Final Environmental Impact Report

# Fifth Avenue Landing Project and Port Master Plan Amendment

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

**OCTOBER 2020**
(UPD #EIR-2016-06; SCH #2016081053)

Volume 3 of 3

# DRAFT ENVIRONMENTAL IMPACT REPORT FIFTH AVENUE LANDING PROJECT AND PORT MASTER PLAN AMENDMENT

## VOLUME II: TECHNICAL APPENDICES

PREPARED FOR:

San Diego Unified Port District
Development Services Department
3165 Pacific Highway
San Diego, CA 92101-1128

Dana Sclar, Senior Planner
dsclar@portofsandiego.org
(619) 400-4765

PREPARED BY:

ICF
525 B Street, Suite 1700
San Diego, California 92101

**December 2017**

ICF. 2017. Draft Environmental Impact Report Technical Appendices, Fifth Avenue Landing Project and Port Master Plan Amendment. December. Prepared for: San Diego Unified Port District.

# Appendix A
# Notice of Preparation

San Diego Unified Port District
P.O. Box 120488
San Diego, California 92112-0488

# NOTICE OF PREPARATION of a DRAFT ENVIRONMENTAL IMPACT REPORT

**PROJECT TITLE:** **FIFTH AVENUE LANDING PROJECT & PORT MASTER PLAN AMENDMENT (UPD #EIR-2016-06)**

**APPLICANT:** Fifth Avenue Landing LLC

**LOCATION:** Convention Way and Marina Park Way, 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 Friday, September 16, 2016** and should be mailed to: Wileen Manaois, San Diego Unified Port District, Real Estate Development-Development Services, 3165 Pacific Highway, San Diego, CA 92101 or emailed to: wmanaois@portofsandiego.org.

**A public scoping meeting regarding the proposed EIR will be held on Wednesday, September 7, 2016 at 5:00 p.m. at the San Diego Unified Port District Administration Building, Training Room, 3165 Pacific Highway, San Diego, CA 92101.**

For questions on this Notice of Preparation, please contact Wileen Manaois, Principal, Development Services, at 619-686-6282.

Signature: Shaun D. Sumner Date: 8/17/16

Shaun D. Sumner
Assistant Vice President, Real Estate Development

San Diego Unified Port District
P.O. Box 120488
San Diego, California 92112-0488

# NOTICE OF PREPARATION
# of a
# DRAFT ENVIRONMENTAL IMPACT REPORT
# for the
# FIFTH AVENUE LANDING PROJECT & PORT MASTER PLAN AMENDMENT
# (UPD #EIR-2016-06)

The Fifth Avenue Landing Project (project or proposed project) would construct an approximately 850-room hotel tower, an approximately 565-bed lower-cost visitor-serving hotel, retail development along the promenade, approximately 2.1 acres of public access plaza space, approximately 213 onsite parking spaces, a connecting bridge from the hotel public access plaza to the San Diego Convention Center, and a marina expansion. In addition, the proposed project would include the potential use of approximately 110 offsite parking spaces in the Convention Center garage and maintain the existing public in-bay water transportation system, including a water ferry service.

Publication of this Notice of Preparation (NOP) initiates the District's environmental review and analysis of the project pursuant to the California Environmental Quality Act (CEQA). The NOP is the first step in the CEQA process. It describes the proposed project and is distributed to responsible agencies, trustee agencies, involved federal agencies, and the general public. As stated in State CEQA 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 Environmental Impact Report (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 proposed project.

## PROJECT PROPONENT/APPLICANT

Fifth Avenue Landing, LLC

## PROJECT LOCATION

As depicted in Figure 1, the proposed project site lies within the City of San Diego, California, at the intersection of Convention Way and Marina Park Way. The site is bounded by the Hilton Bayfront Hotel to the east, Marriott Hotel to the west, Convention Center to the north, San Diego Bay to the south, and South Embarcadero Park to the southwest.

The existing uses on the site include a temporary parking lot, water transportation office, public restrooms, and public open space including the 35-foot-wide bayfront promenade. An existing large vessel slip marina is located on the waterside portion of the site. In addition, the project site currently operates a public in-bay water transportation system, including water ferry service. The ferry system currently services approximately 290,000 passengers annually. These passengers typically walk from nearby hotels, the San Diego Convention Center, or their homes located in downtown San Diego. This service is expandable to other destinations throughout the San Diego Bay.

The proposed project involves the redevelopment of approximately 5 acres of land and the expansion of the existing docks over approximately 9 acres of water area. Public access plazas, parking, retail locations, and a lower-cost visitor-serving hotel would extend easterly from the intersection to the waterfront and adjacent to the existing San Diego Convention Center. The main hotel tower would be located along the southern portion of the intersection along Marina Park Way. Access to the proposed project site is provided via Harbor Drive, which is approximately 0.15 mile from the site. The precise location of the proposed project is shown on the Project Location Map attached as Figure 2.

The project site is within the Marina Planning Subarea of Planning District 3 (Centre City/Embarcadero) of the Port Master Plan (PMP).

## PROJECT DESCRIPTION

The existing uses on the land side of the project site would be demolished to accommodate the construction of the proposed project. The existing water uses would remain but in-water work would be required to accommodate the proposed marina expansion. In addition, the existing 35-foot-wide bayfront promenade would remain. Construction of the proposed project is anticipated to occur over an approximately 30-month timeframe. The following describes the key components of the proposed project. Figure 3 depicts the proposed site plan for the project. Figures 4 through 6 provide proposed renderings of the landside overview, hotel tower, and open-air pedestrian archway components of the proposed project.

### *Hotel Tower*

The proposed project would include the construction of an approximately 850-room hotel tower. The hotel tower would rise approximately 498 feet above mean sea level, which would total 44 stories in height. The hotel tower, including the associated retail and public access plaza, would be approximately 796,336 gross square feet. The hotel tower would include approximately 57,360 square feet of meeting space including a 15,100-square-foot ballroom, 7,100 square feet of junior ballrooms, 27,000 square feet of additional meeting rooms, and 37,000 square feet of prefunction space. The hotel tower design is inspired by sail structures of the latest generation of America's Cup sailboats (see Figures 4 and 5). This design would be a recognition of the maritime uses of San Diego Bay and the high-tech nature of the America's Cup sailboats. Additionally, an expansive open-air pedestrian archway would span the promenade to connect the hotel tower to its ballroom and meeting facilities (see Figure 6). The open-air pedestrian archway would reach a height of approximately 40 feet and would include a small glass bridge to connect guests and members of the public to the ballrooms.

### *Connecting Bridge to the San Diego Convention Center*

The proposed project would include a new public access bridge between the proposed hotel public access plaza and the San Diego Convention Center. This bridge connection would provide visitors with elevated and expansive views of the entire north and mid-bay and would allow for travel to the City's Gaslamp Quarter. Note that concurrence of the San Diego Convention Center would be required to implement this portion of the proposed project.

### *Lower-Cost Visitor-Serving Hotel with Water Transportation Center*

The proposed project includes the construction of an approximately 565-bed lower-cost visitor-serving hotel. The proposed hotel would be a five-story L-shaped structure and would reach an approximate height of 82 feet, with active retail located along the edge of the promenade. The proposed lower-cost visitor-serving hotel would be located near the Hilton Bayfront Hotel and its bayside park. The lower-cost visitor-serving hotel would be a stand-alone development and would be situated on its own leasehold parcel. Additionally, the Water Transportation Center would be integrated into the building footprint of the lower-cost visitor-serving hotel. Parking for the Water Transportation Center would be at the ground level. The Water Transportation Center would provide operational support for the marina and the existing water transportation ferry service.

### *Parking Structure*

A one-level parking structure would be incorporated into the development between the hotel tower and the lower-cost visitor-serving hotel. The proposed visitor-serving retail would mask the parking structure from public view along the promenade. Approximately 213 onsite parking spaces would be provided, and access to the proposed parking structure would be located on Convention Way. The proposed parking structure would incorporate the use of natural light, LED lighting, and natural bay breezes to cool the garage. Limited mechanical systems would be needed to ventilate or provide fresh air to the garage. Charging stations would also be installed to accommodate electric vehicles. In addition to the parking structure, approximately 110 offsite Port-owned parking spaces exist in the Convention Center garage for potential use by the proposed project.

### *Public Access Plazas*

The proposed project would double the total area of public access plazas to approximately 92,142 square feet (2.1 acres) to be used as areas of resting and viewing for visitors and to include interpretive signage and public art. The proposed public access plazas would include approximately the following:

- 83,820-square-foot hotel public access plaza on the roof of the hotel ballrooms and meeting rooms accessible from both the ground-level access promenade and the Convention Center
- 3,632-square-foot lower-cost hotel public access plaza adjacent to the southeast corner of the hotel
- 1,210-square-foot marina overlook public access plaza
- 3,480-square-foot promenade public access plaza south of the parking structure along the promenade

The proposed project would maintain the existing 35-foot-wide bayfront promenade across the site. The promenade would be activated with the transparent open-air pedestrian archway associated with the hotel lobby and by adjoining visitor-serving retail storefronts (see Figure 6).

### *Marina Expansion*

The proposed project includes the expansion of the existing marina by an additional 52,175 square feet of dock space. The expansion would provide area for approximately 40–55 additional small and large vessel slips that would be approximately 8 feet wide by 30–60 feet in length accessible from a main headwalk approximately 20 feet in width. The slips would be attached to a new pile-supported dock that would extend southwest of the existing slips. Additionally, a breakwater may be included as part of the proposed project to reduce wave energy coming into the marina. Each slip would have shoreside power as well as connections to the City’s water and sewer systems. The original leasehold option boundaries would require some re-alignment to reflect the current marina layout and the Port lease would need to be amended to reflect these new parcel boundaries.

The possible fleet mix of the expanded marina would allow for smaller boats to be integrated into the marina while at the same time allowing larger vessels to dock. The possible fleet mix includes the following quantity and size of vessels:

- (10–15) 30 feet to 50 feet
- (20–25) 60 feet to 80 feet
- (10–15) 100 feet to 300 feet

The proposed landside marina improvements would include relocating the existing approximately 400-square-foot marina office to the promenade level of the lower-cost visitor-serving hotel. The new marina office would be approximately 10,000 square feet.

The existing State-approved public in-bay water transportation system, including water ferry service, would continue and expand with the implementation of the proposed project.

### *Visitor-Serving Retail Storefronts*

The proposed project would include up to eight small visitor-serving retail storefronts consisting of open-air cafés, food and beverage outlets, and other visitor-serving retail establishments along the promenade. These retail venues would range in size from approximately 800 square feet to 2,100 square feet and are intended to encourage activation of the currently underutilized promenade.

### *Sustainability Features*

The proposed project would incorporate several sustainable building features. Energy reduction technologies, such as LED lighting, would be used throughout the proposed project. Landscaping would include the use of drought-tolerant plants and the drainage system would be designed to recapture water for irrigation reuse, wherever feasible.

### *Port Master Plan Amendment*

As part of the proposed project, an amendment to the Port Master Plan (PMP) Planning District 3, Centre City Embarcadero, is proposed to change portions of the existing land and water use designations and to update the PMP maps, text, and tables to reflect the proposed improvements. The anticipated PMP land and water use designation changes would include but not be limited to the following: Commercial Recreation to Street, Street to Commercial Recreation, Ship Anchorage to Recreational Boat Berthing, and Ship Navigation Corridor to Recreational Boat Berthing.

## ENVIRONMENTAL CONSIDERATIONS

### *Probable Environmental Effects to be Addressed in the EIR*

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

- Aesthetics and Visual Resources
- Air Quality & Health Risk
- Biological Resources
- Cultural Resources
- Geologic Hazards and Soils
- Greenhouse Gas Emissions & Climate Change
- Hazardous Materials/Hazards
- Hydrology and Water Quality
- Land Use and Planning
- Noise and Vibration
- Public Services and Recreation
- Transportation/Traffic
- Utilities and Energy Use

The EIR would also address feasible mitigation measures, a reasonable range of alternatives, and additional mandatory sections as required by CEQA. The District would also prepare a mitigation monitoring and reporting program to address the potential significant impacts of the proposed project.

### *Resource Areas 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 related to agriculture and forestry resources or mineral resources. Therefore, these issues would be summarized in the Effects Found Not to Be Significant section of the EIR.

#### *Agriculture and Forestry Resources*

The proposed project site is within an urbanized area that does not support any agricultural uses. According to the California Department of Conservation's San Diego County Important Farmland mapper (California Department of Conservation 2015), the proposed project site is classified as "urban and built-up land," which does not contain any agricultural uses or areas designated Prime Farmland, Unique Farmland, or Farmland of Statewide Importance. Furthermore, there are no Williamson Act contracts or forest lands in the project vicinity (California Department of Conservation 2013). Therefore, there would be no impact.

Additionally, the project site is located in an urbanized area that does not support any forestry uses. California's Forests and Rangelands: 2010 Assessment, completed as part of the California Department of Forestry and Fire Protection (CAL FIRE) Fire Resource Assessment Program (FRAP), provides an assessment of the State's inventory of forest land and identifies lands within the project site as Urban (CAL FIRE 2010). Because no forest land, timberland, or Timberland Production occur within the project site, the proposed project would not conflict with existing zoning for, or cause rezoning of, forest land, timberland, or timberland zoned Timberland Production. Therefore, implementation of the proposed project would not result in the loss of forest land or the conversion of forest land to non-forest use. No impacts on forestry resources would occur.

*Mineral Resources*

The proposed project site is underlain by two surficial soil units overlying the marine terrace deposits. The surficial units consist of fill materials that were placed during previous improvements to the bayfront in the 1920s. The depth of this fill is approximately 10–35 feet, increasing toward the bayfront (GEOCON 2009). No mineral resources that would be of future value to the region or State were identified within the proposed project site in the 1996 Update of Mineral Land Classification completed by the California Department of Conservation, Division of Mines and Geology (CDMG). The CDMG Map, Special Report 153, Plate 1, identifies the mineral resource zone (MRZ) designation for the proposed project site as MRZ-1 (CDMG 1996). The MRZ-1 designation is applied to "areas where adequate geologic information indicates that no significant mineral deposits are present, or where it is judged that little likelihood exists for their presence." Therefore, there would be no impacts on mineral resources as a result of implementation of the proposed project.

*Population and Housing*

The proposed project would not construct any homes or businesses or extend roads; however, additional employees and construction workers are anticipated to work at the project site as a result of the construction of the proposed project. Approximately 1,100 jobs (direct, indirect, and induced) would be created during the near-term construction period, and a total of approximately 550 long-term direct and indirect jobs would be created as a result of the proposed project.

Although implementation of the proposed project would require up to 550 new employees and temporarily increase the number of construction workers in the area, the additional jobs are expected to be filled primarily by existing local and regional residents and would not induce substantial population growth. The jobs would not result in the relocation of any significant number of people. Therefore, the proposed project would not directly or indirectly induce substantial population growth in the San Diego region. Impacts would be less than significant.

Furthermore, no housing or people would be directly displaced with implementation of the proposed project. The project site is currently developed with temporary parking lot, water transportation office, public restrooms, and public open space including the 35-foot-wide bayfront promenade and does not include residential housing. The proposed project would construct commercial, recreational, and marina uses. No impact would occur.

## NOP COMMENTS

The NOP is available for a 30-day public review period that starts on **Thursday, August 18, 2016 and ends at 5:00 p.m. on Friday, September 16, 2016**. Written comments will be accepted until 5:00 p.m. on Friday, September 16, 2016. Comments regarding the scope and content of the environmental information that should be included in the EIR and other environmental concerns should be sent to:

San Diego Unified Port District
Attn: Wileen Manaois
Real Estate Development-Development Services
3165 Pacific Highway, San Diego, CA 92101

or emailed to wmanaois@portofsandiego.org

## PUBLIC SCOPING MEETING

A public scoping meeting to solicit comments on the scope and content of the EIR of the proposed project will be held on **Wednesday, September 7, 2016 at 5:00 p.m. at the San Diego Unified Port District Administration Building, Training Room, 3165 Pacific Highway, San Diego, CA 92101.**

The District, as Lead Agency pursuant to CEQA, will review the public comments on the NOP to determine which issues should be addressed in the EIR.

Other opportunities for the public to comment on the environmental effects of the proposed project include, but are not limited to, the following.

- A minimum 45-day public review period for the Draft EIR
- A public hearing before the Board of Port Commissioners to consider certification of the EIR

For questions regarding this NOP, please contact Wileen Manaois, Principal, Development Services, at (619) 686-6282.

## ATTACHMENTS

**Figure 1: Project Vicinity Map**
**Figure 2: Project Location Map**
**Figure 3: Proposed Project Site Plan**
**Figure 4: Landside Overview Rendering**
**Figure 5: Hotel Tower Rendering**
**Figure 6: Open-Air Pedestrian Archway Rendering**

Source: ESRI StreetMap North America (2014)

K:\San Diego\projects\Port of San Diego\00000 00 FifthAveLanding\mapdoc\1 Regional Location.mxd Date: 7/25/2016 35528

**Figure 1**
**Project Vicinity Map**
**Fifth Avenue Landing Project**

Source: Port of San Diego;
ESRI Basemaps, 2016

K:\San Diego\projects\Port of San Diego\00000_00_FifthAveLanding\mapdoc\2_Proj_Loc.mxd 8/15/2016 24991

**Figure 2**
**Project Location Map**
**Fifth Avenue Landing Project**

K:\San Diego\projects\Port of San Diego\00000 00 FifthAveLanding\mapdoc\EIR NOP\3 SitePlan.mxd Date: 8/13/2016 24991

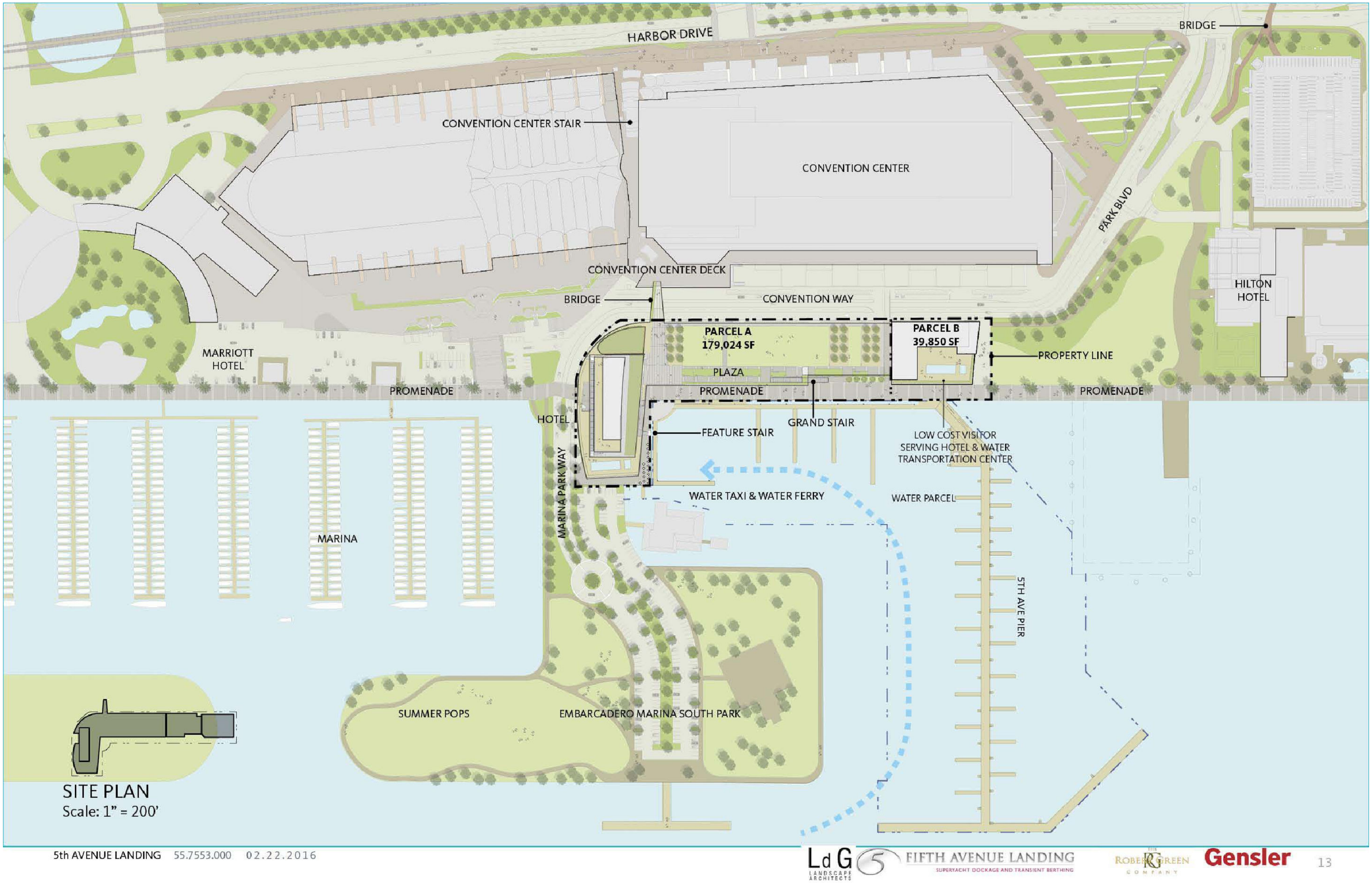


**Figure 3**
**Proposed Project Site Plan**
**Fifth Avenue Landing Project**

K:\San Diego\projects\Port of San Diego\00000 00 FifthAveLanding\mapdoc\EIR NOP\4 LandSideRendering.mxd Date: 8/16/2016 24991

Figure 4
Landside Overview Rendering
Fifth Avenue Landing Project

K:\San Diego\projects\Port_of_San_Diego\00000_00_FifthAveLanding\mapdoc\EIR_NOP\5_HotelTowerRendering.mxd Date: 8/13/2016 24991

Figure 5
Hotel Tower Rendering
Fifth Avenue Landing Project

K:\San Diego\projects\Port of San Diego\00000 00 FifthAveLanding\mapdoc\EIR NOP\6 OpenAirRendering.mxd Date: 8/13/2016 24991

Figure 6
Open-Air Pedestrian Archway Rendering
Fifth Avenue Landing Project

# Appendix B
# Comments Received on the Notice of Preparation

## Watts, Claudia

| | |
|---|---|
| **From:** | Wileen Manaois <wmanaois@portofsandiego.org> |
| **Sent:** | Wednesday, September 14, 2016 9:54 AM |
| **To:** | Asha Bleier; Kathie.Washington@icfi.com; Ralph Hicks |
| **Cc:** | charlie.richmond@icfi.com; Carey Fernandes; Eileen Maher; Todd Miller |
| **Subject:** | FW: Notice of Preparation of a Draft EIR for the Fifth Avenue Landing Project and Port Master Plan Amendment |

FYI…

**From:** Eric Chavez - NOAA Federal [mailto:eric.chavez@noaa.gov]
**Sent:** Wednesday, September 14, 2016 8:13 AM
**To:** Wileen Manaois
**Cc:** Eileen Maher; Bryant Chesney - NOAA Federal; Adam Obaza - NOAA Affiliate
**Subject:** Re: Notice of Preparation of a Draft EIR for the Fifth Avenue Landing Project and Port Master Plan Amendment

Thank you, Wileen. I had only read the one-pager so hadn't seen that detail. As you likely guessed, with 1.2 acres of increased overwater coverage and a possible breakwater, this is one we'll want to engage in. The Overwater Structure (OWS) Programmatic EFH consultation I mentioned and attached in my previous email has a number of avoidance, minimization, and offsetting measures that are applicable to this project. Feel free to contact me with any questions you may have about the OWS programmatic. Looking forward to coordinating with you.

Eric

On Tue, Sep 13, 2016 at 10:09 AM, Wileen Manaois <wmanaois@portofsandiego.org> wrote:
Hi Eric,
Hope all is well and sorry for the late reply. The marina expansion would span 9 acres of water area; however, as noted on the bottom of page 3 of the NOP, the expanded dock area for the marina expansion would be approx 52,175 SF. Let me know if you have further questions.
Thanks, Wileen

Sent from my iPhone

On Aug 18, 2016, at 10:44 AM, Eric Chavez - NOAA Federal <eric.chavez@noaa.gov> wrote:

> Hi Wileen and Eileen,
>
> I see a lot of projects, so it's possible I'm forgetting something, but I believe this is the first I'm hearing of this one. I'm not sure how to interpret the following language:
>
> *"...the expansion of the existing docks over approximately 9 acres of water area in San Diego, California."*
>
> Does that really mean a potential increase in overwater coverage of 9 acres, or is it (hopefully) some much smaller increase to a marina that already spans roughly 9 acres? Regardless, our EFH Programmatic Consultation with the Corps for Overwater Structures will certainly apply (attached).

Thanks,
Eric

On Thu, Aug 18, 2016 at 9:02 AM, Wileen Manaois <wmanaois@portofsandiego.org> wrote:

To:  Agencies and Interested Parties

Please see attached notice re: the Notice of Preparation (NOP) of a Draft EIR for the Fifth Avenue Landing Project and Port Master Plan Amendment. The NOP may be viewed on the District's website at: https://www.portofsandiego.org/environment/ceqa-coastal-act-notices.html

**Wileen C. Manaois**

**Principal, Development Services**

<image001.jpg>

**Real Estate Development**
**PORT OF SAN DIEGO**
3165 Pacific Highway • San Diego, CA 92101
**O:** 619.686.6282  **C:** 619.346.0858

Port administration offices are open Monday-Thursday and every other Friday from 8am-5pm.

--
**Eric Chavez**
*Protected Resources Division*
*NOAA Fisheries West Coast Region*
*U.S. Department of Commerce*
Phone: (562) 980-4064
Eric.Chavez@noaa.gov
www.westcoast.fisheries.noaa.gov

<OverWaterStructure_Final.pdf>

--

**Eric Chavez**
*Protected Resources Division*
*NOAA Fisheries West Coast Region*
*U.S. Department of Commerce*
Phone: (562) 980-4064
Eric.Chavez@noaa.gov
www.westcoast.fisheries.noaa.gov

STATE OF CALIFORNIA
GOVERNOR'S OFFICE *of* PLANNING AND RESEARCH
STATE CLEARINGHOUSE AND PLANNING UNIT

EDMUND G. BROWN JR.
GOVERNOR

KEN ALEX
DIRECTOR

**Notice of Preparation**

RECEIVED
AUG 22 2016
SAN DIEGO UNIFIED
PORT DISTRICT
REAL ESTATE

August 18, 2016

To: Reviewing Agencies

Re: Fifth Avenue Landing Project and Port Master Plan Amendment
SCH# 2016081053

Attached for your review and comment is the Notice of Preparation (NOP) for the Fifth Avenue Landing Project 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:

**Wileen Manaois**
**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. Please refer to the SCH number noted above in all correspondence concerning this project.

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

Attachments
cc: Lead Agency

1400 10th Street P.O. Box 3044 Sacramento, California 95812-3044
(916) 445-0613 FAX (916) 323-3018 www.opr.ca.gov

# Document Details Report
# State Clearinghouse Data Base

| | |
|---|---|
| ***SCH#*** | **2016081053** |
| ***Project Title*** | Fifth Avenue Landing Project and Port Master Plan Amendment |
| ***Lead Agency*** | San Diego Unified Port District |

---

| | |
|---|---|
| ***Type*** | **NOP** Notice of Preparation |
| ***Description*** | The proposed project would construct an approx. 850 room hotel tower, an approx. 565 bed lower cost visitor serving hotel, retail development along the promenade, approx. 2.1 acres of public access plaza space, approx. 213 onsite parking spaces, a connecting bridge from the hotel public access plaza to the San Diego Convention Center, and a marina expansion. In addition, the proposed project would include the potential use of approx. 110 offsite parking spaces in the Convention Center garage and maintain the existing public in-bay water transportation system, including a water ferry service. |

---

## Lead Agency Contact

| | | | |
|---|---|---|---|
| ***Name*** | Wileen Manaois | | |
| ***Agency*** | San Diego Unified Port District | | |
| ***Phone*** | 619-686-6282 | ***Fax*** | |
| ***email*** | | | |
| ***Address*** | 3165 Pacific Hwy | | |
| ***City*** | San Diego | ***State*** CA | ***Zip*** 92101 |

---

## Project Location

| | |
|---|---|
| ***County*** | San Diego |
| ***City*** | San Diego |
| ***Region*** | |
| ***Cross Streets*** | Convention Way and Marina Park Way |
| ***Lat / Long*** | 32° 42' 18.59" N / 117° 9' 43.3" W |
| ***Parcel No.*** | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ***Township*** | | ***Range*** | | ***Section*** | | ***Base*** | |

---

## Proximity to:

| | |
|---|---|
| ***Highways*** | 5, 163, 75, 282, 94 |
| ***Airports*** | SDIA |
| ***Railways*** | BNSF, Amtrak |
| ***Waterways*** | San Diego Bay |
| ***Schools*** | Perksin ES, Burbank ES |
| ***Land Use*** | Commercial Recreation, Park/Plaza, Specialized Berthing, and Marine-Related |

---

| | |
|---|---|
| ***Project Issues*** | Aesthetic/Visual; Air Quality; Archaeologic-Historic; Biological Resources; Coastal Zone; Drainage/Absorption; Economics/Jobs; Flood Plain/Flooding; Geologic/Seismic; Public Services; Recreation/Parks; Sewer Capacity; Soil Erosion/Compaction/Grading; Solid Waste; Toxic/Hazardous; Traffic/Circulation; Vegetation; Water Quality; Water Supply; Landuse; Cumulative Effects; Other Issues |

---

| | |
|---|---|
| ***Reviewing Agencies*** | Resources Agency; Department of Boating and Waterways; California Coastal Commission; Department of Parks and Recreation; Resources, Recycling and Recovery; Department of Fish and Wildlife, Region 5; Department of Housing and Community Development; Office of Emergency Services, California; Native American Heritage Commission; State Lands Commission; Caltrans, Division of Aeronautics; California Highway Patrol; Caltrans, District 11; Department of Toxic Substances Control; Regional Water Quality Control Board, Region 9 |

---

| | | | | | |
|---|---|---|---|---|---|
| ***Date Received*** | 08/18/2016 | ***Start of Review*** | 08/18/2016 | ***End of Review*** | 09/16/2016 |

Print Form

*Appendix C*

# Notice of Completion & Environmental Document Transmittal

2016081053

*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 #**

**Project Title:** Fifth Avenue Landing Project and Port Master Plan Amendment

Lead Agency: San Diego Unified Port District
Contact Person: Wileen Manaois
Mailing Address: 3165 Pacific Highway
Phone: 619-686-6282
City: San Diego, CA
Zip: 92101
County: San Diego

**Project Location:** County: San Diego
City/Nearest Community: City of San Diego
Cross Streets: Convention Way and Marina Park Way
Zip Code: 92101
Longitude/Latitude (degrees, minutes and seconds): 32 ° 42 ′ 18.59″ N / 117 ° 9 ′ 43.39″ W Total Acres: 14
Assessor's Parcel No.: N/A
Section: N/A Twp.: N/A Range: N/A Base: N/A
Within 2 Miles: State Hwy #: 5, 163, 75, 282, 94
Waterways: San Diego Bay
Airports: SDIA
Railways: BNSF, Amtrak
Schools: Perkins ES, Burbank ES

**Document Type:**

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

NEPA:
- ☐ NOI
- ☐ EA
- ☐ Draft EIS
- ☐ FONSI

Other:
- ☐ Joint Document
- ☐ Final Document
- ☐ Other: ________

Governor's Office of Planning & Research

AUG 18 2016

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: PMPAmendment

**Development Type:**

☐ Residential: Units ______ Acres ______
☐ Office: Sq.ft. ______ Acres ______ Employees ______
☒ Commercial: Sq.ft. ______ Acres 5 Employees ______
☐ Industrial: Sq.ft. ______ Acres ______ Employees ______
☐ Educational: ______
☒ Recreational: 2.1 acre public plaza space
☐ Water Facilities: Type ______ MGD ______
☐ Transportation: Type 213 space onsite parking structure
☐ Mining: Mineral ______
☐ Power: Type ______ MW ______
☐ Waste Treatment: Type ______ MGD ______
☐ Hazardous Waste: Type ______
☒ Other: 52,175 sf marina expansion,2 hotels (850-room&565-be

**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: GHGs

**Present Land Use/Zoning/General Plan Designation:**

Commercial Recreation, Park/Plaza, Specialized Berthing, and Marine-Related

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

The proposed project would construct an approximately 850-room hotel tower, an approximately 565-bed lower-cost visitor-serving hotel, retail development along the promenade, approximately 2.1 acres of public access plaza space, approximately 213 onsite parking spaces, a connecting bridge from the hotel public access plaza to the San Diego Convention Center, and a marina expansion. In addition, the proposed project would include the potential use of approximately 110 offsite parking spaces in the Convention Center garage and maintain the existing public in-bay water transportation system, including a water ferry service.

*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

# NOP Distribution List

**County:** San Diego

**SCH#** 2016081053

## sources Agency

**Resources Agency**
Nadell Gayou

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

☒ **California Coastal Commission**
Elizabeth A. Fuchs

☐ **Colorado River Board**
Lisa Johansen

☐ **Dept. of Conservation**
Elizabeth Carpenter

☐ **California Energy Commission**
Eric Knight

☐ **Cal Fire**
Dan Foster

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

☐ **Office of Historic Preservation**
Ron Parsons

**Dept of Parks & Recreation**
Environmental Stewardship Section

☒ **California Department of Resources, Recycling & Recovery**
Sue O'Leary

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

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

## Fish and Game

☐ **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

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

☐ **Depart. of General Services**
Public School Construction

☐ **Dept. of General Services**
Cathy Buck/George Carollo
Environmental Services Section

☐ **Delta Stewardship Council**
Kevan Samsam

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

## Independent Commissions,Boards

☐ **Delta Protection Commission**
Erik Vink

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

☒ **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**
Terri Pencovic

☒ **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**
Eric Federicks – South
Susan Zanchi - North

☐ **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
Cathi Slaminski

- ☐ Transportation Projects
  Nesamani Kalandiyur
- ☐ Industrial/Energy Projects
  Mike Tollstrup

☐ **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**
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** ____________________
____________________
____________________

☐ ____________________
Conservancy

Last Updated 7/19/2016

STATE OF CALIFORNIA EDMUND G. BROWN JR., *Governor*

**CALIFORNIA STATE LANDS COMMISSION**
100 Howe Avenue, Suite 100-South
Sacramento, CA 95825-8202

**JENNIFER LUCCHESI, Executive Officer**
(916) 574-1800 FAX (916) 574-1810
*California Relay Service from TDD Phone* **1-800-735-2929**
*from Voice Phone* **1-800-735-2922**

***Contact Phone:* (916) 574-0450**
***Contact FAX:* (916) 574-1925**

RECEIVED
AUG 29 2016
SAN DIEGO UNIFIED
PORT DISTRICT
REAL ESTATE

August 23, 2016

File Ref: G10-08

William Manaois
San Diego Unified Port Distrcit
3165 Pacific Highway
San Diego, CA 92101

Dear Mr. Manaois:

SUBJECT: **Notice of Preparation (NOP) for the Fifth Avenue Landing Project and Port Master Plan Amendment, San Diego County**

California State Lands Commission staff has reviewed the subject NOP for the Fifth Avenue Landing Project and Port Master Plan Amendment. As background, the California State Lands Commission has oversight authority of all granted tide and submerged lands on behalf of the state. In 1962, the California Legislature created the Port District to manage and operate certain tide and submerged lands within San Diego Bay consistent with the public trust doctrine for the benefit of all the people of California. The Port District is charged with developing these lands for statewide public purposes and uses related to maritime commerce, navigation, fisheries and other water-dependent or water-oriented activities.

The Fifth Avenue Landing Project is located within San Diego Bay tidelands, which were granted in trust to the San Diego Unified Port District pursuant to Chapter 67, Statutes of 1962, First Extraordinary Session, as amended (Port Act). Please send additional information on the Project,including electronic copies of the draft and final EIR to the Commission as plans become finalized.

If you have any questions concerning the above, please contact me at (916) 574-0450 or by email at reid.boggiano@slc.ca.gov.

Sincerely,

Reid Boggiano
Public Land Management Specialist

State of California – Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
South Coast Region
3883 Ruffin Road
San Diego, CA 92123
(858) 467-4201
www.wildlife.ca.gov

**EDMUND G. BROWN JR., Governor**
**CHARLTON H. BONHAM, Director**

September 16, 2016

Ms. Wileen Manaois, Principal,
San Diego Unified Port District Development Services
3165 Pacific Highway
San Diego, CA 92101
wmanaois@portofsandiego.org

**Subject: Comments on the Notice of Preparation of a Draft Environmental Impact Report for the Fifth Avenue Landing Project and Port Master Plan Amendment**

Dear Ms. Manaois:

The California Department of Fish and Wildlife (Department) has reviewed the above-referenced Notice of Preparation (NOP) for the Fifth Avenue Landing Project and Port Master Plan Amendment Draft 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 project area is located within the City of San Diego, California, at the intersection of Convention Way and Marina Park Way. The site is bounded by the Hilton Bayfront Hotel to the east, Marriott Hotel to the west, Convention Center to the north, San Diego Bay to the south, and South Embarcadero Park to the southwest.

The proposed project involves the redevelopment of approximately 5 acres of land and the expansion of the existing docks over approximately 9 acres of water area (proposed project). Public access plazas, parking, retail locations, and a lower-cost visitor-serving hotel would extend easterly from the intersection to the waterfront and adjacent to the existing San Diego Convention Center. The main hotel tower would be located along the southern portion of the intersection along Marina Park Way.

***Hotel Tower***
The proposed project would include the construction of an approximately 850-room hotel tower. The hotel tower would rise approximately 498 feet above mean sea level, which would total 44 stories in height. The hotel tower, including the associated retail and public access plaza, would be approximately 796,336 gross square feet.

***Connecting Bridge to the San Diego Convention Center***
The proposed project would include a new public access bridge between the proposed hotel public access plaza and the San Diego Convention Center.

***Lower-Cost Visitor-Serving Hotel with Water Transportation Center***
The proposed project includes the construction of an approximately 565-bed lower-cost hotel. The proposed hotel would be a five-story L-shaped structure and would reach an approximate height of 82 feet, with active retail located along the edge of the promenade.

***Parking Structure***
A one-level parking structure would be incorporated into the development between the hotel tower and the lower-cost visitor-serving hotel. The proposed visitor-serving retail would mask the parking structure from public view along the promenade. Approximately 213 on-site parking spaces would be provided, and access to the proposed parking structure would be located on Convention Way. The proposed parking structure would incorporate the use of natural light, LED lighting, and natural bay breezes to cool the garage.

***Public Access Plazas***
The proposed project would double the total area of public access plazas to approximately 92,142 square feet (2.1 acres). The proposed project would maintain the existing 35-foot-wide bayfront promenade across the site.

***Marina Expansion***
The proposed project includes the expansion of the existing marina by an additional 52,175 square feet of dock space. The expansion would provide area for approximately 40–55 additional small and large vessel slips that would be approximately 8 feet wide by 30–60 feet in length, accessible from a main headwalk approximately 20 feet in width. The slips would be attached to a new pile-supported dock that would extend southwest of the existing slips. A breakwater may be included as part of the proposed project to reduce wave energy coming into the marina. Each slip would have shoreside power as well as connections to the City's water and sewer systems.

The Department offers the following comments and recommendations to assist the San Diego Unified Port District (Port) in avoiding or minimizing potential project impacts on biological resources.

**Specific Comments**

Marine Habitat and Species

1. The DEIR should clearly identify marine species and habitats currently on the project site and alternative sites. The potential for species or habitat impacts by the proposed project should be analyzed, including temporary and permanent impacts based on significance. The DEIR should identify measures to avoid and reduce all potential impacts predicated on comprehensive baseline biological surveys for federal and CESA-listed species, state species of special concern, and all other sensitive or vulnerable species. Measures and alternatives that would avoid impacts are preferred. The project should minimize potential unavoidable impacts to the maximum extent possible and use ongoing operational conservation measures for long-term reduction of impacts. Unavoidable sensitive habitat losses seen during or after construction will require appropriate compensation on- or off-site if necessary.

2. Surveys should be conducted at the appropriate time of year to determine the presence/absence, location, and abundance of sensitive plant and animal species and natural communities which may occur on the project site. The Department recommends that the DEIR include a discussion on the development of a comprehensive survey program for the various habitats and species that may be impacted by the construction and operation of the proposed project.

3. The NOP indicates that the proposed project would construct approximately 1.2 acres of dock space. The proposed project would result in over-water coverage from docks and a pier as well as shading impacts from the hotels and may result in fill and loss of bay waters from the potential breakwater and pile installations. The Department recommends that the DEIR include a breakwater habitat impacts analysis and a habitat shading impacts analysis of the hotel, docks, and pier. The discussion should identify measures that could be implemented to avoid, minimize, and compensate for habitat impacts and losses as a result of the project. This discussion should also include an analysis of alternatives that reduce or eliminate marine resource impacts such as alternative locations, setbacks, minimizing area, structural designs, configurations, and a reduction in the number of piles to further minimize the over-water coverage.

4. The Department recommends that the DEIR include a discussion on potential impacts to eelgrass as a result of the project. The project proponent will need to conduct pre- and post-construction eelgrass and *Caulerpa taxifolia* surveys to determine shading and other impacts to eelgrass and potential eelgrass habitat. *Caulerpa taxifolia* is a highly invasive algae that has been found in some coastal lagoons in Southern California. *Caulerpa taxifolia* surveys are now conditions of permits issued by the California Coastal Commission, United States Army Corp of Engineers and Regional Water Quality Control Boards throughout Southern California. Eelgrass surveys and any necessary mitigation required should be done in accordance with the California Eelgrass Mitigation Policy, which can be found on the National Marine Fisheries Service's website. (http://www.westcoast.fisheries.noaa.gov/publications/habitat/california_eelgrass_mitigation/Final%20CEMP%20October%202014/cemp_oct_2014_final.pdf).

5. The Department recommends that the DEIR include an analysis of impacts associated with pile driving for the project. The Department recommends the use of non-toxic piles and soft start pile driving conservation measures for piers and docks. The following additional mitigation measures to further minimize pile driving impacts to fish and wildlife should be considered:

    - A vibratory hammer should be used to install piles, when possible. If impact or jetting hammers are required, the pile should be driven as deep as possible with a vibratory hammer prior to the use of the impact or jetting method. This will minimize noise and turbidity impacts.

    - Silt curtains or other appropriate methods should be used to avoid or minimize siltation, re-suspended contaminants, and turbidity plumes from moving off site.

6. The Department recommends that the DEIR include a discussion of the measures that will be taken to avoid impacts to the fully protected and CESA-listed endangered California least tern (*Sterna antillarum browni*). The Department recommends that pile driving and other

ocean bottom disturbing activities be conducted outside of the California least tern breeding and nesting season April 1st through September 15th.

Migratory Birds and Project Design

7. Based on our review of the proposed project design, the Department is concerned with the potential for avian collisions with the reflective glass surfaces of the hotels and the glass pedestrian bridge. We recommend that non-reflective glass and other avian-friendly designs be incorporated into the hotels and glass features. 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) and section 3513 of the California Fish and Game Code. The proposed project is located within the coastal route of the Pacific Flyway, a north-south route for migratory bird species. The Department recommends the Port incorporate guidance by the American Bird Conservancy (ABC, http://collisions.abcbirds.org/).

   While it is well recognized that nighttime lighting can be disruptive and often fatal to migrating birds (Kerlinger et al., 2010, and Gehring et al., 2009), avian collisions also occur when birds are attracted by reflections in windows (American Bird Conservancy, 2015) or indoor lighting shining through windows at dusk or after dark (Klem, 2009). According to the American Bird Conservancy Bird Friendly Building Guide (ABC Building Guide), the properties of glass may cause avian collisions when: a) glass reflects a desirable habitat to which the bird attempts to fly; b) glass creates an illusion of a passage (e.g., glass appears black); or c) avian species collide with transparent glass while attempting to access landscaped or vegetated areas. The ABC Building Guide offers multiple solutions for reducing impacts to avian species, including recommendations that qualify for Leadership in Energy and Environmental Design (LEED) credits (ABC, 2015). Solutions include: building design, orientation, nettings, screens, grills, shades, patterned glass, translucent glass, and appliques. Some solutions discussed are easily retrofitted to existing structures while others can be incorporated into the building design or building material selection. The Department believes that the proposed project presents an opportunity to incorporate design standards to minimize potential biological impacts, implement LEED-compliant features, and exemplify environmental stewardship. Accordingly, we recommend that the Port design the proposed project buildings to incorporate avian-friendly elements.

8. With regard to lighting, the ABC Building Guide offers avian-friendly lighting fixture designs and lighting standards. We recommend that the proposed project incorporate avian-friendly lighting designs provided in ABC's guidance documents. We are available to provide a preliminary review of the lighting design.

**General Comments**

9. 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 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, particularly migratory bird species.

Analyses of the Potential Project-Related Impacts on the Biological Resources

10. 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 DEIR.

    a) A discussion of potential adverse impacts from lighting, noise, and human activity.

    b) Discussions regarding indirect project impacts on biological resources.

    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.

    d) A cumulative effects analysis should be developed as described under CEQA Guidelines, section 15130. General and specific plans, as well as past, present, and anticipated future projects, should be analyzed relative to their impacts on similar plant communities and wildlife habitats.

We appreciate the opportunity to comment on the referenced NOP. Questions and further coordination on marine issues should be directed to Loni Adams, Environmental Scientist at Loni.Adams@wildife.ca.gov or 858-627-3985. Questions and further coordination on other issues should be directed to Eric Weiss, Senior Environmental Scientist at (858) 467-4289 or Eric.Weiss@wildlife.ca.gov.

Sincerely,

Gail K. Sevrens
Environmental Program Manager
South Coast Region

ec: William Paznokas (R7- CDFW)

**References:**

American Bird Conservancy and the New York City Audubon, 2015. Bird-Friendly Building Design. https://abcbirds.org/program/glass-collisions/bird-friendly-design/

Gehring, Joelle; Kerlinger, Paul; and Manville, Albert M., 2009. Communication Towers, Lights, and Birds: Successful Methods of Reducing the Frequency of Avian Collisions. *Ecological Applications* 19(2), pp.505-514, 2009.

Kerlinger, Paul; Gehring, Joelle L.; Erickson, Wallace P.; Curry, Richard; Jain, Aaftab; and Guarnaccia, John, 2010. Night Migrant Fatalities and Obstruction Lighting at Wind Turbines in North America. *Wilson Journal of Ornithology* 122(4): pp.744-754, 2010.

Klem, Jr., D. 2009. Preventing Bird – Window Collisions. *Wilson Journal of Ornithology* 121(2): pp. 314-321, 2009.

**Wileen Manaois**

**From:** Laliberte, Kelly@DTSC <Kelly.Laliberte@dtsc.ca.gov>
**Sent:** Tuesday, September 06, 2016 4:22 PM
**To:** Wileen Manaois
**Cc:** State.clearinghouse@opr.ca.gov; Moskat, Guenther@DTSC; Kereazis, Dave@DTSC; Haddad, Shahir@DTSC
**Subject:** Notice of Preparation (NOP) for an Environmental Impact Report - Fifth Avenue Landing Project & Masterplan Amendment
**Attachments:** FifthAveLandingProject_NOP_09.06.16.pdf

Good afternoon,

Attached for your file is the PDF copy of the comments on the Notice of Preparation (NOP) for an Environmental Impact Report for the Fifth Avenue Landing Project & Masterplan Amendment. The original signed document will be sent via regular mail. If you have any questions, please contact Mr. Johnson Abraham, Project Manager, at 714.484.5476 or at email address Johnson.Abraham@dtsc.ca.gov.

Thank you,

Kelly Laliberte
Brownfields Restoration and School Evaluation Branch
Department of Toxic Substances Control
5796 Corporate Avenue
Cypress, CA 90630
Tel: (714) 484-5475
Email: Kelly.Laliberte@dtsc.ca.gov

Department of Toxic Substances Control

**Matthew Rodriquez**
Secretary for
Environmental Protection

Barbara A. Lee, Director
5796 Corporate Avenue
Cypress, California 90630

**Edmund G. Brown Jr.**
Governor

September 6, 2016

Mr. Wileen Manaois
San Diego Unified Port District
Real Estate Development-Development Services
3165 Pacific Highway
San Diego, California 92101

NOTICE OF PREPARATION (NOP) FOR AN ENVIRONMENTAL IMPACT REPORT FOR THE FIFTH AVENUE LANDING PROJECT & MASTERPLAN AMENDMENT

(SCH# 2016081053)

Dear Mr. Manaois:

The Department of Toxic Substances Control (DTSC) has received your submitted document for the above-mentioned project. As stated in your document: "The proposed project would construct an approximately 850-room hotel tower, an approximately 565-bed lower-cost visitor-serving hotel, retail development along the promenade, approximately 2.1 acres of public access plaza space, approximately 213 onsite parking spaces, a connecting bridge from the hotel public access plaza to the San Diego Convention Center, and a marina expansion. In addition, the proposed project would include the potential use of approximately 110 offsite parking spaces in the Convention Center garage and maintain the existing public in-bay water transportation system including a water ferry service."

Based on the review of the submitted document, DTSC has the following comments:

1. The Environmental Impact Report (EIR) should identify the current or historic uses at the project site that may have resulted in a release of hazardous wastes/substances. A Phase I Environmental Site Assessment may be appropriate to identify recognized environmental conditions, if any.

2. If there are any recognized environmental conditions that exist on the project area, then proper investigation, sampling and remedial actions overseen by the appropriate regulatory agencies should be conducted prior to the new development or any construction.

3. If buildings or other structures are present onsite, then lead-based paints or products, mercury, and asbestos containing materials (ACMs) should be addressed in accordance with all applicable and relevant laws and regulations.

4. If the project plans include discharging wastewater to a storm drain, you may be required to obtain an NPDES permit from the overseeing Regional Water Quality Control Board (RWQCB).

5. If during construction/demolition of the project, soil and/or groundwater contamination is suspected, construction/demolition in the area would cease and appropriate health and safety procedures should be implemented. If it is determined that contaminated soil and/or groundwater exist, the EIR should identify how any required investigation and/or remediation will be conducted, and the appropriate government agency to provide regulatory oversight.

If you have any questions regarding this letter, please contact me at (714) 484-5476 or email at Johnson.Abraham@dtsc.ca.gov.

Sincerely,

Johnson P. Abraham
Project Manager
Brownfields Restoration and School Evaluation Branch
Brownfields and Environmental Restoration Program – Cypress

kl/sh/ja

cc: See next page

cc: Governor's Office of Planning and Research (via e-mail)
State Clearinghouse
P.O. Box 3044
Sacramento, California 95812-3044
State.clearinghouse@opr.ca.gov

Mr. Guenther W. Moskat, Chief (via e-mail)
Planning and Environmental Analysis Section
CEQA Tracking Center
Department of Toxic Substances Control
Guenther.Moskat@dtsc.ca.gov

Mr. Dave Kereazis (via e-mail)
Office of Planning & Environmental Analysis
Department of Toxic Substances Control
Dave.Kereazis@dtsc.ca.gov

Mr. Shahir Haddad, Chief (via e-mail)
Schools Evaluation and Brownfields Cleanup
Brownfields and Environmental Restoration Program - Cypress
Shahir.Haddad@dtsc.ca.gov

CEQA# 2016081053

STATE OF CALIFORNIA Edmund G. Brown Jr., Governor

NATIVE AMERICAN HERITAGE COMMISSION
**1550 Harbor Blvd., Suite 100**
**West Sacramento, CA 95691**
**Phone (916) 373-3710**
**Fax (916) 373-5471**
**Email: nahc@nahc.ca.gov**
**Website: http://www.nahc.ca.gov**
**Twitter: @CA_NAHC**

August 24, 2016

Wileen Manaois
San Diego Unified Port District
3165 Pacific Highway
San Diego, CA 921010

sent via e-mail:
wmanaois@portofsandiego.org

RE: SCH# 2016081053; Fifth Avenue Landing Project and Port Master Plan Amendment, Notice of Preparation for Draft Environmental Impact Report, San Diego County, California

Dear Ms. Manaois:

The Native American Heritage Commission has received the Notice of Preparation (NOP) for the project referenced above. The California Environmental Quality Act (CEQA) (Pub. Resources Code § 21000 et seq.), specifically Public Resources Code section 21084.1, states that a project that may cause a substantial adverse change in the significance of an 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 Section 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, § 15064 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 with the area of project 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 or a notice of negative declaration or 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 **lead agencies consult with all 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 sections 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 section 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 section 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 section 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 section 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 nonfederally 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 sections 21080.3.1 and 21080.3.2 and concluded pursuant to Public Resources Code section 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 section 21080.3.1 (d) and the tribe failed to request consultation within 30 days. (Pub. Resources Code § 21082.3 (d)).

    *This process should be documented in the Cultural Resources section of your environmental document.*

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 section 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 sections 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 been 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, section 15064.5(f) (CEQA Guidelines section 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 section 7050.5, Public Resources Code section 5097.98, and Cal. Code Regs., tit. 14, section 15064.5, subdivisions (d) and (e) (CEQA Guidelines section 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.

Please contact me if you need any additional information at gayle.totton@nahc.ca.gov.

Sincerely,

Gayle Totton

Gayle Totton, M.A., PhD.
Associate Governmental Program Analyst

cc: State Clearinghouse

401 B Street, Suite 800
San Diego, CA 92101-4231
(619) 699-1900
Fax (619) 699-1905
sandag.org

September 15, 2016

File Number: 3300300

Ms. Wileen Manaois
San Diego Unified Port District
3165 Pacific Highway
San Diego, CA 92101

Dear Ms. Manaois:

SUBJECT: Fifth Avenue Landing Project and Port Master Plan Amendment Notice of Preparation

Thank you for the opportunity to comment on the Fifth Avenue Landing Project Notice of Preparation (NOP). The San Diego Association of Governments (SANDAG) appreciates the Port of San Diego's efforts to implement the policies included in San Diego Forward: The Regional Plan (Regional Plan) that emphasize the need for better land use and transportation coordination. These policies will help provide people with more travel and housing choices, protect the environment, create healthy communities, and stimulate economic growth. SANDAG's comments are based on policies included in the Regional Plan and are submitted from a regional perspective.

## Smart Growth

A key goal of the Regional Plan is to focus growth in smart growth opportunity areas. This project is located in an Existing/Planned Metropolitan Center (SD CC-1), a smart growth opportunity area identified on the Smart Growth Concept Map. The proposed project is currently well-served by a number of high-frequency local bus routes (Routes 2, 3, 5, 7, 11, 20, 30, 50, 120, 150, 901, 929, and 992), as well as *Rapid* service (Routes 215, 235, 280, and 290), COASTER service, and Trolley service (Blue, Green, and Orange Lines). Please include the following planned routes/services in the plan documents and facilitate access to these services:

- Trolley service (Route 560 – SDSU to Downtown "Mid-City Trolley")
    - Route 215, currently a *Rapid* service, will be transitioned to a Trolley service
- *Rapid* service (Routes 2, 11, 90, 120, 225, 630, 640, and 910)
    - Routes 2, 11, and 120, currently high-frequency local bus services, will be transitioned to *Rapid* services
- High-frequency local bus service (Routes 4, 83, and 923)
- Streetcar (Routes 553, 554, and 555)

**Transportation Demand Management**

When preparing the Environmental Impact Report for the Fifth Avenue Landing Project, please consider integrating additional Transportation Demand Management (TDM) strategies, which could serve as mitigation measures to assist with reducing single-occupancy vehicle trips to and from the project area, while encouraging alternative travel modes. Examples of TDM strategies could include:

- Provision and promotion of shared mobility services (e.g., carshare, bikeshare, on-demand rideshare) to employees and visitors to reduce reliance on private automobiles, reduce demand for parking, and improve circulation within and around the development.

- Encourage hotel and retail employees to use transportation alternatives and designate an Employee Transportation Coordinator to manage and monitor commuter programs for employees. Commuter programs could include: subsidized transit passes for employees and transit pass sales on-site, promotion of the regional vanpool program and designated parking for vanpools and carpools, or promotion of rideshare services like uberPOOL and Lyft Line.

- Parking management strategies such as shared parking, unbundled parking, priced parking, parking cash-out, and designated parking for vanpools, carpools, and carshare vehicles.

- Bike amenities such as secure and convenient bike parking, showers and locker rooms, and bike repair stands.

- Transportation kiosks with information about regional transportation services.

- Wayfinding signage to transit, shared mobility services, and major downtown destinations.

Other regional TDM programs, such as the SANDAG Vanpool Program, online ridematching and trip planning, the Guaranteed Ride Home Program, and the Regional Bike Parking Program can be promoted to employees and visitors to assist with reducing traffic congestion. Information on these programs can be accessed through iCommuteSD.com, and the SANDAG TDM division can assist with the integration of these measures as part of this project.

**Other Considerations**

SANDAG has a number of resources that can be used in the design of the project or as resources for additional information or clarification on topics discussed in this letter. These can be found on our website at sandag.org/igr:

1. SANDAG Regional Parking Management Toolbox

2. Riding to 2050, the San Diego Regional Bike Plan

3. Regional Multimodal Transportation Analysis: Alternative Approaches for Preparing Multimodal Transportation Analysis in Environmental Impact Reports

4. Planning and Designing for Pedestrians, Model Guidelines for the San Diego Region

5. Trip Generation for Smart Growth

6. Parking Strategies for Smart Growth
7. Designing for Smart Growth, Creating Great Places in the San Diego Region

When available, please send any additional environmental documents related to this project to:

Intergovernmental Review
c/o SANDAG
401 B Street, Suite 800
San Diego, CA 92101

We appreciate the opportunity to comment on the Fifth Avenue Landing Project NOP. If you have any questions, please contact me at (619) 699-1943 or via email at susan.baldwin@sandag.org.

Sincerely,

Susan B. Bald

SUSAN B. BALDWIN, AICP
Senior Regional Planner

KHE/hbr

**San Diego County Archaeological Society, Inc.**

Environmental Review Committee

1 September 2016

RECEIVED
SEP 06 2016
SAN DIEGO UNIFIED
PORT DISTRICT
REAL ESTATE

To: Ms. Wileen Manaois
Real Estate Development Services
San Diego Unified Port District
3165 Pacific Highway
San Diego, California 92101

Subject: Notice of Preparation of a Draft Environmental Impact Report
Fifth Avenue Landing Project and Port Master Plan Amendment

Dear Ms. Manaois:

Thank you for the Notice of Preparation for the subject project, which was received by this Society last month.

We are pleased that cultural resources have been included in the list of subject areas to be addressed in the DEIR. In order to permit us to review the cultural resources aspects of the project, please include us in the distribution of the DEIR when it becomes available for public review. Also, in order to facilitate our review, we would appreciate being provided with one copy of the cultural resources technical report(s) along with the DEIR.

SDCAS appreciates being included in the environmental review process for this project.

Sincerely,

James W Royle Jr.

James W. Royle, Jr., Chairperson
Environmental Review Committee

cc: SDCAS President
File

P.O. Box 81106 San Diego, CA 92138-1106 (858) 538-0935

SAN DIEGO
convention center
CORPORATION

Clifford "Rip" Rippetoe, CFE
President & CEO

September 13, 2016

San Diego Unified Port District
Real Estate Development-Development Services
3165 Pacific Highway
San Diego, California 92101

Submitted via USPS and email to: Wileen Manaois: wmanaois@portofsandiego.org

Subject: **San Diego Convention Center comments on the Notice of Preparation for the Fifth Avenue Landing Project and Port Master Plan Amendment (UPD #EIR-2016-06)**

The San Diego Convention Center Corporation (Corporation) has received and reviewed the Notice of Preparation (NOP) for the Fifth Avenue Landing Project and Port Master Plan Amendment and appreciates this opportunity to provide comments to the Port of San Diego (Port). In response to the NOP, the Corporation has identified potential issues that may result in a significant impact to the operations of the San Diego Convention Center (SDCC).

SDCC staff and Board members have reviewed the NOP and have the following comments:

1. A transportation study should be conducted to evaluate the project's impacts and to identify any potential impediments to the successful delivery of freight and equipment for trade shows, conventions, corporate events and special events at SDCC. The roadway that would service this new property (Convention Way) provides the only ingress and egress to the docks that serve SDCC. Customers, and their contractors, use these docks to bring in the millions of pounds of freight that become exhibits, audio-visual sets, decoration and product to be displayed. Any alteration to this roadway must be coordinated with the Corporation, or else the conventions/trade shows/corporate events/consumer shows could be severely impacted. This impact could decrease the more than 150 events held in SDCC annually; the more than 824,000 in annual attendance would go down

t 619.525.5101 f 619.525.5103 e RIP.RIPPETOE@VISITSANDIEGO.COM | 111 W. HARBOR DRIVE, SAN DIEGO, CA 92101 | VISITSANDIEGO.COM

correspondently, and the direct spending of over $658 million would similarly decrease. This, in turn, could create a substantial decrease in hotel and sales tax revenue.

The hotel and sales tax revenue generated by SDCC significantly contributes to the fiscal health of the City of San Diego. The activity at SDCC generated $23,912,326 in taxes during FY 2016. SDCC is on pace to generate more than $25 million in FY 2017. Expenses against this revenue (marketing, capital investment, bonds and dewatering expense) were $17.2 million in FY 2016. The net ROI from direct activity at SDCC during FY 2016 was over $6.7 million. This ROI is in danger of decreasing significantly if we erode the activity at SDCC due to limited ingress and egress.

2. Pedestrian access and safety is an everyday consideration at SDCC. The design of the plaza areas and the approaches to the project must take into consideration the more than 824,000 guests coming to SDCC annually. Although every visitor to SDCC is a potential pedestrian, over 500,000 of our guests are from out of town. They take shuttles, taxis, Uber and Lyft to SDCC. They then tend to explore the waterfront and the Gaslamp District and to walk to the more than 137 restaurants in the downtown area.

   SDCC requests that a formal study be conducted on pedestrian safety as part of the EIR for this project. We applaud efforts for pedestrian access and safety. We acknowledge the placement of a pedestrian bridge between the proposed project and SDCC. This takes into consideration the safety of our guests. However, we have had no actual conversation regarding this access bridge with the Fifth Avenue Landing team. We have no agreement or understanding of the design, scope, security or use of the bridge. This includes understanding how the bridge will impact the access of the hundreds of tractor-trailers that serve the dock area that is directly adjacent to the proposed project.

   We look forward to receiving this information. We would welcome the opportunity to comment further once we have reviewed this information. However, until that time, we cannot endorse this element of the proposal.

3. Previous EIRs conducted on this area included the proposed contiguous expansion of SDCC. A requirement for SDCC resulting from that process included a requirement that solar voltaic systems be installed on our roof top. The system area is master planned for the East half of SDCC immediately adjacent to this proposed project. The hotel tower of this proposed project appears to be in the direct path of the sun rays that would feed the solar farm that would be installed. The almost 500-foot tower will potentially impact the

usefulness, effectiveness, and the payback of such an installation, possibly making it impractical to move forward.

Since the use of solar is a Port requirement for SDCC, we request that any approvals for this project include a study that ensures the success of such an installation on another Port property (SDCC). Additionally, in the absence of such a study, we request that relief from this requirement be granted prior to any approval of this project.

4. Approval of this project prevents any contiguous expansion of SDCC. The expansion of SDCC is needed to retain the region's largest convention clients, including Comic-Con International. Comic-Con has endorsed a contiguous expansion and has publicly stated that no other alternatives are suitable. A hotel on the adjacent property will prevent any contiguous expansion of SDCC.

   There have been two studies conducted that demonstrate the need for an expansion of the SDCC. One study was commissioned by the Corporation, and one was commissioned by the Tourism Marketing District. Both studies consider the economic benefit of a contiguous expansion of the existing space. We continue to lose conventions because of the need for expansion. Last week we were notified of the loss of another convention due to size restrictions. Specialty Graphic Industry Association (SGIA) has cancelled its 2021 annual convention with us, previously scheduled for 9/14-26/2021. After conducting a full site inspection in July, they and their service contractor have determined that our building is not large enough to house their event. Their more 21,000 attendees would have contributed significantly to our local economy. Unfortunately, this is a story we hear all too often.

   The former proposed expansion was slated for this same property. The current situational analysis of the project has many impediments, including no existing agreement between the Corporation and the FAL group.

5. The outcome of the two initiatives in November will dictate the possible future of any SDCC expansion. We are keenly aware of that. However, until the two initiatives are voted on, it does not seem prudent to proceed with a project of this magnitude at this location. The approval of the current proposed project without an overarching strategy for the downtown district does not serve our customers, our tax revenue creation, or our long-term ability to continue to create economic benefit for the Region.

   We request that any consideration of this project be delayed until after the resolution and certification of the public vote on November 8, 2016.

6. The comments above describe real impacts on SDCC. The resolution of the issues described will be necessary regardless of the project design, scope and use. The Corporation understands this from a unique point of view. The Corporation's public approval process for a project on this same property resulted in many of the same comments. That is where the requirements for a public plaza were determined and ultimately duplicated within this FAL proposed project. It is also where the requirement for the solar voltaic system was determined and issued.

   The Corporation acknowledges the potential for this site. The growth in visitor volume and the need for more hotel rooms is real. We see potential for this site that could be mutually beneficial to SDCC customers, visitors needing hotel rooms, the desired growth of tax revenue for essential City services, and other projects that benefit the citizens of the Region.

7. The Corporation formally recommends that a joint project be considered for this property that addresses all concerns. A combination contiguous expansion of SDCC and hotel complex would change the landscape of this area. Specifically, we recommend a contiguous convention center expansion with a hotel built above it. The two uses would be served by separate entrances and maintain the use of existing docks as well as new dock spaces. Research has shown that 14 of the top 25 convention centers in the United States are connected to a hotel. (See appendix.) The destination appeal of a combined contiguous convention center and hotel all-in-one will give us a competitive advantage over many of our competitors.

   The combined project would require the resolution of the issues stated above. It would also require public access to the waterfront, including the waterfront park, and the creation of a joint operating agreement.

The San Diego Convention Center Corporation is a public benefit corporation whose purpose is to provide a premier gathering place for trade shows, conventions, and events that generate economic benefits to the Region. Our promise is to provide world class service and create a desire for our customers and their guests to return repeatedly in order to invest further in our local economy. This mutually beneficial use could be accomplished with the support of the Port and a collaborative approach to the use of the property.

Thank you for considering our comments. We appreciate the opportunity to respond during this review process. We are available to answer any questions or to provide any additional information you may require.

Respectfully submitted,

Clifford Rippetoe

Clifford "Rip" Rippetoe, CFE
President & CEO

Cc. Mayor Kevin Falconer
San Diego City Council Members
San Diego Convention Center Corporation Board of Directors

September 15, 2016

Wileen Manaois
San Diego Unified Port District
Real Estate Development – Development Services
3165 Pacific Highway
San Diego, CA 92101

Submitted via email to: wmanaois@portofsandiego.org

**RE: FIFTH AVENUE LANDING PROJECT & PORT MASTER PLAN AMENDMENT**
**NOTICE OF PREPARATION OF A DRAFT ENVIRONMENTAL IMPACT REPORT (UPD #EIR-2016-06)**
**COMMENTS BY MARK G. STEPHENS, AICP**

Dear Ms. Manaois:

Thank you for the opportunity to attend the September 7, 2016 public scoping meeting and to comment on the Notice of Preparation (NOP) of a Draft Environmental Impact Report (EIR) for the proposed Fifth Avenue Landing Project and Port Master Plan Amendment. As related informally at the scoping meeting, this proposal is inconsistent with existing plans and out of scale with development previously contemplated or foreseeably appropriate at this site. More extensive comments on the scope and content of the environmental document follow.

*Project Description*. Terminology in the project description is potentially misleading and should more accurately reflect current circumstances, applicable plans, and adverse effects that would result from the project. Specifically, the existing site is largely open, and several staircases (as well as elevator facilities) allow public access to and from the Convention Center, and public pathways and promenades enable at grade movement around the Center. Proposed “public access plazas” and a “public access bridge” would actually encroach on public access and public views. Building would occur over the top of the existing public promenade, turning a segment of it into essentially a tunnel. Describing an existing, open air, public promenade as being “activated” by enclosure in the shadow of a bridge and huge skyscraper is disingenuous at best.

*Aesthetics and Visual Resources*. A basic precept of urban design is that the tallest structures should be located in more inland locations, stepping down to lower scale development along the waterfront and enhancing connections to the coast. At 498 feet, the massive new hotel proposed would be the tallest structure along San Diego Bay, and would permanently block public views up and down the coast. The proposed location on a peninsula jutting into San Diego Bay well beyond the building line of other Downtown coastal high-rise hotels, such as the Hyatt, Marriott and Hilton, would be an awful precedent. The existing Convention Center grand staircase from Harbor Drive leads to an imaginatively designed connection to a viewing platform offering outstanding vistas up and down the coast. The proposed project (especially the hotel tower) would severely compromise these public views. While a rooftop plaza is proposed on the upper level of some of the building area, potential benefits are largely negated by introducing multi-story structures towering directly above the narrow bayfront promenade, with shading impacts and loss of the open, expansive character of existing ground level views. (Also address comments above under Project Description related to visual impacts.) In addition, the hotel tower would be right next to the historic Old Rowing Club structure, dwarfing and shading it with an entirely incompatible design motif.

*Land Use and Planning.* The existing Port Master Plan is widely acknowledged to be outdated and in need of a comprehensive overhaul, and this effort is under way. While the Port District continues to consider inconsistent proposals before completion of the update, allowing such an incompatible and bad precedent setting project to proceed without the context of  an up-to-date overall plan would be extremely ill advised, and cause irreversible adverse impacts. Virtually the entire onshore lease space (and more) is proposed to be intensively developed. This needs to be assessed in the context of California Coastal Act policies and the fact that every square foot of land involved is publicly owned.

*Other Topics*. While not highlighted further in these comments, a thorough analysis of the other subject areas listed at the top of page 5 of the Notice of Preparation is also required (i.e., Air Quality & Health Risk, Biological Resources, Cultural Resources, Geologic Hazards and Soils, Greenhouse Gas Emissions & Climate Change, Hazardous Materials/Hazards, Hydrology and Water Quality, Noise and Vibration, Public Services and Recreation, Transportation/Traffic, and Utilities and Energy Use).

*Cumulative Impacts*. An unprecedented array of other pending or ongoing projects in the general vicinity will need to be assessed in the cumulative impacts analysis. Some of these projects include the Navy Broadway Complex, the Port’s Central Embarcadero Development Project (Seaport Village and surrounding area), Phase III Convention Center Expansion (while not currently progressing, it is still an approved project) and second Hilton Bayfront tower, Tenth Avenue Marine Terminal redevelopment projects, the San Diego Chargers’ proposed Stadium and Convention facilities in East Village, Convention Center major maintenance repairs, a San Diego Symphony permanent facility at South Embarcadero Park (displacing more public park green space), Ballpark Village, Cisterra Development Project, and many other projects, including numerous additional Downtown hotels.

*Alternatives.* With such substantial and likely unmitigable adverse impacts associated with the current proposal, an honest and thorough evaluation of alternatives is essential.  Alternatives should address: substantially reducing building heights, footprints, and square footages; alternative locations, such as private land Downtown (which would be far more appropriate for a major high-rise structure), or in the Chula Vista Bayfront area (which has much more developable land available, reducing the need for such a tall structure, and the City of Chula Vista and the Port have been trying to attract a significant hotel project there for many years); and alternative uses of this proposed site that would complement rather than clash with the surrounding community. The “No Project” alternative would clearly be environmentally superior to the proposed project.

*Conclusions and Recommendation*. With all due respect to the project designers, they are facing an impossible task analogous to fitting a size 13 foot into a size 4 shoe. It doesn’t work! I recommend that this proposal be scrapped in favor of a more realistic project, or be presented for summary denial, which wouldn’t require further environmental review. This would avoid the considerable time and expense involved in an inevitably long, contentious, and acrimonious environmental and project review process. As a Downtown San Diego resident and homeowner for 15 years, development of this proposal with no apparent public input is extremely troubling. Alternatively, a reconceptualized plan could be developed through a process that reaches out to the surrounding community and other affected interests, and offers a much greater potential for obtaining public support and gaining approval.

Please provide notification of any subsequent opportunities for public input regarding this proposal, via email to msdesmtnsea@hotmail.com, or sent to the address below. Thank you for your consideration!

