quality data and volumes for the limited stormwater inputs into the Bank Site. One outfall from Palm Avenue enters the Bank Site. Subsequent design phases will seek to quantify volumes, assess water quality, and if needed to ensure wetland viability, include stormwater BMPs within the project buffer to treat runoff prior to entering the wetland. As currently designed, the existing landscape and proposed restored upland and transition habitat provide a vegetative filter strip. Additional measures, such as level spreaders, bioswales, infiltration basins, and erosion control improvements may be added to the design, if necessary, to address potential concerns associated with existing stormwater inputs.

4.5 *Projected Improvements to Site Ecological Function*

The 80-acre Bank Site restoration footprint is 76.48 acres. The project will convert approximately 64.84 acres of existing upland area to subtidal and intertidal habitat area. The restoration will restore an additional 11.64 acres of transitional/buffer habitat area along the edges of the wetland and on small islands scattered throughout the site. The remaining Bank Site acreage (3.53 acres) is comprised of existing perimeter berms that will remain in place as additional buffer areas.

The proposed Bank design will restore wetland functions and values by removing existing soils to an elevation to support an intertidal marsh plain with a tidal channel network. To reconnect tidal influence for the first time in over 100 years, the existing berm will be breached. The proposed design will create new salt marsh habitat, including subtidal and intertidal, and establish and enhance the vegetation communities associated with these habitats. The vegetation will act as attractors for local wildlife and the overall wetland establishment and enhancement will increase other values, including improved water quality. Additional value enhancements include creating habitat to support spawning and breeding for native fish and birds; this will contribute to the local bird-watching and coastal fishing industries as well as providing habitat to support diverse fish populations and community assemblages within San Diego Bay and across coastal Southern California.

The Bank Site currently provides low to minimum wetland function due to its hydrological isolation, high soil salinity concentrations, and lack of wetland habitats and ecological community assemblages. The new open channel tidal area and associated tidal marsh may improve the physical, biological, and chemical functions of the Otay River Estuary and South San Diego Bay by potentially:

- Increasing natural habitat quality and diversity in South San Diego Bay, including distribution of rare native habitats, such as coastal marsh, eelgrass, and transitional upland shrublands;
- Restoring tidal wetland hydrology to a larger portion of the South San Diego Bay ecosystem;
- Supporting the establishment of intertidal wetland habitat, such as mudflats and saltmarsh, providing potential feeding grounds for migratory bird species such as long-billed curlews (*Numenius americanus*), western sandpipers (*Calidris mauri*), and long-billed dowitchers (*Limnodromus scolopaceus*), among others;
- Supporting the establishment of intertidal wetland habitat, such as mudflats and saltmarsh, providing potential feeding grounds migratory bird species;
- Improving water quality within tidal and freshwater influxes by trapping sediments, filtering storm water runoff, and metabolizing excess nutrients and bacteria;
- Increasing and improving access to nesting, foraging, and breeding habitats for migratory and nesting shorebirds, such as long-billed curlew and elegant tern (*Thalasseus elegans*), estuarine fish, such as slough anchovy (*Anchoa delicatissima*) and topsmelt (*Atherinops affinis*), and green sea turtles (*Chelonia mydas*);
- Expanding and improving habitat connectivity with the NWR restoration projects; and
- Increasing native plant species populations and natural community assemblages in South San Diego Bay.

Within the open channel and tidal marsh, a number of habitat types are predicted based on the frequency of inundation by tides. The elevation data in TABLE 6 are based on the National Oceanic and Atmospheric Administration (NOAA) San Diego Bay gauge (ESA 2017).

The design team compared the habitat elevations in TABLE 6 to elevations of pickleweed (*Sarcocornia pacifica*) and cordgrass (*Spartina foliosa*), at San Dieguito Lagoon in San Diego County for verification (ESA 2017). At San Dieguito Lagoon, average pickleweed elevations (± one standard deviation) ranged from 4.5 to 5.6 feet NAVD88, which falls in the mid marsh category as expected. Average cordgrass elevations at San Dieguito (± one standard deviation) occurred from 3.5 to 3.9 feet NAVD88, which falls in the low marsh category, again as expected. A brief survey (n = 5) of the fringing marsh around Pond 20 indicated pickleweed occurring from 4.9 feet NAVD88 and up to a high of 7.5 feet NAVD88 in some locations. It is not uncommon for pickleweed to grow up into the transition zone.

Although every effort will be made during construction to meet the design target elevations, the actual tidal range that occurs onsite post-construction will affect the specific elevations where different plants may occur. Tidal range may vary based on currents, water salinity, soil conditions, algal growth, and water clarity. Based on conceptual restoration designs, the vegetated salt marsh will consist of high, mid, and low marsh. Intertidal mudflats occur within the range between low marsh and the subtidal habitats and have no or very little vegetation. All of these habitats are considered wetlands and waters of the U.S. under the CWA, as well as waters of the State under the California Coastal Act, and are therefore proposed for mitigation credits. TABLE 6 (page 49) provides a summary of the tidal marsh areas based on the South San Diego Bay Wetland Mitigation Bank 30% design.

The open channel and tidal marsh habitat areas created within the Bank Site will provide a number of benefits for native plant and native and migratory wildlife species found within the vicinity of the project area, as described below.

4.5.1 Intertidal Vegetated Wetland (Salt Marsh)

This habitat type is completely absent within the berm of the Bank Site. These wetlands were not noted in the baseline functional assessment for the Bank Site, but could be established onsite based on adjacent restoration projects in the NWR. Salt Marsh (Pickleweed Mats) is a vegetation community that occurs in the adjacent Nestor Creek and Otay River Tributary drainages.

Species such as cordgrass, saltwort (*Batis maritima*), saltgrass (*Distichlis spicata*), alkali heath (*Frankenia salina*), and jaumea (*Jaumea carnosa*) will be planted. It is anticipated that pickleweed, a pioneering species, will naturally recruit to supplement planted stock. The open channel area of the site may provide habitat for foraging, and breeding for small fish and invertebrate species. Birds will likely utilize the area for foraging, and may use the upland islands described in the bank design as a loafing area or potentially for nesting. The most significant values generated from creating intertidal vegetated wetlands will come from providing habitat for wetland species, water quality improvement, tidal surge protection, and carbon sequestration.

4.5.2 Intertidal Mudflats

Presently, salt flat (Salt Panne) habitat exists onsite. However, it is not the same habitat type as intertidal mudflats, as the current salt flat is too saline to support benthic invertebrates and is hydrologically isolated from tidal flows. Benthic invertebrates are mud-burrowing species, such as worms and mollusks, and include more mobile species such as epibenthic mollusk species and crustaceans. It is anticipated that the new planned mudflat area will be colonized by benthic invertebrates and used for foraging by shorebirds following excavation, and subsequent tidal flushing and soil conditioning activities to reduce soil salinity (see Section 4.3.2). During high tide periods, it is anticipated that fish will also have access to the mudflats for foraging purposes.

The open channel at the Bank Site will enable increased tidal flow. Ultimately, the mudflats will provide foraging areas for both birds and fish, and support benthic invertebrates.

4.5.3 Subtidal Soft-Bottom/Open Water Eelgrass Habitat

The open water channel will provide foraging and hunting habitat for larger species, such as snowy egrets (*Egretta thula*) and great blue heron (*Ardea herodias*), as well as providing access to areas of mudflat for smaller species through the channel. The channel will also provide suitable habitat for eelgrass. Eelgrass is a native species of seagrass that is designated as essential fish habitat and is subject to federal and state regulatory protections. Eelgrass attracts small invertebrates that take shelter in its leaves and fish feed on species that may attach to the eelgrass The presence of eelgrass habitat is critical for a variety of different fish species for breeding, foraging, and shelter.

The mitigation bank design will create eelgrass habitat. Eelgrass will be planted within the subtidal portions of the open water channel. Because eelgrass has specific abiotic habitat requirements, such as water depth, clarity, and temperature, nutrient availability, water circulation, and low sedimentation rates, attention will be paid during the 60% design phase to ensure habitat quality supports eelgrass success at the Bank Site. Additional hydrologic modeling and feasibility studies will be performed to confirm the design will support the appropriate environmental conditions necessary for eelgrass growth and establishment post-restoration at the acreages and tidal elevations specified.

4.5.4 Upland Transitional/Buffer Habitat

Upland transition zones reduce the impacts of edge effects, and allows for potential marsh migration up-slope as sea level rises in the future. Buffer habitat also protects the marine resources from anthropogenic impacts and provides shelter and passage for terrestrial animals during high tide events. Upland transitional habitat supports and provides habitat to a variety of upland species including insects, mammals and birds. Additionally, it provides habitat that, when mature, will attract many native species which utilize this habitat for nesting, breeding, and foraging.

4.5.5 Special Status Species

The wetland and upland habitats that will be created at the Bank Site may provide attractive habitat for special status species. TABLE 8 summarizes the potential for federal or state listed species to occur on the site based on the Bank Site's existing and future suitable onsite habitat.

4.5.6 Environmental Co-Benefits

In addition to the habitat benefits described above, restoration efforts at the site may also provide several environmental co-benefits. The wetland creation project may increase carbon sequestration potential of the Bank Site. Carbon sequestration is the process of capturing carbon dioxide from the atmosphere, measured as a rate of carbon uptake per year (NOAA nd). In salt marshes, this sequestration occurs when emergent tidal salt marsh vegetation absorbs carbon from the atmosphere and fixes it within the marsh sediment as part of a metabolic process. Numerous studies have shown that coastal salt marshes within the United States are some of the most effective carbon sequestration habitat types (e.g., Mcleod et al. 2011; Laffoley and Grimsditch 2009; Nellemann et al. 2009).

TABLE 8: SPECIAL STATUS SPECIES WITH POTENTIAL TO OCCUR ONSITE FOLLOWING BANK CONSTRUCTION

Species Name	State	Federal	Suitable Habitat
Western Snowy Plover *(Charadrius alexandrinus nivosus)*	Threatened	None	Occurs on salt pond levees, sandy beaches, and along the shores of large alkali water bodies. Requires sandy or gravelly substrates for nesting.
Light-footed Ridgway's Rail (*Rallus obsoletus*)	Endangered	Endangered	Found in coastal salt marshes and lagoons, require shallow water and mudflats for foraging, with adjacent higher vegetation for cover during high water. Nests in the lower littoral zone of coastal salt marshes where dense stands of cordgrass are present.
California Least Tern (*Sterna antillarum browni*)	Endangered	Endangered	Nests along the coast on bare or sparsely vegetated flat substrates such as sandy beaches, alkali flats, landfills, or paved areas.
Belding's savannah sparrow (*Passerculus sandwichensis beldingi*)	None	Endangered	Occurs in southern coastal salt marshes and nests in the upper marsh zone or in non-tidal marsh areas near tidal regions.
East Pacific green sea turtle (*Chelonia mydas*)	None	Threatened	Occurs in open water and channels that support eelgrass in south San Diego Bay.
Salt marsh bird's-beak (*Chloropyron maritimum* ssp. *maritimum*)	Endangered	Endangered	Occurs in coastal dunes and saltmarshes in San Diego Bay.

4.6 *Coordination with ORERP and the NWR*

Currently under design, the Otay River Floodplain Site of the ORERP shares the Bank Site's northern boundary and is located within the jurisdiction of the USFWS. As of April 2018, the Final Environmental Impact Statement (EIS) is pending completion. Additionally, completion of 30% design drawings are anticipated in mid-2018. As a result, preliminary hydrodynamic modeling and scour analysis for the Bank Site including ORERP's future conditions have not been completed, but will be performed during subsequent design phases.

Early in the bank design process, preliminary coordination between the Port, the design team, and the ORERP team led to selection of the breach location as shown in the current 30% design (FIGURE 13). The chosen breach location connects to the Otay River Tributary at the Site's northwest corner, thereby minimizing overlap with the ORERP. The current breach design is detailed in APPENDIX M. Under the current design paradigm, the Bank Site and the ORERP site share the Otay River and San Diego Bay as a common water source; water from San Diego Bay and the Otay River will fork at the berm breach, with flows entering the Bank Site to the south and the ORERP site to the north. However, the breach design is currently under review and further coordination with Poseidon is required to finalize this design component.

Current schedule projections indicate ORERP's construction will begin in August 2018 and will precede the mitigation bank construction by at least one year. The ORERP conceptual design includes removal of the existing northern berm along the Otay River and the construction of a new berm along the Bank Site's northern boundary to maintain the Bank Site's hydrological isolation during construction of both projects. When both projects are completed, an upland berm will separate the two wetland areas. The final treatment of the proposed berm is currently undetermined, but there is potential for removal by excavation or natural erosive forces, which may result in contiguous wetland and/or transition zone habitat between the combined projects. Additional coordination and analysis in subsequent design phases will determine the solution and final design for the proposed berm.

To complete the tidal connection to San Diego Bay and establish marsh hydrology, some dredging will be required outside of the Port parcel boundary. The 30% design shows an approximate 0.3-acre area that will be dredged, graded, and restored. However, that reflects a preliminary design subject to revision based upon forthcoming analysis and coordination. Additional coordination between ORERP, the NWR, and the Bank will be required to address any potential impacts to existing or proposed habitat.

4.7 *Success Criteria and Monitoring*

Success criteria (i.e., performance monitoring standards) are a way to measure progress toward an ultimate restoration goal. EPW, the approved project functional assessment tool, will be used during the design process to quantify the ecological function expected to be achieved post-restoration at the Bank Site. This effectively sets a restoration goal that can serve as the basis for success criteria. The Bank will use a variety of monitoring methods to evaluate success, but because restoration success will be defined using EPW, performance metrics will focus primarily on functions assessed by EPW. EPW-equivalent performance standards correlated to relevant USACE Universal Performance Standards (UPS) (12505-SPD) have been provided to facilitate the use of the EPW method to conduct annual monitoring to measure changes and quantify restoration success over time. Using EPW functions as the basis of the Bank's performance standards and monitoring method will allow the Bank Sponsor and regulators to measure and demonstrate progress toward the restoration goals of the Bank.

4.7.1 Performance Standards

The performance standards will cover each type of credit generated by the bank, including:

- Establishment of subtidal eelgrass habitat,
- Establishment of tidal and intertidal marsh wetland habitat; and
- Establishment of upland buffer/transitional habitat.

TABLE 9 provides UPS and EPW-equivalent performance standards for tidal, intertidal, and upland buffer/transitional habitat. TABLE 10 provides UPS and EPW-equivalent performance standards for subtidal eelgrass habitat. The tables include the applicable UPS category number, along with the project performance standard designation, and equivalent EPW indicator (FCI) scores (where relevant). In the tables, "Year 1" refers to the end of the first year of monitoring, which translates to the end of the growing season in the first year after plants are installed. "Year 2" is one year after "Year 1." This pattern repeats for the remaining monitoring years.

The tables indicate a five-year monitoring schedule, but if all performance standards for Year 5 are met prior to the fifth year, all Bank credits could be released and monitoring could end earlier than anticipated per the credit release criteria outlined in the Credit Release Schedule (see TABLE 14 in **SECTION 6**).

4.7.2 Performance Monitoring

The Bank monitoring program is a means to assess whether the Bank is meeting the expected performance standards within the performance monitoring period of five years post-construction. The performance monitoring program will:

- Quantitatively measure function at the Bank using EPW on a year-to-year basis for five years; and
- Guide adaptive management strategies if the Bank is not achieving its performance standards.

Baseline EPW assessments were conducted at the Bank Site in March 2017 to characterize existing site ecological function (see ***Section 3.12***). Post-restoration EPW scores will be assessed and applied during the next design phase, which will identify the projected ecological function of the Bank Site following restoration. Post-restoration function will be compared with current conditions to determine the uplift, or gain in ecological function, generated by the project. Performance monitoring will be closely linked with EPW assessments to ensure the Bank is meeting its ecological performance goals. See APPENDIX K for a detailed overview of the EPW methodology and APPENDIX L for a summary of how baseline EPW scores were assessed for the Bank Site.

TABLE 11 and TABLE 12 provide the monitoring parameters used to assess each performance standard annually over the five-year performance monitoring period, as well as the methods used to complete the assessment.

TABLE 9: PERFORMANCE STANDARDS FOR ESTABLISHED TIDAL AND UPLAND BUFFER/TRANSITIONAL HABITAT WITHIN BANK SITE

1	Date: DA no.: Project manager:	Mitigation site name: South San Diego Bay Wetland Mitigation Bank Cowardin/HGM type: Estuarine Fringe Habitat type: Tidal marsh (low, mid, and high), intertidal mudflat, and upland buffer/transitional habitat Site coordinates: Center/1st endpoint: Lat: 32.586347^0 Lon: -117.101884^0 2nd endpoint (if linear) Lat: Lon:	Reference site name: Pond 10A (remnant marsh) Site coordinates: Center/1st endpoint: Lat: Lon: 2nd endpoint (if linear) Lat: Lon:
2	Mitigation objective(s) to improve: [X] habitat conservation/biodiversity; [ ] water storage/flow attenuation; [ ] water quality; [ ] target population of special status biota; [ ] specific aquatic resource function(s); [ ] other:		
3	Mitigation type (select one): [ ] re-establishment; [X] establishment; [ ] rehabilitation; [ ] enhancement		
	If enhancement, indicate function(s) to be increased: function 1: function 2 (if applicable): function 3 (if applicable):		
4	Primary type(s) of site treatment: [X] introduction of plant materials; [ ] invasive species control; [X] hydrological manipulation; [X] topographic/substrate manipulation		
5	Aquatic resource type (select one): [ ] riverine; [ ] depressional wetland; [X] tidal wetland; [ ] slope wetland; [ ] other:		
6	Performance standard categories (select all that apply): [X] physical; [X] hydrologic; [X] fauna; [X] flora; [ ] water quality (ecological)		
7	Using selections from 2-6 above, insert applicable performance standards and targets from .12505.1-SPD Table of Uniform Performance Standards for Compensatory Mitigation Requirements into worksheet rows below. Add or remove rows for any category, as needed.		

Applicable UPS Categories	Performance Standards	Targets (EPW-equivalent target FCI scores)				
		Year 1	Year 2	Year 3	Year 4	Year 5
Physical-1 (UPS No.1) Flora -1 (UPS No. 28)	Ensure the upland buffer area and transition zone adjacent to the tidal wetland has at least 75% coverage of native vegetation and undisturbed soils throughout upland buffer area by Year 5. EPW Indicators 'Shoreline Bank Erosion Control,' 'Sediment Stabilization,' and 'Water Quality' must each meet the FCI score shown in parentheses to meet the UPS-equivalent percentage-based standard.	<25% (≥0.1)	25-50% (≥0.3)	25-50% (≥0.3)	51-75% (≥0.5)	≥75% (≥0.8)
Physical -3 (UPS No. 11), Hydrologic -2 (UPS No. 14)	**Sediment surface elevations at the tidal marsh (Intertidal Mudflat Area):** Year 1: Post-construction topographic/hydrographic survey reflects sediment surface elevations with 4.0 acres of established unvegetated intertidal mudflat area as compared to the pre-construction survey. Unvegetated intertidal area shall be defined as containing less than 10% coverage of vegetation and between the -0.4 feet and +2.9 feet NAVD88 elevations, as based on tidal inundation frequency. Year 1 target reflects designed grade at implementation. Years 3 and 5: Sediment surface elevation +2.9 feet contour within the tidal marsh is within 0.3 feet of the post-construction survey elevation. Year 3 and Year 5 targets assume some level of variation in total area at designated elevation due to tidal fluctuations.	4.0 acres		4.0± acres		4.0± acres
Physical -4 (UPS No. 11), Hydrologic -3 (UPS No. 14)	**Sediment surface elevations within the tidal marsh (Low Marsh Area):** Year 1: Post-construction topographic/hydrographic survey reflects sediment surface elevations with 1.4 acres of established vegetated intertidal area in the open channel as compared to the pre-construction survey. Vegetated intertidal area is defined as surfaces between the +2.9 feet and +4.1 feet NAVD88 elevations, as based on tidal inundation frequency. Years 3 and 5: Sediment surface elevation +4.1 feet contour within the tidal marsh is within 0.4 feet of the post-construction survey elevation.	1.4 acres		1.4± acres		1.4± acres
Physical -5 (UPS No. 11), Hydrologic -4 (UPS No. 14)	**Sediment surface elevations within the tidal marsh (Mid Marsh Area):** Year 1: Post-construction topographic/hydrographic survey reflects sediment surface elevations with 37.1 acres of established vegetated intertidal area as compared to the pre-construction survey. Vegetated intertidal area is defined as surfaces between the +4.1 feet and +5.7 feet NAVD88 elevations, as based on tidal inundation frequency. Years 3 and 5: Sediment surface elevation +5.7 feet contour within the tidal marsh is within 0.6 feet of the post-construction survey elevation.	37.1 acres		37.1± acres		37.1± acres
Physical -6 (UPS No. 11), Hydrologic -5 (UPS No. 14)	**Sediment surface elevations within the tidal marsh (High Marsh Area):** Year 1: Post-construction topographic/hydrographic survey reflects sediment surface elevations with 20.6 acres of established vegetated intertidal area as compared to the pre-construction survey. Vegetated intertidal area is defined as surfaces between the +5.7 feet and +6.6 feet NAVD88 elevations, as based on tidal inundation frequency. Years 3 and 5: Sediment surface elevation +6.6 feet contour within the tidal marsh is within 0.7 feet of the post-construction survey elevation.	20.6 acres		20.6± acres		20.6± acres
Hydrologic -6 (UPS No. 13 open inlet)	Post-construction water level survey (via tide gauge) conducted in Year 1 and Year 5 reflects an open channel tidal range of at least 80% of the tidal range of the open ocean reference site.	≥80%R				≥80%R

Fauna -1 (UPS No. 25, UPS No. 33)	Intertidal mudflat infaunal community to be at least 75% of the values measured at a selected reference area (Pond 10A) by Year 5. Measures will include species richness and abundance.	≥10%R	≥30%R	≥50%R	≥60%R	≥75%R
Fauna -2 (UPS No. 12)	Presence of marine bird communities within the tidal marsh (i.e. low, mid, and high marsh combined) by Year 5. The EPW Indicator 'Wildlife' must meet the FCI score shown in parentheses to meet the UPS-equivalent standard.					Present (≥0.8)
Fauna -3 (UPS No. 12)	Presence of marine fish communities within the tidal marsh (i.e. low, mid, and high marsh combined) by Year 5. The EPW Indicator 'Fish (Tidal)' must meet the FCI score shown in parentheses to meet the UPS-equivalent standard.					Present (≥0.8)
Flora -2 (UPS No. 26)	At least 50% survivorship/establishment of native vegetation container plants.	≥50%				
Flora -3 (UPS No. 27)	The tidal marsh (i.e. low, mid, and high marsh combined) contains at least 75% coverage of native vegetation by Year 5. EPW Indicators 'Shoreline Bank Erosion Control,' 'Sediment Stabilization,', and 'Water Quality' must each meet the FCI score shown in parentheses to meet the UPS-equivalent percentage-based standard.	<25% (≥0.1)	25-50% (≥0.3)	25-50% (≥0.3)	51-75% (≥0.5)	≥75% (≥0.8)
Flora -4 (UPS No. 29)	The intertidal mudflat area contains less than 10% cover of non-native invasive plant species (rated as high on the Cal-IPC list) each year. EPW Indicators 'Shoreline Bank Erosion Control,' 'Sediment Stabilization,' and 'Water Quality' must each meet the FCI score shown in parentheses to meet the UPS-equivalent percentage-based standard.	<10% (≥0.1)	<10% (≥0.3)	<10% (≥0.3)	<10% (≥0.5)	<10% (≥0.8)
Flora -5 (UPS No. 31)	Target native species richness throughout tidal marsh (i.e. low, mid, and high marsh combined) is at least 75% of reference site (Pond 10A) by Year 5. EPW Indicators 'Shoreline Bank Erosion Control,' 'Sediment Stabilization,' and 'Water Quality' must each meet the FCI score shown in parentheses to meet the UPS-equivalent percentage-based standard.	≥10%R (≥0.1)	≥30%R (≥0.3)	≥50%R (≥0.3)	≥60%R (≥0.5)	≥75%R (≥0.8)

Notes:
"R" indicates comparison to reference site condition
Equivalent EPW target indicator scores are shown in parentheses where applicable

TABLE 10: PERFORMANCE STANDARDS FOR ESTABLISHED SUBTIDAL HABITAT WITHIN BANK SITE

1	Date: DA no.: Project manager:	Mitigation site name: South San Diego Bay Wetland Mitigation Bank Cowardin/HGM type: Estuarine Fringe Habitat type: Subtidal eelgrass bed habitat (subtidal habitat) Site coordinates: Center/1st endpoint: Lat: 32.586347º Lon: -117.101884º 2nd endpoint (if linear) Lat: Lon:	Reference site name: Pond 10A (remnant marsh) Site coordinates: Center/1st endpoint: Lat: Lon: 2nd endpoint (if linear) Lat: Lon:
2	Mitigation objective(s) to improve: [X] habitat conservation/biodiversity; [ ] water storage/flow attenuation; [ ] water quality; [ ] target population of special status biota; [X] specific aquatic resource function(s); [ ] other:		
3	Mitigation type (select one): [ ] re-establishment; [X] establishment; [ ] rehabilitation; [ ] enhancement		
	If enhancement, indicate function(s) to be increased: function 1: function 2 (if applicable): function 3 (if applicable):		
4	Primary type(s) of site treatment: [X] introduction of plant materials; [ ] invasive species control; [ ] hydrological manipulation; [X] topographic/substrate manipulation		
5	Aquatic resource type (select one): [ ] riverine; [ ] depressional wetland; [X] tidal wetland; [ ] slope wetland; [ ] other:		
6	Performance standard categories (select all that apply): [X] physical; [ ] hydrologic; [ ] fauna; [X] flora; [ ] water quality (ecological)		
7	Using selections from 2-6 above, insert applicable performance standards and targets from .12505.1-SPD Table of Uniform Performance Standards for Compensatory Mitigation Requirements into worksheet rows below. Add or remove rows for any category, as needed.		

Applicable UPS Categories	**Performance Standards**	**Targets**				
		Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Physical -2 (UPS No. 11), Hydrologic -1 (UPS No. 14)	**Sediment surface elevations at the tidal marsh (Subtidal Habitat):** Year 1: Post-construction topographic/hydrographic survey reflects sediment surface elevations supporting 1.7 acres of established subtidal area in the tidal marsh as compared to the pre-construction survey. Subtidal area is defined as surfaces below the -0.4 feet NAVD88 elevation, as based on tidal inundation frequency. Years 3 and 5: Sediment surface elevation -0.4 feet contour within the subtidal area is within 0.01 feet of the post-construction survey elevation.	1.7 acres		1.7± acres		1.7± acres
Physical -7 (UPS No.10)	Channel is dominated by sandy silt to fine sand.	>50% sand				>50% sand
Fauna -1 (UPS No. 25, UPS No. 33)	Subtidal habitat infaunal community to be at least 75% of the values measured at a selected reference area (Pond 10A) by Year 5. Measures will include species richness and abundance.	≥10%R	≥30%R	≥50%R	≥60%R	≥75%R
Flora -6 (UPS No. 27)	Coverage of eelgrass within channel planting area is 100% by Year 5.	≥40%	≥85%	≥100%	≥100%	≥100%
Flora -7 (UPS No. 27)	Density of eelgrass within channel planting area is 85% density of reference site by Year 5.	≥20%R	≥70%R	≥85%R	≥85%R	≥85%R
Notes: "R" indicates comparison to reference site condition						

TABLE 11: PERFORMANCE MONITORING PARAMETERS FOR ESTABLISHED TIDAL AND UPLAND BUFFER/TRANSITIONAL HABITAT WITHIN BANK SITE

Number/Categories	Monitoring Parameters	Monitoring Methods
Physical-1 (UPS No.1) Flora -1 (UPS No. 28)	Coverage of native vegetation and soil disturbance within the upland buffer area.	Vegetation cover surveys using the cover-class transect method and EPW scoring.
Physical -2, -3, -4, -5, -6 (UPS No. 11), Hydrologic -1, -2, -3, -4, -5 (UPS No. 14)	Sediment surface elevations and tidally wetted linear edge within tidal marsh.	Topographic/ hydrographic (sonar) surveys.
Hydrologic -6 (UPS No. 13 open inlet)	Tidal range of open channel.	Water level measurement via tide gauge.
Fauna -1 (UPS No. 25, UPS No. 33)	Subtidal and intertidal infaunal species richness and abundance.	Collect and analyze sediment cores; focus on all life stages.
Fauna -2 (UPS No. 12)	Presence of marine bird communities within the open channel.	Incidental surveys when conducting all other onsite data collection, and EPW scoring for Wildlife Element.
Fauna -3 (UPS No. 12)	Presence of marine fish communities within the open channel.	Incidental surveys when conducting all other onsite data collection, and EPW scoring for Fish (Tidal).
Flora -2 (UPS No. 26)	Survivorship of container plants.	Individual plant inventory.
Flora -3 (UPS No. 27)	Coverage of native vegetation survival within the tidal marsh areas.	Vegetation cover surveys using the cover-class transect method and EPW scoring.
Flora -4 (UPS No. 29)	Coverage of non-native invasive vegetation within the tidal marsh areas.	Vegetation cover surveys using the cover-class transect method and EPW scoring.
Flora -5 (UPS No. 31)	Target species richness achieved.	Vegetation cover surveys using the cover-class transect method and EPW scoring.

TABLE 12: MONITORING PARAMETERS FOR ESTABLISHED SUBTIDAL HABITAT WITHIN BANK SITE

Number/Categories	Monitoring Parameters	Monitoring Methods
Physical -7 (UPS No.10)	Sediment grain size for channel.	Collect bottom sediment surface grab samples and tests in Year 2.
Flora -6 (UPS No. 27)	Coverage of eelgrass within channel planting area.	Diver-transect surveys or sonar survey
Flora -7 (UPS No. 27)	Density of eelgrass within channel planting area.	Diver-transect surveys or sonar survey

Both EPW and a select set of UPS metrics require the use of a reference site. Reference sites allow for assessment of performance in the context of the regional environment; some performance standards are not realistically possible when considered in isolation due to abiotic factors (e.g., 70% coverage of a planting area covered by eelgrass). However, taken in the context of a reference site that has the best possible example of a particular performance standard, the designated performance standards for the Bank become realistic. The reference site selected is Pond 10A, a tidal marsh site geographically close to the Bank, is a former salt evaporation pond with restored tidal influence, and shares key characteristics (e.g., habitat types, configuration, and general elevation range).

Pond 10A was assessed remotely to provide the benchmarks for the Bank Site baseline EPW scores. During “Year 1” identical quantitative data will be taken at both the Bank Site and Pond 10A site. Where UPS performance standards identify a reference site, the Bank Site’s data will be annually compared to Pond 10A. Future performance monitoring efforts will utilize Pond 10A reference site data collected either remotely or *in situ* depending on the availability of relevant information in Pond 10A biological monitoring reports.

Success criteria will be assessed for five years after planting of all tidal marsh and upland habitats is completed. The monitoring program is proposed to continue until all credits have been released.

The Bank performance monitoring program will establish fixed transects of sufficient replication in each habitat type to assess the physical and biological characteristics of the Bank Site, as well as the Pond 10A reference site. Monitoring will involve quantitative assessment of vegetation and fauna along the established transects (e.g., quadrat or point sampling, depending on the performance standard being monitored). Monitoring will take place at the same time and at the same intervals each year throughout the monitoring period to ensure uniformity in reporting results. EPW scoring will be based on the EPW Manual guidance and derive from the collected quantitative data (where relevant).

Year 1 data collection will be of the greatest importance as it will provide the baseline post-restoration for the Bank. This is important because the Bank Site does not currently function as a wetland system, so comparisons to this baseline will not be ecologically relevant for monitoring purposes, only ecological uplift considerations. All progress in years following Year 1 will be compared to the Year 1 data for adaptive management purposes. Reporting for collected data will occur on an annual basis; data collected, analyzed, and reported, would be used to adaptively manage the site to ensure the Bank meets all performance standards as quickly as is feasible.

The proposed monitoring program would commence once all plant installation is complete. Monitoring would continue until all performance standards are met, anticipated to be five years; however, achievement of all performance standards may occur in fewer years depending on climactic conditions and site management strategies.

4.8 *Long-Term Management*

The Bank Sponsor anticipates habitats developed for the Bank may be self-sustaining once all performance standards have been achieved. However, the Bank Site is located in a high-traffic urban area and abuts housing developments. Depending on site conditions, long-term management activities may be conducted following the monitoring period, and may include:

- Invasive species monitoring and removal;
- Periodic removal of trash blown or washed in from the adjacent Palm Avenue;
- Maintenance of site control measures (e.g., fencing to keep pedestrians and vehicles from entering the site); and
- Restoration of any damage from management activities, human activities (e.g., illegal trespass), and natural phenomenon (e.g., severe storms).

Preliminary hydrological analysis indicates the proposed tidal inlet location is not at risk of clogging due to sedimentation from tidal flows over time. Likewise, the stormwater outfall located in the southwest corner of the Bank Parcel outside of the berms is located approximately 1,200 feet south of the proposed tidal inlet and is buffered by a wetland, unvegetated drainage feature, and the Otay River Tributary. The Bank Sponsor therefore, does not anticipate the stormwater outfall will contribute large volumes of sediment directly to the proposed tidal channel mouth.

A long-term monitoring plan incorporating these elements will be developed and submitted with the Draft BEI for IRT member review and discussion.

5 SERVICE AREA AND MARKET ANALYSIS

5.1 *Service Area Description*

The Bank Site is located within the San Diego Hydrological Unit (HUC) 18070304. The South San Diego Bay Wetland Mitigation Bank will serve customers with Section 404 impacts within the Service Area shown in FIGURE 15. The Bank Sponsor proposes one service area for the South San Diego Bay Wetland Mitigation Bank to provide compensatory mitigation to intertidal wetlands, salt marsh, and subtidal eelgrass habitats throughout this service area, and the mitigation of freshwater wetland impacts on a case-by-case basis. Inland mitigation options are limited by the availability of freshwater mitigation banks and available land to conduct a suitable mitigation project for individual impacts. Allowing for freshwater wetland credits on a case-by-case basis would expand the options for regulatory agencies in an area that is lacking mitigation options.

The landward boundary of both Service Areas will extend from San Diego through Orange County. The Service Area for intertidal wetlands, saltmarsh, and eelgrass habitats contains nine 8-digit HUCs that intersect the coastline between the Counties of San Diego and Orange:

South San Diego Bay Wetland Mitigation Bank Service Area – Primary (8-digit HUCs)

- 18070304: San Diego
- 18070305: Cottonwood-Tijuana
- 18070303: San Luis Rey-Escondido
- 18070302: Santa Margarita
- 18070301: Aliso-San Onofre
- 18070204: Newport Bay
- 18070203: Santa Ana
- 18070201: Seal Beach
- 18070106: San Gabriel (partial)

The size of the proposed mitigation bank, at approximately 80 acres, is relatively large and needs a large service area to support its economic viability. Given regulatory support for restoring tidal wetland habitat to the southern California coast, and with the understanding that the mitigation bank model will allow for the funding of the project while also providing sorely-needed compensatory mitigation for impacts slated throughout southern California, the Bank Sponsor suggests the proposed Service Area is justified and will support a successful mitigation bank.

FIGURE 15: PROPOSED SERVICE AREA

PROPOSED SERVICE AREA
SOUTH SAN DIEGO BAY WETLAND MITIGATION BANK

SAN DIEGO UNIFIED PORT DISTRICT
FEBRUARY 2018 - FOR BUSINESS PLANNING PURPOSES ONLY

GREAT ecology
ENVIRONMENT + DESIGN

5.2 *Justification of the Service Area*

The Bank Sponsor proposes the South San Diego Bay Wetland Mitigation Bank Service Area for intertidal wetlands, salt marsh, and subtidal eelgrass habitats extend from the U.S.-Mexico border through Orange County. The justification is grounded in ecological, economic, and regulatory bases. The biotic and abiotic environments of the southern California coastal region are consistent across the proposed Service Area, and ecological impacts of coastal wetlands are felt regionally. There is currently a lack of available mitigation sites and credits to provide compensatory mitigation for impacts from development projects throughout the proposed Service Area. This lack of mitigation options has delayed many of these development projects, stymied environmental management, hindered smart development, and stalled regional economic growth. Additionally, the proposed Service Area is sized for the proposed mitigation bank to be economically viable. Following an initial market analysis, a substantial proportion of the South San Diego Bay Wetland Mitigation Bank credit sales would originate from Orange County rather than San Diego County or even entities located primarily along San Diego Bay. Historically, mitigation was allowed across the proposed Service Area via permittee-responsible projects, the most recent of which consisted of open-water marine impacts from the Poseidon Desalination Facility that are being compensated by the ORERP, located in South San Diego Bay. Impacts from the Poseidon Desalination Facility are located HUC 18070303, while the associated mitigation is being completed in HUC 18070304. Both HUCs are located in the same ecoregion—the Southern California Bight—and wetlands within these two HUCs share similar ecological functions and values.

Below are detailed ecological, economic, and regulatory justifications to support the proposed Service Area.

5.2.1 Ecological

Tidal and subtidal wetlands are coastal habitats that serve as fish nurseries, and feeding and breeding sites for a variety of coastal animals, including invertebrates, shorebirds, and terrestrial and marine mammals. Because ecological function represented by impacts to tidal and subtidal wetlands are felt regionally (Worm et al. 2006, Barbier et al. 2011), tidal wetland mitigation can adequately compensate for impacts at a regional scale. Tidal wetlands were historically located all along the coastal Southern California Bight; however, today tidal wetlands are incredibly rare habitat types, and federal and state resource agencies have made conservation and restoration of existing tidal wetlands a top priority.

Within the proposed Service Area, coastal wetland habitats are distributed in varying patterns and at different scales in relation to topography and watershed processes. Coastal wetland habitat in San Diego Bay has direct hydrological connections with freshwater systems upstream, the Bay downstream, and the open ocean. San Diego Bay's tidal wetlands provide many of the same ecological functions and benefits provided by wetlands captured within the proposed Service Area, including surface-water storage, flood-water protection, nutrient transformation and cycling, water quality maintenance, aquatic productivity, shoreline stabilization, and wildlife habitat (Tiner et al. 2002).

Subtidal habitats support a variety of bird and fish populations. The vegetated shallow subtidal habitats found within the boundaries of South San Diego Bay are supported by beds of eelgrass, a critical and productive structural component of benthic habitat. Eelgrass habitats rank among the most productive habitats in the ocean. Within the proposed Service Area, subtidal eelgrass habitats vary in distribution and abundance from season to season, primarily due to changes in depth, sediment grain size, nutrients, light levels, temperature, and salinity.

Eelgrass is a perennial flower species, and can grow and spread by both vegetative growth and seed germination. Eelgrass pollen can spread both on the surface of the water and underwater, born by ocean currents and wind (Newport Bay Conservancy nd).The general ocean current flow patterns observed in San Diego Bay indicate eelgrass can germinate and spread within and beyond the boundaries of the Bay. A critical process in flushing San Diego Bay of its water is the process by which Bay water is mixed with the ocean.

Coastal wetlands exist at the boundary between terrestrial and marine ecosystems. The ecological rational for the proposed Service Area is therefore presented in terms of both marine and terrestrial systems, and is focused on:

- Physical characteristics shared among terrestrial watersheds included in the proposed Service Area;
- Connectivity established by ocean currents that creates an interconnected ecoregion within the marine habitats included in the proposed Service Area; and
- Biological interconnection between terrestrial and marine habitats within the proposed Service Area.

5.2.1.1 TERRESTRIAL

The 8-digit HUCs that comprise the proposed Service Area share similar climate, soils, topography, plant communities, wildlife, special status species, and critical habitat. In addition, they share similar physical environmental concerns, such as surface water quality degradation, channel bed and shoreline erosion, habitat loss, increased prevalence of invasive species, and human population growth and development expansion. The watersheds are hydrologically similar as well, with the majority flowing east-to-west into lagoons, estuaries, or channelized water outlets along the Southern California coast.

The terrestrial environment remains relatively consistent throughout the proposed Service Area, providing comparable functions and services to coastal wetlands. While forcing functions, like land-use, may vary somewhat throughout the proposed Service Area, other controls, such as climate, coastal habitat, topography and geology, hydrology and soils remain constant. These factors define the terrestrial environment in the proposed Service Area and are described below.

Climate

Climate is consistent across the proposed Service Area. Temperatures trend toward uniformity from day to day and season to season (Climate of California 2017). Summers are generally warm and dry, and occasionally moist air drifts northward from the Gulf of California, resulting in scattered heavy showers over the mountainous portions of the proposed Service Area. In winter, the proposed Service Area experiences most of its yearly precipitation, with Pacific storms producing widespread rain at low elevations.

Coastal Habitat Types

The coastal habitat landscape in the proposed Service Area is homogeneous and encompasses intertidal flats, vegetative wetlands, salt flats, subtidal waters, and open water (Grossinger et al. 2011). Although these habitats are distributed in varying mosaics and at different scales along the coast in relation to topography and watershed processes, they collectively provide similar ecological functions and services to the terrestrial species that inhabit the areas.

Topography and Geologic History

In the proposed Service Area, geologic history creates distinct topographic features that influence coastal wetlands and make the area unique through the creation of identifiable, repeating patterns in ecosystem structure and function. For example, the coastal mountain ranges, which include two geomorphic provinces, the Transverse Ranges and the Peninsular Ranges, form a natural amphitheater to the coastline and provide a distinctive setting for watersheds and wetlands (McGinnis et al. 2017). Coastal wetlands throughout the proposed Service Area form at the mouth of the rivers and major streams that run down these mountain ranges and eventually empty into the ocean. The comparable ecosystem structure attributed to topographic and geologic features suggest little regional variations in ecosystem function in the proposed Service Area.

Hydrology

Sprawling urban development throughout the proposed Service Area has shaped its hydrologic system. In the 24 major drainage systems within the Southern California Bight, 53% of the drainage area is controlled by major water retention structures, such as dams and reservoirs (Brownlie and Taylor 1981). These flood control projects allowed urban and agricultural development to expand, but also led to comprehensive changes in quantity and timing of stream flows and sediment transport to the coastal wetlands in the proposed Service Area.

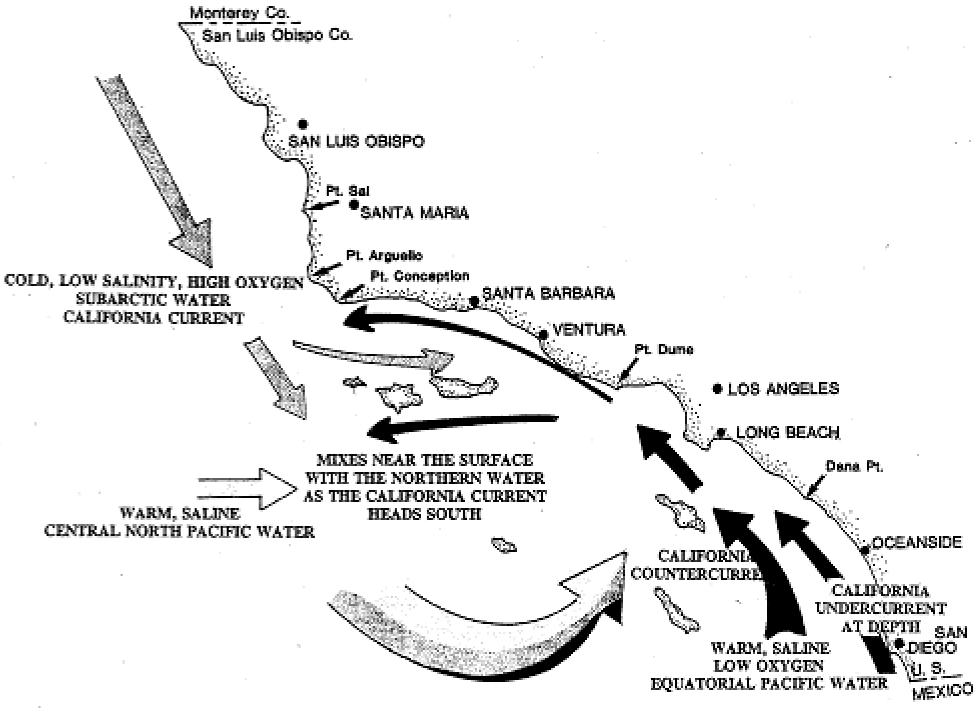
Land Uses

As introduced above, land uses including concentrated urban areas along the coast and agricultural and rural uses upstream are consistent throughout the proposed Service Area. Upstream agricultural and rural land uses can impact local watersheds and have implications on storm water run-off and water quality for the wetlands that lie at the bottom of adjacent watershed. Land use is a crucial factor and any regional variation could affect ecological processes, such as water flow, nutrient recycling, and food chain balance. The coastal wetlands across the proposed Service Area provide the same ecological functions and services, including flood control, water quality maintenance, erosion control, and recreation, in response to these shared land use patterns.

5.2.1.2 MARINE

The proposed Service Area extends through approximately half of the Southern California Bight, a well-defined and widely-accepted marine ecoregion that encompasses the southern Californian coastline from Point Conception to the U.S.-Mexico border (Spalding et al. 2007). Spalding et al. (2007) define ecoregions as “areas of relatively homogenous species composition, clearly distinct from adjacent systems.” The Southern California Bight marine ecoregion boundary was drawn based on an extensive biogeographical analysis that incorporated similarities in species ranges, dominant habitat types, currents, ocean temperatures, and geomorphological features. Within this ecoregion, currents run north along the coastline from San Diego, providing connectivity between waters that originate in San Diego Bay with coastal waters along the Orange County coastline (Browne 1994; FIGURE 16). The distribution of fish species and migratory birds reflects the uniformity and connectivity of the marine environment and are described below.

FIGURE 16: CHARACTERISTIC OCEANIC CIRCULATION PATTER IN THE SOUTHERN CALIFORNIA BIGHT (BROWNE 1994)



Recreational and Commercial Fish Species

The coastal wetlands and subtidal areas within the proposed Service Area support unique fish assemblages that rely on the consistency and connectivity of ecosystem services throughout the ecoregion to survive (Horn and Allen 1985). Subtidal eelgrass beds are a component of this interconnected food web and support species within a variety of trophic levels. For example, invertebrates that grow on eelgrass provide both primary and secondary productivity for consumption by larval and juvenile fish. Much of the eelgrass primary productivity enters the food web as detritus—sediments. Eelgrass beds are loaded with detrital leaves, rhizomes, and nutrients that fuel infaunal invertebrates, which in turn provide food for fishes. Fish use eelgrass beds to escape from predators, as a food source, and as a nursery. Fish lay their eggs on the eelgrass blades and the hatched larvae and juveniles eventually utilize the shelter provided to hide and feed (San Diego Bay INRMP 2013).

Despite the lack of commercial fish species within these coastal wetlands, except for the California halibut (*Paralichthys californicus*), which uses shallow, protected waters as a nursery throughout the proposed Service Area (Haaker 1975; Kramer 1990), ichthyoplankton, or the eggs and larvae of fish, and lower trophic level species are abundant (Nordby 1982). These species, often referred to as forage species, serve as a food source for other economic fish species and depend on ocean circulation and the connectivity of environments within the coastal wetlands throughout this ecoregion to fulfill all life stages. For example, in the North and South Ecoregions of San Diego Bay, wetlands are dominated by juvenile forage species that use the wetlands as a nursery habitat. These forage species are typically pelagic as adults, indicating connectivity between juvenile populations in the Bay and adult populations in nearshore open waters throughout the Southern California Bight (Williams et al. 2016). These critical pelagic fish are central to the food web and prompt "the continued importance of San Diego Bay as a nursery area for bay, estuarine, and nearshore species" (Williams et al. 2016).

Several seasonally migratory native species move into coastal wetlands and utilize them for feeding, spawning, or as a nursery ground. Two such species are topsmelt and the flathead grey mullet (*Mugil cephalus*). Both are food fish species found in South San Diego Bay as well as in most southern California estuaries (Gibson and Barnes 2002; West and Zedler 2000), and their populations move seasonally between San Diego Bay wetland habitats and open coastal wetland habitats. Topsmelt are prominent within shallow littoral zones of tidal marsh habitats (Allen 1982; Rountree and Able 1992) and their populations make seasonal migrations to sea or to other coastal lagoons (Rosecchi and Crivelli 1995). The flathead grey mullet migrates seasonally from estuarine waters to deep, offshore waters to spawn. Larvae and pre-juveniles then migrate inshore to estuaries where they inhabit the intertidal zone (Mahmoudi 2000).

Migratory Birds

Coastal wetlands within the proposed Service Area provide uniform ecosystem function and services to migratory birds as critical stopover habitat and nesting sites. One such species, the elegant tern, is a coastal tern species considered "near threatened" due to its narrow breeding range (Aguilar and Horn 2016). Residing within the Southern California Bight ecoregion, several nesting populations can be found in San Diego Bay, Bolsa Chica Ecological Reserve, and Los Angeles Harbor. A recent study found no genetic difference between elegant tern populations that nest in the Bolsa Chica Ecological Reserve, the South San Diego Bay NWR complex, and Isla Rosa in Mexico, suggesting the populations migrate and interbreed across the region (Aguilar and Horn 2016). Additionally, the southern California populations continue to increase in size, indicating individuals migrate from one habitat to another to better persist during regional disturbances. Another critical species found throughout the service area is Pacific coast population of the western snowy plover. The snowy plover has a breeding range that extends along all coastal wetlands of southern California and has been shown to display breeding site fidelity within the proposed Service Area (USFWS 2000).

5.2.2 Economic

The proposed Service Area includes large coastal population centers, such as San Diego, Oceanside, Carlsbad, coastal Orange County, Long Beach, and Los Angeles, which have collectively been growing at 1% per year on average since 2000 (First Tuesday 2017). While most of the San Diego 8-digit HUC's coastal areas are developed, limiting demand for tidal wetland credits in the immediate vicinity of the Bank, northern coastal San Diego County and Orange County both boast miles of undeveloped coastal shoreline. These areas will drive credit demand through increasing density over time and through regular estuary, lagoon, and river mouth maintenance activities that produce temporary wetland impacts.

In addition, there is a lack of available land to support tidal and subtidal wetland permittee-responsible compensatory mitigation projects within the proposed Service Area. Many entities within the proposed Service Area who are interested in purchasing credits from the Bank have expressed difficulty in finding adequate mitigation opportunities. The lack of available credits and mitigation lands within their jurisdictions have required them to make changes to project scopes that would have provided a net environmental benefit, such as dredging to clear lagoon tidal inlets, to reduce mitigation compliance requirements. There are currently no approved and operational banks located within the proposed Service Area that can provide credits for impacts to tidal and subtidal wetlands to private and public entities, exacerbating the problem for those entities in need of compensatory mitigation. Credits provided by the South San Diego Bay Wetland Mitigation Bank will allow these beneficial environmental projects to be completed while allowing entities to satisfy mitigation requirements appropriately.

USACE's Regulatory In-Lieu Fee (ILF) and Bank Information Tracking System (RIBITS) database shows only five banks located within the Southern California Bight that offer coastal marine resource credits (TABLE 13). San Diego Bay's single operating tidal wetland bank, the Navy Eelgrass Bank, only compensates for Navy-driven impacts. Two banks are pending acceptance in Long Beach: the Colorado Lagoon Mitigation Bank, sponsored by the City of Long Beach, and the Upper Los Cerritos Wetland Mitigation Bank, sponsored by Synergy Oil and Gas. The Colorado Lagoon Mitigation Bank, a single-client bank developed exclusively for use by the City of Long Beach, is close to approval; its Prospectus has been approved and the Banking Instrument was submitted to the IRT in 2016. The Upper Los Cerritos Wetland Mitigation Bank Prospectus was approved in late 2016 and it is unknown when the Banking Instrument will be approved. According to its Prospectus, the Upper Los Cerritos Wetland Mitigation Bank will provide credits for commercial sale.

TABLE 13: SOUTHERN CALIFORNIA COASTAL RESOURCE MITIGATION BANKS (RIBITS 2017)

Location	Bank Name	Bank Sponsor	Clientele	Credit Types	Bank Status
Los Angeles	Port of Los Angeles Mitigation Bank	Port of Los Angeles	Single-Client	Tidal wetlands Eelgrass beds Artificial reefs	Pending
Long Beach	Colorado Lagoon Mitigation Bank	City of Long Beach Tidelands Capital Improvement Division	Single-Client	Subtidal Soft-Bottom Subtidal Eelgrass Intertidal Marine Habitat Upland Transitional Buffer	Pending
Long Beach	Upper Los Cerritos Wetland Mitigation Bank	Synergy Oil and Gas, LLC	Public and Private	Coastal Salt Marsh Transitional Wetland Upland Scrub Buffer	Pending
Long Beach	Anaheim Bay	Port of Long Beach	Single-Client	Intertidal Wetlands Subtidal Wetlands	Sold Out
Huntington Beach	Huntington Beach Mitigation Bank (Talbert Marsh)	MOA with CCC, City of Huntington Beach, HBWC, CalTrans, USFWS, Orange County, and CDFW	Single-Client	Wetlands Sand Dunes Deep Water	Sold Out
San Diego	San Diego Bay Eelgrass Mitigation Bank	U.S. Navy	Single-Client	Subtidal Eelgrass Beds	Operating

Southern California federal and state resource agencies, recognizing the lack of available adequate mitigation, have begun developing a regional ILF program through the Southern California Wetlands Recovery Project (SCWRP) to relieve demand from public entities (USACE 2012). However, the ILF program will not satisfy private sector demand, and USACE mitigation guidance prioritizes the purchase of mitigation banking credits for compensatory mitigation over utilizing an ILF program (73 FR 19670 §332.3(b)).

A San Diego County-only Service Area would restrict the market to a coastal area that is largely already built out, with few coastal wetlands left to be impacted by a development or maintenance project. The proposed Service Area would serve some of Orange County's heavily managed natural coastal areas, such as Dana Point, San Clemente, Newport Bay, Huntington Beach, and Irvine. If the Service Area is too restricted then the number of projects to which the South San Diego Bay Wetland Mitigation Bank could supply will be significantly reduced, putting at risk the viability of the bank development project.

5.2.3 Regional Regulatory Precedents

There is regional precedent for resource agencies approving mitigation projects in locations outside of the watershed where the impact originated. The Port of Los Angeles mitigated for an extensive expansion project by restoring Batiquitos Lagoon in San Diego County, a project located six HUC-8 watersheds away from the original impact, but within the same Southern California Bight ecoregion. Additionally, their proposed Umbrella Mitigation Banking Instrument, currently under IRT review, proposes a service area that begins in Los Angeles and extends through San Diego County to the Mexican border, and alterations to the service area have not been requested so far throughout the multi-year and ongoing review process (K. Prickett, Port of Los Angeles, personal communication). Marine impacts stemming from construction and operation of the Poseidon Desalination Facility, located in an open coastal area of Carlsbad, is being mitigated with a tidal wetland restoration project located in South San Diego Bay. Lastly, the regional ILF program currently in development by the USACE and other key resource agencies comprises the entirety of the Southern California Bight (USACE 2012).

6 BANK CREDITING AND CREDIT TRANSFERS

The South San Diego Bay Wetland Mitigation Bank will restore a diverse and highly functioning tidal marsh complex to the historic Otay River Estuary in South San Diego Bay. Creation activities will be performed to generate approximately 76.48 wetland mitigation credits for tidal wetland and upland buffer habitats, as described in **SECTION 4**. Credit generation for Section 404 Waters of the U.S. and California Coastal Act/Porter-Cologne Water Quality Control Act Waters of the State wetland habitat is presented in TABLE 14 on a per-acre basis, released according the schedule outlined in TABLE 15. These quantities are based on the project’s 30% design, anticipated SLR, the results of a wetland delineation and jurisdictional determination in process for the Bank Site, and baseline wetland functional assessment results, and will likely be refined following additional coordination with the ORERP team and input from the IRT.

TABLE 14: PROPOSED CREDITING SUMMARY FOR SOUTH SAN DIEGO BAY WETLAND MITIGATION BANK

Credit Type	Proposed Ratio	Acres Created	Proposed Credits Waters of the U.S. and State
Created Subtidal Eelgrass Habitat Includes subtidal eelgrass habitat, converted from non-tidal upland via fill removal and excavation of tidal channel	1:1	1.68	1.68
Created Intertidal Marsh Habitat Includes intertidal mudflat, low-, mid-, and high marsh habitats, converted from non-tidal upland via grading	1:1	*Mudflat = 4.00* *Low Marsh = 1.43* *Mid Marsh = 37.10* *High Marsh = 20.63* Total = 63.16	63.16
Created Upland Buffer Includes transition zone and upland habitats, converted from unproductive upland via placed fill and planting	1:1	*Transition Zone = 3.81* *Upland Buffer = 7.83* Total = 11.64	11.64
	Total	**76.48**	**76.48**

TABLE 15: ANTICIPATED CREDIT RELEASE SCHEDULE FOR WATERS OF THE U.S. (2017 BEI TEMPLATE)

Credit Release Number	Credits Released	Credit Release Criteria
1	11.47 (15%)	Upon Date of Bank Establishment and successful completion of pre-release items.
2	19.12 (25%)	Bank Sponsor has submitted as-built drawings to USACE and EPA[1] Credit Release 1 has occurred
3	11.47 (15%)	Bank Sponsor has submitted the annual report Attainment of Year 2 Performance Standards Credit Release 2 has occurred A minimum of two years of monitoring have been conducted since all requirements for Credit Release 2 have been met
4	11.47 (15%)	Bank Sponsor has submitted annual report Attainment of Year 3 Performance Standards Credit Release 3 has occurred A minimum of one year of monitoring has been conducted since all requirements for Credit Release 3 have been met
5	11.47 (15%)	Bank Sponsor has submitted annual report Attainment of Year 4 Performance Standards Submission of aquatic resources delineation on Bank Site Credit Release 4 has occurred A minimum of one year of monitoring has been conducted since all requirements for Credit Release 4 have been met
6	11.48 (remaining credits)	Bank Sponsor has submitted annual report, including the final Monitoring Report Attainment of Final Performance Standards Credit Release 5 has occurred A minimum of one year of monitoring has been conducted since all requirements for Credit Release 5 have been met
	76.48 (100%)	**All credits released**

[1] As-built drawings of the Bank Site, with accurate maps of the established, enhanced, and/or restored Waters of the U.S. to the USACE and EPA no later than 90 calendar days following completion of construction associated with the establishment, restoration, and/or enhancement of the Waters of the U.S. on the Bank Site.

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APPENDIX A:
USACE GUIDE TO PROSPECTUS CHECKLIST

Checklist
Prospectus for Mitigation Banks
[Revised September 2010 by the Multi-Agency Product Delivery Team]

Please refer to the Cover Sheet, revised *September 2010*, for information and instructions related to the submission requirements for a mitigation bank proposal.[1] Please provide the following information and a copy of this checklist with the submittal of a Prospectus:

☒ Proposed Bank Name - Use a short name based on a geographic feature if possible and include "Mitigation Bank" in the name;[2]

☒ Bank contacts – Include the name, address, phone, fax, and email for: Bank Sponsor, Property Owner, Consultants, etc;

☒ General location map and address of the proposed Bank Property;

☒ Accurate current map of the proposed Bank Property on a 7.5-minute USGS map showing proposed boundaries of the mitigation bank;

☒ Color aerial photographs that reflect current conditions proposed Bank Property and surrounding properties. Briefly discuss compatibility of proposed mitigation bank with adjacent property land uses including known present and proposed zoning designations;

☒ Description of how the mitigation bank will be established and operated, including the proposed ownership arrangements and long-term management strategy, and any phases planned [include description of phases, boundaries, target habitat/species, and the number of credits associated with each phase];

☒ Qualifications of the Bank Sponsor to successfully complete the type(s) of mitigation project(s) proposed, including information describing any similar activities by the Bank Sponsor;

☒ [***USACE District to include the appropriate language:*** Approved or

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[1] Additional information may be requested to deem the prospectus complete.

[2] A name change may be requested if the proposed bank name is already being used.

preliminary[3]] jurisdictional determination (JD) of on-site wetlands and other waters of the U.S;

☒ Preliminary Biological Resources Survey(s) - This section should describe the biotic and abiotic baseline of the proposed Bank Property and should include descriptions of the following, with maps: a) Bank geographic location and features, including topography, hydrology, soils, and vegetation; b) current functions and services of aquatic resources; c) inventory of all biological resources, including description of vegetation communities and a complete plant species list, presence of federally threatened or endangered species, and/or their habitats, as determined by protocol surveys or other appropriate survey methodology, state-listed threatened and endangered species and other species of special concern, other wildlife species that may be present, and presence of non-native species; and d) past and present land uses, including grazing practices;

☒ Map of the proposed mitigation bank service area(s), description of the general need for the mitigation bank and basis for such determination;

☒ A map depicting other conserved lands in the vicinity of the proposed Bank Property;

☒ Bank Objectives/Conceptual Plan - This document describes the objectives of the mitigation bank and activities and methods for establishing, restoring, rehabilitating and/or preserving wetlands and other waters of the U.S. and habitat for federal and state listed species. Include maps detailing the anticipated location, acreages, and credits of wetlands and other waters of the U.S., habitat for federal and state listed species. The plan should detail anticipated increases in

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[3] [***USACE District to include, depending on the USACE District's requirement for an approved vs. a preliminary JD:*** A preliminary JD can only be used to determine that wetlands or other water bodies that exist on a particular site "may be" jurisdictional waters of the United States. For the purposes of this document, a preliminary JD is one done in accordance with the requirements of USACE Regulatory Guidance Letter 08-02.]

functions and services of existing aquatic resources and their corresponding effect within the watershed (i.e., habitat diversity and connectivity, floodplain management, or other landscape scale functions). Describe ecological suitability of the site to achieve the objectives of the mitigation bank (i.e., watershed/hydrology analysis, soils, topography, compatibility with adjacent land uses, watershed management plans). If a restoration site, should include historic aerial photographs and/or historic topographic maps, if available. Include proposed Performance Standards and monitoring methods for assessing how the objectives of the mitigation bank will be met;

- ☒ Explain how the proposed bank would contribute to connectivity and ecosystem function. Also discuss potential conflicts and compatibility with any conservation plans, CDFG conceptual area plans, or other land use plans, policies, or regulations;
- ☒ Real Estate Records and Assurances:
  - ☒ Current (within one year of submittal) Preliminary Title Report indicating any easements or other encumbrances and a figure depicting all relevant property lines, easements, dedications, etc. on the proposed Bank Property. Note: any liens and easements on the proposed Bank Property that may affect a mitigation bank's viability will need to be resolved before a mitigation bank can be approved. Provide a property assessment that summarizes and explains each recorded or unrecorded lien or encumbrance on, or interest in, the proposed Bank Property, including, without limitation, each exception listed in the Preliminary Title Report and describing the manner in which each encumbrance may affect the mitigation bank's operation or habitat services;
  - ☒ Assurance of sufficient water rights to support the long-term sustainability of the mitigation bank;
  - ☒ Provide details including ownership information on interest of surface and sub-surface mineral rights;
  - ☒ Identification and description of access to the proposed Bank Property;
  - ☒ An affirmative statement that a conservation easement covering the

proposed Bank Property in perpetuity or fee title transfer of the proposed Bank Property to a specified and approved grantee will occur as part of the mitigation bank establishment. Include number of acres of the proposed Bank Property, excluding any easement areas that allow uses incompatible with conservation. Note: Pursuant to California Civil Code Section 815 and Government Code Section 65965, only certain entities may be approved to hold an interest in mitigation lands. CDFG Regional offices can provide information related to these statutory requirements.

☒ Has the proposed Bank Property been:

- Used as mitigation for a previous project(s);
- Already designated or dedicated for passive park or open space use, where that use is generally compatible with sustaining biological values;
- Designated for purposes which are inconsistent with habitat preservation (i.e., lands purchased for roads, landfills, etc.); and
- Acquired by a public entity (e.g., with State Bond Act funds) or provided to a jurisdiction for park or natural open space purposes. This criterion excludes land purchased by state and local agencies specifically for the purposes of mitigation or mitigation banking assuming the funding source is appropriate;

☒ Any other restrictions on the proposed Bank Property;

☒ Details regarding public funding received (if applicable) for restoration, acquisition or other purposes on all or a portion of the proposed Bank Property (e.g., funding source, amount received, purpose, number of acres affected by each purpose, etc.); and

☒ A list of federal, state, and local permits required for construction and operation of the mitigation bank.

APPENDIX B:

PHOTO LOG: COMPLETED PORT OF SAN DIEGO RESTORATION PROJECTS

Port of San Diego Mitigation/Restoration Projects

SOUTH SAN DIEGO BAY WETLAND RESTORATION PROJECT (COMPLETED 2011)

Photo Courtesy of: Dale Frost (https://www.portofsandiego.org/environment/2507-san-diego-bay-habitat-restoration-celebrated.html)

Source: https://www.portofsandiego.org/environment/2260-port-federal-agencies-celebrate-start-of-major-restoration-of-south-san-diego-bay.html

D STREET HABITAT RESTORATION TO BENEFIT THE CALIFORNIA LEAST LERN & WESTERN SNOWY PLOVER (COMPLETED 2012)

Photo Courtesy of: Eileen Maher
(https://www.portofsandiego.org/?start=688)

Photo Courtesy of: Eileen Maher
Source: (https://www.portofsandiego.org/environment/2413-volunteers-sought-for-habitat-restoration-project.html)

TELEGRAPH CREEK MARSH AND CHULA VISTA WILDLIFE RESERVE ENHANCEMENT PROJECT (COMPLETED 2008)

Photo Courtesy of: Eileen Maher
Source: (https://www.portofsandiego.org/environment/2386-progress-underway-at-chula-vista-wildlife-reserve-restoration-project.html)

Photo Courtesy of: Eileen Maher
Source: (https://www.portofsandiego.org/environment/2252-groundbreaking-set-for-september-23-for-major-wildlife-and-shorebirds-restoration-project.html)

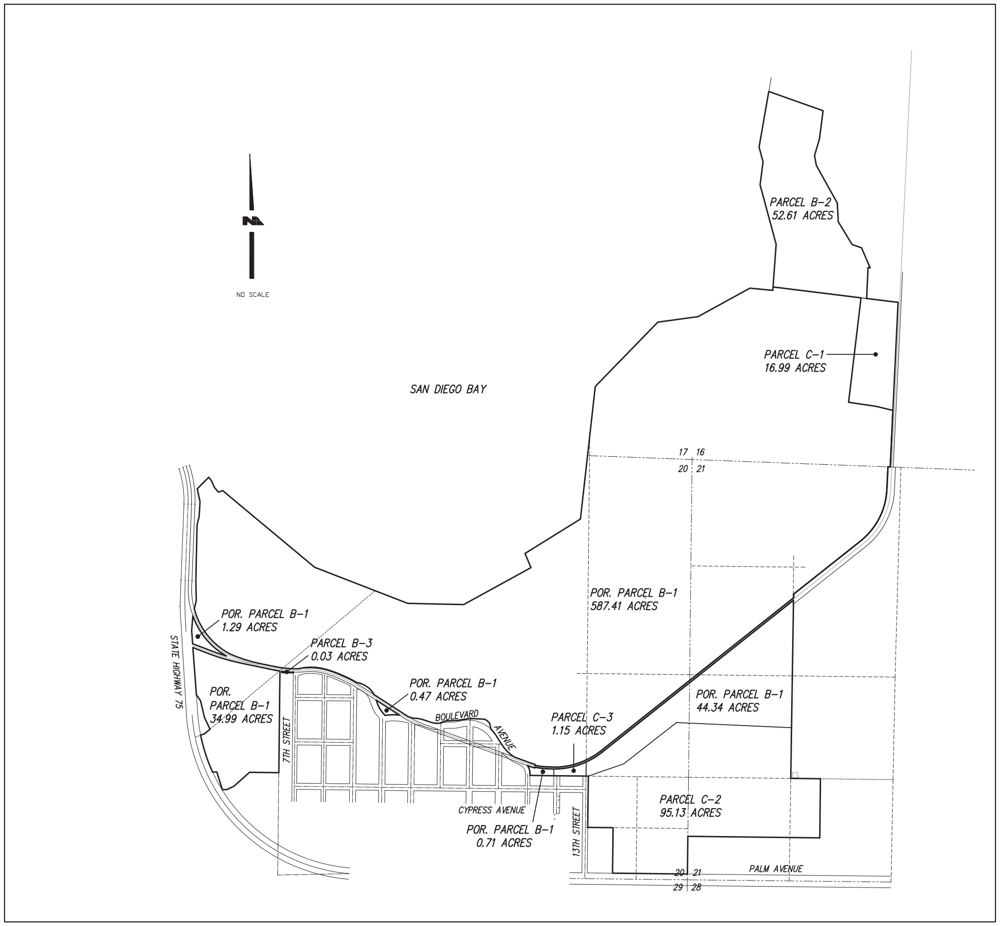
EMORY COVE SHORELINE ENHACEMENT PROJECT (COMPLETED 2011)

Photo Courtesy of: USFWS/Carolyn Lieberman
Source:
(https://www.fws.gov/FieldNotes/regmap.cfm?arskey=31462)

Photo Courtesy of: Eileen Maher
Source: (https://s3.amazonaws.com/sitesusa/wp-content/uploads/sites/502/2016/07/maher_10_12_12_Maher_-_Port_of_San_Diego_-_Restoration_South_Bay-PIANIC_conference_Oct-2012.pdf)

APPENDIX C:

MAP OF SOUTH SAN DIEGO BAY MITIGATION BANK PROPERTY LINES AND EASEMENTS



LEGAL DESCRIPTION

PARCEL B-1:
(SALT PONDS PARCEL)

Those portions of Sections 16, 17, 19, 20, and 21, Township 18 South Range 2 West San Bernardino Meridian and a portion of Rancho Peninsula in the County of San Diego, State of California described as follows:

BEGINNING at the Southwest corner of Parcel Map No. 16887 recorded June 26, 1992 as File No. 92-0400010 Official Records; thence along the Southerly boundary thereof South 82°59'40" East, 1156.26 feet; thence leaving said Southerly boundary South 06°47'08" West, 1371.58 feet; thence South 81°32'22" East, 363.54 feet; thence South 76°20'07" East, 224.05 feet to the Westerly line of the San Diego and Arizona Eastern Railway right-of-way; thence along said Westerly line South 02°43'45" West, 737.75 feet; thence North 87°51'01" West, 30.00 feet; thence South 02°43'45" West, 299.59 feet to the beginning of a curve concave to the Northwest having a radius of 905.36 feet; thence Southwesterly 771.45 feet along said curve through a central angle of 48°49'17"; thence South 51°33'02" West, 1114.98 feet to the Easterly line of the Southwest Quarter of the Northwest Quarter of Section 21, Township 18 South, Range 2 West; thence leaving said right-of-way line and along said Easterly line of the Southwest Quarter of the Northwest Quarter and the Easterly line of the Northwest Quarter of the Southwest Quarter of said Section 21 South 00°53'26" West, 1741.82 feet; thence leaving said Easterly line North 87°27'05" West, 1501.38 feet; thence South 51°58'22 West, 875.07 feet; thence South 70°54'23" West, 487.21 feet to a point on the Southerly line of the Northeast quarter of the Southeast quarter of said Section 20; thence along said Southerly line North 89°20'49" West, 30.00 feet to the Southwest corner thereof; thence along the Easterly line of the Northwest quarter of the Southeast quarter of said Section 20 North 00°38'17" East, 182.87 feet to a point on the Southerly line of said San Diego and Arizona Eastern Railway right-of-way, said point being on curve concave Northerly having a radus of 997.95 feet to which point a radial bears South 24°34'36" East; thence Westerly 434.13 feet along said curve through a central angle of 24°55'29"; thence South 00°37'24" West 87.74 feet to the Southerly line of said Northwest Quarter of the Southeast Quarter of said Section 20; thence along said Southerly line North 89°20'57" West, 310.01 feet to the Easterly line of Boulevard Avenue; thence along the Northeasterly and Northerly line of said Boulevard Avenue North 00°39'33" East, 19.98 feet to the Beginning of a curve concave to the Southwest having a radius of 188.95 feet; thence Northwesterly 228.66 feet through a central angle of 69°20'13"; thence non-tangent to said curve North 63°43'50" West, 89.24 feet to the beginning of a non-tangent curve concave to the Northeast having a radius of 515.00 feet to which beginning a radial bears South 31°16'00" West; thence Northwesterly 239.91 feet along said curve through a central angle of 26°41'28"; thence North 32°02'36" West, 136.54 feet to the beginning of a curve concave to the Southwest having a radius of 430.00 feet; thence Northwesterly 105.61 feet along said curve through a central angle of 14°04'18"; thence leaving said Boulevard Avenue North 12°49'10" West, 82.36 feet; thence North 46°43'16" West, 48.12 feet; thence North 59°05'57" West, 35.16 feet; thence North 87°13'49" West, 190.37 feet to a point on the Northerly prolongation of the centerline of 11th Street; thence South 81°44'27" West, 165.49 feet; thence South 87°12'38" West 152.38 feet; thence South 70°45'03" West, 68.03 feet to the Northerly prolongation of the centerline of 10th Street; thence along said Northerly prolongation South 00°40'35" West, 6.52 feet to said Northerly line of Boulevard Avenue, being a point on a curve concave to the North having a radius of 320.00 feet, a radial to said point bears South 07°23'36" East; thence Westerly along said curve and said Northerly line of Boulevard Avenue 161.63 feet to the beginning of a reverse curve concave Southerly having a radius of 620.00 feet to which beginning a radial bears North 22°34'50" East; thence Westerly 216.97 feet along said curve through a central angle of 20°03'02" to the beginning of a non-tangent curve concave to the South having a radius of 730.00 feet to which beginning a radial bears North 19°35'25" East; thence Westerly 363.59 feet along said curve through a central angle of 28°32'14" to the beginning of a non-tangent curve concave to the Northeast having a radius of 470.00 feet to which beginning a radial bears South 45°40'55" West; thence Northwesterly 239.66 feet along said curve through a central angle of 29°12'57" to the beginning of a reverse curve concave to the Southwest having a radius of 305.00 feet to which beginning a radial bears North 74°53'52" East; thence Northwesterly 355.17 feet along said curve through a central angle of 66°43'17" to the beginning of a non-tangent curve concave to the Southwest having a radius of 1466.19 feet to which beginning a radial bears North 31°09'28" East; thence Northwesterly 265.46 feet along said curve through a central angle of 10°22'26"; thence North 69°12'58" West, 96.16 feet to the beginning of a curve concave to the South having a radius of 762.41 feet; thence Westerly 321.58 feet along said curve through a central angle of 24°10'00" to the beginning of a compound curve concave to the Southeast having a radius of 524.06 feet to which beginning of compound curve a radial bears North 03°22'58" West; thence Southwesterly 107.17 feet along said curve through a central angle of 11°43'02" to an intersection with the Northerly line of the San Diego and Arizona Eastern Railroad right-of-way, said intersection being a point on a curve concave to the North having a radius of 1214.44 feet to which point a radial line bears South 02°43'36" East; thence leaving said Northerly line of Boulevard Avenue and along said Northerly right-of-way line Westerly 212.92 feet along said curve through a central angle of 10°02'43" to the Southeasterly line of Rancho Peninsula of San Diego; thence leaving said right-of-way line and along said Southeasterly line of Rancho Peninsula South 50°01'08" West, 60.33 feet to the Southerly line of said San Diego and Arizona Eastern Railroad right-of-way, being a point on a curve concave to the North having a radius of 1259.44 feet, to which point a radial line bears South 09°10'49" West; thence Easterly 6.18 feet along said curve and said Southerly right-of-way line through a central angle of 00°16'52" to the Easterly line of Section 19, Township 18 South, Range 2 West as shown on Record of Survey No. 12442 recorded in the Office of the County Recorder of San Diego County December 14, 1989 as File No. 89-677077; thence along said Westerly line South 00°37'06" West, 1324.55 feet to the Southeast corner of said Record of Survey No. 12442; thence along the Southerly, Southeasterly, Westerly and Northwesterly lines thereof North 89°25'33" West, 381.44 feet; thence South 48°22'41" West, 270.92 feet; thence South 64°01'41" West 103.04 feet; thence North 89°24'27" West, 60.02 feet; thence North 17°15'37" West, 239.36 feet; thence North 89°21'16" West 55.42 feet to a point on the Easterly line of California State Highway No. 75 (XI SD 75), said point being on a curve concave to the Northeast having a radius of 2161.00 feet, to which point a radial bears South 65°16'57" West; thence Northerly 505.86 feet along said curve and Easterly line of California State Highway No. 75 through a central angle of 13°24'44" to the Southeasterly line of said Rancho Peninsula of San Diego; thence leaving said Easterly line of Highway 75 and along said Southeasterly line of Rancho Peninsula North 69°02'08" East, 57.67 feet; thence North 50°01'08" East, 89.77 feet; thence leaving said Southeasterly line and the Northwesterly line of Record of Survey No. 12442 North 25°33'45" West, 165.18 feet; thence North 13°18'55" West, 227.06 feet; thence North 35°05'50" West, 94.54 feet to the Easterly line of said California State Highway No. 75 (XI SD 75); thence along said Easterly line North 04°12'33" West, 841.35 feet to a point in the lands condemned in that certain action in the United States District Court of the United States, in and for the Southern District of California Southern Division, entitled United States of America Plaintiff vs. J.D. and A.B. Spreckels Company, a Corporation et al Defendants, Civil Case No. 202, a certified copy of the decree on declaration of taking having been recorded October 23, 1942 in book 1422, page 230 of official records in the Office of the County Recorder of San Diego County; thence leaving said Easterly line of Highway No. 75 and along the East line of said lands condemned North 04°44'58" East, 207.58 feet; thence North 13°08'24" East, 187.50 feet; thence North 01°02'10" West, 253.87 feet; thence North 01°11'26" East, 732.31 feet; thence North 13°51'03" East, 113.64 feet; thence North 03°15'39" East, 195.05 feet; thence North 12°02'33" West, 171.22 feet; thence North 44°41'24" East, 211.81 feet to a line shown on Miscellaneous Map No. 79 recorded in the Office of the County Recorder of San Diego County December 15, 1926 as File No. 76218 and Miscellaneous Map No. 149 recorded September 11, 1940 as File No. 45492, said line is referred to as mean high tide line of San Diego Bay; thence along said line South 40°09'24" East, 52.75 feet; thence South 23°51'47" East, 103.27 feet; thence South 42°00'46" East, 81.10 feet; thence North 68°28'12" East, 55.60 feet; thence South 50°10'46" East, 287.29 feet; thence South 50°13'46" East, 1275.30 feet; thence South 68°47'46" East, 1300.00 feet; thence South 88°47'46" East, 730.00 feet; thence North 61°12'14" East, 1000.00 feet; thence North 22°47'46" West, 200.00 feet; thence North 58°12'14" East, 850.00 feet; thence North 06°23'14" East, 1740.00 feet; thence North 44°12'14" East, 1170.00 feet; thence North 82°12'14" East, 530.00 feet; thence North 61°12'14" East, 770.00 feet; thence South 84°31'46" East, 300.00 feet; thence North 03°45'47" East, 44.04 feet to the POINT OF BEGINNING.

PARCEL B-1 (continued)

Excepting therefrom, all those lands lying within the San Diego and Arizona Railroad right-of-way as laid out and constructed and also those areas described in those deeds recorded in the Official Records of San Diego County as follows:

1) on December 6, 1887, in Book 108, Page 234 of Deeds

2) on June 12, 1888, in Book 130, Page 155 of Deeds

3) on August 17, 1889, in Book 153, Page 120 of Deeds

4) on September 12, 1891, in Book 191, Page 28 of Deeds

5) on December 28, 1894, in Book 234, Page 23 of Deeds

PARCEL B-1.1
(RAILROAD RIGHT OF WAY PARCELS)

All those lands lying within the perimeter of the lands described in Exhibit B-1, hereto, which also lie either within the San Diego and Arizona Railroad right-of-way, as laid outh and constructed or within those areas described in those certain deeds recorded in the Official Records of San Diego County as follows:

1) on December 6, 1887, in Book 108, Page 234 of Deeds

2) on June 12, 1888, in Book 130, Page 155 of Deeds

3) on August 17, 1889, in Book 153, Page 120 of Deeds

4) on September 12, 1891, in Book 191, Page 28 of Deeds

5) on December 28, 1894, in Book 234, Page 23 of Deeds

PARCEL B-2:
(NORTHEAST PARCEL)

Parcel 1 of Parcel Map No. 16887, in the City of Chula Vista, County of San Diego, State of California, filed in the Office of the County Recorder of San Diego County June 26, 1992 as File No. 1992-0400010 of Official Records.

PARCEL B-2(1):
(30 FOOT EASEMENT PARCEL)

Those interests in lands, rights and obligations as provided in that THIRTY FOOT (30') ACCESS EASEMENT AND MAINTENANCE AGREEMENT, as described in that document recorded September 24, 1996 as file No. 1996-0484279 in the Office of the County Recorder of San Diego County, California.

PARCEL B-3:
(SEVENTH STREET PARCEL)

Lot 1 in Block 70 of South San Diego Company's addition to South San Diego, in the City of Imperial Beach, County of San Diego, State of California, according to the Map thereof No. 497, filed in the Office of the County Recorder of said San Diego County October 4, 1887.

Together with the Westerly 10 feet of Seventh Street, adjoining said Lot 1 on the East, as vacated by Resolution No. 1439 of the City Council of the City of Imperial Beach recorded November 4, 1968 as File No. 193024 of Official Records.

PARCEL C-1
(SALT PLANT PARCEL)

That portion of the Southeast Quarter of the Southwest Quarter, and Fractional lot 3 of the Southwest Quarter of Section 16, Township 18 South, Range 2 West, (San Bernardino Meridian), in the City of San Diego, County of San Diego, State of California, more more particularly described as follows:

BEGINNING at the Southeast corner of Parcel 2 of Parcel Map No. 16887 recorded June 26, 1992 in the Office of the County Recorder of San Diego County as File No. 92-0400010 Official Records, said corner bears North 82°59'40" East from the Southwest corner thereof (North 82°59'51" West Record), said Point of Beginning also being on the Westerly line of the San Diego and Arizona Eastern Railway right-of-way; thence along said Westerly line of Railway right-of-way South 02°43'45" West 1410.69 feet; thence leaving said Westerly line North 76°20'07" West 224.05 feet; thence North 81°32'22" West 363.54 feet; thence North 06°47'08" East 1371.58 feet to the Southerly line of Parcel 1 of said Parcel Map No. 16887; thence along the Southerly line of said Parcels 1 and 2 of said Parcel Map No. 16887 South 82°59'40" East; 486.03 feet to the point of BEGINNING.

PARCEL C-2
(POND 20 PARCEL)

Those portions of the Southeast Quarter of the Southeast Quarter of Section 20, the Northwest Quarter of the Southwest Quarter, the South half of the Southwest Quarter of Section 21, both in Township 18 South, Range 2 West, (San Bernardino Meridian), in the City of San Diego, County of San Diego, State of California, more particularly described as follows:

BEGINNING at a point on the Easterly line of 13th Street as said Street is shown on Record of Survey Map No. 12049, recorded February 16, 1989 in the Office of the County Recorder of San Diego County as File no. 89-82977, said point being the Westerly Southwest corner of Record of Survey Map No. 12049, recorded February 16, 1989 in the Office of the County Recorder of San Diego County as File No. 89-82977, the Northwest Corner of said Record of Survey bears North 00°38'17" East: (North 00°38'34" East Record) thence along the Westerly line of said Record of Survey North 00°38'17" East 668.49 feet to the Northwest Corner thereof; thence leaving said Westerly line North 70°54'23" East 487.21 feet; thence North 51°58'22" East 875.07 feet; thence South 87°27'05" East 1501.38 feet to the East line of the Northwest Quarter of the Southwest Quarter of said Section 21; thence along said East line South 00°53'26" West 661.94 feet to the North line of the South half of the Southwest Quarter of said Section 21; thence along said North line South 89°20'35" East 386.88 feet to the Northeast corner of the West 1720.00 feet of the North 770.00 feet of the South half of the Southwest Quarter of said Section 21; thence along the Easterly line thereof South 00°39'00" West, 770.00 feet to the Southeast corner of said West 1720.00 feet of the North 770.00 feet; thence along the Southerly line thereof North 89°20'35" West, 1720.00 feet to a point of the West line of said Section 21, said point also being on the Easterly line of said Record of Survey Map No. 12049; thence along said Easterly line South 00°39'00" West 492.29 feet to the Southeast corner of said Record of Survey; thence along the southerly line thereof North 89°20'07" West 976.29 feet to the West line of said Record of Survey; thence along said West line North 00°39'09" East 593.57 feet to an angle point in said Record of Survey; thence North 89°20'24" West 329.97 feet to the Point of BEGINNING.

PARCEL C-3:
(FLORENCE STREET PARCEL)

That portion of the Northwest Quarter of the Southeast Quarter of Section 20, Township 18, South, Range 2 West, in the City of San Diego, County of San Diego State of California being described as follows:

BEGINNING at the Southeast corner of said Northwest Quarter of the Southeast Quarter of said Section 20; thence along the Southerly line thereof North 89°21'09" West, 420.06 feet; thence leaving said Southerly line North 00°37'24" East, 87.74 feet to a point on the Southerly line of said San Diego and Arizona Eastern Railway right-of-way, said point being a point on a curve concave to the North having a radius of 997.95 feet, to which said beginning a radial bears South 00°20'53" West; thence Easterly 434.13 feet along said curve through a central angle of 24°55'29" to the Easterly line of said Northwest Quarter of the Southeast Quarter; thence along said Easterly line South 00°38'17" West 182.87 feet to the POINT OF BEGINNING.

BASIS OF BEARINGS

THE BASIS OF BEARINGS FOR THIS SURVEY IS THE NAD 83, ZONE 6, GRID BEARING BETWEEN STATION "1313" AND STATION "1315" AS SAID STATIONS ARE SHOWN ON RECORD OF SURVEY NO. 14492 AND PUBLISHED IN THE SAN DIEGO CITY HORIZONTAL CONTROL BOOK. I.E. NORTH 03°10'11" EAST

QUOTED BEARINGS FROM REFERENCE MAPS/DEEDS MAY OR MAY NOT BE IN TERMS OF SAID SYSTEM.

SURVEYOR'S CERTIFICATE

TO: PORT OF SAN DIEGO, STATE OF CALIFORNIA STATE LANDS COMMISSION AND STEWART TITLE OF CALIFORNIA

THIS IS TO CERTIFY THAT THIS MAP OR PLAT AND THE SURVEY ON WHICH IT IS BASED WERE MADE (i) IN ACCORDANCE WITH "MINIMUM STANDARD DETAIL REQUIREMENTS FOR ALTA/ACSM LAND TITLE SURVEYS," JOINTLY ESTABLISHED AND ADOPTED BY ALTA AND ACSM IN 1992, AND
ii) PURSUANT TO THE ACCURACY STANDARDS (AS ADOPTED BY ALTA AND ACSM AND IN EFFECT ON THE DATE OF THIS CERTIFICATION) OF AN URBAN SURVEY.

DATE: ____________________

BY: ____________________
RONALD C. PARKER
REGISTRATION NO.: 4312

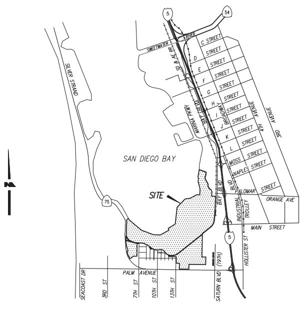
No. 4312
EXP. 6-30-00

NOTES

1. THE SURVEY IS BASED ON THE TITLE REPORT PREPARED BY:
   STEWART TITLE OF CALIFORNIA, INC.,SAN DIEGO DIVISION
   ORDER NO. 01-178943 DATED DECEMBER 23, 1998
2. THE GROSS AREA WITHIN THE BOUNDARY OF THIS SURVEY IS 835.12 ACRES.
3. UTILITY EASEMENTS SHOWN REPRESENT INTENDED LOCATIONS OF SAID UTILITY. ACTUAL LOCATION OF UTILITY PIPES AND STRUCTURES MAY OR MAY NOT COINCIDE WITH EASEMENT.
4. THIS ALTA SURVEY PREPARED FOR:
   H.G. FENTON COMPANY/WESTERN SALT COMPANY
   7220 TRADE STREET, SUITE 300
   SAN DIEGO, CA 92121-2327
5. TITLE TO SAID ESTATE OR INTEREST AT THE DATE OF THIS SURVEY IS VESTED IN:
   WESTERN SALT COMPANY, A CALIFORNIA CORPORATION
6. ASSESSOR'S PARCEL NO:
   615-050-02, 03, 04; 616-010-01; 616-020-08, 12;
   616-021-01, 03, 07; 617-011-04; 621-010-01; 621-020-04, 05, 07
7. THE FLOOD ZONE DESIGNATION IS ZONES A, AE, & X (SPECIAL FLOOD HAZARD AREA INUNDATED BY 100 YEAR FLOOD) PER FLOOD INSURANCE RATE MAP, COMMUNITY PANEL I.D. NOs. 060287, 060291, & 060295; PANEL NOs. 2151 F, 2152 F, 2153 F, AND 2154 F DATED 6-19-97.

SURVEYOR'S NOTE

DURING THE COURSE OF THIS SURVEY, THERE WAS NO ATTEMPT TO FIND, LOCATE OR ASCERTAIN THE SOURCE, LOCATION OR EXISTENCE OF ANY POSSIBLE HAZARDOUS MATERIALS, ENVIRONMENTALLY SENSITIVE AREAS OR ENDANGERED PLANTS, ANIMALS AND CONDITIONS OF THE LAND UNLESS OTHERWISE SHOWN ON THE SURVEY.



VICINITY MAP

NOT TO SCALE

LEGEND

●	INDICATES FOUND MONUMENT AS NOTED
( )	INDICATES RECORD DATA PER MAP NO.
AC	ASPHALTIC CONCRETE
☼	AREA LIGHTS
Conc	CONCRETE
DI □	DROP INLET
O/H	OVERHEAD ELECTRIC LINE
PP ●	POWER POLE WITH ANCHOR
SMH ○	SEWER MANHOLE
	SHRUBS
	TREES

EXCEPTION TABLE

② AN EASEMENT AFFECTING SAID LAND FOR THE PURPOSES STATED HEREIN AND INCIDENTAL PURPOSES

FOR: RAILROAD
RECORDED: DECEMBER 6, 1887 IN BOOK 108, PAGE 234 OF DEEDS

SAID DEED DOES NOT CONTAIN THE LOCATION OF SAID EASEMENT

③ AN EASEMENT AFFECTING SAID LAND FOR THE PURPOSES STATED HEREIN AND INCIDENTAL PURPOSES

IN FAVOR OF: THE CORONADO RAILROAD COMPANY, A CORPORATION
FOR: A LINE OF RAILROADS
RECORDED: JUNE 12, 1888 IN BOOK 130, PAGE 155 OF DEEDS

SAID DEED DOES NOT CONTAIN THE LOCATION OF SAID EASEMENT.

REFERENCE IS MADE TO SAID DOCUMENT FOR FULL PARTICULARS.

④ AN EASEMENT AFFECTING SAID LAND FOR THE PURPOSES STATED AND INCIDENTAL PURPOSES

IN FAVOR OF: THE CORONADO RAILROAD COMPANY, A CORPORATION
FOR: A LINE OF RAILROADS
RECORDED: AUGUST 17, 1889 IN BOOK 153, PAGE 120 OF DEEDS

SAID DEED DOES NOT CONTAIN THE LOCATION OF SAID EASEMENT.

REFERENCE IS MADE TO SAID DOCUMENT FOR FULL PARTICULARS.

⑤ AN EASEMENT AFFECTING SAID LAND FOR THE PURPOSES STATED HEREIN AND INCIDENTAL PURPOSES

IN FAVOR OF: CORONADO RAILROAD COMPANY
FOR: RAILROAD
RECORDED: OCTOBER 14, 1889 IN BOOK 155, PAGE 127 OF DEEDS

SAID DEED DOES NOT CONTAIN THE LOCATION OF SAID EASEMENT.

SAID MATTER AFFECTS A PORTION OF PARCEL B-2.

⑥ AN EASEMENT AFFECTING SAID LAND FOR THE PURPOSES STATED HEREIN AND INCIDENTAL PURPOSES

IN FAVOR OF: THE CORONADO RAILROAD COMPANY, A CORPORATION
FOR: A LINE OF RAILROADS
RECORDED: SEPTEMBER 12, 1891 IN BOOK 191, PAGE 28 OF DEEDS

SAID DEED DOES NOT CONTAIN THE LOCATION OF SAID EASEMENT.

REFERENCE IS MADE TO SAID DOCUMENT FOR FULL PARTICULARS.

⑦ AN EASEMENT AFFECTING SAID LAND FOR THE PURPOSES STATED HEREIN AND INCIDENTAL PURPOSES

IN FAVOR OF: THE CORONADO RAILROAD COMPANY
FOR: RAILROAD
RECORDED: DECEMBER 28, 1894 IN BOOK 234, PAGE 23 OF DEEDS

SAID DEED DOES NOT CONTAIN THE LOCATION OF SAID EASEMENT.

REFERENCE IS MADE TO SAID DOCUMENT FOR FULL PARTICULARS.

⑨ AN EASEMENT AFFECTING THE PORTION OF SAID LAND AND FOR THE

PURPOSES STATED HEREIN AND INCIDENTAL PURPOSES
IN FAVOR OF: SAN DIEGO GAS & ELECTRIC COMPANY
FOR: TRANSMISSION AND DISTRIBUTION OF ELECTRICITY
RECORDED: MARCH 10, 1943 IN BOOK 1461, PAGE 486 OF O.R.

SAID MATTER AFFECTS A PORTION OF PARCEL C-2.

REFERENCE IS MADE TO SAID DOCUMENT FOR FULL PARTICULARS.

⑩ AN EASEMENT AFFECTING SAID LAND FOR THE PURPOSES STATED HEREIN AND INCIDENTAL PURPOSES

IN FAVOR OF: SAN DIEGO GAS & ELECTRIC COMPANY
FOR: TRANSMISSION AND DISTRIBUTION OF ELECTRICITY
RECORDED: JULY 6, 1943 IN BOOK 1514, PAGE 324 OF O.R.

PORTION OF SAID EASEMENT NOT ON PROPERTY

⑪ AN EASEMENT AFFECTING SAID LAND FOR THE PURPOSES STATED AND INCIDENTAL PURPOSES

IN FAVOR OF: SAN DIEGO GAS & ELECTRIC COMPANY
FOR: TRANSMISSION AND DISTRIBUTION OF ELECTRICITY
RECORDED: OCTOBER 31, 1944 IN BOOK 1767, PAGE 190 OF O.R.

SAID DEED DOES NOT CONTAIN THE LOCATION OF SAID EASEMENT.

SAID MATTER AFFECTS A PORTION OF PARCEL B-3.

⑫ AN EASEMENT AFFECTING SAID LAND FOR THE PURPOSES STATED HEREIN AND INCIDENTAL PURPOSES

IN FAVOR OF: SAN DIEGO GAS & ELECTRIC COMPANY
FOR: PLACING, ERECTING, CONSTRUCTING AN ANODE CONSISTING OF A SECTION OF METAL PIPE 8 OR MORE INCHES IN DIAMETER AND APPROXIMATELY 100 FEET IN LENGTH, AND ALSO THE NECESSARY ELECTRICAL CONDUCTORS AND OTHER FIXTURES FOR USE IN CONNECTION THEREWITH, TOGETHER WITH THE RIGHT OF INGRESS THERETO AND EGRESS THEREFROM TO AND ALONG SAID ANODE AND CONDUCTORS
RECORDED: MAY 29, 1952 IN BOOK 4482, PAGE 514 OF O.R.

SAID DEED DOES NOT CONTAIN THE LOCATION OF SAID EASEMENT.

SAID MATTER AFFECTS A PORTION OF PARCEL C-3

⑬ AN EASEMENT AFFECTING SAID LAND FOR THE PURPOSES STATED HEREIN AND INCIDENTAL PURPOSES

IN FAVOR OF: THE COUNTY OF SAN DIEGO
FOR: A DRAINAGE CHANNEL
RECORDED: DECEMBER 4, 1952 IN BOOK 4676, PAGE 275 OF O.R.

SAID DEED DOES NOT CONTAIN THE LOCATION OF SAID EASEMENT.

SAID MATTER AFFECTS PARCEL B-3.

⑭ AN EASEMENT AFFECTING SAID LAND FOR THE PURPOSES STATED HEREIN AND INCIDENTAL PURPOSES

IN FAVOR OF: THE PALM CITY SANITATION DISTRICT
FOR: SEWER DITCH AND PIPELINES
RECORDED: APRIL 5, 1955 IN BOOK 5593, PAGE 489 OF O.R.

REFERENCE IS MADE TO SAID DOCUMENT FOR FULL PARTICULARS.

SAID MATTER AFFECTS A PORTION OF PARCEL B-3.

⑰ AN EASEMENT AFFECTING SAID LAND FOR THE PURPOSES STATED HEREIN AND INCIDENTAL PURPOSES

IN FAVOR OF: SAN DIEGO GAS & ELECTRIC COMPANY
FOR: TRANSMISSION AND DISTRIBUTION OF ELECTRICITY
RECORDED: SEPTEMBER 17, 1965 AS FILE NO. 1965-169572 OF O.R.

⑱ AN EASEMENT AFFECTING SAID LAND FOR THE PURPOSES STATED HEREIN AND INCIDENTAL PURPOSES

IN FAVOR OF: THE CITY OF IMPERIAL
FOR: SANITARY SEWERS AND STORM DRAINS
RECORDED: NOVEMBER 4, 1968 AS FILE NO. 1968-193024 OF O.R.

SAID MATTER AFFECTS A PORTION OF PARCEL C-3.

⑲ AN EASEMENT AFFECTING SAID LAND FOR THE PURPOSES STATED HEREIN AND INCIDENTAL PURPOSES

IN FAVOR OF: CITY OF IMPERIAL BEACH, A MUNICIPAL CORPORATION
FOR: STORM DRAIN FIXTURES
RECORDED: APRIL 6, 1970 AS FILE NO. 1970-58969 OF O.R.

⑳ COVENANTS, CONDITIONS AND RESTRICTIONS IN AN INSTRUMENT RECORDED SEPTEMBER 20, 1982 AS FILE NO. 1982-290449 OF O.R.

㉑ COVENANTS, CONDITIONS AND RESTRICTIONS IN AN INSTRUMENT RECORDED SEPTEMBER 20, 1982 AS FILE NO. 1982-290450 OF O.R.

㉒ AN EASEMENT AFFECTING SAID LAND FOR THE PURPOSES STATED &EIN AND INCIDENTAL PURPOSES

IN FAVOR OF: THE CITY OF SAN DIEGO
FOR: A SEWER MAIN
RECORDED: SEPTEMBER 10, 1986 AS FILE NO. 1986-396004 OF O.R.

㉔ AN AGREEMENT TO WHICH REFERENCE IS HEREBY MADE FOR FULL PARTICULARS

DATED: DECEMBER 20, 1990

BY & BETWEEN: SAN DIEGO AND ARIZONA EASTERN RAILWAY COMPANY, A CORPORATION (THE WHOLLY OWNED SUBSIDIARY OF THE SAN DIEGO METROPOLITAN TRANSIT DEVELOPMENT BOARD) AND WESTERN SALT
REGARDING: EASEMENT AGREEMENT
RECORDED: OCTOBER 4, 1991 AS FILE NO. 1991-0514506 OF O.R.

SAID MATTER AFFECTS PARCEL C-1.

㉕ AN AGREEMENT TO WHICH REFERENCE IS HEREBY MADE FOR FULL PARTICULARS

DATED: DECEMBER 28, 1990
BY & BETWEEN: SAN DIEGO AND ARIZONA EASTERN RAILWAY COMPANY, A CORPORATION (THE WHOLLY OWNED SUBSIDIARY OF THE SAN DIEGO METROPOLITAN TRANSIT DEVELOPMENT BOARD) AND WESTERN SALT
REGARDING: EASEMENT AGREEMENT
RECORDED: OCTOBER 4, 1991 AS FILE NO. 1991-0514507 OF O.R.

SAID MATTER AFFECTS PARCEL C-1.

㉗ AN AGREEMENT TO WHICH REFERENCE IS HEREBY MADE FOR FULL PARTICULARS

DATED: SEPTEMBER 10, 1996
BY & BETWEEN: W.W. GRAINGER, INC., AN ILLINOIS CORPORATION AND WESTERN SALT COMPANY, A CALIFORNIA CORPORATION
REGARDING: THIRTY FOOT ACCESS EASEMENT AND MAINTENANCE
RECORDED: SEPTEMBER 24, 1996 AS FILE NO. 1996-0484279 OF O.R.

SAID MATTER AFFECTS PARCEL B-2.

㉘ ANY RIGHTS IN FAVOR OF THE PUBLIC WHICH MAY EXIST ON SAID LAND FOR PARKING, BEACH OR RECREATIONAL USES, IF SAID LAND OR PORTIONS THEREOF WERE AT ANY TIME USED BY PUBLIC FOR SUCH PURPOSES.

DATE: 01/06/00 TIME: 08:19
SERVER: SDS1 SERVICE: PROJ
PATH: N:\SD0519\00\Cadd\
DRAWING NAME: ALTA.DWG
PLOTTING VIEW: SHT1
DESIGNER: LAP PROJ. MGR: RCP

NO.	BY	DATE	REVISIONS:
1	LAP	3-16-99	REVISED PARCEL DESIGNATIONS. AFFECTS ALL SHEETS.

XREFS: 10496.dwg...

CAUTION: The engineer preparing these plans will not be responsible for, or liable for, unauthorized changes to or uses of these plans. All changes to the plans must be in writing and must be approved by the preparer of these plans.

NOLTE
BEYOND ENGINEERING
15090 AVENUE OF SCIENCE, SUITE 101 SAN DIEGO, CA. 92128
619.385.0500 TEL 619.385.0400 FAX WWW.NOLTE.COM

PREPARED FOR: H.G. FENTON COMPANY/WESTERN SALT COMPANY

ALTA/ACSM SURVEY

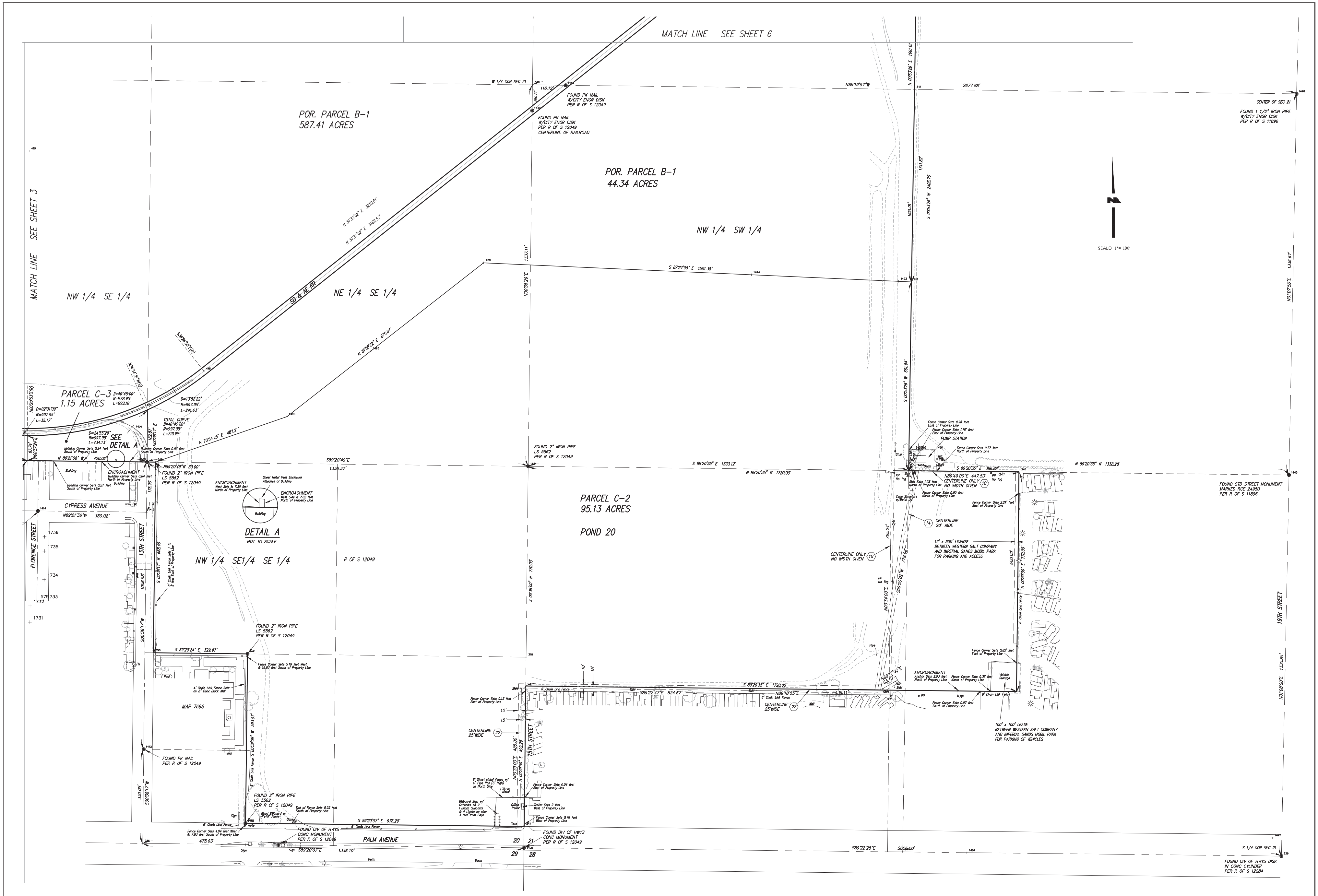
WESTERN SALT COMPANY LANDS

DATE SUBMITTED: 3-23-99

SHEET NUMBER 1 OF 8 SHEETS

SCALE
VERTICAL: 1"=
HORIZONTAL: 1"=

JOB NUMBER
SD0519



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TIME:	08:19
SERVER:	SDS1
SERVICE:	PROJ
PATH:	N:\SD0519\00\Cadd\
DRAWING NAME:	ALTA.DWG
PLOTTING VIEW:	SHT2
DESIGNER:	LAP
PROJ. MGR:	RCP

NO.	BY	DATE	REVISIONS:

XREFS: 10496.dwg...

CAUTION: The engineer preparing these plans will not be responsible for, or liable for, unauthorized changes to or uses of these plans. All changes to the plans must be in writing and must be approved by the preparer of these plans.

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ALTA/ACSM SURVEY

WESTERN SALT COMPANY LANDS

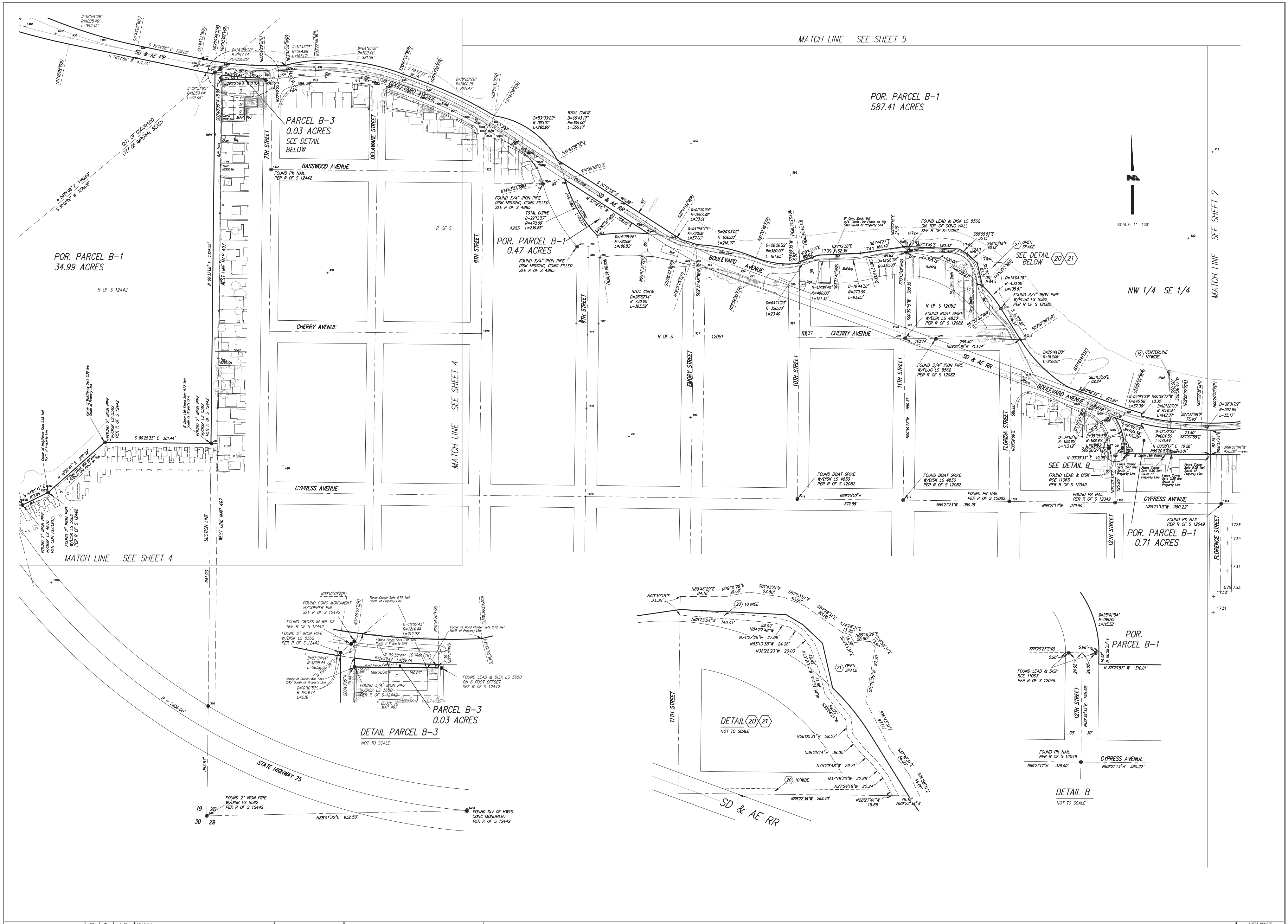
PREPARED FOR: H.G. FENTON COMPANY/WESTERN SALT COMPANY

DATE SUBMITTED:

SHEET NUMBER 2 OF 8 SHEETS

SCALE
VERTICAL: 1"=
HORIZONTAL: 1"= 100'
0 25 50 100 150

JOB NUMBER SD0519



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PATH: N:\SD0519\00\Cadd\	
DRAWING NAME: ALTA.DWG	
PLOTTING VIEW: SHT3	
DESIGNER: LAP	PROJ. MGR: RCP

NO.	BY	DATE	REVISIONS:

XREFS: 10496.dwg...

CAUTION: The engineer preparing these plans will not be responsible for, or liable for, unauthorized changes to or uses of these plans. All changes to the plans must be in writing and must be approved by the preparer of these plans.

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619.385.0500 TEL 619.385.0400 FAX WWW.NOLTE.COM

ALTA/ACSM SURVEY

WESTERN SALT COMPANY LANDS

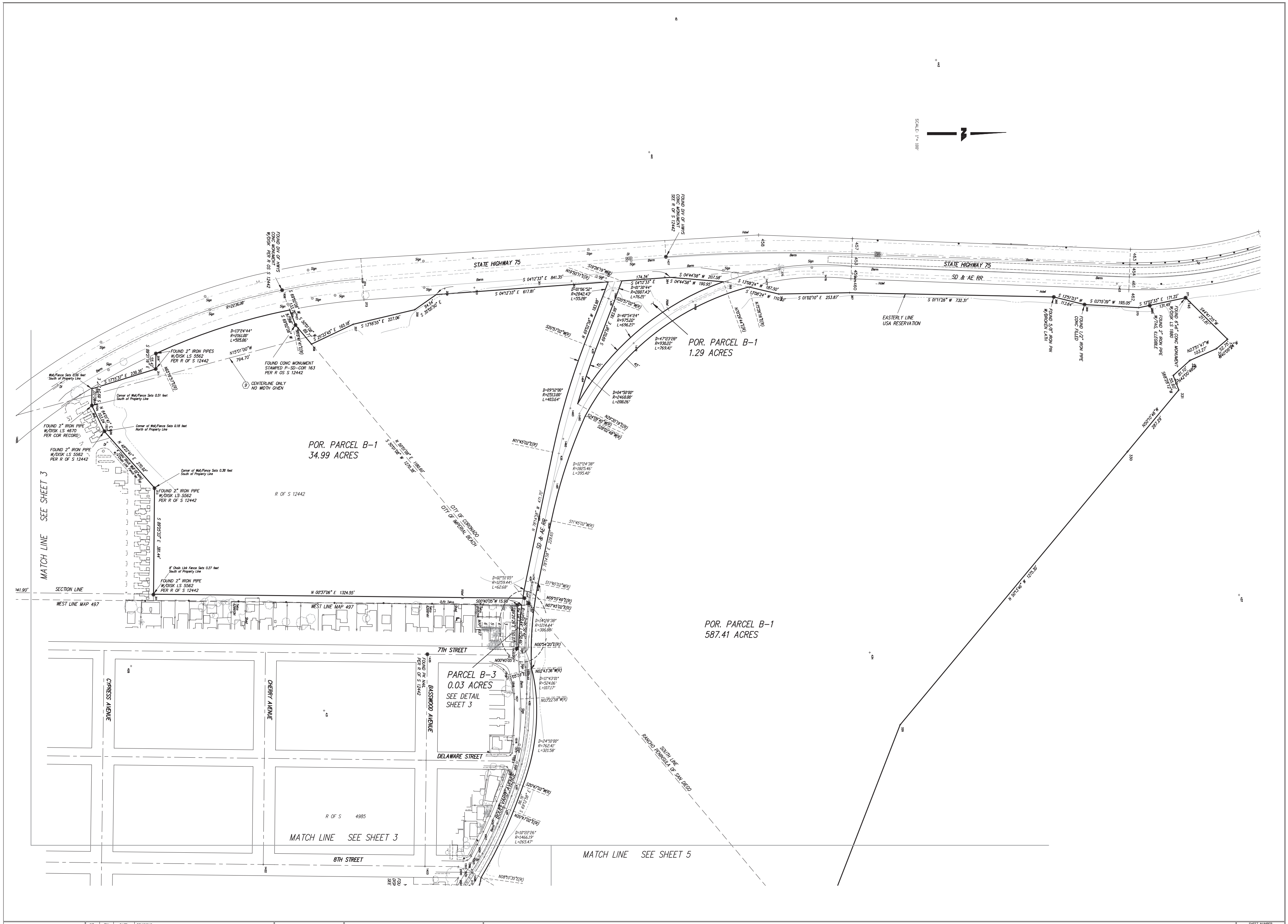
PREPARED FOR: H.G. FENTON COMPANY/WESTERN SALT COMPANY

DATE SUBMITTED:

SHEET NUMBER 3 OF 8 SHEETS

SCALE
VERTICAL: 1"=
HORIZONTAL: 1"= 100'
0 25 50 100 150

JOB NUMBER
SD0519



DATE: 01/06/00 TIME: 08:19
SERVER: SDS1 SERVICE: PROJ
PATH: N:\SD0519\00\Cadd\
DRAWING NAME: ALTA.DWG
PLOTTING VIEW: SHT4
DESIGNER: LAP PROJ. MGR: RCP

NO.	BY	DATE	REVISIONS:

CAUTION: The engineer preparing these plans will not be responsible for, or liable for, unauthorized changes to or uses of these plans. All changes to the plans must be in writing and must be approved by the preparer of these plans.

NOLTE
BEYOND ENGINEERING
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619.385.0500 TEL 619.385.0400 FAX WWW.NOLTE.COM

ALTA/ACSM SURVEY

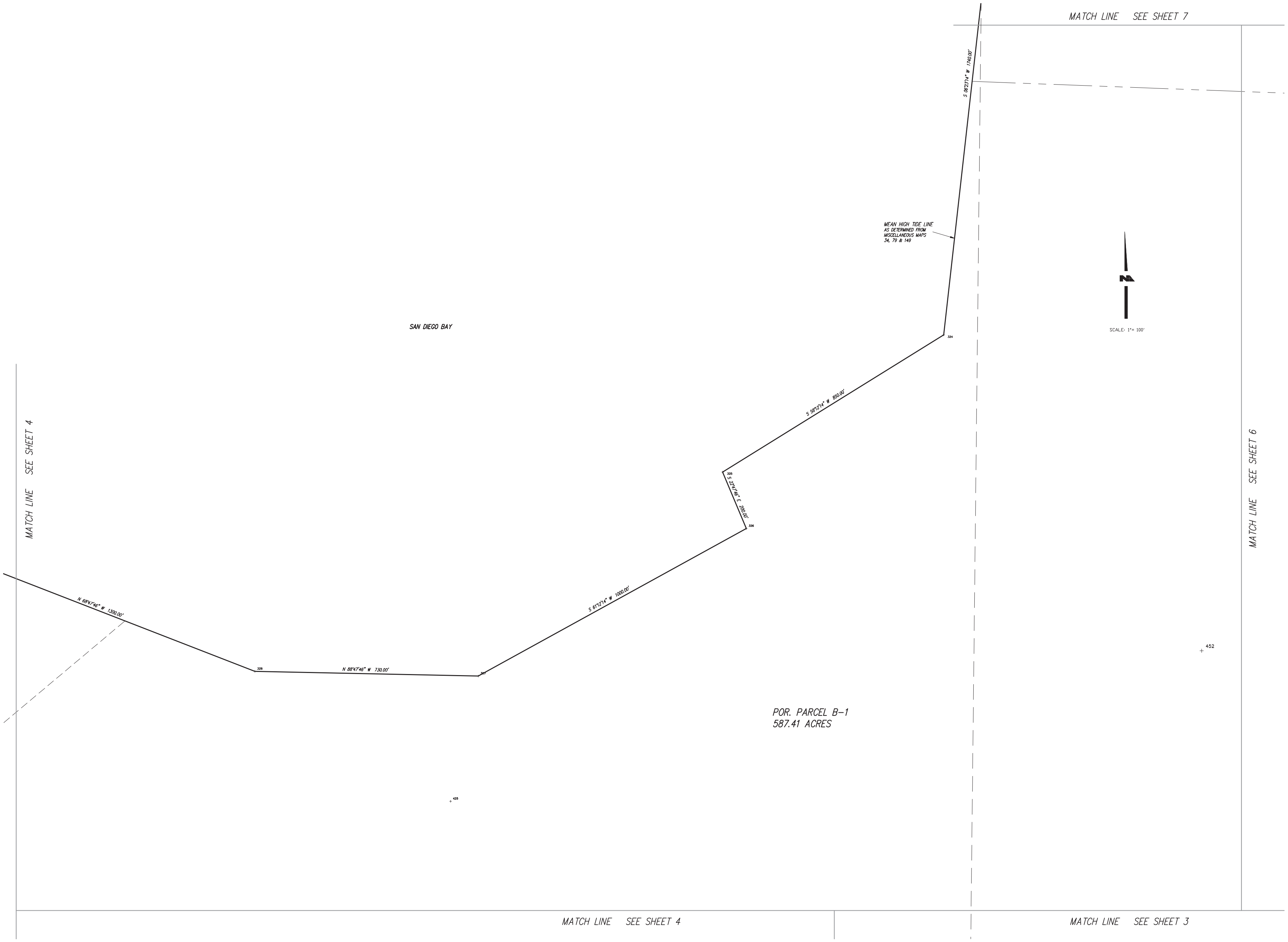
WESTERN SALT COMPANY LANDS

PREPARED FOR: H.G. FENTON COMPANY/WESTERN SALT COMPANY

DATE SUBMITTED:

SHEET NUMBER 4 OF 8 SHEETS
SCALE
VERTICAL: 1"=
HORIZONTAL: 1"= 100'
0 25 50 100 150
JOB NUMBER SD0519

XREFS: 10496.dwg



DATE: 01/06/00 TIME: 08:19
SERVER: SDS1 SERVICE: PROJ
PATH: N:\SD0519\00\Cadd\
DRAWING NAME: ALTA.DWG
PLOTTING VIEW: SHT5
DESIGNER: LAP PROJ. MGR: RCP

NO.	BY	DATE	REVISIONS:

XREFS: 10496.dwg...

CAUTION: The engineer preparing these plans will not be responsible for, or liable for, unauthorized changes to or uses of these plans. All changes to the plans must be in writing and must be approved by the preparer of these plans.

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619.385.0500 TEL 619.385.0400 FAX WWW.NOLTE.COM

ALTA/ACSM SURVEY
WESTERN SALT COMPANY LANDS

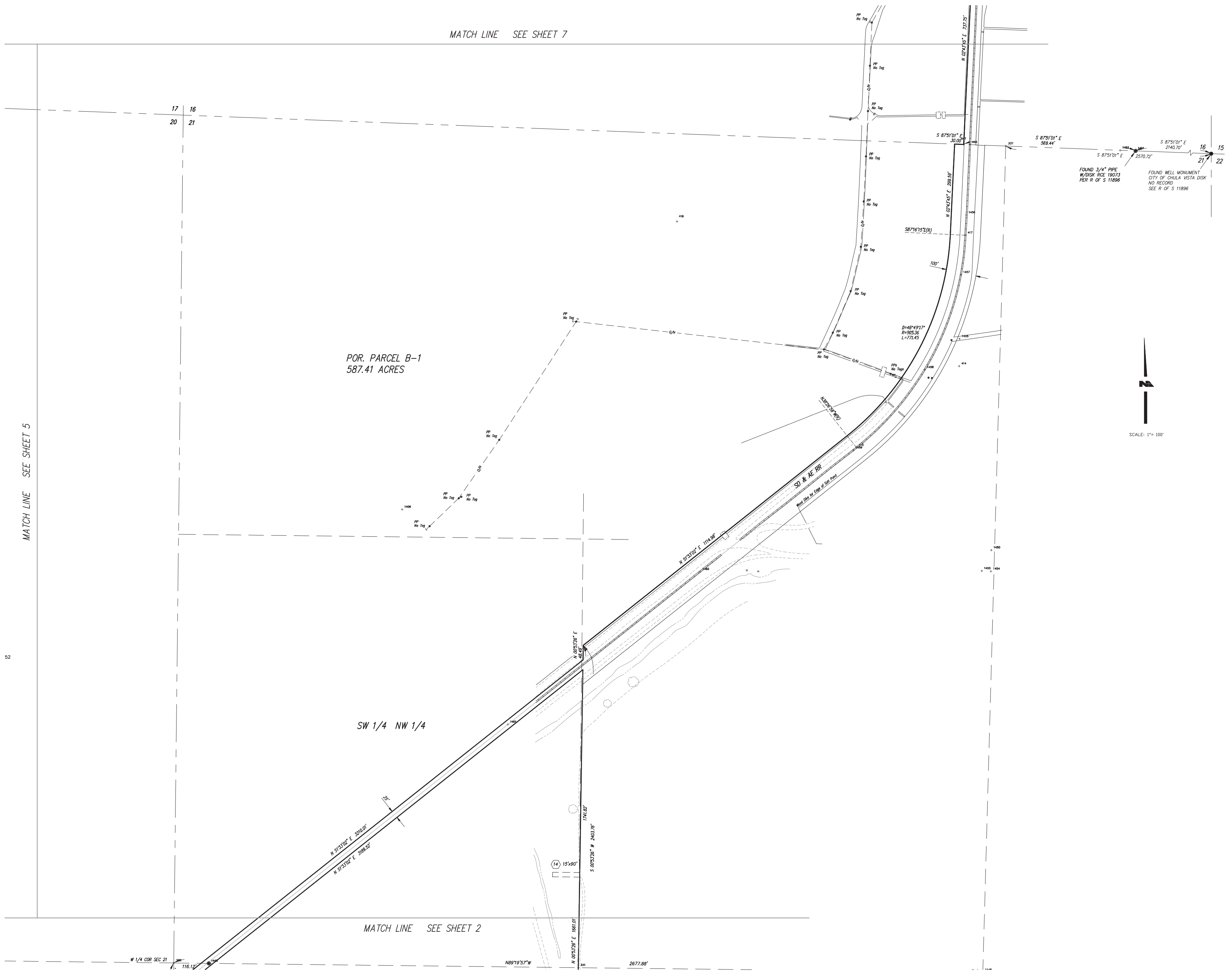
PREPARED FOR: H.G. FENTON COMPANY/WESTERN SALT COMPANY

DATE SUBMITTED:

SHEET NUMBER
5
OF 8 SHEETS

SCALE
VERTICAL: 1"=
HORIZONTAL: 1"= 100'
0 25 50 100 150

JOB NUMBER
SD0519



DATE: 01/06/00 TIME: 08:19
SERVER: SDS1 SERVICE: PROJ
PATH: N:\SD0519\00\Cadd\
DRAWING NAME: ALTA.DWG
PLOTTING VIEW: SHT6
DESIGNER: LAP PROJ. MGR: RCP

XREFS: 10496.dwg...

NO.	BY	DATE	REVISIONS:

CAUTION: The engineer preparing these plans will not be responsible for, or liable for, unauthorized changes to or uses of these plans. All changes to the plans must be in writing and must be approved by the preparer of these plans.

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619.385.0500 TEL 619.385.0400 FAX WWW.NOLTE.COM

PREPARED FOR: H.G. FENTON COMPANY/WESTERN SALT COMPANY

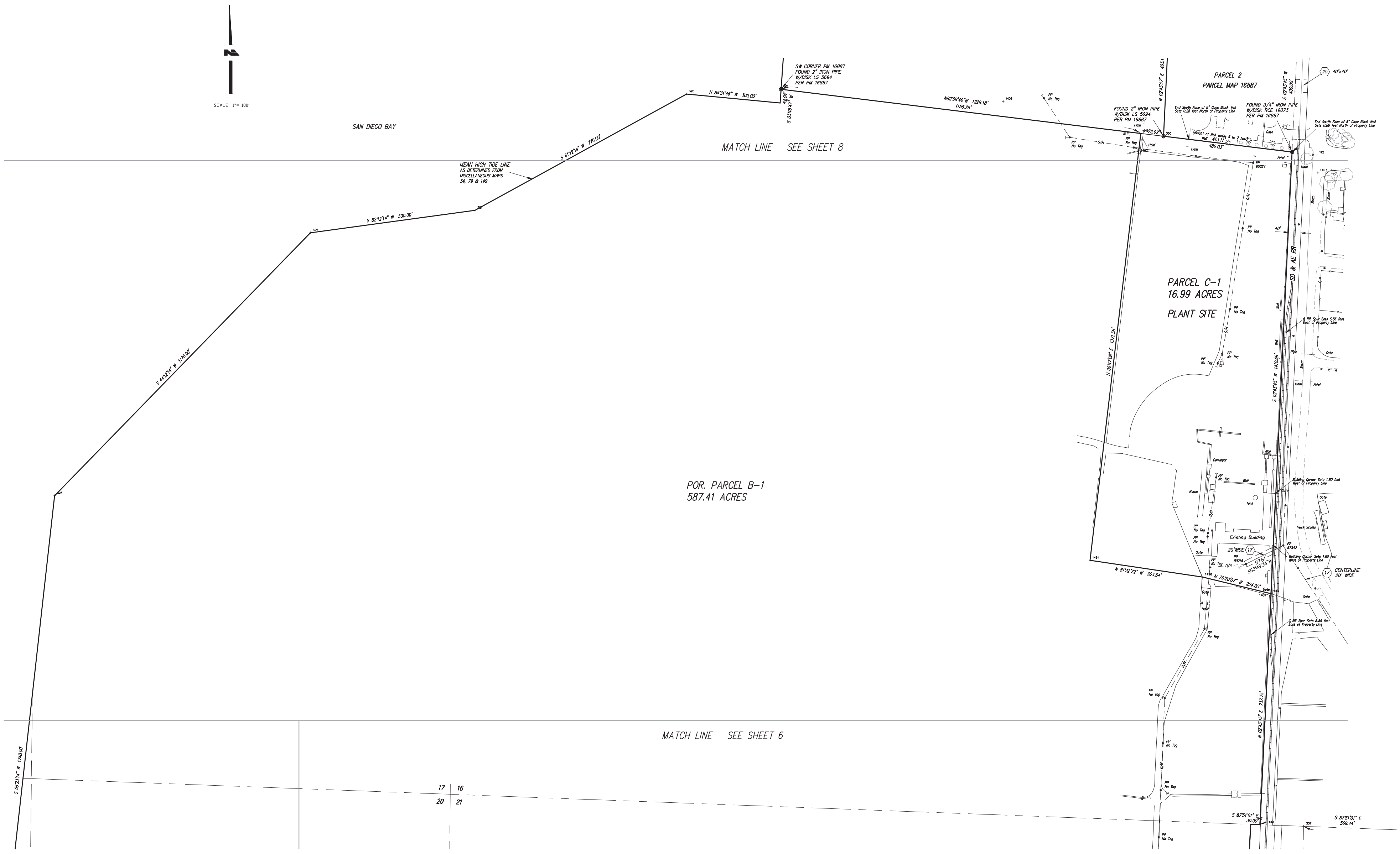
ALTA/ACSM SURVEY
WESTERN SALT COMPANY LANDS

DATE SUBMITTED:

SHEET NUMBER
6
OF 8 SHEETS

SCALE
VERTICAL: 1"=
HORIZONTAL: 1"= 100'
0 25 50 100 150

JOB NUMBER
SD0519



XREFS: 10496.dwg...

DATE: 01/06/00 TIME: 08:19
SERVER: SDS1 SERVICE: PROJ
PATH: N:\SD0519\00\Cadd\
DRAWING NAME: ALTA.DWG
PLOTTING VIEW: SHT7
DESIGNER: LAP PROJ. MGR: RCP

NO.	BY	DATE	REVISIONS:

CAUTION: The engineer preparing these plans will not be responsible for, or liable for, unauthorized changes to or uses of these plans. All changes to the plans must be in writing and must be approved by the preparer of these plans.

NOLTE
BEYOND ENGINEERING
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619.385.0500 TEL 619.385.0400 FAX WWW.NOLTE.COM

ALTA/ACSM SURVEY

WESTERN SALT COMPANY LANDS

PREPARED FOR: H.G. FENTON COMPANY/WESTERN SALT COMPANY

DATE SUBMITTED:

SHEET NUMBER
7
OF 8 SHEETS

SCALE
VERTICAL: 1"=
HORIZONTAL: 1"= 100'
0 25 50 100 150

JOB NUMBER
SD0519

DATE: 01/06/00 TIME: 08:19
SERVER: SDS1 SERVICE: PROJ
PATH: N:\SD0519\00\Cadd\
DRAWING NAME: ALTA.DWG
PLOTTING VIEW: SHT8
DESIGNER: LAP PROJ. MGR: RCP

NO.	BY	DATE	REVISIONS:
1	AP	6-99	REVISED PARCEL DESIGNATIONS. AFFECTS ALL SHEETS.

CAUTION: The engineer preparing these plans will not be responsible for, or liable for, unauthorized changes to or uses of these plans. All changes to the plans must be in writing and must be approved by the preparer of these plans.

XREFS: 10496.dwg...

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BEYOND ENGINEERING
15090 AVENUE OF SCIENCE, SUITE 101 SAN DIEGO, CA. 92128
619.385.0500 TEL 619.385.0400 FAX WWW.NOLTE.COM

PREPARED FOR: H.G. FENTON COMPANY/WESTERN SALT COMPANY

ALTA/ACSM SURVEY
WESTERN SALT COMPANY LANDS

DATE SUBMITTED:

SHEET NUMBER 8 OF 8 SHEETS

SCALE
VERTICAL: 1"=
HORIZONTAL: 1"= 100'
0 25 50 100 150

JOB NUMBER
SD0519

APPENDIX D:
SOUTH SAN DIEGO BAY MITIGATION BANK PRELIMINARY TITLE REPORT

Chicago Title Company

2365 Northside Drive, Suite 600, San Diego, CA 92108
Phone: (619) 521-3500 ● Fax: (619) 521-3608

Issuing Policies of Chicago Title Insurance Company

ORDER NO.: **00084416-993-SD2-CFU**

Port of San Diego
3165 Pacific Highway
San Diego, CA 92101
ATTN: Brent Eastty
Email: beastty@portofsandiego.org
Ref:

Escrow/Customer Phone: **(619) 521-3500**

Title Officer: **Ken Cyr & Mark Franklin**
Title Officer Phone: **(619) 521-3673**
Title Officer Fax: **(619) 521-3608**
Title Officer Email: **TeamCyrFranklin@ctt.com**

PROPERTY: **POND 20 / VACANT LAND, SAN DIEGO, CA**

PRELIMINARY REPORT

In response to the application for a policy of title insurance referenced herein, **Chicago Title Company** *hereby reports that it is prepared to issue, or cause to be issued, as of the date hereof, a policy or policies of title insurance describing the land and the estate or interest therein hereinafter set forth, insuring against loss which may be sustained by reason of any defect, lien or encumbrance not shown or referred to as an exception herein or not excluded from coverage pursuant to the printed Schedules, Conditions and Stipulations or Conditions of said policy forms.*

The printed Exceptions and Exclusions from the coverage and Limitations on Covered Risks of said policy or policies are set forth in Attachment One. The policy to be issued may contain an arbitration clause. When the Amount of Insurance is less than that set forth in the arbitration clause, all arbitrable matters shall be arbitrated at the option of either the Company or the Insured as the exclusive remedy of the parties. Limitations on Covered Risks applicable to the CLTA and ALTA Homeowner's Policies of Title Insurance which establish a Deductible Amount and a Maximum Dollar Limit of Liability for certain coverages are also set forth in Attachment One. Copies of the policy forms should be read. They are available from the office which issued this report.

This report (and any supplements or amendments hereto) is issued solely for the purpose of facilitating the issuance of a policy of title insurance and no liability is assumed hereby. If it is desired that liability be assumed prior to the issuance of a policy of title insurance, a Binder or Commitment should be requested.

The policy(s) of title insurance to be issued hereunder will be policy(s) of Chicago Title Insurance Company, a Florida corporation.

Please read the exceptions shown or referred to herein and the exceptions and exclusions set forth in Attachment One of this report carefully. The exceptions and exclusions are meant to provide you with notice of matters which are not covered under the terms of the title insurance policy and should be carefully considered.

It is important to note that this preliminary report is not a written representation as to the condition of title and may not list all liens, defects and encumbrances affecting title to the land.

Chicago Title Company

By: ______________________
Authorized Signature

By
Randy Quirk, President
Attest
Michael Gravelle, Secretary

PRELIMINARY REPORT

EFFECTIVE DATE: **February 15, 2018 at 7:30 a.m.**

ORDER NO.: 00084416-993-SD2-CFU

The form of policy or policies of title insurance contemplated by this report is:

A Preliminary Report Only

1. THE ESTATE OR INTEREST IN THE LAND HEREINAFTER DESCRIBED OR REFERRED TO COVERED BY THIS REPORT IS:

   A FEE

2. TITLE TO SAID ESTATE OR INTEREST AT THE DATE HEREOF IS VESTED IN:

   SAN DIEGO UNIFIED PORT DISTRICT

3. THE LAND REFERRED TO IN THIS REPORT IS DESCRIBED AS FOLLOWS:

   See Exhibit A attached hereto and made a part hereof.

EXHIBIT “A”

LEGAL DESCRIPTION

THE LAND REFERRED TO HEREIN BELOW IS SITUATED SAN DIEGO, IN THE COUNTY OF SAN DIEGO, STATE OF CALIFORNIA, AND IS DESCRIBED AS FOLLOWS:

THOSE PORTIONS OF THE SOUTHEAST QUARTER OF THE SOUTHEAST QUARTER OF SECTION 20, THE NORTHWEST QUARTER OF THE SOUTHWEST QUARTER, THE SOUTH HALF OF THE SOUTHWEST QUARTER OF SECTION 21, TOWNSHIP 18 SOUTH, RANGE 2 WEST, (SAN BERNARDINO MERIDIAN), IN THE CITY OF SAN DIEGO, COUNTY OF SAN DIEGO, STATE OF CALIFORNIA, MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT A POINT ON THE EASTERLY LINE OF 13TH STREET AS SAID STREET IS SHOWN ON RECORD OF SURVEY MAP NO. 12049, RECORDED FEBRUARY 16, 1989 IN THE OFFICE OF THE COUNTY RECORDER OF SAN DIEGO COUNTY AS FILE NO. 89-82977, SAID POINT BEING THE WESTERLY SOUTHWEST CORNER OF RECORD OF SURVEY MAP NO. 12049, RECORDED FEBRUARY 16, 1989 IN THE OFFICE OF THE COUNTY RECORDER OF SAN DIEGO COUNTY AS FILE NO. 89-82977, THE NORTHWEST CORNER OF SAID RECORD OF SURVEY BEARS NORTH 00°38'17" EAST; (NORTH 00°38'34" EAST RECORD) THENCE ALONG THE WESTERLY LINE OF SAID RECORD OF SURVEY NORTH 00°38'17" EAST 668.49 FEET TO THE NORTHWEST CORNER THEREOF; THENCE LEAVING SAID WESTERLY LINE NORTH 70°54’23" EAST 487.21 FEET; THENCE NORTH 51°58'22" EAST 876.07 FEET; THENCE SOUTH 87°27'05" EAST 1501.38 FEET TO THE EAST LINE OF THE NORTHWEST QUARTER OF THE SOUTHWEST QUARTER OF SAID SECTION 21; THENCE ALONG SAID EAST LINE SOUTH 00°53'26" WEST 661.94 FEET TO THE NORTH LINE OF THE SOUTH HALF OF THE SOUTHWEST QUARTER OF SAID SECTION 21; THENCE ALONG SAID NORTH LINE SOUTH 89°20'35" EAST 386.88 FEET TO THE NORTHEAST CORNER OF THE WEST 1720.00 FEET OF THE NORTH 770.00 FEET OF THE SOUTH HALF OF THE SOUTHWEST QUARTER OF SAID SECTION 21; THENCE ALONG THE EASTERLY LINE THEREOF SOUTH 00°39'00" WEST, 770.00 FEET TO THE SOUTHEAST COMER OF SAID WEST 1720.00 FEET OF THE NORTH 770.00 FEET; THENCE ALONG THE SOUTHERLY LINE THEREOF NORTH 89°20'35" WEST, 1720.00 FEET TO A POINT ON THE WEST LINE OF SAID SECTION 21, SAID POINT ALSO BEING ON THE EASTERLY LINE OF SAID RECORD OF SURVEY MAP NO. 12049; THENCE ALONG SAID EASTERLY LINE SOUTH 00°39'00" WEST 492.29 FEET TO THE SOUTHEAST CORNER OF SAID RECORD OF SURVEY; THENCE ALONG THE SOUTHERLY LINE THEREOF NORTH 89°20'07" WEST 976.29 FEET TO THE WEST LINE OF SAID RECORD OF SURVEY; THENCE ALONG SAID WEST LINE NORTH 00°39'09" EAST 593.57 FEET TO AN ANGLE POINT IN SAID RECORD OF SURVEY; THENCE NORTH 89°20’24" WEST 329.97 FEET TO THE POINT OF BEGINNING.

APN(S): 616-020-08 AND 616-020-12; 616-021-08, 621-020-04 AND 621-020-08

EXCEPTIONS

AT THE DATE HEREOF, ITEMS TO BE CONSIDERED AND EXCEPTIONS TO COVERAGE IN ADDITION TO THE PRINTED EXCEPTIONS AND EXCLUSIONS IN SAID POLICY FORM WOULD BE AS FOLLOWS:

A. Taxes not assessed.

B. The lien of supplemental or escaped assessments of property taxes, if any, made pursuant to the provisions of Chapter 3.5 (commencing with Section 75) or Part 2, Chapter 3, Articles 3 and 4, respectively, of the Revenue and Taxation Code of the State of California as a result of the transfer of title to the vestee named in Schedule A or as a result of changes in ownership or new construction occurring prior to Date of Policy.

1. Rights and easements for navigation and fishery which may exist over that portion of said Land lying beneath the waters of the Otay River and its tributaries..

2. Easement(s) for the purpose(s) shown below and rights incidental thereto, as granted in a document:

Granted to:	San Diego Consolidated Gas and Electric Company
Purpose:	public utilities, ingress, egress
Recording Date:	July 6, 1943
Recording No:	in Book 1514, page 324 of Official Records
Affects:	A portion of the Land described herein.

3. Easement(s) for the purpose(s) shown below and rights incidental thereto, as granted in a document:

Granted to:	County of San Diego
Purpose:	drainage channel
Recording Date:	December 4, 1952
Recording No:	151932, in book 4676, page 275 of Official Records
Affects:	A portion of the Land described herein.

4. Easement(s) for the purpose(s) shown below and rights incidental thereto, as granted in a document:

Granted to:	City of San Diego
Purpose:	sewer main
Recording Date:	September 10, 1986
Recording No:	1986-0396004 of Official Records
Affects:	A portion of the Land described herein.

5. Matters contained in that certain document

Entitled:	San Diego Unified Port District/Western Salt Company Title Settlement Agreement
Recording Date:	April 01, 1999
Recording No:	1999-0219107 of Official Records

Standard Reimbursement Agreement as evidenced by San Diego Unified Port District Document No. 38437.

Reference is hereby made to said document for full particulars.

6. Discrepancies, conflicts in boundary lines, shortage in area, encroachments, or any other matters shown on

Map:	16404 of Record of Survey

EXCEPTIONS
(Continued)

7. Any interest of the person(s) shown below appearing as assessed owner(s) of said Land on the county secured tax rolls.

   Name(s): VMT Auto Inc <DBA VMT Auto Sales, CC Medina Holdings Inc <DBA Clear Channel Outdoor and Imperial Sands Mobile Park LLC

8. Water rights, claims or title to water, whether or not disclosed by the public records.

9. BPC Policy No. 774 as evidenced by San Diego Unified Port District Document No. 64246.

10. Cooperative Agreement between the United States Department of the Interior Fish and Wildlife Service and the San Diego Unified Port District as evidenced by San Diego Unified Port District Document No. 38129.

PLEASE REFER TO THE "INFORMATIONAL NOTES" AND "REQUIREMENTS" SECTIONS WHICH FOLLOW FOR INFORMATION NECESSARY TO COMPLETE THIS TRANSACTION.

END OF EXCEPTIONS

REQUIREMENTS SECTION

None

END OF REQUIREMENTS

INFORMATIONAL NOTES SECTION

1. None of the items shown in this report will cause the Company to decline to attach CLTA Endorsement Form 100 to an Extended Coverage Loan Policy, when issued.

2. The Company is not aware of any matters which would cause it to decline to attach CLTA Endorsement Form 116 indicating that there is located on said Land Undeveloped Land properties, known as Pond 20 / Vacant Land, located within the city of San Diego, California, , to an Extended Coverage Loan Policy.

3. Note: The policy of title insurance will include an arbitration provision. The Company or the insured may demand arbitration. Arbitrable matters may include, but are not limited to, any controversy or claim between the Company and the insured arising out of or relating to this policy, any service of the Company in connection with its issuance or the breach of a policy provision or other obligation. Please ask your escrow or title officer for a sample copy of the policy to be issued if you wish to review the arbitration provisions and any other provisions pertaining to your Title Insurance coverage.

4. Notice: Please be aware that due to the conflict between federal and state laws concerning the cultivation, distribution, manufacture or sale of marijuana, the Company is not able to close or insure any transaction involving Land that is associated with these activities.

5. Pursuant to Government Code Section 27388.1, as amended and effective as of 1-1-2018, a Documentary Transfer Tax (DTT) Affidavit may be required to be completed and submitted with each document when DTT is being paid or when an exemption is being claimed from paying the tax. If a governmental agency is a party to the document, the form will not be required. DTT Affidavits may be available at a Tax Assessor-County Clerk-Recorder.

6. plotted easements

END OF INFORMATIONAL NOTES

Ken Cyr & Mark Franklin/rp

Wire Fraud Alert

This Notice is not intended to provide legal or professional advice. If you have any questions, please consult with a lawyer.

All parties to a real estate transaction are targets for wire fraud and many have lost hundreds of thousands of dollars because they simply relied on the wire instructions received via email, without further verification. **If funds are to be wired in conjunction with this real estate transaction, we strongly recommend verbal verification of wire instructions through a known, trusted phone number prior to sending funds.**

In addition, the following non-exclusive self-protection strategies are recommended to minimize exposure to possible wire fraud.

- **NEVER RELY** on emails purporting to change wire instructions. Parties to a transaction rarely change wire instructions in the course of a transaction.
- **ALWAYS VERIFY** wire instructions, specifically the ABA routing number and account number, by calling the party who sent the instructions to you. DO NOT use the phone number provided in the email containing the instructions, use phone numbers you have called before or can otherwise verify. **Obtain the phone number of relevant parties to the transaction as soon as an escrow account is opened**. DO NOT send an email to verify as the email address may be incorrect or the email may be intercepted by the fraudster.
- **USE COMPLEX EMAIL PASSWORDS** that employ a combination of mixed case, numbers, and symbols. Make your passwords greater than eight (8) characters. Also, change your password often and do NOT reuse the same password for other online accounts.
- **USE MULTI-FACTOR AUTHENTICATION** for email accounts. Your email provider or IT staff may have specific instructions on how to implement this feature.

For more information on wire-fraud scams or to report an incident, please refer to the following links:

Federal Bureau of Investigation:	***Internet Crime Complaint Center:***
http://www.fbi.gov	***http://www.ic3.gov***

FIDELITY NATIONAL FINANCIAL

PRIVACY NOTICE

At Fidelity National Financial, Inc., we respect and believe it is important to protect the privacy of consumers and our customers. This Privacy Notice explains how we collect, use, and protect any information that we collect from you, when and to whom we disclose such information, and the choices you have about the use of that information. A summary of the Privacy Notice is below, and we encourage you to review the entirety of the Privacy Notice following this summary. You can opt-out of certain disclosures by following our opt-out procedure set forth at the end of this Privacy Notice.

Types of Information Collected. You may provide us with certain personal information about you, like your contact information, address demographic information, social security number (SSN), driver's license, passport, other government ID numbers and/or financial information. We may also receive browsing information from your Internet browser, computer and/or mobile device if you visit or use our websites or applications.

How Information is Collected. We may collect personal information from you via applications, forms, and correspondence we receive from you and others related to our transactions with you. When you visit our websites from your computer or mobile device, we automatically collect and store certain information available to us through your Internet browser or computer equipment to optimize your website experience.

Use of Collected Information. We request and use your personal information to provide products and services to you, to improve our products and services, and to communicate with you about these products and services. We may also share your contact information with our affiliates for marketing purposes.

When Information Is Disclosed. We may disclose your information to our affiliates and/or nonaffiliated parties providing services for you or us, to law enforcement agencies or governmental authorities, as required by law, and to parties whose interest in title must be determined.

Choices With Your Information. Your decision to submit information to us is entirely up to you. You can opt-out of certain disclosure or use of your information or choose to not provide any personal information to us.

Information From Children. We do not knowingly collect information from children who are under the age of 13, and our website is not intended to attract children.

Privacy Outside the Website. We are not responsible for the privacy practices of third parties, even if our website links to those parties' websites.

International Users. By providing us with your information, you consent to its transfer, processing and storage outside of your country of residence, as well as the fact that we will handle such information consistent with this Privacy Notice.

The California Online Privacy Protection Act. Some FNF companies provide services to mortgage loan servicers and, in some cases, their websites collect information on behalf of mortgage loan servicers. The mortgage loan servicer is responsible for taking action or making changes to any consumer information submitted through those websites.

Your Consent To This Privacy Notice. By submitting information to us or by using our website, you are accepting and agreeing to the terms of this Privacy Notice.

Access and Correction; Contact Us. If you desire to contact us regarding this notice or your information, please contact us at privacy@fnf.com or as directed at the end of this Privacy Notice.

FIDELITY NATIONAL FINANCIAL, INC.
PRIVACY NOTICE

Fidelity National Financial, Inc. and its majority-owned subsidiary companies providing title insurance, real estate- and loan-related services (collectively, "FNF", "our" or "we") respect and are committed to protecting your privacy. We will take reasonable steps to ensure that your Personal Information and Browsing Information will only be used in compliance with this Privacy Notice and applicable laws. This Privacy Notice is only in effect for Personal Information and Browsing Information collected and/or owned by or on behalf of FNF, including Personal Information and Browsing Information collected through any FNF website, online service or application (collectively, the "Website").

Types of Information Collected
We may collect two types of information from you: Personal Information and Browsing Information.

Personal Information. FNF may collect the following categories of Personal Information:
- contact information (e.g., name, address, phone number, email address);
- demographic information (e.g., date of birth, gender, marital status);
- social security number (SSN), driver's license, passport, and other government ID numbers;
- financial account information; and
- other personal information needed from you to provide title insurance, real estate- and loan-related services to you.

Browsing Information. FNF may collect the following categories of Browsing Information:
- Internet Protocol (or IP) address or device ID/UDID, protocol and sequence information;
- browser language and type;
- domain name system requests;
- browsing history, such as time spent at a domain, time and date of your visit and number of clicks;
- http headers, application client and server banners; and
- operating system and fingerprinting data.

How Information is Collected
In the course of our business, we may collect *Personal Information* about you from the following sources:
- applications or other forms we receive from you or your authorized representative;
- the correspondence you and others send to us;
- information we receive through the Website;
- information about your transactions with, or services performed by, us, our affiliates or nonaffiliated third parties; and
- information from consumer or other reporting agencies and public records maintained by governmental entities that we obtain directly from those entities, our affiliates or others.

If you visit or use our Website, we may collect *Browsing Information* from you as follows:
- Browser Log Files. Our servers automatically log each visitor to the Website and collect and record certain browsing information about each visitor. The Browsing Information includes generic information and reveals nothing personal about the user.
- Cookies. When you visit our Website, a "cookie" may be sent to your computer. A cookie is a small piece of data that is sent to your Internet browser from a web server and stored on your computer's hard drive. When you visit a website again, the cookie allows the website to recognize your computer. Cookies may store user preferences and other information. You can choose whether or not to accept cookies by changing your Internet browser settings, which may impair or limit some functionality of the Website.

Use of Collected Information
Information collected by FNF is used for three main purposes:
- To provide products and services to you or any affiliate or third party who is obtaining services on your behalf or in connection with a transaction involving you.
- To improve our products and services.
- To communicate with you and to inform you about our, our affiliates' and third parties' products and services, jointly or independently.

When Information Is Disclosed
We may provide your Personal Information (excluding information we receive from consumer or other credit reporting agencies) and Browsing Information to various individuals and companies, as permitted by law, without obtaining your prior authorization. Such laws do not allow consumers to restrict these disclosures. Please see the section "Choices With Your Personal Information" to learn how to limit the discretionary disclosure of your Personal Information and Browsing Information.

Disclosures of your Personal Information may be made to the following categories of affiliates and nonaffiliated third parties:
- to third parties to provide you with services you have requested, and to enable us to detect or prevent criminal activity, fraud, material misrepresentation, or nondisclosure;
- to our affiliate financial service providers for their use to market their products or services to you;
- to nonaffiliated third party service providers who provide or perform services on our behalf and use the disclosed information only in connection with such services;
- to nonaffiliated third party service providers with whom we perform joint marketing, pursuant to an agreement with them to market financial products or services to you;
- to law enforcement or other governmental authority in connection with an investigation, or civil or criminal subpoena or court order;
- to lenders, lien holders, judgment creditors, or other parties claiming an interest in title whose claim or interest must be determined, settled, paid, or released prior to closing; and
- other third parties for whom you have given us written authorization to disclose your Personal Information.

We may disclose Personal Information and/or Browsing Information when required by law or in the good-faith belief that such disclosure is necessary to:

- comply with a legal process or applicable laws;
- enforce this Privacy Notice;
- investigate or respond to claims that any material, document, image, graphic, logo, design, audio, video or any other information provided by you violates the rights of a third party; or
- protect the rights, property or personal safety of FNF, its users or the public.

We maintain reasonable safeguards to keep your Personal Information secure. When we provide Personal Information to our affiliates or third party service providers as discussed in this Privacy Notice, we expect that these parties process such information in compliance with our Privacy Notice or in a manner that is in compliance with applicable privacy laws. The use of your information by a business partner may be subject to that party's own Privacy Notice. Unless permitted by law, we do not disclose information we collect from consumer or credit reporting agencies with our affiliates or others without your consent.

We reserve the right to transfer your Personal Information, Browsing Information, and any other information, in connection with the sale or other disposition of all or part of the FNF business and/or assets, or in the event of our bankruptcy, reorganization, insolvency, receivership or an assignment for the benefit of creditors. You expressly agree and consent to the use and/or transfer of the foregoing information in connection with any of the above described proceedings. We cannot and will not be responsible for any breach of security by a third party or for any actions of any third party that receives any of the information that is disclosed to us.

Choices With Your Information

Whether you submit Personal Information or Browsing Information to FNF is entirely up to you. If you decide not to submit Personal Information or Browsing Information, FNF may not be able to provide certain services or products to you. The uses of your Personal Information and/or Browsing Information that, by law, you cannot limit, include:

- for our everyday business purposes – to process your transactions, maintain your account(s), to respond to law
- enforcement or other governmental authority in connection with an investigation, or civil or criminal subpoenas or court
- orders, or report to credit bureaus;
- for our own marketing purposes;
- for joint marketing with financial companies; and
- for our affiliates' everyday business purposes – information about your transactions and experiences.

You may choose to prevent FNF from disclosing or using your Personal Information and/or Browsing Information under the following circumstances ("opt-out"):

- for our affiliates' everyday business purposes – information about your creditworthiness; and
- for our affiliates to market to you.

To the extent permitted above, you may opt-out of disclosure or use of your Personal Information and Browsing Information by notifying us by one of the methods at the end of this Privacy Notice. We do not share your personal information with non-affiliates for their direct marketing purposes.

For California Residents: We will not share your Personal Information and Browsing Information with nonaffiliated third parties, except as permitted by California law. Currently, our policy is that we do not recognize "do not track" requests from Internet browsers and similar devices.

For Nevada Residents: You may be placed on our internal Do Not Call List by calling (888) 934-3354 or by contacting us via the information set forth at the end of this Privacy Notice. Nevada law requires that we also provide you with the following contact information: Bureau of Consumer Protection, Office of the Nevada Attorney General, 555 E. Washington St., Suite 3900, Las Vegas, NV 89101; Phone number: (702) 486-3132; email: BCPINFO@ag.state.nv.us.

For Oregon Residents: We will not share your Personal Information and Browsing Information with nonaffiliated third parties for marketing purposes, except after you have been informed by us of such sharing and had an opportunity to indicate that you do not want a disclosure made for marketing purposes.

For Vermont Residents: We will not share your Personal Information and Browsing Information with nonaffiliated third parties, except as permitted by Vermont law, such as to process your transactions or to maintain your account. In addition, we will not share information about your creditworthiness with our affiliates except with your authorization. For joint marketing in Vermont, we will only disclose your name, contact information and information about your transactions.

Information From Children

The Website is meant for adults and is not intended or designed to attract children under the age of thirteen (13).We do not collect Personal Information from any person that we know to be under the age of thirteen (13) without permission from a parent or guardian. By using the Website, you affirm that you are over the age of 13 and will abide by the terms of this Privacy Notice.

Privacy Outside the Website

The Website may contain links to other websites. FNF is not and cannot be responsible for the privacy practices or the content of any of those other websites.

International Users

FNF's headquarters is located within the United States. If you reside outside the United States or are a citizen of the European Union, please note that we may transfer your Personal Information and/or Browsing Information outside of your country of residence or the European Union for any of the purposes described in this Privacy Notice. By providing FNF with your Personal Information and/or Browsing Information, you consent to our collection and transfer of such information in accordance with this Privacy Notice.

The California Online Privacy Protection Act

For some FNF websites, such as the Customer CareNet ("CCN"), FNF is acting as a third party service provider to a mortgage loan servicer. In those instances, we may collect certain information on behalf of that mortgage loan servicer via the website. The information which we may collect on behalf of the mortgage loan servicer is as follows:

- first and last name;
- property address;
- user name and password;
- loan number;
- social security number - masked upon entry;
- email address;
- three security questions and answers; and
- IP address.

The information you submit through the website is then transferred to your mortgage loan servicer by way of CCN. **The mortgage loan servicer is responsible for taking action or making changes to any consumer information submitted through this website. For example, if you believe that your payment or user information is incorrect, you must contact your mortgage loan servicer.**

CCN does not share consumer information with third parties, other than (1) those with which the mortgage loan servicer has contracted to interface with the CCN application, or (2) law enforcement or other governmental authority in connection with an investigation, or civil or criminal subpoenas or court orders. All sections of this Privacy Notice apply to your interaction with CCN, except for the sections titled "Choices with Your Information" and "Access and Correction." If you have questions regarding the choices you have with regard to your personal information or how to access or correct your personal information, you should contact your mortgage loan servicer.

Your Consent To This Privacy Notice
By submitting Personal Information and/or Browsing Information to FNF, you consent to the collection and use of the information by us in compliance with this Privacy Notice. Amendments to the Privacy Notice will be posted on the Website. Each time you provide information to us, or we receive information about you, following any amendment of this Privacy Notice will signify your assent to and acceptance of its revised terms for all previously collected information and information collected from you in the future. We may use comments, information or feedback that you submit to us in any manner that we may choose without notice or compensation to you.

Accessing and Correcting Information; Contact Us
If you have questions, would like to access or correct your Personal Information, or want to opt-out of information sharing with our affiliates for their marketing purposes, please send your requests to privacy@fnf.com or by mail or phone to:

Fidelity National Financial, Inc.
601 Riverside Avenue
Jacksonville, Florida 32204
Attn: Chief Privacy Officer
(888) 934-3354

Notice of Available Discounts

Pursuant to Section 2355.3 in Title 10 of the California Code of Regulations Fidelity National Financial, Inc. and its subsidiaries ("FNF") must deliver a notice of each discount available under our current rate filing along with the delivery of escrow instructions, a preliminary report or commitment. Please be aware that the provision of this notice does not constitute a waiver of the consumer's right to be charged the field rate. As such, your transaction may not qualify for the below discounts.

You are encouraged to discuss the applicability of one or more of the below discounts with a Company representative. These discounts are generally described below; consult the rate manual for a full description of the terms, conditions and requirements for each discount. These discounts only apply to transaction involving services rendered by the FNF Family of Companies. This notice only applies to transactions involving property improved with a one-to-four family residential dwelling.

FNF Underwritten Title Company	**FNF Underwriter**
CTC - Chicago Title Company	CTIC - Chicago Title Insurance Company

Available Discounts

CREDIT FOR PRELIMINARY REPORTS AND/OR COMMITMENTS ON SUBSEQUENT POLICIES (CTIC)

Where no major change in the title has occurred since the issuance of the original report or commitment, the order may be reopened within 12 months and all or a portion of the charge previously paid for the report or commitment may be credited on a subsequent policy charge within the following time period from the date of the report.

DISASTER LOANS (CTIC)

The charge for a lender's Policy (Standard or Extended coverage) covering the financing or refinancing by an owner of record, within 24 months of the date of a declaration of a disaster area by the government of the United States or the State of California on any land located in said area, which was partially or totally destroyed in the disaster, will be 50% of the appropriate title insurance rate.

CHURCHES OR CHARITABLE NON-PROFIT ORGANIZATIONS (CTIC)

On properties used as a church or for charitable purposes within the scope of the normal activities of such entities, provided said charge is normally the church's obligation the charge for an owner's policy shall be 50% to 70% of the appropriate title insurance rate, depending on the type of coverage selected. The charge for a lender's policy shall be 40% to 50% of the appropriate title insurance rate, depending on the type of coverage selected.

EMPLOYEE RATE (CTC and CTIC)

No charge shall be made to employees (including employees on approved retirement) of the Company or its underwritten, subsidiary title companies for policies or escrow services in connection with financing, refinancing, sale or purchase of the employees' bona fide home property. Waiver of such charges is authorized only in connection with those costs which the employee would be obligated to pay, by established custom, as a party to the transaction.

ATTACHMENT ONE

CALIFORNIA LAND TITLE ASSOCIATION
STANDARD COVERAGE POLICY – 1990

EXCLUSIONS FROM COVERAGE

The following matters are expressly excluded from the coverage of this policy and the Company will not pay loss or damage, costs, attorneys' fees or expenses which arise by reason of:

1. (a) Any law, ordinance or governmental regulation (including but not limited to building or zoning laws, ordinances, or regulations) restricting, regulating, prohibiting or relating (i) the occupancy, use, or enjoyment of the land; (ii) the character, dimensions or location of any improvement now or hereafter erected on the land; (iii) a separation in ownership or a change in the dimensions or area of the land or any parcel of which the land is or was a part; or (iv) environmental protection, or the effect of any violation of these laws, ordinances or governmental regulations, except to the extent that a notice of the enforcement thereof or a notice of a defect, lien, or encumbrance resulting from a violation or alleged violation affecting the land has been recorded in the public records at Date of Policy.
   (b) Any governmental police power not excluded by (a) above, except to the extent that a notice of the exercise thereof or notice of a defect, lien or encumbrance resulting from a violation or alleged violation affecting the land has been recorded in the public records at Date of Policy.
2. Rights of eminent domain unless notice of the exercise thereof has been recorded in the public records at Date of Policy, but not excluding from coverage any taking which has occurred prior to Date of Policy which would be binding on the rights of a purchaser for value without knowledge.
3. Defects, liens, encumbrances, adverse claims or other matters:
   (a) whether or not recorded in the public records at Date of Policy, but created, suffered, assumed or agreed to by the insured claimant;
   (b) not known to the Company, not recorded in the public records at Date of Policy, but known to the insured claimant and not disclosed in writing to the Company by the insured claimant prior to the date the insured claimant became an insured under this policy;
   (c) resulting in no loss or damage to the insured claimant;
   (d) attaching or created subsequent to Date of Policy; or
   (e) resulting in loss or damage which would not have been sustained if the insured claimant had paid value for the insured mortgage or for the estate or interest insured by this policy.
4. Unenforceability of the lien of the insured mortgage because of the inability or failure of the insured at Date of Policy, or the inability or failure of any subsequent owner of the indebtedness, to comply with the applicable doing business laws of the state in which the land is situated.
5. Invalidity or unenforceability of the lien of the insured mortgage, or claim thereof, which arises out of the transaction evidenced by the insured mortgage and is based upon usury or any consumer credit protection or truth in lending law.
6. Any claim, which arises out of the transaction vesting in the insured the estate of interest insured by this policy or the transaction creating the interest of the insured lender, by reason of the operation of federal bankruptcy, state insolvency or similar creditors' rights laws.

EXCEPTIONS FROM COVERAGE - SCHEDULE B, PART I

This policy does not insure against loss or damage (and the Company will not pay costs, attorneys' fees or expenses) which arise by reason of:

1. Taxes or assessments which are not shown as existing liens by the records of any taxing authority that levies taxes or assessments on real property or by the public records.
   Proceedings by a public agency which may result in taxes or assessments, or notices of such proceedings, whether or not shown by the records of such agency or by the public records.
2. Any facts, rights, interests, or claims which are not shown by the public records but which could be ascertained by an inspection of the land or which may be asserted by persons in possession thereof.
3. Easements, liens or encumbrances, or claims thereof, not shown by the public records.
4. Discrepancies, conflicts in boundary lines, shortage in area, encroachments, or any other facts which a correct survey would disclose, and which are not shown by the public records.
5. (a) Unpatented mining claims; (b) reservations or exceptions in patents or in Acts authorizing the issuance thereof; (c) water rights, claims or title to water, whether or not the matters excepted under (a), (b) or (c) are shown by the public records.
6. Any lien or right to a lien for services, labor or material not shown by the public records.

CLTA HOMEOWNER'S POLICY OF TITLE INSURANCE (12-02-13)
ALTA HOMEOWNER'S POLICY OF TITLE INSURANCE

EXCLUSIONS

In addition to the Exceptions in Schedule B, You are not insured against loss, costs, attorneys' fees, and expenses resulting from:

1. Governmental police power, and the existence or violation of those portions of any law or government regulation concerning:
   a. building;
   b. zoning;
   c. land use;
   d. improvements on the Land;
   e. land division; and
   f. environmental protection.

   This Exclusion does not limit the coverage described in Covered Risk 8.a., 14, 15, 16, 18, 19, 20, 23 or 27.
2. The failure of Your existing structures, or any part of them, to be constructed in accordance with applicable building codes. This Exclusion does not limit the coverage described in Covered Risk 14 or 15.
3. The right to take the Land by condemning it. This Exclusion does not limit the coverage described in Covered Risk 17.
4. Risks:
   a. that are created, allowed, or agreed to by You, whether or not they are recorded in the Public Records;
   b. that are Known to You at the Policy Date, but not to Us, unless they are recorded in the Public Records at the Policy Date;

   c. that result in no loss to You; or
   d. that first occur after the Policy Date - this does not limit the coverage described in Covered Risk 7, 8.e., 25, 26, 27 or 28.
5. Failure to pay value for Your Title.
6. Lack of a right:
   a. to any land outside the area specifically described and referred to in paragraph 3 of Schedule A; and
   b. in streets, alleys, or waterways that touch the Land.

   This Exclusion does not limit the coverage described in Covered Risk 11 or 21.
7. The transfer of the Title to You is invalid as a preferential transfer or as a fraudulent transfer or conveyance under federal bankruptcy, state insolvency, or similar creditors' rights laws.
8. Contamination, explosion, fire, flooding, vibration, fracturing, earthquake, or subsidence.
9. Negligence by a person or an Entity exercising a right to extract or develop minerals, water, or any other substances.

LIMITATIONS ON COVERED RISKS

Your insurance for the following Covered Risks is limited on the Owner's Coverage Statement as follows:

- For Covered Risk 16, 18, 19, and 21 Your Deductible Amount and Our Maximum Dollar Limit of Liability shown in Schedule A.

The deductible amounts and maximum dollar limits shown on Schedule A are as follows:

	Your Deductible Amount	Our Maximum Dollar Limit of Liability
Covered Risk 16:	1.00% % of Policy Amount Shown in Schedule A or $2,500.00 (whichever is less)	$ 10,000.00
Covered Risk 18:	1.00% % of Policy Amount Shown in Schedule A or $5,000.00 (whichever is less)	$ 25,000.00
Covered Risk 19:	1.00% of Policy Amount Shown in Schedule A or $5,000.00 (whichever is less)	$ 25,000.00
Covered Risk 21:	1.00% of Policy Amount Shown in Schedule A or $2,500.00 (whichever is less)	$ 5,000.00

2006 ALTA LOAN POLICY (06-17-06)

EXCLUSIONS FROM COVERAGE

The following matters are expressly excluded from the coverage of this policy, and the Company will not pay loss or damage, costs, attorneys' fees, or expenses that arise by reason of:

1. (a) Any law, ordinance, permit, or governmental regulation (including those relating to building and zoning) restricting, regulating, prohibiting, or relating to
      (i) the occupancy, use, or enjoyment of the Land;
      (ii) the character, dimensions, or location of any improvement erected on the Land;
      (iii) the subdivision of land; or
      (iv) environmental protection;

      or the effect of any violation of these laws, ordinances, or governmental regulations. This Exclusion 1(a) does not modify or limit the coverage provided under Covered Risk 5.
   (b) Any governmental police power. This Exclusion 1(b) does not modify or limit the coverage provided under Covered Risk 6.
2. Rights of eminent domain. This Exclusion does not modify or limit the coverage provided under Covered Risk 7 or 8.
3. Defects, liens, encumbrances, adverse claims, or other matters
   (a) created, suffered, assumed, or agreed to by the Insured Claimant;
   (b) not Known to the Company, not recorded in the Public Records at Date of Policy, but Known to the Insured Claimant and not disclosed in writing to the Company by the Insured Claimant prior to the date the Insured Claimant became an Insured under this policy;
   (c) resulting in no loss or damage to the Insured Claimant;
   (d) attaching or created subsequent to Date of Policy (however, this does not modify or limit the coverage provided under Covered Risk 11, 13 or 14); or
   (e) resulting in loss or damage that would not have been sustained if the Insured Claimant had paid value for the Insured Mortgage.
4. Unenforceability of the lien of the Insured Mortgage because of the inability or failure of an Insured to comply with applicable doing-business laws of the state where the Land is situated.
5. Invalidity or unenforceability in whole or in part of the lien of the Insured Mortgage that arises out of the transaction evidenced by the Insured Mortgage and is based upon usury or any consumer credit protection or truth-in-lending law.
6. Any claim, by reason of the operation of federal bankruptcy, state insolvency, or similar creditors' rights laws, that the transaction creating the lien of the Insured Mortgage, is
   (a) a fraudulent conveyance or fraudulent transfer, or
   (b) a preferential transfer for any reason not stated in Covered Risk 13(b) of this policy.
7. Any lien on the Title for real estate taxes or assessments imposed by governmental authority and created or attaching between Date of Policy and the date of recording of the Insured Mortgage in the Public Records. This Exclusion does not modify or limit the coverage provided under Covered Risk 11(b).

The above policy form may be issued to afford either Standard Coverage or Extended Coverage. In addition to the above Exclusions from Coverage, the Exceptions from Coverage in a Standard Coverage policy will also include the following Exceptions from Coverage:

EXCEPTIONS FROM COVERAGE

(Except as provided in Schedule B - Part II,(t(or T)his policy does not insure against loss or damage, and the Company will not pay costs, attorneys' fees or expenses, that arise by reason of:

(PART I

(The above policy form may be issued to afford either Standard Coverage or Extended Coverage. In addition to the above Exclusions from Coverage, the Exceptions from Coverage in a Standard Coverage policy will also include the following Exceptions from Coverage:

1. (a) Taxes or assessments that are not shown as existing liens by the records of any taxing authority that levies taxes or assessments on real property or by the Public Records; (b) proceedings by a public agency that may result in taxes or assessments, or notices of such proceedings, whether or not shown by the records of such agency or by the Public Records.
2. Any facts, rights, interests, or claims that are not shown by the Public Records but that could be ascertained by an inspection of the Land or that may be asserted by persons in possession of the Land.
3. Easements, liens or encumbrances, or claims thereof, not shown by the Public Records.
4. Any encroachment, encumbrance, violation, variation, or adverse circumstance affecting the Title that would be disclosed by an accurate and complete land survey of the Land and not shown by the Public Records.
5. (a) Unpatented mining claims; (b) reservations or exceptions in patents or in Acts authorizing the issuance thereof; (c) water rights, claims or title to water, whether or not the matters excepted under (a), (b), or (c) are shown by the Public Records.
6. Any lien or right to a lien for services, labor or material not shown by the Public Records.

PART II

In addition to the matters set forth in Part I of this Schedule, the Title is subject to the following matters, and the Company insures against loss or damage sustained in the event that they are not subordinate to the lien of the Insured Mortgage:)

2006 ALTA OWNER'S POLICY (06-17-06)

EXCLUSIONS FROM COVERAGE

The following matters are expressly excluded from the coverage of this policy, and the Company will not pay loss or damage, costs, attorneys' fees, or expenses that arise by reason of:

1. (a) Any law, ordinance, permit, or governmental regulation (including those relating to building and zoning) restricting, regulating, prohibiting, or relating to
   (i) the occupancy, use, or enjoyment of the Land;
   (ii) the character, dimensions, or location of any improvement erected on the Land;
   (iii) the subdivision of land; or
   (iv) environmental protection;
   or the effect of any violation of these laws, ordinances, or governmental regulations. This Exclusion 1(a) does not modify or limit the coverage provided under Covered Risk 5.
   (b) Any governmental police power. This Exclusion 1(b) does not modify or limit the coverage provided under Covered Risk 6.
2. Rights of eminent domain. This Exclusion does not modify or limit the coverage provided under Covered Risk 7 or 8.
3. Defects, liens, encumbrances, adverse claims, or other matters
   (a) created, suffered, assumed, or agreed to by the Insured Claimant;
   (b) not Known to the Company, not recorded in the Public Records at Date of Policy, but Known to the Insured Claimant and not disclosed in writing to the Company by the Insured Claimant prior to the date the Insured Claimant became an Insured under this policy;
   (c) resulting in no loss or damage to the Insured Claimant;
   (d) attaching or created subsequent to Date of Policy (however, this does not modify or limit the coverage provided under Covered Risk 9 and 10); or
   (e) resulting in loss or damage that would not have been sustained if the Insured Claimant had paid value for the Title.
4. Any claim, by reason of the operation of federal bankruptcy, state insolvency, or similar creditors' rights laws, that the transaction vesting the Title as shown in Schedule A, is
   (a) a fraudulent conveyance or fraudulent transfer; or
   (b) a preferential transfer for any reason not stated in Covered Risk 9 of this policy.
5. Any lien on the Title for real estate taxes or assessments imposed by governmental authority and created or attaching between Date of Policy and the date of recording of the deed or other instrument of transfer in the Public Records that vests Title as shown in Schedule A.

The above policy form may be issued to afford either Standard Coverage or Extended Coverage. In addition to the above Exclusions from Coverage, the Exceptions from Coverage in a Standard Coverage policy will also include the following Exceptions from Coverage:

EXCEPTIONS FROM COVERAGE

This policy does not insure against loss or damage, and the Company will not pay costs, attorneys' fees or expenses, that arise by reason of:

(The above policy form may be issued to afford either Standard Coverage or Extended Coverage. In addition to the above Exclusions from Coverage, the Exceptions from Coverage in a Standard Coverage policy will also include the following Exceptions from Coverage:

1. (a) Taxes or assessments that are not shown as existing liens by the records of any taxing authority that levies taxes or assessments on real property or by the Public Records; (b) proceedings by a public agency that may result in taxes or assessments, or notices of such proceedings, whether or not shown by the records of such agency or by the Public Records.
2. Any facts, rights, interests, or claims that are not shown in the Public Records but that could be ascertained by an inspection of the Land or that may be asserted by persons in possession of the Land.
3. Easements, liens or encumbrances, or claims thereof, not shown by the Public Records.
4. Any encroachment, encumbrance, violation, variation, or adverse circumstance affecting the Title that would be disclosed by an accurate and complete land survey of the Land and that are not shown by the Public Records.
5. (a) Unpatented mining claims; (b) reservations or exceptions in patents or in Acts authorizing the issuance thereof; (c) water rights, claims or title to water, whether or not the matters excepted under (a), (b), or (c) are shown by the Public Records.
6. Any lien or right to a lien for services, labor or material not shown by the Public Records.
7. (Variable exceptions such as taxes, easements, CC&R's, etc. shown here.)

ALTA EXPANDED COVERAGE RESIDENTIAL LOAN POLICY (12-02-13)

EXCLUSIONS FROM COVERAGE

The following matters are expressly excluded from the coverage of this policy and the Company will not pay loss or damage, costs, attorneys' fees or expenses which arise by reason of:

1. (a) Any law, ordinance, permit, or governmental regulation (including those relating to building and zoning) restricting, regulating, prohibiting, or relating to
    - (i) the occupancy, use, or enjoyment of the Land;
    - (ii) the character, dimensions, or location of any improvement erected on the Land;
    - (iii) the subdivision of land; or
    - (iv) environmental protection;

    or the effect of any violation of these laws, ordinances, or governmental regulations. This Exclusion 1(a) does not modify or limit the coverage provided under Covered Risk 5, 6, 13(c), 13(d), 14 or 16.

    (b) Any governmental police power. This Exclusion 1(b) does not modify or limit the coverage provided under Covered Risk 5, 6, 13(c), 13(d), 14 or 16.
2. Rights of eminent domain. This Exclusion does not modify or limit the coverage provided under Covered Risk 7 or 8.
3. Defects, liens, encumbrances, adverse claims, or other matters
    - (a) created, suffered, assumed, or agreed to by the Insured Claimant;
    - (b) not Known to the Company, not recorded in the Public Records at Date of Policy, but Known to the Insured Claimant and not disclosed in writing to the Company by the Insured Claimant prior to the date the Insured Claimant became an Insured under this policy;
    - (c) resulting in no loss or damage to the Insured Claimant;
    - (d) attaching or created subsequent to Date of Policy (however, this does not modify or limit the coverage provided under Covered Risk 11, 16, 17, 18, 19, 20, 21, 22, 23, 24, 27 or 28); or
    - (e) resulting in loss or damage that would not have been sustained if the Insured Claimant had paid value for the Insured Mortgage.
4. Unenforceability of the lien of the Insured Mortgage because of the inability or failure of an Insured to comply with applicable doing-business laws of the state where the Land is situated.
5. Invalidity or unenforceability in whole or in part of the lien of the Insured Mortgage that arises out of the transaction evidenced by the Insured Mortgage and is based upon usury, or any consumer credit protection or truth-in-lending law. This Exclusion does not modify or limit the coverage provided in Covered Risk 26.
6. Any claim of invalidity, unenforceability or lack of priority of the lien of the Insured Mortgage as to Advances or modifications made after the Insured has Knowledge that the vestee shown in Schedule A is no longer the owner of the estate or interest covered by this policy. This Exclusion does not modify or limit the coverage provided in Covered Risk 11.
7. Any lien on the Title for real estate taxes or assessments imposed by governmental authority and created or attaching subsequent to Date of Policy. This Exclusion does not modify or limit the coverage provided in Covered Risk 11(b) or 25.
8. The failure of the residential structure, or any portion of it, to have been constructed before, on or after Date of Policy in accordance with applicable building codes. This Exclusion does not modify or limit the coverage provided in Covered Risk 5 or 6.
9. Any claim, by reason of the operation of federal bankruptcy, state insolvency, or similar creditors' rights laws, that the transaction creating the lien of the Insured Mortgage, is
    - (a) a fraudulent conveyance or fraudulent transfer, or
    - (b) a preferential transfer for any reason not stated in Covered Risk 27(b) of this policy.
10. Contamination, explosion, fire, flooding, vibration, fracturing, earthquake, or subsidence.
11. Negligence by a person or an Entity exercising a right to extract or develop minerals, water, or any other substances.

08

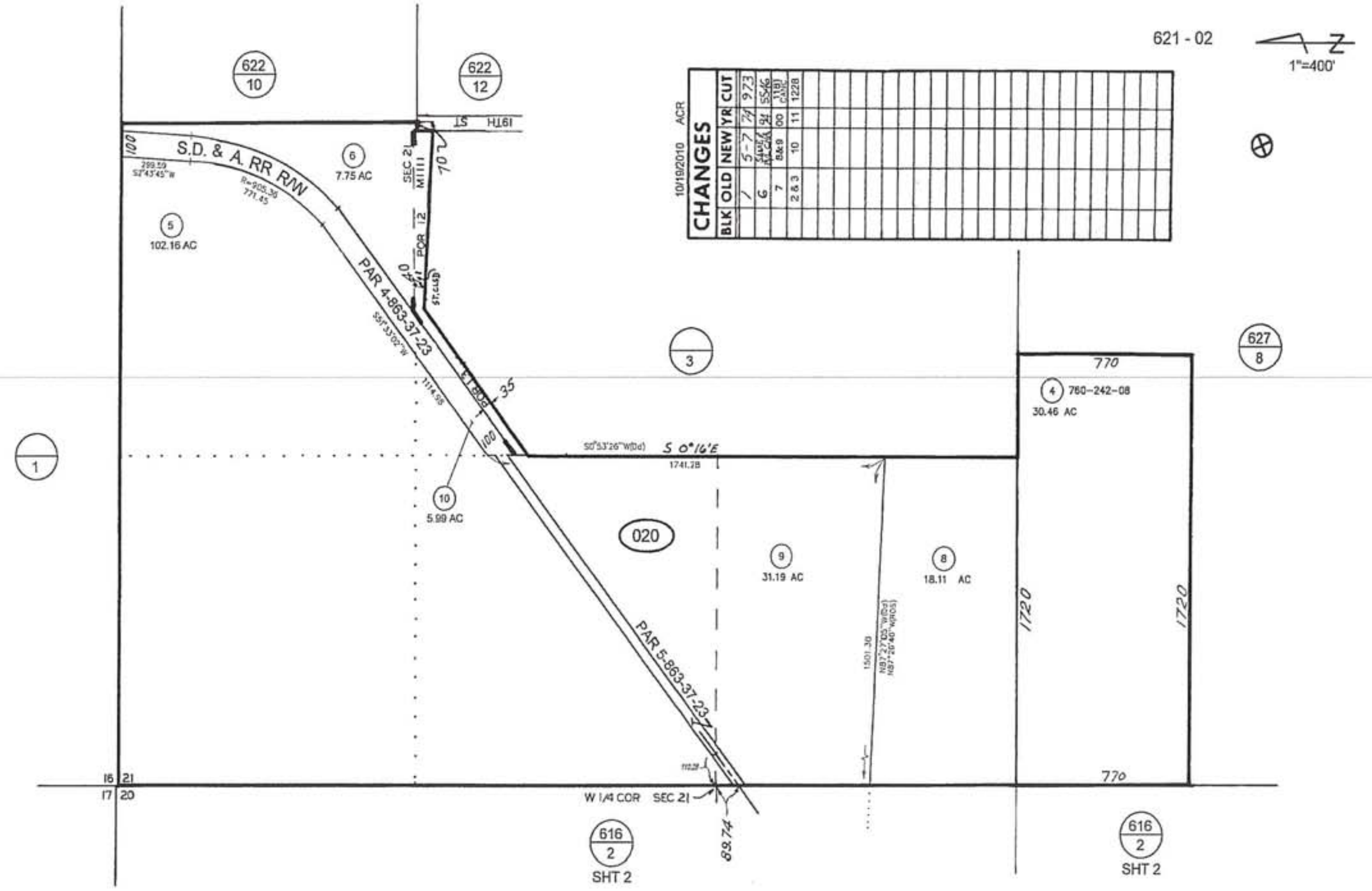
621-020

This map/plat is being furnished as an aid in locating the herein described Land in relation to adjoining streets, natural boundaries and other land, and is not a survey of the land depicted. Except to the extent a policy of title insurance is expressly modified by endorsement, if any, the Company does not insure dimensions, distances, location of easements, acreage or other matters shown thereon.

Order: QuickView_
Doc: 621-2 MAP ASSESSOR

Page 1 of 1

Requested By: , Printed: 1/29/2018 8:22 AM



10/19/2010 ACR

CHANGES

BLK	OLD	NEW	YR	CUT
	1	5-7	74	973
	6	[illegible]	94	5546
	7	8&9	00	1181 CANC
	2&3	10	11	1228

SAN DIEGO COUNTY
ASSESSOR'S MAP
BOOK 621 PG 02

THIS MAP WAS PREPARED FOR ASSESSMENT PURPOSES ONLY. NO LIABILITY IS ASSUMED FOR THE ACCURACY OF THE DATA SHOWN. ASSESSOR'S PARCELS MAY NOT COMPLY WITH LOCAL SUBDIVISION OR BUILDING ORDINANCES.

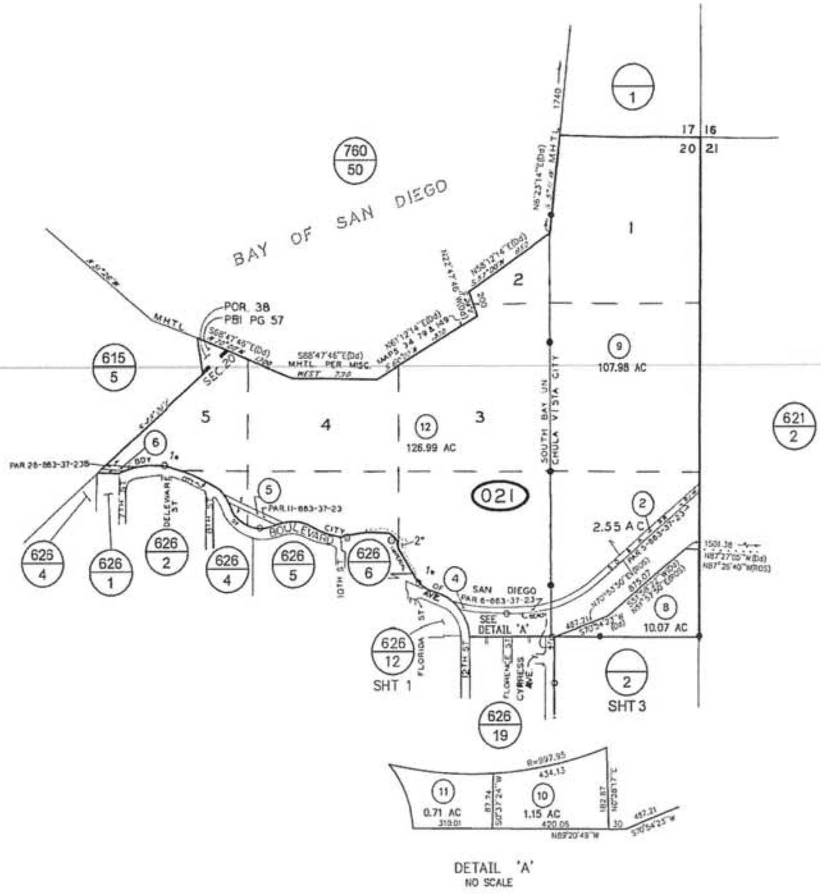
SEC 21 - T18S - R2W - POR W 1/2
MAP 1111 - GARDEN VILLA TRACT
ROS 16785

08

020 - 919

616 - 02
SHT 1 OF 3

1"=800'



6/30/2004 JGD ✓

CHANGES					
BLK	OLD	NEW	YR	CUT	
	13	14 & 15	74	90	
	14	RED TO BLK	79	5652	
020	14	CONDM	80	583	
020	15	CONDM	81	797	
021	020-1-7	1-7	82	10126	
021	1,3&7	8-12	)		
		626-060-07	00	1181	CANC
	12	SAME & OP SP	04	5604	

1* SEE ADJ PGS FOR BRGS & DISTS

2* OPEN SPACE

1874
5-16-73

SAN DIEGO COUNTY
ASSESSOR'S MAP
BOOK 616 PAGE 02 SHT 1 OF 3

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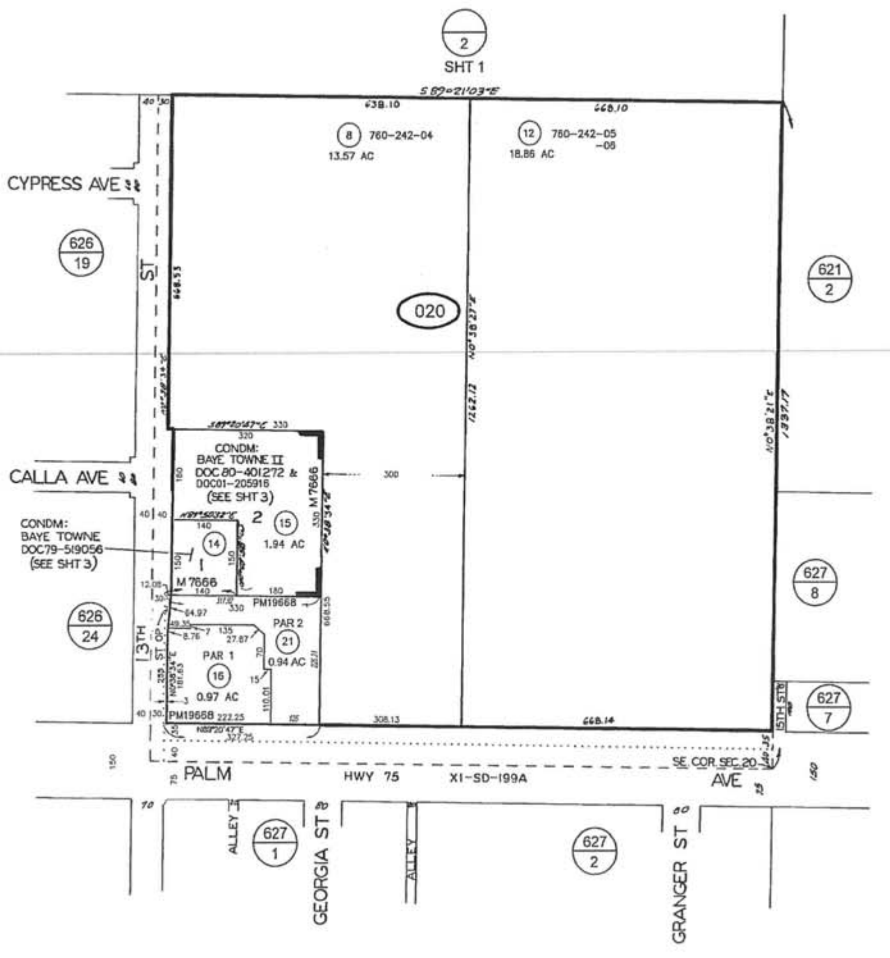
PB I PG 57 - RHO PENINSULA
SEC 20 - T18S-R2W - POR
ROS 12081,16785

08

616-02
SHT 2 OF 3

1"=200'



09/12/2011 ACR

CHANGES

BLK	OLD	NEW	YR	CUT
020	14	CONDM	80	583
	15	CONDM	81	797
	12	SURVEY AC CHG	82	5907
	10	SAME & ST OP	99	4767
	10	16&17	06	1426
	11&17	18	08	1281
	18	19 & 20	09	1335
	19 & 20	21	09	1351

RC

Z.A.
4-21-82

SAN DIEGO COUNTY
ASSESSOR'S MAP
BOOK 616 PAGE 02 SHT 2 OF 3

THIS MAP WAS PREPARED FOR ASSESSMENT PURPOSES ONLY. NO LIABILITY IS ASSUMED FOR THE ACCURACY OF THE DATA SHOWN. ASSESSOR'S PARCELS MAY NOT COMPLY WITH LOCAL SUBDIVISION OR BUILDING ORDINANCES.

MAP 7666 - SOUTHLAND MANOR
SEC 20-T18S-R2W-SE 1/4 OF SE 1/4
ROS 12049,15483

616-020

APPENDIX E:
PRELIMINARY HORTICULTURAL SOIL QUALITY EVALUATION REPORT

WETLANDS RESTORATION OF SALT POND 20

SOIL QUALITY AND PLANTABILITY EVALUATION REPORT

MAY 22, 2017

Submitted to:

Port of San Diego
3165 Pacific Hwy.
San Diego, CA 92101

GREAT ecology
ENVIRONMENT + DESIGN

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Acronyms and Abbreviations

DDT	dichlorodiphenyltrichloroethane
dS	deciSiemens
ECe	salinity
Enthalpy	Enthalpy Analytical, Inc.
EPA	U.S. Environmental Protection Agency
ERM	effects range median
ft	feet/foot
g	gram(s)
GC/ECD	gas chromatography/electron capture dissociation
GC/FPD	gas chromatography/flame photometric detection
GC/MS SIM	gas chromatography/mass spectroscopy selective ion monitoring
kg	kilogram(s)
L	liters
MDL	method detection limit
meq	milliequivalents
mg	milligram(s)
MLLW	mean lower low water
ND	non-detect
P20	Pond 20
PAH	polycyclic aromatic hydrocarbon
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCB	polychlorinated biphenyl
Port	Port of San Diego
QC	quality control
RB	California Regional Water Quality Control Board
SAP	sampling and analysis plan
SAR	sodium adsorption ratio
TOC	total organic carbon
TPH	total petroleum hydrocarbon
USACE	U.S. Army Corps of Engineers
µg	microgram(s)

1 INTRODUCTION

The Port of San Diego (Port) proposes a wetland restoration project at the Pond 20 site (Site). The Site consists of a former salt evaporation pond on an 83.5-acre parcel of land, located in South San Diego Bay in San Diego, CA. The Port has engaged Great Ecology to design and permit a mitigation bank at the Site, which would conceptually excavate materials to lower the average elevation by several feet. The new topography would be designed to restore tidal habitat, and bank credits would be sold under terms of a mitigation banking agreement. Significant excavation is included in the conceptual design, and we sought to prepare a Sampling and Analysis Plan suitable for regulatory review and implement a modest investigation of soil quality consistent with a feasibility-level analysis. This report includes results of our investigation.

1.1 Site Description

The Site consists primarily of a low diked area, which is hydrologically isolated from the Nestor Creek and Otay River systems. Based on historical survey information, and to be verified by pending topographic survey data, the elevation of the area within the dike ranges from approximately 4.5 to 11.5 feet above mean lower low water (ft MLLW; 1988 North American Vertical Datum [NAVD88]). The proposed average restoration target elevations range from -0.5 to 16.2 ft MLLW (NAVD88), with the majority of restored habitat below 7.0 ft MLLW.

Site materials subject to this investigation are primarily in non-wetland upland areas currently above the High Water Line (+7.79 ft MLLW for San Diego Bay, NOAA Station ID: 9410170) and isolated from tides. We therefore use the conventional term “soils” in this report, although some materials from deeper portions of the conceptual excavation prism might be considered sediments.

Data presented in this report are intended to inform an evaluation of placement options for upland soils, and an evaluation of the viability of underlying soils for planting.

1.2 Geologic and Hydrogeologic Conditions

The Site is located within the western Peninsular Range Geomorphic Province of Southern California, which stretches 900 miles from the Los Angeles Basin and the Transverse Ranges to the southern end of Baja California (Norris and Webb 1990).

The Site lies within the Otay Hydrologic Unit, a watershed covering 154 square miles that is drained by the Otay River and its tributaries. The Otay River flows east to west toward San Diego Bay. The Site is located adjacent to Nestor Creek, and includes a tidal channel just upstream of the mouth of the Otay River where it meets San Diego Bay (FIGURE 1). The majority of the Site is hydrologically isolated from storm and municipal runoff. Soils subject to this investigation are in the upland portion of the Site, and from the existing surface elevation to the proposed finished grade.

1.3 Field and Database Reconnaissance

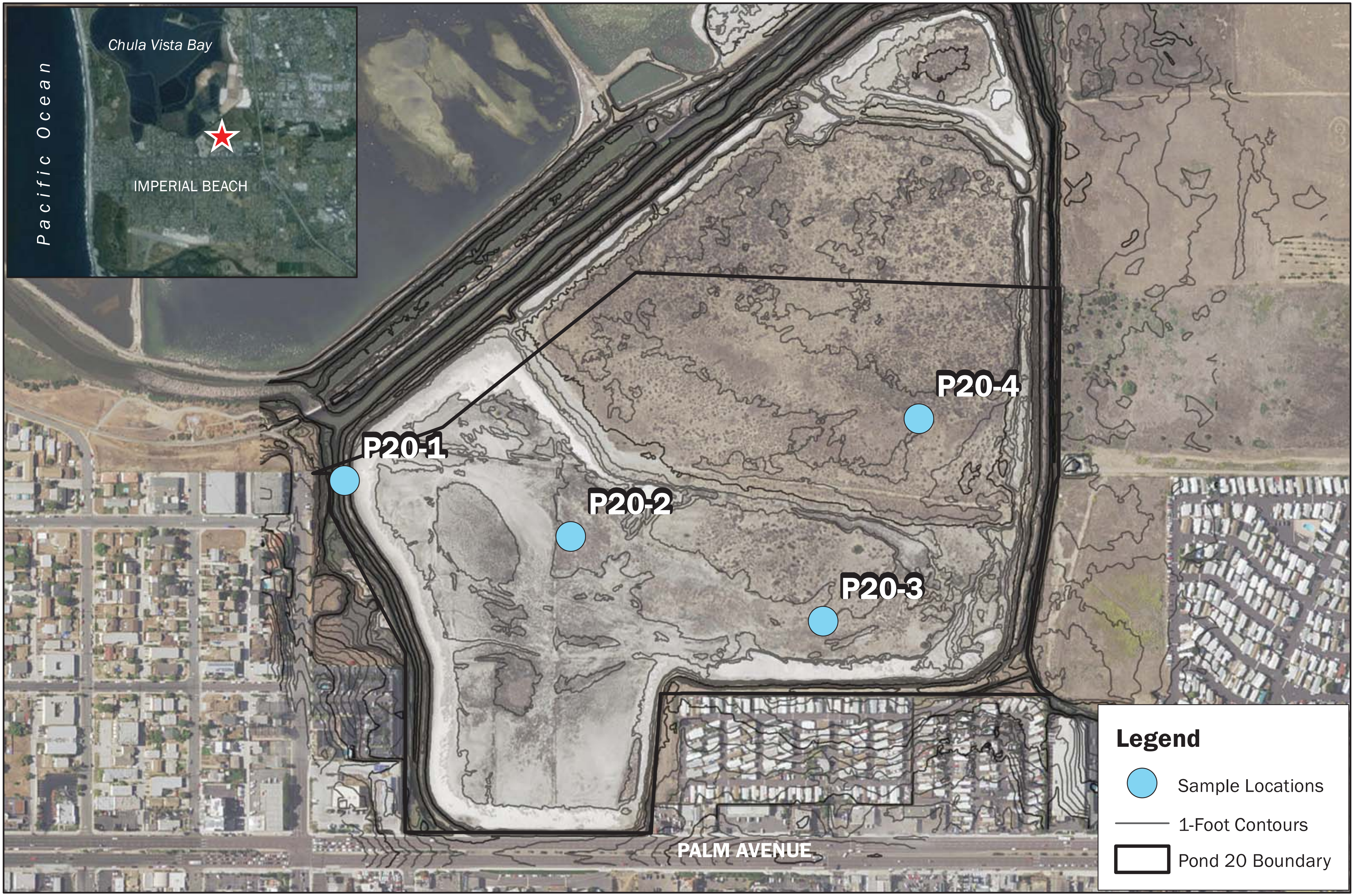
Field reconnaissance has indicated no history of spills or releases of hazardous materials, nor any visual indications of soil degradation (e.g., staining from hydrocarbons). The California State Water Resources Control Board Geotracker database has also been reviewed and indicates the Site does not have any history of cleanup investigations.

1.4 Adjacent Parcel information

The Otay River Floodplain has long been under consideration as a mitigation site, and was selected by Poseidon Resources for mitigation of their Carlsbad Desalination facility as required by their Coastal Development Permit E-06-013 (Coastal Commission 2013). The Poseidon mitigation project also includes the Pond 15 site, located north of the San Diego Bay National Wildlife Refuge on the east side of San Diego Bay. The Otay River Floodplain Site lies to the north and east of Pond 20, and, based on visual assessment of the sites and a limited survey of historical aerial photography, some of the Otay River Floodplain mitigation site may share a similar land use history. The specific area likely to share a land use history lies south of the Otay River Channel and west of the Nestor Creek channel.

Poseidon prepared several studies which informed their initial design. One study, a cultural resource survey of the Otay River Floodplain site, revealed significant Native American artifacts in the northeastern corner of the site (i.e., on the far side of the area relative to the Pond 20 site). A detailed soil characterization analysis, found significant soil contamination from DDT, chlordane, and PCBs in the eastern portion of the Otay River Floodplain site, east of Nestor Creek. Some areas of DDT contamination had concentrations high enough to be considered hazardous (Coastal Commission 2013). Contamination is likely related to historical agricultural uses (which did not occur at Pond 20).

Regardless, extensive review of Poseidon’s mitigation effort indicated the soil quality of lands directly north of Pond 20 did not affect the proposed mitigation use and furthermore, bulk soil chemistry data indicated placement of materials in an estuarine environment with sensitive biological



0 250 500 FEET

1 INCH = 500 FEET

POND 20
TOPOGRAPHY AND SAMPLING LOCATIONS

PORT OF SAN DIEGO
FEBURARY 2017

FIGURE 1
1:6,400
NAD83, California State Plane, Zone VI, US Foot

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receptors was fully consistent with natural resource conservation at the San Diego Bay National Wildlife Refuge (Coastal Commission 2013). Since Pond 20 shares its land use history with the western portion of the Otay River Floodplain site, and not the agricultural uses which appear to co-occur with contamination on the eastern portion of the Otay River Floodplain site, the Poseidon data indicates land uses at salt ponds did not result in contamination. Furthermore, the data indicate that soil quality associated with historical salt production are consistent with reuse of materials as substrate for sensitive biological resources in San Diego Bay.

1.5 Study Objectives

This sampling and analysis effort includes three distinct objectives to assess conditions at the Site:

1. Characterize the post-excavation (or z-layer) surface for soil structure parameters;
2. Characterize the post-excavation (or z-layer) for plant growth characteristics; and
3. Conduct a screening-level assessment of anticipated excavation (cut).

1.6 Approach and Report Organization

Although the final deposition site for excess materials is currently unknown, we anticipate a combination of regulatory agencies will have a role in the project permitting process. Great Ecology generally followed guidance provided by the Southern California Dredge Material Management Team (DMMT) of regulatory agencies, which include the U.S. Army Corps of Engineers, the Environmental Protection Agency (EPA), the California Coastal Commission, and the California Regional Water Quality Control Board (RB). We followed general guidance for soil and sediment testing provided in the Inland Testing Manual (EPA/USACE 1998), and were consistent regarding parameters listed in the RB Solid Waste Waiver (RB 2014). We also conducted standard horticultural analyses.

To accomplish study objectives, Great Ecology prepared a Sampling and Analysis Plan (SAP) to document approach, field activities, analytical methods, quality assurance parameters (Great Ecology 2017) (APPENDIX A). Great Ecology established four stations within the Site property boundary. Two stations characterized the eastern half of the Site, one station characterized the central western portion of the Site, and one station characterized the berm where it will be breached to create a connection to the Otay River. Great Ecology collected core soil samples to generate the study dataset, which included an assessment of the three-dimensional extent of potential contaminants and soil structure characteristics. Additional core samples collected from the z-layer were tested for plantability characteristics.

2 METHODS

2.1 *Sample Collection and Documentation*

Great Ecology designated four sampling stations to investigate soil conditions at 1) the conceptual future berm breach area and 2) the interior of the Site. Interior stations were positioned to capture conditions across the site. Stations were identified in the field using latitude and longitude data generated prior to the field effort and also landscape feature cues from available aerial photography (e.g., vegetation changes, erosional patterns, and hydrological features). On January 30, 2017, Great Ecology collected core sediment samples using a hand auger. FIGURE 1 is a map of the Site sample locations overlaid on topographic data generated in 2017. Field staff successfully collected samples representative of the proposed locations, and verified field positioning with visual landmarks.

Great Ecology recorded field conditions and observations relating to the sampling in a field log. Recorded data included date and time of sample collection; study name, station identifier, volume and identification codes of subsamples collected; latitude and longitude of station locations; meteorological information; core sample characteristics: penetration and sediment characteristics at approximately one foot increments; and presence (or absence) of unusual colors, odors, debris, petroleum hydrocarbon sheens, or other relevant sediment characteristics. We provide the original field logs in APPENDIX B and photographic documentation of the grab samples and cores associated with each station in APPENDIX C.

Logs also included the vertical dimensions of subsampled strata and a sample inventory for each location. Individual composite samples varied with respect to dimensions of vertical profile sampled based on the achieved depth of each core and soil characteristics. For example, in shallow borings (e.g., sample P20-2), the surficial sediment sample comprised of the top one foot of sediment, whereas for deeper borings with consistent soil characteristics, a deeper boundary was established for the bottom of surficial sediment stratum (e.g., the top three feet of sediment at P20-3).

2.2 *Sample Handling*

Prior to sampling, and in between each station, we thoroughly cleaned all non-disposable sampling equipment with Alconox detergent and rinsed with deionized water (retained and disposed offsite).

Field staff collected core samples using a stainless steel hand auger with a maximum depth of 10 feet. Each one foot section of core was placed on a clean Visqueen sheet for stockpiling and labeled by depth for assessment following the achievement of target depth or deepest possible penetration depth.

Field staff logged, photographed, and subsampled the core using clean stainless steel spoons. Composite samples of the core were prepared in stainless steel mixing bowls to represent the top soil layer, the mid-level zone of accumulation, and the z-layer. The z-layer was subsampled immediately by the staff geologist immediately upon reaching the deepest layers to preserve the best percent moisture test conditions.

Once materials were laid out on the Visqueen, sample characteristics were reviewed and a decision made with regard to subsample strata boundaries. Clean stainless steel spoons and bowls were used to prepare representative composite samples of sufficient volume for analyses. Once field-homogenized, composite materials were transferred to clean containers provided by the NELAP-accredited analytical laboratory, Enthalpy Analytical, Inc. (Enthalpy) of Orange, California. Based on the shallow profile of the borings, all excess materials were backfilled into the borehole to minimize waste.

For sample identification, Great Ecology used a standard sample identification code: three characters to denote the study site (P20) followed by one character to denote the station identifier (i.e., 1 through 4, from FIGURE 1). The last character denoted the depth horizon, with "T" representing the surface soils, "M" representing the mid-level soils, and "Z" representing the bottom soils. For example, the sample identifier of P20-1T corresponds to the soil collection at Station 1 in the surface horizon of the soil profile.

Field staff retained samples overnight in iced coolers before delivering the samples to an Enthalpy courier who transported the samples to the laboratory. Samples were accompanied by a Chain of Custody document that denoted requested analyses.

2.3 Bulk Sediment Analysis

Enthalpy evaluated all samples for metals, total petroleum hydrocarbons (TPH), pesticides, polychlorinated biphenyls (PCBs), and polycyclic aromatic hydrocarbons (PAHs), sulfides, and conventional analyses (TABLE 1). Where appropriate, analytical results were compared to relevant

TABLE 1: SAMPLE ANALYSIS METHODS AND TARGET REPORTING LIMITS

Parameter	Method	Procedure	Sediment Target Reporting Limits[a]
Conventional Analyses			
Grain Size	ASTM D4464M	Sieve/Optical	0.1 g
Percent Solids	SM 2540Bh	Gravimetric	0.1 percent
TOC	USEPA 9060i	Combustion	0.1 percent
Total Sulfides	USEPA 376.2Mh	Titrametric	0.1 mg/kg
Dissolved Sulfides	USEPA 376.2Mh	Titrametric	0.1 mg/kg
Metals			
As, Cd, Cr, Cu, Pb, Ni, Se, Ag	USEPA 6020[h]	ICP-MS	0.1 mg/kg
Mercury (Hg)	USEPA 7471A[h]	GFAAS	0.02 mg/kg
Zinc (Zn)	USEPA 6020[h]	ICP-MS	1.0 mg/kg
Organics			
TPH[b]	USEPA 8015B[h]	GC	0.5 mg/kg
Pesticides[c]	USEPA 8081A[h]	GC/ECD	2-20 μg/kg
PCBs[d]	USEPA 8082[h]	GC/SIM	10 μg/kg
PAHs[e]	USEPA 8270C[h]	GC/MS SIM	20 μg/kg

[a] Target reporting limits provided by Calscience Environmental Laboratories.

[b] Includes diesel range organics, TPH as gasoline, and TPH as motor oil.

[c] Includes 4,4- isomers of DDD, DDE, and DDT; aldrin; α-, β-, δ- and γ-BHC; chlordane; dieldrin; endosulfan I and II; endosulfan sulfate; endrin and endrin aldehyde; heptachlor and heptachlor epoxide; methoxychlor; and toxaphene.

[d] Includes congener analysis only.

[e] Includes Low Molecular Weight PAHs (naphthylene, acenaphthylene, acenaphthene, fluorine, and phenanthrene) and High Molecular Weight PAHs (fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(b,k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene).

Mass Units: kg = kilogram, g = gram, mg = milligram, μg = microgram
As = arsenic, Cd = cadmium, Cr = chromium, Cu = copper, Pb = lead, Ni = nickel, Se = selenium, Ag = silver
PAH = polycyclic aromatic hydrocarbon
PCB = polychlorinated biphenyl
TPH = total petroleum hydrocarbons
ICP-MS = inductively coupled plasma mass spectroscopy
GFAAS = graphite furnace atomic absorption spectroscopy
GC/ECD = gas chromatography/electron capture dissociation method
GC/MS SIM = gas chromatography/mass spectroscopy selective ion monitoring method

screening criteria, which in this case were Effects Range-Low (ERL) and Effects Range-Median (ERM) values (Buchman 2008). ERL concentrations correspond to the level above which there may be ecological effect in marine environments. Concentrations were well below the Effects Range-Median (ERM) concentrations, above which ecological effects are likely. In addition, Waypoint Analytical (Waypoint) evaluated the z-layer for agricultural suitability (plantability). Plantability was assessed by comparing results to horticultural benchmarks.

2.4 *Leachability Analysis*

Once bulk soil results were available, arsenic was found to be the only constituent above screening concentrations (per RB 2014). We conducted limited synthetic precipitation leaching procedure (SPLP) testing to assess leachability. SPLP testing used the same metals analysis (EPA 6010B) as was used for bulk soil chemistry, but were prepared to evaluate the mobility of pollutants (EPA 1312/3010A). Arsenic was the only analyte evaluated for leachability.

3 RESULTS

The following section describes bulk sediment analytical chemistry results, as well as leachability test results. APPENDIX D contains original laboratory reports provided by Enthalpy, including quality assurance data and summary tables with all the analytical data. APPENDIX E contains original soil plantability laboratory report provided by Waypoint Analytical.

3.1 *Field Data*

Great Ecology successfully sampled all four stations. With the exception of the berm location (Station P20-1), field staff were unable to achieve grab target recovery objectives due to the presence of groundwater (TABLES 2 and 3). Berm materials from location P20-1 were predominantly moist gray clay with lenses of fine sand. Berm materials were generally consistent with the visual/textural characteristics of materials at the top of the berm (the upper limit of our boring was approximately five feet below the crest of the berm) and berm materials in general (extending south and northeast of the sampling location, see FIGURE 1).

Core subsections from Station 2, 3, and 4 were generally dominated by sandy loams. Groundwater was shallower in the westernmost location within the berm. Soils in the interior portions of the berm were generally consistent with respect to the relative percentage of sand to clay (see APPENDIX B for field log data).

TABLE 2: SUMMARY CORE LOCATION INFORMATION

Station ID	Date (Time)	Latitude	Longitude	Target Recovery (ft)	Actual Core Depth (ft)
P20 – 1	1/30/17 (14:30)	32⁰35'14.91"	117⁰06'18.84"	6 [1]	6.5 [1]
P20 – 2	1/30/17 (12:55)	32⁰35'12.99"	117⁰06'09.36"	9.2	3.0
P20 – 3	1/30/17 (11:30)	32⁰35'10.04"	117⁰05'59.02"	10.5	8.0
P20 – 4	1/30/17 (09:30)	32⁰35'17.09"	117⁰05'55.09"	12.8	9.2

[1] Target recovery was adjusted in the field based on observed site characteristics.
ft = feet

TABLE 3: CORE LOG SUMMARY INFORMATION

Station ID	Target Recovery (ft)	Depth (ft)	Core Material Description
P20 – 1	6 [1]	6.5 [1]	Top 2 ft: moist brown clay with mottling in soil. From 2 to 6.5 ft: moist gray clay with minor lenses of fine sand. No groundwater.
P20 – 2	9.2	3.0	Top 1 ft: moist, dark brown. From 1 to 3 ft: wet, dark brown fine sand. Groundwater at 1.5 ft.
P20 – 3	10.5	8.0	Top 3 ft: Medium tan sand. From 3 to 5 ft: Fine tan sand. From 5 to 8 ft: gray, medium-coarse wet sand with mud. Groundwater at 3 ft.
P20 – 4	12.8	9.2	Top 3 ft: loose, brown, dry sand. From 3 to 5 ft: more compact material, similar to the top 3 ft with minor clay. From 5 to 9.2 ft: sand with lenses of clayey material and coarse sand. Groundwater at 5 ft.

[1] Target recovery was adjusted in the field based on observed site characteristics.
ft = feet

3.2 Bulk Sediment Chemistry Results

TABLES 4 to 12 summarize the bulk sediment analytical results. Contaminants were generally very low qualitatively, consistent with the minimal historical development of the site and hydrological isolation. All estimated concentrations are noted with "J" qualifiers (if applicable).

Total petroleum hydrocarbons were not detected (TABLE 5). Other organic contaminants were nearly absent, except very minor detections of PAHs, well below ground surface at Location P20-1 (TABLES 6 and 7). Pesticides and PCBs were not detected (TABLES 8 to 10).

TABLE 4: POND 20 CONVENTIONAL ANALYSES

Sample ID	TOC (mg/kg)	Total Solids (%)	Dissolved Sulfide (mg/kg)	Total Sulfide (mg/kg)
Method	**EPA 9060A**	**SM 2540 B (M)**	**EPA 376.2M**	**EPA 376.2M**
RL:	560-820	0.10	0.56-0.82	0.56-15
1T	6300	71.4	ND	ND
1M	16000	61.2	ND	9.8
1Z	11000	68.6	ND	230
2T	ND	79.1	ND	ND
2Z	9400	69.8	ND	0.72
3T	ND	88.6	ND	ND
3M	2500	76.4	ND	ND
3Z	ND	84.8	ND	ND
4T	600	89.0	ND	ND
4M	ND	79.7	ND	ND
4Z	ND	80.3	ND	ND

Notes:
All values are dry weight masses
kg = kilograms
μg = micrograms
ND = non-detect
TOC = total organic carbon

TABLE 5: POND 20 ORGANICS – TOTAL PETROLEUM HYDROCARBONS

Sample ID	TPH (C8 to C10) (mg/kg)	TPH (C10 to C28) (mg/kg)	TPH (C28 to C40) (mg/kg)
Method	**EPA 8015M**		
RL:	22.48-32.66	11.24-16.33	11.24-12.45
1T	ND	ND	ND
1M	ND	ND	ND
1Z	ND	ND	ND
2T	ND	ND	ND
2Z	ND	ND	ND
3T	ND	ND	ND
3M	ND	ND	ND
3Z	ND	ND	ND
4T	ND	ND	ND
4M	ND	ND	ND
4Z	ND	ND	ND

Notes:
All values are dry weight masses
kg = kilograms
μg = micrograms
ND = non-detect
TPH = total petroleum hydrocarbons

TABLE 6: POND 20 ORGANICS – LOW-MOLECULAR WEIGHT POLYCYCLIC AROMATIC HYDROCARBONS

Sample ID	Acenaphthene (µg/kg)	Acenaphthylene (µg/kg)	Anthracene (µg/kg)	Fluorene (µg/kg)	Naphthalene (µg/kg)	Phenanthrene (µg/kg)
Method	**EPA 8270CM**					
RL:	11.24-16.33	11.24-16.33	11.24-16.33	11.24-16.33	11.24-16.33	11.24-16.33
1T	ND	ND	ND	ND	ND	ND
1M	ND	ND	ND	ND	ND	ND
1Z	ND	ND	ND	ND	ND	ND
2T	ND	ND	ND	ND	ND	ND
2Z	ND	ND	ND	ND	ND	ND
3T	ND	ND	ND	ND	ND	ND
3M	ND	ND	ND	ND	ND	ND
3Z	ND	ND	ND	ND	ND	ND
4T	ND	ND	ND	ND	ND	ND
4M	ND	ND	ND	ND	ND	ND
4Z	ND	ND	ND	ND	ND	ND

Notes:
All values are dry weight masses
kg = kilograms
µg = micrograms
ND = non-detect

TABLE 7: POND 20 ORGANICS – HIGH-MOLECULAR WEIGHT POLYCYCLIC AROMATIC HYDROCARBONS

Sample ID	**Benz(a) anthracene (µg/kg)**	**Benzo(a) pyrene (µg/kg)**	**Benzo(b) fluoranthene (µg/kg)**	**Benzo(g,h,i) perylene (µg/kg)**	**Benzo(k) fluoranthene (µg/kg)**	**Chrysene (µg/kg)**	**Dibenz(a,h) anthracene (µg/kg)**	**Fluoranthene (µg/kg)**	**Indeno (1,2,3-cd) pyrene (µg/kg)**	**Pyrene (µg/kg)**
Method	**EPA 8270CM**									
RL:	11.24-16.33	11.24-16.33	11.24-16.33	11.24-16.33	11.24-16.33	11.24-16.33	11.24-16.33	11.24-16.33	11.24-16.33	11.24-16.33
Berm Location – P20-1										
1T	ND L	ND	ND L	ND	ND	ND	ND	ND	ND	ND
1M	ND L	ND	ND L	ND	ND	ND	ND	ND	ND	ND
1Z	19 L	16	ND L	ND	ND	22	ND	ND	ND	ND
Interior Locations – P20-2, P20-3, P20-4										
2T	ND L	ND	ND L	ND	ND	ND	ND	ND	ND	ND
2Z	ND L	ND	ND L	ND	ND	ND	ND	ND	ND	ND
3T	ND L	ND	ND L	ND	ND	ND	ND	ND	ND	ND
3M	ND L	ND	ND L	ND	ND	ND	ND	ND	ND	ND
3Z	ND L	ND	ND L	ND	ND	ND	ND	ND	ND	ND
4T	ND L	ND	ND L	ND	ND	ND	ND	ND	ND	ND
4M	ND L	ND	ND L	ND	ND	ND	ND	ND	ND	ND
4Z	ND L	ND	ND L	ND	ND	ND	ND	ND	ND	ND

Notes:
All values are dry weight masses
kg = kilograms
µg = micrograms
L = The laboratory control sample (LCS) or laboratory control sample duplicate (LCSD) was out of control limits. Associated sample data was reported with qualifier.ND = non-detect

TABLE 8: POND 20 ORGANICS – PESTICIDES (PART I)

Sample ID	**Total 4,4'-DDT (µg/kg)**	**α-BHC (µg/kg)**	**β-BHC (µg/kg)**	**δ-BHC (µg/kg)**	**Lindane (γ-BHC) (µg/kg)**	**Chlordane (µg/kg)**	**Dieldrin (µg/kg)**	**Endosulfan I (µg/kg)**	**Endosulfan II (µg/kg)**	**Endosulfan sulfate (µg/kg)**
Method	**EPA 8081A NELAC**									
RL:	5.62-8.17	5.62-8.17	5.62-8.17	5.62-8.17	5.62-8.17	56.20-81.66	5.62-8.17	5.62-8.17	5.62-8.17	5.62-8.17
Berm Location – P20-1										
1T	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1M	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1Z	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Interior Locations – P20-2, P20-3, P20-4										
2T	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2Z	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3T	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3M	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3Z	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4T	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4M	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4Z	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Notes:
All values are dry weight masses
kg = kilograms
µg = micrograms
ND = non-detect

TABLE 9: POND 20 ORGANICS – PESTICIDES (PART II)

Sample ID	**Endrin (µg/kg)**	**Endrin aldehyde (µg/kg)**	**Endrin Ketone (µg/kg)**	**Heptachlor (µg/kg)**	**Heptachlor epoxide (µg/kg)**	**Methoxychlor (µg/kg)**	**Toxaphene (µg/kg)**	**Aldrin (µg/kg)**
Method	**EPA 8081A** NELAC							
RL:	5.62-8.17	5.62-8.17	5.62-8.17	5.62-8.17	5.62-8.17	11.24-16.33	112.40-163.32	5.62-8.17
Berm Location – P20-1								
1T	ND	ND	ND	ND	ND	ND	ND	ND
1M	ND	ND	ND	ND	ND	ND	ND	ND
1Z	ND	ND	ND	ND	ND	ND	ND	ND
Interior Locations – P20-2, P20-3, P20-4								
2T	ND	ND	ND	ND	ND	ND	ND	ND
2Z	ND	ND	ND	ND	ND	ND	ND	ND
3T	ND	ND	ND	ND	ND	ND	ND	ND
3M	ND	ND	ND	ND	ND	ND	ND	ND
3Z	ND	ND	ND	ND	ND	ND	ND	ND
4T	ND	ND	ND	ND	ND	ND	ND	ND
4M	ND	ND	ND	ND	ND	ND	ND	ND
4Z	ND	ND	ND	ND	ND	ND	ND	ND

Notes:
All values are dry weight masses
kg = kilograms
µg = micrograms
ND = non-detect

TABLE 10: POND 20 ORGANICS – POLYCHLORINATED BIPHENYLS

Sample ID	**PCB-1016 (µg/kg)**	**PCB-1221 (µg/kg)**	**PCB-1232 (µg/kg)**	**PCB-1242 (µg/kg)**	**PCB-1248 (µg/kg)**	**PCB-1254 (µg/kg)**	**PCB-1260 (µg/kg)**	**PCB-1262 (µg/kg)**	**PCB-1268 (µg/kg)**
Method	**EPA 8082 NELAC**								
RL:	56.20-81.66	56.20-81.66	56.20-81.66	56.20-81.66	56.20-81.66	56.20-81.66	56.20-81.66	56.20-81.66	56.20-81.66
Berm Location – P20-1									
1T	ND	ND	ND	ND	ND	ND	ND	ND	ND
1M	ND	ND	ND	ND	ND	ND	ND	ND	ND
1Z	ND	ND	ND	ND	ND	ND	ND	ND	ND
Interior Locations – P20-2, P20-3, P20-4									
2T	ND	ND	ND	ND	ND	ND	ND	ND	ND
2Z	ND	ND	ND	ND	ND	ND	ND	ND	ND
3T	ND	ND	ND	ND	ND	ND	ND	ND	ND
3M	ND	ND	ND	ND	ND	ND	ND	ND	ND
3Z	ND	ND	ND	ND	ND	ND	ND	ND	ND
4T	ND	ND	ND	ND	ND	ND	ND	ND	ND
4M	ND	ND	ND	ND	ND	ND	ND	ND	ND
4Z	ND	ND	ND	ND	ND	ND	ND	ND	ND

Notes:
All values are dry weight masses
kg = kilograms
µg = micrograms
ND = non-detect
PCB = polychlorinated biphenyls

TABLE 11: POND 20 METALS ANALYSES

Sample ID	Arsenic (mg/kg)	Arsenic (mg/L) SPLP	Cadmium (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)	Zinc (mg/kg)
Method	EPA 3050B/6010B NELAC	EPA 1212/3010A/6010B NELAC	EPA 3050B/6010B NELAC	EPA 3050B/6010B NELAC	EPA 3050B/6010B NELAC	EPA 3050B/6010B NELAC	EPA 3050B/6010B NELAC	EPA 3050B/6010B NELAC	EPA 3050B/6010B NELAC	EPA 3050B/6010B NELAC	EPA 3050B/6010B NELAC
ERM	**70**	NA	**9.6**	**370**	**270**	**218**	**0.71**	**51.6**	**-**	**3.7**	**410**
ERL	**8.2**	NA	**1.2**	**81**	**34**	**46.7**	**0.15**	**20.9**	**-**	**1.0**	**150**
STLC		5									
MUN		0.050									
CCC		0.036									
RL:	1.12-1.63	0.01	0.56-0.82	1.12-1.63	1.12-1.63	1.12-1.63	0.16-0.23	1.69-2.45	1.12-1.63	0.56-0.82	5.62-8.17
Berm Location – P20-1											
1T	8.5	-	0.72	30.2	16.2	5.68	ND	11.7	ND	ND	66.2
1M	10.7	0. 013	1.07	41.3	21.8	5.49	0.04 J	16	ND	ND	85.7
1Z	7.98	-	0.89	23.9	17.4	5.83	ND	11.3	ND	ND	65.4
Interior Locations – P20-2, P20-3, P20-4											
2T	3.65	-	ND	8.82	6.07	2.01	ND	2.84	ND	0.19 J	22.0
2Z	5.57	ND	0.48 J	15.8	15.8	3.72	ND	7.32	ND	ND	47.8
3T	2.26	-	ND	5.23	2.32	1.93	ND	1.51 J	ND	ND	13.2
3M	4.56	-	0.47 J	10.7	9.31	2.99	ND	5.01	ND	0.36 J	35.8
3Z	4.86	ND	0.26 J	7.4	5.8	2.12	ND	2.91	ND	ND	24.0
4T	2.47	-	0.25 J	6.12	3.83	2.44	ND	2.28	ND	ND	18.6
4M	3.14	-	0.31 J	9.71	7.07	2.53	ND	4.14	ND	ND	34.4
4Z	4.93	0.016	0.27 J	9.81	6.73	2.62	ND	4.03	ND	ND	30.9

Notes:
All values are dry weight masses (except SPLP)
CCC = Saltwater Criterion Continuous Concentration, California Toxics Rule, EPA 2000
ERL/ERM = effects range low/median (Buchman 2008)
J = Reported value is above the Method Detection Limit and below the Reporting Limit. Reported value is estimated.
kg = kilograms
µg = micrograms
MUN = Domestic or Municipal supply waters, San Diego Basin Plan 2016
ND = non-detect
STLC = Soluble Threshold Leaching Concentration (California Title 22)
SPLP = Synthetic Precipitation Leaching Procedure (California Title 22)

TABLE 12: POND 20 AGRICULTURAL SUITABILITY

Sample ID	pH	ECe (dS/m)	Ca (meq/L)		Mg (meq/L)	Na (meq/L)	K (meq/L)	B (ppm)	SO_4 (meq/L)	SAR
1Z	7.9	69.2	25.5		119.0	723.0	14.7	2.42	58.4	85.06
2Z	7.8	60.4	58.4		112.0	559.0	18.4	10.50	103.0	60.56
3Z	8.0	71.9	17.7		117.0	613.0	16.4	8.18	91.1	74.70
4Z	7.2	88.6	35.9		161.0	746.0	12.4	3.63	73.7	75.18

Notes:
Ca = calcium, Mg = magnesium, Na = sodium, K = potassium, B = boron, SO_4 = sulfate
dS = deciSiemens
L = liters
m = meters
meq = milliequivalents
ppm = parts per million
ECe = salinity
SAR = sodium adsorption ratio

Metals concentrations (TABLE 11) were also very low; nearly all locations contained sediments with concentrations below the Effects Range-Low (ERL) concentrations. Only two samples, both at P20-1 (the berm) exceeded ERL levels, which exceeded only the arsenic ERL. The surface and mid-depth samples exhibited only minor exceedances of the ERL, and were well below the ERM. This result, particularly in the absence of other ERL exceedances, indicates a very low likelihood of ecological effects in marine environments.

The presence of arsenic at levels above a screening threshold resulted in additional characterization to assess leachability. For these analyses, the highest bulk sediment concentration samples from each of the four locations were tested to consider a “worst-case” scenario using the SPLP method. Selected soil samples were: P20-1M, P20-2Z, P20-3Z, and P20-4Z; results are included in TABLE 11. All leachability results were well below the STLC limit, in all cases by between 2 and 3 orders of magnitude. When arsenic was detected (2 of the 4 samples; concentrations of 0.013 mg/L in sample P20-1M, and 0.016 in sample P20-4Z), values were below both the Basin Plan levels for waters designated as domestic or municipal supply (MUN = 0.050 mg/L, RB 2016) and the most stringent environmental water quality standard (California Toxics Rule, Saltwater Criterion Continuous Concentration = 0.036 mg/L, EPA 2000).

3.3 Data Quality and Validity

Great Ecology reviewed the quality assurance compliance data provided by Enthalpy to ensure analytical data were valid and representative. There were no quality assurance data provided by Waypoint. In this section, Great Ecology provides summary data for the Enthalpy reports; additional data are included as case narrative statements and quality control data within their respective reports (APPENDIX D).

The maximum achieved reporting limits were higher than the target values for some organic analytes, as well as the metals, but the vast majority fell below the lowest respective guideline values (i.e., ERL concentrations), where applicable.

For mercury, analytical reporting limits fell below the ERM value (0.71 mg/kg), but above the ERL concentration (0.15 mg/kg). However, the method detection limit (MDLs) were reviewed and ranged from 0.02-0.03 mg/kg. Therefore, if it had been present at levels above the ERL, mercury would have been detected and qualified as an estimate. In addition, Great Ecology found the quality control data for mercury method blank, matrix spike, and laboratory control samples to be in compliance with quality assurance control limits. Mercury data are therefore deemed valid and representative.

For the metals analyses, several method blank detections were present in QC Batch 1174933 (see Page 28 of Enthalpy Lab Request 387148). Method blank detections included antimony, selenium, and zinc; all detections were below respective reporting limits (1 to 5 mg/kg), but above respective method detection limits. Great Ecology reviewed data for the samples that corresponded to QC Batch 1174933; all results were non-detect or less than the ERL (see above tables); therefore, any overestimation of actual antimony, selenium, or zinc was considered moot.

The matrix spike analyses for antimony were out of acceptable control ranges. However, data were considered valid on the basis of laboratory control sample analyses. Therefore, data are deemed valid.

The lab control and matrix spike analyses for benz(a)anthracene and benzo(b)fluoranthene overestimated concentrations to a degree outside control limits. Since these analytes were not detected, a conservative interpretation of the results concludes that these analytes are not present at levels of concern. The naphthalene laboratory control samples were out of control limits, but the matrix spike data (and surrogate analyses) were within control limits and are therefore deemed valid. These data were appropriately qualified.

A single deviation from the SAP (attached as APPENDIX A) was recognized in that only the 4,4- isomers of DDD, DDE, and DDT were analyzed. 2,4 isomers were not analyzed, and were a minor component of DDT-containing products (historically). Since assessment of 4,4 isomers of DDTs is consistent with current guidance regarding how Total DDTs are calculated and compared to benchmark screening criteria (e.g., Buchman 2008), this deviation did not impact the conclusions of this report.

In summary, we consider the reported bulk sediment chemistry data to be valid and representative.

3.4 Data Limitations

The statements above generalize sediment quality on the basis of a small number of sample locations relative to the anticipated volume of excavation. However, generalization is justifiable based on land use history, minimal development, hydrological isolation, and consistency with available bulk sediment chemistry for adjacent lands with similar land uses and hydrology (e.g., USFWS 2016).

4 DISCUSSION

4.1 Field Operations

Great Ecology staff members performed field collection efforts, sample handling, and soil analyses as outlined in the study SAP (see APPENDIX A). Field staff achieved limited progress toward core target depth at three of four stations due to shallow groundwater. Recovery depths were limited as a result of groundwater intrusion and borehole collapse at interior locations. Soil sampling at the berm location (P20-1) was successful.

4.2 General Soil Conditions

The particle size distribution data was observed to be qualitatively different at the interior stations when compared to berm soils. Berm soil was generally finer material, and was observed to have higher TOC and moisture content (TABLE 2). Berm materials appeared visually and texturally distinct from interior soils (see APPENDIX C).

4.3 Bulk Sediment Chemistry

Apart from metals, the majority of priority pollutant contaminants were not detected at the Site. The following categories of contaminants were non-detect at all stations and depth horizons:

- Total petroleum hydrocarbons (TPHs);
- Low-molecular weight polycyclic aromatic hydrocarbons (LPAHs);
- Pesticides; and
- Polychlorinated biphenyls (PCBs).

Location P20-1 had detected levels of high-molecular weight polycyclic aromatic hydrocarbons (HPAHs) in the z-layer; however, combined these HPAHs totaled 57 µg/kg, well below the ERL concentration for HPAHs (1,700 µg/kg) and Total PAHs (4,022 µg/kg) (Buchman 2008).

Arsenic was the only metal with concentrations exceeding benchmark concentrations. At Location P20-1, arsenic concentrations in the top and middle soil horizons exceeded the ERL (8.2 mg/kg). Interior stations did not exceed ERL criteria. SPLP testing demonstrates that the arsenic is insoluble at all locations, and comparisons to water quality criteria indicate no threat to surface or groundwater conditions.

All encountered concentrations are low with regard to ecological risk criteria.

4.4 Horticultural Evaluation of the Z-Layer

Salinity presents the most significant constituent from a horticultural/plantability perspective. Soil salinity was not limited to surficial soils, and extended into the z-layer samples. Salinity far exceeded the tolerance of the majority of salt marsh plants (>30 dS/m) in the z-layer at all stations. Station 2 had the lowest salinity relative to the other stations, and Station 4 had the highest. These represent the shallowest and deepest samples, respectively, taken within the berm at the Site.

The agricultural suitability analyses revealed additional concerns for plantability. The sodium adsorption ratio (SAR) for every station indicates these soils are sodic (>15). Sodic conditions lead to a negative impact on soils structure and water infiltration. Further, the elevated levels of boron present a concern; elevated boron can cause burning of foliage and negatively impact survivorship rates for young plants.

High salinity coupled with high SAR and boron values and low total organic carbon at most stations represent a threat to plant survivorship and indicate a need for soil amendments and leaching prior to planting onsite. Further detail on the agricultural suitability analysis is available in Waypoint's attached report (APPENDIX E).

4.5 Conclusion

A review of the Pond 20 hydrology and site history indicate a lack of contaminant sources in the recent and extended history of the Site, and available bulk sediment chemistry from adjacent parcels corroborates this opinion (Coastal Commission 2013). Direct testing of materials encountered during our investigation indicated that bulk sediment physical characteristics and bulk sediment chemistry were consistent with the hypothesized lack of contamination. Soil arsenic was the only analyte to exceed a screening value; additional leachability testing indicated that it is tightly bound and does not present a risk to even the most susceptible aquatic receptors. As a result, data collected herein indicate that the materials areEF substantially 'inert' with regard to beneficial reuse at offsite locations

5 REFERENCES

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APPENDIX A: SAMPLING AND ANALYSIS PLAN

POND 20 MITIGATION BANK

SAMPLING AND ANALYSIS PLAN
FOR SOIL/SEDIMENT CHARACTERIZATION

Submitted to:

San Diego Unified Port District
3165 Pacific Hwy.
San Diego, CA 92101

Date:

January 24, 2017

Prepared by:

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List of Figures (Attached)

1 INTRODUCTION

The San Diego Unified Port District (District) is planning a wetland mitigation bank for the Pond 20 site, located in South San Diego Bay in San Diego, CA. The District engaged Great Ecology to design the mitigation bank. As part of a previously completed feasibility study, Great Ecology created a conceptual design for an 83.5-acre mitigation bank on Sub-parcel B (Site; FIGURE 1). The Site currently consists of largely barren upland open space resulting from its historic use as a salt evaporator pond. The conceptual design includes proposed channels that re-establish tidal connections and excavation of the Site to elevations appropriate to support the establishment of tidal wetlands. Preliminary estimates indicate a significant volume of soil/sediment (between approximately 100,000 and 250,000 cubic yards) will be excavated and either relocated onsite or exported offsite for reuse.

1.1 Document Purpose

This Sampling and Analysis Plan (SAP) was prepared by Great Ecology to outline our sampling and analysis approach. The analysis will characterize the materials, document soil/sediment characteristics, and describe anticipated post-excavation surface conditions (or z-layer conditions) to inform the design process.

This SAP was prepared in accordance with guidance provided by the Southern California Dredge Material Management Team (DMMT) of regulatory agencies, which include the U.S. Army Corps of Engineers, the Environmental Protection Agency (EPA), the California Coastal Commission, and the Regional Water Quality Control Board. Although the final deposition site for excess materials is currently unknown, we anticipate a combination of DMMT agencies will have a role in the project permitting process.

2 SITE CONTEXT

2.1 Geologic, Topographic, and Hydrogeologic Conditions

The Site is located within the western Peninsular Range Geomorphic Province of Southern California, which stretches 900 miles from the Los Angeles Basin and the Transverse Ranges to the southern end of Baja California (Norris and Webb 1990).

The Site consists primarily of a low diked area, which is hydrologically isolated from the Nestor Creek and Otay River systems. Based on historical survey information, and to be verified by pending topographic survey data, the approximate elevation of the area within the dike ranges from approximately 4.5 to 11.5 feet above mean lower low water (MLLW; 1988 North American Vertical

Datum [NAVD88]). The proposed average restoration target elevations range from -0.5 to 16.2 feet MLLW (NAVD88), with the majority of restored habitat below 7.0 feet MLLW.

The Site lies within the Otay Hydrologic Unit, a watershed covering 154 square miles that is drained by the Otay River and its tributaries. The Otay River flows east to west toward San Diego Bay. The Site is located adjacent to Nestor Creek, and includes a tidal channel just upstream of the mouth of the Otay River where it meets San Diego Bay (FIGURE 1). The Site soils/sediments subject to this investigation are in the upland portion of the Site, and from the existing surface elevation to the proposed finished grade.

2.2 *Field and Database Reconnaissance*

Field reconnaissance has indicated no history of spills or releases of hazardous materials, nor any visual indications of soil degradation (e.g., staining from hydrocarbons).

3 METHODOLOGY

3.1 *Objectives and Approach*

This sampling and analysis effort includes three distinct objectives:

1. Characterize the post-excavation (or z-layer) surface for soil structure parameters;
2. Characterize the post-excavation (or z-layer) for plant growth characteristics; and
3. Conduct a screening-level assessment of anticipated excavation spoils (cut).

3.2 *Soil/Sediment Sampling Protocol*

The sampling protocol will employ a hand auger team to sample four locations (FIGURE 2). Clean plastic sheeting (e.g., Visqueen) will be used to establish a zone for equipment mobilization and for sample handling. Hand auger progress will be monitored and logged by staff under the supervision of a California-licensed geologist or engineer.

Materials will be stockpiled on the surface during excavation for subsequent subsampling with the exception of the z-layer, which will be subsampled immediately upon reaching target depth to preserve the best percent moisture test conditions. Archive samples may be collected if warranted by field conditions.

Sampling at each location will result in two samples: a z-layer sample, which will receive comprehensive analysis, and a composite of the overlying soils/sediments, which will be tested for an abbreviated list of analytes limited to conventional, metals, and organic compound analyses.

Borings will not be tested at a scale finer than two feet (materials will be logged at an appropriate scale). If horizons less than two feet in length are observed to exhibit unexpected or unusual characteristics (e.g., hydrocarbon staining), those soils/sediments will be sampled and at minimum archived for potential analysis.

3.3 Soil/Sediment Sample Analysis

Samples collected during the site investigation will be analyzed by a National Environmental Laboratory Accreditation Program (NELAP) certified laboratory using EPA and other standard methods of analysis (e.g., ASTM International). Analyses are focused on four primary indicators:

- Conventional descriptive analyses;
- Soil/sediment characteristics;
- Metals; and
- Organic pollutants.

Respective methods, method publications, and target analytical concentrations are detailed in TABLE 1. The table is subject to modification based on ongoing review; duplication of methods by different laboratories will be avoided if independent testing is necessary.

3.4 Sample Management and Shipment

Chain of custody documentation will serve as a tracking tool to ensure proper analyses are undertaken in accordance with this plan. Chain of custody documentation will accompany iced coolers when transported to the laboratory, and during any subsequent transfer. All samples will be packed and shipped to the laboratory in such a manner as to prevent loss of sample due to breakage, leaks, or cross-contamination. The transfer from the field team to the laboratory will occur at the end of the sampling period, and the Great Ecology field coordinator will be responsible for completing chain of custody documentation for all samples prior to their shipment to the laboratory. The laboratory will be instructed to homogenize samples prior to collection of aliquots for specific analyses.

Upon collection, each sample container will be labeled with water-resistant ink. The sample label information will include the project name, a unique sample identification number (e.g., “P20-1”), sampling date and time, and the sampler's initials. The unique sample identification number will, at minimum, include information corresponding to the boring number and sample horizon or composite nature.

Sample containers for chemical analysis will be labeled, placed in freezer bags, if needed, and immediately placed on bagged ice in a cooler. Additional bagged ice will be placed over the top of the samples for shipment/transport as needed.

Great Ecology will make arrangements to ensure the samples are delivered within an appropriate time frame for fixed laboratory analysis.

TABLE 1 CONVENTIONAL, GEOTECHNICAL, AND ANALYTICAL TESTING ANALYSES

Parameter	Method	Procedure/ Specification	Soil/Sediment Target Reporting Limits[a]
CONVENTIONAL ANALYSES			
Grain Size	ASTM D4464M	Sieve/Optical	0.1 g
Percent Solids	SM 2540B[h]	Gravimetric	0.1 percent
TOC	USEPA 9060[i]	Combustion	0.1 percent
Total Sulfides	USEPA 376.2M[h]	Titrametric	0.1 mg/kg
Dissolved Sulfides	USEPA 376.2M[h]	Titrametric	0.1 mg/kg
GEOTECHNICAL CHARACTERISTICS			
Plasticity Index	ASTM D4318	Atterberg Limit	-
In-Situ Moisture	ASTM D2937)	Gravimetric	-
Shear Strength	ASTM D2166	Unconfined Compressure	-
Grain Size	ASTM D422	Sieve/Hydrometer	0.1 g
METALS			
As, Cd, Cr, Cu, Pb, Ni, Se, Ag	USEPA 6020[i]	ICP-MS	0.1 mg/kg
Zn	USEPA 6020[i]	ICP-MS	1.0 mg/kg
Hg	USEPA 7471A[i]	GFAAS	0.02 mg/kg
ORGANICS			
TRPH	USEPA 418.1M[h]	IR Spectroscopy	1.0 mg/kg
Pesticides[b]	USEPA 8081A[i]	GC/ECD	2-20 µg/kg
PCBs[c]	USEPA 8082[i]	GC/ECD	10 µg/kg
PAHs[d]	USEPA 8270C[i]	GC/MS SIM	20 µg/kg
PLANTABILITY ANALYSES			
Various, by Agricultural Laboratory – salinity, sodium adsorption ratio (SAR), soluble cations, sulfate, boron, pH, and qualitative lime.			

[a] Target reporting limits provided by Calscience Environmental Laboratories

[b] Includes 2,4- and 4,4- isomers of DDD, DDE, and DDT; α–, β–, δ–, and γ-BHC; chlordane; dieldrin; endosulfan I and II; endosulfan sulfate; endrin and endrin aldehyde; heptachlor and heptachlor epoxide; methoxychlor; and toxaphene.

[c] Includes congeners and Aroclors 1016, 1221, 1232, 1242, 1248, 1254, 1260, and 1262.

[d] Includes Low Molecular Weight PAHs (naphthylene, acenaphthylene, acenaphthene, fluorine, and phenanthrene) and High Molecular Weight PAHs (fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(b,k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene).

[h] *Standard Methods for the Examination of Water and Wastewater*, 19th Edition (APHA, 1995)

[i] SW-846. Test methods for Evaluating Solid Waste, Physical/Chemical Methods (USEPA 1986-1996)

Mass Units: kg – kilogram, g – gram, mg – milligram, µg – microgram, ng – nanogram L – liter
ASTM – American Society for Testing & Materials
TOC – total organic carbon
PAH – polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
TRPH – total recoverable petroleum hydrocarbons
NA – not applicable
ICPMS – inductively coupled plasma mass spectroscopy
IR – infrared
GFAAS – graphite furnace atomic absorption spectroscopy
GC/ECD – gas chromatography/electron capture dissociation method
GC/MS SIM – gas chromatography/mass spectroscopy selective ion monitoring method
GC/FPD – gas chromatography/flame photometric detection method

4 REPORTING

A final report will document the above investigation and be supported by tables, figures, and appendices, as appropriate. The report will characterize the Site soil/sediment, describe its chemical characteristics, and if feasible given boring depths, identify underlying native soil conditions and estimate the vertical extent and volume of fill material.

5 OTHER INVESTIGATION ACTIVITIES

5.1 Photographs

Photographs will be taken of the sampling locations and surrounding site to document the sampling areas, use of field equipment, and related activities.

5.2 Boring Logs

Boring logs will be generated for each boring completed. Boring logs will document the depth below ground surface from which sample volumes are extracted. The logs will include the date, the total depth, the depth at which groundwater was encountered (if any), and the soil type in accordance with the Unified Soil Classification System. The logs will also include observations regarding soil discoloration and/or odors in ambient air, and corresponding sample identifiers.

5.3 Site Control

To avoid open boreholes at the site, with the attendant safety hazards, the boreholes will be backfilled with excavated materials. Great Ecology appreciates that spoil from the borings could be considered "investigation-derived waste," which typically would be containerized and transported offsite for disposal. However, there is no indication that the material is hazardous waste or could pose any kind of health issue and, as a result, materials will be returned to the boring holes.

5.4 Permitting and Utility Clearance

The County of San Diego, Department of Environmental Health (SDCoDEH) requires permits for soil borings to depths greater than 20 feet below ground surface; our borings will be well above this threshold and permits are therefore not needed. As required by law, Underground Service Alert of Southern California (DigAlert) will be notified of the planned investigation so that the appropriate utility companies have the opportunity to respond and check for conflicts.

5.5 Health and Safety Plan (HASP)

The proposed investigation will be conducted in accordance with a site-specific HASP. The HASP will describe the site-specific chemical and physical hazards that may be encountered, as well as "generic" hazards associated with working in proximity to trenching, drilling, and other equipment. The HASP will specify the minimum health and safety procedures and measures to eliminate or minimize site-specific and generic hazards. In addition to preparing onsite workers and management for the anticipated potential hazards, the HASP will enable workers and management to respond to changing conditions and make professional judgments regarding the interpretation of subsurface assessment data and related control measures. Specifically, the HASP will:

- Inform all field personnel, contractors, subcontractors, and visitors of the potential hazards associated with the work to be performed at the site; and
- Identify the minimum precautionary measures and personal protective equipment.

Field personnel will be required to read, understand, and follow the HASP in the field. Subcontractors must also follow the HASP or follow their own health and safety procedures, provided these are at least as stringent.

Prior to any field work during which exposure to hazardous conditions could occur, contractor and subcontractor personnel will be required to sign a HASP review form as an acknowledgement of their understanding of its contents and as an agreement to follow its procedures and guidance. Visitors to the Site will be familiarized with the HASP and will be required to sign a HASP review form. A copy of the HASP will be available onsite while soil/sediment sampling work is in progress.

5.6 Anticipated Schedule

The project team anticipates completing field work associated with soil and soil/sediment sampling and investigation between January 25 and February 10, 2017. Reporting is anticipated to be completed and delivered within 45 days of completion of field activities.

6 REFERENCES

California Coastal Commission. 2013. Condition Compliance for CDP No. E-06-013, Special Condition 8 – Poseidon Resources (Channelside), LLC. Agenda item W14a. November 22.

Norris, R.M., and R.W. Webb. 1990. *Geology of California*. 2nd edition, John Wiley. New York.

POND 20 SUBPARCELS

SAN DIEGO UNIFIED PORT DISTRICT

FIGURE 1

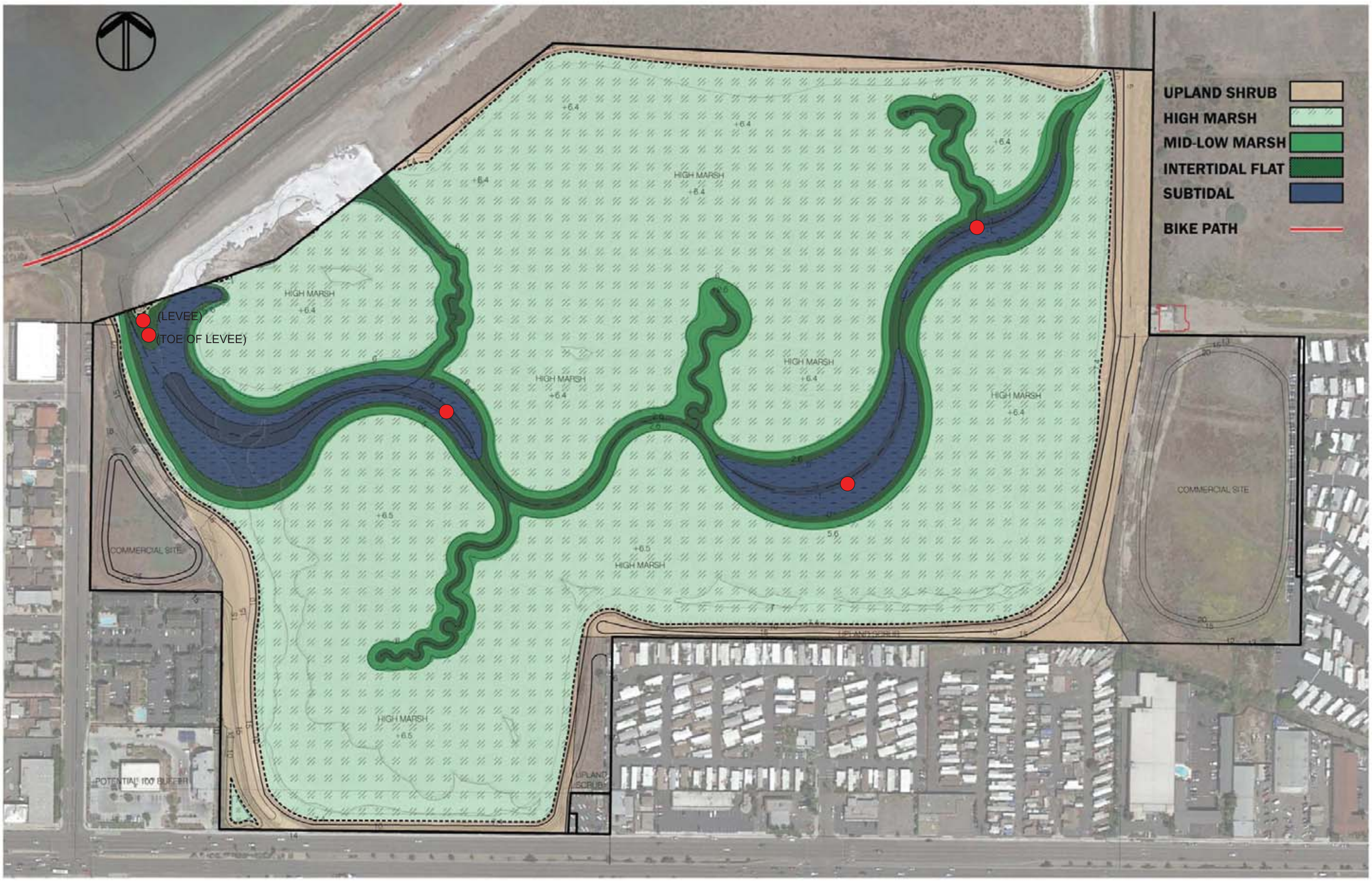
0 0.125 0.25 Miles

N

1:4,800

NAD 83 CALIFORNIA STATE PLANE FIPS IV

GREATecology
ENVIRONMENT + DESIGN



● PROPOSED SAMPLING LOCATION (APPROXIMATE)

POND 20 MITIGATION DESIGN *DRAFT*
PLAN VIEW

SAN DIEGO UNIFIED PORT DISTRICT
APRIL 2016

FIGURE 2
N.T.S

GREATecology
ENVIRONMENT + DESIGN

APPENDIX B: FIELD LOGS

SOIL/SEDIMENT COLLECTION FIELD LOG

Pond 20 – Sediment/Soil Investigation		Date: 1/30/17
Latitude: 32° ~~35'08"~~ NB	Longitude: 117° ~~06'18"~~ NB	Station ID: P20-1
35'14.91	06'18.84"	Arrival Time: 2:30
Sampler Type: **Hand Auger**		Depart Time: 500
Weather: Sunny		Sampler Initials: AT, NB

Core Description (grain size, color, odor, sheens, shell hash):

Archive:

TOP

1T

Moist
Brown clay, mottling in soil

2ft

1M

Moist
Gray clay w/minor lenses of fine sand

4ft

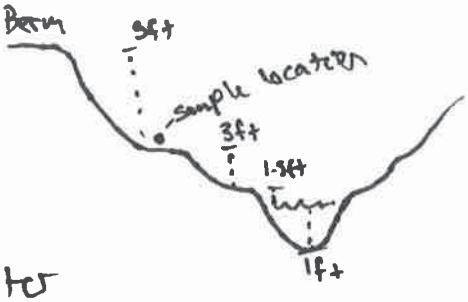
1Z

6.0'

6.5'

BOTTOM

Time: 4:45



Photos Taken: [✓ Yes] / No

Sample Inventory:

Comments: No groundwater

4 oz:

16 oz: 6 (1T×2, 1M×2, 1Z×2

Bags: 1 (1Z)

Times: T - 1500
M - 1510
Z - 1520

GREATecology
ENVIRONMENT • DESIGN

SOIL/SEDIMENT COLLECTION FIELD LOG

Pond 20 – Sediment/Soil Investigation		Date: 1/30/17
Latitude: ~~32° 35'9"~~ NB	Longitude: ~~117°06' 17"~~ NB	Station ID: P20-2
35' 12.99	06' 09.36"	Arrival Time: 12:55
Sampler Type: **Hand Auger**		Depart Time: 1350
Weather: Sunny		Sampler Initials: AT, NB

Core Description (grain size, color, odor, sheens, shell hash):

Archive:

TOP

2T

Moist, dark brown sand

1'0"

1'6" (hit water)

Wet, dark brown Fine sand

2Z

BOTTOM

3'0"

Photos Taken: [✓ Yes] / No

Sample Inventory:

Comments:

4 oz:

16 oz: 4 (2×2T, [redacted], 2×2Z)

Bags: 1 (2Z)

Times: T - 13:20

[redacted]

Z - 13:40

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ENVIRONMENT + DESIGN

SOIL/SEDIMENT COLLECTION FIELD LOG

Pond 20 – Sediment/Soil Investigation

Date: 1/30/17

Latitude: 32° ~~35' 11.0"~~ NB 35' 10.04"

Longitude: 117° ~~05' 59"~~ NB 05' 59.02"

Station ID: P20-3

Arrival Time: 11:30

Sampler Type: **Hand Auger**

Depart Time: 12:45

Weather: Sunny

Sampler Initials: AT, NB

Core Description (grain size, color, odor, sheens, shell hash):

Archive:

TOP

3T

Medium tan Sand

3ft (hit water)

Fine tan sand

3M

5ft

3Z

Gray, medium-coarse wet Sand w/ mud

BOTTOM

8 ft

Photos Taken: [✓ Yes] / No

Sample Inventory:

4 oz:

16 oz: 6 (2x 3T, 2x 3M, 2x 3Z

Bags: 1 (3Z)

Comments: Sample located just north of twin cypress trees

Times: T - 12:00

M - 12:10

Z - 12:20

GREATecology
ENVIRONMENT + DESIGN

SOIL/SEDIMENT COLLECTION FIELD LOG

Pond 20 – Sediment/Soil Investigation		Date: 1/30/17
Latitude: 32° ~~35' 06.00"~~ NB	Longitude: 117° ~~05' 57.00"~~ NB	Station ID: P20-4
35' 17.09	05' 55.09	Arrival Time: 9:30
Sampler Type: **Hand Auger**		Depart Time: 11:15
Weather: Sunny		Sampler Initials: AT, NB

Core Description (grain size, color, odor, sheens, shell hash):

Archive:

0'0"

TOP

~~Brown loo~~ Brown, Loose, Dry Sand

4T

3ft

More compact material, similar to top 3ft w/ minor clay

4'0"

5ft (hit water)

4M

-- sand w/ lenses of clayey material and coarse sand

8'0"

4Z

9.0ft

BOTTOM

9.~~0~~ft 2 inches

9'2"

Photos Taken: [✓ Yes] / No

Sample Inventory:

Comments: sample located at transition from transition to brush from iceplant

4 oz:

16 oz: 6 (2x 4T, 2x 4M, 2x 4Z)

Bags: 1 (4Z)

Times: T - 10:15
M - 10:25
Z - 10:35

APPENDIX C: PHOTODOCUMENTATION

Photodocumentation of Location 1 (view to west, right), and 1-ft strata (left, presented from surface to depth).

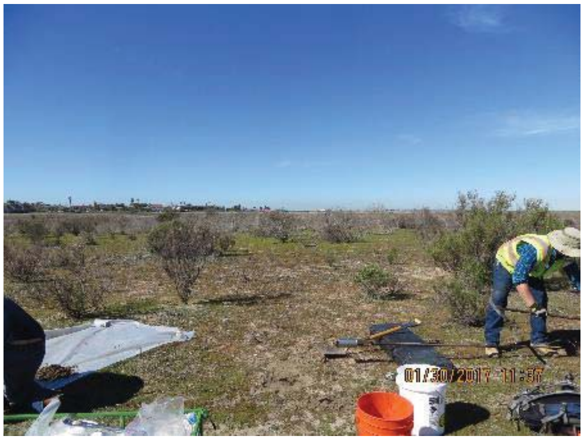
Photodocumentation of Location 2 (view to west, right), and 1-ft strata (left, presented from surface to depth).


01/30/2017 13:27


01/30/2017 12:58


01/30/2017 13:26

Photodocumentation of Location 3 (view to west, right), and 1-ft strata (left, presented from surface to depth).



Photodocumentation of Location 4 (view to west, right), and

1-ft strata (left, presented from surface to depth [counter clockwise from lower left]).

APPENDIX D: SOIL ANALYTICAL DATA REPORT

Enthalpy Analytical, Inc.
Formerly Associated Labs
806 N. Batavia - Orange, CA 92868
Tel: (714)771-6900   Fax: (714)538-1209
www.associatedlabs.com
info-sc@enthalpy.com

MONTROSE
ENVIRONMENTAL

Client: Great Ecology
Address: 2251 San Diego Ave.
Suite A218
San Diego, CA 92110
Attn: Nick Buhbe

Lab Request: 387148
Report Date: 04/21/2017
Date Received: 01/31/2017
Client ID: 15631

Comments: Pond 20 Mitigation Bank

All results have been dry weight corrected.

Supplemental Report 1

This laboratory request covers the following listed samples which were analyzed for the parameters indicated on the attached Analytical Result Report. All analyses were conducted using the appropriate methods. Methods accredited by NELAC are indicated on the report. This cover letter is an integral part of the final report.

Sample #	**Client Sample ID**
387148-001	P20-1T
387148-002	P20-1M
387148-003	P20-1Z
387148-004	P20-2T
387148-005	P20-2Z
387148-006	P20-3T
387148-007	P20-3M
387148-008	P20-3Z
387148-009	P20-4T
387148-010	P20-4M
387148-011	P20-4Z

Thank you for the opportunity to be of service to your company. Please feel free to call if there are any questions regarding this report or if we can be of further service.

Winston Yu

Report Review performed by: Winston Yu, Project Manager

NOTE: Unless notified in writing, all samples will be discarded by appropriate disposal protocol 60 days from date received.