Sincerely,

Mark G. Stephens

Mark G. Stephens, AICP
500 W. Harbor Dr., Unit 514
San Diego, CA 92101

# Appendix C
# Proposed Port Master Plan Amendment

*San Diego Unified Port District*

# *DRAFT*

# *Fifth Avenue Landing*
# *Port Master Plan Amendment*

***Existing/Proposed Plan***
***Text and Graphics***

***October 17, 2017***

***Note: Text to be deleted shown ~~stricken~~ and text to be added shown underlined.***
***Text in italics is for clarification only and is not part of the Plan Amendment.***

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

| *LAND USE* | *ACRES* | *WATER USE* | *TOTAL ACRES* | *ACRES* | *% of TOTAL* |
|---|---|---|---|---|---|
| **COMMERCIAL** | **454.5~~457.9~~** | **COMMERCIAL** | **400.5~~388.8~~** | **855~~846.7~~** | **15%** |
| 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 | 394.8~~398.2~~ | Recreational Boat Berthing | 352.9~~341.2~~ | | |
| Sportfishing | 4.3 | Sportfishing Berthing | 11.1 | | |
| **INDUSTRIAL** | **1158.7** | **INDUSTRIAL** | **206.9~~212.0~~** | **1365.6~~1370.7~~** | **24%** |
| Aviation Related Industrial | 152.9 | Specialized Berthing | 159.7~~164.8~~ | | |
| Industrial Business Park | 69.5 | Terminal Berthing | 47.2 | | |
| Marine Related Industrial | 318.6 | | | | |
| Marine Terminal | 149.6 | | | | |
| International Airport | 468.1 | | | | |
| **PUBLIC RECREATION** | **412.8~~407.5~~** | **PUBLIC RECREATION** | **681.1** | **1093.9~~1088.6~~** | **19%** |
| | **[414.5~~413.7~~*]** | | | **[1094.8*]** | |
| Open Space | 66.9 | Open Bay/Water | 681.1 | | |
| Park/Plaza | 216.2~~211.0~~ | | | | |
| | [217.9~~2~~*] | | | | |
| Golf Course | 97.8 | | | | |
| Promenade | 31.9~~31.8~~ | | | | |
| **CONSERVATION** | **485.3** | **CONSERVATION** | **1084.6** | **1569.9** | **28%** |
| Wetlands | 375.8 | Estuary | 1084.6 | | |
| Habitat Replacement | 109.5 | | | | |
| **PUBLIC FACILITIES** | **239.5~~241.4~~** | **PUBLIC FACILITIES** | **381.3~~387.9~~** | **620.8~~629.3~~** | **11%** |
| Harbor Services | 2.6 | Harbor Services | 10.5 | | |
| City Pump Station | 0.4 | Boat Navigation Corridor | 274.3 | | |
| Streets | 236.5~~238.4~~ | Boat Anchorage | 25.0 | | |
| | | Ship Navigation Corridor | 47.3~~53.9~~ | | |
| | | Ship Anchorage | 24.2 | | |
| **MILITARY** | **25.9** | **MILITARY** | **125.6** | **151.5** | **3%** |
| Navy Fleet School | 25.9 | Navy Small Craft Berthing | 6.2 | | |
| | | Navy Ship Berthing | 119.4 | | |
| **TOTAL LAND AREA** | **2776.7** | **TOTAL WATER AREA** | **2880.0** | | |
| **MASTER PLAN LAND AND WATER ACREAGE TOTAL** | | | | **5656.7**** | **100%** |

**Includes 1.7~~6.3~~ acres of rooftop park/plaza ~~& inclined walkway~~*

*** Does not include 1.7~~6.3~~ acres of rooftop park/plaza ~~& inclined walkway~~*

# CENTRE CITY EMBARCADERO:
### PLANNING DISTRICT 3

## *Introduction*

The Embarcadero of San Diego is the downtown waterfront area for an urban region of over 2.7 million people. The pierside maritime activities of commercial fishing boats, merchant ships, Navy vessels and pleasure craft contribute to the fabric of the Embarcadero. Planning District 3 covers all of the Port District waterfront from the U.S. Coast Guard Air Station to the Tenth Avenue Marine Terminal. From Laurel Street to Market, Port land boundaries follow parallel to the shoreline and extend easterly to Pacific Highway, except for two major land blocks; the five-block-long property of the County of San Diego's Administrative Center and the four-block-long property of the U.S. Navy's Commander, Naval Base San Diego and Naval Supply Center. The owners of both of these properties have proposed extensive renovation and redevelopment plans, which include commercial recreation, county government's administration, and U.S. Navy uses.

In order to coordinate the redevelopment of this area and adjoining agency properties, an alliance was formed to develop a single, comprehensive plan. The North Embarcadero Alliance includes the Port District, City of San Diego, County of San Diego, Centre City Development Corporation, and the U.S. Navy. The Alliance developed a Visionary Plan in 1998 to guide the redevelopment of the contiguous properties. The specific recommendations of the Visionary Plan that pertain to Port District land and water areas within the Planning District 3 Precise Plan area are incorporated into the Master Plan. All other recommendations of the Visionary Plan guide development within Planning District 3.

## Precise Plan Concept

The basic concept of the redevelopment of the Embarcadero is to create a unified waterfront, both visually and physically, which creates an overall sense of place. In this concept, the Embarcadero becomes a pedestrian spine along which commercial and recreational activities are located. In order to emphasize the pedestrian oriented waterfront experience, through traffic is routed to Pacific Highway, and considerable effort is directed toward improving the amenities and people spaces of the public thoroughfare along North Harbor Drive. Industrial uses adjacent to the airport are renovated and retained as important employment centers and as airport buffer land use activities. The renovation of marine terminal facilities will retain the active use of deep draft berthing and continue carefully selected functions of a working port. The commercial fishing industry is given a major focus at several locations with the development of new piers and a mooring basin. A major hotel and commercial complex with recreational facilities is proposed to connect and enhance nearby portions of downtown.

The Embarcadero is intensively used by many people. With the mixture of activities going on here, it is important to emphasize that several activities may occur at the same location, depending on a scheduling overlap to accommodate all of them. For example, Broadway Pier may be used at different times for tuna fleet berthing, cruise ship berthing, excursion or ferry boat berthing, public access, passive recreation, and commercial recreation. The redefined Specialized Berthing designation applies to this precise plan area only, and may include marine-related uses such as transient and general berthing of small boats, historic ship berthing, ferry or excursion boat berthing, and commercial fishing boat berthing as the highest priority use. The designation carried on the

Precise Plan indicates the primary use but secondary uses may occur. This is particularly true of water areas and of public access, which may be available at other sites than those mentioned.

## Land and Water Use Allocations

The Precise Plan allocates a balanced distribution of commercial, industrial, public recreation and public facility uses in this 434- acre planning area. More detailed allocations are indicated in the Land and Water Use **Table 10**, and use areas are graphically portrayed on the **Precise Plan Map**.

## Centre City Embarcadero Planning Subareas

The Planning District has been divided into six subareas as shown in ***Figure 12***.

The North Embarcadero Alliance Visionary Plan area includes all of Subareas 31, 32, 33, and part of Subarea 34. The Visionary Plan proposes to revitalize San Diego's downtown waterfront through a concept for public improvements and by guiding development to optimize property values, public access opportunities and priority waterfront and water-dependent uses. The Plan recommends a substantial linear esplanade park on the urban waterfront with public art, street furniture, public spaces, expansive Bay views and public parking. The Plan proposes two major parks and plazas at the County Building and the foot of Broadway, and includes recreational piers and associated public facilities, harbor excursion landings and water-related commercial uses on Port tidelands. General commercial, residential, and commuter traffic would utilize an enhanced Pacific Highway grand boulevard, while North Harbor Drive would serve waterfront public access, water-dependent, and Embarcadero commercial recreational uses. An extension of the downtown San Diego small-block street grid across the railroad right-of-way, off Port lands, to the Bay would enhance public views and pedestrian access opportunities from upland areas *(See Visionary Plan Figure 3.1 for illustrative plan of the area)*. Aboveground parking structures which are visible at the perimeter of a development should be limited to a maximum of six levels of parking or 60 feet above grade. *(See Visionary Plan - p.79)* North Harbor Drive, Broadway, Ash Street, and Grape Street are envisioned as active pedestrian linkages to the Bay from upland areas. Building frontage adjacent to these streets shall be developed with uses that promote pedestrian activity and public oriented uses. On other streets, ground-level facades shall maximize the sense of contact between indoor and outdoor activities. *(See Visionary Plan - pp.67, 68.)*

## Laurel Street Corridor

The established aviation related industrial use in this subarea, subsequent to renovation and beautification of the physical plant, is anticipated to continue in operation: however, if such use is discontinued, the Visionary Plan proposes the extension of vehicle and pedestrian access, parking, service access, and view corridors along extensions of Kalmia, Juniper, and Ivy streets through this parcel to North Harbor Drive. Building height limits of 60 feet are proposed for this area; however, this height limit would be superseded by any more-stringent FAA runway approach zone restrictions. *(See Visionary Plan Figures 4.5, 4.10, 4.11, and 4.12.)* Grape and Hawthorn Streets, Pacific Highway and North Harbor Drive from Laurel Street to Hawthorn Street will be modified to accommodate traffic flow and with streetscape improvements to match the balance of the streets through Subareas 31-34. Geometric improvements to direct traffic flow from North Harbor Drive to Pacific Highway will be made at the Grape Street intersections with these roadways. The block between Hawthorn, Grape, Pacific Highway and North Harbor Drive (2.3 acres) will remain in commercial recreation use with some landscape improvements or possible parking facility development. The landscaped triangle at Laurel and North Harbor Drive is shown on the Plan as Open Space.

### Crescent Zone

The most important element influencing design in the Crescent Zone is the curvilinear form of the waterfront. Dramatic panoramic views can be realized at either vehicular or pedestrian speeds. The Port Master Plan capitalizes on this attribute to establish a grand pedestrian-oriented esplanade (no less than 100-feet wide) and major entryway into the Centre City district from Grape Street to Broadway. The promenade connects with the North Harbor Drive bicycle path to provide a continuous pedestrian/bicycle path from Navy Estuary to Fifth Avenue, a distance of four miles. Pacific Highway streetscape improvements would continue through this subarea. An esplanade at least 25-feet wide, bayward of Harbor Drive, will be added from Laurel Street to Grape Street. North Harbor Drive will be narrowed to three lanes to reduce through traffic. The unused right-of-way will be developed with landscaped promenades, parks and plazas. Along the water's edge the concrete pathway will continue its present use as both pedestrian promenade and service area for commercial fishing boats tied up along the Crescent Zone bulkhead. Four public viewing/vista points would be spaced along the Crescent shoreline.

The waterfront between Grape Street and Ash Street will be used for Ship Anchorage, Boat Navigation Corridor, and Specialized Berthing. The three existing piers no longer function or are needed as commercial fishing berthing or fuel pier; therefore they will be replaced with a 30,000 square-foot curvilinear pier at Grape Street, with a 12,000-square-foot public boat dock designated as Park Plaza. The waterside termination of this pier is designated as Commercial Recreation to allow possible development of a commercial facility. Wave attenuation structures would protect the boat docks. A 5,000-square-foot parcel with a maximum 10,000-square-foot floor area designated as Commercial Recreation will provide for a major restaurant or other commercial recreation use on the esplanade at the foot of the Grape Street Pier. Development density with a Floor Area Ratio (FAR) of 3.0 and a building height limit of 12 feet is prescribed for this area, with the exceptions of the proposed commercial recreation parcel where a 13-foot high second story would be allowed. Building stepbacks along the inland side of North Harbor Drive for upper stories shall be 25-foot minimum at 50 feet along the inland side of North Harbor Drive and 15-foot on east-west streets. *(See Visionary Plan Figures 4.4, 4.5 and 4.8)* Commercial Fishing Berthing has been allocated to the Crescent water interface (18.6 acres) as the highest priority use; however, this water is also used for transient berthing and occasional general berthing for small boats. The boat channel area just offshore is also used for temporary anchorage for small boats; therefore, the designation is changed to Specialized Berthing, which includes these uses within this precise plan area only.

Anchorage A-3, Laurel Street Roadstead Anchorage, is sheltered from the open sea but is located in both the most visible and the widest part of northern San Diego Bay. Approximately 20.6 acres of water area is allocated to accommodate about 50 vessels on swing point mooring buoys. Onshore, a public rest room, three dinghy floats and connecting shore ramps provide for the landing needs of the anchorage user. As a federally designated anchorage, the boundaries are shown on coastal charts and identified on site by boundary markers. Administration of the anchorage is exercised by the Port District, pursuant to local ordinance. Thirty to forty percent of the moorings are to be set aside for short-term use by cruising or transient vessels. Section III, Water Based

Transportation system, contains information on the baywide small craft anchoring system.

### Civic Zone

The zone of highest activity is the Civic Zone from Ash Street to Broadway. This zone reflects its waterfront orientation, with operating piers extending into the bay, Navy facilities, commercial fishing activity, and historic sailing vessels. Its physical relationship to Centre City attracts large numbers of people and the future development of both areas is integrated by the Visionary Plan.

Significant redevelopment is recommended for the Civic Zone. The landscaped esplanade and streetscape improvements mentioned in the Crescent Zone will be continued along North Harbor Drive and Pacific Highway through the Civic Zone. North Harbor Drive will be reduced by narrowing to three lanes. Parking areas along the street will be interspersed with landscaping, vertical elements used to frame and enhance views, and lawn areas. *(See Visionary Plan Fig. 5.3)*

The esplanade expands into plazas at Beech and Ash Streets, B Street Pier, and Broadway Pier. These plazas will be designed to provide open space, sitting and strolling areas for tourists and nearby workers, and to increase the sense of destination for Embarcadero visitors.

Passive green spaces (parks) are proposed between the plazas on the esplanade, providing recreational opportunities and places for people to relax, play, and enjoy Bay views. The promenade is a continuous 25-foot-wide paved area adjacent to the water's edge. The wharf side remains clear of objects or furnishings that would block Bay views. A delicate string of lights, a planting area with tall palms, and a 10-foot-wide bike path border the landward side of the promenade *(See Figure 5.3 of the Visionary Plan)*.

The most important element in this zone is the conversion of the old Lane Field site and Navy Engineering building into a new complex of buildings and open spaces. Primary consideration is a 600-to-800-room hotel. The intent of the plan is to retain flexibility for considering a wide array of development options. The concept includes possible multiple utilization of activities that could provide for commercial recreation; international trade, travel and cultural complexes; commercial and office space for maritime business; support facilities related to the Port; and subject to negotiation with the U.S. Navy, the provision of equal or better building space for the relocation of the Naval Facilities Engineering Command. The FAR for Lane Field parcel is 7.0 and 6.5, while building height limits range from 400 feet to 200 feet sloping toward the Bay. Special setback requirements along the Broadway side of this parcel range from 55 feet to 65 feet, widening toward the Bay (See Figure 4.7 of the Visionary Plan, which also illustrates the special radius setback on North Harbor Drive/ Broadway SW corner). Stepbacks for upper stories are 25-feet minimum at 50-feet building height except for the B Street side of the parcel and on other east-west streets where they are 15 feet. There are no stepback requirements along Pacific Highway. *(See Visionary Plan Figures 4.5, 4.6, 4.7 and 4.8)*

The Visionary Plan proposes public right-of-ways aligned with existing downtown streets through development parcels, including Lane Field. These right-of-ways include pedestrian and vehicle traffic, view corridors, parking and service access. The right-of-ways shall be a minimum of 80-feet-wide with the character of a public street, and would enhance the physical and visual access to the Bay. The C Street segment through Lane Field may vary in alignment with existing street up to 20 feet north or south, and it may or may not accommodate vehicular circulation. A north-south pedestrian link, if practical, is also proposed through this parcel. *(See Visionary Plan Figures 4.10, 4.11, 4.12, and 6.1)*.

B Street Pier is scheduled for substantial redevelopment of the apron wharf and the structures on the pier. The south shed will be removed or redesigned to create space for parking and a promenade. The western end of the pier will be converted for specialized commercial uses such as a shopping bazaar, and foods and services reflecting the maritime character of the Embarcadero and which will be compatible with cruise ship berthing. The Cruise Ship Terminal will be expanded and both sides of the pier will accommodate ship berthing. Cruise ships may tie up at both the B Street and Broadway Piers. The shopping bazaar could be expanded into the terminal building and the existing Maritime Museum could be provided with land-based support area, storage and work area, and possibly a living museum of nautical craftsmen; however, loading, off-loading, and storage capabilities for general cargo will be retained as needed. Alternatively, the Maritime Museum may be relocated to another location along the Embarcadero, such as the curvilinear pier at Grape Street. A FAR of 2.0 applies to the B Street and Broadway piers. The building height limit for the B Street Pier is 50 feet; however, an expanded cruise ship terminal, now under study, may require (for functional reasons) building(s) in excess of 50 feet in height. Pursuant to the Port's cruise ship terminal study, alternative height restrictions and other guidelines affecting B Street Pier may be appropriate and acceptable, and they should be considered by the Alliance. *(See Visionary Plan Figs. 4.4, 4.5 and pp. 63, 64)*

Broadway Pier will continue to provide recreational space on its plaza and viewing platform, as well as accommodating commercial shipping and miscellaneous vessel berthing, including day cruisers. Improvements to the pier will include paving, plantings, lighting, and furniture. The harbor excursion and ferryboat water lease north of Broadway Pier may also remain as part of the recreational experience along the waterfront or move to another location along the Embarcadero.

## Tuna Harbor

This subarea consists of the Tuna Harbor, the harbor formed by its pier, the proposed new bayfront public park, the new Pier Walk building with commercial recreation and commercial fishing uses, parking, and adjacent areas.

Tuna Harbor and the shoreline area between it and Navy Pier are planned to provide space for commercial fishing and commercial recreation activities. The plan concept is to create a physical and visual linkage along North Harbor Drive by tying together Broadway Pier and the Tuna Harbor area.

The aircraft carrier Midway is docked on the south side of the Navy Pier. The Terminal Berthing designation would be changed to Commercial Recreation and Park/Plaza for the proposed 0.8-acre public viewing area with a designated vista point on the bow deck of the ship. The Commercial Fishing Berthing designations in this water area would be replaced with Specialized Berthing to accommodate multiple uses. Landscaping and streetscape improvements on North Harbor Drive would continue through this area.

Parking for visitors to the Midway and its museum will be provided, on an interim basis, at the Navy Pier, pursuant to the museum's lease with the United States Navy. When and if the Navy determines that its use of the Navy Pier is no longer necessary, the Port will accept the proposal by the San Diego Aircraft Carrier Museum to convert the Navy Pier into a "public park" use, thereby allowing the pier to be converted into a memorial park complementing the Midway and its museum, while affording additional public open space and bay vistas. Vehicle parking for museum visitors will then be shifted to nearby offsite locations. However, since the Navy Pier's future is uncertain and will be determined by decisions of the federal government, the conversion of the pier to a 5.7-acre memorial park is a specific planning goal of the Port, and environmental analysis for the park conversion will be conducted prior to the Navy relinquishing ownership and/or control of the Navy Pier such that construction of the park can occur as soon as feasible thereafter. The park conversion will be subject to all appropriate laws at the time the Navy Pier Park is proposed.

Mitigation for the loss of 4.1 acres of open water habitat resulting from the placement of the aircraft carrier Midway and its mooring platform structures has been provided by an expansion of an existing degraded marsh, known as Lovett Marsh, east of south San Diego Bay, in the City of National City, resulting in the creation of approximately 5.8 acres of new coastal salt marsh.

A small waterfront plaza, fishing technology displays, restaurants, marine related office and retail space is planned on the periphery of the mole. Tourist traffic on the public areas will be encouraged, consistent with safety. The Embarcadero pedestrian path loops through the area.

A substantial portion of Tuna Harbor is devoted to commercial fishing use. It is anticipated that offices for the tuna and fresh fish fleet will locate here, as well as ancillary uses such as small seafood processors, fish markets, marine instrument and equipment sales, fishing and ocean technology displays, and automobile parking. The northern side of the mole has been renovated by stabilizing the existing concrete slab wall with rock revetment. The south face of the mole has been renovated with rock revetment for shore protection. Floating docks will provide 50- and 60-foot berths for commercial fishing boats. Low level lighting is provided for the berths. Landside support services, auto parking, and truck access are included. Approximately 100 commercial fishing berths are provided alongside the floating docks.

To shelter Tuna Harbor from the south, a concrete breakwater pier approximately 400 feet long has been built from the land lying between the former Harbor Seafood Mart area and Seaport Village. The pier provides additional berthing for tuna seiners and large market fishing boats, allows public access to the water, and accommodates water taxi service. The entrance to this joint use pier will be enhanced to provide a strong pedestrian linkage from waterfront viewing areas to the reconfigured commercial fishing and retail area (formerly occupied by the Harbor Seafood Mart building). This pier walk will connect to the new bayfront public park to the north, as well as the entrance to Seaport Village and the south side of the redeveloped Old Police Headquarters (OPH) building.

The Harbor Seafood Mart building is planned to be demolished and the site redeveloped with a new Pier Walk building of comparable size and use allocation, which will consist of an improved fish processing facility with sufficient parking and loading/unloading spaces to support the operation, as well as ancillary retail and restaurant uses related to and supportive of the commercial fish processing uses in the building. The development will be designed so that the commercial fishing use will be able to continue to utilize and maintain the existing fish unloading dock, with direct, unrestricted access to joint use of the pier/dockside facilities. The new facility will be large enough to support both the current capacity requirements of the fishing industry, and allow for the expansion of services for seafood processing. The Precise Plan underlying the portion of the new Pier Walk building nearest the unloading dock will have a land use designation of Commercial Fishing to provide for the retention of valued commercial fishing activities. The facility will be integrated with the surrounding public walkways and plazas with opportunities for public viewing and access opportunities.

In conjunction with the reconfiguration of the fishing facility, the Precise Plan will also be designated as Park/Plaza to allow for the construction of a new three-acre bayfront public park on the north end of the site. The open space provided by the new bayfront park will enhance pedestrian and visual access to the Bay, as well as create a pleasant rest area and viewing place along the Embarcadero promenade for event gatherings and public activities. Adjoining parking areas will also be reconfigured and enhanced with landscaping and pedestrian linkages to the surrounding uses. The parking areas are intended to serve the public park, commercial fishing and recreation uses, reactivated Old Police Headquarters building, as well as Seaport Village.

### Marina Zone

The Marina Zone, located along Harbor Drive from Pacific Highway to Park Boulevard, is planned to be intensively developed as a major public and commercial recreational complex. Major projects, including the 22-acre Embarcadero Marina Park; the restaurant and specialty retail center of Seaport Village; a regional convention center and, convention hotels and marina, have started the transformation of this waterfront area into an attractive commercial and recreational resource. Marina Zone projects will provide the southerly anchor for the Embarcadero development and the six-mile long promenade that extends north to Spanish Landing Park along the waterfront. Pedestrian linkages from the upland areas will provide access to this lively activity center for residents and visitors alike.

The plan concept is to rehabilitate and reactivate the historically designated, and presently vacant, Old Police Headquarters building with restaurant, specialty retail, indoor/outdoor public market, and entertainment uses. On the district Precise Plan, this area will be designated as Commercial Recreation. The north side of the site along Harbor Drive will be designated as Park/Plaza and will be redeveloped into an urban park and plaza area of approximately one acre in size with enhanced landscaping and pedestrian features. The new urban park will create visual and physical linkages from the OPH to the new bayfront park across Pacific Highway, as well as link to enhanced pedestrian connections to and along the Embarcadero through Seaport Village and along Kettner Boulevard. A small portion of the site on the north side of OPH will retain the Commercial Recreation land use designation in order to allow for associated outdoor commercial, or activating, uses. The parking areas surrounding the OPH and Seaport Village will be reconfigured to accommodate vehicles more efficiently, as well as allow for valet parking and loading areas.

Across from the hotel development, the west side of Kettner Boulevard from Harbor Drive to Seaport Village will be developed with landscaping and pedestrian features to provide improved connectivity between tideland uses, as well as increase activating uses.

Between the existing Marriott and Hyatt Hotels, an accessway known as “Marina Walk” is proposed consistent with the South Embarcadero Public Access Program, as amended. Marina Walk will improve public pedestrian connectivity between Harbor Drive and the Embarcadero shoreline promenade and enhance public views towards the Bay through removal of existing landscaping and surface parking, leveling of the existing grade, relocation of the large cooling towers, and construction of a joint, cohesive public accessway spanning both the Marriott and Hyatt leaseholds. Approximately one half of the Marina Walk length will be a total of 50 feet wide and will contain a 40-foot-wide public pedestrian access corridor, and a 10-foot-wide landscape buffer to help screen the adjacent Hyatt parking structure. The 40-foot-wide public access corridor will include a 33.5-foot-wide dedicated pedestrian walkway, a 2-foot width for intermittent benches and lighting, and a 4.5-foot-wide landscape buffer with low-level, drought-resistant shrubs and groundcover that shall not exceed 3 feet in height. Adjacent to the existing approximately 10-foot-wide mechanical equipment enclosure on the Hyatt leasehold, the public access corridor may narrow to approximately 32 feet wide to allow for construction of a low-scale retaining wall and vine plantings to screen the enclosure. Marina Walk will contain amenities such as decorative paving, signage, public art features, low-level lighting, bicycle racks, benches, trash receptacles, a wheelchair accessible ramp, and restrooms open to the public during daylight hours. Marina Walk will widen to 80 feet as it approaches the Embarcadero promenade, and will widen to 145 feet at the Harbor Drive gateway to Marina Walk. At the project level, minor adjustments and revisions to the corridor, parking areas, and driveway may be made to increase the width of the walkway and improve connectivity between Marina Walk, Marina Terrace, and the Embarcadero promenade. Adjacent to this gateway, removal of the existing parking booths/gates and substantial narrowing of the entry drive (from 78 feet to 40 feet in width) will create a more inviting entrance and will encourage a more pedestrian-oriented environment. The Harbor Drive gateway area will be kept clear of physical barriers, signage, or visual obstructions that would discourage public use of Marina Walk.

Bayward of the Marriott and Hyatt hotels, a continuous pedestrian promenade links the two Embarcadero Marina Park peninsulas and assures public access along the shoreline. Pedestrian linkage to the uplands is provided around and over the expanded Convention Center. An existing accessway between the Marriott Hotel and the Convention Center has been improved to provide functional, safe, and environmentally educational passage to the waterfront, as provided in the Public Access Program. The Convention Center includes another public accessway with a minimum width of 20 feet over the Convention Center connecting Harbor Drive and the Embarcadero Promenade. The public accessway will continue to be open and publicly accessible via stairs and the funicular on the Harbor Drive side of the Convention Center. At the intersection of Park Boulevard (formerly Eighth Avenue) and Harbor Drive, the promenade connects with the adjacent Gaslamp Quarter pedestrian and trolley facilities. The public accessway extends from the south end of the Convention Center expansion and along both sides of Park Boulevard. A pedestrian bridge spans Harbor Drive at the Park Boulevard and Harbor Drive intersection and provides a contiguous link from the waterfront to downtown and the ballpark. The expansion to the Hilton San Diego Bayfront will provide an elevated public pedestrian accessway that will link the existing pedestrian bridge with the waterfront promenade. The elevated pedestrian accessway will culminate with a new staircase from the existing porte-cochere to ground-level adjacent to the waterfront promenade.

The District, in conjunction with the City of San Diego, has implemented a public access program of signage, pavement markings, amenities and public information to inform and invite the public to and along the Embarcadero, as is more specifically shown in the Convention Center’s “Public Access Program” (as revised) and the “South Embarcadero Public Access Program” (as amended), which are incorporated into the plan by reference.

It is recognized that providing all required parking on-site can result in a significant amount of waterfront land being dedicated to parking lots and structures, thereby limiting the ability to provide visitor-serving uses such as parks and commercial development. New commercial development in the Marina Zone shall participate in the implementation of the Parking Management and Monitoring Plan (PMMP), as amended. Such participation is intended to achieve maximum feasible reduction in automotive traffic, facilitate the extension and utilization of mass transit to serve the Marina Zone, provide and support means of non-automobile circulation to employees and guests, make more efficient use of existing parking lots and structures, and help avoid significant effects associated with a lack of parking for waterfront projects. Additionally, the PMMP requires new commercial development to provide maximum feasible on-site or proximate parking facilities on Port and nearby City lands, and participate in the tiered, legally available, off-site parking program to address peak individual and cumulative demand. Required participation in the PMMP shall be monitored and reported annually to the Port and California Coastal Commission for the economic life of the development. Throughout the South Embarcadero (G Street mole to the Hilton San Diego Bayfront Hotel and Expansion Hotel), commercial development is also required to participate in and contribute a fair share to the Port District's implementation of a permanent bayside shuttle system that would serve and connect tideland uses along the waterfront, such as the Convention Center Hotel Public Parking Facility, hotels, Seaport Village, and other waterfront destinations. Although outside the South Embarcadero, the bayside shuttle should also provide service to the Midway. In addition, this bayside shuttle system should include linkages to public roadside shuttle systems serving downtown San Diego, the airport, and MTS transportation hubs. Port District implementation of the bayside shuttle system is intended to serve visitors as part of an integrated waterfront access and parking program that the Port District shall pursue in conjunction with the City of San Diego, CCDC and MTS. The Port District will fund the bayside shuttle system at its cost and may seek cost recovery and financial participation consistent with its policies and practices and applicable laws. Cost recovery and financial participation may include: collection of fares, grants, advertising, voluntary tenant participation, mandatory tenant participation at the time of issuance of coastal development permits for Port District tenant projects within the South Embarcadero, and other sources as may be identified by the Port District. If rider fares are collected, fares will be kept at a low cost as compared to comparable transportation services within the region. The District will prepare a bayside shuttle system program and operational plan prior to the shuttle system commencing operations. The bayside shuttle system will be operational in accordance with the conditions of approval for the North Embarcadero Visionary Plan (NEVP) Phase 1 project.

The regional Convention Center is supported by major hotel complexes: Marriott Hotel and Hyatt Hotel. The Marriott Hotel is located immediately adjacent to the northwest of the Convention Center and contains twin 25-story towers accommodating 1,400 hotel rooms and a 450-slip marina. The Hyatt Hotel is located north of the Marriott Hotel and contains two hotel towers, one with 875 rooms and the other with 750 rooms. The 750-room second hotel tower was constructed with a minimum 100-foot set back from Harbor Drive, and a maximum height of 62 feet for the lobby galleria/ballroom structure connecting the second tower to the first tower. The second tower includes meeting space, 34,000 square feet of exhibit space, and 30,000 square feet of ballroom space. Ancillary uses in this area include banquet, meeting, restaurant, hotel guest-oriented retail space, court game areas, and automobile parking.

The Marriott Hotel proposes a renovation/expansion of its Marriott Hall meeting space to include approximately 44,000 square feet of additional ballroom and exhibit space. The aesthetics and visual accessibility of the area will be enhanced through the contemporary, transparent architectural features and siting of the new Marriott Hall building, which will be reoriented such that its public side faces Harbor Drive. The maximum height of the new Marriott Hall shall not exceed 68 feet, including rooftop equipment and parapet wall, and the distance between the new Marriott Hall building and Hyatt parking structure shall be a minimum of 120.5 feet. Removal of underutilized hotel parking will allow for construction of the new meeting space and Marina Walk public access improvements, which will enhance physical and visual access to the Bay, and encourage a more pedestrian-oriented environment.

To further enhance and activate public access in the South Embarcadero, the Marriott proposes a 25,000-square-foot paved, flexible outdoor space at the bayward terminus of Marina Walk, adjacent to the Embarcadero promenade, known as “Marina Terrace.” Marina Terrace will be used for hotel events such as mixers, cocktail parties, luncheons, and receptions, and occasionally may be increased to a maximum size of 35,000 square feet. When not in use for outdoor hotel events, Marina Terrace will be accessible for use by the public as an open gathering and activity space (see South Embarcadero Public Access Program, as amended). During the times when Marina Terrace will be publicly accessible, approximately 85% of the year, the Marriott will provide and/or facilitate the provision of public pedestrian-activating amenities on Marina Terrace such as seasonal events/festivals, temporary visitor-serving retail such as food carts and vendors, and placement of movable modular street furniture for public use on Marina Terrace. This modular furniture will include public benches, chairs, tables, and outside shade structures. At a minimum, the Marriott will ensure that permanent public seating is provided along the bayward perimeter of Marina Terrace. Six-foot-wide paved pathways through the existing landscape buffer will ensure vertical pedestrian linkages between Marina Terrace and the Embarcadero promenade. Public pedestrian use of the Marina Terrace space will be further encouraged with consistent paving and low-level vegetation to help attract visitors along Marina Walk and the Embarcadero promenade. To encourage interaction between the public spaces on Marina Terrace, Marina Walk, and the Embarcadero promenade, the Marriott will promote and inform the public about various activities and pedestrian-serving amenities available at Marina Terrace through use of interchangeable signage and other methods of advertisement. In addition, Marriott will provide fixed picnic-type tables between Marina Terrace and the Embarcadero promenade on a permanent basis. The 35-space parking lot between Marina Walk and Marina Terrace shall be signed and designated for marina use (30 spaces) and public use (5 spaces).

Marriott’s proposed improvements trigger its mandatory participation in the Port District’s implementation of the permanent bayside shuttle system. The bayside shuttle system will be operational prior to the opening of the Marriott Hall expansion, and Marriott’s participation in the shuttle system will be a condition precedent to issuance of a certificate of occupancy for the proposed Marriott Hall expansion.

Situated within the eastern portion of the Marina Zone is an 11-acre site, fronting onto Harbor Drive and Fifth Avenue, which has been developed into a regional Convention Center that opened in 1989. Floor area is allocated for display and exhibit area, meeting rooms, and support space, such as lobbies, storage, food service, and parking.

Phase II of the Convention Center, completed in 2001, expanded the facility into a contiguous 13-acre site southeast of the facility, occupying the area bounded by Harbor Drive, Park Boulevard, and Convention Way. Fifth Avenue, an undedicated street south of Harbor Drive, was closed as part of the development of the original Convention Center. Harbor Drive is partially depressed to provide an alternate access to an existing underground parking garage and to enhance the urban design character at the Convention Center. Phase II added approximately one million gross feet of floor area to the Convention Center. ~~A Phase III expansion to the Convention Center is proposed to add approximately 400,000 square feet of exhibit area, meeting rooms, and ballrooms, and approximately 560,000 square feet of support spaces. Approximately 15,000 square feet of visitor-serving uses (i.e., retail, museum, art gallery, vitrines, or other activating uses) is planned along the southwesterly facing (bayside) façade of the Phase III expansion. Convention Way will be shifted closer to the waterfront to accommodate~~

~~the Phase III expansion. The south side of the Convention Center will expand onto the Fifth Avenue Landing site and into a parcel (site originally proposed for a 250-room hotel) on the south side of the park entry road. The Embarcadero Promenade will not be affected by the Phase III expansion. A pedestrian accessway immediately adjacent to, and inland of, the realigned Convention Way will be constructed to improve pedestrian circulation inland of Convention Way and provide access to the visitor-serving uses proposed along the southwesterly façade of the Phase III expansion. At least three crosswalks will be provided at regular intervals along Convention Way to provide access between the waterfront promenade and the visitor-serving uses on the inland side of Convention Way.~~

~~Public access from Harbor Drive to San Diego Bay, the waterfront promenade, and Embarcadero Marina Park South will be improved through the addition of the following new permanent physical enhancements. Amenity stations, with street furniture such as benches and pedestrian lighting, will be located at periodic intervals on Harbor Drive along Phases II and III of the Convention Center to allow pedestrians the opportunity to stop and rest and enjoy downtown views while walking southeast to the Park Boulevard/Harbor Drive intersection. Wayfinding signage will be installed at the public access elevators and escalators, at the amenity stations along Harbor Drive, and along Park Boulevard, to guide pedestrians to their destination.~~

~~An integrated wayfinding program that will recognize the partnership with the Port, City of San Diego, and Coastal Commission shall be developed prior to issuance of a Coastal Development Permit for the Convention Center Expansion; the wayfinding program will be prepared by Permittee. The comprehensive signage package will address size, location and placement of public access signage, including directional signage to/from the bay and city. The program may include replacement of existing signage to better facilitate a comprehensive wayfinding system.~~

~~The Park Boulevard corridor will serve to orient visitors, whether by vehicle or by foot, and draw them to the waterfront. The corridor will consist of open lawn, landscaped areas (including low scale shrubbery), artwork, enhanced concrete paving, pedestrian scale lighting, and furnishings that provides a visual and physical linkage to the bay. Treatments in corridor will also provide a linkage to both the Convention Center and Hilton Hotel.~~ The Park Boulevard view corridor will be preserved. ~~This space~~It will ~~also~~ feature a landscaped area adjacent to the hotel amenities. Along Park Boulevard, treatment of the exposed exterior of the parking garage structure and ramp to the Hilton Hotel will be treated with public art (i.e., mosaics) and/or decorative vertical landscaping to enhance the pedestrian experience between Harbor Drive and the Hilton access route. The waterside promenade will maintain its 35-foot width.~~ Shade trees will be located, as appropriate, within the 35-foot wide waterside promenade.~~

~~An approximately five acre public park/plaza will be constructed on the rooftop of the Phase III expansion. This public realm space, which will vary between approximately 50 to 100 feet above grade, will be accessible from at least six access points, including: the grand stairs and funicular at Harbor Drive, the grand stairs and elevator at the southwest corner of the rooftop park/plaza, elevators at the south midpoint of the rooftop park/plaza, the landscaped inclined walkway, and the elevator along Park Boulevard, as well as one access point from within the Convention Center. The rooftop park/plaza will include a mix of hardscape and landscape, including lawns, grasses, wildflowers, shrubs, trees, wetland plants; and pavilions and formal and non-formal gardens with lighted paths and fixed and movable furnishings. Observation vistas will be placed at opportune locations throughout the rooftop park/plaza to provide views to the Bay and uplands~~

~~skyline. Support facilities such as restrooms, park maintenance and mechanical facilities, and power and water service will also be provided.~~

~~There are 15 distinct rooftop park/plaza spaces including: Spine, Grove, Great Lawn, Pavilion, Coastal Chaparral, Gathering Place, Bluff Gardens, Living Room, Reading Room, Summit Plaza, Mesa, Lower Plaza, Overlooks, Ascent, and Non-Accessible Green Roof Areas.~~

~~The Spine would be a paved walkway that features furnishings to allow people to move freely between the spaces. The Spine serves as a transect through the various garden environments, offering rhythm and cadence to the experience of ascending to the park's high point as well as descending to the lower vistas in the park.~~

~~The Grove would be a flexible and adaptable-use space with large canopy trees in planters and paving and movable site furnishings. This space would offer power and water sources for events, services, and pedestrian lighting.~~

~~The Great Lawn would be a sculpted and sloping lawn plane. The Great Lawn would serve a wide range of passive and active recreational needs of the community such as, but not limited to, performance/event space, picnicking, and other lawn oriented activities.~~

~~The Pavilion would be an overhead open air shade structure. This environment would offer visitors shade for seating and events and a grand scale architectural feature that gives a focus to the Grove and the Great Lawn.~~

~~The Coastal Chaparral vegetation would consist of native coastal shrubs, ground covers and coastal trees. The character of the Coastal Chaparral is inspired by the beauty and simplicity of the native coastal bluff landscapes of southern California. The intent of this landscape is to offer users interesting and intimate gardens for interaction, strolling, and relaxation.~~

~~The Gathering Place would be a hardscape plaza environment designed to accommodate a wide range of events and activity. There would be both fixed and movable furnishings and paving, pavilions with power and water service, restrooms, pedestrian lighting, and vegetation.~~

~~The Bluff Gardens would be similar to the Coastal Chaparral with the addition of paved areas and additional planting, lighting, and furnishing that would give park visitors additional places to picnic and host small gatherings.~~

~~The Living Room would be a primary destination for shade and relaxation embedded within the heart of the public park/plaza. The space would feature a grand scale canopy supported by an informally organized glade of support columns that create an atmosphere of being in a tree glade. The canopy area would be furnished with hanging porch swings, movable tables and chairs, pedestrian lighting and power/water sources for event staging. Cornering the space would be a water feature that would be designed to engage both children and adults.~~

~~The Reading Room would be a contemplative garden destination immersed within the vegetation of the Coastal Chaparral. The Reading Room would consist of walkways, furnishings, sculpted lawn forms, and plantings that give the space an internal focus with an emphasis of orienting the experience to the San Diego skyline.~~

~~The Summit Plaza would be a mixed environment of plaza paving and structured event turf that would serve as a destination gathering space for public events, weddings, and ceremonies. This space would feature both power and water sources for event use.~~

~~The Mesa would be a sculpted grass landform set at the high point of the green roof's ascent.~~

~~The Mesa would provide a grand scale viewing perch that would offer users sweeping views of the San Diego Bay and the surrounding San Diego skyline. The grass slope would allow for small performances and group gatherings while the bleacher-like steps offer casual seating and views to the park's gardens and spaces. Restrooms, park maintenance and mechanical facilities would be constructed below the Mesa's surface with a convenient adjacency to the Summit Plaza event space.~~

~~The Lower Plaza would be a predominantly paved environment with trees in planters, pedestrian lights, and paving. This space would offer both power and water sources for special events.~~

~~The Overlooks would be viewing areas along the southerly edge of the rooftop park/plaza that would offer intimate spaces that are discovered and provide views to the horizon. Several of the overlooks may be cantilevered over the Ascent.~~

~~The Ascent would be a 1,200-foot walkway leading from Convention Way to the base of the rooftop park/plaza on the southwestern corner. The grade of the ascent would be 5% and the width would be approximately 30 feet. As the Ascent proceeds westerly from its base, landscape and hardscape features would be designed to create a sense of compression and release.~~

~~Some portions of the rooftop park/plaza would be inaccessible due to weight limits and difficult access. These Non-Accessible Green Roof sections would be planted with small scale plants and would create a visual foreground to bay views from the rooftop.~~

~~The rooftop park/plaza would feature both native and exotic plants to the southern California coast, with the intent of capturing the character and feel of a coastal bluff landscape. Irrigation of the vegetation will be accomplished via subsurface drip using the existing brackish groundwater pumped daily using the de-watering system for the subterranean parking facility beneath Phase I of the Convention Center. The brackish groundwater will be blended with potable water to maintain low concentrations of salt that would be suitable for landscape application.~~

~~The rooftop park/plaza will be publicly accessible 85 percent of the year. Completion of the rooftop park/plaza will be required prior to the issuance of a final Certificate of Occupancy for the Phase III expansion. The rooftop park/plaza will be open to the public and managed for public access during hours similar to that of other Port parks.~~

~~Upon completion and opening of the Phase III Convention Center Expansion rooftop park/plaza, written quarterly reports will be provided to the California Coastal Commission by the appropriate entity having responsibility for such matters on the following:~~

- ~~Utilization of the rooftop park/plaza and promenade for all public and private events during the prior quarter;~~
- ~~Information on park programming and activities implemented to invite the public to access the rooftop park/plaza, promenade and coast;~~
- ~~Marketing activities and signage to enhance way-finding and public usage of the rooftop park/plaza, promenade, and coastal access.~~

~~Responsibility for the above described items will be addressed in the subsequent coastal development permit issued by the Port to the City of San Diego and other agreements entered into by the parties.~~

~~Quarterly public meetings will be called by the Port subject to the Ralph M. Brown Act (Government Code Section 54950, et seq.) at the San Diego Convention Center to pursue strategies and funding to encourage public utilization of the rooftop park/plaza, promenade, and coastal access. Those invited to participate in these~~

~~quarterly meetings shall include, but not be limited to, elected officials or officers representing the City of San Diego, San Diego Convention Center Corporation or any successor corporation or public agency, and the State Assembly Member and State Senator representing the Public Trust Land on which the convention center is located. Notice for and minutes of these meetings will be sent to the California Coastal Commission in accordance with provisions of the Ralph M. Brown Act.~~

~~No later than five years following completion and opening of the Phase III Convention Center Expansion, a report will be provided to the California Coastal Commission on the roof top park, promenade and coastal access utilization and potential opportunities that may be pursued by the appropriate entities that could enhance public access to the roof top park and waterfront promenade including possible additional access points and related infrastructure. This report will be an informational item and does not subject any of the entities involved in this Project, including the Port and the City of San Diego, to commitments regarding financing any such infrastructure or improvements.~~

~~Further, in order to ensure public access to the rooftop park/plaza, the subsequent coastal development permit issued by the Port to the City of San Diego will require the City of San Diego to reprioritize $500,000 of the City's construction budget in consultation with the Executive Director of the California Coastal Commission to implement alternative access measures to activate the rooftop park/plaza. In prioritizing the use of these funds, consideration will be given to enhancements to the existing stairways and skywalk (including paving treatments, public art, etc.).~~

The Convention Center operator is required to implement the Parking Management Plan and Monitoring Program (November 1995, as amended and is incorporated by reference into the master plan) to meet the needs of the Convention Center visitors and support functions, as well as the public seeking access to the Embarcadero Marina Park South.

## Convention Way Basin

~~A southward shift of Convention Way is planned to accommodate Phase III of the Convention Center. The earth mounds located near the end of Park Boulevard will be removed as part of the realignment of Convention Way.~~

The Fifth Avenue Landing project is proposed to include an up to 850-room, approximately 44-story hotel tower with approximately 55,600 square feet of meeting space; an up to 565-bed, approximately 82-foot-high lower-cost, visitor-serving hotel; approximately 6,000 square feet of visitor-serving retail along the promenade; and approximately 85,490 square feet of public plaza and park areas. Portions of this park and plaza space will be open to the public as specified in the South Embarcadero Public Access Program, as amended. Public access and wayfinding signage will be installed to direct visitors to these publicly accessible areas. A public pedestrian bridge may be developed that will cross Convention Way and will link the Convention Center to the hotel tower rooftop public plaza, providing elevated and expansive views of the Bay. A minimum of five elevated public vista areas will be provided at opportune locations, as shown on the Precise Plan map (see also South Embarcadero Public Access Program, as amended).

A water transit center for harbor excursion boats, water taxis and ferries is located adjacent to the promenade along Convention Way. Water taxi and ferry service to the Convention Center hotels and to other San Diego Bay locations is provided at the water transit center~~, which will be relocated west onto the former Spinnaker Hotel site.~~ The existing "transient oriented" marina can ~~also~~ accommodate ~~up to 20-30~~ large yacht slips and will be expanded with up to 50 new slips. At least one boat slip accommodating a vessel 30 feet in length will be provided for public use, at low cost or no cost. In addition, the existing water transportation center will be rebuilt as a new, approximately 6,100-square-foot facility incorporated into the lower-cost visitor-serving hotel.~~ A public plaza (minimum 1,900 sq. ft.) will be located east of the relocated water transit center building. Adjacent to the relocated water transit center will be a public parking lot with at least 12 short-term public parking spaces~~.

Bayside improvements to this area include the continued extension of the pedestrian promenade along the waterfront, including extending the waterside promenade south (towards Embarcadero Marina Park South) to connect to the existing promenade adjacent to the over-water restaurant. This would provide for a continued waterside promenade from the Embarcadero Promenade to Embarcadero Marina Park South. Park/Plaza areas~~, which include the public plaza to be constructed adjacent to the relocated water transit center building, and the shoreline promenade will maintain views to the waterfront from Convention Way~~. The promenade is extended into the Embarcadero Marina Park South on the east side (restaurant side) of the park entry. The continuous promenade extends along the water's edge of the entire Fifth Avenue Landing and Hilton San Diego Bayfront (former Campbell Shipyard) sites, and connects to Harbor Drive for complete public pedestrian access throughout the public park/plaza areas in the vicinity of the Convention Center and Hilton Hotel. The Park Boulevard pedestrian corridor between Harbor Drive and the shoreline promenade ranges in width from 10-25 feet and includes landscaping, benches, and public art.

The former shipyard area is redeveloped with a 1200-room Convention Hotel (Hilton San Diego Bayfront) and support facilities including restaurant, retail, meeting space, ballroom, and an up to 2000-car public parking facility. The 1200-room hotel has a 20-foot building height for buildings along the promenade, stepping back to 50-feet in height in the development area to create a pedestrian-scaled public environment. The approximately 375-foot high hotel tower and parking structure are located outside and southeast of the Park Boulevard view corridor to maintain public views to the Bay from Harbor Drive. The Hilton may be expanded with a second hotel tower located adjacent to the parking structure. The expansion hotel may include up to 500 rooms, a lobby, approximately 55,000 net square feet of ballroom/meeting space, and other ancillary uses. To utilize the close proximity to the existing hotel and to reduce redundancy of facilities, the expansion hotel may share some support facilities with the existing hotel. In order for the expansion hotel to remain outside of the Park Boulevard view corridor, a portion of the hotel may cantilever over the existing parking garage and the ramp to the existing hotel. As such, the expansion hotel shall not encroach into the Park Boulevard view corridor. The height of the expansion hotel shall not exceed the height of the existing hotel. All rooftop equipment shall be screened from public view and shall be designed to be visually attractive from all public viewing areas. The existing public parking facility accommodates parking for the hotel, hotel expansion and public waterfront access.

The Hilton San Diego Bayfront Expansion Hotel will add up to 500 additional rooms within walking distance of the San Diego Convention Center and bayfront. With its adjacent location to the convention center and its participation in the South Embarcadero Public Access Program, as amended, the Hilton San Diego Bayfront Expansion Hotel creates synergy with the San Diego Convention Center and provides needed accommodations to users of the bayfront and convention center. As a special condition of the Coastal Development Permit for the hotel expansion, the Permittee for the Hilton San Diego Bayfront Expansion Hotel will develop or designate its fair-share of on-site or off-site lower cost visitor accommodations or pay an in-lieu fee based on a study conducted by the District.

The Hilton operator is required to implement the Parking Management Plan and Monitoring Program (May 2012) which is incorporated by reference into the master plan to meet the needs of the Hilton guests and support functions.

The Hilton San Diego Bayfront Hotel and Expansion Hotel shall maintain pedestrian access along two major corridors, Park Boulevard and the Embarcadero promenade. Landscaped setbacks and/or street-front retail must be provided along these access ways. Pedestrian-oriented uses compatible with the Commercial Recreation land use designation, such as visitor serving retail shops and restaurants, which may include outdoor seating, are provided in the Hilton San Diego Bayfront Hotel to activate the pedestrian access ways. Shoreline promenade and landscape improvements are included in the 35-foot minimum setback of the hotel from the water's edge. The first 26 feet of promenade adjacent to the water's edge shall remain open and unobstructed for public pedestrian use.

A public access pier (adjacent to Hilton San Diego Bayfront) is set back a distance sufficient to preserve the continued use of the Tenth Avenue Marine Terminal Berths 1 and 2 for commercial cargoes. Perimeter railings and seating will be extended onto the public access pier, which will also be made ADA accessible. State-of-the-art best management practices will be used in the marina to reduce spills, reduce or prohibit toxic bottom paints, and mandate new pump-out stations.

Specific implementation proposals will be evaluated by the San Diego Water Quality Control Board for compliance with all applicable regulations and will include the best management practices required by the Port District Urban Runoff Action Plan and Stormwater Management Ordinance.

The amount of water coverage in Subarea 36, Convention Way Basin, resulting from redevelopment of the bulkhead and pier structure shall be minimized and necessary to construct the public promenade, water transit center, public access pier, and recreational marina. Any increase in water coverage from that which previously existed when the leaseholds were developed with the Campbell shipyard and R.E. Staite marine construction yard shall be subject to further environmental review and mitigation.

The public promenade, public access pier and Embarcadero Marina Park South will be open to general public use at all times. Any temporary special events held in these areas must obtain a special event permit from the San Diego Unified Port District, according to the Port District Special Event Procedures and Guidelines. The pier will be publicly accessible 85 percent of the year. At no time will the public access to the sidewalk promenade be fenced, screened or blocked off by any structure. Completion of the improvements to the public access pier will be required prior to the issuance of a final Certificate of Occupancy for the expansion to the Hilton San Diego Bayfront.

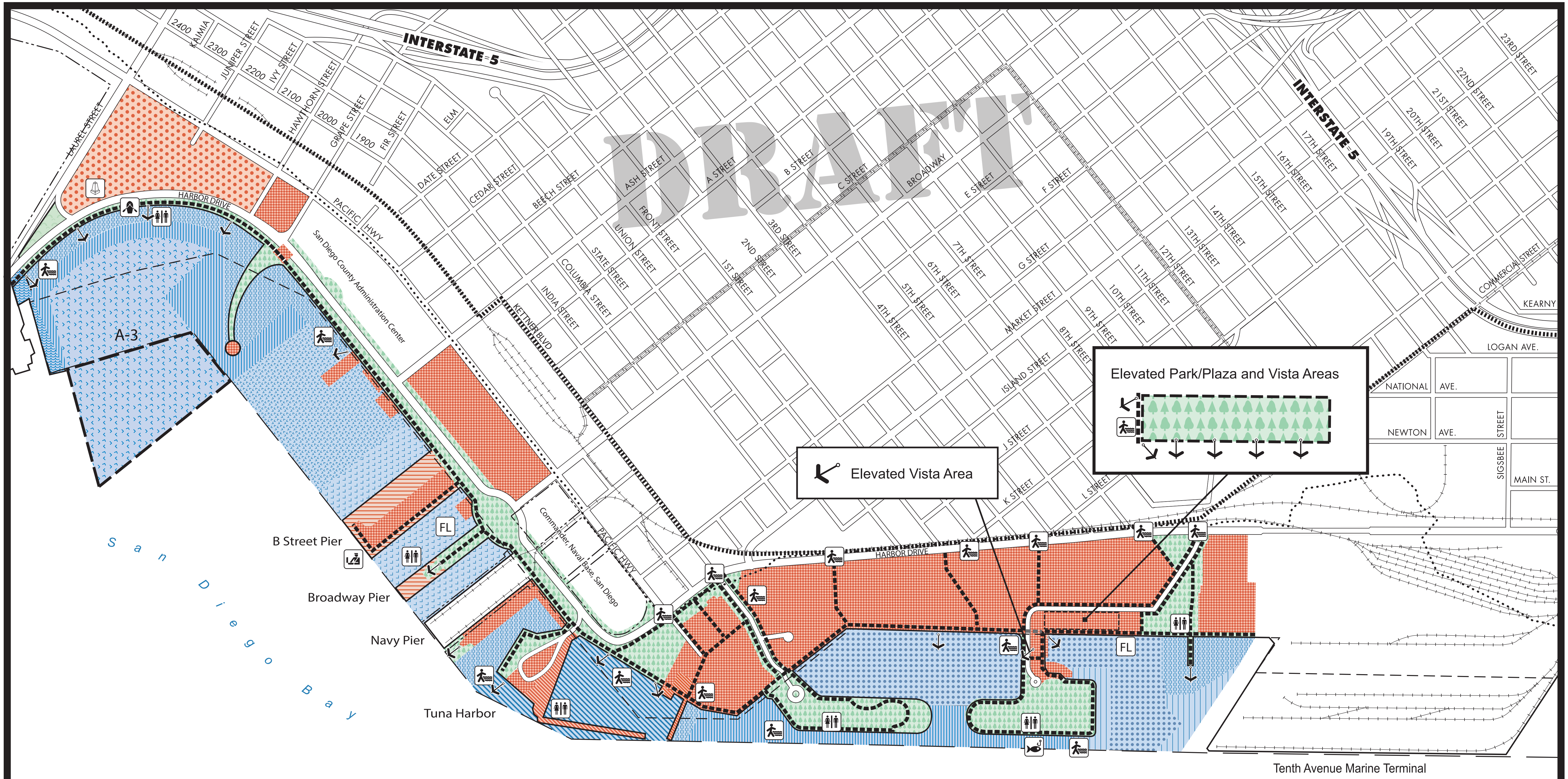
# TABLE 10: Precise Plan Land and Water Use Allocation
## CENTRE CITY EMBARCADERO: PLANNING DISTRICT 3

| ***LAND USE*** | ***ACRES*** | ***WATER USE*** | ***ACRES*** | ***TOTAL ACRES*** | ***% of TOTAL*** |
|---|---|---|---|---|---|
| COMMERCIAL | 107.7~~111.1~~ | COMMERCIAL | 47.5~~35.8~~ | 155.2~~146.9~~ | 35~~33~~% |
| Commercial Fishing | 5.4 | Commercial Fishing Berthing | 13.1 | | |
| Commercial Recreation | 102.3~~105.7~~ | Recreational Boat Berthing | 34.4~~22.7~~ | | |
| INDUSTRIAL | 29.2 | INDUSTRIAL | 56.4~~61.5~~ | 85.6~~90.7~~ | 19~~21~~% |
| Aviation Related Industrial | 22.3 | Specialized Berthing | 38.2~~43.3~~ | | |
| Marine Terminal | 6.9 | Terminal Berthing | 18.2 | | |
| PUBLIC RECREATION | 63.5~~58.2~~ | PUBLIC RECREATION | 4.7 | 68.2~~62.9~~ | 16~~14~~% |
| | [65.2~~64.4~~*] | | | [69.1*] | |
| Open Space | 0.7 | Open Bay/Water | 4.7 | | |
| Park/Plaza | 55.1~~49.9~~ | | | | |
| | [60.8~~56.1~~*] | | | | |
| Promenade | 7.7~~6~~ | | | | |
| PUBLIC FACILITIES | 44.9~~46.8~~ | PUBLIC FACILITIES | 87.3~~93.9~~ | 132.2~~140.7~~ | 30~~32~~% |
| Streets | 44.9~~46.8~~ | Boat Navigation Corridor | 29.6 | | |
| | | Boat Anchorage | 25.0 | | |
| | | Ship Navigation Corridor | 8.5~~15.1~~ | | |
| | | Ship Anchorage | 24.2 | | |
| **TOTAL LAND AREA** | **245.3** | **TOTAL WATER AREA** | **195.9** | | |
| **PRECISE PLAN LAND AND WATER ACREAGE TOTAL** | | | | **441.2**** | **100%** |

*Note: Does not include: State Submerged Tidelands 22.6 acres*

_* Includes 1.7~~6.3~~ acres of rooftop park/plaza & inclined walkway_

_** Does not include 1.7~~6.3~~ acres of rooftop park/plaza & inclined walkway_



## COMMERCIAL

| Land | Water |
|---|---|
| 🟥 Commercial Recreation | ▦ Recreational Boat Berthing |
| ▨ Commercial Fishing | ▨ Commercial Fishing Berthing |
| | ⛽ Fueling Dock |

## INDUSTRIAL

| Land | Water |
|---|---|
| ▤ Marine Terminal | ▦ Terminal Berthing |
| ▦ Aviation Related | ▦ Specialized Berthing |

## PUBLIC RECREATION

| Land | Water |
|---|---|
| 🟩 Park/Plaza | ≋ Open Bay |
| 🟩 Open Space | 🐟 Public Fishing Pier |
| ■■■■ Promenade | |
| 🚶 Public Access | |
| ← Vista Area | |
| 🔔 Historic Feature | |

## PUBLIC FACILITIES

| Land | Water |
|---|---|
| 🚻 Comfort Station | ▥ Boat Navigation Corridor |
| 🛂 U.S. Customs | ▥ Ship Navigation Corridor |
| ⚓ Anchorage Landing | ▦ Ship Anchorage |
| FL Ferry Landing | ▦ Boat Anchorage |

| | |
|---|---|
| ·········· | MEAN HIGH TIDE LINE |
| —·—·— | SDUPD LIMITS |
| —— —— | US PIERHEAD LINE |
| — — — — | US BULKHEAD LINE |
| —·—·— | COMBINED US PIERHEAD/BULKHEAD LINE |
| ▬ ▬ ▬ | STATE LANDS LEASED TO PORT DISTRICT |
| ▮▮▮▮▮▮ | COASTAL ZONE BOUNDARY |

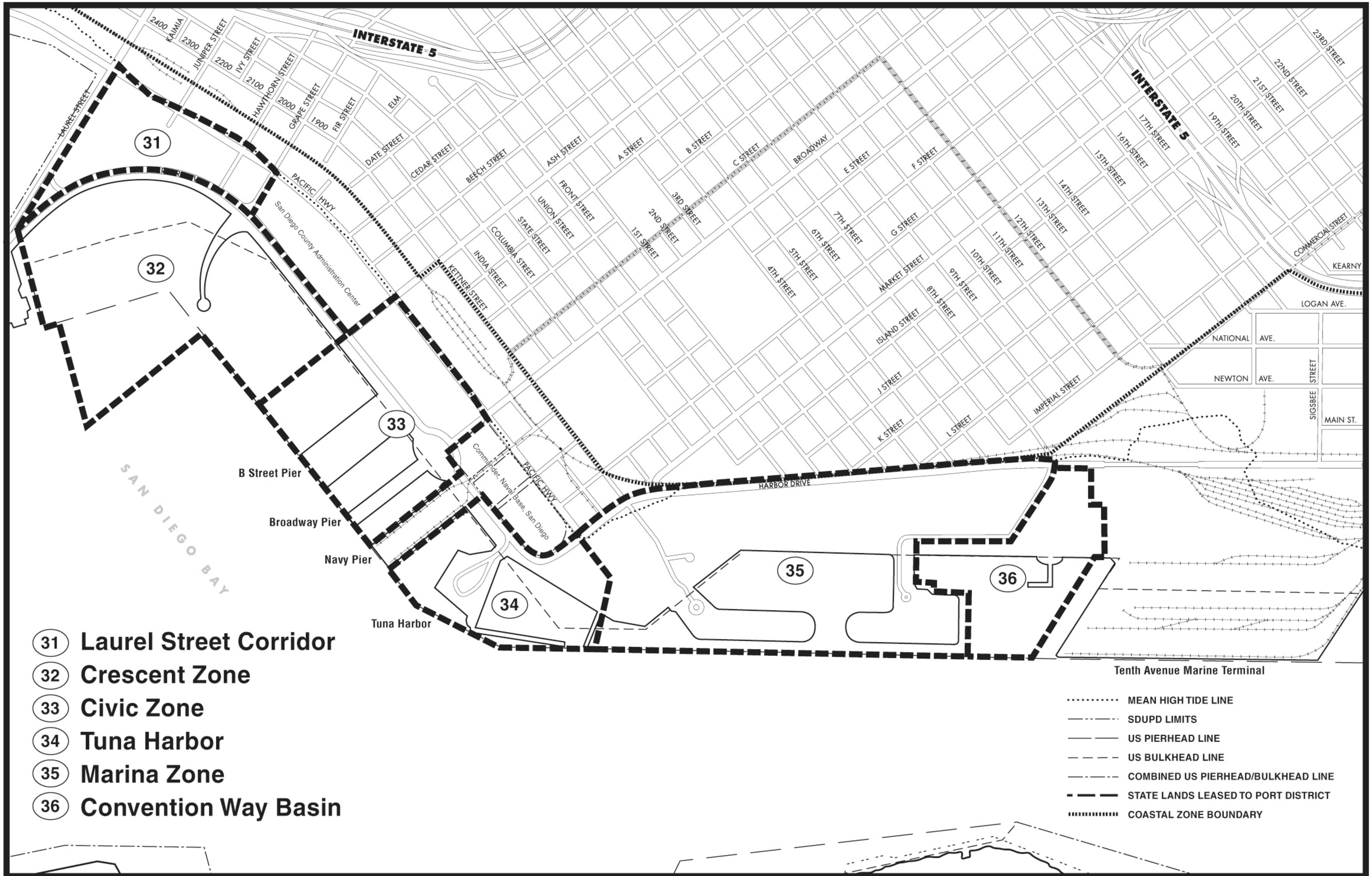
scale approx.
0 200' 400'
Land Use Planning

**Planning District 3**
**CENTRE CITY EMBARCADERO**

TITLE:
# PRECISE PLAN

**FIGURE 11**

DATE:
DRWN / CHK:
FILE TITLE:



scale approx.
0 200' 400'
Land Use Planning

**Planning District 3**
**CENTRE CITY EMBARCADERO**

TITLE:
## Planning Subareas

FIGURE 12

DATE:
4/03/02
DRWN / CHK:
TO

FILE TITLE:
PP_dist3subareas
n&sDEC12.ai

## TABLE 11: Project List

### CENTRE CITY/EMBARCADERO:
### PLANNING DISTRICT 3

| | | Sub | Dev | App | FiscYear |
|---|---|---|---|---|---|
| 1. | NORTH HARBOR DRIVE, GRAPE TO BROADWAY: Reduce traffic lanes; install landscaping, irrigation; develop bike path | 33 | P | Y | 2005-20 |
| 2. | PUBLIC ACCESS: Pedestrian access improvements to waterfront and promenade | 35 | T | N | 2007-08 |
| 3. | LANE FIELD DEVELOPMENT: 600-to-800-room hotel, office building, retail, and parking | 33 | T | Y | 2005-10 |
| 4. | NORTH EMBARCADERO REDEVELOPMENT: (a) Visionary Plan public improvements, (b) esplanade, (c) street improvements, (d) vista points, (e) Grape Street piers replacement + restaurant, (f) park and plaza areas, (g) Broadway Pier cruise ship terminal (approximately 60,000 sq. ft., maximum 50-foot building height ) to cover no more than 50 percent of the pier, public events space, 15,000 sq. ft. public recreation and viewing area, a 25-foot wide public access corridor along the southern side of the pier, and infrastructure improvements, (h) B and C Street linkages between Pacific Highway and North Harbor Drive. | 31-34 | P | Y* | 2005-20 |
| 5. | PASSENGER TERMINAL AT B STREET PIER: Cruise Ship Terminal Modernization. | 33 | P | N | 2006-10 |
| 6. | WATER TRANSIT CENTER~~ AND MARINA~~: ~~Relocate ~~Prepare site, construct buildings, piers, ~~(including ticket offices, marina offices, and public restrooms) and parking (of which at least 12 will be dedicated for short-term public parking) to the west on former Spinnaker Hotel site,~~ maintain pedestrian access and extend continuous (minimum 25'-wide) waterside promenade to connect to south towards Embarcadero Marina Park South; ~~add public plaza (minimum 1,900 sf) east of the relocated water transit center building; ~~maintain landscape improvements to and along the San Diego Bay shoreline; accommodate water-based transportation, including a ferry landing, water taxi access, transient-oriented berthing (including yachts), and public boat access. | 36 | T | N** | ~~2015-2018~~2001-05 |
| 7. | HILTON SAN DIEGO BAYFRONT: Construct hotel tower with up to 1200 rooms, a lobby, ballroom, meeting rooms, retail shops, restaurants, other ancillary uses, above-grade parking structure, public access pier, ground-level and elevated pedestrian access to the waterfront, plaza, and landscape improvements; expand hotel with second hotel (not to exceed height of existing hotel tower) adjacent to and on top of parking garage (and outside of Park Boulevard view corridor) with up to 500 rooms, a lobby, up to 55,000 net sq. ft. of ballroom/meeting rooms, up to 2,500 sq. ft. retail space, other ancillary uses, and landscape improvements. | 36 | T | Y | 2006-18 |
| ~~8.~~ | ~~CONVENTION CENTER PHASE III: Construct third phase of regional convention center to provide contiguous expansion, including adding up to 400,000 sq. ft. of exhibit area, meeting rooms, and ballrooms, 560,000 sq. ft. of support spaces, and approximately 15,000 sq. ft. of visitor-serving uses, infrastructure upgrades, landscape improvements, realign Convention Way to the south (bayward), add 5-acre public rooftop park/plaza on top of expansion.~~ | ~~35~~ | ~~T~~ | ~~N~~ | ~~2015-18~~ |
| ~~9~~8. | PEDESTRIAN BRIDGE OVER HARBOR DRIVE: Self-anchored suspension bridge over Harbor Drive connecting to public parking garage to Eighth Avenue. | 35 | T | N | 2006-08 |
| ~~10~~9. | EIGHTH AVENUE PEDESTRIAN CROSSING: At grade pedestrian crossing to be completed with pedestrian bridge over Harbor Drive. | 35 | T | N | 2006-10 |
| ~~11~~10. | OLD POLICE HEADQUARTERS REHABILITATION: Rehabilitation and adaptive reuse of historically designated Old Police Headquarters building with a mix of specialty retail, entertainment and restaurant uses; reconfiguration of surrounding parking areas; and, pedestrian access, plaza and landscape improvements. | 34,35 | T | Y | 2007-08 |
| ~~12~~11. | PIER WALK BUILDING: Remove existing Harbor Seafood Mart building and construct | 34 | T | Y | 2008-09 |

| | | | | |
|---|---|---|---|---|
| new Pier Walk building to accommodate existing commercial fish processing operations, as well as associated retail, restaurant and other services/support uses. | | | | |
| ~~13~~12. BAYFRONT PARK: Construct new bayfront public park along the southern edge of Harbor Drive, between the waterfront and Pacific Highway, including lawn and landscaped areas, walkways, as well as other park/plaza features. | 34 | P | N | 2009-10 |
| ~~14~~13. MARRIOTT HOTEL MEETING SPACE EXPANSION: Demolish and reconstruct Marriott Hall; create new outdoor hotel/public space (“Marina Terrace”); construct improved and widened Marina Walk walkway; improve public amenities, including public views towards the bay and pedestrian access; modify parking configuration; install landscape and hardscape improvements. | 35 | T | Y | 2013-14 |
| 14. FIFTH AVENUE LANDING: Construct 850-room hotel (with associated retail, restaurant and meeting space) and 565-bed lower-cost visitor serving hotel; public plaza and park areas; reconstruct water transportation center and expand marina with up to 50 new slips;. | 36 | T | Y | 2019-21 |

P- Port District T- Tenant N- No Y- Yes

* "Vista Points" and Broadway Pier infrastructure improvements are non-appealable projects.

** Any modifications to the marina for “recreational small craft marina related facilities” is an appealable project.

## Appendix D

# Air Quality and Greenhouse Gas Calculations

---

- **Greenhouse Gas Targets**
- **Operation Emission Calculation Sheets**
- **Landside Construction Sheets**
- **Waterside Construction Sheets**
- **Carbon Monoxide Hotspot Sheets**

# Greenhouse Gas Targets

**Hotel Efficiency Metric**

2006 and 2020 SF, Rooms, and MT from Lodging/Hotels from CAP and Appendices
2030 SF, Rooms, and MT extrapoled linearly from 2020
MT/Room calculated

| | Metrics in CAP | | CAP Lodging | Calculated | Efficiency | Relative to |
|---|---|---|---|---|---|---|
| | sf | rooms | MTCO2e | MT/Room | Performance | Base Case |
| 2006 base | 5,082,371 | 4,793 | 137,429 | 28.67 | - | - |
| 2020 bau | 9,382,830 | 8,927 | 249,852 | 27.99 | - | 2% |
| 2020 target | 9,382,830 | 8,927 | 124,004 | 13.89 | 50% | 52% |
| 2021 bau | 9,690,006 | 9,222 | 257,882 | 27.96 | | 2% |
| 2021 target | 9,690,006 | 9,222 | 119,043 | 12.91 | 54% | 55% |
| 2030 BAU | 12,454,586 | 11,880 | 330,154 | 27.79 | | 3% |
| 2030 target | 12,454,586 | 11,880 | 74,402 | 6.26 | 77% | 78% |
| 2050 BAU | 18,598,099 | 17,786 | 490,758 | 27.59 | | 4% |
| 2050 target | 18,598,099 | 17,786 | 24,801 | 1.39 | 95% | 95% |

**Boating Calc**

| | | GHG Emissions Summary by Category and Activity Type | | | | | | Percent Reductions | |
|---|---|---|---|---|---|---|---|---|---|
| **Category** | **Activity** | **2006** | **2020 BAU** | **2020 with state** | **2035 with state** | **2050 with state** | **2020 target (1990)** | **Below Existing** | **Below 2020 BAU** |
| Port Operations | – | *37,164* | *38,930* | *30,044* | *27,411* | *27,097* | *33,533* | *10%* | *14%* |
| Maritime | **Ocean Going Vessels** | 55,162 | 72,786 | 62,365 | 100,018 | 109,280 | 49,773 | *10%* | *32%* |
| | **Recreational Boating** | 80,441 | 118,252 | 106,391 | 120,247 | 132,252 | 72,583 | *10%* | *39%* |
| | **Other Terminal Activity** | 89,242 | 109,859 | 92,000 | 119,751 | 124,213 | 80,524 | *10%* | *27%* |
| | ***Total Maritime*** | *224,845* | *300,897* | *260,756* | *340,016* | *365,745* | *202,880* | *10%* | *33%* |
| Other | **Industrial** | 137,426 | 138,258 | 131,725 | 130,960 | 130,869 | 124,001 | *10%* | *10%* |
| | **Shipbuilding** | 123,725 | 123,545 | 90,187 | 88,776 | 88,608 | 111,638 | *10%* | *10%* |
| | **Lodging** | 137,429 | 249,852 | 197,750 | 186,684 | 185,365 | 124,004 | *10%* | *50%* |
| | **Other** | 165,840 | 188,217 | 145,025 | 133,331 | 131,945 | 149,639 | *10%* | *20%* |
| | ***Total Other*** | 564,420 | 699,872 | 564,687 | 539,751 | 536,787 | 509,282 | *10%* | *27%* |
| | **TOTAL** | 826,429 | 1,039,699 | 855,487 | 907,178 | 929,629 | 745,695 | *10%* | *28%* |

Remove LCFS 10% (CAP only presents emissions beyond 2020 with LCFS reductions. Removed for purposes of estimating a true BAU)

rate per yr, MT 935

**for FAL**

| | Recreational Boating BAU | | | | | Targets | | | |
|---|---|---|---|---|---|---|---|---|---|
| 2016 | **2020** | **2035** | **2050** | **2021** | ***2030***<br>(interpolated) | **2020**<br>1990 levels | **2021**<br>- | **2030**<br>40% below 1990 | **2050**<br>80% below 1990 |
| 114,513 | 118,252 | 132,272 | 145,477 | 119,187 | 127,598 | 72,583 | 69,679 | 43,550 | 14,517 |
| | | | | | reduction target | -39% | -42% | -66% | -90% |

# Operation Emission Calculation Sheets

| **ADT** | lookup col 5 | | | | | | **Pounds per Day** | | | | | | | | | | | **Metric tons per year** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Element** | **Source** | **Year** | **ADT** | **VMT per** | **VMT/day** | **VMT/year** | **ROG** | **NOX** | **CO** | **PM10E** | **PM2.5E** | **PM10 D** | **PM2.5 D** | **SO2** | **CO2** | **CH4** | **N2O** | **CO2** | **CH4** | **N2O** | **CO2e** |
| Marina | Motor Vehicle | 2016 | 48 | 5.95 | 286 | 104,308 | 0.16 | 0.45 | 1.27 | 0.04 | 0.02 | 0.04 | 0.02 | 0.00 | 297.16 | 0.01 | 0.02 | 49.20 | 0.00 | 0.00 | 50.15 |
| Hotel Tower | Motor Vehicle | 2021 | 7650 | 5.95 | 45,545 | 16,624,040 | 16.74 | 48.92 | 126.75 | 5.40 | 2.33 | 29.39 | 7.38 | 0.41 | 41445.29 | 1.09 | 2.03 | 6861.73 | 0.18 | 0.34 | 6966.66 |
| Low-cost Hotel | Motor Vehicle | 2021 | 565 | 5.95 | 3,360 | 1,226,391 | 1.24 | 3.61 | 9.35 | 0.40 | 0.17 | 2.17 | 0.54 | 0.03 | 3057.77 | 0.08 | 0.15 | 506.25 | 0.01 | 0.02 | 513.99 |
| Marina | Motor Vehicle | 2021 | 192 | 7.82 | 1,502 | 548,278 | 0.50 | 1.43 | 3.90 | 0.18 | 0.08 | 0.97 | 0.24 | 0.01 | 1342.75 | 0.04 | 0.06 | 222.31 | 0.01 | 0.01 | 225.40 |
| Park | Motor Vehicle | 2021 | 63 | 6.43 | 405 | 147,784 | 0.14 | 0.42 | 1.10 | 0.05 | 0.02 | 0.26 | 0.07 | 0.00 | 366.43 | 0.01 | 0.02 | 60.67 | 0.00 | 0.00 | 61.57 |
| Retail | Motor Vehicle | 2021 | 0 | 0 | 0 | 0 | 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 |
| Hotel Tower | Motor Vehicle | 2030 | 7650 | 5.95 | 45,545 | 16,624,040 | 11.09 | 31.52 | 79.93 | 5.23 | 2.19 | 29.38 | 7.37 | 0.31 | 32168.18 | 1.02 | 1.31 | 5325.80 | 0.17 | 0.22 | 5394.71 |
| Low-cost Hotel | Motor Vehicle | 2030 | 565 | 5.95 | 3,360 | 1,226,391 | 0.82 | 2.33 | 5.90 | 0.39 | 0.16 | 2.17 | 0.54 | 0.02 | 2373.34 | 0.07 | 0.10 | 392.93 | 0.01 | 0.02 | 398.02 |
| Marina | Motor Vehicle | 2030 | 192 | 7.82 | 1,502 | 548,278 | 0.34 | 0.89 | 2.47 | 0.17 | 0.07 | 0.97 | 0.24 | 0.01 | 1039.83 | 0.03 | 0.04 | 172.15 | 0.01 | 0.01 | 174.12 |
| Park | Motor Vehicle | 2030 | 63 | 6.43 | 405 | 147,784 | 0.10 | 0.27 | 0.70 | 0.05 | 0.02 | 0.26 | 0.07 | 0.00 | 284.22 | 0.01 | 0.01 | 47.06 | 0.00 | 0.00 | 47.64 |
| Retail | Motor Vehicle | 2030 | 0 | 0 | 0 | 0 | 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 |
| Hotel Tower | Motor Vehicle | 2050 | 7650 | 5.95 | 45,545 | 16,624,040 | 7.64 | 30.69 | 62.04 | 5.17 | 2.11 | 29.36 | 7.35 | 0.29 | 30048.35 | 0.90 | 1.28 | 4974.84 | 0.15 | 0.21 | 5041.58 |
| Low-cost Hotel | Motor Vehicle | 2050 | 565 | 5.95 | 3,360 | 1,226,391 | 0.56 | 2.27 | 4.58 | 0.38 | 0.16 | 2.17 | 0.54 | 0.02 | 2216.97 | 0.07 | 0.09 | 367.04 | 0.01 | 0.02 | 371.97 |
| Marina | Motor Vehicle | 2050 | 192 | 7.82 | 1,502 | 548,278 | 0.23 | 0.85 | 1.93 | 0.17 | 0.07 | 0.97 | 0.24 | 0.01 | 968.63 | 0.03 | 0.04 | 160.37 | 0.00 | 0.01 | 162.24 |
| Park | Motor Vehicle | 2050 | 63 | 6.43 | 405 | 147,784 | 0.07 | 0.26 | 0.54 | 0.05 | 0.02 | 0.26 | 0.07 | 0.00 | 265.26 | 0.01 | 0.01 | 43.92 | 0.00 | 0.00 | 44.48 |
| Retail | Motor Vehicle | 2050 | 0 | 0 | 0 | 0 | 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 |

**Electricity** lookup col 6

| | | | | | Pounds per Day | | | Metric tons per year | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Element** | **Source** | **yr** | **Kwh/year** | **kwh/day** | **CO2** | **CH4** | **N2O** | **CO2** | **CH4** | **N2O** | **CO2e** |
| Marina | Electricity | 2016 | 1,342,558 | 3,678 | 2069.49 | 0.25 | 0.05 | 342.63 | 0.04 | 0.01 | 345.94 |
| Hotel Tower | Electricity | 2021 | 14,661,782 | 40,169 | 21471.82 | 2.76 | 0.50 | 3554.90 | 0.46 | 0.08 | 3591.08 |
| Low-cost Hotel | Electricity | 2021 | 1,309,986 | 3,589 | 1918.44 | 0.25 | 0.04 | 317.62 | 0.04 | 0.01 | 320.85 |
| Marina | Electricity | 2021 | 86,280 | 236 | 126.35 | 0.02 | 0.00 | 20.92 | 0.00 | 0.00 | 21.13 |
| Park | Electricity | 2021 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Retail | Electricity | 2021 | 129,906 | 356 | 190.24 | 0.02 | 0.00 | 31.50 | 0.00 | 0.00 | 31.82 |
| Hotel Tower | Electricity | 2030 | 14,661,782 | 40,169 | 19764.19 | 2.76 | 0.50 | 3272.18 | 0.46 | 0.08 | 3308.36 |
| Low-cost Hotel | Electricity | 2030 | 1,309,986 | 3,589 | 1765.87 | 0.25 | 0.04 | 292.36 | 0.04 | 0.01 | 295.59 |
| Marina | Electricity | 2030 | 86,280 | 236 | 116.31 | 0.02 | 0.00 | 19.26 | 0.00 | 0.00 | 19.47 |
| Park | Electricity | 2030 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Retail | Electricity | 2030 | 129,906 | 356 | 175.11 | 0.02 | 0.00 | 28.99 | 0.00 | 0.00 | 29.31 |
| Hotel Tower | Electricity | 2050 | 14,661,782 | 40,169 | 19764.19 | 2.76 | 0.50 | 3272.18 | 0.46 | 0.08 | 3308.36 |
| Low-cost Hotel | Electricity | 2050 | 1,309,986 | 3,589 | 1765.87 | 0.25 | 0.04 | 292.36 | 0.04 | 0.01 | 295.59 |
| Marina | Electricity | 2050 | 86,280 | 236 | 116.31 | 0.02 | 0.00 | 19.26 | 0.00 | 0.00 | 19.47 |
| Park | Electricity | 2050 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Retail | Electricity | 2050 | 129,906 | 356 | 175.11 | 0.02 | 0.00 | 28.99 | 0.00 | 0.00 | 29.31 |

| **Natural Gas** | lookup col 7 | | | | Pounds per Day | | | | | | | | | | | Metric tons per year | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Element** | **Source** | **yr** | **kbtu/yr** | **kbtu/day** | **ROG** | **NOX** | **CO** | **PM10E** | **PM2.5E** | **PM10 D** | **PM2.5 D** | **SO2** | **CO2** | **CH4** | **N2O** | **CO2** | **CH4** | **N2O** | **CO2e** |
| Marina | Natural Gas | 2016 | 2,403,608 | 6,585.2 | 0.07 | 0.65 | 0.54 | 0.05 | 0.05 | 0.00 | 0.00 | 0.00 | 774.73 | 0.01 | 0.01 | 128.27 | 0.00 | 0.00 | 129.03 |
| Hotel Tower | Natural Gas | 2021 | 23,504,628 | 64,396.2 | 0.69 | 6.31 | 5.30 | 0.48 | 0.48 | 0.00 | 0.00 | 0.04 | 7576.03 | 0.15 | 0.14 | 1254.30 | 0.02 | 0.02 | 1261.75 |
| Low-cost Hotel | Natural Gas | 2021 | 2,684,596 | 7,355.1 | 0.08 | 0.72 | 0.61 | 0.05 | 0.05 | 0.00 | 0.00 | 0.00 | 865.30 | 0.02 | 0.02 | 143.26 | 0.00 | 0.00 | 144.11 |
| Marina | Natural Gas | 2021 | 46,031 | 126.1 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 14.84 | 0.00 | 0.00 | 2.46 | 0.00 | 0.00 | 2.47 |
| Park | Natural Gas | 2021 | 0 | 0.0 | 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 |
| Retail | Natural Gas | 2021 | 86,658 | 237.4 | 0.00 | 0.02 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 27.93 | 0.00 | 0.00 | 4.62 | 0.00 | 0.00 | 4.65 |
| Hotel Tower | Natural Gas | 2030 | 23,504,628 | 64,396.2 | 0.69 | 6.31 | 5.30 | 0.48 | 0.48 | 0.00 | 0.00 | 0.04 | 7576.03 | 0.15 | 0.14 | 1254.30 | 0.02 | 0.02 | 1261.75 |
| Low-cost Hotel | Natural Gas | 2030 | 2,684,596 | 7,355.1 | 0.08 | 0.72 | 0.61 | 0.05 | 0.05 | 0.00 | 0.00 | 0.00 | 865.30 | 0.02 | 0.02 | 143.26 | 0.00 | 0.00 | 144.11 |
| Marina | Natural Gas | 2030 | 46,031 | 126.1 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 14.84 | 0.00 | 0.00 | 2.46 | 0.00 | 0.00 | 2.47 |
| Park | Natural Gas | 2030 | 0 | 0.0 | 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 |
| Retail | Natural Gas | 2030 | 86,658 | 237.4 | 0.00 | 0.02 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 27.93 | 0.00 | 0.00 | 4.62 | 0.00 | 0.00 | 4.65 |
| Hotel Tower | Natural Gas | 2050 | 23,504,628 | 64,396.2 | 0.69 | 6.31 | 5.30 | 0.48 | 0.48 | 0.00 | 0.00 | 0.04 | 7576.03 | 0.15 | 0.14 | 1254.30 | 0.02 | 0.02 | 1261.75 |
| Low-cost Hotel | Natural Gas | 2050 | 2,684,596 | 7,355.1 | 0.08 | 0.72 | 0.61 | 0.05 | 0.05 | 0.00 | 0.00 | 0.00 | 865.30 | 0.02 | 0.02 | 143.26 | 0.00 | 0.00 | 144.11 |
| Marina | Natural Gas | 2050 | 46,031 | 126.1 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 14.84 | 0.00 | 0.00 | 2.46 | 0.00 | 0.00 | 2.47 |
| Park | Natural Gas | 2050 | 0 | 0.0 | 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 |
| Retail | Natural Gas | 2050 | 86,658 | 237.4 | 0.00 | 0.02 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 27.93 | 0.00 | 0.00 | 4.62 | 0.00 | 0.00 | 4.65 |

**Water-Indoor** lookup col 9

| | | | | | | | Pounds per Day | | | Metric tons per year | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Element** | **Source** | **yr** | **MG/Yr** | **kwh/MG** | **Kwh/year** | **kwh/day** | **CO2** | **CH4** | **N2O** | **CO2** | **CH4** | **N2O** | **CO2e** |
| Marina | Water-Indoor | 2016 | 1.8 | 13,021 | 23,395 | 64 | 36.06 | 0.00 | 0.00 | 5.97 | 0.00 | 0.00 | 6.03 |
| Hotel Tower | Water-Indoor | 2021 | 38.2 | 13,021 | 497,698 | 1,364 | 728.87 | 0.09 | 0.02 | 120.67 | 0.02 | 0.00 | 121.90 |
| Low-cost Hotel | Water-Indoor | 2021 | 7.3 | 13,021 | 94,534 | 259 | 138.44 | 0.02 | 0.00 | 22.92 | 0.00 | 0.00 | 23.15 |
| Marina | Water-Indoor | 2021 | 0 | 13,021 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Park | Water-Indoor | 2021 | 0 | 13,021 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Retail | Water-Indoor | 2021 | 0 | 13,021 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Hotel Tower | Water-Indoor | 2030 | 38.2 | 13,021 | 497,698 | 1,364 | 670.90 | 0.09 | 0.02 | 111.08 | 0.02 | 0.00 | 112.30 |
| Low-cost Hotel | Water-Indoor | 2030 | 7.3 | 13,021 | 94,534 | 259 | 127.43 | 0.02 | 0.00 | 21.10 | 0.00 | 0.00 | 21.33 |
| Marina | Water-Indoor | 2030 | 0 | 13,021 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Park | Water-Indoor | 2030 | 0 | 13,021 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Retail | Water-Indoor | 2030 | 0 | 13,021 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Hotel Tower | Water-Indoor | 2050 | 38.2 | 13,021 | 497,698 | 1,364 | 670.90 | 0.09 | 0.02 | 111.08 | 0.02 | 0.00 | 112.30 |
| Low-cost Hotel | Water-Indoor | 2050 | 7.3 | 13,021 | 94,534 | 259 | 127.43 | 0.02 | 0.00 | 21.10 | 0.00 | 0.00 | 21.33 |
| Marina | Water-Indoor | 2050 | 0 | 13,021 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Park | Water-Indoor | 2050 | 0 | 13,021 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Retail | Water-Indoor | 2050 | 0 | 13,021 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**Water-Outdoor** lookup col 8

| | | | | | | | Pounds per Day | | | Metric tons per year | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Element** | **Source** | **yr** | **MG/Yr** | **kwh/MG** | **Kwh/year** | **kwh/day** | **CO2** | **CH4** | **N2O** | **CO2** | **CH4** | **N2O** | **CO2e** |
| Marina | Water-Outdoor | 2016 | 0.0 | 13,021 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Hotel Tower | Water-Outdoor | 2021 | 0.0 | 13,021 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Low-cost Hotel | Water-Outdoor | 2021 | 0.0 | 13,021 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Marina | Water-Outdoor | 2021 | 0 | 13,021 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Park | Water-Outdoor | 2021 | 0 | 13,021 | 1,599 | 4 | 2.34 | 0.00 | 0.00 | 0.39 | 0.00 | 0.00 | 0.39 |
| Retail | Water-Outdoor | 2021 | 0 | 13,021 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Hotel Tower | Water-Outdoor | 2030 | 0.0 | 13,021 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Low-cost Hotel | Water-Outdoor | 2030 | 0.0 | 13,021 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Marina | Water-Outdoor | 2030 | 0 | 13,021 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Park | Water-Outdoor | 2030 | 0 | 13,021 | 1,599 | 4 | 2.16 | 0.00 | 0.00 | 0.36 | 0.00 | 0.00 | 0.36 |
| Retail | Water-Outdoor | 2030 | 0 | 13,021 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Hotel Tower | Water-Outdoor | 2050 | 0.0 | 13,021 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Low-cost Hotel | Water-Outdoor | 2050 | 0.0 | 13,021 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Marina | Water-Outdoor | 2050 | 0 | 13,021 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Park | Water-Outdoor | 2050 | 0 | 13,021 | 1,599 | 4 | 2.16 | 0.00 | 0.00 | 0.36 | 0.00 | 0.00 | 0.36 |
| Retail | Water-Outdoor | 2050 | 0 | 13,021 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**Wastewater** lookup col 9

| | | | | | | | Day | | Metric tons per year | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Element** | **Source** | **yr** | **gallons/day** | **gallons/Yr** | | | **CH4** | | **CH4** | **CO2e** |
| Marina | Wastewater | 2016 | 4,922 | 1796696.0 | *2016Wastewater* | - | 0.01 | - | 0.002 | 0.05 |
| Hotel Tower | Wastewater | 2021 | 104,720 | 38222695 | *2021Wastewater* | - | 0.28 | | 0.047 | 1.16 |
| Low-cost Hotel | Wastewater | 2021 | 19,891 | 7260105 | *2021Wastewater* | - | 0.05 | | 0.009 | 0.22 |
| Marina | Wastewater | 2021 | 0 | 0 | *2021Wastewater* | - | 0.00 | | 0.000 | 0.00 |
| Park | Wastewater | 2021 | 0 | 0 | *2021Wastewater* | - | 0.00 | | 0.000 | 0.00 |
| Retail | Wastewater | 2021 | 0 | 0 | *2021Wastewater* | - | 0.00 | - | 0.000 | 0.00 |
| Hotel Tower | Wastewater | 2030 | 104,720 | 38222695 | *2030Wastewater* | - | 0.28 | | 0.047 | 1.16 |
| Low-cost Hotel | Wastewater | 2030 | 19,891 | 7260105 | *2030Wastewater* | - | 0.05 | | 0.009 | 0.22 |
| Marina | Wastewater | 2030 | 0 | 0 | *2030Wastewater* | - | 0.00 | | 0.000 | 0.00 |
| Park | Wastewater | 2030 | 0 | 0 | *2030Wastewater* | - | 0.00 | | 0.000 | 0.00 |
| Retail | Wastewater | 2030 | 0 | 0 | *2030Wastewater* | - | 0.00 | | 0.000 | 0.00 |
| Hotel Tower | Wastewater | 2050 | 104,720 | 38222695 | *2050Wastewater* | - | 0.28 | | 0.047 | 1.16 |
| Low-cost Hotel | Wastewater | 2050 | 19,891 | 7260105 | *2050Wastewater* | - | 0.05 | | 0.009 | 0.22 |
| Marina | Wastewater | 2050 | 0 | 0 | *2050Wastewater* | - | 0.00 | | 0.000 | 0.00 |
| Park | Wastewater | 2050 | 0 | 0 | *2050Wastewater* | - | 0.00 | | 0.000 | 0.00 |
| Retail | Wastewater | 2050 | 0 | 0 | *2050Wastewater* | - | 0.00 | | 0.000 | 0.00 |

**Solid Waste** lookup col 10

| Element | Source | yr | ton/day | tons/yr | Metric tons per year<br>CH4 | CO2e |
|---|---|---|---|---|---|---|
| Marina | Waste | 2016 | 0.9 | 311 | 3.734 | 93.34 |
| Hotel Tower | Waste | 2021 | 1.0 | 379 | 4.547 | 113.67 |
| Low-cost Hotel | Waste | 2021 | 0.6 | 206 | 2.473 | 61.83 |
| Marina | Waste | 2021 | 0.9 | 311 | 3.734 | 93.34 |
| Park | Waste | 2021 | 0.0 | 0 | 0.000 | 0.00 |
| Retail | Waste | 2021 | 0.9 | 311 | 3.734 | 93.34 |
| Hotel Tower | Waste | 2030 | 1.0 | 379 | 4.547 | 113.67 |
| Low-cost Hotel | Waste | 2030 | 0.6 | 206 | 2.473 | 61.83 |
| Marina | Waste | 2030 | 0.9 | 311 | 3.734 | 93.34 |
| Park | Waste | 2030 | 0.0 | 0 | 0.000 | 0.00 |
| Retail | Waste | 2030 | 0.9 | 311 | 3.734 | 93.34 |
| Hotel Tower | Waste | 2050 | 1.0 | 379 | 4.547 | 113.67 |
| Low-cost Hotel | Waste | 2050 | 0.6 | 206 | 2.473 | 61.83 |
| Marina | Waste | 2050 | 0.9 | 311 | 3.734 | 93.34 |
| Park | Waste | 2050 | 0.0 | 0 | 0.000 | 0.00 |
| Retail | Waste | 2050 | 0.9 | 311 | 3.734 | 93.34 |

| **Consumer Products** | lookup col 16 | | | **Pounds per Day** |
|---|---|---|---|---|
| **Element** | **Source** | **yr** | **SF** | **ROG** |
| Marina | Consumer Products | 2016 | 50,000 | 1.07 |
| Hotel Tower | Consumer Products | 2021 | 796,000 | 17.03 |
| Low-cost Hotel | Consumer Products | 2021 | 90,000 | 1.93 |
| Marina | Consumer Products | 2021 | 57,696 | 1.23 |
| Park | Consumer Products | 2021 | 127,290 | 2.72 |
| Retail | Consumer Products | 2021 | 6,025 | 0.13 |
| Hotel Tower | Consumer Products | 2030 | 796,000 | 17.03 |
| Low-cost Hotel | Consumer Products | 2030 | 90,000 | 1.93 |
| Marina | Consumer Products | 2030 | 57,696 | 1.23 |
| Park | Consumer ProductsPar | 2030 | 127,290 | 0.01 |
| Retail | Consumer Products | 2030 | 6,025 | 0.13 |
| Hotel Tower | Consumer Products | 2050 | 796,000 | 17.03 |
| Low-cost Hotel | Consumer Products | 2050 | 90,000 | 1.93 |
| Marina | Consumer Products | 2050 | 57,696 | 1.23 |
| Park | Consumer Products | 2050 | 127,290 | 2.72 |
| Retail | Consumer Products | 2050 | 6,025 | 0.13 |

**Architectural Coatings** lookup col 16

| Element | Source | yr | SF/total | SF/Year | SF/Daily | Pounds per Day<br>ROG |
|---|---|---|---|---|---|---|
| Marina | Architectural Coatings | 2016 | 50,000 | 5000 | 13.70 | 0.16 |
| Hotel Tower | Architectural Coatings | 2021 | 796,000 | 79,600.0 | 218.08 | 2.59 |
| Low-cost Hotel | Architectural Coatings | 2021 | 90,000 | 9,000.0 | 24.66 | 0.29 |
| Marina | Architectural Coatings | 2021 | 57,696 | 5,769.6 | 15.81 | 0.19 |
| Park | Architectural Coatings | 2021 | 127,290 | 12,729.0 | 34.87 | 0.41 |
| Retail | Architectural Coatings | 2021 | 6,025 | 602.5 | 1.65 | 0.02 |
| Hotel Tower | Architectural Coatings | 2030 | 796,000 | 79,600.0 | 218.08 | 2.59 |
| Low-cost Hotel | Architectural Coatings | 2030 | 90,000 | 9,000.0 | 24.66 | 0.29 |
| Marina | Architectural Coatings | 2030 | 57,696 | 5,769.6 | 15.81 | 0.19 |
| Park | Architectural Coatings | 2030 | 127,290 | 12,729.0 | 34.87 | 0.41 |
| Retail | Architectural Coatings | 2030 | 6,025 | 602.5 | 1.65 | 0.02 |
| Hotel Tower | Architectural Coatings | 2050 | 796,000 | 79,600.0 | 218.08 | 2.59 |
| Low-cost Hotel | Architectural Coatings | 2050 | 90,000 | 9,000.0 | 24.66 | 0.29 |
| Marina | Architectural Coatings | 2050 | 57,696 | 5,769.6 | 15.81 | 0.19 |
| Park | Architectural Coatings | 2050 | 127,290 | 12,729.0 | 34.87 | 0.41 |
| Retail | Architectural Coatings | 2050 | 6,025 | 602.5 | 1.65 | 0.02 |

## Emission Factor Summary

| Emission Source | year | mode | metric | conc | TOG | ROG | NOX | CO | PM10 | PM2.5 | SO2 | CO2 | CH4 | N2O | | | Source |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Visitors | 2016 | travel | g/vmt | 2016aggregate | 0.184 | 0.156 | 0.453 | 1.434 | 0.057 | 0.026 | 0.004 | 442 | 0.012 | 0.019 | aggregate | | CalEEMod |
| Visitors | 2021 | travel | g/vmt | 2021aggregate | 0.124 | 0.104 | 0.260 | 0.908 | 0.053 | 0.023 | 0.004 | 382 | 0.011 | 0.011 | aggregate | | CalEEMod |
| Visitors | 2030 | travel | g/vmt | 2030aggregate | 0.088 | 0.074 | 0.125 | 0.587 | 0.052 | 0.021 | 0.003 | 294 | 0.010 | 0.005 | aggregate | | CalEEMod |
| Visitors | 2050 | travel | g/vmt | 2050aggregate | 0.067 | 0.054 | 0.101 | 0.465 | 0.051 | 0.021 | 0.003 | 271 | 0.009 | 0.004 | aggregate | | CalEEMod |
| Visitors | 2016 | starts | g/trip | 2016starts | 0.614 | 0.584 | 1.522 | 3.442 | 0.004 | 0.004 | 0.002 | 177 | 0.005 | 0.063 | starts | | CalEEMod |
| Visitors | 2021 | starts | g/trip | 2021starts | 0.389 | 0.372 | 1.353 | 2.108 | 0.003 | 0.003 | 0.002 | 182 | 0.005 | 0.056 | starts | | CalEEMod |
| Visitors | 2030 | starts | g/trip | 2030starts | 0.228 | 0.218 | 1.122 | 1.244 | 0.002 | 0.002 | 0.001 | 159 | 0.005 | 0.047 | starts | | CalEEMod |
| Visitors | 2050 | starts | g/trip | 2050starts | 0.137 | 0.130 | 1.219 | 0.908 | 0.001 | 0.001 | 0.002 | 168 | 0.006 | 0.051 | starts | | CalEEMod |
| Road Dust | all | | g/vmt | | | | | | 0.292 | 0.073 | | | | | | | |
| Natural Gas | 2016 | Non-res | g/kBTU | 2016Natural Gas | 0.005 | 0.005 | 0.044 | 0.037 | 0.003 | 0.003 | 0.000 | 53 | 0.001 | 0.001 | | | CalEEMod Appx, Table 8.2; converted to g/kbtu |
| Natural Gas | 2021 | Non-res | g/kBTU | 2021Natural Gas | 0.005 | 0.005 | 0.044 | 0.037 | 0.003 | 0.003 | 0.000 | 53 | 0.001 | 0.001 | | | CalEEMod Appx, Table 8.2; converted to g/kbtu |
| Natural Gas | 2030 | Non-res | g/kBTU | 2030Natural Gas | 0.005 | 0.005 | 0.044 | 0.037 | 0.003 | 0.003 | 0.000 | 53 | 0.001 | 0.001 | | | CalEEMod Appx, Table 8.2; converted to g/kbtu |
| Natural Gas | 2050 | Non-res | g/kBTU | 2050Natural Gas | 0.005 | 0.005 | 0.044 | 0.037 | 0.003 | 0.003 | 0.000 | 53 | 0.001 | 0.001 | | | CalEEMod Appx, Table 8.2; converted to g/kbtu |
| Electricity | 2016 | | g/kWh | 2016Electricity | - | - | - | - | - | - | - | 255 | 0.031 | 0.006 | | | SDGE Responsibility Report for 2016; CH4 and N2O eGrid |
| Electricity | 2021 | | g/kWh | 2021Electricity | - | - | - | - | - | - | - | 242 | 0.031 | 0.006 | | | SDG&E Procurement to date for 2020 (45.2%) |
| Electricity | 2030 | | g/kWh | 2030Electricity | - | - | - | - | - | - | - | 223 | 0.031 | 0.006 | | | 50% RPS |
| Electricity | 2050 | | g/kWh | 2050Electricity | - | - | - | - | - | - | - | 223 | 0.031 | 0.006 | | | 50% RPS |
| Water-Indoor | 2016 | | g/kWh | 2016Water-Indoor | - | - | - | - | - | - | - | 255 | 0.031 | 0.006 | | 13,021 | kwh/MG |
| Water-Indoor | 2021 | | g/kWh | 2021Water-Indoor | - | - | - | - | - | - | - | 242 | 0.031 | 0.006 | | | |
| Water-Indoor | 2030 | | g/kWh | 2030Water-Indoor | - | - | - | - | - | - | - | 223 | 0.031 | 0.006 | | | |
| Water-Indoor | 2050 | | g/kWh | 2050Water-Indoor | - | - | - | - | - | - | - | 223 | 0.031 | 0.006 | | | |
| Water-Outdoor | 2016 | | g/kWh | 2016Water-Outdoor | - | - | - | - | - | - | - | 255 | 0.031 | 0.006 | | 11,110 | kwh/MG |
| Water-Outdoor | 2021 | | g/kWh | 2021Water-Outdoor | - | - | - | - | - | - | - | 242 | 0.031 | 0.006 | | | |
| Water-Outdoor | 2030 | | g/kWh | 2030Water-Outdoor | - | - | - | - | - | - | - | 223 | 0.031 | 0.006 | | | |
| Water-Outdoor | 2050 | | g/kWh | 2050Water-Outdoor | - | - | - | - | - | - | - | 223 | 0.031 | 0.006 | | | |
| Wastewater | 2016 | | g/gallon | 2016Wastewater | - | - | - | - | - | - | - | - | 0.001 | - | | | |
| Wastewater | 2021 | | g/gallon | 2021Wastewater | - | - | - | - | - | - | - | - | 0.001 | - | | | |
| Wastewater | 2030 | | g/gallon | 2030Wastewater | - | - | - | - | - | - | - | - | 0.001 | - | | | |
| Wastewater | 2050 | | g/gallon | 2050Wastewater | - | - | - | - | - | - | - | - | 0.001 | - | | | |
| Waste | 2016 | | MT/ton | 2016Waste | - | - | - | - | - | - | - | - | 0.017 | - | | | |
| Waste | 2021 | | MT/ton | 2021Waste | - | - | - | - | - | - | - | - | 0.017 | - | | | |
| Waste | 2030 | | MT/ton | 2030Waste | - | - | - | - | - | - | - | - | 0.017 | - | | | |
| Waste | 2050 | | MT/ton | 2050Waste | - | - | - | - | - | - | - | - | 0.017 | - | | | |
| Consumer Products | 2016 | sf | g/sf | 2016Consumer Products | - | 0.009707 | - | - | - | - | - | - | - | - | | | |
| Consumer Products | 2021 | sf | g/sf | 2021Consumer Products | - | 0.009707 | - | - | - | - | - | - | - | - | | | |
| Consumer Products | 2030 | sf | g/sf | 2030Consumer Products | - | 0.009707 | - | - | - | - | - | - | - | - | | | |
| Consumer Products | 2050 | sf | g/sf | 2050Consumer Products | - | 0.009707 | - | - | - | - | - | - | - | - | | | |
| Consumer Products | 2016 | park | g/sf | 2016Consumer Productspark | - | 2.34E-05 | - | - | - | - | - | - | - | - | | | |
| Consumer Products | 2021 | park | g/sf | 2021Consumer Productspark | - | 2.34E-05 | - | - | - | - | - | - | - | - | | | |
| Consumer Products | 2030 | park | g/sf | 2030Consumer Productspark | - | 2.34E-05 | - | - | - | - | - | - | - | - | | | |
| Consumer Products | 2050 | park | g/sf | 2050Consumer Productspark | - | 2.34E-05 | - | - | - | - | - | - | - | - | | | |
| Architectural Coatings | 2016 | | g/sf | 2016Architectural Coatings | - | 5.382516 | - | - | - | - | - | - | - | - | | 250 g/l | |
| Architectural Coatings | 2021 | | g/sf | 2021Architectural Coatings | - | 5.382516 | - | - | - | - | - | - | - | - | | 250 g/l | |
| Architectural Coatings | 2030 | | g/sf | 2030Architectural Coatings | - | 5.382516 | - | - | - | - | - | - | - | - | | 250 g/l | |
| Architectural Coatings | 2050 | | g/sf | 2050Architectural Coatings | - | 5.382516 | - | - | - | - | - | - | - | - | | 250 g/l | |

# Site Location and Mitigation Reductions for FAL

| Reductions | | | | reduction | CAPCOA Measure | source |
|---|---|---|---|---|---|---|
| | Mobile | | total Mobile | 29.3% | | |
| | | Transit access | | 9.19% | LUT-5 | CAPCOA, based on 0.4 miles (see below) |
| | | Walkability | | 21.3% | LUT-8, 3.1.9 | CAPCOA, max reduction (calculated to be 46.3%), based on 175 intersections/mi2 from Chen Ryan |
| | | Electric charging station | | 0.5% | SDT-8 | CAPCOA, min reduction, citing SMAQMD Recommended Reductions |
| | | | | | LUT-8, 3.1.8 | CAPCOA, min reduction, citing CCAP guiidebook that attributes a 1% to 5% reduction in VMT to the use of bicycles and 0.625% from bike parking alone |
| | | Bike Facility | | 0.625% | | |
| | Indoor Water | water reduction = GHG reduction | | 20% | | |
| | Solid Wate | detailed utility consumption showed about 60% of waste to be recycled or composted | | 60% | | |

**Calculation details**

| Transit access | | | |
|---|---|---|---|
| LUT-5 | % VMT = Transit * B [not to exceed 30%] | | |
| | B= | 0.67 | |
| | Transit= | 11.2% | |
| | based on X distance to transit center= | 0.4 | 0.4 for 12th&Imperial; Gaslamp trolley stop about 0.15 mi away, but only trolley, no buses |
| | max reduction = | 30.0% | not using; calculated reduction lower |
| | estimate of trips reduction applies to | 82.1% | only visitors and workers affected by transit; other trips not affected (weighted by trip lengths) |

| Walkability | | | |
|---|---|---|---|
| LUT-8 | % VMT Reduction = Intersections * B | 38.0% | higher than max allowed; not using |
| | Avg Intersections per square mile | 36 | from CAPCOA, LUT-8 |
| | intersections per square mile | 175 | Chen Ryan: Rough Calculation: There are 300+ intersections downtown, downtown is about 1.7 square miles, so conservatively there is around 175 intersections per square mile downtown. |
| | B = | 0.12 | |
| | max reduction = | 21.3% | |
| | estimate of trips reduction applies to | 82.1% | only visitors and workers affected by walkingt; other trips not affected |

**Relevant CalEEMod operational metrics**

### Table 4.1 Road Characteristics

| Location Type | Name | Average Vehicle Weight | Percent of Paved Roads | | | |
|---|---|---|---|---|---|---|
| | | | Construction Worker | Construction Hauling | Construction Vendor | Operational Mobile |
| Counties | San Diego | 2.4 | 100 | 100 | 100 | 100 |

### Table 4.2 Mobile Trip Characteristics Dependent on Location

| Location Type | Name | Rural Trip Length (miles) | | | | | | Urban Trip Length (miles) | | | | | | Residential Trip Type Percentage | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | C-C | C-NW | C-W | H-O | H-S | H-W | C-C | C-NW | C-W | H-O | H-S | H-W | H-W | H-S | H-O |
| Counties | San Diego | 6.6 | 6.6 | 14.7 | 7.9 | 7.1 | 16.8 | 7.3 | 7.3 | 9.5 | 7.5 | 7.3 | 10.8 | 41.6 | 18.8 | 39.6 |

### Table 4.3 Mobile Trip Rates, Trip Purpose, Trip Type by Land Use

| Land Use Type | Land Use Sub Type | Size Metric | Trip Rate | | | Primary % | Diverted % | PassBy % | Trip Type | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Week day | Saturday | Sunday | | | | C-C % | C-W % | C-NW % |
| Recreational | City Park | Acre | 1.89 | 22.75 | 16.74 | 66 | 28 | 6 | 48 | 33 | 19 |
| Recreational | Hotel | Room | 8.17 | 8.19 | 5.95 | 58 | 38 | 4 | 61.6 | 19.4 | 19 |
| Recreational | Motel | Room | 5.63 | 5.63 | 5.63 | 58 | 38 | 4 | 62 | 19 | 19 |
| | Marina | | - | - | - | 100 | 0 | 0 | 57.2 | 23.8 | 19 |

### Table 6.1 Architectural Coating Emission Factors

| Name | EMFAC_ID | CoatingType | Start Date | End Date | ROG, g/L | Rule Name | Amended Date |
|---|---|---|---|---|---|---|---|
| San Diego | SDAB | esidential Ex | 1/1/1900 | 12/31/3000 | 250 | Default | NULL |
| | SDAB | esidential Int | 1/1/1900 | 12/31/3000 | 250 | Default | NULL |
| | SDAB | Parking | 1/1/1900 | 12/31/3000 | 250 | Default | NULL |
| | SDAB | sidential Exte | 1/1/1900 | 12/31/3000 | 250 | Default | NULL |
| | SDAB | sidential Inte | 1/1/1900 | 12/31/3000 | 250 | Default | NULL |
| San Diego County APCD | SDAPCD | esidential Ex | 1/1/1900 | 12/31/3000 | 250 | Default | NULL |
| | SDAPCD | esidential Int | 1/1/1900 | 12/31/3000 | 250 | Default | NULL |
| | SDAPCD | Parking | 1/1/1900 | 12/31/3000 | 250 | Default | NULL |
| | SDAPCD | sidential Exte | 1/1/1900 | 12/31/3000 | 250 | Default | NULL |
| | SDAPCD | sidential Inte | 1/1/1900 | 12/31/3000 | 250 | Default | NULL |

### Table 7.1 Number of Snow and Summer Days

Default: 0 Snow Days and 180 Summer Days

| Location Type | Name | Number Snow Days | Number Summer Days |
|---|---|---|---|
| | San Diego | 0 | 180 |

### Table 7.2 Landscape Equipment Running Emission Factors

| Equipment Type | Year | Engine Type | Commercial or Residential | Low Hp | High Hp | TOG g/bhp-hr | ROG g/bhp-hr | CO, g/bhp-hr | NOX, g/bhp-hr | SO2, g/bhp-hr | PM10, g/bhp-hr | PM2_5, g/bhp-hr | CO2, g/bhp-hr | CH4, g/bhp-hr | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Chainsaws | | | | | 356.698 | 725.905 | 1571.385 | 13.911 | 0.174 | 2.633 | 2.633 | 4229.982 | 45.118 | |
| | Chainsaws Preempt | | | | | 118.899 | 149.069 | 412.763 | 3.386 | 0.044 | 0.687 | 0.687 | 1069.305 | 9.265 | |
| | Front Mowers | | | | | 10.2 | 7.641 | 543.13 | 5.471 | 0.024 | 0.37 | 0.37 | 858.879 | 0.429 | |
| | Lawn & Garden Tractors | | | | | 9.652 | 6.775 | 543.056 | 4.799 | 0.024 | 0.324 | 0.324 | 858.879 | 0.381 | Worst case 2 |
| | Lawn Mowers | | | | | 9.704 | 16.284 | 387.332 | 4.034 | 0.035 | 2.501 | 2.501 | 858.879 | 1.012 | |
| | Leaf Blowers/Vacuums | | | | | 72.62 | 96.221 | 480.736 | 2.987 | 0.035 | 1.861 | 1.861 | 858.88 | 5.98 | |
| | Other Lawn & Garden Equipment | | | | | 279.469 | 71.211 | 545.911 | 4.893 | 0.035 | 1.97 | 1.97 | 858.879 | 4.426 | |
| | Rear Engine Riding Mowers | | | | | 12.769 | 7.641 | 543.131 | 5.471 | 0.024 | 0.37 | 0.37 | 858.88 | 0.429 | |
| | Shredders | | | | | 10.954 | 17.348 | 454.545 | 7.516 | 0.035 | 7.199 | 7.199 | 858.879 | 0.975 | |
| | Snowblowers | | | | | 104.069 | 50.166 | 601.586 | 4.97 | 0.035 | 1.647 | 1.647 | 858.88 | 3.118 | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Tillers | 7.779 | 14.021 | 417.224 | 3.555 | 0.029 | 2.199 | 2.199 | 858.879 | 0.788 |
| Trimmers/Edgers/Brush Cutters | 47.193 | 77.75 | 380.309 | 8.589 | 0.031 | 0.449 | 0.449 | 858.879 | 4.832 |
| Wood Splitters | 8.873 | 13.11 | 450.835 | 3.337 | 0.029 | 2.026 | 2.026 | 858.879 | 0.737 |

**Table 7.3 Landscape Equipment Usage**

| Land Use Type | Landscape Equipment T | Usage | Units |
|---|---|---|---|
| Non-Residential | Chainsaws | 2.47E-05 | hr/sqft/day |
| | Chainsaws Preempt | 2.47E-05 | hr/sqft/day |
| | Front Mowers | 1.81E-06 | hr/sqft/day |
| | Lawn & Garden Tractors | 4.04E-07 | hr/sqft/day |
| | Lawn Mowers | 2.49E-05 | hr/sqft/day |
| | Leaf Blowers/Vacuums | 9.54E-06 | hr/sqft/day |
| | Other Lawn & Garden Equ | 1.43E-05 | hr/sqft/day |
| | Rear Engine Riding Mowe | 1.81E-06 | hr/sqft/day |
| | Shredders | 8.60E-06 | hr/sqft/day |
| | Snowblowers | 1.41E-07 | hr/sqft/day |
| | Tillers | 1.07E-06 | hr/sqft/day |
| | Trimmers/Edgers/Brush C | 1.96E-05 | hr/sqft/day |
| | Wood Splitters | 7.18E-06 | hr/sqft/day |

92101 = climate zone 13

**Table 8.1 Energy Use by Climate Zone and Land Use Type**

| Land Use Sub Type | Climate Zone | Historical | T24 Electricity | NT24 Electricity | Lighting Electricity | T24 Natural Gas | NT24 Natural |
|---|---|---|---|---|---|---|---|
| | | | KWhr per DU or SQFT | | | kBtu per DU or SQFT | |
| Health Club | 13 | N | 1.27 | 4.27 | 2.91 | 4 | 7 |
| City Park | 13 | N | 0.00 | 0.00 | 0.00 | 0 | 0 |
| Hotel | 13 | N | 5.01 | 3.67 | 4.61 | 48 | 11 |
| Motel | 13 | N | 5.01 | 3.67 | 4.61 | 48 | 11 |
| Strip Mall | 13 | N | 3.34 | 3.16 | 6.39 | 1 | 1 |

for marina

% of

| T24 Electricity | NT24 Electricity | Lighting Electricity | T24 Natural | NT24 Natural Gas |
|---|---|---|---|---|
| 15% | 51% | 34% | 37% | 63% |
| #DIV/0! | #DIV/0! | #DIV/0! | #DIV/0! | #DIV/0! |
| 38% | 28% | 35% | 81% | 19% |
| 38% | 28% | 35% | 81% | 19% |
| 26% | 25% | 50% | 51% | 49% |

**Table 8.2 Natural Gas Emission Factors**

| Land Use Type | TOG, lb/MMBTU | ROG, lb/MMBTU | SO2, lb/MMBTU | NOX, lb/MMBTU | PB, lb/MMBTU | PM10, lb/MMBTU | PM2_5, lb/MMBTU | CO, lb/MMBTU | CO2_NBIO, lb/MMBTU | CH4, lb/MMBTU | N2O, lb/MMBTU |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nonresidential | 0.010784314 | 0.01078431 | 0.00058824 | 0.09803922 | 4.90196E-07 | 0.00745098 | 0.007451 | 0.082353 | 117.6471 | 0.002255 | 0.002157 |

| | TOG | ROG | NOX |
|---|---|---|---|
| lbs/mmbtu | 0.01 | 0.01 | 0.10 |
| g/kbtu | 0.00 | 0.00 | 0.04 |
| g/therm | 0.00 | 0.00 | 0.00 |
| g/MMBTu | 4.891682422 | 4.891682 | 44.46984 |

**Table 9.1 Water Use Rates**

| Land Use Sub Type | Size Metric | Indoor Water, gal/size/year[1] | Outdoor Water, gal/size/year[1] |
|---|---|---|---|

not needed

**Table 9.2 Water and Wastewater Electricity Intensity**

| Location Type | Name | Source | Supply Water | Treat Water | Distribute Water | Wastewater Treatment |
|---|---|---|---|---|---|---|
| | | | kWhr/ million gallons | | | |
| Counties | San Diego | 2 | 9727 | 111 | 1272 | 1911 |

13021 indoor
11110 outdoor

**Table 9.3 Percent of Wastewater Distribution Types**

| Location Type | Name | Source | Septic Tank | Aerobic | Anaerobic, Facultative Lagoons | Anaerobic, Combustion of Gas | Anaerobic, Cogeneration of Gas |
|---|---|---|---|---|---|---|---|
|  | San Diego County APCD | 1 | 10.33 | 87.46 | 2.21 | 100 | 0 |
|  |  |  | 0 | 100% | 0 | 100 |  |

(did not see SD County)

for hotel downtown

CH4 emissions (MT) = Wastewater x Digester Gas

Wastewater = variable in calcs - gallon

Digester Gas = 0.01

| | |
|---|---|
| Fch4 | 0.65 |
| pch4 | 662 |
| DE | 0.99 |
| conversion | 0.0283 |
| conversion | 0.001 |
| conversion | 0.001 |
| 1.21775E-09 | multiplier |

### Table 9.4 Wastewater Treatment Direct Emissions

| Wastewater Treatment Type | CO2 Biogenic, ton/gal | CO2 Non-Biogenic, ton/gal | CH4, ton/gal | N2O, ton/gal |
|---|---|---|---|---|
| Septic | 0 | 0 | 2.5036E-07 | 8.4812E-10 |
| Aerobic | 3.89999E-07 | 0 | 1.3423E-09 | 8.4812E-10 |
| Anaerobic Facultative | 3.89999E-07 | 0 | 4.0192E-07 | 8.4812E-10 |
| Digester Burn | 0 | 0 | 0 | 0 |
| Digester Cogen | 0 | 0 | 0 | 0 |

**Note:**
Digester combustion emissions are estimated using water intensity emission factors.

### Table 10.1 Solid Waste Disposal Rates

| Location Type | Name | d Use Sub T | Size Metric | Rate, ton/size/year |
|---|---|---|---|---|
| not needed |  |  |  |  |

### Table 10.2 Support for Solid Waste Emission Factors

| MSW Category | Fraction Total Organic Degradable Carbon per Waste Type[a] | Default Decomposable Anaerobic Fraction[b] | Waste Stream Compostion Fraction[c] | Fraction of Carbon Emissions |
|---|---|---|---|---|
| Newspaper | 0.465 | 0.161 | 0.013 | 0.00049 |
| Office Paper | 0.398 | 0.874 | 0.019 | 0.00330 |
| Corrugated Boxes | 0.405 | 0.383 | 0.048 | 0.00372 |
| Coated paper | 0.405 | 0.21 | 0.094 | 0.00400 |
| Food | 0.117 | 0.828 | 0.155 | 0.00751 |
| Grass | 0.192 | 0.322 | 0.02533333 | 0.00078 |
| Leaves | 0.478 | 0.1 | 0.01266667 | 0.00030 |
| Branches | 0.279 | 0.176 | 0.033 | 0.00081 |
| Lumber | 0.43 | 0.233 | 0.145 | 0.00726 |
| textiles | 0.24 | 0.5 | 0.054 | 0.00324 |
| diapers | 0.24 | 0.5 | 0.043 | 0.00258 |
| construction demolition | 0.04 | 0.5 | 0.146 | 0.00146 |
| medical waste | 0.15 | 0.5 | 0 | 0.00000 |
| sludge/manure | 0.05 | 0.5 | 0.001 | 0.00001 |

| | | |
|---|---|---|
| Generation Fraction | mass carbon | 0.03547 |
|  | mass CH4 | 0.04730 |
|  | mass CO2 | 0.13006 |

### Emission Factors

| Description | Collection Efficiency | Destruction Fraction | Oxidation Fraction | CO2 Emissions,[d] ton/ton waste | CH4 Emissions,[e] ton/ton waste |
|---|---|---|---|---|---|
| No LFG Collection | 0 | 0 | 0.1 | 0 | 0 |

a) California Air Resources Board, the California Climate Action

| | | | | | |
|---|---|---|---|---|---|
| LFG Collect and Combust | 0.75 | 0.98 | 0.1 | 0 | 0 |
| Cogen | | | waste*(0.2289 - 6.3382E-0 | | 0 |

b) CARB, 2008, Table 9.7 Default Decomposable Anaerobic Fraction (DANF)of the TDOC per waste type
c) California Integrated Waste Management Board, California
d) CO2 emission factor, ton/ton waste = generation fraction x
e) CH4 emission factor, ton/ton waste = generation fraction x

**Table 12.1 Diesel Emergency Generator and Fire Pump Emission Factors**

| Equipment Type | Low HP | High HP | TOG | ROG | CO | NOX | SO2 | PM10 | PM2.5 | CO2 | CH4 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | lb/hp-hr | lb/hp-hr | g/hp-hr | g/hp-hr | g/hp-hr | g/hp-hr | g/hp-hr | lb/hp-hr | g/hp-hr |
| Emergency Generator | 0 | 11 | 0.00247 | 0.00225 | 5.97 | 5.32 | 0.00494 | 0.60 | 0.60 | 1.15 | 0.073 |
| Emergency Generator | 11 | 25 | 0.00247 | 0.00225 | 4.93 | 5.32 | 0.00494 | 0.60 | 0.60 | 1.15 | 0.073 |
| Emergency Generator | 25 | 50 | 0.00247 | 0.00225 | 4.10 | 5.32 | 0.00494 | 0.45 | 0.45 | 1.15 | 0.073 |
| Emergency Generator | 50 | 75 | 0.00247 | 0.00225 | 3.70 | 3.33 | 0.00494 | 0.15 | 0.15 | 1.15 | 0.073 |
| Emergency Generator | 75 | 100 | 0.00247 | 0.00225 | 3.70 | 3.33 | 0.00494 | 0.15 | 0.15 | 1.15 | 0.073 |
| Emergency Generator | 100 | 175 | 0.00247 | 0.00225 | 3.70 | 2.85 | 0.00494 | 0.15 | 0.15 | 1.15 | 0.073 |
| Emergency Generator | 175 | 300 | 0.00247 | 0.00225 | 2.60 | 2.85 | 0.00494 | 0.15 | 0.15 | 1.15 | 0.073 |
| Emergency Generator | 300 | 600 | 0.00247 | 0.00225 | 2.60 | 2.85 | 0.00494 | 0.15 | 0.15 | 1.15 | 0.073 |
| Emergency Generator | 600 | 750 | 0.00247 | 0.00225 | 2.60 | 2.85 | 0.00494 | 0.15 | 0.15 | 1.15 | 0.073 |
| Emergency Generator | 750 | 9999 | 0.00247 | 0.00225 | 2.60 | 4.56 | 0.00494 | 0.15 | 0.15 | 1.15 | 0.073 |
| Fire Pump | 0 | 11 | 0.00247 | 0.00225 | 6.00 | 5.32 | 0.00494 | 0.30 | 0.30 | 1.15 | 0.073 |
| Fire Pump | 11 | 25 | 0.00247 | 0.00225 | 4.90 | 5.32 | 0.00494 | 0.30 | 0.30 | 1.15 | 0.073 |
| Fire Pump | 25 | 50 | 0.00247 | 0.00225 | 4.10 | 5.32 | 0.00494 | 0.22 | 0.22 | 1.15 | 0.073 |
| Fire Pump | 50 | 75 | 0.00247 | 0.00225 | 3.70 | 3.33 | 0.00494 | 0.30 | 0.30 | 1.15 | 0.073 |
| Fire Pump | 75 | 100 | 0.00247 | 0.00225 | 3.70 | 3.33 | 0.00494 | 0.30 | 0.30 | 1.15 | 0.073 |
| Fire Pump | 100 | 175 | 0.00247 | 0.00225 | 3.70 | 2.85 | 0.00494 | 0.22 | 0.22 | 1.15 | 0.073 |
| Fire Pump | 175 | 300 | 0.00247 | 0.00225 | 2.60 | 2.85 | 0.00494 | 0.15 | 0.15 | 1.15 | 0.073 |
| Fire Pump | 300 | 600 | 0.00247 | 0.00225 | 2.60 | 2.85 | 0.00494 | 0.15 | 0.15 | 1.15 | 0.073 |
| Fire Pump | 600 | 750 | 0.00247 | 0.00225 | 2.60 | 2.85 | 0.00494 | 0.15 | 0.15 | 1.15 | 0.073 |
| Fire Pump | 750 | 9999 | 0.00247 | 0.00225 | 2.60 | 4.56 | 0.00494 | 0.15 | 0.15 | 1.15 | 0.073 |

**Table 12.2 Natural Gas Emergency Generator Emission Factors**

| Equipment Type | Low HP | High HP | TOG | ROG | CO | NOX | SO2 | PM10 | PM2.5 | CO2 | CH4 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | lb/MMBtu | ppmv | ppmv | ppmv | lb/MMBtu | lb/MMBtu | lb/MMBtu | lb/MMBtu | lb/MMBtu |
| Emergency Generator | 0 | 500 | 0.358 | 250 | 2000 | 45 | 0.0006 | 0.0095 | 0.0095 | 110 | 0.23 |
| Emergency Generator | 500 | 9999 | 0.358 | 250 | 2000 | 36 | 0.0006 | 0.0095 | 0.0095 | 110 | 0.23 |

**Table 12.3 Diesel Boiler Emission Factors**

| Equipment Type | Rated Heat Input | | TOG | ROG | CO | NOX | SO2 | PM10 | PM2.5 | CO2 | CH4 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Low | High | lb/10$^3$gal | lb/10$^3$gal | lb/10$^3$gal | lb/MMBtu | lb/10$^3$gal | lb/10$^3$gal | lb/10$^3$gal | lb/10$^3$gal | lb/10$^3$gal |
| Boiler | 0 | 9999 | 0.556 | 0.340 | 5.00 | 0.05 | 0.225 | 1.00 | 0.25 | 25000 | 0.216 |

**Table 12.4 Natural Boiler Emission Factors**

| Equipment Type | Rated Heat Input | | TOG | ROG | CO | NOX | SO2 | PM10 | PM2.5 | CO2 | CH4 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Low | High | lb/10$^6$scf | lb/10$^6$scf | lb/10$^6$scf | lb/MMBtu | lb/10$^6$scf | lb/10$^6$scf | lb/10$^6$scf | lb/10$^6$scf | lb/10$^6$scf |
| Boiler | 0 | 2 | 11 | 5.5 | 98 | 0.024 | 0.6 | 7.6 | 7.6 | 120000 | 2.3 |
| Boiler | 2 | 5 | 11 | 5.5 | 98 | 0.011 | 0.6 | 7.6 | 7.6 | 120000 | 2.3 |
| Boiler | 5 | 75 | 11 | 5.5 | 98 | 0.011 | 0.6 | 7.6 | 7.6 | 120000 | 2.3 |
| Boiler | 75 | 9999 | 11 | 5.5 | 98 | 0.0062 | 0.6 | 7.6 | 7.6 | 120000 | 2.3 |

| | | | | |
|---|---|---|---|---|
| **General Assumptions** | | | | |
| General | wind | | 2.6 | m/s |
| | precip | | 40 | days |
| | climate zone | | 13 | |
| | N2O_NOX Gasoline | | 0.041600 | ARB EMFAC FAQs' |
| Consumer ROG | consumer products-general | | 2.14E-05 | lb ROG/sf/day |
| | consumer products-park | | 5.152E-08 | lb ROG/sf/day |
| Coatings ROG | coatings | | 10% | reapplication rate |
| | coating EF | | 250 | g/L |
| Conversions | lbs/gram | | 0.002204623 | |
| | kg/mt | | 1000 | |
| | mt/gram | | 0.000001 | |
| | mt/lbs | | 0.000453592 | |
| | ton/lbs | | 0.0005 | |
| | MT/gram | | 0.0000010 | |
| | ton/gram | | 0.0000011 | |
| | days/yr | | 365 | |
| GWP | CH4 | | 25 | AR4 |
| | N2O | | 298 | AR4 |
| | SF6 | | 22,800 | AR4 |
| | million | | 1,000,000 | |
| Project Info | Service Pop | | 1415 | rooms+beds |
| | CH4 | | N2O | |
| lbs/GWh | | 31.12 | 5.67 | CAMX, CR 2016 |
| lbs/MWh | | 0.03112 | 0.00567 | |

**ADT** lookup col 5

| | | | | | | | Pounds per Day | | | | | | | | | | | Metric tons per year | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Element** | **Source** | **Year** | **ADT** | **VMT per** | **VMT/day** | **VMT/year** | **ROG** | **NOX** | **CO** | **PM10E** | **PM2.5E** | **PM10 D** | **PM2.5 D** | **SO2** | **CO2** | **CH4** | **N2O** | **CO2** | **CH4** | **N2O** | **CO2e** |
| Marina | Motor Vehicle | 2016 | 48 | 5.95 | 286 | 104,308 | 0.16 | 0.45 | 1.27 | 0.04 | 0.02 | 0.04 | 0.02 | 0.00 | 297.16 | 0.01 | 0.02 | 49.20 | 0.00 | 0.00 | 50.15 |
| Hotel Tower | Motor Vehicle | 2021 | 7650 | 5.95 | 32,186 | 11,747,989 | 13.67 | 41.26 | 99.99 | 3.83 | 1.66 | 20.78 | 5.23 | 0.30 | 30187.71 | 0.77 | 1.72 | 4997.91 | 0.13 | 0.28 | 5085.80 |
| Low-cost Hotel | Motor Vehicle | 2021 | 565 | 5.95 | 2,374 | 866,674 | 1.01 | 3.05 | 7.38 | 0.28 | 0.12 | 1.53 | 0.39 | 0.02 | 2227.27 | 0.06 | 0.13 | 368.75 | 0.01 | 0.02 | 375.24 |
| Marina | Motor Vehicle | 2021 | 192 | 7.82 | 1,062 | 387,461 | 0.40 | 1.18 | 3.02 | 0.13 | 0.05 | 0.69 | 0.17 | 0.01 | 971.46 | 0.03 | 0.05 | 160.84 | 0.00 | 0.01 | 163.37 |
| Park | Motor Vehicle | 2021 | 63 | 6.43 | 286 | 104,437 | 0.12 | 0.35 | 0.87 | 0.03 | 0.01 | 0.18 | 0.05 | 0.00 | 266.36 | 0.01 | 0.01 | 44.10 | 0.00 | 0.00 | 44.85 |
| Retail | Motor Vehicle | 2021 | 0 | 0 | 0 | 0 | 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 |
| Hotel Tower | Motor Vehicle | 2030 | 7650 | 5.95 | 32,186 | 11,747,989 | 8.92 | 27.83 | 62.64 | 3.71 | 1.56 | 20.77 | 5.21 | 0.23 | 23518.43 | 0.72 | 1.16 | 3893.74 | 0.12 | 0.19 | 3953.82 |
| Low-cost Hotel | Motor Vehicle | 2030 | 565 | 5.95 | 2,374 | 866,674 | 0.66 | 2.05 | 4.62 | 0.27 | 0.11 | 1.53 | 0.38 | 0.02 | 1735.23 | 0.05 | 0.09 | 287.29 | 0.01 | 0.01 | 291.72 |
| Marina | Motor Vehicle | 2030 | 192 | 7.82 | 1,062 | 387,461 | 0.27 | 0.77 | 1.90 | 0.12 | 0.05 | 0.68 | 0.17 | 0.01 | 754.55 | 0.02 | 0.03 | 124.92 | 0.00 | 0.01 | 126.60 |
| Park | Motor Vehicle | 2030 | 63 | 6.43 | 286 | 104,437 | 0.08 | 0.23 | 0.54 | 0.03 | 0.01 | 0.18 | 0.05 | 0.00 | 207.32 | 0.01 | 0.01 | 34.32 | 0.00 | 0.00 | 34.83 |
| Retail | Motor Vehicle | 2030 | 0 | 0 | 0 | 0 | 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 |
| Hotel Tower | Motor Vehicle | 2050 | 7650 | 5.95 | 32,186 | 11,747,989 | 6.04 | 27.72 | 48.34 | 3.66 | 1.50 | 20.75 | 5.20 | 0.21 | 22067.97 | 0.64 | 1.15 | 3653.60 | 0.11 | 0.19 | 3713.14 |
| Low-cost Hotel | Motor Vehicle | 2050 | 565 | 5.95 | 2,374 | 866,674 | 0.45 | 2.05 | 3.57 | 0.27 | 0.11 | 1.53 | 0.38 | 0.02 | 1628.24 | 0.05 | 0.09 | 269.57 | 0.01 | 0.01 | 273.97 |
| Marina | Motor Vehicle | 2050 | 192 | 7.82 | 1,062 | 387,461 | 0.18 | 0.75 | 1.47 | 0.12 | 0.05 | 0.68 | 0.17 | 0.01 | 705.43 | 0.02 | 0.03 | 116.79 | 0.00 | 0.01 | 118.42 |
| Park | Motor Vehicle | 2050 | 63 | 6.43 | 286 | 104,437 | 0.05 | 0.23 | 0.42 | 0.03 | 0.01 | 0.18 | 0.05 | 0.00 | 194.32 | 0.01 | 0.01 | 32.17 | 0.00 | 0.00 | 32.67 |
| Retail | Motor Vehicle | 2050 | 0 | 0 | 0 | 0 | 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 |

**Water-Indoor** lookup col 9

| Element | Source | yr | MG/Yr | kwh/MG | Kwh/year | kwh/day | Pounds per Day CO2 | Pounds per Day CH4 | Pounds per Day N2O | Metric tons per year CO2 | Metric tons per year CH4 | Metric tons per year N2O | Metric tons per year CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Marina | Water-Indoor | 2016 | 1.8 | 13,021 | 23,395 | 64 | 36.06 | 0.00 | 0.00 | 5.97 | 0.00 | 0.00 | 6.03 |
| Hotel Tower | Water-Indoor | 2021 | 30.6 | 13,021 | 398,158 | 1,091 | 583.09 | 0.07 | 0.01 | 96.54 | 0.01 | 0.00 | 97.52 |
| Low-cost Hotel | Water-Indoor | 2021 | 5.8 | 13,021 | 75,627 | 207 | 110.75 | 0.01 | 0.00 | 18.34 | 0.00 | 0.00 | 18.52 |
| Marina | Water-Indoor | 2021 | 0 | 13,021 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Park | Water-Indoor | 2021 | 0 | 13,021 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Retail | Water-Indoor | 2021 | 0 | 13,021 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Hotel Tower | Water-Indoor | 2030 | 30.6 | 13,021 | 398,158 | 1,091 | 536.72 | 0.07 | 0.01 | 88.86 | 0.01 | 0.00 | 89.84 |
| Low-cost Hotel | Water-Indoor | 2030 | 5.8 | 13,021 | 75,627 | 207 | 101.95 | 0.01 | 0.00 | 16.88 | 0.00 | 0.00 | 17.06 |
| Marina | Water-Indoor | 2030 | 0 | 13,021 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Park | Water-Indoor | 2030 | 0 | 13,021 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Retail | Water-Indoor | 2030 | 0 | 13,021 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Hotel Tower | Water-Indoor | 2050 | 30.6 | 13,021 | 398,158 | 1,091 | 536.72 | 0.07 | 0.01 | 88.86 | 0.01 | 0.00 | 89.84 |
| Low-cost Hotel | Water-Indoor | 2050 | 5.8 | 13,021 | 75,627 | 207 | 101.95 | 0.01 | 0.00 | 16.88 | 0.00 | 0.00 | 17.06 |
| Marina | Water-Indoor | 2050 | 0 | 13,021 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Park | Water-Indoor | 2050 | 0 | 13,021 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Retail | Water-Indoor | 2050 | 0 | 13,021 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| **Solid Waste** | lookup col 10 | | | | | | **Day** | **Metric tons per year** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Element** | **Source** | **yr** | **ton/day** | **tons/yr** | | | **CH4** | **CO2** | **CH4** | **N2O** | **CO2e** |
| Marina | Waste | 2016 | 0.9 | 311 | *2016Waste* | - | 31.64 | 0 | 5.238 | 0 | 130.95 |
| Hotel Tower | Waste | 2021 | 0.4 | 152 | *2021Waste* | - | 15.41 | 0 | 2.551 | 0 | 63.78 |
| Low-cost Hotel | Waste | 2021 | 0.2 | 82 | *2021Waste* | - | 8.38 | 0 | 1.388 | 0 | 34.69 |
| Marina | Waste | 2021 | 0.3 | 125 | *2021Waste* | - | 12.65 | 0 | 2.095 | 0 | 52.38 |
| Park | Waste | 2021 | 0.0 | 0 | *2021Waste* | - | 0.00 | 0 | 0.000 | 0 | 0.00 |
| Retail | Waste | 2021 | 0.3 | 125 | *2021Waste* | - | 12.65 | 0 | 2.095 | 0 | 52.38 |
| Hotel Tower | Waste | 2030 | 0.4 | 152 | *2030Waste* | - | 15.41 | 0 | 2.551 | 0 | 63.78 |
| Low-cost Hotel | Waste | 2030 | 0.2 | 82 | *2030Waste* | - | 8.38 | 0 | 1.388 | 0 | 34.69 |
| Marina | Waste | 2030 | 0.3 | 125 | *2030Waste* | - | 12.65 | 0 | 2.095 | 0 | 52.38 |
| Park | Waste | 2030 | 0.0 | 0 | *2030Waste* | - | 0.00 | 0 | 0.000 | 0 | 0.00 |
| Retail | Waste | 2030 | 0.3 | 125 | *2030Waste* | - | 12.65 | 0 | 2.095 | 0 | 52.38 |
| Hotel Tower | Waste | 2050 | 0.4 | 152 | *2050Waste* | - | 15.41 | 0 | 2.551 | 0 | 63.78 |
| Low-cost Hotel | Waste | 2050 | 0.2 | 82 | *2050Waste* | - | 8.38 | 0 | 1.388 | 0 | 34.69 |
| Marina | Waste | 2050 | 0.3 | 125 | *2050Waste* | - | 12.65 | 0 | 2.095 | 0 | 52.38 |
| Park | Waste | 2050 | 0.0 | 0 | *2050Waste* | - | 0.00 | 0 | 0.000 | 0 | 0.00 |
| Retail | Waste | 2050 | 0.3 | 125 | *2050Waste* | - | 12.65 | 0 | 2.095 | 0 | 52.38 |

## Ferry Emisisons

**Annual**

| | | Total | Load | Annual | Tons per year | | | | | | | | | MT/yr | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Vessel** | **Engine** | **HP** | **Factor** | **Hours** | **NOx** | **DPM** | **PM2.5** | **ROG** | **CO** | **SOx** | **CO2** | **CH4** | **N2O** | **CO2** | **CH4** | **N2O** | **CO2e** |
| Old Ferry | Propulsion | 780 | 0.42 | 2190 | 5.32 | 0.27 | 0.26 | 0.43 | 1.67 | 0.00 | 465 | 0.008 | 0.017 | 421.95 | 0.01 | 0.02 | 426.81 |
| | Auxiliary | 100 | 0.43 | 4380 | 1.37 | 0.11 | 0.11 | 0.34 | 1.13 | 0.00 | 122 | 0.006 | 0.005 | 110.77 | 0.01 | 0.00 | 112.14 |
| | Total | | | | 6.69 | 0.38 | 0.37 | 0.78 | 2.79 | 0.01 | 587 | 0.014 | 0.022 | 532.72 | 0.01 | 0.02 | 538.95 |
| New Ferry | Propulsion | 460 | 0.42 | 2190 | 1.76 | 0.03 | 0.03 | 0.23 | 1.74 | 0.00 | 274 | 0.005 | 0.010 | 248.84 | 0.00 | 0.01 | 251.71 |
| | Auxiliary | 60 | 0.43 | 4380 | 0.63 | 0.02 | 0.02 | 0.19 | 0.46 | 0.00 | 73 | 0.004 | 0.003 | 66.46 | 0.00 | 0.00 | 67.29 |
| | Total | | | | 2.39 | 0.06 | 0.05 | 0.42 | 2.20 | 0.00 | 348 | 0.008 | 0.013 | 315.30 | 0.01 | 0.01 | 318.99 |

**Daily**

| | | Total | Load | Daily | lbs per day | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Vessel** | **Engine** | **HP** | **Factor** | **Hours** | **NOx** | **DPM** | **PM2.5** | **ROG** | **CO** | **SOx** |
| Old Ferry | Propulsion | 780 | 0.42 | 6 | 29.15 | 1.48 | 1.44 | 2.38 | 9.13 | 0.02 |
| | Auxiliary | 100 | 0.43 | 12 | 7.50 | 0.61 | 0.59 | 1.88 | 6.19 | 0.01 |
| | Total | | | | 36.66 | 2.09 | 2.02 | 4.25 | 15.31 | 0.03 |
| New Ferry | Propulsion | 460 | 0.42 | 6 | 9.67 | 0.17 | 0.17 | 1.25 | 9.53 | 0.01 |
| | Auxiliary | 60 | 0.43 | 12 | 3.44 | 0.13 | 0.12 | 1.05 | 2.55 | 0.00 |
| | Total | | | | 13.11 | 0.30 | 0.29 | 2.30 | 12.08 | 0.02 |

**Ferry Info**

| | | Propulsion | | Auxiliary | |
|---|---|---|---|---|---|
| | MY | No. | HP | No. | HP |
| Old Ferry | 2003 | 2 | 390 | 2 | 50 |
| New Ferry | 2017 | 2 | 230 | 2 | 30 |

California Harbor Craft Survey ARB, *Statewide Commercial Harbor Craft Survey* , Final

| | Average Horsepower | | | |
|---|---|---|---|---|
| | Propulsion | Auxiliary | Ratio | aux from Table 5, Ferry Boats |
| Ferry | 733 | 94 | 0.128 | Main from Table 6, Ferry Boats |

| | Load Factors | | ARB, Harbor | | |
|---|---|---|---|---|---|
| | Propulsion | Auxiliary | | | |
| Ferry | 0.42 | 0.43 | | 290.901 | 37.295 |
| | | | | 171.557 | 22.377 |

| | Annual Operating Hours | | Daily Operating | |
|---|---|---|---|---|
| | Propulsion | Auxiliary | Propulsion | Auxiliary |
| Ferry | 2,190 | 4,380 | 6 | 12 |

| | |
|---|---|
| HC Survey 2004 | https://www.arb.ca.gov/ports/marinevess/documents/hcsurveyrep0304.pdf |
| HC Methods 2010 | https://www.arb.ca.gov/regact/2010/chc10/appc.pdf |

**Ferry Emission Factor**

**Zero Hour Emission Factors (g/hp-hr)**

| Vessel | Engine | NOx | DPM | PM2.5 | ROG | CO | SOx | CO2 | CH4 | N2O |
|---|---|---|---|---|---|---|---|---|---|---|
| Old Ferry | Propulsion | 7.31 | 0.36 | 0.35 | 0.68 | 1.97 | 0.13 | 588 | 0.013 | 0.023 |
| | Auxiliary | 6.90 | 0.64 | 0.62 | 2.14 | 5.15 | 0.13 | 588 | 0.043 | 0.023 |
| New Ferry | Propulsion | 3.99 | 0.08 | 0.08 | 0.68 | 3.73 | 0.13 | 588 | 0.013 | 0.023 |
| | Auxiliary | 5.32 | 0.22 | 0.21 | 2.14 | 3.73 | 0.13 | 588 | 0.043 | 0.023 |

**Harborcraft ULSD Correction Factors**

| Years | NOx | DPM | PM2.5 | ROG | CO | SOx | CO2 | CH4 | N2O |
|---|---|---|---|---|---|---|---|---|---|
| Pre-1995 | 0.930 | 0.720 | 0.720 | 0.720 | 1.000 | 0.043 | 1.000 | 0.720 | 0.930 |
| 1996-2010 | 0.948 | 0.800 | 0.800 | 0.720 | 1.000 | 0.043 | 1.000 | 0.720 | 0.948 |
| 2011 + | 0.948 | 0.852 | 0.852 | 0.720 | 1.000 | 0.043 | 1.000 | 0.720 | 0.948 |

**ULSD Emission Factors (g/kWh)**

| Vessel | Engine | NOx | DPM | PM2.5 | ROG | CO | SOx | CO2 | CH4 | N2O |
|---|---|---|---|---|---|---|---|---|---|---|
| Old Ferry | Propulsion | 6.36 | 0.29 | 0.28 | 0.49 | 1.97 | 0.01 | 588 | 0.010 | 0.022 |
| | Auxiliary | 6.54 | 0.51 | 0.50 | 1.54 | 5.15 | 0.01 | 588 | 0.031 | 0.022 |
| New Ferry | Propulsion | 3.78 | 0.07 | 0.07 | 0.49 | 3.73 | 0.01 | 588 | 0.010 | 0.022 |
| | Auxiliary | 5.04 | 0.19 | 0.18 | 1.54 | 3.73 | 0.01 | 588 | 0.031 | 0.022 |

| Engine | Useful Life | Annual Hours | Deter Cap |
|---|---|---|---|
| Propulsion | 20 | 2,190 | 5.48 |
| Auxiliary | 20 | 4,380 | 2.74 |

**Deterioration Factors**

| Engine | NOx | PM | HC | CO |
|---|---|---|---|---|
| Propulsion | 0.21 | 0.67 | 0.44 | 0.25 |
| Auxiliary | 0.06 | 0.31 | 0.51 | 0.41 |

**Ferry Emission Factors (g/kWh)**

| Vessel | Engine | NOx | DPM | PM2.5 | ROG | CO | SOx | CO2 | CH4 | N2O |
|---|---|---|---|---|---|---|---|---|---|---|
| Old Ferry | Propulsion | 6.73 | 0.34 | 0.33 | 0.55 | 2.11 | 0.01 | 588 | 0.010 | 0.022 |
| | Auxiliary | 6.59 | 0.53 | 0.52 | 1.65 | 5.44 | 0.01 | 588 | 0.031 | 0.022 |
| New Ferry | Propulsion | 3.78 | 0.07 | 0.07 | 0.49 | 3.73 | 0.01 | 588 | 0.010 | 0.022 |
| | Auxiliary | 5.04 | 0.19 | 0.18 | 1.54 | 3.73 | 0.01 | 588 | 0.031 | 0.022 |

## Recreational Boating Emissions

### Baseline Emissions (2016)

| | | | | | | Emissions (tons/year) | | | | | | | | | Cold Iron |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Slip Size | Engine | Calls for yachts/slips for smaller | HP | LF | Hrs | NOx | DPM | PM2.5 | ROG | CO | SOx | CO2 | CH4 | N2O | CO2e |
| 50 | All | 1 | | | 49.21 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| 150 | Propulsion | 6.64 | 2,949 | 0.45 | 9.85 | 0.76 | 0.040 | 0.039 | 0.06 | 0.22 | 0.001 | 56.24 | 0.001 | 0.002 | |
| | Auxiliary | 6.64 | 295 | 0.43 | 9.85 | 0.06 | 0.002 | 0.002 | 0.01 | 0.03 | 0.000 | 5.37 | 0.000 | 0.000 | 233.10 |
| 175 | Propulsion | 6.64 | 3,489 | 0.45 | 3.15 | 0.25 | 0.010 | 0.009 | 0.02 | 0.11 | 0.000 | 21.29 | 0.000 | 0.001 | |
| | Auxiliary | 6.64 | 349 | 0.43 | 3.15 | 0.03 | 0.001 | 0.001 | 0.00 | 0.01 | 0.000 | 2.03 | 0.000 | 0.000 | 276 |
| | | Total | | | | 1.10 | 0.05 | 0.05 | 0.09 | 0.36 | 0.00 | 84.94 | 0.00 | 0.00 | 508.90 |