ACCREDITED IN ACCORDANCE WITH nelac

Matrix:	Solid	**Client:**	Great Ecology	**Collector:**	
Sampled:	01/30/2017 15:00	**Site:**			
Sample #:	**387148-001**	**Client Sample #:**	P20-1T	**Sample Type:**	

Analyte	Result	DF	MDL	RDL	Units	Prepared	Analyzed	By	Notes
Method: CFA S:18.0	Prep Method: Method						QCBatchID:		
See Attached		1							
Method: EPA 6010B *NELAC*	Prep Method: EPA 3050B						QCBatchID: QC1174933		
Arsenic	**8.50**	1	0.50	1.40	mg/Kg	02/01/17	02/02/17	JN	
Cadmium	**0.72**	1	0.29	0.70	mg/Kg	02/01/17	02/02/17	JN	
Chromium	**30.2**	1	0.18	1.40	mg/Kg	02/01/17	02/02/17	JN	
Copper	**16.2**	1	0.43	1.40	mg/Kg	02/01/17	02/02/17	JN	
Lead	**5.68**	1	0.45	0.70	mg/Kg	02/01/17	02/02/17	JN	
Nickel	**11.7**	1	0.28	2.10	mg/Kg	02/01/17	02/02/17	JN	
Selenium	ND	1	1.01	1.40	mg/Kg	02/01/17	02/02/17	JN	
Silver	ND	1	0.18	0.70	mg/Kg	02/01/17	02/02/17	JN	
Zinc	**66.2**	1	0.39	7.00	mg/Kg	02/01/17	02/02/17	JN	
Method: EPA 7471A *NELAC*	Prep Method: EPA 7471A						QCBatchID: QC1175029		
Mercury	ND	1	0.03	0.20	mg/Kg	02/03/17	02/03/17	JP	
Method: EPA 8015M	Prep Method:						QCBatchID: QC1174924		
TPH (C10 to C28)	ND	1		14.00	mg/Kg	02/01/17	02/03/17	LT	
TPH (C28 to C40)	ND	1		28.01	mg/Kg	02/01/17	02/03/17	LT	
TPH (C8 to C10)	ND	1		14.00	mg/Kg	02/01/17	02/03/17	LT	
Method: EPA 8081A *NELAC*	Prep Method: EPA 3545						QCBatchID: QC1174915		
4,4'-DDD	ND	1	0.94	7.00	ug/Kg	02/01/17	02/02/17	LW	
4,4'-DDE	ND	1	0.80	7.00	ug/Kg	02/01/17	02/02/17	LW	
4,4'-DDT	ND	1	1.33	7.00	ug/Kg	02/01/17	02/02/17	LW	
a-BHC	ND	1	0.28	7.00	ug/Kg	02/01/17	02/02/17	LW	
Aldrin	ND	1	0.48	7.00	ug/Kg	02/01/17	02/02/17	LW	
b-BHC	ND	1	1.68	7.00	ug/Kg	02/01/17	02/02/17	LW	
Chlordane (technical)	ND	1	16.80	70.02	ug/Kg	02/01/17	02/02/17	LW	
d-BHC	ND	1	0.63	7.00	ug/Kg	02/01/17	02/02/17	LW	
Dieldrin	ND	1	0.88	7.00	ug/Kg	02/01/17	02/02/17	LW	
Endosulfan I	ND	1	0.39	7.00	ug/Kg	02/01/17	02/02/17	LW	
Endosulfan II	ND	1	1.12	7.00	ug/Kg	02/01/17	02/02/17	LW	
Endosulfan sulfate	ND	1	2.38	7.00	ug/Kg	02/01/17	02/02/17	LW	
Endrin	ND	1	0.87	7.00	ug/Kg	02/01/17	02/02/17	LW	
Endrin aldehyde	ND	1	1.26	7.00	ug/Kg	02/01/17	02/02/17	LW	
Endrin Ketone	ND	1	1.68	7.00	ug/Kg	02/01/17	02/02/17	LW	
Heptachlor	ND	1	0.62	7.00	ug/Kg	02/01/17	02/02/17	LW	
Heptachlor epoxide	ND	1	0.38	7.00	ug/Kg	02/01/17	02/02/17	LW	
Lindane (Gamma-BHC)	ND	1	0.42	7.00	ug/Kg	02/01/17	02/02/17	LW	
Methoxychlor	ND	1	7.28	14.00	ug/Kg	02/01/17	02/02/17	LW	
Toxaphene	ND	1	16.80	140.04	ug/Kg	02/01/17	02/02/17	LW	
Surrogate	*% Recovery*			*Limits*	*Notes*				
Decachlorobiphenyl DCB (SUR)	*106*			*50-150*					
Tetrachloro-m-xylene TCMX (SUR)	*118*			*50-150*					
Method: EPA 8082 *NELAC*	Prep Method: EPA 3545						QCBatchID: QC1174916		
PCB-1016	ND	1	4.20	70.02	ug/Kg	02/01/17	02/02/17	LW	
PCB-1221	ND	1	19.61	70.02	ug/Kg	02/01/17	02/02/17	LW	
PCB-1232	ND	1	13.30	70.02	ug/Kg	02/01/17	02/02/17	LW	
PCB-1242	ND	1	19.61	70.02	ug/Kg	02/01/17	02/02/17	LW	
PCB-1248	ND	1	26.61	70.02	ug/Kg	02/01/17	02/02/17	LW	
PCB-1254	ND	1	28.01	70.02	ug/Kg	02/01/17	02/02/17	LW	
PCB-1260	ND	1	9.66	70.02	ug/Kg	02/01/17	02/02/17	LW	
PCB-1262	ND	1	23.81	70.02	ug/Kg	02/01/17	02/02/17	LW	
PCB-1268	ND	1	12.04	70.02	ug/Kg	02/01/17	02/02/17	LW	

Matrix:	Solid	**Client:**	Great Ecology	**Collector:**	
Sampled:	01/30/2017 15:00	**Site:**			
Sample #:	**387148-001**	**Client Sample #:**	P20-1T	**Sample Type:**	

Analyte	Result	DF	MDL	RDL	Units	Prepared	Analyzed	By	Notes
Surrogate	*% Recovery*			*Limits*	*Notes*				
Decachlorobiphenyl DCB (SUR)	*98*			*50-150*					
Method: EPA 8270CM	Prep Method: EPA 3545						QCBatchID: QC1174944		
1-Methylnapthalene	ND	1	5.18	14.00	ug/Kg	02/02/17	02/02/17	BB	
2-Methylnaphthalene	ND	1	5.32	14.00	ug/Kg	02/02/17	02/02/17	BB	
Acenaphthene	ND	1	1.96	14.00	ug/Kg	02/02/17	02/02/17	BB	
Acenaphthylene	ND	1	4.62	14.00	ug/Kg	02/02/17	02/02/17	BB	
Anthracene	ND	1	1.68	14.00	ug/Kg	02/02/17	02/02/17	BB	
Benz(a)anthracene	ND	1	1.54	14.00	ug/Kg	02/02/17	02/02/17	BB	L
Benzo(a)pyrene	ND	1	2.52	14.00	ug/Kg	02/02/17	02/02/17	BB	
Benzo(b)fluoranthene	ND	1	2.38	14.00	ug/Kg	02/02/17	02/02/17	BB	L
Benzo(g,h,i)perylene	ND	1	1.68	14.00	ug/Kg	02/02/17	02/02/17	BB	
Benzo(k)fluoranthene	ND	1	2.38	14.00	ug/Kg	02/02/17	02/02/17	BB	
Chrysene	ND	1	1.16	14.00	ug/Kg	02/02/17	02/02/17	BB	
Dibenz(a,h)anthracene	ND	1	1.96	14.00	ug/Kg	02/02/17	02/02/17	BB	
Fluoranthene	ND	1	1.18	14.00	ug/Kg	02/02/17	02/02/17	BB	
Fluorene	ND	1	1.82	14.00	ug/Kg	02/02/17	02/02/17	BB	
Indeno(1,2,3-cd)pyrene	ND	1	2.52	14.00	ug/Kg	02/02/17	02/02/17	BB	
Naphthalene	ND	1	5.60	14.00	ug/Kg	02/02/17	02/02/17	BB	
Phenanthrene	ND	1	1.96	14.00	ug/Kg	02/02/17	02/02/17	BB	
Pyrene	ND	1	1.09	14.00	ug/Kg	02/02/17	02/02/17	BB	
Surrogate	*% Recovery*			*Limits*	*Notes*				
2-Fluorobiphenyl (SUR)	*75*			*30-120*					
Nitrobenzene-d5 (SUR)	*79*			*27-125*					
p-Terphenyl (SUR)	*114*			*33-155*					
Method: EPA 9034 *NELAC*	Prep Method: See Attached						QCBatchID:		
See Attached		1							
Method: SM 2540-G	Prep Method: Method						QCBatchID: QC1175058		
Total Solids	**71.4**	1			%	02/02/17	02/02/17	TP	

Matrix:	Solid	**Client:**	Great Ecology	**Collector:**	Client
Sampled:	01/30/2017 15:10	**Site:**			
Sample #:	**387148-002**	**Client Sample #:**	P20-1M	**Sample Type:**	

Analyte	Result	DF	MDL	RDL	Units	Prepared	Analyzed	By	Notes
Method: CFA S:18.0	Prep Method: Method						QCBatchID:		
See Attached		1							
Method: EPA 6010B *NELAC*	Prep Method: EPA 1312/3010A						QCBatchID: QC1177607		
Arsenic	**0.013**	1	0.004	0.01	mg/L	04/20/17	04/21/17	KLN	
Method: EPA 6010B *NELAC*	Prep Method: EPA 3050B						QCBatchID: QC1174933		
Arsenic	**10.7**	1	0.59	1.63	mg/Kg	02/01/17	02/02/17	JN	
Cadmium	**1.07**	1	0.34	0.82	mg/Kg	02/01/17	02/03/17	JN	
Chromium	**41.3**	1	0.21	1.63	mg/Kg	02/01/17	02/02/17	JN	
Copper	**21.8**	1	0.51	1.63	mg/Kg	02/01/17	02/02/17	JN	
Lead	**5.49**	1	0.52	0.82	mg/Kg	02/01/17	02/02/17	JN	
Nickel	**16.0**	1	0.33	2.45	mg/Kg	02/01/17	02/02/17	JN	
Selenium	ND	1	1.18	1.63	mg/Kg	02/01/17	02/02/17	JN	
Silver	ND	1	0.21	0.82	mg/Kg	02/01/17	02/02/17	JN	
Zinc	**85.7**	1	0.46	8.17	mg/Kg	02/01/17	02/02/17	JN	
Method: EPA 7471A *NELAC*	Prep Method: EPA 7471A						QCBatchID: QC1175029		
Mercury	**0.04 J**	1	0.03	0.23	mg/Kg	02/03/17	02/03/17	JP	J
Method: EPA 8015M	Prep Method:						QCBatchID: QC1174924		
TPH (C10 to C28)	ND	1		16.33	mg/Kg	02/01/17	02/03/17	LT	
TPH (C28 to C40)	ND	1		32.66	mg/Kg	02/01/17	02/03/17	LT	
TPH (C8 to C10)	ND	1		16.33	mg/Kg	02/01/17	02/03/17	LT	
Method: EPA 8081A *NELAC*	Prep Method: EPA 3545						QCBatchID: QC1174915		
4,4'-DDD	ND	1	1.09	8.17	ug/Kg	02/01/17	02/02/17	LW	
4,4'-DDE	ND	1	0.93	8.17	ug/Kg	02/01/17	02/02/17	LW	
4,4'-DDT	ND	1	1.55	8.17	ug/Kg	02/01/17	02/02/17	LW	
a-BHC	ND	1	0.33	8.17	ug/Kg	02/01/17	02/02/17	LW	
Aldrin	ND	1	0.56	8.17	ug/Kg	02/01/17	02/02/17	LW	
b-BHC	ND	1	1.96	8.17	ug/Kg	02/01/17	02/02/17	LW	
Chlordane (technical)	ND	1	19.60	81.66	ug/Kg	02/01/17	02/02/17	LW	
d-BHC	ND	1	0.73	8.17	ug/Kg	02/01/17	02/02/17	LW	
Dieldrin	ND	1	1.03	8.17	ug/Kg	02/01/17	02/02/17	LW	
Endosulfan I	ND	1	0.46	8.17	ug/Kg	02/01/17	02/02/17	LW	
Endosulfan II	ND	1	1.31	8.17	ug/Kg	02/01/17	02/02/17	LW	
Endosulfan sulfate	ND	1	2.78	8.17	ug/Kg	02/01/17	02/02/17	LW	
Endrin	ND	1	1.01	8.17	ug/Kg	02/01/17	02/02/17	LW	
Endrin aldehyde	ND	1	1.47	8.17	ug/Kg	02/01/17	02/02/17	LW	
Endrin Ketone	ND	1	1.96	8.17	ug/Kg	02/01/17	02/02/17	LW	
Heptachlor	ND	1	0.72	8.17	ug/Kg	02/01/17	02/02/17	LW	
Heptachlor epoxide	ND	1	0.44	8.17	ug/Kg	02/01/17	02/02/17	LW	
Lindane (Gamma-BHC)	ND	1	0.49	8.17	ug/Kg	02/01/17	02/02/17	LW	
Methoxychlor	ND	1	8.49	16.33	ug/Kg	02/01/17	02/02/17	LW	
Toxaphene	ND	1	19.60	163.32	ug/Kg	02/01/17	02/02/17	LW	

Surrogate	*% Recovery*	*Limits*	*Notes*
Decachlorobiphenyl DCB (SUR)	*84*	*50-150*	
Tetrachloro-m-xylene TCMX (SUR)	*131*	*50-150*	

Analyte	Result	DF	MDL	RDL	Units	Prepared	Analyzed	By	Notes
Method: EPA 8082 *NELAC*	Prep Method: EPA 3545						QCBatchID: QC1174916		
PCB-1016	ND	1	4.90	81.66	ug/Kg	02/01/17	02/02/17	LW	
PCB-1221	ND	1	22.86	81.66	ug/Kg	02/01/17	02/02/17	LW	
PCB-1232	ND	1	15.52	81.66	ug/Kg	02/01/17	02/02/17	LW	
PCB-1242	ND	1	22.86	81.66	ug/Kg	02/01/17	02/02/17	LW	
PCB-1248	ND	1	31.03	81.66	ug/Kg	02/01/17	02/02/17	LW	
PCB-1254	ND	1	32.66	81.66	ug/Kg	02/01/17	02/02/17	LW	
PCB-1260	ND	1	11.27	81.66	ug/Kg	02/01/17	02/02/17	LW	

Matrix:	Solid	**Client:**	Great Ecology	**Collector:**	Client
Sampled:	01/30/2017 15:10	**Site:**			
Sample #:	**387148-002**	**Client Sample #:**	P20-1M	**Sample Type:**	

Analyte	Result	DF	MDL	RDL	Units	Prepared	Analyzed	By	Notes
PCB-1262	ND	1	27.76	81.66	ug/Kg	02/01/17	02/02/17	LW	
PCB-1268	ND	1	14.05	81.66	ug/Kg	02/01/17	02/02/17	LW	

Surrogate	*% Recovery*	*Limits*	*Notes*
Decachlorobiphenyl DCB (SUR)	*77*	*50-150*	

Method: EPA 8270CM Prep Method: EPA 3545 QCBatchID: QC1174944

Analyte	Result	DF	MDL	RDL	Units	Prepared	Analyzed	By	Notes
1-Methylnapthalene	ND	1	6.04	16.33	ug/Kg	02/02/17	02/02/17	BB	
2-Methylnaphthalene	ND	1	6.21	16.33	ug/Kg	02/02/17	02/02/17	BB	
Acenaphthene	ND	1	2.29	16.33	ug/Kg	02/02/17	02/02/17	BB	
Acenaphthylene	ND	1	5.39	16.33	ug/Kg	02/02/17	02/02/17	BB	
Anthracene	ND	1	1.96	16.33	ug/Kg	02/02/17	02/02/17	BB	
Benz(a)anthracene	ND	1	1.80	16.33	ug/Kg	02/02/17	02/02/17	BB	L
Benzo(a)pyrene	ND	1	2.94	16.33	ug/Kg	02/02/17	02/02/17	BB	
Benzo(b)fluoranthene	ND	1	2.78	16.33	ug/Kg	02/02/17	02/02/17	BB	L
Benzo(g,h,i)perylene	ND	1	1.96	16.33	ug/Kg	02/02/17	02/02/17	BB	
Benzo(k)fluoranthene	ND	1	2.78	16.33	ug/Kg	02/02/17	02/02/17	BB	
Chrysene	ND	1	1.36	16.33	ug/Kg	02/02/17	02/02/17	BB	
Dibenz(a,h)anthracene	ND	1	2.29	16.33	ug/Kg	02/02/17	02/02/17	BB	
Fluoranthene	ND	1	1.37	16.33	ug/Kg	02/02/17	02/02/17	BB	
Fluorene	ND	1	2.12	16.33	ug/Kg	02/02/17	02/02/17	BB	
Indeno(1,2,3-cd)pyrene	ND	1	2.94	16.33	ug/Kg	02/02/17	02/02/17	BB	
Naphthalene	ND	1	6.53	16.33	ug/Kg	02/02/17	02/02/17	BB	
Phenanthrene	ND	1	2.29	16.33	ug/Kg	02/02/17	02/02/17	BB	
Pyrene	ND	1	1.27	16.33	ug/Kg	02/02/17	02/02/17	BB	

Surrogate	*% Recovery*	*Limits*	*Notes*
2-Fluorobiphenyl (SUR)	*67*	*30-120*	
Nitrobenzene-d5 (SUR)	*72*	*27-125*	
p-Terphenyl (SUR)	*108*	*33-155*	

Method: EPA 9034 ***NELAC*** Prep Method: See Attached QCBatchID:

Analyte	Result	DF	MDL	RDL	Units	Prepared	Analyzed	By	Notes
See Attached		1							

Method: SM 2540-G Prep Method: Method QCBatchID: QC1175058

Analyte	Result	DF	MDL	RDL	Units	Prepared	Analyzed	By	Notes
Total Solids	**61.2**	1			%	02/02/17	02/02/17	TP	

Matrix:	Solid	**Client:**	Great Ecology	**Collector:**	Client
Sampled:	01/30/2017 15:20	**Site:**			
Sample #:	**387148-003**	**Client Sample #:**	P20-1Z	**Sample Type:**	

Analyte	Result	DF	MDL	RDL	Units	Prepared	Analyzed	By	Notes
Method: CFA S:18.0	Prep Method: Method						QCBatchID:		
See Attached		1							
Method: EPA 6010B *NELAC*	Prep Method: EPA 3050B						QCBatchID: QC1174933		
Arsenic	**7.98**	1	0.53	1.46	mg/Kg	02/01/17	02/02/17	JN	
Cadmium	**0.89**	1	0.31	0.73	mg/Kg	02/01/17	02/03/17	JN	
Chromium	**23.9**	1	0.19	1.46	mg/Kg	02/01/17	02/02/17	JN	
Copper	**17.4**	1	0.45	1.46	mg/Kg	02/01/17	02/02/17	JN	
Lead	**5.83**	1	0.47	0.73	mg/Kg	02/01/17	02/02/17	JN	
Nickel	**11.3**	1	0.29	2.19	mg/Kg	02/01/17	02/02/17	JN	
Selenium	ND	1	1.05	1.46	mg/Kg	02/01/17	02/02/17	JN	
Silver	ND	1	0.19	0.73	mg/Kg	02/01/17	02/02/17	JN	
Zinc	**65.4**	1	0.41	7.29	mg/Kg	02/01/17	02/02/17	JN	
Method: EPA 7471A *NELAC*	Prep Method: EPA 7471A						QCBatchID: QC1175029		
Mercury	ND	1	0.03	0.20	mg/Kg	02/03/17	02/03/17	JP	
Method: EPA 8015M	Prep Method:						QCBatchID: QC1174924		
TPH (C10 to C28)	ND	1		14.58	mg/Kg	02/01/17	02/03/17	LT	
TPH (C28 to C40)	ND	1		29.17	mg/Kg	02/01/17	02/03/17	LT	
TPH (C8 to C10)	ND	1		14.58	mg/Kg	02/01/17	02/03/17	LT	
Method: EPA 8081A *NELAC*	Prep Method: EPA 3545						QCBatchID: QC1174915		
4,4'-DDD	ND	1	0.98	7.29	ug/Kg	02/01/17	02/02/17	LW	
4,4'-DDE	ND	1	0.83	7.29	ug/Kg	02/01/17	02/02/17	LW	
4,4'-DDT	ND	1	1.39	7.29	ug/Kg	02/01/17	02/02/17	LW	
a-BHC	ND	1	0.29	7.29	ug/Kg	02/01/17	02/02/17	LW	
Aldrin	ND	1	0.50	7.29	ug/Kg	02/01/17	02/02/17	LW	
b-BHC	ND	1	1.75	7.29	ug/Kg	02/01/17	02/02/17	LW	
Chlordane (technical)	ND	1	17.50	72.92	ug/Kg	02/01/17	02/02/17	LW	
d-BHC	ND	1	0.66	7.29	ug/Kg	02/01/17	02/02/17	LW	
Dieldrin	ND	1	0.92	7.29	ug/Kg	02/01/17	02/02/17	LW	
Endosulfan I	ND	1	0.41	7.29	ug/Kg	02/01/17	02/02/17	LW	
Endosulfan II	ND	1	1.17	7.29	ug/Kg	02/01/17	02/02/17	LW	
Endosulfan sulfate	ND	1	2.48	7.29	ug/Kg	02/01/17	02/02/17	LW	
Endrin	ND	1	0.90	7.29	ug/Kg	02/01/17	02/02/17	LW	
Endrin aldehyde	ND	1	1.31	7.29	ug/Kg	02/01/17	02/02/17	LW	
Endrin Ketone	ND	1	1.75	7.29	ug/Kg	02/01/17	02/02/17	LW	
Heptachlor	ND	1	0.64	7.29	ug/Kg	02/01/17	02/02/17	LW	
Heptachlor epoxide	ND	1	0.39	7.29	ug/Kg	02/01/17	02/02/17	LW	
Lindane (Gamma-BHC)	ND	1	0.44	7.29	ug/Kg	02/01/17	02/02/17	LW	
Methoxychlor	ND	1	7.58	14.58	ug/Kg	02/01/17	02/02/17	LW	
Toxaphene	ND	1	17.50	145.84	ug/Kg	02/01/17	02/02/17	LW	
Surrogate	*% Recovery*			*Limits*	*Notes*				
Decachlorobiphenyl DCB (SUR)	*93*			*50-150*					
Tetrachloro-m-xylene TCMX (SUR)	*118*			*50-150*					
Method: EPA 8082 *NELAC*	Prep Method: EPA 3545						QCBatchID: QC1174916		
PCB-1016	ND	1	4.38	72.92	ug/Kg	02/01/17	02/02/17	LW	
PCB-1221	ND	1	20.42	72.92	ug/Kg	02/01/17	02/02/17	LW	
PCB-1232	ND	1	13.85	72.92	ug/Kg	02/01/17	02/02/17	LW	
PCB-1242	ND	1	20.42	72.92	ug/Kg	02/01/17	02/02/17	LW	
PCB-1248	ND	1	27.71	72.92	ug/Kg	02/01/17	02/02/17	LW	
PCB-1254	ND	1	29.17	72.92	ug/Kg	02/01/17	02/02/17	LW	
PCB-1260	ND	1	10.06	72.92	ug/Kg	02/01/17	02/02/17	LW	
PCB-1262	ND	1	24.79	72.92	ug/Kg	02/01/17	02/02/17	LW	
PCB-1268	ND	1	12.54	72.92	ug/Kg	02/01/17	02/02/17	LW	

Matrix:	Solid	**Client:**	Great Ecology	**Collector:**	Client
Sampled:	01/30/2017 15:20	**Site:**			
Sample #:	**387148-003**	**Client Sample #:**	P20-1Z	**Sample Type:**	

Analyte	Result	DF	MDL	RDL	Units	Prepared	Analyzed	By	Notes
Surrogate	*% Recovery*			*Limits*	*Notes*				
Decachlorobiphenyl DCB (SUR)	*90*			*50-150*					
Method: EPA 8270CM	Prep Method: EPA 3545						QCBatchID: QC1174944		
1-Methylnapthalene	ND	1	5.40	14.58	ug/Kg	02/02/17	02/02/17	BB	
2-Methylnaphthalene	ND	1	5.54	14.58	ug/Kg	02/02/17	02/02/17	BB	
Acenaphthene	ND	1	2.04	14.58	ug/Kg	02/02/17	02/02/17	BB	
Acenaphthylene	ND	1	4.81	14.58	ug/Kg	02/02/17	02/02/17	BB	
Anthracene	ND	1	1.75	14.58	ug/Kg	02/02/17	02/02/17	BB	
Benz(a)anthracene	**19**	1	1.60	14.58	ug/Kg	02/02/17	02/02/17	BB	L
Benzo(a)pyrene	**16**	1	2.63	14.58	ug/Kg	02/02/17	02/02/17	BB	
Benzo(b)fluoranthene	ND	1	2.48	14.58	ug/Kg	02/02/17	02/02/17	BB	L
Benzo(g,h,i)perylene	ND	1	1.75	14.58	ug/Kg	02/02/17	02/02/17	BB	
Benzo(k)fluoranthene	ND	1	2.48	14.58	ug/Kg	02/02/17	02/02/17	BB	
Chrysene	**22**	1	1.21	14.58	ug/Kg	02/02/17	02/02/17	BB	
Dibenz(a,h)anthracene	ND	1	2.04	14.58	ug/Kg	02/02/17	02/02/17	BB	
Fluoranthene	ND	1	1.23	14.58	ug/Kg	02/02/17	02/02/17	BB	
Fluorene	ND	1	1.90	14.58	ug/Kg	02/02/17	02/02/17	BB	
Indeno(1,2,3-cd)pyrene	ND	1	2.63	14.58	ug/Kg	02/02/17	02/02/17	BB	
Naphthalene	ND	1	5.83	14.58	ug/Kg	02/02/17	02/02/17	BB	
Phenanthrene	ND	1	2.04	14.58	ug/Kg	02/02/17	02/02/17	BB	
Pyrene	ND	1	1.14	14.58	ug/Kg	02/02/17	02/02/17	BB	
Surrogate	*% Recovery*			*Limits*	*Notes*				
2-Fluorobiphenyl (SUR)	*68*			*30-120*					
Nitrobenzene-d5 (SUR)	*72*			*27-125*					
p-Terphenyl (SUR)	*104*			*33-155*					
Method: EPA 9034 *NELAC*	Prep Method: See Attached						QCBatchID:		
See Attached		1							
Method: SM 2540-G	Prep Method: Method						QCBatchID: QC1175058		
Total Solids	**68.6**	1			%	02/02/17	02/02/17	TP	

Matrix: Solid
Sampled: 01/30/2017 13:20
Sample #: **387148-004**
Client: Great Ecology
Site:
Client Sample #: P20-2T
Collector: Client
Sample Type:

Analyte	Result	DF	MDL	RDL	Units	Prepared	Analyzed	By	Notes
Method: CFA S:18.0	Prep Method: Method						QCBatchID:		
See Attached		1							
Method: EPA 6010B *NELAC*	Prep Method: EPA 3050B						QCBatchID: QC1174933		
Arsenic	**3.65**	1	0.46	1.26	mg/Kg	02/01/17	02/02/17	JN	
Cadmium	ND	1	0.27	0.63	mg/Kg	02/01/17	02/02/17	JN	
Chromium	**8.82**	1	0.16	1.26	mg/Kg	02/01/17	02/02/17	JN	
Copper	**6.07**	1	0.39	1.26	mg/Kg	02/01/17	02/02/17	JN	
Lead	**2.01**	1	0.40	0.63	mg/Kg	02/01/17	02/02/17	JN	
Nickel	**2.84**	1	0.25	1.90	mg/Kg	02/01/17	02/02/17	JN	
Selenium	ND	1	0.91	1.26	mg/Kg	02/01/17	02/02/17	JN	
Silver	**0.19 J**	1	0.16	0.63	mg/Kg	02/01/17	02/02/17	JN	J
Zinc	**22.0**	1	0.35	6.32	mg/Kg	02/01/17	02/02/17	JN	
Method: EPA 7471A *NELAC*	Prep Method: EPA 7471A						QCBatchID: QC1175029		
Mercury	ND	1	0.03	0.18	mg/Kg	02/03/17	02/03/17	JP	
Method: EPA 8015M	Prep Method:						QCBatchID: QC1174924		
TPH (C10 to C28)	ND	1		12.64	mg/Kg	02/01/17	02/03/17	LT	
TPH (C28 to C40)	ND	1		25.28	mg/Kg	02/01/17	02/03/17	LT	
TPH (C8 to C10)	ND	1		12.64	mg/Kg	02/01/17	02/03/17	LT	
Method: EPA 8081A *NELAC*	Prep Method: EPA 3545						QCBatchID: QC1174915		
4,4'-DDD	ND	1	0.85	6.32	ug/Kg	02/01/17	02/02/17	LW	
4,4'-DDE	ND	1	0.72	6.32	ug/Kg	02/01/17	02/02/17	LW	
4,4'-DDT	ND	1	1.20	6.32	ug/Kg	02/01/17	02/02/17	LW	
a-BHC	ND	1	0.25	6.32	ug/Kg	02/01/17	02/02/17	LW	
Aldrin	ND	1	0.43	6.32	ug/Kg	02/01/17	02/02/17	LW	
b-BHC	ND	1	1.52	6.32	ug/Kg	02/01/17	02/02/17	LW	
Chlordane (technical)	ND	1	15.17	63.20	ug/Kg	02/01/17	02/02/17	LW	
d-BHC	ND	1	0.57	6.32	ug/Kg	02/01/17	02/02/17	LW	
Dieldrin	ND	1	0.80	6.32	ug/Kg	02/01/17	02/02/17	LW	
Endosulfan I	ND	1	0.35	6.32	ug/Kg	02/01/17	02/02/17	LW	
Endosulfan II	ND	1	1.01	6.32	ug/Kg	02/01/17	02/02/17	LW	
Endosulfan sulfate	ND	1	2.15	6.32	ug/Kg	02/01/17	02/02/17	LW	
Endrin	ND	1	0.78	6.32	ug/Kg	02/01/17	02/02/17	LW	
Endrin aldehyde	ND	1	1.14	6.32	ug/Kg	02/01/17	02/02/17	LW	
Endrin Ketone	ND	1	1.52	6.32	ug/Kg	02/01/17	02/02/17	LW	
Heptachlor	ND	1	0.56	6.32	ug/Kg	02/01/17	02/02/17	LW	
Heptachlor epoxide	ND	1	0.34	6.32	ug/Kg	02/01/17	02/02/17	LW	
Lindane (Gamma-BHC)	ND	1	0.38	6.32	ug/Kg	02/01/17	02/02/17	LW	
Methoxychlor	ND	1	6.57	12.64	ug/Kg	02/01/17	02/02/17	LW	
Toxaphene	ND	1	15.17	126.41	ug/Kg	02/01/17	02/02/17	LW	

Surrogate	*% Recovery*	*Limits*	*Notes*
Decachlorobiphenyl DCB (SUR)	*88*	*50-150*	
Tetrachloro-m-xylene TCMX (SUR)	*102*	*50-150*	

Analyte	Result	DF	MDL	RDL	Units	Prepared	Analyzed	By	Notes
Method: EPA 8082 *NELAC*	Prep Method: EPA 3545						QCBatchID: QC1174916		
PCB-1016	ND	1	3.79	63.20	ug/Kg	02/01/17	02/02/17	LW	
PCB-1221	ND	1	17.70	63.20	ug/Kg	02/01/17	02/02/17	LW	
PCB-1232	ND	1	12.01	63.20	ug/Kg	02/01/17	02/02/17	LW	
PCB-1242	ND	1	17.70	63.20	ug/Kg	02/01/17	02/02/17	LW	
PCB-1248	ND	1	24.02	63.20	ug/Kg	02/01/17	02/02/17	LW	
PCB-1254	ND	1	25.28	63.20	ug/Kg	02/01/17	02/02/17	LW	
PCB-1260	ND	1	8.72	63.20	ug/Kg	02/01/17	02/02/17	LW	
PCB-1262	ND	1	21.49	63.20	ug/Kg	02/01/17	02/02/17	LW	
PCB-1268	ND	1	10.87	63.20	ug/Kg	02/01/17	02/02/17	LW	

Matrix:	Solid	**Client:**	Great Ecology	**Collector:**	Client
Sampled:	01/30/2017 13:20	**Site:**			
Sample #:	**387148-004**	**Client Sample #:**	P20-2T	**Sample Type:**	

Analyte	Result	DF	MDL	RDL	Units	Prepared	Analyzed	By	Notes
Surrogate	*% Recovery*			*Limits*	*Notes*				
Decachlorobiphenyl DCB (SUR)	*91*			*50-150*					
Method: EPA 8270CM	Prep Method: EPA 3545							QCBatchID: QC1174944	
1-Methylnapthalene	ND	1	4.68	12.64	ug/Kg	02/02/17	02/02/17	BB	
2-Methylnaphthalene	ND	1	4.80	12.64	ug/Kg	02/02/17	02/02/17	BB	
Acenaphthene	ND	1	1.77	12.64	ug/Kg	02/02/17	02/02/17	BB	
Acenaphthylene	ND	1	4.17	12.64	ug/Kg	02/02/17	02/02/17	BB	
Anthracene	ND	1	1.52	12.64	ug/Kg	02/02/17	02/02/17	BB	
Benz(a)anthracene	ND	1	1.39	12.64	ug/Kg	02/02/17	02/02/17	BB	L
Benzo(a)pyrene	ND	1	2.28	12.64	ug/Kg	02/02/17	02/02/17	BB	
Benzo(b)fluoranthene	ND	1	2.15	12.64	ug/Kg	02/02/17	02/02/17	BB	L
Benzo(g,h,i)perylene	ND	1	1.52	12.64	ug/Kg	02/02/17	02/02/17	BB	
Benzo(k)fluoranthene	ND	1	2.15	12.64	ug/Kg	02/02/17	02/02/17	BB	
Chrysene	ND	1	1.05	12.64	ug/Kg	02/02/17	02/02/17	BB	
Dibenz(a,h)anthracene	ND	1	1.77	12.64	ug/Kg	02/02/17	02/02/17	BB	
Fluoranthene	ND	1	1.06	12.64	ug/Kg	02/02/17	02/02/17	BB	
Fluorene	ND	1	1.64	12.64	ug/Kg	02/02/17	02/02/17	BB	
Indeno(1,2,3-cd)pyrene	ND	1	2.28	12.64	ug/Kg	02/02/17	02/02/17	BB	
Naphthalene	ND	1	5.06	12.64	ug/Kg	02/02/17	02/02/17	BB	
Phenanthrene	ND	1	1.77	12.64	ug/Kg	02/02/17	02/02/17	BB	
Pyrene	ND	1	0.99	12.64	ug/Kg	02/02/17	02/02/17	BB	
Surrogate	*% Recovery*			*Limits*	*Notes*				
2-Fluorobiphenyl (SUR)	*76*			*30-120*					
Nitrobenzene-d5 (SUR)	*83*			*27-125*					
p-Terphenyl (SUR)	*113*			*33-155*					
Method: EPA 9034 *NELAC*	Prep Method: See Attached							QCBatchID:	
See Attached		1							
Method: SM 2540-G	Prep Method: Method							QCBatchID: QC1175058	
Total Solids	**79.1**	1			%	02/02/17	02/02/17	TP	

Matrix:	Solid	**Client:**	Great Ecology	**Collector:**	Client
Sampled:	01/30/2017 13:40	**Site:**			
Sample #:	**387148-005**	**Client Sample #:**	P20-2Z	**Sample Type:**	

Analyte	Result	DF	MDL	RDL	Units	Prepared	Analyzed	By	Notes
Method: CFA S:18.0	Prep Method: Method						QCBatchID:		
See Attached		1							
Method: EPA 6010B *NELAC*	Prep Method: EPA 1312/3010A						QCBatchID: QC1177607		
Arsenic	ND	1	0.004	0.01	mg/L	04/20/17	04/21/17	KLN	
Method: EPA 6010B *NELAC*	Prep Method: EPA 3050B						QCBatchID: QC1174933		
Arsenic	**5.57**	1	0.52	1.43	mg/Kg	02/01/17	02/02/17	JN	
Cadmium	**0.48 J**	1	0.30	0.72	mg/Kg	02/01/17	02/02/17	JN	J
Chromium	**15.8**	1	0.19	1.43	mg/Kg	02/01/17	02/02/17	JN	
Copper	**15.8**	1	0.44	1.43	mg/Kg	02/01/17	02/02/17	JN	
Lead	**3.72**	1	0.46	0.72	mg/Kg	02/01/17	02/02/17	JN	
Nickel	**7.32**	1	0.29	2.15	mg/Kg	02/01/17	02/02/17	JN	
Selenium	ND	1	1.03	1.43	mg/Kg	02/01/17	02/02/17	JN	
Silver	ND	1	0.19	0.72	mg/Kg	02/01/17	02/02/17	JN	
Zinc	**47.8**	1	0.40	7.17	mg/Kg	02/01/17	02/02/17	JN	
Method: EPA 7471A *NELAC*	Prep Method: EPA 7471A						QCBatchID: QC1175029		
Mercury	ND	1	0.03	0.20	mg/Kg	02/03/17	02/03/17	JP	
Method: EPA 8015M	Prep Method:						QCBatchID: QC1174924		
TPH (C10 to C28)	ND	1		14.33	mg/Kg	02/01/17	02/03/17	LT	
TPH (C28 to C40)	ND	1		28.67	mg/Kg	02/01/17	02/03/17	LT	
TPH (C8 to C10)	ND	1		14.33	mg/Kg	02/01/17	02/03/17	LT	
Method: EPA 8081A *NELAC*	Prep Method: EPA 3545						QCBatchID: QC1174915		
4,4'-DDD	ND	1	0.96	7.17	ug/Kg	02/01/17	02/02/17	LW	
4,4'-DDE	ND	1	0.82	7.17	ug/Kg	02/01/17	02/02/17	LW	
4,4'-DDT	ND	1	1.36	7.17	ug/Kg	02/01/17	02/02/17	LW	
a-BHC	ND	1	0.29	7.17	ug/Kg	02/01/17	02/02/17	LW	
Aldrin	ND	1	0.49	7.17	ug/Kg	02/01/17	02/02/17	LW	
b-BHC	ND	1	1.72	7.17	ug/Kg	02/01/17	02/02/17	LW	
Chlordane (technical)	ND	1	17.20	71.66	ug/Kg	02/01/17	02/02/17	LW	
d-BHC	ND	1	0.64	7.17	ug/Kg	02/01/17	02/02/17	LW	
Dieldrin	ND	1	0.90	7.17	ug/Kg	02/01/17	02/02/17	LW	
Endosulfan I	ND	1	0.40	7.17	ug/Kg	02/01/17	02/02/17	LW	
Endosulfan II	ND	1	1.15	7.17	ug/Kg	02/01/17	02/02/17	LW	
Endosulfan sulfate	ND	1	2.44	7.17	ug/Kg	02/01/17	02/02/17	LW	
Endrin	ND	1	0.89	7.17	ug/Kg	02/01/17	02/02/17	LW	
Endrin aldehyde	ND	1	1.29	7.17	ug/Kg	02/01/17	02/02/17	LW	
Endrin Ketone	ND	1	1.72	7.17	ug/Kg	02/01/17	02/02/17	LW	
Heptachlor	ND	1	0.63	7.17	ug/Kg	02/01/17	02/02/17	LW	
Heptachlor epoxide	ND	1	0.39	7.17	ug/Kg	02/01/17	02/02/17	LW	
Lindane (Gamma-BHC)	ND	1	0.43	7.17	ug/Kg	02/01/17	02/02/17	LW	
Methoxychlor	ND	1	7.45	14.33	ug/Kg	02/01/17	02/02/17	LW	
Toxaphene	ND	1	17.20	143.33	ug/Kg	02/01/17	02/02/17	LW	
Surrogate		*% Recovery*		*Limits*	*Notes*				
Decachlorobiphenyl DCB (SUR)		*79*		*50-150*					
Tetrachloro-m-xylene TCMX (SUR)		*104*		*50-150*					
Method: EPA 8082 *NELAC*	Prep Method: EPA 3545						QCBatchID: QC1174916		
PCB-1016	ND	1	4.30	71.66	ug/Kg	02/01/17	02/02/17	LW	
PCB-1221	ND	1	20.07	71.66	ug/Kg	02/01/17	02/02/17	LW	
PCB-1232	ND	1	13.62	71.66	ug/Kg	02/01/17	02/02/17	LW	
PCB-1242	ND	1	20.07	71.66	ug/Kg	02/01/17	02/02/17	LW	
PCB-1248	ND	1	27.23	71.66	ug/Kg	02/01/17	02/02/17	LW	
PCB-1254	ND	1	28.67	71.66	ug/Kg	02/01/17	02/02/17	LW	
PCB-1260	ND	1	9.89	71.66	ug/Kg	02/01/17	02/02/17	LW	

Matrix:	Solid	**Client:**	Great Ecology	**Collector:**	Client
Sampled:	01/30/2017 13:40	**Site:**			
Sample #:	**387148-005**	**Client Sample #:**	P20-2Z	**Sample Type:**	

Analyte	Result	DF	MDL	RDL	Units	Prepared	Analyzed	By	Notes
PCB-1262	ND	1	24.37	71.66	ug/Kg	02/01/17	02/02/17	LW	
PCB-1268	ND	1	12.33	71.66	ug/Kg	02/01/17	02/02/17	LW	

Surrogate	*% Recovery*	*Limits*	*Notes*
Decachlorobiphenyl DCB (SUR)	*79*	*50-150*	

Method: EPA 8270CM Prep Method: EPA 3545 QCBatchID: QC1174944

Analyte	Result	DF	MDL	RDL	Units	Prepared	Analyzed	By	Notes
1-Methylnapthalene	ND	1	5.30	14.33	ug/Kg	02/02/17	02/02/17	BB	
2-Methylnaphthalene	ND	1	5.45	14.33	ug/Kg	02/02/17	02/02/17	BB	
Acenaphthene	ND	1	2.01	14.33	ug/Kg	02/02/17	02/02/17	BB	
Acenaphthylene	ND	1	4.73	14.33	ug/Kg	02/02/17	02/02/17	BB	
Anthracene	ND	1	1.72	14.33	ug/Kg	02/02/17	02/02/17	BB	
Benz(a)anthracene	ND	1	1.58	14.33	ug/Kg	02/02/17	02/02/17	BB	L
Benzo(a)pyrene	ND	1	2.58	14.33	ug/Kg	02/02/17	02/02/17	BB	
Benzo(b)fluoranthene	ND	1	2.44	14.33	ug/Kg	02/02/17	02/02/17	BB	L
Benzo(g,h,i)perylene	ND	1	1.72	14.33	ug/Kg	02/02/17	02/02/17	BB	
Benzo(k)fluoranthene	ND	1	2.44	14.33	ug/Kg	02/02/17	02/02/17	BB	
Chrysene	ND	1	1.19	14.33	ug/Kg	02/02/17	02/02/17	BB	
Dibenz(a,h)anthracene	ND	1	2.01	14.33	ug/Kg	02/02/17	02/02/17	BB	
Fluoranthene	ND	1	1.20	14.33	ug/Kg	02/02/17	02/02/17	BB	
Fluorene	ND	1	1.86	14.33	ug/Kg	02/02/17	02/02/17	BB	
Indeno(1,2,3-cd)pyrene	ND	1	2.58	14.33	ug/Kg	02/02/17	02/02/17	BB	
Naphthalene	ND	1	5.73	14.33	ug/Kg	02/02/17	02/02/17	BB	
Phenanthrene	ND	1	2.01	14.33	ug/Kg	02/02/17	02/02/17	BB	
Pyrene	ND	1	1.12	14.33	ug/Kg	02/02/17	02/02/17	BB	

Surrogate	*% Recovery*	*Limits*	*Notes*
2-Fluorobiphenyl (SUR)	*67*	*30-120*	
Nitrobenzene-d5 (SUR)	*80*	*27-125*	
p-Terphenyl (SUR)	*116*	*33-155*	

Method: EPA 9034 ***NELAC*** Prep Method: See Attached QCBatchID:

Analyte	Result	DF	MDL	RDL	Units	Prepared	Analyzed	By	Notes
See Attached		1							

Method: SM 2540-G Prep Method: Method QCBatchID: QC1175058

Analyte	Result	DF	MDL	RDL	Units	Prepared	Analyzed	By	Notes
Total Solids	**69.8**	1			%	02/02/17	02/02/17	TP	

Matrix:	Solid	**Client:**	Great Ecology	**Collector:**	Client
Sampled:	01/30/2017 12:00	**Site:**			
Sample #:	**387148-006**	**Client Sample #:**	P20-3T	**Sample Type:**	

Analyte		Result	DF	MDL	RDL	Units	Prepared	Analyzed	By	Notes
Method: CFA S:18.0	Prep Method: Method							QCBatchID:		
See Attached			1							
Method: EPA 6010B *NELAC*	Prep Method: EPA 3050B							QCBatchID:	QC1174933	
Arsenic		**2.26**	1	0.41	1.13	mg/Kg	02/01/17	02/02/17	JN	
Cadmium		ND	1	0.24	0.56	mg/Kg	02/01/17	02/02/17	JN	
Chromium		**5.23**	1	0.15	1.13	mg/Kg	02/01/17	02/02/17	JN	
Copper		**2.32**	1	0.35	1.13	mg/Kg	02/01/17	02/02/17	JN	
Lead		**1.93**	1	0.36	0.56	mg/Kg	02/01/17	02/02/17	JN	
Nickel		**1.51 J**	1	0.23	1.69	mg/Kg	02/01/17	02/02/17	JN	J
Selenium		ND	1	0.81	1.13	mg/Kg	02/01/17	02/02/17	JN	
Silver		ND	1	0.15	0.56	mg/Kg	02/01/17	02/02/17	JN	
Zinc		**13.2**	1	0.32	5.64	mg/Kg	02/01/17	02/02/17	JN	
Method: EPA 7471A *NELAC*	Prep Method: EPA 7471A							QCBatchID:	QC1175029	
Mercury		ND	1	0.02	0.16	mg/Kg	02/03/17	02/03/17	JP	
Method: EPA 8015M	Prep Method:							QCBatchID:	QC1174924	
TPH (C10 to C28)		ND	1		11.28	mg/Kg	02/01/17	02/03/17	LT	
TPH (C28 to C40)		ND	1		22.57	mg/Kg	02/01/17	02/03/17	LT	
TPH (C8 to C10)		ND	1		11.28	mg/Kg	02/01/17	02/03/17	LT	
Method: EPA 8081A *NELAC*	Prep Method: EPA 3545							QCBatchID:	QC1174915	
4,4'-DDD		ND	1	0.76	5.64	ug/Kg	02/01/17	02/02/17	LW	
4,4'-DDE		ND	1	0.64	5.64	ug/Kg	02/01/17	02/02/17	LW	
4,4'-DDT		ND	1	1.07	5.64	ug/Kg	02/01/17	02/02/17	LW	
a-BHC		ND	1	0.23	5.64	ug/Kg	02/01/17	02/02/17	LW	
Aldrin		ND	1	0.38	5.64	ug/Kg	02/01/17	02/02/17	LW	
b-BHC		ND	1	1.35	5.64	ug/Kg	02/01/17	02/02/17	LW	
Chlordane (technical)		ND	1	13.54	56.41	ug/Kg	02/01/17	02/02/17	LW	
d-BHC		ND	1	0.51	5.64	ug/Kg	02/01/17	02/02/17	LW	
Dieldrin		ND	1	0.71	5.64	ug/Kg	02/01/17	02/02/17	LW	
Endosulfan I		ND	1	0.32	5.64	ug/Kg	02/01/17	02/02/17	LW	
Endosulfan II		ND	1	0.90	5.64	ug/Kg	02/01/17	02/02/17	LW	
Endosulfan sulfate		ND	1	1.92	5.64	ug/Kg	02/01/17	02/02/17	LW	
Endrin		ND	1	0.70	5.64	ug/Kg	02/01/17	02/02/17	LW	
Endrin aldehyde		ND	1	1.02	5.64	ug/Kg	02/01/17	02/02/17	LW	
Endrin Ketone		ND	1	1.35	5.64	ug/Kg	02/01/17	02/02/17	LW	
Heptachlor		ND	1	0.50	5.64	ug/Kg	02/01/17	02/02/17	LW	
Heptachlor epoxide		ND	1	0.30	5.64	ug/Kg	02/01/17	02/02/17	LW	
Lindane (Gamma-BHC)		ND	1	0.34	5.64	ug/Kg	02/01/17	02/02/17	LW	
Methoxychlor		ND	1	5.87	11.28	ug/Kg	02/01/17	02/02/17	LW	
Toxaphene		ND	1	13.54	112.83	ug/Kg	02/01/17	02/02/17	LW	

Surrogate	*% Recovery*	*Limits*	*Notes*
Decachlorobiphenyl DCB (SUR)	*98*	*50-150*	
Tetrachloro-m-xylene TCMX (SUR)	*103*	*50-150*	

Analyte		Result	DF	MDL	RDL	Units	Prepared	Analyzed	By	Notes
Method: EPA 8082 *NELAC*	Prep Method: EPA 3545							QCBatchID:	QC1174916	
PCB-1016		ND	1	3.38	56.41	ug/Kg	02/01/17	02/02/17	LW	
PCB-1221		ND	1	15.80	56.41	ug/Kg	02/01/17	02/02/17	LW	
PCB-1232		ND	1	10.72	56.41	ug/Kg	02/01/17	02/02/17	LW	
PCB-1242		ND	1	15.80	56.41	ug/Kg	02/01/17	02/02/17	LW	
PCB-1248		ND	1	21.44	56.41	ug/Kg	02/01/17	02/02/17	LW	
PCB-1254		ND	1	22.57	56.41	ug/Kg	02/01/17	02/02/17	LW	
PCB-1260		ND	1	7.79	56.41	ug/Kg	02/01/17	02/02/17	LW	
PCB-1262		ND	1	19.18	56.41	ug/Kg	02/01/17	02/02/17	LW	
PCB-1268		ND	1	9.70	56.41	ug/Kg	02/01/17	02/02/17	LW	

Matrix:	Solid	**Client:**	Great Ecology	**Collector:**	Client
Sampled:	01/30/2017 12:00	**Site:**			
Sample #:	**387148-006**	**Client Sample #:**	P20-3T	**Sample Type:**	

Analyte	Result	DF	MDL	RDL	Units	Prepared	Analyzed	By	Notes
Surrogate	*% Recovery*			*Limits*	*Notes*				
Decachlorobiphenyl DCB (SUR)	*101*			*50-150*					
Method: EPA 8270CM	Prep Method: EPA 3545						QCBatchID: QC1174944		
1-Methylnapthalene	ND	1	4.17	11.28	ug/Kg	02/02/17	02/02/17	BB	
2-Methylnaphthalene	ND	1	4.29	11.28	ug/Kg	02/02/17	02/02/17	BB	
Acenaphthene	ND	1	1.58	11.28	ug/Kg	02/02/17	02/02/17	BB	
Acenaphthylene	ND	1	3.72	11.28	ug/Kg	02/02/17	02/02/17	BB	
Anthracene	ND	1	1.35	11.28	ug/Kg	02/02/17	02/02/17	BB	
Benz(a)anthracene	ND	1	1.24	11.28	ug/Kg	02/02/17	02/02/17	BB	L
Benzo(a)pyrene	ND	1	2.03	11.28	ug/Kg	02/02/17	02/02/17	BB	
Benzo(b)fluoranthene	ND	1	1.92	11.28	ug/Kg	02/02/17	02/02/17	BB	L
Benzo(g,h,i)perylene	ND	1	1.35	11.28	ug/Kg	02/02/17	02/02/17	BB	
Benzo(k)fluoranthene	ND	1	1.92	11.28	ug/Kg	02/02/17	02/02/17	BB	
Chrysene	ND	1	0.94	11.28	ug/Kg	02/02/17	02/02/17	BB	
Dibenz(a,h)anthracene	ND	1	1.58	11.28	ug/Kg	02/02/17	02/02/17	BB	
Fluoranthene	ND	1	0.95	11.28	ug/Kg	02/02/17	02/02/17	BB	
Fluorene	ND	1	1.47	11.28	ug/Kg	02/02/17	02/02/17	BB	
Indeno(1,2,3-cd)pyrene	ND	1	2.03	11.28	ug/Kg	02/02/17	02/02/17	BB	
Naphthalene	ND	1	4.51	11.28	ug/Kg	02/02/17	02/02/17	BB	
Phenanthrene	ND	1	1.58	11.28	ug/Kg	02/02/17	02/02/17	BB	
Pyrene	ND	1	0.88	11.28	ug/Kg	02/02/17	02/02/17	BB	
Surrogate	*% Recovery*			*Limits*	*Notes*				
2-Fluorobiphenyl (SUR)	*82*			*30-120*					
Nitrobenzene-d5 (SUR)	*90*			*27-125*					
p-Terphenyl (SUR)	*121*			*33-155*					
Method: EPA 9034 *NELAC*	Prep Method: See Attached						QCBatchID:		
See Attached		1							
Method: SM 2540-G	Prep Method: Method						QCBatchID: QC1175058		
Total Solids	**88.6**	1			%	02/02/17	02/02/17	TP	

Matrix:	Solid	**Client:**	Great Ecology	**Collector:**	Client
Sampled:	01/30/2017 12:10	**Site:**			
Sample #:	**387148-007**	**Client Sample #:**	P20-3M	**Sample Type:**	

Analyte	Result	DF	MDL	RDL	Units	Prepared	Analyzed	By	Notes
Method: CFA S:18.0 Prep Method: Method QCBatchID:									
See Attached		1							
Method: EPA 6010B *NELAC* Prep Method: EPA 3050B QCBatchID: QC1174933									
Arsenic	**4.56**	1	0.47	1.31	mg/Kg	02/01/17	02/02/17	JN	
Cadmium	**0.47 J**	1	0.27	0.65	mg/Kg	02/01/17	02/02/17	JN	J
Chromium	**10.7**	1	0.17	1.31	mg/Kg	02/01/17	02/02/17	JN	
Copper	**9.31**	1	0.41	1.31	mg/Kg	02/01/17	02/02/17	JN	
Lead	**2.99**	1	0.42	0.65	mg/Kg	02/01/17	02/02/17	JN	
Nickel	**5.01**	1	0.26	1.96	mg/Kg	02/01/17	02/02/17	JN	
Selenium	ND	1	0.94	1.31	mg/Kg	02/01/17	02/02/17	JN	
Silver	**0.36 J**	1	0.17	0.65	mg/Kg	02/01/17	02/02/17	JN	J
Zinc	**35.8**	1	0.37	6.54	mg/Kg	02/01/17	02/02/17	JN	
Method: EPA 7471A *NELAC* Prep Method: EPA 7471A QCBatchID: QC1175029									
Mercury	ND	1	0.03	0.18	mg/Kg	02/03/17	02/03/17	JP	
Method: EPA 8015M Prep Method: QCBatchID: QC1174924									
TPH (C10 to C28)	ND	1		13.08	mg/Kg	02/01/17	02/03/17	LT	
TPH (C28 to C40)	ND	1		26.17	mg/Kg	02/01/17	02/03/17	LT	
TPH (C8 to C10)	ND	1		13.08	mg/Kg	02/01/17	02/03/17	LT	
Method: EPA 8081A *NELAC* Prep Method: EPA 3545 QCBatchID: QC1174915									
4,4'-DDD	ND	1	0.88	6.54	ug/Kg	02/01/17	02/02/17	LW	
4,4'-DDE	ND	1	0.75	6.54	ug/Kg	02/01/17	02/02/17	LW	
4,4'-DDT	ND	1	1.24	6.54	ug/Kg	02/01/17	02/02/17	LW	
a-BHC	ND	1	0.26	6.54	ug/Kg	02/01/17	02/02/17	LW	
Aldrin	ND	1	0.44	6.54	ug/Kg	02/01/17	02/02/17	LW	
b-BHC	ND	1	1.57	6.54	ug/Kg	02/01/17	02/02/17	LW	
Chlordane (technical)	ND	1	15.70	65.42	ug/Kg	02/01/17	02/02/17	LW	
d-BHC	ND	1	0.59	6.54	ug/Kg	02/01/17	02/02/17	LW	
Dieldrin	ND	1	0.82	6.54	ug/Kg	02/01/17	02/02/17	LW	
Endosulfan I	ND	1	0.37	6.54	ug/Kg	02/01/17	02/02/17	LW	
Endosulfan II	ND	1	1.05	6.54	ug/Kg	02/01/17	02/02/17	LW	
Endosulfan sulfate	ND	1	2.22	6.54	ug/Kg	02/01/17	02/02/17	LW	
Endrin	ND	1	0.81	6.54	ug/Kg	02/01/17	02/02/17	LW	
Endrin aldehyde	ND	1	1.18	6.54	ug/Kg	02/01/17	02/02/17	LW	
Endrin Ketone	ND	1	1.57	6.54	ug/Kg	02/01/17	02/02/17	LW	
Heptachlor	ND	1	0.58	6.54	ug/Kg	02/01/17	02/02/17	LW	
Heptachlor epoxide	ND	1	0.35	6.54	ug/Kg	02/01/17	02/02/17	LW	
Lindane (Gamma-BHC)	ND	1	0.39	6.54	ug/Kg	02/01/17	02/02/17	LW	
Methoxychlor	ND	1	6.80	13.08	ug/Kg	02/01/17	02/02/17	LW	
Toxaphene	ND	1	15.70	130.84	ug/Kg	02/01/17	02/02/17	LW	

Surrogate	*% Recovery*	*Limits*	*Notes*
Decachlorobiphenyl DCB (SUR)	*86*	*50-150*	
Tetrachloro-m-xylene TCMX (SUR)	*98*	*50-150*	

Method: EPA 8082 *NELAC* Prep Method: EPA 3545 QCBatchID: QC1174916									
PCB-1016	ND	1	3.93	65.42	ug/Kg	02/01/17	02/02/17	LW	
PCB-1221	ND	1	18.32	65.42	ug/Kg	02/01/17	02/02/17	LW	
PCB-1232	ND	1	12.43	65.42	ug/Kg	02/01/17	02/02/17	LW	
PCB-1242	ND	1	18.32	65.42	ug/Kg	02/01/17	02/02/17	LW	
PCB-1248	ND	1	24.86	65.42	ug/Kg	02/01/17	02/02/17	LW	
PCB-1254	ND	1	26.17	65.42	ug/Kg	02/01/17	02/02/17	LW	
PCB-1260	ND	1	9.03	65.42	ug/Kg	02/01/17	02/02/17	LW	
PCB-1262	ND	1	22.24	65.42	ug/Kg	02/01/17	02/02/17	LW	
PCB-1268	ND	1	11.25	65.42	ug/Kg	02/01/17	02/02/17	LW	

Matrix:	Solid	**Client:**	Great Ecology	**Collector:**	Client
Sampled:	01/30/2017 12:10	**Site:**			
Sample #:	**387148-007**	**Client Sample #:**	P20-3M	**Sample Type:**	

Analyte	Result	DF	MDL	RDL	Units	Prepared	Analyzed	By	Notes
Surrogate	*% Recovery*			*Limits*	*Notes*				
Decachlorobiphenyl DCB (SUR)	*86*			*50-150*					
Method: EPA 8270CM	Prep Method: EPA 3545						QCBatchID: QC1174944		
1-Methylnapthalene	ND	1	4.84	13.08	ug/Kg	02/02/17	02/02/17	BB	
2-Methylnaphthalene	ND	1	4.97	13.08	ug/Kg	02/02/17	02/02/17	BB	
Acenaphthene	ND	1	1.83	13.08	ug/Kg	02/02/17	02/02/17	BB	
Acenaphthylene	ND	1	4.32	13.08	ug/Kg	02/02/17	02/02/17	BB	
Anthracene	ND	1	1.57	13.08	ug/Kg	02/02/17	02/02/17	BB	
Benz(a)anthracene	ND	1	1.44	13.08	ug/Kg	02/02/17	02/02/17	BB	L
Benzo(a)pyrene	ND	1	2.36	13.08	ug/Kg	02/02/17	02/02/17	BB	
Benzo(b)fluoranthene	ND	1	2.22	13.08	ug/Kg	02/02/17	02/02/17	BB	L
Benzo(g,h,i)perylene	ND	1	1.57	13.08	ug/Kg	02/02/17	02/02/17	BB	
Benzo(k)fluoranthene	ND	1	2.22	13.08	ug/Kg	02/02/17	02/02/17	BB	
Chrysene	ND	1	1.09	13.08	ug/Kg	02/02/17	02/02/17	BB	
Dibenz(a,h)anthracene	ND	1	1.83	13.08	ug/Kg	02/02/17	02/02/17	BB	
Fluoranthene	ND	1	1.10	13.08	ug/Kg	02/02/17	02/02/17	BB	
Fluorene	ND	1	1.70	13.08	ug/Kg	02/02/17	02/02/17	BB	
Indeno(1,2,3-cd)pyrene	ND	1	2.36	13.08	ug/Kg	02/02/17	02/02/17	BB	
Naphthalene	ND	1	5.23	13.08	ug/Kg	02/02/17	02/02/17	BB	
Phenanthrene	ND	1	1.83	13.08	ug/Kg	02/02/17	02/02/17	BB	
Pyrene	ND	1	1.02	13.08	ug/Kg	02/02/17	02/02/17	BB	
Surrogate	*% Recovery*			*Limits*	*Notes*				
2-Fluorobiphenyl (SUR)	*81*			*30-120*					
Nitrobenzene-d5 (SUR)	*86*			*27-125*					
p-Terphenyl (SUR)	*120*			*33-155*					
Method: EPA 9034 *NELAC*	Prep Method: See Attached						QCBatchID:		
See Attached		1							
Method: SM 2540-G	Prep Method: Method						QCBatchID: QC1175058		
Total Solids	**76.4**	1			%	02/02/17	02/02/17	TP	

Matrix:	Solid	**Client:**	Great Ecology	**Collector:**	Client
Sampled:	01/30/2017 12:20	**Site:**			
Sample #:	**387148-008**	**Client Sample #:**	P20-3Z	**Sample Type:**	

Analyte	Result	DF	MDL	RDL	Units	Prepared	Analyzed	By	Notes
Method: CFA S:18.0	Prep Method: Method						QCBatchID:		
See Attached		1							
Method: EPA 6010B *NELAC*	Prep Method: EPA 1312/3010A						QCBatchID: QC1177607		
Arsenic	ND	1	0.004	0.01	mg/L	04/20/17	04/21/17	KLN	
Method: EPA 6010B *NELAC*	Prep Method: EPA 3050B						QCBatchID: QC1174933		
Arsenic	**4.86**	1	0.42	1.18	mg/Kg	02/01/17	02/02/17	JN	
Cadmium	**0.26 J**	1	0.25	0.59	mg/Kg	02/01/17	02/02/17	JN	J
Chromium	**7.40**	1	0.15	1.18	mg/Kg	02/01/17	02/02/17	JN	
Copper	**5.80**	1	0.37	1.18	mg/Kg	02/01/17	02/02/17	JN	
Lead	**2.12**	1	0.38	0.59	mg/Kg	02/01/17	02/02/17	JN	
Nickel	**2.91**	1	0.24	1.77	mg/Kg	02/01/17	02/02/17	JN	
Selenium	ND	1	0.85	1.18	mg/Kg	02/01/17	02/02/17	JN	
Silver	ND	1	0.15	0.59	mg/Kg	02/01/17	02/02/17	JN	
Zinc	**24.0**	1	0.33	5.89	mg/Kg	02/01/17	02/02/17	JN	
Method: EPA 7471A *NELAC*	Prep Method: EPA 7471A						QCBatchID: QC1175029		
Mercury	ND	1	0.02	0.17	mg/Kg	02/03/17	02/03/17	JP	
Method: EPA 8015M	Prep Method:						QCBatchID: QC1174924		
TPH (C10 to C28)	ND	1		11.79	mg/Kg	02/01/17	02/03/17	LT	
TPH (C28 to C40)	ND	1		23.58	mg/Kg	02/01/17	02/03/17	LT	
TPH (C8 to C10)	ND	1		11.79	mg/Kg	02/01/17	02/03/17	LT	
Method: EPA 8081A *NELAC*	Prep Method: EPA 3545						QCBatchID: QC1174915		
4,4'-DDD	ND	1	0.79	5.89	ug/Kg	02/01/17	02/02/17	LW	
4,4'-DDE	ND	1	0.67	5.89	ug/Kg	02/01/17	02/02/17	LW	
4,4'-DDT	ND	1	1.12	5.89	ug/Kg	02/01/17	02/02/17	LW	
a-BHC	ND	1	0.24	5.89	ug/Kg	02/01/17	02/02/17	LW	
Aldrin	ND	1	0.40	5.89	ug/Kg	02/01/17	02/02/17	LW	
b-BHC	ND	1	1.41	5.89	ug/Kg	02/01/17	02/02/17	LW	
Chlordane (technical)	ND	1	14.15	58.94	ug/Kg	02/01/17	02/02/17	LW	
d-BHC	ND	1	0.53	5.89	ug/Kg	02/01/17	02/02/17	LW	
Dieldrin	ND	1	0.74	5.89	ug/Kg	02/01/17	02/02/17	LW	
Endosulfan I	ND	1	0.33	5.89	ug/Kg	02/01/17	02/02/17	LW	
Endosulfan II	ND	1	0.94	5.89	ug/Kg	02/01/17	02/02/17	LW	
Endosulfan sulfate	ND	1	2.00	5.89	ug/Kg	02/01/17	02/02/17	LW	
Endrin	ND	1	0.73	5.89	ug/Kg	02/01/17	02/02/17	LW	
Endrin aldehyde	ND	1	1.06	5.89	ug/Kg	02/01/17	02/02/17	LW	
Endrin Ketone	ND	1	1.41	5.89	ug/Kg	02/01/17	02/02/17	LW	
Heptachlor	ND	1	0.52	5.89	ug/Kg	02/01/17	02/02/17	LW	
Heptachlor epoxide	ND	1	0.32	5.89	ug/Kg	02/01/17	02/02/17	LW	
Lindane (Gamma-BHC)	ND	1	0.35	5.89	ug/Kg	02/01/17	02/02/17	LW	
Methoxychlor	ND	1	6.13	11.79	ug/Kg	02/01/17	02/02/17	LW	
Toxaphene	ND	1	14.15	117.88	ug/Kg	02/01/17	02/02/17	LW	
Surrogate		*% Recovery*		*Limits*	*Notes*				
Decachlorobiphenyl DCB (SUR)		*81*		*50-150*					
Tetrachloro-m-xylene TCMX (SUR)		*100*		*50-150*					
Method: EPA 8082 *NELAC*	Prep Method: EPA 3545						QCBatchID: QC1174916		
PCB-1016	ND	1	3.54	58.94	ug/Kg	02/01/17	02/02/17	LW	
PCB-1221	ND	1	16.50	58.94	ug/Kg	02/01/17	02/02/17	LW	
PCB-1232	ND	1	11.20	58.94	ug/Kg	02/01/17	02/02/17	LW	
PCB-1242	ND	1	16.50	58.94	ug/Kg	02/01/17	02/02/17	LW	
PCB-1248	ND	1	22.40	58.94	ug/Kg	02/01/17	02/02/17	LW	
PCB-1254	ND	1	23.58	58.94	ug/Kg	02/01/17	02/02/17	LW	
PCB-1260	ND	1	8.13	58.94	ug/Kg	02/01/17	02/02/17	LW	

Matrix: Solid		**Client:** Great Ecology		**Collector:** Client	
Sampled: 01/30/2017 12:20		**Site:**			
Sample #: **387148-008**		**Client Sample #:** P20-3Z		**Sample Type:**	

Analyte	Result	DF	MDL	RDL	Units	Prepared	Analyzed	By	Notes
PCB-1262	ND	1	20.04	58.94	ug/Kg	02/01/17	02/02/17	LW	
PCB-1268	ND	1	10.14	58.94	ug/Kg	02/01/17	02/02/17	LW	

Surrogate	*% Recovery*	*Limits*	*Notes*
Decachlorobiphenyl DCB (SUR)	*80*	*50-150*	

Method: EPA 8270CM Prep Method: EPA 3545 QCBatchID: QC1174944

Analyte	Result	DF	MDL	RDL	Units	Prepared	Analyzed	By	Notes
1-Methylnapthalene	ND	1	4.36	11.79	ug/Kg	02/02/17	02/07/17	BB	
2-Methylnaphthalene	ND	1	4.48	11.79	ug/Kg	02/02/17	02/07/17	BB	
Acenaphthene	ND	1	1.65	11.79	ug/Kg	02/02/17	02/07/17	BB	
Acenaphthylene	ND	1	3.89	11.79	ug/Kg	02/02/17	02/07/17	BB	
Anthracene	ND	1	1.41	11.79	ug/Kg	02/02/17	02/07/17	BB	
Benz(a)anthracene	ND	1	1.30	11.79	ug/Kg	02/02/17	02/07/17	BB	L
Benzo(a)pyrene	ND	1	2.12	11.79	ug/Kg	02/02/17	02/07/17	BB	
Benzo(b)fluoranthene	ND	1	2.00	11.79	ug/Kg	02/02/17	02/07/17	BB	L
Benzo(g,h,i)perylene	ND	1	1.41	11.79	ug/Kg	02/02/17	02/07/17	BB	
Benzo(k)fluoranthene	ND	1	2.00	11.79	ug/Kg	02/02/17	02/07/17	BB	
Chrysene	ND	1	0.98	11.79	ug/Kg	02/02/17	02/07/17	BB	
Dibenz(a,h)anthracene	ND	1	1.65	11.79	ug/Kg	02/02/17	02/07/17	BB	
Fluoranthene	ND	1	0.99	11.79	ug/Kg	02/02/17	02/07/17	BB	
Fluorene	ND	1	1.53	11.79	ug/Kg	02/02/17	02/07/17	BB	
Indeno(1,2,3-cd)pyrene	ND	1	2.12	11.79	ug/Kg	02/02/17	02/07/17	BB	
Naphthalene	ND	1	4.72	11.79	ug/Kg	02/02/17	02/07/17	BB	
Phenanthrene	ND	1	1.65	11.79	ug/Kg	02/02/17	02/07/17	BB	
Pyrene	ND	1	0.92	11.79	ug/Kg	02/02/17	02/07/17	BB	

Surrogate	*% Recovery*	*Limits*	*Notes*
2-Fluorobiphenyl (SUR)	*78*	*30-120*	
Nitrobenzene-d5 (SUR)	*88*	*27-125*	
p-Terphenyl (SUR)	*120*	*33-155*	

Method: EPA 9034 *NELAC* Prep Method: See Attached QCBatchID:

Analyte	Result	DF	MDL	RDL	Units	Prepared	Analyzed	By	Notes
See Attached		1							

Method: SM 2540-G Prep Method: Method QCBatchID: QC1175058

Analyte	Result	DF	MDL	RDL	Units	Prepared	Analyzed	By	Notes
Total Solids	**84.8**	1			%	02/02/17	02/02/17	TP	

Matrix:	Solid	**Client:**	Great Ecology	**Collector:**	Client
Sampled:	01/30/2017 10:15	**Site:**			
Sample #:	**387148-009**	**Client Sample #:**	P20-4T	**Sample Type:**	

Analyte	Result	DF	MDL	RDL	Units	Prepared	Analyzed	By	Notes
Method: CFA S:18.0	Prep Method: Method						QCBatchID:		
See Attached		1							
Method: EPA 6010B *NELAC*	Prep Method: EPA 3050B						QCBatchID: QC1174933		
Arsenic	**2.47**	1	0.40	1.12	mg/Kg	02/01/17	02/02/17	JN	
Cadmium	**0.25 J**	1	0.24	0.56	mg/Kg	02/01/17	02/02/17	JN	J
Chromium	**6.12**	1	0.15	1.12	mg/Kg	02/01/17	02/02/17	JN	
Copper	**3.83**	1	0.35	1.12	mg/Kg	02/01/17	02/02/17	JN	
Lead	**2.44**	1	0.36	0.56	mg/Kg	02/01/17	02/02/17	JN	
Nickel	**2.28**	1	0.22	1.69	mg/Kg	02/01/17	02/02/17	JN	
Selenium	ND	1	0.81	1.12	mg/Kg	02/01/17	02/02/17	JN	
Silver	ND	1	0.15	0.56	mg/Kg	02/01/17	02/02/17	JN	
Zinc	**18.6**	1	0.31	5.62	mg/Kg	02/01/17	02/02/17	JN	
Method: EPA 7471A *NELAC*	Prep Method: EPA 7471A						QCBatchID: QC1175029		
Mercury	ND	1	0.02	0.16	mg/Kg	02/03/17	02/03/17	JP	
Method: EPA 8015M	Prep Method:						QCBatchID: QC1174924		
TPH (C10 to C28)	ND	1		11.24	mg/Kg	02/01/17	02/03/17	LT	
TPH (C28 to C40)	ND	1		22.48	mg/Kg	02/01/17	02/03/17	LT	
TPH (C8 to C10)	ND	1		11.24	mg/Kg	02/01/17	02/03/17	LT	
Method: EPA 8081A *NELAC*	Prep Method: EPA 3545						QCBatchID: QC1174915		
4,4'-DDD	ND	1	0.75	5.62	ug/Kg	02/01/17	02/02/17	LW	
4,4'-DDE	ND	1	0.64	5.62	ug/Kg	02/01/17	02/02/17	LW	
4,4'-DDT	ND	1	1.07	5.62	ug/Kg	02/01/17	02/02/17	LW	
a-BHC	ND	1	0.22	5.62	ug/Kg	02/01/17	02/02/17	LW	
Aldrin	ND	1	0.38	5.62	ug/Kg	02/01/17	02/02/17	LW	
b-BHC	ND	1	1.35	5.62	ug/Kg	02/01/17	02/02/17	LW	
Chlordane (technical)	ND	1	13.49	56.20	ug/Kg	02/01/17	02/02/17	LW	
d-BHC	ND	1	0.51	5.62	ug/Kg	02/01/17	02/02/17	LW	
Dieldrin	ND	1	0.71	5.62	ug/Kg	02/01/17	02/02/17	LW	
Endosulfan I	ND	1	0.31	5.62	ug/Kg	02/01/17	02/02/17	LW	
Endosulfan II	ND	1	0.90	5.62	ug/Kg	02/01/17	02/02/17	LW	
Endosulfan sulfate	ND	1	1.91	5.62	ug/Kg	02/01/17	02/02/17	LW	
Endrin	ND	1	0.70	5.62	ug/Kg	02/01/17	02/02/17	LW	
Endrin aldehyde	ND	1	1.01	5.62	ug/Kg	02/01/17	02/02/17	LW	
Endrin Ketone	ND	1	1.35	5.62	ug/Kg	02/01/17	02/02/17	LW	
Heptachlor	ND	1	0.49	5.62	ug/Kg	02/01/17	02/02/17	LW	
Heptachlor epoxide	ND	1	0.30	5.62	ug/Kg	02/01/17	02/02/17	LW	
Lindane (Gamma-BHC)	ND	1	0.34	5.62	ug/Kg	02/01/17	02/02/17	LW	
Methoxychlor	ND	1	5.84	11.24	ug/Kg	02/01/17	02/02/17	LW	
Toxaphene	ND	1	13.49	112.40	ug/Kg	02/01/17	02/02/17	LW	
Surrogate	*% Recovery*			*Limits*	*Notes*				
Decachlorobiphenyl DCB (SUR)	*87*			*50-150*					
Tetrachloro-m-xylene TCMX (SUR)	*97*			*50-150*					
Method: EPA 8082 *NELAC*	Prep Method: EPA 3545						QCBatchID: QC1174916		
PCB-1016	ND	1	3.37	56.20	ug/Kg	02/01/17	02/02/17	LW	
PCB-1221	ND	1	15.74	56.20	ug/Kg	02/01/17	02/02/17	LW	
PCB-1232	ND	1	10.68	56.20	ug/Kg	02/01/17	02/02/17	LW	
PCB-1242	ND	1	15.74	56.20	ug/Kg	02/01/17	02/02/17	LW	
PCB-1248	ND	1	21.36	56.20	ug/Kg	02/01/17	02/02/17	LW	
PCB-1254	ND	1	22.48	56.20	ug/Kg	02/01/17	02/02/17	LW	
PCB-1260	ND	1	7.76	56.20	ug/Kg	02/01/17	02/02/17	LW	
PCB-1262	ND	1	19.11	56.20	ug/Kg	02/01/17	02/02/17	LW	
PCB-1268	ND	1	9.67	56.20	ug/Kg	02/01/17	02/02/17	LW	

Matrix:	Solid	**Client:**	Great Ecology	**Collector:**	Client
Sampled:	01/30/2017 10:15	**Site:**			
Sample #:	**387148-009**	**Client Sample #:**	P20-4T	**Sample Type:**	

Analyte	Result	DF	MDL	RDL	Units	Prepared	Analyzed	By	Notes
Surrogate	*% Recovery*			*Limits*	*Notes*				
Decachlorobiphenyl DCB (SUR)	*89*			*50-150*					
Method: EPA 8270CM	Prep Method: EPA 3545						QCBatchID: QC1174944		
1-Methylnapthalene	ND	1	4.16	11.24	ug/Kg	02/02/17	02/02/17	BB	
2-Methylnaphthalene	ND	1	4.27	11.24	ug/Kg	02/02/17	02/02/17	BB	
Acenaphthene	ND	1	1.57	11.24	ug/Kg	02/02/17	02/02/17	BB	
Acenaphthylene	ND	1	3.71	11.24	ug/Kg	02/02/17	02/02/17	BB	
Anthracene	ND	1	1.35	11.24	ug/Kg	02/02/17	02/02/17	BB	
Benz(a)anthracene	ND	1	1.24	11.24	ug/Kg	02/02/17	02/02/17	BB	L
Benzo(a)pyrene	ND	1	2.02	11.24	ug/Kg	02/02/17	02/02/17	BB	
Benzo(b)fluoranthene	ND	1	1.91	11.24	ug/Kg	02/02/17	02/02/17	BB	L
Benzo(g,h,i)perylene	ND	1	1.35	11.24	ug/Kg	02/02/17	02/02/17	BB	
Benzo(k)fluoranthene	ND	1	1.91	11.24	ug/Kg	02/02/17	02/02/17	BB	
Chrysene	ND	1	0.93	11.24	ug/Kg	02/02/17	02/02/17	BB	
Dibenz(a,h)anthracene	ND	1	1.57	11.24	ug/Kg	02/02/17	02/02/17	BB	
Fluoranthene	ND	1	0.94	11.24	ug/Kg	02/02/17	02/02/17	BB	
Fluorene	ND	1	1.46	11.24	ug/Kg	02/02/17	02/02/17	BB	
Indeno(1,2,3-cd)pyrene	ND	1	2.02	11.24	ug/Kg	02/02/17	02/02/17	BB	
Naphthalene	ND	1	4.50	11.24	ug/Kg	02/02/17	02/02/17	BB	
Phenanthrene	ND	1	1.57	11.24	ug/Kg	02/02/17	02/02/17	BB	
Pyrene	ND	1	0.88	11.24	ug/Kg	02/02/17	02/02/17	BB	
Surrogate	*% Recovery*			*Limits*	*Notes*				
2-Fluorobiphenyl (SUR)	*77*			*30-120*					
Nitrobenzene-d5 (SUR)	*85*			*27-125*					
p-Terphenyl (SUR)	*116*			*33-155*					
Method: EPA 9034 *NELAC*	Prep Method: See Attached						QCBatchID:		
See Attached		1							
Method: SM 2540-G	Prep Method: Method						QCBatchID: QC1175058		
Total Solids	**89.0**	1			%	02/02/17	02/02/17	TP	

Matrix:	Solid	**Client:**	Great Ecology	**Collector:**	Client
Sampled:	01/30/2017 10:25	**Site:**			
Sample #:	**387148-010**	**Client Sample #:**	P20-4M	**Sample Type:**	

Method: CFA S:18.0 Prep Method: Method QCBatchID:

Analyte	Result	DF	MDL	RDL	Units	Prepared	Analyzed	By	Notes
See Attached		1							

Method: EPA 6010B *NELAC* Prep Method: EPA 3050B QCBatchID: QC1174933

Analyte	Result	DF	MDL	RDL	Units	Prepared	Analyzed	By	Notes
Arsenic	**3.14**	1	0.45	1.26	mg/Kg	02/01/17	02/02/17	JN	
Cadmium	**0.31 J**	1	0.26	0.63	mg/Kg	02/01/17	02/02/17	JN	J
Chromium	**9.71**	1	0.16	1.26	mg/Kg	02/01/17	02/02/17	JN	
Copper	**7.07**	1	0.39	1.26	mg/Kg	02/01/17	02/02/17	JN	
Lead	**2.53**	1	0.40	0.63	mg/Kg	02/01/17	02/02/17	JN	
Nickel	**4.14**	1	0.25	1.88	mg/Kg	02/01/17	02/02/17	JN	
Selenium	ND	1	0.90	1.26	mg/Kg	02/01/17	02/02/17	JN	
Silver	ND	1	0.16	0.63	mg/Kg	02/01/17	02/02/17	JN	
Zinc	**34.4**	1	0.35	6.28	mg/Kg	02/01/17	02/02/17	JN	

Method: EPA 7471A *NELAC* Prep Method: EPA 7471A QCBatchID: QC1175029

Analyte	Result	DF	MDL	RDL	Units	Prepared	Analyzed	By	Notes
Mercury	ND	1	0.03	0.18	mg/Kg	02/03/17	02/03/17	JP	

Method: EPA 8015M Prep Method: QCBatchID: QC1174924

Analyte	Result	DF	MDL	RDL	Units	Prepared	Analyzed	By	Notes
TPH (C10 to C28)	ND	1		12.55	mg/Kg	02/01/17	02/03/17	LT	
TPH (C28 to C40)	ND	1		25.10	mg/Kg	02/01/17	02/03/17	LT	
TPH (C8 to C10)	ND	1		12.55	mg/Kg	02/01/17	02/03/17	LT	

Method: EPA 8081A *NELAC* Prep Method: EPA 3545 QCBatchID: QC1174915

Analyte	Result	DF	MDL	RDL	Units	Prepared	Analyzed	By	Notes
4,4'-DDD	ND	1	0.84	6.28	ug/Kg	02/01/17	02/02/17	LW	
4,4'-DDE	ND	1	0.72	6.28	ug/Kg	02/01/17	02/02/17	LW	
4,4'-DDT	ND	1	1.19	6.28	ug/Kg	02/01/17	02/02/17	LW	
a-BHC	ND	1	0.25	6.28	ug/Kg	02/01/17	02/02/17	LW	
Aldrin	ND	1	0.43	6.28	ug/Kg	02/01/17	02/02/17	LW	
b-BHC	ND	1	1.51	6.28	ug/Kg	02/01/17	02/02/17	LW	
Chlordane (technical)	ND	1	15.06	62.76	ug/Kg	02/01/17	02/02/17	LW	
d-BHC	ND	1	0.56	6.28	ug/Kg	02/01/17	02/02/17	LW	
Dieldrin	ND	1	0.79	6.28	ug/Kg	02/01/17	02/02/17	LW	
Endosulfan I	ND	1	0.35	6.28	ug/Kg	02/01/17	02/02/17	LW	
Endosulfan II	ND	1	1.00	6.28	ug/Kg	02/01/17	02/02/17	LW	
Endosulfan sulfate	ND	1	2.13	6.28	ug/Kg	02/01/17	02/02/17	LW	
Endrin	ND	1	0.78	6.28	ug/Kg	02/01/17	02/02/17	LW	
Endrin aldehyde	ND	1	1.13	6.28	ug/Kg	02/01/17	02/02/17	LW	
Endrin Ketone	ND	1	1.51	6.28	ug/Kg	02/01/17	02/02/17	LW	
Heptachlor	ND	1	0.55	6.28	ug/Kg	02/01/17	02/02/17	LW	
Heptachlor epoxide	ND	1	0.34	6.28	ug/Kg	02/01/17	02/02/17	LW	
Lindane (Gamma-BHC)	ND	1	0.38	6.28	ug/Kg	02/01/17	02/02/17	LW	
Methoxychlor	ND	1	6.53	12.55	ug/Kg	02/01/17	02/02/17	LW	
Toxaphene	ND	1	15.06	125.52	ug/Kg	02/01/17	02/02/17	LW	

Surrogate	*% Recovery*	*Limits*	*Notes*
Decachlorobiphenyl DCB (SUR)	*66*	*50-150*	
Tetrachloro-m-xylene TCMX (SUR)	*92*	*50-150*	

Method: EPA 8082 *NELAC* Prep Method: EPA 3545 QCBatchID: QC1174916

Analyte	Result	DF	MDL	RDL	Units	Prepared	Analyzed	By	Notes
PCB-1016	ND	1	3.77	62.76	ug/Kg	02/01/17	02/02/17	LW	
PCB-1221	ND	1	17.57	62.76	ug/Kg	02/01/17	02/02/17	LW	
PCB-1232	ND	1	11.92	62.76	ug/Kg	02/01/17	02/02/17	LW	
PCB-1242	ND	1	17.57	62.76	ug/Kg	02/01/17	02/02/17	LW	
PCB-1248	ND	1	23.85	62.76	ug/Kg	02/01/17	02/02/17	LW	
PCB-1254	ND	1	25.10	62.76	ug/Kg	02/01/17	02/02/17	LW	
PCB-1260	ND	1	8.66	62.76	ug/Kg	02/01/17	02/02/17	LW	
PCB-1262	ND	1	21.34	62.76	ug/Kg	02/01/17	02/02/17	LW	
PCB-1268	ND	1	10.79	62.76	ug/Kg	02/01/17	02/02/17	LW	

Matrix:	Solid	**Client:**	Great Ecology	**Collector:**	Client
Sampled:	01/30/2017 10:25	**Site:**			
Sample #:	**387148-010**	**Client Sample #:**	P20-4M	**Sample Type:**	

Analyte	Result	DF	MDL	RDL	Units	Prepared	Analyzed	By	Notes
Surrogate	*% Recovery*			*Limits*	*Notes*				
Decachlorobiphenyl DCB (SUR)	*66*			*50-150*					
Method: EPA 8270CM	Prep Method: EPA 3545						QCBatchID: QC1174944		
1-Methylnapthalene	ND	1	4.64	12.55	ug/Kg	02/02/17	02/02/17	BB	
2-Methylnaphthalene	ND	1	4.77	12.55	ug/Kg	02/02/17	02/02/17	BB	
Acenaphthene	ND	1	1.76	12.55	ug/Kg	02/02/17	02/02/17	BB	
Acenaphthylene	ND	1	4.14	12.55	ug/Kg	02/02/17	02/02/17	BB	
Anthracene	ND	1	1.51	12.55	ug/Kg	02/02/17	02/02/17	BB	
Benz(a)anthracene	ND	1	1.38	12.55	ug/Kg	02/02/17	02/02/17	BB	L
Benzo(a)pyrene	ND	1	2.26	12.55	ug/Kg	02/02/17	02/02/17	BB	
Benzo(b)fluoranthene	ND	1	2.13	12.55	ug/Kg	02/02/17	02/02/17	BB	L
Benzo(g,h,i)perylene	ND	1	1.51	12.55	ug/Kg	02/02/17	02/02/17	BB	
Benzo(k)fluoranthene	ND	1	2.13	12.55	ug/Kg	02/02/17	02/02/17	BB	
Chrysene	ND	1	1.04	12.55	ug/Kg	02/02/17	02/02/17	BB	
Dibenz(a,h)anthracene	ND	1	1.76	12.55	ug/Kg	02/02/17	02/02/17	BB	
Fluoranthene	ND	1	1.05	12.55	ug/Kg	02/02/17	02/02/17	BB	
Fluorene	ND	1	1.63	12.55	ug/Kg	02/02/17	02/02/17	BB	
Indeno(1,2,3-cd)pyrene	ND	1	2.26	12.55	ug/Kg	02/02/17	02/02/17	BB	
Naphthalene	ND	1	5.02	12.55	ug/Kg	02/02/17	02/02/17	BB	
Phenanthrene	ND	1	1.76	12.55	ug/Kg	02/02/17	02/02/17	BB	
Pyrene	ND	1	0.98	12.55	ug/Kg	02/02/17	02/02/17	BB	
Surrogate	*% Recovery*			*Limits*	*Notes*				
2-Fluorobiphenyl (SUR)	*85*			*30-120*					
Nitrobenzene-d5 (SUR)	*85*			*27-125*					
p-Terphenyl (SUR)	*116*			*33-155*					
Method: EPA 9034 *NELAC*	Prep Method: See Attached						QCBatchID:		
See Attached		1							
Method: SM 2540-G	Prep Method: Method						QCBatchID: QC1175059		
Total Solids	**79.7**	1			%	02/02/17	02/02/17	TP	

Matrix:	Solid	**Client:**	Great Ecology	**Collector:**	Client
Sampled:	01/30/2017 10:35	**Site:**			
Sample #:	**387148-011**	**Client Sample #:**	P20-4Z	**Sample Type:**	

Analyte	Result	DF	MDL	RDL	Units	Prepared	Analyzed	By	Notes
Method: CFA S:18.0	Prep Method: Method						QCBatchID:		
See Attached		1							
Method: EPA 6010B *NELAC*	Prep Method: EPA 1312/3010A						QCBatchID: QC1177607		
Arsenic	**0.016**	1	0.004	0.01	mg/L	04/20/17	04/21/17	KLN	
Method: EPA 6010B *NELAC*	Prep Method: EPA 3050B						QCBatchID: QC1174933		
Arsenic	**4.93**	1	0.45	1.24	mg/Kg	02/01/17	02/02/17	JN	
Cadmium	**0.27 J**	1	0.26	0.62	mg/Kg	02/01/17	02/02/17	JN	J
Chromium	**9.81**	1	0.16	1.24	mg/Kg	02/01/17	02/02/17	JN	
Copper	**6.73**	1	0.39	1.24	mg/Kg	02/01/17	02/02/17	JN	
Lead	**2.62**	1	0.40	0.62	mg/Kg	02/01/17	02/02/17	JN	
Nickel	**4.03**	1	0.25	1.87	mg/Kg	02/01/17	02/02/17	JN	
Selenium	ND	1	0.90	1.24	mg/Kg	02/01/17	02/02/17	JN	
Silver	ND	1	0.16	0.62	mg/Kg	02/01/17	02/02/17	JN	
Zinc	**30.9**	1	0.35	6.22	mg/Kg	02/01/17	02/02/17	JN	
Method: EPA 7471A *NELAC*	Prep Method: EPA 7471A						QCBatchID: QC1175029		
Mercury	ND	1	0.02	0.17	mg/Kg	02/03/17	02/03/17	JP	
Method: EPA 8015M	Prep Method:						QCBatchID: QC1174924		
TPH (C10 to C28)	ND	1		12.45	mg/Kg	02/01/17	02/03/17	LT	
TPH (C28 to C40)	ND	1		24.89	mg/Kg	02/01/17	02/03/17	LT	
TPH (C8 to C10)	ND	1		12.45	mg/Kg	02/01/17	02/03/17	LT	
Method: EPA 8081A *NELAC*	Prep Method: EPA 3545						QCBatchID: QC1174915		
4,4'-DDD	ND	1	0.83	6.22	ug/Kg	02/01/17	02/02/17	LW	
4,4'-DDE	ND	1	0.71	6.22	ug/Kg	02/01/17	02/02/17	LW	
4,4'-DDT	ND	1	1.18	6.22	ug/Kg	02/01/17	02/02/17	LW	
a-BHC	ND	1	0.25	6.22	ug/Kg	02/01/17	02/02/17	LW	
Aldrin	ND	1	0.42	6.22	ug/Kg	02/01/17	02/02/17	LW	
b-BHC	ND	1	1.49	6.22	ug/Kg	02/01/17	02/02/17	LW	
Chlordane (technical)	ND	1	14.94	62.24	ug/Kg	02/01/17	02/02/17	LW	
d-BHC	ND	1	0.56	6.22	ug/Kg	02/01/17	02/02/17	LW	
Dieldrin	ND	1	0.78	6.22	ug/Kg	02/01/17	02/02/17	LW	
Endosulfan I	ND	1	0.35	6.22	ug/Kg	02/01/17	02/02/17	LW	
Endosulfan II	ND	1	1.00	6.22	ug/Kg	02/01/17	02/02/17	LW	
Endosulfan sulfate	ND	1	2.12	6.22	ug/Kg	02/01/17	02/02/17	LW	
Endrin	ND	1	0.77	6.22	ug/Kg	02/01/17	02/02/17	LW	
Endrin aldehyde	ND	1	1.12	6.22	ug/Kg	02/01/17	02/02/17	LW	
Endrin Ketone	ND	1	1.49	6.22	ug/Kg	02/01/17	02/02/17	LW	
Heptachlor	ND	1	0.55	6.22	ug/Kg	02/01/17	02/02/17	LW	
Heptachlor epoxide	ND	1	0.34	6.22	ug/Kg	02/01/17	02/02/17	LW	
Lindane (Gamma-BHC)	ND	1	0.37	6.22	ug/Kg	02/01/17	02/02/17	LW	
Methoxychlor	ND	1	6.47	12.45	ug/Kg	02/01/17	02/02/17	LW	
Toxaphene	ND	1	14.94	124.47	ug/Kg	02/01/17	02/02/17	LW	

Surrogate	*% Recovery*	*Limits*	*Notes*
Decachlorobiphenyl DCB (SUR)	*91*	*50-150*	
Tetrachloro-m-xylene TCMX (SUR)	*92*	*50-150*	

Analyte	Result	DF	MDL	RDL	Units	Prepared	Analyzed	By	Notes
Method: EPA 8082 *NELAC*	Prep Method: EPA 3545						QCBatchID: QC1174916		
PCB-1016	ND	1	3.73	62.24	ug/Kg	02/01/17	02/02/17	LW	
PCB-1221	ND	1	17.43	62.24	ug/Kg	02/01/17	02/02/17	LW	
PCB-1232	ND	1	11.82	62.24	ug/Kg	02/01/17	02/02/17	LW	
PCB-1242	ND	1	17.43	62.24	ug/Kg	02/01/17	02/02/17	LW	
PCB-1248	ND	1	23.65	62.24	ug/Kg	02/01/17	02/02/17	LW	
PCB-1254	ND	1	24.89	62.24	ug/Kg	02/01/17	02/02/17	LW	
PCB-1260	ND	1	8.59	62.24	ug/Kg	02/01/17	02/02/17	LW	

Matrix:	Solid	**Client:**	Great Ecology	**Collector:**	Client
Sampled:	01/30/2017 10:35	**Site:**			
Sample #:	**387148-011**	**Client Sample #:**	P20-4Z	**Sample Type:**	

Analyte	Result	DF	MDL	RDL	Units	Prepared	Analyzed	By	Notes
PCB-1262	ND	1	21.16	62.24	ug/Kg	02/01/17	02/02/17	LW	
PCB-1268	ND	1	10.70	62.24	ug/Kg	02/01/17	02/02/17	LW	

Surrogate	*% Recovery*	*Limits*	*Notes*
Decachlorobiphenyl DCB (SUR)	*93*	*50-150*	

Method: EPA 8270CM Prep Method: EPA 3545 QCBatchID: QC1174944

Analyte	Result	DF	MDL	RDL	Units	Prepared	Analyzed	By	Notes
1-Methylnapthalene	ND	1	4.61	12.45	ug/Kg	02/02/17	02/02/17	BB	
2-Methylnaphthalene	ND	1	4.73	12.45	ug/Kg	02/02/17	02/02/17	BB	
Acenaphthene	ND	1	1.74	12.45	ug/Kg	02/02/17	02/02/17	BB	
Acenaphthylene	ND	1	4.11	12.45	ug/Kg	02/02/17	02/02/17	BB	
Anthracene	ND	1	1.49	12.45	ug/Kg	02/02/17	02/02/17	BB	
Benz(a)anthracene	ND	1	1.37	12.45	ug/Kg	02/02/17	02/02/17	BB	L
Benzo(a)pyrene	ND	1	2.24	12.45	ug/Kg	02/02/17	02/02/17	BB	
Benzo(b)fluoranthene	ND	1	2.12	12.45	ug/Kg	02/02/17	02/02/17	BB	L
Benzo(g,h,i)perylene	ND	1	1.49	12.45	ug/Kg	02/02/17	02/02/17	BB	
Benzo(k)fluoranthene	ND	1	2.12	12.45	ug/Kg	02/02/17	02/02/17	BB	
Chrysene	ND	1	1.03	12.45	ug/Kg	02/02/17	02/02/17	BB	
Dibenz(a,h)anthracene	ND	1	1.74	12.45	ug/Kg	02/02/17	02/02/17	BB	
Fluoranthene	ND	1	1.05	12.45	ug/Kg	02/02/17	02/02/17	BB	
Fluorene	ND	1	1.62	12.45	ug/Kg	02/02/17	02/02/17	BB	
Indeno(1,2,3-cd)pyrene	ND	1	2.24	12.45	ug/Kg	02/02/17	02/02/17	BB	
Naphthalene	ND	1	4.98	12.45	ug/Kg	02/02/17	02/02/17	BB	
Phenanthrene	ND	1	1.74	12.45	ug/Kg	02/02/17	02/02/17	BB	
Pyrene	ND	1	0.97	12.45	ug/Kg	02/02/17	02/02/17	BB	

Surrogate	*% Recovery*	*Limits*	*Notes*
2-Fluorobiphenyl (SUR)	*38*	*30-120*	
Nitrobenzene-d5 (SUR)	*41*	*27-125*	
p-Terphenyl (SUR)	*60*	*33-155*	

Method: EPA 9034 ***NELAC*** Prep Method: See Attached QCBatchID:

Analyte	Result	DF	MDL	RDL	Units	Prepared	Analyzed	By	Notes
See Attached		1							

Method: SM 2540-G Prep Method: Method QCBatchID: QC1175059

Analyte	Result	DF	MDL	RDL	Units	Prepared	Analyzed	By	Notes
Total Solids	**80.3**	1			%	02/02/17	02/02/17	TP	

QCBatchID:	QC1174915	**Analyst:**	nhernandez	**Method:**	EPA 8081A
Matrix:	Solid	**Analyzed:**	02/01/2017	**Instrument:**	SVOA-GC (group)

Blank Summary

Analyte	Blank Result	Units	MDL	RDL	Notes	
QC1174915MB1						
4,4'-DDD	ND	ug/Kg	0.67	5		
4,4'-DDE	ND	ug/Kg	0.57	5		
4,4'-DDT	ND	ug/Kg	0.95	5		
a-BHC	ND	ug/Kg	0.2	5		
Aldrin	ND	ug/Kg	0.34	5		
b-BHC	ND	ug/Kg	1.2	5		
Chlordane (technical)	ND	ug/Kg	12	50		
d-BHC	ND	ug/Kg	0.45	5		
Dieldrin	ND	ug/Kg	0.63	5		
Endosulfan I	ND	ug/Kg	0.28	5		
Endosulfan II	ND	ug/Kg	0.8	5		
Endosulfan sulfate	ND	ug/Kg	1.7	5		
Endrin	ND	ug/Kg	0.62	5		
Endrin aldehyde	ND	ug/Kg	0.9	5		
Endrin Ketone	ND	ug/Kg	1.2	5		
Heptachlor	ND	ug/Kg	0.44	5		
Heptachlor epoxide	ND	ug/Kg	0.27	5		
Lindane (Gamma-BHC)	ND	ug/Kg	0.3	5		
Methoxychlor	ND	ug/Kg	5.2	10		
Toxaphene	ND	ug/Kg	12	100		

Lab Control Spike/ Lab Control Spike Duplicate Summary

	Spike Amount		Spike Result			Recoveries			Limits		
Analyte	LCS	LCSD	LCS	LCSD	Units	LCS	LCSD	RPD	%Rec	RPD	Notes
QC1174915LCS1											
4,4'-DDE	50		50		ug/Kg	100			70-130		
4,4'-DDT	50		50		ug/Kg	100			70-130		
a-BHC	50		55		ug/Kg	110			70-130		
Aldrin	50		52		ug/Kg	104			70-130		
b-BHC	50		53		ug/Kg	106			70-130		
d-BHC	50		52		ug/Kg	104			70-130		
Dieldrin	50		54		ug/Kg	108			70-130		
Endosulfan I	50		49		ug/Kg	98			70-130		
Endosulfan II	50		49		ug/Kg	98			70-130		
Endosulfan sulfate	50		55		ug/Kg	110			70-130		
Endrin	50		54		ug/Kg	108			70-130		
Endrin aldehyde	50		37		ug/Kg	74			70-130		
Heptachlor	50		54		ug/Kg	108			70-130		
Heptachlor epoxide	50		54		ug/Kg	108			70-130		
Lindane (Gamma-BHC)	50		53		ug/Kg	106			70-130		
Methoxychlor	50		54		ug/Kg	108			70-130		

Matrix Spike/Matrix Spike Duplicate Summary

	Sample	Spike Amount		Spike Result			Recoveries			Limits		
Analyte	Amount	MS	MSD	MS	MSD	Units	MS	MSD	RPD	%Rec	RPD	Notes
QC1174915MS1, QC1174915MSD1										**Source:**	**387148-001**	
4,4'-DDE	ND	50	50	52	43	ug/Kg	104	86	18.9	70-130	20	
4,4'-DDT	ND	50	50	48	42	ug/Kg	96	84	13.3	70-130	20	
a-BHC	ND	50	50	53	44	ug/Kg	106	88	18.6	70-130	20	
Aldrin	ND	50	50	50	42	ug/Kg	100	84	17.4	70-130	20	
b-BHC	ND	50	50	51	44	ug/Kg	102	88	14.7	70-130	20	

QCBatchID:	**QC1174915**	**Analyst:** nhernandez	**Method:**	EPA 8081A
Matrix:	Solid	**Analyzed:** 02/01/2017	**Instrument:**	SVOA-GC (group)

Analyte	Sample Amount	Spike Amount MS	Spike Amount MSD	Spike Result MS	Spike Result MSD	Units	Recoveries MS	Recoveries MSD	RPD	Limits %Rec	Limits RPD	Notes
QC1174915MS1, QC1174915MSD1											**Source:**	**387148-001**
d-BHC	ND	50	50	52	44	ug/Kg	104	88	16.7	70-130	20	
Dieldrin	ND	50	50	53	45	ug/Kg	106	90	16.3	70-130	20	
Endosulfan I	ND	50	50	49	41	ug/Kg	98	82	17.8	70-130	20	
Endosulfan II	ND	50	50	48	41	ug/Kg	96	82	15.7	70-130	20	
Endosulfan sulfate	ND	50	50	53	47	ug/Kg	106	94	12.0	70-130	20	
Endrin	ND	50	50	53	44	ug/Kg	106	88	18.6	70-130	20	
Endrin aldehyde	ND	50	50	38	37	ug/Kg	76	74	2.7	70-130	20	
Heptachlor	ND	50	50	52	44	ug/Kg	104	88	16.7	70-130	20	
Heptachlor epoxide	ND	50	50	53	44	ug/Kg	106	88	18.6	70-130	20	
Lindane (Gamma-BHC)	ND	50	50	51	43	ug/Kg	102	86	17.0	70-130	20	
Methoxychlor	ND	50	50	50	44	ug/Kg	100	88	12.8	70-130	20	

QCBatchID:	**QC1174916**	**Analyst:**	nhernandez	**Method:**	EPA 8082
Matrix:	Solid	**Analyzed:**	02/01/2017	**Instrument:**	SVOA-GC (group)

Blank Summary

Analyte	Blank Result	Units	MDL	RDL	Notes	
QC1174916MB1						
PCB-1016	ND	ug/Kg	3	50		
PCB-1221	ND	ug/Kg	14	50		
PCB-1232	ND	ug/Kg	9.5	50		
PCB-1242	ND	ug/Kg	14	50		
PCB-1248	ND	ug/Kg	19	50		
PCB-1254	ND	ug/Kg	20	50		
PCB-1260	ND	ug/Kg	6.9	50		
PCB-1262	ND	ug/Kg	17	50		
PCB-1268	ND	ug/Kg	8.6	50		

Lab Control Spike/ Lab Control Spike Duplicate Summary

	Spike Amount		Spike Result			Recoveries			Limits		
Analyte	LCS	LCSD	LCS	LCSD	Units	LCS	LCSD	RPD	%Rec	RPD	Notes
QC1174916LCS1											
PCB-1016	500		440		ug/Kg	88			70-130		
PCB-1260	500		510		ug/Kg	102			70-130		

Matrix Spike/Matrix Spike Duplicate Summary

	Sample	Spike Amount		Spike Result			Recoveries			Limits		
Analyte	Amount	MS	MSD	MS	MSD	Units	MS	MSD	RPD	%Rec	RPD	Notes
QC1174916MS1, QC1174916MSD1										**Source:**	**387148-001**	
PCB-1016	ND	500	500	460	450	ug/Kg	92	90	2.2	70-130	20	
PCB-1260	ND	500	500	510	510	ug/Kg	102	102	0.0	70-130	20	

QCBatchID: QC1174924 **Analyst:** lytagas **Method:** EPA 8015M

Matrix: Solid **Analyzed:** 02/01/2017 **Instrument:** SVOA-GC (group)

Blank Summary

Analyte	Blank Result	Units	MDL	RDL	Notes	
QC1174924MB1						
TPH (C10 to C28)	ND	mg/Kg	10	10		
TPH (C28 to C40)	ND	mg/Kg	20	20		
TPH (C8 to C10)	ND	mg/Kg	10	10		

Lab Control Spike/ Lab Control Spike Duplicate Summary

	Spike Amount		Spike Result			Recoveries			Limits		
Analyte	LCS	LCSD	LCS	LCSD	Units	LCS	LCSD	RPD	%Rec	RPD	Notes
QC1174924LCS1, QC1174924LCSD1											
TPH (C10 to C28)	250	250	240	230	mg/Kg	96	92	4	70-130	20	

QCBatchID:	QC1174933	**Analyst:**	kedy	**Method:**	EPA 6010B
Matrix:	Solid	**Analyzed:**	02/01/2017	**Instrument:**	AAICP (group)

Blank Summary

Analyte	Blank Result		Units	MDL	RDL	Notes
QC1174933MB1						
Antimony	**0.49**	**J**	mg/Kg	0.37	3	
Arsenic	ND		mg/Kg	0.36	1	
Barium	ND		mg/Kg	0.23	1	
Beryllium	ND		mg/Kg	0.17	0.5	
Cadmium	ND		mg/Kg	0.21	0.5	
Chromium	ND		mg/Kg	0.13	1	
Cobalt	ND		mg/Kg	0.19	0.5	
Copper	ND		mg/Kg	0.31	1	
Lead	ND		mg/Kg	0.32	0.5	
Molybdenum	ND		mg/Kg	0.13	1	
Nickel	ND		mg/Kg	0.2	1.5	
Selenium	**0.97**	**J**	mg/Kg	0.72	1	
Silver	ND		mg/Kg	0.13	0.5	
Thallium	ND		mg/Kg	0.42	1	
Vanadium	ND		mg/Kg	0.37	0.5	
Zinc	**0.38**	**J**	mg/Kg	0.28	5	

Lab Control Spike/ Lab Control Spike Duplicate Summary

	Spike Amount		Spike Result			Recoveries			Limits		
Analyte	LCS	LCSD	LCS	LCSD	Units	LCS	LCSD	RPD	%Rec	RPD	Notes
QC1174933LCS1											
Antimony	100		97.5		mg/Kg	98			80-120		
Arsenic	100		101		mg/Kg	101			80-120		
Barium	100		103		mg/Kg	103			80-120		
Beryllium	100		96.6		mg/Kg	97			80-120		
Cadmium	100		100		mg/Kg	100			80-120		
Chromium	100		98.8		mg/Kg	99			80-120		
Cobalt	100		103		mg/Kg	103			80-120		
Copper	100		99.0		mg/Kg	99			80-120		
Lead	100		101		mg/Kg	101			80-120		
Molybdenum	100		103		mg/Kg	103			80-120		
Nickel	100		101		mg/Kg	101			80-120		
Selenium	100		93.6		mg/Kg	94			80-120		
Silver	100		91.4		mg/Kg	91			80-120		
Thallium	100		106		mg/Kg	106			80-120		
Vanadium	100		103		mg/Kg	103			80-120		
Zinc	100		99.5		mg/Kg	100			80-120		

Matrix Spike/Matrix Spike Duplicate Summary

	Sample	Spike Amount		Spike Result			Recoveries			Limits		
Analyte	Amount	MS	MSD	MS	MSD	Units	MS	MSD	RPD	%Rec	RPD	Notes
QC1174933MS1, QC1174933MSD1											**Source:**	**387148-009**
Antimony	ND	100	100	43.4	49.4	mg/Kg	43	49	12.9	75-125	20	M
Arsenic	2.47	100	100	114	113	mg/Kg	112	111	0.9	75-125	20	
Barium	52.8	100	100	166	158	mg/Kg	113	105	4.9	75-125	20	
Beryllium	ND	100	100	111	116	mg/Kg	111	116	4.4	75-125	20	
Cadmium	0.25	100	100	116	119	mg/Kg	116	119	2.6	75-125	20	
Chromium	6.12	100	100	121	122	mg/Kg	115	116	0.8	75-125	20	
Cobalt	3.64	100	100	120	122	mg/Kg	116	118	1.7	75-125	20	
Copper	3.83	100	100	114	116	mg/Kg	110	112	1.7	75-125	20	
Lead	2.44	100	100	111	113	mg/Kg	109	111	1.8	75-125	20	

QCBatchID:	QC1174933	**Analyst:**	kedy	**Method:**	EPA 6010B
Matrix:	Solid	**Analyzed:**	02/01/2017	**Instrument:**	AAICP (group)

	Sample	Spike Amount		Spike Result			Recoveries			Limits		
Analyte	Amount	MS	MSD	MS	MSD	Units	MS	MSD	RPD	%Rec	RPD	Notes
QC1174933MS1, QC1174933MSD1											**Source:**	**387148-009**
Molybdenum	ND	100	100	103	106	mg/Kg	103	106	2.9	75-125	20	
Nickel	2.28	100	100	118	119	mg/Kg	116	117	0.8	75-125	20	
Selenium	ND	100	100	86.9	92.7	mg/Kg	87	93	6.5	75-125	20	
Silver	ND	100	100	93.6	95.0	mg/Kg	94	95	1.5	75-125	20	
Thallium	ND	100	100	106	109	mg/Kg	106	109	2.8	75-125	20	
Vanadium	30.1	100	100	156	151	mg/Kg	126	121	3.3	75-125	20	M
Zinc	18.6	100	100	138	137	mg/Kg	119	118	0.7	75-125	20	

QCBatchID:	**QC1174944**	**Analyst:**	nhernandez	**Method:**	EPA 8270CM
Matrix:	Solid	**Analyzed:**	02/02/2017	**Instrument:**	SVOA-MS (group)

Blank Summary

Analyte	Blank Result	Units	MDL	RDL	Notes
QC1174944MB1					
2-Methylnaphthalene	ND	ug/Kg	3.8	10	
Acenaphthene	ND	ug/Kg	1.4	10	
Acenaphthylene	ND	ug/Kg	3.3	10	
Anthracene	ND	ug/Kg	1.2	10	
Benz(a)anthracene	ND	ug/Kg	1.1	10	
Benzo(a)pyrene	ND	ug/Kg	1.8	10	
Benzo(b)fluoranthene	ND	ug/Kg	1.7	10	
Benzo(g,h,i)perylene	ND	ug/Kg	1.2	10	
Benzo(k)fluoranthene	ND	ug/Kg	1.7	10	
Chrysene	ND	ug/Kg	0.83	10	
Dibenz(a,h)anthracene	ND	ug/Kg	1.4	10	
Fluoranthene	ND	ug/Kg	0.84	10	
Fluorene	ND	ug/Kg	1.3	10	
Indeno(1,2,3-cd)pyrene	ND	ug/Kg	1.8	10	
Naphthalene	ND	ug/Kg	4	10	
Phenanthrene	ND	ug/Kg	1.4	10	
Pyrene	ND	ug/Kg	0.78	10	

Lab Control Spike/ Lab Control Spike Duplicate Summary

	Spike Amount		Spike Result			Recoveries			Limits		
Analyte	LCS	LCSD	LCS	LCSD	Units	LCS	LCSD	RPD	%Rec	RPD	Notes
QC1174944LCS1											
1-Methylnaphthalene	50		38.8650		ug/Kg	78			70-130		
2-Methylnaphthalene	50		39		ug/Kg	78			70-130		
Acenaphthene	50		47		ug/Kg	94			70-130		
Acenaphthylene	50		41		ug/Kg	82			70-130		
Anthracene	50		49		ug/Kg	98			70-130		
Benz(a)anthracene	50		68		ug/Kg	136			70-130		L
Benzo(a)pyrene	50		47		ug/Kg	94			70-130		
Benzo(b)fluoranthene	50		83		ug/Kg	166			70-130		L
Benzo(g,h,i)perylene	50		38		ug/Kg	76			70-130		
Benzo(k)fluoranthene	50		52		ug/Kg	104			70-130		
Chrysene	50		44		ug/Kg	88			70-130		
Dibenz(a,h)anthracene	50		52		ug/Kg	104			70-130		
Fluoranthene	50		56		ug/Kg	112			70-130		
Fluorene	50		46		ug/Kg	92			70-130		
Indeno(1,2,3-cd)pyrene	50		50		ug/Kg	100			70-130		
Naphthalene	50		37		ug/Kg	74			70-130		
Phenanthrene	50		52		ug/Kg	104			70-130		
Pyrene	50		54		ug/Kg	108			70-130		

Matrix Spike/Matrix Spike Duplicate Summary

	Sample	Spike Amount		Spike Result			Recoveries			Limits		
Analyte	Amount	MS	MSD	MS	MSD	Units	MS	MSD	RPD	%Rec	RPD	Notes
QC1174944MS1, QC1174944MSD1										**Source:**	**387148-006**	
2-Methylnaphthalene	ND	50	50	37	35	ug/Kg	74	70	5.6	70-130	35	
Acenaphthene	ND	50	50	47	43	ug/Kg	94	86	8.9	70-130	35	
Acenaphthylene	ND	50	50	39	38	ug/Kg	78	76	2.6	70-130	35	
Anthracene	ND	50	50	48	45	ug/Kg	96	90	6.5	70-130	35	
Benz(a)anthracene	ND	50	50	71	65	ug/Kg	142	130	8.8	70-130	35	M
Benzo(a)pyrene	ND	50	50	49	46	ug/Kg	98	92	6.3	70-130	35	

QCBatchID:	QC1174944	**Analyst:**	nhernandez	**Method:**	EPA 8270CM
Matrix:	Solid	**Analyzed:**	02/02/2017	**Instrument:**	SVOA-MS (group)

Analyte	Sample Amount	Spike Amount MS	Spike Amount MSD	Spike Result MS	Spike Result MSD	Units	Recoveries MS	Recoveries MSD	RPD	Limits %Rec	Limits RPD	Notes
QC1174944MS1, QC1174944MSD1											**Source:**	**387148-006**
Benzo(b)fluoranthene	ND	50	50	91	85	ug/Kg	182	170	6.8	70-130	35	M
Benzo(g,h,i)perylene	ND	50	50	37	35	ug/Kg	74	70	5.6	70-130	35	
Benzo(k)fluoranthene	ND	50	50	49	46	ug/Kg	98	92	6.3	70-130	35	
Chrysene	ND	50	50	43	41	ug/Kg	86	82	4.8	70-130	35	
Dibenz(a,h)anthracene	ND	50	50	56	51	ug/Kg	112	102	9.3	70-130	35	
Fluoranthene	ND	50	50	55	51	ug/Kg	110	102	7.5	70-130	35	
Fluorene	ND	50	50	51	46	ug/Kg	102	92	10.3	70-130	35	
Indeno(1,2,3-cd)pyrene	ND	50	50	57	50	ug/Kg	114	100	13.1	70-130	35	
Naphthalene	ND	50	50	34	33	ug/Kg	68	66	3.0	70-130	35	M
Phenanthrene	ND	50	50	50	45	ug/Kg	100	90	10.5	70-130	35	
Pyrene	ND	50	50	53	50	ug/Kg	106	100	5.8	70-130	35	

QCBatchID:	QC1175029	**Analyst:**	dswafford	**Method:**	EPA 7471A
Matrix:	Solid	**Analyzed:**	02/03/2017	**Instrument:**	AAICP-HG1

Blank Summary

Analyte	Blank Result	Units	MDL	RDL	Notes	
QC1175029MB1						
Mercury	ND	mg/Kg	0.02	0.14		

Lab Control Spike/ Lab Control Spike Duplicate Summary

Analyte	Spike Amount LCS	Spike Amount LCSD	Spike Result LCS	Spike Result LCSD	Units	Recoveries LCS	Recoveries LCSD	RPD	Limits %Rec	Limits RPD	Notes
QC1175029LCS1											
Mercury	0.83		0.79		mg/Kg	95			80-120		

Matrix Spike/Matrix Spike Duplicate Summary

Analyte	Sample Amount	Spike Amount MS	Spike Amount MSD	Spike Result MS	Spike Result MSD	Units	Recoveries MS	Recoveries MSD	RPD	Limits %Rec	Limits RPD	Notes
QC1175029MS1, QC1175029MSD1											**Source:**	**387148-009**
Mercury	ND	0.83	0.83	0.88	0.86	mg/Kg	104	101	2.3	75-125	20	

QCBatchID:	**QC1175058**	**Analyst:**	trinh	**Method:**	SM 2540-G
Matrix:	Solid	**Analyzed:**	02/02/2017	**Instrument:**	CHEM (group)

Duplicate Summary

Analyte	Sample Amount	Duplicate Amount	Units	RPD	Limits RPD	Notes
QC1175058DUP1						**Source: 387148-001**
Total Solids	71.4	71.0	%	0.6		

QCBatchID:	**QC1175059**	**Analyst:**	trinh	**Method:**	SM 2540-G
Matrix:	Solid	**Analyzed:**	02/02/2017	**Instrument:**	CHEM (group)

Duplicate Summary

Analyte	Sample Amount	Duplicate Amount	Units	RPD	Limits RPD	Notes
QC1175059DUP1						**Source: 387148-010**
Total Solids	79.7	78.8	%	2.7		

QCBatchID:	QC1177607	**Analyst:**	dswafford	**Method:**	EPA 6010B
Matrix:	Solid	**Analyzed:**	04/20/2017	**Instrument:**	AAICP (group)

Blank Summary

Analyte	Blank Result	Units	MDL	RDL	Notes	
QC1177607MB1						
Arsenic	ND	mg/L	0.004	0.01		

Lab Control Spike/ Lab Control Spike Duplicate Summary

Analyte	Spike Amount LCS	Spike Amount LCSD	Spike Result LCS	Spike Result LCSD	Units	Recoveries LCS	Recoveries LCSD	RPD	Limits %Rec	Limits RPD	Notes
QC1177607LCS1											
Arsenic	2		1.82		mg/L	91			80-120		

Matrix Spike/Matrix Spike Duplicate Summary

Analyte	Sample Amount	Spike Amount MS	Spike Amount MSD	Spike Result MS	Spike Result MSD	Units	Recoveries MS	Recoveries MSD	RPD	Limits %Rec	Limits RPD	Notes
QC1177607MS1, QC1177607MSD1											**Source:**	**387148-005**
Arsenic	ND	1	1	1.01	1.00	mg/L	101	100	1.0	75-125	20	

Data Qualifiers and Definitions

Qualifiers

A	See Report Comments.
B	Analyte was present in an associated method blank.
B1	Analyte was present in a sample and associated method blank greater than MDL but less than RDL.
BQ1	No valid test replicates. Sample Toxicity is possible. Best result was reported.
BQ2	No valid test replicates.
BQ3	No valid test replicates. Final DO is less than 1.0 mg/L. Result may be greater.
C	Possible laboratory contamination.
D	RPD was not within control limits. The sample data was reported without further clarification.
D1	Lesser amount of sample was used due to insufficient amount of sample supplied.
D2	Reporting limit is elevated due to sample matrix. Target analyte was not detected above the elevated reporting limit.
DW	Sample result is calculated on a dry weigh basis.
E	Concentration is estimated because it exceeds the quantification limits of the method.
I	The sample was read outside of the method required incubation period.
J	Reported value is estimated
L	The laboratory control sample (LCS) or laboratory control sample duplicate (LCSD) was out of control limits. Associated sample data was reported with qualifier.
M	The matrix spike (MS) or matrix spike duplicate (MSD) was not within control limits due to matrix interference. The associated LCS and/or LCSD was within control limits and the sample data was reported without further clarification.
M1	The matrix spike (MS) or matrix spike duplicate (MSD) is not within control limits due to matrix interference.
M2	The matrix spike (MS) or matrix spike duplicate (MSD) was not within control limits. The associated LCS and/or LCSD was not within control limits. Sample result is estimated.
N1	Sample chromatography does not match the specified TPH standard pattern.
NC	The analyte concentration in the sample exceeded the spike level by a factor of four or greater, spike recovery and limits do not apply.
P	Sample was received without proper preservation according to EPA guidelines.
P1	Temperature of sample storage refrigerator was out of acceptance limits.
P2	The sample was preserved within 24 hours of collection in accordance with EPA 218.6.
Q1	Analyte Calibration Verification exceeds criteria. The result is estimated.
Q2	Analyte calibration was not verified and the result was estimated.
Q3	Analyte initial calibration was not available or exceeds criteria. The result was estimated.
S	The surrogate recovery was out of control limits due to matrix interference. The associated method blank surrogate recovery was within control limits and the sample data was reported without further clarification.
S1	The associated surrogate recovery was out of control limits; result is estimated.
S2	The surrogate was diluted out due to the presence of high concentrations of target and/or non-target compounds. Surrogate recoveries in the associated batch QC met recovery criteria.
S3	Internal Standard did not meet recovery limits. Analyte concentration is estimated.
T	Sample was extracted/analyzed past the holding time.
T1	Reanalysis was reported past hold time due to failing replicates in the original analysis (BOD only).
T2	Sample was analyzed ASAP but received and analyzed past the 15 minute holding time.
T3	Sample received and analyzed out of hold time per client’s request.
T4	Sample was analyzed out of hold time per client’s request.
T5	Reanalysis was reported past hold time. The original analysis was within hold time, but not reportable.
T6	Hold time is indeterminable due to unspecified sampling time.
T7	Sample was analyzed past hold time due to insufficient time remaining at time of receipt.

Definitions

DF	Dilution Factor
MDL	Method Detection Limit. Result is reported ND when it is less than or equal to MDL.
ND	Analyte was not detected or was less than the detection limit.
NR	Not Reported. See Report Comments.
RDL	Reporting Detection Limit
TIC	Tentatively Identified Compounds

ENTHALPHY ANALYTICAL, INC.
806 N. Batavia St., Orange, CA 92868
Phone: (714) 771-6900 Fax: (714)771-9933

Billing: Enthalpy - SoCal
c/o Montrose Environmental Group
1 Park Plaza, Suite 1000, Irvine, CA 92614

Chain of Custody Record

Lab No: 38748

Page: of

Turn Around Time (Rush by advanced notice only)

Standard:	☑	4 Day:	☐	3 Day:	☐
2 Day:	☐	1 Day:	☐	Same Day:	☐

Matrix: A = Air DW = Drinking Water
FL = Food Liquid FS = Food Solid L = Liquid
PP = Pure Product S = Solid SeaW = Sea Water
SW = Swab W = Water WP = Wipe O = Other

Preservatives: 1 = $Na_2S_2O_3$ 2 = HCl 3 = HNO_3
4 = H_2SO_4 5 = NaOH 6 = Other

CUSTOMER INFORMATION		PROJECT INFORMATION	
Company:	Great Ecology	Name:	Pond 20 Mitigation Bank
Report To:	Nick Buhbe	Number:	
Email:	nbuhbe@greatecology.com	P.O. #:	
Address:	2251 San Diego Ave., Suite A218	Address:	
	San Diego, CA 92110		
Phone:	858-750-3201	Global ID:	
Fax:		Sampled By:	Nick Buhbe, Ashley Tuggle

Analysis Request

	Sample ID	Sampling Date	Sampling Time	Matrix	Container No. / Size	Pres.	Percent Solids , TOC	Total Sulfides, Dissolved Sulfides	Plasticity Index, In-Situ Moisture, Shear Strength	~~Grain Size (ASTM D422)~~	~~Grain Size (ASTM D4464M)~~	As, Cd, Cr, Cu, Pb, Ni, Se, Ag, Zn	Hg	TRPH	Pesticides	PCBs, PAHs
1	P20-1T	1/30/17	15:00	Soil	2-16oz		X	X				X	X	X	X	X
2	P20-1M	|	15:10	|	|		|	|				|	|	|	|	|
3	P20-1Z	|	15:20	|	|		|	|				|	|	|	|	|
4	P20-2T	|	13:20	|	|		|	|				|	|	|	|	|
5	P20-2Z	|	13:40	|	|		|	|				|	|	|	|	|
6	P20-3T	|	12:00	|	|		|	|				|	|	|	|	|
7	P20-3M	|	12:10	|	|		|	|				|	|	|	|	|
8	P20-3Z	|	12:20	|	|		|	|				|	|	|	|	|
9	P20-4T	|	10:15	|	|		|	|				|	|	|	|	|
10	P20-4M	|	10:25	|	|		|	|				|	|	|	|	|

Test Instructions / Comments

Please send a copy of results to: atuggle@greatecology.com

~~homogenize [illegible] samples b/f taking aliquots~~ samples not homogenized collect representative samples from containers, retain excess sample

	Signature	Print Name	Company / Title	Date / Time
1 Relinquished By:		N. BUHBE	Great Ecology	1/31/17
1 Received By:		L. Marroletti		1/31/17 1200
2 Relinquished By:		L. Marroletti		1/31/17 1330
2 Received By:		T Nash	EA	1/31/17 1407
3 Relinquished By:				
3 Received By:				

ENTHALPY ANALYTICAL, INC.		**Chain of Custody Record**	**Turn Around Time (Rush by advanced notice only)**
806 N. Batavia St., Orange, CA 92868 Phone: (714) 771-6900 Fax: (714)771-9933		Lab No: 387148 Page: of	Standard: ✓ 4 Day: 3 Day: 2 Day: 1 Day: Same Day:
Billing: Enthalpy - SoCal c/o Montrose Environmental Group 1 Park Plaza, Suite 1000, Irvine, CA 92614	ENTHALPY analytical, inc.	**Matrix:** A = Air DW = Drinking Water FL = Food Liquid FS = Food Solid L = Liquid PP = Pure Product S = Solid SeaW = Sea Water SW = Swab W = Water WP = Wipe O = Other	**Preservatives:** 1 = $Na_2S_2O_3$ 2 = HCl 3 = HNO_3 4 = H_2SO_4 5 = NaOH 6 = Other

CUSTOMER INFORMATION		PROJECT INFORMATION	
Company:	Great Ecology	Name:	Pond 20 Mitigation Bank
Report To:	Nick Buhbe	Number:	
Email:	nbuhbe@greatecology.com	P.O. #:	
Address:	2251 San Diego Ave., Suite A218	Address:	
	San Diego, CA 92110		
Phone:	858-750-3201	Global ID:	
Fax:		Sampled By:	Nick Buhbe, Ashley Tuggle

Test Instructions / Comments

Please send a copy of results to: atuggle@greatecology.com

~~homogenize~~ samples not homogenized collect representative samples from containers, retain excess sample material

	Sample ID	Sampling Date	Sampling Time	Matrix	Container No. / Size	Pres.	Percent Solids , TOC	Total Sulfides, Dissolved Sulfides	Plasticity Index, In-Situ Moisture, Shear Strength	Grain Size (ASTM D422)	Grain Size (ASTM D4464M)	As, Cd, Cr, Cu, Pb, Ni, Se, Ag , Zn	Hg	TRPH	Pesticides	PCBs, PAHs
1	P20-4Z	1/30/17	10-35				X	X				X	X	X	X	X
2																
3																
4																
5																
6																
7																
8																
9																
10																

	Signature	Print Name	Company / Title	Date / Time
1 Relinquished By:		N. BUHBE	Great Ecology	1/31/17
1 Received By:		L. Marrokti		1/31/17 1200
2 Relinquished By:		L. Marrokti		1/31/17 1336
2 Received By:		T. Nash	EA	1/31/17 1407
3 Relinquished By:				
3 Received By:				

ENTHALPY
analytical inc

SAMPLE ACCEPTANCE CHECKLIST

Section 1

Client: GREAT ECOLOGY Project: POND 20 MITIGATION BANK

Date Received: 1/31/17 Sampler's Name Present: [✓ Yes] No

Sample(s) received in a cooler? [✓ Yes] How many? 1 No (skip section 2) Sample Temp (°C):______

Sample Temp (°C) from each cooler: #1: 9.7°C #2: ______ #3: ______ #4: ______

(Acceptance range is 0 to 6°C or, for samples collected the same day as sample receipt, arrival on ice; For Microbiology sample 0 to 10°C or, for samples collected the same day as sample receipt, arrival on ice)

Shipping Information:______

Section 2

Was the cooler packed with: ✓ Ice ___ Ice Packs ___ Bubble Wrap ___ Styrofoam ___ Paper ___ None ___ Other______

Cooler Temp (°C): #1: 2.3°C #2: ______ #3: ______ #4: ______

Section 3	YES	NO	N/A
Was a COC received?	✓		▨
Were sample IDs present?	✓		▨
Were sampling dates & times present?	✓		▨
Was a relinquished signature present?	✓		▨
Were the tests required clearly indicated?	✓		▨
Were custody seals present?		✓	▨
If Yes – were they intact?			✓
Were all samples sealed in plastic bags?	✓		
Did all samples arrive intact? If no, indicate below.	✓		▨
Did all bottle labels agree with COC? (ID, dates and times)	✓		▨
Were correct containers used for the tests required?	✓		▨
Was a sufficient amount of sample sent for tests indicated?	✓		▨
Was there headspace in VOA vials?			✓
Were the containers labeled with correct preservatives?			✓

Section 4

Explanations/Comments:______

Section 5

For discrepancies, how was the Project Manager notified? Verbal PM Initials:____ Date/Time______

Email (email sent to/on):____ /______

Project Manager's response:

Completed By:______ Date: 1/31/17

Enthalpy Analytical, a subsidiary of Montrose Environmental Group ,Inc.
931 W. Barkley Ave, Orange, CA 92868 • T: (714) 771-6900 • F: (714) 538-1209
www.enthalpy.com/socal
Sample Acceptance Checklist – Rev 2.2, 11/2/2016

Ranjit Clarke

From: Nick Buhbe <nbuhbe@greatecology.com>
Sent: Thursday, April 13, 2017 9:27 AM
To: Ranjit Clarke
Subject: RE: Pond 20 Mitigation Bank (01/30/17) - Enthalpy Analytical Final Report #387148

Ranjit-
Good morning,
We would like to proceed with running the Pond 20 samples for SPLP, and analyze for arsenic. We will run the samples with the highest dry weight values in each core: P20-1M (Berm), and also samples P20-2Z, P20-3Z, and P20-4Z (Interior). So four samples total of the batch. From a QA perspective, there will be a duplicate in the batch, correct? (i.e., not necessarily one of our samples).

Thanks
Nick

Nick Buhbe, M.S.
Director, Western Region

GREAT ecology
ENVIRONMENT + DESIGN

P | 858.750.3201 C | 619.985.9111 E | nbuhbe@greatecology.com

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From: Ranjit Clarke [mailto:Ranjit.Clarke@enthalpy.com]
Sent: Thursday, April 06, 2017 3:01 PM
To: Nick Buhbe <nbuhbe@greatecology.com>
Subject: RE: Pond 20 Mitigation Bank (01/30/17) - Enthalpy Analytical Final Report #387148

Nick,

SPLP extraction = $35
EPA 6010B As = $15

Total = $50 per sample (standard 5-7 business day TAT)

Ranjit

ENTHALPY
ANALYTICAL

Ranjit Clarke
Senior Project Manager
O: 714-771-9906 / M: 657-274-9864 / F: 714-538-1209
Ranjit.Clarke@enthalpy.com

From: Nick Buhbe [mailto:nbuhbe@greatecology.com]
Sent: Tuesday, April 04, 2017 2:39 PM
To: Ranjit Clarke <Ranjit.Clarke@enthalpy.com>
Subject: RE: Pond 20 Mitigation Bank (01/30/17) - Enthalpy Analytical Final Report #387148

Ranjit-
How much would it cost to run SPLP analyses for arsenic alone, for four of the samples?

I think there may be a set-up fee, then a per sample cost? At least that's how they used to price these at CEL, for dredge material.

And are there holding time restrictions on this analysis that would come into play?

Thanks,
Nick

Nick Buhbe, M.S.
Director, Western Region

P | 858.750.3201 C | 619.985.9111 E | nbuhbe@greatecology.com

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From: Ranjit Clarke [mailto:Ranjit.Clarke@enthalpy.com]
Sent: Monday, April 03, 2017 6:19 PM
To: Nick Buhbe <nbuhbe@greatecology.com>
Subject: RE: Pond 20 Mitigation Bank (01/30/17) - Enthalpy Analytical Final Report #387148

Nick,

We still have the samples.

Ranjit

Ranjit Clarke
Senior Project Manager
O: 714-771-9906 / M: 657-274-9864 / F: 714-538-1209
Ranjit.Clarke@enthalpy.com

From: Nick Buhbe [mailto:nbuhbe@greatecology.com]
Sent: Monday, April 03, 2017 10:15 AM
To: Ranjit Clarke <Ranjit.Clarke@enthalpy.com>
Subject: FW: Pond 20 Mitigation Bank (01/30/17) - Enthalpy Analytical Final Report #387148

Ranjit-
Good morning,

We have a potential request from this client to perform SPLP analyses on these samples. We are working out the precise request in terms of how many samples, modifications to the method, etc., but first things first:

Can you verify that you still have the samples on-hand?

Thank you.
Nick

Nick Buhbe, M.S.
Director, Western Region

P | 858.750.3201 C | 619.985.9111 E | nbuhbe@greatecology.com

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From: Ranjit Clarke [mailto:Ranjit.Clarke@enthalpy.com]
Sent: Monday, February 13, 2017 4:32 PM
To: Nick Buhbe <nbuhbe@greatecology.com>
Subject: RE: Pond 20 Mitigation Bank (01/30/17) - Enthalpy Analytical Final Report #387148

Nick,

I generated an EDD and Calscience sent one as well. I guess I forgot to attach them. Here you go.

Ranjit Clarke
Senior Project Manager
O: 714-771-9906 / M: 657-274-9864 / F: 714-538-1209
Ranjit.Clarke@enthalpy.com

From: Nick Buhbe [mailto:nbuhbe@greatecology.com]
Sent: Monday, February 13, 2017 3:46 PM
To: Ranjit Clarke <Ranjit.Clarke@enthalpy.com>
Subject: RE: Pond 20 Mitigation Bank (01/30/17) - Enthalpy Analytical Final Report #387148

Ranjit-
Do you happen to have an EDD?
We would like the data in a ‘manipulable’ form for conversion to report tables.

Thanks,
Nick

PS, I hope to see Dennis tomorrow at the SDEP meeting.

Nick Buhbe, M.S.
Director, Western Region

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P | 858.750.3201 C | 619.985.9111 E | nbuhbe@greatecology.com

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From: Ranjit Clarke [mailto:Ranjit.Clarke@enthalpy.com]
Sent: Thursday, February 09, 2017 6:17 PM
To: Nick Buhbe <nbuhbe@greatecology.com>
Subject: Pond 20 Mitigation Bank (01/30/17) - Enthalpy Analytical Final Report #387148

Hi Nick Buhbe,

Attached is your final report #387148.

Thank you.

In accordance with our paperless initiative, we are no longer mailing or faxing reports by default. If you require a hard copy, please inform your Project Manager.

Data qualifiers and additional information necessary for the interpretation of the test results are contained in the PDF file and may not be included in the EDD.

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WORK ORDER NUMBER: 17-02-0124

The difference is service

AIR | SOIL | WATER | MARINE CHEMISTRY

Analytical Report For

Client: Enthalpy Analytical, Inc.

Client Project Name: 387148

Attention: Ranjit Clarke
931 W. Barkley Avenue
Orange, CA 92868-1208

Approved for release on 02/09/2017 by:
Xuan Dang
Project Manager

ResultLink ▸

Email your PM ▸

Contents

Client Project Name: 387148
Work Order Number: 17-02-0124

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Work Order Narrative

Work Order: 17-02-0124 Page 1 of 1

Condition Upon Receipt:

Samples were received under Chain-of-Custody (COC) on 02/01/17. They were assigned to Work Order 17-02-0124.

Unless otherwise noted on the Sample Receiving forms all samples were received in good condition and within the recommended EPA temperature criteria for the methods noted on the COC. The COC and Sample Receiving Documents are integral elements of the analytical report and are presented at the back of the report.

Holding Times:

All samples were analyzed within prescribed holding times (HT) and/or in accordance with the Calscience Sample Acceptance Policy unless otherwise noted in the analytical report and/or comprehensive case narrative, if required.

Any parameter identified in 40CFR Part 136.3 Table II that is designated as "analyze immediately" with a holding time of <= 15 minutes (40CFR-136.3 Table II, footnote 4), is considered a "field" test and the reported results will be qualified as being received outside of the stated holding time unless received at the laboratory within 15 minutes of the collection time.

Quality Control:

All quality control parameters (QC) were within established control limits except where noted in the QC summary forms or described further within this report.

Subcontractor Information:

Unless otherwise noted below (or on the subcontract form), no samples were subcontracted.

Additional Comments:

Air - Sorbent-extracted air methods (EPA TO-4A, EPA TO-10, EPA TO-13A, EPA TO-17): Analytical results are converted from mass/sample basis to mass/volume basis using client-supplied air volumes.

Solid - Unless otherwise indicated, solid sample data is reported on a wet weight basis, not corrected for % moisture. All QC results are always reported on a wet weight basis.

SM 2540B - TOTAL SOLIDS:
The values for % solids were provided by Enthalpy.

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Sample Summary

Client:	Enthalpy Analytical, Inc. 931 W. Barkley Avenue Orange, CA 92868-1208	Work Order:	17-02-0124
		Project Name:	387148
		PO Number:	
		Date/Time Received:	02/01/17 16:07
		Number of Containers:	11
Attn:	Ranjit Clarke		

Sample Identification	Lab Number	Collection Date and Time	Number of Containers	Matrix
P20-1T (387148-001)	17-02-0124-1	01/30/17 15:00	1	Solid
P20-1M (387148-002)	17-02-0124-2	01/30/17 15:10	1	Solid
P20-1Z (387148-003)	17-02-0124-3	01/30/17 15:20	1	Solid
P20-2T (387148-004)	17-02-0124-4	01/30/17 13:20	1	Solid
P20-2Z (387148-005)	17-02-0124-5	01/30/17 13:40	1	Solid
P20-3T (387148-006)	17-02-0124-6	01/30/17 12:00	1	Solid
P20-3M (387148-007)	17-02-0124-7	01/30/17 12:10	1	Solid
P20-3Z (387148-008)	17-02-0124-8	01/30/17 12:20	1	Solid
P20-4T (387148-009)	17-02-0124-9	01/30/17 10:15	1	Solid
P20-4M (387148-010)	17-02-0124-10	01/30/17 10:25	1	Solid
P20-4Z (387148-011)	17-02-0124-11	01/30/17 10:35	1	Solid

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Detections Summary

Client:	Enthalpy Analytical, Inc. 931 W. Barkley Avenue Orange, CA 92868-1208	Work Order: Project Name: Received:	17-02-0124 387148 02/01/17
Attn:	Ranjit Clarke		Page 1 of 1

Client SampleID **Analyte**	**Result**	**Qualifiers**	**RL**	**Units**	**Method**	**Extraction**
P20-1T (387148-001) (17-02-0124-1)						
Carbon, Total Organic	6300		700	mg/kg	EPA 9060A	N/A
Solids, Total	71.4		0.100	%	SM 2540 B (M)	N/A
P20-1M (387148-002) (17-02-0124-2)						
Sulfide, Total	9.8		0.82	mg/kg	EPA 376.2M	N/A
Carbon, Total Organic	16000		820	mg/kg	EPA 9060A	N/A
Solids, Total	61.2		0.100	%	SM 2540 B (M)	N/A
P20-1Z (387148-003) (17-02-0124-3)						
Sulfide, Total	230		15	mg/kg	EPA 376.2M	N/A
Carbon, Total Organic	11000		730	mg/kg	EPA 9060A	N/A
Solids, Total	68.6		0.100	%	SM 2540 B (M)	N/A
P20-2T (387148-004) (17-02-0124-4)						
Solids, Total	79.1		0.100	%	SM 2540 B (M)	N/A
P20-2Z (387148-005) (17-02-0124-5)						
Sulfide, Total	0.72		0.72	mg/kg	EPA 376.2M	N/A
Carbon, Total Organic	9400		720	mg/kg	EPA 9060A	N/A
Solids, Total	69.8		0.100	%	SM 2540 B (M)	N/A
P20-3T (387148-006) (17-02-0124-6)						
Solids, Total	88.6		0.100	%	SM 2540 B (M)	N/A
P20-3M (387148-007) (17-02-0124-7)						
Carbon, Total Organic	2500		650	mg/kg	EPA 9060A	N/A
Solids, Total	76.4		0.100	%	SM 2540 B (M)	N/A
P20-3Z (387148-008) (17-02-0124-8)						
Solids, Total	84.8		0.100	%	SM 2540 B (M)	N/A
P20-4T (387148-009) (17-02-0124-9)						
Carbon, Total Organic	600		560	mg/kg	EPA 9060A	N/A
Solids, Total	89.0		0.100	%	SM 2540 B (M)	N/A
P20-4M (387148-010) (17-02-0124-10)						
Solids, Total	79.7		0.100	%	SM 2540 B (M)	N/A
P20-4Z (387148-011) (17-02-0124-11)						
Solids, Total	80.3		0.100	%	SM 2540 B (M)	N/A

Subcontracted analyses, if any, are not included in this summary.

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* MDL is shown

Analytical Report

Enthalpy Analytical, Inc.		Date Received:	02/01/17
931 W. Barkley Avenue		Work Order:	17-02-0124
Orange, CA 92868-1208		Preparation:	N/A
		Method:	EPA 376.2M
		Units:	mg/kg
Project: 387148			Page 1 of 3

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
P20-1T (387148-001)	**17-02-0124-1-A**	**01/30/17 15:00**	**Solid**	**N/A**	**02/03/17**	**02/03/17 15:28**	**H0203SL2**

Comment(s): - Results are reported on a dry weight basis.
- Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Sulfide, Total	ND	0.70	0.54	1.00	

P20-1M (387148-002)	**17-02-0124-2-A**	**01/30/17 15:10**	**Solid**	**N/A**	**02/03/17**	**02/03/17 15:28**	**H0203SL2**

Comment(s): - Results are reported on a dry weight basis.
- Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Sulfide, Total	9.8	0.82	0.63	1.00	

P20-1Z (387148-003)	**17-02-0124-3-A**	**01/30/17 15:20**	**Solid**	**N/A**	**02/03/17**	**02/03/17 15:28**	**H0203SL2**

Comment(s): - Results are reported on a dry weight basis.
- Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Sulfide, Total	230	15	11	20.0	

P20-2T (387148-004)	**17-02-0124-4-A**	**01/30/17 13:20**	**Solid**	**N/A**	**02/03/17**	**02/03/17 15:28**	**H0203SL2**

Comment(s): - Results are reported on a dry weight basis.
- Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Sulfide, Total	ND	0.63	0.48	1.00	

P20-2Z (387148-005)	**17-02-0124-5-A**	**01/30/17 13:40**	**Solid**	**N/A**	**02/03/17**	**02/03/17 15:28**	**H0203SL2**

Comment(s): - Results are reported on a dry weight basis.
- Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Sulfide, Total	0.72	0.72	0.55	1.00	

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RL: Reporting Limit. DF: Dilution Factor. MDL: Method Detection Limit.

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Analytical Report

Enthalpy Analytical, Inc.	Date Received: 02/01/17
931 W. Barkley Avenue	Work Order: 17-02-0124
Orange, CA 92868-1208	Preparation: N/A
	Method: EPA 376.2M
	Units: mg/kg
Project: 387148	Page 2 of 3

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
P20-3T (387148-006)	**17-02-0124-6-A**	**01/30/17 12:00**	**Solid**	**N/A**	**02/03/17**	**02/03/17 15:28**	**H0203SL2**

Comment(s): - Results are reported on a dry weight basis.
- Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Sulfide, Total	ND	0.56	0.43	1.00	

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
P20-3M (387148-007)	**17-02-0124-7-A**	**01/30/17 12:10**	**Solid**	**N/A**	**02/03/17**	**02/03/17 15:28**	**H0203SL2**

Comment(s): - Results are reported on a dry weight basis.
- Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Sulfide, Total	ND	0.65	0.50	1.00	

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
P20-3Z (387148-008)	**17-02-0124-8-A**	**01/30/17 12:20**	**Solid**	**N/A**	**02/03/17**	**02/03/17 15:28**	**H0203SL2**

Comment(s): - Results are reported on a dry weight basis.
- Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Sulfide, Total	ND	0.59	0.45	1.00	

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
P20-4T (387148-009)	**17-02-0124-9-A**	**01/30/17 10:15**	**Solid**	**N/A**	**02/03/17**	**02/03/17 15:28**	**H0203SL2**

Comment(s): - Results are reported on a dry weight basis.
- Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Sulfide, Total	ND	0.56	0.43	1.00	

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
P20-4M (387148-010)	**17-02-0124-10-A**	**01/30/17 10:25**	**Solid**	**N/A**	**02/03/17**	**02/03/17 15:28**	**H0203SL2**

Comment(s): - Results are reported on a dry weight basis.
- Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Sulfide, Total	ND	0.63	0.48	1.00	

Return to Contents

RL: Reporting Limit. DF: Dilution Factor. MDL: Method Detection Limit.

Analytical Report

Enthalpy Analytical, Inc.		Date Received:	02/01/17
931 W. Barkley Avenue		Work Order:	17-02-0124
Orange, CA 92868-1208		Preparation:	N/A
		Method:	EPA 376.2M
		Units:	mg/kg
Project: 387148			Page 3 of 3

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
P20-4Z (387148-011)	**17-02-0124-11-A**	**01/30/17 10:35**	**Solid**	**N/A**	**02/03/17**	**02/03/17 15:28**	**H0203SL2**

Comment(s): - Results are reported on a dry weight basis.
- Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Sulfide, Total	ND	0.62	0.48	1.00	

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
Method Blank	**099-05-001-5954**	**N/A**	**Solid**	**N/A**	**02/03/17**	**02/03/17 15:28**	**H0203SL2**

Comment(s): - Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Sulfide, Total	ND	0.50	0.38	1.00	

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RL: Reporting Limit. DF: Dilution Factor. MDL: Method Detection Limit.

Analytical Report

Enthalpy Analytical, Inc.
931 W. Barkley Avenue
Orange, CA 92868-1208

Date Received:	02/01/17
Work Order:	17-02-0124
Preparation:	N/A
Method:	EPA 376.2M
Units:	mg/kg

Project: 387148

Page 1 of 3

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
P20-1T (387148-001)	**17-02-0124-1-A**	**01/30/17 15:00**	**Solid**	**N/A**	**02/03/17**	**02/03/17 13:15**	**H0203DSL1**

Comment(s): - Results are reported on a dry weight basis.
- Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Sulfide, Dissolved	ND	0.70	0.42	1.00	

P20-1M (387148-002)	**17-02-0124-2-A**	**01/30/17 15:10**	**Solid**	**N/A**	**02/03/17**	**02/03/17 13:15**	**H0203DSL1**

Comment(s): - Results are reported on a dry weight basis.
- Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Sulfide, Dissolved	ND	0.82	0.49	1.00	

P20-1Z (387148-003)	**17-02-0124-3-A**	**01/30/17 15:20**	**Solid**	**N/A**	**02/03/17**	**02/03/17 13:15**	**H0203DSL1**

Comment(s): - Results are reported on a dry weight basis.
- Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Sulfide, Dissolved	ND	0.73	0.43	1.00	

P20-2T (387148-004)	**17-02-0124-4-A**	**01/30/17 13:20**	**Solid**	**N/A**	**02/03/17**	**02/03/17 13:15**	**H0203DSL1**

Comment(s): - Results are reported on a dry weight basis.
- Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Sulfide, Dissolved	ND	0.63	0.38	1.00	

P20-2Z (387148-005)	**17-02-0124-5-A**	**01/30/17 13:40**	**Solid**	**N/A**	**02/03/17**	**02/03/17 13:15**	**H0203DSL1**

Comment(s): - Results are reported on a dry weight basis.
- Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Sulfide, Dissolved	ND	0.72	0.43	1.00	

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RL: Reporting Limit. DF: Dilution Factor. MDL: Method Detection Limit.

Analytical Report

Enthalpy Analytical, Inc.
931 W. Barkley Avenue
Orange, CA 92868-1208

Date Received:	02/01/17
Work Order:	17-02-0124
Preparation:	N/A
Method:	EPA 376.2M
Units:	mg/kg

Project: 387148

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Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
P20-3T (387148-006)	**17-02-0124-6-A**	**01/30/17 12:00**	**Solid**	**N/A**	**02/03/17**	**02/03/17 13:15**	**H0203DSL1**

Comment(s): - Results are reported on a dry weight basis.
- Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Sulfide, Dissolved	ND	0.56	0.34	1.00	

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
P20-3M (387148-007)	**17-02-0124-7-A**	**01/30/17 12:10**	**Solid**	**N/A**	**02/03/17**	**02/03/17 13:15**	**H0203DSL1**

Comment(s): - Results are reported on a dry weight basis.
- Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Sulfide, Dissolved	ND	0.65	0.39	1.00	

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
P20-3Z (387148-008)	**17-02-0124-8-A**	**01/30/17 12:20**	**Solid**	**N/A**	**02/03/17**	**02/03/17 13:15**	**H0203DSL1**

Comment(s): - Results are reported on a dry weight basis.
- Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Sulfide, Dissolved	ND	0.59	0.35	1.00	

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
P20-4T (387148-009)	**17-02-0124-9-A**	**01/30/17 10:15**	**Solid**	**N/A**	**02/03/17**	**02/03/17 13:15**	**H0203DSL1**

Comment(s): - Results are reported on a dry weight basis.
- Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Sulfide, Dissolved	ND	0.56	0.33	1.00	

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
P20-4M (387148-010)	**17-02-0124-10-A**	**01/30/17 10:25**	**Solid**	**N/A**	**02/03/17**	**02/03/17 13:15**	**H0203DSL1**

Comment(s): - Results are reported on a dry weight basis.
- Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Sulfide, Dissolved	ND	0.63	0.37	1.00	

Return to Contents

RL: Reporting Limit. DF: Dilution Factor. MDL: Method Detection Limit.

Analytical Report

Enthalpy Analytical, Inc.		Date Received:	02/01/17
931 W. Barkley Avenue		Work Order:	17-02-0124
Orange, CA 92868-1208		Preparation:	N/A
		Method:	EPA 376.2M
		Units:	mg/kg
Project: 387148			Page 3 of 3

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
P20-4Z (387148-011)	**17-02-0124-11-A**	**01/30/17 10:35**	**Solid**	**N/A**	**02/03/17**	**02/03/17 13:15**	**H0203DSL1**

Comment(s): - Results are reported on a dry weight basis.

- Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Sulfide, Dissolved	ND	0.62	0.37	1.00	

Method Blank	**099-05-001-5955**	**N/A**	**Solid**	**N/A**	**02/03/17**	**02/03/17 13:15**	**H0203DSL1**

Comment(s): - Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Sulfide, Dissolved	ND	0.50	0.30	1.00	

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Analytical Report

Enthalpy Analytical, Inc.
931 W. Barkley Avenue
Orange, CA 92868-1208

Date Received:	02/01/17
Work Order:	17-02-0124
Preparation:	N/A
Method:	EPA 9060A
Units:	mg/kg

Project: 387148

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Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
P20-1T (387148-001)	**17-02-0124-1-A**	**01/30/17 15:00**	**Solid**	**TOC 9**	**02/07/17**	**02/07/17 17:00**	**H0207TOCL1**

Comment(s): - Results are reported on a dry weight basis.
- Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Carbon, Total Organic	6300	700	240	1.00	

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
P20-1M (387148-002)	**17-02-0124-2-A**	**01/30/17 15:10**	**Solid**	**TOC 9**	**02/07/17**	**02/07/17 17:00**	**H0207TOCL1**

Comment(s): - Results are reported on a dry weight basis.
- Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Carbon, Total Organic	16000	820	280	1.00	

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
P20-1Z (387148-003)	**17-02-0124-3-A**	**01/30/17 15:20**	**Solid**	**TOC 9**	**02/07/17**	**02/07/17 17:00**	**H0207TOCL1**

Comment(s): - Results are reported on a dry weight basis.
- Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Carbon, Total Organic	11000	730	250	1.00	

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
P20-2T (387148-004)	**17-02-0124-4-A**	**01/30/17 13:20**	**Solid**	**TOC 9**	**02/07/17**	**02/07/17 17:00**	**H0207TOCL1**

Comment(s): - Results are reported on a dry weight basis.
- Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Carbon, Total Organic	ND	630	220	1.00	

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
P20-2Z (387148-005)	**17-02-0124-5-A**	**01/30/17 13:40**	**Solid**	**TOC 9**	**02/07/17**	**02/07/17 17:00**	**H0207TOCL1**

Comment(s): - Results are reported on a dry weight basis.
- Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Carbon, Total Organic	9400	720	250	1.00	

Return to Contents

RL: Reporting Limit. DF: Dilution Factor. MDL: Method Detection Limit.

Analytical Report

Enthalpy Analytical, Inc.		Date Received:	02/01/17
931 W. Barkley Avenue		Work Order:	17-02-0124
Orange, CA 92868-1208		Preparation:	N/A
		Method:	EPA 9060A
		Units:	mg/kg
Project: 387148			Page 2 of 3

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
P20-3T (387148-006)	**17-02-0124-6-A**	**01/30/17 12:00**	**Solid**	**TOC 9**	**02/07/17**	**02/07/17 17:00**	**H0207TOCL1**

Comment(s): - Results are reported on a dry weight basis.
- Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Carbon, Total Organic	ND	560	200	1.00	

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
P20-3M (387148-007)	**17-02-0124-7-A**	**01/30/17 12:10**	**Solid**	**TOC 9**	**02/07/17**	**02/07/17 17:00**	**H0207TOCL1**

Comment(s): - Results are reported on a dry weight basis.
- Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Carbon, Total Organic	2500	650	230	1.00	

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
P20-3Z (387148-008)	**17-02-0124-8-A**	**01/30/17 12:20**	**Solid**	**TOC 9**	**02/07/17**	**02/07/17 17:00**	**H0207TOCL1**

Comment(s): - Results are reported on a dry weight basis.
- Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Carbon, Total Organic	ND	590	200	1.00	

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
P20-4T (387148-009)	**17-02-0124-9-A**	**01/30/17 10:15**	**Solid**	**TOC 9**	**02/07/17**	**02/07/17 17:00**	**H0207TOCL1**

Comment(s): - Results are reported on a dry weight basis.
- Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Carbon, Total Organic	600	560	200	1.00	

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
P20-4M (387148-010)	**17-02-0124-10-A**	**01/30/17 10:25**	**Solid**	**TOC 9**	**02/07/17**	**02/07/17 17:00**	**H0207TOCL1**

Comment(s): - Results are reported on a dry weight basis.
- Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Carbon, Total Organic	ND	630	220	1.00	

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RL: Reporting Limit. DF: Dilution Factor. MDL: Method Detection Limit.

Analytical Report

Enthalpy Analytical, Inc.
931 W. Barkley Avenue
Orange, CA 92868-1208

Date Received: 02/01/17
Work Order: 17-02-0124
Preparation: N/A
Method: EPA 9060A
Units: mg/kg

Project: 387148

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Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
P20-4Z (387148-011)	**17-02-0124-11-A**	**01/30/17 10:35**	**Solid**	**TOC 9**	**02/07/17**	**02/07/17 17:00**	**H0207TOCL1**

Comment(s): - Results are reported on a dry weight basis.
- Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Carbon, Total Organic	ND	620	220	1.00	

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
Method Blank	**099-06-013-1666**	**N/A**	**Solid**	**TOC 9**	**02/07/17**	**02/07/17 17:00**	**H0207TOCL1**

Comment(s): - Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Carbon, Total Organic	ND	500	170	1.00	

Return to Contents

RL: Reporting Limit. DF: Dilution Factor. MDL: Method Detection Limit.

Analytical Report

Enthalpy Analytical, Inc.		Date Received:	02/01/17
931 W. Barkley Avenue		Work Order:	17-02-0124
Orange, CA 92868-1208		Preparation:	N/A
		Method:	SM 2540 B (M)
		Units:	%
Project: 387148			Page 1 of 3

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
P20-1T (387148-001)	**17-02-0124-1-A**	**01/30/17 15:00**	**Solid**	**N/A**	**N/A**	**02/04/17 12:00**	**H0204TSB3**

Comment(s): - Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.
- Please see Work Order Narrative, additional comments section.

Parameter	Result	RL	MDL	DF	Qualifiers
Solids, Total	71.4	0.100	0.100	1.00	

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
P20-1M (387148-002)	**17-02-0124-2-A**	**01/30/17 15:10**	**Solid**	**N/A**	**N/A**	**02/04/17 12:00**	**H0204TSB3**

Comment(s): - Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.
- Please see Work Order Narrative, additional comments section.

Parameter	Result	RL	MDL	DF	Qualifiers
Solids, Total	61.2	0.100	0.100	1.00	

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Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
P20-1Z (387148-003)	**17-02-0124-3-A**	**01/30/17 15:20**	**Solid**	**N/A**	**N/A**	**02/04/17 12:00**	**H0204TSB3**

Comment(s): - Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.
- Please see Work Order Narrative, additional comments section.

Parameter	Result	RL	MDL	DF	Qualifiers
Solids, Total	68.6	0.100	0.100	1.00	

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
P20-2T (387148-004)	**17-02-0124-4-A**	**01/30/17 13:20**	**Solid**	**N/A**	**N/A**	**02/04/17 12:00**	**H0204TSB3**

Comment(s): - Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.
- Please see Work Order Narrative, additional comments section.

Parameter	Result	RL	MDL	DF	Qualifiers
Solids, Total	79.1	0.100	0.100	1.00	

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
P20-2Z (387148-005)	**17-02-0124-5-A**	**01/30/17 13:40**	**Solid**	**N/A**	**N/A**	**02/04/17 12:00**	**H0204TSB3**

Comment(s): - Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.
- Please see Work Order Narrative, additional comments section.

Parameter	Result	RL	MDL	DF	Qualifiers
Solids, Total	69.8	0.100	0.100	1.00	

RL: Reporting Limit. DF: Dilution Factor. MDL: Method Detection Limit.

Analytical Report

Enthalpy Analytical, Inc.
931 W. Barkley Avenue
Orange, CA 92868-1208

Date Received: 02/01/17
Work Order: 17-02-0124
Preparation: N/A
Method: SM 2540 B (M)
Units: %

Project: 387148

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Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
P20-3T (387148-006)	**17-02-0124-6-A**	**01/30/17 12:00**	**Solid**	**N/A**	**N/A**	**02/04/17 12:00**	**H0204TSB3**

Comment(s): - Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.
- Please see Work Order Narrative, additional comments section.

Parameter	Result	RL	MDL	DF	Qualifiers
Solids, Total	88.6	0.100	0.100	1.00	

P20-3M (387148-007)	**17-02-0124-7-A**	**01/30/17 12:10**	**Solid**	**N/A**	**N/A**	**02/04/17 12:00**	**H0204TSB3**

Comment(s): - Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.
- Please see Work Order Narrative, additional comments section.

Parameter	Result	RL	MDL	DF	Qualifiers
Solids, Total	76.4	0.100	0.100	1.00	

P20-3Z (387148-008)	**17-02-0124-8-A**	**01/30/17 12:20**	**Solid**	**N/A**	**N/A**	**02/04/17 12:00**	**H0204TSB3**

Comment(s): - Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.
- Please see Work Order Narrative, additional comments section.

Parameter	Result	RL	MDL	DF	Qualifiers
Solids, Total	84.8	0.100	0.100	1.00	

P20-4T (387148-009)	**17-02-0124-9-A**	**01/30/17 10:15**	**Solid**	**N/A**	**N/A**	**02/04/17 12:00**	**H0204TSB3**

Comment(s): - Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.
- Please see Work Order Narrative, additional comments section.

Parameter	Result	RL	MDL	DF	Qualifiers
Solids, Total	89.0	0.100	0.100	1.00	

P20-4M (387148-010)	**17-02-0124-10-A**	**01/30/17 10:25**	**Solid**	**N/A**	**N/A**	**02/04/17 12:00**	**H0204TSB3**

Comment(s): - Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.
- Please see Work Order Narrative, additional comments section.

Parameter	Result	RL	MDL	DF	Qualifiers
Solids, Total	79.7	0.100	0.100	1.00	

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RL: Reporting Limit. DF: Dilution Factor. MDL: Method Detection Limit.

Analytical Report

Enthalpy Analytical, Inc.		Date Received:	02/01/17
931 W. Barkley Avenue		Work Order:	17-02-0124
Orange, CA 92868-1208		Preparation:	N/A
		Method:	SM 2540 B (M)
		Units:	%
Project: 387148			Page 3 of 3

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
P20-4Z (387148-011)	**17-02-0124-11-A**	**01/30/17 10:35**	**Solid**	**N/A**	**N/A**	**02/04/17 12:00**	**H0204TSB3**

Comment(s): - Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.
- Please see Work Order Narrative, additional comments section.

Parameter	Result	RL	MDL	DF	Qualifiers
Solids, Total	80.3	0.100	0.100	1.00	

Method Blank	**099-05-019-3547**	**N/A**	**Solid**	**N/A**	**N/A**	**02/04/17 12:00**	**H0204TSB3**

Comment(s): - Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Solids, Total	ND	0.100	0.100	1.00	

Return to Contents

RL: Reporting Limit. DF: Dilution Factor. MDL: Method Detection Limit.

Quality Control - Spike/Spike Duplicate

Enthalpy Analytical, Inc.		Date Received:	02/01/17
931 W. Barkley Avenue		Work Order:	17-02-0124
Orange, CA 92868-1208		Preparation:	N/A
		Method:	EPA 9060A
Project: 387148			Page 1 of 1

Quality Control Sample ID	Type	Matrix	Instrument	Date Prepared	Date Analyzed	MS/MSD Batch Number
P20-1T (387148-001)	**Sample**	**Solid**	**TOC 9**	**02/07/17**	**02/07/17 17:00**	**H0207TOC1**
P20-1T (387148-001)	**Matrix Spike**	**Solid**	**TOC 9**	**02/07/17**	**02/07/17 17:00**	**H0207TOC1**
P20-1T (387148-001)	**Matrix Spike Duplicate**	**Solid**	**TOC 9**	**02/07/17**	**02/07/17 17:00**	**H0207TOC1**

Parameter	Sample Conc.	Spike Added	MS Conc.	MS %Rec.	MSD Conc.	MSD %Rec.	%Rec. CL	RPD	RPD CL	Qualifiers
Carbon, Total Organic	4520	30000	36810	108	35960	105	75-125	2	0-25	

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RPD: Relative Percent Difference. CL: Control Limits

Quality Control - Sample Duplicate

Enthalpy Analytical, Inc.
931 W. Barkley Avenue
Orange, CA 92868-1208

Project: 387148

Date Received: 02/01/17
Work Order: 17-02-0124
Preparation: N/A
Method: EPA 376.2M

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Quality Control Sample ID	Type	Matrix	Instrument	Date Prepared	Date Analyzed	Duplicate Batch Number
P20-1T (387148-001)	**Sample**	**Solid**	**N/A**	**02/03/17 00:00**	**02/03/17 15:28**	**H0203SD2**
P20-1T (387148-001)	**Sample Duplicate**	**Solid**	**N/A**	**02/03/17 00:00**	**02/03/17 15:28**	**H0203SD2**

Parameter	Sample Conc.	DUP Conc.	RPD	RPD CL	Qualifiers
Sulfide, Total	ND	ND	N/A	0-25	

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RPD: Relative Percent Difference. CL: Control Limits

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Quality Control - Sample Duplicate

Enthalpy Analytical, Inc.
931 W. Barkley Avenue
Orange, CA 92868-1208

Project: 387148

Date Received:	02/01/17
Work Order:	17-02-0124
Preparation:	N/A
Method:	EPA 376.2M

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Quality Control Sample ID	Type	Matrix	Instrument	Date Prepared	Date Analyzed	Duplicate Batch Number
P20-4Z (387148-011)	**Sample**	**Solid**	**N/A**	**02/03/17 00:00**	**02/03/17 13:15**	**H0203DSD1**
P20-4Z (387148-011)	**Sample Duplicate**	**Solid**	**N/A**	**02/03/17 00:00**	**02/03/17 13:15**	**H0203DSD1**

Parameter	Sample Conc.	DUP Conc.	RPD	RPD CL	Qualifiers
Sulfide, Dissolved	ND	ND	N/A	0-25	

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RPD: Relative Percent Difference.   CL: Control Limits

Quality Control - LCS/LCSD

Enthalpy Analytical, Inc.		Date Received:	02/01/17
931 W. Barkley Avenue		Work Order:	17-02-0124
Orange, CA 92868-1208		Preparation:	N/A
		Method:	EPA 376.2M
Project: 387148			Page 1 of 2

Quality Control Sample ID	Type	Matrix	Instrument	Date Prepared	Date Analyzed	LCS/LCSD Batch Number
099-05-001-5954	**LCS**	**Solid**	**N/A**	**02/03/17**	**02/03/17 15:28**	**H0203SL2**
099-05-001-5954	**LCSD**	**Solid**	**N/A**	**02/03/17**	**02/03/17 15:28**	**H0203SL2**

Parameter	Spike Added	LCS Conc.	LCS %Rec.	LCSD Conc.	LCSD %Rec.	%Rec. CL	RPD	RPD CL	Qualifiers
Sulfide, Total	5.000	4.000	80	4.250	85	80-120	6	0-20	

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RPD: Relative Percent Difference. CL: Control Limits

Quality Control - LCS/LCSD

Enthalpy Analytical, Inc.
931 W. Barkley Avenue
Orange, CA 92868-1208

Project: 387148

Date Received: 02/01/17
Work Order: 17-02-0124
Preparation: N/A
Method: EPA 9060A

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Quality Control Sample ID	Type	Matrix	Instrument	Date Prepared	Date Analyzed	LCS/LCSD Batch Number
099-06-013-1666	**LCS**	**Solid**	**TOC 9**	**02/07/17**	**02/07/17 17:00**	**H0207TOCL1**
099-06-013-1666	**LCSD**	**Solid**	**TOC 9**	**02/07/17**	**02/07/17 17:00**	**H0207TOCL1**

Parameter	Spike Added	LCS Conc.	LCS %Rec.	LCSD Conc.	LCSD %Rec.	%Rec. CL	RPD	RPD CL	Qualifiers
Carbon, Total Organic	6000	6185	103	6219	104	80-120	1	0-20	

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RPD: Relative Percent Difference. CL: Control Limits

Glossary of Terms and Qualifiers

Work Order: 17-02-0124 Page 1 of 1

Qualifiers	Definition
*	See applicable analysis comment.
<	Less than the indicated value.
>	Greater than the indicated value.
1	Surrogate compound recovery was out of control due to a required sample dilution. Therefore, the sample data was reported without further clarification.
2	Surrogate compound recovery was out of control due to matrix interference. The associated method blank surrogate spike compound was in control and, therefore, the sample data was reported without further clarification.
3	Recovery of the Matrix Spike (MS) or Matrix Spike Duplicate (MSD) compound was out of control due to suspected matrix interference. The associated LCS recovery was in control.
4	The MS/MSD RPD was out of control due to suspected matrix interference.
5	The PDS/PDSD or PES/PESD associated with this batch of samples was out of control due to suspected matrix interference.
6	Surrogate recovery below the acceptance limit.
7	Surrogate recovery above the acceptance limit.
B	Analyte was present in the associated method blank.
BU	Sample analyzed after holding time expired.
BV	Sample received after holding time expired.
CI	See case narrative.
E	Concentration exceeds the calibration range.
ET	Sample was extracted past end of recommended max. holding time.
HD	The chromatographic pattern was inconsistent with the profile of the reference fuel standard.
HDH	The sample chromatographic pattern for TPH matches the chromatographic pattern of the specified standard but heavier hydrocarbons were also present (or detected).
HDL	The sample chromatographic pattern for TPH matches the chromatographic pattern of the specified standard but lighter hydrocarbons were also present (or detected).
J	Analyte was detected at a concentration below the reporting limit and above the laboratory method detection limit. Reported value is estimated.
JA	Analyte positively identified but quantitation is an estimate.
ME	LCS Recovery Percentage is within Marginal Exceedance (ME) Control Limit range (+/- 4 SD from the mean).
ND	Parameter not detected at the indicated reporting limit.
Q	Spike recovery and RPD control limits do not apply resulting from the parameter concentration in the sample exceeding the spike concentration by a factor of four or greater.
SG	The sample extract was subjected to Silica Gel treatment prior to analysis.
X	% Recovery and/or RPD out-of-range.
Z	Analyte presence was not confirmed by second column or GC/MS analysis.
	Solid - Unless otherwise indicated, solid sample data is reported on a wet weight basis, not corrected for % moisture. All QC results are reported on a wet weight basis.
	Any parameter identified in 40CFR Part 136.3 Table II that is designated as "analyze immediately" with a holding time of <= 15 minutes (40CFR-136.3 Table II, footnote 4), is considered a "field" test and the reported results will be qualified as being received outside of the stated holding time unless received at the laboratory within 15 minutes of the collection time.
	A calculated total result (Example: Total Pesticides) is the summation of each component concentration and/or, if "J" flags are reported, estimated concentration. Component concentrations showing not detected (ND) are summed into the calculated total result as zero concentrations.

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Rm

Enthalpy Analytical
Formerly Associated Labs
1 Park Plaza, Suite 1000
Irvine, CA 92614
Tel: 714.771.6900 Fax: 714.538.1209
info-sc@enthalpy.com

MONTROSE
ENVIRONMENTAL

17-02-0124

Subcontract Laboratory:

Eurofins CalScience - Sub
7440 Lincoln Way
Garden Grove, CA 92841

ATTN: Xuan Dang
PO# 387148

Project: 387148 **Due:**
PM: Ranjit Clarke
Email: ranjit.clarke@enthalpy.com
CC: incomingreports@enthalpy.com

Require: ☑ EDD ☐ EDF ☐ EDT

Report To: ☐ MDL

Note:

	Matrix	Sampled	Sample ID	Analysis	Comment
1	Solid	01/30/17 15:00	P20-1T (387148-001)	9034 Total Sulfide_OUT	Total & Dissolved
	Solid	01/30/17 15:00	P20-1T (387148-001)	TOC Solid_OUT	
2	Solid	01/30/17 15:10	P20-1M (387148-002)	9034 Total Sulfide_OUT	Total & Dissolved
	Solid	01/30/17 15:10	P20-1M (387148-002)	TOC Solid_OUT	
3	Solid	01/30/17 15:20	P20-1Z (387148-003)	9034 Total Sulfide_OUT	Total & Dissolved
	Solid	01/30/17 15:20	P20-1Z (387148-003)	TOC Solid_OUT	
4	Solid	01/30/17 13:20	P20-2T (387148-004)	9034 Total Sulfide_OUT	Total & Dissolved
	Solid	01/30/17 13:20	P20-2T (387148-004)	TOC Solid_OUT	
5	Solid	01/30/17 13:40	P20-2Z (387148-005)	9034 Total Sulfide_OUT	Total & Dissolved
	Solid	01/30/17 13:40	P20-2Z (387148-005)	TOC Solid_OUT	
6	Solid	01/30/17 12:00	P20-3T (387148-006)	9034 Total Sulfide_OUT	Total & Dissolved
	Solid	01/30/17 12:00	P20-3T (387148-006)	TOC Solid_OUT	
7	Solid	01/30/17 12:10	P20-3M (387148-007)	9034 Total Sulfide_OUT	Total & Dissolved
	Solid	01/30/17 12:10	P20-3M (387148-007)	TOC Solid_OUT	
8	Solid	01/30/17 12:20	P20-3Z (387148-008)	9034 Total Sulfide_OUT	Total & Dissolved
	Solid	01/30/17 12:20	P20-3Z (387148-008)	TOC Solid_OUT	
9	Solid	01/30/17 10:15	P20-4T (387148-009)	9034 Total Sulfide_OUT	Total & Dissolved
	Solid	01/30/17 10:15	P20-4T (387148-009)	TOC Solid_OUT	
10	Solid	01/30/17 10:25	P20-4M (387148-010)	9034 Total Sulfide_OUT	Total & Dissolved
	Solid	01/30/17 10:25	P20-4M (387148-010)	TOC Solid_OUT	
11	Solid	01/30/17 10:35	P20-4Z (387148-011)	9034 Total Sulfide_OUT	Total & Dissolved
	Solid	01/30/17 10:35	P20-4Z (387148-011)	TOC Solid_OUT	

Note:
STANDARD TAT

9034: It is o.k. to run EPA 376.2M instead. Please report total and dissolved sulfides (if possible).

Relinquished By	Received By:
	Sal Ram
Date/Time 2/1/17 15:20	Date/Time 2/1/17 15:20
Sam	Dunnyle ECI
Date/Time 2/1/17 16:07	Date/Time 2/1/17 16:07

eurofins | Calscience

WORK ORDER NUMBER: 17-02- 0124

SAMPLE RECEIPT CHECKLIST

COOLER 1 **OF** 1

CLIENT: Enthalpy Analytical

DATE: 02 / 01 **/ 2017**

TEMPERATURE: (Criteria: 0.0°C – 6.0°C, not frozen except sediment/tissue)

Thermometer ID: SC3B (CF: 0.0°C); Temperature (w/o CF): 3.8 °C (w/ CF): 3.8 °C; ☐ Blank ☒ Sample

☐ Sample(s) outside temperature criteria (PM/APM contacted by: ________)

☐ Sample(s) outside temperature criteria but received on ice/chilled on same day of sampling

☐ Sample(s) received at ambient temperature; placed on ice for transport by courier

Ambient Temperature: ☐ Air ☐ Filter

Checked by: 619

CUSTODY SEAL:

Cooler	☐ Present and Intact	☐ Present but Not Intact	☒ Not Present	☐ N/A	Checked by: 459
Sample(s)	☐ Present and Intact	☐ Present but Not Intact	☒ Not Present	☐ N/A	Checked by: 681

SAMPLE CONDITION:	Yes	No	N/A
Chain-of-Custody (COC) document(s) received with samples	☒	☐	☐
COC document(s) received complete	☒	☐	☐
☐ Sampling date ☐ Sampling time ☐ Matrix ☐ Number of containers			
☐ No analysis requested ☐ Not relinquished ☐ No relinquished date ☐ No relinquished time			
Sampler's name indicated on COC	☐	☐	☒
Sample container label(s) consistent with COC	☒	☐	☐
Sample container(s) intact and in good condition	☒	☐	☐
Proper containers for analyses requested	☒	☐	☐
Sufficient volume/mass for analyses requested	☒	☐	☐
Samples received within holding time	☒	☐	☐
Aqueous samples for certain analyses received within 15-minute holding time			
☐ pH ☐ Residual Chlorine ☐ Dissolved Sulfide ☐ Dissolved Oxygen	☐	☐	☒
Proper preservation chemical(s) noted on COC and/or sample container	☐	☐	☒
Unpreserved aqueous sample(s) received for certain analyses			
☐ Volatile Organics ☐ Total Metals ☐ Dissolved Metals			
Container(s) for certain analysis free of headspace	☐	☐	☒
☐ Volatile Organics ☐ Dissolved Gases (RSK-175) ☐ Dissolved Oxygen (SM 4500)			
☐ Carbon Dioxide (SM 4500) ☐ Ferrous Iron (SM 3500) ☐ Hydrogen Sulfide (Hach)			
Tedlar™ bag(s) free of condensation	☐	☐	☒

CONTAINER TYPE: **(Trip Blank Lot Number: ________________)**

Aqueous: ☐ VOA ☐ VOAh ☐ $VOAna_2$ ☐ 100PJ ☐ $100PJna_2$ ☐ 125AGB ☐ 125AGBh ☐ 125AGBp ☐ 125PB ☐ **125PBznna** ☐ 250AGB ☐ 250CGB ☐ 250CGBs ☐ 250PB ☐ 250PBn ☐ 500AGB ☐ 500AGJ ☐ 500AGJs ☐ 500PB ☐ 1AGB ☐ $1AGBna_2$ ☐ 1AGBs ☐ 1PB ☐ 1PBna ☐ ________ ☐ ________ ☐ ________ ☐ ________

Solid: ☒ 4ozCGJ ☐ 8ozCGJ ☐ 16ozCGJ ☐ Sleeve (_____) ☐ EnCores® (_____) ☐ TerraCores® (_____) ☐ ________

Air: ☐ Tedlar™ ☐ Canister ☐ Sorbent Tube ☐ PUF ☐ ________ **Other Matrix** (____________): ☐ ________ ☐ ________

Container: **A** = Amber, **B** = Bottle, **C** = Clear, **E** = Envelope, **G** = Glass, **J** = Jar, **P** = Plastic, and **Z** = Ziploc/Resealable Bag

Preservative: **b** = buffered, **f** = filtered, **h** = HCl, **n** = HNO_3, **na** = NaOH, **na₂** = $Na_2S_2O_3$, **p** = H_3PO_4, **s** = H_2SO_4, **u** = ultra-pure, **x** = $Na_2SO_3+NaHSO_4.H_2O$, **znna** = $Zn(CH_3CO_2)_2$ + NaOH

Labeled/Checked by: 681

Reviewed by: 1017

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APPENDIX E: SOIL AGRICULTURAL SUITABILITY REPORT

Waypoint ANALYTICAL

Anaheim Office
Lab No: 17-039-0008
February 17, 2017

Great Ecology
2251 San Diego Ave. Suite A218
San Diego, CA 92110

Attn: Nick Buhbe

POND 20 SAN DIEGO, CA-JOB # CA281.002

Attached are the results of the analyses performed on four soil samples that were received by our laboratory on February 8, 2017. These samples were analyzed to determine salinity (ECe), sodium adsorption ratio (SAR), soluble cations (calcium, magnesium, potassium and sodium), sulfate, boron, pH and qualitative lime.

Analytical Results:

Salinity (ECe) is elevated in all four samples, ranging from 60.4 dS/m in the P20-2Z to 88.6 dS/m in the P20-4Z sample. In all four samples, soluble sodium is the greatest contributor to salinity and is not properly balanced by calcium and magnesium in regards to soil structure formation and water infiltration, as indicated by the high sodium adsorption ratio (SAR) values ranging from 60.56 in the P20-2Z sample to 85.06 in the P20-1Z sample. Soils with an SAR of 15 or greater are described as “sodic”. This is a condition in which sodium is expected to have a severe negative impact on soil structure and water infiltration.

Boron is elevated in the four samples, ranging from 2.42 parts per million (ppm) in the P20-1Z sample to 10.50 ppm in the P20-2Z sample. Elevated boron can cause burning of foliage and when very high can have a severe negative impact on plant growth of many species and, potentially, survivability.

The reaction of the soil represented by the P20-2Z sample is slightly alkaline at 7.2 on the pH scale, which is suitable for a broad range of plants. The other three samples are moderately alkaline with pH values ranging from 7.8 in the P20-Z sample to 8.0 in the P20-3Z sample. Salt marsh plants do tend to have some tolerance for alkaline soil conditions and this may not be an issue, though some plants could potentially show some yellowing of younger foliage. An absence of qualitative lime in all four samples indicates that the soil is weakly buffered in the alkaline range.

Comments

These salinity levels are even higher throughout than in the past analysis at Del Mar Phase 2.

We assume that salt marsh plants with a high tolerance of saline soil conditions are slated for this project.

In the event that an attempt is made to reclaim this soil for non-halophytes, the following comments are provided as they were in the previous report.

If there is a desire to reduce soluble salts then leaching irrigations should be applied to flush salts from the root zone. Drainage must be sufficient for leaching to be effective. Severely compacted areas should be ripped or tilled to a depth of at least 9 inches.

It would also be prudent to incorporate gypsum in areas to be leached to provide additional soluble calcium to help adjust SAR values downward. It is worth noting that we often see good downward water movement through the soil profile in sodic soils when the ECe value is also very high, as is the case in all of these samples. In those instances, water movement will often be sufficient at the start of leaching but as the ECe decreases and the SAR remains elevated, the soil can “lock up” and drainage will slow. Gypsum should help with this but it is something to monitor for.

Be sure to allow the soil to dry slightly between irrigations to avoid creating anaerobic soil conditions. Leaching irrigations should be applied evenly and in a manner that avoids run off and pooling.

The amount of leaching that will be applied to reduce salts should also reduce boron in the soil. After leaching, consider submitting samples for re-testing to determine post-leaching salinity, SAR and boron values. Additional leaching and/or gypsum application may be needed.

Also keep in mind that as salts are flushed out of the root zone, the sub soil is likely to remain saline and high in boron. Some plants could still potentially show burning of foliage.

Provided below are gypsum application rates and leaching recommendations. These estimates are designed with the goals of reducing salinity to less than 4.0 dS/m and reducing the SAR to less than 6.0. If the plants chosen for this project have a high tolerance to elevated salinity, less gypsum will be required.

Sample Identification	**Lbs. of gypsum to apply in lbs. per 1000 sq. ft. to a depth of 6 inches**	**Amount of leaching to apply in inches.**
P20-1Z	200	13
P20-2Z	200	12
P20-3Z	200	13
P20-4Z	200	14

There is some chance that pH values may also decrease as the SAR values decrease. However, high pH values due to sodic conditions are typically in the 8.5 to 9.0 range and it does not appear that, in this case, the alkaline reaction is due to sodicity. The pH values will likely remain in the alkaline range even as the SAR values decrease.

If follow up testing again shows moderately alkaline reaction and you wish to adjust the pH values downward to avoid any potential issues of alkalinity induced chlorosis that can be accomplished by incorporating soil sulfur. The rates of sulfur incorporation should be based on pH values after the SAR values have reached safely low levels.

If we can be of any further assistance, please feel free to contact us.

Joe Kiefer

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San Diego CA 92110

Waypoint ANALYTICAL
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Main 714-282-8777 ° Fax 714-282-8575
www.waypointanalytical.com

Project : Pond 20
San Diego, Ca.
Job# Ca281.002

AGRICULTURAL SUITABILITY

Report No : **17-039-0008**
Purchase Order :
Date Printed : 02/13/2017
Date Recd : 02/08/2017

Sample Description - Sample Id - Plant Name	**HalfSat %**	**pH s.u.**	**Qual. Lime**	**OM %**	**Saturation Extract**									**Bulk Density**	**Lab No**
					ECe dS/m	**Ca meq/L**	**Mg meq/L**	**Na meq/L**	**K meq/L**	**B ppm**	**SO_4 meq/L**	**Cl meq/L**	**SAR**		
P20-1Z	33	7.9	None		69.2	25.5	119.0	723.0	14.7	2.42	58.4		85.06		05841
P20-2Z	20	7.8	None		60.4	58.4	112.0	559.0	18.4	10.50	103.0		60.56		05842
P20-3Z	14	8.0	None		71.9	17.7	117.0	613.0	16.4	8.18	91.1		74.70		05843
P20-4Z	16	7.2	None		88.6	35.9	161.0	746.0	12.4	3.63	73.7		75.18		05844

Half Saturation %= approximate field moisture capacity. Salinity , saturation extract = ECe (dS/m at 25 degree C)
SAR = Sodium Adsorption Ratio . Ca - calcium , Mg - magnesium , K - potassium , Na - sodium , B - boron , SO_4 - sulfate

APPENDIX F:
JURISDICTIONAL DETERMINATION REPORT FOR WATERS OF THE U.S.

DELINEATION OF JURISDICTIONAL WETLANDS AND NON-WETLAND WATERS UNDER CLEAN WATER ACT SECTION 404

PROPOSED SOUTH SAN DIEGO BAY WETLAND MITIGATION BANK (POND 20)

December 4, 2017

Submitted to:

United States Army Corps of Engineers
Los Angeles District
5900 La Place Court #100
Carlsbad, CA 92008

Submitted on behalf of:

Port of San Diego
Planning & Green Port
3165 Pacific Highway
San Diego, CA 92101

LIST OF PREPARERS

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Brian Felten, J.D.	Technical Ecologist and Regulatory Specialist
Marlene Tyner-Valencourt, M.E.S.M	Technical Ecologist and GIS Analyst

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FIGURES

APPENDICES

1 INTRODUCTION

The proposed South San Diego Bay Wetland Mitigation Bank (hereafter referred to as the Site) is located just south of San Diego Bay in the City of San Diego in San Diego County, California (FIGURE 1). Approximately 83.5 acres in size, the Site is a contiguous land parcel owned by the Port of San Diego (Port). The Port seeks to create a wetland mitigation bank within the bermed area at the former salt pond referred to as Pond 20, by conducting a significant restoration effort to restore wetlands to the interior of the pond. As part of the mitigation bank development and entitlement process, the Port engaged Great Ecology to identify jurisdictional wetlands and non-wetland Waters of the United States (waters or WUS) and to quantify their extent, as defined in 33 CFR 328.4 and regulated by the United States Army Corps of Engineers (USACE) under the authority of Section 404 of the Clean Water Act (1972) (CWA). Great Ecology conducted a preliminary data evaluation followed by a four-day field wetland delineation beginning January 31, 2017, the results of which are synthesized in this report for coordination with USACE.

1.1 Site Description

Pond 20 is located on the southernmost end of San Diego Bay in Township 18 South, Range 2 West, Sections 20 and 21. It is located on the north side of Palm Avenue, west of Saturn Boulevard, and east of 13th Street. The Site centroid is Latitude 32.5869°N, Longitude 117.1004°W. There is no official address for the Site. The northern boundary and a portion of the western boundary abut the South San Diego Bay Unit of the U.S. Fish and Wildlife Service's (USFWS) San Diego National Wildlife Refuge (Refuge). Within the Refuge and located along the immediate north and east boundaries of Pond 20 lies a vacant parcel with an identical site use history, which will be the site of the Otay River Estuary Restoration Project (ORERP), a mitigation project stemming from impacts to marine life caused by the Poseidon Water Resources Desalination Facility located in Carlsbad, CA. To the north of the ORERP site is the channelized Otay River, which flows from east to northwest where it enters San Diego Bay. The southern boundary of the Site is lined with residential, commercial, and infrastructure development. The Site receives an average of 9.73 inches of precipitation annually, with February being the wettest month on average (WRCC Station No. 041758, 1918-2016).

The Pond 20 Site is comprised of three distinct parcels of land (FIGURE 2):

- The Pond 20: a wholly bermed and enclosed non-operational solar salt evaporator pond that was formerly part of the Western Salt Company's South San Diego Bay Saltworks;
- The Nestor Creek Area (not a component of the mitigation bank): includes portions of Nestor Creek and wetland habitats within and surrounding the channel on the outside of Pond 20's eastern berm; and

- The Otay River Tributary Area (not a component of the mitigation bank): includes a section of the Otay River Tributary and wetland habitats surrounding the channel on the outside of Pond 20's western berm.

The interior of the bermed area at Pond 20 is surrounded by earthen berms and is comprised of disturbed upland salt flats and isolated hypersaline pools perched on fill material. The interior of Pond 20 is isolated from surface tidal flows and only receives surface water inputs via precipitation and stormwater flows from Palm Avenue, located along the southern border (FIGURE 2). The average elevation of the interior of Pond 20 is 9.05 feet Mean Lower Low Water (MLLW), and ranges from 4.43 to 12.43 feet MLLW (Towill 2017). The berm heights surrounding the Pond are between 13.43 and 14.43 feet MLLW and enclose the entirety of the interior of Pond 20(FIGURE 3).

The Nestor Creek and Otay River Tributary are each comprised of channelized flows where the berms surrounding Pond 20 form one of the channel banks. Nestor Creek, located outside the eastern berm, is an urban freshwater-to-brackish stream that flows north past Pond 20 into the Otay River. The Otay River Tributary, located outside the western berm of Pond 20 is tidal water that flows south from the Otay River near its entrance to San Diego Bay. The Otay River Tributary terminates in the southwest corner of the exterior of Pond 20. Neither Nestor Creek nor the Otay River Tributary flow into or through the interior of Pond 20 (FIGURE 2). The average elevation of the Nestor Creek Area is 6.19 feet MLLW, and ranges from 4.43 to 11.43 feet MLLW at the tow of the berm. The average elevation of the Otay River Tributary Area is 5.45 feet MLLW, and ranges from 4.43 to 6.43 feet MLLW at the toe of the berm (FIGURE 3).

1.2 Historic Land Uses

The interior of Pond 20 use history was investigated and evaluated in depth using historical imagery and review of available documents, and is summarized here. Pond 20 is located south of the confluence of Nestor Creek and the Otay River, and is South of San Diego Bay. Pond 20 supported wetland habitats until at least 1870 when it was incorporated into the salt works evaporation system (Grossinger et al. 2011, APPENDIX B Image 1A and 1B; BLM 1987, APPENDIX B Image 2). The salt evaporation and extraction industry has operated in south San Diego Bay since the early 1870s and included the interior of Pond 20 (EDAW 2001). In the 1890s, the Western Salt Company acquired most of the salt producing entities and lands in South San Diego Bay.

The "Saltworks," as the Western Salt Company operation is known, includes a large complex of networked condensation and crystallization salt evaporator ponds in south San Diego Bay. The salt works operations include the intake of bay water entering the salt pond evaporation system, and water traveling through the evaporation ponds by the pull of gravity, siphons, or pumps. The salt concentrates as the water evaporates, and the increasingly saline water is pumped from pond to pond until the salt precipitate is harvested.

Pond 20, was constructed by excavating borrow areas at the base of the interior berms for the reconstruction and repair of the berms. These borrow areas are estimated at 2-4 below the existing grades within Pond 20. Additionally, these borrow areas also provided water storage for transfers of water from one pond to another within the salt pond system (Merkel 2008).

In 1916, the Savage Dam failed causing the release of the Lower Otay Lake into the lower watershed including Pond 20. The dam failure washed away several berms within the Saltworks, including those of Pond 20, and deposited substantial volumes of sediment. Pond 20 and the rest of the Saltworks were restored and operational by 1918, with water entering Pond 20 via siphons. However, the additional sediment caused the interior elevation of Pond 20 to increase to a height that, along with its southern location and distance from the other ponds, made its continued use logistically and economically inefficient within the Saltworks operation. Western Salt attempted to reincorporate Pond 20 again into Saltworks operations in the 1960s using a new system of electrical pumps to facilitate the movement of water to the other ponds in the network. This effort ultimately failed and Pond 20 and the surrounding area as a whole have since remained vacant.

1.3 Regulatory Background

Rivers and Harbors Act of 1899, Section 10

Under Section 10 of the Rivers and Harbors Act of 1899 (RHA), USACE regulates the activities within or affecting navigable waters of the United States. Navigable waters are defined as those waters subject to the ebb and flow of the tides shoreward to the mean high water (MHW) mark, and have or are currently used in part to transport interstate or foreign commerce. Pond 20 does not lie within the historic MHW mark for San Diego Bay, nor is Pond 20 subject to the ebb and flow of the tides due to the surrounding berms. In a letter from USACE to Eileen Maher at the Port of San Diego, dated February 22, 2000, USACE declined to exert jurisdiction over the Site under RHA Section 10 following an analysis of the Pond's location relative to the historic meander line of an 1870 U.S. Land Office Map (BLM 1870; Durham 2000).

Clean Water Act, Section 404

Under Section 404 of the CWA, first enacted in 1972, USACE regulates the discharge of dredged or fill material into jurisdictional waters of the U.S., which include those waters listed in 33 CFR 328.3. For this delineation, all waters of the U.S., including waters listed in 33 CFR 328.3, were delineated to their jurisdictional limits as defined by 33 CFR 328.4 and per the regulations and applicable guidance in effect prior to August 28, 2015.

1.4 Summary of Potential Jurisdictional Areas

APPENDIX A depicts the extent of jurisdictional wetland and non-wetland waters outside the berm at Pond 20 based on a wetland delineation conducted by Great Ecology on January 31 through February 6, 2017. TABLE 1 summarizes the acreage of these CWA Section 404 jurisdictional areas. No wetlands occur within the interior berm at Pond 20.

TABLE 1: SUMMARY OF POTENTIAL SECTION 404 JURISDICTIONAL AREAS OUTSIDE OF POND 20

Site Features Name	Classification	Potential Jurisdictional Determination	Estimated Area (acres)
Otay Tributary (Outside the Pond 20 Berm)			
Wetland 1	Emergent Wetland (PEM1F)	Wetland Water of the U.S.	0.0086
Wetland 2	Salt Marsh Wetland (E2EM1P)	Wetland Water of the U.S.	0.8977
Drainage Feature 1	Unvegetated drainage	Non-Wetland Water of the U.S.	0.0303
Nestor Creek (Outside the Pond 20 Berm)			
Wetland 3	Emergent Brackish Marsh Wetland (E2EM1N)	Wetland Water of the U.S.	0.0025
Wetland 4	Salt Marsh Wetland (E2EM1P)	Wetland Water of the U.S.	0.2285
Wetland 5	Emergent Brackish Marsh Wetland (E2EM1N)	Wetland Water of the U.S.	0.0055
Wetland 6	Emergent Brackish Marsh Wetland (E2EM1N)	Wetland Water of the U.S.	0.0158
Wetland 7	Emergent Brackish Marsh Wetland (E2EM1N)	Wetland Water of the U.S.	0.0027
Open Water 1	Otay River tributary; tidal riverine (R1UB3)	Non-Wetland Water of the U.S.	0.2019
Open Water 2	Nestor Creek; tidal riverine (R1UB3)	Non-Wetland Water of the U.S.	0.1394
Wetland Waters of the U.S. Total Area			1.16
Non-Wetland Waters of the U.S. Total Area			0.37

2 PRELIMINARY DATA GATHERING AND ANALYSIS

Prior to conducting the delineation, Great Ecology reviewed site data, including historical aerial imagery, U.S. Geological Survey (USGS) topographic maps, Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRMs), USFWS National Wetland Inventory (NWI) maps, and Natural Resources Conservation Service (NRCS) soil survey data, to assist in identifying surface waters and potential wetland areas in and outside of Pond 20. Site-specific data are described below.

2.1 Historical Aerial Imagery

Historical aerial imagery was reviewed to identify suspected wetlands or water bodies that may be present on outside and within the berm at Pond 20. Great Ecology provided analyses of an 1852 T-sheet, an 1870 U.S. Land Office map, and aerial imagery dated from 1953 to 2014. All images are collected in APPENDIX B.

A T-sheet dated 1852 shows that Pond 20 was located within an estuary complex and comprised of vegetated wetlands. The T-sheet shows a multi-branch channel leading from South San Diego Bay into the wetland complex, though these channels did not extend into the Pond 20 boundaries. The 1852 T-sheet shows the entirety of the Saltworks complex as either intertidal flats or vegetated wetlands.

A U.S. Land Office Map, prepared by the Bureau of Land Management (BLM) in 1870, shows the Site was located within a wetland complex located to the south of San Diego Bay (APPENDIX B). According to an analysis of this map by the USACE South Coast Chief in 2000, the Site was not located within the historic meander line of San Diego Bay (Durham 2000).

Historical investigations focusing on the Saltworks estimate that the berms were constructed in the late 1870s (EDAW 2001). The earliest aerial photograph available shows the berms present in 1953.

Aerial photographs from 1953 through 1989 show the majority of the southern interior of Pond 20 as completely inundated, and the northern portion of Pond 20 exposed, except for the borrow areas at the base of the interior berms. The southern portion of Pond 20 within the berm is intermittently exposed throughout this time period.

The water in the southern portion of Pond 20 begins to recede starting in 1989, with the 1994 imagery showing exposed salt crust. Photographs from 1994 to 2014 show that inundation characteristics within Pond 20 are consistent with current conditions. Great Ecology saw no indication of salt evaporator pond operations within Pond 20 since 1953. The aerial imagery suggests that surface water features located in the borrow areas at the base of the southern and western perimeter berms within Pond 20 are perennial.

2.2 *Topographic Maps Summary*

Great Ecology reviewed USGS 7.5 Minute topographic maps of Pond 20 to classify topography and identify drainages or WUS.

The Imperial Beach quadrangle, San Diego County, California can be seen in FIGURE 4. The USGS map shows Pond 20 as nearly flat and the presence of berms outlining Pond 20, denoted as a "salt evaporator pond" on the map. Directly north of Pond 20 is the Otay River, situated in a northeast-to-southwest orientation, followed by individual salt evaporator impoundments located within the Refuge. The Otay River flows east to west, to the north of Pond 20, before turning northwest to empty into San Diego Bay. The nearest permanent water source and WUS appears to be the Otay River, which flows between 200 and 1,300 feet north of the northern boundary of Pond 20.

A high-resolution topography map was developed in January 2017 (FIGURE 3), which was referenced extensively for this delineation effort.

2.3 *Tidal and Floodplain Summary*

Great Ecology reviewed the FEMA National Flood Insurance Program's FIRM for San Diego County, California (Panel 2153, revised April 2016) to identify the location of the Site relative to a 100-year floodplain. The Site is located in the 100-year floodplain for the Otay River and San Diego Bay (APPENDIX C). The Bermed Area is distinctly denoted in the northeast corner of the FIRM by a surrounding unaccredited levee. An unaccredited levee is one for which FEMA has not been provided the design, data, and documentation required by Federal regulations to support a determination that the levee provides "a base chance or greater level of flood hazard reduction" (FEMA 2016). The state of being unaccredited does not mean the levee does not provide flood hazard risk reduction, but rather that documentation may not have been submitted or reviewed by FEMA and updated in the FIRM panel.

Waters from San Diego Bay, the Otay River and its Tributary, and Nestor Creek are unable to enter the interior of Pond 20 via surface water flows, even under extreme high tides. TABLE 2 shows the berm height surrounding Pond 20 as compared with the height of the maximum tide height measured in North San Diego Bay (NOAA Tidal Gauge #9410170) between 1950 and 2017 (NOAA 2017). The data shows a difference of 5.8 to 6.8 feet MLLW or more between the height of the berm and the highest recorded tide.

TABLE 2: COMPARISON OF BERM AND TIDE HEIGHTS, 1950-2017 (DATUM: MLLW)

Berm Height (feet)	Maximum Tide Height (feet)	Difference (feet)
13.43 – 14.43	7.63	5.8 – 6.8

2.4 National Wetland Inventory Summary

Great Ecology reviewed the USFWS National Wetland Inventory (NWI) maps for Pond 20, last updated in 2006, to identify potential wetland areas within the project boundary. NWI is only intended to provide reconnaissance level information of potential wetlands and does not delineate jurisdictional WUS (USFWS 2017). The type and extent of wetlands was field-validated as part of this evaluation and our findings and are presented in the Results section below. The NWI map of Pond 20 is included as FIGURE 5.

NWI shows the exterior of Pond 20 – Nestor Creek and the Otay River tributary as almost entirely intertidal, unconsolidated shore estuarine and marine wetlands and intertidal emergent estuarine and marine wetlands impounded by a berm that obstructs inflow or outflow of water. Directly east along the exterior of Pond 20 is Nestor Creek, classified as an estuarine and marine wetland with intertidal influence, which leads northwest and drains into the Otay River. On the east side of the Pond 20 berm is the Otay River Tributary, classified as estuarine and marine wetland with intertidal influence, which extends north-northwest along the western boundary of Pond 20 and also drains towards the Otay River.

The onsite field investigation revealed that current conditions within Pond 20 do not reflect the NWI categorizations shown on the map. The interior of Pond 20 is currently comprised of largely disturbed upland habitat with large, isolated pools located in the borrow areas at the base of the northern, western, and southern berms, and isolated topographic depressions located on the eastern side of Pond 20. The habitat types located along the Nestor Creek and Otay River Tributary Areas on the east and west edges of Pond 20 outside of the berms are largely consistent with the NWI classifications.

2.5 Soil Survey Summary

Great Ecology reviewed the NRCS Web Soil Survey (2014) to identify soil types, including hydric soils that may be located within Pond 20. The soil survey map is included as FIGURE 6 and soil types identified within the project area are summarized in TABLE 3.

TABLE 3: SOIL TYPES PRESENT ON SITE (NRCS SOIL SURVEY 2014)

Soil Map Unit Name	% of Site	Drainage Type	Depth to Water Table (inches)	Flooding Frequency	Ponding Frequency	Hydric Rating
LG-W- Lagoon Water	55.2	N/A	N/A	N/A	N/A	No
GoA- Grangeville fine sandy loam, 0 to 2 percent slopes	39.8	Somewhat poorly drained	24 to 48	Rare	None	Yes
HuC Huerhuero-Urban land complex, 2 to 9 percent slopes	4.6	Moderately well drained	>80	None	None	No
HrC- Huerhuero loam, 2 to 9 percent slopes	0.3	Moderately well drained	>80	None	None	Yes

The northern portion of the interior of Pond 20 is characterized by Grangeville fine sandy loam. Test pits dug within this soil map unit revealed non-native soils with textures ranging from sand to silt to clay. Great Ecology found hydric soil indicators at one of six test pits dug within this soil map unit (see FIGURES 6 and 7).

The southern portion of the interior of Pond 20 is categorized as Lagoon Water. Aerial imagery and the field investigation show areas of Pond 20 categorized as Lagoon Water do not currently entirely reflect that condition. Pond 20 is isolated from tidal flows.

The northern portion of the interior of Pond 20 has not been completely submerged or worked as a salt evaporation pond since the 1960s, and the southern portion of the interior of Pond 20 has not been submerged since 1989, according to the historical aerial imagery analysis (see ***Section 2.1*** and APPENDIX B). Approximately 7.4 acres of persistent isolated ponds of water are present in Pond 20 within this soil map unit. These isolated pools receive surface water flows exclusively from precipitation and stormwater runoff originating from Palm Avenue along the southern border of Pond 20. Pond 20 was engineered to hold water within a retention basin bounded by berms and an impervious subterranean seal forming the bottom of the pond (EDAW 2011). Pond 20 therefore collects and holds precipitation, and rainwater does not drain from the pond, it only evaporates. Test pits (T1.2, T2.2, and T3.2; see FIGURE 7) dug in recently inundated depressional areas within this soil unit revealed non-native soils comprised of sandy loam and foreign fill materials, including construction lumber debris. Great Ecology encountered moderately alkaline soils defined as a problematic soil condition in the Arid West Regional Supplement to the Wetland Delineation Manual (USACE 2008). Using guidance outlined within the Arid West supplement (Arid West Regional Supplement), Great Ecology determined that these soils are not hydric (see an in-depth discussion of this in ***Section 4.4***).

2.6 *Previous Site Delineation Efforts*

Jurisdictional wetland delineation field efforts were conducted in 1997 and 2008 (Dudek 1997; Merkel 2008). Both efforts were consistent in their delineation of jurisdictional wetlands and non-wetland waters of the U.S. in the Otay River Tributary and Nestor Creek Areas.

The delineations consistently recorded positive wetland hydrology indicators across Pond 20. Additionally, both delineations consistently found a lack of positive hydrophytic vegetation indicators. Since 1997, Pond 20 has been observed to be comprised of two distinct vegetation communities: the largely unvegetated salt flats and upland herbaceous community populating the lower-lying southern area, and disturbed upland scrub present on the higher-elevation northern portion.

The 1997 delineation did not record positive hydric soil indicators, but the 2008 delineation did within unvegetated topographic depressional features. The 1997 delineation was conducted during an average rainfall year, while the 2008 delineation was conducted in July, two months after May, which was characterized by above normal precipitation (here, "above normal" precipitation is defined as above the 70th percentile for the region, and "below normal" as below the 30th percentile) (TABLE 4). It can be difficult to identify hydric soils in the field, and the interpretation of indicators is highly subjective. The inconsistency in the presence or absence of hydric soil indicators within Pond 20 over time could be due to differences in interpretation of indicators by field delineators across all delineation events, or it may indicate that soil characteristics within Pond 20 are dependent on interannual variability in precipitation and long-term changes in climate.

TABLE 4: PRECIPITATION COMPARISION BETWEEN PREVIOUS DELINEATION YEARS

Month	Average Precipitation (inches)	30th Percentile Precipitation (inches)	70th Percentile Precipitation (inches)	1996 Precipitation (inches)	2008 Precipitation (inches)
January	1.75	0.56	2.02	0.61	0.58[M]
February	2.27	1.13	2.78	1.74	0.57[M]
March	1.3	0.61	1.53	1.12	0
April	0.63	0.22	0.68	0.33	0.02
May	0.2	0	0.12	0	1.53
June	0.05	0	0	0	0
July	0.06	0	0	0	0*,[M]
August	0.01	0	0	0	0[M]
September	0.11	0	0	0*	0
October	0.49	0	0.24	1.33	0
November	0.63	0.29	0.68	1.6	0.21
December	1.4	0.63	1.57	0.88	2.07[M]

Source: NRCS Wetlands (WETS) Climate Tables, Chula Vista, CA Station
Notes
* Month in which delineation effort was conducted

[M] Month missing any data
Orange cell – recorded monthly precipitation was lower than 30th Percentile
Green cell – recorded monthly precipitation was higher than 70th Percentile

3 FIELD METHODS

From January 31, 2017 to February 6, 2017, Marlene Tyner-Valencourt, Brian Felten, and Ashley Tuggle from Great Ecology (team or Great Ecology) conducted an onsite jurisdictional delineation. The field effort was conducted during an above-average rainy season following a four-year drought. Temperatures on the Site during the field delineation effort ranged from 52°F to 65°F, and precipitation during the field effort was limited to less than 0.01 inches of rain on February 6. Approximately 0.58 inches of rain fell in the week before the field effort. Site conditions observed during the field delineation effort are discussed in **SECTION 4**.

The team located, delineated, and mapped wetland features using standard wetland delineation protocols (USACE 1987; WTI 1995; USACE 2008; WTI 2013). The team determined wetland boundaries by the prevalence of hydrophytic vegetation, hydric soils, and indicators of wetland hydrology. Great Ecology documented these conditions using Routine Wetland Determination Data Forms for the Arid West Region (APPENDIX D). The team followed standard guidance for sites greater than five acres by utilizing the transect-based sampling method, employing four transects. As the team walked the transect lines from east to west, the team interspersed paired (one in an upland habitat and one in suspected wetland habitat) or triplet (one in a local depression and two in the surrounding upland) sample plots to characterize areas where the vegetation community and/or elevation dramatically shifted. Transects and sample point locations are shown in FIGURE 7.

Sample plots included soil pit sampling and a vegetation survey. The team examined and described the soil from the pit to a depth of 20 inches, and noted any hydrologic indicators (standing water, etc.). In addition, the team identified herbaceous vegetation within a five-foot radius of the sample plot center, shrubs within a 15-foot radius, and trees within a 30-foot radius. The team used visual evidence of an Ordinary High Water Mark (OHWM) to delineate boundaries of open water surface features per standard USACE Guidance (USACE 2005; Lichvar and McColley 2008). The team measured OHWM width at several points along the Nestor Creek and Otay River tributary, respectively.

For open water features located in the interior of the Pond 20 berms, the team walked the OHWM boundary using a handheld Trimble Geo 7x GPS unit, capable of capturing GPS data at sub-meter accuracy. For Nestor Creek and the Otay River tributary features, the team used the average width of the OHWM measured at seven and nine locations along each channel, respectively, as a standard buffer distance for a centerline plotted in ArcGIS 10.1. The team measured the salt marsh extent on along Nestor Creek as five feet from the OHWM at several points along the Creek and used that as a standard buffer radius to digitize the salt marsh extent. The team walked the boundary of the salt marsh community along the east side of the Otay River tributary where passable. In areas where the slope degree inhibited walking the line, the team matched the line captured in the field by our GPS unit to one-foot contour lines as measured by the January 2017 topography survey conducted by Towill, Inc. surveyors (2017). Great Ecology mapped freshwater marsh habitat within the Nestor Creek by marking the northern and southern limits using the GPS units.

3.1 Difficult Wetland Situations in the Arid West

The Arid West Regional Supplement (USACE 2008) includes procedures to identify wetlands when problematic or atypical conditions have altered wetland hydrology, soils, or vegetation, collectively referred to by the USACE as "Difficult Wetland Situations." Problematic situations reflect normal seasonal or annual environmental variability, whereas atypical wetland situations refer to recent human activities or natural events. Under both types of situations, indicators of wetland vegetation, soils, or hydrology may be absent.

To determine if any sample points taken met the criteria for problematic or atypical situations, Great Ecology utilized the list of difficult wetland situations included in the Arid West Regional Supplement to identify areas with problematic hydrophytic vegetation, problematic hydric soil, and wetlands that periodically lack indicators of wetland hydrology. This was augmented by referencing guidance on problem areas and atypical situations included in the 1987 Manual and Arid West Regional Supplement (USACE 1987; USACE 2008). The results of our analysis regarding the applicability of difficult wetland situations within Pond 20 are discussed in ***Section 4.4***. The rationale for all wetland determinations based on fewer than three parameters was explained on the data sheets included in APPENDIX D. The 1987 Manual and Arid West Regional Supplement do not include an exhaustive list of the difficult situations that may be encountered during delineations in the Arid West. Great Ecology therefore used its best professional judgment and understanding of regional wetland ecology to interpret all data collected.

4 SUMMARY OF CURRENT SITE CONDITIONS

During the January 31 to February 6, 2017 field survey, Great Ecology made observations of current site conditions, including characteristics of soils, hydrology, and vegetation communities. This information was utilized to support jurisdictional determinations in the field and is summarized below.

4.1 Hydrology

4.1.1 Precipitation

The field delineation effort was conducted during an above-average rainy season following a four-year drought which occurred from 2012 through 2016. Approximately 0.58 inches of rain fell the week before the field effort. In the 2016 to 2017 wet season, precipitation was above normal for two months prior to the field delineation effort. Rainfall recorded in December 2016 and January 2017 was greater than the 70th percentile of the 30-year precipitation regime for each of those months, respectively, and 2016 total annual precipitation was greater than the 70th percentile annual precipitation level as well (TABLE 5). There is no indication that this short-term variability in the regional climate affected the interpretation of hydrology indicators encountered during the delineation.

TABLE 5: WETS TABLE PRECIPITATION (1987-2017) AND 2016-2017 RECORDED MONTHLY PRECIPITATION

Month	Average Precipitation (inches)	30th Percentile Precipitation (inches)	70th Percentile Precipitation (inches)	2016 Precipitation (inches)	2017 Precipitation (inches)
January	1.75	0.56	2.02	2.34	3.75
February	2.27	1.13	2.78	0.43	3.6*
March	1.3	0.61	1.53	0.84	0.05
April	0.63	0.22	0.68	0.88	0
May	0.2	0	0.12	0.69	1.06
June	0.05	0	0	0	0
July	0.06	0	0	0	0
August	0.01	0	0	0	
September	0.11	0	0	0.5	
October	0.49	0	0.24	0.07	
November	0.63	0.29	0.68	0.38	
December	1.4	0.63	1.57	3.98	
Annual	8.91	6.83	10.08	10.11	

Source: NRCS Wetlands (WETS) Climate Tables, Chula Vista, CA Station

Notes

* Month in which delineation effort was conducted

^{M} Month missing any data

Orange cell – recorded monthly precipitation was lower than 30th Percentile

Green cell – recorded monthly precipitation was higher than 70th Percentile

4.1.2 Hydrology of the interior of Pond 20

The interior of Pond 20 contains permanent and ephemeral water features. Permanent ponds and intermittent pools are located predominately along the inside edge or the borrow areas at the base of the berm. Water features within Pond 20 are not connected to any surface water features outside of the berms via surface or groundwater.

The water source for the intermittent pools identified within the berms is solely rainfall. The permanent ponds receive water from rain events and from stormwater runoff entering Pond 20 via sheet water flows and from two stormwater drains from Palm Avenue into the interior of Pond 20 along the southern boundary (FIGURE 2).

Water levels in these isolated water features fluctuate seasonally and are highly dependent on the closed system evaporative processes, which, in addition to Pond 20's history as a salt evaporator pond, have rendered the water hypersaline. Water levels within the borrow areas and their fluctuation rates are controlled by decades of drought and heavy rainfall. Standing water within the borrow areas is generally found below a nearly complete salt crust, though water may sit atop the crust temporarily following precipitation events.

4.1.3 Hydrology of the Otay River Tributary and Nestor Creek Areas

Two drainage features are located outside of Pond 20; Nestor Creek flows north along the eastern boundary and joins with the Otay River northeast of Pond 20, and a tributary of the Otay River runs along the western boundary of Pond 20, flowing to the Otay River (FIGURE 2). Both the Otay River Tributary and Nestor Creek receive tidal influence from San Diego Bay. Nestor Creek is concrete-lined upstream of Pond 20 and is fed by freshwater flows from the adjacent urban neighborhood. During high stormwater flows, the Otay River tributary receives fresh water from a Municipal Separate Storm Sewer (MS4) drainage, which drains Palm Avenue. Hydrology indicators near the MS4 indicate that high water flows pass through the non-wetland area of the Otay River Tributary during storm events. Neither the Otay River Tributary, Nestor Creek, nor the Otay River, enter or flow through the interior of Pond 20 (FIGURE 2).

4.2 Soils

Pond 20 is largely comprised of a salt flat surrounded by a berm ranging in height from 13.48 to 14.48 feet MLLW. Nestor Creek and the Otay River Tributary are located outside the berms along the eastern and western boundaries, respectively. The Pond 20 berm is made of highly compacted clay. Shell hash is present on the surface of the berm, indicating the berm is comprised of marine dredge material. Prior to the 1870s, Pond 20 supported wetland and estuarine habitat. In the 1870s, Pond 20 was constructed as an isolated pond enclosed by high berms, purposely constructed with silts and clay soils to hold water until it evaporated to facilitate the collection of salt precipitate. The upstream failure of Savage Dam in 1918 damaged the berm and filled the northern portion of Pond 20 with sand, sediment, and soil. Pond 20 is currently at grades of approximately 9.05 feet MLLW on average and is comprised of fill material. Great Ecology found soils ranging from sand to clays and observed construction lumber within the soil column at various locations, and a relatively random distribution of soil types across the site and within the soil profile (FIGURE 6).

A spot soil sample (not formally documented) taken in the unvegetated salt flats adjacent to the open water pools in the southeastern section of Pond 20 using a hand auger revealed a hard-packed dark clay layer overlaid by a coarse mix of sandy soil and salt precipitate (see APPENDIX E, Image 11). This clay layer is present adjacent to the perennial pools that often flood during storms and remains inundated for long periods of time. The clay layer causes the water to either drain very slowly or not at all, leaving only evaporative processes to drive the recession of ponded water. Hydric soil indicators were not observed in this spot sample above the clay layer.

Soils within the Nestor Creek and Otay River Tributary Areas on the east and west sides of Pond 20 were characteristic of coastal wetland habitats with a high organic material content and exhibited several hydric soil indicators. Hydric soils were not observed in the non-wetland area at the southern end of the Otay River Tributary Area near the MS4 outfall (FIGURE 7, soil samples T4.1 and T4.2).

4.3 Vegetation

Great Ecology identified upland vegetation communities within Pond 20, and wetland vegetation communities in the Nestor Creek and Otay River Tributary (FIGURE 8A). Pond 20 exhibited characteristics of a salt flat and supported a largely upland herbaceous vegetation community comprised of slenderleaf iceplant (*Mesembryanthemum nodiflorum),* perennial ragweed (*Ambrosia psilostachya*)*,* and crystalline iceplant (*Mesembryanthemum crystallinum*). The higher elevation upland areas located in the northeast of Pond 20 supported upland shrub-scrub communities of coyotebush (*Baccharis pilularis*), mulefat (*B. salicifolia*), coastal cholla (*Cylindropuntia prolifera*), Menzie's goldenbush (*Isocoma menziesii*), and coastal prickly pear (*Opuntia littoralis*). Three tamarisk (*Tamarix* spp.) individuals were also observed within this community.

Two wetland community types were identified along Nestor Creek (FIGURE 8B), which is outside the berm of Pond 20. A salt marsh community predominately comprised of Pacific swampfire (*Sarcocornia pacifica*, also known colloquially as pickleweed), shore grass (*Distichlis littoralis*), saltwort (*Batis maritima*), and alkalai sea-heath (*Frankenia salina*) were observed on either side of Nestor Creek. Patches of freshwater marshes receiving periodic pulses of saline water (referred to as brackish marsh in this report) and predominately comprised of California club-rush (*Schoenoplectus californicus*) were also located in Nestor Creek within the OHWM boundaries.

Three wetland community types were identified within the Otay River Tributary Area (FIGURE 8A), which is outside the berm of Pond 20. Salt marsh of the same community composition as the Nestor Creek were observed along the Otay River Tributary, with the addition of a patch of coastal salt grass (*Distichlis spicata*) located on the southeast bank. Small stands of saltwater cordgrass (*Spartina alterniflora*) were observed on limited mudflats located on the west side of the Otay River Tributary. In the southwest portion of the Otay River Tributary Area, a small patch of freshwater marsh dominated by narrow-leaf cattail (*Typha angustifolia*) at the mouth of an MS4 drainage was observed. Immediately to the west of this freshwater marsh was a non-wetland floodplain community comprised of arroyo willow (*Salix lasiolepis*), green ash (*Fraxinus pennsylvanica*), and Brazilian pepper tree (*Schinus terebinthifolius*). Lastly, an unvegetated mud-bottom drainage that connects the freshwater MS4 wetland with the southern end of the Otay River Tributary was observed.

The Otay River Tributary and Nestor Creek were both determined to be unvegetated, perennial open water features.

4.4 Regulatory Interpretation of Site Conditions

Based on data gathered, site observations, and relevant regulations and regulatory guidance, Great Ecology determined that normal circumstances are present and vegetation and soil conditions observed within Pond 20 are not naturally problematic. A summary of this analysis is provided below. Conditions observed in the Nestor Creek and Otay River Tributary Areas were easily interpreted and did not warrant such an analysis.

Normal Circumstances vs. Atypical Situations

Atypical situations are derived from unauthorized human activities in wetland areas. Pond 20 was constructed and the wetlands within its interior filled in the 1870s, a century prior to the passage of the CWA. Waters that are legally converted to upland, either with permit authorization or due to the action being taken prior to enactment of the CWA, are no longer WUS and are not subject to CWA jurisdiction (45 FR 85344, Dec. 24, 1980). Additionally, the interior of Pond 20 has not, over time, naturally regained wetland characteristics such that it meets the definition of “wetlands,” precluding any restoration of CWA jurisdiction (RGL 86-09). Atypical situation analysis is not used for activities that were previously authorized under the CWA or predate the passage of CWA (USACE 2008), so therefore normal circumstances are determined to be present and all site observations were interpreted relative to current conditions rather than historical wetland conditions.

Problem Areas

Problem areas are wetland types in which wetland indicators of one or more parameters may be periodically lacking due to normal seasonal or annual variations in environmental conditions that result from causes other than human activities or catastrophic natural events. The 2017 delineation was conducted following a four year drought and immediately after a significantly wet winter season. Great Ecology therefore conducted analytical as procedures outlined in the Arid West Regional Supplement (USACE 2008) to determine if the lack of positive wetland indicators observed was indicative of naturally problematic site conditions, or if our observations were representative of normal site conditions. Great Ecology's analysis focuses on hydrophytic vegetation and hydric soils given the clear wetland hydrology present within many water features across Pond 20 during the delineation event and in the recent past.

Hydrophytic Vegetation

According to the Arid West Regional Supplement (USACE 2008), problematic hydrophytic vegetation may be present if both hydric soils and wetland hydrology are present but hydrophytic vegetation communities are not. Hydrophytic vegetation communities were not observed across Pond 20, including in topographic depressional areas that exhibited positive hydrology indicators. We observed positive hydric soil indicators in only one of these ten depressions; however, further investigation determined that the soils are not hydric (see next section). The Arid West Regional Supplement's procedure to identify problematic hydrophytic vegetation first requires the presence of positive wetland hydrology and hydric soil indicators within a suspect area. Because only wetland hydrology was present within these features and hydric soils were not present due to normal, non-problematic conditions, Great Ecology did not apply the problematic hydrophytic vegetation identification procedure per procedural guidance (USACE 2008).

However, given the drought conditions that preceded the field effort, we continued our analysis of potential problematic hydrophytic vegetation to determine if a temporal shift in vegetation due to drought occurred within Pond 20. A review of previous delineation efforts revealed that Pond 20 has not supported hydrophytic vegetation communities since at least 1997, or for 20 years prior to the 2017 delineation effort (see ***Section 2.6***). In addition, the 2017 delineation was conducted during an above-average wet portion of the growing season (TABLE 5), which should have been sufficient to support the development of a hydrophytic vegetation community, if present. However, only slenderleaf iceplant (FACU) monocultures, a decidedly upland vegetation community, and disturbed upland scrub were observed, consistent with observations taken during previous delineation efforts spanning two decades. The lack of positive hydrophytic vegetation indicators was therefore interpreted as a feature of normal site conditions, rather than a reflection of drought conditions, and vegetation was therefore not considered to be naturally problematic.

Hydric Soils

Naturally problematic hydric soils may be identified if wetland hydrology and hydrophytic vegetation are present, but positive hydric soil indicators are not observed. Within Pond 20, wetland hydrology was present in ten topographic depressional features, but no hydrophytic vegetation communities were observed. As previously discussed, the absence of hydrophytic vegetation reflects normal, non-problematic conditions. The procedure to identify problematic hydric soils as outlined in the Arid West Regional Supplement first requires wetland hydrology and hydrophytic vegetation to be present within a suspect area before further analysis to determine if the soil is problematically hydric. Because only wetland hydrology was present within these features and hydrophytic vegetation was not present due to normal, non-problematic conditions, Great Ecology did not apply the problematic hydric soils identification procedure per procedural guidance (USACE 2008).

Great Ecology does recognize that in the Arid West, soil alkalinity, which correlates with high soil salinity, may inhibit the formation of redox concentrations and depletions in soils and may constitute a problematic hydric soil situation (USACE 2008). Great Ecology sampled soils in three topographical depressions on the eastern side of the Bermed Area and found positive hydric soil indicators in only one of these features, while positive wetland hydrology indicators were observed in all three. Soil pH was tested to determine if these observations were due to soil alkalinity. Great Ecology found that the soils within the topographical depressions that did not display positive hydric soil indicators were Moderately Alkaline (pH between 8.1 and 8.3; USDA 2002), which may have prevented the formation of hydric soil indicators. However, the Arid West Regional Supplement only defines high alkalinity soils as problematic hydric soils if both wetland hydrology and hydrophytic vegetation are present. Because hydrophytic vegetation communities were not present in these areas and their absence was determined to be non-problematic, these alkaline soils do not qualify as problematic hydric soils.

To understand how observations of hydric soil indicators have varied over time within Pond 20, Great Ecology reviewed the results of the 1997 and 2008 delineations (Dudek 1997; Merkel 2008). The results of the 1997 delineation were consistent with observations made in 2017 – that soils within topographic depressional features located within Pond 20 did not display positive hydric soil indicators. However, the 2008 delineation identified hydric soils within the features that did not display positive hydric soil indicators in 2017. The discrepancy could be due to differences in how hydric soils were identified in the field between 1997, 2008, and 2017; the 1997 delineation referenced the *1987 Corps of Engineers Wetland Delineation Manual* (USACE 1987), the 2008 delineation referenced the *2006 Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region* (USACE 2006), and the 2017 delineation referenced the *2008 Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0)* (USACE 2008). The discrepancy could be due to subjective interpretation of observed indicators by field delineators across all years, or it could indicate that the hydric nature of the soils in these features changes over time and is likely influenced by short- and long-term climatic variations. Approved jurisdictional determinations are only valid for five years, largely because USACE recognizes that site conditions change over time. Therefore, Great Ecology interprets the observed soil conditions within Pond 20 as reflective of normal site conditions in the short-term, and considers them to be non-problematic.

5 SUMMARY OF FIELD OBSERVATIONS

Great Ecology sampled 18 point-locations to collect data relating to wetland indicators. Sample locations are shown in FIGURE 7 and a summary of observed positive wetland indicators are included in TABLE 6. Wetland delineation data forms may be found in APPENDIX D and photographs capturing the sample point brackets in APPENDIX E.

TABLE 6: FIELD INDICATOR SUMMARY FOR SAMPLE POINTS, 2017

Sampling Point	Site Area	Positive Field Indicator			Potential Jurisdiction	General Location Type
		Vegetation	Soil	Hydrology		
Interior of Pond 20						
T1.1	Pond 20					Upland
T1.2	Pond 20		X	X		Vegetated depression
T1.3	Pond 20					Upland
T2.1	Pond 20					Upland
T2.2	Pond 20			X		Vegetated depression
T2.3	Pond 20					Upland
Otay River Tributary						
T2.4	Otay River Tributary					Upper berm slope
T2.5	Otay River Tributary	X	X	X	USACE	Salt marsh, lower berm slope
Interior of Pond 20						
T3.1	Pond 20					Upland
T3.2	Pond 20			X		Vegetated depression
T3.3	Pond 20					Upland
Otay River Tributary						
T3.4	Otay River Tributary					Upper berm slope
T3.5	Otay River Tributary	X	X	X	USACE	Salt marsh, lower berm slope
T4.1	Otay River Tributary	X	X	X	USACE	MS4 drainage mouth
T4.2	Otay River Tributary	X		X		Floodplain adjacent to MS4

Sampling	Site Area	Positive Field Indicator			Potential	General Location Type
Nestor Creek						
N1	Nestor Creek	X	X	X	USACE	Brackish marsh, lower berm slope
N2	Nestor Creek					Upper berm slope
N3	Nestor Creek	X	X	X	USACE	In-channel brackish marsh

Using this data, Great Ecology located twenty-two unique water features onsite during the January 31 to February 6 field survey. These features are depicted in FIGURES 8A and 8B and their attributes are summarized in TABLE 7. Each water feature was evaluated using field delineation procedures. Observations and the potential jurisdiction associated with each of these water features is discussed in **SECTIONS 6** and **7**. Below, is a summary of the major features observed by each site referenced.

Otay River Tributary Area (Figure 7) (point locations T2.4, T2.5, T3.4, T3.5, T4.1, and T4.2)

- One unvegetated, perennial tidal open water feature was identified as the Otay River Tributary;
- One three-parameter estuarine wetland was identified surrounding the Otay River Tributary;
- One three-parameter freshwater wetland feature was identified at the southern end of the Otay River Tributary Area abutting an MS4 drainage; and
- One unvegetated drainage was identified at the southern end of the Otay River Tributary Area, located between the southernmost extent of the Otay River Tributary and the northern boundary of the freshwater wetland feature.

Nestor Creek Area (Figure 7) (point locations N1, N2, and N3)

- One unvegetated, perennial brackish open water feature was identified as Nestor Creek;
- One three-parameter estuarine wetland was identified surrounding Nestor Creek; and
- Four brackish marsh wetland features were identified within the Nestor Creek channel.

Interior Pond 20 (Figure 7) (point locations T1.1, T1.2, T1.3, T2.1, T2.2, T2.3, T3.1, T3.2, and T3.3)

- Two perennial, unvegetated open water features; and
- Ten vegetated intermittently-flooded topographic depressions (borrow area).

Great Ecology determined that water features identified within Pond 20 do not meet the three-parameter criteria for wetland features. Perennial pools located within the borrow areas of Pond 20 unvegetated and were thus determined to be non-wetland features. The intermittently flooded depressions did not exhibit positive results for all three wetland indicators and thus were also determined to be non-wetland features (point location T1.2, T2.2, T3.2). The pools and the depressions were observed to be hydrologically isolated from adjacent jurisdictional WUS and associated wetlands, and were therefore determined to be non-jurisdictional isolated intrastate waters. The rationale for the jurisdictional determination presented here is discussed in **SECTIONS 6** and **7**, and in depth in the attached Regulatory Analysis (APPENDIX F).

TABLE 7: ONSITE WATER FEATURES IDENTIFIED AND ANALYZED FOR POTENTIAL JURISDICTION

Site Feature Name	Type	Estimated Area (acres)	Potential Jurisdictional Determination	Description
Otay River Tributary				
Wetland 1	Freshwater marsh	0.0086	Wetland Water of the U.S.	Emergent vegetation dominated by narrow-leaf cattail (*Typha angustifolia*) surrounding a man-made drainage feature.
Wetland 2	Salt marsh	0.8977	Wetland Water of the U.S.	Coastal salt marsh dominated with pickleweed (*Sarcocornia pacifica*).
Nestor Creek				
Wetland 3	Brackish marsh	0.0025	Wetland Water of the U.S.	Emergent vegetation dominated by California club-rush (*Schoenoplectus californicus*).
Wetland 4	Salt marsh	0.2285	Wetland Water of the U.S.	Coastal salt marsh dominated by alkali sea-heath (*Frankenia salina*).
Wetland 5	Brackish marsh	0.0055	Wetland Water of the U.S.	Emergent vegetation dominated by California club-rush (*S.californicus*).
Wetland 6	Brackish marsh	0.0158	Wetland Water of the U.S.	Emergent vegetation dominated by California club-rush (*S. californicus*).
Wetland 7	Brackish marsh	0.0027	Wetland Water of the U.S.	Emergent vegetation dominated by California club-rush (*S. californicus*).
Otay River Tributary				
Open Water 1	Unvegetated open water	0.2019	Non-Wetland Water of the U.S.	Otay River tributary; surface water present in the drainage.
Nestor Creek				
Open Water 2	Unvegetated open water	0.1394	Non-Wetland Water of the U.S.	Nestor Creek; surface water present in the channelized creek.
Interior Pond 20				
Open Water 3	Unvegetated open water	1.917	Non-Jurisdictional	Isolated semi-permanently flooded salt pond; surface water present in deepest part of the salt depression.
Open Water 4	Unvegetated open water	5.436	Non-Jurisdictional	Isolated semi-permanently flooded salt pond; surface water present in deepest part of the salt depression.
Otay River Tributary				
Drainage Feature 1	Unvegetated drainage	0.0303	Non-Wetland Water of the U.S.	Unvegetated drainage basin with some surface water present.
Borrow Areas (Interior Pond 20)				
Depression 1	Vegetated depression	0.0982	Non-Jurisdictional	Isolated depression within the salt flat supporting slenderleaf iceplant (*Mesembryanthemum nodiflorum*) and other upland herbaceous vegetation.

Site Feature Name	Type	Estimated Area (acres)	Potential Jurisdictional Determination	Description
Depression 2	Vegetated depression	0.1272	Non-Jurisdictional	Isolated depression within the salt flat supporting slenderleaf iceplant (*M. nodiflorum*) and other upland herbaceous vegetation.
Depression 3	Vegetated depression	0.1779	Non-Jurisdictional	Isolated depression within the salt flat supporting slenderleaf iceplant (*M. nodiflorum*) and other upland herbaceous vegetation.
Depression 4	Vegetated depression	0.2384	Non-Jurisdictional	Isolated depression within the salt flat supporting slenderleaf iceplant (*M. nodiflorum*) and other upland herbaceous vegetation.
Depression 5	Vegetated depression	0.3975	Non-Jurisdictional	Isolated depression within the salt flat supporting slenderleaf iceplant (*M. nodiflorum*) and other upland herbaceous vegetation.
Depression 6	Vegetated depression	0.3129	Non-Jurisdictional	Isolated depression within the salt flat supporting slenderleaf iceplant (*M. nodiflorum*) and other upland herbaceous vegetation.
Depression 7	Vegetated depression	0.1406	Non-Jurisdictional	Isolated depression within the salt flat supporting slenderleaf iceplant (*M. nodiflorum*) and other upland herbaceous vegetation.
Depression 8	Vegetated depression	0.0045	Non-Jurisdictional	Isolated depression within the salt flat supporting slenderleaf iceplant (*M. nodiflorum*) and other upland herbaceous vegetation.
Depression 9	Vegetated depression	0.0045	Non-Jurisdictional	Isolated depression within the salt flat supporting slenderleaf iceplant (*M. nodiflorum*) and other upland herbaceous vegetation.
Depression 10	Vegetated depression	0.0462	Non-Jurisdictional	Isolated depression within the salt flat supporting slenderleaf iceplant (*M. nodiflorum*) and other upland herbaceous vegetation.
Total Estimated Area		**10.43**		

6 SECTION 404 WATERS OF THE U.S.

Great Ecology identified seven water features outside the Pond 20 berm along Nestor Creek and the Otay River Tributary that exhibited positive soil, hydrology, and vegetation wetland indicators (FIGURE 8A). These seven areas are all located outside of Pond 20 (Wetlands 1 through 7) and have connectivity to WUS, and are thus jurisdictional wetlands. The freshwater marsh wetland located adjacent to the MS4 outfall in the Otay River Tributary Area was dominated by narrowleaf cattail. The four brackish marsh wetlands located in the Nestor Creek channel were dominated by California club-rush. The two salt marsh wetlands located along the banks of the Otay River tributary and

Nestor Creek were dominated by alkali sea-heath *and* pickleweed. Great Ecology also identified three non-wetland WUS features—two open water features and one unvegetated drainage bounded by clear OHWMs. Each wetland and non-wetland WUS feature is described in depth below and shown in APPENDIX A.

Great Ecology did not identify any jurisdictional wetlands or non-wetland WUS within the interior of Pond 20 (see **SECTION 7** for a detailed discussion of features).

6.1 Wetland Waters of the U.S. in the Otay River Tributary and Nestor Creek

Wetland 1 (Map W3)

Wetland 1 is located at the southern end of the Otay River Tributary Area at the mouth of an MS4 drainage and is dominated by narrowleaf cattail. This wetland is intermittently submerged during storm events with stormwater flows from the MS4 and sheet water flows from Palm Avenue. Although the presence of surface water and a high water table prevented a high-integrity soil sample, Great Ecology observed one centimeter of muck at the top of the soil matrix, and noted a hydrogen sulfide odor upon excavation of the soil sample within Wetland 1. At the time of sampling, the wetland vegetation had been recently cleared for stormwater system maintenance purposes, and the team observed a tree stump located within the wetland that was likely arroyo willow. The soils in Wetland 1 are hydric.

Wetland 2 (Map W1, W2, and W3)

Wetland 2 is located in the Otay River Tributary. The wetland contains dense salt marsh vegetation dominated by pickleweed, saltwort, alkali sea-heath, and shore grass. Patches of cordgrass were also observed. Portions of the wetland are intermittently submerged with tidal flows during high tide, but the steep elevation of the tributary banks prevents submersion of the entire wetland. The soils in Wetland 2 are clay and displayed concentrated redox features within a depleted matrix.

Wetland 4 (Map E1, E2, and E3)

Wetland 4 is located in Nestor Creek on the eastern edge Pond 20. Nestor Creek is freshwater, but is tidally influenced due to its proximity to the Otay River mouth and San Diego Bay. The wetland contains dense hydrophytic vegetation which includes both typical salt marsh and freshwater marsh species, including pickleweed, alkali sea-heath, and California club-rush. The soils in Wetland 4 are sandy loam and exhibited redox concentrations within the soil matrix upon excavation of the soil sample. The wetland is intermittently saturated with both tidal fluctuations and high freshwater flows during storm events.

Wetlands 3, 5, 6, and 7 (Map E2 and E3)

Wetlands 3, 5, 6, and 7 are located in Nestor Creek on the eastern boundary of Pond 20. These wetlands are characterized as being entirely within Nestor Creek OHWM limits with vegetation dominated by California club-rush. Although surface water and high water table prevented a high-integrity soil sample, Great Ecology observed one centimeter of muck on the top of the soil matrix within these wetlands. Given the prevalence of obligate hydrophytic vegetation community, Great Ecology assumed the soils to be hydric. Nestor Creek is freshwater, but is tidally influenced due to its proximity to the Otay River mouth and San Diego Bay. Great Ecology could not confirm the year-round hydrological regime for these wetland features using aerial imagery. Evidence encountered in the field suggests that, under normal climatic conditions, Wetlands 3, 5, 6, and 7 are inundated year-round with fresh water and likely receive pulses of saline water during high tides, resulting in a brackish mix of fresh and marine waters (soil samples N1, N2, and N3).

6.2 Non-Wetland Waters of the U.S.

Open Water 1 (Map W1, W2, and W3)

Open Water 1 is located within the Otay River Tributary. It is located on the western boundary of Pond 20 entirely outside of the berm. The surface water feature appears to be permanently inundated near the northern end of its extent, and becomes semi-permanently inundated at the southern end depending on the fluctuation of tidal prism through the channel. The feature also carries storm water discharges from the MS4 drainage which sheet flows from Palm Avenue during storm flows. The tributary was surrounded by salt marsh (Wetland 2) and showed a clear OHWM. The channel bottom is comprised of unconsolidated mud and is unvegetated. The soils in Open Water 1 are hydric.

Open Water 2 (Map E1, E2, and E3)

Open Water 2 is located in Nestor Creek along the eastern boundary Pond 20, entirely outside of the berm. The surface water appears to be permanent and empties into the Otay River approximately 1,500 feet to the north. Nestor Creek is surrounded by salt marsh (Wetland 4) and contains brackish marsh (Wetlands 3, 5, 6, and 7) within its OHWM. The channel bottom is comprised of unconsolidated mud and is unvegetated except for areas covered by vegetation noted in Wetlands 3, 5, 6, and 7.

Drainage Feature 1 (Map W3)

Drainage Feature 1 is located between the southern terminus of Open Water 2 (the Otay River Tributary) and the northern boundary of Wetland 1. Drainage Feature 1 is a shallow, unvegetated drainage basin that had intermittent surface water present at the time of the field wetland delineation. During the wetland delineation field effort, Open Water 2 and Wetland 1 were not directly connected via Drainage Feature 1, but the presence of standing water indicates that there was some level of surface water connectivity between the two. The drainage may receive tidal flows from the Otay River tributary to the north, and stormwater discharge from both the MS4 drainage and surface runoff from Palm Avenue. During a December 2016 storm event, Great Ecology observed surface water connectivity between Open Water 1, Drainage Feature 1, and Wetland 1. This area, contained within an OHWM boundary, is comprised of an unconsolidated mud bottom, and is unvegetated. Outside of the OHWM boundary, Drainage Feature 1 is flanked by salt marsh wetlands dominated by coastal salt grass, and three Brazilian pepper tree individuals.

7 POND 20 ISOLATED WATERS

7.1 Regulatory Basis

Pond 20 is not considered WUS, based on the following. Great Ecology considered the definitions for isolated intrastate waters and man-induced wetlands when making the jurisdictional determination for wetland and non-wetland waters based on the field survey conducted. A complete discussion of these issues is offered in the attached Regulatory Analysis for Bermed Area Features memorandum (APPENDIX F), and a brief summary is included here.

Isolated wetland and non-wetland waters may be exempt from USACE jurisdiction under the CWA as interpreted by the U.S. Supreme Court's ruling for *Rapanos v. United States* 547 U.S. 715 (2006). Specifically, the USACE does not have jurisdiction over wetlands and non-wetland waters that do not have a hydrological or otherwise significant nexus (SNX) to, and are not adjacent to a traditional "navigable waters of the U.S." (TNW), and do not exhibit any other interstate commerce connection. Subsequent judicial interpretations of the Supreme Court's *Rapanos* have distinguished between non-wetland waters and wetlands in the context of adjacency and concluded that

non-wetland waters adjacent to WUS can only be WUS where a hydrological connection or otherwise SNX to a TNW exists.

7.2 Isolated Intrastate Waters Identified Onsite

Great Ecology identified twelve isolated intrastate water features located within Pond 20. Two features are perennial open waters, and ten are intermittently flooded waters. Pond 20 is hydrologically isolated from surrounding surface waters. The height and extent of the berm that surrounds Pond 20 prevents the flow of surface water between the Otay River, Otay River Tributary, and Nestor Creek, all located outside of Pond 20, and the surface water features located within Pond 20 (TABLE 2). Water only enters Pond 20 via precipitation and surface storm water flows from Palm Avenue, which lines the southernmost border (FIGURE 2). Great Ecology staff observed two stormwater conveyances that funnel street-level water from Palm Avenue into Pond 20, and evidence of surface sheet flow from the street into Pond 20 (APPENDIX E). Palm Avenue is at an elevation of 14.43 feet MLLW and the average elevation of Pond 20 is 9.05 feet MLLW. Palm Avenue is therefore approximately 5.38 feet MLLW above the grade of Pond 20 and thus no surface water can flow from Pond 20 onto the street. Additionally, Great Ecology did not observe any fluctuations in the water level of the perennial pools with the tides, indicating that there is likely no subterranean connection between the tidal flows and the perennial pools within Pond 20. Great Ecology therefore determined standing water within the features located in Pond 20 is due only to the collection of rainwater and from sheet flow from Palm Avenue during storm events, not from the flow of surface water or groundwater into Pond 20 from surrounding WUS. These are non-wetland features; there exist no wetlands within Pond 20. Accordingly, although arguably adjacent to the Otay River and Nestor Creek, they are only jurisdictional if they have a hydrologic or otherwise SNX to these waterways,

These perennial open waters and intermittently flooded depressions are discussed in depth below.

Open Waters 3 and 4 (Map 8A)

Open Waters 3 and 4 are semi-permanently flooded borrow areas encrusted with salt located wholly within Pond 20, which is completely enclosed by a berm that obstructs the flow of water. These borrow areas surface water levels are driven entirely by precipitation and evaporation regimes. Seasonally and during drought conditions, the borrow areas may be intermittently exposed with an unconsolidated mud bottom. The borrow areas receive water exclusively from rain events and from stormwater run-off entering Pond 20 via sheet water flows and from two stormwater downspouts from Palm Avenue into the site along its southernmost boundary. Once collected, water remains in the borrow areas due to low-permeability soil.

The berm surrounding Pond 20 inhibits the flow of surface water between Open Waters 3 and 4 and surrounding WUS features. In addition, multiple observations conducted over the multi-day delineation effort demonstrated that the surface water level of the interior of Pond 20 does not fluctuate with the tides, indicating that Pond 20 is isolated from any groundwater connections to the tidal features outside the berms. Because the borrow areas are located completely within the berm they are not hydrologically connected to, nor do they possess a SNX connection with, the Otay River, its tributary, nor Nestor Creek; thus, they are not jurisdictional (see APPENDIX F for a detailed regulatory analysis employed to support this determination).

Depressions 1 to 10 (Map 8A and 8B)

Depressions 1 through 10 are intermittently flooded depressional water features located within Pond 20. These depressions showed an OHWM due to the regular collection of rainwater and stormwater inputs from Palm Avenue. Great Ecology identified positive wetland hydrology indicators within the depressions. Several depressions were flooded at the time of the delineation. The sample depressions had a water table measured at 11 inches, and saturation present at 10 inches. No positive indicators for hydrophytic vegetation were observed. The isolated depressions were predominately unvegetated with mats of slenderleaf iceplant (Arid West indicator status FACU) established along the edges. Soils within these depressions appear to be a predominantly sandy clay loam and did not exhibit hydric soil features despite the landscape position and hydrology of these features. Soil tests obtained after the wetland delineation indicated a moderately high pH ranging from 8.1 to 8.3, and high soil salinity ranging from 16 to 35 microSiemens (μS) at sample points located within representative depressional features. Alkaline soils with pH greater than 7.9 may inhibit the formation of redox features within the soil matrix. These soils reflect the moderately alkaline soil conditions listed as a problematic soil type in the Arid West Regional Supplement (USACE 2008). Great Ecology used this guidance to make a determination regarding the hydric nature of the soils. Given the soils do not support hydrophytic vegetation and therefore only exhibit one positive wetland indicator for hydrology, Great Ecology determined the soils are not hydric within these features (see ***Section 4.4*** for a discussion of this determination).

Great Ecology determined the intermittently flooded depressions are not wetlands. The presence of an OHWM indicates these features are non-wetland waters. These intermittently flooded depressions are hydrologically isolated from jurisdictional features outside the berm, with no flow of surface water nor groundwater between the depressions and the outer WUS features. Because the features are not wetlands and lack a hydrological connection or SNX to the nearby waterways, they are not jurisdictional. (see APPENDIX F for a detailed regulatory analysis employed to support this determination).

8 USACE JURISDICTIONAL DELINEATION

Great Ecology delineated 1.16 acres of wetland WUS and 0.37 acres of non-wetland waters that are considered jurisdictional under Section 404 of the CWA in Nestor Creek and the Otay River tributary. The extents of these wetland and non-wetland water features are depicted in APPENDIX A. These features are located exclusively within the Nestor Creek and Otay River Tributary areas and all are hydrologically connected to the Otay River Tributary or Nestor Creek and San Diego Bay. All identified wetland and non-wetland water features are therefore either defined as traditional “navigable waters of the U.S.” (TNW) or are tributary to a TNW and therefore meet the definition of jurisdictional wetland waters and non-wetland waters under Section 404 of the CWA. Great Ecology did not delineation any wetland or non-wetland WUS within Pond 20.

Great Ecology identified and classified each jurisdictional wetland and non-wetland water by wetland type using the National Wetlands Classification Standard utilized by the USFWS (FGDC 2013) and adapted from Cowardin et al. (1979). Great Ecology confirmed the presence of two estuarine intertidal persistent emergent wetlands, irregularly flooded (Wetlands 2 and 4; E2EM1P), four estuarine intertidal persistent emergent wetland, regularly flooded (Wetlands 3, 5, 6, and 7; E2EM1N), one persistent, semi-permanently flooded, freshwater marsh (Wetlands 1; PEM1F), two open water riverine systems with tidal influence and a unconsolidated bottom (Open Water 1 and 2; R1UB3), and one palustrine, intermittently flooded drainage feature with an unconsolidated mud bottom (Drainage Feature 1, PUB3J). It is Great Ecology's opinion that these features should be classified jurisdictional. However, only the USACE can make the final determination of the jurisdictional status of wetlands or water bodies and on the need for permitting and compensatory mitigation.

The conclusions of this delineation are based on conditions observed at the time of the field delineation surveys conducted on January 31 through February 6, 2017.

TABLE 8 below summarizes the potential jurisdictional determination for each site feature.

TABLE 8: POTENTIAL JURISDICTIONAL DETERMINATION FOR ONSITE WATER FEATURES

Site Feature	Great Ecology-Designated Cowardin Wetland Classification	Jurisdictional Determination	Estimated Area (acres)
Otay River Tributary			
Wetland 1	PEM1F	Wetland Water of the U.S.	0.0086
Wetland 2	E2EM1P	Wetland Water of the U.S.	0.8977
Nestor Creek			
Wetland 3	E2EM1N	Wetland Water of the U.S.	0.0025
Wetland 4	E2EM1P	Wetland Water of the U.S.	0.2285
Wetland 5	E2EM1N	Wetland Water of the U.S.	0.0055
Wetland 6	E2EM1N	Wetland Water of the U.S.	0.0158
Wetland 7	E2EM1N	Wetland Water of the U.S.	0.0027
Otay River Tributary			
Drainage Feature 1	PUB3J	Non-Wetland Water of the U.S.	0.0303
Open Water 1	R1UB3	Non-Wetland Water of the U.S.	0.2019
Nestor Creek			
Open Water 2	R1UB3	Non-Wetland Water of the U.S.	0.1369
Interior Pond 20			
Open Water 3		Non-Jurisdictional	1.917
Open Water 4		Non-Jurisdictional	5.436
Borrow Areas (Interior Pond 20)			
Depression 1		Non-Jurisdictional	0.0982
Depression 2		Non-Jurisdictional	0.1272
Depression 3		Non-Jurisdictional	0.1779
Depression 4		Non-Jurisdictional	0.2384
Depression 5		Non-Jurisdictional	0.3975
Depression 6		Non-Jurisdictional	0.3129
Depression 7		Non-Jurisdictional	0.1406
Depression 8		Non-Jurisdictional	0.0045
Depression 9		Non-Jurisdictional	0.0045
Depression 10		Non-Jurisdictional	0.0462
Wetland Waters of the U.S. Total Area			1.16
Non-Wetland Waters of the U.S. Total Area			0.37
Non-Wetland Intrastate Isolated Waters Total Area			8.90

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SITE OVERVIEW
SOUTH SAN DIEGO BAY WETLAND MITIGATION BANK

SAN DIEGO UNIFIED PORT DISTRICT
NOVEMBER 2017

0 0.15 0.3 Miles

N

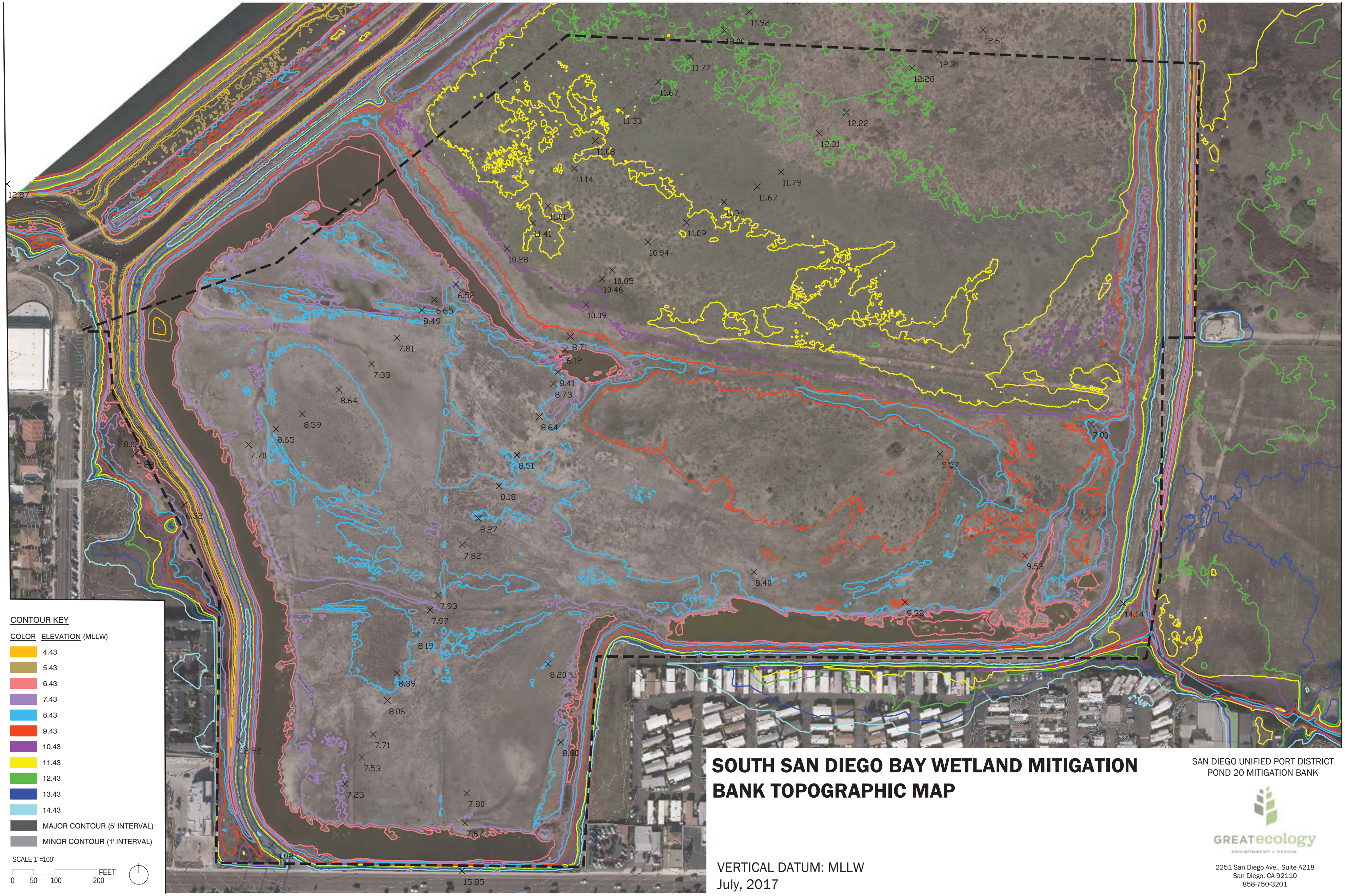
1:7,500
NAD 83 CA STATE PLANE FIPS IV 0406
CENTROID: 32.5869° N, 117.1004° W

GREATecology
ENVIRONMENT + DESIGN

POND 20 - EXISTING HYDROLOGIC FEATURES

SAN DIEGO UNIFIED PORT DISTRICT
AUGUST, 2017

GREATecology
ENVIRONMENT + DESIGN



CONTOUR KEY

COLOR	ELEVATION (MLLW)
🟧	4.43
🟫	5.43
🟥	6.43
🟪	7.43
🟦	8.43
🟥	9.43
🟪	10.43
🟨	11.43
🟩	12.43
🟦	13.43
🟦	14.43
⬛	MAJOR CONTOUR (5' INTERVAL)
⬛	MINOR CONTOUR (1' INTERVAL)

SCALE 1"=100'

0 50 100 200 FEET

SOUTH SAN DIEGO BAY WETLAND MITIGATION BANK TOPOGRAPHIC MAP

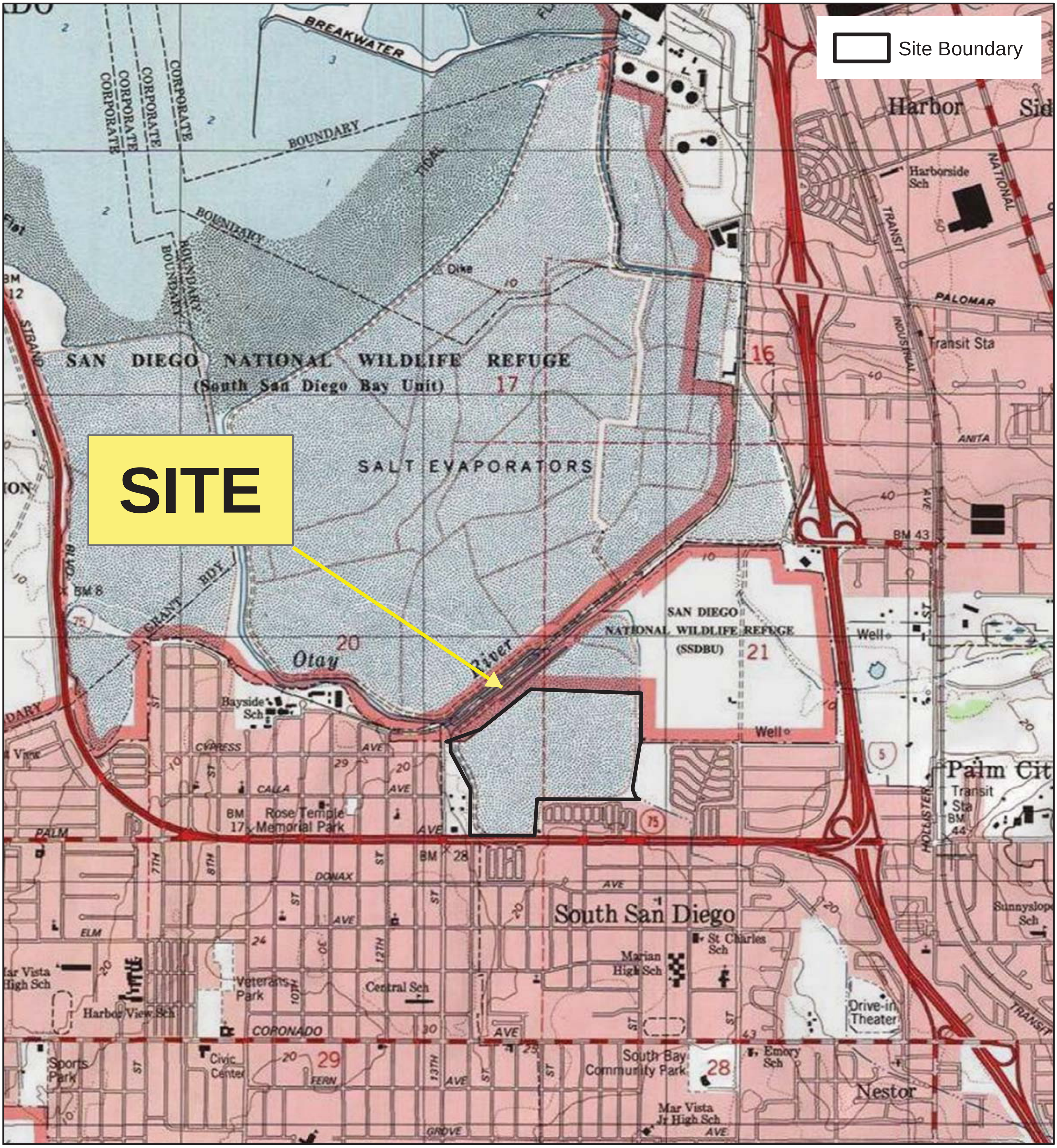
VERTICAL DATUM: MLLW

July, 2017

SAN DIEGO UNIFIED PORT DISTRICT
POND 20 MITIGATION BANK

GREATecology
ENVIRONMENT + DESIGN

2251 San Diego Ave., Suite A218
San Diego, CA 92110
858-750-3201



TOPOGRAPHIC MAP (USGS 2002)
SOUTH SAN DIEGO BAY WETLAND MITIGATION BANK

7.5 MINUTE QUADRANGLE: IMPERIAL BEACH
SAN DIEGO UNIFIED PORT DISTRICT
APRIL 2017

1:25,000
WGS 1984 WEB MERCATOR

0 0.5 1 Miles

N

GREATecology
ENVIRONMENT + DESIGN

Legend

- 🟪 E2EM1Nh - Estuarine Intertidal Emergent Persistent Regularly Flooded, Diked/Impounded
- 🟩 E2EM1Px - Estuarine Intertidal Emergent Persistent Irregularly Flooded, Excavated
- 🟦 E2SBMx - Estuarine Intertidal Streambed Irregularly Exposed, Excavated
- 🟦 E2SBNx - Estuarine Intertidal Streambed Regularly Flooded, Excavated
- 🟧 E2SSP - Estuarine Intertidal Scrub-Shrub Irregularly Flooded
- 🟨 E2SSPh - Estuarine Intertidal Scrub-Shrub Irregularly Flooded, Diked/Impounded
- 🟩 E2USNh - Estuarine Intertidal Unconsolidated Shore Regularly Flooded, Diked/Impounded
- 🟩 E2USPh - Estuarine Intertidal Unconsolidated Shore Irregularly Flooded, Diked/Impounded

1:4,000
NAD 83 CA STATE PLANE FIPS IV

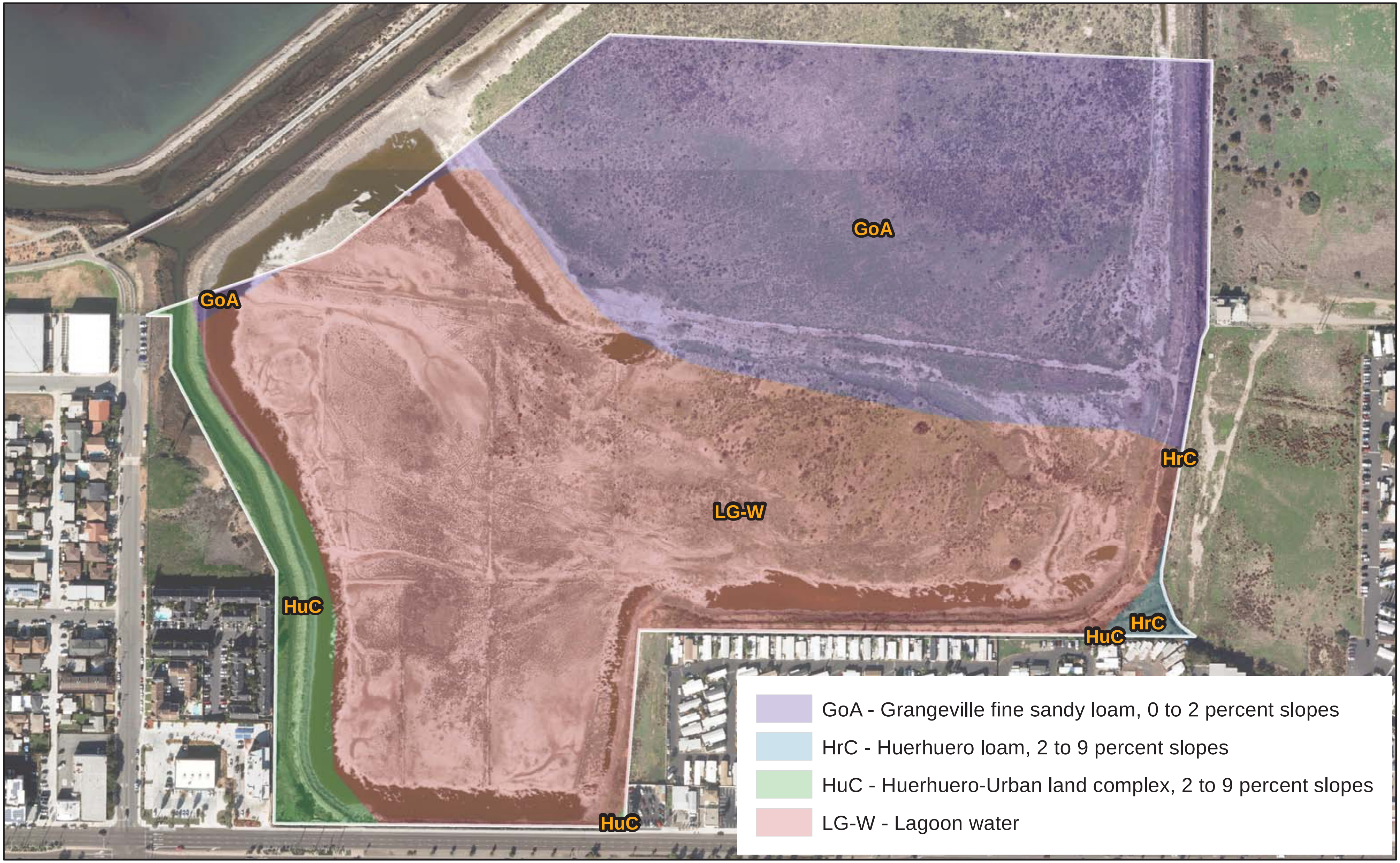
NATIONAL WETLANDS INVENTORY (2006)
SOUTH SAN DIEGO BAY WETLAND MITIGATION BANK

SAN DIEGO UNIFIED PORT DISTRICT
APRIL 2017

0 0.05 0.1 Miles

N

GREATecology
ENVIRONMENT + DESIGN



SOIL SURVEY (NRCS 1973)
SOUTH SAN DIEGO BAY WETLAND MITIGATION BANK

SAN DIEGO UNIFIED PORT DISTRICT
APRIL 2017

0 0.05 0.1 Miles

N

1:4,000
NAD 1983 CA STATE PLANE FIPS IV

GREATecology
ENVIRONMENT + DESIGN

SAMPLING TRANSECTS, SAMPLING POINTS, AND PHOTO POINTS
SOUTH SAN DIEGO BAY WETLAND MITIGATION BANK

1:4,000
NAD 1983 CA STATE PLANE VI

SAN DIEGO UNIFIED PORT DISTRICT
SEPTEMBER 2017

0 0.05 0.1 Miles

N

GREAT ecology
ENVIRONMENT + DESIGN

IDENTIFIED ONSITE WATER FEATURES - OVERVIEW
SOUTH SAN DIEGO BAY WETLAND MITIGATION BANK

1:4,000
NAD 1983 CA STATE PLANE FIPS VI

SAN DIEGO UNIFIED PORT DISTRICT
APRIL 2017

0 0.05 0.1 Miles

N

GREATecology
ENVIRONMENT + DESIGN

POTENTIAL JURISDICTIONAL WATERS - W1
SOUTH SAN DIEGO BAY **WETLAND** MITIGATION BANK

1:750
NAD 1983 CA STATE PLANE FIPS IV

SAN DIEGO UNIFIED PORT DISTRICT
APRIL 2017

0 50 100 Feet

N

GREAT ecology
ENVIRONMENT + DESIGN

POTENTIAL JURISDICTIONAL WATERS - W2
SOUTH SAN DIEGO BAY **WETLAND** MITIGATION BANK

1:750
NAD 1983 CA STATE PLANE FIPS IV

SAN DIEGO UNIFIED PORT DISTRICT
APRIL 2017

0 50 100 Feet

N

GREATecology
ENVIRONMENT + DESIGN

POTENTIAL JURISDICTIONAL WATERS - W3
SOUTH SAN DIEGO BAY WETLAND MITIGATION BANK

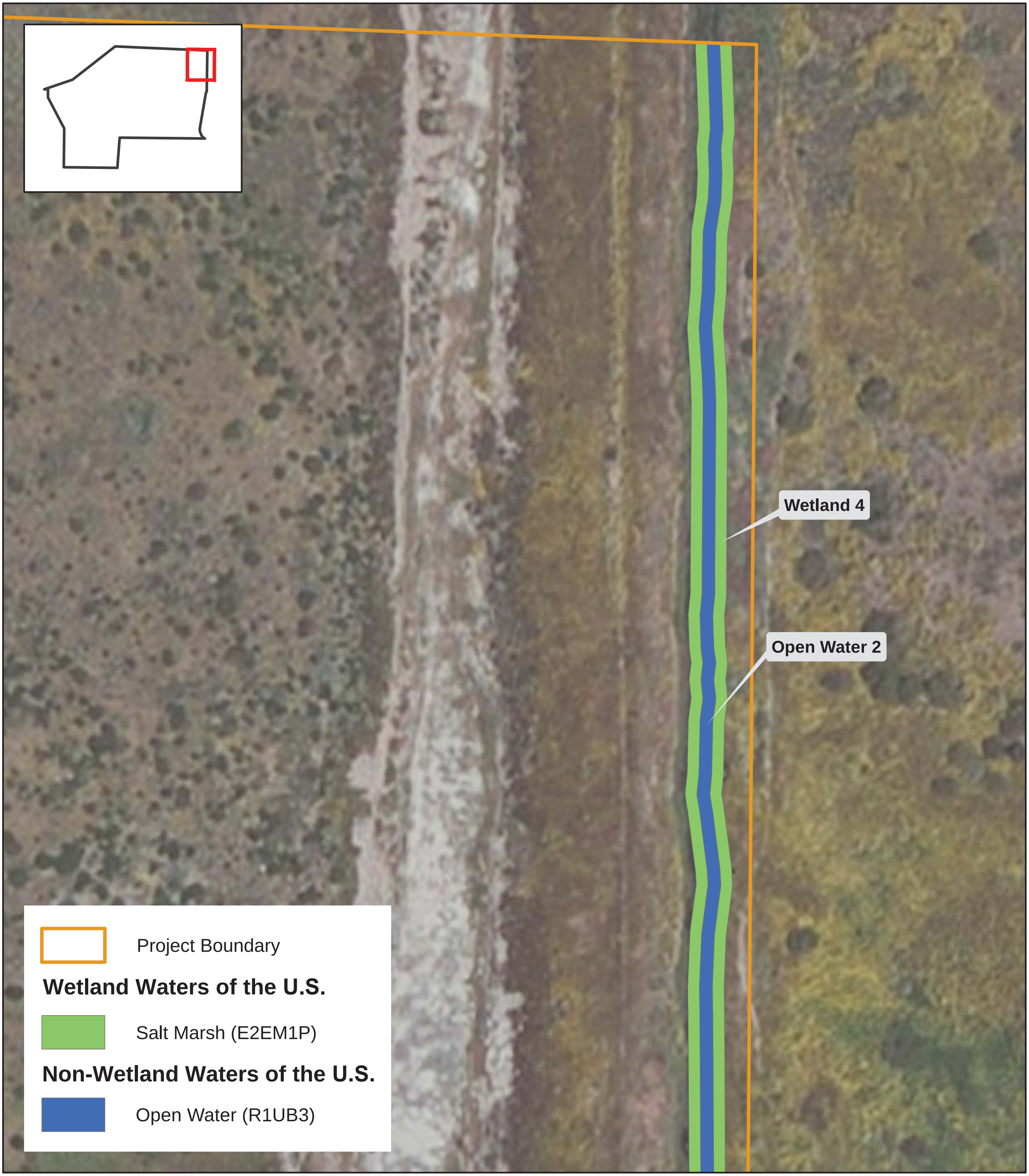
1:750
NAD 1983 CA STATE PLANE FIPS IV

SAN DIEGO UNIFIED PORT DISTRICT
APRIL 2017

Feet
0 50 100

N

GREATecology
ENVIRONMENT + DESIGN



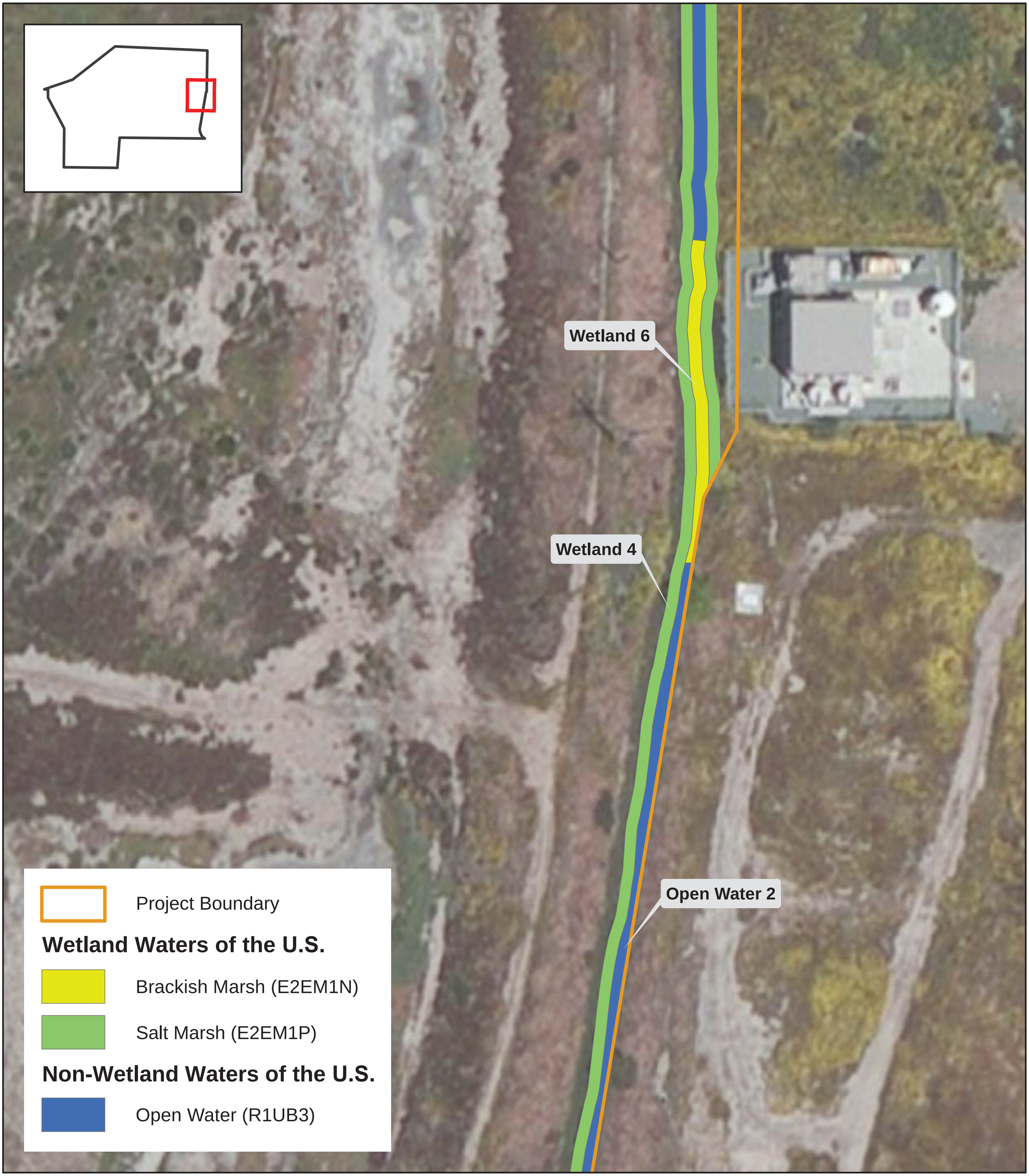
POTENTIAL JURISDICTIONAL WATERS - E1

SOUTH SAN DIEGO BAY **WETLAND** MITIGATION BANK

1:750
NAD 1983 CA STATE PLANE FIPS IV

SAN DIEGO UNIFIED PORT DISTRICT
APRIL 2017

GREATecology
ENVIRONMENT + DESIGN



POTENTIAL JURISDICTIONAL WATERS - E2
SOUTH SAN DIEGO BAY **WETLAND** MITIGATION BANK

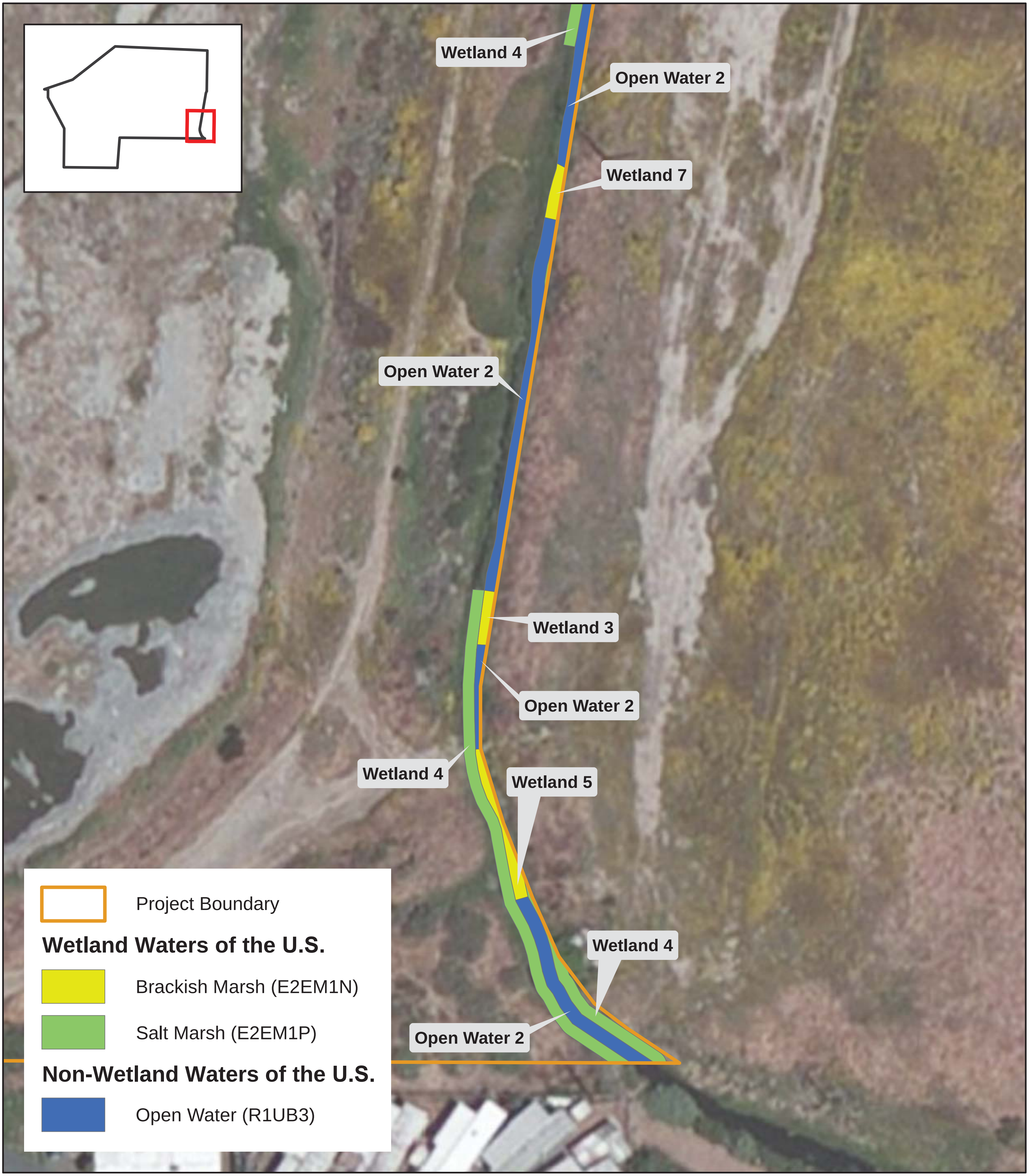
1:750
NAD 1983 CA STATE PLANE FIPS IV

SAN DIEGO UNIFIED PORT DISTRICT
APRIL 2017

0 50 100 Feet

N

GREATecology
ENVIRONMENT + DESIGN



POTENTIAL JURISDICTIONAL WATERS - E3
SOUTH SAN DIEGO BAY **WETLAND** MITIGATION BANK

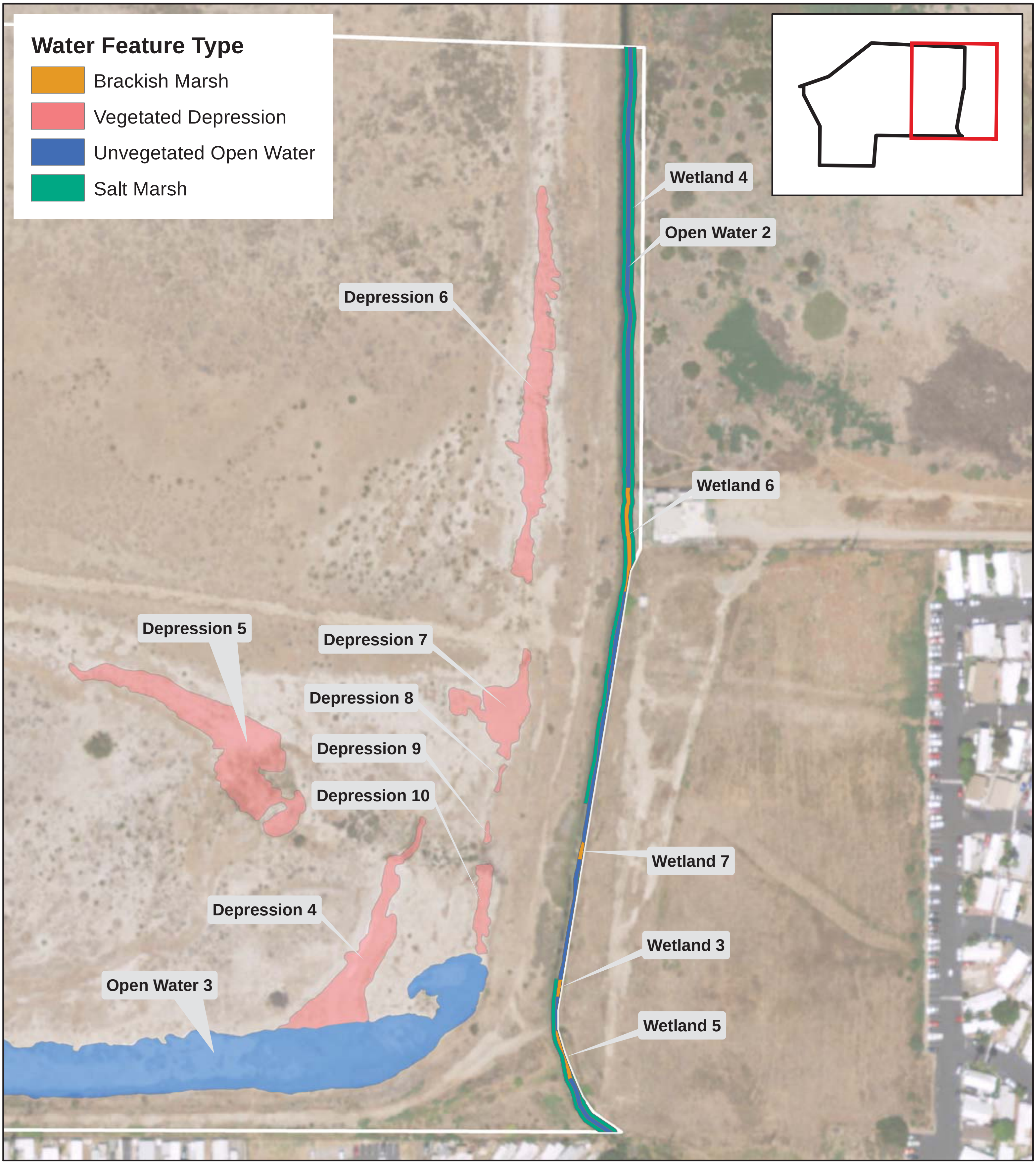
1:750
NAD 1983 CA STATE PLANE FIPS IV

SAN DIEGO UNIFIED PORT DISTRICT
APRIL 2017

0 50 100 Feet

N

GREATecology
ENVIRONMENT + DESIGN



IDENTIFIED ONSITE WATER FEATURES - EAST
SOUTH SAN DIEGO BAY WETLAND MITIGATION BANK

1:2,400
NAD 1983 CA STATE PLANE FIPS VI

SAN DIEGO UNIFIED PORT DISTRICT
APRIL 2017

0 0.05 0.1 Miles

N

GREATecology
ENVIRONMENT + DESIGN

APPENDIX A:
PRELIMINARY SECTION 404 JURISDICTIONAL MAPS

POTENTIAL JURISDICTIONAL WATERS - OVERVIEW
SOUTH SAN DIEGO BAY WETLAND MITIGATION BANK

SAN DIEGO UNIFIED PORT DISTRICT
APRIL 2017

1:4,000
NAD 1983 CA STATE PLANE FIPS IV

0 0.05 0.1 Miles

N

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ENVIRONMENT + DESIGN

POTENTIAL JURISDICTIONAL WATERS - W1
SOUTH SAN DIEGO BAY WETLAND MITIGATION BANK

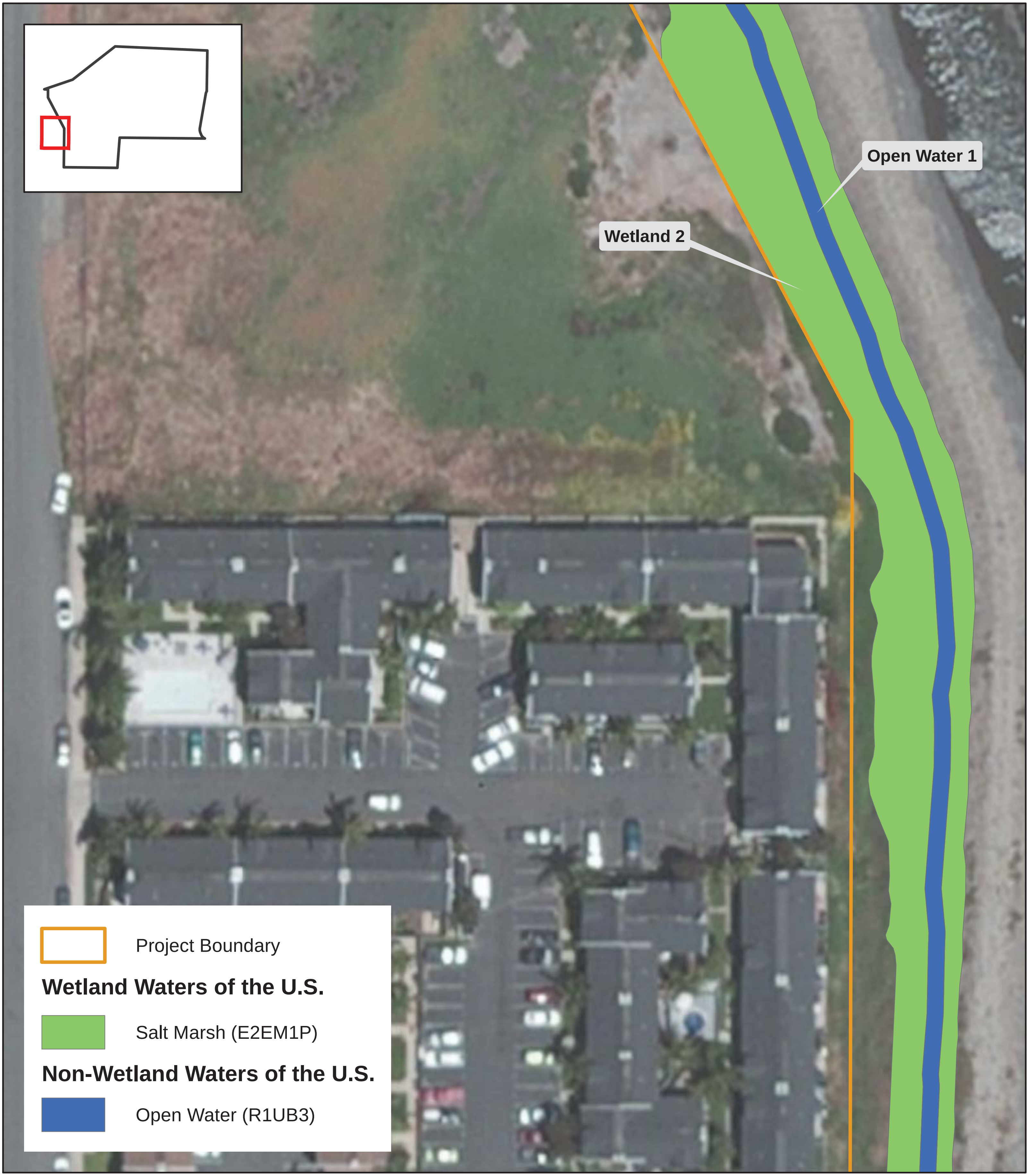
1:750
NAD 1983 CA STATE PLANE FIPS IV

SAN DIEGO UNIFIED PORT DISTRICT
APRIL 2017

0 50 100 Feet

N

GREATecology
ENVIRONMENT + DESIGN



POTENTIAL JURISDICTIONAL WATERS - W2
SOUTH SAN DIEGO BAY WETLAND MITIGATION BANK

1:750
NAD 1983 CA STATE PLANE FIPS IV

SAN DIEGO UNIFIED PORT DISTRICT
APRIL 2017

0 50 100 Feet

N

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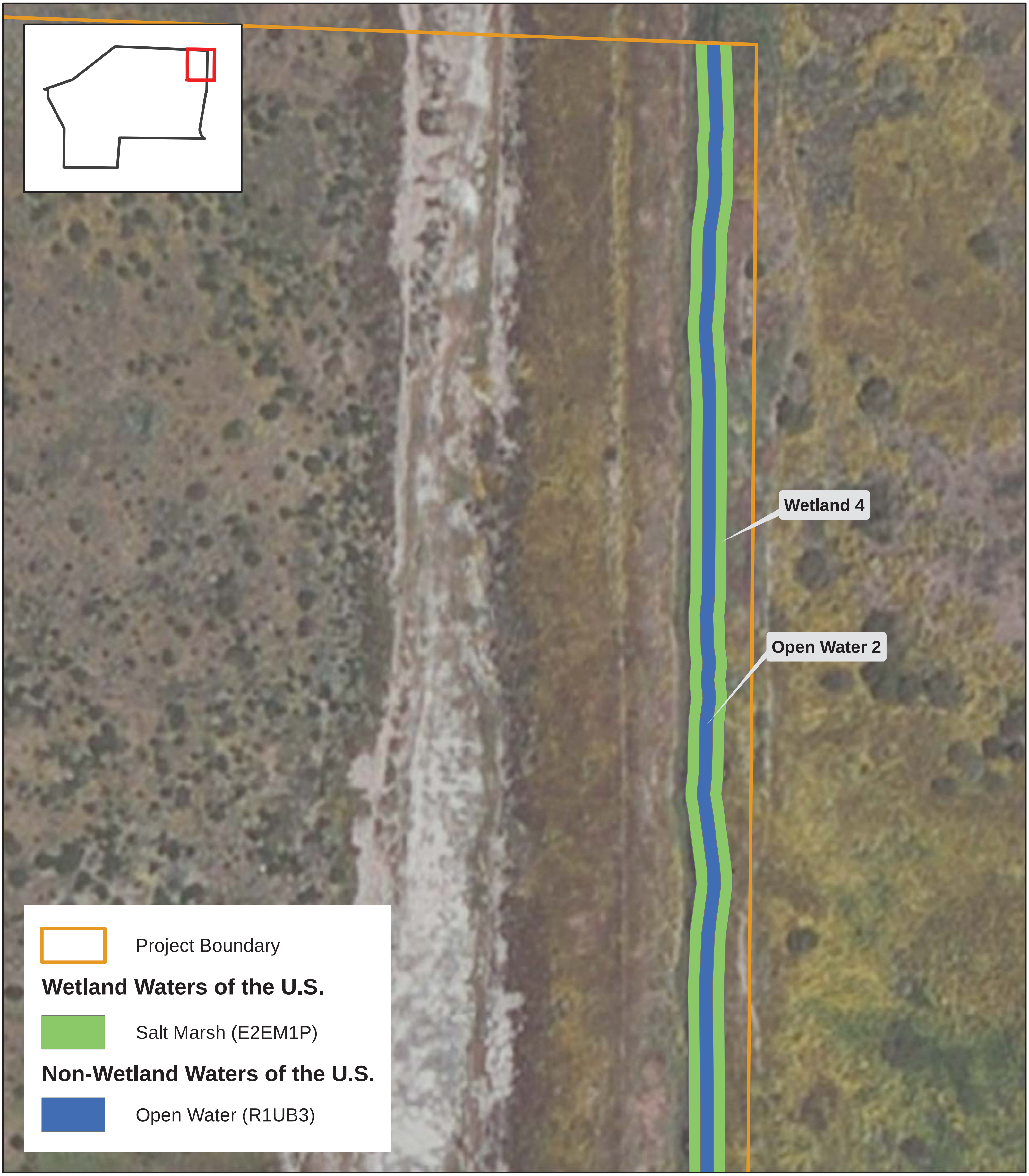
POTENTIAL JURISDICTIONAL WATERS - W3
SOUTH SAN DIEGO BAY WETLAND MITIGATION BANK

1:750
NAD 1983 CA STATE PLANE FIPS IV

SAN DIEGO UNIFIED PORT DISTRICT
APRIL 2017

GREATecology
ENVIRONMENT + DESIGN



POTENTIAL JURISDICTIONAL WATERS - E1
SOUTH SAN DIEGO BAY WETLAND MITIGATION BANK

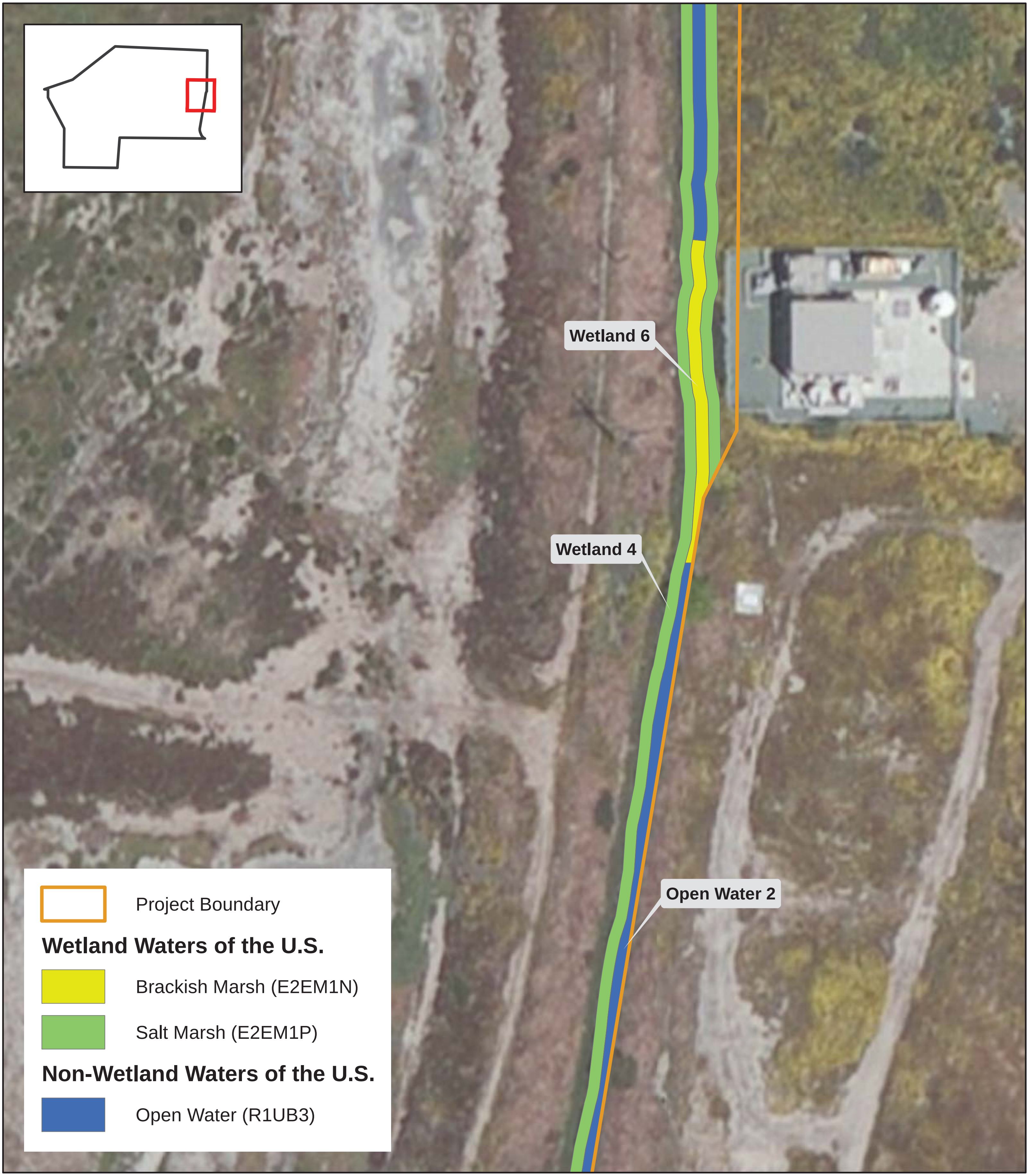
1:750
NAD 1983 CA STATE PLANE FIPS IV

SAN DIEGO UNIFIED PORT DISTRICT
APRIL 2017

0 50 100 Feet

N

GREATecology
ENVIRONMENT + DESIGN



POTENTIAL JURISDICTIONAL WATERS - E2
SOUTH SAN DIEGO BAY WETLAND MITIGATION BANK

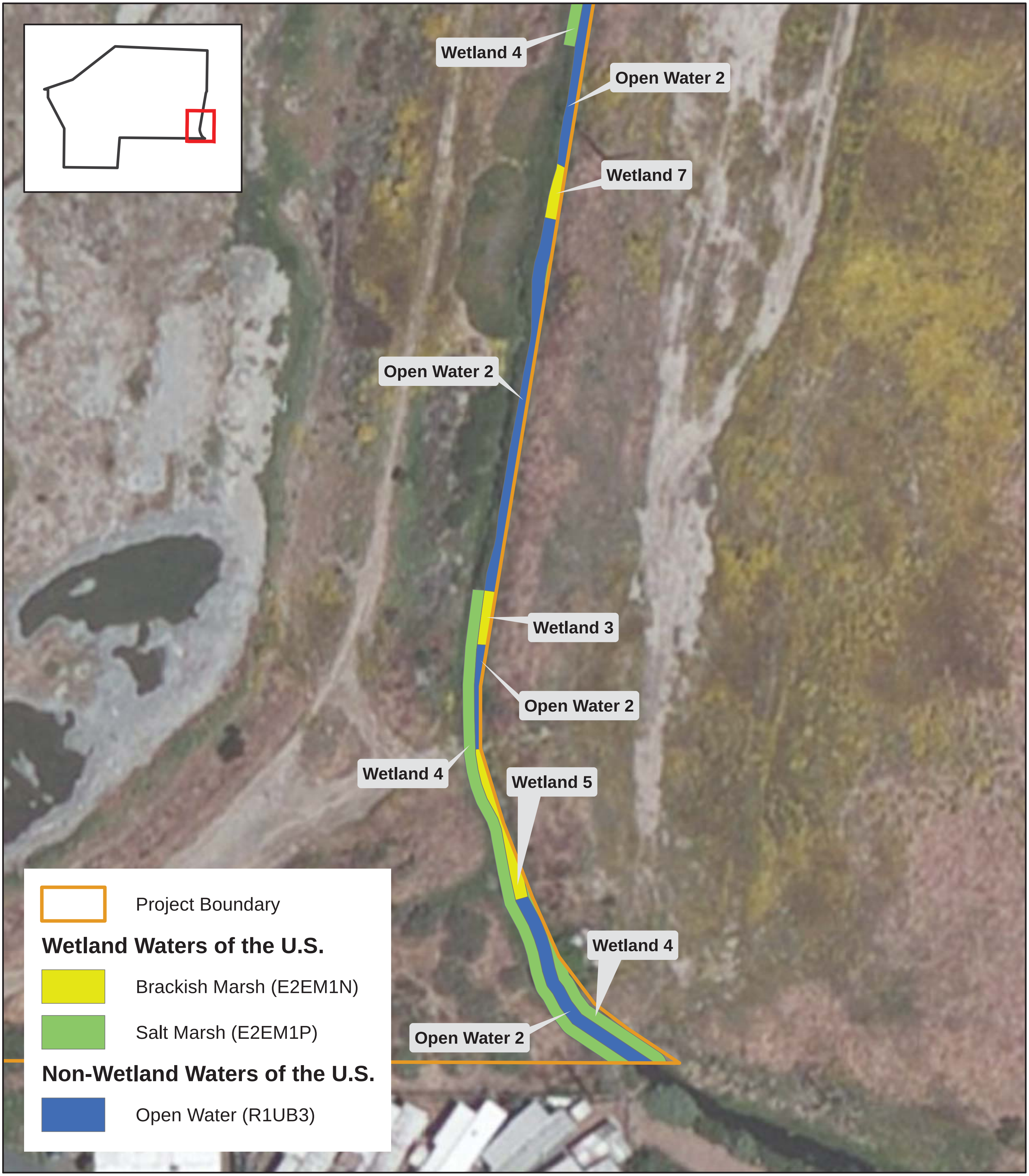
1:750
NAD 1983 CA STATE PLANE FIPS IV

SAN DIEGO UNIFIED PORT DISTRICT
APRIL 2017

0 50 100 Feet

N

GREATecology
ENVIRONMENT + DESIGN



POTENTIAL JURISDICTIONAL WATERS - E3
SOUTH SAN DIEGO BAY WETLAND MITIGATION BANK

1:750
NAD 1983 CA STATE PLANE FIPS IV

SAN DIEGO UNIFIED PORT DISTRICT
APRIL 2017

0 50 100 Feet

N

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APPENDIX B:
HISTORICAL AERIAL PHOTOGRAPHS

FIGURE 1A: 1852 T-SHEET NO. T-365 (SOURCE: GROSSINGER ET AL. 2011)

REGISTER Nº.:	T-365
PUBLISHED:	1852
SURVEYOR:	A. M. HARRISON
LOCALE:	TIJUANA ESTUARY, SOUTHERN PART OF SAN DIEGO BAY

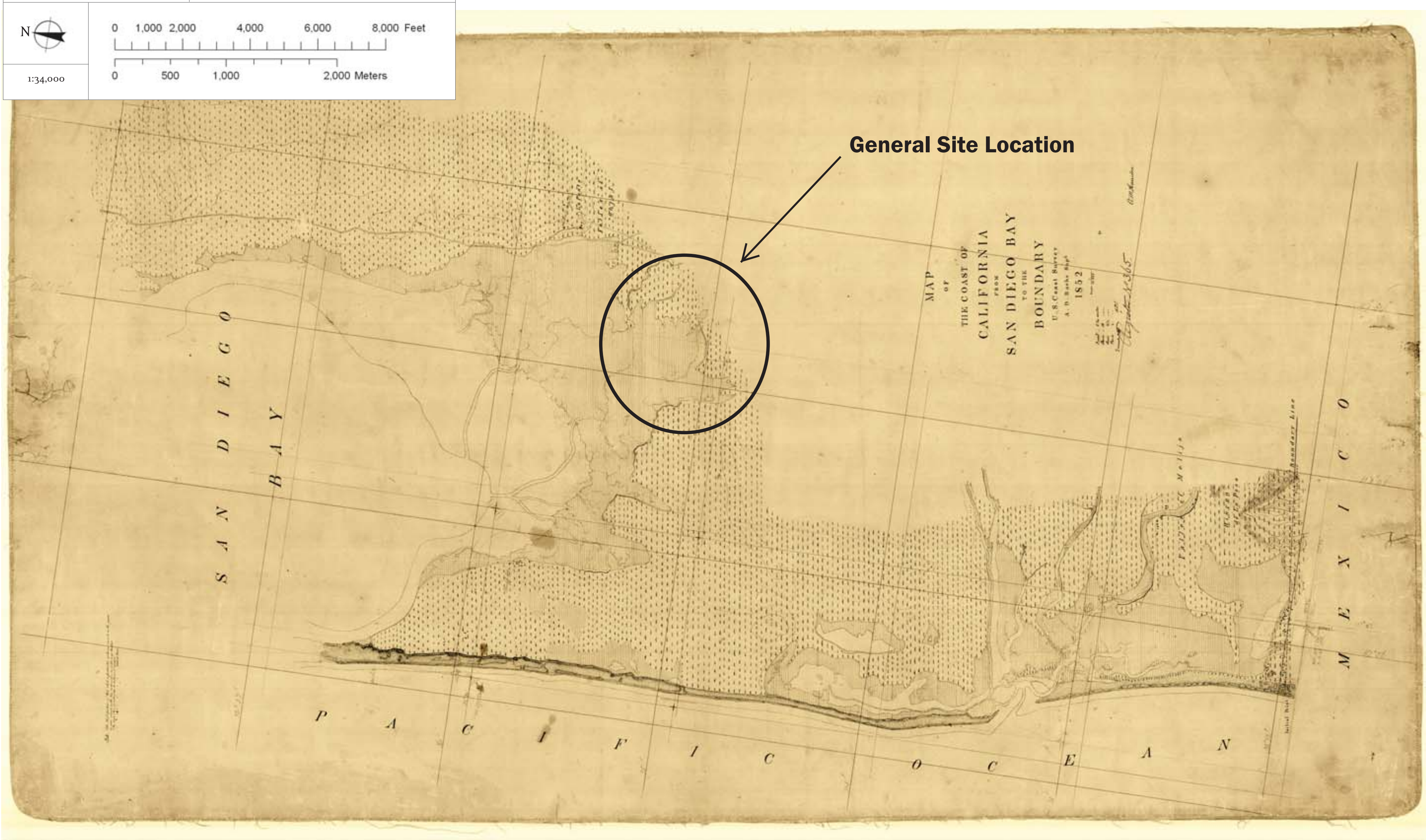


Figure 29. T-365 (full extent).