### Phase 1 Emissions (2021)

| | | | | | | Emissions (tons/year) | | | | | | | | | 2021 RPS Cold Iron | 2021 BAU Cold Iron | 2030 RPS Cold Iron |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Slip Size | Engine | Calls for yachts/slips for smaller | HP | LF | Hrs | NOx | DPM | PM2.5 | ROG | CO | SOx | CO2 | CH4 | N2O | CO2e | CO2e | CO2e |
| 50 | All | 8 | | | 49.21 | 0.00 | 0.000 | 0.000 | 0.00 | 0.00 | 0.000 | 0.00256 | 0.000 | 0.000 | | | |
| 60 | All | 4 | | | 53.85 | 0.00 | 0.000 | 0.000 | 0.00 | 0.00 | 0.000 | 0.00 | 0.000 | 0.000 | | | |
| 75 | All | 2 | | | 59.26 | 0.00 | 0.000 | 0.000 | 0.00 | 0.00 | 0.000 | 0.00 | 0.000 | 0.000 | | | |
| 100 | Propulsion | 46.45 | 1,024 | 0.45 | 11.55 | 2.85 | 0.115 | 0.112 | 0.17 | 0.63 | 0.002 | 160.29 | 0.003 | 0.006 | | | |
| | Auxiliary | 46.45 | 102 | 0.43 | 11.55 | 0.22 | 0.013 | 0.012 | 0.02 | 0.10 | 0.000 | 15.32 | 0.000 | 0.001 | 538 | 788 | 495 |
| 175 | Propulsion | 6.64 | 3,109 | 0.45 | 9.68 | 0.79 | 0.042 | 0.041 | 0.06 | 0.23 | 0.001 | 58.29 | 0.001 | 0.002 | | | |
| | Auxiliary | 6.64 | 311 | 0.43 | 9.68 | 0.07 | 0.003 | 0.002 | 0.01 | 0.03 | 0.000 | 5.57 | 0.000 | 0.000 | 234 | 342 | 215 |
| 200 | Propulsion | 6.64 | 3,489 | 0.45 | 9.82 | 0.89 | 0.048 | 0.046 | 0.07 | 0.26 | 0.001 | 66.30 | 0.001 | 0.002 | | | |
| | Auxiliary | 6.64 | 349 | 0.43 | 9.82 | 0.05 | 0.001 | 0.001 | 0.01 | 0.04 | 0.000 | 6.34 | 0.000 | 0.000 | 262 | 383 | 241 |
| | | Total | | | | 4.87 | 0.221 | 0.215 | 0.35 | 1.30 | 0.003 | 312.11 | 0.005 | 0.012 | 1034 | 1513 | 952 |

### Phase 2 Emissions (2032)

| | | | | | | Emissions (tons/year) | | | | | | | | | 2021 RPS Cold Iron | 2021 BAU Cold Iron | 2030 RPS Cold Iron |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Slip Size | Engine | Calls for yachts/slips for smaller | HP | LF | Hrs | NOx | DPM | PM2.5 | ROG | CO | SOx | CO2 | CH4 | N2O | CO2e | CO2e | CO2e |
| 50 | All | 0 | | | 49.21 | - | - | - | - | - | - | - | - | - | | | |
| 60 | All | 0 | | | 53.85 | - | - | - | - | - | - | - | - | - | | | |
| 75 | All | 0 | | | 59.26 | - | - | - | - | - | - | - | - | - | | | |
| 100 | Propulsion | 126.09 | 1,024 | 0.45 | 11.55 | 7.74 | 0.313 | 0.303 | 0.47 | 1.71 | 0.004 | 435.07 | 0.007 | 0.016 | | | |
| | Auxiliary | 126.09 | 102 | 0.43 | 11.55 | 0.59 | 0.035 | 0.034 | 0.07 | 0.27 | 0.000 | 41.57 | 0.001 | 0.002 | 1461 | 2138 | 1345 |
| 150 | Propulsion | 59.73 | 2,949 | 0.45 | 9.85 | 6.83 | 0.364 | 0.353 | 0.55 | 1.99 | 0.005 | 506.18 | 0.008 | 0.019 | | | |
| | Auxiliary | 59.73 | 295 | 0.43 | 9.85 | 0.58 | 0.022 | 0.022 | 0.05 | 0.25 | 0.000 | 48.37 | 0.001 | 0.002 | 1993 | 2916 | 1835 |
| 240 | Propulsion | 6.64 | 4,402 | 0.45 | 9.52 | 1.09 | 0.058 | 0.057 | 0.09 | 0.32 | 0.001 | 81.12 | 0.001 | 0.003 | | | |
| | Auxiliary | 6.64 | 440 | 0.43 | 9.52 | 0.06 | 0.002 | 0.002 | 0.01 | 0.05 | 0.000 | 7.75 | 0.000 | 0.000 | 331 | 484 | 304 |
| | | Total | | | | 16.90 | 0.793 | 0.769 | 1.24 | 4.59 | 0.011 | 1,120 | 0.019 | 0.042 | 3785 | 5538 | 3484 |

## Recreational Boating Emissions

### Baseline Emissions (2016)

| | | | | | | Emissions (lbs/average day) | | | | | | MT/year | | | Cold Iron | project | bau |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Slip Size | Engine | Calls for yachts/slips for smaller | HP | LF | Hrs | NOX | PM10 | PM2.5 | ROG | CO | SO2 | CO2 | CH4 | N2O | CO2 | CO2e | CO2e |
| 50 | All | 1 | | | 49.21 | 0.00019 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | 0 | 0 |
| 150 | Propulsion | 6.64 | 2,949 | 0.45 | 9.85 | 4.16 | 0.22 | 0.21 | 0.33 | 1.21 | 0.00 | 51.0 | 0.00 | 0.00 | - | 52 | - |
| | Auxiliary | 6.64 | 295 | 0.43 | 9.85 | 0.35 | 0.01 | 0.01 | 0.03 | 0.15 | 0.00 | 4.9 | 0.00 | 0.00 | 211 | 216 | - |
| 175 | Propulsion | 6.64 | 3,489 | 0.45 | 3.15 | 1.39 | 0.05 | 0.05 | 0.13 | 0.59 | 0.00 | 19.31 | 0.00 | 0.00 | | 20 | |
| | Auxiliary | 6.64 | 349 | 0.43 | 3.15 | 0.15 | 0.01 | 0.01 | 0.01 | 0.04 | 0.00 | 1.85 | 0.00 | 0.00 | 250 | 252 | |
| | | Total | | | | 6.05 | 0.30 | 0.29 | 0.50 | 2.00 | 0.00 | 77.05 | 0.00 | 0.00 | 461.67 | 539.61 | |

### Phase 1 Emissions (2021)

| | | | | | | Emissions (lbs/average day) | | | | | | MT/year | | | 2021 RPS Cold Iron | 2021 BAU Cold Iron | 2030 RPS Cold Iron | 2021 Proje | 2021 BAU | 2030 Proje |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Slip Size | Engine | Calls for yachts/slips for smaller | HP | LF | Hrs | NOX | PM10 | PM2.5 | ROG | CO | SO2 | CO2 | CH4 | N2O | CO2e | CO2e | CO2e | CO2e | CO2e | |
| 50 | All | 8 | | | 49.21 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | | | | 0 | 0 | 0 |
| 60 | All | 4 | | | 53.85 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | | | | 0 | 0 | 0 |
| 75 | All | 2 | | | 59.26 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | | | 0 | 0 | 0 |
| 100 | Propulsion | 46.45 | 1,024 | 0.45 | 11.55 | 15.63 | 0.63 | 0.61 | 0.95 | 3.45 | 0.01 | 145 | 0.00 | 0.01 | | | | 147 | 163 | 163 |
| | Auxiliary | 46.45 | 102 | 0.43 | 11.55 | 1.20 | 0.07 | 0.07 | 0.13 | 0.55 | 0.00 | 13.9 | 0.00 | 0.00 | 488 | 714 | 449 | 502 | 730 | 465 |
| 175 | Propulsion | 6.64 | 3,109 | 0.45 | 9.68 | 4.31 | 0.23 | 0.22 | 0.35 | 1.26 | 0.00 | 52.88 | 0.00 | 0.00 | | | | 53 | 59 | 59 |
| | Auxiliary | 6.64 | 311 | 0.43 | 9.68 | 0.36 | 0.01 | 0.01 | 0.03 | 0.15 | 0.00 | 5.05 | 0.00 | 0.00 | 212 | 310 | 195 | 217 | 316 | 201 |
| 200 | Propulsion | 6.64 | 3,489 | 0.45 | 9.82 | 4.90 | 0.26 | 0.25 | 0.39 | 1.43 | 0.00 | 60.15 | 0.00 | 0.00 | | | | 61 | 68 | 68 |
| | Auxiliary | 6.64 | 349 | 0.43 | 9.82 | 0.29 | 0.01 | 0.01 | 0.04 | 0.24 | 0.00 | 5.75 | 0.00 | 0.00 | 238 | 348 | 219 | 244 | 354 | 225 |
| | | Total | | | | 26.70 | 1.213 | 1.177 | 1.90 | 7.11 | 0.016 | 283 | 0.005 | 0.011 | 938 | 1,372 | 863 | 1,224 | 1,690 | 1,181 |

### Phase 2 Emissions (2032)

| | | | | | | Emissions (lbs/average day) | | | | | | MT/year | | | 2021 RPS Cold Iron | 2021 BAU Cold Iron | 2030 RPS Cold Iron | project | bau | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Slip Size | Engine | Calls for yachts/slips for smaller | HP | LF | Hrs | NOx | DPM | PM2.5 | ROG | CO | SOx | CO2 | CH4 | N2O | CO2 | CO2 | | CO2e | CO2e | |
| 50 | All | 0 | | | 49.21 | - | - | - | - | - | - | - | - | - | | | | - | - | - |
| 60 | All | 0 | | | 53.85 | - | - | - | - | - | - | - | - | - | | | | - | - | - |
| 75 | All | 0 | | | 59.26 | - | - | - | - | - | - | - | - | - | | | | - | - | - |
| 100 | Propulsion | 126.09 | 1,024 | 0.45 | 11.55 | 42.43 | 1.71 | 1.66 | 2.59 | 9.37 | 0.02 | 395 | 0.01 | 0.01 | | | | 399 | 443 | 443 |
| | Auxiliary | 126.09 | 102 | 0.43 | 11.55 | 3.25 | 0.19 | 0.18 | 0.36 | 1.49 | 0.00 | 37.7 | 0.00 | 0.00 | 1,325 | 1,939 | 1,220 | 1,364 | 1,982 | 1,262 |
| 150 | Propulsion | 59.73 | 2,949 | 0.45 | 9.85 | 37.43 | 1.99 | 1.93 | 3.01 | 10.90 | 0.03 | 459.20 | 0.01 | 0.02 | | | | 464 | 516 | 516 |
| | Auxiliary | 59.73 | 295 | 0.43 | 9.85 | 3.16 | 0.12 | 0.12 | 0.29 | 1.35 | 0.00 | 43.88 | 0.00 | 0.00 | 1,808 | 2,645 | 1,664 | 1,853 | 2,695 | 1,714 |
| 240 | Propulsion | 6.64 | 4,402 | 0.45 | 9.52 | 6.00 | 0.32 | 0.31 | 0.48 | 1.75 | 0.00 | 73.59 | 0.00 | 0.00 | | | | 74 | 83 | 83 |
| | Auxiliary | 6.64 | 440 | 0.43 | 9.52 | 0.35 | 0.01 | 0.01 | 0.05 | 0.29 | 0.00 | 7.03 | 0.00 | 0.00 | 300 | 439 | 276 | 307 | 447 | 284 |
| | | Total | | | | 92.62 | 4.347 | 4.216 | 6.77 | 25.15 | 0.058 | 1,016 | 0.017 | 0.038 | 3,434 | 5,024 | 3,160 | 4,461 | 6,164 | 4,301 |

| VESSNAME | IMO | MMSI | SHIP_TYPE | LLOYDS_TY | KEEL | MAIN_KW | DESIGN | DESIGNATIO | DISP | MAIN_ENGIN | CATEGORY | AUX_KW | LL_FLAG | SPEED | TEUS | NRT | GT | DWT | DWT_CATEGO | DWT_RANGE | OPERATOR | STATUS | Length (m) | Length (ft) | Slip |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ZENITH | 9677416 |  | YACHT | Yacht | 2012 | 1640 | Caterpillar | C32 | 2.7 | HSD | 1 |  | SVC | 14.00 | 0 | 91 | 114 | 0 | 1 | All | Aston Enterprise Agency LLC | In Service/Commission | 24.0 | 79 | 100 |
| KHAULAH | 9699713 | 253063000 | YACHT | Yacht | 2012 | 354 | Yanmar | 4LHA-STP | 0.9 | HSD | 1 |  | LUX | 10.00 | 0 | 35 | 119 | 0 | 1 | All | Luxembourg Marine Services SA | In Service/Commission | 24.0 | 79 | 100 |
| NASIMA | 9671840 |  | YACHT | Yacht | 2010 | 204 | Deutz | DTA44 | 1.0 | HSD | 1 |  | RUS | 10.00 | 0 | 71 | 123 | 0 | 1 | All | Yar-yachting Ltd | In Service/Commission | 24.4 | 80 | 100 |
| KING BABY | 9703148 | 538070932 | YACHT | Yacht (Saili | 2011 | 261 | Cummins | QSB5.9 | 1.0 | HSD | 1 |  | MAI | 13.00 | 0 | 34 | 111 | 0 | 1 | All | Castlefin Inc | In Service/Commission | 24.9 | 82 | 100 |
| SCOUT | 1005576 | 235010950 | YATCH | Yacht | 1991 | 588 | Caterpillar | 3406TA | 2.4 | HSD | 1 |  | GBI | 12.00 | 0 | 47 | 159 | 0 | 1 | All | Green Marine Ltd | In Service/Commission | 26.8 | 88 | 100 |
| MRS D | 1005825 |  | YACHT | Yacht (Saili | 1996 | 214 | M.T.U. | 10V183AA61 | 1.8 | HSD | 1 |  | BER | 11.30 | 0 | 31 | 106 | 0 | 1 | All | Go Ahead International | In Service/Commission | 27.0 | 89 | 100 |
| LADY GENYR | 6608919 | 367007580 | YACHT | Yacht | 1965 | 563 | Caterpillar | D398SCAC | 4.0 | HSD | 1 |  | USA | 12.00 | 0 | 56 | 164 | 0 | 1 | All | Devaux S | In Service/Commission | 27.0 | 89 | 100 |
| WINNING DRIVE | 9747223 | 319062500 | YACHT | Yacht | 2012 | 1440 | M.T.U. | 8V2000M72 | 2.2 | HSD | 1 |  | CAY | 12.00 | 0 | 0 | 107 | 0 | 1 | All | My Zehava Yachting Ltd | In Service/Commission | 28.0 | 92 | 100 |
| QM OF LONDON | 9649017 |  | YACHT | Yacht | 2009 | 1618 | MAN | D2842LE | 1.8 | HSD | 1 |  | MTA | 11.00 | 0 | 184 | 267 | 186 | 1 | All | Ocean Management GmbH | In Service/Commission | 28.2 | 93 | 100 |
| ZAZOU | 5311698 | 234773000 | YATCH | Yacht | 1962 | 1169 | Caterpillar | 3516TA | 4.3 | HSD | 1 |  | GBI | 11.00 | 0 | 51 | 170 | 0 | 1 | All | Galaxy Lights Ltd | In Service/Commission | 29.2 | 96 | 100 |
| SEAHAWK | 1011123 | 319026500 | YACHT | Yacht (Saili | 2007 | 350 | Cummins | QSM11-M | 1.8 | HSD | 1 |  | CAY | 13.00 | 0 | 34 | 114 | 13 | 1 | All | Sarafin Ltd | In Service/Commission | 30.2 | 99 | 100 |
| PARADISE | 8744327 | 366749490 | YACHT | Yacht | 1982 | 1470 | Lugger | L6140LA2 | 2.5 | HSD | 1 |  | USA | 15.00 | 0 | 55 | 185 | 0 | 1 | All | Red Rooster III | In Service/Commission | 31.4 | 103 | 125 |
| GITANA | 1002562 | 378111105 | YACHT | Yacht | 1988 | 750 | Caterpillar | 3412TA | 2.2 | HSD | 1 |  | VGI | 12.00 | 0 | 0 | 151 | 0 | 1 | All | Silver Star Shipping | In Service/Commission | 31.7 | 104 | 125 |
| MILK MONEY | 9702285 | 518801000 | YACHT | Yacht | 2013 | 1492 | Caterpillar | C32 ACERT | 2.7 | HSD | 1 |  | GIB | 26.00 | 0 | 72 | 243 | 0 | 1 | All | MS Yachts | In Service/Commission | 32.6 | 107 | 125 |
| GOLDEN SHADOW | 9707039 | 311000159 | YACHT | Yacht | 2006 | 866 | Caterpillar | 3406C-TA | 2.4 | HSD | 1 |  | BAH | 13.00 | 0 | 89 | 299 | 0 | 1 | All | Owner Unknown | In Service/Commission | 32.9 | 108 | 125 |
| ODESSA | 9022350 |  | YATCH | Yacht | 2001 | 1030 | Caterpillar | 3412 | 2.2 | HSD | 1 |  | UNK | 13.00 | 0 | 68 | 228 | 0 | 1 | All | Far Niente Enterprises | In Service/Commission | 33.2 | 109 | 125 |
| SOY AMOR | 7308700 |  | YACHT | Yacht | 1956 | 294 | General Motors | 8V-71-N | 1.2 | HSD | 1 |  | CAN | 10.00 | 0 | 87 | 203 | 0 | 1 | All | Inter Coast Towing Ltd | In Service/Commission | 33.2 | 109 | 125 |
| MERIDIAN | 9674701 |  | YACHT | Yacht (Saili | 2012 | 522 | Cummins | QSB5.9 | 1.0 | HSD | 1 |  | CAY | 10.00 | 0 | 0 | 234 | 15 | 1 | All | Neegu Ltd | In Service/Commission | 33.5 | 110 | 125 |
| SERENITY | 9539133 | 538070849 | YACHT | Yacht | 2006 | 2942 | M.T.U. | 16V2000M91 | 2.0 | HSD | 1 |  | MAI | 17.00 | 0 | 74 | 247 | 0 | 1 | All | Smith B | In Service/Commission | 33.7 | 110 | 125 |
| GRACE E | 9644706 | 538071020 | YACHT | Yacht | 2011 | 1492 | Caterpillar | C32 ACERT | 2.7 | HSD | 1 |  | MAI | 23.00 | 0 | 89 | 298 | 0 | 1 | All | Rock Technology Trading Ltd | In Service/Commission | 33.7 | 111 | 125 |
| ESCAPADE | 1002225 | 538070946 | YACHT | Yacht | 1993 | 756 | Caterpillar | 3408TA | 2.2 | HSD | 1 |  | MAI | 12.00 | 0 | 113 | 378 | 387 | 1 | All | Rptd Sold Undisclosed Interest | In Service/Commission | 34.0 | 112 | 125 |
| MEDUSE | 8981884 | 366828690 | YACHT | Yacht | 1999 | 358 | Caterpillar | 3406TA | 2.4 | HSD | 1 |  | USA | 11.00 | 0 | 59 | 197 | 0 | 1 | All | Medical Foundation | In Service/Commission | 34.0 | 112 | 125 |
| THUMPER | 9784922 | 319086800 | YACHT | Yacht | 2013 | 1000 | Caterpillar | C18 | 3.0 | HSD | 1 |  | CAY | 13.00 | 0 | 0 | 315 | 0 | 1 | All | Camper & Nicholsons France | In Service/Commission | 34.0 | 112 | 125 |
| ZENITH | 1002184 | 235019268 | YATCH | Yacht | 1977 | 736 | Caterpillar | 3412TA | 2.2 | HSD | 1 |  | GBI | 10.00 | 0 | 89 | 233 | 0 | 1 | All | Safehaven International Ltd | In Service/Commission | 34.5 | 113 | 125 |
| HARMONY | 9662863 | 319042600 | YACHT | Yacht | 2011 | 3878 | M.T.U. | 16V2000M94 | 2.2 | HSD | 1 |  | CAY | 20.00 | 0 | 70 | 236 | 34 | 1 | All | Ocean Sunshine Ltd | In Service/Commission | 34.7 | 114 | 125 |
| LADY MAY | 8745058 | 367593540 | YACHT | Yacht | 2009 | 2680 | M.T.U. | 12V2000M93 | 2.2 | HSD | 1 |  | USA | 15.00 | 0 | 87 | 293 | 0 | 1 | All | Hillman H | In Service/Commission | 34.7 | 114 | 125 |
| GRACE | 1004948 | 234225000 | YATCH | Yacht | 1992 | 1136 | MWM | TBD234V12 | 1.8 | HSD | 1 |  | GBI | 14.00 | 0 | 61 | 205 | 0 | 1 | All | Carlevaris A & Partners | In Service/Commission | 34.7 | 114 | 125 |
| SAMAX | 9686261 | 533130093 | YACHT | Yacht | 2010 | 1618 | MAN | D2842LE | 1.8 | HSD | 1 |  | MAL | 13.00 | 0 | 85 | 285 | 0 | 1 | All | Tang WL | In Service/Commission | 34.8 | 114 | 125 |
| HEY JUDE | 1012165 | 235100877 | YACHT | Yacht | 2011 | 1066 | Caterpillar | C18 | 3.0 | HSD | 1 |  | JER | 10.50 | 0 | 0 | 230 | 193 | 1 | All | Float Investments Ltd | In Service/Commission | 35.3 | 116 | 125 |
| BRAZIL | 8998318 |  | YACHT | Yacht (Saili | 1989 | 434 | M.T.U. | 10V183AA61 | 1.8 | HSD | 1 |  | UNK | 11.00 | 0 | 42 | 141 | 0 | 1 | All | Green Shoe | In Service/Commission | 36.0 | 118 | 125 |
| LADY SURA | 9656709 | 229106000 | YACHT | Yacht | 2009 | 1220 | Yanmar | 6AYM-ETE | 3.4 | HSD | 1 |  | MTA | 12.00 | 0 | 104 | 341 | 0 | 1 | All | Lunik Ltd | In Service/Commission | 36.0 | 118 | 125 |
| MISTRESS | 9521459 | 319047100 | YACHT | Yacht | 1991 | 2618 | M.T.U. | 12V396TE94 | 4.0 | HSD | 1 |  | CAY | 19.00 | 0 | 108 | 361 | 0 | 1 | All | Moran Yacht & Ship | In Service/Commission | 36.1 | 119 | 125 |
| CAKEWALK | 9129990 | 246859000 | YACHT | Yacht | 1995 | 1174 | Caterpillar | 3512 | 4.3 | HSD | 1 |  | NTH | 14.00 | 0 | 79 | 264 | 0 | 1 | All | Lars Yacht Charter BV | In Service/Commission | 36.4 | 119 | 125 |
| LADYSHIP | 9677844 | 319859000 | YACHT | Yacht | 2007 | 1066 | Caterpillar | C18 | 3.0 | HSD | 1 |  | CAY | 10.50 | 0 | 96 | 323 | 0 | 1 | All | Far Far Away Yachting Ltd | In Service/Commission | 36.5 | 120 | 125 |
| LEVANTE | 1002081 | 232008000 | YACHT | Yacht (Saili | 1981 | 441 | MWM | TBD604-6 | 3.7 | HSD | 1 |  | GBI | 10.00 | 0 | 162 | 221 | 0 | 1 | All | Jagare Shipping | In Service/Commission | 36.5 | 120 | 125 |
| HEUREKA | 1003762 | 538080088 | YACHT | Yacht | 1990 | 1000 | Caterpillar | 3512TA | 4.3 | HSD | 1 |  | MAI | 12.00 | 0 | 89 | 298 | 0 | 1 | All | Talanda Trading | In Service/Commission | 36.5 | 120 | 125 |
| LADY K II | 1010765 | 235064976 | YACHT | Yacht | 2007 | 4080 | M.T.U. | 12V4000M90 | 4.1 | HSD | 1 |  | GBI | 20.00 | 0 | 67 | 224 | 47 | 1 | All | Ocean Pride Shipping Co Ltd | In Service/Commission | 36.5 | 120 | 125 |
| TELEOST | 1010997 | 319003700 | YACHT | Yacht | 2008 | 4080 | M.T.U. | 12V4000M90 | 4.1 | HSD | 1 |  | CAY | 28.00 | 0 | 66 | 223 | 0 | 1 | All | Verpeka Yacht Brokerage | In Service/Commission | 36.5 | 120 | 125 |
| BOADICEA | 9700914 | 367585110 | YACHT | Yacht | 2011 | 3878 | M.T.U. | 16V2000M94 | 2.2 | HSD | 1 |  | USA | 17.00 | 0 | 84 | 282 | 452 | 1 | All | Circle Marine LLC | In Service/Commission | 36.7 | 120 | 125 |
| MOONLIGHT | 9024906 | 235011760 | YATCH | Yacht (Saili | 1991 | 894 | M.T.U. | 12V183TE91 | 1.8 | HSD | 1 |  | IOM | 12.50 | 0 | 90 | 302 | 0 | 1 | All | Perini Navi USA Inc | In Service/Commission | 36.7 | 120 | 125 |
| SEA EAGLE | 1003413 | 310525000 | YATCH | Yacht | 1990 | 2610 | Caterpillar | 3512TA | 4.3 | HSD | 1 |  | BER | 13.00 | 0 | 95 | 318 | 0 | 1 | All | Quorum Ltd | In Service/Commission | 36.7 | 120 | 125 |
| APOSTROPHE | 1006594 | 319858000 | YACHT | Yacht | 1996 | 588 | Caterpillar | 3406E | 2.4 | HSD | 1 |  | GBI | 13.00 | 0 | 84 | 283 | 0 | 1 | All | Enrapture | In Service/Commission | 36.9 | 121 | 125 |
| NAMELESS | 9694206 | 235098655 | YACHT | Yacht | 2013 | 2160 | M.T.U. | 12V2000M72 | 2.2 | HSD | 1 |  | IOM | 14.00 | 0 | 89 | 298 | 0 | 1 | All | YCO SAM | In Service/Commission | 36.9 | 121 | 125 |
| NORWEGIAN QUEEN | 9652856 | 319339000 | YACHT | Yacht | 2010 | 2160 | M.T.U. | 12V2000M72 | 2.2 | HSD | 1 |  | CAY | 14.00 | 0 | 86 | 287 | 36 | 1 | All | Commanwealth Marine Ltd | In Service/Commission | 36.9 | 121 | 125 |
| INUKSHUK | 1000849 | 316149000 | YACHT | Yacht (Saili | 1989 | 600 | MAN | D2866LE | 2.0 | HSD | 1 |  | CAN | 10.00 | 0 | 0 | 285 | 0 | 1 | All | Woolger E | In Service/Commission | 37.0 | 121 | 125 |
| INVADER | 9642825 |  | YACHT | Yacht | 2009 | 3824 | M.T.U. | 16V2000M93 | 2.2 | HSD | 1 |  | IOM | 21.00 | 0 | 84 | 280 | 0 | 1 | All | Pelagos Yachts Ltd | In Service/Commission | 37.3 | 122 | 125 |
| RAINBOW | 1000954 | 229210000 | YACHT | Yacht | 1983 | 708 | Caterpillar | 3412TA | 2.2 | HSD | 1 |  | MTA | 12.00 | 0 | 74 | 245 | 0 | 1 | All | Blue Attraction Yacht Charters | In Service/Commission | 37.5 | 123 | 125 |
| ASYA | 1012505 | 577203000 | YACHT | Yacht (Saili | 2012 | 375 | Caterpillar | C9 | 1.5 | HSD | 1 |  | VAN | 9.00 | 0 | 56 | 188 | 27 | 1 | All | Waddilove Yachts Pty Ltd | In Service/Commission | 37.5 | 123 | 125 |
| JAGARE | 1002691 | 314094000 | YATCH | Yacht | 1981 | 1066 | Caterpillar | D348TA | 2.4 | HSD | 1 |  | BBD | 11.00 | 0 | 77 | 257 | 0 | 1 | All | Yacht Services Intl Ltd | In Service/Commission | 37.9 | 124 | 125 |
| BLUSH | 9755713 | 538071025 | YACHT | Yacht | 2014 | 1492 | Caterpillar | C32 ACERT | 2.7 | HSD | 1 |  | MAI | 15.50 | 0 | 85 | 284 | 0 | 1 | All | Impero Holdings | In Service/Commission | 38.0 | 125 | 125 |
| ATOMIC | 1011733 |  | YACHT | Yacht | 2009 | 448 | Caterpillar | C18 | 3.0 | HSD | 1 |  | IOM | 14.50 | 0 | 59 | 199 | 0 | 1 | All | Safehaven International Ltd | In Service/Commission | 38.1 | 125 | 125 |
| ONIKA | 8742264 | 229864000 | YACHT | Yacht | 1996 | 4480 | M.T.U. | 16V396TE94 | 4.0 | HSD | 1 |  | MTA | 16.00 | 0 | 125 | 417 | 0 | 1 | All | Edmiston Yacht Management Ltd | In Service/Commission | 38.1 | 125 | 125 |
| SERENITAS | 1007782 | 310397000 | YACHT | Yacht | 2001 | 1156 | Caterpillar | 3508TA | 4.3 | HSD | 1 |  | BER | 14.00 | 0 | 136 | 456 | 0 | 1 | All | Sterling Management | In Service/Commission | 38.4 | 126 | 150 |
| MORNING STAR | 9693343 | 319224000 | YACHT | Yacht | 2009 | 1066 | Caterpillar | C18 | 3.0 | HSD | 1 |  | CAY | 10.50 | 0 | 96 | 319 | 564 | 1 | All | Sea Explorer Ltd | In Service/Commission | 38.4 | 126 | 150 |
| MUSTANG SALLY | 9655834 | 355793000 | YACHT | Yacht | 2002 | 1576 | M.T.U. | 12V2000M70 | 2.0 | HSD | 1 |  | PAN | 12.00 | 0 | 89 | 297 | 0 | 1 | All | Estry United Ltd | In Service/Commission | 38.5 | 126 | 150 |
| ALEKSANDRA | 9690456 | 319483000 | YACHT | Yacht | 1987 | 1492 | Caterpillar | C32 ACERT | 2.7 | HSD | 1 |  | CAY | 12.00 | 0 | 71 | 236 | 0 | 1 | All | Campbell Corporate Serv Ltd | In Service/Commission | 38.7 | 127 | 150 |
| MAVERICK | 1010868 | 256893000 | YACHT | Yacht | 2007 | 1470 | MAN | D2842LE | 1.8 | HSD | 1 |  | MTA | 14.00 | 0 | 129 | 431 | 275 | 1 | All | Verenity Ltd | In Service/Commission | 39.0 | 128 | 150 |
| BACARELLA | 1011329 | 319788000 | YACHT | Yacht | 2009 | 1000 | Caterpillar | C18 | 3.0 | HSD | 1 |  | CAY | 11.00 | 0 | 116 | 388 | 60 | 1 | All | Moran Yacht Management Inc | In Service/Commission | 39.0 | 128 | 150 |
| O' PARI 3 | 9776054 | 256428000 | YACHT | Yacht | 2015 | 1198 | Caterpillar | C18 ACERT | 3.0 | HSD | 1 |  | MTA | 12.00 | 0 | 84 | 285 | 0 | 1 | All | Taransay GmbH & Co KG | In Service/Commission | 39.0 | 128 | 150 |
| NASSIMA | 9670456 | 319576000 | YACHT | Yacht | 2009 | 984 | Caterpillar | C32 ACERT | 2.7 | HSD | 1 |  | CAY | 12.00 | 0 | 127 | 425 | 82 | 1 | All | Safira Maritime Holdings LLC | In Service/Commission | 39.3 | 129 | 150 |
| DRIZZLE | 9623207 | 235096604 | YACHT | Yacht (Saili | 2010 | 533 | Caterpillar | C18 | 3.0 | HSD | 1 |  | IOM | 14.00 | 0 | 76 | 256 | 25 | 1 | All | Dohle Private Clients Ltd | In Service/Commission | 39.5 | 129 | 150 |
| MINDERELLA | 9068964 | 319732001 | YACHT | Yacht | 1973 | 588 | Caterpillar | 3406 | 2.4 | HSD | 1 |  | CAY | 15.00 | 0 | 53 | 131 | 0 | 1 | All | Caicos Live Aboard Diving | In Service/Commission | 39.6 | 130 | 150 |
| DIVINE | 9539896 | 538070734 | YACHT | Yacht | 2008 | 4080 | M.T.U. | 12V4000M90 | 4.1 | HSD | 1 |  | MAI | 20.00 | 0 | 99 | 333 | 0 | 1 | All | Rice Quarters II Ltd | In Service/Commission | 39.6 | 130 | 150 |
| SAMURAI | 9539901 | 319022100 | YACHT | Yacht | 2008 | 4080 | M.T.U. | 12V4000M90 | 4.1 | HSD | 1 |  | CAY | 20.00 | 0 | 99 | 333 | 0 | 1 | All | Rptd Sold Undisclosed Interest | In Service/Commission | 39.6 | 130 | 150 |
| ACHILLES | 9557496 | 319009200 | YACHT | Yacht | 2008 | 3898 | M.T.U. | 12V4000M90 | 4.1 | HSD | 1 |  | CAY | 20.00 | 0 | 99 | 333 | 0 | 1 | All | Milk Money Services II LLC | In Service/Commission | 39.6 | 130 | 150 |
| BART ROBERTS | 9557501 | 319011700 | YACHT | Yacht | 2008 | 2640 | M.T.U. | 12V4000M60 | 4.1 | HSD | 1 |  | CAY | 20.00 | 0 | 99 | 333 | 11 | 1 | All | Aphrodite Marine Ltd | In Service/Commission | 39.6 | 130 | 150 |
| EXCELLENCE V | 9583562 | 367481320 | YACHT | Yacht | 2008 | 4080 | M.T.U. | 12V4000M90 | 4.1 | HSD | 1 |  | USA | 12.00 | 0 | 99 | 333 | 0 | 1 | All | Gene Machine LLC | In Service/Commission | 39.6 | 130 | 150 |
| SEA OWL | 9620188 | 367541760 | YACHT | Yacht | 2010 | 4080 | M.T.U. | 12V4000M90 | 4.1 | HSD | 1 |  | USA | 20.00 | 0 | 99 | 333 | 62 | 1 | All | Winning Way LLC | In Service/Commission | 39.6 | 130 | 150 |
| KANALOA | 9633238 | 319042300 | YACHT | Yacht | 2011 | 4080 | M.T.U. | 12V4000M90 | 4.1 | HSD | 1 |  | CAY | 20.00 | 0 | 99 | 333 | 61 | 1 | All | Campbell Corporate Serv Ltd | In Service/Commission | 39.6 | 130 | 150 |
| PEARL | 9633240 | 338083000 | YACHT | Yacht | 2011 | 4320 | M.T.U. | 12V4000M73L | 4.1 | HSD | 1 |  | USA | 20.00 | 0 | 99 | 333 | 59 | 1 | All | LG Corporation of Palm Beach | In Service/Commission | 39.6 | 130 | 150 |
| RM ELEGANT | 9654921 | 338264000 | YACHT | Yacht | 2011 | 4320 | M.T.U. | 12V4000M73L | 4.1 | HSD | 1 |  | USA | 20.00 | 0 | 99 | 333 | 62 | 1 | All | Seven LXX LLC | In Service/Commission | 39.6 | 130 | 150 |
| FLYING FOX | 9663788 | 319056200 | YACHT | Yacht | 2012 | 4024 | M.T.U. | 12V4000M90 | 4.3 | HSD | 1 |  | CAY | 20.00 | 0 | 99 | 333 | 0 | 1 | All | Westport Shipyard Inc | In Service/Commission | 39.6 | 130 | 150 |
| FUSION | 9678496 | 538071050 | YACHT | Yacht | 2012 | 4262 | M.T.U. | 12V4000M73L | 4.3 | HSD | 1 |  | CAY | 20.00 | 0 | 99 | 333 | 0 | 1 | All | Far Niente Ventures LLC | In Service/Commission | 39.6 | 130 | 150 |
| COCOA BEAN | 9685360 | 319089200 | YACHT | Yacht | 2015 | 4320 | M.T.U. | 12V4000M73L | 4.3 | HSD | 1 |  | CAY | 20.00 | 0 | 100 | 334 | 56 | 1 | All | Westport Shipyard Inc | In Service/Commission | 39.6 | 130 | 150 |
| LEXICON | 1001489 | 339319000 | YACHT | Yacht | 1989 | 2238 | Caterpillar | 3512TA | 4.3 | HSD | 1 |  | JAM | 12.00 | 0 | 100 | 334 | 0 | 1 | All | Baker B | In Service/Commission | 39.6 | 130 | 150 |
| REEF CHIEF | 1012373 | 367618660 | YACHT | Yacht | 2012 | 2386 | Caterpillar | C32 | 2.7 | HSD | 1 |  | USA | 16.00 | 0 | 0 | 499 | 0 | 1 | All | Akino Corp | In Service/Commission | 39.6 | 130 | 150 |
| MARIPOSA | 1011783 |  | YACHT | Yacht (Saili | 2010 | 294 | Scania | DI12 M | 2.0 | HSD | 1 |  | CUR | 11.00 | 0 | 28 | 94 | 176 | 1 | All | Rainbow BV | In Service/Commission | 40.0 | 131 | 150 |
| SMILING T | 1011862 | 319237000 | YACHT | Yacht | 2010 | 1940 | Caterpillar | C32 ACERT | 2.7 | HSD | 1 |  | CAY | 15.40 | 0 | 138 | 462 | 129 | 1 | All | Northern Trust Corp | In Service/Commission | 40.0 | 131 | 150 |
| THE WELLESLEY | 8673097 | 319053900 | YACHT | Yacht | 2011 | 4680 | M.T.U. | 12V4000M93 | 4.3 | HSD | 1 |  | CAY | 12.00 | 0 | 101 | 338 | 0 | 1 | All | Rptd Sold Cayman Islands | In Service/Commission | 40.0 | 131 | 150 |
| REEF CHIEF | 8988870 | 538080008 | YACHT | Yacht | 1993 | 762 | Caterpillar | 3508 | 4.3 | HSD | 1 |  | MAI | 12.00 | 0 | 96 | 322 | 220 | 1 | All | Hill Robinson International | In Service/Commission | 40.0 | 131 | 150 |
| FAR AWAY | 9694012 | 319044500 | YACHT | Yacht | 2011 | 4680 | M.T.U. | 12V4000M93 | 4.3 | HSD | 1 |  | CAY | 23.00 | 0 | 118 | 395 | 0 | 1 | All | Princess Yachts Intl Plc | In Service/Commission | 40.0 | 131 | 150 |
| GOLDEN ODYSSEY II | 9751987 | 229942000 | YACHT | Yacht | 2013 | 4680 | M.T.U. | 12V4000M93 | 4.3 | HSD | 1 |  | MTA | 12.00 | 0 | 101 | 338 | 0 | 1 | All | Thumper Ltd | In Service/Commission | 40.0 | 131 | 150 |

| VESSNAME | IMO | MMSI | SHIP_TYPE | LLOYDS_TY | KEEL | MAIN_KW | DESIGN | DESIGNATIO | DISP | MAIN_ENGIN | CATEGORY | AUX_KW | LL_FLAG | SPEED | TEUS | NRT | GT | DWT | DWT_CATEGO | DWT_RANGE | OPERATOR | STATUS | Length (m) | Length (ft) | Slip |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| W | 9752747 | 319070300 | YACHT | Yacht | 2013 | 4680 | M.T.U. | 12V4000M93 | 4.3 | HSD | 1 | | CAY | 12.00 | 0 | 101 | 338 | 0 | 1 | All | Imperial Yachts SARL | In Service/Commission | 40.0 | 131 | 150 |
| IRIMARI | 9600841 | 248499000 | YACHT | Yacht | 2007 | 1640 | Caterpillar | C32 | 2.7 | HSD | 1 | | MTA | 12.00 | 0 | 116 | 388 | 0 | 1 | All | Itatzel Marketing Inc | In Service/Commission | 40.1 | 131 | 150 |
| OKTO | 9669225 | 319844000 | YACHT | Yacht | 2010 | 2238 | M.T.U. | 12V2000M72 | 2.2 | HSD | 1 | | CAY | 14.00 | 0 | 103 | 346 | 0 | 1 | All | B C Ltd | In Service/Commission | 40.2 | 132 | 150 |
| FINISH LINE | 9695236 | 538071092 | YACHT | Yacht | 2011 | 2160 | M.T.U. | 12V2000M72 | 2.2 | HSD | 1 | | CRO | 14.00 | 0 | 103 | 346 | 0 | 1 | All | Autozubak-Zagreb doo | In Service/Commission | 40.2 | 132 | 150 |
| SENSES | 8734281 | 538070715 | YACHT | Yacht | 1970 | 976 | Caterpillar | D348TA | 2.4 | HSD | 1 | | MAI | 14.00 | 0 | 70 | 235 | 0 | 1 | All | Alchemy Ventures Ltd | In Service/Commission | 40.3 | 132 | 150 |
| I NOVA | 9660401 | 319311000 | YACHT | Yacht | 2013 | 2206 | M.T.U. | 12V2000M91 | 2.0 | HSD | 1 | | CAY | 14.00 | 0 | 110 | 366 | 59 | 1 | All | Ocean Management GmbH | In Service/Commission | 40.5 | 133 | 150 |
| DEJA VU | 8651386 | 378019000 | YATCH | Yacht | 1990 | 2000 | M.T.U. | 8V396TE74 | 4.0 | HSD | 1 | | VGI | 13.00 | 0 | 92 | 324 | 0 | 1 | All | Biltmore Management Ltd | In Service/Commission | 40.5 | 133 | 150 |
| KATYA | 1011458 | 319036500 | YACHT | Yacht | 2008 | 3700 | M.T.U. | 12V4000M71 | 4.1 | HSD | 1 | | CAY | 28.00 | 0 | 138 | 461 | 46 | 1 | All | Star 7 Holdings LLC | In Service/Commission | 40.5 | 133 | 150 |
| LAZY Z | 8980309 | 339333000 | YATCH | Yacht | 1995 | 3090 | Caterpillar | 3516B-TA | 4.3 | HSD | 1 | | JAM | 20.00 | 0 | 146 | 488 | 0 | 1 | All | Rock Chalk Boat Co | In Service/Commission | 40.5 | 133 | 150 |
| TANGO 5 | 1011874 | 538070874 | YACHT | Yacht | 2010 | 1492 | Caterpillar | C32 | 2.7 | HSD | 1 | | MAI | 14.50 | 0 | 140 | 469 | 335 | 1 | All | Ferrum Investments Ltd | In Service/Commission | 40.5 | 133 | 150 |
| IL SOLE | 8991425 | 377714000 | YACHT | Yacht | 1987 | 2238 | M.T.U. | 12V396TB83 | 4.0 | HSD | 1 | | SVC | 13.00 | 0 | 144 | 482 | 0 | 1 | All | Azzura Yacht Management | In Service/Commission | 40.6 | 133 | 150 |
| PLAN B | 9665982 | 319067700 | YACHT | Yacht | 2010 | 4680 | M.T.U. | 12V4000M93 | 4.3 | HSD | 1 | | CAY | 24.00 | 0 | 101 | 338 | 46 | 1 | All | Alloya Ltd | In Service/Commission | 40.8 | 134 | 150 |
| ANDIAMO! | 9640073 | 225449000 | YACHT | Yacht | 2011 | 1066 | Caterpillar | C18 | 3.0 | HSD | 1 | | SPN | 10.50 | 0 | 130 | 388 | 60 | 1 | All | Aldabra Marine SL | In Service/Commission | 40.9 | 134 | 150 |
| STAR | 1008542 | 319407000 | YACHT | Yacht (Saili | 2003 | 448 | Lugger | L6140LA2 | 2.5 | HSD | 1 | | CAY | 12.00 | 0 | 59 | 198 | 0 | 1 | All | Mountain Country Ltd | In Service/Commission | 41.0 | 134 | 150 |
| RUYA | 1012684 | 319085300 | YACHT | Yacht | 2013 | 746 | Caterpillar | C32 ACERT | 2.7 | HSD | 1 | | CAY | 12.00 | 0 | 149 | 498 | 146 | 1 | All | West Nautical Ltd | In Service/Commission | 41.0 | 134 | 150 |
| PENELOPE | 1000617 | 538080089 | YACHT | Yacht | 1987 | 778 | Kelvin | TBSC8 | 3.9 | HSD | 1 | | MAI | 13.00 | 0 | 105 | 352 | 0 | 1 | All | Kota Ltd | In Service/Commission | 41.0 | 135 | 150 |
| SUERTE | 9672428 | 319053100 | YACHT | Yacht | 2012 | 4680 | M.T.U. | 12V4000M93 | 4.3 | HSD | 1 | | CAY | 23.00 | 0 | 106 | 356 | 0 | 1 | All | Gulf Craft Inc | In Service/Commission | 41.1 | 135 | 150 |
| TOMMY | 9671230 | 229477000 | YACHT | Yacht | 2012 | 3878 | M.T.U. | 16V2000M94 | 2.2 | HSD | 1 | | MTA | 17.00 | 0 | 105 | 351 | 0 | 1 | All | Star Chartering Ltd | In Service/Commission | 41.2 | 135 | 150 |
| MISSING LINK | 9093000 | 319825000 | YACHT | Yacht | 1987 | 1492 | Caterpillar | 3508B | 4.3 | HSD | 1 | | CAY | 14.00 | 0 | 131 | 439 | 0 | 1 | All | Moran Yacht Management Inc | In Service/Commission | 41.4 | 136 | 150 |
| SOLEMAR | 9689457 | 319987000 | YACHT | Yacht | 2010 | 2162 | Caterpillar | C32 ACERT | 2.7 | HSD | 1 | | CAY | 14.00 | 0 | 131 | 439 | 0 | 1 | All | BURGESS | In Service/Commission | 41.9 | 138 | 150 |
| KISMET | 9737682 | 378377000 | YACHT | Yacht | 2011 | 2162 | Caterpillar | C32 ACERT | 2.7 | HSD | 1 | | VGI | 14.00 | 0 | 139 | 464 | 77 | 1 | All | Fraser Worldwide SAM | In Service/Commission | 41.9 | 138 | 150 |
| SAVANNAH | 1012206 | 319075800 | YACHT | Yacht | 2015 | 3530 | Caterpillar | 3512C | 4.9 | HSD | 1 | | CAY | 16.50 | 0 | 143 | 479 | 0 | 1 | All | Supertoys | In Service/Commission | 42.0 | 138 | 150 |
| LORETTA ANNE | 8741404 | 538080061 | YACHT | Yacht (Saili | 1992 | 346 | Lugger | L6140A | 2.5 | HSD | 1 | | MAI | 11.00 | 0 | 69 | 231 | 0 | 1 | All | M3 Marine Ltd | In Service/Commission | 42.0 | 138 | 150 |
| SAVARONA | 9069633 | 518571000 | YACHT | Yacht | 1988 | 1308 | M.T.U. | 8V396TB63 | 4.0 | HSD | 1 | | CKI | 12.50 | 0 | 106 | 354 | 0 | 1 | All | Rptd Sold Undisclosed Interest | In Service/Commission | 42.0 | 138 | 150 |
| GENE MACHINE | 9747039 | 229867000 | YACHT | Yacht | 2012 | 2160 | M.T.U. | 12V2000M72 | 2.2 | HSD | 1 | | MTA | 14.00 | 0 | 0 | 275 | 0 | 1 | All | YCO SAM | In Service/Commission | 42.0 | 138 | 150 |
| AQUILA | 9796004 | 538071119 | YACHT | Yacht | 2013 | 2386 | Caterpillar | C32 ACERT | 2.7 | HSD | 1 | | MAI | 15.00 | 0 | 140 | 469 | 0 | 1 | All | Vessel Safety Management | In Service/Commission | 42.0 | 138 | 150 |
| SEARCHER | 1002093 | 319706000 | YACHT | Yacht | 1984 | 1268 | Caterpillar | D398TA | 4.0 | HSD | 1 | | CAY | 12.00 | 0 | 0 | 373 | 0 | 1 | All | Yachting Partners Intl Monaco | In Service/Commission | 42.0 | 138 | 150 |
| AZZURRA II | 8657732 | 367545250 | YATCH | Yacht | 1994 | 2796 | MWM | TBD604BV12 | 4.4 | HSD | 1 | | USA | 13.00 | 0 | 214 | 458 | 0 | 1 | All | Christensen Abbracci LLC | In Service/Commission | 42.1 | 138 | 150 |
| LATITUDE | 8949965 | 312881000 | YACHT | Yacht | 1974 | 1618 | General Motors | YYYYYY | 2.4 | HSD | 1 | | BLZ | 12.00 | 0 | 118 | 371 | 0 | 1 | All | Sun Dancer Belize Ltd | In Service/Commission | 42.1 | 138 | 150 |
| ASPEN ALTERNATIVE | 8999647 | 229689000 | YACHT | Yacht | 1994 | 2498 | M.T.U. | 12V396TE94 | 4.0 | HSD | 1 | | MTA | 19.00 | 0 | 87 | 339 | 77 | 1 | All | Serene Waters Ltd | In Service/Commission | 42.1 | 138 | 150 |
| LA MASQUERADE | 8990275 | 256670000 | YATCH | Yacht | 1963 | 956 | Caterpillar | D399TA | 4.0 | HSD | 1 | | MTA | 12.00 | 0 | 94 | 316 | 0 | 1 | All | Gem-Star Yacht | In Service/Commission | 42.3 | 139 | 150 |
| MIRABELLA III | 1001829 | 319739000 | YACHT | Yacht | 1990 | 1398 | MWM | TBD604BL6 | 4.4 | HSD | 1 | | UNK | 14.50 | 0 | 131 | 437 | 0 | 1 | All | Rptd Sold Undisclosed Interest | In Service/Commission | 42.4 | 139 | 150 |
| SARABETH | 9752668 | 319071900 | YACHT | Yacht | 2012 | 2160 | M.T.U. | 12V2000M72 | 2.2 | HSD | 1 | | CAY | 14.00 | 0 | 140 | 467 | 83 | 1 | All | Feranti Ventures Ltd | In Service/Commission | 42.5 | 139 | 150 |
| BLUE SKY | 1011769 | | YACHT | Yacht | 2009 | 2460 | Caterpillar | 3512C | 4.3 | HSD | 1 | | ITL | 17.00 | 0 | 143 | 479 | 90 | 1 | All | UniCredit Leasing SpA | In Service/Commission | 42.5 | 139 | 150 |
| LADY M | 8928492 | 319112000 | YACHT | Yacht | 1991 | 4480 | M.T.U. | 16V396TE94 | 4.0 | HSD | 1 | | CAY | 20.00 | 0 | 148 | 431 | 0 | 1 | All | CSO Yachts Ltd | In Service/Commission | 42.7 | 140 | 150 |
| ROCKSTAR | 9653032 | 235090917 | YACHT | Yacht | 2007 | 2908 | Caterpillar | 3512B | 4.3 | HSD | 1 | | GBI | 15.50 | 0 | 125 | 419 | 105 | 1 | All | Pelagos Yachts Ltd | In Service/Commission | 42.8 | 140 | 150 |
| CV-9 | 1005629 | 235720000 | YATCH | Yacht | 1988 | 3234 | M.T.U. | 16V396TB93 | 4.0 | HSD | 1 | | IOM | 21.00 | 0 | 94 | 316 | 0 | 1 | All | Redline Developments Ltd | In Service/Commission | 43.0 | 141 | 150 |
| WHY WORRY | 9548031 | 319002600 | YACHT | Yacht | 2005 | 1640 | Caterpillar | C32 | 2.7 | HSD | 1 | | CAY | 14.00 | 0 | 119 | 399 | 96 | 1 | All | EPBC Holdings Ltd | In Service/Commission | 43.0 | 141 | 150 |
| ELFJE | 1003750 | 319130000 | YATCH | Yacht | 1993 | 1156 | Caterpillar | 3508TA | 4.3 | HSD | 1 | | CAY | 12.00 | 0 | 131 | 438 | 0 | 1 | All | Teka Investment Ltd | In Service/Commission | 43.0 | 141 | 150 |
| SEA EAGLE | 1012787 | 319082400 | YACHT | Yacht (Saili | 2013 | 533 | Caterpillar | C18 | 3.0 | HSD | 1 | | CAY | 14.00 | 0 | 69 | 233 | 35 | 1 | All | Rptd Sold Undisclosed Interest | In Service/Commission | 43.0 | 141 | 150 |
| MOKA | 8742393 | 538080063 | YATCH | Yacht | 1996 | 1766 | General Motors | 16V-149 | 2.4 | HSD | 1 | | UNK | 16.00 | 0 | 126 | 423 | 0 | 1 | All | Lady Nora Ltd | In Service/Commission | 43.0 | 141 | 150 |
| PRINCESS K | 9776901 | 338214000 | YACHT | Yacht | 2012 | 3898 | M.T.U. | 12V4000M73L | 4.3 | HSD | 1 | | USA | 17.00 | 0 | 285 | 497 | 0 | 1 | All | King Baby Marine II | In Service/Commission | 43.0 | 141 | 150 |
| BLACK MAGIC | 1004132 | 229694000 | YACHT | Yacht | 1972 | 1544 | Caterpillar | D398TA | 4.0 | HSD | 1 | | MTA | 12.00 | 0 | 99 | 330 | 0 | 1 | All | Maltover Seas Co I Ltd | In Service/Commission | 43.0 | 141 | 150 |
| FARFALLA | 1002407 | 253081000 | YACHT | Yacht | 1992 | 1210 | MWM | TBD234V12 | 1.8 | HSD | 1 | | LUX | 12.00 | 0 | 117 | 390 | 0 | 1 | All | Carola Shipping SA | In Service/Commission | 43.1 | 141 | 150 |
| FOREVER ONE | 8969159 | 239994000 | YATCH | Yacht | 1995 | 1912 | Caterpillar | 3508TA | 4.3 | HSD | 1 | | GRC | 14.00 | 0 | 188 | 496 | 0 | 1 | All | Fantasy Cruises | In Service/Commission | 43.1 | 141 | 150 |
| RAHIL | 9658733 | 229889000 | YACHT | Yacht | 2012 | 1940 | Caterpillar | C32 ACERT | 2.7 | HSD | 1 | | MTA | 17.00 | 0 | 114 | 381 | 62 | 1 | All | Carolis Shipping Ltd | In Service/Commission | 43.2 | 142 | 150 |
| ANNA | 9707936 | 319077100 | YACHT | Yacht | 2012 | 2738 | M.T.U. | 12V4000M53 | 4.8 | HSD | 1 | | CAY | 14.00 | 0 | 144 | 480 | 85 | 1 | All | YES Marine Ltd | In Service/Commission | 43.3 | 142 | 150 |
| PARAFFIN | 9570046 | 319017900 | YACHT | Yacht | 2007 | 1640 | Caterpillar | C32 | 2.7 | HSD | 1 | | CAY | 14.00 | 0 | 126 | 380 | 77 | 1 | All | Sands Point Ltd | In Service/Commission | 43.3 | 142 | 150 |
| PREDICTION | 1010105 | 319057800 | YACHT | Yacht | 2007 | 1640 | Caterpillar | 3508 | 4.3 | HSD | 1 | | CAY | 15.00 | 0 | 144 | 480 | 0 | 1 | All | Merl M | In Service/Commission | 43.3 | 142 | 150 |
| ICE BEAR | 1012062 | 319648000 | YACHT | Yacht (Saili | 2011 | 533 | Caterpillar | C18 | 3.0 | HSD | 1 | | CAY | 14.00 | 0 | 69 | 233 | 36 | 1 | All | Blue Papillon Ltd | In Service/Commission | 43.3 | 142 | 150 |
| ESTER III | 9589334 | 311000170 | YACHT | Yacht | 2005 | 1000 | Caterpillar | 3412E | 2.2 | HSD | 1 | | BAH | 10.00 | 0 | 141 | 473 | 79 | 1 | All | IMA Yachts LLC | In Service/Commission | 43.4 | 142 | 150 |
| MADCAP | 9025285 | 339378000 | YACHT | Yacht | 1998 | 2460 | Caterpillar | 3512B | 4.3 | HSD | 1 | | UNK | 15.00 | 0 | 131 | 439 | 0 | 1 | All | J&M Charters Inc | In Service/Commission | 43.5 | 143 | 150 |
| DWINGER | 1002342 | 310245000 | YACHT | Yacht | 1991 | 1156 | Caterpillar | 3508TA | 4.3 | HSD | 1 | | BER | 12.00 | 0 | 146 | 489 | 0 | 1 | All | Pink Sands Holdings | In Service/Commission | 43.6 | 143 | 150 |
| SALT DANCER | 8736174 | 319041800 | YATCH | Yacht | 1992 | 3360 | M.T.U. | 12V396TE94 | 4.0 | HSD | 1 | | CAY | 14.00 | 0 | 132 | 440 | 0 | 1 | All | Clearfield Properties Ltd | In Service/Commission | 43.6 | 143 | 150 |
| HAMPSHIRE II | 9611761 | 319023700 | YACHT | Yacht | 2008 | 1940 | Caterpillar | C32 ACERT | 2.7 | HSD | 1 | | CAY | 12.00 | 0 | 136 | 456 | 90 | 1 | All | Chilinea Holding Ltd | In Service/Commission | 43.6 | 143 | 150 |
| LADY SARA | 9673070 | 319659000 | YACHT | Yacht | 2010 | 1492 | Caterpillar | C32 ACERT | 2.7 | HSD | 1 | | CAY | 26.00 | 0 | 136 | 456 | 100 | 1 | All | Reflection Marine Ventures | In Service/Commission | 43.6 | 143 | 150 |
| AMARULA SUN | 9745782 | 229888000 | YACHT | Yacht | 2011 | 1938 | Caterpillar | C32 ACERT | 2.7 | HSD | 1 | | MTA | 14.00 | 0 | 136 | 456 | 100 | 1 | All | Farwood Marine Ltd | In Service/Commission | 43.6 | 143 | 150 |
| ODESSA II | 9664718 | 518728000 | YACHT | Yacht (Saili | 2011 | 447 | Caterpillar | C18 ACERT | 3.0 | HSD | 1 | | CKI | 10.00 | 0 | 78 | 258 | 0 | 1 | All | Eclipse Marine Ltd | In Service/Commission | 43.9 | 144 | 150 |
| SURI | 1011044 | 319044000 | YACHT | Yacht | 2008 | 1118 | Caterpillar | C32 | 2.7 | HSD | 1 | | CAY | 14.00 | 0 | 127 | 426 | 418 | 1 | All | Kingship Marine Ltd | In Service/Commission | 44.0 | 144 | 150 |
| HERCULINA | 1012555 | 503018980 | YACHT | Yacht | 2013 | 1790 | Caterpillar | C32 | 2.7 | HSD | 1 | | AUS | 15.00 | 0 | 149 | 497 | 149 | 1 | All | Motor Yacht Build Ltd | In Service/Commission | 44.0 | 144 | 150 |
| LADY CANDY | 9446922 | 319774000 | YACHT | Yacht | 2005 | 2460 | Caterpillar | 3512B-DITA | 4.3 | HSD | 1 | | CAY | 13.50 | 0 | 148 | 494 | 0 | 1 | All | Fairport Yacht Support | In Service/Commission | 44.2 | 145 | 150 |
| SEA RHAPSODY | 9709104 | 319057200 | YACHT | Yacht | 2007 | 898 | Caterpillar | 3412 | 2.2 | HSD | 1 | | CAY | 12.00 | 0 | 150 | 498 | 148 | 1 | All | Balodessa Services Ltd | In Service/Commission | 44.2 | 145 | 150 |
| CAROLINE SEA II | 1010583 | 477991303 | YACHT | Yacht | 2009 | 1576 | M.T.U. | 12V2000M70 | 2.0 | HSD | 1 | | HKG | 14.20 | 0 | 149 | 499 | 0 | 1 | All | Jetpon Asia Co Ltd | In Service/Commission | 44.7 | 146 | 150 |
| MQ2 | 1009807 | 319071600 | YACHT | Yacht | 2007 | 1574 | M.T.U. | 12V2000M70 | 2.0 | HSD | 1 | | CAY | 10.00 | 0 | 149 | 498 | 300 | 1 | All | Atomic Yachting LLC | In Service/Commission | 44.8 | 147 | 150 |
| JANICE OF WYOMING | 1002720 | 232130000 | YACHT | Yacht | 1983 | 3980 | M.T.U. | 16V538TE82 | 5.4 | HSD | 1 | | GBI | 18.00 | 0 | 130 | 435 | 0 | 1 | All | Sunrise Yachting Yatcilik | In Service/Commission | 44.8 | 147 | 150 |
| MY ZEHAVA | 1011238 | 319058900 | YACHT | Yacht | 2008 | 1940 | Caterpillar | C32 | 2.7 | HSD | 1 | | CAY | 14.50 | 0 | 148 | 496 | 56 | 1 | All | Yacht Logistics Inc | In Service/Commission | 45.0 | 148 | 150 |
| AUDACIA | 1011408 | 378361000 | YACHT | Yacht | 2011 | 1940 | Caterpillar | C32 | 2.7 | HSD | 1 | | VGI | 12.50 | 0 | 148 | 496 | 90 | 1 | All | Hill Robinson Yacht Management | In Service/Commission | 45.0 | 148 | 150 |
| MALIBU | 1012153 | 319064300 | YACHT | Yacht (Saili | 2011 | 551 | Volvo Penta | D16MH750 | 2.7 | HSD | 1 | | CAY | 15.00 | 0 | 48 | 162 | 0 | 1 | All | Equiom Isle of Man Ltd | In Service/Commission | 45.0 | 148 | 150 |
| TALITHA | 1012608 | 319080200 | YACHT | Yacht | 2012 | 1766 | Caterpillar | C32 | 2.7 | HSD | 1 | | CAY | 15.00 | 0 | 0 | 496 | 0 | 1 | All | Campbell Corporate Serv Ltd | In Service/Commission | 45.0 | 148 | 150 |
| WABI-SABI | 9663829 | 373423000 | YACHT | Yacht | 2012 | 2588 | M.T.U. | 12V4000M60 | 4.1 | HSD | 1 | | PAN | 16.00 | 0 | 147 | 491 | 0 | 1 | All | Horizon Yacht Co Ltd | In Service/Commission | 45.0 | 148 | 150 |
| FALCON LAIR | 9757761 | 319072700 | YACHT | Yacht | 2014 | 2162 | Caterpillar | C32 ACERT | 2.7 | HSD | 1 | | CAY | 14.00 | 0 | 149 | 499 | 90 | 1 | All | Rptd Sold Undisclosed Interest | In Service/Commission | 45.0 | 148 | 150 |
| YOU & ME | 9767869 | 319077400 | YACHT | Yacht | 2014 | 948 | Cummins | QSM11 | 1.8 | HSD | 1 | | CAY | 12.00 | 0 | 143 | 479 | 130 | 1 | All | Seaisee Holdings Ltd | In Service/Commission | 45.0 | 148 | 150 |
| J'ADE | 9590656 | 538080068 | YACHT | Yacht | 2008 | 1566 | Caterpillar | 3508B-TA | 4.3 | HSD | 1 | | MAI | 10.00 | 0 | 149 | 496 | 95 | 1 | All | Temple Marine Ltd | In Service/Commission | 45.1 | 148 | 150 |
| CRYSTAL | 9641211 | 229362000 | YACHT | Yacht | 2009 | 1530 | Mitsubishi | S12A2-MTK | 2.8 | HSD | 1 | | UNK | 14.50 | 0 | 131 | 437 | 42 | 1 | All | Katerina Shipping & Yachting | In Service/Commission | 45.2 | 148 | 150 |
| AQUIJO | 8991140 | 319055500 | YACHT | Yacht | 1991 | 1140 | Caterpillar | 3508TA | 4.3 | HSD | 1 | | GBI | 15.00 | 0 | 144 | 480 | 134 | 1 | All | Aquarius Star Ltd | In Service/Commission | 45.4 | 149 | 150 |
| MOGAMBO | 9663568 | 319274000 | YACHT | Yacht | 2008 | 1640 | Caterpillar | 3508C | 4.3 | HSD | 1 | | CAY | 20.00 | 0 | 149 | 497 | 158 | 1 | All | Carson Maritime LLC | In Service/Commission | 45.4 | 149 | 150 |
| APHRODITE | 9022831 | 538071013 | YATCH | Yacht | 1991 | 1386 | General Motors | 16V-149-NA | 2.4 | HSD | 1 | | MAI | 14.60 | 0 | 143 | 477 | 0 | 1 | All | Island Girl Ltd | In Service/Commission | 45.7 | 150 | 150 |
| PASSION | 8980294 | 316001670 | YACHT | Yacht | 1997 | 3310 | Caterpillar | 3512B-TA | 4.3 | HSD | 1 | | CAN | 18.00 | 0 | 154 | 515 | 0 | 1 | All | Great Pacific Capital Corp | In Service/Commission | 45.7 | 150 | 150 |
| JAGUAR | 9331969 | 366705000 | YACHT | Yacht | 2002 | 3000 | Caterpillar | 3512B | 4.3 | HSD | 1 | | USA | 18.50 | 0 | 139 | 465 | 107 | 1 | All | Fairport Yacht Support | In Service/Commission | 45.7 | 150 | 150 |
| OCEAN PARADISE | 9669847 | 319053800 | YACHT | Yacht | 2011 | 2984 | Caterpillar | C32 | 2.7 | HSD | 1 | | CAY | 15.00 | 0 | 131 | 437 | 61 | 1 | All | Status Quo Inc | In Service/Commission | 45.7 | 150 | 150 |
| LARS | 1010521 | 319059200 | YACHT | Yacht | 2009 | 1425 | Caterpillar | 3512B | 4.3 | HSD | 1 | | SVC | 14.50 | 0 | 145 | 485 | 320 | 1 | All | Fairport Yacht Support | In Service/Commission | 45.7 | 150 | 150 |
| SURPINA | 9470636 | 319009600 | YACHT | Yacht | 2007 | 1492 | Caterpillar | 3508 | 4.3 | HSD | 1 | | CAY | 16.00 | 0 | 141 | 472 | 0 | 1 | All | Midwest Yachting LLC | In Service/Commission | 46.0 | 151 | 175 |

| VESSNAME | IMO | MMSI | SHIP_TYPE | LLOYDS_TY | KEEL | MAIN_KW | DESIGN | DESIGNATIO | DISP | MAIN_ENGIN | CATEGORY | AUX_KW | LL_FLAG | SPEED | TEUS | NRT | GT | DWT | DWT_CATEGO | DWT_RANGE | OPERATOR | STATUS | Length (m) | Length (ft) | Slip |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FORMOSA | 9501306 | 319200000 | YACHT | Yacht | 2006 | 4080 | M.T.U. | 12V4000M90 | 4.1 | HSD | 1 |  | CAY | 18.00 | 0 | 149 | 498 | 75 | 1 | All | Freedom Sea LLC | In Service/Commission | 46.0 | 151 | 175 |
| ENCORE | 1002706 | 310034000 | YACHT | Yacht | 1993 | 1623 | Caterpillar | 3508TA | 4.3 | HSD-ED | 1 |  | BER | 15.00 | 0 | 161 | 537 | 0 | 1 | All | Fraser Worldwide SAM | In Service/Commission | 46.0 | 151 | 175 |
| STATE OF GRACE | 1003621 | 538071110 | YATCH | Yacht | 1989 | 2400 | MWM | TBD604BV12 | 4.4 | HSD | 1 |  | MAI | 13.00 | 0 | 98 | 328 | 276 | 1 | All | Houlihan-Parnes | In Service/Commission | 46.0 | 151 | 175 |
| MOON SAND | 1012127 | 229492000 | YACHT | Yacht | 2011 | 533 | Caterpillar | C18 | 3.0 | HSD | 1 |  | MTA | 16.00 | 0 | 75 | 251 | 0 | 1 | All | McMaster Yachts Ltd | In Service/Commission | 46.0 | 151 | 175 |
| PRIDE | 1012359 | 319059500 | YACHT | Yacht | 2014 | 2388 | Caterpillar | C32 | 2.7 | HSD | 1 |  | CAY | 16.00 | 0 | 121 | 406 | 44 | 1 | All | Lodestone Corp Ltd | In Service/Commission | 46.0 | 151 | 175 |
| APOLLO | 1012672 | 319077900 | YACHT | Yacht | 2012 | 1790 | Caterpillar | C32 | 2.7 | HSD | 1 |  | CAY | 19.50 | 0 | 126 | 423 | 57 | 1 | All | Med Yacht Services Srl | In Service/Commission | 46.0 | 151 | 175 |
| SARAMOUR | 8847349 | 229401000 | YATCH | Yacht | 1991 | 2830 | M.T.U. | 12V396TB93 | 4.0 | HSD | 1 |  | MTA | 18.00 | 0 | 123 | 411 | 0 | 1 | All | Imperial Holdings Ltd | In Service/Commission | 46.0 | 151 | 175 |
| INSPIRATION | 9666821 | 235093493 | YACHT | Yacht | 2012 | 3530 | Caterpillar | 3512C | 4.9 | HSD | 1 |  | GBI | 14.50 | 0 | 149 | 499 | 0 | 1 | All | Cote d'Azur Banque Populaire | In Service/Commission | 46.0 | 151 | 175 |
| TRIDENT | 9671010 | 319090800 | YACHT | Yacht | 2011 | 3000 | Caterpillar | 3512C-HD | 4.9 | HSD | 1 |  | CAY | 14.00 | 0 | 149 | 499 | 70 | 1 | All | Wilson Yacht Management | In Service/Commission | 46.0 | 151 | 175 |
| VITAMIN | 9741695 | 378379000 | YACHT | Yacht | 2012 | 3530 | Caterpillar | 3512C | 4.9 | HSD | 1 |  | VGI | 14.00 | 0 | 149 | 499 | 65 | 1 | All | Lighthouse Yacht Management | In Service/Commission | 46.0 | 151 | 175 |
| AURORA A | 9770672 | 235109157 | YACHT | Yacht | 2012 | 3000 | Caterpillar | 3512 | 4.3 | HSD | 1 |  | IOM | 18.00 | 0 | 149 | 499 | 65 | 1 | All | Ocean Management GmbH | In Service/Commission | 46.0 | 151 | 175 |
| DESIRE | 9779329 | 256593000 | YACHT | Yacht | 2008 | 2908 | Caterpillar | 3512B | 4.3 | HSD | 1 |  | MTA | 12.00 | 0 | 148 | 496 | 100 | 1 | All | Santa Lucija Yacht Co Ltd | In Service/Commission | 46.3 | 152 | 175 |
| IMPERIAL PRINCESS | 9779915 | 235111456 | YACHT | Yacht | 2008 | 2910 | Caterpillar | 3512B-HD | 4.9 | HSD | 1 |  | IOM | 12.00 | 0 | 146 | 489 | 0 | 1 | All | Arrow Services Monaco | In Service/Commission | 46.3 | 152 | 175 |
| BIG ZIP | 1011927 | 256969000 | YACHT | Yacht | 2010 | 1938 | Caterpillar | C32 | 2.7 | HSD | 1 |  | MTA | 10.00 | 0 | 150 | 499 | 70 | 1 | All | Ocean Management GmbH | In Service/Commission | 46.4 | 152 | 175 |
| OSTAR | 9520730 | 319982000 | YACHT | Yacht | 2004 | 1492 | Caterpillar | 3512B | 4.3 | HSD | 1 |  | CAY | 18.00 | 0 | 149 | 499 | 99 | 1 | All | QX Maritime LLC | In Service/Commission | 46.6 | 153 | 175 |
| RED ROOSTER III | 1011264 | 229056000 | YACHT | Yacht | 2010 | 2320 | M.T.U. | 8V4000M70 | 4.1 | HSD | 1 |  | MTA | 15.50 | 0 | 147 | 491 | 0 | 1 | All | Hill Robinson Yacht Management | In Service/Commission | 46.7 | 153 | 175 |
| PHILMI | 1012438 | 319067900 | YACHT | Yacht | 2012 | 2000 | M.T.U. | 8V4000M70 | 4.1 | HSD | 1 |  | CAY | 15.50 | 0 | 149 | 499 | 107 | 1 | All | Art of Yacht Management Ltd | In Service/Commission | 46.7 | 153 | 175 |
| DARLING | 1011240 | 244814000 | YACHT | Yacht | 2009 | 3260 | M.T.U. | 16V2000M92 | 2.2 | HSD | 1 |  | NTH | 17.00 | 0 | 149 | 499 | 98 | 1 | All | Blue Seas Chartering Corp BV | In Service/Commission | 47.0 | 154 | 175 |
| BIG CITY | 1011915 | 235093789 | YACHT | Yacht | 2010 | 2000 | M.T.U. | 8V4000M70 | 4.1 | HSD | 1 |  | IOM | 15.50 | 0 | 147 | 491 | 0 | 1 | All | Fraser Worldwide SAM | In Service/Commission | 47.0 | 154 | 175 |
| TULLY | 1012440 | 319564000 | YACHT | Yacht | 2012 | 2000 | M.T.U. | 8V4000M70 | 4.1 | HSD | 1 |  | CAY | 15.50 | 0 | 149 | 499 | 0 | 1 | All | YCO SAM | In Service/Commission | 47.0 | 154 | 175 |
| LIONHEART | 9657703 | 538071062 | YACHT | Yacht | 2009 | 2160 | M.T.U. | 12V2000M72 | 2.2 | HSD | 1 |  | CAY | 14.00 | 0 | 148 | 495 | 102 | 1 | All | RBC Wealth Management | In Service/Commission | 47.0 | 154 | 175 |
| QUATTROELLE | 9723875 | 235102586 | YACHT | Yacht | 2012 | 4320 | M.T.U. | 12V4000M73L | 4.3 | HSD | 1 |  | IOM | 23.00 | 0 | 148 | 495 | 0 | 1 | All | Dominion Marine Corporate Serv | In Service/Commission | 47.0 | 154 | 175 |
| MOUSE TRAP | 1002926 | 319946000 | YACHT | Yacht | 1987 | 2090 | M.T.U. | 12V396TE74 | 4.0 | HSD | 1 |  | CAY | 12.00 | 0 | 129 | 402 | 5 | 1 | All | Sapir Organization | In Service/Commission | 47.0 | 154 | 175 |
| SUN DANCER II | 1011800 | 319589000 | YACHT | Yacht | 2010 | 2386 | Caterpillar | C32 ACERT | 2.7 | HSD | 1 |  | CAY | 17.00 | 0 | 133 | 444 | 0 | 1 | All | Newson S | In Service/Commission | 47.1 | 154 | 175 |
| AMANTI | 8657653 | 245938000 | YACHT | Yacht (Saili | 1999 | 400 | M.T.U. | 12V2000M60 | 2.0 | HSD | 1 |  | NTH | 10.00 | 0 | 101 | 339 | 280 | 1 | All | Victorius Shipping Co NV | In Service/Commission | 47.3 | 155 | 175 |
| BLUE MOON | 9570345 | 538070840 | YACHT | Yacht | 2009 | 2462 | Caterpillar | 3512C | 4.3 | HSD | 1 |  | MAI | 16.80 | 0 | 246 | 822 | 0 | 1 | All | Dohle Private Clients Ltd | In Service/Commission | 47.5 | 156 | 175 |
| RASSELAS | 1012256 | 319059300 | YACHT | Yacht (Saili | 2014 | 533 | Caterpillar | C18 | 3.0 | HSD | 1 |  | CAY | 14.00 | 0 | 75 | 252 | 0 | 1 | All | Marine Construction Mgmt | In Service/Commission | 47.7 | 156 | 175 |
| DIAMOND A | 9516612 | 319010700 | YACHT | Yacht | 2006 | 2640 | M.T.U. | 12V4000M60 | 4.1 | HSD | 1 |  | CAY | 17.50 | 0 | 149 | 499 | 79 | 1 | All | Megayacht Technical Services | In Service/Commission | 47.9 | 157 | 175 |
| MONDANGO 3 | 1007952 | 538071061 | YATCH | Yacht | 1990 | 1350 | Caterpillar | 3508TA | 4.3 | HSD | 1 |  | MAI | 14.50 | 0 | 154 | 515 | 448 | 1 | All | Burgess | In Service/Commission | 47.9 | 157 | 175 |
| RUYA | 1005411 | 319093000 | YACHT | Yacht | 1994 | 3042 | Deutz | TBD620BV12 | 4.4 | HSD | 1 |  | CAY | 17.00 | 0 | 162 | 543 | 0 | 1 | All | Hill Robinson Yacht Management | In Service/Commission | 48.0 | 157 | 175 |
| STARFIRE | 8731942 | 319860000 | YACHT | Yacht (Saili | 1989 | 1066 | Caterpillar | C18 | 3.0 | HSD | 1 |  | CAY | 12.00 | 0 | 91 | 304 | 320 | 1 | All | Pelagos Yachts Ltd | In Service/Commission | 48.0 | 157 | 175 |
| ULYSSES | 9436525 | 240934000 | YATCH | Yacht | 1996 | 3530 | General Motors | 16V-149-TI | 2.4 | HSD | 1 |  | GRC | 14.00 | 0 | 129 | 432 | 0 | 1 | All | Inspiration Yacht Charterers | In Service/Commission | 48.0 | 157 | 175 |
| ELENVAR | 1005435 | 319142000 | YATCH | Yacht | 1997 | 1350 | Caterpillar | 3508TA | 4.3 | HSD | 1 |  | CAY | 14.50 | 0 | 149 | 499 | 46 | 1 | All | International Yacht Collection | In Service/Commission | 48.2 | 158 | 175 |
| ANTARA | 1005796 | 319495000 | YATCH | Yacht | 1996 | 1790 | Cummins | KTA-38-M2 | 3.2 | HSD | 1 |  | CAY | 15.00 | 0 | 180 | 603 | 589 | 1 | All | Elmwood Ventures Ltd | In Service/Commission | 48.5 | 159 | 175 |
| RICE QUARTERS H2O2 | 9744348 | 319065600 | YACHT | Yacht | 2012 | 3878 | M.T.U. | 16V2000M94 | 2.2 | HSD | 1 |  | CAY | 32.00 | 0 | 145 | 485 | 0 | 1 | All | Swift Marine | In Service/Commission | 48.5 | 159 | 175 |
| ACTION | 1000239 | 229551000 | YACHT | Yacht | 1990 | 1148 | General Motors | 16V-92-TA | 1.5 | HSD | 1 |  | MTA | 12.00 | 0 | 140 | 467 | 0 | 1 | All | Luxembourg Marine Services SA | In Service/Commission | 48.6 | 159 | 175 |
| AZAMANTA | 9485485 | 319001100 | YACHT | Yacht | 2006 | 2604 | M.T.U. | 12V4000M60 | 4.1 | HSD | 1 |  | CAY | 17.00 | 0 | 147 | 491 | 87 | 1 | All | Green Dolphin Marine Ventures | In Service/Commission | 48.7 | 160 | 175 |
| INVICTUS | 9683154 | 319063200 | YACHT | Yacht | 2010 | 2460 | Caterpillar | 3512C-HD | 4.9 | HSD | 1 |  | CAY | 16.00 | 0 | 149 | 499 | 92 | 1 | All | Harlan Ltd | In Service/Commission | 48.7 | 160 | 175 |
| SECRET | 9560728 | 319582000 | YACHT | Yacht | 2007 | 2604 | M.T.U. | 12V4000M60 | 4.1 | HSD | 1 |  | CAY | 17.50 | 0 | 149 | 498 | 84 | 1 | All | ACA Megayachts LLC | In Service/Commission | 48.8 | 160 | 175 |
| LADY GOODGIRL | 1006219 | 319451000 | YACHT | Yacht | 1997 | 1350 | Caterpillar | 3508TA | 4.3 | HSD | 1 |  | CAY | 14.50 | 0 | 146 | 487 | 0 | 1 | All | Teleost Cayman | In Service/Commission | 48.8 | 160 | 175 |
| MICHAELA ROSE | 1011630 | 319038100 | YACHT | Yacht (Saili | 2009 | 600 | M.T.U. | 12V2000M60 | 2.0 | HSD | 1 |  | CAY | 17.00 | 0 | 72 | 241 | 0 | 1 | All | Campus Mare Ltd | In Service/Commission | 49.0 | 161 | 175 |
| VIRGINIAN | 8747824 | 319827000 | YACHT | Yacht | 1992 | 4480 | M.T.U. | 16V396TE94 | 4.0 | HSD | 1 |  | CAY | 19.00 | 0 | 140 | 466 | 0 | 1 | All | 963 Luxury Ltd | In Service/Commission | 49.0 | 161 | 175 |
| ABBRACCI | 9509566 | 319370000 | YACHT | Yacht | 2004 | 3356 | Caterpillar | 3512B | 4.3 | HSD | 1 |  | CAY | 18.00 | 0 | 141 | 470 | 135 | 1 | All | Fairport Yacht Support | In Service/Commission | 49.1 | 161 | 175 |
| CACOS V | 9537458 | 319002200 | YACHT | Yacht | 2006 | 1940 | Caterpillar | 3512B | 4.3 | HSD | 1 |  | CAY | 18.00 | 0 | 142 | 476 | 130 | 1 | All | New Idea LLC | In Service/Commission | 49.1 | 161 | 175 |
| HALO | 9557692 | 319009300 | YACHT | Yacht | 2006 | 3310 | Caterpillar | 3512B | 4.3 | HSD | 1 |  | CAY | 17.50 | 0 | 132 | 442 | 122 | 1 | All | Campbell Corporate Serv Ltd | In Service/Commission | 49.1 | 161 | 175 |
| MADAME KATE | 9668104 | 319045300 | YACHT | Yacht | 2010 | 3530 | Caterpillar | 3512C | 4.9 | HSD | 1 |  | CAY | 14.00 | 0 | 141 | 473 | 290 | 1 | All | Pensum Ltd | In Service/Commission | 49.2 | 161 | 175 |
| SURI | 7722059 | 538070349 | YACHT | Yacht | 1977 | 1368 | General Motors | 16V-149 | 2.4 | HSD | 1 |  | MAI | 12.00 | 0 | 405 | 1352 | 845 | 1 | All | Suri Holdings Ltd | In Service/Commission | 49.2 | 162 | 175 |
| TWILIGHT | 1002756 | 233731000 | YATCH | Yacht | 1984 | 1526 | Deutz | SBA6M528 | 10.6 | MSD | 2 |  | GBI | 14.00 | 0 | 269 | 525 | 0 | 1 | All | Rochelle Marine Ltd | In Service/Commission | 49.3 | 162 | 175 |
| ARCTIC SUNRISE | 7382902 | 244538000 | YACHT | Yacht | 1974 | 1618 | MaK | 9M452AK | 36.2 | MSD | 3 |  | NTH | 13.00 | 0 | 353 | 949 | 610 | 1 | All | Greenpeace Council Stichting | In Service/Commission | 49.5 | 162 | 175 |
| GENESIS II | 9485473 | 538080060 | YACHT | Yacht | 2005 | 2604 | M.T.U. | 12V4000M60 | 4.1 | HSD | 1 |  | MAI | 17.00 | 0 | 147 | 491 | 0 | 1 | All | McDonald's Casino Royale Ltd | In Service/Commission | 49.7 | 163 | 175 |
| ENTOURAGE | 7309546 | 303938000 | YACHT | Yacht | 1963 | 588 | White Superior | 40-M-6 | 9.8 | MSD | 2 |  | FIJ | 12.00 | 0 | 399 | 579 | 309 | 1 | All | Lau Shipping Co Ltd | In Service/Commission | 49.7 | 163 | 175 |
| STEP ONE | 1012658 | 319083700 | YACHT | Yacht | 2015 | 3528 | Caterpillar | 3512C-HD | 4.9 | HSD | 1 |  | CAY | 20.00 | 0 | 254 | 849 | 210 | 1 | All | Ocean Management GmbH | In Service/Commission | 49.7 | 163 | 175 |
| LADY BRITT | 9606247 | 247323600 | YACHT | Yacht (Saili | 2010 | 1081 | Caterpillar | C32 ACERT | 2.7 | HSD | 1 |  | ITL | 14.00 | 0 | 111 | 370 | 65 | 1 | All | Enterprise Shipping Agency Srl | In Service/Commission | 49.7 | 163 | 175 |
| LADY DEE | 9641560 | 319617000 | YACHT | Yacht | 2008 | 3356 | Caterpillar | 3512B | 4.3 | HSD | 1 |  | CAY | 16.00 | 0 | 138 | 455 | 123 | 1 | All | C Fly Marine Services LLC | In Service/Commission | 49.8 | 163 | 175 |
| LIONWIND | 9707041 | 319054400 | YACHT | Yacht | 2010 | 3480 | M.T.U. | 12V4000M70 | 4.1 | HSD | 1 |  | CAY | 12.00 | 0 | 233 | 746 | 131 | 1 | All | Trident Trust Co BVI Ltd | In Service/Commission | 49.8 | 163 | 175 |
| TAIBA | 9599705 | 538071065 | YACHT | Yacht | 2010 | 1640 | Caterpillar | 3508B-TA | 4.3 | HSD | 1 |  | MAI | 20.00 | 0 | 150 | 498 | 0 | 1 | All | COCASENELREFRI | In Service/Commission | 49.8 | 163 | 175 |
| ALCHEMY | 1006520 | 319368000 | YACHT | Yacht | 1997 | 3280 | Caterpillar | 3516TA | 4.3 | HSD | 1 |  | CAY | 18.00 | 0 | 182 | 608 | 110 | 1 | All | Next Century Marine | In Service/Commission | 49.9 | 164 | 175 |
| SAINT | 8954752 | 319780000 | YACHT | Yacht | 1996 | 3310 | M.T.U. | 12V396TE94 | 4.0 | HSD | 1 |  | CAY | 18.00 | 0 | 149 | 496 | 0 | 1 | All | YCO SAM | In Service/Commission | 49.9 | 164 | 175 |
| VIVA MAS | 9557513 | 339396000 | YACHT | Yacht | 2008 | 3520 | M.T.U. | 16V4000M60 | 4.1 | HSD | 1 |  | JAM | 20.00 | 0 | 147 | 492 | 90 | 1 | All | Doria Acquisitions LLC | In Service/Commission | 49.9 | 164 | 175 |
| STATUS QUO | 9583574 | 319181000 | YACHT | Yacht | 2009 | 3520 | M.T.U. | 16V4000M60 | 4.1 | HSD | 1 |  | CAY | 12.00 | 0 | 147 | 492 | 0 | 1 | All | Yacht Logistics Inc | In Service/Commission | 49.9 | 164 | 175 |
| RED SAPPHIRE SHADOW | 1012036 | 378111881 | YACHT | Yacht | 2011 | 3530 | Caterpillar | 3512C | 4.9 | HSD | 1 |  | VGI | 14.50 | 0 | 0 | 498 | 100 | 1 | All | BA Maritime Corp | In Service/Commission | 50.0 | 164 | 175 |
| ARIANNA | 8977534 | 319735000 | YACHT | Yacht | 1993 | 2618 | MWM | TBD604BV12 | 4.4 | HSD | 1 |  | CAY | 18.50 | 0 | 122 | 407 | 0 | 1 | All | Ilsole Ltd | In Service/Commission | 50.0 | 164 | 175 |
| LIFE SAGA | 8979805 | 256676000 | YACHT | Yacht | 1989 | 1126 | Caterpillar | 3412TA | 2.2 | HSD | 1 |  | MTA | 12.00 | 0 | 202 | 675 | 0 | 1 | All | Seven Seas Navigation Ltd | In Service/Commission | 50.0 | 164 | 175 |
| ROYAL ROMANCE | 9763899 | 319074600 | YACHT | Yacht | 2012 | 2000 | M.T.U. | 8V4000M63 | 4.8 | HSD | 1 |  | CAY | 12.00 | 0 | 149 | 497 | 112 | 1 | All | Titan Fleet Management Sarl | In Service/Commission | 50.0 | 164 | 175 |
| BELUGA | 1005966 | 229761000 | YACHT | Yacht | 1996 | 2028 | Caterpillar | 3512B-HD | 4.9 | HSD | 1 |  | MTA | 15.50 | 0 | 196 | 656 | 600 | 1 | All | Istros Ltd | In Service/Commission | 50.0 | 164 | 175 |
| GODSPEED | 1007158 | 319663000 | YACHT | Yacht | 2000 | 1790 | Cummins | KTA-38-M2 | 3.2 | HSD | 1 |  | CAY | 15.00 | 0 | 183 | 613 | 0 | 1 | All | Titan Fleet Management Sarl | In Service/Commission | 50.0 | 164 | 175 |
| SINDHU SANKALP | 1008023 | 319055000 | YACHT | Yacht | 1992 | 1136 | Caterpillar | 3516TA | 4.3 | HSD | 1 |  | BER | 12.00 | 0 | 0 | 655 | 0 | 1 | All | Rptd Sold Undisclosed Interest | In Service/Commission | 50.0 | 164 | 175 |
| TURKS & CAICOS AGGRESSOR II | 1004819 | 538070743 | YACHT | Yacht | 1994 | 2236 | Caterpillar | 3512TA | 4.3 | HSD | 1 |  | MAI | 12.00 | 0 | 197 | 658 | 0 | 1 | All | ALB Ltd | In Service/Commission | 50.0 | 164 | 175 |
| SERENITY J | 1012737 | 319084300 | YACHT | Yacht | 2015 | 2000 | M.T.U. | 8V4000M63 | 4.8 | HSD | 1 |  | CAY | 12.00 | 0 | 149 | 499 | 127 | 1 | All | Ann G Voyage Ltd | In Service/Commission | 50.0 | 164 | 175 |
| DREAM | 9526320 | 367368250 | YACHT | Yacht | 2005 | 3310 | Caterpillar | 3512B | 4.3 | HSD | 1 |  | USA | 18.00 | 0 | 139 | 466 | 130 | 1 | All | Norwegian Queen Management LLC | In Service/Commission | 50.0 | 164 | 175 |
| ONLY ONE | 9556923 | 367403020 | YACHT | Yacht | 2006 | 3310 | Caterpillar | 3512B | 4.3 | HSD | 1 |  | USA | 20.00 | 0 | 136 | 456 | 130 | 1 | All | Hendrick Marine LLC | In Service/Commission | 50.0 | 164 | 175 |
| KIBO | 9581980 | 319972000 | YACHT | Yacht | 2009 | 2460 | Caterpillar | 3512C | 4.9 | HSD | 1 |  | CAY | 16.00 | 0 | 149 | 498 | 100 | 1 | All | Frazier Overseas Ltd | In Service/Commission | 50.0 | 164 | 175 |
| ALUCIA | 9583251 | 319018500 | YACHT | Yacht | 2007 | 2625 | Caterpillar | 3512B | 4.3 | HSD | 1 |  | CAY | 12.00 | 0 | 137 | 459 | 146 | 1 | All | Rptd Sold USA | In Service/Commission | 50.0 | 164 | 175 |
| FORWIN | 9599640 | 319021700 | YACHT | Yacht | 2007 | 1940 | Caterpillar | 3512B | 4.3 | HSD | 1 |  | CAY | 12.00 | 0 | 147 | 490 | 130 | 1 | All | Automotive Management Services | In Service/Commission | 50.0 | 164 | 175 |
| ENDEAVOUR | 9737981 | 319077500 | YACHT | Yacht | 2012 | 2460 | Caterpillar | 3512C | 4.9 | HSD | 1 |  | CAY | 13.00 | 0 | 238 | 795 | 135 | 1 | All | GRNF Denizcilik ve Insaat | In Service/Commission | 50.0 | 164 | 175 |
| TURMOIL | 9658006 | 319044100 | YACHT | Yacht | 2009 | 1440 | M.T.U. | 8V2000M72 | 2.2 | HSD | 1 |  | CAY | 12.00 | 0 | 123 | 410 | 0 | 1 | All | Rainbow Peak Ltd | In Service/Commission | 50.2 | 165 | 175 |
| KAMAXITHA | 1004936 | 319214000 | YACHT | Yacht | 1992 | 1884 | Caterpillar | 3512TA | 4.3 | HSD | 1 |  | CAY | 15.50 | 0 | 204 | 680 | 680 | 1 | All | Burgess | In Service/Commission | 50.3 | 165 | 175 |
| SECRET LOVE | 1006556 | 319642000 | YACHT | Yacht | 1997 | 2238 | Caterpillar | 3512TA | 4.3 | HSD | 1 |  | CAY | 16.50 | 0 | 207 | 692 | 0 | 1 | All | RSO Holdings Ltd | In Service/Commission | 50.3 | 165 | 175 |
| REMEMBER WHEN | 8988208 | 319126000 | YATCH | Yacht | 1983 | 2648 | MaK | 12M282AK | 12.7 | MSD | 2 |  | CAY | 17.00 | 0 | 180 | 603 | 186 | 1 | All | SBK Marine | In Service/Commission | 50.5 | 166 | 175 |
| MY SKY | 9458664 | 229963000 | YACHT | Yacht | 2005 | 1840 | Deutz | TBD620V8 | 4.4 | HSD | 1 |  | ITL | 13.00 | 0 | 0 | 783 | 0 | 1 | All | Fraser Worldwide SAM | In Service/Commission | 50.5 | 166 | 175 |
| DYNA R | 5035816 | 316004442 | YATCH | Yacht | 1953 | 736 | Caterpillar | D399TA | 4.0 | HSD | 1 |  | CAN | 10.00 | 0 | 190 | 634 | 332 | 1 | All | Oak Bay Marina Ltd | In Service/Commission | 50.6 | 166 | 175 |
| RENA | 8030594 | 470459000 | YACHT | Yacht | 1981 | 1654 | Caterpillar | D399SCAC | 4.0 | HSD | 1 |  | UAE | 12.00 | 0 | 321 | 1073 | 1200 | 1 | All | Al Ali MAR | In Service/Commission | 50.6 | 166 | 175 |

| VESSNAME | IMO | MMSI | SHIP_TYPE | LLOYDS_TY | KEEL | MAIN_KW | DESIGN | DESIGNATIO | DISP | MAIN_ENGIN | CATEGORY | AUX_KW | LL_FLAG | SPEED | TEUS | NRT | GT | DWT | DWT_CATEGO | DWT_RANGE | OPERATOR | STATUS | Length (m) | Length (ft) | Slip |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DARDANELLA | 1004651 | 319307000 | YACHT | Yacht | 1994 | 2520 | M.T.U. | 12V396TE74 | 4.0 | HSD | 1 | | CAY | 16.50 | 0 | 191 | 638 | 0 | 1 | All | Fairport Yacht Support | In Service/Commission | 50.8 | 166 | 175 |
| SUNRISE | 8981353 | 319577000 | YATCH | Yacht | 1988 | 1752 | Caterpillar | 3512TA | 4.3 | HSD | 1 | | CAY | 12.00 | 0 | 184 | 614 | 0 | 1 | All | Cool Fur Enterprises | In Service/Commission | 50.9 | 167 | 175 |
| LADY PETRA | 8734449 | 255909750 | YATCH | Yacht | 1995 | 3580 | MWM | TBD604BV16 | 4.4 | HSD | 1 | | POR | 14.00 | 0 | 142 | 474 | 0 | 1 | All | Sea Metria Srl | In Service/Commission | 51.0 | 167 | 175 |
| ORYX | 5038911 | | YACHT | Yacht | 1960 | 942 | Fairbanks | 4-38D8-1/8 | 8.5 | MSD | 2 | | CAY | 11.00 | 0 | 204 | 683 | 107 | 1 | All | Irvine C | In Service/Commission | 51.1 | 167 | 175 |
| TZARINA | 1012139 | 319071400 | YACHT | Yacht | 2011 | 2760 | M.T.U. | 12V4000M53 | 4.8 | HSD | 1 | | CAY | 15.60 | 0 | 194 | 648 | 0 | 1 | All | Maybol Enterprises Ltd | In Service/Commission | 51.1 | 168 | 175 |
| ITALIA | 1002017 | 538080081 | YACHT | Yacht | 1987 | 2236 | Caterpillar | 3512TA | 4.3 | HSD | 1 | | MAI | 15.00 | 0 | 181 | 603 | 0 | 1 | All | DB Marine Consulting | In Service/Commission | 51.3 | 168 | 175 |
| DUSUR | 8975952 | 319238000 | YACHT | Yacht | 1989 | 2516 | Caterpillar | 3516TA | 4.3 | HSD | 1 | | CAY | 12.00 | 0 | 212 | 710 | 0 | 1 | All | Fraser Worldwide SAM | In Service/Commission | 51.7 | 170 | 175 |
| MONACO | 1007275 | 319874000 | YACHT | Yacht | 2000 | 2238 | Caterpillar | 3512B-HD | 4.9 | HSD | 1 | | CAY | 15.50 | 0 | 258 | 863 | 0 | 1 | All | Megayacht Technical Services | In Service/Commission | 51.8 | 170 | 175 |
| SALMON SEEKER | 1005409 | 319674000 | YACHT | Yacht | 1995 | 2520 | M.T.U. | 12V396TE74 | 4.0 | HSD | 1 | | CAY | 16.00 | 0 | 191 | 638 | 1000 | 1 | All | BURGESS | In Service/Commission | 51.8 | 170 | 175 |
| SATISFACTION | 9753715 | 319070900 | YACHT | Yacht | 2009 | 3946 | M.T.U. | 16V4000M61 | 4.1 | HSD | 1 | | CAY | 18.00 | 0 | 234 | 783 | 0 | 1 | All | Jade959 Ltd-CHT | In Service/Commission | 51.8 | 170 | 175 |
| LUNA | 6726826 | | YATCH | Yacht | 1966 | 920 | Polar | SF15RS-C | 14.7 | MSD | 2 | | ECU | 12.50 | 0 | 0 | 790 | 241 | 1 | All | Sotomayor Neira J | In Service/Commission | 51.8 | 170 | 175 |
| SEAISEE I | 1006180 | 319354000 | YACHT | Yacht | 1996 | 2802 | Caterpillar | 3516TA | 4.3 | HSD | 1 | | CAY | 16.50 | 0 | 221 | 737 | 0 | 1 | All | Biltmore Management Ltd | In Service/Commission | 52.0 | 171 | 175 |
| TRIBU | 1012244 | 319062800 | YACHT | Yacht (Saili | 2014 | 550 | Scania | DI16 | 2.0 | HSD | 1 | | CAY | 15.90 | 0 | 69 | 232 | 42 | 1 | All | YCO SAM | In Service/Commission | 52.0 | 171 | 175 |
| PUMULA | 1001702 | 229693000 | YACHT | Yacht (Saili | 1960 | 930 | Caterpillar | 3412T | 2.2 | HSD | 1 | | MTA | 12.00 | 0 | 88 | 295 | 0 | 1 | All | Palawan Island Co Ltd | In Service/Commission | 52.1 | 171 | 175 |
| ATLANTIC GOOSE | 1005643 | 319225000 | YACHT | Yacht | 1997 | 1908 | Caterpillar | 3512TA | 4.3 | HSD | 1 | | CAY | 16.00 | 0 | 246 | 822 | 0 | 1 | All | Starvisions Ltd | In Service/Commission | 52.2 | 171 | 175 |
| INGOT | 1011513 | 319065700 | YACHT | Yacht | 2009 | 3520 | M.T.U. | 16V4000M60 | 4.1 | HSD | 1 | | CAY | 30.00 | 0 | 0 | 485 | 0 | 1 | All | Moran Yacht Management Inc | In Service/Commission | 52.2 | 171 | 175 |
| ARK ANGEL | 7821867 | 312480000 | YACHT | Yacht | 1978 | 956 | Hanshin | 6LUN28AG | 29.6 | MSD | 2 | | BLZ | 12.00 | 0 | 214 | 713 | 0 | 1 | All | Jupiter the Fourth Ltd | In Service/Commission | 52.2 | 171 | 175 |
| ARK ANGEL | 1006403 | 240771000 | YACHT | Yacht | 1993 | 3072 | Caterpillar | 3516B | 4.9 | HSD | 1 | | GRC | 18.00 | 0 | 352 | 695 | 0 | 1 | All | Dioryx Maritime Corp | In Service/Commission | 52.3 | 171 | 175 |
| ENTERPRISE | 1011111 | 319009700 | YACHT | Yacht | 2009 | 2100 | M.T.U. | 16V2000M70 | 2.0 | HSD | 1 | | CAY | 15.00 | 0 | 201 | 672 | 0 | 1 | All | Ocean Management GmbH | In Service/Commission | 52.3 | 172 | 175 |
| CHIRUNDOS | 1011941 | 319051600 | YACHT | Yacht | 2010 | 2100 | M.T.U. | 16V2000M70 | 2.0 | HSD | 1 | | CAY | 15.50 | 0 | 201 | 671 | 0 | 1 | All | FYS Yachts Monaco | In Service/Commission | 52.3 | 172 | 175 |
| SEA FALCON 2 | 1009467 | 319331000 | YACHT | Yacht | 2006 | 2100 | M.T.U. | 16V2000M70 | 2.0 | HSD | 1 | | CAY | 15.00 | 0 | 192 | 642 | 0 | 1 | All | Were Dreams Ltd | In Service/Commission | 52.4 | 172 | 175 |
| MATCH POINT | 8987694 | 319698000 | YATCH | Yacht (Saili | 1999 | 1030 | Caterpillar | 3412E | 2.2 | HSD | 1 | | CAY | 14.00 | 0 | 108 | 361 | 0 | 1 | All | Atalante Yachting Sarl | In Service/Commission | 53.0 | 174 | 175 |
| FORTY TWO | 1005734 | 377618000 | YACHT | Yacht | 1995 | 2314 | Deutz | SBV6M628 | 12.7 | MSD | 2 | | SVC | 17.00 | 0 | 224 | 747 | 0 | 1 | All | BJAV Marine Ltd | In Service/Commission | 53.3 | 175 | 175 |
| BATAI | 1007756 | 319295000 | YACHT | Yacht | 2001 | 2760 | Caterpillar | 3512B | 4.3 | HSD | 1 | | CAY | 17.00 | 0 | 268 | 894 | 189 | 1 | All | Royale Oceanic Intl Yacht | In Service/Commission | 53.3 | 175 | 175 |
| TARANSAY | 1010557 | 538070721 | YACHT | Yacht | 2008 | 4946 | M.T.U. | 16V4000M90 | 4.1 | HSD | 1 | | MAI | 18.50 | 0 | 253 | 846 | 0 | 1 | All | Sentoff M | In Service/Commission | 53.3 | 175 | 175 |
| ADIX | 1002328 | 319699000 | YACHT | Yacht | 1984 | 2940 | Deutz | RBV8M626 | 12.7 | MSD | 2 | | CAY | 17.00 | 0 | 167 | 558 | 0 | 1 | All | YCO SAM | In Service/Commission | 53.3 | 175 | 175 |
| ATTITUDE | 9636515 | 319007600 | YACHT | Yacht | 2008 | 3372 | Caterpillar | 3516B-HD | 4.9 | HSD | 1 | | CAY | 15.00 | 0 | 278 | 928 | 133 | 1 | All | Jana | In Service/Commission | 53.8 | 176 | 200 |
| COLUMBIA | 1002641 | 235241000 | YACHT | Yacht | 1989 | 2312 | Caterpillar | 3516TA | 4.3 | HSD | 1 | | GBI | 12.00 | 0 | 312 | 1042 | 0 | 1 | All | Wilson Yacht Management | In Service/Commission | 54.0 | 177 | 200 |
| SERENITY II | 1011953 | 235100386 | YACHT | Yacht | 2010 | 2100 | M.T.U. | 16V2000M70 | 2.0 | HSD | 1 | | IOM | 15.50 | 0 | 201 | 670 | 164 | 1 | All | EN Marine Ltd | In Service/Commission | 54.0 | 177 | 200 |
| CARPE DIEM | 9658721 | 319072200 | YACHT | Yacht | 2012 | 2460 | Caterpillar | 3512B | 4.3 | HSD | 1 | | CAY | 16.00 | 0 | 0 | 875 | 138 | 1 | All | Rptd Sold Undisclosed Interest | In Service/Commission | 54.7 | 179 | 200 |
| WERE DREAMS | 1012622 | 235112247 | YACHT | Yacht | 2015 | 2460 | Caterpillar | 3512C | 4.9 | HSD | 1 | | GBI | 15.00 | 0 | 307 | 1024 | 150 | 1 | All | Fraser Worldwide SAM | In Service/Commission | 54.8 | 180 | 200 |
| BLUE ATTRACTION | 1005071 | 319915000 | YACHT | Yacht | 1994 | 3878 | Caterpillar | 3516TA | 4.3 | HSD | 1 | | CAY | 18.00 | 0 | 264 | 881 | 0 | 1 | All | YCO SAM | In Service/Commission | 55.0 | 180 | 200 |
| ANDROMEDA LA DEA | 1007495 | 319076300 | YACHT | Yacht | 2000 | 2760 | Caterpillar | 3512B | 4.3 | HSD | 1 | | IOM | 17.00 | 0 | 272 | 909 | 189 | 1 | All | Yacht Logistics Inc | In Service/Commission | 55.0 | 180 | 200 |
| AZIZA | 1007536 | 235739000 | YACHT | Yacht | 2001 | 2610 | Caterpillar | 3512B-TA | 4.3 | HSD | 1 | | GBI | 15.00 | 0 | 240 | 802 | 0 | 1 | All | Coniston Marine Ltd | In Service/Commission | 55.0 | 180 | 200 |
| TRANQUILITY | 1010832 | 538071074 | YACHT | Yacht | 2009 | 2100 | M.T.U. | 16V2000M70 | 2.0 | HSD | 1 | | CAY | 13.00 | 0 | 201 | 672 | 176 | 1 | All | Moran Yacht Management Inc | In Service/Commission | 55.0 | 180 | 200 |
| ILLUSION | 1012050 | 319053400 | YACHT | Yacht | 2011 | 2760 | M.T.U. | 12V4000M53 | 4.8 | HSD | 1 | | CAY | 17.00 | 0 | 288 | 962 | 170 | 1 | All | Success Sail Ltd | In Service/Commission | 55.0 | 180 | 200 |
| LADY NORA | 1012103 | 319165000 | YACHT | Yacht | 2010 | 2100 | M.T.U. | 16V2000M70 | 2.0 | HSD | 1 | | CAY | 15.50 | 0 | 201 | 671 | 0 | 1 | All | Dohle Private Clients Ltd | In Service/Commission | 55.0 | 180 | 200 |
| CARYALI | 1012361 | 319061900 | YACHT | Yacht | 2012 | 2100 | M.T.U. | 16V2000M70 | 2.0 | HSD | 1 | | CAY | 15.50 | 0 | 201 | 671 | 0 | 1 | All | Imperial Yachts SARL | In Service/Commission | 55.0 | 180 | 200 |
| MIA ELISE | 1012385 | 319061400 | YACHT | Yacht | 2012 | 2100 | M.T.U. | 16V2000M70 | 2.0 | HSD | 1 | | CAY | 13.00 | 0 | 201 | 671 | 0 | 1 | All | Catalano Shipping Services SAM | In Service/Commission | 55.0 | 180 | 200 |
| SIBELLE | 1012543 | 319085100 | YACHT | Yacht | 2012 | 2760 | M.T.U. | 12V4000M53 | 4.8 | HSD | 1 | | CAY | 13.00 | 0 | 296 | 988 | 170 | 1 | All | Rptd Sold Hong Kong | In Service/Commission | 55.0 | 180 | 200 |
| 4YOU | 1012660 | 319075600 | YACHT | Yacht | 2013 | 2100 | M.T.U. | 16V2000M70 | 2.0 | HSD | 1 | | CAY | 15.50 | 0 | 201 | 671 | 159 | 1 | All | Moravia Holdings Ltd | In Service/Commission | 55.0 | 180 | 200 |
| VEGA | 1012696 | 319078200 | YACHT | Yacht | 2013 | 2100 | M.T.U. | 16V2000M70 | 2.0 | HSD | 1 | | CAY | 15.50 | 0 | 201 | 671 | 159 | 1 | All | Ocean Management GmbH | In Service/Commission | 55.0 | 180 | 200 |
| AZAMANTA | 1012713 | 319080700 | YACHT | Yacht | 2015 | 2760 | M.T.U. | 12V4000M53 | 4.8 | HSD | 1 | | CAY | 13.00 | 0 | 227 | 757 | 0 | 1 | All | Transatlantic Yacht Management | In Service/Commission | 55.0 | 180 | 200 |
| HALO | 1012775 | 319086500 | YACHT | Yacht | 2013 | 2956 | M.T.U. | 12V4000M63 | 4.8 | HSD | 1 | | CAY | 16.00 | 0 | 300 | 1001 | 244 | 1 | All | Edmiston Yacht Management Ltd | In Service/Commission | 55.0 | 180 | 200 |
| PEGASUS | 9636424 | 235098671 | YACHT | Yacht | 2010 | 3530 | Caterpillar | 3512C | 4.9 | HSD | 1 | | IOM | 15.00 | 0 | 213 | 710 | 0 | 1 | All | Future Trillion Enterprises | In Service/Commission | 55.0 | 180 | 200 |
| WHEELS | 9652868 | 319964000 | YACHT | Yacht | 2010 | 1640 | Caterpillar | 3508B | 4.3 | HSD | 1 | | CAY | 15.00 | 0 | 212 | 707 | 115 | 1 | All | Master Yachts Consultancy SL | In Service/Commission | 55.4 | 182 | 200 |
| SIRONA III | 8990495 | 256393000 | YACHT | Yacht | 1990 | 2252 | M.T.U. | 12V396TE74L | 4.0 | HSD | 1 | | MTA | 17.00 | 0 | 195 | 608 | 0 | 1 | All | Saba Chartering Co Ltd | In Service/Commission | 55.6 | 182 | 200 |
| AXIOMA | 9774202 | 319082200 | YACHT | Yacht | 2012 | 3000 | M.T.U. | 12V4000M63 | 4.8 | HSD | 1 | | CAY | 18.00 | 0 | 303 | 1013 | 0 | 1 | All | Palumbo Group SpA | In Service/Commission | 55.7 | 183 | 200 |
| WISP | 1003267 | 319306000 | YATCH | Yacht | 1981 | 1656 | Caterpillar | D399TA | 4.0 | HSD | 1 | | CAY | 16.00 | 0 | 177 | 591 | 474 | 1 | All | Wilson Yacht Management | In Service/Commission | 55.7 | 183 | 200 |
| ALUCIA | 7347823 | 538005999 | YACHT | Yacht | 1974 | 2984 | Cummins | KTA-50-M2 | 3.2 | HSD | 1 | | SVC | 11.00 | 0 | 418 | 1396 | 959 | 1 | All | Megayacht Technical Services | In Service/Commission | 55.8 | 183 | 200 |
| ELENA | 1012476 | 229863000 | YACHT | Yacht | 2012 | 2760 | M.T.U. | 12V4000M53 | 4.8 | HSD | 1 | | MTA | 12.00 | 0 | 315 | 1051 | 160 | 1 | All | Azimut-Benetti SpA | In Service/Commission | 56.0 | 184 | 200 |
| BG | 1010959 | 235091361 | YACHT | Yacht | 2008 | 2760 | Caterpillar | 3512B | 4.3 | HSD | 1 | | IOM | 16.00 | 0 | 263 | 878 | 190 | 1 | All | Fraser Worldwide SAM | In Service/Commission | 56.1 | 184 | 200 |
| MAGARI | 8810308 | 419751000 | YACHT | Yacht | 1988 | 1103 | Fuji | 6S32G | 49.1 | MSD | 3 | | IND | 11.50 | 0 | 213 | 709 | 103 | 1 | All | Seaport Shipping Pvt Ltd | In Service/Commission | 56.3 | 185 | 200 |
| FAR FAR AWAY | 1007718 | 538070201 | YACHT | Yacht | 2001 | 2610 | Caterpillar | 3512B | 4.3 | HSD | 1 | | MAI | 15.00 | 0 | 275 | 917 | 152 | 1 | All | Fraser Yachts Florida Inc | In Service/Commission | 56.5 | 185 | 200 |
| SCORPION | 9599664 | 319039300 | YACHT | Yacht | 2008 | 3650 | Caterpillar | 3516C-HD | 4.9 | HSD | 1 | | CAY | 12.00 | 0 | 234 | 782 | 138 | 1 | All | Fairport Yacht Support | In Service/Commission | 56.7 | 186 | 200 |
| TOPAZ | 1001178 | 319822000 | YACHT | Yacht | 1986 | 2700 | Deutz | SBV6M628 | 12.7 | MSD | 2 | | CAY | 17.00 | 0 | 210 | 702 | 0 | 1 | All | Vessel Safety Management | In Service/Commission | 57.0 | 187 | 200 |
| SHADOWL | 1006673 | 319833000 | YACHT | Yacht | 1998 | 2320 | Deutz | TBD620BV12 | 4.4 | HSD | 1 | | CAY | 15.00 | 0 | 297 | 993 | 240 | 1 | All | YCO SAM | In Service/Commission | 57.0 | 187 | 200 |
| TATIANA | 1011991 | 319061300 | YACHT | Yacht (Saili | 2011 | 1081 | Caterpillar | C32 | 2.7 | HSD | 1 | | CAY | 17.40 | 0 | 149 | 498 | 71 | 1 | All | Atlas Glove Ltd | In Service/Commission | 57.0 | 187 | 200 |
| TROPIC SUN | 1006013 | 319002100 | YACHT | Yacht | 1996 | 2802 | Caterpillar | 3516TA | 4.3 | HSD | 1 | | CAY | 16.00 | 0 | 314 | 1049 | 0 | 1 | All | Diamond A Maritime Co | In Service/Commission | 57.3 | 188 | 200 |
| LA DOLCE VITA | 1007017 | 319807000 | YACHT | Yacht | 1999 | 2864 | Caterpillar | 3516TA | 4.3 | HSD | 1 | | CAY | 16.00 | 0 | 327 | 1092 | 180 | 1 | All | Dynamic Yacht Management LLC | In Service/Commission | 57.3 | 188 | 200 |
| ZABAVA | 1000019 | | YATCH | Yacht | 1961 | 1236 | Sulzer | 8TAD24 | 18.1 | MSD | 2 | | PAN | 13.50 | 0 | 165 | 551 | 164 | 1 | All | Azure Maritime Ltd | In Service/Commission | 57.6 | 189 | 200 |
| ARETE | 1011903 | 319167000 | YACHT | Yacht | 2011 | 2280 | M.T.U. | 12V4000M53R | 4.8 | HSD | 1 | | CAY | 15.50 | 0 | 282 | 941 | 0 | 1 | All | YCO SAM | In Service/Commission | 57.6 | 189 | 200 |
| AURORA B | 1009170 | 319201000 | YACHT | Yacht | 2004 | 2982 | Caterpillar | 3516B-TA | 4.3 | HSD | 1 | | CAY | 16.00 | 0 | 329 | 1099 | 185 | 1 | All | Dynamic Yacht Management LLC | In Service/Commission | 57.8 | 189 | 200 |
| MY SECRET | 1012452 | 229907000 | YACHT | Yacht | 2014 | 2760 | Caterpillar | 3512 | 4.3 | HSD | 1 | | MTA | 18.00 | 0 | 288 | 963 | 188 | 1 | All | Camper & Nicholsons France | In Service/Commission | 58.0 | 190 | 200 |
| VARIETY VOYAGER | 9499785 | 538070921 | YACHT | Yacht | 2007 | 3000 | M.T.U. | 12V4000M61 | 4.1 | HSD | 1 | | MAI | 16.00 | 0 | 281 | 939 | 297 | 1 | All | Hill Robinson Yacht Management | In Service/Commission | 58.2 | 191 | 200 |
| COCKTAILS | 9590383 | 319025100 | YACHT | Yacht | 2005 | 3372 | Caterpillar | 3516B-HD | 4.9 | HSD | 1 | | CAY | 12.00 | 0 | 224 | 749 | 157 | 1 | All | Fairport Yacht Support | In Service/Commission | 58.2 | 191 | 200 |
| CORAL ISLAND | 9526318 | 319003900 | YACHT | Yacht | 2005 | 2960 | Caterpillar | 3512 | 4.3 | HSD | 1 | | CAY | 18.00 | 0 | 240 | 803 | 234 | 1 | All | BURGESS | In Service/Commission | 58.2 | 191 | 200 |
| GANESHA | 1003085 | 240661000 | YACHT | Yacht | 1986 | 2312 | Caterpillar | 3516TA | 4.3 | HSD | 1 | | GRC | 14.00 | 0 | 245 | 819 | 0 | 1 | All | Thetis Shipholding SA | In Service/Commission | 58.5 | 192 | 200 |
| JUST J'S | 9669366 | 235097329 | YACHT | Yacht (Saili | 2011 | 1440 | M.T.U. | 8V2000M72 | 2.2 | HSD | 1 | | IOM | 15.50 | 0 | 147 | 491 | 60 | 1 | All | Ox Pasture Chartering Ltd | In Service/Commission | 58.6 | 192 | 200 |
| SOLANDGE | 9722132 | 235102716 | YACHT | Yacht (Saili | 2015 | 1440 | M.T.U. | 8V2000M72 | 2.2 | HSD | 1 | | IOM | 12.50 | 0 | 147 | 491 | 71 | 1 | All | Dohle Private Clients Ltd | In Service/Commission | 58.6 | 192 | 200 |
| PALMARINA | 1011642 | 319733000 | YACHT | Yacht | 2010 | 3000 | Caterpillar | 3512C | 4.9 | HSD | 1 | | CAY | 13.00 | 0 | 335 | 1119 | 250 | 1 | All | Imperial Yachts SARL | In Service/Commission | 58.8 | 193 | 200 |
| UNBRIDLED | 9559755 | 319893000 | YACHT | Yacht | 2006 | 1480 | Caterpillar | 3512TA | 4.3 | HSD | 1 | | CAY | 14.00 | 0 | 315 | 1052 | 275 | 1 | All | Fancy Style Investments Ltd | In Service/Commission | 59.8 | 196 | 200 |
| BLUE PAPILLON | 1002990 | 319403000 | YACHT | Yacht | 1983 | 4414 | M.T.U. | 12V1163TB62 | 11.6 | MSD | 2 | | CAY | 19.00 | 0 | 290 | 968 | 770 | 1 | All | YCO SAM | In Service/Commission | 60.0 | 197 | 200 |
| DRUMBEAT | 1006946 | 319646000 | YACHT | Yacht | 1999 | 2984 | Caterpillar | 3516TA | 4.3 | HSD | 1 | | CAY | 16.50 | 0 | 327 | 1092 | 0 | 1 | All | Fraser Worldwide SAM | In Service/Commission | 60.0 | 197 | 200 |
| PHAEDRA | 1008994 | 319271000 | YACHT | Yacht | 2004 | 4000 | Caterpillar | 3516B-DITA | 4.9 | HSD | 1 | | CAY | 17.00 | 0 | 464 | 1549 | 0 | 1 | All | Inserve Yachts Ltd | In Service/Commission | 60.0 | 197 | 200 |
| CAROLINA | 1010947 | 319806000 | YACHT | Yacht | 2007 | 2760 | Caterpillar | 3512B | 4.3 | HSD | 1 | | CAY | 16.00 | 0 | 318 | 1060 | 240 | 1 | All | BURGESS | In Service/Commission | 60.0 | 197 | 200 |
| KRISS | 1011654 | 319077800 | YACHT | Yacht | 2015 | 3530 | Caterpillar | 3512C | 4.9 | HSD | 1 | | CAY | 16.50 | 0 | 342 | 1140 | 250 | 1 | All | Yachting Concept Sarl | In Service/Commission | 60.0 | 197 | 200 |
| MOKA | 1012426 | 319099400 | YACHT | Yacht | 2012 | 2880 | M.T.U. | 16V4000M73L | 4.3 | HSD | 1 | | CAY | 12.00 | 0 | 308 | 1029 | 235 | 1 | All | Alya Yatcilik Sanayi | In Service/Commission | 60.0 | 197 | 200 |
| D'NATALIN IV | 8972443 | 319092300 | YACHT | Yacht | 1996 | 3044 | Caterpillar | 3512B | 4.3 | HSD | 1 | | UNK | 18.00 | 0 | 296 | 987 | 0 | 1 | All | Al Seer Marine Supplies | In Service/Commission | 60.0 | 197 | 200 |
| BELLE ANNA | 9668594 | 319079700 | YACHT | Yacht | 2010 | 2760 | M.T.U. | 12V4000M53 | 4.8 | HSD | 1 | | CAY | 15.00 | 0 | 326 | 1089 | 240 | 1 | All | Fraser Yachts Monaco SAM | In Service/Commission | 60.0 | 197 | 200 |
| ACE | 9712838 | 538071106 | YACHT | Yacht | 2013 | 2000 | Cummins | KTA-38-M2 | 3.2 | HSD | 1 | | MAI | 13.70 | 0 | 363 | 1212 | 253 | 1 | All | Exmar Yachting NV | In Service/Commission | 60.0 | 197 | 200 |
| DOUBLE TROUBLE | 1008920 | 319821000 | YACHT | Yacht | 2004 | 3372 | Caterpillar | 3516B-HD-DITA | 4.9 | HSD | 1 | | CAY | 14.00 | 0 | 416 | 1428 | 0 | 1 | All | International Yacht Collection | In Service/Commission | 60.1 | 197 | 200 |

| VESSNAME | IMO | MMSI | SHIP_TYPE | LLOYDS_TY | KEEL | MAIN_KW | DESIGN | DESIGNATIO | DISP | MAIN_ENGIN | CATEGORY | AUX_KW | LL_FLAG | SPEED | TEUS | NRT | GT | DWT | DWT_CATEGO | DWT_RANGE | OPERATOR | STATUS | Length (m) | Length (ft) | Slip |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 60 YEARS | 1008360 | 319984000 | YACHT | Yacht | 2003 | 2984 | Caterpillar | 3516B-DITA | 4.3 | HSD | 1 |  | CAY | 16.40 | 0 | 330 | 1102 | 137 | 1 | All | Moore K | In Service/Commission | 60.4 | 198 | 200 |
| SCOUT | 1012347 | 319072900 | YACHT | Yacht | 2012 | 2280 | M.T.U. | 12V4000M53R | 4.8 | HSD | 1 |  | CAY | 15.00 | 0 | 315 | 1052 | 172 | 1 | All | Ocean Management GmbH | In Service/Commission | 60.5 | 199 | 200 |
| LAU TRADER | 1004675 | 319305000 | YACHT | Yacht | 1994 | 2550 | Caterpillar | 3516TA | 4.3 | HSD | 1 |  | CAY | 16.00 | 0 | 308 | 1028 | 0 | 1 | All | Fraser Yachts Florida Inc | In Service/Commission | 60.6 | 199 | 200 |
| FAITH | 9563524 | 538080087 | YACHT | Yacht | 2009 | 2984 | M.T.U. | 16V4000M53R | 4.8 | HSD | 1 |  | MAI | 15.50 | 0 | 489 | 1632 | 185 | 1 | All | Vessel Safety Management | In Service/Commission | 60.9 | 200 | 200 |
| VOYAGER | 1012048 | 319064100 | YACHT | Yacht | 2011 | 2460 | Caterpillar | 3512C | 4.3 | HSD | 1 |  | CAY | 16.50 | 0 | 321 | 1070 | 125 | 1 | All | FOS4U SA | In Service/Commission | 61.0 | 200 | 200 |
| MYSTERE C. I. | 1012567 | 319088500 | YACHT | Yacht | 2016 | 3530 | Caterpillar | 3512C | 4.9 | HSD | 1 |  | CAY | 13.00 | 0 | 0 | 1160 | 0 | 1 | All | Rptd Sold Undisclosed Interest | In Service/Commission | 61.0 | 200 | 200 |
| CASINO ROYALE | 8985957 | 353270000 | YACHT | Yacht | 1972 | 1654 | Caterpillar | D399SCAC | 4.0 | HSD | 1 |  | PAN | 13.00 | 0 | 234 | 780 | 0 | 1 | All | Rptd Sold Undisclosed Interest | In Service/Commission | 61.0 | 200 | 200 |
| SAFIRA | 1006544 | 319868000 | YACHT | Yacht | 2000 | 3878 | Caterpillar | 3516B-TA | 4.3 | HSD | 1 |  | CAY | 17.00 | 0 | 344 | 1149 | 0 | 1 | All | Pacific Yacht Operations | In Service/Commission | 61.5 | 202 | 240 |
| NONO | 1011604 | 311000106 | YACHT | Yacht | 2009 | 3040 | M.T.U. | 16V4000M53R | 4.8 | HSD | 1 |  | BAH | 16.00 | 0 | 448 | 1494 | 236 | 1 | All | Edge Yachts Ltd | In Service/Commission | 62.0 | 203 | 240 |
| VIKING LEGACY | 1004493 | 310181000 | YACHT | Yacht | 1990 | 2400 | MAN | 12V20/27 | 8.5 | MSD | 2 |  | BER | 12.00 | 0 | 308 | 1027 | 0 | 1 | All | Megayacht Technical Services | In Service/Commission | 62.2 | 204 | 240 |
| SOLIS | 1006697 | 319571000 | YACHT | Yacht | 1998 | 2984 | Caterpillar | 3516B-TA | 4.3 | HSD | 1 |  | CAY | 17.00 | 0 | 323 | 1078 | 241 | 1 | All | Vessel Safety Management | In Service/Commission | 62.3 | 204 | 240 |
| ANDREA | 1010258 | 319573000 | YACHT | Yacht | 2007 | 3700 | M.T.U. | 12V4000M71 | 4.1 | HSD | 1 |  | CAY | 16.00 | 0 | 379 | 1266 | 240 | 1 | All | Fairport Yacht Support | In Service/Commission | 62.5 | 205 | 240 |
| OHANA | 1007990 | 235009930 | YACHT | Yacht | 2002 | 3370 | Caterpillar | 3516B-HD | 4.9 | HSD | 1 |  | IOM | 16.00 | 0 | 416 | 1389 | 273 | 1 | All | Bimini Yachting Ltd | In Service/Commission | 63.0 | 207 | 240 |
| ENDLESS SUMMER | 1011056 | 319594000 | YACHT | Yacht | 2008 | 3040 | M.T.U. | 16V4000M61 | 4.1 | HSD | 1 |  | CAY | 16.00 | 0 | 369 | 1231 | 0 | 1 | All | Vessel Safety Management | In Service/Commission | 63.0 | 207 | 240 |
| GRACEFUL | 9776535 | 235110453 | YACHT | Yacht | 2012 | 3000 | M.T.U. | 12V4000M63 | 4.8 | HSD | 1 |  | IOM | 17.00 | 0 | 404 | 1347 | 0 | 1 | All | Corpus Ventures Corp-BVI | In Service/Commission | 63.1 | 207 | 240 |
| ATALANTE | 1001544 | 319908000 | YACHT | Yacht | 1988 | 3050 | Deutz | SBV8M628 | 12.7 | MSD | 2 |  | CAY | 18.00 | 0 | 340 | 1134 | 0 | 1 | All | Hill Robinson Yacht Management | In Service/Commission | 64.0 | 210 | 240 |
| CARDIGRAE VI | 1005679 | 235000230 | YACHT | Yacht (Saili | 1996 | 588 | Cummins | NTA-855-M | 2.3 | HSD | 1 |  | GBI | 12.00 | 0 | 175 | 586 | 0 | 1 | All | Jubilee Sailing Trust Ltd | In Service/Commission | 65.0 | 213 | 240 |
| CARSON | 1011977 | 319062900 | YACHT | Yacht | 2011 | 4000 | Caterpillar | 3516C | 4.9 | HSD | 1 |  | CAY | 13.00 | 0 | 449 | 1499 | 0 | 1 | All | Edmiston Yacht Management Ltd | In Service/Commission | 65.0 | 213 | 240 |
| LOIA | 1010648 | 319020900 | YACHT | Yacht | 2008 | 4000 | Caterpillar | 3516C | 4.9 | HSD | 1 |  | CAY | 17.00 | 0 | 450 | 1503 | 0 | 1 | All | Ocean Management GmbH | In Service/Commission | 65.5 | 215 | 240 |
| GOLDEN EAGLE | 1011082 | 319329000 | YACHT | Yacht | 2008 | 3840 | Caterpillar | 3516B-HD | 4.9 | HSD | 1 |  | CAY | 17.00 | 0 | 583 | 1943 | 432 | 1 | All | BURGESS | In Service/Commission | 65.5 | 215 | 240 |
| KISS | 1012189 | 319072300 | YACHT | Yacht | 2014 | 3000 | M.T.U. | 12V4000M63 | 4.8 | HSD | 1 |  | CAY | 18.00 | 0 | 458 | 1527 | 238 | 1 | All | B Yachting Sarl | In Service/Commission | 66.0 | 216 | 240 |
| LATIKO | 1012335 | 319064900 | YACHT | Yacht | 2012 | 3530 | Caterpillar | 3512C-HD | 4.9 | HSD | 1 |  | CAY | 18.00 | 0 | 344 | 1149 | 180 | 1 | All | Keely Yachting Ltd | In Service/Commission | 66.0 | 216 | 240 |
| C SIDE | 1005136 | 310094000 | YACHT | Yacht | 1993 | 3960 | Deutz | SBV9M628 | 12.7 | MSD | 2 |  | BER | 16.00 | 0 | 387 | 1293 | 1016 | 1 | All | Fraser Worldwide SAM | In Service/Commission | 66.8 | 219 | 240 |
| ERICA XI OF HAMILTON | 1000150 | 232398000 | YACHT | Yacht (Saili | 1984 | 397 | MAN | D2848LXE | 1.8 | HSD | 1 |  | GBI | 10.00 | 0 | 87 | 291 | 0 | 1 | All | Cherokee Bay Ltd | In Service/Commission | 67.0 | 220 | 240 |
| BIG FISH | 1011719 | 256701000 | YACHT | Yacht | 2009 | 3040 | M.T.U. | 16V4000M | 4.1 | HSD | 1 |  | MTA | 15.00 | 0 | 380 | 1269 | 0 | 1 | All | Camper & Nicholsons France | In Service/Commission | 67.0 | 220 | 240 |
| FLEURTJE | 1006099 | 319421000 | YACHT | Yacht | 1996 | 2984 | Caterpillar | 3516TA | 4.3 | HSD | 1 |  | CAY | 16.00 | 0 | 386 | 1289 | 0 | 1 | All | Arran Point Charters Ltd | In Service/Commission | 68.6 | 225 | 240 |
| PERSEUS 3 | 1011185 | 256977000 | YACHT | Yacht | 2011 | 3650 | Caterpillar | 3516B-HD | 4.9 | HSD | 1 |  | MTA | 16.50 | 0 | 0 | 1467 | 287 | 1 | All | Magellan Management | In Service/Commission | 69.3 | 227 | 240 |
| LUNAR | 1007287 | 319741000 | YACHT | Yacht | 2000 | 4000 | M.T.U. | 16V4000M70 | 4.1 | HSD | 1 |  | CAY | 17.00 | 0 | 599 | 1998 | 285 | 1 | All | Fraser Yachts Florida Inc | In Service/Commission | 70.7 | 232 | 240 |
| Z | 9735244 | 256477000 | YACHT | Yacht | 2015 | 4634 | Caterpillar | 3516C | 4.3 | HSD | 1 |  | MTA | 15.50 | 0 | 512 | 1708 | 340 | 1 | All | Golden Yachts Ltd | In Service/Commission | 71.0 | 233 | 240 |
| QING | 1011109 | 319088700 | YACHT | Yacht | 2008 | 4000 | Caterpillar | 3516-HD | 4.9 | HSD | 1 |  | CAY | 18.00 | 0 | 634 | 2114 | 0 | 1 | All | Hill Robinson Yacht Management | In Service/Commission | 72.0 | 236 | 240 |
| AMARYLLIS | 9571143 | 229894000 | YACHT | Yacht | 2007 | 4632 | Caterpillar | 3516C | 4.9 | HSD | 1 |  | MTA | 17.00 | 0 | 486 | 1620 | 262 | 1 | All | Yachting Partners Intl Monaco | In Service/Commission | 72.0 | 236 | 240 |
| DIAMONDS ARE FOREVER | 9334442 | 240349000 | YACHT | Yacht | 2002 | 3324 | Caterpillar | 3516B-HD | 4.9 | HSD | 1 |  | GRC | 17.00 | 0 | 462 | 1541 | 500 | 1 | All | WEM Lines SA | In Service/Commission | 72.5 | 238 | 240 |
| BEAUGESTE | 1004833 | 310077000 | YACHT | Yacht | 1992 | 2864 | Caterpillar | 3516TA | 4.3 | HSD | 1 |  | BER | 12.00 | 0 | 413 | 1379 | 0 | 1 | All | Coral Island | In Service/Commission | 72.6 | 238 | 240 |
| KARIMA | 1011886 | 319048800 | YACHT | Yacht | 2014 | 3280 | Caterpillar | C32 | 2.7 | HSD | 1 |  | GBI | 16.50 | 0 | 562 | 1590 | 0 | 1 | All | BURGESS | In Service/Commission | 73.0 | 239 | 240 |
| CHOPI CHOPI | 9645671 | 538070951 | YACHT | Yacht | 2009 | 3520 | M.T.U. | 16V4000M60 | 4.1 | HSD | 1 |  | MAI | 17.00 | 0 | 531 | 1767 | 1530 | 1 | All | Camper & Nicholsons France | In Service/Commission | 73.1 | 240 | 240 |
| NOVA SPIRIT | 9650602 | 319618000 | YACHT | Yacht | 2009 | 3520 | M.T.U. | 16V4000M60 | 4.1 | HSD | 1 |  | CAY | 17.00 | 0 | 400 | 1773 | 220 | 1 | All | Royale Oceanic Intl Yacht | In Service/Commission | 73.1 | 240 | 240 |

Tons per year

| Row Labels | Population | Total Hours | NOx | PM10 | PM2.5 | ROG | CO | SOx | CO2 |
|---|---|---|---|---|---|---|---|---|---|
| **Inboard** | **7,229** | **433,764** | **0.3391** | **0.0071** | **0.0054** | **0.4929** | **2.9576** | **0.0004** | **36.2421** |
| **Diesel** | **2,313** | **138,804** | **0.1984** | **0.0044** | **0.0033** | **0.0588** | **0.0879** | **0.0001** | **10.0187** |
| 15 | 289 | 17,351 | 0.0010 | 0.0000 | 0.0000 | 0.0003 | 0.0005 | 0.0000 | 0.0701 |
| 25 | 289 | 17,351 | 0.0024 | 0.0001 | 0.0000 | 0.0007 | 0.0011 | 0.0000 | 0.1597 |
| 50 | 289 | 17,351 | 0.0044 | 0.0001 | 0.0001 | 0.0013 | 0.0020 | 0.0000 | 0.2685 |
| 120 | 289 | 17,351 | 0.0100 | 0.0002 | 0.0002 | 0.0030 | 0.0044 | 0.0000 | 0.5622 |
| 175 | 289 | 17,351 | 0.0173 | 0.0004 | 0.0003 | 0.0051 | 0.0076 | 0.0000 | 0.8857 |
| 250 | 289 | 17,351 | 0.0292 | 0.0007 | 0.0006 | 0.0086 | 0.0129 | 0.0000 | 1.4493 |
| 500 | 289 | 17,351 | 0.0467 | 0.0010 | 0.0008 | 0.0138 | 0.0207 | 0.0000 | 2.3100 |
| 750 | 289 | 17,351 | 0.0875 | 0.0020 | 0.0015 | 0.0259 | 0.0388 | 0.0000 | 4.3133 |
| **Gasoline** | **4,916** | **294,959** | **0.1407** | **0.0027** | **0.0021** | **0.4340** | **2.8697** | **0.0003** | **26.2234** |
| 15 | 925 | 55,482 | 0.0012 | 0.0000 | 0.0000 | 0.0213 | 0.0331 | 0.0000 | 0.2479 |
| 25 | | | - | - | - | - | - | - | - |
| 50 | | | - | - | - | - | - | - | - |
| 120 | | | - | - | - | - | - | - | - |
| 175 | | | - | - | - | - | - | - | - |
| 250 | 730 | 43,778 | 0.0821 | 0.0003 | 0.0003 | 0.0587 | 0.3139 | 0.0000 | 3.5015 |
| 500 | 3,258 | 195,468 | 0.1072 | 0.0023 | 0.0018 | 0.3538 | 2.5198 | 0.0003 | 22.4297 |
| 750 | 4 | 232 | 0.0001 | 0.0000 | 0.0000 | 0.0002 | 0.0029 | 0.0000 | 0.0443 |
| **Outboard** | **23,614** | **1,464,097** | **0.4643** | **0.3314** | **0.2504** | **4.4117** | **11.0895** | **0.0008** | **50.4172** |
| **Gasoline** | **23,614** | **1,464,097** | **0.4643** | **0.3314** | **0.2504** | **4.4117** | **11.0895** | **0.0008** | **50.4172** |
| 15 | 7,369 | 456,894 | 0.0153 | 0.0128 | 0.0097 | 0.3835 | 0.5616 | 0.0000 | 1.9725 |
| 25 | 3,193 | 197,963 | 0.0179 | 0.0178 | 0.0134 | 0.3597 | 0.5806 | 0.0000 | 2.2097 |
| 50 | 4,276 | 265,111 | 0.0516 | 0.0422 | 0.0319 | 0.7743 | 1.4107 | 0.0001 | 5.7001 |
| 120 | 5,244 | 325,130 | 0.1252 | 0.1001 | 0.0757 | 1.5766 | 3.5174 | 0.0003 | 15.5672 |
| 175 | 1,508 | 93,486 | 0.0644 | 0.0506 | 0.0382 | 0.6497 | 1.9236 | 0.0001 | 8.2802 |
| 250 | 1,558 | 96,605 | 0.1410 | 0.0918 | 0.0698 | 0.5754 | 2.0807 | 0.0002 | 12.2641 |
| 500 | 466 | 28,910 | 0.0488 | 0.0161 | 0.0122 | 0.0924 | 1.0150 | 0.0001 | 4.4235 |
| 750 | | | - | - | - | - | - | - | - |
| **Stemdrive** | **15,780** | **741,650** | **0.3968** | **0.0045** | **0.0034** | **0.7133** | **3.2669** | **0.0005** | **43.9182** |
| **Gasoline** | **15,780** | **741,650** | **0.3968** | **0.0045** | **0.0034** | **0.7133** | **3.2669** | **0.0005** | **43.9182** |
| 15 | 4,001 | 188,064 | 0.0071 | 0.0001 | 0.0001 | 0.0713 | 0.1091 | 0.0000 | 0.8392 |
| 25 | | | - | - | - | - | - | - | - |
| 50 | | | - | - | - | - | - | - | - |
| 120 | 1 | 33 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0001 | 0.0000 | 0.0012 |
| 175 | 3,597 | 169,071 | 0.1548 | 0.0010 | 0.0008 | 0.1123 | 0.5667 | 0.0001 | 9.9290 |
| 250 | 4,983 | 234,205 | 0.1551 | 0.0017 | 0.0013 | 0.2924 | 1.5758 | 0.0002 | 17.3277 |
| 500 | 3,180 | 149,450 | 0.0789 | 0.0016 | 0.0012 | 0.2340 | 1.0097 | 0.0002 | 15.6629 |
| 750 | 18 | 827 | 0.0009 | 0.0000 | 0.0000 | 0.0032 | 0.0056 | 0.0000 | 0.1581 |
| **Grand Total** | **46,624** | **2,639,511** | **1.2002** | **0.3430** | **0.2591** | **5.6178** | **17.3140** | **0.0017** | **130.5775** |

365.00

| pop | hrs | hrs/year | hrs/day |
|---|---|---|---|
| 7,229 | 433,764 | 60.0000 | 0.16 |
| 2,313 | 138,804 | 60.0000 | 0.16 |
| 4,916 | 294,959 | 60.0000 | 0.16 |
| 23,614 | 1,464,097 | 62.0000 | 0.17 |
| 23,614 | 1,464,097 | 62.0000 | 0.17 |
| 15,780 | 741,650 | 47.0000 | 0.13 |
| 15,780 | 741,650 | 47.0000 | 0.13 |
| 46,624 | 2,639,511 | 56.6131 | 0.16 |

From GHG Inventory Sources and Sinks 2015

| | CH4 | N2O | CO2 |
|---|---|---|---|
| Diesel | 0.02 | 0.14 | 3194 |
| Gasoline | 0.23 | 0.08 | 3085 |

From GREET 2016

| | Carbon | CO2 |
|---|---|---|
| Diesel | 87.1% | 3194 |
| Gasoline | 82.8% | 3085 |

Diesel
Emission Rates (g/hr)

| Slip Size | Hr/yr | NOx | PM10 | PM2.5 | ROG | CO | SOx | CO2 | CH4 | N2O | Share |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50 | 60 | 1.52 | 0.034 | 0.026 | 0.45 | 0.68 | 0.001 | 0.7 | 0.000 | 0.000 | 5% |
| 60 | 60 | 2.44 | 0.054 | 0.041 | 0.72 | 1.08 | 0.001 | 1.1 | 0.000 | 0.000 | 4% |
| 75 | 60 | 4.57 | 0.102 | 0.077 | 1.36 | 2.03 | 0.003 | 2.0 | 0.000 | 0.000 | 93% |

Gasoline
Emission Rates (g/hr)

| Slip Size | Hr/yr | NOx | PM10 | PM2.5 | ROG | CO | SOx | CO2 | CH4 | N2O | Share |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50 | 60 | 0.67 | 0.007 | 0.005 | 1.22 | 6.50 | 0.001 | 6.5 | 0.000 | 0.000 | 12% |
| 60 | 60 | 0.50 | 0.011 | 0.008 | 1.64 | 11.69 | 0.001 | 11.7 | 0.001 | 0.000 | 48% |
| 75 | 60 | 0.24 | 0.018 | 0.014 | 0.89 | 11.43 | 0.002 | 11.4 | 0.001 | 0.000 | 1% |

10.19 mins/day?

| | Inboard | Outboard | Stemdrive | overall |
|---|---|---|---|---|
| 50 | 60 | 60 | 47 | 49.2 |
| 60 | 60 | 60 | 47 | 53.9 |
| 75 | 60 | 60 | 47 | 59.3 |

Gasoline
Emission Rates (g/hr)

| Slip Size | Hr/yr | NOx | PM10 | PM2.5 | ROG | CO | SOx | CO2 | CH4 | N2O | Share |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50 | 47 | 0.60 | 0.007 | 0.005 | 1.13 | 6.10 | 0.001 | 6.1 | 0.000 | 0.000 | 83% |
| 60 | 47 | 0.48 | 0.010 | 0.007 | 1.42 | 6.13 | 0.001 | 6.1 | 0.000 | 0.000 | 47% |
| 75 | 47 | 1.02 | 0.018 | 0.014 | 3.54 | 6.18 | 0.002 | 6.2 | 0.000 | 0.000 | 6% |

Average Emission Rates (g/hr)

| Slip Size | Hr/yr | NOx | PM10 | PM2.5 | ROG | CO | SOx | CO2 | CH4 | N2O |
|---|---|---|---|---|---|---|---|---|---|---|
| 50 | 49.2 | 0.65 | 0.01 | 0.01 | 1.11 | 5.89 | 0.001 | 5.9 | 0.000 | 0.000 |
| 60 | 53.9 | 0.57 | 0.01 | 0.01 | 1.50 | 8.61 | 0.001 | 8.6 | 0.001 | 0.000 |
| 75 | 59.3 | 4.32 | 0.10 | 0.07 | 1.47 | 2.38 | 0.003 | 2.4 | 0.000 | 0.000 |

FAL to Point Loma 8.38 nm
Point Loma to OC 46.00 nm

| Row Labels | Model Yr | Prop kW | Service Speed | Hp Prop | Aux | One-Way Time | Age 2016 | 2021 | 2032 | |
|---|---|---|---|---|---|---|---|---|---|---|
| 100 | 1999 | 764 | 11.75 | 1,024 | 102 | 5.78 | 17.18 | 22.18 | 33.18 | 0.66 |
| 125 | 1999 | 1,597 | 14.30 | 2,141 | 214 | 5.08 | 16.71 | 21.71 | 32.71 | - |
| 150 | 2003 | 2,199 | 15.02 | 2,949 | 295 | 4.93 | 12.56 | 17.56 | 28.56 | 0.31 |
| 175 | 2000 | 2,319 | 15.44 | 3,109 | 311 | 4.84 | 16.03 | 21.03 | 32.03 | - |
| 200 | 2004 | 2,602 | 15.30 | 3,489 | 349 | 4.91 | 12.38 | 17.38 | 28.38 | - |
| 240 | 2004 | 3,284 | 15.88 | 4,402 | 440 | 4.76 | 12.14 | 17.14 | 28.14 | 0.03 |
| **Grand Total** | **2002** | **2,280** | **15.05** | | | | | | | |

Ratio set at 30% based upon 2015 Port of Los Angeles Inventory for Crew Boats

Calls

Turn-over 55 days 6.64 Hoteling per call 13.20 hours
Speed 4.5 knot

Load Factors

| Propulsion | Auxiliary |
|---|---|
| 0.45 | 0.43 |

Based upon Crew Boats in ARB Harborcraft methodology

Electricity GHGs

| | | | | | RPS |
|---|---|---|---|---|---|
| 2016 | 568 | lb/MWh | 190.39 | g/hp-hr | 35.2% |
| 2021 | 535 | lb/Mwh | 180.88 | g/hp-hr | 45.2% |
| 2030 | 492 | lb/Mwh | 166.49 | g/hp-hr | 50.0% |
| 2021/2032 bau | 782 | lb/Mwh | 264.64 | g/hp-hr | 33.0% (same as CAP BAU for 2020) |
| 1MW = | 1340.48 | hp | | | |

0.68

Taken from 2013 Port of Long Beach Inventory

| | g/kwh | | g/hp-hr | |
|---|---|---|---|---|
| Engine | CH4 | N2O | CH4 | N2O |
| Propulsion | 0.018 | 0.031 | 0.013 | 0.023 |
| Auxiliary | 0.022 | 0.031 | 0.016 | 0.023 |

ULSD

| | |
|---|---|
| Carbon Content | 87.1% |
| CO2/C | 3.666667 |
| CO2/fuel | 3.193667 |

Zero Hour Emission Factors (g/hp-hr)

| Slip Size | Engine | NOx | DPM | PM2.5 | ROG | CO | SOx | CO2 | CH4 | N2O |
|---|---|---|---|---|---|---|---|---|---|---|
| 100 | Propulsion | 9.64 | 0.36 | 0.35 | 0.68 | 1.97 | 0.13 | 588 | 0.013 | 0.023 |
| | Auxiliary | 8.75 | 0.58 | 0.56 | 1.18 | 3.59 | 0.13 | 588 | 0.016 | 0.023 |
| 125 | Propulsion | 9.64 | 0.36 | 0.35 | 0.68 | 1.97 | 0.13 | 588 | 0.013 | 0.023 |
| | Auxiliary | 8.17 | 0.32 | 0.31 | 0.81 | 2.78 | 0.13 | 588 | 0.016 | 0.023 |
| 150 | Propulsion | 7.31 | 0.36 | 0.35 | 0.68 | 1.97 | 0.13 | 588 | 0.013 | 0.023 |
| | Auxiliary | 7.31 | 0.32 | 0.31 | 0.81 | 2.78 | 0.13 | 588 | 0.016 | 0.023 |
| 175 | Propulsion | 7.31 | 0.36 | 0.35 | 0.68 | 1.97 | 0.13 | 588 | 0.013 | 0.023 |
| | Auxiliary | 7.31 | 0.32 | 0.31 | 0.81 | 2.78 | 0.13 | 588 | 0.016 | 0.023 |
| 200 | Propulsion | 7.31 | 0.36 | 0.35 | 0.68 | 1.97 | 0.13 | 588 | 0.013 | 0.023 |
| | Auxiliary | 5.30 | 0.15 | 0.15 | 0.81 | 3.73 | 0.13 | 588 | 0.016 | 0.023 |
| 240 | Propulsion | 7.31 | 0.36 | 0.35 | 0.68 | 1.97 | 0.13 | 588 | 0.013 | 0.023 |
| | Auxiliary | 5.30 | 0.15 | 0.15 | 0.81 | 3.73 | 0.13 | 588 | 0.016 | 0.023 |