FIGURE 1B: COASTAL FEATURES DIGITIZED FROM T-SHEET NO. T-365, OVERLAID ON MODERN AERIAL PHOTOGRAPHY (USDA 2005) (SOURCE: GROSSINGER ET AL. 2011

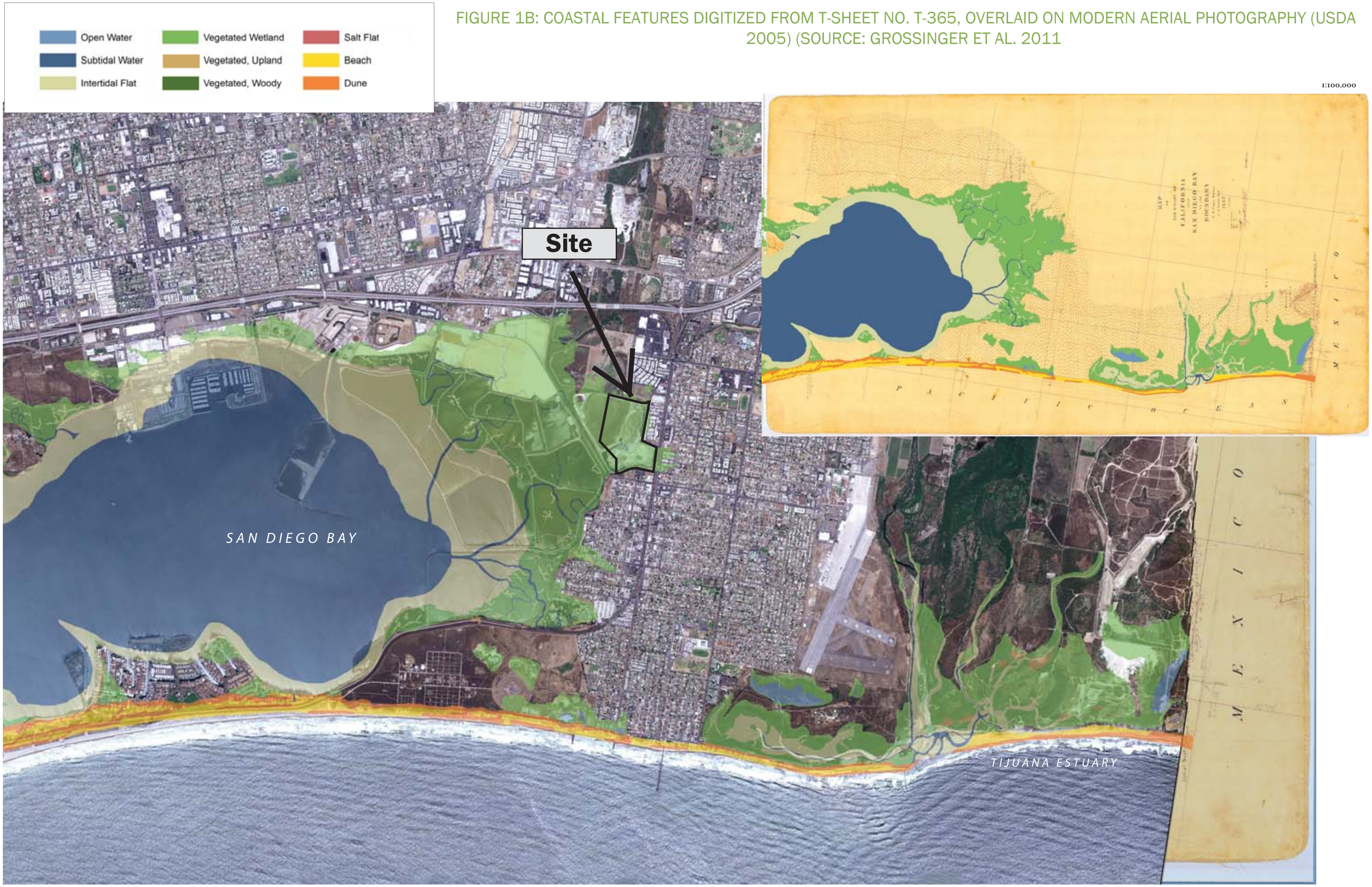
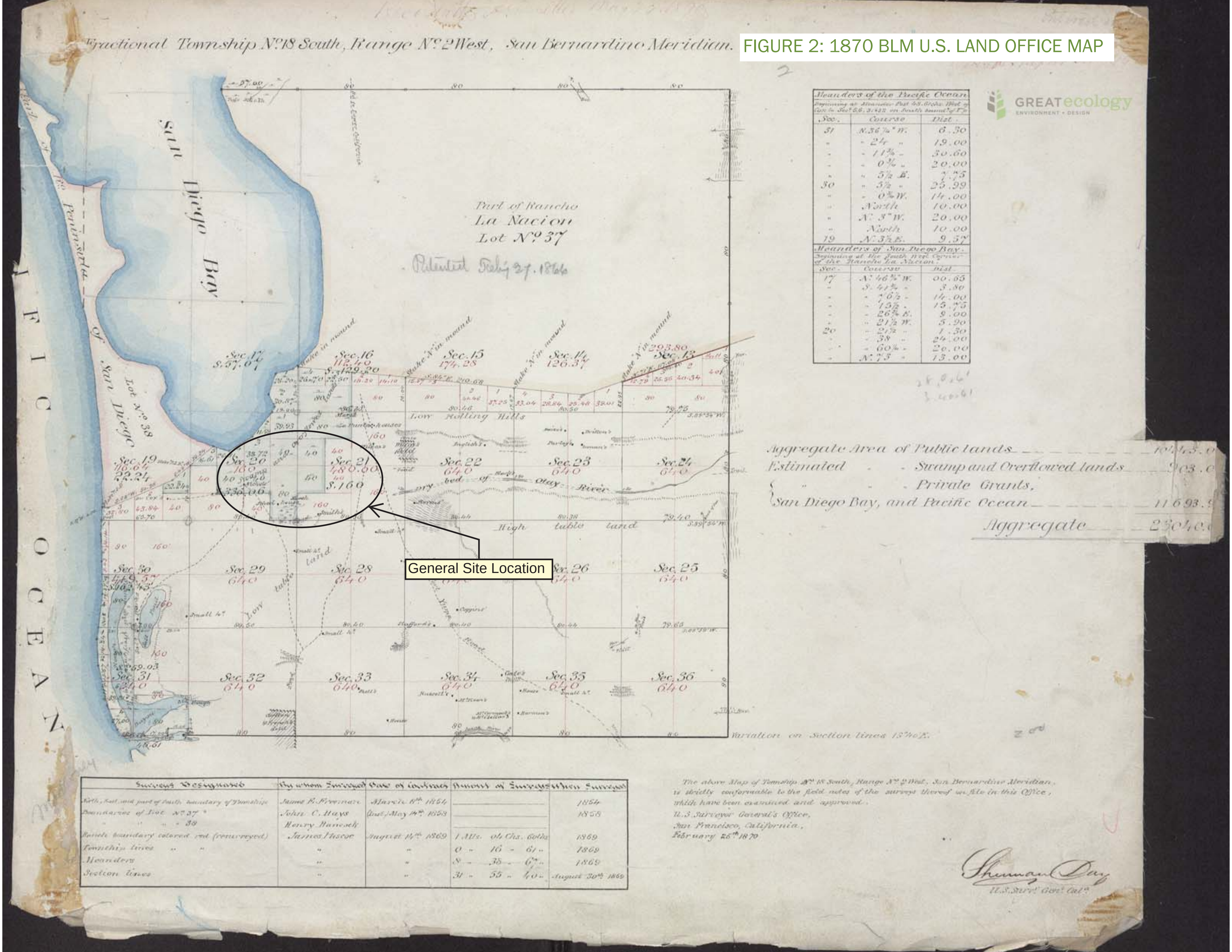


Figure 30. Coastal features digitized from T-365, overlaid on modern aerial photography (USDA 2005), at same scale as facing T-sheet.

Historical Wetlands of the Southern California Coast • 39

FIGURE 2: 1870 BLM U.S. LAND OFFICE MAP



Meanders of the Pacific Ocean		
Beginning at Meander Post 48.61 chs. West of Cor. to Secs. 5.6. 31&32 on South bound. of T. p		
Sec.	Course	Dist.
31	N. 36¾° W.	6.30
"	" 24 "	19.00
"	" 11¾ "	30.60
"	" 0¾ "	20.00
"	" 5½ E.	7.75
30	" 5½ "	25.99
"	" 0¾ W.	14.00
"	North	10.00
"	N. 3° W.	20.00
"	North	10.00
19	N. 3½ E.	9.57
Meanders of San Diego Bay.		
Beginning at the South West Corner of the Rancho La Nacion.		
Sec.	Course	Dist.
17	N. 46¾° W.	00.65
"	S. 41¾ "	3.80
"	" 76½ "	14.00
"	" 13½ "	15.75
"	" 26¾ E.	9.00
"	" 21½ W.	5.90
20	" 21½ "	1.30
"	" 38 "	24.00
"	" 60¾ "	20.00
"	N. 75 "	13.00

Aggregate Area of Public lands — 10,4[illegible]5.
Estimated " " Swamp and Overflowed lands — 903.
{ " " " Private Grants,
San Diego Bay, and Pacific Ocean — 11693.
Aggregate — 23040.

Surveys Designated	By whom Surveyed	Date of Contract	Amount of Surveys	When Surveyed
North, East and part of South boundary of Township	James E. Freeman	March 8th 1854		1854
Boundaries of Lot No. 37 "	John C. Hays	(Inst.) May 14th 1858		1858
" " " 38	Henry Hancock			
Rancho boundary colored red (resurveyed)	James Pascoe	August 14th 1869	1 Mls. 04 Chs. 60 lks	1869
Township lines " "	"	"	0 " 16 " 61 "	1869
Meanders	"	"	8 " 38 " 67 "	1869
Section lines	"	"	31 " 55 " 40 "	August 30th 1869

The above Map of Township No. 18 South, Range No. 2 West, San Bernardino Meridian, is strictly conformable to the field notes of the surveys thereof on file in this Office, which have been examined and approved.

U.S. Surveyor General's Office,
San Francisco, California,
February 25th 1870

Sherman Day
U.S. Surv. Genl. Cal.

IMAGE 3: HISTORICAL AERIAL IMAGERY, 1953

IMAGE 4: HISTORICAL AERIAL IMAGERY, 1964

IMAGE 5: HISTORICAL AERIAL IMAGE, 1966

IMAGE 6: HISTORICAL AERIAL IMAGERY, 1989

IMAGE 7: HISTORICAL AERIAL IMAGERY, 1994

IMAGE 8: HISTORICAL AERIAL IMAGERY, 1996

IMAGE 9: HISTORICAL AERIAL IMAGERY, 1998

1998 Aerial Image

IMAGE 10: HISTORICAL AERIAL IMAGERY, 2000 AERIAL IMAGE

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ENVIRONMENT + DESIGN

IMAGE 11: HISTORICAL AERIAL IMAGERY, 2001

IMAGE 12: HISTORICAL AERIAL IMAGERY, 2003

IMAGE 13: HISTORICAL AERIAL IMAGERY, 2004

IMAGE 14: HISTORICAL AERIAL IMAGERY, 2005

IMAGE 15: HISTORICAL AERIAL IMAGERY, 2006

IMAGE 16: HISTORICAL AERIAL IMAGERY, 2007

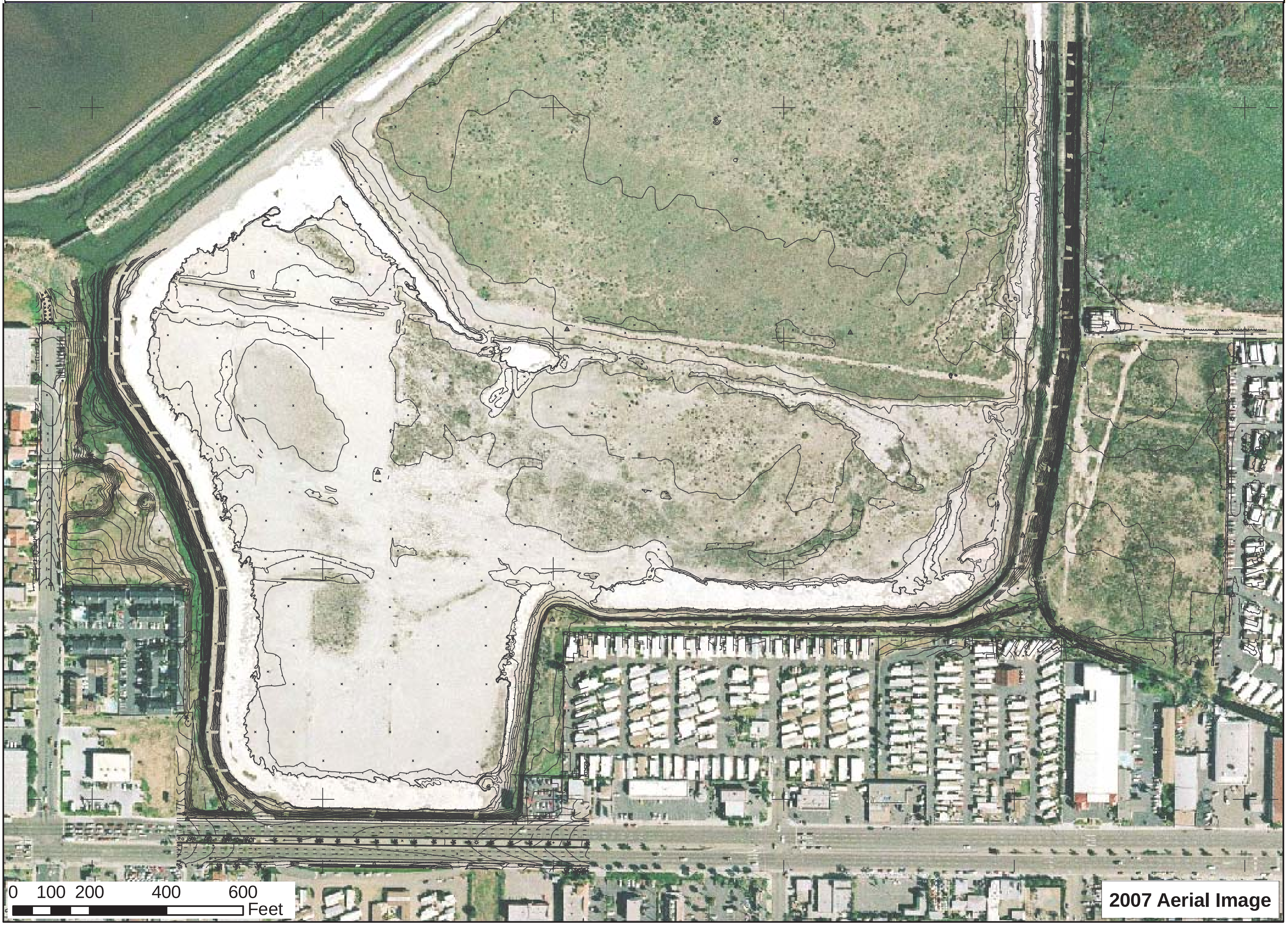


IMAGE 17: HISTORICAL AERIAL IMAGERY, 2008

IMAGE 18: HISTORICAL AERIAL IMAGERY, 2014

APPENDIX C:
FEMA FLOOD INSURANCE RATE MAP (FIRM)

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) Zone 11N. The **horizontal datum** was NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242**, or visit its website at http://www.ngs.noaa.gov/.

Base map information shown on this FIRM was provided in digital format by the USDA National Agriculture Imagery Program (NAIP). This information was photogrammetrically compiled at a scale of 1:24,000 from aerial photography dated 2009.

This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

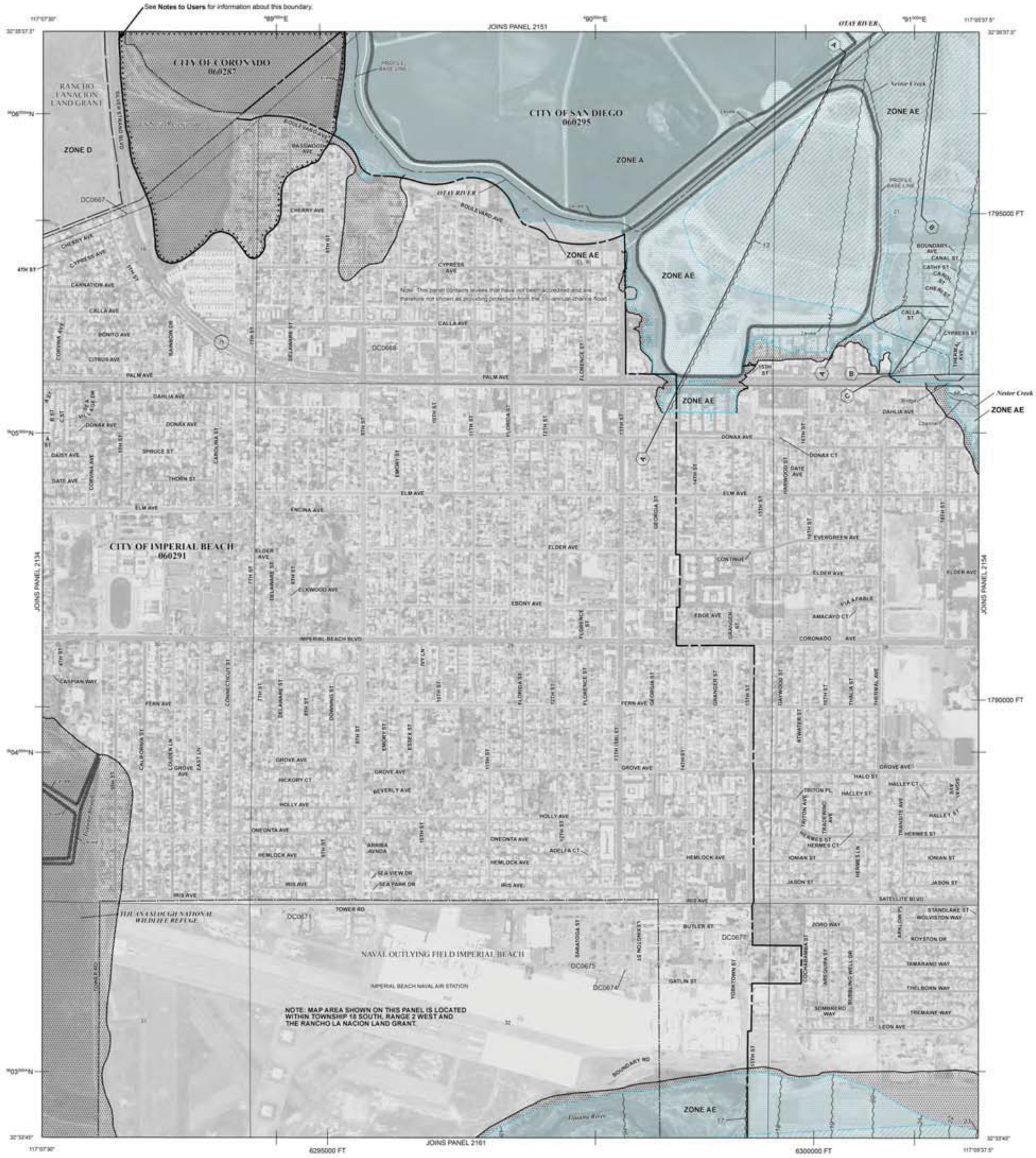
Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information and questions about this map, available products associated with this FIRM including historic versions of this FIRM, how to order products or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Map Service Center website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website. Users may determine the current map date for each FIRM panel by visiting the FEMA Map Service Center website or by calling the FEMA Map Information eXchange.

The **"profile base lines"** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the "profile base line", in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

ATTENTION: The levee, dike, or other structure that impacts flood hazards inside this boundary has not been shown to comply with Section 65.10 of the NFIP Regulations. As such, this FIRM panel will be revised at a later date to update the flood hazard information associated with this structure.

The flood hazard data inside this boundary on the FIRM panel has been republished from the previous effective (historic) FIRM for this area, after being converted from NGVD 29 to NAVD 88.



LEGEND

▨ SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Areas to be protected from 1% annual chance flood event by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

▨ FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

▒ OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

☐ OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

▧ COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

☐ OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

———	1% annual chance floodplain boundary
———	0.2% annual chance floodplain boundary
- - - -	Floodway boundary
— — —	Zone D boundary
••••••••	CBRS and OPA boundary
▬	Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities
~~ 513 ~~~	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

(A)———(A)	Cross section line
(23)- - - -(23)	Transect line
87°07'30", 32°22'30"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
4275000m E	1000-meter Universal Transverse Mercator grid ticks, zone 11
6000000 FT	5000-foot grid values: California State Plane coordinate system, Zone VI (FIPSZONE = 406), Lambert projection
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
● M1.5	River Mile

MAP REPOSITORIES
Refer to Map Repositories List on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
June 19, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
April 5, 2016 - to change Special Flood Hazard Areas and to update map elevations to North American Vertical Datum of 1988.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 250 500 750 1,000 FEET
150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 2153G

FIRM
FLOOD INSURANCE RATE MAP
SAN DIEGO COUNTY, CALIFORNIA
AND INCORPORATED AREAS

PANEL 2153 OF 2375

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
CORONADO, CITY OF	060287	2153	G
IMPERIAL BEACH, CITY OF	060291	2153	G
SAN DIEGO, CITY OF	060295	2153	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
06073C2153G

MAP REVISED
APRIL 5, 2016

Federal Emergency Management Agency

APPENDIX D:
WETLAND DELINEATION DATA FORMS

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Wetlands Restoration of Salt Pond 20 City/County: San Diego, San Diego County Sampling Date: 1-31-2017
Applicant/Owner: San Diego Unified Port District State: CA Sampling Point: T1.1
Investigator(s): M. Tyner-Valencourt, B. Felten, A. Tuggle Section, Township, Range: T18S R2W
Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Concave Slope (%): 1
Subregion (LRR): C - Mediterranean California Lat: 32.588875 Long: -117.097318 Datum: NAD 1983
Soil Map Unit Name: GoA - Grangeville fine sandy loam, 0 to 2 percent slopes NWI classification: E2USPh
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ● No ○ (If no, explain in Remarks.)
Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ● No ○
Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ○ No ●
Hydric Soil Present? Yes ○ No ●
Wetland Hydrology Present? Yes ○ No ●

Is the Sampled Area within a Wetland? **Yes** ○ **No** ●

Remarks: Site historically supported estuary wetland habitat but was filled and bermed in the 1870s for use as a salt evaporator pond, and has not been restored since. Delineation conducted on site during an above-average rainy season following 5+ years of severe drought. Sample site located on moderate slope.

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:	%		
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
Total Cover:	%		
Herb Stratum			
1. *Mesembryanthemum nodiflorum*	50	Yes	FACU
2. *Spergularia rubra*	25	Yes	FAC
3. *Ambrosia psilostachya*	5	No	FACU
4.			
5.			
6.			
7.			
8.			
Total Cover:	80 %		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum 20 % % Cover of Biotic Crust 0 %

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	1	(A)
Total Number of Dominant Species Across All Strata:	2	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	50.0 %	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	0
FACW species		x 2 =	0
FAC species	25	x 3 =	75
FACU species	55	x 4 =	220
UPL species		x 5 =	0
Column Totals:	80	(A)	295 (B)

Prevalence Index = B/A = 3.69

Hydrophytic Vegetation Indicators:

- ☐ Dominance Test is >50%
- ☐ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? **Yes** ○ **No** ●

Remarks: Living vegetation community entirely herbaceous, standing dead Baccharis spp. individuals present.

SOIL

Sampling Point: T1.1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features				Texture[3]	Remarks
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]		
0-7	10YR 4/2	85	7.5YR 5/8	15	C	M	Sand	2" of sparse CS between 4-6"
7-16	10YR 2/2	100					Loamy Sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.
[3]Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

☐ Histosol (A1)
☐ Histic Epipedon (A2)
☐ Black Histic (A3)
☐ Hydrogen Sulfide (A4)
☐ Stratified Layers (A5) (**LRR C**)
☐ 1 cm Muck (A9) (**LRR D**)
☐ Depleted Below Dark Surface (A11)
☐ Thick Dark Surface (A12)
☐ Sandy Mucky Mineral (S1)
☐ Sandy Gleyed Matrix (S4)
☐ Sandy Redox (S5)
☐ Stripped Matrix (S6)
☐ Loamy Mucky Mineral (F1)
☐ Loamy Gleyed Matrix (F2)
☐ Depleted Matrix (F3)
☐ Redox Dark Surface (F6)
☐ Depleted Dark Surface (F7)
☐ Redox Depressions (F8)
☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[4]:

☐ 1 cm Muck (A9) (**LRR C**)
☐ 2 cm Muck (A10) (**LRR B**)
☐ Reduced Vertic (F18)
☐ Red Parent Material (TF2)
☐ Other (Explain in Remarks)

[4]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? **Yes** ○ **No** ●

Remarks: Observed sparse coated sand grain redox features between 4-6 inches of the soil profile, but not sufficient to support hydric soil determination.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

☐ Surface Water (A1)
☐ High Water Table (A2)
☐ Saturation (A3)
☐ Water Marks (B1) (**Nonriverine**)
☐ Sediment Deposits (B2) (**Nonriverine**)
☐ Drift Deposits (B3) (**Nonriverine**)
☐ Surface Soil Cracks (B6)
☐ Inundation Visible on Aerial Imagery (B7)
☐ Water-Stained Leaves (B9)
☐ Salt Crust (B11)
☐ Biotic Crust (B12)
☐ Aquatic Invertebrates (B13)
☐ Hydrogen Sulfide Odor (C1)
☐ Oxidized Rhizospheres along Living Roots (C3)
☐ Presence of Reduced Iron (C4)
☐ Recent Iron Reduction in Plowed Soils (C6)
☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

☐ Water Marks (B1) (**Riverine**)
☐ Sediment Deposits (B2) (**Riverine**)
☐ Drift Deposits (B3) (**Riverine**)
☐ Drainage Patterns (B10)
☐ Dry-Season Water Table (C2)
☐ Thin Muck Surface (C7)
☐ Crayfish Burrows (C8)
☐ Saturation Visible on Aerial Imagery (C9)
☐ Shallow Aquitard (D3)
☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ● Depth (inches):
Water Table Present? Yes ○ No ● Depth (inches):
Saturation Present? (includes capillary fringe) Yes ○ No ● Depth (inches):

Wetland Hydrology Present? **Yes** ○ **No** ●

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:
No inundation visible on aerial imagery.

Remarks: Sample site located at toe of berm where terrain shifts from steep to flat; small amount of surface soil cracks on slope, but no evidence of water ponding so not considered a hydrology indicator. No wetland hydrology indicators observed.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Wetlands Restoration of Salt Pond 20 City/County: San Diego, San Diego County Sampling Date: 1-31-2017
Applicant/Owner: San Diego Unified Port District State: CA Sampling Point: T1.2
Investigator(s): M. Tyner-Valencourt, B. Felten, A. Tuggle Section, Township, Range: T18S R2W S21
Landform (hillslope, terrace, etc.): Local relief (concave, convex, none): None Slope (%): 0
Subregion (LRR): C - Mediterranean California Lat: 32.588862 Long: -117.097417 Datum: NAD 1983
Soil Map Unit Name: GoA - Grangeville fine sandy loam, 0 to 2 percent slopes NWI classification: E2USPh
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ● No ○ (If no, explain in Remarks.)
Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ● No ○
Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ○	No ●
Hydric Soil Present?	Yes ●	No ○
Wetland Hydrology Present?	Yes ●	No ○

Is the Sampled Area within a Wetland? **Yes** ○ **No** ●

Remarks: Site historically supported estuary wetland habitat but was filled and bermed in the 1870s for use as a salt evaporator pond, and has not been restored since. Delineation conducted on site during an above-average rainy season following 5+ years of severe drought. Sample point located on a dry area next to standing surface water at a similar elevation within a localized landscape depression.

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:	%		
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
Total Cover:	%		
Herb Stratum			
1. *Mesembryanthemum nodiflorum*	80	Yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
8.			
Total Cover:	80 %		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum 20 % % Cover of Biotic Crust 0 %

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	0	(A)
Total Number of Dominant Species Across All Strata:	1	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	0.0 %	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	0
FACW species		x 2 =	0
FAC species		x 3 =	0
FACU species	80	x 4 =	320
UPL species		x 5 =	0
Column Totals:	80 (A)		320 (B)

Prevalence Index = B/A = 4.00

Hydrophytic Vegetation Indicators:

- ○ Dominance Test is >50%
- ○ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? **Yes** ○ **No** ●

Remarks: Relatively thick monotypic herbaceous layer of an upland species observed. No hydrophytic vegetation observed.

SOIL

Sampling Point: T1.2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture[3]	Remarks
0-10	10YR 3/1	65	7.5YR 5/8	35	C	M	Sand	Redox form is coated sand grain
10-20	GLEY1 3/N	85	7.5YR 2.5/3	15	C	PL	Clay	

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2] Location: PL=Pore Lining, RC=Root Channel, M=Matrix.
[3] Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (**LRR C**)
- ☐ 1 cm Muck (A9) (**LRR D**)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☒ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils:[4]

- ☐ 1 cm Muck (A9) (**LRR C**)
- ☐ 2 cm Muck (A10) (**LRR B**)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[4] Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? **Yes** ● **No** ○

Remarks: Soils are very saturated; west side of sample soil pit exhibits largely clay soils, east side exhibits mostly sand soils, indicative of fill material.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☒ High Water Table (A2)
- ☒ Saturation (A3)
- ☐ Water Marks (B1) (**Nonriverine**)
- ☐ Sediment Deposits (B2) (**Nonriverine**)
- ☐ Drift Deposits (B3) (**Nonriverine**)
- ☒ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Plowed Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) (**Riverine**)
- ☐ Sediment Deposits (B2) (**Riverine**)
- ☐ Drift Deposits (B3) (**Riverine**)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ● Depth (inches):
Water Table Present? Yes ● No ○ Depth (inches): 15
Saturation Present? (includes capillary fringe) Yes ● No ○ Depth (inches): 7

Wetland Hydrology Present? **Yes** ● **No** ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:
Evidence of some salt precipitate deposition at sample location in aerial imagery.

Remarks: Sample point located next to a standing water feature during an atypical storm season, evidence of surface water ponding but water has since evaporated and infiltrated from this particular location.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Wetlands Restoration of Salt Pond 20 City/County: San Diego, San Diego County Sampling Date: 1-31-2017
Applicant/Owner: San Diego Unified Port District State: CA Sampling Point: T1.3
Investigator(s): M. Tyner-Valencourt, B. Felten, A. Tuggle Section, Township, Range: T18S R2W S21
Landform (hillslope, terrace, etc.): Upland Local relief (concave, convex, none): None Slope (%): 0
Subregion (LRR): C - Mediterranean California Lat: 32.588918 Long: -117.097554 Datum: NAD 1983
Soil Map Unit Name: GoA - Grangeville fine sandy loam, 0 to 2 percent slopes NWI classification: E2SSPh
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ● No ○ (If no, explain in Remarks.)
Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ● No ○
Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ○	No ●	
Hydric Soil Present?	Yes ○	No ●	Is the Sampled Area
Wetland Hydrology Present?	Yes ○	No ●	within a Wetland? **Yes** ○ **No** ●

Remarks: Site historically supported estuary wetland habitat but was filled and bermed in the 1870s for use as a salt evaporator pond, and has not been restored since. Delineation conducted on site during an above-average rainy season following 5+ years of severe drought. Sample point located on upland area adjacent to depression at toe of berm on east side of Site.

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:	%		
Sapling/Shrub Stratum			
1. *Cylindropuntia prolifera*	40	No	FACU
2.			
3.			
4.			
5.			
Total Cover:	40 %		
Herb Stratum			
1. *Mesembryanthemum crystallinum*	60	Yes	FACU
2. *Erodium botrys*	5	No	FACU
3. *Hirschfeldia incana*	5	No	Not Listed
4.			
5.			
6.			
7.			
8.			
Total Cover:	70 %		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum 20 % % Cover of Biotic Crust 0 %

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	0	(A)
Total Number of Dominant Species Across All Strata:	1	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	0.0 %	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species		x 1 =	0	
FACW species		x 2 =	0	
FAC species		x 3 =	0	
FACU species	105	x 4 =	420	
UPL species	5	x 5 =	25	
Column Totals:	110	(A)	445	(B)

Prevalence Index = B/A = 4.05

Hydrophytic Vegetation Indicators:

☐ Dominance Test is >50%
☐ Prevalence Index is ≤3.0[1]
☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? **Yes** ○ **No** ●

Remarks: Standing dead Baccharis pilularis and Hirschfeldia incana present in shrub layer, also scattered live B. pilularis individuals, though none occurred in our sample plot.

SOIL

Sampling Point: T1.3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features				Texture[3]	Remarks
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]		
0-17	10YR 4/3	100					Sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

[3]Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

☐ Histosol (A1)
☐ Histic Epipedon (A2)
☐ Black Histic (A3)
☐ Hydrogen Sulfide (A4)
☐ Stratified Layers (A5) (**LRR C**)
☐ 1 cm Muck (A9) (**LRR D**)
☐ Depleted Below Dark Surface (A11)
☐ Thick Dark Surface (A12)
☐ Sandy Mucky Mineral (S1)
☐ Sandy Gleyed Matrix (S4)

☐ Sandy Redox (S5)
☐ Stripped Matrix (S6)
☐ Loamy Mucky Mineral (F1)
☐ Loamy Gleyed Matrix (F2)
☐ Depleted Matrix (F3)
☐ Redox Dark Surface (F6)
☐ Depleted Dark Surface (F7)
☐ Redox Depressions (F8)
☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[4]:

☐ 1 cm Muck (A9) (**LRR C**)
☐ 2 cm Muck (A10) (**LRR B**)
☐ Reduced Vertic (F18)
☐ Red Parent Material (TF2)
☐ Other (Explain in Remarks)

[4]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? **Yes** ○ **No** ●

Remarks: No hydric soil indicators observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

☐ Surface Water (A1)
☐ High Water Table (A2)
☐ Saturation (A3)
☐ Water Marks (B1) (**Nonriverine**)
☐ Sediment Deposits (B2) (**Nonriverine**)
☐ Drift Deposits (B3) (**Nonriverine**)
☐ Surface Soil Cracks (B6)
☐ Inundation Visible on Aerial Imagery (B7)
☐ Water-Stained Leaves (B9)

☐ Salt Crust (B11)
☐ Biotic Crust (B12)
☐ Aquatic Invertebrates (B13)
☐ Hydrogen Sulfide Odor (C1)
☐ Oxidized Rhizospheres along Living Roots (C3)
☐ Presence of Reduced Iron (C4)
☐ Recent Iron Reduction in Plowed Soils (C6)
☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

☐ Water Marks (B1) (**Riverine**)
☐ Sediment Deposits (B2) (**Riverine**)
☐ Drift Deposits (B3) (**Riverine**)
☐ Drainage Patterns (B10)
☐ Dry-Season Water Table (C2)
☐ Thin Muck Surface (C7)
☐ Crayfish Burrows (C8)
☐ Saturation Visible on Aerial Imagery (C9)
☐ Shallow Aquitard (D3)
☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ● Depth (inches):
Water Table Present? Yes ○ No ● Depth (inches):
Saturation Present? (includes capillary fringe) Yes ○ No ● Depth (inches):

Wetland Hydrology Present? **Yes** ○ **No** ●

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:
No surface water observed in aerial imagery.

Remarks: No hydrology indicators observed.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Wetlands Restoration of Salt Pond 20 City/County: San Diego, San Diego County Sampling Date: 1-31-2017
Applicant/Owner: San Diego Unified Port District State: CA Sampling Point: T2.1
Investigator(s): M. Tyner-Valencourt, B. Felten, A. Tuggle Section, Township, Range: T18S R2W S21
Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Concave Slope (%): 2
Subregion (LRR): C - Mediterranean California Lat: 32.587237 Long: -117.097331 Datum: NAD 1983
Soil Map Unit Name: GoA - Grangeville fine sandy loam, 0 to 2 percent slopes NWI classification: N/A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ● No ○ (If no, explain in Remarks.)
Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ● No ○
Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ○	No ●	
Hydric Soil Present?	Yes ○	No ●	Is the Sampled Area
Wetland Hydrology Present?	Yes ○	No ●	within a Wetland? Yes ○ No ○

Remarks: Site historically supported estuary wetland habitat but was filled and bermed in the 1870s for use as a salt evaporator pond, and has not been restored since. Delineation conducted on site during an above-average rainy season following 5+ years of severe drought. Sample point located on upland berm slope right before topographical transition to depression.

VEGETATION

(Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum			
1.			
2.			
3.			
4.			
Total Cover:	%		
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
Total Cover:	%		
Herb Stratum			
1. *Mesembryanthemum nodiflorum*	50	Yes	FACU
2. *Spergularia rubra*	35	Yes	FAC
3. *Ambrosia psilostachya*	5	No	FACU
4.			
5.			
6.			
7.			
8.			
Total Cover:	90 %		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum 10 % % Cover of Biotic Crust 0 %

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	1	(A)
Total Number of Dominant Species Across All Strata:	2	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	50.0 %	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	0
FACW species		x 2 =	0
FAC species	35	x 3 =	105
FACU species	55	x 4 =	220
UPL species		x 5 =	0
Column Totals:	90	(A)	325 (B)

Prevalence Index = B/A = 3.61

Hydrophytic Vegetation Indicators:

- ☐ Dominance Test is >50%
- ☐ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? **Yes** ○ **No** ●

Remarks: Living vegetation made up of sprouting upland vegetation. In this community but outside of sample plot we observed live Cylindropuntia prolifera individuals sparsely distributed near top of berm. Also observed dead standing Baccharis pilularis in the shrub layer, and dead Mesembryanthemum crystallinum in the herb layer.

SOIL

Sampling Point: T2.1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture[3]	Remarks
0-12	7.5YR 3/3	100					Loamy sand	
12-20	10YR 4/3	90	7.5YR 5/8	10			Loam	

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2] Location: PL=Pore Lining, RC=Root Channel, M=Matrix.
[3] Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (**LRR C**)
- ☐ 1 cm Muck (A9) (**LRR D**)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[4]:

- ☐ 1 cm Muck (A9) (**LRR C**)
- ☐ 2 cm Muck (A10) (**LRR B**)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[4] Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? **Yes** ○ **No** ●

Remarks: No hydric soil indicators observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) (**Nonriverine**)
- ☐ Sediment Deposits (B2) (**Nonriverine**)
- ☐ Drift Deposits (B3) (**Nonriverine**)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Plowed Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) (**Riverine**)
- ☐ Sediment Deposits (B2) (**Riverine**)
- ☐ Drift Deposits (B3) (**Riverine**)
- ☒ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ● Depth (inches):
Water Table Present? Yes ○ No ● Depth (inches):
Saturation Present? (includes capillary fringe) Yes ○ No ● Depth (inches):

Wetland Hydrology Present? **Yes** ○ **No** ●

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:
No surface water observed at sample location in aerial imagery.

Remarks: Observed surface features indicating water flows across surface in storm events. No wetland hydrology indicators observed.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Wetlands Restoration of Salt Pond 20 City/County: San Diego, San Diego County Sampling Date: 1-31-2017

Applicant/Owner: San Diego Unified Port District State: CA Sampling Point: T2.2

Investigator(s): M. Tyner-Valencourt, B. Felten, A. Tuggle Section, Township, Range: T18S R2W S21

Landform (hillslope, terrace, etc.): Depression Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR): C - Mediterranean California Lat: 32.587239 Long: -117.097476 Datum: NAD 1983

Soil Map Unit Name: GoA - Grangeville fine sandy loam, 0 to 2 percent slopes NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ● No ○ (If no, explain in Remarks.)

Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ● No ○

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ○	No ●	
Hydric Soil Present?	Yes ○	No ●	**Is the Sampled Area**
Wetland Hydrology Present?	Yes ●	No ○	**within a Wetland?** **Yes** ○ **No** ●

Remarks: Site historically supported estuary wetland habitat but was filled and bermed in the 1870s for use as a salt evaporator pond, and has not been restored since. Delineation conducted on site during an above-average rainy season following 5+ years of severe drought. Sample point is located in a topographical depression at the toe of the berm slope on the east side of the Site.

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:	%		
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
Total Cover:	%		
Herb Stratum			
1. *Spergularia rubra*	25	Yes	FAC
2. *Mesembryanthemum nodiflorum*	20	Yes	FACU
3. *Ambrosia psilostachya*	10	Yes	FACU
4. *Bromus diandrus*	7	No	Not Listed
5. *Sarcocornia pacifica*	5	No	OBL
6. *Medicago polymorpha*	1	No	FACU
7.			
8.			
Total Cover:	68 %		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum 32 % % Cover of Biotic Crust %

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	1	(A)
Total Number of Dominant Species Across All Strata:	3	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	33.3 %	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	5	x 1 =	5
FACW species		x 2 =	0
FAC species	25	x 3 =	75
FACU species	31	x 4 =	124
UPL species	7	x 5 =	35
Column Totals:	68 (A)		239 (B)

Prevalence Index = B/A = 3.51

Hydrophytic Vegetation Indicators:

- ☐ Dominance Test is >50%
- ☐ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? **Yes** ○ **No** ●

Remarks: Patchy distribution of herbaceous species. Observed dead standing unidentified species in herb layer.

SOIL

Sampling Point: T2.2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture[3]	Remarks
0-11	10YR 3/1	100					Silty clay loam	
11-19	10YR 3/2	90	5YR 3/4	10	C	M	Loamy sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

[3]Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (**LRR C**)
- ☐ 1 cm Muck (A9) (**LRR D**)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils:[4]

- ☐ 1 cm Muck (A9) (**LRR C**)
- ☐ 2 cm Muck (A10) (**LRR B**)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[4]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? **Yes** ○ **No** ●

Remarks: No hydric soil indicators observed. Soil pH measured at 8.1 (2/6/2017 at 10:45) and soil salinity measured at 16-20 microS (2/9/2017 at 15:00), may have inhibited the development of redox deposits given hydrological conditions.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☒ High Water Table (A2)
- ☒ Saturation (A3)
- ☐ Water Marks (B1) (**Nonriverine**)
- ☒ Sediment Deposits (B2) (**Nonriverine**)
- ☐ Drift Deposits (B3) (**Nonriverine**)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Plowed Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) (**Riverine**)
- ☐ Sediment Deposits (B2) (**Riverine**)
- ☐ Drift Deposits (B3) (**Riverine**)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ● Depth (inches):

Water Table Present? Yes ● No ○ Depth (inches): 6

Saturation Present? (includes capillary fringe) Yes ● No ○ Depth (inches): 5

Wetland Hydrology Present? **Yes** ● **No** ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

No standing water observed in aerial imagery.

Remarks: Sample point located in topographical depression, surrounding area dry at the time of sampling but soil surface shows evidence of recent inundation. Observed some silt present on dead standing vegetation.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Wetlands Restoration of Salt Pond 20 City/County: San Diego, San Diego County Sampling Date: 1-31-2017

Applicant/Owner: San Diego Unified Port District State: CA Sampling Point: T2.3

Investigator(s): M. Tyner-Valencourt, B. Felten, A. Tuggle Section, Township, Range: T18S R2W S21

Landform (hillslope, terrace, etc.): Upland Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR): C - Mediterranean California Lat: 32.587247 Long: -117.09765 Datum: NAD 1983

Soil Map Unit Name: GoA - Grangeville fine sandy loam, 0 to 2 percent slopes NWI classification: E2SSPh

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ● No ○ (If no, explain in Remarks.)

Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ● No ○

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ○ No ●
Hydric Soil Present? Yes ○ No ●
Wetland Hydrology Present? Yes ○ No ●

Is the Sampled Area within a Wetland? **Yes** ○ **No** ○

Remarks: Site historically supported estuary wetland habitat but was filled and bermed in the 1870s for use as a salt evaporator pond, and has not been restored since. Delineation conducted on site during an above-average rainy season following 5+ years of severe drought. Sample point located on upland area to the west of the depressional area at the toe of the berm slope.

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:	%		
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
Total Cover:	%		
Herb Stratum			
1. *Mesembryanthemum crystallinum*	30	Yes	FACU
2. *Spergularia rubra*	30	Yes	FAC
3. *Mesembryanthemum nodiflorum*	20	Yes	FACU
4. *Erodium botrys*	5	No	FACU
5. *Medicago polymorpha*	2	No	FACU
6.			
7.			
8.			
Total Cover:	87 %		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum 20 % % Cover of Biotic Crust 0 %

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33.3 % (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	0
FACW species		x 2 =	0
FAC species	30	x 3 =	90
FACU species	57	x 4 =	228
UPL species		x 5 =	0
Column Totals:	87	(A)	318 (B)

Prevalence Index = B/A = 3.66

Hydrophytic Vegetation Indicators:

- ☐ Dominance Test is >50%
- ☐ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? **Yes** ○ **No** ●

Remarks: Sample point located in the transition to the upland community characterizing the bulk of the pond area of the site. Observed disturbed coastal sage scrub communities outside of sample plot that included Baccharis pilularis, B. salicifolia, Cylindropuntia prolifera, and Isocoma menziesii No hydrophytic vegetation present at sample location.

SOIL

Sampling Point: T2.3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture[3]	Remarks
0-20	10YR 4/1	100					Loamy sand	

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2] Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

[3] Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (**LRR C**)
- ☐ 1 cm Muck (A9) (**LRR D**)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[4]:

- ☐ 1 cm Muck (A9) (**LRR C**)
- ☐ 2 cm Muck (A10) (**LRR B**)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[4] Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? **Yes** ○ **No** ●

Remarks: No hydric soil indicators observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) (**Nonriverine**)
- ☐ Sediment Deposits (B2) (**Nonriverine**)
- ☐ Drift Deposits (B3) (**Nonriverine**)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Plowed Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) (**Riverine**)
- ☐ Sediment Deposits (B2) (**Riverine**)
- ☐ Drift Deposits (B3) (**Riverine**)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ○ Depth (inches):

Water Table Present? Yes ○ No ○ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ○ Depth (inches):

Wetland Hydrology Present? **Yes** ○ **No** ●

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:
No surface water observed in aerial imagery.

Remarks: No hydrology indicators observed.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Wetlands Restoration of Salt Pond 20 City/County: San Diego, San Diego County Sampling Date: 2-1-2017
Applicant/Owner: San Diego Unified Port District State: CA Sampling Point: T2.4
Investigator(s): M. Tyner-Valencourt, B. Felten Section, Township, Range: T18S R2W S20
Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Concave Slope (%): 35
Subregion (LRR): C - Mediterranean California Lat: 32.587527 Long: -117.105223 Datum: NAD 1983
Soil Map Unit Name: HuC - Huerhuero-Urban land complex, 2 to 9 percent slopes NWI classification: N/A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ● No ○ (If no, explain in Remarks.)
Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ● No ○
Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ○	No ●	
Hydric Soil Present?	Yes ○	No ●	**Is the Sampled Area**
Wetland Hydrology Present?	Yes ○	No ●	**within a Wetland? Yes ○ No ●**

Remarks: Site historically supported estuary wetland habitat but was filled and bermed in the 1870s for use as a salt evaporator pond, and has not been restored since. Delineation conducted on site during an above-average rainy season following 5+ years of severe drought. Sample point located on steep, west-facing slope of berm on west side of Site.

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:	%		
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
Total Cover:	%		
Herb Stratum			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
Total Cover:	%		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum 100 % % Cover of Biotic Crust 0 %

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	0	(A)
Total Number of Dominant Species Across All Strata:	0	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	0 %	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	0
FACW species		x 2 =	0
FAC species		x 3 =	0
FACU species		x 4 =	0
UPL species		x 5 =	0
Column Totals:	(A)	0	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ○ Dominance Test is >50%
- ○ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes ○ No ●

Remarks: No vegetation present.

SOIL

Sampling Point: T2.4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features				Texture[3]	Remarks
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]		

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2] Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

[3] Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (**LRR C**)
- ☐ 1 cm Muck (A9) (**LRR D**)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[4]:

- ☐ 1 cm Muck (A9) (**LRR C**)
- ☐ 2 cm Muck (A10) (**LRR B**)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[4] Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? **Yes** ○ **No** ●

Remarks: Observed marine shell deposition on surface of berm indicating placement of fill material. Unable to dig a soil pit at this location given the high degree of soil compaction and steepness of slope.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) (**Nonriverine**)
- ☐ Sediment Deposits (B2) (**Nonriverine**)
- ☐ Drift Deposits (B3) (**Nonriverine**)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Plowed Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) (**Riverine**)
- ☐ Sediment Deposits (B2) (**Riverine**)
- ☐ Drift Deposits (B3) (**Riverine**)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ○ Depth (inches):

Water Table Present? Yes ○ No ○ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ○ Depth (inches):

Wetland Hydrology Present? **Yes** ○ **No** ●

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:
No surface water observed in aerial imagery at this location.

Remarks: No hydrology indicators observed. Sampling site located on a steep slope. Surface soil cracks are present alongside evidence of erosion patterns, indicating flow of large volume of surface over this location during storm events.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Wetlands Restoration of Salt Pond 20 City/County: San Diego, San Diego County Sampling Date: 2-1-2017
Applicant/Owner: San Diego Unified Port District State: CA Sampling Point: T2.5
Investigator(s): M. Tyner-Valencourt, B. Felten Section, Township, Range: T18S R2W S20
Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): None Slope (%): 0
Subregion (LRR): C - Mediterranean California Lat: 32.587534 Long: -117.105273 Datum: NAD 1983
Soil Map Unit Name: HuC - Huerhuero-Urban land complex, 2 to 9 percent slopes NWI classification: E2SBMx
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ● No ○ (If no, explain in Remarks.)
Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ● No ○
Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ● No ○
Hydric Soil Present? Yes ● No ○
Wetland Hydrology Present? Yes ● No ○

Is the Sampled Area within a Wetland? **Yes** ● **No** ○

Remarks: Site historically supported estuary wetland habitat but was filled and bermed in the 1870s for use as a salt evaporator pond, and has not been restored since. Delineation conducted on site during an above-average rainy season following 5+ years of severe drought. Sample point is located in floodplain of tidally-influenced Otay River tributary on western side of Site.

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:	%		
Sapling/Shrub Stratum			
1. *Batis maritima*	30	Yes	OBL
2.			
3.			
4.			
5.			
Total Cover:	30 %		
Herb Stratum			
1. *Sarcocornia pacifica*	110	Yes	OBL
2. *Frankenia salina*	30	Yes	OBL
3. *Limonium californicum*	5	No	FACW
4.			
5.			
6.			
7.			
8.			
Total Cover:	145 %		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum 0 % % Cover of Biotic Crust 0 %

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	3	(A)
Total Number of Dominant Species Across All Strata:	3	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	100.0 %	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	170	x 1 =	170	
FACW species	5	x 2 =	10	
FAC species		x 3 =	0	
FACU species		x 4 =	0	
UPL species		x 5 =	0	
Column Totals:	175	(A)	180	(B)

Prevalence Index = B/A = 1.03

Hydrophytic Vegetation Indicators:

- ☒ Dominance Test is >50%
- ☒ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? **Yes** ● **No** ○

Remarks: Very thick herbaceous and shrub salt marsh community

SOIL

Sampling Point: T2.5

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture[3]	Remarks
0-20	10YR 4/1	60	10YR 3/6	40	C	M	Clay	Root material present at 0-2 in.

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2] Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

[3] Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (**LRR C**)
- ☐ 1 cm Muck (A9) (**LRR D**)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☒ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[4]:

- ☐ 1 cm Muck (A9) (**LRR C**)
- ☐ 2 cm Muck (A10) (**LRR B**)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[4] Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? **Yes** ● **No** ○

Remarks: Strong salt smell when excavating soil pit.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☒ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) (**Nonriverine**)
- ☐ Sediment Deposits (B2) (**Nonriverine**)
- ☐ Drift Deposits (B3) (**Nonriverine**)
- ☐ Surface Soil Cracks (B6)
- ☒ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Plowed Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) (**Riverine**)
- ☐ Sediment Deposits (B2) (**Riverine**)
- ☐ Drift Deposits (B3) (**Riverine**)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ● Depth (inches):

Water Table Present? Yes ● No ○ Depth (inches): 12

Saturation Present? (includes capillary fringe) Yes ○ No ● Depth (inches):

Wetland Hydrology Present? **Yes** ● **No** ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Tidal gauge data at NOAA Station 9410170 at sample time was approximately 1.86 ft, a local minimum for the day.

Remarks: No evidence of soil saturation but clay texture may inhibit degree of saturation.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Wetlands Restoration of Salt Pond 20 City/County: San Diego, San Diego County Sampling Date: 2-1-2017
Applicant/Owner: San Diego Unified Port District State: CA Sampling Point: T3.1
Investigator(s): M. Tyner-Valencourt, B. Felten Section, Township, Range: T18S R2W S21
Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Concave Slope (%): 3
Subregion (LRR): C - Mediterranean California Lat: 32.586249 Long: -117.097531 Datum: NAD 1983
Soil Map Unit Name: LG-W - Lagoon water NWI classification: N/A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ● No ○ (If no, explain in Remarks.)
Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ● No ○
Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ○ No ●
Hydric Soil Present? Yes ○ No ●
Wetland Hydrology Present? Yes ○ No ●

Is the Sampled Area within a Wetland? **Yes** ○ **No** ●

Remarks: Site historically supported estuary wetland habitat but was filled and bermed in the 1870s for use as a salt evaporator pond, and has not been restored since. Delineation conducted on site during an above-average rainy season following 5+ years of severe drought. Sample point located on west-facing berm slope on east side of Site.

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:	%		
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
Total Cover:	%		
Herb Stratum			
1. *Mesembryanthemum crystallinum*	40	Yes	FACU
2. *Erodium botrys*	10	Yes	FACU
3. *Spergularia rubra*	5	No	FAC
4.			
5.			
6.			
7.			
8.			
Total Cover:	55 %		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum 40 % % Cover of Biotic Crust 0 %

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	0	(A)
Total Number of Dominant Species Across All Strata:	2	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	0.0 %	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	0
FACW species		x 2 =	0
FAC species	5	x 3 =	15
FACU species	50	x 4 =	200
UPL species		x 5 =	0
Column Totals:	55	(A)	215 (B)

Prevalence Index = B/A = 3.91

Hydrophytic Vegetation Indicators:

- ○ Dominance Test is >50%
- ○ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? **Yes** ○ **No** ●

Remarks: Sample site representative of patchy distribution of herbaceous upland vegetation on inner berm slope.

SOIL

Sampling Point: T3.1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features				Texture[3]	Remarks
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]		
0-9	10YR 3/2	100					Loamy Sand	
9-10	10YR 4/2	95	7.5YR 5/8	5	C	M	Loamy Sand	Coated sand grains redox type
10-20	10YR 2/2	100					Silty clay	

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2] Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

[3] Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (**LRR C**)
- ☐ 1 cm Muck (A9) (**LRR D**)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[4]:

- ☐ 1 cm Muck (A9) (**LRR C**)
- ☐ 2 cm Muck (A10) (**LRR B**)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[4] Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ **No** ●

Remarks: No hydric soil indicators observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) (**Nonriverine**)
- ☐ Sediment Deposits (B2) (**Nonriverine**)
- ☐ Drift Deposits (B3) (**Nonriverine**)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Plowed Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) (**Riverine**)
- ☐ Sediment Deposits (B2) (**Riverine**)
- ☐ Drift Deposits (B3) (**Riverine**)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ● Depth (inches):

Water Table Present? Yes ○ No ● Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ● Depth (inches):

Wetland Hydrology Present? Yes ○ **No** ●

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:
No surface water observed in aerial imagery.

Remarks: No hydrology indicators observed.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Wetlands Restoration of Salt Pond 20 City/County: San Diego, San Diego County Sampling Date: 2-1-2017

Applicant/Owner: San Diego Unified Port District State: CA Sampling Point: T3.2

Investigator(s): M. Tyner-Valencourt, B. Felten Section, Township, Range: T18S R2W S21

Landform (hillslope, terrace, etc.): Low-elevation terrace Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR): C - Mediterranean California Lat: 32.586248 Long: -117.097592 Datum: NAD 1983

Soil Map Unit Name: LG-W - Lagoon water NWI classification: E2USNh

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ● No ○ (If no, explain in Remarks.)

Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ● No ○

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ○	No ●
Hydric Soil Present?	Yes ○	No ●
Wetland Hydrology Present?	Yes ●	No ○

Is the Sampled Area within a Wetland? **Yes** ○ **No** ●

Remarks: Site historically supported estuary wetland habitat but was filled and bermed in the 1870s for use as a salt evaporator pond, and has not been restored since. Delineation conducted on site during an above-average rainy season following 5+ years of severe drought. Sample point is located in a topographical depression at the toe of the berm slope that may serve as a floodplain for surface water that pools at an adjacent depression.

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:	%		
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
Total Cover:	%		
Herb Stratum			
1. *Mesembryanthemum nodiflorum*	95	Yes	FACU
2. *Mesembryanthemum crystallinum*	1	No	FACU
3.			
4.			
5.			
6.			
7.			
8.			
Total Cover:	96 %		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum 4 % % Cover of Biotic Crust 0 %

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	0	(A)
Total Number of Dominant Species Across All Strata:	1	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	0.0 %	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	0
FACW species		x 2 =	0
FAC species		x 3 =	0
FACU species	96	x 4 =	384
UPL species		x 5 =	0
Column Totals:	96	(A)	384 (B)

Prevalence Index = B/A = 4.00

Hydrophytic Vegetation Indicators:

- ☐ Dominance Test is >50%
- ☐ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? **Yes** ○ **No** ●

Remarks: No hydrophytic vegetation community indicators observed.

SOIL

Sampling Point: T3.2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features				Texture[3]	Remarks
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]		
0-10	10YR 3/1	100					Sandy loam	
10-14							Sandy clay loam	Lumber detritus obscuring layer
10-20	10YR 2/2	100					Clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

[3]Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (**LRR C**)
- ☐ 1 cm Muck (A9) (**LRR D**)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[4]:

- ☐ 1 cm Muck (A9) (**LRR C**)
- ☐ 2 cm Muck (A10) (**LRR B**)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[4]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? **Yes** ○ **No** ●

Remarks: Soil profile is not entirely stratified based on texture, and lumber debris is present as a layer at this sample point. These conditions stem from historic fill placement. Soil pH measured at 8.3 (2/6/2017 at 11:00) and soil salinity measured at 30-35 microS (2/9/2017 at 15:15), may have inhibited the development of redox deposits given hydrological conditions.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☒ High Water Table (A2)
- ☒ Saturation (A3)
- ☐ Water Marks (B1) (**Nonriverine**)
- ☐ Sediment Deposits (B2) (**Nonriverine**)
- ☐ Drift Deposits (B3) (**Nonriverine**)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Plowed Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) (**Riverine**)
- ☐ Sediment Deposits (B2) (**Riverine**)
- ☐ Drift Deposits (B3) (**Riverine**)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ● Depth (inches):

Water Table Present? Yes ● No ○ Depth (inches): 11

Saturation Present? (includes capillary fringe) Yes ● No ○ Depth (inches): 10

Wetland Hydrology Present? **Yes** ● **No** ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:
No surface water observed in aerial imagery.

Remarks: Sample site located near toe of slope, surface soil and vegetation evidence for recent inundation at sample location.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Wetlands Restoration of Salt Pond 20 City/County: San Diego, San Diego County Sampling Date: 2-1-2017

Applicant/Owner: San Diego Unified Port District State: CA Sampling Point: T3.3

Investigator(s): M. Tyner-Valencourt, B. Felten Section, Township, Range: T18S R2W S21

Landform (hillslope, terrace, etc.): Upland Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR): C - Mediterranean California Lat: 32.58623 Long: -117.097682 Datum: NAD 1983

Soil Map Unit Name: LG-W - Lagoon water NWI classification: E2USNh

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ● No ○ (If no, explain in Remarks.)

Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ● No ○

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ○ No ●

Hydric Soil Present? Yes ○ No ●

Wetland Hydrology Present? Yes ○ No ●

Is the Sampled Area within a Wetland? Yes ○ No ●

Remarks: Site historically supported estuary wetland habitat but was filled and bermed in the 1870s for use as a salt evaporator pond, and has not been restored since. Delineation conducted on site during an above-average rainy season following 5+ years of severe drought. Sample point located in upland area adjacent to topographical depression at toe of berm.

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:	%		
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
Total Cover:	%		
Herb Stratum			
1. *Mesembryanthemum nodiflorum*	30	Yes	FACU
2. *Spergularia rubra*	5	Yes	FAC
3. *Erodium botrys*	2	Yes	FACU
4. *Mesembryanthemum crystallinum*	1	Yes	FACU
5.			
6.			
7.			
8.			
Total Cover:	38 %		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum 60 % % Cover of Biotic Crust 0 %

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 25.0 % (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	0
FACW species		x 2 =	0
FAC species	5	x 3 =	15
FACU species	33	x 4 =	132
UPL species		x 5 =	0
Column Totals:	38	(A)	147 (B)

Prevalence Index = B/A = 3.87

Hydrophytic Vegetation Indicators:

- ○ Dominance Test is >50%
- ○ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes ○ No ●

Remarks: No hydrophytic vegetation community indicators observed.

SOIL

Sampling Point: T3.3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features				Texture[3]	Remarks
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]		
0-10	10YR 4/1	100					Sand	
10-20	10YR 3/1	99	7.5YR 3/4	1	C	M	Loam	

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2] Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

[3] Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (**LRR C**)
- ☐ 1 cm Muck (A9) (**LRR D**)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[4]:

- ☐ 1 cm Muck (A9) (**LRR C**)
- ☐ 2 cm Muck (A10) (**LRR B**)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[4] Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ **No** ●

Remarks: No hydric soil indicators observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) (**Nonriverine**)
- ☐ Sediment Deposits (B2) (**Nonriverine**)
- ☐ Drift Deposits (B3) (**Nonriverine**)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Plowed Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) (**Riverine**)
- ☐ Sediment Deposits (B2) (**Riverine**)
- ☐ Drift Deposits (B3) (**Riverine**)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ● Depth (inches):

Water Table Present? Yes ○ No ● Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ● Depth (inches):

Wetland Hydrology Present? Yes ○ **No** ●

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:
No surface water observed in aerial imagery.

Remarks: No hydrology indicators observed.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Wetlands Restoration of Salt Pond 20 City/County: San Diego, San Diego County Sampling Date: 2-1-2017
Applicant/Owner: San Diego Unified Port District State: CA Sampling Point: T3.4
Investigator(s): M. Tyner-Valencourt, B. Felten Section, Township, Range: T18S R2W S20
Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Concave Slope (%): 12.5
Subregion (LRR): C - Mediterranean California Lat: 32.585807 Long: -117.10436 Datum: NAD 1983
Soil Map Unit Name: HuC - Huerhuero-Urban land complex, 2 to 9 percent slopes NWI classification: N/A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ● No ○ (If no, explain in Remarks.)
Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ● No ○
Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ○	No ●	
Hydric Soil Present?	Yes ○	No ●	**Is the Sampled Area**
Wetland Hydrology Present?	Yes ○	No ●	**within a Wetland?** **Yes** ○ **No** ●

Remarks: Site historically supported estuary wetland habitat but was filled and bermed in the 1870s for use as a salt evaporator pond, and has not been restored since. Delineation conducted on site during an above-average rainy season following 5+ years of severe drought. Sample site is located on an unvegetated upland constructed slope along berm on west side of Site.

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:	%		
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
Total Cover:	%		
Herb Stratum			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
Total Cover:	%		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum 100 % % Cover of Biotic Crust 0 %

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	0	(A)
Total Number of Dominant Species Across All Strata:	0	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	0 %	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	0
FACW species		x 2 =	0
FAC species		x 3 =	0
FACU species		x 4 =	0
UPL species		x 5 =	0
Column Totals:	(A)		0 (B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ☐ Dominance Test is >50%
- ☐ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? **Yes** ○ **No** ●

Remarks: Sample location is unvegetated. No hydrophytic vegetation community indicators observed.

SOIL

Sampling Point: T3.4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture[3]	Remarks

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2] Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

[3] Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (**LRR C**)
- ☐ 1 cm Muck (A9) (**LRR D**)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[4]:

- ☐ 1 cm Muck (A9) (**LRR C**)
- ☐ 2 cm Muck (A10) (**LRR B**)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[4] Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ **No** ●

Remarks: Unable to dig a sample pit due to the degree of soil compaction at this location. Observed marine invertebrate shells and debris on soil surface along berm, stemming from berm having been constructed with marine dredge material.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) (**Nonriverine**)
- ☐ Sediment Deposits (B2) (**Nonriverine**)
- ☐ Drift Deposits (B3) (**Nonriverine**)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Plowed Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) (**Riverine**)
- ☐ Sediment Deposits (B2) (**Riverine**)
- ☐ Drift Deposits (B3) (**Riverine**)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ● Depth (inches):

Water Table Present? Yes ○ No ● Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ● Depth (inches):

Wetland Hydrology Present? Yes ○ **No** ●

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:
No surface water observed in aerial photos

Remarks: Surface soil cracks observed, but give the sample site elevation and slope we determined that cracks were due to water and wind erosion. No hydrology indicators observed.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Wetlands Restoration of Salt Pond 20 City/County: San Diego, San Diego County Sampling Date: 2-1-2017
Applicant/Owner: San Diego Unified Port District State: CA Sampling Point: T3.5
Investigator(s): M. Tyner-Valencourt, B. Felten Section, Township, Range: T18S R2W S20
Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): None Slope (%): 0
Subregion (LRR): C - Mediterranean California Lat: 32.5858 Long: -117.104395 Datum: NAD 1983
Soil Map Unit Name: HuC - Huerhuero-Urban land complex, 2 to 9 percent slopes NWI classification: E2SBMx
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ● No ○ (If no, explain in Remarks.)
Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ● No ○
Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ●	No ○	
Hydric Soil Present?	Yes ●	No ○	**Is the Sampled Area**
Wetland Hydrology Present?	Yes ●	No ○	**within a Wetland?** **Yes** ● **No** ○

Remarks: Site historically supported estuary wetland habitat but was filled and bermed in the 1870s for use as a salt evaporator pond, and has not been restored since. Delineation conducted on site during an above-average rainy season following 5+ years of severe drought. Sample site is located on vegetated slope next to the tidally-influenced Otay River tributary located on the west side of the Site.

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:	%		
Sapling/Shrub Stratum			
1. *Batis maritima*	15		OBL
2.			
3.			
4.			
5.			
Total Cover:	15 %		
Herb Stratum			
1. *Sarcocornia pacifica*	110	Yes	OBL
2. *Distichlis littoralis*	60	Yes	OBL
3. *Frankenia salina*	20	Yes	OBL
4. *Limonium californicum*	5	No	FACW
5.			
6.			
7.			
8.			
Total Cover:	195 %		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum 0 % % Cover of Biotic Crust 0 %

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	3	(A)
Total Number of Dominant Species Across All Strata:	3	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	100.0 %	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	205	x 1 =	205	
FACW species	5	x 2 =	10	
FAC species		x 3 =	0	
FACU species		x 4 =	0	
UPL species		x 5 =	0	
Column Totals:	210	(A)	215	(B)

Prevalence Index = B/A = 1.02

Hydrophytic Vegetation Indicators:

- ☒ Dominance Test is >50%
- ☒ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? **Yes** ● **No** ○

Remarks: Very thick salt marsh vegetation present.

SOIL

Sampling Point: T3.5

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture[3]	Remarks
0-20	10YR 4/1	65	10R 3/6	35	C	M	Clay	

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2] Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

[3] Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (**LRR C**)
- ☐ 1 cm Muck (A9) (**LRR D**)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☒ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[4]:

- ☐ 1 cm Muck (A9) (**LRR C**)
- ☐ 2 cm Muck (A10) (**LRR B**)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[4] Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? **Yes** ● **No** ○

Remarks: Sample pit located next to tidal channel in salt marsh community.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) (**Nonriverine**)
- ☐ Sediment Deposits (B2) (**Nonriverine**)
- ☐ Drift Deposits (B3) (**Nonriverine**)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Plowed Soils (C6)
- ☒ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) (**Riverine**)
- ☐ Sediment Deposits (B2) (**Riverine**)
- ☐ Drift Deposits (B3) (**Riverine**)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ● Depth (inches):

Water Table Present? Yes ○ No ● Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ● Depth (inches):

Wetland Hydrology Present? **Yes** ● **No** ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:
Tidal height measured at NOAA Station 9410170 at time of sample was recorded and verified at approximately 2.25 ft

Remarks: Sample pit located in immediate flooplain of tidal channel on west side of site. Sample was taken at low-to-mid tide, which may explain lack of water table observed in sample pit. At high tide we would expect a high water table and soil saturation near surface. Additionally, clay soils will inhibit soil saturation.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Wetlands Restoration of Salt Pond 20 City/County: San Diego, San Diego County Sampling Date: 2-1-2017
Applicant/Owner: San Diego Unified Port District State: CA Sampling Point: T4.1
Investigator(s): M. Tyner-Valencourt, B. Felten Section, Township, Range: T18S R2W S20
Landform (hillslope, terrace, etc.): Localized depression Local relief (concave, convex, none): Convex Slope (%): 0
Subregion (LRR): C - Mediterranean California Lat: 32.584132 Long: -117.104186 Datum: NAD 1986
Soil Map Unit Name: HuC - Huerhuero-Urban land complex, 2 to 9 percent slopes NWI classification: E2SBMx
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ● No ○ (If no, explain in Remarks.)
Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ● No ○
Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ● No ○
Hydric Soil Present? Yes ● No ○
Wetland Hydrology Present? Yes ● No ○

Is the Sampled Area within a Wetland? Yes ● No ○

Remarks: Site historically supported estuary wetland habitat but was filled and bermed in the 1870s for use as a salt evaporator pond, and has not been restored since. Delineation conducted on site during an above-average rainy season following 5+ years of severe drought. Sample point is located in a freshwater wetland located at the mouth of the MS4 conveyance at the southwest corner of the Site. Vegetation was recently cleared for stormwater management.

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:	%		
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
Total Cover:	%		
Herb Stratum			
1. *Typha latifolia*	60	Yes	OBL
2.			
3.			
4.			
5.			
6.			
7.			
8.			
Total Cover:	60 %		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum 40 % % Cover of Biotic Crust 0 %

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	1	(A)
Total Number of Dominant Species Across All Strata:	1	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	100.0 %	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	60	x 1 =	60
FACW species		x 2 =	0
FAC species		x 3 =	0
FACU species		x 4 =	0
UPL species		x 5 =	0
Column Totals:	60 (A)		60 (B)

Prevalence Index = B/A = 1.00

Hydrophytic Vegetation Indicators:

- ☒ Dominance Test is >50%
- ☒ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes ● No ○

Remarks: Large arroyo willow (Salix lasiolepis) was removed for stormwater management within the sample location vegetation assessment plot. T. latifolia was cut and is beginning to resprout.

SOIL

Sampling Point: T4.1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture[3]	Remarks
0-6	10YR 2/1	100						

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2] Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

[3] Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☒ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (**LRR C**)
- ☒ 1 cm Muck (A9) (**LRR D**)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[4]:

- ☐ 1 cm Muck (A9) (**LRR C**)
- ☐ 2 cm Muck (A10) (**LRR B**)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[4] Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? **Yes** ● **No** ○

Remarks: Surface water and high water table prevented the collection of a high-integrity soil sample. Other hydric soil indicators observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☒ Surface Water (A1)
- ☒ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) (**Nonriverine**)
- ☐ Sediment Deposits (B2) (**Nonriverine**)
- ☐ Drift Deposits (B3) (**Nonriverine**)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☒ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Plowed Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) (**Riverine**)
- ☐ Sediment Deposits (B2) (**Riverine**)
- ☐ Drift Deposits (B3) (**Riverine**)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ● No ○ Depth (inches): 2

Water Table Present? Yes ● No ○ Depth (inches): 0

Saturation Present? (includes capillary fringe) Yes ○ No ● Depth (inches):

Wetland Hydrology Present? **Yes** ● **No** ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Vegetation obscuring ground view in aerial imagery, unable to determine if surface water is present.

Remarks: Hydrology indicators present. Area located at mouth of of MS4 conveyance, water source attributed to this and other stormwater inputs from Palm Avenue.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Wetlands Restoration of Salt Pond 20 City/County: San Diego, San Diego County Sampling Date: 2-1-2017

Applicant/Owner: San Diego Unified Port District State: CA Sampling Point: T4.2

Investigator(s): M. Tyner-Valencourt, B. Felten Section, Township, Range: T18S R2W S20

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR): C - Mediterranean California Lat: 32.584108 Long: -117.104242 Datum: NAD 1983

Soil Map Unit Name: HuC - Huerhuero-Urban land complex, 2 to 9 percent slopes NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ● No ○ (If no, explain in Remarks.)

Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ● No ○

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ●	No ○	
Hydric Soil Present?	Yes ○	No ●	**Is the Sampled Area**
Wetland Hydrology Present?	Yes ●	No ○	**within a Wetland? Yes ○ No ●**

Remarks: Site historically supported estuary wetland habitat but was filled and bermed in the 1870s for use as a salt evaporator pond, and has not been restored since. Delineation conducted on site during an above-average rainy season following 5+ years of severe drought. Sample point is located in the floodplain area adjacent to the stormwater-fed wetland and the southwest site boundary. Large felled willow tree has been placed on top of standing vegetation, obscuring vegetation cover assessments.

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Fraxinus pennsylvanica*	5		FACW
2.			
3.			
4.			
Total Cover:	5 %		
Sapling/Shrub Stratum			
1. *Salix lasiolepis*	70	Yes	FACW
2. *Ricinus communis*	10	No	FACU
3. *Fraxinus pennsylvanica*	5	No	FACW
4.			
5.			
Total Cover:	85 %		
Herb Stratum			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
Total Cover:	%		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum 0 % % Cover of Biotic Crust 0 %

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0 % (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	0
FACW species	80	x 2 =	160
FAC species		x 3 =	0
FACU species	10	x 4 =	40
UPL species		x 5 =	0
Column Totals:	90 (A)		200 (B)

Prevalence Index = B/A = 2.22

Hydrophytic Vegetation Indicators:

- ☒ Dominance Test is >50%
- ☒ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes ● No ○

Remarks: Thick layer of duff present, no herbaceous layer observed. Much of the observed litter may have been placed from vegetation removal activities elsewhere on site. One individual plant, a large, mature arroyo willow (Salix lasiolepis), was felled and placed on top of standing live vegetation in the habitat covered at this sample location prior to the delineation effort. This individual likely accounted for 60-70% of tree stratum cover when it stood.

SOIL

Sampling Point: T4.2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features				Texture³	Remarks
(inches)	Color (moist)	%	Color (moist)	%	Type¹	Loc²		
0-20	10YR 3/2	100					Loam	

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix. ²Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

³Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (**LRR C**)
- ☐ 1 cm Muck (A9) (**LRR D**)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils⁴:

- ☐ 1 cm Muck (A9) (**LRR C**)
- ☐ 2 cm Muck (A10) (**LRR B**)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

⁴Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? **Yes** ○ **No** ●

Remarks: No hydric soil indicators observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) (**Nonriverine**)
- ☐ Sediment Deposits (B2) (**Nonriverine**)
- ☒ Drift Deposits (B3) (**Nonriverine**)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Plowed Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) (**Riverine**)
- ☐ Sediment Deposits (B2) (**Riverine**)
- ☐ Drift Deposits (B3) (**Riverine**)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ● Depth (inches):

Water Table Present? Yes ○ No ● Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ● Depth (inches):

Wetland Hydrology Present? **Yes** ● **No** ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Surface water not observed in aerial imagery at this location.

Remarks: Downed willow was placed on top of existing standing and dead vegetation, confusing the interpretation of vegetation debris distribution. However, the sample location is located near a stormwater input area and in separate site assessments the area has been observed to be inundated during significant storm events.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Wetlands Restoration of Salt Pond 20 City/County: San Diego, San Diego County Sampling Date: 2-1-2017

Applicant/Owner: San Diego Unified Port District State: CA Sampling Point: N1

Investigator(s): M. Tyner-Valencourt, B. Felten Section, Township, Range: T18S R2W S21

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR): C - Mediterranean California Lat: 32.586336 Long: -117.097239 Datum: NAD 1983

Soil Map Unit Name: LG-W - Lagoon water NWI classification: E2SBNx

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ● No ○ (If no, explain in Remarks.)

Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ● No ○

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ● No ○

Hydric Soil Present? Yes ● No ○

Wetland Hydrology Present? Yes ● No ○

Is the Sampled Area within a Wetland? **Yes** ● **No** ○

Remarks: Site historically supported estuary wetland habitat but was filled and bermed in the 1870s for use as a salt evaporator pond, and has not been restored since. Delineation conducted on site during an above-average rainy season following 5+ years of severe drought. Sample point is located on the Nestor Creek floodplain on the east side of the Site, to the immediate east of the eastern berm.

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:	%		
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
Total Cover:	%		
Herb Stratum			
1. *Frankenia salina*	100	Yes	OBL
2. *Sarcocornia pacifica*	5	No	OBL
3. *Schoenoplectus californicus*	5	No	OBL
4.			
5.			
6.			
7.			
8.			
Total Cover:	110 %		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum 0 % % Cover of Biotic Crust 0 %

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0 % (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	110	x 1 =	110
FACW species		x 2 =	0
FAC species		x 3 =	0
FACU species		x 4 =	0
UPL species		x 5 =	0
Column Totals:	110 (A)		110 (B)

Prevalence Index = B/A = 1.00

Hydrophytic Vegetation Indicators:

- ☒ Dominance Test is >50%
- ☒ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? **Yes** ● **No** ○

Remarks: Thick community of hydrophytic vegetation and include both typical salt marsh and freshwater marsh species. Nestor Creek is freshwater but is tidally influenced due to its proximity to the Otay River mouth and San Diego Bay. In addition, site history as a salt evaporator pond may have caused high salt concentrations in the soil.

SOIL

Sampling Point: N1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features				Texture[3]	Remarks
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]		
0-20	10YR 3/1	70	7.5YR 3/4	30	C	M	Sandy loam	Roots present at 0-3 inches

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2] Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

[3] Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

☐ Histosol (A1)
☐ Histic Epipedon (A2)
☐ Black Histic (A3)
☐ Hydrogen Sulfide (A4)
☐ Stratified Layers (A5) (**LRR C**)
☐ 1 cm Muck (A9) (**LRR D**)
☐ Depleted Below Dark Surface (A11)
☐ Thick Dark Surface (A12)
☐ Sandy Mucky Mineral (S1)
☐ Sandy Gleyed Matrix (S4)
☒ Sandy Redox (S5)
☐ Stripped Matrix (S6)
☐ Loamy Mucky Mineral (F1)
☐ Loamy Gleyed Matrix (F2)
☐ Depleted Matrix (F3)
☐ Redox Dark Surface (F6)
☐ Depleted Dark Surface (F7)
☐ Redox Depressions (F8)
☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[4]:

☐ 1 cm Muck (A9) (**LRR C**)
☐ 2 cm Muck (A10) (**LRR B**)
☐ Reduced Vertic (F18)
☐ Red Parent Material (TF2)
☐ Other (Explain in Remarks)

[4] Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? **Yes** ● **No** ○

Remarks: Top three inches of soil profile support high rhizome density. Hydric soil indicators observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

☐ Surface Water (A1)
☒ High Water Table (A2)
☒ Saturation (A3)
☐ Water Marks (B1) (**Nonriverine**)
☐ Sediment Deposits (B2) (**Nonriverine**)
☐ Drift Deposits (B3) (**Nonriverine**)
☐ Surface Soil Cracks (B6)
☐ Inundation Visible on Aerial Imagery (B7)
☐ Water-Stained Leaves (B9)
☐ Salt Crust (B11)
☐ Biotic Crust (B12)
☐ Aquatic Invertebrates (B13)
☐ Hydrogen Sulfide Odor (C1)
☐ Oxidized Rhizospheres along Living Roots (C3)
☐ Presence of Reduced Iron (C4)
☐ Recent Iron Reduction in Plowed Soils (C6)
☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

☐ Water Marks (B1) (**Riverine**)
☐ Sediment Deposits (B2) (**Riverine**)
☒ Drift Deposits (B3) (**Riverine**)
☐ Drainage Patterns (B10)
☐ Dry-Season Water Table (C2)
☐ Thin Muck Surface (C7)
☐ Crayfish Burrows (C8)
☐ Saturation Visible on Aerial Imagery (C9)
☐ Shallow Aquitard (D3)
☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○	No ●	Depth (inches):
Water Table Present?	Yes ●	No ○	Depth (inches): 9
Saturation Present? (includes capillary fringe)	Yes ●	No ○	Depth (inches): 1

Wetland Hydrology Present? **Yes** ● **No** ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Sample point is located in Nestor Creek floodplain. Drift deposits notes at higher elevations, suggesting high water flows through the channel and floodplain during storm events.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Wetlands Restoration of Salt Pond 20 City/County: San Diego, San Diego County Sampling Date: 2-1-2017
Applicant/Owner: San Diego Unified Port District State: CA Sampling Point: N2
Investigator(s): M. Tyner-Valencourt, B. Felten Section, Township, Range: T18S R2W S21
Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Concave Slope (%): 3
Subregion (LRR): C - Mediterranean California Lat: 32.586335 Long: -117.097211 Datum: NAD 1983
Soil Map Unit Name: HrC - Huerhuero loam, 2 to 9 percent slopes NWI classification: E2SBNx
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ● No ○ (If no, explain in Remarks.)
Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ● No ○
Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ○	No ●	
Hydric Soil Present?	Yes ○	No ●	**Is the Sampled Area**
Wetland Hydrology Present?	Yes ○	No ●	**within a Wetland?** **Yes** ○ **No** ●

Remarks: Site historically supported estuary wetland habitat but was filled and bermed in the 1870s for use as a salt evaporator pond, and has not been restored since. Delineation conducted on site during an above-average rainy season following 5+ years of severe drought. Sample point is located on the upland west-facing slope east of Nestor Creek.

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:	%		
Sapling/Shrub Stratum			
1. *Ricinus communis*	10	No	FACU
2.			
3.			
4.			
5.			
Total Cover:	10 %		
Herb Stratum			
1. *Ambrosia psilostachya*	45	Yes	FACU
2. *Festuca spp.**	25	Yes	FACU
3. *Rumex crispus*	10	No	FAC
4. *Limonium californicum*	5	No	FACW
5. *Mesembryanthemum crystallinum*	5	No	FACU
6.			
7.			
8.			
Total Cover:	90 %		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum 10 % % Cover of Biotic Crust 0 %

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	0	(A)
Total Number of Dominant Species Across All Strata:	2	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	0.0 %	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	0
FACW species	5	x 2 =	10
FAC species	10	x 3 =	30
FACU species	85	x 4 =	340
UPL species		x 5 =	0
Column Totals:	100 (A)		380 (B)

Prevalence Index = B/A = 3.80

Hydrophytic Vegetation Indicators:

- ☐ Dominance Test is >50%
- ☐ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? **Yes** ○ **No** ●

Remarks: Sample point located just above transition between salt marsh and upland community. Rumex crispus was only observed near the boundary between the salt marsh and upland communities, and not further up the slope.
*Two unknown grass species observed in juvenile stage, leaf blades resemble Festuca spp. We combined here and used FACU designation given its occurrence in an upland plant community, its growth pattern on the landscape, and that the majority of Festuca spp. known to occur in the Arid West are designated as such.

SOIL

Sampling Point: N2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture[3]	Remarks
0-20	10YR 3/2	100						

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2] Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

[3] Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (**LRR C**)
- ☐ 1 cm Muck (A9) (**LRR D**)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[4]:

- ☐ 1 cm Muck (A9) (**LRR C**)
- ☐ 2 cm Muck (A10) (**LRR B**)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[4] Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ **No** ●

Remarks: No hydric soil indicators observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) (**Nonriverine**)
- ☐ Sediment Deposits (B2) (**Nonriverine**)
- ☐ Drift Deposits (B3) (**Nonriverine**)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Plowed Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) (**Riverine**)
- ☐ Sediment Deposits (B2) (**Riverine**)
- ☐ Drift Deposits (B3) (**Riverine**)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ● Depth (inches):

Water Table Present? Yes ○ No ● Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ● Depth (inches):

Wetland Hydrology Present? Yes ○ **No** ●

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: No hydrology indicators observed.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Wetlands Restoration of Salt Pond 20 City/County: San Diego, San Diego County Sampling Date: 2-1-2017

Applicant/Owner: San Diego Unified Port District State: CA Sampling Point: N3

Investigator(s): M. Tyner-Valencourt, B. Felten Section, Township, Range: T18S R2W S21

Landform (hillslope, terrace, etc.): Creek Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR): C - Mediterranean California Lat: 32.586403 Long: -117.097251 Datum: NAD 1983

Soil Map Unit Name: LG-W - Lagoon water NWI classification: E2SBNx

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ● No ○ (If no, explain in Remarks.)

Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ● No ○

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ● No ○

Hydric Soil Present? Yes ● No ○

Wetland Hydrology Present? Yes ● No ○

Is the Sampled Area within a Wetland? Yes ● No ○

Remarks: Site historically supported estuary wetland habitat but was filled and bermed in the 1870s for use as a salt evaporator pond, and has not been restored since. Delineation conducted on site during an above-average rainy season following 5+ years of severe drought. Sample point is located in the freshwater marsh habitat within the Nestor Creek channel.

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:	%		
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
Total Cover:	%		
Herb Stratum			
1. *Schoenoplectus californicus*	85	Yes	OBL
2.			
3.			
4.			
5.			
6.			
7.			
8.			
Total Cover:	85 %		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum 15 % % Cover of Biotic Crust 0 %

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	1	(A)
Total Number of Dominant Species Across All Strata:	1	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	100.0 %	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	85	x 1 =	85
FACW species		x 2 =	0
FAC species		x 3 =	0
FACU species		x 4 =	0
UPL species		x 5 =	0
Column Totals:	85 (A)		85 (B)

Prevalence Index = B/A = 1.00

Hydrophytic Vegetation Indicators:

- ☒ Dominance Test is >50%
- ☒ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes ● No ○

Remarks: Vegetation is contained entirely within Nestor Creek channel OHWM limits. Floodplain is characterized with salt marsh vegetation sampled at Point N1.

SOIL

Sampling Point: N3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture[3]	Remarks
0-20	10YR 3/2	100						

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2] Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

[3] Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (**LRR C**)
- ☒ 1 cm Muck (A9) (**LRR D**)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[4]:

- ☐ 1 cm Muck (A9) (**LRR C**)
- ☐ 2 cm Muck (A10) (**LRR B**)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[4] Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes ● **No** ○

Remarks: Sample point is located within Nestor Creek and is inundated with ~1 foot of standing water. Unable to collect a soil sample. We observed 1cm of muck on the surface of the sediment within the channel. We assume hydric soils are present given the presence of hydrophytic vegetation within a perennial freshwater stream channel.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☒ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) (**Nonriverine**)
- ☐ Sediment Deposits (B2) (**Nonriverine**)
- ☐ Drift Deposits (B3) (**Nonriverine**)
- ☐ Surface Soil Cracks (B6)
- ☒ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Plowed Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) (**Riverine**)
- ☐ Sediment Deposits (B2) (**Riverine**)
- ☐ Drift Deposits (B3) (**Riverine**)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ● No ○ Depth (inches): 12

Water Table Present? Yes ○ No ● Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ● Depth (inches):

Wetland Hydrology Present? Yes ● **No** ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:
Water consistently observed in stream channel at this location across several years of aerial photos queried on Google Earth.

Remarks: Surface water is contained within the Nestor Creek channel.

APPENDIX E:
WETLAND DELINEATION PHOTO LOGS

PHOTO 1: TRANSECT 1, SAMPLE POINTS T1.1 TO T1.3 (FACING SOUTHWEST)

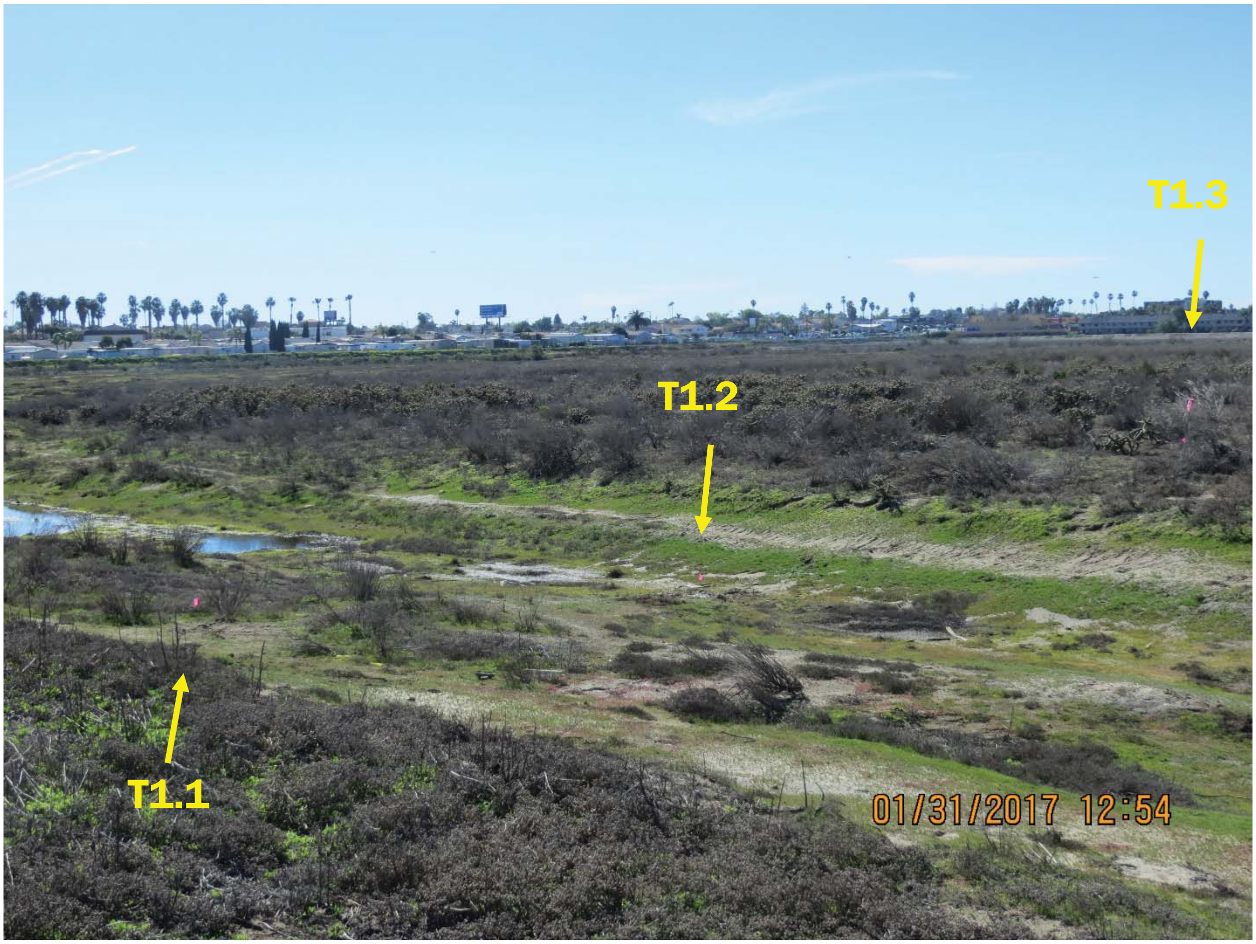


PHOTO 2: TRANSECT 2, SAMPLE POINTS T2.1 TO T2.3 (FACING WEST)

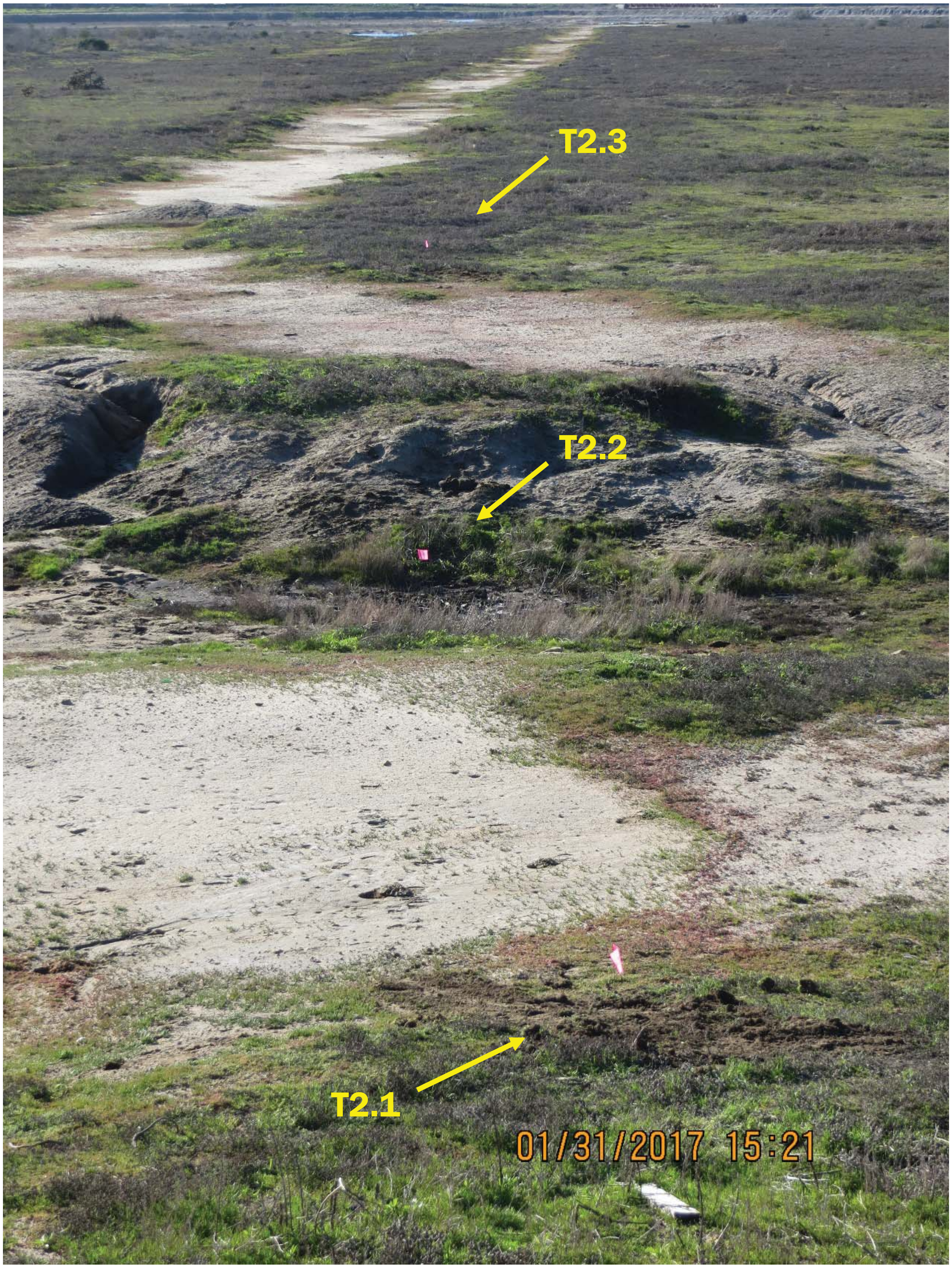


PHOTO 3: TRANSECT 2, SAMPLE POINTS T2.4 TO T2.5 (FACING SOUTHWEST)

PHOTO 4: TRANSECT 3, SAMPLE POINTS T3.1 TO T3.3

Not pictured

PHOTO 5: TRANSECT 3, SAMPLE POINTS T3.4 TO T3.5 (FACING SOUTH)

PHOTO 6: TRANSECT 4, SAMPLE POINTS T4.1 TO T4.2 (FACING SOUTH-SOUTHWEST)

PHOTO 7: NESTOR CREEK, SAMPLE POINTS N1 TO N3 (FACING NORTH)

PHOTO 8: MS4 DRAINAGE AND DISTURBED FRESHWATER MARSH, OTAY RIVER TRIBUTARY AREA

PHOTO 9: STORMWATER CONVEYANCE #1 ENTERING BERMED AREA FROM PALM AVENUE

PHOTO 10: STORMWATER CONVEYANCE #2 ENTERING BERMED AREA FROM PALM AVENUE

PHOTO 11: EROSIONAL GULLY CAUSED BY STORMWATER ENTERING BERMED AREA THROUGH BREAK IN WATTLES

PHOTO 12: DENSELY PACKED CLAY SOIL UNDERLYING UNVEGETATED SALT FLATS ADJACENT TO POOLS IN BERMED AREA

APPENDIX F:
REGULATORY ANALYSIS FOR BERMED AREA FEATURES

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ENVIRONMENT + DESIGN

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MEMORANDUM

TO: Robert Revo Smith, Jr., P.E., M. ASCE
Senior Project Manager, Regulatory Division
U.S. Army Corps of Engineers

FROM: Mark S. Laska, Ph.D.
Principal and Project Manager
Great Ecology

CC: Eileen Maher
Brent Eastty
Planning & Green Port
Port of San Diego

DATE: December 4, 2017

PROJECT: South San Diego Bay Wetland Mitigation Bank

SUBJECT: Regulatory Analysis for interior Pond 20 Features

BACKGROUND

The Port of San Diego (Port) seeks to develop a wetland mitigation bank on an 83.5 acre parcel in South San Diego Bay known as Pond 20 (Site). In support of that project, a wetland delineation was conducted by Great Ecology on the Site in February 2017, and a delineation report was submitted to the U.S. Army Corps of Engineers (USACE) Los Angeles District Office in April 2017. USACE Senior Project Manager Robert Smith, P.E., M. ASCE submitted comments on the delineation report to the Port on June 22, 2017, and the comments were discussed during a phone meeting that took place on August 3, 2017 between Robert Smith, Eileen Maher and Brent Eastty (Port), and Marlene Tyner-Valencourt (Great Ecology). USACE comments were largely focused on its jurisdiction over ponds located within the interior of Pond 20 (FIGURE 1). Notwithstanding the conclusion in the delineation report that these ponds are isolated intrastate waters, the USACE expressed its initial opinion that portions of the interior of Pond 20 may be jurisdictional under the Rivers and Harbors Act of 1899 (RHA) and under the Clean Water Act (CWA).

In response to USACE's written comments and the topics discussed during the August 3 phone meeting, Great Ecology has developed this memorandum to address whether the non-wetland ponds within the interior of Pond 20 are waters of the U.S. pursuant to the RHA and the CWA. This memorandum does not address the jurisdictional status of any features outside of the Pond 20 berm. This memorandum is intended to support USACE's approved jurisdictional determination for the Port of San Diego's Pond 20 mitigation bank project. The memorandum should be read in conjunction with Great Ecology's 2017 jurisdictional delineation report and all other material facts and evidence required to perform the determination.

This memorandum reviews the relevant laws and agency guidance, applies them to site conditions at Pond 20, and draws objective conclusions regarding agency jurisdiction.

SUMMARY

There are no waters of the U.S., or navigable waters, subject to RHA or CWA jurisdiction within Pond 20.

First, there is no RHA jurisdiction over any part of the interior of Pond 20 because:

- Pond 20 was never below the mean high water (MHW) mark; and
- In 2000, the USACE formally confirmed it does not have RHA jurisdiction over the interior of Pond 20.

Second, there is no CWA jurisdiction over the non-wetland borrow areas within Pond 20 because:

- The borrow areas are not "adjacent" to a navigable water because adjacency jurisdiction only applies to wetlands;
- The borrow areas are not a tributary of nor otherwise hydrologically connected to a navigable water; and
- The borrow areas do not significantly affect the chemical, physical, and biological integrity of a navigable water.

FACTUAL SETTING

Pond 20 is located just south of San Diego Bay in the City of San Diego in San Diego County, California. The Otay River runs along the northern boundary of Pond 20, the Otay River Tributary along the western boundary, and Nestor Creek along the eastern boundary. All three drainages are located outside of the berms and do not flow into or through Pond 20. Palm Avenue runs on the southern border of Pond 20. The average elevation of Pond 20 is 9.05 feet Mean Lower Low Water (MLLW), and ranges from 4.43 to 12.43 feet MLLW. The berm heights are between 13.43 and 14.43 feet MLLW and completely enclose Pond 20. Surface water flows into Pond 20 are limited to precipitation and storm water entering via conveyances and surface sheet flow from Palm Avenue; no surface water flows out of Pond 20 (FIGURE 1). Pond 20 is located within the Federal Emergency Management Agency's (FEMA) 100-year floodplain of the Otay River (FIGURE 2).

Pond 20 is a wholly bermed and enclosed non-operational solar salt evaporator pond that was formerly part of the Western Salt Company's South San Diego Bay Saltworks operations. The berms were originally constructed in the 1870s and were rehabilitated after the 1916 failure of Savage Dam that destroyed much of the Saltworks and deposited tons of fill material within Pond 20. Pond 20 and the rest of the Saltworks were restored and operational by 1918, with water entering Pond 20 via siphons. However, the high elevation of Pond 20, along with its inland location and distance from the other ponds, soon made its continued use logistically and economically inefficient within the Saltworks operation. The Pond 20 was disconnected from Saltworks operations in the 1960s and has since remained vacant.

In the decades since, Pond 20 has remained hydrologically isolated from surrounding surface flows; precipitation events alone have supported the establishment and persistence of perennial pools (borrow areas) located along the inside edges of the berms. These borrow areas are the subject of the jurisdictional analysis presented below.

RIVERS AND HARBORS ACT OF 1899 JURISDICTION

This section discusses USACE jurisdiction under the RHA. Specifically, this section addresses:

1. Whether USACE has jurisdiction over the entire interior of Pond 20 because it is, or was, below the MHW mark; and
2. Whether USACE has jurisdiction over the interior of Pond 20 based on the concept of "indelible navigability."

Pond 20 is not subject to RHA jurisdiction for two key reasons. First, Pond 20 is not, nor was it ever, below the MHW mark, which demarcates the physical limits of RHA jurisdiction. Second, USACE affirmatively surrendered its RHA jurisdiction over Pond 20 in 2000, meaning the concept of “indelible navigability” does not apply. Once affirmatively surrendered, RHA jurisdiction may not be reasserted over a site.

1. **USACE does not have jurisdiction over Pond 20 under the RHA because it is not, nor was it ever, below the MHW.**

The RHA regulates activities that effect the navigable capacity of "navigable waters of the United States."[1] In tidal contexts, navigable waters of the U.S. include:

> the entire surface and bed of all waterbodies subject to tidal action. Jurisdiction thus extends to the edge ... of all such waterbodies, even though portions of the waterbody may be extremely shallow, or obstructed by shoals, vegetation, or other barriers. Marshlands and similar areas are thus considered 'navigable in law,' but only so far as the area is subject to inundation by the mean high waters. The relevant test is therefore the presence of the mean high tidal waters ....[2]

Here, historic coastal T-sheets, specifically T365, indicate Pond 20 may have historically been a tidal marsh, identified on the T-sheet by tight parallel line symbols.[3] Even if it could be confirmed that the parallel lines on T365 represent tidal marsh, which it cannot, "[o]ne of the basic obstacles in using the T-sheets is the absence of a standardized legend."[4] Thus, "the best way to confirm accurate interpretation" is to compare "multiple, independent historical sources."[5]

The Fractional Township No. 18 South, Range No. 2 West, San Bernardino Meridian 1870 U.S. Land Office Map, which was created by the Bureau of Land Management (BLM), indicates that the Bermed Area, in its unobstructed natural state, was above the MHW. USACE relied on this map in 2000 to make this same determination.[6] Based on known T-sheet map symbol inaccuracies, the more recent BLM map representing pre-pond construction conditions should be relied upon to determine the historic MHW boundary.

Furthermore, in its present bermed condition, Pond 20 is above the MHW's current location. Currently, the berm's height ranges between 13.43 and 14.43 feet above MLLW. Based on historical data

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[1] 33 USC § 403.

[2] 33 CFR § 329.12(b).

[3] See, T-sheet T365, available at http://www.caltsheets.org/socal/; *see also* Grossinger, et.al., San Francisco Estuary Institute, *T-Sheet User Guide,* SFEI Report No. 427, September 2005. pages 27-28; 35 (describing T-sheet map symbology and symbology variability).

[4] Grossinger, et.al., San Francisco Estuary Institute, *T-Sheet User Guide,* SFEI Report No. 427, September 2005.

[5] *Id.*

[6] *See*, Mark Durham, U.S. Army Corps of Engineer Chief South Coast Regulatory Branch; Reply Letter to February 4, 2000 Port of San Diego Letter, February 22, 2000 (ATTACHMENT 1).

collected by the North San Diego Bay tidal gauge (#9410170), the ten highest high tides recorded between 1950 and 2017 were 7.63 feet above MLLW, or less.[7] Thus, the MHW does not reach the berm's interior and Pond 20 is not "subject to tidal action," nor is it subject to "inundation by the mean high waters."

Therefore, Pond 20 is not subject to RHA jurisdiction because a) historic map evidence indicates Pond 20 was above the MHW before the berm was constructed, and b) tidal data collected in the bay indicates that the MHW is at least 6.8 feet below the top of the berm in its present state. As discussed below, in 2000, USACE concluded the project area is above the MHW.

2. **USACE does not have RHA jurisdiction over Pond 20 based on indelible navigability because USACE affirmatively surrendered its RHA jurisdiction over the Site in 2000.**

The indelible navigability principle asserts that "sudden or man-made changes to a water body or its navigable capacity do not alter the extent of RHA jurisdiction, and thus the area occupied or formerly occupied by that water body will always be subject to RHA jurisdiction."[8]

Although, based on this rule, man-made changes to navigable waters do not extinguish a waterbody's navigable in law status, the USACE can determine whether a water feature remains or otherwise is navigable

The USACE made just such an explicit determination for Pond 20. Specifically, in 2000, the USACE assessed its RHA jurisdiction over the interior of Pond 20. The agency concluded that "Pond 20 is not subject to our authorization under Section 10 of the RHA" because "the subject property in its unobstructed, natural state was located above MHW and is not defined as navigable waters ... ."[9]

USACE's 2000 letter to the Port is unequivocal and includes unmistakable terms regarding its RHA jurisdiction over Pond 20. USACE's letter is an affirmative government statement that RHA jurisdiction does not apply. USACE should not reassert RHA jurisdiction over Pond 20 now, even if it were to purport that Pond 20 was below the historic or present MHW mark locations.

CLEAN WATER ACT JURISDICTION

This section discusses USACE jurisdiction under the CWA. Specifically, this section addresses USACE jurisdiction over the non-wetland ponds based on:

1. Adjacency to the Otay River or Nestor Creek;
2. Tributary status/hydrologic connectivity to the Otay River and Nestor Creek;
3. Location below the MHW elevation; and
4. Lack of significant nexus to Waters of the U.S.

First, USACE does not have jurisdiction over the non-wetland ponds within the berms at Pond 20 by reason of adjacency; adjacency applies only to wetlands.

Second, USACE does not have jurisdiction over non-wetland borrow areas within Pond 20 based on the ponds being a tributary to the Otay River or Nestor Creek, because there is no evidence that the ponds have ever flowed over, or through the berms into the river or creek. Tributary status requires a direct surface water connection between a traditional navigable water and a non-wetland tributary

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[7] National Oceanic and Atmospheric Administration [NOAA]. Water Level Reports – Top Ten Max/Min in Period, Station 9410170 San Diego, CA, Period January 1, 1950 to July 31, 2017. Web https://tidesandcurrents.noaa.gov/reports.html?id=9410170

[8] Earl H. Stockdale, U.S. Army Corps of Engineers Chief Counsel; *Legal Principles to Guide the Approved Jurisdictional Determination for the Redwood City Salt Plant*, January 9, 2014 (ATTACHMENT 2).

[9] Mark Durham, U.S. Army Corps of Engineer Chief South Coast Regulatory Branch; Reply Letter to February 4, 2000 Port of San Diego Letter, February 22, 2000 (ATTACHMENT 1).

water. There is no evidence that surface water connection exists between the Otay River or Nestor Creek and the isolated ponds located within Pond 20.

Third, USACE does not have jurisdiction over the non-wetland borrow areas within the berm at Pond 20 based on them being below the MHW elevation, because CWA jurisdiction for tidal waters is based on the location of the high tide line, which is on the outer perimeter of Pond 20. Pond 20 is completely isolated from tidal flows, and was constructed lawfully, meaning the current extent of the high tide line delimits USACE's landward extent of CWA jurisdiction over tidal waters. The isolated ponds located within Pond 20 are beyond the reach of that jurisdiction.

Fourth, USACE does not have jurisdiction over isolated non-wetland waters that do not have a significant nexus to a navigable waterway. The non-wetland borrow areas within Pond 20 have no surface or groundwater connection to surrounding waters; they are not hydrologically connected. Nor is there a chemical or biological significant nexus with navigable waterways; there is no water exchange with the Otay River or Nestor Creek from inside the berm to outside the berm, which thus precludes passage of chemicals and aquatic organisms between Pond 20 and the surrounding surface water features.

The lack of significant nexus ties back into all of the other arguments and will be discussed in conjunction with them below, rather than as a separate argument.

1. **USACE does not have jurisdiction over the non-wetland borrow areas within the Pond 20 berms by reason of adjacency, because jurisdiction based on adjacency applies only to wetlands.**

Waters that are legally converted to upland pursuant to a CWA permit, or before the CWA was enacted, are no longer waters of the U.S. and are not subject to the CWA.[10] Where an existing wetland water of the U.S. is "converted to another use," altering its "wetland characteristics" so that the wetland is no longer a water of the U.S., it is not subject to USACE jurisdiction.[11] If the area's use is abandoned and the area "regains wetland characteristics" that meet USACE's wetland definition, USACE jurisdiction is restored.[12]

Here, it is undisputed that the interior of Pond 20 likely consisted of wetland before the berm and salt ponds were constructed. The berm and salt ponds were constructed by Western Salt in the 1870s, decades before the CWA was enacted.[13] The wetlands on which the salt ponds were constructed would have been waters of the U.S., if such a designation existed at that time, because they were adjacent to San Diego Bay, the Otay River, and Nestor Creek. Construction of the berm and salt ponds hydrologically disconnected Pond 20 from San Diego Bay, the Otay River, and Nestor Creek. More importantly, for this analysis, pre-CWA salt pond construction converted the marsh wetland to non-wetland. Thus, the pre-construction wetlands were legally converted to non-wetland, because the conversion occurred before the CWA was enacted.

Salt production activities within Pond 20 ceased during the 1960s and since then, Pond 20 was left fallow. Several wetland delineations were conducted at Pond 20 after salt production ended, the most

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[10] Environmental Protection Agency, *Guidelines for Specification of Disposal Sites for Dredged or Fill Material*, 45 Fed. Reg. 85344 (Dec. 24, 1980); *see also* Earl H. Stockdale, U.S. Army Corps of Engineers Chief Counsel; *Legal Principles to Guide the Approved Jurisdictional Determination for the Redwood City Salt Plant*, January 9, 2014 (ATTACHMENT 2) ("areas that are lawfully filled, either before the passage of the CWA or pursuant to a CWA permit, are no longer subject to CWA jurisdiction.").

[11] RGL 86-09

[12] *Id.*

[13] EDAW. 2001. Historic resource evaluation report for Western Salt Company Salt Works, San Diego County, Chula Vista, California. Prepared for Tierra Environmental Services and California Department of Transportation (CalTrans), 102 pp.

recent being conducted in 2017. No wetlands were delineated during any of those efforts. Therefore, since the historic wetlands were legally converted to non-wetland, and Pond 20 never regained wetland characteristics after salt production activities ceased, no portion of Pond 20 can be considered a wetland water of the U.S.

The borrow areas within Pond 20 are part of a salt production operation, are not wetlands, and are separated from the Otay River and Nestor Creek--navigable tributaries to San Diego Bay--by an earthen levee. Thus, although arguably adjacent to these water features, the non-wetland borrow areas within the interior of Pond 20 cannot be considered waters of the U.S by reason of adjacency because they are not connected to either waterway and CWA jurisdiction based on mere adjacency alone does not apply to the non-wetland ponds; it only applies to wetlands.

2. **USACE does not have jurisdiction over non-wetland borrow areas within the interior of Pond 20 based on tributary status to the Otay River and Nestor Creek, because there is no evidence the ponds have ever flowed over, or through the berms into the river.**

USACE will assert CWA jurisdiction over "relatively permanent" "non-navigable tributaries to traditional navigable waters."[14] USACE will also assert jurisdiction over water features with a significant nexus to navigable waters. Accordingly, non-wetland water features can be jurisdictional, but only if they exhibit a hydrological or otherwise significant nexus to a navigable waterway. As described below, given the physical barrier that exists between the water features within Pond 20 and Otay Creek and Nestor Creek, no hydrologic connect or otherwise chemical or biological significant nexus exists between Pond 20 and these nearby waterways.

Here, the waterbodies at issue are non-wetland salt ponds separated by an earthen levee from a navigable tributary to tidal bay waters. Even during the highest recorded tide of 7.63 feet MLLW, Otay River water has never overtopped the berm and flowed into Pond 20's borrow areas.

Furthermore, that Pond 20 is within the FEMA 100-year floodplain does not *per se* establish jurisdiction. A hydrologic connection or other significant nexus must exist. There is no evidence that such a relationship exists between the interior of Pond 20 and the surrounding waterways.

Moreover, it is noteworthy that although Pond 20's berm is identified on FEMA's Federal Insurance Rate Map's (FIRM) Panel 2153 (FIGURE 2), the 100-year floodplain extent represented on Panel 2153 is pending revision, because Pond 20's berm effect on the 100-year floodplain has not been taken into account (i.e. the levees are shown as unaccredited). Thus, FEMA itself recognizes that the 100-year floodplain extent is inaccurate, rendering any conclusion based on this map that a hydrological connection between the borrow area and the Otay River exists, entirely speculative.

Thus, the non-wetland ponds within the Bermed Area cannot be considered waters of the U.S., because a) there is no evidence that water has ever flowed, or could flow, from the non-wetland ponds to the Otay River and Nestor Creek; and b) any assertion that non-wetland ponds have a significant impact on the chemical, physical, and biological integrity of a navigable water is speculative.

3. **USACE does not have jurisdiction over the non-wetland borrow areas ponds within Pond 20 because CWA jurisdiction for tidal waters is based on the location of the high tide line and the ponds are not tidal, nor do tidal waters flow over the berm into the borrow areas.**

Under the CWA, "tidal waters" are "waters that rise and fall ... due to the gravitational pulls of the moon and sun." [15] The landward limits of jurisdiction in tidal waters extends to the high tide line.[16] The "high

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[14] *See* USEPA/USACE*, Clean Water Act Jurisdiction Following the U.S. Supreme Court's Decision in Rapanos v. United States and Carabell v. United States*, December 2, 2008; *see also* Corps of Engineers, Department of the Army, *Final Rule for Regulatory Programs of the Corps of Engineers,* 51 Fed. Reg. 41250 (Nov. 13 1986).

[15] Corps of Engineers, Department of the Army, *Final Rule for Regulatory Programs of the Corps of Engineers,* 51 Fed. Reg. 41250 (Nov. 13 1986).

[16] *Id.*

tide line" is the "line of intersection of the land with the water's surface at the maximum height reached by a rising tide," which "encompasses spring high tides ... but does not include storm surges ... as those accompanying a hurricane or other intense storm." [17]

The non-wetland borrow areas within the Pond 20 berm do not rise and fall due to gravitational forces. Rather the surface water elevation in the ponds fluctuate due to localized storm water inputs and evaporative processes. The ponds are not tidal waters. Furthermore, the tidal San Diego Bay, Otay River, and Nestor Creek waters never overtop the berm. This is evidenced by the berm elevation data and San Diego Bay tidal elevation data provided above.

Additionally, it cannot be argued that, in its natural state, Pond 20 would be subject to tidal influence and would be below the high tide line, because as described above, Pond 20 was lawfully converted from its original wetland state when the berms were constructed. Therefore, the existing location of the high tide line, which is on the outer perimeter of the berm, delimits USACE's landward extent of CWA jurisdiction over tidal waters, and the non-wetland ponds are beyond the reach of that jurisdiction.

CONCLUSION

There are no waters of the U.S. or navigable waters within Pond 20. The non-wetland borrow areas are isolated intrastate waters and are not subject to RHA or CWA laws and regulations.

Regarding the RHA, USACE does not have jurisdiction over Pond 20 because it is not, nor was it ever, below the MHW mark. Furthermore, the USACE affirmatively confirmed it does not have RHA jurisdiction over the Site in 2000.

Regarding CWA jurisdiction, USACE does not have jurisdiction over the non-wetland borrow areas within the Pond 20 berms by reason of adjacency, because jurisdiction based on adjacency applies only to wetlands. Second, USACE does not have jurisdiction over the non-wetland borrow areas within the Pond 20 berms based on them being tributaries to the Otay River or Nestor Creek, because there is no evidence that the ponds have ever flowed over, or through the berms into the river nor is there otherwise a significant nexus between Pond 20 and the nearby waterways. Third, USACE does not have jurisdiction over the non-wetland borrow areas within the Pond 20 berms based on them being below the MHW elevation, because CWA jurisdiction for tidal waters is based on the location of the high tide line, which is on the outer perimeter of the berms.

LIST OF FIGURES

ATTACHMENTS

ATTACHMENT 1	Mark Durham, U.S. Army Corps of Engineer Chief South Coast Regulatory Branch; Reply Letter to February 4, 2000 Port of San Diego Letter, February 22, 2000
ATTACHMENT 2	Earl H. Stockdale, U.S. Army Corps of Engineers Chief Counsel; *Legal Principles to Guide the Approved Jurisdictional Determination for the Redwood City Salt Plant*, January 9, 2014

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[17] *Id.*

FIGURES

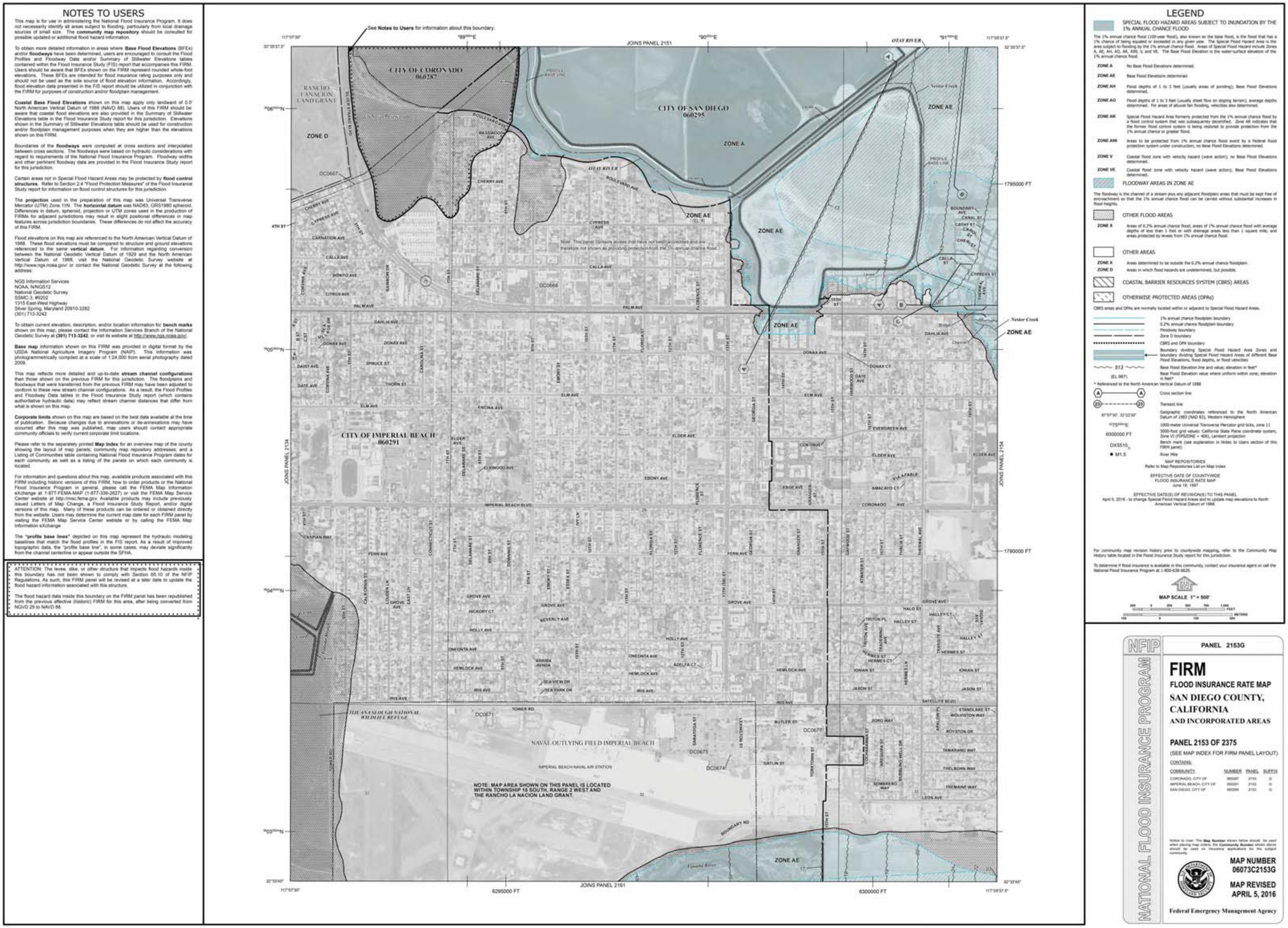
FIGURE 1: REFERENCED SITE AREAS AND HYDROLOGY OVERVIEW

POND 20 - EXISTING HYDROLOGIC FEATURES

SAN DIEGO UNIFIED PORT DISTRICT
AUGUST, 2017

GREATecology
ENVIRONMENT + DESIGN

FIGURE 2: FEMA FLOOD INSURANCE RATE MAP (FIRM)



NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) Zone 11N. The **horizontal datum** was NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242**, or visit its website at http://www.ngs.noaa.gov/.

Base map information shown on this FIRM was provided in digital format by the USDA National Agriculture Imagery Program (NAIP). This information was photogrammetrically compiled at a scale of 1:24,000 from aerial photography dated 2009.

This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information and questions about this map, available products associated with this FIRM including historic versions of this FIRM, how to order products or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Map Service Center website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website. Users may determine the current map date for each FIRM panel by visiting the FEMA Map Service Center website or by calling the FEMA Map Information eXchange.

The **"profile base lines"** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the "profile base line", in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

ATTENTION: The levee, dike, or other structure that impacts flood hazards inside this boundary has not been shown to comply with Section 65.10 of the NFIP Regulations. As such, this FIRM panel will be revised at a later date to update the flood hazard information associated with this structure.

The flood hazard data inside this boundary on the FIRM panel has been republished from the previous effective (historic) FIRM for this area, after being converted from NGVD 29 to NAVD 88.

LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Areas to be protected from 1% annual chance flood event by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

	1% annual chance floodplain boundary
	0.2% annual chance floodplain boundary
	Floodway boundary
	Zone D boundary
	CBRS and OPA boundary
	Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities
513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

A — A	Cross section line
23 - - - 23	Transect line
87°07'30", 32°22'30"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
4275000mE	1000-meter Universal Transverse Mercator grid ticks, zone 11
6000000 FT	5000-foot grid values: California State Plane coordinate system, Zone VI (FIPSZONE = 406), Lambert projection
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
• M1.5	River Mile

MAP REPOSITORIES
Refer to Map Repositories List on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
June 19, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
April 5, 2016 - to change Special Flood Hazard Areas and to update map elevations to North American Vertical Datum of 1988.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 2153G

FIRM
FLOOD INSURANCE RATE MAP
SAN DIEGO COUNTY, CALIFORNIA
AND INCORPORATED AREAS

PANEL 2153 OF 2375

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
CORONADO, CITY OF	060287	2153	G
IMPERIAL BEACH, CITY OF	060291	2153	G
SAN DIEGO, CITY OF	060295	2153	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
06073C2153G

MAP REVISED
APRIL 5, 2016

Federal Emergency Management Agency

ATTACHMENT 1

DEPARTMENT OF THE ARMY
LOS ANGELES DISTRICT, CORPS OF ENGINEERS
P.O BOX 532711
LOS ANGELES, CALIFORNIA 90053-2325

February 22, 2000

RECEIVED
FEB 25 2000
ENVIRONMENTAL SERVICES

REPLY TO
ATTENTION OF:

Office of the Chief
Regulatory Branch

Eileen M. Maher
Snr. Environmental Specialist
Port of San Diego
PO Box 120488
San Diego, California 92112-0488

Dear Ms. Maher:

This is sent in reply to your letter dated February 4, 2000 in which you requested the Corps of Engineers to concur with your determination. That Pond 20, which is located south of San Diego Bay, in San Diego County, California, is not jurisdictional and not subject to authorization under Section 10 of the Rivers and Harbors Act (RHA) of 1899 or Section 404 of the Clean Water Act (CWA).

Based on a review of the information in our files pertaining to the project area, Pond 20 is not subject to our authorization under Section 10 of the RHA. To make this determination, the subject property was compared to the historic meander line, as presented on a reproduction of an 1870 U.S. Land Office map, entitled Fractional Township No. 18 South, Range No. 2 West, San Bernardino Meridian, prepared by Bureau of Land Management (BLM). The meander (or mean high water, MHW) line is plotted by survey datum points from 1869 by the BLM. This exhibit illustrates that the subject property in its unobstructed, natural state was located above MHW and is not defined as navigable waters, per 33 C.F.R. 329.1.

Based on the review, it is not clear if Pond 20 is subject to our authorization under Section 404 of the CWA. Our records indicate that a jurisdictional delineation was conducted for the site in September of 1996, and a report submitted on August 11, 1997. This report indicated that the subject property did not support waters of the United States (U.S.). On June 11, 1997, the Corps and the U.S. Fish & Wildlife Service conducted an onsite field investigation to verify the preliminary findings of the September 1996 jurisdictional delineation. During the investigations, it was recorded that the southwest portion of Parcel 20 was flooded with water. The notes indicate that the perimeter of the property also supported *salicornia*, a wetland (obligate) indicator species. The notes also indicate that migratory waterfowl were observed onsite. These observations were recorded by site photo-documentation. In a more recent discussion with the Service (February 18, 2000), it is believed that flooding occurs seasonally and regularly on the site. Based on these considerations, it appears that the subject property, in part, may be defined as waters of the U.S., per 33 C.F.R. 328.1.

At this time, we do not concur with your findings and recommend that you update and revise the 1996 jurisdictional delineation, as appropriate. We suggest that the revised report graphically present waters of the U.S. and estimate acreage using Federal-approved methods. It is recommended that the map identifies graphically both wetlands and non-wetland waters, and report states the acreage estimates for both, respectfully. After the results are submitted to the Corps, we will field verify your findings. Following, we will state our findings in the record, and we will notify you via written correspondence.

In the event that you or your staff (or other representative) is unable to perform the delineation, or should you choose not to obtain the services of an environmental consulting firm, we can perform the wetland delineation on your behalf. However, due to staffing limitations, we would place you on a waiting list and perform the delineation in about one-year.

If you have any questions, please call Russell L Kaiser at (213) 452-3293.

Sincerely,

Mark Durham

Mark Durham
Chief, South Coast Section
Regulatory Branch

ATTACHMENT 2

Legal Principles to Guide the Approved Jurisdictional Determination for the Redwood City Salt Plant

CECC-ZA

9 January 2014

Introduction and Summary of Conclusions

For more than a century, private industry has been conducting salt making operations in the San Francisco Bay area. Because the salt making facilities are constructed at sites in or near tidal waters, there has been ongoing interest in the Corps' authority to exercise jurisdiction over these sites under Section 10 of the Rivers and Harbors Act of 1899 (RHA) and Section 404 of the Clean Water Act (CWA). Most recently, this interest has focused on the Redwood City salt plant, which is a part of Cargill's larger salt making operations in the Bay area.

DMB Redwood City Saltworks, the entity that represents Cargill and the potential developer of the site, has recently requested an approved jurisdictional determination for the 1,365 acre salt plant facility in Redwood City, CA. Because of this request, the Corps must examine the relevant laws and regulations as interpreted by the courts to identify the legal standards applicable to a jurisdictional determination for the site.

On several occasions the Corps and the courts have addressed the question of jurisdiction over other property in the Bay area owned by Cargill and used for salt making operations. The decisions reached on those occasions have involved different facts and have been made against a backdrop of evolving jurisprudence regarding the extent of the Corps' regulatory jurisdiction under the RHA and CWA. While the Corps' understanding of RHA jurisdiction has not changed substantially in recent years, the Supreme Court has issued several landmark decisions addressing CWA jurisdiction since the last time a court has considered the issue as it relates to a salt making operation on the San Francisco Bay.

Relying on binding precedents of the Supreme Court and the Court of Appeals for the Ninth Circuit, this document sets forth the legal standards that must be applied in determining RHA and CWA jurisdiction over the site of the Redwood City salt plant. It explains that the government's RHA jurisdiction in tidal waters extends shoreward to the mean high water (MHW) mark in its unobstructed, natural state. It concludes that the Cargill Redwood City property should be divided into two parcels for analytical purposes, one developed before 1940 and the other developed after 1940. There is no evidence in the record to suggest that the

Attachment 4

Army ever exerted RHA jurisdiction over the parcel developed before 1940; the parcel was either never subject to RHA jurisdiction or RHA jurisdiction has been surrendered. The other parcel was developed pursuant to a 1940 War Department permit, and the Army retains RHA jurisdiction up to the MHW mark as it existed immediately prior to the construction of levees and a dyke authorized in this permit. The 1940 War Department permit authorizing the levees and dyke should be given deference when determining the historic location of the MHW mark. Finally, this document concludes that the liquids on both parcels, which have been subject to several years of industrial salt making processes, are not "waters of the United States" subject to CWA jurisdiction.

Discussion

Factual Setting[1]

As previously mentioned, a significant portion of the southern San Francisco Bay shoreline has been used for the production of salt through a process called solar evaporation. The Redwood City Saltworks site is comprised of approximately 1,365 acres that currently and/or historically have been used to make salt. The development of the Redwood City site can be described as having occurred on two distinct parcels in two phases, one of which involved a War Department permit issued in 1940 to a former owner, the Stauffer Chemical Company.[2] The two parcels are highlighted in different colors on the attached map.[3]

Parcel 1: The first phase of development occurred prior to 1940 and involved the western portion of the site, roughly between the historic location of First Slough and the current location of Seaport Boulevard. This portion of the site is identified in green on the attached map. It is bounded by a railroad line on the west, Bayshore Highway on the south, an existing levee on the east, and Westpoint Slough on the north. In 1940, it was shown as containing "Salt Evaporating Ponds," "Reclaimed Marsh," and a cement works.[4] This area approximately corresponds to the area that Cargill calls its crystallizer complex.[5]

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[1] The information presented in this section explains the context of the discussion of controlling legal standards and is based on the applicant's submission, information conveyed during site visits, and other sources. A formal determination of the physical characteristics of the site will be undertaken by the San Francisco District of the U.S. Army Corps of Engineers during the processing of the request for an approved jurisdictional determination.

[2] War Department Permit issued to Stauffer Chemical Company, January 16, 1940. The permit includes a diagram of the levee and dyke profiles in relation to the surrounding topography marked "Sheet 1" and a map of the site marked "Sheet 2." These documents together will be collectively referred to as "the permit" or "1940 permit."

[3] The attached map is a copy of the map that accompanied the 1940 permit and was identified as "Sheet 2" of that permit. The color highlighting has been added.

[4] War Department Permit issued to Stauffer Chemical Company, January 16, 1940 (Sheet 2); see also Attachment C to Exhibit 7 of the Redwood City Salt Plant Approved Jurisdictional Determination Submission (May 30, 2012).

[5] See Exhibit 2 of the Redwood City Salt Plant Approved Jurisdictional Determination Submission (May 30, 2012).

Parcel 2: The second phase of development occurred after 1940, immediately east of the first phase of development. The parcel where this development occurred is shown in red on the attached map. The development was undertaken pursuant to a War Department permit authorizing construction of "an earth dyke or levee across and along the bank of First Slough, and along the banks of Westpoint Slough and an unnamed tributary thereof" to enclose an area immediately east of the first development.[6] This area was leveed off from the Bay and developed into a complex of containment cells for salt production. The parcel is bordered on the west by the existing levee that forms the eastern border of the area developed prior to 1940, except that this common border diverges at the "Location of the Proposed Dam" across First Slough. From that point, the western border of the parcel follows the eastern shore of First Slough north, where the proposed levee or dyke is shown as a darker line. The northern border of the parcel follows this dark line along the southern shore of Westpoint Slough, and the eastern border follows the same darker line along the western shore of the unnamed tributary to Westpoint Slough. The southern border is the darker line that generally parallels the "Road on Levee." It approximately corresponds to the area Cargill calls its pickle and bittern complexes.[7]

The Redwood City salt plant entails only the later stages of the salt production process.[8] The initial stages of the process are conducted on other parcels, where the process begins by pumping raw Bay water into a leveed evaporation pond. The water is moved through a series of containment cells as the salinity increases. After approximately four years of subjecting the water to solar evaporation at other locations, the resulting liquid ("pickle") is transferred to the pickle complex at the Redwood City facility. Additional solar evaporation occurs there until the solution is saturated, at which point the pickle is moved into the crystallizer cells where the salt precipitates out of suspension. The resulting liquid, called "bittern," is pumped into the bittern complex cells, where it is stored until moved off site to be sold or recycled back into the salt production process. The salt that remains on the floor of the crystallizer cells is then mechanically scraped from the dry ground and loaded into trucks to be moved offsite.

Rivers and Harbors Act of 1899

Overview

Congress enacted the RHA to protect the navigable capacity of tidal and non-tidal waters. RHA jurisdiction is closely connected to the Federal navigation servitude, which reaches to the limits of navigable waters and permits the sovereign to prevent or remove

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[6] War Department Permit issued to Stauffer Chemical Company, January 16, 1940.

[7] *Id.*

[8] This description is based on the Redwood City Salt Plant Approved Jurisdictional Determination Submission (May 30, 2012).

obstructions to navigation without compensation. This document explains that RHA jurisdiction extends to the MHW mark, which ordinarily is determined by identifying a line on the shore based on the average high tides over a period of years. This line can be ambulatory and special rules may apply to account for forces of nature, which may cause a shoreline to increase or decrease, or manmade improvements that counter these forces. Even where jurisdiction may normally attach, it may be surrendered by the government. Applying these legal precepts is necessary to determine the limits of RHA jurisdiction over Cargill's Redwood City property.

Geographic Scope of RHA Jurisdiction

The RHA regulates obstructions to the navigable capacity of any "navigable water of the United States."[9]

> [It] prohibits the creation of 'any obstruction not affirmatively authorized by Congress[] to the navigable capacity of any of the waters of the United States' [and] . . . make[s] it unlawful to 'build or commence the building of any wharf, pier, dolphin, boom, weir, breakwater, bulkhead, jetty, or other structures in any port, roadstead, haven, harbor, canal, navigable river, or other water of the United States . . . except on plans recommended by the Chief of Engineers and authorized by the Secretary of the Army' or to 'excavate or fill, or in any manner to alter or modify the course, location, condition, or capacity of . . . the channel of any navigable water of the United States, unless the work has been recommended by the Chief of Engineers and authorized by the Secretary of the Army prior to beginning the same.'[10]

Citing Supreme Court precedents, the Ninth Circuit has recognized that:

> The term "navigable waters" has been judicially defined to cover: (1) nontidal waters which were navigable in the past or which could be made navigable in fact by "reasonable improvements," *United States v. Appalachian Electric Power Co.*, 311 U.S. 377 (1940); *Economy Light & Power Co. v. United States*, 256 U.S. 113 (1921); and (2) waters within the ebb and flow of the tide. *The Propeller Genesee Chief v. Fitzhugh*, 53 U.S. 443 (1851); *United States v. Stoeco Homes, Inc.*, 498 F.2d 597 (3d Cir. 1974), cert. denied, 420 U.S. 927.[11]

With respect to tidal waters, the Supreme Court has held that the term "navigable waters" as used in the RHA, extends to all places covered by the ebb and flow of the tide to the MHW

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[9] 33 U.S.C. § 403.

[10] *U.S. v. Milner*, 583 F.3d 1174, 1191 (9th Cir. 2009) (quoting 33 U.S.C. § 403).

[11] *Leslie Salt Co. v. Froehlke*, 578 F.2d 742, 753 (9th Cir. 1978) (hereinafter "*Froehlke*"). This is consistent with the general definition of "navigable waters of the United States" codified in regulation at 33 C.F.R. § 329.4.

mark.[12] This regulatory authority "is not dependent upon the depth and shallowness of the water," and includes "[m]arshlands and similar areas" that are "subject to inundation by the mean high waters."[13] The MHW mark is determined by where on the shore the average of all high tides reaches over a period of 18.6 years.[14]

RHA jurisdiction is coextensive with the reach of the federal navigation servitude.[15] The navigation servitude,

> sometimes referred to as a "dominant servitude," . . . or a "superior navigation easement," . . . is the privilege to appropriate without compensation which attaches to the exercise of the "power of the government to control and regulate navigable waters in the interest of commerce." *United States v. Commodore Park*, 324 U.S. 386, 390, 65 S.Ct. 803, 89 L.Ed. 1017.[16]

The limits of RHA jurisdiction and the navigation servitude are coextensive because their origins are grounded in the same desired purpose of preserving the navigable capacity of waterways.

In summary, the general rule in tidal areas is that RHA jurisdiction extends to the line on the shore reached by the plane of the mean high water averaged over a period of 18.6 years. This general rule applies when there is a relatively static, natural shoreline. But shorelines may not remain static. Oceans may rise, tides may wash away beaches, and humans may build bulkheads on the shore. If the shoreline has changed or has otherwise been altered, additional analysis must be undertaken to determine if the extent of jurisdiction has changed along with the changes to the shoreline, or if the extent of jurisdiction remains fixed at the MHW mark as it existed before the changes. If there have been changes in the shoreline, jurisdiction is either ambulatory, following the changes in the shoreline, or indelible, remaining fixed despite the changes.

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[12] *Borax,* 296 U.S. at 26-27. See 33 C.F.R. § 329.12(a)(2), which was changed in a rulemaking in 1982 in response to the *Froehlke* decision to eliminate the sentence that established the shoreward limit of navigable waters on the Pacific coast as the mean higher high waters. This regulatory change made the shoreward limit of jurisdiction for all coastal waters (Atlantic and Pacific) the same – the mean high water mark. 47 Fed. Reg. 31794, 31797-98 (July 22, 1982).

[13] See *Greenleaf-Johnson Lumber Co. v. Garrison*, 237 U.S. 251, 263 (1915) and 33 C.F.R. § 329.12(b).

[14] *Borax Consolidated v. City of Los Angeles*, 296 U.S. 10, 26-27 (1935); *Frohlke*, 578 F.2d at 746.

[15] *Froehlke*, 578 F.2d. at 748-750, 752 ("The navigational servitude reaches to the shoreward limit of navigable waters.").

[16] *U.S. v. Virginia Electric Co.*, 365 U.S. 624, 327-28 (1961) (quoted in *Froehlke*, 578 F.2d at 752).

Ambulatory Nature of Jurisdiction

The scope and extent of RHA jurisdiction is ambulatory when there are gradual, lasting shifts in the volume of the water body or the character of the banks or shoreline.[17] In such cases, jurisdiction changes to follow the changing path and extent of the water:

> It is the established rule that a riparian proprietor of land bounded by a stream, the banks of which are changed by the gradual and imperceptible process of accretion or erosion, continues to hold the stream as his boundary; if his land is increased, he is not accountable for the gain, and if it is diminished he has no recourse for the loss. But where a stream suddenly and perceptibly abandons its old channel, the title is not affected, and the boundary remains at the former line.[18]

The Supreme Court has described how Federal regulatory authority shifts to follow the course of a water body as it moves over time, just as title follows the course of a water body as it moves over time:

> Nor is the authority of Congress limited to so much of the water of the river as flows over the bed of forty years ago. The alterations produced in the course of years by the action of the water do not restrict the exercise of Federal control in the regulation of commerce. Its bed may vary and its banks may change, but the Federal power remains paramount over the stream, and this control may not be defeated by the action of the state in restricting the public right of navigation within the river's ancient lines. The public right of navigation follows the stream and the authority of Congress goes with it.[19]

Thus, the contours of RHA jurisdiction change when the physical changes to the course or shoreline of a water body are gradual and long-lasting.[20] If the changes to the course or shoreline are sudden and perceptible due to avulsion[21] or man-made improvements, then the principle of indelible navigability applies to fix the previous limits of jurisdiction despite the changes as discussed further below.

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[17] *Jefferis v. East Omaha Land Co.*, 134 U.S. 178, 189 (1890) (cited in *Milner*, 583 F.3d at 1187).

[18] *Philadelphia Co. v. Stimson*, 223 U.S. 605, 624 (1912). See also *Oklahoma v. Texas*, 260 U.S. 606 (1923); *Hughes v. Washington*, 389 U.S. 290 (1967).

[19] *Philadelphia Co. v. Stimson*, 223 U.S. at 634-35.

[20] *State of Cal. ex rel. State Lands Commission v. U.S.*, 805 F.2d 857, 864 (1986) ("When a water line that constitutes a property boundary changes gradually and imperceptibly by the gradual deposit of solid material on its shore (accretion) or by gradual recession (reliction), the property boundary changes with it. . . . In such a situation, title is "ambulatory.").

[21] *Id.* at 864 ("where a water line changes violently and visibly, i.e., by avulsion, the property boundary does not change with the water but remains where it was prior to the change").

The Principle of Indelible Navigability

The principle of indelible navigability holds that sudden or man-made changes to a water body or its navigable capacity do not alter the extent of RHA jurisdiction, and thus the area occupied or formerly occupied by that water body will always be subject to RHA jurisdiction. This principle was discussed and relied upon by the Supreme Court in *Economy Light & Power*,[22] and has been incorporated in the Corps' definition of "navigable waters of the United States:" "A determination of navigability, once made, applies laterally over the entire surface of the water body, and is not extinguished by later actions or events which may impede or destroy navigable capacity."[23] The rule is expanded upon in 33 C.F.R. §§ 329.9 and 329.13: "an area will remain 'navigable in law,' even though no longer covered with water, whenever the change has occurred suddenly, or was caused by artificial forces intended to produce that change."[24] These regulatory definitions implementing the rule of indelible navigability have been unchanged since September 9, 1972.[25]

The Ninth Circuit decision in *Froehlke* embraced the rule of indelible navigability. The court reversed the lower court decision that "the Corps's jurisdiction under the River and Harbors Act includes all areas within the former line of MHHW in its unobstructed, natural state" and instead ruled that jurisdiction is to be fixed at the former line of MHW its unobstructed, natural state.[26] The opinion cited to "the principle in *Willink* . . . that one who develops areas below the MHW line does do at his peril" as dictating this result.[27] Thus, while RHA jurisdiction "extend[s] to all places covered by the ebb and flow of the tide to the mean high water (MHW) mark in its unobstructed, natural state," where the natural state has been obstructed by a sudden change or an artificial change intended to produce that result, the former mean high water line as it existed before the obstruction becomes the fixed limit of RHA jurisdiction.[28]

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[22] *Economy Light & Power Co. v. U.S.*, 256 US 113, 118 (1921) ("The fact . . . that artificial obstructions [to navigation] exist capable of being abated by due exercise of the public authority, does not prevent the [water body] from being regarded as navigable in law, if, supposing them to be abated, it be navigable in fact in its natural state. The authority of Congress to prohibit added obstructions is not taken away by the fact that it has omitted to take action in previous cases.")

[23] 33 C.F.R. § 329.4.

[24] 33 C.F.R. § 329.13.

[25] 37 Fed. Reg. 18289-92 (Sept. 9, 1972).

[26] *Froehlke*, 578 at 753.

[27] *Id.*

[28] *Id.*; 33 C.F.R. § 329.13. The principle of indelible navigability does not apply when natural changes that come about slowly due to accretion or reliction alter the course or limits of a water body. In such cases, "[t]he public right of navigation follows the stream . . . and the authority of Congress goes with it." *Philadelphia v. Stimson*, 223 U.S. 605, 634-635 (1912).

The Ninth Circuit issued a decision after its *Froehlke* decision that also addressed the effect of levees on RHA jurisdiction. The decision in *Milner* considered whether a shore defense structure that was constructed in uplands beyond RHA jurisdiction could become jurisdictional if gradual erosion caused the shoreline to move to intersect the previously constructed shore defense structure, such that the structure was now located in jurisdictional waters. The court found that such shore defense structures were subject to RHA jurisdiction, but did not determine how to fix the limits of RHA jurisdiction. Unlike the shore defense structures under consideration in *Milner*, the levees before us at the Cargill Redwood City site were permitted, water is not passing through or over them, erosion is not a factor, and there is no indication that the levees are in any way obstructing navigation.[29] *Milner* did not change the rule in *Frohlke* and is not applicable to circumstances at the Redwood City site.

Thus, under current Ninth Circuit jurisprudence, RHA jurisdiction in the San Francisco Bay area generally applies "to all places covered by the ebb and flow of the tide to the mean high water (MHW) mark in its unobstructed, natural state."[30] The Federal regulations implementing the RHA are consistent with this rule of law and define the jurisdictional scope of the RHA statute to be fixed if "later actions or events [such as the construction of a levee or other improvement] . . . impede or destroy navigable capacity."[31]

Surrender of Jurisdiction

Several courts have added nuance to the principle of indelible navigability, specifically by introducing the concept of surrender of jurisdiction. The Third Circuit introduced the concept of surrender of jurisdiction in the case of *United States v. Stoeco Homes, Inc.*, which concerned the jurisdictional status of a parcel of land that had previously been a salt marsh subject to the ebb and flow of the tide, some areas of which had been filled to form fast land several decades earlier.[32] At the time the land at issue in *Stoeco* was filled, it was behind established harbor lines and it was Corps policy not to require any RHA permits for filling shoreward of established bulkhead lines.[33] The question before the court in *Stoeco* was whether blanket permission to fill behind established bulkhead lines could lead to the

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[29] If there was any obstruction of navigation, the Corps could protect the navigable capacity of the waters by invoking subsection (f) of the 1940 permit.

[30] *Froehlke*, 578 F.2d at 753.

[31] "A determination of navigability, once made, applies laterally over the entire surface of the water body, and is not extinguished by later actions or events which may impede or destroy navigable capacity." 33 C.F.R. § 329.4. The rule is expanded upon in sections 329.9 and 329.13 of the regulations: "an area will remain 'navigable in law,' even though no longer covered with water, whenever the change has occurred suddenly, or was caused by artificial forces intended to produce that change." 33 C.F.R. § 329.13.

[32] *U.S. v. Stoeco Homes, Inc,.* 498 F.2d 597, 600 (3rd Cir. 1974).

[33] *Id.* at 602-603.

permanent loss of RHA jurisdiction if the land was "improved" while the permission was in effect.[34] The Third Circuit looked at the statutory language and found:

> Section 10 by its plain language contemplates congressional consent to some encroachments on the navigational servitude, and delegates to the Army Corps of Engineers and the Secretary of the Army authority to grant such consent on its behalf. If the administrative agency gives an express consent by permit in a specific instance, with no reservation of the right to compel removal, surely that consent must be considered to be a surrender of the federal servitude over the fee in question.[35]

In *Stoeco*, the "improved" land was made fast by filling "substantially above mean high tide,"[36] and the court expressly limited the holding finding surrender "to tidal marshlands which had become fast land" during the time that the filling of those waters was permitted without restriction or reservation.[37] However, the fact that the improvement that resulted in a finding of surrender in this case was making the land fast does not mean that this is the only way a surrender could occur through improvement or modification of jurisdictional waters.

In *Froehlke*, the Ninth Circuit suggested that the concept of surrender could apply in the San Francisco Bay, as well. In evaluating the scope of RHA and CWA jurisdiction over salt plants within the Bay, the Ninth Circuit held that "in tidal areas, 'navigable waters of the United States,' as used in the Rivers and Harbors Act, extend to all places covered by the ebb and flow of the tide to the mean high water (MHW) mark in its unobstructed, natural state."[38] However, the court continued:

> Our holding that the MHW line is to be fixed in accordance with its natural, unobstructed state is dictated by the principle recognized in *Willink*, supra, that one who develops areas below the MHW line does so at his peril. We recognize that under this holding issues of whether the Government's power may be surrendered or its exercise estopped, and if so, under what circumstances and to what extent, may arise. Leslie, for example, may contend that there has been a surrender by the Corps of its

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[34] The three-part inquiry that the Third Circuit made to determine whether RHA jurisdiction was surrendered in *Stoeco* included "whether Congress intended that §10 was intended [sic] to have continuing application to *improved* land formerly within the navigable waters of the United States." *Stoeco*, 498 F.2d at 608 (emphasis added). "Improve" is defined by Webster's as, inter alia, "to augment or enhance in value or good quality; to make more profitable, excellent, or desirable;" and "to enhance in value by bringing under cultivation or reclaiming for agriculture or stock raising." *Webster's New International Dictionary of the English Language*, Second Edition, Unabridged, 1939.

[35] *Stoeco*, 498 F.2d at 610.

[36] *Id.* at 600.

[37] *Id.* at 611.

[38] *Froehlke*, 578 F.2d at 754.

> power under the Rivers and Harbors Act with respect to certain land below the MHW line.[39]

The court also observed that "at this time it is not necessary for us to pass on issues such as were before the court in *Stoeco*."[40] Thus, the Ninth Circuit recognized that it may be possible that the United States could surrender jurisdiction, but the court did not rule on this point.

Surrender Applied to the Redwood City Salt Plant

In the case of the Redwood City salt plant, separate surrender analyses are necessary for the two parcels described above because of their distinctive histories.

The western portion of the site (parcel 1, shown in green on the attached map) was already improved for salt-making purposes at the time the January 16, 1940, War Department permit was issued. The map accompanying the 1940 War Department permit shows this parcel as "Salt Evaporating Ponds" and "Reclaimed Marsh," and identifies the location of the existing levee surrounding those areas.[41] There is no evidence that the Corps ever asserted jurisdiction over this area or the construction of the levees on this parcel.[42] Given the acquiescence of the Corps to the improvement of the western portion of the site prior to 1940, either the property was never subject to RHA jurisdiction or RHA jurisdiction has been surrendered.[43]

The analysis is different for the eastern portion of the site (parcel 2, shown in red on the attached map), which was leveed off from the San Francisco Bay pursuant to the 1940 War Department permit. Here, the question of whether the Corps retains RHA jurisdiction over formerly tidal waters is principally informed by the terms of the permit. The permit authorized the Stauffer Chemical Company, Cargill's predecessor in interest, to:

> construct an earth dyke or levee across and along the bank of First Slough, and along the banks of Westpoint Slough and an unnamed tributary thereof, in Westpoint Slough at about 1.0 mile southeasterly of the mouth of Redwood Creek, San Mateo County,

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[39] *Id.* at 753.

[40] *Id.*

[41] Aerial photographs submitted by the applicant show the levees depicted on the 1940 permit existed in the same configuration in 1930. See Attachment C to Exhibit 7 of the Redwood City Salt Plant Approved Jurisdictional Determination Submission (May 30, 2012).

[42] This is consistent with the Corps practice immediately following the passage of the RHA of only regulating areas and activities that would have a relatively direct impact on the navigable capacity of navigable waters. See *Stoeco*, 498 F.2d at 606.

[43] *Stoeco* holds that the "long-standing administrative practice" not to require explicit or specific permission to fill behind harbor lines prior to 1970 was sufficient consent to surrender the navigation servitude. Similarly, the administrative practice of only regulating activities that would have a relatively direct impact on the navigable capacity of waters at the turn of the last century may also be sufficient to surrender the navigation servitude where navigable waters were filled or otherwise developed with the acquiescence of the Federal government during that period.

> California, in accordance with the plans shown on the drawing attached hereto marked "Proposed Dam and Levee East of Redwood Cr., San Mateo County, California, Application by Stauffer Chemical Co., Dated Dec. 1939."[44]

The permit also contains a number of conditions that are designed to protect the navigable capacity of the named waters. It is accompanied by a map (Sheet 2) and a diagram (Sheet 1), which depicts certain features of the site and elevation data. Reading these documents together, it is clear that the Army was exercising its jurisdiction under the RHA when it sought to regulate the construction of these improvements under the permit.

The permit also contains an express reservation that allows the United States to force the removal of any of the permitted work:

> That if future operations by the United States require an alteration in the position of the structure or work herein authorized, or if, in the opinion of the Secretary of War, it shall cause unreasonable obstruction to the free navigation of said water, the owner will be required, upon due notice from the Secretary of War, to remove or alter the structural work or obstruction caused thereby without expense to the United States, so as to render navigation reasonably free, easy, and unobstructed.[45]

This condition would seem to be exactly the type of "reservation of the right to compel removal" that the Third Circuit indicated could prevent surrender of jurisdiction.[46] While this reservation has limitations regarding when the Corps can order removal of permitted fill, the fact that there is *any* reservation is sufficient to put the landowner on notice that "one who develops areas below MHW does so at his own peril"[47] and thus prevents a surrender of jurisdiction. Because there is no surrender, the areas previously below the MHW mark continue to be regulated under the RHA.

On this basis, surrender has not been triggered and the rule of indelible navigability applies to the eastern portion of the site. Accordingly, any areas that were RHA jurisdictional waters when the levees were permitted in 1940 are still jurisdictional under the RHA.

Determining the Extent of RHA Jurisdiction

With these legal rules in mind, the San Francisco District should expeditiously finalize the jurisdictional determination for the Redwood City salt plant site. Consistent with the

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[44] War Department Permit issued to Stauffer Chemical Company, January 16, 1940.

[45] Condition (f) of the January 16, 1940 War Department permit.

[46] See *Stoeco*, 498 F.2d at 610.

[47] *Froelke*, 578 F.2d at 753

foregoing discussion, the determination should include different findings for the two parcels comprising the site.

For the western portion of the site (parcel 1, highlighted in green on the attached map), RHA jurisdiction does not attach. There is no evidence that the Army ever asserted jurisdiction over this area or the construction that took place on this parcel. Either the property was never subject to RHA jurisdiction or RHA jurisdiction has been surrendered. No further analysis is required for this parcel.

For the eastern portion of the site (parcel 2, highlighted in red on the attached map), which is bordered by the levees that were authorized by the 1940 permit and which includes the area behind the dyke on First Slough, jurisdiction has not been surrendered and is retained by the rule of indelible navigability. For this area, the scope of RHA jurisdiction was fixed at the time the levees were constructed. Accordingly, the District must determine what areas of the parcel, if any, were below the MHW mark at the time the levees were constructed.

In making this determination, the District must take into account the information contained in the 1940 permit and accompanying attachments. These documents reflect the understanding of the parties at the time the permit was issued and should be accepted as the best available evidence of the locations of the features of the site, the elevations of the levees and dyke to be constructed, and the resources warranting protection. The permit identifies three of the more substantial features, First Slough, Westpoint Slough, and an unnamed tributary thereof, in specifying the location of the levees to be constructed.[48] The terms of the permit indicate that these were the waters that the terms and conditions were intended to protect. The diagram accompanying the permit (Sheet 1) shows that the base of the dyke that was constructed across First Slough was below the MHW mark. It also shows that the other levees on the site were to be constructed on marshlands at locations near the above named waters at elevations generally equal to the mean higher high water mark, which is above the MHW mark. The marshlands appear to be identified by horizontal lines shading specific areas of the map. Finally, the map (Sheet 2) also shows the levees crossing three smaller sloughs. These smaller sloughs are not specifically identified in the permit. The permit and its accompanying documents are silent on the elevations of these sloughs and on whether the Army intended to extend RHA protection to them.

In finalizing its jurisdictional determination for this parcel, the District may also consider other existing historical information that supplements the information contained in the permit and its accompanying documents to ensure a full and accurate understanding of the site. However, the District has the burden of substantiating the location of any tidal waters that

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[48] War Department Permit issued to Stauffer Chemical Company, January 16, 1940.

were below the MHW mark at the time the levees were constructed to assert RHA jurisdiction over those areas. The information and representations in the permit should receive deference unless there is convincing evidence that the other historical materials provide a more accurate representation of the site at the time the levees were constructed.

Clean Water Act

Overview

The geographic extent of CWA jurisdiction is a distinct question from RHA jurisdiction.[49] The geographic extent of CWA jurisdiction is generally greater than that under the RHA; however, that is not always the case.[50] Because of the different goals of the statutes and as a consequence of the rule of indelible navigability, some areas that are no longer covered by "waters" may be subject to RHA jurisdiction but not CWA jurisdiction. There is no comparable rule of indelible jurisdiction for the CWA.[51] The following discussion analyzes the CWA and implementing regulations in light of relevant legal precedent to determine whether the site of the Redwood City salt plant is subject to CWA jurisdiction. It concludes that the liquid pickle and bittern on the site is not "water" and that therefore these liquids are not subject to CWA jurisdiction. It examines the Ninth Circuit's basis for finding CWA jurisdiction over other Bay-area salt plant sites in *Froehlke*, and explains why that decision is not applicable to the Redwood City site.

Factual Setting

The factual setting set forth at the beginning of this document is relevant to the discussion of CWA jurisdiction over the site. However, there are some details that are particularly relevant to CWA jurisdiction that merit mention here. Specifically, the entire site is controlled by Cargill, and other parties cannot access the site without Cargill's permission. The entire Redwood City site had been converted into its current configuration by 1951, before passage of the CWA in 1972, and has operated as an industrial salt-making facility since that time.[52] That conversion required significant manipulation of the immediate geography. The

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[49] See *Milner*, 583 F.3d at 1194 ("the scope of the Corps' regulatory authority under the CWA and RHA is not the same").

[50] See *U.S. v. Riverside Bayview Homes, Inc.*, 474 US 121, 133 (1985) ("Congress evidently intended to repudiate limits that had been placed on federal regulation by earlier water pollution control statutes and to exercise its powers under the Commerce Clause to regulate at least some waters that would not be deemed "navigable" under the classical understanding of that term.").

[51] Environmental Protection Agency, *Guidelines for Specification of Disposal Sites for Dredged or Fill Material*, 45 Fed. Reg. 85,336, 85,340 (Dec. 24, 1980) ("When a portion of the Waters of the United States has been legally converted to fast land by a discharge of dredged or fill material, it does not remain waters of the United States subject to section 301(a). The discharge may be legal because it was authorized by a permit or because it was made before there was a permit requirement.").

[52] Redwood City Salt Plant Approved Jurisdictional Determination Submission (May 30, 2012) Attachment B. p. 9.

site is partitioned into various cells by a network of levees that also serve as roads and building pads.[53] Most of the cells are used to contain the liquids that are used to produce salt or that are a by-product of the salt making process. The process on this site begins when pickle is pumped from facilities at other locations after several years of processing. That liquid is then moved through a succession of cells at the Redwood City site before the salt is precipitated out of suspension in the crystallizer cells.[54] Once the salt precipitates out of solution, the remaining liquid, bittern, is moved into other cells to be recycled back into the process or sold for other uses.[55] The content of the cells is controlled by the operator of the site and all cells can be entirely drained.[56] For the solar evaporation process to work and increase the concentration of the pickle, the containment cells must be hydrologically separated from the neighboring Bay waters.[57] Any discharge of the pickle or bittern into CWA jurisdictional waters would require a CWA permit.[58]

CWA Statutory Scheme

Congress enacted the CWA to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters."[59] The statute makes "the discharge of any pollutant by any person [into the waters of the United States] . . . unlawful" unless such discharge is permitted under Section 402 or 404 of the Act.[60] The U.S. Environmental Protection Agency (EPA) administers the Section 402 program through the National Pollution Discharge Elimination System (NPDES) to regulate all pollutants except for dredged material and fill material.[61] As part of the NPDES program, EPA establishes effluent limitations guidelines that set pollution control standards for specific pollutants or classes of pollutants. Any discharge of pollutants with effluent limitations requires a permit and must meet those guidelines to comply with the CWA. The U.S. Army Corps of Engineer administers the Section 404 program to regulate the discharge of dredged material and fill material.[62]

The geographic scope of CWA jurisdiction is defined in statute as "navigable waters" and the "contiguous zone or the ocean."[63] "Navigable waters" is further defined by the statute to

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[53] *Id.* at 4.
[54] *Id.* at 3-4.
[55] *Id.*
[56] *Id.*
[57] *Id.* at 8.
[58] *Id.* at 25 n.49. See also 40 C.F.R. § 415.160 et seq.
[59] 33 U.S.C. § 1251.
[60] 33 U.S.C. § 1311. See also 33 U.S.C. § 1362(7) and (12) defining "navigable waters" and "discharge of a pollutant" respectively.
[61] 33 U.S.C. § 1342.
[62] 33 U.S.C. § 1344.
[63] 33 U.S.C. § 1362.

mean "the waters of the United States, including the territorial seas."[64] The structure of the statute makes it clear that the CWA was intended to protect more than just the "traditional navigable waters" that are jurisdictional under the RHA.[65] Congress meant for the definition of the term "navigable waters" to "be given the broadest constitutional interpretation"[66] because "[w]ater moves in hydrologic cycles and it is essential that discharge of pollutants be controlled at the source."[67] However, recent Supreme Court opinions have held that the term "navigable" cannot be read out of the statute when interpreting the jurisdictional scope of the CWA.[68] Thus, Corps permits are required for discharges of dredged material or fill material into "navigable waters" defined as "waters of the United States."

Regulations Implementing the CWA

The agencies charged with implementing the CWA, the EPA and the Corps, define "waters of the United States" by regulation to reach beyond "navigable waters" as that term was traditionally used to protect "all waters that together form the entire aquatic system."[69] While the regulatory definition of jurisdictional "waters of the United States" is broad, it does not cover everything that is wet.[70] Indeed, the Supreme Court has recognized that certain types of waters are not jurisdictional,[71] as has the Ninth Circuit.[72] EPA and Corps regulations set forth seven generally defined types of water bodies that are jurisdictional "waters of the United States:"

> (1) All waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;
> (2) All interstate waters including interstate wetlands;
> (3) All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa

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[64] 33 U.S.C. § 1362(7).

[65] *Rapanos v. U.S.*, 547 U.S. 715, 731 (SCALIA, majority), 767-68 (KENNEDY, concurring) (2009).

[66] 42 Fed.Reg. 37122, 37127 (July 19, 1977) (quoting H.R. Report No. 92-1465 at 144).

[67] S.Rep. No. 92-414, 1972 U.S.C.C.A.N 3668, 3742 (1972).

[68] *Rapanos*, 547 U.S. at 731 (SCALIA, majority), 779 (KENNEDY, concurring).

[69] *U.S. v. Riverside Bayview Homes,* 474 US at 133 (quoting the preamble to the rulemaking establishing the regulations defining the geographic scope of CWA jurisdiction, 42 Fed.Reg. 37128 (1977)); see also 33 C.F.R. Part 328.

[70] For example, "non-tidal drainage and irrigation ditches excavated on dry land." 51 Fed. Reg. 41206, 41217 (Nov. 13, 1986).

[71] See *Rapanos*, 547 U.S. 715; *Solid Waste Agency of Northern Cook County v. USACE*, 531 U.S. 159 (2001) (hereinafter "*SWANCC*").

[72] See *San Francisco Baykeeper v. Cargill Salt Division*, 481 F.3d 700 (9th Cir. 2007) (holding that a pond alleged to be jurisdictional was not a "water of the United States" because "mere adjacency provides a basis for CWA coverage only when the relevant waterbody is a 'wetland,' and no other reason for CWA coverage of Cargill's pond is supported by evidence").

> lakes, or natural ponds, the use, degradation or destruction of which could affect interstate or foreign commerce including any such waters:
> (i) Which are or could be used by interstate or foreign travelers for recreational or other purposes; or
> (ii) From which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or
> (iii) Which are used or could be used for industrial purpose by industries in interstate commerce;
> (4) All impoundments of waters otherwise defined as waters of the United States under the definition;
> (5) Tributaries of waters identified in paragraphs (a) (1) through (4) of this section;
> (6) The territorial seas;
> (7) Wetlands adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs (a)(1) through (6) of this section.[73]

Any water that does not fall within one of those defined types of water is not jurisdictional under the CWA. Additionally, even if a water falls within one of the seven defined types, jurisdiction will not attach if it is one of two categories of water explicitly excluded from jurisdiction by the regulations:

> (8) Waters of the United States do not include prior converted cropland. Notwithstanding the determination of an area's status as prior converted cropland by any other Federal agency, for the purposes of the Clean Water Act, the final authority regarding Clean Water Act jurisdiction remains with EPA.
>
> Waste treatment systems, including treatment ponds or lagoons designed to meet the requirements of CWA (other than cooling ponds as defined in 40 CFR 423.11(m) which also meet the criteria of this definition) are not waters of the United States.[74]

Corps districts must determine if a water falls within one of the seven categories of jurisdictional water. If a district determines that the water does not fall within one of these seven categories or that it is one of the explicitly excluded types, then the water is not jurisdictional.

In reviewing this list of "waters of the United States," it is evident on first impression that the liquids on the Redwood City site do not fall clearly into any of the seven categories. The site has been highly altered to facilitate the salt manufacturing process. This alteration of the site and a century of industrial salt making have eliminated any trace of the prior marshland

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[73] 33 C.F.R. § 328.3(a).
[74] 33 C.F.R. § 328.3(a).

or wetland character of the site. The liquids on the site are intentionally hydrologically separated from the Bay and are not subject to the ebb and flow of the tide. While the liquids on the site originated as water from the Bay, they have been subjected to years of carefully managed processing that has rendered the liquids legally and chemically distinguishable from the water in the Bay. These liquids are wholly within the boundaries of the State of California and are not navigated in interstate commerce, or a part of the territorial seas. Likewise, the liquids are not impoundments of waters otherwise defined as waters of the United States.

These facts suggest that the liquids on the Redwood City site do not fall in any of the seven categories of "waters of the United States" as set forth in the regulations. However, several recent Supreme Court decisions have made the task of determining CWA jurisdiction more complicated than simply applying the regulations. The Court has twice found that the Corps' interpretation and application of the regulatory definition of "waters of the United States" exceeded the scope of jurisdiction provided by the CWA statute. Therefore, the Corps must apply both the regulatory definition of the scope of jurisdiction and the standards for jurisdiction established by the Supreme Court. A water must be determined to be jurisdictional under the regulations *and* the standards established by the Supreme Court for the CWA to apply.

CWA Applies Prospectively

The Supreme Court has "long declined to give retroactive effect to statutes burdening private rights unless Congress had made clear its intent."[75] This presumption holds true for the CWA. The CWA is intended "to regulate discharges of dredged or fill material into the aquatic system as it exists, and not as it may have existed over a record period of time."[76] This was recently confirmed by the Ninth Circuit in *Milner*:

> if land was dry upland at the time the CWA was enacted, it will not be considered part of the waters of the United States unless the waters actually overtake the land, even if it at one point had been submerged before the CWA was enacted or if there have been subsequent lawful improvements to the land in its dry state.[77]

Thus, areas that were lawfully filled, either before the passage of the CWA or pursuant to a CWA permit, are no longer subject to CWA jurisdiction.[78] The fact that the majority of the area

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[75] *Landgraf v. USI Film Products*, 511 U.S. 244, 270 (1994).

[76] 42 Fed. Reg. 37122, 37128 (July 19, 1977).

[77] *Milner*, 583 F.3d at 1195.

[78] Environmental Protection Agency, *Guidelines for Specification of Disposal Sites for Dredged or Fill Material*, 45 Fed. Reg. 85,336, 85,340 (Dec. 24, 1980) ("When a portion of the Waters of the United States has been legally converted to fast land by a discharge of dredged or fill material, it does not remain waters of the United States

within the Redwood City site was improved in a manner that did not necessarily raise the elevation above that of the MHW does not make this principal any less applicable. A CWA jurisdictional determination must be based on the site conditions today and not some prior site condition that no longer exists.[79]

Supreme Court Holdings on CWA Jurisdiction

The Supreme Court has twice found that the Corps' application of the regulations defining the jurisdictional scope of the CWA exceeded the statutory authority.[80] The Court expressed concern over the Corps' broad interpretation and application of the term "waters of the United States" in both cases. Indeed, the Supreme Court observed that in drafting those regulations, the agencies "deliberately sought to extend the definition of 'the waters of the United States' to the outer limits of Congress's commerce power."[81] The Supreme Court held "that 'the waters of the United States' in § 1362(7) cannot bear the expansive meaning that the Corps would give it"[82] and is "not 'based on a permissible construction of the statute.'"[83] In the most recent of those cases, *Rapanos,* the Supreme Court set out two alternative standards for determining CWA jurisdiction. As a result, the Corps must ensure that any assertion of CWA jurisdiction is consistent with the regulations *and* at least one of the two alternative standards established in the *Rapanos* decision.

The two alternative standards for determining what is jurisdictional under the CWA exist because Supreme Court's decision in *Rapanos* was issued without a majority opinion. Three Justices joined in the plurality opinion that Justice Scalia authored, which had arguably the narrower standard for what is jurisdictional under the CWA. Justice Kennedy concurred in the judgment but wrote his own opinion setting forth a different legal standard than that of the plurality. Four justices dissented and would have held that a far more inclusive standard applied. In such cases, controlling legal principles may be derived from those principles espoused by five or more justices.[84] Therefore, there is CWA jurisdiction when the plurality's standard, authored by Justice Scalia, is satisfied, or when the standard in Justice Kennedy's

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subject to section 301(a). The discharge may be legal because it was authorized by a permit or because it was made before there was a permit requirement.").

[79] See *Milner*, 583 F.3d at 1195;

[80] *Rapanos*, 547 U.S. 715; *SWANCC*, 531 U.S. 159.

[81] *Rapanos*, 547 U.S. at 724 (SCALIA, plurality).

[82] *Id.* at 731-32 (SCALIA, plurality), 778-79 (KENNEDY, concurring).

[83] *Id.* at 739 (SCALIA, plurality).

[84] See *Marks v. United States*, 430 U.S. 188, 193-94 (1977); *Waters v. Churchill*, 511 U.S. 661, 685 (1994) (Souter, J., concurring) (analyzing the points of agreement between plurality, concurring, and dissenting opinions to identify the legal "test ... that lower courts should apply," under *Marks*, as the holding of the Court); cf. *League of United Latin American Citizens v. Perry*, 126 S. Ct. 2594, 2607 (2006) (analyzing concurring and dissenting opinions in a prior case to identify a legal conclusion of a majority of the Court); *Alexander v. Sandoval*, 532 U.S. 275, 281-282 (2001) (same).

concurring opinion is satisfied. The plurality concluded that the agencies' regulatory authority should extend only to "relatively permanent, standing or continuously flowing bodies of water . . . connected to traditional interstate navigable waters," and to "wetlands with a continuous surface connection to" such relatively permanent waters.[85] Justice Kennedy held that "to constitute 'navigable waters' under the Act, a water or wetland must possess a 'significant nexus' to waters that are or were navigable in fact or that could reasonably be so made."[86]

Supreme Court on CWA Jurisdiction and What Constitutes "Waters"

Applying the standards for CWA jurisdiction set forth by the Supreme Court to the Redwood City site will be more instructive than applying the regulations to determine if the liquids located there are jurisdictional. This is because the liquids at the site raise a fundamental question: what kinds of liquids constitute "water" as that term would be understood by a majority of the Supreme Court?

In the Supreme Court's most recent decision regarding CWA jurisdiction, *Rapanos*, the plurality opinion emphasized that "the CWA authorizes federal jurisdiction only over 'waters.'"[87] The opinion analyzes the meaning of the statutory definition of "navigable waters," which is "the waters of the United States," to determine if the agencies' interpretation and application of that term is consistent with the authority conferred by the statute. The analysis includes an extensive dissection of the definition of "water" from the second edition of Webster's New International Dictionary because the term "water" is not defined in statute or regulation. The plurality concludes that the term can only mean "relatively permanent, standing or flowing bodies of water."[88] The plurality opinion cites to this definition to require a more limited scope of CWA jurisdiction than the agencies' interpretation, which allowed for CWA jurisdiction over certain intermittent and ephemeral waters. The plurality demanded that the scope of CWA jurisdiction "accord[] with the commonsense understanding of the term [water]."[89] The concurring opinion in *Rapanos* also looks at the same dictionary definition, but does so to show that an understanding of the term "waters" that is broader than the majority's also accords with the dictionary and common sense.[90] Justice Kennedy does not reject the principle that the definition of "water" needs to accord with the commonsense understanding, but rather he believes that a broader interpretation of the term is possible within such a commonsense understanding. The *Rapanos* decision shows that the Supreme Court will closely

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[85] *Rapanos*, 547 U.S. at 739, 742 (SCALIA, plurality).

[86] *Id.* at 759 (KENNEDY, concurring). Chief Justice Roberts wrote a separate concurring opinion explaining his agreement with the plurality. See 547 U.S. at 757-759.

[87] *Rapanos*, 547 U.S. at 731.

[88] *Id.* at 732.

[89] *Id.* at 733.

[90] *Id.* at 770.

examine regulatory interpretations of the scope of CWA jurisdiction, and that while interpretations of language may differ, the Supreme Court will likely demand that any interpretation of "waters of the United States" be consistent with commonly accepted understandings of terms such as "water."

Applying this analysis to the Redwood City site, the Corps must determine whether the liquids on the site are "water" as a majority of the Supreme Court understands that term. The *Rapanos* decision is instructive on the type and method of inquiry involved, but the specific analysis in *Rapanos* is not relevant to the issue at hand because the discussion in that case contrasted geographic features that were regularly covered with water with features that were normally dry or only occasionally covered with water. It did not address what kinds of liquids qualify as "water." Therefore, we are left to apply the analytical rubric from *Rapanos* to this slightly different question regarding the meaning of the term "water."

Looking at the definition of "water" in the second edition of Webster's New International Dictionary, the same definition relied on by Justice Scalia in the plurality opinion in *Rapanos*, one finds that the first two definitions of "water" refer to the naturally occurring substance that (1.a.) "descends from the clouds in rain," (1.b.) the "substance having the composition H_2O," or (2) "liquid substance occurring not chemically combined, in any of various quantities, states or aspects" . . . (2.a.) "[a]s derived from natural sources" or (2.b.) "[a]s found in streams and bodies forming geographical features such as oceans, rivers, lakes."[91] Only the third definition includes "liquid containing or resembling or of the fluidity and appearance of water" or a "liquid prepared with water, as by solution."[92] Tellingly, this later meaning of the term is defined by contrasting the liquid with "water," meaning that identifying such liquids as "water" is more attenuated and less "commonsense" than those described in the first two definitions.

Applying the *Rapanos* plurality's method of analysis, the "commonsense understanding" of "water" would include relatively naturally occurring forms of H_2O such as those found in "rivers, lakes, and seas." This doesn't mean that only pure water, or pure sea water, is regulated under the CWA. After all, the Cuyahoga River was not a pure, unadulterated water when it caught fire in 1969. That event is widely regarded as "one of a handful of disasters that led to . . . the passage of the Clean Water Act."[93] So, it can be assumed that natural, but contaminated or adulterated, water bodies like the Cuyahoga in 1969 are among the types of

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[91] *Webster's New International Dictionary* 2882 (2nd ed. 1954) (hereinafter "Webster's Second").

[92] *Id.*

[93] Christopher Maag, *From the Ashes of '69, a River Reborn*, N.Y. Times, June 21, 2009, http://www.nytimes.com/2009/06/21/us/21river.html; see also *Rapanos*, 547 U.S. at 809 (STEVENS, dissent) ("Congress passed the Clean Water act in response to widespread recognition – based on events like the 1969 burning of the Cuyahoga River in Cleveland – that our waters had become appallingly polluted.").

waters that Congress intended to cover under the CWA. However, the liquids on the Redwood City site are a different sort. Those liquids are not within a natural water body; they are contained within an intentionally engineered industrial complex. The composition of the liquids is not a consequence of the discharge of pollutants or the disposal of wastes, but a consequence of a purposeful industrial process to create a product. And, unlike the Cuyahoga River, there are no potential users of the liquids at the Redwood City site other than the site owner that could be impacted by their composition.[94]

The commonsense understanding of the term "water," and one that accords with the definition of "water" in Webster's Second, does not include the pickle or bittern on the Redwood City site, which are products of an industrial process. Other than being in an aqueous form and being originally derived from Bay waters, the liquids on the Redwood City site are more commonly understood to be a chemical used in, or a byproduct of, an industrial process. Additionally, these liquids are regulated as a pollutant under Subpart P (Sodium Chloride Production Subcategory) of the CWA.[95] Thus, these liquids should be treated as an industrial product and not as "water," which is consistent with how EPA has classified this substance in its regulations and which means that they should not be treated as a jurisdictional water under the CWA.

Applicability of the CWA to the Redwood City Site

In sum, the pickle and bittern liquids at the Redwood City site are an industrial product regulated as a pollutant under the CWA; the site is not part of the aquatic system; and any discharge of the liquids to waters of the United States would require a CWA permit. Given these facts and the purposes the CWA is intended to serve, the pickle and bittern liquids at the site are *not* "water" potentially subject to jurisdiction under the CWA.

Leslie Salt Co. v. Froehlke

The *Froehlke* decision was discussed extensively in the section above on RHA jurisdiction, but it bears mentioning again here because that case addressed the jurisdictional status of Bay area salt ponds under the CWA as well as the RHA. In *Froehlke*, the Ninth Circuit

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[94] This is similar to waste treatment systems, which are categorically excluded from CWA jurisdiction in the regulatory definition of "waters of the United States" because they are not susceptible to being used by entities operating in interstate commerce other than the entity that controls the waste treatment system. The rationale behind this is that the agencies were concerned with regulating water pollution that has the potential to affect entities operating in interstate commerce, rather than regulating the use of waters in interstate commerce if that use had no potential to affect other users in interstate commerce. See EPA, Decision of the General Counsel, *NPDES Permits*, Opinion No. 73 (Dec 15, 1978); *National Pollutant Discharge Elimination System; Revision of Regulations, Final Rule*, 44 Fed.Reg. 32854, 32858 (June 7, 1979). See also, EPA, *A Collection of Legal Opinions*, Vol. 1 at 295.

[95] 40 C.F.R. § 415.160 et seq.

corrected the district court's holding that CWA jurisdiction was "coterminous" with RHA jurisdiction and that both were determined by identifying the "former line of MHHW of the bay in its unobstructed, natural state."[96] The Ninth Circuit made it clear that instead of being "coterminous" with RHA jurisdiction, CWA jurisdiction was generally broader than RHA jurisdiction.[97] The Ninth Circuit also addressed the question of "whether the Corps' jurisdiction covers waters which are no longer subject to tidal inundation because of man-made obstructions such as Leslie's dikes," which the court viewed as the central issue under review in that case.[98] In addressing this question, the court relied on the finding that the liquid behind the levees was the same as the water in the San Francisco Bay.[99] The court also noted that Leslie used the salt ponds to manufacture a product that is sold in interstate commerce as a basis for regulating them under the CWA.[100] On those grounds, the Ninth Circuit held that "the Corps's jurisdiction under the FWPCA [CWA] extends at least to waters which are no longer subject to tidal inundation because of Leslie's dikes without regard to the location of historic tidal water lines in their unobstructed, natural state."[101]

In sum, the *Froehlke* finding that CWA jurisdiction could extend to waters behind levees was based on two premises: first, that the liquid behind the levees was the "same" as the water in the Bay and equally worthy of protection from pollution; and second, that the end product that was extracted from the impounded water was sold in interstate commerce and therefore within the constitutional limits of the Commerce Clause. However, in the intervening 35 years since the *Froehlke* decision, there have been a number of Supreme Court cases that bear upon the continued validity of these premises and the Ninth Circuit's finding based upon them.

Frohlke: "Water" Behind Levees has a Status Equal to Water in the Bay

The Ninth Circuit's premise for affirming CWA jurisdiction in the *Froehlke* case, which is that the liquid behind the levees confining the Bay area salt plants was the "same" water as in the Bay, has been brought into doubt by intervening Supreme Court decisions, at least with respect to the liquids at the Redwood City site. As discussed above, by the time liquids are transferred to the Redwood City site, they have been processed for at least four years, resulting

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[96] *Froehlke*, 578 F.2d at 753.

[97] *Id.* at 754-55.

[98] *Id.* at 754.

[99] *Id.* at 755 ("We see no reason to suggest that the United States may protect these waters from pollution while they are outside of Leslie's tide gates, but may no longer do so once they have passed through these gates into Leslie's ponds.").

[100] *Id.* ("Moreover, there can be no question that activities within Leslie's salt ponds affect interstate commerce, since Leslie is a major supplier of salt for industrial, agricultural, and domestic use in the western United States. Much of the salt which Leslie harvests from the Bay's waters at the rate of about one million tons annually enters interstate and foreign commerce.").

[101] *Id.* at 756.

in a significantly higher salinity than the Bay water; they have been hydrologically severed from the larger aquatic system; and they are regulated as pollutants under the CWA. The liquids at the Redwood City site are therefore chemically distinguishable, ecologically distinguishable, and legally distinguishable from the Bay waters. They are no longer the type of resource the CWA was intended to protect. The liquids at the Redwood City site are more commonly understood to be a chemical used in, or a byproduct of, an industrial process rather than "water."

Given what recent Supreme Court precedents reveal about the scope of CWA jurisdiction, we cannot reasonably expect to regulate as "water" liquids that have been managed as part of a closed-system industrial solar evaporation process for a period of several years or more and that are regulated as a pollutant under the CWA. Therefore, the Corps should not assert CWA jurisdiction over the industrial process (pickle and bittern) liquids at the Redwood City site.

Frohlke: Interstate Commerce Connection

Because the industrial process liquids at the Redwood City site are not "water" for the purposes of CWA jurisdiction, the question of whether there is an interstate commerce connection with the liquids on the site is no longer relevant. Even with an appropriate interstate commerce connection to the liquids at the site, those liquids must be "water" for CWA jurisdiction to attach. Moreover, the Supreme Court's recent decisions requiring that "the word 'navigable' in the Act must be given some effect" or "significance" when interpreting the jurisdictional scope of the CWA suggest that the type of interstate commerce connection identified by the Ninth Circuit in *Frohlke* is not the type of interstate commerce connection required to establish CWA jurisdiction.[102]

The specific interstate commerce connection the Ninth Circuit cited in *Froelke* was that "Leslie is a major supplier of salt for industrial, agricultural, and domestic use in the western United States."[103] This interstate commerce connection does not give any significance to the word 'navigable' in the Act.[104] After the Supreme Court's decisions in *SWANCC* and *Rapanos*,

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[102] *Rapanos*, 547 U.S. at 731 (SCALIA, majority), 779 (KENNEDY, concurring).

[103] *Froehlke*, 578 F.2d at 755.

[104] Additionally, this type of interstate commerce connection was not what was contemplated by the agencies when the CWA regulations were developed. The valid test is not whether a liquid is susceptible to use in interstate commerce by the entity that controls the liquid, but rather whether a liquid is susceptible to use in a manner that would affect interstate commerce by entities other than the entity that controls the liquid. See EPA, *A Collection of Legal Opinions*, Vol. 1 at 295; EPA, Decision of the General Counsel, *NPDES Permits*, Opinion No. 73 (Dec. 15, 1978); 44 Fed.Reg. at 32858.

the Corps should not assert CWA jurisdiction under 33 C.F.R. § 328.3(a)(3) on the basis of a connection to interstate commerce unless there is a significant nexus to navigable waters.[105]

Bases for CWA Geographic Jurisdiction

There does not appear to be any reasonable legal basis for asserting CWA jurisdiction over the Redwood City site. The liquids on the site are more commonly understood to be chemicals used in, or a byproduct of, an industrial process rather than "water." Additionally, the *Froehlke* decision's findings on CWA jurisdiction have been brought into doubt by more recent Supreme Court decisions and should not be relied on when determining CWA jurisdiction at the Redwood City site. For these reasons, the Corps should not exercise CWA jurisdiction over the highly concentrated saline liquids ("pickle") or waste product from this process ("bittern"), and no further CWA analysis is required.

As mentioned above, CWA jurisdiction is normally broader than RHA jurisdiction, but that is not always the case.[106] In some instances CWA jurisdiction is narrower, such as where the principle of indelible navigability is invoked to assert RHA jurisdiction over areas that are no longer inundated with water. Such is the case here. *Milner* holds that this difference "is explained by the RHA's concern with preventing obstructions, on the one hand, and the CWA's focus on discharges into water, on the other."[107]

Continued Coordination

The close coordination between the San Francisco District, South Pacific Division, and Headquarters staff on the correct legal principles to apply when making RHA and CWA jurisdictional determinations at the Redwood City site is appreciated. This office looks forward to continuing that coordination on the approved jurisdictional determination for the site.

Earl Stockdale

Earl H. Stockdale
Chief Counsel

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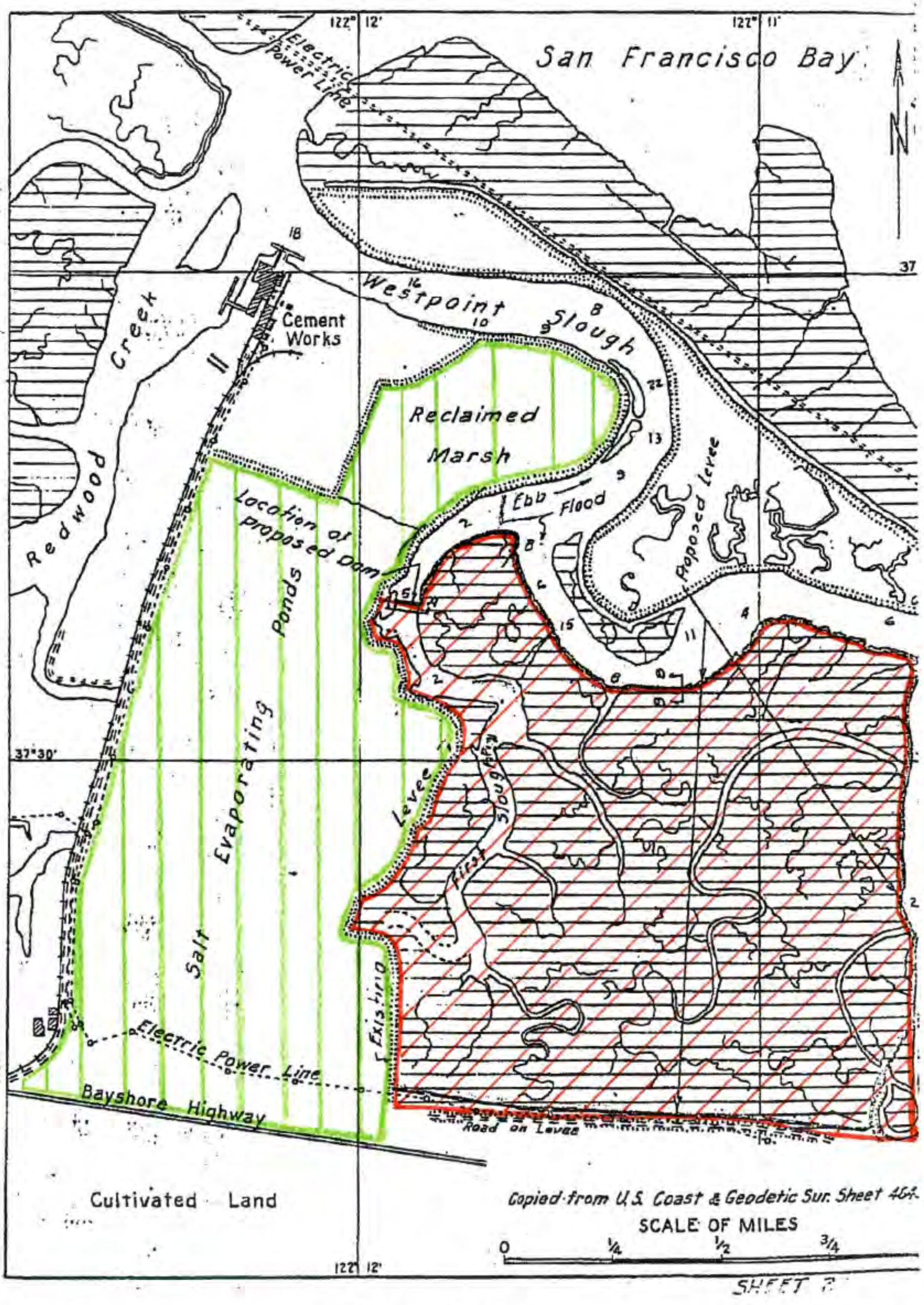
[105] The meaning of "navigable waters" as that term is used in the CWA has been ruled on by numerous courts, and more is required for a water to be a "navigable water" than just the capacity to float a boat. Waters need to be "susceptible of being used, in their ordinary condition, as highways for commerce" to be navigable-in-fact and thus a "navigable water" on the basis of their capacity to be navigated. *The Daniel Ball*, 77 U.S. 557, 563 (1870). Such susceptibility does not exist at the Redwood City site in its ordinary condition.

[106] *Milner*, 583 F.3d at 1196.

[107] *Id.*

ATTACHMENT 1



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"SHEET 2" from January 19, 1940 War Department Permit

Supplement to "Legal Principles to Guide the Approved Jurisdictional Determination for the Redwood City Salt Plant" 9 January 2014

CECC-ZA

25 March 2014

Introduction

This document supplements the 9 January 2014 memorandum titled "Legal Principles to Guide the Approved Jurisdictional Determination for the Redwood City Salt Plant" to address questions raised regarding positions taken in that document and to discuss new information and views that were subsequently provided by the Corps' San Francisco District. Specifically, this document addresses the determination of Rivers and Harbors Act of 1899 (RHA) jurisdiction over the western portion of the Redwood City salt plant site (parcel 1, shown in green on the map attached to the 9 January 2014 document). The previous writing concluded that RHA jurisdiction should not be exercised over the western portion of the site because that area was either never subject to RHA jurisdiction or because any RHA jurisdiction that arguably might have existed over that area had been surrendered.

The discussions between the Corps district, division, and headquarters personnel and a review of the additional information and recommendations provided by the San Francisco District prompted this further elaboration on the issue of surrender and RHA jurisdiction over the western parcel of the site. For the purposes of making an approved jurisdictional determination for the Redwood City site, it is unnecessary to establish a definitive, general rule on how and when surrender of RHA jurisdiction can occur in every situation and circumstance. Likewise, while there is evidence that major portions of the western parcel were never jurisdictional under RHA, it is unnecessary to trace in detail the jurisdictional status of the different areas of the site over time to determine how to proceed under the RHA. The history of permit actions for the site distinguishes the western parcel from those cases in which courts found that jurisdiction has not been surrendered and from the circumstances that were briefed in the *Cargill v. West* case in which the issue of surrender was raised but not litigated to finality with respect to another parcel of Bay-area property in the 1990s.[1]

The history specific to the western portion of the Redwood City salt plant site creates an unfavorable factual record that could form the basis for compelling arguments in any litigation brought by the landowner that either RHA jurisdiction never existed over the western portion of the site, or that any RHA jurisdiction that may have existed prior to the development of the site has been surrendered. The challenges created by the unfavorable factual record are

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[1] *Cargill v. West, et al.*, No. C-92-20756-RMW (N.D. Cal. Dec. 23, 1994) (Order Denying Defendants' Motion to Dismiss and Remanding the Case to the Corps).

Attachment 5

compounded by the lack of clarity on the legal standard regarding when there is a surrender of RHA jurisdiction. Because of these challenges, which would likely lead to an unfavorable legal precedent from the federal courts, the Corps shall decline to assert any RHA jurisdiction it arguably may have had or has over the western portion of the site.

Legal Standard for Surrender

There is scant case law on surrender of RHA jurisdiction that is pertinent to the circumstances at this site. As previously discussed, the leading case is *United States v. Stoeco Homes, Inc.* However, subsequent decisions have made clear that surrender will not be implied or be based on acquiescence, but must be in "unmistakable terms."[2] However, in the cases where surrender was found, the "unmistakable terms" that accomplished surrender were something less than an explicit statement by the government that regulatory jurisdiction or the navigation servitude was being surrendered or forfeited. There is no bright line rule that can be applied mechanically to determine if there is a surrender. Instead, the factual circumstances of any situation where surrender is a possibility should be evaluated in light of those few cases that have addressed claims that RHA jurisdiction or the navigation servitude was surrendered.[3]

Many cases that address surrender involve condemnation actions or takings claims, but there are several cases with analysis that may be relevant to claims that RHA jurisdiction has been surrendered.[4] Cases where courts have found that jurisdiction was not surrendered generally involved prior acquiescence to obstructions to navigation,[5] fill deposited by the United States in furtherance of navigation,[6] prior activities on tidal wetlands that did not destroy their wetland characteristics,[7] or disposition of fee interest in the land below the MHW mark.[8] The commonality between these cases is that the government action (or inaction) at issue in each case was taken without any statement regarding the jurisdictional status of the waters or former waters at issue, and there was no reasonable basis for expecting the property to be unhindered by the navigation servitude or RHA jurisdiction. In contrast, several cases found that RHA jurisdiction or the navigation servitude were surrendered based on some affirmative government statement regarding the status of RHA jurisdiction or the navigation servitude over the waters at issue, whether it was the formal establishment of harbor lines

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[2] *US v. Cherokee Nation of Oklahoma*, 480 U.S. 700 (1987); *Lambert v. JA Jones*, 835 F2d 1105 (5th Cir 1988).

[3] While there may be grounds for distinguishing regulatory jurisdiction under the RHA and the navigation servitude, as suggested by *Boone v. United States*, 944 F.2d 1489 (9th Cir. 1991), there does not appear to be legal consensus that RHA jurisdiction can only be extinguished through equitable estoppel and not through the surrender analysis employed by the court in *Stoeco*. *See Cargill v. West, et al.*, No. C-92-20756-RMW (N.D. Cal. Jul 12,1994)(Order on Dispositive Motions) (order applying surrender analysis to RHA jurisdiction after the U.S. argued that only equitable estoppel was applicable).

[4] The following is not intended to be an exhaustive examination of all cases addressing surrender.

[5] *U.S. v. Sasser*, 771 F.Supp 720 (D. S.C. 1991).

[6] *US v. 49.79 Acres of Land, More or Less*, 582 F.Supp 368 (D.Del. 1983).

[7] *U.S. v Ciampitti*, 583 F.Supp 483 (D. N.J. 1984).

[8] *US v. Cherokee Nation of Oklahoma*, 480 U.S. 700 (1987).

behind which fill was given blanket authorization,[9] or entering into a stipulation agreement whereby certain promises were made by the United States to a landowner to protect the landowner's interests and improvements to property over which the navigation servitude was previously asserted.[10] In both of these cases, the court also found that the landowners had a reasonable basis for believing the land was unhindered by the navigation servitude or RHA jurisdiction.

History of the Western Portion of the Redwood City Site

The western portion of the Redwood City site (parcel 1, shown in green on the map attached to the 9 January 2014 document) has a long history of development and involvement by the Corps. Specifically, the three permits discussed below provide evidence of the Corps' understanding of the condition of the western parcel. These permit actions are sufficient for the landowner to make strong arguments that most if not all of that parcel was never subject to RHA jurisdiction, or that any RHA jurisdiction that may have existed over the western parcel has been surrendered.

There is no indication that there were any permits or other authorizations required for the construction of the levees around the western portion of the Redwood City site. This is consistent with the practice at the time of only requiring permits for those activities that would have affected the navigable capacity of navigable-in-fact waters.[11] In 1940, the War Department issued a permit for the construction of levees bordering the eastern portion of the site (parcel 2, shown in red on the map attached to the 9 January 2014 document), immediately adjacent to the western parcel.[12] The 1940 permit identifies the northern portion of the western parcel as "reclaimed marsh" and the rest of the western parcel as "salt evaporating ponds," showing that the western parcel had been developed by that time and that the Corps did not require permits for that work. Admittedly, the 1940 permit request did not propose any work for the western parcel, so representation of the western parcel in that permit is less pertinent to whether there was surrender over the western parcel than the eastern parcel. However, the permit does show that the Corps was aware that the western parcel had been improved for salt-making operations and was no longer in its natural condition. Again, no permits were required for the prior work on the western parcel.

A subsequent Department of War permit issued to Leslie Salt in 1947 more squarely addressed the circumstances of the western parcel.[13] That permit authorized the dredging of material from four separate areas (two areas within Redwood Creek, one area with Westpoint Slough, and one area within a diked area to the west of the western parcel) and the "deposit

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[9] *Stoeco*, 498 F.2d 597 (3rd Cir. 1974).

[10] *U.S. v. 119.67 Acres of Land*, 663 F.2d 1328 (5th Cir. 1981).

[11] See *U.S. v. Alaska*, 503 U.S. 569, 580-81 (1992).

[12] War Department Permit issued to Stauffer Chemical Company, January 16, 1940.

[13] War Department Permit issued to Leslie Salt Company, April 26, 1947.

[of] the material removed on property belonging to the applicant *above the high water line*."[14] On the map accompanying the permit, the entire area in the western parcel previously identified in the 1940 permit as "salt evaporating ponds" is marked as "area to be filled." The logical interpretation of the language of the permit, read in conjunction with the accompanying map, is that the majority of the western parcel (that portion shown as "salt evaporating ponds" on the 1940 permit) was above the mean high water line in 1947, that is, it had been converted into fast land and was therefore not subject to RHA jurisdiction.[15] Additionally, the public notice soliciting comment on the application for the 1947 permit explicitly stated that the permit "expresses the assent of the Federal Government in so far as concerns the <u>public rights of navigation</u>," making it clear what resource impacts were of interest.[16] This permit did not address the northern-most portion of the western parcel shown as "reclaimed marsh" in the 1940 permit.

In addition, part of this northern-most portion of the western parcel (the "reclaimed marsh") was addressed in a much more recent permit action from 2002.[17] This permit was for the development of Westpoint Marina in part of the area formerly occupied by Cargill's "Pond 10" and that generally corresponds to the area shown as "reclaimed marsh" on the 1940 permit. This area had been used to store bittern. The project that was subject to the 2002 permit action involved construction of an upland area to support roadways and other facilities, as well as the excavation of the marina basin. The only activity that was subject to jurisdiction under the RHA was "work to breach the existing levee after marina construction has been completed." Thus, the Corps did not assert RHA jurisdiction over the interior portion of the site to be developed as Westpoint Marina.[18] It is true that the lack of jurisdiction over the interior portion of this area has little direct relevance to the jurisdictional status of the rest of the site, but it does constitute evidence of the Corps' consistent pattern of practice of not asserting RHA jurisdiction over the western parcel.

<u>Analysis of Law and Fact</u>

The law regarding surrender is not well defined; there exists significant ambiguity as to what qualifies as the "unmistakable terms" required for there to be a surrender. The cases in which courts found that there was surrender involved some affirmative statement by the government about the jurisdictional status of the property (even if only as a class), as opposed to actions or inaction that did not purport to address jurisdiction. In the case of the western portion of the Redwood City site, there are multiple affirmative statements from the Corps that

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[14] *Id.* (emphasis added).

[15] *U.S. v. Willow River Power Co.*, 324 U.S. 499, 509 (1945)("High-water mark bounds the bed of the river. Lands above it are fast lands. . .").

[16] War Department, Corps of Engineers San Francisco District, Public Notice No. 47-43, March 28, 1947 (emphasis in original).

[17] USACE San Francisco District, *Public Notice; Project: WestPoint Marina*, Permit No. 22454S (May 17, 2002).

[18] In the permit for the Westpoint Marina, the Corps asserted RHA jurisdiction over work within the interior of the marina basin once the exterior levee was breached and the basin was inundated with water directly from the Bay.

could reasonably be interpreted to qualify as the type of unmistakable terms that the court relied on in *Stoeco* to find a surrender of any regulatory jurisdiction that may have existed. This is in contrast to the eastern portion of the site, where the initial activity modifying the natural topography was subject to a permit that contained an explicit reservation of jurisdiction.

Should the Corps assert RHA jurisdiction over any portion of the western parcel, there is a substantial likelihood that the property owner would challenge that assertion of jurisdiction in the federal courts. Given the uncertain law and the unfavorable facts regarding surrender in this circumstance, there is a high likelihood that a court could make bad law on surrender were the Corps to assert RHA jurisdiction over the western portion of the Redwood City site.

Alternative Interpretation of RHA Jurisdiction under *Froehlke* and *Milner*

In discussions with the San Francisco District about the 9 January 2014 memorandum, an alternative interpretation of the legal standard for RHA jurisdiction that should be derived from *Froehlke* and *Milner* was proffered.[19] It was suggested that the rule established in *Froehlke* and followed in *Milner* that RHA jurisdiction "extend[s] to all places covered by the ebb and flow of the tide to the mean high water (MHW) mark in its unobstructed, natural state" should be interpreted to mean that any area that *is currently* below the theoretical plane of the MHW mark projected across the landscape or that *would currently be* below this theoretical plane but for an artificial improvement (such as a levee as in *Froehlke* or a shore defense structure as in *Milner*, but possibly including other artificial improvements) is subject to RHA jurisdiction. Thus, in the case of a low-lying area separated from tidal waters by a levee, the levee and any area behind it that is below the elevation of the current MHW mark would be currently subject to RHA jurisdiction even if those areas had never been covered by water in the past.

Neither *Froehlke* nor *Milner* require this interpretation. The *Froehlke* decision merely determined whether the relevant benchmark for jurisdiction on the Pacific was the MHW mark or the mean higher high water (MHHW) mark, and did not apply the standard established to the circumstances in the case, so it is impossible to know how that court intended the standard to be implemented.[20] The *Milner* decision only held that the shore defense structures that were previously above the MHW mark at the time that they were constructed, but have come to be, at least in part, below the MHW mark now (because of erosion, sea level rise, or other changes), are now subject to RHA jurisdiction.[21] The court in *Milner* did not make any explicit holding regarding RHA jurisdiction over lands lying on the upland side of those shore defense structures. Thus, neither case held that land that is currently below the projected plane of the MHW line in its unobstructed natural state, but that currently is not covered with water due to

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[19] *Leslie Salt Co. v. Froehlke*, 578 F.2d 742, 753 (9th Cir. 1978) (hereinafter "*Froehlke*"); *U.S. v. Milner*, 583 F.3d 1174, 1191 (9th Cir. 2009).

[20] *Froehlke*, 578 F.2d at 753.

[21] *Milner*, 583 F.3d at 1193.

an artificial obstruction, is now subject to RHA jurisdiction. The standard established for RHA jurisdiction in the 9 January 2014 memo is consistent with the holdings of *Froehlke* and *Milner*, more closely follow the Corps regulations implementing the RHA, and has more defensible implications for what areas may currently be jurisdictional under the RHA.

However, even if one were to accept the San Francisco District's alternative interpretation of the rule dictated by *Froehlke* and *Milner*, a court reviewing the matter would likely find that there is no RHA jurisdiction over the western parcel based on the San Francisco District's long-standing and well-publicized policy for determining RHA jurisdiction behind dikes or levees. The policy provides:

> Section 10 [RHA] jurisdiction will be exercised over areas behind dikes if <u>all</u> of the following criteria are met:
>
> 1. The area is <u>presently</u> at or below mean high water (MHW),
> 2. The area was historically at or below MHW in its "unobstructed, natural state" (i.e., the area was at or below MHW before the dikes were built), and
> 3. There is no evidence (elevation data) that the area was ever above MHW.[22]

Applying the evidence previously discussed to the rules established in the San Francisco District policy would result in a strong case that no RHA jurisdiction now can be or should be exercised. Specifically, the western portion of the site appears to fail the second and possibly the third elements of the District policy. As previously discussed, the 1947 permit indicates that the area identified as "salt evaporating ponds" on the 1940 permit was above MHW at the time of the 1947 permit evaluation, meaning that the third element is not satisfied. The evidence is less direct for the area identified as "reclaimed marsh" in the 1940 permit, but the 1940 permit along with the 2002 Westpoint Marina permit and maps that predate the development of the site all suggest that the "reclaimed marsh" area was above MHW either before the levees were constructed or were made so subsequently, and therefore fails either the second or third elements of the policy, or both. If the Corps were now to try to assert RHA jurisdiction over the western portion of the site, a reviewing federal court likely would rule that the Corps is now estopped from asserting RHA jurisdiction, because the owners of that portion have relied on the District policy that precludes the assertion of jurisdiction since at least 1983, the year in which the policy was promulgated.

<u>Conclusion</u>

The landowners of the Redwood City salt plant site have several strong legal arguments supporting their position that RHA jurisdiction should not be exercised over the western

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[22] Calvin Fong, Chief, Regulatory Functions Branch, *Reg. Functions Bull. Memorandum, Regulatory Function's Policy on Section 10 Jurisdiction Behind Dikes (Levees)* (May 25, 1983) (emphasis in original; internal citations omitted).

portion of the stie. There is substantial evidence that would receive deference from the Federal courts that any RHA jurisdiction that may have existed over the western portion of the site was surrendered, or alternatively that jurisdiction should not be exercised based on long-standing District policy. Therefore, as a matter of judgment and risk calculation, based on the specific facts and history discussed above, which are unique to the site, the Corps shall decline to assert any RHA jurisdiction that it may be able to claim over the western portion of the Redwood City site.

Earl Stockdale

Earl H. Stockdale
Chief Counsel

481 F.3d 700 (2007)

SAN FRANCISCO BAYKEEPER; Citizens Committee to Complete the Refuge; Michael R. Lozeau, Plaintiffs-Appellees,
v.
CARGILL SALT DIVISION; Cargill Inc., Defendants-Appellants.
San Francisco Baykeeper; Citizens Committee to Complete the Refuge, Plaintiffs-Appellants, and Michael R. Lozeau, Plaintiff,
v.
Cargill Salt Division; Cargill Inc., Defendants-Appellees.

Nos. 04-17554, 05-15051.

United States Court of Appeals, Ninth Circuit.

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Filed March 8, 2007.

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702 *702 Before CANBY, HAWKINS, and GOULD, Circuit Judges.

CANBY, Circuit Judge.

San Francisco Baykeeper and Citizens Committee to Complete the Refuge (collectively "Baykeeper") filed this citizen suit under the Clean Water Act, 33 U.S.C. § 1251 et seq., ("CWA" or "the Act") against Cargill Salt Division and Cargill, Incorporated (collectively "Cargill"). Baykeeper alleged that Cargill discharged pollutants into "waters of the United States" without a permit. The body of water into which Cargill allegedly discharged waste is a non-navigable, intrastate pond ("the Pond"), not determined to be a "wetland," that collects polluted runoff within Cargill's waste containment facility located near the southeastern edge of San Francisco Bay. The district court granted summary judgment in favor of Baykeeper after determining that the Pond qualifies as a "water[] of the United States" because it is adjacent to a protected water of the United States (Mowry Slough). Cargill then brought this appeal. Because we conclude that mere adjacency provides a basis for CWA coverage only when the relevant waterbody is a "wetland," and no other reason for CWA coverage of Cargill's Pond is supported by evidence or is properly before us, we reverse the district court's summary judgment.

Background

Cargill and its predecessors have conducted salt-making operations at the edge of San Francisco Bay, in Alameda County, California, since the 1860's. In 1979, the United States acquired some 15,000 acres of Cargill's lands for inclusion in the Don Edwards San Francisco Bay Wildlife Refuge ("the Refuge"). Cargill retained an easement over 12,000 acres that permits it to continue its salt-making operation.

Cargill produces salt by evaporating water from the Bay in a series of ponds. The harvesting and refinement of the salt results in the production of waste residue that is heavily saline and contains other pollutants. Cargill maintains within the Refuge a 17-acre waste containment facility that it uses for disposal of salt-processing residue. The northern portion of the disposal site (the "upper elevation") contains a pile of uncovered waste several acres in size ("the Pile"). During storms, rainwater carries residue from the upper elevation (including the Pile) to the southern portion of the site (the "lower elevation") where it drains into the non-navigable Pond. An earthen levee separates the southern edge of the Pond from Mowry Slough, a navigable tributary of San Francisco Bay. The parties agree that Mowry Slough is a "water[] of the United States."

The horizontal distance between the edge of the Slough and the edge of the Pond varies considerably depending on the tide. At low tide, the Pond and the Slough are separated by as much as 125 feet, including the surrounding wetlands. At high tide, however, Slough water inundates the wetlands up to the levee and has, on some occasions, overtopped the levee and flowed into the Pond. While there is no evidence in the record that liquid has ever flowed from the Pond to the Slough, the district court made no specific rulings on that issue. Cargill from time to time pumps waste water away from the Pond to prevent the level of the Pond from approaching the top of the levee.

In 1996, Baykeeper filed a citizen suit pursuant to 33 U.S.C. § 1365 against Cargill, stating various claims under the CWA arising from Cargill's alleged unpermitted discharge of pollution into "waters of the *703 United States" (the Pond). From the beginning, the parties have disputed whether the Pond is within the coverage of the CWA. 703

In its first motion for summary judgment, Baykeeper alleged that the Pond is a "water[] of the United States" under the "Migratory Bird Rule" of the Environmental Protection Agency ("the EPA"), 53 Fed.Reg. 20,764, 20,765 (June 6, 1988), because it is used intermittently as habitat by migratory birds. The district court agreed and granted summary judgment in favor of Baykeeper on two claims.[1] While appeals were pending here, however, the Supreme Court issued its decision in *Solid Waste Agency of Northern Cook County v. United States Army Corps of Engineers* ("*SWANCC*"), 531 U.S. 159, 121 S.Ct. 675, 148 L.Ed.2d 576 (2001), holding that the identical Migratory Bird Rule of the Army Corps of Engineers ("the Corps"), when applied to isolated intrastate waters, exceeded the Corps' authority under the CWA. *Id.* at 174, 121 S.Ct. 675. In light of *SWANCC,* we vacated the district court's summary judgment and remanded for consideration of whether alternative grounds exist for CWA jurisdiction. *San Francisco Baykeeper v. Cargill Salt Div.*, 263 F.3d 963 (9th Cir.2001).

On remand, Baykeeper again moved for summary judgment, this time advancing the theory that the Pond is a "water[] of the United States" because it is adjacent to Mowry Slough. Cargill opposed the motion, arguing that, under controlling regulations, adjacency provides a basis for CWA coverage only in the case of wetlands. Baykeeper has apparently never argued or presented evidence that the Pond qualifies as a "wetland" under the applicable regulatory definition. *See* 40 C.F.R. § 122.2 (2006).

The district court granted summary judgment a second time in favor of Baykeeper after determining that "bodies of water that are adjacent to navigable waters are `waters of the United States' and are therefore protected under the Clean Water Act." Noting that adjacent wetlands qualify for CWA protection under the applicable regulations and Supreme Court precedent, the court reasoned that "the same characteristics that justif[y] protection of adjacent wetlands ... apply as well to adjacent ponds." In support of its determination that the Pond is a water of the United States, the district court found as undisputed facts that: (1) "the Pond was adjacent to Mowry Slough at the time that the suit was filed"; (2) "the soils between the Pond and Mowry Slough are saturated"; and (3) "the berm between the Pond and Mowry Slough leaked and allowed Slough water to enter the Pond at high tide."[2]

704 *704 The parties subsequently entered into a settlement agreement setting forth potential remedies contingent on further proceedings, and preserving the right to appeal certain issues (including the district court's finding of CWA jurisdiction based on adjacency). As part of the agreement, Baykeeper waived the right "now or in the future" to assert "any theories of CWA jurisdiction over the Site (including the Pond), other than the Adjacent Waters Theory upon which the District Court based its Jurisdictional Ruling." The district court issued a final judgment incorporating the terms of the settlement agreement, and this appeal followed.

Jurisdiction and Standard of Review

We have jurisdiction under 28 U.S.C. § 1291. We review de novo the district court's grant of summary judgment that the Pond is a "water[] of the United States." *Baccarat Fremont Developers, LLC v. United States Army Corps of Eng'rs,* 425 F.3d 1150, 1153 (9th Cir. 2005).

Discussion

We conclude that the district court improperly expanded the regulatory definition of "waters of the United States" when it held that bodies of water that are adjacent to navigable waters are subject to the CWA by reason of that adjacency. Our conclusion is based on the CWA, the regulations promulgated by the agencies responsible for administering it, and the decisions of the Supreme Court addressing the reach of the Act and its regulations.

Congress passed the CWA in 1972 "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." 86 Stat. 816, *codified at* 33 U.S.C. § 1251(a). One of its principal provisions prohibits the unpermitted discharge of pollutants into "navigable waters." 33 U.S.C. § 1311(a). The term "navigable waters" is defined elsewhere in the Act to mean "waters of the United States." *Id.* § 1362(7).

By not defining further the meaning of "waters of the United States," Congress implicitly delegated policy-making authority to the EPA and the Corps, the agencies charged with the CWA's administration. *See Chevron, USA Inc. v. Natural Res. Def. Council,* 467 U.S. 837, 844, 104 S.Ct. 2778, 81 L.Ed.2d 694 (1984) (holding that congressional delegation to an agency may be implicit).[3] Although the Corps initially construed the Act to cover only waters navigable-in-fact, the Corps and the EPA have since issued nearly identical regulations expanding the definition of "waters of the United States" to include some intrastate waterbodies that are not navigable in the traditional sense.[4]

As relevant here, current regulations protect not only navigable-in-fact waters but also tributaries of such waters, 40 C.F.R. § 122.2 ("Waters" (e)),[5] non-navigable waterbodies whose use or misuse could affect interstate commerce, *id.* § 122.2 ("Waters" (c)), and, most important for our purposes, "`wetlands' adjacent to waters *705 (other than waters that are themselves wetlands)" otherwise covered by the Act, *id.* § 122.2 ("Waters" (g)). "Wetlands" are defined to mean

> areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Id.

Under the controlling regulations, therefore, the only areas that are defined as waters of the United States by reason of adjacency to other such waters are "wetlands." There is little doubt that the regulatory definition is intended to be exhaustive; the context makes that clear, as does the fact that the definition states what "Waters of the United States ... means," not what those waters "include." *See id.; Shell Oil Co. v. EPA,* 950 F.2d 741, 753 (1992) (giving restrictive effect to a definition that states what a term "means" as opposed to what it "includes"). Disregarding the unambiguous regulations limiting to wetlands the areas subject to the CWA because of adjacency, the district court determined that the Pond is covered by the Act because "the same characteristics that justif[y] protection of adjacent wetlands... apply as well to adjacent ponds." This analysis was improper.

When legislation implicitly grants to an agency the authority to elucidate the meaning of a statutory provision, "a court may not substitute its own construction of a statutory provision for a reasonable interpretation made by the administrator of an agency." *Chevron,* 467 U.S. at 844, 104 S.Ct. 2778; *see also United States v. Mead Corp.,* 533 U.S. 218, 229, 121 S.Ct. 2164, 150 L.Ed.2d 292 (2001); *Wash., Dep't of Ecology v. U.S. EPA,* 752 F.2d 1465, 1469 (9th Cir.1985) (an agency's reasonable interpretation of a statute is entitled to deference "even if the agency could also have reached another reasonable interpretation, or even if [the court] would have reached a different result had[it] construed the statute initially"). This principle applies with particular force where, as here, "statutory construction involves reconciling conflicting policies, and a full understanding of the force of the statutory policy in the given situation (depends) upon more than ordinary knowledge respecting the matters subjected to agency regulations." *Wash., Dep't of Ecology,* 752 F.2d at 1469 (internal quotation marks and citations omitted; parenthesis in original). The district court did not determine, nor was it argued, that the existing regulatory definition of "waters of the United States" is unreasonable because it fails to include *all* waterbodies, or some other subcategory of waterbodies, adjacent to navigable waters. Moreover, for reasons that will become apparent, it was not unreasonable for the EPA to view wetlands as a special category subject to CWA jurisdiction that otherwise would not extend beyond navigable waters. We conclude, therefore, that the district court erred when it found that the Pond is subject to CWA jurisdiction solely because it is "adjacent"[6] to Mowry Slough.

It is true that, in certain kinds of cases, there is a tension between the purpose of authorized citizen suits and *Chevron* *706 deference. The purpose of the citizen suit provision of the CWA, 33 U.S.C. § 1365, is to permit citizens to enforce the Clean Water Act when the responsible agencies fail or refuse to do so. For that reason, the CWA provides that a citizen must give sixty days notice to the relevant agency prior to commencing a citizen suit, and cannot bring such an action if the agency is prosecuting an enforcement action. *See id.* § 1365(b)(1). In most cases, citizen suits are brought to enforce limitations included in a permit issued by the EPA, *see, e.g.,* *Sierra Club, Lone Star Chapter v. Cedar Point Oil Co.,* 73 F.3d 546, 566 (5th Cir.1996), and the suit does not call into question any interpretation of the statute by the agency. On occasion, however, a citizen sues because of a discharge that the EPA has elected not to regulate. If the decision of the EPA is given conclusive deference, the citizen suit would be defeated. Suit is therefore allowed despite the EPA's inaction, and a court may decide whether the offending substance is a pollutant even when the EPA has not decided that question. *See id.* at 566-67. Thus, we have held that a court may, in entertaining a citizen suit, decide whether a discharge of particular matter into navigable waters violates the CWA even though the regulating agency determined that the discharge was not subject to the requirement of a permit. *Ass'n to Protect Hammersley, Eld, and Totten Inlets v. Taylor Resources, Inc.,* 299 F.3d 1007, 1012-13 (9th Cir.2002).

These cases do not, however, justify courts in denying deference to the EPA or the Corps when, by formal regulation, those agencies construe the meaning of a statutory term that establishes the reach of the CWA that they administer. *Cf.* *Mead Corp.,* 533 U.S. at 230, 121 S.Ct. 2164 (stating that the "overwhelming number of our cases applying *Chevron* deference have reviewed the fruits of notice-and-comment rulemaking or formal adjudication"). Indeed, in deciding the merits of the citizens' claim in *Taylor Resources,* we were heavily guided by the EPA's definition of "point sources" in order not to "undermine the agency's interpretation of the Clean Water Act." *Taylor Resources,* 299 F.3d at 1019. To decide the present case brought by Baykeeper, the district court and we are required to determine whether Cargill has discharged pollutants into a water of the United States without a permit. For reasons already stated, it is most appropriate to defer to the administering agencies in construing the statutory term "waters of the United States," which establishes the reach of the CWA. Deference is especially suitable because this borderline determination of non-navigable areas to be made subject to the CWA is one that involves "conflicting policies" and expert factual considerations for which the agencies are especially well suited. *See* *Wash., Dep't of Ecology,* 752 F.2d at 1469. Because we do not want to undermine or throw into chaos the EPA's and the Corps' construction of the statute that establishes the reach of the CWA, *Chevron* deference is required, even in this citizen suit.

Baykeeper appears to concede that the regulatory definition of "waters of the United States" does not support the district court's expansive construction. Nevertheless, it argues that summary judgment was appropriately granted because "the Supreme Court has repeatedly held that the CWA protects all waterbodies with a `significant nexus' to navigable waters." This is simply not the case. In *United States v. Riverside Bayview Homes, Inc.,* 474 U.S. 121, 106 S.Ct. 455, 88 L.Ed.2d 419 (1985), the Court held that the Corps did not exceed its statutory authority when it defined "waters of the United States" to include adjacent *wetlands. Id.* at 134-35, 106 S.Ct. 455. The *707 Supreme Court's opinion leaves little doubt about two of its foundations: (1) that it is up to the Corps to determine where "waters of the United States" end, and (2) that the Corps' regulation was reasonable in treating adjacent wetlands as a unique category subject to the CWA despite their non-navigability:

> The Corps has concluded that wetlands may affect the water quality of adjacent lakes, rivers, and streams even when the waters of those bodies do not actually inundate the wetlands. For example, wetlands that are not flooded by adjacent waters may still tend to drain into those waters. In such circumstances, the Corps has concluded that wetlands may serve to filter and purify water draining into adjacent bodies of water and to slow the flow of surface runoff into lakes, rivers, and streams and thus prevent flooding and erosion.... In addition, adjacent wetlands may "serve significant natural biological functions, including food chain production, general habitat, and nesting, spawning, rearing and resting sites for aquatic ... species." In short, the Corps has concluded that wetlands adjacent to lakes, rivers, streams, and other bodies of water may function as integral parts of the aquatic environment even when the moisture creating the wetlands does not find its source in the adjacent bodies of water. Again, we cannot say that the Corps' judgment on these matters is unreasonable....

Id. (internal citations omitted). It is simply not permissible to conclude from this passage that a *court* is authorized to conclude, when the administering agencies have reasonably ruled to the contrary, that other non-navigable bodies of water, which are not wetlands, are waters of the United States because they are adjacent to such waters.

Sixteen years after *Bayview,* the Supreme Court in *SWANCC* struck down the Migratory Bird Rule, noting that isolated intrastate ponds, unlike wetlands, lack a significant nexus to navigable waters. 531 U.S. at 167-68, 121 S.Ct. 675. *SWANCC* did not hold, however, that the Corps would be *required* to regulate all non-navigable bodies of water with some nexus to navigable waters, and it certainly did not hold that a court would be free to impose such a regulatory requirement if the administering agencies did not.

Baykeeper's reliance on *Rapanos v. United States,* ___ U.S. ___, 126 S.Ct. 2208, 165 L.Ed.2d 159 (2006), is similarly misplaced. *Rapanos,* like *Riverside Bayview,* concerned the scope of the Corps' authority to regulate adjacent *wetlands.* Justice Kennedy's controlling concurrence explained that only wetlands with a significant nexus to a navigable-in-fact waterway are covered by the

Act. *Id.* at 2248 (Kennedy, J., concurring) ("Consistent with *SWANCC* and *Riverside Bayview* and with the need to give the term `navigable' some meaning, the Corps' jurisdiction over wetlands depends upon the existence of a significant nexus between the wetlands in question and navigable waters in the traditional sense."). No Justice, even in dictum, addressed the question whether all waterbodies with a significant nexus to navigable waters are covered by the Act.

We conclude, therefore, that nothing in *Bayview, SWANCC* or *Rapanos* requires or supports the view that Cargill's Pond is a water of the United States because it is adjacent to Mowry Slough. Baykeeper contends, however, that the Pond is more than merely adjacent; it has a nexus to Mowry Slough. It is not sufficient, however, for Baykeeper simply to make its individual case; it 708 must establish that it was unreasonable for the EPA to confine to wetlands the CWA's reach to *708 non-navigable waterbodies adjacent to protected waters. Even on its own terms, however, Baykeeper's argument fails. The evidence in support of Baykeeper's nexus falls far short of the nexus that Justice Kennedy required in *Rapanos* even for wetlands that the Corps sought to hold subject to the CWA:

> [W]etlands possess the requisite nexus, and thus come within the statutory phrase "navigable waters," if the wetlands, either alone or in combination with similarly situated lands in the region, *significantly affect the chemical, physical, and biological integrity of other covered waters more readily understood as "navigable."* When, in contrast, wetlands' effects on water quality are *speculative or insubstantial,* they fall outside the zone fairly encompassed by the statutory term "navigable waters."

Rapanos, 126 S.Ct. at 2248 (Kennedy, J., concurring) (emphasis added). By any permissible view of the evidence, the effect of Cargill's Pond on Mowry Slough is speculative or insubstantial; the Pond does not significantly affect the integrity of the Slough. First, there is no evidence that any water has ever flowed from the Pond to the Slough. One expert, asked whether "given the right hydrology conditions," water could flow from the Pond to the Slough, answered that "it is possible." There is no evidence, however, that those "right hydrology conditions" have ever existed or were likely to exist. This testimony fits the definition of "speculative." There was also much emphasis on the fact that, in some high tide situations, water from the Slough has flowed over the levee, or seeped through the levee, into the Pond. But flow in that direction does not affect the navigable body of water in the Slough. Thus the evidence does not meet Justice Kennedy's standard, and we emphasize that this standard was for wetlands, for which the Corps had made special allowance beyond the margins of the usual navigable waters at which the CWA is aimed. We therefore reject the "adjacency-plus-nexus" argument that Baykeeper puts forward.[7]

Relying on *Headwaters, Inc. v. Talent Irrigation District,* 243 F.3d 526 (9th Cir.2001), Baykeeper next argues that the Pond is a "water[] of the United States" because even intermittent hydrologic connections are sufficient to trigger CWA jurisdiction. In *Headwaters,* we held that an irrigation canal that drained intermittently into a protected waterbody was subject to the CWA because it qualified as a "tributary" under 40 C.F.R. § 230.3(s)(5). *Headwaters,* 243 F.3d at 533. While *Headwaters* is relevant to the permissible scope of the Corps' tributary jurisdiction, it has no bearing on the issue presented here: whether the Pond is protected under the CWA because it is adjacent to navigable waters. In any event, the instant record does not support a finding that the Pond is a tributary of the Slough; there is no evidence that water from the Pond has ever flowed into the Slough or the Slough's wetland.

Our decisions in *Baccarat Fremont Developers, LLC v. United States,* 425 F.3d 1150 (9th Cir.2005), and *Northern California River* 709 *Watch v. City of Healdsburg,* 457 F.3d 1023 (9th Cir.2006), also do not *709 support Baykeeper's position that CWA jurisdiction extends to all adjacent waterbodies. In *Baccarat,* we held simply that *SWANCC* did not modify the Supreme Court's holding in *Riverside Bayview* that the Corps can appropriately exercise jurisdiction over adjacent *wetlands. Baccarat,* 425 F.3d at 1156-57. We expressed no opinion regarding the Corps' jurisdiction over adjacent waterbodies not qualifying as wetlands.

City of Healdsburg also concerned the Corps' jurisdiction over adjacent wetlands. There, we applied Justice Kennedy's "significant nexus" standard, *see* Rapanos, 126 S.Ct. at 2248, and concluded that the wetland at issue was a "water[] of the United States" because (among other reasons) its waters seep directly into a protected river. *City of Healdsburg,* 457 F.3d at 1030-31. All told, we know of no case holding that all waterbodies adjacent to navigable waters are covered by the Act.

As its fallback, Baykeeper argues that, under EPA regulations, the Pond qualifies for CWA protection as a waterbody whose use or misuse could affect interstate commerce, 40 C.F.R. § 122.2 (Waters (a), (c)), and as a "tributary" of a protected waterbody.[8] *Id.* (Waters (e)). We note that neither of these theories was urged as an independent ground of jurisdiction in support of the most recent summary judgment, and that, following that judgment, Baykeeper executed a settlement agreement waiving the right to assert all jurisdictional theories "other than the Adjacent Waters Theory upon which the District Court based its Jurisdictional Ruling." Baykeeper apparently concedes that the waiver provision is valid and enforceable.[9] It argues, however, that its alternative theories are not waived because the "Adjacent Waters Theory," broadly construed, includes consideration of facts other than mere physical proximity.

Construing the waiver provision liberally in Baykeeper's favor, we conclude that Baykeeper reserved (at most) the right to assert theories of CWA coverage that are supported by facts on which the district court based its ruling. Although the district court noted that the soils between the Pond and the Slough are saturated, and that liquid from the Slough has entered the Pond at high tide, it did not point to any evidence, and we have found none, that liquid or matter from the Pond has *710 flowed or will flow to the Slough or its wetlands (a factual predicate for tributary jurisdiction). Nor did the district court base its ruling on the fact that Cargill's discharge of pollutants into the Pond "could affect interstate or foreign commerce." In short, the "Adjacent Waters Theory upon which the District Court based its Jurisdictional Ruling" does not rely on evidence of tributary status or effect on interstate commerce. Accordingly, we conclude that these alternative theories are independent of the "Adjacent Waters Theory" and are waived.

Conclusion

For the foregoing reasons, the district court's summary judgment ruling is REVERSED. In light of that ruling, Baykeeper's cross-appeal is DISMISSED as moot.

[1] The district court granted summary judgment that Cargill violated 33 U.S.C. §§ 1311 and 1342(p)(2)(B) by discharging stormwater associated with industrial activity into "waters of the United States," and that Cargill violated 33 U.S.C. § 1311 by discharging non-stormwater pollutants into "waters of the United States." Following the summary judgment ruling, Baykeeper dismissed its remaining claims with prejudice.

[2] In a separate summary judgment ruling, the district court held that it lacked jurisdiction to order removal of that portion of the Pile created before 1991 because: (1) Baykeeper's 1996 "notice" letter failed to provide the requisite specificity concerning pre-1991 discharges; and (2) the five-year limitations period in 28 U.S.C. § 2462 barred relief for any time prior to five years preceding the filing of the complaint. Baykeeper filed a cross-appeal arguing that the district court erred in declining to order removal of pre-1991 discharges. Because we conclude that the district court erred in determining that the Pond is a "water[] of the United States," we do not reach the issues raised in Baykeeper's cross-appeal.

[3] The CWA explicitly authorizes the Administrator of the EPA "to pre-scribe such regulations as are necessary to carry out his functions under this chapter." 33 U.S.C. § 1361(a).

[4] For present purposes, the two agencies' regulatory definitions of "waters of the United States" are substantively identical.

[5] Section 122.2 of the regulations sets forth alphabetically the words or terms being defined, and in some cases then provides letter-designated subdivisions under a definition. For convenience, this opinion cites the subdivisions under the definition of "Waters of the United States" as "Waters (a)" etc.

[6] For present purposes, we accept Baykeeper's definition of "adjacent" as extending beyond physical proximity to include the additional factors relied upon by the district court in determining that the Pond is adjacent to the Slough (i.e., that the soils between the Pond and the Slough are saturated, and that liquid has intermittently flowed from the Slough to the Pond).

[7] It is important to keep in mind the key claim before us in this case: that Cargill discharged pollutants into *its Pond* without a permit. There is no question that, if Cargill engaged in some action that caused the discharge, or permitted the leakage, of pollutants from the Pond into Mowry Slough without a permit, it would be in violation of the CWA because of that discharge *into the Slough,* which all parties agree is a water of the United States. No such violation has been shown or is now claimed.

[8] These grounds for CWA coverage are also recognized in substantively identical regulations issued by the Army Corps of Engineers. *See* 40 C.F.R. §§ 230.3(s)(1), (3), (5).

[9] Some confusion has been caused by the fact that we and the parties have from time to time referred to the issue in this case as whether the Pond is within the "jurisdiction" of the CWA. A better statement of the issue would be whether the Pond is within the coverage of the CWA. In any event, the "jurisdiction" of the CWA has nothing to do with the jurisdiction of this court. Baykeeper's complaint alleged that Cargill had violated the CWA by discharging pollutants into the waters of the United States. That colorable allegation clearly gave the district court jurisdiction over the case, *see* 33 U.S.C. § 1365(a), 28 U.S.C. § 1331, and we have jurisdiction over this appeal pursuant to 28 U.S.C. § 1291. Baykeeper's failure to establish that Cargill's Pond was a water of the United States is a failure to make out a case, not a failure to establish the jurisdiction of the court. *See Arbaugh v. Y & H Corp.,* 546 U.S. 500, 126 S.Ct. 1235, 1242-45, 163 L.Ed.2d 1097 (2006) (discussing loose use of term "jurisdiction" and holding that failure to establish that defendant is covered by the governing statute is failure to make out a claim, not a failure to establish jurisdiction). Thus, Baykeeper's stipulation is not subject to question as an attempt to limit the scope of our subject-matter jurisdiction. *See id.* at 1244 ("[S]ubject-matter jurisdiction, because it involves the court's power to hear a case, can never be forfeited or waived.") (internal quotation marks omitted).

APPENDIX G:

SUPPLEMENTAL JURISDICTIONAL DETERMINATION REPORT FOR WATERS OF THE STATE

South San Diego Bay Wetland Mitigation Bank

CALIFORNIA COASTAL COMMISSION
SUPPLEMENTAL WETLAND DELINEATION REPORT

Prepared for:

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Date:

December 4, 2017

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CALIFORNIA COASTAL COMMISSION
SUPPLEMENTAL WETLAND DELINEATION REPORT

BACKGROUND

The Port of San Diego is developing the majority of its Pond 20 property (the Site) into a wetland mitigation bank. The 83.5 acre Site is located in south San Diego Bay in the City of San Diego, San Diego County, California and is wholly within the Coastal Zone (FIGURE 1). As part of the bank planning and entitlement process, a formal wetland delineation to determine the boundaries of United States Army Corps of Engineers (USACE) jurisdiction was completed within the bermed area and immediately adjacent to the bermed area at the former salt pond referred to as Pond 20 between January 31 and February 6, 2017 by Great Ecology. With submission of the delineation report to the Interagency Review Team (IRT) in April 2017, representatives from the California Coastal Commission (CCC) requested that areas falling under CCC jurisdiction also be delineated on the Site. A CCC delineation was therefore conducted on the Site on July 6, 2017 by Great Ecology staff. The results of the CCC delineation are summarized here and are submitted as a supplement to the USACE delineation report.

SITE DESCRIPTION

Pond 20 is bordered by the Otay River Estuary Restoration Project (ORERP) site, the Otay River, and the South San Diego Bay Unit of the U.S. Fish & Wildlife Service (USFWS) National Wildlife Refuge (NWR) to the north; residential and commercial development to the west; Palm Avenue and residential development to the south; and the City of San Diego's Otay River Pump Station and open space managed by the Port of San Diego and the Otay Valley Regional Park to the east (FIGURE 2).

The majority of Pond 20 is a bermed former salt evaporator pond, but the project boundaries also include surface water features that run alongside the pond area outside the berms. Nestor Creek flows north to the Otay River outside the berm along the eastern boundary of Pond 20, and a tributary of the Otay River flows south from the Otay River outside the berm along Pond 20's western boundary, terminating in the southwest corner. These two water features are tidal; they do not flow through the proposed Pond 20 mitigation bank enclosed by berms, nor do they ever overtop the berms.

For ease of reference the Site is divided into three distinct areas:

- **Pond 20:** A wholly bermed and enclosed non-operational solar salt evaporator pond that was formerly part of the Western Salt Company's South San Diego Bay Saltworks. Pond 20 comprises the majority of the Site and is hydrologically isolated from all surrounding surface water features. Surface water only enters Pond 20 via precipitation and occasional storm water runoff from Palm Avenue via one point conveyance and surface sheet flow. This area is shown within the white boundary in FIGURE 1 and is also referred to as the Bank Site;
- **The Nestor Creek Area (not a component of the mitigation bank):** Located outside the eastern berm, includes portions of Nestor Creek, a channelized mud-bottom urban freshwater-to-brackish stream that flows north past Pond 20 into the Otay River, and wetlands within and surrounding the channel; and
- **The Otay River Tributary Area (not a component of the mitigation bank):** Located outside the western berm, includes a section of the Otay River Tributary, a tidal mud-bottom surface water feature that flows south from the Otay River near its entrance to San Diego Bay and terminates at the southern end of the Area, and wetlands surrounding the channel.

Both the Otay River Tributary and Nestor Creek are subject to the tides; Pond 20 is not subject to tidal flows.

Pond 20 was constructed in the 1870s, specifically to retain water as part of the south San Diego Bay Saltworks operations. In 1916, the Savage Dam failed and released Lower Otay Lake to the lower watershed. The dam failure washed away several berms within the Saltworks, including those of Pond 20, and deposited substantial volumes of sediment within Pond 20. Pond 20 and the rest of the Saltworks were restored and operational by 1918, with water moved through Pond 20 using a system of pumps and siphons. However, the high elevation of Pond 20, along with its inland location and distance from the other ponds, soon made its continued use logistically and economically inefficient within the Saltworks operation. Western Salt attempted to reincorporate Pond 20 into Saltworks operations in the 1960s using a new system of electrical pumps to facilitate the movement of water from Pond 20 to the other ponds in the network. This effort ultimately failed and Pond 20 and Site as a whole have since remained vacant.

Please see the USACE delineation report (Great Ecology 2017) for detailed site data, including topography, historical aerial imagery analysis, tidal and floodplain information, National Wetlands Inventory, soil survey, and a summary of previous USACE delineation efforts.

REGULATORY OVERVIEW

The CCC has the authority to regulate wetlands within the Coastal Zone within the State of California via the Coastal Act, which defines wetlands as:

> *[L]ands within the coastal zone which may be covered periodically or permanently with shallow water and include saltwater marshes, freshwater marshes, open or closed brackish water marshes, swamps, mudflats, and fens.* (Coastal Act Section 30121)

To provide further specificity, the CCC uses a one parameter definition of wetlands, which requires the presence of only one wetland attribute to be present for the area to be considered a wetland:

> *Wetland shall be defined as land where the water table is at, near, or above the land surface long enough to promote the formation of hydric soils or to support the growth of hydrophytes, and shall also include those types of wetlands where vegetation is lacking and soil is poorly developed or absent as a result of frequent and drastic fluctuations of surface water levels, wave action, water flow, turbidity or high concentrations of salts or other substances in the substrate. Such wetlands can be recognized by the presence of surface water or saturated substrate at some time during each year and their location within, or adjacent to, vegetated wetlands or deep-water habitats.* (14 CCR Section 13577)

This is in contrast to USACE, which requires positive identification of field indicators of all three wetland parameters – hydrophytic vegetation communities, hydric soils, and wetland hydrology.

SITE OVERVIEW
SOUTH SAN DIEGO BAY MITIGATION BANK

SAN DIEGO UNIFIED PORT DISTRICT
NOVEMBER 2017

FIGURE 1
1:7,500
CENTROID: 32.5869° N, 117.1004° W
NAD 83 CA STATE PLANE FIPS IV 0406

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CURRENT LANDSCAPE CONTEXT
SOUTH SAN DIEGO BAY MITIGATION BANK

SAN DIEGO UNIFIED PORT DISTRICT
NOVEMBER 2017

0 0.75 1.5 Miles

N

FIGURE 2
1:45,000
WGS 1984 WEB MERCATOR

GREAT ecology
ENVIRONMENT + DESIGN

To delineate these areas in the field, CCC provides few guidelines on how to identify the upland boundaries of wetlands. These guidelines include:

a. *The boundary between land within predominantly hydrophytic cover and land with predominantly mesophytic or xerophytic cover;*

b. *The boundary between soil that is predominantly hydric and soil that is predominantly nonhydric; or*

c. *In the case of wetlands without vegetation or soils, the boundary between land that is flooded or saturated at some time during years of normal precipitation, and land that is not.* (14 CCR Section 13577)

However, these guidelines are not technically field specific. CCC therefore defers to several other sources that delineators can reference when investigating wetland boundaries in the field. These include:

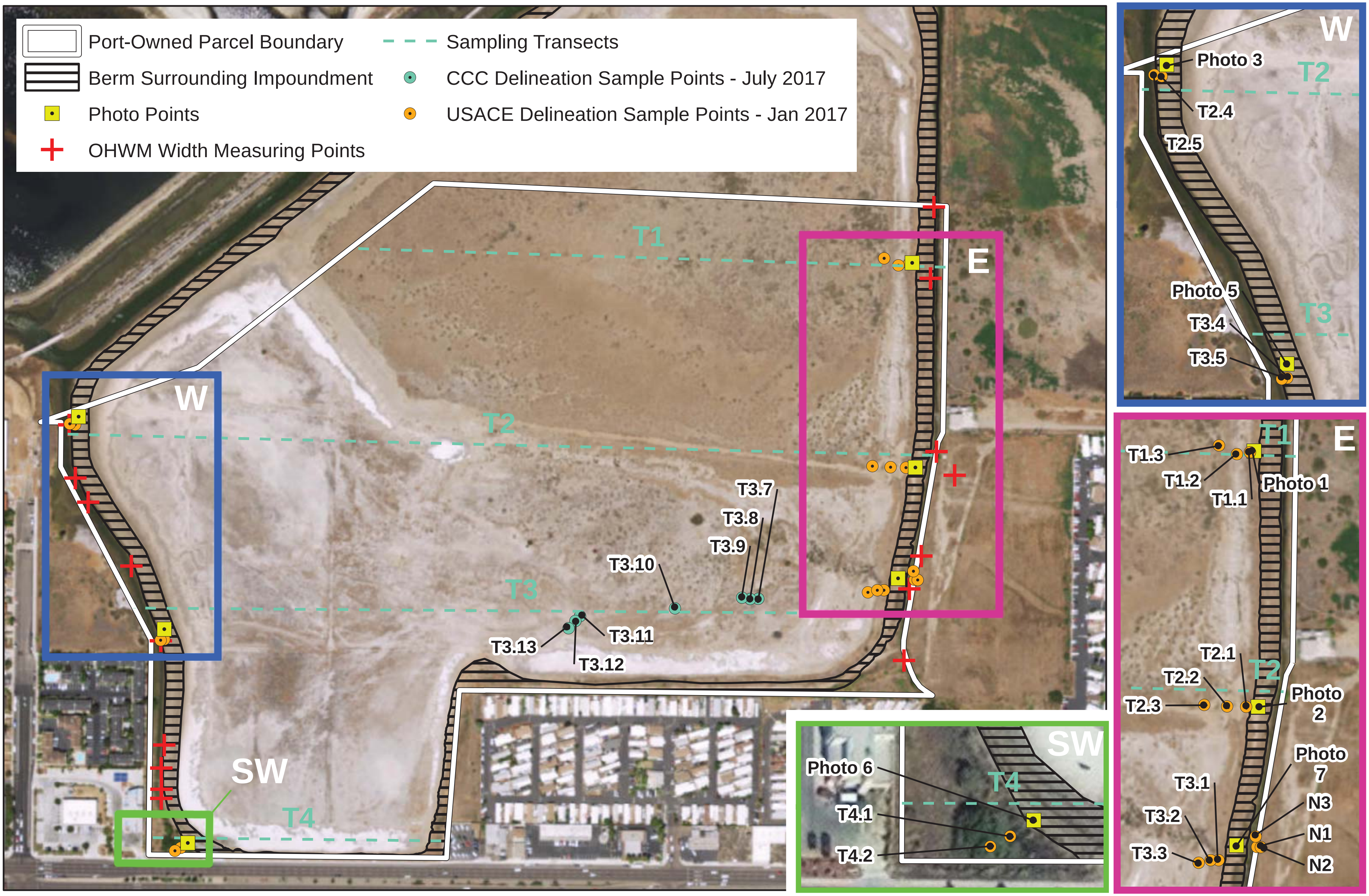
- 1987 Army Corps of Engineers Wetland Delineation Manual and Regional Supplements;
- The National Wetland Plant List (NWPL), which replaces the U.S. Fish & Wildlife Service's 1988 National List of Plant Species that Occur in Wetlands (USACE 2012); and
- Natural Resource Conservation Service Field Indicators of Hydric Soils in the United States.

The CCC encourages reference of these resources in the context of professional judgement when determining wetland boundaries within the Coastal Zone.

FIELD METHODS

Great Ecology staff conducted a field investigation to identify the boundaries of potential CCC wetland areas on July 6, 2017. Great Ecology followed the same sampling protocol and wetland indicator identification process found in the USACE Wetland Delineation Manual (1987) and the Arid West Supplement (2008) and detailed the Pond 20 USACE delineation report (Great Ecology 2017). Great Ecology sampled 25 points in total across the Site – 18 during the January and February 2017 USACE delineation, and seven additional points for the CCC delineation along Transect 3 from east to west. Great Ecology targeted our sampling for the CCC event to more closely investigate subtle changes in topography and vegetation communities within Pond 20 (FIGURE 3).

To provide a comprehensive supplement, Great Ecology included areas identified during the February 2017 delineation field event that exhibited at least one positive wetland parameter. Datasheets for the USACE and CCC delineation efforts are included in APPENDIX A and a photo log of both events in APPENDIX B.



SAMPLING TRANSECTS, SAMPLING POINTS, AND PHOTO POINTS
SOUTH SAN DIEGO BAY WETLAND MITIGATION BANK

SAN DIEGO UNIFIED PORT DISTRICT
NOVEMBER 2017

0 0.075 0.15 Miles

N

FIGURE 3
1:4,500
NAD 1983 CA STATE PLANE VI

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SUMMARY OF OBSERVED SITE CONDITIONS

Pond 20

Pond 20 contains isolated semi-permanent and ephemeral water features. Semi-permanent ponds, unvegetated salt flats, and intermittent depressional pools are located predominately along the inside edge of the berms.

Semi-Permanent Ponds

The inside edges of the eastern and southern berms support approximately 7.35 acres of semi-permanent ponds. The ponds are completely isolated from surface and groundwater features located outside the berms. The water sources for the ponds are exclusively direct rainfall and occasionally stormwater entering Pond 20 via sheet water flows and from one stormwater downspout that extends from Palm Avenue into Pond 20 along the southern boundary. Due to Pond 20's constructed purpose as a water retention facility for the Saltworks, the soils underlying Pond 20 are impermeable to prevent the loss of surface water via leaching. The water levels within the perennial ponds therefore do not fluctuate with the tides observed in the adjacent Otay River Tributary. The pond water levels instead fluctuate seasonally, completely dependent on closed system evaporative processes which render the retained water hypersaline. Water levels within the pools and their fluctuation rates are controlled by decades of drought and heavy rainfall. During the 2011 to 2017 drought, water levels were at a minimum in the ponds. Extreme (i.e. >70th percentile) rainfall fell in December 2016 and January 2017, recharging the water levels in the ponds. Standing water within the isolated pools is generally found below a nearly complete salt crust, though water may sit atop the crust following sufficient cumulative precipitation.

For safety reasons, Great Ecology did not sample soils within the permanent ponds but assumed them to be hydric based on observations made during previous delineation efforts, and the long-term hydrology patterns for those features observed in historical aerial imagery. The ponds are unvegetated and therefore do not support hydrophytic wetland plant communities.

Because there is no surface or groundwater nexus between the ponds and surface water features located outside the berms, the ponds do not provide basic aquatic functions and services, such as transport of detritus and/or nutrients, moderation of groundwater flow or discharge, energy dissipation or export of organic carbon, or particulate retention. No fish have been observed in the ponds, and no substantial wildlife use of the ponds has been observed beyond a small number of birds resting on them. The ponds provide very low capacity for all aquatic functions and are of very low ecological value.

Unvegetated Salt Flats

The unvegetated salt flats are located in low-lying areas adjacent to the semi-permanent ponds and comprise approximately 5.61 acres. Hydrologically isolated from groundwater and surface water features located outside the berms, the water source of the unvegetated salt flats is exclusively direct rainfall, and these areas are only intermittently inundated following cumulative rainfall events. Positive hydric soil indicators were only observed in one of two locations within this feature type. Soil is sand or sandy loam. Great Ecology infers that water drains laterally down-gradient from the salt flats into the semi-permanent ponds due to its higher elevational position relative to the ponds. The salt flats are unvegetated, so no hydrophytic wetland plant communities were observed on this feature type.

Because of hydrologic isolation, the salt flats do not provide basic aquatic functions and services such as such as transport of detritus and/or nutrients, moderation of groundwater flow or discharge, energy dissipation or export of organic carbon, or particulate retention. Additionally, the salt flats do not provide short- or long-term water storage services. The salt flats do not support substantial wildlife use beyond a small number of birds resting on them. No bird species have been observed nesting on the salt flats.

Ephemeral Vegetated and Unvegetated Depressions

On the eastern and central/southern portions of Pond 20 are 14 well-drained topographic depressions comprising approximately 2.03 acres.

Pond 20 was filled with sediment from an upstream dam failure in 1916. Evidence of this fill material is still present today. While the majority of Pond 20 fill is sand, Great Ecology noted random distributions of loams, and clays within the soil profile at most sample points within the intermittent depressional pools on the east side of Pond 20. At several sample points, old pieces of wood lumber at various stages of decay formed horizontal layers down the soil column. Hydric soil indicators were only observed in four of 16 sample points taken within Pond 20.