Taken from ARB Harborcraft Inventory Methodology
Diesel Emission Rates (Zero Hour - non fuel corrected)

| HP | | Model | Zero Hour Non-Fuel Corrected Emission Factors (g/bhp-hr) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Min | Max | Year | ME ROG | ME CO | ME NOx | ME PM | AE ROG | AE CO | AE NOx | AE PM | Fuel | CO2 | SOx |
| 51 | 120 | 1999 | 0.99 | 2.55 | 10.33 | 0.66 | 1.18 | 3.59 | 8.75 | 0.58 | 184.16 | 588 | 0.129 |
| 176 | 250 | 1999 | 0.68 | 1.97 | 9.64 | 0.36 | 0.81 | 2.78 | 8.17 | 0.32 | 184.16 | 588 | 0.129 |
| 251 | 500 | 2000 | 0.68 | 1.97 | 7.31 | 0.36 | 0.81 | 2.78 | 7.31 | 0.32 | 184.16 | 588 | 0.129 |
| 251 | 500 | 2003 | 0.68 | 1.97 | 7.31 | 0.36 | 0.81 | 2.78 | 7.31 | 0.32 | 184.16 | 588 | 0.129 |
| 251 | 500 | 2004 | 0.68 | 3.73 | 5.10 | 0.15 | 0.81 | 3.73 | 5.10 | 0.15 | 184.16 | 588 | 0.129 |
| 751 | 1900 | 1999 | 0.68 | 1.97 | 9.64 | 0.36 | 0.81 | 2.78 | 8.17 | 0.32 | 184.16 | 588 | 0.129 |
| 1901 | 3300 | 1999 | 0.68 | 1.97 | 9.64 | 0.36 | 0.81 | 2.78 | 8.17 | 0.32 | 184.16 | 588 | 0.129 |
| 1901 | 3300 | 2000 | 0.68 | 1.97 | 7.31 | 0.36 | 0.81 | 2.78 | 7.31 | 0.32 | 184.16 | 588 | 0.129 |
| 1901 | 3300 | 2003 | 0.68 | 1.97 | 7.31 | 0.36 | 0.81 | 2.78 | 7.31 | 0.32 | 184.16 | 588 | 0.129 |
| 3301 | 5000 | 2004 | 0.68 | 1.97 | 7.31 | 0.36 | 0.81 | 2.78 | 7.31 | 0.32 | 184.16 | 588 | 0.129 |

Harborcraft ULSD Correction Factors

| Years | NOx | DPM | PM2.5 | ROG | CO | SOx | CO2 | CH4 | N2O |
|---|---|---|---|---|---|---|---|---|---|
| Pre-1995 | 0.930 | 0.720 | 0.720 | 0.720 | 1.000 | 0.043 | 1.000 | 0.720 | 0.930 |
| 1996-2010 | 0.948 | 0.800 | 0.800 | 0.720 | 1.000 | 0.043 | 1.000 | 0.720 | 0.948 |
| 2011 + | 0.948 | 0.852 | 0.852 | 0.720 | 1.000 | 0.043 | 1.000 | 0.720 | 0.948 |

Fuel Corrected Emission Factors (g/hp-hr)

| Slip Size | Engine | NOx | DPM | PM2.5 | ROG | CO | SOx | CO2 | CH4 | N2O |
|---|---|---|---|---|---|---|---|---|---|---|
| 100 | Propulsion | 9.14 | 0.29 | 0.28 | 0.49 | 1.97 | 0.01 | 588 | 0.010 | 0.022 |
| | Auxiliary | 8.30 | 0.46 | 0.45 | 0.85 | 3.59 | 0.01 | 588 | 0.012 | 0.022 |
| 125 | Propulsion | 9.14 | 0.29 | 0.28 | 0.49 | 1.97 | 0.01 | 588 | 0.010 | 0.022 |
| | Auxiliary | 7.75 | 0.26 | 0.25 | 0.58 | 2.78 | 0.01 | 588 | 0.012 | 0.022 |
| 150 | Propulsion | 6.93 | 0.29 | 0.28 | 0.49 | 1.97 | 0.01 | 588 | 0.010 | 0.022 |
| | Auxiliary | 6.93 | 0.26 | 0.25 | 0.58 | 2.78 | 0.01 | 588 | 0.012 | 0.022 |
| 175 | Propulsion | 6.93 | 0.29 | 0.28 | 0.49 | 1.97 | 0.01 | 588 | 0.010 | 0.022 |
| | Auxiliary | 6.93 | 0.26 | 0.25 | 0.58 | 2.78 | 0.01 | 588 | 0.012 | 0.022 |
| 200 | Propulsion | 6.93 | 0.29 | 0.28 | 0.49 | 1.97 | 0.01 | 588 | 0.010 | 0.022 |
| | Auxiliary | 4.84 | 0.12 | 0.12 | 0.58 | 3.73 | 0.01 | 588 | 0.012 | 0.022 |
| 240 | Propulsion | 6.93 | 0.29 | 0.28 | 0.49 | 1.97 | 0.01 | 588 | 0.010 | 0.022 |
| | Auxiliary | 4.84 | 0.12 | 0.12 | 0.58 | 3.73 | 0.01 | 588 | 0.012 | 0.022 |

Useful Annual Deter

| Engine | Life | Hours | Cap |
|---|---|---|---|
| Propulsion | 22 | 788 | 15.23 |
| Auxiliary | 22 | 3,036 | 3.95 |

Average annual hours and useful life for crew boats

**Deterioration Factors**

| Engine | NOx | PM | HC | CO |
|---|---|---|---|---|
| Propulsion | 0.21 | 0.67 | 0.44 | 0.25 |
| Auxiliary | 0.06 | 0.31 | 0.51 | 0.41 |

**2016 Deterioiated Emission Factors (g/hp-hr)**

| Slip Size | Engine | NOx | DPM | PM2.5 | ROG | CO | SOx | CO2 | CH4 | N2O |
|---|---|---|---|---|---|---|---|---|---|---|
| 100 | Propulsion | 10.47 | 0.42 | 0.41 | 0.64 | 2.31 | 0.01 | 588 | 0.010 | 0.022 |
|  | Auxiliary | 8.38 | 0.49 | 0.47 | 0.93 | 3.86 | 0.01 | 588 | 0.012 | 0.022 |
| 125 | Propulsion | 10.47 | 0.42 | 0.41 | 0.64 | 2.31 | 0.01 | 588 | 0.010 | 0.022 |
|  | Auxiliary | 7.83 | 0.27 | 0.26 | 0.64 | 2.99 | 0.01 | 588 | 0.012 | 0.022 |
| 150 | Propulsion | 7.76 | 0.40 | 0.39 | 0.61 | 2.25 | 0.01 | 588 | 0.010 | 0.022 |
|  | Auxiliary | 7.00 | 0.27 | 0.26 | 0.64 | 2.99 | 0.01 | 588 | 0.012 | 0.022 |
| 175 | Propulsion | 7.94 | 0.42 | 0.41 | 0.64 | 2.31 | 0.01 | 588 | 0.010 | 0.022 |
|  | Auxiliary | 7.00 | 0.27 | 0.26 | 0.64 | 2.99 | 0.01 | 588 | 0.012 | 0.022 |
| 200 | Propulsion | 7.75 | 0.40 | 0.39 | 0.61 | 2.25 | 0.01 | 588 | 0.010 | 0.022 |
|  | Auxiliary | 4.89 | 0.13 | 0.12 | 0.64 | 4.00 | 0.01 | 588 | 0.012 | 0.022 |
| 240 | Propulsion | 7.73 | 0.40 | 0.38 | 0.61 | 2.24 | 0.01 | 588 | 0.010 | 0.022 |
|  | Auxiliary | 4.89 | 0.13 | 0.12 | 0.64 | 4.00 | 0.01 | 588 | 0.012 | 0.022 |

**2021/2032 Deteroirated Emission Factors (g/hp-hr)**

| Slip Size | Engine | NOx | DPM | PM2.5 | ROG | CO | SOx | CO2 | CH4 | N2O |
|---|---|---|---|---|---|---|---|---|---|---|
| 100 | Propulsion | 10.47 | 0.42 | 0.41 | 0.64 | 2.31 | 0.01 | 588 | 0.010 | 0.022 |
|  | Auxiliary | 8.38 | 0.49 | 0.47 | 0.93 | 3.86 | 0.01 | 588 | 0.012 | 0.022 |
| 125 | Propulsion | 10.47 | 0.42 | 0.41 | 0.64 | 2.31 | 0.01 | 588 | 0.010 | 0.022 |
|  | Auxiliary | 7.83 | 0.27 | 0.26 | 0.64 | 2.99 | 0.01 | 588 | 0.012 | 0.022 |
| 150 | Propulsion | 7.94 | 0.42 | 0.41 | 0.64 | 2.31 | 0.01 | 588 | 0.010 | 0.022 |
|  | Auxiliary | 7.00 | 0.27 | 0.26 | 0.64 | 2.99 | 0.01 | 588 | 0.012 | 0.022 |
| 175 | Propulsion | 7.94 | 0.42 | 0.41 | 0.64 | 2.31 | 0.01 | 588 | 0.010 | 0.022 |
|  | Auxiliary | 7.00 | 0.27 | 0.26 | 0.64 | 2.99 | 0.01 | 588 | 0.012 | 0.022 |
| 200 | Propulsion | 7.94 | 0.42 | 0.41 | 0.64 | 2.31 | 0.01 | 588 | 0.010 | 0.022 |
|  | Auxiliary | 4.89 | 0.13 | 0.12 | 0.64 | 4.00 | 0.01 | 588 | 0.012 | 0.022 |
| 240 | Propulsion | 7.94 | 0.42 | 0.41 | 0.64 | 2.31 | 0.01 | 588 | 0.010 | 0.022 |
|  | Auxiliary | 4.89 | 0.13 | 0.12 | 0.64 | 4.00 | 0.01 | 588 | 0.012 | 0.022 |

# Landside Construction Sheets

## Offroad Emissions Calculations

| ID | Phase | Yr | Days | Equip | E or D | #/day | hrs/day | CMOD | HP Bin | HP/kW | LF | Concat | Pounds per day | | | | | | Metric tons per day | | | | Tons per year | | | | | | Metric tons per year | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | ROG | NOX | CO | PM10 | PM2.5 | SO2 | CO2 | CH4 | N2O | CO2e | ROG | NOX | CO | PM10 | PM2.5 | SO2 | CO2 | CH4 | N2O | CO2e |
| Phase1.1 | Mobilization/Demolition | 2018 | 17 | AC Cold Planer | D | 1 | 8 | Paving Equipment | 250 | 225 | 0.4 | 2018Paving Equipment250 | 0.4 | 5.1 | 1.8 | 0.2 | 0.2 | 0.0 | 0.3 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5.3 | 0.0 | 0.0 | 5.4 |
| Phase1.1 | | 2018 | 17 | Loader | D | 1 | 8 | Rubber Tired Loaders | 250 | 203 | 0.4 | 2018Rubber Tired Loaders25 | 0.4 | 5.4 | 1.7 | 0.2 | 0.2 | 0.0 | 0.3 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4.9 | 0.0 | 0.0 | 4.9 |
| Phase1.1 | | 2018 | 17 | Backhoe Loader | D | 1 | 8 | Tractors/Loaders/Backhoes | 120 | 97 | 0.4 | 2018Tractors/Loaders/Backh | 0.3 | 2.6 | 2.3 | 0.2 | 0.2 | 0.0 | 0.1 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.4 | 0.0 | 0.0 | 2.4 |
| Phase1.2 | Dewatering/Shoring | 2019 | 10 | Drill/ Auger rig | D | 1 | 8 | Bore/Drill Rigs | 250 | 221 | 0.5 | 2019Bore/Drill Rigs250 | 0.3 | 3.7 | 2.1 | 0.1 | 0.1 | 0.0 | 0.4 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4.2 | 0.0 | 0.0 | 4.3 |
| Phase1.2 | | 2019 | 10 | *dewater pumps | E | 6 | 24 | dewater pumps | - | 5 | 0.8 | 2019dewater pumps- | - | - | - | - | - | - | - | - | - | 0.1 | - | - | - | - | - | - | - | - | - | 1.3 |
| Phase1.2 | | 2019 | 10 | Loader | D | 1 | 8 | Rubber Tired Loaders | 250 | 203 | 0.4 | 2019Rubber Tired Loaders25 | 0.4 | 4.9 | 1.7 | 0.2 | 0.1 | 0.0 | 0.3 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.8 | 0.0 | 0.0 | 2.9 |
| Phase2.1 | Excavation and Foundation | 2019 | 100 | Pile Driving Rig | D | 2 | 8 | Bore/Drill Rigs | 250 | 221 | 0.5 | 2019Bore/Drill Rigs250 | 0.6 | 7.4 | 4.2 | 0.2 | 0.2 | 0.0 | 0.8 | 0.0 | 0.0 | 0.9 | 0.0 | 0.4 | 0.2 | 0.0 | 0.0 | 0.0 | 84.5 | 0.0 | 0.0 | 85.9 |
| Phase2.1 | | 2019 | 100 | *dewater pumps | E | 6 | 24 | dewater pumps | - | 5 | 0.8 | | - | - | - | - | - | - | - | - | - | 0.1 | - | - | - | - | - | - | - | - | - | 13.4 |
| Phase2.1 | | 2019 | 100 | Grader | D | 1 | 8 | Graders | 175 | 187 | 0.4 | 2019Graders175 | 0.8 | 8.1 | 4.9 | 0.5 | 0.4 | 0.0 | 0.3 | 0.0 | 0.0 | 0.3 | 0.0 | 0.4 | 0.2 | 0.0 | 0.0 | 0.0 | 29.9 | 0.0 | 0.0 | 30.4 |
| Phase2.1 | | 2019 | 100 | Excavator | D | 2 | 8 | Excavators | 175 | 158 | 0.4 | 2019Excavators175 | 0.5 | 5.4 | 6.6 | 0.3 | 0.2 | 0.0 | 0.5 | 0.0 | 0.0 | 0.5 | 0.0 | 0.3 | 0.3 | 0.0 | 0.0 | 0.0 | 46.6 | 0.0 | 0.0 | 47.3 |
| Phase2.1 | | 2019 | 100 | Loader | D | 2 | 8 | Rubber Tired Loaders | 250 | 203 | 0.4 | 2019Rubber Tired Loaders25 | 0.8 | 9.7 | 3.4 | 0.3 | 0.3 | 0.0 | 0.6 | 0.0 | 0.0 | 0.6 | 0.0 | 0.5 | 0.2 | 0.0 | 0.0 | 0.0 | 56.4 | 0.0 | 0.0 | 57.3 |
| Phase2.1 | | 2019 | 100 | Backhoe Loader | D | 2 | 8 | Tractors/Loaders/Backhoes | 120 | 97 | 0.4 | 2019Tractors/Loaders/Backh | 0.5 | 4.7 | 4.6 | 0.3 | 0.3 | 0.0 | 0.3 | 0.0 | 0.0 | 0.3 | 0.0 | 0.2 | 0.2 | 0.0 | 0.0 | 0.0 | 27.8 | 0.0 | 0.0 | 28.2 |
| Phase2.2 | Structural Frame | 2019 | 273 | *Tower Crane | E | 1 | 10 | tower crane | - | 75 | 0.3 | 2019tower crane- | - | - | - | - | - | - | - | - | - | 0.0 | - | - | - | - | - | - | - | - | - | 12.7 |
| Phase2.2 | | 2019 | 273 | *crane low-rise | E | 1 | 10 | crane low-rise | - | 60 | 0.3 | 2019crane low-rise- | - | - | - | - | - | - | - | - | - | 0.0 | - | - | - | - | - | - | - | - | - | 10.1 |
| Phase2.2 | | 2019 | 273 | *Concrete Pump | E | 1 | 10 | concrete pump | - | 60 | 0.8 | 2019concrete pump- | - | - | - | - | - | - | - | - | - | 0.1 | - | - | - | - | - | - | - | - | - | 30.4 |
| Phase2.2 | | 2019 | 273 | Mobile Concrete Pump | D | 1 | 8 | Pumps | 120 | 84 | 0.7 | 2019Pumps120 | 0.5 | 3.8 | 3.8 | 0.2 | 0.2 | 0.0 | 0.3 | 0.0 | 0.0 | 0.3 | 0.1 | 0.5 | 0.5 | 0.0 | 0.0 | 0.0 | 77.2 | 0.0 | 0.0 | 77.9 |
| Phase2.2 | | 2019 | 273 | All Terrain Forklifs | D | 2 | 8 | Rough Terrain Forklifts | 120 | 100 | 0.4 | 2019Rough Terrain Forklifts1 | 0.3 | 3.7 | 4.6 | 0.2 | 0.2 | 0.0 | 0.3 | 0.0 | 0.0 | 0.3 | 0.0 | 0.5 | 0.6 | 0.0 | 0.0 | 0.0 | 84.9 | 0.0 | 0.0 | 86.2 |
| Phase2.2 | | 2019 | 273 | 15T Wheeled Hydro Crane | D | 1 | 8 | Cranes | 250 | 231 | 0.3 | 2019Cranes250 | 0.5 | 6.0 | 2.3 | 0.3 | 0.2 | 0.0 | 0.3 | 0.0 | 0.0 | 0.3 | 0.1 | 0.8 | 0.3 | 0.0 | 0.0 | 0.0 | 70.3 | 0.0 | 0.0 | 71.4 |
| Phase2.2 | | 2019 | 273 | Backhoe Loader | D | 1 | 8 | Tractors/Loaders/Backhoes | 120 | 97 | 0.4 | 2019Tractors/Loaders/Backh | 0.2 | 2.3 | 2.3 | 0.2 | 0.1 | 0.0 | 0.1 | 0.0 | 0.0 | 0.1 | 0.0 | 0.3 | 0.3 | 0.0 | 0.0 | 0.0 | 37.9 | 0.0 | 0.0 | 38.5 |
| Phase2.3 | Exterior Closure and Roofing | 2020 | 328 | Boom Lifts | D | 5 | 8 | Aerial Lifts | 50 | 63 | 0.3 | 2020Aerial Lifts50 | 0.3 | 5.1 | 5.3 | 0.1 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 0.4 | 0.0 | 0.8 | 0.9 | 0.0 | 0.0 | 0.0 | 133.8 | 0.0 | 0.0 | 135.9 |
| Phase2.3 | | 2020 | 328 | *Man/ Material Hoist | E | 4 | 10 | man/mtl tower | - | 10 | 0.5 | 2020man/mtl tower- | - | - | - | - | - | - | - | - | - | 0.0 | - | - | - | - | - | - | - | - | - | 16.0 |
| Phase2.3 | | 2020 | 328 | All Terrain Forklifs | D | 2 | 8 | Rough Terrain Forklifts | 120 | 100 | 0.4 | 2020Rough Terrain Forklifts1 | 0.3 | 3.5 | 4.6 | 0.1 | 0.1 | 0.0 | 0.3 | 0.0 | 0.0 | 0.3 | 0.0 | 0.6 | 0.8 | 0.0 | 0.0 | 0.0 | 99.8 | 0.0 | 0.0 | 101.4 |
| Phase2.5 | Interior Rough-In (Elev./MEP/Framing) | 2020 | 179 | none; w/ structure, finishes | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Phase2.6 | Interior Construction/ Finishes | 2020 | 276 | All Terrain Forklifs | D | 1 | 8 | Rough Terrain Forklifts | 120 | 100 | 0.4 | 2020Rough Terrain Forklifts1 | 0.1 | 1.7 | 2.3 | 0.1 | 0.1 | 0.0 | 0.2 | 0.0 | 0.0 | 0.2 | 0.0 | 0.2 | 0.3 | 0.0 | 0.0 | 0.0 | 42.0 | 0.0 | 0.0 | 42.6 |
| Phase2.6 | | 2020 | 276 | Scissor Lift | D | 6 | 8 | Aerial Lifts | 50 | 63 | 0.3 | 2020Aerial Lifts50 | 0.3 | 6.1 | 6.4 | 0.1 | 0.1 | 0.0 | 0.5 | 0.0 | 0.0 | 0.5 | 0.0 | 0.8 | 0.9 | 0.0 | 0.0 | 0.0 | 135.1 | 0.0 | 0.0 | 137.2 |
| Phase2.7 | MEP Systems | 2020 | 187 | All Terrain Forklifs | D | 1 | 8 | Rough Terrain Forklifts | 120 | 100 | 0.4 | 2020Rough Terrain Forklifts1 | 0.1 | 1.7 | 2.3 | 0.1 | 0.1 | 0.0 | 0.2 | 0.0 | 0.0 | 0.2 | 0.0 | 0.2 | 0.2 | 0.0 | 0.0 | 0.0 | 28.4 | 0.0 | 0.0 | 28.9 |
| Phase2.7 | | 2020 | 187 | Scissor Lift | D | 6 | 8 | Aerial Lifts | 50 | 63 | 0.3 | 2020Aerial Lifts50 | 0.3 | 6.1 | 6.4 | 0.1 | 0.1 | 0.0 | 0.5 | 0.0 | 0.0 | 0.5 | 0.0 | 0.6 | 0.6 | 0.0 | 0.0 | 0.0 | 91.5 | 0.0 | 0.0 | 93.0 |
| Phase2.8 | Phase Completion Work | 2021 | 73 | none | - | | - | - | - | 0 | 0 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Phase3.1 | Foundations | 2019 | 40 | Pile Driving Rig | D | 1 | 8 | Bore/Drill Rigs | 250 | 221 | 0.5 | 2019Bore/Drill Rigs250 | 0.3 | 3.7 | 2.1 | 0.1 | 0.1 | 0.0 | 0.4 | 0.0 | 0.0 | 0.4 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 16.9 | 0.0 | 0.0 | 17.2 |
| Phase3.1 | | 2019 | 40 | *dewater pumps | E | 6 | 24 | dewater pumps | - | 5 | 0.8 | 2019dewater pumps- | - | - | - | - | - | - | - | - | - | 0.1 | - | - | - | - | - | - | - | - | - | 5.4 |
| Phase3.1 | | 2019 | 40 | Mobile Concrete Pump | D | 1 | 8 | Pumps | 120 | 84 | 0.7 | 2019Pumps120 | 0.5 | 3.8 | 3.8 | 0.2 | 0.2 | 0.0 | 0.3 | 0.0 | 0.0 | 0.3 | 0.0 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 11.3 | 0.0 | 0.0 | 11.4 |
| Phase3.2 | Structural Frame | 2019 | 141 | *Tower Crane | E | 1 | 10 | tower crane | - | 75 | 0.3 | 2019tower crane- | - | - | - | - | - | - | - | - | - | 0.0 | - | - | - | - | - | - | - | - | - | 6.5 |
| Phase3.2 | | 2019 | 141 | *crane low-rise | E | 1 | 10 | crane low-rise | - | 60 | 0.3 | 2019crane low-rise- | - | - | - | - | - | - | - | - | - | 0.0 | - | - | - | - | - | - | - | - | - | 5.2 |
| Phase3.2 | | 2019 | 141 | Mobile Concrete Pump | D | 1 | 8 | Pumps | 120 | 84 | 0.7 | 2019Pumps120 | 0.5 | 3.8 | 3.8 | 0.2 | 0.2 | 0.0 | 0.3 | 0.0 | 0.0 | 0.3 | 0.0 | 0.3 | 0.3 | 0.0 | 0.0 | 0.0 | 39.8 | 0.0 | 0.0 | 40.2 |
| Phase3.3 | Exterior Closure | 2020 | 216 | Boom Lifts | D | 3 | 8 | Aerial Lifts | 50 | 63 | 0.3 | 2020Aerial Lifts50 | 0.2 | 3.0 | 3.2 | 0.0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.2 | 0.0 | 0.3 | 0.3 | 0.0 | 0.0 | 0.0 | 52.9 | 0.0 | 0.0 | 53.7 |
| Phase3.3 | | 2020 | 216 | *Man/ Material Hoist | E | 2 | 10 | man/mtl low rise | - | 10 | 0.5 | 2020man/mtl low rise- | - | - | - | - | - | - | - | - | - | 0.0 | - | - | - | - | - | - | - | - | - | 5.3 |
| Phase3.3 | | 2020 | 216 | *Man/ Material Hoist | E | 2 | 10 | man/mtl public low rise | - | 10 | | 2020man/mtl public low rise | - | - | - | - | - | - | - | - | - | 0.0 | - | - | - | - | - | - | - | - | - | 0.0 |
| Phase3.3 | | 2020 | 216 | All Terrain Forklifs | D | 1 | 8 | Rough Terrain Forklifts | 120 | 100 | 0.4 | 2020Rough Terrain Forklifts1 | 0.1 | 1.7 | 2.3 | 0.1 | 0.1 | 0.0 | 0.2 | 0.0 | 0.0 | 0.2 | 0.0 | 0.2 | 0.2 | 0.0 | 0.0 | 0.0 | 32.9 | 0.0 | 0.0 | 33.4 |
| Phase3.4 | Interior Construction/ Finishes | 2020 | 211 | Scissor Lift | D | 6 | 8 | Aerial Lifts | 50 | 63 | 0.3 | 2020Aerial Lifts50 | 0.3 | 6.1 | 6.4 | 0.1 | 0.1 | 0.0 | 0.5 | 0.0 | 0.0 | 0.5 | 0.0 | 0.6 | 0.7 | 0.0 | 0.0 | 0.0 | 103.3 | 0.0 | 0.0 | 104.9 |
| Phase3.5 | Phase Completion Work | 2021 | 20 | Scissor Lift | D | 6 | 8 | Aerial Lifts | 50 | 63 | 0.3 | 2021Aerial Lifts50 | 0.3 | 6.0 | 6.4 | 0.1 | 0.1 | 0.0 | 0.5 | 0.0 | 0.0 | 0.5 | 0.0 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 9.8 | 0.0 | 0.0 | 9.9 |
| Phase4.1 | Offsite Demolition / Grading / Utilities | 2020 | 128 | Loader | D | 1 | 8 | Rubber Tired Loaders | 250 | 203 | 0.4 | 2020Rubber Tired Loaders25 | 0.4 | 4.4 | 1.6 | 0.1 | 0.1 | 0.0 | 0.3 | 0.0 | 0.0 | 0.3 | 0.0 | 0.3 | 0.1 | 0.0 | 0.0 | 0.0 | 35.3 | 0.0 | 0.0 | 35.9 |
| Phase4.1 | | 2020 | 128 | Backhoe Loader | D | 2 | 8 | Tractors/Loaders/Backhoes | 120 | 97 | 0.4 | 2020Tractors/Loaders/Backh | 0.4 | 4.2 | 4.5 | 0.3 | 0.2 | 0.0 | 0.3 | 0.0 | 0.0 | 0.3 | 0.0 | 0.3 | 0.3 | 0.0 | 0.0 | 0.0 | 34.8 | 0.0 | 0.0 | 35.3 |
| Phase4.1 | | 2020 | 128 | skid steer | D | 2 | 8 | Skid Steer Loaders | 120 | 65 | 0.4 | 2020Skid Steer Loaders120 | 0.2 | 2.1 | 2.8 | 0.1 | 0.1 | 0.0 | 0.2 | 0.0 | 0.0 | 0.2 | 0.0 | 0.1 | 0.2 | 0.0 | 0.0 | 0.0 | 23.1 | 0.0 | 0.0 | 23.5 |
| Phase4.1 | | 2020 | 128 | Bobcat | D | 2 | 8 | Tractors/Loaders/Backhoes | 120 | 97 | 0.4 | 2020Tractors/Loaders/Backh | 0.4 | 4.2 | 4.5 | 0.3 | 0.2 | 0.0 | 0.3 | 0.0 | 0.0 | 0.3 | 0.0 | 0.3 | 0.3 | 0.0 | 0.0 | 0.0 | 34.8 | 0.0 | 0.0 | 35.3 |
| Phase4.4 | Site Improvements | 2020 | 81 | Asphalt Paver | D | 1 | 8 | Pavers | 120 | 130 | 0.4 | 2020Pavers120 | 0.4 | 4.2 | 3.4 | 0.3 | 0.3 | 0.0 | 0.2 | 0.0 | 0.0 | 0.2 | 0.0 | 0.2 | 0.1 | 0.0 | 0.0 | 0.0 | 16.4 | 0.0 | 0.0 | 16.7 |
| Phase4.4 | | 2020 | 81 | Vibratory roller | D | 2 | 8 | Rollers | 120 | 80 | 0.4 | 2020Rollers120 | 0.4 | 4.1 | 3.7 | 0.3 | 0.2 | 0.0 | 0.2 | 0.0 | 0.0 | 0.2 | 0.0 | 0.2 | 0.2 | 0.0 | 0.0 | 0.0 | 18.4 | 0.0 | 0.0 | 18.7 |
| Phase4.4 | | 2020 | 81 | Backhoe/ loader | D | 3 | 8 | Tractors/Loaders/Backhoes | 120 | 97 | 0.4 | 2020Tractors/Loaders/Backh | 0.6 | 6.3 | 6.8 | 0.4 | 0.4 | 0.0 | 0.4 | 0.0 | 0.0 | 0.4 | 0.0 | 0.3 | 0.3 | 0.0 | 0.0 | 0.0 | 33.0 | 0.0 | 0.0 | 33.5 |
| Phase4.4 | | 2020 | 81 | Excavator | D | 1 | 8 | Excavators | 175 | 158 | 0.4 | 2020Excavators175 | 0.2 | 2.4 | 3.3 | 0.1 | 0.1 | 0.0 | 0.2 | 0.0 | 0.0 | 0.2 | 0.0 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 18.5 | 0.0 | 0.0 | 18.8 |
| Phase4.4 | | 2020 | 81 | Bobcat | D | 2 | 8 | Tractors/Loaders/Backhoes | 120 | 97 | 0.4 | 2020Tractors/Loaders/Backh | 0.4 | 4.2 | 4.5 | 0.3 | 0.2 | 0.0 | 0.3 | 0.0 | 0.0 | 0.3 | 0.0 | 0.2 | 0.2 | 0.0 | 0.0 | 0.0 | 22.0 | 0.0 | 0.0 | 22.4 |
| Phase4.4 | | 2020 | 81 | All Terrain Forklifs | D | 1 | 8 | Rough Terrain Forklifts | 120 | 100 | 0.4 | 2020Rough Terrain Forklifts1 | 0.1 | 1.7 | 2.3 | 0.1 | 0.1 | 0.0 | 0.2 | 0.0 | 0.0 | 0.2 | 0.0 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 12.3 | 0.0 | 0.0 | 12.5 |
| Phase4.4 | | 2020 | 81 | Mobile Concrete Pump | D | 1 | 8 | Pumps | 120 | 84 | 0.7 | 2020Pumps120 | 0.4 | 3.5 | 3.8 | 0.2 | 0.2 | 0.0 | 0.3 | 0.0 | 0.0 | 0.3 | 0.0 | 0.1 | 0.2 | 0.0 | 0.0 | 0.0 | 22.9 | 0.0 | 0.0 | 23.1 |

**Proposed Project**
**(no below grade parking)**

## Onroad Emissions Calculations

| | ID | Year | | Concat | Vehicle | Days | Workers per day | Employ Trip/Da | Employ Mi/ Day | Employ Mi/Yr | Truck Trip/Day r/t | #Loads/Yr | Truck Mi/ Day | Truck Mi/ Yr | Vehicle |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Phase1.1 | 2018 | Phase1.1:2018 | LDA/LDT1/LDT22018 | Employee | 17 | 20 | 40 | 432 | 7,344 | | | | | LDA/LDT1/LDT |
| | Phase1.2 | 2019 | Phase1.2:2019 | LDA/LDT1/LDT22019 | Employee | 10 | 30 | 60 | 648 | 6,480 | | | | | LDA/LDT1/LDT |
| | Phase2.1 | 2019 | Phase2.1:2019 | LDA/LDT1/LDT22019 | Employee | 100 | 30 | 60 | 648 | 64,800 | | | | | LDA/LDT1/LDT |
| | Phase2.2 | 2019 | Phase2.2:2019 | LDA/LDT1/LDT22019 | Employee | 273 | 90 | 180 | 1,944 | 530,712 | | | | | LDA/LDT1/LDT |
| | Phase2.3 | 2020 | Phase2.3:2020 | LDA/LDT1/LDT22020 | Employee | 328 | 60 | 120 | 1,296 | 425,088 | | | | | LDA/LDT1/LDT |
| | Phase2.5 | 2020 | Phase2.5:2020 | LDA/LDT1/LDT22020 | Employee | 179 | 110 | 220 | 2,376 | 425,304 | | | | | LDA/LDT1/LDT |
| | Phase2.6 | 2020 | Phase2.6:2020 | LDA/LDT1/LDT22020 | Employee | 276 | 40 | 80 | 864 | 238,464 | | | | | LDA/LDT1/LDT |
| | Phase2.7 | 2020 | Phase2.7:2020 | LDA/LDT1/LDT22020 | Employee | 187 | 125 | 250 | 2,700 | 504,900 | | | | | LDA/LDT1/LDT |
| | Phase2.8 | 2021 | Phase2.8:2021 | LDA/LDT1/LDT22021 | Employee | 73 | 115 | 230 | 2,484 | 181,332 | | | | | LDA/LDT1/LDT |
| | Phase3.1 | 2019 | Phase3.1:2019 | LDA/LDT1/LDT22019 | Employee | 40 | 10 | 20 | 216 | 8,640 | | | | | LDA/LDT1/LDT |
| | Phase3.2 | 2019 | Phase3.2:2019 | LDA/LDT1/LDT22019 | Employee | 141 | 15 | 30 | 324 | 45,684 | | | | | LDA/LDT1/LDT |
| | Phase3.3 | 2020 | Phase3.3:2020 | LDA/LDT1/LDT22020 | Employee | 216 | 10 | 20 | 216 | 46,656 | | | | | LDA/LDT1/LDT |
| | Phase3.4 | 2020 | Phase3.4:2020 | LDA/LDT1/LDT22020 | Employee | 211 | 20 | 40 | 432 | 91,152 | | | | | LDA/LDT1/LDT |
| | Phase3.5 | 2021 | Phase3.5:2021 | LDA/LDT1/LDT22021 | Employee | 20 | 25 | 50 | 540 | 10,800 | | | | | LDA/LDT1/LDT |
| | Phase4.1 | 2020 | Phase4.1:2020 | LDA/LDT1/LDT22020 | Employee | 128 | 15 | 30 | 324 | 41,472 | | | | | LDA/LDT1/LDT |
| | Phase4.4 | 2020 | Phase4.4:2020 | LDA/LDT1/LDT22020 | Employee | 81 | 60 | 120 | 1,296 | 104,976 | | | | | LDA/LDT1/LDT |
| | Phase1.1 | 2018 | Phase1.1:2018 | T7SC2018 | Haul Truck | 17 | | | | | 9 | 75 | 146 | 2,490 | T7SC |
| | Phase1.2 | 2019 | Phase1.2:2019 | T7SC2019 | Haul Truck | 10 | | | | | 6 | 30 | 454 | 4,536 | T7SC |
| | Phase2.1 | 2019 | Phase2.1:2019 | T7SC2019 | Haul Truck | 100 | | | | | 46 | 2,300 | 3,478 | 347,760 | T7SC |
| | Phase2.2 | 2019 | Phase2.2:2019 | T7SC2019 | Haul Truck | 273 | | | | | 0 | 0 | 0 | 0 | T7SC |
| | Phase2.3 | 2020 | Phase2.3:2020 | T7SC2020 | Haul Truck | 328 | | | | | 0 | 0 | 0 | 0 | T7SC |
| | Phase2.5 | 2020 | Phase2.5:2020 | T7SC2020 | Haul Truck | 179 | | | | | 0 | 0 | 0 | 0 | T7SC |
| | Phase2.6 | 2020 | Phase2.6:2020 | T7SC2020 | Haul Truck | 276 | | | | | 0 | 0 | 0 | 0 | T7SC |
| Offsite | Phase2.7 | 2020 | Phase2.7:2020 | T7SC2020 | Haul Truck | 187 | | | | | 0 | 0 | 0 | 0 | T7SC |
| | Phase2.8 | 2021 | Phase2.8:2021 | T7SC2021 | Haul Truck | 73 | | | | | 0 | 0 | 0 | 0 | T7SC |
| | Phase3.1 | 2019 | Phase3.1:2019 | T7SC2019 | Haul Truck | 40 | | | | | 0 | 0 | 0 | 0 | T7SC |
| | Phase3.2 | 2019 | Phase3.2:2019 | T7SC2019 | Haul Truck | 141 | | | | | 0 | 0 | 0 | 0 | T7SC |
| | Phase3.3 | 2020 | Phase3.3:2020 | T7SC2020 | Haul Truck | 216 | | | | | 0 | 0 | 0 | 0 | T7SC |
| | Phase3.4 | 2020 | Phase3.4:2020 | T7SC2020 | Haul Truck | 211 | | | | | 0 | 0 | 0 | 0 | T7SC |
| | Phase3.5 | 2021 | Phase3.5:2021 | T7SC2021 | Haul Truck | 20 | | | | | 0 | 0 | 0 | 0 | T7SC |
| | Phase4.1 | 2020 | Phase4.1:2020 | T7SC2020 | Haul Truck | 128 | | | | | 1 | 50 | 13 | 1,660 | T7SC |
| | Phase4.4 | 2020 | Phase4.4:2020 | T7SC2020 | Haul Truck | 81 | | | | | 0 | 0 | 0 | 0 | T7SC |
| | Phase1.1 | 2018 | Phase1.1:2018 | T6Heavy2018 | Delivery | 17 | | | | | 0 | 0 | 0 | 0 | T6Heavy |
| | Phase1.2 | 2019 | Phase1.2:2019 | T6Heavy2019 | Delivery | 10 | | | | | 0 | 0 | 0 | 0 | T6Heavy |
| | Phase2.1 | 2019 | Phase2.1:2019 | T6Heavy2019 | Delivery | 100 | | | | | 10 | 500 | 73 | 7,300 | T6Heavy |
| | Phase2.2 | 2019 | Phase2.2:2019 | T6Heavy2019 | Delivery | 273 | | | | | 29 | 3,900 | 209 | 56,940 | T6Heavy |
| | Phase2.3 | 2020 | Phase2.3:2020 | T6Heavy2020 | Delivery | 328 | | | | | 4 | 600 | 27 | 8,760 | T6Heavy |
| | Phase2.5 | 2020 | Phase2.5:2020 | T6Heavy2020 | Delivery | 179 | | | | | 3 | 300 | 24 | 4,380 | T6Heavy |
| | Phase2.6 | 2020 | Phase2.6:2020 | T6Heavy2020 | Delivery | 276 | | | | | 1 | 150 | 8 | 2,190 | T6Heavy |
| | Phase2.7 | 2020 | Phase2.7:2020 | T6Heavy2020 | Delivery | 187 | | | | | 1 | 100 | 8 | 1,460 | T6Heavy |
| | Phase2.8 | 2021 | Phase2.8:2021 | T6Heavy2021 | Delivery | 73 | | | | | 4 | 150 | 30 | 2,190 | T6Heavy |
| | Phase3.1 | 2019 | Phase3.1:2019 | T6Heavy2019 | Delivery | 40 | | | | | 5 | 100 | 37 | 1,460 | T6Heavy |
| | Phase3.2 | 2019 | Phase3.2:2019 | T6Heavy2019 | Delivery | 141 | | | | | 10 | 700 | 72 | 10,220 | T6Heavy |
| | Phase3.3 | 2020 | Phase3.3:2020 | T6Heavy2020 | Delivery | 216 | | | | | 1 | 100 | 7 | 1,460 | T6Heavy |
| | Phase3.4 | 2020 | Phase3.4:2020 | T6Heavy2020 | Delivery | 211 | | | | | 1 | 125 | 9 | 1,825 | T6Heavy |
| | Phase3.5 | 2021 | Phase3.5:2021 | T6Heavy2021 | Delivery | 20 | | | | | 6 | 60 | 44 | 876 | T6Heavy |
| | Phase4.1 | 2020 | Phase4.1:2020 | T6Heavy2020 | Delivery | 128 | | | | | 0 | 0 | 0 | 0 | T6Heavy |
| | Phase4.4 | 2020 | Phase4.4:2020 | T6Heavy2020 | Delivery | 81 | | | hrs/day | trucks | 4 | 160 | 29 | 2,336 | T6Heavy |
| | Phase1.1 | 2018 | Phase1.1:2018 | T6Heavy_52018 | Water Truck | 17 | | | 8 | 1 | - | - | 40 | 680 | T6Heavy_5 |
| | Phase1.2 | 2019 | Phase1.2:2019 | T6Heavy_52019 | Water Truck | 10 | | | 8 | 1 | - | - | 40 | 400 | T6Heavy_5 |
| | Phase2.1 | 2019 | Phase2.1:2019 | T6Heavy_52019 | Water Truck | 100 | | | 8 | 1 | - | - | 40 | 4,000 | T6Heavy_5 |
| | Phase2.2 | 2019 | Phase2.2:2019 | T6Heavy_52019 | Water Truck | 273 | | | 8 | 1 | - | - | 40 | 10,920 | T6Heavy_5 |
| | Phase4.1 | 2020 | Phase4.1:2020 | T6Heavy_52020 | Water Truck | 128 | | | 8 | 1 | - | - | 40 | 5,120 | T6Heavy_5 |
| Onsite | Phase4.4 | 2020 | Phase4.4:2020 | T6Heavy_52020 | Water Truck | 81 | | | 8 | 2 | - | - | 80 | 6,480 | T6Heavy_5 |
| | Phase1.1 | 2018 | Phase1.1:2018 | T7SC_52018 | End Dumps | 17 | | | 8 | 2 | - | - | 80 | 1,360 | T7SC_5 |
| | Phase1.2 | 2019 | Phase1.2:2019 | T7SC_52019 | End Dumps | 10 | | | 8 | 2 | - | - | 80 | 800 | T7SC_5 |
| | Phase2.1 | 2019 | Phase2.1:2019 | T7SC_52019 | End Dumps | 100 | | | 8 | 5 | - | - | 200 | 20,000 | T7SC_5 |
| | Phase4.1 | 2020 | Phase4.1:2020 | T7SC_52020 | End Dumps | 128 | | | 8 | 2 | - | - | 80 | 10,240 | T7SC_5 |
| | Phase4.4 | 2020 | Phase4.4:2020 | T7SC_52020 | End Dumps | 81 | | | 8 | 2 | - | - | 80 | 6,480 | T7SC_5 |

| ID | Concat | Pounds per day | | | | | | | | Metric tons per day | | | | Tons per year | | | | | | | | Metric tons per year | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ROG | NOX | CO | PM10 | PM2.5 | PM10 D | PM2.5 D | SO2 | CO2 | CH4 | N2O | CO2e | ROG | NOX | CO | PM10 | PM2.5 | PM10 D | PM2.5 D | SO2 | CO2 | CH4 | N2O | CO2e |
| Phase1.1 | LDA/LDT1/LDT22018 | 0.0 | 0.1 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 0.0000 | 0.0000 | 3 |
| Phase1.2 | LDA/LDT1/LDT22019 | 0.0 | 0.2 | 1.4 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 0.0000 | 0.0000 | 2 |
| Phase2.1 | LDA/LDT1/LDT22019 | 0.0 | 0.2 | 1.4 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 22 | 0.0003 | 0.0003 | 22 |
| Phase2.2 | LDA/LDT1/LDT22019 | 0.1 | 0.5 | 4.2 | 0.0 | 0.0 | 0.2 | 0.1 | 0.0 | 1 | 0.0 | 0.0 | 0.7 | 0.0 | 0.1 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 179 | 0.0023 | 0.0024 | 179 |
| Phase2.3 | LDA/LDT1/LDT22020 | 0.1 | 0.3 | 2.6 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 | 0 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 139 | 0.0017 | 0.0018 | 139 |
| Phase2.5 | LDA/LDT1/LDT22020 | 0.1 | 0.5 | 4.8 | 0.0 | 0.0 | 0.2 | 0.1 | 0.0 | 1 | 0.0 | 0.0 | 0.8 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 139 | 0.0017 | 0.0018 | 139 |
| Phase2.6 | LDA/LDT1/LDT22020 | 0.0 | 0.2 | 1.7 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 78 | 0.0010 | 0.0010 | 78 |
| Phase2.7 | LDA/LDT1/LDT22020 | 0.1 | 0.6 | 5.4 | 0.0 | 0.0 | 0.3 | 0.1 | 0.0 | 1 | 0.0 | 0.0 | 0.9 | 0.0 | 0.1 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 165 | 0.0020 | 0.0021 | 165 |
| Phase2.8 | LDA/LDT1/LDT22021 | 0.1 | 0.5 | 4.7 | 0.0 | 0.0 | 0.2 | 0.1 | 0.0 | 1 | 0.0 | 0.0 | 0.8 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 57 | 0.0007 | 0.0007 | 57 |
| Phase3.1 | LDA/LDT1/LDT22019 | 0.0 | 0.1 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 0.0000 | 0.0000 | 3 |
| Phase3.2 | LDA/LDT1/LDT22019 | 0.0 | 0.1 | 0.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 15 | 0.0002 | 0.0002 | 15 |
| Phase3.3 | LDA/LDT1/LDT22020 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 15 | 0.0 | 0.0 | 15 |
| Phase3.4 | LDA/LDT1/LDT22020 | 0.0 | 0.1 | 0.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 30 | 0.0 | 0.0 | 30 |
| Phase3.5 | LDA/LDT1/LDT22021 | 0.0 | 0.1 | 1.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 0.0 | 0.0 | 3 |
| Phase4.1 | LDA/LDT1/LDT22020 | 0.0 | 0.1 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 14 | 0.0 | 0.0 | 14 |
| Phase4.4 | LDA/LDT1/LDT22020 | 0.1 | 0.3 | 2.6 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 | 0 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 34 | 0.0 | 0.0 | 34 |
| Phase1.1 | T7SC2018 | 0.0 | 1.7 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4 | 0.0 | 0.0 | 4 |
| Phase1.2 | T7SC2019 | 0.1 | 4.9 | 0.5 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 1 | 0.0 | 0.0 | 0.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 7 | 0.0 | 0.0 | 7 |
| Phase2.1 | T7SC2019 | 1.0 | 37.9 | 4.0 | 0.3 | 0.2 | 0.7 | 0.3 | 0.1 | 6 | 0.0 | 0.0 | 5.8 | 0.1 | 1.9 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 573 | 0.0 | 0.0 | 578 |
| Phase2.2 | T7SC2019 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| Phase2.3 | T7SC2020 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| Phase2.5 | T7SC2020 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| Phase2.6 | T7SC2020 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| Phase2.7 | T7SC2020 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| Phase2.8 | T7SC2021 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| Phase3.1 | T7SC2019 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| Phase3.2 | T7SC2019 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| Phase3.3 | T7SC2020 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| Phase3.4 | T7SC2020 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| Phase3.5 | T7SC2021 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| Phase4.1 | T7SC2020 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 0.0 | 0.0 | 3 |
| Phase4.4 | T7SC2020 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| Phase1.1 | T6Heavy2018 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| Phase1.2 | T6Heavy2019 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| Phase2.1 | T6Heavy2019 | 0.0 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 9 | 0.0 | 0.0 | 9 |
| Phase2.2 | T6Heavy2019 | 0.0 | 1.3 | 0.1 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.3 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 69 | 0.0 | 0.0 | 70 |
| Phase2.3 | T6Heavy2020 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 11 | 0.0 | 0.0 | 11 |
| Phase2.5 | T6Heavy2020 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5 | 0.0 | 0.0 | 5 |
| Phase2.6 | T6Heavy2020 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 0.0 | 0.0 | 3 |
| Phase2.7 | T6Heavy2020 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 0.0 | 0.0 | 2 |
| Phase2.8 | T6Heavy2021 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 0.0 | 0.0 | 3 |
| Phase3.1 | T6Heavy2019 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 0.0 | 0.0 | 2 |
| Phase3.2 | T6Heavy2019 | 0.0 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 0.0 | 0.0 | 12 |
| Phase3.3 | T6Heavy2020 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 0.0 | 0.0 | 2 |
| Phase3.4 | T6Heavy2020 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 0.0 | 0.0 | 2 |
| Phase3.5 | T6Heavy2021 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 0.0 | 0.0 | 1 |
| Phase4.1 | T6Heavy2020 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| Phase4.4 | T6Heavy2020 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 0.0 | 0.0 | 3 |
| Phase1.1 | T6Heavy_52018 | 0.0 | 0.9 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 0.0 | 0.0 | 2 |
| Phase1.2 | T6Heavy_52019 | 0.0 | 0.9 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 0.0 | 0.0 | 1 |
| Phase2.1 | T6Heavy_52019 | 0.0 | 0.9 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 9 | 0.0 | 0.0 | 9 |
| Phase2.2 | T6Heavy_52019 | 0.0 | 0.9 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25 | 0.0 | 0.0 | 25 |
| Phase4.1 | T6Heavy_52020 | 0.0 | 0.9 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 0.0 | 0.0 | 12 |
| Phase4.4 | T6Heavy_52020 | 0.1 | 1.8 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 15 | 0.0 | 0.0 | 15 |
| Phase1.1 | T7SC_52018 | 0.2 | 3.3 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4 | 0.0 | 0.0 | 4 |
| Phase1.2 | T7SC_52019 | 0.2 | 3.2 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 0.0 | 0.0 | 3 |
| Phase2.1 | T7SC_52019 | 0.5 | 8.1 | 1.5 | 0.1 | 0.0 | 0.1 | 0.1 | 0.0 | 1 | 0.0 | 0.0 | 0.7 | 0.0 | 0.4 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 65 | 0.0 | 0.0 | 65 |
| Phase4.1 | T7SC_52020 | 0.1 | 3.0 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.3 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 33 | 0.0 | 0.0 | 33 |
| Phase4.4 | T7SC_52020 | 0.1 | 3.0 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.3 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 21 | 0.0 | 0.0 | 21 |

## Offroad Emissions Calculations

| ID | Phase | Yr | Days | Equip | E or D | #/day | hrs/day | CMOD | HP Bin | HP/kW | LF | Concat | Pounds per day | | | | | | Metric tons per day | | | | Tons per year | | | | | | Metric tons per year | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | ROG | NOX | CO | PM10 | PM2.5 | SO2 | CO2 | CH4 | N2O | CO2e | ROG | NOX | CO | PM10 | PM2.5 | SO2 | CO2 | CH4 | N2O | CO2e |
| Phase1.1 | Mobilization/Demolition | 2018 | 17 | AC Cold Planer | D | 1 | 8 | Paving Equipment | 250 | 225 | 0.4 | 2018Paving Equipment250 | 0.4 | 5.1 | 1.8 | 0.2 | 0.2 | 0.0 | 0.3 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5.3 | 0.0 | 0.0 | 5.4 |
| Phase1.1 | | 2018 | 17 | Loader | D | 1 | 8 | Rubber Tired Loaders | 250 | 203 | 0.4 | 2018Rubber Tired Loaders25 | 0.4 | 5.4 | 1.7 | 0.2 | 0.2 | 0.0 | 0.3 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4.9 | 0.0 | 0.0 | 4.9 |
| Phase1.1 | | 2018 | 17 | Backhoe Loader | D | 1 | 8 | Tractors/Loaders/Backhoes | 120 | 97 | 0.4 | 2018Tractors/Loaders/Backh | 0.3 | 2.6 | 2.3 | 0.2 | 0.2 | 0.0 | 0.1 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.4 | 0.0 | 0.0 | 2.4 |
| Phase1.2 | Dewatering/Shoring | 2019 | 10 | Drill/ Auger rig | D | 1 | 8 | Bore/Drill Rigs | 250 | 221 | 0.5 | 2019Bore/Drill Rigs250 | 0.3 | 3.7 | 2.1 | 0.1 | 0.1 | 0.0 | 0.4 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4.2 | 0.0 | 0.0 | 4.3 |
| Phase1.2 | | 2019 | 10 | *dewater pumps | E | 6 | 24 | dewater pumps | - | 5 | 0.8 | 2019dewater pumps- | - | - | - | - | - | - | - | - | - | 0.1 | - | - | - | - | - | - | - | - | - | 1.3 |
| Phase1.2 | | 2019 | 10 | Loader | D | 1 | 8 | Rubber Tired Loaders | 250 | 203 | 0.4 | 2019Rubber Tired Loaders25 | 0.4 | 4.9 | 1.7 | 0.2 | 0.1 | 0.0 | 0.3 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.8 | 0.0 | 0.0 | 2.9 |
| Phase2.1 | Excavation and Foundation | 2019 | 100 | Pile Driving Rig | D | 2 | 8 | Bore/Drill Rigs | 250 | 221 | 0.5 | 2019Bore/Drill Rigs250 | 0.6 | 7.4 | 4.2 | 0.2 | 0.2 | 0.0 | 0.8 | 0.0 | 0.0 | 0.9 | 0.0 | 0.4 | 0.2 | 0.0 | 0.0 | 0.0 | 84.5 | 0.0 | 0.0 | 85.9 |
| Phase2.1 | | 2019 | 100 | *dewater pumps | E | 6 | 24 | dewater pumps | - | 5 | 0.8 | | - | - | - | - | - | - | - | - | - | 0.1 | - | - | - | - | - | - | - | - | - | 13.4 |
| Phase2.1 | | 2019 | 100 | Grader | D | 1 | 8 | Graders | 175 | 187 | 0.4 | 2019Graders175 | 0.8 | 8.1 | 4.9 | 0.5 | 0.4 | 0.0 | 0.3 | 0.0 | 0.0 | 0.3 | 0.0 | 0.4 | 0.2 | 0.0 | 0.0 | 0.0 | 29.9 | 0.0 | 0.0 | 30.4 |
| Phase2.1 | | 2019 | 100 | Excavator | D | 2 | 8 | Excavators | 175 | 158 | 0.4 | 2019Excavators175 | 0.5 | 5.4 | 6.6 | 0.3 | 0.2 | 0.0 | 0.5 | 0.0 | 0.0 | 0.5 | 0.0 | 0.3 | 0.3 | 0.0 | 0.0 | 0.0 | 46.6 | 0.0 | 0.0 | 47.3 |
| Phase2.1 | | 2019 | 100 | Loader | D | 2 | 8 | Rubber Tired Loaders | 250 | 203 | 0.4 | 2019Rubber Tired Loaders25 | 0.8 | 9.7 | 3.4 | 0.3 | 0.3 | 0.0 | 0.6 | 0.0 | 0.0 | 0.6 | 0.0 | 0.5 | 0.2 | 0.0 | 0.0 | 0.0 | 56.4 | 0.0 | 0.0 | 57.3 |
| Phase2.1 | | 2019 | 100 | Backhoe Loader | D | 2 | 8 | Tractors/Loaders/Backhoes | 120 | 97 | 0.4 | 2019Tractors/Loaders/Backh | 0.5 | 4.7 | 4.6 | 0.3 | 0.3 | 0.0 | 0.3 | 0.0 | 0.0 | 0.3 | 0.0 | 0.2 | 0.2 | 0.0 | 0.0 | 0.0 | 27.8 | 0.0 | 0.0 | 28.2 |
| Phase2.2 | Structural Frame | 2019 | 273 | *Tower Crane | E | 1 | 10 | tower crane | - | 75 | 0.3 | 2019tower crane- | - | - | - | - | - | - | - | - | - | 0.0 | - | - | - | - | - | - | - | - | - | 12.7 |
| Phase2.2 | | 2019 | 273 | *crane low-rise | E | 1 | 10 | crane low-rise | - | 60 | 0.3 | 2019crane low-rise- | - | - | - | - | - | - | - | - | - | 0.0 | - | - | - | - | - | - | - | - | - | 10.1 |
| Phase2.2 | | 2019 | 273 | *Concrete Pump | E | 1 | 10 | concrete pump | - | 60 | 0.8 | 2019concrete pump- | - | - | - | - | - | - | - | - | - | 0.1 | - | - | - | - | - | - | - | - | - | 30.4 |
| Phase2.2 | | 2019 | 273 | Mobile Concrete Pump | D | 1 | 8 | Pumps | 120 | 84 | 0.7 | 2019Pumps120 | 0.5 | 3.8 | 3.8 | 0.2 | 0.2 | 0.0 | 0.3 | 0.0 | 0.0 | 0.3 | 0.1 | 0.5 | 0.5 | 0.0 | 0.0 | 0.0 | 77.2 | 0.0 | 0.0 | 77.9 |
| Phase2.2 | | 2019 | 273 | All Terrain Forklifs | D | 2 | 8 | Rough Terrain Forklifts | 120 | 100 | 0.4 | 2019Rough Terrain Forklifts1 | 0.3 | 3.7 | 4.6 | 0.2 | 0.2 | 0.0 | 0.3 | 0.0 | 0.0 | 0.3 | 0.0 | 0.5 | 0.6 | 0.0 | 0.0 | 0.0 | 84.9 | 0.0 | 0.0 | 86.2 |
| Phase2.2 | | 2019 | 273 | 15T Wheeled Hydro Crane | D | 1 | 8 | Cranes | 250 | 231 | 0.3 | 2019Cranes250 | 0.5 | 6.0 | 2.3 | 0.3 | 0.2 | 0.0 | 0.3 | 0.0 | 0.0 | 0.3 | 0.1 | 0.8 | 0.3 | 0.0 | 0.0 | 0.0 | 70.3 | 0.0 | 0.0 | 71.4 |
| Phase2.2 | | 2019 | 273 | Backhoe Loader | D | 1 | 8 | Tractors/Loaders/Backhoes | 120 | 97 | 0.4 | 2019Tractors/Loaders/Backh | 0.2 | 2.3 | 2.3 | 0.2 | 0.1 | 0.0 | 0.1 | 0.0 | 0.0 | 0.1 | 0.0 | 0.3 | 0.3 | 0.0 | 0.0 | 0.0 | 37.9 | 0.0 | 0.0 | 38.5 |
| Phase2.3 | Exterior Closure and Roofing | 2020 | 328 | Boom Lifts | D | 5 | 8 | Aerial Lifts | 50 | 63 | 0.3 | 2020Aerial Lifts50 | 0.3 | 5.1 | 5.3 | 0.1 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 0.4 | 0.0 | 0.8 | 0.9 | 0.0 | 0.0 | 0.0 | 133.8 | 0.0 | 0.0 | 135.9 |
| Phase2.3 | | 2020 | 328 | *Man/ Material Hoist | E | 4 | 10 | man/mtl tower | - | 10 | 0.5 | 2020man/mtl tower- | - | - | - | - | - | - | - | - | - | 0.0 | - | - | - | - | - | - | - | - | - | 16.0 |
| Phase2.3 | | 2020 | 328 | All Terrain Forklifs | D | 2 | 8 | Rough Terrain Forklifts | 120 | 100 | 0.4 | 2020Rough Terrain Forklifts1 | 0.3 | 3.5 | 4.6 | 0.1 | 0.1 | 0.0 | 0.3 | 0.0 | 0.0 | 0.3 | 0.0 | 0.6 | 0.8 | 0.0 | 0.0 | 0.0 | 99.8 | 0.0 | 0.0 | 101.4 |
| Phase2.5 | Interior Rough-In (Elev./MEP/Framing) | 2020 | 179 | none; w/ structure, finishes | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Phase2.6 | Interior Construction/ Finishes | 2020 | 276 | All Terrain Forklifs | D | 1 | 8 | Rough Terrain Forklifts | 120 | 100 | 0.4 | 2020Rough Terrain Forklifts1 | 0.1 | 1.7 | 2.3 | 0.1 | 0.1 | 0.0 | 0.2 | 0.0 | 0.0 | 0.2 | 0.0 | 0.2 | 0.3 | 0.0 | 0.0 | 0.0 | 42.0 | 0.0 | 0.0 | 42.6 |
| Phase2.6 | | 2020 | 276 | Scissor Lift | D | 6 | 8 | Aerial Lifts | 50 | 63 | 0.3 | 2020Aerial Lifts50 | 0.3 | 6.1 | 6.4 | 0.1 | 0.1 | 0.0 | 0.5 | 0.0 | 0.0 | 0.5 | 0.0 | 0.8 | 0.9 | 0.0 | 0.0 | 0.0 | 135.1 | 0.0 | 0.0 | 137.2 |
| Phase2.7 | MEP Systems | 2020 | 187 | All Terrain Forklifs | D | 1 | 8 | Rough Terrain Forklifts | 120 | 100 | 0.4 | 2020Rough Terrain Forklifts1 | 0.1 | 1.7 | 2.3 | 0.1 | 0.1 | 0.0 | 0.2 | 0.0 | 0.0 | 0.2 | 0.0 | 0.2 | 0.2 | 0.0 | 0.0 | 0.0 | 28.4 | 0.0 | 0.0 | 28.9 |
| Phase2.7 | | 2020 | 187 | Scissor Lift | D | 6 | 8 | Aerial Lifts | 50 | 63 | 0.3 | 2020Aerial Lifts50 | 0.3 | 6.1 | 6.4 | 0.1 | 0.1 | 0.0 | 0.5 | 0.0 | 0.0 | 0.5 | 0.0 | 0.6 | 0.6 | 0.0 | 0.0 | 0.0 | 91.5 | 0.0 | 0.0 | 93.0 |
| Phase2.8 | Phase Completion Work | 2021 | 73 | none | - | | - | - | - | 0 | 0 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Phase3.1 | Foundations | 2019 | 40 | Pile Driving Rig | D | 1 | 8 | Bore/Drill Rigs | 250 | 221 | 0.5 | 2019Bore/Drill Rigs250 | 0.3 | 3.7 | 2.1 | 0.1 | 0.1 | 0.0 | 0.4 | 0.0 | 0.0 | 0.4 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 16.9 | 0.0 | 0.0 | 17.2 |
| Phase3.1 | | 2019 | 40 | *dewater pumps | E | 6 | 24 | dewater pumps | - | 5 | 0.8 | 2019dewater pumps- | - | - | - | - | - | - | - | - | - | 0.1 | - | - | - | - | - | - | - | - | - | 5.4 |
| Phase3.1 | | 2019 | 40 | Mobile Concrete Pump | D | 1 | 8 | Pumps | 120 | 84 | 0.7 | 2019Pumps120 | 0.5 | 3.8 | 3.8 | 0.2 | 0.2 | 0.0 | 0.3 | 0.0 | 0.0 | 0.3 | 0.0 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 11.3 | 0.0 | 0.0 | 11.4 |
| Phase3.2 | Structural Frame | 2019 | 141 | *Tower Crane | E | 1 | 10 | tower crane | - | 75 | 0.3 | 2019tower crane- | - | - | - | - | - | - | - | - | - | 0.0 | - | - | - | - | - | - | - | - | - | 6.5 |
| Phase3.2 | | 2019 | 141 | *crane low-rise | E | 1 | 10 | crane low-rise | - | 60 | 0.3 | 2019crane low-rise- | - | - | - | - | - | - | - | - | - | 0.0 | - | - | - | - | - | - | - | - | - | 5.2 |
| Phase3.2 | | 2019 | 141 | Mobile Concrete Pump | D | 1 | 8 | Pumps | 120 | 84 | 0.7 | 2019Pumps120 | 0.5 | 3.8 | 3.8 | 0.2 | 0.2 | 0.0 | 0.3 | 0.0 | 0.0 | 0.3 | 0.0 | 0.3 | 0.3 | 0.0 | 0.0 | 0.0 | 39.8 | 0.0 | 0.0 | 40.2 |
| Phase3.3 | Exterior Closure | 2020 | 216 | Boom Lifts | D | 3 | 8 | Aerial Lifts | 50 | 63 | 0.3 | 2020Aerial Lifts50 | 0.2 | 3.0 | 3.2 | 0.0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.2 | 0.0 | 0.3 | 0.3 | 0.0 | 0.0 | 0.0 | 52.9 | 0.0 | 0.0 | 53.7 |
| Phase3.3 | | 2020 | 216 | *Man/ Material Hoist | E | 2 | 10 | man/mtl low rise | - | 10 | 0.5 | 2020man/mtl low rise- | - | - | - | - | - | - | - | - | - | 0.0 | - | - | - | - | - | - | - | - | - | 5.3 |
| Phase3.3 | | 2020 | 216 | *Man/ Material Hoist | E | 2 | 10 | man/mtl public low rise | - | 10 | | 2020man/mtl public low rise | - | - | - | - | - | - | - | - | - | 0.0 | - | - | - | - | - | - | - | - | - | 0.0 |
| Phase3.3 | | 2020 | 216 | All Terrain Forklifs | D | 1 | 8 | Rough Terrain Forklifts | 120 | 100 | 0.4 | 2020Rough Terrain Forklifts1 | 0.1 | 1.7 | 2.3 | 0.1 | 0.1 | 0.0 | 0.2 | 0.0 | 0.0 | 0.2 | 0.0 | 0.2 | 0.2 | 0.0 | 0.0 | 0.0 | 32.9 | 0.0 | 0.0 | 33.4 |
| Phase3.4 | Interior Construction/ Finishes | 2020 | 211 | Scissor Lift | D | 6 | 8 | Aerial Lifts | 50 | 63 | 0.3 | 2020Aerial Lifts50 | 0.3 | 6.1 | 6.4 | 0.1 | 0.1 | 0.0 | 0.5 | 0.0 | 0.0 | 0.5 | 0.0 | 0.6 | 0.7 | 0.0 | 0.0 | 0.0 | 103.3 | 0.0 | 0.0 | 104.9 |
| Phase3.5 | Phase Completion Work | 2021 | 20 | Scissor Lift | D | 6 | 8 | Aerial Lifts | 50 | 63 | 0.3 | 2021Aerial Lifts50 | 0.3 | 6.0 | 6.4 | 0.1 | 0.1 | 0.0 | 0.5 | 0.0 | 0.0 | 0.5 | 0.0 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 9.8 | 0.0 | 0.0 | 9.9 |
| Phase4.1 | Offsite Demolition / Grading / Utilities | 2020 | 128 | Loader | D | 1 | 8 | Rubber Tired Loaders | 250 | 203 | 0.4 | 2020Rubber Tired Loaders25 | 0.4 | 4.4 | 1.6 | 0.1 | 0.1 | 0.0 | 0.3 | 0.0 | 0.0 | 0.3 | 0.0 | 0.3 | 0.1 | 0.0 | 0.0 | 0.0 | 35.3 | 0.0 | 0.0 | 35.9 |
| Phase4.1 | | 2020 | 128 | Backhoe Loader | D | 2 | 8 | Tractors/Loaders/Backhoes | 120 | 97 | 0.4 | 2020Tractors/Loaders/Backh | 0.4 | 4.2 | 4.5 | 0.3 | 0.2 | 0.0 | 0.3 | 0.0 | 0.0 | 0.3 | 0.0 | 0.3 | 0.3 | 0.0 | 0.0 | 0.0 | 34.8 | 0.0 | 0.0 | 35.3 |
| Phase4.1 | | 2020 | 128 | skid steer | D | 2 | 8 | Skid Steer Loaders | 120 | 65 | 0.4 | 2020Skid Steer Loaders120 | 0.2 | 2.1 | 2.8 | 0.1 | 0.1 | 0.0 | 0.2 | 0.0 | 0.0 | 0.2 | 0.0 | 0.1 | 0.2 | 0.0 | 0.0 | 0.0 | 23.1 | 0.0 | 0.0 | 23.5 |
| Phase4.1 | | 2020 | 128 | Bobcat | D | 2 | 8 | Tractors/Loaders/Backhoes | 120 | 97 | 0.4 | 2020Tractors/Loaders/Backh | 0.4 | 4.2 | 4.5 | 0.3 | 0.2 | 0.0 | 0.3 | 0.0 | 0.0 | 0.3 | 0.0 | 0.3 | 0.3 | 0.0 | 0.0 | 0.0 | 34.8 | 0.0 | 0.0 | 35.3 |
| Phase4.4 | Site Improvements | 2020 | 81 | Asphalt Paver | D | 1 | 8 | Pavers | 120 | 130 | 0.4 | 2020Pavers120 | 0.4 | 4.2 | 3.4 | 0.3 | 0.3 | 0.0 | 0.2 | 0.0 | 0.0 | 0.2 | 0.0 | 0.2 | 0.1 | 0.0 | 0.0 | 0.0 | 16.4 | 0.0 | 0.0 | 16.7 |
| Phase4.4 | | 2020 | 81 | Vibratory roller | D | 2 | 8 | Rollers | 120 | 80 | 0.4 | 2020Rollers120 | 0.4 | 4.1 | 3.7 | 0.3 | 0.2 | 0.0 | 0.2 | 0.0 | 0.0 | 0.2 | 0.0 | 0.2 | 0.2 | 0.0 | 0.0 | 0.0 | 18.4 | 0.0 | 0.0 | 18.7 |
| Phase4.4 | | 2020 | 81 | Backhoe/ loader | D | 3 | 8 | Tractors/Loaders/Backhoes | 120 | 97 | 0.4 | 2020Tractors/Loaders/Backh | 0.6 | 6.3 | 6.8 | 0.4 | 0.4 | 0.0 | 0.4 | 0.0 | 0.0 | 0.4 | 0.0 | 0.3 | 0.3 | 0.0 | 0.0 | 0.0 | 33.0 | 0.0 | 0.0 | 33.5 |
| Phase4.4 | | 2020 | 81 | Excavator | D | 1 | 8 | Excavators | 175 | 158 | 0.4 | 2020Excavators175 | 0.2 | 2.4 | 3.3 | 0.1 | 0.1 | 0.0 | 0.2 | 0.0 | 0.0 | 0.2 | 0.0 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 18.5 | 0.0 | 0.0 | 18.8 |
| Phase4.4 | | 2020 | 81 | Bobcat | D | 2 | 8 | Tractors/Loaders/Backhoes | 120 | 97 | 0.4 | 2020Tractors/Loaders/Backh | 0.4 | 4.2 | 4.5 | 0.3 | 0.2 | 0.0 | 0.3 | 0.0 | 0.0 | 0.3 | 0.0 | 0.2 | 0.2 | 0.0 | 0.0 | 0.0 | 22.0 | 0.0 | 0.0 | 22.4 |
| Phase4.4 | | 2020 | 81 | All Terrain Forklifs | D | 1 | 8 | Rough Terrain Forklifts | 120 | 100 | 0.4 | 2020Rough Terrain Forklifts1 | 0.1 | 1.7 | 2.3 | 0.1 | 0.1 | 0.0 | 0.2 | 0.0 | 0.0 | 0.2 | 0.0 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 12.3 | 0.0 | 0.0 | 12.5 |
| Phase4.4 | | 2020 | 81 | Mobile Concrete Pump | D | 1 | 8 | Pumps | 120 | 84 | 0.7 | 2020Pumps120 | 0.4 | 3.5 | 3.8 | 0.2 | 0.2 | 0.0 | 0.3 | 0.0 | 0.0 | 0.3 | 0.0 | 0.1 | 0.2 | 0.0 | 0.0 | 0.0 | 22.9 | 0.0 | 0.0 | 23.1 |