During both 2017 delineation efforts, the majority of Pond 20 was populated by a monoculture of upland iceplant species – slenderleaf iceplant (*Mesembryanthemum nodiflorum*) in January and February 2017, and crystalline iceplant (*Mesembryanthemum crystallinum*) in July 2017. The higher-elevation north and northeastern portions of Pond 20 support an upland scrub-shrub community of coyotebush (*Baccharis pilularis*), mulefat (*B. salicifolia*), coastal cholla (*Cylindropuntia prolifera*), Menzie's goldenbush (*Isocoma menziesii*), and coastal prickly pear (*Opuntia littoralis*). Three tamarisk (*Tamarix* spp.) individuals were also observed within this community. No hydrophytic vegetation communities were observed within Pond 20. These two predominant vegetation communities have remained consistent in their composition and distribution since 1997 (Dudek 1997, Merkel 2008). Observed wildlife use has been restricted to rabbits, woodrats, and hunting raptor species characteristic of upland coastal sage scrub communities.

Because of their hydrologic isolation, the vegetated and unvegetated topographical depressions do not provide basic aquatic functions and services such as such as transport of detritus and/or nutrients, moderation of groundwater flow or discharge, energy dissipation or export of organic carbon, or particulate retention. The depressions do not support substantial wildlife use beyond those of upland scrub species. No bird species have been observed nesting on the salt flats.

Nestor Creek Area

Directly east of the berm is Nestor Creek, classified as an estuarine and marine wetland with intertidal influence, which leads northwest toward the Otay River. The Nestor Creek Area contains permanent open water features and wetlands, including 0.14 acres of unvegetated open water and 0.25 acres of salt and brackish marsh.

Nestor Creek is concrete-lined upstream of the Site and is fed by freshwater flows from the adjacent urban floodplain. During high stormwater flows, the Otay River tributary appears to move water from a Municipal Separate Storm Sewer (MS4) drainage and Palm Avenue north to the Otay River. Hydric vegetation and soils, as well as hydrology indicators were present at two of three sample points taken on Nestor Creek. The only sample point where no wetland indicators were present was on the upper berm slope.

Two wetland community types were identified within the Nestor Creek Area along Nestor Creek. A salt marsh community predominately comprised of pickleweed (*Sarcocornia pacifica*), shore grass (*Distichlis littoralis*), saltwort (*Batis maritima*), and alkalai sea-heath (*Frankenia salina*) were observed on either side of Nestor Creek. Patches of freshwater marshes receiving periodic pulses of saline water (referred to as brackish marsh in this report) and predominately comprised of California club-rush (*Schoenoplectus californicus*) were located in Nestor Creek within the ordinary high water mark (OHWM) boundaries.

These communities provide forage and breeding habitat for birds, as well as some refugia for fish in the form of permanent standing water that is periodically flushed due to tidal connection and influence from San Diego Bay. Further, the marshes present along Nestor Creek have been observed to catch particulates (large and small) flowing down from the adjacent urban areas. The vegetation provides some nutrient removal capacity, as well as acting as a buffer to slow storm flows entering into San Diego Bay.

Otay River Tributary Area

The Otay River Tributary Area contains permanent open water features and wetlands, including 0.20 acres of unvegetated open water, 0.03 acres of unvegetated drainage basin, 0.05 acres of forested floodplain, and 0.90 acres of salt and freshwater marsh.

Some combination of hydric vegetation and soils, as well as hydrology indicators were present at three of four sample points taken in the Otay River Tributary Area. Two sample points had all positive wetland field indicators. The forested floodplain adjacent to the MS4 near this location did not have hydric soil indicators, pointing to infrequent and temporary inundation that has allowed hydrophytic vegetation to take root and hydrology indicators to develop. As with Nestor Creek, the only sample point where no wetland indicators were present was on the upper berm slope.

Three wetland community types were identified within the Otay River Tributary Area along the Otay River Tributary. Salt marsh of the same community composition as the Nestor Creek Area were observed on either side of the Otay River Tributary, with the addition of a patch of coastal salt grass (*Distichlis spicata*) located on the southeast bank of the Otay River Tributary. Small stands of saltwater cordgrass (*Spartina alterniflora*) were observed on limited mudflats located on the west side of the Otay River Tributary. In the southwest portion of the Otay River Tributary Area, a small patch of freshwater marsh dominated by narrow-leaf cattail (*Typha angustifolia*) at the mouth of an MS4 drainage was observed. Immediately to the west of this freshwater marsh was a non-wetland floodplain community comprised of arroyo willow (*Salix lasiolepis*), green ash (*Fraxinus pennsylvanica*), and the non-native Brazilian pepper tree (*Schinus terebinthifolius*). Lastly, an unvegetated mud-bottom drainage that connects the freshwater MS4 wetland with the southern end of the Otay River Tributary was observed.

These communities provide forage and breeding habitat for birds. With the direct connection to the MS4 drainage associated with Palm Avenue, this section of wetlands provides some nutrient removal and particulate retention for stormwater during the wet season, reducing the pollutant load that enters into the Otay River and San Diego Bay. The drainage provides buffer protection of San Diego Bay during storms.

RESULTS

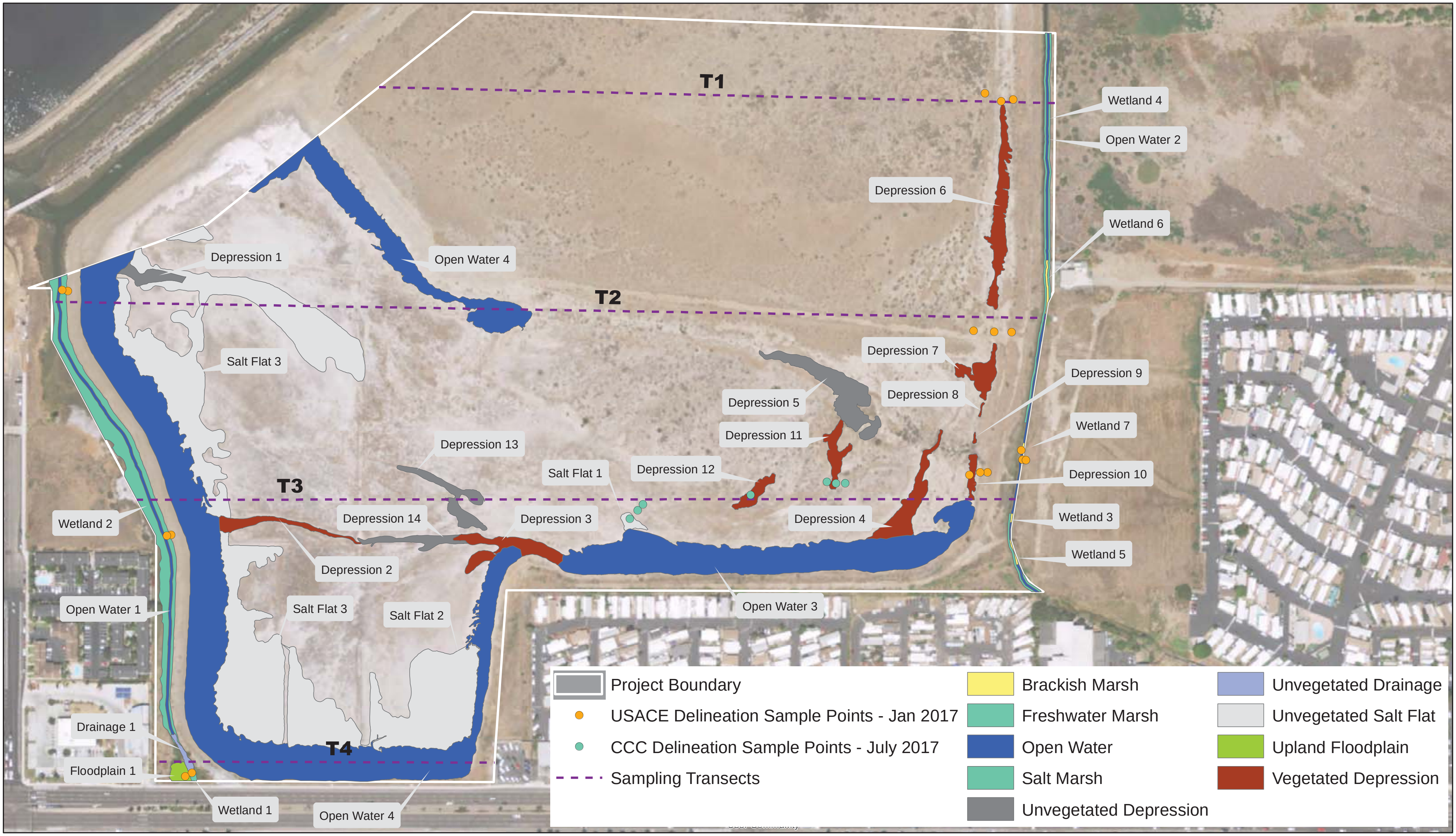
Great Ecology located thirty unique water features onsite across both 2017 delineation field efforts. These features are depicted in FIGURE 4 through FIGURE 11 and their attributes are summarized in TABLE 1. Each feature was evaluated for potential CCC wetland status.

TABLE 1: ONSITE WATER FEATURES EVALUATED FOR CCC JURISDICTION

Site Area	Site Feature Name	Type	Estimated Area (acres)	Potential Jurisdictional Determination	Description
Otay River Tributary Area	Wetland 1	Freshwater marsh	0.0086	Wetland Water of the State	Emergent vegetation dominated by narrow-leaf cattail surrounding a man-made drainage feature.
	Wetland 2	Salt marsh	0.8977	Wetland Water of the State	Coastal salt marsh dominated with pickleweed.
	Open Water 1	Unvegetated open water	0.2019	Non-Wetland Water of the State	Otay River tributary; surface water present in the drainage.
	Drainage Feature 1	Unvegetated drainage	0.0303	Wetland Water of the State	Unvegetated drainage basin with some surface water present.
	Floodplain 1	Vegetated freshwater floodplain	0.0492	Wetland Water of the State	Upland floodplain located adjacent to the Wetland 1, dominated by arroyo willow and green ash.
Nestor Creek Area	Open Water 2	Unvegetated open water	0.1369	Non-Wetland Water of the State	Nestor Creek; surface water present in the channelized creek.
	Wetland 3	Brackish marsh	0.0025	Wetland Water of the State	Emergent vegetation dominated by California club-rush.
	Wetland 4	Salt marsh	0.2285	Wetland Water of the State	Coastal salt marsh dominated by alkali sea-heath.
	Wetland 5	Brackish marsh	0.0055	Wetland Water of the State	Emergent vegetation dominated by California club-rush.
	Wetland 6	Brackish marsh	0.0158	Wetland Water of the State	Emergent vegetation dominated by California club-rush.
	Wetland 7	Brackish marsh	0.0027	Wetland Water of the State	Emergent vegetation dominated by California club-rush.
Pond 20	Open Water 3	Unvegetated open water	1.917	Non-Jurisdictional	Isolated semi-permanently flooded salt pond; surface water present in deepest part of the salt depression.
	Open Water 4	Unvegetated open water	5.436	Non-Jurisdictional	Isolated semi-permanently flooded salt pond; surface water present in deepest part of the salt depression.
	Depression 1	Unvegetated depression	0.0982	Non-Jurisdictional	Isolated unvegetated depression.
	Depression 2	Vegetated depression	0.1272	Non-Jurisdictional	Isolated depression supporting slenderleaf iceplant, crystalline iceplant, and other upland herbaceous vegetation.

Site Area	Site Feature Name	Type	Estimated Area (acres)	Potential Jurisdictional Determination	Description
	Depression 3	Vegetated depression	0.1779	Non-Jurisdictional	Isolated depression within the salt flat supporting slenderleaf iceplant, and other upland herbaceous vegetation.
	Depression 4	Vegetated depression	0.2384	Non-Jurisdictional	Isolated depression supporting slenderleaf iceplant, crystalline iceplant, and other upland herbaceous vegetation.
	Depression 5	Unvegetated depression	0.3975	Non-Jurisdictional	Isolated unvegetated depression.
	Depression 6	Vegetated depression	0.3129	Non-Jurisdictional	Isolated depression supporting slenderleaf iceplant, crystalline iceplant, and other upland herbaceous vegetation.
	Depression 7	Vegetated depression	0.1406	Non-Jurisdictional	Isolated depression supporting slenderleaf iceplant, crystalline iceplant, and other upland herbaceous vegetation.
	Depression 8	Vegetated depression	0.0045	Non-Jurisdictional	Isolated depression supporting slenderleaf iceplant, crystalline iceplant, and other upland herbaceous vegetation.
	Depression 9	Vegetated depression	0.0045	Non-Jurisdictional	Isolated depression supporting slenderleaf iceplant, crystalline iceplant, and other upland herbaceous vegetation.
	Depression 10	Vegetated depression	0.0462	Non-Jurisdictional	Isolated depression supporting slenderleaf iceplant, crystalline iceplant, and other upland herbaceous vegetation.
	Depression 11	Vegetated depression	0.1152	Non-Jurisdictional	Isolated depression supporting slenderleaf iceplant, crystalline iceplant, and other upland herbaceous vegetation.
	Depression 12	Vegetated depression	0.0779	Non-Jurisdictional	Isolated depression supporting slenderleaf iceplant, crystalline iceplant, and other upland herbaceous vegetation.
	Depression 13	Unvegetated depression	0.1809	Non-Jurisdictional	Isolated unvegetated depression.
	Depression 14	Unvegetated depression	0.1103	Non-Jurisdictional	Isolated unvegetated depression.
	Salt Flat 1	Unvegetated salt flat	0.0393	Non-Jurisdictional	Intermittently flooded, unvegetated salt flat, thick salt precipitate present on top of soil surface.

Site Area	Site Feature Name	Type	Estimated Area (acres)	Potential Jurisdictional Determination	Description
	Salt Flat 2	Unvegetated salt flat	1.759	Non-Jurisdictional	Intermittently flooded, unvegetated salt flat, thick salt precipitate present on top of soil surface.
	Salt Flat 3	Unvegetated salt flat	3.751	Non-Jurisdictional	Intermittently flooded, unvegetated salt flat, thick salt precipitate present on top of soil surface.
Total Estimated Area			**16.51**		

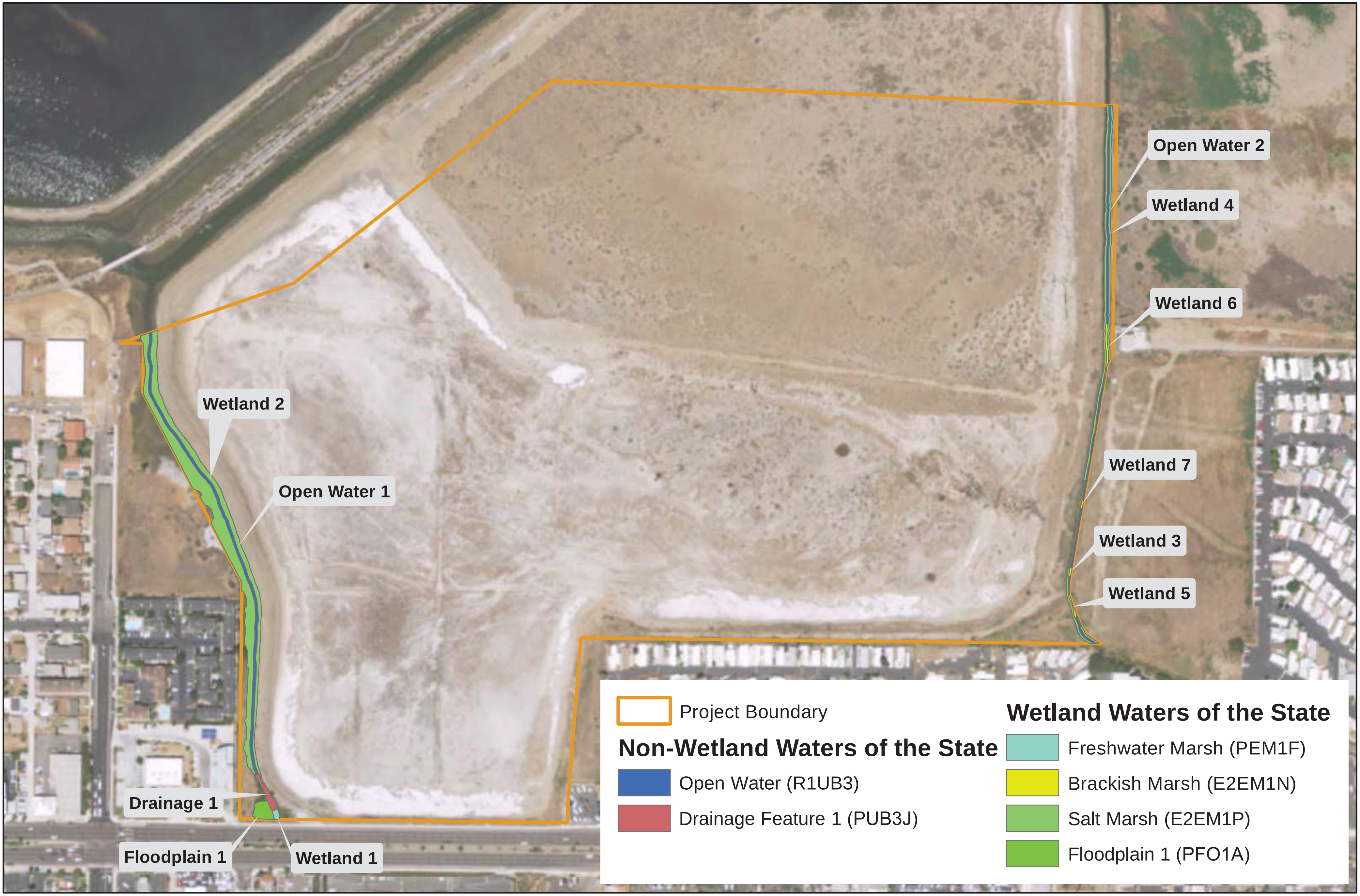


POTENTIAL JURISDICTIONAL WATERS - OVERVIEW
SOUTH SAN DIEGO BAY MITIGATION BANK SAN DIEGO

UNIFIED PORT DISTRICT
OCTOBER 2017

FIGURE 4
1:3,200
NAD 1983 CA STATE PLANE FIPS IV

GREATecology
ENVIRONMENT + DESIGN



POTENTIAL JURISDICTIONAL WATERS - **SITE**
SOUTH SAN DIEGO BAY MITIGATION BANK

SAN DIEGO UNIFIED PORT DISTRICT
JULY 2017

0 0.05 0.1 Miles

N

FIGURE 5
1:4,000
NAD 1983 CA STATE PLANE FIPS IV

GREATecology
ENVIRONMENT + DESIGN

POTENTIAL JURISDICTIONAL WATERS - W1
SOUTH SAN DIEGO BAY MITIGATION BANK

FIGURE 6
1:750
NAD 1983 CA STATE PLANE FIPS IV

SAN DIEGO UNIFIED PORT DISTRICT
JULY 2017

0 50 100 Feet

N

GREATecology
ENVIRONMENT + DESIGN

POTENTIAL JURISDICTIONAL WATERS - W2
SOUTH SAN DIEGO BAY MITIGATION BANK

FIGURE 7
1:750
NAD 1983 CA STATE PLANE FIPS IV

SAN DIEGO UNIFIED PORT DISTRICT
JULY 2017

0 50 100 Feet

N

GREATecology
ENVIRONMENT + DESIGN

POTENTIAL JURISDICTIONAL WATERS - W3
SOUTH SAN DIEGO BAY MITIGATION BANK

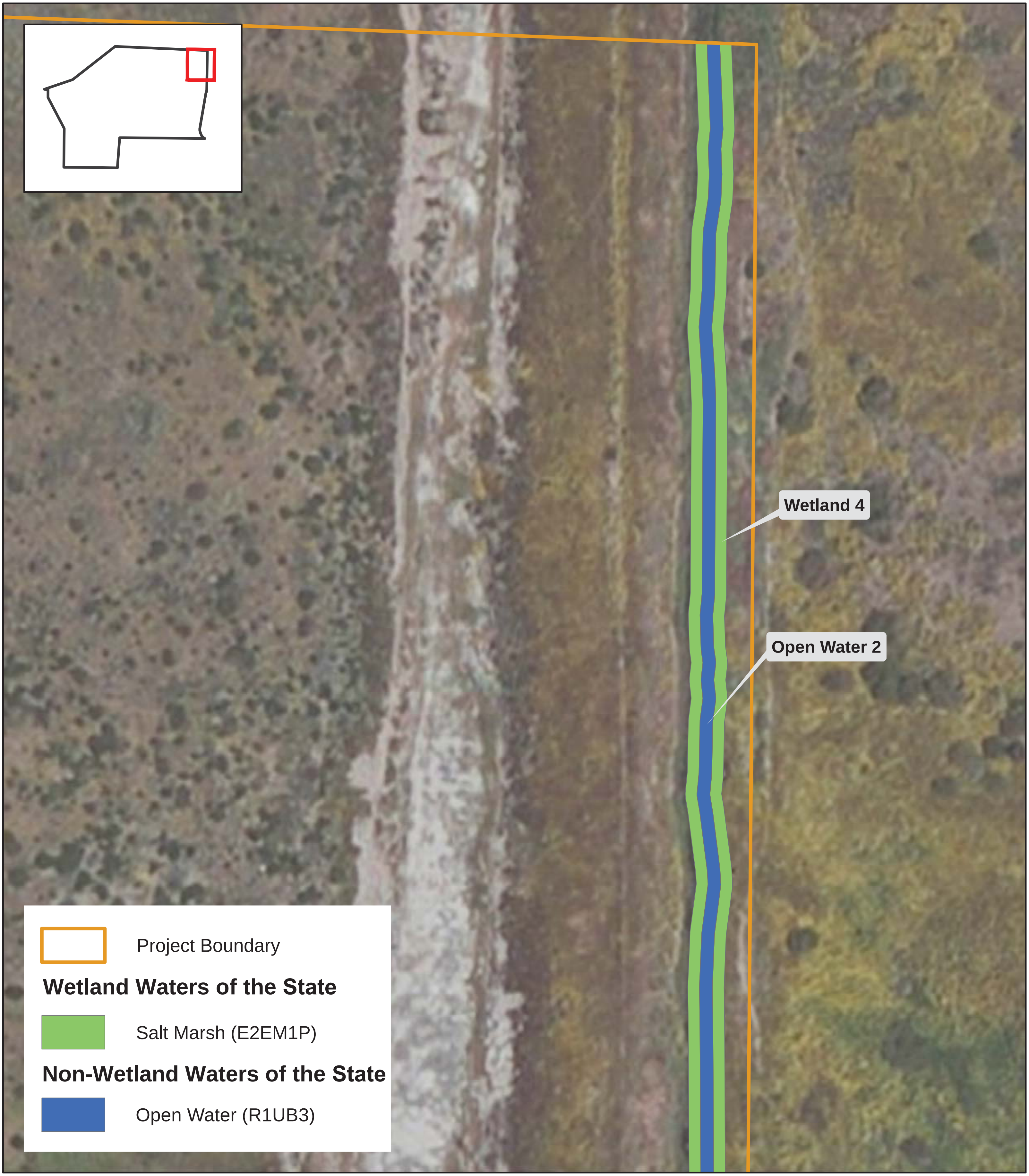
FIGURE 8
1:750
NAD 1983 CA STATE PLANE FIPS IV

SAN DIEGO UNIFIED PORT DISTRICT
JULY 2017

0 50 100 Feet

N

GREATecology
ENVIRONMENT + DESIGN



POTENTIAL JURISDICTIONAL WATERS - E1
SOUTH SAN DIEGO BAY MITIGATION BANK

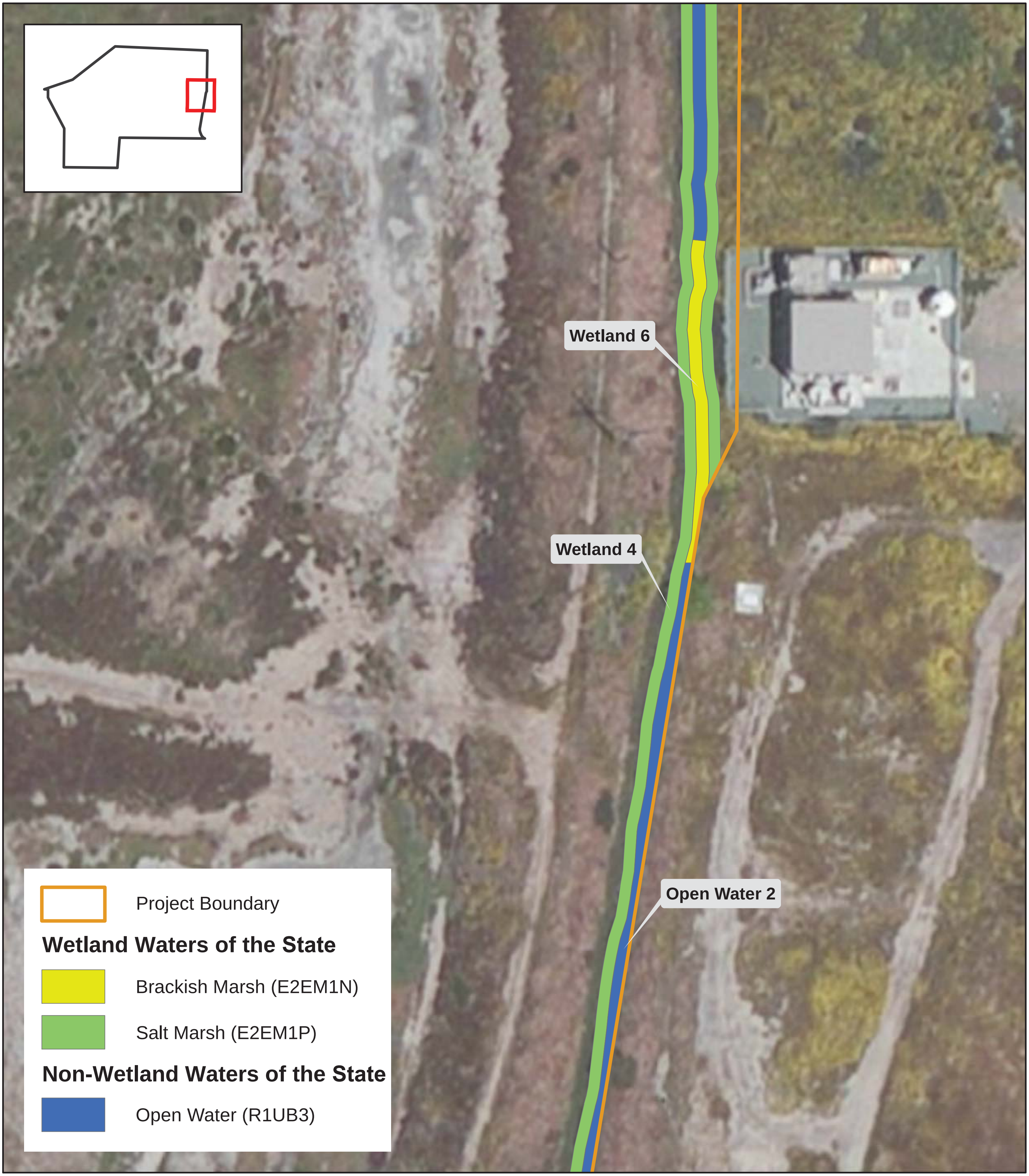
FIGURE 9
1:750
NAD 1983 CA STATE PLANE FIPS IV

SAN DIEGO UNIFIED PORT DISTRICT
JULY 2017

Feet
0 50 100

N

GREATecology
ENVIRONMENT + DESIGN



POTENTIAL JURISDICTIONAL WATERS - E2
SOUTH SAN DIEGO BAY MITIGATION BANK

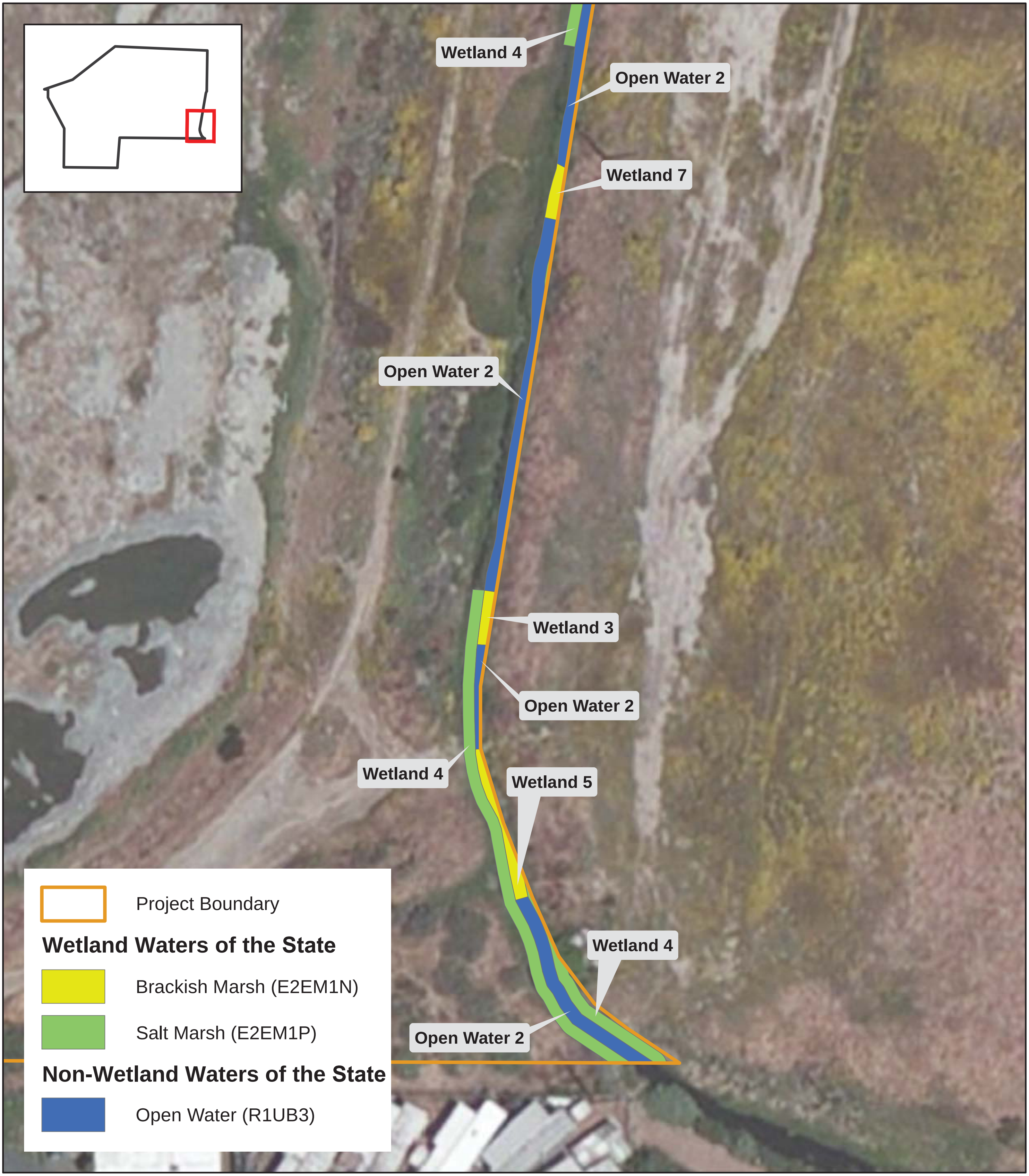
FIGURE 10
1:750
NAD 1983 CA STATE PLANE FIPS IV

SAN DIEGO UNIFIED PORT DISTRICT
JULY 2017

0 50 100 Feet

N

GREAT ecology
ENVIRONMENT + DESIGN



POTENTIAL JURISDICTIONAL WATERS - E3
SOUTH SAN DIEGO BAY MITIGATION BANK

FIGURE 11
1:750
NAD 1983 CA STATE PLANE FIPS IV

SAN DIEGO UNIFIED PORT DISTRICT
JULY 2017

0 50 100 Feet

N

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CCC Jurisdictional Areas

Areas delineated as CCC jurisdictional during the winter 2017 field delineation event and the July 6, 2017 field delineation event are summarized in TABLE 2 and mapped in FIGURE 5 through FIGURE 11. In total, Great Ecology identified eight water features comprising 1.58 acres of areas under CCC jurisdiction, which are located exclusively within the Otay River Tributary and Nestor Creek Areas.

TABLE 2: SUMMARY OF CCC JURISDICTIONAL AREAS WITHIN THE SITE

Site Area	Site Features Name	Classification	Potential Jurisdictional Determination	Estimated Area (acres)
Otay River Tributary Area	Open Water 1	Otay River Tributary; tidal riverine (R1UB3)	Non-Wetland Water of the State	0.2019
	Wetland 1	Emergent Wetland (PEM1F)	Wetland Water of the State	0.0086
	Wetland 2	Salt Marsh Wetland (E2EM1P)	Wetland Water of the State	0.8977
	Drainage Feature 1	Unvegetated drainage	Wetland Water of the State	0.0303
	Floodplain 1	Forested Floodplain (PFO1A)	Wetland Water of the State	0.0492
Nestor Creek Area	Open Water 2	Nestor Creek; tidal riverine (R1UB3)	Non-Wetland Water of the State	0.1369
	Wetland 3	Emergent Brackish Marsh Wetland (E2EM1N)	Wetland Water of the State	0.0025
	Wetland 4	Salt Marsh Wetland (E2EM1P)	Wetland Water of the State	0.2285
	Wetland 5	Emergent Brackish Marsh Wetland (E2EM1N)	Wetland Water of the State	0.0055
	Wetland 6	Emergent Brackish Marsh Wetland (E2EM1N)	Wetland Water of the State	0.0158
	Wetland 7	Emergent Brackish Marsh Wetland (E2EM1N)	Wetland Water of the State	0.0027
CCC Wetlands Total Area				1.58

Otay River Tributary Area Jurisdictional Features

Open Water 1 (Figure 6 through Figure 8)

Open Water 1 is located within the Otay River Tributary Area and is known as the Otay River Tributary. It is located on the western boundary of the Site entirely outside Pond 20. The surface water feature appears to be permanently inundated near the northern end of its extent, and becomes semi-permanently inundated at the southern end depending on the fluctuation of tidal prism through the channel. The feature also carries storm water discharges entering the Site from the MS4 drainage and sheet flows from Palm Avenue during high storm flows. The tributary was surrounded by salt marsh (Wetland 2) and showed a clear OHWM. The channel bottom is comprised of unvegetated, unconsolidated mud.

Wetland 1 (Figure 8)

Wetland 1 is located at the southern end of the Otay River Tributary Area at the mouth of an MS4 drainage and is dominated by narrowleaf cattail. This wetland is intermittently submerged during storm events with stormwater flows from the MS4 and sheet water flows onto the Site, outside the berm, from Palm Avenue. Although the presence of surface water and a high water table prevented a high-integrity soil sample, Great Ecology ecologists observed one centimeter of muck at the top of the soil matrix, and noted a hydrogen sulfide odor upon excavation of the soil sample within Wetland 1. At the time of sampling, the wetland vegetation had been recently cleared for stormwater system maintenance purposes, and the team observed a tree stump located within the wetland that was likely arroyo willow, debris from which was observed deposited on the upland area directly adjacent to Wetland 1.

Wetland 2 (Figure 6 through Figure 8)

Wetland 2 is located in the Otay River Tributary Area and completely surrounds the Otay River tributary. The wetland contains dense salt marsh vegetation dominated by pickleweed, saltwort, alkali sea-heath, and shore grass. Patches of cordgrass were also observed along the banks of the Otay River Tributary. Portions of the wetland are intermittently submerged with tidal flows during high tide, but the steep elevation of tributary banks prevents submersion of the entire wetland. The soils in Wetland 2 are clay and displayed concentrated redox features within a depleted matrix.

Drainage Feature 1 (Figure 8)

Drainage Feature 1 is a shallow, unvegetated drainage basin that had intermittent surface water present at the time of the field wetland delineation. Drainage Feature 1 is located between the southern terminus of Open Water 2 (the Otay River Tributary) and the northern boundary of Wetland 1. During the wetland delineation field effort, Open Water 2 and Wetland 1 were not directly connected via Drainage Feature 1, but the presence of standing water indicates some level of surface water connectivity between the two existed in the recent past. The drainage may receive tidal flows from the Otay River tributary to the north, and stormwater discharge from both the MS4 drainage and sheet surface runoff from Palm Avenue. During a December 2016 storm event, Great Ecology staff observed surface water connectivity between Open Water 1, Drainage Feature 1, and Wetland 1. This area, contained within an OHWM boundary, is comprised of an unconsolidated mud bottom, and is unvegetated. Outside of the OHWM boundary, Drainage Feature 1 is flanked by salt marsh wetlands dominated by coastal salt grass, and three Brazilian pepper tree individuals.

Floodplain 1 (Figure 8)

Floodplain 1 is located within the Otay River Tributary Area and directly adjacent to the MS4 drainage associated with Palm Avenue that feeds into the Otay River Tributary. While hydric soil indicators were not present, wetland hydrology and vegetation were present. This wetland feature appears to be infrequently inundated, only flooding during excess stormflows from the MS4. It is not tidally influenced. Vegetation was typically shrubby and dominated by specicies characteristic of disturbed freshwater floodplains, including arroyo willow, green ash, and castorbean (*Ricinus communis*). There was a thick layer of duff present and no herbaceous layer. Much of the litter appeared to be vegetation cut and placed from elsewhere. In addition, there was a mature arroyo willow that had been cut and laid down in this area.

Nestor Creek Area Jurisdictional Features

Open Water 2 (Figure 9 through Figure 11)

Open Water 2 is located in the Nestor Creek Area and known as Nestor Creek. It is located along the eastern boundary of Pond 20, entirely outside of the berm. The surface water appears to be permanent and empties into the Otay River approximately 1,500 feet to the north. Nestor Creek is surrounded by salt marsh (Wetland 4) and contains brackish marsh (Wetlands 3, 5, 6, and 7) within its OHWM. The channel bottom is comprised of unconsolidated mud and is unvegetated except for Wetlands 3, 5, 6, and 7.

Wetland 4 (Figure 9 through Figure 11)

Wetland 4 is located on the eastern edge of Pond 20, entirely outside of the berm, and completely surrounds Nestor Creek. Nestor Creek is freshwater, but is tidally influenced due to its proximity to the Otay River mouth and San Diego Bay. The wetland contains dense hydrophytic vegetation including both typical salt marsh and freshwater marsh species, i.e. pickleweed, alkali sea-heath, and California club-rush. Wetland 4 soils are sandy loam and exhibited redox concentrations within the soil matrix. The wetland is intermittently saturated with both tidal fluctuations and high freshwater flows during storm events.

Wetlands 3, 5, 6, and 7 (Figure 10 and Figure 11)

Wetlands 3, 5, 6, and 7 are located in the Nestor Creek Area on the eastern boundary of Pond 20, entirely outside of the berm. These wetlands are characterized as being entirely within Nestor Creek OHWM limits with vegetation dominated by California club-rush. Although surface water and high water table prevented a high-integrity soil sample, Great Ecology observed one centimeter of muck on the top of the soil matrix within these wetlands and, given the prevalence of obligate hydrophytic vegetation community, Great Ecology staff assumed the soils to be hydric. Nestor Creek is freshwater, but is tidally influenced due to its proximity to the Otay River mouth and San Diego Bay. Great Ecology could not confirm the year-round hydrological regime for these wetland features using aerial imagery given the limited areal extent. Evidence encountered in the field suggests that, under normal climatic conditions, Wetlands 3, 5, 6, and 7 are inundated year-round with fresh water and likely receive pulses of saline water during high tides, resulting in a brackish mix of fresh and marine waters.

Pond 20 Water Features Not Considered CCC Jurisdictional

Great Ecology identified additional water features within Pond 20 that exhibited at least one positive wetland field indicator defined by CCC, totaling approximately 15 acres. These include the Open Water, Salt Flat, and Depression features listed in TABLE 1. While these locations exhibit one positive wetland field indicator, there is no substantial wildlife use. These hydrologically isolated locations do not provide chemical cycling and transformation in plants, nor do they transport detritus and/or nutrients. These areas do not provide substantial subsurface storage capacity. In short, these areas do not offer the ecosystem services associated with wetlands protected under the Coastal Act, similar to waters identified and determined non-jurisdictional for the South Bay Power Plant project (CCC 2014).

Perennial Ponds (Figure 4, Open Water 3 and Open Water 4)

The salt ponds have standing water for the majority of the year and an OHWM is present, indicating positive wetland hydrology. These ponds are fed exclusively by precipitation and have no connection to groundwater or tidal influence. Birds have been anecdotally observed resting and loafing in the ponds while onsite, but ponds are hypersaline to the point that no fish are present to forage on, nor is there aquatic vegetation for forage. The ponds evaporate during the summer and the salt precipitates into a smooth crust that is unusable for foraging, nesting, or breeding by most species. These areas are completely unvegetated when dry and the hypersaline conditions make wetland plant establishment in the current conditions impossible.

Unvegetated Salt Flats (Figure 4, Salt Flat 1 through Salt Flat 3)

The salt flats are large stretches of unvegetated landscape directly adjacent to the perennial ponds. The soils are wet or saturated during the wet season and are covered in a salt precipitate during the dry season, indicating positive wetland hydrology and hydric soils. As with other parts of Pond 20, there is no hydrological connection to any source of water apart from the nearby ponds, which are fed exclusively by precipitation. The soils in this area, particularly, have been found to be underlain by an impermeable clay layer. There is nothing living in or on these soils due to the hypersaline nature of the area, making them unsuitable forage habitat.

Unvegetated Depressions (Figure 4A, Depression 1, Depression 5, Depression 13, and Depression 14)

The unvegetated depressions are well-drained topographical depressions located within the Pond 20 landscape matrix. The depressions exhibit positive wetland hydrology indicators, but hydric soils and hydrophytic vegetation communities are not present. Some depressions have a surface water connection to the perennial ponds, while others are isolated on the landscape. Some interior unvegetated depressions are deeper than those near the ponds, which indicates there is no groundwater influence at play in water depth. The ponds are unvegetated and fill with water during the wet season. The standing water evaporates over a period of days to weeks, depending on the size of the depression, leaving behind a salt crust precipitate. There are no fish in these depressions or vegetation for foraging, likely due to hypersaline conditions and lack of surface water connectivity over decades.

Vegetated Depressions (Figure 4, Depression 2 through Depression 4, and Depression 6 through Depression 12)

The vegetated depressions are well-drained topographical depressions located within the Pond 20 landscape matrix. The vegetated depressions exhibit positive wetland hydrology, but do not support hydric soils or hydrophytic vegetation communities. There is standing water in the depressions during the wet season and the soils may remain saturated throughout the year depending on the depth of the depression and its proximity to the nearby ponds. The depressions are vegetated with a mix of upland and facultative wetland plants.

One sample point (T3.9) scored positive for hydrophytic vegetation, but this is the result of limitations in the characterization procedures proscribed for this wetland indicator. The majority of the vegetation community in this area was dominated by goldenbush, classified as Facultative by the Corps' Arid West Plant List (2016), with most other plants in the community being upland or facultative upland species (e.g., coyotebush, beach evening primrose [*Camissoniopsis cheiranthifolia*], crystalline iceplant). In San Diego, goldenbush is frequently a component of native vegetation communities that establish on sandy uplands, such as coastal sage scrub, and not necessarily coastal wetland plant communities. The area characterized by T3.9 is a sandy upland with robust shrub cover, and young goldenbush growth is restricted to the edge of the adjacent vegetated topographic depression.

Overall, these vegetated communities do not provide substantial wetland function in these depressions. They have some potential for retention of particulates from decaying vegetation; however the depression areas are relatively small and the area of effect would be limited to the boundaries of the depression. While the vegetation has some potential for nutrient cycling and transformation of elements and compounds within individual depressions, the depressions are small and isolated, fed only by precipitation. No fish have been observed in the depressions, nor have there been any observations of substantial wildlife use during field surveys. In spite of the irregular presence of individual hydrophytic plants within various depressions, they do not offer any significant ecological value in terms of overall wetland function at Pond 20.

REFERENCES

California Coastal Commission (CCC). 2014. W15a: Staff Report: Regular Calendar, Application No. E-12-015. 37 pp.

Great Ecology. 2017. Delineation of Jurisdictional Wetlands and Non-Wetland Waters Under Clean Water Action Section 404, Proposed South San Diego Bay Wetland Mitigation Bank (Pond 20). Report prepared for the Port of San Diego, Planning & Green Port, 180 pp.

United States Army Corps of Engineers (USACE). 2012. Updated 2012 National Wetland Plant List. Accessed: 13 October 2017. http://www.usace.army.mil/Media/News-Releases/News-Release-Article-View/Article/475438/updated-2012-national-wetland-plant-list-is-available/.

APPENDIX A: DATA FORMS

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Wetlands Restoration of Salt Pond 20 City/County: San Diego, San Diego County Sampling Date: 7-6-2017
Applicant/Owner: San Diego Unified Port District State: CA Sampling Point: T3.7
Investigator(s): M. Tyner-Valencourt, A. Tuggle Section, Township, Range: T18S R2W S21
Landform (hillslope, terrace, etc.): Flat upland Local relief (concave, convex, none): None Slope (%): 0
Subregion (LRR): C - Mediterranean California Lat: 32.5861721 Long: -117.0987227 Datum: NAD 1983
Soil Map Unit Name: LG-W - Lagoon water NWI classification: E2SSP
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ● No ○ (If no, explain in Remarks.)
Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ● No ○
Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ○ No ●
Hydric Soil Present? Yes ○ No ●
Wetland Hydrology Present? Yes ○ No ●

Is the Sampled Area within a Wetland? **Yes** ○ **No** ○

Remarks: Site historically supported tidal estuary habitat but was filled and bermed in mid-1850s for use as a salt evaporator pond, and has not been restored since. Delineation conducted on site during the summer following an above-average rainy season after 5+ years of severe drought.

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:	%		
Sapling/Shrub Stratum			
1. *Baccharis pilularis*	10	No	Not Listed
2. *Isocoma menziesii*	10	No	FAC
3. *Atriplex polycarpa*	2	No	FACU
4.			
5.			
Total Cover:	22 %		
Herb Stratum			
1. *Camissonia cheiranthifolia*	35	Yes	Not Listed
2. *Isocoma menziesii*	20	Yes	FAC
3. *Mesembryanthemum crystallinum*	1	No	FACU
4.			
5.			
6.			
7.			
8.			
Total Cover:	56 %		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum ____ % % Cover of Biotic Crust ____ %

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)
Total Number of Dominant Species Across All Strata: 2 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 50.0 % (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	0
FACW species		x 2 =	0
FAC species	30	x 3 =	90
FACU species	3	x 4 =	12
UPL species	45	x 5 =	225
Column Totals:	78	(A)	327 (B)

Prevalence Index = B/A = 4.19

Hydrophytic Vegetation Indicators:

- ☐ Dominance Test is >50%
- ☐ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? **Yes** ○ **No** ●

Remarks: Vegetation community is not hydrophytic.

SOIL

Sampling Point: T3.7

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture[3]	Remarks
	10YR 5/3	100					Sand	Unable to determine if stratified

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2] Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

[3] Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (**LRR C**)
- ☐ 1 cm Muck (A9) (**LRR D**)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[4]:

- ☐ 1 cm Muck (A9) (**LRR C**)
- ☐ 2 cm Muck (A10) (**LRR B**)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[4] Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ●

Remarks: Could not collect and analyze a full soil core due to the dry, sandy nature of the soil, which collapsed on itself upon extraction from soil pit. No hydric soil indicators observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) (**Nonriverine**)
- ☐ Sediment Deposits (B2) (**Nonriverine**)
- ☐ Drift Deposits (B3) (**Nonriverine**)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Plowed Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) (**Riverine**)
- ☐ Sediment Deposits (B2) (**Riverine**)
- ☐ Drift Deposits (B3) (**Riverine**)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ● Depth (inches):

Water Table Present? Yes ○ No ● Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ● Depth (inches):

Wetland Hydrology Present? Yes ○ No ●

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: No positive hydrology indicators observed.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Wetlands Restoration of Salt Pond 20 City/County: San Diego, San Diego County Sampling Date: 7-6-2017
Applicant/Owner: San Diego Unified Port District State: CA Sampling Point: T3.8
Investigator(s): M. Tyner-Valencourt, A. Tuggle Section, Township, Range: T18S R2W S21
Landform (hillslope, terrace, etc.): Depression Local relief (concave, convex, none): Concave Slope (%): 0
Subregion (LRR): C - Mediterranean California Lat: 32.5861703 Long: -117.0987998 Datum: NAD 1983
Soil Map Unit Name: LG-W - Lagoon water NWI classification: E2SSP
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ● No ○ (If no, explain in Remarks.)
Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ● No ○
Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ○	No ●	
Hydric Soil Present?	Yes ○	No ●	**Is the Sampled Area**
Wetland Hydrology Present?	Yes ○	No ●	**within a Wetland?** **Yes** ● **No** ○

Remarks: Site historically supported tidal estuary habitat but was filled and bermed in mid-1850s for use as a salt evaporator pond, and has not been restored since. Delineation conducted on site during the summer following an above-average rainy season after 5+ years of severe drought.

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:	%		
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
Total Cover:	%		
Herb Stratum			
1. *Mesembryanthemum crystallinum*	150	Yes	FACU
2. *Atriplex prostrata*	15	No	FACW
3. *Isocoma menziesii*	15	No	FAC
4. *Bassia hyssopifolia*	1	No	FACU
5.			
6.			
7.			
8.			
Total Cover:	181 %		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum ____ % % Cover of Biotic Crust ____ %

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	0	(A)
Total Number of Dominant Species Across All Strata:	1	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	0.0 %	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	0
FACW species	15	x 2 =	30
FAC species	15	x 3 =	45
FACU species	151	x 4 =	604
UPL species		x 5 =	0
Column Totals:	181 (A)		679 (B)

Prevalence Index = B/A = 3.75

Hydrophytic Vegetation Indicators:

- ☐ Dominance Test is >50%
- ☐ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? **Yes** ○ **No** ●

Remarks: Isocoma menziesii is distributed primarily along the edges of the feature. Hydrophytic vegetation community not observed.

SOIL

Sampling Point: T3.8

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features				Texture[3]	Remarks
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]		
0-7	7.5YR 3/5	90	7.5YR 5/8	10	C	M	Loamy Sand	Mottles at bottom of strata
7-13	10YR 6/1	88	7.5YR 5/8	12	C	M	Sand	Large patches of redox features

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2] Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

[3] Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (**LRR C**)
- ☐ 1 cm Muck (A9) (**LRR D**)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[4]:

- ☐ 1 cm Muck (A9) (**LRR C**)
- ☐ 2 cm Muck (A10) (**LRR B**)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[4] Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ●

Remarks: No hydric soil indicators observed

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) (**Nonriverine**)
- ☐ Sediment Deposits (B2) (**Nonriverine**)
- ☐ Drift Deposits (B3) (**Nonriverine**)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Plowed Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) (**Riverine**)
- ☐ Sediment Deposits (B2) (**Riverine**)
- ☐ Drift Deposits (B3) (**Riverine**)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ● Depth (inches):

Water Table Present? Yes ○ No ● Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ● Depth (inches):

Wetland Hydrology Present? **Yes** ○ **No** ●

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: No wetland hydrology indicators observed

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Wetlands Restoration of Salt Pond 20 City/County: San Diego, San Diego County Sampling Date: 7-6-2017

Applicant/Owner: San Diego Unified Port District State: CA Sampling Point: T3.9

Investigator(s): M. Tyner-Valencourt, A. Tuggle Section, Township, Range: T18S R2W S21

Landform (hillslope, terrace, etc.): Upland Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR): C - Mediterranean California Lat: 32.5861797 Long: -117.098876 Datum: NAD 1983

Soil Map Unit Name: LG-W - Lagoon water NWI classification: E2SSP

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ● No ○ (If no, explain in Remarks.)

Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ● No ○

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ●	No ○	
Hydric Soil Present?	Yes ○	No ●	**Is the Sampled Area**
Wetland Hydrology Present?	Yes ○	No ●	**within a Wetland?** **Yes** ○ **No** ○

Remarks: Site historically supported tidal estuary habitat but was filled and bermed in mid-1850s for use as a salt evaporator pond, and has not been restored since. Delineation conducted on site during the summer following an above-average rainy season after 5+ years of severe drought.

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:	%		
Sapling/Shrub Stratum			
1. *Isocoma menziesii*	40	Yes	FAC
2. *Baccharis pilularis*	5	No	Not Listed
3.			
4.			
5.			
Total Cover:	45 %		
Herb Stratum			
1. *Camissonia cheiranthifolia*	60	Yes	Not Listed
2. *Isocoma menziesii*	20	Yes	FAC
3. *Mesembryanthemum crystallinum*	5	No	FACU
4. *Cressa truxillensis*	1	No	FACW
5.			
6.			
7.			
8.			
Total Cover:	86 %		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum ____ % % Cover of Biotic Crust ____ %

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	2	(A)
Total Number of Dominant Species Across All Strata:	3	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	66.7 %	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species		x 1 =	0	
FACW species	1	x 2 =	2	
FAC species	60	x 3 =	180	
FACU species	5	x 4 =	20	
UPL species	65	x 5 =	325	
Column Totals:	131	(A)	527	(B)

Prevalence Index = B/A = 4.02

Hydrophytic Vegetation Indicators:

- ☒ Dominance Test is >50%
- ☐ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? **Yes** ● **No** ○

Remarks: Dominance test shows hydrophytic vegetation community present, based entirely on the presence of Isocoma menziesii in a low-diversity community of shrubs and herbaceous vegetation.

SOIL

Sampling Point: T3.9

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features				Texture[3]	Remarks
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]		
	7.5YR 4/2	100					Sand	Unable to determine if stratified

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2] Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

[3] Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (**LRR C**)
- ☐ 1 cm Muck (A9) (**LRR D**)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[4]:

- ☐ 1 cm Muck (A9) (**LRR C**)
- ☐ 2 cm Muck (A10) (**LRR B**)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[4] Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ●

Remarks: Could not collect and analyze a full soil core due to the dry, sandy nature of the soil, which collapsed on itself upon extraction from soil pit. No hydric soil indicators observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) (**Nonriverine**)
- ☐ Sediment Deposits (B2) (**Nonriverine**)
- ☐ Drift Deposits (B3) (**Nonriverine**)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Plowed Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) (**Riverine**)
- ☐ Sediment Deposits (B2) (**Riverine**)
- ☐ Drift Deposits (B3) (**Riverine**)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ● Depth (inches):

Water Table Present? Yes ○ No ● Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ● Depth (inches):

Wetland Hydrology Present? Yes ○ No ●

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: No wetland hydrology indicators present

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Wetlands Restoration of Salt Pond 20 City/County: San Diego, San Diego County Sampling Date: 7-6-2017
Applicant/Owner: San Diego Unified Port District State: CA Sampling Point: T3.10
Investigator(s): M. Tyner-Valencourt, A. Tuggle Section, Township, Range: T18S R2W S21
Landform (hillslope, terrace, etc.): Flat upland Local relief (concave, convex, none): None Slope (%): 0
Subregion (LRR): C - Mediterranean California Lat: 32.5860887 Long: -117.0995126 Datum: NAD 1983
Soil Map Unit Name: LG-W - Lagoon water NWI classification: E2SSP
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ● No ○ (If no, explain in Remarks.)
Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ● No ○
Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ○ No ●
Hydric Soil Present? Yes ● No ○
Wetland Hydrology Present? Yes ○ No ●

Is the Sampled Area within a Wetland? Yes ○ No ○

Remarks: Site historically supported tidal estuary habitat but was filled and bermed in mid-1850s for use as a salt evaporator pond, and has not been restored since. Delineation conducted on site during the summer following an above-average rainy season after 5+ years of severe drought.

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:	%		
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
Total Cover:	%		
Herb Stratum			
1. *Mesembryanthemum crystallinum*	45	Yes	FACU
2. *Unidentified Forb #1*	5	Yes	FAC
3. *Atriplex prostrata*	2	No	FACW
4. *Camissonia cheiranthifolia*	2	No	Not Listed
5. *Isocoma menziesii*	2	No	FAC
6. *Sarcocornia pacifica*	2	No	OBL
7.			
8.			
Total Cover:	58 %		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum % % Cover of Biotic Crust %

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	1	(A)
Total Number of Dominant Species Across All Strata:	2	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	50.0 %	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	2	x 1 =	2
FACW species	2	x 2 =	4
FAC species	7	x 3 =	21
FACU species	45	x 4 =	180
UPL species	2	x 5 =	10
Column Totals:	58 (A)		217 (B)

Prevalence Index = B/A = 3.74

Hydrophytic Vegetation Indicators:

- ☐ Dominance Test is >50%
- ☐ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes ○ No ●

Remarks: One thriving Sarcocornia pacifica shrub surrounded by primarily disturbed upland vegetation.

SOIL

Sampling Point: T3.10

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture[3]	Remarks
0-5	10YR 4/2	70	2.5YR 4/8	20	C	M	Loamy sand	Concentrations of clay in matrix
5-6	10YR 2/2	95	10YR 5/6	5	C	M	Silty loam	
6-14	10YR 4/3	50	7.5YR 5/6	50	C	M	Loamy sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.
[3]Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (**LRR C**)
- ☐ 1 cm Muck (A9) (**LRR D**)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☒ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[4]:

- ☐ 1 cm Muck (A9) (**LRR C**)
- ☐ 2 cm Muck (A10) (**LRR B**)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[4]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes ● No ○

Remarks: Salt precipitate present in 0-2", clayey mix in 2-5"

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) (**Nonriverine**)
- ☐ Sediment Deposits (B2) (**Nonriverine**)
- ☐ Drift Deposits (B3) (**Nonriverine**)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Plowed Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) (**Riverine**)
- ☐ Sediment Deposits (B2) (**Riverine**)
- ☐ Drift Deposits (B3) (**Riverine**)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ● Depth (inches):

Water Table Present? Yes ○ No ● Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ● Depth (inches):

Wetland Hydrology Present? Yes ○ No ●

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: No wetland hydrology indicators observed

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Wetlands Restoration of Salt Pond 20 City/County: San Diego, San Diego County Sampling Date: 7-6-2017
Applicant/Owner: San Diego Unified Port District State: CA Sampling Point: T3.11
Investigator(s): M. Tyner-Valencourt, A. Tuggle Section, Township, Range: T18S R2W S21
Landform (hillslope, terrace, etc.): Upland Local relief (concave, convex, none): None Slope (%): 0
Subregion (LRR): C - Mediterranean California Lat: 32.5860217 Long: -117.1004141 Datum: NAD 1983
Soil Map Unit Name: LG-W - Lagoon water NWI classification: E2SSP
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ● No ○ (If no, explain in Remarks.)
Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ● No ○
Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ○	No ●	
Hydric Soil Present?	Yes ○	No ●	**Is the Sampled Area**
Wetland Hydrology Present?	Yes ○	No ●	**within a Wetland?** **Yes** ○ **No** ○

Remarks: Site historically supported tidal estuary habitat but was filled and bermed in mid-1850s for use as a salt evaporator pond, and has not been restored since. Delineation conducted on site during the summer following an above-average rainy season after 5+ years of severe drought.

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:	%		
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
Total Cover:	%		
Herb Stratum			
1. *Mesembryanthemum crystallinum*	40	Yes	FACU
2. *Atriplex prostrata*	15	No	FACW
3. *Bassia hyssopifolia*	2	No	FACU
4. *Camissonia cheiranthifolia*	2	No	Not Listed
5. *Baccharis salicifolia*	1	No	FAC
6. *Erodium ssp.*	1	No	FAC
7.			
8.			
Total Cover:	61 %		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum ____ % % Cover of Biotic Crust ____ %

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	0	(A)
Total Number of Dominant Species Across All Strata:	1	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	0.0 %	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	0
FACW species	15	x 2 =	30
FAC species	2	x 3 =	6
FACU species	42	x 4 =	168
UPL species	2	x 5 =	10
Column Totals:	61 (A)		214 (B)

Prevalence Index = B/A = 3.51

Hydrophytic Vegetation Indicators:

- ☐ Dominance Test is >50%
- ☐ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? **Yes** ○ **No** ●

Remarks:

SOIL

Sampling Point: T3.11

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture[3]	Remarks
	10YR 3/2	100					Sand	Unable to determine if stratified

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2] Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

[3] Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (**LRR C**)
- ☐ 1 cm Muck (A9) (**LRR D**)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[4]:

- ☐ 1 cm Muck (A9) (**LRR C**)
- ☐ 2 cm Muck (A10) (**LRR B**)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[4] Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ●

Remarks: Could not collect and analyze a full soil core due to the dry, sandy nature of the soil, which collapsed on itself upon extraction from soil pit. No hydric soil indicators observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) (**Nonriverine**)
- ☐ Sediment Deposits (B2) (**Nonriverine**)
- ☐ Drift Deposits (B3) (**Nonriverine**)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Plowed Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) (**Riverine**)
- ☐ Sediment Deposits (B2) (**Riverine**)
- ☐ Drift Deposits (B3) (**Riverine**)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ● Depth (inches):

Water Table Present? Yes ○ No ● Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ● Depth (inches):

Wetland Hydrology Present? **Yes** ○ **No** ●

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: No wetland hydrology indicators observed.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Wetlands Restoration of Salt Pond 20 City/County: San Diego, San Diego County Sampling Date: 7-6-2017
Applicant/Owner: San Diego Unified Port District State: CA Sampling Point: T3.12
Investigator(s): M. Tyner-Valencourt, A. Tuggle Section, Township, Range: T18S R2W S21
Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Concave Slope (%): 1
Subregion (LRR): C - Mediterranean California Lat: 32.5859813 Long: -117.100457 Datum: NAD 1983
Soil Map Unit Name: LG-W - Lagoon water NWI classification: E2SSP
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ● No ○ (If no, explain in Remarks.)
Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ● No ○
Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ○	No ●
Hydric Soil Present?	Yes ○	No ●
Wetland Hydrology Present?	Yes ○	No ●

Is the Sampled Area within a Wetland? Yes ○ No ○

Remarks: Site historically supported tidal estuary habitat but was filled and bermed in mid-1850s for use as a salt evaporator pond, and has not been restored since. Delineation conducted on site during the summer following an above-average rainy season after 5+ years of severe drought.

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:	%		
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
Total Cover:	%		
Herb Stratum			
1. *Mesembryanthemum crystallinum*	110	Yes	FACU
2. *Bassia hyssopifolia*	10	No	FACU
3. *Atriplex prostrata*	5	No	FACW
4. *Unidentified Forb #1*	2	No	FACU
5. *Camissonia cheiranthifolia*	1	No	Not Listed
6.			
7.			
8.			
Total Cover:	128 %		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum ____ % % Cover of Biotic Crust ____ %

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	0	(A)
Total Number of Dominant Species Across All Strata:	1	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	0.0 %	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	0
FACW species	5	x 2 =	10
FAC species		x 3 =	0
FACU species	122	x 4 =	488
UPL species	1	x 5 =	5
Column Totals:	128 (A)		503 (B)

Prevalence Index = B/A = 3.93

Hydrophytic Vegetation Indicators:

- ○ Dominance Test is >50%
- ○ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes ○ No ●

Remarks: Hydrophytic vegetation community not observed

SOIL

Sampling Point: T3.12

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture[3]	Remarks
0-1	7.5YR 4/4	100					Loamy sand	
1-3	7.5YR 5/4	65	2.5YR 4/6	30	C	M	Loam	
			10YR 2/1	5	C	M		
3-7	2.5YR 5/1	65	10YR 5/8	20	C	M	Loam	
			2.5YR 2/1					
7-14	10YR 3/2	100					Sandy loam	

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2] Location: PL=Pore Lining, RC=Root Channel, M=Matrix.
[3] Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (**LRR C**)
- ☐ 1 cm Muck (A9) (**LRR D**)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[4]:

- ☐ 1 cm Muck (A9) (**LRR C**)
- ☐ 2 cm Muck (A10) (**LRR B**)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[4] Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? **Yes** ○ **No** ●

Remarks: Salt precipitate present in 0-1"

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) (**Nonriverine**)
- ☐ Sediment Deposits (B2) (**Nonriverine**)
- ☐ Drift Deposits (B3) (**Nonriverine**)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Plowed Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) (**Riverine**)
- ☐ Sediment Deposits (B2) (**Riverine**)
- ☐ Drift Deposits (B3) (**Riverine**)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ● Depth (inches):

Water Table Present? Yes ○ No ● Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ● Depth (inches):

Wetland Hydrology Present? **Yes** ○ **No** ●

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: No wetland hydrology indicators observed

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Wetlands Restoration of Salt Pond 20 City/County: San Diego, San Diego County Sampling Date: 7-6-2017
Applicant/Owner: San Diego Unified Port District State: CA Sampling Point: T3.13
Investigator(s): M. Tyner-Valencourt, A. Tuggle Section, Township, Range: T18S R2W S21
Landform (hillslope, terrace, etc.): Depression Local relief (concave, convex, none): None Slope (%): 0
Subregion (LRR): C - Mediterranean California Lat: 32.5859229 Long: -117.1005228 Datum: NAD 1983
Soil Map Unit Name: LG-W - Lagoon water NWI classification: E2USNh
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ● No ○ (If no, explain in Remarks.)
Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ● No ○
Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ○	No ●	
Hydric Soil Present?	Yes ●	No ○	**Is the Sampled Area**
Wetland Hydrology Present?	Yes ●	No ○	**within a Wetland?** **Yes** ○ **No** ○

Remarks: Site historically supported tidal estuary habitat but was filled and bermed in mid-1850s for use as a salt evaporator pond, and has not been restored since. Delineation conducted on site during the summer following an above-average rainy season after 5+ years of severe drought.

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:	%		
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
Total Cover:	%		
Herb Stratum			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
Total Cover:	%		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum % % Cover of Biotic Crust %

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	0	(A)
Total Number of Dominant Species Across All Strata:	0	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	0 %	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	0
FACW species		x 2 =	0
FAC species		x 3 =	0
FACU species		x 4 =	0
UPL species		x 5 =	0
Column Totals:		(A)	0 (B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ☐ Dominance Test is >50%
- ☐ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? **Yes** ○ **No** ●

Remarks: No vegetation present

SOIL

Sampling Point: T3.13

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features				Texture[3]	Remarks
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]		
0-4	10YR 4/3	100					Sandy loam	
4-10	10 YR 2/1	30	2.5YR 5/4	60	C	M	Silty clay loam	Redox features occur in layers
10-13	GLEY 3/N	85	10YR 4/6	15	C	M	Silty clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

[3]Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (**LRR C**)
- ☐ 1 cm Muck (A9) (**LRR D**)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☒ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils:[4]

- ☐ 1 cm Muck (A9) (**LRR C**)
- ☐ 2 cm Muck (A10) (**LRR B**)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[4]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? **Yes** ● **No** ○

Remarks: Salt precipitate present in 0-1"

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☒ Water Marks (B1) (**Nonriverine**)
- ☐ Sediment Deposits (B2) (**Nonriverine**)
- ☐ Drift Deposits (B3) (**Nonriverine**)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☒ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☒ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Plowed Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) (**Riverine**)
- ☐ Sediment Deposits (B2) (**Riverine**)
- ☐ Drift Deposits (B3) (**Riverine**)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ● Depth (inches):

Water Table Present? Yes ○ No ● Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ● Depth (inches):

Wetland Hydrology Present? **Yes** ● **No** ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Aerial imagery shows area occasionally inundated and presence of salt crust.

Remarks: OHWM present, salt crust and evidence of water evaporation present.

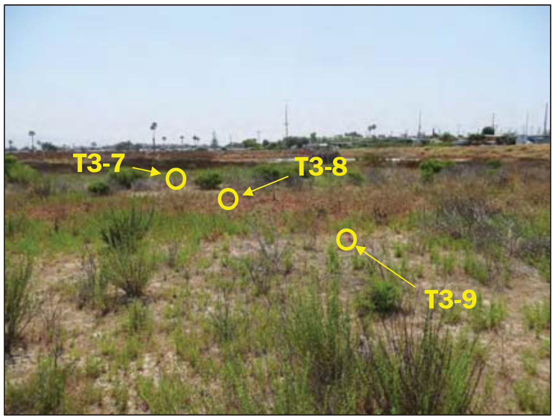
APPENDIX B: PHOTOLOG

CALIFORNIA COASTAL COMMISSION DELINEATION PHOTOGRAPHS

TRANSECT 3

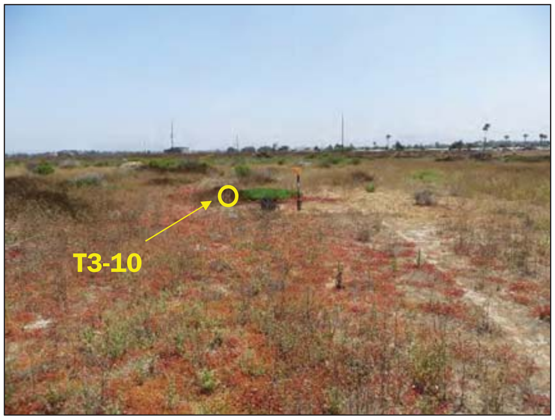
July 6, 2017

T3-7 to T3-9a



T3-7 to T3-9b

T3-10



T3-11 to T3-13

Hard Clay Pan underlying Salt Flats **Consolidated clay layer**

Inflow from Palm Avenue

APPENDIX H:

ESTIMATED SPECIES DENSITIES PER VEGETATION ALLIANCE, NOVEMBER 2017

Appendix B - Plant density estimates for vegetation polygons.

Point ID - BAC

Baccharis sarothroides Shrubland Alliance/*Mesembryanthemum* sp. Semi-Natural Herbaceous Stands		
Scientific Name	**Common Name**	**Estimated Cover**
Baccharis sarothroides	Desertbroom Baccharis	30%
Mesembryanthemum sp.[1]	Ice Plant	10%
Isocoma menzii	Menzies' goldenbush	5%
M. nodiflorum & crystallinum		

Point ID – BRM-1 - Berm vegetation – nearly bare

Mesembryanthemum sp. Semi-Natural Herbaceous Stands		
Scientific Name	**Common Name**	**Estimated Cover**
Mesembryanthemum sp.[1]	Ice Plant	1%
[1] *M. nodiflorum & crystallinum*		

Point ID – BRM-2 - Berm mixed native and nonnative vegetation

Point ID - CYL

Cylindropuntia prolifera Shrubland Alliance/ *Mesembryanthemum* sp. Semi-Natural Herbaceous Stands		
Scientific Name	**Common Name**	**Estimated Cover**
Mesembryanthemum sp.[1]	Ice Plant	30%
Cylindropuntia prolifera	Coastal cholla	15%
Salicornia subterminalis	Parish's Pickleweed	8%
[1] *M. nodiflorum & crystallinum*		

Point ID -HIR

Hirschfeldia incana Semi-Natural Herbaceous Stand		
Scientific Name	**Common Name**	**Estimated Cover**
Hirschfeldia incana	Wild Mustard	45%
Mesembryanthemum sp.[1]	Ice Plant	15%
Astragalus trichopodus	Santa Barbara Milkvetch	5%
[1] *M. nodiflorum & crystallinum*		

Point ID – ISO - 1

Isocoma menzii Shrubland/*Mesembryanthemum* sp. Semi-Natural Herbaceous Stands		
Scientific Name	**Common Name**	**Estimated Cover**
Mesembryanthemum sp.[1]	Ice Plant	40%
Isocoma menzii	Menzies' Goldenbush	20%
Cylindropuntia prolifera	Coastal Cholla	5%
Gnaphalium californicum	California Everlasting	1%
Astragalus trichopodus	Santa Barbara Milkvetch	1%
Stephanomeria sp	Wire Lettuce	1%
[1] *M. nodiflorum & crystallinum*		

Appendix B - Plant density estimates for vegetation polygons.

Point ID – ISO - 2

Isocoma menzii Shrubland/*Mesembryanthemum* sp. Semi-Natural Herbaceous Stands		
Scientific Name	**Common Name**	**Estimated Cover**
Mesembryanthemum sp.[1]	Ice Plant	25%
Isocoma menzii	Menzies' goldenbush	15%
Salicornia subterminalis	Parish's Pickleweed	1%
[1] *M. nodiflorum & crystallinum*		

Point ID – ISO-BAC

Isocoma menzii - Baccharis sarothroides Shrubland		
Scientific Name	**Common Name**	**Percentage Cover (approx.)**
Isocoma menzii	Menzies' goldenbush	55%
Baccharis sarothroides	Desertbroom Baccharis	20%
Atriplex rosea	Redscale	%
Salsola tragus	Russianthistle	5%
Camissonia sp	Suncup	5%
Melilotus indica (dry)	Annual Yellow Sweetclover	2%

Point ID – LIM – Berm mixed vegetation including Limonium sp.

Point ID – MEL

Melilotus Semi-Natural Herbaceous Stand/ *Mesembryanthemum* sp. Semi-Natural Herbaceous Stands		
Scientific Name	**Common Name**	**Estimated Cover**
Melilotus sp (dry)	Sweetclover	50%
Mesembryanthemum sp.[1]	Ice Plant	30%
Atriplex rosea	Redscale	15%
Salicornia subterminalis	Parish's Pickleweed	1%
[1] *M. nodiflorum & crystallinum*		

Point ID – MES-A

Mesembryanthemum sp. Semi-Natural Herbaceous Stands		
Scientific Name	**Common Name**	**Estimated Cover**
Mesembryanthemum sp.[1]	Ice Plant	45%
Suaeda taxifolia	Woolly Seablite	8%
Salsola tragus	Russianthistle	1%
Glebionis coronaria	Crown Daisy	1%
[1] *M. nodiflorum & crystallinum*		

Point ID – MES-B

Mesembryanthemum sp. Semi-Natural Herbaceous Stands		
Scientific Name	**Common Name**	**Estimated Cover**
Mesembryanthemum sp.[1]	Ice Plant	40%
Atriplex rosea	Redscale	25%
Conyza canadensis	Canada Horseweed	3%
Centaurea melitensis	Tocalote	3%
Salsola tragus	Russianthistle	2%
Salicornia subterminalis	Parish's Pickleweed	1%
[1] *M. nodiflorum & crystallinum*		

Appendix B - Plant density estimates for vegetation polygons.

Point ID – MES -C

Mesembryanthemum sp. Semi-Natural Herbaceous Stands		
Scientific Name	**Common Name**	**Estimated Cover**
Mesembryanthemum sp.[1]	Ice Plant	80%
Sisymbrium sp.	London Rocket	20%
Atriplex rosea	Redscale	2%
Lactuca serriola	Prickly Lettuce	2%
[1] *M. nodiflorum & crystallinum*		

Point ID - MES - D

Mesembryanthemum sp. Semi-Natural Herbaceous Stands		
Scientific Name	**Common Name**	**Estimated Cover**
Mesembryanthemum sp.[1]	Ice Plant	75%
Suaeda taxifolia	Woolly Seablite	1%
Atriplex rosea	Redscale	1%
Sisymbrium sp.	London Rocket	1%
[1] *M. nodiflorum & crystallinum*		

Point ID – MES - E

Mesembryanthemum sp. Semi-Natural Herbaceous Stands		
Scientific Name	**Common Name**	**Estimated Cover**
Mesembryanthemum sp.[1]	Ice Plant	60%
Salicornia subterminalis	Parish's Pickleweed	25%
Baccharis sarothroides	Desertbroom Baccharis	1%
[1] *M. nodiflorum & crystallinum*		

Point ID – MES - F

Mesembryanthemum sp. Semi-Natural Herbaceous Stands		
Scientific Name	**Common Name**	**Estimated Cover**
Mesembryanthemum sp.[1]	Ice Plant	60%
Melilotus indica (dry)	Annual Yellow Sweetclover	20%
Salicornia subterminalis	Parish's Pickleweed	8%
[1] *M. nodiflorum & crystallinum*		

Point ID – MES - X

Mesembryanthemum sp. Semi-Natural Herbaceous Stands		
Scientific Name	**Common Name**	**Estimated Cover**
Mesembryanthemum sp.[1]	Ice Plant	5-40%
[1] *M. nodiflorum & crystallinum*		

Appendix B - Plant density estimates for vegetation polygons.

Point ID - MESSAL

Mesembryanthemum- Salicornia Semi-Natural Herbaceous Stands		
Scientific Name	**Common Name**	**Estimated Cover**
Mesembryanthemum sp.[1]	Ice Plant	50%
Salicornia subterminalis	Parish's Pickleweed	20%
[1] *M. nodiflorum & crystallinum*		

Point ID - RDWY

Mesembryanthemum sp. Semi-Natural Herbaceous Stands		
Scientific Name	**Common Name**	**Estimated Cover**
Mesembryanthemum sp.[1]	Ice Plant	5%
Conyza canadensis	Canada Horseweed	2%
[1] *M. nodiflorum & crystallinum*		

Point ID - SALIC

Salicornia sp. Semi-Natural Herbaceous Stands		
Scientific Name	**Common Name**	**Estimated Cover**
Salicornia subterminalis	Parish's Pickleweed	30%
Mesembryanthemum sp.[1]	Ice Plant	20%
Atriplex rosea	Redscale	10%
[1] *M. nodiflorum & crystallinum*		

Point ID - SALIX

Salix lasiolepis Shrubland/*Conyza canadensis* Semi-Natural Herbaceous Stand		
Scientific Name	**Common Name**	**Estimated Cover**
Conyza canadensis	Canada Horseweed	40%
Salix lasiolepis	Arroyo Willow	10%
Schinus terebinthifolius	Brazilian Pepper Tree	5%
Ricinus communis	Castor Bean	5%
Nicotiana glauca	Tree Tobacco	2%
Carya illinoinensis	Pecan	2%
Mesembryanthemum sp.[1]	Ice Plant	2%
Stephanomeria sp	Wire Lettuce	1%
Rumex crispus	Curly Dock	1%
Foeniculum vulgare	Sweet Fennel	1%
Glebionis coronaria	Crown Daisy	1%
[1] *M. nodiflorum & crystallinum*		

Point ID – SALT – SaltPan unvegetated.

Point ID - SUEDA

Suaeda taxifolia Shrubland		
Scientific Name	**Common Name**	**Estimated Cover**
Suaeda taxifolia	Woolly Seablite	50%
Atriplex rosea	Redscale	20%
Mesembryanthemum sp.[1]	Ice Plant	15%
Salicornia subterminalis	Parish's Pickleweed	1%
[1] *M. nodiflorum & crystallinum*		

APPENDIX I:
LIST OF OBSERVED PLANT AND WILDLIFE SPECIES, SEPTEMBER 2017

Appendix A - List of Species Observed at Pond 20, September 2017

Scientific Name	Common Name	**Sensitive Status**
Plants		
Allenrolphia sp	Iodinebush	
Amblyopappus pusillus	Pineapple Weed	
Astragalus trichopodus	Santa Barbara Milkvetch	
Atriplex rosea	Redscale	
Baccharis sarothroides	Desertbroom Baccharis	
Bassia hyssopifolia	Fivehook Bassia	
Bromus madritensis	Foxtail Brome	
Camissonia sp	Suncup	
Carya illinoinensis	Pecan	
Centaurea melitensis	Tocalote	
Conyza canadensis	Canada Horseweed	
Cylindropuntia prolifera	Coastal Cholla	
Distichilis spicata	Saltgrass	
Dittrichia graveolens	Stinkwort	
Foeniculum vulgare	Sweet Fennel	
Frankenia palmeri	Palmer's Frankenia	
Glebionis coronaria	Crown Daisy	
Gnaphalium californicum	California Everlasting	
Hirschfeldia incana	Wild Mustard	
Isocoma menzii	Menzies' Goldenbush	
Lactuca serriola	Prickly Lettuce	
Lycium californicum	California Boxthorn	CNPS 4.2
Melilotus sp (dry)	Sweetclover	
Mesembryanthemum crystallinum	Ice Plant	
Mesembryanthemum nodiflorum	Ice Plant	
Nicotiana glauca	Tree Tobacco	
Nitrophila occidentalis	Boraxweed	
Phragmites australis	Common Reed	
Phytolacca americana	Pokeberry	
Ricinus communis	Castor Bean	
Rumex crispus	Curly Dock	
Salicornia subterminalis	Parish's Pickleweed	
Salix lasiolepis	Arroyo Willow	
Salsola tragus	Russianthistle	
Schinus molle	Peruvian Peppertree	
Schinus terebinthifolius	Brazilian Pepper Tree	
Sisymbrium sp.	London Rocket	
Stephanomeria sp	Wire Lettuce	
Suaeda taxifolia	Woolly Seablite	
Wildlife		
	Invertebrates	
Brephidium exilis	Western Pygmy-Blue	
Vanessa cardui	Painted Lady	
	Birds	
Athene cunicularia	Burrowing Owl	G4, S3, BLM, SSC,

Appendix A - List of Species Observed at Pond 20, September 2017

		LC, BCC
Cathartes aura	Turkey Vulture	
Circus cyaneus	Northern Harrier	
	Reptiles	
Pituophis catenifer catenifer	Pacific Gopher Snake (dead)	
Uta stansburiana elegans	Western Side-blotched Lizard	
	Mammals	
Sylvilagus audubonii	Desert Cottontail	
Lepus californicus bennettii	San Diego black-tailed Jackrabbit	G5T3T4, S3S4, SSC

Plants – CNPS Rank
4: Plants of Limited Distribution - A Watch list (Includes Rare Plant Ranks 4.1, 4.2, 4.3)
The plants in this category are of limited distribution or infrequent throughout a broader area in California, and their vulnerability or susceptibility to threat appears low at this time. While we cannot call these plants "rare" from a statewide perspective, they are uncommon enough that their status should be monitored regularly. Should the degree of endangerment or rarity of a Rank 4 plant change, we will transfer it to a more appropriate rank or delete it from consideration.

Threat Ranks:
The California Rare Plant Ranks (CRPR) use a decimal-style threat rank. The threat rank is an extension added onto the CRPR and designates the level of threats by a 1 to 3 ranking with 1 being the most threatened and 3 being the least threatened. Most CRPRs read as 1B.1, 1B.2, 1B.3, etc. Note that some Rank 3 plants do not have a threat code extension due to difficulty in ascertaining threats. Rank 1A and 2A plants also do not have threat code extensions since there are no known extant populations in California.

4. Plants of limited distribution - Watch list	.2- Moderately threatened in California (20-80% of occurrencesthreatened / moderate degree and immediacy of threat)

Wildlife
BCC – USFWS Birds of Conservation Concern
BLM – Bureau of Land Management -Sensitve
G4 - Apparently Secure—Uncommon but not rare; some cause for long-term concern due to declines or other factors.
G5 - Demonstrably Secure—Common; widespread and abundant.
LC - International Union for Conservation of Nature (IUCN) - Least Concern
S1 - Critically Imperiled—Critically imperiled in the state because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province.
S3 - Vulnerable—Vulnerable in the state due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.
S4 - Apparently Secure—Uncommon but not rare; some cause for long-term concern due to declines or other factors.
SSC – CDFW Species of Special Concern
T - Rank applies to a subspecies or variety under the G rank

APPENDIX J:
LIST OF OBSERVED AVIAN SPECIES, 2016-2017 SEASON

Appendix D - Avian Species Observed at Pond 20, SD Bay 2016-2017 survey (Tierra Data 2017)

Row Labels	High Tide	Low Tide	Total Observed	Status
American Avocet	1	11	12	
American Coot	28	67	95	
American Crow	9	24	33	
American Kestrel	2	5	7	
American Pipit	79	34	113	
American Wigeon	79	14	93	
Anna's Hummingbird	5	7	12	
Barn Swallow	0	14	14	
Belding's Savannah Sparrow	16	51	67	G5T3, S3, SE
Belted Kingfisher	0	3	3	
Black Phoebe	2	6	8	
Black Skimmer	0	1	1	G5, S2, SSC, LC, YWL, BCC, (Nesting colony)
Black-Bellied Plover	2	0	2	
Black-necked Stilt	54	63	117	
Blue-winged Teal	3	19	22	
Bufflehead	0	8	8	
Burrowing Owl	0	1	1	G4, S3, BLM, SSC, LC, BCC, (Burrow sites & some wintering sites)
Caspian Tern	0	3	3	G5, S4, LC, BCC, (Nesting colony)
Cinnamon Teal	2	2	4	
Cliff Swallow	0	153	153	
Common Raven	3	4	7	
Common Yellowthroat	3	1	4	
Double-crested Cormorant	1	1	2	G5, S4, WL, LC, (Nesting colony)
Eared Grebe	2	0	2	
Elegant Tern	0	5	5	G2, S2, WL, NT, (Nesting colony)
European Starling	0	23	23	
Forster's Tern	0	3	3	
Gadwall	2	8	10	
Great Blue Heron	0	1	1	G5, S4, CDF, LC, (Nesting colony)
Great Egret	0	4	4	G5, S4, CDF, LC, (Nesting colony)
Greater Yellowlegs	22	15	37	
Green Heron	0	1	1	
Green-winged Teal	0	15	15	
Gull-Billed Tern	0	26	26	G5, S1, SSC, LC, YWL, BCC, (Nesting colony)
Herring Gull	0	2	2	
Horned Lark	108	298	406	G5, T4Q, S4, WL, LC
House Finch	26	193	219	
Hummingbird sp.	1	0	1	
Killdeer	8	23	31	
Long-billed Curlew	0	1	1	G5, S2, WL, LC, YWL, BCC, (Nesting)
Mallard	15	20	35	
Mourning Dove	6	20	26	
Northern Harrier	1	4	5	G5, S3, SSC, LC, (Nesting)
Northern Mockingbird	2	10	12	
Northern Rough-winged Swallow	0	1	1	
Northern Shoveler	102	0	102	
Osprey	0	2	2	G5, S4, CDF, WL, LC, (Nesting)
Redhead	2	0	2	G5, S3S4, SSC, LC (Nesting)
Red-tailed Hawk	0	5	5	
Ring-billed Gull	3	2	5	
Rock Pigeon	0	2	2	

Appendix D - Avian Species Observed at Pond 20, SD Bay 2016-2017 survey (Tierra Data 2017)

Ruddy Duck	18	27	45	
Say's Phoebe	0	1	1	
Scaup sp.	1	1	2	
Snowy Egret	1	4	5	G5, S4, LC, (Nesting colony)
Snowy Plover	0	8	8	G3T3, S2S3, ST, SSC, RWL, BCC
Song Sparrow	4	2	6	G5, S3?, SSC
Spotted Sandpiper	1	4	5	
Tree Swallow	0	4	4	
Turkey Vulture	1	3	4	
Western Grebe	0	2	2	
Western Gull	1	8	9	
Western Meadowlark	24	13	37	
Western Sandpiper	2	0	2	
Whimbrel	0	77	77	
White-crowned Sparrow	18	24	42	
Willet	10	22	32	
Yellow-rumped Warbler	3	4	7	
Grand Total	**673**	**1380**	**2053**	

BCC – USFWS Birds of Conservation Concern
FE – Federally-Listed as Endangered
FP – California Department of Fish and Wildlife – Fully Protected.
FT – Federally-listed as Threatened
G2 - Imperiled—At high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.
G3 = Vulnerable—At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors.
G4 - Apparently Secure—Uncommon but not rare; some cause for long-term concern due to declines or other factors.
G5 - Secure—Common; widespread and abundant.
LC - International Union for Conservation of Nature (IUCN) - Least Concern
NT - International Union for Conservation of Nature (IUCN) – Near Threatened
RWL - North American Bird Conservation Initiative (NABCI) - Red Watch List
S1 - Critically Imperiled—Critically imperiled in the state because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province.
S2 = Imperiled—Imperiled in the state because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the state.
S3 = Vulnerable—Vulnerable in the state due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation from the state.
S4 = Apparently Secure—Uncommon but not rare in the state; some cause for long-term concern due to declines or other factors.
SE – State-listed as Endangered
SSC – CDFW Species of Special Concern
ST – State-listed as Threatened
USFS - U. S. Forest Service - Sensitive: Sensitive
WBWG-H: Western Bat Working Group – High Priority
WBWG-M: Western Bat Working Group – Medium Priority
WL - California Department of Fish and Wildlife – Watch List
YWL - North American Bird Conservation Initiative (NABCI) - Yellow Watch List
T - Rank applies to a subspecies or variety under the G rank

APPENDIX K:

EVALUATION OF PLANNED WETLANDS FUNCTIONAL ASSESSMENT HANDBOOK (BARTOLDUS ET AL. 1994)

EVALUATION FOR PLANNED WETLANDS (EPW)

A Procedure for Assessing Wetland Functions and a Guide to Functional Design

by
Candy C. Bartoldus
Edgar W. Garbisch
and
Mark L. Kraus

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List of Figures and Tables

Figures

Tables

Preface

This book is the culmination of four years work on the development of a comprehensive guide to assessing and designing for wetland functions. It provides a versatile rapid wetland assessment procedure that can be used in a variety of situations including wetland creation, restoration, mitigation banking, impact analysis, and watershed planning. Newly released, the use of this new procedure is rapidly growing among regulatory agencies. Its unique approach is invaluable during the mitigation process because it enables the user to set project goals and objectives, as well as prepare the design based on wetland functions. In addition to an extensive literature review on the individual wetland features influencing function, this book contains an in-depth guide on how to incorporate these features in a wetland design.

The steps of EPW and most of the terminology are the same as that used in the *Procedure for Assessing Wetland Functions Based on Hydrogeopmorphic Classification, Reference Wetlands, and Functional Indices*; a procedure being developed by the U.S. Army Engineer Wetlands Research Program. The EPW assessment models can also be used in this procedure.

The assessment models for each function are generic models designed for application throughout the United States. Users are encouraged to modify these models, if necessary, to better describe wetlands in their respective regions.

We invite your comments and input so that we may improve upon future versions of this manual.

Edgar W. Garbisch, Ph.D.
President
Environmental Concern Inc.

Calculation of **SHORELINE BANK EROSION CONTROL** FCI

PROJECT TITLE: MARLEY CREEK

Selected Scores (#) Element

COMPARISON: WAA, planned wetland (e.g., WAA/planned wetland)

Site Suitability For Planned Wetland:

1.0, 1.0 (2) Fetch

NA, 1.0 (14a) Steepness of existing shore

If result = 0.1 for either element, then the planned wetland site is UNSUITABLE

If result ≠ 0.1 for both elements, then continue with model

0.5, 1.0 (1a) Water contact with toe of bank

If result = NA, then STOP: **Shoreline Bank Erosion Control FCI** = NA

If other, record score → 1a = 0.5, 1.0 Potential for Erosion (E)

NA, NA (3) Shoreline structures/obstacles → 3 = NA, NA Shoreline Structures/ Obstacles

1.0, 1.0 (2) Fetch

NA, NA (4a) Disturbance at site (SS)

NA, NA (5a) Surface runoff (bank erosion)

NA, NA (6) Boat traffic

NA, NA (7a) Water level fluctuation

NA, NA (8a) Hours of sunlight

NA, NA (9a) Substrate suitability for vegetation

NA, NA (14b) Steepness of planned wetland shore

average for elements with available scores = 1.0, 1.0 Physical Influences on Rate of Erosion

1.0, 1.0 (10a) Plant (basal) cover

NA, NA (10e) Rooted vascular aquatic beds

1.0, 1.0 (10g) Plant height

0.5, 0.8 (10i) Root structure

0.8, 0.8 (10k) Vegetation persistence

Equation #5 or #6 = 0.77, 0.87 Vegetation Influences on Rate of Erosion

average for available scores = 0.89, 0.94 Influences on Rate of Erosion (I)

$\frac{E + I}{2}$ = 0.70, 0.97 **Shoreline Bank Erosion Control FCI**

Equation #5:

If 10e applicable:

$$\frac{10a\ (10g + 10i + 10k) + 10e}{4}$$

Equation #6:

If 10e not applicable:

$$\frac{10a\ (10g + 10i + 10k)}{3}$$

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The authors wish to thank those individuals who provided comments on the draft including Dan Smith, Alan Ammann, Paul Garrett, and Charles DesJardins. We are also thankful for the comments received from several classes that used and critiqued EPW during various stages of its development.

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Chapter 1. Introduction

1.1 Background

1.1.1 Purpose of EPW

The Evaluation for Planned Wetlands (EPW) (formerly WREP) is a rapid-assessment procedure for use in determining whether a planned wetland has been adequately designed to achieve defined wetland function goals. EPW provides —

- a technique for assessing 6 wetland functions,
- guidance in applying EPW throughout the various steps of the planning process, and
- a method for calculating the size of the planned wetland required to meet planning/mitigation goals.

A **wetland assessment area (WAA)** represents a designated wetland area to which the planned wetland will be compared. In many cases the wetland assessment area will be the wetland impact area of a project. The term planned wetland is used to describe a variety of related activities directed at providing wetland functions, e.g., wetland construction, restoration, or enhancement. Thus, a **planned wetland** is a design or an implemented design for a constructed, restored, or enhanced wetland. The steps to developing a planned wetland are jointly referred to as the planning process.

1.1.2 EPW compared to other assessment techniques

While other assessment techniques may be adequate for various purposes, EPW has been developed specifically for use during the wetland planning process. Problematic characteristics of other techniques which limit their application to this process were avoided in EPW (Bartoldus 1992). Key properties that distinguish EPW are discussed below.

The EPW format allows the designer and decision maker to readily identify elements which are important to each function. Information can be easily extracted by the designer so that changes can be made to improve the plans for the planned wetland. The format also facilitates the decision maker in determining how and if the planning goals can be attained.

The use of threshold values was avoided, unless such values could be literature validated or validated through consultation with noted experts. Threshold values are cutoff values used in the evaluation, above or below which it is assumed that a wetland's capacity to perform a function substantially changes. For example, the technique may operate under the assumption that a ≥ 20 foot wide wetland will effectively provide the shoreline bank erosion control function; anything less would be considered ineffective. Different assessment techniques use different threshold widths. Thus, if the assessment technique is used as a guide to design, then substantially different design criteria could be obtained depending upon the technique employed.

Wetland assessment techniques often use a minimum number (e.g., 3–5) of elements to assess each function. While this simplification may produce an adequate rapid general assessment, they exclude elements critical to wetland design. EPW uses several elements (7–20) to evaluate each function, including those elements considered important to design.

EPW does not use opportunity elements to describe a wetland's capacity to perform a function. Opportunity elements are those characteristics of a wetland or its surroundings which determine if the opportunity is available for that wetland to perform a function. In most techniques, the wetland is assigned a higher score as the opportunity increases. While the importance of opportunity is recognized, there are two problems associated with this approach. First, the function score will vary depending upon how much weight is placed upon opportunity. A procedure which assumes that opportunity contributes greatly to a wetland's functional capacity (e.g., 50% of score) will produce different results than one which considers opportunity less important (e.g., 10% of score). The function scores, therefore, reflect each procedures bias. The second problem arises when it is assumed that the wetland is performing the function efficiently irrespective of the magnitude of the opportunity. Many of the opportunity elements describe conditions which, if excessive, could change the planned wetland's capacity to perform a function. For example, it is often assumed that greater pollutant input makes a wetland more valuable for the water quality function. Unfortunately, no upper limit is placed on this opportunity. Therefore, the evaluation may erroneously assign a high rating when the capacity of the wetland to perform a function may be minimal or exceeded due to excessive pollutant input. For these reasons, EPW does not use the opportunity elements to describe function performance. EPW does, however, use opportunity elements to identify conditions which could reduce the planned wetland's capacity to perform a function.

The planning process goals are often aimed at achieving compensation for functions lost in a wetland assessment area. EPW has been designed to have a greater degree of sensitivity then most other techniques. EPW detects and highlights differences between the wetland assessment area and plans for the planned wetland. The application of several techniques revealed that most techniques were not sensitive enough to detect differences, even when the planned wetlands were designed with substantial improvements in wetland function.

For reasons given, most wetland assessment techniques would require modification to be applicable to the planning process.

Key Properties of EPW

- Documents and displays procedure and results to facilitate the design and review of the planned wetland
- Provides validated threshold values for design elements
- Includes elements applicable to planned wetland design
- Does not use opportunity elements to describe function performance
- Is sensitive enough to detect differences between wetlands

1.2 Uses

1.2.1 Use of EPW during the permit review process for wetland mitigation

In most cases, EPW will be used within the framework of the U.S. Army Corps of Engineers and state wetland permit programs. The Corps reviews proposed activities in wetlands (pursuant to Section 10 of the Rivers and Harbor Act and Section 404 of the Clean Water Act) and assesses the impact these activities might have on the capacity of a wetland to perform specific functions. After measures to avoid or minimize impacts are addressed, then the Corps must consider measures to compensate for unavoidable project impacts. This compensation is achieved through a gain in function which is provided by a planned wetland. The steps to deciding upon adequate compensation within the context of the Corps permit program are jointly referred to as the **mitigation process.** EPW has been developed as a simple rapid-assessment technique in order to meet the time and cost constraints of the permit review process.

When a permit application is reviewed the permit may be (a) denied, (b) issued without mitigation for unavoidable impacts, or (c) issued with compensatory mitigation. EPW is to be used in the latter case, i.e., when it has been determined that a project is permitted and that mitigation is to be considered (Figure 1.1). Thus, other assessment techniques (e.g., Habitat Evaluation Procedure [HEP] [USFWS 1980]; Hollands and McGee 1986; Wetland Evaluation Technique [WET 2.0] [Adamus et al. 1987]) will still be applied during the earlier stages of impact and alternatives analyses. EPW should not be used as a substitute for assessment techniques used for these purposes.

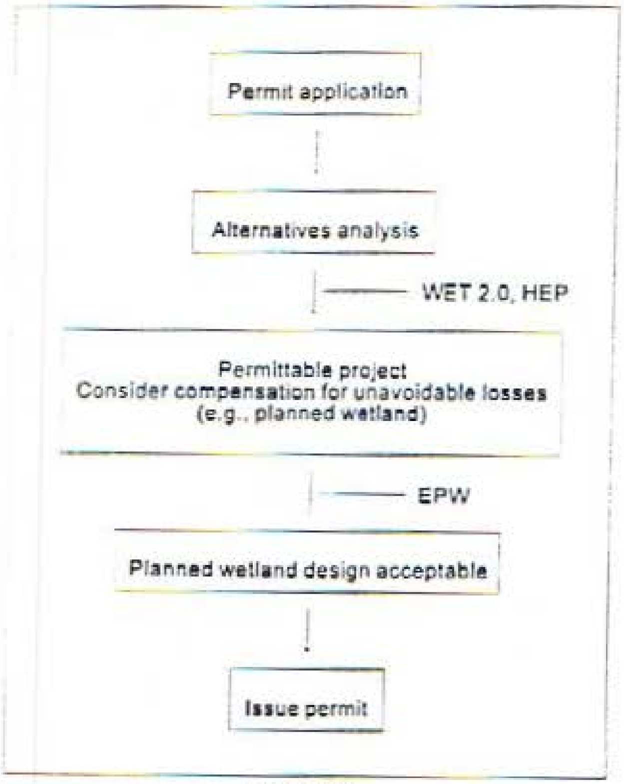


Figure 1.1.
Use of EPW in the context of the permit review process

EPW is designed for making comparisons between a wetland assessment area and a planned wetland. The procedure can be used for various types of comparisons commonly considered during the mitigation process. These include:

- **Compare alternate design strategies:** compare alternative designs for a planned wetland.
- **Compare potential sites:** assess conceptual plans for different sites to identify potential or possible limitation(s) for providing wetland functions.
- **Assess attainment of mitigation goals:** compare a constructed planned wetland to the original design. Comparison can be short term (e.g., year after construction) or long term (e.g., two or more years post construction). This comparison can be used to determine if the implemented planned wetland corresponds to the design and persists through time.
- **Predict initial and future attainment of mitigation goals:** compare predicted conditions of the planned wetland at initial establishment (time = 0 yrs) to predicted future conditions (e.g., age = 5 or 50 years). This comparison may prove important in cases when immediate realization of mitigation goals (e.g., construction of forested wetland) is not feasible.
- **Compare planned wetland to reference wetland:** compare the planned wetland to a reference wetland which has attributes the planned wetland is designed to replicate. A reference wetland may be used when there is no wetland assessment area available for comparison (e.g., wetland was impacted/filled prior to assessment or out-of-kind mitigation).
- **Compare wetland before and after restoration:** use in cases involving restoration of existing wetland.

1.2.2 Other recommended uses

EPW may also be used to assess functions in a planned wetland design which was not developed in response to a permit application. For example, EPW may be applied to plans for the creation of a new wetland associated with a park improvement. EPW would guide planners through the process of defining goals, assessing the design, and determining whether the design is adequate. The proposed wetland creation design might be compared to a neighboring reference wetland which the planners would like to replicate.

1.3 Origin of EPW

When wetlands were first being constructed (e.g., prior to late 1970s), the intent was to provide specific functions such as shoreline bank erosion control, wildlife habitat, and water quality improvement. With the advent of wetland permit programs, wetlands are now also being constructed, restored, and enhanced to compensate for unavoidable impacts. For years, decision makers have determined the adequacy of planned wetlands based upon professional judgement and established policy (e.g., mitigation ratios). The importance of considering function was well recognized, but there was no suitable tool for assessing function within the framework of the planning process (see section 1.1.2). After repeated use of existing assessment techniques on planned wetlands revealed considerable problems, Environmental Concern Inc., decided to initiate the development of EPW. The first version of EPW was released for limited review in July 1992 under the title "Wetland Replacement Evaluation Procedures (WREP)" (Bartoldus et al. 1992).

The EPW format represents a blend of existing approaches. As with other techniques, EPW has been built upon and has benefitted from the work of earlier wetland assessment techniques. The authors would like to acknowledge the following techniques which were referred to and proved invaluable during the development of EPW: Golet (1976), Reppert et al. (1979), USFWS (1980), Euler et al. (1984), Ammann et al. (1986), Hollands and McGee (1986), Adamus et al. (1987), USCOE & Minnesota Environmental Quality Board (1988), Adamus et al. (1991), Tippett (1990), and Ammann and Lindley Stone (1991). The development of EPW has also benefitted from comments provided by the Procedural Committee working on the U.S. Army Corps of Engineers' new functional assessment procedure.

Chapter 2. Overview of EPW

2.1 Wetland Functions

EPW provides a technique for evaluating six major wetland functions addressed during the planning process. Additional functions (e.g., flood flow alteration) will be included in later versions, as necessary. The functions used in EPW are defined in Table 2.1:

Table 2.1.
Definitions of EPW functions

Function	Definition
Shoreline Bank Erosion Control (SB)	capacity to provide erosion control and to dissipate erosive forces at the shoreline bank
Sediment Stabilization (SS)	capacity to stabilize and retain previously deposited sediments
Water Quality (WQ)	capacity to retain and process dissolved or particulate materials to the benefit of downstream surface water quality
Wildlife (WL)	degree to which a wetland functions as habitat for wildlife as described by habitat complexity
Fish **Tidal fish (FT)** **Non-tidal Stream/River (FS)** **Non-tidal Pond/Lake (FP)**	degree to which a wetland habitat meets the food/cover, reproductive, and water quality requirements of fish
Uniqueness/Heritage (UH)	presence of characteristics that distinguish a wetland as unique, rare, or valuable

2.2 Units of Comparison

EPW provides a technique for comparing functional capacity of a wetland assessment area and a planned wetland. **Functional capacity** is the magnitude or degree to which a wetland performs a function. The differences between wetlands are expressed in terms of:

- element score
- Functional Capacity Index (FCI)
- Functional Capacity Units (FCU)

The most basic comparison occurs at the level of the element. EPW utilizes 7 to 20 elements to evaluate each function, for a total of 81 elements. An **element** is a physical, chemical, or biological characteristic of the wetland or landscape that dominates the wetland's capacity to perform a function. The **element score** is a unitless number from 0.0 to 1.0 or an equation, where 1.0 represents the optimal condition for maximizing functional capacity and 0.0 represents an unsuitable condition. The element score is determined by what **condition,** or form the element takes in the wetland. There is a list of conditions from which to choose for each element. Each condition is assigned a numerical score on a scale from 0 to 1.0 or noted as not applicable (NA) or information not available (INA). A high score (e.g., 1.0) implies that, in comparison to the other conditions for that element, this particular condition has a greater potential to increase the wetland's functional capacity. Conversely, a low score (e.g., 0.1) implies that there is a low potential. In the example provided in Figure 2.1, (p. 2–3) the wetland assessment area (WAA) has a hydroperiod that "does not or rarely follows the natural tidal hydroperiod." The user selected and recorded the corresponding score for condition "c" because it best described the wetland. This condition receives a low score (0.1) because it hinders tidal fish access and utilization.

From a design perspective, it is important to evaluate elements as separate contributors to a function. The designer needs to know the conditions for the individual elements in order to determine if they can be replaced or improved upon. Alternatively, it is equally important to know how these elements, as a whole, contribute to a wetland's functional capacity. For this reason, differences between the wetlands are also expressed in terms of Functional Capacity Indices. The **Functional Capacity Index (FCI)** is a dimensionless number from 0.0 to 1.0 which describes a wetland's relative capacity to perform a function, where 0.0 represents no functional capacity and 1.0 represents optimal functional capacity. The FCI is based on an assessment model that combines element scores based on the relationship between elements and the function. Chapters 4–9 provide examples of models and calculations of FCIs.

The FCI characterizes the wetlands with little or no consideration of its size. The FCI is used to derive **Functional Capacity Units (FCUs),** which serve as a standardized basis for comparing function differences over space and time. Simplified, the FCI represents the "quality" of functional capacity per unit area, whereas the FCUs represent the "quantity" of functional capacity. FCUs are calculated in the following Equation 1:

$$FCI_{AY} \times AREA_{AY} \cdot FCU_{AY} \qquad (1)$$

where:

FCI_{AY} = Functional Capacity Index of wetland area "A" for wetland function "Y"

$AREA_{AY}$ = Size of wetland area "A," or portion thereof, that performs or has the capacity to perform function "Y"

FCU_{AY} = Functional Capacity Units for wetland area "A" for wetland function "Y"

FCUs are calculated for all functions, except Uniqueness/Heritage because the FCI is a sufficient unit of comparison for this function. The Uniqueness/Heritage FCI simply indicates whether the wetland contains (FCI = 1.0) or does not contain (FCI = 0.0) some characteristic which makes it unique. This uniqueness may or may not be related to size; therefore, it is inappropriate to multiply the FCI value by area.

Each function is assessed separately and receives a separate FCI and FCUs. EPW does not provide for the summation of FCIs and FCUs into an overall grand score for a wetland. The FCIs and FCUs are the main units of comparison used by decision makers when setting planning goals. The concepts of the FCI and FCUs are analogous to those of habitat suitability indices and habitat units used in the Habitat Evaluation Procedure (HEP) of the U.S. Fish and Wildlife Service (1980).

Each function is assessed separately and receives a separate FCI and FCUs. EPW does not provide for the summation of FCIs and FCUs into an overall grand score for a wetland.

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned-WAA)
		WAA	Planned Wetland	If both scores are NA, record NA
7b. Most permanent hydroperiod	[FT]			Assume NA = 1.0
a. Natural tidal hydroperiod -OR- if the area is impounded, provisions have been made (e.g., culverts installed) so that hydroperiod mimics natural hydroperiod.	NA			
b. Hydroperiod usually follows natural tidal hydroperiod (e.g., hydroperiod periodically altered to manage for mosquito control).	0.5	0.1	0.5	(+)
c. Hydroperiod does not or rarely follows natural tidal hydroperiod.	0.1			

Figure 2.1.
Example of element and conditions

2.3 EPW Assumptions

2.3.1 General assumptions

Users should be aware of the following assumptions of the procedure:

- **The capacity of a wetland to perform a specific function is expressed in terms of a functional capacity index (FCI).** The FCI is based on empirical data and expert opinion.

- **Wetlands of different wetland classes cannot be directly compared particularly for the wildlife and fish functions.** EPW distinguishes four wetland classes based upon hydrologic conditions. The comparison of wetlands within a class is considered valid because they are functionally similar. Since differences between classes are substantial, comparisons between wetlands in different classes are generally considered inappropriate. For example, it is meaningless to compare the fish function in a tidal wetland and a non-tidal pond/lake wetland since these wetland classes support different fish species. The same is generally true for the wildlife function. Limited comparisons, however, may be done for the non-biological functions (e.g., shoreline bank erosion control).

- **A few major elements are determinants of functional capacity.** EPW uses a minimum number of elements to derive relative measures of functional capacity. The contribution of other elements is recognized; however, it is assumed that their contribution is minor.

- **A wetland's capacity to perform a function is directly related to size.** This assumption pertains to the calculation of functional capacity units which are derived by multiplying the functional capacity index by area of the wetland which performs a function.

- **Landscape context is considered indirectly because of the approach taken.** For elements which are influenced by scale, the size of the wetland assessment area will usually trigger the importance of an element. For example, shoreline irregularity is considered an important element of the wildlife function. A wetland assessment area may appear to have a regular shoreline; however, the shoreline may be "irregular" if it is evaluated in the context of a larger wetland which it is part of. The wetland type, its geographic location, and size of area being evaluated will determine the threshold for when an element is important. It is assumed that if the wetland assessment area is large enough to detect shoreline irregularity, then this irregularity should be considered for inclusion in the planned wetland. Scale plays a major role for several elements of the wildlife function (e.g., vegetation strata, number of cover types, degree of cover type interspersion). The landscape context is also factored into the water quality function, especially by the use of Element 15 (*Hydrologic condition*) (section 6.4, p. 6–15) which describes several hydrologic settings and their relative influence on the capacity of a wetland to improve water quality.

- **Uniqueness/Heritage characteristics cannot be directly compared.** For example, it is meaningless to compare a wetland with endangered species with a wetland that has historic properties. The Uniqueness/Heritage function simply indicates whether a wetland contains one or more characteristics that should be given special consideration.

2.3.2 Scale of measurement

EPW utilizes an ordinal scale of measurement, i.e., all conditions are ranked and each condition is assigned a score on a scale of 0 to 1.0 relative to all other conditions. The scores have been assigned to conditions based on subjective preferences that are supported by the documentation provided in Chapters 4–9. In general, a score of 1.0 represents the optimal condition, 0.1 represents an unsuitable condition, and scores in between represent intermediate conditions on a relative scale. The numerical scores do not represent real "values" or distances and the relationships may not be linear. For example, with Element 1 (*Water contact with toe of bank*), a wetland with infrequent water contact at the toe of the bank (score = 1.0) is not 10 times better than a wetland with frequent water contact at the toe of the bank (score = 0.1).

Functional capacity indices (FCIs) are also expressed as numerical scores. An FCI of 1.0 indicates that the wetland has a relatively high capacity to perform a function, whereas an FCI of 0.0 indicates that the wetland does not perform the function. FCI values in between represent intermediate functional capacities. An FCI of 1.0 does not indicate that a wetland is one of the highest functioning wetlands possible.

An ordinal scale is used for two reasons. It has been found that the procedure is easier to execute and interpret because users generally prefer working with numbers rather than qualitative categories (e.g., high, medium, or low). Also, numerical scores, in particular the FCI, can be used to estimate wetland acreages required to achieve functional capacity goals of the planned wetland.

2.4 Limitations of EPW

2.4.1 Designed for assessing planned wetlands

This version of EPW has been developed for the purpose of assessing and comparing a planned wetland with a wetland assessment area (described in section 1.2.1). Its applicability to other purposes has not yet been determined. Some reviewers have expressed interest in using EPW for impacts analysis or watershed management. While using EPW for these other purposes may be informative, the authors caution that the results may be inaccurate or misleading. However, later testing may reveal that EPW is also suitable for these and other purposes.

EPW's applicability for impacts analysis, watershed management, and other purposes has not yet been determined.

2.4.2 FCIs and FCUs provide estimates of functional capacity

The products of EPW, the functional capacity indices (FCIs) and functional capacity units (FCUs), are estimates and are not direct measures of functional capacity. The extent to which a wetland is actually functioning can only be determined by a detailed study (e.g., measurement of pollutant removal efficiencies, observations of the number of nesting and breeding birds).

2.4.3 Limited number of functions

This version of EPW provides models for assessing six (6) functions: shoreline bank erosion control, sediment stabilization, water quality, wildlife, fish (tidal, non-tidal stream/river, and non-tidal pond/lake), and uniqueness/heritage. Although other functions may be important, they are not included because (a) an assessment of functions cannot be performed without a detailed field study, and/or (b) conflicting information in the literature makes it difficult to identify simple elements and relationships which can be used in an assessment. The groundwater recharge and groundwater discharge functions provide the best examples. These functions are not well understood as illustrated by controversy found in the literature (Adamus et al. 1991, Hammer 1992). Also, these functions cannot be assessed from a simple site examination. Determining groundwater flow often requires, at a minimum, the installation of piezometers and regular monitoring of water levels.

A model for the floodflow alteration function is not included in this version of EPW, but it is being prepared and will be released at a later date. Floodflow alteration or flood water control is an important function of some wetland systems. Large wetland tracts, usually associated with river and stream systems, can provide substantial surface area for receiving excess water during storm or spring tide events. These wetlands temporarily store the excess water, then return the water to the stream or river system as water levels in the stream or river subside. Floodplain wetlands desynchronize flood waters, thus reducing down stream flood peaks. Floodflow alteration is not considered in this version of EPW because it was assumed that most planned wetlands are small (1–10 acres) and have a minimal impact on floodflow alteration. This function is not often designed for in a planned wetland. If floodflow alteration is an important concern, then it is addressed during the impact analysis through the application of models specifically designed for analyzing floodflow alteration (e.g., HEC-2 [USCOE 1991], TR-55 [SCS 1976]) are used. Comments from reviewers of EPW revealed a need for a simple rapid assessment model for this function; therefore, it is being prepared.

Stormwater management is not addressed as a separate function because it deals with several functions, including water quality improvement and floodflow alteration. The EPW water quality function model is applicable to stormwater management projects, but more sophisticated analyses may be warranted if pre-determined pollutant removal efficiencies are to be achieved. At this time, it is assumed that local authorities will address the floodflow alteration function and determine the need for more detailed function analyses for individual stormwater management projects.

2.4.4 Other limitations

EPW **considers only some aspects of landscape context.** The capacity of a wetland to perform a function depends upon forces from within and outside the wetland. EPW is a site specific technique that focuses on elements that can be considered during site selection, or manipulated in the design and construction of a planned wetland. EPW includes some landscape elements; however, it is not a landscape level assessment technique.

EPW, **like other rapid assessment techniques, has a low level of accuracy.** Detailed field studies and/or complex assessment techniques provide more reliable data; however, they are usually considered time and cost prohibitive.

EPW **describes only wetland areas.** Adjacent upland areas (e.g., buffers) and islands are not evaluated, but may be considered in a later version.

EPW **does not describe functional capacity with respect to opportunities present.** For example, the Water Quality FCI describes the capacity of a wetland to improve water quality, which would be analogous to describing a water filter's filtering capacity. The FCI does not consider opportunity (e.g., pollutant input) or describe the wetlands capacity with respect to that opportunity (e.g., removal efficiency).

The EPW **method for calculating planned wetland size may be based on an assumption which is not valid** for certain function(s). The relationship between wetland size and functional capacity may be linear or non-linear, but it is usually unknown. Increasing the acreage of a planned wetland may not make a difference in functional capacity for some functions. A determination on the actual relationships would require further research. In the absence of this information, EPW provides a standard method for calculating acreages as an alternative to the current practice of using arbitrary ratios. The EPW method for calculating acreages is provided only as a guideline. Decisions regarding required acreages should ultimately be based upon best professional judgement, using EPW as a tool to aide in this decision.

2.5 Note to Users

Field testing has shown EPW to be a useful and reliable procedure. The authors suggest training in its use, but also offer to answer questions to insure EPW's proper use. We have attempted to provide sufficient information up front so that the users are fully aware of the assumptions and limitations. We would like to further clarify that:

- The same user should assess each of the wetlands being compared. EPW is a comparative procedure and consistent interpretation of assessment questions is key to detecting differences between wetlands.
- EPW should be performed by qualified wetland scientists, otherwise misinterpretation of questions or results could lead to erroneous conclusions.
- EPW is a tool to support professional judgement during the planning process when there are time and cost constraints. EPW results do not replace or override professional judgement.
- Common sense and responsible decisions should be used in the development of a planned wetland. The planned wetland should be designed within an acceptable range of complexity found in comparable natural wetlands. It should not be overloaded with features to increase the functional capacity indices (e.g., do not cram 26 vegetation cover types in a small one [1] acre site).

Chapter 3. Conducting EPW

The process of evaluating and comparing a WAA and a planned wetland involves seven steps (Table 3.1, p. 3–2). This chapter provides instructions for completing these steps and an explanation on how these steps are integrated into the planning process. For convenience, all of the materials required to complete the EPW procedure are compiled in Appendix A.

3.1 Define Scope of Evaluation (Step 1)

3.1.1 Define evaluation objectives

The first step in the EPW procedure is to define the objectives of the evaluation. The objectives will depend on the focus of the individual project. Decisions must be made regarding which wetlands are being compared, the number of comparison required, and assumed time period of the wetlands being assessed. The need for additional information beyond EPW (e.g., detailed field study) should also be identified at this time.

For most projects the objective is to compare functional capacity between a planned wetland and a wetland assessment area (WAA). Other projects may require two or more comparisons. For example, wetland enhancement would involve the assessment of three wetlands: a WAA, an existing wetland before enhancement, and a planned wetland. The WAA would be assessed first. Then, the existing wetland and the design for the planned wetland would be assessed and compared to document anticipated gains in function due to the enhancement. Finally, the gains from the enhancement would be compared to the losses associated with the WAA.

The assumed time period, or stage of development of the wetland, should be defined before proceeding with the assessment(s). The assumed period for most WAAs will be irrelevant, unless there are anticipated short-term changes in the wetland. The identification of time period is important for the planned wetland because short and long-term changes are anticipated. Since the assessment will be based on predicted or planned future conditions, users must identify the time to which the prediction applies. A difference in the assumed stage of wetland development (e.g., at planting, one or more years after construction) could make a substantial difference in results.

As projects become more complicated by involving several wetlands, it is important that decision makers clarify the scope of the evaluation. The objectives should be discussed and described in very specific terms to avoid any misunderstanding and unnecessary work.

Table 3.1.
Steps in conducting EPW for wetland restoration and mitigation projects

Steps		Description	
1.	Define scope of evaluation	1.1	Define evaluation objectives
		1.2	Select functions
2.	Characterize wetland assessment area (WAA)	2.1	Identify project area
		2.2	Delineate WAA
		2.3	Prepare maps
		2.4	Complete cover sheet
3.	Assess WAA	3.1	Complete data sheets
		3.2	Calculate FCIs
		3.3	Calculate FCUs
4.	Set goals	4.1	Define goals of planned wetland
		4.2	Define type of comparison
		4.3	Determine Target FCUs
		4.4	Estimate Minimum Area required to meet goals
5.	Select planned wetland site	5.	Identify and screen potential sites, and select site
6.	Design planned wetland	6.1	Identify conditions needed to achieve planned wetland goals
		6.2	Prepare design
7.	Assess planned wetland design	7.1	Complete data sheets
		7.2	Calculate FCIs and FCUs
		7.3	Determine whether goals are met

3.1.2 Select functions

Wetland functions form the basis of the planning process. When a wetland is impacted, the goals are normally set to compensate for the entire suite of functions performed by that wetland. EPW provides a tool for quantifying and comparing functional capacity. All six wetland functions should be assessed in order to provide a more complete description of the wetlands being compared.

Decision makers may elect to assess fewer functions for a variety of reasons. For example, if the sole purpose of the planned wetland is to improve shoreline bank erosion control at an existing wetland, then only that function should be assessed.

In another example, comprehensive field data may be available for one function; therefore, only the remaining five functions would need to be evaluated with EPW. Time and cost constraints may also be a limiting factor. The evaluation of individual functions is made easy in EPW because separate data sheets are provided for each function.

When all functions are present, they all should be assessed in order to provide a more complete description of the wetlands being compared.

3.2 Characterize Wetland Assessment Area (Step 2)

3.2.1 Identify project area

Wetlands to be assessed should be defined in the context of a **project area**, i.e., the area in which the activities related to the project occur. The project area is defined by the nature of the project. For example, the project area for a proposed highway will likely be large and include many wetland areas. A project area should always be identified, especially if the evaluation involves more than one wetland area. Information regarding the spatial arrangement of the wetlands within the project area and other pertinent information (e.g., upland buffer areas) may be useful when the goals are being set for the planned wetland.

3.2.2 Delineate wetland assessment areas

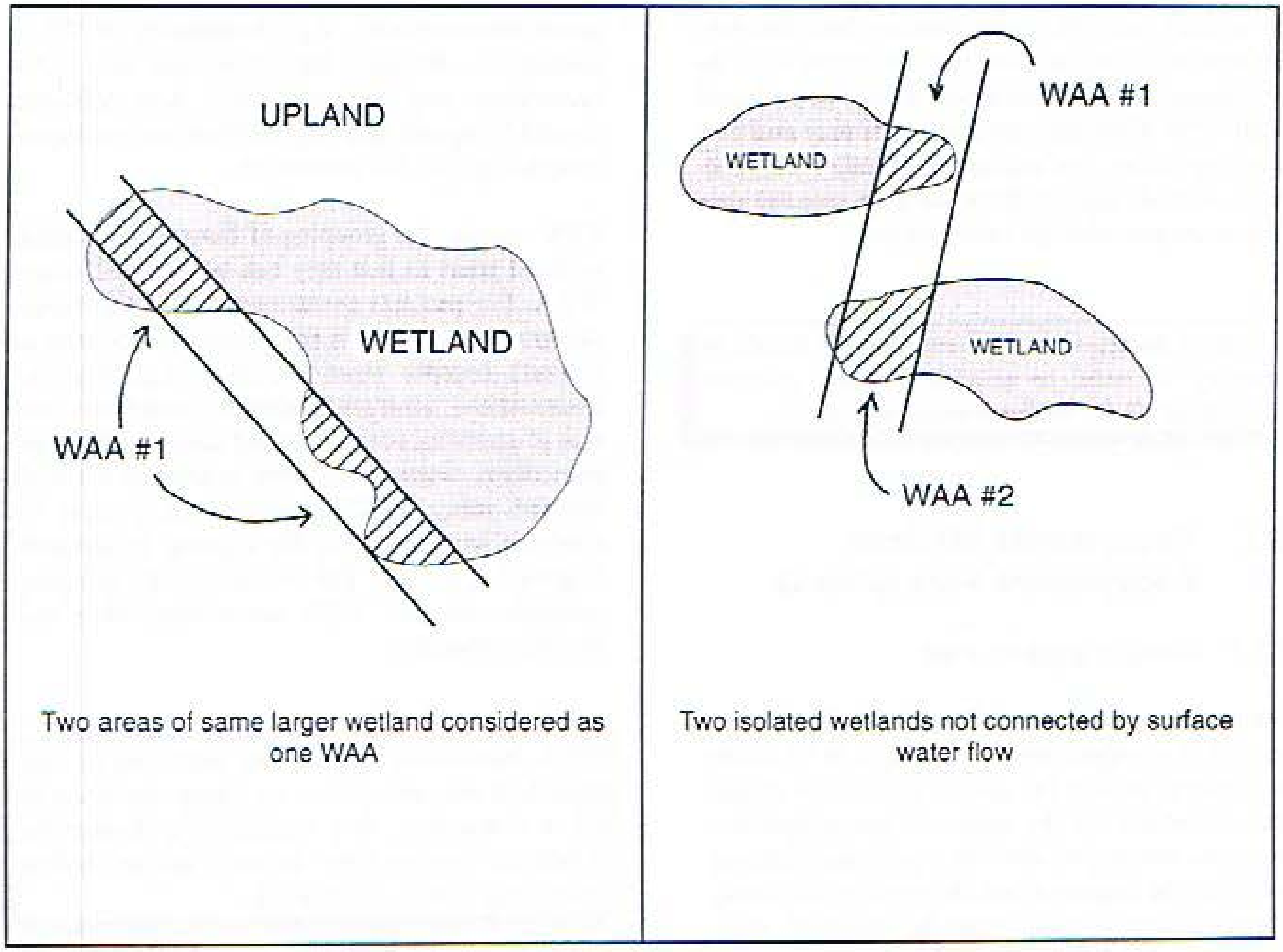
The WAA is a designated wetland area which the planned wetland will be compared to. The boundaries of the WAA depend upon the proposed activities; however, they should be restricted to the immediate area of concern. It is recommended for proposed fill projects that the WAA be limited to the boundaries of the fill or the "foot print" of the project. Thus, the upper and lower limits of the WAA would be defined by the extent of the proposed encroachment, e.g., boundaries of fill or restoration. Broader definitions for the WAA boundaries may be considered. Any definition should be agreed upon by decision makers before proceeding with the evaluation.

EPW requires the grouping of functionally similar wetland areas so that they can be assessed as one WAA. For projects containing one wetland area, this grouping exercise is not necessary. However, as projects become more complex (e.g., highway construction), users are confronted with the tedious task of assessing several wetland areas. While some procedures require a separate evaluation for each wetland area, EPW simplifies the process by allowing one evaluation for a group of wetlands (Figure 3.1, p. 3–4). The two criteria for grouping wetlands into one WAA are wetland class and physical separation.

WAA boundaries should be restricted to the immediate area of concern, e.g., proposed limits of fill or restoration. Any definition of boundaries should be approved by decision makers before proceeding with the evaluation.

A difference in wetland class is the most common reason for distinguishing WAAs. A **wetland class** is a wetland area which is assumed to be functionally similar due to the similarity in hydrologic conditions. EPW divides wetlands into four wetland classes (Table 3.2, p. 3–5): Tidal; Non-tidal (stream/river); Non-tidal (pond/lake); Non-tidal (depression).

The authors recognize that there is a diversity of wetlands and that all wetland types do not perform the same functions in the same manner. For this reason, EPW distinguishes four different wetland classes. We acknowledge that this classification is simplistic. Other wetland classification approaches are more precise (e.g., Cowardin et al. 1979, Brinson 1993), but the use of a minimum number of



Two areas of same larger wetland considered as one WAA

Two isolated wetlands not connected by surface water flow

Figure 3.1.
Examples illustrating grouping and separation of wetland assessment areas

Table 3.2.
Definition of wetland classes distinguished in EPW

Wetland class	Definition
Tidal	wetland where water fluctuates under tidal influence
Non-tidal (stream/river)	wetland associated with the channel, floodplain, or terrace of a river or stream
Non-tidal (pond/lake))	wetland associated with pond or lake (ponds and lakes are defined as having depths greater than 2 meters at low water)
Non-tidal (depression)	wetland associated with a topographic depression, or seep with depths less than 2 meters at low water (e.g., kettles, potholes, vernal pools, and Carolina bays)

classes is compatible with the rapid assessment format and is sufficient for the wetland planning process.

Physical separation of the wetlands is another reason for distinguishing WAAs. In some cases, decision makers may choose to perform separate evaluations although two wetlands are in the same class. Physical separation may be cause for assuming that two wetland areas function differently. Criteria for identifying separate wetlands include:

- wetlands located in a different wetland complex (e.g., wetland associated with different watershed).
- wetlands separated by constriction of water flow (e.g., weir, dam, road, or culvert) where flow is uni-directional.
- wetlands not connected by surface water flow.

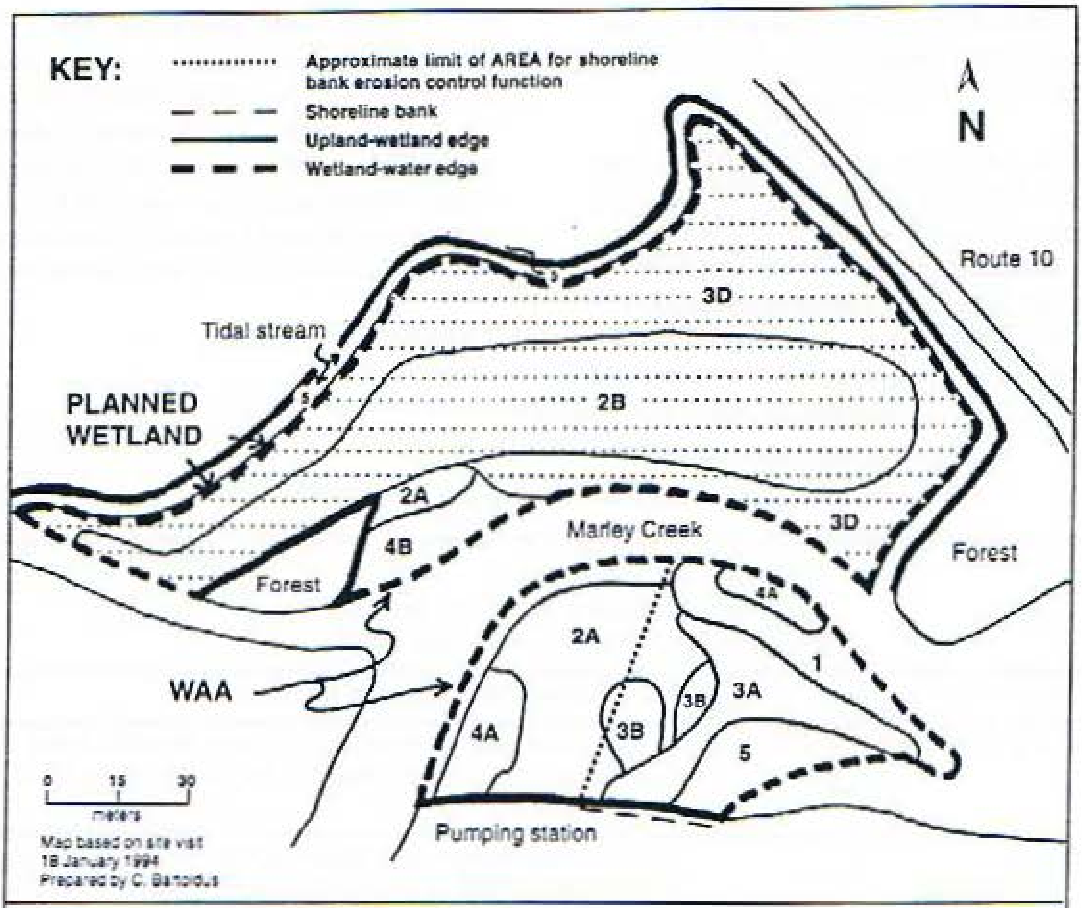
Users should compare wetlands in the project area using project maps and field observations to determine whether there is one or more WAA.

The decision to delineate more than one WAA affects the approach for designing and assessing the planned wetland. For the simple comparison of one WAA and one planned wetland, the evaluation is straight forward. Direct comparisons can easily be made between elements, FCIs, and FCUs. If there is more than one WAA, then the users must decide on a different approach to designing and evaluating the planned wetland. The easiest approach is to design one planned wetland for each WAA. Then the evaluation would provide direct and complete comparisons of elements, FCIs, and FCUs. If the goals are based upon the sum of FCUs for two or more WAAs (section 3.4), then comparisons to the planned wetland are more difficult to report because there will be different FCIs and element scores for each WAA (section 3.7.3).

3.2.3 Prepare maps

EPW requires a map for each wetland assessed (Figure 3.2 (p. 3–7) and example in Appendix B). Depending upon the scale of the project, one or more wetland areas can be illustrated on one map. There is no standard format. Time for map preparation should be kept to a minimum; therefore, it is recommended that existing maps be utilized and modified as needed. These maps should contain the following information:

1. **Title Block.** Include (a) wetland name and/or identification code and (b) town, county, and state in which wetland is located.
2. **North arrow**
3. **Legend (Key)**
4. **Scale**
5. **Date of field check** (if applicable) and **date of preparation**
6. **Source(s) of information** (e.g., project map, NWI Map, Aerial photographs, site visit, USGS topographic map, SCS Soil map, town zoning map)
7. **Name of person(s) responsible for preparing map**
8. **Roads, railroads, power lines, pipelines, utility rights of way, etc.**
9. **Watercourse(s)** (including lakes and ponds)
10. **Wetland assessment area(s).** WAA may be derived from aerial photographs, NWI maps, or the project plans, but for existing wetlands they must be verified in the field. Reasons for distinguishing different WAAs (e.g., wetland class, absence of surface water connection) and acreage estimates for each should be stated on the map and/or the cover sheet.
11. **Planned wetland(s).** Reasons for distinguishing different planned wetlands (e.g., wetland class) and acreage estimates for each should be stated on the map and/or the cover sheet.
12. **Wetland class(s).** Wetland classes may be derived from aerial photographs, NWI maps, or the planned wetland design, but for existing wetlands they must be verified in the field. Definitions of wetland classes are provided in Table 3.2, p. 3–5.
13. **Wetland cover type(s).** Wetland cover types of the existing wetland must be mapped in the field, although aerial photographs and/or NWI maps may be used for preliminary identification. The planned wetland cover types should be predicted based upon the design. Definitions of wetland cover types are provided in Table A.3, p. A 37–39 of the data sheets (Appendix A).
14. **Function weighting areas (AREAs) for the Shoreline Bank Erosion Control and Fish functions.** Indicate those portions of the wetland that have the capacity to perform each of these functions. Definitions are provided below. If the entire wetland will be involved in performing all functions, this can be simply stated on the map.
15. **Areas of disturbance.** Indicate any areas of disturbance including grazing by waterfowl, muskrat eatouts, nutria activity, cattle grazing and trampling, human activity such as the use of off-road vehicles, controlled burning, and litter and debris. Also note areas which have been drained, tilled, filled, logged, clear-cut, burned, mowed, or excavated. Record any disturbance of stream/river channels including dredging, fallen trees, fill, and confinement to culvert.
16. **Upland-wetland boundary.** Identify this boundary on the map.
17. **Wetland-water boundary.** Identify this boundary on the map.
18. **Shoreline bank.** Delineate shoreline bank, if present. Note location and type of shoreline obstacles/structures which may effect bank erosion.



WETLAND COVER TYPES

WAA:

1. Tall persistent: *Typha angustifolia*
2. Short persistent:
   2A. *Carex stricta*
3. Short non-persistent:
   3A. *Peltandra virginica*
   3B. *Eleocharis obtusa*
   3C. *Leersia oryzoides*
4. Bushy deciduous:
   4A. *Hibiscus moscheutos*
   4B. *Viburnum dentatum* - *Rosa palustris*
5. Mud

Approximately 1.5 acres

PLANNED WETLAND:

2. Short persistent:
   2B. *Scirpus pungens*
3. Short non-persistent
   3D. *Peltandra virginica*
5. Mud

Proposed High Marsh = 0.72 acres
Proposed Low Marsh = 0.92 acres
Proposed Tidal Stream = 0.36 acres

AREA for SB function = approximately 0.5 acres for WAA

AREA for all other functions = entire wetland for planned wetland and WAA

Figure 3.2.
Example of project area map (Marley Creek exercise)
Marley Creek Marsh, Harundale, Anne Arundel County, Maryland

19. **Mean High Water, Mean Low Water, and the vegetation water edge.** Identify these boundaries in tidal wetlands only.

The function weighting areas (AREAs) for the Shoreline Bank Erosion Control and Fish functions must be identified and delineated before proceeding with the assessment (Table 3.3) since these functions may not pertain to the entire wetland. For example, only a small portion of a wetland may have sufficient hydrology to provide fish access and utilization.

For projects with several WAAs or planned wetlands, it may be easier to provide some of the information on a base map which illustrates relative sizes and locations of each wetland. More specific information can then be provided on maps of individual wetland areas. The maps can be prepared at any convenient scale. Overlays, either as transparencies or on separate sheets, may also be used.

Table 3.3.
Definition of function weighting areas for the
Shoreline Bank Erosion Control and Fish functions

Function	**Function weighting area (AREA)**
Shoreline Bank Erosion Control	The shore, i.e., the vegetated or non-vegetated areas of the wetland located channelward of the bank (Appendix A: Figure A.2)
Fish (Tidal)	Areas that, based upon water regime, have the capacity to support tidal fish (e.g, tidally influenced areas up to line of spring high tides).
Fish (Non-tidal stream/river)	Areas that, based upon water regime, have the capacity to support non-tidal stream/river fish. The period of inundation can vary throughout the site. Suitable wetland water regimes include permanently flooded, intermittently exposed, semi-permanently flooded and seasonally flooded. Unsuitable water regimes may include saturated or intermittently flooded.
Fish (Non-tidal pond/lake or depression)	Areas that, based upon water and regime, have the capacity to support non-tidal pond/lake fish. The period of inundation can vary throughout the site. Suitable wetland water regimes include permanently flooded, intermittently exposed, semi-permanently flooded and seasonally flooded. Unsuitable water regimes may include saturated or intermittently flooded.

3.2.4 Complete cover sheet

The cover sheet includes basic information regarding the scope of the evaluation (Figure 3.3 (p. 3–10) and Appendix B). In addition to identifying the project title, location, and evaluators, the cover sheet also summarizes important decisions regarding the assessment (e.g., selected functions, change and/or modifications to the procedure, seasonal context of the assessment).

3.3 Assess Wetland Assessment Area (Step 3)

3.3.1 Complete data sheets

The assessment of the WAA is key to the planning process because it provides measures of functional capacity which become the basis for establishing the goals. The following section provides instructions and illustrations on how to execute the assessment of the WAA within the project area.

The assessment is initiated by recording the selected element scores for the WAA on the data sheets provided for each function. The data sheets contain five columns (Figure 3.4, p. 3–11):

Element

This column contains the element title and list of conditions which describe the various forms the element can take in the wetland or landscape. The same element may be used to calculate FCIs for one or more functions. The function(s) to which an element applies is identified by the initials SB, SS, WQ, WL, FT, FS, FP, and UH (Table 2.1, p. 2–1).

Selection of scores for element conditions

Each condition is assigned a score on a scale from 0.0 to 1.0, indicating its relative potential to increase the wetland's functional capacity. Some conditions are otherwise noted as not applicable (NA) or information not available (INA).

Selected scores for elements/wetland assessment area (WAA)

This blank column is used for recording the scores which correspond to the condition which best describes the WAA. These scores are later used to calculate FCIs.

Selected scores for elements/planned wetland

This blank column is used for recording the scores which correspond to the condition which best describes the planned wetland. These scores are later used to calculate FCIs.

Difference in scores

This blank column is used for recording the difference in scores between the planned wetland and WAA. Elements with differences will be later identified and explained on the summary table (Table A.2, p. 3–29, section 3.7.3).

Completing the data sheets is simple and direct when there is one wetland in the WAA. If the WAA consists of several wetland areas, these areas should be considered and described as one area. For example, to estimate percent cover the user should select the percentage which best describes the cover for all areas combined.

A separate set of data sheets must be used for each WAA. Data sheets should first be reviewed in the office and filled-in where the information is available. Field examination is a necessary part of the procedure. All data sheets should be completed based upon field observations; questions answered in the office must be reviewed and revised, if necessary.

The data sheets may be modified to accommodate a comparison of three wetlands, e.g., a wetland to be restored, a design for restoration, and the restored wetland. The data sheet header can be slightly modified to allow room for the three comparisons.

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned-WAA)
		WAA	Planned Wetland	If both scores are NA, record NA
1a. Water contact with toe of bank (**see Figure A.1**)	[SB, WQ]*			Assume NA = 1.0
a. No shoreline bank.	NA			
b. Infrequent water contact at toe of bank, i.e., no undercutting of bank (e.g., contact once annually or less).	1.0	0.5		
c. Occasional water contact at toe of bank (e.g., contact once a month).	0.7			
d. Moderate water contact at toe of bank (moderate undercutting of bank).	0.5			
e. Frequent water contact at toe of bank (severe undercutting of bank).	0.1			

Figure 3.4.
Example of data sheet: response for wetland assessment area (WAA)

Chapters 4–9 provide examples of completed data sheets for each function.

3.3.2 Calculate FCIs

The Functional Capacity Index (FCI) for each function is calculated on separate model diagrams using the element scores recorded for the WAA (Figure 3.5, p. 3–13). The scores are placed to the left of the slash on each blank line. The right side is reserved for the planned wetland scores. Calculations are performed as indicated. Note that elements with an "NA" or "INA" are not included in the calculations. For example, if two out of five elements are recorded as "NA," then calculate an average for the three remaining elements with numerical scores. When calculations are completed, the FCIs for all applicable functions are summarized in Table A.1 (Figure 3.6, p. 3–14).

3.3.3 Calculate FCUs

The Functional Capacity Units (FCUs) for each function, except the Uniqueness/Heritage function, are calculated using the following Equation 2:

$$FCI \times AREA \cdot FCUs \tag{2}$$

The function weighting areas (AREAs) for the Sediment Stabilization, Water Quality, and Wildlife functions are equivalent to the total acreage of the WAA. The AREAs for the Shoreline Bank Erosion Control and Fish functions may be less. Acreages for all of these functions can be estimated from the delineations already made on the project maps (section 3.2.3). The results of the FCI calculations are summarized in Table A.1 (Figure 3.6).

Uniqueness/Heritage characteristics may or may not be related to size; therefore it is inappropriate to multiply the FCI by area to calculate FCUs. In this case, the FCI is considered a sufficient unit of comparison because it simply indicates whether the wetland contains (FCI = 1.0) or does not contain (FCI = 0) some characteristic which makes it unique.

3.4 Set Goals (Step 4)

3.4.1 Define goals of planned wetland

The goals of the planned wetland are based upon the results of the assessment on the WAA (Step 3) and recommendations of participating federal, state, or local agencies. The goals may be defined with the intent to accomplish one or more of the following with respect to the WAA:

- **provide the same functions at the same level of performance** (i.e., equal FCIs and FCUs)
- **provide the same functions at different level of performance** (i.e., greater or less FCIs and FCUs)
- **provide and maximize the performance of one or several functions that are not provided in the wetland assessment area**
- **establish the same wetland class with same vegetation cover types**
- **establish the same wetland class with different vegetation cover types**
- **establish a different wetland class**

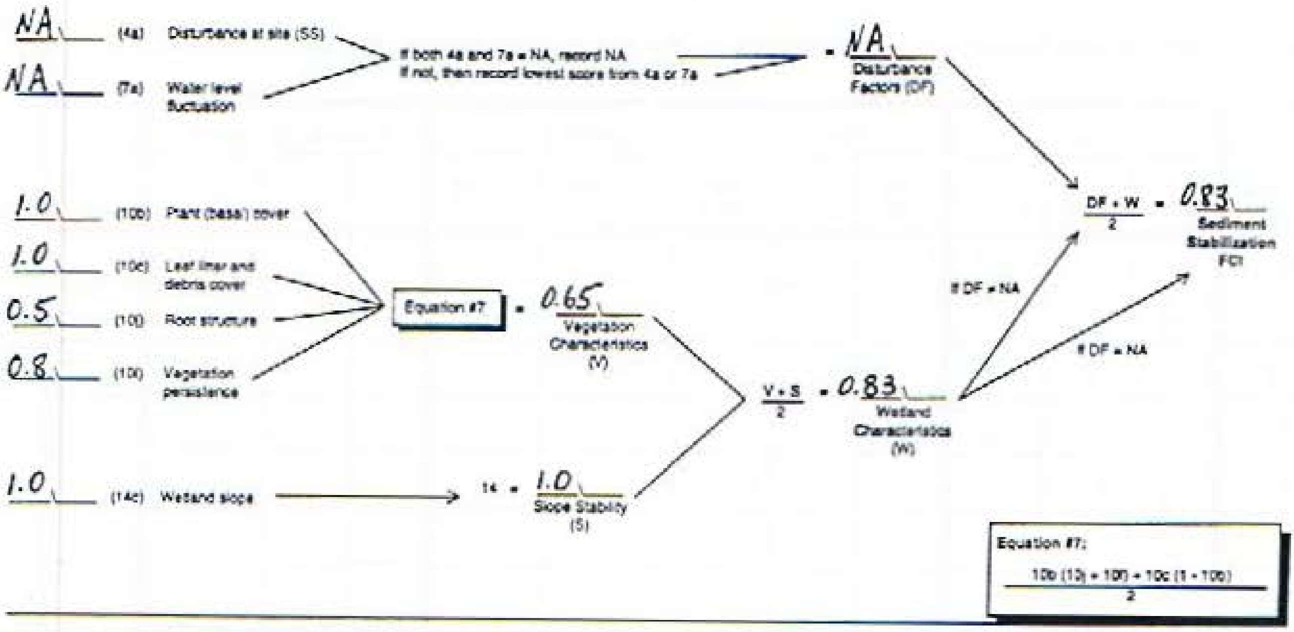
Planned wetland goals can be defined in a variety of ways depending upon the project. However, ultimately they must be expressed in terms of Target FCIs and Target FCUs. For example, the goals for FCIs in the planned wetland can be expressed as a simple statement such as, "The planned wetland FCIs must meet or exceed the FCI for each function in the WAA." Thus, if the WAA Sediment Stabilization FCI equals 0.7, then the planned wetland must have a Target FCI of 0.7 or greater. If the comparison involves more than one baseline WAA with a broad range of FCIs (e.g., 0.1–0.6), then the goal may be, for example, to achieve the highest FCI (e.g., FCI ≥ 0.6). Target FCUs are usually more

Calculation of SEDIMENT STABILIZATION FCI

PROJECT TITLE: MARLEY CREEK

Selected Scores (#) Element

COMPARISON: WAA Planned Wetland (e.g., WAA/planned wetland)



NA (4a) Disturbance at site (SS)
NA (7a) Water level fluctuation
If both 4a and 7a = NA, record NA
If not, then record lowest score from 4a or 7a
= NA Disturbance Factors (DF)

1.0 (10b) Plant (basal) cover
1.0 (10c) Leaf litter and debris cover
0.5 (10f) Root structure
0.8 (10i) Vegetation persistence
Equation #7 = 0.65 Vegetation Characteristics (V)

1.0 (14c) Wetland slope
14 = 1.0 Slope Stability (S)

$\frac{V+S}{2}$ = 0.83 Wetland Characteristics (W)

$\frac{DF+W}{2}$ = 0.83 Sediment Stabilization FCI

Equation #7:

$$\frac{10b\,(10i + 10f) + 10c\,(1 - 10b)}{2}$$

Figure 3.5.
Example of model used to calculate functional capacity index (FCI): answers completed for the WAA

Table A.1.
Comparison of WAA and planned wetland: calculations of FCIs and FCUs

Project Title: Marley Creek

Comparison between WAA # 1 and planned wetland # 1

	WAA			Goals for Planned Wetland**					Planned Wetland			Check if goals met
Function	FCI	AREA	FCUs*	Target FCI	R	Target FCUs	Predicted FCI	Minimum Area	FCI	AREA	FCUs*	
SB	0.7	0.5 acre	0.4									
SS	0.83	1.5 ac	1.2									
WQ	0.92	1.5 ac	1.4									
WL	0.54	1.5 ac	0.8									
FT	0.48	1.5 ac	0.7									
FS	X	X	X									
FP	X	X	X									
UH	1.0	▨	▨		▨	▨	▨	▨		▨	▨	

*FCUs = FCI x AREA
**Target FCI = *goal* established by decision makers
R = multiplying factor established by decision makers
Target FCUs = $FCU_{WAA} \times R$ (i.e., planned wetland *goal*)
Predicted FCI = FCIs which designers presume planned wetland may achieve at a particular site (Note: this may be greater than Target FCI).
Minimum Area = Target FCUs/Predicted FCI

Figure 3.6.
Example of Table A. 1 completed with information from the assessment of the WAA

quantitative and stipulate the number of FCUs to be gained per function (section 3.7.3).

One consideration in determining goals is the number of WAAs and planned wetlands. If a different planned wetland is being designed for each WAA, then separate goals should be defined based on FCIs and FCUs for each WAA. This approach will allow simple direct comparisons between FCIs, FCUs, and elements for the two wetlands. Alternatively, if a single planned wetland is designed based on an assessment of several WAA within the same wetland class, then goals should be based on the sum of the FCUs and the entire range of FCIs (e.g., 0.2–0.7 FCI) for all WAAs. The approach for defining the Target FCI may vary. For example, the Target FCI may represent an average or the highest from the range of FCI. A comparison of element scores provides useful information; however, if there are several WAAs, a comparison of element scores may be too complex and impractical (section 3.7.3).

The goals established for the planned wetland by decision makers are expressed in terms of Target FCIs and Target FCUs.

Another consideration in determining goals for the planned wetland is location. The criteria for selecting the location of the planned wetland should be established based on a consideration of functions being replaced and capacities of the site to perform the function. For example, if the goal is to provide the flood control function, then the site must be located near a flood prone waterway (e.g., stream). Also, it may be preferable to locate the planned wetland within close proximity to the WAA, so that the compensation of functions occurs within the same general area. Alternatively, the choice may be to replace functions off-site where a greater need is perceived. Policy may also dictate the location of the planned wetland (e.g., within an existing right-of-way).

One goal may be to provide in-kind mitigation, i.e. provide a wetland of the same type as the WAA. The interpretation of in-kind mitigation varies (e.g., same wetland class, or subclass, or cover type); therefore, the goals for the planned wetland must be clearly stated. For out-of-kind mitigation (i.e, provide wetland of different type from the WAA), a comparison between the planned wetland and WAA is feasible as long as they are in the same wetland class.

Goals for the Uniqueness/Heritage function are not defined in terms of Target FCIs and Target FCUs. The FCI for Uniqueness/Heritage simply indicates whether a wetland contains one or more characteristics which should be given special consideration. If a unique characteristic is found in the WAA, the goals for the planned wetland must be defined with caution. It would be meaningless to provide a different unique characteristic in the planned wetland (e.g., endangered species habitat in the planned wetland compared to historic properties in the WAA). It must be decided whether creation/enhancement of the unique characteristic in the planned wetland is feasible or desirable.

As the goals (Target FCIs and Target FCUs) are defined, they are summarized in Table A.1 (Figure 3.7, p. 3–16) and the cover sheet. Note that Target FCIs may be established first. Additional calculations may be required to establish Target FCUs (section 3.4.3).

3.4.2 Define type of comparison

Decision makers must determine if they will account for changes over time in the planned wetland. The baseline data for the WAA can be compared to the planned wetland in one of two ways:

- **Baseline comparison:** Functional capacity of the planned wetland is quantified at one point in time (only one assessment).
- **Time interval comparison:** Functional capacity of the planned wetland is quantified at

Table A.1.
Comparison of WAA and planned wetland: calculations of FCIs and FCUs

Project Title: Marley Creek

Comparison between WAA # 1 and planned wetland # 1

	WAA			Goals for Planned Wetland**					Planned Wetland			
Function	FCI	AREA	FCUs*	Target FCI	R	Target FCUs	Predicted FCI	Minimum Area	FCI	AREA	FCUs*	Check if goals met
SB	0.7	0.5 acre	0.4	> 0.7								
SS	0.83	1.5 ac	1.2	> 0.8								
WQ	0.92	1.5 ac	1.4	> 0.9								
WL	0.54	1.5 ac	0.8	> 0.6								
FT	0.48	1.5 ac	0.7	> 0.5								
FS	X	X	X	X								
FP	X	X	X	X								
UH	1.0	▨	▨	1.0	▨	▨	▨	▨		▨	▨	

*FCUs = FCI x AREA
**Target FCI = *goal* established by decision makers
R = multiplying factor established by decision makers
Target FCUs = $FCU_{WAA} \times R$ (i.e., planned wetland *goal*)
Predicted FCI = FCIs which designers presume planned wetland may achieve at a particular site
(Note: this may be greater than Target FCI).
Minimum Area = Target FCUs/Predicted FCI

Figure 3.7.
Example of Table A. 1 completed with Target FCIs (i.e., the goals for the planned wetland)

several points-in-time (e.g., several assessments are done on predicted conditions at fixed intervals until the planned wetland has reached the Target FCIs and Target FCUs).

The baseline comparison is the simplest form of comparison. First, the WAA is assessed for one point in time (e.g., peak of the growing season). Next, the planned wetland is assessed at an assumed point in time (e.g. peak of first growing season). The results of both baseline assessments are then compared.

The time-interval comparison is applied when there is concern regarding a loss of function performance due to time delay in the planned wetland. Some functions in the planned wetland may reach the designed functional capacity relatively quickly (e.g., 1–2 years following construction of a wetland designed to provide shoreline bank erosion control), whereas others may take several years (Figure 3.8, p. 3–18). If the cumulative loss of function during a time lag is considered substantial, it may be necessary to compensate for the loss. The basic steps for a time-interval comparison for one function are:

- Select target years for future prediction
- Predict area of wetland providing function for future years (Note: area may change)
- Predict FCIs and FCUs for future years
- Calculate cumulative FCUs
- Calculate difference between cumulative FCUs for WAA and planned wetland

Several methods can be used for calculating cumulative FCUs. The simplest approach is to graph the FCUs with assumed linear relationships between broadly spaced target years and to estimate the area under the curve (Figure 3.8). The difference between FCUs lost in the WAA and FCUs gained in the planned wetland can then be calculated. More comprehensive estimates can be generated by using numerous target years, known non-linear relationships, and then calculating area and differences.

3.4.3 Determine Target FCUs

The goals for the planned wetland are based on the WAA assessment results (Table A.1, Figure 3.6, p. 3–14), but the Target FCUs may differ in magnitude for a variety of reasons. Target FCUs are calculated in the following Equation 3:

$$Target\ FCUs = FCUs \times R \qquad (3)$$

where:

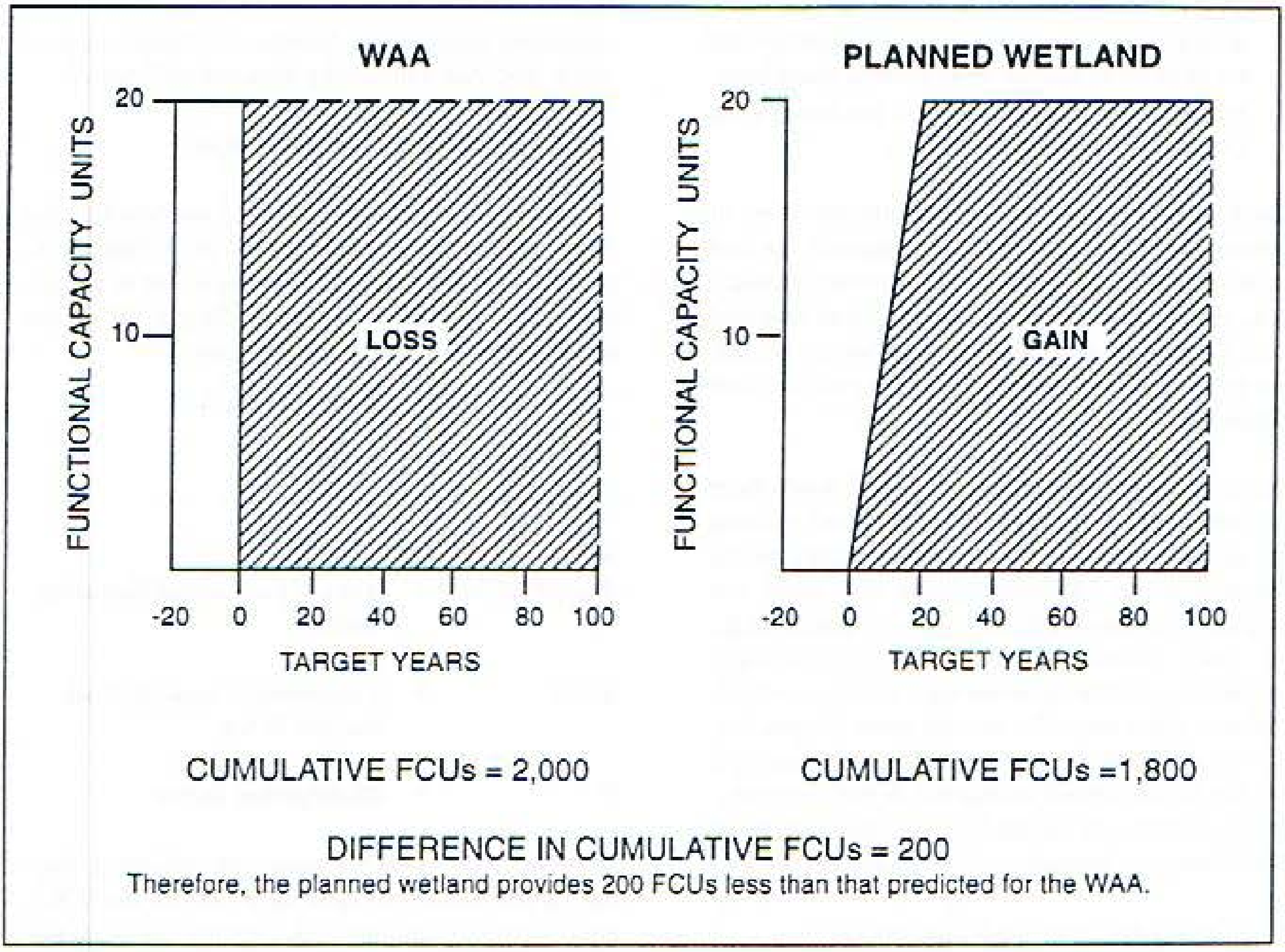
Target FCUs = **Target Functional Capacity Units**

FCUs = **Functional Capacity Units for the WAA**

R = **Multiplying factor**

If the goal is to provide equal compensation, then the Target FCUs will equal the FCUs for the WAA and no multiplying factor is used (or R = 1). If the goal is to provide greater compensation (e.g., 2:1 mitigation ratio), then the Target FCUs are calculated by multiplying the FCUs by the appropriate multiplying factor (e.g., R = 2). The multiplying factor will usually be the same, but can differ for each function. In some situations compensation for project activities is required at a ratio greater than 1:1. The reasons for requiring greater compensation include:

- **Anticipated failure of some portion of planned wetland.** With the construction of wetlands it is possible that some portion will not become established as planned. Possible causes of the failure may include plant die off from waterfowl grazing, muskrat eatouts, drought, or vandalism. The extent of anticipated problems varies with the wetland type and region. It is common practice for decision makers to require



CUMULATIVE FCUs = 2,000

CUMULATIVE FCUs =1,800

DIFFERENCE IN CUMULATIVE FCUs = 200

Therefore, the planned wetland provides 200 FCUs less than that predicted for the WAA.

Figure 3.8.
Comparison of planned wetland and WAA expressed in terms of cumulative FCUs

a larger planned wetland with the hope of providing some guaranteed compensation for the total losses associated with the WAA.

- **Out-of-kind mitigation.** Depending upon the wetland types involved, decision makers may recommend the construction of a relatively larger or smaller planned wetland. Ratios as high as 10:1 have been suggested for emergent planned wetlands used to compensate for the loss of forested wetlands.
- **Off-site mitigation.** If a nearby site is not available, the planned wetland may be located in a different locale (e.g., out of watershed) far from the WAA. Since compensation is not provided in the same area, decision makers may recommend construction of a larger planned wetland.
- **Time/function delays.** This refers to the loss in functional capacity during the time it takes the planned wetland to reach long term functional capacity goals. It may not be feasible to construct a wetland which will immediately provide all of the desired functions. For example, a planned wetland planted with saplings may be designed for the long term goal of a forested wetland. Decision makers may choose to estimate these losses by comparing the same wetland at different points in time (section 3.4.2) which is time consuming, or simply require additional acreage to offset the anticipated loss of function during the period while the planned wetland is maturing.
- **Federal, state, or local mitigation ratios:** Some federal, state, and local agencies have instituted regulations or policies which stipulate mitigation ratios. The ratios have often been set in response to unsuccessful planned wetlands. Since planned wetlands are frequently perceived as being unsuccessful or not totally successful, ratios are established to provide compensation for the anticipated failure of some portion of a project. The hope is that a larger planned wetland will provide some guaranteed compensation for the losses. The types of ratios include:

  (a) State, federal, or local standard ratios: In some cases, standard ratios are stipulated in regulations and/or guidelines which are required for mitigation projects. The ratio may be the same for all wetland types (e.g., 3:1) or different depending upon the WAA (e.g., 1:1 for emergent wetland replacing emergent wetland or 3:1 for emergent wetland replacing forested wetland).

  (b) State bonus for rarity: In some cases, standard ratios are stipulated for the planned wetland when the project involves mitigation for a rare wetland type.

The Target FCUs can be set once the decision regarding multiplying factors has been made. The multiplying factors and the Target FCUs should then be recorded on Table A.1 (Figure 3.9, p. 3–20).

The goals for the exercise used in this chapter are based solely on the assessment of the WAA. The multiplying factor (R) equals 1 because there are no required mitigation ratios. The objective is to design a wetland which will equal or exceed the functional capacity provided by the WAA, thus the Target FCUs are equal to the WAA FCUs.

3.4.4 Estimate Minimum Area required to meet goals

Estimate the Minimum Area required to achieve the Target FCUs before searching for a planned wetland site. This allows the search to be restricted to those sites which can achieve the goals. An estimate of Minimum Area is derived as follows:

1. Define Predicted FCIs
2. Calculate Minimum Area required to meet goals for each function

Table A.1.
Comparison of WAA and planned wetland: calculations of FCIs and FCUs

Project Title: Marley Creek

Comparison between WAA # 1 and planned wetland # 1

	WAA			Goals for Planned Wetland**					Planned Wetland			
Function	FCI	AREA	FCUs*	Target FCI	R	Target FCUs	Predicted FCI	Minimum Area	FCI	AREA	FCUs*	Check if goals met
SB	0.7	0.5 acre	0.4	> 0.7	1	0.4						
SS	0.83	1.5 ac	1.2	> 0.8	1	1.2						
WQ	0.92	1.5 ac	1.4	> 0.9	1	1.4						
WL	0.54	1.5 ac	0.8	> 0.6	1	0.8						
FT	0.48	1.5 ac	0.7	> 0.5	1	0.7						
FS	X	X	X	X	X	X						
FP	X	X	X	X	X	X						
UH	1.0	▨	▨	1.0	▨	▨	▨	▨		▨	▨	

*FCUs = FCI x AREA

**Target FCI = *goal* established by decision makers

R = multiplying factor established by decision makers

Target FCUs = $FCU_{WAA} \times R$ (i.e., planned wetland *goal*)

Predicted FCI = FCIs which designers presume planned wetland may achieve at a particular site (Note this may be greater than Target FCI).

Minimum Area = Target FCUs/Predicted FCI

Figure 3.9.
Example of Table A.1 completed with calculations of Target FCUs

First, note which FCIs have the potential to be increased or improved in the planned wetland. Then define **Predicted FCIs**, i.e., FCIs which designers predict a planned wetland may achieve at a particular site (note the Predicted FCIs may be greater than Target FCIs). These predicted FCIs should represent realistic values which can be achieved under the given circumstances. Predicted FCIs are recorded in Table A.1 (Figure 3.10, p. 3–22). Note that the Predicted FCIs are estimates. The FCIs achieved in the final planned wetland design can differ from the Predicted FCIs.

Next, calculate the Minimum Area for each function as in the following Equation 4:

$$\textit{Minimum Area} = \frac{\textit{Target FCUs}}{\textit{Predicted FCI}} \tag{4}$$

For example, it may be determined that the planned wetland has the potential to provide relatively high quality wildlife habitat so the Predicted FCI is set at 0.8. If the Target FCUs = 6.5 units, then the Minimum Area would be 8.1 acres.

The results of these calculations are recorded in Table A.1 (Figure 3.10). The Minimum Areas, which represent the minimum acreages required to satisfy the goals for each function are considered during the preparation of the planned wetland design (Step 6).

Target FCIs are the FCI goals established for the planned wetland by decision makers. **Predicted FCIs** are the FCIs which designers predict a planned wetland may achieve at a particular site.

The steps to determining Target FCUs and Minimum Areas are illustrated in Figure 3.10. In the example provided, the minimum acreage required for the planned wetland is greater than the acreage of the WAA. If the FCIs in the planned wetland are less than the WAA FCIs, then the planned wetland must be larger. If the Target FCIs are greater than the WAA FCIs, then the goals can be achieved with a planned wetland which is smaller than the WAA.

3.5 Select Planned Wetland Site (Step 5)

Many projects, particularly mitigation projects, require the selection of a suitable site for the planned wetland. This step is not applicable to some situations, such as restoration projects. The selection of the planned wetland site involves the identification of potential sites, screening of these sites to eliminate the unacceptable ones, and the final selection based upon a more detailed examination. The planning process should not continue until a suitable planned wetland site is selected.

Potential sites are initially identified based upon simple criteria such as Minimum Area (section 3.4) and availability. Once identified, sites must be screened to determine which one(s) have the capacity to achieve the goals given a variety of constraints (Table 3.4, p. 3–23). Wetland function is one of several factors considered during site selection. Other procedures which may be employed include hydrologic verification, the collection of biological benchmark data, a field survey for pollutant sources, a cultural resource survey, a land use survey, construction access determination, a topographic survey, and a cost estimate.

EPW should be used mainly as a reference document during site screening. The user should:

1. Review and be familiar with the elements and conditions that are critical to functions emphasized in the goals,
2. Examine the potential sites, and then
3. Determine which site(s) can provide or can be modified to provide the conditions necessary to

Table A.1.
Comparison of WAA and planned wetland: calculations of FCIs and FCUs

Project Title: Marley Creek

Comparison between WAA # 1 and planned wetland # 1

	WAA			Goals for Planned Wetland**					Planned Wetland			
Function	FCI	AREA	FCUs*	Target FCI	R	Target FCUs	Predicted FCI	Minimum Area	FCI	AREA	FCUs*	Check if goals met
SB	0.7	0.5 acre	0.4	> 0.7	1	0.4	0.7	0.5 acre				
SS	0.83	1.5 ac	1.2	> 0.8	1	1.2	0.8	1.5 ac				
WQ	0.92	1.5 ac	1.4	> 0.9	1	1.4	0.9	1.6 ac				
WL	0.54	1.5 ac	0.8	> 0.6	1	0.8	0.6	1.3 ac				
FT	0.43	1.5 ac	0.7	> 0.5	1	0.7	0.5	1.4 ac				
FS	X	X	X	X	X	X	X	X				
FP	X	X	X	X	X	X	X	X				
UH	1.0	▨	▨	1.00	▨	▨	▨	▨		▨	▨	

*FCUs = FCI x AREA
**Target FCI = *goal* established by decision makers
R = multiplying factor established by decision makers
Target FCUs = $FCU_{WAA} \times R$ (i.e., planned wetland *goal*)
Predicted FCI = FCIs which designers presume planned wetland may achieve at a particular site (Note: this may be greater than Target FCI)
Minimum Area = Target FCUs/Predicted FCI

Figure 3.10
Example of Table A.1 summarizing calculated Minimum Areas required to achieve Target FCUs

Table 3.4.
Constraints to consider during planned wetland site selection

Required Site Characteristics

Conditions needed to establish & maintain planned wetland (e.g., adequate hydrology, soils, water quality, and landscape context)

[*] Conditions needed to achieve function based goals (Target FCIs)

[*] Sufficient acreage to meet the goals (e.g., Target FCIs, Target FCUs, and mitigation ratios)

[*] Problems that could jeopardize planned wetland establishment (e.g., invasive vegetation, problem animals, excessive shade or fetch)

Institutional Constraints

Goal location criteria (e.g., on-site, off-site, within right-of-way)

Compatibility with land use, zoning, buffer zone requirements, or water rights

[*] Avoidance of special features (e.g., natural landmark, archeological and historical sites, critical habitat for endangered species, farmland preservation)

Economic Feasibility

Funds available

Total costs of planned wetland: land acquisition + construction costs + post-construction maintenance.

Construction Constraints

Utility lines (e.g., sewers, water supply, and power transmission)

Limited site access (e.g., physical barriers or denied access by adjacent landowners)

Physical features which limit design or hinder construction efforts (e.g., outcrops, steep topographic relief)

Potential hazardous wastes

[*] Refer to EPW

attain the goals for the planned wetland (Target FCIs and Target FCUs).

In most cases, a simple comparison of site characteristics to EPW elements should suffice. FCI calculations may also be done if there are questions regarding the attainment of FCIs and FCUs for the planned wetland.

The extent to which elements are examined during site selection will vary. The evaluation of some elements may only require cursory office or "windshield" evaluations, whereas other elements may require a set procedure with frequent field monitoring. For example, the site hydrology usually requires a thorough evaluation because it is most crucial to the success of a planned wetland. The hydrologic analysis not only verifies the planned wetland feasibility, but it also verifies the conditions needed to achieve the function goals.

Site screening may result in the identification of one or more suitable candidate sites. At some point, final selection will be made and the planned wetland can be designed.

3.6 Design Planned Wetland (Step 6)

3.6.1 Identify conditions needed to achieve planned wetland goals

Refer to the Target FCIs and Target FCUs, and the assessment procedure to determine which element conditions are necessary to meet the goals. As the planned wetland design is developed, incorporate the appropriate conditions. Periodically refer to EPW elements to identify the best conditions for maximizing the functional capacity. Include these conditions and avoid or minimize unsuitable conditions in the planned wetland design.

3.6.2 Prepare design

The planned wetland design is prepared for the selected site(s) at a scale necessary to establish site-specific design considerations. The design must also provide sufficient detail to perform the assessment. Detailed information such as specific grading and landscaping requirements are not required at this time, although this information may be provided. Designs are usually prepared in two stages:

1. Conceptual design

2. Construction plans and specifications

A conceptual design provides a brief description of the planned wetland through drawings and text which confirms feasibility and facilitates early review by decision makers. Construction plans and specifications provide sufficiently detailed site-specific information for the general contractor to insure that the planned wetland is constructed as planned. It is better to assess a conceptual design since the more detailed information (e.g., specific grading and landscaping requirements) are not required to perform the assessment. A decision to delay and to assess the construction plans and specifications may result in undue costs if the assessment reveals the need for revisions.

The planned wetland map should contain the same information as is required for the WAA (section 3.2.3). A map should be prepared for each planned wetland. Depending upon the scale of the project, one or more planned wetland areas can be illustrated on one map.

3.7 Assess Planned Wetland Design (Step 7)

3.7.1 Complete data sheets

The assessment of the planned wetland provides the measures of functional capacity which are used to determine if the goals are achieved. The following section provides instructions and illustrations on how to execute the assessment of the planned wetland.

The planned wetland must be in the same wetland class as the WAA. Comparisons between wetlands in different wetland classes are generally considered inappropriate because they are functionally dissimilar.

The same data sheets used for the WAA are used to record the assessment of the planned wetland. Record the selected element scores for the planned wetland on the data sheets (Figure 3.11, p. 3–26) and indicate differences in scores in the last column, as follows:

(+)	:	indicates a positive difference
(-)	:	indicates a negative difference
(0)	:	indicates no difference
NA	:	the element is not applicable for both wetlands
INA	:	information is not available for both wetlands
Equation	:	indication of both scores may be necessary when a directional difference (+, -, or 0) cannot be determined (e.g., planned wetland - WAA = NA - 1.0).

Directions regarding any assumed numerical score for NA (e.g., Assume NA = 1.0) should be followed. It may be inappropriate to calculate a difference when one of the selections is NA or INA. Directions are provided for those cases when both selections should be recorded as an equation.

Chapters 4–9 provide examples of completed data sheets for each function.

3.7.2 Calculate FCIs and FCUs

The FCI for each function is calculated on the same model diagrams used for the WAA using the element scores recorded for the planned wetland (Figure 3.12, p. 3–27). The scores are placed to the right of the slash on each blank line. Calculations are performed as indicated. When calculations are completed, the FCIs for all functions are summarized in Table A.1 (Figure 3.13, p. 3–28). The FCUs for each function, except Uniqueness/Heritage, are also calculated and summarized in Table A.1.

3.7.3 Determine whether goals are met

The assessment results of the planned wetland are compared to the Target FCIs and Target FCUs to determine if the goals are met. The comparison of FCIs (WAA, Target, and planned wetland) is summarized in Table A.2 (Figure 3.14, p. 3–29). The predicted FCIs are not noted because they are predicted indices used to estimate the planned wetland Minimum Area (section 3.4.4). In the Marley Creek example, the goals for the planned wetland were not met for all functions. If the assessment reveals that the planned wetland does not meet the Target FCIs, the design should be revised and re-assessed. The comparison of elements is also summarized in Table A.2 by listing elements with different scores for the WAA and planned wetland. The type of difference (+, -, or an equation) and an explanation for the cause of this difference are also recorded. This information can be used to explain how specific differences in wetland features have resulted in a change in FCIs.

The comparison of FCUs (Target and planned wetland) is summarized in Table A.1 (Figure 3.13). If the assessment results show that the planned

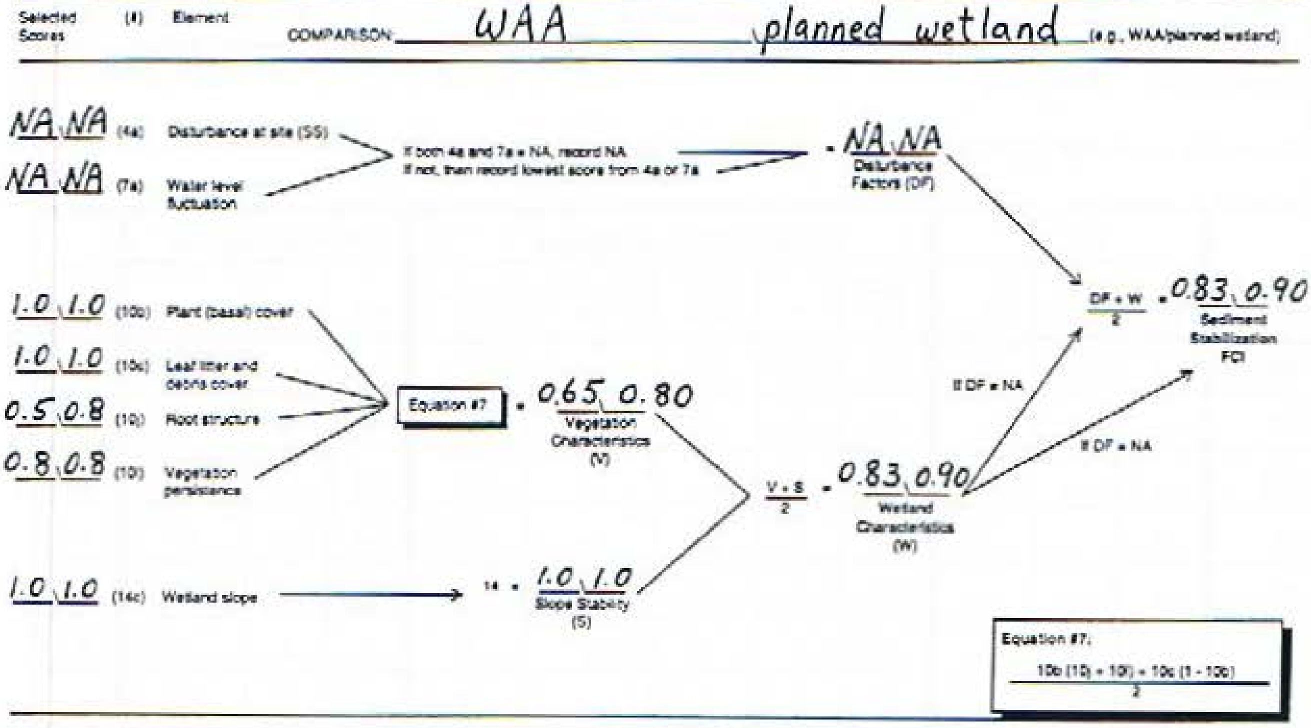
ELEMENT		SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned-WAA)
			WAA	Planned Wetland	If both scores are NA, record NA
1a	Water contact with toe of bank (see Figure A.1)	[SB, WQ]*			Assume NA = 1.0
a.	No shoreline bank.	NA			
b.	Infrequent water contact at toe of bank, i.e., no undercutting of bank (e.g., contact once annually or less).	1.0	0.5	1.0	(+)
c.	Occasional water contact at toe of bank (e.g., contact once a month).	0.7			
d.	Moderate water contact at toe of bank (moderate undercutting of bank).	0.5			
e.	Frequent water contact at toe of bank (severe undercutting of bank).	0.1			

Figure 3.11.
Example of data sheet: completed for planned wetland

Calculation of **SEDIMENT STABILIZATION** FCI

PROJECT TITLE: MARLEY CREEK

COMPARISON: WAA planned wetland (e.g., WAA/planned wetland)



Equation #7:

$$\frac{10b\,(10j + 10l) + 10c\,(1 - 10b)}{2}$$

Figure 3.12
Example of model used to calculate FCIs: answers completed for WAA and planned wetland

Table A.1.
Comparison of WAA and planned wetland: calculations of FCIs and FCUs

Project Title: Marley Creek

Comparison between WAA # 1 and planned wetland # 1

	WAA			Goals for Planned Wetland**					Planned Wetland			
Function	FCI	AREA	FCUs*	Target FCI	R	Target FCUs	Predicted FCI	Minimum Area	FCI	AREA	FCUs*	Check if goals met
SB	0.7	0.5 acre	0.4	> 0.7	1	0.4	0.7	0.5 acre	0.97	2 acre	1.9	✓
SS	0.83	1.5 ac	1.2	> 0.8	1	1.2	0.8	1.5 ac	0.90	2 ac	1.8	✓
WQ	0.92	1.5 ac	1.4	> 0.9	1	1.4	0.9	1.6 ac	0.83	2 ac	1.7	NO
WL	0.54	1.5 ac	0.8	> 0.6	1	0.8	0.6	1.3 ac	0.35	2 ac	0.7	NO
FT	0.48	1.5 ac	0.7	> 0.5	1	0.7	0.5	1.4 ac	0.20	2 ac	0.4	NO
FS	X	X	X	X	X	X	X	X	X	X	X	X
FP	X	X	X	X	X	X	X	X	X	X	X	X
UH	1.0	▨	▨	1.0	▨	▨	▨	▨	1.0	▨	▨	✓

*FCUs = FCI x AREA
**Target FCI = *goal* established by decision makers
R = multiplying factor established by decision makers
Target FCUs = $FCU_{WAA} \times R$ (i.e., planned wetland *goal*)
Predicted FCI = FCIs which designers presume planned wetland may achieve at a particular site (Note this may be greater than Target FCI).
Minimum Area = Target FCUs/Predicted FCI

Figure 3.13.
Example of Table A. 1: calculations completed for planned wetland FCUs

Table A.2.
Comparison of FCIs and element scores

PROJECT TITLE:

Function	Functional Capacity Index		Elements with different scores for WAA and planned wetland		
	WAA	Planned Wetland	Element Number	Difference	Explanation
Shoreline Bank Erosion Control (SB)	0.7	0.97	1 a	+	Undercutting observed in WAA
		Target: >0.7	10 i	+	Planned wetland has more root mat forming plant species
Sediment Stabilization (SS)	0.83	0.90 **Target: >0.8**	10 j	+	Planned wetland has more root mat forming plant species
Water Quality (WQ)	0.92	0.83	1 a	+	Undercutting in WAA; planned wetland design prevents this
		Target: >0.9	15	-	Less water/wetland contact because planned wetland contains high and low marsh
Wildlife (WL)	0.54	0.35	11 a	-	Fewer layers in planned wetland
			11 b	-	Planned wetland predominantly 1 layer
			11 c	NA-1.0	No shrubs in planned wetland
			12 a	-	Fewer cover types in planned wetland
			12 b	-	Proportion of cover types not balanced
			12 c	-	Less interspersion in planned wetland
		Target: >0.6	12 e	1.0-NA	Planned wetland does not have tall persistent and bushy deciduous cover types
Fish (FT, FS, FP)	0.5	0.2	1 b	+	Planned wetland has no shoreline bank erosion
			7 c	-	Hydroperiod less favorable for fish in planned wetland
			9 c	-	Substrate less suitable for fish in planned wetland
			21 b	+	Wetland/water edge in planned wetland irregular compared to regular edge in WAA
		Target: >0.5	22 b	-	WAA has some dense brush, whereas planned wetland lacks this and other attractors
Uniqueness/Heritage (UH)	NA	1	35	+	Planned wetland is deed restricted
		Target: 1.0	36	+	Planned wetland is research site

Figure 3.14.
Example of Table A.2

wetland does not meet the Target FCUs, then the FCUs can be increased by:

1. Increasing the AREA for the function(s) which did not meet the Target FCUs. This may require increasing the size of the entire wetland.
2. Re-designing the planned wetland to increase the FCI for the function(s) which did not meet the Target FCI.

If the planned wetland is compared to several WAAs of the same class (section 3.4.1), then a direct comparison can be made between the planned wetland and Target FCIs and FCUs. The comparison of element scores is more difficult. Users and the decision makers must agree upon the format and extent of comparison, depending upon the individual project.

Chapter 4. Shoreline Bank Erosion Control

4.1 Definition

Wetlands function to stabilize the shoreline bank and to dissipate erosive forces associated with waves, currents, ice, rainfall, seepage, obstacles in the water, water-level fluctuations, or groundwater flow. The Shoreline Bank Erosion Control FCI provides a relative measure of the wetland's capacity to provide erosion control and to dissipate erosive forces at the shoreline bank.

A **shoreline bank** is a steep ascending slope of land of any height raised above the adjacent shore that can experience undercutting if it is in contact with water. A bank can form at various locations on the marsh surface ranging from the lower elevations at the vegetation water interface, to within the wetland proper, or higher at the wetland-upland interface (Figure 4.1, p. 4–2). Shoreline banks are often the product of erosional processes. Regardless of whether or not the bank was created by erosion, banks are still most prone to erosion because of their steep profiles. Erosion occurs when water flow removes sediments from the bank face grain by grain (e.g., from non-cohesive bank material) or as assemblages of grains (e.g., from cohesive bank material). Garbisch and Garbisch (1994) have demonstrated that bank erosion in a wetland can be controlled when contact of water with the bank face is eliminated. Bank erosion protection is provided by increasing the shore height. Vegetation is then planted on the slope to protect the shore (Figure 4.2, p. 4–3). The vegetation serves to (a) reduce wave energy before it reaches the bank face, (b) stabilize and reduce the rate of shore erosion which maintains the rate of bank erosion, and/or (c) develop a peat bank to offset any water level rises or land subsidence.

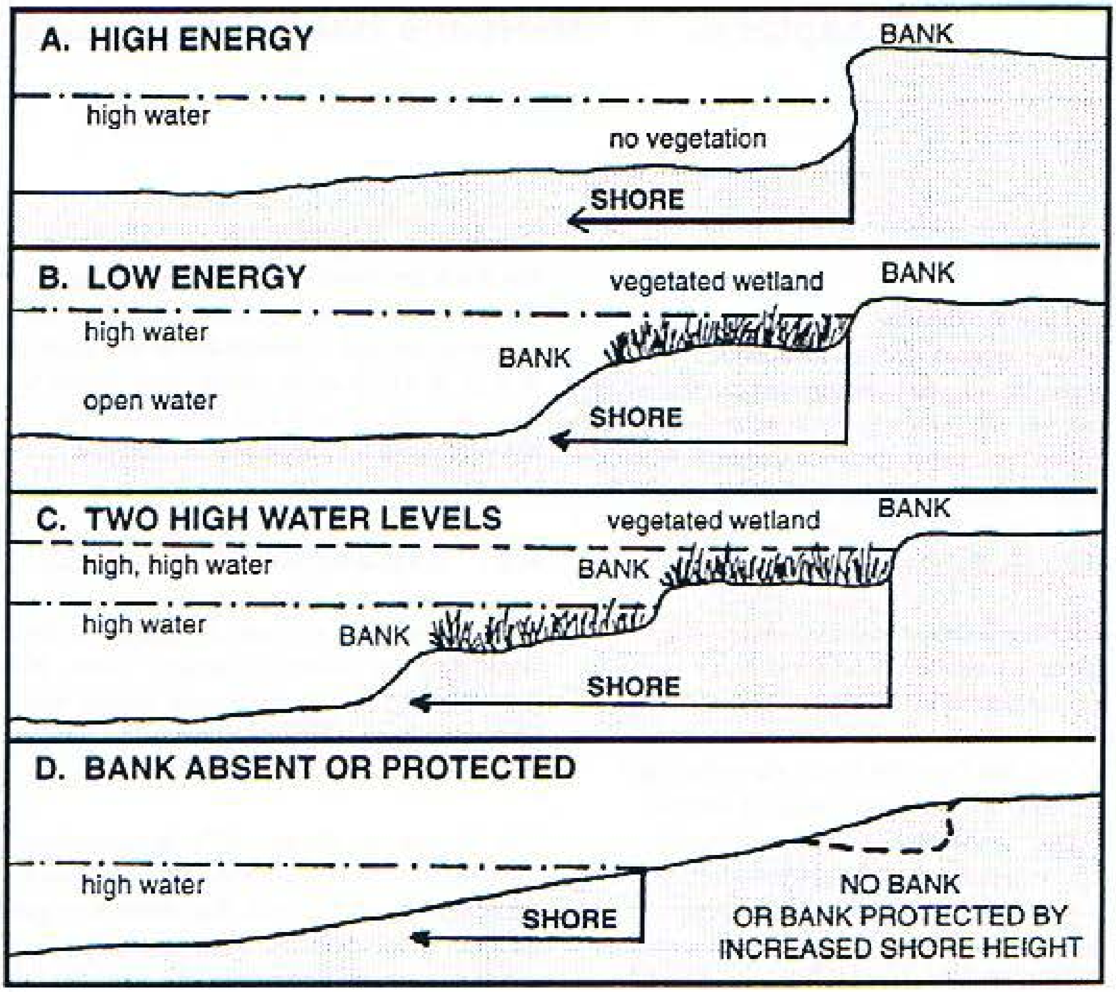
The function weighting area (AREA) for the Shoreline Bank Erosion Control function is the **shore**, i.e., the vegetated and unvegetated substrate (areas of the wetland) located channelward of the bank (Figure A.2, p. A 4). In cases where there might be more than one bank, consider all areas channelward of the banks (Figure 4.1, examples B and C, p. 4–2).

4.2 Explanation of the Model

Sixteen elements are used to assess the Shoreline Bank Erosion Control function. These elements contribute to five components which define the Shoreline Bank Erosion Control FCI (Figure 4.3, p. 4–4).

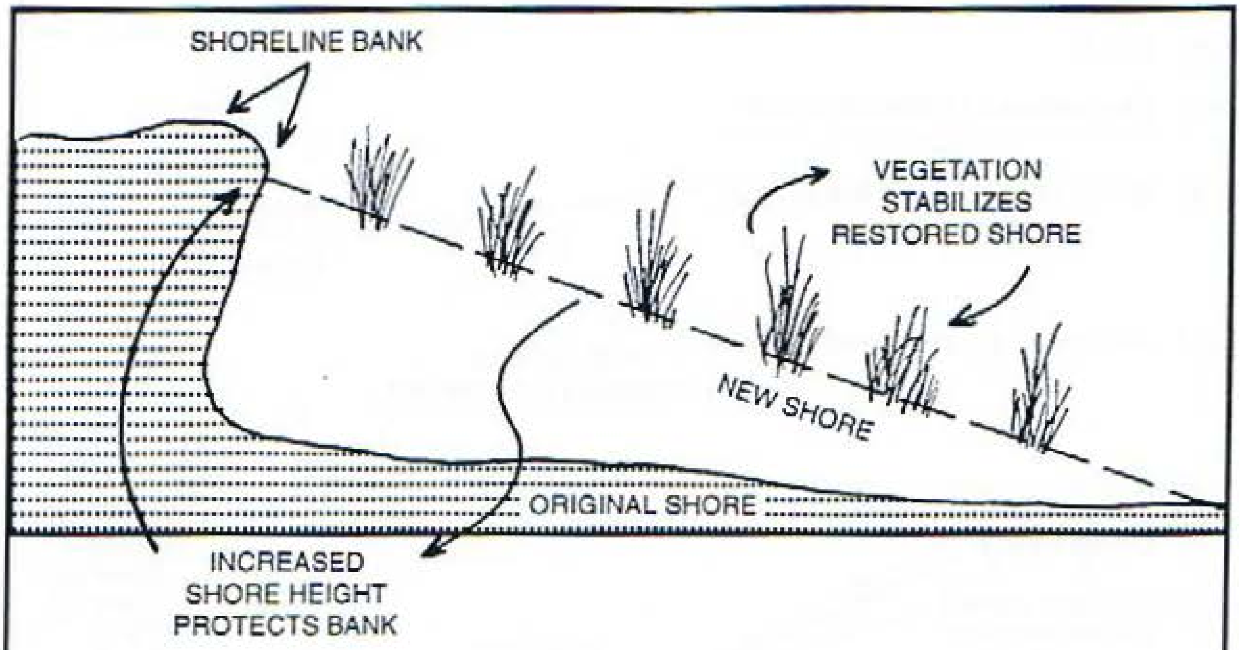
The assessment begins with the examination of *Water contact with toe of the bank* (Element 1a). If there is no shoreline bank, then there is no potential for providing shoreline bank erosion control. The assessment is not continued. If a shoreline is present, then *Fetch* (Element 2) and *Steepness of existing shore* (Element 14a) are examined to determine if a site is suitable for the construction or maintenance of a planned wetland. If the score for either one of these elements is 0.1, then the site is unsuitable.

The Shoreline Bank Erosion Control FCI is a product of two components: Potential for Erosion and Influences on Rate of Erosion. The Potential for Erosion component is described by only one element, *Water contact with toe of bank*, which is used (a) to determine if the function is applicable and/or (b) to define the extent of shoreline bank erosion. If there is no shoreline bank, the function is not applicable and the FCI is not calculated. If the answer to



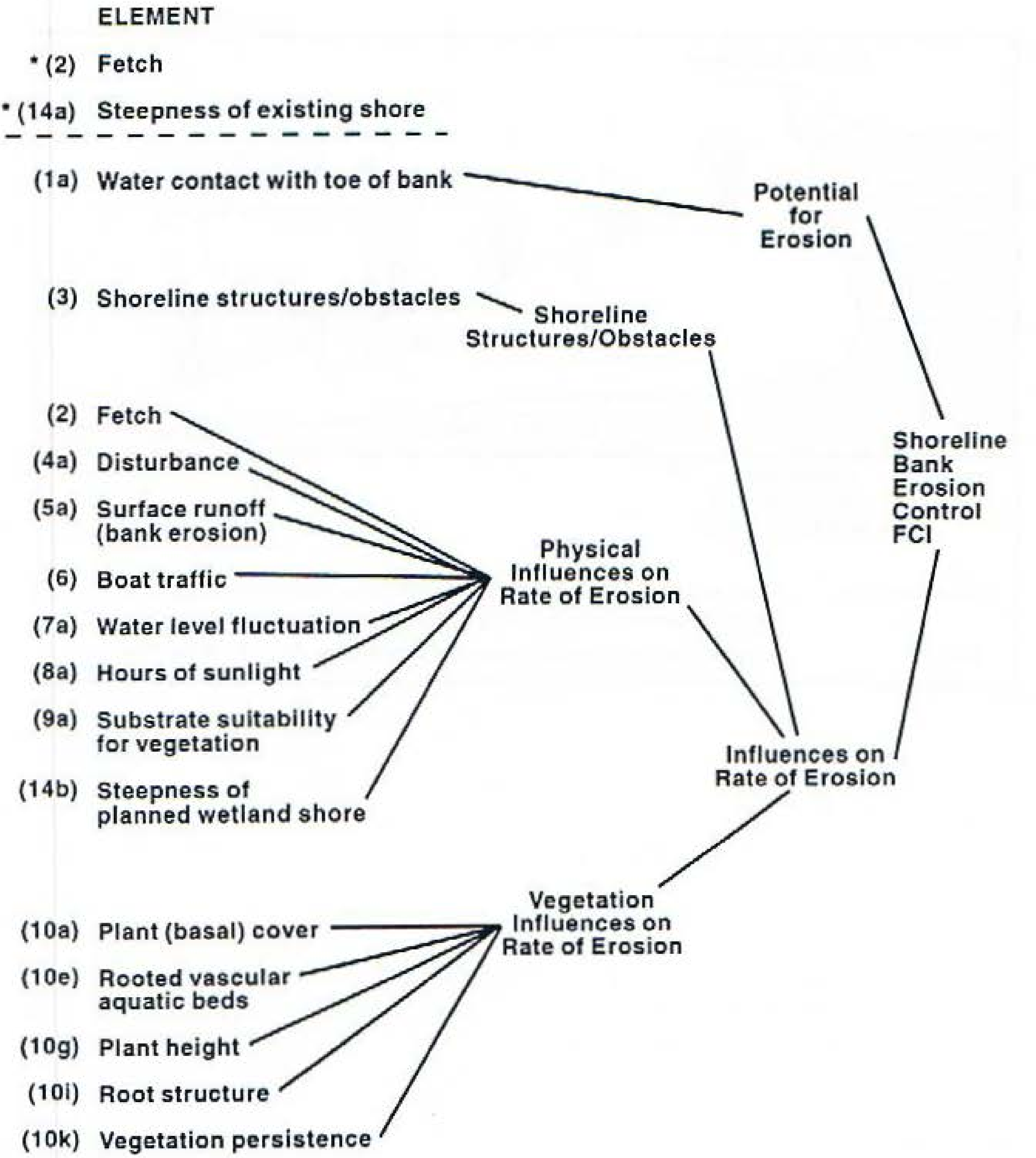
A. HIGH ENERGY:	Bank at wetland upland interface (e.g., upland bluff).
B. LOW ENERGY:	Banks at wetland-upland and wetland-water interfaces. Slope and wave climate permit vegetation on slope.
C. TWO HIGH WATER LEVELS:	Three possible banks: wetland-upland, within wetland proper, and wetland-water. A bank within the wetland may be caused by ice sheer during winter low water period (e.g., regulated lake levels).
D. BANK ABSENT OR PROTECTED	(by increased shore height)

Figure 4.1.
Examples of possible locations of a shoreline bank



Shoreline Bank:	Steep ascending slope of land of any height raised above the adjacent shore, that can experience undercutting if it is in contact with water.
Shore:	Vegetated or non-vegetated substrate located channelward of the bank.

Figure 4.2
The role of vegetation and the shore in shoreline bank erosion control



** Examined first to determine if function is applicable*

Figure 4.3

Relationships of elements and components in the Shoreline Bank Erosion Control FCI model this element yields a score, then this score will represent the wetland's Potential for Erosion.

The Influences on Rate of Erosion component is defined by three components: Shoreline Structures/Obstacles, Physical Influences on Rate of Erosion, and Vegetation Influences on Rate of Erosion. The Shoreline Structures/Obstacles component considers the influence of structures on erosional processes. The Physical Influences on Rate of Erosion component identifies potential physical influences which may act separately or in combination to increase the erosion rate. In most situations, there will be a score for Element 2 (*Fetch*); the remaining elements will be considered *not applicable (NA)*. Fetch is always assigned a score because it is the only physical influence which is always a consideration. The other elements are factored into the FCI only when conditions may be too severe to maintain an existing wetland and/or to establish a planned wetland.

The Vegetation Influences on Rate of Erosion component is described by five vegetation characteristics. The relationship of this component to other components illustrates that vegetation effects on shoreline bank erosion control are complex and dependent upon other influencing factors. Vegetation cannot be simply classed as a benefit or liability to bank stability without detailed consideration of other factors including processes responsible for retreat or advance, bank material properties, and bank geometry, and the type, age, density, and health of vegetation (Thorne 1990). In EPW, it is assumed that the contribution of vegetation to shoreline bank erosion control is relatively minor compared to the combination of other physical factors.

The main element in the Vegetation Influences on the Rate of Erosion component is *Plant (basal) cover. Plant height*, *Root structure*, and *Vegetation persistence* all depend on the amount of available plant (basal) cover. Therefore, the contribution of these three elements is weighted by the score (i.e., relative score for percent cover on a 0 to 1.0 score) for *Plant (basal) cover*. The inclusion of Element 10e, *Rooted vascular aquatic beds*, recognizes the importance of rooted vascular aquatic beds in providing the Shoreline Bank Erosion Control function. The score for this component is calculated using the following Equation 5:

$$\left.\begin{array}{c}\textbf{Vegetation Influence}\\\textbf{on}\\\textbf{Rate of Erosion}\end{array}\right\} - \frac{10a\,(10g - 10l - 10k) - 10e}{4}$$

(5)

If rooted vascular aquatic beds are not present (i.e., 10e is not applicable), then use Equation 6:

$$\left.\begin{array}{c}\textbf{Vegetation Influence}\\\textbf{on}\\\textbf{Rate of Erosion}\end{array}\right\} - \frac{10a\,(10g - 10i - 10k)}{3}$$

(6)

4.3 Rationale and Assumptions

ELEMENT 1a. WATER CONTACT WITH TOE OF BANK

Directions: Determine if a shoreline bank is present. If present, then determine the frequency of water contact with the toe of bank (Figure A.1, p. A 2).

Rationale and assumptions: Erosion along a shoreline bank is caused by a variety of forces and processes acting together. The most prevalent causes of bank erosion are scour at the toe of the bank by waves (Element 1a) and the instability of the bank materials themselves (addressed in Element 9a) (USCOE 1981). The relative frequency of water contact at the toe of the bank and the extent of bank undercutting are considered the key indicators of the potential for shoreline bank erosion. The underlying principle used for this element is that the rate of bank erosion increases as the frequency of contact of water with the bank face increases. The importance of this element is demonstrated by existing techniques used in tidal wetlands constructed and/or enhanced for the purpose of providing shoreline bank erosion control. The technique often involves creating (restoring) new elevated shores along the bank such that water contact with the bank face is largely reduced or eliminated (Garbisch and Garbisch 1994). Less frequently, banks are eliminated through grading to create new shores which are largely above MHW (Sharp and Vaden 1970).

In the assessment procedure, this element and the Shoreline Bank Erosion Control function are considered not applicable if there is no shoreline bank (condition "a"). Element 1a is factored into the Shoreline Bank Erosion Control FCI only when a shoreline bank is present. Conditions "b" through "e" represent a range of frequencies of water contact with the toe of the bank. The frequency of contact is associated with different degrees of potential to cause erosion. Bank erosion is considered minimal when there is infrequent water contact at the toe of the bank (condition "b"). The worst condition (condition "e") occurs when there is frequent water contact at the toe of the bank. The other conditions "c" (occasional contact) and "d" (moderate contact) represent intermediate frequencies and are assigned intermediate scores based upon their potential to cause erosion.

ELEMENT 2. FETCH

Directions: Determine if a bank is present. If present, then estimate the maximum fetch by using maps, field observations, or photointerpretation. Select the applicable condition based upon maximum fetch. **Fetch** is the maximum distance over which wind can blow, unimpeded, across open water to generate waves

Rationale and assumptions: One of the most critical causes of erosion and sediment release into waterways is wind borne waves. When fetch is large, waves become more intense, and there is greater potential for undermining; sediment carrying capacity of the water also increases (Settlemeyer and Gardiner 1977). If the fetch is very long, wave intensity may be severe enough to result in continuous erosion and eventual destruction of an existing wetland.

Several authors have identified wave stress as a critical factor affecting initial establishment and long-term stability of planned wetland projects (e.g., Teas 1977, Kruczynski 1982, Knutson and Woodhouse 1982, Lewis 1982a, Webb 1982, Garbisch and Garbisch 1994). Lewis (1982a) explained that even with some sort of wave barrier or erosion protection such as tires, the plantings of mangroves in an area exposed to a long fetch were nearly 100% unsuccessful. In a study on the western Gulf of Mexico, Webb (1982) concluded that transplants along shorelines exposed to a long fetch would not likely survive unless wave protection was provided. Transplants were repeatedly washed out of the sandy soil on Lake Pontchatrain, Louisiana, by wave action which was generated over a 20 mile fetch. Within a month of planting, Webb (1982) reported excellent survival of planted *Spartina alterniflora* on a salt marsh in the western Gulf of Mexico; fetch at the site was not more than a couple of miles. In a palustrine emergent wetland a distance of 0.8 km (0.5 mile) generated waves capable of resuspending wetland sediments (Carper and Bachman 1984).

During a survey of 104 planted salt marshes on existing shores in the United States, Knutson et al. (1981) found that marsh establishment was most successful when the average fetch was less than .95 km (0.6 miles) and the greatest fetch for a given site was no greater than 1.9 km (1.2 miles). The lowest success rates were found where the average and longest fetches were greater than 9 and 18 km (5.6 and 11.2 miles) respectively. In a paper summarizing marsh development design and specifications for bank erosion control in Maryland Chesapeake Bay areas, Garbisch and Garbisch (1994) noted that the development of wetlands on newly constructed (or restored) shores was limited to fairly protected areas with fetches less than 1.6 to 3.2 km (1 to 2 miles). It should be noted that the slope of newly constructed (or restored) shores is always greater than the original slope, and consequently it is more prone to erosion than those of existing shores. The increased shore height protects the bank, while the establishment of vegetation on the newly sloped shore protects the slope from erosion (Figure 4.2, p. 4–3).

There is no one reported critical value for fetch. The selection of conditions, and the assignment of scores are based upon Environmental Concern's experience with the construction of wetlands designed for the purpose of providing shoreline bank erosion control.

In the assessment procedure, Element 2 is always factored into the Shoreline Bank Erosion Control FCI. The best condition for the construction and maintenance of a wetland (condition "a" = Fetch < 1.6 km [1 mile]) is assigned the highest numerical score (i.e., 1.0). The literature cited generally supports the assumption that if the fetch is less than 1.6 km (1 mile), the erosion potential would be minimal for both natural and planned wetlands. Condition "b" represents an unacceptable fetch of greater than 1.6 km (1 mile) in any direction.

ELEMENT 3. SHORELINE STRUCTURES/OBSTACLES

Directions: Determine if a shoreline bank is present. If present, then determine if there are any shoreline protection structures (e.g., groins, revetment, breakwater, bulkhead), and/or other structures (e.g., bridge piers, boat docks, dam) or natural obstacles (e.g., fallen trees, debris, or potential for moving chunks of ice) present along the water body. If present, note if shore bank erosion **in those areas influenced by the shoreline structures/obstacles** is minimal, moderate, or significant. This determination may apply only to a small portion of the shoreline, or to the entire shoreline depending upon the structures/obstacles present. There may be several structures (e.g., bulkhead + riprap + breakwater) installed to protect the shoreline; these structures may or may not be effective. If this is the case, determine the overall effectiveness of these structures. Any signs of erosion should be considered as an indicator of ineffectiveness.

Rationale and assumptions: Artificial structures or natural obstacles can cause significant changes in flow characteristics and erosion/accretion patterns, and substantially increase or decrease the potential for bank erosion. Structures/obstacles can cause erosion by creating eddy currents, by interrupting shore sediment drift, or by direct impact or abrasion. In a guideline manual for streambank protection, Keown (1983) addresses the effect of obstacles and classifies them under three general categories: obstacles that (a) are built completely across the stream (e.g., dam), (b) constrict the streamflow, and (c) deflect the streamflow. The concern with any of these structures/obstacles is that they may create a rotating current, called an eddy, which can cause severe bank erosion. Eddy currents may also be generated by structures/obstacles in non-stream environments (e.g., estuarine, palustrine), and thus are equally a concern in these systems.

Structures/obstacles also interrupt sediment drift which may cause an increase or decrease in bank erosion. Shoreline structures can control, be ineffective at controlling, or cause erosion. This is illustrated by the possible effects resulting from the construction of a groin along a shoreline. Groins are designed to trap sediments in order to deter erosion on the updrift side. Material passes around the groin to the downdrift shore, but at a slower rate than before the groin was constructed. If properly designed, the groin will provide updrift erosion control. The extent of downdrift erosion should be minimal; however, if improperly designed, the groin will cause significant erosion on the downdrift shore.

Finally, structures/obstacles can cause bank erosion by grinding against the shoreline bank (abrasion) or through direct impact. Keown (1983) notes that during breakup, chunks of pack ice can pass through a stream channel where banks have already thawed and cause severe bank erosion due to abrasion. Debris (e.g., fallen trees, discarded construction materials) can also cause bank erosion by abrasion or direct impact.

Shoreline structures are often constructed along a shoreline to control erosion. The effectiveness of these structures is important, particularly when attempting to establish a new wetland (e.g., Webb 1982). In some cases, structures may be present, but ineffective. Lewis (1982a) found that plantings of mangroves in an area exposed to a long fetch were nearly 100% unsuccessful, even when wave barrier or a tire erosion protection structure was provided. The fetch was apparently too great, so that the wave severity rendered the structures ineffective. In many cases, adequate protection can be provided by shoreline structures. Structures are often used in conjunction with plantings in the construction of wetlands for shoreline bank erosion control (e.g., Garbisch and Garbisch 1994).

It is assumed that the frequency of water contact with the toe of the bank is a major factor in shoreline bank erosion control. Element 3 is included in the assessment to acknowledge the importance of structures/obstacles. When this element is applicable, it becomes apparent how structures/obstacles add to the complexity in assessing the potential for erosion control. In some cases, the effect of a structure/obstacle may be clearly evident. In other cases, it may be difficult to discern if a structure/obstacle is the cause of or if it just contributes to other erosive forces (e.g., wave action). For simplicity, the element asks only for a description of the extent of erosion. If a structure/obstacle is present and erosion evident, then it should be determined if the erosion is minimal, moderate, or substantial for those areas influenced by the shoreline structure/obstacle. If any changes are made in a planned wetland to minimize erosion potential (e.g., new structure, combination of structure and planting of a fringe marsh), this change will be reflected in the selection of a more suitable element condition.

In the assessment procedure, this element is considered not applicable if shoreline structures/obstacles are absent (condition "a"), or if structures/obstacles are present and shore erosion is minimal (condition "b"). Element 3 is factored into the Shoreline Bank Erosion Control FCI only when shoreline structures/obstacles are present and erosion is moderate (condition "c") or substantial (condition "d") since these conditions may continue to aggravate erosion in an existing wetland and/or threaten the successful establishment of a planned wetland.

ELEMENT 4a. DISTURBANCE AT SITE (Sediment Stabilization)

Directions: Determine if there is disturbance at the site (e.g., grazing by herbivores, human activity which disrupts sediments) by field observations and/or local inquiry. Do not consider observations of debris as evidence of disturbance. If the site is subject to disturbance, note if (a) the disturbance is minimal, moderate, or substantial and (b) if any actions have been taken to minimize the potential for erosion (e.g., installation of exclosure fences, mulching, seeding, planting).

Rationale and assumptions: The erosion caused by animal or human activity in wetlands is generally considered inconsequential. However, there are situations when these activities increase, erosion is aggravated, and the capacity of the wetland to provide the Shoreline Bank Erosion Control function can be significantly reduced. Significant wetland disturbance in both natural and planned wetlands have been reported from muskrat eatouts, overgrazing by ducks (e.g., Serodes and Troudes

1984), and recreational use of off-road vehicles in these areas (personal observation by authors).

Animal activities can cause extensive and long term sediment instability in a wetland. In a study of freshwater wetlands in southwestern Florida, Winchester et al. (1985) found that disturbance due to feral hog rooting in some wetlands was so great that no unturned areas within a vegetation zone could be found. Disturbances caused by both feral hog rooting and cattle grazing are important determinants of vegetation zone composition. Winchester et al. (1985) noted that if this disturbance occurred annually, perennial species could be excluded leaving a predominance of annuals. The disturbance causes two changes which reduce the wetland's capacity to provide the Shoreline Bank Erosion Control function. First, there is the direct disturbance of the shoreline substrate and decrease in the sediment stabilization of the shore which may lead to shore erosion. As the shore erodes and decreases in elevation, the frequency of water contact with the bank face increases. This leads to an increase of shore bank erosion. Second, there is the change from perennial species to annuals which generally have vegetative characteristics that are considered less favorable for this function (e.g., change from root mat to non-root mat structure [Element 10i]; change from persistent to non-persistent vegetation [Element 10k]).

If the damage to a wetland is severe and/or if the habitat is susceptible to disturbance, then the damages may be irreversible. For example, in cold tundra environments, recovery from damage is often slow, especially if the vegetation mat is removed and thermokarst (i.e., the process by which the surface develops heat pitting, collapses, and results in the thinning or disappearance of the permafrost) is initiated. In the tundra, the resulting erosion may or may not be stopped by a revegetation program (Webber and Ives 1978). The same may be true for other wetland habitats.

In the assessment procedure, this element is considered not applicable if disturbance at the site is absent or minimal (condition "a") or if measures have been taken to prevent erosion (condition "b"). Element 4a is factored into the Shoreline Bank Erosion Control FCI only when there is evidence of moderate (condition "c") or substantial (condition "d") disturbance which might aggravate erosion in an existing wetland and/or threaten the successful establishment of a planned wetland.

ELEMENT 5a. SURFACE RUNOFF FROM UPSLOPE AREAS (Bank Erosion)

Directions: Determine if a shoreline bank is present. If present, then determine to what extent surface runoff from upslope areas contributes to bank erosion at the site (e.g., not an apparent contributor, minimal, moderate, or substantial).

Rationale and assumptions: If surface conditions in upslope areas cannot withstand erosive forces associated with surface runoff, then the runoff may remove particles in thin layers (sheet erosion) or form small channels or gullies (rill erosion). Unless effectively controlled, overbank drainage can cause sheet and rill erosion on the shoreline bank (Keown 1983) (Figure 4.4, p. 4–10). Shoreline bank erosion can be further aggravated as the surface runoff erodes the shore leading to a reduction in shore elevation and an increase in water contact with the bank face. Measures which can be taken to minimize the damage from surface runoff include the filling of surface of cracks, diverting surface runoff from the bank by ditches or swales, and following standard erosion control practices which are designed to stabilize sites after disturbance (e.g., placement of mulch, seeding, or planting). The importance of managing point discharges of stormwater is well recognized by those experienced with the construction of wetlands designed for shoreline bank erosion control. Garbisch and Garbisch (1994) reported that minor physical alteration of site topography through the operation of heavy construction equipment along the top of

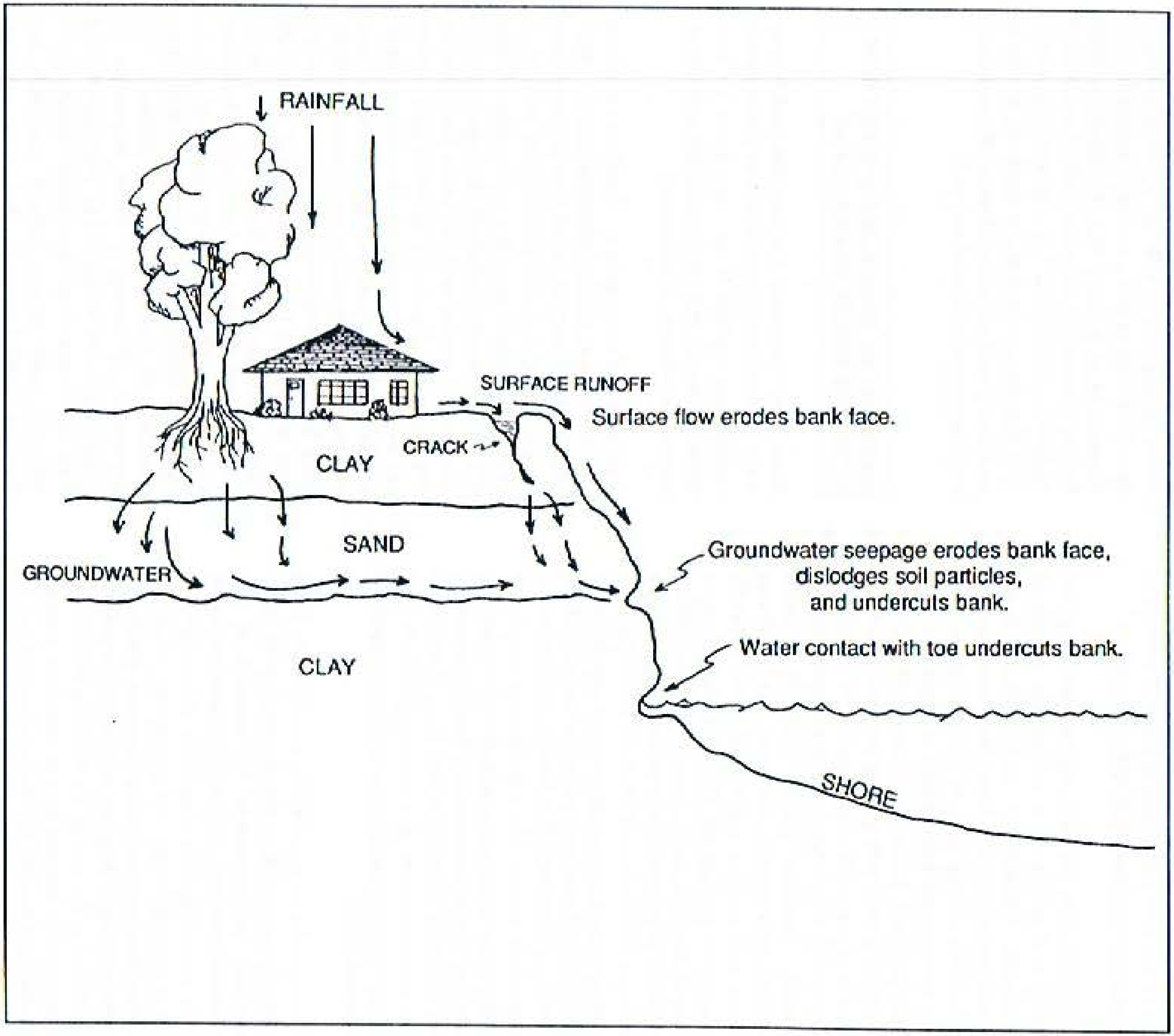


Figure 4.4.
Causes of bank erosion (modified from USCOE 1981)

the bank can affect site drainage and result in stormwater discharge gullies in the new shoreline.

In the assessment procedure, this element is considered not applicable if surface runoff from upslope areas is not an apparent contributor to bank erosion (condition "a") or if surface runoff contribution to bank erosion is minimal due to presence of effective infiltration and drainage controls in adjacent areas (condition "b"). Element 5a is factored into the Shoreline Bank Erosion Control FCI only when it is observed in the field that surface runoff from upslope areas causes a moderate (condition "c") or a substantial (condition "d") erosion problem in an existing wetland or may threaten the successful establishment of a planned wetland.

ELEMENT 6. EXPOSURE TO WAVES FROM HEAVY BOAT TRAFFIC

Directions: Determine if a shoreline bank is present. If present, then determine the extent of boat traffic (e.g., no or minimal, moderate, or heavy) by field observations and/or by local inquiry. Note any landforms or structures which would protect the wetland from boat wakes.

Rationale and assumptions: Wetlands require sufficient shelter to prevent excessive erosion from not only wind borne waves, but also from waves generated by heavy boat traffic. Heavy commercial traffic or recreational activity can contribute to bank erosion (Keown 1983). The impacts of vessel wakes on bank erosion can be substantial, depending upon the size and shape of the boat, boat speed and drag, water depth, and width of the channel (Camfield et al. 1980). Heavy boat traffic is a well recognized problem by those experienced with the construction of wetlands in erosion prone areas (Garbisch and Garbisch 1994).

In the assessment procedure, this element is considered not applicable if there is no or minimal boat traffic (condition "a"), or if the wetland is protected from boat traffic by a land form (condition "b") or structure (condition "c") that intercepts waves. Element 6 is factored into the Shoreline Bank Erosion Control FCI only when boat traffic can potentially aggravate erosion in an existing wetland or threaten the successful establishment of a planned wetland, i.e., when the wetland is exposed to waves caused by moderate (condition "d") or heavy (condition "e") boat traffic.

ELEMENT 7a. WATER LEVEL FLUCTUATION

Directions: (Not applicable to tidal wetlands) Determine if water fluctuation is occasionally drastic causing severe erosion and/or preventing vegetation establishment. Topographic maps should be examined to note presence of impoundments or other potential sources of rapid water release or drawdown. Appropriate information may also be obtained by field observations (evidence of water level fluctuations) and/or by local inquiry.

Rationale and assumptions: Shoreline bank erosion can be caused by frequent water contact with the bank (see Element 1a, *Water contact with toe of bank*) and by drastic rapid water level fluctuations. The intensity of water flow during the rapid rise and fall of flood waters is accompanied by powerful erosive forces which can scour and undermine a shoreline bank. These flood waters can be from a natural flood event, but drastic water-level fluctuations are commonly caused by rapid releases of water from an upstream impoundment. Another type of rapid water fluctuation, termed drawdown, occurs within impoundments (e.g., reservoir, pump storage facility). Because of the extreme water level changes, drawdowns often prevent the establishment of shoreline vegetation leaving exposed sediments on an erosion prone shoreline. Drastic water level fluctuations affect the establishment and maintenance of both natural and planned wetlands. Keown (1983) listed rapid drawdown as apossible indicator of trouble when evaluating a streambank for erosion. Stevens et al. (1990) monitored riparian wetland restoration sites in Idaho and listed highly fluctuating river levels among the problems affecting the success of this effort.

In the assessment procedure, this element is considered not applicable if the wetland is tidal (condition "a"), if there is no fluctuating water level (condition "b"), or if the fluctuating water level causes no or moderate erosion (condition "c"). Element 7a is factored into the Shoreline Bank Erosion Control FCI only when the water level fluctuation can potentially aggravate erosion in an existing wetland or threaten the successful establishment of a planned wetland, i.e. when fluctuation is occasionally drastic causing severe erosion and/or preventing vegetation establishment (condition "d").

ELEMENT 8a. HOURS OF DIRECT SUNLIGHT THROUGHOUT SHORE

Directions: Determine if shoreline bank is present. If present, note if sunlight is sufficient, adequate, or insufficient for vegetation development. Look for evidence of vegetation shade intolerance along shoreline bank (e.g., low percent plant cover or density, low aboveground biomass compared to the same species in unshaded portions of wetland, alteration of normal morphology) and use estimate of hours of direct sunlight along shoreline bank to make determination. For planned wetlands, refer to Thunhorst (1993) for shade tolerance of plant species. If species are intolerant or tolerance is unknown, estimate number of hours of direct sunlight and answer conditions based upon ranges given in the examples (e.g., condition a ≥ 6 hours/day, condition b = 3 to 6 hours/day, condition c ≤ 3 hours/day).

Rationale and assumptions: Adequate direct sunlight must be available to maintain vegetation. Emergent wetlands which abut a tree-lined shoreline often exhibit a low percent vegetation cover, reduction in aboveground biomass, and alteration of normal morphology at the emergent-tree border. Shading by trees prevents the establishment of dense cover, and it may also result in a narrow band where vegetation is absent.

The importance of shading in erosion control has become evident in efforts to construct wetlands designed for the purpose of providing erosion control. Garbisch and Garbisch (1994) maintained that a suitable site for the successful construction of a wetland designed for shoreline bank erosion control in the Chesapeake Bay region should have at least six hours of direct sunlight daily at the toe of the bank during the growing season. Fewer hours of direct sunlight is considered a constraint which limits the construction feasibility.

In the assessment procedure, this element is considered not applicable if the hours of direct sunlight are sufficient for vegetation development (condition "a"). Element 8a is factored into the Shoreline Bank Erosion Control FCI only when hours of sunlight are considered adequate (condition "b") or insufficient (condition "c") for vegetation establishment and erosion control. The definitions for the conditions and the assignment of results to conditions are based upon Environmental Concern's experience with the construction of wetlands designed for the purpose of providing shoreline bank erosion control.

ELEMENT 9a. SUBSTRATE SUITABILITY FOR VEGETATION ESTABLISHMENT

Directions: Determine if shoreline bank is present. If present, note if the shoreline is stable, unstable with suitable substrate for vegetation establishment, or unstable with unsuitable substrate for vegetation establishment. Determine substrate suitability for vegetation establishment through field observations of (a) the substrate and (b) the vegetation characteristics (e.g., Is there evidence of stunted growth, low vegetation cover, density, or aboveground biomass?). Examples of possible unsuitable substrates include bedrock, pure clay, gravel, and cobble.

Rationale and assumptions: Erosion along a shoreline bank is caused by a variety of forces and processes acting together. The most prevalent causes of bank erosion are scour at the toe of the bank by waves (addressed in Element 1a) and the instability of the bank materials (USCOE 1981). Wetland vegetation provides a valuable erosion barrier, thus, if a shoreline is unvegetated, it will be more vulnerable to erosive forces. One of the factors responsible for sparse or absent vegetation is an unsuitable substrate. Substrate chemical and physical properties are often identified as factors affecting the growth and establishment of wetland vegetation (e.g., Tanner and Dodd 1984; Broome et al. 1988; Stevens et al. 1990). While it is recognized that chemical properties are important, this version of EPW requires only the examination of those elements which can be readily identified in the field, i.e., basic substrate physical composition.

It is assumed that *water contact with toe of bank* (Element 1a) is more important than substrate. Suitable substrate at an elevation that is too low for bank protection (frequent water contact with bank) will not provide the needed protection even if vegetation is or can be established. If the elevation is appropriate for adequate bank protection, substrate is then important.

In the assessment procedure, this element is considered not applicable if the shoreline is stable with and/or without vegetation (condition "a") or the shoreline is unstable, but the substrate is suitable for vegetation establishment (condition "b"). Element 9a is factored into the Shoreline Bank Erosion Control FCI only when the shoreline is unstable and the substrate is inappropriate for the establishment of vegetation (condition "c").

ELEMENT 10a. PLANT (BASAL) COVER (Shoreline Bank Erosion Control)

Directions: Determine by visual estimate the percent plant (basal) cover in the upper shore zone during the growing season (Figure A.3, p. A 8). Consider only those parts of the vegetation which have contact with water flow. **Upper shore zone** = vegetated or non-vegetated portion of the shore located between the bank and the potential lower limit of emergent or woody vegetation as dictated by water depth or tide level (Figure A.2, p. A 4).

Rationale and assumptions: Shorelines are protected from erosion by the ability of wetland plants to reduce wave energy, bind the substrate, enhance slope stability, and/or increase deposition by slowing the current, thus protecting the bank face. Parsons (1963) maintained that the principal function of shoreline vegetation is to keep fast-moving water and transported coarse materials away from the soil surface. In a study on streambank protection methods, Keown et al. (1977) found that a well established stand of grass could reduce the water velocity by up to 90%. Vegetation increases the effective roughness height of the water/soil interface, increasing flow resistance which has the effect of reducing the erosive forces acting on the bank surface (Thorne 1990).

In an oligohaline environment, Benner et al. (1982) determined that unvegetated areas eroded continuously over an eight year period at nearly four times the average rate of a vegetated shoreline which had been planted with *Spartina alterniflora*, *Typha latifolia*, and *Phragmites australis*. In a Gulf coast study, Wayne (1975, 1976) found that the salt marsh species *S. alterniflora* reduced small wave height and energy by 71% and 92%, respectively. The value and use of wetland vegetation as an erosion barrier and stabilizer has been further demonstrated in other studies (e.g., Phillips and Eastham 1959; Woodhouse et al. 1974, 1976; Garbisch et al. 1975; Dodd and Webb 1975; Knutson and Woodhouse 1983, Garbisch and Garbisch 1994). For literature on rooted vascular aquatic beds, refer to Element 10e rationale (below).

While wetland vegetation is important in reducing wave action, fluvial erosion, and storm damage, the role that it plays in shoreline protection depends upon the vegetation type, its structure, plant vigor, and density of the plant community (Pfankuch 1975; Reppert et al. 1979; Thorne 1990; Watts and Watts 1990). For example, lower plant forms (e.g., mosses) may provide little shore erosion protection; however, they could provide some measure of sediment stabilization if abundant (Pfankuch 1975). As plant density increases, the roughness coefficient of the marsh surface also increases, thereby dissipating wave energy. Woodhouse et al. (1974, 1976) reported that by increasing plant density, there was increased success of marsh establishment on a wave-exposed planned wetland. In a laboratory experiment, Gleason et al. (1979) demonstrated that the greatest accretion on a wave exposed shore coincided with the highest stem density of *Spartina alterniflora*. These studies illustrate that higher stem densities more effectively dissipate wave energy. Density and spacing is also important with woody species. Single or small groups of trees (live, dead upright, or downed) tend to generate large scale turbulence and severe bank scour in their wakes (Thorne 1990). Thorne (1990) notes that for effective flow reduction, trees need to be densely distributed and spaced sufficiently close so that the wake zone of one tree extends to the next tree downstream.

The ability of plants to protect an area from erosion is species and region specific. The physical properties of the plants (e.g., their height, width, shape, rigidity, and density) determine the amount of frictional resistance the vegetated area will provide as waves and flood waters pass through. While comparison of these variables may be more accurate, it would be time consuming to take the necessary measurements and to analyze the data. Many assessment procedures use percent aerial cover as a variable for assessing a wetland's capacity to provide erosion control or sediment stabilization. Since all or only some of the aerial portions of the plant may contribute to stabilizing shore sediments, EPW considers only those portions of the vegetation which are directly involved with energy dissipation (Figure A.3, p. A 8). The estimate of basal cover serves as a surrogate for estimating the degree of shore erosion control provided by the vegetation. A similar approach was used by Pfankuch (1975) in the Stream Reach Inventory and Channel Stability procedure. However, Pfankuch (1975) emhasized root contribution to bank protection and assumed that percent ground cover (trees, shrubs, grass, and forbs) inferred root mat density and depth. Leaf litter cover is not considered in the cover estimate for this EPW element because its contribution to erosion control is generally negligible, particularly for the wetland which is subject to intense erosive forces.

In the assessment procedure, Element 10a is always factored into the Shoreline Bank Erosion Control FCI because the range from a high percent cover (condition "a") to a low percent cover (condition "d") represents all the possible degrees of erosion protection provided by vegetative cover. The highest percent cover (condition "a") has the greatest potential to provide erosion control. Decreased cover is accompanied by a lower potential, therefore the lower percent cover ranges are assigned relatively lower scores.

ELEMENT 10e. ROOTED VASCULAR AQUATIC BEDS (Lower Shore Zone Erosion Areas)

Directions: Determine if a shoreline bank or open water are present. If both are present, examine the open water areas for evidence of bottom erosion (e.g., scouring, wave ripples). If there is evidence of erosion, determine by visual estimate the percent cover of rooted vascular aquatic beds in the shallow open water areas of the shore during the growing season (i.e., **Lower shore zone** = the vegetated or non-vegetated portion of the shore channelward of the potential lower limit of emergent or woody vegetation (Figure A.2, p. A 4).

Rationale and assumptions: Rooted vascular aquatic beds play a role in controlling shoreline and bank erosion. Phillips (1982) reported that seagrasses reduce surface erosion and increase the rate of particle sedimentation by binding sediments together with their roots and by providing wave energy protection with their leaves. *Thalassia testudinum* (turtle grass) was found to reduce short period wave height and energy by 42% and 67%, respectively (Wayne 1975, 1976). Rooted vascular aquatic beds function to dampen wave and tidal energies (Wayne 1975, 1976), reduce stream velocity (Watts and Watts 1990), increase sedimentation (Harlin et al. 1982), maintain coastline stability by immobilizing nearshore sediments (Christiansen et al. 1981), and reduce resuspension of sediments (Ginsburg and Lowenstam 1958).

In the assessment procedure, this element is considered not applicable if there is no lower shore zone to support rooted vascular aquatic beds (condition "a"), or if the available lower shore zone is not subject to bottom erosion (condition"b"). Element 10e is factored into the Shoreline Bank Erosion Control FCI only when there is evidence of shore bottom erosion in open water areas. EPW assumes that rooted vascular aquatic beds are important to the Shoreline Bank Erosion Control function because of the role they play in protecting the shore from erosion, which in turn contributes to bank erosion protection. The range from a high percent cover (condition "c") to a low percent cover (condition "f") represents different degrees of shore erosion protection provided by vegetative cover. The highest percent cover (condition "c") would have the greatest potential to provide erosion control. Decreased cover is accompanied by a lower potential for erosion control, therefore the lower percent cover ranges are assigned relatively lower scores.

ELEMENT 10g. PLANT HEIGHT (Upper Shore Zone)

Directions: Determine average plant height relative to average high water from visual estimate for vegetation in the upper shore zone during the growing season. **Upper shore zone** = vegetated or non-vegetated portion of the shore located between the bank and the potential lower limit of emergent or woody vegetation as dictated by water depth or tide level (Figure A.2, p. A 4).

Rationale and assumptions: Vegetation provides resistance to water flow and waves, but this resistance decreases as water depth becomes greater than vegetation height (Camfield 1977). Dean (1979) identified four mechanisms by which vegetation can mitigate shoreline erosion. One mechanism (i.e., dampening of waves before reaching shoreline) is described by an equation which uses measures of grass stand height, grass stalk diameter, density, and width of vegetation stand to estimate percent reduction of energy dissipation. Knutson et al. (1982) field tested and calibrated Dean's (1979) empirical model and found it to be useful for describing wave decay in coastal marshes. While plant height and stem length data were collected, they were not used in the wave dampening analysis. However, Knutson et al. (1982) reported that the wetland was most effective when water depth is less than plant height.

The effect of plant height in riverine systems is demonstrated in a study by Watts and Watts (1990) on the effect of seasonal changes in aquatic vegetation on channel flow. As the growing season progressed, vegetation growth disrupted the flow pattern and reduced velocity. In general, there was a decrease in mean velocity with an increase in vegetation height relative to water depth. While Watts and Watts (1990) noted that simple measures of vegetation height in relation to water depth (i.e., relative roughness) may provide a useful resistance estimate, they cautioned that other factors must be taken into consideration (e.g., vegetation forms, texture, density, uniformity).

In the assessment procedure, Element 10g is always factored into the Shoreline Bank Erosion Control FCI because the conditions describe the possible range of protection which can be provided by different plant heights. The wetland is considered most effective at dissipating wave energy when the average plant height is equal to or taller than the average high water level (condition "a"). The wetland is considered effective, but not as effective at dissipating wave energy when the average plant height is shorter than the average high water level (condition "c"); therefore, this condition has been assigned a moderate score (i.e., 0.5). A wetland with near equal proportions of vegetation which is "taller than" and "shorter than" the high water level is considered as an intermediate condition (condition "b"). A wetland is considered least effective at dissipating wave energy when vegetation is absent (condition "d"). In the equation used to calculate the Vegetation Influences on the Rate of Erosion component, *Plant height* is weighted by *Plant (basal) cover* (10a x 10g) because basal cover dictates the overall capacity of the wetland to dissipate wave energy (i.e., a wetland with 90% coverage of plants with a height greater than average water depth will be much more effective at wave dampening than a wetland with only 10% plant cover).

ELEMENT 10i. ROOT STRUCTURE (Upper Shore Zone)

Directions: Determine if vegetation and/or a belowground root system are present in the upper shore zone during the growing season. If present, note the predominant root structure in the upper shore zone by (a) examining the plant growth forms (e.g., Is the wetland dominated by annuals, or bunchgrasses, or sod-forming grasses, etc.) and/or (b) by minimal sampling of belowground biomass (e.g., one to two small cores or simple extraction of individual plants). **Upper shore zone** = vegetated or non-vegetated portion of the shore located between the bank and the potential lower limit of emergent or woody vegetation as dictated by water depth or tide level (Figure A.2, p. A 4).

Rationale and assumptions: Vegetation can mitigate shoreline or bank erosion by the increased durability of the sediment-root matrix and overall increased bank stability (Dean 1979, Keown 1983, Thorne 1990). The plant species density, age, and vigor dictate the root or rhizome system's ability to provide shore stabilization (Reppert et al. 1979) or shoreline bank stability (Pfankuch 1975, Thorne 1990).

The type of vegetation on the shore or stream bank is important. In a long term study of constructed freshwater tidal wetlands on dredge material islands, Landin et al. (1989) reported that one site which became vegetated with woody species on the containment dike remained relatively stable, whereas a site without woody species eventually eroded and broke up into two small islands. In this example, the deeply rooted system of woody species apparently provided the structure needed to give overall stability to the narrow upland dike. The woody species were considered a contributor to containment site stability. In the context of the Shoreline Bank Erosion Control function, woody species are not generally considered favorable. In a discussion regarding the relative effectiveness of vegetation type, Thorne (1990) explained how grasses are effective when flow is at low velocities, but their effectiveness at retarding flow decreases as velocities increase. Conversely, while the stems of woody species continue to retard flow at high velocities, surface scour may be generated through the local acceleration of flow around trunks.

In the assessment procedure, Element 10i is always factored into the Shoreline Bank Erosion Control FCI because the conditions describe the possible range of protection which could be provided by different root structures. Herbaceous species that form a root mat are considered to provide the best shore erosion control (condition "a"). Woody species (condition "d") or herbaceous species that do not form a root mat (condition "c") are effective, but not as effective for shore erosion control; therefore, these conditions have been assigned a moderate score (i.e., 0.5). Those wetlands with near equal proportions of root mat forming and non-root mat forming species are considered as an intermediate condition (condition "b"). A wetland is considered least effective at erosion control when vegetation is absent and the below ground root system is absent or dead (condition "e"). In the equation used to calculate the Vegetation Influences on the Rate of Erosion component, *Root structure* is weighted by *Plant (basal) cover* (10a × 10i) because basal cover dictates the overall capacity of the wetland to bind sediments (i.e., a wetland with 90% coverage of plants with fibrous root systems will be much more effective in binding sediments than a wetland with only 10% plant cover).

ELEMENT 10k. VEGETATION PERSISTENCE (Upper Shore Zone)

Directions: Determine if vegetation is present in the upper shore zone during the growing season. If present, note if the vegetation is predominantly persistent, predominantly non-persistent, or if there are approximately equal proportions of persistent and non-persistent vegetation. **Persistent vegetation** is defined as vegetation (woody or herbaceous) that normally remains standing at least until the beginning of the next growing season. **Non-persistent vegetation** is defined as emergent plants, the leaves and stems of which break down at the end of the growing season so that most above-ground portions of the plants are easily transported by currents, waves, or ice. **Upper shore zone** = vegetated or non-vegetated portion of the shore located between the bank and the potential lower limit of emergent or woody vegetation as dictated by water depth or tide level (Figure A.2, p. A 4).

Rationale and assumptions: Persistent vegetation will provide more effective bank erosion control than non-persistent vegetation because it remains standing during both the growing and non-growing seasons. Thus, the vegetation is available to dissipate wave energy for most, if not all, of the year. Non-persistent vegetation has less of an opportunity to provide bank erosion control because most of the aboveground portions are present only during the growing season. When species die back in winter, they provide little or no protection during that season. In terms of providing shoreline bank erosion control, this seasonal dieback may be critical since vegetative cover may be absent during the period of most significant bank erosion (Thorne 1990).

In the assessment procedure, Element 10k is always factored into the Shoreline Bank Erosion Control FCI because the conditions describe the possible range of protection which can be provided by different degrees of vegetation persistence. A predominance of persistent vegetation is considered to provide the most effective erosion control (condition "a"). Non-persistent vegetation is considered effective, but not as effective for erosion control (condition "c"), therefore it has been assigned a moderate score (i.e., 0.5). Those wetlands with near equal proportions of persistent and non-persistent vegetation are considered as an intermediate condition (condition "b"). A wetland is considered least effective at erosion control when vegetation is absent (condition "d"). In the equation used to calculate the Vegetation Influences on the Rate of Erosion component, *Vegetation persistence* is weighted by *Plant (basal) cover* (10a x 10k) because basal cover dictates the overall capacity of the wetland to protect the bank from erosion (i.e., a wetland with 90% coverage of persistent vegetation will be more effective at erosion abatement than a wetland with only 10% plant cover).

ELEMENT 14a. STEEPNESS OF EXISTING SHORE

Directions: Applicable to planned wetland site only. Determine if a shoreline bank is present on the existing shore. If present, then determine the steepness (slope) of the existing shore. If shore is judged to be too steep for local conditions (i.e. > 10:1), record slope. **Shore** = vegetated or non-vegetated substrate located channelward of the bank (Figure A.2, p. A 4).

Rationale and assumptions: Steepness of the existing shore is an important consideration in the design of planned wetlands used to perform the shoreline bank erosion control function. In order to reduce bank erosion, the shore slope must be modified to eliminate water contact with the toe of the bank. This involves increasing the slope (Figure 4.2, p. 4–3); thus, if the slope of the existing shore is too steep to accommodate these changes, the site may be unsuitable (Garbisch and Garbisch 1994).

In the assessment procedure, Element 14a is always considered before calculating the Shoreline Bank Erosion Control FCI for the planned wetland. The best condition for construction and maintenance of a wetland (shore gradual; condition "a") is assigned the highest score (i.e., 1.0). If the existing shore is steep (condition "b"), then the site is considered unsuitable for construction of a planned wetland which can effectively perform the Shoreline Bank Erosion Control function.

ELEMENT 14b. STEEPNESS OF PLANNED WETLAND SHORE

Directions: Applicable to planned wetland only. Determine if a shoreline bank is present. If present, then determine the steepness (slope) of the planned wetland shore by referring to the design or by observations. If shore is judged to be too steep for local conditions, record slope. **Shore** = vegetated or non-vegetated substrate located channelward of the bank (Figure A.2 in SBEC data sheets).

Rationale and assumptions: The steeper the slope, the more vulnerable the shore is to erosion. Consequently, the shoreline bank will also be more prone to erosion since the shore will no longer provide long term protection. Shore steepness is an important consideration in the design of planned wetlands. If the design includes a very steep slope, the planned wetland will be ineffective at providing shoreline bank erosion control (Garbisch and Garbisch 1994).

In the assessment procedure, this element is considered not applicable if the shore is gradual (condition "a"). Element 14b is factored into the Shoreline Bank Erosion Control FCI only when the shore is too steep (condition "b") to be stable and thus could threaten the successful establishment of a planned wetland.

4.4 Additional Design Considerations

The following section outlines design considerations, including EPW elements and additional factors, which are to be considered for the Shoreline Bank Erosion Control function.

Factor	Remarks
PHYSICAL FEATURES	
Water contact with toe of bank (Element 1a)	Wetlands designed for the purpose of providing shoreline bank erosion control should be designed to reduce or eliminate water contact with the toe of the bank. A common technique in tidal wetlands involves creating (or restoring) new elevated shores along the bank (Garbisch and Garbisch 1994). Less frequently, banks are eliminated through grading to create new shores which are largely above MHW (Sharp and Vaden 1970).
Fetch (Element 2)	Avoid locating a planned wetland where fetch is long enough to generate a wave climate that will erode the peat bank (from the emergent marsh) once it emerges from the sediment surface. A fetch greater than one mile is generally considered unacceptable (see literature review in rationale for Element 2). Wave barriers may be used if selected site is exposed to a long fetch; however, these barriers may be ineffective (e.g., Lewis 1982a) or cost prohibitive.
Shoreline structures/obstacles (Element 3)	Determine if there are any structures/obstacles and whether they might cause erosion of the planned wetland. Use measures to substantially reduce or eliminate erosion from any of these structures/obstacles.
Disturbance (Element 4a)	The potential for disturbance is a major concern in site selection and during the initial establishment of planned wetlands. Garbisch and Garbisch (1994) noted that Canada geese can eliminate a newly planted shore in the Chesapeake Bay region overnight. The recommended solution to this problem is the construction of a goose exclosure fence at the time of planting. Protection is considered no longer warranted after a thick root mat develops in two to three years, because feeding on the belowground biomass becomes more laborious for the geese. Webb (1982) reported that cattle had to be excluded from a transplant area on the shoreline of Lake Pontchatrain, Louisiana, to avoid problems encountered when trying to establish *Spartina alterniflora*, *Phragmites australis*, and *Rosa bracteata*. Many of the bald cypress (*Taxodium distichum*) plantings in Louisiana coastal forests have experienced nutria and/or swamp rabbit herbivory (e.g., Blair and Langlinais 1960, Conner and Flynn 1989). Conner and Flynn (1989) found that chickenwire fence was effective in excluding nutria from bald cypress planted seedlings.

Factor	Remarks
Surface runoff from upslope areas (Element 5a)	Determine the potential for damage to the bank from runoff. Consider that minor physical alteration of the planned wetland site and adjacent upland areas through the operation of construction equipment may also result in sheet and rill erosion (gullies) on the shoreline bank. Upland runoff should be managed by the filling of surface cracks and the construction of a swale to direct stormwater to one discharge point. Also, disturbed and exposed soils should be stabilized (e.g., placement of mulch, seeding, or planting).
Exposure to waves from heavy boat traffic (Element 6)	A suitable site for the successful construction of a planned wetland designed for shoreline bank erosion control should have low motor boating activity (Garbisch and Garbisch 1994). The presence of heavy boat traffic is considered a constraint which will limit construction feasibility. The designer must determine what constitutes heavy boat traffic for local conditions based upon experience.
Water level fluctuation (Element 7a)	Drastic water level fluctuations can prevent the successful establishment of a planned wetland. Determine if the site is unsuitable due to extreme water level fluctuations.
Hours of direct sunlight throughout shore (Element 8a)	Adequate direct sunlight must be available to establish and maintain vegetation in a planned wetland. Consider the shade tolerance of the individual species. Those species which tolerate partial and even full shade (see list of wetland species in Thunhorst 1993) are generally broad leaved herbaceous, but also include many trees and shrubs. The narrow leaved grasses, sedges, and rushes are often shade intolerant and require substantial amounts of full sun daily. Environmental Concern has developed the following guidelines for shade intolerant plant species based upon greenhouse shading experiments: those plants that are shade intolerant require at least six hours of direct, full sunlight each day during the growing season to maintain normal productivity, rate of spread, and morphology.
Substrate suitability for vegetation establishment (Element 9a)	The existing shoreline should be examined for large grain size sand particles, pebbles, and/or gravel which may indicate a high wave energy environment. These large particles may become suspended in the water column and damage installed plant material through physical abrasion, thus reducing or eliminating the possibility of a successful shoreline restoration project.

Factor	Remarks
Steepness of existing shore (Element 14a)	Determine if existing shore is too steep to be modified in order to eliminate water contact with the toe of the bank. Based upon the construction of over 200 marshes designed to control shoreline bank erosion in the Maryland Chesapeake Bay area, Garbisch and Garbisch (1994) noted that an existing site was unsuitable if its slope was steeper than 10:1 because the slopes required for the planned wetland restored shores would be too great to be stable. It is possible that in extremely protected locations, these limitations may not apply. Two approaches to designing slope of a restored shore were presented (Table 4.1, p. 4–22).
Steepness of planned wetland shore (Element 14b)	Determine if planned wetland shore is too steep to be stable or effective at providing shoreline bank erosion control. Garbisch and Garbisch (1994) recommended a minimum slope of 10:1 as a design standard for shore restoration (Table 4.1, p. 4–22). As the existing shore slope approaches 10:1, the design shore approaches 5:1 (following design criteria given in Approach 2, Table 4.1) which is considered to be unstable and thus, unsuitable design criteria. It is possible that in extremely protected locations, these limitations may not apply.

Table 4.1.
Summary of design criteria for two approaches of shore restoration developed for the Chesapeake Bay area

	Approach 1	**Approach 2**
Slope of restored shore	10:1 constant	> 10:1 variable (a) (in general, no greater than 5:1)
Height of restored shore	0.76 m (2.5 ft) above MHW at the bank face	0.76 m (2.5 ft) above MHW at the bank face
Length of restored shore channelward from bank face	> 7.6 m (25 ft) variable (y)	7.6m (25 ft) constant
Equation	y = 25 ft (b / b - 10) *where* y = length of restored shore b = slope of existing shore*	a = 25 / [2.5 + (25 / b)] *where* a = slope of restored shore b = slope of existing shore
Comments	Generally unacceptable due to: •Increased cost due to additional materials required for increased slope. •Increased wetlands impact (shore filling) with increased slope.	Adopted approach because: •Cost not significantly affected by slope of existing shore. •Wetland impacts independent of slope of existing shore.

*If slope is 10:1, then b = 10

Source: Garbisch and Garbisch (1994)

Factor	Remarks
VEGETATION FEATURES	
Plant (basal) cover (Element 10a)	Maximize the percent plant (basal) cover to protect the shoreline bank from erosion.
Vegetation on upland areas	Vegetation on the upland portion of the bank is important in maintaining slope and bank stability. Thorne (1990) explains that vegetated banks are more stable than unvegetated banks because they are drier and better drained. Vegetated banks are drier because (a) the canopy intercepts 13-30% of the precipitation and re-evaporates it, thus preventing it from reaching the soil surface, (b) the plants reduce soil moisture and lower the water table by drawing water from the soils and transpiring it to the atmosphere, and (c) the roots extract water increasing the capillary fringe, drawing water from greater depths than in an unvegetated bank. Drier banks are more stable because the bulk unit weight of the soil is reduced and cohesion is increased. Despite this, woody vegetation in particular may accelerate bank erosion (See rationale for Element 10i and discussion on root structure in this section.).
Rooted vascular aquatic beds (Element 10e)	When possible, maximize the percent cover of rooted vascular aquatic beds in the lower shore zone of erosion prone areas to protect the shoreline bank from erosion.
Plant height (Element 10g)	Plant species which have an average plant height equal to or taller than the average high water level because taller plants are more effective at dissipating wave energy (Camfield 1977, Knutson et. al. 1982).

... Vegetation features continue on following page

Factor	Remarks
Root structure (Element 10i)	Plant species which form a root mat (e.g., rhizomatous species) to increase durability of the sediment-root matrix and overall bank stability. Trees planted on a bank may cause future bank failures. Keown (1983) maintained that the weight of trees may offset any advantage provided by root systems. Tree root systems do not always penetrate to the toe of the bank, so if the toe erodes the weight of the tree and root mass may cause bank failure. Shoreline banks characteristically exhibit enhanced erosion around exposed tree and shrub roots. The roots provide a seepage path for water (a) in direct contact with the roots (e.g., waves) and (b) from upslope areas (e.g., groundwater) (Figure 4.4, p. 4–10). **Seepage** is that portion of the rainfall that infiltrates downward through the subsurface layers of the soil joining the ground water flow. As seepage occurs, soil particles at the bank face may be forced loose and bank erosion may intensify downslope with the combined movement of seepage water and loosened soil particles (Keown 1983). The internal strength of the soil is decreased by seepage flow along tree roots which accelerates the erosion process (USCOE 1981). Increased bank erosion has been reported with reforestation of floodplain forests which shaded out herbaceous ground cover (Murgatroyd and Ternan 1983). In general, a species with a dense network of fibrous roots is of more benefit for upland bank erosion control than one with a sparse network of woody roots (Thorne 1990).
Vegetation persistence (Element 10k)	Plant persistent vegetation remains standing during the growing and non-growing seasons and thus provides more effective bank erosion control than non-persistent vegetation.

4.5 Example of Assessment of the Shoreline Bank Erosion Control Function

PROJECT TITLE: MARLEY CREEK

SHORELINE BANK EROSION CONTROL
DATA SHEETS

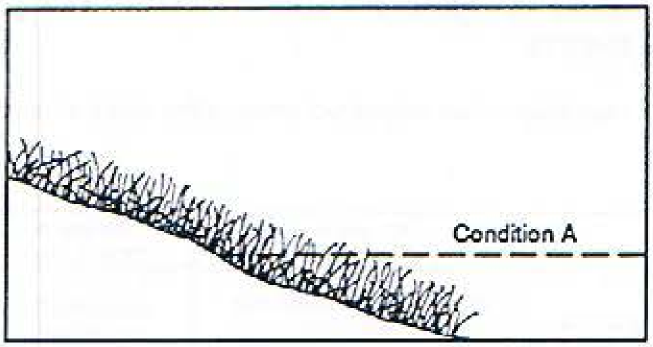
Function weighting area (AREA) = The shore, i.e., the vegetated or non-vegetated areas of the wetland located channelward of the bank (see Figure A.2).

		For use in FCI Model		For use in Table A 2 only
ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
Potential for erosion:				
1. Bank characteristics				Assume NA = 1.0
1a. Water contact with toe of bank **(see Figure A.1)**	[SB, WQ]*			
a. No shoreline bank.	NA			
b. Infrequent water contact at toe of bank, i.e., no undercutting of bank (e.g., contact once annually or less).	1.0	0.5	1.0	(+)
c. Occasional water contact at toe of bank (e.g., contact once a month).	0.7			
d. Moderate water contact at toe of bank (moderate undercutting of bank).	0.5			
e. Frequent water contact at toe of bank (severe undercutting of bank).	0.1			

NOTE: If the score for element 1 = NA (no shoreline bank), there is no potential for providing the shoreline bank erosion control function; therefore the Shoreline Bank Erosion Control FCI is not applicable (NA). Continue only if score ≠ NA.

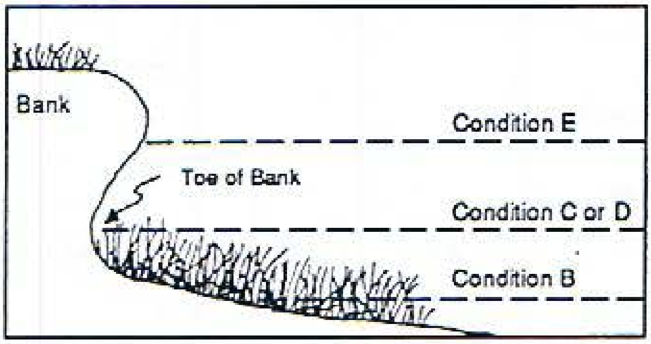
Site suitability for planned wetland (elements 2 and 14a):				
2. Fetch (Fetch = maximum distance over which wind can blow, unimpeded, across open water to generate waves)	[SB]			Assume NA = 1.0
a. < 1.6 km (1 mile).	1.0			
b. > 1.6 km (1 mile).	0.1	1.0	1.0	0

* Denotes function(s) to which element applies: SB = Shoreline Bank Erosion Control; SS = Sediment Stabilization; WQ = Water Quality; WL = Wildlife; FT = Fish (Tidal); FS = Fish (Stream/River); FP = Fish (Pond/Lake); and UH = Uniqueness/Heritage



Bank Absent

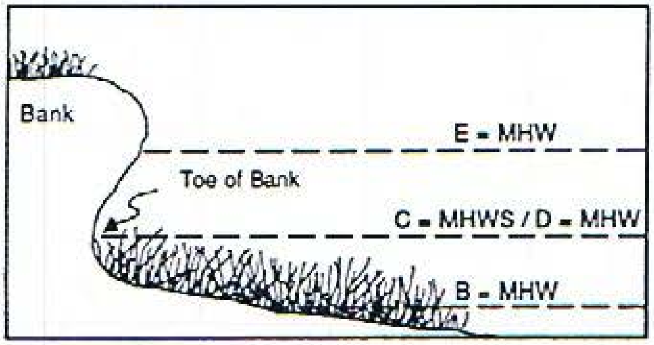
Condition A = No Shoreline Bank



Bank Present

Condition B = Infrequent water contact at toe of bank, i.e., no undercutting of bank (e.g., contact once annually or less).
Condition C = Occasional water contact at toe of bank (e.g., contact once a month).
Condition D = Moderate water contact at toe of bank (moderate undercutting of bank).
Condition E = Frequent water contact at toe of bank (severe undercutting of bank).

Example = Tidal System



Condition B = Mean High Water (MHW) below toe of bank
Condition C = Mean High Water Spring (MHWS)
Condition D = MHW at toe of bank
Condition E = MHW above toe of bank

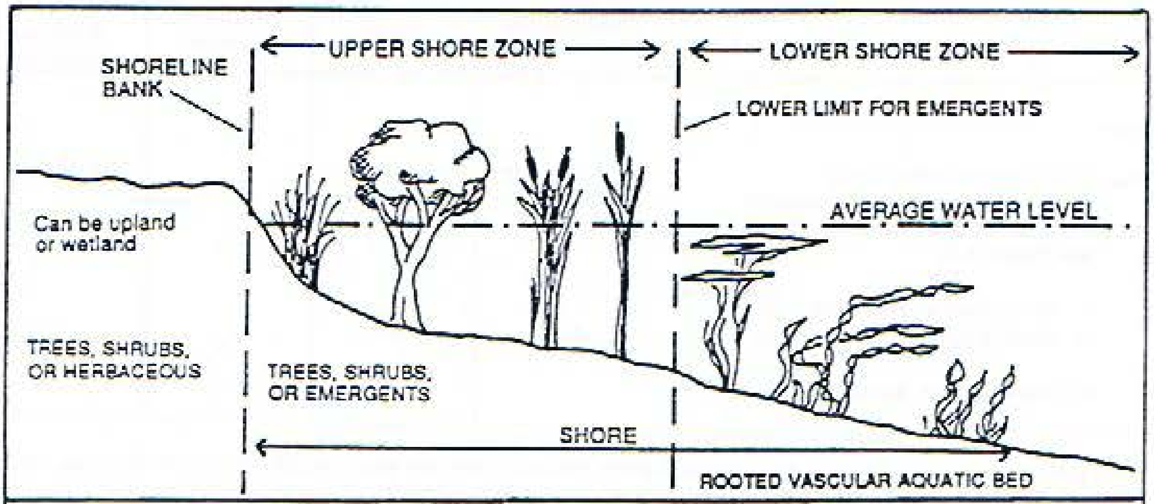
Figure A.1.
Water contact with toe of bank (element 1a)

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
14. Slope				
14a. Steepness of existing shore (Shore = vegetated or non-vegetated substrate located channelward of the bank; **See Figure A.2**)	[SB]			Assume NA = 1.0
a. Shore gradual (e.g., slope < 10:1).	1.0			
b. Shore steep (e.g., slope > 10:1).	0.1	NA	1.0	1.0-NA
If condition b, then record slope: ________				

NOTE: For planned wetland only. If score for elements 2 and/or 14a is 0.1, then the site is UNSUITABLE. The Shoreline Bank Erosion Control FCI will be low. Continue with data sheet for the planned wetland, only if scores for both elements ≠ 0.1.

Shoreline structures/obstacles:				
3 Shoreline structures/obstacles	[SB]			Assume NA = 1.0
a. No shoreline structures present.	NA			
b. Structure/obstacle present. Shore erosion minimal.	NA	NA (b)	NA (b)	NA
c. Structure/obstacle present. Moderate shore erosion problem present.	0.5			
d. Structure/obstacle present. Substantial shore erosion problem present.	0.1			
If structure/obstacle present, check type(s):				

Structure/Obstacle	WAA	Planned Wetland
Bulkhead	____	____
Rubble	____	____
Riprap	____	____
Revetments (e.g., stone, concrete, gabion)	____	____
Breakwater	____	____
Groins	____	____
Beach fill	____	____
Bridge pier	____	____
Boat dock	____	____
Fallen trees	____	____
Debris	____	____
Potential for moving ice chunks	____	____
Other ____________	____	____



Shoreline Bank:	Steep ascending slope of land of any height raised above the adjacent shore that can experience undercutting if it is in contact with water.
Shore:	Vegetated or non-vegetated substrate located channelward of the bank.
Upper Shore Zone:	Vegetated or non-vegetated portion of the shore located between the bank and the potential lower limit of emergent or woody vegetation as dictated by water depth or tide level.
Lower Shore Zone:	Vegetated or non-vegetated portion of the shore located channelward of the potential lower limit of emergent or woody vegetation.
Entire Wetland:	Includes wetland areas landward of the bank, the bank, the upper shore zone, and the lower shore zone.

Examples: Aerial View of Wetlands

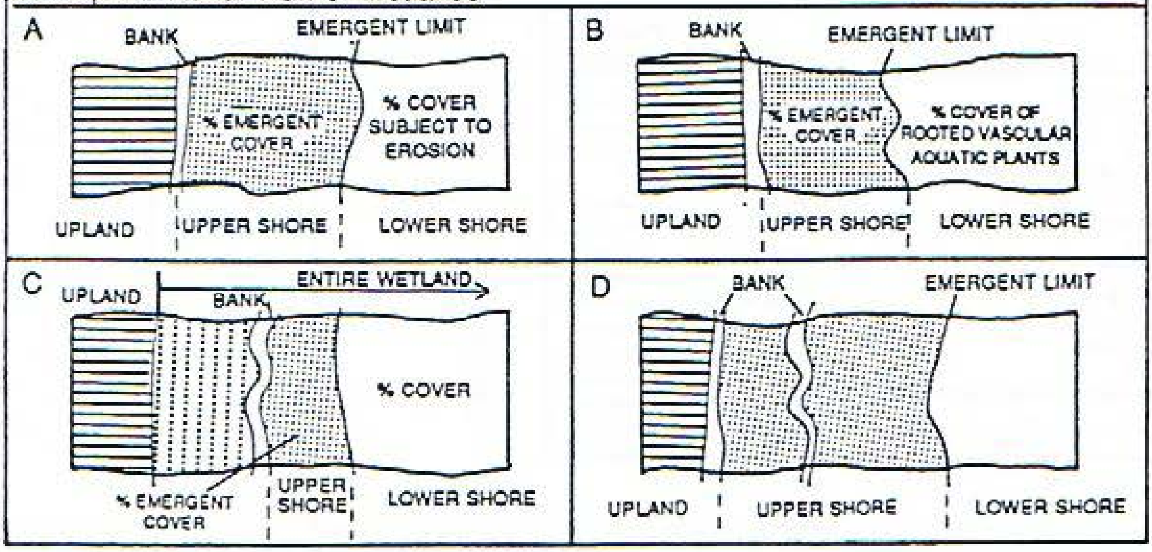
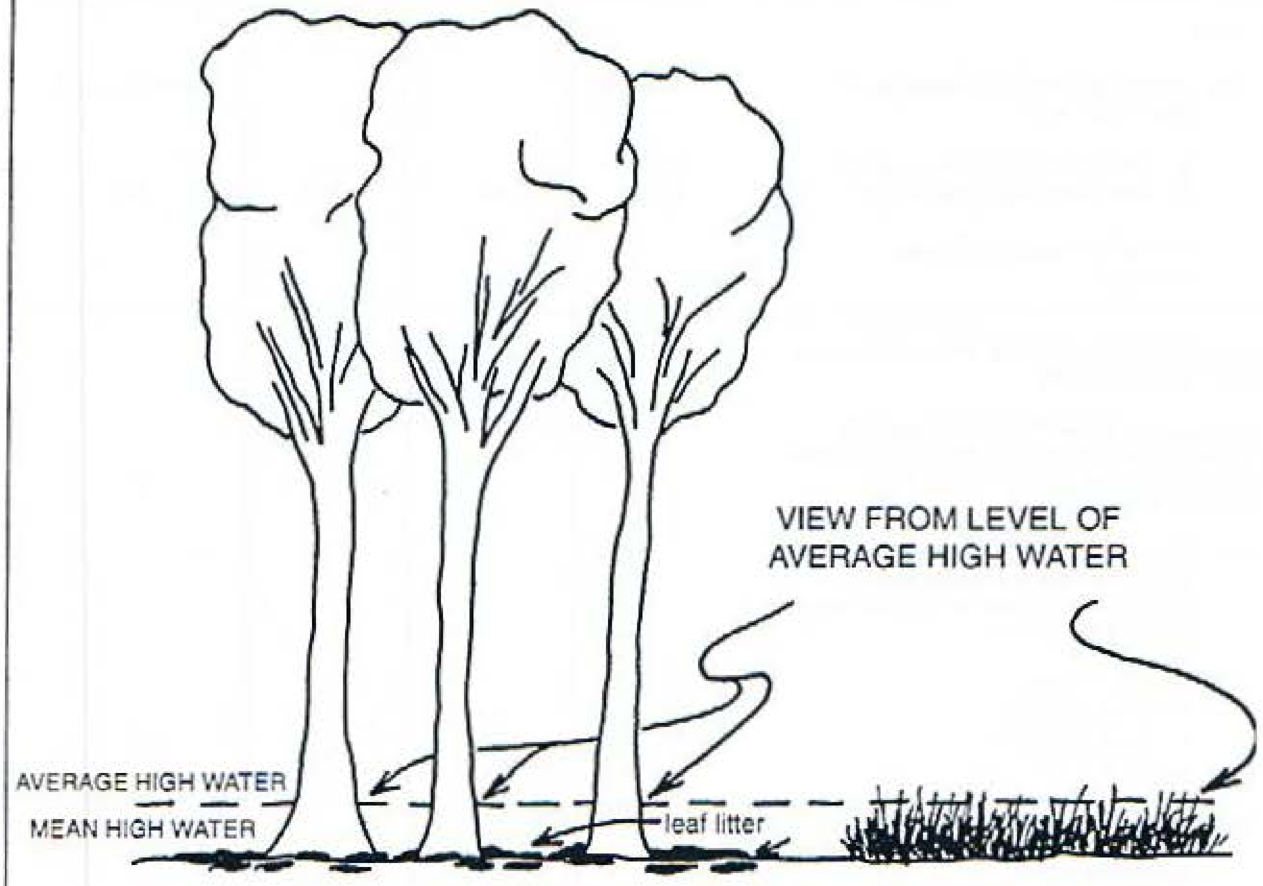


Figure A.2.
Definitions of shoreline bank, shore, upper shore zone, lower shore zone, and entire wetland (element 10)

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
Physical influences on rate of erosion (elements 2, 4a, 5a, 6, 7a, 8a, 9a, and 14b):				
2. Fetch (element already scored above)				
4. Disturbance				
4a. Disturbance at site (Sediment Stabilization)	[SB, SS, FT, FS, FP]			Assume NA = 1.0
(Do not include observations of debris)				
a. No or minimal disturbance.	NA			
b. Potential for periodic disturbance present, but preventative action taken (e.g., installation of enclosure fences for herbivores and/or human disturbance) -OR- if recently disturbed, soils sufficiently stabilized with mulch, seeding, or planting.	NA	NA (a)	NA (b)	NA
c. Moderate disturbance (e.g., disturbance of sediments only in portion of site, infrequent grazing by waterfowl).	0.5			
d. Evidence of substantial periodic disturbance which makes substrate unstable (e.g., muskrat eatouts, overgrazing by waterfowl, cattle grazing and trampling, nutria activity, human activity such as the use of off-road vehicles; wetland tilled, filled, logged, clear-cut or excavated and not stabilized by seeding or planting).	0.1			
5. Surface runoff from upslope areas (upland and/or wetland immediately adjacent to site).				
5a. Surface runoff from upslope areas (bank erosion)	[SB]			Assume NA = 1.0
a. Surface runoff from upslope areas not an apparent contributor to bank erosion at site (e.g., No or minimal evidence of surface erosion in upland areas, e.g., unstabilized gullies absent).	NA			
b. Surface runoff contribution to bank erosion minimal due to presence of effective infiltration and drainage controls in adjacent upslope areas (e.g., surface runoff through wetland conveyed by stabilized gullies; upslope surface cracks filled).	NA	NA (a)	NA (b)	NA
c. Surface runoff from upslope areas causes moderate bank erosion.	0.5			
d. Surface runoff from upslope areas causes substantial bank erosion	0.1			

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
6. Exposure to waves from heavy boat traffic	[SB]			Assume NA = 1.0
a. No or minimal boat traffic present.	NA	NA (a)	NA (a)	NA
b. Wetland protected from boat traffic by land form that intercepts waves (e.g., island, delta, spit, bar, peninsula, cove).	NA			
c. Wetland protected from boat traffic by structure (e.g., jetty, riprap).	NA			
d. Wetland exposed to waves caused by moderate boat traffic.	0.5			
e. Wetland exposed to waves caused by heavy boat traffic.	0.1			
7. Hydroperiod				
7a. Water level fluctuation	[SB,SS,WQ]			Assume NA = 1.0
a. Tidal wetland.	NA	NA (a)	NA (a)	NA
b. No fluctuating water level.	NA			
c. Fluctuating water level causing no or moderate erosion.	NA			
d. Fluctuation occasionally drastic causing sever erosion and/or preventing vegetation establishment (e.g., periodic release from upstream impoundment; reservoir drawdown).	0.1			
8. Sunlight				
8a. Hours of direct sunlight throughout shore (i.e., daylight hours without shade)	[SB]			Assume NA = 1.0
a. Hours of sunlight sufficient for vegetation (e.g., > 6 hrs per day).	NA	NA	NA	NA
b. Sunlight adequate (e.g., 3 - 6 hrs/day).	0.5			
c. Sunlight insufficient (e.g., < 3 hrs/day).	0.1			
9. Substrate				
9a. Suitability for vegetation establishment	[SB]			Assume NA = 1.0
a. Shoreline is stable with and/or without vegetation.	NA	NA (b)	NA (a)	NA
b. Shoreline is unstable. Substrate suitable for vegetation establishment (e.g., medium or fine grain materials).	NA			
c. Shoreline is unstable. Substrate unsuitable for vegetation establishment (e.g., gravel, cobble).	0.1			

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
14. Slope				
14b. Steepness of planned wetland shore (**See Figure A.2**)	[SB]			Assume NA = 1.0
a. Shore gradual (e.g., slope < 5:1).	NA			
b. Shore steep (e.g., slope > 5:1).	0.1	**NA**	NA	NA
If condition b, then record slope: ______				
Vegetation influences on the rate of erosion (elements 10a, 10e, 10g, 10i, and 10k):				
10. Vegetation characteristics **during growing season** (Note differences in definitions for upper shore zone, lower shore zone, and entire wetland. **See Figure A.2**).				
10a. Percent plant (basal) cover in **upper shore zone**. (Consider only those parts of vegetation which have contact with water flow. **See Figure A.3**).	[SB]			
a. Cover > 75%.	1.0			
b. Cover 51 - 75%.	0.7	1.0 (a)	1.0 (a)	0
c. Cover 25 - 50%.	0.3			
d. Cover < 25%.	0.1			
10e. Percent cover of rooted vascular aquatic beds in **lower shore zone which is subject** to bottom erosion.	[SB]			Assume NA = 1.0
a. No lower shore zone (e.g., no open water).	NA			
b. Lower shore zone not subject to bottom erosion (e.g., no evidence of scouring, i.e., no wave ripples).	NA	NA (b)	NA (b)	NA
c. Cover > 75%.	1.0			
d. Cover 51 - 75%.	0.7			
e. Cover 25 - 50%.	0.5			
f. Cover < 25%.	0.1			
10g. Plant height in **upper shore zone**.	[SB]			
a. Average plant height equal to or taller than average high water level.	1.0			
b. Intermediate condition, i.e., approximately equal proportions of plants equal to or taller -AND- plants shorter than average high water level.	0.8	1.0	1.0	0
c. Average plant height shorter than average high water level.	0.5			
d. Vegetation absent.	0.1			



Examples:

	Forest	Emergent Marsh
Percent (Basal) Cover (Elements 10a, 10b, or 10d)	<25%	>75%
Percent Leaf Litter & Debris Cover (Element 10c)	>75%	Ground surface areas almost entirely covered by live vegetation

Figure A.3.
Percent plant cover (elements 10a, 10b, 10c, and 10d)

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
10i. Root structure in **upper shore zone.**	[SB]			
Wetland predominantly vegetated by:				
a. Herbaceous species that form a root mat (e.g., rhizome propagating species).	1.0			
b. Intermediate condition.	0.8			
c. Herbaceous species that do not form a root mat (bulb [*Peltandra virginica*], tuber [*Sagittaria latifolia*], or bunch [*Carex spp.*] species).	0.5	0.5	0.8	(+)
d. Woody species.	0.5			
e. Vegetation absent. Belowground root system absent or dead.	0.1			
10k. Vegetation persistence in **upper shore zone**.	[SB]			
Dominant plant cover.				
a. Persistent vegetation.	1.0			
b. Approximately equal proportions of persistent and non-persistent vegetation.	0.8	0.8	0.8	0
c. Non-persistent vegetation.	0.5			
d. Vegetation absent.	0.1			

Chapter 5. Sediment Stabilization

5.1 Definition

The Sediment Stabilization FCI provides a relative measure of the wetland's capacity to stabilize and retain previously deposited sediments. While closely related, this function is distinguished from the wetland's capacity to promote sedimentation (i.e., the process of depositing and retaining suspended matter) which is addressed under the Water Quality function.

The natural process of marsh development whereby sediments are deposited and mudflats are formed and stabilized through colonization of vascular plants is a commonly observed and studied phenomenon (e.g., White 1989). The capacity to stabilize sediments and to accrete vertically and laterally over the long term is best illustrated in Redfield's (1972) model or description of the Barnstable Marsh development. The Redfield model provides an explanation on how high latitude tidal marshes responded to sea level rise over the past 4,000 years through sediment accretion and peat accumulation. While the Redfield model is useful for explaining the Sediment Stabilization function, long-term wetland stability is not addressed in EPW because it is a complicated issue which cannot be assessed without a detailed study. An assessment of long-term stability in coastal marshes, for example, might require a determination on several processes including sediment accretion, coastal submergence caused by rising sea level and marsh surface subsidence, and terrigenous sediment input from river systems (Mitsch and Gosselink 1986, Stevenson et al. 1988).

The function weighting area (AREA) for the Sediment Stabilization is the entire wetland, which includes wetland areas landward of the bank, the bank, the upper shore zone, and the lower shore zone.

5.2 Explanation of the Model

Seven elements are used to assess the Sediment Stabilization function. These elements contribute to four components which define the Sediment Stabilization FCI (see Figure 5.1, p. 5–2).

The Sediment Stabilization FCI is a product of two components: Disturbance Factors and Wetland Characteristics. Disturbance Factors identifies those elements, besides the general wetland characteristics, which can have a profound affect on the stabilization and retention of sediments in a wetland. In most situations, the Disturbance Factors component will be considered *not applicable (NA)* and will not be used in the calculation of the FCI. The Disturbance Factors component will be factored into the FCI only when conditions may be too severe to establish a planned wetland or to maintain sediment stability in an existing wetland.