**Proposed Project**
**(no below grade parking)**

## Onroad Emissions Calculations

| | ID | Year | | Concat | Vehicle | Days | Workers per day | Employ Trip/Da | Employ Mi/ Day | Employ Mi/Yr | Truck Trip/Day r/t | #Loads/Yr | Truck Mi/ Day | Truck Mi/ Yr | Vehicle | Pounds per day | | | | | | | | Metric tons per day | | | | Tons per year | | | | | | | | Metric tons per year | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | ROG | NOX | CO | PM10 | PM2.5 | PM10 D | PM2.5 D | SO2 | CO2 | CH4 | N2O | CO2e | ROG | NOX | CO | PM10 | PM2.5 | PM10 D | PM2.5 D | SO2 | CO2 | CH4 | N2O | CO2e |
| | Phase1.1 | 2018 | Phase1.1:2018 | LDA/LDT1/LDT22018 | Employee | 17 | 20 | 40 | 432 | 7,344 | | | | | LDA/LDT1/LDT2 | 0.0 | 0.1 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 0.0000 | 0.0000 | 3 |
| | Phase1.2 | 2019 | Phase1.2:2019 | LDA/LDT1/LDT22019 | Employee | 10 | 30 | 60 | 648 | 6,480 | | | | | LDA/LDT1/LDT2 | 0.0 | 0.2 | 1.4 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 0.0000 | 0.0000 | 2 |
| | Phase2.1 | 2019 | Phase2.1:2019 | LDA/LDT1/LDT22019 | Employee | 100 | 30 | 60 | 648 | 64,800 | | | | | LDA/LDT1/LDT2 | 0.0 | 0.2 | 1.4 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 22 | 0.0003 | 0.0003 | 22 |
| | Phase2.2 | 2019 | Phase2.2:2019 | LDA/LDT1/LDT22019 | Employee | 273 | 90 | 180 | 1,944 | 530,712 | | | | | LDA/LDT1/LDT2 | 0.1 | 0.5 | 4.2 | 0.0 | 0.0 | 0.2 | 0.1 | 0.0 | 1 | 0.0 | 0.0 | 0.7 | 0.0 | 0.1 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 179 | 0.0023 | 0.0024 | 179 |
| | Phase2.3 | 2020 | Phase2.3:2020 | LDA/LDT1/LDT22020 | Employee | 328 | 60 | 120 | 1,296 | 425,088 | | | | | LDA/LDT1/LDT2 | 0.1 | 0.3 | 2.6 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 | 0 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 139 | 0.0017 | 0.0018 | 139 |
| | Phase2.5 | 2020 | Phase2.5:2020 | LDA/LDT1/LDT22020 | Employee | 179 | 110 | 220 | 2,376 | 425,304 | | | | | LDA/LDT1/LDT2 | 0.1 | 0.5 | 4.8 | 0.0 | 0.0 | 0.2 | 0.1 | 0.0 | 1 | 0.0 | 0.0 | 0.8 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 139 | 0.0017 | 0.0018 | 139 |
| | Phase2.6 | 2020 | Phase2.6:2020 | LDA/LDT1/LDT22020 | Employee | 276 | 40 | 80 | 864 | 238,464 | | | | | LDA/LDT1/LDT2 | 0.0 | 0.2 | 1.7 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 78 | 0.0010 | 0.0010 | 78 |
| | Phase2.7 | 2020 | Phase2.7:2020 | LDA/LDT1/LDT22020 | Employee | 187 | 125 | 250 | 2,700 | 504,900 | | | | | LDA/LDT1/LDT2 | 0.1 | 0.6 | 5.4 | 0.0 | 0.0 | 0.3 | 0.1 | 0.0 | 1 | 0.0 | 0.0 | 0.9 | 0.0 | 0.1 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 165 | 0.0020 | 0.0021 | 165 |
| | Phase2.8 | 2021 | Phase2.8:2021 | LDA/LDT1/LDT22021 | Employee | 73 | 115 | 230 | 2,484 | 181,332 | | | | | LDA/LDT1/LDT2 | 0.1 | 0.5 | 4.7 | 0.0 | 0.0 | 0.2 | 0.1 | 0.0 | 1 | 0.0 | 0.0 | 0.8 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 57 | 0.0007 | 0.0007 | 57 |
| | Phase3.1 | 2019 | Phase3.1:2019 | LDA/LDT1/LDT22019 | Employee | 40 | 10 | 20 | 216 | 8,640 | | | | | LDA/LDT1/LDT2 | 0.0 | 0.1 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 0.0000 | 0.0000 | 3 |
| | Phase3.2 | 2019 | Phase3.2:2019 | LDA/LDT1/LDT22019 | Employee | 141 | 15 | 30 | 324 | 45,684 | | | | | LDA/LDT1/LDT2 | 0.0 | 0.1 | 0.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 15 | 0.0002 | 0.0002 | 15 |
| | Phase3.3 | 2020 | Phase3.3:2020 | LDA/LDT1/LDT22020 | Employee | 216 | 10 | 20 | 216 | 46,656 | | | | | LDA/LDT1/LDT2 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 15 | 0.0 | 0.0 | 15 |
| | Phase3.4 | 2020 | Phase3.4:2020 | LDA/LDT1/LDT22020 | Employee | 211 | 20 | 40 | 432 | 91,152 | | | | | LDA/LDT1/LDT2 | 0.0 | 0.1 | 0.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 30 | 0.0 | 0.0 | 30 |
| | Phase3.5 | 2021 | Phase3.5:2021 | LDA/LDT1/LDT22021 | Employee | 20 | 25 | 50 | 540 | 10,800 | | | | | LDA/LDT1/LDT2 | 0.0 | 0.1 | 1.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 0.0 | 0.0 | 3 |
| | Phase4.1 | 2020 | Phase4.1:2020 | LDA/LDT1/LDT22020 | Employee | 128 | 15 | 30 | 324 | 41,472 | | | | | LDA/LDT1/LDT2 | 0.0 | 0.1 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 14 | 0.0 | 0.0 | 14 |
| | Phase4.4 | 2020 | Phase4.4:2020 | LDA/LDT1/LDT22020 | Employee | 81 | 60 | 120 | 1,296 | 104,976 | | | | | LDA/LDT1/LDT2 | 0.1 | 0.3 | 2.6 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 | 0 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 34 | 0.0 | 0.0 | 34 |
| | Phase1.1 | 2018 | Phase1.1:2018 | T7SC2018 | Haul Truck | 17 | | | | | 9 | 75 | 146 | 2,480 | T7SC | 0.0 | 1.7 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4 | 0.0 | 0.0 | 4 |
| | Phase1.2 | 2019 | Phase1.2:2019 | T7SC2019 | Haul Truck | 10 | | | | | 6 | 30 | 454 | 4,536 | T7SC | 0.1 | 4.9 | 0.5 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 1 | 0.0 | 0.0 | 0.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 7 | 0.0 | 0.0 | 7 |
| | Phase2.1 | 2019 | Phase2.1:2019 | T7SC2019 | Haul Truck | 100 | | | | | 46 | 2,300 | 3,478 | 347,760 | T7SC | 1.0 | 37.9 | 4.0 | 0.3 | 0.2 | 0.7 | 0.3 | 0.1 | 6 | 0.0 | 0.0 | 5.8 | 0.1 | 1.9 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 573 | 0.0 | 0.0 | 578 |
| | Phase2.2 | 2019 | Phase2.2:2019 | T7SC2019 | Haul Truck | 273 | | | | | 0 | 0 | 0 | 0 | T7SC | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| | Phase2.3 | 2020 | Phase2.3:2020 | T7SC2020 | Haul Truck | 328 | | | | | 0 | 0 | 0 | 0 | T7SC | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| | Phase2.5 | 2020 | Phase2.5:2020 | T7SC2020 | Haul Truck | 179 | | | | | 0 | 0 | 0 | 0 | T7SC | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| | Phase2.6 | 2020 | Phase2.6:2020 | T7SC2020 | Haul Truck | 276 | | | | | 0 | 0 | 0 | 0 | T7SC | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| Offsite | Phase2.7 | 2020 | Phase2.7:2020 | T7SC2020 | Haul Truck | 187 | | | | | 0 | 0 | 0 | 0 | T7SC | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| | Phase2.8 | 2021 | Phase2.8:2021 | T7SC2021 | Haul Truck | 73 | | | | | 0 | 0 | 0 | 0 | T7SC | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| | Phase3.1 | 2019 | Phase3.1:2019 | T7SC2019 | Haul Truck | 40 | | | | | 0 | 0 | 0 | 0 | T7SC | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| | Phase3.2 | 2019 | Phase3.2:2019 | T7SC2019 | Haul Truck | 141 | | | | | 0 | 0 | 0 | 0 | T7SC | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| | Phase3.3 | 2020 | Phase3.3:2020 | T7SC2020 | Haul Truck | 216 | | | | | 0 | 0 | 0 | 0 | T7SC | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| | Phase3.4 | 2020 | Phase3.4:2020 | T7SC2020 | Haul Truck | 211 | | | | | 0 | 0 | 0 | 0 | T7SC | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| | Phase3.5 | 2021 | Phase3.5:2021 | T7SC2021 | Haul Truck | 20 | | | | | 0 | 0 | 0 | 0 | T7SC | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| | Phase4.1 | 2020 | Phase4.1:2020 | T7SC2020 | Haul Truck | 128 | | | | | 1 | 50 | 13 | 1,660 | T7SC | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 0.0 | 0.0 | 3 |
| | Phase4.4 | 2020 | Phase4.4:2020 | T7SC2020 | Haul Truck | 81 | | | | | 0 | 0 | 0 | 0 | T7SC | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| | Phase1.1 | 2018 | Phase1.1:2018 | T6Heavy2018 | Delivery | 17 | | | | | 0 | 0 | 0 | 0 | T6Heavy | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| | Phase1.2 | 2019 | Phase1.2:2019 | T6Heavy2019 | Delivery | 10 | | | | | 0 | 0 | 0 | 0 | T6Heavy | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| | Phase2.1 | 2019 | Phase2.1:2019 | T6Heavy2019 | Delivery | 100 | | | | | 10 | 500 | 73 | 7,300 | T6Heavy | 0.0 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 9 | 0.0 | 0.0 | 9 |
| | Phase2.2 | 2019 | Phase2.2:2019 | T6Heavy2019 | Delivery | 273 | | | | | 29 | 3,900 | 209 | 56,940 | T6Heavy | 0.0 | 1.3 | 0.1 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.3 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 69 | 0.0 | 0.0 | 70 |
| | Phase2.3 | 2020 | Phase2.3:2020 | T6Heavy2020 | Delivery | 328 | | | | | 4 | 600 | 27 | 8,760 | T6Heavy | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 11 | 0.0 | 0.0 | 11 |
| | Phase2.5 | 2020 | Phase2.5:2020 | T6Heavy2020 | Delivery | 179 | | | | | 3 | 300 | 24 | 4,380 | T6Heavy | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5 | 0.0 | 0.0 | 5 |
| | Phase2.6 | 2020 | Phase2.6:2020 | T6Heavy2020 | Delivery | 276 | | | | | 1 | 150 | 8 | 2,190 | T6Heavy | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 0.0 | 0.0 | 3 |
| | Phase2.7 | 2020 | Phase2.7:2020 | T6Heavy2020 | Delivery | 187 | | | | | 1 | 100 | 8 | 1,460 | T6Heavy | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 0.0 | 0.0 | 2 |
| | Phase2.8 | 2021 | Phase2.8:2021 | T6Heavy2021 | Delivery | 73 | | | | | 4 | 150 | 30 | 2,190 | T6Heavy | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 0.0 | 0.0 | 3 |
| | Phase3.1 | 2019 | Phase3.1:2019 | T6Heavy2019 | Delivery | 40 | | | | | 5 | 100 | 37 | 1,460 | T6Heavy | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 0.0 | 0.0 | 2 |
| | Phase3.2 | 2019 | Phase3.2:2019 | T6Heavy2019 | Delivery | 141 | | | | | 10 | 700 | 72 | 10,220 | T6Heavy | 0.0 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 0.0 | 0.0 | 12 |
| | Phase3.3 | 2020 | Phase3.3:2020 | T6Heavy2020 | Delivery | 216 | | | | | 1 | 100 | 7 | 1,460 | T6Heavy | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 0.0 | 0.0 | 2 |
| | Phase3.4 | 2020 | Phase3.4:2020 | T6Heavy2020 | Delivery | 211 | | | | | 1 | 125 | 9 | 1,825 | T6Heavy | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 0.0 | 0.0 | 2 |
| | Phase3.5 | 2021 | Phase3.5:2021 | T6Heavy2021 | Delivery | 20 | | | | | 6 | 60 | 44 | 876 | T6Heavy | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 0.0 | 0.0 | 1 |
| | Phase4.1 | 2020 | Phase4.1:2020 | T6Heavy2020 | Delivery | 128 | | | | | 0 | 0 | 0 | 0 | T6Heavy | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| | Phase4.4 | 2020 | Phase4.4:2020 | T6Heavy2020 | Delivery | 81 | | | hrs/day | trucks | 4 | 160 | 29 | 2,336 | T6Heavy | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 0.0 | 0.0 | 3 |
| | Phase1.1 | 2018 | Phase1.1:2018 | T6Heavy_S2018 | Water Truck | 17 | | | 8 | 1 | - | - | 40 | 680 | T6Heavy_S | 0.0 | 0.9 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 0.0 | 0.0 | 2 |
| | Phase1.2 | 2019 | Phase1.2:2019 | T6Heavy_S2019 | Water Truck | 10 | | | 8 | 1 | - | - | 40 | 400 | T6Heavy_S | 0.0 | 0.9 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 0.0 | 0.0 | 1 |
| | Phase2.1 | 2019 | Phase2.1:2019 | T6Heavy_S2019 | Water Truck | 100 | | | 8 | 1 | - | - | 40 | 4,000 | T6Heavy_S | 0.0 | 0.9 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 9 | 0.0 | 0.0 | 9 |
| | Phase2.2 | 2019 | Phase2.2:2019 | T6Heavy_S2019 | Water Truck | 273 | | | 8 | 1 | - | - | 40 | 10,920 | T6Heavy_S | 0.0 | 0.9 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25 | 0.0 | 0.0 | 25 |
| | Phase4.1 | 2020 | Phase4.1:2020 | T6Heavy_S2020 | Water Truck | 128 | | | 8 | 1 | - | - | 40 | 5,120 | T6Heavy_S | 0.0 | 0.9 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 0.0 | 0.0 | 12 |
| Onsite | Phase4.4 | 2020 | Phase4.4:2020 | T6Heavy_S2020 | Water Truck | 81 | | | 8 | 2 | - | - | 80 | 6,480 | T6Heavy_S | 0.1 | 1.8 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 15 | 0.0 | 0.0 | 15 |
| | Phase1.1 | 2018 | Phase1.1:2018 | T7SC_S2018 | End Dumps | 17 | | | 8 | 2 | - | - | 80 | 1,360 | T7SC_S | 0.2 | 3.3 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4 | 0.0 | 0.0 | 4 |
| | Phase1.2 | 2019 | Phase1.2:2019 | T7SC_S2019 | End Dumps | 10 | | | 8 | 2 | - | - | 80 | 800 | T7SC_S | 0.2 | 3.2 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 0.0 | 0.0 | 3 |
| | Phase2.1 | 2019 | Phase2.1:2019 | T7SC_S2019 | End Dumps | 100 | | | 8 | 5 | - | - | 200 | 20,000 | T7SC_S | 0.5 | 8.1 | 1.5 | 0.1 | 0.0 | 0.1 | 0.1 | 0.0 | 1 | 0.0 | 0.0 | 0.7 | 0.0 | 0.4 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 65 | 0.0 | 0.0 | 65 |
| | Phase4.1 | 2020 | Phase4.1:2020 | T7SC_S2020 | End Dumps | 128 | | | 8 | 2 | - | - | 80 | 10,240 | T7SC_S | 0.1 | 3.0 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.3 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 33 | 0.0 | 0.0 | 33 |
| | Phase4.4 | 2020 | Phase4.4:2020 | T7SC_S2020 | End Dumps | 81 | | | 8 | 2 | - | - | 80 | 6,480 | T7SC_S | 0.1 | 3.0 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.3 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 21 | 0.0 | 0.0 | 21 |

**Alternative 6**
**(below grade parking alternative; unmitigated)**

## Onroad Emissions Calculations

| | ID | Year | | Concat | Vehicle | Days | Workers per day | Employ Trip/Da | Employ Mi/ Day | Employ Mi/ Yr | Truck Trip/Day r/t | #Loads/Yr | Truck Mi/ Day | Truck Mi/ Yr | Vehicle | Pounds per day | | | | | | | | Metric tons per day | | | | Tons per year | | | | | | | | Metric tons per year | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | ROG | NOX | CO | PM10 | PM2.5 | PM10 D | PM2.5 D | SO2 | CO2 | CH4 | N2O | CO2e | ROG | NOX | CO | PM10 | PM2.5 | PM10 D | PM2.5 D | SO2 | CO2 | CH4 | N2O | CO2e |
| Offsite | Phase1.1 | 2018 | Phase1.1:2018 | LDA/LDT1/LDT22018 | Employee | 17 | 20 | 40 | 432 | 7,344 | | | | | LDA/LDT1/LDT2 | 0.0 | 0.1 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 0.0 | 0.0 | 3 |
| | Phase1.2 | 2019 | Phase1.2:2019 | LDA/LDT1/LDT22019 | Employee | 10 | 30 | 60 | 648 | 6,480 | | | | | LDA/LDT1/LDT2 | 0.0 | 0.2 | 1.4 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 0.0 | 0.0 | 2 |
| | Phase2.1 | 2019 | Phase2.1:2019 | LDA/LDT1/LDT22019 | Employee | 100 | 30 | 60 | 648 | 64,800 | | | | | LDA/LDT1/LDT2 | 0.0 | 0.2 | 1.4 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 22 | 0.0 | 0.0 | 22 |
| | Phase2.2 | 2019 | Phase2.2:2019 | LDA/LDT1/LDT22019 | Employee | 273 | 90 | 180 | 1,944 | 530,712 | | | | | LDA/LDT1/LDT2 | 0.1 | 0.5 | 4.2 | 0.0 | 0.0 | 0.2 | 0.1 | 0.0 | 1 | 0.0 | 0.0 | 0.7 | 0.0 | 0.1 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 179 | 0.0 | 0.0 | 179 |
| | Phase2.3 | 2020 | Phase2.3:2020 | LDA/LDT1/LDT22020 | Employee | 328 | 60 | 120 | 1,296 | 425,088 | | | | | LDA/LDT1/LDT2 | 0.1 | 0.3 | 2.6 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 | 0 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 139 | 0.0 | 0.0 | 139 |
| | Phase2.5 | 2020 | Phase2.5:2020 | LDA/LDT1/LDT22020 | Employee | 179 | 110 | 220 | 2,376 | 425,304 | | | | | LDA/LDT1/LDT2 | 0.1 | 0.5 | 4.8 | 0.0 | 0.0 | 0.2 | 0.1 | 0.0 | 1 | 0.0 | 0.0 | 0.8 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 139 | 0.0 | 0.0 | 139 |
| | Phase2.6 | 2020 | Phase2.6:2020 | LDA/LDT1/LDT22020 | Employee | 276 | 40 | 80 | 864 | 238,464 | | | | | LDA/LDT1/LDT2 | 0.0 | 0.2 | 1.7 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 78 | 0.0 | 0.0 | 78 |
| | Phase2.7 | 2020 | Phase2.7:2020 | LDA/LDT1/LDT22020 | Employee | 187 | 125 | 250 | 2,700 | 504,900 | | | | | LDA/LDT1/LDT2 | 0.1 | 0.6 | 5.4 | 0.0 | 0.0 | 0.3 | 0.1 | 0.0 | 1 | 0.0 | 0.0 | 0.9 | 0.0 | 0.1 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 165 | 0.0 | 0.0 | 165 |
| | Phase2.8 | 2021 | Phase2.8:2021 | LDA/LDT1/LDT22021 | Employee | 73 | 115 | 230 | 2,484 | 181,332 | | | | | LDA/LDT1/LDT2 | 0.1 | 0.5 | 4.7 | 0.0 | 0.0 | 0.2 | 0.1 | 0.0 | 1 | 0.0 | 0.0 | 0.8 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 57 | 0.0 | 0.0 | 57 |
| | Phase3.1 | 2019 | Phase3.1:2019 | LDA/LDT1/LDT22019 | Employee | 40 | 10 | 20 | 216 | 8,640 | | | | | LDA/LDT1/LDT2 | 0.0 | 0.1 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 0.0 | 0.0 | 3 |
| | Phase3.2 | 2019 | Phase3.2:2019 | LDA/LDT1/LDT22019 | Employee | 141 | 15 | 30 | 324 | 45,684 | | | | | LDA/LDT1/LDT2 | 0.0 | 0.1 | 0.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 15 | 0.0 | 0.0 | 15 |
| | Phase3.3 | 2020 | Phase3.3:2020 | LDA/LDT1/LDT22020 | Employee | 216 | 10 | 20 | 216 | 46,656 | | | | | LDA/LDT1/LDT2 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 15 | 0.0 | 0.0 | 15 |
| | Phase3.4 | 2020 | Phase3.4:2020 | LDA/LDT1/LDT22020 | Employee | 211 | 20 | 40 | 432 | 91,152 | | | | | LDA/LDT1/LDT2 | 0.0 | 0.1 | 0.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 30 | 0.0 | 0.0 | 30 |
| | Phase3.5 | 2021 | Phase3.5:2021 | LDA/LDT1/LDT22021 | Employee | 20 | 25 | 50 | 540 | 10,800 | | | | | LDA/LDT1/LDT2 | 0.0 | 0.1 | 1.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 0.0 | 0.0 | 3 |
| | Phase4.1 | 2020 | Phase4.1:2020 | LDA/LDT1/LDT22020 | Employee | 128 | 15 | 30 | 324 | 41,472 | | | | | LDA/LDT1/LDT2 | 0.0 | 0.1 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 14 | 0.0 | 0.0 | 14 |
| | Phase4.4 | 2020 | Phase4.4:2020 | LDA/LDT1/LDT22020 | Employee | 81 | 60 | 120 | 1,296 | 104,976 | | | | | LDA/LDT1/LDT2 | 0.1 | 0.3 | 2.6 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 | 0 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 34 | 0.0 | 0.0 | 34 |
| | Phase1.1 | 2018 | Phase1.1:2018 | T7SC2018 | Haul Truck | 17 | | | | | 9 | 75 | 146 | 2,490 | T7SC | 0.0 | 1.7 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4 | 0.0 | 0.0 | 4 |
| | Phase1.2 | 2019 | Phase1.2:2019 | T7SC2019 | Haul Truck | 10 | | | | | 6 | 30 | 454 | 4,536 | T7SC | 0.1 | 4.9 | 0.5 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 1 | 0.0 | 0.0 | 0.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 7 | 0.0 | 0.0 | 7 |
| | Phase2.1 | 2019 | Phase2.1:2019 | T7SC2019 | Haul Truck | 100 | | | | | 196 | 9,800 | 14,818 | 1,481,760 | T7SC | 4.4 | 161.6 | 17.1 | 1.1 | 1.0 | 3.2 | 1.2 | 0.5 | 24 | 0.0 | 0.0 | 24.6 | 0.2 | 8.1 | 0.9 | 0.1 | 0.1 | 0.2 | 0.1 | 0.0 | 2,441 | 0.1 | 0.1 | 2,463 |
| | Phase2.2 | 2019 | Phase2.2:2019 | T7SC2019 | Haul Truck | 273 | | | | | 0 | 0 | 0 | 0 | T7SC | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| | Phase2.3 | 2020 | Phase2.3:2020 | T7SC2020 | Haul Truck | 328 | | | | | 0 | 0 | 0 | 0 | T7SC | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| | Phase2.5 | 2020 | Phase2.5:2020 | T7SC2020 | Haul Truck | 179 | | | | | 0 | 0 | 0 | 0 | T7SC | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| | Phase2.6 | 2020 | Phase2.6:2020 | T7SC2020 | Haul Truck | 276 | | | | | 0 | 0 | 0 | 0 | T7SC | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| | Phase2.7 | 2020 | Phase2.7:2020 | T7SC2020 | Haul Truck | 187 | | | | | 0 | 0 | 0 | 0 | T7SC | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| | Phase2.8 | 2021 | Phase2.8:2021 | T7SC2021 | Haul Truck | 73 | | | | | 0 | 0 | 0 | 0 | T7SC | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| | Phase3.1 | 2019 | Phase3.1:2019 | T7SC2019 | Haul Truck | 40 | | | | | 0 | 0 | 0 | 0 | T7SC | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| | Phase3.2 | 2019 | Phase3.2:2019 | T7SC2019 | Haul Truck | 141 | | | | | 0 | 0 | 0 | 0 | T7SC | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| | Phase3.3 | 2020 | Phase3.3:2020 | T7SC2020 | Haul Truck | 216 | | | | | 0 | 0 | 0 | 0 | T7SC | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| | Phase3.4 | 2020 | Phase3.4:2020 | T7SC2020 | Haul Truck | 211 | | | | | 0 | 0 | 0 | 0 | T7SC | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| | Phase3.5 | 2021 | Phase3.5:2021 | T7SC2021 | Haul Truck | 20 | | | | | 0 | 0 | 0 | 0 | T7SC | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| | Phase4.1 | 2020 | Phase4.1:2020 | T7SC2020 | Haul Truck | 128 | | | | | 1 | 50 | 13 | 1,660 | T7SC | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 0.0 | 0.0 | 3 |
| | Phase4.4 | 2020 | Phase4.4:2020 | T7SC2020 | Haul Truck | 81 | | | | | 0 | 0 | 0 | 0 | T7SC | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| | Phase1.1 | 2018 | Phase1.1:2018 | T6Heavy2018 | Delivery | 17 | | | | | 0 | 0 | 0 | 0 | T6Heavy | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| | Phase1.2 | 2019 | Phase1.2:2019 | T6Heavy2019 | Delivery | 10 | | | | | 0 | 0 | 0 | 0 | T6Heavy | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| | Phase2.1 | 2019 | Phase2.1:2019 | T6Heavy2019 | Delivery | 100 | | | | | 10 | 500 | 73 | 7,300 | T6Heavy | 0.0 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 9 | 0.0 | 0.0 | 9 |
| | Phase2.2 | 2019 | Phase2.2:2019 | T6Heavy2019 | Delivery | 273 | | | | | 29 | 3,900 | 209 | 56,940 | T6Heavy | 0.0 | 1.3 | 0.1 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.3 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 69 | 0.0 | 0.0 | 70 |
| | Phase2.3 | 2020 | Phase2.3:2020 | T6Heavy2020 | Delivery | 328 | | | | | 4 | 600 | 27 | 8,760 | T6Heavy | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 11 | 0.0 | 0.0 | 11 |
| | Phase2.5 | 2020 | Phase2.5:2020 | T6Heavy2020 | Delivery | 179 | | | | | 3 | 300 | 24 | 4,380 | T6Heavy | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5 | 0.0 | 0.0 | 5 |
| | Phase2.6 | 2020 | Phase2.6:2020 | T6Heavy2020 | Delivery | 276 | | | | | 1 | 150 | 8 | 2,190 | T6Heavy | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 0.0 | 0.0 | 3 |
| | Phase2.7 | 2020 | Phase2.7:2020 | T6Heavy2020 | Delivery | 187 | | | | | 1 | 100 | 8 | 1,460 | T6Heavy | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 0.0 | 0.0 | 2 |
| | Phase2.8 | 2021 | Phase2.8:2021 | T6Heavy2021 | Delivery | 73 | | | | | 4 | 150 | 30 | 2,190 | T6Heavy | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 0.0 | 0.0 | 3 |
| | Phase3.1 | 2019 | Phase3.1:2019 | T6Heavy2019 | Delivery | 40 | | | | | 5 | 100 | 37 | 1,460 | T6Heavy | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 0.0 | 0.0 | 2 |
| | Phase3.2 | 2019 | Phase3.2:2019 | T6Heavy2019 | Delivery | 141 | | | | | 10 | 700 | 72 | 10,220 | T6Heavy | 0.0 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 0.0 | 0.0 | 12 |
| | Phase3.3 | 2020 | Phase3.3:2020 | T6Heavy2020 | Delivery | 216 | | | | | 1 | 100 | 7 | 1,460 | T6Heavy | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 0.0 | 0.0 | 2 |
| | Phase3.4 | 2020 | Phase3.4:2020 | T6Heavy2020 | Delivery | 211 | | | | | 1 | 125 | 9 | 1,825 | T6Heavy | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 0.0 | 0.0 | 2 |
| | Phase3.5 | 2021 | Phase3.5:2021 | T6Heavy2021 | Delivery | 20 | | | | | 6 | 60 | 44 | 876 | T6Heavy | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 0.0 | 0.0 | 1 |
| | Phase4.1 | 2020 | Phase4.1:2020 | T6Heavy2020 | Delivery | 128 | | | | | 0 | 0 | 0 | 0 | T6Heavy | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| | Phase4.4 | 2020 | Phase4.4:2020 | T6Heavy2020 | Delivery | 81 | | | hrs/day | trucks | 4 | 160 | 29 | 2,336 | T6Heavy | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 0.0 | 0.0 | 3 |
| Onsite | Phase1.1 | 2018 | Phase1.1:2018 | T6Heavy_S2018 | Water Truck | 17 | | | 8 | 1 | - | - | 40 | 680 | T6Heavy_S | 0.0 | 0.9 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 0.0 | 0.0 | 2 |
| | Phase1.2 | 2019 | Phase1.2:2019 | T6Heavy_S2019 | Water Truck | 10 | | | 8 | 1 | - | - | 40 | 400 | T6Heavy_S | 0.0 | 0.9 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 0.0 | 0.0 | 1 |
| | Phase2.1 | 2019 | Phase2.1:2019 | T6Heavy_S2019 | Water Truck | 100 | | | 8 | 1 | - | - | 40 | 4,000 | T6Heavy_S | 0.0 | 0.9 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 9 | 0.0 | 0.0 | 9 |
| | Phase2.2 | 2019 | Phase2.2:2019 | T6Heavy_S2019 | Water Truck | 273 | | | 8 | 1 | - | - | 40 | 10,920 | T6Heavy_S | 0.0 | 0.9 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25 | 0.0 | 0.0 | 25 |
| | Phase4.1 | 2020 | Phase4.1:2020 | T6Heavy_S2020 | Water Truck | 128 | | | 8 | 1 | - | - | 40 | 5,120 | T6Heavy_S | 0.0 | 0.9 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 0.0 | 0.0 | 12 |
| | Phase4.4 | 2020 | Phase4.4:2020 | T6Heavy_S2020 | Water Truck | 81 | | | 8 | 2 | - | - | 80 | 6,480 | T6Heavy_S | 0.1 | 1.8 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 15 | 0.0 | 0.0 | 15 |
| | Phase1.1 | 2018 | Phase1.1:2018 | T7SC_S2018 | End Dumps | 17 | | | 8 | 2 | - | - | 80 | 1,360 | T7SC_S | 0.2 | 3.3 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4 | 0.0 | 0.0 | 4 |
| | Phase1.2 | 2019 | Phase1.2:2019 | T7SC_S2019 | End Dumps | 10 | | | 8 | 2 | - | - | 80 | 800 | T7SC_S | 0.2 | 3.2 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 0.0 | 0.0 | 3 |
| | Phase2.1 | 2019 | Phase2.1:2019 | T7SC_S2019 | End Dumps | 100 | | | 8 | 5 | - | - | 200 | 20,000 | T7SC_S | 0.5 | 8.1 | 1.5 | 0.1 | 0.0 | 0.1 | 0.1 | 0.0 | 1 | 0.0 | 0.0 | 0.7 | 0.0 | 0.4 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 65 | 0.0 | 0.0 | 65 |
| | Phase4.1 | 2020 | Phase4.1:2020 | T7SC_S2020 | End Dumps | 128 | | | 8 | 2 | - | - | 80 | 10,240 | T7SC_S | 0.1 | 3.0 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.3 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 33 | 0.0 | 0.0 | 33 |
| | Phase4.4 | 2020 | Phase4.4:2020 | T7SC_S2020 | End Dumps | 81 | | | 8 | 2 | - | - | 80 | 6,480 | T7SC_S | 0.1 | 3.0 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.3 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 21 | 0.0 | 0.0 | 21 |

**Alternative 6**
**(below grade parking alternative; mitigated)**

**Onroad Emissions Calculations**

| | ID | Year | Concat | Vehicle | Days | Workers per day | Employ Trip/Da | Employ Mi/ Day | Employ Mi/Yr | Truck Trip/Day r/t | #Loads/Yr | Truck Mi/ Day | Truck Mi/ Yr | Vehicle | Pounds per day | | | | | | | | Metric tons per day | | | | Tons per year | | | | | | | | Metric tons per year | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | ROG | NOX | CO | PM10 | PM2.5 | PM10 D | PM2.5 D | SO2 | CO2 | CH4 | N2O | CO2e | ROG | NOX | CO | PM10 | PM2.5 | PM10 D | PM2.5 D | SO2 | CO2 | CH4 | N2O | CO2e |
| | Phase1.1 | 2018 | Phase1.1:2018 | LDA/LDT1/LDT22018 | Employee | 17 | 20 | 40 | 432 | 7,344 | | | | LDA/LDT1/LDT2 | 0.0 | 0.1 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 0.0000 | 0.0000 | 3 |
| | Phase1.2 | 2019 | Phase1.2:2019 | LDA/LDT1/LDT22019 | Employee | 10 | 30 | 60 | 648 | 6,480 | | | | LDA/LDT1/LDT2 | 0.0 | 0.2 | 1.4 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 0.0000 | 0.0000 | 2 |
| | Phase2.1 | 2019 | Phase2.1:2019 | LDA/LDT1/LDT22019 | Employee | 100 | 30 | 60 | 648 | 64,800 | | | | LDA/LDT1/LDT2 | 0.0 | 0.2 | 1.4 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 22 | 0.0003 | 0.0003 | 22 |
| | Phase2.2 | 2019 | Phase2.2:2019 | LDA/LDT1/LDT22019 | Employee | 273 | 90 | 180 | 1,944 | 530,712 | | | | LDA/LDT1/LDT2 | 0.1 | 0.5 | 4.2 | 0.0 | 0.0 | 0.2 | 0.1 | 0.0 | 1 | 0.0 | 0.0 | 0.7 | 0.0 | 0.1 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 179 | 0.0023 | 0.0024 | 179 |
| | Phase2.3 | 2020 | Phase2.3:2020 | LDA/LDT1/LDT22020 | Employee | 328 | 60 | 120 | 1,296 | 425,088 | | | | LDA/LDT1/LDT2 | 0.1 | 0.3 | 2.6 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 | 0 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 139 | 0.0017 | 0.0018 | 139 |
| | Phase2.5 | 2020 | Phase2.5:2020 | LDA/LDT1/LDT22020 | Employee | 179 | 110 | 220 | 2,376 | 425,304 | | | | LDA/LDT1/LDT2 | 0.1 | 0.5 | 4.8 | 0.0 | 0.0 | 0.2 | 0.1 | 0.0 | 1 | 0.0 | 0.0 | 0.8 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 139 | 0.0017 | 0.0018 | 139 |
| | Phase2.6 | 2020 | Phase2.6:2020 | LDA/LDT1/LDT22020 | Employee | 276 | 40 | 80 | 864 | 238,464 | | | | LDA/LDT1/LDT2 | 0.0 | 0.2 | 1.7 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 78 | 0.0010 | 0.0010 | 78 |
| | Phase2.7 | 2020 | Phase2.7:2020 | LDA/LDT1/LDT22020 | Employee | 187 | 125 | 250 | 2,700 | 504,900 | | | | LDA/LDT1/LDT2 | 0.1 | 0.6 | 5.4 | 0.0 | 0.0 | 0.3 | 0.1 | 0.0 | 1 | 0.0 | 0.0 | 0.9 | 0.0 | 0.1 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 165 | 0.0020 | 0.0021 | 165 |
| | Phase2.8 | 2021 | Phase2.8:2021 | LDA/LDT1/LDT22021 | Employee | 73 | 115 | 230 | 2,484 | 181,332 | | | | LDA/LDT1/LDT2 | 0.1 | 0.5 | 4.7 | 0.0 | 0.0 | 0.2 | 0.1 | 0.0 | 1 | 0.0 | 0.0 | 0.8 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 57 | 0.0007 | 0.0007 | 57 |
| | Phase3.1 | 2019 | Phase3.1:2019 | LDA/LDT1/LDT22019 | Employee | 40 | 10 | 20 | 216 | 8,640 | | | | LDA/LDT1/LDT2 | 0.0 | 0.1 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 0.0000 | 0.0000 | 3 |
| | Phase3.2 | 2019 | Phase3.2:2019 | LDA/LDT1/LDT22019 | Employee | 141 | 15 | 30 | 324 | 45,684 | | | | LDA/LDT1/LDT2 | 0.0 | 0.1 | 0.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 15 | 0.0002 | 0.0002 | 15 |
| | Phase3.3 | 2020 | Phase3.3:2020 | LDA/LDT1/LDT22020 | Employee | 216 | 10 | 20 | 216 | 46,656 | | | | LDA/LDT1/LDT2 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 15 | 0.0002 | 0.0002 | 15 |
| | Phase3.4 | 2020 | Phase3.4:2020 | LDA/LDT1/LDT22020 | Employee | 211 | 20 | 40 | 432 | 91,152 | | | | LDA/LDT1/LDT2 | 0.0 | 0.1 | 0.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 30 | 0.0004 | 0.0004 | 30 |
| | Phase3.5 | 2021 | Phase3.5:2021 | LDA/LDT1/LDT22021 | Employee | 20 | 25 | 50 | 540 | 10,800 | | | | LDA/LDT1/LDT2 | 0.0 | 0.1 | 1.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 0.0000 | 0.0000 | 3 |
| | Phase4.1 | 2020 | Phase4.1:2020 | LDA/LDT1/LDT22020 | Employee | 128 | 15 | 30 | 324 | 41,472 | | | | LDA/LDT1/LDT2 | 0.0 | 0.1 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 14 | 0.0 | 0.0 | 14 |
| | Phase4.4 | 2020 | Phase4.4:2020 | LDA/LDT1/LDT22020 | Employee | 81 | 60 | 120 | 1,296 | 104,976 | | | | LDA/LDT1/LDT2 | 0.1 | 0.3 | 2.6 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 | 0 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 34 | 0.0 | 0.0 | 34 |
| | Phase1.1 | 2018 | Phase1.1:2018 | T7SC2018 | Haul Truck | 17 | | | | | 9 | 75 | 146 | 2,490 | T7SC | 0.0 | 1.7 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4 | 0.0 | 0.0 | 4 |
| | Phase1.2 | 2019 | Phase1.2:2019 | T7SC2019 | Haul Truck | 10 | | | | | 6 | 30 | 454 | 4,536 | T7SC | 0.1 | 4.9 | 0.5 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 1 | 0.0 | 0.0 | 0.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 7 | 0.0 | 0.0 | 7 |
| | Phase2.1 | 2019 | Phase2.1:2019 | T7SC2019 | Haul Truck | 115 | | | | | 170 | 9,800 | 12,885 | 1,481,760 | T7SC | 3.8 | 140.5 | 14.9 | 0.9 | 0.9 | 2.8 | 1.0 | 0.4 | 21 | 0.0 | 0.0 | 21.4 | 0.2 | 8.1 | 0.9 | 0.1 | 0.1 | 0.2 | 0.1 | 0.0 | 2,441 | 0.1 | 0.1 | 2,463 |
| | Phase2.2 | 2019 | Phase2.2:2019 | T7SC2019 | Haul Truck | 273 | | | | | 0 | 0 | 0 | 0 | T7SC | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| | Phase2.3 | 2020 | Phase2.3:2020 | T7SC2020 | Haul Truck | 328 | | | | | 0 | 0 | 0 | 0 | T7SC | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| | Phase2.5 | 2020 | Phase2.5:2020 | T7SC2020 | Haul Truck | 179 | | | | | 0 | 0 | 0 | 0 | T7SC | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| | Phase2.6 | 2020 | Phase2.6:2020 | T7SC2020 | Haul Truck | 276 | | | | | 0 | 0 | 0 | 0 | T7SC | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| Offsite | Phase2.7 | 2020 | Phase2.7:2020 | T7SC2020 | Haul Truck | 187 | | | | | 0 | 0 | 0 | 0 | T7SC | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| | Phase2.8 | 2021 | Phase2.8:2021 | T7SC2021 | Haul Truck | 73 | | | | | 0 | 0 | 0 | 0 | T7SC | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| | Phase3.1 | 2019 | Phase3.1:2019 | T7SC2019 | Haul Truck | 40 | | | | | 0 | 0 | 0 | 0 | T7SC | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| | Phase3.2 | 2019 | Phase3.2:2019 | T7SC2019 | Haul Truck | 141 | | | | | 0 | 0 | 0 | 0 | T7SC | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| | Phase3.3 | 2020 | Phase3.3:2020 | T7SC2020 | Haul Truck | 216 | | | | | 0 | 0 | 0 | 0 | T7SC | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| | Phase3.4 | 2020 | Phase3.4:2020 | T7SC2020 | Haul Truck | 211 | | | | | 0 | 0 | 0 | 0 | T7SC | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| | Phase3.5 | 2021 | Phase3.5:2021 | T7SC2021 | Haul Truck | 20 | | | | | 0 | 0 | 0 | 0 | T7SC | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| | Phase4.1 | 2020 | Phase4.1:2020 | T7SC2020 | Haul Truck | 128 | | | | | 1 | 50 | 13 | 1,660 | T7SC | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 0.0 | 0.0 | 3 |
| | Phase4.4 | 2020 | Phase4.4:2020 | T7SC2020 | Haul Truck | 81 | | | | | 0 | 0 | 0 | 0 | T7SC | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| | Phase1.1 | 2018 | Phase1.1:2018 | T6Heavy2018 | Delivery | 17 | | | | | 0 | 0 | 0 | 0 | T6Heavy | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| | Phase1.2 | 2019 | Phase1.2:2019 | T6Heavy2019 | Delivery | 10 | | | | | 0 | 0 | 0 | 0 | T6Heavy | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| | Phase2.1 | 2019 | Phase2.1:2019 | T6Heavy2019 | Delivery | 100 | | | | | 10 | 500 | 73 | 7,300 | T6Heavy | 0.0 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 9 | 0.0 | 0.0 | 9 |
| | Phase2.2 | 2019 | Phase2.2:2019 | T6Heavy2019 | Delivery | 273 | | | | | 29 | 3,900 | 209 | 56,940 | T6Heavy | 0.0 | 1.3 | 0.1 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.3 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 69 | 0.0 | 0.0 | 70 |
| | Phase2.3 | 2020 | Phase2.3:2020 | T6Heavy2020 | Delivery | 328 | | | | | 4 | 600 | 27 | 8,760 | T6Heavy | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 11 | 0.0 | 0.0 | 11 |
| | Phase2.5 | 2020 | Phase2.5:2020 | T6Heavy2020 | Delivery | 179 | | | | | 3 | 300 | 24 | 4,380 | T6Heavy | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5 | 0.0 | 0.0 | 5 |
| | Phase2.6 | 2020 | Phase2.6:2020 | T6Heavy2020 | Delivery | 276 | | | | | 1 | 150 | 8 | 2,190 | T6Heavy | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 0.0 | 0.0 | 3 |
| | Phase2.7 | 2020 | Phase2.7:2020 | T6Heavy2020 | Delivery | 187 | | | | | 1 | 100 | 8 | 1,460 | T6Heavy | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 0.0 | 0.0 | 2 |
| | Phase2.8 | 2021 | Phase2.8:2021 | T6Heavy2021 | Delivery | 73 | | | | | 4 | 150 | 30 | 2,190 | T6Heavy | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 0.0 | 0.0 | 3 |
| | Phase3.1 | 2019 | Phase3.1:2019 | T6Heavy2019 | Delivery | 40 | | | | | 5 | 100 | 37 | 1,460 | T6Heavy | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 0.0 | 0.0 | 2 |
| | Phase3.2 | 2019 | Phase3.2:2019 | T6Heavy2019 | Delivery | 141 | | | | | 10 | 700 | 72 | 10,220 | T6Heavy | 0.0 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 0.0 | 0.0 | 12 |
| | Phase3.3 | 2020 | Phase3.3:2020 | T6Heavy2020 | Delivery | 216 | | | | | 1 | 100 | 7 | 1,460 | T6Heavy | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 0.0 | 0.0 | 2 |
| | Phase3.4 | 2020 | Phase3.4:2020 | T6Heavy2020 | Delivery | 211 | | | | | 1 | 125 | 9 | 1,825 | T6Heavy | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 0.0 | 0.0 | 2 |
| | Phase3.5 | 2021 | Phase3.5:2021 | T6Heavy2021 | Delivery | 20 | | | | | 6 | 60 | 44 | 876 | T6Heavy | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 0.0 | 0.0 | 1 |
| | Phase4.1 | 2020 | Phase4.1:2020 | T6Heavy2020 | Delivery | 128 | | | | | 0 | 0 | 0 | 0 | T6Heavy | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 |
| | Phase4.4 | 2020 | Phase4.4:2020 | T6Heavy2020 | Delivery | 81 | | | hrs/day | trucks | 4 | 160 | 29 | 2,336 | T6Heavy | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 0.0 | 0.0 | 3 |
| | Phase1.1 | 2018 | Phase1.1:2018 | T6Heavy_S2018 | Water Truck | 17 | | | 8 | 1 | - | - | 40 | 680 | T6Heavy_S | 0.0 | 0.9 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 0.0 | 0.0 | 2 |
| | Phase1.2 | 2019 | Phase1.2:2019 | T6Heavy_S2019 | Water Truck | 10 | | | 8 | 1 | - | - | 40 | 400 | T6Heavy_S | 0.0 | 0.9 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 0.0 | 0.0 | 1 |
| | Phase2.1 | 2019 | Phase2.1:2019 | T6Heavy_S2019 | Water Truck | 100 | | | 8 | 1 | - | - | 40 | 4,000 | T6Heavy_S | 0.0 | 0.9 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 9 | 0.0 | 0.0 | 9 |
| | Phase2.2 | 2019 | Phase2.2:2019 | T6Heavy_S2019 | Water Truck | 273 | | | 8 | 1 | - | - | 40 | 10,920 | T6Heavy_S | 0.0 | 0.9 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25 | 0.0 | 0.0 | 25 |
| | Phase4.1 | 2020 | Phase4.1:2020 | T6Heavy_S2020 | Water Truck | 128 | | | 8 | 1 | - | - | 40 | 5,120 | T6Heavy_S | 0.0 | 0.9 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 0.0 | 0.0 | 12 |
| Onsite | Phase4.4 | 2020 | Phase4.4:2020 | T6Heavy_S2020 | Water Truck | 81 | | | 8 | 2 | - | - | 80 | 6,480 | T6Heavy_S | 0.1 | 1.8 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 15 | 0.0 | 0.0 | 15 |
| | Phase1.1 | 2018 | Phase1.1:2018 | T7SC_S2018 | End Dumps | 17 | | | 8 | 2 | - | - | 80 | 1,360 | T7SC_S | 0.2 | 3.3 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4 | 0.0 | 0.0 | 4 |
| | Phase1.2 | 2019 | Phase1.2:2019 | T7SC_S2019 | End Dumps | 10 | | | 8 | 2 | - | - | 80 | 800 | T7SC_S | 0.2 | 3.2 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 0.0 | 0.0 | 3 |
| | Phase2.1 | 2019 | Phase2.1:2019 | T7SC_S2019 | End Dumps | 100 | | | 8 | 5 | - | - | 200 | 20,000 | T7SC_S | 0.5 | 8.1 | 1.5 | 0.1 | 0.0 | 0.1 | 0.1 | 0.0 | 1 | 0.0 | 0.0 | 0.7 | 0.0 | 0.4 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 65 | 0.0 | 0.0 | 65 |
| | Phase4.1 | 2020 | Phase4.1:2020 | T7SC_S2020 | End Dumps | 128 | | | 8 | 2 | - | - | 80 | 10,240 | T7SC_S | 0.1 | 3.0 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.3 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 33 | 0.0 | 0.0 | 33 |
| | Phase4.4 | 2020 | Phase4.4:2020 | T7SC_S2020 | End Dumps | 81 | | | 8 | 2 | - | - | 80 | 6,480 | T7SC_S | 0.1 | 3.0 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.3 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 21 | 0.0 | 0.0 | 21 |

## Re-entrained Paved Road Dust Emissions

*Methodology*

Calculation Methodology: USEPA AP-42, Paved Roads, Section 13.2.1, Revised January 2011:

http://www.epa.gov/ttn/chief/ap42/ch13/final/c13s0201.pdf

Avg vehicle weight and silt loading on Local Roads within San Diego County

http://www.arb.ca.gov/ei/areasrc/fullpdf/full7-9.pdf

Precipitation Days greater than 0.254mm (0.01 in) for San Diego

CalEEMod

*Emission Factor Calculation*

$$E_{ext} = [\,k\,(sL)^{0.91} \times (W)^{1.02}\,]\,(1 - P/4N)$$

| Pollutant | Variables | | | | | Emission Factor (g per mi) |
|---|---|---|---|---|---|---|
| | k | sL | W | P | N | |
| $PM_{10}$ | 1.00 | 0.32 | 2.4 | 40 | 365 | 0.84224 |
| $PM_{2.5}$ | 0.25 | 0.32 | 2.4 | 40 | 365 | 0.21056 |

| | |
|---|---|
| E = particulate emission factor (grams of particulate matter/VMT) | |
| k = particle size multiplier (lb/VMT) | *default from AP-42* |
| sL = roadway silt loading (g/m2) | *ARB Section 7.9, Table 3 & 9, San Diego, Urban Local* |
| W = average weight of vehicles on the road (tons) | *ARB Section 7.9, Table 9, San Diego* |
| P = number of wet days with at least 0.254mm of precipitation | *CalEEmod Appx D* |
| N = number of days in the averaging period | *annual days (365)* |
| g to lb conversion | *0.002204623* |

*PM Emissions (daily)* Offsite VMT only

| ID | Year | Pounds per Day | | VMT |
|---|---|---|---|---|
| | | PM10 | PM2.5 | |
| Phase1.1 | 2018 | 1.07 | 0.27 | 578 |
| Phase1.2 | 2019 | 2.05 | 0.51 | 1,102 |
| Phase2.1 | 2019 | 7.80 | 1.95 | 4,199 |
| Phase2.2 | 2019 | 4.00 | 1.00 | 2,153 |
| Phase2.3 | 2020 | 2.46 | 0.61 | 1,323 |
| Phase2.5 | 2020 | 4.46 | 1.11 | 2,400 |
| Phase2.6 | 2020 | 1.62 | 0.40 | 872 |
| Phase2.7 | 2020 | 5.03 | 1.26 | 2,708 |
| Phase2.8 | 2021 | 4.67 | 1.17 | 2,514 |
| Phase3.1 | 2019 | 0.47 | 0.12 | 253 |
| Phase3.2 | 2019 | 0.74 | 0.18 | 396 |
| Phase3.3 | 2020 | 0.41 | 0.10 | 223 |
| Phase3.4 | 2020 | 0.82 | 0.20 | 441 |
| Phase3.5 | 2021 | 1.08 | 0.27 | 584 |
| Phase4.1 | 2020 | 0.63 | 0.16 | 337 |
| Phase4.4 | 2020 | 2.46 | 0.61 | 1,325 |

*PM Emissions (annual)*

| ID | Year | Tons per Year | | VMT |
|---|---|---|---|---|
| | | PM10 | PM2.5 | |
| Phase1.1 | 2018 | 0.01 | 0.00 | 9,834 |
| Phase1.2 | 2019 | 0.01 | 0.00 | 11,016 |
| Phase2.1 | 2019 | 0.39 | 0.10 | 419,860 |
| Phase2.2 | 2019 | 0.55 | 0.14 | 587,652 |
| Phase2.3 | 2020 | 0.40 | 0.10 | 433,848 |
| Phase2.5 | 2020 | 0.40 | 0.10 | 429,684 |
| Phase2.6 | 2020 | 0.22 | 0.06 | 240,654 |
| Phase2.7 | 2020 | 0.47 | 0.12 | 506,360 |
| Phase2.8 | 2021 | 0.17 | 0.04 | 183,522 |
| Phase3.1 | 2019 | 0.01 | 0.00 | 10,100 |
| Phase3.2 | 2019 | 0.05 | 0.01 | 55,904 |
| Phase3.3 | 2020 | 0.04 | 0.01 | 48,116 |
| Phase3.4 | 2020 | 0.09 | 0.02 | 92,977 |
| Phase3.5 | 2021 | 0.01 | 0.00 | 11,676 |
| Phase4.1 | 2020 | 0.04 | 0.01 | 43,132 |
| Phase4.4 | 2020 | 0.10 | 0.02 | 107,312 |

## Fugitive Dust from Excavation, Clearing, and Demolition

| Phase ID | # Days | Activity |  |  |  | Grading EF (lbs/acre) |  | Loding EF (lbs/ton) |  | DozingEF (lbs/ton) |  | Demo EF (lbs/ton) |  | Grading (lbs/d) |  | Loading (lbs/d) |  | Dozing lbs/d) |  | Demo EF lbs/d) |  | Grading (tons/yr) |  | Loading (tons/yr) |  | Dozing (tons/yr) |  | Demo (tons/yr) |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  | Total acres Graded | Total Excavation CY) | hrs of Bolldozing | Total Demo Tons | PM10 | PM2.5 | PM10 | PM2.5 | PM10 | PM2.5 | PM10 | PM2.5 | PM10 | PM2.5 | PM10 | PM2.5 | PM10 | PM2.5 | PM10 | PM2.5 | PM10 | PM2.5 | PM10 | PM2.5 | PM10 | PM2.5 | PM10 | PM2.5 |
| Phase 1.1 | 17 |  | 1050 | 8 | 3298 | 1.06 | 0.11 | 0.00 | 0.00 | 0.75 | 0.41 | 0.02 | 0.00 |  |  | 0.01 | 0.00 | 6.02 | 3.31 | 4.15 | 0.63 |  |  | 0.00 | 0.00 | 0.05 | 0.03 | 0.04 | 0.01 |
| Phase 1.2 | 10 |  | 420 |  |  | 1.06 | 0.11 | 0.00 | 0.00 | 0.75 | 0.41 | 0.02 | 0.00 |  |  | 0.00 | 0.00 |  |  |  |  |  |  | 0.00 | 0.00 |  |  |  |  |
| Phase 2.1 | 100 | 3.4 | 33530 | 8 |  | 1.06 | 0.11 | 0.00 | 0.00 | 0.75 | 0.41 | 0.02 | 0.00 | 0.91 | 0.10 | 0.03 | 0.01 | 6.02 | 3.31 |  |  | 0.05 | 0.00 | 0.00 | 0.00 | 0.30 | 0.17 |  |  |
| Phase 2.2 | 273 |  |  |  |  | 1.06 | 0.11 | 0.00 | 0.00 | 0.75 | 0.41 | 0.02 | 0.00 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Phase 2.3 | 328 |  |  |  |  | 1.06 | 0.11 | 0.00 | 0.00 | 0.75 | 0.41 | 0.02 | 0.00 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Phase 2.5 | 179 |  |  |  |  | 1.06 | 0.11 | 0.00 | 0.00 | 0.75 | 0.41 | 0.02 | 0.00 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Phase 2.6 | 276 |  |  |  |  | 1.06 | 0.11 | 0.00 | 0.00 | 0.75 | 0.41 | 0.02 | 0.00 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Phase 2.7 | 187 |  |  |  |  | 1.06 | 0.11 | 0.00 | 0.00 | 0.75 | 0.41 | 0.02 | 0.00 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Phase 2.8 | 73 |  |  |  |  | 1.06 | 0.11 | 0.00 | 0.00 | 0.75 | 0.41 | 0.02 | 0.00 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Phase 3.1 | 40 |  |  |  |  | 1.06 | 0.11 | 0.00 | 0.00 | 0.75 | 0.41 | 0.02 | 0.00 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Phase 3.2 | 141 |  |  |  |  | 1.06 | 0.11 | 0.00 | 0.00 | 0.75 | 0.41 | 0.02 | 0.00 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Phase 3.3 | 216 |  |  |  |  | 1.06 | 0.11 | 0.00 | 0.00 | 0.75 | 0.41 | 0.02 | 0.00 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Phase 3.4 | 211 |  |  |  |  | 1.06 | 0.11 | 0.00 | 0.00 | 0.75 | 0.41 | 0.02 | 0.00 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Phase 3.5 | 20 |  |  |  |  | 1.06 | 0.11 | 0.00 | 0.00 | 0.75 | 0.41 | 0.02 | 0.00 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Phase 4.1 | 128 | 1.7 | 3000 | 8 | 2251 | 1.06 | 0.11 | 0.00 | 0.00 | 0.75 | 0.41 | 0.02 | 0.00 | 0.46 | 0.05 | 0.00 | 0.00 | 6.02 | 3.31 | 0.38 | 0.06 | 0.03 | 0.00 | 0.00 | 0.00 | 0.39 | 0.21 | 0.02 | 0.00 |
| Phase 4.4 | 81 |  |  | 8 |  | 1.06 | 0.11 | 0.00 | 0.00 | 0.75 | 0.41 | 0.02 | 0.00 |  |  |  |  | 0.07 | 0.04 |  |  |  |  |  |  | 0.00 | 0.00 |  |  |

**ROG emissions from Paving**

Emissions based on Calculation Details in CalEEMod Users Guide, Appendix A, pages 16-17

Eap = Efap x Aparking

| | Phase 4.4 | |
|---|---|---|
| VOC Emissions € (lbs/day) | 0.13 | max pounds of VOC per day |
| VOC Emissions € (ton/year) | 0.01 | tons of VOC per year (2017) |
| EF | 2.62 | lbs of VOC per acre paved |
| SF_total | 178481 | total paving square footage |
| A_total | 4.0973 | total paving acreage |
| SF_day | 2203 | Daily paving square footage |
| A_day | 0.0506 | Daily paving acreage |

Note:

*per PD there is going to be a apraking structure with 213 spaces. It is assumed asphalt paving will be applied. ------> Total acres

*"2500Sf-4500SF square feet of retail development along the promenade" assumed to be paved 4.097349

*Approximately 2.1 acres of public access plaza space throughout the project site

Note:

per equipment list and construction scheduel, seems paving occures in phase 4.4 (81 days) 81

## VOC emissions from Architectural Coatings

Emissions based on Calculation Details in CalEEMod Users Guide, Appendix A, pages 15-16

Eac = Efac x F x Apaint
EFac = Cvoc / 454 (g/lb) x 3.875 (L/GAL) / 180 (sqft)

| **Unmitigated** | Phase 2.6 | Phase 3.4 | Phase 4.4 | *description* |
|---|---|---|---|---|
| VOC Emissions (lbs/day) | 68 | 10 | 39 | pounds of VOC per day; unmitigated |
| VOC Emissions (ton/year) | 9 | 1 | 2 | |
| Eexterior (day) | 51 | 8 | 29 | |
| Einterior (day) | 17 | 3 | 10 | |
| Eexterior (annual) | 14,169 | 1,602 | 2,339 | |
| Einterior (annual) | 4,723 | 534 | 780 | |
| EF -exterior | 0.01187 | 0.01187 | 0.01187 | emission factor (lbs per sq. ft.) |
| EF - interior | 0.01187 | 0.01187 | 0.01187 | emission factor (lbs per sq. ft.) |
| New construction (sf) | 796,000 | 90,000 | 131,415 | The hotel tower, including the associated retail and public access plaza, would be approxim |
| Days of coatings | 276 | 211 | 81 | |
| Construction SF per day | 2,884 | 427 | 1,622 | ft2 |
| Fraction exterior | 75% | 75% | 75% | exterior fraction of surface area. Default is 75% of area is exterior surface and 25% interior |
| Fraction interior | 25% | 25% | 25% | interior fraction of surface area. Default is 75% of area is exterior surface and 25% interior |
| **Cext** | **250** | **250** | **250** | **Exterior VOC content (g/L)** |
| **Cint** | **250** | **250** | **250** | **Interior VOC content (g/L)** |
| scaling factor for A - surface painting | 2 | 2 | 2 | |
| g/lb | 453.59236 | 453.59236 | 453.59236 | |
| liters per gallon | 3.87541178 | 3.87541178 | 3.87541178 | |
| | 180 | 180 | 180 | |

## General Assumptions

| | | | |
|---|---|---|---|
| N2O_CO2 Diesel Equipment | 0.000026 | Climate Registry 2016 | |
| CH4_CO2 Diesel Equipment | 0.000057 | Climate Registry 2016 | |
| N2O_NOX Gasoline | 0.041600 | ARB EMFAC FAQs' | |
| lbs/gram | 0.002204623 | | |
| kg/mt | 1000 | | |
| mt/gram | 0.000001 | | |
| mt/lbs | 0.000453592 | | |
| ton/lbs | 0.0005 | | |
| ton/gram | 1.10E-06 | | |
| ton per cy conversion | 1.2641662 | CalEEMod | |
| ton per SF conversion | 0.046 | CalEEMod | |
| acre per SF conversion | 2.30E-05 | | |
| | | | |
| CH4 GWP | 25 | AR4 | |
| N2O GWP | 298 | AR4 | |
| | | | |
| Employee Trip length 1-way | 10.8 | CalEEMod (H-W, San Diego, Urban) | |
| Delivery Trip length 1-way | 7.3 | CalEEMod (C-NW, San Diego, Urban) | |
| | | | |
| Haul Truck Mileage | 16.6 | demo to Miramar/Otay | |
| Haul Truck Mileage | 75.6 | soils to Imperial | all soils and demo assu |
| Trips per employee | 2 | | |
| Onsite Truck mph | 5 | | |
| | | | |
| Paving ROG EF | 2.62 | lbs/acre | CalEEMod (no mitigation) |
| Grading PM10 EF | 1.0605 | lbs/acre | CalEEMod (no mitigation) |
| Grading PM2.5 EF | 0.1145 | lbs/acre | CalEEMod (no mitigation) |
| Bulldozing PM10 EF | 0.752760759 | lbs/hr | CalEEMod (no mitigation) |
| Bulldozing PM2.5 EF | 0.413778428 | lbs/hr | CalEEMod (no mitigation) |
| Truck loading PM10 EF | 0.000039 | lb/ton | CalEEMod (no mitigation) |
| Truck loading PM2.5 EF | 0.000006 | lb/ton | CalEEMod (no mitigation) |
| Demo PM10 EF | 0.021400 | lb/ton | CalEEMod (no mitigation) |
| Demo PM2.5 EF | 0.003244 | lb/ton | CalEEMod (no mitigation) |

| | |
|---|---|
| % of demo debris haul | |
| to recycling | 84% |
| to landfill | 16% |
| % of excav material haul | |
| to recycling | 96% |
| to landfill | 4% |

|  |  |  |  | Days by Year |  |  |  | Percentage of Days |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Code** | **Start Date** | **End Date** | **Working Days** | 2018 | 2019 | 2020 | 2021 | 2018 | 2019 | 2020 | 2021 |
| Phase1.1 | 12/5/2018 | 12/28/2018 | 17 | 17 | 0 | 0 | 0 | 100 | 0 | 0 | 0 |
| Phase1.2 | 12/31/2018 | 1/14/2019 | 10 | 1 | 9 | 0 | 0 | 10 | 90 | 0 | 0 |
| Phase2.1 | 1/10/2019 | 5/30/2019 | 100 | 0 | 100 | 0 | 0 | 0 | 100 | 0 | 0 |
| Phase2.2 | 5/3/2019 | 6/16/2020 | 273 | 0 | 173 | 100 | 0 | 0 | 63 | 37 | 0 |
| Phase2.3 | 1/15/2020 | 4/19/2021 | 328 | 0 | 0 | 252 | 76 | 0 | 0 | 77 | 23 |
| Phase2.5 | 11/4/2019 | 7/10/2020 | 179 | 0 | 42 | 137 | 0 | 0 | 23 | 77 | 0 |
| Phase2.6 | 5/20/2020 | 6/10/2021 | 276 | 0 | 0 | 162 | 114 | 0 | 0 | 59 | 41 |
| Phase2.7 | 10/28/2019 | 7/15/2020 | 187 | 0 | 47 | 140 | 0 | 0 | 25 | 75 | 0 |
| Phase2.8 | 3/19/2021 | 6/30/2021 | 73 | 0 | 0 | 0 | 73 | 0 | 0 | 0 | 100 |
| Phase3.1 | 3/1/2019 | 6/16/2020 | 40 | 0 | 218 | -178 | 0 | 0 | 545 | -445 | 0 |
| Phase3.2 | 12/2/2019 | 6/16/2020 | 141 | 0 | 22 | 119 | 0 | 0 | 16 | 84 | 0 |
| Phase3.3 | 5/13/2020 | 3/11/2021 | 216 | 0 | 0 | 167 | 49 | 0 | 0 | 77 | 23 |
| Phase3.4 | 5/27/2020 | 3/18/2021 | 211 | 0 | 0 | 157 | 54 | 0 | 0 | 74 | 26 |
| Phase3.5 | 5/21/2021 | 6/18/2021 | 20 | 0 | 0 | 0 | 20 | 0 | 0 | 0 | 100 |
| Phase4.1 | 4/14/2020 | 10/9/2020 | 128 | 0 | 0 | 128 | 0 | 0 | 0 | 100 | 0 |
| Phase4.4 | 10/12/2020 | 2/2/2021 | 81 | 0 | 0 | 59 | 22 | 0 | 0 | 73 | 27 |
|  | 12/5/2018 | 6/30/2021 |  |  |  |  |  |  |  |  |  |
|  |  | 565 | working days |  |  |  |  |  |  |  |  |
|  |  | 938 | overall days |  |  |  |  |  |  |  |  |
|  |  | 2.6 | years |  |  |  |  |  |  |  |  |

| Marina | when hotel 70% complete |
|---|---|
| 9/21/2020 | 6/22/2021 |

so, fall 2020 through late Spring/Early Summer 2021
6-9 months to complete

*Last Updated: 11-2016(Unmitigated)* CALEEMOD EMISSION FACTORS (all in g/hphr)

*1 2 3 4 5 6 7 8 9 10 11*

| Equipment Type | Year | Concatenate | HP | ROG | NOX | CO | PM10 | PM2.5 | SO2 | CO2 | CH4 | **N2O** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aerial Lifts | 2018 | 2018Aerial Lifts15 | 15 | 0.1817 | 3.2101 | 3.11639 | 0.0542 | 0.0499 | 0.0054 | 545.4939 | 0.1698 | 0.014 |
| Aerial Lifts | 2018 | 2018Aerial Lifts25 | 25 | 0.1817 | 3.2101 | 3.11639 | 0.0542 | 0.0499 | 0.0054 | 545.4939 | 0.1698 | 0.014 |
| Aerial Lifts | 2018 | 2018Aerial Lifts50 | 50 | 0.1817 | 3.2101 | 3.11639 | 0.0542 | 0.0499 | 0.0054 | 545.4939 | 0.1698 | 0.014 |
| Aerial Lifts | 2018 | 2018Aerial Lifts120 | 120 | 0.1219 | 2.0636 | 3.16685 | 0.0571 | 0.0525 | 0.0049 | 490.4742 | 0.1527 | 0.013 |
| Aerial Lifts | 2018 | 2018Aerial Lifts500 | 500 | 0.0623 | 0.63368 | 0.93655 | 0.0088 | 0.0081 | 0.0049 | 490.4122 | 0.1527 | 0.013 |
| Aerial Lifts | 2018 | 2018Aerial Lifts750 | 750 | 0.225 | 2.385 | 1.037 | 0.071 | 0.071 | 0.005 | 568.299 | 0.02 | 0.015 |
| Aerial Lifts | 2019 | 2019Aerial Lifts15 | 15 | 0.1719 | 3.07945 | 3.11451 | 0.0417 | 0.0384 | 0.0054 | 536.7427 | 0.1698 | 0.014 |
| Aerial Lifts | 2019 | 2019Aerial Lifts25 | 25 | 0.1719 | 3.07945 | 3.11451 | 0.0417 | 0.0384 | 0.0054 | 536.7427 | 0.1698 | 0.014 |
| Aerial Lifts | 2019 | 2019Aerial Lifts50 | 50 | 0.1719 | 3.07945 | 3.11451 | 0.0417 | 0.0384 | 0.0054 | 536.7427 | 0.1698 | 0.014 |
| Aerial Lifts | 2019 | 2019Aerial Lifts120 | 120 | 0.1182 | 1.97658 | 3.17254 | 0.0485 | 0.0446 | 0.0049 | 482.6056 | 0.1527 | 0.012 |
| Aerial Lifts | 2019 | 2019Aerial Lifts500 | 500 | 0.0655 | 0.63586 | 0.94139 | 0.0089 | 0.0082 | 0.0049 | 482.5446 | 0.1527 | 0.012 |
| Aerial Lifts | 2019 | 2019Aerial Lifts750 | 750 | 0.212 | 2.117 | 1.023 | 0.064 | 0.064 | 0.005 | 568.299 | 0.019 | 0.015 |
| Aerial Lifts | 2020 | 2020Aerial Lifts15 | 15 | 0.1676 | 2.95486 | 3.09942 | 0.0309 | 0.0284 | 0.0054 | 525.0743 | 0.1698 | 0.013 |
| Aerial Lifts | 2020 | 2020Aerial Lifts25 | 25 | 0.1676 | 2.95486 | 3.09942 | 0.0309 | 0.0284 | 0.0054 | 525.0743 | 0.1698 | 0.013 |
| Aerial Lifts | 2020 | 2020Aerial Lifts50 | 50 | 0.1676 | 2.95486 | 3.09942 | 0.0309 | 0.0284 | 0.0054 | 525.0743 | 0.1698 | 0.013 |
| Aerial Lifts | 2020 | 2020Aerial Lifts120 | 120 | 0.1149 | 1.86859 | 3.1768 | 0.0416 | 0.0382 | 0.0049 | 472.1142 | 0.1527 | 0.012 |
| Aerial Lifts | 2020 | 2020Aerial Lifts500 | 500 | 0.0688 | 0.63803 | 0.94623 | 0.009 | 0.0083 | 0.0049 | 472.0545 | 0.1527 | 0.012 |
| Aerial Lifts | 2020 | 2020Aerial Lifts750 | 750 | 0.2 | 1.868 | 1.013 | 0.057 | 0.057 | 0.005 | 568.299 | 0.018 | 0.015 |
| Aerial Lifts | 2021 | 2021Aerial Lifts15 | 15 | 0.1648 | 2.92238 | 3.11369 | 0.0265 | 0.0244 | 0.0054 | 525.0743 | 0.1698 | 0.013 |
| Aerial Lifts | 2021 | 2021Aerial Lifts25 | 25 | 0.1648 | 2.92238 | 3.11369 | 0.0265 | 0.0244 | 0.0054 | 525.0743 | 0.1698 | 0.013 |
| Aerial Lifts | 2021 | 2021Aerial Lifts50 | 50 | 0.1648 | 2.92238 | 3.11369 | 0.0265 | 0.0244 | 0.0054 | 525.0743 | 0.1698 | 0.013 |
| Aerial Lifts | 2021 | 2021Aerial Lifts120 | 120 | 0.1088 | 1.74368 | 3.17624 | 0.0333 | 0.0306 | 0.0049 | 472.1142 | 0.1527 | 0.012 |
| Aerial Lifts | 2021 | 2021Aerial Lifts500 | 500 | 0.072 | 0.64021 | 0.95107 | 0.0091 | 0.0083 | 0.0049 | 472.0545 | 0.1527 | 0.012 |
| Aerial Lifts | 2021 | 2021Aerial Lifts750 | 750 | 0.187 | 1.61 | 1.004 | 0.05 | 0.05 | 0.005 | 568.299 | 0.016 | 0.015 |
| Air Compressors | 2018 | 2018Air Compressors15 | 15 | 0.766 | 4.762 | 3.58 | 0.256 | 0.256 | 0.008 | 568.299 | 0.069 | 0.015 |
| Air Compressors | 2018 | 2018Air Compressors25 | 25 | 0.807 | 4.661 | 2.531 | 0.232 | 0.232 | 0.007 | 568.3 | 0.072 | 0.015 |
| Air Compressors | 2018 | 2018Air Compressors50 | 50 | 1.3 | 4.707 | 5.439 | 0.329 | 0.329 | 0.007 | 568.299 | 0.117 | 0.015 |
| Air Compressors | 2018 | 2018Air Compressors120 | 120 | 0.603 | 4.05 | 3.744 | 0.304 | 0.304 | 0.006 | 568.3 | 0.054 | 0.015 |
| Air Compressors | 2018 | 2018Air Compressors175 | 175 | 0.435 | 3.228 | 3.205 | 0.17 | 0.17 | 0.006 | 568.299 | 0.039 | 0.015 |
| Air Compressors | 2018 | 2018Air Compressors250 | 250 | 0.321 | 2.797 | 1.146 | 0.087 | 0.087 | 0.006 | 568.3 | 0.029 | 0.015 |
| Air Compressors | 2018 | 2018Air Compressors500 | 500 | 0.307 | 2.465 | 1.101 | 0.083 | 0.083 | 0.005 | 568.299 | 0.027 | 0.015 |
| Air Compressors | 2018 | 2018Air Compressors750 | 750 | 0.309 | 2.533 | 1.101 | 0.084 | 0.084 | 0.005 | 568.299 | 0.027 | 0.015 |
| Air Compressors | 2018 | 2018Air Compressors1000 | 1000 | 0.343 | 4.325 | 1.21 | 0.111 | 0.111 | 0.005 | 568.299 | 0.03 | 0.015 |
| Air Compressors | 2019 | 2019Air Compressors15 | 15 | 0.748 | 4.647 | 3.562 | 0.241 | 0.241 | 0.008 | 568.299 | 0.067 | 0.015 |
| Air Compressors | 2019 | 2019Air Compressors25 | 25 | 0.787 | 4.596 | 2.501 | 0.222 | 0.222 | 0.007 | 568.299 | 0.071 | 0.015 |
| Air Compressors | 2019 | 2019Air Compressors50 | 50 | 1.129 | 4.546 | 5.283 | 0.287 | 0.287 | 0.007 | 568.299 | 0.101 | 0.015 |
| Air Compressors | 2019 | 2019Air Compressors120 | 120 | 0.538 | 3.706 | 3.718 | 0.26 | 0.26 | 0.006 | 568.299 | 0.048 | 0.015 |
| Air Compressors | 2019 | 2019Air Compressors175 | 175 | 0.401 | 2.874 | 3.204 | 0.15 | 0.15 | 0.006 | 568.299 | 0.036 | 0.015 |
| Air Compressors | 2019 | 2019Air Compressors250 | 250 | 0.304 | 2.469 | 1.132 | 0.078 | 0.078 | 0.006 | 568.299 | 0.027 | 0.015 |
| Air Compressors | 2019 | 2019Air Compressors500 | 500 | 0.293 | 2.193 | 1.086 | 0.075 | 0.075 | 0.005 | 568.299 | 0.026 | 0.015 |
| Air Compressors | 2019 | 2019Air Compressors750 | 750 | 0.294 | 2.247 | 1.086 | 0.076 | 0.076 | 0.005 | 568.299 | 0.026 | 0.015 |
| Air Compressors | 2019 | 2019Air Compressors1000 | 1000 | 0.324 | 4.073 | 1.182 | 0.102 | 0.102 | 0.005 | 568.299 | 0.029 | 0.015 |
| Air Compressors | 2020 | 2020Air Compressors15 | 15 | 0.731 | 4.542 | 3.546 | 0.227 | 0.227 | 0.008 | 568.299 | 0.066 | 0.015 |
| Air Compressors | 2020 | 2020Air Compressors25 | 25 | 0.769 | 4.538 | 2.473 | 0.212 | 0.212 | 0.007 | 568.3 | 0.069 | 0.015 |
| Air Compressors | 2020 | 2020Air Compressors50 | 50 | 1.001 | 4.397 | 5.164 | 0.25 | 0.25 | 0.007 | 568.299 | 0.09 | 0.015 |
| Air Compressors | 2020 | 2020Air Compressors120 | 120 | 0.489 | 3.4 | 3.698 | 0.224 | 0.224 | 0.006 | 568.299 | 0.044 | 0.015 |
| Air Compressors | 2020 | 2020Air Compressors175 | 175 | 0.374 | 2.558 | 3.203 | 0.133 | 0.133 | 0.006 | 568.299 | 0.033 | 0.015 |
| Air Compressors | 2020 | 2020Air Compressors250 | 250 | 0.288 | 2.172 | 1.121 | 0.069 | 0.069 | 0.006 | 568.299 | 0.026 | 0.015 |
| Air Compressors | 2020 | 2020Air Compressors500 | 500 | 0.279 | 1.935 | 1.076 | 0.067 | 0.067 | 0.005 | 568.299 | 0.025 | 0.015 |
| Air Compressors | 2020 | 2020Air Compressors750 | 750 | 0.28 | 1.982 | 1.076 | 0.067 | 0.067 | 0.005 | 568.299 | 0.025 | 0.015 |
| Air Compressors | 2020 | 2020Air Compressors1000 | 1000 | 0.306 | 3.828 | 1.158 | 0.093 | 0.093 | 0.005 | 568.3 | 0.027 | 0.015 |
| Air Compressors | 2021 | 2021Air Compressors15 | 15 | 0.717 | 4.462 | 3.531 | 0.214 | 0.214 | 0.008 | 568.299 | 0.064 | 0.015 |
| Air Compressors | 2021 | 2021Air Compressors25 | 25 | 0.752 | 4.497 | 2.446 | 0.201 | 0.201 | 0.007 | 568.299 | 0.067 | 0.015 |
| Air Compressors | 2021 | 2021Air Compressors50 | 50 | 0.887 | 4.221 | 5.021 | 0.212 | 0.212 | 0.007 | 568.299 | 0.08 | 0.015 |
| Air Compressors | 2021 | 2021Air Compressors120 | 120 | 0.442 | 3.083 | 3.67 | 0.19 | 0.19 | 0.006 | 568.299 | 0.039 | 0.015 |
| Air Compressors | 2021 | 2021Air Compressors175 | 175 | 0.343 | 2.218 | 3.192 | 0.115 | 0.115 | 0.006 | 568.299 | 0.03 | 0.015 |
| Air Compressors | 2021 | 2021Air Compressors250 | 250 | 0.268 | 1.859 | 1.108 | 0.06 | 0.06 | 0.006 | 568.299 | 0.024 | 0.015 |
| Air Compressors | 2021 | 2021Air Compressors500 | 500 | 0.261 | 1.663 | 1.064 | 0.058 | 0.058 | 0.005 | 568.299 | 0.023 | 0.015 |
| Air Compressors | 2021 | 2021Air Compressors750 | 750 | 0.262 | 1.699 | 1.064 | 0.058 | 0.058 | 0.005 | 568.299 | 0.023 | 0.015 |
| Air Compressors | 2021 | 2021Air Compressors1000 | 1000 | 0.284 | 3.565 | 1.134 | 0.082 | 0.082 | 0.005 | 568.3 | 0.025 | 0.015 |
| Bore/Drill Rigs | 2018 | 2018Bore/Drill Rigs15 | 15 | 0.7669 | 4.86917 | 4.56857 | 0.3294 | 0.303 | 0.0055 | 554.2038 | 0.1725 | 0.014 |
| Bore/Drill Rigs | 2018 | 2018Bore/Drill Rigs25 | 25 | 0.7669 | 4.86917 | 4.56857 | 0.3294 | 0.303 | 0.0055 | 554.2038 | 0.1725 | 0.014 |
| Bore/Drill Rigs | 2018 | 2018Bore/Drill Rigs50 | 50 | 0.7669 | 4.86917 | 4.56857 | 0.3294 | 0.303 | 0.0055 | 554.2038 | 0.1725 | 0.014 |
| Bore/Drill Rigs | 2018 | 2018Bore/Drill Rigs120 | 120 | 0.269 | 3.39962 | 3.32325 | 0.1844 | 0.1696 | 0.0048 | 479.6719 | 0.1493 | 0.012 |
| Bore/Drill Rigs | 2018 | 2018Bore/Drill Rigs175 | 175 | 0.2032 | 2.35662 | 2.96107 | 0.1034 | 0.0952 | 0.0049 | 495.0734 | 0.1541 | 0.013 |
| Bore/Drill Rigs | 2018 | 2018Bore/Drill Rigs250 | 250 | 0.1545 | 2.15308 | 1.07328 | 0.0608 | 0.056 | 0.0048 | 484.5605 | 0.1509 | 0.012 |
| Bore/Drill Rigs | 2018 | 2018Bore/Drill Rigs500 | 500 | 0.1349 | 1.74562 | 1.03203 | 0.0522 | 0.0481 | 0.0048 | 485.6893 | 0.1512 | 0.012 |
| Bore/Drill Rigs | 2018 | 2018Bore/Drill Rigs750 | 750 | 0.126 | 1.67873 | 1.00559 | 0.0545 | 0.0501 | 0.0049 | 489.7301 | 0.1525 | 0.013 |
| Bore/Drill Rigs | 2018 | 2018Bore/Drill Rigs1000 | 1000 | 0.1252 | 3.03153 | 0.97772 | 0.0604 | 0.0556 | 0.0049 | 490.2427 | 0.1526 | 0.013 |
| Bore/Drill Rigs | 2019 | 2019Bore/Drill Rigs15 | 15 | 0.7216 | 4.71795 | 4.49723 | 0.3025 | 0.2783 | 0.0055 | 545.293 | 0.1725 | 0.014 |
| Bore/Drill Rigs | 2019 | 2019Bore/Drill Rigs25 | 25 | 0.7216 | 4.71795 | 4.49723 | 0.3025 | 0.2783 | 0.0055 | 545.293 | 0.1725 | 0.014 |
| Bore/Drill Rigs | 2019 | 2019Bore/Drill Rigs50 | 50 | 0.7216 | 4.71795 | 4.49723 | 0.3025 | 0.2783 | 0.0055 | 545.293 | 0.1725 | 0.014 |
| Bore/Drill Rigs | 2019 | 2019Bore/Drill Rigs120 | 120 | 0.2672 | 3.32102 | 3.33202 | 0.1802 | 0.1658 | 0.0048 | 472.4527 | 0.1495 | 0.012 |