The Wetland Characteristics component is defined by two other components: Vegetation Characteristics and Slope Stability. The Vegetation Characteristics component is described by four vegetation characteristics. The amount of protection provided by cover is described by *Plant (basal) cover* and *Leaf litter and debris.* The relative importance of *Root structure* and *Vegetation persistence* depends on the amount of available plant (basal) cover. Therefore, the contribution of these two elements is weighted by the score (i.e., a relative score for percent cover on a 0 to 1.0 scale) for *Plant (basal) cover.* The inclusion of Element 10c recognizes the importance of leaf litter and debris in providing ground cover for those areas not protected by live vegetation. Element 10c is therefore multiplied by "1 - 10b", the amount of available ground area not covered by plant (basal) cover. The score for this component is calculated using the following Equation 7:

$$\text{Vegetation Characteristics} = \frac{10b\,(10j \cdot 10f) + 10c\,(1 - 10b)}{2} \tag{7}$$

The Slope Stability component is described by one element which indicates whether or not the wetland slope, regardless of the vegetation characteristics, has the potential to be stable. A determination of slope stability could depend upon one or several factors (e.g., topographic features, substrate composition, wave climate) and thus must be evaluated on a case by case basis. It is assumed that if the slope is unstable, the wetland will be relatively ineffective for sediment stabilization, particularly over the long term.

5.3 Rationale and Assumptions

ELEMENT 4a. DISTURBANCE AT SITE (Sediment Stabilization)

Directions: Determine if there is disturbance at the site (e.g., grazing by herbivores, human activity which disrupts sediments) by field observations and/or local inquiry. Do not consider observations of debris as evidence of disturbance. If site is subject to disturbance, note if (a) the disturbance is minimal, moderate, or substantial and (b) if any actions have been taken to minimize the potential for erosion (e.g., installation of exclosure fences, mulching, seeding, planting).

Rationale and assumptions: Animal or human activities can cause extensive and long-term instability in a wetland. Refer to Element 4a rationale for Shoreline Bank Erosion Control function which is also applicable to the Sediment Stabilization function.

In the assessment procedure, this element is considered not applicable if disturbance at the site is absent or minimal (condition "a") or if measures have been taken to prevent erosion (condition "b"). Element 4a is factored into the Sediment Stabilization FCI only when there is evidence of moderate (condition "c") or substantial (condition "d") disturbance which might disrupt sediments in an existing wetland or threaten the successful establishment of a planned wetland.

ELEMENT 7a. WATER LEVEL FLUCTUATION

Directions: (not applicable to tidal wetlands) Determine if water fluctuation is occasionally drastic causing severe erosion and/or preventing vegetation establishment. Topographic maps should be examined to note presence of impoundments or other potential sources of rapid water release or drawdown. Appropriate information may also be obtained by field observations (evidence of water level fluctuations) and/or by local inquiry.

Rationale and assumptions: Drastic rapid water level fluctuations from a natural flood event, rapid release of water from an upstream impoundment, or an impoundment drawdown, etc., can cause severe erosion in a wetland. When fluctuations are periodic they may also prevent the establishment of vegetation, thereby substantially impairing the wetland's capacity to stabilize and retain sediments.

There are situations when drastic water level fluctuations do not cause erosion, but instead are used as a management practice to correct an erosion problem. For example, Lehto and Murphy (1989) described how the Soil Conservation Service intentionally pumped water out of a severely eroded 541-ha diked marsh in Louisiana to expose the soil surface, and to initiate germination of emergent species and revegetation of the marsh. For this reason, Element 7a distinguishes those water level fluctuations which cause no or moderate erosion (condition "c") from fluctuations which cause severe erosion (condition "d"). For further discussion refer to Element 7a rationale for Shoreline Bank Erosion Control function which is also applicable to the Sediment Stabilization function.

In the assessment procedure, this element is considered not applicable if the wetland is tidal (condition "a"), if there is no fluctuating water level (condition "b"), or if the fluctuating water level causes no or moderate erosion (condition "c"). Element 7a is factored into the Sediment Stabilization FCI only when the water level fluctuation can potentially disrupt sediments in an existing wetland or threaten the successful establishment of a planned wetland, i.e., when fluctuation is occasionally drastic causing severe erosion and/or preventing vegetation establishment (condition "d").

ELEMENT 10b. PLANT (BASAL) COVER (Entire Wetland)

Directions: Determine by visual estimate the percent plant (basal) cover during the growing season for the entire wetland area (Figure A.3, p. A 17). Include rooted vascular aquatic beds in estimate. Consider only those parts of the vegetation which have contact with water flow.

Rationale and assumptions: Sediments are stabilized by the ability of wetland plants to bind the substrate, reduce erosive factors (e.g., wave and current energy), and control water infiltration rates. Refer to rationale for Elements 10a and 10e under the Shoreline Bank Erosion Control function for discussion on substrate binding, the reduction of erosive factors, and bank stability which is also applicable to the Sediment Stabilization function.

In the assessment procedure, Element 10b is always factored into the Sediment Stabilization FCI because the range from a high percent cover (condition "a") to a low percent cover (condition "d") represents all the possible degrees of protection provided by vegetative cover. The highest percent cover (condition "a") would have the greatest potential to provide sediment stabilization. Decreased cover is accompanied by a lower potential, therefore the lower percent cover ranges are assigned relatively lower scores.

ELEMENT 10c. LEAF LITTER and DEBRIS COVER

Directions: Determine by visual estimate the percent cover provided by leaf litter and debris on ground surface areas not covered by live vegetation during the growing season. Consider entire wetland and include submerged surfaces.

Rationale and assumptions: Wetland plant leaf litter and debris provide sediment stabilization by covering the substrate and thus insuring that sediments which have been previously deposited are retained. This element is one of four vegetation elements used to describe the relative capacity of the wetland to provide sediment stabilization by absorbing the erosive energy of rainfall impact, controlling infiltration, and reducing sheetwash. Both live vegetation and litter cover are important for soil infiltration (and sediment stabilization) because they protect soil from packing by raindrops and provide organic matter for binding soil particles together in open aggregates, creating large soil interstitial spaces and facilitating infiltration (Dunne and Leopold 1978).

Leaf litter and debris are important to maintaining sediment stability, particularly in wetlands which undergo dramatic seasonal changes in herbaceous ground cover. In many situations, leaf litter provides an alternative cover during months when nonpersistent herbaceous ground cover is absent. Depending upon local conditions and species specific decomposition rates, leaf litter may also provide valuable cover throughout the growing season. The value of leaf litter and debris is illustrated in the application of litter (or mulch) treatment for soil erosion protection. Similar to the function served by leaf litter, the purpose of mulch treatments is to absorb erosive energy of rainfall impact (the primary mechanism for soil detachment) and to reduce sheetwash (the primary agent of transport)(Buxton and Caruccio 1979). A review of several studies has shown the practice of mulching to be the most efficient method of reducing soil erosion and increasing infiltration (Dunne and Leopold 1978).

The importance of plant canopy cover (i.e., aerial parts of vegetation above the line of contact with water flow (Figure A.3, p. A 17) for energy dissipation of rainfall impact is acknowledged, but for simplification it has been assumed that the distribution of leaf litter will reflect and represent the contribution of plant aerial cover to this function.

In the assessment procedure, Element 10c is always factored into the Sediment Stabilization FCI because the conditions describe all the possible degrees of sediment stabilization provided by leaf litter and debris cover. When ground surface areas are almost entirely covered by live vegetation (cover of live vegetation > 75%; condition "a"), a high degree of sediment stabilization is already being provided without the leaf litter and debris; therefore, this condition is assigned a high score. When live vegetation cover is insufficient, leaving exposed ground surface area, then leaf litter and debris plays a more important role in sediment stabilization. The highest percent cover of leaf litter and debris (condition "b") would have the greatest potential to provide sediment stabilization. Decreased cover is accompanied by a lower potential, therefore the lower percent cover ranges are assigned relatively lower scores. In the equation used to calculate the Vegetation Characteristics component, *Leaf litter and debris* is weighted by the percent available ground surface area not cover by live vegetation (i.e., 1 - 10b) because the amount of available cover determines the relative importance of leaf litter and debris (i.e., the presence of 90% leaf litter and debris in a wetland with predominantly unvegetated ground surface area will be more important to sediment stabilization than 90% cover in a wetland already protected by a high percent cover of live vegetation).

ELEMENT 10j. ROOT STRUCTURE (Entire wetland)

Directions: Determine if vegetation and/or a belowground root system are present in the entire wetland area during the growing season. If present, note the predominant root structure in the wetland by (a) examining the plant growth forms (e.g., Is the wetland dominated by annuals or bunchgrasses, sod-forming grasses, or rooted vascular aquatic beds?) or (b) by minimal sampling of belowground biomass (e.g., one or two small cores or simple extraction of individual plants).

Rationale and assumptions: Vegetation root structure plays an important role in reducing sediment stabilization by increasing durability of the sediment-root matrix (Dean 1979) and by controlling water infiltration rates (Dadkhah and Gifford 1980). Refer to Element 10i rationale under Shoreline Bank Erosion Control function for discussion on the sediment root matrix which is also applicable to the Sediment Stabilization function.

The importance of root structure in providing sediment stabilization was demonstrated through a comparison of soil loss from various land uses (Dunne and Leopold 1978). The greatest erosion and soil loss is usually associated with bare fallow lands and other exposed soils such as road cuts and building sites. In general, ranges and pastureland have relatively lower erosion rates than lands with extensive periodic disruption of the root structure (e.g., tilled croplands). The role of growth form and associated root structure was demonstrated in the results of a study by Dadkhah and Gifford (1980) on the influence of vegetation, rock cover, and trampling on infiltration rates and sediment production from loam soil. The comparison of two growth forms of grass revealed that sod-forming grass (a continuous distribution) infiltrated slightly, though significantly more water than bunchgrass (discrete distribution). Thus, the grass that formed a "root mat," the sod-forming grass, is better at providing sediment stabilization. Weber and Ives (1978) noted that vegetation canopy and root systems provide the most efficient means for reducing erosion and restoring damaged tundra.

In the assessment procedure, Element 10j is always factored into the Sediment Stabilization FCI because the conditions describe the possible range of stabilization which can be provided by different root structures. Herbaceous species that form a root mat are considered to provide the best sediment stabilization (condition "a"). Woody species or rooted aquatic vascular beds (condition "d") or herbaceous species that do not form a root mat (condition "c") are effective, but not as effective for sediment stabilization; therefore, these conditions have been assigned a moderate score (i.e., 0.5). Those wetlands with near equal proportions of root mat forming and non-root mat forming species are considered as an intermediate condition (condition "c"). A wetland is considered least effective at sediment stabilization when vegetation is absent and the below ground root system is absent or dead (condition "e"). In the equation used to calculate the Vegetation Characteristics component, *Root structure* is weighted by *Plant (basal) cover* (10b × 10j) because basal cover dictates the overall capacity of the wetland to bind sediments (i.e., a wetland with 90% coverage of plants with fibrous root systems will be much more effective in binding sediments than a wetland with only 10% cover).

ELEMENT 10l. VEGETATION PERSISTENCE (Entire wetland)

Directions: Determine if vegetation is present in the entire wetland area during the growing season. If present, note if the vegetation is predominantly persistent, predominantly non-persistent, or if there are approximately equal proportions of persistent and non-persistent vegetation. *Persistent vegetation* is defined as vegetation (woody or herbaceous) that normally remains standing at least until the beginning of the next growing season. *Non-persistent vegetation* is defined as emergent plants whose leaves and stems break down at the end of the growing season so that most above-ground portions of the plants are easily transported by currents, waves, or ice.

Rationale and assumptions: Persistent vegetation will provide more effective sediment stabilization than non-persistent vegetation because it remains standing during both the growing and non-growing seasons. Non-persistent vegetation has less of an opportunity to provide sediment stabilization because most of the aboveground portions are present only during the growing season.

In the assessment procedure, Element 10l is always factored into the Sediment Stabilization FCI because the conditions describe the possible range of stabilization which can be provided by different degrees of vegetation persistence. A predominance of persistent vegetation is considered to provide the most effective sediment stabilization (condition "a"). Non-persistent vegetation is considered effective, but not as effective for sediment stabilization (condition "c"); therefore it has been assigned a moderate score (i.e., 0.5). Those wetlands with near equal proportions of persistent and non-persistent vegetation are considered as an intermediate condition (condition "b"). A wetland is considered least effective at sediment stabilization when vegetation is absent (condition "d"). In the equation used to calculate the Vegetation Characteristics component, *Vegetation persistence* is weighted by *Plant (basal) cover* (10b × 10l) because basal cover dictates the overall capacity of the wetland to maintain sediment stabilization (i.e., a wetland with 90% coverage of plants with persistent vegetation will be much more effective in binding sediments than a wetland with only 10% cover).

ELEMENT 14c. WETLAND SLOPE

Directions: Determine if wetland slope is stable with and/or without vegetation. Look for signs of slope instability, e.g., evidence of scouring, a net loss of shore sediments, development of a shoreline bank, or gullies. Note that there is no standard slope which can be used as a guide for determining stability. A determination of adequate slope depends upon several factors (e.g., sediment composition, soil erosivisity, wave climate, and current velocity) and must be made based upon local site conditions.

Rationale and assumptions: In general, the steeper the slope, the more vulnerable the wetland to erosion and sediment disruption. Garbisch and Garbisch (1994) recommended a slope of 10:1 for the construction of marshes designed to stabilize eroding shoreline banks for the Maryland Chesapeake Bay area. A wetland constructed in the Chesapeake Bay was found to be unstable, until it achieved a 600:1 slope (E. Garbisch, unpublished). For this reason, no standard for slope should be used to determine wetland stability unless it has been proven applicable to local site conditions.

In the assessment procedure, Element 14c is always factored into the Sediment Stabilization FCI. The capacity of the wetland to maintain sediment stability is considered best when the slope is stable with and/or without vegetation (condition "a") or when the slope is stable and erosion protection is provided by leaf litter and debris (condition "b"). Sediment stabilization cannot be maintained if the slope is unstable (condition "c").

5.4 Additional Design Considerations

The following section outlines design considerations, including EPW elements and additional factors, which are to be considered for the Sediment Stabilization function.

Factor	Remarks
PHYSICAL FEATURES	
Disturbance (Element 4a)	Disturbance, especially herbivory, is a major concern during the initial establishment of planned wetlands. The recommended solution is the construction of an exclosure fence at the time of planting. Exclosure fences have proven effective in excluding geese, cattle, and nutria (e.g., Webb 1982, Conner and Flynn 1989, Garbisch and Garbisch 1994).
Upland Disturbance	Determine the potential for disturbance in adjacent upland areas and consider the effect on erosion in the wetland. For example, excessive trampling can decrease infiltration rates (Dadkhah and Gifford 1980) and increase surface runoff and erosion in the wetland. Consider the use of exclosure fences or other methods to maximize the percent plant (basal) cover.
Water level fluctuation (Element 7a)	Drastic water level fluctuations can cause severe erosion and prevent the establishment of a planned wetland. Determine if the site is unsuitable due to extreme water level fluctuations.
Wetland slope (Element 14c)	Design the planned wetland so that it is stable with and/or without vegetation. There is no standard slope which can be used as a guide for determining stability. A determination of adequate slope depends upon several factors (e.g., sediment composition, soil erosivisity, wave climate, and current velocity) and must be made based upon local site conditions.

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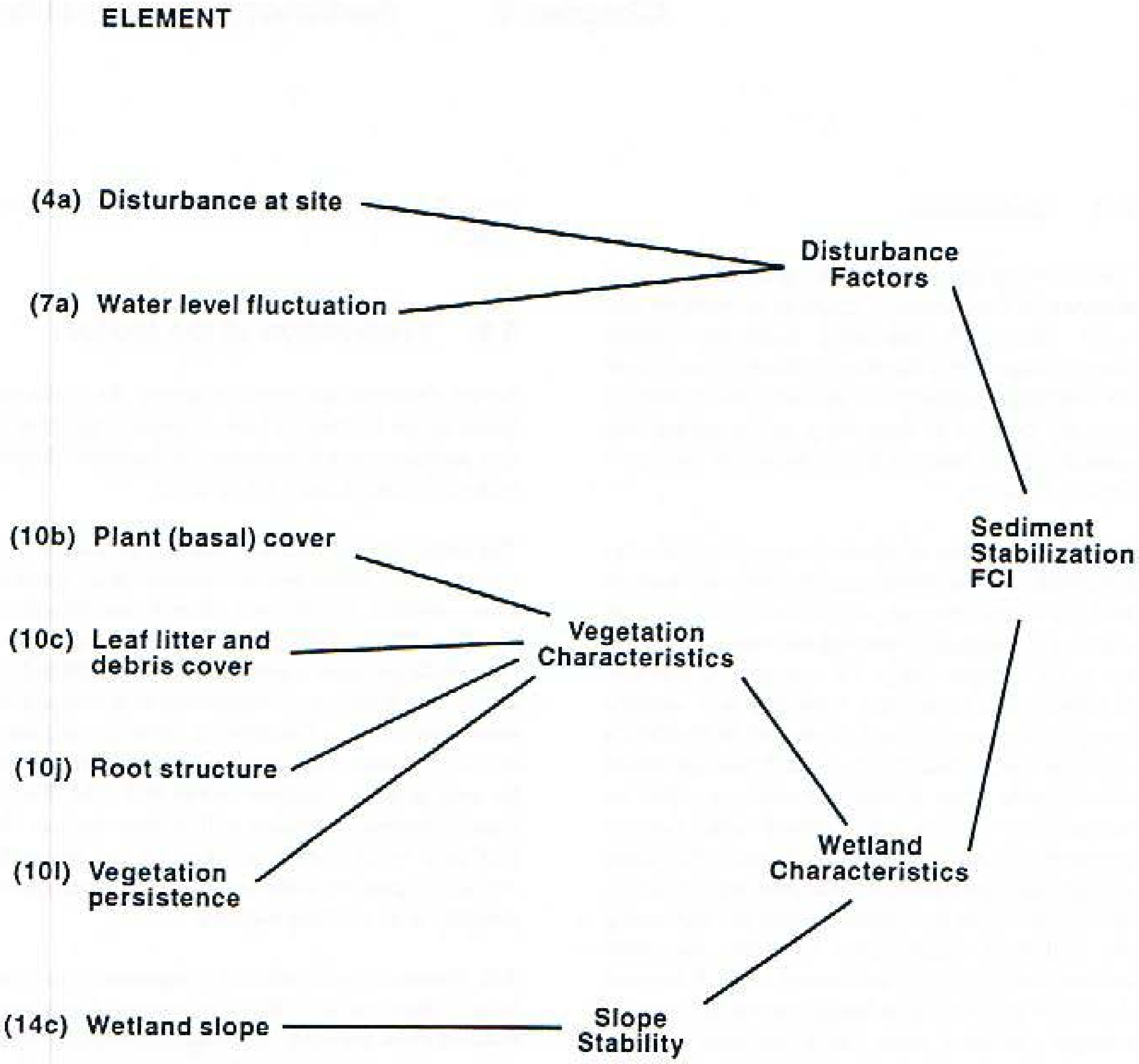
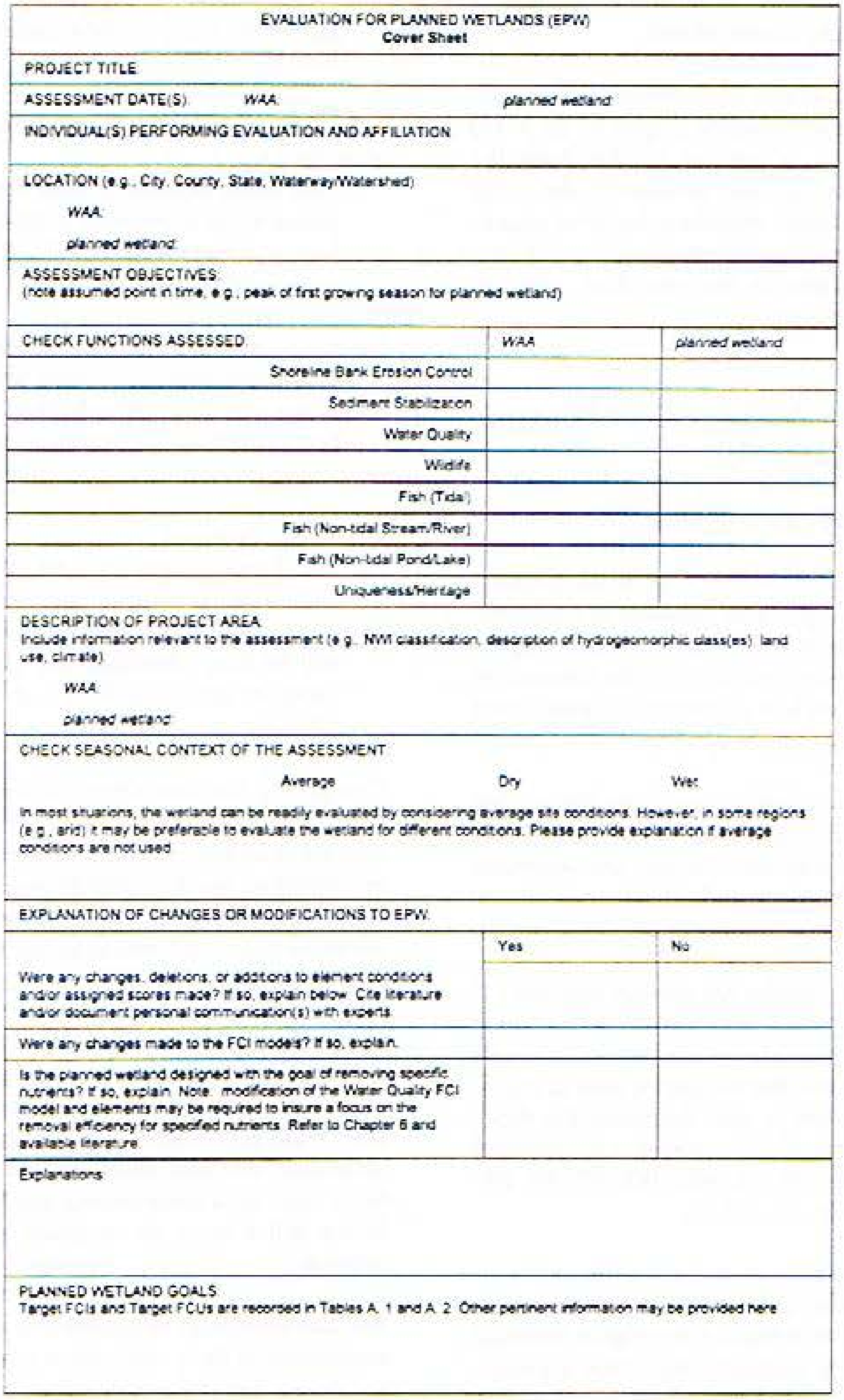


Figure 5.1.
Relationships of elements and components in the Sediment Stabilization FCI model



EVALUATION FOR PLANNED WETLANDS (EPW)
Cover Sheet

PROJECT TITLE:

ASSESSMENT DATE(S): *WAA:* *planned wetland:*

INDIVIDUAL(S) PERFORMING EVALUATION AND AFFILIATION

LOCATION (e.g., City, County, State, Waterway/Watershed)

WAA:

planned wetland:

ASSESSMENT OBJECTIVES:
(note assumed point in time, e.g., peak of first growing season for planned wetland)

CHECK FUNCTIONS ASSESSED:	*WAA*	*planned wetland*
Shoreline Bank Erosion Control		
Sediment Stabilization		
Water Quality		
Wildlife		
Fish (Tidal)		
Fish (Non-tidal Stream/River)		
Fish (Non-tidal Pond/Lake)		
Uniqueness/Heritage		

DESCRIPTION OF PROJECT AREA
Include information relevant to the assessment (e.g., NWI classification, description of hydrogeomorphic class(es), land use, climate)

WAA:

planned wetland:

CHECK SEASONAL CONTEXT OF THE ASSESSMENT:

Average Dry Wet

In most situations, the wetland can be readily evaluated by considering average site conditions. However, in some regions (e.g., arid) it may be preferable to evaluate the wetland for different conditions. Please provide explanation if average conditions are not used.

EXPLANATION OF CHANGES OR MODIFICATIONS TO EPW:

	Yes	No
Were any changes, deletions, or additions to element conditions and/or assigned scores made? If so, explain below. Cite literature and/or document personal communication(s) with experts.		
Were any changes made to the FCI models? If so, explain.		
Is the planned wetland designed with the goal of removing specific nutrients? If so, explain. Note: modification of the Water Quality FCI model and elements may be required to insure a focus on the removal efficiency for specified nutrients. Refer to Chapter 6 and available literature.		

Explanations:

PLANNED WETLAND GOALS:
Target FCIs and Target FCUs are recorded in Tables A.1 and A.2. Other pertinent information may be provided here.

Figure 3.3.
Example of cover sheet

Factor	Remarks
VEGETATION FEATURES	
Plant (basal) cover (Element 10b)	Maximize the percent plant (basal) cover to protect the wetland from erosion.
Vegetation on upland areas	Examine vegetation on adjacent upland areas and determine the need to increase percent cover. Vegetation in adjacent upland areas is important in maintaining sediment stabilization in the wetland due to the role it plays in the process of water infiltration and its effect on sediment erosion. Infiltration, or the movement of water into the soil, becomes a concern when the soil can no longer absorb water (i.e., rainfall exceeds infiltration capacity) and the excess rainfall runs quickly over the ground surface (i.e., runoff) increasing surface erosion force. Vegetation cover is one of the most important controls of infiltration. If vegetation density is decreased under the same rainfall regime and soil type, it usually results in a distinct reduction in infiltration capacity (e.g., Dunne and Leopold 1978, Dadkhah and Gifford 1980, Thorne 1990). As a consequence, the volume of surface runoff is increased, increasing its capacity to generate surface erosion. Dadkhah and Gifford (1980) found that percent grass cover was the most important factor influencing sediment production from a loam soil, explaining 40 to 62% of the variation associated with sediment yield at various trampling percentages. Sediment production decreased exponentially as the percent plant cover increased, regardless of the degree of trampling.
Leaf litter and debris (Element 10c)	If there is a potential erosion problem in the wetland or adjacent uplands, consider using mulch. Materials used as mulch include straw, hay, leaves, sawdust, wood shavings, paper scraps, and bark chips. In wetland situations where water flow or fluctuation is expected, mulch cannot be used below the expected high water mark because the mulch will float. Mulch can be used in situations where water flow and/or fluctuation is not expected (e.g., groundwater systems where the water table is below the ground surface).
Root structure (Element 10j)	Plant species which form a root mat (e.g., rhizomatous) to increase durability of the sediment-root matrix and overall wetland stability.
Vegetation persistence (Element 10l)	Plant persistent vegetation because it remains standing during the growing and non-growing seasons, and thus will provide more effective sediment stabilization.

PROJECT TITLE: MARLEY CREEK

SEDIMENT STABILIZATION
DATA SHEETS

Function weighting area (AREA) = Entire wetland assessment area

		For use in FCI Model		For use in Table A.2 only
ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
Disturbance factors (elements 4a and 7a):				
4a. Disturbance (Sediment Stabilization)	[SB, SS, FT, FS, FP]*			Assume NA = 1.0
(Do not include observations of debris)				
a. No or minimal disturbance.	NA			
b. Potential for periodic disturbance present, but preventative action taken (e.g., installation of exclosure fences for herbivores and/or human disturbance). OR If recently disturbed, soils sufficiently stabilized with mulch, seeding, or planting.	NA	NA	NA	NA
c. Moderate disturbance (e.g., disturbance of sediments only in portion of site, infrequent grazing by waterfowl).	0.5			
d. Evidence of substantial periodic disturbance which makes substrate unstable (e.g., muskrat eatouts, overgrazing by waterfowl, cattle grazing and trampling, nutria activity, human activity such as the use of off-road vehicles; wetland tilled, filled, logged, clear-cut or excavated and not stabilized by seeding or planting).	0.1			

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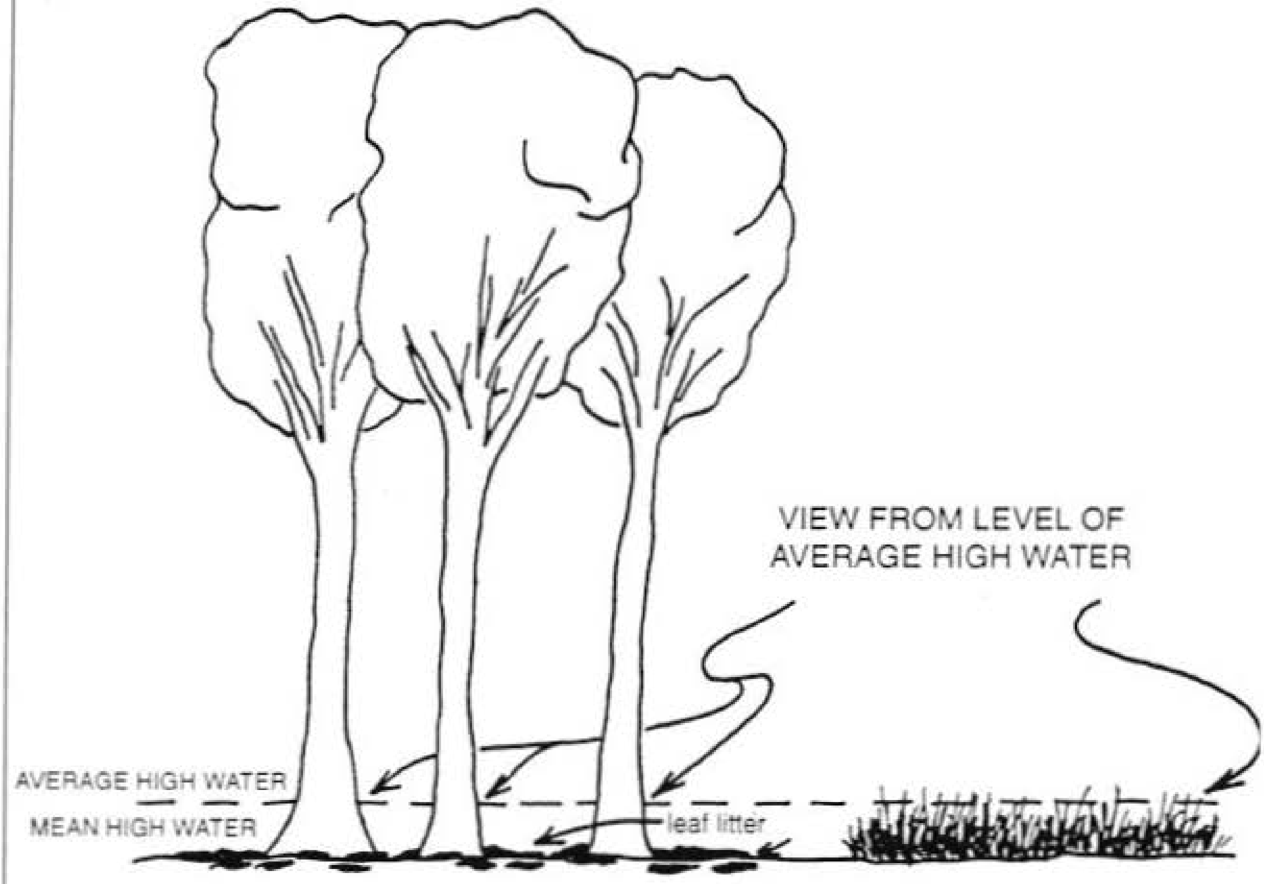
* Denotes function(s) to which element applies: SB = Shoreline Bank Erosion Control, SS = Sediment Stabilization; WQ = Water Quality; WL = Wildlife; FT = Fish (Tidal); FS = Fish (Stream/River); FP = Fish (Pond/Lake); and UH = Uniqueness/Heritage

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
7. Hydroperiod				
7a. Water level fluctuation	[SB,SS,WQ]			Assume NA = 1.0
a. Tidal wetland.	NA	NA (a)	NA (a)	NA
b. No fluctuating water level.	NA			
c. Fluctuating water level causing no or moderate erosion.	NA			
d. Fluctuation occasionally drastic causing sever erosion and/or preventing vegetation establishment (e.g., periodic release from upstream impoundment; reservoir drawdown).	0.1			
Vegetation characteristics affecting sediment stabilization (elements 10b, 10c, 10j, and 10i):				
10. Vegetation characteristics **during growing season**				
10b. Percent plant (basal) cover, including rooted vascular aquatic beds, **in entire wetland**. (Consider only those parts of vegetation which have contact with water flow. **See Figure A.3**)	[SS, WQ]			
a. Cover > 75%.	1.0	1.0	1.0	0
b. Cover 51 - 75%.	0.7			
c. Cover 25 - 50%.	0.3			
d. Cover < 25%.	0.1			
10c. Percent cover provided by leaf litter and debris on **ground surface areas not covered by live vegetation**. (Applicable to **entire wetland**. Include submerged surfaces.)	[SS]			
a. Ground surface areas almost entirely covered by live vegetation (i.e., cover of live vegetation > 75%).	1.0	1.0 (a)	1.0 (a)	0
b. Cover > 75% leaf litter and debris.	1.0			
c. Cover 51 - 75%.	0.7			
d. Cover 25 - 50%.	0.3			
e. Cover < 25%.	0.1			



Examples:

	Forest	Emergent Marsh
Percent (Basal) Cover (Elements 10a, 10b, or 10d)	<25%	>75%
Percent Leaf Litter & Debris Cover (Element 10c)	>75%	Ground surface areas almost entirely covered by live vegetation

Figure A. 3.
Percent plant cover (elements 10a, 10b, 10c, and 10d)

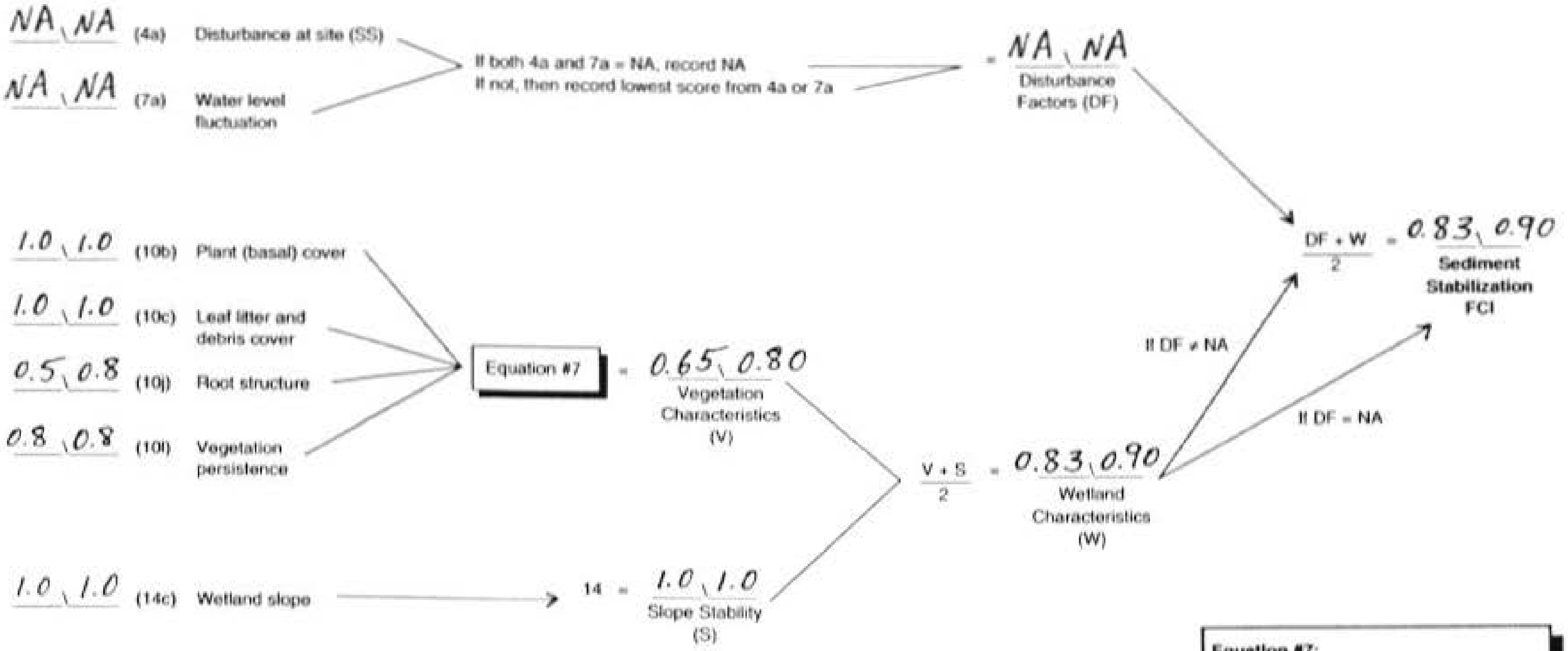
Evaluation for Planned Wetlands

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA)
		WAA	Planned Wetland	If both scores are NA, record NA
10j. Root structure in **entire wetland**. (Include rooted vascular aquatic beds)	[SS]			
Wetland predominantly vegetated by:				
a. Herbaceous species that form a root mat (e.g., rhizome propagating species).	1.0			
b. Intermediate condition.	0.8			
c. Herbaceous species that do not form a root mat (bulb (*Peltandra virginica*), tuber (*Sagittaria latifolia*), or bunch (*Carex spp.*) species).	0.5	0.5 (c)	0.8	(+)
d. Woody species -OR- rooted aquatic vascular beds.	0.5			
e. Vegetation absent. Belowground root system absent or dead.	0.1			
10l. Vegetation persistence in **entire wetland**. (Include rooted vascular aquatic beds)	[SS, WQ]			
Dominant plant cover:				
a. Persistent vegetation.	1.0			
b. Approximately equal proportions of persistent and non-persistent vegetation.	0.8	0.8	0.8	0
c. Non-persistent vegetation.	0.5			
d. Vegetation absent.	0.1			
The influence of slope on sediment stabilization (element 14c):				
14c. Vegetated or unvegetated wetland slope (**Entire wetland**)	[SS, WQ]			
a. Slope is stable with and/or without vegetation (e.g., a slope which is adjusted to the wave climate would be stable even in the absence of vegetation).	1.0	1.0 (a)	1.0 (a)	0
b. Slope is stable. Erosion protection provided by leaf litter and debris.	1.0			
c. Slope is unstable (e.g., an unvegetated slope with gullies; evidence of a net loss of shore sediments beginning the development of a bank; evidence of scouring, i.e., wave ripples.)	0.1			

Calculation of **SEDIMENT STABILIZATION** FCI

PROJECT TITLE: MARLEY CREEK

Selected Scores (#) Element COMPARISON: WAA \ planned wetland (e.g., WAA/planned wetland)



Equation #7:

$$\frac{10b\,(10j + 10l) + 10c\,(1 - 10b)}{2}$$

Chapter 6. Water Quality

6.1 Definition

Wetlands function to influence water quality by various processes including sedimentation, plant uptake and release, litter decomposition, soil nutrient retention, and microbial activity. The Water Quality FCI provides a relative measure of the wetland's capacity to retain and process dissolved or particulate materials to the benefit of downstream surface water quality. EPW does not address the influence of wetlands on groundwater or water quality within the wetland system.

The fate of chemicals released by any of the aforementioned processes determines the effect of these processes on downstream water quality (Figure 6.1, p. 6–2). It is assumed that any fluxes in chemical concentrations in a closed wetland, that is a wetland with no outlet, will remain on site. Since there is no potential for downstream export, the water quality function is considered not applicable to closed wetlands (Figure A.4, p. A. 20, conditions A and B). Only wetlands with an outlet are considered for the water quality function because the released exported elements will have the potential to affect downstream waters. Under these conditions, it can be determined if the influence of the wetlands on water quality is beneficial or detrimental.

Wetlands may serve as nutrient sinks, sources, or transformers of chemicals depending upon the wetland type, hydrologic conditions, season, or year (Mitsch and Gosselink 1986). If a wetland has a net retention of an element or a form of that element (i.e., inputs are greater than outputs), then it is considered a **sink**. A wetland is considered a **source** if it exports more of an element downstream (i.e., outputs are greater than inputs). If a wetland transforms a chemical, but does not change the amount going into and out of the wetland (input equals output), then it is considered to be a **transformer**. Over time, a wetland may play different roles, particularly if there are changes in the input content, outlet features, etc. This change has been demonstrated in some wetlands used for wastewater treatment which initially served as nutrient sinks and after several years reached their assimilatory capacity for certain chemical constituents (Kadlec and Kadlec 1979, Kadlec 1985, 1987b; Brinson 1985; Richardson 1985; Girts and Knight 1989). For additional information on the role of wetlands as a sink, source, or transformer for the various geographic regions of the United States, refer to Nixon and Lee (1986).

The task of identifying a wetland as a source, sink, or transformer cannot be determined upon cursory visual observations. Determining the fate of dissolved and particulate materials entering a wetland is not simple. The complexity of inputs, outputs, and internal cycling of materials is illustrated in the mass balance flow diagram developed by Nixon and Lee (1986) (Figure 6.2, p. 6–3). Following this diagram, materials can be stored in seven storages (or compartments) and flow through 28 pathways. This model could be further complicated if the actions of microbes or herbivores were considered. A generalized description of inflows, intracycling, and outflows is provided in Figure 6.3, p. 6–4.

The function weighting area (AREA) for Water Quality is the entire wetland, which includes wetland areas landward of the bank, the bank, the upper shore zone, and the lower shore zone.

As a rapid assessment technique, EPW is designed to consider the potential for overall water quality improvement. It does not require chemical analysis of collected water samples; therefore, a detailed

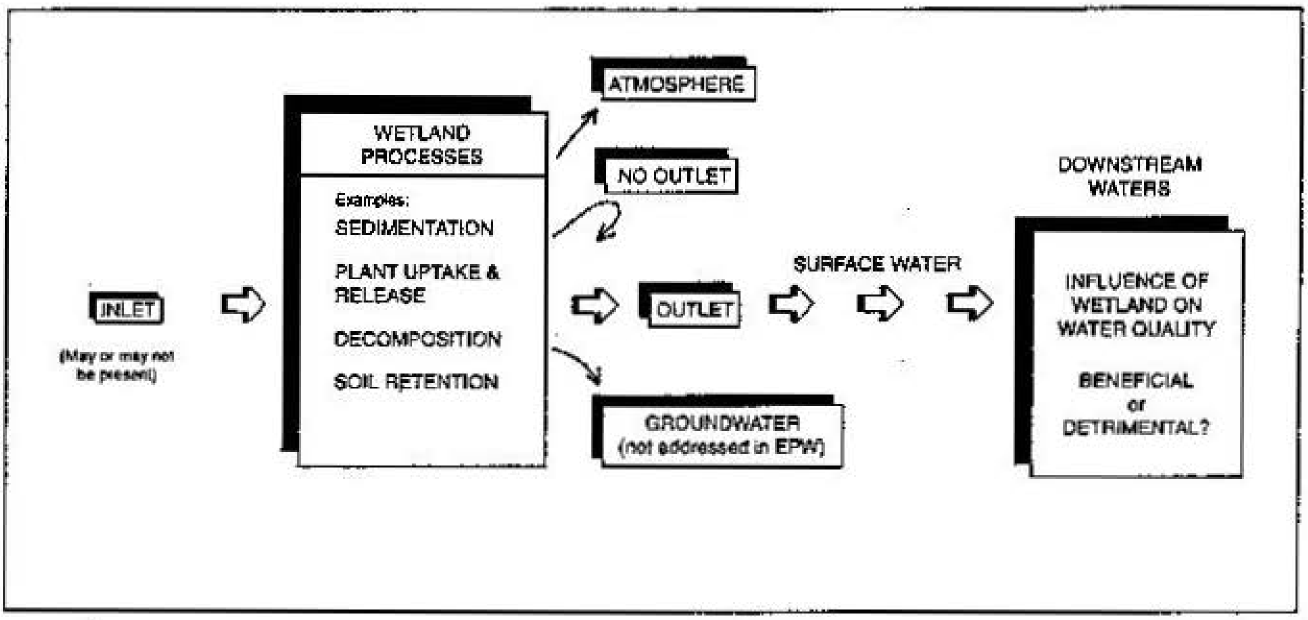
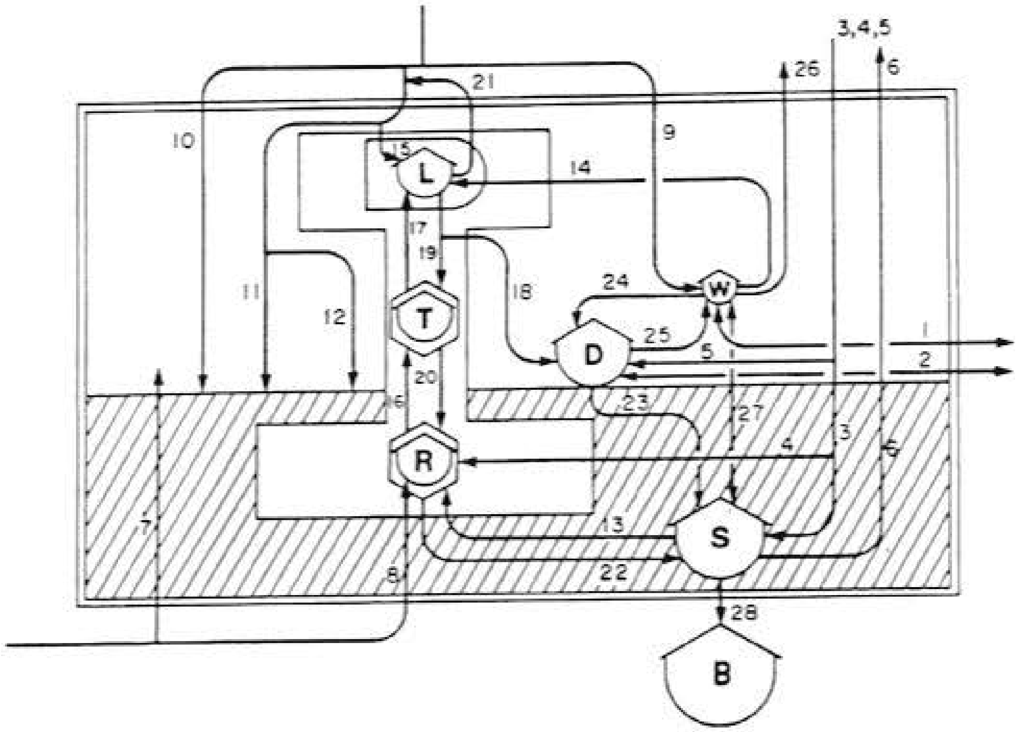


Figure 6.1.
Fate of dissolved or particulate materials released from a wetland



Storages:

L = above-ground shoots
T = trunks and branches, perennial above-ground storage
R = roots and rhizomes
W = dissolved and suspended particulates in surface water
D = litter or detritus
S = near-surface sediments
B = deep sediments essentially removed from internal cycling

Flows:

1, 2	exchanges of dissolved and particulate materials with adjacent waters
3 - 5	nitrogen fixation by sediments, rhizosphere microflora, and litter
6	denitrification by sediments (N_2 and N_2O)
7, 8	ground-water inputs to surface water and roots
9	atmospheric deposition on water
10	atmospheric deposition on land
11, 12	aqueous deposition from the canopy and in stemflow
13	uptake by roots
14	foliar uptake from surface water
15	uptake from rainfall
16, 17	translocations from roots through trunks and stems to leaves
18	the production of litter
19, 20	the readsorption of materials from leaves through trunks and stems to roots and rhizomes
21	leaching from leaves
22	death or sloughing of root material
23	incorporation of litter into sediments or peat
24	uptake by decomposing litter
25	release from decomposing litter
26	volitization of ammonia
27	sediment-water exchange
28	long-term burial in sediments

Figure 6.2.
Simplified general model of major flow and storages of materials that have been measured in wetlands in attempts to assess the role of these systems in influencing the quality of adjacent waters
(Figure and caption from Nixon and Lee 1986, reprinted with permission)

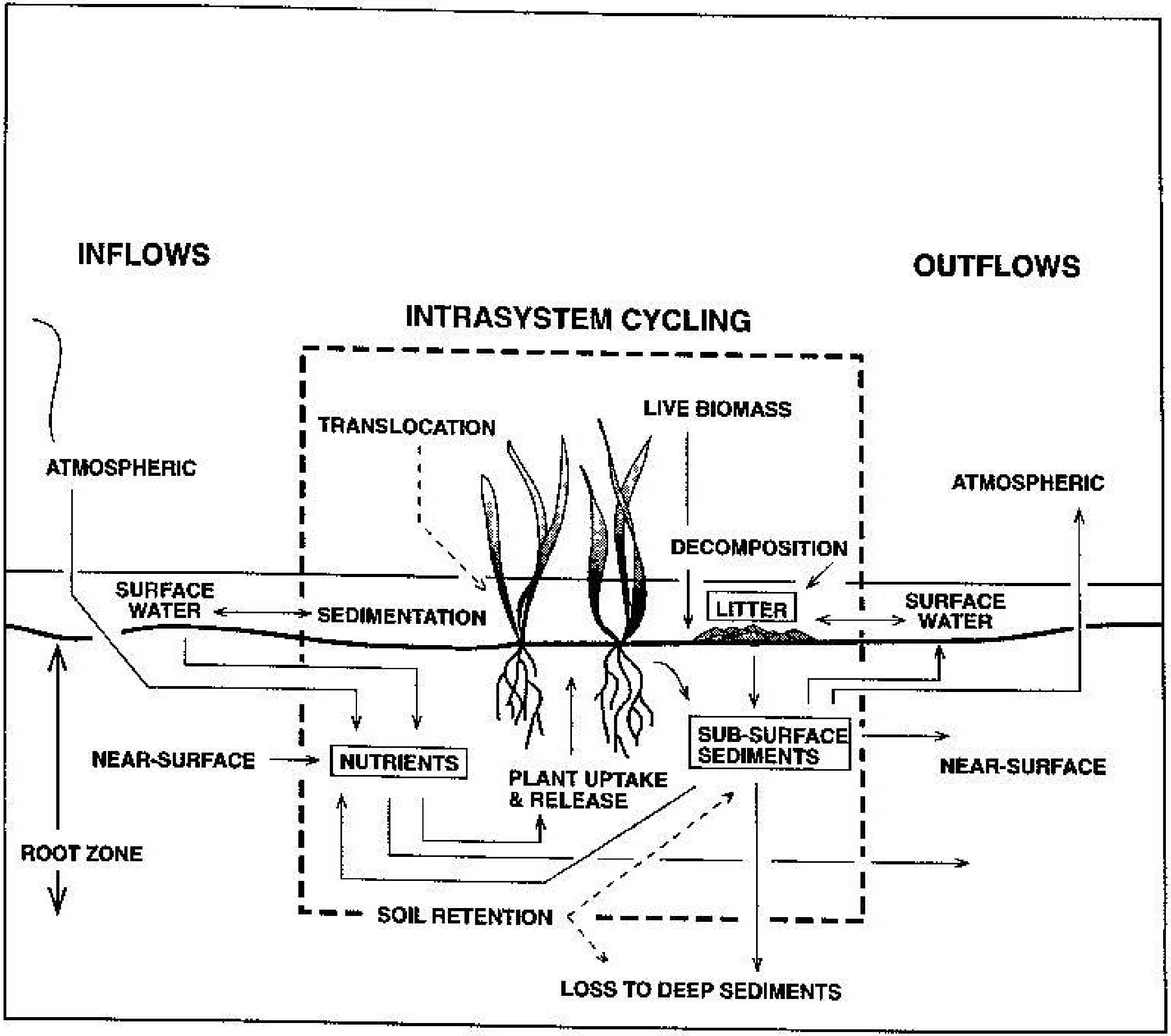


Figure 6.3.
Generalized diagram of components of a wetland mass balance (modified from Mitsch and Gosselink 1986)

evaluation on the fate of specific pollutants cannot be provided. Conditions considered optimal for the removal of one pollutant may not provide conditions for the efficient removal of another pollutant. If the project goals and objectives focus on the removal of a specific pollutant (e.g., phosphorus), then the elements and Water Quality FCI model may need to be modified. Section 6.5 identifies additional factors which may be considered in wetland design for a few nutrients. Any changes in EPW should be based upon the current literature.

6.2 Major Sediment and Nutrient Retention Processes

The following section describes four major wetland processes which may influence downstream water quality. These and other processes were considered in the development of the EPW Water Quality FCI model.

1. Sedimentation

Sedimentation is the process by which particulates and associated pollutants are physically deposited on the wetland soil surface. Major factors affecting sediment transport and deposition are (1) particle size, (2) depth and velocity of current flow, (3) wave, wind, and tidal energy, (4) salt-fresh water interactions, (4) flocculation and deflocculation, (5) impoundment or detention of water, (6) vegetation and litter cover, and (7) form of sediment delivery (e.g., seasonal flooding or surface runoff) (Postma 1967, Dunne and Leopold 1978, Boto and Patrick 1979, Gleason et al. 1979, Dadkhah and Gifford 1980, Kao 1980, Phillips 1984, Brown and Stark 1989, Johnston 1991). The relative importance of each factor depends upon the wetland type. For example, the effect of vegetation on sedimentation may be important in salt marshes and riparian wetlands, yet minor in estuarine wetlands (Boto and Patrick 1979, Cooper et al. 1986).

Sediment deposition, accumulation, and burial is an important mechanism of pollutant removal. When suspended, particulates often transport relatively large quantities of nutrients, heavy metals, and other substances. Deposition of these suspended sediments in wetlands, where there is little reworking of the sediments, can result in the permanent removal of most pollutants (Boto and Patrick 1979). Wetlands located in an accreting environment will generally retain sediments and associated contaminants. Wetlands in an eroding environment may temporarily retain, but are more likely to release sediments and associated contaminants due to erosional forces. Reworking of sediments may occur due to several factors including wind induced wave scour (Settlemeyer and Gardiner 1977), wind resuspension (Carper and Bachman 1984), eddy currents (Keown 1983), and disturbance by animal or human activity (Winchester et al. 1985).

2. Plant Uptake and Release

The phrase — plant uptake and release — refers to the process by which pollutants (nutrients and/or contaminants) are adsorbed and assimilated into living plant tissue, and then released with litter production (Figure 6.2, p. 6–3 — Flow 18) and death to sloughing root material (Flow 22). Chemicals may be supplied to the plant by foliar uptake from surface water and rain water (Flows 14 and 15), root uptake from groundwater and near surface sediments (Flows 8 and 13), and by nitrogen fixation in rhizosphere microflora (Flow 4). The bulk of nutrient uptake comes from near surface sediments (Kadlec and Kadlec 1979, Brinson et al. 1984, Kadlec 1987a). However, significant phosphorus uptake from the water column has been recorded in rarely encountered hypereutrophic waters (Carignan and Kalff 1980). The extent of plant uptake in a given wetland depends upon the assimilative capacity of the individual plant species and the amount of vegetation biomass produced per unit area.

Wetland vegetation represents a structure used for the temporary storage and cycling of chemicals (Figure 6.2, p. 6–3). The vegetation itself can be separated into three storage compartments: aboveground leaves (Storage L), aboveground trunks and branches (T), and roots (R). There is a tendency to equate aboveground biomass with uptake and retention. Due to the complexity of storages and numerous flow pathways, it is difficult to determine what amount of net annual retention can be attributed to wetland plants. It cannot be assumed that nutrient standing stock (i.e., percent nutrient concentrations for aboveground plant tissue × peak live biomass) represents net annual uptake and retention of chemicals. Biomass may expand with nutrient uptake, but the plants will reach a saturation condition where the release of nutrients to litter decay offsets any uptake in new growth (Kadlec 1985, Kadlec and Hammer 1988).

The few studies which have attempted to quantify net annual retention of phosphorus or nitrogen in plant biomass, report a range of 26–54% retention in herbaceous and 0–56% retention (mean = 23%) in woody freshwater wetland vegetation (Johnston 1991). The significance of this retention to downstream water quality is not known. While these numbers may be interesting, the reader is reminded that plant retention is only one of several removal mechanisms. For reasons given, EPW focuses more on the role of plants in water-surface interactions (e.g., sedimentation and mechanical filtering).

3. Litter Decomposition

Litter constitutes a dynamic storage compartment (Figure 6.2, p. 6–3 — Storage D) where dead plant material breaks down into simpler constituents, often to elements themselves, by the process of decomposition. Once leaves have senesced (Flow 18), they enter the litter storage and interact with the surface water (Flows 2, 24, and 25). As plant litter decomposes, chemicals may be incorporated into the sediments (Flow 23) or released into the surface water as dissolved or suspended particulates (Flow 25). Major factors affecting decomposition rates include the chemical makeup of the litter, moisture conditions, temperature, and oxygen availability (Wiegert and Evans 1964, Reddy and Patrick 1975, Polunin 1984, Johnston 1991).

Litter fall pattern and decomposition rate are considered to play a dominant role in the removal of nitrogen (N), phosphorus (P), and heavy metals (van der Valk et al. 1979, Simpson et al. 1983). The effect of litter decomposition on water quality depends upon the fate of elements released from plant litter; elements incorporated in the sediments (Flow 23) could be beneficial to downstream water quality, while export to downstream waters (Flow 2) could be detrimental (Johnston 1991). While important to the mass balance, this mechanism and its effect on water quality are difficult to quantify.

4. Soil Retention

Soil retention refers to the incorporation of dissolved and particulate materials into a wetland's near-surface or deep sediments (Figure 6.2, p. 6–3: Storage S and B). Near-surface sediments receive inputs from nitrogen fixation (Flow 3), decaying roots and litter (Flows 22 and 23), and surface water (Flow 27). Alternatively, materials may be released from the sediments via denitrification (Flow 6), root uptake (Flow 13), and exchange with surface water (Flow 27).

The accumulation of materials in the soil may vary substantially from year to year in response to nutrient changes or hydrological factors. A water quality model simulation revealed that annual litter and root decay controls nutrient concentrations in interstitial water and thus controls plant growth (Kadlec and Hammer 1988). The most apparent beneficial mechanism for water quality is long-term burial in deep sediments (Flow 28), which is depicted as an irreversible flow. Based upon a literature review, Johnston (1991) found that the average turnover rate for phosphorus in freshwater wetlands' near-surface sediments was 96 years (range 8–225 years), with an extreme reported upper limit at 5,600 years. Nitrogen turnover rates were comparable.

6.3 Explanation of the Model

Fourteen elements are used to assess the Water Quality function. These elements contribute to six components which define the Water Quality FCI (Figure 6.4, p. 6–8).

The assessment begins with the examination of the existing *Hydrologic condition* (Element 15). It is assumed that the Water Quality function is applicable only when there is an outlet to convey surface water released from the wetland downstream. Therefore, the Water Quality FCI will be considered *not applicable (NA)* for closed wetlands (Figure A.4, p. A 20: wetlands with no outlet as described by conditions A and B).

The Water Quality FCI is a product of two components: Wetland Condition and Water Contact. It is assumed that the extent of water contact and the wetland condition are major components affecting wetland processes. The Wetland Condition component considers factors which may reduce the potential pollutant removal efficiency (e.g., limiting factors such as disturbance) and general wetland surface characteristics (e.g., substrate-slope, vegetation cover) which influence water-surface interactions. Equally important to the Water Quality function is the Water Contact component which is described by basic aspects of wetland hydrology. For this component, it is assumed that the greater the contact surface available per unit volume of water, the greater the opportunity to benefit water quality by processes associated with water-surface interaction.

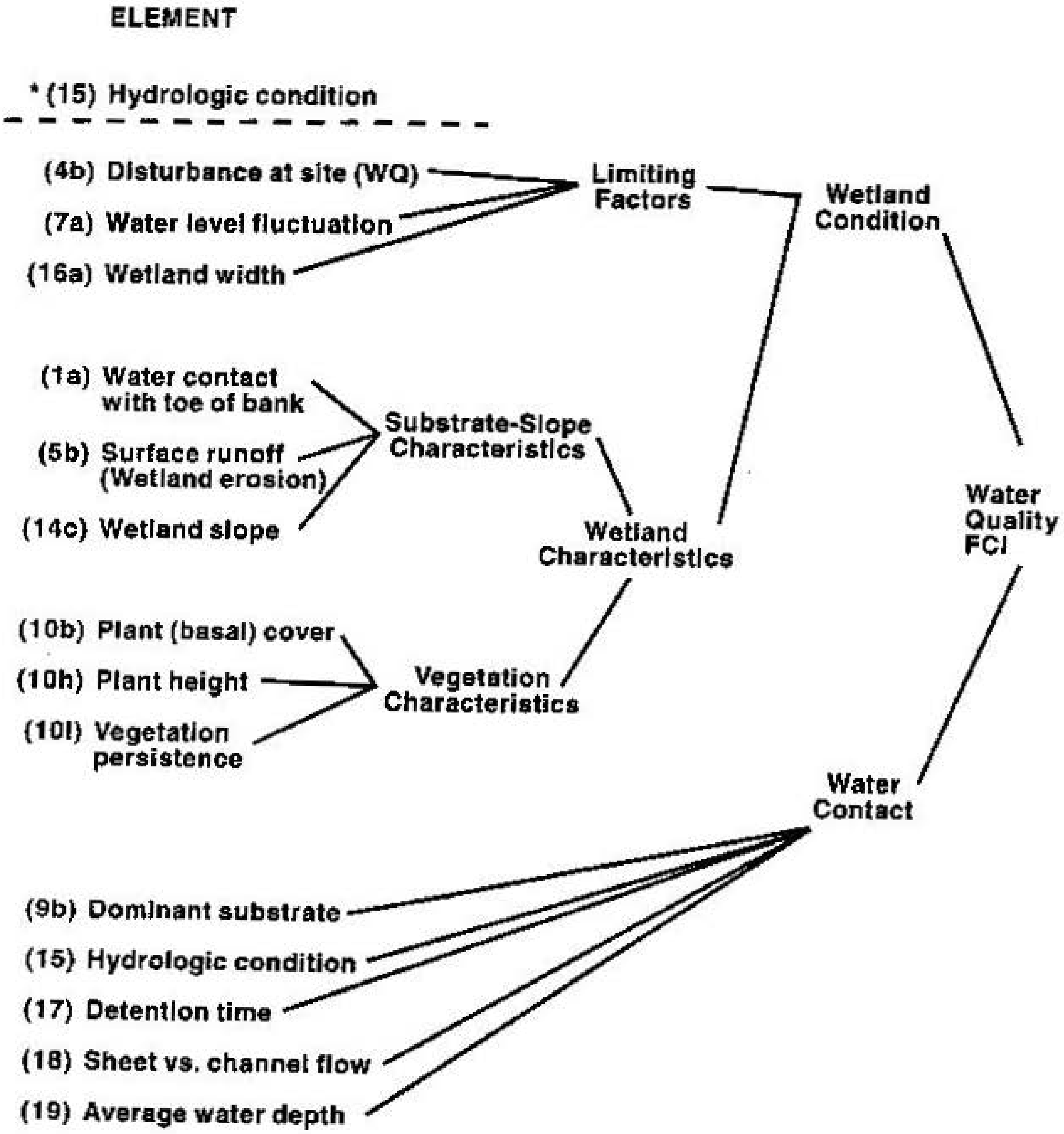
The Wetland Condition component is described by two other components: Limiting Factors and Wetland Characteristics. The Limiting Factors component considers those elements which may act separately or in combination to limit the potential for water quality improvement. In most situations, the Limiting Factors component will be considered not applicable (NA) and will not be used in the calculation of the FCI. The only time Limiting Factors will be factored into the FCI is when one or more of the contributing element conditions could substantially reduce the wetland's capacity to improve water quality (e.g., there is evidence of substantial periodic disturbance from dumping debris or litter).

The Wetland Characteristics component is defined by two other components: Substrate-Slope Characteristics and Vegetation Characteristics. The Substrate-Slope component is described by physical factors, other than vegetation characteristics, that influence processes associated with water-surface interaction. Three elements are used to describe wetland substrate stability at the bank face and within the wetland proper. It is assumed that a wetland's overall capacity to improve water quality will be reduced if the substrate is unstable. The instability, if severe, may make the wetland a sediment source.

The Vegetation Characteristics component is described by three plant characteristics. It is difficult to make general assumptions about the contribution of vegetation to water quality by some processes (e.g., plant uptake and release, decomposition). The Vegetation Characteristics component is included to recognize the importance of vegetation to water-surface interaction processes, such as sedimentation and mechanical filtering. It is assumed that greater vegetation cover will promote these processes. The main element in this component is *Plant (basal) cover*. The relative importance of *Plant height* and *Vegetation persistence* depends on the amount of available plant (basal) cover. Therefore, the contribution of these two elements is weighted by the score (i.e., a relative score for percent cover on a 0 – 1.0 scale) for *Plant (basal) cover*.

The score for this component is calculated using the following Equation 8:

$$\textbf{Vegetation Characteristics} = \frac{10b\,(10h + 10f)}{2} \qquad (8)$$



*Examined first to determine if function is applicable

Figure 6.4.
Relationships of elements and components in the Water Quality FCI model

The Water Contact component is described by one substrate element and four wetland hydrology elements. The substrate element is calculated into the Water Contact component only when there is a notable difference in substrate type for the wetlands being compared (e.g., cobble vs. clay substrate). Otherwise, it is assumed that similar substrate conditions will have a comparable effect on the wetland's capacity to perform the Water Quality function. The wetland hydrology elements describe the extent of wetland water contact.

6.4 Rationale and Assumptions

ELEMENT 1a. WATER CONTACT WITH TOE OF BANK

Directions: Determine if a shoreline bank is present. If present, then determine the frequency of water contact with the toe of bank (Figure A.1, p. A 24).

Rationale and assumptions: The frequency of water contact with the toe of the bank is an indicator of bank stability and the potential for shoreline bank erosion. For a wetland to improve water quality by promoting sedimentation, it is important that the substrate and slope are relatively stable. The shoreline bank represents one location in the wetland where there is potential for substrate instability and sediment release. It is assumed that the rate of bank erosion and sediment release increases as the frequency of water contact with the bank face increases. Refer to rationale for Element 1a under the Shoreline Bank Erosion Control function for discussion on bank erosion which is also applicable to the Water Quality function.

In the assessment procedure, this element is considered not applicable if there is no shoreline bank (condition "a"). Element 1a is only factored into the Water Quality FCI when a shoreline bank is present. Conditions "b" through "e" represent a range of frequencies of water contact with the toe of the bank. The frequency of contact is associated with different degrees of potential to cause erosion and release sediments. Bank erosion is considered minimal when there is infrequent water contact at the toe of the bank (condition "b"). The worst condition (condition "e") occurs when there is frequent water contact at the toe of the bank. The other conditions ("c" and "d") represent intermediate frequencies and are assigned intermediate scores based upon their potential to cause erosion and release sediments.

ELEMENT 4b. DISTURBANCE AT SITE (Water Quality)

Directions: Determine if there is disturbance at the site (e.g., grazing by herbivores, human activity which disrupts sediments) by field observations and/or local inquiry. Consider observations of debris as evidence of disturbance. If site is subject to disturbance, note if (a) the disturbance is minimal, moderate, or substantial and (b) if any actions have been taken to minimize the potential for erosion (e.g., installation of exclosure fences, mulching, seeding, planting).

Rationale and assumptions: Disturbance of the wetland can (1) cause erosion and the release of sediments or toxicants into the water, (2) cause a decrease in vegetation which otherwise functions to stabilize sediments and increase sedimentation, and/or (3) diminish water quality through the presence of litter and debris. If disturbance is substantial, the wetland's ability to improve water quality will not only be impaired, the wetland may also become a source of sediments, contaminants, or nutrients and contribute to downstream water quality degradation. The effects of site disturbances such as fire, plant disease, insects, or wildlife damage on water quality is a well recognized problem in wetlands constructed for wastewater treatment (e.g., Girts and Knight 1989). For applicable discussion on disturbance through erosion and sediment destabilization, refer to rationale for

Element 4a under the Shoreline Bank Erosion Control and Sediment Stabilization functions. Element 4b differs from Element 4a by the inclusion of debris. Debris is often associated with water quality degradation, and thus is considered a disturbance factor in the Water Quality function.

In the assessment procedure, this element is considered not applicable if disturbance at the site is absent or minimal (condition "a") or if measures have been taken to prevent erosion (condition "b"). Element 4b is factored into the Water Quality FCI only when there is evidence of moderate (condition "c") or substantial (condition "d") disturbance which might cause erosion or the release of sediments or contaminants in an existing wetland and/or planned wetland.

ELEMENT 5b. SURFACE RUNOFF FROM UPSLOPE AREAS (Wetland Erosion)

Directions: Determine to what extent surface runoff from upslope areas contributes to erosion in the wetland including a shoreline bank, if present (e.g., not an apparent contributor, minimal, moderate, or substantial).

Rationale and assumptions: Water quality can be degraded when upslope surface runoff aggravates erosion causing the release of sediments and any associated contaminants in the wetland. Element 5b is distinguished by the consideration of a factor outside the wetland, i.e., upland drainage. Upland drainage can have considerable influence on wetland stability and, consequently, can change a wetland's capacity to perform the water quality function. Unless surface runoff from upslope areas is effectively controlled, the wetland will be subject to sheet and/or rill erosion. An applicable discussion on the effects of upslope drainage is provided in the Element 5a rationale for the Shoreline Bank Erosion Control function.

In the assessment procedure, this element is considered not applicable if surface runoff from upslope areas is not an apparent contributor to wetland erosion (condition "a") or if surface runoff contribution to wetland erosion is minimal due to presence of effective infiltration and drainage controls in adjacent areas (condition "b"). Element 5b is factored into the Water Quality FCI only when surface runoff from upslope areas causes a moderate (condition "c") or a substantial (condition "d") erosion problem in the existing wetland or may threaten the successful establishment of a planned wetland.

ELEMENT 7a. WATER LEVEL FLUCTUATION

Directions: (not applicable to tidal wetlands) Determine if water fluctuation is occasionally drastic causing severe erosion and/or preventing vegetation establishment. Topographic maps should be examined to note presence of impoundments or other potential sources of rapid water release or drawdown. Appropriate information may also be obtained by field observations (evidence of water level fluctuations) and/or by local inquiry.

Rationale and assumptions: Water level fluctuations that cause undermining of a shoreline bank and/or scour in the wetland, also degrade water quality through the disruption and release of sediments and any associated contaminants in the wetland. An applicable discussion on the effects of water level fluctuation is provided in the Element 7a rationale for the Shoreline Bank Erosion Control and Sediment Stabilization functions.

In the assessment procedure, this element is considered not applicable if the wetland is tidal (condition "a"), if there is no fluctuating water level (condition "b"), or if the fluctuating water level causes no or moderate erosion (condition "c"). Element 7a is factored into the Water Quality FCI only when the water level fluctuation can potentially aggravate erosion and cause the release of sediments in an existing wetland and/or threaten the successful establishment of a planned wetland, i.e. when fluctuation is occasionally drastic causing severe erosion and/or preventing vegetation establishment (condition "d").

ELEMENT 9b. SUBSTRATE TYPE

Directions: Determine dominant substrate type from field observations, soils maps, and/or sample cores. The substrate type should be described by the upper surface layer , where there is good surface water-substrate and root contact. The upper surface is generally the top 46 cm (18 inches). It may be shallower (e.g., 15 cm (6 inches)) if the soils are poorly drained or it may be deeper if the vegetation penetrates lower into the soil (e.g., 76 cm (30 inches) for *Phragmites australis*).

Rationale and assumptions: Many of the processes by which nutrients/chemicals are retained or transformed are affected by the chemical and physical properties of the substrate. Unfortunately, there is no one ideal substrate type that can facilitate overall water quality improvement because the processes are determined by different substrate properties (e.g., grain size, iron content, carbon availability). For some nutrients substrate composition is critical (e.g., phosphorous removal), whereas in other cases the substrate maybe relatively unimportant (e.g., sulfur retention).

Element 9b is used to recognize the importance of substrate composition to the water quality function. This simplified assessment examines one basic property of substrate (i.e., grain size); however, it is recognized that the relationship between pollutants and substrate properties are varied and complex. Grain size determines the extent of substrate/water contact; therefore, it describes the general opportunity for water quality improvement. The substrate types are separated into three groups, ranked by their relative capacity for water/substrate contact. Mineral and organic soils provide the greatest opportunity for water quality improvement because they permit more water-substrate contact which maximizes adsorption onto the substrate matrix, chemical precipitation, and bacterial action. Coarse grain materials (e.g., sand, cobble, rubble, and gravel) provide the least opportunity for water-substrate contact, nutrient retention, or chemical transformation because of the rapid movement of water and high conductivity values. Medium sized sand would represent an intermediate substrate grain size, with moderate potential for water-substrate contact.

Much of the literature addressing the influence of substrate on water quality concentrates on the removal of phosphorus by soil sorption processes. Richardson (1985) found that wetland types with predominantly mineral soils and high amorphous aluminum content have higher capacities to retain phosphorous than organic soils. Although the phosphorous adsorption potential in wetlands may be predicted from the extractable amorphous aluminum content of the soil (Richardson 1985), this information is not incorporated in EPW because it focuses on the removal of a specific nutrient. Also, soil testing is beyond the scope of this rapid assessment procedure. For more information regarding substrate composition and the removal or specific pollutants, refer to section 6.5 and literature on the effects of wetlands on water quality (e.g., Nixon and Lee 1986, Reed et al. 1988, Hammer 1989, Johnston 1991).

In the assessment procedure, Element 9b is always factored into the Water Quality FCI because the conditions represent a full range of possible substrate types and their potential contribution to water quality improvement. Fine mineral soils or soils with high organic content (condition "a") would have the greatest potential to remove pollutants. Course sand, bedrock rubble, or cobble (condition "c") have little opportunity for water-substrate contact and would contribute least to water quality improvement. Medium sized sand represent an intermediate condition (condition "b") with moderate pollutant removal potential.

Note: This element may require modification, particularly if the planned wetland is being designed to target the removal of a specific nutrient or contaminant. For example, if the goal is to provide phosphorus removal, then organic soil could be moved to the intermediate condition (condition "b") to reflect that it is has a relatively low phosphorous sorption capacity compared to mineral soils.

ELEMENT 10b. PLANT (BASAL) COVER (Entire Wetland)

Directions: Determine by visual estimate the percent plant (basal) cover in the upper shore zone during the growing season for the entire wetland area (Figure A.3, p. A 26). Include rooted vascular aquatic beds in estimate. Consider only those parts of the vegetation which have contact with water flow.

Rationale and assumptions: Plants generally improve water quality by (1) reducing flow velocity and modifying currents to increase sedimentation (e.g., Brown and Stark 1989, Thorne 1990, Watts and Watts 1990), (2) mechanically filtering suspended particles as water passes through substrate and root masses (Tchobanoglous and Culp 1980, Reed et al. 1988, Watson et al. 1989), and (3) the uptake and of nutrients and metals (e.g., Simpson et al. 1983, Richardson 1985, Thut 1989).

The degree to which plants encourage sediment accumulation depends upon the density of plant cover (e.g., Gleason et al. 1979, Kao 1980, Harlin et al. 1982, Brown 1985a). Gearheart et al. (1984) found that > 75% plant cover provided relatively efficient and consistent removal of suspended solids, biochemical oxygen demand, and fecal coliforms compared to lower coverages; thus they recommended ≥ 75% plant coverage for the design of wetlands for wastewater treatment. Since the bulk of nutrients adsorbed into plants is released (Kadlec and Kadlec 1979, Johnston 1991), EPW assumes that the importance of plant cover for the Water Quality function is related to its role in water-surface interaction processes (e.g., sedimentation and mechanical filtering).

Water quality improvement can be achieved by reducing flow velocity to increase sedimentation. This element asks for an estimate of cover/abundance for those portions of the vegetation which are directly involved in energy dissipation (e.g., wave, current). It is assumed that the higher the percent cover, the greater the sedimentation rate, and the greater the potential to enhance water quality.

Authors often associate sedimentation with water quality benefits. In a report on channel management practices in an agricultural watershed, Karr and Schlosser (1978) emphasized that riparian vegetation improved water quality by reducing nutrient and sediment transport from terrestrial to aquatic systems. The role of vegetation density in improving water quality was demonstrated in a study by Brown and Stark (1989) in a wetland used for tertiary treatment of wastewater in Minnesota. They determined that compared to a spruce tamarack fen section of a wetland, the cattail marsh was more capable of retaining suspended solids, total phosphorous, and total ammonia plus organic nitrogen. Brown and Stark (1989) concluded that the more dense the vegetation, the greater retention capability of the marsh. They also showed that denser vegetation promoted settling of particulate nitrogen, suspended solids, and phosphorous at a greater rate than the less dense, open-water characteristics of the fen. For further discussion on the role of plant cover in sedimentation, refer to rationale for Elements 10b and 10e for the Sediment Stabilization and Shoreline Bank Erosion Control functions since much of the literature cited is also applicable to the Water Quality function.

There are several pathways and storages of nutrient cycling involving macrophytes in wetlands (Figure 6.2, p. 6–3; Figure 6.3, p. 6–4). Some studies demonstrate effective plant uptake and removal of nutrients by vegetation (e.g., Simpson et al. 1983, Thut 1989), while others show the plants to be short-term storages (Kadlec 1987a). The extent of nutrient uptake is species specific and a seasonal phenomenon, making it difficult to generalize about the efficiency of different wetlands. For further discussion on pollutant uptake and release, and decomposition refer to section 6.2.

With regard to the role of epiphytes, these organisms use living plant surface primarily as a neutral substrate for attachment and interchange nutrients with surface water; a small amount of nutrients may be transferred from plant to epiphyte (Cattaneo and Kalff 1979). Wetzel (1983) noted that the epiphytes may also release nutrients to benefit the macrophytes to which they are attached. Thus, this storage of pollutants in plants is, in general, a temporary phenomenon.

It is assumed that even in situations where there is a net release of nutrients to the water, there will be a general improvement in water quality due to the processes of sedimentation and mechanical filtering.

In the assessment procedure, Element 10b is always factored into the Water Quality FCI because the range from a high percent cover (condition "a") to a low percent cover (condition "d") represents all the possible degrees of pollutant removal through sedimentation, filtration, and adsorption provided by vegetation cover in the upper shore zone. The highest percent cover (condition "a") would have the greatest potential to improve water quality. Decreased cover is accompanied by a lower potential, therefore the lower percent cover ranges are assigned relatively lower scores.

ELEMENT 10h. PLANT HEIGHT (Entire Wetland)

Directions: Determine average plant height relative to average high water from visual estimate for vegetation in the entire wetland during the growing season.

Rationale and assumptions: Plants generally improve water quality by reducing flow velocity and wave energy, which increases the rate of sedimentation (e.g., Phillips 1982, 1984; Harlin et al. 1982; Brown and Stark 1989; Thorne 1990; Watts and Watts 1990). The reduction of flow velocity and/or wave energy depends upon the amount of vegetation found both on the horizontal (i.e., Element 10b — *Plant (basal) cover*) and vertical (Element 10h — *Plant height*) planes.

There is a direct relationship between plant height and energy dissipation. Vegetation provides resistance to water flow and waves, but this resistance decreases as water depth becomes greater than vegetation height (Camfield 1977). Based upon a review of several studies, Karr and Schlosser (1978) noted that the capacity of vegetation to reduce sediment transport was effected by plant height relative to water depth. Up to 54% reduction in sediment loads had been recorded when water depths were much less than grass height. Flow high enough to submerge the vegetation reduces "filtering" efficiency ultimately to zero. EPW assumes that a plant is most effective at increasing sedimentation when its height is equal to or taller than the average high water level. For further discussion, refer to Element 10g rationale for Shoreline Bank Erosion Control function which is also applicable to the Water Quality function.

In the assessment procedure, Element 10h is always factored into the Water Quality FCI because the conditions describe the possible range of water quality improvement which can be provided by different plant heights through sedimentation and filtration. The wetland is considered most effective at promoting sedimentation when average plant height is equal to or taller than the average high water level (condition "a"). The wetland is considered to be effective, but not as effective at promoting sedimentation when the average plant height is shorter than the average high water level (condition "c"); therefore, this condition has been assigned a moderate score (i.e., 0.5). A wetland with near equal proportions of vegetation which is "taller than" and "shorter than" the average high water level is considered as an intermediate condition (condition "b"). A wetland is considered least effective at promoting sedimentation when vegetation is absent (condition "d"). In the equation used to calculate the Vegetation Characteristics component, *Plant height* is weighted by *Plant (basal) cover* (10b × 10h) because basal cover dictates the overall capacity of the wetland to promote sedimentation (i.e., a wetland with 90% coverage of plants with a height greater than average water depth will be much more effective at promoting sedimentation than a wetland with only 10% plant cover).

ELEMENT 10I. VEGETATION PERSISTENCE (Entire wetland)

Directions: Determine if vegetation is present during the growing season. If present, note if the vegetation is predominantly persistent, predominantly non-persistent, or if there are approximately equal proportions of persistent and non-persistent vegetation. *Persistent vegetation* is defined as vegetation (woody or herbaceous) that normally remains standing at least until the beginning of the next growing season. *Non-persistent vegetation* is defined as emergent plants whose leaves and stems break down at the end of the growing season so that most above-ground portions of the plants are easily transported by currents, waves, or ice.

Rationale and assumptions: Plants generally improve water quality by (1) reducing flow velocity and wave current to increase sedimentation, (2) mechanically filtering suspended particles, and (3) the uptake and transformation of nutrients (see references cited in Element 10b, above). Persistent vegetation will be more effective at inducing sedimentation (Meyer 1985) and removing pollutants than non-persistent vegetation because it remains standing during both the growing and non-growing seasons. Non-persistent vegetation has less of an opportunity to remove pollutants because most of the aboveground portions are present only during the growing season. The seasonal dieback of vegetation may be important to the water quality function since vegetation cover may be absent during the period of most significant erosion (Thorne 1990) or high sediment/pollutant load.

Richardson (1985) noted that rooted emergents serve as short term sinks because they assimilate large quantities of phosphate and then rapidly release 35–75% of plant phosphorus after tissue death. The value of some species for water quality improvement may then be dependent upon decomposition rates, i.e., the more rapid the decomposition rates, the quicker the release of nutrients to the water. In general, non-persistent vegetation decomposes more rapidly than persistent vegetation. Van der Valk et al. (1979) noted that fallen litter will accumulate phosphorus after an initial period of loss due to leaching. Litter that decomposes slowly (e.g., persistent vegetation) tends to accumulate greater quantities of phosphorus and facilitate the removal of phosphorus from the system by burial.

In the assessment procedure, Element 10k is always factored into the Water Quality FCI because the conditions describe the possible range of water quality improvement which can be provided by different degrees of vegetation persistence through sedimentation and filtration. A predominance of persistent vegetation is considered to be the most effective at promoting sedimentation (condition "a"). Non-persistent vegetation is considered effective, but not as effective at promoting sedimentation (condition "c"); therefore, it has been assigned a moderate score (i.e., 0.5). Those wetlands with near equal proportions of persistent and non-persistent vegetation are considered as an intermediate condition (condition "b"). A wetland is considered least effective at promoting sedimentation when vegetation is absent (condition "d"). In the equation used to calculate the Vegetation Characteristics component, *Vegetation persistence* is weighted by *Plant (basal) cover* (10b × 10l) because basal cover dictates the overall capacity of the wetland to promote sedimentation (i.e., a wetland with 90% coverage of persistent vegetation will be more effective at promoting sedimentation than a wetland with only 10% plant cover).

ELEMENT 14c. WETLAND SLOPE

Directions: Determine if wetland slope is stable with or without vegetation. Look for signs of slope instability, e.g., evidence of scouring, a net loss of shore sediments, development of a shoreline bank, or gullies. Note that there is no standard slope which can be used as a guide for determining stability. A determination of adequate slope depends upon several factors (e.g., sediment composition, soil erosivisity, wave climate, and current velocity) and must be made based upon local site conditions.

Rationale and assumptions: If the wetland slope is unstable water quality can be degraded by erosion which causes (1) the release of sediments and associated pollutants into the water and (2) a decrease in vegetation which otherwise functions to increase sedimentation. It is assumed that when the wetland slope is stable the wetland may reach its potential for the water quality function. Refer to Element 14c rationale under the Sediment Stabilization function for discussion on wetland slope which is also applicable to the Water Quality function.

In the assessment procedure, Element 14c is always factored into the Water Quality FCI because the conditions represent the range of slope conditions and their potential affects on water quality function. A slope which is stable with and/or without vegetation (condition "a") or stable due to the presence of debris (condition "b") will maintain the wetland's capacity to remove pollutants. By contrast, a wetland with an unstable slope (condition "c") will result in the release of sediments and associated pollutants, thus impairing an existing and/or planned wetland's capacity to improve water quality.

ELEMENT 15. HYDROLOGIC CONDITION

Directions: Determine hydrologic condition of the wetland site from field examination, maps, and/or aerial photographs. If the site is a tidal wetland, note if it is predominantly low marsh, high marsh, or consists of approximately equal proportions of high and low marsh. If site is a non-tidal wetland, determine its position in the landscape and select the most appropriate condition from those depicted in Figure A.4 (p. A 20) (e.g., site including both semipermanently and permanently flooded wetland areas, which is part of an expansive wetland associated with a braided stream would match the condition "e" in Figure A.4).

Rationale and assumptions: Several authors identify hydrology as the primary determinant of the water quality function (e.g., Gosselink and Turner 1978, van der Valk et al. 1979, Mitsch and Gosselink 1986, Kadlec 1987b). Hydrologic and geomorphic conditions act together to define a wetland setting, which thereby determines the wetland capacity to retain or transform different types of nutrients/pollutants. There are several hydrologic and geomorphic factors which influence the water quality improvement function including (a) hydroperiod, (b) frequency of inundation, (c) flood duration, (d) ratio of water volume to wetland surface area, (e) direction of surface water flow, (f) wetland shape, (g) surface contours of the landscape, (h) substrate, and (i) groundwater movement.

Several studies have examined an individual factor and identified the processes controlling the retention or transformation of specific nutrients/pollutants. For example, work on hydroperiod has shown that wetlands that have predominantly saturated substrates with strongly reduced conditions enhance sulfate reduction, storage and volatilization (Faulkner and Richardson 1989). Wetlands that alternate between reducing and oxidizing conditions (e.g., typically saturated substrates that are periodically exposed) maximize the removal of phosphorus and nitrogen (Reddy and Patrick 1975, 1976; Tilton and Schwegler 1979; Faulkner and Richardson 1989).

The relationships between water quality and specific hydrologic factors is complex. Even a basic understanding of how wetlands influence water quality requires detailed examination of the water budget, nutrient budgets, or the ecosystem mass balance for each of the different wetland types (e.g., Simpson et al. 1978; Whigham and Bayley 1979; Peterjohn and Correll 1984; Nixon and Lee 1986; Mitsch and Gosselink 1986; Kadlec 1987a; Kadlec and Hammer 1988). There is no one ideal hydrologic condition that can facilitate overall water quality improvement. This is best illustrated in the research on the use of wetlands for wastewater treatment which shows how pollutant removal depends upon the individual pollutant and a wide variety of wetland factors (e.g., Kadlec and Kadlec 1979, Godfrey et al. 1985, Reed et al. 1988, Hammer 1989).

Element 15 is included in EPW to recognize the importance of hydrologic condition to the Water Quality function. However, since the relationship between pollutants and hydrology is so complex, this assessment simply considers the basic characteristics that maximize contact between surface water and the wetlands surface area. The 15 conditions (i.e., conditions a–k) are designed to include the possible range of tidal and non-tidal wetland settings. While not directly identified, many of the aforementioned influencing factors are implied in the wetland condition descriptions/illustrations. Other factors were intentionally excluded in this element and function because of the lack of a simple direct method of measurement (e.g., groundwater movement), or the need to select a condition which would favor the removal of one pollutant over another (e.g., If hydroperiod were used, it would require a decision between alternating oxidizing and reducing conditions which promotes removal of nitrogen and phosphorus, and a permanently flooded condition which favors sulfur removal).

Tidal wetlands are considered separately from non-tidal wetlands. Tidal low marsh is assigned the highest score because the frequency and length of inundation provides the greatest opportunity for water quality improvement since the extent of water-wetland contact is maximized. Subject to periodic inundation, the tidal high marsh provides a moderate opportunity for water-wetland contact (score = 0.5). A site with approximately equal proportions of high and low marsh represents an intermediate condition (score = 0.7).

Non-tidal wetlands are described by eight basic hydrologic conditions (Figure A.4, p. A 20–21). Depressional wetlands with no outlet (conditions "a" and "b") are considered not applicable to the Water Quality function because there is no potential for downstream export. The effect of water quality fluctuations on on-site organisms (e.g., fish and wildlife) is not considered. There is no simple method to assess water quality in a closed depressional wetland. Water chemistry of closed wetlands, such as prairie potholes, change annually in response to climatic variation and groundwater interactions (e.g., La Baugh 1989). Surface water quality may be improved or may be subject to degradation through eutrophication and concentration of toxicants because of the long residence time of water.

Non-tidal conditions "c" through "h" all are considered applicable to the Water Quality function due to the presence of an outlet and downstream export. Sites located in wetlands with constricted outlets (conditions "c" and "d") provide the most opportunity for water-wetland contact and water quality improvement. Condition "c" is assigned a slightly higher score (i.e., 1.0) than condition "d" (score = 0.8) because is contains a pond which, due to the longer detention time, enhances sedimentation. A constriction acts to stop or slow the flow of water through the wetland. The potential for water quality enhancement is greater if water is retained long enough to allow sedimentation and adsorption of pollutants by wetland soils and vegetation. Impounded wetlands were found to export less particulate matter and nutrients than wetlands without impoundments in both freshwater non-tidal (McDowell and Naiman 1986) and salt water tidal (McKeller et al. 1987) wetlands. For additional discussion refer to Element 17 (*Detention time*).

The least opportunity for water quality improvement is provided by conditions "g" and "h" (scores = 0.1). Water-wetland contact is minimized because the wetland fringe (e.g., one year flood elevation) is relatively narrow compared to the open water/stream width and the outlet permits unrestricted outflow with little potential for water detention and sedimentation. Conditions "e" and "f", also with an unrestricted outlet, represent an intermediate condition (scores = 0.3) with increased potential for water quality improvement due to the relatively broad wetland fringe.

In the assessment procedure, this element is considered not applicable if the wetland has no outlet (conditions "a" and "b"). Element 15 is factored into the Water Quality FCI when an outlet is present. A tidal wetland site's capacity to remove and retain pollutants is considered to be most effective when it is predominantly low marsh (condition "i"), least effective when it is predominantly high marsh (condition "k"), and moderately effective when it contains approximately equal proportions of high and low marsh (condition "j"). A site associated with a non-tidal wetland with a constricted outlet is considered to be the most effective when it retains water (condition "c") and nearly as effective when it does not retain water (condition "d"). A site associated with a non-tidal wetland with no constricted outlet is considered least effective when the wetland fringe is narrow (conditions "g" and "h") and moderately effective when the wetland fringe is broad (conditions "e" and "f").

Note: This element may require modification if the wetland is being designed to target the removal of a specific nutrient or contaminant. For example, if a planned wetland is being designed for phosphorus and nitrogen removal, then the user may want to modify the conditions and scores to reflect differences in hydroperiod. Then, a condition with alternating oxidizing and reducing conditions would be assigned a relatively high score and a permanently flooded condition would be assigned a low score.

ELEMENT 16a. WETLAND WIDTH

Directions: Determine if the site has a low potential to improve water quality because of its narrow width. If yes, provide a brief explanation.

Rationale and assumptions: The width of wetlands can affect water quality by two processes: (1) increased vegetation width increases frictional drag on waves and currents to abate erosion and increase sedimentation and (2) increasing surface area (vegetated or non-vegetated), increases the water interaction with soil and vegetation, which improves filtration and anaerobic breakdown (when the soil is not frozen). These processes are addressed in the Water Quality function rationale sections for Elements 10b, 10h, 10l, 15, 18, and 19.

Some studies suggest that the wetland's effectiveness in water quality improvement is related to width and that this effectiveness is independent of whether vegetation is present or not. In a controlled experiment comparing vegetated and non-vegetated artificial marsh plots, Thut (1989) found that the presence of plants had no substantial effect on removal efficiencies for total suspended solids, biochemical oxygen demand, and organic nitrogen. Thut (1989) suggested that filtration and anaerobic breakdown were the removal mechanisms for these pollutants. In a study of a freshwater marsh used for wastewater treatment, Gearheart et al. (1984) found that the majority of suspended solids, biochemical oxygen demand, and fecal coliforms were removed in the first 15.2 m (50 ft) from the inflow. In a study of riparian areas in four watersheds of North Carolina, Cooper et al. (1986) found that riparian strips as narrow as 16 m (52 ft) were effective in removing nitrate nitrogen. Cooper (1986) et al. believed that the removal of nitrate nitrogen through assimilation by riparian vegetation accounted for a low percentage of the nitrogen removal because of the high amount of nitrogen moving through small riparian areas. He attributed the nitrogen loss primarily to denitrification of surface water as it moved through the poorly drained riparian soils/sediments which were conducive to denitrification, i.e., had low oxidation reduction potential and high organic matter (2–46%).

Several studies on the use of naturally occurring and constructed wetlands for wastewater treatment have reported optimal length to width ratios for pollutant assimilation (e.g., Dinges 1979, Stowell et al. 1985, Knight 1987, Watson and Hobson 1989). Refer to section 6.5 for discussion and recommendations on wetland length to width ratio.

Element 16a is included in the assessment procedure to recognize the importance of wetland width to the water quality function. While there are studies demonstrating the importance of wetland width to water quality improvement, there is little data to support the selection of a minimum or maximum criteria and relative scores for these criteria. For this reason, no thresholds are used. Element 16a is designed to highlight those few cases when the user has reason to believe that the capacity of a wetland to improve water quality is severely limited by its narrow width. The decision on minimum width is left up to the discretion of the user who is familiar with local conditions.

In the assessment procedure, this element is considered not applicable if the wetland width is judged wide enough to provide some water quality improvement (condition "a"). Element 16a is factored into the Water Quality FCI only when it has been determined that a site has a low potential to improve water quality because of its narrow width (condition "b").

ELEMENT 17. DETENTION TIME

Directions: Calculate detention time, if feasible (**detention time** = storage volume/outflow rate). Detention time for some wetlands may be estimated from available hydrological data (e.g., information on flooding events, frequency, and duration), inferred from vegetation/soil characteristics, and/or determined by field observations or local inquiry.

The information needed to estimate detention time may not be readily available for many planned wetlands. This element is most critical in wetlands designed for wastewater treatment or stormwater management, but in some cases it may be prudent to estimate detention time, particularly if the wetland replacement goal focuses on the water quality function. The decision to calculate detention time depends on many factors, including time and cost constraints.

Rationale and assumptions: Nutrient and/or contaminant removal efficiencies of a wetland is partially dependent on detention time (Livingston 1989). Water in a wetland must be retained long enough to allow precipitation and adsorption of pollutants by wetland soils and vegetation. The importance of detention time is documented in literature on the use of wetlands for wastewater and stormwater treatment. It is assumed that the same principle is applicable to other wetlands where water may be retained for extended periods of time. The recommended minimum detention times vary greatly (e.g., 15 hours to 14 days) depending upon the effluent type and desired removal efficiencies (Table 6.1, p. 6–26).

Thut (1989) tested the pollutant removal efficiency of four marsh types (i.e., cattail (*Typha latifolia*), reed (*Phragmites australis*), cordgrass (*Spartina cynosuroides*), and no plants) and detention times of 6 hours, 15 hours, and 24 hours. Percent removal efficiencies for total suspended solids (52–68%), biochemical oxygen demand (32–41%), ammonia (11–88%), organic nitrogen (16–29%), and phosphorus (9–31%) were found to be a function of detention time. While detention times of 24 hours were more effective than 6 hours, the increment of improvement between 15 and 24 hours was considered slight. Thut (1989) concluded that a wetland designed for about 15 hours detention would be adequate for the treatment of pulp mill effluent.

Bavor et al. (1989) developed a simple first-order kinetics model which included detention time as a variable for use in predicting pollutant removal from wastewater. Acceptable model verification was obtained for nitrogen species, coliforms, and other pollutants. Bavor found the best correlations between detention time and reductions in fecal coliforms, total kjeldahl nitrogen, and ammonium nitrogen.

Element 17 is used to recognize the importance of detention time to the water quality function. The selected range of detention times (< 12 hours, 12–24 hours, and ≥ 24 hours for 1 year storm) is based upon the lower detention times recommended for urban runoff. It is assumed that these recommended detention times reflect the goal for general water quality improvement.

In the assessment procedure, this element is considered not applicable if the wetland is tidal (condition "a"). If the information is not available, condition "b" applies. Element 17 is factored into the Water Quality FCI only when the detention time can be estimated. A wetland is considered to have the greatest potential to remove pollutants if there is data demonstrating relatively high removal efficiencies (condition "c") or the estimated detention time is ≥ 24 hours for a 1 year storm (condition "d"). Pollutant removal efficiency is considered moderate when detention time is 12–24 hours (condition "e") and relatively low when detention time is < 12 hours (condition "f").

Note: This element may require modification if the wetland is being designed to target the removal of a specific pollutant or the treatment of a specific effluent type (e.g., wastewater, urban runoff, mine tailings).

ELEMENT 18. SHEET VS. CHANNEL FLOW

Directions: (not applicable to tidal wetlands). Determine if water flow within or through the wetland is predominantly sheetflow, occasionally sheetflow, or channel flow by field observations and/or by local inquiry.

Rationale and assumptions: When water flow through the wetland is predominantly sheetflow, it has a greater potential to improve water quality because of (1) increased frictional resistance which increases sedimentation and (2) increased surface area which increases the water interaction with soil/vegetation (i.e., greater contact with surfaces). As water moves more by sheet flow than by channel flow, the flow rate is decreased. The resulting decrease in velocity and presence of vegetation promotes the fallout of suspended particulates from the surface water. This process generally benefits water quality through the removal of sediments and adsorbed contaminants such as nutrients, pesticides, heavy metals, and other toxics (Boto and Patrick 1979). Channelization of flow through wetlands has been found to increase runoff and decrease the capability of a wetland to retain pollutants such as total suspended solids, total phosphorus, and total nitrogen (Brown 1985b).

The greatest pollutant removal efficiency of detention basins and wetlands used for stormwater treatment systems occurs when uniform sheet flow is maintained across the wetland (Meyer 1985, Brown 1985a). This principle is used in the design of wetlands for stormwater treatment. For example, the design and performance standards for wetland management systems in Florida's Department of Environmental Regulation specifies that stormwater must be discharged into the wetland via sheet flow so that channelized flow is minimized (Livingston 1989).

In the assessment procedure, this element is considered not applicable if the wetland is tidal (condition "a"). Element 18 is factored into the Water Quality FCI only when the wetland is non-tidal. A wetland with predominantly sheetflow is considered to be most effective (condition "b") and a wetland with predominantly channel flow is considered least effective (condition "d") for pollutant removal. A wetland with occasional sheetflow is considered an intermediate condition (condition "c").

ELEMENT 19. WATER DEPTH

Directions: Estimate average depth of surface water for periods when surface water is present.

Rationale and assumptions: As water depth in a wetland decreases, there is greater contact surface available per unit volume of water, and a greater opportunity to improve water quality by processes associated with water and soil/vegetation interaction (e.g., sedimentation, filtration, anaerobic breakdown, denitrification). Measurements of water volume are not always available, therefore, the estimate of average water depth is used as a surrogate for the surface area/water volume ratio.

It is assumed that the lower the average depth, the greater the opportunity to enhance water quality. The 0–91 cm (0–36 inch) water depth range used in this element covers the general range of inundation which emergent vegetation can tolerate. If present, emergents are important to the sedimentation process. This range also corresponds with the water depths recommended by several authors in the design of wetlands for water treatment (Table 6.2, p. 6–28).

In the assessment procedure, this element is considered not applicable if the wetland is tidal (condition "a"). Element 19 is factored into the Water Quality FCI only when the wetland is non-tidal. The lowest average water depth (condition "b") would have the greatest potential to improve water quality. Increased average water depth is accompanied by a low potential, therefore the higher depth ranges are assigned relatively lower scores.

6.5 Additional Design Considerations

The following section outlines design considerations, including EPW elements and additional factors, which are to be considered for the Water Quality function. The discussions are brief. If the wetland is being designed for the removal of specific pollutants, refer to current literature and provide necessary engineering calculations (e.g., detention time).

Factor	Remarks
PHYSICAL FEATURES	
Water contact with toe of bank (Element 1a)	Design the planned wetland to reduce or eliminate water contact with the toe of the bank. A common technique in tidal wetlands involves creating (or restoring) new elevated shores along the bank (Garbisch and Garbisch 1994). Less frequently, banks are eliminated through grading to create new shores which are largely above MHW (Sharp and Vaden 1970).
Disturbance (Element 4b)	Disturbance, especially herbivory, is a major concern during the initial establishment of planned wetlands. The recommended solution is the construction of an exclosure fence at the time of planting. Exclosure fences have proven effective in excluding geese, cattle, and nutria (e.g., Webb 1982, Conner and Flynn 1989, Garbisch and Garbisch 1994).
Surface runoff from upslope areas (Element 5b)	Determine the potential for damage to the wetland from runoff. Consider that minor physical alteration of the planned wetland site and adjacent upland areas through the operation of construction equipment may result in sheet and rill erosion (gullies) in the wetland. Upland runoff should be managed by filling of surface cracks and the construction of a swale to direct stormwater to one discharge point. Also, disturbed and exposed soils should be stabilized (e.g., placement of mulch, seeding, or planting).

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Factor	Remarks
Substrate (Element 9b)	For general water quality improvement use mineral or organic soils because they permit more water–substrate contact. Substrate may be important for the removal of specific pollutants (refer to nutrient/chemical removal discussions). Under certain conditions, substrate may be relatively unimportant, depending on the specific pollutant removal needs. Steiner and Freeman (1989) noted that in wetlands constructed for wastewater treatment, substrate has little impact on suspended solids and organics removal for surface flow (SF) or subsurface flow (SSF) systems. In both systems the major removal mechanisms are sedimentation and filtration. While gravel is ranked in Element 9b as having minimal capacity to improve water quality, it may be a preferred substrate under certain conditions. Some "success" has been reported in using gravel-bed systems for treating wastewater (e.g., Brix 1987, DeBusk et al. 1989, Brix and Schierup 1989). The ability of some wetland systems to treat wastewater has been improved by growing emergent plants in gravel beds to stimulate uptake and create suitable conditions for the oxidation of the substrate (Gutenspergen et al. 1989). Gersberg et al. (1989) demonstrated the removal of a wide variety of chemical and biological contaminants from wastewater in controlled experiments using artificial wetlands vegetated with cattails (*Typha spp.*), bulrushes (*Scirpus spp.*), and reeds (*Phragmites australis*) in a gravel substrate. Steiner and Freeman (1989) recommended the use of gravel and/or sand substrate for most subsurface flow (SSF) wetland systems used for wastewater treatment.
Wetland slope (Element 14c)	Design the planned wetland so that it is stable with and/or without vegetation. There is no standard slope which can be used as a guide for determining stability. A determination of adequate slope depends upon several factors (e.g., sediment composition, soil erosivisity, wave climate, and current velocity) and must be made based upon local site conditions.

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Factor	Remarks
Wetland width (Element 16a)	The planned wetland width depends upon several factors, including site characteristics and construction constraints. There appears to be no standard wetland width which is optimal for water quality improvement. A width of approximately 15 m (50 ft) was found to be effective in reducing suspended solids, biochemical oxygen demand, and fecal coliforms in a freshwater marsh (Gearheart et al. 1984) and nitrate nitrogen in riparian areas (Cooper et al. 1986). Intuitively, it seems that very narrow strips of wetland vegetation will contribute little to water quality enhancement; however, Oakland (1983) reported a significant removal of several pollutants from stormwater which passed through a relatively narrow (i.e., 10 ft wide × 100 ft long × 1 ft deep) grass swale.
Wetland length to width ratio .	Several studies on the use of naturally occurring and constructed wetlands for wastewater treatment have reported optimal length to width ratios for pollutant assimilation. This ratio typically varies from 3:1 to 10:1, although some studies suggest that ratios approaching 1:1 may be more appropriate for certain removals (Tchobanoglous 1987). Knight (1987) calculated a 2:1 optimal ratio for a hypothetical freshwater wetland, based upon an observed relationship between loading and removal rates for organic matter and total nitrogen. Dinges (1979) in a review of water hyacinth systems in Texas, recommended a ratio grater that 3:1. Gearheart et al. (1984) found a 10:1 ratio provided acceptable and consistent removal efficiencies in a freshwater treatment system in California. Stowell et al. (1985) used a larger 12:1 ratio in a hyacinth system, but proceeded to recommend an even greater ratio of 15:1. Watson and Hobson (1989) noted that in wetlands constructed for wastewater treatment, surface flow systems are usually large (e.g., 10:1 or greater) to insure plug flow conditions and minimal short circuiting. MDNR (1987) recommended a ratio of 2:1 to reduce short circuiting in the design of shallow stormwater wetlands. Watson and Hobson (1989) recommended that in wetlands designed for wastewater treatment, the ratio for subsurface systems be less than 3:1 for most gravel beds and less than 1:1 for subsurface soil beds. In summary, a ratio range of 2:1 to 15:1 appears to cover the reported range of recommended optimal ratios for wetlands constructed for wastewater and stormwater treatment. Ratios above and below these values may be considered extremes in providing greater and lesser potential for water quality improvement.
Surface area	Maximize surface areas of wetland to improve water quality by processes associated with water and soil/vegetation interaction.

Factor	Remarks
Wetland/watershed ratio	Wetland/watershed size ratio may need to be addressed during site selection for wetlands designed with a focus on the Water Quality function. The greater the percentage of wetlands in the watershed, the greater the potential for water quality improvement (Harrington 1986). To provide adequate pollutant removal efficiencies in wetlands designed for stormwater management, MDNR (1987) recommended that the wetland size be a minimum of 3% of the drainage area. The authors cautioned against using this 3% ratio since none of the other literature reviewed stated a "preferred" threshold. The user is reminded that pollutant removal is determined by many factors including hydrologic condition, substrate, vegetation characteristics, climate (e.g., the potential for freezing), concentration of contaminants in the inflow, etc. The percentage of wetland cover required to effectively remove pollutants may vary considerably. However, the concept of considering wetland/watershed ratio is valid. In some drainage basins, the design goal may be to add acreage and increase total wetland acreage to achieve a higher cover of wetlands in the watershed. If the watershed already has a relatively high percent wetland cover, it may be preferable to choose an alternative site in a watershed that has relatively lower percent cover.
Channel features	Streams associated with riverine wetlands should be designed to minimize erosion and sediment transport. Stream energy can be minimized by inclusion of meanders, pools and riffles, concave longitudinal beds, and backwaters (Nunnally and Keller 1979). Pools and riffle streams were found to have lower erosive energy and sediment transporting capacity compared to uniform channels especially during medium and low flow conditions (Stall and Yang 1972). van der Valk et al. (1979) recommended the construction of a network of shallow channels and levees to spread incoming water more evenly over the wetland as a measure to increase nutrient removal efficiency. To promote sheet flow and reduce channelization, baffles may be placed within the wetland (Meyer 1985, Reed et al. 1988).

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Factor	Remarks
HYDROLOGIC FEATURES	
Water level fluctuation (Element 7a)	Drastic water level fluctuations can cause severe erosion and prevent the establishment of a planned wetland. Determine if the site is unsuitable due to extreme water level fluctuations.
Hydrologic condition (Element 15)	Select a site and/or create the conditions which maximize a wetland's capacity to retain and process dissolved or particulate materials to the benefit of downstream surface water quality. Refer to Figure A.4, p. A 20 and Element 15 for illustrated examples and scores which indicate relative capacities.
Detention time (Element 17)	Wetlands constructed for the purpose of improving water quality (e.g., stormwater, wastewater, or pulp mill effluent) should be designed to retain water from storm events long enough to allow precipitation and adsorption of pollutants. Recommended optimum detention times vary greatly (e.g., 15 hours to 14 days) depending upon the type of effluent and the desired removal efficiencies (Table 6.1, p. 6–26). Detention time, which is a function of flow velocity and wetland size, can be lengthened by increasing wetland length, width, or depth. Increasing depth of the wetland or detention basin may increase the potential detention time for a given velocity; however, it is not recommended because it lowers pollutant removal efficiency (Hammer and Kadlec 1983).
Outflow regulation	The outflow may be designed for desired water depths, detention times, and patterns of flooding and exposure with the goal of managing for the removal of specific pollutants (Tchobanoglous and Culp 1980).
Flushing	Periodic flushing may be used as a management technique to control the accumulation and/or release of specific pollutants (Tchobanoglous and Culp 1980).
Sheet vs. channel flow (Element 18)	Design for predominantly sheetflow to improve water quality because (a) it increases frictional resistance and sedimentation, and (b) increases the water and soil/vegetation interaction.

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Table 6.1.
Recommended detention times for the efficient removal of pollutants

Detention time	Treatment	Wetland type	Reference	Comments
0.6 days (15 hrs)	pulp mill effluent	cattail, reed, cordgrass, and no plants	Thut 1989	Study results: range of removal efficiencies TSS (52–68%), BOD_5 (32–41%), ammonia (11–88%), organic N (16–29%), phosphorus (9–31%)
1 day	urban runoff		Clark et al. 1977	Study: Removal of > 66% sediment, nutrients, and trace metal ions
1 day (1 year storm)	stormwater	shallow freshwater non-tidal marsh	MDNR 1987	Recommended detention time
1 day	organic waste	cattail (*Typha spp.*) or reed (*Phragmites australis*)	Wolverton and McDonald 1981	Study: Removal of 60–90% phenol and m-cresol
1.5 days > 5.4 days	wastewater	shallow marsh: cattail, bulrush, watercress, marsh pennywort, duckweed and grasses	Gearheart et al. 1984	Recommend: 1.5 days for SS; > 5.4 days for BOD, fecal coliforms, and nitrogen removal
2–10 days	wastewater	cattail, and softstem bulrush (*Scirpus validus*) growing in gravel; *Myriophyllum aquatica* in open water	Bavor et al. 1989	Study: Annual mean removal for BOD_5 (95%), SS (94%), total nitrogen (67%), phosphorus (15%)
≥ 5 days	wastewater	emergent marsh	Watson et al. 1989	Recommended for nitrogen removal
6–10 days	wastewater	marsh (e.g., reeds, rushes) and marsh-pond	Tchobanoglous and Culp 1980	Recommended detention time
7 days	wastewater	cattail	Wile et al. 1985	Recommended for nitrogen removal by nitrification
≥ 7 days	wastewater	alluvial floodplain swamp	Brinson et al. 1984	Recommended retention in sediments for inorganic nitrogen removal
7–14 days	wastewater	cattail	Herskowitz et al. 1987, Miller 1989	Study: removal efficiencies
9 days	urban runoff	shallow wet ponds (6–8 ft); shallow emergent marsh (0.5–2 ft)	Harrington 1986	Study: 70% removal of sediment loads
14 days	phosphorus removal		Rast and Lee 1983	Model: results for recommended phosphorus removal

Factor	Remarks
Average water depth (Element 19)	Minimize the average water depth to improve water quality by processes associated with water and soil/vegetation interaction. Recommended water depth for wetlands designed for wastewater treatment are listed in Table 6.2, p. 6–28.
VEGETATION FEATURES	
Plant (basal) cover (Element 10b)	Maximize the percent plant (basal) cover to improve water quality by (a) increasing sedimentation, (b) mechanically filtering suspended particulates, and (c) plant uptake of pollutants.
Plant height (Element 10h)	Plant species which have an average plant height equal to or taller than the average high water level because taller plants are more effective at increasing the rate of sedimentation.
Vegetation persistence (Element 10l)	Plant persistent vegetation because it remains standing during the growing and non-growing seasons, and thus is more effective at increasing the rate of sedimentation.
Plant growth forms	Emergent and floating leaved species have been used in wastewater treatment studies. Many submerged aquatic plants may be unsuitable in a wastewater treatment system because they have low production rates, are often intolerant of eutrophic conditions, and/or have detrimental interactions with algae in the water column (Gutenspergen et al. 1989).

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Table 6.2.
Water depths for wetlands designed for water treatment

Recommended water depth	Treatment	Reference
30 – 46 cm (12 – 18 in) maximum 61 cm (24 in)	wastewater	Watson and Hobson 1989
marsh: 25 cm (10 in) pond: 60 cm (24 in)	wastewater	Tchobanoglous and Culp 1980
30 – 60 cm (12 – 24 in)	wastewater	Gearheart et al. 1984
marsh: < 31 cm (< 12 in) pond: > 102 cm (> 40 in)	stormwater	MDNR 1987
0 – 90 cm (0 – 36 in)	urban runoff	Martin 1988

Factor	Remarks
Plant harvest	Plant harvest, which can be a dominant pathway for the removal of nutrients (e.g., Peterjohn and Correll 1984) is a common management practice in wetlands used for wastewater treatment. However, in some cases harvesting is not regarded as a practical method for nutrient removal (e.g., Wile et al. 1985, Brinson 1985, Tchobanoglous 1987). Plant biomass may be periodically harvested to maintain removal efficiency and prevent saturation (i.e., the point at which the wetland reaches its limit for pollutant removal, after which removal rates are considered quite slow) of the biomass compartment (Sloey et al. 1978, Tchobanoglous and Culp 1980, Kadlec 1985). DeBusk and Reddy (1987) note that plant harvest is a requisite of phosphorus removal and may improve nitrogen and BOD_5 removal in floating aquatic macrophyte treatment systems. Knight et al. (1986) reported that constructed wetlands can provide significant assimilation of both organic matter and total nitrogen without harvesting. Lime or an alkalinity-generating substrate may need to be incorporated to ameliorate effects of acidity and metals during treatment (Girts and Knight 1989). In addition to plant harvesting, plants may be managed by controlled burning of dead plant material during late winter or early spring, or by controlled grazing of marsh plants by such animals as goats (Wolverton 1987).
Root depth	Deeper root zone depth may encourage higher removal efficiencies. Watson et al. (1989) noted that removal efficiencies (BOD_5 and N) for wetlands used for wastewater treatment in Santee, California were greater in the 76 cm (30 in) deep reed (*Phragmites australis*) and 60 cm (24 in) deep bulrush (*Scirpus validus*) marshes compared to the more shallow 30 cm (12 in) deep cattail (*Typha latifolia*) marshes.

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Factor	Remarks
NUTRIENT/CHEMICAL REMOVAL	
Nitrogen removal	If nitrogen removal is desired, the wetland should be designed to alternate between oxidizing and reducing condition (Faulkner and Richardson 1989), i.e., hydrologic regime should include periods of flooding and exposure. Fluctuations between anaerobic and aerobic conditions favor nitrogen removal (Reddy and Patrick 1975, 1976; Tilton and Schwegler 1979; Heliotis and DeWitt 1983). If mineral soils are used to establish the planned wetland, the low carbon availability may limit the system's capability to process nitrogen through denitrification. Faulkner and Richardson (1989) recommended the addition of an available carbon source to overcome this problem in newly constructed wetlands until litter sources are available. Gersberg et al. (1984a) demonstrated that plant biomass, mulched and applied to the wetland surface, was an effective substitute for methanol as a carbon source for denitrification.
Phosphorus removal	Phosphorus is removed by soil sorption processes, therefore, selection of the wetland substrate is critical. To maximize sorption, the substrate should be predominantly mineral soils high in oxalate-extractable aluminum and iron (Richardson 1985). Organic soils have relatively low phosphorus sorption capacity compared to mineral soils (Richardson 1985), therefore they should be avoided if phosphorus removal is desired. The wetland should also be designed to alternate oxidizing and reducing conditions to recharge sorption sites (Faulkner and Richardson 1989). For the removal of phosphorus, Steiner and Freeman (1989) recommended (1) using clay soils with iron and aluminum content, (2) adding sand to the finer textured soils which have high phosphorus removal capacity to improve hydraulic conductivity, or (3) adding iron or aluminum to the substrate and/or the wastewater. Phosphorus removal capability may change with time. While some wastewater treatment studies show continuing ability to remove P (e.g., Winchester et al. 1987), others show substantial decline within a few years (e.g., Brinson 1985).

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Factor	Remarks
Sulfur retention	If sulfur removal/storage is desired, the wetlands should be designed to create and maintain anaerobic, strongly reduced conditions to enhance (1) SO_4^{-2} reduction, (2) storage in organic forms, and (3) volatilization as H_2S or other organic S gases (Faulkner and Richardson 1989). Aerobic soil conditions during dry periods oxidize reduced S to SO_4^{-2} which may be exported later with flood waters (Wieder 1985, Bayley et al. 1986). The hydrologic regime should be permanently flooded or have few periods of exposure.
Metal removal	Substrates influence the removal of metals through ion exchange. The preferred substrate is organic soils with high humic content since they readily remove metallic ions; however, the designer should be made aware that site saturation may limit longevity (Steiner and Freeman 1989). That is, the wetland may reach its assimilatory capacity and no longer provide effective metal removal. Plant harvest is a common practice used for the removal of heavy metals in floating aquatic macrophyte wastewater treatment systems (e.g., Dinges 1979, DeBusk and Reddy 1987). Information on metals removal in wetlands is limited. Some authors report high metal (e.g., lead, copper, zinc, cadmium) removal efficiencies in wetlands treated with wastewater, industrial, or stormwater drainage (e.g., Gersberg et al. 1984b, Best 1987, Martin 1988). However, Watson et al. (1989) cautioned against any firm conclusions because the data were from short-term pilot projects subjected to low application rates.
MISCELLANEOUS	
Wastewater treatment	For the treatment of wastewater, refer to available nutrient behavior models (e.g., Hammer and Kadlec 1983, Kadlec 1987a, Kadlec and Hammer 1988) and other pertinent references addressing pollutant removal mechanisms (e.g., Reddy 1984, Godfrey et al. 1985, USEPA 1985, Reddy and Smith 1987, Reed et al. 1988, Hammer 1989).
Stormwater management techniques	For design criteria and discussion on artificial wetland systems used for stormwater management refer to other pertinent references (e.g., Meyer 1985, Schuler 1987, Martin 1988, Stockdale 1991, Washington State Department of Ecology 1991).

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WATER QUALITY DATA SHEETS

Function weighting area (AREA) = Entire wetland assessment area

		For use in FCI Model		For use in Table A.2 only
ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
Applicability of water quality function (element 15):				
15. Hydrologic condition (Define hydrologic condition of non-tidal wetland site by considering its position in the landscape) **(See Figure A.4 for non-tidal wetland conditions)**	[WQ]*			Assume NA = 0
a. Non-tidal, Condition A.	NA	1.0	0.7	(-)
b. Non-tidal, Condition B.	NA			
c. Non-tidal, Condition C.	1.0			
d. Non-tidal, Condition D.	0.8			
e. Non-tidal, Condition E.	0.3			
f. Non-tidal, Condition F.	0.3			
g. Non-tidal, Condition G.	0.1			
h. Non-tidal, Condition H.	0.1			
i. Tidal, site predominantly low marsh.	1.0			
j. Tidal, site approximately equal proportions of high and low marsh.	0.7			
k. Tidal, site predominantly high marsh.	0.5			

If the score for element 15 = NA, then the Water Quality FCI is considered not applicable (NA) because there is no outlet to convey surface water from the wetland downstream. Continue only if information on elements is required for comparison between wetlands.

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* Denotes function(s) to which element applies: SB = Shoreline Bank Erosion Control; SS = Sediment Stabilization; WQ = Water Quality; WL = Wildlife; FT = Fish (Tidal); FS = Fish (Stream/River); FP = Fish (Pond/Lake); and UH = Uniqueness/Heritage

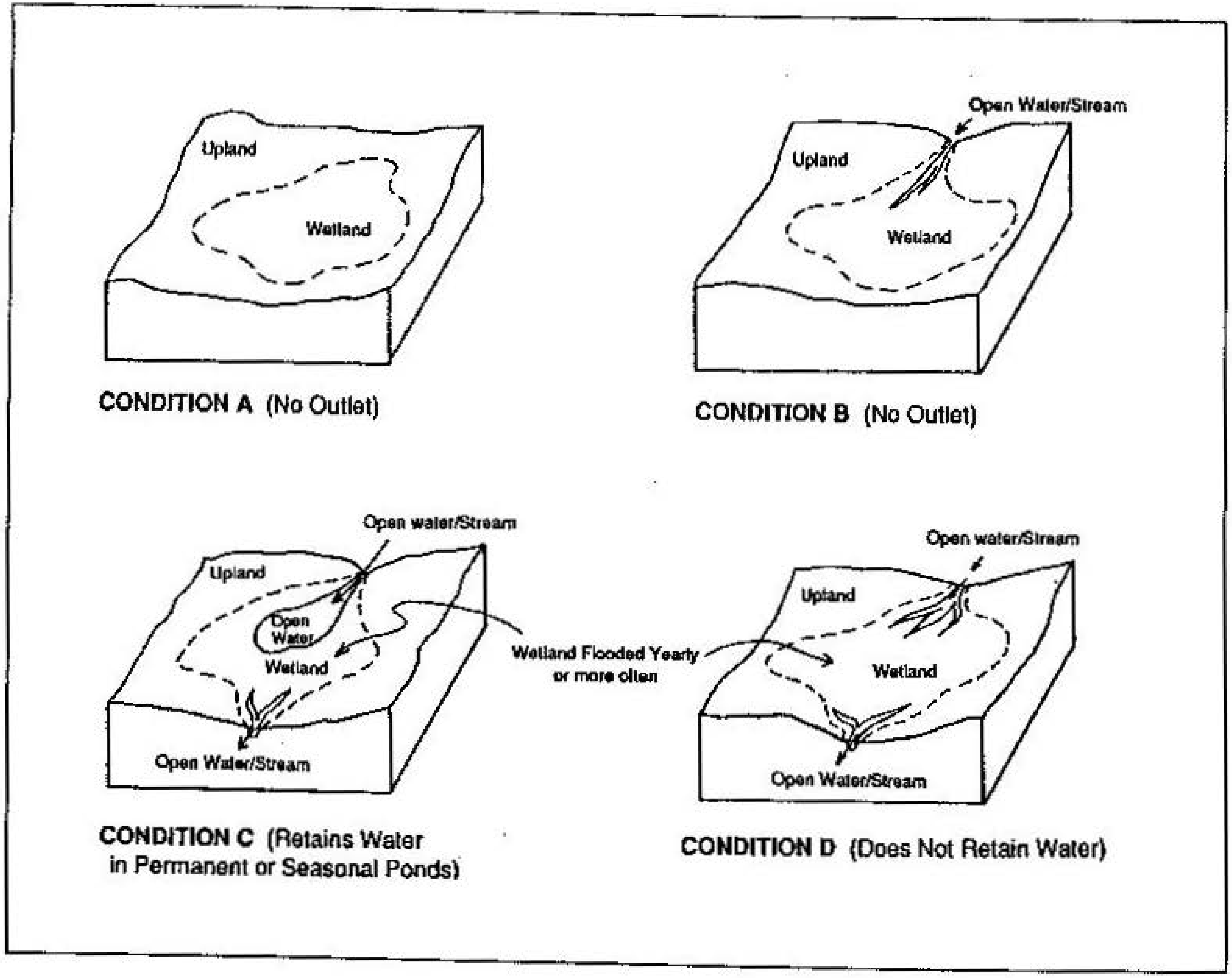
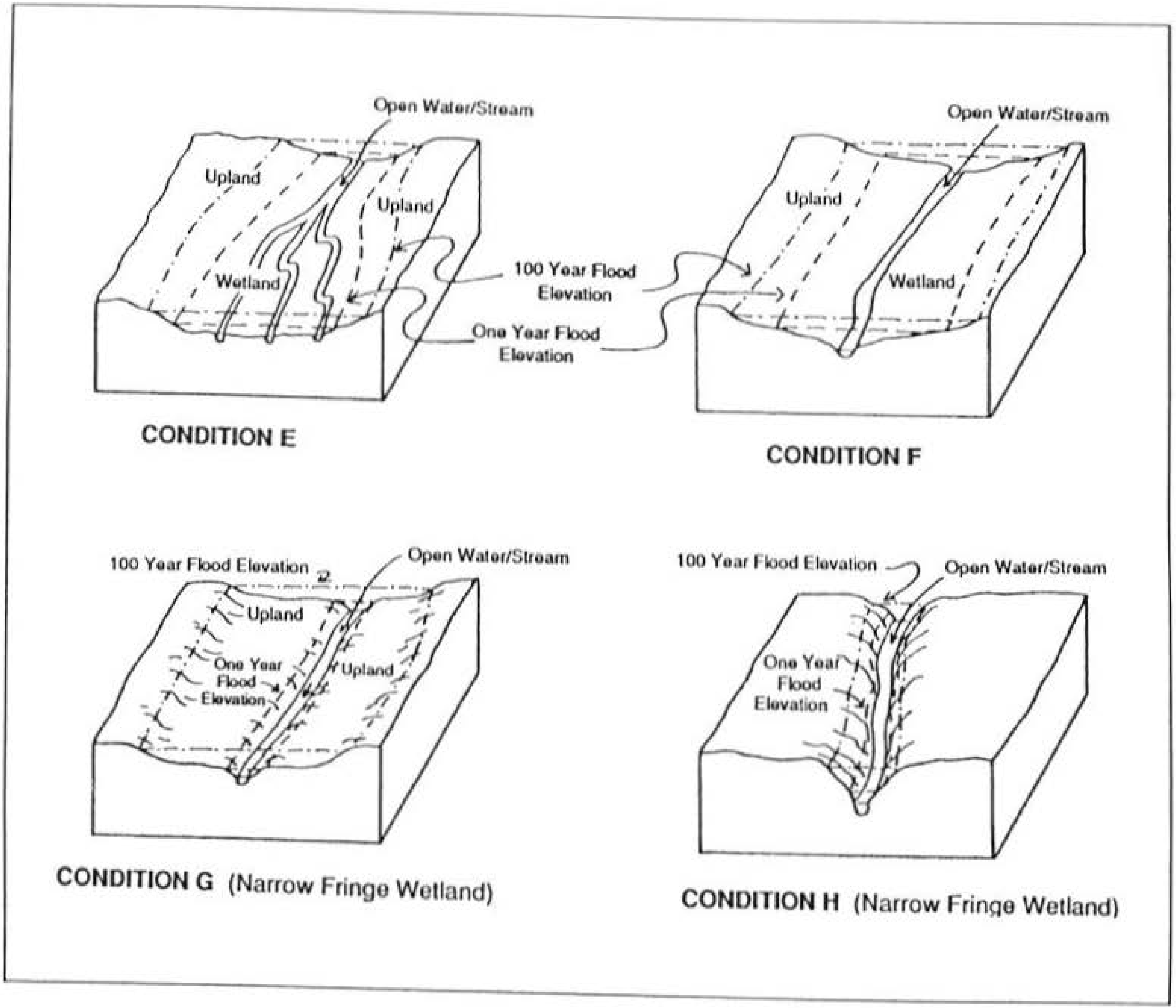


Figure A.4.

Non-tidal hydrologic condition (element 15; modified from Hollands and McGee 1986) - *continued on p. 6–37*



CONDITION E

CONDITION F

CONDITION G (Narrow Fringe Wetland)

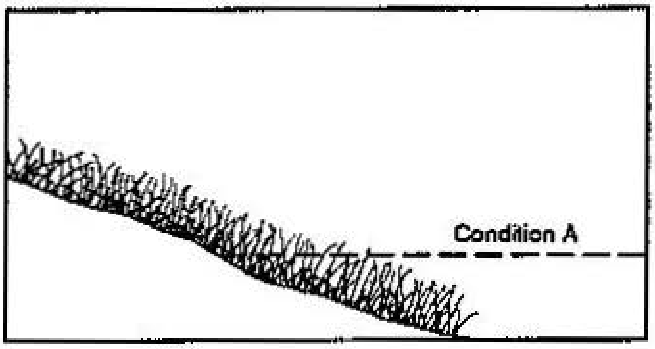
CONDITION H (Narrow Fringe Wetland)

Figure A.4 *(continued)*
Non-tidal hydrologic condition (element 15, modified from Hollands and McGee 1986)

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS: WAA	SELECTED SCORES FOR ELEMENTS: Planned Wetland	DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
Factors limiting the potential for water quality improvement (elements 4b, 7a, and 16a):				
4b. Disturbance at site (Water Quality)	[WQ]			Assume NA = 1.0
(Include observations of debris)				
a. No or minimal disturbance.	NA	NA (a)	NA (b)	NA
b. Potential for periodic disturbance present, but preventative action taken (e.g., installation of exclosure fences for herbivores and/or human disturbance) OR If recently disturbed, soils sufficiently stabilized with mulch, seeding, or planting.	NA			
c. Moderate disturbance (e.g., disturbance of sediments only in portion of site; infrequent grazing by waterfowl; **deposits of debris**).	0.5			
d. Evidence of substantial periodic disturbance which makes substrate unstable (e.g., muskrat eatouts, overgrazing by waterfowl, cattle grazing and trampling, nutria activity, human activity such as the use of off-road vehicles, wetland tilled, filled, logged, clear-cut or excavated and not stabilized by seeding or planting) -OR- **evidence of substantial dumping of debris (e.g., truckload of garbage).**	0.1			
7. Hydroperiod				
7a. Water level fluctuation	[SB, SS, WQ]			Assume NA = 1.0
a. Tidal wetland.	NA	NA (a)	NA (a)	NA
b. No fluctuating water level.	NA			
c. Fluctuating water level causing no or moderate erosion.	NA			
d. Fluctuation occasionally drastic causing severe erosion and/or preventing vegetation establishment (e.g., periodic release from upstream impoundment; reservoir drawdown).	0.1			

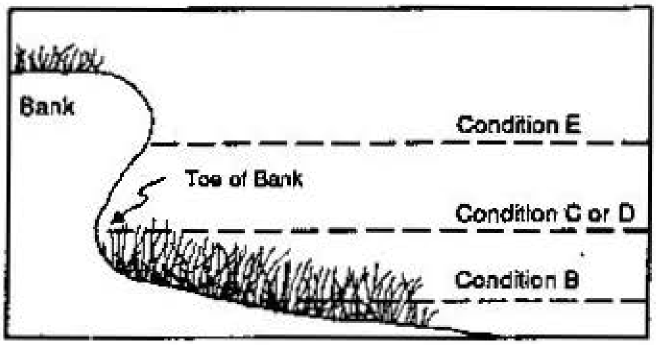
ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
16. Size				
16a. Wetland width	[WQ]			Assume NA = 1.0
Is the site considered to have a low potential to improve water quality because of its narrow width (e.g., wetland < 2 feet wide)?				
a. No.	NA			
b. Yes.	0.1			
If yes explain: ____________ ____________		NA	NA	NA
Substrate-slope characteristics affecting water quality (elements 1a, 5b, and 14c).				
1. Bank characteristics	[SB, WQ]			Assume NA = 1.0
1a. Water contact with toe of bank **(see Figure A.1)**				
a. No shoreline bank.	NA			
b. Infrequent water contact at toe of bank, i.e., no undercutting of bank (e.g., contact once annually or less).	1.0	0.5	1.0	+
c. Occasional water contact at toe of bank (e.g., contact once a month).	0.7			
d. Moderate water contact at toe of bank (moderate undercutting of bank).	0.5			
e. Frequent water contact at toe of bank (severe undercutting of bank).	0.1			

Bank Absent



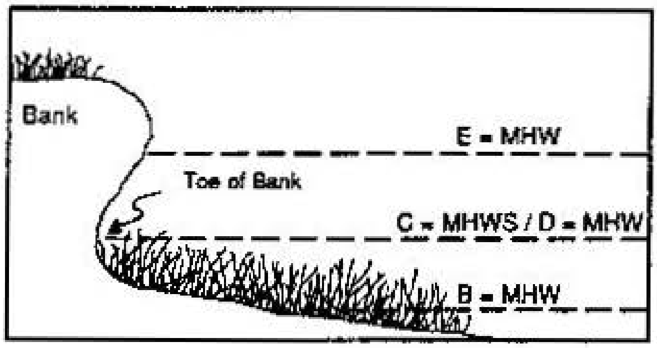
Condition A = No Shoreline Bank

Bank Present



Condition B = Infrequent water contact at toe of bank, i.e., no undercutting of bank (e.g., contact once annually or less).
Condition C = Occasional water contact at toe of bank (e.g., contact once a month).
Condition D = Moderate water contact at toe of bank (moderate undercutting of bank).
Condition E = Frequent water contact at toe of bank (severe undercutting of bank).

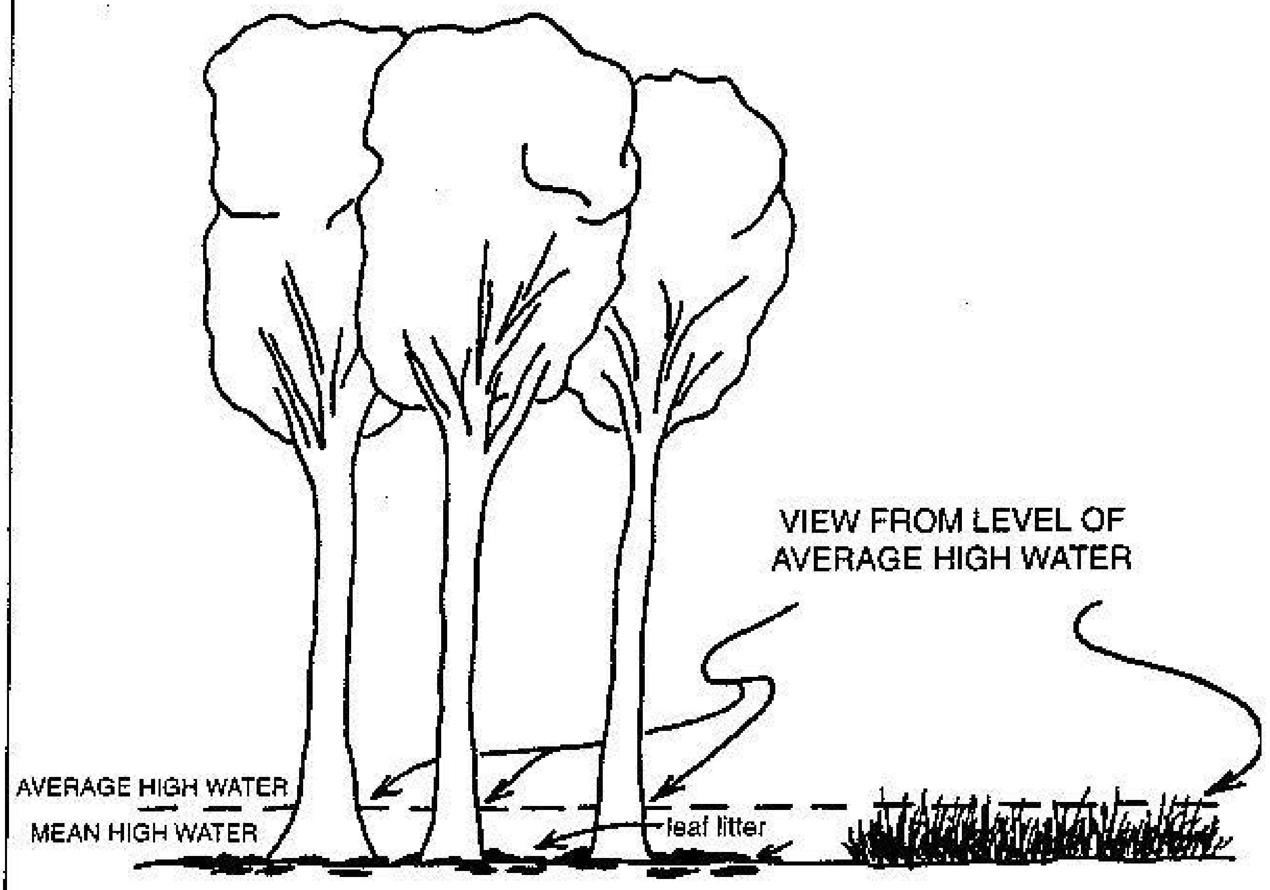
Example = Tidal System



Condition B = Mean High Water (MHW) below toe of bank
Condition C = Mean High Water Spring (MHWS)
Condition D = MHW at toe of bank
Condition E = MHW above toe of bank

Figure A.1.
Water contact with toe of bank (element 1a)

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
5. Surface runoff from upslope areas				
5b. Surface runoff from upslope areas (erosion of bank and wetland proper)	[WQ]			Assume NA = 1.0
a. Surface runoff from upslope areas not an apparent contributor to erosion in the wetland (e.g., No or minimal evidence of surface erosion in upland areas, e.g., unstabilized gullies absent).	NA			
b. Surface runoff contribution to wetland erosion minimal due to presence of effective infiltration and drainage controls in adjacent upslope areas (e.g., surface runoff through wetland conveyed by stabilized gullies; upslope surface cracks filled).	NA	NA (a)	NA (b)	NA
c. Surface runoff from upslope areas causes moderate wetland erosion.	0.5			
d. Surface runoff from upslope areas causes substantial wetland erosion.	0.1			
14. Slope				
14c. Vegetated or unvegetated wetland slope (**Entire wetland**)	[SS, WQ]			
a. Slope is stable with and/or without vegetation (e.g., a slope which is adjusted to the wave climate would be stable even in the absence of vegetation).	1.0	1.0 (a)	1.0 (a)	0
b. Slope is stable. Erosion protection provided by leaf litter and debris.	1.0			
c. Slope is unstable (e.g., an unvegetated slope with gullies; evidence of a net loss of shore sediments beginning the development of a bank; evidence of scouring, i.e., wave ripples.)	0.1			
Vegetation characteristics affecting water quality (elements 10b, 10h, and 10i):				
10. Vegetation characteristics **during growing season**				
10b. Percent plant (basal) cover, including rooted vascular aquatic beds, in **entire wetland**. (Consider only those parts of vegetation which have contact with water flow. **See Figure A.3**)	[SS, WQ]			
a. Cover > 75%.	1.0	1.0	1.0	0
b. Cover 51 - 75%.	0.7			
c. Cover 25 - 50%.	0.3			
d. Cover < 25%.	0.1			



Examples:

	Forest	Emergent Marsh
Percent (Basal) Cover (Elements 10a, 10b, or 10d)	<25%	>75%
Percent Leaf Litter & Debris Cover (Element 10c)	>75%	Ground surface areas almost entirely covered by live vegetation

Figure A.3.
Percent plant cover (elements 10a, 10b, 10c, and 10d)

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA)
		WAA	Planned Wetland	If both scores are NA, record NA
10h. Plant height in **entire wetland**. (Include rooted vascular aquatic beds)	[WQ]			Assume NA = 0
a. Average plant height equal to or taller than average high water level.	1.0			
b. Intermediate condition, i.e., approximately equal proportions of plants equal to or taller -AND- plants shorter than average high water level.	0.8	1.0	1.0	0
c. Average plant height shorter than average high water level.	0.5			
d. Vegetation absent.	0.1			
10i. Vegetation persistence in **entire wetland**. (Include rooted vascular aquatic beds)	[SS, WQ]			
Dominant plant cover:				
a. Persistent vegetation.	1.0			
b. Approximately equal proportions of persistent and non-persistent vegetation.	0.8	0.8	0.8	0
c. Non-persistent vegetation.	0.5			
d. Vegetation absent.	0.1			
Elements defining the extent of water contact with wetland surface (elements 9b, 15, 17, 18, and 19):				
9. Substrate				
9b. Dominant substrate type	[WQ]			
a. Fine mineral soils (e.g., alluvial, alfisol, loam, ferric, clay) -OR- soils with high organic content (> 20% by weight).	1.0	1.0	1.0	0
b. Medium sized sand.	0.5			
c. Course sand, bedrock, rubble, or cobble.	0.1			
15. Hydrologic condition (element already answered above).				

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA)
		WAA	Planned Wetland	If both scores are NA, record NA
17. Detention time (Answer only if hydrologic calculations are available, e.g., site designed for stormwater management).	[WQ]			If NA and/or INA, record both scores.
a. Tidal wetland.	NA			
b. Information not available.	INA			
c. Data available to demonstrate wetland detention time adequate for effective nutrient removal. Explain: ______ ______	1.0	NA	NA	NA
d. ≥ 24 hours for 1 year storms.	1.0			
e. 12 - 24 hours for 1 year storms.	0.5			
f. < 12 hours for 1 year storms.	0.1			
18. Sheet vs. channel flow	[WQ]			If one NA, record both scores.
a. Tidal wetland.	NA			
b. Water flow within or through wetland predominantly sheetflow (e.g., > 50% of the flow enters and passes through wetland as sheetflow).	1.0	NA (a)	NA (a)	NA
c. Water flow occasionally sheetflow (e.g., 10 - 50% of flow is sheetflow; extensively braided channel flow).	0.5			
d. Water flows primarily in channel and rarely spreads over adjacent wetland.	0.1			
19. Average water depth (during periods when surface water is present)	[WQ]			If one NA, record both scores.
a. Tidal wetland.	NA			
b. < 15 cm (< 6 in.).	1.0			
c. 15 - 30 cm (6 - 12 in.).	0.8	NA	NA	NA
d. 30 - 61 cm (12 - 24 in.).	0.6			
e. 61 - 91 cm (24 - 36 in.).	0.4			
f. > 91 cm (36 in.).	0.2			

Calculation of **WATER QUALITY** FCI

PROJECT TITLE: MARLEY CREEK

Selected Scores	(#)	Element

COMPARISON: WAA \ planned wetland (e.g., WAA/planned wetland)

1.0 \ 0.7 (15) Hydrologic condition
If result = NA, then STOP. **Water Quality FCI** is not applicable.
If score selected, then continue with model.

NA \ NA (4b) Disturbance at site (WQ)
NA \ NA (7a) Water level fluctuation
NA \ NA (16a) Wetland width
If all results = NA, record NA.
If score(s) selected, then calculate average for elements with available scores
= NA \ NA Limiting Factors (LF)

0.5 \ 1.0 (1a) Water contact with toe of bank
NA \ NA (5b) Surface runoff (wetland erosion)
1.0 \ 1.0 (14c) Wetland slope
average for elements with available scores = 0.75 \ 1.0 Substrate-Slope Characteristics (SS)

1.0 \ 1.0 (10b) Plant (basal) cover
1.0 \ 1.0 (10h) Plant height
0.8 \ 0.8 (10l) Vegetation persistence
Equation #8 = 0.90 \ 0.90 Vegetation Characteristics (V)

$\frac{SS + V}{2}$ = 0.83 \ 0.95 Wetland Characteristics (W)

If LF ≠ NA: $\frac{LF + W}{2}$ = 0.83 \ 0.95 Wetland Condition (C)
If LF = NA: Wetland Condition (C)

1.0 \ 1.0 (9b) Dominant substrate
If scores different, include in average for WC
If scores same, do not include in average.
1.0 \ 0.7 (15) Hydrologic condition
NA \ NA (17) Detention time
NA \ NA (18) Sheet vs. channel flow
NA \ NA (19) Average water depth
average for elements with available scores = 1.0 \ 0.7 Water Contact (WC)

$\frac{C + WC}{2}$ = 0.92 \ 0.83 **Water Quality FCI**

Equation #8:

$$\frac{10b\ (10h + 10l)}{2}$$

Chapter 7. Wildlife

7.1 Definition

Wetlands function to provide food, cover, and nesting habitat for a variety of wildlife species. The Wildlife FCI provides a relative measure of the degree to which a wetland functions as habitat for wildlife as described by habitat complexity. It is assumed that greater habitat complexity can be expected to attract a higher diversity and/or abundance of wildlife.

The importance of habitat complexity in determining wildlife species diversity and abundance has been demonstrated by several authors (e.g., Chasko and Gates 1982, Harris et al. 1983, Kantrud and Stewart 1984, Swift et al. 1984, Kantrud 1986, Short 1988, Ball and Nudds 1989, Finch 1989). These authors have attributed increases in wildlife diversity and/or abundance to different forms of habitat complexity. For example, MacArthur et al. (1962) concluded that horizontal variability in habitat types (patchiness) was the main factor affecting birds species diversity. Weller and Spatcher (1965) demonstrated that the ratio of emergent vegetation to water was an important determinant in marsh bird abundance. Roth (1976) found that an increase in patches created by the horizontal overlap of additional vegetation layers resulted in increased bird species richness.

Habitat complexity on both horizontal and vertical axes can be described in a variety of ways. According to Ball and Nudds (1989), each axis can be further divided into and described by the following categories:

"(a) the number of patch types ("patch" being a portion of space which is homogeneous with respect to the kind or density of some structural habitat component),

(b) the equitability of representation of these patches (i.e., the ratio of the areas covered by various patch types),

(c) the degree to which these patches are juxtaposed or interspersed, and

(d) the size of the patches."

The assessment describes each axis using the above categories, where possible. For example, the horizontal axis is described by the number of cover types ("a"), ratio of cover types ("b"), and cover type interspersion ("c"). Similar categories are used for vegetation strata which represents the vertical axis and vegetation-water proportions which is an alternative description of the horizontal axis. The size of patches ("d") was not used because it is not feasible to use a vegetation patch size that has broad application to all wildlife species since their habitat requirements are so diverse. The use of any thresholds would be arbitrary. Other features considered in the assessment which increase habitat complexity include the shape of upland/wetland edge, wildlife attractors, and islands.

As a rapid assessment technique, EPW does not require wildlife surveys or sampling; therefore, it cannot provide detailed information on potential changes to the populations of individual species. Also, EPW is designed to provide a general description of habitat which is assumed to be applicable to a wide range of wildlife species. The conditions considered best in this procedure may be optimal for some, but not all wildlife species. If goals for the planned wetland focus on habitat requirements of a specific species or group (e.g., amphibians and reptiles), then the EPW elements and Wildlife FCI model may need modification.

7.2 Explanation of the Model

Fifteen elements are used to assess the Wildlife function. These elements contribute to five components which define the Wildlife FCI (Figure 7.1, p. 7–3).

The Wildlife FCI is a product of two main components: Features Which Reduce Habitat Value and Habitat Complexity. Habitat Complexity is defined by four components: Vegetation Strata, Vegetation Cover Types, Vegetation/Water Proportions, and Physical Features. The Vegetation Strata component describes habitat complexity on the vertical axis. Habitat complexity on the horizontal axis is described by the Vegetation Cover Types and the Vegetation/Water Proportions components. Vegetation/Water Proportions is distinguished as a separate component because of its demonstrated importance in determining wetland dwelling bird abundance/diversity. The Physical Features component describes other features which have been shown to increase habitat complexity and increase wildlife diversity/abundance. The Features Which Reduce Habitat Value component considers those elements which may act separately or in combination to substantially limit the degree to which a wetland provides wildlife habitat. In most situations, this component will be considered not applicable (NA) and will not be used in the calculation of the FCI.

7.3 Rationale and Assumptions

ELEMENT 4c. DISTURBANCE OF WILDLIFE HABITAT

Directions: Determine if there is recent disturbance of wildlife habitat (e.g., wetland tilled, filled, excavated, burned, or mowed) by field observations and/or local inquiry. If site is subject to disturbance, note (a) if the disturbance is moderate or substantial, and (b) if the disturbance is used as a wildlife management practice (e.g., controlled burning).

Rationale and assumptions: Disturbance in and around wetlands can cause a range from negligible to devastating effects on wildlife. Unfortunately, there is no simple method of relating disturbance to wildlife usage (e.g., no set number of passing boats will equate to a predictable reduction in bird abundance). The issue is complicated by both the variety of wildlife species and types of disturbances. Regardless of the type of disturbance, if the habitat is altered, populations of some species may be adversely affected while others may benefit. For simplicity, only substantial recent periodic disturbances which reduce habitat availability and leave no opportunity for recovery are considered as factors in the reduction of habitat value. For all other disturbances, it is assumed that the site will recover and that current element conditions (e.g., low vegetation cover) will sufficiently describe the quality of the altered habitat.

Wildlife utilization is affected by the amount of disturbance, if any, to the wetland. Disturbance of vegetation cover and/or soils by periodic tilling, burning, or mowing will likely lower habitat value by (1) the removal of vegetation which is used for cover and food, (2) the elimination of litter which is used for cover and as nesting material, and (3) the disruption and reduction of animal and invertebrate populations which are used as food sources. Heavy recreational activities directly in or immediately adjacent to a wetland area can also reduce wildlife use.

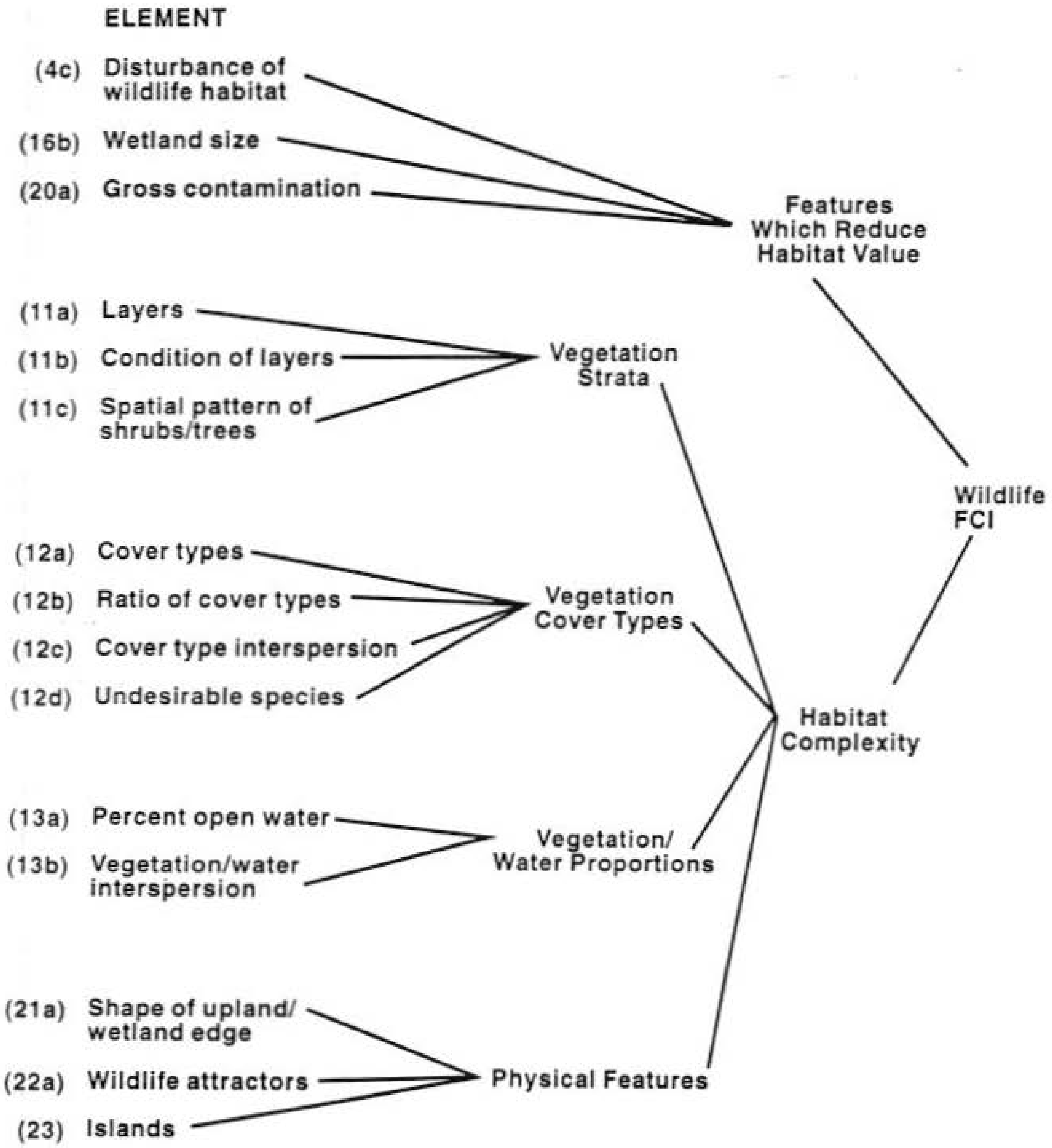


Figure 7.1.
Relationships of elements and components in the Wildlife FCI model

Disturbances caused by agricultural use of wetlands generally decreases the habitat value for waterfowl. In a study of 28 breeding wetland dwelling birds in North Dakota, Kantrud and Stewart (1984) recorded only two species breeding on tilled wetlands (American avocet and Wilson's phalarope). Talent et al. (1982) noted that mallard broods were seldom seen on wetlands with a history of recent and repeated tillage. They reasoned that these disturbed wetlands did not maintain adequate animal and plant communities for use by duck broods. Kantrud and Stewart (1977) noted that the value of tillage wetlands to breeding waterfowl was partially dependent on the presence of stubble, dead weeds, and crop residue. The reduced waterfowl use of tillage wetlands was attributed to a relatively low invertebrate fauna, which resulted from a lack of organic substrate in the ponds (Krapu 1974, Kantrud and Stewart 1977). Usage was found to be greater if the tillage wetland contained stubble or other dead vegetation debris.

Several authors have documented the affects of human disturbance (e.g., boating, hunting, and logging activities) on birds and mammals (e.g., Korschgen et al. 1983, Kaiser and Fritzell 1984, Cross 1985, Reid et al. 1989). Human disturbance is even considered in HEP models for the redhead (wintering), roseate spoonbill, and osprey (Howard and Kantrud 1983, Lewis 1983, Bana-Miller 1987). In a study on the effects of recreational boating activities on waterfowl migration along the Upper Mississippi River in Minnesota, Korschgen et al. (1983) concluded that disturbances can be detrimental to production and energetically costly to females. The affects of human disturbance may also be negligible, depending upon the species. In a review of literature on the great blue heron, Short and Cooper (1985) noted that nesting herons may be habituated to noise, traffic, and other human activity. Kaiser and Fritzell (1984) found that while green-backed heron activity on the river channel declined with increased recreational boating, heron use of backwater habitats was not noticeably affected even though the herons heard and saw humans.

Some disturbances are the result of management practices which are employed to improve wildlife habitat and utilization (e.g., Kaminski and Prince 1981, Schnick et al. 1982, Rutherford and Snyder 1983, Krueger and Anderson 1985, Kantrud 1986, Gordon et al. 1989, Kadlec and Smith 1989, Payne 1992). Management practices include water level and salinity manipulation, burning, disking, mowing, crushing, dredging, shading out with sediment or surface (e.g, plastic) covers, and controlled grazing. These disturbances may (a) temporarily reduce habitat use and/or (b) permanently alter the habitat to attract specific species. In this procedure, these disturbances are not considered as substantially limiting to wildlife utilization, especially since the goal is to improve habitat.

In the assessment procedure, this element is considered not applicable if there is no or moderate disturbance of wildlife habitat (condition "a") or if the periodic disturbance is used as a wildlife management practice (condition "b"). Element 4c is factored into the Wildlife FCI only when there is evidence of recent substantial periodic disturbance which reduces habitat availability (condition "c").

ELEMENT 11a. LAYERS

Directions: Determine the number of layers in the wetland by field observations. The six possible layers include:

a. **Tree.** The tree layer is present if leaves and twigs occur ≥ 8 m (≥ 26 ft) above the apparent surface and the canopy cover is ≥ 5% of the area when projected to the surface.

b. **Stem bole.** The stem bole layer is present if the density of tree stems is ≥25 cm (≥10 in) dbh or structures analogous to tree stems (e.g., nest boxes) are ≥5 per ha (≥2/ac). **Diameter breast height (dbh)** = Diameter of a plant measured at breast height [1.4 m; 4.5 ft]).

c. **Midstory.** The midstory layer is present if leaf and twig tissue occur from 1.0 m–8 m (3–26 ft) above the apparent surface and this cover is ≥ 5% of the area when projected to the surface.

d. **Groundcover.** Groundcover layer includes a variety of surface coverings from 0–1.0 m (0–3 ft) above the apparent surface (e.g., herbaceous vegetation, bare ground, rock outcrop).

e. **Surface water.** Includes surface water from 0–25 cm (0–19 in) in depth.

f. **Water column.** In open water extends down from 25 cm (19 in) below the surface of the water.

Rationale and assumptions: A high diversity of wildlife is most likely to occur in wetlands with a greater complexity of vegetation on the vertical axis since the addition of layers increases habitat structure complexity. Birds tend to partition a habitat by occupying different vertical layers, such as high canopy, tree trunks, shrubs, and the herbaceous layer (Pianka 1978). Avian diversity has been shown to increase with the addition of shrub and tree layers (e.g., Karr and Roth 1971, Roth 1976, Stauffer and Best 1980, Swift et al. 1984, Finch 1989). Mammals, amphibians, and reptiles also are distributed throughout the vertical dimension of vegetation communities (Short 1988).

Habitat complexity on the vertical axis can be described by the number of patches (Ball and Nudds 1989). Expressed in terms of layers, habitat complexity is described in Element 11a by the number of layers. Habitat complexity on the vertical axis is most often described by three vegetation layers — trees, shrubs and ground cover. This simplification, which is used in many classification schemes, does not adequately represent habitat complexity for vertebrate wildlife species. For this reason, Short (1988) developed a habitat structure model based on the association of many wildlife species with the vertical structure of habitats. The layer categories used in this procedure represent a modification of the habitat layers defined by Short (1984a, 1988). The two categories not included in this procedure are subsurface layer and open water bottom substrate.

An increase in layers (vertical stratification) is generally associated with an increase in avian diversity and abundance. Swift et al. (1984) found that vegetation structure had a significant effect on breeding bird communities in forested wetlands of Massachusetts. Breeding bird density and bird species richness were found to be positively correlated with small shrub (1–3 m height) density. In a study of habitat area requirements of breeding forest birds in mid Atlantic states, Robbins et al. (1989) determined that the relative abundance of 75 bird species was most often related to percent forest cover (mostly positive, some negative correlation). Burger (1985) noted that while vertical stratification is minimal in prairie and salt marshes, nesting birds have still adapted by building nests at different levels: floating nests, elevated nest platforms, or cup nests attached to several vegetation stems.

Each layer provides different habitat. The midstory and tree layers are important because they provide additional cover and food, particularly for canopy foragers. Limbs and branches of these upper layers provide song and roosting perches, as well as support for nests (Weller 1988). For example, Ringelman and Longcore (1982) noted how overhead vegetation provide concealment from predators and shelter from severe weather for black ducks in Maine. Gilmer et al. (1975) noted that mallards, show a preference for woody vegetation in nest site selection and construction. They attributed the higher mallard densities to the availability of loafing sites and cover in the overhanging brush shorelines. The stem bole or mature tree trunk, if large enough in diameter (≥25 cm dbh), provides habitat for cavity-nesting species (Short 1988). Groundcover is used for cover, food, nesting, and loafing for a variety of wildlife species.

Vertical stratification may increase the abundance of some species, but lower the abundance of others.

For example, in a study of small-mammals in Iowa riparian communities, Geier and Best (1980) concluded that an increase of shrub cover and/or decrease in forb coverage would raise abundance of two species, but decrease abundance of five other species.

In the assessment procedure, Element 11a is always factored into the Wildlife FCI because the conditions represent a full range of possible layers and their contribution to habitat complexity. The greatest number of layers (condition "a") would be the most complex and thus most likely to support a high diversity of wildlife species. Fewer layers would likely support a lower diversity of wildlife; therefore, the lower number of layers are assigned relatively lower scores.

ELEMENT 11b. CONDITION OF LAYERS

Directions: Determine by visual estimate the condition or proportions of layer coverage (Figure A.5, p. 7–54; A 34). Consider canopy cover of each of the three vegetation layers: tree, midstory, and herbaceous groundcover. (**Canopy cover** = proportion of the site included in vertical projections from the general outline of plants, ignoring minor gaps between branches and holes in the center of the plant).

Rationale and assumptions: A high diversity of wildlife is most likely to occur in wetlands with a greater complexity of vegetation on the vertical axis. Habitat complexity can be described by equitability of representation of patches on the vertical axis (Ball and Nudds 1989). Expressed in terms of layers, habitat complexity is described in Element 11b by the equitability of coverage for the three vegetation layers. It is assumed that there is greater potential for increased habitat complexity when there is a high percent cover (e.g., > 40%) for each layer and the layer proportions are near equal. Thus a wetland with near equal proportions of two layers (e.g., 90% tree cover : 80% emergent cover) would have greater habitat complexity than one dominated by one layer with a very small patch of another (e.g., 100% tree cover : 10% emergent cover). The surface water and water column layers are not included in this element because they are addressed separately in Elements 13a and 13b.

Increased layer coverage is generally associated with increased avian diversity and abundance. Karr and Roth (1971) recorded a rapid increase in bird diversity with an increase in both coverage (from 80–120%) and structure of the vegetation (from 1–3 plant strata). Highest diversities were recorded with percent vegetation coverage > 200% indicating that diversity was strongly correlated with structural complexity of the plant community. Robbins et al. (1989) determined that the relative abundance of breeding forest birds in mid Atlantic states was most often related to percent forest cover. Lynch and Whigham (1984) noted a tendency for bird species to favor forests with a dense herbaceous groundcover. For this procedure, it is assumed that the abundance and diversity of other wildlife species would also increase with the equitability of layer coverage.

Complete coverage (e.g., near 100%) for each layer may result in a lower wildlife abundance and diversity compared to a less dense wetland with openings. Bird species diversity has been found to be lower in closed-canopy forests compared to some shrublands, forests with broken canopies, and woods with early tree layers (Karr and Roth 1971, Roth 1976, Lynch and Whigham 1984). Roth (1976) reasoned that the older closed-canopy forests supported a lower bird species diversity, despite their having more vegetation layers or volume, because they were less patchy. In a study on breeding birds in forested wetlands of Massachusetts, Swift et al. (1984) found a negative ($P \leq 0.01$) correlation between crown cover and bird species richness. He suggested that the openings in the canopy increased structural heterogeneity and enhanced diversity of the bird community. In the procedure, no distinction is made between wetlands with closed canopies and wetlands with openings in the canopy. For simplicity, wetlands with high coverage in each layer are considered the most complex. In order to assign a high score to wetlands with openings, the best condition is described by a moderate coverage (e.g., > 40%) for each layer.

In the assessment procedure, Element 11b is always factored into the Wildlife FCI because the conditions represent the full range of proportion relationships among the layers. Approximately equal proportions and high percent cover for each vegetation layer (condition "a") would be considered the most complex habitat and thus most likely to support a high diversity of wildlife species. The least complex habitat would consist of a low percent cover for each vegetation layer (condition "d") or predominantly an unvegetated layer (condition "e"). Habitat complexity is considered moderate when vegetation proportions are described by intermediate conditions (condition "b") and relatively low when the wetland contains predominantly one layer (condition "c").

ELEMENT 11c. SPATIAL PATTERN OF SHRUBS/TREES

Directions: Determine by field observations whether woody species are present. If several individual shrubs and/or trees are present (e.g., > 2), then determine if the individual plants are distributed in a regular or an irregular spatial pattern (Figure A.6, p. 7–55; A 35). A "regular" spatial pattern exists only if the shrubs and/or trees are located in a very regular, orderly fashion, i.e., spacing that is typical of row planting used on crops and in some landscape techniques. Spacing will be "irregular" in most cases.

Rationale and assumptions: A high diversity of wildlife is more likely to occur on wetlands with a greater complexity of vegetation on the vertical axis. Habitat complexity on the vertical axis can be described by the degree to which patches are juxtaposed or interspersed (Ball and Nudds 1989). The degree of interspersion of layers is difficult to describe or quantify for the purposes of a rapid-assessment technique. Habitat complexity is instead described in Element 11c in terms of juxtaposition or the spacing of shrubs and/or trees.

Irregular spacing of woody species is generally associated with an increase in avian diversity and abundance. Studies in upland systems have demonstrated that clumps of shrubs and small trees increase species diversity, abundance, and successful nesting (Chasko and Gates 1982). Only a few bird species would be expected to use a habitat with a regular distribution of uniformly shaped and sized trees/shrubs (e.g., orchard), whereas several different bird species would be expected to use habitat with variation in spacing, height, and shape of trees/shrubs (Roth 1976). For this procedure, it is assumed that the same applies to most wildlife species.

In the assessment procedure, this element is considered not applicable if there are no woody species or if few individual plants of woody species are present (condition "a"). Element 11c is factored into the Wildlife FCI only when there are several individual woody plants present, the distribution of which may affect habitat complexity. Irregular spacing (conditions "b") is considered more complex and thus most likely to support a higher diversity of wildlife species. Habitat complexity is considered relatively low when spacing is regular (condition"c").

ELEMENT 11d. DIFFERENCE IN LAYERS

Directions: Determine if the planned wetland contains the same layers as the wetland assessment area (WAA). If not, then provide an explanation.

Rationale and assumptions: This element has been included to note any difference in layer types contained in each of the wetlands being compared. Difference in layer types is not considered in the calculation for the Wildlife FCI because it is assumed that any two layers will provide comparable habitat complexity. This assumption was made in order to maintain a simplified evaluation. Also, the authors found no basis in the literature for justifying that one combination of layers was better than any other. Since different layers do provide different habitat, Element 11d has been included to provide the user the opportunity to acknowledge and explain any difference in layer types.

In the assessment procedure, Element 11d is not included in the Wildlife FCI calculation, but it is included in Table A.2, p. 3–29 and p. A v. This element is considered not applicable if the planned wetland contains the same layers as the WAA (condition "a"). If the planned wetland does not contain the same layers as the WAA (condition "b"), the planned wetland is assigned a score of 1.0 in order to detect a difference in scores between wetlands.

ELEMENT 12a. COVER TYPES

Directions: Decide and record the minimum coverage that will be used to determine which cover types at the site will be included in the assessment. Then determine the number of cover types in each layer of the wetland from field observations (Table A.3, p. 7–57 for definition of cover types). Calculate the relative score by dividing the number of cover types by 27 (i.e., the total number of possible cover types) (Figure 7.2, p. 7–9).

Rationale and assumptions: A high diversity of wildlife is most likely to occur in wetlands with a greater complexity of vegetation on the horizontal axis. While birds usually partition microhabitat vertically, mammals generally partition microhabitat horizontally (Pianka 1978). Some mammals may stay in areas near specific types of vegetation and others may occupy ground beneath or the open space between shrubs. Habitat complexity can be described by the number of patch types (Ball and Nudds 1989). Expressed in terms of cover types, habitat complexity is described in Element 12a by the number of cover types.

An increase in cover types is generally associated with increased avian diversity and abundance (e.g., Weller 1978, Harris et al. 1983, Kantrud and Stewart 1984, Burger 1985). Kantrud and Stewart (1984) found that, compared to other wetland types in the prairie pothole region, semipermanent wetlands supported the highest diversity and abundance of breeding wetland dwelling birds. The high bird species richness was attributed to the presence of several vegetation zones, each with a characteristic life form which creates a greater habitat diversity. Delphey and Dinsmore (1993) noted a lower species richness of breeding birds in recently restored prairie potholes in comparison to natural praire potholes and attributed this difference to the incomplete developmet of typical vegetation structure.

The presence of trees may be important to wildlife species abundance. Stauffer and Best (1980) found that the abundance of most breeding birds species of Iowa riparian communities species increased with an increase in sapling/tree species richness. The dead-tree cover type is also important for some avian species. In a study on breeding birds in Massachusetts wetlands, Swift et al. (1984) observed that the abundance of ground and herb foragers was positively correlated to number of dead trees.

The term **cover type** is used in this procedure to describe areas that are distinguished by the dominance of distinct vegetation life-forms or unvegetated surfaces. Cover types are grouped by life-form because it has been shown that the physical structure or growth habit of a plant is relatively more important to bird species abundance and richness than vegetation species composition (e.g., Golet and Larson 1974, Weller and Spatcher 1965, Burger 1985). It is assumed that the same applies to other wildlife species. Both vegetated and unvegetated cover types are listed to include the broad range of possible habitat requirements for a variety of wildlife species.

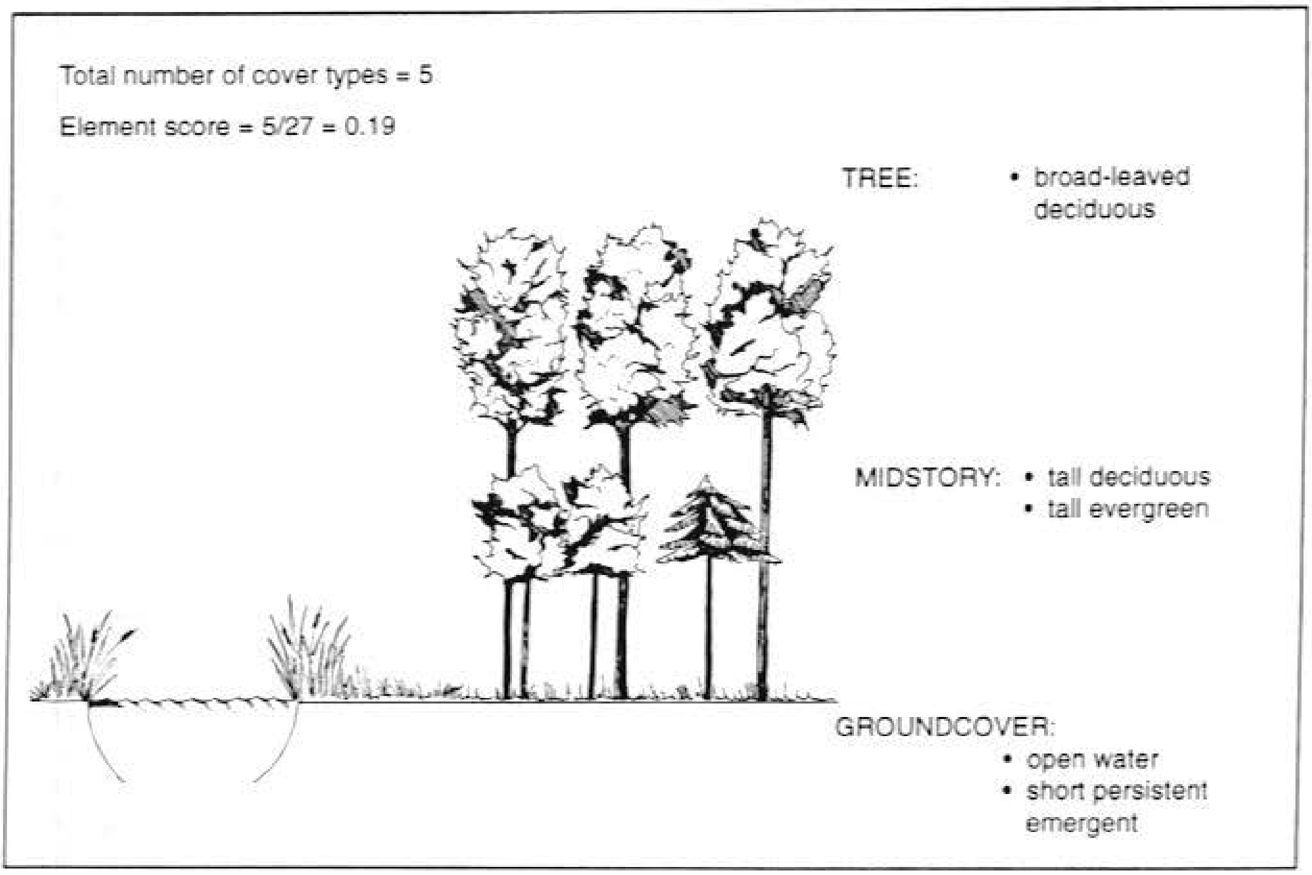


Figure 7.2
Example illustrating calculations for Element 12a: total number of cover types and element score

Vegetation and non-vegetation (e.g., mudflat and open water) cover both contribute to and are important to describing habitat complexity (e.g., Kantrud and Stewart 1984). Waterbirds frequently use open water habitat and mudflats for feeding areas, resting, preening, and foraging (e.g., Manci and Rusch 1989, Korschgen 1989). One of the most important non-vegetation cover types is open water. For example, Swift et al. (1984) found that percent surface wetness was directly related to avian density and species richness. The most poorly drained sites were found to have the most abundant diverse bird populations. Swift attributed the increased bird populations to increased water availability, moderating temperature changes, presence of more luxuriant vegetation, greater variety of niches, and greater amount and variety of food (plants and invertebrates).

Different types of plants provide different food, cover, and nesting material. Greater vegetation complexity is important for waterfowl because the different types of plants attract different invertebrates, thereby diversifying the food source. Vegetation complexity is important for providing seasonal or even year-round nutritional requirements of wetland-dwelling birds. In a study of the feeding ecology of wood ducks in South Carolina, Landers et al. (1977) found that females fed on invertebrates in shallow, open water during spring; on white waterlily seeds from late summer to early fall; and acorns from flooded hardwoods during fall and winter. This example shows three cover types providing the feeding requirements for one species. The importance of wetland complexes (and therefore diversity in cover types) was also demonstrated by a study showing that mallard hens occupied a range of 7–22 wetlands during the nesting season in the prairie pothole region (Dwyer and Krapu 1979).

Bird species have been shown to select nesting habitat based upon life forms. Mate requirements for nest-sites can be satisfied by plants of many species as long as they are similar in life form; some species favor tall, course emergents, while others utilize short and less robust plants (Weller and Spatcher 1965). Burger (1985) used the example of red-wing blackbirds to illustrate the importance of life form in nest selection. In salt marshes, red-wings nest in both *Iva frutescens* and *Baccharis sp.* because they have similar structure and strength. In prairie marshes, however, red-wings prefer to nest in *Typha spp.* rather than *Scirpus spp.* reeds because the reeds provide less support and are easily blown in the wind. Chasko and Gates (1982) reported successful nests with vegetation heterogeneity or patchiness along a transmission line corridor in Maryland.

Increased habitat complexity on the horizontal axis may increase species richness and/or abundance in some situations, but lower it in others. For example, in a study of habitat selection by small mammals in Iowa riparian communities, Geier and Best (1980) found that seven out of nine species avoided areas with high plant species richness. Percent forb cover was most consistently correlated with small-mammal species abundance, whereas the more complex shrub covered areas were associated with lower abundance. Maximum abundance and maximum diversity are not strictly compatible (Golet and Larson 1974). While the presence of additional vegetation cover types may increase wildlife species richness, it should not assumed that there will be a concomitant increase in wildlife abundance.

Each layer can be analyzed as a habitat (Giles 1978) and it is important that each be considered in describing overall complexity of the wetland. Many classification schemes and assessment techniques describe habitat by the canopy layer only. Thus, a forest with deciduous trees and no shrubs or groundcover would be described by the same cover type as a far more complex forest with deciduous trees, deciduous and evergreen shrubs, and emergent groundcover. To be more accurate, this procedure requires that cover types in each layer be recognized as contributing to overall habitat complexity.

In the assessment procedure, Element 12a is always factored into the Wildlife FCI because the list of cover types represents all possible cover types that can be found in wetlands. Wetlands with the greater number of cover types are the most complex and thus most likely to support a high diversity of wildlife species. Fewer cover types result in lower complexity; therefore, the lower number of cover types are assigned relatively lower scores.

Note: The cover types recognized in the procedure are described in Table A.3, p. 7–57, A 37. The list of cover types represents a modification of the subclasses listed in the Cowardin et al. (1979) and Golet and Larson (1974) classifications systems. Most notable are the following changes to the Cowardin et al. (1979) system:

a. Increase from four scrub-shrub subclasses distinguished by leaf shape (needle-leaved and broad-leaved) to six cover types distinguished by height and branching.

b. Increase from two emergent subclasses distinguished by persistence to four cover types distinguished by both persistence and height.

c. Reduction from four aquatic-bed subclasses to one cover type. The subclasses algal beds, aquatic moss, and floating vascular plants are not included since they cannot always be detected. The occurrence of plants in these subclasses is transient, seasonal, or sporadic depending upon changes in chemical (e.g. nutrient availability) or physical (e.g., temperature, light, water velocity) conditions. While these subclasses may be observed in an existing wetland, there would be little confidence in predicting their occurrence in planned wetlands. Only rooted vascular plants are included in the procedure because their physical rooting makes them a more stationary and predictable component of the wetland. Also, they can be planted to initiate establishment in a planned wetland.

d. All unvegetated subclasses are included. For example, the cover type "dead fallen trees/shrubs" is added to note those areas which have resulted from natural (e.g., fire, beaver activity, flooding) or unnatural (e.g., clearcutting) causes.

ELEMENT 12b. RATIO OF COVER TYPES

Directions: Determine by visual estimate the ratio of cover types (Figure A.7, p. 7–60; A 40). Consider canopy cover of each cover type throughout all layers. To determine ratio of cover types, estimate the percent cover for each cover type (e.g., broad-leaved deciduous tree canopy = 40% ; bushy deciduous scrub-shrub canopy = 40% ; short persistent emergent cover = 50% ; and organic non-vegetation cover = 50%). Select the condition which most closely describes the ratio of layer coverage. The ratio of cover type for the above example is 40:40:50:50, which is best described by condition "a". (**Canopy cover** = proportion of the site included in vertical projections from the general outline of plants, ignoring minor gaps between branches and holes in the center of the plant).

Rationale and assumptions: A high diversity of wildlife is most likely to occur in wetlands with a greater complexity of vegetation on the horizontal axis. Habitat complexity on the horizontal axis can be described by the equitability of representation of patches, i.e., ratio of the areas covered by various patch types (Ball and Nudds 1989). Expressed in terms of cover types, habitat complexity is described in Element 12b by the ratio of cover types.

There is greater potential for increased habitat complexity if the coverage of each cover type is maximized and their respective proportions are near equal (Element 11b rationale). Thus, a wetland with near equal proportions of two cover types (e.g., 90% broad-leaved deciduous forest : 80% tall persistent emergent) would have greater habitat complexity than one dominated by one layer with a very small patch of another (e.g., 100% broad-leaved deciduous forest : 10% tall persistent emergent).

In the assessment procedure, Element 12b is always factored into the Wildlife FCI because the conditions represent the full range of possible ratio relationships among cover types. Approximately equal proportions of two or more cover types (condition "a") would be considered the most complex and thus most likely to support a high diversity of wildlife species. The least complex habitat would consist of predominantly one cover type (condition "c"). Habitat complexity is considered moderate when the vegetation cover type proportions are described by intermediate conditions (condition "b").

ELEMENT 12c. COVER TYPE INTERSPERSION

Directions: Determine by visual estimate the degree of cover type interspersion (Figure A.8, p. 7–61; A 41). Consider canopy cover of each cover type. (**Canopy cover** = proportion of the site included in vertical projections from the general outline of plants, ignoring minor gaps between branches and holes in the center of the plant).

Rationale and assumptions: A high diversity of wildlife is most likely to occur in wetlands with a greater complexity of vegetation on the horizontal axis. Habitat complexity on the horizontal axis can be described by the degree to which patches are juxtaposed or interspersed (Ball and Nudds 1989). Expressed in terms of cover types, habitat complexity is described in Element 12c by the degree of cover type interspersion.

Interspersion is a measure of the extent of intermixing of different cover types. High vegetation interspersion is characterized by many cover types distributed in variable sizes and shapes, resulting in abundant types and length of edge (Figure A.8). Interspersion is used in this procedure to describe an important spatial component to wildlife habitat, i.e., edge. **Edge** is the boundary where one kind of cover type starts and another stops. Edges generally support a greater diversity and abundance of wildlife species than either adjoining cover types (Golet and Larson 1974, Giles 1978, Harris et al. 1983). This is referred to as edge effect. Interspersion describes the edge characteristics that are vital to optimal wildlife populations (e.g., variety and length of edge) (Giles 1978).

A high diversity and/or abundance of wildlife is more likely to occur in a wetland with well dispersed vegetation cover types and thus greater edge diversity, than in one with low interspersion (e.g., Harris et al. 1983). Interspersion of food and cover is important to waterfowl use of ponds (Ringelman and Longcore 1982). Interspersion is also important to nest selection and breeding pairs. Although the response varies depending upon the species, most marsh nesting bird species generally prefer to nest at the edge of plants of different physiognomy and at cover-water edges (Weller and Spatcher 1965). The use of wetlands by waterfowl broods was found to increase as the number of vegetation cover types at the open water edge increased (Hopper 1972). The importance of interspersion to wildlife diversity/abundance is commonly recognized in wetlands assessment techniques (e.g., Golet 1976, Hollands and McGee 1986, Adamus et al. 1987), although different terminology may be used to describe patch types (e.g., vegetation classes, subclasses, subforms, cover types, zones).

In the assessment procedure, Element 12c is always factored into the Wildlife FCI because the conditions represent the full range of possible cover type interspersion. High interspersion for two or more cover types (condition "a") would be considered the most complex and thus most likely to support a high diversity of wildlife species. The least complex habitat would have low or no interspersion (condition "c"). Habitat complexity is considered moderate when vegetation cover type interspersion is described by an intermediate condition (condition "b").

ELEMENT 12d. UNDESIRABLE SPECIES

Directions: Determine from field observations if undesirable vegetation species (e.g., *Phragmites australis, Lythrum salicaria*) are present. If present, identify these undesirable species and determine if they dominate the wetland site based upon canopy cover. (**Canopy cover** = proportion of the site included in vertical projections from the general outline of plants, ignoring minor gaps between branches and holes in the center of the plant).

Rationale and assumptions: Due to the lack of habitat complexity (rationale for Elements 11a–c and Elements 12a–c), monocultural stands of plants are often associated with a low diversity of wildlife. Monocultural stands of some plant species, however, are considered to provide even less desirable wildlife habitat. For example, in a study of waterfowl broods on South Dakota stock ponds, Mack and Flake (1980) found that cattail (*Typha spp.*) was the only emergent vegetation that was negatively associated with pintail and gadwall occurrence. The change of many semipermanent wetlands to monotypic stands of tall, robust hydrophytes such as *Typha spp.* is now considered one of the major causes of decreased waterfowl use in the prairie pothole region (Kantrud 1986). The water elm is an example of a tree species which may be considered undesirable when it becomes a dominant because it is a less valuable food source to waterfowl than oaks (Weller 1988).

Other terms used to described undesirable species include nuisance species, weed, pest plant, exotics, and disturbance species. Examples of species which are often considered undesirable include:

Phragmites australis	common reed
Lythrum salicaria	purple loosestrife
Phalaris arundinaceae	reed canary grass
Typha spp.	cattail
Andropogon virginicus	bluestem
Xanthium spp.	cockleburr
Scirpus spp.	bulrush
Planera aquatica	water elm

In the assessment procedure, this element is considered not applicable if vegetation species which are considered to have limited habitat value are absent or do not dominate the site (condition "a"). Element 12d is factored into the Wildlife FCI only when the site is dominated by vegetation species considered to have limited habitat value (condition "b").

ELEMENT 12e. DIFFERENCE IN COVER TYPES

Directions: Determine if the planned wetland contains the same cover types as the wetland assessment area (WAA). If not, then provide an explanation.

Rationale and assumptions: This element has been included to note if there is any difference in cover types contained in each of the wetlands being compared. Difference in cover types is not considered in the calculation for the Wildlife FCI because it is assumed that any two cover types will provide comparable habitat complexity. This assumption was made in order to maintain a simplified assessment. Also, the authors found little basis in the literature for justifying that one combination of cover types was generally better than any other. Since different cover types provide different habitat, Element 12e has been included to provide the user the opportunity to acknowledge and explain any difference in cover types.

In the assessment procedure, Element 12e is not included in the Wildlife FCI calculation, but it is included in Table A.2. This element is considered not applicable if the planned wetland contains the same cover types as the WAA (condition "a"). If the planned wetland does not contain the same cover types as the WAA (condition "b"), the planned wetland is assigned a score of 1.0 in order to detect a difference in scores between wetlands.

ELEMENT 13a. PERCENT OPEN WATER

Directions: Determine the percent cover of open water from field observations, maps, and/or aerial photographs. In tidal systems, estimate open water at mid tide. Water areas underneath the canopy of trees, shrubs, and emergents are not considered open water. For example, if the entire site is covered by water, but includes vegetated areas, estimate vegetation canopy cover and subtract this value from 100%. (**Open water** = water at any depth with no woody or emergent vegetation. Include mudflat areas which are periodically inundated). (**Canopy cover** = proportion of the site included in vertical projections from the general outline of plants, ignoring minor gaps between branches and holes in the center of the plant).

Rationale and assumptions: A greater abundance and diversity of water dependent birds and muskrats are more likely to occur in wetlands with a vegetation cover to water ratio of 50:50 (e.g., Weller and Spatcher 1965, Kaminski and Prince 1981, Murkin et al. 1982, Burger 1985). Habitat extremes are tolerated by a few species, but are not ideal for most marsh species (Weller and Spatcher 1965).

Vegetation/water proportions can be expressed either as a ratio or in terms of percent cover. Percent cover is used in this assessment procedure. Several studies indicate that 50% open water would likely support a maximum diversity/abundance of waterfowl. Weller and Spatcher (1965) examined the role of habitat in the distribution and abundance of marsh birds during an intensive five-year study of two marshes in Iowa and found that peak populations were reached when the ratio of emergent vegetation to water was 50:50. In North Dakota prairie potholes, Trauger (1967) found that duck brood densities were greatest on potholes with 33–50% open water; therefore, he recommended that a wetland be at least 40% open water to promote dabbling duck brood use. Percent open water is also important to other wildlife. Cover conditions are considered optimal for muskrats when there is 50–

80% emergent cover and 20–50% permanent non-fluctuating open water (Allen and Hoffman 1984).

Open water cover of less than 30% or greater than 70% has generally been found to support a low diversity and/or abundance of water-dependent birds. Bélanger and Couture (1988) found that dabbling duck brood use of man-made ponds in Québec, Canada was significantly less on ponds with > 70% open water. Weller and Spatcher (1965) also noted that duck numbers were lowest when the emergent vegetation, which provided brood cover, was virtually eliminated and the marsh was converted to open water habitat. A study in Maine revealed that black ducks seldom used ponds that contained large expanses of open water because there was little or no food and concealment (Ringelman and Longcore 1983). Too little open water is also considered unfavorable. Natural wetlands of Saskatchewan parklands with < 33% open water had low use by mallard, blue-winged teal, and pintail broods (Stoudt 1971 cited in Mack and Flake 1980). In a study in North Dakota prairie potholes, Trauger (1967) found that duck brood use decreased substantially in potholes containing less than 20% open water.

Not all waterfowl and other wildlife species prefer 50% open water cover. Expressed in terms of percent herbaceous cover, the optimal cover for the western grebe is relatively low at < 30% (Short 1984b), whereas the optimal cover for the slider turtle is relatively high at > 90% (Morreale and Gibbons 1986) (Additional species listed in Table 7.3, p. 7–29).

In the assessment procedure, Element 13a is always factored into the Wildlife FCI because the conditions describe the entire range possible for percent open water. Wetlands with the approximately 50% open water (condition "a") are most likely to support a high diversity/abundance of water dependent birds. A wetland with no, minimal (< 10%), or abundant (> 90%) cover of open water (condition "c") is considered least likely to support a diversity/abundance of water dependent birds. Habitat complexity is considered moderate when percent cover is described by intermediate conditions (condition "b").

ELEMENT 13b. VEGETATION/WATER INTERSPERSION

Directions: Determine by visual estimate the degree of vegetation/water interspersion (Figure A.9, p. 7–61; A 41). Consider canopy cover of the vegetation. (**Canopy cover** = proportion of the site included in vertical projections from the general outline of plants, ignoring minor gaps between branches and holes in the center of the plant).

Rationale and assumptions: A greater abundance and diversity of water dependent birds is more likely to occur in wetlands with high interspersion of vegetation cover and open water (Weller and Spatcher 1965, Mack and Flake 1980, Kaminski and Prince 1981, Burger 1985, Kantrud 1986). High vegetation/water interspersion attracts a high diversity and abundance of waterfowl due to the abundance of aquatic invertebrates and increased visual isolation for breeding and nesting pairs (Kaminski and Prince 1981, Kantrud 1986). For many marsh-nesting birds, the amount of vegetation-open water edge is an important cue in nest-site selection and the amount of edge often relates directly to the number or placement of nests (Burger 1985). Although the response varies depending upon the species, most species generally prefer to nest at vegetation-water edges (Weller and Spatcher 1965, Burger 1985).

Several studies have also shown the importance of vegetation/water interspersion to individual species. Mack and Flake (1980) found in a study of South Dakota stock ponds that vegetation/water interspersion affected blue-winged teal and pintail occurrence and it apparently had a greater effect than percent open water on pintail brood use. In a study of breeding gadwall in Saskatchewan, Hines and Mitchell (1983) observed that breeding pairs dispersed over the marsh in relation to the interspersion of open water and cover, but later aggregate their nests in safe insular habitats. A high degree of vegetation/water interspersion is a critical habitat factor for the western grebe which may place nests at intervals as short as 2 m (6 ft) along the edge of emergent vegetation bordering open water (Davis 1961 cited in Short 1984b).

In the assessment procedure, Element 13b is always factored into the Wildlife FCI because the conditions represent the full range of possible vegetation/water interspersion. High interspersion (condition "a") would be considered the most complex and thus most likely to support a high diversity of wildlife species. The least complex habitat would have low or no interspersion (condition "c"). Habitat complexity is considered moderate when vegetation/water interspersion is described by an intermediate condition (condition "b").

ELEMENT 16b. WETLAND SIZE

Directions: Determine if the site has a very low wildlife value because of its small size and poor conditions in or around the wetland (e.g., 1 ft wide × 20 ft long fringe marsh with access to other wetlands or upland wildlife habitat blocked by urban development). If yes, provide a brief explanation.

Rationale and assumptions: Size can affect the diversity and/or abundance of wildlife which can utilize a wetland. The extent of this affect varies depending upon the habitat requirements of the various wildlife species, and the availability of these requirements within and around the wetland.

While many wetlands may be considered small for use by most species, they still may provide sufficient habitat for the smaller fauna (e.g., amphibians and reptiles). Small wetlands may also play an important role for the persistence of local populations of wetland associated animals (Gibbs 1993). Element 16b is included in the assessment procedure to recognize the importance of wetland size to the wildlife function. While there are studies demonstrating the importance of wetland size to individual wildlife species, there are no studies to support the selection of minimum or maximum criteria applicable to all wildlife. For this reason thresholds are not used for this element. Element 16b is designed to highlight those few cases when the user has evidence to conclude that the capacity of a wetland to provide wildlife habitat is severely limited by its small size and poor conditions in or around the site. The selection of a minimum size is left up to the discretion of the user who is familiar with local conditions.

Each species theoretically has a minimum habitat size requirement, but often the information is not available to quantify this value. The lack of information on minimum habitat area is noted in several HEP models, e.g. slider turtle (Morreale and Gibbons 1986), bullfrog (Graves and Anderson 1987a), snapping turtle (Graves and Anderson 1987b), and red-spotted newt (Sousa 1985c). Even if the information were available, there are two main problems with using a minimum habitat size to measure habitat suitability. First, size alone is not an appropriate variable for describing habitat suitability. Graves and Anderson (1987a) illustrated this point by giving an example on bullfrogs. Upon noting the presence of bullfrogs in a small permanent 1.5 m (1.6 yd) diameter pond, but their absence in a larger 20m (22 yd) pond, Graves and Anderson (1987a) concluded that the wetland size and depth likely indicated desiccation and winter ice thickness, rather than the spatial requirements of the bullfrog. The same point was made by Lynch and Whigham (1984) who, based on a study of the effects of forest fragmentation in Maryland, concluded that both habitat quality and area are important, and to some extent compensatory in their influences on breeding bird occurrence.

A second problem with using minimum habitat size pertains to deciding what the minimum represents in the assessment procedure. Is it a threshold below which there is no or minimal wildlife use? Is it a threshold below which habitat requirements for a specific wildlife group cannot be provided (e.g., waterfowl brood habitat). Is it a threshold above which to expect optimal species richness, i.e. is it on the high end of a species area curve? Thus, the definition of minimum acreage can vary greatly. The selection of a definition is critical because it can substantially change the wildlife function definition and the planned wetland design criteria.

Many wetland assessment procedures use size thresholds to demonstrate the relative habitat values of wetlands. The commonly used five acre minimum threshold (e.g., Hollands and McGee 1986, Adamus et al. 1987) is based primarily on waterfowl literature. The use of five acres as a standard minimum is inappropriate, even for waterfowl, since lower acreages (e.g., 1 acre, < 0.5 acre) have been found to be adequate for nesting/breeding of many waterfowl species (e.g., Gilmer et al. 1975, Ringelman and Longcore 1982, Hudson 1983, Schroeder 1984, Brown and Dinsmore 1986, Bélanger and Couture 1988, Leschisin et al. 1992). Additionally, it is important to realize that with some procedures birds are used to represent other wildlife categories. At one extreme five acres may be too small to support several individual mammal species. Alternatively, 0.1 acre may exceed the habitat requirements of some amphibians and reptiles.

Several studies demonstrate the importance of wetland size to waterfowl useage (e.g., Rumble and Flake 1983). In a study of waterfowl production of Montana stock ponds, Hudson (1983) found that breeding pair use was primarily a function of pond size rather than other measured habitat features. Although the larger sized ponds had a greater number of breeding pairs, greater pair densities were on intermediate size (1.3–3.7 ac [0.51–1.50 ha]) ponds. In a study on constructed wetlands in Minnesota, Leschisin et al. (1992) found that wetlands with a surface area ranging from 0.62 to 1.24 ac (0.25–0.50 ha) received the most use. Again, the smaller wetlands (< 0.62 ac [< 0.25 ha]) had slightly more use per unit area than larger wetlands.

In study of habitat area requirements of breeding forest birds in mid Atlantic states, Robbins et al. (1989) found that forest areas was a significant predictor of relative abundance for 38 out of 75 species analyzed. For most neotropical migrant species, the predicted probability of occurrence increased as the area of forest increased. Five species of short-distance migrants showed negative relationships. Most forest-nesting neo-tropical migrants require hundreds of hectares of contiguous forest to reach their highest probability of occurrence. Most forest-nesting short-distance migrants readily use small forests; some can nest in forest < 20 ha (49 ac); and several can nest in forests < 1 ha (< 2.5 ac) (e.g., Carolina chickadee, Carolina wren, northern cardinal).

Abundance of some bird species is dependent on wetland size, while wetland size is not a the deciding factor with others. In a study of Iowa marshes, Brown and Dinsmore (1986) found that marsh size and isolation accounted for 75% of the variation in bird species richness (waterfowl and other). Of the 25 recorded species only seven species exhibited a significant linear relationship between frequency of occurrence and marsh size (e.g., blue-winged teal, swamp sparrow, mallard, pied-billed grebe, ruddy duck, black duck, and Canada goose). The frequency of occurrence of seven species (red-winged blackbird, yellow-headed blackbird, common grackle, Virginia rail, sora, ring-necked duck, great-tailed grackle) was little affected by marsh size. In general, there was a lower species richness associated with decreased marsh size.

In the assessment procedure, this element is considered not applicable if the wetland size is judged large enough to provide some wildlife habitat (condition "a"). Element 16b is factored into the Wildlife FCI only when it has been determined that a site has a very low wildlife value because of its size and conditions in the surrounding landscape (condition "b").

ELEMENT 20a. GROSS CONTAMINATION

Directions: Determine if there is potential for contaminant input by field observations and/or local inquiry. If there is potential for contaminant input note (a) if the potential is minimal or there is evidence of highly toxic contaminants and (b) if any preventative measures have been taken to minimize contaminant input.

Rationale and assumptions: Contamination in the wetland can cause illness, deformities, or mortality of wildlife species either directly (e.g., direct contact) or indirectly (e.g., feeding on contaminated vegetation, invertebrates, fish, or mammals). The effects of contaminants on wildlife vary greatly depending upon the type and concentration of contaminant and the tolerance of individual species. It is difficult to make any definitive statements or generalizations regarding the effects of contaminants because, for the most part, the effects of contaminants are not obvious. Additionally, data to prove direct cause and effect relationships are rarely available. For these reasons, it should not be assumed that there will be a release of toxics at levels that are detrimental to wildlife even when a source of toxic substances is present, since making this assumption could lead to erroneous conclusions regarding potential habitat value.

This element has been included to recognize contaminants as a possible factor which may reduce habitat value. Although many contaminants may be detrimental to wildlife, for simplicity only highly toxic contaminants are considered in this assessment procedure. Summaries on the effect of contaminants on waterfowl in different regions of North America are contained in Smith et al. (1989). The site must either have observable (e.g., plant stunted or with abnormal morphology) or documented contamination problems (e.g., hazardous waste site).

Certain types of contaminants may actually provide benefits to wildlife. For example, ducks are attracted to sewage ponds due to the abundance of aquatic invertebrates (e.g., Swanson 1977, Piest and Sowls 1985). Although these ponds provide an unattractive feeding site for dabbling ducks (i.e., the basin morphology is relatively deep and flat with abrupt barren sand and rubble shorelines), they serve as a valuable food source because of the high organic base which provides favorable conditions for invertebrate production (Swanson 1977). Duck brood use has also been found to be significantly greater on sewage ponds than in other types of man-made ponds (Bélander and Couture 1988).

Herbicides and pesticides can have lethal effects on wildlife. For this procedure, it is assumed that the effects of these contaminants are not substantial since their application is regulated by federal, state, and local laws and regulations. Pesticides may enter a wetland in runoff from treated agricultural lands. Herbicides are sometimes used in marsh management to create open-water areas for waterfowl nesting, travel, and diving; destroy undesirable plants; and control algae.

In the assessment procedure, this element is considered not applicable if there is minimal or no potential for contaminant input (condition "a") or if the potential for contaminant input is present, but preventative measures have been taken (condition "b"). Element 20a is factored into the Wildlife FCI only when there is evidence of and/or known sources contributing highly toxic contaminants (condition "c") since these conditions might substantially reduce wildlife utilization in an existing and/or planned wetland.

ELEMENT 21a. SHAPE OF UPLAND/WETLAND EDGE

Directions: Determine from field observations, maps, and/or aerial photographs whether the upland/wetland edge shape is predominantly regular or irregular (Figure A.10, p. 7–64; A 44).

Rationale and assumptions: A greater abundance of waterfowl is more likely to occur in wetlands with an irregular upland/wetland edge (e.g., Mack and Flake 1980, Hudson 1983, Leschisin et al. 1992). Several authors have noted an increase in waterfowl use with increased shoreline irregularity (i.e., irregular upland/wetland edge). South Dakota stock ponds used by blue-winged teal, mallard, and pintail broods were found to have significantly greater shoreline length than unused ponds (Mack and Flake 1980). Ponds containing broods of these three species had a mean shoreline length more than double the length of other ponds sampled. Montana stock ponds with irregular shorelines were also found to have greater number of waterfowl broods than ponds with regular shorelines (Hudson 1983).

Shape of the upland/wetland edge and size of the wetland combined may determine waterfowl abundance. In a study on the use of 20 man-made ponds by dabbling duck broods in southern Québec, Bélander and Couture (1988) found that surface area and shoreline irregularity determined brood size, i.e., presence of broods was significantly greater on ponds ≥1.2 acres with irregular shorelines. Ponds with a shoreline irregularity index of ≥1.5 attracted more broods and produced significantly more broods/ha than any other ponds. Other studies have shown shoreline length to be a better predictor of brood occurrence than actual pond size (e.g., Patterson 1976, Mack and Flake 1980, Hudson 1983).

An irregular upland/wetland edge is important in defining territories for male waterfowl defense. As the edge becomes more irregular, more territories can be set up (Pers. comm, Harold Kantrud, USFWS — Northern Prairie Wildlife Research Center, Jamestown ND, 3 December 1990). Low cross-shaped (upland) islands are used in wildlife management areas because their irregular shape and increased edge permits the establishment of several distinct territories, thus maximizing waterfowl utilization of space (Pers. comm., Holliday Obrecht, USFWS—Patuxent Wildlife Research Center, Laurel MD, 4 December 1990) (Figure 7.3, p. 7–20).

Land-water interface (i.e., the amount of edge) was found to be the most important of nine measured habitat features in a study on the relationships between nesting populations of wading birds along the Atlantic coast (Erwin et al. 1987). Only small correlations were found due to, among other things, the scale of maps used. However, the finding was interpreted as suggesting the importance of feeding habitat to wading birds.

Two assumptions were made when including this element in the assessment procedure. First, although the literature cited refers only to waterfowl and wading birds, it is assumed that the relationship between increased upland/wetland edge and increased abundance/diversity is applicable to other wildlife species. Second, although most of the literature cited pertains to wetlands associated with ponds, it is assumed that upland/wetland edge irregularity may be important to birds in both protected low energy environments (e.g., ponds) and in some high energy environments. For example, an irregular shoreline would likely provide protected areas (e.g. coves) for waterfowl/shorebirds in coastal wetlands.

In the assessment procedure, this element is considered not applicable if there is no upland/wetland edge (condition "a"). Element 21a is factored into the Wildlife FCI only when the upland/wetland edge is present. An irregular edge (condition "b") is considered more likely to support a higher diversity and/or abundance of wildlife species than a regular edge (condition "c").

Note: A wetland area may appear to have a regular shoreline; however, the shoreline may be considered "irregular" when it is evaluated in the context of a larger wetland which it may be part of (Figure 7.4, p. 7–21). Thus, the size of the assessment area may determine if shoreline irregularity is detected. The scale at which shoreline irregularity becomes important depends upon the wetland type and wildlife species of concern. It is assumed that if the WAA is large enough to detect shoreline irregularity, then it would be appropriate to include this irregularity in the planned wetland design.

ELEMENT 22a. WILDLIFE ATTRACTORS

Directions: Determine if wildlife attractors are absent, sparse, or abundant by field observations. If present, record the type of attractor(s) and estimate percent cover. In some cases, it may be better to record the number of attractors (e.g., nesting boxes).

Rationale and assumptions: Wildlife attractors include those features of a wetland which are not described by the other elements, yet are known to increase habitat complexity and provide special habitat requirements. The importance of specific attractors is discussed below.

Snags are dead or partially dead standing trees/shrubs. The importance of snags to cavity-nesting birds has been well documented (e.g., Raphael and White 1984, Kress 1985, Johnson and Beck 1988, Sedgewick and Knopf 1990). Snags provide special habitat requirements for many cavity-nesting birds (e.g., woodpeckers, nuthatches, screech owls). Snags also provide roosting sites for raptors and wading birds. In a study of avifauna of riparian communities in Iowa, Stauffer and Best (1980) found that snag size was frequently (positively) related to bird species abundance and richness. Stauffer and Best (1980) noted that the positive relationship between cavity-nester densities and snag size likely reflected the use of snags for nesting and foraging sites. Other wildlife species may also

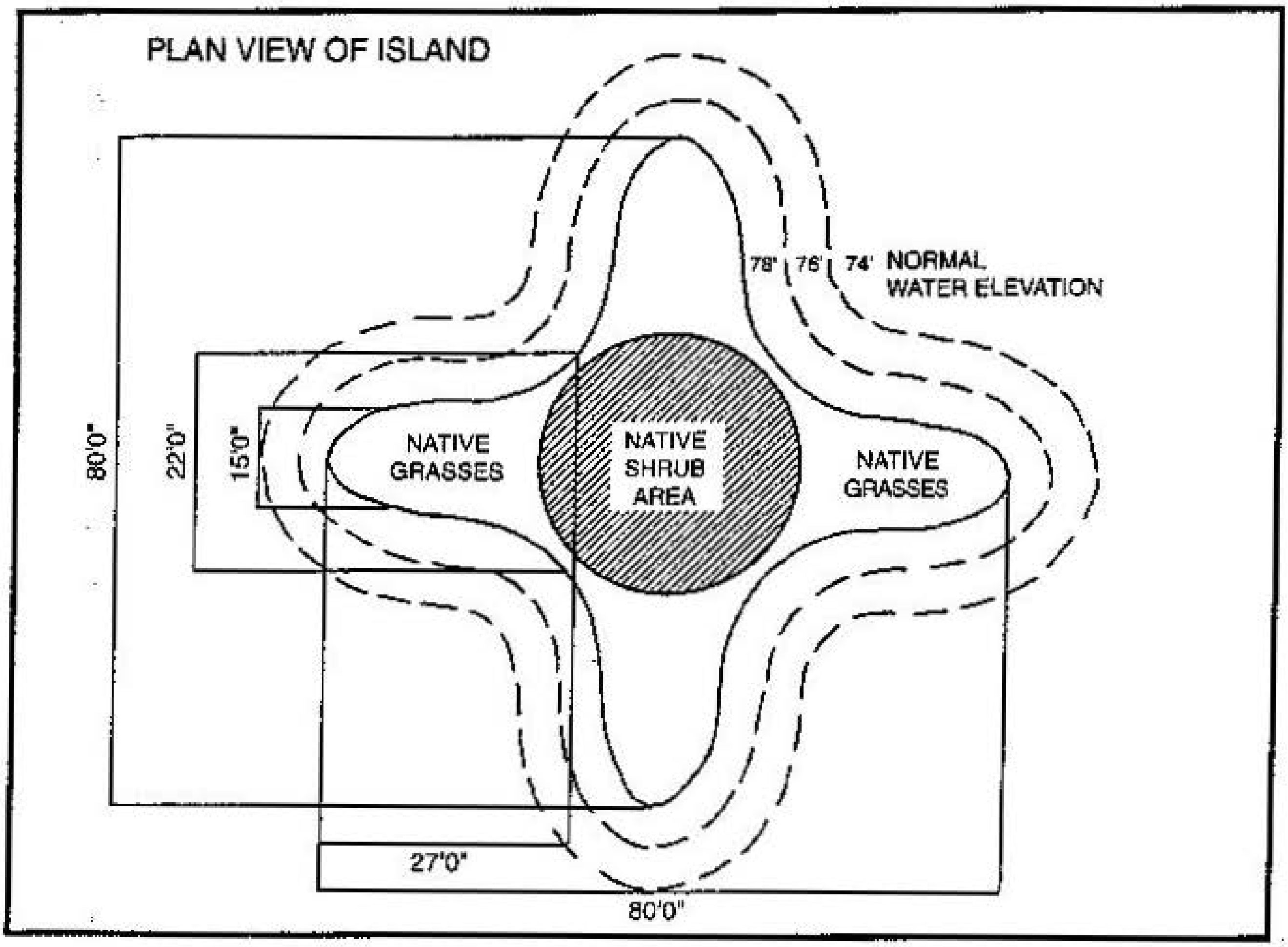


Figure 7.3.
Example of island shape designed to maximize waterfowl utilization of space

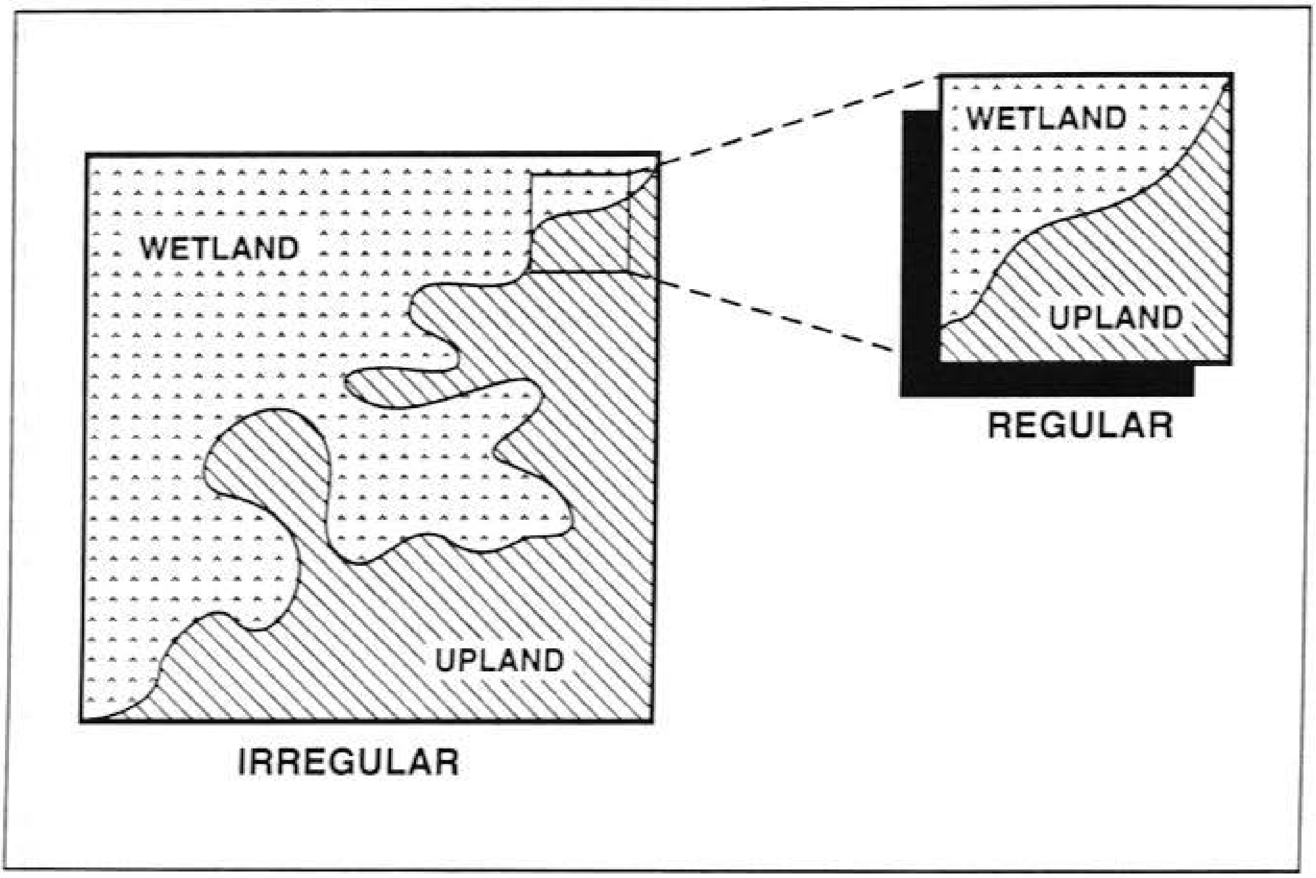


Figure 7.4.
Shoreline irregularity: examples illustrating a large wetland with an irregular shoreline and a smaller assessment area with a regular shoreline

select habitat characteristics associated with snag size.

Dense brush is characterized by low scrub vegetation which is dense enough to conceal/cover and protect wildlife (e.g., bushy fence rows, hedges, brambles). Significant positive correlations have been found between the abundance of woody plant debris (logs, brushpiles, or stumps) and small-mammal numbers (Geier and Best 1980, Mason 1989). Mason (1989) observed that deer mice use woody debris in riparian habitats as a source of flood-transported food items, a refuge from aerial or terrestrial predators, a path over water or rough ground, or as a nest site. It is assumed that a similar relationship is applicable to many wildlife species because dense brush provides wildlife with cover for nesting, escape from predators, and shelter from weather. Some species of brush may also serve as a food source. The importance of dense brush is reflected in the practice of building **brush piles** to improve wildlife habitat (e.g., Yoakum et al. 1980, Kress 1985, Green and Salter 1987, Payne 1992, Ambrose et al 1983a, 1983b).

Fallen trees provide cover, loafing sites, protection from predation, and shelter from weather for waterfowl, small mammals, amphibians, and reptiles. Significant positive correlations have been found between the abundance of woody plant debris (logs, brushpiles, or stumps) and small-mammal numbers (Geier and Best 1980). A study in Washington showed that Canada geese preferred to locate nest sites near logs or driftwood (Yocum 1952). The habitat of other wetland dependent birds may also be enhanced by the presence of fallen trees. The importance of fallen trees is reflected in the practice of placing logs in and along side of stock ponds to improve wildlife habitat (e.g., Payne 1992).

Rocks, boulders, or rockpiles provide cover, loafing sites, protection from predation, and shelter from weather for small mammals, amphibians, and reptiles. The importance of rocks is reflected in the practice of building rock piles to improve wildlife habitat (e.g., Kress 1985, Green and Salter 1987, Ambrose et al. 1983a, 1983b).

Artificial structures such as nesting structures, roosting sites, and artificial tree cavities are often used to attract wildlife species (e.g., Kress 1985, Green and Salter 1987, Payne 1992). The purpose of these structures is to provide habitat which is lacking in an existing wetland.

In the assessment, this element is considered not applicable if wildlife attractors are absent or sparse (condition "a"). Element 22a is factored into the Wildlife FCI only when there are moderate or abundant wildlife attractors (condition "b") which would increase habitat complexity and thus be most likely to support a higher diversity/abundance of wildlife species.

ELEMENT 23. ISLANDS

Directions: Determine from field observations, maps and/or aerial photographs whether islands are present or absent within the wetland.

Rationale and assumptions: Islands are often considered important habitat because of observed high waterfowl nesting densities and nesting success. The value of islands for nesting is attributed to (1) the relative freedom from disturbance and predation; (2) the high ratio of water edge to land mass which increases the capacity for territorial occupancy; and (3) the close proximity of water, food, loafing sites, and nesting cover (e.g., Hammond and Mann 1956, Duebbert et al. 1983, Piest and Sowls 1985). The importance of islands to individual species has been documented by several authors (e.g., Raveling 1977, Duebbert et al. 1983, Hines and Mitchell 1983).

In the assessment procedure, Element 23 is always factored into the Wildlife FCI. A wetland with islands (condition "a") is considered to be more complex and more likely to support high waterfowl nesting densities compared to a wetland with no island (condition "b").

Note: The purpose of this element is to recognize the importance of islands to waterfowl. When comparing wetlands, relative size and number of islands must be considered. This element does not allow for a detailed comparison because any assignment of values (e.g., number and/or size of islands) would be arbitrary. A separate statement should be provided in Table A.2 explaining how and if the planned wetland provides comparable "island" habitat.

NOTE: The literature documenting the importance of several of the EPW elements and the following factors is based primarily on studies which focused on waterfowl. Many of these studies were conducted in the prairie pothole region. These elements include vegetation/water interspersion, percent open water, irregular upland/wetland edge, and islands. The relationships described may not be applicable to other wildlife, some waterfowl species, and/or other regions of the United States.

7.4 Additional Design Considerations

The following section outlines design considerations, including EPW elements and additional factors, which are to be considered for the Wildlife function.

Factor	Remarks
VEGETATION FEATURES	
Vegetation species	Refer to current documents providing guidelines on vegetation design, plant selection, time of planting, site preparation, equipment, etc. (e.g., Lewis 1982b, Garbisch 1986, Hammer 1992, SCS 1992, Thunhorst 1993)
Vegetation layers (Elements 11a, 11b, and 11c)	A planned wetland designed to have a greater complexity of vegetation on the vertical axis can generally be expected to attract a higher diversity of wildlife (Elements 11a, 11b, and 11c rationale). Vertical habitat complexity can be increased several ways. First, a planned wetland can include several layers. While it is impractical to plant mature trees, saplings can be planted to accelerate the development of a tree layer. Since a forest with broken canopy tends to support a higher bird species diversity compared to a closed canopy forest, it might be best to plan for some open areas. Complexity can also be increased by arranging the vegetation layers so there is a relatively high percent cover with nearly equal proportions for each layer. Additionally, any planted shrubs/trees can be spaced in irregular, rather than regular patterns. Note that the layers used in EPW are defined with the intent to distinguish basic layers. The criteria to identify different layers (e.g., stem bole ≥25 cm) are not absolute threshold values that are to be used as strict design criteria. Species are distributed on the vertical axis based upon their individual habitat requirements. If desired, this information may be obtained through a literature review. For example, refer to Short (1989) for a list of individual bird species in the glaciated prairie region and the identification of the layers they use for foraging and nesting. In some situations fewer layers or a lower percent cover may provide better wildlife habitat. Geier and Best (1980) found that some small mammals in Iowa riparian communities decreased in abundance within an increase in shrub cover. The preferred habitat was a less complex habitat with forb cover. A reduction in vegetation layers may be desired depending upon the habitat requirements of target species. Waterfowl nesting islands are often managed to remove the shrub layer (e.g., willow — *Salix* spp.) because the shrub layer is not considered desirable (Hammond and Mann 1956). In forests, habitat complexity can be enhanced by creating openings which would help increase bird species diversity (e.g., Roth 1976, Swift et al. 1984).

Factor	Remarks
Vegetation cover types (Elements 12a, 12b, and 12c)	A planned wetland designed to have a greater complexity of vegetation on the horizontal axis can generally be expected to attract a higher diversity and/or abundance of wildlife (Element 12a rationale). Cover type complexity can be increased by (a) including several cover types, (b) by arranging cover types so there is a relatively high percentage of cover with nearly equal proportions for each cover type, and (c) by maximizing the degree of cover type interspersion. A diversity of wetland plants and cover types can be initiated by planting and seeding. Early introduction of plants limits the establishment and dominance of opportunistic colonizers such as *Typha* spp. and enhances long-term diversity of vegetation in planted wetlands (Reinartz and Warne 1993). The importance of establishing initial cover in the planned wetland is demonstrated in a study by Reinartz and Warne (1993) which revealed a much higher diversity and richness of native wetland species in seeded wetlands than in unseeded created Wisconsin wetlands after two years. Designers must consider the implications of providing more cover types in the planned wetland than in the WAA. In many cases, it may suffice to provide the same number of cover types. While additional vegetation cover types may increase wildlife species richness, it should not be assumed that there will be a concomitant increase in the abundance of these species. Maximum abundance and maximum diversity are not strictly compatible (Golet 1976). A wetland with one cover type may provide optimal habitat to maximize abundance of one species, but this may be to the detriment of other species. Conversely, increased cover types may increase species diversity, but reduce the amount of a certain type of habitat on an acreage basis, to the detriment of those species relying on that particular habitat type. In some situations, one or only a few cover types and/or low interspersion may provide better wildlife habitat than a more diverse community. For example, Geier and Best (1980) found that seven out of nine small mammal species in Iowa riparian communities avoided areas with high plant species richness. Given this information, a planned wetland in this setting may be designed to have low species richness, particularly if the goal was to enhance small mammal habitat. The selection of cover types may be critical, particularly if the goal is to attract certain wildlife species. For example, Reinecke et al. (1989) noted that forested wetlands may provide good wildlife habitat, but could be undesirable for waterfowl because of the relatively low food

Factor	Remarks
	production. A simple choice between vegetated and non-vegetated cover type may be important. For example, greater numbers of mallard broods would be expected to use ponds with brushy or grassy shorelines or residual vegetation, as opposed to bare shorelines (Rumble and Flake 1983). The habitat requirements (e.g., food, cover, nesting habitat) of any target wildlife species should be known before selecting cover types. Species are distributed in a wetland based upon their individual habitat requirements. If desired, this information may be obtained through a literature review. An illustration of species distribution based upon food requirements is provided in Table 7.1, p. 7–27. Short (1989) provides a similar illustration which arrays individual bird species in the glaciated prairie region using the criteria of nest site requirements.
Plant height and density	Plant height and density may be important habitat factors for some wildlife species. If data is available demonstrating the importance of plant height and/or density to target wildlife species, then this should be considered in the selection of plants for the planned wetland. In a study of breeding forest bird species of the middle Atlantic states, Robbins et al. (1989) found that there were several habitat factors for which there was significant correlation with the abundance of 13 species which preferred wetland habitats. The most common factor (found in six species) was "foliage density between 0.3 and 1 m" (1–3.3 ft). No significant correlation was found for the other three foliage density intervals: from ground level to 0.3 m (1 ft), between 1–2 m (3.3–6.6 ft), and between 2–3 m (6.6–9.8 ft). These results suggest that preferable plant height for breeding forest birds falls within the 0.3–1 m (1–3.3 ft) range. Visual obstruction in adjacent uplands is an important factor for nesting and brood use of some waterfowl. **Visual obstruction** is measured as the height at which a pole is totally obscured by vegetation when viewed from a distance of 4 m (13.1 ft) (Sousa 1985a). Mallard brood use was found to be positively associated with visual obstruction readings of shoreline vegetation (Rumble and Flake 1983). Mallards, gadwall, and blue-winged teal typically select tall dense herbaceous vegetation in which to nest. As the herbaceous height and density increase, the potential for nest establishment is enhanced (Sousa 1985a, 1985b, Lokemoen et al. 1990). Based on a study of dabbling duck brood use in Quebec man-made ponds, Bélanger and Couture (1988) recommended maintenance procedures to encourage ≥30% emergent vegetation cover and a stem density of ≥30 stems/m^2.

Table 7.1.
Habitat conditions that attract vertebrates to moist-soil impoundments and reclaimed gravel pits

	Moist-soil impoundments[a]											**Reclaimed gravel pits**[b]
	Foods					**Openings**		**Vegetative cover**				
Vertebrate group	Vertebrates	Invertebrates	Seeds	Browse	Water depth (cm)[c]	Water	Mudflat	Rank	Short	Dense	Sparse	Water depth (cm)
Amphibians		✓			0–20	✓	✓		✓		✓	
Reptiles	✓	✓			0–50	✓		✓	✓	✓	✓	
Grebes	✓				25+	✓			✓		✓	
Geese			✓	✓	0–10	✓	✓		✓	✓	✓	
Dabbling ducks		✓	✓		5–25	✓	✓	✓				30–200 with 30–70% of pit < 60 cm deep
Diving ducks		✓	✓		25+	✓						60–240; average 100
Hawks	✓				NA				✓	✓	✓	
Galliforms		✓	✓		D–M			✓	✓	✓	✓	
Herons	✓	✓			7–12	✓			✓		✓	
Rails		✓	✓		5–30			✓	✓	✓		
Coots			✓	✓	28–33	✓			✓		✓	
Puddle ducks												30–180; average 45
Shorebirds		✓			0–7	✓	✓		✓		✓	< 30 for 20% of pond when full
Owls	✓				D–M				✓	✓	✓	
Swallows		✓			NA	✓			✓		✓	
Sedge wrens		✓			NA			✓		✓		
Nesting passerines		✓	✓		NA			✓	✓	✓	✓	
Winter fringillids			✓		NA			✓	✓	✓	✓	
Rabbit				✓	0			✓		✓		
Raccoon	✓	✓	✓		0–10	✓	✓	✓	✓	✓	✓	
Deer				✓	0			✓				
Muskrats and nutria												20–45

[a] source: Fredricks and Taylor (1982)
[b] source: Payne (1992)
[c] D–M = range dry to moist
NA = not applicable (use is not dependent on flooding or specific water depths)

Factor	Remarks
	Plant height has been included as an important habitat variable in the HEP models for some species. The optimal average height of herbaceous vegetation for several species follow in Table 7.2. Table 7.2 identifies vegetative cover densities observed to attract different vertebrate groups in moist-soil impoundments. While this information provides a general guide for design, local experts should be consulted to confirm requirements for target species.

Table 7.2.
Optimal average height of vegetation for individual species
(based upon HEP models)

Species	Optimal average height of vegetation	Reference
Lesser scaup (nesting)	25–60 cm (10–24 in) : herbaceous	Allen (1986a)
Gadwall (breeding)	≥ 25 cm (10 in) : mean visual obstruction	Sousa (1985b)
Blue-winged teal (breeding)	≥ 25 cm (10 in) : mean visual obstruction	Sousa (1985a)
Least tern	≤ 10 cm (3.9 in) : herbaceous and shrub	Carreker (1985)
Roseate spoonbill	3–20 m (9.8–65.6 ft) : woody vegetation on wetland mainland 0.5–10 m (1.6–32.8 ft) : woody vegetation on wetland/upland island	Lewis (1983)
Red-spotted newt	≥ 1 m (3.3 ft) : herbaceous	Sousa (1985c)

Percent open water (Element 13a)	A planned wetland designed to have an approximately 50:50 vegetation to water ratio can generally be expected to attract a higher diversity and/or abundance of water dependent birds (Element 13a rationale). For this reason several authors recommend that wetlands be designed and/or managed to maintain approximately 50% open water (e.g., Weller and Spatcher 1965; Verry 1982, 1989; Bookhout et al. 1989, Pederson et al. 1989; Ball and Nudds 1989; Payne 1992).

Factor	Remarks
	A 50:50 vegetation/water ratio may not provide the best habitat for some wetland dwelling birds or other wildlife species. Table 7.3 lists optimal conditions for specific species.

Table 7.3.
Optimal percent vegetative cover for individual wildlife species
(based upon HEP models)

Species	**Herbaceous**	**Shrub**	**Tree**	**Reference**
Least tern	< 15%			Carreker (1985)
Western grebe	< 30%			Short (1984b)
Canvasback (breeding)	10–35% (pair/brood)			Schroeder (1984)
	30–60% (nesting)			
Lesser scaup (breeding)	20–50% (brood)			Allen (1986a)
	30–75% (nesting)	10–25%		
Mallard (winter, lower Mississippi Valley)	50–90%		50–80%	Allen (1987)
Muskrat	50–80%			Allen and Hoffman (1984)
Swamp rabbit	> 75%	> 50%	25–60%	Allen 1985
Beaver		40–60%	40–60%	Allen 1983
Mink		≥75%	≥75%	Allen 1986b
Slider turtle	> 90% *			Morreale and Gibbons (1986)
Red-spotted newt			≥75%	Sousa (1985c)

* includes submerged vegetation

Factor	Remarks
Vegetation/water interspersion (Element 13b)	A planned wetland designed to have high vegetation/water interspersion can generally be expected to attract a higher diversity and/or abundance of water dependent birds (Element 13b rationale). For this reason several authors recommend that wetlands be designed and/or managed to maintain high vegetation/water interspersion (e.g., Weller and Spatcher 1965, Bookhout et al. 1989, Pederson et al. 1989, Verry 1989, Payne 1992). Size of the open water patches in the planned wetland may be important to some wildlife species. The most commonly recommended patch size is 0.1–0.2 ha (0.25–0.5 ac) (e.g., Weller and Spatcher 1965, Kaminski and Prince 1981, Ball and Nudds 1989, Bookhout et al. 1989, Pederson et al. 1989, Verry 1989), although other patch sizes may be suitable. Weller and Spatcher (1965) found that experimentally cut 0.025 acre areas in large dense stands of cattail were unattractive to most species, except redwings. Presumably, these areas were too small for waterfowl take-off and landings. Openings approximately 0.004–0.012 ha (0.01–0.03 ac) appeared to provide attractive habitat for many species; interconnecting waterways between pools were more preferable for some marsh birds (e.g., ducks and grebes). Larger areas of 0.1–0.2 ha (0.25–0.5 ac) seem necessary to attract swimmers and slow flyers (Weller and Spatcher 1965). Kaminski and Prince (1981) recommended randomly spaced (a) circles at least 0.1 ha (0.25 ac) to reduce aggregations of breeding ducks and to allow diving ducks to take flight or (b) sinuous shaped strips to increase edge and reduce visual encounters between conspecific pairs of ducks. Ball and Nudds (1989) recommended patches of about 0.15 ha (0.4 ac) for mallards in cattail marshes. Linde (1982) described excavated potholes in Wisconsin wetlands as rectangular, commonly with the following dimensions: 4.6–6.1 m (15–20 ft) wide, 12.2–18.3 m (40–60 ft). long, and 1.2–1.5 (4–5 ft) deep; with optimal spacing of 61 m (200 ft). Techniques for creating openings include use of a bulldozer, a dragline, and blasting (Linde 1982). Mowing is preferable to burning to create open water patches because mowing allows better control of habitat configuration, initially produces more abundant invertebrates, and may produce long-lasting openings in shallow water (Ball and Nudds 1989). Establishing and maintaining a well interspersed 50:50 ratio of vegetation to water may not be feasible or practical. If the open water areas are too small or shallow amidst a field of aggressive plant species (e.g., *Typha* spp., *Phragmites australis*) then the small openings will rapidly become revegetated. There may be little benefit to creating

Factor	Remarks
	small openings unless there are plans for management (e.g, water level control, prescribed burning, herbicide application).
Aquatic vegetation	Aquatic vegetation (e.g., *Potomogeton* spp., *Myriophyllum* spp., and *Ceratophyllum* spp.) provides habitat for aquatic organisms which in turn are an important food item for wildlife species such as diving ducks. To encourage the production of aquatic vegetation in constructed stock ponds, Rumble and Flake (1983) recommended maximizing the amount of shallow water areas and shallow inlets. Korschgen (1989) addresses factors which can affect the establishment and maintenance of aquatic vegetation (e.g., water quality, drawdown, control of carp). Seek advise from local experts for guidance on local management practices for aquatic plant control. Appropriate references can also be obtained from The Center for Aquatic Plants, University of Florida, 7922 NW 91st Street, Gainesville, Florida 32606 (Tel. 904-392-1799).
Undesirable plant species	Several management practices have been tested and/or initiated, particularly for herbaceous monotypic wetlands (e.g., burning; grazing; mowing; scarification by rototilling; water level management; blasting; and use of chemicals such as Rodeo, Roundup, and glycophosphate) to increase habitat heterogeneity for the purpose of increasing waterfowl use (Murkin et al. 1982, Kaminski and Prince 1981, Linde 1982, Kantrud 1986, Ball and Nudds 1989, Jorde et al. 1989, Hindman and Stotts 1989, Reid et al. 1989).
GEOMORPHIC FEATURES	
Shape of upland/wetland edge (Element 21a)	A planned wetland designed to have an irregular upland/wetland edge can generally be expected to attract a greater abundance of waterfowl (Element 21a rationale). Some authors have recommended irregular shorelines in planned wetlands. Based upon a study of constructed wetlands in Minnesota, Leschisin et al. (1992) concluded that for mallard management, wetlands should be constructed with maximum shoreline length. Bélanger and Couture (1988) recommended that man-made ponds have a shore irregularity index ≥ 1.5 to encourage use by dabbling duck broods. Uresk and Severson (1988) recommended a shoreline irregularity index of at least 2.2 for reclaimed mining areas. **Shoreline irregularity index** is the shoreline length divided by the circumference of a circle with an area equal that of the lake (Wetzel 1975).

Factor	Remarks
Wetland/open water edge	Wetland vegetation/open water edge may be an important habitat factor for some wildlife species. The amount of edge has been found to be a critical habitat factor for nesting density of several wetland dwelling birds, e.g. western grebe and red-winged blackbird (e.g., Short 1984b, Murken et al. 1989) Edge should be considered in conjunction with the width of vegetation and open water patches. To recognize the importance of cover-water interface (edge) and the width dimension of both cover and open water, Murkin et al. (1989) introduced the phrase "functional edge."
Water/land slope	Wetlands with a gradual slope from shallow water areas up to and past the upland/wetland edge may be required for some wildlife species. The wetland/upland edge is an important access area between the two habitats. A gradual slope permits free movement for many waterfowl species which nest in and/or obtain food from adjacent upland areas. A gradual slope also maximizes the amount of available shallow water habitat which is desirable for foraging and as habitat for potential food sources, e.g., invertebrates, fish, crayfish, snails, tadpoles. Some authors identified and recommended specific slopes. Kress (1985) recommended a 3:1 slope in the deep part of a pond grading into a 6:1 slope to create a shallow shoreline to attract wading birds. Recommended slopes for planned wetlands include 4:1 (Green and Salter 1987) and no steeper than 5:1 (Proctor et al. 1983) to provide easy access to and from the water. To provide productive habitat for waterfowl, it is recommended that a planned wetland be designed to have a gradual (approximately 4:1–6:1) slope with some diversity of topography (Pers. comm., James Parnell, University of North Carolina-Wilmington, Dec. 4, 1990). Steep slopes not only hinder free movement, but have also been found to cause high mortality in broods. The young waterfowl can drown if they are unable to go ashore.
Orientation	Wetland orientation may be an important habitat factor for some wildlife species. Ringelman et al. (1989) recommended the design of long, narrow wetlands oriented east-west, especially in cold climates, to maximize southern shoreline exposure for wintering ducks.
Ratio of uplands to wetlands	Some literature suggests the use of an uplands to wetlands ratio for planned wetlands. A 3:1 or 4:1 ratio of uplands to wetland has been used in Minnesota (Pichl 1986 cited in Payne 1992). In a technique for evaluating the development of wetlands for waterfowl, Dobie (1986

Factor	Remarks
	cited in Payne 1992) assigned the highest score to a 3:1 ratio of secure upland nesting cover to wetland area (secure cover = permanent undisturbed grassland, no-till small grains, or alfalfa left unmowed until after July 31). Dobie noted that a 1:1 ratio might be acceptable if seasonal predator management is practiced. While these ratios may be applicable to Minnesota wetlands, they should not be applied to other geographic areas without supporting data or advise from experts.
Adjacent uplands for waterfowl	Conditions in the adjacent upland may be an important habitat factor, particularly if a goal is to attract waterfowl. Many waterfowl species select for certain characteristics in the establishment of nests sites. For example, blue-winged teal typically select the tallest, most dense herbaceous vegetation available in which to nest (Sousa 1985a). Lack of disturbance is also important. Undisturbed vegetation (e.g., not tilled, mowed, or burned) is the most productive nesting habitat for blue-winged teal (Kirsch et al. 1978).
Islands (Element 23)	A planned wetland designed to include upland islands can be expected to benefit waterfowl which can use the islands for nesting, loafing, and cover (Element 23 rationale). Size may be important, particularly if the island is to support waterfowl nesting pairs. Kress (1985) noted that islands as small as 2.8 m^2 (30 ft^2) are large enough to shelter at least one nest. One recommended minimum size is ≥0.02 ha (0.05 ac) (Ambrose 1983a, Proctor et al. 1983). The minimum size should be determined for local/regional setting either from the literature or by contacting an expert with practical experience in establishing waterfowl habitat in the region. Shape in combination with size may determine the potential number of waterfowl nests. In a study of wetlands in the Dakotas, Nebraska, and Prairie Provinces, Hammond and Mann (1956) found that islands with surfaces 4.5–9 m (15–30 ft) wide usually had more use, per acre, compared to larger islands. Low cross-shaped (upland) islands are used in wildlife management areas because their irregular shape and increased edge permits the establishment of several distinct territories, thus maximizing waterfowl utilization of space (Pers. comm., Holliday Obrecht, USFWS — Patuxent Wildlife Research Center, Laurel MD, 4 December 1990) (Figure 7.3, p. 7–20).

Factor	Remarks
	Islands are capable of very high waterfowl production, but only if maintained in a predator-free state and spaced properly to allow sufficient nesting territory. Depending upon local predators, islands may support a concentration of nesting waterfowl that is only comparable to that found on the mainland. There may be no added benefit to including islands in a planned wetland. Before including an island(s), it should be determined what predators are present and if they pose a threat to successful nesting. Possible predators include: mink, raccoons, foxes, skunks, weasels, badgers, crows, dogs, cats, and humans. It may be necessary to establish a minimum distance of open water between the mainland and island to significantly reduce the risk of predation (Table 7.4, p. 7–35). These distances, however, will not deter avian predators. In rural areas where native predators such as mink are prevalent, maintaining a minimum distance may be critical to achieving a predator-free island. The long distances recommended in rural areas may not be necessary in urban areas where the main predators are humans, cats, or dogs. Methods of island construction vary. The islands may be permanent or short-term features. One method involves placing litter brushpiles covered with hay or piles of earth on top of the ice in the winter (Linde 1969: cited in Rakstad and Probst 1982). These islands may only last one to four years depending upon weather conditions. Location with respect to the prevailing wind direction may be an important consideration for islands subject to strong wave action on large bodies of water. Planting can be done on the mainland to reduce winds and/or on the island to reduce erosion (Ambrose et al. 1983a, Proctor et al. 1983).

Factor **Remarks**

Table 7.4.
Recommended island distance from mainland

Distance from mainland	Water depth	Locale	Reference
20-50 m (66-164 ft)	0.3-1.0 m (1-3.3 ft)	Canadian prairie provinces	Green and Salter (1987)
> 9.1 m (> 30 ft)	0.5-0.6 m (1.5-2 ft)	Central and Southern Appalachia Green River-Hams Fork Region of Colorado, Utah, and Wyoming	Ambrose et al. (1983a) Proctor et al. (1983)
150-200 m (492–656 ft)	2-3 m (6.6-9.8 ft)	North Dakota	Duebbert et al. (1983)
Several hundred feet	≥0.3 m (≥1 ft)	North Dakota, South Dakota, Nebraska, and the Prairie Provinces	Hammond and Mann (1956)
Several hundred feet–(0.5 mile) (0.8 km)	2-3 m (6.6-9.8 ft)	Prairie Pothole Region	Pers. comm., Harold Kantrud, Northern Prairie Wildlife Research Center, Jamestown, ND, Dec. 3, 1990

Wetland size
(Element 16b)

The decision to add habitat to an existing wetland or to create an isolated wetland depends upon management objectives. There is no scientific basis for using a minimum acreage above which it can be assumed that a wetland will provide substantially better habitat for all wildlife species. Some general guidance can be extracted from the literature, but first it must be decided if the planned wetland is to be designed to attract particular wildlife groups or species. If so, then acreage should be considered in conjunction with other habitat requirements. The U.S. Fish and Wildlife Service HEP models and other literature (e.g., Robbins et al. 1989) should be consulted for guidance on habitat requirements for individual species.

Several authors have recommended minimum acreages for ponds and/or wetlands (Table 7.5, p. 7–36). Before following these or any other recommended minimum acreages, the justification for establishing the minimum size should be researched and known. The use of a recommended minimum acreages may be inappropriate for several reasons. The acreage may be applicable to different wildlife species or groups, geographic regions, and/or wetland types. Additionally, the threshold may not be literature validated or based upon sufficient data.

Factor	Remarks

Table 7.5.
Recommended minimum size for ponds and/or wetlands

Size	Comment	Locale	Reference
≥0.5 ha (≥1.24 ac)	Man-made ponds designed for use by dabbling duck broods	Northeastern United States	Bélanger and Couture (1988)
0.4–2.0 ha (1–5 ac)	Optimal for reclaimed mining areas	Green River-Hams Fork region of Colorado, Utah, and Wyoming	Proctor et al. (1983)
0.4–4.0 ha (1–10 ac)	Reclaimed mining areas	Northern Great Plains	Uresk and Severson (1988)
< 4 ha (≤10 ac)	Assessment for waterfowl use of wetlands: small wetlands are generally more productive per unit area		Dobie (1986) cited in Payne (1992)
> 2 ha (> 5 ac)	Guide to wetland functional design	Contiguous United States	Marble (1990)

Width of riparian habitat

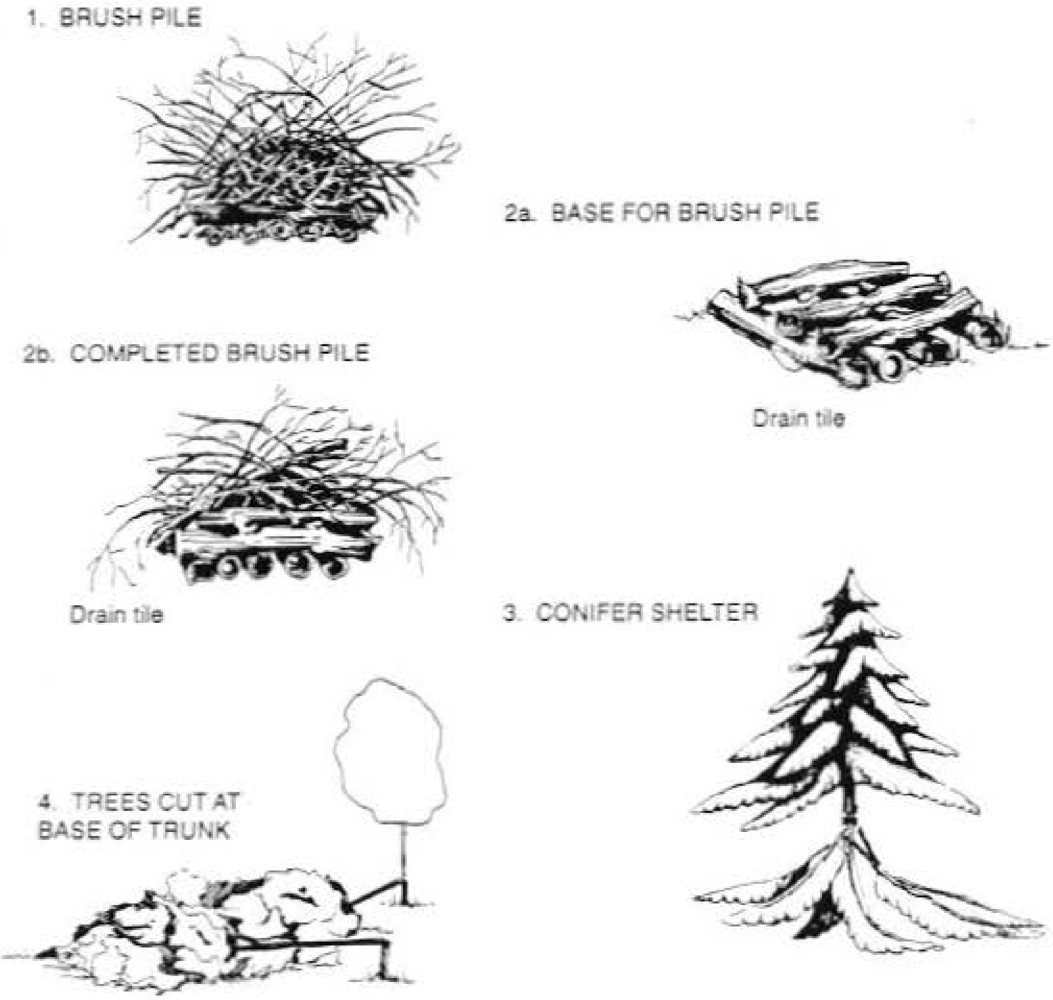
Greater width of riparian habitat may benefit some wildlife species. Stauffer and Best (1980) found that bird species richness in Iowa increased significantly with increased width of wooded riparian habitats (e.g. number increased from 15–30 breeding species for wooded habitat widths from about 2.4–6.1 m [8–20 ft]). A similar trend was found in a comparison of herbaceous streamside habitats (e.g., numbers increased from three to seven species for herbaceous widths 1.8–5.1 m [6–17 ft]). Based upon a study of avian communities of Maryland and Delaware, Keller et al. (1993) recommended that riparian forests be at least 100 m (328 ft) to provide some nesting habitat for area-sensitive birds. In this survey of 25–800 m wide corridors, probabilities of occurrence increased most rapidly between 25 and 100 m.

Substrate

Substrate may be an important factor for some wildlife species. In a study of the use of American bulrush (*Scirpus americanus*) marshes by greater snow geese in Québec, Giroux and Bédard (1988) found that the proportion of silt and the abundance of rock/gravel in the marsh

Factor	Remarks
	were negatively correlated with the number of geese. Therefore, they recommended that when creating sanctuaries, selected marshes should have soft substrate, low abundance of rock and high subterranean biomass of bulrush. The importance of substrate may also be critical for other wildlife species, especially amphibians and reptiles. This is illustrated in the bullfrog and snapping turtle HEP models which assume that a habitat is more suitable as winter cover when it has greater percent silt in the substrate (Graves and Anderson 1987a, 1987b).
Water depth	Water depth may be an important factor for some wildlife species. Different water depths create different conditions that are compatible with the preferred feeding modes of a variety of wildlife species. For example, based upon the HEP model, the optimal water depth for the slider turtle is 1–2 m (3.3–6.6 ft) (Morreale and Gibbons 1986). Table 7.1 (p. 7–27) identifies water depths observed to attract different vertebrate groups in moist soil impoundments. Recommended depths for reclaimed gravel pits are also provided. An irregular topography may attract more species to a planned wetland. Fredrickson and Taylor (1982) noted that an irregular topography is important for managed water impoundments because the diverse depths create different conditions that are compatible with the preferred feeding modes of a variety of bird species. Water depths can be managed to optimize wildlife use. For example, Magee et al. (1993) recommends for willow wetlands that water depths not exceed 50 cm (20 in) and that the water levels be decreased to 20–30 cm (8–12 in) to coincide with water bird migration or breeding activities. Refer to discussion on water-level manipulation in this section for additional information. The depths listed in Table 7.1 (p. 7–27) provide a general guide for design; however, local experts should be consulted to confirm specific requirements for target species and appropriate water levels for particular wetland types.

Factor	Remarks
ATTRACTORS	
Attractors (Element 22a)	A planned wetland designed to have abundant wildlife attractors can generally be expected to attract a greater diversity/abundance of wildlife (Element 22a rationale). If attractors are included in the planned wetland, then the designer should examine local comparable natural wetlands to determine what is appropriate (e.g., type of attractor, sizes, distribution).
Snags	Snags are important habitat factors, particularly to cavity-nesting birds. Size and species of dead trees may be critical to determining which birds species can use the trees for nesting. Larger snags generally support a greater abundance and diversity of cavity-nesting birds. Each bird species has specific size requirements. For the EPW procedure, tree stems (stem bole) with a dbh of ≥25 cm (≥10 in) are recognized as a separate vegetation layers and are thus considered large enough in to provide habitat for cavity nesting birds. Green and Salter (1987) indicated that a suitable snag size is 5–10 m (16–33 ft) tall and at least a 20–30 cm (8–12 in) dbh. Average dbh of preferred nesting trees for individual species may be as small as 20 cm (8 in) for the downy woodpecker or as great as 74 cm (188 in) for the European starling (Kress 1985, Sedgewick and Knopf 1990). For additional information regarding snag densities and sizes for cavity nesting birds, refer to Kress (1985, pp. 30–35) and Sedgewick and Knopf (1990).
Dense brush	Dense brush may be an important habitat for wildlife species. A planned wetland can be designed to include low dense shrub vegetation and/or brush piles. There are several methods for building brush piles (Figure 7.5, p. 7–39). To encourage amphibians, Payne (1992) recommended placing brush piles in water 6 cm (24 in) deep or in stock ponds for egg laying. Before including brush piles, it should be determined if site conditions are suitable. For example, it may be useless to install brush piles in an area subject to extreme water fluctuations and/or high current velocities. If brush piles are constructed, they should be located away from potential ignition sources because they can become fire hazards (Green and Salter 1987).



1. Center pieces of log or rock over a bowl-shaped depression. For the central core of the pile use large branches > 1.2 m (4 ft.) long with a diameter $\geq$ 5 cm ($\geq$ 2 in.) and anchor in soil. Fill gaps in central core and outer parts of brush pile with small branches (Green and Salter 1987).
2. Lay four 1.8 m (6 ft.) long logs [10-20 cm (4-8 in.)] on ground and then lay 4 approximately same sized logs perpendicular to first set. Pile cut shrubs and pruned branch stems pointing toward ground, on top of logs to make mound. Alternative methods include constructing brush pile over 3 rock piles in a V-formation or over ceramic drainage tiles (Kress 1985).
3. Slice underside of conifer lower branches to create teepee-like shelter (Kress 1985).
4. Cut trees at base of trunk so that enough bark remains intact for tree to live and sprout after it falls (Kress 1985). The survival and successful sprouting will depend upon the tree species. For example, Red maple (*Acer rubrum*) was found to sprout, whereas sweetgum (*Liquidamber stryaciflua*) did not survive in an attempt to create brush piles in Maryland (Pers. comm., Holliday Obrecht, USFWS, Patuxent Wildlife Research Center, Laurel, Maryland, 4 December 1990).
5. Fell trees or bring trees cut off-site (e.g., used Christmas trees) to create brush pile.

Figure 7.5.
Examples of methods for building brush piles (sources: Kress 1985, Green and Salter 1987)

Factor	Remarks
Fallen trees	Fallen trees may be an important habitat factor for several wildlife species. Green and Salter (1987) suggest that the best cover would be provided by larger diameter trees (50 cm [20 in]). Payne (1992) made the following recommendations. To encourage amphibians in stock ponds, tree branches should be placed in water 6 dm (24 in) deep or less for egg laying. Some downed tree branches should be place along at least 25% of the total pond bank. In most ponds, five to ten logs, 1.5–2.4 m (5–8 ft) long and 15 cm (6 in) wide, should be placed with part of the log in the water, preferably with the entire underside touching the bottom. While useful, these recommendations may not be appropriate for all wetlands. Suitable tree length, diameter and density may vary widely depending upon wetland type, geographic region, and requirements of the individual target species.
Rocks	Rocks/boulders may be placed within a planned wetland to provide additional cover and loafing sites for wildlife. Location may be important. For example, Johnson (1983 cited in Payne 1992) noted that rock piles placed along the north shore of ponds were used as sunning sites by turtles and snakes and as shelter by bullfrogs and salamanders. Instructions on how rock piles can be built to improve wildlife habitat are provided by Kress (1985), Green and Salter (1987), Ambrose et al. (1983a), and Proctor et al. (1983). General recommendations are for the use of coarse angular rocks because they provide larger interior spaces within a pile, are more stable, and less subject to weathering (Ambrose et al. 1983a, Proctor et al. 1983). Recommended dimensions are provided in Table 7.6, p. 7–41. Recommendations on rock pile size, placement, and habitat should be made by local wildlife biologists. There are no formal guidelines.

Factor **Remarks**

Table 7.6.
Recommended dimensions for rock piles

Length	Width	Height	Locale	Reference
Hand-placed 1.8 m (6 ft)	1.8 m (6 ft)	0.6–0.9 m (2–3 ft)	Central and Southern Appalachia	Ambrose et al. (1983a)
Equipment-placed > 4.3 m (> 14 ft)	> 4.3 m (> 14 ft)	1.2 m (4 ft)		
4 m (3.3 ft)	4 m (3.3 ft)	2 m (6.6 ft)	Green River-Hams Fork region of Colorado, Utah, & Wyoming	Proctor et al. (1983a)
Total area 10 m^2		1–4 m (0.3–3.3 ft)	Canadian Prairie provinces	Green and Salter (1987)

Artificial structures

Artificial structures such as nesting structures, roosting sites, and artificial tree cavities are often used to attract wildlife species. Details on methods of constructing and installing artificial structures can be obtained in references on wildlife management techniques (e.g., Yoakum 1980, Ambrose et al. 1983a, Proctor et al. 1983, Kress 1985, Green and Salter 1987, Payne 1992). Payne (1992) cautions that the installation of artificial nesting and loafing sites is expensive and sometime useless. While islands may increase carrying capacity, artificial structures may not, unless they provide better protection from predators than natural sites. Maintenance of artificial structures should also be considered.

DISTURBANCE
(Element 4c)

Animal activities

Animal activities (e.g., grazing, burrowing) can cause extensive and long term damage to existing wetland habitat (e.g., Winchester et al. 1985) and planned wetlands (e.g., Blair and Langlinais 1960, Webb 1982, Conner and Flynn 1989, SCS 1992, Llewellyn and Shaffer 1993, Garbisch and Garbisch 1994) (refer to Element 4a rationale for SB function). While over grazing by geese in natural wetlands may be naturally prevented for a variety of reasons (Reed 1989), it may prove

Factor	Remarks
	disastrous in a newly planted wetland which has only shallow and sparse belowground biomass.

One solution to wildlife eatouts is the construction of an exclosure fence at the time of planting. Garbisch and Garbisch (1994) recommended the use exclosure fences until after a thick root mat develops in two to three years as a method to protect planted shores in the Chesapeake Bay area from Canada goose grazing. Conner and Flynn (1989) found chickenwire fence to be effective in excluding nutria from bald cypress planted seedlings in Louisiana. Fencing has also been used to exclude cattle (Webb 1982). Payne (1992) recommended a rest-rotation grazing system to protect areas around stock ponds from overgrazing by cattle (refer to following discussion on controlled grazing).

Another solution to wildlife eatouts is to initially establish wetland plants that are resistant to herbivory. For example, Llewellyn and Shaffer (1993) demonstrated that *Justica lanceolata* is amenable for use in marsh restoration in the southeastern region of the United States because (a) it is resistant to nutria herbivory and may be a herbivore repellent, (b) it is resilient to saline storm surges, (c) it is effective at trapping sediments and raising marsh elevations, and (d) once it is established, it is readily outcompeted by other wetland plant species.

Some species are considered undesirable because they prey upon waterfowl. Habitat improvements designed to attract waterfowl also attract high densities of predators such as raccoon, red foxes, striped skunks, opossums, crows, gulls, snapping turtles, and competitors such as blackbirds. Methods for controlling these species are addressed by Novak et al. (1987 cited in Payne 1992).

Beaver can interfere with the control of artificial impoundments. Beaver invasion can be discouraged by the use of screened culverts and water control structures with anti-beaver devices, the use of explosives to blow out beaver dams, the installation of drains that prevent beaver from controlling water level, and/or by selecting vegetation that beavers do not like (Yoakum 1980, Buech 1982, Payne 1992, SCS 1992). Beaver ponds can be considered important in meeting the needs of winter and migratory waterfowl. Arner and Hepp (1989) describe an approach to managing beaver ponds for waterfowl in the southern United States.

Factor	Remarks
Fish	An abundance of rough fish (e.g., carp, bullheads, buffalo, and sheephead) within the wetland is considered undesirable because this group is likely to lower invertebrate availability. The importance of carp is illustrated by the use of "carp presence" as a determinant of habitat suitability in the red-winged blackbird HEP model developed by Short (1985). Carp disturb the submergent vegetation within the wetland, which then destroys habitat for emergent aquatic insects and reduces wetland food sources (Short 1985, SCS 1992). If necessary, rough fish can be controlled by netting, drawdowns, chemical treatment (e.g., rotenone), or installation of barriers. If drawdown is used, special care must be taken to insure that small pools of water do not remain (SCS 1992).
Controlled grazing	Controlled livestock grazing (e.g., cattle, horses, sheep) is one method to manage vegetation in existing wetlands for improving wildlife habitat (e.g., Kantrud 1986, Pederson et al 1989). Thus, it may also be considered as a management practice for a planned wetland. Grazing can be used to (a) open up dense patches of cover so that diving ducks and other waterbirds can penetrate for nesting (Rutherford and Snyder 1983), (b) increase structural diversity with the goal of increasing bird and mammal use (Krueger and Anderson 1985), and (c) reduce certain undesirable perennial plants (Chabreck et al. 1989). Controlled grazing may require limiting access to the wetland to specific time periods. Rutherford and Snyder (1983) recommended using cattle for two to three months in late winter and early spring. Chabreck et al. (1989) suggested that cattle be excluded from freshwater and brackish marshes during July, August, and Sept. Guidelines for grazing in riparian systems are summarized in Payne (1992). Payne (1992) noted that if management for shorebirds is preferred, controlled grazing may be used to encourage mudflats. To enhance waterfowl brood use of stockponds, Rumble and Flake (1983) recommended distributing livestock and maintaining grazing levels to allow continued growth and existence of shoreline and emersed vegetation.
Human activities	Human activities (e.g., recreational boating) can adversely affect wildlife use of a planned wetland (Element 4c rationale). Initial construction impacts to existing wildlife in and around the planned wetland may be minimized by avoiding sensitive time periods (e.g., nesting) for particular species. Impacts from activities after construction, can be reduced or avoided by (a) locating the planned wetland away from potential disturbances and/or (b) establishing use restrictions (e.g., boating restrictions). For example, based upon a study

Factor	Remarks
	in the Dakotas, Duebbert and Frank (1984) recommended a July 21 earliest date for any required mowing in duck nesting areas (e.g., highway right-of-way). August 1st was considered preferable on areas managed for ground-nesting birds. Appropriate dates will depend upon the type of impact, wetland, region, and species of interest.
FOOD	
Food	Wildlife use a variety of foods including vegetation, invertebrates, fish, and vertebrates (Table 7.1, p. 7–27). The primary food source may vary depending upon the species, season, age, and sex. For example, the primary food of gadwalls during fall and winter is vegetation, whereas animal food (e.g., crustaceans) makes up a large portion of their spring and summer diet (Sousa 1985a). The following paragraphs address basic wildlife food requirements.
Vegetation	Vegetation provides a variety of foods for wildlife species. It is desirable to include plants that provide wildlife food, then refer to documents listing these species (e.g., Fredrickson and Taylor 1982, Smith et al. 1989, Payne 1992, Thunhorst 1993). Some shrub and tree species supply valuable foods through the production of their seeds, berries, acorns, etc. The importance of tree species is illustrated in the practice of constructing impoundments or **greentree reservoirs (GTRs)**. A GTR is a bottomland hardwood area shallowly flooded for short periods during the dormant period for the purpose of attracting waterfowl and increasing mast production. Management of GTRs is addressed in Yoakum et al. (1980) and Reinecke et al. (1989). A list of tree species with relative food values to ducks is provided by Payne (1992, p. 27).
Fish	Fish are the primary food source for many wildlife species. Therefore, depending upon the target species, it may be important to determine if fish are potentially present and if conditions are conducive to foraging. To be present, water depths must be sufficient to provide a refuge for fish during freezing and/or drought. Water depth is critical to the success of foraging for some wildlife. HEP models for the belted kingfisher, great blue heron, and Forster's tern indicate that these species catch fish primarily in shallow waters at < 60 cm (24 in), ≤50 cm (20 in), and < 1 m (39 in) deep, respectively (Prose 1985, Short and Cooper 1985, Martin and Zwank 1987). Based

Factor	Remarks
	upon these values, it would appear that a shallow water depth < 50 cm (20 in) would provide sufficient access for these species and perhaps would also be appropriate for other bird species that forage on fish. Fish size may also be critical depending upon the target species. For example, habitat for the western grebe is considered suitable in the HEP model only if the wetland possesses a population of fish about 27–88 mm (1–3.5 in) in length (Short 1984b).
Invertebrates	Invertebrates are an important food source for many bird species, including the canvasback, northern pintail, and wood duck (Sousa and Farmer 1983, Schroeder 1984, Suchy and Anderson 1987). The value of vegetation types lies not only in their being a direct source of food for waterfowl, but also in their association with a variety of aquatic invertebrates. Available food supply is generally improved with increased vegetative diversity because it is accompanied by the diversification of the invertebrate community. Techniques to increase invertebrates include water-level manipulation (e.g., Bélanger and Couture 1988, Magee et al. 1993) and the addition of hay/straw. For example, Green and Salter (1987) recommended spreading a 2 cm (0.8 in) layer of hay or straw on the bottom of pits to expedite development of aquatic invertebrates in mine reclamation. The importance of plant litter is evident in the increased usage in tillage wetlands that contain stubble or other dead vegetative debris. Kantrud and Stewart (1977) noted that the value of tillage wetlands to breeding waterfowl was partially dependent on the presence of stubble, dead weeds, and crop residue. The reduced waterfowl use of some tillage wetlands was attributed to a relatively low invertebrate fauna, which resulted from a lack of organic substrate in the ponds (Kantrud and Stewart 1977, Krapu 1974).
WATER	
Water quality (Element 20a)	The quality of the input water may be a critical wildlife habitat factor, particularly if there is gross contamination (Element 20a rationale) and/or levels of other water quality parameters which might limit productivity. Before the planned wetland is designed, the water quality should be assessed. If there is potential for contaminant input, then an alternative site may need to be explored. General water quality parameters should also be examined to determine if they fall within

Factor	Remarks
	ranges that plants, fish, and other aquatic organisms can tolerate (Table 7.7). Extremes in these parameters will likely result in low production which in turn would result in low abundance and/or diversity of consumers such as waterfowl. Table 7.7 should only be used as a guide. Depending upon the wetland type, the planned wetland may normally have high or extreme values for one or more of the water quality parameters. For example, bogs have extremely low pH and are normally characterized by low populations of animals and the absence of entire groups of fauna such as mollusks (Mitsch and Gosselink 1986).

Table 7.7.
Water quality parameters required to support fish and other aquatic organisms

	Range	
Parameter	**Fish and other aquatic organisms**[a]	**Freshwater fish**[b]
pH	6.5–9	6.5–8.5
Alkalinity	≥ 20 mg/L	—
Hardness	20–150 mg/L	—
Dissolved oxygen	≥ 5 mg/L	≥ 5 mg/L (warmwater fish) ≥ 6 mg/L (salmonoids)
Total dissolved solids	Productivity generally positively correlated	—
Temperature	≤ 20–30°C (≤ 68–86° F) depending on species and acclimation	< 29°C (< 80°F) (warmwater fish) < 21°C (< 70°F) (salmonoids)

[a] source: Herricks (1982)
[b] source: Stroud (1967)

Factor	Remarks
Water temperature	Water temperature may be critical for some wildlife species, particularly amphibians and reptiles. Examples of optimal temperature ranges required for some species are provided in Table 7.8. If the goal is to provide habitat for a species or group of species which has specific water temperature requirements, then this should be taken into consideration in the planned wetland design.

Table 7.8.
Optimal mean surface water temperatures for wildlife species
(based upon HEP models)

Species	Temperature	Reference
Slider turtle	25–30 °C: Growing season (77-86 °F)	Morreale and Gibbons (1986)
Snapping turtle	approx. 16–28 °C: Summer (61-83 °F)	Graves and Anderson (1987b)
Bullfrog	approx. 24–32 °C: Summer (76-90 °F)	Graves and Anderson (1987a)

Current velocity	Current velocity may be critical for some wildlife species. Examples of optimal current velocities required for some species are provided in Table 7.9. If the goal is to provide habitat for a species or group which have specific water current velocity requirements, then this should be taken into consideration in the planned wetland design.

Table 7.9.
Optimal mean current velocities
(based upon HEP models)

Species	Mean current velocity	Reference
Bullfrog	< 15 cm/sec (< 0.5 ft/sec) (at mid depth during summer)	Graves and Anderson (1987a)
Snapping turtle	< 60 cm/sec (< 2 ft/sec)	Graves and Anderson (1987b)
Slider turtle	< 80 cm/sec (< 2.6 ft/sec)	Morreale and Gibbons (1986)

Factor	Remarks
Water-level manipulation	Water-level manipulation is often used in wetlands to maximize wildlife habitat diversity, to control undesirable plant species, and to manage invertebrate availability (refer to previous discussion on invertebrates). Water can be managed for flooding depth, duration, and timing. The water level may be controlled with drawdowns or be kept constant. In northern prairie wetlands, drawdowns are used to promote emergent vegetation for use as cover and nesting material by waterfowl (Meredino et al. 1990). In southern areas, drawdowns are used to promote annuals used by migrating and wintering waterfowl after fall flooding (Payne 1992). Naturally occurring drawdowns also enhance waterfowl use. For example, closed basin lakes in interior Alaska (Yukon Flats) which experience extensive periods of drawdown have been observed to have high productivity of waterfowl (Lensink and Derksen 1986). Drawdowns can be cyclic (e.g., every five years) or noncyclic, complete or partial, fast or slow, early or later, depending upon geographic area and management objectives. For additional information refer to literature on wildlife management practices (e.g., Yoakum 1980, Fredrickson and Taylor 1982, Knighton 1982, Gordon et al. 1989, Smith et al. 1989, Payne 1992). If drawdowns are being considered, it is recommended that the local National Wildlife Refuge managers be contacted for guidance. Other considerations may need to be addressed before finalizing plans for water-level manipulation (e.g., mosquito control, flood control). Wetlands can be managed to encourage waterfowl use and to control mosquitoes (e.g., Meredith et al. 1985, Breininger and Smith 1990, SCS 1992). Strategies to control mosquitoes include (a) maintaining flooded conditions during summer mosquito breeding season and/or (b) stocking with mosquito fish (*Gambusia affinis*) to provide natural control. Refer to literature for specific information on the design of water control structures, conveyance channels and ditches, spillway design, pool elevations, and techniques for sealing a pond (e.g., Anderson 1982, Fredrickson and Taylor 1982, Payne 1992, SCS 1992). ***NOTE:*** If the planned wetland is to attract wildlife species, then it should be designed based upon the best available information for the target species in that region. In some cases, the revision or elimination of one or more of the EPW elements may be necessary. Also, if data is available demonstrating the importance of factors not included in the assessment (e.g., substrate) to target species, then these factors should be considered in the planned wetland design.

7.5 Example of Assessment of the Wildlife Function

PROJECT TITLE: MARLEY CREEK

WILDLIFE DATA SHEETS

Function weighting area (AREA) = Entire wetland assessment area

		For use in FCI Model		For use in Table A.2 only
ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both are NA, record NA
		WAA	Planned Wetland	
Features which reduce habitat value (elements 4c, 16b, and 20a):				
4. Disturbance				
4c. Disturbance of wildlife habitat	[WL]*			Assume NA = 1.0
a. No or moderate disturbance.	NA			
b. Periodic disturbance used as wildlife management practice (e.g., controlled burning).	NA			
c. Evidence of recent (e.g., within last year) substantial periodic disturbance which reduces habitat availability (e.g., wetland tilled, filled, excavated, burned, or mowed).	0.1	NA (a)	NA (a)	NA
16. Size				
16b. Wetland site size	[WL]			Assume NA = 1.0
Is the site considered to have a very low wildlife value because of its small size and poor conditions in or around the wetland (e.g., 1 ft. wide x 20 ft. long fringe marsh with access to other wetlands or upland wildlife habitat blocked by urban development)?				
a. No.	NA	NA	NA	NA
b. Yes.	0.1			
If yes, explain: ____________				

---

* Denotes function(s) to which element applies: SB = Shoreline Bank Erosion Control; SS = Sediment Stabilization; WQ = Water Quality; WL = Wildlife; FT = Fish (Tidal); FS = Fish (Stream/River); FP = Fish (Pond/Lake); and UH = Uniqueness/Heritage

Evaluation for Planned Wetlands

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both are NA, record NA
		WAA	Planned Wetland	
20. Water quality				
20a. Gross contamination	[WL]			Assume NA = 1.0
a. Minimal or no potential for contaminant input.	NA			
b. Potential for contaminant input present, but preventative measures taken (e.g., construction of swales and/or drainage ditches to direct highway runoff away from wetland).	NA	NA (b)	NA (b)	NA
c. Evidence of presence of highly toxic contaminants (e.g., stunted plant growth, excessive growth, and/or abnormal morphology; oil sheen on marsh surface) AND/OR known source(s) contributing highly toxic contaminants to the wetland (e.g., hazardous waste sites, superfund sites, landfills).	0.1			
Habitat complexity (elements 11a, 11b, 11c, 12a, 12b, 12c, 12d, 13a, 13b, 21a, 22a, and 23):				
11. Vegetation strata				
11a. Number of layers in wetland (Do not include layers in upland areas) Choose from 6 possible layers: • **tree** vegetation ≥ 6 m (20 ft) canopy cover ≥ 5% • **stem bole** tree stems ≥ 25 cm (10 in) dbh ≥ 5 per ha (2/ac) • **midstory** woody vegetation 1 - 6 m (3 - 20 ft) canopy cover ≥ 5% • **groundcover** variety surface covering 0 - 1 m (0 - 3 ft) • **surface water** 0 - 25 cm (0 - 10 in) in depth • **water column** open water below 25 cm (10 in)	[WL]			
a. 6 layers.	1.0	0.5	0.3	(-)
b. 5 layers.	0.9			
c. 4 layers.	0.7			
d. 3 layers.	0.5			
e. 2 layers.	0.3			
f. 1 layer.	0.1			

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA)
		WAA	Planned Wetland	If both are NA, record NA
11b. Condition of layer coverage (**See Figure A.5**). (Consider canopy cover of each of the three vegetation layers: tree, midstory and herbaceous groundcover)	[WL]			
a. Approximately equal proportions and high percent cover (e.g., > 40%) for each layer.	1.0			
b. Intermediate condition.	0.7	0.7	0.3	(-)
c. Predominantly 1 layer.	0.3			
d. Low percent cover for each vegetation layer.	0.1			
e. Predominantly unvegetated layer (e.g., open water, mudflat, bare ground, rock outcrop, and/or aquatic bed).	0.1			
11c. Spatial pattern of shrubs and/or trees (**See Figure A.6**)	[WL]			If one NA, record both scores.
a. No woody species -OR- few individual plants of woody species present (e.g., spatial pattern irrelevant for 2 trees).	NA	1.0	NA	NA-1.0
b. Irregular (e.g., random, aggregate, or clumped distribution).	1.0			
c. Regular (e.g., uniform distribution, row planting, orchard).	0.1			
11d. Difference in layers	[WL]			Record both scores.
a. Planned wetland contains same layers as WAA.	NA			
b. Planned wetland does not contain same layers as WAA.	1.0	NA	NA	NA
If answer "b", explain: ______________				

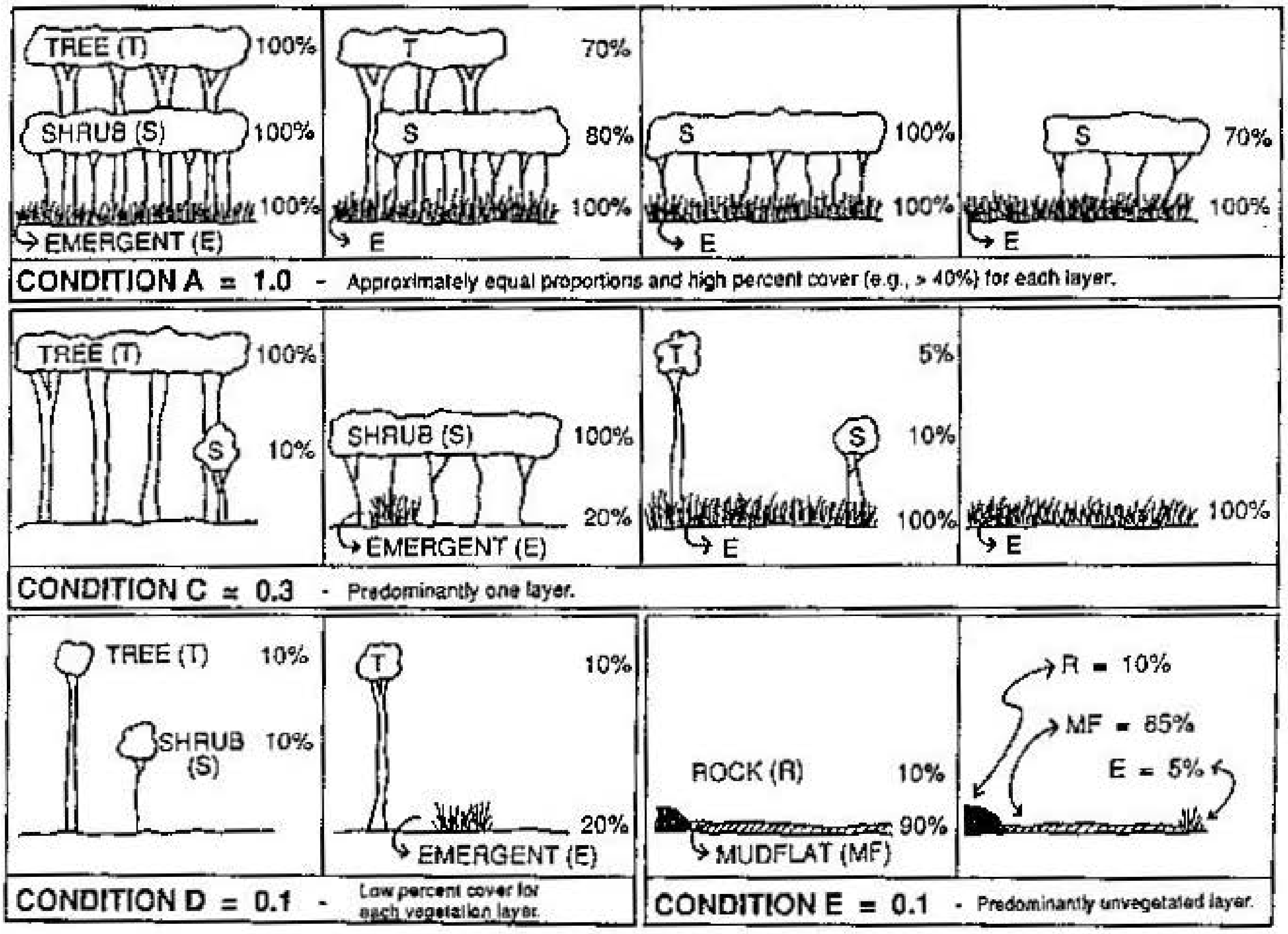
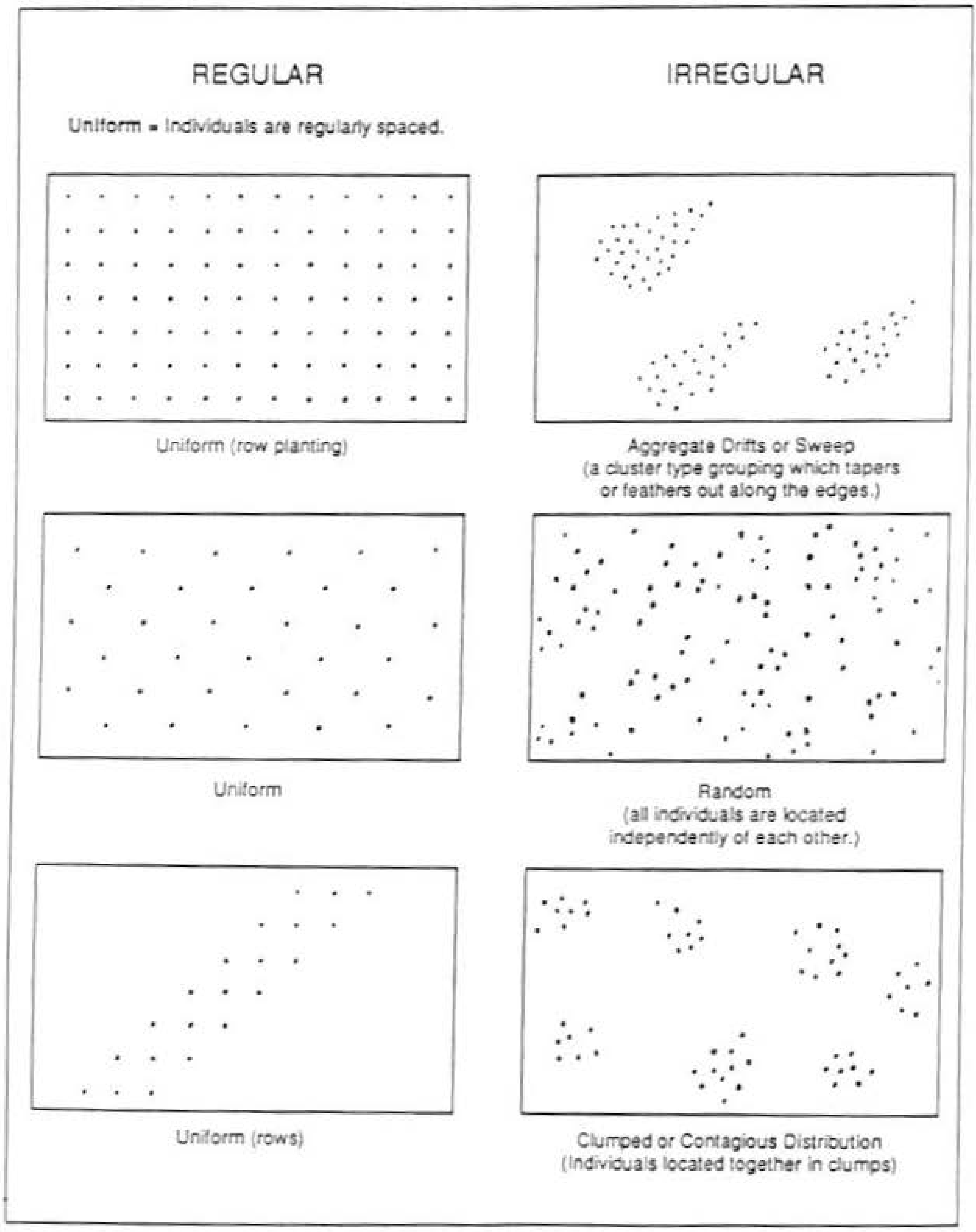


Figure A.5.
Examples illustrating conditions of layer coverage (element 11b)



REGULAR

IRREGULAR

Uniform = Individuals are regularly spaced.

Uniform (row planting)

Aggregate Drifts or Sweep
(a cluster type grouping which tapers
or feathers out along the edges.)

Uniform

Random
(all individuals are located
independently of each other.)

Uniform (rows)

Clumped or Contagious Distribution
(Individuals located together in clumps)

Figure A.6.
Examples of spatial patterns (element 11c)

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA)
		WAA	Planned Wetland	If both are NA, record NA

12. Cover types (27 listed) (refer to Table A.3):

Trees:
Needle-leaved evergreen
Broad-leaved evergreen
Needle-leaved deciduous
Broad-leaved deciduous
Dead

Emergent:
Tall persistent
Short persistent
Tall nonpersistent
Short nonpersistent

Scrub-Shrub:
Tall evergreen
Bushy evergreen
Low compact evergreen
Tall deciduous
Bushy deciduous
Low compact deciduous
Dead

Moss-lichen:
Moss
Lichen

Non-vegetative:
Bedrock
Rubble
Cobble-gravel
Sand
Mud
Organic
Dead fallen trees/shrubs
Open Water

Aquatic-bed:
Rooted-vascular

12a. Number of cover types in each layer at site [WL]

Decide minimum coverage and use this minimum to determine which cover types at the site will be included in the evaluation:

__✓__ 10% _____ 5% _____ Other

Thus, an area must be at least __10%__ (e.g., 10%) of the wetland site size to be recognized as a separate cover type.

Fill in the following information:

Wetland: # of cover types		Calculation of Relative score \# of cover types / 27
	(e.g.)	(example)
WAA	: __5__ (1)	__0.19__ (1/27=0.04)
Planned	: __3__ (4)	__0.11__ (4/27=0.15)

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	WAA	Planned Wetland	DIFFERENCE IN SCORES (Planned - WAA)
12a. Number of cover types in each layer at site [WL]		0.19	0.11	(–)
12b. Ratio of cover types (**See Figure A.7**). (Consider canopy cover of each cover type in each layer.) [WL]				
a. Approximately equal proportions.	1.0			
b. Intermediate condition.	0.5	1.0	0.5	(–)
c. Predominantly 1 cover type.	0.1			
12c. Degree of cover type interspersion (**See Figure A.8**). [WL]				
a. High.	1.0			
b. Intermediate condition.	0.5			
c. Low -OR- no interspersion (1 cover type)	0.1	1.0	0.1	(–)

Table A.3.
Description of Cover Types

Cover types based upon classification schemes of Cowardin et al. (1979) and Golet and Larson (1974). Definitions taken directly from Cowardin et al. (1979), unless otherwise indicated.

TREES. Woody vegetation that is 6 m (20 ft) or taller.

Needle-leaved evergreen. Areas dominated by woody gymnosperms with green, needle-shaped, or scale-like leaves that are retained by plants throughout the year. Examples:

black spruce	*Picea mariana*
Northern white cedar	*Thuja occidentalis*
Atlantic white cedar	*Chamaecyparis thyoides*

Broad-leaved evergreen. Areas dominated by woody angiosperms with relatively wide, flat leaves that generally remain green and are usually persistent for a year or more. Examples:

red mangrove	*Rhizophora mangle*
black mangrove	*Avicennia germinans*
white mangrove	*Laguncularia racemosa*
red bay	*Persea borbonia*
loblolly bay	*Gordonia lasianthus*
sweet bay	*Magnolia virginiana*

Needle-leaved deciduous. Areas dominated by woody gymnosperms with needle-shaped or scale-like leaves that are shed during the cold or dry season. Example:

bald cypress	*Taxodium distichum*

Broad-leaved deciduous. Areas dominated by woody angiosperms with relatively wide, flat leaves that are shed during cold or dry season. Examples:

black ash	*Fraxinus nigra*
red ash	*F. pennsylvanica*
American elm	*Ulmus americana*
black gum	*Nyssa sylvatica*
tupelo gum	*N. aquatica*
swamp white oak	*Quercus bicolor*
overcup oak	*Q. lyrata*
basket oak	*Q. michauxii*
red maple	*Acer rubrum*

Dead. Areas dominated by dead woody vegetation taller than 6 m (20 ft).

SCRUB-SHRUB. Area dominated by woody vegetation less than 6 m (20 ft) tall (including vines).

Tall evergreen.* Areas dominated by woody gymnosperms 3 to 6 m (10 to 20 ft) tall. Examples:

black spruce	*Picea mariana*
pond pine	*Pinus serotina*
young trees	(ex. *Rhizophora mangle* *Laguncularia racemosa* *Avicennia germinans*)

Bushy evergreen.* Areas dominated by woody gymnosperms 1.2 to 2 m (4 to 7 ft) tall. Examples:

sweet gale	*Myrica gale*
coastal sweetbells	*Leucothoe axillaris*
fetterbush	*Lyonia lucida*
inkberry	*Ilex glabra*

Low compact evergreen.* Areas dominated by woody gymnosperms less than 1.2 m (4 ft) tall. Examples:

sheep laurel	*Kalmia angustifolia*
bog laurel	*K. polifolia*
leatherleaf	*Chamaedaphne calyculata*
labrador tea	*Ledum groenlandicum*
bog rosemary	*Andromeda glaucophylla*
black ti-ti	*Cyrilla racemiflora*

Table A.3.
Description of Cover Types

Tall deciduous.* Areas dominated by woody angiosperms 3 to 6 m (10 to 20 ft) tall. Examples:

speckled alder	*Alnus rugosa*
highbush blueberry	*Vaccinium corymbosum*
young trees	(e.g., red maple - *Acer rubrum*)
willow	*Salix* spp.

Bushy deciduous.* Areas dominated by woody angiosperms 1.2 to 2 m (4 to 7 ft) tall. Examples:

sea-myrtle	*Baccharis halimifolia*
marsh elder	*Iva frutescens*
buttonbush	*Cephalanthus occidentalis*
silky dogwood	*Cornus ammomum*
willow	*Salix* spp.
sweet pepper-bush	*Clethra alnifolia*
bog birch	*Betula pumila*

Low compact deciduous.* Areas dominated by woody angiosperms less than 1.2 m (4 ft) tall. Examples:

marsh elder	*Iva frutescens*
silky dogwood	*Cornus ammomum*

EMERGENT. Area dominated by erect, rooted, herbaceous angiosperms that may be temporarily to permanently flooded at the base but do not tolerate prolonged inundation of the entire plant.

Tall persistent.* Emergent hydrophytes over 1.5 m (5 ft) tall that normally remain standing at least until the beginning of the next growing season. Examples:

cattails	*Typha* spp.
reed	*Phragmites australis*
purple loosestrife	*Lythrum salicaria*
water willow	*Decodon verticillatus*
salt-marsh cordgrass (tall form)	*Spartina alterniflora*
big cordgrass	*S. cynosuroides*
southern wild rice	*Zizaniopsis miliacea*

Short persistent.* Emergent hydrophytes less than 1.5 m (5 ft) tall that normally remain standing at least until the beginning of the next growing season. Examples:

salt-marsh cordgrass (short form)	*Spartina alterniflora*
California cordgrass	*S. foliosa*
sedges	*Carex* spp.
needlerush	*Juncus roemerianus*
rice-cutgrass	*Leersia oryzoides*
common pickleweed	*Salicornia virginica*
bulrushes	*Scirpus* spp.
manna grasses	*Glyceria* spp.

Tall nonpersistent.* Emergent hydrophytes over 1.5 m (5 ft) tall whose leaves and stems break down at the end of the growing season so that most above-ground portions of the plants are easily transported by currents, waves, or ice. Example:

wild rice	*Zizania aquatica*

Short nonpersistent.* Emergent hydrophytes less than 1.5 m (5 ft) tall whose leaves and stems break down at the end of the growing season so that most above-ground portions of the plants are easily transported by currents, waves, or ice. Note: If waves, currents, or ice removes all traces of emergent vegetation, then classify as short nonpersistent. Examples:

arrow arum	*Peltandra virginica*
pickerelweed	*Pontederia cordata*
arrowheads	*Sagittaria* spp.

Table A.3.
Description of Cover Types

MOSS-LICHEN. Areas where mosses or lichens cover substrates other than rock and where emergents, shrubs, or trees make up less than 30% of the areal cover.

Moss. Areas dominated by mosses. Examples:

peat mosses	*Sphagnum* spp.
moss	*Campylium stellatum*
moss	*Aulacomnium palustre*
moss	*Oncophorus wahlenbergii*

Lichen. Areas dominated by lichens. Example:

reindeer moss	*Cladonian rangiferina*

AQUATIC-BED. Areas dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years.

Rooted vascular. Areas dominated by rooted vascular plants that grow principally on or below the surface of the water for most of the growing season in most years. Examples:

turtle grass	*Thalasia testudinum*
shoalgrass	*Halodule wrightii*
widgeon grass	*Ruppia maritima*
wild celery	*Vallisneria americana*
eelgrass	*Zostera marina*
pondweed	*Potamogeton* spp.
naids	*Najas* spp.
water milfoil	*Myriophyllum* spp.
ditch grasses	*Ruppia* spp.
waterweed	*Elodea* spp.
yellow water lily	*Nuphar luteum*
water lilies	*Nymphaea* spp.
water smartweed	*Polygonum amphibium*

NON-VEGETATIVE.[*] Areas characterized by a lack of live vegetation cover.

Bedrock. Area characterized by a bedrock substrate covering 75% or more of the surface and less than 30% areal coverage of macrophytes.

Rubble. Area characterized by aerial cover with less than 75% bedrock, but stones and boulders alone, or in combination with bedrock, cover 75% or more of the surface.

Cobble-gravel. Area dominated by cobble and/or gravel. Cobbles are defined as rock fragments 7.6 cm (3 in) to 25.4 cm (10 in) in diameter. Gravel is a mixture composed primarily of rock fragments 2 mm (0.8 in) to 7.6 cm (3 in) in diameter; it usually contains sand.

Sand. Area dominated by sand. Sand is composed predominantly of coarse-grained mineral sediments with diameters larger than 0.074 mm and smaller than 2 mm.

Mud. Areas dominated by mud, i.e., wet soft earth composed predominantly of clay and silt-fine mineral sediments less than 0.074 mm in diameter.

Organic. Areas dominated by organic soil, i.e., soil composed of predominantly organic rather than mineral material.

Dead fallen trees/shrubs.[*] Area dominated by dead fallen trees and/or shrubs.

Open water. Water of any depth with no woody or emergent vegetation.

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[*] Definitions modification of Cowardin et al. (1979) and Golet and Larson (1974).

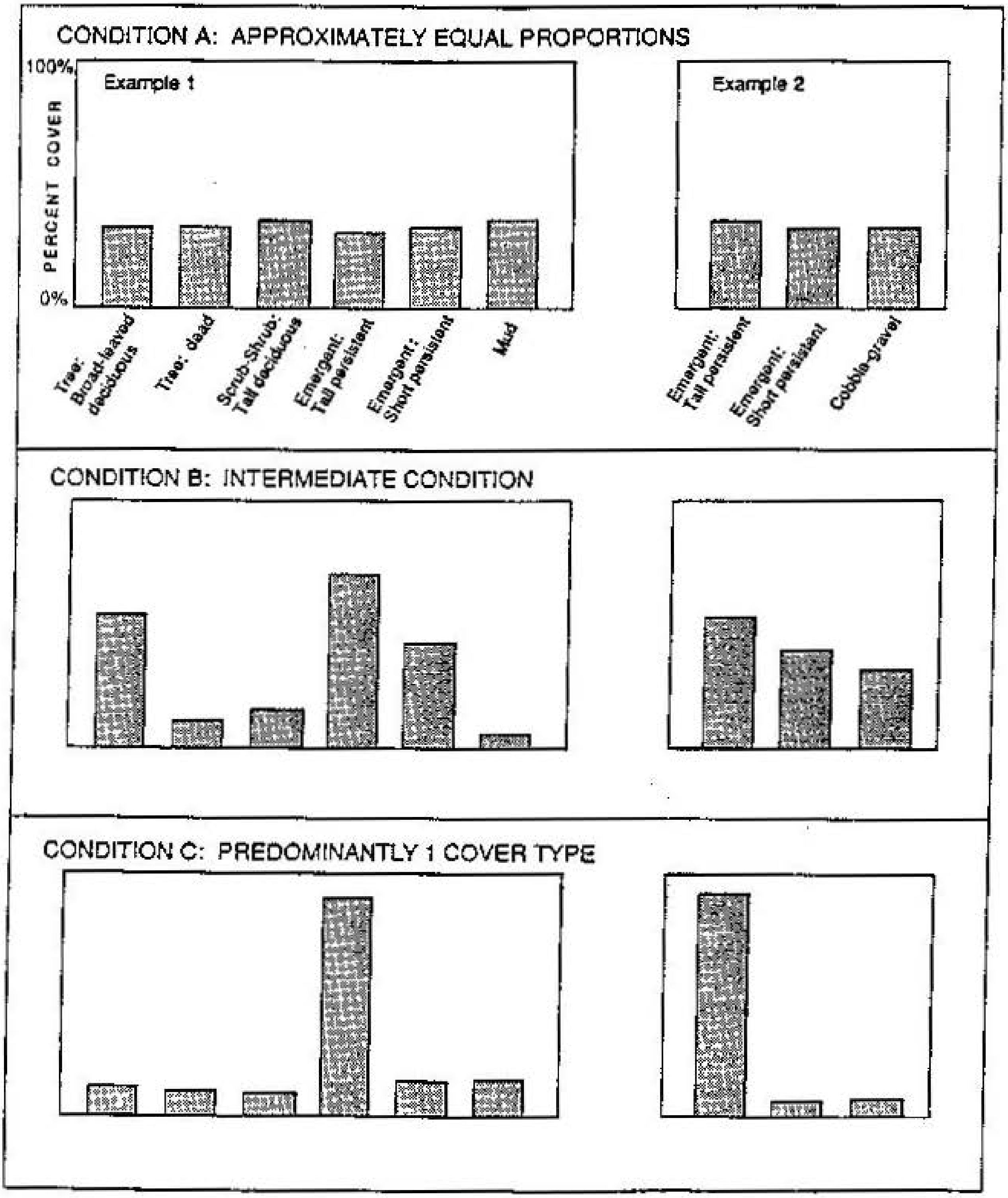


Figure A.7.
Examples illustrating conditions for ratio of cover types (element 12b)

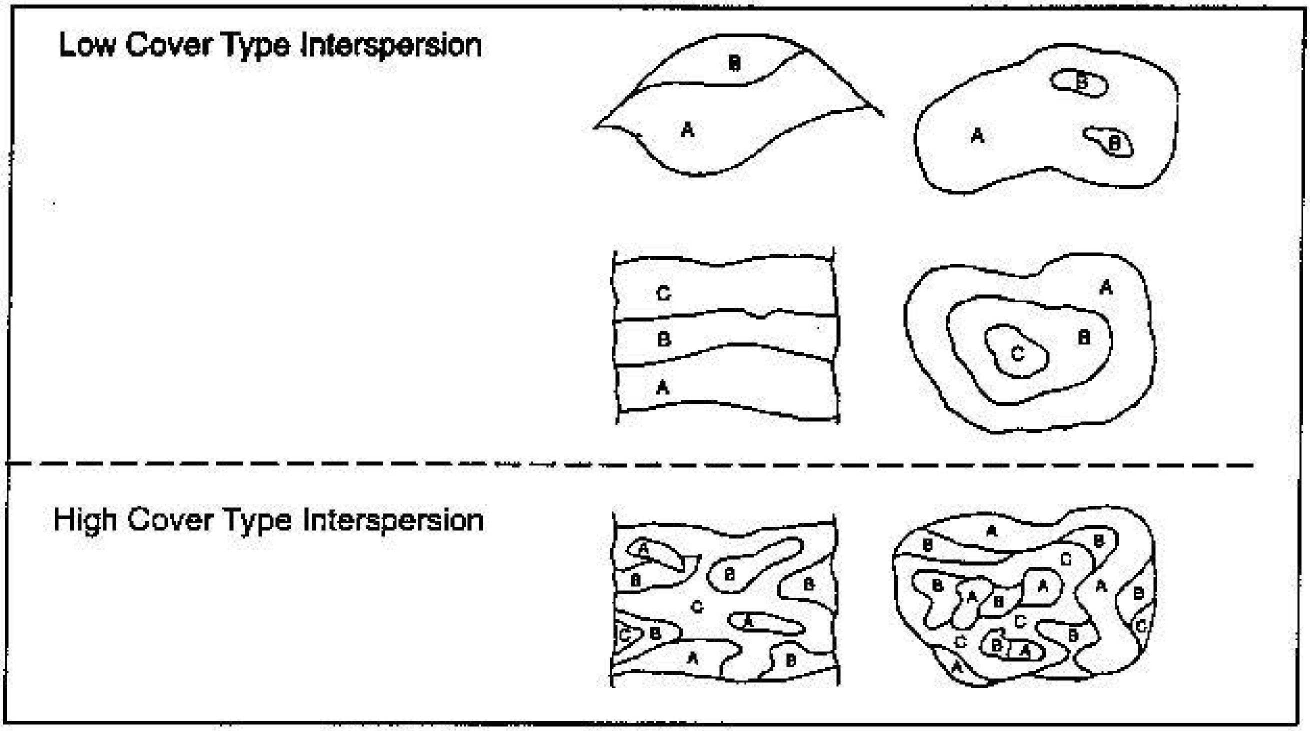


Figure A.8.
Cover type interspersion (element 12c)

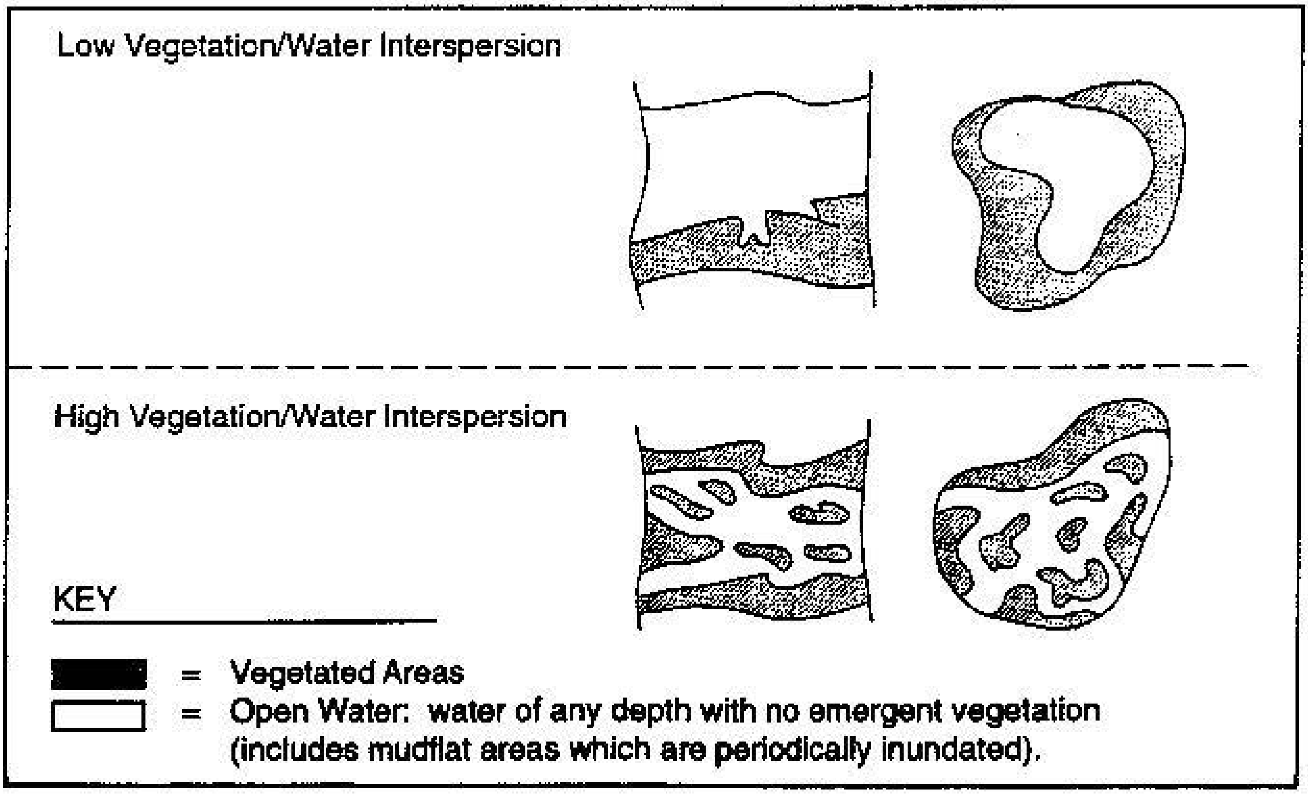


Figure A.9.
Vegetation/water interspersion (element 13b)

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both are NA, record NA
		WAA	Planned Wetland	
12d. Undesirable species	[WL]			Assume NA = 1.0
a. Vegetation species which are considered to have limited habitat value (e.g., *Phragmites australis, Lythrum salicaria*) are absent -OR- if present, do not dominate site.	NA			
b. Site dominated by vegetation species considered to have limited habitat value.	0.1	NA	NA	NA
If present, identify species: ____________ ____________				
12e. Difference in cover types	[WL]			Record both scores.
a. Planned wetland contains same cover types as WAA.	NA			
b. Planned wetland does not contain same cover types as WAA.	1.0	NA	1.0	1.0 - NA
If answer "b", explain: ____________ ____________				
13. Vegetation/water proportions				
13a. Percent open water (Open water = water of any depth with no woody or emergent vegetation. Include mudflat areas which are periodically inundated. Note: in tidal systems estimate open water coverage at mid-tide.)	[WL]			If one NA, record both scores.
a. Approximately 50%.	1.0			
b. Intermediate condition (e.g. 10 - 30% or 70 - 90%).	0.5			
c. Open water absent or minimal coverage (e.g., < 10%) -OR- open water predominant cover (e.g., > 90%).	0.1	0.5	0.5	0
13b. Degree of vegetation/water interspersion (See Figure A.9).	[WL]			If one NA, record both scores.
a. High.	1.0			
b. Intermediate condition.	0.5			
c. Low -OR- no interspersion (e.g., site all vegetation or all open water).	0.1	0.1	0.1	0

ELEMENT		SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA)
			WAA	Planned Wetland	If both are NA, record NA
21. Shape of edge					
21a. Shape of upland/wetland edge (See Figure A.10).		[WL]			
a. Upland/wetland edge absent.	NA				
b. Irregular.	1.0		0.1	1.0	(+)
c. Regular, smooth.	0.1				
22. Fish and wildlife attractors (in wetland only)					Assume NA = 0
22a. Wildlife attractors		[WL]			
Abundance of cover, other than live vegetation (e.g., snags, dense brush, fallen tree/logs, rocks/boulders, or artificial attractors).					
a. Absent or sparse.	NA				
b. Moderate to abundant.	1.0				
If present, check type of attractors and estimate percent cover. In some cases it may be best to count and record the number of attractors (e.g., nesting boxes).			1.0	NA	NA-1.0
23. Islands		[WL]	0.1	0.1	0
a. Upland island(s) present.	1.0				
b. Upland island absent.	0.1				

Attractor	WAA	Planned Wetland
Snags	✓	___
Dense brush	___	___
Brush piles	___	___
Fallen trees/logs	___	___
Rocks/boulders	___	___
Artificial:		
Nesting structures	___	___
Roosting sites	___	___
Artificial tree cavities	___	___
Other:________	___	___

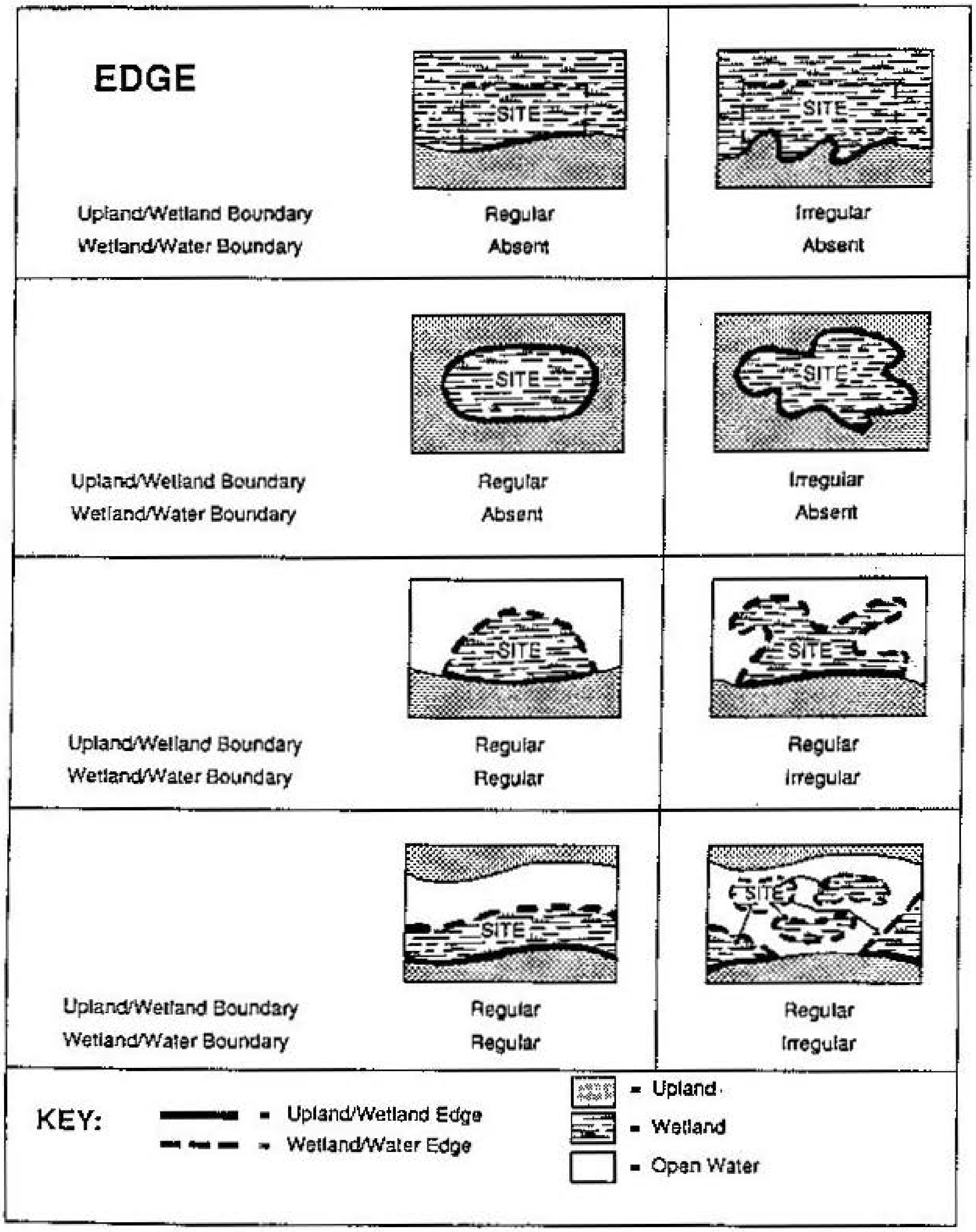


Figure A.10.
Examples of regular and irregular boundaries at the upland/wetland and wetland/water edges (element 21)

Calculation of **WILDLIFE** FCI

PROJECT TITLE: MARLEY CREEK

COMPARISON: WAA, planned wetland (e.g., WAA/planned wetland)

Selected Scores	(#)	Element
NA, NA	(4c)	Disturbance of wildlife habitat
NA, NA	(20a)	Gross contamination
NA, NA	(16b)	Wetland size
0.5, 0.3	(11a)	Layers
0.7, 0.3	(11b)	Condition of layers
1.0, NA	(11c)	Spatial pattern of shrubs/trees
0.19, 0.11	(12a)	Cover types
1.0, 0.5	(12b)	Ratio of cover types
1.0, 0.1	(12c)	Cover type interspersion
NA, NA	(12d)	Undesirable species
0.5, 0.5	(13a)	% open water
0.1, 0.1	(13b)	Vegetation/water interspersion
0.1, 1.0	(21a)	Shape of upland/wetland edge
1.0, NA	(22a)	Wildlife attractors
0.1, 0.1	(23)	Islands

(4c), (20a), (16b) → If 4c, 16b, and 20a = NA, record NA. If any score = 0.1, record 0.1 = NA, NA Features Which Reduce Habitat Value (F)

(11a)–(11c) → average for elements with available scores = 0.73, 0.30 Vegetation Strata

(12a)–(12d) → average for elements with available scores = 0.73, 0.24 Vegetation Cover Types

(13a)–(13b) → average for elements with available scores = 0.30, 0.30 Vegetation/Water Proportions

(21a), (22a), (23) → average for elements with available scores = 0.40, 0.55 Physical Features

Vegetation Strata, Vegetation Cover Types, Vegetation/Water Proportions, Physical Features → average for available scores = 0.54, 0.35 Habitat Complexity (HC)

If F ≠ NA: $\frac{F + HC}{2}$ = 0.54, 0.35 Wildlife FCI

If F = NA: HC = 0.54, 0.35 Wildlife FCI

Chapter 8. Fish

8.1 Definition

Wetlands function to provide a refuge from predators, spawning and nursery habitat, and a source of food for a variety of fish species. The Fish FCI provides a relative measure of the degree to which a wetland habitat meets the food/cover, reproductive, and water quality requirements of fish.

The Food/Cover component describes habitat structure. Cover and food are considered as one component because the same surfaces that provide cover (e.g., live vegetation, fallen trees/logs, rocks, boulders) also provide a substrate for food sources such as macroinvertebrates. It is assumed that greater habitat complexity generally supports a higher diversity and/or abundance of fish. The importance of habitat complexity in determining fish species diversity and abundance has been demonstrated by several authors (e.g., Gorman and Karr 1978, Tonn and Magnuson 1982, Rahel 1984, Thorman 1986).

Water Quality component describes the chemical (e.g., oxygen, pH) and physical (e.g., temperature) influences on fish survival. Poor water quality may limit fish survival, even if the habitat structure is suitable. For example, Rahel (1984) described a situation where habitat was suitable in a Wisconsin lake; however, stocking attempts were unsuccessful due to low winter oxygen levels.

The Reproduction component describes elements known to affect embryo survival of most species. This component is not included in the Tidal Fish FCI because the reproductive requirements of fish inhabiting tidal wetlands are so varied and specific. For example, temperature is a critical factor to red drum spawning success (Buckley 1984); Atlantic menhaden and Atlantic croakers spawn in marine waters and eggs are pelagic (Diaz and Onuf 1985, Rogers and Van Den Avyle 1989).

As a rapid assessment technique, EPW does not require fish surveys or sampling; therefore, it cannot provide detailed information on potential changes to the populations of individual species. Also, EPW is designed to provide a general description of habitat which is assumed to be applicable to a wide range of fish species. The conditions considered best in this procedure may be optimal for some, but not all fish species. If goals for the planned wetland focus on habitat requirements of a specific species or group (e.g., salmon), then the EPW elements and Fish FCI model may need modification.

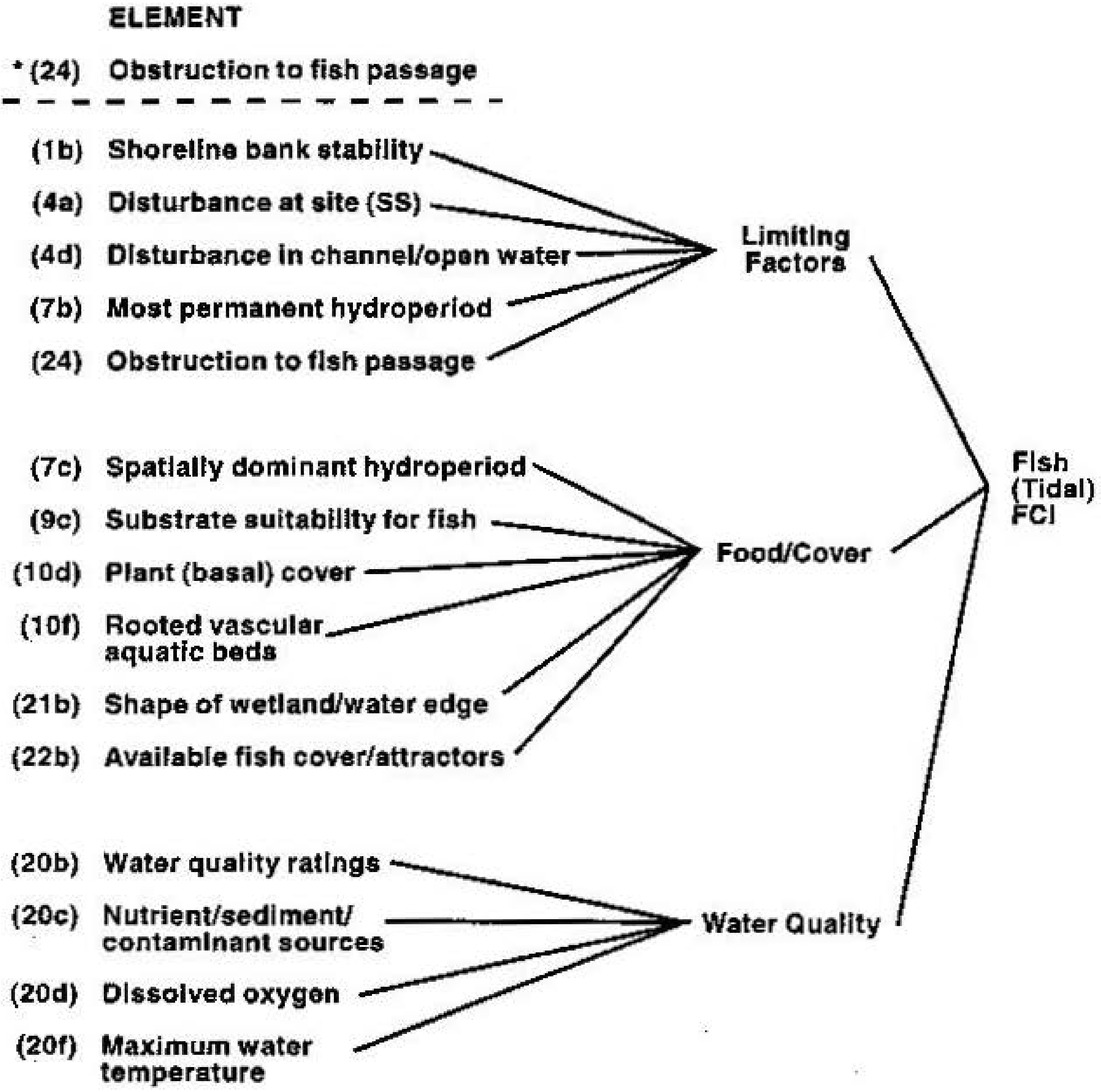
8.2 Explanation of Models

8.2.1 Tidal Fish

Fifteen elements are used to assess the Tidal Fish FCI. These elements contribute to three components which define the Tidal Fish FCI (Figure 8.1, p. 8-2).

The assessment begins with an examination for any potential *Obstruction to fish passage* (Element 24). The Fish FCI is considered not applicable (NA) when there are conditions which impose absolute physical or behavioral barriers to fish passage, i.e., fish access to and survival at the site is precluded.

The Tidal Fish FCI is a product of three components: Limiting Factors, Food/Cover, and Water Quality. Food/Cover is described by six habitat structure characteristics. The main element in this component is *Spatially dominant hydroperiod*. It is assumed that the relative importance of the remain-



* *Examined first to determine if function is applicable*

Figure 8.1.
Relationships of elements and components in the Fish (Tidal) FCI

ing five elements depends upon how frequently the assessment area is accessible to fish. Therefore, the contribution of the five elements is weighted by the score (i.e., a relative score for period of inundation on 0–1.0 scale) for *Spatially dominant hydroperiod* (Element 7c). The amount of available vegetation is described by two elements (*Plant (basal) cover* and *Rooted vascular aquatic beds*) to distinguish the separate contribution of emergent and aquatic vegetation. The relative contribution of these vegetation types to overall habitat complexity depends upon the portion of the total AREA which they occupy. For this reason, the score for *Rooted vascular aquatic beds* is multiplied by "x" (portion of AREA which is represented by the lower shore zone) and the score for *Plant (basal) cover* is multiplied by "1-x," the remaining portion of the AREA. The score for this component is calculated using the following Equation 9:

$$\text{Food/Cover} = \frac{7c\,(9c + (1-x)(10d) + (x)(10f) + 21b + 22b)}{4} \tag{9}$$

where:

x = portion of AREA which is represented by lower shore zone in increments of 0.1 (e.g., 0.1, 0.2...1.0)

The Water Quality component which describes the chemical and physical influences on fish survival, is based upon the state water quality ratings, if available. Otherwise, three other elements are used to describe water quality. Limiting Factors considers those elements which act separately or in combination to substantially limit the degree to which a wetland provides fish habitat. In most situations, this component will be considered not applicable (NA) and will not be used in the calculation of the FCI.

8.2.2 Non-tidal Stream/River Fish

Twenty elements are used to assess the Non-tidal Stream/River Fish FCI. These elements contribute to four components which define the Non-tidal Stream/River Fish FCI (Figure 8.2, p. 8–4).

The assessment begins with an examination for any potential *Obstruction to fish passage* (Element 24). The Fish FCI is considered not applicable (NA) when there are conditions which impose absolute physical or behavioral barriers to fish passage, i.e., fish access to and survival at the site is precluded.

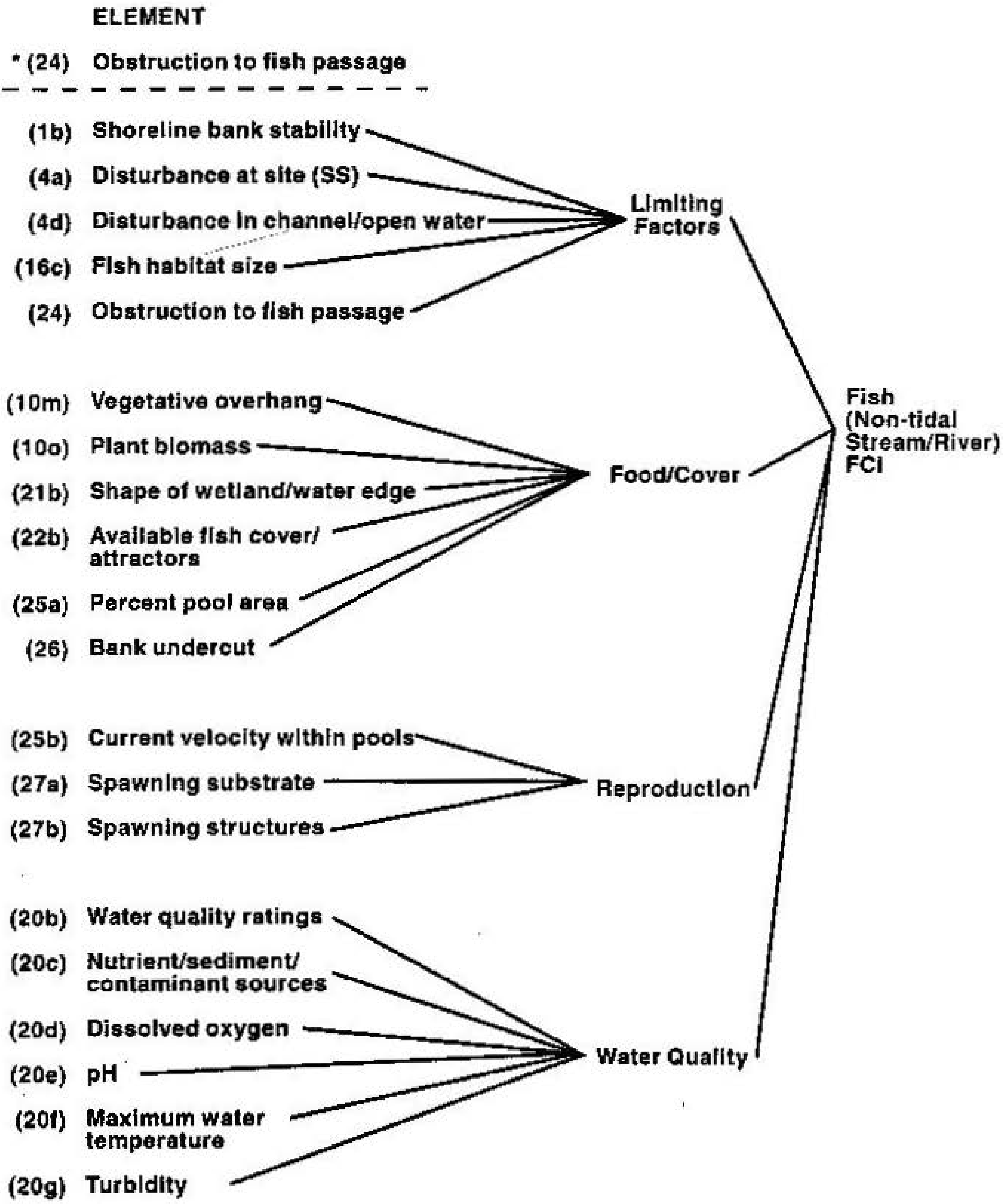
The Non-tidal Stream/River Fish FCI is a product of four components: Limiting Factors, Food/Cover, Reproduction, and Water Quality. Food/Cover is described by six habitat structure characteristics. The Reproduction component describes three elements known to affect embryo survival. The Water Quality component, which describes the chemical and physical influences on fish survival, is based upon the state water quality ratings, if available. Otherwise, five other elements are used to describe water quality. Limiting Factors considers those elements which act separately or in combination to substantially limit the degree to which a wetland provides fish habitat. In most situations, this component will be considered not applicable (NA) and will not be used in the calculation of the FCI.

Note: Some elements distinguish suitable conditions for trout versus warmwater fish (i.e., Elements 20d, 20e, 20f, 22b, 25a, and 25b). These elements and others may need modification if the goals for the planned wetland focus on habitat requirements of a specific species or group (e.g., salmon).

8.2.3 Non-tidal Pond/Lake Fish

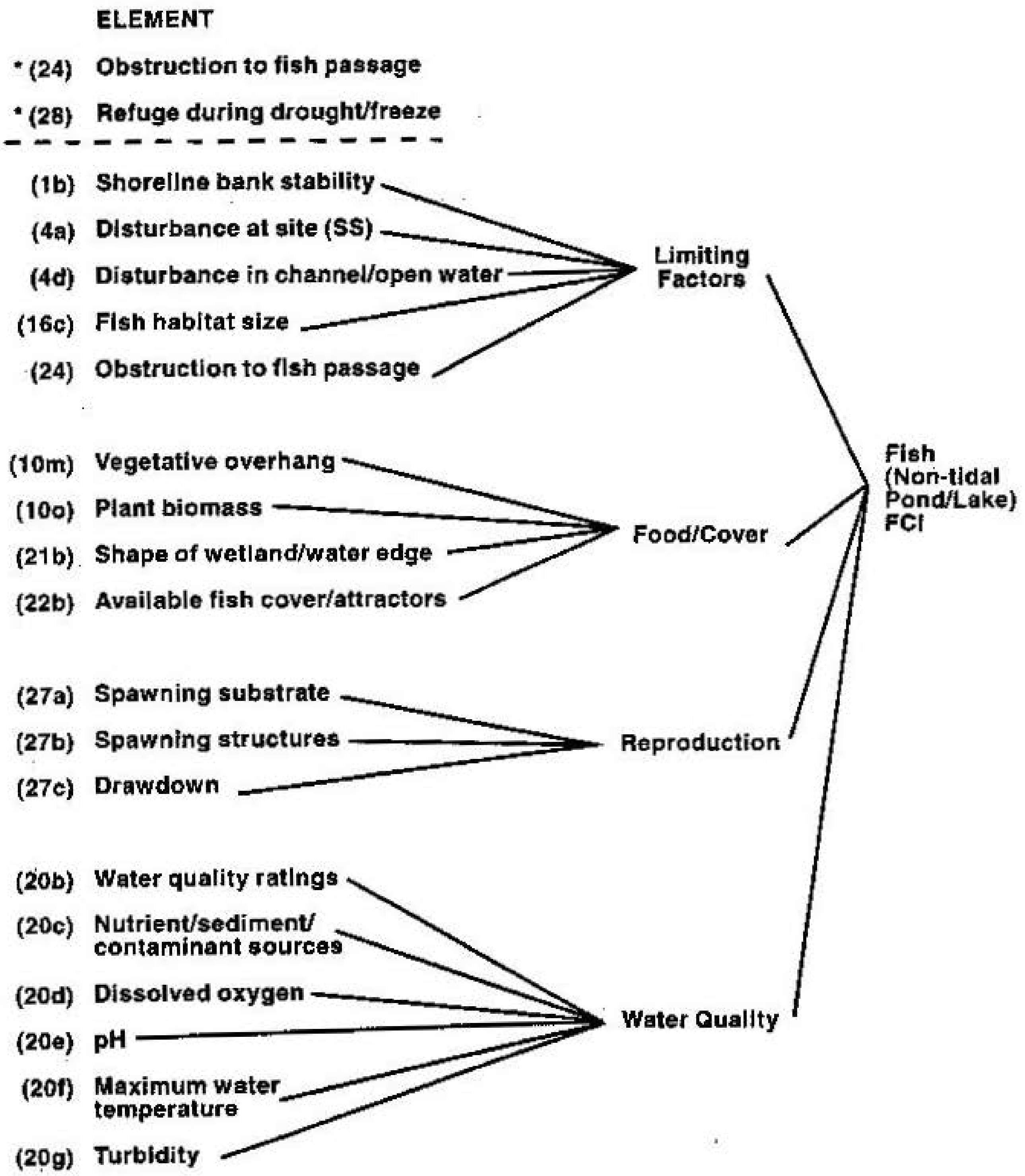
Nineteen elements are used to assess the Non-tidal Pond/Lake Fish FCI. These elements contribute to four components which define the Non-tidal Pond/Lake) Fish FCI (Figure 8.3, p. 8–5).

The assessment begins with an examination for any potential *Obstruction to fish passage* (Element 24) and/or lack of *Refuge during drought/freeze* (Element 28). The Fish FCI is considered not applicable



** Examined first to determine if function is applicable*

Figure 8.2.
Relationships of elements and components in the Fish (Non-tidal Stream/River) FCI



** Examined first to determine if function is applicable*

Figure 8.3.
Relationships of elements and components in the Fish (Non-tidal Pond/Lake) FCI

(NA) when there are conditions which impose absolute physical or behavioral barriers to fish passage or survival.

The Non-tidal Pond/Lake Fish FCI is a product of four components: Limiting Factors, Food/Cover, Reproduction, and Water Quality. Food/Cover is described by four habitat structure characteristics. The Reproduction component describes three elements known to affect embryo survival. The Water Quality component, which describes the chemical and physical influences on fish survival, is based upon the state water quality ratings, if available. Otherwise, five other elements are used to describe water quality. Limiting Factors considers those elements which act separately or in combination to substantially limit the degree to which a wetland provides fish habitat. In most situations, this component will be considered not applicable (NA) and will not be used in the calculation of the FCI.

8.3 Rationale and Assumptions

ELEMENT 1b. SHORELINE BANK STABILITY

Directions: Determine if there is a shoreline on-site by field observations. If present, note the degree to which the shoreline bank surface is protected from erosion by vegetation, boulders/rubble/gravel, or structures. For sites with partially eroded shorelines, select condition which best describes the overall shoreline.

Rationale and assumptions: Streambank stability plays a major role in determining the productivity of riparian ecosystems (Platts et al. 1987). It is assumed that bank instability lowers fisheries habitat value by increasing sedimentation, reducing water quality, and degrading available habitat (e.g., loss of vegetation and bank overhang).

A stable bank typically has shoreline vegetation on an overhanging bank which (1) provides shading and cover for fish, (2) is the source of detritus for invertebrates (fish food source), (3) helps regulate stream water temperature, and (4) minimizes solar heating of the water and potential problems from algal blooms. Vegetation plays an important role in controlling erosive forces and influencing the bank stability. If the bank becomes unstable, it may exhibit substantial undercutting and sloughing off of bank material. The shoreline vegetation and substrate can be washed away, removing the cover and possibly causing water quality problems due to higher sediment loads. The resulting siltation may result in a loss of spawning gravel and/or feeding areas in streams. Skinner and Stone (1983) identified bank erosion as the most prevalent hazard to trout habitat quality in Wyoming streams and described the process and consequences of bank erosion in streams.

The importance of bank stability is demonstrated by its inclusion as a habitat variable in other methods used to evaluate fish habitat suitability in streams (e.g., Platts et al. 1983; Raleigh et al. 1984, 1986a; Hunter 1991). For example, Raleigh et al. (1984, 1986a) considered > 75% rooted aquatic vegetation and stable rocky ground cover along a streambank as optimal rainbow and brown trout habitat. Increased shoreline instability is generally associated with poor fish habitat.

A stable bank also provides optimal habitat for tidal fish. In a study of tidal freshwater fish, McIvor et al. (1989) found that the most abundant species (banded killifish, mummichog, bluegill, pumpkinseed) were more abundant at marsh surface sites adjacent to shallow sloped depositional banks compared to steeper-sloped erosional banks. This difference in spatial distribution was attributed to food availability (more abundant invertebrates) and the threat of predation.

Refer to rationale for Element 1a under the Shoreline Bank Erosion Control function for discussion on bank erosion which is also applicable to the Fish function.

In the assessment procedure, this element is considered not applicable if there is no shoreline on-site (condition "a") or if shoreline bank erosion is minimal (condition "b"). Element 1b is factored into the Fish FCI only when there is evidence of moderate (condition "c") or substantial (condition "d") shoreline bank erosion which might degrade fisheries habitat through the release of sediments in the water column and loss of bank habitat.

✓

ELEMENT 4a. DISTURBANCE AT SITE (Sediment Stabilization)

Directions: Determine if there is disturbance at the site by field observations and/or local inquiry. Do not consider observations of litter or debris as evidence of disturbance. If site is subject to disturbance, note if (a) the disturbance is minimal, moderate, or substantial and (b) any actions have been taken to minimize the potential for erosion (e.g., installation of exclosure fences, mulching, seeding, planting). For sites with partial disturbance, select condition which best describes the overall site.

Rationale and assumptions: Disturbance in the wetland proper can have negligible to devastating effects on fish. Unfortunately, there is no simple method of relating disturbance to fish usage (e.g., no set number of cattle and frequency of grazing will equate to a predictable reduction in fish abundance). The issue is complicated by both the variety of fish species and types of disturbances. Regardless of the type of disturbance, if the habitat is altered, populations of some species may be adversely affected while others may benefit.

Fish utilization is affected by the amount of disturbance, if any, to the wetland. Disturbance of vegetation cover and/or soils by periodic wildlife grazing, tilling, logging, or other similar activities will lower habitat value by (1) the removal of vegetation and/or substrate which is used for cover, food, and spawning, (2) the burial of vegetation and/or substrate by increased sedimentation, and (3) the disruption and reduction of invertebrate populations which are used as a food source (Armour et al. 1991).

Overgrazing by livestock causes loss of streamside vegetation and trampling of the streambank, which can result in reduced populations or the elimination of trout (Stuber 1985, Armour et al. 1991). It is assumed that a similar reduction in fish abundance and diversity can occur with disturbance in tidal and non-tidal systems.

Refer to rationales for Element 4a under the Shoreline Bank Erosion Control and Sediment Stabilization functions which are also applicable to the Fish function.

In the assessment procedure, this element is considered not applicable if disturbance at the site is absent or minimal (condition "a") or if measures have been taken to prevent erosion (condition "b"). Element 4a is factored into the Fish FCI only when there is evidence of moderate (condition "c") or substantial (condition "d") disturbance which might degrade fisheries habitat through the disruption of vegetation/substrate and the release of sediments into the water column.

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ELEMENT 4d. DISTURBANCE OF CHANNEL/OPEN WATER BOTTOM

Directions: Determine if a channel and/or open water are present by field observations, maps, and/or aerial photographs. If present, note if there has been no or minimal recent disturbance, past disturbance with some site recovery, or recent substantial disturbance of the bottom surface. For sites with partial disturbance, select condition which best describes overall site conditions. (**Open water** = water of any depth with no emergent vegetation).

Rationale and assumptions: Disturbance of the channel/open water bottom can have negligible to devastating effects on fish. Typical channel disturbances include dredging, widening, filling, snagging, clearing, and installation of structures. These disturbances lower fish habitat value by damaging or removing vegetation, invertebrates, and substrate which are used for cover, food, and spawning. The impacts of specific disturbances have been addressed by several authors (e.g., Schnick et al. 1982, Skinner and Stone 1983, Schultz and Wilcox 1985, Wesche 1985, Armour et al. 1991). Some of the affects of these disturbances are listed in Table 8.1, p. 8–9.

Fish utilization is affected by the type, magnitude, and timing of the disturbance. Fish diversity, biomass, and production can be substantially lower in disturbed/channelized sections than in natural sections of streams (e.g., Gorman and Karr 1978, Portt et al. 1986). Fish communities may also be seasonally less stable in disturbed compared to natural streams (e.g., Gorman and Karr 1978). Simple changes such as the removal of woody debris can be devastating to the invertebrate community and cause substantial reduction in fish diversity and abundance (Angermeier and Karr 1984, Benke et al. 1985). Physical features that are important to fish habitat (e.g., woody debris, vegetative overhang, bank undercut) may require years to recover. For simplicity, it is assumed that most disturbances of the channel/open water bottom will substantially reduce habitat value until natural characteristics recover.

Recovery of fish and/or invertebrates generally occurs within a year after channel disturbance, but may be more rapid. For example, Van Dolah et al. (1984) found that the effects of dredging and open-water disposal on benthic macroinvertebrate abundance and species composition in a South Carolina estuary were short term, with substantial recovery occurring within three months. Reviews of several studies revealed that stream invertebrate recolonization to previous numbers can be as rapid as a few days to 500 days (Barton 1977, Gore 1985b). Barton (1977) reported a temporary significant drop in fish numbers only during construction of a highway stream crossing. There was no change in riffle macroinvertebrate abundance and species richness during or after construction, but species composition shifted.

Some disturbances cause changes that do not lead to complete recovery of macroinvertebrate and fish populations. For example, Barnby et al. (1985) reported a decrease in macroinvertebrate species richness in ditched salt marsh potholes compared to unditched marshes due to a change in tidal influence. In comparison of open and plugged backfilled canals in Louisiana coastal marshes, Neill and Turner (1987) found that plugged canals reduced use by migrant species and decreased available nursery habitat by rendering areas behind plugs inaccessible.

It is assumed that complete recovery of natural characteristics is not considered necessary for the reestablishment of most macroinvertebrate and fish populations. However, a better fish community would be expected with complete recovery of natural characteristics. Specific habitat characteristics (e.g., vegetative overhang, fish attractors) are described by other elements. Any differences in habitat structure resulting from disturbances are detected by assessing these elements individually.

In the assessment procedure, this element is considered not applicable if the channel/open water is absent (condition "a") or disturbance of the channel/open water bottom is absent or minimal (condition "b"). Element 4d is factored into the Fish FCI only when the disturbance considerably reduces fish habitat value, i.e., when the site has been recently or substantially disturbed (condition "d") or when the site has been disturbed in the past, but has begun to recover some of the natural characteristics (condition "c").

Table 8.1.
List of some channel/open water disturbances and adverse effects

Disturbance	**Adverse effects**
Disturb bottom sediments	*Short term:* • Increase total dissolved solids, nutrients, and contaminants • Increase oxygen demand created by resuspended sediments • Oxygen deficiency downstream due to nutrient release • Decrease photosynthetic rates due to increased turbidity
Remove vegetation and debris (shoreline and in-water; live and dead)	*Long term:* • Directly reduces substrate for periphyton and macroinvertebrates which are important fish foods • Indirectly promotes accumulation of detritus which is correlated with invertebrate abundance and diversity • Change in stream morphology • Increase temperature • Reduce fish cover and shelter
Remove gravel berms	Decrease habitat diversity and spawning habitat
Remove pools	Eliminate fish resting areas
Remove scour holes and slack water areas	Eliminate resting and plankton production area
Widen channel	Increase temperature due to greater surface water area
Channelize stream	Reduce space (by loss of meanders)
Destabilize bank	Increase suspended solids
Place fill	Reduce invertebrate food base by direct burial Reduce or prevent fish access

ELEMENT 7b. MOST PERMANENT HYDROPERIOD

Tidal Fish Only

Directions: Determine if the tidal hydroperiod is natural, usually follows the natural cycle, or rarely follows the natural cycle by field observations and/or local inquiry.

Rationale and assumptions: Impounded tidal marshes which are closed to tidal influence (a) prevent the use of the tidal marsh by migrant species, (b) decrease available nursery habitat for tidal fish, and (c) provide poor fish habitat due to stressed conditions (e.g., high temperature, high salinities, and low dissolved oxygen) (e.g., Neill and Turner 1987).

Openings in the impoundment that permit tidal flux may provide suitable tidal fish habitat; however, the extent of fish utilization will depend upon the size of the openings and the timing and range of the tidal cycle behind the berm as compared to the natural tidal cycle. A small opening may permit sufficient access to migrant species (Gilmore et al. 1981, Neill and Turner 1987). For example, Gilmore et al. (1981) found that a small 80 cm diameter culvert was large enough to permit migrant fish access to a 159.2 hectare (398 acre) impoundment.

Species migration, richness, and abundance generally decrease with water control or a reduction in natural water flow (McGovern and Wenner 1990, Rogers et al. 1992). A comparison of salt marsh impoundments in Florida showed a depauperate fishery (12 species) in a closed impoundment compared to a rich fishery (41 species) in an impoundment re-opened to tidal influence by one culvert (Gilmore et al. 1981). Harrington and Harrington (1982) also reported a substantial decrease in fish species diversity (from 16 to 11 species) and abundance after a Florida salt marsh was impounded.

Impoundment of tidal marshes for mosquito control, wildlife management, and erosion control usually has a detrimental effect on fish. However, there are methods that permit tidal flux, creating semi-impoundments which achieve management and fisheries objectives and are compatible with fish utilization (Gilmore 1987, Carlson 1987). For example, the rotational opening and closing of Florida mangrove impoundments on a seasonal cycle (e.g., RIM = Rotational Impoundment Management) has been found to be compatible with various fish species.

In the assessment procedure, this element is considered not applicable if the hydroperiod follows the natural cycle (condition "a"). Element 7b is factored into the Fish FCI when a change in hydroperiod considerably reduces fish habitat value, i.e., when the hydroperiod usually (condition "b") or rarely (condition "c") follows the natural tidal cycle.

ELEMENT 7c. SPATIALLY DOMINANT HYDROPERIOD

Tidal Fish Only

Directions: Determine the spatially dominant hydroperiod (e.g., regularly flooded, irregularly flooded, deep water) within the assessment area from field observations, maps, and/or aerial photographs.

Rationale and assumptions: Tidal fish utilize the lower marsh surface more than the high marsh which is inundated less frequently.

Fish utilization is affected by water depths and vegetation density. In a study of fish use of tidal freshwater marsh surface, McIvor et al. (1989) found that most fish were either juveniles or adults of small species. The shallow water depths and dense vegetation on marsh surfaces are considered physical constraints that allow only small individuals access to this habitat. The marsh surface serves as good refuge from large predatory fish. Species which do not make regular use of the marsh surface are likely constrained by size, diminished foraging efficiency, specialized food requirements, and interference with schooling (McIvor et al. 1989).

A regularly flooded condition is considered optimal because it is frequently accessible and the vegetation provides a refuge for juveniles and small adults. It is assumed that deep water habitat provides comparatively poor habitat because it lacks vegetation, or protection from predators. An irregularly flooded condition is considered suboptimal because it is usually not accessible.

South side

In the assessment procedure, Element 7c is always factored into the Tidal Fish FCI because the conditions represent the full range of possibilities for hydroperiod spatial distribution. A regularly flooded condition (condition "a") is considered optimal because it is frequently accessible. Deep water habitat (condition "d") and irregularly flooded conditions are both assigned low scores for reasons given above. A mix of irregularly flood and regularly flooded (condition "b") is considered an intermediate condition.

North

ELEMENT 9c. SUBSTRATE SUITABILITY FOR FISH

Tidal Fish Only

Must get info from BC or perform our own sampling

Directions: Determine percent mud composition in substrate, i.e., the top 5 cm (2 in) of a core, by field observations. (Mud = wet soft earth composed predominantly of clay and silt-fine mineral sediments.)

Rationale and assumptions: Substrate composition plays an important role in determining the distribution of many fish which utilize tidal marshes. A predominance of mud is considered optimal, whereas hard material such as rock and shell are considered unsuitable (Table 8.2, p. 8–12). The criteria and scores used for this element are based upon the HEP model for juvenile Atlantic croaker (Diaz and Onuf 1985). A preference for mud substrate is also noted for the species listed in Table 8.2. Diaz and Onuf (1985) reasoned that the organic content of the sediment determines habitat suitability for the juvenile croaker's prey, and indirectly for the croakers themselves since the croakers do not directly use organic rich sediments.

Substrate composition has been shown to influence the distribution of tidal fish. The abundance of blackcheek tonguefish and Atlantic croaker were found to be positively correlated, and the abundance of Atlantic silverside and tidewater silverside were found to be negatively correlated with percent organics (Weinstein 1979).

In the assessment procedure, Element 9c is always factored into the Fish Tidal FCI because the conditions represent a full range of possible substrate types. Substrate with > 75% mud content (condition "a") is considered most suitable. Decreased mud content is considered less suitable; therefore, the lower percent mud content categories are assigned relatively lower scores.

ELEMENT 10d. PLANT (BASAL) COVER — (Tidal)

Tidal Fish Only

Directions: Determine by visual estimate the percent plant (basal) cover during the growing season, excluding the lower shore zone (Figure A.2, p. 8–61; A 51). The lower shore zone and any rooted vascular aquatic beds will be considered in Element 10f. Consider only those parts of the vegetation which have contact with water (Figure A.3, p. 8–62; A 52).

Rationale and assumptions: Emergent and submerged vegetation provides refuge from predators, nursery habitat, and an indirect source of food for

Table 8.2.
Optimal and unsuitable substrate for individual fish species
(based upon HEP models)

Species	Optimum	Unsuitable	Reference
Juvenile Atlantic croaker	> 75% mud	seagrass beds or mostly rock and shell; no soft material	Diaz and Onuf 1985
Red drum	mud	shell	Buckley 1984
Southern flounder	> 66% mud, remainder silt and sand	rock or coral	Enge and Mulholland 1985
Tarpon	mud or sandy mud		Zale and Merrifield 1989*

* Not HEP model; USFWS species profile

fish. Emergent vegetation is also important because it is a major producer of detritus which decomposes and becomes the major source of food to primary consumers (Mitsch and Gosselink 1986).

Vegetation is an important habitat factor for several species including red drum, ladyfish, tarpon, Atlantic menhaden, southern flounder, banded killifish, mummichogs, bluespotted sunfish, juvenile salmonoids, and spotted seatrout (Holt et al. 1983, Buckley 1984, Kostecki 1984, Enge and Mulholland 1985, Rozas and Odum 1987a, Macdonald et al. 1987, Zale and Merrifield 1989, Roger and Van Den Avyle 1989). Many species (e.g., spot, Atlantic croaker, and mummichog) may select shallow marsh habitats in an estuary to take advantage of reduced competition, scarcity of predators, slow currents, and abundance of food supply in these areas (Weinstein 1979, Rozas and Hackney 1984, Boesch and Turner 1984). Killifish prefer vegetated areas and tend to remain in the salt marsh rather than the open channel (Lipcius and Subrahmanyam 1986). The importance of intertidal vegetation is also demonstrated in the positive correlation between commercial yield of penaeid shrimp and the abundance of intertidal vegetation (Turner 1977).

Vegetated areas generally provide superior habitat compared to unvegetated areas. Several authors have found that submerged aquatic vegetation contains a greater density of fauna than unvegetated substrates (e.g., Zimmerman et al. 1984, Rozas and Odum 1987a, Sogard and Able 1991).

Numerous studies have shown that submerged aquatic vegetation and shallow marsh areas are optimal habitat for fish (e.g., Weinstein 1979, Rozas and Odum 1987a). Numerically dominant species that occurred in submerged aquatic vegetation at low tide and on the marsh surface at high tide were found to be similar (Rozas and Odum 1987a).

It is assumed that species abundance increases with an increase in percent vegetation cover. However, there may be exceptions. In a study of an urban estuarine bayou, Felley and Felley (1986) found that while most resident fish species preferred cover and vegetated areas, other species did not preferentially associate with cover (including schooling forms such as gulf killifish and tidewater silverside). Holt et al. (1983) found significantly more red drum in heterogeneous sea-grass meadows (mix of vegetated and non-vegetated bottom) than in homogeneous vegetated sites.

In the assessment procedure, this element is considered not applicable when the assessment area is all lower shore zone (condition "a"). Otherwise, Element 10d is factored into the Fish Tidal FCI and described by one of several conditions ranging from a high percent cover (condition "b") to a low percent vegetation cover (condition "e"). The highest percent cover (condition "b") is considered most suitable. Decreased cover is less suitable, therefore the lower percent cover ranges are assigned relatively lower scores.

ELEMENT 10f. ROOTED VASCULAR AQUATIC BEDS (Lower Shore Zone)

Tidal Fish Only

Directions: Determine if there is a lower shore zone. If present, determine by visual estimate the percent rooted vascular aquatic beds during the growing season (**Lower shore zone** = the vegetated or non-vegetated portion of the shore channelward of the potential lower limit of emergent or woody vegetation [Figure A.2, p. 8–61; A 51]).

Rationale and assumptions: Emergent vegetation and submerged vascular aquatic beds provide refuge from predators, nursery habitat, and an indirect source of fish food. Refer to rationale for Element 10d which is also applicable to this element. Rooted vascular beds are addressed as a separate element from emergent vegetation (Element 10d) to distinguish a difference in habitat types available to tidal fish.

In the assessment procedure, this element is considered not applicable when there is no lower shore zone (condition "a"). Otherwise, Element 10d is factored into the Fish Tidal FCI and described by one of several conditions ranging from a high percent cover (condition "b") to a low percent vegetation cover (condition "e"). The highest percent cover (condition "b") is considered most suitable. Decreased cover is less suitable, therefore the lower percent cover ranges are assigned relatively lower scores.

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ELEMENT 10m. VEGETATIVE OVERHANG

Non-tidal Stream/River and Pond/Lake Fish Only

Directions: Determine if there is a shoreline onsite by field observations. If present, estimate optimal percent overhang for this habitat type in region and note abundance of vegetative overhang within the assessment area relative to this optimum. Note the percent of shoreline which has greater than 30 cm (1 ft) vegetative overhang during the growing season. (**Vegetative overhang** = Vegetation overhanging the water column within 30 cm (12 in) vertical of the water surface during average high water (Figure 8.4, p. 8–14).

Rationale and assumptions: Vegetative overhang (a) provides cover, (b) indirectly provides food as a source of detritus and nutrients, and (c) provides shade which regulates the water temperature (Platts et al. 1987).

Greater vegetative overhang is associated with increased fish abundance and biomass. After the removal of overhanging brush cover from a Montana trout stream, Boussu (1954) found a substantial reduction in number and weight of legal-sized fish. Wesche et al. (1987) found a significant positive correlation between percent overhead bank cover and trout abundance. Overhead bank cover (measured as undercut banks, overhanging vegetation, logs, and debris jams) was also found to explain the greatest amount of variation in trout abundance.

The importance of vegetative overhang (or shoreline vegetation) is demonstrated by its inclusion as a habitat variable in other methods used to evaluate

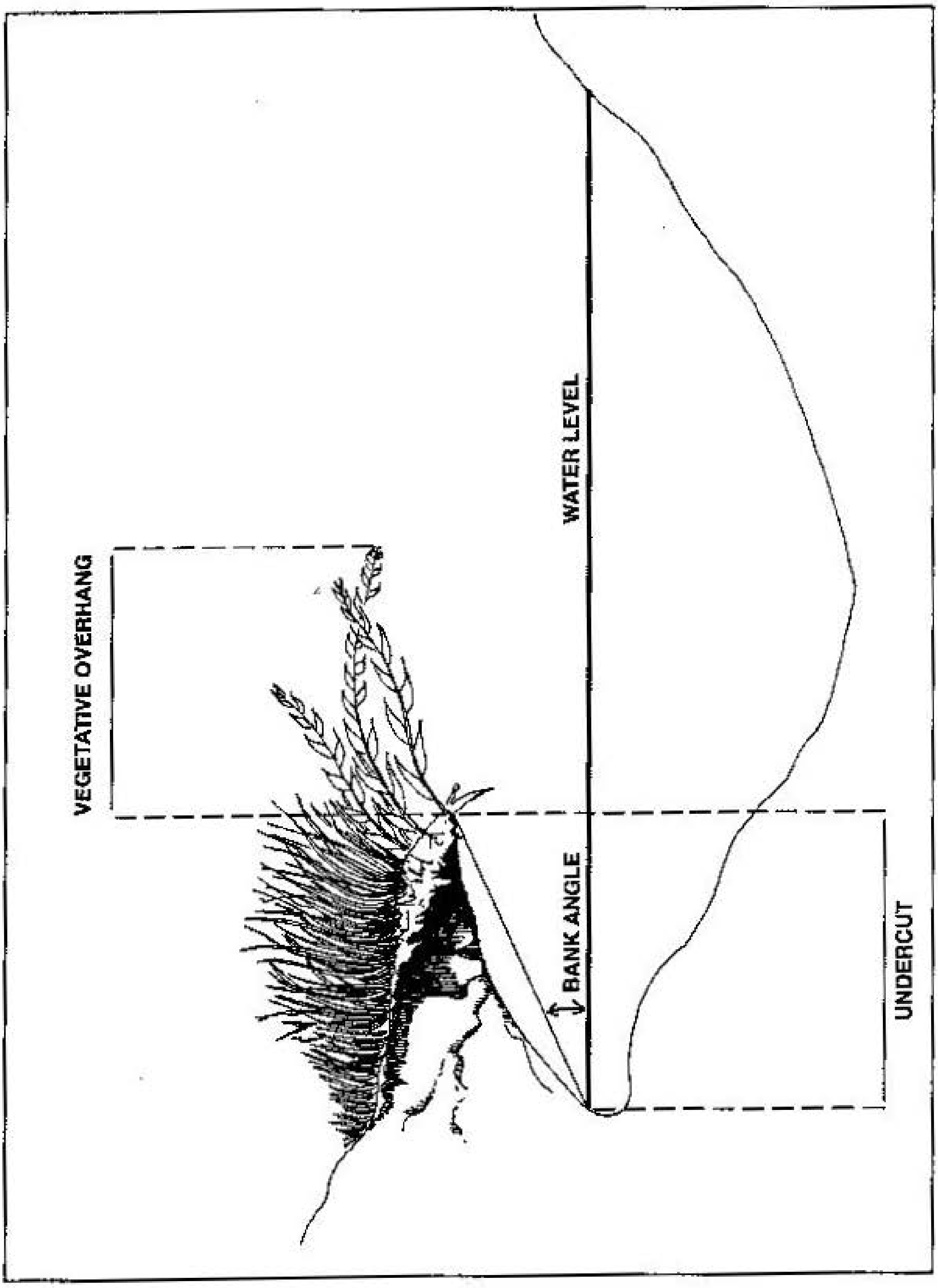

Figure 8.4.
Measurements of vegetative overhang and bank undercut

fish habitat suitability in streams (e.g., Platts et al. 1983; Raleigh et al. 1984, 1986a; Hunter 1991). The criteria (examples of percent vegetative overhang) and assigned scores for streams are based upon the rating system for trout habitat developed by Hunter (1991). It is assumed that vegetative overhang is an important habitat factor in ponds/lakes. The criteria (examples of percent vegetative overhang) for ponds/lakes are based upon the assumption that habitat suitability increased with an increase in percent vegetative overhang.

This measurement does not include bank undercut which is considered separately in Element 26. In the assessment procedure, this element is considered not applicable if there is no shoreline on-site (condition "a"). Element 10m is factored into the Fish FCI when a shoreline is present. Vegetative overhang is considered optimal for fisheries when it is abundant (greater than 30 cm on 50% of stream/river shoreline; greater than 30 cm on > 75% of pond/lake shoreline) (condition "b"). Vegetative overhang is considered unsuitable when it is sparse or absent (greater than 30 cm on < 20% of stream/river shoreline; greater than 30 cm on < 25% of pond/lake shoreline) (condition "d"). Moderate cover (condition "c") is considered an intermediate condition.

ELEMENT 10o. PLANT BIOMASS

Non-tidal Stream/River and Pond/Lake Fish Only

Directions: Roughly determine the potential aboveground plant biomass for the wetland at the present stage of development from field observations, comparison to comparable sites, and local inquiry. Do not consider the lower shore zone. Determine the degree to which the aboveground plant biomass in the wetland meets its potential. For example, if a wetland was normally sparsely vegetated, but near its potential, it would be considered the best possible habitat under those circumstances. Alternatively, a wetland which is devoid of vegetation due to grazing would be considered poor habitat since it has a greater potential to be vegetated. (**Lower shore zone** = vegetated or non-vegetated portion of the shore located channelward of the potential lower limit of emergent or woody vegetation).

Rationale and assumptions: Vegetation in the wetland proper provides cover, food, and spawning habitat for fish. Higher plants and algae are an important component in the diet of species such as the longnose sucker (e.g., Brown and Graham 1954). Aquatic vegetation is also important for the production of fish because it creates microhabitat, renews detritus, stores and releases nutrients, intercepts sunlight, and buffers water movements (Engel 1988).

The extent to which vegetated wetland habitat is used depends upon the requirements of individual fish species and the accessibility of the wetland which is determined by the frequency, timing, and duration of inundation. For some species, such as the smallmouth buffalo and northern pike, vegetation provides the most suitable substrate for spawning (Edwards and Twomey 1982, McCarraher and Thomas 1972). These and other species may only use vegetated areas during short periods of high water (e.g., spring). Since short periods of high water may be critical for fish life cycles, EPW considers a wetland potentially valuable regardless of the length of time which it is accessible to fish.

High fish species diversity, richness, biomass, and abundance have been observed to occur in vegetated habitats (e.g., Conrow et al. 1990). Vegetation habitat complexity may also be important. Rahel (1984) identified habitat heterogeneity (described by abundance of aquatic vegetation and proportion of lake bottom consisting of hard substrate) as one of the major environmental factors influencing fish community type and species richness in Wisconsin lakes. Additional studies on Wisconsin lakes revealed significant positive correlations between species richness and vegetated cover/diversity (Tonn and Magnuson 1982, Rahel 1984)

This element, which describes vegetation cover relative to the normal naturally occurring condition without disturbance, represents a modification of the vegetation rating developed by Platts et al. (1987) for riparian habitats. The wetland is evaluated on the basis of how much it differs from optimal conditions for the respective habitat type. It is assumed that a wetland's capacity to provide overall fish habitat can be expressed in terms of potential aboveground plant biomass for a wetland class at its present stage of development.

may be slightly below potential

In the assessment procedure, Element 10o is always factored into the Fish FCI because the conditions represent the full potential range for plant biomass. When aboveground plant biomass is at or near its potential for a site (condition "a"), it is considered more likely to support a diversity/abundance of fish species. Decreased biomass results in lower habitat availability; therefore, the lower ranges for percent biomass are assigned relatively lower scores.

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ELEMENT 16c. FISH HABITAT SIZE

Non-tidal Stream/River and Pond/Lake Fish Only

Directions: Determine if the assessment area has a very low fishery habitat value (1) because of its small size and surrounding landscape (e.g., < 0.1 acre and bordered by urban development) or (2) because it is ephemeral. If yes, provide a brief explanation.

Rationale and assumptions: Size can affect the diversity and/or abundance of fish which can utilize a wetland. The extent of this affect varies depending upon the habitat requirements of the various fish species and the availability of the habitat meeting the requirements of these species within and around the wetland.

Each species theoretically has a minimum habitat size requirement, but often the information is not available to quantify this value. The lack of information on minimum habitat area is noted in several HEP models, e.g., walleye (McMahon et al. 1984b), slough darter (Edwards et al. 1982b), gizzard shad (Williamson and Nelson 1985), white crappie (Edwards et al. 1982a), bigmouth buffalo (Edwards 1983b), and northern pike (Inskip 1982). Even if the information were available, size alone is not an appropriate variable for describing habitat suitability. Many fish could survive in a fish tank. Size must be considered along with habitat quality (e.g., temperature, substrate, oxygen availability) (refer to rationale for Wildlife element 16b).

In the assessment procedure, this element is considered not applicable if the assessment area is judged large enough to provide fish habitat (condition "a"). Element 16c is factored into the Fish FCI only when it has been determined that the assessment area has a very low fish habitat value (1) because of its small size and surrounding landscape or (2) because it is ephemeral (condition "b").

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ELEMENT 20b. WATER QUALITY RATINGS

Directions: Define the state water quality ratings and assign each to one of three categories (i.e., high, medium, or low) to indicate relative pollution level with respect to impact on fisheries. Note the water quality rating for the waterway associated with the site.

Rationale and assumptions: Pollutants can cause high fish mortality directly or indirectly by contaminating or reducing the abundance of food sources. Some species such as brown bullhead are very pollution tolerant and can meet nutritional requirements with detritus, sewage, and acid-tolerant invertebrates (Klarberg and Benson 1975). Other species are not. The fish community composition often reflects degraded water quality by the dominance of tolerant species and noticeable absence of intolerant species.

Water quality is a critical determinant of fish habitat suitability. Most states have developed water quality ratings and assigned these ratings to waterways which indicate relative pollution level with respect to fisheries. Since water sampling and analysis are not required, EPW uses the state water quality ratings or existing data (Elements 20c, 20d, 20e, 20f, and 20g).

In the assessment procedure, this element is not factored into the Fish FCI if the information is not available (condition "a"). Water quality is considered optimal when the state water quality rating is high (condition "b") and unsuitable when the state water quality rating is low (condition "d"). A moderate state water quality rating (condition "c") is considered an intermediate condition.

ELEMENT 20c. NUTRIENT, SEDIMENT, OR CONTAMINANT SOURCES

Directions: Determine if there is evidence of nutrient, sediment, or contaminant input by field observations and/or local inquiry. If there is evidence, note if the input is minimal, moderate, or high.

Rationale and assumptions: Pollutants can cause high fish mortality directly or indirectly by contaminating or reducing the abundance of food sources. Some species such as the brown bullhead are very pollution tolerant and can meet nutritional requirements with detritus, sewage, and acid-tolerant invertebrates (Klarberg and Benson 1975). Other species are not. The fish community composition often reflects degraded water quality by the dominance of tolerant species and noticeable absences of intolerant species.

Water quality is a critical determinant of fish habitat suitability. If state water quality ratings are not available (Element 20b), then water quality is described by noting evidence of nutrient, sediment, or contaminant sources (Element 20c) and by reviewing available data (Elements 20d, 20e, 20f, and 20g).

In some cases evidence of stress to fishery and/or aquatic habitat may be obvious. For example, fish kills may be observed from extreme thermal conditions, e.g., nuclear reactor cooling and electric power plant reservoirs (Roosenburg et al. 1989, Summerfelt 1993). In other examples, fiddler crabs suffered substantial mortality and slowed escape responses in a salt marsh contaminated with fuel oil and sewer sludge containing chlorinated hydrocarbons (Krebs and Burns 1977, Krebs and Valiela 1978) and grass shrimp exhibited reduced ability to avoid predators in a mercury contaminated environment (Kraus and Kraus 1986).

In the assessment procedure, this element is not factored into the Fish FCI if the information is not available (condition "a") or if the state water quality ratings are available (Element 20b). Water quality is considered optimal when there is no or little potential for nutrient, sediment, or contaminant input (condition "b"). Water quality is considered unsuitable when there is evidence of high nutrient input (condition "d"), high inorganic sediment input (condition "e"), high contaminant input (condition "f"), or conditions known to stress fish (condition "g"). Evidence of moderate nutrient, sediment, or contaminant input (condition "c") is considered an intermediate condition.

ELEMENT 20d. DISSOLVED OXYGEN

Directions: Determine the dissolved oxygen level in pools or along littoral areas during summer from available data.

Rationale and assumptions: Oxygen is one of the most important chemical properties of water because it is involved in the regulation of metabolic processes of most fish and affects their survival, growth, and larval development. Since the tolerances of fish species differ, oxygen levels also affect fish diversity and abundance. One study indicated that the fish assemblages in Wisconsin lakes were related to oxygen concentrations in winter, interacting with the availability of refuges from either a severe physical environment (low oxygen during winter) or from large piscivores (Tonn and Magnuson 1982). Low dissolved oxygen levels may cause stress on fish populations and cause imbalanced fish communities dominated by undesirable species such as common carp and bullheads (Moyle 1993, Wiley and Wydoski 1993). Extreme prolonged low levels may be lethal causing fish kills (e.g., Rahel 1984). However, when possible, fish tend to redistribute in lakes if oxygen levels are reduced and aggregate around inlet/outlet streams (Johnson and Moyle 1969, Tonn and Magnuson 1984).

Activities such as dredging and resuspension of bottom sediments as well as discharge of sewage or organic industrial waste may trigger episodes of low dissolved oxygen. Natural processes such as poor circulation, and plankton blooms also cause low dissolved oxygen problems.

Optimal oxygen levels are those where fish growth and survival are highest. Levels which are lethal are considered unsuitable. The criteria and scores used for this element are based upon a review of several HEP fish models (e.g., Stuber et al. 1982a, 1982b; Edwards et al. 1982a, 1982b; McMahon et al. 1984a, 1984b). A dissolved oxygen level of 5 mg/l is considered an adequate limit to sustain optimal growth and survival for most freshwater fish (Stroud 1967, Davis 1975). Higher levels may be more suitable for some warmwater species, such as the largemouth bass which exhibits reduced growth at dissolved oxygen levels of less than 8 mg/l (Stewart et al. 1967). Levels below 2 mg/l are considered unsuitable for most species; however, some species (e.g., northern pike, yellow perch, central mudminnow, and brook stickleback, and Atlantic menhaden) can survive dissolved oxygen concentrations as low as 0.1–0.4 mg/l for short periods of time (Petrosky and Magnuson 1973, Burton et al. 1980, Magnuson et al. 1989). Critical oxygen concentration may differ depending upon water temperature, water velocities, salinity, and other environmental factors (Silver et al. 1963, Davis 1975, Moyle 1993).

Optimal and unsuitable conditions used for tidal fish, which are the same as for warmwater fish, are based upon HEP criteria for the Atlantic croaker and southern flounder (Enge and Mulholland 1985; Diaz and Onuf 1985). Oxygen level is not a factor to some species such are the tarpon which are obligate air breathers (Zale and Merrifield 1989). In a study of a North Carolina oligohaline marsh, Rozas and Hackney (1984) found that dissolved oxygen levels as low as 2.6 mg/l were normal during warmer months and coincided with the period when the greatest number of species were present in the marsh. This condition may be acceptable, but it is not considered optimal in the assessment procedure. It is assumed that dissolved oxygen concentrations that are frequently < 2 mg/l are unsuitable.

Trout dissolved oxygen requirements are generally higher than for warmwater fish (Table 8.3, p. 8–19). The oxygen levels used for trout in this assessment procedure represent midpoints in the range of optimal and unsuitable conditions listed in Table 8.3. Stroud (1967) considers a dissolved oxygen level of 6.0 mg/l an adequate minimum for good production of salmonoid fish. Davis (1975) considers 8.09 mg/l as a level where the average salmonoid larvae and mature eggs start to exhibit symptoms of oxygen distress.

In the assessment procedure, this element is not factored into the Fish FCI if the information is not available (condition "a") or if the state water quality ratings are available (Element 20b). The water oxygen content is considered optimal when oxygen levels are usually greater than 5 mg/l (> 9 mg/l for trout) (condition "b") and unsuitable when oxygen levels are frequently less than 2 mg/l (< 5 mg/l for trout) (condition "d"). Intermediate oxygen levels (condition "c") are considered suboptimal, but not lethal.

Table 8.3.
Optimal and unsuitable oxygen concentrations for individual fish species
(based upon HEP models)

Species	**Optimum**	**Unsuitable**	**Reference**
Rainbow trout			Raleigh et al. 1984
≤ 15 °C	> 7 mg/l	< 3 mg/l	
> 15 °C	> 9 mg/l	< 5 mg/l	
Brown trout			Raleigh et al. 1986a
≤ 10 °C	> 10 mg/l	< 3 mg/l	
> 10 °C	> 13 mg/l	< 6 mg/l	
Lake trout	> 8 mg/l	< 6 mg/l	Marcus et al. 1984
Chinook salmon			Raleigh et al. 1986b
≤ 5 °C	> 9 mg/l	< 2.5 mg/l	
> 5 – ≤ 10 °C	> 9 mg/l	< 4.5 mg/l	
> 10 °C	> 13 mg/l	< 4.5 mg/l	
Coho salmon	> 8 mg/l	< 3 mg/l	McMahon 1983

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ELEMENT 20e. pH RANGE

Non-tidal Stream/River and Pond/Lake Fish Only

Directions: Determine the pH level from available data. (pH is the logarithm of the reciprocal of the concentration of free hydrogen ions which is used to express both acidity and alkalinity on a scale from 0–14. A 7 represents neutrality, numbers less than 7 indicate increasing acidity, and numbers greater than 7 indicate increasing alkalinity.)

Rationale and assumptions: The pH level of water is critical because it affects fish survival, growth, and larval development. Since the tolerances of fish species differ, pH levels also affects fish diversity and abundance. Extreme low or high pH levels may cause stress on fish populations, change fish communities, or cause fish kills (e.g., Carline et al. 1992, Rahel 1984).

Optimal pH levels are those where fish growth and survival rates are highest. Levels which are lethal are considered unsuitable. The criteria and scores used for this element are based upon a review of several HEP fish models (e.g., Stuber 1982; Stuber et al. 1982a, 1982b; Edwards et al. 1982a, 1982b; Edwards 1983a, 1983b; McMahon et al. 1984a, 1984b). A pH range of 6.5–8.5 is considered adequate to sustain good production, growth, and survival for all life stages of freshwater fish (Stroud 1967). In general, the most productive lakes and streams with fast fish growth rates are slightly alkaline (pH around 8) (Moyle 1993). Levels below 5.0 are considered unsuitable for most warmwater fish (Stroud 1967); however, some species such as the black bullhead, yellow perch, and central mudminnow reportedly can tolerate short term exposures as low as 3.2 (Klarberg and Benson 1975, Magnuson et al. 1989). Levels above 9.5 are considered unsuitable for most warmwater fish species; however, some species (e.g., warmouth, northern pike, largemouth bass, and flathead minnow) can tolerate short term exposures as high as 9.5–10.5 (McCarraher 1962, McMahon et al. 1984a).

Trout pH requirements are generally more narrow than for warmwater fish. The pH levels used for trout in this assessment procedure are based on the assumption that most trout populations can probably tolerate a pH range of 5.5–9.0, with an optimal range of 6.5–8.0 (Hartman and Gill 1968). While brook and brown trout can survive pH values as low as 5.5, rainbow trout are considered less tolerant of low pH levels (Hunter 1991).

In the assessment procedure, this element is not factored into the Fish FCI if the information is not available (condition "a") or if the state water ratings are available (Element 20b). The pH is considered optimal when levels are 6.5–8.5 (6.5–8.0 for trout) (condition "b") and unsuitable when pH levels are ≤ 5.0 or ≥ 9.5 (≤ 5.5 or ≥ 9.0 for trout) (condition "d"). Intermediate pH levels (condition "c") are considered suboptimal, but not lethal.

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ELEMENT 20f. MAXIMUM MID-SUMMER TEMPERATURE

Directions: Determine the maximum mid-summer temperature within pools or littoral areas from available data. If measurements are taken, measure water temperature for 1 + minute in a shaded (stream) pool or littoral area during the hottest part of the day (e.g., 2:00 and 3:00 p.m.) to obtain maximum. For lacustrine habitats, use the temperature strata nearest to optimum in dissolved oxygen zones with > 3 mg/l.

Rationale and assumptions: Water temperature is critical because it affects fish survival, growth, spawning, and larval development (Moyle 1993). Water temperature also affects the diversity and abundance since the tolerances of fish species differ. Extreme low or high water temperatures may cause stress on fish populations and possibly result in fish kills (e.g., Roosenburg et al. 1989). Platts et al. (1987) explained how streams may lose fish biomass when they are too cold in the winter or when they are too warm during the critical parts of the summer. Sudden or extreme changes of temperature can also be lethal to some species, such as the gizzard shad, even if the change occurs within the normal optimal range for that species (Williamson and Nelson 1985).

Optimal water temperatures are distinguished for four fish groups: warmwater stream, trout stream, pond/lake, and tidal. Optimal water temperature levels are those where fish growth and survival are highest. Levels which are lethal are considered unsuitable.

The criteria and scores used for the warmwater stream and pond/lake fish are the same and based upon a review of several HEP fish models (e.g., Stuber 1982; Stuber et al. 1982a, 1982b; Edwards and Twomey 1982; Inskip 1982; McMahon et al. 1984a, 1984b).

It is assumed that a mid-summer water temperature range of 20–30° C is an adequate range to sustain good production, growth, and survival for most freshwater fish. This range is compatible with the 18–29° C preferred range for percids noted by Hokanson (1977). These temperatures may not be suitable for species such as the yellow perch which reportedly experienced high mortality at 28–33° C (Hokanson 1977). Temperatures below 15° C are considered unsuitable for most warmwater fish; however, some species such as the northern pike can tolerate temperatures as low as 5–7° C (Johnson 1966). Temperatures greater than 34° C are considered unsuitable for most warmwater fish species; however, some desert pupfish can tolerate temperatures as high as 42° C (Moyle 1993). The 34° C upper limit may also be too high for species like the white crappie for which temperatures above 31° C are considered lethal (Edwards et al. 1982a)

Temperature is the most important variable distinguishing trout streams from warmwater streams (Barton et al. 1985). In general, trout water temperature requirements are lower and more narrow than temperature requirements for warmwater fish. The criteria and scores used for this element are based upon a review of several HEP fish models (e.g., Raleigh et al. 1984, 1986a; Edwards 1983a; Trial et al. 1983; Marcus et al. 1984). It is assumed that a mid-summer water temperature range of 12–19° C is an adequate range to sustain good production, growth, and survival for most trout or other coldwater species. This range may be too narrow for some species such as the rainbow trout which were found well distributed in a lake at temperatures between 7–21° C (Fast 1973). Temperatures below 2° C are considered unsuitable for most trout; however, the brown trout and rainbow trout can survive in temperatures as low 0° C (Maciolek and Needham 1952). Temperatures greater than 25° C are considered unsuitable for most trout species; however, some species such as the rainbow trout can tolerate temperatures as high as 26.7° C (Fast 1973). The 25° C upper limit may also be too high for some trout species.

Optimal and unsuitable conditions used for tidal fish are based upon HEP criteria for the spotted seatrout, larval red drum, and southern flounder (Buckley, Kostecki 1984, Enge and Mulholland 1985).

Spawning water temperatures are generally more narrow and specific (section 8.4).

In the assessment procedure, this element is not factored into the Fish FCI if the information is not available (condition "a") or if state water quality ratings are available (Element 20b). The water temperature is considered optimal when levels are 20–32 ° C for tidal fish, 20–30° C for warmwater fish, or 12–19° C for trout (condition "b"). Temperatures are unsuitable when levels are < 5 or > 40° C for tidal fish, < 15 or > 34° C for warmwater fish, or < 2 or > 25° C for trout (condition "d"). Intermediate temperatures (condition "c") are considered suboptimal, but not lethal.

Note: Water temperature requirements for salmon are lower than for trout. The coho salmon optimal temperature range is 5–10° C; unsuitable temperatures are > 25° C (McMahon 1983). Chinook salmon optimal temperature range is 8–12° C; unsuitable temperatures are > 24° C (Raleigh et al. 1986b). The criteria for this element may need to be changed for specific target species and life states (e.g., Chinook salmon - spawning).

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ELEMENT 20g. MAXIMUM MONTHLY AVERAGE TURBIDITY

Non-tidal Stream/River and Pond/Lake Fish Only

Directions: Determine maximum monthly turbidity during average summer flow or summer stratification from available data. Turbidity is described in general terms of low, moderate, and high with examples given for corresponding levels in the JTU and secchi depth scales. The scale of measurement for available information may differ. Consult fisheries and/or water quality experts to select conditions that best describes local conditions. (**Turbidity** is an optical property of water that causes light to be scattered or adsorbed in the water, resulting in a decrease in water transparency. There are several scales of turbidity measurement including the Jackson Turbidity Unit (JTU), secchi depth, and parts per million Total Dissolved Solids (TDS)).

Rationale and assumptions: Turbidity is important because it affects the distribution and intensity of photosynthesis in the body of water. Increased turbidity can result in decreased photosynthesis, primary productivity, and food sources for fish.

Optimal turbidity levels are those where fish food production is highest. It is assumed that very high turbidities adversely affect fish populations by limiting food production (Edwards et al. 1982b). Therefore, levels which limit food production are considered unsuitable. The criteria and scores used for this element are based upon a review of several HEP fish models (e.g., Edwards and Twomey 1982; Edwards et al. 1982a, 1982b; Stuber et al. 1982a; Trial et al. 1983; Edwards 1983b; McMahon et al. 1984a). A low maximum monthly average turbidity (e.g. < 80 JTU, secchi depth > 2 m) is considered adequate to sustain good food production. This limit may not be suitable for some species such as the smallmouth buffalo and fallfish which require lower turbidities (e.g., < 40 JTU) (Edwards and Twomey 1983, Trial et al. 1983). High turbidity (e.g., 200 JTU, secchi depth = 0 m) is considered unsuitable because there is little or no light penetration to support photosynthesis and food production.

Some turbidity may be beneficial to fish. In a study of California streams, Moyle and Nichols (1973) found a high abundance of many species (e.g., largemouth bass, green sunfish, and mosquito fish) associated with moderate turbidity.

In the assessment procedure, this element is not factored into the Fish FCI if the information is not available (condition "a") or if state water quality ratings are available (Element 20b). Low turbidity is considered optimal (condition "b"), high turbidity is considered unsuitable (condition "d"), and intermediate turbidity is considered suboptimal (condition "c").

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ELEMENT 21b. SHAPE OF WETLAND/WATER EDGE

Directions: Determine from field observations, maps, and/or aerial photographs if a vegetated wetland/water edge is present. If present, note if the edge is predominantly regular or irregular (Figure A.10, p. 8-63; A 53).

Rationale and assumptions: The edge between the wetland and open water provides a microhabitat for fish that includes cover, feeding areas, and an access point to and from the marsh. Tidal marshes with complex, well-developed creek systems are more productive for fish than marshes with few or no tidal creeks (i.e., fringing marshes) (Rozas and Odum 1987b). Sunfish species, most larvae, and juveniles were found to congregate along shoreline areas of a Kentucky stream (Floyd et al. 1984). It is assumed that greater edge length increases habitat availability and productivity, i.e., an irregular edge provides more microhabitat and access to the marsh surface than a regular edge or no edge.

A greater abundance of tidal fish and shrimp have been associated with the presence of or increased complexity or reticulation of the wetland/water edge (Weinstein 1979, Zimmerman et al. 1984). A study of North Carolina tidal marshes revealed that post larvae of commercially important species are abundant at the headwaters of shallow tributary creeks and along the marsh fringe at the rivers edge (Weinstein 1979). Gilmore (1987) reported a greater fish species diversity in semi-impounded Florida mangrove marshes compared to the adjacent estuarine seagrass habitats. The perimeter ditch within the impoundment was found to be important because it (a) was a preferred microhabitat for transient species during seasonally high sea levels compared to the upper marsh flats and (b) allowed more fish species to survive during upper marsh exposure periods.

While shallow marsh areas are optimal habitat for fish (e.g., refer to rationale for Elements 10d and 10o), providing access to the marsh surface may be critical to insuring utilization of that habitat. Neill and Turner (1987) found that canals backfilled to restore marshes to benefit wildlife, instead created a barrier thus reducing canal use by migrating fish species and decreasing available nursery habitat. High densities of brown shrimp in a Galveston Bay salt marsh were attributed to, among other things, the reticulation in salt marsh macrostructure (Zimmerman et al. 1984). The amount of edge between the marsh and adjacent subtidal zone facilitates shrimp access and movement.

In the assessment procedure, Element 21b is always factored into the Fish FCI because the conditions represent the range of possibilities with regard to the wetland/water edge. An irregular edge (condition "a") is considered optimal because edge habitat is available and abundant. Minimal or absent edge (condition "c") is considered to provide relatively poor habitat. Although a regular edge (condition "b") provides edge habitat, it is considered as an intermediate condition because the amount of edge is less abundant.

ELEMENT 22b. AVAILABLE FISH COVER/ATTRACTORS

Directions: Estimate potential cover for wetland in the region and note abundance of cover within the assessment area relative to this optimum. Consider abundance of cover in entire fish AREA, including wetland and open water areas. Examples of optimums are provided based upon a literature review; however, it is best to determine optimum for local conditions. For tidal fish, determine the abundance of cover, other than live vegetation, which is accessible to fish anytime of the year. For non-tidal fish, determine percent cover including vegetation in littoral areas, pools, and backwater areas during summer. If present, record the type of attractor(s) and estimate percent cover. In some cases, it may be better to record the number or size of attractors (e.g., dimension of tire structure). (**Fish attractor** = any artificial means (i.e., sound, light, cover, food, water flow, etc.) of intentionally concentrating fish to enhance angler harvest).

Rationale and assumptions: Fish cover/attractors include those features of a wetland which are not described by the other elements, yet are known to improve fish habitat by increasing the structural complexity and providing special habitat requirements. Habitat complexity is positively correlated with fish species diversity and abundance (Gorman and Karr 1978, Tonn and Magnuson 1982, Crowder and Cooper 1982, Thorman 1986, Bohnsack et al. 1991).

Crowder and Cooper (1982) found a positive correlation between prey density and structural complexity. This correlation was attributed to a greater availability of (1) food and substrate for the prey and (2) refuge from predators. Thus, structural complexity is important to the dynamics of fish populations because of its effect on the ecological interactions between fish and their prey. Although prey diversity and abundance may increase with increased structural complexity (Hall et al. 1970), prey capture rates tend to decline (Crowder and Cooper 1982, Savino and Stein 1982). At some point, increased structural complexity may not provide any added benefit or my even reduce habitat suitability. For this reason, intermediate levels of structural complexity are considered optimal because prey densities are relatively high and predator feeding rates are highest.

The criteria for this element are expressed in terms of relative abundance. The potential cover for habitat type in the region is determined and the actual abundance is compared to this optimum. Examples of optimal percent cover were not found in the literature nor included in EPW for tidal fish.

Examples of percent cover and assigned scores for warmwater fish are based upon the HEP suitability graphs developed for the green sunfish, largemouth bass, white crappie, bigmouth buffalo, northern pike, and longnose sucker (Inskip 1982; Stuber 1982a, 1982b; Edwards et al. 1982a, Edwards 1983a, 1983b). A range of 25–75% cover is generally considered optimal for warmwater fish. This is further supported by Wiley et al. (1984), who developed and tested a simple model predicting the parabolic relationship between plant standing crop during the growing season and largemouth bass production. Based on this model, the predicted optimal macrophyte concentration was approximately 36% of surface area cover for a small pond. Wiley et al. (1984) cautioned that different types of fisheries may have different optimal solutions. Greater than 75% cover is considered suboptimal because it (a) provides too much protection for prey, (b) is unsuitable for spawning and/or rearing, and (c) the excessive vegetation can deplete dissolved oxygen when decomposing during the winter (Stuber et al. 1982a, 1982b; Inskip 1982).

Examples of percent cover and assigned scores used for trout are based upon the HEP suitability index graphs developed for the brown trout, rainbow trout, coho salmon, and chinook salmon (McMahon 1983; Raleigh et al. 1984, 1986a, 1986b). It is assumed that the cover is associated more with pools which, under optimal conditions, should comprise 50% of the total stream area. Thus, the optimal conditions exists when the useable cover comprise < 50% of the total stream area (Raleigh et al. 1984, 1986a, 1986b).

The importance of attractors is recognized in several techniques used to evaluate fish habitat (e.g., Platts et al. 1987, Hunter 1991) and reflected in the practice of using artificial attractors (e.g., Seaman and Sprague 1991a, Kohler and Hubert 1993). EPW describes abundance in simple terms of relative abundance. Comprehensive methods for describing attractors are available (e.g., Platts et al. 1983).

Vegetation: Many fish species such as the white crappie, smallmouth bass, smallmouth buffalo, rock bass, largemouth bass, sunfish, northern pike, and bigmouth buffalo tend to congregate or spawn around vegetation, submerged trees, brush, and boulders (Trautman 1981, McCarraher and Thomas 1972, Edwards and Twomey 1982, Wiley et al. 1984, Probst et al. 1984, Sechnick et al. 1986, Petering and Johnson 1991). Live and dead vegetation provides a refuge from predation, hunting cover, substrate for spawning, and substrate for food sources such as macroinvertebrates. The amount of vegetation cover was found to be significantly positively correlated with the abundance of largemouth bass, green sunfish, bluegill, mosquito fish, golden shiner, and rainbow trout (Moyle and Nichols 1973).

Dense brush is characterized by low scrub vegetation which is dense enough to conceal/cover and protect fish and wildlife. Significant positive correlations have been found between the abundance of woody plant debris (e.g., logs, brushpiles, and block brush structures) and fish diversity and abundance (Wilbur 1978, Angermeier and Karr 1984). Boussu (1954) found an increase in abundance and weight of total fish by adding artificial brush cover in a Montana trout stream. In a study of an Arkansas stream, spotted bass consistently preferred brush shelters over unsheltered habitat; largemouth bass were selective for shelters in early spawning season (Vogele and Rainwater 1975). The importance of dense brush is reflected in the practice of building brush shelters and other structures to improve fishery habitat (e.g., Schnick et al. 1982, Polovina 1991; section 8.4).

Fallen trees provide cover and protection from predation. Organic debris in the form of fallen trees and leaf litter provides substrate for the development of periphyton and colonization by macroinvertebrates, which are an important food base for fish. The importance of snags, or submerged woody substrate, as a source of habitat and food for fish was demonstrated in a study of a Georgia stream, where snags were found to support 60% of total invertebrate biomass (Benke et al. 1985). All utilized snags, but four of eight major fish species obtained at least 60% of their prey biomass from snags. Organic debris also plays a role in determining channel morphometry and in regulating the movement of sediments in streams by creating obstructions which catch and accumulate sediments. A significant positive correlation has been found between the abundance of logs/fallen trees and fish numbers (Moring et al. 1986). Smallmouth bass were found to be most associated with log complexes and root wads (Probst et al. 1984). The importance of fallen trees is reflected in the practice of placing logs or dead trees into the water to improve fish habitat (e.g., Saunders and Smith 1962, Prince et al. 1977, Burgess and Bider 1980, Schnick et al. 1982, Ambrose et al. 1983a) and the development of a technique for measuring and mapping organic debris (Platts et al. 1987). Habitat improvements for salmonids often include the installation of structures, including logs and branches, which mimic the effects of naturally occurring woody debris. These manipulations can result in increased growth/biomass, survival, and abundance of salmonid species (Boussu 1954, Saunders and Smith 1962, Burgess and Bider 1980). The addition of woody debris also can result in increased abundance and diversity of fish in a warmwater stream (Angermeier and Karr 1984).

Rocks, boulders, or rockpiles provide cover and protection from predation. When located in wide, shallow, fast streams, large boulders create small pools and quiet resting areas for fish on the downstream side. For example, juvenile salmonids were observed to concentrate behind large rocks in an estuary for refuge and to have easy access to prey (Macdonald et al. 1987). The importance of rocks is reflected in the practice of installing rocks and building rockpiles to improve fish habitat (e.g., Burgess and Bider 1980).

Artificial attractors such as stake beds, artificial seaweed, vitrified pipe attractors, and tire structures are often used to attract fish (e.g., Wilbur 1978, Prince et al. 1977, USFWS 1978, Schnick et al. 1982, Ambrose et al. 1983a, Wesche 1985, Seaman and Sprague 1991a, Kohler and Hubert 1993). The purpose of these structures is to provide habitat which is lacking in an existing wetland and/or waterbody. Artificial fish attractors provide (a) a substrate for development of periphyton, the establishment of aquatic macrophytes, and colonization by macroinvertebrates, (b) cover from predators, and (c) spawning habitat (Summerfelt 1993). Artificial reefs have been shown to effectively concentrate warmwater sport fish (e.g., bass, sunfish, and catfish) in structure-deficient nonflowing waters (Prince et al. 1977).

In the assessment procedure, Element 22b is always factored into the Fish FCI because the conditions describe the full potential range for cover. Fish habitat is considered optimal when fish cover/attractors are abundant (condition "a") and poor when cover/attractors are sparse or excessive (condition "c" or "d"). Moderate cover is assigned an intermediate score.

NO

ELEMENT 24. OBSTRUCTION TO FISH PASSAGE

Directions: Determine if there are any barriers to on-site fish passage by field observations, maps, and/or aerial photographs. Consider physical (e.g., impoundment, thermal plumes), chemical (water pH), and behavioral barriers to fish passage. If barriers are present, note if the conditions permit, curtail, or preclude fish utilization.

Rationale and assumptions: Fish may not occupy an area because an obstacle imposes an absolute physical or behavioral barrier. The barriers to fish passage can be the result of natural causes (e.g., rock and/or mud slides) or construction activities (e.g., dam, highway extension, or industrial development). When barriers are established fish populations may significantly decrease, undergo a change in community structure, or be eliminated (e.g., Gilmore et al. 1981, Harrington and Harrington 1982, Herke and Rogers 1989, McGovern and Werner 1990).

The range of effects to the fishery population depends upon the barrier type and size and the resource which it is impacting. The changes to fish populations may be reversible (e.g., construction of an impoundment converting a trout stream to a lake). There are a variety of methods to improve fish passage, e.g., construction of fishways and modification of water control structures (section 8.4) (e.g., Schnick et al. 1982, Rogers et al. 1992, Orth and White 1993).

In the assessment procedure the Fish FCI is considered not applicable when there are conditions which may impose absolute physical or behavioral barriers to fish access (condition "f"). This element is considered not applicable if there is no barrier present (condition "a"); a barrier is present, but conditions have been modified to permit fish passage (condition "b"); a barrier is utilized for fish management practices (condition "c"); or if the site is isolated but utilized by fish (condition "d").

Element 24 is factored into the Fish FCI only when a barrier curtails fish passage (condition "e") or prevents fish access and survival at the site (condition "f").

ELEMENT 25a. PERCENT POOL AREA

Non-tidal Stream/River Fish Only

Directions: Determine if there is a stream on-site by field observations. If present, estimate the percent pool area in the stretch of stream. It may be necessary to consider areas outside of relatively small assessment areas in order to determine a percent which is representative of the stream. For a trout stream, note the percent pool area during the late growing season, low-water periods. For a warmwater stream, note the pool area during average summer flow. (**Pool** = portion of the water column that has less than average water velocity, a greater than average depth, and substrates composed of silt/fines. **Riffle** = portion of the water column that has greater than average water velocity, a less than average depth, and substrates composed of gravel/rubble/course sand).

Rationale and assumptions: Pool and riffle areas are important habitat types in streams. Pools provide (a) resting areas, (b) feeding areas, (c) a refuge from adverse conditions during the winter, (d) downwelling of water into egg nests located in ripple areas which insures a constant supply of oxygen and removal of metabolic wastes, and (e) an effective sediment trap to protect downstream riffle areas (Raleigh et al. 1984, Wesche 1985, Gore 1985b).

The pool–riffle ratio is commonly used to assess a stream's potential for rearing fish. A measure of pool area is used as an estimate of a stream's capacity to provide resting and feeding area. A measure of riffle area is used as an estimate of a stream's capacity to produce food and support spawning. A ratio of 1 pool : 1 riffle, or approximately 50% pool cover, is considered optimal (Platts et al. 1983, Hunter 1991). A few studies, however, have reported high trout concentrations in streams with ratios as low as 0.4:1 (29% pool) and as high as 1.5:1 (60% pool) (Hunter 1991).

Both trout and warmwater species typically inhabit pool areas of streams. It is assumed that optimal percent pool cover supports a high abundance of fish. An unsuitable percent pool cover supports low abundance of fish.

The criteria and scores used for warmwater fish are based upon a review of several HEP fish models (e.g., Inskip 1982; Stuber et al. 1982a, 1982b; Edwards et al. 1982a, 1982b; Edwards and Twomey 1982; Stuber 1982; Edwards 1983b; Edwards and Schreck 1983; McMahon et al. 1984a). Greater than 50% pool cover is considered optimal riverine habitat for most freshwater species. Higher percent pools may be more suitable for species such as the warmouth and northern pike which occur almost exclusively in marshes, backwaters, and pools (Trautman 1981, Inskip 1982). No or minimal pool cover (e.g., < 2%) is considered unsuitable for most species. The extreme of too much pool cover (e.g., 100%) may be unsuitable for a few species (e.g., smallmouth buffalo, bigmouth buffalo, longnose dace), but it is assumed that this does not apply to the majority of the warmwater species.

Trout percent pool cover requirements are generally more consistent than the variety of percentages recommended for warmwater fish. The 1:1 pool to riffle ratio is considered optimal for trout and salmon. The criteria are based upon Platts et al. (1983), Hunter (1991), and a review of HEP models for the brown trout, rainbow trout, coho salmon, and chinook salmon (McMahon 1983; Raleigh et al. 1984, 1986a, 1986b).

Pools are often created to enhance stream habitat by the construction of small dams and deflectors, which are low barriers to streamflow (e.g., Saunders and Smith 1962, Burgess and Bider 1980, Wesche 1985). Studies have shown that these manipulations can increase fish abundance. For example, Burgess and Bider (1980) reported a substantial increase in trout abundance and biomass within two years after a Quebec stream had been improved by the creation of 50% pool area and the addition of cover.

In the assessment procedure, this element is not factored into the Fish FCI if a stream is not on-site (condition "a"). The pool area is considered optimal when it is > 50% for warmwater streams and approximately 50% for trout (condition "b"), and unsuitable when it is sparse (condition "d"). Intermediate percent pool area (condition "c") is considered suboptimal.

ELEMENT 25b. CURRENT VELOCITY

Non-tidal Stream/River Trout Only

Directions: Determine if a shoreline is present on-site by field observations. If present, note the average current velocity over spawning areas during spawning and embryo development. Use available information or measure with a water-current meter at 0.6 (six-tenths) of the total water depth.

Rationale and assumptions: Current velocity is an important habitat consideration for the various life stages of fish. Many species, particularly the salmonids, occupy relatively slow-moving water during spawning and embryo development and gradually move to faster water as they mature. Within these waters, salmonids will spawn in riffle areas. The faster currents carry dissolved oxygen to the eggs and effectively remove metabolic waste, silt and debris (Silver et al. 1963, Wesche 1985). The faster moving waters (e.g., riffles) provide more abundant and diverse aquatic invertebrates which serve as food for juveniles and adults (Raleigh et al. 1984, Wesche 1985, Hunter 1991).

Optimal average current velocities are those that result in the highest survival of embryos. Velocities that result in reduced survival are considered unsuitable. The criteria and scores used for this element are based upon a review of several HEP fish models (e.g., Raleigh et al. 1984, 1986a, 1986b). Velocities below 15 cm/sec and greater than 85 cm/sec are considered unsuitable. This is consistent with Wesche (1985) who concluded that generally acceptable spawning areas exhibit water velocities between 15–90 cm/sec (Wesche 1985). Hunter (1991) cautions that since the HEP criteria for rainbow and brown trout are based on observations of trout in the Pacific northwest, these criteria may not be applicable to northeastern streams.

While velocity may be an important habitat requirement, optimal current velocities vary widely depending upon the fish species and life stage (Table 8.6, p. 8–41). There appears to be no general range of velocities which is applicable to the majority of fish species, with the exception of trout spawning requirements. Thus, current velocity is considered only for trout in this assessment procedure.

In the assessment procedure, this element is not factored into the Fish FCI if it is a warmwater stream (condition "a"), there is no stream on-site (condition "b"), or if the information is not available (condition "c"). Average current velocity is considered optimal at 30–70 cm/sec (condition "d") and unsuitable at < 15 cm/sec or > 85 cm/sec (condition "f"). Intermediate current velocities (condition "e") are considered suboptimal.

ELEMENT 26. BANK UNDERCUT

Non-tidal Stream/River Fish Only

Directions: Determine if a shoreline is present on-site by field observations. If present, note if the bank undercut is absent or provides minimal (predominantly < 15 cm), moderate, or abundant (predominantly > 15 cm) cover for fish (Figure 8.4, p. 8–14).

Rationale and assumptions: Bank undercut provides valuable cover and rearing habitat for fish

(Platts et al. 1983, Hunter 1991). Fish abundance and biomass have been associated with the availability of bank undercut.

Fish often congregate at the bank-water interface (Platts et al. 1983, Floyd et al. 1984). Platts et al. (1983) describes the favorable condition as an undercut (< 90 ° angle) or perpendicular (90° angle) bank which provides greater bank-water edge habitat. Habitat value is considered comparatively low if the bank is located back away from the water column (> 90 ° angle) (Figure 8.4, p. 8–14). Wesche et al. (1987) found a significant positive correlation between percent overhead bank cover and trout abundance in small Wyoming streams. Overhead bank cover (measured as undercut bank, overhanging vegetation, logs, and debris) explained the greatest amount of variation in trout abundance (Wesche et al. 1987).

Streambank undercut is also regarded as a condition favorable to producing high fish biomass, especially in small streams (Platts et al. 1987). The relationship is illustrated by the substantial reduction in number and average weight of trout reported after the removal of undercut bank from a Montana stream (Boussu 1954).

The importance of undercut banks is well documented in the literature. For example, Armour et al. (1991) considers the collapse of overhanging banks due to livestock grazing as one of the principal factors contributing to the decline of native trout in the west. Stream restoration efforts often include the creation of bank cover and artificial overhang to improve fish habitat (e.g., Wesche 1985).

In the assessment procedure, this element is considered not applicable if there is no shoreline on-site (condition "a"). Element 26 is factored into the Fish FCI when a shoreline is present. Bank undercut habitat is considered optimal for fish when the undercut provides abundant cover (condition "b") and poor when the undercut is minimal or absent (condition "d"). Moderate bank undercut (condition "c") is considered an intermediate condition.

√

ELEMENT 27a. SPAWNING SUBSTRATE

Non-tidal Stream/River and Pond/Lake Fish Only

Directions: Determine if the site is accessible during spawning. If accessible, note the predominant substrate.

Rationale and assumptions: Some species choose very specific substrates for spawning. Optimal spawning substrate are those that result in the highest survival of embryos. Substrates that result in reduced survival are considered unsuitable. The criteria and scores used for this element are based on a review of several HEP models (Stuber et al. 1982a, 1982b; Stuber 1982; Inskip 1982; Edwards 1983a, 1983b; Trial et al. 1983; McMahon 1983; McMahon et al. 1984b; Hubert et al. 1984; Marcus et al. 1984; Raleigh et al. 1984, 1986a, 1986b) (Table 8.4, p. 8–37) and other references (e.g., Trautman 1981; Wesche 1985, Hunter 1991).

Gravel, pebbles, and emergent/aquatic vegetation are considered to provide optimal spawning habitat in ponds/lakes because several lacustrine species show a preference for these substrates (Table 8.4). It is assumed that bedrock and boulders are unsuitable for most species.

Gravel/rubble is considered to provide optimal spawning habitat in streams/rivers because several riverine species, including largemouth bass and trout, show a preference for this substrate (e.g., Stuber 1982b, Raleigh et al. 1986a, Hunter 1991). Bedrock, boulders, and fine sediments are unsuitable for most species.

In the assessment procedure, Element 27a is always factored into the Fish FCI because it considers site accessibility during spawning and the full range of possible substrate types. If the site is not accessible during spawning (condition "d" for stream/river; condition "e" for pond/lake) it is considered unsuitable. The optimal substrate in stream/river habitat is gravel/rubble (condition "a"), whereas the optimal substrate in pond/lake habitat is gravel/pebbles and emergent/aquatic vegetation (conditions "a" and "b"). Other substrates are assigned relatively lower scores.

Note: The conditions and scores used for this element are generalized. If necessary determine the optimal substrate for the target species and modify the element accordingly. The rating system developed by Hunter (1991) for trout habitat may be used as follows:

Rating	Description	(EPW scores)
Excellent	Gravel/rubble/ boulder	1.0
Good–Fair	Gravel/rubble and/or sand/silt	0.5
Poor	Sand, silt, boulder (in any combination)	0.1

✓ ELEMENT 27b. SPAWNING STRUCTURES

Non-tidal Stream/River and Pond/Lake Fish Only

Directions: Determine if the site is accessible during spawning. If accessible, note and briefly describe any spawning structures which may be present.

Rationale and assumptions: Several techniques have been developed and structures designed to increase spawning success (e.g., Prevost 1956, Johnson 1961, Vogele and Rainwater 1975, Schnick et al. 1982, Bohnsack et al. 1991). Techniques used include the construction and/or placement of gravel or rock spawning shoals, artificial reefs, gravel filled boxes, suspended platforms, spawning boxes, pipes, tires, and a variety of fish shelters. The effectiveness of these structures depends upon their placement, wave climate, the surrounding substrate type and size, siltation rates, predation, and other factors.

It is assumed that spawning structures will be designed and installed properly and that their use will increase spawning.

In the assessment procedure, this element is considered not applicable if the site is not accessible during spawning (condition "a") or if spawning structures are absent (condition "b"). Element 27b is factored into the Fish FCI only when a spawning structure is present (condition "c").

✓ ELEMENT 27c. DRAWDOWN

Non-tidal Pond/Lake Fish Only

Directions: Determine the extent of water drawdown during spawning and embryo development from field observations, water level records, and local inquiry. Note if the drawdown is minimal, moderate or sufficient enough to expose spawning substrate. Consider tolerances of species present and refer to list of known unsuitable drawdown levels for individual species. Consult local fisheries expert, if necessary.

Rationale and assumptions: Drawdown can interrupt spawning activity, desiccate eggs, and/or strand and destroy larvae and fry. Spawning of some species can be hampered or prevented due to drawdown in reservoirs (e.g., Ploskey 1982).

Stable water levels during and after spawning ensure optimal survival of eggs and embryo. Drawdown of water levels that expose spawning habitat and affect embryo survival is considered unsuitable. Examples of drawdown levels used for this element are based upon a review of several HEP fish models (e.g., Stuber et al. 1982a, 1982b; Stuber 1982; Inskip 1982; Edwards et al. 1983; Edwards 1983b; Williamson and Nelson 1985).

Unsuitable drawdown levels vary depending upon the depths at which the individual species spawn. For example, a drawdown greater than 1 m may be unsuitable for the northern pike which usually spawns in water less than 0.5 m deep (Inskip 1982). Alternatively, species such as the largemouth bass may tolerate as much as a 7 m drop in water level (Stuber et al. 1982b). Rapid, short-term drawdowns may be deleterious. Holland (1987) reported no mortality of walleye and northern pike eggs at short-term (1–12 hr) dewatering, but significant mortality of larvae at dewatering frequencies of 1 or 3 hr (Holland 1987). For examples of unsuitable drawdown levels, refer to Table 8.7, p. 8–42.

In the assessment procedure, this element is considered not applicable if there is no or minimal drawdown (condition "a"). Element 27c is factored into the Fish FCI only when drawdown is moderate (condition "b") or sufficient enough to expose spawning substrate (condition "c") and potentially reduce embryo survival.

ELEMENT 28. REFUGE DURING DROUGHT/FREEZE

Non-tidal Pond/Lake Fish Only

Directions: Determine if there is an accessible water body with areas of sufficient depth which will not dry up during a drought and/or freeze throughout the water column.

Rationale and assumptions: Maintaining a fish community in shallow water pond/lake may not be feasible or may be difficult if it is subject to a periodic drought or a freeze.

A freeze could (a) affect most of the water column and prevent the establishment of any fishery in an isolated shallow depression or (b) result in oxygen depletion and cause a winterkill in a pond/lake. Frequent winterkills occur in large shallow lakes. When heavy snow covers the ice, fish suffocate due to oxygen depletion resulting from the oxygen demand of decomposing plant, plankton, invertebrates, and fish (Johnson and Moyle 1969). Species that adapt and persist in lakes with low winter oxygen use oxygenated microhabitats within the lake (e.g., spring seepage areas) and emigrate to outlet streams (Magnuson et al. 1989).

Drought could (a) affect most of the water column and prevent the establishment of any fishery in an isolated depression or (b) result in a fish kill due to the lack of refuge. For example, refuge areas maintained by the input of cool water from streams or groundwater prove effective for fish in reservoirs which receive heated effluents from a nuclear reactor. However, a major fish kill occurred when the size of the refuges declined during a drought (Roosenburg et al. 1989).

In the assessment procedure, Element 28 is not factored into the Fish FCI, but is used to determine if the Non-tidal Pond/Lake Fish function is applicable. There is no potential for this function when a refuge during drought or freeze is not available (condition "b").

8.4 Additional Design Considerations

The following section outlines design considerations including EPW elements and additional factors, which are to be considered for the Fish function.

Factor	Remarks
PHYSICAL FEATURES	
Disturbance (Elements 4a and 4d)	Disturbance, especially herbivory, is a major concern during the initial establishment and maintenance of planned wetlands. The recommended solution, an exclosure fence, has proven effective in excluding geese, cattle, and nutria (e.g., Webb 1982, Stuber 1985, Conner and Flynn 1989, Garbisch and Garbisch 1994). Adverse impacts associated with livestock can be minimized by managing the numbers of livestock and/or season of use (Armour et al. 1991). Adverse impacts of disturbances in open water can be minimized by scheduling the disturbance (e.g., dredging, construction activities) to avoid spawning periods for target fish species. Natural channel/open water and shoreline characteristics (e.g., reestablish vegetation, fallen trees and debris) should be maintained and/or restored.
Shoreline bank stability (Element 1b)	Design the planned wetland to insure no or minimal shoreline bank erosion. The optimal condition for fisheries is a stable, vegetated bank with some undercutting and relatively short bank height. While bank undercut provides valuable cover (refer to rationale for Element 26) substantial undercutting should be avoided to minimize the adverse impacts associated with erosion. If feasible, the shoreline bank should be vegetated since vegetation generally provides better fish habitat (refer to rationale for Elements 10d, 10f, and 10m). Six approaches are used separately or in combination to provide bank erosion control: revetments, groins, breakwaters, surface soil stabilized, vegetation, and bank shaping without structures. In designing for shoreline bank erosion control consider the basic erosional processes as well as fish habitat requirements. Techniques which establish and/or maintain the shoreline vegetation are preferable. For environmental designs for streambank protection projects refer to Henderson (1986), Binns (1986), and Orth and White (1993). There are several other publications which provide design criteria (e.g., USCOE 1981, 1984; Schnick et al. 1982; Keown 1983; Schultze and Wilcox 1985; Garbisch 1986). If vegetation is to be planted, select species which will provide suitable cover for fish (overhanging perennials which can withstand flooding and drought). Refer to Thunhorst (1993) and/or consult local experts to determine appropriate plant materials.

Factor	Remarks
Bank height	Based on Hunter (1991) a bank height which on average is less than 30 cm (1 ft) with brush/sod is excellent for trout habitat; an average of 30–91 cm (1–3 ft) boulder/rubble is rated as good–fair; and an average greater than 91 cm (3 ft) is considered poor. The poor rating is based upon the assumption that a vertical bank higher than 91 cm (3 ft) is considered an indication of an unstable, incised channel. Bank height conditions which provide the best habitat for fisheries should be determined for local conditions.
Fish habitat size (Element 16c)	**Non-tidal fish only** The decision to add habitat to an existing wetland or to create an isolated wetland depends upon management objectives. First, it must be decided if the planned wetland is to be designed to support a particular fishery (e.g, warmwater pond, warmwater stream, coldwater stream) or target species. If so, then acreage should be considered in conjunction with other habitat requirements. A review of the literature revealed no information on minimum habitat areas for individual species (refer to rationale for Element 16c).
Shape of wetland/water edge (Element 21b)	Maximize the amount of wetland/water edge to the extent which it naturally occurs for the wetland type in the region.
Obstruction to fish passage (Element 24)	Note any obstruction to fish passage and consider actions to permit fish access. Culverts installed in a variety of situations (e.g., previously impounded salt marshes, road stream crossing) should be designed to permit free passage of fish. *Non-tidal:* To insure that fish can pass through a stream, the design might include a low flow channel, a water depth great enough to submerge the largest fish, and a maximum acceptable water velocity. To design structures that will not obstruct fish passage requires an understanding of the behavior and swimming capacity of fish. The critical swimming speeds and leaping abilities of the target species must be known in order to design effective fishways, culverts, and guiding devices (Orth and White 1993). Culvert and fishway designs are summarized in Schnick et al. (1982) and Osborn (1987). Orth and White (1993) outline the following common problems associated with culverts which can be avoided by proper design:

Factor	Remarks

- Excessive drop at the downstream end
- Velocities exceeding critical swimming speeds
- Shallow flow
- Lack of resting pools at inlets and outlets
- Upstream blockage due to debris

Recommendations include:

- Design culverts so mean velocity of water passing through is significantly less than the critical prolonged swimming speed for the target species
- Design culverts to permit passage by fish in five minutes or less
- Install baffles or other devices in existing culverts where velocity or shallowness limits passage
- Provide resting areas at upstream and downstream ends of culverts.

In streams, debris may accumulate to create obstructions to flow. Refer to the following section regarding approaches for debris removal.

Considerations in removing an obstruction and permitting fish access in non-tidal waters include:

- Cost and feasibility of providing maintenance (e.g., clearing culvert of debris)
- Allowing passage of undesirable fish species from one watershed into another where these species are absent.

Tidal: The installation of single culverts in previously impounded salt marshes has proven effective in improving/restoring fish utilization (e.g., Gilmore et al. 1981). Based on comparison of white shrimp production Paille et al. (1989) concluded that when properly operated, a large diameter variable-crest flap-gated culvert may provide greater recruitment opportunities for white shrimp than either a standard-level crest weir or a low level weir. Rogers et al. (1992) illustrated and compared the effects of three different water control structures on the movements of coastal fish and macrocrustaceans. Recommendations for the management of culverts and weirs in tidal waters include:

- If the impounded marsh is managed for such purposes as mosquito control, consider methods which are compatible with fish utilization, e.g., Rotational Impoundment Management (RIM) (Carlson 1987, Gilmore 1987).

Factor	Remarks
	• Increase openings of manageable water-control structures at critical ingress and egress times to reduce deleterious effects on marine transient organisms. • Raise inside gates at water control structure to lower impoundment water levels so that water flows out through the bottom. This allows more organisms to escape to an adjacent tidal creek. • Manage to provide an opportunity to escape possible adverse environmental conditions. For example, during summer months, water levels should not be raised to cause little or no tidal circulation. Increased circulation is necessary for moderating high temperatures and low dissolved oxygen concentrations (McGovern and Wenner 1990). • Manage to permit target species the opportunity to complete life cycles. For example, in Louisiana brown shrimp emigrate primarily near the new and full moon, thus structures should be open during these critical times (Rogers et al. 1992). • Manage to maximize recruitment and production, e.g., the flap-gated culvert should be open throughout the recruitment season. One management technique used to restore tidal marshes involves backfilling canals. Complete backfilling prevents access by migrating fish; thus, backfilled canals should be opened or only partially plugged to allow access by migrating fish and to increase the area of available nursery habitat (Neill and Turner 1987). Considerations in using culverts to permit fish access include the cost and feasibility of managing water levels and providing maintenance (e.g., clearing culvert of debris).
Debris removal	*Stream restoration:* If debris is to be removed (e.g., for purpose of flood control) be selective and maintain some debris for fisheries. Guidelines for stream obstruction removal to improve fish habitat are provided by the Wildlife Society and American Fisheries Society (1983) and McConnell et al. (1980). Recommendations include: • Only log, debris, sediment, and soil accumulations that obstruct flows to a degree that result in significant flooding or sedimentation should be removed.

Factor	Remarks
	• Do not disturb single logs if they are (a) embedded, jammed, or rooted in the channel or floodplain, and (b) not subject to displacement by currents. • Do not cut rooted trees unless they are leaning over the channel and will likely fall into the channel within one year. • Leave small debris, except for accumulations around blockages. • Cut rooted trees selected for removal well above the base, leaving the stump and roots undisturbed.
Bank undercut (Element 26)	**Non-tidal Stream/River fish only** Bank undercut provides cover and rearing habitat. Platts et al. (1983) described the most favorable bank condition in streams as undercut (< 90° angle) or perpendicular (90° angle). Habitat value is considered comparatively low if the bank is located back away from the water column (> 90° angle), thus providing no shoreline bank cover for fish (Figure 8.4, p. 8–14). Designs to create or enhance bank cover are available in the literature (e.g., Wesche 1985, Orth and White 1993).
Substrate	*Non-tidal:* Substrate composition may be a critical factor influencing the production of aquatic invertebrates used as food. When feasible, use larger substrates (e.g., rubble, cobble, gravel) since they tend to provide a greater standing crop of benthic invertebrates (Wesche 1985). *Tidal:* Use predominantly mud substrate to provide optimal fish habitat. Avoid the use of hard material such as rock and shell (Element 9c rationale).
Spawning substrate (Element 27a)	**Non-tidal fish only** Substrate composition may be a critical factor influencing the survival of embryos after spawning. Optimal conditions vary depending upon the species (Table 8.4, p. 8–37): In general, acceptable spawning areas in streams and rivers have substrate sizes between 0.6–7.6 cm (1.5–19 in) (Wesche 1985). Fish size determines, to a large degree, if an area is acceptable for spawning,

Factor	Remarks
	with larger fish being able to dislodge larger substrate and endure swifter currents than smaller fish. Wesche (1985) provided the following recommendations regarding substrate development. Stream substrate composition can be improved by installing current deflectors or low-profile dams which collect spawning gravels upstream and encourage the development of gravel bars downstream. Properly sized substrate particles can also be added. Before adding spawning substrate, determine why the natural substrate is not available (e.g., flow scours gravels) and consider the need for structures to slacken the current. If the watershed is prone to be a high producer of fine sediments, reconsider adding gravel since the availability may be only temporary. Basic steps for adding spawning gravels: (1) Determine the size of substrate required by the target species. (2) Select favorable locations (e.g., pool-riffle interchanges are ideal for the addition of gravel). (3) Excavate the existing stream bed to a depth of 0.4–0.6 m to remove cobbles and other large particles that might interfere with redd construction. (4) Fill the excavation with the proper size gravels. (5) If stream is subject to high runoff, install stabilizing structures (e.g., gabions, logs) into the bed below the excavation to hold the gravels in place.

Table 8.4.
Optimal spawning substrate for individual fish species
(based on HEP models)

Species	**Optimum**	**Unsuitable**	**Reference**
Riverine/Lacustrine			
Walleye	gravel/rubble (2.5–15 cm)	sand, silt, and detritus	McMahon et al. 1984b
Largemouth bass	gravel (0.2–6.4 cm) predominant	boulders and bedrock predominant (≥50%)	Stuber et al. 1982b
Green sunfish	pebbles and gravel (0.2–5.0 cm) predominant	boulder (>20cm) and bedrock predominant (≤50%)	Stuber et al. 1982a
Black bullhead	fines dominant (> 50%)	fines (< 2mm) and gravel insignificant (≤10%)	Stuber 1982
Some cichlids	mud		Moyle 1993*
Bigmouth buffalo	abundant inundated terrestrial, submergent, or emergent aquatic vegetation	no vegetation, clear substrate	Edwards 1983b
Northern pike	dense vegetation > 80% bottom covered	sparse vegetation or debris only	Inskip 1982
Yellow perch	aquatic plants		Moyle 1993*
Riverine:			
Brown trout	rock-gravel	fines	Raleigh et al. 1986a
Rainbow trout	rock-gravel	fines	Raleigh et al. 1984
Coho salmon	gravel	fines	McMahon 1983
Chinook salmon	rock/gravel	fines	Raleigh et al. 1986b
Lake trout	patches of cobble (2–30 cm) (0.8–11.8 ft) on lake bottom between 0.5–5 m(1.6–16 ft) deep	substrate lacking protective cover for eggs and larvae	Marcus et al. 1984
Fallfish	sand and gravel	mud, silt, detritus, fine sand, large rocks, & bedrock	Trial et al. 1983
Longnose sucker	gravel and rock (1–20 cm)	mud, silt, detritus, or bedrock	Edwards 1983a
Paddlefish	gravel (1.5–10 cm)		Hubert et al. 1984

* not HEP model

Factor	Remarks
Spawning structures (Element 27b)	**Non-tidal fish only** Designs for spawning structures are available in the literature (e.g., Schnick et al. 1982, Ambrose et al. 1983a, Prince et al. 1977). If constructed from inappropriate material or improperly located, a spawning structure may be ineffective or have a negative effect on fish populations. For example, eggs may be lost to predation if the particle size provides inadequate protection (Hacker 1956, Prevost 1956). Considerations in site selection and design of spawning structures include: • Place in path of known spawning run or area of previous spawning activity. • Consider need and availability for habitat requirements (e.g., escape cover, running water, substrate type and size, shade, dissolved oxygen, pH, and minimum water levels). • Consider limiting factors which may prevent optimal use (e.g., excessive wave action, siltation). • Select appropriate structure and dimensions based on observed habits of target species.
Shade	The amount of sunlight is an important factor affecting fishery habitat because it is the energy base for photosynthesis and stream temperature. Extreme amounts of sunlight can be detrimental to fish, e.g., too much may result in prolonged high lethal temperatures or algal blooms, and too little may limit aquatic productivity. The amount of sunlight is regulated by shading from surrounding vegetation and topographic features. The importance of shading to fisheries is recognized in methods for evaluating trout habitat (Table 8.5, p. 8–39). Platts et al. (1987) detailed several techniques for measuring shading from surrounding vegetation and topographic/vegetation features. A precise description of shading and the identification of optimal conditions can be complicated and require several measurements (e.g., stream width and orientation; vegetation height and density; shadow characteristics such as shadow length, declination of sun, and hour angle; prevailing meteorological conditions; basin topographical characteristics; and time of year). The simplest method is to visually estimate the amount of shading that covers the stream around noon.

Factor	Remarks
	Raleigh et al. (1984, 1986) cautioned that shading is variable from site to site. Lower latitudes with warmer climates may require abundant shading to maintain cool waters, whereas minimal shading may be preferred in cooler climates. Optimal percent shading should be determined for local conditions.

Table 8.5.
Optimal percent shade for trout

Species	**Percent shade**	**Reference**
Trout	40–60%	Hunter 1991
Rainbow trout Brown trout	50–75% stream shaded between 10 a.m.–2 p.m. for stream ≤ 50 m (164 ft) wide. Not applicable for cold (< 18° C [< 64° F]), unproductive streams	Raleigh et al. 1984, 1986

Refuge during drought/freeze (Element 28)

Non-tidal Pond/Lake fish only

Insure the presence of an accessible refuge during drought or freeze. The refuge may be deep water habitat, stream input, or groundwater seepage. For a deep water refuge, determine the minimum depth and proportion of waterbody which is appropriate for local conditions.

HYDROLOGIC CONDITIONS

Most permanent hydroperiod (Element 7b)

Tidal fish only

When a tidal wetland is impounded, consider creating openings to re-establish the natural hydroperiod. If the impoundment is managed for mosquito control, wildlife, erosion control, or other purposes, use a water level management method that is compatible with fish utilization (e.g., Rotational Impoundment Management-RIM) (e.g., Gilmore 1987, Carlson 1987).

Factor	Remarks
Spatially dominant hydroperiod (Element 7c)	**Tidal fish only** The regularly flooded "low marsh" provides both vegetation cover and adequate water depths for small fish compared to the less accessible high marsh. Therefore, to maximize fish utilization, maximize the amount of regularly flooded low marsh in the planned wetland.
Current velocity over spawning areas (Element 25b)	**Non-tidal Stream/River fish only** Determine if the current velocity over spawning areas during spawning and embryo development is optimal for target species (Table 8.6, p. 8–41). Verify suitable current velocity with local fisheries expert to insure that the selected velocities are applicable to the region. For example, the HEP criteria for rainbow and brown trout (Raleigh et al. 1984, 1986a) are based on observations of trout in the Pacific Northwest. Hunter (1991) cautions that these criteria may not be applicable to northeastern streams where hydraulic characteristics and trout size can vary greatly. If necessary, manipulate current velocity by installing structures such as deflectors, dams, or boulders (Gore 1985b, Wesche 1985).

Table 8.6.
Optimal current velocity (cm/sec) for individual fish species
(based on HEP models)

Species	**Optimum**	**Unsuitable**	**Reference**
Black bullhead	< 4 cm/sec	> 40 cm/sec	Stuber 1982
Slough darter	< 5	> 24	Edwards et al. 1982b
Smallmouth bass	< 10		Sechnick et al. 1986*
Largemouth bass Embryo	< 6 < 3	> 20 > 10	Stuber et al. 1982b
Warmouth	< 6	> 25	McMahon et al. 1984a
Green sunfish Embryo	< 10 < 10	> 25 > 15	Stuber et al. 1982a
White crappie	< 20	> 40	Edwards et al. 1982a
Bigmouth buffalo	< 30	> 120	Edwards 1983b
Longnose sucker Embryo	30–110	0	Edwards 1983a
Longnose dace Embryo	45–65	0	Edwards et al. 1983
Smallmouth buffalo Embryo	60–80 < 20	0 or > 185 > 45	Edwards and Twomey 1982
Fallfish	> 40	< 10	Trial et al. 1983
Rainbow trout	30–70	< 10 or > 90	Raleigh et al. 1984
Brown trout	40–70	> 90	Raleigh et al. 1986a
Trout	15–90		Wesche 1985*
Chinook salmon	30–85	< 20 or > 115	Raleigh et al. 1986b

* not HEP model

Factor	Remarks
Drawdown (Element 27c)	**Non-tidal Pond/Lake fish only**

Determine if drawdown is severe enough to interrupt spawning activity, desiccate eggs, and/or destroy larvae. Examples are provided in Table 8.7.

Water levels may need to be managed to insure successful spawning (Schnick et al. 1982, Summerfelt 1993). If drawdown cannot be controlled, design the planned wetland to avoid or minimize adverse impacts on fisheries associated with drawdown. For example, design to maximize the amount of area with elevations that have a good potential for spawning success.

Table 8.7.
Unsuitable drawdown levels for individual fish species
(based on HEP models)

Species	Unsuitable		Reference
Gizzard shad	> 0.5 m	(>1.6 ft)	Williamson and Nelson 1985
Green sunfish	> 1 m	(> 3.3 ft)	Stuber et al. 1982a
Northern pike	> 1 m	(> 3.3 ft)	Inskip 1982
Black bullhead	> 2 m	(> 6.6 ft)	Stuber 1982
Longnose dace	> 3 m	(> 9.8 ft)	Edwards et al. 1983
Largemouth bass	> 7 m	(> 23 ft)	Stuber et al. 1982b

Factor	Remarks
Discharge	Discharge, or the amount of water that flows past a specific point during a specific time, is an important consideration in the design and construction of trout restoration projects (Hunter 1991). Insufficient water supply may be a limiting factor for trout or other fish species. Water availability for different water stages (e.g., average annual flow by month, annual low flow, frequency and magnitude of flood events) should be confirmed by reviewing available data and/or measuring stream discharge. Orth and White (1993) provides a review of methods for determine acceptable flow regimes.
WATER QUALITY	
General water quality (Element 20b)	Before the planned wetland is designed, water quality should be assessed. If there is a potential for high input of nutrients, sediments, or contaminants, then an alternative site may need to be explored. General water quality parameters should be examined to determine if they fall within ranges that fish and other aquatic organisms can tolerate (refer to following paragraphs on dissolved oxygen, pH, temperature, and turbidity). Some water quality parameters may be controlled on site, whereas others would require landscape changes (e.g., watershed improvement, regulation of land use activities, stream flow regulation) (Wesche 1985). Tolerances of fish to different water quality parameters differ depending upon the species. General ranges of optimal and unsuitable conditions for dissolved oxygen, pH, and temperature are provided in Tables 8.8–8.11. If the goal is to provide habitat for a species or group of species which has specific requirements, then this should be taken into consideration in site selection and the planned wetland design.
Dissolved oxygen (Element 20d)	If dissolved oxygen problems are anticipated, design for solutions. For example, dissolved oxygen depletion in lakes and streams can be alleviated by the use of a variety of artificial aeration techniques. Three basic approaches are destratification (whole lake aeration), aeration of the anoxic lower stratum (hyolimnetic aeration), and supplemental stream aeration (e.g., Schnick et al. 1982).

Factor **Remarks**

Table 8.8.
Optimal and unsuitable dissolved oxygen levels for fish

	Optimum	Suboptimum	Unsuitable
Tidal, pond/lake, or warmwater stream	usually > 5 mg/l	usually between 2 and 5 mg/l	frequently < 2 mg/l
Trout stream	usually > 9 mg/l	usually between 5 and 9 mg/l	frequently < 5 mg/l

pH range
(Element 20e)

Non-tidal fish only

If pH problems are anticipated, explore possible solutions. For example, acidic conditions in streams have been alleviated by stream neutralization with limestone sand and silt (e.g., Hunter 1991). This technique, which has been used for large scale improvements, may not be practical for small planned wetland projects.

Table 8.9.
Optimal and unsuitable pH range for fish

	Optimum	Suboptimum	Unsuitable
Pond/lake or warmwater stream	6.5–8.5	between 5.0 and 6.5 -OR- 8.5 and 9.5	≤ 5.0 -OR- ≥ 9.5
Trout stream	6.5–8.0	between 5.5 and 6.5 -OR- 8.0 and 9.0	≤ 5.5 -OR- ≥ 9.0

Factor	Remarks
Temperature (Element 20f)	Spawning and embryo water temperature requirements are generally more narrow than for adults. Refer to HEP models and other literature if the focus is on these life stages.

Table 8.10.
Optimal and unsuitable maximum mid-summer temperature for fish

	Optimum	Suboptimum		Unsuitable	
Tidal	68–90° F (20–32° C)	41–68° F 90–104° F	(5–20° C) (32–40° C)	< 41° F > 104° F	(< 5° C) (> 40° C)
Warmwater stream	68–86° F (20–30° C)	59–68° F 86–93° F	(12–20° C) (30–34° C)	< 59° F > 93° F	(< 15° C) (> 34° C)
Trout stream	54–66° F (12–19° C)	36–54° F 66–77° F	(2–12° C) (12–25° C)	< 36° F > 77° F	(< 2° C) (> 25° C)
Trout (Hunter 1991)	58–64 ° F (14–18° C)	55–70 ° F	(13–21° C)	< 50 ° F > 72 ° F	(< 10° C) (> 22° C)

Turbidity (Element 20g)	Tolerances of fish to turbidity levels differ depending upon the species. In general high turbidity (e.g., 200 JTU, secchi depth = 0 m) is unsuitable.
Salinity	Tolerances of freshwater fish to salinity differ depending upon the species (Table 8.11, p. 8–46).

Factor **Remarks**

Table 8.11.
Optimal and unsuitable maximum salinity during growing season
(based on HEP models)

Species	Optimum	Unsuitable	Reference
Smallmouth buffalo	0.02–0.9 ppt	> 9 ppt	Edwards and Twomey 1982
White crappie	0.1–0.6 ppt	> 1.3 ppt	Edwards et al. 1982a
Black bullhead	< 2 ppt	> 14 ppt	Stuber 1982
Embryo + fry	< 2 ppt	> 8 ppt	
Green sunfish	< 2.5 ppt	> 5.5 ppt	Stuber et al. 1982a
Largemouth bass	< 4 ppt	> 24 ppt	Stuber et al. 1982b
Fry	< 2 ppt	> 6 ppt	
Embryo	< 1.5 ppt	> 10.5 ppt	
Bigmouth buffalo	< 4 ppt	> 9.5 ppt	Edwards 1983b

VEGETATION FEATURES

Vegetation species

Refer to current documents providing guidelines on vegetation design, plant selection, time of planting, site preparation, equipment, etc. (e.g. Lewis 1982b, Garbisch 1986, Platts et al. 1987, Hammer 1992, SCS 1992, Thunhorst 1993).

Plant cover
(Elements 10d, 10f, and 10o)

Tidal: Maximize the percent plant cover (emergents and/or rooted vascular aquatic beds) to provide a refuge, nursery habitat, and an indirect source of food for fish. While 100 % plant cover is considered best, it may not be optimal for some species. For example, a 50–75% vegetation cover is considered optimal in the red drum HEP model since open water over non-vegetated substrate is important for feeding (Buckley 1984). Also, seagrass beds are considered an unsuitable food/cover for juvenile Atlantic croaker (Diaz and Onuf 1985).

Non-tidal: Maximize the plant cover to the extent it would occur naturally for the wetland type in the region.

Factor	Remarks
Vegetative overhang (Element 10m)	**Non-tidal fish only** Plant species along the shoreline to establish vegetative overhang which will provide fish cover, a source of detritus and nutrients, and shade for regulating water temperature. Increased overhead bank cover is associated with greater trout abundance (Wesche et al. 1987). Based upon Hunter (1991) the optimal condition for a trout stream is greater than 30 cm (1 ft) overhang on 50% of the bank (Figure 8.4, p. 8–14). Wesche et al. (1987) provided two tested models which relate trout standing crop to cover parameters (including overhead bank cover). These models may be used to compare alternatives for stream restoration. Seek advice from fisheries biologist to determine the optimal percent overhang for the wetland type in the region.
Aquatic plant infestation	**Non-tidal fish only** Aquatic vegetation may require management to increase sport fishery. The optimal amount of aquatic vegetation depends upon management goals. Seek advise from local experts for guidance on local management practices for aquatic plant control. Appropriate references can also be obtained from the Center for Aquatic Plants, University of Florida, 7922 N.W. 71st Street, Gainesville, Florida 32606 (Tel. 904-392-1799).
Streamside vegetation	Platts et al. (1987) rated shrubs as the best streamside vegetation for stability and fish cover, followed by trees, grasses, forbs, and exposed soil. Based on Hunter (1991) a streamside with brush/sod is excellent for trout; boulder/rubble, trees, roots, and brush are rated as good to fair; and bare soil is considered poor. Vegetated banks are relatively stable when compared to unvegetated banks. While vegetated banks may experience some erosion, the resulting undercut and vegetation overhang provide valuable fish cover. Bare soil has the least potential to provide cover because it lacks features (e.g., vegetation, boulder, rubble, brush, old root mass) which provide the structure to develop an undercut. It is often assumed that tree cover provides better shading and habitat compared to shrubs. Platts et al. (1983) rated brush cover higher than tree cover because of a study which showed that streams bordered by

Factor	Remarks
	brush had a higher fish standing crop than similar sized streams with tree borders.
Percent stream shaded	Stream shading regulates water temperature, a factor which can be limiting or lethal to fish. The percent canopy cover or dimensions of a riparian vegetation buffer required to be effective depends upon several factors including the species of interest, climate (arid or temperate), and soil and ground water temperature. Shading conditions which provide the best fisheries habitat should be determined for local conditions. Based on Hunter (1991), 20–60% shade is excellent for trout; less than 25% or greater than 75% shade is rated as good to fair; and less than 10% or greater than 90% shade is considered poor. 100% canopy closure may not be optimal. Studies on the effect of logging indicate that opening the canopy over a stream tends to improve the rate of energy transfer in the biological community (e.g., increase microbial respiration, increase primary production) and thus result in increased densities of predators such as salmonids (e.g., Murphy et al. 1981, Scrivener and Anderson 1984). A model relating maximum weekly temperature to buffer length and width has been developed by Barton et al. (1985) for southern Ontario.
Percent pool area (Element 25a)	**Non-tidal stream/river fish only** The pool-riffle sequence in streams is important in providing cover, resting, and food production area (Wesche 1985). General ranges of optimal and unsuitable percent pool area are provided in Table 8.12, p. 8–49 (refer to rationale for Element 25a). A ratio of 1 to 1 is considered optimal; however, some studies have reported high fish production in streams with relatively low or high pool/riffle ratios (Platts et al. 1983). A pool/riffle ratio which provides the best fisheries habitat should be determined for local conditions based upon consultation with local experts. Pools can be created by the construction of small dams, which are low barriers to streamflow. Designs for check dams can be found in the literature (e.g., Burgess and Bider 1980, Wesche 1985, Orth and White 1993).

Factor **Remarks**

Estimate frequency of pools and riffles for hydrologic balance and incorporate into the design (refer to Hasfurther 1985). A recommended spacing for the pool and riffle patterns is six times the channel width for the pilot (mean annual flood) channel (Leopold et al. 1964 as cited in Hasfurther 1985). Artificial riffles and pools spaced five to seven channel widths apart proved effective in restoring a more natural fish and invertebrate fauna in comparison to channelized streams (Edwards et al. 1984).

Table 8.12.
Optimal and unsuitable percent pool area in stretch of stream

	Period	Optimum	Suboptimum	Unsuitable
Warmwater stream	Pool area during average summer flow	predominant (e.g., > 50%)	low (e.g., 20–40%)	sparse (e.g., < 2%)
Trout stream	Pool area during late growing season, low-water periods	approx. 50% (e.g., 35–65%)	low (e.g., 5–35%) -OR- high (e.g., > 65%)	sparse (e.g., < 2%)

Channel water width:depth ratio **Non-tidal stream/river fish only**

The relationship between water width and depth is important for trout habitat (Stuber 1985, Scarnecchia and Bergersen 1987, Hunter 1991). A narrow, deep channel is considered best because it provides a variety of habitats characterized by undercut banks and overhanging vegetation. Alternatively, a wide, shallow stream may not provide adequate pool habitat or cover. Based on Hunter (1991), a 5:1 ratio is excellent for trout; 20:1 is rated as good to fair; and 40:1 is considered poor. Scarnecchia and Bergersen (1987) provided an approach for assessing habitat suitability for trout which includes a measurement of the width:depth ratio.

In general, the width to depth ratio should follow that of natural undisturbed streams. The ratio which provides the best fisheries habitat should be determined for local conditions based upon consultation with local experts.

Factor	Remarks
Stream reclamation	Guidelines on approaches to stream restoration are provided in Gore (1985a) and Orth and White (1993). A summary of literature and brief descriptions of techniques used in riparian creation and restoration is provided by Manci (1989).
ATTRACTORS	
Attractors (Element 22b)	A planned wetland designed to have abundant fish attractors can generally be expected to attract a greater diversity/abundance of fish. The attractors may be composed of a variety of natural and/or manufactured materials. The designer should examine local comparable natural wetlands to determine what is appropriate (e.g., type of attractors, size, and distribution). Note the optimal percent cover given as an example in EPW data sheets (Element 22b rationale). The optimal percent cover will depend upon the target species and habitat type. The following guidelines are offered for artificial structures, based upon the reviewed literature and personal experience: • Do not make the planned wetland too complex because there is a point at which the benefits may be lost. Avoid promoting potential or existing imbalances in fish populations. • Place attractors in areas where structure is insignificant or lacking. The number of installed fish attractors should not be too large nor should they be placed in habitat where cover is already abundant because excessive protection provided by the attractors could result in the stunting of prey species. • Place structures at depths not subject to oxygen depletion. • Place structures on firm bottom to prevent sinking. Avoid areas having soft and/or unstable substrate. • Position and adequately anchor structures to prevent them from being a hazard to navigation and/or other recreational activities. If necessary, mark location of structures with signs or other markers such as buoys. • Determine if proposed structure will cause excessive bank erosion (e.g. weirs and deflectors). If so, consider alternative designs. • If the structural stability is in question for given circumstances, use an alternative design (e.g., use the three-tree instead of the single fallen tree unit). Note that structures which may be stable in lentic waters, may be inappropriate in lotic waters where they may be dislodged or destroyed by currents. • Place structures where they will not catch trash and create and unwanted dams, particularly in streams.

Factor	Remarks
Vegetation	Many fish species not only congregate, but also spawn around vegetation (refer to rationale for Element 10d and 22b). A decision on optimal percent cover and vegetation species must be made on a case-by-case basis.
Dense brush	Brush (woody debris) structures are commonly used fish attractors because the material is inexpensive and readily assembled into various configurations. Several designs have been developed (e.g., Boussu 1954, Saunders and Smith 1962, Vogele and Rainwater 1975, Prince et al. 1977, Burgess and Bider 1980, Everhart and Youngs 1981, Schnick et al. 1982, Angermeier and Karr 1984, Brown 1986, Polovina 1991). Possible configurations include stacked brush frames, bundled brush, anchored trees, log cribs, and block-brush. The simplest structures consist of bundled brush or single trees (e.g., discarded Christmas trees) weighted with ballast. Recommendations include: ● Determine if current velocities and other site conditions are suitable to install and maintain a structure. ● Use green oak or other green hardwoods for logs and brush. Drywood is undesirable because it is too buoyant and requires more ballast. ● Provide sufficient ballast to maintain stability. ● Install by constructing structure in the dry (a) on the selected locations during drawdown, (b) on ice-covered water over selected location, or (c) on a ramp over the water, then tow by boat to selected location and lower. Spacing, size, and orientation of debris may have a greater effect on aquatic habitat than does volume of debris alone (Platts et al. 1987). Benke et al. (1985) found that a Georgia stream snag represented a relatively small habitat surface (4% of total habitat surface), but supported 60% of total invertebrate biomass. Thus, a relatively small amount of brush may be sufficient. Seek advice from a local fisheries expert on adequate spacing, size, and orientation of brush structures.

Factor	Remarks
Fallen trees/logs	Shoreline attractors can be created by felling large trees into the water (Ambrose et al. 1983a, Schnick et al. 1982). Recommendations include: • Fell, position, and weight trees with ballast during drawdown periods or on the ice, if possible. • Trim and remove most of the tree top. • Leave tree anchored by its roots for stability.
Rocks/boulders	Large rocks (boulders) may be placed in a stream or pond/lake to provide additional cover for fish (e.g., USFWS 1978, Ambrose et al. 1983a, D'Itri 1985, Starnes 1985). Location may be important. Recommendations include: • Place large boulders with in areas with gravel bottoms to prevent burial in finer materials • Use sizes and spacing to be compatible with natural conditions • Place so that flow is not blocked. • Use large irregularly shaped rocks since indentations provide aquatic invertebrate habitat. • Place in locations which avoid deflecting the current toward unprotected banks and causing erosion. Alternatives to large boulders include the installation of instream rectangular gabions with the long axis perpendicular to the stream flow, submerged riprap, notched weirs, wing deflectors, and low rock sills.
Stake beds	Stake beds are constructed by driving long wooden stakes or pipes to form a rectangular bed (USFWS 1978). They have been found successful in attracting crappie in some cases, but they are expensive and difficult to build (USFWS 1978).
Junk metal	Junk cars and debris from demolition projects are often used as fish attractors, particularly in tidal systems (Grove et al. 1991). The cars should be stripped of upholstery and steam cleaned to remove petroleum residues before they are installed in the desired location (Prince et al. 1977). Disadvantages with using car bodies is that they are expensive, difficult to handle, and deteriorate in three to five years in saltwater (USFWS 1978). As an alternative, Grove et al. (1991) described more durable reef materials made of concrete and steel, "polycon," and plastic.

Factor	Remarks
Boats and barges	Old boats and barges are often used as attractors. Hulls should be cleaned and floatable materials removed before the boats are towed to the appropriate location and sunk (Prince et al. 1977).
Concrete products	Concrete culverts, cubes, and blocks can be used as attractors (e.g., D'Itri 1985, Seaman and Sprague 1991b, Bohnsack et al. 1991, Grove et al. 1991).
Artificial submerged aquatics	Plastic strips have been used as artificial submerged aquatics (e.g., Brashears and Dartnell 1967, USFWS 1978, Phillips 1990). Buoyant plastic is cut into narrow strips, tied into clumps, and the tied end placed in the sediment with a base weight.
Tire structures	Tire structures are popular fish attractors because tires are inexpensive, last indefinitely, are easy to manipulate, and are readily assembled into various configurations. One simple structure, typically used in small ponds, consists of three small tires tied together in a triangle and weighted with rocks so the structure will sink but remain upright. Several designs have been developed (e.g., Prince et al. 1977, 1985; USFWS 1978, Ambrose et al. 1983a). Recommendations noted in the literature include the following: • Build a high profile structure as close to the surface as legally permissible because it will concentrate fish more effectively than smaller structures. • Slash or punch holes in the tires to permit trapped gases to escape. • String individual units with synthetic rope, wire, or cable to improve stability. • Weight down structures with rock, concrete, or other ballast.
Invertebrate attractors	Some attractors are designed to provide habitat for shellfish including mussels (*Mytilus* spp.) and oysters (*Crassostrea virginica*) (e.g., Webber 1972, Mangos 1992).
Vitrified clay pipes	The attractor made of vitrified clay pipes can be bundled with plastic binding material to form a pyramid or irregular shape. Several bundles are usually arranged clustered in close proximity; solitary, short, or large-diameter pipes may also be placed within the cluster (Wilbur 1978).

Factor	Remarks
Low check dams	Low check dams are generally used on small streams to deepen or create pools, collect spawning gravels, or aerate the water. Several designs for dam structures have been developed (e.g., Saunders and Smith 1962, Burgess and Bider 1980, Schnick et al. 1982, Wesche 1985, Orth and White 1993). Low dams should be used on small (1–9 m wide), high gradient (0.5–20% slope), headwater streams not susceptible to excessive flood flows (peaks from approximately 2.8–5.7 m^3/sec) (Wesche 1985).
Current deflectors	Current deflectors are in-stream structures installed at an angle to the flow which extend only part of the way across the channel. They are generally designed to direct and concentrate stream flows to improve fish habitats and reduce bank erosion. Designs are available in the literature (e.g., Saunders and Smith 1962, USFWS 1978, Wesche 1985). Current deflectors can be used successfully on streams of various size.

8.5 Examples of Assessment of the Fish Function

PROJECT TITLE: MARLEY CREEK

FISH (Tidal)
DATA SHEETS

Function weighting area (AREA) = That portion of the assessment area which, based upon water regime, has the capacity to support tidal fish (e.g., tidally influenced areas up to line of spring high tides).

		For use in FCI model		For use in Table A.2 only
ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
Suitability for tidal fish (element 24):				
24. Obstruction to on-site fish passage (obstruction can be on- or off-site)	[FT, FS, FP]*			Assume NA = 1.0
a. No barrier(s) present.	NA			
b. Barrier(s) present, but conditions modified to permit fish passage (e.g., fish ladder, installation of culverts in mosquito control impoundments to re-establish tidal exchange and fish passage).	NA	NA (a)	NA (a)	NA (a)
c. Barrier(s) present and utilized for fish management practices.	NA			
d. Site isolated, but utilized by fish (e.g., pond).	NA			
e. Condition(s) present which curtail fish passage (e.g., impingement on industrial intakes) or interfere with migratory cycles (e.g., semi-impoundment control structures such as weirs, undersized culvert).	0.5			
f. Condition(s) present which imposes absolute physical (e.g., impoundment for mosquito control, tide gate, dam, waterfall, thermal plume), chemical (extreme in pH), or behavioral barriers to fish passage. **Fish access to the site and survival at site is precluded.**	0.1			

If score for element 24 = 0.1, then there is no potential for providing the tidal fish function; therefore, the Fish (Tidal) FCI is not applicable (NA). Continue if scores = NA or 0.5.

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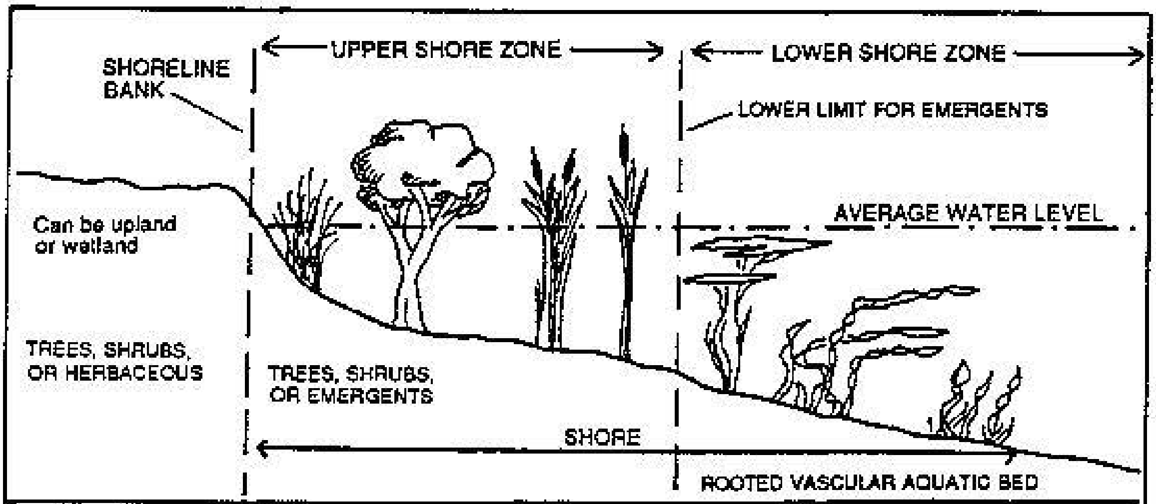
* Denotes function(s) to which element applies: SB = Shoreline Bank Erosion Control; SS = Sediment Stabilization; WQ = Water Quality; WL = Wildlife; FT = Fish (Tidal); FS = Fish (Stream/River); FP = Fish (Pond/Lake); and UH = Uniqueness/Heritage

Evaluation for Planned Wetlands

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA)
		WAA	Planned Wetland	If both scores are NA, record NA
Disturbance factors (elements 1b, 4a, 4d, 7b, and 24):				
1. Bank characteristics				
1b. Shoreline bank stability	[FT, FS, FP]			Assume NA = 1.0
a. No shoreline on-site.	NA			
b. Shoreline bank erosion is minimal (e.g., > 75% bank surface protected by vegetation, boulders/rubble/gravel, or other materials).	NA	0.5	NA	(+)
c. Shoreline bank erosion is moderate.	0.5			
d. Shoreline bank erosion is substantial (e.g., < 25% bank surface protected).	0.1			
4. Disturbance				
4a. Disturbance at site (Sediment Stabilization)	[SB, SS, FT, FS, FP]			Assume NA = 1.0
(Do not include observations of debris)				
a. No or minimal disturbance.	NA			
b. Potential for periodic disturbance present, but preventative action taken (e.g., installation of exclosure fences for herbivores and/or human disturbance) -OR- if recently disturbed, soils sufficiently stabilized with mulch, seeding, or planting.	NA	NA (a)	NA (b)	NA
c. Moderate disturbance (e.g., disturbance of sediments only in portion of site; infrequent grazing by waterfowl).	0.5			
d. Evidence of substantial periodic disturbance which makes substrate unstable (e.g., muskrat eatouts, overgrazing by waterfowl, cattle grazing and trampling, nutria activity, human activity such as the use of off-road vehicles; wetland tilled, filled, logged, clear-cut or excavated and not stabilized by seeding or planting).	0.1			

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
4d. Disturbance of channel/open water bottom (Open water = water of any depth with no emergent vegetation)	[FT, FS, FP]	NA (a)	NA (a)	Assume NA = 1.0 NA
a. Channel/open water absent.	NA			
b. No or minimal recent disturbance.	NA			
c. Channel/open water disturbed in the past (e.g., dredged, channelized), but has begun to recover some of the natural channel/open water and shoreline characteristics (e.g., return to near original depths; and re-establishment of aquatic and shoreline vegetation, fallen trees, woody debris, and rocks).	0.5			
d. Channel/open water recently disturbed (e.g., filled, confined to culvert, or dredged in past year) -OR- substantially altered to prevent recovery of natural characteristics (e.g., cement channel).	0.1			
7. Hydroperiod				
7b. Most permanent hydroperiod	[FT]	NA	NA	Assume NA = 1.0 NA
a. Natural tidal hydroperiod -OR- if the area is impounded, provisions have been made (e.g., culverts installed) so that hydroperiod mimics natural hydroperiod.	NA			
b. Hydroperiod usually follows natural tidal hydroperiod (e.g., hydroperiod periodically altered to manage for mosquito control).	0.5			
c. Hydroperiod does not or rarely follows natural tidal hydroperiod.	0.1			
24. Obstruction to on-site fish passage (Element already answered above.)				
Description of available food/cover (elements 7c, 9c, 10d, 10f, 21b, and 22b):				
7. Hydroperiod				
7c. Spatially dominant hydroperiod	[FT]	1.0	0.5	(-)
a. Regularly flooded (e.g., low marsh).	1.0			
b. Both irregularly flooded and regularly flooded vegetated codominant (i.e., high and low marsh approximately equal proportions).	0.5			
c. Irregularly flooded (e.g., high marsh).	0.2			
d. Deep water (e.g., > 2 m at low tide).	0.1			

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
9. Substrate				
9c. Substrate suitability for fish	[FT]			
a. > 75% mud.	1.0			
b. 25 - 75% mud.	0.5			
c. < 25% mud; composed predominantly of hard material (e.g., sand, rock, shell).	0.2	1.0	0.5	(-)
d. All hard material (e.g., rock, shell).	0.1			
10. Vegetation characteristics during growing season (Note definition of lower shore zone in Figure A.2)				
10d. Percent plant (basal) cover excluding lower shore zone. (Consider only those parts of vegetation which have contact with water flow. See Figure A.3.)	[FT]			If one NA, record both scores.
a. Assessment area is all lower shore zone.	NA	1.0	1.0	0
b. > 75%.	1.0			
c. 51 - 75%.	0.7			
d. 25 - 50%.	0.3			
e. < 25%.	0.1			
10f. Percent cover of rooted vascular aquatic beds in lower shore zone. (See Figure A.2.)	[FT]			If one NA, record both scores.
a. No lower shore zone.	NA	0.1	0.1	0
b. Cover > 75%.	1.0			
c. Cover 51 - 75%.	0.7			
d. Cover 25 - 50%.	0.3			
e. Cover < 25%.	0.1			
21. Shape of edge				
21b. Vegetated wetland/water edge (e.g., shape of tidal creek or channel) (See Figure A.10.)	[FT, FS, FP]			
a. Irregular.	1.0	0.5	1.0	(+)
b. Regular, smooth.	0.5			
c. Edge absent or minimal (i.e., no channel in study wetland area).	0.1			



Shoreline Bank:	Steep ascending slope of land of any height raised above the adjacent shore that can experience undercutting if it is in contact with water.
Shore:	Vegetated or non-vegetated substrate located channelward of the bank.
Upper Shore Zone:	Vegetated or non-vegetated portion of the shore located between the bank and the potential lower limit of emergent or woody vegetation as dictated by water depth or tide level.
Lower Shore Zone:	Vegetated or non-vegetated portion of the shore located channelward of the potential lower limit of emergent or woody vegetation.
Entire Wetland:	Includes wetland areas landward of the bank, the bank, the upper shore zone, and the lower shore zone.

Examples: Aerial View of Wetlands

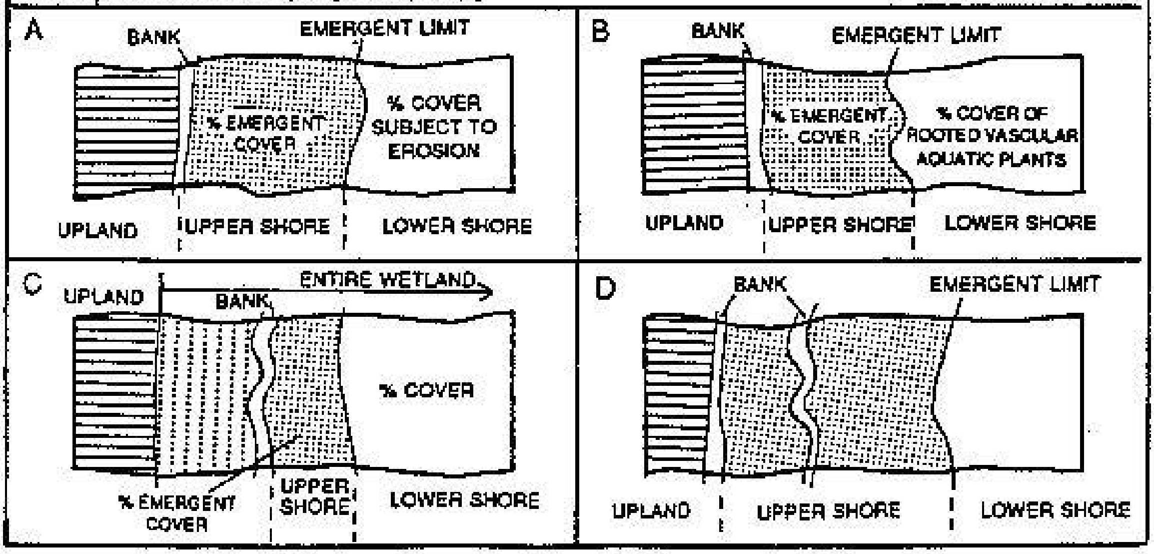
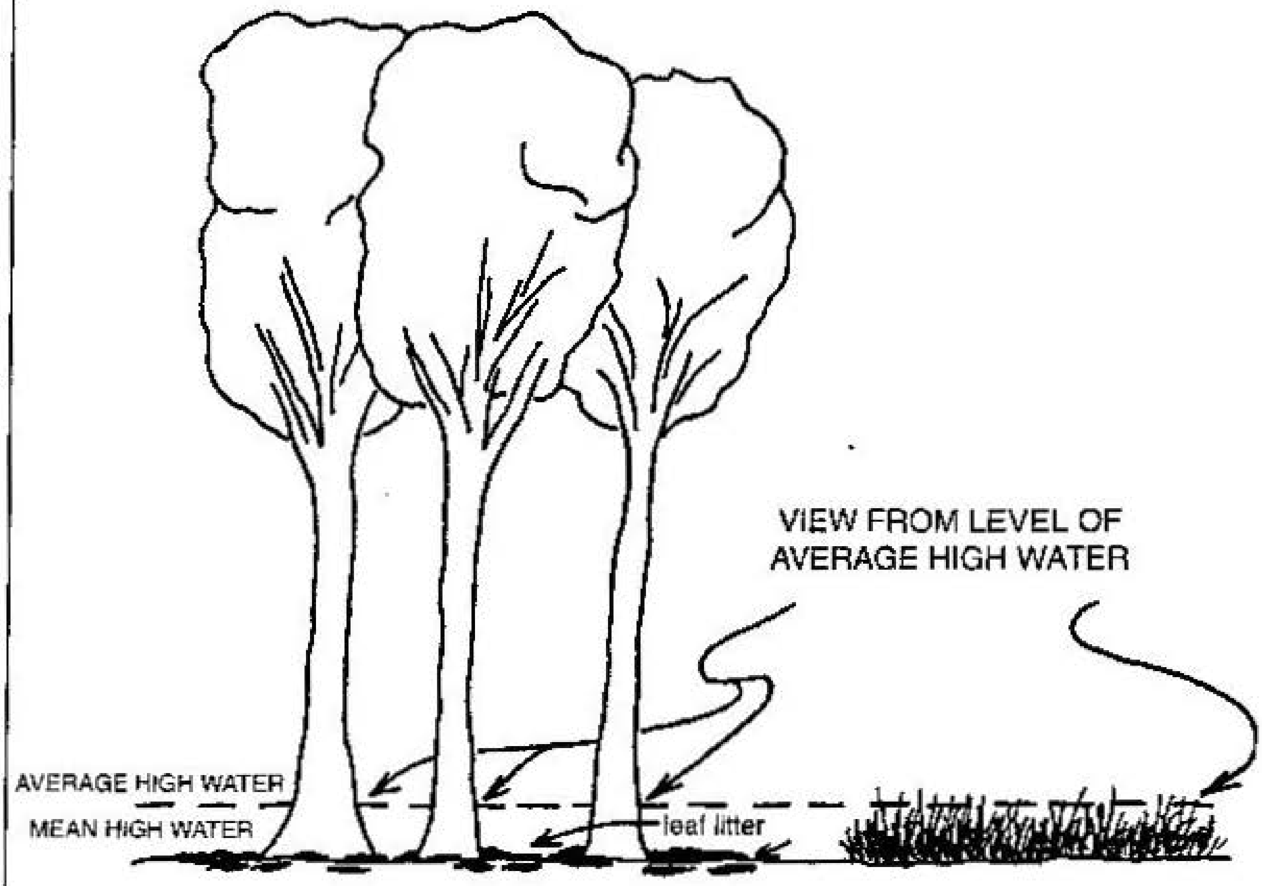


Figure A.2.
Definitions of shoreline bank, shore, upper shore zone, lower shore zone, and entire wetland (element 10)



Examples:

	Forest	Emergent Marsh
Percent (Basal) Cover (Elements 10a, 10b, or 10d)	<25%	>75%
Percent Leaf Litter & Debris Cover (Element 10c)	>75%	Ground surface areas almost entirely covered by live vegetation

Figure A.3.
Percent plant cover (elements 10a, 10b, 10c, and 10d)

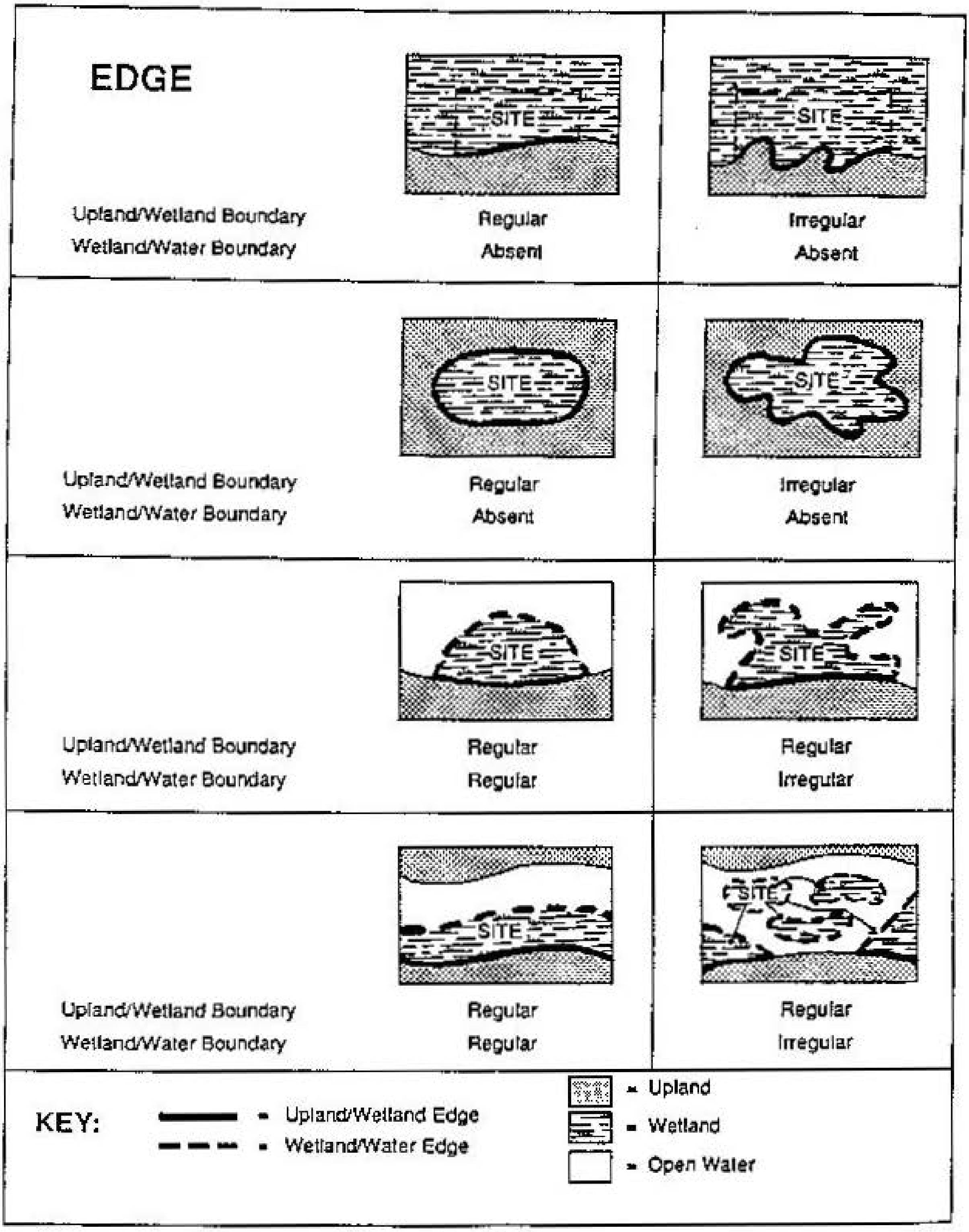


Figure A.10
Examples of regular and irregular boundaries at the upland/wetland and wetland/water edges (element 21)

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
22. Fish and wildlife attractors				
22b. Available fish cover/attractors	[FT, FS, FP]			Assume NA = 0
Abundance of cover, other than live vegetation (e.g., snags, dense brush, fallen tree/logs, rocks/boulders, or artificial attractors), accessible to fish anytime of year				
Estimate potential cover for this habitat type in region (e.g., 15%): 15% . Note abundance relative to this optimum.				
a. Abundant.	1.0	1.0	0.1	(-)
b. Moderate cover.	0.5			
c. No cover or sparse.	0.1			
d. Excessive (e.g., 90% debris and garbage).	0.1			
If present, check type of attractors and estimate percent cover. In some cases it may be best to count and record number of attractors.				

Attractor	WAA	Planned Wetland
Dense brush	✓	
Fallen trees/logs	✓	
Rocks/boulders		
Artificial:		
Stake beds		
Junk metal (e.g., cars)		
Boats, barges		
Concrete products		
Artificial seaweed		
Tire structures		
Shellfish attractor		
Brush piles		
Vitrified clay pipe		
Low check dam		
Other:__________		

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
Factors describing water quality (elements 20b, 20c, 20d, and 20f):				
20. Water quality				
20b. Water quality ratings	[FT, FS, FP]			If one INA, record both scores.
Define state water quality ratings and assign to following categories:				
High: ____________				
(e.g., Class A = no or minimal pollution)				
Moderate: ____________				
(e.g., Class B and C = moderate pollution)				
Low: ____________				
(e.g., Class D = severe pollution)				
Water quality rating for waterway:				
a. Information not available.	INA	INA	INA	INA
b. High.	1.0			
c. Moderate.	0.5			
e. Low.	0.1			

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
20c. Evidence of nutrient, sediment, or contaminant sources (If more than one score applicable, record lowest score).	[FT, FS, FP]			If one INA, record both scores.
a. Information not available.	INA			
b. Little or no potential for nutrient, sediment, or contaminant input.	1.0			
c. Evidence of or potential for moderate nutrient, sediment, or contaminant input.	0.5			
d. Evidence of high nutrient concentration in the wetland/waterway (e.g., recurrent algal blooms) or known source(s) contributing nutrients to the wetland/waterway (e.g., sewage outfalls, mine tailings, landfills, septic fields, active pasturelands and croplands).	0.1	0.1 (d)	0.1 (d)	0
e. Evidence of high inorganic sediment input (e.g., stormwater outfalls; irrigation return flows; direct observation of sediment inputs, i.e., sediment plumes of turbid water at inlet; predominant soils/slopes classified as eroding or erosion hazard by SCS).	0.1			
f. Evidence of presence of contaminants (e.g., stunted plant growth, excessive growth, and/or abnormal morphology; oil sheen on marsh surface -AND/OR- known source(s) contributing contaminants to the wetland/waterway (e.g., hazardous water sites, superfund sites, landfills).	0.1			
g. Evidence of conditions known to stress fish (e.g., low DO, high turbidity, extremes in temperature, thermal plume).	0.1			
20d. Dissolved oxygen (DO) during summer	[FT, FS, FP]			If one INA, record both scores
a. Information not available.	INA			
b. Usually > 5 mg/l.	1.0	INA	INA	INA
c. Usually between 2 and 5 mg/l.	0.5			
d. Frequently < 2 mg/l.	0.1			
20f. Maximum mid-summer temperature within pools or littoral areas	[FT, FS, FP]			If one INA, record both scores
a. Information not available.	INA			
b. 68 - 90° F (20 - 32° C).	1.0			
c. 41 - 68° F (5 - 20° C) -OR- 90 - 104° F (32 - 40° C).	0.5	INA	INA	INA
d. < 41° F -OR- > 104° F (< 5° C -OR- > 40° C).	0.1			

Calculation of FISH (Tidal) FCI

PROJECT TITLE: MARLEY CREEK

Selected Scores	(#)	Element

COMPARISON: WAA planned wetland (e.g., WAA/planned wetland)

NA NA	(24)	Obstruction to fish passage

→ If score = 0.1, STOP. There is no potential for providing tidal fish habitat.
→ If score ≠ 0.1 or NA, then continue with model.

0.5 NA	(1b)	Shoreline bank stability
NA NA	(4a)	Disturbance at site (SS)
NA NA	(4d)	Disturbance in channel/open water
NA NA	(7b)	Most permanent hydroperiod
NA NA	(24)	Obstruction to fish passage

average for elements with available scores = 0.5 NA Limiting Factors

1.0 0.5	(7c)	Spatially dominant hydroperiod
1.0 0.5	(9c)	Substrate suitability for fish
1.0 1.0	(10d)	Plant (basal) cover
0.1 0.1	(10f)	Rooted vascular aquatic beds
0.5 1.0	(21b)	Shape of wetland/water edge
1.0 0.1	(22b)	Available fish cover/attractors

Equation #9 = 0.83 0.30 Food/Cover

average for available scores = 0.48 0.20 **Fish (Tidal) FCI**

INA INA	(20b)	Water quality ratings

→ If score available, record score for WQ
→ If information not available, continue.

0.1 0.1	(20c)	Nutrient/sediment/contaminant sources
INA INA	(20d)	Dissolved oxygen
INA INA	(20f)	Maximum water temperature

average for elements with available scores = 0.1 0.1 Water Quality (WQ)

Equation #9:

$$7c\,\frac{[9c + (1-x)(10d) + (x)(10f) + 21b + 22b]}{4}$$

where x = portion of AREA which is represented by lower shore zone in increments of 0.1 (e.g., 0.1, 0.2, 0.3, ... 1.0)

PROJECT TITLE: Rockaway River

FISH (Non-tidal Stream/River)
DATA SHEETS

Function weighting area (AREA) = That portion of the assessment area which, based upon water regime, has the capacity to support non-tidal stream/river fish. The period of inundation can vary throughout the site. Suitable wetland water regimes include permanently flooded, intermittently exposed, semipermanently flooded and seasonally flooded. Unsuitable water regimes may include saturated or intermittently flooded.

		For use in FCI model		For use in Table A.2 only
ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
Suitability for non-tidal stream/river fish (element 24):				
24. Obstruction to on-site fish passage (obstruction can be on- or off-site)	[FT, FS, FP]*			Assume NA = 1.0
a. No barrier(s) present.	NA			
b. Barrier(s) present, but conditions modified to permit fish passage (e.g., fish ladder, installation of culverts in mosquito control impoundments to re-establish tidal exchange and fish passage).	NA			
c Barrier(s) present and utilized for fish management practices.	NA	NA (a)	NA (a)	NA
d. Site isolated, but utilized by fish (e.g., pond).	NA			
e. Condition(s) present which curtail fish passage (e.g., impingement on industrial intakes) or interfere with migratory cycles (e.g., semi-impoundment control structures such as weirs, undersized culvert).	0.5			
f. Condition(s) present which imposes absolute physical (e.g., impoundment for mosquito control, tide gate, dam, waterfall, thermal plume), chemical (extreme in pH), or behavioral barriers to fish passage. **Fish access to the site and survival at site is precluded.**	0.1			

NOTE: If score for element 24 = 0.1, then there is no potential for providing the non-tidal fish function; therefore, the FISH (Non-tidal Stream/River) FCI is not applicable (NA). Continue if scores = NA or 0.5.

* Denotes function(s) to which element applies: SB = Shoreline Bank Erosion Control; SS = Sediment Stabilization; WQ = Water Quality; WL = Wildlife; FT = Fish (Tidal); FS = Fish (Stream/River); FP = Fish (Pond/Lake); and UH = Uniqueness/Heritage

Evaluation for Planned Wetlands

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
Disturbance factors (elements 1b, 4a, 4d, 16c, and 24):				
1. Bank characteristics				
1b. Shoreline bank stability	[FT, FS, FP]			Assume NA = 1.0
a. No shoreline on-site.	NA			
b. Shoreline bank erosion is minimal (e.g., > 75% bank surface protected by vegetation, boulders/rubble/gravel, or other materials).	NA	NA (b)	NA (b)	NA
c. Shoreline bank erosion is moderate.	0.5			
d. Shoreline bank erosion is substantial (e.g., < 25% bank surface protected).	0.1			
4. Disturbance				
4a. Disturbance at site (Sediment Stabilization) (Do not include observations of debris)	[SB, SS, FT, FS, FP]			Assume NA = 1.0
a. No or minimal disturbance.	NA			
b. Potential for periodic disturbance present, but preventative action taken (e.g., installation of enclosure fences for herbivores and/or human disturbance) -OR- if recently disturbed, soils sufficiently stabilized with mulch, seeding, or planting.	NA	NA (a)	NA (b)	NA
c. Moderate disturbance (e.g., disturbance of sediments only in portion of site; infrequent grazing by waterfowl).	0.5			
d. Evidence of substantial periodic disturbance which makes substrate unstable (e.g., muskrat eatouts, overgrazing by waterfowl, cattle grazing and trampling, nutria activity, human activity such as the use of off-road vehicles; wetland tilled, filled, logged, clear-cut or excavated and not stabilized by seeding or planting).	0.1			

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
4d Disturbance of channel/open water bottom (Open water = water of any depth with no emergent vegetation)	[FT, FS, FP]	NA (b)	NA (b)	Assume NA = 1.0 NA
a. Channel/open water absent.	NA			
b. No or minimal recent disturbance.	NA			
c. Channel/open water disturbed in the past (e.g., dredged, channelized), but has begun to recover some of the natural channel/open water and shoreline characteristics (e.g., return to near original depths; and re-establishment of aquatic and shoreline vegetation, fallen trees, woody debris, and rocks).	0.5			
d. Channel/open water recently disturbed (e.g., filled, confined to culvert, or dredged in past year) -OR- substantially altered to prevent recovery of natural characteristics (e.g., cement channel).	0.1			
16. Size				
16c. Fish habitat size	[FS, FP]	NA	NA	Assume NA = 1.0 NA
Does the assessment AREA have a very low fishery habitat value because of (1) its small size and surrounding landscape (e.g., < 0.1 acre and bordered by urban development) or (2) because it is ephemeral.				
a. No.	NA			
b. Yes.	0.1			
If yes, explain: ____________				
24. Obstruction to on-site fish passage (Element already answered above.)				
Description of available food/cover (elements 10m, 10o, 21b, 22b, 25a, and 26):				
10. Vegetation characteristics during growing season				
10m. Vegetative overhang (within 30 cm (1 ft) of water surface)	[FS,FP]	0.1	1.0	If one NA, record both scores. (+)
Estimate optimum % overhang for this habitat type in region (e.g., > 50%): 50%. Note abundance relative to this optimum.				
a. No shoreline on-site.	NA			
b. Abundant (e.g., > 1 ft. on 50% of shoreline).	1.0			
c. Moderate (e.g., > 1 ft. on 30 - 45% of shoreline).	0.5			
d. Sparse (e.g., > 1 ft. on less than 20% of shoreline).	0.1			

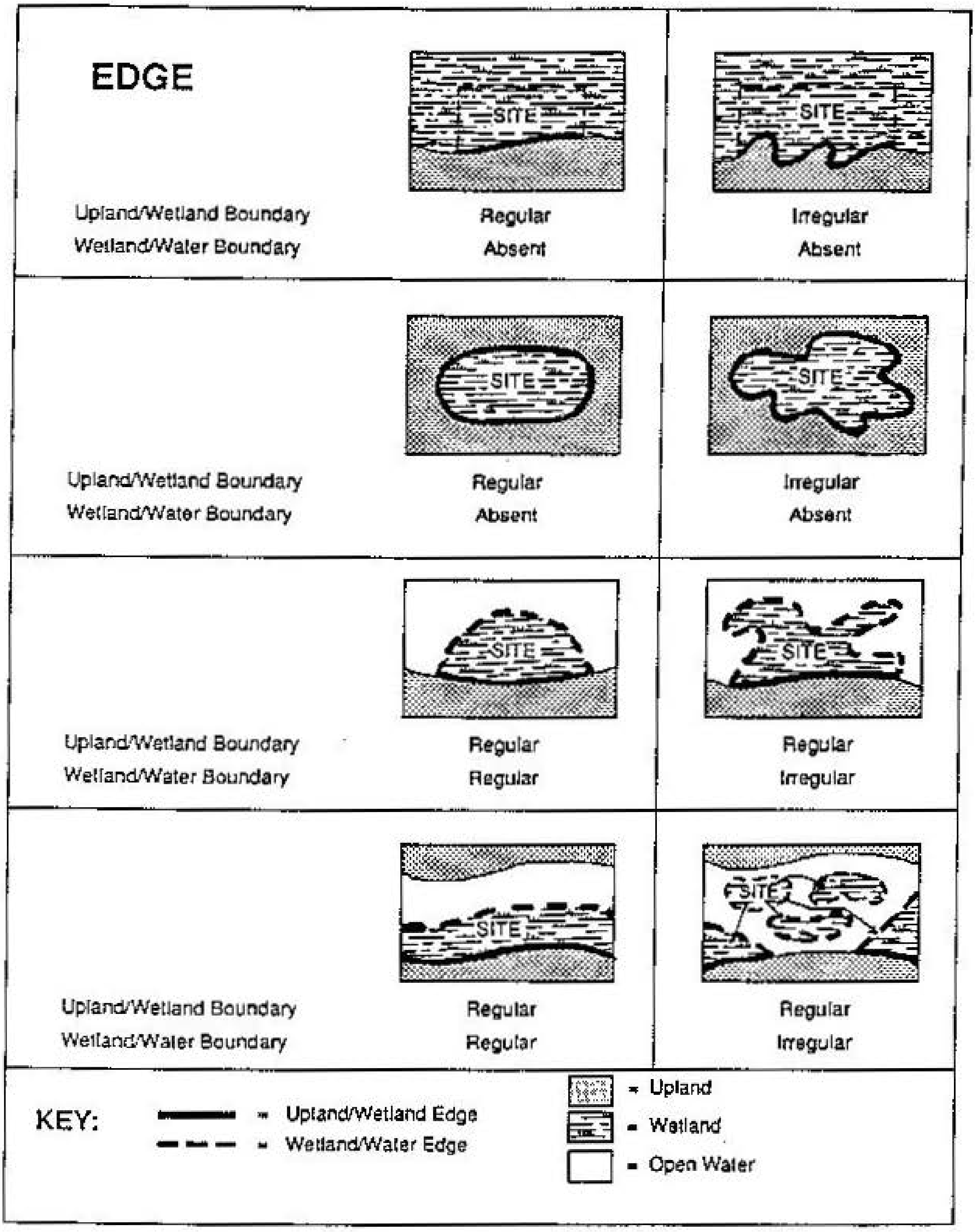


Figure A.10.
Examples of regular and irregular boundaries at the upland/wetland and wetland/water edges (element 21)

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
10b. Aboveground plant biomass in wetland, **excluding lower shore zone**	[FS, FP]			
a. Almost all potential aboveground plant biomass at present stage of development remains. Plant cover is close to that which would occur naturally without disturbance. If bare areas exist (e.g., bedrock), they are not a result of loss of vegetation from land uses.	1.0	1.0	1.0	0
b. Plant biomass 50 - 75% of potential due to disturbance (e.g., grazing).	0.7			
c. Plant biomass 25 - 50%.	0.3			
d. Plant biomass < 25 (e.g., only root system and part of stems remain).	0.1			
21. Shape of edge				
21b. Vegetated wetland/water edge (e.g., shape of tidal creek or channel) (See Figure A.10).	[FT, FS, FP]			
a. Irregular.	1.0			
b. Regular, smooth.	0.5			
c. Edge absent or minimal (i.e., no channel in study wetland area).	0.1	0.5	1.0	(+)
22. Fish and wildlife attractors				
22b. Available fish cover/attractors	[FT, FS, FP]			
Abundance of cover (e.g., vegetation, dense brush, fallen tree/logs, rocks/boulders, or artificial attractors) in littoral areas, pools, and backwaters during summer.				
Estimate potential cover for this habitat type in region (e.g., 25 - 75%): 25-75% Note abundance relative to this optimum.				
Warmwater fisheries:				
a. Optimal (e.g., 25 - 75%).	1.0			
b. Near optimal (e.g., 15 - 25% or 75 - 90%).	0.8	0.3	1.0	(+)
c. Adequate (e.g., 3 - 15%) or excessive (e.g., 90 - 100%).	0.3			
d. No cover or sparse (e.g., < 3%).	0.1			
Trout stream:				
a. Optimal (e.g., 15 - 50%).	1.0			
b. Moderate (e.g., 2 - 15%).	0.5			
c. Excessive (e.g., > 50%).	0.1			
d. No cover or sparse (e.g., < 2%).	0.1			

(Element 22b continues on page 8–74.)

Evaluation for Planned Wetlands

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
22b. Available fish cover/attractors *(con't)*				
If present, check type of attractors and estimate percent cover. In some cases it may be best to count and record the number of attractors.				

Attractor	WAA	Planned Wetland
Emergent vegetation	✓	✓
Submerged vegetation		
Dense brush		
Fallen trees/logs		✓
Rocks/boulders		✓
Artificial:		
Stake beds		
Junk metal (e.g., cars)		
Boats, barges		
Concrete products		
Artificial seaweed		
Tire structures		
Shellfish attractor		
Brush piles		
Vitrified clay pipe		
Low check dam		
Other:________		

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	WAA	Planned Wetland	DIFFERENCE IN SCORES (Planned - WAA)
25. Pool/riffle				
25a. Percent pool area in stretch of stream	[FS]			If one NA, record both scores.
(Note: may need to consider areas outside of small assessment areas to determine percentage which is representative of stream.)				
Trout stream: Estimate pool area during late growing season, low-water periods:				
a. No stream on-site.	NA			
b. Approximately 50% (e.g., 35 - 65%).	1.0			
c. Low (e.g., 5 - 35%) or high (> 65%).	0.5			
d. Sparse (e.g., < 2%).	0.1			
Warmwater stream: Estimate pool area during average summer flow:				
a. No stream on-site.	NA			
b Predominant (e.g., > 50%).	1.0	1.0	1.0	0
c. Low (e.g., 20 - 40%).	0.5			
d. Sparse (e.g., < 5%).	0.1			

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
26. Bank undercut	[FS]			If one NA, record both scores.
a. No shoreline on-site.	NA			
b. Bank undercut present and providing abundant cover for fish (e.g., undercut predominantly > 15 cm [> 6 inches]).	1.0	0.1	0.5	(+)
c. Bank undercut present and providing moderate cover.	0.5			
d. Bank undercut minimal or absent (e.g., undercut predominantly < 15 cm [< 6 inches]).	0.1			
Factors affecting reproduction (elements 25b, 27a, and 27b):				
25b. Average current velocity over spawning areas during spawning and embryo development	[FS]			If NA and/or INA, record both scores.
Trout stream:				
a. Warmwater stream.	NA			
b. No stream on-site.	NA	NA (a)	NA (a)	NA
c. Information not available.	INA			
d. 30 to 70 cm/sec (12 to 28 in/sec).	1.0			
e. 15 to 30 cm/sec (6 to 12 in/sec) -OR- 70 to 85 cm/sec (28 to 34 in/sec).	0.5			
f. < 15 cm/sec (< 6 in/sec) -OR- > 85 cm/sec (> 34 in/sec).	0.1			
27. Spawning habitat				
27a. Spawning substrate, **accessible during spawning periods**. Select dominant substrate.	[FS, FP]			
a. Gravel/rubble.	1.0	0.5	0.5	0
b. Sand.	0.5			
c. Boulders, bedrock, or fines (e.g., silt, mud, clay).	0.2			
d. Site not accessible during spawning.	0.1			
27b. Spawning structures	[FS,FP]			Assume NA = 0
a. Site not accessible during spawning.	NA			
b. Absent.	NA			
c. Present (e.g., gravel or rock spawning shoals, artificial reef, suspended platforms, spawning box).	1.0	NA (b)	NA (b)	NA
If present, describe: ____________				

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
Factors describing water quality (elements 20b, 20c, 20d, 20e, 20f, and 20g):				
20. Water quality				
20b. Water quality ratings Define state water quality ratings and assign to following categories:	[FT, FS, FP]			If one INA, record both scores.
High: __________				
(e.g., Class A = no or minimal pollution)				
Moderate: Class B				
(e.g., Class B and C = moderate pollution)				
Low: __________				
(e.g., Class D = severe pollution)				
Water quality rating for waterway:				
a. Information not available.	INA	0.5	0.5	0
b. High.	1.0			
c. Moderate.	0.5			
e. Low.	0.1			
20c. Evidence of nutrient, sediment, or contaminant sources (If more than one answer applicable, record lowest score).	[FT, FS, FP]			If one INA, record both scores.
a. Information not available.	INA			
b. Little or no potential for nutrient, sediment, or contaminant input.	1.0			
c. Evidence of or potential for moderate nutrient, sediment, or contaminant input.	0.5			
d. Evidence of high nutrient concentration in the wetland/waterway (e.g., recurrent algal blooms) or known source(s) contributing nutrients to the wetland/waterway (e.g., sewage outfalls, mine tailings, landfills, septic fields, active pasturelands and croplands).	0.1			
e. Evidence of high inorganic sediment input (e.g., stormwater outfalls; irrigation return flows; direct observation of sediment inputs, i.e., sediment plumes of turbid water at inlet; predominant soils/slopes classified as eroding or erosion hazard by SCS).	0.1	0.5	0.5	0
f. Evidence of presence of contaminants (e.g., stunted plant growth, excessive growth, and/or abnormal morphology; oil sheen on marsh surface -AND/OR- known source(s) contributing contaminants to the wetland/waterway (e.g., hazardous water sites, superfund sites, landfills).	0.1			
g. Evidence of conditions known to stress fish (e.g., low DO, high turbidity, extremes in temperature, thermal plume).	0.1			

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
20d. Dissolved oxygen (DO) during summer	[FT, FS, FP]			If one INA, record both scores.
Trout stream:				
a. Information not available.	INA			
b. Usually > 9 mg/l.	1.0			
c. Usually between 5 and 9 mg/l.	0.5			
d. Frequently < 5 mg/l.	0.1			
Warmwater stream:				
a. Information not available.	INA	INA	INA	INA
b. Usually > 5 mg/l.	1.0			
c. Usually between 2 and 5 mg/l.	0.5			
d. Frequently < 2 mg/l.	0.1			
20e. pH range	[FS, FP]			If one INA, record both scores.
Trout stream:				
a. Information not available.	INA			
b. 6.5 to 8.0.	1.0			
c. Between 5.5 and 6.5 -OR- 8.0 and 9.0.	0.5			
d. ≤ 5.5 -OR- ≥ 9.0.	0.1			
Warmwater stream:				
a. Information not available.	INA	INA	INA	INA
b. 6.5 to 8.5.	1.0			
c. Between 5.0 and 6.5 -OR- 8.5 and 9.5.	0.5			
d. ≤ 5.0 -OR- ≥ 9.5.	0.1			
20f. Maximum mid-summer temperature within pools or littoral areas	[FT, FS, FP]			If one INA, record both scores.
Trout stream:				
a. Information not available.	INA			
b. 54 - 66° F (12 - 19° C).	1.0			
c. 36 - 54° F (2 - 12° C) -OR- 66 - 77° F (19 - 25° C).	0.5			
d. < 36° F -OR- > 77° F (< 2° C -OR- > 25° C).	0.1			
Warmwater stream:				
a. Information not available.	INA	INA	INA	INA
b. 68 - 86° F (20 - 30° C).	1.0			
c. 59 - 68° F (15 - 20° C) -OR- 86 - 93° F (30 - 34° C).	0.5			
d. < 59° F -OR- > 93° F (< 15° C -OR- > 34° C).	0.1			

Evaluation for Planned Wetlands

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
20g. Maximum monthly average turbidity during summer	[FS, FP]			If one INA, record both scores.
a. Information not available.	INA	INA	INA	INA
b. Low (e.g., < 80 JTU, secchi depth > 2 m).	1.0			
c. Moderate (e.g., approx. 150 JTU).	0.5			
d. High (e.g., 200 JTU, secchi depth = 0 m).	0.1			

Calculation of FISH (Non-tidal Stream/River) FCI

PROJECT TITLE: ROCKAWAY RIVER

COMPARISON: WAA \ planned wetland (e.g., WAA/planned wetland)

Selected Scores	(#)	Element	
NA \ NA	(24)	Obstruction to fish passage	→ If score = 0.1, STOP. There is no potential for providing stream/river fish habitat. → If score ≠ 0.1, then continue with model.
NA \ NA	(1b)	Shoreline bank stability	
NA \ NA	(4a)	Disturbance at site (SS)	
NA \ NA	(4d)	Disturbance in channel/open water	
NA \ NA	(16c)	Fish habitat size	
NA \ NA	(24)	Obstruction to fish passage	
0.1 \ 1.0	(10m)	Vegetative overhang	
1.0 \ 1.0	(10o)	Plant biomass	
0.5 \ 1.0	(21b)	Shape of wetland/water edge	
0.3 \ 1.0	(22b)	Available fish cover/attractors	
1.0 \ 1.0	(25a)	% pool area	
0.1 \ 0.5	(26)	Bank undercut	
NA \ NA	(25b)	Current velocity within pools	
0.5 \ 0.5	(27a)	Spawning substrate	
NA \ NA	(27b)	Spawning structures	
0.5 \ 0.5	(20b)	Water quality ratings	→ If score available, record score for WQ → If information not available, continue.
0.5 \ 0.5	(20c)	Nutrient/sediment/contaminant sources	
INA \ INA	(20d)	Dissolved oxygen	
INA \ INA	(20e)	pH	
INA \ INA	(20f)	Maximum water temperature	
INA \ INA	(20g)	Turbidity	

(1b), (4a), (4d), (16c), (24): average for elements with available scores = NA \ NA Limiting Factors

(10m), (10o), (21b), (22b), (25a), (26): average for elements with available scores = 0.50 \ 0.92 Food/Cover

(25b), (27a), (27b): average for elements with available scores = 0.50 \ 0.50 Reproduction

(20c), (20d), (20e), (20f), (20g): average for elements with available scores = 0.50 \ 0.50 Water Quality (WQ)

Limiting Factors, Food/Cover, Reproduction, Water Quality: average for available scores = 0.50 \ 0.64 Fish (Non-tidal Stream/River) FCI

PROJECT TITLE: Franklin Farm

FISH (Non-tidal Pond/Lake)
DATA SHEETS

Function weighting area (AREA) = That portion of the assessment area which, based upon water regime, has the capacity to support non-tidal pond/lake fish. The period of inundation can vary throughout the site. Suitable wetland water regimes include permanently flooded, intermittently exposed, semipermanently flooded and seasonally flooded. Unsuitable water regimes may include saturated or intermittently flooded.

		For use in FCI model		For use in Table A.2 only
ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS: WAA	SELECTED SCORES FOR ELEMENTS: Planned Wetland	DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
Suitability for non-tidal pond/lake fish (elements 24 and 28):				
24. Obstruction to on-site fish passage (obstruction can be on- or off-site)	[FT, FS, FP]*			Assume NA = 1.0
a. No barrier(s) present.	NA			
b. Barrier(s) present, but conditions modified to permit fish passage (e.g., fish ladder, installation of culverts in mosquito control impoundments to re-establish tidal exchange and fish passage).	NA			
c. Barrier(s) present and utilized for fish management practices.	NA	NA	NA	NA
d. Site isolated, but utilized by fish (e.g., pond).	NA	(d)	(d)	
e. Condition(s) present which curtail fish passage (e.g., impingement on industrial intakes) or interfere with migratory cycles (e.g., semi-impoundment control structures such as weirs, undersized culvert).	0.5			
f. Condition(s) present which imposes absolute physical (e.g., impoundment for mosquito control, tide gate, dam, waterfall, thermal plume), chemical (extreme in pH), or behavioral barriers to fish passage. **Fish access to the site and survival at site is precluded.**	0.1			
28. Available refuge during drought and/or freeze Is there an accessible water body with areas of sufficient depth which will not dry up during a drought and/or freeze throughout the water column.	[FP]			Assume NA = 1.0
a. Yes.	NA	NA	NA	NA
b. No.	0.1			

NOTE: If score for element 24 and/or element 28 = 0.1, then there is no potential for providing the non-tidal fish function; therefore, the FISH (Non-tidal Pond/Lake) FCI is not applicable (NA). Continue if scores = NA or 0.5.

---

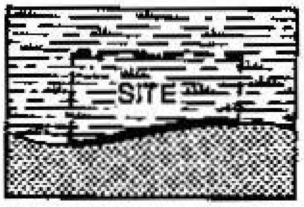
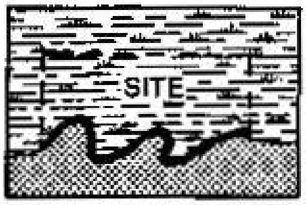
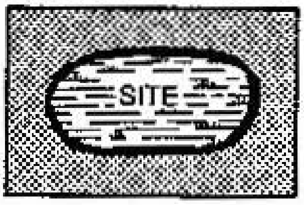
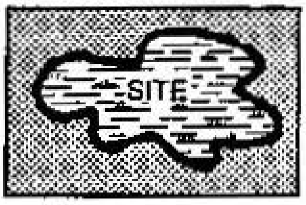
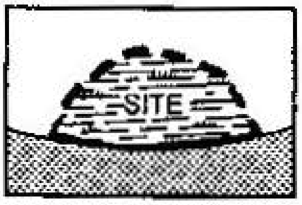
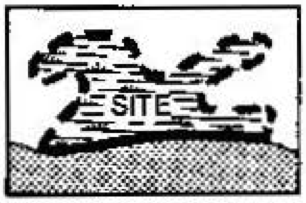
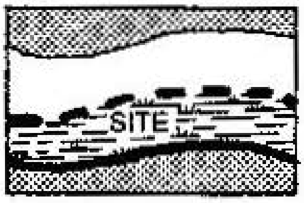
* Denotes function(s) to which element applies: SB = Shoreline Bank Erosion Control; SS = Sediment Stablization; WQ = Water Quality; WL = Wildlife; FT = Fish (Tidal); FS = Fish (Stream/River); FP = Fish (Pond/lake); and UH = Uniqueness/Heritage

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA)
		WAA	Planned Wetland	If both scores are NA, record NA
Disturbance factors (elements 1b, 4a, 4d, 16c, and 24):				
4. Disturbance				
1b. Shoreline bank stability	[FT,FS, FP]			Assume NA = 1.0
a. No shoreline on-site.	NA			
b. Shoreline bank erosion is minimal (< e.g., >75% bank surface protected by vegetation, boulders/rubble/gravel, or other materials).	NA	NA (b)	NA (b)	NA
c. Shoreline bank erosion is moderate.	0.5			
d. Shoreline bank erosion is substantial (e.g., < 25% bank surface protected).	0.1			
4a. Disturbance at site (Sediment Stabilization)	[SB, SS, FT, FS, FP]			Assume NA = 1.0
(Do not include observations of debris)				
a. No or minimal disturbance.	NA			
b. Potential for periodic disturbance present, but preventative action taken (e.g., installation of enclosure fences for herbivores and/or human disturbance) -OR- if recently disturbed, soils sufficiently stabilized with mulch, seeding, or planting.	NA			
c. Moderate disturbance (e.g., disturbance of sediments only in portion of site; infrequent grazing by waterfowl).	0.5	0.5	NA (a)	(+)
d. Evidence of substantial periodic disturbance which makes substrate unstable (e.g., muskrat eatouts, overgrazing by waterfowl, cattle grazing and trampling, nutria activity, human activity such as the use of off-road vehicles; wetland tilled, filled, logged, clear-cut or excavated and not stabilized by seeding or planting).	0.1			

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
4d. Disturbance of channel/open water bottom (Open water = water of any depth with no emergent vegetation)	[FT, FS, FP]			Assume NA = 1.0
a. Channel/open water absent. disturbance.	NA			
b. No or minimal evidence of recent disturbance.	NA			
c. Channel/open water disturbed in the past (e.g., dredged, channelized), but has begun to recover some of the natural channel/open water and shoreline characteristics (e.g., return to near original depths; and re-establishment of aquatic and shoreline vegetation, fallen trees, woody debris, and rocks).	0.5	NA (b)	NA (b)	NA
d. Channel/open water recently disturbed (e.g., filled, confined to culvert, or dredged in past year) -OR- substantially altered to prevent recovery of natural characteristics (e.g., cement channel).	0.1			
16. Size				
16c. Fish habitat size	[FS,FP]			Assume NA = 1.0
Does the assessment AREA have a very low fishery habitat value because of (1) its small size and surrounding landscape (e.g., < 0.1 acre and bordered by urban development) or (2) because it is ephemeral.				
a. No.	NA	NA	NA	NA
b. Yes.	0.1			
If yes, explain: ______________________				
24. Obstruction to on-site fish passage (Element already answered above.)				

Evaluation for Planned Wetlands

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
Description of available food/cover (elements 10m, 10o, 21b, and 22b):				
10. Vegetation characteristics during growing season				
10m. Vegetative overhang (within 30 cm (1 ft) of water surface)	[FS,FP]			If one NA, record both scores.
Estimate optimum % overhang for this habitat type in region (e.g., > 75%): > 75%. Note abundance relative to this optimum.				
a. No shoreline on-site.	NA			
b. Abundant (e.g., > 1 ft. on > 75% of shoreline).	1.0	0.1	0.5	(+)
c. Moderate (e.g., > 1 ft. on 25 - 75% of shoreline).	0.5			
d. Sparse or absent (e.g., > 1 ft. on less than 25% of shoreline).	0.1			
10o. Aboveground plant biomass in wetland, **excluding lower shore zone.**	[FS,FP]			
a. Almost all potential aboveground plant biomass at present stage of development remains. Plant cover is close to that which would occur naturally without disturbance. If bare areas exist (e.g., bedrock), they are not a result of loss of vegetation from land uses.	1.0			
b. Plant biomass 50 - 75% of potential due to disturbance (e.g., grazing).	0.7	0.7	1.0	(+)
c. Plant biomass 25 - 50%.	0.3			
d. Plant biomass < 25 (e.g., only root system and part of stems remain).	0.1			
21. Shape of edge				
21b. Vegetated wetland/water edge (e.g., shape of tidal creek or channel) **(See Figure A.10).**	[FT, FS, FP]			
a. Irregular.	1.0	0.5	0.5	0
b. Regular, smooth.	0.5			
c. Edge absent or minimal (i.e., no channel in study wetland area).	0.1			

EDGE		
Upland/Wetland Boundary Wetland/Water Boundary	 Regular Absent	 Irregular Absent
Upland/Wetland Boundary Wetland/Water Boundary	 Regular Absent	 Irregular Absent
Upland/Wetland Boundary Wetland/Water Boundary	 Regular Regular	 Regular Irregular
Upland/Wetland Boundary Wetland/Water Boundary	 Regular Regular	 Regular Irregular

KEY:

▬ = Upland/Wetland Edge

\- - - = Wetland/Water Edge

▨ = Upland

☰ = Wetland

☐ = Open Water

Figure A.10.
Examples of regular and irregular boundaries at the upland/wetland and wetland/water edges (element 21)

Evaluation for Planned Wetlands

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
22. Fish and wildlife attractors				
22b. Available fish cover/attractors	[FT, FS, FP]			
Abundance of cover (e.g., vegetation, dense brush, fallen tree/logs, rocks/boulders, or artificial attractors) in littoral areas, pools, and backwaters during summer.				
Estimate potential cover for this habitat type in region (e.g., 25 - 75%): 25-75%. Note abundance relative to this optimum.				
a. Optimal (e.g., 25 - 75%).	1.0	0.3	0.8	(+)
b. Near optimal (e.g., 15 - 25% or 75 - 90%).	0.8			
c. Adequate (e.g., 3 - 15%) or excessive (e.g., 90 - 100%).	0.3			
d. No cover or sparse (e.g., < 3%).	0.1			
If present, check type of attractors and estimate percent cover. In some cases it may be best to count and record the number of attractors.				

Attractor	WAA	Planned Wetland
Emergent vegetation	✓	✓
Submerged vegetation	✓	
Dense brush		✓
Fallen trees/logs		✓
Rocks/boulders		
Artificial:		
Stake beds		
Junk metal (e.g., cars)		
Boats, barges		
Concrete products		
Artificial seaweed		
Tire structures		
Shellfish attractor		
Brush piles		
Vitrified clay pipe		
Low check dam		
Other:		

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
Factors affecting reproduction (elements 27a, 27b, and 27c):				
27. Spawning habitat				
27a. **Spawning substrate, accessible during spawning periods.** Select dominant substrate:	[FS,FP]			
a. Gravel and/or pebbles.	1.0			
b. Emergent and/or aquatic vegetation.	1.0	1.0 (b)	1.0 (b)	0
c. Sand and/or fine sediments (e.g., silt, mud, clay).	0.5			
d. Bedrock and/or boulders.	0.2			
e. Site not accessible during spawning.	0.1			
27b. Spawning structures	[FS,FP]			Assume NA = 0
a. Site not accessible during spawning.	NA			
b. Absent.	NA			
c. Present (e.g., gravel or rock spawning shoals, artificial reef, suspended platforms, spawning box).	1.0	NA (b)	NA (b)	NA
If present describe: ____________				
27c. Drawdown of water during spawning and embryo development (under normal conditions)	[FP]			Assume NA = 1.0
a. No or minimal drawdown.	NA			
b. Moderate drawdown causing some loss of spawning habitat.	0.5	0.5	NA	(+)
c. Drawdown sufficient to expose spawning substrate thus causing substantial loss of spawning habitat.	0.1			
Examples of unsuitable drawdown levels:				
gizzard shad >0.5 m (>1.6 ft)				
green sunfish >1 m (>3.3 ft)				
northern pike >1 m (>3.3 ft)				
black bullhead >2 m (>6.6 ft)				
longnose dace >3 m (>9.8 ft)				
largemouth bass >7 m (>23 ft)				

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA)
		WAA	Planned Wetland	If both scores are NA, record NA
Factors describing water quality (elements 20b, 20c, 20d, 20e, 20f, and 20g):				
20. Water quality				
20b. Water quality ratings	[FT, FS, FP]			If one INA, record both scores.
Define state water quality ratings and assign to following categories:				
High: ____________				
(e.g., Class A = no or minimal pollution)				
Moderate: ____________				
(e.g., Class B and C = moderate pollution)				
Low: ____________				
(e.g., Class D = severe pollution)				
Water quality rating for waterway:				
a. Information not available.	INA	INA	INA	INA
b. High.	1.0			
c. Moderate.	0.5			
d. Low.	0.1			

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA)
		WAA	Planned Wetland	If both scores are NA, record NA
20c. Evidence of nutrient, sediment, or contaminant sources (If more than one score applicable, record lowest score).	[FT, FS, FP]			If one INA, record both scores.
a. Information not available.	INA			
b. Little or no potential for nutrient, sediment, or contaminant input.	1.0			
c. Evidence of or potential for moderate nutrient, sediment, or contaminant input.	0.5			
d. Evidence of high nutrient concentration in the wetland/waterway (e.g., recurrent algal blooms) or known source(s) contributing nutrients to the wetland/waterway (e.g., sewage outfalls, mine tailings, landfills, septic fields, active pasturelands and croplands).	0.1	0.5	0.5	0
e. Evidence of high inorganic sediment input (e.g., stormwater outfalls; irrigation return flows; direct observation of sediment inputs, i.e., sediment plumes of turbid water at inlet; predominant soils/slopes classified as eroding or erosion hazard by SCS).	0.1			
f. Evidence of presence of contaminants (e.g., stunted plant growth, excessive growth, and/or abnormal morphology; oil sheen on marsh surface AND/OR known source(s) contributing contaminants to the wetland/waterway (e.g., hazardous water sites, superfund sites, landfills).	0.1			
g. Evidence of conditions known to stress fish (e.g., low DO, high turbidity, extremes in temperature, thermal plume).	0.1			
20d. Dissolved oxygen (DO) during summer	[FT, FS, FP]			If one INA, record both scores.
a. Information not available.	INA	0.5	0.5	0
b. Usually > 5 mg/l.	1.0			
c. Usually between 2 and 5 mg/l.	0.5			
d. Frequently < 2 mg/l.	0.1			
20e. pH range	[FS, FP]			If one INA, record both scores.
a. Information not available.	INA	1.0	1.0	0
b. 6.5 to 8.5.	1.0			
c. Between 5.0 and 6.5 -OR- 8.5 and 9.5.	0.5			
d. ≤ 5.0 -OR- ≥ 9.5.	0.1			

Evaluation for Planned Wetlands

ELEMENT		SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
			WAA	Planned Wetland	
20f.	Maximum mid-summer temperature within pools or littoral areas	[FT, FS, FP]			If one INA, record both scores.
	a. Information not available.	INA	0.5	0.5	0
	b. 68 - 86° F (20 - 30° C).	1.0			
	c. 59 - 68° F (15 - 20° C) -OR- 86 - 93° F (30 - 34° C).	0.5			
	d. < 59° F -OR- > 93° F (< 15° C -OR- > 34° C).	0.1			
20g.	Maximum monthly average turbidity during summer	[FS, FP]			If one INA, record both scores.
	a. Information not available.	INA	INA	INA	INA
	b. Low (e.g., < 80 JTU, secchi depth > 2 m).	1.0			
	c. Moderate (e.g., approx. 150 JTU).	0.5			
	d. High (e.g., 200 JTU, secchi depth = 0 m).	0.1			

Calculation of FISH (Non-tidal Pond/Lake) FCI

PROJECT TITLE: FRANKLIN FARM

COMPARISON: WAA \ planned wetland (e.g., WAA/planned wetland)

Selected Scores	(#)	Element
NA \ NA	(24)	Obstruction to fish passage
NA \ NA	(28)	Refuge during drought/freeze

If score = 0.1 for either element, STOP. There is no potential for providing pond/lake fish habitat.
If score ≠ 0.1, then continue with model.

Selected Scores	(#)	Element
NA \ NA	(1b)	Shoreline bank stability
0.5 \ NA	(4a)	Disturbance at site (SS)
NA \ NA	(4d)	Disturbance in channel/open water
NA \ NA	(16c)	Fish habitat size
NA \ NA	(24)	Obstruction to fish passage

average for elements with available scores = 0.5 \ NA Limiting Factors

Selected Scores	(#)	Element
0.1 \ 0.5	(10m)	Vegetative overhang
0.7 \ 1.0	(10o)	Plant biomass
0.5 \ 0.5	(21b)	Shape of wetland/water edge
0.3 \ 0.8	(22b)	Available fish cover/attractors

average for elements with available scores = 0.40 \ 0.70 Food/Cover

Selected Scores	(#)	Element
1.0 \ 1.0	(27a)	Spawning substrate
NA \ NA	(27b)	Spawning structures
0.5 \ NA	(27c)	Drawdown

average for elements with available scores = 0.75 \ 1.0 Reproduction

Selected Scores	(#)	Element
INA \ INA	(20b)	Water quality ratings

→ If score available, record score for WQ
→ If information not available, continue.

Selected Scores	(#)	Element
0.5 \ 0.5	(20c)	Nutrient/sediment/contaminant sources
0.5 \ 0.5	(20d)	Dissolved oxygen
1.0 \ 1.0	(20e)	pH
0.5 \ 0.5	(20f)	Maximum water temperature
INA \ INA	(20g)	Turbidity

average for elements with available scores = 0.63 \ 0.63 Water Quality (WQ)

average for available scores = 0.57 \ 0.78 Fish (Non-tidal Pond/Lake) FCI

Chapter 9. Uniqueness/Heritage

9.1 Definition

The Uniqueness/Heritage FCI indicates the presence of characteristics that distinguish a wetland as unique, rare, or valuable. Several of the elements used in this function describe special designations established by society to recognize the importance of preserving or protecting particular resources (e.g., Wild and Scenic Rivers, Natural Landmarks, cultural resources). The remaining elements identify other reasons to give a wetland site special consideration (e.g., educational site).

9.2 Explanation of the Model

Eight elements are used to assess the Uniqueness/Heritage function (Figure 9.1, p. 9–2). The elements are relatively simple, with most containing only two conditions, i.e., the characteristic is either present or absent. A high score (e.g., 0.9 or 1.0) is assigned when the characteristic is present, otherwise the element is considered not applicable (score = NA). The Uniqueness/Heritage FCI is calculated by averaging the scores for the elements which are applicable to the particular wetland. In most projects, a wetland will not contain a unique characteristic, thus the FCI will not be applicable. If any of the elements are applicable, then a Uniqueness/Heritage FCI ranging from 0.9 to 1.0 will be produced. An FCI score indicates that one or more wetland characteristics may require special consideration in the planned wetland. Under some circumstances, a separate review process will be initiated to meet other regulation requirements (e.g., Section 7 coordination for the Endangered Species Act).

9.3 Rationale and Assumptions

ELEMENT 29. ENDANGERED SPECIES

Directions: Determine whether the site is known to be inhabited by threatened or endangered species (at both the federal and state level) or if the site serves as critical habitat for these species. A second consideration, which is scored slightly less (0.9 vs. 1.0), is whether the site is within the known range of threatened or endangered species, and is suitable habitat for these species. If applicable, identify the species and where it is listed (e.g., state threatened).

Rationale and assumptions: Endangered species habitat is related to the wildlife function. However, society has placed additional significance on endangered and threatened species. The Endangered Species Act of 1973 (16 U.S.C. Section 1531 *et seq.*) and legislation in many states attest to the importance society has placed on these organisms.

ELEMENT 30. RARE OR UNCOMMON WETLANDS IN THE REGION

Directions: Determine whether the wetland habitat is rare or uncommon in the region. If applicable, identify the wetland type and regional context. Region can be defined by a multitude of parameters including political and geographic boundaries.

Rationale and assumptions: Rare or uncommon wetlands may be associated with certain functions not performed by other wetlands in a given region. Alternately, rare wetland types may perform the same functions as more common wetlands in the region. Rare wetland types may not be rare in other

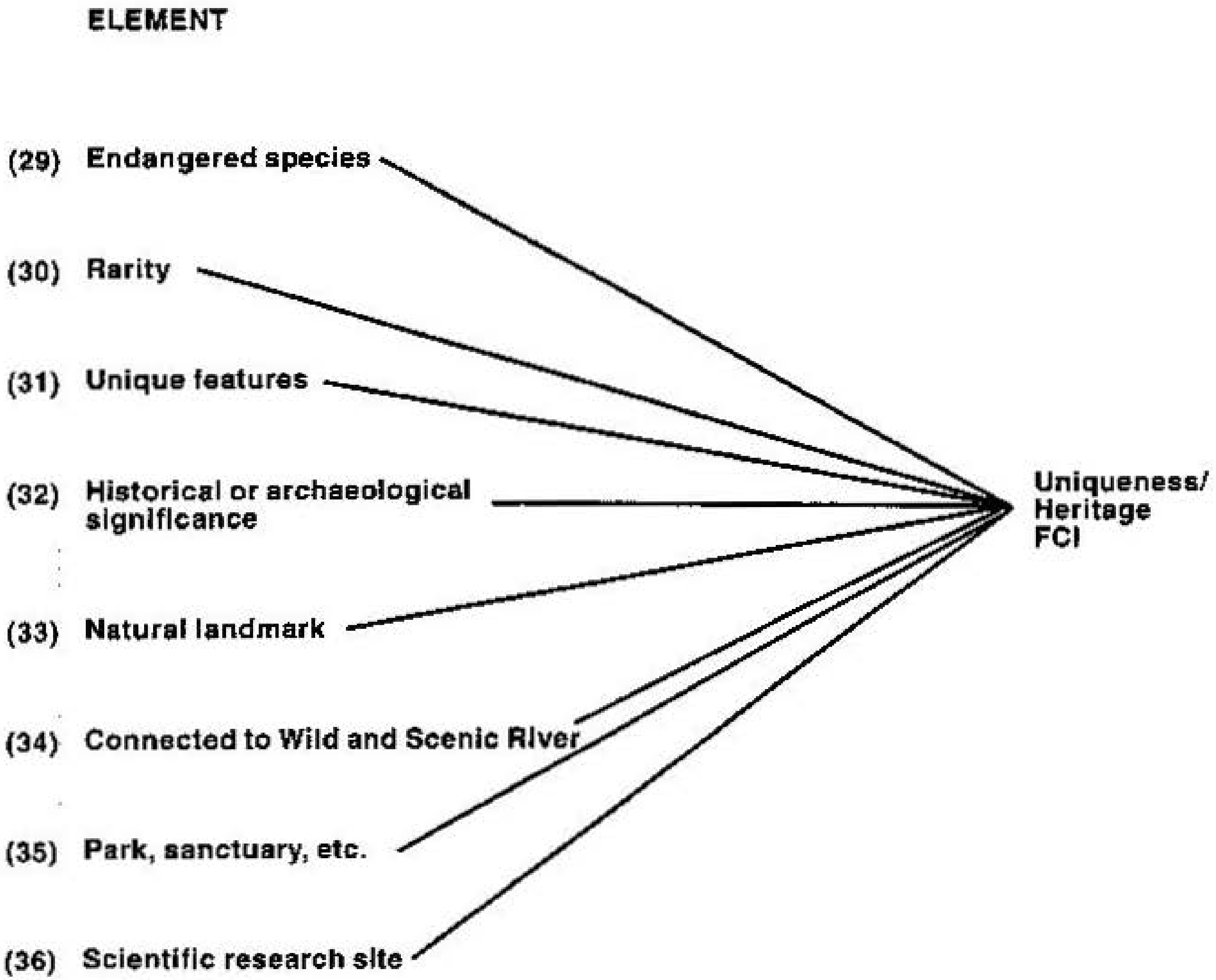


Figure 9.1
Relationships of elements in the Uniqueness/Heritage FCI model

parts of the country. They may be relict, or at the extreme geographic range of a given plant community. Society tends to assign special significance to rare habitat in a given region because of the habitat's uniqueness for that region, regardless of the habitat's functions.

ELEMENT 31. UNIQUE FEATURES

Directions: Determine whether the site contains biological, geological, or other features that are unique to the region. If applicable, identify the feature and regional context. Region does not have to be defined consistently with Element 30. For example, a given wetland type may be rare for a county, whereas a geologic formation adjacent to the wetland may be unique for the state or nation. Regional context must be defined for each element.

Rationale and assumptions: Society assigns special significance to rare or unique features in the landscape. The perceived benefits can range from pure aesthetics to the ability of the feature to serve as a tourist attraction.

ELEMENT 32. HISTORICAL OR ARCHEOLOGICAL SIGNIFICANCE

Directions: Determine whether the site contains any properties listed on or eligible for inclusion on the National Register of Historic Places. In some instances a site may be designated as having archaeological or historic significance by a county, community, or other local entity. These situations should be considered as well. If applicable, provide a brief explanation.

Rationale and assumptions: The societal importance of archaeological and historic sites has been codified at the federal level by the National Historic Preservation Act of 1966 (16 U.S.C. Section 470 *et seq.*). Many state, county, and local governments also have similar or companion laws and regulations to the federal act.

ELEMENT 33. NATURAL LANDMARKS

Directions: Determine whether the site is listed on the federal or a state natural landmarks list or is eligible for inclusion. If applicable, identify the landmark and the list on which it appears.

Rationale and assumptions: Natural landmarks are considered important for many reasons including aesthetics, historical relevance, and their appeal as a tourist attraction. A federal list of National Landmarks and a list of sites eligible for inclusion have been established by the U.S. Department of the Interior under the authority of the Historic Sites Act of 1935 (16 U.S.C. Section 461 *et seq.*). Many states also have a list of State Natural Landmarks.

ELEMENT 34. HYDROLOGIC CONNECTION WITH A WILD AND SCENIC RIVER

Directions: Determine whether the site is connected to a federal or state designated Wild and Scenic River. If applicable, identify the water body and the list it appears on.

Rationale and assumptions: The U.S. Congress passed the Wild and Scenic Rivers Act (16 U.S.C. Section 1278 *et seq.*) to preserve unimpacted rivers or sections of rivers within the United States. Many states also have similar designations for state water bodies.

ELEMENT 35. OWNED BY AN ORGANIZED CONSERVATION GROUP OR PUBLIC AGENCY FOR THE PURPOSE OF PRESERVATION, ECOLOGICAL ENHANCEMENT OR RECREATION

Directions: Determine whether the site is owned or controlled by a public or private organization for the purpose of preservation, ecological enhancement, or low intensity recreation. If applicable, list the group/agency and the use(s).

Rationale and assumptions: Many wetland areas are owned or controlled by organized conservation groups or public agencies. These lands are held for many purposes including preservation, ecological enhancement, and/or low intensity recreation. These areas are held in the public trust because society recognizes the special benefits derived from their protection and/or uses.

ELEMENT 36. SCIENTIFIC RESEARCH STUDY SITE

Directions: Determine whether the site is used for scientific research or study and/or is used for educational purposes at the secondary or post secondary level. If applicable, explain the use(s) and organization(s) that uses it.

Rationale and assumptions: Society places a great deal of emphasis on science education and research. If the site is used as an educational resource, the impact of removing or modifying (negative or positive) that resource must be considered. In addition, scientific inquiry into wetland functions is crucial to understanding these habitats. Many studies are long-term. The impact of modifying or removing the wetland from further use as a research site is an important consideration.

9.4 Example of Assessment of the Uniqueness/Heritage Function

PROJECT TITLE: MARLEY CREEK

UNIQUENESS/HERITAGE
DATA SHEETS

Function weighting area (AREA) = Entire wetland assessment area

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	For use in FCI Model SELECTED SCORES FOR ELEMENTS WAA	For use in FCI Model SELECTED SCORES FOR ELEMENTS Planned Wetland	For use in Table A.2 only DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
29. Endangered species (state- or federally-listed)	[UH]*			Assume NA = 0
a. Wetland not within known range of any threatened or endangered species.	NA			
b. Wetland is known to be inhabited by threatened or endangered species.	1.0			
c. Wetland is considered critical habitat for threatened or endangered species.	1.0	NA	NA	NA
d. Wetland is within known range of threatened or endangered species; habitat suitable for these species.	0.9			
If answer b, c, or d selected, then note: Species name(s) ______				
30. Site contains or is part of a wetland which is considered rare or uncommon in the region. (e.g., a wetland unlike others in the area with respect to size or vegetation type).	[UH]			Assume NA = 0
a. No.	NA	NA	NA	NA
b. Yes.	1.0			
If yes, fill out the following: Wetland type: ______ Region/context: ______				

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* Denotes function(s) to which element applies: SB = Shoreline Bank Erosion Control; SS = Sediment Stabilization; WQ = Water Quality; WL = Wildlife; FT = Fish (Tidal); FS = Fish (Stream/River); FP = Fish (Pond/Lake); and UH = Uniqueness/Heritage

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA)
		WAA	Planned Wetland	If both scores are NA, record NA
31. Site has documented biological, geological, or other feature which is rare or unique in region.	[UH]			Assume NA = 0
a. No.	NA			
b. Yes.	1.0	NA	NA	NA
If yes, fill out the following:				
Feature: ____________				
Region/context: ____________				
32. Site contains any properties that are listed on or are eligible for inclusion on the National Register of Historic Places -OR- contains any properties included in the state listing of historical or archeological sites.	[UH]			Assume NA = 0
a. No.	NA	NA	NA	NA
b. Yes.	1.0			
If yes, explain: ____________				
33. Site is included on a state or federal list of natural landmarks.	[UH]			Assume NA = 0
a. No	NA	NA	NA	NA
b. Yes.	1.0			
Landmark: ____________				
34. Site is hydrologically connected to a state or federally designated Wild and Scenic river.	[UH]			Assume NA = 0
a. No.	NA	NA	NA	NA
b. Yes.	1.0			
If yes, fill out the following:				
River: ____________				

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
35. Site is owned by an organized conservation group or public agency for the primary purpose of preservation, ecological enhancement, or low-intensity recreation (e.g., park, scenic route, marine sanctuary).	[UH]			Assume NA = 0
a. No.	NA	NA	1.0	(+)
b. Yes.	1.0			
If yes, fill out the following:				
Group/Agency: MD SHA				
Use: Deed restricted mitigation site				
36. Site is known scientific research study site -OR- used for other educational purposes.	[UH]			Assume NA = 0
a. No.	NA	NA	1.0	(+)
b. Yes	1.0			
If yes, explain: Research site				

Calculation of UNIQUENESS/HERITAGE FCI

PROJECT TITLE: MARLEY CREEK

COMPARISON: WAA, Planned Wetland (e.g., WAA/planned wetland)

Selected Scores	(#)	Element
NA, NA	(29)	Endangered species
NA, NA	(30)	Rarity
NA, NA	(31)	Unique features
NA, NA	(32)	Historical or archaeological significance
NA, NA	(33)	Natural landmark
NA, NA	(34)	Connected to Wild and Scenic River
NA, 1.0	(35)	Park, sanctuary, etc.
NA, 1.0	(36)	Scientific research site

average for elements with available scores = NA, 1.0 Uniqueness/Heritage FCI

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Literature Cited

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EVALUATION FOR PLANNED WETLANDS (EPW)
Cover Sheet

PROJECT TITLE:

ASSESSMENT DATE(S): *WAA:* *planned wetland:*

INDIVIDUAL(S) PERFORMING EVALUATION AND AFFILIATION:

LOCATION (e.g., City, County, State, Waterway/Watershed):

WAA:

planned wetland:

ASSESSMENT OBJECTIVES:
(note assumed point in time, e.g., peak of first growing season for planned wetland)

CHECK FUNCTIONS ASSESSED:	*WAA*	*planned wetland*
Shoreline Bank Erosion Control		
Sediment Stabilization		
Water Quality		
Wildlife		
Fish (Tidal)		
Fish (Non-tidal Stream/River)		
Fish (Non-tidal Pond/Lake)		
Uniqueness/Heritage		

DESCRIPTION OF PROJECT AREA:
Include information relevant to the assessment (e.g., NWI classification, description of hydrogeomorphic class(es), land use, climate).

WAA:

planned wetland:

...cover sheet continues on reverse

Table A.1.
Comparison of WAA and planned wetland: calculations of FCIs and FCUs

Project Title:

Comparison between WAA # __________ and planned wetland # __________

	WAA			Goals for Planned Wetland**					Planned Wetland			Check if goals met
Function	FCI	AREA	FCUs*	Target FCI	R	Target FCUs	Predicted FCI	Minimum Area	FCI	AREA	FCUs*	
SB												
SS												
WQ												
WL												
FT												
FS												
FP												
UH		▨	▨		▨	▨	▨	▨		▨	▨	

*FCUs = FCI x AREA

**Target FCI = *goal* established by decision makers

R = multiplying factor established by decision makers

Target FCUs = $FCU_{WAA} \times R$ (i.e., planned wetland *goal*)

Predicted FCI = FCIs which designers presume planned wetland may achieve at a particular site (Note this may be greater than Target FCI).

Minimum Area = Target FCUs/Predicted FCI

Table A.2.
Comparison of FCIs and element scores

PROJECT TITLE:

	Functional Capacity Index		Elements with different scores for WAA and planned wetland		
Function	WAA	Planned Wetland	Element Number	Difference	Explanation
Shoreline Bank Erosion Control (SB)		**Target:**			
Sediment Stabilization (SS)		**Target:**			

Table A.2. (page 1 of 3)

Table A.2.
Comparison of FCIs and element scores

PROJECT TITLE:

	Functional Capacity Index		Elements with different scores for WAA and planned wetland		
Function	WAA	Planned Wetland	Element Number	Difference	Explanation
Water Quality (WQ)		Target:			
Wildlife (WL) *Reminder: Include elements 11d and/or 12e if there are differences in scores		Target:			

Table A.2. (page 2 of 3)

Table A.2.
Comparison of FCIs and element scores

PROJECT TITLE:

Function	Functional Capacity Index		Elements with different scores for WAA and planned wetland		
	WAA	Planned Wetland	Element Number	Difference	Explanation
Fish (FT, FS, FP)		Target:			
Uniqueness/Heritage (UH)		Target:			

Table A.2. (page 3 of 3)

PROJECT TITLE: ____________________________

SHORELINE BANK EROSION CONTROL DATA SHEETS

Function weighting area (AREA) = The shore, i.e., the vegetated or non-vegetated areas of the wetland located channelward of the bank (see Figure A.2).

		For use in FCI Model		For use in Table A.2 only
ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
Potential for erosion:				
1. Bank characteristics				Assume NA = 1.0
1a. Water contact with toe of bank (**see Figure A.1**)	[SB, WQ]*			
a. **No** shoreline bank.	NA			
b. Infrequent water contact at toe of bank, i.e., no undercutting of bank (e.g., contact once annually or less).	1.0			
c. Occasional water contact at toe of bank (e.g., contact once a month).	0.7			
d. Moderate water contact at toe of bank (moderate undercutting of bank).	0.5			
e. Frequent water contact at toe of bank (severe undercutting of bank).	0.1			

NOTE: If the score for element 1 = NA (no shoreline bank), there is no potential for providing the shoreline bank erosion control function; therefore the Shoreline Bank Erosion Control FCI is not applicable (NA). Continue only if score ≠ NA.

Site suitability for planned wetland (elements 2 and 14a):				
2. Fetch (Fetch = maximum distance over which wind can blow, unimpeded, across open water to generate waves)	[SB]			Assume NA = 1.0
a. < 1.6 km (1 mile).	1.0			
b. > 1.6 km (1 mile).	0.1			

---

* Denotes function(s) to which element applies: SB = Shoreline Bank Erosion Control; SS = Sediment Stabilization; WQ = Water Quality; WL = Wildlife; FT = Fish (Tidal); FS = Fish (Stream/River); FP = Fish (Pond/Lake); and UH = Uniqueness/Heritage

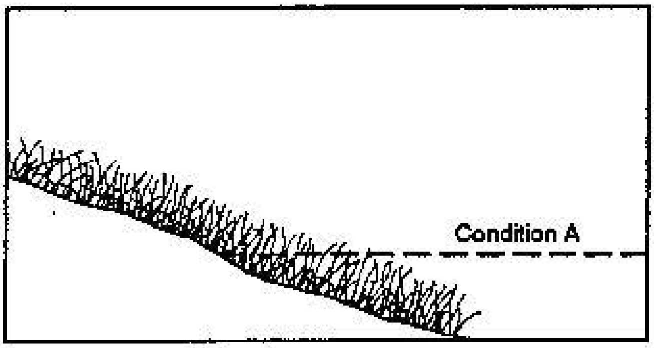
ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
14. Slope				
14a. Steepness of existing shore (Shore = vegetated or non-vegetated substrate located channelward of the bank; **See Figure A.2)** [SB]				Assume NA = 1.0
a. Shore gradual (e.g., slope < 10:1).	1.0			
b. Shore steep (e.g., slope > 10:1).	0.1	NA		
If condition b, then record slope: ________				

NOTE: For planned wetland only. If score for elements 2 and/or 14a is 0.1, then the site is UNSUITABLE. The Shoreline Bank Erosion Control FCI will be low. Continue with data sheet for the planned wetland, only if scores for both elements ≠ 0.1.

Shoreline structures/obstacles:				
3. Shoreline structures/obstacles [SB]				Assume NA = 1.0
a. No shoreline structures present.	NA			
b. Structure/obstacle present. Shore erosion minimal.	NA			
c. Structure/obstacle present. Moderate shore erosion problem present.	0.5			
d. Structure/obstacle present. Substantial shore erosion problem present.	0.1			

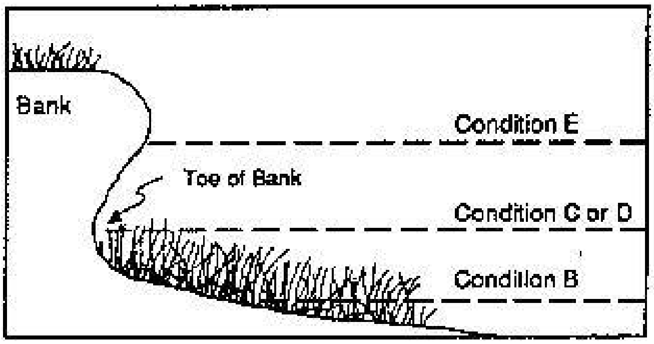
If structure/obstacle present, check type(s):

Structure/Obstacle	WAA	Planned Wetland
Bulkhead	____	____
Rubble	____	____
Riprap	____	____
Revetments (e.g., stone, concrete, gabion)	____	____
Breakwater	____	____
Groins	____	____
Beach fill	____	____
Bridge pier	____	____
Boat dock	____	____
Fallen trees	____	____
Debris	____	____
Potential for moving ice chunks	____	____
Other: ____________	____	____



Bank Absent

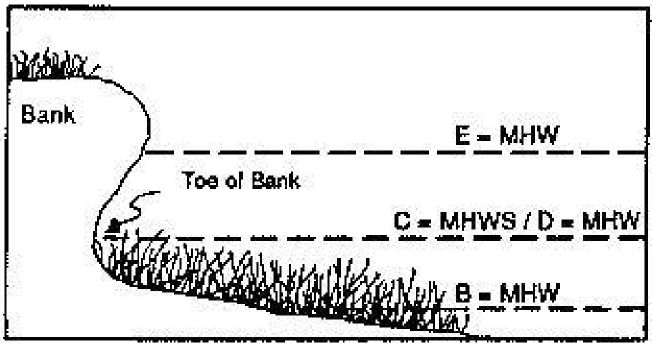
Condition A = No Shoreline Bank



Bank Present

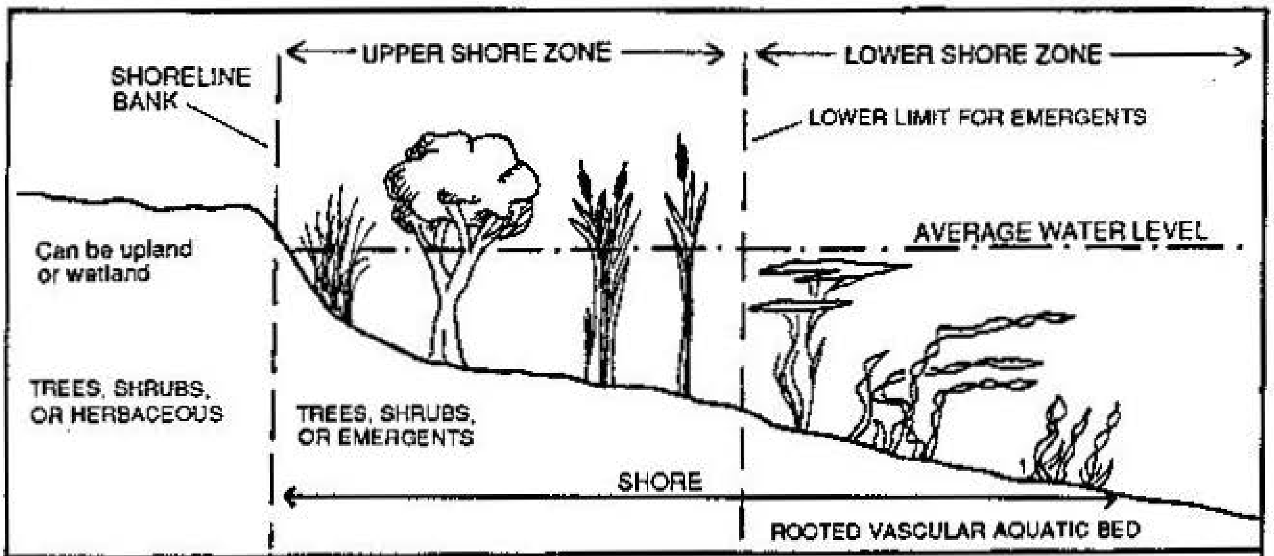
Condition B = Infrequent water contact at toe of bank, i.e., no undercutting of bank (e.g., contact once annually or less).
Condition C = Occasional water contact at toe of bank (e.g., contact once a month).
Condition D = Moderate water contact at toe of bank (moderate undercutting of bank).
Condition E = Frequent water contact at toe of bank (severe undercutting of bank).

Example = Tidal System



Condition B = Mean High Water (MHW) below toe of bank
Condition C = Mean High Water Spring (MHWS)
Condition D = MHW at toe of bank
Condition E = MHW above toe of bank

Figure A.1.
Water contact with toe of bank (element 1a)



Shoreline Bank:	Steep ascending slope of land of any height raised above the adjacent shore that can experience undercutting if it is in contact with water.
Shore:	Vegetated or non-vegetated substrate located channelward of the bank.
Upper Shore Zone:	Vegetated or non-vegetated portion of the shore located between the bank and the potential lower limit of emergent or woody vegetation as dictated by water depth or tide level.
Lower Shore Zone:	Vegetated or non-vegetated portion of the shore located channelward of the potential lower limit of emergent or woody vegetation.
Entire Wetland:	Includes wetland areas landward of the bank, the bank, the upper shore zone, and the lower shore zone.

Examples: Aerial View of Wetlands

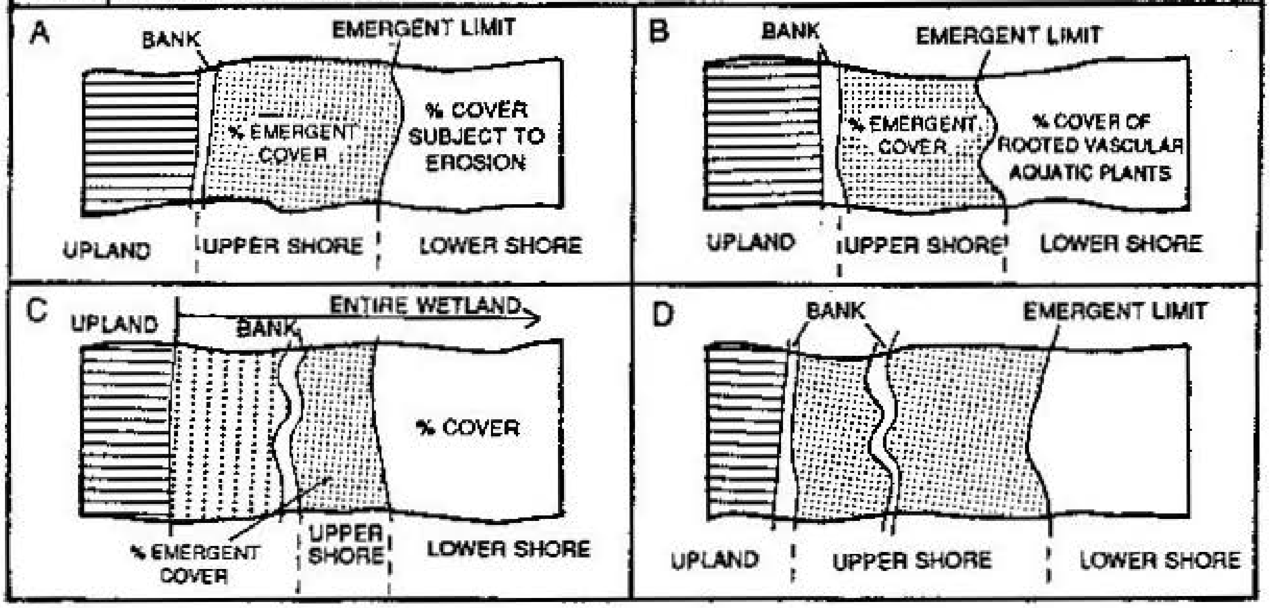
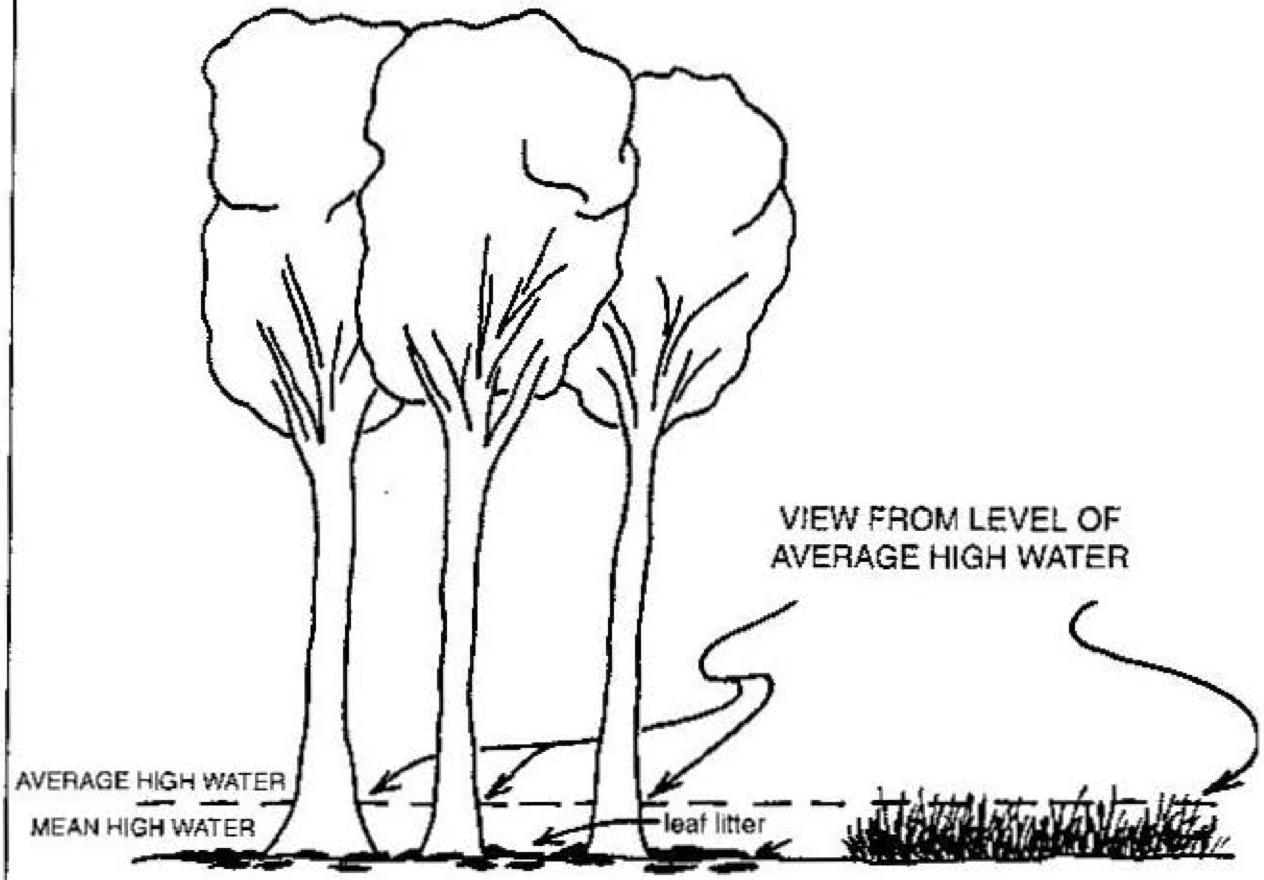


Figure A.2.
Definitions of shoreline bank, shore, upper shore zone, lower shore zone, and entire wetland (element 10)

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
Physical influences on rate of erosion (elements 2, 4a, 5a, 6, 7a, 8a, 9a, and 14b):				
2. Fetch (element already scored above)				
4. Disturbance				
4a. Disturbance at site (Sediment Stabilization)	[SB, SS, FT, FS, FP]			Assume NA = 1.0
(Do not include observations of debris)				
a. No or minimal disturbance.	NA			
b. Potential for periodic disturbance present, but preventative action taken (e.g., installation of enclosure fences for herbivores and/or human disturbance) -OR- if recently disturbed, soils sufficiently stabilized with mulch, seeding, or planting.	NA			
c. Moderate disturbance (e.g., disturbance of sediments only in portion of site; infrequent grazing by waterfowl).	0.5			
d. Evidence of substantial periodic disturbance which makes substrate unstable (e.g., muskrat eatouts, overgrazing by waterfowl, cattle grazing and trampling, nutria activity, human activity such as the use of off-road vehicles; wetland tilled, filled, logged, clear-cut or excavated and not stabilized by seeding or planting).	0.1			
5. Surface runoff from upslope areas (upland and/or wetland immediately adjacent to site).				
5a. Surface runoff from upslope areas (bank erosion)	[SB]			Assume NA = 1.0
a. Surface runoff from upslope areas not an apparent contributor to bank erosion at site (e.g., No or minimal evidence of surface erosion in upland areas, e.g., unstabilized gullies absent).	NA			
b. Surface runoff contribution to bank erosion minimal due to presence of effective infiltration and drainage controls in adjacent upslope areas (e.g., surface runoff through wetland conveyed by stabilized gullies; upslope surface cracks filled).	NA			
c. Surface runoff from upslope areas causes moderate bank erosion.	0.5			
d. Surface runoff from upslope areas causes substantial bank erosion.	0.1			

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
6. Exposure to waves from heavy boat traffic	[SB]			Assume NA = 1.0
a. No or minimal boat traffic present.	NA			
b. Wetland protected from boat traffic by land form that intercepts waves (e.g., island, delta, spit, bar, peninsula, cove).	NA			
c. Wetland protected from boat traffic by structure (e.g., jetty, riprap).	NA			
d. Wetland exposed to waves caused by moderate boat traffic.	0.5			
e. Wetland exposed to waves caused by heavy boat traffic.	0.1			
7. Hydroperiod				
7a. Water level fluctuation	[SB,SS,WQ]			Assume NA = 1.0
a. Tidal wetland.	NA			
b. No fluctuating water level.	NA			
c. Fluctuating water level causing no or moderate erosion.	NA			
d. Fluctuation occasionally drastic causing sever erosion and/or preventing vegetation establishment (e.g., periodic release from upstream impoundment; reservoir drawdown).	0.1			
8. Sunlight				
8a. Hours of direct sunlight throughout shore (i.e., daylight hours without shade)	[SB]			Assume NA = 1.0
a. Hours of sunlight sufficient for vegetation (e.g., > 6 hrs per day).	NA			
b. Sunlight adequate (e.g., 3 - 6 hrs/day).	0.5			
c. Sunlight insufficient (e.g., < 3 hrs/day).	0.1			
9. Substrate				
9a. Suitability for vegetation establishment	[SB]			Assume NA = 1.0
a. Shoreline is stable with and/or without vegetation.	NA			
b. Shoreline is unstable. Substrate suitable for vegetation establishment (e.g., medium or fine grain materials).	NA			
c. Shoreline is unstable. Substrate unsuitable for vegetation establishment (e.g., gravel, cobble).	0.1			

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
14. Slope				
14b. Steepness of planned wetland shore (**See Figure A.2**)	[SB]			Assume NA = 1.0
a. Shore gradual (e.g., slope < 5:1).	NA			
b. Shore steep (e.g., slope > 5:1).	0.1	NA		
If condition b, then record slope: ________				
Vegetation influences on the rate of erosion (elements 10a, 10e, 10g, 10i, and 10k):				
10. Vegetation characteristics **during growing season** (Note differences in definitions for upper shore zone, lower shore zone, and entire wetland. **See Figure A.2**).				
10a. Percent plant (basal) cover in **upper shore zone**. (Consider only those parts of vegetation which have contact with water flow. **See Figure A.3**).	[SB]			
a. Cover > 75%.	1.0			
b. Cover 51 - 75%.	0.7			
c. Cover 25 - 50%.	0.3			
d. Cover < 25%.	0.1			
10e. Percent cover of rooted vascular aquatic beds in **lower shore zone** which is subject to bottom erosion.	[SB]			Assume NA = 1.0
a. No lower shore zone (e.g., no open water).	NA			
b. Lower shore zone not subject to bottom erosion (e.g., no evidence of scouring, i.e., no wave ripples).	NA			
c. Cover > 75%.	1.0			
d. Cover 51 - 75%.	0.7			
e. Cover 25 - 50%.	0.5			
f. Cover < 25%.	0.1			
10g. Plant height in **upper shore zone**.	[SB]			
a. Average plant height equal to or taller than average high water level.	1.0			
b. Intermediate condition, i.e., approximately equal proportions of plants equal to or taller -AND- plants shorter than average high water level.	0.8			
c. Average plant height shorter than average high water level.	0.5			
d. Vegetation absent.	0.1			



Examples:

	Forest	Emergent Marsh
Percent (Basal) Cover (Elements 10a, 10b, or 10d)	<25%	>75%
Percent Leaf Litter & Debris Cover (Element 10c)	>75%	Ground surface areas almost entirely covered by live vegetation

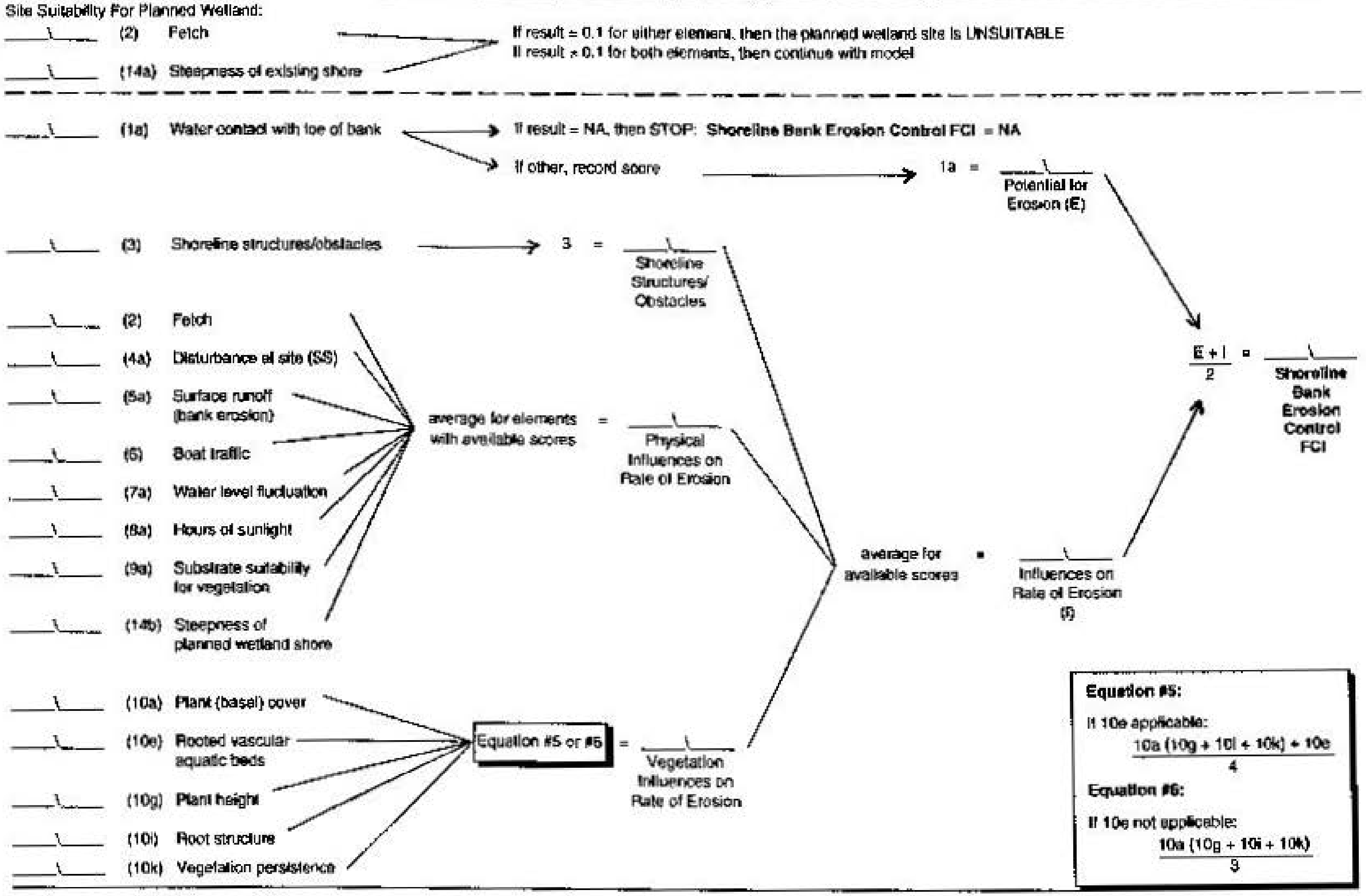
Figure A.3.
Percent plant cover (elements 10a, 10b, 10c, and 10d)

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
10i. Root structure in **upper shore zone**.	[SB]			
Wetland predominantly vegetated by:				
a. Herbaceous species that form a root mat (e.g., rhizome propagating species).	1.0			
b. Intermediate condition.	0.8			
c. Herbaceous species that do not form a root mat (bulb [*Peltandra virginica*], tuber [*Sagittaria latifolia*], or bunch [*Carex spp.*] species).	0.5			
d. Woody species.	0.5			
e. Vegetation absent. Belowground root system absent or dead.	0.1			
10k. Vegetation persistence in **upper shore zone**.	[SB]			
Dominant plant cover:				
a. Persistent vegetation.	1.0			
b. Approximately equal proportions of persistent and non-persistent vegetation.	0.8			
c. Non-persistent vegetation.	0.5			
d. Vegetation absent.	0.1			

Calculation of **SHORELINE BANK EROSION CONTROL FCI** PROJECT TITLE: ____________________

Selected Scores (#) Element

COMPARISON: ________________________ (e.g., WAA/planned wetland)



Site Suitability For Planned Wetland:

________ (2) Fetch

________ (14a) Steepness of existing shore

If result = 0.1 for either element, then the planned wetland site is UNSUITABLE

If result ≠ 0.1 for both elements, then continue with model

________ (1a) Water contact with toe of bank

If result = NA, then STOP: **Shoreline Bank Erosion Control FCI = NA**

If other, record score → 1a = ________ Potential for Erosion (E)

________ (3) Shoreline structures/obstacles → 3 = ________ Shoreline Structures/ Obstacles

________ (2) Fetch

________ (4a) Disturbance at site (SS)

________ (5a) Surface runoff (bank erosion)

________ (6) Boat traffic

________ (7a) Water level fluctuation

________ (8a) Hours of sunlight

________ (9a) Substrate suitability for vegetation

________ (14b) Steepness of planned wetland shore

average for elements with available scores = ________ Physical Influences on Rate of Erosion

________ (10a) Plant (basal) cover

________ (10e) Rooted vascular aquatic beds

________ (10g) Plant height

________ (10i) Root structure

________ (10k) Vegetation persistence

Equation #5 or #6 = ________ Vegetation Influences on Rate of Erosion

average for available scores = ________ Influences on Rate of Erosion (I)

$\frac{E + I}{2}$ = ________ **Shoreline Bank Erosion Control FCI**

Equation #5:

If 10e applicable:

$$\frac{10a\ (10g + 10i + 10k) + 10e}{4}$$

Equation #6:

If 10e not applicable:

$$\frac{10a\ (10g + 10i + 10k)}{3}$$

PROJECT TITLE: ____________________

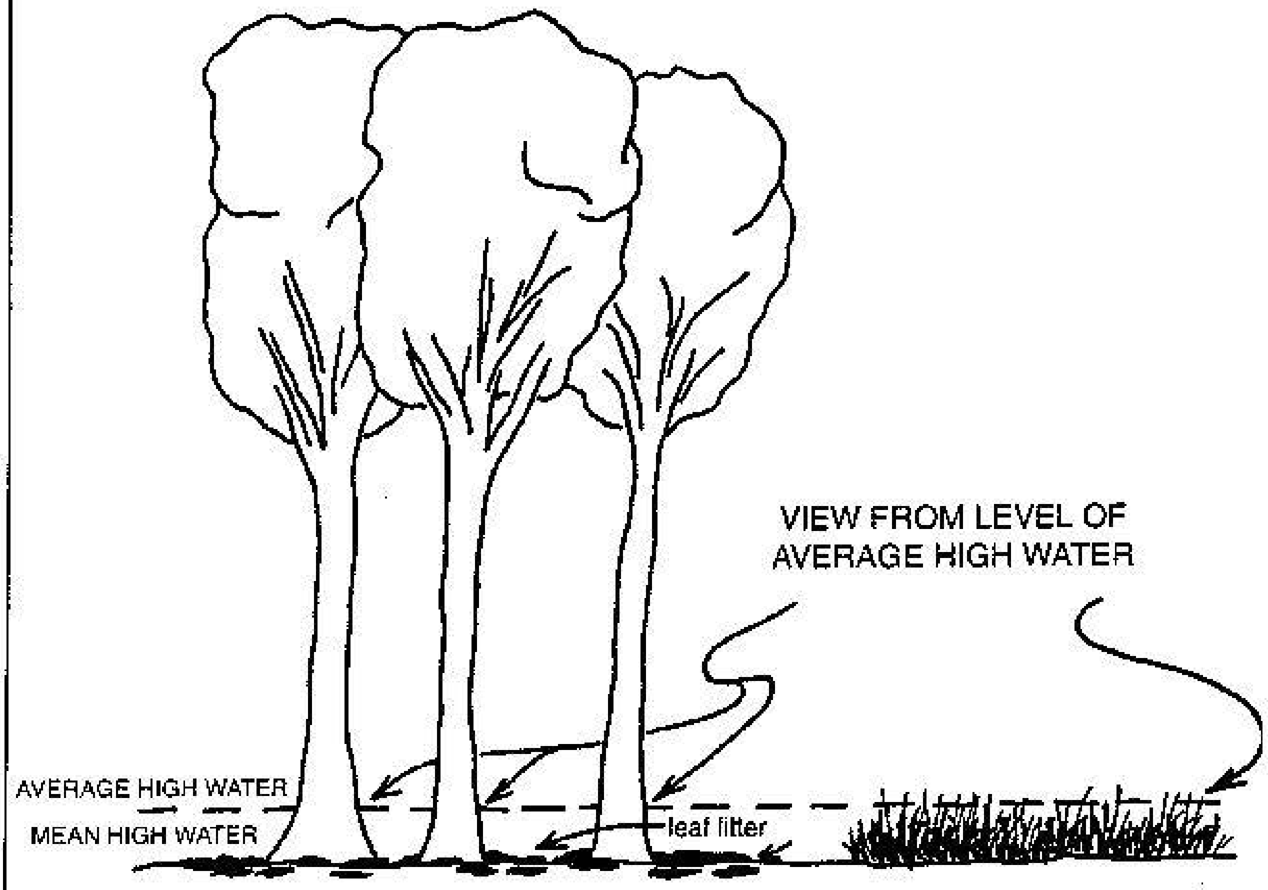
SEDIMENT STABILIZATION DATA SHEETS

Function weighting area (AREA) = Entire wetland assessment area

		For use in FCI Model		For use in Table A.2 only
		SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA)
ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	WAA	Planned Wetland	If both scores are NA, record NA
Disturbance factors (elements 4a and 7a):				
4a. Disturbance (Sediment Stabilization)	[SB, SS, FT, FS, FP]*			Assume NA = 1.0
(Do not include observations of debris)				
a. No or minimal disturbance.	NA			
b. Potential for periodic disturbance present, but preventative action taken (e.g., installation of exclosure fences for herbivores and/or human disturbance). OR If recently disturbed, soils sufficiently stabilized with mulch, seeding, or planting.	NA			
c. Moderate disturbance (e.g., disturbance of sediments only in portion of site; infrequent grazing by waterfowl).	0.5			
d. Evidence of substantial periodic disturbance which makes substrate unstable (e.g., muskrat eatouts, overgrazing by waterfowl, cattle grazing and trampling, nutria activity, human activity such as the use of off-road vehicles; wetland tilled, filled, logged, clear-cut or excavated and not stabilized by seeding or planting).	0.1			

* Denotes function(s) to which element applies: SB = Shoreline Bank Erosion Control; SS = Sediment Stabilization; WQ = Water Quality; WL = Wildlife; FT = Fish (Tidal); FS = Fish (Stream/River); FP = Fish (Pond/Lake); and UH = Uniqueness/Heritage

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
7. Hydroperiod				
7a. Water level fluctuation	[SB,SS,WQ]			Assume NA = 1.0
a. Tidal wetland.	NA			
b. No fluctuating water level.	NA			
c. Fluctuating water level causing no or moderate erosion.	NA			
d. Fluctuation occasionally drastic causing sever erosion and/or preventing vegetation establishment (e.g., periodic release from upstream impoundment; reservoir drawdown).	0.1			
Vegetation characteristics affecting sediment stabilization (elements 10b, 10c, 10j, and 10l):				
10. Vegetation characteristics **during growing season**				
10b. Percent plant (basal) cover, including rooted vascular aquatic beds, in **entire wetland**. (Consider only those parts of vegetation which have contact with water flow. **See Figure A.3**)	[SS, WQ]			
a. Cover > 75%.	1.0			
b. Cover 51 - 75%.	0.7			
c. Cover 25 - 50%.	0.3			
d. Cover < 25%.	0.1			
10c. Percent cover provided by leaf litter and debris **on ground surface areas not covered by live vegetation** (Applicable to **entire wetland**. Include submerged surfaces)	[SS]			
a. Ground surface areas almost entirely covered by live vegetation (i.e., cover of live vegetation > 75%).	1.0			
b. Cover > 75% leaf litter and debris.	1.0			
c. Cover 51 - 75%.	0.7			
d. Cover 25 - 50%.	0.3			
e. Cover < 25%.	0.1			



Examples:

	Forest	Emergent Marsh
Percent (Basal) Cover (Elements 10a, 10b, or 10d)	<25%	>75%
Percent Leaf Litter & Debris Cover (Element 10c)	>75%	Ground surface areas almost entirely covered by live vegetation

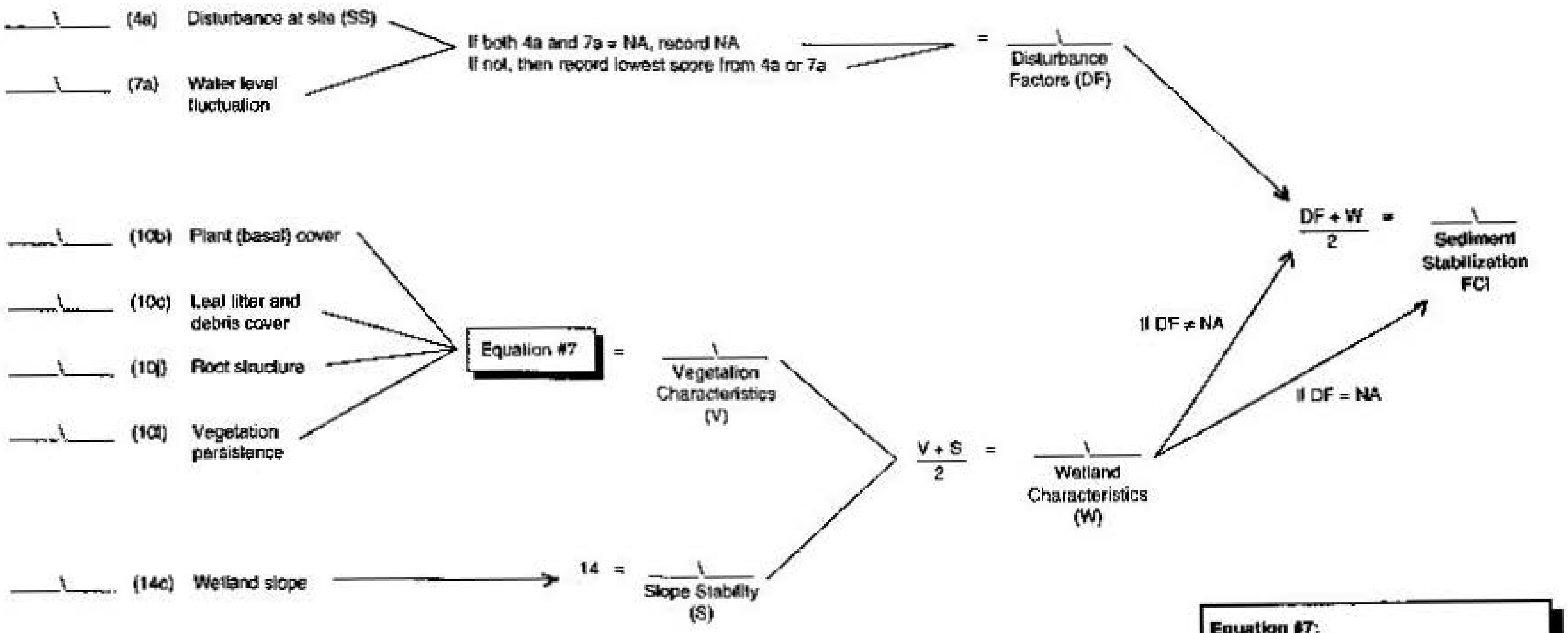
Figure A.3.
Percent plant cover (elements 10a, 10b, 10c, and 10d)

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
10j. Root structure in **entire wetland**. (Include rooted vascular aquatic beds)	[SS]			
Wetland predominantly vegetated by:				
a. Herbaceous species that form a root mat (e.g., rhizome propagating species).	1.0			
b. Intermediate condition.	0.8			
c. Herbaceous species that do not form a root mat (bulb (*Peltandra virginica*), tuber (*Sagittaria latifolia*), or bunch (*Carex spp.*) species).	0.5			
d. Woody species -OR- rooted aquatic vascular beds.	0.5			
e. Vegetation absent. Belowground root system absent or dead.	0.1			
10l. Vegetation persistence in **entire wetland**. (Include rooted vascular aquatic beds)	[SS, WQ]			
Dominant plant cover:				
a. Persistent vegetation.	1.0			
b. Approximately equal proportions of persistent and non-persistent vegetation.	0.8			
c. Non-persistent vegetation.	0.5			
d. Vegetation absent.	0.1			
The influence of slope on sediment stabilization (element 14c):				
14c. Vegetated or unvegetated wetland slope (**Entire wetland**)	[SS, WQ]			
a. Slope is stable with and/or without vegetation (e.g., a slope which is adjusted to the wave climate would be stable even in the absence of vegetation).	1.0			
b. Slope is stable. Erosion protection provided by leaf litter and debris.	1.0			
c. Slope is unstable (e.g., an unvegetated slope with gullies; evidence of a net loss of shore sediments beginning the development of a bank; evidence of scouring, i.e., wave ripples.)	0.1			

Calculation of **SEDIMENT STABILIZATION** FCI

PROJECT TITLE: ____________________

Selected Scores | (#) | Element | COMPARISON: __________ \ __________ (e.g., WAA/planned wetland)



Equation #7:

$$\frac{10b\,(10j + 10l) + 10c\,(1 - 10b)}{2}$$

PROJECT TITLE: ____

WATER QUALITY DATA SHEETS

Function weighting area (AREA) = Entire wetland assessment area

		For use in FCI Model		For use in Table A.2 only
		SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA)
ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	WAA	Planned Wetland	If both scores are NA, record NA
Applicability of water quality function (element 15):				
15. Hydrologic condition (Define hydrologic condition of non-tidal wetland site by considering its position in the landscape) (**See Figure A.4** for non-tidal wetland conditions)	[WQ]*			Assume NA = 0
a. Non-tidal, Condition A.	NA			
b. Non-tidal, Condition B.	NA			
c. Non-tidal, Condition C.	1.0			
d. Non-tidal, Condition D.	0.8			
e. Non-tidal, Condition E.	0.3			
f. Non-tidal, Condition F.	0.3			
g. Non-tidal, Condition G.	0.1			
h. Non-tidal, Condition H.	0.1			
i. Tidal, site predominantly low marsh.	1.0			
j. Tidal, site approximately equal proportions of high and low marsh.	0.7			
k. Tidal, site predominantly high marsh.	0.5			

If the score for element 15 = NA, then the Water Quality FCI is considered not applicable (NA) because there is no outlet to convey surface water from the wetland downstream. Continue only if information on elements is required for comparison between wetlands.

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* Denotes function(s) to which element applies: SB = Shoreline Bank Erosion Control; SS = Sediment Stabiliation; WQ = Water Quality; WL = Wildlife; FT = Fish (Tidal), FS = Fish (Stream/River); FP = Fish (Pond/Lake); and UH = Uniqueness/Heritage

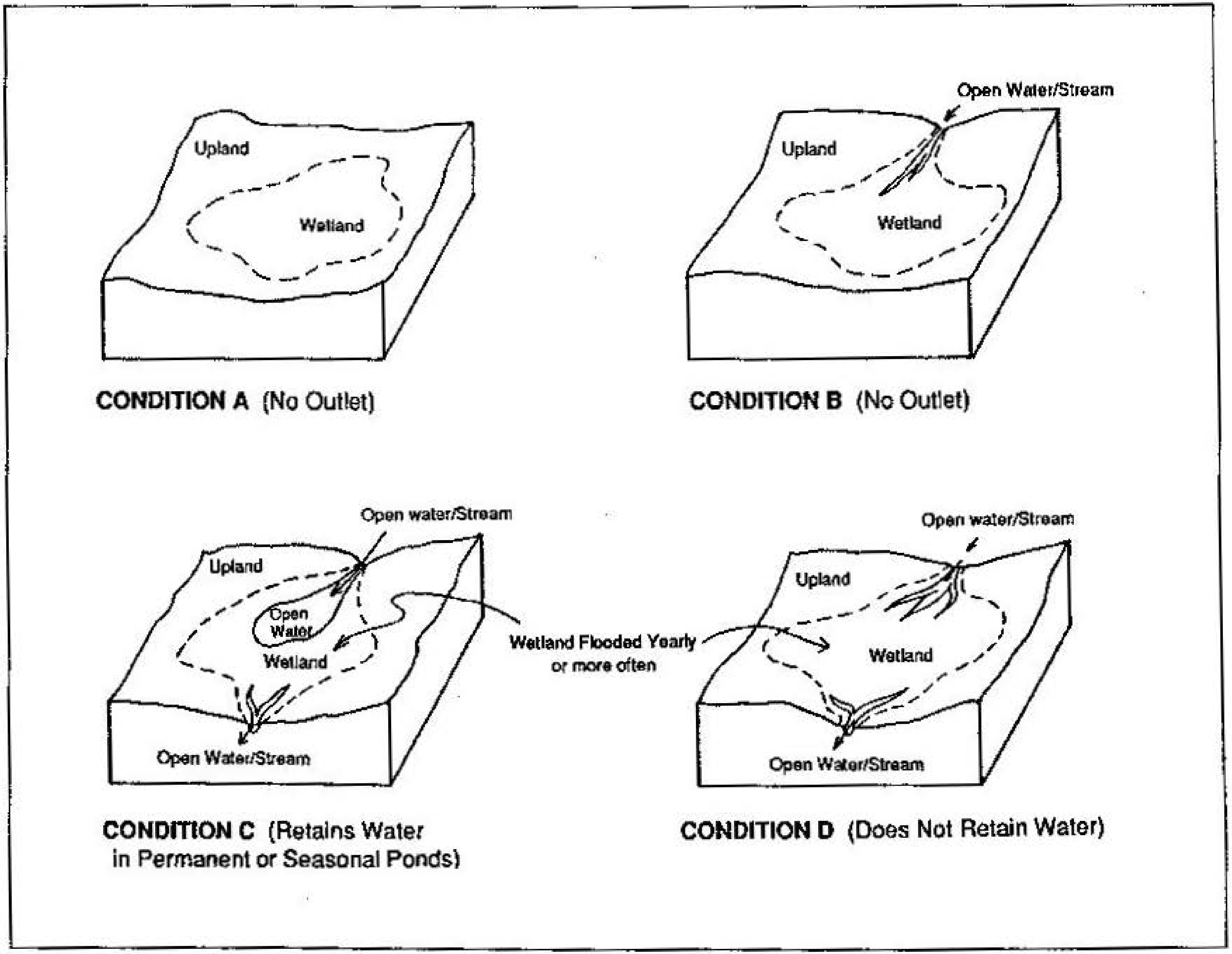


Figure A.4.
Non-tidal hydrologic condition (element 15, modified from Hollands and McGee 1985) — *con't on p. A 21*

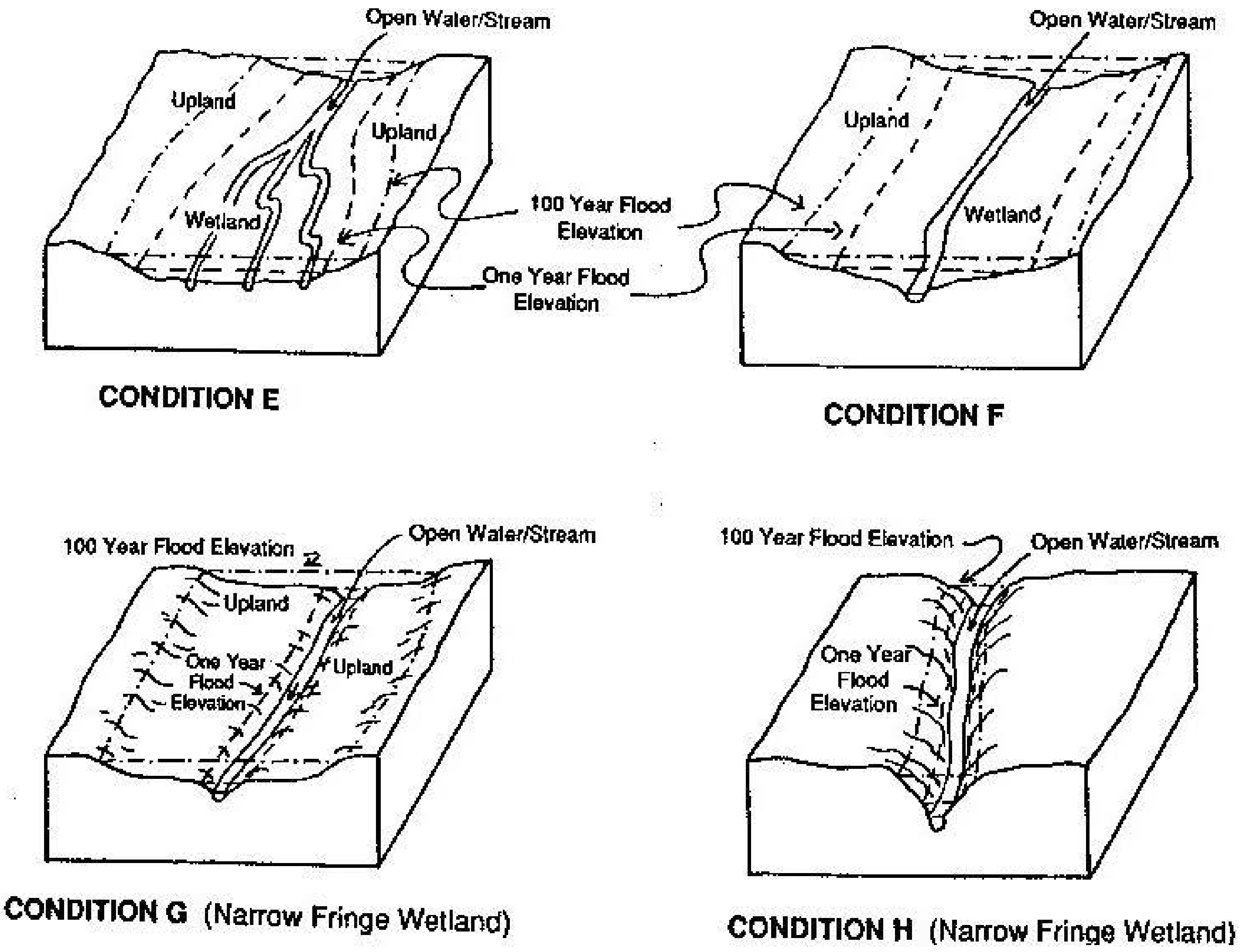
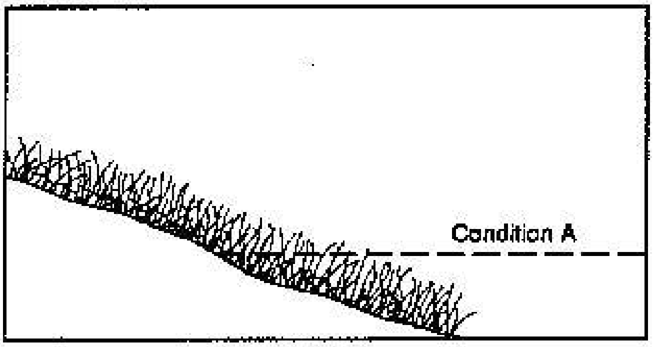


Figure A.4. *(con't from p. A 20)*
Non-tidal hydrologic condition (element 15; modified from Hollands and McGee 1986)

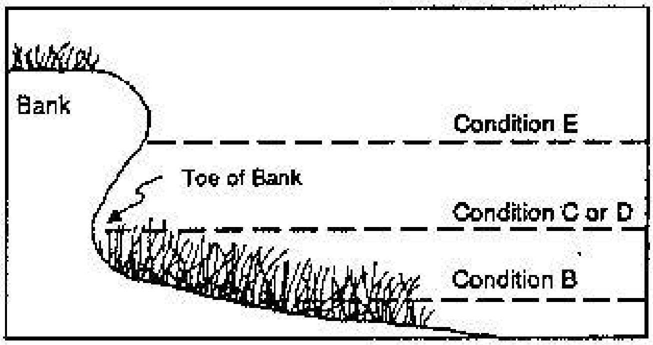
ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA)
		WAA	Planned Wetland	If both scores are NA, record NA
Factors limiting the potential for water quality improvement (elements 4b, 7a, and 16a):				
4b. Disturbance at site (Water Quality) (Include observations of debris)	[WQ]			Assume NA = 1.0
a. No or minimal disturbance.	NA			
b. Potential for periodic disturbance present, but preventative action taken (e.g., installation of exclosure fences for herbivores and/or human disturbance) OR If recently disturbed, soils sufficiently stabilized with mulch, seeding, or planting.	NA			
c. Moderate disturbance (e.g., disturbance of sediments only in portion of site; infrequent grazing by waterfowl; **deposits of debris**).	0.5			
d. Evidence of substantial periodic disturbance which makes substrate unstable (e.g., muskrat eatouts, overgrazing by waterfowl, cattle grazing and trampling, nutria activity, human activity such as the use of off-road vehicles; wetland tilled, filled, logged, clear-cut or excavated and not stabilized by seeding or planting) **-OR- evidence of substantial dumping of debris (e.g., truckload of garbage)**.	0.1			
7. Hydroperiod				
7a. Water level fluctuation	[SB, SS, WQ]			Assume NA = 1.0
a. Tidal wetland.	NA			
b. No fluctuating water level.	NA			
c. Fluctuating water level causing no or moderate erosion.	NA			
d. Fluctuation occasionally drastic causing severe erosion and/or preventing vegetation establishment (e.g., periodic release from upstream impoundment; reservoir drawdown).	0.1			

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
16. Size				
16a. Wetland width	[WQ]			Assume NA = 1.0
Is the site considered to have a low potential to improve water quality because of its narrow width (e.g., wetland < 2 feet wide)?				
a. No.	NA			
b. Yes.	0.1			
If yes explain: ____________________ ____________________				
Substrate-slope characteristics affecting water quality (elements 1a, 5b, and 14c):				
1. Bank characteristics	[SB, WQ]			Assume NA = 1.0
1a. Water contact with toe of bank (see Figure A.1)				
a. No shoreline bank.	NA			
b. Infrequent water contact at toe of bank, i.e., no undercutting of bank (e.g., contact once annually or less).	1.0			
c. Occasional water contact at toe of bank (e.g., contact once a month).	0.7			
d. Moderate water contact at toe of bank (moderate undercutting of bank).	0.5			
e. Frequent water contact at toe of bank (severe undercutting of bank).	0.1			



Bank Absent

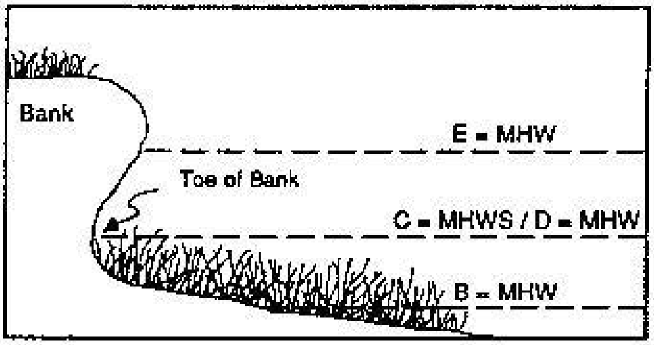
Condition A = No Shoreline Bank



Bank Present

Condition B = Infrequent water contact at toe of bank, i.e., no undercutting of bank (e.g., contact once annually or less).
Condition C = Occasional water contact at toe of bank (e.g., contact once a month).
Condition D = Moderate water contact at toe of bank (moderate undercutting of bank).
Condition E = Frequent water contact at toe of bank (severe undercutting of bank).

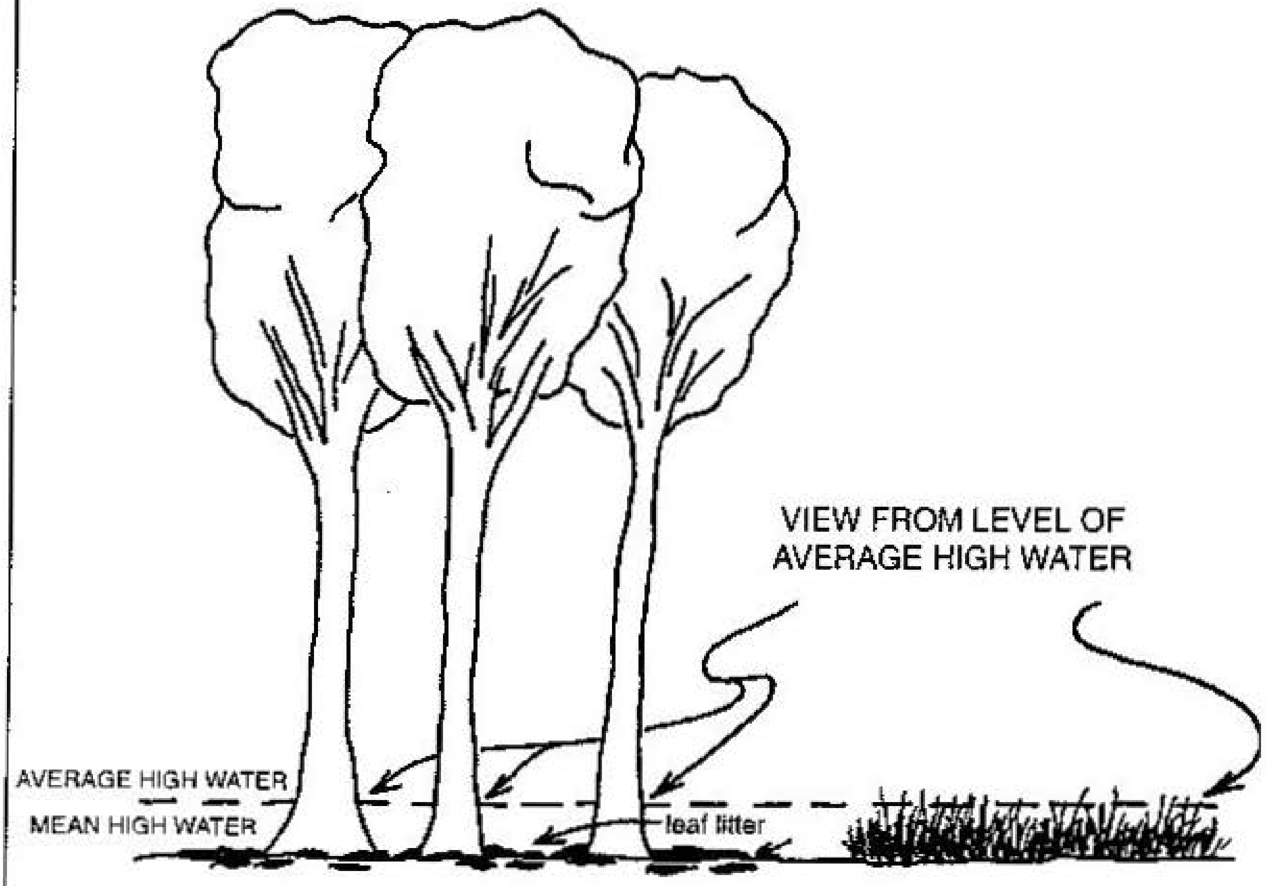
Example = Tidal System



Condition B = Mean High Water (MHW) below toe of bank
Condition C = Mean High Water Spring (MHWS)
Condition D = MHW at toe of bank
Condition E = MHW above toe of bank

Figure A.1.
Water contact with toe of bank (element 1a)

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA)
		WAA	Planned Wetland	If both scores are NA, record NA
5. Surface runoff from upslope areas				
5b. Surface runoff from upslope areas (erosion of bank and wetland proper)	[WQ]			Assume NA = 1.0
a. Surface runoff from upslope areas not an apparent contributor to erosion in the wetland (e.g., No or minimal evidence of surface erosion in upland areas, e.g., unstabilized gullies absent).	NA			
b. Surface runoff contribution to wetland erosion minimal due to presence of effective infiltration and drainage controls in adjacent upslope areas (e.g., surface runoff through wetland conveyed by stabilized gullies; upslope surface cracks filled).	NA			
c. Surface runoff from upslope areas causes moderate wetland erosion.	0.5			
d. Surface runoff from upslope areas causes substantial wetland erosion.	0.1			
14. Slope				
14c. Vegetated or unvegetated wetland slope (**Entire wetland**)	[SS, WQ]			
a. Slope is stable with and/or without vegetation (e.g., a slope which is adjusted to the wave climate would be stable even in the absence of vegetation).	1.0			
b. Slope is stable. Erosion protection provided by leaf litter and debris.	1.0			
c. Slope is unstable (e.g., an unvegetated slope with gullies; evidence of a net loss of shore sediments beginning the development of a bank; evidence of scouring, i.e., wave ripples.)	0.1			
Vegetation characteristics affecting water quality (elements 10b, 10h, and 10i):				
10. Vegetation characteristics **during growing season**				
10b. Percent plant (basal) cover, including rooted vascular aquatic beds, in **entire wetland**. (Consider only those parts of vegetation which have contact with water flow. **See Figure A.3**)	[SS, WQ]			
a. Cover > 75%.	1.0			
b. Cover 51 - 75%.	0.7			
c. Cover 25 - 50%.	0.3			
d. Cover < 25%.	0.1			



Examples:

	Forest	Emergent Marsh
Percent (Basal) Cover (Elements 10a, 10b, or 10d)	<25%	>75%
Percent Leaf Litter & Debris Cover (Element 10c)	>75%	Ground surface areas almost entirely covered by live vegetation

Figure A.3.
Percent plant cover (elements 10a, 10b, 10c, and 10d)

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
10h. Plant height in entire wetland. (Include rooted vascular aquatic beds)	[WQ]			Assume NA = 0
a. Average plant height equal to or taller than average high water level.	1.0			
b. Intermediate condition, i.e., approximately equal proportions of plants equal to or taller -AND- plants shorter than average high water level.	0.8			
c. Average plant height shorter than average high water level.	0.5			
d. Vegetation absent.	0.1			
10i. Vegetation persistence in entire wetland. (Include rooted vascular aquatic beds)	[SS, WQ]			
Dominant plant cover:				
a. Persistent vegetation.	1.0			
b. Approximately equal proportions of persistent and non-persistent vegetation.	0.8			
c. Non-persistent vegetation.	0.5			
d. Vegetation absent.	0.1			
Elements defining the extent of water contact with wetland surface (elements 9b, 15, 17, 18, and 19):				
9. Substrate				
9b. Dominant substrate type	[WQ]			
a. Fine mineral soils (e.g., alluvial, alfisol, loam, ferric, clay) -OR- soils with high organic content (> 20% by weight).	1.0			
b. Medium sized sand.	0.5			
c. Course sand, bedrock, rubble, or cobble.	0.1			
15. Hydrologic condition (element already answered above).				

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA)
		WAA	Planned Wetland	If both scores are NA, record NA
17. Detention time (Answer only if hydrologic calculations are available, e.g., site designed for stormwater management).	[WQ]			If NA and/or INA, record both scores.
a. Tidal wetland.	NA			
b. Information not available.	INA			
c. Data available to demonstrate wetland detention time adequate for effective nutrient removal. Explain: ______________ ______________	1.0			
d. ≥ 24 hours for 1 year storms.	1.0			
e. 12 - 24 hours for 1 year storms.	0.5			
f. < 12 hours for 1 year storms.	0.1			
18. Sheet vs. channel flow	[WQ]			If one NA, record both scores.
a. Tidal wetland.	NA			
b. Water flow within or through wetland predominantly sheetflow (e.g., > 50% of the flow enters and passes through wetland as sheetflow).	1.0			
c. Water flow occasionally sheetflow (e.g., 10 - 50% of flow is sheetflow; extensively braided channel flow).	0.5			
d. Water flows primarily in channel and rarely spreads over adjacent wetland.	0.1			
19. Average water depth (during periods when surface water is present)	[WQ]			If one NA, record both scores.
a. Tidal wetland.	NA			
b. < 15 cm (< 6 in.)	1.0			
c. 15 - 30 cm (6 - 12 in.).	0.8			
d. 30 - 61 cm (12 - 24 in.).	0.6			
e. 61 - 91 cm (24 - 36 in.).	0.4			
f. > 91 cm (36 in.).	0.2			

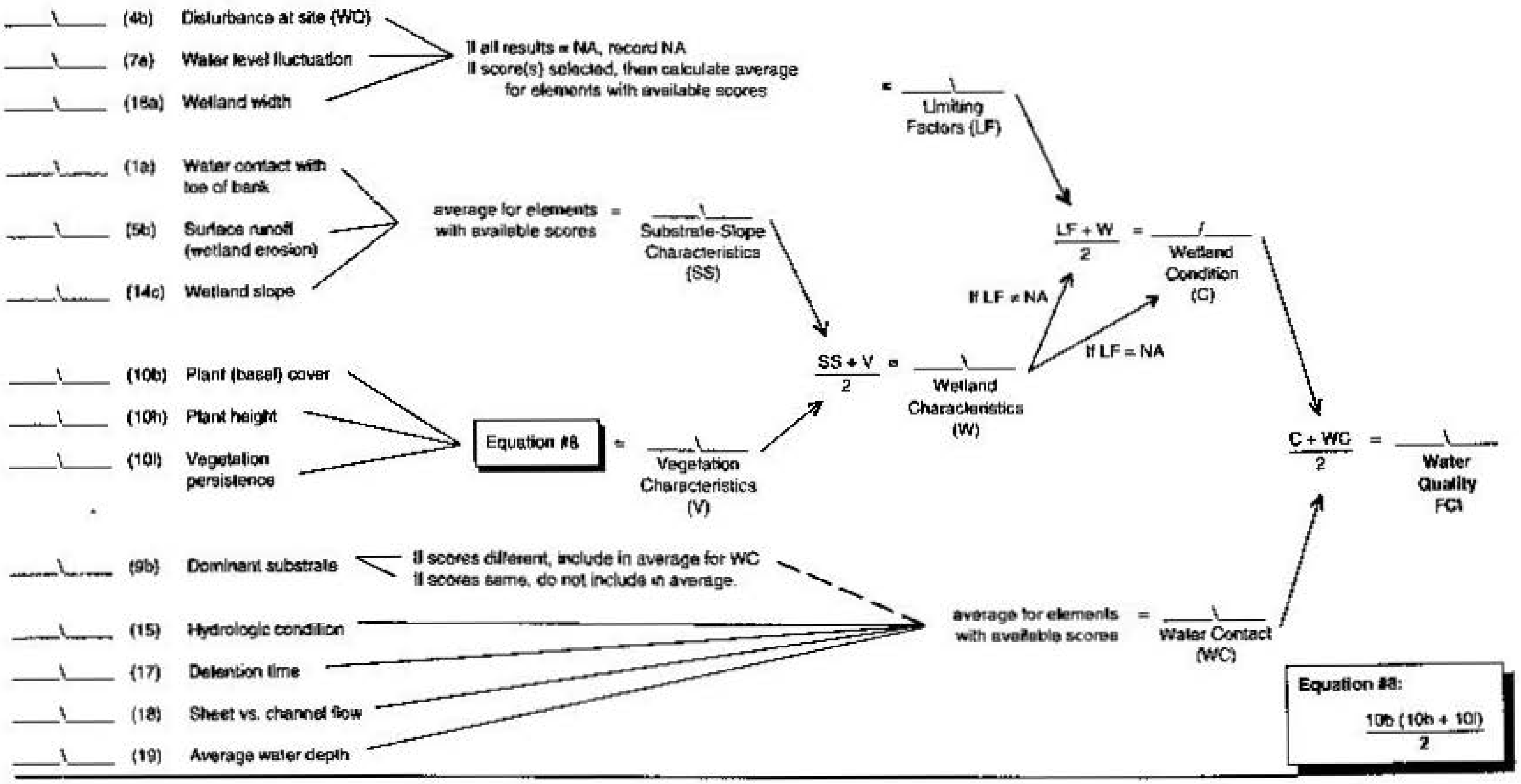
Calculation of **WATER QUALITY FCI**

PROJECT TITLE: ____________________

Selected Scores (#) Element

COMPARISON: ____________ \ ____________ (e.g., WAA/planned wetland)

________ (15) Hydrologic condition — If result = NA, then STOP. **Water Quality FCI** is not applicable. If score selected, then continue with model.



PROJECT TITLE: ______________________________

WILDLIFE
DATA SHEETS

Function weighting area (AREA) = Entire wetland assessment area

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	For use in FCI Model SELECTED SCORES FOR ELEMENTS: WAA	For use in FCI Model SELECTED SCORES FOR ELEMENTS: Planned Wetland	For use in Table A.2 only DIFFERENCE IN SCORES (Planned - WAA) If both are NA, record NA
Features which reduce habitat value (elements 4c, 16b, and 20a):				
4. Disturbance				
4c. Disturbance of wildlife habitat	[WL]*			Assume NA = 1.0
a. No or moderate disturbance.	NA			
b. Periodic disturbance used as wildlife management practice (e.g., controlled burning).	NA			
c. Evidence of recent (e.g., within last year) substantial periodic disturbance which reduces habitat availability (e.g., wetland tilled, filled, excavated, burned, or mowed).	0.1			
16. Size				
16b. Wetland site size				
Is the site considered to have a very low wildlife value because of its small size and poor conditions in or around the wetland (e.g., 1 ft. wide x 20 ft. long fringe marsh with access to other wetlands or upland wildlife habitat blocked by urban development)?	[WL]			Assume NA = 1.0
a. No.	NA			
b. Yes.	0.1			
If yes, explain: ______________________				

---

* Denotes function(s) to which element applies: SB = Shoreline Bank Erosion Control; SS = Sediment Stabilization; WQ = Water Quality; WL = Wildlife; FT = Fish (Tidal); FS = Fish (Stream/River); FP = Fish (Pond/Lake); and UH = Uniqueness/Heritage

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both are NA, record NA
		WAA	Planned Wetland	
20. Water quality				
20a. Gross contamination	[WL]			Assume NA = 1.0
a. Minimal or no potential for contaminant input.	NA			
b. Potential for contaminant input present, but preventative measures taken (e.g., construction of swales and/or drainage ditches to direct highway runoff away from wetland).	NA			
c. Evidence of presence of highly toxic contaminants (e.g., stunted plant growth, excessive growth, and/or abnormal morphology; oil sheen on marsh surface) AND/OR known source(s) contributing highly toxic contaminants to the wetland (e.g., hazardous waste sites, superfund sites, landfills).	0.1			
Habitat complexity (elements 11a, 11b, 11c, 12a, 12b, 12c, 12d, 13a, 13b, 21a, 22a, and 23):				
11. Vegetation strata				
11a. Number of layers in wetland (Do not include layers in upland areas)	[WL]			
Choose from 6 possible layers:				
• **tree** vegetation ≥ 8 m (26 ft) canopy cover ≥ 5% • **stem bole** tree stems ≥ 25 cm (10 in) dbh ≥ 5 per ha (2/ac) • **midstory** woody vegetation 1 - 8 m (3 - 26 ft) canopy cover ≥ 5% • **groundcover** variety surface covering 0 - 1 m (0 - 3 ft) • **surface water** 0 - 25 cm (0 - 10 in) in depth • **water column** open water below 25 cm (10 in)				
a. 6 layers.	1.0			
b. 5 layers.	0.9			
c. 4 layers.	0.7			
d. 3 layers.	0.5			
e. 2 layers.	0.3			
f. 1 layer.	0.1			

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA)
		WAA	Planned Wetland	If both are NA, record NA
11b. Condition of layer coverage (**See Figure A.5**). (Consider canopy cover of each of the three vegetation layers: tree, midstory and herbaceous groundcover)	[WL]			
a. Approximately equal proportions and high percent cover (e.g., > 40%) for each layer.	1.0			
b. Intermediate condition.	0.7			
c. Predominantly 1 layer.	0.3			
d. Low percent cover for each vegetation layer.	0.1			
e. Predominantly unvegetated layer (e.g., open water, mudflat, bare ground, rock outcrop, and/or aquatic bed).	0.1			
11c. Spatial pattern of shrubs and/or trees (**See Figure A.6**)	[WL]			If one NA, record both scores.
a. No woody species -OR- few individual plants of woody species present (e.g., spatial pattern irrelevant for 2 trees).	NA			
b. Irregular (e.g., random, aggregate, or clumped distribution).	1.0			
c. Regular (e.g., uniform distribution, row planting, orchard).	0.1			
11d. Difference in layers	[WL]			Record both scores.
a. Planned wetland contains same layers as WAA.	NA	NA		
b. Planned wetland does not contain same layers as WAA.	1.0			
If answer "b", explain: ______________________				

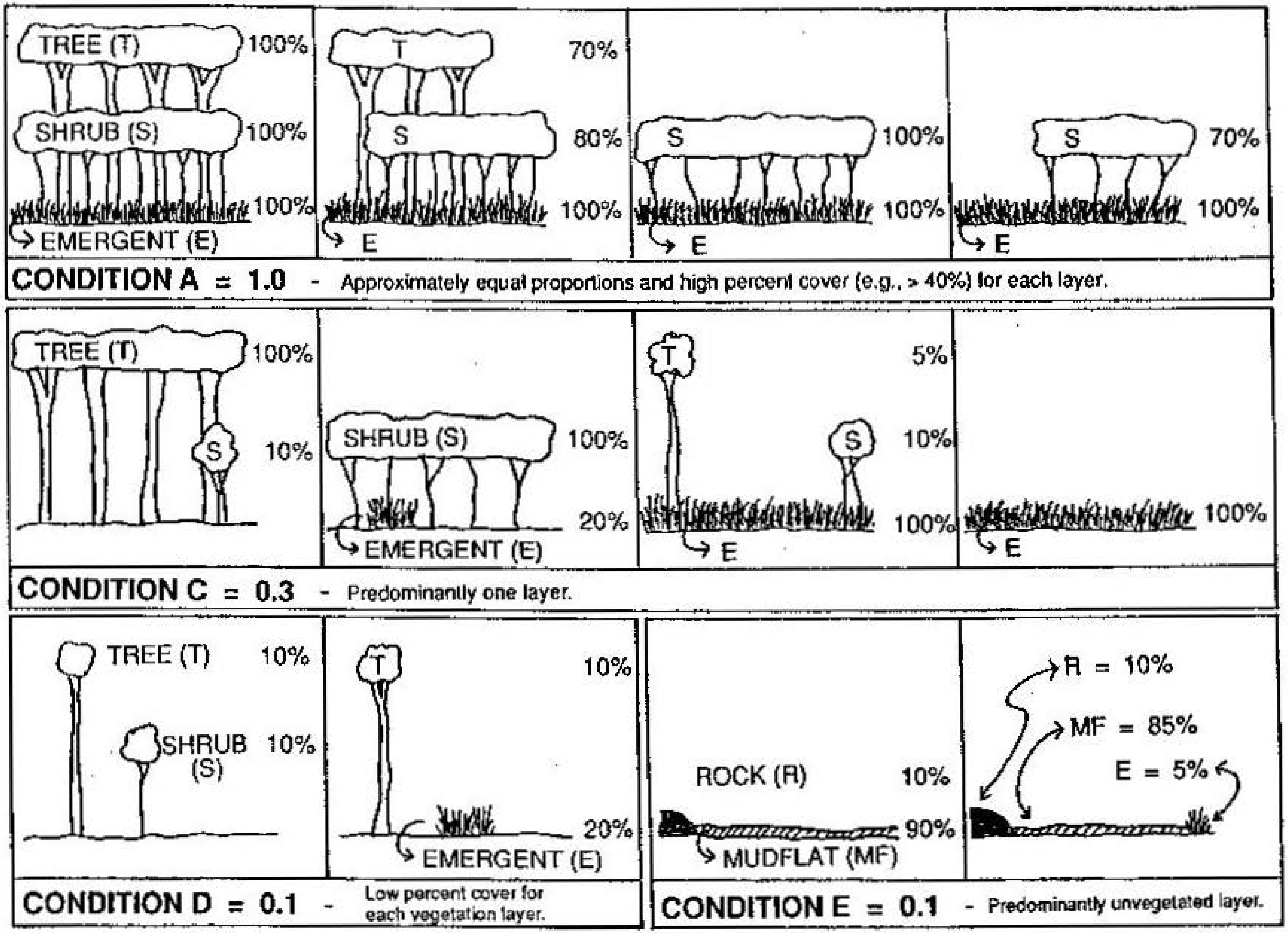
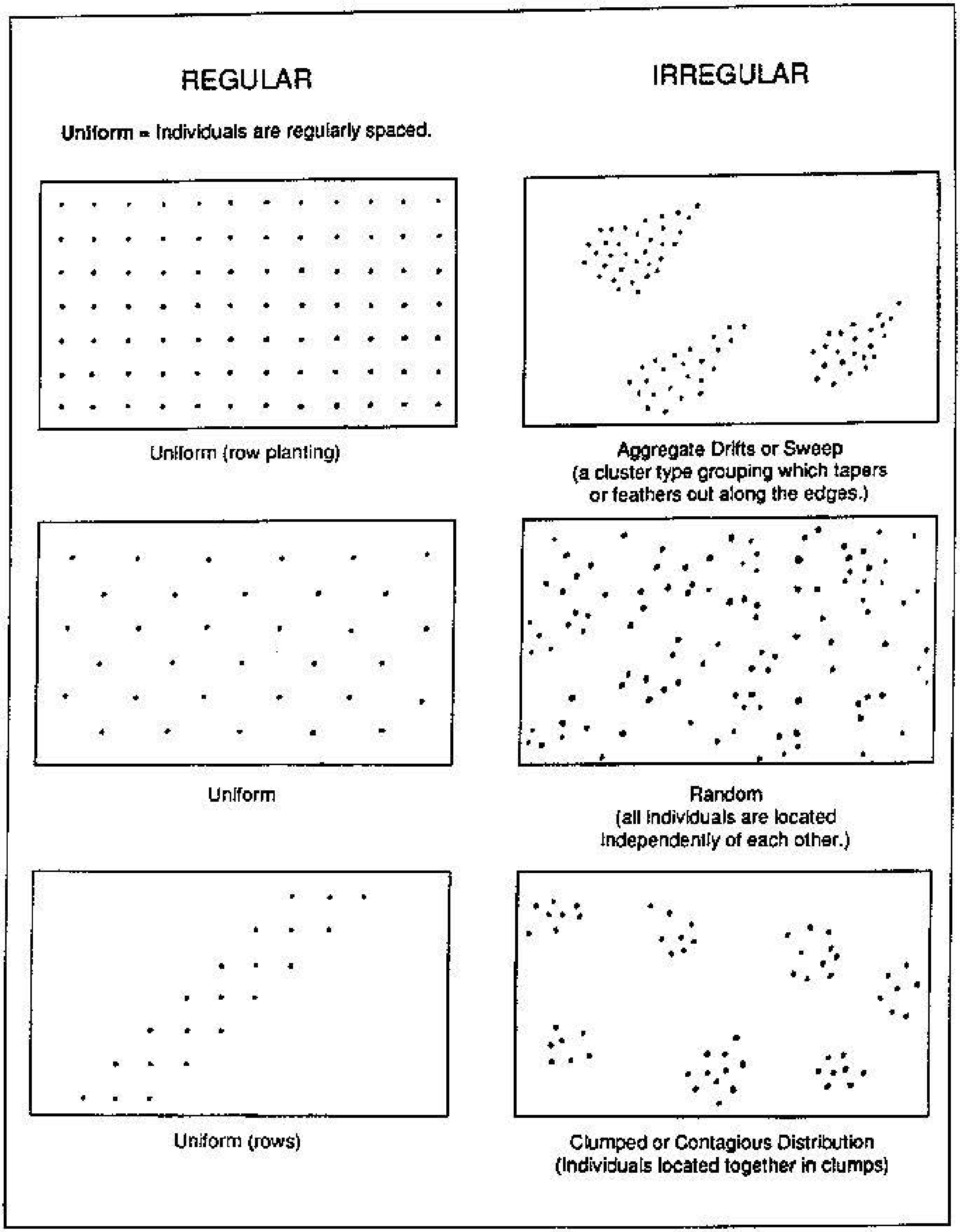


Figure A.5.
Examples illustrating conditions of layer coverage (element 11b)



Uniform = Individuals are regularly spaced.

Uniform (row planting)

Aggregate Drifts or Sweep
(a cluster type grouping which tapers
or feathers out along the edges.)

Uniform

Random
(all individuals are located
independently of each other.)

Uniform (rows)

Clumped or Contagious Distribution
(Individuals located together in clumps)

Figure A.6.
Examples of spatial patterns (element 11c)

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both are NA, record NA
		WAA	Planned Wetland	

12. Cover types (27 listed) (refer to Table A.3):

Trees:
Needle-leaved evergreen
Broad-leaved evergreen
Needle-leaved deciduous
Broad-leaved deciduous
Dead

Emergent:
Tall persistent
Short persistent
Tall nonpersistent
Short nonpersistent

Scrub-Shrub:
Tall evergreen
Bushy evergreen
Low compact evergreen
Tall deciduous
Bushy deciduous
Low compact deciduous
Dead

Moss-lichen:
Moss
Lichen

Non-vegetative:
Bedrock
Rubble
Cobble-gravel
Sand
Mud
Organic
Dead fallen trees/shrubs
Open Water

Aquatic-bed:
Rooted-vascular

12a. Number of cover types in each layer at site [WL]

Decide minimum coverage and use this minimum to determine which cover types at the site will be included in the evaluation:

_____ 10% _____ 5% _____ Other

Thus, an area must be at least _____ (e.g., 10%) of the wetland site size to be recognized as a separate cover type.

Fill in the following information:

Wetland: # of cover types		Calculation of Relative score \# of cover types / 27	
	(e.g.)		(example)
WAA : _____	(1)	_____	(1/27=0.04)
Planned : _____	(4)	_____	(4/27=0.15)

12b. Ratio of cover types **(See Figure A.7)**. (Consider canopy cover of each cover type in each layer.) [WL]

a. Approximately equal proportions.	1.0
b. Intermediate condition.	0.5
c. Predominantly 1 cover type.	0.1

12c. Degree of cover type interspersion **(See Figure A.8)**. [WL]

a. High.	1.0
b. Intermediate condition.	0.5
c. Low -OR- no interspersion (1 cover type)	0.1

Table A.3.
Description of Cover Types

Cover types based upon classification schemes of Cowardin et al. (1979) and Golet and Larson (1974). Definitions taken directly from Cowardin et al. (1979), unless otherwise indicated.

TREES. Woody vegetation that is 6 m (20 ft) or taller.

Needle-leaved evergreen. Areas dominated by woody gymnosperms with green, needle-shaped, or scale-like leaves that are retained by plants throughout the year. Examples:

black spruce	*Picea mariana*
Northern white cedar	*Thuja occidentalis*
Atlantic white cedar	*Chamaecyparis thyoides*

Broad-leaved evergreen. Areas dominated by woody angiosperms with relatively wide, flat leaves that generally remain green and are usually persistent for a year or more. Examples:

red mangrove	*Rhizophora mangle*
black mangrove	*Avicennia germinans*
white mangrove	*Laguncularia racemosa*
red bay	*Persea borbonia*
loblolly bay	*Gordonia lasianthus*
sweet bay	*Magnolia virginiana*

Needle-leaved deciduous. Areas dominated by woody gymnosperms with needle-shaped or scale-like leaves that are shed during the cold or dry season. Example:

bald cypress	*Taxodium distichum*

Broad-leaved deciduous. Areas dominated by woody angiosperms with relatively wide, flat leaves that are shed during cold or dry season. Examples:

black ash	*Fraxinus nigra*
red ash	*F. pennsylvanica*
American elm	*Ulmus americana*
black gum	*Nyssa sylvatica*
tupelo gum	*N. aquatica*
swamp white oak	*Quercus bicolor*
overcup oak	*Q. lyrata*
basket oak	*Q. michauxii*
red maple	*Acer rubrum*

Dead. Areas dominated by dead woody vegetation taller than 6 m (20 ft).

SCRUB-SHRUB. Area dominated by woody vegetation less than 6 m (20 ft) tall (including vines).

Tall evergreen.* Areas dominated by woody gymnosperms 3 to 6 m (10 to 20 ft) tall. Examples:

black spruce	*Picea mariana*
pond pine	*Pinus serotina*
young trees	(ex. *Rhizophora mangle* *Laguncularia racemosa* *Avicennia germinans*)

Bushy evergreen.* Areas dominated by woody gymnosperms 1.2 to 2 m (4 to 7 ft) tall. Examples:

sweet gale	*Myrica gale*
coastal sweetbells	*Leucothoe axillaris*
fetterbush	*Lyonia lucida*
inkberry	*Ilex glabra*

Low compact evergreen.* Areas dominated by woody gymnosperms less than 1.2 m (4 ft) tall. Examples:

sheep laurel	*Kalmia angustifolia*
bog laurel	*K. polifolia*
leatherleaf	*Chamaedaphne calyculata*
labrador tea	*Ledum groenlandicum*
bog rosemary	*Andromeda glaucophylla*
black ti-ti	*Cyrilla racemiflora*

Table A.3.
Description of Cover Types

(continued)

Tall deciduous.[*] Areas dominated by woody angiosperms 3 to 6 m (10 to 20 ft) tall. Examples:

speckled alder	*Alnus rugosa*
highbush blueberry	*Vaccinium corymbosum*
young trees	(e.g., red maple - *Acer rubrum*)
willow	*Salix* spp.

Bushy deciduous.[*] Areas dominated by woody angiosperms 1.2 to 2 m (4 to 7 ft) tall. Examples:

sea-myrtle	*Baccharis halimifolia*
marsh elder	*Iva frutescens*
buttonbush	*Cephalanthus occidentalis*
silky dogwood	*Cornus ammomum*
willow	*Salix* spp.
sweet pepper-bush	*Clethra alnifolia*
bog birch	*Betula pumila*

Low compact deciduous.[*] Areas dominated by woody angiosperms less than 1.2 m (4 ft) tall. Examples:

marsh elder	*Iva frutescens*
silky dogwood	*Cornus ammomum*

EMERGENT. Area dominated by erect, rooted, herbaceous angiosperms that may be temporarily to permanently flooded at the base but do not tolerate prolonged inundation of the entire plant.

Tall persistent.[*] Emergent hydrophytes over 1.5 m (5 ft) tall that normally remain standing at least until the beginning of the next growing season. Examples:

cattails	*Typha* spp.
reed	*Phragmites australis*
purple loosestrife	*Lythrum salicaria*
water willow	*Decodon verticillatus*
salt-marsh cordgrass (tall form)	*Spartina alterniflora*
big cordgrass	*S. cynosuroides*
southern wild rice	*Zizaniopsis miliacea*

Short persistent.[*] Emergent hydrophytes less than 1.5 m (5 ft) tall that normally remain standing at least until the beginning of the next growing season. Examples:

salt-marsh cordgrass (short form)	*Spartina alterniflora*
California cordgrass	*S. foliosa*
sedges	*Carex* spp.
needlerush	*Juncus roemerianus*
rice-cutgrass	*Leersia oryzoides*
common pickleweed	*Salicornia virginica*
bulrushes	*Scirpus* spp.
manna grasses	*Glyceria* spp.

Tall nonpersistent.[*] Emergent hydrophytes over 1.5 m (5 ft) tall whose leaves and stems break down at the end of the growing season so that most above-ground portions of the plants are easily transported by currents, waves, or ice. Example:

wild rice	*Zizania aquatica*

Short nonpersistent.[*] Emergent hydrophytes less than 1.5 m (5 ft) tall whose leaves and stems break down at the end of the growing season so that most above-ground portions of the plants are easily transported by currents, waves, or ice. Note: If waves, currents, or ice removes all traces of emergent vegetation, then classify as short nonpersistent. Examples:

arrow arum	*Peltandra virginica*
pickerelweed	*Pontedaria cordata*
arrowheads	*Sagittaria* spp.

Table A.3.
Description of Cover Types

(continued)

MOSS-LICHEN. Areas where mosses or lichens cover substrates other than rock and where emergents, shrubs, or trees make up less than 30% of the areal cover.

Moss. Areas dominated by mosses. Examples:

peat mosses	*Sphagnum* spp.
moss	*Campylium stellatum*
moss	*Aulacomnium palustre*
moss	*Oncophorus wahlenbergii*

Lichen. Areas dominated by lichens. Example:

reindeer moss	*Cladonian rangiferina*

AQUATIC-BED. Areas dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years.

Rooted vascular. Areas dominated by rooted vascular plants that grow principally on or below the surface of the water for most of the growing season in most years. Examples:

turtle grass	*Thalasia testudinum*
shoalgrass	*Halodule wrightii*
widgeon grass	*Ruppia maritima*
wild celery	*Vallisneria americana*
eelgrass	*Zostera marina*
pondweed	*Potamogeton* spp.
naids	*Najas* spp.
water milfoil	*Myriophyllum* spp.
ditch grasses	*Ruppia* spp.
waterweed	*Elodea* spp.
yellow water lily	*Nuphar luteum*
water lilies	*Nymphaea* spp.
water smartweed	*Polygonum emphibium*

NON-VEGETATIVE.* Areas characterized by a lack of live vegetation cover.

Bedrock. Area characterized by a bedrock substrate covering 75% or more of the surface and less than 30% areal coverage of macrophytes.

Rubble. Area characterized by aerial cover with less than 75% bedrock, but stones and boulders alone, or in combination with bedrock, cover 75% or more of the surface.

Cobble-gravel. Area dominated by cobble and/or gravel. Cobbles are defined as rock fragments 7.6 cm (3 in) to 25.4 cm (10 in) in diameter. Gravel is a mixture composed primarily of rock fragments 2 mm (0.8 in) to 7.6 cm (3 in) in diameter; it usually contains sand.

Sand. Area dominated by sand. Sand is composed predominantly of coarse-grained mineral sediments with diameters larger than 0.074 mm and smaller than 2 mm.

Mud. Areas dominated by mud, i.e., wet soft earth composed predominantly of clay and silt-fine mineral sediments less than 0.074 mm in diameter.

Organic. Areas dominated by organic soil, i.e., soil composed of predominantly organic rather than mineral material.

Dead fallen trees/shrubs.* Area dominated by dead fallen trees and/or shrubs.

Open water. Water of any depth with no woody or emergent vegetation.

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*Definitions modification of Cowardin et al. (1979) and Golet and Larson (1974).

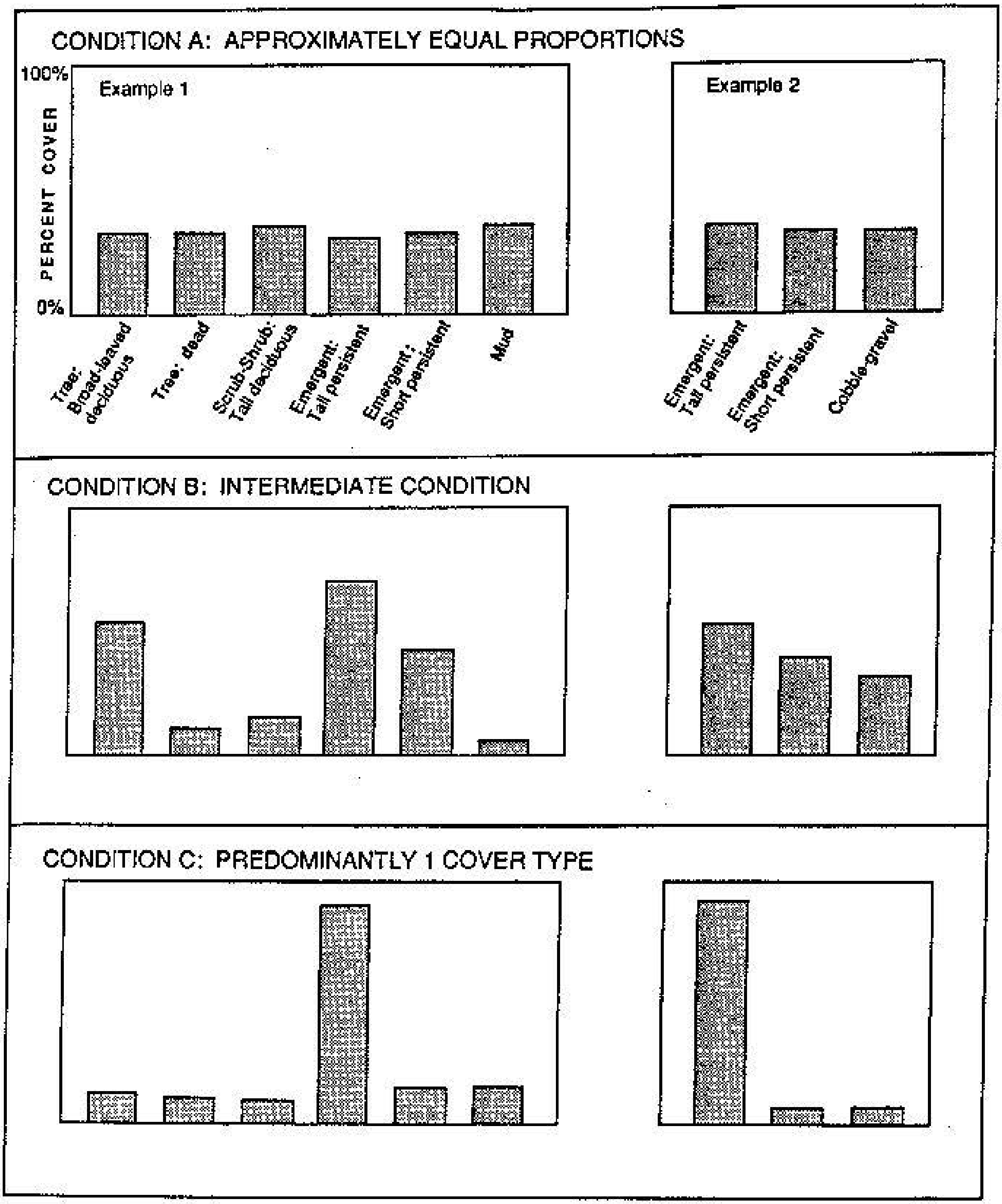


Figure A.7.
Examples illustrating conditions for ratio of cover types (element 12b)

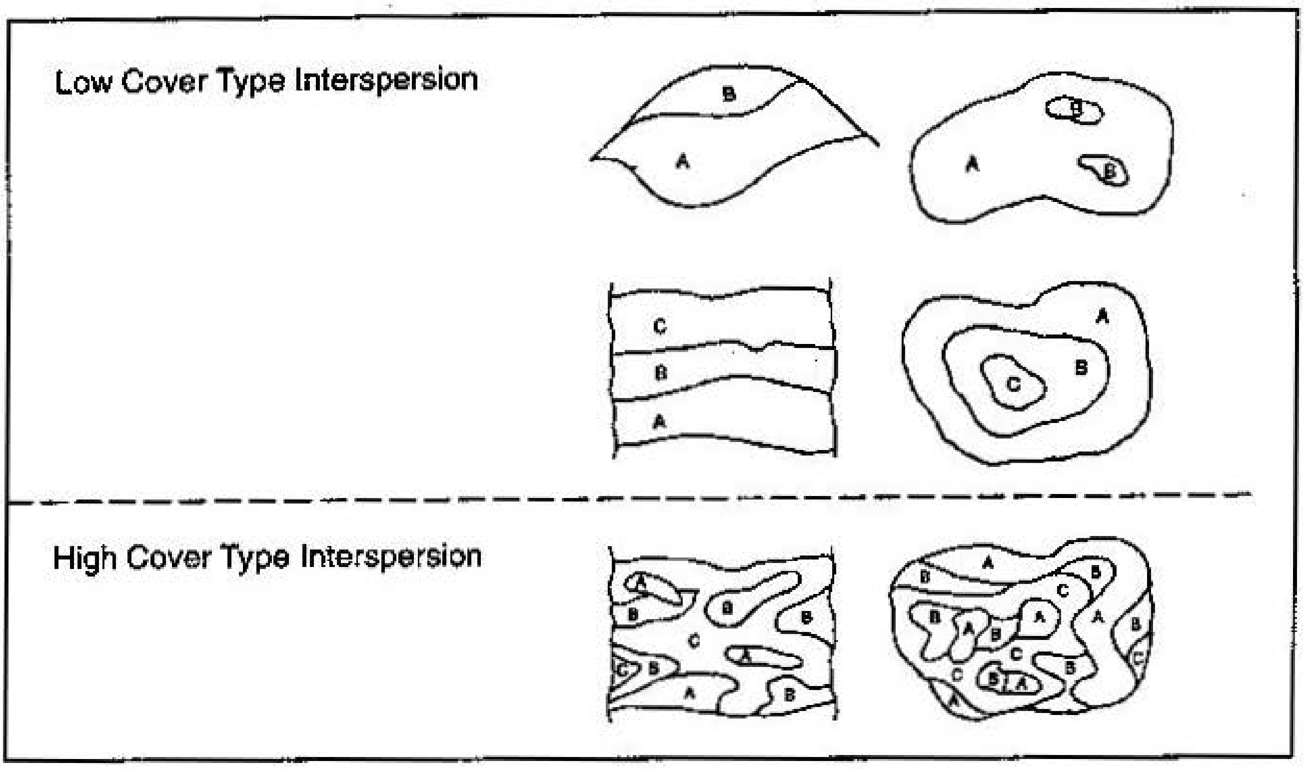
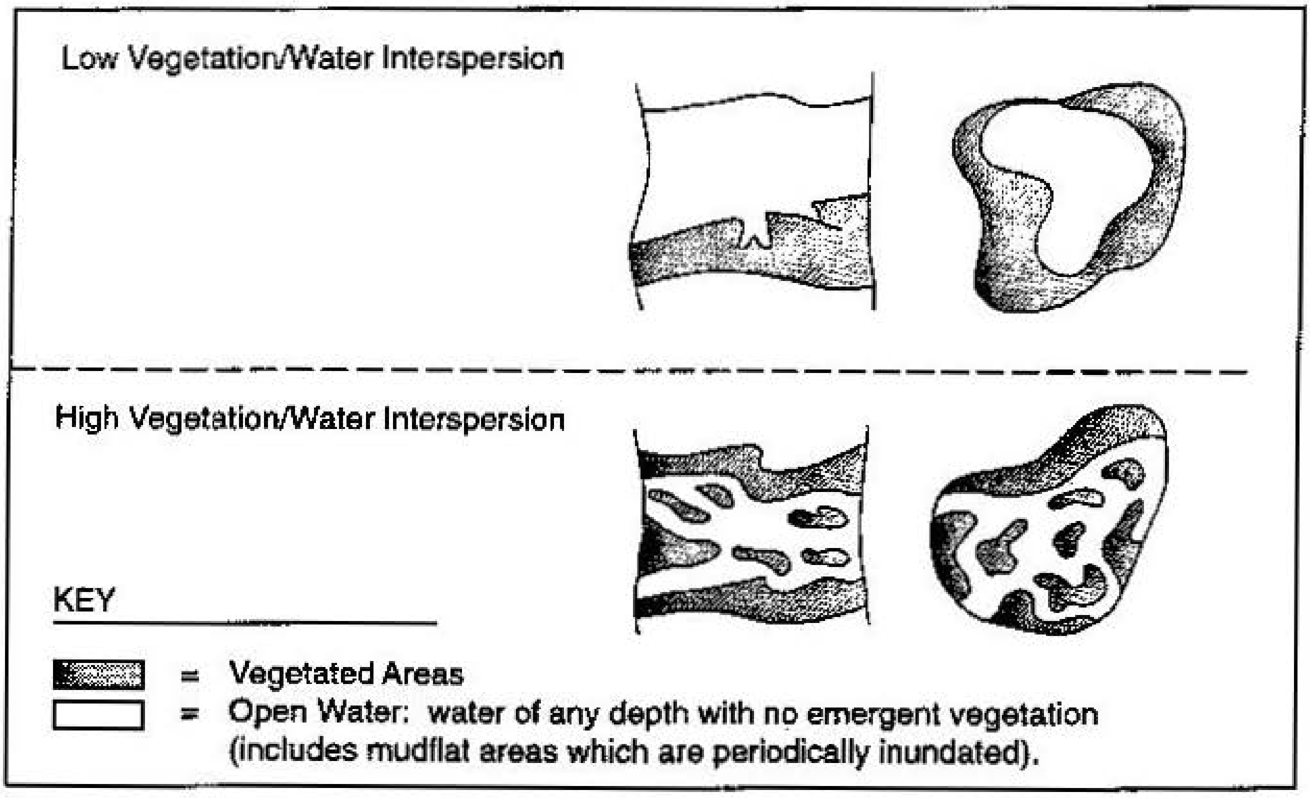


Figure A.8.
Cover type interspersion (element 12c)



KEY

▨ = Vegetated Areas

☐ = Open Water: water of any depth with no emergent vegetation (includes mudflat areas which are periodically inundated).

Figure A.8.
Vegetation/water interspersion (element 13b)

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA)
		WAA	Planned Wetland	If both are NA, record NA
12d. Undesirable species	[WL]			Assume NA = 1.0
a. Vegetation species which are considered to have limited habitat value (e.g., *Phragmites australis*, *Lythrum salicaria*) are absent -OR- If present, do not dominate site.	NA			
b. Site dominated by vegetation species considered to have limited habitat value. If present, identify species:	0.1			
12e. Difference in cover types	[WL]			Record both scores.
a. Planned wetland **contains** same cover types as WAA.	NA	NA		
b. Planned wetland **does not contain** same cover types as WAA.	1.0			
If answer "b", explain:				
13. Vegetation/water proportions				
13a. Percent open water (Open water = water of any depth with no woody or emergent vegetation. Include mudflat areas which are periodically inundated. Note: in tidal systems estimate open water coverage at mid-tide.)	[WL]			If one NA, record both scores.
a. Approximately 50%.	1.0			
b. Intermediate condition (e.g, 10 - 30% or 70 - 90%).	0.5			
c. Open water absent or minimal coverage (e.g., < 10%) -OR- open water predominant cover (e.g., > 90%).	0.1			
13b. Degree of vegetation/water interspersion (See Figure A.9).	[WL]			If one NA, record both scores.
a. High.	1.0			
b. Intermediate condition.	0.5			
c. Low -OR- no interspersion (e.g., site all vegetation or all open water).	0.1			

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both are NA, record NA
		WAA	Planned Wetland	
21. Shape of edge				
21a. Shape of upland/wetland edge (See Figure A.10).	[WL]			
a. Upland/wetland edge absent.	NA			
b. Irregular.	1.0			
c. Regular, smooth.	0.1			
22. Fish and wildlife attractors (in wetland only)				Assume NA = 0
22a. Wildlife attractors	[WL]			
Abundance of cover, other than live vegetation (e.g., snags, dense brush, fallen tree/logs, rocks/boulders, or artificial attractors).				
a. Absent or sparse.	NA			
b. Moderate to abundant.	1.0			
If present, check type of attractors and estimate percent cover. In some cases it may be best to count and record the number of attractors (e.g., nesting boxes).				

Attractor	WAA	Planned Wetland
Snags	____	____
Dense brush	____	____
Brush piles	____	____
Fallen trees/logs	____	____
Rocks/boulders	____	____
Artificial:		
Nesting structures	____	____
Roosting sites	____	____
Artificial tree cavities	____	____
Other:__________	____	____

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	WAA	Planned Wetland	DIFFERENCE IN SCORES (Planned - WAA)
23. Islands	[WL]			
a. Upland island(s) present.	1.0			
b. Upland island absent.	0.1			

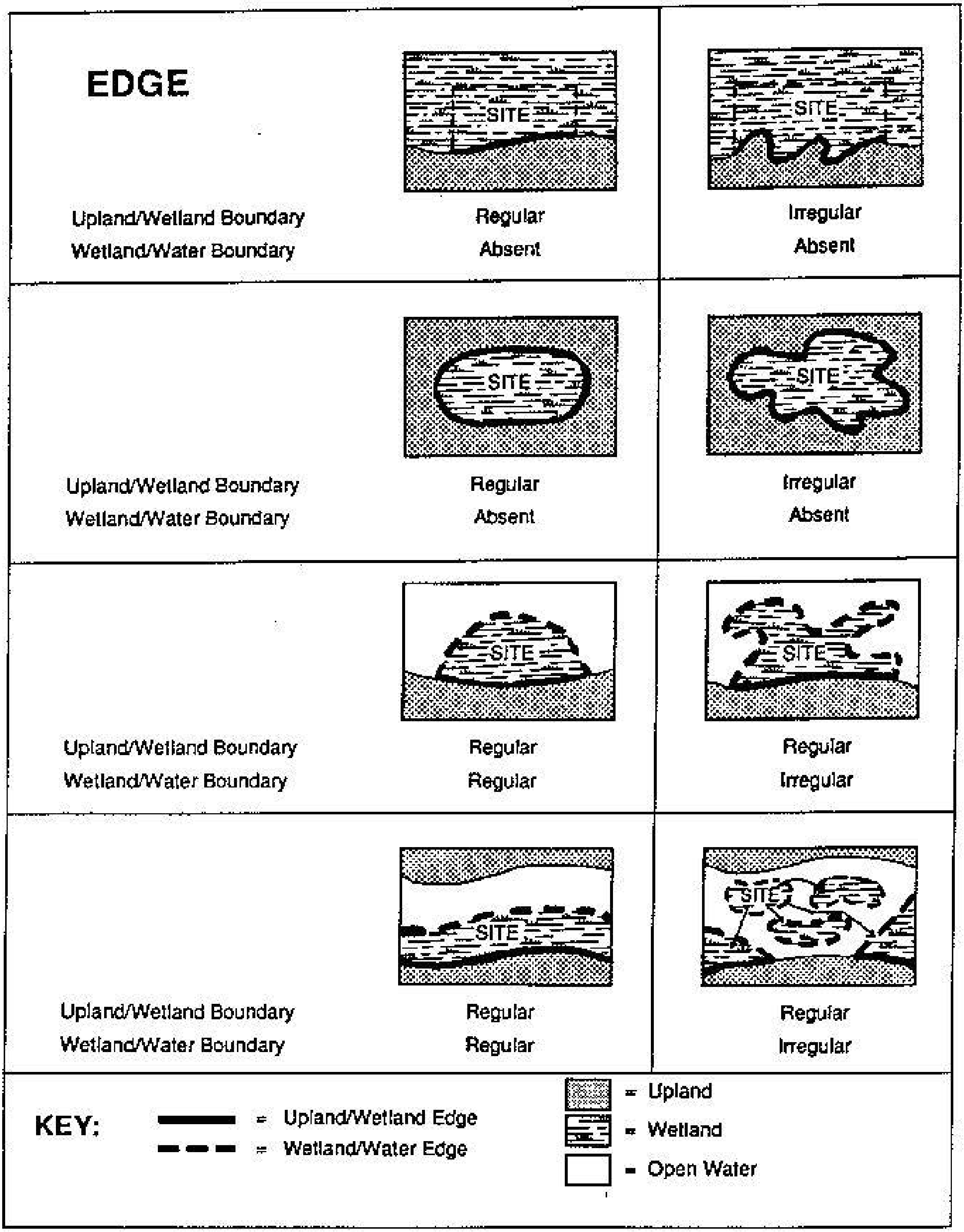


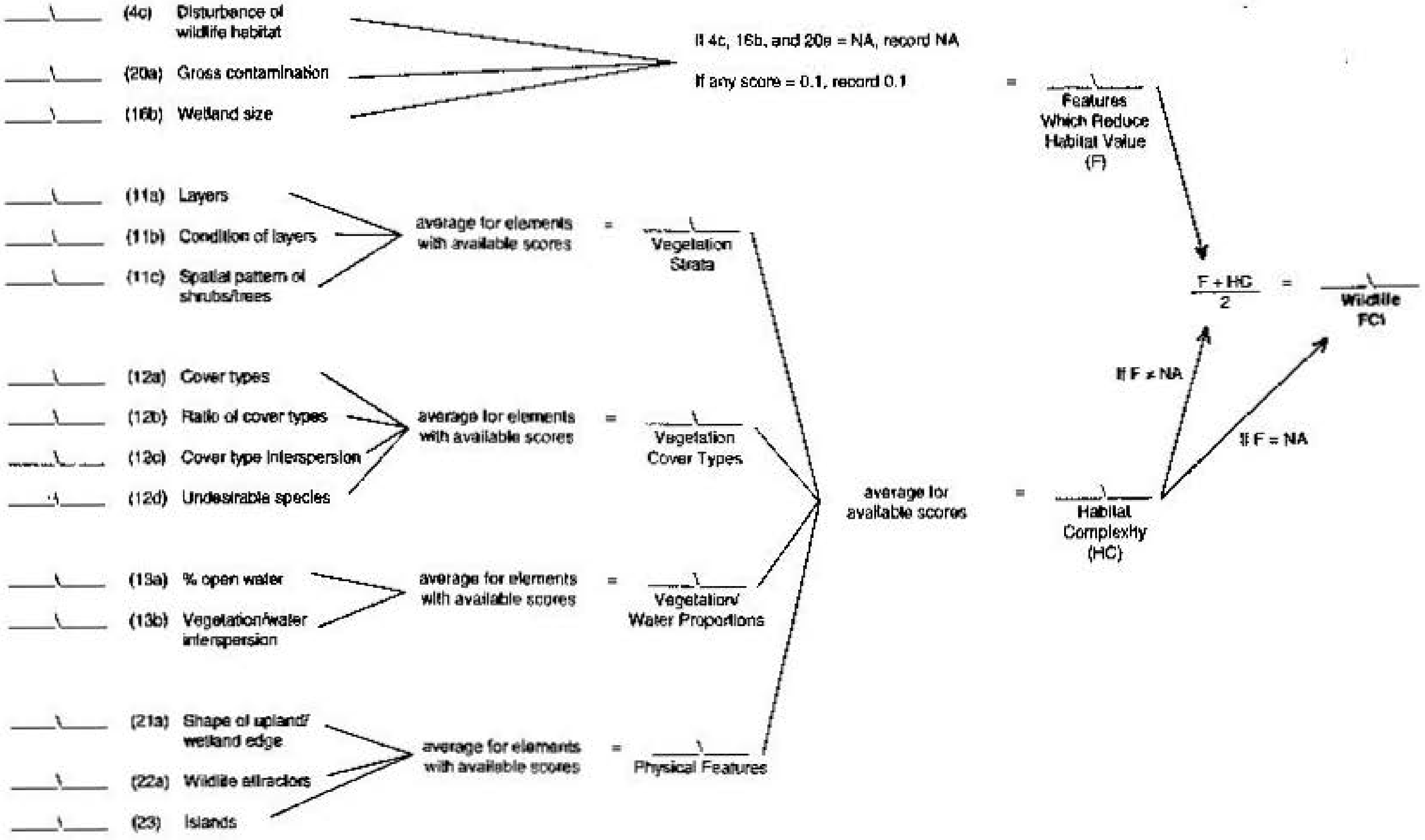
Figure A.10.
Examples of regular and irregular boundaries at the upland/wetland and wetland/water edges (element 21)

Calculation of **WILDLIFE** FCI

PROJECT TITLE: ____________________

Selected Scores | (#) | Element

COMPARISON: ____ (e.g., WAA/planned wetland)



________ (4c) Disturbance of wildlife habitat

________ (20a) Gross contamination

________ (16b) Wetland size

If 4c, 16b, and 20a = NA, record NA

If any score = 0.1, record 0.1

= ________ Features Which Reduce Habitat Value (F)

________ (11a) Layers

________ (11b) Condition of layers

________ (11c) Spatial pattern of shrubs/trees

average for elements with available scores = ________ Vegetation Strata

________ (12a) Cover types

________ (12b) Ratio of cover types

________ (12c) Cover type interspersion

________ (12d) Undesirable species

average for elements with available scores = ________ Vegetation Cover Types

________ (13a) % open water

________ (13b) Vegetation/water interspersion

average for elements with available scores = ________ Vegetation/ Water Proportions

________ (21a) Shape of upland/ wetland edge

________ (22a) Wildlife attractors

________ (23) Islands

average for elements with available scores = ________ Physical Features

average for available scores = ________ Habitat Complexity (HC)

If F ≠ NA

If F = NA

$\frac{F + HC}{2}$ = ________ **Wildlife FCI**

PROJECT TITLE: ______________________________

FISH (Tidal)
DATA SHEETS

Function weighting area (AREA) = That portion of the assessment area which, based upon water regime, has the capacity to support tidal fish (e.g., tidally influenced areas up to line of spring high tides).

		For use in FCI model		For use in Table A.2 only
ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
Suitability for tidal fish (element 24):				
24. Obstruction to on-site fish passage (obstruction can be on- or off-site)	[FT, FS, FP]*			Assume NA = 1.0
a. No barrier(s) present.	NA			
b. Barrier(s) present, but conditions modified to permit fish passage (e.g., fish ladder, installation of culverts in mosquito control impoundments to re-establish tidal exchange and fish passage).	NA			
c. Barriers present, and utilized for fish management practices.	NA			
d. Site isolated, but utilized by fish (e.g., pond).	NA			
e. Condition(s) present which curtail fish passage (e.g., impingement on industrial intakes) or interfere with migratory cycles (e.g., semi-impoundment control structures such as weirs, undersized culvert).	0.5			
f. Condition(s) present which imposes absolute physical (e.g., impoundment for mosquito control, tide gate, dam, waterfall, thermal plume), chemical (extreme in pH), or behavioral barriers to fish passage. **Fish access to the site and survival at site is precluded.**	0.1			

If score for element 24 = 0.1, then there is no potential for providing the tidal fish function; therefore, the Fish (Tidal) FCI is not applicable (NA). Continue if scores = NA or 0.5.

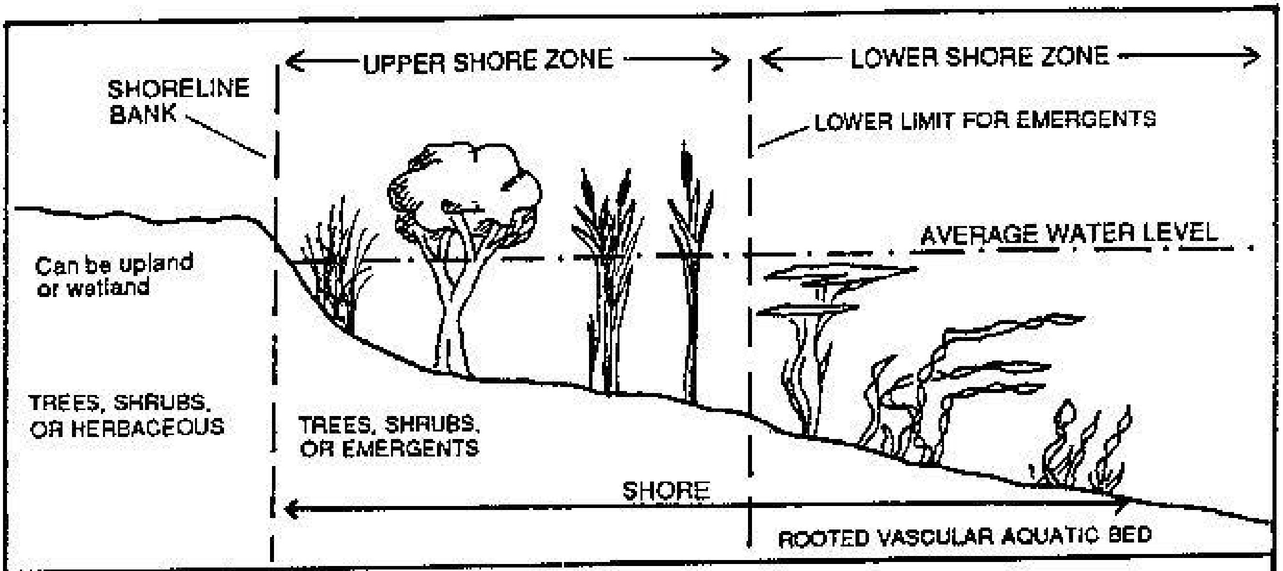
---

* Denotes funtion(s) to which element applies: SB = Shoreline Bank Erosion Control; SS = Sediment Stabilization; WQ = Water Quality; WL = Wildlife; FT = Fish (Tidal); FS = Fish (Stream/River); FP = Fish (Pond/Lake); and UH = Uniqueness/Heritage

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
Disturbance factors (elements 1b, 4a, 4d, 7b, and 24):				
1. **Bank characteristics**				
1b. Shoreline bank stability	[FT, FS, FP]			Assume NA = 1.0
a. No shoreline on-site.	NA			
b. Shoreline bank erosion is minimal (e.g., > 75% bank surface protected by vegetation, boulders/rubble/gravel, or other materials).	NA			
c. Shoreline bank erosion is moderate.	0.5			
d. Shoreline bank erosion is substantial (e.g., < 25% bank surface protected).	0.1			
4. Disturbance				
4a. Disturbance at site (Sediment Stabilization)	[SB, SS, FT, FS, FP]			Assume NA = 1.0
(Do not include observations of debris)				
a. No or minimal disturbance.	NA			
b. Potential for periodic disturbance present, but preventative action taken (e.g., installation of exclosure fences for herbivores and/or human disturbance) -OR- if recently disturbed, soils sufficiently stabilized with mulch, seeding, or planting.	NA			
c. Moderate disturbance (e.g., disturbance of sediments only in portion of site; infrequent grazing by waterfowl).	0.5			
d. Evidence of substantial periodic disturbance which makes substrate unstable (e.g., muskrat eatouts, overgrazing by waterfowl, cattle grazing and trampling, nutria activity, human activity such as the use of off-road vehicles; wetland tilled, filled, logged, clear-cut or excavated and not stabilized by seeding or planting).	0.1			

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
4d. Disturbance of channel/open water bottom (Open water = water of any depth with no emergent vegetation)	[FT, FS, FP]			Assume NA = 1.0
a. Channel/open water absent.	NA			
b. No or minimal recent disturbance.	NA			
c. Channel/open water disturbed in the past (e.g., dredged, channelized), but has begun to recover some of the natural channel/open water and shoreline characteristics (e.g., return to near original depths; and re-establishment of aquatic and shoreline vegetation, fallen trees, woody debris, and rocks).	0.5			
d. Channel/open water recently disturbed (e.g., filled, confined to culvert, or dredged in past year) -OR- substantially altered to prevent recovery of natural characteristics (e.g., cement channel).	0.1			
7. Hydroperiod				
7b. Most permanent hydroperiod	[FT]			Assume NA = 1.0
a. Natural tidal hydroperiod -OR- if the area is impounded, provisions have been made (e.g., culverts installed) so that hydroperiod mimics natural hydroperiod.	NA			
b. Hydroperiod usually follows natural tidal hydroperiod (e.g., hydroperiod periodically altered to manage for mosquito control).	0.5			
c. Hydroperiod does not or rarely follows natural tidal hydroperiod.	0.1			
24. Obstruction to on-site fish passage (Element already answered above.)				
Description of available food/cover (elements 7c, 9c, 10d, 10f, 21b, and 22b):				
7. Hydroperiod				
7c. Spatially dominant hydroperiod	[FT]			
a. Regularly flooded (e.g., low marsh).	1.0			
b. Both irregularly flooded and regularly flooded vegetated codominant (i.e., high and low marsh approximately equal proportions).	0.5			
c. Irregularly flooded (e.g., high marsh).	0.2			
d. Deep water (e.g., > 2 m at low tide).	0.1			

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
9. **Substrate**				
9c. Substrate suitability for fish	[FT]			
a. > 75% mud.	1.0			
b. 25 - 75% mud.	0.5			
c. < 25% mud; composed predominantly of hard material (e.g., sand, rock, shell).	0.2			
d. All hard material (e.g., rock, shell).	0.1			
10. **Vegetation characteristics during growing season** (Note definition of lower shore zone in **Figure A.2**)				
10d. **Percent plant (basal) cover excluding lower shore zone.** (Consider only those parts of vegetation which have contact with water flow. See **Figure A.3.**)	[FT]			If one NA, record both scores.
a. Assessment area is all lower shore zone.	NA			
b. > 75%.	1.0			
c. 51 - 75%.	0.7			
d. 25 - 50%.	0.3			
e. < 25%.	0.1			
10f. Percent cover of rooted vascular aquatic beds in **lower shore zone**. (See **Figure A.2.**)	[FT]			If one NA, record both scores.
a. No lower shore zone.	NA			
b. Cover > 75%.	1.0			
c. Cover 51 - 75%.	0.7			
d. Cover 25 - 50%.	0.3			
e. Cover < 25%.	0.1			
21. Shape of edge				
21b. Vegetated wetland/water edge (e.g., shape of tidal creek or channel) (See **Figure A.10.**)	[FT, FS, FP]			
a. Irregular.	1.0			
b. Regular, smooth.	0.5			
c. Edge absent or minimal (i.e., no channel in study wetland area).	0.1			



Shoreline Bank:	Steep ascending slope of land of any height raised above the adjacent shore that can experience undercutting if it is in contact with water.
Shore:	Vegetated or non-vegetated substrate located channelward of the bank.
Upper Shore Zone:	Vegetated or non-vegetated portion of the shore located between the bank and the potential lower limit of emergent or woody vegetation as dictated by water depth or tide level.
Lower Shore Zone:	Vegetated or non-vegetated portion of the shore located channelward of the potential lower limit of emergent or woody vegetation.
Entire Wetland:	Includes wetland areas landward of the bank, the bank, the upper shore zone, and the lower shore zone.

Examples: Aerial View of Wetlands

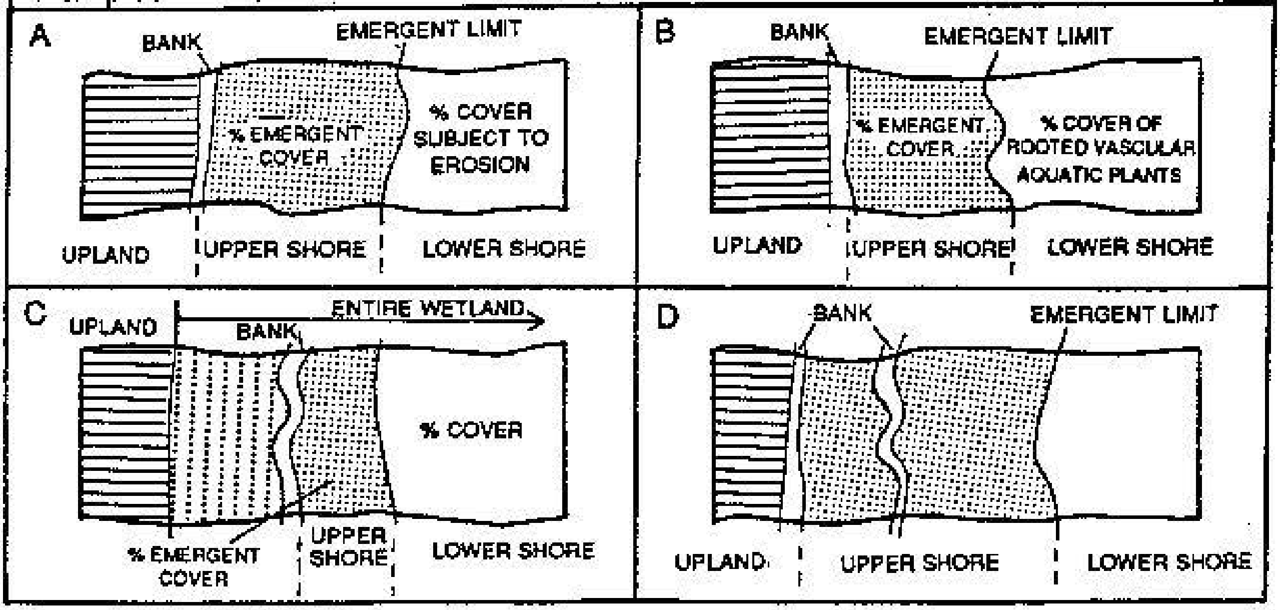
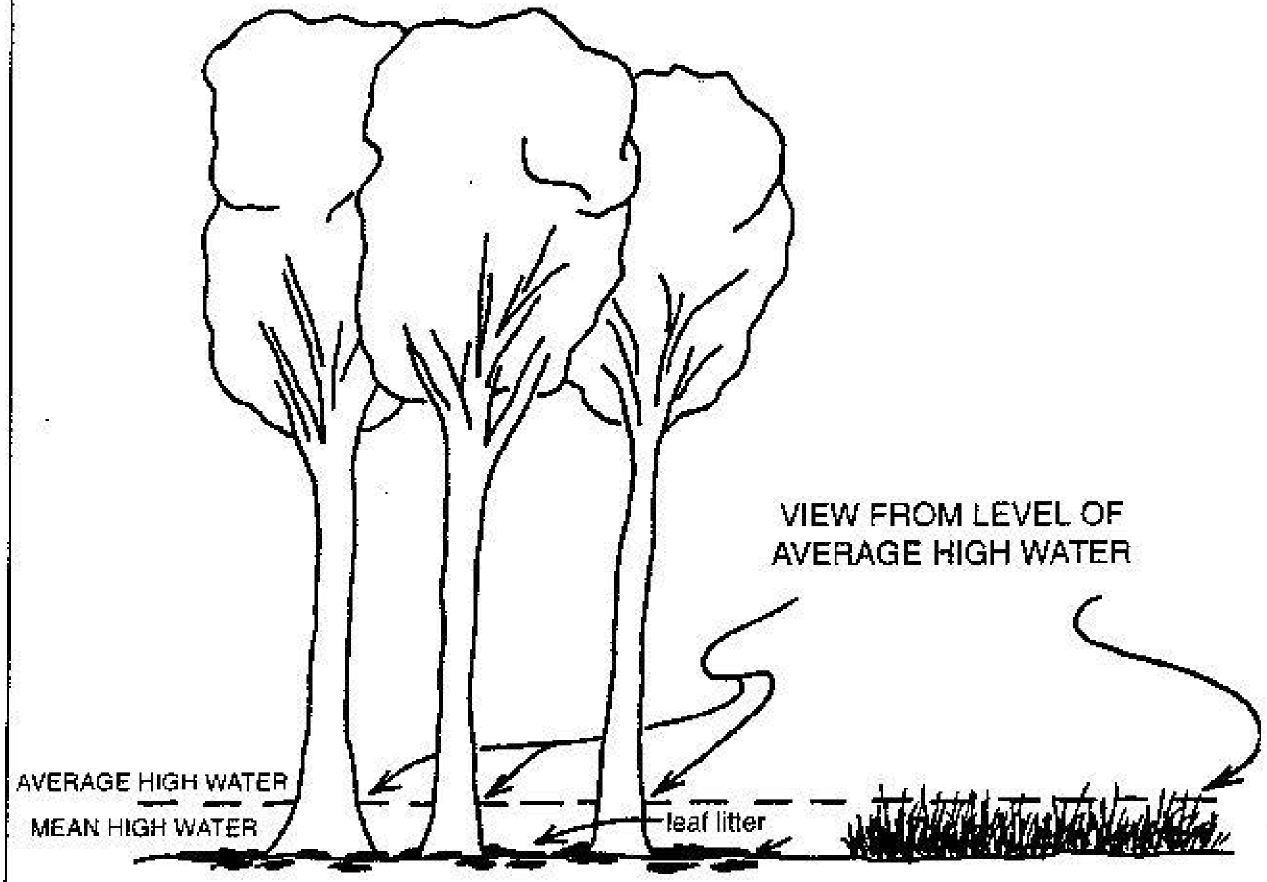


Figure A.2.
Definitions of shoreline bank, shore, upper shore zone, lower shore zone, and entire wetland (element 10)



Examples:

	Forest	Emergent Marsh
Percent (Basal) Cover (Elements 10a, 10b, or 10d)	<25%	>75%
Percent Leaf Litter & Debris Cover (Element 10c)	>75%	Ground surface areas almost entirely covered by live vegetation

Figure A.3.
Percent plant cover (elements 10a, 10b, 10c, and 10d)

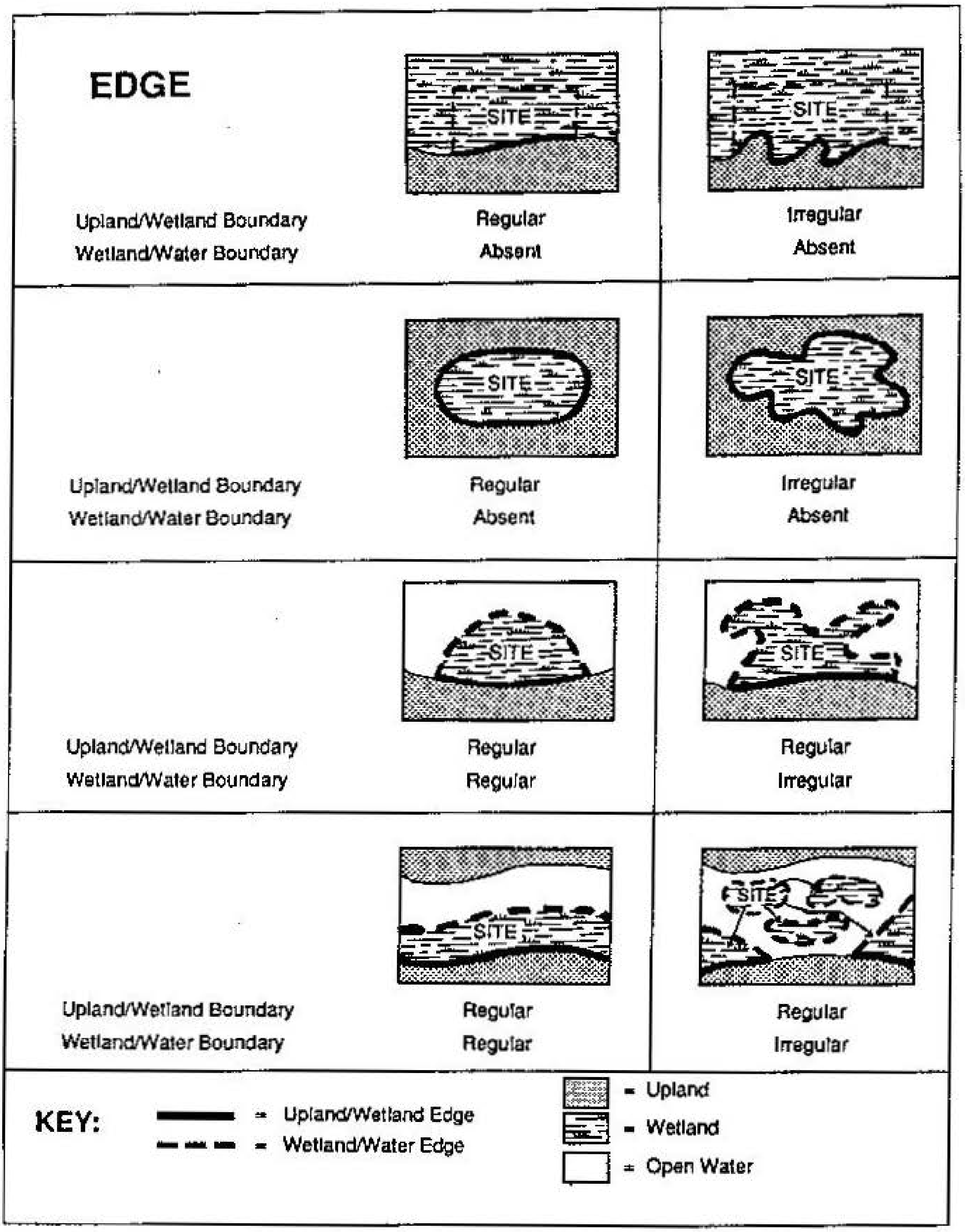


Figure A.10.
Examples of regular and irregular boundaries at the upland/wetland and wetland/water edges (element 21)

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
22. Fish and wildlife attractors				
22b. Available fish cover/attractors	[FT, FS, FP]			Assume NA = 0
Abundance of cover, **other than live vegetation** (e.g., snags, dense brush, fallen tree/logs, rocks/boulders, or artificial attractors), accessible to fish anytime of year				
Estimate potential cover for this habitat type in region (e.g., 15%): ____________. Note abundance relative to this optimum.				
a. Abundant.	1.0			
b. Moderate cover.	0.5			
c. No cover or sparse.	0.1			
d. Excessive (e.g., 90% debris and garbage).	0.1			
If present, check type of attractors and estimate percent cover. In some cases it may be best to count and record number of attractors.				

Attractor	WAA	Planned Wetland
Dense brush	___	___
Fallen trees/logs	___	___
Rocks/boulders	___	___
Artificial:		
Stake beds	___	___
Junk metal (e.g., cars)	___	___
Boats, barges	___	___
Concrete products	___	___
Artificial seaweed	___	___
Tire structures	___	___
Shellfish attractor	___	___
Brush piles	___	___
Vitrified clay pipe	___	___
Low check dam	___	___
Other: __________	___	___

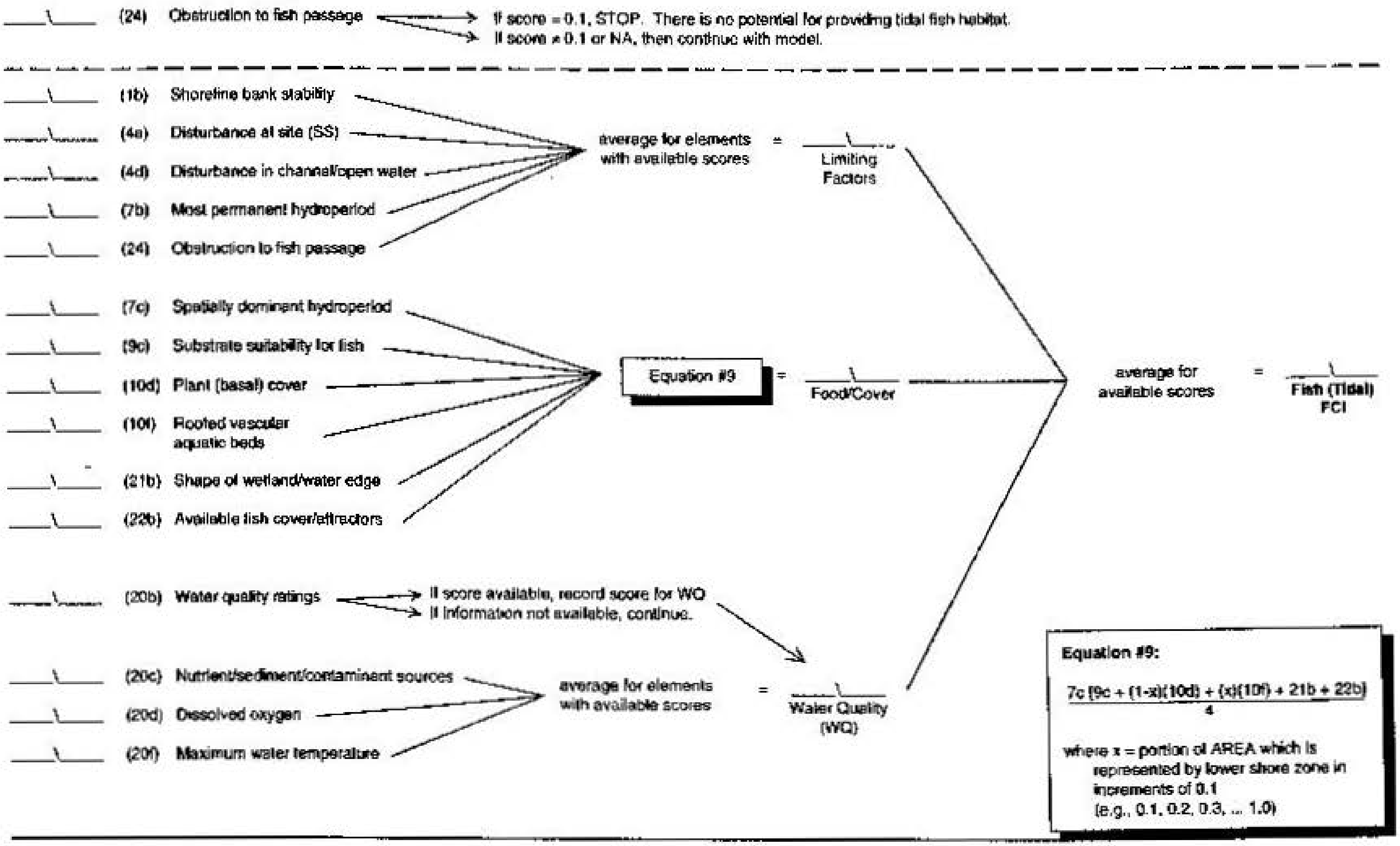
ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
Factors describing water quality (elements 20b, 20c, 20d, and 20f):				
20. Water quality				
20b. Water quality ratings	[FT, FS, FP]			If one INA, record both scores.
Define state water quality ratings and assign to following categories:				
High: ______________				
(e.g., Class A = no or minimal pollution)				
Moderate: ______________				
(e.g., Class B and C = moderate pollution)				
Low: ______________				
(e.g., Class D = severe pollution)				
Water quality rating for waterway:				
a. Information not available.	INA			
b. High.	1.0			
c. Moderate.	0.5			
e. Low.	0.1			

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA)
		WAA	Planned Wetland	If both scores are NA, record NA
20c. Evidence of nutrient, sediment, or contaminant sources (If more than one score applicable, record lowest score).	[FT, FS, FP]			If one INA, record both scores.
a. Information not available.	INA			
b. Little or no potential for nutrient, sediment, or contaminant input.	1.0			
c. Evidence of or potential for moderate nutrient, sediment, or contaminant input.	0.5			
d. Evidence of high nutrient concentration in the wetland/waterway (e.g., recurrent algal blooms) or known source(s) contributing nutrients to the wetland/waterway (e.g., sewage outfalls, mine tailings, landfills, septic fields, active pasturelands and croplands).	0.1			
e. Evidence of high inorganic sediment input (e.g., stormwater outfalls; irrigation return flows; direct observation of sediment inputs, i.e., sediment plumes of turbid water at inlet; predominant soils/slopes classified as eroding or erosion hazard by SCS).	0.1			
f. Evidence of presence of contaminants (e.g., stunted plant growth, excessive growth, and/or abnormal morphology; oil sheen on marsh surface -AND/OR- known source(s) contributing contaminants to the wetland/waterway (e.g., hazardous water sites, superfund sites, landfills).	0.1			
g. Evidence of conditions known to stress fish (e.g., low DO, high turbidity, extremes in temperature, thermal plume).	0.1			
20d. Dissolved oxygen (DO) during summer	[FT, FS, FP]			If one INA, record both scores
a. Information not available.	INA			
b. Usually > 5 mg/l.	1.0			
c. Usually between 2 and 5 mg/l.	0.5			
d. Frequently < 2 mg/l.	0.1			
20f. Maximum mid-summer temperature within pools or littoral areas	[FT, FS, FP]			If one INA, record both scores
a. Information not available.	INA			
b. 68 - 90° F (20 - 32° C).	1.0			
c. 41 - 68° F (5 - 20° C) -OR- 90 - 104° F (32 - 40° C).	0.5			
d. < 41° F -OR- > 104° F (< 5° C -OR- > 40° C).	0.1			

Calculation of FISH (Tidal) FCI

PROJECT TITLE: ____________________

COMPARISON: ________________________ (e.g., WAA/planned wetland)



Selected Scores	(#)	Element
________	(24)	Obstruction to fish passage

If score = 0.1, STOP. There is no potential for providing tidal fish habitat.
If score ≠ 0.1 or NA, then continue with model.

Selected Scores	(#)	Element
________	(1b)	Shoreline bank stability
________	(4a)	Disturbance at site (SS)
________	(4d)	Disturbance in channel/open water
________	(7b)	Most permanent hydroperiod
________	(24)	Obstruction to fish passage

average for elements with available scores = ________ Limiting Factors

Selected Scores	(#)	Element
________	(7c)	Spatially dominant hydroperiod
________	(9c)	Substrate suitability for fish
________	(10d)	Plant (basal) cover
________	(10f)	Rooted vascular aquatic beds
________	(21b)	Shape of wetland/water edge
________	(22b)	Available fish cover/attractors

Equation #9 = ________ Food/Cover

Selected Scores	(#)	Element
________	(20b)	Water quality ratings

If score available, record score for WQ
If information not available, continue.

Selected Scores	(#)	Element
________	(20c)	Nutrient/sediment/contaminant sources
________	(20d)	Dissolved oxygen
________	(20f)	Maximum water temperature

average for elements with available scores = ________ Water Quality (WQ)

average for available scores = ________ **Fish (Tidal) FCI**

Equation #9:

$$\frac{7c\ [9c + (1-x)(10d) + (x)(10f) + 21b + 22b]}{4}$$

where x = portion of AREA which is represented by lower shore zone in increments of 0.1 (e.g., 0.1, 0.2, 0.3, ... 1.0)

PROJECT TITLE: ______________________________

FISH (Non-tidal Stream/River)
DATA SHEETS

Function weighting area (AREA) = That portion of the assessment area which, based upon water regime, has the capacity to support non-tidal stream/river fish. The period of inundation can vary throughout the site. Suitable wetland water regimes include permanently flooded, intermittently exposed, semipermanently flooded and seasonally flooded. Unsuitable water regimes may include saturated or intermittently flooded.

		For use in FCI model		For use in Table A.2 only
ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
Suitability for non-tidal stream/river fish (element 24):				
24. Obstruction to on-site fish passage (obstruction can be on- or off-site)	[FT, FS, FP]*			Assume NA = 1.0
a. No barrier(s) present.	NA			
b. Barrier(s) present, but conditions modified to permit fish passage (e.g., fish ladder, installation of culverts in mosquito control impoundments to re-establish tidal exchange and fish passage).	NA			
c. Barrier(s) present and utilized for fish management practices.	NA			
d. Site isolated, but utilized by fish (e.g., pond).	NA			
e. Condition(s) present which curtail fish passage (e.g., impingement on industrial intakes) or interfere with migratory cycles (e.g., semi-impoundment control structures such as weirs, undersized culvert).	0.5			
f. Condition(s) present which imposes absolute physical (e.g., impoundment for mosquito control, tide gate, dam, waterfall, thermal plume), chemical (extreme in pH), or behavioral barriers to fish passage. **Fish access to the site and survival at site is precluded.**	0.1			

NOTE: If score for element 24 = 0.1, then there is no potential for providing the non-tidal fish function; therefore, the FISH (Non-tidal Stream/River) FCI is not applicable (NA). Continue if scores = NA or 0.5.

---

* Denotes function(s) to which element applies: SB = Shoreline Bank Erosion Control; SS = Sediment Stabilization; WQ = Water Quality; WL = Wildlife; FT = Fish (Tidal); FS = Fish (Stream/River); FP = Fish (Pond/Lake); and UH = Uniqueness/Heritage

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
Disturbance factors (elements 1b, 4a, 4d, 16c, and 24):				
1. Bank characteristics				
1b. Shoreline bank stability	[FT, FS, FP]			Assume NA = 1.0
a. No shoreline on-site.	NA			
b. Shoreline bank erosion is minimal (e.g., > 75% bank surface protected by vegetation, boulders/rubble/gravel, or other materials).	NA			
c. Shoreline bank erosion is moderate.	0.5			
d. Shoreline bank erosion is substantial (e.g., < 25% bank surface protected).	0.1			
4. Disturbance				
4a. Disturbance at site (Sediment Stabilization)	[SB, SS, FT, FS, FP]			Assume NA = 1.0
(Do not include observations of debris)				
a. No or minimal disturbance.	NA			
b. Potential for periodic disturbance present, but preventative action taken (e.g., installation of enclosure fences for herbivores and/or human disturbance) -OR- if recently disturbed, soils sufficiently stabilized with mulch, seeding, or planting.	NA			
c. Moderate disturbance (e.g., disturbance of sediments only in portion of site; infrequent grazing by waterfowl).	0.5			
d. Evidence of substantial periodic disturbance which makes substrate unstable (e.g., muskrat eatouts, overgrazing by waterfowl, cattle grazing and trampling, nutria activity, human activity such as the use of off-road vehicles; wetland tilled, filled, logged, clear-cut or excavated and not stabilized by seeding or planting).	0.1			

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
4d. Disturbance of channel/open water bottom (Open water = water of any depth with no emergent vegetation)	[FT, FS, FP]			Assume NA = 1.0
a. Channel/open water absent.	NA			
b. No or minimal recent disturbance.	NA			
c. Channel/open water disturbed in the past (e.g., dredged, channelized), but has begun to recover some of the natural channel/open water and shoreline characteristics (e.g., return to near original depths; and re-establishment of aquatic and shoreline vegetation, fallen trees, woody debris, and rocks).	0.5			
d. Channel/open water recently disturbed (e.g., filled, confined to culvert, or dredged in past year) -OR- substantially altered to prevent recovery of natural characteristics (e.g., cement channel).	0.1			
16. Size				
16c. Fish habitat size	[FS, FP]			Assume NA = 1.0
Does the assessment AREA have a very low fishery habitat value because of (1) its small size and surrounding landscape (e.g., < 0.1 acre and bordered by urban development) or (2) because it is ephemeral.				
a. No.	NA			
b. Yes.	0.1			
If yes, explain: ____________________				
24. Obstruction to on-site fish passage (Element already answered above.)				
Description of available food/cover (elements 10m, 10o, 21b, 22b, 25a, and 26):				
10. Vegetation characteristics **during growing season**				
10m. Vegetative overhang (within 30 cm (1 ft) of water surface)	[FS,FP]			If one NA, record both scores.
Estimate optimum % overhang for this habitat type in region (e.g., > 50%): ______. Note abundance relative to this optimum.				
a. No shoreline on-site.	NA			
b. Abundant (e.g., > 1 ft. on 50% of shoreline).	1.0			
c. Moderate (e.g., > 1 ft. on 30 - 45% of shoreline).	0.5			
d. Sparse (e.g., > 1 ft. on less than 20% of shoreline).	0.1			

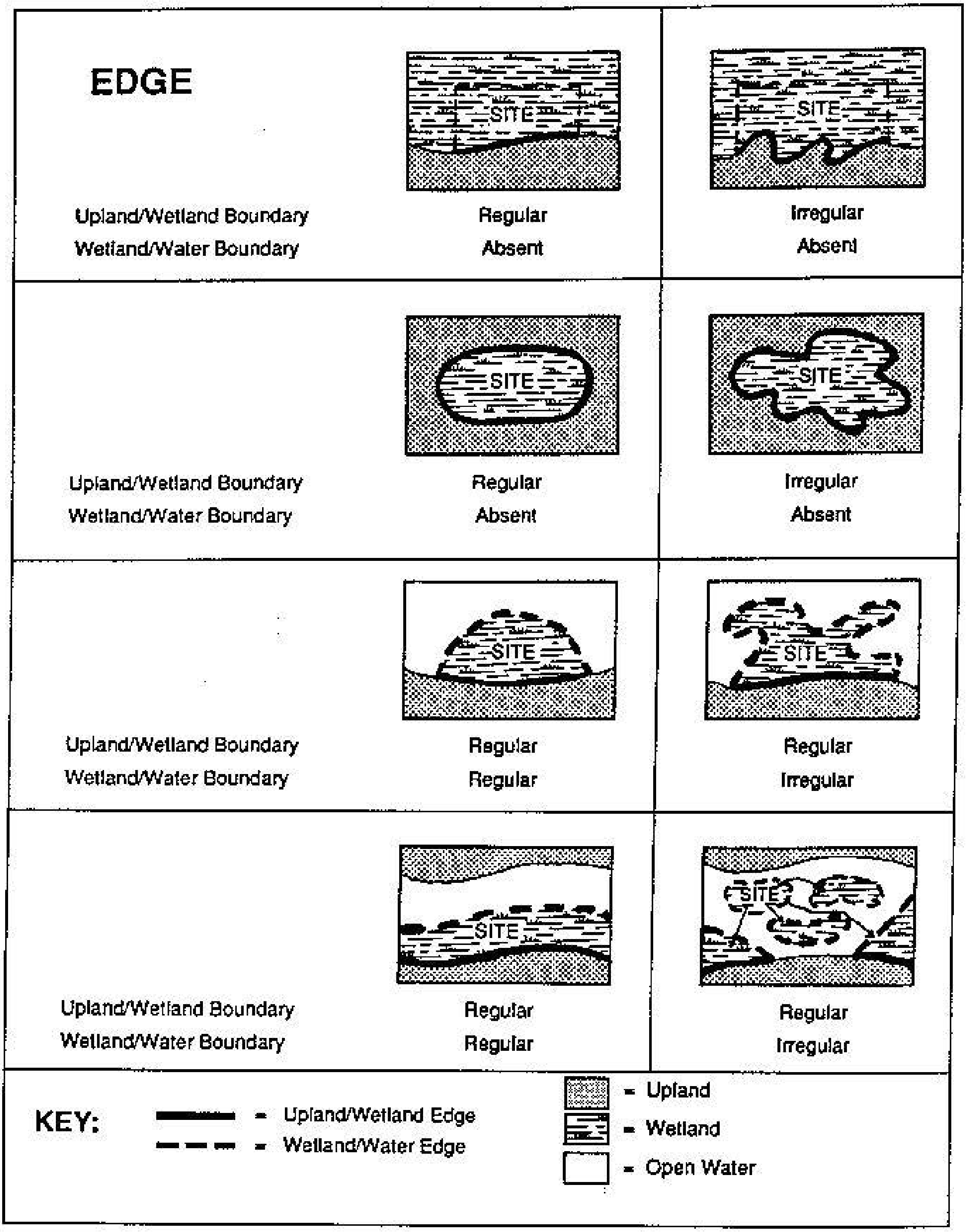


Figure A.10.
Examples of regular and irregular boundaries at the upland/wetland and wetland/water edges (element 21)

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
10c. Aboveground plant biomass in wetland, **excluding lower shore zone**	[FS, FP]			
a. Almost all potential aboveground plant biomass at present stage of development remains. Plant cover is close to that which would occur naturally without disturbance. If bare areas exist (e.g., bedrock), they are not a result of loss of vegetation from land uses.	1.0			
b. Plant biomass 50 - 75% of potential due to disturbance (e.g., grazing).	0.7			
c. Plant biomass 25 - 50%.	0.3			
d. Plant biomass < 25 (e.g., only root system and part of stems remain).	0.1			
21. Shape of edge				
21b. Vegetated wetland/water edge (e.g., shape of tidal creek or channel) (**See Figure A.10**).	[FT, FS, FP]			
a. Irregular.	1.0			
b. Regular, smooth.	0.5			
c. Edge absent or minimal (i.e., no channel in study wetland area).	0.1			
22. Fish and wildlife attractors				
22b. Available fish cover/attractors	[FT, FS, FP]			
Abundance of cover (e.g., vegetation, dense brush, fallen tree/logs, rocks/boulders, or artificial attractors) in littoral areas, pools, and backwaters during summer.				
Estimate potential cover for this habitat type in region (e.g., 25 - 75%): ________. Note abundance relative to this optimum.				
Warmwater fisheries:				
a. Optimal (e.g., 25 - 75%).	1.0			
b. Near optimal (e.g., 15 - 25% or 75 - 90%).	0.8			
c. Adequate (e.g., 3 - 15%) or excessive (e.g., 90 - 100%).	0.3			
d. No cover or sparse (e.g., < 3%).	0.1			
Trout stream:				
a. Optimal (e.g., 15 - 50%).	1.0			
b. Moderate (e.g., 2 - 15%).	0.5			
c. Excessive (e.g., > 50%).	0.1			
d. No cover or sparse (e.g., < 2%).	0.1			
(Element 22b continues on next page.)				

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
22b. Available fish cover/attractors *(con't)* If present, check type of attractors and estimate percent cover. In some cases it may be best to count and record the number of attractors.				

Attractor	WAA	Planned Wetland
Emergent vegetation	____	____
Submerged vegetation	____	____
Dense brush	____	____
Fallen trees/logs	____	____
Rocks/boulders	____	____
Artificial:		
Stake beds	____	____
Junk metal (e.g., cars)	____	____
Boats, barges	____	____
Concrete products	____	____
Artificial seaweed	____	____
Tire structures	____	____
Shellfish attractor	____	____
Brush piles	____	____
Vitrified clay pipe	____	____
Low check dam	____	____
Other:__________	____	____

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	WAA	Planned Wetland	DIFFERENCE IN SCORES
25. Pool/riffle				
25a. Percent pool area in stretch of stream	[FS]			If one NA, record both scores.
(Note: may need to consider areas outside of small assessment areas to determine percentage which is representative of stream.)				
Trout stream: Estimate pool area during late growing season, low-water periods:				
a. No stream on-site.	NA			
b. Approximately 50% (e.g., 35 - 65%).	1.0			
c. Low (e.g., 5 - 35%) or high (> 65%).	0.5			
d. Sparse (e.g., < 2%).	0.1			
Warmwater stream: Estimate pool area during average summer flow:				
a. No stream on-site.	NA			
b. Predominant (e.g., > 50%)	1.0			
c. Low (e.g., 20 - 40%).	0.5			
d. Sparse (e.g., < 5%).	0.1			

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
Description of available food/cover (elements 10m, 10o, 21b, and 22b):				
10. Vegetation characteristics **during growing season**				
10m. Vegetative overhang (within 30 cm (1 ft) of water surface)	[FS,FP]			If one NA, record both scores.
Estimate optimum % overhang for this habitat type in region (e.g., > 75%:) _____. Note abundance relative to this optimum.				
a. No shoreline on-site.	NA			
b. Abundant (e.g., > 1 ft. on > 75% of shoreline).	1.0			
c. Moderate (e.g., > 1 ft. on 25 - 75% of shoreline).	0.5			
d. Sparse or absent (e.g., > 1 ft. on less than 25% of shoreline).	0.1			
10o. Aboveground plant biomass in wetland, **excluding lower shore zone.**	[FS,FP]			
a. Almost all potential aboveground plant biomass at present stage of development remains. Plant cover is close to that which would occur naturally without disturbance. If bare areas exist (e.g., bedrock), they are not a result of loss of vegetation from land uses.	1.0			
b. Plant biomass 50 - 75% of potential due to disturbance (e.g., grazing).	0.7			
c. Plant biomass 25 - 50%.	0.3			
d. Plant biomass < 25 (e.g., only root system and part of stems remain).	0.1			
21. Shape of edge				
21b. Vegetated wetland/water edge (e.g., shape of tidal creek or channel) **(See Figure A.10).**	[FT, FS, FP]			
a. Irregular.	1.0			
b. Regular, smooth.	0.5			
c. Edge absent or minimal (i.e., no channel in study wetland area).	0.1			

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA)
		WAA	Planned Wetland	If both scores are NA, record NA
26. Bank undercut	[FS]			If one NA, record both scores.
a. No shoreline on-site.	NA			
b. Bank undercut present and providing abundant cover for fish (e.g., undercut predominantly > 15 cm [> 6 inches]).	1.0			
c. Bank undercut present and providing moderate cover.	0.5			
d. Bank undercut minimal or absent (e.g., undercut predominantly < 15 cm [< 6 inches]).	0.1			
Factors affecting reproduction (elements 25b, 27a, and 27b):				
25b. Average current velocity over spawning areas during spawning and embryo development	[FS]			If NA and/or INA, record both scores.
Trout stream:				
a. Warmwater stream.	NA			
b. No stream on-site.	NA			
c. Information not available.	INA			
d. 30 to 70 cm/sec (12 to 28 in/sec).	1.0			
e. 15 to 30 cm/sec (6 to 12 in/sec) -OR- 70 to 85 cm/sec (28 to 34 in/sec).	0.5			
f. < 15 cm/sec (< 6 in/sec) -OR- > 85 cm/sec (> 34 in/sec).	0.1			
27. Spawning habitat				
27a. Spawning substrate, accessible during spawning periods. Select dominant substrate.	[FS, FP]			
a. Gravel/rubble.	1.0			
b. Sand.	0.5			
c. Boulders, bedrock, or fines (e.g., silt, mud, clay).	0.2			
d. Site not accessible during spawning.	0.1			
27b. Spawning structures	[FS,FP]			Assume NA = 0
a. Site not accessible during spawning.	NA			
b. Absent.	NA			
c. Present (e.g., gravel or rock spawning shoals, artificial reef, suspended platforms, spawning box).	1.0			
If present, describe: ______________ ______________				

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
Factors describing water quality (elements 20b, 20c, 20d, 20e, 20f, and 20g):				
20. Water quality				
20b. Water quality ratings	[FT, FS, FP]			If one INA, record both scores.
Define state water quality ratings and assign to following categories:				
High: ____________				
(e.g., Class A = no or minimal pollution)				
Moderate: ____________				
(e.g., Class B and C = moderate pollution)				
Low: ____________				
(e.g., Class D = severe pollution)				
Water quality rating for waterway:				
a. Information not available.	INA			
b. High.	1.0			
c. Moderate.	0.5			
e. Low.	0.1			
20c. Evidence of nutrient, sediment, or contaminant sources (If more than one answer applicable, record lowest score).	[FT, FS, FP]			If one INA, record both scores.
a. Information not available.	INA			
b. Little or no potential for nutrient, sediment, or contaminant input.	1.0			
c. Evidence of or potential for moderate nutrient, sediment, or contaminant input.	0.5			
d. Evidence of high nutrient concentration in the wetland/waterway (e.g., recurrent algal blooms) or known source(s) contributing nutrients to the wetland/waterway (e.g., sewage outfalls, mine tailings, landfills, septic fields, active pasturelands and croplands).	0.1			
e. Evidence of high inorganic sediment input (e.g., stormwater outfalls; irrigation return flows; direct observation of sediment inputs, i.e., sediment plumes of turbid water at inlet; predominant soils/slopes classified as eroding or erosion hazard by SCS).	0.1			
f. Evidence of presence of contaminants (e.g., stunted plant growth, excessive growth, and/or abnormal morphology; oil sheen on marsh surface -AND/OR- known source(s) contributing contaminants to the wetland/waterway (e.g., hazardous water sites, superfund sites, landfills).	0.1			
g. Evidence of conditions known to stress fish (e.g., low DO, high turbidity, extremes in temperature, thermal plume).	0.1			

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
20d. Dissolved oxygen (DO) during summer	[FT, FS, FP]			If one INA, record both scores.
Trout stream:				
a. Information not available.	INA			
b. Usually > 9 mg/l.	1.0			
c. Usually between 5 and 9 mg/l.	0.5			
d. Frequently < 5 mg/l.	0.1			
Warmwater stream:				
a. Information not available.	INA			
b. Usually > 5 mg/l.	1.0			
c. Usually between 2 and 5 mg/l.	0.5			
d. Frequently < 2 mg/l.	0.1			
20e. pH range	[FS, FP]			If one INA, record both scores.
Trout stream:				
a. Information not available.	INA			
b. 6.5 to 8.0.	1.0			
c. Between 5.5 and 6.5 -OR- 8.0 and 9.0.	0.5			
d. ≤ 5.5 -OR- ≥ 9.0.	0.1			
Warmwater stream:				
a. Information not available.	INA			
b. 6.5 to 8.5.	1.0			
c. Between 5.0 and 6.5 -OR- 8.5 and 9.5.	0.5			
d. ≤ 5.0 -OR- ≥ 9.5.	0.1			
20f. Maximum mid-summer temperature within pools or littoral areas	[FT, FS, FP]			If one INA, record both scores.
Trout stream:				
a. Information not available.	INA			
b. 54 - 66° F (12 - 19° C).	1.0			
c. 36 - 54° F (2 - 12° C) -OR- 66 - 77° F (19 - 25° C).	0.5			
d. < 36° F -OR- > 77° F (< 2° C -OR- > 25° C).	0.1			
Warmwater stream:				
a. Information not available.	INA			
b. 68 - 86° F (20 - 30° C).	1.0			
c. 59 - 68° F (15 - 20° C) -OR- 86 - 93° F (30 - 34° C).	0.5			
d. < 59° F -OR- > 93° F (< 15° C -OR- > 34° C).	0.1			

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
20g. Maximum monthly average turbidity during summer	[FS, FP]			If one INA, record both scores.
a. Information not available.	INA			
b. Low (e.g., < 80 JTU, secchi depth > 2 m).	1.0			
c. Moderate (e.g., approx. 150 JTU).	0.5			
d. High (e.g., 200 JTU, secchi depth = 0 m).	0.1			

Calculation of FISH (Non-tidal Stream/River) FCI

PROJECT TITLE: ____________________

Selected Scores	(#)	Element

COMPARISON: ____(e.g., WAA/planned wetland)

________ (24) Obstruction to fish passage
→ If score = 0.1, STOP. There is no potential for providing stream/river fish habitat.
→ If score ≠ 0.1, then continue with model.

________ (1b) Shoreline bank stability
________ (4a) Disturbance at site (SS)
________ (4d) Disturbance in channel/open water
________ (16c) Fish habitat size
________ (24) Obstruction to fish passage

average for elements with available scores = ________ Limiting Factors

________ (10m) Vegetative overhang
________ (10o) Plant biomass
________ (21b) Shape of wetland/water edge
________ (22b) Available fish cover/attractors
________ (25a) % pool area
________ (26) Bank undercut

average for elements with available scores = ________ Food/Cover

________ (25b) Current velocity within pools
________ (27a) Spawning substrate
________ (27b) Spawning structures

average for elements with available scores = ________ Reproduction

________ (20b) Water quality ratings
→ If score available, record score for WQ
→ If information not available, continue.

________ (20c) Nutrient/sediment/contaminant sources
________ (20d) Dissolved oxygen
________ (20e) pH
________ (20f) Maximum water temperature
________ (20g) Turbidity

average for elements with available scores = ________ Water Quality (WQ)

average for available scores = ________ Fish (Non-tidal Stream/River) FCI

PROJECT TITLE: ____________________

FISH (Non-tidal Pond/Lake)
DATA SHEETS

Function weighting area (AREA) = That portion of the assessment area which, based upon water regime, has the capacity to support non-tidal pond/lake fish. The period of inundation can vary throughout the site. Suitable wetland water regimes include permanently flooded, intermittently exposed, semipermanently flooded and seasonally flooded. Unsuitable water regimes may include saturated or intermittently flooded.

		For use in FCI model		For use in Table A.2 only
		SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	WAA	Planned Wetland	
Suitability for non-tidal pond/lake fish (elements 24 and 28):				
24. Obstruction to on-site fish passage (obstruction can be on- or off-site)	[FT, FS, FP]*			Assume NA = 1.0
a. No barrier(s) present.	NA			
b. Barrier(s) present, but conditions modified to permit fish passage (e.g., fish ladder, installation of culverts in mosquito control impoundments to re-establish tidal exchange and fish passage).	NA			
c. Barrier(s) present and utilized for fish management practices.	NA			
d. Site isolated, but utilized by fish (e.g., pond).	NA			
e. Condition(s) present which curtail fish passage (e.g., impingement on industrial intakes) or interfere with migratory cycles (e.g., semi-impoundment control structures such as weirs, undersized culvert).	0.5			
f. Condition(s) present which imposes absolute physical (e.g., impoundment for mosquito control, tide gate, dam, waterfall, thermal plume), chemical (extreme in pH), or behavioral barriers to fish passage. **Fish access to the site and survival at site is precluded.**	0.1			
28. Available refuge during drought and/or freeze	[FP]			Assume NA = 1.0
Is there an accessible water body with areas of sufficient depth which will not dry up during a drought and/or freeze throughout the water column.				
a. Yes.	NA			
b. No.	0.1			

NOTE: If score for element 24 and/or element 28 = 0.1, then there is no potential for providing the non-tidal fish function; therefore, the FISH (Non-tidal Pond/Lake) FCI is not applicable (NA). Continue if scores = NA or 0.5.

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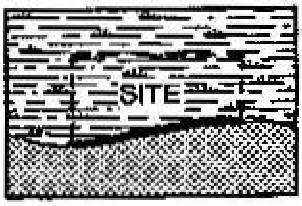
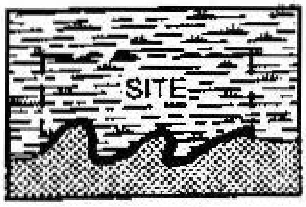
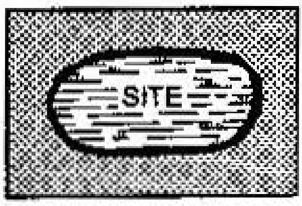
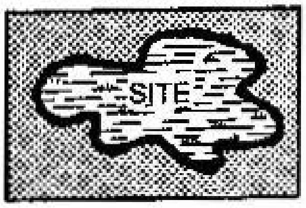
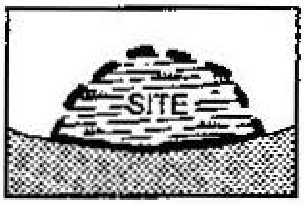
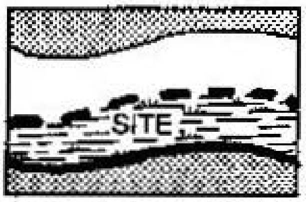
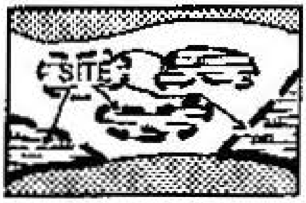
* Denotes function(s) to which element applies: SB = Shoreline Bank Erosion Control; SS = Sediment Stabilization; WQ = Water Quality; WL = Wildlife; FT = Fish (Tidal); FS = Fish (Stream/River); FP = Fish (Pond/lake); and UH = Uniqueness/Heritage

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
Disturbance factors (elements 1b, 4a, 4d, 16c, and 24):				
4. Disturbance				
1b. Shoreline bank stability	[FT,FS, FP]			Assume NA = 1.0
a. No shoreline on-site.	NA			
b. Shoreline bank erosion is minimal (< e.g., >75% bank surface protected by vegetation, boulders/rubble/gravel, or other materials).	NA			
c. Shoreline bank erosion is moderate.	0.5			
d. Shoreline bank erosion is substantial (e.g., < 25% bank surface protected).	0.1			
4a. Disturbance at site (Sediment Stabilization)	[SB, SS, FT, FS, FP]			Assume NA = 1.0
(Do not include observations of debris)				
a. No or minimal disturbance.	NA			
b. Potential for periodic disturbance present, but preventative action taken (e.g., installation of enclosure fences for herbivores and/or human disturbance) -OR- if recently disturbed, soils sufficiently stabilized with mulch, seeding, or planting.	NA			
c. Moderate disturbance (e.g., disturbance of sediments only in portion of site; infrequent grazing by waterfowl).	0.5			
d. Evidence of substantial periodic disturbance which makes substrate unstable (e.g., muskrat eatouts, overgrazing by waterfowl, cattle grazing and trampling, nutria activity, human activity such as the use of off-road vehicles; wetland tilled, filled, logged, clear-cut or excavated and not stabilized by seeding or planting).	0.1			

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
4d. Disturbance of channel/open water bottom (Open water = water of any depth with no emergent vegetation)	[FT, FS, FP]			Assume NA = 1.0
a. Channel/open water absent. disturbance.	NA			
b. No or minimal evidence of recent disturbance.	NA			
c. Channel/open water disturbed in the past (e.g., dredged, channelized), but has begun to recover some of the natural channel/open water and shoreline characteristics (e.g., return to near original depths; and re-establishment of aquatic and shoreline vegetation, fallen trees, woody debris, and rocks).	0.5			
d. Channel/open water recently disturbed (e.g., filled, confined to culvert, or dredged in past year) -OR- substantially altered to prevent recovery of natural characteristics (e.g., cement channel).	0.1			
16. Size				
16c. Fish habitat size	[FS,FP]			Asume NA = 1.0
Does the assessment AREA have a very low fishery habitat value because of (1) its small size and surrounding landscape (e.g., < 0.1 acre and bordered by urban development) or (2) because it is ephemeral.				
a. No.	NA			
b. Yes.	0.1			
If yes, explain: ____________________ ____________________				
24. Obstruction to on-site fish passage (Element already answered above.)				

EDGE		
Upland/Wetland Boundary	Regular	Irregular
Wetland/Water Boundary	Absent	Absent
		
Upland/Wetland Boundary	Regular	Irregular
Wetland/Water Boundary	Absent	Absent
		
Upland/Wetland Boundary	Regular	Regular
Wetland/Water Boundary	Regular	Irregular
		
Upland/Wetland Boundary	Regular	Regular
Wetland/Water Boundary	Regular	Irregular

KEY:

━━━ = Upland/Wetland Edge

▬ ▬ ▬ = Wetland/Water Edge

▨ = Upland

☰ = Wetland

☐ = Open Water

Figure A.10.
Examples of regular and irregular boundaries at the upland/wetland and wetland/water edges (element 21)

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
22. Fish and wildlife attractors				
22b. Available fish cover/attractors	[FT, FS, FP]			
Abundance of cover (e.g., vegetation, dense brush, fallen tree/logs, rocks/boulders, or artificial attractors) in littoral areas, pools, and backwaters during summer.				
Estimate potential cover for this habitat type in region (e.g., 25 - 75%): ________. Note abundance relative to this optimum.				
a. Optimal (e.g., 25 - 75%).	1.0			
b. Near optimal (e.g., 15 - 25% or 75 - 90%).	0.8			
c. Adequate (e.g., 3 - 15%) or excessive (e.g., 90 - 100%).	0.3			
d. No cover or sparse (e.g., < 3%).	0.1			
If present, check type of attractors and estimate percent cover. In some cases it may be best to count and record the number of attractors.				

Attractor	WAA	Planned Wetland
Emergent vegetation	___	___
Submerged vegetation	___	___
Dense brush	___	___
Fallen trees/logs	___	___
Rocks/boulders	___	___
Artificial:		
Stake beds	___	___
Junk metal (e.g., cars)	___	___
Boats, barges	___	___
Concrete products	___	___
Artificial seaweed	___	___
Tire structures	___	___
Shellfish attractor	___	___
Brush piles	___	___
Vitrified clay pipe	___	___
Low check dam	___	___
Other:________	___	___

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
Factors affecting reproduction (elements 27a, 27b, and 27c):				
27. Spawning habitat				
27a. **Spawning substrate, accessible during spawning periods.** Select dominant substrate.	[FS,FP]			
a. Gravel and/or pebbles.	1.0			
b. Emergent and/or aquatic vegetation.	1.0			
c. Sand and/or fine sediments (e.g., silt, mud, clay).	0.5			
d. Bedrock and/or boulders.	0.2			
e. Site not accessible during spawning.	0.1			
27b. Spawning structures	[FS,FP]			Assume NA = 0
a. Site not accessible during spawning.	NA			
b. Absent.	NA			
c. Present (e.g., gravel or rock spawning shoals, artificial reef, suspended platforms, spawning box).	1.0			
If present describe: ______________				
27c. Drawdown of water during spawning and embryo development (under normal conditions)	[FP]			Assume NA = 1.0
a. No or minimal drawdown.	NA			
b. Moderate drawdown causing some loss of spawning habitat.	0.5			
c. Drawdown sufficient to expose spawning substrate thus causing substantial loss of spawning habitat.	0.1			
Examples of unsuitable drawdown levels: gizzard shad >0.5 m (>1.6 ft) green sunfish >1 m (>3.3 ft) northern pike >1 m (>3.3 ft) black bullhead >2 m (>6.6 ft) longnose dace >3 m (>9.8 ft) largemouth bass >7 m (>23 ft)				

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
Factors describing water quality (elements 20b, 20c, 20d, 20e, 20f, and 20g):				
20. Water quality				
20b. Water quality ratings	[FT, FS, FP]			If one INA, record both scores.
Define state water quality ratings and assign to following categories:				
High: ______________				
(e.g., Class A = no or minimal pollution)				
Moderate: ______________				
(e.g., Class B and C = moderate pollution)				
Low: ______________				
(e.g., Class D = severe pollution)				
Water quality rating for waterway:				
a. Information not available.	INA			
b. High.	1.0			
c. Moderate.	0.5			
d. Low.	0.1			

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA)
		WAA	Planned Wetland	If both scores are NA, record NA
20c. Evidence of nutrient, sediment, or contaminant sources (If more than one score applicable, record lowest score).	[FT, FS, FP]			If one INA, record both scores.
a. Information not available.	INA			
b. Little or no potential for nutrient, sediment, or contaminant input.	1.0			
c. Evidence of or potential for moderate nutrient, sediment, or contaminant input.	0.5			
d. Evidence of high nutrient concentration in the wetland/waterway (e.g., recurrent algal blooms) or known source(s) contributing nutrients to the wetland/waterway (e.g., sewage outfalls, mine tailings, landfills, septic fields, active pasturelands and croplands).	0.1			
e. Evidence of high inorganic sediment input (e.g., stormwater outfalls; irrigation return flows; direct observation of sediment inputs, i.e., sediment plumes of turbid water at inlet; predominant soils/slopes classified as eroding or erosion hazard by SCS).	0.1			
f. Evidence of presence of contaminants (e.g., stunted plant growth, excessive growth, and/or abnormal morphology; oil sheen on marsh surface AND/OR known source(s) contributing contaminants to the wetland/waterway (e.g., hazardous water sites, superfund sites, landfills).	0.1			
g. Evidence of conditions known to stress fish (e.g., low DO, high turbidity, extremes in temperature, thermal plume).	0.1			
20d. Dissolved oxygen (DO) during summer	[FT, FS, FP]			If one INA, record both scores.
a. Information not available.	INA			
b. Usually > 5 mg/l.	1.0			
c. Usually between 2 and 5 mg/l.	0.5			
d. Frequently < 2 mg/l.	0.1			
20e. pH range	[FS, FP]			If one INA, record both scores.
a. Information not available.	INA			
b. 6.5 to 8.5.	1.0			
c. Between 5.0 and 6.5 -OR- 8.5 and 9.5.	0.5			
d. ≤ 5.0 -OR- ≥ 9.5.	0.1			

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
20f. Maximum mid-summer temperature within pools or littoral areas	[FT, FS, FP]			If one INA, record both scores.
a. Information not available.	INA			
b. 68 - 86° F (20 - 30° C).	1.0			
c. 59 - 68° F (15 - 20° C) -OR- 86 - 93° F (30 - 34° C).	0.5			
d. < 59° F -OR- > 93° F (< 15° C -OR- > 34° C).	0.1			
20g. Maximum monthly average turbidity during summer	[FS, FP]			If one INA, record both scores.
a. Information not available.	INA			
b. Low (e.g., < 80 JTU, secchi depth > 2 m).	1.0			
c. Moderate (e.g., approx. 150 JTU).	0.5			
d. High (e.g., 200 JTU, secchi depth = 0 m).	0.1			

Calculation of FISH (Non-tidal Pond/Lake) FCI

PROJECT TITLE: ____________________

COMPARISON: ________________________ (e.g., WAA/planned wetland)

Selected Scores	(#)	Element
________	(24)	Obstruction to fish passage
________	(28)	Refuge during drought/freeze

If score = 0.1 for either element, STOP. There is no potential for providing pond/lake fish habitat.
If score ≠ 0.1, then continue with model.

Selected Scores	(#)	Element
________	(1b)	Shoreline bank stability
________	(4a)	Disturbance at site (SS)
________	(4d)	Disturbance in channel/open water
________	(16c)	Fish habitat size
________	(24)	Obstruction to fish passage

average for elements with available scores = ________ Limiting Factors

Selected Scores	(#)	Element
________	(10m)	Vegetative overhang
________	(10o)	Plant biomass
________	(21b)	Shape of wetland/water edge
________	(22b)	Available fish cover/attractors

average for elements with available scores = ________ Food/Cover

Selected Scores	(#)	Element
________	(27a)	Spawning substrate
________	(27b)	Spawning structures
________	(27c)	Drawdown

average for elements with available scores = ________ Reproduction

Selected Scores	(#)	Element
________	(20b)	Water quality ratings

→ If score available, record score for WQ
→ If information not available, continue

Selected Scores	(#)	Element
________	(20c)	Nutrient/sediment/contaminant sources
________	(20d)	Dissolved oxygen
________	(20e)	pH
________	(20f)	Maximum water temperature
________	(20g)	Turbidity

average for elements with available scores = ________ Water Quality (WQ)

average for available scores = ________ **Fish (Non-tidal Pond/Lake) FCI**

PROJECT TITLE: ____________________

UNIQUENESS/HERITAGE DATA SHEETS

Function weighting area (AREA) = Entire wetland assessment area

		For use in FCI Model		For use in Table A.2 only
ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
29 Endangered species (state- or federally-listed)	[UH]*			Assume NA = 0
a. Wetland not within known range of any threatened or endangered species.	NA			
b. Wetland is known to be inhabited by threatened or endangered species.	1.0			
c. Wetland is considered critical habitat for threatened or endangered species.	1.0			
d. Wetland is within known range of threatened or endangered species; habitat suitable for these species.	0.9			
If answer b, c, or d selected, then note: Species name(s) ____________				
30. Site contains or is part of a wetland which is considered rare or uncommon in the region. (e.g., a wetland unlike others in the area with respect to size or vegetation type).	[UH]			Assume NA = 0
a. No.	NA			
b. Yes.	1.0			
If yes, fill out the following: Wetland type: ____________ Region/context. ____________				

---

* Denotes function(s) to which element applies: SB = Shoreline Bank Erosion Control; SS = Sediment Stabilization; WQ = Water Quality; WL = Wildlife; FT = Fish (Tidal); FS = Fish (Stream/River); FP = Fish (Pond/Lake); and UH = Uniqueness/Heritage

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
31. Site has documented biological, geological, or other feature which is rare or unique in region.	[UH]			Assume NA = 0
a. No.	NA			
b. Yes.	1.0			
If yes, fill out the following:				
Feature: ______				
Region/context: ______				
32. Site contains any properties that are listed on or are eligible for inclusion on the National Register of Historic Places -OR- contains any properties included in the state listing of historical or archeological sites.	[UH]			Assume NA = 0
a. No.	NA			
b. Yes.	1.0			
If yes, explain: ______				
33. Site is included on a state or federal list of natural landmarks.	[UH]			Assume NA = 0
a. No.	NA			
b. Yes.	1.0			
Landmark: ______				
34. Site is hydrologically connected to a state or federally designated Wild and Scenic river.	[UH]			Assume NA = 0
a. No.	NA			
b. Yes.	1.0			
If yes, fill out the following:				
River: ______				

ELEMENT	SELECTION OF SCORES FOR ELEMENT CONDITIONS	SELECTED SCORES FOR ELEMENTS		DIFFERENCE IN SCORES (Planned - WAA) If both scores are NA, record NA
		WAA	Planned Wetland	
35. Site is owned by an organized conservation group or public agency for the primary purpose of preservation, ecological enhancement, or low-intensity recreation (e.g., park, scenic route, marine sanctuary).	[UH]			Assume NA = 0
a. No.	NA			
b. Yes.	1.0			
If yes, fill out the following: Group/Agency: ____________ Use: ____________				
36. Site is known scientific research study site -OR- used for other educational purposes.	[UH]			Assume NA = 0
a. No.	NA			
b. Yes.	1.0			
If yes, explain: ____________				

Calculation of **UNIQUENESS/HERITAGE** FCI

PROJECT TITLE: ______________________

COMPARISON: ____________________________ (e.g., WAA/planned wetland)

Selected Scores	(#)	Element
________	(29)	Endangered species
________	(30)	Rarity
________	(31)	Unique features
________	(32)	Historical or archaeological significance
________	(33)	Natural landmark
________	(34)	Connected to Wild and Scenic River
________	(35)	Park, sanctuary, etc.
________	(36)	Scientific research site

average for elements with available scores = ________ **Uniqueness/ Heritage FCI**

EVALUATION FOR PLANNED WETLANDS (EPW)
Cover Sheet

PROJECT TITLE: Sweetwater Swamp

ASSESSMENT DATE(S): WAA: 2/10/94 planned wetland: 2/10/94

INDIVIDUAL(S) PERFORMING EVALUATION AND AFFILIATION:

J. Smith, Environmental Concern Inc.

LOCATION (e.g., City, County, State, Waterway/Watershed):

WAA: Branchville, Sussex Co., NJ — Richland Run

planned wetland: same as above

ASSESSMENT OBJECTIVES:
(note assumed point in time, e.g., peak of first growing season for planned wetland)

Assess the WAA and compare it to the planned wetland at the peak of the planned wetland's first growing season. It was decided not to evaluate the planned wetland at a point in time in the future.

CHECK FUNCTIONS ASSESSED:	WAA	planned wetland
Shoreline Bank Erosion Control		
Sediment Stabilization	✓	✓
Water Quality	✓	✓
Wildlife	✓	✓
Fish (Tidal)	✓	✓
Fish (Non-tidal Stream/River)	✓	✓
Fish (Non-tidal Pond/Lake)	✓	✓
Uniqueness/Heritage	✓	✓

DESCRIPTION OF PROJECT AREA:
Include information relevant to the assessment (e.g., NWI classification, description of hydrogeomorphic class(es), land use, climate).

WAA: NWI: PFO1 & PSS1
HGM: Riverine upper perennial

planned wetland: NWI: PSS1
HGM: Riverine upper perennial

...cover sheet continues on reverse

CHECK SEASONAL CONTEXT OF THE ASSESSMENT:

[✓ Average] Dry Wet

In most situations, the wetland can be readily evaluated by considering average site conditions. However, in some regions (e.g., arid) it may be preferable to evaluate the wetland for different conditions. Please provide explanation if average conditions are not used.

EXPLANATION OF CHANGES OR MODIFICATIONS TO EPW:

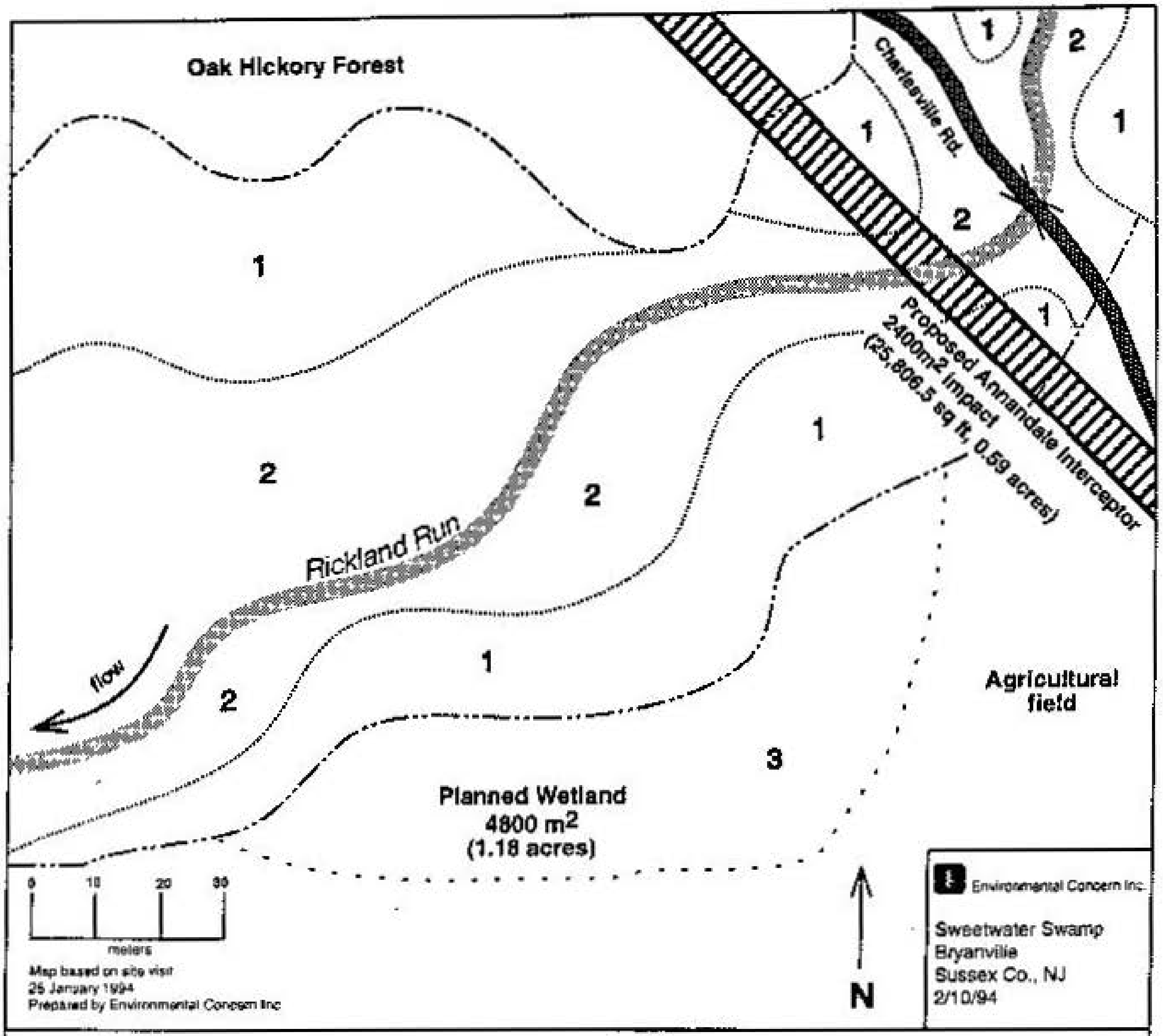
	Yes	No
Were any changes, deletions, or additions to element conditions and/or assigned scores made? If so, explain below. Cite literature and/or document personal communication(s) with experts.		✓
Were any changes made to the FCI models? If so, explain.		✓
Is the planned wetland designed with the goal of removing specific nutrients? If so, explain. Note: modification of the Water Quality FCI model and elements may be required to insure a focus on the removal efficiency for specified nutrients. Refer to Chapter 6 and available literature.		✓

Explanations:

PLANNED WETLAND GOALS:

Target FCIs and Target FCUs are recorded in Table A. 1 and Table A. 2. Other pertinent information may be provided here.

1. *Goal was to equal or exceed the FCUs of the WAA for each assessed function.*
2. *Regulatory requirements included a 2:1 acreage replacement in addition to the function based goals (target FCIs and FCUs).*
3. *Shoreline Bank Erosion Control was not considered due to the linear nature of the project and the minor stream crossing.*
4. *Both sites are within an EPA Priority Wetland area, therefore, UH=1.*
5. *Local regulations required a 15% increase in water quality benefits. It was agreed that this requirement could be met by making the R for Water Quality in the planned wetland = 1.15.*



WETLAND COVER TYPES

Sites are homogeneous with high species interspersion. There are no distinct vegetation zones.

WAA:

1. A. Trees
    - i. Broad leaved deciduous
        - *Acer rubrum*
        - *Nyssa sylvatica*
        - *Liquidambar styraciflua*
        - *Liriodendron tulipifera*
   B. Dead standing
   C. Scrub/Shrub
    - i. Bushy deciduous
        - *Lindera benzoin*
        - *Clethra alnifolia*
        - *Vaccinium corymbosum*
   D. Dead fallen trees/shrubs

2. A. Scrub/Shrub
    - i. Bushy deciduous
        - *Lindera benzoin*
        - *Clethra alnifolia*
        - *Cephalanthus occidentalis*
    - ii. Dead
   B. Emergent
    - i. Short persistent
        - *Carex stricta*
   C. Non-vegetated
    - i. Open water

PLANNED WETLAND:

3. A. Scrub/Shrub
    - i. Tall evergreen
        - *Tsuga canadensis*
    - ii. Tall deciduous
        - *Acer rubrum*
        - *Nyssa sylvatica*
        - *Liquidambar styraciflua*
   B. Dead fallen trees/shrubs
   C. Emergent
    - i. Tall persistent
        - *Panicum virgatum*
    - ii. Short persistent
        - KY 31

Table A.1.
Comparison of WAA and planned wetland: calculations of FCIs and FCUs

Project Title: Sweetwater Swamp

Comparison between WAA # 1 and planned wetland # 1

Function	WAA			Goals for Planned Wetland**					Planned Wetland			Check if goals met
	FCI	acres AREA	FCUs*	Target FCI	R	Target FCUs	Predicted FCI	acres Minimum Area	FCI	acres AREA	FCUs*	
SB	NA								NA			
SS	0.83	.59	.5	≤.83	NA	.50	.8	.62	.78	1.18	.92	✓
WQ	0.60	.59	.4	≤.60	1.15	.46	.7	.66	.72	1.18	.85	✓
WL	0.54	.59	.3	≤.54	NA	.30	.4	.75	.38	1.18	.45	✓[1]
FT	NA								NA			
FS	0.73	.59	.4	≤.73	NA	.40	.4	1.0	.36	1.18	.42	✓[2]
FP	NA								NA			
UH	1	▨	▨		▨	▨	▨	▨	1	▨	▨	

*FCUs = FCI x AREA
**Target FCI = *goal* established by decision makers
R = multiplying factor established by decision makers
Target FCUs = $FCU_{WAA} \times R$ (i.e., planned wetland *goal*)
Predicted FCI = FCIs which designers presume planned wetland may achieve at a particular site (Note this may be greater than Target FCI).
Minimum Area = Target FCUs/Predicted FCI

[1] The Target FCU for WL was not met because the planned wetland was assessed at the peak of the first growing season, prior to site maturity. The planned wetland met the target FCU because it was twice the size of the WAA.

[2] The Target FCI for FS was not met because the planned wetland is not on the stream. The Target FCU was met because the planned wetland is twice the size of the WAA.

Table A.2.
Comparison of FCIs and element scores

PROJECT TITLE: Sweetwater Swamp

	Functional Capacity Index		Elements with different scores for WAA and planned wetland		
Function	WAA	Planned Wetland	Element Number	Difference	Explanation
Shoreline Bank Erosion Control (SB) NA		Target:			
Sediment Stabilization (SS)	0.83	0.78 Target: ≤ .83	10b 10e	— —	Planned wetland has moderate vegetative coverage compared to the WAA Planned wetland has moderate leaf litter coverage compared to the WAA

Table A.2. (page 1 of 3)

Table A.2.
Comparison of FCIs and element scores

PROJECT TITLE: Sweetwater Swamp

	Functional Capacity Index		Elements with different scores for WAA and planned wetland		
Function	WAA	Planned Wetland	Element Number	Difference	Explanation
Water Quality (WQ)	0.60	0.72 Target: ≤.60	10j	0	Planned wetland has more root mat forming species than does the WAA
Wildlife (WL)	0.54	0.38 Target: ≤.54	11a	—	Fewer layers in the planned wetland
			12a	—	Fewer cover types in the planned wetland
			13a	—	No open water in the planned wetland
*Reminder: Include elements 11d and/or 12e if there are differences in scores					

Table A.2.
Comparison of FCIs and element scores

PROJECT TITLE: Sweetwater Swamp

Function	Functional Capacity Index		Elements with different scores for WAA and planned wetland		
	WAA	Planned Wetland	Element Number	Difference	Explanation
Fish (FT, [✓ FS], FP)	0.73	0.36	10	—	No shoreline present in the planned wetland
			22b	—	No or few fish attractors in the planned wetland
		Target: ≤.73	25	—	No pool area in the planned wetland during the summer
Uniqueness/Heritage (UH)	1	1 Target: 1	30	0	EPA Priority Wetland

Table A.2 (page 3 of 3)

Appendix C. Glossary Terms

Glossary Terms

Bank undercut: furthest point of protrusion of the bank to the furthest undercut of the bank

Basal cover: proportion of the site included in vertical projections from stems' intersection with average high water (Figure A.3, p. A 8)

Baseline comparison: functional capacity of the planned wetland is quantified at one point in time and compared to functional capacity of a wetland assessment area

Canopy cover: proportion of the site included in vertical projections from the general outline of plants, ignoring minor gaps between branches and holes in the center of the plant

Condition: form an EPW element takes in the wetland

Cover type: areas that are distinguished by the dominance of distinct vegetative life-forms or unvegetated surfaces

Detention time: storage volume divided by outflow rate

Diameter breast height (dbh): diameter of a plant measured at breast height (breast height = 1.4 m; 4.5 ft)

Edge: boundary where one kind of cover type starts and another stops

Element: physical, chemical, or biological characteristic of the wetland or landscape that dominates the wetland's capacity to perform a function

Element score: unitless number from 0.0 to 1.0 or an equation where 1.0 represents the optimal condition for maximizing functional capacity and 0.0 represents an unsuitable condition

Fetch: maximum distance over which wind can blow, unimpeded, across open water to generate waves

Fish (function): degree to which a wetland habitat meets the food/cover, reproductive, and water quality requirements of fish

Functional capacity: magnitude or degree to which a wetland performs a function

Functional capacity Index (FCI): a measure of functional capacity expressed as an index, where 0.0 represents no functional capacity and 1.0 represents optimal functional capacity

Functional capacity units (FCUs): measure of functional capacity, expressed in terms of quantity per unit area, which accounts for difference in space and time (FCUs = FCI x AREA)

Function weighting area (AREA): portion of the wetland assessment area or planned wetland that has the capacity to perform a function; this distinction is used for the shoreline bank erosion control and fish functions which may only pertain to portions of a wetland (Table 3.3, p. 3–8)

Gravel: mixture composed primarily of rock fragments 2 mm (0.8 in) to 7.6 cm (3 in) in diameter; usually contains much sand

Greentree reservoirs (GTRs): bottomland hardwood area shallowly flooded for short periods during dormant growth period for the purpose of attracting waterfowl and increasing mast production

Intermittently exposed: surface water is present throughout the year except in years of extreme drought

Intermittently flooded: the substrate is usually exposed, but surface water is present for variable periods without detectable seasonal periodicity; weeks, months, or years may intervene between periods of inundation

Interspersion: measure of the extent of intermixing of different cover types (Figure A.9, p. A 41)

Lower shore zone: vegetated or non-vegetated portion of the shore channelward of the potential lower limit of emergent or woody vegetation (Figure A.2, p. A 4)

Mean high water: average height of the high water over 19 years (tidal system)

Mean low water: average height of the low water over 19 years (tidal system)

Minimum area: minimum acreage required to satisfy the Target FCUs for each function being considered in the planned wetland (Minimum Area = Target FCUs/Predicted FCUs)

Mitigation process: steps to deciding upon adequate compensation within the context of the U.S. Army Corps of engineers Section 404 permit review process

Mud: wet soft earth composed predominantly of clay and silt-fine mineral sediments

Multiplying factor (R): factor used in the equation for calculating Target FCUs; this factor is established by decision makers to achieve greater compensation compared to FCUs in the wetland assessment area

Non-persistent vegetation: emergent plants whose leaves and stems break down at the end of the growing season so that most above-ground portions of the plants are easily transported by currents, waves, or ice

Off-site mitigation: replacing a wetland in a different locale (e.g., out of watershed)

Organic soil: soil composed of predominantly organic rather than mineral material

Open water: water of any depth with no emergent vegetation; include mudflat areas which are periodically inundated (Note: in tidal systems, estimate open water coverage at mid-tide)

Out-of-kind mitigation: replacing one wetland type with another

Planned wetland: design or an implemented design for a constructed, restored, or enhanced wetland

Permanently flooded: water covers the land surface throughout the year in all years; vegetation is composed of obligate hydrophytes

Persistent vegetation: vegetation(woody or herbaceous) that normally remains standing at least until the beginning of the next growing season

pH: logarithm of the reciprocal of the concentration of free hydrogen ions which is used to express both acidity and alkalinity on a scale from 0 to 14; "7" represents neutrality; a number less than 7 indicates increasing acidity; numbers greater than 7 indicate increasing alkalinity

Pool: portion of the water column that has less than average water velocity, a greater than average depth, and substrates composed of silt/fines

Predicted FCIs: FCIs that the planned wetland is predicted to achieve

Project area: area in which the activities related to the project occur

Riffle: portion of the water column that has greater than average water velocity, a less than average depth, and substrates composed of gravel/rubble/course sand

Sand: composed predominantly of coarse-grained mineral sediments with diameters larger than 0.074 mm and smaller than 2 mm

Saturated: substrate is saturated to the surface for extended periods during the growing season, but surface water is seldom present

Seasonally flooded: surface water is present for extended periods especially early in the growing season, but is absent by the end of the season in most years; when surface water is absent, the water table is often near the land surface

Sediment Stabilization (function): capacity to stabilize and retain previously deposited sediments

Sedimentation: process by which particulates and associated pollutants are physically deposited on the wetland soil surface

Seepage: that portion of the rainfall that infiltrates downward through the subsurface layers of the soil, joining the ground water flow

Semipermanently flooded: surface water persists throughout the growing season in most years; when surface water is absent, the water table is usually at or very near the land surface

Shore: vegetated and unvegetated substrate areas of the wetland located channelward of the bank

Shoreline bank: steep ascending slope of land of any height raised above the adjacent shore that can experience undercutting if it is in contact with water

Shoreline Bank Erosion Control (function): capacity to provide erosion control and to dissipate erosive forces at the shoreline bank

Sink: wetland that has a net retention of an element or a form of that element (i.e., inputs are greater than the outputs)

Snags: dead or partially dead standing trees/shrubs

Source: wetland that exports more of an element downstream (i.e., outputs are greater than inputs)

Target functional capacity index (Target FCI): functional capacity index goals established for the planned wetland

Target functional capacity units (Target FCUs): functional capacity units goals established for the planned wetland (Target FCUs = FCUs x R)

Temporarily flooded: surface water is present for brief periods during the growing season, but the water table usually lies well below the soil surface for most of the season

Time interval comparison: functional capacity of the planned wetland is quantified at several points in time to account for the trend/pattern of change; assessments are done based on predicted conditions at fixed intervals until the planned wetland has reached the Target FCIs and Target FCUs

Turbidity: optical property of water that causes light to be scattered or adsorbed in the water, resulting in a decrease in water transparency

Uniqueness/Heritage (function): presence of characteristics which render the wetland important to humans for social or political reasons

Upper shore zone: vegetated or non-vegetated portion of the shore located between the bank and the potential lower limit of emergent or woody vegetation as dictated by water depth or tide level (Figure A.2, p. A 4)

Vegetation overhang: vegetation overhanging the water column within 30 cm (12 in) vertical of the water surface during average high water (Figure 8.4, p. 8–14)

Visual obstruction: height at which a pole is totally obscured by vegetation when viewed from a distance of 4 m (13.1 ft)

Water Quality (function): capacity to retain and process dissolved or particulate materials to the benefit of downstream surface water quality

Wetland assessment area (WAA): designated wetland area to which the planned wetland will be compared

Wetland class: wetland area which is assumed to be functionally similar due to the similarity in hydrologic conditions; EPW distinguishes four wetland classes (Table 3.2, p. 3–5): tidal, nontidal stream/river, non-tidal pond/lake, and non-tidal depression

Wildlife (function): degree to which a wetland functions as habitat for wildlife as described by habitat complexity

Appendix D. Species List

Species List

Common and scientific names of fauna referred to in EPW.

Common name	Scientific name
Mammals	
Raccoon	*Procyon lotor*
Weasel	*Mustela* spp.
Mink	*Mustela vison*
Badger	*Taxidea taxus*
Skunk	*Mephitis mephitis*
Fox	*Vulpes vulpes*
Muskrat	*Ondatra zibethicus*
Nutria	*Myocastor coypus*
Beaver	*Castor canadensis*
Swamp rabbit	*Sylvilagus aquaticus*
Reptilia	
Snapping turtle	*Chelydra serpentina*
Slider turtle	*Pseudemys scripta*
Amphibia	
Bullfrog	*Rana catesbiana*
Red-spotted newt	*Notophthalmus viridescens viridescens*
Birds	
Western grebe	*Aechmophorus occidentalis*
Pied-billed grebe	*Podilymbus podiceps*
Great blue heron	*Ardea herodias*
Green-backed heron	*Butorides striatus*
Roseate spoonbill	*Ajaia ajaja*
Greater snow goose	*Chen caerulescens*
Northern pintail	*Anas strepera*
Mallard	*Anas platyrhynchos*
Gadwall	*Anas acuta*
Blue-winged teal	*Anas discors*
Black duck	*Anas rubripes*
Wood duck	*Aix sponsa*
Canvasback	*Aythya valisineria*
Lesser scaup	*Aythya affinis*
Ring-necked duck	*Aythya collaris*
Redhead	*Aytha americanus*
Ruddy duck	*Oxyura jamaicensis*
Western grebe	*Aechmophorus occidentalis*
Virginia rail	*Rallus limicola*
Sora	*Porzana carolina*
Osprey	*Pandion haliaetus*
American avocet	*Recurvirostra americana*
Wilson's phalarope	*Phalaropus tricolor*
Forster's tern	*Sterna forsteri*
Least tern	*Sterna antillarum*
Belted kingfisher	*Ceryle alcyon*
American crow	*Corvus brachyrhynchos*
Carolina wren	*Thryothorus ludovicianus*
European starling	*Sturnus vulgaris*

Common name	**Scientific name**
Red-winged blackbird	*Agelaius phoeniceus*
Great-tailed grackle	*Quiscalus mexicanus*
Northern cardinal	*Cardinalis cardinalis*
Swamp sparrow	*Melospiza georgiana*

Fish

Common name	**Scientific name**
Paddlefish	*Polyodon spathula*
Gizzard shad	*Dorosoma cepedianum*
Rainbow trout	*Salmo gairdneri*
Brown trout	*Salmo trutta*
Brook trout	*Salvelinus fontinalis*
Chinook salmon	*Oncorhynchus tshawytscha*
Coho salmon	*Oncorhynchus kisutch*
Common carp	*Cyprinus carpio*
Central mudminnow	*Umbra limi*
Golden shiner	*Notemigonus crysoleucas*
Bigmouth buffalo	*Ictiobus cyprinellus*
Smallmouth buffalo	*Ictiobus bubalus*
Longnose sucker	*Catostomus catostomus*
Black bullhead	*Ictalurus melas*
Mummichog	*Fundulus heteroclitus*
Banded killifish	*Fundulus diaphanus*
Gulf killifish	*Fundulus grandis*
Longnose killifish	*Fundulus similis*
Killifish	*Fundulus maculatur*
Mosquito fish	*Gambusia affinis*
Atlantic silverside	*Menidia menidia*
Tidewater silverside	*Menidia beryllina*
Atlantic menhaden	*Brevoortia tyrannus*
Rock bass	*Ambloplites rupestris*
Warmouth	*Lepomis gulosus*
Bluegill	*Lepomis macrochirus*
Green sunfish	*Lepomis cyanellus*
Bluespotted sunfish	*Enneacanthus gloriosus*
Smallmouth bass	*Micropterus dolomieui*
Largemouth bass	*Micropterus salmoides*
Yellow perch	*Perca flavescens*
Fallfish	*Semotilus corporalis*
Red drum	*Sciaenops ocellatus*
Atlantic croaker	*Micropogonias undulatus*
White crappie	*Pomoxis annularis*
Slough darter	*Etheostoma gracile*
Longnose dace	*Rhinichthys cataractae*
Southern flounder	*Paralichthys lethostigma*
Northern pike	*Esox lucius*
Spotted seatrout	*Cynoscion nebulosus*
Walleye	*Stizostedion vitreum vitreum*
Blackcheek tonguefish	*Symphurus plagiusa*
Atlantic croaker	*Micropogonias undulatus*
Stripped mullet	*Mugil cephalus*
Brook stickleback	*Culaea inconstans*

Arthropods

Common name	**Scientific name**
Fiddler crab	*Uca pugnax*
Brown shrimp	*Penaeus aztecus*
White shrimp	*Penaeus setiferus*

Appendix E. Element List

Element List

List of elements used to evaluate each function.

#	Element	SB	SS	WQ	WL	FT	FS	FP	UH
1a.	Water contact with toe of bank	✓		✓					
1b.	Shoreline bank stability					✓	✓	✓	
2.	Fetch	✓							
3.	Shoreline structures/obstacles	✓							
4a.	Disturbance at site (SS)	✓	✓			✓	✓	✓	
4b.	Disturbance at site (WQ)			✓					
4c.	Disturbance of wildlife habitat				✓				
4d.	Disturbance in channel/open water					✓	✓	✓	
5a.	Surface runoff (bank erosion)	✓							
5b.	Surface runoff (wetland erosion)			✓					
6.	Boat traffic	✓							
7a.	Water level fluctuation	✓	✓	✓					
7b.	Most permanent hydroperiod					✓			
7c.	Spatially dominant hydroperiod					✓			
8a.	Hours of sunlight	✓							
9a.	Substrate suitability for vegetation establishment	✓							
9b.	Dominant substrate			✓					
9c.	Substrate suitability for fish					✓			
10a.	Plant (basal) cover – upper shore zone	✓							
10b.	Plant (basal) cover – entire wetland		✓	✓					

#	Element	SB	SS	WQ	WL	FT	FS	FP	UH
10c.	Leaf litter and debris cover		✓						
10d.	Plant (basal) cover – tidal					✓			
10e.	Rooted vascular aquatic beds in erosion areas	✓							
10f.	Rooted vascular aqutic beds (lower shore zone)					✓			
10g.	Plant height – upper shore zone	✓							
10h.	Plant height – entire wetland			✓					
10i.	Root structure – upper shore zone	✓							
10j.	Root structure – entire wetland		✓						
10k.	Vegetation persistence – upper shore zone	✓							
10l.	Vegetation persistence – entire wetland		✓	✓					
10m.	Vegetation overhang						✓	✓	
10o.	Aboveground plant biomass						✓	✓	
11a.	Layers				✓				
11b.	Condition of layer coverage				✓				
11c.	Spatial pattern of shrubs and/or trees				✓				
11d.*	Difference in layers				✓				
12a.	Cover types				✓				
12b.	Ratio of cover types				✓				
12c.	Cover type interspersion				✓				
12d.	Undesirable species				✓				
12e.*	Difference in cover types				✓				
13a.	Percent open water				✓				

#	Element	SB	SS	WQ	WL	FT	FS	FP	UH
13b.	Vegetation/water interspersion				✓				
14a.*	Steepness of existing shore	✓							
14b.	Steepness of planned wetland shore	✓							
14c.	Wetland slope		✓	✓					
15.	Hydrologic condition			✓					
16a.	Wetland width			✓					
16b.	Wetland site size				✓				
16c.	Fish habitat size						✓	✓	
17.	Detention time			✓					
18.	Sheet vs. channel flow			✓					
19.	Average water depth			✓					
20a.	Gross contamination				✓				
20b.	Water quality ratings					✓	✓	✓	
20c.	Nutrient/sediment/contaminants					✓	✓	✓	
20d.	Dissolved oxygen					✓	✓	✓	
20e.	pH range						✓	✓	
20f.	Maximum water temperature					✓	✓	✓	
20g.	Turbidity						✓	✓	
21a.	Shape of upland/wetland edge				✓				
21b.	Shape of wetland/water edge					✓	✓	✓	
22a.	Wildlife attractors				✓				
22b.	Available fish cover/attractors					✓	✓	✓	

#	Element	SB	SS	WQ	WL	FT	FS	FP	UH
23.	Islands				✓				
24.	Obstruction to fish passsage					✓	✓	✓	
25a.	Percent pool area						✓		
25b.	Current velocity within pools						✓		
26.	Bank undercut						✓		
27a.	Spawning substrate						✓	✓	
27b.	Spawning structures						✓	✓	
27c.	Drawdown							✓	
28.*	Refuge during drought/freeze							✓	
29.	Endangered species								✓
30.	Rarity								✓
31.	Unique features								✓
32.	Historical or archaeological significance								✓
33.	Natural landmark								✓
34.	Connected to Wild and Scenic River								✓
35.	Park, sanctuary, etc.								✓
36.	Scientific research site								✓
	TOTAL	16	7	14	17	15	20	19	8
	Number used to calculate FCI	15	7	14	15	15	20	18	8

* Not used to calculate FCI

APPENDIX L:
SOUTH SAN DIEGO BAY WETLAND MITIGATION BANK BASELINE FUNCTIONAL ASSESSMENT RESULTS (EVALUATION OF PLANNED WETLANDS)

EVALUATION OF PLANNED WETLANDS PROCEDURE AT SALT POND 20

INTRODUCTION

Wetland functional assessments are field-based protocols to quantify ecological function of existing and planned wetland habitats. There are hundreds of wetland functional assessment protocols in existence; Great Ecology utilized the Evaluation for Planned Wetlands (EPW) to the Salt Pond 20 Site (Site). The Evaluation for Planned Wetlands (EPW) handbook (Bartoldus et al. 1994) describes EPW as "…a rapid-assessment procedure used to determine whether a planned wetland has been adequately designed to achieve defined wetland function goals. The EPW allows the designer and decision maker to identify characteristics which are important to each function and determine how and if the planning goals are attainable." Details on the EPW process described herein derive from the handbook.

For a mitigation bank, functional assessments are applied to calculate the increase in ecological function relative to a starting value, or baseline that will stem from a restoration project in order to calculate the appropriate number of credits generated by the project. Great Ecology applied the EPW to Salt Pond 20 (Bank Site) to quantify the baseline wetland function of current Site conditions relative to a designated reference site. The baseline data will be compared to the projected increase in ecological function, which will be quantified during the 60% design process, to ultimately inform the final crediting ratio for the Bank.

METHODOLOGY SUMMARY

An EPW evaluation is conducted on a wetland assessment area (WAA). The WAA encompasses a designated wetland area to which the planned wetland will be compared. The WAAs represent existing conditions and the planned wetlands are the design concept. The EPW evaluates a site on six (6) major wetland functions, defined in TABLE 1.

TABLE 1: DEFINITIONS OF EPW FUNCTIONS

Function	**Definition**
Shoreline Bank Erosion Control	Capacity to provide erosion control and to dissipate erosive forces at the shoreline bank.
Sediment Stabilization	Capacity to stabilize and retain previously deposited sediments.
Water Quality	Capacity to retain and process dissolved or particulate materials to the benefit of downstream surface water quality.
Wildlife	Degree to which a wetland functions as habitat for wildlife as described by habitat complexity.
Fish Tidal Non-tidal Stream/River Non-tidal Pond/Lake	Degree to which a wetland habitat meets the foot, shelter, reproductive, and water quality requirements of fish.
Uniqueness/Heritage	Presence of characteristics that distinguish the wetland as unique, rare, or valuable. This function is not applied to a spatial unit.

To measure ecological function, the EPW applies a unitless element score that represents the functional capacity of a single physical, chemical or biological characteristic of the habitat. Each function is comprised of multiple elements. Each element score ranges from 0.0 to 1.0, where 0.0 represents unsuitable conditions and 1.0 represents the “optimal” condition. “Optimal” is a variable state. In EPW, a nearby reference site is selected to characterize optimal conditions *attainable* for the region where a target wetland is located. The reference site acts as a region-specific yardstick against which progress on the restoration site will be measured; a low functional score for a habitat characteristic at the reference site indicates a low potential for functional capacity of that habitat at the restored site. Conversely, a high score at the reference site indicates a greater potential to increase the habitat’s functional capacity at the restoration site.

The multiple element scores that comprise each EPW function are combined according to the formulas in TABLE 2 and ultimately averaged to calculate a functional capacity index (FCI). The FCI is a dimensionless number ranging from 0.0 to 1.0 that describes a wetland’s relative capacity to perform a function, where 0.0 indicates no functional capacity and 1.0 indicates optimal function capacity. The FCI and WAA are then used to derive the functional capacity units (FCUs). The FCIs represent the “quality” of functional capacity per unit area, whereas the FCUs represent the “quantity” of functional capacity. FCUs are calculated by multiplying FCI times the area of the planned impact area.

The ultimate score for an EPW analysis is one averaged FCI score that is translated into an FCU score for the total project area.

TABLE 2: EPW CALCULATIONS (BARTOLDUS ET AL. 1994)

Function	**Definition**
Shoreline Bank Erosion Control	$\frac{Potential\ for\ Erosion + Avg\ (SSO, PIRE, VIRE)}{2}$
Sediment Stabilization	$\frac{Disturbance\ Factors + Avg(VC, SS)}{2}$
Water Quality	$\frac{\frac{Avg\ (SSC, VC) + Limiting\ Factors}{2} + Water\ Contact}{2}$
Wildlife	$\frac{Avg(VS, VCT, VWP, PF) + FRHV}{2}$
Fish – Tidal	$Avg(Limiting\ Factors, Food/Cover, Water\ Quality)$
Uniqueness/Heritage	$Uniqueness/Heritage$

SSO = Shoreline Structures/Obstacles
PIRE = Physical Influences on Rate of Erosion
VIRE = Vegetation Influence on Rate of Erosion
VC = Vegetation Characteristics
SS = Slope Stability
SSC = Substrate-Slope Characteristics
VS = Vegetation Strata
VCT = Vegetation Cover Types
VWP = Vegetation/Water Proportions
PF = Physical Features
FRHV = Features that Reduce Habitat Value

Baseline EPW Results for Salt Pond 20

TABLE 3 provides the baseline FCI scores for the Bank Site and designated reference site (Salt Pond 10), which represent the current wetland ecological function at each site.

The next step in the EPW process will be to score the post-restoration condition of the site using the 60% design set. The score differential between baseline and post-restoration at the site will be used to calculate uplift, which will form the basis of crediting from the Bank site.

TABLE 3: BASELINE FCI SCORES FOR SALT POND 20 AND SALT POND 10 REFERENCE SITE

Element	Salt Pond 10 Reference Site	Salt Pond 20
Shoreline Bank Erosion Control		
Potential for Erosion	1.00	0.00
Shoreline Structures/ Obstacles	1.00	1.00
Physical Influence on Rate of Erosion	1.00	0.76
Vegetation Influences on Rate of Erosion	1.00	0.05
Influences on Rate of Erosion	1.00	0.61
Sediment Stabilization		
Disturbance Factors	1.00	0.10
Vegetation Characteristics	1.00	0.04
Slope Stability	1.00	1.00
Wetland Characteristics	1.00	0.52
Water Quality		
Hydrologic Condition	1.00	0.10
Limiting Factors	1.00	0.23
Substrate-Slope Characteristics	1.00	0.50
Vegetation Characteristics	1.00	0.02
Wetland Characteristics	1.00	0.26
Wetland Condition	1.00	0.25
Water Contact	1.00	0.33
Wildlife		
Features that Reduce Habitat Value	1.00	0.10
Vegetation Strata	1.00	0.62
Vegetation Cover Types	1.00	0.27
Vegetation/Water Proportions	1.00	0.17
Physical Features	1.00	0.07
Habitat Complexity	1.00	0.28
Fish (Tidal)		
Limiting Factors	1.00	0.16
Food/Cover	1.00	0.02
Water Quality	1.00	Information Not Available
Uniqueness/Heritage		
Uniqueness/Heritage	0.36	0.24
AVERAGE	**1.00**	**0.24**

REFERENCES

Bartoldus CC, EW Garbisch, ML Kraus. 1994. *Evaluation for Planned Wetlands (EPW): A Procedure for Assessing Wetland Functions and a Guide to Functional Design.* Environmental Concern, St. Michaels, MD: 442 pp.

APPENDIX M:
WETLAND RESTORATION OF SALT POND 20: BASIS OF DESIGN REPORT (DRAFT)

Draft

WETLAND RESTORATION OF SALT POND 20

Basis of Design Report

Prepared for
San Diego Unified Port District
Great Ecology

October 24, 2017

Draft

WETLAND RESTORATION OF SALT POND 20

Basis of Design Report

Prepared for
San Diego Unified Port District
Great Ecology

October 24, 2017

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D150733.02

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1 Introduction

This report documents the preliminary design of the Salt Pond 20 Wetland Restoration and transmits the 30%-complete drawings and preliminary construction cost estimate. This Basis of Design (BOD) report describes the design work completed since the conceptual design presented in the memorandum titled Conceptual Planning-Level Engineering/Site Analysis for Pond 20 (Concept Memo) prepared for Great Ecology by ESA on April 25, 2016. This BOD report provides details on the project that can be used to inform the regulatory agency permitting processes, refine a project description for environmental review, and as a basis for initiating the final design.

1.1 Project Background

The San Diego Unified Port District (District) owns a 95-acre parcel in South San Diego Bay called Pond 20. Pond 20 lies in the Otay River Floodplain (Figure 1) and historically supported rich tidal wetland habitat, but was filled and used as a commercial solar salt evaporator pond from the late 1800s until the 1940s. The District acquired the parcel in 1998 and, after many years of study and public outreach, determined the best use of Pond 20 was to restore it and use it as a commercial wetland mitigation bank.

The Pond 20 project would lower the overall elevation of the 85-acre interior sub-parcel of the property and reconnect it to tidal flows from San Diego Bay via cut channels. The design would generate tidal wetlands and upland transitional coastal sage scrub habitat along the perimeter of the property. The majority of Pond 20 would support mid and high marsh habitat, but the project would also establish low marsh and intertidal mudflats across the marshplain, and subtidal habitat within the tidal channels. Sheet 14 of the 30%-complete construction plans shows a distribution of habitat types and corresponding acreage (Appendix A). To the north of the project site is the Otay River Floodplain Site (Figure 2), which is part of the Otay River Estuary Restoration Project (ORERP) proposed by Poseidon Water L.P. (Poseidon) in coordination with the U.S. Fish and Wildlife Service and the San Diego Bay National Wildlife Refuge. The ORERP is being designed to addresses Poseidon’s mitigation responsibilities for impacts caused by the construction and operation of the Carlsbad desalination plant. As of September 2017, the Final EIR for the ORERP is pending, and 30%-complete drawings of the Otay River Floodplain Site are expected by the end of the year.

The Pond 20 restoration will need to coordinate restoration design with ORERP for eventual construction. However, at this stage, the projects are being designed separately, and this memo does not reflect incorporation of the ORERP. The final version of this report, which will be submitted along with the 60%-complete drawings, is expected to be updated to include the ORERP design. Additionally, hydrodynamic modeling of flood conditions and scour potential will be completed and incorporated into this memo after the ORERP 30%-complete drawings are received from the Poseidon team. ***Placeholders have been included in this report to identify outstanding analyses.***

1.2 Basis of Design Report Scope

This report describes the design work subsequent to the conceptual design. It documents the constraints and considerations (Section 2) specific to the Pond 20 restoration that formed the basis for the 30%-complete design. The services completed for the BOD include topographic mapping by Towill, preliminary geotechnical investigation (Geocon 2017), assessment of soils conditions (Great Ecology 2017), topographic surveys conducted by ESA, base map creation using a variety of topographic and utilities information, an assessment of flood conditions, including coastal flooding, fluvial flooding, and contribution of wind waves, and detailing of restoration elements to a preliminary (or 30%-complete) level of design. The BOD documents preliminary design analyses (Section 3) and the preliminary design (Section 4).

SOURCE: ESRI

Mitigation Banking at Pond 20. D150733

Figure 1
Project Location

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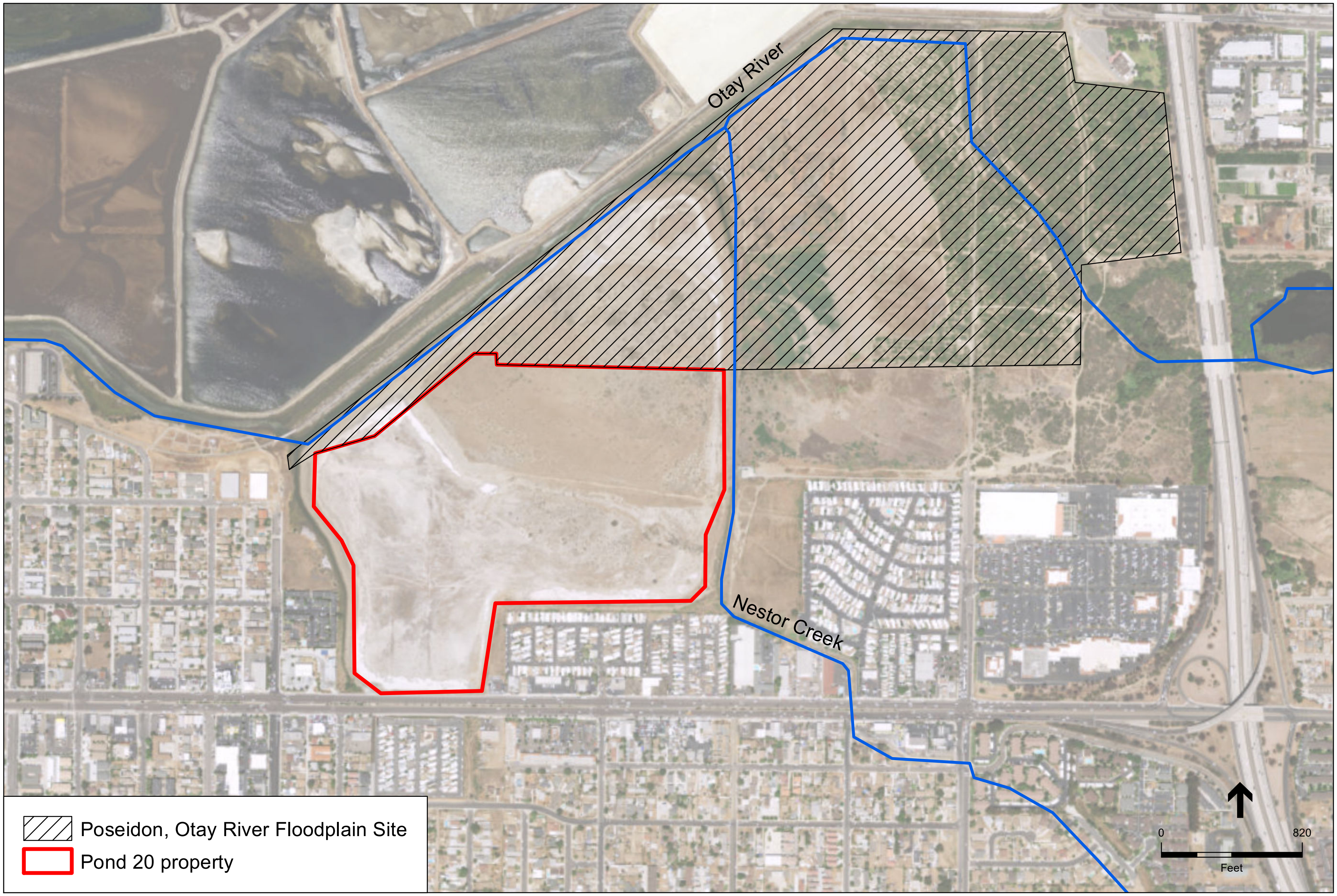

SOURCE: ESRI

Wetland Restoration of Salt Pond 20 .
D150733 **Figure 2**
Site Map

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2 Design Constraints and Considerations

The proposed restoration design was developed to account for multiple design constraints and considerations. Constraints are defined as factors that must be considered while developing the design, while considerations are factors that contribute to the design, but are not limiting. The design constraints and considerations are described in general at planning-level detail below.

2.1 Design Constraints

2.1.1 Flood Management

The restoration must maintain or improve existing levels of flood protection to the properties along the perimeter of the site. The site is currently separated from the tides by a perimeter levee, but is low lying and is within the FEMA flood zone for Otay River (see Section 3.1 and 3.2). A portion of Palm Avenue and the Bayside Palms Mobile home Village are directly adjacent to the restoration site along the southern boundary. The potential changes in flood risk to these sites resulting from the restoration will be assessed in Section 3.6, Hydrodynamic Modeling.

2.1.2 Wave Action

Opening the site to tidal action can lead to wind wave impacts on the existing levees along the perimeter and development leeward of the levees. An assessment of wave conditions was used to determine appropriate fill slopes that will prevent excessive wave run-up and erosion on the levees, and is discussed in Section 3.2 below.

2.2 Considerations

2.2.1 Mitigation Banking

Restoration sustainability, mitigation banking success, and the balance between the two have been considered in the development of this 30%-complete design. The primary goal of the project is creation of a successful mitigation bank, which will be achieved through the restoration of a functioning tidal marsh that produces sufficient credits to make the bank financially viable. There are unique challenges associated with creating sustainable habitat for the maximum number of mitigation credits at the lowest possible development cost. For example, creating flat slopes around the edges of a wetland restoration site is generally considered a restoration “best practice” because it provides higher elevations zones for the marsh to migrate into over time as sea-levels rise, increasing habitat sustainability. To strike a balance between the financial and restoration goals of the project, the current 30% design utilizes creditable high marsh wetland, rather than uncreditable upland, as the beneficial transition zone, providing higher elevation space for lower marsh levels to migrate into over time, while generating wetland credits today. This approach creates wetlands with a high proportion of high marsh wetland, to enhance site sustainability compared to an approach that creates a higher proportion of mid and low marsh wetlands. Due to the region’s low precipitation rates, establishment of high marsh vegetation may take more time than low and mid marsh vegetation. Although this tradeoff could result in lower initial credit availability, we consider the creation of high marsh to provide valuable habitat that balances sustainability and mitigation banking goals. Note that further assessment of restored wetland response to sea level rise may be needed in subsequent phases of the mitigation banking process.

3 Preliminary Design Analyses

This section describes several of the technical analyses conducted by ESA and others as part of the preliminary design. These analyses include data analysis and geomorphic assessment of tidal channels in the San Diego Bay area, and implications on restoration design. As part of these analyses, ESA collected, reviewed, and analyzed data sets for hydrologic phenomena, such as tides, coastal and fluvial flooding events, and wave generation occurring at the project site. This information was used to assess whether the project would likely increase flood risk to adjacent properties by converting a large, relatively dry former salt pond to a tidal basin with variable bay water levels. An assessment of scour of the Otay River channel downstream of the project site was initiated, but additional modeling and study is anticipated to occur at subsequent stages of the project.

3.1 Water Levels

This section presents a discussion on water levels affecting the project site, including the tidal datums and published elevations of typical observed and predicted tidal hydrology in San Diego Bay, and extreme coastal and fluvial water levels that occur during storms and major flood events.

3.1.1 Tidal Datums and Observed Water Levels

Tide data has been collected by NOAA (ID. 9410170) at the Navy Pier in downtown San Diego and by the TRNERR monitoring program at the mouth of the Otay River (Crooks et al 2015). Table 1 summarizes tidal datums from the two locations relative to the North American Vertical Datum of 1988 (NAVD88) in feet. The NOAA tidal datums are based on a longer period of record, better vertical control, and a more complete dataset. The NOAA gage has been collecting water levels from 1906 to present (the longest period of record in San Diego Bay), is surveyed in NAVD88 datum using NOAA quality control procedures, and provides all relevant tidal datums. The TRNERR gage has been collecting water levels since 2010, is surveyed into NAVD88 periodically, but may shift slightly between surveys, and provides tidal datums for only the upper part of the tide range.[1]

ESA has made a recommendation to the District to collect water level data in the Otay River next to the project site. Data would be gathered by installing a tide gage and surveying it into the project datum. When sufficient data has been collected, it will be compared to the NOAA and TRNERR data and used to determine the appropriate tidal datums to use at the site. It is anticipated that the high tides observed in the restoration site will be similar to those observed in San Diego Bay, but that the low tides may be elevated above low tide observed in the Bay. Since the elevations where different marsh species occur are dependent on tide water levels, and even a few inches can make a difference to the success of specific species, understanding water levels at

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[1] The TRNERR tide gage was surveyed into NAVD on 2/25/15; however, the gage is removed from this location every 2-4 weeks for data download. It is likely that the location of the gage shifts slightly when it is re-installed. Additionally, the gage is located within the river bed and dries out at the lowest tides (below -1.6 ft NAVD), so the low tide datums are not calculated.

the site is essential. Collecting data and conducting modeling will help inform the optimal target elevations for grading of restoration features.

TABLE 1
TIDAL DATUMS AND OBSERVED WATER LEVELS IN SAN DIEGO BAY

Tidal Datum		San Diego (NOAA) ft NAVD88	Otay River Entrance (TRNERR), ft NAVD88
Highest observed (12/13/2012)	HOWL	7.7 (8:12 AM)	7.8 (9:24 AM)
Highest Astronomical Tide	HAT	7.3	-
Mean Higher High Water	MHHW	5.3	5.3
Mean High Water	MHW	4.6	4.6
Mean Tide Level	MTL	2.5	-
Mean Sea Level	MSL	2.5	-
Diurnal Tide Level	DTL	2.4	-
National Geodetic Vertical Datum of 1929	NGVD	2.1	-
Mean Low Water	MLW	0.5	-
North American Vertical Datum of 1988	NAVD	0	0
Mean Lower Low Water	MLLW	-0.4	-
Lowest Astronomical Tide	LAT	-2.5	-
Lowest Observed	LOWL	-3.5	-1.6

3.1.2 Extreme Coastal Flooding

Coastal flooding has been assessed by FEMA, as part of the mapping updates to coastal flood hazard areas along the coast of California, and by ESA (2016). Table 2 presents extreme still water levels analyzed by ESA. ESA estimated extreme still water levels from the 51 years of recorded data at the NOAA San Diego tide gage (1965-2015) (ESA 2016), and found the 100-year still water level (SWL) to be approximately 8.1 feet NAVD.

TABLE 2
EXTREME COASTAL STILL WATER LEVELS FOR SAN DIEGO BAY

Storm Event	Still Water Level (feet NAVD)
0.02%, 500-year[1]	8.4
1%, 100-year	8.1
2%, 50-year	8.0
5%, 20-year	7.8
10%, 10-year	7.7
20%, 5-year	7.5
50%, 2-year	7.4

1. The “500-year” is the event that has a 0.02% chance of occurrence each year.

Recent mapping by FEMA for the vicinity of the project area indicates that the SWL elevations presented in Table 2 are in close agreement to the results of their preliminary mapping. Figure 3 presents a map excerpted from the preliminary mapping for south San Diego Bay near Imperial Beach. As shown in the map, the base flood elevation (BFE) in the AE zones[2] are 8 feet NAVD, which is close to the 100-year coastal SWL computed by ESA (2016). Different statistical methods may account for the minor difference in elevations. Also of note in Figure 3 is the AE zone with BFE of 9 feet NAVD in the northwest portion of the map. This area is a former salt pond that was restored to tidal wetlands by the US Fish and Wildlife Service. The dotted line indicates a wave transect where FEMA computed the wave heights and wave runup. The relatively higher BFE in this area indicates that wave generation in the pond contributed wave runup, increasing the BFE. This is discussed more in Section 3.2 below.

3.1.3 Fluvial Flooding

In addition to coastal flooding, Figure 3 presents the 100-year fluvial flood extents of the Otay River, indicated by the red and blue hatching. The estimated 100-year flood water level varies across Pond 20 from 13.2 ft NAVD on the western side of the project area to14 ft NAVD in the east. The fluvial flood dominates the flood mechanism at the site, and impacts properties adjacent to the project site. In its existing state, the Pond 20 basin may provide some storage of floodwater, but according to the Flood Insurance Study (FIS) for San Diego County, Otay River flows on the order of a 10-year event will likely damage the pond levees in the area. The effect of converting the site to tidal conditions on fluvial flood elevations is not known at this time. ESA anticipates conducting hydraulic modeling at subsequent design stages.

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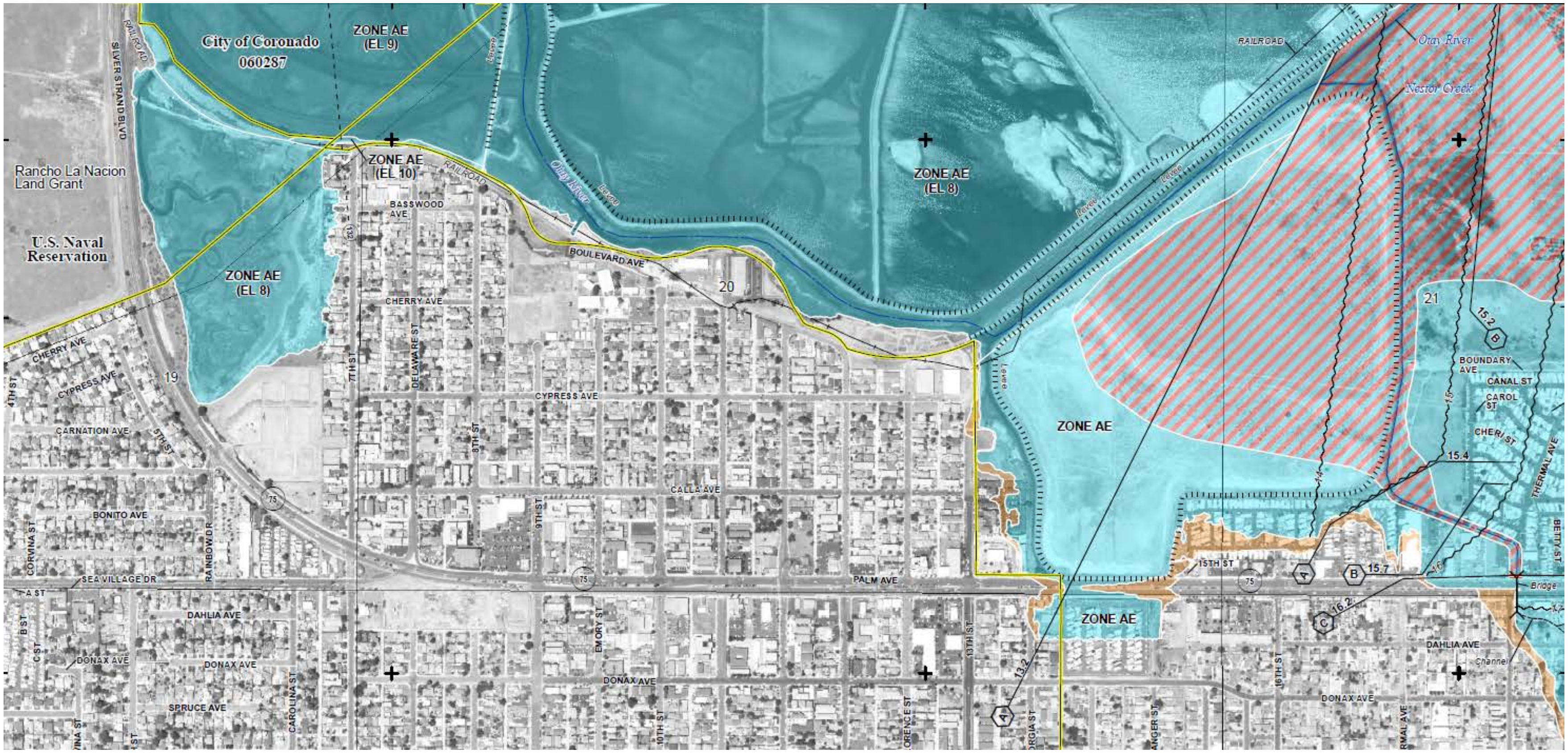
[2] FEMA AE zone is a special flood hazard zone with ponded water and without significant wave hazards



Wetland Restoration of Salt Pond 20 . D150733

SOURCE: FEMA 2017

Figure 3
FEMA Preliminary Flood Insurance Rate Map
With Recently Updated Coastal Analysis

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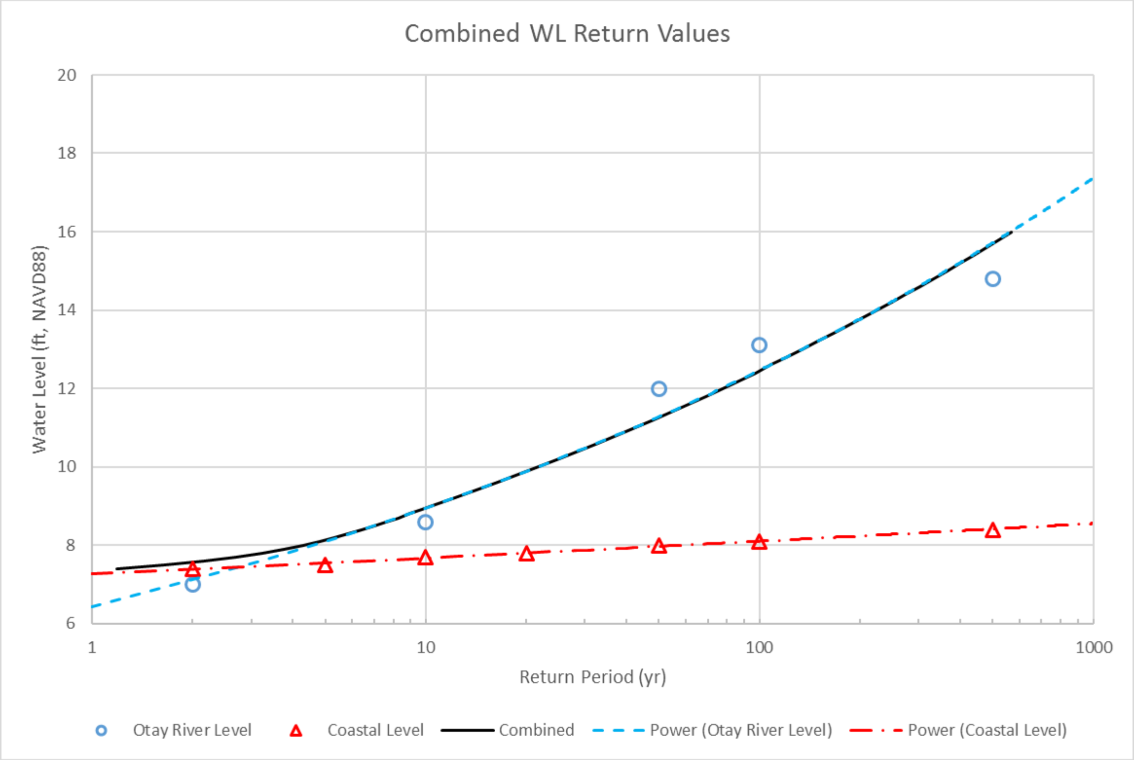
3.1.4 Combined Flooding

To assess whether combined coastal and fluvial water levels results in an increased water level for a given return period, extreme values were determined for each source independently then combined. For a variety of return periods, coastal water levels were calculated as described in the Concept Memo (ESA 2016), and fluvial water levels were leveraged from the FEMA FIS for the Otay River (FEMA 2014). An exponential curve was fit through each of these datasets, and the probability of a given water level was assumed to be the sum of its probabilities from each source (effectively assuming independence of coastal and fluvial water levels). The result is shown in Figure 3, which makes it evident that, while the site may experience occasional coastal flooding, severe floods are almost exclusively fluvial. Although this analysis indicates that the combined effect of coastal and fluvial flooding is small, this simple approach is not sufficient to fully assess the joint probability of a coastal and fluvial floods occurring simultaneously, nor has hydraulic modeling of the interaction of the fluvial flows with coastal water levels been performed. ESA plans on conducting modeling of the Otay River in subsequent stage of design.



Source: FEMA FIS 2014 and ESA 2016

Figure 4
Combined Flooding Return Periods for Fluvial and Coastal Flood Sources

3.2 Wind and Waves

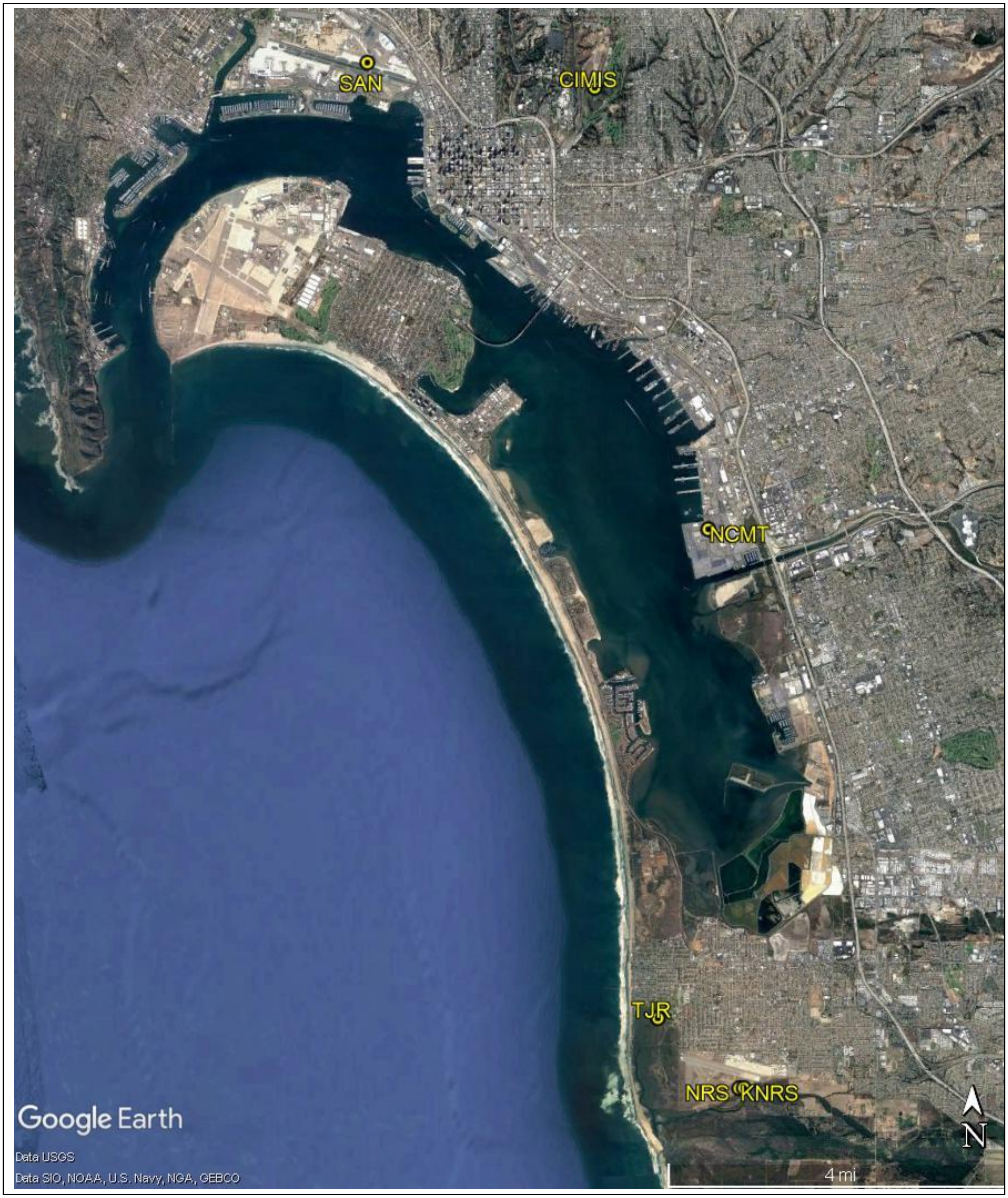
Figure 5 shows the location of six local wind data stations near San Diego Bay considered in this project, whose attributes are summarized in Table 3. The San Diego Airport station (SAN) has over 60 years of data hosted by NOAA, making it the longest of the datasets. While this provides a good sense of the general wind climate in San Diego, the station is more sheltered (by Point

Loma) than the project site. The CIMIS station (#184) is too short and too far north to provide data for the project site directly, but it does offer insight into the strong directionality of wind east of the bay. Farther south, there is a station at the National City Marine Terminal (NCMT), which has a shorter record, but is close enough to the project site to provide a representative directional distribution under normal conditions. The three sites in the Tijuana Estuary are closest to the project site. The first, maintained by TRNERR, has the shortest record, making the other two stations preferable. The stations at the Imperial Beach Naval Outlying Field Station, Ream Field (NRS and KNRS in Figure 4) are both derived from the same NOAA dataset, processed and maintained by different organizations; thus, the longer dataset obtained directly from NWS ASOS (NRS) was used in this study. This dataset is long enough to capture normal wind distribution and extreme conditions near enough to be representative of the project site.

The dominant winds at the project site originate from the west and, to a lesser degree, from the west-southwest. Extreme wind speeds are estimated to be 39 mph at the 10-year level and 47 mph at the 100-year recurrence level.

TABLE 3
WIND STATIONS AROUND SAN DIEGO BAY

Station ID	Station Name	Source	Period of Record	Longitude	Latitude
SAN	Lindbergh Field (SAN DIEGO/LINDBERG)	ASOS (NWS)	1955-2017	-117.18449	32.73392
CIMIS	CIMIS Station 184	CA Irrigation Mgmt. Info. Sys.	2002-2013	-117.13949	32.72948
NCMT	National City Marine Terminal	National City Marine Terminal	2011-2014	-117.11700	32.65616
TRJ	Tijuana River Tidal Linkage	NERR (NOAA)	2001-2017	-117.12700	32.57470
KNRS	Imperial Beach Naval Outlying Field - Ream Field	MesoWest (Univ. of Utah)	1999-2017	-117.11091	32.56302
NRS	Imperial Beach, Ream Field (IMPERIAL BEACH/REAM)	ASOS (NWS)	1970-2017	-117.11000	32.56306



SOURCE: Google Earth, 2017

Figure 5
San Diego Wind Record Locations

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While the project site is relatively sheltered from San Diego Bay, lying behind the other salt ponds in the south bay, wind over the newly created wetland is expected to generate waves. While these may not be as large as waves in the bay, even small waves can cause significant erosion, especially on levees that have been dry for a long period, such as those separating the project site from adjacent neighborhoods and infrastructure in Imperial Beach.

To evaluate waves in the restored site, a neighboring site was used as a representative case study, based on the wind analysis described above. The recent Preliminary FIRM released by FEMA includes a revised coastal analysis of the San Diego Bay National Wildlife Refuge Complex (south unit), which includes a wave analysis. The resulting BFE published by FEMA is one foot higher than protected areas without waves, indicating that the waves provide a one-foot increase in water levels due to wave runup. Since this project is of a similar scale and in a similar location, it is assumed that wave action will contribute an additional one foot to the FEMA BFE at the project site, but will not lead to further inundation of surrounding areas on the other side of the levees. This may be of interest to regulatory agencies, who could require additional documentation that the project will not result in an increase in flood risk to neighboring properties. Overall, the dominance of the fluvial flood indicates that the changes in the site use will have little impact on the dominant flood elevations.

While flood extents are not expected to change outside of the project site, there is potential for erosion of the inboard side of levees. To address this hazard, the design includes a transitional slope to reduce wave power on the levee (see Section 4.3.4 for additional information).

3.3 Sea Level Rise

Performance of the project for future condition with sea level rise will likely need to be communicated to regulatory agencies for permitting and for understanding the expectations of the project for meeting mitigation targets. The regulatory permitting needs include assessing sea level rise impacts, timing, and potential adaptation approaches as part of a Coastal Development Permit (CDP) issued by the California Coastal Commission (CCC). The assessment should also address issues with evolution of habitats due to sea level rise, and the potential timing of those changes. The following information is presented to provide a summary of pertinent and relevant policy guidance issued by the State of California and the federal government.

The California Coastal Commission Sea Level Rise Policy Guidance (CCC 2015) provides guidance for California projects on how to use predictions of global sea level rise for long-term planning purposes. The guidance document recommends using the estimates provided by the National Research Council’s (NRC) report on *Sea-Level Rise for the Coasts of California, Oregon, and Washington* (2012) as a starting place to select values. The NRC (2012) document presents different sea level rise amounts over time for a range in global emissions scenarios. Table 4 presents the sea-level rise amounts for the range of projections at the planning horizons of the NRC study. These sea level rise projections are defined relative to the year 2000. Although minimal sea level rise has been observed between 2000 and 2017, rapid acceleration of sea level rise is expected to follow periods of dynamical suppression of sea level rise along the Pacific coast (Bromirski et al. 2011). Therefore, the sea level rise projections relative to 2000 are used to account for potential rapid acceleration of sea level rise that could have a significant effect on the project.

TABLE 4
SEA LEVEL RISE PROJECTIONS BASED ON NRC (2012)

Emissions Scenario	2030	2050	2100
Low	2 in	5 in	17 in (1.4 ft)
Mid	6 in	11 in	37 in (3.1 ft)
High	12 in	24 in	66 in (5.5 ft)

These estimates account for regionally published vertical land motion based on Los Angeles

Recently, the Ocean Protection Council (OPC) funded an update on Sea-Level Rise Guidance (Griggs et al. 2017). The recent study provides minor updates to the sea level rise amounts for the prior emissions scenarios, but also considers a more extreme scenario resulting in rapid sea level rise of almost 10 feet by 2100. However, the State of California is currently in a process to determine how and whether to update policy guidance to include the results of the recent study.

Additional sea level rise guidance has been issued by the U.S. Army Corps of Engineers (USACE) for federally funded projects (USACE 2013). The USACE guidance recommends values similar to those presented in Table 4, but the low projection is based on historically observed sea level rise. The USACE guidance is not expected to be required for this project, as this is not a USACE-funded project

ESA recommends considering sea level rise in the design and planning for the project, and anticipates that regulatory agencies will request a technical study assessing the performance and impacts of the project due to sea level rise over the century. The sea level rise amounts should be based on State Policy Guidance (OPC 2013, CCC 2015), which does not include the extreme cases recently assessed by Griggs et al. (2017). Typically, the permitting resource agencies, such as the CCC, request assessing the project over a range of sea level rise amounts at multiple time periods over the planning horizon of the project, and to include the high emissions scenario.

3.4 Tidal Channel Layout and Sizing

The tidal channel planform layout (e.g., channel length per marsh area and sinuosity) and sizing (cross-section dimensions) can be designed based on empirical tidal channel layout/sizing data from reference wetlands. Hydraulic geometry relationships are empirical relationships between tidal prism or marsh area and channel geometry (e.g., channel depth, width, cross-sectional area). PWA (now ESA) developed hydraulic geometry relationships for coastal salt marshes based on survey data collected in relatively undisturbed marshes in San Diego Bay and San Francisco Bay (PWA 1995, Williams et. al. 2002).

Larger (higher order) tidal channels branch (bifurcate) into smaller (lower order) channels. Based on wetland area, the Pond 20 channel system can support a third or fourth order channel network, meaning the channels branch into smaller channels three or four times (ending in the smallest or first order channels). The 30% design assumes excavation of a full third order system, including first order channels. The larger channel systems are generally laid out to drain to the outside bends of the main third order channel as in natural wetland systems.

Table 5 lists preliminary tidal channel dimensions by channel order. The dimensions are based on hydraulic geometry relationships, but are adjusted for constructability.

TABLE 5
TIDAL CHANNEL DIMENSIONS BY CHANNEL ORDER

Channel order	Top width at marshplain (ft)	Bottom width (ft)	Side slope (H:V)	Invert elevation (ft NAVD)	Depth (ft below marshplain)	Note
3	54 to 72	8	4:1	-3.3 to -1.0	6.0 to 8.3	Subtidal
2	30 to 40	4	3:1	-1.0 to 0	5.0 to 6.0	Subtidal
1	14	2	2:1	0.4	4.6	Intertidal

Note: Channels are ordered from smallest (first order) to largest. Two first order channels join to form a second order channel, two second order channels join to form a third order channel, etc.

3.5 Target Salt Marsh Habitat Elevations

Salt marsh habitat zones can be defined for different areas based on the elevation of the area relative to tidal datums (i.e., as a surrogate for the frequency of tidal inundation). ESA calculated estimated habitat elevation ranges at Pond 20 based on vegetation-inundation relationships measured at other reference sites and a limited number of measurements for the fringing marsh around Pond 20.

At the Ballona Wetlands in Los Angeles, inundation frequencies were determined for each habitat zone (ESA 2015). Table 6 presents the percent inundations and the corresponding elevations based on the NOAA San Diego Bay gage. These elevations may be revised based on the tide data collected (see Section 3.1.1).

TABLE 6
ELEVATION BANDS AND INUNDATION FREQUENCIES OF DIFFERENT HABITAT TYPES

Habitat Type	Elevation Band (feet NAVD)	Annual Inundation Frequency (% time)
Upland	> 7.6	< 3-yr tidal inundation
Transition Zone	6.6 to 7.6	1% to 3-yr inundation
High Marsh	5.7 to 6.6	1% to 5%
Mid Marsh	4.1 to 5.7	5% to 26%
Low Marsh	2.9 to 4.1	26% to 51%
Mudflat	-0.4 to 2.9	51% to MLLW
Subtidal	< -0.4	> MLLW

The habitat elevations in Table 6 were compared to elevations of pickleweed and cordgrass at San Dieguito Lagoon in San Diego County for verification. At San Dieguito, average pickleweed elevations (± one standard deviation) ranged from 4.5 to 5.6 feet NAVD, which falls in the mid marsh category as expected. Average cordgrass elevations at San Dieguito (± one standard deviation) occurred from 3.5 to 3.9 feet NAVD, which falls in the low category, again as expected. A brief survey (n = 5) of the fringing marsh around Pond 20 showed pickleweed occurring down to 4.9 feet NAVD and up to as high as 7.5 feet NAVD in some locations. It is not uncommon for pickleweed to grow up into the transition zone.

These habitat elevations were used to design the grading of the site to achieve the desired balance of habitats.

3.6 Hydrodynamic Modeling

<To be completed for 60%-complete design>

3.7 Scour Analysis

Just downstream of the site, a recently retrofitted pedestrian bridge spans the Otay River. Figure 5 presents a photo of the bridge looking downstream the Otay River from the northwest corner of the project site, near the proposed breach location. Restoration of the Pond 20 site, as well as the ORERP, will increase tidal flows in the area, which may increase scour at the bridge. An initial review of the scour analysis conducted by the Poseidon team has been completed (Section 3.7.1), hydraulic geometry relationships at the bridge have been analyzed (Section 3.7.2), and hydrodynamic scour modeling will be conducted as part of the 60%-complete design (Section 3.7.3). These different lines of evidence will be used to evaluate the impacts of the increased tidal flows on the bridge.

Figure 6
Pedestrian Bridge located downstream of the project site, spanning the Otay River
Small tidal drainage channel connected to the Otay River is shown on the left

3.7.1 Review of the ORERP Bridge Scour Analysis

ESA reviewed the ORERP bridge scour analysis to determine if the analysis was sufficient to rule out any impacts to the bridge caused by increasing the tidal flow at Pond 20. Poseidon used a hydrodynamic model to assess tidal hydraulics and potential scour and deposition for the restored site. They used the TIDE_FEM hydrodynamic model, which showed tidal current velocity maximums of 0.66 feet per second (fps) under the bridge for the final restoration. Evaluation of project site sediment grain size indicated a threshold of motion of 0.72 fps. The analysis concluded that velocities of 0.35 fps to 0.72 fps would result in bedload transport, but not scour. The Poseidon team concluded that the two pinch points under the bridge (where velocities were modeled to reach 0.66 fps) were the only potential scour-prone locations. The Poseidon team suggested some spot channel hardening at the pinch points, but concluded that there were no other scour or erosion concerns at the project site based on their modeling. Their analysis did not take into account breaching of the Pond 20 site.

The ORERP bridge scour analysis did not provide enough information to determine whether restoration at Pond 20 would increase flow velocities above the 0.72 fps threshold. The analysis does show that the bridge can accommodate some increase in tidal flows- further modeling is needed to determine how much (see Section 3.7.3).

3.7.2 Hydraulic Geometry Analysis

The proposed restoration will increase tidal current velocities downstream of the project area. Based on other restoration experience, it is anticipated that increased tidal velocities will result in channel deepening until a new channel geometry occurs, which is in equilibrium with the system's tidal prism. Hydraulic geometry relationships (PWA 1995) were applied to estimate an anticipated amount of channel down-cutting and scour along the main channel and near the railroad bridge following tidal restoration.

Based on the restored tidal prism and hydraulic geometry relationships (PWA 1995), it is estimated that the downstream channel bed will eventually deepen 3.1 feet and widen 60 feet after restoration of Pond 20 (Table 7). This is a very approximate estimate and assumes a natural, cohesive-bay-mud channel bed free of armoring or other obstructions. With the ORERP, the potential for channel erosion is much greater (Table 7). Assuming the ORERP is constructed first, the Pond 20 restoration is expected to deepen the channel by an extra 0.4 feet and widen it by 20 feet.

TABLE 7
TIDAL PRISM AND CHANNEL DIMENSIONS DOWNSTREAM OF THE PROJECT SITE

	Tidal Prism (ac-ft)	Channel Depth (ft below MHHW)	Channel Width @ MHHW (ft)	Channel Area (ft^2)
Existing Conditions[1] (EC)	6	6.1	30	100
EC + Pond 20[2]	60	9.2	90	460
EC + Poseidon Project[3]	240	11.7	160	1090
All (EC + Poseidon + Pond 20)	300	12.1	180	1250

1. PWA 2003
2. Tidal prism from Great Ecology
3. Tidal prism from Jenkins and Wasyl 2010

Recent calculations by ESA of the tidal prism presented in this preliminary design is less than previously estimated by Great Ecology, and as presented in the analysis above. The recent tidal prism is roughly estimated at 30 acre-feet. The analysis here will be updated to reflect these updates during subsequent stages of design.

3.7.3 Scour Modeling

<To be completed for 60%-complete design>

3.8 Soil Analysis

Great Ecology's Soil Quality and Plantability Evaluation Report, completed on May 22, 2017, summarizes the results of soil sampling and analysis for both plant growth suitability and potential for off-site reuse. Sampling included soils from the approximate future marsh planting elevations, and lab tests indicated high salinity, boron content, and low organic carbon. The analysis concluded that soil conditioning, including leaching and incorporation of amendments, will likely be necessary due to the existing soil characteristics. Additional analysis should be completed during the construction phase, after excavation and grading activities, to determine appropriate soil treatment measures prior to planting.

In addition, testing and analyses of bulk sediment physical characteristics and bulk sediment chemistry indicated a lack of contamination. Soil arsenic was the only analyte to exceed a screening value; additional leachability testing indicated that it is tightly bound and does not present a risk to even the most susceptible aquatic receptors. As a result, the analyses indicate that the materials are substantially ‘inert’ with regard to beneficial reuse at offsite locations.

4 Preliminary Design

This section describes the preliminary design and is intended to document several engineering decisions and assumptions that were made to develop preliminary construction plans to 30%-complete, and a preliminary construction cost estimate. The 30%-complete preliminary construction plans are presented at half-size scale (11” x 17”) in Appendix A. The following sections refer to the design presented in the attached drawings.

4.1 Approach

The preliminary design describes restoration design elements (Section 4.3), construction access (Section 4.4), specifications (Section 4.5), and the preliminary construction cost estimate (Section 4.5). The design will be refined during the 60%-complete design and in the final design prior to construction.

4.2 General Criteria

The following describe general criteria that apply broadly to the preliminary restoration design.

4.2.1 Project Extents

The extents for the mitigation site comprises approximately 76.5 acres of the Pond 20 parcel, and includes 0.3 acres northwest of the parcel boundary. Excavation of the tributary channel to Otay River would require agreement from U.S. Fish and Wildlife Service.

4.2.2 Site Survey and Datums

Towill set horizontal and vertical control around the perimeter of the site, and prepared a basemap based on LIDAR flown in 2017. The project is described using the vertical datum NAVD88 in feet and the horizontal coordinate system California State Plane Zone VI in feet. ESA conducted additional ground survey transects of the project site on April 5, 2016 and February 9, 2017, including attempts to survey the borrow ditch and the existing pond bed.[3] A hard impenetrable surface was observed in the borrow ditch, and is likely the remnant of salt production where various material precipitates and creates hard surfaces, such as gypsum. The field survey collected some elevations of the top of this hard surface, and a couple points extending below this surface. For the purpose of the design sections that follow, ESA estimated elevations at the bottom of the borrow ditch. The survey transects show the variation in elevation across the pond bed, with elevations in the southwestern half of the site between 6 and 10 feet NAVD, and between 10 to 12 feet NAVD in the northeastern half of the pond.

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[3] ESA performs land surveys and collects hydrographic data to augment traditional surveying services for the purposes of geomorphic interpretation, monitoring of project performance, and other specific uses consistent with Geologic and Landscape Surveys as defined in the Professional Land Surveyors’ Act (California Business and Professionals Code). ESA does not provide traditional land survey services such as property boundaries and maps for general use by others. ESA recommends that these traditional surveying services be accomplished by a licensed, professional land surveyor either under direct contract with the client or as a sub-consultant to ESA.

4.3 Design Elements

The following sections provide a brief description of various restoration design elements, including the design geometries, and special considerations for construction. Additional assessments that are needed to refine the design and reduce uncertainties are included as well.

4.3.1 Marshplain Grading

The primary activity associated with construction of the project is grading and excavation of the existing pond bed to reach design grades compatible with marsh restoration.

- **Purpose –** Provide lower site grades to match the range of elevations for proposed habitats (Section 3.5) and thereby promote establishment of a range of intertidal marsh vegetation through planting and natural recruitment.

- **Extents –** The marshplain will be graded in the entirety of the project site, with some areas requiring up to approximately 6 feet of excavation to achieve target marshplain elevations.

- **Geometry –** Marshplain design is based on observations at reference sites and through assessing the anticipated tidal hydraulics (Section 3.5). The lowest elevation of the marshplain is 5 feet NAVD at the tops of channels, and the highest elevation is 7 feet NAVD atop marsh mounds and 6.5 feet NAVD along the toe of the transition slope.

- **Materials –** Local soil materials excavated from onsite.

- **Construction Techniques –** Excavate site grades to elevations shown on the preliminary design using large equipment, such as scrapers. Scrapers are used by contractors to move large quantities of earth, and typically result in a graded surface that is within a precise vertical range to the upper end of the allowed vertical tolerance of the design. This practice also can result in a surface that is highly compacted and conditioned to prevent infiltration of water into the ground, which is not an ideal surface for marsh restoration. Therefore, the upper 1 foot of soil should be ripped using standard rippers or discs to help loosen the surface of the marshplain. The ripping activity can result in a slight increase in the finished grade, which should be accounted for in subsequent design documents that accommodate the increase in the finished grade to comply with target marsh elevations. The details on handling material needs to be assessed, to include how material is excavated and whether it is rehandled from excavation to offhaul. This has a significant effect on the cost of the project.

- **Additional Issues to Consider**

    - Prior to planting, additional analysis of finished grade soils should be completed to determine specific treatment measures needed to condition the sediment for successful establishment of marsh and upland vegetation.

  - Additional soil sampling and analysis should be completed prior to construction to confirm suitability of off-site reuse of site soils.

4.3.2 Tidal Channels

A tidal channel network will be excavated throughout the site to provide sufficient hydraulic capacity to allow for changes in tidal water levels.

- **Purpose –** Facilitate adequate site drainage and more rapid vegetation establishment by providing natural tidal exchange through equilibrium channel geometry described in Section 3.4. Allow for low marsh vegetation establishment along the channel edge.

- **Extents –** As depicted on the preliminary design, throughout the entire project site.

- **Geometry –** Channel sizing is described in Section 3.4. Design guidelines were used to develop long-term equilibrium channel dimensions of cross sectional area, depth, and width, as based on regressions developed for San Diego Bay and San Francisco Bay. Three channel sizes were selected for construction based on the channel sizing, and are shown by typical sections in the plans. These channels will have constant side slopes, constant top elevation of 5 feet NAVD, and a varying bottom elevation that slopes upward moving into the site from the tidal breach.

- **Materials –** Local soil materials excavated from onsite.

- **Construction Techniques –** Channel construction will require excavation to reach the thalweg elevation, and fill only in areas where the channel crosses or utilizes existing borrow ditches within the site. The excavation of the channels in this design is referred to as “dredging,” which is applied to excavation lower than elevation 5 feet NAVD. It is anticipated that dredging will likely utilize low ground pressure track-mounted excavators that place spoils in trucks to transport material. Elevations within the existing borrow ditches are unknown due to a thick salt crust that has formed at approximately 5 feet NAVD, which has prevented survey of the ditch below. Grading within this part of the site may require additional survey data to refine the design or field fitting during construction.

4.3.3 Levee Breach

Construction of the levee breach will connect the restoration site to the tidal portion of the Otay River through the tributary channel and ultimately to San Diego Bay. The levee breach is an important feature that provides a transition between the existing tidal river and the restoration site, and which will require special construction considerations, including equipment type and timing.

- **Purpose –** Promote exchange of tide, nutrients, and biota to support wetland habitat development.

- **Extents –** As depicted on the preliminary design, within approximately 100 feet of the bottom of the levee on both sides of the levee.

- **Geometry –** The breach will result in a top width of approximately 32 feet at elevation 5 feet NAVD. The side slopes will vary between 4:1 and 3:1 for excavation through the levee and the pond or marsh, respectively. The breach will have an 8-foot bottom width at EL -3.3 ft NAVD. The downstream end of the breach through the tributary channel will need to daylight upward into the existing Otay River thalweg elevation. Additional survey of the outboard marsh, tributary channel, Otay River, and the borrow ditch in the pond would help refine this feature.

- **Materials –** Local soil materials excavated from onsite.

- **Construction Techniques –** Excavation of the levee breach will require using low-ground pressure track-mounted excavators from the levee crest. The areas within approximately 100 feet of the base of the levee would need to be excavated first, and when all excavation on the interior of the site is completed, the final levee breaching would occur to open up the site to the tides. At this point, material excavated would need to be placed in trucks and offhauled. Additional construction issues should be considered for this activity, including the ability of the levee to support the equipment, and whether there are biological or habitat constraints on excavating through the outboard marsh.

- **Additional Issues to Consider**

    - The ability or capacity of the existing levee crest to accommodate heavy construction equipment for final excavation of the levee during breaching of the site needs to be assessed by the geotechnical engineer for the project. The levee would need to potentially support one or more excavators and possibly trucks that would offhaul excavated materials during breaching. The excavators would then need to “walk” off the site along the outboard levees.

    - Habitat and biological constraints of excavating through the outboard marsh and into the Otay River.

4.3.4 Ditch Fill and Transitional Slope

Along the border of the project site, a gently sloping transition zone will be constructed to connect the restoration site to the existing levee and uplands. This element will require filling the existing borrow ditch and creating a stable slope that would be planted with different plant types depending on the elevation, and that would be sufficient in dissipating wind wave energy without being eroded. Additional assessment of the ability of the slope to withstand erosion impacts by waves is needed during subsequent design phases.

- **Purpose –** Provide a gradual transition from the marsh to terrestrial upland vegetation along the existing berm. Attenuate wave action on the existing berm and minimize wave run-up and overtopping during storms. Accommodate marsh migration as sea level rises.

- **Extents –** As depicted on the preliminary design along west, south, and east existing berms.
- **Geometry –** Low elevation is 6.5 ft NAVD where it meets the marshplain described above. High elevation is 10 ft NAVD where it meets the existing berm. The average slope of the transitional berm shown in the plans is approximately 20:1.
- **Materials –** Local materials borrowed from onsite.
- **Construction Techniques –** The borrow ditches will be filled with material excavated from onsite marshplain grading and channel excavation. The ditches are seasonally filled with water, and therefore recommendations on how to appropriately dewater, fill the ditches, and construct a stable slope are needed from the project geotechnical engineer. Also, elevations within the existing borrow ditches are unknown due to a thick crust that has formed at approximately 5 feet NAVD, and which has prevented survey of the ditch below. Grading within this part of the site may require additional survey data to refine the design or field fitting during construction.
- **Additional Issues to Consider**
    - Prior to planting, additional analysis of finished grade soils should be completed to determine specific treatment measures needed to condition the sediment for successful establishment of marsh and upland vegetation.
    - Methods on filling the borrow ditch to create a stable condition for constructing the transition slope, including recommendations from geotechnical engineer on methods, need to dewater or place sediment in water, compaction, settlement, etc.

4.4 Construction Access and Staging

Construction access and staging to the site is shown on the project plans (Appendix A). An area located east of the project site within District property was preliminarily identified as a potential suitable location for construction staging and site access.

The construction staging area will require preparation, including minor grading, clearing and grubbing, and surfacing using gravel or similar. The construction staging area should be large enough to accommodate equipment storage and stockpile for a reasonable amount of project materials imported for the project. The staging area should not be used as a stockpile location for materials excavated from the site. The contractor will need to comply with best management practices to control stormwater runoff, potential contamination during equipment refueling, and other issues.

Access to the site will require additional site investigations, but at this point it is anticipated that the access will require at least two utilities crossings, a temporary bridge, allowance for overhead electric lines, and grading of access from the levee to the pond bed. Utilities crossings would likely consist of a minimum vertical coverage of 4 to 6 feet, with 3 feet of crushed gravel, and covered with a steel plate. The utility crossings will need to be coordinated with the respective utility district to meet their requirements and obtain approvals.

At the completion of the project, the access and staging areas will need to be restored to existing conditions, or those identified by the District.

4.5 Specifications Outline

Below is a possible applicable example of how specifications will be developed for the project. This example outline specifications were prepared using the 1997 Construction Specifications Institute (CSI) format. Although the final format desired by the District may vary from the format presented, the primary sections are likely to be similar to those included below. ESA will update the specifications outline and format at 60% design based on input by the District.

DIVISION 1 – GENERAL REQUIREMENTS

Section 01020 - Summary
Section 01025 - Measurement and Payment
Section 01050 - Field Engineering
Section 01315 - Project Meetings
Section 01330 - Submittals Procedures
Section 01500 - Temporary Facilities and Controls Section 01770 - Closeout Procedures
Section 01800 - Environmental Protection

TECHNICAL SPECIFICATIONS - DIVISION 2 - SITE WORK

Section 02060 - Order of Work
Section 02100 - Mobilization
Section 02110 - Site Access
Section 02300 - Earthwork
Section 02900 - Planting

4.6 Engineering Cost Estimate

Table 8 presents a summary of the preliminary opinion of probable construction costs. This cost estimate is considered preliminary and representative of the 30%-complete level of design. The construction cost estimated in Table 8 presents a total base project estimate, which excludes costs to offhaul the net surplus excavated material and other related activities, and a total additional cost that includes an approximate allowance for offhaul. As shown in the table, the cost to offhaul and reuse, place, or stockpile the surplus material is on the order of $10M, approximately equal to the cost for all other construction activities. ESA understands that the District and others involved in a separate project at the Chula Vista Bayfront have potential candidate sites for receiving the surplus material. Based on discussions with District staff (L. Scott, pers. comm.), a framework has not been established for the accounting and sharing of project costs for potentially off-hauling surplus material from the Pond 20 Project to the Chula Vista Bayfront Project. ESA has therefore included the additional estimate with material offhaul and reuse for the Pond 20 estimate in Table 8 for the purposes of the 30% design and the District's consideration, planning, and accounting.

Placement of material at the Chula Vista Bayfront, whether from the Pond 20 project or any other potential sources, will require site preparation and clearing and grubbing at the placement site, compaction at 8-inch lifts, erosion control (hydro-seeding with special native seed mix), biological surveys (birds), geotechnical testing for compatibility with suitable material, and environmental testing to test for potential contamination.[4] The unit cost of $14 per cubic yard for offhauling plus the 10% mobilization and 30% contingency is likely sufficient to cover these various requirements associated with the placement site. As discussed above, these placement costs are included as an additional cost for the Pond 20 Project because a framework has not been established for the accounting and sharing of Pond 20 and Chula Vista Bayfront Project costs. For planning purposes, the District does assign a net benefit of $25 to $50 per cubic yard for material that is placed in their Chula Vista Bayfront receiver sites to these requirements, meaning that the 430,000 cubic yards (in-situ volume, after trucking) would offset the Pond 20 costs by $10,750,000 to $21,500,000.

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[4] Personal Communication, Linda Scott, Capital Project Manager II, Engineering-Construction, Port of San Diego, October 9, 2017.

TABLE 8
PRELIMINARY CONSTRUCTION COST ESTIMATE

Item	Description	Quantity	Unit	Unit Price	Extended Cost
Base Project Estimate					
1	Mobilization	1	LS	$ 800,000	$ 800,000
2	Clearing and Demo				$ 49,000
	Clear and Grub	*80*	*AC*	*$ 300*	*$ 24,000*
	Miscellaneous Demo (allow)	*5*	*EA*	*$ 5,000*	*$ 25,000*
3	Earthwork				$ 5,579,500
	Mass Excavation	*405,000*	*CY*	*$ 12*	*$ 4,860,000*
	Dredging	*43,000*	*CY*	*$ 9*	*$ 365,500*
	Breach Excavation	*6,000*	*CY*	*$ 15*	*$ 90,000*
	Fill Placement	*24,000*	*CY*	*$ 6*	*$ 144,000*
	Fine Grading	*80*	*AC*	*$ 1,500*	*$ 120,000*
4	Planting	1	LS	$ 1,700,000	$ 1,700,000
	Subtotal				$ 8,128,500
	Contingency (30%)				$ 2,438,550
	Total Base Estimate				$ 10,567,050
	Total Base Estimate (Rounded)				**$ 10,600,000**
Additional Estimate with Material Offhaul and Reuse					
	Mobilization	1	LS	$ 752,500	$ 752,500
	Material Offhaul and Reuse	537,500	CY	$ 14	$ 7,525,000
	Subtotal				$ 8,277,500
	Contingency (30%)				$ 2,483,250
	Total Additional Estimate				$ 10,760,750
	Total Additional Estimate (Rounded)				$ 10,800,000
	Total Base + Additional Estimate (Rounded)				**$ 21,400,000**

This cost estimate is intended to provide an approximation of total project costs appropriate for the preliminary level of design. This cost estimate is considered to be approximately -15% to +30% accurate, and include a 30% contingency to account for project uncertainties (such as final design, permitting restrictions and bidding climate). These estimates are subject to refinement and revisions as the design is developed in future stages of the project. This table does include estimated project costs for permitting, design, monitoring and/or ongoing maintenance. Estimated costs are presented in 2017 dollars, and would need to be adjusted to account for price escalation for implementation in future years. This opinion of probable construction cost is based on ESA's previous experience, bid prices from similar projects, consultation with contractors and suppliers, and R.S. Means. Please note that in providing opinions of probable construction costs, ESA has no control over the actual costs at the time of construction. The actual cost of construction may be impacted by the availability of construction equipment and crews and fluctuation of supply prices at the time the work is bid. ESA makes no warranty, expressed or implied, as to the accuracy of such opinions as compared to bids or actual costs.

Besides the cost of material offhaul, the primary cost of construction is earthwork, which includes mass excavation, dredging, and onsite reuse. The following are a summary of the assumptions used to determine the unit costs associated with the earthwork sub-items:

- The mass excavation associated with marshplain grading at elevations greater than elevation 5 feet NAVD will likely be accomplished using scrapers.
- Below elevation 5 feet NAVD, excavators will dredge the channels and transport excavated material using low-ground pressure trucks.
- Onsite fill will be placed in areas where there are existing ditches and depressions. For any onsite fill, losses on the order of 20% are assumed for various losses and compaction. Therefore, the volume was increased from the “neat,” or bank volume, by 20% to account for compaction.
- In determining the volume and unit cost for offhauling to stockpile, the following was assumed:
  - Material expands by 25% from bank or in-situ volume to truck volume
  - Unit cost includes hauling, dumping, and spreading into a stockpile, and no additional handling after initial excavation.
  - Unit cost includes erosion control at stockpile location
  - Hauling distance determined assuming stockpile location is 3.5 miles from the project site for the Chula Vista Bayfront Project (CVBP).

The total project cost is heavily influenced by the assumptions in how the pond materials are excavated and transported. Additional information can help reduce the cost of the project significantly. As discussed above, the cost-share between the Salt Pond 20 Wetland Restoration and the Chula Vista Bayfront Project needs to be identified.

The 30% contingency is included to account for many project uncertainties. Reducing the contingency would require additional details on several uncertain issues, including standard contractor practices and availability of water for dust control, environmental issues and potential restrictions to the construction, or issues that may require ongoing biological monitoring of the site, and other engineering details that may be affected by recommendations from the geotechnical engineer on site improvements. ESA understands that no contamination is known at the site, but recommends preparation of a material sampling and testing plan that will need to be implemented to facilitate offhaul of materials from the site.

4.7 Additional Design Issues and Next Steps

As described in various sections above, additional issues need to be addressed during subsequent stages of the design process. The issues identified in this report include the following:

- Additional survey data in Otay River and within the site at borrow ditches.
- Verification of water levels at the project site, and resulting modifications to habitat elevations, and final design grades.
- Refinement to channel design at subsequent design stages to include updates to geometries, refinement of plan view to include variable thalweg elevation and resulting change in top width, and updated information for horizontal control tables.
- Geotechnical recommendations on current design geometries, including slopes of channels, mass grading information, including the expansion factors, methods for filling the borrow ditch and constructing the transitional slope, and suitability of the existing levee for accommodating heavy equipment for construction of the levee breach.
- Sediment sampling and analysis plan to test the offhaul materials for suitability of reuse.
- Confirmation of environmental needs, such as biological constraints to construction, including any monitoring or special considerations of habitat windows for construction activities.
- Refinements to the cost estimate to include better understanding of material offhaul.

5. References

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6. List of Preparers

This report was prepared by the following ESA staff:

James Jackson, PE

Alex Trahan, PE

Lindsey Sheehan, PE (Project Manager)

Louis White, PE (Project Engineer – C76509)

Nick Garrity, PE (Project Director)

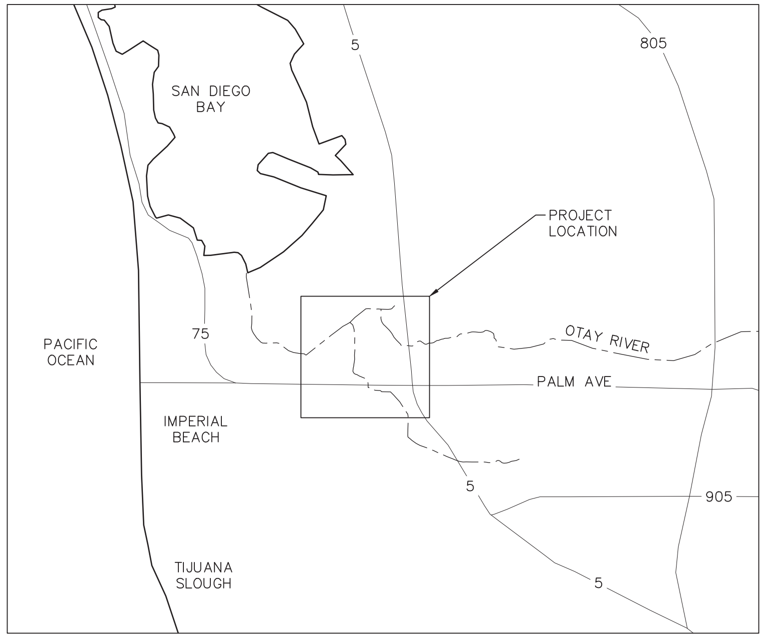
APPENDIX A:

HALF-SIZE PRELIMINARY (30%-COMPLETE) CONSTRUCTION PLANS

WETLAND RESTORATION OF SALT POND 20
PRELIMINARY DESIGN (30% COMPLETE)

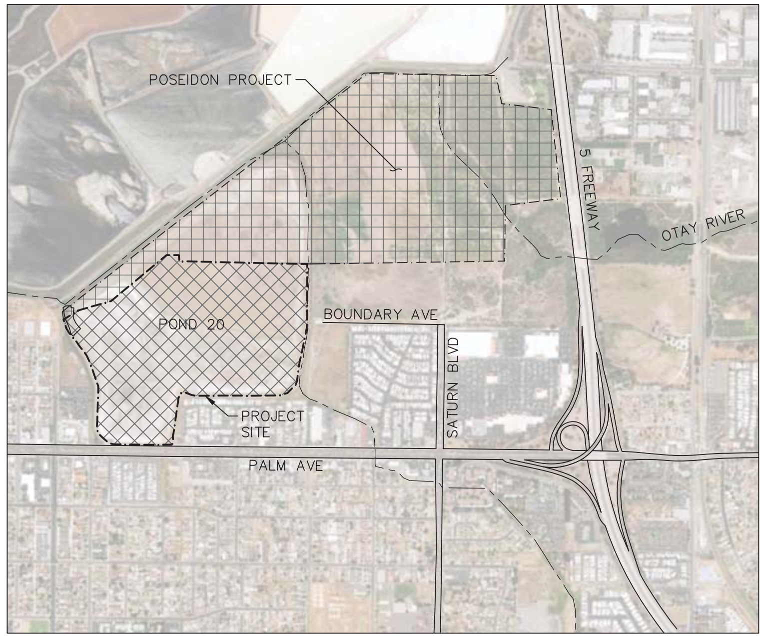
OCTOBER 6, 2017

SAN DIEGO, CALIFORNIA



VICINITY MAP

1" = 5000'



LOCATION MAP

1" = 1000'

INDEX OF SHEETS

DEFINITIONS

PROJECT OWNER:	PORT OF SAN DIEGO 3165 PACIFIC HIGHWAY SAN DIEGO, CA 92101 CONTACT: ARMANDO MORA PH: (619) 725-6097
PROJECT ENGINEER:	ENVIRONMENTAL SCIENCE ASSOCIATES 550 KEARNY STREET, SUITE 800 SAN FRANCISCO, CA 94108 CONTACT: LOUIS WHITE, PE PH: (415) 896-5900
PROJECT ECOLOGIST/ LANDSCAPE ARCHITECT:	GREAT ECOLOGY 2251 SAN DIEGO AVE, SUITE A218 SAN DIEGO, CA 92110 CONTACT: MARK LASKA PH: (858) 750-3201

PORT of SAN DIEGO

ESA

550 Kearny Street
Suite 800
San Francisco, CA 94108
415.262.2300 phone

GREATecology
ENVIRONMENT + DESIGN

VERIFY SCALE

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PRELIMINARY
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ENGINEER OF RECORD

DATE:

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SPEC NO. XXXX-XX WBS NO. P0000-0
REFERENCES
PROJECT ENGINEER LOUIS WHITE, PE C76509
CONTRACTOR -
CONSTRUCTION STARTED -
CONSTRUCTION COMPLETED -
COST - INSPECTOR -

REVISIONS

DATE / APPROVED

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CHECKED LAW

APPROVAL RECOMMENDED
DISTRICT PROJECT MANAGER

APPROVED
DISTRICT MANAGER–DESIGN

WETLAND RESTORATION OF SALT POND 20
PRELIMINARY DESIGN

TITLE SHEET, VICINITY & LOCATION MAPS, DRAWING LIST

DATE 10/6/2017
A/E NO.
SHEET 1 OF 14
DRAWING NO. G-1-XXXX-XX
REV. -

LEGEND

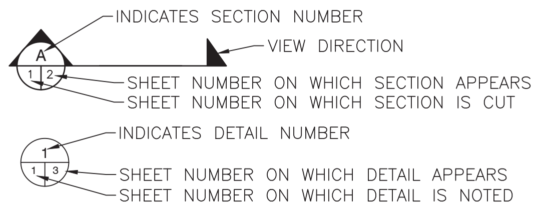
— — —	PROPERTY LINE
— ··· —	(E) CHANNEL CENTERLINE
— · — · —	GRADING LIMIT
— — — — —	EXISTING GRADE (PROFILE & SECTION)
———	DESIGN GRADE (PROFILE & SECTION)
- - - - - - -	GRADE BREAK
—o—o—o—o—o—	ACCESS ROUTE
5	(E) MAJOR CONTOUR LINE (EG)
4	(E) MINOR CONTOUR LINE (EG)
5	(N) MAJOR CONTOUR LINE (DG)
4	(N) MINOR CONTOUR LINE (DG)
— E — E —	(E) OVERHEAD POWER LINE
— SS —	(E) UNDERGROUND SEWER PIPE
— X — X —	(E) FENCE
— XX — XX —	(N) TEMPORARY CONSTRUCTION FENCING

LEGEND (CONT.)

⁙	FILL MATERIAL
▨	CUT MATERIAL
▦	POSEIDON PROJECT AREA
■	CONSTRUCTION STAGING AREA
⇦	CONSTRUCTION SITE ACCESS

LEGEND (CONT.)

Y	CUT OR FILL SLOPE



INDICATES SECTION NUMBER
VIEW DIRECTION
SHEET NUMBER ON WHICH SECTION APPEARS
SHEET NUMBER ON WHICH SECTION IS CUT
INDICATES DETAIL NUMBER
SHEET NUMBER ON WHICH DETAIL APPEARS
SHEET NUMBER ON WHICH DETAIL IS NOTED

△	SURVEY BENCHMARK
×	GROUND SURVEY (ESA)
⊕	GRADING CONTROL POINT

ABBREVIATIONS

AB	AGGREGATE BASE
AC	ASPHALT CONCRETE
APPROX	APPROXIMATE
DEMO	DEMOLISH/DEMOLISHION
DG	DESIGN GRADE
(E)	EXISTING
EG	EXISTING GRADE
EL	ELEVATION
FT	FEET
GB	GRADE BREAK
IRR	IRRIGATION
LF	LINEAR FEET
MAX	MAXIMUM
MIN	MINIMUM
(N)	NEW
PIP	PROTECT IN PLACE
RC	RELATIVE COMPACTION
TBD	TO BE DETERMINED
TYP	TYPICAL
VIF	VERIFY IN FIELD

NOTES

1. TOPOGRAPHIC MAPPING PREPARED BY TOWILL USING LIMITED FIELD SURVEY AND CONTROL AND LiDAR. SUPPLEMENTAL GROUND SURVEY WAS PERFORMED BY ESA IN 2016 AND 2017. NOT ALL SURVEY POINTS ARE SHOWN, BUT THEY ARE AVAILABLE TO THE CONTRACTOR IF REQUESTED, THE AERIAL PHOTOGRAPHY WAS TAKEN AT THE SAME TIME AS THE LiDAR COLLECTED BY TOWILL.
2. ELEVATIONS ARE REFERENCED TO NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88). HORIZONTAL CONTROL IS CALIFORNIA STATE PLANE COORDINATE SYSTEM, ZONE 6, IN FEET (NAD 83). ALL ELEVATIONS AND HORIZONTAL COORDINATES ARE IN FEET. TIDAL DATUMS AT PORT OF SAN DIEGO, MEAN HIGHER HIGH WATER (MHHW) IS 5.3 FT NAVD, MEAN TIDE LEVEL (MTL) IS 2.5 FT NAVD, MEAN LOWER LOW WATER (MLLW) IS −0.4 FT NAVD.

ADDITIONAL NOTES WILL BE PROVIDED AS PART OF SUBSEQUENT DESIGN STAGES

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REFERENCES
PROJECT ENGINEER LOUIS WHITE, PE C76509
CONTRACTOR -
CONSTRUCTION STARTED -
CONSTRUCTION COMPLETED -
COST - INSPECTOR -

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WETLAND RESTORATION OF SALT POND 20
PRELIMINARY DESIGN

LEGEND, ABBREVIATIONS, & GENERAL NOTES

DATE 10/6/2017
A/E NO.
SHEET 2 OF 14
DRAWING NO. G-2-XXXX-XX
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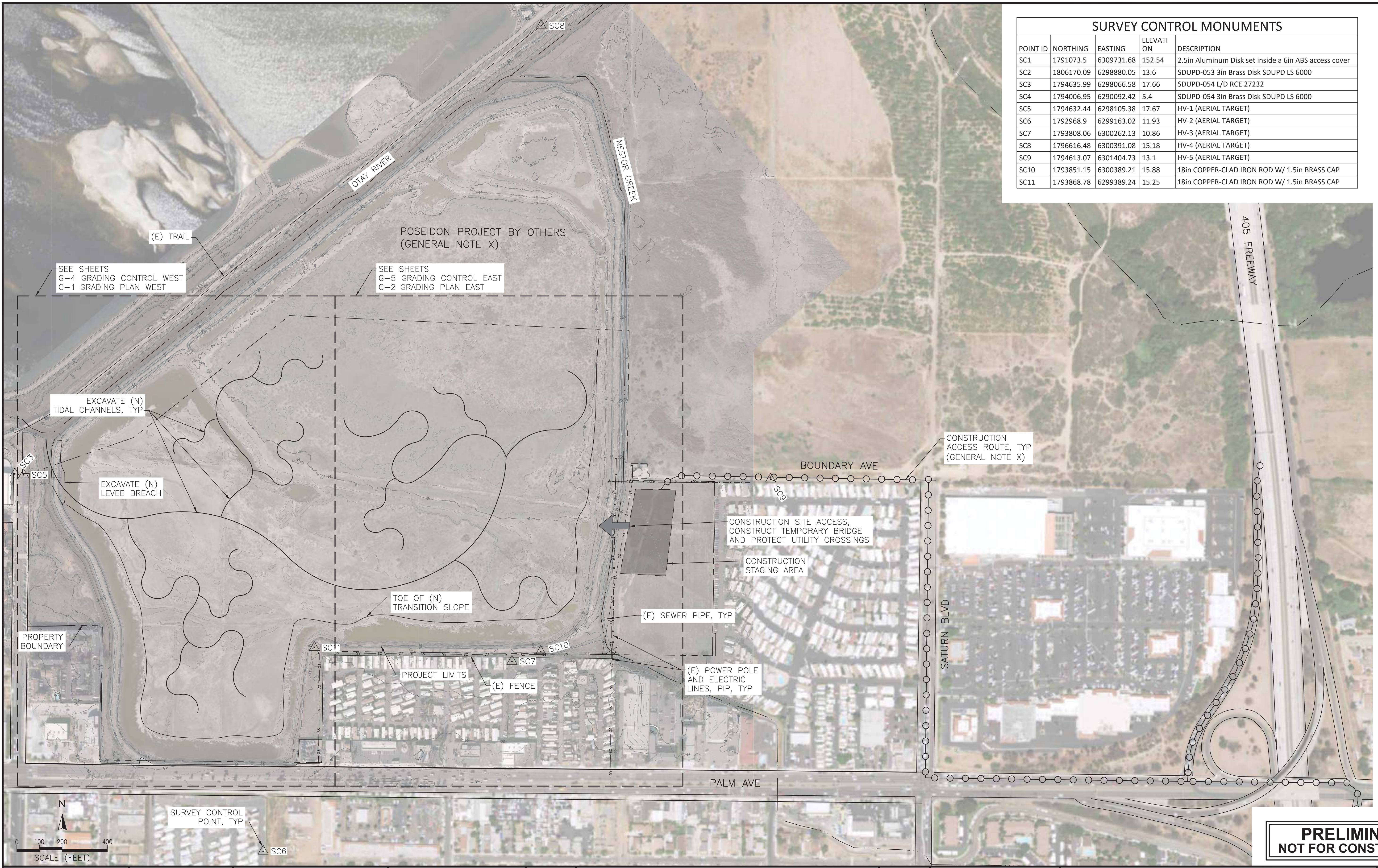

SURVEY CONTROL MONUMENTS

POINT ID	NORTHING	EASTING	ELEVATION	DESCRIPTION
SC1	1791073.5	6309731.68	152.54	2.5in Aluminum Disk set inside a 6in ABS access cover
SC2	1806170.09	6298880.05	13.6	SDUPD-053 3in Brass Disk SDUPD LS 6000
SC3	1794635.99	6298066.58	17.66	SDUPD-054 L/D RCE 27232
SC4	1794006.95	6290092.42	5.4	SDUPD-054 3in Brass Disk SDUPD LS 6000
SC5	1794632.44	6298105.38	17.67	HV-1 (AERIAL TARGET)
SC6	1792968.9	6299163.02	11.93	HV-2 (AERIAL TARGET)
SC7	1793808.06	6300262.13	10.86	HV-3 (AERIAL TARGET)
SC8	1796616.48	6300391.08	15.18	HV-4 (AERIAL TARGET)
SC9	1794613.07	6301404.73	13.1	HV-5 (AERIAL TARGET)
SC10	1793851.15	6300389.21	15.88	18in COPPER-CLAD IRON ROD W/ 1.5in BRASS CAP
SC11	1793868.78	6299389.24	15.25	18in COPPER-CLAD IRON ROD W/ 1.5in BRASS CAP

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WETLAND RESTORATION OF SALT POND 20 PRELIMINARY DESIGN

SITE PLAN, ACCESS, STAGING & SURVEY CONTROL

DATE 10/6/2017
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SHEET 3 OF 14
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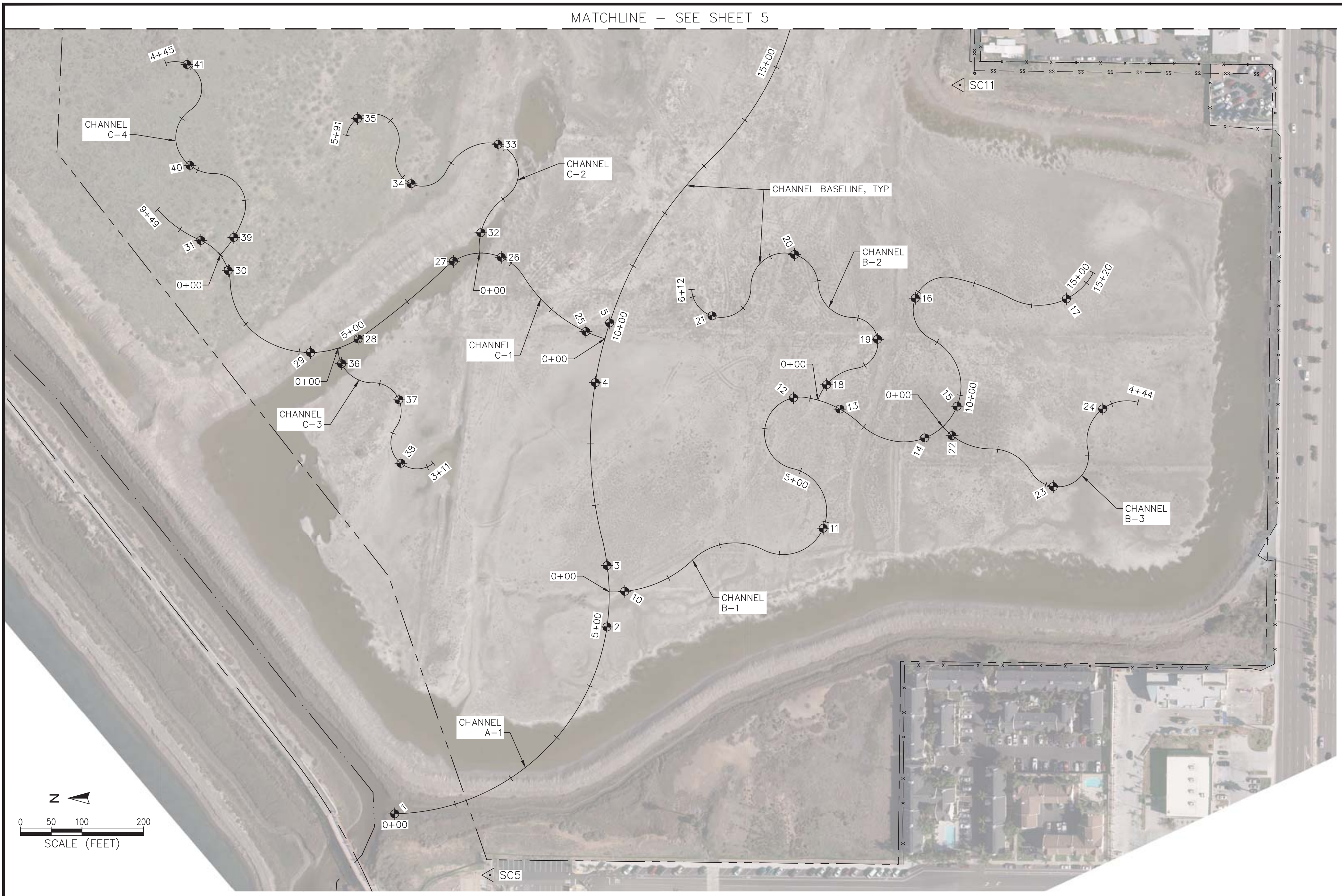

GRADING CONTROL TABLE						
POINT #	NORTHING	EASTING	THALWEG EL	CHAN ID	STATION	CHAN TYPE
1	1794787.1414'	6298204.9054'	-3.3	A-1	0+00	3
2	1794442.3352'	6298508.7191'	-3.3	A-1	5+00	3
3	1794442.0406'	6298608.3977'	-3.3	A-1	6+00	3
4	1794461.1889'	6298905.6730'	-3.3	A-1	9+00	3
5	1794437.8489'	6299002.8065'	-3.3	A-1	10+00	3
6	1794124.0711'	6299612.1864'	-2.5	A-1	17+00	3
7	1794241.1378'	6299988.8703'	-2.0	A-1	21+00	3
8	1794303.2862'	6300067.0142'	-1.5	A-1	22+00	3
9	1794659.3854'	6300233.0396'	-1.0	A-1	26+00	3
10	1794413.4589'	6298566.5063'	-1.0	B-1	0+25	2
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NOTES

1. NOTES

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WETLAND RESTORATION OF SALT POND 20
PRELIMINARY DESIGN

GRADING CONTROL WEST

DATE 10/6/2017
A/E NO.
SHEET 4 OF 14
DRAWING NO. G-4-XXXX-XX
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NOTES

1. NOTES

GRADING CONTROL TABLE						
POINT #	NORTHING	EASTING	THALWEG EL	CHAN ID	STATION	CHAN TYPE
1	1794787.1414'	6298204.9054'	-3.3	A-1	0+00	3
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10	1794413.4589'	6298566.5063'	-1.0	B-1	0+25	2
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SUBSEQUENT DESIGN

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SPEC NO. XXXX-XX WBS NO. P0000-0
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WETLAND RESTORATION OF SALT POND 20
PRELIMINARY DESIGN

GRADING CONTROL EAST

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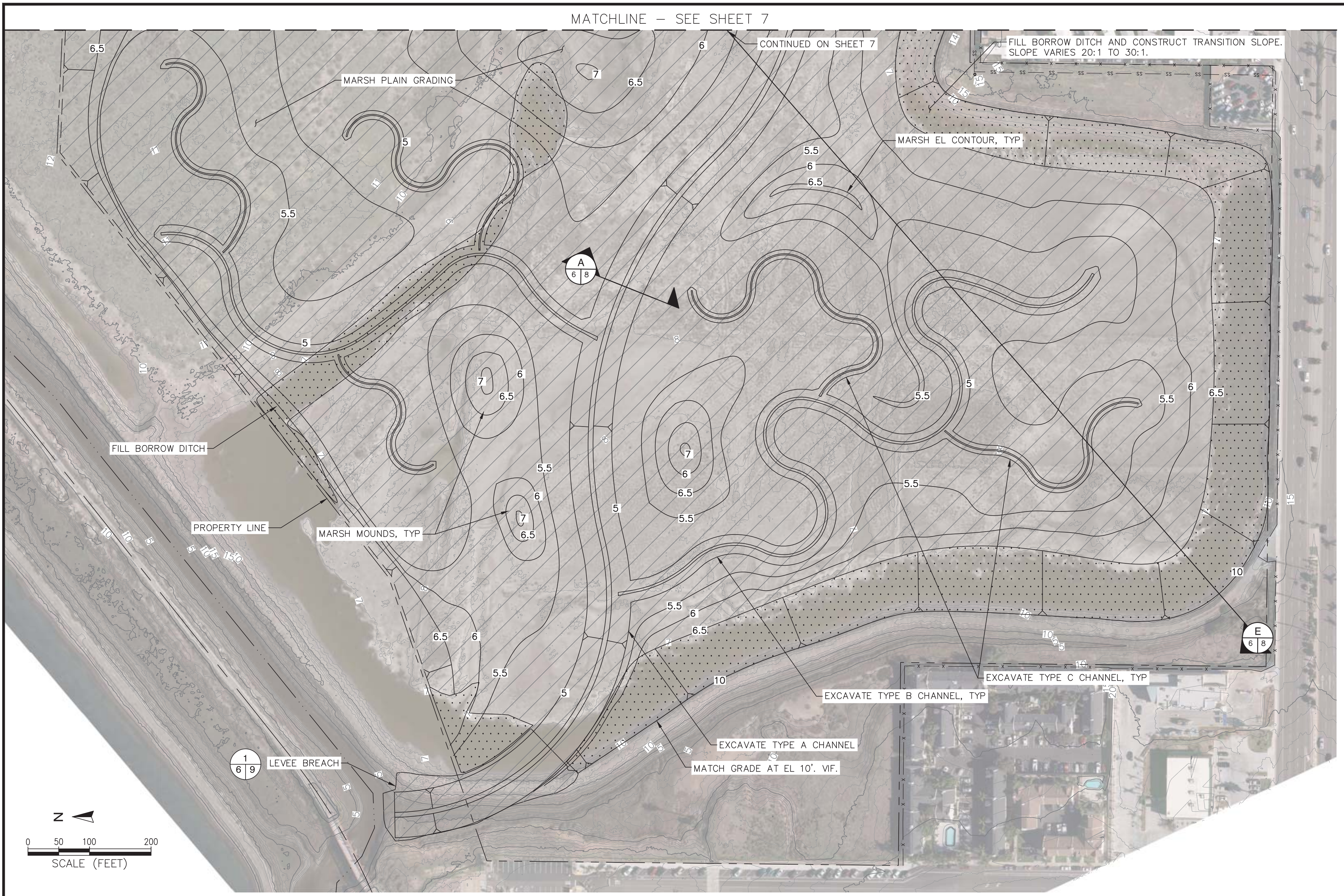

NOTES

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SPEC NO. XXXX-XX WBS NO. P0000-0
REFERENCES
PROJECT ENGINEER LOUIS WHITE, PE C76509
CONTRACTOR -
CONSTRUCTION STARTED -
CONSTRUCTION COMPLETED -
COST - INSPECTOR -

REVISIONS
DATE / APPROVED

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Port District
San Diego • California

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DRAWN JRJ
CHECKED LAW

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DISTRICT MANAGER–DESIGN

WETLAND RESTORATION OF SALT POND 20
PRELIMINARY DESIGN

GRADING PLAN WEST

DATE 10/6/2017
A/E NO.
SHEET 6 OF 14
DRAWING NO. C-1-XXXX-XX
REV. -

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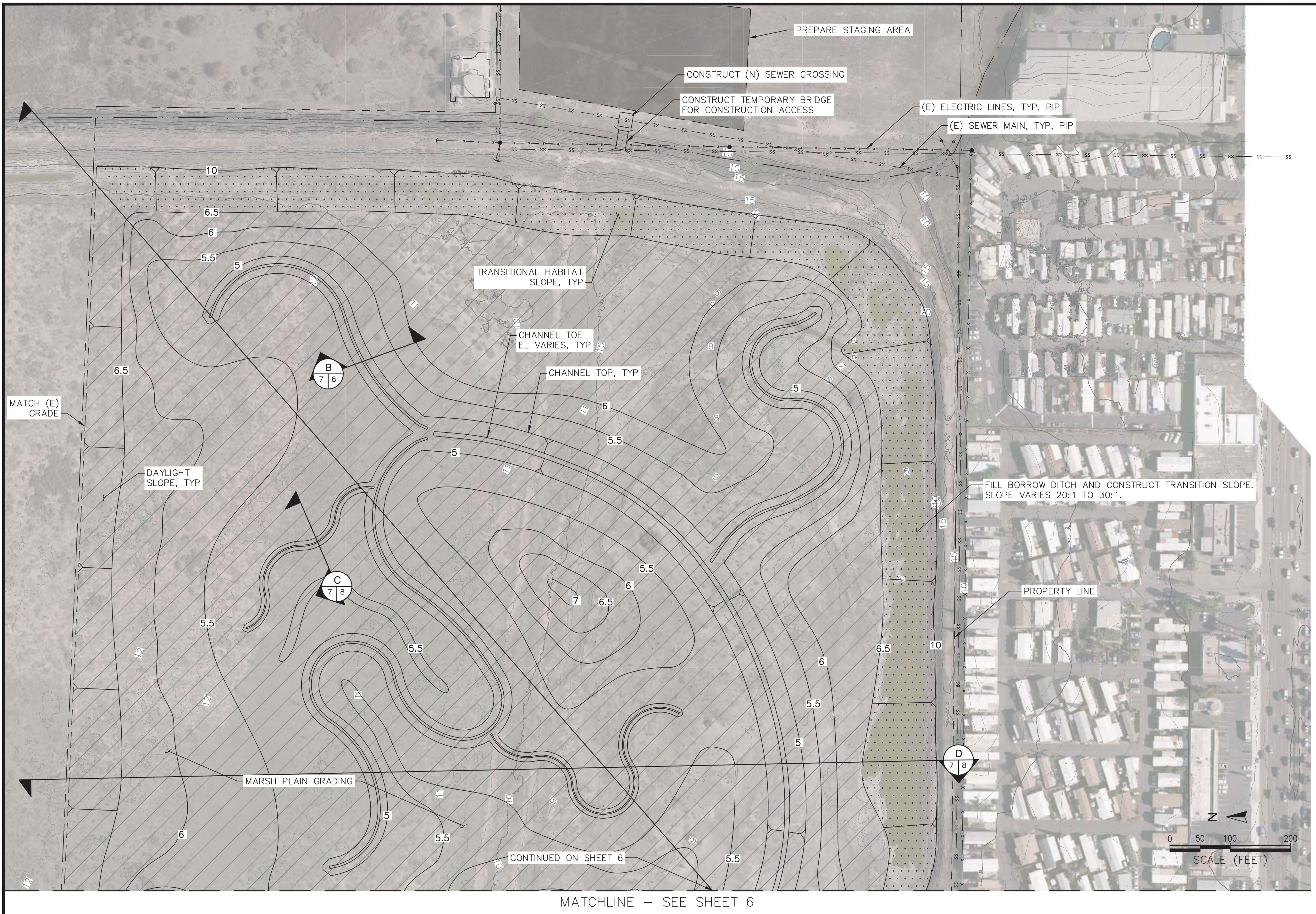

NOTES

1. NOTES

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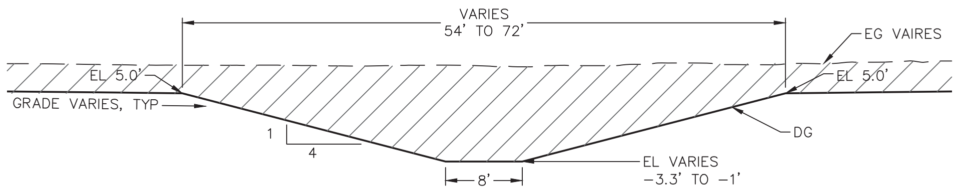
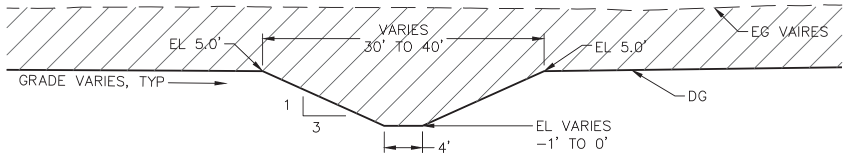
WETLAND RESTORATION OF SALT POND 20
PRELIMINARY DESIGN

GRADING PLAN EAST

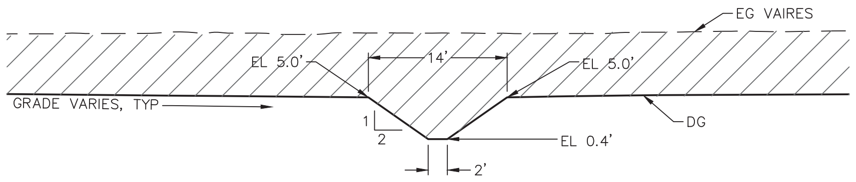
DATE 10/6/2017
A/E NO.
SHEET 7 OF 14
DRAWING NO. C-2-XXXX-XX
REV. -



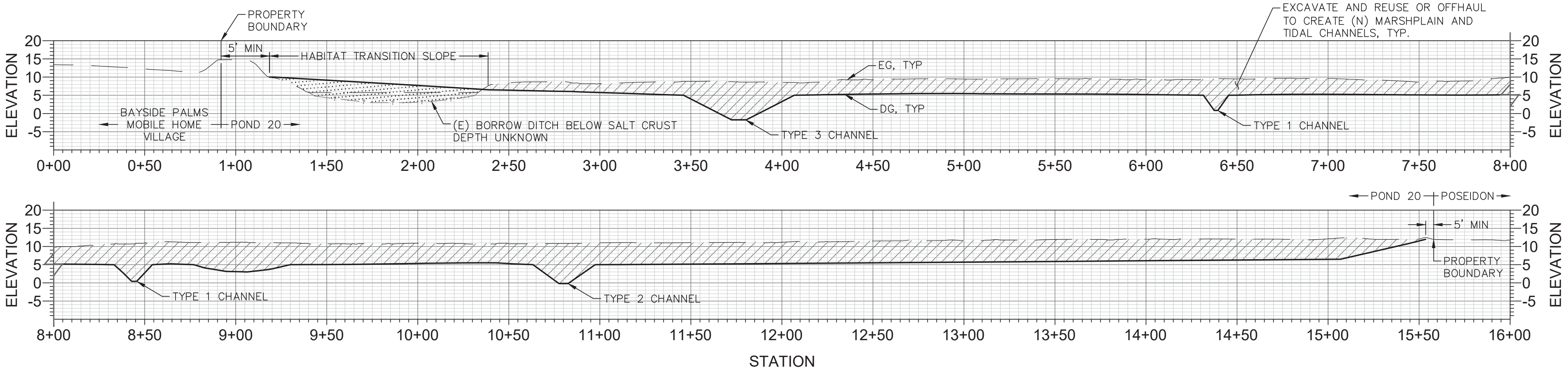
A 6 | 8 TYPE 3 CHANNEL (3RD ORDER) TYPICAL SECTION SCALE: 1"=10'



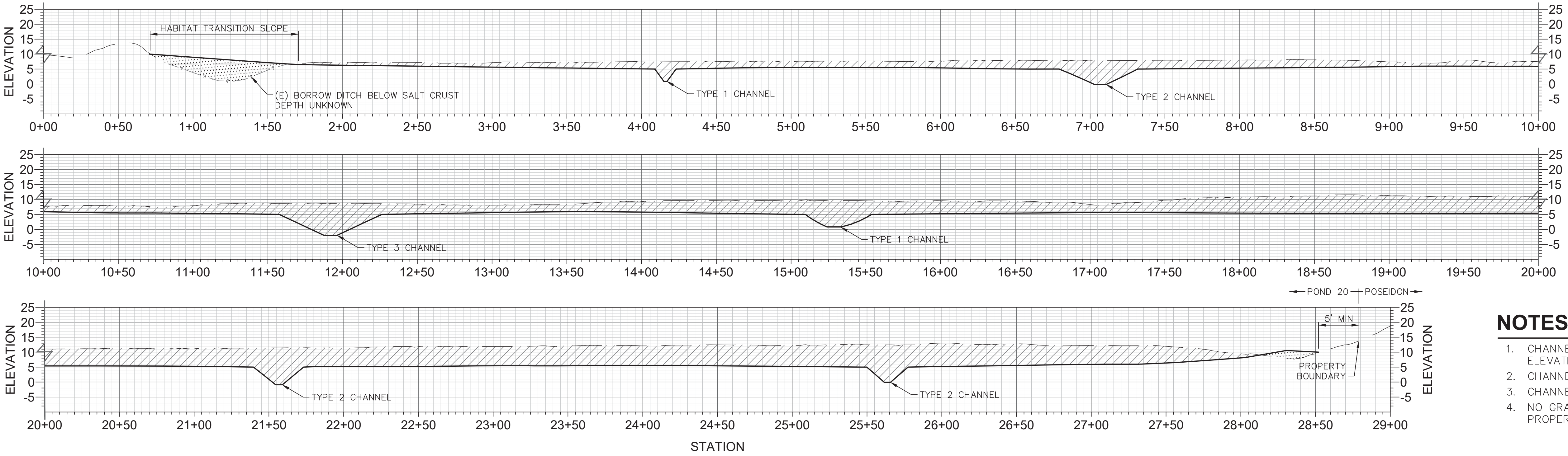
B 7 | 8 TYPE 2 CHANNEL (2ND ORDER) TYPICAL SECTION SCALE: 1"=10'



C 7 | 8 TYPE 1 CHANNEL (1ST ORDER) TYPICAL SECTION SCALE: 1"=10'



D 7 | 8 SITE GRADING CROSS SECTION SCALE: HORZ: 1"=40' VERT: 1"=20'



E 6 | 8 SITE GRADING CROSS SECTION SCALE: HORZ: 1"=40' VERT: 1"=20'

NOTES

1. CHANNEL TOP WIDTH VARIES AS THALWEG ELEVATION VARIES.
2. CHANNEL SIDE SLOPES REMAIN CONSTANT.
3. CHANNEL BOTTOM WIDTH REMAINS CONSTANT.
4. NO GRADING WITHIN 5 FOOT BUFFER FROM PROPERTY BOUNDARY.

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WETLAND RESTORATION OF SALT POND 20
PRELIMINARY DESIGN
GRADING SECTIONS

DATE 10/6/2017
A/E NO.
SHEET 8 OF 14
DRAWING NO. C-3-XXXX-XX
REV. -

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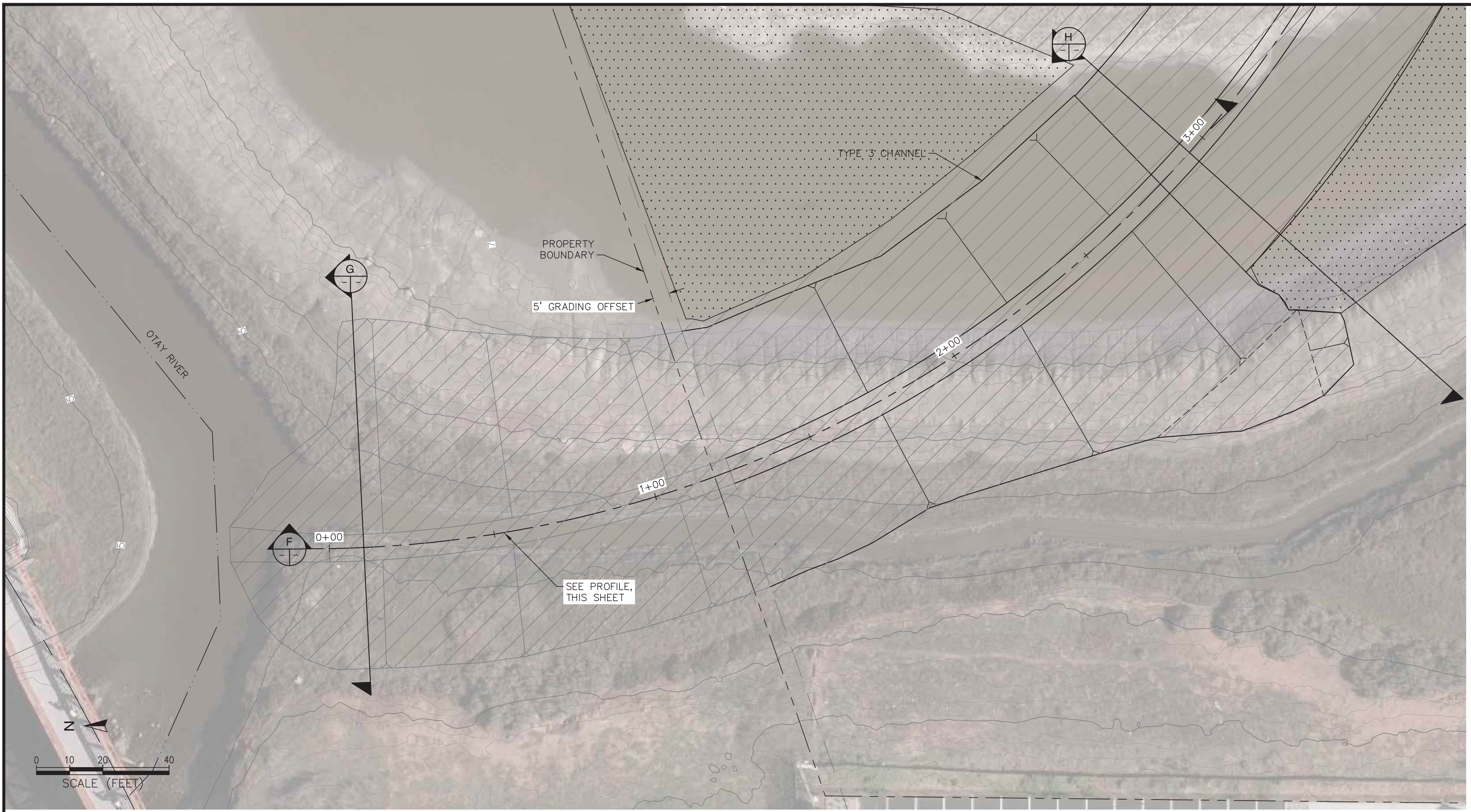
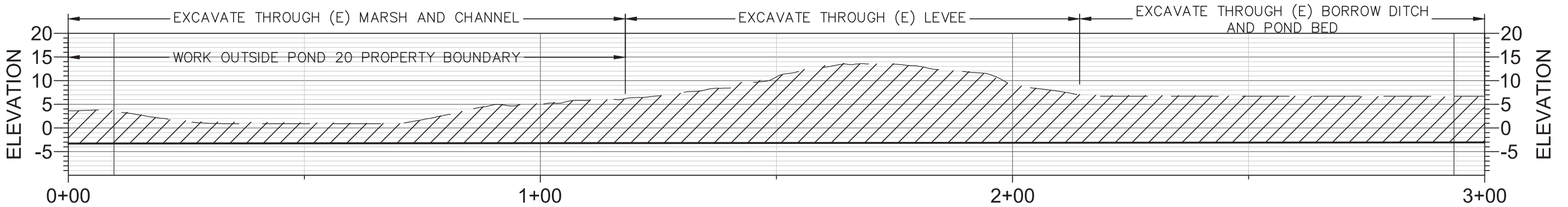
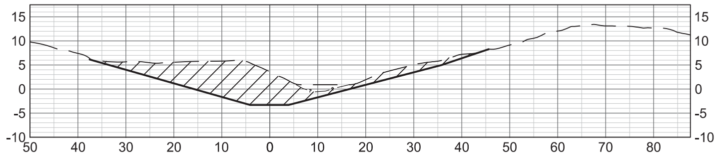


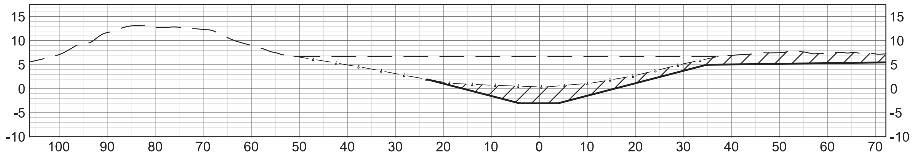
1 | 6 9 LEVEE BREACH DETAIL
PLAN SCALE: 1" = 20'



F | - - LEVEE BREACH DETAIL
PROFILE SCALE: 1" = 20'



G | - - LEVEE BREACH DETAIL
SECTION SCALE: 1" = 20'



H | - - LEVEE BREACH DETAIL
SECTION SCALE: 1" = 20'

NOTES

1. NOTES

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CONSTRUCTION COMPLETED -
COST - INSPECTOR -

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DRAWN JRJ
CHECKED LAW

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DISTRICT MANAGER–DESIGN

WETLAND RESTORATION OF SALT POND 20
PRELIMINARY DESIGN

GRADING DETAIL - LEVEE BREACH PLAN, PROFILE, & SECTIONS

DATE 10/6/2017
A/E NO.
SHEET 9 OF 14
DRAWING NO. C-4-XXX-XX
REV. -

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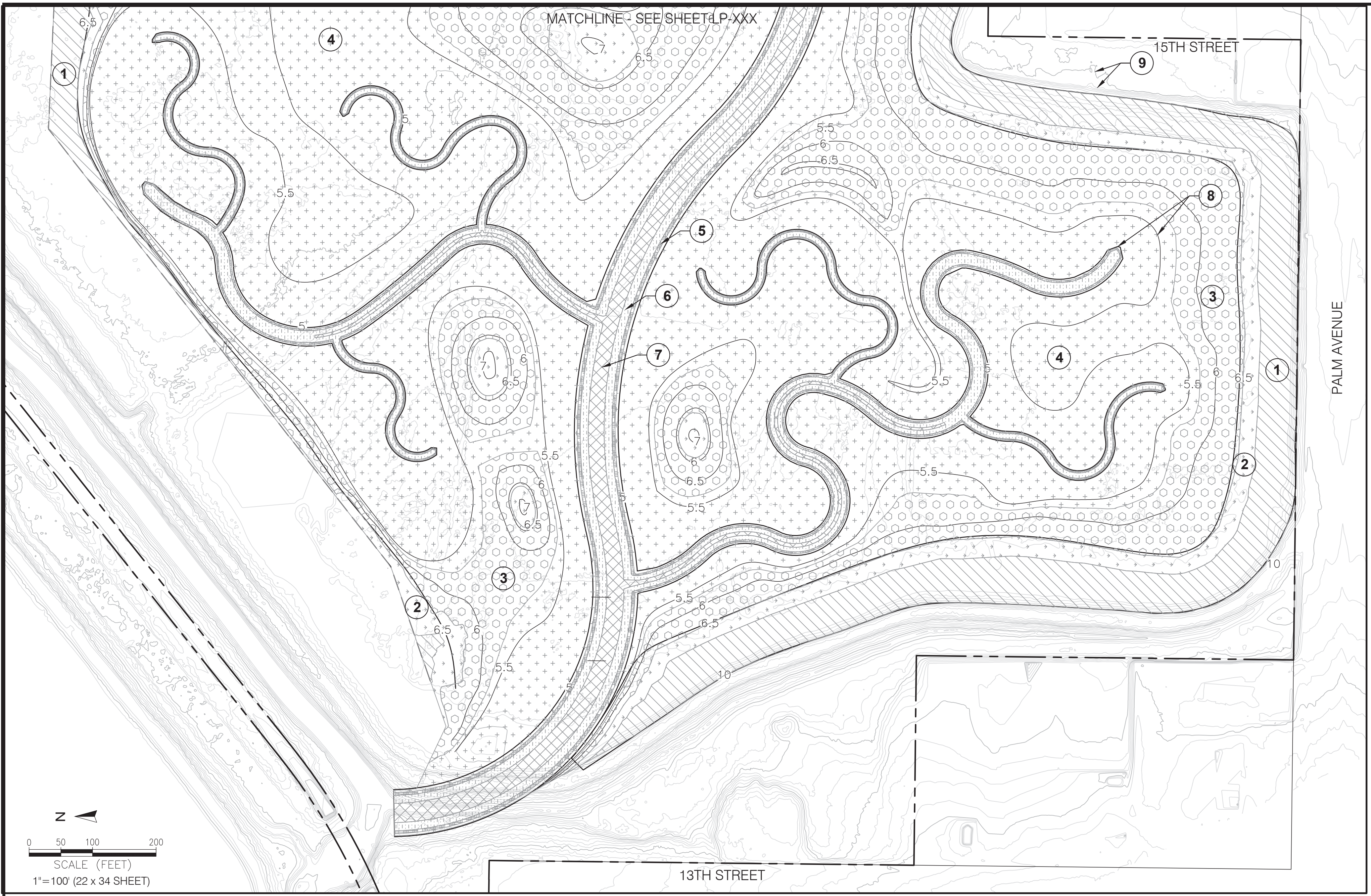

NOTES

(TO BE INCLUDED IN 60% DESIGN SET)

LEGEND

①	▨	UPLAND
②	░	TRANSITION ZONE
③	○	HIGH MARSH
④	+	MID MARSH
⑤	▦	LOW MARSH
⑥	▤	MUDFLAT
⑦	▩	SUBTIDAL
⑧		PROPOSED CONTOURS
⑨		EXISTING CONTOURS

LICENSED LANDSCAPE ARCHITECT
CHRISTOPHER LOFTUS
LA 6259
Signature
Renewal Date
Date
STATE OF CALIFORNIA

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WETLAND RESTORATION OF SALT POND 20
PRELIMINARY DESIGN

PLANTING PLAN - WEST

DATE 10/06/2017
A/E NO.
SHEET 12 OF 14
DRAWING NO. LP-xxxx-xx
REV. -

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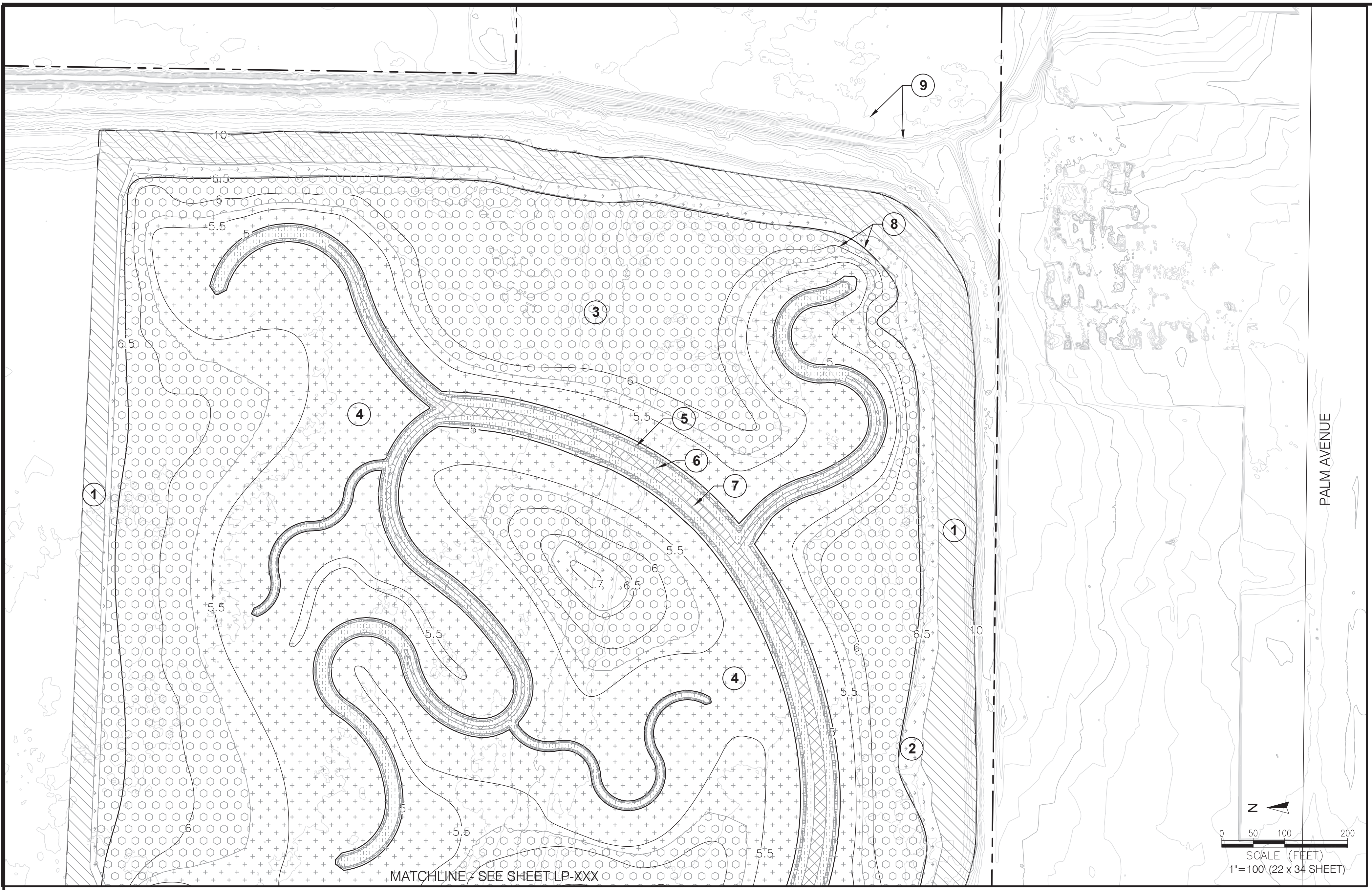

NOTES

(TO BE INCLUDED IN 60% DESIGN SET)

LEGEND

①	▨	UPLAND
②	⋯	TRANSITION ZONE
③	○	HIGH MARSH
④	+	MID MARSH
⑤	▦	LOW MARSH
⑥	┄	MUDFLAT
⑦	⊠	SUBTIDAL
⑧		PROPOSED CONTOURS
⑨		EXISTING CONTOURS

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LICENSED LANDSCAPE ARCHITECT
CHRISTOPHER LOFTUS
LA 6259
Signature
Renewal Date
Date
STATE OF CALIFORNIA

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WETLAND RESTORATION OF SALT POND 20
PRELIMINARY DESIGN

PLANTING PLAN - EAST

DATE 10/06/2017
A/E NO.
SHEET 13 OF 14
DRAWING NO. LP-xxxx-xx
REV. -

HABITAT ACREAGE SUMMARY

① ▨ UPLAND: >7.6'
(7.83 ACRES)

② ▨ TRANSITION ZONE: 6.6'-7.6'
(3.81 ACRES)

③ ▨ HIGH MARSH: 5.7'-6.6'
(20.63 ACRES)

④ ▨ MID MARSH: 4.1'-5.7'
(37.10 ACRES)

⑤ ▨ LOW MARSH: 2.9'-4.1'
(1.43 ACRES)

⑥ ▨ MUDFLAT: -0.4'-2.9'
(4.00 ACRES)

⑦ ▨ SUBTIDAL: <-0.4'
(1.68 ACRES)

TOTAL: 76.48 ACRES

PRELIMINARY PLANT SPECIES LIST

Scientific Name	Common Name
Subtidal	
Zostera marina	Eelgrass
Low Marsh	
Batis maritima	Saltwort
Spartina foliosa	Cordgrass
Mid Marsh	
Distichlis spicata	Saltgrass
Frankenia salina	Alkali heath
Jaumea carnosa	Jaumea
Lasthenia glabrata	Yellow rayed goldfields
Limonium californicum	Sea lavender
Salicornia pacifica	Pickleweed
Triglochin concinna	Arrow grass
High Marsh	
Arthrocnemum subterminale	Parish's glasswort
Cressa truxillensis	Alkali weed
Distichlis spicata	Saltgrass
Frankenia salina	Alkali heath
Jaumea carnosa	Jaumea
Juncus acutus ssp. leopoldii	Leopold's rush
Lasthenia glabrata	Yellow rayed goldfields
Limonium californicum	Sea lavender
Monanthochloe littoralis	Shoregrass
Pluchea odorata	Saltmarsh fleabane
Salicornia pacifica	Pickleweed
Suaeda californica	California seablite
Upland	
Achillea millefolium	Yarrow
Acmispon glaber	Deerweed
Ambrosia psilostachya	Western ragweed
Baccharis pilularis	Coyote brush
Peritoma arborea	Bladderpod
Cressa truxillensis	Alkali weed
Elymus condensatus	Giant wild rye
Elymus triticoides	Beardless wild rye
Encelia californica	California brittlebush
Eriogonum fasciculatum	California buckwheat
Eschscholzia californica	California poppy
Isocoma menziesii	Coast goldenbush
Stipa pulchra	Purple needlegrass
Salvia apiana	White sage
Salvia mellifera	Black sage
Brackish-Tolerant	
Schoenoplectus californicus	California bulrush

NOTE:

1. REFINED PLANT SPECIES LIST WITH CONTAINER SIZES, PLANT SPACING, SEED MIXES, AND APPLICATION RATES WILL BE SPECIFIED IN THE 60% DESIGN SET.

PLANTING NOTES

(TO BE INCLUDED IN 60% DESIGN SET)

PLANTING DETAILS

(TO BE INCLUDED IN 60% DESIGN SET)

CHRISTOPHER LOFTUS
LA 6259
Signature
Renewal Date
Date

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APPROVED
DISTRICT MANAGER–DESIGN

WETLAND RESTORATION OF SALT POND 20
PRELIMINARY DESIGN

PLANT SCHEDULE

DATE 10/06/2017
A/E NO.
SHEET 14 OF 14
DRAWING NO. LP-xxxx-xx
REV. -

Appendix D. Air Quality and Greenhouse Gas Emissions Study

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Air Quality and Greenhouse Gas Emissions Study

Wetland Mitigation Bank at Pond 20 and Port Master Plan Amendment

San Diego, California

March 2021

Contents

Tables

Figures

Appendices

Acronyms

°F	Fahrenheit
AB	Assembly Bill
AQIA	Air Quality Impact Analysis
BAU	business as usual
CAAQS	California Ambient Air Quality Standards
CalEEMod	California Emissions Estimator Model
CARB	California Air Resources Board
CCAA	California Clean Air Act
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalents
EO	Executive Order
EPA	Environmental Protection Agency
FCAA	Federal Clean Air Act
GHG	greenhouse gas
GWP	Global Warming Potential
HFC	Hydrofluorocarbons
MT	metric tons
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NO_2	nitrogen dioxide
O_3	ozone
Pb	lead
PM_{10}	particles of 10 micrometers and smaller
$PM_{2.5}$	particles of 2.5 micrometers and smaller
ppm	parts per million
PMP	Port Master Plan
PMPA	Port Master Plan Amendment
RAQS	Regional Air Quality Strategy
ROG	reactive organic gas
RPS	Renewable Portfolio Standard
SANDAG	San Diego Association of Governments
SB	Senate Bill
SDAB	San Diego Air Basin
SDAPCD	San Diego Air Pollution Control District
SF_6	sulfur hexafluoride
SIP	State Implementation Plan
SLCP	Short-Lived Climate Pollutant
SO_2	sulfur dioxide
SO_X	sulfur oxides
TAC	toxic air contaminant
VOC	volatile organic compound
U.S.	United States

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1 Introduction

This Air Quality and Greenhouse Gas (GHG) Emission Study was completed for the proposed Wetland Mitigation Bank at Pond 20 and Port Master Plan Amendment (PMPA) Project (project) to identify potential impacts to nearby sensitive land uses. This study provides a description of the project, the regulatory framework for air quality and global climate change, the physical setting of the project site, and the environmental consequences of implementing the project.

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2 Project Location and Description

2.1 Project Location

The project site consists of approximately 95 acres of San Diego Unified Port District (District)-owned and federally managed land located in the City of San Diego, east of the City of Imperial Beach and south of the confluences of Otay River and San Diego Bay (Figure 2-1). The project site is located within the Imperial Beach United States (U.S.) Geological Survey 7.5-minute quadrangle and is entirely within the Coastal Zone.

There is no official address for the project site; however, it is located immediately north of Palm Avenue (State Route 75), south of the San Diego Bay National Wildlife Refuge South San Diego Bay Unit managed by U.S. Fish and Wildlife Service, east of 13th Street, and west of 16th Street, and southwest of Otay Valley Regional Park. Interstate 5 is located approximately 1 mile east of the project site (Figure 2-2).

The project site is composed of six parcels of land identified as assessor parcel numbers:

- 616-020-(08/12)
- 616-021-08
- 616-021-09 (portion)
- 621-020-(04/08)

2.2 Project Description

The proposed project includes two primary project components: the creation of the Wetland Mitigation Bank at Pond 20 (Bank Site) and a PMPA. The project site is divided into three main areas, as shown on Figure 2-2: the Bank Parcel, Parcels A, B, and C, and the berm breach location. The Bank Parcel is 83.5 acres and contains the southern portion of the former salt evaporation pond known as Pond 20 and extends beyond the existing salt pond berms to also include Nestor Creek and the Otay River Tributary. The Bank Site would be developed within the existing Pond 20 berms in the Bank Parcel and would be up to 80 acres in size. Parcels A, B, and C are immediately adjacent to the Bank Parcel but entirely outside the Pond 20 berms. The proposed project includes a “project-level” and “program-level” environmental evaluation.

2.2.1 Project-Level Components – Wetland Mitigation Bank at Pond 20

The District is proposing the creation of a wetland mitigation bank within a portion of District-owned property, which was historically used as salt evaporation pond (Bank Parcel). The project includes associated construction and long-term operation and maintenance activities of the mitigation bank. The District is proposing a PMPA to incorporate the Bank Parcel into the District’s Port Master Plan (PMP), and assign a land use designation of wetlands. The creation of the wetland mitigation bank, as well as the incorporation and land use designation of the wetland mitigation bank into the PMP, is evaluated at a “project level” in this report.

Construction Schedule and Workforce

Construction of the proposed project is anticipated to take approximately 17 months. Construction would start following certification of the environmental impact report and issuance of a finding of no significant impact by the U.S. Fish and Wildlife Service, final design engineering, and receipt of all applicable permits. It is anticipated these would be complete by early 2021, and construction would commence in 2021. The estimated duration of each construction activity is summarized in Table 2-1.

Construction would occur during daytime hours, Monday through Saturday from 7 a.m. to 4 p.m. Work restrictions may occur because of exceptionally high tides or delays due to rain or post rain until the ground is dry enough for earth moving equipment to travel safely. A construction crew of approximately 14 people would be on site for the majority of construction, with up to 24 personnel on site for approximately 6 months during mass grading and 4 months during fine grading. The peak number of personnel on site during landscaping activities would be 36 people. Construction is anticipated to commence in early 2021, with clearing and grubbing which would occur in April and May and utilize 40 hauling trucks per day for 2 months. Mass grading would occur June through November and utilize 80 hauling trucks per day for 6 months. Fine grading would occur in December and January and utilize 10 to 15 hauling trucks per day for 2 to 3 weeks.

Table 2-1. Proposed Construction Schedule

Activity	Estimated Duration (Months)
Clearing and grubbing	2
Mass grading	6
Fine grading	4
Landscaping	4
Breech excavation/opening	1

Construction Equipment

A variety of equipment and vehicles would be used during construction. Table 2-2 lists the construction equipment and vehicles and their estimated schedule during construction. Hauling trucks would be double trailers.

Table 2-2. Construction Equipment and Duration of Use

Type of Equipment	Quantity	Estimated Schedule (Months)
Excavator	2	7
Graders	2	4
Scrapers	1	4
Bull dozers	3	11

Table 2-2. Construction Equipment and Duration of Use

Type of Equipment	Quantity	Estimated Schedule (Months)
Loaders	4	10
Backhoes	2	3
Water trucks	2	15
Hauling trucks	20 to 80	10

Operation

Once construction of the wetland mitigation bank is complete, a 5-year monitoring program would begin. During this 5-year period, one vehicle would visit the project site monthly to monitor performance standards and success criteria. After all performance standards have been met, the long-term maintenance and monitoring phase would begin, which assumes one vehicle would visit the site annually. Long-term management may be needed for maintenance of:

- Invasive species monitoring and removal;
- Trash removal;
- Maintenance of site control measures (e.g., fencing); or
- Restoration of any damage from human or maintenance activities or natural phenomenon.

2.2.2 Program-Level Components – Parcels A, B, and C Port Master Plan Amendment

As part of the PMPA, the District is proposing to incorporate Parcels A, B, and C into the District's PMP and assign land use designations. The Bank Site and Parcels A, B, and C are under California Coastal Commission jurisdiction and are District-owned property; however, currently these areas are not formally incorporated into the PMP. Parcels A, B, and C would be assigned a commercial recreation land use designation. Incorporation of Parcels A, B, and C is evaluated at a "program level," and the incorporation of the Bank Site is evaluated at a "project level" in this report.

The program-level analysis of Parcels A, B, and C evaluates the reasonable development scenario. No construction is proposed on these parcels at this time; however, the analysis considers reasonable development assumptions as follows:

- Parcel A – maximum commercial development of 25,000 square feet and 2 stories
- Parcel B – maximum commercial development of 5,000 square feet and 2 stories
- Parcel C – maximum commercial development of 75,000 square feet and 2 stories

This analysis assumes construction of future commercial development would occur after the construction of the wetland mitigation bank. No projects have been identified on Parcels A, B, and C, and any future commercial development proposals would need to go through District review, including California Environmental Quality Act (CEQA) compliance.

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Figure 2-1. Regional Location and Project Vicinity

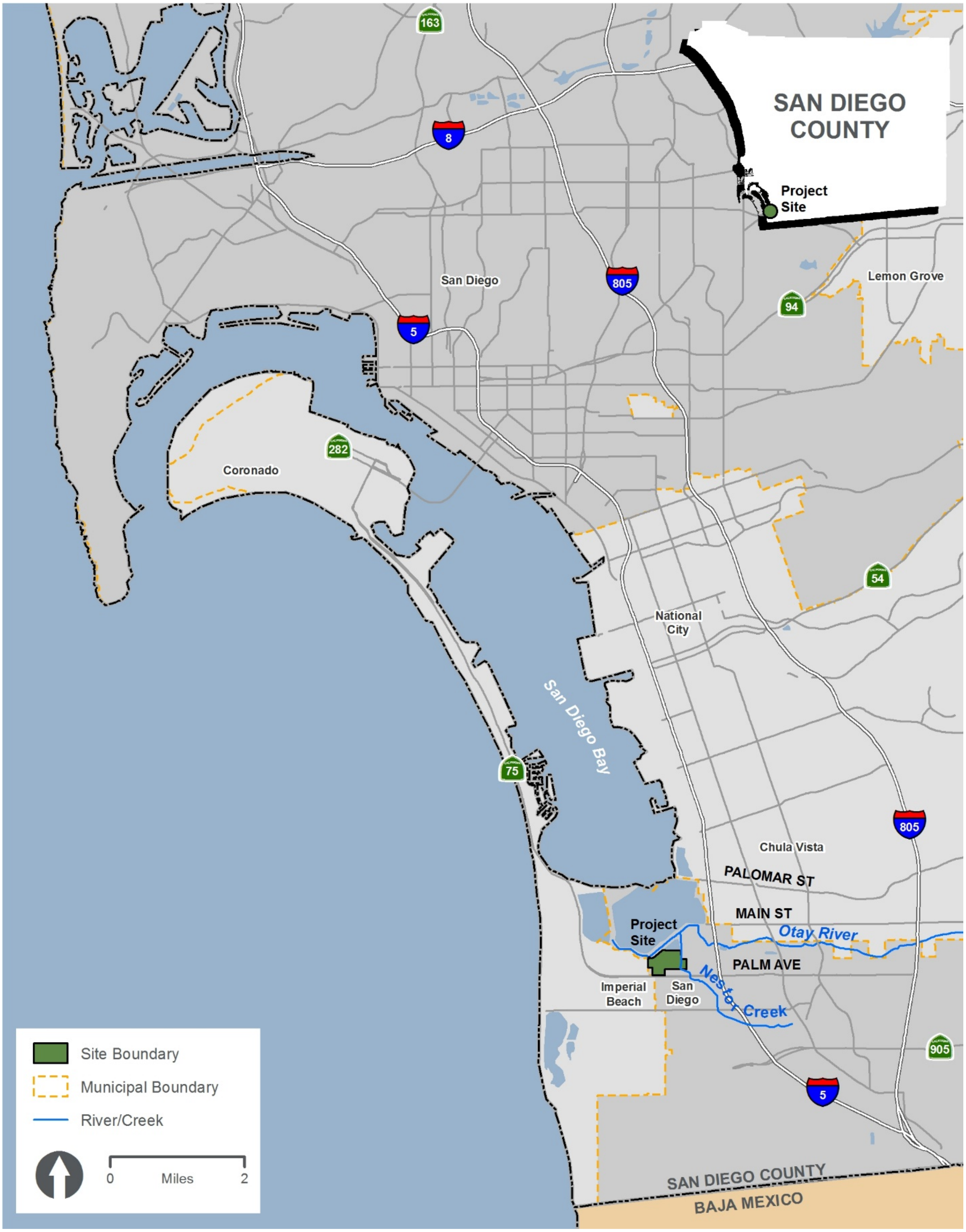

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Figure 2-2. Project Site Characteristics

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3 Regulatory Framework

3.1 Federal

3.1.1 Federal Clean Air Act

The Federal Clean Air Act (FCAA), as amended, is the primary federal law that governs air quality. These laws, and related regulations by the U.S. Environmental Protection Agency (EPA) and California Air Resources Board (CARB), set standards for the concentration of pollutants in the air. At the federal level, these standards are called National Ambient Air Quality Standards (NAAQS). NAAQS standards have been established for six transportation-related criteria pollutants that have been linked to potential health concerns: carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), particulate matter which is broken down for regulatory purposes into particles of 10 micrometers and smaller (PM_{10}) and particles of 2.5 micrometers and smaller ($PM_{2.5}$), and sulfur dioxide (SO_2). In addition, national standards exist for lead (Pb). The NAAQS standards are set at levels that protect public health with a margin of safety and are subject to periodic review and revision. Toxic air contaminants (TAC; air toxics) are covered as well.

Federal air quality standards and regulations provide the basic scheme for project-level air quality analysis under the National Environmental Policy Act. In addition to this environmental analysis, a parallel “conformity” requirement under the FCAA also applies.

The FCAA requires U.S. EPA to designate areas as attainment, nonattainment, or maintenance (previously nonattainment and currently attainment) for each criteria pollutant based on whether the NAAQS have been achieved. The federal standards are summarized in Table 3-1. The U.S. EPA has classified the San Diego Air Basin (SDAB) as attainment/unclassified for CO, PM_{10}, $PM_{2.5}$, SO_2, Pb, and NO_2 and nonattainment for O_3.

3.1.2 Federal General Conformity

The conformity requirement is based on FCAA Section 176(c), which prohibits federal agencies from funding, authorizing, or approving plans, programs, or projects that do not conform to the State Implementation Plan (SIP) for attaining NAAQS.

Conformity requirements apply only in nonattainment and maintenance areas for NAAQS and only for the specific NAAQS that are or were violated. U.S. EPA regulations at 40 Code of Federal Regulations (CFR) 93 govern the conformity process. Conformity requirements do not apply in unclassifiable/attainment areas for NAAQS and do not apply at all for state standards regardless of the status of the area.

The U.S. EPA General Conformity Rule (40 CFR 93 Subpart B) applies to Federal actions, other than those related to highway and transit planning and projects, that result in emissions of nonattainment or maintenance pollutants or their precursors, in federally designated nonattainment or maintenance areas. The U.S. EPA General Conformity Rule establishes a process to demonstrate that federal actions would be consistent with applicable SIPs and would not cause or contribute to new violations of NAAQS, increase the frequency or severity of existing violations of NAAQS, or delay the timely attainment of NAAQS. The emissions thresholds that trigger requirements of the General Conformity Rule for Federal actions emitting nonattainment or maintenance pollutants, or their precursors, are called *de minimis* levels. The general conformity *de minimis* thresholds are defined in 40 CFR 93.153(b).

Table 3-1. State and Federal Criteria Air Pollutant Standards, Effects, and Sources

Pollutant	Averaging Time	State Standard[h]	Federal Standard[i]	Principal Health and Atmospheric Effects	Typical Sources	SDAB Attainment Status
O_3[b]	1 hour 8 hours	0.09 ppm 0.070 ppm	--- 0.070 ppm[d] (4th highest in 3 years)	High concentrations irritate lungs. Long-term exposure may cause lung tissue damage and cancer. Long-term exposure damages plant materials and reduces crop productivity. Precursor organic compounds include many known TACs. Biogenic VOC may also contribute.	Low-altitude O_3 is almost entirely formed from ROG or VOC and NO_X in the presence of sunlight and heat. Major sources include motor vehicles and other mobile sources, solvent evaporation, and industrial and other combustion processes.	Federal: Marginal Nonattainment (8-hour) State: Nonattainment (1-hour and 8-hour)
CO	1 hour 8 hours 8 hours (Lake Tahoe)	20 ppm 9.0 ppm[a] 6 ppm	35 ppm 9 ppm ---	CO interferes with the transfer of oxygen to the blood and deprives sensitive tissues of oxygen. CO also is a minor precursor for photochemical O_3.	Combustion sources, especially gasoline-powered engines and motor vehicles. CO is the traditional signature pollutant for on-road mobile sources at the local and neighborhood scale.	Federal: Attainment State: Attainment
Respirable Particulate Matter (PM_{10})[b]	24 hours Annual	50 $\mu g/m^3$ 20 $\mu g/m^3$	150 $\mu g/m^3$ ---[b] (expected number of days above standard < or equal to 1)	Irritates eyes and respiratory tract. Decreases lung capacity. Associated with increased cancer and mortality. Contributes to haze and reduced visibility. Includes some TACs. Many aerosol and solid compounds are part of PM_{10}.	Dust- and fume-producing industrial and agricultural operations; combustion smoke and vehicle exhaust; atmospheric chemical reactions; construction and other dust-producing activities; unpaved road dust and re-entrained paved road dust; natural sources.	Federal: Unclassified State: Nonattainment

Table 3-1. State and Federal Criteria Air Pollutant Standards, Effects, and Sources

Pollutant	Averaging Time	State Standard[h]	Federal Standard[i]	Principal Health and Atmospheric Effects	Typical Sources	SDAB Attainment Status
Fine Particulate Matter ($PM_{2.5}$)[b]	24 hours	—	35 $\mu g/m^3$	Increases respiratory disease, lung damage, cancer, and premature death. Reduces visibility and produces surface soiling. Most diesel exhaust particulate matter – a TAC – is in the $PM_{2.5}$ size range. Many toxic and other aerosol and solid compounds are part of $PM_{2.5}$.	Combustion including motor vehicles, other mobile sources, and industrial activities; residential and agricultural burning; also formed through atmospheric chemical (including photochemical) reactions involving other pollutants including NO_X, SO_X, ammonia, and ROG.	Federal: Attainment State: Nonattainment
	Annual	12 $\mu g/m^3$	12.0 $\mu g/m^3$			
	Secondary Standard (annual)	—	15 $\mu g/m^3$ (98th percentile over 3 years)			
NO_2	1 hour	0.18 ppm	100 ppb[f] (98th percentile over 3 years)	Irritating to eyes and respiratory tract. Colors atmosphere reddish-brown. Contributes to acid rain. Part of the NO_X group of O_3 precursors.	Motor vehicles and other mobile sources; refineries; industrial operations.	Federal: Attainment State: Attainment
	Annual	0.030 ppm	0.053 ppm			
SO_2	1 hour	0.25 ppm	75 ppb[g] (99th percentile over 3 years)	Irritates respiratory tract; injures lung tissue. Can yellow plant leaves. Destructive to marble, iron, steel. Contributes to acid rain. Limits visibility.	Fuel combustion (especially coal and high-sulfur oil), chemical plants, sulfur recovery plants, metal processing; some natural sources like active volcanoes. Limited contribution possible from heavy-duty diesel vehicles if ultra-low sulfur fuel not used.	Federal: Attainment State: Attainment
	3 hours	—	0.5 ppm[i]			
	24 hours	0.04 ppm	0.14 ppm			
	Annual Arithmetic Mean	—	0.03 ppm			
Pb[c]	Monthly	1.5 $\mu g/m^3$ —	—1.5 $\mu g/m^3$	Disturbs gastrointestinal system. Causes anemia, kidney disease, and neuromuscular and neurological	Pb-based industrial processes like battery production and smelters. Pb paint, leaded gasoline. Aerially	Federal: Attainment

Table 3-1. State and Federal Criteria Air Pollutant Standards, Effects, and Sources

Pollutant	Averaging Time	State Standard[h]	Federal Standard[i]	Principal Health and Atmospheric Effects	Typical Sources	SDAB Attainment Status
	Calendar Quarter Rolling 3-month average	—	0.15 µg/m^{3}[j]	dysfunction. Also a TAC and water pollutant.	deposited Pb from gasoline may exist in soils along major roads.	State: Attainment
Sulfate	24 hours	25 µg/m^{3}	—	Premature mortality and respiratory effects. Contributes to acid rain. Some TACs attach to sulfate aerosol particles.	Industrial processes, refineries and oil fields, mines, natural sources like volcanic areas, salt-covered dry lakes, and large sulfide rock areas.	Federal: — State: Attainment
Hydrogen Sulfide (H_2S)	1 hour	0.03 ppm	—	Colorless, flammable, poisonous. Respiratory irritant. Neurological damage and premature death. Headache, nausea.	Industrial processes such as: refineries and oil fields, asphalt plants, livestock operations, sewage treatment plants, and mines. Some natural sources like volcanic areas and hot springs.	Federal: — State: Attainment/ Unclassified
Visibility Reducing Particles	8 hours	Visibility of 10 miles or more (Tahoe: 30 miles) at relative humidity less than 70 percent	—	Reduces visibility. Produces haze. NOTE: not related to the Regional Haze program under the FCAA, which is oriented primarily toward visibility issues in National Parks and other “Class I” areas.	See particulate matter above.	Federal: — State: Attainment/ Unclassified

Table 3-1. State and Federal Criteria Air Pollutant Standards, Effects, and Sources

Pollutant	Averaging Time	State Standard[h]	Federal Standard[i]	Principal Health and Atmospheric Effects	Typical Sources	SDAB Attainment Status
Vinyl Chloride[c]	24 hours	0.01 ppm	—	Neurological effects, liver damage, cancer. Also considered a TAC.	Industrial processes	Federal: — State: Attainment/ Unclassified

Sources: CARB 2016, CARB 2018

[a] Rounding to an integer value is not allowed for the state 8-hour CO standard. Violation occurs at or above 9.05 ppm.

[b] Annual PM_{10} NAAQS revoked October 2006; was 50 µg/m3. 24-hour. PM2.5 NAAQS tightened October 2006; was 65 $\mu g/m^3$. Annual $PM_{2.5}$ NAAQS tightened from 15 $\mu g/m^3$ to 12 $\mu g/m^3$ December 2012, and secondary standard set at 15 µg/m3.

[c] The CARB has identified vinyl chloride and the particulate matter fraction of diesel exhaust as TACs. Diesel exhaust particulate matter is part of PM_{10} and, in larger proportion, $PM_{2.5}$. Both the CARB and the EPA have identified Pb and various organic compounds that are precursors to O_3 and $PM_{2.5}$ as TACs. There are no exposure criteria for substantial health effects due to TACs, and control requirements may apply at ambient concentrations below any criteria levels specified above for these pollutants or the general categories of pollutants to which they belong.

[d] Prior to June 2005, the 1-hour NAAQS was 0.12 ppm. Emission budgets for 1-hour O_3 are still in use in some areas where 8-hour O_3 emission budgets have not been developed, such as the San Francisco Bay Area. On October 1, 2015, the national 8-hour O_3 primary and secondary standards were lowered from 0.075 to 0.070 ppm.

[e] The 0.08 ppm 1997 O_3 standard is revoked FOR CONFORMITY PURPOSES ONLY when area designations for the 2008 0.75 ppm standard become effective for conformity use (July 20, 2013). Conformity requirements apply for all NAAQS, including revoked NAAQS, until emission budgets for newer NAAQS are found adequate, SIP amendments for the newer NAAQS are approved with an emission budget, EPA specifically revokes conformity requirements for an older standard, or the area becomes attainment/unclassified. SIP-approved emission budgets remain in force indefinitely unless explicitly replaced or eliminated by a subsequent approved SIP amendment. During the "Interim" period prior to availability of emission budgets, conformity tests may include some combination of build vs. no build, build vs. baseline, or compliance with prior emission budgets for the same pollutant.

[f] Final 1-hour NO2 NAAQS published in the *Federal Register* on February 9, 2010, effective March 9, 2010. Initial area designation for California (2012) was attainment/unclassifiable throughout. Project-level hot-spot analysis requirements do not currently exist. Near-road monitoring starting in 2013 may cause redesignation to nonattainment in some areas after 2016.

[g] The EPA finalized a 1-hour SO_2 standard of 75 ppb in June 2010. Nonattainment areas have not yet been designated as of September 2012.

[h] California standards for O_3, carbon monoxide (except 8-hour Lake Tahoe), sulfur dioxide (1 and 24 hour), nitrogen dioxide, and particulate matter (PM_{10}, $PM_{2.5}$, and visibility reducing particles), are values that are not to be exceeded. All others are not to be equaled or exceeded. California ambient air quality standards are listed in the Table of Standards in Section 70200 of Title 17 of the California Code of Regulations.

Table 3-1. State and Federal Criteria Air Pollutant Standards, Effects, and Sources

Pollutant	Averaging Time	State Standard[h]	Federal Standard[i]	Principal Health and Atmospheric Effects	Typical Sources	SDAB Attainment Status

[i] National standards (other than O_3, particulate matter, and those based on annual arithmetic mean) are not to be exceeded more than once a year. The O_3 standard is attained when the fourth highest 8-hour concentration measured at each site in a year, averaged over three years, is equal to or less than the standard. For PM10, the 24 hour standard is attained when the expected number of days per calendar year with a 24-hour average concentration above 150 µg/m3 is equal to or less than one. For PM2.5, the 24 hour standard is attained when 98 percent of the daily concentrations, averaged over three years, are equal to or less than the standard. Contact the U.S. EPA for further clarification and current national policies.

[j] Pb NAAQS are not considered in Transportation Conformity analysis.

CO=carbon monoxide; FCAA=Federal Clean Air Act; NO_2=nitrogen dioxide; NO_X=nitrogen oxides; O_3=ozone; Pb=lead; PM_{10}=particles of 10 micrometers and smaller; $PM_{2.5}$=particles of 2.5 micrometers and smaller; ppm=parts per million; ROG=reactive organic gases; SDAB=San Diego Air Basin; SO_2=sulfur dioxide; SO_X=sulfur oxides; TAC=toxic air contaminant; VOC=volatile organic compound; —=not applicable

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3.2 State

3.2.1 California Clean Air Act

In California, the California Clean Air Act (CCAA) is administered by the CARB at the state level and by the air quality management districts and air pollution control districts at the regional and local levels. The CARB, which became part of the California EPA in 1991, is responsible for meeting the state requirements of the FCAA, administering the CCAA, and establishing the California Ambient Air Quality Standards (CAAQS). The CCAA, as amended in 1992, requires all air districts in the state to endeavor to achieve and maintain CAAQS. CAAQS are generally more stringent than the corresponding federal standards and incorporate additional standards for sulfates, hydrogen sulfide, vinyl chloride, and visibility-reducing particles.

CARB regulates mobile air pollution sources, such as motor vehicles. CARB is responsible for setting emission standards for vehicles sold in California and for other emission sources, such as consumer products and certain off-road equipment. CARB established passenger vehicle fuel specifications, which became effective in March 1996. CARB oversees the functions of local air pollution control districts and air quality management districts, which, in turn, administer air quality activities at the regional and county levels.

The state standards are summarized in Table 3-1. CCAA requires CARB to designate areas within California as either attainment or nonattainment for each criteria pollutant based on whether CAAQS have been achieved. Under CCAA, areas are designated as nonattainment for a pollutant if air quality data shows that a state standard for the pollutant was violated at least once during the previous 3 calendar years. Exceedances that are impacted by highly irregular or infrequent events are not considered violations of a state standard and are not used as a basis for designating areas as nonattainment. Under CCAA, SDAB is designated as a nonattainment area for O_3, $PM_{2.5}$, and PM_{10}.

3.2.2 California State Implementation Plan

The 1990 amendments to the FCAA set new deadlines for attainment based on the severity of the pollution problem and launched a comprehensive planning process for attaining NAAQS. The promulgation of the national 8-hour O_3 standard and $PM_{2.5}$ standards in 1997 resulted in additional statewide air quality planning efforts. In response to new federal regulations, SIPs also began to address ways to improve visibility in national parks and wilderness areas. SIPs are not single documents but rather a compilation of new and previously submitted plans, programs, district rules, state regulations, and federal controls.

Many of California's SIPs rely on the same core set of control strategies, including emission standards for cars and heavy trucks, fuel regulations, and limits on emissions from consumer products. State law makes CARB the lead agency for all purposes related to the SIP. Local air districts and other agencies prepare SIP elements and submit them to CARB for review and approval. CARB then forwards SIP revisions to the U.S. EPA for approval and publication in the *Federal Register*. CFR Title 40, Chapter I, Part 52, Subpart F, Section 52.220 lists all of the items which are included in the California SIP.

3.3 Regional

3.3.1 San Diego Air Pollution Control District

The San Diego Air Pollution Control District (SDAPCD) is the local agency responsible for the administration and enforcement of air quality regulations for the SDAB, which includes all of San Diego County. SDAPCD regulates most air pollutant sources, except for motor vehicles, marine vessels, aircraft, and agricultural equipment, which are regulated by CARB or the U.S. EPA. State and local government projects, as well as projects proposed by the private sector, are subject to SDAPCD requirements if the sources are regulated by the SDAPCD. Additionally, SDAPCD, along with CARB, maintains and operates ambient air quality monitoring stations at numerous locations throughout San Diego County. These stations are used to measure and monitor ambient criteria and toxic air pollutant levels.

The San Diego Association of Governments (SANDAG) is the San Diego region's primary public planning, transportation, and research agency, providing the public forum for regional policy decisions about growth, transportation planning and construction, environmental management, housing, open space, energy, public safety, and binational topics. SANDAG directors are mayors, councilmembers, and a supervisor from each of the region’s 18 cities and county government. SDAPCD and SANDAG are responsible for developing and implementing the clean air plan for attainment and maintenance of NAAAQS in the SDAB. The San Diego County Regional Air Quality Strategy (RAQS) was initially adopted in 1991, and is updated on a triennial basis. The RAQS was updated in 1995, 1998, 2001, 2004, 2009, and most recently in December 2016 (SDAPCD 2016). The RAQS outlines SDAPCD’s plans and control measures designed to attain the state air quality standards for O_3. SDAPCD has also developed the SDAB’s input to the SIP, which is required under FCAA for pollutants that are designated as being in nonattainment for national air quality standards for the SDAB.

The RAQS relies on information from CARB and SANDAG, including mobile and area source emissions, as well as information regarding projected growth in the county, to project future emissions and then establish the strategies necessary for the reduction of emissions through regulatory controls. CARB mobile source emission projections and SANDAG growth projections are based on population and vehicle trends and land use plans developed by the cities and by the county as part of the development of their general plans. As such, projects that propose development consistent with the growth anticipated by the general plans would be consistent with the RAQS. In the event that a project would propose development that is less dense than anticipated within the general plan, the project would likewise be consistent with the RAQS. If the project proposes development that is greater than that anticipated in the general plan and SANDAG’s growth projections, the project might be in conflict with the RAQS and SIP, and might have a potentially significant impact related to air quality.

The SIP relies on the same information from SANDAG to develop emission inventories and emission reduction strategies that are included in the attainment demonstration for the SDAB. The SIP also includes rules and regulations that have been adopted by SDAPCD to control emissions from stationary sources. These SIP-approved rules may be used as a guideline to determine whether a project’s emissions would have the potential to conflict with the SIP and, thereby, hinder attainment of NAAQS for O_3.

In December 2005, SDAPCD adopted the Measures to Reduce Particulate Matter in San Diego County. This document identifies fugitive dust as the major source of directly emitted particulate matter in the county, with mobile sources and residential wood combustion as minor contributors. Data on $PM_{2.5}$ source apportionment indicates that the main contributors to $PM_{2.5}$ in the county are combustion organic carbon, and ammonium sulfate and ammonium nitrate from combustion sources. The main contributors to PM_{10} include resuspended soil and road dust from unpaved and paved roads, construction and demolition sites, and mineral extraction and processing. Based on the report's evaluation of control measures recommended by CARB to reduce particulate matter emissions, the SDAPCD adopted Rule 55, the Fugitive Dust Rule, in June 2009. SDAPCD requires that construction activities implement the measures listed in Rule 55 to minimize fugitive dust emissions. Rule 55 requires the following:

1. No person shall engage in construction or demolition activity in a manner that discharges visible dust emissions into the atmosphere beyond the property line for a period or periods aggregating more than 3 minutes in any 60 minute period; and
2. Visible roadway dust as a result of active operations, spillage from transport trucks, erosion, or track-out/carry-out shall be minimized by the use of any of the equally effective track-out/carry-out and erosion control measures listed in Rule 55 that apply to the project or operation. These measures include: track-out grates or gravel beds at each egress point; wheel-washing at each egress during muddy conditions; soil binders, chemical soil stabilizers, geotextiles, mulching, or seeding; watering for dust control; and using secured tarps or cargo covering, watering, or treating of transported material for outbound transport trucks. Erosion control measures must be removed at the conclusion of each work day when active operations cease, or every 24 hours for continuous operations.

3.3.2 City of San Diego Municipal Code

The San Diego Municipal Code addresses odor impacts at Chapter 14, Article 2, Division 7 paragraph 142.0710, "Air Contaminant Regulations," which states:

> Air contaminants including smoke, charred paper, dust, soot, grime, carbon, noxious acids, toxic fumes, gases, odors, and particulate matter, or any emissions that endanger human health, cause damage to vegetation or property, or cause soiling shall not be permitted to emanate beyond the boundaries of the premises upon which the use emitting the contaminants is located.

3.4 Climate Change

3.4.1 State Regulations

Executive Order S-3-05 – Statewide Greenhouse Gas Emission Targets

On June 1, 2005, the Governor issued Executive Order (EO) S-3-05 which set the following GHG emission reduction targets:

- By 2010, reduce GHG emissions to 2000 levels
- By 2020, reduce GHG emissions to 1990 levels
- By 2050, reduce GHG emissions to 80 percent below 1990 levels

This EO also directed the secretary of the California EPA to oversee the efforts made to reach these targets and to prepare biannual reports on the progress made toward meeting the targets and the impacts to California related to global warming. The first such Climate Action Team Assessment Report was produced in March 2006 and has been updated every 2 years thereafter.

California Global Warming Solutions Act (Assembly Bill 32)

In 2006, the California State Legislature enacted the California Global Warming Solutions Act of 2006, also known as Assembly Bill (AB) 32. AB 32 focuses on reducing GHG emissions in California. GHGs, as defined under AB 32, include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), Hydrofluorocarbons (HFC), perfluorocarbons, and sulfur hexafluoride (SF_6). AB 32 requires that GHGs emitted in California be reduced to 1990 levels by the year 2020. CARB is the state agency charged with monitoring and regulating sources of emissions of GHGs that cause global warming in order to reduce emissions of GHGs. AB 32 also requires that by January 1, 2008, CARB must determine what the statewide GHG emissions level was in 1990, and it must approve a statewide GHG emissions limit so it may be applied to the 2020 benchmark. CARB approved a 1990 GHG emissions level of 427 million metric tons (MT) of carbon dioxide equivalents (CO_2e) on December 6, 2007 in its Staff Report. Therefore, in 2020, emissions in California are required to be at or below 427 million MT of CO_2e.

Under the business as usual (BAU) scenario established in 2008, statewide emissions were increasing at a rate of approximately 1 percent per year, as noted below. It was estimated that the 2020 estimated BAU of 596 million MT of CO_2e would have required a 28 percent reduction to reach the 1990 level of 427 million MT of CO_2e.

Executive Order B-30-15

On April 20, 2015, Governor Edmund G. Brown Jr. signed EO B-30-15 to establish a California GHG reduction target of 40 percent below 1990 levels by 2030. The Governor's EO aligns California's GHG reduction targets with those of leading international governments, such as the 28-nation European Union, which adopted the same target in October 2014. California is on track to meet or exceed its legislated target of reducing GHG emissions to 1990 levels by 2020, as established in the California Global Warming Solutions Act of 2006 (AB 32, summarized above).

California's new emission reduction target of 40 percent below 1990 levels by 2030 will make it possible to reach the ultimate goal of reducing emissions 80 percent below 1990 levels by 2050. This is in line with the scientifically established levels needed in the U.S. to limit global warming below 2°Celcius, the warming threshold at which there will likely be major climate disruptions, such as super droughts and rising sea levels.

Senate Bill 32

Senate Bill (SB) 32 was signed into law on September 8, 2016, and expands upon AB 32 to reduce GHG emissions. SB 32 sets into law the mandated GHG emissions target of 40 percent below 1990 levels by 2030 written into EO B-30-15.

Climate Change Scoping Plan

The Scoping Plan released by CARB in 2008 outlined the state's strategy to achieve the AB 32 goals. This Scoping Plan, developed by CARB in coordination with the Climate Action Team, proposed a comprehensive set of actions designed to reduce overall GHG emissions in California, improve the environment, reduce dependence on oil, diversify our energy sources, save energy, create new jobs, and enhance public health. It was adopted by CARB at its meeting in December 2008. According to the Scoping Plan, the 2020 target of 427 million MT of CO_2e requires the reduction of 169 million MT of CO_2e, or approximately 28.3 percent, from the state's projected 2020 BAU emissions level of 596 million MT of CO_2e.

In August 2011, the Scoping Plan was re-approved by CARB and includes the Final Supplement to the Scoping Plan Functional Equivalent Document. This document includes expanded analysis of project alternatives, as well as updates the 2020 emission projections in light of the current economic forecasts. Considering the updated 2020 BAU estimate of 507 million MT of CO_2e, only a 16 percent reduction below the estimated new BAU levels would be necessary to return to 1990 levels by 2020. The 2011 Scoping Plan expands the list of 9 early action measures into a list of 39 recommended actions.

In May 2014, CARB developed, in collaboration with the Climate Action Team, the first update to California's Climate Change Scoping Plan (Update), which shows that California is on track to meet the near-term 2020 GHG limit and is well positioned to maintain and continue reductions beyond 2020, as required by AB 32. In accordance with the United Nations Framework Convention on Climate Change, CARB is beginning to transition to the use of the fourth assessment report's 100-year Global Warming Potentials (GWP) in its climate change programs. CARB has recalculated the 1990 GHG emissions level with the AR4 GWPs to be 431 million MT of CO_2e; therefore, the 2020 GHG emissions limit established in response to AB 32 is now slightly higher than the 427 million MT of CO_2e in the initial Scoping Plan.

In 2016, legislature passed SB 32, which codifies a 2030 GHG emissions reduction target of 40 percent below 1990 levels. With SB 32, the legislature passed companion legislation AB 197, which provides additional direction for developing the Scoping Plan. CARB is moving forward with a second update to the Scoping Plan to reflect the 2030 target set by EO B-30-15 and codified by SB 32. According to the 2017 Scoping Plan, the 2030 target of 260 million MT of CO_2e requires the reduction of 129 million MT of CO_2e, or approximately 33.2 percent, from the state's projected 2030 BAU emissions level of 389 million MT of CO_2e.

Assembly Bill 1493 – Light-duty Vehicle Greenhouse Gas Emissions Standards

AB 1493 (commonly known as Pavley) requires CARB to develop and adopt regulations that achieve "the maximum feasible reduction of GHGs emitted by passenger vehicles and light-duty truck and other vehicles determined by CARB to be vehicles whose primary use is noncommercial personal transportation in the state."

On September 24, 2009, CARB adopted amendments to the Pavley regulations that intend to reduce GHG emissions in new passenger vehicles from 2009 through 2016. The amendments bind California's enforcement of AB 1493 (starting in 2009), while providing vehicle manufacturers with new compliance flexibility. The amendments also prepare California to merge its rules with the federal Corporate Average Fuel Economy rules for passenger vehicles. In January 2012, CARB approved a new emissions-control program for model years 2017 through 2025. The program combines the control of smog, soot, and global warming gases and requirements for greater numbers of zero-emission vehicles into a single packet of standards called Advanced Clean Cars.

Executive Order S-01-07

This EO, signed by Governor Schwarzenegger on January 18, 2007, directs that a statewide goal be established to reduce the carbon intensity of California's transportation fuels by at least 10 percent by the year 2020. It orders that a low carbon fuel standard for transportation fuels be established for California and directs the CARB to determine whether a low carbon fuel standard can be adopted as a discrete early action measure pursuant to AB 32.

CARB approved the low carbon fuel standard as a discrete early action item with a regulation adopted and implemented in April 2010.

Renewable Portfolio Standard

The Renewable Portfolio Standard (RPS) promotes diversification of the state's electricity supply and decreased reliance on fossil fuel energy sources. Originally adopted in 2002, with a goal to achieve a 20 percent renewable energy mix by 2020 (referred to as the initial RPS), the goals have been accelerated and increased by EO S-14-08 and EO S-21-09 to a goal of 33 percent by 2020.

In April 2011, the Governor signed SB 2 (1X) codifying California's 33 percent RPS goal; Section 399.19 requires the California Public Utilities Commission, in consultation with the California Energy Commission, to report to the legislature on the progress and status of RPS procurement and other benchmarks. The purpose of the RPS upon full implementation is to provide 33 percent of the state's electricity needs through renewable energy sources. Renewable energy includes, but is not limited to, wind, solar, geothermal, small hydroelectric, biomass, anaerobic digestion, and landfill gas.

The RPS is included in CARB's Scoping Plan list of GHG reduction measures to reduce energy sector emissions. It is designed to accelerate the transformation of the electricity sector through such means as investment in the energy transmission infrastructure and systems to allow integration of large quantities of intermittent wind and solar generation. Increased use of renewables would decrease California's reliance on fossil fuels, thus reducing emissions of GHGs from the electricity sector. In 2008, as part of the Scoping Plan original estimates, CARB estimated that full achievement of the RPS would decrease statewide GHG emissions by 21.3 million MT of CO_2e. In 2010, CARB revised this number upwards to 24.0 million MT of CO_2e. The state's RPS was further augmented through the adoption of SB 350 and SB 100.

Senate Bill 350

SB 350 was signed into law in September 2015. SB 350 establishes tiered increases to the RPS of 40 percent by 2024, 45 percent by 2027, and 50 percent by 2030. SB 350 also set a new goal to double the energy efficiency savings in electricity and natural gas through energy efficiency and conservation measures.

Senate Bill 100

SB 100, adopted in September 2018, requires the state's retail electricity to achieve a 60 percent renewable energy portfolio by 2030 (an increase from 50 percent set forth by SB 350) and 100 percent carbon-free renewable energy portfolio by 2045.

Senate Bill 375 – Regional Emissions Targets

SB 375 was signed into law in September 2008 and requires CARB to set regional targets for reducing passenger vehicle GHG emissions in accordance with the Scoping Plan. The purpose of SB 375 is to align regional transportation planning efforts, regional GHG reduction targets, and fair-share housing allocations under state housing law. SB 375 requires Metropolitan Planning Organizations to adopt a Sustainable Communities Strategy or Alternative Planning Strategy to address GHG reduction targets from cars and light-duty trucks in the context of that Metropolitan Planning Organization's Regional Transportation Plan.

Senate Bill 97 – CEQA Greenhouse Gas Amendments

SB 97 acknowledges that climate change is a prominent environmental issue that requires analysis under CEQA. The California Natural Resources Agency adopted amendments to the CEQA Guidelines to address GHG emissions, consistent with the Legislature's directive in Public Resources Code Section 21083.05.

State of California Building Energy Efficiency Standards (Title 24, Part 6)

California's Energy Efficiency Standards for Residential and Nonresidential Buildings (24 California Code of Regulations Part 6) were first established in 1978 in response to a legislative mandate to reduce California's energy consumption. The standards are updated periodically to allow consideration and possible incorporation of new energy efficiency technologies and methods. The premise for the standards is that energy efficient buildings require less electricity, natural gas, and other fuels. Electricity production from fossil fuels and on-site fuel combustion (typically for space and water heating) results in GHG emissions.

The California Energy Commission adopted new 2019 Building Energy Efficiency Standards effective January 1, 2020. The 2019 Building Energy Efficiency Standards improve upon the 2016 Energy Standards for new construction of, and additions and alterations to, residential and nonresidential buildings. The most significant efficiency improvements to the residential standards include the introduction of photovoltaic into the prescriptive package and improvements for attics, walls, water heating, and lighting.

California Integrated Waste Management Act

The California Integrated Waste Management Act (AB 939), passed in 1989, repealed portions of the Title 7.3 of the Government Code governing solid waste management and portions of the Health and Safety Code related to garbage and refuse disposal. The Integrated Waste Management Act established an integrated waste management hierarchy to guide local agencies in implementing source reduction, recycling and composting, and environmentally safe transformation and land disposal. The Integrated Waste Management Act created the California Integrated Waste Management Board and required counties to create a task force for the development of Source Reduction and Recycling Elements. Additionally, it established a mandated waste diversion target of 50 percent of all solid waste from landfills by 2020.

3.4.2 Local Regulations

San Diego Unified Port District Climate Action Plan

The District adopted a Climate Action Plan in December 2013. The Climate Action Plan includes an inventory of existing emissions broken into smaller sectors including: energy, water use and waste water, on road transportation, off road transportation, and waste. The Climate Action Plan includes projections for emissions for 2020 and 2035 dates, specific targets to reduce GHGs by 2020 and 2035 in order to achieve statewide 2020 and 2030 targets, and putting the District on the trajectory of meeting its share of the 2050 statewide target. The District's reduction measures include those required by state and federal regulations, and District-specific policies and measures focus on the following:

- **Transportation Land Use Planning:** Support alternatively fueled technology and implement management systems that increase the efficiency of transportation and reduce energy consumption
- **Energy Conservation and Efficiency:** Employ energy strategies in buildings and exterior spaces that save money on utility costs, reduce GHG emissions, and provide other community benefits
- **Water Conservation and Recycling:** Conserve, treat, and reuse water to minimize GHG emissions and conserve a scarce resource
- **Alternative Energy Generation:** Meet energy demands through renewable energy generation
- **Waste Reduction and Recycling:** Promote behavioral changes that encourage conserving resources, reuse, and recycling

City of San Diego Municipal Code

On July 1, 2008, Chapter 6, Article 6, Division 6: Construction and Demolition Debris Diversion Deposit Program took effect. The ordinance requires that the majority of construction, demolition and remodeling projects requiring building or demolition permits:

- Pay a refundable construction and demolition debris recycling deposit
- Divert their debris by recycling, reusing, or donating usable materials
- Keep construction and demolition materials out of local landfills and ensure they get recycled

4 Methodology

The air quality analysis contained herein evaluates the proposed project's short-term construction and long-term operation emissions using the following methodologies and significance thresholds.

4.1 Methods

4.1.1 Criteria Air Pollutants

Emissions of criteria air pollutants were estimated using existing conditions information, project construction details, and project operations information, as well as a combination of emission factors from the following sources:

- California Emissions Estimator Model (CalEEMod; Version 2016.3.2) emission model for estimating exhaust emissions from off-road construction equipment and on-road motor vehicles

4.1.2 Quantification of Greenhouse Gases

As with the criteria air pollutants, the proposed project's GHG emissions were estimated using the CalEEMod emission model. Construction emissions were amortized over the life of the project (defined as 20 years) added to the operational emissions, and compared to the applicable GHG significance thresholds.

4.1.3 Federal General Conformity Rule

As discussed in Section 3.1.2, the emissions thresholds that trigger requirements of the General Conformity Rule for federal actions emitting nonattainment or maintenance pollutants, or their precursors, are called *de minimis* levels. The general conformity *de minimis* thresholds are defined in 40 CFR 93.153(b). The Federal General Conformity Rule does not apply to federal actions in areas designated as nonattainment for only CAAQS.

Based on the attainment status listed in Table 3-1, the *de minimis* thresholds that apply to the SDAB are listed in Table 4-1. These thresholds apply to all direct and indirect emissions generated during construction and operation of a project. The SDAB is currently designated as attainment/unclassified for the PM_{10}, $PM_{2.5}$, and CO NAAQS. Therefore, there are no *de minimis* thresholds for those pollutants.

Table 4-1. *De Minimis* Thresholds for the San Diego Air Basin

Pollutant	Threshold (Tons/year)
NO_X	100
VOC	100
PM_{10}	—
$PM_{2.5}$	—

Table 4-1. *De Minimis* Thresholds for the San Diego Air Basin

Pollutant	Threshold (Tons/year)
CO	—

Source: U.S. EPA 2017

Notes:

CO=carbon monoxide; NO_X=nitrogen oxides; PM_{10}=particles of 10 micrometers and smaller; $PM_{2.5}$=particles of 2.5 micrometers and smaller; VOC=volatile organic compound

4.2 Thresholds of Significance

Appendix G of the CEQA Guidelines contains significance criteria for evaluation of the air quality impacts of a project. Impacts would be considered significant if the project would result in any of the following:

1. Conflict with or obstruct implementation of the applicable air quality plan;
2. Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is nonattainment under an applicable federal or state ambient air quality standard;
3. Expose sensitive receptors to substantial pollutant concentrations; or
4. Result in other emissions such as those leading to odors adversely affecting a substantial number of people.

Similarly, Appendix G of the CEQA Guidelines contains two significance criteria for evaluation GHG emissions of a project:

5. Would the project generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment?
6. Would the project conflict with an applicable plan, policy, or regulation adopted for the purposes of reducing the emissions of GHGs?

4.2.1 Significance Thresholds – Air Quality

Criteria Pollutant Emissions

Neither the City of San Diego nor the District has developed CEQA thresholds of significance for air quality. SDAPCD does not provide specific quantitative thresholds for determining the significance of air quality impacts under CEQA. However, SDAPCD does specify Air Quality Impact Analysis (AQIA) trigger levels for new or modified stationary sources (SDAPCD Rules 20.2 and 20.3). If these incremental levels for stationary sources are exceeded, an AQIA must be performed for the source. Although these trigger levels do not generally apply to mobile sources or general land development projects, for comparative purposes these levels may be used to evaluate increases in emissions.

SDAPCD Rule 20.2, which outlines these significance level thresholds, states that any project which results in an emissions increase equal to or greater than any of these levels, must:

> …demonstrate through an AQIA… that the project will not (A) cause a violation of a State or national ambient air quality standard anywhere that does not already exceed such standard, nor (B) cause additional violations of a national ambient air quality standard anywhere the standard is already being exceeded, nor (C) cause additional violations of a State ambient air quality standard anywhere the standard is already being exceeded, nor (D) prevent or interfere with the attainment or maintenance of any State or national ambient air quality standard.

For projects whose stationary-source emissions are below these criteria, no AQIA is typically required, and project-level emissions are presumed to be less than significant. For CEQA purposes, these screening-level thresholds can be used to demonstrate that a project's total emissions (e.g., stationary and fugitive emissions, as well as emissions from mobile sources) would not result in a significant impact to air quality.

SDAPCD Rules 20.2 and 20.3 do not have AQIA thresholds for emissions of volatile organic compounds (VOC) and $PM_{2.5}$. The County of San Diego notes that the use of the screening level for VOCs specified by the South Coast Air Quality Management District, which generally has stricter emissions thresholds than SDAPCD, is recommended for evaluating projects in San Diego County. For $PM_{2.5}$, the U.S. EPA "Proposed Rule to Implement the Fine Particle National Ambient Air Quality Standards" published September 8, 2005, which quantifies significant emissions as 10 tons per year, was identified by the County of San Diego as an appropriate screening threshold. If project emissions exceed these screening level thresholds, specific modeling will be required for NO_2, SO_2, CO, and Pb to demonstrate that the project's ground-level concentrations, including appropriate background levels, do not exceed NAAQS and CAAQS. For O_3 precursors, PM_{10} and $PM_{2.5}$, exceedances of the screening level thresholds result in a significant impact. The reason for this is that the SDAB is currently not in attainment for PM_{10}, $PM_{2.5}$, and O_3.

Table 4-2 shows the significance thresholds that have been established by SDAPCD. Projects in the SDAB with construction- or operation-related emissions that exceed any of the emission thresholds are considered a significant impact under CEQA.

Table 4-2. San Diego Air Pollution Control District Pollution Thresholds for Stationary Sources

Pollutant	Emission Rate		
	pounds/hour	pounds/day	tons/year
CO	100	550	100
NO_X	25	250	40
PM_{10}	—	100	15
SO_X	25	250	40
Pb and Pb compounds	—	3.2	0.6
$PM_{2.5}$	—	55*	—

Table 4-2. San Diego Air Pollution Control District Pollution Thresholds for Stationary Sources

Pollutant	Emission Rate		
	pounds/hour	pounds/day	tons/year
VOC or ROG	—	75	15

Source: SDAPCD 1999

Notes:

* The SDAPCD do not list a threshold for $PM_{2.5}$; therefore, the threshold from the South Coast Air Quality Management District is used for determining significance.

CO=carbon monoxide; NO_X=nitrogen oxides; PM_{10}=particles of 10 micrometers and smaller; $PM_{2.5}$=particles of 2.5 micrometers and smaller; ROG=reactive organic gas; SO_X=sulfur oxides; Pb=lead; VOC=volatile organic compound

Carbon Monoxide Hot-Spots

For CO hotspot impacts, the significance of localized project impacts under CEQA depend on whether ambient CO levels in the vicinity of the project are above or below state and federal CO standards. The local emission concentration standards for CO are:

- California state 1-hour CO standard of 20.0 parts per million (ppm); and/or
- California state 8-hour CO standard of 9.0 ppm.

A project with daily emission rates, risk values, or concentrations below these thresholds is generally considered to have a less than significant impact on air quality.

Odors

Determining the significance of potential odor impacts should be based on what is known about the quantity of the odor compounds that would result from the project‘s proposed uses, the types of neighboring uses potentially impacted, the distances between the project‘s point sources and the neighboring uses (such as sensitive receptors), and the resultant concentrations at the receptors. A more detailed odor analysis may be required to fully evaluate and determine significance of the potential impacts if the proposed project would result in objectionable odors to nearby sensitive receptors.

For a project proposing placement of sensitive receptors near an existing odor source, a significant odor impact will be identified if the project site is closer to the odor source than any existing sensitive receptor where there has been more than 1 confirmed or 3 confirmed complaints per year (averaged over a 3 week period) about the odor source.

For projects proposing placement of sensitive receptors near a source of odors where there is currently no nearby existing receptors, the determination of significance should be based on the distance and frequency at which odor complaints from the public have occurred in the vicinity of a similar odor source at another location.

4.2.2 Significance Thresholds – Greenhouse Gases

Neither CARB nor SDAPCD has adopted significance criteria applicable to land use development projects for the evaluation of GHG emissions under CEQA. California's Office of Planning and Research's Technical Advisory titled "CEQA and Climate Change: Addressing Climate Change through CEQA Review" states, "public agencies are encouraged, but not required to adopt thresholds of significance for environmental impacts. Even in the absence of clearly defined thresholds for GHG emissions, the law requires that such emissions from CEQA projects must be disclosed and mitigated to the extent feasible whenever the lead agency determines that the project contributes to a significant, cumulative climate change impact." Furthermore, the advisory document indicates, "in the absence of regulatory standards for GHG emissions or other scientific data to clearly define what constitutes a 'significant impact,' individual lead agencies may undertake a project-by-project analysis, consistent with available guidance and current CEQA practice."

The District, as the CEQA lead agency for this project, is analyzing the proposed project using the *San Diego County Recommended Approach for Addressing Climate Change*, which uses a screening threshold of 900 MT of CO_2e per year (County of San Diego 2015). A project that exceeds the 900 MT of CO_2e per year screening threshold would be required to conduct a more detailed GHG analysis. Screening thresholds are recommended based on various land use densities and project types. Projects that meet or fall below the screening thresholds are expected to result in 900 MT of CO_2e per year or less and would not require additional analysis; the GHG emissions-related impacts would be considered less than significant.

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5 Affected Environment

5.1 Climate

The project site is located in the City of San Diego in San Diego County, which is part of the SDAB and is under the jurisdiction of SDAPCD.

Air quality in the planning area is not only affected by various emission sources (mobile, industry, etc.) but also by atmospheric conditions, such as wind speed, wind direction, temperature, rainfall, etc. Climate in the SDAB is determined by its terrain and geographical location. The boundaries of the SDAB are contiguous with the political boundaries of San Diego County. The County of San Diego encompasses approximately 4,260 square miles and is bounded on the north by Orange and Riverside Counties, on the east by Imperial County, on the west by the Pacific Ocean, and on the south by the Mexican State of Baja California. The San Diego County is divided by the Laguna Mountain Range, which runs approximately parallel to the coast about 45-miles inland and separates the coastal area from the desert portion of the county. The Laguna Mountains have peaks reaching over 6,000 feet, with the highest point in the county being Hot Springs Mountain, rising to 6,533 feet.

The coastal region is made up of coastal terraces that rise from the ocean into wide mesas which then, moving farther east, transition into the Laguna Foothills. Farther east, the topography gradually rises to the rugged mountains. On the east side, the mountains drop off rapidly to the Anza-Borrego Desert, which is characterized by several broken mountain ranges with desert valleys in between. To the north of San Diego County are the Santa Ana Mountains, which run along the coast of Orange County, turning east to join with the Laguna Mountains near the San Diego-Orange County border.

The climate of the SDAB, as with all of Southern California, is largely dominated by the strength and position of the semi-permanent high-pressure system over the Pacific Ocean, known as the Pacific High. This high-pressure ridge over the West Coast often creates a pattern of late-night and early-morning low clouds, hazy afternoon sunshine, daytime onshore breezes, and little temperature variation year round. The climatic classification for San Diego is a Mediterranean climate, with warm, dry summers and mild, wet winters. Average annual precipitation ranges from approximately 10 inches on the coast to over 30 inches in the mountains to the east (the desert regions of San Diego County generally receive between 4 and 6 inches per year).

The annual average temperature varies little throughout the SDAB, ranging from the low to middle 60s, measured in degrees Fahrenheit (°F). With a more pronounced oceanic influence, coastal areas show less variability in annual minimum and maximum temperatures than inland areas. The annual average maximum temperature recorded at the San Diego Airport, the closest climatological station to the project site, is 69.9°F, and the annual average minimum is 56.5°F. January is typically the coldest month in this area of the SDAB (Western Regional Climate Center 2016).

The majority of annual rainfall in the SDAB occurs between November and April. Average rainfall measured at the San Diego Airport Station varied from 2.0 inches in January to 0.21 inches or less between May and September, with an average annual total of 10.13 inches.

5.2 Monitored Air Quality

The SDAPCD monitors air quality conditions at 12 locations throughout the SDAB. The closest monitoring station to the project site is the Chula Vista – 80 East J Street station. This station monitors NO_2, O_3, PM_{10}, and $PM_{2.5}$. The closest station that monitors CO and SO_2 is the El Cajon station.

Table 5-1 shows pollutant levels, the state and federal standards, and the number of exceedances recorded at the Chula Vista and El Cajon Monitoring Stations from 2016 to 2018.

Table 5-1. Ambient Air Quality Monitoring Concentrations

Pollutant	Pollutant Concentration and Standard	Maximum Concentration		
		2016	2017	2018
CO	Maximum 1-hour Concentration (ppm)	1.6	1.5	1.5
	Days> 20 ppm (state 1-hr standard)	0	0	0
	Days> 35 ppm (federal 1-hr standard)	0	0	0
	Maximum 8-hour Concentration (ppm)	1.3	1.4	1.1
	Days> 9 ppm (state 8-hr standard)	0	0	0
	Days> 9 ppm (federal 8-hr standard)	0	0	0
O_3	Maximum 1-hour Concentration (ppm)	0.073	0.085	0.076
	Days> 0.09 ppm (state 1-hr standard)	0	0	0
	Maximum 8-hour Concentration (ppm)	0.068	0.074	0.064
	Days> 0.070 ppm (state 8-hr standard)	0	1	0
	Days> 0.070 ppm (federal 8-hr standard)	0	1	0
NO_2	Maximum 1-hour Concentration (ppb)	54.0	57.0	52.0
	Days> 180 ppb (state 1-hr standard)	0	0	0
	Days> 100 ppb (federal 1-hr standard)	0	0	0
	Annual Arithmetic Mean (ppb)	9	9	9
	Exceed 30 ppb? (state Annual Standard)	No	No	No
	Exceed 53 ppb? (federal Annual Standard)	No	No	No
SO_2	Maximum 1-hour Concentration (ppb)	0.6	1.1	3.5
	Days> 250 ppb (state 1-hr standard)	0	0	0
	Days> 75 ppb (federal 1-hr standard)	0	0	0
PM_{10}	Maximum 24-hour Concentration (µg/m^3)	48.0	61.0	45.0
	Days> 50 µg/m^3 (state 24-hr standard)	0	1	0
	Days> 150 µg/m^3 (federal 24-hr standard)	0	0	0
	Annual Arithmetic Mean (µg/m^3)	21.8	21.7	20.7
	Exceed 20 µg/m^3? (state Annual Standard)	Yes	Yes	Yes
$PM_{2.5}$	Maximum 24-hour Concentration (µg/m^3)	23.9	42.7	41.9
	Days> 35 µg/m^3 (federal 24-hr standard)	0	1	1

Table 5-1. Ambient Air Quality Monitoring Concentrations

Pollutant	Pollutant Concentration and Standard	Maximum Concentration		
		2016	2017	2018
	Annual Arithmetic Mean (µg/m^3)	8.7	—	9.9
	Exceed 12 µg/m^3? (state Annual Standard)	No	—	No
	Exceed 12 µg/m^3? (federal Annual Standard)	No	—	No

Source: CARB 2020; U.S. EPA 2020a

Notes:

CO=carbon monoxide; NO_2=nitrogen dioxide; O_3=ozone; PM_{10}=particles of 10 micrometers and smaller; $PM_{2.5}$=particles of 2.5 micrometers and smaller; ppb=parts per billion; ppm=parts per million; SO_2=sulfur dioxide

5.2.1 Carbon Monoxide

CO is a colorless and odorless gas formed by the incomplete combustion of fossil fuels. CO is emitted almost exclusively from motor vehicles, power plants, refineries, industrial boilers, ships, aircraft, and trains. CO is a nonreactive air pollutant that dissipates relatively quickly, so ambient CO concentrations generally follow the spatial and temporal distributions of vehicular traffic. CO concentrations are influenced by local meteorological conditions, primarily wind speed, topography, and atmospheric stability. As shown in Table 5-1, the CO concentrations in the vicinity of the project have not exceeded the federal or state standards in the past 3 years.

5.2.2 Ozone

O_3 is a colorless gas that is formed in the atmosphere when reactive organic gas (ROG), which includes VOC, and NO_X react in the presence of ultraviolet sunlight. O_3 is not a primary pollutant; it is a secondary pollutant formed by complex interactions of two pollutants directly emitted into the atmosphere. The primary sources of ROG and NO_X, the components of O_3, are automobile exhaust and industrial sources. Meteorology and terrain play major roles in O_3 formation. Ideal conditions occur during summer and early autumn on days with low wind speeds or stagnant air, warm temperatures, and cloudless skies. The greatest source of smog-producing gases is the automobile. Short-term exposure (lasting for a few hours) to O_3 at levels typically observed in Southern California can result in breathing pattern changes, reduction of breathing capacity, increased susceptibility to infections, inflammation of the lung tissue, and some immunological changes. As shown in Table 5-1, the 8-hour O_3 standards were exceeded in 2017.

5.2.3 Nitrogen Dioxide

NO_2, like O_3, is not directly emitted into the atmosphere but is formed by an atmospheric chemical reaction between nitric oxide and atmospheric oxygen. Nitric oxide and NO_2 are collectively referred to as NO_X and are major contributors to O_3 formation. NO_2 also contributes to the formation of PM_{10}. High concentrations of NO_2 can result in a brownish-red cast to the atmosphere with reduced visibility and can cause breathing difficulties. As shown in Table 5-1, there have been no exceedances of the state or federal NO_2 standards within the past 3 years.

5.2.4 Oxides of Sulfur

SO_2 is a colorless, pungent gas formed primarily by the combustion of sulfur-containing fossil fuels. Main sources of SO_2 are coal and oil used in power plants and industries. Generally, the highest levels of SO_2 are found near large industrial complexes. In recent years, SO_2 concentrations have been reduced by the increasingly stringent controls placed on stationary source emissions of SO_2 and limits on the sulfur content of fuels. SO_2 is an irritant gas that attacks the throat and lungs. It can cause acute respiratory symptoms and diminished ventilator function in children. As shown in Table 5-1, there were no exceedances of the state or federal SO_2 standards within the past 3 years.

5.2.5 Coarse Particulate Matter

Particulate matter pollution consists of very small liquid and solid particles floating in the air, which can include smoke, soot, dust, salts, acids, and metals. Particulate matter also forms when gases emitted from industries and motor vehicles undergo chemical reactions in the atmosphere. Inhalable particulate matter, or PM_{10}, is about 1/7 the thickness of a human hair. Major sources of PM_{10} include crushing or grinding operations; dust stirred up by vehicles traveling on roads; wood burning stoves and fireplaces; dust from construction, landfills, and agriculture; wildfires and brush/waste burning; industrial sources; windblown dust from open lands; and atmospheric chemical and photochemical reactions. When inhaled, PM_{10} particles can penetrate the human respiratory system's natural defenses and damage the respiratory tract. PM_{10} can increase the number and severity of asthma attacks, cause or aggravate bronchitis and other lung diseases, and reduce the body's ability to fight infections. As shown in Table 5-1, the 24-hour state standard was exceeded once in 2017 and the annual state standard was exceeded in all 3 years. The federal PM_{10} standard was not exceeded.

5.2.6 Fine Particulate Matter

Fine particulate matter, or $PM_{2.5}$, is roughly 1/28 the diameter of a human hair. $PM_{2.5}$ results from fuel combustion (e.g., motor vehicles, power generation, and industrial facilities), residential fireplaces, and wood stoves. In addition, $PM_{2.5}$ can be formed in the atmosphere from gases such as SO_2, NO_X, and VOC. Very small particles of substances, such as Pb, sulfates, and nitrates can cause lung damage directly. These substances can be absorbed into the blood stream and cause damage elsewhere in the body. These substances can transport absorbed gases, such as chlorides or ammonium, into the lungs and cause injury. Whereas PM_{10} tends to collect in the upper portion of the respiratory system, $PM_{2.5}$ is so tiny that it can penetrate deeper into the lungs and damage lung tissues. Suspended particulates also damage and discolor surfaces on which they settle, as well as produce haze and reduce regional visibility. As shown in Table 5-1, the 24-hour federal standard was exceeded once in 2017 and 2018. The state and federal annual standards were not exceeded in the past 3 years.

5.2.7 Volatile Organic Compounds or Reactive Organic Gases

VOCs are carbon-containing compounds that evaporate into the air. VOCs contribute to the formation of smog and/or may be toxic. VOCs often have an odor and examples include gasoline, alcohol, and the solvents used in paints. SDAPCD does not directly monitor VOCs. There are no specific state or federal VOC thresholds, as they are regulated by individual air districts as O_3 precursors.

5.3 Global Climate Change and Greenhouse Gas Emission Inventory

5.3.1 Global Climate Change

Climate change refers to long-term changes in temperature, precipitation, wind patterns, and other elements of the earth's climate system. An ever-increasing body of scientific research attributes these climatological changes to GHG emissions, particularly those generated from the production and use of fossil fuels.

While climate change has been a concern for several decades, the establishment of the Intergovernmental Panel on Climate Change by the United Nations and World Meteorological Organization in 1988 has led to increased efforts devoted to GHG emissions reduction and climate change research and policy. These efforts are primarily concerned with the emissions of GHGs generated by human activity, including CO_2, CH_4, N_2O, tetrafluoromethane, hexafluoroethane, sulfur hexafluoride, fluoroform, 1,1,1,2-tetrafluoroethane, and difluoroethane.

In the U.S., the main source of GHG emissions is electricity generation, followed by transportation. In California, transportation sources (including passenger cars, light-duty trucks, other trucks, buses, and motorcycles) make up the largest source of GHG-emitting sources. The dominant GHG emitted is CO_2, mostly from fossil fuel combustion (Intergovernmental Panel on Climate Change 2014).

GHGs vary considerably in terms of GWP, which is a concept developed to compare the ability of each GHG to trap heat in the atmosphere relative to another gas. The GWP is based on several factors, including the relative effectiveness of a gas to absorb infrared radiation and the length of time that the gas remains in the atmosphere (atmospheric lifetime). The GWP of each gas is measured relative to CO_2, the most abundant GHG. The definition of GWP for a particular GHG is the ratio of heat trapped by 1 unit mass of the GHG to the ratio of heat trapped by 1 unit mass of CO_2 over a specified time period. GHG emissions are typically measured in terms of pounds or tons of CO_2e.

GHGs are global pollutants, unlike criteria air pollutants, which occur locally or globally, and local concentrations respond to locally implemented control measures. The long atmospheric lifetimes of GHGs allows them to be transported great distances from sources and become well mixed and do not exhibit strong concentration gradients from point sources. GHG and global climate change represent cumulative impacts; therefore, GHG emissions contribute cumulatively to the significant adverse environmental impacts of global climate change.

5.3.2 Principal Greenhouse Gases

There are numerous GHGs, both naturally occurring and human-made. The Intergovernmental Panel on Climate Change and CEQA Section 15364.5 identify the principal GHGs of concern. The primary GHGs of concern are described below:

- **CO_2** enters the atmosphere through the burning of fossil fuels (oil, natural gas, and coal), solid waste, trees and wood products, respiration, and as a result of other chemical reactions (e.g., manufacture of cement). CO_2 is also removed from the atmosphere when it is absorbed by plants as part of the biological carbon cycle.
- **CH_4** is emitted during the production and transportation of fossil fuels. CH_4 also results from livestock and other agricultural practices and by the decay of organic waste in municipal solid waste landfill.

- **N_2O** is emitted during agricultural and industrial activities, as well as during the burning of fossil fuels and solid waste.
- **HFC** are human-made chemicals used in commercial, industrial, and consumer products and have high GWP. HFCs are generally used as substitutes for O_3-depleting substances in automobile air conditioners and refrigerants.
- **SF_6** are human-made chemicals used as an electrical insulating fluid for power distribution equipment, in the magnesium industry, in semiconductor manufacturing, and also as a tracer chemical for the study of oceanic and atmospheric processes.

Table 5-2 shows the GWPs for each type of GHG. For example, SF_6 is 23,900 times more potent at contributing to global warming than CO_2.

Table 5-2. Global Warming Potential of Greenhouse Gases

Gas	Atmospheric Lifetime (Years)	GWP (100-year Time Horizon)
CO_2	50–200	1
CH_4	12	21
N_2O	114	310
HFC-23	270	11,700
HFC-134a	14	1,300
HFC-152a	1.4	140
PFC: Tetrafluoromethane (CF_4)	50,000	6,500
PFC: Hexafluoromethane (C_2F_6)	10,000	9,200
SF_6	3,200	23,900

Source: Intergovernmental Panel on Climate Change 2007

Notes:
CH_4=methane; CO_2=carbon dioxide; GWP=Global Warming Potential; HFC=Hydrofluorocarbons; N_2O=nitrous oxide; PCF=perfluorocarbons; SF_6=sulfur hexafluoride

5.3.3 Greenhouse Gas Emissions Inventory

An emissions inventory that identifies and quantifies the primary human-generated sources and sinks of GHGs is a well-recognized and useful tool for addressing climate change. This section summarizes the latest information on global, national, California, and local GHG emission inventories.

Global Emissions

Worldwide emissions of GHGs in 2017 were 32.5 billion MT of CO_2e per year (International Energy Agency 2019). Global estimates are based on country inventories developed as part of programs of the United Nations Framework Convention on Climate Change.

Federal Emissions

In 2018, total U.S. GHG emissions were 6,677 million MT of CO_2e (U.S. EPA 2020b). Emissions increased from 2017 to 2018 by 3.1 percent (after accounting for sequestration from the land sector). This increase was largely driven by an increase in emissions from fossil fuel combustion, which was a result of multiple factors, including more electricity use due to greater heating and cooling needs due to a colder winter and hotter summer in 2018 in comparison to 2017. GHG emissions in 2018 (after accounting for sequestration from the land sector) were 10.2 percent below 2005 levels.

State Emissions

According to CARB emission inventory estimates, California emitted approximately 429 million MT of CO_2e emissions in 2016 (CARB 2019). Emissions in 2016 are down 13.3 percent from the 2004 peak of 495 million MT of CO_2e.

CARB has established that the level of annual GHG emissions in 1990 was 431 million MT of CO_2e (CARB 2017). Therefore, the state has achieved its goal of meeting 1990 levels by the 2020 goal set by AB 32.

Project Site

The project site consists of approximately 95 acres of District-owned and federally managed land that is currently vacant. Therefore, the GHG emissions from the project site are currently negligible.

5.4 Toxic Air Contaminants

A substance is considered toxic if it has the potential to cause adverse health effects in humans, including increasing the risk of cancer upon exposure, or acute and/or chronic noncancer health effects. A toxic substance released into the air is considered a TAC. Examples include certain aromatic and chlorinated hydrocarbons, certain metals, and asbestos. TACs are generated by a number of sources, including stationary sources such as dry cleaners, gas stations, combustion sources, and laboratories; mobile sources such as automobiles; and area sources such as landfills. Adverse health effects associated with exposure to TACs may include carcinogenic (i.e., cancer-causing) and noncarcinogenic effects. Noncarcinogenic effects typically affect one or more target organ systems and may be experienced either on short-term (acute) or long-term (chronic) exposure to a given TAC. CARB has identified diesel engine exhaust particulate matter as the predominant TAC in California. Diesel particulate matter is emitted into the air by diesel-powered mobile vehicles, including heavy-duty diesel trucks, construction equipment, and passenger vehicles. Certain ROGs may also be designated as TACs.

5.5 Sensitive Receptors

Sensitive populations are more susceptible to the effects of air pollution than the general population. Sensitive populations (sensitive receptors) that are in proximity to localized sources of toxics, particulate matter, and CO are of particular concern. Land uses considered sensitive receptors include residences, schools, playgrounds, childcare centers, athletic facilities, long-term health care facilities, rehabilitation centers, convalescent centers, and retirement homes. The majority of the sensitive receptors within or adjacent to the project site are residential uses.

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6 Environmental Consequences

6.1 Air Quality

Air pollutant emissions associated with construction of the proposed project would be released from the exhausts of construction equipment, soil hauling trucks, delivery trucks, and worker commute vehicles. Particulate matter emissions would result from soil movement and wind-blown dust from disturbed surfaces. Operational emissions would be generated by the employee trips required for long-term management and maintenance of the mitigation bank. At this time, no construction is proposed on Parcels A, B, or C; however, the land use designation of commercial recreation would allow for future commercial development of these parcels. Operational emissions associated with future commercial development would be generated by project-related vehicular trips and stationary source emissions from on-site energy consumption.

6.1.1 Impact Analysis

Threshold (1)	***Would the project conflict with or obstruct implementation of the applicable air quality plan?***

Project Level – Wetland Mitigation Bank

The applicable air quality plans are the SIP and RAQS. As discussed in Section 3, the SIP includes strategies and tactics to be used to attain and maintain acceptable air quality in the SDAB. The RAQS is a separate document that contains a list of strategies to maintain acceptable air quality. Consistency with the RAQS is typically determined by two standards. The first standard is whether the proposed project would exceed assumptions contained in the RAQS. The second standard is whether the proposed project would increase the frequency or severity of existing air quality violations, contribute to new violations, or delay the timely attainment of air quality standards or interim reductions as specified in the RAQS.

The RAQS and SIP are intended to address cumulative impacts in the SDAB based on future growth predicted by SANDAG in the 2050 Regional Growth Forecast Update (SANDAG 2010). SANDAG uses growth projections from the local jurisdictions' adopted general plans; therefore, development consistent with the applicable general plan would be generally consistent with the growth projections in the air quality plans. Cumulative development would generally not be expected to result in a significant impact in terms of conflicting with RAQS, because the cumulative projects would be required to demonstrate that the proposed development is consistent with local planning documents. However, some projects may involve plan amendments that would exceed the growth assumptions in the planning document and RAQS. Therefore, cumulative development in the SDAB may have the potential to exceed the growth assumptions in the RAQS and result in a conflict with applicable air quality plans.

As described in Section 2.2.1, very minimal maintenance would be required for operation of the facility, amounting to only one employee-related trip to the facility monthly for 5 years and then once annually in the long term. Therefore, the wetland mitigation bank is not expected to result in any long-term regional air quality impacts. The wetland mitigation bank is consistent and would not conflict with implementation of the SIP and RAQS. No significant impact would occur with implementation of the wetland mitigation bank.

Program Level – Parcels A, B, and C Port Master Plan Amendment

As the future commercial development of Parcels A, B, and C would not generate emissions that exceed the SDAPCD's thresholds or the *de minimis* criteria is not expected to result in any long-term regional air quality impacts. Therefore, the program-level PMPA for Parcels A, B, and C would not conflict with implementation of the SIP and RAQS. No significant impact would occur with implementation of the proposed PMPA.

Project-Level and Program-Level Buildout

Construction

The activities associated with the construction of the proposed wetland mitigation bank would not overlap with the construction of the future commercial development, which is not scheduled as there is no proposal being considered at this time. Therefore, the construction emissions associated with the project-level component would not combine with the emissions generated by the program-level component.

Operation

The proposed wetland mitigation bank would be completed prior to the opening day of the future commercial development. However, as there are no long-term operational emissions associated with the wetland mitigation bank, it would not increase long-term emissions beyond the estimated long-term emissions that would be generated by the future commercial development. The impact from the combined emissions from both the project-level and program-level components

Threshold (2)	***Would the project result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard?***

Project Level – Wetland Mitigation Bank

Construction

Construction activities produce combustion emissions from various sources such as site grading, utility engines, on-site heavy-duty construction vehicles, equipment hauling materials to and from the site, and motor vehicles transporting the construction crew. Exhaust emissions from construction activities envisioned on site would vary daily as construction activity levels change. The use of construction equipment on site would result in localized exhaust emissions. A description of the construction phases, expected equipment, and duration is included in Section 2.2.1.

The most recent version of the CalEEMod model (Version 2016.3.2) was used to calculate the construction emissions. The results of the modeling are shown in Table 6-1 and Table 6-2 for the peak daily and annual conditions for the project site. The analysis assumes that construction would take approximately 17 months and begin in 2021.

In order to minimize dust emissions, all active grading areas would be watered at least twice per day, as required by SDAPCD Rule 55, which requires that visible dust emissions do not extend beyond the property line for more than 3 minutes in any 60-minute period. Appendix A presents the CalEEMod output reports with more detail.

Table 6-1. Peak Day Construction Emissions (pounds/day)

Year	CO	NO_X	ROG	SO_X	PM_{10}	$PM_{2.5}$
2021	44.1	88.1	6.9	0.1	13.4	7.8
2022	21.2	38.8	3.8	0.0	7.1	4.1
SDAPCD Threshold	**550**	**250**	**75**	**250**	**100**	**55**
Significant?	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**

Notes:

CO=carbon monoxide; NO_X=nitrogen oxides; PM_{10}=particles of 10 micrometers and smaller; $PM_{2.5}$=particles of 2.5 micrometers and smaller; ROG=reactive organic gas; SO_X=sulfur oxides

Table 6-2. Annual Construction Emissions (tons/year)

Year	CO	NO_X	ROG	SO_X	PM_{10}	$PM_{2.5}$
2021	6.1	11.7	1.0	0.0	1.9	1.2
2022	1.2	1.7	0.2	0.0	0.4	0.2
SDAPCD Threshold	**100**	**40**	**15**	**40**	**15**	—
Significant?	**NO**	**NO**	**NO**	**NO**	**NO**	—
***De Minimis* Criteria**	—	**100**	**100**	—	—	—
Exceedance	—	**NO**	**NO**	—	—	—

Notes:

CO=carbon monoxide; NO_X=nitrogen oxides; PM_{10}=particles of 10 micrometers and smaller; $PM_{2.5}$=particles of 2.5 micrometers and smaller; ROG=reactive organic gas; SO_X=sulfur oxides

As shown in Table 6-1 and Table 6-2, the wetland mitigation bank's construction emissions would not exceed either the SDAPCD's daily or annual emission thresholds. In addition, as shown in Table 6-2, the annual construction emissions would not exceed the *de minimis* criteria for the SDAB. Therefore, short-term air quality impacts from the creation of the wetland mitigation bank would be less than significant.

Operation

Long-term air pollutant emission impacts are those associated with stationary sources and mobile sources involving any project-related changes. Once all performance standards have been met, the wetland mitigation bank is anticipated to be self-sustaining. However, because of the urban surroundings, long-term management may be needed for maintenance of:

- Invasive species monitoring and removal;
- Trash removal;
- Maintenance of site control measures (e.g., fencing); and
- Restoration of any damage from human or maintenance activities or natural phenomenon.

As described in Section 2.2.1, very minimal maintenance would be required for operation of the facility, amounting to only one employee-related trip to the facility monthly for 5 years and then once annually in the long term. Therefore, the project's operational emissions would not exceed SDAPCD's thresholds or the *de minimis* criteria, and impacts would be less than significant.

Program Level – Parcels A, B, and C Port Master Plan Amendment

At this time, no construction or operational activities are proposed on Parcels A, B, or C; however, the land use designation of commercial recreation would allow for future commercial development of these parcels. This impact analysis evaluates the reasonable development scenario for Parcels A, B, and C, which is a future commercial land use.

Construction

Construction activities produce combustion emissions from various sources such as site grading, utility engines, on-site heavy-duty construction vehicles, equipment hauling materials to and from the site, asphalt paving, and motor vehicles transporting the construction crew. Exhaust emissions from construction activities envisioned on site would vary daily as construction activity levels change. The use of construction equipment on site would result in localized exhaust emissions.

The most recent version of the CalEEMod model (Version 2016.3.2) was used to calculate the construction emissions. The potential impacts were estimated using the default construction equipment and durations in CalEEMod for 105,000 square feet of total commercial development across all three parcels. The results of the modeling are shown in Table 6-3 and Table 6-4 for the peak daily and annual conditions for the project site.

In order to minimize dust emissions, all active grading areas would be watered at least twice per day, as required by SDAPCD Rule 55, which requires that visible dust emissions do not extend beyond the property line for more than 3 minutes in any 60-minute period. Appendix A presents the CalEEMod output reports with more detail.

Table 6-3. Program Level – Peak Day Construction Emissions (pounds/day)

Year	CO	NO_X	ROG	SO_X	PM_{10}	$PM_{2.5}$
2023	28.5	34.6	3.4	0.1	9.5	5.7
2024	19.2	16.0	28.8	0.0	1.1	0.8
SDAPCD Threshold	**550**	**250**	**75**	**250**	**100**	**55**
Significant?	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**

Notes:
CO=carbon monoxide; NO_X=nitrogen oxides; PM_{10}=particles of 10 micrometers and smaller; $PM_{2.5}$=particles of 2.5 micrometers and smaller; ROG=reactive organic gas; SO_X=sulfur oxides

Table 6-4. Program Level – Annual Construction Emissions (tons/year)

Year	CO	NO_X	ROG	SO_X	PM_{10}	$PM_{2.5}$
2023	2.3	2.2	0.2	0.0	0.2	0.1
2024	1.1	0.9	1.3	0.0	0.1	0.0
SDAPCD Threshold	**100**	**40**	**15**	**40**	**15**	—
Significant?	**NO**	**NO**	**NO**	**NO**	**NO**	—
***De Minimis* Criteria**	—	**100**	**100**	—	—	—
Exceedance	—	**NO**	**NO**	—	—	—

Notes:
CO=carbon monoxide; NO_X=nitrogen oxides; PM_{10}=particles of 10 micrometers and smaller; $PM_{2.5}$=particles of 2.5 micrometers and smaller; ROG=reactive organic gas; SO_X=sulfur oxides

As shown in Table 6-3 and Table 6-4, the program-level construction emissions would not exceed either SDAPCD's daily or annual emission thresholds. In addition, as shown in Table 6-4, the annual construction emissions would not exceed the *de minimis* criteria for the SDAB. Therefore, the program-level, short-term air quality impacts would be less than significant.

Operation

Long-term air pollutant emission impacts are those associated with stationary sources and mobile sources involving any project-related changes. Future commercial development would have potential long-term operational air quality impacts from mobile source emissions associated with project-related vehicular trips and stationary source emissions from on-site energy consumption. The most recent version of the CalEEMod model (Version 2016.3.2) was used to calculate the operational emissions. The potential impacts were estimated using the traffic volumes included in the transportation study memo (Chen Ryan 2020) and the default settings in CalEEMod for 105,000 square feet total of specialty retail/strip commercial development across all three parcels. The results of the modeling are shown in Table 6-5 and Table 6-6 for the peak daily and annual conditions for the project site.

Table 6-5. Program Level – Peak Day Operation Emissions (pounds/day)

Source	CO	NO_X	ROG	SO_X	PM_{10}	$PM_{2.5}$
Area	0.01	0.0	2.9	0.0	0.0	0.0
Energy	0.05	0.1	0.0	0.0	0.0	0.0
Mobile	45.0	17.3	4.9	0.2	13.8	3.8
Total	**45.1**	**17.4**	**7.8**	**0.2**	**13.8**	**3.8**
SDAPCD Threshold	**550**	**250**	**75**	**250**	**100**	**55**
Significant?	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**

Notes:

CO=carbon monoxide; NO_X=nitrogen oxides; PM_{10}=particles of 10 micrometers and smaller; $PM_{2.5}$=particles of 2.5 micrometers and smaller; ROG=reactive organic gas; SO_X=sulfur oxides

Table 6-6. Program Level – Annual Operation Emissions (tons/year)

Source	CO	NO_X	ROG	SO_X	PM_{10}	$PM_{2.5}$
Area	0.0	0.0	0.5	0.0	0.0	0.0
Energy	0.0	0.0	0.0	0.0	0.0	0.0
Mobile	7.6	3.0	0.8	0.02	2.3	0.6
Total	**7.6**	**3.0**	**1.3**	**0.02**	**2.3**	**0.6**
SDAPCD Threshold	**100**	**40**	**15**	**40**	**15**	**—**
Significant?	**NO**	**NO**	**NO**	**NO**	**NO**	**—**
***De Minimis* Criteria**	**—**	**100**	**100**	**—**	**—**	**—**
Exceedance	**—**	**NO**	**NO**	**—**	**—**	**—**

Notes:
CO=carbon monoxide; NO_X=nitrogen oxides; PM_{10}=particles of 10 micrometers and smaller; $PM_{2.5}$=particles of 2.5 micrometers and smaller; ROG=reactive organic gas; SO_X=sulfur oxides

As shown in Table 6-5 and Table 6-6, the program-level operational emissions would not exceed either SDAPCD's daily or annual emission thresholds. In addition, as shown in Table 6-4, the annual operational emissions would not exceed the *de minimis* criteria for the SDAB. Therefore, the program-level operational air quality impacts would be less than significant.

Project-Level and Program-Level Buildout

Construction

The activities associated with the construction of the proposed wetland mitigation bank are not anticipated to overlap with the construction of the future commercial development, which is not scheduled as there is no proposal being considered at this time. Therefore, the construction emission associated with the project-level component would not combine with the emissions generated by the program-level component.

Operation

The proposed wetland mitigation bank would be completed prior to the opening day of the future commercial development. However, as there are no long-term operational emissions associated the wetland mitigation bank it would not increase long-term emissions beyond the estimated long-term emissions that would be generated by the future commercial development.

Threshold (3)	**Would the project expose sensitive receptors to substantial pollutant concentrations?**

Project Level – Wetland Mitigation Bank

Toxic Air Contaminants

Project construction would result in emissions of diesel particulate matter from heavy-duty construction equipment and trucks operating at the project site (e.g., water trucks and haul trucks). Diesel particulate matter is characterized as a TAC by CARB. The Office of Environmental Health Hazard Assessment has identified carcinogenic and chronic noncarcinogenic effects from long-term (chronic) exposure, but it has not identified health effects due to short-term (acute) exposure to diesel particulate matter. There are several residential communities located within close proximity to the proposed construction areas. However, due to the size of the project, the construction duration adjacent to any one sensitive land use would be minimal. Over the entire project construction period the average distance to the off-site sensitive receptors would be 250 feet. In addition, as shown in Table 2-1, the mass grading phase, the phase with the largest equipment, would require only six months to complete. Additionally, as shown in Table 6-1 and Table 6-2, the wetland mitigation bank's construction emissions would not exceed either the SDAPCD's daily or annual emission thresholds. Therefore, the project construction would not expose sensitive receptors to substantial pollutant concentrations. Impacts would be less than significant.

Naturally Occurring Asbestos

The project is located in San Diego County, which is not among the counties listed as containing serpentine and ultramafic rock (Van Gosen and Clinkenbeard 2011). Therefore, an impact from naturally occurring asbestos during construction of the project on the project site would not occur. A less than significant impact associated with this issue would occur with implementation of the project.

Long-Term Microscale (Carbon Monoxide Hot Spot) Analysis

Typically, high CO concentrations are associated with roadways or intersections operating at unacceptable levels of service or with extremely high traffic volumes. In areas with high ambient background CO concentrations, modeling is recommended, to determine a project's impact on local CO levels.

An assessment of project-related impacts on localized ambient air quality requires that future ambient air quality levels be projected. Existing CO concentrations in the immediate project vicinity are not available. Ambient CO levels monitored in the Chula Vista – 80 East J Street station showed a highest recorded 1-hour concentration of 1.6 ppm (state standard is 20 ppm) and a highest 8-hour concentration of 1.4 ppm (state standard is 9 ppm) during the past 3 years (Table 5-1). The highest CO concentrations would normally occur during peak traffic hours; therefore, CO impacts calculated under peak traffic conditions represent a worst-case analysis.

Given the extremely low level of CO concentrations in the vicinity of the project site, the minimal maintenance trips required for the project site are not expected to result in the CO concentrations exceeding the state or federal CO standards. Impacts would be less than significant.

Program Level – Parcels A, B, and C Port Master Plan Amendment

At this time, no construction or operational activities are proposed on Parcels A, B, or C; however, the land use designation of commercial recreation would allow for commercial development of these parcels. This impact analysis evaluates the reasonable development scenario for Parcels A, B, and C, which is a future commercial land use.

Toxic Air Contaminants

There are several residential communities located within close proximity to the proposed construction areas. However, due to the size of the project, the construction duration adjacent to any one sensitive land use would be minimal. As shown in Table 6-3, Table 6-4, Table 6-5, and Table 6-6, construction and operation of future commercial development would not exceed either SDAPCD's daily or annual emission thresholds. Therefore, the future commercial development construction would not expose sensitive receptors to substantial pollutant concentrations. Impacts would be less than significant.

Naturally Occurring Asbestos

The project is located in San Diego County, which is not among the counties listed as containing serpentine and ultramafic rock. Therefore, the impact from naturally occurring asbestos during construction of future commercial development on the project site would be minimal to none. A less than significant impact would occur with implementation of the project.

Long-Term Microscale (Carbon Monoxide Hot Spot) Analysis

Typically, high CO concentrations are associated with roadways or intersections operating at unacceptable levels of service or with extremely high traffic volumes. In areas with high ambient background CO concentrations, modeling is recommended, to determine a project's impact on local CO levels.

An assessment of project-related impacts on localized ambient air quality requires that future ambient air quality levels be projected. Existing CO concentrations in the immediate project vicinity are not available. Ambient CO levels monitored in the Chula Vista – 80 East J Street station showed a highest recorded 1-hour concentration of 1.6 ppm (state standard is 20 ppm) and a highest 8-hour concentration of 1.4 ppm (state standard is 9 ppm) during the past 3 years (Table 5-1). The highest CO concentrations would normally occur during peak traffic hours; therefore, CO impacts calculated under peak traffic conditions represent a worst-case analysis.

Given the extremely low level of CO concentrations in the vicinity of the project site, the 126 a.m. and 378 p.m. peak hour trips associated with the future commercial developments are not expected to result in the CO concentrations exceeding the state or federal CO standards. Impacts would be less than significant.

Project-Level and Program-Level Buildout

Construction

The activities associated with the construction of the proposed wetland mitigation bank would not overlap with the construction of the future commercial development, which is not scheduled as there is no proposal being considered at this time. Therefore, the construction emissions associated with the project-level component would not combine with the emissions generated by the program-level component.

Operation

The proposed wetland mitigation bank would be completed prior to the opening day of the future commercial development. However, as there are no long-term operational emissions associated the wetland mitigation bank, it would not increase long-term emissions beyond the estimated long-term emissions that would be generated by the future commercial development.

Threshold (4)	***Would the project result in other emissions (such as those leading to odors) adversely affecting a substantial number of people?***

Project Level – Wetland Mitigation Bank

Construction of the wetland mitigation bank could result in emission of odors from construction equipment and vehicles (e.g., diesel exhaust). It is anticipated that these odors would be short term, limited in extent at any given time, and distributed throughout the project site during the duration of construction, and therefore, would not affect a substantial number of individuals. Therefore, a less than significant impact would occur with implementation of the project.

Program Level – Parcels A, B, and C Port Master Plan Amendment

At this time, no construction is proposed on Parcels A, B, or C; however, the land use designation of commercial recreation would allow for commercial development of these parcels. This impact analysis evaluates the worst-case development scenario for Parcels A, B, and C, which is a future commercial land use.

The future commercial development construction activities could result in emission of odors from construction equipment and vehicles (e.g., diesel exhaust). It is anticipated that these odors would be short term, limited in extent at any given time, and distributed throughout the project site during the duration of construction and would not affect a substantial number of individuals. Once operation, the commercial/retail uses are not expected to be a significant source of long-term odors. Therefore, a less than significant impact would occur with implementation of the program-level developments.

Project-Level and Program-Level Buildout

Construction

The activities associated with the construction of the proposed wetland mitigation bank would not overlap with the construction of the future commercial development, which is not scheduled as there is no proposal being considered at this time. Therefore, the construction emissions associated with the project-level component would not combine with odors generated by the project-level component.

Operation

The proposed wetland mitigation bank would be completed prior to the opening day of the future commercial development. However, as there are no long-term operational odors associated with the wetland mitigation bank it would not increase any odors generated within the future commercial development.

6.2 Greenhouse Gas Emissions

6.2.1 Impact Analysis

Threshold (1)	***Would the project generate greenhouse gas emissions, either directly or indirectly, that may have an adverse effect on the environment?***

Project Level – Wetland Mitigation Bank

Construction

Construction of the wetland mitigation bank would result in temporary emissions associated with diesel engine combustion from mass grading, and site preparation construction equipment is assumed to occur for engines running at the correct fuel-to-air ratios (the ratio whereby complete combustion of the diesel fuel occurs).

The project site would be cleared, graded, and constructed over the course of approximately 17 months. The most recent version of the CalEEMod model (Version 2016.3.2) was used to calculate the construction emissions. Table 6-7 quantifies the expected GHG emissions from construction activities. As shown, construction of the proposed project would generate 1,760.6 MT of CO_2e.

Table 6-7. Project Construction Greenhouse Gas Emissions

	Pollutant Emissions (MT/year)			
Year	CO_2	CH_4	N_2O	CO_2e
2021	1,549.5	0.4	0.0	1,558.6
2022	200.4	0.1	0.0	202.0
Total	**1,749.9**	**0.5**	**0.0**	**1,760.6**

Notes:
CH_4=methane; CO_2=carbon dioxide; CO_2e=carbon dioxide equivalents; MT=metric tons; N_2O=nitrous oxide

In accordance with the county's guidelines, the proposed project is analyzed under a 900 MT of CO_2e per year screening threshold. As stated in the county guidelines, construction emissions may be distributed over the expected (long-term) operational life of a project, which can conservatively be estimated at 20 years (County of San Diego 2015). Thus, the yearly contribution to GHG from the aggregate of construction on the project site would be 88.0 MT of CO_2e per year. This is below the 900 MT of CO_2e per year screening threshold established by the county. Impacts would be less than significant.

Operations

As discussed in Section 6.1, very minimal maintenance is required for operation of the facility. Therefore, when added to the construction emissions, the project operations would not generate GHG emissions in excess of the county's 900 MT of CO_2e per year screening threshold. Impacts would be less than significant.

Program Level – Parcels A, B, and C Port Master Plan Amendment

At this time, no construction or operational activities is proposed on Parcels A, B, or C; however, the land use designation of commercial recreation would allow for commercial development of these parcels. This impact analysis evaluates the reasonable development scenario for Parcels A, B, and C, which is a future commercial land use.

Construction

Construction of the future commercial developments would result in temporary emissions associated with diesel engine combustion from mass grading, site preparation, and building construction.

The project site would be cleared, graded, and constructed after the completion of the wetland mitigation bank. The most recent version of the CalEEMod model (Version 2016.3.2) was used to calculate the construction emissions. The potential impacts were estimated using the default settings in CalEEMod for 105,000 square feet of specialty retail/strip commercial development for all 3 parcels. Table 6-8 quantifies the expected GHG emissions from construction activities. As shown, construction of the future commercial developments would generate 584.0 MT of CO_2e.

Table 6-8. Program Level – Construction Greenhouse Gas Emissions

Year	Pollutant Emissions (MT/year)			
	CO_2	CH_4	N_2O	CO_2e
2023	397.8	0.1	0.0	400.1
2024	182.3	0.0	0.0	183.2
Total	**580.1**	**0.1**	**0.0**	**583.3**

Notes:
CH_4=methane; CO_2=carbon dioxide; CO_2e=carbon dioxide equivalents; N_2O=nitrous oxide

In accordance with the county's guidelines, the future commercial development is analyzed under a 900 MT of CO_2e per year screening threshold. As stated in the county guidelines, construction emissions may be distributed over the expected (long-term) operational life of a project, which can conservatively be estimated at 20 years, for the purposes of determining a cumulatively considerable contribution (County of San Diego 2015). Thus, the yearly contribution to GHG from the aggregate of construction on the project site would be 29.2 MT of CO_2e per year. This is below the 900 MT of CO_2e per year screening threshold established by the county.

Operations

The operational GHG emission estimates were also calculated using CalEEMod. The potential impacts were estimated using the traffic volumes included in the project's transportation memorandum (Chen Ryan Associates 2020) and the default settings in CalEEMod for 105,000 square feet total of specialty retail/strip commercial development across all three parcels. The following activities associated with the project could directly or indirectly contribute to the generation of GHG emissions:

- **Gas, Electricity, and Water Use** – Natural gas use results in the emissions of two GHGs: CH_4 (the major component of natural gas) and CO_2 from the combustion of natural gas. Electricity use can result in GHG production if the electricity is generated by combusting fossil fuel. Annual electricity emissions were estimated using the reported GHG emissions per kilowatt-hour for San Diego Gas and Electric; the supplier would provide electricity for the project.

- **Solid Waste Disposal** – Solid waste generated by the project could contribute to GHG emissions in a variety of ways. Landfilling and other methods of disposal use energy for transporting and managing the waste, and they produce additional GHGs to varying degrees. Landfilling, the most common waste management practice, results in the release of CH_4 from the anaerobic decomposition of organic materials. CH_4 is 21 times more potent a GHG than CO_2. However, landfill CH_4 can also be a source of energy. In addition, many materials in landfills do not decompose fully, and the carbon that remains is sequestered in the landfill and not released into the atmosphere.
- **Motor Vehicle Use** – Transportation associated with the program developments would result in GHG emissions from the combustion of fossil fuels in vehicle trips. The developments would result in GHG emissions through the vehicular traffic generated.
- **Combined Emissions** – The GHG emission estimates presented in Table 6-9 show the emissions associated with the level of development at build-out. Table 6-9 shows that program-level project operations would result in total estimated annual emissions of 2,910 MT of CO_2e per year.

Table 6-9. Program Level – Projected Annual Greenhouse Gas Emissions

	Pollutant Emissions (MT/year)					
Source	**Biogenic CO_2**	**Nonbiogenic CO_2**	**CO_2**	**CH_4**	**N_2O**	**CO_2e**
Construction emissions amortized over 20 years	0.0	29.0	29.0	0.0	0.0	29.2
Operational Emissions						
Area sources	0.0	0.0	0.0	0.0	0.0	0.0
Energy sources	0.0	443.5	443.5	0.02	0.0	445.1
Mobile sources	0.0	2,315.6	2,315.6	0.1	0.0	2,318.8
Waste sources	22.4	0.0	22.4	1.3	0.0	55.4
Water usage	2.5	50.4	52.9	0.3	0.01	61.2
Total operational emissions	**24.8**	**2,809.5**	**2,834.4**	**1.7**	**0.01**	**2,880.4**
Total program-level project emissions	**24.8**	**2,838.5**	**2,863.4**	**1.7**	**0.01**	**2,909.6**

Notes:
Columns may not add up due to rounding.
CH_4=methane; CO_2=carbon dioxide; CO_2e=carbon dioxide equivalent; MT=metric tons; N_2O=nitrous oxide

Construction activities would generate GHG emissions from equipment use and transportation of workers travelling to and from the project site, as described above. The amount of GHG emissions that would be generated is not anticipated to be substantial due to the temporary nature of construction. Operation of the future commercial development would result in annual emissions of 2,880.4 MT of CO2e per year. Combined, construction and operational emissions would result in 2,909.6 MT of CO_2e per year, which exceeds the 900 MT of CO_2e per year screening threshold established by the county. Therefore, the future commercial development would have a potentially significant impact relative to GHG emissions. Refer to Section 7.2.2 for proposed mitigation.

Project-Level and Program-Level Buildout

The creation of the wetland mitigation bank would result in 88.0 MT of CO_2e per year, which is below the 900 MT of CO_2e per year screening threshold established by the county. Under a reasonable scenario of Parcels A, B, and C being developed with 105,000 combined construction and operational emissions would result in 2909.6 MT of CO_2e per year. The amortized construction emissions associated with the wetland mitigation bank would add 88.0 MT of CO_2e per year to the 2,909.6MT of CO_2e per year generated by the construction and operation of the future commercial development. The total annual emissions of 2,997.6 MT of CO_2e would potentially exceed the 900 MT of CO_2e per year screening threshold. Therefore, as the proposed project could conflict with state GHG reduction goals, impacts would be considered significant, and mitigation is required. Refer to Section 7.2.2 for proposed mitigation.

Threshold (2)	***Would the project conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of greenhouse gases?***

Project Level – Wetland Mitigation Bank

As indicated above, the wetland mitigation bank's short-term construction and long-term operational emissions would not exceed the 900 MT of CO_2e per year screening threshold established by the county. Therefore, the wetland mitigation bank would not conflict with the GHG reduction goals of the state. Impacts would be less than significant.

Program Level – Parcels A, B, and C Port Master Plan Amendment

As indicated above, the short-term construction and long-term operational emissions associated with the future commercial developments would potentially exceed the 900 MT of CO_2e per year screening threshold established by the county. Therefore, as the proposed project could conflict with state GHG reduction goals, impacts would be considered significant, and mitigation is required. Refer to Section 7.2.2 for proposed mitigation.

Project-Level and Program-Level Buildout

The creation of the wetland mitigation bank would result in 88.0 MT of CO_2e per year, which is below the 900 MT of CO_2e per year screening threshold established by the county. Under a reasonable scenario of Parcels A, B, and C being developed with 105,000 combined construction and operational emissions would result in 2909.6 MT of CO_2e per year. The amortized construction emissions associated with the wetland mitigation bank would add 88.0 MT of CO_2e per year to the 2,909.6 MT of CO_2e per year generated by the construction and operation of the future commercial development. The total annual emissions of 2,997.6 MT of CO_2e would potentially exceed the 900 MT of CO_2e per year screening threshold. Therefore, as the proposed project could conflict with state GHG reduction goals, impacts would be considered significant, and mitigation is required. Refer to Section 7.2.2 for proposed mitigation.

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7 Mitigation Measures

7.1 Air Quality

7.1.1 Project Level – Wetland Mitigation Bank

No mitigation measures are required for the short-term construction or long-term operation of the proposed project.

7.1.2 Program Level – Parcels A, B, and C Port Master Plan Amendment

No mitigation measures are required for the short-term construction or long-term operation of future commercial developments.

7.2 Greenhouse Gas Emissions

7.2.1 Project Level – Wetland Mitigation Bank

No mitigation measures are required for the short-term construction or long-term operation of the proposed project.

7.2.2 Program Level – Parcels A, B, and C Port Master Plan Amendment

The following mitigation measures are proposed for future commercial development:

GHG-1 **GHG Emission-Reducing Design.** Prior to approval, future commercial developments shall list all GHG emission-reducing measures and demonstrate where these measures would be located in the plans. A report demonstrating compliance shall be submitted to the District's Planning Department.

The following is a list of proposed sustainability measures from the District CAP that shall be required and incorporated into the Coastal Development Permit for the project.

- General measures:
  - No commercial drive-through shall be implemented.
- Water:
  - Indoor water consumption shall be reduced by 20 percent lower than baseline buildings (defined by Leadership in Energy and Environmental Design as indoor water use after meeting Energy Policy Act of 1992 fixture performance requirements) through use of low-flow fixtures in all administrative and common area bathrooms.
  - Low-water plantings and drip irrigation shall be installed, and domestic water demand from the city system for landscaping purposes shall be minimized.

- Waste:
    - Compliance with AB 939 shall be mandatory and include recycling at least 50 percent of solid waste; recycling of demolition debris shall be mandatory and include recycling at least 65 percent of all construction and demolition debris.
    - All commercial, restaurant, and retail uses shall implement recycling, composting of food waste and other organics, and the use of reusable products instead of disposable products to divert solid waste from the landfill stream.
    - Recycled, regional, and rapidly renewable materials shall be used where appropriate during project construction.
- Energy:
    - Energy efficiency design features shall be incorporated that exceed the most recent Title 24 California Building Energy Efficiency Standards. Measures that may be implemented include:
        - Only fluorescent, light-emitting diodes, compact fluorescent lights, or the most energy-efficient lighting that meets required lighting standards and is commercially available shall be used.
        - Occupancy sensors for all vending machines shall be installed in new buildings at the project site.
        - On-site renewable energy to new buildings shall be implemented, unless the system cannot be built due to structural and operational constraints; evidence must be provided if not feasible, subject to District concurrence.
        - Cogeneration systems (i.e., combined heat and power systems) shall be installed in new buildings constructed at the project site.
        - High-performance glazing with a low solar heat gain coefficient value that reduces the amount of solar heat allowed into the building shall be installed, without compromising natural illumination.
        - Increased insulation shall be installed.
        - Cool roofs with an R value of 30 or better shall be installed.
        - Sun-shading devices shall be installed, as appropriate.
        - High-efficiency heating, ventilating, and air conditioning systems and controls shall be installed.
        - Programmable thermostats shall be installed.
        - Variable frequency drives shall be installed.
        - Energy Star-rated appliances shall be installed.
- Mobile sources:
    - A minimum 6 percent of parking spaces shall be electric vehicle-ready.
    - A transportation demand management plan for each project component that requires mandatory employer commuting measures, such as carpooling,

    transit subsidies, and vanpools, shall be implemented to reduce worker trips and parking demand.

  - Bicycle parking shall be included in project design. The number of spaces shall be, at a minimum, 5 percent of new automobile parking spaces.
- Carbon sequestration and land use:
  - Trees and shrub planters shall be installed throughout the project area as part of the landscape plan.

GHG-2 **Electric Heating and Zero Net Energy Building.** The District shall require all development to meet the state's Zero Net Energy standards, if the standards are adopted prior to commencement of construction.

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Appendix A. California Emissions Estimator Model Emission Calculations

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Port of San Diego Mitigation Bank

San Diego Air Basin, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Other Non-Asphalt Surfaces	95.00	Acre	95.00	4,138,200.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.6	**Precipitation Freq (Days)**	40
Climate Zone	13			**Operational Year**	2022
Utility Company	San Diego Gas & Electric				
CO2 Intensity (lb/MWhr)	720.49	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use -

Construction Phase - Phasing and durations based on project description

Off-road Equipment - Equipment list from project description

Off-road Equipment - Equipment list from project description

Off-road Equipment - Equipment list from project description

Off-road Equipment - Equipment list from project description

Grading - Total area graded is 80 acres

Off-road Equipment -

Trips and VMT - Haul truck trips and employee trips are from the project description

Construction Off-road Equipment Mitigation -

Table Name	Column Name	Default Value	New Value
tblConstructionPhase	NumDays	60.00	47.00
tblConstructionPhase	NumDays	155.00	107.00
tblConstructionPhase	NumDays	155.00	101.00
tblConstructionPhase	NumDaysWeek	5.00	6.00
tblConstructionPhase	NumDaysWeek	5.00	6.00
tblConstructionPhase	NumDaysWeek	5.00	6.00
tblConstructionPhase	NumDaysWeek	5.00	6.00
tblConstructionPhase	NumDaysWeek	5.00	6.00
tblConstructionPhase	PhaseEndDate	3/18/2022	8/27/2021
tblConstructionPhase	PhaseEndDate	8/13/2021	2/26/2021
tblConstructionPhase	PhaseStartDate	8/14/2021	3/1/2021
tblConstructionPhase	PhaseStartDate	5/22/2021	1/4/2021
tblGrading	AcresOfGrading	310.00	80.00
tblGrading	AcresOfGrading	0.00	80.00

tblGrading	AcresOfGrading	214.00	80.00
tblGrading	AcresOfGrading	0.00	80.00
tblGrading	MaterialExported	0.00	537,500.00
tblOffRoadEquipment	OffRoadEquipmentType		Excavators
tblOffRoadEquipment	OffRoadEquipmentType		Rubber Tired Dozers
tblOffRoadEquipment	OffRoadEquipmentType		Rubber Tired Dozers
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	3.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	4.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	3.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	4.00
tblTripsAndVMT	HaulingTripNumber	0.00	216.00
tblTripsAndVMT	HaulingTripNumber	67,188.00	12,480.00
tblTripsAndVMT	HaulingTripNumber	0.00	1,920.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2021	0.9712	11.6947	6.0857	0.0169	3.1162	0.4530	3.5692	1.5974	0.4169	2.0143	0.0000	1,549.5206	1,549.5206	0.3624	0.0000	1,558.5800
2022	0.1679	1.6844	1.1778	2.2800e-003	0.6581	0.0812	0.7393	0.3409	0.0747	0.4156	0.0000	200.4147	200.4147	0.0630	0.0000	201.9887
Maximum	**0.9712**	**11.6947**	**6.0857**	**0.0169**	**3.1162**	**0.4530**	**3.5692**	**1.5974**	**0.4169**	**2.0143**	**0.0000**	**1,549.5206**	**1,549.5206**	**0.3624**	**0.0000**	**1,558.5800**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2021	0.9712	11.6947	6.0857	0.0169	1.4903	0.4530	1.9432	0.7428	0.4169	1.1598	0.0000	1,549.5194	1,549.5194	0.3624	0.0000	1,558.5788
2022	0.1679	1.6844	1.1778	2.2800e-003	0.3003	0.0812	0.3814	0.1545	0.0747	0.2292	0.0000	200.4145	200.4145	0.0630	0.0000	201.9884
Maximum	**0.9712**	**11.6947**	**6.0857**	**0.0169**	**1.4903**	**0.4530**	**1.9432**	**0.7428**	**0.4169**	**1.1598**	**0.0000**	**1,549.5194**	**1,549.5194**	**0.3624**	**0.0000**	**1,558.5788**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**52.56**	**0.00**	**46.04**	**53.71**	**0.00**	**42.84**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Quarter	Start Date	End Date	Maximum Unmitigated ROG + NOX (tons/quarter)	Maximum Mitigated ROG + NOX (tons/quarter)
1	**1-4-2021**	**4-3-2021**	2.6679	2.6679
2	**4-4-2021**	**7-3-2021**	3.7029	3.7029
3	**7-4-2021**	**10-3-2021**	3.3517	3.3517
4	**10-4-2021**	**1-3-2022**	2.8444	2.8444
5	**1-4-2022**	**4-3-2022**	1.0411	1.0411
6	**4-4-2022**	**7-3-2022**	0.7749	0.7749
		Highest	3.7029	3.7029

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.4114	1.0000e-005	8.7000e-004	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	1.7000e-003	1.7000e-003	0.0000	0.0000	1.8100e-003
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.4114**	**1.0000e-005**	**8.7000e-004**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**1.7000e-003**	**1.7000e-003**	**0.0000**	**0.0000**	**1.8100e-003**

2.2 Overall Operational

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.4114	1.0000e-005	8.7000e-004	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	1.7000e-003	1.7000e-003	0.0000	0.0000	1.8100e-003
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.4114**	**1.0000e-005**	**8.7000e-004**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**1.7000e-003**	**1.7000e-003**	**0.0000**	**0.0000**	**1.8100e-003**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Clearing and Grubbing	Site Preparation	1/4/2021	2/26/2021	6	47	
2	Mass Grading	Grading	3/1/2021	8/27/2021	6	155	
3	Fine Grading	Grading	8/30/2021	12/31/2021	6	107	
4	Landscaping	Grading	1/3/2022	4/29/2022	6	101	
5	Breech Excavation	Trenching	5/2/2022	5/27/2022	6	23	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 95

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0; Striped Parking Area: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Fine Grading	Excavators	2	8.00	158	0.38
Landscaping	Excavators	2	8.00	158	0.38
Fine Grading	Graders	2	8.00	187	0.41
Landscaping	Graders	0	8.00	187	0.41
Mass Grading	Excavators	2	8.00	158	0.38
Fine Grading	Rubber Tired Dozers	3	8.00	247	0.40
Landscaping	Rubber Tired Dozers	2	8.00	247	0.40
Mass Grading	Graders	2	8.00	187	0.41
Fine Grading	Scrapers	1	8.00	367	0.48
Landscaping	Scrapers	0	8.00	367	0.48
Fine Grading	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Landscaping	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Mass Grading	Rubber Tired Dozers	3	8.00	247	0.40
Clearing and Grubbing	Rubber Tired Dozers	3	8.00	247	0.40
Mass Grading	Scrapers	1	8.00	367	0.48
Breech Excavation	Excavators	2	8.00	158	0.38
Mass Grading	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Clearing and Grubbing	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Breech Excavation	Rubber Tired Dozers	2	8.00	247	0.40
Breech Excavation	Rubber Tired Dozers	2	8.00	247	0.40

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Fine Grading	12	30.00	0.00	216.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Landscaping	6	15.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Breech Excavation	6	15.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Mass Grading	12	30.00	0.00	12,480.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Clearing and Grubbing	7	18.00	0.00	1,920.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Water Exposed Area

3.2 Clearing and Grubbing - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.4670	0.0000	0.4670	0.2380	0.0000	0.2380	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0914	0.9517	0.4971	8.9000e-004		0.0480	0.0480		0.0442	0.0442	0.0000	78.5739	78.5739	0.0254	0.0000	79.2092
Total	**0.0914**	**0.9517**	**0.4971**	**8.9000e-004**	**0.4670**	**0.0480**	**0.5150**	**0.2380**	**0.0442**	**0.2822**	**0.0000**	**78.5739**	**78.5739**	**0.0254**	**0.0000**	**79.2092**

3.2 Clearing and Grubbing - 2021

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	7.2100e-003	0.2507	0.0618	7.3000e-004	0.0164	7.6000e-004	0.0172	4.5100e-003	7.2000e-004	5.2400e-003	0.0000	73.1156	73.1156	6.6000e-003	0.0000	73.2806
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.4700e-003	1.0500e-003	0.0106	3.0000e-005	3.3900e-003	2.0000e-005	3.4200e-003	9.0000e-004	2.0000e-005	9.2000e-004	0.0000	2.9632	2.9632	8.0000e-005	0.0000	2.9653
Total	**8.6800e-003**	**0.2518**	**0.0724**	**7.6000e-004**	**0.0198**	**7.8000e-004**	**0.0206**	**5.4100e-003**	**7.4000e-004**	**6.1600e-003**	**0.0000**	**76.0788**	**76.0788**	**6.6800e-003**	**0.0000**	**76.2459**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.2101	0.0000	0.2101	0.1071	0.0000	0.1071	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0914	0.9517	0.4971	8.9000e-004		0.0480	0.0480		0.0442	0.0442	0.0000	78.5738	78.5738	0.0254	0.0000	79.2092
Total	**0.0914**	**0.9517**	**0.4971**	**8.9000e-004**	**0.2101**	**0.0480**	**0.2582**	**0.1071**	**0.0442**	**0.1513**	**0.0000**	**78.5738**	**78.5738**	**0.0254**	**0.0000**	**79.2092**

3.2 Clearing and Grubbing - 2021

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	7.2100e-003	0.2507	0.0618	7.3000e-004	0.0164	7.6000e-004	0.0172	4.5100e-003	7.2000e-004	5.2400e-003	0.0000	73.1156	73.1156	6.6000e-003	0.0000	73.2806
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.4700e-003	1.0500e-003	0.0106	3.0000e-005	3.3900e-003	2.0000e-005	3.4200e-003	9.0000e-004	2.0000e-005	9.2000e-004	0.0000	2.9632	2.9632	8.0000e-005	0.0000	2.9653
Total	**8.6800e-003**	**0.2518**	**0.0724**	**7.6000e-004**	**0.0198**	**7.8000e-004**	**0.0206**	**5.4100e-003**	**7.4000e-004**	**6.1600e-003**	**0.0000**	**76.0788**	**76.0788**	**6.6800e-003**	**0.0000**	**76.2459**

3.3 Mass Grading - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.4803	0.0000	1.4803	0.7799	0.0000	0.7799	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.4791	5.2201	2.9634	5.9500e-003		0.2360	0.2360		0.2171	0.2171	0.0000	522.8943	522.8943	0.1691	0.0000	527.1222
Total	**0.4791**	**5.2201**	**2.9634**	**5.9500e-003**	**1.4803**	**0.2360**	**1.7163**	**0.7799**	**0.2171**	**0.9971**	**0.0000**	**522.8943**	**522.8943**	**0.1691**	**0.0000**	**527.1222**

3.3 Mass Grading - 2021

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0469	1.6297	0.4020	4.7800e-003	0.1068	4.9200e-003	0.1117	0.0293	4.7100e-003	0.0340	0.0000	475.2516	475.2516	0.0429	0.0000	476.3239
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	8.0800e-003	5.7700e-003	0.0581	1.8000e-004	0.0186	1.3000e-004	0.0188	4.9500e-003	1.2000e-004	5.0800e-003	0.0000	16.2872	16.2872	4.7000e-004	0.0000	16.2988
Total	**0.0549**	**1.6354**	**0.4601**	**4.9600e-003**	**0.1254**	**5.0500e-003**	**0.1305**	**0.0343**	**4.8300e-003**	**0.0391**	**0.0000**	**491.5388**	**491.5388**	**0.0434**	**0.0000**	**492.6227**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.6661	0.0000	0.6661	0.3510	0.0000	0.3510	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.4791	5.2201	2.9634	5.9500e-003		0.2360	0.2360		0.2171	0.2171	0.0000	522.8937	522.8937	0.1691	0.0000	527.1216
Total	**0.4791**	**5.2201**	**2.9634**	**5.9500e-003**	**0.6661**	**0.2360**	**0.9021**	**0.3510**	**0.2171**	**0.5681**	**0.0000**	**522.8937**	**522.8937**	**0.1691**	**0.0000**	**527.1216**

3.3 Mass Grading - 2021

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0469	1.6297	0.4020	4.7800e-003	0.1068	4.9200e-003	0.1117	0.0293	4.7100e-003	0.0340	0.0000	475.2516	475.2516	0.0429	0.0000	476.3239
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	8.0800e-003	5.7700e-003	0.0581	1.8000e-004	0.0186	1.3000e-004	0.0188	4.9500e-003	1.2000e-004	5.0800e-003	0.0000	16.2872	16.2872	4.7000e-004	0.0000	16.2988
Total	**0.0549**	**1.6354**	**0.4601**	**4.9600e-003**	**0.1254**	**5.0500e-003**	**0.1305**	**0.0343**	**4.8300e-003**	**0.0391**	**0.0000**	**491.5388**	**491.5388**	**0.0434**	**0.0000**	**492.6227**

3.4 Fine Grading - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.0090	0.0000	1.0090	0.5359	0.0000	0.5359	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.3307	3.6035	2.0457	4.1100e-003		0.1629	0.1629		0.1499	0.1499	0.0000	360.9658	360.9658	0.1167	0.0000	363.8844
Total	**0.3307**	**3.6035**	**2.0457**	**4.1100e-003**	**1.0090**	**0.1629**	**1.1719**	**0.5359**	**0.1499**	**0.6858**	**0.0000**	**360.9658**	**360.9658**	**0.1167**	**0.0000**	**363.8844**

3.4 Fine Grading - 2021

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	8.1000e-004	0.0282	6.9600e-003	8.0000e-005	1.8500e-003	9.0000e-005	1.9300e-003	5.1000e-004	8.0000e-005	5.9000e-004	0.0000	8.2255	8.2255	7.4000e-004	0.0000	8.2441
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	5.5800e-003	3.9800e-003	0.0401	1.2000e-004	0.0129	9.0000e-005	0.0130	3.4200e-003	8.0000e-005	3.5000e-003	0.0000	11.2434	11.2434	3.2000e-004	0.0000	11.2514
Total	**6.3900e-003**	**0.0322**	**0.0471**	**2.0000e-004**	**0.0147**	**1.8000e-004**	**0.0149**	**3.9300e-003**	**1.6000e-004**	**4.0900e-003**	**0.0000**	**19.4689**	**19.4689**	**1.0600e-003**	**0.0000**	**19.4955**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.4540	0.0000	0.4540	0.2411	0.0000	0.2411	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.3307	3.6035	2.0457	4.1100e-003		0.1629	0.1629		0.1499	0.1499	0.0000	360.9653	360.9653	0.1167	0.0000	363.8839
Total	**0.3307**	**3.6035**	**2.0457**	**4.1100e-003**	**0.4540**	**0.1629**	**0.6169**	**0.2411**	**0.1499**	**0.3910**	**0.0000**	**360.9653**	**360.9653**	**0.1167**	**0.0000**	**363.8839**

3.4 Fine Grading - 2021

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	8.1000e-004	0.0282	6.9600e-003	8.0000e-005	1.8500e-003	9.0000e-005	1.9300e-003	5.1000e-004	8.0000e-005	5.9000e-004	0.0000	8.2255	8.2255	7.4000e-004	0.0000	8.2441
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	5.5800e-003	3.9800e-003	0.0401	1.2000e-004	0.0129	9.0000e-005	0.0130	3.4200e-003	8.0000e-005	3.5000e-003	0.0000	11.2434	11.2434	3.2000e-004	0.0000	11.2514
Total	**6.3900e-003**	**0.0322**	**0.0471**	**2.0000e-004**	**0.0147**	**1.8000e-004**	**0.0149**	**3.9300e-003**	**1.6000e-004**	**4.0900e-003**	**0.0000**	**19.4689**	**19.4689**	**1.0600e-003**	**0.0000**	**19.4955**

3.5 Landscaping - 2022

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.6507	0.0000	0.6507	0.3389	0.0000	0.3389	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.1216	1.2369	0.9166	1.7000e-003		0.0599	0.0599		0.0551	0.0551	0.0000	149.1931	149.1931	0.0483	0.0000	150.3994
Total	**0.1216**	**1.2369**	**0.9166**	**1.7000e-003**	**0.6507**	**0.0599**	**0.7106**	**0.3389**	**0.0551**	**0.3941**	**0.0000**	**149.1931**	**149.1931**	**0.0483**	**0.0000**	**150.3994**

3.5 Landscaping - 2022

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.4900e-003	1.7100e-003	0.0176	6.0000e-005	6.0700e-003	4.0000e-005	6.1200e-003	1.6100e-003	4.0000e-005	1.6500e-003	0.0000	5.1119	5.1119	1.4000e-004	0.0000	5.1154
Total	**2.4900e-003**	**1.7100e-003**	**0.0176**	**6.0000e-005**	**6.0700e-003**	**4.0000e-005**	**6.1200e-003**	**1.6100e-003**	**4.0000e-005**	**1.6500e-003**	**0.0000**	**5.1119**	**5.1119**	**1.4000e-004**	**0.0000**	**5.1154**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.2928	0.0000	0.2928	0.1525	0.0000	0.1525	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.1216	1.2369	0.9166	1.7000e-003		0.0599	0.0599		0.0551	0.0551	0.0000	149.1929	149.1929	0.0483	0.0000	150.3992
Total	**0.1216**	**1.2369**	**0.9166**	**1.7000e-003**	**0.2928**	**0.0599**	**0.3527**	**0.1525**	**0.0551**	**0.2077**	**0.0000**	**149.1929**	**149.1929**	**0.0483**	**0.0000**	**150.3992**

3.5 Landscaping - 2022

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.4900e-003	1.7100e-003	0.0176	6.0000e-005	6.0700e-003	4.0000e-005	6.1200e-003	1.6100e-003	4.0000e-005	1.6500e-003	0.0000	5.1119	5.1119	1.4000e-004	0.0000	5.1154
Total	**2.4900e-003**	**1.7100e-003**	**0.0176**	**6.0000e-005**	**6.0700e-003**	**4.0000e-005**	**6.1200e-003**	**1.6100e-003**	**4.0000e-005**	**1.6500e-003**	**0.0000**	**5.1119**	**5.1119**	**1.4000e-004**	**0.0000**	**5.1154**

3.6 Breech Excavation - 2022

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0432	0.4454	0.2396	5.1000e-004		0.0212	0.0212		0.0195	0.0195	0.0000	44.9455	44.9455	0.0145	0.0000	45.3090
Total	**0.0432**	**0.4454**	**0.2396**	**5.1000e-004**		**0.0212**	**0.0212**		**0.0195**	**0.0195**	**0.0000**	**44.9455**	**44.9455**	**0.0145**	**0.0000**	**45.3090**

3.6 Breech Excavation - 2022

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	5.7000e-004	3.9000e-004	4.0000e-003	1.0000e-005	1.3800e-003	1.0000e-005	1.3900e-003	3.7000e-004	1.0000e-005	3.8000e-004	0.0000	1.1641	1.1641	3.0000e-005	0.0000	1.1649
Total	**5.7000e-004**	**3.9000e-004**	**4.0000e-003**	**1.0000e-005**	**1.3800e-003**	**1.0000e-005**	**1.3900e-003**	**3.7000e-004**	**1.0000e-005**	**3.8000e-004**	**0.0000**	**1.1641**	**1.1641**	**3.0000e-005**	**0.0000**	**1.1649**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0432	0.4454	0.2396	5.1000e-004		0.0212	0.0212		0.0195	0.0195	0.0000	44.9455	44.9455	0.0145	0.0000	45.3089
Total	**0.0432**	**0.4454**	**0.2396**	**5.1000e-004**		**0.0212**	**0.0212**		**0.0195**	**0.0195**	**0.0000**	**44.9455**	**44.9455**	**0.0145**	**0.0000**	**45.3089**

3.6 Breech Excavation - 2022

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	5.7000e-004	3.9000e-004	4.0000e-003	1.0000e-005	1.3800e-003	1.0000e-005	1.3900e-003	3.7000e-004	1.0000e-005	3.8000e-004	0.0000	1.1641	1.1641	3.0000e-005	0.0000	1.1649
Total	**5.7000e-004**	**3.9000e-004**	**4.0000e-003**	**1.0000e-005**	**1.3800e-003**	**1.0000e-005**	**1.3900e-003**	**3.7000e-004**	**1.0000e-005**	**3.8000e-004**	**0.0000**	**1.1641**	**1.1641**	**3.0000e-005**	**0.0000**	**1.1649**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Other Non-Asphalt Surfaces	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
Other Non-Asphalt Surfaces	9.50	7.30	7.30	0.00	0.00	0.00	0	0	0

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
Other Non-Asphalt Surfaces	0.598645	0.040929	0.181073	0.106149	0.015683	0.005479	0.016317	0.023976	0.001926	0.001932	0.006016	0.000753	0.001122

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
Other Non-Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
Other Non-Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
Other Non-Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.3 Energy by Land Use - Electricity

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
Other Non-Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.4114	1.0000e-005	8.7000e-004	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	1.7000e-003	1.7000e-003	0.0000	0.0000	1.8100e-003
Unmitigated	0.4114	1.0000e-005	8.7000e-004	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	1.7000e-003	1.7000e-003	0.0000	0.0000	1.8100e-003

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.1439					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.2675					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	8.0000e-005	1.0000e-005	8.7000e-004	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	1.7000e-003	1.7000e-003	0.0000	0.0000	1.8100e-003
Total	**0.4114**	**1.0000e-005**	**8.7000e-004**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**1.7000e-003**	**1.7000e-003**	**0.0000**	**0.0000**	**1.8100e-003**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.1439					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.2675					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	8.0000e-005	1.0000e-005	8.7000e-004	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	1.7000e-003	1.7000e-003	0.0000	0.0000	1.8100e-003
Total	**0.4114**	**1.0000e-005**	**8.7000e-004**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**1.7000e-003**	**1.7000e-003**	**0.0000**	**0.0000**	**1.8100e-003**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
Other Non-Asphalt Surfaces	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

7.2 Water by Land Use

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
Other Non-Asphalt Surfaces	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
Other Non-Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
Other Non-Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

11.0 Vegetation

Port of San Diego Mitigation Bank

San Diego Air Basin, Summer

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Other Non-Asphalt Surfaces	95.00	Acre	95.00	4,138,200.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.6	**Precipitation Freq (Days)**	40
Climate Zone	13			**Operational Year**	2022
Utility Company	San Diego Gas & Electric				
CO2 Intensity (lb/MWhr)	720.49	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Port of San Diego Mitigation Bank - San Diego Air Basin, Summer

Project Characteristics -

Land Use -

Construction Phase - Phasing and durations based on project description

Off-road Equipment - Equipment list from project description

Off-road Equipment - Equipment list from project description

Off-road Equipment - Equipment list from project description

Off-road Equipment - Equipment list from project description

Grading - Total area graded is 80 acres

Off-road Equipment -

Trips and VMT - Haul truck trips and employee trips are from the project description

Construction Off-road Equipment Mitigation -

Table Name	Column Name	Default Value	New Value
tblConstructionPhase	NumDays	60.00	47.00
tblConstructionPhase	NumDays	155.00	107.00
tblConstructionPhase	NumDays	155.00	101.00
tblConstructionPhase	NumDaysWeek	5.00	6.00
tblConstructionPhase	NumDaysWeek	5.00	6.00
tblConstructionPhase	NumDaysWeek	5.00	6.00
tblConstructionPhase	NumDaysWeek	5.00	6.00
tblConstructionPhase	NumDaysWeek	5.00	6.00
tblConstructionPhase	PhaseEndDate	3/18/2022	8/27/2021
tblConstructionPhase	PhaseEndDate	8/13/2021	2/26/2021
tblConstructionPhase	PhaseStartDate	8/14/2021	3/1/2021
tblConstructionPhase	PhaseStartDate	5/22/2021	1/4/2021
tblGrading	AcresOfGrading	310.00	80.00
tblGrading	AcresOfGrading	0.00	80.00

tblGrading	AcresOfGrading	214.00	80.00
tblGrading	AcresOfGrading	0.00	80.00
tblGrading	MaterialExported	0.00	537,500.00
tblOffRoadEquipment	OffRoadEquipmentType		Excavators
tblOffRoadEquipment	OffRoadEquipmentType		Rubber Tired Dozers
tblOffRoadEquipment	OffRoadEquipmentType		Rubber Tired Dozers
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	3.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	4.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	3.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	4.00
tblTripsAndVMT	HaulingTripNumber	0.00	216.00
tblTripsAndVMT	HaulingTripNumber	67,188.00	12,480.00
tblTripsAndVMT	HaulingTripNumber	0.00	1,920.00

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2021	6.8834	88.0622	44.0818	0.1413	20.7543	3.1098	23.8641	10.5145	2.8633	13.3778	0.0000	14,490.7432	14,490.7432	3.0138	0.0000	14,566.0890
2022	3.8023	38.7593	21.2082	0.0456	13.0074	1.8421	14.1950	6.7438	1.6948	7.8365	0.0000	4,425.8559	4,425.8559	1.3966	0.0000	4,460.7696
Maximum	**6.8834**	**88.0622**	**44.0818**	**0.1413**	**20.7543**	**3.1098**	**23.8641**	**10.5145**	**2.8633**	**13.3778**	**0.0000**	**14,490.7432**	**14,490.7432**	**3.0138**	**0.0000**	**14,566.0890**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2021	6.8834	88.0622	44.0818	0.1413	10.2488	3.1098	13.3586	4.9796	2.8633	7.8429	0.0000	14,490.7431	14,490.7431	3.0138	0.0000	14,566.0890
2022	3.8023	38.7593	21.2082	0.0456	5.9211	1.8421	7.1087	3.0527	1.6948	4.1453	0.0000	4,425.8559	4,425.8559	1.3966	0.0000	4,460.7696
Maximum	**6.8834**	**88.0622**	**44.0818**	**0.1413**	**10.2488**	**3.1098**	**13.3586**	**4.9796**	**2.8633**	**7.8429**	**0.0000**	**14,490.7431**	**14,490.7431**	**3.0138**	**0.0000**	**14,566.0890**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**52.11**	**0.00**	**46.22**	**53.46**	**0.00**	**43.49**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	2.2549	9.0000e-005	9.7100e-003	0.0000		3.0000e-005	3.0000e-005		3.0000e-005	3.0000e-005		0.0208	0.0208	5.0000e-005		0.0222
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**2.2549**	**9.0000e-005**	**9.7100e-003**	**0.0000**	**0.0000**	**3.0000e-005**	**3.0000e-005**	**0.0000**	**3.0000e-005**	**3.0000e-005**		**0.0208**	**0.0208**	**5.0000e-005**	**0.0000**	**0.0222**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	2.2549	9.0000e-005	9.7100e-003	0.0000		3.0000e-005	3.0000e-005		3.0000e-005	3.0000e-005		0.0208	0.0208	5.0000e-005		0.0222
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**2.2549**	**9.0000e-005**	**9.7100e-003**	**0.0000**	**0.0000**	**3.0000e-005**	**3.0000e-005**	**0.0000**	**3.0000e-005**	**3.0000e-005**		**0.0208**	**0.0208**	**5.0000e-005**	**0.0000**	**0.0222**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Clearing and Grubbing	Site Preparation	1/4/2021	2/26/2021	6	47	
2	Mass Grading	Grading	3/1/2021	8/27/2021	6	155	
3	Fine Grading	Grading	8/30/2021	12/31/2021	6	107	
4	Landscaping	Grading	1/3/2022	4/29/2022	6	101	
5	Breech Excavation	Trenching	5/2/2022	5/27/2022	6	23	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 95

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0; Striped Parking Area: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Fine Grading	Excavators	2	8.00	158	0.38
Landscaping	Excavators	2	8.00	158	0.38
Fine Grading	Graders	2	8.00	187	0.41
Landscaping	Graders	0	8.00	187	0.41
Mass Grading	Excavators	2	8.00	158	0.38
Fine Grading	Rubber Tired Dozers	3	8.00	247	0.40
Landscaping	Rubber Tired Dozers	2	8.00	247	0.40
Mass Grading	Graders	2	8.00	187	0.41
Fine Grading	Scrapers	1	8.00	367	0.48
Landscaping	Scrapers	0	8.00	367	0.48
Fine Grading	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Landscaping	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Mass Grading	Rubber Tired Dozers	3	8.00	247	0.40
Clearing and Grubbing	Rubber Tired Dozers	3	8.00	247	0.40
Mass Grading	Scrapers	1	8.00	367	0.48
Breech Excavation	Excavators	2	8.00	158	0.38
Mass Grading	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Clearing and Grubbing	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Breech Excavation	Rubber Tired Dozers	2	8.00	247	0.40
Breech Excavation	Rubber Tired Dozers	2	8.00	247	0.40

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Fine Grading	12	30.00	0.00	216.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Landscaping	6	15.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Breech Excavation	6	15.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Mass Grading	12	30.00	0.00	12,480.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Clearing and Grubbing	7	18.00	0.00	1,920.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Water Exposed Area

3.2 Clearing and Grubbing - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					19.8714	0.0000	19.8714	10.1256	0.0000	10.1256			0.0000			0.0000
Off-Road	3.8882	40.4971	21.1543	0.0380		2.0445	2.0445		1.8809	1.8809		3,685.6569	3,685.6569	1.1920		3,715.4573
Total	**3.8882**	**40.4971**	**21.1543**	**0.0380**	**19.8714**	**2.0445**	**21.9158**	**10.1256**	**1.8809**	**12.0065**		**3,685.6569**	**3,685.6569**	**1.1920**		**3,715.4573**

3.2 Clearing and Grubbing - 2021

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.3032	10.4715	2.5618	0.0315	0.7138	0.0320	0.7458	0.1956	0.0306	0.2262		3,454.6939	3,454.6939	0.3052		3,462.3232
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0623	0.0405	0.4774	1.4700e-003	0.1479	1.0200e-003	0.1489	0.0392	9.4000e-004	0.0402		146.5994	146.5994	4.1800e-003		146.7040
Total	**0.3655**	**10.5119**	**3.0392**	**0.0330**	**0.8617**	**0.0330**	**0.8947**	**0.2349**	**0.0315**	**0.2664**		**3,601.2933**	**3,601.2933**	**0.3094**		**3,609.0272**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.9421	0.0000	8.9421	4.5565	0.0000	4.5565			0.0000			0.0000
Off-Road	3.8882	40.4971	21.1543	0.0380		2.0445	2.0445		1.8809	1.8809	0.0000	3,685.6569	3,685.6569	1.1920		3,715.4573
Total	**3.8882**	**40.4971**	**21.1543**	**0.0380**	**8.9421**	**2.0445**	**10.9866**	**4.5565**	**1.8809**	**6.4374**	**0.0000**	**3,685.6569**	**3,685.6569**	**1.1920**		**3,715.4573**

3.2 Clearing and Grubbing - 2021

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.3032	10.4715	2.5618	0.0315	0.7138	0.0320	0.7458	0.1956	0.0306	0.2262		3,454.6939	3,454.6939	0.3052		3,462.3232
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0623	0.0405	0.4774	1.4700e-003	0.1479	1.0200e-003	0.1489	0.0392	9.4000e-004	0.0402		146.5994	146.5994	4.1800e-003		146.7040
Total	**0.3655**	**10.5119**	**3.0392**	**0.0330**	**0.8617**	**0.0330**	**0.8947**	**0.2349**	**0.0315**	**0.2664**		**3,601.2933**	**3,601.2933**	**0.3094**		**3,609.0272**

3.3 Mass Grading - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					19.1009	0.0000	19.1009	10.0636	0.0000	10.0636			0.0000			0.0000
Off-Road	6.1820	67.3558	38.2370	0.0768		3.0451	3.0451		2.8015	2.8015		7,437.3206	7,437.3206	2.4054		7,497.4551
Total	**6.1820**	**67.3558**	**38.2370**	**0.0768**	**19.1009**	**3.0451**	**22.1460**	**10.0636**	**2.8015**	**12.8651**		**7,437.3206**	**7,437.3206**	**2.4054**		**7,497.4551**

3.3 Mass Grading - 2021

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.5977	20.6389	5.0492	0.0621	1.4069	0.0630	1.4699	0.3856	0.0603	0.4458		6,809.0903	6,809.0903	0.6015		6,824.1274
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1038	0.0674	0.7957	2.4500e-003	0.2464	1.7000e-003	0.2482	0.0654	1.5700e-003	0.0669		244.3323	244.3323	6.9700e-003		244.5066
Total	**0.7014**	**20.7064**	**5.8449**	**0.0645**	**1.6534**	**0.0647**	**1.7180**	**0.4509**	**0.0618**	**0.5128**		**7,053.4226**	**7,053.4226**	**0.6085**		**7,068.6339**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.5954	0.0000	8.5954	4.5286	0.0000	4.5286			0.0000			0.0000
Off-Road	6.1820	67.3558	38.2370	0.0768		3.0451	3.0451		2.8015	2.8015	0.0000	7,437.3206	7,437.3206	2.4054		7,497.4551
Total	**6.1820**	**67.3558**	**38.2370**	**0.0768**	**8.5954**	**3.0451**	**11.6405**	**4.5286**	**2.8015**	**7.3301**	**0.0000**	**7,437.3206**	**7,437.3206**	**2.4054**		**7,497.4551**

3.3 Mass Grading - 2021

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.5977	20.6389	5.0492	0.0621	1.4069	0.0630	1.4699	0.3856	0.0603	0.4458		6,809.0903	6,809.0903	0.6015		6,824.1274
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1038	0.0674	0.7957	2.4500e-003	0.2464	1.7000e-003	0.2482	0.0654	1.5700e-003	0.0669		244.3323	244.3323	6.9700e-003		244.5066
Total	**0.7014**	**20.7064**	**5.8449**	**0.0645**	**1.6534**	**0.0647**	**1.7180**	**0.4509**	**0.0618**	**0.5128**		**7,053.4226**	**7,053.4226**	**0.6085**		**7,068.6339**

3.4 Fine Grading - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					18.8592	0.0000	18.8592	10.0163	0.0000	10.0163			0.0000			0.0000
Off-Road	6.1820	67.3558	38.2370	0.0768		3.0451	3.0451		2.8015	2.8015		7,437.3206	7,437.3206	2.4054		7,497.4551
Total	**6.1820**	**67.3558**	**38.2370**	**0.0768**	**18.8592**	**3.0451**	**21.9043**	**10.0163**	**2.8015**	**12.8178**		**7,437.3206**	**7,437.3206**	**2.4054**		**7,497.4551**

3.4 Fine Grading - 2021

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0150	0.5175	0.1266	1.5600e-003	0.0353	1.5800e-003	0.0369	9.6700e-003	1.5100e-003	0.0112		170.7168	170.7168	0.0151		171.0938
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1038	0.0674	0.7957	2.4500e-003	0.2464	1.7000e-003	0.2482	0.0654	1.5700e-003	0.0669		244.3323	244.3323	6.9700e-003		244.5066
Total	**0.1188**	**0.5849**	**0.9223**	**4.0100e-003**	**0.2817**	**3.2800e-003**	**0.2850**	**0.0750**	**3.0800e-003**	**0.0781**		**415.0490**	**415.0490**	**0.0221**		**415.6004**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.4866	0.0000	8.4866	4.5073	0.0000	4.5073			0.0000			0.0000
Off-Road	6.1820	67.3558	38.2370	0.0768		3.0451	3.0451		2.8015	2.8015	0.0000	7,437.3206	7,437.3206	2.4054		7,497.4551
Total	**6.1820**	**67.3558**	**38.2370**	**0.0768**	**8.4866**	**3.0451**	**11.5317**	**4.5073**	**2.8015**	**7.3088**	**0.0000**	**7,437.3206**	**7,437.3206**	**2.4054**		**7,497.4551**

3.4 Fine Grading - 2021

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0150	0.5175	0.1266	1.5600e-003	0.0353	1.5800e-003	0.0369	9.6700e-003	1.5100e-003	0.0112		170.7168	170.7168	0.0151		171.0938
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1038	0.0674	0.7957	2.4500e-003	0.2464	1.7000e-003	0.2482	0.0654	1.5700e-003	0.0669		244.3323	244.3323	6.9700e-003		244.5066
Total	**0.1188**	**0.5849**	**0.9223**	**4.0100e-003**	**0.2817**	**3.2800e-003**	**0.2850**	**0.0750**	**3.0800e-003**	**0.0781**		**415.0490**	**415.0490**	**0.0221**		**415.6004**

3.5 Landscaping - 2022

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					12.8842	0.0000	12.8842	6.7112	0.0000	6.7112			0.0000			0.0000
Off-Road	2.4085	24.4925	18.1502	0.0336		1.1868	1.1868		1.0919	1.0919		3,256.5792	3,256.5792	1.0532		3,282.9103
Total	**2.4085**	**24.4925**	**18.1502**	**0.0336**	**12.8842**	**1.1868**	**14.0710**	**6.7112**	**1.0919**	**7.8030**		**3,256.5792**	**3,256.5792**	**1.0532**		**3,282.9103**

3.5 Landscaping - 2022

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0491	0.0307	0.3700	1.1800e-003	0.1232	8.3000e-004	0.1241	0.0327	7.7000e-004	0.0335		117.6840	117.6840	3.2000e-003		117.7639
Total	**0.0491**	**0.0307**	**0.3700**	**1.1800e-003**	**0.1232**	**8.3000e-004**	**0.1241**	**0.0327**	**7.7000e-004**	**0.0335**		**117.6840**	**117.6840**	**3.2000e-003**		**117.7639**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					5.7979	0.0000	5.7979	3.0200	0.0000	3.0200			0.0000			0.0000
Off-Road	2.4085	24.4925	18.1502	0.0336		1.1868	1.1868		1.0919	1.0919	0.0000	3,256.5792	3,256.5792	1.0532		3,282.9102
Total	**2.4085**	**24.4925**	**18.1502**	**0.0336**	**5.7979**	**1.1868**	**6.9847**	**3.0200**	**1.0919**	**4.1119**	**0.0000**	**3,256.5792**	**3,256.5792**	**1.0532**		**3,282.9102**

3.5 Landscaping - 2022

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0491	0.0307	0.3700	1.1800e-003	0.1232	8.3000e-004	0.1241	0.0327	7.7000e-004	0.0335		117.6840	117.6840	3.2000e-003		117.7639
Total	**0.0491**	**0.0307**	**0.3700**	**1.1800e-003**	**0.1232**	**8.3000e-004**	**0.1241**	**0.0327**	**7.7000e-004**	**0.0335**		**117.6840**	**117.6840**	**3.2000e-003**		**117.7639**

3.6 Breech Excavation - 2022

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	3.7533	38.7286	20.8383	0.0445		1.8413	1.8413		1.6940	1.6940		4,308.1720	4,308.1720	1.3934		4,343.0057
Total	**3.7533**	**38.7286**	**20.8383**	**0.0445**		**1.8413**	**1.8413**		**1.6940**	**1.6940**		**4,308.1720**	**4,308.1720**	**1.3934**		**4,343.0057**

3.6 Breech Excavation - 2022

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0491	0.0307	0.3700	1.1800e-003	0.1232	8.3000e-004	0.1241	0.0327	7.7000e-004	0.0335		117.6840	117.6840	3.2000e-003		117.7639
Total	**0.0491**	**0.0307**	**0.3700**	**1.1800e-003**	**0.1232**	**8.3000e-004**	**0.1241**	**0.0327**	**7.7000e-004**	**0.0335**		**117.6840**	**117.6840**	**3.2000e-003**		**117.7639**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	3.7533	38.7286	20.8383	0.0445		1.8413	1.8413		1.6940	1.6940	0.0000	4,308.1720	4,308.1720	1.3934		4,343.0057
Total	**3.7533**	**38.7286**	**20.8383**	**0.0445**		**1.8413**	**1.8413**		**1.6940**	**1.6940**	**0.0000**	**4,308.1720**	**4,308.1720**	**1.3934**		**4,343.0057**

3.6 Breech Excavation - 2022

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0491	0.0307	0.3700	1.1800e-003	0.1232	8.3000e-004	0.1241	0.0327	7.7000e-004	0.0335		117.6840	117.6840	3.2000e-003		117.7639
Total	**0.0491**	**0.0307**	**0.3700**	**1.1800e-003**	**0.1232**	**8.3000e-004**	**0.1241**	**0.0327**	**7.7000e-004**	**0.0335**		**117.6840**	**117.6840**	**3.2000e-003**		**117.7639**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Other Non-Asphalt Surfaces	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
Other Non-Asphalt Surfaces	9.50	7.30	7.30	0.00	0.00	0.00	0	0	0

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
Other Non-Asphalt Surfaces	0.598645	0.040929	0.181073	0.106149	0.015683	0.005479	0.016317	0.023976	0.001926	0.001932	0.006016	0.000753	0.001122

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Other Non-Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Other Non-Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	2.2549	9.0000e-005	9.7100e-003	0.0000		3.0000e-005	3.0000e-005		3.0000e-005	3.0000e-005		0.0208	0.0208	5.0000e-005		0.0222
Unmitigated	2.2549	9.0000e-005	9.7100e-003	0.0000		3.0000e-005	3.0000e-005		3.0000e-005	3.0000e-005		0.0208	0.0208	5.0000e-005		0.0222

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.7882					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	1.4658					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Landscaping	9.0000e-004	9.0000e-005	9.7100e-003	0.0000		3.0000e-005	3.0000e-005		3.0000e-005	3.0000e-005		0.0208	0.0208	5.0000e-005		0.0222
Total	**2.2549**	**9.0000e-005**	**9.7100e-003**	**0.0000**		**3.0000e-005**	**3.0000e-005**		**3.0000e-005**	**3.0000e-005**		**0.0208**	**0.0208**	**5.0000e-005**		**0.0222**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.7882					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	1.4658					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Landscaping	9.0000e-004	9.0000e-005	9.7100e-003	0.0000		3.0000e-005	3.0000e-005		3.0000e-005	3.0000e-005		0.0208	0.0208	5.0000e-005		0.0222
Total	**2.2549**	**9.0000e-005**	**9.7100e-003**	**0.0000**		**3.0000e-005**	**3.0000e-005**		**3.0000e-005**	**3.0000e-005**		**0.0208**	**0.0208**	**5.0000e-005**		**0.0222**

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

11.0 Vegetation

Port of San Diego Mitigation Bank

San Diego Air Basin, Winter

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Other Non-Asphalt Surfaces	95.00	Acre	95.00	4,138,200.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.6	**Precipitation Freq (Days)**	40
Climate Zone	13			**Operational Year**	2022
Utility Company	San Diego Gas & Electric				
CO2 Intensity (lb/MWhr)	720.49	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use -

Construction Phase - Phasing and durations based on project description

Off-road Equipment - Equipment list from project description

Off-road Equipment - Equipment list from project description

Off-road Equipment - Equipment list from project description

Off-road Equipment - Equipment list from project description

Grading - Total area graded is 80 acres

Off-road Equipment -

Trips and VMT - Haul truck trips and employee trips are from the project description

Construction Off-road Equipment Mitigation -

Table Name	Column Name	Default Value	New Value
tblConstructionPhase	NumDays	60.00	47.00
tblConstructionPhase	NumDays	155.00	107.00
tblConstructionPhase	NumDays	155.00	101.00
tblConstructionPhase	NumDaysWeek	5.00	6.00
tblConstructionPhase	NumDaysWeek	5.00	6.00
tblConstructionPhase	NumDaysWeek	5.00	6.00
tblConstructionPhase	NumDaysWeek	5.00	6.00
tblConstructionPhase	NumDaysWeek	5.00	6.00
tblConstructionPhase	PhaseEndDate	3/18/2022	8/27/2021
tblConstructionPhase	PhaseEndDate	8/13/2021	2/26/2021
tblConstructionPhase	PhaseStartDate	8/14/2021	3/1/2021
tblConstructionPhase	PhaseStartDate	5/22/2021	1/4/2021
tblGrading	AcresOfGrading	310.00	80.00
tblGrading	AcresOfGrading	0.00	80.00

tblGrading	AcresOfGrading	214.00	80.00
tblGrading	AcresOfGrading	0.00	80.00
tblGrading	MaterialExported	0.00	537,500.00
tblOffRoadEquipment	OffRoadEquipmentType		Excavators
tblOffRoadEquipment	OffRoadEquipmentType		Rubber Tired Dozers
tblOffRoadEquipment	OffRoadEquipmentType		Rubber Tired Dozers
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	3.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	4.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	3.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	4.00
tblTripsAndVMT	HaulingTripNumber	0.00	216.00
tblTripsAndVMT	HaulingTripNumber	67,188.00	12,480.00
tblTripsAndVMT	HaulingTripNumber	0.00	1,920.00

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2021	6.9138	88.2485	44.3520	0.1401	20.7543	3.1111	23.8654	10.5145	2.8646	13.3791	0.0000	14,358.1325	14,358.1325	3.0332	0.0000	14,433.9629
2022	3.8090	38.7631	21.1853	0.0456	13.0074	1.8421	14.1950	6.7438	1.6948	7.8365	0.0000	4,418.6508	4,418.6508	1.3964	0.0000	4,453.5600
Maximum	**6.9138**	**88.2485**	**44.3520**	**0.1401**	**20.7543**	**3.1111**	**23.8654**	**10.5145**	**2.8646**	**13.3791**	**0.0000**	**14,358.1325**	**14,358.1325**	**3.0332**	**0.0000**	**14,433.9629**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2021	6.9138	88.2485	44.3520	0.1401	10.2488	3.1111	13.3599	4.9796	2.8646	7.8442	0.0000	14,358.1325	14,358.1325	3.0332	0.0000	14,433.9629
2022	3.8090	38.7631	21.1853	0.0456	5.9211	1.8421	7.1087	3.0527	1.6948	4.1453	0.0000	4,418.6508	4,418.6508	1.3964	0.0000	4,453.5600
Maximum	**6.9138**	**88.2485**	**44.3520**	**0.1401**	**10.2488**	**3.1111**	**13.3599**	**4.9796**	**2.8646**	**7.8442**	**0.0000**	**14,358.1325**	**14,358.1325**	**3.0332**	**0.0000**	**14,433.9629**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**52.11**	**0.00**	**46.22**	**53.46**	**0.00**	**43.49**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	2.2549	9.0000e-005	9.7100e-003	0.0000		3.0000e-005	3.0000e-005		3.0000e-005	3.0000e-005		0.0208	0.0208	5.0000e-005		0.0222
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**2.2549**	**9.0000e-005**	**9.7100e-003**	**0.0000**	**0.0000**	**3.0000e-005**	**3.0000e-005**	**0.0000**	**3.0000e-005**	**3.0000e-005**		**0.0208**	**0.0208**	**5.0000e-005**	**0.0000**	**0.0222**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	2.2549	9.0000e-005	9.7100e-003	0.0000		3.0000e-005	3.0000e-005		3.0000e-005	3.0000e-005		0.0208	0.0208	5.0000e-005		0.0222
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**2.2549**	**9.0000e-005**	**9.7100e-003**	**0.0000**	**0.0000**	**3.0000e-005**	**3.0000e-005**	**0.0000**	**3.0000e-005**	**3.0000e-005**		**0.0208**	**0.0208**	**5.0000e-005**	**0.0000**	**0.0222**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Clearing and Grubbing	Site Preparation	1/4/2021	2/26/2021	6	47	
2	Mass Grading	Grading	3/1/2021	8/27/2021	6	155	
3	Fine Grading	Grading	8/30/2021	12/31/2021	6	107	
4	Landscaping	Grading	1/3/2022	4/29/2022	6	101	
5	Breech Excavation	Trenching	5/2/2022	5/27/2022	6	23	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 95

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0; Striped Parking Area: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Fine Grading	Excavators	2	8.00	158	0.38
Landscaping	Excavators	2	8.00	158	0.38
Fine Grading	Graders	2	8.00	187	0.41
Landscaping	Graders	0	8.00	187	0.41
Mass Grading	Excavators	2	8.00	158	0.38
Fine Grading	Rubber Tired Dozers	3	8.00	247	0.40
Landscaping	Rubber Tired Dozers	2	8.00	247	0.40
Mass Grading	Graders	2	8.00	187	0.41
Fine Grading	Scrapers	1	8.00	367	0.48
Landscaping	Scrapers	0	8.00	367	0.48
Fine Grading	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Landscaping	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Mass Grading	Rubber Tired Dozers	3	8.00	247	0.40
Clearing and Grubbing	Rubber Tired Dozers	3	8.00	247	0.40
Mass Grading	Scrapers	1	8.00	367	0.48
Breech Excavation	Excavators	2	8.00	158	0.38
Mass Grading	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Clearing and Grubbing	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Breech Excavation	Rubber Tired Dozers	2	8.00	247	0.40
Breech Excavation	Rubber Tired Dozers	2	8.00	247	0.40

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Fine Grading	12	30.00	0.00	216.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Landscaping	6	15.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Breech Excavation	6	15.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Mass Grading	12	30.00	0.00	12,480.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Clearing and Grubbing	7	18.00	0.00	1,920.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Water Exposed Area

3.2 Clearing and Grubbing - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					19.8714	0.0000	19.8714	10.1256	0.0000	10.1256			0.0000			0.0000
Off-Road	3.8882	40.4971	21.1543	0.0380		2.0445	2.0445		1.8809	1.8809		3,685.6569	3,685.6569	1.1920		3,715.4573
Total	**3.8882**	**40.4971**	**21.1543**	**0.0380**	**19.8714**	**2.0445**	**21.9158**	**10.1256**	**1.8809**	**12.0065**		**3,685.6569**	**3,685.6569**	**1.1920**		**3,715.4573**

3.2 Clearing and Grubbing - 2021

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.3116	10.5618	2.7230	0.0310	0.7138	0.0326	0.7465	0.1956	0.0312	0.2268		3,395.0062	3,395.0062	0.3152		3,402.8861
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0706	0.0454	0.4488	1.3800e-003	0.1479	1.0200e-003	0.1489	0.0392	9.4000e-004	0.0402		137.6186	137.6186	3.9500e-003		137.7174
Total	**0.3822**	**10.6072**	**3.1718**	**0.0323**	**0.8617**	**0.0337**	**0.8953**	**0.2349**	**0.0322**	**0.2670**		**3,532.6248**	**3,532.6248**	**0.3192**		**3,540.6035**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.9421	0.0000	8.9421	4.5565	0.0000	4.5565			0.0000			0.0000
Off-Road	3.8882	40.4971	21.1543	0.0380		2.0445	2.0445		1.8809	1.8809	0.0000	3,685.6569	3,685.6569	1.1920		3,715.4573
Total	**3.8882**	**40.4971**	**21.1543**	**0.0380**	**8.9421**	**2.0445**	**10.9866**	**4.5565**	**1.8809**	**6.4374**	**0.0000**	**3,685.6569**	**3,685.6569**	**1.1920**		**3,715.4573**

3.2 Clearing and Grubbing - 2021

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.3116	10.5618	2.7230	0.0310	0.7138	0.0326	0.7465	0.1956	0.0312	0.2268		3,395.0062	3,395.0062	0.3152		3,402.8861
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0706	0.0454	0.4488	1.3800e-003	0.1479	1.0200e-003	0.1489	0.0392	9.4000e-004	0.0402		137.6186	137.6186	3.9500e-003		137.7174
Total	**0.3822**	**10.6072**	**3.1718**	**0.0323**	**0.8617**	**0.0337**	**0.8953**	**0.2349**	**0.0322**	**0.2670**		**3,532.6248**	**3,532.6248**	**0.3192**		**3,540.6035**

3.3 Mass Grading - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					19.1009	0.0000	19.1009	10.0636	0.0000	10.0636			0.0000			0.0000
Off-Road	6.1820	67.3558	38.2370	0.0768		3.0451	3.0451		2.8015	2.8015		7,437.3206	7,437.3206	2.4054		7,497.4551
Total	**6.1820**	**67.3558**	**38.2370**	**0.0768**	**19.1009**	**3.0451**	**22.1460**	**10.0636**	**2.8015**	**12.8651**		**7,437.3206**	**7,437.3206**	**2.4054**		**7,497.4551**

3.3 Mass Grading - 2021

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.6142	20.8170	5.3670	0.0610	1.4069	0.0643	1.4712	0.3856	0.0615	0.4471		6,691.4477	6,691.4477	0.6212		6,706.9788
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1177	0.0757	0.7480	2.3000e-003	0.2464	1.7000e-003	0.2482	0.0654	1.5700e-003	0.0669		229.3643	229.3643	6.5900e-003		229.5290
Total	**0.7319**	**20.8926**	**6.1150**	**0.0633**	**1.6534**	**0.0660**	**1.7194**	**0.4509**	**0.0631**	**0.5140**		**6,920.8120**	**6,920.8120**	**0.6278**		**6,936.5078**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.5954	0.0000	8.5954	4.5286	0.0000	4.5286			0.0000			0.0000
Off-Road	6.1820	67.3558	38.2370	0.0768		3.0451	3.0451		2.8015	2.8015	0.0000	7,437.3206	7,437.3206	2.4054		7,497.4551
Total	**6.1820**	**67.3558**	**38.2370**	**0.0768**	**8.5954**	**3.0451**	**11.6405**	**4.5286**	**2.8015**	**7.3301**	**0.0000**	**7,437.3206**	**7,437.3206**	**2.4054**		**7,497.4551**

3.3 Mass Grading - 2021

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.6142	20.8170	5.3670	0.0610	1.4069	0.0643	1.4712	0.3856	0.0615	0.4471		6,691.4477	6,691.4477	0.6212		6,706.9788
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1177	0.0757	0.7480	2.3000e-003	0.2464	1.7000e-003	0.2482	0.0654	1.5700e-003	0.0669		229.3643	229.3643	6.5900e-003		229.5290
Total	**0.7319**	**20.8926**	**6.1150**	**0.0633**	**1.6534**	**0.0660**	**1.7194**	**0.4509**	**0.0631**	**0.5140**		**6,920.8120**	**6,920.8120**	**0.6278**		**6,936.5078**

3.4 Fine Grading - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					18.8592	0.0000	18.8592	10.0163	0.0000	10.0163			0.0000			0.0000
Off-Road	6.1820	67.3558	38.2370	0.0768		3.0451	3.0451		2.8015	2.8015		7,437.3206	7,437.3206	2.4054		7,497.4551
Total	**6.1820**	**67.3558**	**38.2370**	**0.0768**	**18.8592**	**3.0451**	**21.9043**	**10.0163**	**2.8015**	**12.8178**		**7,437.3206**	**7,437.3206**	**2.4054**		**7,497.4551**

3.4 Fine Grading - 2021

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0154	0.5219	0.1346	1.5300e-003	0.0353	1.6100e-003	0.0369	9.6700e-003	1.5400e-003	0.0112		167.7673	167.7673	0.0156		168.1566
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1177	0.0757	0.7480	2.3000e-003	0.2464	1.7000e-003	0.2482	0.0654	1.5700e-003	0.0669		229.3643	229.3643	6.5900e-003		229.5290
Total	**0.1331**	**0.5976**	**0.8825**	**3.8300e-003**	**0.2817**	**3.3100e-003**	**0.2850**	**0.0750**	**3.1100e-003**	**0.0782**		**397.1315**	**397.1315**	**0.0222**		**397.6857**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.4866	0.0000	8.4866	4.5073	0.0000	4.5073			0.0000			0.0000
Off-Road	6.1820	67.3558	38.2370	0.0768		3.0451	3.0451		2.8015	2.8015	0.0000	7,437.3206	7,437.3206	2.4054		7,497.4551
Total	**6.1820**	**67.3558**	**38.2370**	**0.0768**	**8.4866**	**3.0451**	**11.5317**	**4.5073**	**2.8015**	**7.3088**	**0.0000**	**7,437.3206**	**7,437.3206**	**2.4054**		**7,497.4551**

3.4 Fine Grading - 2021

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0154	0.5219	0.1346	1.5300e-003	0.0353	1.6100e-003	0.0369	9.6700e-003	1.5400e-003	0.0112		167.7673	167.7673	0.0156		168.1566
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1177	0.0757	0.7480	2.3000e-003	0.2464	1.7000e-003	0.2482	0.0654	1.5700e-003	0.0669		229.3643	229.3643	6.5900e-003		229.5290
Total	**0.1331**	**0.5976**	**0.8825**	**3.8300e-003**	**0.2817**	**3.3100e-003**	**0.2850**	**0.0750**	**3.1100e-003**	**0.0782**		**397.1315**	**397.1315**	**0.0222**		**397.6857**

3.5 Landscaping - 2022

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					12.8842	0.0000	12.8842	6.7112	0.0000	6.7112			0.0000			0.0000
Off-Road	2.4085	24.4925	18.1502	0.0336		1.1868	1.1868		1.0919	1.0919		3,256.5792	3,256.5792	1.0532		3,282.9103
Total	**2.4085**	**24.4925**	**18.1502**	**0.0336**	**12.8842**	**1.1868**	**14.0710**	**6.7112**	**1.0919**	**7.8030**		**3,256.5792**	**3,256.5792**	**1.0532**		**3,282.9103**

3.5 Landscaping - 2022

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0558	0.0345	0.3470	1.1100e-003	0.1232	8.3000e-004	0.1241	0.0327	7.7000e-004	0.0335		110.4788	110.4788	3.0200e-003		110.5543
Total	**0.0558**	**0.0345**	**0.3470**	**1.1100e-003**	**0.1232**	**8.3000e-004**	**0.1241**	**0.0327**	**7.7000e-004**	**0.0335**		**110.4788**	**110.4788**	**3.0200e-003**		**110.5543**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					5.7979	0.0000	5.7979	3.0200	0.0000	3.0200			0.0000			0.0000
Off-Road	2.4085	24.4925	18.1502	0.0336		1.1868	1.1868		1.0919	1.0919	0.0000	3,256.5792	3,256.5792	1.0532		3,282.9102
Total	**2.4085**	**24.4925**	**18.1502**	**0.0336**	**5.7979**	**1.1868**	**6.9847**	**3.0200**	**1.0919**	**4.1119**	**0.0000**	**3,256.5792**	**3,256.5792**	**1.0532**		**3,282.9102**

3.5 Landscaping - 2022

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0558	0.0345	0.3470	1.1100e-003	0.1232	8.3000e-004	0.1241	0.0327	7.7000e-004	0.0335		110.4788	110.4788	3.0200e-003		110.5543
Total	**0.0558**	**0.0345**	**0.3470**	**1.1100e-003**	**0.1232**	**8.3000e-004**	**0.1241**	**0.0327**	**7.7000e-004**	**0.0335**		**110.4788**	**110.4788**	**3.0200e-003**		**110.5543**

3.6 Breech Excavation - 2022

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	3.7533	38.7286	20.8383	0.0445		1.8413	1.8413		1.6940	1.6940		4,308.1720	4,308.1720	1.3934		4,343.0057
Total	**3.7533**	**38.7286**	**20.8383**	**0.0445**		**1.8413**	**1.8413**		**1.6940**	**1.6940**		**4,308.1720**	**4,308.1720**	**1.3934**		**4,343.0057**

3.6 Breech Excavation - 2022

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0558	0.0345	0.3470	1.1100e-003	0.1232	8.3000e-004	0.1241	0.0327	7.7000e-004	0.0335		110.4788	110.4788	3.0200e-003		110.5543
Total	**0.0558**	**0.0345**	**0.3470**	**1.1100e-003**	**0.1232**	**8.3000e-004**	**0.1241**	**0.0327**	**7.7000e-004**	**0.0335**		**110.4788**	**110.4788**	**3.0200e-003**		**110.5543**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	3.7533	38.7286	20.8383	0.0445		1.8413	1.8413		1.6940	1.6940	0.0000	4,308.1720	4,308.1720	1.3934		4,343.0057
Total	**3.7533**	**38.7286**	**20.8383**	**0.0445**		**1.8413**	**1.8413**		**1.6940**	**1.6940**	**0.0000**	**4,308.1720**	**4,308.1720**	**1.3934**		**4,343.0057**

3.6 Breech Excavation - 2022

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0558	0.0345	0.3470	1.1100e-003	0.1232	8.3000e-004	0.1241	0.0327	7.7000e-004	0.0335		110.4788	110.4788	3.0200e-003		110.5543
Total	**0.0558**	**0.0345**	**0.3470**	**1.1100e-003**	**0.1232**	**8.3000e-004**	**0.1241**	**0.0327**	**7.7000e-004**	**0.0335**		**110.4788**	**110.4788**	**3.0200e-003**		**110.5543**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Other Non-Asphalt Surfaces	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
Other Non-Asphalt Surfaces	9.50	7.30	7.30	0.00	0.00	0.00	0	0	0

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
Other Non-Asphalt Surfaces	0.598645	0.040929	0.181073	0.106149	0.015683	0.005479	0.016317	0.023976	0.001926	0.001932	0.006016	0.000753	0.001122

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Other Non-Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Other Non-Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	2.2549	9.0000e-005	9.7100e-003	0.0000		3.0000e-005	3.0000e-005		3.0000e-005	3.0000e-005		0.0208	0.0208	5.0000e-005		0.0222
Unmitigated	2.2549	9.0000e-005	9.7100e-003	0.0000		3.0000e-005	3.0000e-005		3.0000e-005	3.0000e-005		0.0208	0.0208	5.0000e-005		0.0222

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.7882					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	1.4658					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Landscaping	9.0000e-004	9.0000e-005	9.7100e-003	0.0000		3.0000e-005	3.0000e-005		3.0000e-005	3.0000e-005		0.0208	0.0208	5.0000e-005		0.0222
Total	**2.2549**	**9.0000e-005**	**9.7100e-003**	**0.0000**		**3.0000e-005**	**3.0000e-005**		**3.0000e-005**	**3.0000e-005**		**0.0208**	**0.0208**	**5.0000e-005**		**0.0222**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.7882					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	1.4658					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Landscaping	9.0000e-004	9.0000e-005	9.7100e-003	0.0000		3.0000e-005	3.0000e-005		3.0000e-005	3.0000e-005		0.0208	0.0208	5.0000e-005		0.0222
Total	**2.2549**	**9.0000e-005**	**9.7100e-003**	**0.0000**		**3.0000e-005**	**3.0000e-005**		**3.0000e-005**	**3.0000e-005**		**0.0208**	**0.0208**	**5.0000e-005**		**0.0222**

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

11.0 Vegetation

Port of San Diego - Program Analysis

San Diego Air Basin, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Strip Mall	105.00	1000sqft	11.70	105,000.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.6	**Precipitation Freq (Days)**	40
Climate Zone	13			**Operational Year**	2024
Utility Company	San Diego Gas & Electric				
CO2 Intensity (lb/MWhr)	720.49	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - Strip Mall used to represent the specialty retail/strip commercial land use from the traffic study

Construction Phase - Architectural Coating would overlap with construction and paving

Vehicle Trips - trip rate modified to match traffic analysis

Construction Off-road Equipment Mitigation -

Table Name	Column Name	Default Value	New Value
tblConstructionPhase	NumDays	20.00	90.00
tblLandUse	LotAcreage	2.41	11.70
tblVehicleTrips	ST_TR	42.04	40.00
tblVehicleTrips	WD_TR	44.32	40.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2023	0.2360	2.2313	2.2581	4.5300e-003	0.2621	0.0980	0.3601	0.1149	0.0917	0.2066	0.0000	397.8482	397.8482	0.0906	0.0000	400.1123
2024	1.3165	0.8903	1.0990	2.0800e-003	0.0230	0.0383	0.0613	6.2400e-003	0.0361	0.0423	0.0000	182.2612	182.2612	0.0363	0.0000	183.1690
Maximum	**1.3165**	**2.2313**	**2.2581**	**4.5300e-003**	**0.2621**	**0.0980**	**0.3601**	**0.1149**	**0.0917**	**0.2066**	**0.0000**	**397.8482**	**397.8482**	**0.0906**	**0.0000**	**400.1123**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2023	0.2360	2.2313	2.2581	4.5300e-003	0.1409	0.0980	0.2389	0.0580	0.0917	0.1496	0.0000	397.8478	397.8478	0.0906	0.0000	400.1119
2024	1.3165	0.8903	1.0990	2.0800e-003	0.0230	0.0383	0.0613	6.2400e-003	0.0361	0.0423	0.0000	182.2611	182.2611	0.0363	0.0000	183.1689
Maximum	**1.3165**	**2.2313**	**2.2581**	**4.5300e-003**	**0.1409**	**0.0980**	**0.2389**	**0.0580**	**0.0917**	**0.1496**	**0.0000**	**397.8478**	**397.8478**	**0.0906**	**0.0000**	**400.1119**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**42.52**	**0.00**	**28.77**	**47.02**	**0.00**	**22.89**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Quarter	Start Date	End Date	Maximum Unmitigated ROG + NOX (tons/quarter)	Maximum Mitigated ROG + NOX (tons/quarter)
1	**1-2-2023**	**4-1-2023**	0.7094	0.7094
2	**4-2-2023**	**7-1-2023**	0.5672	0.5672
3	**7-2-2023**	**10-1-2023**	0.5734	0.5734
4	**10-2-2023**	**1-1-2024**	0.5736	0.5736
5	**1-2-2024**	**4-1-2024**	1.1125	1.1125
6	**4-2-2024**	**7-1-2024**	1.0335	1.0335
7	**7-2-2024**	**9-30-2024**	0.0151	0.0151
		Highest	1.1125	1.1125

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.5318	1.0000e-005	9.6000e-004	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	1.8800e-003	1.8800e-003	0.0000	0.0000	2.0000e-003
Energy	1.2600e-003	0.0115	9.6400e-003	7.0000e-005		8.7000e-004	8.7000e-004		8.7000e-004	8.7000e-004	0.0000	443.4905	443.4905	0.0176	3.8200e-003	445.0681
Mobile	0.7796	2.9890	7.5933	0.0250	2.2668	0.0203	2.2871	0.6069	0.0189	0.6258	0.0000	2,315.6139	2,315.6139	0.1257	0.0000	2,318.7570
Waste						0.0000	0.0000		0.0000	0.0000	22.3798	0.0000	22.3798	1.3226	0.0000	55.4449
Water						0.0000	0.0000		0.0000	0.0000	2.4675	50.4047	52.8721	0.2555	6.4000e-003	61.1671
Total	**1.3127**	**3.0005**	**7.6039**	**0.0251**	**2.2668**	**0.0212**	**2.2880**	**0.6069**	**0.0198**	**0.6267**	**24.8472**	**2,809.5110**	**2,834.3582**	**1.7214**	**0.0102**	**2,880.4390**

2.2 Overall Operational

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.5318	1.0000e-005	9.6000e-004	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	1.8800e-003	1.8800e-003	0.0000	0.0000	2.0000e-003
Energy	1.2600e-003	0.0115	9.6400e-003	7.0000e-005		8.7000e-004	8.7000e-004		8.7000e-004	8.7000e-004	0.0000	443.4905	443.4905	0.0176	3.8200e-003	445.0681
Mobile	0.7796	2.9890	7.5933	0.0250	2.2668	0.0203	2.2871	0.6069	0.0189	0.6258	0.0000	2,315.6139	2,315.6139	0.1257	0.0000	2,318.7570
Waste						0.0000	0.0000		0.0000	0.0000	22.3798	0.0000	22.3798	1.3226	0.0000	55.4449
Water						0.0000	0.0000		0.0000	0.0000	2.4675	50.4047	52.8721	0.2555	6.4000e-003	61.1671
Total	**1.3127**	**3.0005**	**7.6039**	**0.0251**	**2.2668**	**0.0212**	**2.2880**	**0.6069**	**0.0198**	**0.6267**	**24.8472**	**2,809.5110**	**2,834.3582**	**1.7214**	**0.0102**	**2,880.4390**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Site Preparation	Site Preparation	1/30/2023	2/10/2023	5	10	
2	Grading	Grading	2/13/2023	3/24/2023	5	30	
3	Building Construction	Building Construction	3/27/2023	5/17/2024	5	300	
4	Paving	Paving	6/10/2024	7/5/2024	5	20	
5	Architectural Coating	Architectural Coating	2/5/2024	6/7/2024	5	90	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 75

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 157,500; Non-Residential Outdoor: 52,500; Striped Parking Area: 0 (Architectural Coating – sqft)

<u>OffRoad Equipment</u>

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Site Preparation	Rubber Tired Dozers	3	8.00	247	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	2	8.00	158	0.38
Grading	Graders	1	8.00	187	0.41
Grading	Rubber Tired Dozers	1	8.00	247	0.40
Grading	Scrapers	2	8.00	367	0.48
Grading	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Building Construction	Cranes	1	7.00	231	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45
Paving	Pavers	2	8.00	130	0.42
Paving	Paving Equipment	2	8.00	132	0.36
Paving	Rollers	2	8.00	80	0.38
Architectural Coating	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Site Preparation	7	18.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	8	20.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	34.00	17.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	15.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	7.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Water Exposed Area

3.2 Site Preparation - 2023

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0133	0.1376	0.0912	1.9000e-004		6.3300e-003	6.3300e-003		5.8200e-003	5.8200e-003	0.0000	16.7254	16.7254	5.4100e-003	0.0000	16.8606
Total	**0.0133**	**0.1376**	**0.0912**	**1.9000e-004**	**0.0903**	**6.3300e-003**	**0.0967**	**0.0497**	**5.8200e-003**	**0.0555**	**0.0000**	**16.7254**	**16.7254**	**5.4100e-003**	**0.0000**	**16.8606**

3.2 Site Preparation - 2023

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.8000e-004	1.9000e-004	1.9400e-003	1.0000e-005	7.2000e-004	0.0000	7.3000e-004	1.9000e-004	0.0000	2.0000e-004	0.0000	0.5842	0.5842	2.0000e-005	0.0000	0.5845
Total	**2.8000e-004**	**1.9000e-004**	**1.9400e-003**	**1.0000e-005**	**7.2000e-004**	**0.0000**	**7.3000e-004**	**1.9000e-004**	**0.0000**	**2.0000e-004**	**0.0000**	**0.5842**	**0.5842**	**2.0000e-005**	**0.0000**	**0.5845**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0407	0.0000	0.0407	0.0223	0.0000	0.0223	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0133	0.1376	0.0912	1.9000e-004		6.3300e-003	6.3300e-003		5.8200e-003	5.8200e-003	0.0000	16.7253	16.7253	5.4100e-003	0.0000	16.8606
Total	**0.0133**	**0.1376**	**0.0912**	**1.9000e-004**	**0.0407**	**6.3300e-003**	**0.0470**	**0.0223**	**5.8200e-003**	**0.0282**	**0.0000**	**16.7253**	**16.7253**	**5.4100e-003**	**0.0000**	**16.8606**

3.2 Site Preparation - 2023

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.8000e-004	1.9000e-004	1.9400e-003	1.0000e-005	7.2000e-004	0.0000	7.3000e-004	1.9000e-004	0.0000	2.0000e-004	0.0000	0.5842	0.5842	2.0000e-005	0.0000	0.5845
Total	**2.8000e-004**	**1.9000e-004**	**1.9400e-003**	**1.0000e-005**	**7.2000e-004**	**0.0000**	**7.3000e-004**	**1.9000e-004**	**0.0000**	**2.0000e-004**	**0.0000**	**0.5842**	**0.5842**	**2.0000e-005**	**0.0000**	**0.5845**

3.3 Grading - 2023

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.1301	0.0000	0.1301	0.0540	0.0000	0.0540	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0498	0.5177	0.4208	9.3000e-004		0.0214	0.0214		0.0197	0.0197	0.0000	81.8028	81.8028	0.0265	0.0000	82.4642
Total	**0.0498**	**0.5177**	**0.4208**	**9.3000e-004**	**0.1301**	**0.0214**	**0.1515**	**0.0540**	**0.0197**	**0.0736**	**0.0000**	**81.8028**	**81.8028**	**0.0265**	**0.0000**	**82.4642**

3.3 Grading - 2023

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	9.4000e-004	6.2000e-004	6.4500e-003	2.0000e-005	2.4100e-003	2.0000e-005	2.4200e-003	6.4000e-004	2.0000e-005	6.5000e-004	0.0000	1.9472	1.9472	5.0000e-005	0.0000	1.9485
Total	**9.4000e-004**	**6.2000e-004**	**6.4500e-003**	**2.0000e-005**	**2.4100e-003**	**2.0000e-005**	**2.4200e-003**	**6.4000e-004**	**2.0000e-005**	**6.5000e-004**	**0.0000**	**1.9472**	**1.9472**	**5.0000e-005**	**0.0000**	**1.9485**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0586	0.0000	0.0586	0.0243	0.0000	0.0243	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0498	0.5177	0.4208	9.3000e-004		0.0214	0.0214		0.0197	0.0197	0.0000	81.8027	81.8027	0.0265	0.0000	82.4641
Total	**0.0498**	**0.5177**	**0.4208**	**9.3000e-004**	**0.0586**	**0.0214**	**0.0799**	**0.0243**	**0.0197**	**0.0439**	**0.0000**	**81.8027**	**81.8027**	**0.0265**	**0.0000**	**82.4641**

3.3 Grading - 2023

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	9.4000e-004	6.2000e-004	6.4500e-003	2.0000e-005	2.4100e-003	2.0000e-005	2.4200e-003	6.4000e-004	2.0000e-005	6.5000e-004	0.0000	1.9472	1.9472	5.0000e-005	0.0000	1.9485
Total	**9.4000e-004**	**6.2000e-004**	**6.4500e-003**	**2.0000e-005**	**2.4100e-003**	**2.0000e-005**	**2.4200e-003**	**6.4000e-004**	**2.0000e-005**	**6.5000e-004**	**0.0000**	**1.9472**	**1.9472**	**5.0000e-005**	**0.0000**	**1.9485**

3.4 Building Construction - 2023

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1573	1.4385	1.6244	2.6900e-003		0.0700	0.0700		0.0658	0.0658	0.0000	231.8048	231.8048	0.0551	0.0000	233.1833
Total	**0.1573**	**1.4385**	**1.6244**	**2.6900e-003**		**0.0700**	**0.0700**		**0.0658**	**0.0658**	**0.0000**	**231.8048**	**231.8048**	**0.0551**	**0.0000**	**233.1833**

3.4 Building Construction - 2023

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	3.7700e-003	0.1296	0.0402	4.4000e-004	0.0113	1.6000e-004	0.0114	3.2600e-003	1.5000e-004	3.4100e-003	0.0000	42.9157	42.9157	2.9200e-003	0.0000	42.9886
Worker	0.0106	7.0200e-003	0.0731	2.4000e-004	0.0273	1.9000e-004	0.0275	7.2500e-003	1.7000e-004	7.4200e-003	0.0000	22.0682	22.0682	5.7000e-004	0.0000	22.0825
Total	**0.0144**	**0.1366**	**0.1133**	**6.8000e-004**	**0.0386**	**3.5000e-004**	**0.0389**	**0.0105**	**3.2000e-004**	**0.0108**	**0.0000**	**64.9839**	**64.9839**	**3.4900e-003**	**0.0000**	**65.0711**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1573	1.4385	1.6244	2.6900e-003		0.0700	0.0700		0.0658	0.0658	0.0000	231.8045	231.8045	0.0551	0.0000	233.1830
Total	**0.1573**	**1.4385**	**1.6244**	**2.6900e-003**		**0.0700**	**0.0700**		**0.0658**	**0.0658**	**0.0000**	**231.8045**	**231.8045**	**0.0551**	**0.0000**	**233.1830**

3.4 Building Construction - 2023

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	3.7700e-003	0.1296	0.0402	4.4000e-004	0.0113	1.6000e-004	0.0114	3.2600e-003	1.5000e-004	3.4100e-003	0.0000	42.9157	42.9157	2.9200e-003	0.0000	42.9886
Worker	0.0106	7.0200e-003	0.0731	2.4000e-004	0.0273	1.9000e-004	0.0275	7.2500e-003	1.7000e-004	7.4200e-003	0.0000	22.0682	22.0682	5.7000e-004	0.0000	22.0825
Total	**0.0144**	**0.1366**	**0.1133**	**6.8000e-004**	**0.0386**	**3.5000e-004**	**0.0389**	**0.0105**	**3.2000e-004**	**0.0108**	**0.0000**	**64.9839**	**64.9839**	**3.4900e-003**	**0.0000**	**65.0711**

3.4 Building Construction - 2024

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0736	0.6722	0.8083	1.3500e-003		0.0307	0.0307		0.0288	0.0288	0.0000	115.9246	115.9246	0.0274	0.0000	116.6099
Total	**0.0736**	**0.6722**	**0.8083**	**1.3500e-003**		**0.0307**	**0.0307**		**0.0288**	**0.0288**	**0.0000**	**115.9246**	**115.9246**	**0.0274**	**0.0000**	**116.6099**

3.4 Building Construction - 2024

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	1.8200e-003	0.0639	0.0195	2.2000e-004	5.6400e-003	8.0000e-005	5.7200e-003	1.6300e-003	7.0000e-005	1.7000e-003	0.0000	21.3215	21.3215	1.4400e-003	0.0000	21.3575
Worker	5.0400e-003	3.2200e-003	0.0342	1.2000e-004	0.0136	9.0000e-005	0.0137	3.6200e-003	8.0000e-005	3.7100e-003	0.0000	10.5997	10.5997	2.6000e-004	0.0000	10.6063
Total	**6.8600e-003**	**0.0671**	**0.0536**	**3.4000e-004**	**0.0193**	**1.7000e-004**	**0.0194**	**5.2500e-003**	**1.5000e-004**	**5.4100e-003**	**0.0000**	**31.9212**	**31.9212**	**1.7000e-003**	**0.0000**	**31.9638**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0736	0.6722	0.8083	1.3500e-003		0.0307	0.0307		0.0288	0.0288	0.0000	115.9244	115.9244	0.0274	0.0000	116.6097
Total	**0.0736**	**0.6722**	**0.8083**	**1.3500e-003**		**0.0307**	**0.0307**		**0.0288**	**0.0288**	**0.0000**	**115.9244**	**115.9244**	**0.0274**	**0.0000**	**116.6097**

3.4 Building Construction - 2024

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	1.8200e-003	0.0639	0.0195	2.2000e-004	5.6400e-003	8.0000e-005	5.7200e-003	1.6300e-003	7.0000e-005	1.7000e-003	0.0000	21.3215	21.3215	1.4400e-003	0.0000	21.3575
Worker	5.0400e-003	3.2200e-003	0.0342	1.2000e-004	0.0136	9.0000e-005	0.0137	3.6200e-003	8.0000e-005	3.7100e-003	0.0000	10.5997	10.5997	2.6000e-004	0.0000	10.6063
Total	**6.8600e-003**	**0.0671**	**0.0536**	**3.4000e-004**	**0.0193**	**1.7000e-004**	**0.0194**	**5.2500e-003**	**1.5000e-004**	**5.4100e-003**	**0.0000**	**31.9212**	**31.9212**	**1.7000e-003**	**0.0000**	**31.9638**

3.5 Paving - 2024

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	9.8800e-003	0.0953	0.1463	2.3000e-004		4.6900e-003	4.6900e-003		4.3100e-003	4.3100e-003	0.0000	20.0265	20.0265	6.4800e-003	0.0000	20.1885
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**9.8800e-003**	**0.0953**	**0.1463**	**2.3000e-004**		**4.6900e-003**	**4.6900e-003**		**4.3100e-003**	**4.3100e-003**	**0.0000**	**20.0265**	**20.0265**	**6.4800e-003**	**0.0000**	**20.1885**

3.5 Paving - 2024

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.4000e-004	2.8000e-004	3.0100e-003	1.0000e-005	1.2000e-003	1.0000e-005	1.2100e-003	3.2000e-004	1.0000e-005	3.3000e-004	0.0000	0.9353	0.9353	2.0000e-005	0.0000	0.9359
Total	**4.4000e-004**	**2.8000e-004**	**3.0100e-003**	**1.0000e-005**	**1.2000e-003**	**1.0000e-005**	**1.2100e-003**	**3.2000e-004**	**1.0000e-005**	**3.3000e-004**	**0.0000**	**0.9353**	**0.9353**	**2.0000e-005**	**0.0000**	**0.9359**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	9.8800e-003	0.0953	0.1463	2.3000e-004		4.6900e-003	4.6900e-003		4.3100e-003	4.3100e-003	0.0000	20.0265	20.0265	6.4800e-003	0.0000	20.1884
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**9.8800e-003**	**0.0953**	**0.1463**	**2.3000e-004**		**4.6900e-003**	**4.6900e-003**		**4.3100e-003**	**4.3100e-003**	**0.0000**	**20.0265**	**20.0265**	**6.4800e-003**	**0.0000**	**20.1884**

3.5 Paving - 2024

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.4000e-004	2.8000e-004	3.0100e-003	1.0000e-005	1.2000e-003	1.0000e-005	1.2100e-003	3.2000e-004	1.0000e-005	3.3000e-004	0.0000	0.9353	0.9353	2.0000e-005	0.0000	0.9359
Total	**4.4000e-004**	**2.8000e-004**	**3.0100e-003**	**1.0000e-005**	**1.2000e-003**	**1.0000e-005**	**1.2100e-003**	**3.2000e-004**	**1.0000e-005**	**3.3000e-004**	**0.0000**	**0.9353**	**0.9353**	**2.0000e-005**	**0.0000**	**0.9359**

3.6 Architectural Coating - 2024

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.2167					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	8.1300e-003	0.0549	0.0815	1.3000e-004		2.7400e-003	2.7400e-003		2.7400e-003	2.7400e-003	0.0000	11.4896	11.4896	6.5000e-004	0.0000	11.5058
Total	**1.2248**	**0.0549**	**0.0815**	**1.3000e-004**		**2.7400e-003**	**2.7400e-003**		**2.7400e-003**	**2.7400e-003**	**0.0000**	**11.4896**	**11.4896**	**6.5000e-004**	**0.0000**	**11.5058**

3.6 Architectural Coating - 2024

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	9.3000e-004	6.0000e-004	6.3300e-003	2.0000e-005	2.5300e-003	2.0000e-005	2.5400e-003	6.7000e-004	2.0000e-005	6.9000e-004	0.0000	1.9641	1.9641	5.0000e-005	0.0000	1.9653
Total	**9.3000e-004**	**6.0000e-004**	**6.3300e-003**	**2.0000e-005**	**2.5300e-003**	**2.0000e-005**	**2.5400e-003**	**6.7000e-004**	**2.0000e-005**	**6.9000e-004**	**0.0000**	**1.9641**	**1.9641**	**5.0000e-005**	**0.0000**	**1.9653**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.2167					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	8.1300e-003	0.0549	0.0815	1.3000e-004		2.7400e-003	2.7400e-003		2.7400e-003	2.7400e-003	0.0000	11.4896	11.4896	6.5000e-004	0.0000	11.5058
Total	**1.2248**	**0.0549**	**0.0815**	**1.3000e-004**		**2.7400e-003**	**2.7400e-003**		**2.7400e-003**	**2.7400e-003**	**0.0000**	**11.4896**	**11.4896**	**6.5000e-004**	**0.0000**	**11.5058**

3.6 Architectural Coating - 2024

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	9.3000e-004	6.0000e-004	6.3300e-003	2.0000e-005	2.5300e-003	2.0000e-005	2.5400e-003	6.7000e-004	2.0000e-005	6.9000e-004	0.0000	1.9641	1.9641	5.0000e-005	0.0000	1.9653
Total	**9.3000e-004**	**6.0000e-004**	**6.3300e-003**	**2.0000e-005**	**2.5300e-003**	**2.0000e-005**	**2.5400e-003**	**6.7000e-004**	**2.0000e-005**	**6.9000e-004**	**0.0000**	**1.9641**	**1.9641**	**5.0000e-005**	**0.0000**	**1.9653**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.7796	2.9890	7.5933	0.0250	2.2668	0.0203	2.2871	0.6069	0.0189	0.6258	0.0000	2,315.6139	2,315.6139	0.1257	0.0000	2,318.7570
Unmitigated	0.7796	2.9890	7.5933	0.0250	2.2668	0.0203	2.2871	0.6069	0.0189	0.6258	0.0000	2,315.6139	2,315.6139	0.1257	0.0000	2,318.7570

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Strip Mall	4,200.00	4,200.00	2145.15	6,016,062	6,016,062
Total	4,200.00	4,200.00	2,145.15	6,016,062	6,016,062

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
Strip Mall	9.50	7.30	7.30	16.60	64.40	19.00	45	40	15

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
Strip Mall	0.606234	0.039465	0.179154	0.102641	0.014368	0.005395	0.016820	0.024508	0.001929	0.001857	0.005869	0.000761	0.000998

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	430.9954	430.9954	0.0174	3.5900e-003	432.4987
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	430.9954	430.9954	0.0174	3.5900e-003	432.4987
NaturalGas Mitigated	1.2600e-003	0.0115	9.6400e-003	7.0000e-005		8.7000e-004	8.7000e-004		8.7000e-004	8.7000e-004	0.0000	12.4951	12.4951	2.4000e-004	2.3000e-004	12.5694
NaturalGas Unmitigated	1.2600e-003	0.0115	9.6400e-003	7.0000e-005		8.7000e-004	8.7000e-004		8.7000e-004	8.7000e-004	0.0000	12.4951	12.4951	2.4000e-004	2.3000e-004	12.5694

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
Strip Mall	234150	1.2600e-003	0.0115	9.6400e-003	7.0000e-005		8.7000e-004	8.7000e-004		8.7000e-004	8.7000e-004	0.0000	12.4951	12.4951	2.4000e-004	2.3000e-004	12.5694
Total		**1.2600e-003**	**0.0115**	**9.6400e-003**	**7.0000e-005**		**8.7000e-004**	**8.7000e-004**		**8.7000e-004**	**8.7000e-004**	**0.0000**	**12.4951**	**12.4951**	**2.4000e-004**	**2.3000e-004**	**12.5694**

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
Strip Mall	234150	1.2600e-003	0.0115	9.6400e-003	7.0000e-005		8.7000e-004	8.7000e-004		8.7000e-004	8.7000e-004	0.0000	12.4951	12.4951	2.4000e-004	2.3000e-004	12.5694
Total		**1.2600e-003**	**0.0115**	**9.6400e-003**	**7.0000e-005**		**8.7000e-004**	**8.7000e-004**		**8.7000e-004**	**8.7000e-004**	**0.0000**	**12.4951**	**12.4951**	**2.4000e-004**	**2.3000e-004**	**12.5694**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
Strip Mall	1.3188e+006	430.9954	0.0174	3.5900e-003	432.4987
Total		**430.9954**	**0.0174**	**3.5900e-003**	**432.4987**

5.3 Energy by Land Use - Electricity

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
Strip Mall	1.3188e+006	430.9954	0.0174	3.5900e-003	432.4987
Total		**430.9954**	**0.0174**	**3.5900e-003**	**432.4987**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.5318	1.0000e-005	9.6000e-004	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	1.8800e-003	1.8800e-003	0.0000	0.0000	2.0000e-003
Unmitigated	0.5318	1.0000e-005	9.6000e-004	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	1.8800e-003	1.8800e-003	0.0000	0.0000	2.0000e-003

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.1217					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.4101					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	9.0000e-005	1.0000e-005	9.6000e-004	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	1.8800e-003	1.8800e-003	0.0000	0.0000	2.0000e-003
Total	**0.5318**	**1.0000e-005**	**9.6000e-004**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**1.8800e-003**	**1.8800e-003**	**0.0000**	**0.0000**	**2.0000e-003**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.1217					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.4101					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	9.0000e-005	1.0000e-005	9.6000e-004	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	1.8800e-003	1.8800e-003	0.0000	0.0000	2.0000e-003
Total	**0.5318**	**1.0000e-005**	**9.6000e-004**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**1.8800e-003**	**1.8800e-003**	**0.0000**	**0.0000**	**2.0000e-003**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	52.8721	0.2555	6.4000e-003	61.1671
Unmitigated	52.8721	0.2555	6.4000e-003	61.1671

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
Strip Mall	7.77761 / 4.76693	52.8721	0.2555	6.4000e-003	61.1671
Total		**52.8721**	**0.2555**	**6.4000e-003**	**61.1671**

7.2 Water by Land Use

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
Strip Mall	7.77761 / 4.76693	52.8721	0.2555	6.4000e-003	61.1671
Total		**52.8721**	**0.2555**	**6.4000e-003**	**61.1671**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	22.3798	1.3226	0.0000	55.4449
Unmitigated	22.3798	1.3226	0.0000	55.4449

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
Strip Mall	110.25	22.3798	1.3226	0.0000	55.4449
Total		**22.3798**	**1.3226**	**0.0000**	**55.4449**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
Strip Mall	110.25	22.3798	1.3226	0.0000	55.4449
Total		**22.3798**	**1.3226**	**0.0000**	**55.4449**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

11.0 Vegetation

Port of San Diego - Program Analysis

San Diego Air Basin, Summer

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Strip Mall	105.00	1000sqft	11.70	105,000.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.6	**Precipitation Freq (Days)**	40
Climate Zone	13			**Operational Year**	2024
Utility Company	San Diego Gas & Electric				
CO2 Intensity (lb/MWhr)	720.49	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - Strip Mall used to represent the specialty retail/strip commercial land use from the traffic study

Construction Phase - Architectural Coating would overlap with construction and paving

Vehicle Trips - trip rate modified to match traffic analysis

Construction Off-road Equipment Mitigation -

Table Name	Column Name	Default Value	New Value
tblConstructionPhase	NumDays	20.00	90.00
tblLandUse	LotAcreage	2.41	11.70
tblVehicleTrips	ST_TR	42.04	40.00
tblVehicleTrips	WD_TR	44.32	40.00

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2023	3.3837	34.5530	28.5094	0.0636	18.2141	1.4256	19.4811	9.9699	1.3115	11.1355	0.0000	6,162.3911	6,162.3911	1.9481	0.0000	6,211.0945
2024	28.8460	16.0029	19.2260	0.0373	0.4519	0.6779	1.1298	0.1225	0.6413	0.7637	0.0000	3,609.4932	3,609.4932	0.7167	0.0000	3,625.9581
Maximum	**28.8460**	**34.5530**	**28.5094**	**0.0636**	**18.2141**	**1.4256**	**19.4811**	**9.9699**	**1.3115**	**11.1355**	**0.0000**	**6,162.3911**	**6,162.3911**	**1.9481**	**0.0000**	**6,211.0945**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2023	3.3837	34.5530	28.5094	0.0636	8.2777	1.4256	9.5447	4.5080	1.3115	5.6737	0.0000	6,162.3911	6,162.3911	1.9481	0.0000	6,211.0945
2024	28.8460	16.0029	19.2260	0.0373	0.4519	0.6779	1.1298	0.1225	0.6413	0.7637	0.0000	3,609.4932	3,609.4932	0.7167	0.0000	3,625.9581
Maximum	**28.8460**	**34.5530**	**28.5094**	**0.0636**	**8.2777**	**1.4256**	**9.5447**	**4.5080**	**1.3115**	**5.6737**	**0.0000**	**6,162.3911**	**6,162.3911**	**1.9481**	**0.0000**	**6,211.0945**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**53.23**	**0.00**	**48.21**	**54.12**	**0.00**	**45.90**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	2.9147	1.0000e-004	0.0107	0.0000		4.0000e-005	4.0000e-005		4.0000e-005	4.0000e-005		0.0230	0.0230	6.0000e-005		0.0245
Energy	6.9200e-003	0.0629	0.0528	3.8000e-004		4.7800e-003	4.7800e-003		4.7800e-003	4.7800e-003		75.4714	75.4714	1.4500e-003	1.3800e-003	75.9199
Mobile	4.9196	17.3021	45.0176	0.1543	13.7127	0.1198	13.8325	3.6644	0.1114	3.7758		15,735.0701	15,735.0701	0.8155		15,755.4584
Total	**7.8412**	**17.3651**	**45.0812**	**0.1546**	**13.7127**	**0.1246**	**13.8373**	**3.6644**	**0.1162**	**3.7806**		**15,810.5644**	**15,810.5644**	**0.8170**	**1.3800e-003**	**15,831.4028**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	2.9147	1.0000e-004	0.0107	0.0000		4.0000e-005	4.0000e-005		4.0000e-005	4.0000e-005		0.0230	0.0230	6.0000e-005		0.0245
Energy	6.9200e-003	0.0629	0.0528	3.8000e-004		4.7800e-003	4.7800e-003		4.7800e-003	4.7800e-003		75.4714	75.4714	1.4500e-003	1.3800e-003	75.9199
Mobile	4.9196	17.3021	45.0176	0.1543	13.7127	0.1198	13.8325	3.6644	0.1114	3.7758		15,735.0701	15,735.0701	0.8155		15,755.4584
Total	**7.8412**	**17.3651**	**45.0812**	**0.1546**	**13.7127**	**0.1246**	**13.8373**	**3.6644**	**0.1162**	**3.7806**		**15,810.5644**	**15,810.5644**	**0.8170**	**1.3800e-003**	**15,831.4028**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Site Preparation	Site Preparation	1/30/2023	2/10/2023	5	10	
2	Grading	Grading	2/13/2023	3/24/2023	5	30	
3	Building Construction	Building Construction	3/27/2023	5/17/2024	5	300	
4	Paving	Paving	6/10/2024	7/5/2024	5	20	
5	Architectural Coating	Architectural Coating	2/5/2024	6/7/2024	5	90	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 75

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 157,500; Non-Residential Outdoor: 52,500; Striped Parking Area: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Site Preparation	Rubber Tired Dozers	3	8.00	247	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	2	8.00	158	0.38
Grading	Graders	1	8.00	187	0.41
Grading	Rubber Tired Dozers	1	8.00	247	0.40
Grading	Scrapers	2	8.00	367	0.48
Grading	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Building Construction	Cranes	1	7.00	231	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45
Paving	Pavers	2	8.00	130	0.42
Paving	Paving Equipment	2	8.00	132	0.36
Paving	Rollers	2	8.00	80	0.38
Architectural Coating	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Site Preparation	7	18.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	8	20.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	34.00	17.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	15.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	7.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Water Exposed Area

3.2 Site Preparation - 2023

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					18.0663	0.0000	18.0663	9.9307	0.0000	9.9307			0.0000			0.0000
Off-Road	2.6595	27.5242	18.2443	0.0381		1.2660	1.2660		1.1647	1.1647		3,687.3081	3,687.3081	1.1926		3,717.1219
Total	**2.6595**	**27.5242**	**18.2443**	**0.0381**	**18.0663**	**1.2660**	**19.3323**	**9.9307**	**1.1647**	**11.0954**		**3,687.3081**	**3,687.3081**	**1.1926**		**3,717.1219**

3.2 Site Preparation - 2023

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0557	0.0337	0.4124	1.3600e-003	0.1479	9.8000e-004	0.1489	0.0392	9.0000e-004	0.0401		135.8221	135.8221	3.5100e-003		135.9099
Total	**0.0557**	**0.0337**	**0.4124**	**1.3600e-003**	**0.1479**	**9.8000e-004**	**0.1489**	**0.0392**	**9.0000e-004**	**0.0401**		**135.8221**	**135.8221**	**3.5100e-003**		**135.9099**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.1298	0.0000	8.1298	4.4688	0.0000	4.4688			0.0000			0.0000
Off-Road	2.6595	27.5242	18.2443	0.0381		1.2660	1.2660		1.1647	1.1647	0.0000	3,687.3081	3,687.3081	1.1926		3,717.1219
Total	**2.6595**	**27.5242**	**18.2443**	**0.0381**	**8.1298**	**1.2660**	**9.3958**	**4.4688**	**1.1647**	**5.6336**	**0.0000**	**3,687.3081**	**3,687.3081**	**1.1926**		**3,717.1219**

3.2 Site Preparation - 2023

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0557	0.0337	0.4124	1.3600e-003	0.1479	9.8000e-004	0.1489	0.0392	9.0000e-004	0.0401		135.8221	135.8221	3.5100e-003		135.9099
Total	**0.0557**	**0.0337**	**0.4124**	**1.3600e-003**	**0.1479**	**9.8000e-004**	**0.1489**	**0.0392**	**9.0000e-004**	**0.0401**		**135.8221**	**135.8221**	**3.5100e-003**		**135.9099**

3.3 Grading - 2023

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.6733	0.0000	8.6733	3.5965	0.0000	3.5965			0.0000			0.0000
Off-Road	3.3217	34.5156	28.0512	0.0621		1.4245	1.4245		1.3105	1.3105		6,011.4777	6,011.4777	1.9442		6,060.0836
Total	**3.3217**	**34.5156**	**28.0512**	**0.0621**	**8.6733**	**1.4245**	**10.0978**	**3.5965**	**1.3105**	**4.9070**		**6,011.4777**	**6,011.4777**	**1.9442**		**6,060.0836**

3.3 Grading - 2023

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0619	0.0374	0.4582	1.5100e-003	0.1643	1.0900e-003	0.1654	0.0436	1.0000e-003	0.0446		150.9134	150.9134	3.9000e-003		151.0109
Total	**0.0619**	**0.0374**	**0.4582**	**1.5100e-003**	**0.1643**	**1.0900e-003**	**0.1654**	**0.0436**	**1.0000e-003**	**0.0446**		**150.9134**	**150.9134**	**3.9000e-003**		**151.0109**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					3.9030	0.0000	3.9030	1.6184	0.0000	1.6184			0.0000			0.0000
Off-Road	3.3217	34.5156	28.0512	0.0621		1.4245	1.4245		1.3105	1.3105	0.0000	6,011.4777	6,011.4777	1.9442		6,060.0836
Total	**3.3217**	**34.5156**	**28.0512**	**0.0621**	**3.9030**	**1.4245**	**5.3275**	**1.6184**	**1.3105**	**2.9290**	**0.0000**	**6,011.4777**	**6,011.4777**	**1.9442**		**6,060.0836**

3.3 Grading - 2023

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0619	0.0374	0.4582	1.5100e-003	0.1643	1.0900e-003	0.1654	0.0436	1.0000e-003	0.0446		150.9134	150.9134	3.9000e-003		151.0109
Total	**0.0619**	**0.0374**	**0.4582**	**1.5100e-003**	**0.1643**	**1.0900e-003**	**0.1654**	**0.0436**	**1.0000e-003**	**0.0446**		**150.9134**	**150.9134**	**3.9000e-003**		**151.0109**

3.4 Building Construction - 2023

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.5728	14.3849	16.2440	0.0269		0.6997	0.6997		0.6584	0.6584		2,555.2099	2,555.2099	0.6079		2,570.4061
Total	**1.5728**	**14.3849**	**16.2440**	**0.0269**		**0.6997**	**0.6997**		**0.6584**	**0.6584**		**2,555.2099**	**2,555.2099**	**0.6079**		**2,570.4061**

3.4 Building Construction - 2023

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0369	1.2879	0.3827	4.4300e-003	0.1151	1.5200e-003	0.1166	0.0331	1.4500e-003	0.0346		478.2390	478.2390	0.0314		479.0242
Worker	0.1053	0.0636	0.7790	2.5700e-003	0.2793	1.8500e-003	0.2812	0.0741	1.7000e-003	0.0758		256.5528	256.5528	6.6300e-003		256.7186
Total	**0.1421**	**1.3515**	**1.1617**	**7.0000e-003**	**0.3944**	**3.3700e-003**	**0.3978**	**0.1072**	**3.1500e-003**	**0.1104**		**734.7918**	**734.7918**	**0.0380**		**735.7428**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.5728	14.3849	16.2440	0.0269		0.6997	0.6997		0.6584	0.6584	0.0000	2,555.2099	2,555.2099	0.6079		2,570.4061
Total	**1.5728**	**14.3849**	**16.2440**	**0.0269**		**0.6997**	**0.6997**		**0.6584**	**0.6584**	**0.0000**	**2,555.2099**	**2,555.2099**	**0.6079**		**2,570.4061**

3.4 Building Construction - 2023

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0369	1.2879	0.3827	4.4300e-003	0.1151	1.5200e-003	0.1166	0.0331	1.4500e-003	0.0346		478.2390	478.2390	0.0314		479.0242
Worker	0.1053	0.0636	0.7790	2.5700e-003	0.2793	1.8500e-003	0.2812	0.0741	1.7000e-003	0.0758		256.5528	256.5528	6.6300e-003		256.7186
Total	**0.1421**	**1.3515**	**1.1617**	**7.0000e-003**	**0.3944**	**3.3700e-003**	**0.3978**	**0.1072**	**3.1500e-003**	**0.1104**		**734.7918**	**734.7918**	**0.0380**		**735.7428**

3.4 Building Construction - 2024

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.4716	13.4438	16.1668	0.0270		0.6133	0.6133		0.5769	0.5769		2,555.6989	2,555.6989	0.6044		2,570.8077
Total	**1.4716**	**13.4438**	**16.1668**	**0.0270**		**0.6133**	**0.6133**		**0.5769**	**0.5769**		**2,555.6989**	**2,555.6989**	**0.6044**		**2,570.8077**

3.4 Building Construction - 2024

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0356	1.2700	0.3708	4.3900e-003	0.1151	1.4800e-003	0.1166	0.0331	1.4200e-003	0.0345		475.1630	475.1630	0.0311		475.9392
Worker	0.1000	0.0584	0.7283	2.4700e-003	0.2793	1.8200e-003	0.2811	0.0741	1.6700e-003	0.0758		246.4446	246.4446	6.1000e-003		246.5970
Total	**0.1356**	**1.3283**	**1.0991**	**6.8600e-003**	**0.3944**	**3.3000e-003**	**0.3977**	**0.1072**	**3.0900e-003**	**0.1103**		**721.6076**	**721.6076**	**0.0372**		**722.5362**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.4716	13.4438	16.1668	0.0270		0.6133	0.6133		0.5769	0.5769	0.0000	2,555.6989	2,555.6989	0.6044		2,570.8077
Total	**1.4716**	**13.4438**	**16.1668**	**0.0270**		**0.6133**	**0.6133**		**0.5769**	**0.5769**	**0.0000**	**2,555.6989**	**2,555.6989**	**0.6044**		**2,570.8077**

3.4 Building Construction - 2024

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0356	1.2700	0.3708	4.3900e-003	0.1151	1.4800e-003	0.1166	0.0331	1.4200e-003	0.0345		475.1630	475.1630	0.0311		475.9392
Worker	0.1000	0.0584	0.7283	2.4700e-003	0.2793	1.8200e-003	0.2811	0.0741	1.6700e-003	0.0758		246.4446	246.4446	6.1000e-003		246.5970
Total	**0.1356**	**1.3283**	**1.0991**	**6.8600e-003**	**0.3944**	**3.3000e-003**	**0.3977**	**0.1072**	**3.0900e-003**	**0.1103**		**721.6076**	**721.6076**	**0.0372**		**722.5362**

3.5 Paving - 2024

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.9882	9.5246	14.6258	0.0228		0.4685	0.4685		0.4310	0.4310		2,207.5472	2,207.5472	0.7140		2,225.3963
Paving	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**0.9882**	**9.5246**	**14.6258**	**0.0228**		**0.4685**	**0.4685**		**0.4310**	**0.4310**		**2,207.5472**	**2,207.5472**	**0.7140**		**2,225.3963**

3.5 Paving - 2024

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0441	0.0258	0.3213	1.0900e-003	0.1232	8.0000e-004	0.1240	0.0327	7.4000e-004	0.0334		108.7256	108.7256	2.6900e-003		108.7928
Total	**0.0441**	**0.0258**	**0.3213**	**1.0900e-003**	**0.1232**	**8.0000e-004**	**0.1240**	**0.0327**	**7.4000e-004**	**0.0334**		**108.7256**	**108.7256**	**2.6900e-003**		**108.7928**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.9882	9.5246	14.6258	0.0228		0.4685	0.4685		0.4310	0.4310	0.0000	2,207.5472	2,207.5472	0.7140		2,225.3963
Paving	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**0.9882**	**9.5246**	**14.6258**	**0.0228**		**0.4685**	**0.4685**		**0.4310**	**0.4310**	**0.0000**	**2,207.5472**	**2,207.5472**	**0.7140**		**2,225.3963**

3.5 Paving - 2024

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0441	0.0258	0.3213	1.0900e-003	0.1232	8.0000e-004	0.1240	0.0327	7.4000e-004	0.0334		108.7256	108.7256	2.6900e-003		108.7928
Total	**0.0441**	**0.0258**	**0.3213**	**1.0900e-003**	**0.1232**	**8.0000e-004**	**0.1240**	**0.0327**	**7.4000e-004**	**0.0334**		**108.7256**	**108.7256**	**2.6900e-003**		**108.7928**

3.6 Architectural Coating - 2024

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	27.0375					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.1808	1.2188	1.8101	2.9700e-003		0.0609	0.0609		0.0609	0.0609		281.4481	281.4481	0.0159		281.8443
Total	**27.2183**	**1.2188**	**1.8101**	**2.9700e-003**		**0.0609**	**0.0609**		**0.0609**	**0.0609**		**281.4481**	**281.4481**	**0.0159**		**281.8443**

3.6 Architectural Coating - 2024

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0206	0.0120	0.1500	5.1000e-004	0.0575	3.7000e-004	0.0579	0.0153	3.4000e-004	0.0156		50.7386	50.7386	1.2600e-003		50.7700
Total	**0.0206**	**0.0120**	**0.1500**	**5.1000e-004**	**0.0575**	**3.7000e-004**	**0.0579**	**0.0153**	**3.4000e-004**	**0.0156**		**50.7386**	**50.7386**	**1.2600e-003**		**50.7700**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	27.0375					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.1808	1.2188	1.8101	2.9700e-003		0.0609	0.0609		0.0609	0.0609	0.0000	281.4481	281.4481	0.0159		281.8443
Total	**27.2183**	**1.2188**	**1.8101**	**2.9700e-003**		**0.0609**	**0.0609**		**0.0609**	**0.0609**	**0.0000**	**281.4481**	**281.4481**	**0.0159**		**281.8443**

3.6 Architectural Coating - 2024

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0206	0.0120	0.1500	5.1000e-004	0.0575	3.7000e-004	0.0579	0.0153	3.4000e-004	0.0156		50.7386	50.7386	1.2600e-003		50.7700
Total	**0.0206**	**0.0120**	**0.1500**	**5.1000e-004**	**0.0575**	**3.7000e-004**	**0.0579**	**0.0153**	**3.4000e-004**	**0.0156**		**50.7386**	**50.7386**	**1.2600e-003**		**50.7700**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	4.9196	17.3021	45.0176	0.1543	13.7127	0.1198	13.8325	3.6644	0.1114	3.7758		15,735.0701	15,735.0701	0.8155		15,755.4584
Unmitigated	4.9196	17.3021	45.0176	0.1543	13.7127	0.1198	13.8325	3.6644	0.1114	3.7758		15,735.0701	15,735.0701	0.8155		15,755.4584

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Strip Mall	4,200.00	4,200.00	2145.15	6,016,062	6,016,062
Total	4,200.00	4,200.00	2,145.15	6,016,062	6,016,062

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
Strip Mall	9.50	7.30	7.30	16.60	64.40	19.00	45	40	15

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
Strip Mall	0.606234	0.039465	0.179154	0.102641	0.014368	0.005395	0.016820	0.024508	0.001929	0.001857	0.005869	0.000761	0.000998

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	6.9200e-003	0.0629	0.0528	3.8000e-004		4.7800e-003	4.7800e-003		4.7800e-003	4.7800e-003		75.4714	75.4714	1.4500e-003	1.3800e-003	75.9199
NaturalGas Unmitigated	6.9200e-003	0.0629	0.0528	3.8000e-004		4.7800e-003	4.7800e-003		4.7800e-003	4.7800e-003		75.4714	75.4714	1.4500e-003	1.3800e-003	75.9199

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Strip Mall	641.507	6.9200e-003	0.0629	0.0528	3.8000e-004		4.7800e-003	4.7800e-003		4.7800e-003	4.7800e-003		75.4714	75.4714	1.4500e-003	1.3800e-003	75.9199
Total		**6.9200e-003**	**0.0629**	**0.0528**	**3.8000e-004**		**4.7800e-003**	**4.7800e-003**		**4.7800e-003**	**4.7800e-003**		**75.4714**	**75.4714**	**1.4500e-003**	**1.3800e-003**	**75.9199**

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Strip Mall	0.641507	6.9200e-003	0.0629	0.0528	3.8000e-004		4.7800e-003	4.7800e-003		4.7800e-003	4.7800e-003		75.4714	75.4714	1.4500e-003	1.3800e-003	75.9199
Total		**6.9200e-003**	**0.0629**	**0.0528**	**3.8000e-004**		**4.7800e-003**	**4.7800e-003**		**4.7800e-003**	**4.7800e-003**		**75.4714**	**75.4714**	**1.4500e-003**	**1.3800e-003**	**75.9199**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	2.9147	1.0000e-004	0.0107	0.0000		4.0000e-005	4.0000e-005		4.0000e-005	4.0000e-005		0.0230	0.0230	6.0000e-005		0.0245
Unmitigated	2.9147	1.0000e-004	0.0107	0.0000		4.0000e-005	4.0000e-005		4.0000e-005	4.0000e-005		0.0230	0.0230	6.0000e-005		0.0245

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.6667					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	2.2470					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Landscaping	9.9000e-004	1.0000e-004	0.0107	0.0000		4.0000e-005	4.0000e-005		4.0000e-005	4.0000e-005		0.0230	0.0230	6.0000e-005		0.0245
Total	**2.9147**	**1.0000e-004**	**0.0107**	**0.0000**		**4.0000e-005**	**4.0000e-005**		**4.0000e-005**	**4.0000e-005**		**0.0230**	**0.0230**	**6.0000e-005**		**0.0245**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.6667					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	2.2470					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Landscaping	9.9000e-004	1.0000e-004	0.0107	0.0000		4.0000e-005	4.0000e-005		4.0000e-005	4.0000e-005		0.0230	0.0230	6.0000e-005		0.0245
Total	**2.9147**	**1.0000e-004**	**0.0107**	**0.0000**		**4.0000e-005**	**4.0000e-005**		**4.0000e-005**	**4.0000e-005**		**0.0230**	**0.0230**	**6.0000e-005**		**0.0245**

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

11.0 Vegetation

Port of San Diego - Program Analysis

San Diego Air Basin, Winter

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Strip Mall	105.00	1000sqft	11.70	105,000.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.6	**Precipitation Freq (Days)**	40
Climate Zone	13			**Operational Year**	2024
Utility Company	San Diego Gas & Electric				
CO2 Intensity (lb/MWhr)	720.49	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - Strip Mall used to represent the specialty retail/strip commercial land use from the traffic study

Construction Phase - Architectural Coating would overlap with construction and paving

Vehicle Trips - trip rate modified to match traffic analysis

Construction Off-road Equipment Mitigation -

Table Name	Column Name	Default Value	New Value
tblConstructionPhase	NumDays	20.00	90.00
tblLandUse	LotAcreage	2.41	11.70
tblVehicleTrips	ST_TR	42.04	40.00
tblVehicleTrips	WD_TR	44.32	40.00

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2023	3.3923	34.5576	28.4801	0.0635	18.2141	1.4256	19.4811	9.9699	1.3115	11.1355	0.0000	6,153.1570	6,153.1570	1.9479	0.0000	6,201.8547
2024	28.8652	16.0058	19.2045	0.0370	0.4519	0.6780	1.1299	0.1225	0.6413	0.7638	0.0000	3,579.1635	3,579.1635	0.7165	0.0000	3,595.6587
Maximum	**28.8652**	**34.5576**	**28.4801**	**0.0635**	**18.2141**	**1.4256**	**19.4811**	**9.9699**	**1.3115**	**11.1355**	**0.0000**	**6,153.1570**	**6,153.1570**	**1.9479**	**0.0000**	**6,201.8547**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2023	3.3923	34.5576	28.4801	0.0635	8.2777	1.4256	9.5447	4.5080	1.3115	5.6737	0.0000	6,153.1570	6,153.1570	1.9479	0.0000	6,201.8547
2024	28.8652	16.0058	19.2045	0.0370	0.4519	0.6780	1.1299	0.1225	0.6413	0.7638	0.0000	3,579.1635	3,579.1635	0.7165	0.0000	3,595.6587
Maximum	**28.8652**	**34.5576**	**28.4801**	**0.0635**	**8.2777**	**1.4256**	**9.5447**	**4.5080**	**1.3115**	**5.6737**	**0.0000**	**6,153.1570**	**6,153.1570**	**1.9479**	**0.0000**	**6,201.8547**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**53.23**	**0.00**	**48.21**	**54.12**	**0.00**	**45.90**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	2.9147	1.0000e-004	0.0107	0.0000		4.0000e-005	4.0000e-005		4.0000e-005	4.0000e-005		0.0230	0.0230	6.0000e-005		0.0245
Energy	6.9200e-003	0.0629	0.0528	3.8000e-004		4.7800e-003	4.7800e-003		4.7800e-003	4.7800e-003		75.4714	75.4714	1.4500e-003	1.3800e-003	75.9199
Mobile	4.7425	17.5810	45.7403	0.1461	13.7127	0.1207	13.8334	3.6644	0.1123	3.7767		14,907.1480	14,907.1480	0.8324		14,927.9583
Total	**7.6641**	**17.6440**	**45.8038**	**0.1465**	**13.7127**	**0.1255**	**13.8383**	**3.6644**	**0.1171**	**3.7815**		**14,982.6423**	**14,982.6423**	**0.8339**	**1.3800e-003**	**15,003.9027**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	2.9147	1.0000e-004	0.0107	0.0000		4.0000e-005	4.0000e-005		4.0000e-005	4.0000e-005		0.0230	0.0230	6.0000e-005		0.0245
Energy	6.9200e-003	0.0629	0.0528	3.8000e-004		4.7800e-003	4.7800e-003		4.7800e-003	4.7800e-003		75.4714	75.4714	1.4500e-003	1.3800e-003	75.9199
Mobile	4.7425	17.5810	45.7403	0.1461	13.7127	0.1207	13.8334	3.6644	0.1123	3.7767		14,907.1480	14,907.1480	0.8324		14,927.9583
Total	**7.6641**	**17.6440**	**45.8038**	**0.1465**	**13.7127**	**0.1255**	**13.8383**	**3.6644**	**0.1171**	**3.7815**		**14,982.6423**	**14,982.6423**	**0.8339**	**1.3800e-003**	**15,003.9027**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Site Preparation	Site Preparation	1/30/2023	2/10/2023	5	10	
2	Grading	Grading	2/13/2023	3/24/2023	5	30	
3	Building Construction	Building Construction	3/27/2023	5/17/2024	5	300	
4	Paving	Paving	6/10/2024	7/5/2024	5	20	
5	Architectural Coating	Architectural Coating	2/5/2024	6/7/2024	5	90	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 75

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 157,500; Non-Residential Outdoor: 52,500; Striped Parking Area: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Site Preparation	Rubber Tired Dozers	3	8.00	247	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	2	8.00	158	0.38
Grading	Graders	1	8.00	187	0.41
Grading	Rubber Tired Dozers	1	8.00	247	0.40
Grading	Scrapers	2	8.00	367	0.48
Grading	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Building Construction	Cranes	1	7.00	231	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45
Paving	Pavers	2	8.00	130	0.42
Paving	Paving Equipment	2	8.00	132	0.36
Paving	Rollers	2	8.00	80	0.38
Architectural Coating	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Site Preparation	7	18.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	8	20.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	34.00	17.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	15.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	7.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Water Exposed Area

3.2 Site Preparation - 2023

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					18.0663	0.0000	18.0663	9.9307	0.0000	9.9307			0.0000			0.0000
Off-Road	2.6595	27.5242	18.2443	0.0381		1.2660	1.2660		1.1647	1.1647		3,687.3081	3,687.3081	1.1926		3,717.1219
Total	**2.6595**	**27.5242**	**18.2443**	**0.0381**	**18.0663**	**1.2660**	**19.3323**	**9.9307**	**1.1647**	**11.0954**		**3,687.3081**	**3,687.3081**	**1.1926**		**3,717.1219**

3.2 Site Preparation - 2023

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0635	0.0378	0.3860	1.2800e-003	0.1479	9.8000e-004	0.1489	0.0392	9.0000e-004	0.0401		127.5113	127.5113	3.3100e-003		127.5940
Total	**0.0635**	**0.0378**	**0.3860**	**1.2800e-003**	**0.1479**	**9.8000e-004**	**0.1489**	**0.0392**	**9.0000e-004**	**0.0401**		**127.5113**	**127.5113**	**3.3100e-003**		**127.5940**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.1298	0.0000	8.1298	4.4688	0.0000	4.4688			0.0000			0.0000
Off-Road	2.6595	27.5242	18.2443	0.0381		1.2660	1.2660		1.1647	1.1647	0.0000	3,687.3081	3,687.3081	1.1926		3,717.1219
Total	**2.6595**	**27.5242**	**18.2443**	**0.0381**	**8.1298**	**1.2660**	**9.3958**	**4.4688**	**1.1647**	**5.6336**	**0.0000**	**3,687.3081**	**3,687.3081**	**1.1926**		**3,717.1219**

3.2 Site Preparation - 2023

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0635	0.0378	0.3860	1.2800e-003	0.1479	9.8000e-004	0.1489	0.0392	9.0000e-004	0.0401		127.5113	127.5113	3.3100e-003		127.5940
Total	**0.0635**	**0.0378**	**0.3860**	**1.2800e-003**	**0.1479**	**9.8000e-004**	**0.1489**	**0.0392**	**9.0000e-004**	**0.0401**		**127.5113**	**127.5113**	**3.3100e-003**		**127.5940**

3.3 Grading - 2023

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.6733	0.0000	8.6733	3.5965	0.0000	3.5965			0.0000			0.0000
Off-Road	3.3217	34.5156	28.0512	0.0621		1.4245	1.4245		1.3105	1.3105		6,011.4777	6,011.4777	1.9442		6,060.0836
Total	**3.3217**	**34.5156**	**28.0512**	**0.0621**	**8.6733**	**1.4245**	**10.0978**	**3.5965**	**1.3105**	**4.9070**		**6,011.4777**	**6,011.4777**	**1.9442**		**6,060.0836**

3.3 Grading - 2023

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0706	0.0420	0.4289	1.4200e-003	0.1643	1.0900e-003	0.1654	0.0436	1.0000e-003	0.0446		141.6792	141.6792	3.6800e-003		141.7711
Total	**0.0706**	**0.0420**	**0.4289**	**1.4200e-003**	**0.1643**	**1.0900e-003**	**0.1654**	**0.0436**	**1.0000e-003**	**0.0446**		**141.6792**	**141.6792**	**3.6800e-003**		**141.7711**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					3.9030	0.0000	3.9030	1.6184	0.0000	1.6184			0.0000			0.0000
Off-Road	3.3217	34.5156	28.0512	0.0621		1.4245	1.4245		1.3105	1.3105	0.0000	6,011.4777	6,011.4777	1.9442		6,060.0836
Total	**3.3217**	**34.5156**	**28.0512**	**0.0621**	**3.9030**	**1.4245**	**5.3275**	**1.6184**	**1.3105**	**2.9290**	**0.0000**	**6,011.4777**	**6,011.4777**	**1.9442**		**6,060.0836**

3.3 Grading - 2023

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0706	0.0420	0.4289	1.4200e-003	0.1643	1.0900e-003	0.1654	0.0436	1.0000e-003	0.0446		141.6792	141.6792	3.6800e-003		141.7711
Total	**0.0706**	**0.0420**	**0.4289**	**1.4200e-003**	**0.1643**	**1.0900e-003**	**0.1654**	**0.0436**	**1.0000e-003**	**0.0446**		**141.6792**	**141.6792**	**3.6800e-003**		**141.7711**

3.4 Building Construction - 2023

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.5728	14.3849	16.2440	0.0269		0.6997	0.6997		0.6584	0.6584		2,555.2099	2,555.2099	0.6079		2,570.4061
Total	**1.5728**	**14.3849**	**16.2440**	**0.0269**		**0.6997**	**0.6997**		**0.6584**	**0.6584**		**2,555.2099**	**2,555.2099**	**0.6079**		**2,570.4061**

3.4 Building Construction - 2023

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0389	1.2822	0.4201	4.3200e-003	0.1151	1.6000e-003	0.1167	0.0331	1.5300e-003	0.0347		465.9179	465.9179	0.0331		466.7459
Worker	0.1200	0.0714	0.7291	2.4200e-003	0.2793	1.8500e-003	0.2812	0.0741	1.7000e-003	0.0758		240.8547	240.8547	6.2500e-003		241.0109
Total	**0.1589**	**1.3535**	**1.1492**	**6.7400e-003**	**0.3944**	**3.4500e-003**	**0.3978**	**0.1072**	**3.2300e-003**	**0.1105**		**706.7726**	**706.7726**	**0.0394**		**707.7568**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.5728	14.3849	16.2440	0.0269		0.6997	0.6997		0.6584	0.6584	0.0000	2,555.2099	2,555.2099	0.6079		2,570.4061
Total	**1.5728**	**14.3849**	**16.2440**	**0.0269**		**0.6997**	**0.6997**		**0.6584**	**0.6584**	**0.0000**	**2,555.2099**	**2,555.2099**	**0.6079**		**2,570.4061**

3.4 Building Construction - 2023

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0389	1.2822	0.4201	4.3200e-003	0.1151	1.6000e-003	0.1167	0.0331	1.5300e-003	0.0347		465.9179	465.9179	0.0331		466.7459
Worker	0.1200	0.0714	0.7291	2.4200e-003	0.2793	1.8500e-003	0.2812	0.0741	1.7000e-003	0.0758		240.8547	240.8547	6.2500e-003		241.0109
Total	**0.1589**	**1.3535**	**1.1492**	**6.7400e-003**	**0.3944**	**3.4500e-003**	**0.3978**	**0.1072**	**3.2300e-003**	**0.1105**		**706.7726**	**706.7726**	**0.0394**		**707.7568**

3.4 Building Construction - 2024

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.4716	13.4438	16.1668	0.0270		0.6133	0.6133		0.5769	0.5769		2,555.6989	2,555.6989	0.6044		2,570.8077
Total	**1.4716**	**13.4438**	**16.1668**	**0.0270**		**0.6133**	**0.6133**		**0.5769**	**0.5769**		**2,555.6989**	**2,555.6989**	**0.6044**		**2,570.8077**

3.4 Building Construction - 2024

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0375	1.2643	0.4068	4.2800e-003	0.1151	1.5600e-003	0.1166	0.0331	1.4900e-003	0.0346		463.0067	463.0067	0.0327		463.8239
Worker	0.1143	0.0655	0.6806	2.3200e-003	0.2793	1.8200e-003	0.2811	0.0741	1.6700e-003	0.0758		231.3741	231.3741	5.7400e-003		231.5175
Total	**0.1518**	**1.3298**	**1.0874**	**6.6000e-003**	**0.3944**	**3.3800e-003**	**0.3978**	**0.1072**	**3.1600e-003**	**0.1104**		**694.3808**	**694.3808**	**0.0384**		**695.3414**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.4716	13.4438	16.1668	0.0270		0.6133	0.6133		0.5769	0.5769	0.0000	2,555.6989	2,555.6989	0.6044		2,570.8077
Total	**1.4716**	**13.4438**	**16.1668**	**0.0270**		**0.6133**	**0.6133**		**0.5769**	**0.5769**	**0.0000**	**2,555.6989**	**2,555.6989**	**0.6044**		**2,570.8077**

3.4 Building Construction - 2024

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0375	1.2643	0.4068	4.2800e-003	0.1151	1.5600e-003	0.1166	0.0331	1.4900e-003	0.0346		463.0067	463.0067	0.0327		463.8239
Worker	0.1143	0.0655	0.6806	2.3200e-003	0.2793	1.8200e-003	0.2811	0.0741	1.6700e-003	0.0758		231.3741	231.3741	5.7400e-003		231.5175
Total	**0.1518**	**1.3298**	**1.0874**	**6.6000e-003**	**0.3944**	**3.3800e-003**	**0.3978**	**0.1072**	**3.1600e-003**	**0.1104**		**694.3808**	**694.3808**	**0.0384**		**695.3414**

3.5 Paving - 2024

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.9882	9.5246	14.6258	0.0228		0.4685	0.4685		0.4310	0.4310		2,207.5472	2,207.5472	0.7140		2,225.3963
Paving	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**0.9882**	**9.5246**	**14.6258**	**0.0228**		**0.4685**	**0.4685**		**0.4310**	**0.4310**		**2,207.5472**	**2,207.5472**	**0.7140**		**2,225.3963**

3.5 Paving - 2024

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0504	0.0289	0.3003	1.0200e-003	0.1232	8.0000e-004	0.1240	0.0327	7.4000e-004	0.0334		102.0768	102.0768	2.5300e-003		102.1401
Total	**0.0504**	**0.0289**	**0.3003**	**1.0200e-003**	**0.1232**	**8.0000e-004**	**0.1240**	**0.0327**	**7.4000e-004**	**0.0334**		**102.0768**	**102.0768**	**2.5300e-003**		**102.1401**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.9882	9.5246	14.6258	0.0228		0.4685	0.4685		0.4310	0.4310	0.0000	2,207.5472	2,207.5472	0.7140		2,225.3963
Paving	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**0.9882**	**9.5246**	**14.6258**	**0.0228**		**0.4685**	**0.4685**		**0.4310**	**0.4310**	**0.0000**	**2,207.5472**	**2,207.5472**	**0.7140**		**2,225.3963**

3.5 Paving - 2024

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0504	0.0289	0.3003	1.0200e-003	0.1232	8.0000e-004	0.1240	0.0327	7.4000e-004	0.0334		102.0768	102.0768	2.5300e-003		102.1401
Total	**0.0504**	**0.0289**	**0.3003**	**1.0200e-003**	**0.1232**	**8.0000e-004**	**0.1240**	**0.0327**	**7.4000e-004**	**0.0334**		**102.0768**	**102.0768**	**2.5300e-003**		**102.1401**

3.6 Architectural Coating - 2024

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	27.0375					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.1808	1.2188	1.8101	2.9700e-003		0.0609	0.0609		0.0609	0.0609		281.4481	281.4481	0.0159		281.8443
Total	**27.2183**	**1.2188**	**1.8101**	**2.9700e-003**		**0.0609**	**0.0609**		**0.0609**	**0.0609**		**281.4481**	**281.4481**	**0.0159**		**281.8443**

3.6 Architectural Coating - 2024

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0235	0.0135	0.1401	4.8000e-004	0.0575	3.7000e-004	0.0579	0.0153	3.4000e-004	0.0156		47.6358	47.6358	1.1800e-003		47.6654
Total	**0.0235**	**0.0135**	**0.1401**	**4.8000e-004**	**0.0575**	**3.7000e-004**	**0.0579**	**0.0153**	**3.4000e-004**	**0.0156**		**47.6358**	**47.6358**	**1.1800e-003**		**47.6654**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	27.0375					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.1808	1.2188	1.8101	2.9700e-003		0.0609	0.0609		0.0609	0.0609	0.0000	281.4481	281.4481	0.0159		281.8443
Total	**27.2183**	**1.2188**	**1.8101**	**2.9700e-003**		**0.0609**	**0.0609**		**0.0609**	**0.0609**	**0.0000**	**281.4481**	**281.4481**	**0.0159**		**281.8443**

3.6 Architectural Coating - 2024

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0235	0.0135	0.1401	4.8000e-004	0.0575	3.7000e-004	0.0579	0.0153	3.4000e-004	0.0156		47.6358	47.6358	1.1800e-003		47.6654
Total	**0.0235**	**0.0135**	**0.1401**	**4.8000e-004**	**0.0575**	**3.7000e-004**	**0.0579**	**0.0153**	**3.4000e-004**	**0.0156**		**47.6358**	**47.6358**	**1.1800e-003**		**47.6654**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	4.7425	17.5810	45.7403	0.1461	13.7127	0.1207	13.8334	3.6644	0.1123	3.7767		14,907.1480	14,907.1480	0.8324		14,927.9583
Unmitigated	4.7425	17.5810	45.7403	0.1461	13.7127	0.1207	13.8334	3.6644	0.1123	3.7767		14,907.1480	14,907.1480	0.8324		14,927.9583

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Strip Mall	4,200.00	4,200.00	2145.15	6,016,062	6,016,062
Total	4,200.00	4,200.00	2,145.15	6,016,062	6,016,062

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
Strip Mall	9.50	7.30	7.30	16.60	64.40	19.00	45	40	15

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
Strip Mall	0.606234	0.039465	0.179154	0.102641	0.014368	0.005395	0.016820	0.024508	0.001929	0.001857	0.005869	0.000761	0.000998

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	6.9200e-003	0.0629	0.0528	3.8000e-004		4.7800e-003	4.7800e-003		4.7800e-003	4.7800e-003		75.4714	75.4714	1.4500e-003	1.3800e-003	75.9199
NaturalGas Unmitigated	6.9200e-003	0.0629	0.0528	3.8000e-004		4.7800e-003	4.7800e-003		4.7800e-003	4.7800e-003		75.4714	75.4714	1.4500e-003	1.3800e-003	75.9199

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Strip Mall	641.507	6.9200e-003	0.0629	0.0528	3.8000e-004		4.7800e-003	4.7800e-003		4.7800e-003	4.7800e-003		75.4714	75.4714	1.4500e-003	1.3800e-003	75.9199
Total		**6.9200e-003**	**0.0629**	**0.0528**	**3.8000e-004**		**4.7800e-003**	**4.7800e-003**		**4.7800e-003**	**4.7800e-003**		**75.4714**	**75.4714**	**1.4500e-003**	**1.3800e-003**	**75.9199**

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Strip Mall	0.641507	6.9200e-003	0.0629	0.0528	3.8000e-004		4.7800e-003	4.7800e-003		4.7800e-003	4.7800e-003		75.4714	75.4714	1.4500e-003	1.3800e-003	75.9199
Total		**6.9200e-003**	**0.0629**	**0.0528**	**3.8000e-004**		**4.7800e-003**	**4.7800e-003**		**4.7800e-003**	**4.7800e-003**		**75.4714**	**75.4714**	**1.4500e-003**	**1.3800e-003**	**75.9199**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	2.9147	1.0000e-004	0.0107	0.0000		4.0000e-005	4.0000e-005		4.0000e-005	4.0000e-005		0.0230	0.0230	6.0000e-005		0.0245
Unmitigated	2.9147	1.0000e-004	0.0107	0.0000		4.0000e-005	4.0000e-005		4.0000e-005	4.0000e-005		0.0230	0.0230	6.0000e-005		0.0245

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.6667					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	2.2470					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Landscaping	9.9000e-004	1.0000e-004	0.0107	0.0000		4.0000e-005	4.0000e-005		4.0000e-005	4.0000e-005		0.0230	0.0230	6.0000e-005		0.0245
Total	**2.9147**	**1.0000e-004**	**0.0107**	**0.0000**		**4.0000e-005**	**4.0000e-005**		**4.0000e-005**	**4.0000e-005**		**0.0230**	**0.0230**	**6.0000e-005**		**0.0245**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.6667					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	2.2470					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Landscaping	9.9000e-004	1.0000e-004	0.0107	0.0000		4.0000e-005	4.0000e-005		4.0000e-005	4.0000e-005		0.0230	0.0230	6.0000e-005		0.0245
Total	**2.9147**	**1.0000e-004**	**0.0107**	**0.0000**		**4.0000e-005**	**4.0000e-005**		**4.0000e-005**	**4.0000e-005**		**0.0230**	**0.0230**	**6.0000e-005**		**0.0245**

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

11.0 Vegetation