| Equipment Type | Year | Concatenate | HP | ROG | NOX | CO | PM10 | PM2.5 | SO2 | CO2 | CH4 | N2O |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bore/Drill Rigs | 2019 | 2019Bore/Drill Rigs175 | 175 | 0.1813 | 2.01775 | 2.95563 | 0.0876 | 0.0806 | 0.0049 | 487.3552 | 0.1542 | 0.012 |
| Bore/Drill Rigs | 2019 | 2019Bore/Drill Rigs250 | 250 | 0.1434 | 1.8943 | 1.06058 | 0.0537 | 0.0494 | 0.0048 | 475.7896 | 0.1505 | 0.012 |
| Bore/Drill Rigs | 2019 | 2019Bore/Drill Rigs500 | 500 | 0.1292 | 1.55098 | 1.03449 | 0.0479 | 0.0441 | 0.0048 | 477.0462 | 0.1509 | 0.012 |
| Bore/Drill Rigs | 2019 | 2019Bore/Drill Rigs750 | 750 | 0.1165 | 1.44865 | 0.97074 | 0.0478 | 0.044 | 0.0049 | 481.8363 | 0.1524 | 0.012 |
| Bore/Drill Rigs | 2019 | 2019Bore/Drill Rigs1000 | 1000 | 0.1294 | 3.04139 | 0.98342 | 0.0609 | 0.056 | 0.0049 | 482.3593 | 0.1526 | 0.012 |
| Bore/Drill Rigs | 2020 | 2020Bore/Drill Rigs15 | 15 | 0.7158 | 4.6451 | 4.51013 | 0.2941 | 0.2706 | 0.0055 | 535.2948 | 0.1731 | 0.014 |
| Bore/Drill Rigs | 2020 | 2020Bore/Drill Rigs25 | 25 | 0.7158 | 4.6451 | 4.51013 | 0.2941 | 0.2706 | 0.0055 | 535.2948 | 0.1731 | 0.014 |
| Bore/Drill Rigs | 2020 | 2020Bore/Drill Rigs50 | 50 | 0.7158 | 4.6451 | 4.51013 | 0.2941 | 0.2706 | 0.0055 | 535.2948 | 0.1731 | 0.014 |
| Bore/Drill Rigs | 2020 | 2020Bore/Drill Rigs120 | 120 | 0.2462 | 3.06601 | 3.32347 | 0.1586 | 0.1459 | 0.0048 | 463.5827 | 0.1499 | 0.012 |
| Bore/Drill Rigs | 2020 | 2020Bore/Drill Rigs175 | 175 | 0.1743 | 1.87149 | 2.96948 | 0.0822 | 0.0757 | 0.0049 | 477.722 | 0.1545 | 0.012 |
| Bore/Drill Rigs | 2020 | 2020Bore/Drill Rigs250 | 250 | 0.1424 | 1.80732 | 1.06766 | 0.0521 | 0.0479 | 0.0048 | 466.8342 | 0.151 | 0.012 |
| Bore/Drill Rigs | 2020 | 2020Bore/Drill Rigs500 | 500 | 0.1245 | 1.40938 | 1.01263 | 0.0446 | 0.041 | 0.0048 | 466.8219 | 0.151 | 0.012 |
| Bore/Drill Rigs | 2020 | 2020Bore/Drill Rigs750 | 750 | 0.1086 | 1.23085 | 0.97413 | 0.0409 | 0.0377 | 0.0049 | 473.6679 | 0.1532 | 0.012 |
| Bore/Drill Rigs | 2020 | 2020Bore/Drill Rigs1000 | 1000 | 0.1329 | 3.05008 | 0.98839 | 0.0612 | 0.0563 | 0.0049 | 471.8492 | 0.1526 | 0.012 |
| Bore/Drill Rigs | 2021 | 2021Bore/Drill Rigs15 | 15 | 0.7106 | 4.63432 | 4.54836 | 0.291 | 0.2677 | 0.0055 | 535.3782 | 0.1732 | 0.014 |
| Bore/Drill Rigs | 2021 | 2021Bore/Drill Rigs25 | 25 | 0.7106 | 4.63432 | 4.54836 | 0.291 | 0.2677 | 0.0055 | 535.3782 | 0.1732 | 0.014 |
| Bore/Drill Rigs | 2021 | 2021Bore/Drill Rigs50 | 50 | 0.7106 | 4.63432 | 4.54836 | 0.291 | 0.2677 | 0.0055 | 535.3782 | 0.1732 | 0.014 |
| Bore/Drill Rigs | 2021 | 2021Bore/Drill Rigs120 | 120 | 0.2169 | 2.73675 | 3.30573 | 0.131 | 0.1205 | 0.0048 | 464.9725 | 0.1504 | 0.012 |
| Bore/Drill Rigs | 2021 | 2021Bore/Drill Rigs175 | 175 | 0.1542 | 1.5983 | 2.9614 | 0.0697 | 0.0641 | 0.0049 | 477.0482 | 0.1543 | 0.012 |
| Bore/Drill Rigs | 2021 | 2021Bore/Drill Rigs250 | 250 | 0.1325 | 1.55102 | 1.06418 | 0.047 | 0.0433 | 0.0048 | 467.9916 | 0.1514 | 0.012 |
| Bore/Drill Rigs | 2021 | 2021Bore/Drill Rigs500 | 500 | 0.117 | 1.22069 | 1.01479 | 0.0409 | 0.0376 | 0.0049 | 469.8158 | 0.1519 | 0.012 |
| Bore/Drill Rigs | 2021 | 2021Bore/Drill Rigs750 | 750 | 0.0976 | 0.95517 | 0.97176 | 0.0334 | 0.0307 | 0.0049 | 474.079 | 0.1533 | 0.012 |
| Bore/Drill Rigs | 2021 | 2021Bore/Drill Rigs1000 | 1000 | 0.1359 | 3.05759 | 0.99261 | 0.0614 | 0.0565 | 0.0049 | 471.8158 | 0.1526 | 0.012 |
| Cement and Mortar Mixers | 2018 | 2018Cement and Mortar Mixers15 | 15 | 0.661 | 4.142 | 3.469 | 0.163 | 0.163 | 0.008 | 568.299 | 0.059 | 0.015 |
| Cement and Mortar Mixers | 2018 | 2018Cement and Mortar Mixers25 | 25 | 0.749 | 4.504 | 2.44 | 0.205 | 0.205 | 0.007 | 568.299 | 0.067 | 0.015 |
| Cement and Mortar Mixers | 2019 | 2019Cement and Mortar Mixers15 | 15 | 0.661 | 4.142 | 3.469 | 0.162 | 0.162 | 0.008 | 568.299 | 0.059 | 0.015 |
| Cement and Mortar Mixers | 2019 | 2019Cement and Mortar Mixers25 | 25 | 0.735 | 4.469 | 2.417 | 0.196 | 0.196 | 0.007 | 568.299 | 0.066 | 0.015 |
| Cement and Mortar Mixers | 2020 | 2020Cement and Mortar Mixers15 | 15 | 0.661 | 4.142 | 3.47 | 0.161 | 0.161 | 0.008 | 568.299 | 0.059 | 0.015 |
| Cement and Mortar Mixers | 2020 | 2020Cement and Mortar Mixers25 | 25 | 0.723 | 4.442 | 2.397 | 0.187 | 0.187 | 0.007 | 568.299 | 0.065 | 0.015 |
| Cement and Mortar Mixers | 2021 | 2021Cement and Mortar Mixers15 | 15 | 0.661 | 4.142 | 3.469 | 0.161 | 0.161 | 0.008 | 568.299 | 0.059 | 0.015 |
| Cement and Mortar Mixers | 2021 | 2021Cement and Mortar Mixers25 | 25 | 0.712 | 4.419 | 2.381 | 0.18 | 0.18 | 0.007 | 568.299 | 0.064 | 0.015 |
| Concrete/Industrial Saws | 2018 | 2018Concrete/Industrial Saws25 | 25 | 0.685 | 4.332 | 2.339 | 0.161 | 0.161 | 0.007 | 568.299 | 0.061 | 0.015 |
| Concrete/Industrial Saws | 2018 | 2018Concrete/Industrial Saws50 | 50 | 1.032 | 4.492 | 4.766 | 0.277 | 0.277 | 0.007 | 568.299 | 0.093 | 0.015 |
| Concrete/Industrial Saws | 2018 | 2018Concrete/Industrial Saws120 | 120 | 0.498 | 3.754 | 3.571 | 0.256 | 0.256 | 0.006 | 568.299 | 0.044 | 0.015 |
| Concrete/Industrial Saws | 2018 | 2018Concrete/Industrial Saws175 | 175 | 0.359 | 2.945 | 3.072 | 0.145 | 0.145 | 0.006 | 568.299 | 0.032 | 0.015 |
| Concrete/Industrial Saws | 2019 | 2019Concrete/Industrial Saws25 | 25 | 0.685 | 4.332 | 2.339 | 0.161 | 0.161 | 0.007 | 568.299 | 0.061 | 0.015 |
| Concrete/Industrial Saws | 2019 | 2019Concrete/Industrial Saws50 | 50 | 0.899 | 4.338 | 4.645 | 0.242 | 0.242 | 0.007 | 568.299 | 0.081 | 0.015 |
| Concrete/Industrial Saws | 2019 | 2019Concrete/Industrial Saws120 | 120 | 0.443 | 3.441 | 3.55 | 0.22 | 0.22 | 0.006 | 568.3 | 0.04 | 0.015 |
| Concrete/Industrial Saws | 2019 | 2019Concrete/Industrial Saws175 | 175 | 0.33 | 2.618 | 3.072 | 0.128 | 0.128 | 0.006 | 568.299 | 0.029 | 0.015 |
| Concrete/Industrial Saws | 2020 | 2020Concrete/Industrial Saws25 | 25 | 0.685 | 4.332 | 2.339 | 0.161 | 0.161 | 0.007 | 568.299 | 0.061 | 0.015 |
| Concrete/Industrial Saws | 2020 | 2020Concrete/Industrial Saws50 | 50 | 0.798 | 4.196 | 4.552 | 0.212 | 0.212 | 0.007 | 568.299 | 0.072 | 0.015 |
| Concrete/Industrial Saws | 2020 | 2020Concrete/Industrial Saws120 | 120 | 0.401 | 3.163 | 3.535 | 0.19 | 0.19 | 0.006 | 568.299 | 0.036 | 0.015 |
| Concrete/Industrial Saws | 2020 | 2020Concrete/Industrial Saws175 | 175 | 0.306 | 2.324 | 3.072 | 0.114 | 0.114 | 0.006 | 568.299 | 0.027 | 0.015 |
| Concrete/Industrial Saws | 2021 | 2021Concrete/Industrial Saws25 | 25 | 0.685 | 4.332 | 2.34 | 0.161 | 0.161 | 0.007 | 568.299 | 0.061 | 0.015 |
| Concrete/Industrial Saws | 2021 | 2021Concrete/Industrial Saws50 | 50 | 0.722 | 4.063 | 4.481 | 0.184 | 0.184 | 0.007 | 568.3 | 0.065 | 0.015 |
| Concrete/Industrial Saws | 2021 | 2021Concrete/Industrial Saws120 | 120 | 0.369 | 2.913 | 3.523 | 0.166 | 0.166 | 0.006 | 568.299 | 0.033 | 0.015 |
| Concrete/Industrial Saws | 2021 | 2021Concrete/Industrial Saws175 | 175 | 0.286 | 2.055 | 3.072 | 0.101 | 0.101 | 0.006 | 568.299 | 0.025 | 0.015 |
| Cranes | 2018 | 2018Cranes50 | 50 | 2.0722 | 6.00385 | 7.24744 | 0.624 | 0.5741 | 0.0053 | 538.1219 | 0.1675 | 0.014 |
| Cranes | 2018 | 2018Cranes120 | 120 | 0.9316 | 7.93075 | 4.45237 | 0.5831 | 0.5364 | 0.0048 | 488.1172 | 0.152 | 0.013 |
| Cranes | 2018 | 2018Cranes175 | 175 | 0.6212 | 6.5572 | 3.66571 | 0.3511 | 0.323 | 0.0049 | 493.0451 | 0.1535 | 0.013 |
| Cranes | 2018 | 2018Cranes250 | 250 | 0.4831 | 5.77298 | 2.13445 | 0.2499 | 0.2299 | 0.0049 | 491.4069 | 0.153 | 0.013 |
| Cranes | 2018 | 2018Cranes500 | 500 | 0.3697 | 4.63433 | 3.1871 | 0.187 | 0.172 | 0.0049 | 490.8912 | 0.1528 | 0.013 |
| Cranes | 2018 | 2018Cranes750 | 750 | 0.2706 | 3.7688 | 1.61304 | 0.1368 | 0.1259 | 0.0049 | 489.0536 | 0.1522 | 0.013 |
| Cranes | 2018 | 2018Cranes9999 | 9999 | 0.1623 | 2.33544 | 0.98282 | 0.0585 | 0.0538 | 0.0049 | 490.4122 | 0.1527 | 0.013 |
| Cranes | 2019 | 2019Cranes50 | 50 | 2.0454 | 5.95197 | 7.24465 | 0.6148 | 0.5657 | 0.0053 | 529.4626 | 0.1675 | 0.014 |
| Cranes | 2019 | 2019Cranes120 | 120 | 0.8032 | 6.95786 | 4.26491 | 0.5005 | 0.4604 | 0.0048 | 480.3251 | 0.152 | 0.012 |
| Cranes | 2019 | 2019Cranes175 | 175 | 0.5677 | 5.94857 | 3.5982 | 0.3177 | 0.2923 | 0.0049 | 485.1817 | 0.1535 | 0.012 |
| Cranes | 2019 | 2019Cranes250 | 250 | 0.4266 | 5.0842 | 1.94079 | 0.2155 | 0.1983 | 0.0049 | 483.4616 | 0.153 | 0.012 |
| Cranes | 2019 | 2019Cranes500 | 500 | 0.3491 | 4.29654 | 2.96893 | 0.173 | 0.1592 | 0.0049 | 483.1422 | 0.1529 | 0.012 |
| Cranes | 2019 | 2019Cranes750 | 750 | 0.252 | 3.42803 | 1.44568 | 0.1238 | 0.1139 | 0.0049 | 481.1192 | 0.1522 | 0.012 |
| Cranes | 2019 | 2019Cranes9999 | 9999 | 0.1723 | 2.34854 | 0.9912 | 0.0595 | 0.0547 | 0.0049 | 482.5446 | 0.1527 | 0.012 |
| Cranes | 2020 | 2020Cranes50 | 50 | 2.0835 | 5.98471 | 7.37625 | 0.6237 | 0.5738 | 0.0053 | 517.9263 | 0.1675 | 0.013 |
| Cranes | 2020 | 2020Cranes120 | 120 | 0.7319 | 6.38117 | 4.17141 | 0.4529 | 0.4167 | 0.0048 | 469.8821 | 0.152 | 0.012 |
| Cranes | 2020 | 2020Cranes175 | 175 | 0.5369 | 5.5697 | 3.56232 | 0.2978 | 0.274 | 0.0049 | 474.5939 | 0.1535 | 0.012 |
| Cranes | 2020 | 2020Cranes250 | 250 | 0.384 | 4.563 | 1.790 | 0.188 | 0.173 | 0.005 | ###### | 0.153 | 0.012 |
| Cranes | 2020 | 2020Cranes500 | 500 | 0.321 | 3.862 | 2.660 | 0.155 | 0.142 | 0.005 | ###### | 0.153 | 0.012 |
| Cranes | 2020 | 2020Cranes750 | 750 | 0.2418 | 3.10471 | 1.44353 | 0.116 | 0.1067 | 0.0049 | 470.4254 | 0.1521 | 0.01205 |
| Cranes | 2020 | 2020Cranes9999 | 9999 | 0.1822 | 2.3614 | 0.99943 | 0.0604 | 0.0556 | 0.0049 | 472.0545 | 0.1527 | 0.012092 |
| Cranes | 2021 | 2021Cranes50 | 50 | 2.1145 | 6.01375 | 7.48883 | 0.6311 | 0.5806 | 0.0053 | 517.8995 | 0.1675 | 0.013266 |
| Cranes | 2021 | 2021Cranes120 | 120 | 0.6514 | 5.73085 | 4.06507 | 0.3983 | 0.3664 | 0.0048 | 469.8867 | 0.152 | 0.012037 |
| Cranes | 2021 | 2021Cranes175 | 175 | 0.4984 | 5.1125 | 3.51648 | 0.2728 | 0.251 | 0.0049 | 474.5458 | 0.1535 | 0.012156 |
| Cranes | 2021 | 2021Cranes250 | 250 | 0.3495 | 4.10439 | 1.67824 | 0.1666 | 0.1533 | 0.0049 | 472.9057 | 0.1529 | 0.012114 |
| Cranes | 2021 | 2021Cranes500 | 500 | 0.2954 | 3.44253 | 2.44833 | 0.1385 | 0.1274 | 0.0049 | 472.4553 | 0.1528 | 0.012102 |
| Cranes | 2021 | 2021Cranes750 | 750 | 0.2278 | 2.72739 | 1.43956 | 0.1068 | 0.0982 | 0.0049 | 470.5495 | 0.1522 | 0.012053 |
| Cranes | 2021 | 2021Cranes9999 | 9999 | 0.1918 | 2.37402 | 1.00751 | 0.0614 | 0.0565 | 0.0049 | 472.0545 | 0.1527 | 0.012092 |

| Equipment Type | Year | Concatenate | HP | ROG | NOX | CO | PM10 | PM2.5 | SO2 | CO2 | CH4 | N2O |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Crawler Tractors | 2018 | 2018Crawler Tractors50 | 50 | 2.4455 | 6.16323 | 8.0094 | 0.7038 | 0.6475 | 0.0053 | 536.1409 | 0.1669 | 0.013734 |
| Crawler Tractors | 2018 | 2018Crawler Tractors120 | 120 | 0.7979 | 6.72257 | 4.1231 | 0.5658 | 0.5205 | 0.0049 | 494.9217 | 0.1541 | 0.012678 |
| Crawler Tractors | 2018 | 2018Crawler Tractors175 | 175 | 0.5549 | 5.8588 | 3.42131 | 0.3255 | 0.2994 | 0.0049 | 490.0002 | 0.1525 | 0.012552 |
| Crawler Tractors | 2018 | 2018Crawler Tractors250 | 250 | 0.3983 | 5.28959 | 1.65354 | 0.2001 | 0.1841 | 0.0049 | 491.606 | 0.153 | 0.012593 |
| Crawler Tractors | 2018 | 2018Crawler Tractors500 | 500 | 0.344 | 4.37324 | 2.38218 | 0.1694 | 0.1559 | 0.0049 | 493.5104 | 0.1536 | 0.012642 |
| Crawler Tractors | 2018 | 2018Crawler Tractors750 | 750 | 0.2957 | 3.8336 | 1.4447 | 0.1415 | 0.1301 | 0.0049 | 491.2659 | 0.1529 | 0.012584 |
| Crawler Tractors | 2018 | 2018Crawler Tractors1000 | 1000 | 0.4889 | 7.56366 | 2.10483 | 0.2249 | 0.2069 | 0.0049 | 494.1052 | 0.1538 | 0.012657 |
| Crawler Tractors | 2019 | 2019Crawler Tractors50 | 50 | 2.2254 | 5.85476 | 7.58896 | 0.6404 | 0.5892 | 0.0053 | 525.9767 | 0.1664 | 0.013473 |
| Crawler Tractors | 2019 | 2019Crawler Tractors120 | 120 | 0.7572 | 6.39347 | 4.08842 | 0.5347 | 0.4919 | 0.0049 | 486.9909 | 0.1541 | 0.012475 |
| Crawler Tractors | 2019 | 2019Crawler Tractors175 | 175 | 0.5169 | 5.38191 | 3.37886 | 0.2996 | 0.2756 | 0.0049 | 481.6222 | 0.1524 | 0.012337 |
| Crawler Tractors | 2019 | 2019Crawler Tractors250 | 250 | 0.3796 | 4.9721 | 1.60445 | 0.1875 | 0.1725 | 0.0049 | 483.4489 | 0.153 | 0.012384 |
| Crawler Tractors | 2019 | 2019Crawler Tractors500 | 500 | 0.3187 | 3.93412 | 2.21938 | 0.1528 | 0.1406 | 0.0049 | 485.8645 | 0.1537 | 0.012446 |
| Crawler Tractors | 2019 | 2019Crawler Tractors750 | 750 | 0.2663 | 3.34253 | 1.35585 | 0.123 | 0.1132 | 0.0049 | 483.3879 | 0.1529 | 0.012382 |
| Crawler Tractors | 2019 | 2019Crawler Tractors1000 | 1000 | 0.4598 | 7.21215 | 2.02037 | 0.2106 | 0.1938 | 0.0049 | 486.2545 | 0.1538 | 0.012456 |
| Crawler Tractors | 2020 | 2020Crawler Tractors50 | 50 | 2.0528 | 5.64276 | 7.3 | 0.5912 | 0.5439 | 0.0053 | 515.679 | 0.1668 | 0.01321 |
| Crawler Tractors | 2020 | 2020Crawler Tractors120 | 120 | 0.7148 | 6.00933 | 4.04412 | 0.5005 | 0.4604 | 0.0049 | 476.3284 | 0.1541 | 0.012202 |
| Crawler Tractors | 2020 | 2020Crawler Tractors175 | 175 | 0.4761 | 4.87226 | 3.33989 | 0.2722 | 0.2504 | 0.0049 | 471.015 | 0.1523 | 0.012065 |
| Crawler Tractors | 2020 | 2020Crawler Tractors250 | 250 | 0.36 | 4.63225 | 1.55491 | 0.1746 | 0.1606 | 0.0049 | 472.941 | 0.153 | 0.012115 |
| Crawler Tractors | 2020 | 2020Crawler Tractors500 | 500 | 0.3013 | 3.62175 | 2.0875 | 0.1409 | 0.1296 | 0.0049 | 475.2338 | 0.1537 | 0.012173 |
| Crawler Tractors | 2020 | 2020Crawler Tractors750 | 750 | 0.2562 | 3.13716 | 1.31018 | 0.1151 | 0.1059 | 0.0049 | 473.3119 | 0.1531 | 0.012124 |
| Crawler Tractors | 2020 | 2020Crawler Tractors1000 | 1000 | 0.463 | 7.23682 | 2.02764 | 0.212 | 0.195 | 0.0049 | 475.6525 | 0.1538 | 0.012184 |
| Crawler Tractors | 2021 | 2021Crawler Tractors50 | 50 | 2.064 | 5.61511 | 7.34869 | 0.5906 | 0.5433 | 0.0053 | 516.1077 | 0.1669 | 0.01322 |
| Crawler Tractors | 2021 | 2021Crawler Tractors120 | 120 | 0.6728 | 5.65746 | 4.00549 | 0.4657 | 0.4285 | 0.0049 | 476.437 | 0.1541 | 0.012204 |
| Crawler Tractors | 2021 | 2021Crawler Tractors175 | 175 | 0.4356 | 4.3947 | 3.30982 | 0.2445 | 0.225 | 0.0049 | 471.421 | 0.1525 | 0.012076 |
| Crawler Tractors | 2021 | 2021Crawler Tractors250 | 250 | 0.3427 | 4.33394 | 1.51456 | 0.1631 | 0.15 | 0.0049 | 472.9246 | 0.153 | 0.012114 |
| Crawler Tractors | 2021 | 2021Crawler Tractors500 | 500 | 0.2832 | 3.27633 | 2.02434 | 0.129 | 0.1187 | 0.0049 | 474.4843 | 0.1535 | 0.012154 |
| Crawler Tractors | 2021 | 2021Crawler Tractors750 | 750 | 0.2393 | 2.82478 | 1.26985 | 0.1038 | 0.0955 | 0.0049 | 473.0941 | 0.153 | 0.012119 |
| Crawler Tractors | 2021 | 2021Crawler Tractors1000 | 1000 | 0.3993 | 6.3992 | 1.89563 | 0.1816 | 0.1671 | 0.0049 | 471.8224 | 0.1526 | 0.012086 |
| Crushing/Proc. Equipment | 2018 | 2018Crushing/Proc. Equipment50 | 50 | 1.225 | 4.657 | 5.461 | 0.31 | 0.31 | 0.007 | 568.299 | 0.11 | 0.014557 |
| Crushing/Proc. Equipment | 2018 | 2018Crushing/Proc. Equipment120 | 120 | 0.58 | 3.881 | 3.763 | 0.284 | 0.284 | 0.006 | 568.299 | 0.052 | 0.014557 |
| Crushing/Proc. Equipment | 2018 | 2018Crushing/Proc. Equipment175 | 175 | 0.427 | 3.049 | 3.234 | 0.161 | 0.161 | 0.006 | 568.299 | 0.038 | 0.014557 |
| Crushing/Proc. Equipment | 2018 | 2018Crushing/Proc. Equipment250 | 250 | 0.322 | 2.622 | 1.146 | 0.083 | 0.083 | 0.006 | 568.299 | 0.029 | 0.014557 |
| Crushing/Proc. Equipment | 2018 | 2018Crushing/Proc. Equipment500 | 500 | 0.309 | 2.312 | 1.099 | 0.079 | 0.079 | 0.005 | 568.299 | 0.027 | 0.014557 |
| Crushing/Proc. Equipment | 2018 | 2018Crushing/Proc. Equipment750 | 750 | 0.308 | 2.358 | 1.097 | 0.079 | 0.079 | 0.005 | 568.299 | 0.027 | 0.014557 |
| Crushing/Proc. Equipment | 2018 | 2018Crushing/Proc. Equipment9999 | 9999 | 0.361 | 4.168 | 1.198 | 0.107 | 0.107 | 0.005 | 568.299 | 0.032 | 0.014557 |
| Crushing/Proc. Equipment | 2019 | 2019Crushing/Proc. Equipment50 | 50 | 1.064 | 4.495 | 5.316 | 0.269 | 0.269 | 0.007 | 568.299 | 0.096 | 0.014557 |
| Crushing/Proc. Equipment | 2019 | 2019Crushing/Proc. Equipment120 | 120 | 0.519 | 3.544 | 3.739 | 0.241 | 0.241 | 0.006 | 568.299 | 0.046 | 0.014557 |
| Crushing/Proc. Equipment | 2019 | 2019Crushing/Proc. Equipment175 | 175 | 0.394 | 2.7 | 3.233 | 0.141 | 0.141 | 0.006 | 568.299 | 0.035 | 0.014557 |
| Crushing/Proc. Equipment | 2019 | 2019Crushing/Proc. Equipment250 | 250 | 0.304 | 2.3 | 1.134 | 0.074 | 0.074 | 0.006 | 568.299 | 0.027 | 0.014557 |
| Crushing/Proc. Equipment | 2019 | 2019Crushing/Proc. Equipment500 | 500 | 0.295 | 2.046 | 1.087 | 0.071 | 0.071 | 0.005 | 568.299 | 0.026 | 0.014557 |
| Crushing/Proc. Equipment | 2019 | 2019Crushing/Proc. Equipment750 | 750 | 0.294 | 2.085 | 1.085 | 0.071 | 0.071 | 0.005 | 568.299 | 0.026 | 0.014557 |
| Crushing/Proc. Equipment | 2019 | 2019Crushing/Proc. Equipment9999 | 9999 | 0.345 | 3.927 | 1.173 | 0.098 | 0.098 | 0.005 | 568.299 | 0.031 | 0.014557 |
| Crushing/Proc. Equipment | 2020 | 2020Crushing/Proc. Equipment50 | 50 | 0.947 | 4.347 | 5.211 | 0.233 | 0.233 | 0.007 | 568.299 | 0.085 | 0.014557 |
| Crushing/Proc. Equipment | 2020 | 2020Crushing/Proc. Equipment120 | 120 | 0.473 | 3.249 | 3.722 | 0.206 | 0.206 | 0.006 | 568.299 | 0.042 | 0.014557 |
| Crushing/Proc. Equipment | 2020 | 2020Crushing/Proc. Equipment175 | 175 | 0.367 | 2.392 | 3.234 | 0.124 | 0.124 | 0.006 | 568.299 | 0.033 | 0.014557 |
| Crushing/Proc. Equipment | 2020 | 2020Crushing/Proc. Equipment250 | 250 | 0.289 | 2.014 | 1.125 | 0.065 | 0.065 | 0.006 | 568.299 | 0.026 | 0.014557 |
| Crushing/Proc. Equipment | 2020 | 2020Crushing/Proc. Equipment500 | 500 | 0.281 | 1.799 | 1.078 | 0.063 | 0.063 | 0.005 | 568.299 | 0.025 | 0.014557 |
| Crushing/Proc. Equipment | 2020 | 2020Crushing/Proc. Equipment750 | 750 | 0.281 | 1.835 | 1.077 | 0.063 | 0.063 | 0.005 | 568.299 | 0.025 | 0.014557 |
| Crushing/Proc. Equipment | 2020 | 2020Crushing/Proc. Equipment9999 | 9999 | 0.329 | 3.699 | 1.153 | 0.089 | 0.089 | 0.005 | 568.299 | 0.029 | 0.014557 |
| Crushing/Proc. Equipment | 2021 | 2021Crushing/Proc. Equipment50 | 50 | 0.862 | 4.211 | 5.136 | 0.201 | 0.201 | 0.007 | 568.299 | 0.077 | 0.014557 |
| Crushing/Proc. Equipment | 2021 | 2021Crushing/Proc. Equipment120 | 120 | 0.438 | 2.989 | 3.711 | 0.178 | 0.178 | 0.006 | 568.299 | 0.039 | 0.014557 |
| Crushing/Proc. Equipment | 2021 | 2021Crushing/Proc. Equipment175 | 175 | 0.344 | 2.114 | 3.235 | 0.109 | 0.109 | 0.006 | 568.299 | 0.031 | 0.014557 |
| Crushing/Proc. Equipment | 2021 | 2021Crushing/Proc. Equipment250 | 250 | 0.274 | 1.756 | 1.119 | 0.057 | 0.057 | 0.006 | 568.299 | 0.024 | 0.014557 |
| Crushing/Proc. Equipment | 2021 | 2021Crushing/Proc. Equipment500 | 500 | 0.268 | 1.574 | 1.072 | 0.055 | 0.055 | 0.005 | 568.3 | 0.024 | 0.014557 |
| Crushing/Proc. Equipment | 2021 | 2021Crushing/Proc. Equipment750 | 750 | 0.268 | 1.606 | 1.072 | 0.055 | 0.055 | 0.005 | 568.299 | 0.024 | 0.014557 |
| Crushing/Proc. Equipment | 2021 | 2021Crushing/Proc. Equipment9999 | 9999 | 0.314 | 3.487 | 1.136 | 0.08 | 0.08 | 0.005 | 568.299 | 0.028 | 0.014557 |
| Dumpers/Tenders | 2018 | 2018Dumpers/Tenders25 | 25 | 0.686 | 4.35 | 2.339 | 0.169 | 0.169 | 0.007 | 568.299 | 0.061 | 0.014557 |
| Dumpers/Tenders | 2019 | 2019Dumpers/Tenders25 | 25 | 0.686 | 4.341 | 2.339 | 0.167 | 0.167 | 0.007 | 568.299 | 0.061 | 0.014557 |
| Dumpers/Tenders | 2020 | 2020Dumpers/Tenders25 | 25 | 0.685 | 4.336 | 2.339 | 0.165 | 0.165 | 0.007 | 568.299 | 0.061 | 0.014557 |
| Dumpers/Tenders | 2021 | 2021Dumpers/Tenders25 | 25 | 0.685 | 4.333 | 2.339 | 0.163 | 0.163 | 0.007 | 568.299 | 0.061 | 0.014557 |
| Excavators | 2018 | 2018Excavators25 | 25 | 0.6874 | 4.39518 | 4.70022 | 0.2841 | 0.2614 | 0.0054 | 545.3468 | 0.1698 | 0.013969 |
| Excavators | 2018 | 2018Excavators50 | 50 | 0.6874 | 4.39518 | 4.70022 | 0.2841 | 0.2614 | 0.0054 | 545.3468 | 0.1698 | 0.013969 |
| Excavators | 2018 | 2018Excavators120 | 120 | 0.3681 | 3.76366 | 3.56214 | 0.2505 | 0.2304 | 0.0048 | 486.056 | 0.1513 | 0.012451 |
| Excavators | 2018 | 2018Excavators175 | 175 | 0.2731 | 2.92361 | 3.09338 | 0.1418 | 0.1304 | 0.0049 | 490.6725 | 0.1528 | 0.012569 |
| Excavators | 2018 | 2018Excavators250 | 250 | 0.2019 | 2.59377 | 1.15209 | 0.0788 | 0.0725 | 0.0049 | 490.2569 | 0.1526 | 0.012558 |
| Excavators | 2018 | 2018Excavators500 | 500 | 0.1746 | 2.05045 | 1.13951 | 0.0664 | 0.0611 | 0.0049 | 489.1025 | 0.1523 | 0.012529 |
| Excavators | 2018 | 2018Excavators750 | 750 | 0.1889 | 2.26567 | 1.22359 | 0.0759 | 0.0698 | 0.0048 | 487.6528 | 0.1518 | 0.012492 |
| Excavators | 2019 | 2019Excavators25 | 25 | 0.6374 | 4.19867 | 4.59698 | 0.2503 | 0.2303 | 0.0054 | 536.9132 | 0.1699 | 0.013753 |
| Excavators | 2019 | 2019Excavators50 | 50 | 0.6374 | 4.19867 | 4.59698 | 0.2503 | 0.2303 | 0.0054 | 536.9132 | 0.1699 | 0.013753 |
| Excavators | 2019 | 2019Excavators120 | 120 | 0.3248 | 3.36874 | 3.52421 | 0.2107 | 0.1938 | 0.0048 | 478.2452 | 0.1513 | 0.012251 |
| Excavators | 2019 | 2019Excavators175 | 175 | 0.2462 | 2.53264 | 3.08163 | 0.1221 | 0.1124 | 0.0049 | 482.6838 | 0.1527 | 0.012364 |
| Excavators | 2019 | 2019Excavators250 | 250 | 0.1856 | 2.24187 | 1.12671 | 0.068 | 0.0625 | 0.0049 | 482.2503 | 0.1526 | 0.012353 |
| Excavators | 2019 | 2019Excavators500 | 500 | 0.1621 | 1.77986 | 1.1135 | 0.0578 | 0.0532 | 0.0049 | 481.2361 | 0.1523 | 0.012327 |
| Excavators | 2019 | 2019Excavators750 | 750 | 0.1762 | 1.98661 | 1.17289 | 0.0671 | 0.0618 | 0.0048 | 479.2876 | 0.1516 | 0.012277 |
| Excavators | 2020 | 2020Excavators25 | 25 | 0.5932 | 4.03131 | 4.50032 | 0.2222 | 0.2044 | 0.0054 | 525.3675 | 0.1699 | 0.013458 |

| Equipment Type | Year | Concatenate | HP | ROG | NOX | CO | PM10 | PM2.5 | SO2 | CO2 | CH4 | N2O |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Excavators | 2020 | 2020Excavators50 | 50 | 0.5932 | 4.03131 | 4.50032 | 0.2222 | 0.2044 | 0.0054 | 525.3675 | 0.1699 | 0.013458 |
| Excavators | 2020 | 2020Excavators120 | 120 | 0.2992 | 3.08964 | 3.50495 | 0.1848 | 0.17 | 0.0048 | 468.0546 | 0.1514 | 0.01199 |
| Excavators | 2020 | 2020Excavators175 | 175 | 0.2314 | 2.27838 | 3.08597 | 0.1104 | 0.1015 | 0.0049 | 472.2891 | 0.1527 | 0.012098 |
| Excavators | 2020 | 2020Excavators250 | 250 | 0.1774 | 2.02738 | 1.11778 | 0.0614 | 0.0565 | 0.0049 | 471.8828 | 0.1526 | 0.012088 |
| Excavators | 2020 | 2020Excavators500 | 500 | 0.1534 | 1.57199 | 1.1016 | 0.0518 | 0.0476 | 0.0049 | 470.2956 | 0.1521 | 0.012047 |
| Excavators | 2020 | 2020Excavators750 | 750 | 0.1697 | 1.79718 | 1.14543 | 0.0612 | 0.0563 | 0.0048 | 468.8706 | 0.1516 | 0.01201 |
| Excavators | 2021 | 2021Excavators25 | 25 | 0.5624 | 3.91866 | 4.46094 | 0.2016 | 0.1855 | 0.0054 | 525.3774 | 0.1699 | 0.013458 |
| Excavators | 2021 | 2021Excavators50 | 50 | 0.5624 | 3.91866 | 4.46094 | 0.2016 | 0.1855 | 0.0054 | 525.3774 | 0.1699 | 0.013458 |
| Excavators | 2021 | 2021Excavators120 | 120 | 0.275 | 2.84891 | 3.49196 | 0.1606 | 0.1478 | 0.0048 | 467.7906 | 0.1513 | 0.011983 |
| Excavators | 2021 | 2021Excavators175 | 175 | 0.2164 | 2.03357 | 3.08975 | 0.0986 | 0.0907 | 0.0049 | 472.3586 | 0.1528 | 0.0121 |
| Excavators | 2021 | 2021Excavators250 | 250 | 0.1628 | 1.70572 | 1.10324 | 0.0523 | 0.0481 | 0.0049 | 471.7931 | 0.1526 | 0.012085 |
| Excavators | 2021 | 2021Excavators500 | 500 | 0.143 | 1.33174 | 1.08777 | 0.0446 | 0.041 | 0.0049 | 469.6156 | 0.1519 | 0.01203 |
| Excavators | 2021 | 2021Excavators750 | 750 | 0.1653 | 1.61856 | 1.14978 | 0.0562 | 0.0517 | 0.0049 | 469.547 | 0.1519 | 0.012028 |
| Forklifts | 2018 | 2018Forklifts50 | 50 | 1.3934 | 5.05181 | 6.10276 | 0.4466 | 0.4109 | 0.0054 | 545.9188 | 0.17 | 0.013984 |
| Forklifts | 2018 | 2018Forklifts120 | 120 | 0.5674 | 5.0153 | 3.85819 | 0.4002 | 0.3682 | 0.0049 | 489.8657 | 0.1525 | 0.012548 |
| Forklifts | 2018 | 2018Forklifts175 | 175 | 0.4272 | 4.42984 | 3.33646 | 0.2412 | 0.2219 | 0.0049 | 490.4659 | 0.1527 | 0.012564 |
| Forklifts | 2018 | 2018Forklifts250 | 250 | 0.4252 | 4.93757 | 1.83475 | 0.2072 | 0.1906 | 0.0049 | 491.7326 | 0.1531 | 0.012596 |
| Forklifts | 2018 | 2018Forklifts500 | 500 | 0.282 | 3.01864 | 1.87814 | 0.1245 | 0.1146 | 0.0049 | 492.0335 | 0.1532 | 0.012604 |
| Forklifts | 2019 | 2019Forklifts50 | 50 | 1.2437 | 4.86189 | 5.88034 | 0.4009 | 0.3688 | 0.0054 | 537.1608 | 0.17 | 0.01376 |
| Forklifts | 2019 | 2019Forklifts120 | 120 | 0.5095 | 4.54965 | 3.80391 | 0.3525 | 0.3243 | 0.0049 | 482.0069 | 0.1525 | 0.012347 |
| Forklifts | 2019 | 2019Forklifts175 | 175 | 0.3823 | 3.86458 | 3.28831 | 0.2102 | 0.1934 | 0.0049 | 482.5975 | 0.1527 | 0.012362 |
| Forklifts | 2019 | 2019Forklifts250 | 250 | 0.3743 | 4.2498 | 1.6773 | 0.1753 | 0.1613 | 0.0049 | 483.8438 | 0.1531 | 0.012394 |
| Forklifts | 2019 | 2019Forklifts500 | 500 | 0.2675 | 2.75148 | 1.814 | 0.112 | 0.103 | 0.0049 | 484.1399 | 0.1532 | 0.012402 |
| Forklifts | 2020 | 2020Forklifts50 | 50 | 1.1238 | 4.68572 | 5.70563 | 0.3601 | 0.3313 | 0.0054 | 525.4833 | 0.17 | 0.013461 |
| Forklifts | 2020 | 2020Forklifts120 | 120 | 0.4587 | 4.13299 | 3.75954 | 0.3079 | 0.2833 | 0.0049 | 471.5285 | 0.1525 | 0.012079 |
| Forklifts | 2020 | 2020Forklifts175 | 175 | 0.3381 | 3.3196 | 3.24885 | 0.1797 | 0.1653 | 0.0049 | 472.1062 | 0.1527 | 0.012093 |
| Forklifts | 2020 | 2020Forklifts250 | 250 | 0.2928 | 3.24149 | 1.44178 | 0.1259 | 0.1158 | 0.0049 | 473.3255 | 0.1531 | 0.012125 |
| Forklifts | 2020 | 2020Forklifts500 | 500 | 0.2513 | 2.43991 | 1.47807 | 0.0967 | 0.0889 | 0.0049 | 473.6151 | 0.1532 | 0.012132 |
| Forklifts | 2021 | 2021Forklifts50 | 50 | 1.0021 | 4.5202 | 5.53477 | 0.3178 | 0.2924 | 0.0054 | 525.4833 | 0.17 | 0.013461 |
| Forklifts | 2021 | 2021Forklifts120 | 120 | 0.412 | 3.75592 | 3.72 | 0.2666 | 0.2453 | 0.0049 | 471.5285 | 0.1525 | 0.012079 |
| Forklifts | 2021 | 2021Forklifts175 | 175 | 0.3083 | 2.9207 | 3.23128 | 0.1577 | 0.1451 | 0.0049 | 472.1062 | 0.1527 | 0.012093 |
| Forklifts | 2021 | 2021Forklifts250 | 250 | 0.2489 | 2.58195 | 1.33672 | 0.0992 | 0.0912 | 0.0049 | 473.3255 | 0.1531 | 0.012125 |
| Forklifts | 2021 | 2021Forklifts500 | 500 | 0.2536 | 2.30266 | 1.48481 | 0.0938 | 0.0863 | 0.0049 | 473.6151 | 0.1532 | 0.012132 |
| Generator Sets | 2018 | 2018Generator Sets15 | 15 | 0.679 | 4.728 | 3.58 | 0.237 | 0.237 | 0.008 | 568.299 | 0.061 | 0.014557 |
| Generator Sets | 2018 | 2018Generator Sets25 | 25 | 0.744 | 4.661 | 2.531 | 0.224 | 0.224 | 0.007 | 568.299 | 0.067 | 0.014557 |
| Generator Sets | 2018 | 2018Generator Sets50 | 50 | 0.895 | 4.366 | 4.182 | 0.253 | 0.253 | 0.007 | 568.299 | 0.08 | 0.014557 |
| Generator Sets | 2018 | 2018Generator Sets120 | 120 | 0.461 | 3.752 | 3.418 | 0.239 | 0.239 | 0.006 | 568.299 | 0.041 | 0.014557 |
| Generator Sets | 2018 | 2018Generator Sets175 | 175 | 0.319 | 2.989 | 2.93 | 0.133 | 0.133 | 0.006 | 568.299 | 0.028 | 0.014557 |
| Generator Sets | 2018 | 2018Generator Sets250 | 250 | 0.226 | 2.582 | 1.048 | 0.072 | 0.072 | 0.006 | 568.299 | 0.02 | 0.014557 |
| Generator Sets | 2018 | 2018Generator Sets500 | 500 | 0.211 | 2.31 | 1.028 | 0.069 | 0.069 | 0.005 | 568.299 | 0.019 | 0.014557 |
| Generator Sets | 2018 | 2018Generator Sets750 | 750 | 0.215 | 2.37 | 1.028 | 0.07 | 0.07 | 0.005 | 568.299 | 0.019 | 0.014557 |
| Generator Sets | 2018 | 2018Generator Sets9999 | 9999 | 0.28 | 4.058 | 1.128 | 0.095 | 0.095 | 0.005 | 568.299 | 0.025 | 0.014557 |
| Generator Sets | 2019 | 2019Generator Sets15 | 15 | 0.662 | 4.617 | 3.562 | 0.224 | 0.224 | 0.008 | 568.299 | 0.059 | 0.014557 |
| Generator Sets | 2019 | 2019Generator Sets25 | 25 | 0.731 | 4.596 | 2.501 | 0.214 | 0.214 | 0.007 | 568.299 | 0.066 | 0.014557 |
| Generator Sets | 2019 | 2019Generator Sets50 | 50 | 0.779 | 4.215 | 4.076 | 0.222 | 0.222 | 0.007 | 568.299 | 0.07 | 0.014557 |
| Generator Sets | 2019 | 2019Generator Sets120 | 120 | 0.405 | 3.446 | 3.396 | 0.206 | 0.206 | 0.006 | 568.299 | 0.036 | 0.014557 |
| Generator Sets | 2019 | 2019Generator Sets175 | 175 | 0.29 | 2.669 | 2.929 | 0.118 | 0.118 | 0.006 | 568.299 | 0.026 | 0.014557 |
| Generator Sets | 2019 | 2019Generator Sets250 | 250 | 0.211 | 2.285 | 1.036 | 0.064 | 0.064 | 0.006 | 568.299 | 0.019 | 0.014557 |
| Generator Sets | 2019 | 2019Generator Sets500 | 500 | 0.199 | 2.056 | 1.015 | 0.062 | 0.062 | 0.005 | 568.299 | 0.018 | 0.014557 |
| Generator Sets | 2019 | 2019Generator Sets750 | 750 | 0.202 | 2.104 | 1.015 | 0.062 | 0.062 | 0.005 | 568.299 | 0.018 | 0.014557 |
| Generator Sets | 2019 | 2019Generator Sets9999 | 9999 | 0.261 | 3.829 | 1.103 | 0.087 | 0.087 | 0.005 | 568.299 | 0.023 | 0.014557 |
| Generator Sets | 2020 | 2020Generator Sets15 | 15 | 0.646 | 4.516 | 3.546 | 0.212 | 0.212 | 0.008 | 568.299 | 0.058 | 0.014557 |
| Generator Sets | 2020 | 2020Generator Sets25 | 25 | 0.721 | 4.538 | 2.473 | 0.205 | 0.205 | 0.007 | 568.299 | 0.065 | 0.014557 |
| Generator Sets | 2020 | 2020Generator Sets50 | 50 | 0.691 | 4.075 | 3.995 | 0.194 | 0.194 | 0.007 | 568.299 | 0.062 | 0.014557 |
| Generator Sets | 2020 | 2020Generator Sets120 | 120 | 0.364 | 3.173 | 3.38 | 0.179 | 0.179 | 0.006 | 568.299 | 0.032 | 0.014557 |
| Generator Sets | 2020 | 2020Generator Sets175 | 175 | 0.267 | 2.38 | 2.93 | 0.105 | 0.105 | 0.006 | 568.299 | 0.024 | 0.014557 |
| Generator Sets | 2020 | 2020Generator Sets250 | 250 | 0.198 | 2.016 | 1.026 | 0.057 | 0.057 | 0.006 | 568.299 | 0.017 | 0.014557 |
| Generator Sets | 2020 | 2020Generator Sets500 | 500 | 0.188 | 1.816 | 1.005 | 0.055 | 0.055 | 0.005 | 568.299 | 0.017 | 0.014557 |
| Generator Sets | 2020 | 2020Generator Sets750 | 750 | 0.191 | 1.858 | 1.005 | 0.056 | 0.056 | 0.005 | 568.299 | 0.017 | 0.014557 |
| Generator Sets | 2020 | 2020Generator Sets9999 | 9999 | 0.242 | 3.608 | 1.082 | 0.079 | 0.079 | 0.005 | 568.3 | 0.021 | 0.014557 |
| Generator Sets | 2021 | 2021Generator Sets15 | 15 | 0.634 | 4.441 | 3.531 | 0.201 | 0.201 | 0.008 | 568.299 | 0.057 | 0.014557 |
| Generator Sets | 2021 | 2021Generator Sets25 | 25 | 0.712 | 4.497 | 2.446 | 0.196 | 0.196 | 0.007 | 568.299 | 0.064 | 0.014557 |
| Generator Sets | 2021 | 2021Generator Sets50 | 50 | 0.613 | 3.916 | 3.905 | 0.165 | 0.165 | 0.007 | 568.299 | 0.055 | 0.014557 |
| Generator Sets | 2021 | 2021Generator Sets120 | 120 | 0.326 | 2.888 | 3.361 | 0.153 | 0.153 | 0.006 | 568.299 | 0.029 | 0.014557 |
| Generator Sets | 2021 | 2021Generator Sets175 | 175 | 0.243 | 2.068 | 2.925 | 0.091 | 0.091 | 0.006 | 568.299 | 0.021 | 0.014557 |
| Generator Sets | 2021 | 2021Generator Sets250 | 250 | 0.183 | 1.73 | 1.016 | 0.049 | 0.049 | 0.006 | 568.299 | 0.016 | 0.014557 |
| Generator Sets | 2021 | 2021Generator Sets500 | 500 | 0.175 | 1.562 | 0.996 | 0.048 | 0.048 | 0.005 | 568.299 | 0.015 | 0.014557 |
| Generator Sets | 2021 | 2021Generator Sets750 | 750 | 0.177 | 1.596 | 0.996 | 0.048 | 0.048 | 0.005 | 568.299 | 0.016 | 0.014557 |
| Generator Sets | 2021 | 2021Generator Sets9999 | 9999 | 0.22 | 3.372 | 1.06 | 0.07 | 0.07 | 0.005 | 568.3 | 0.019 | 0.014557 |
| Graders | 2018 | 2018Graders50 | 50 | 2.8087 | 6.17962 | 8.62631 | 0.7895 | 0.7264 | 0.005 | 511.9098 | 0.1594 | 0.013113 |
| Graders | 2018 | 2018Graders120 | 120 | 1.0752 | 8.51954 | 4.69711 | 0.6971 | 0.6413 | 0.0048 | 487.6979 | 0.1518 | 0.012493 |
| Graders | 2018 | 2018Graders175 | 175 | 0.6614 | 6.60465 | 3.70957 | 0.3713 | 0.3416 | 0.0049 | 497.3767 | 0.1548 | 0.012741 |
| Graders | 2018 | 2018Graders250 | 250 | 0.3843 | 5.27094 | 1.41595 | 0.1713 | 0.1576 | 0.0049 | 495.431 | 0.1542 | 0.012691 |
| Graders | 2018 | 2018Graders500 | 500 | 0.3243 | 3.34465 | 1.56446 | 0.1295 | 0.1191 | 0.0049 | 490.5758 | 0.1527 | 0.012566 |
| Graders | 2018 | 2018Graders750 | 750 | 0.353 | 2.543 | 1.286 | 0.09 | 0.09 | 0.005 | 568.299 | 0.031 | 0.014557 |

| Equipment Type | Year | Concatenate | HP | ROG | NOX | CO | PM10 | PM2.5 | SO2 | CO2 | CH4 | N2O |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Graders | 2019 | 2019Graders50 | 50 | 2.6164 | 5.94463 | 8.27912 | 0.7367 | 0.6778 | 0.005 | 503.7509 | 0.1594 | 0.012904 |
| Graders | 2019 | 2019Graders120 | 120 | 1.0321 | 8.1592 | 4.6424 | 0.6653 | 0.612 | 0.0048 | 479.9011 | 0.1518 | 0.012293 |
| Graders | 2019 | 2019Graders175 | 175 | 0.6088 | 6.01354 | 3.65586 | 0.3365 | 0.3096 | 0.0049 | 489.0419 | 0.1547 | 0.012527 |
| Graders | 2019 | 2019Graders250 | 250 | 0.3599 | 4.86575 | 1.35927 | 0.1562 | 0.1437 | 0.0049 | 486.3288 | 0.1539 | 0.012458 |
| Graders | 2019 | 2019Graders500 | 500 | 0.3227 | 3.21794 | 1.52849 | 0.1244 | 0.1145 | 0.0049 | 482.5879 | 0.1527 | 0.012362 |
| Graders | 2019 | 2019Graders750 | 750 | 0.335 | 2.276 | 1.255 | 0.08 | 0.08 | 0.005 | 568.299 | 0.03 | 0.014557 |
| Graders | 2020 | 2020Graders50 | 50 | 2.5164 | 5.82549 | 8.13394 | 0.7086 | 0.6519 | 0.005 | 492.8615 | 0.1594 | 0.012625 |
| Graders | 2020 | 2020Graders120 | 120 | 0.976 | 7.72513 | 4.56142 | 0.622 | 0.5722 | 0.0048 | 469.3371 | 0.1518 | 0.012022 |
| Graders | 2020 | 2020Graders175 | 175 | 0.5667 | 5.53045 | 3.62102 | 0.3085 | 0.2838 | 0.0049 | 478.0403 | 0.1546 | 0.012245 |
| Graders | 2020 | 2020Graders250 | 250 | 0.3519 | 4.67787 | 1.34183 | 0.1495 | 0.1376 | 0.0049 | 475.3037 | 0.1537 | 0.012175 |
| Graders | 2020 | 2020Graders500 | 500 | 0.322 | 3.10731 | 1.5256 | 0.1206 | 0.111 | 0.0049 | 471.9795 | 0.1526 | 0.01209 |
| Graders | 2020 | 2020Graders750 | 750 | 0.319 | 2.031 | 1.229 | 0.072 | 0.072 | 0.005 | 568.299 | 0.028 | 0.014557 |
| Graders | 2021 | 2021Graders50 | 50 | 2.2353 | 5.48468 | 7.62621 | 0.6313 | 0.5808 | 0.005 | 492.9352 | 0.1594 | 0.012627 |
| Graders | 2021 | 2021Graders120 | 120 | 0.9009 | 7.12535 | 4.45175 | 0.5698 | 0.5242 | 0.0048 | 469.0701 | 0.1517 | 0.012016 |
| Graders | 2021 | 2021Graders175 | 175 | 0.5053 | 4.83947 | 3.55896 | 0.27 | 0.2484 | 0.0049 | 478.5289 | 0.1548 | 0.012258 |
| Graders | 2021 | 2021Graders250 | 250 | 0.335 | 4.38134 | 1.30687 | 0.1388 | 0.1277 | 0.0049 | 474.5386 | 0.1535 | 0.012156 |
| Graders | 2021 | 2021Graders500 | 500 | 0.322 | 3.01257 | 1.46044 | 0.117 | 0.1077 | 0.0049 | 471.8981 | 0.1526 | 0.012088 |
| Graders | 2021 | 2021Graders750 | 750 | 0.303 | 1.808 | 1.207 | 0.064 | 0.064 | 0.005 | 568.299 | 0.027 | 0.014557 |
| Off-Highway Tractors | 2018 | 2018Off-Highway Tractors120 | 120 | 0.5219 | 4.78732 | 3.83227 | 0.3728 | 0.343 | 0.0049 | 492.8709 | 0.1534 | 0.012625 |
| Off-Highway Tractors | 2018 | 2018Off-Highway Tractors175 | 175 | 0.3149 | 3.49764 | 3.2191 | 0.1756 | 0.1616 | 0.0049 | 491.3128 | 0.153 | 0.012585 |
| Off-Highway Tractors | 2018 | 2018Off-Highway Tractors250 | 250 | 0.2716 | 3.45421 | 1.29494 | 0.1186 | 0.1091 | 0.0049 | 488.6765 | 0.1521 | 0.012518 |
| Off-Highway Tractors | 2018 | 2018Off-Highway Tractors750 | 750 | 0.1955 | 2.1656 | 1.11871 | 0.0806 | 0.0741 | 0.0049 | 490.1818 | 0.1526 | 0.012556 |
| Off-Highway Tractors | 2018 | 2018Off-Highway Tractors1000 | 1000 | 0.1291 | 2.35874 | 0.99773 | 0.0602 | 0.0554 | 0.0049 | 490.4122 | 0.1527 | 0.012562 |
| Off-Highway Tractors | 2019 | 2019Off-Highway Tractors120 | 120 | 0.4731 | 4.42145 | 3.79465 | 0.3311 | 0.3046 | 0.0049 | 484.2693 | 0.1532 | 0.012405 |
| Off-Highway Tractors | 2019 | 2019Off-Highway Tractors175 | 175 | 0.2941 | 3.20755 | 3.21895 | 0.1586 | 0.1459 | 0.0049 | 483.4306 | 0.153 | 0.012383 |
| Off-Highway Tractors | 2019 | 2019Off-Highway Tractors250 | 250 | 0.2385 | 2.9142 | 1.21832 | 0.0976 | 0.0898 | 0.0049 | 481.2751 | 0.1523 | 0.012328 |
| Off-Highway Tractors | 2019 | 2019Off-Highway Tractors750 | 750 | 0.2052 | 2.17682 | 1.12934 | 0.082 | 0.0754 | 0.0049 | 482.3091 | 0.1526 | 0.012355 |
| Off-Highway Tractors | 2019 | 2019Off-Highway Tractors1000 | 1000 | 0.1396 | 2.37757 | 1.00978 | 0.0616 | 0.0567 | 0.0049 | 482.5446 | 0.1527 | 0.012361 |
| Off-Highway Tractors | 2020 | 2020Off-Highway Tractors120 | 120 | 0.4479 | 4.18317 | 3.78798 | 0.307 | 0.2825 | 0.0049 | 474.1481 | 0.1533 | 0.012146 |
| Off-Highway Tractors | 2020 | 2020Off-Highway Tractors175 | 175 | 0.271 | 2.89032 | 3.21511 | 0.1402 | 0.129 | 0.0049 | 472.9169 | 0.153 | 0.012114 |
| Off-Highway Tractors | 2020 | 2020Off-Highway Tractors250 | 250 | 0.2214 | 2.57547 | 1.1813 | 0.0862 | 0.0793 | 0.0049 | 470.943 | 0.1523 | 0.012064 |
| Off-Highway Tractors | 2020 | 2020Off-Highway Tractors750 | 750 | 0.2014 | 2.04663 | 1.13143 | 0.0762 | 0.0701 | 0.0049 | 471.8151 | 0.1526 | 0.012086 |
| Off-Highway Tractors | 2020 | 2020Off-Highway Tractors1000 | 1000 | 0.15 | 2.39599 | 1.02156 | 0.063 | 0.058 | 0.0049 | 472.0545 | 0.1527 | 0.012092 |
| Off-Highway Tractors | 2021 | 2021Off-Highway Tractors120 | 120 | 0.3948 | 3.77306 | 3.74258 | 0.261 | 0.2401 | 0.0049 | 474.5155 | 0.1535 | 0.012155 |
| Off-Highway Tractors | 2021 | 2021Off-Highway Tractors175 | 175 | 0.2587 | 2.65962 | 3.21953 | 0.1286 | 0.1183 | 0.0049 | 472.9236 | 0.153 | 0.012114 |
| Off-Highway Tractors | 2021 | 2021Off-Highway Tractors250 | 250 | 0.1997 | 2.11341 | 1.16179 | 0.0723 | 0.0665 | 0.0049 | 471.0028 | 0.1523 | 0.012065 |
| Off-Highway Tractors | 2021 | 2021Off-Highway Tractors750 | 750 | 0.1812 | 1.71505 | 1.12237 | 0.063 | 0.058 | 0.0049 | 471.8056 | 0.1526 | 0.012086 |
| Off-Highway Tractors | 2021 | 2021Off-Highway Tractors1000 | 1000 | 0.1601 | 2.41401 | 1.0331 | 0.0644 | 0.0592 | 0.0049 | 472.0545 | 0.1527 | 0.012092 |
| Off-Highway Trucks | 2018 | 2018Off-Highway Trucks175 | 175 | 0.3834 | 3.54273 | 3.38333 | 0.1922 | 0.1768 | 0.0048 | 488.0439 | 0.1519 | 0.012502 |
| Off-Highway Trucks | 2018 | 2018Off-Highway Trucks250 | 250 | 0.3407 | 3.45071 | 1.54329 | 0.1413 | 0.13 | 0.0048 | 487.6353 | 0.1518 | 0.012491 |
| Off-Highway Trucks | 2018 | 2018Off-Highway Trucks500 | 500 | 0.287 | 3.08995 | 1.5595 | 0.1128 | 0.1038 | 0.0049 | 493.5059 | 0.1536 | 0.012642 |
| Off-Highway Trucks | 2018 | 2018Off-Highway Trucks750 | 750 | 0.3478 | 3.69054 | 2.17619 | 0.1431 | 0.1316 | 0.0049 | 492.1136 | 0.1532 | 0.012606 |
| Off-Highway Trucks | 2018 | 2018Off-Highway Trucks1000 | 1000 | 0.2966 | 4.85753 | 1.35734 | 0.1265 | 0.1163 | 0.0048 | 487.7902 | 0.1519 | 0.012495 |
| Off-Highway Trucks | 2019 | 2019Off-Highway Trucks175 | 175 | 0.3225 | 2.82463 | 3.32598 | 0.1494 | 0.1375 | 0.0049 | 480.3623 | 0.152 | 0.012305 |
| Off-Highway Trucks | 2019 | 2019Off-Highway Trucks250 | 250 | 0.307 | 2.98481 | 1.46079 | 0.119 | 0.1095 | 0.0049 | 480.1703 | 0.1519 | 0.0123 |
| Off-Highway Trucks | 2019 | 2019Off-Highway Trucks500 | 500 | 0.2635 | 2.66851 | 1.48346 | 0.097 | 0.0893 | 0.0049 | 485.3832 | 0.1536 | 0.012433 |
| Off-Highway Trucks | 2019 | 2019Off-Highway Trucks750 | 750 | 0.3269 | 3.32044 | 2.04129 | 0.1286 | 0.1183 | 0.0049 | 483.2182 | 0.1529 | 0.012378 |
| Off-Highway Trucks | 2019 | 2019Off-Highway Trucks1000 | 1000 | 0.2952 | 4.76495 | 1.3561 | 0.1242 | 0.1142 | 0.0049 | 480.3479 | 0.152 | 0.012304 |
| Off-Highway Trucks | 2020 | 2020Off-Highway Trucks175 | 175 | 0.3099 | 2.62769 | 3.3388 | 0.137 | 0.126 | 0.0049 | 470.0967 | 0.152 | 0.012042 |
| Off-Highway Trucks | 2020 | 2020Off-Highway Trucks250 | 250 | 0.2748 | 2.50726 | 1.39106 | 0.0977 | 0.0899 | 0.0049 | 470.1675 | 0.1521 | 0.012044 |
| Off-Highway Trucks | 2020 | 2020Off-Highway Trucks500 | 500 | 0.2461 | 2.34677 | 1.41417 | 0.0855 | 0.0787 | 0.0049 | 474.5787 | 0.1535 | 0.012157 |
| Off-Highway Trucks | 2020 | 2020Off-Highway Trucks750 | 750 | 0.3123 | 3.05816 | 2.02683 | 0.1196 | 0.11 | 0.0049 | 472.7499 | 0.1529 | 0.01211 |
| Off-Highway Trucks | 2020 | 2020Off-Highway Trucks1000 | 1000 | 0.303 | 4.79365 | 1.37163 | 0.1252 | 0.1152 | 0.0049 | 469.8892 | 0.152 | 0.012037 |
| Off-Highway Trucks | 2021 | 2021Off-Highway Trucks175 | 175 | 0.2784 | 2.24626 | 3.32405 | 0.1131 | 0.1041 | 0.0049 | 470.2898 | 0.1521 | 0.012047 |
| Off-Highway Trucks | 2021 | 2021Off-Highway Trucks250 | 250 | 0.2494 | 2.10869 | 1.34839 | 0.0821 | 0.0755 | 0.0049 | 470.1932 | 0.1521 | 0.012044 |
| Off-Highway Trucks | 2021 | 2021Off-Highway Trucks500 | 500 | 0.2249 | 1.95357 | 1.33781 | 0.0717 | 0.0659 | 0.0049 | 474.542 | 0.1535 | 0.012156 |
| Off-Highway Trucks | 2021 | 2021Off-Highway Trucks750 | 750 | 0.2932 | 2.66798 | 1.93522 | 0.1064 | 0.0979 | 0.0049 | 472.991 | 0.153 | 0.012116 |
| Off-Highway Trucks | 2021 | 2021Off-Highway Trucks1000 | 1000 | 0.2558 | 4.15817 | 1.25154 | 0.0988 | 0.0909 | 0.0049 | 471.0552 | 0.1523 | 0.012066 |
| Other Construction Equipment | 2018 | 2018Other Construction Equipment15 | 15 | 1.1686 | 5.27161 | 5.54108 | 0.4492 | 0.4133 | 0.0054 | 548.9388 | 0.1709 | 0.014061 |
| Other Construction Equipment | 2018 | 2018Other Construction Equipment25 | 25 | 1.1686 | 5.27161 | 5.54108 | 0.4492 | 0.4133 | 0.0054 | 548.9388 | 0.1709 | 0.014061 |
| Other Construction Equipment | 2018 | 2018Other Construction Equipment50 | 50 | 1.1686 | 5.27161 | 5.54108 | 0.4492 | 0.4133 | 0.0054 | 548.9388 | 0.1709 | 0.014061 |
| Other Construction Equipment | 2018 | 2018Other Construction Equipment120 | 120 | 0.5977 | 5.44123 | 3.79863 | 0.4166 | 0.3833 | 0.0049 | 490.018 | 0.1525 | 0.012552 |
| Other Construction Equipment | 2018 | 2018Other Construction Equipment175 | 175 | 0.4364 | 4.75499 | 3.26346 | 0.2502 | 0.2302 | 0.0048 | 487.9859 | 0.1519 | 0.0125 |
| Other Construction Equipment | 2018 | 2018Other Construction Equipment500 | 500 | 0.2509 | 3.16693 | 1.81261 | 0.1146 | 0.1054 | 0.0049 | 493.36 | 0.1536 | 0.012638 |
| Other Construction Equipment | 2019 | 2019Other Construction Equipment15 | 15 | 1.1519 | 5.20338 | 5.54123 | 0.4374 | 0.4024 | 0.0054 | 539.7349 | 0.1708 | 0.013826 |
| Other Construction Equipment | 2019 | 2019Other Construction Equipment25 | 25 | 1.1519 | 5.20338 | 5.54123 | 0.4374 | 0.4024 | 0.0054 | 539.7349 | 0.1708 | 0.013826 |
| Other Construction Equipment | 2019 | 2019Other Construction Equipment50 | 50 | 1.1519 | 5.20338 | 5.54123 | 0.4374 | 0.4024 | 0.0054 | 539.7349 | 0.1708 | 0.013826 |
| Other Construction Equipment | 2019 | 2019Other Construction Equipment120 | 120 | 0.5504 | 5.04831 | 3.7535 | 0.3789 | 0.3486 | 0.0049 | 482.2177 | 0.1526 | 0.012352 |
| Other Construction Equipment | 2019 | 2019Other Construction Equipment175 | 175 | 0.4121 | 4.4331 | 3.25619 | 0.2335 | 0.2148 | 0.0049 | 480.4518 | 0.152 | 0.012307 |
| Other Construction Equipment | 2019 | 2019Other Construction Equipment500 | 500 | 0.2335 | 2.85547 | 1.66739 | 0.1026 | 0.0944 | 0.0049 | 485.4127 | 0.1536 | 0.012434 |
| Other Construction Equipment | 2020 | 2020Other Construction Equipment15 | 15 | 1.0722 | 5.03626 | 5.40446 | 0.4052 | 0.3728 | 0.0054 | 527.9656 | 0.1708 | 0.013524 |
| Other Construction Equipment | 2020 | 2020Other Construction Equipment25 | 25 | 1.0722 | 5.03626 | 5.40446 | 0.4052 | 0.3728 | 0.0054 | 527.9656 | 0.1708 | 0.013524 |
| Other Construction Equipment | 2020 | 2020Other Construction Equipment50 | 50 | 1.0722 | 5.03626 | 5.40446 | 0.4052 | 0.3728 | 0.0054 | 527.9656 | 0.1708 | 0.013524 |
| Other Construction Equipment | 2020 | 2020Other Construction Equipment120 | 120 | 0.5191 | 4.7712 | 3.73189 | 0.3537 | 0.3254 | 0.0049 | 472.2162 | 0.1527 | 0.012096 |
| Other Construction Equipment | 2020 | 2020Other Construction Equipment175 | 175 | 0.3877 | 4.11203 | 3.23528 | 0.217 | 0.1996 | 0.0049 | 469.9837 | 0.152 | 0.012039 |

| Equipment Type | Year | Concatenate | HP | ROG | NOX | CO | PM10 | PM2.5 | SO2 | CO2 | CH4 | N2O |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Other Construction Equipment | 2020 | 2020Other Construction Equipment500 | 500 | 0.2242 | 2.63672 | 1.6338 | 0.096 | 0.0883 | 0.0049 | 475.2326 | 0.1537 | 0.012173 |
| Other Construction Equipment | 2021 | 2021Other Construction Equipment15 | 15 | 1.0095 | 4.90234 | 5.30749 | 0.3816 | 0.351 | 0.0054 | 527.7834 | 0.1707 | 0.01352 |
| Other Construction Equipment | 2021 | 2021Other Construction Equipment25 | 25 | 1.0095 | 4.90234 | 5.30749 | 0.3816 | 0.351 | 0.0054 | 527.7834 | 0.1707 | 0.01352 |
| Other Construction Equipment | 2021 | 2021Other Construction Equipment50 | 50 | 1.0095 | 4.90234 | 5.30749 | 0.3816 | 0.351 | 0.0054 | 527.7834 | 0.1707 | 0.01352 |
| Other Construction Equipment | 2021 | 2021Other Construction Equipment120 | 120 | 0.4817 | 4.4558 | 3.70304 | 0.3234 | 0.2975 | 0.0049 | 472.275 | 0.1527 | 0.012098 |
| Other Construction Equipment | 2021 | 2021Other Construction Equipment175 | 175 | 0.3295 | 3.43847 | 3.18275 | 0.1798 | 0.1654 | 0.0048 | 469.7642 | 0.1519 | 0.012033 |
| Other Construction Equipment | 2021 | 2021Other Construction Equipment500 | 500 | 0.2151 | 2.42822 | 1.59874 | 0.0897 | 0.0825 | 0.0049 | 475.2124 | 0.1537 | 0.012173 |
| Other General Industrial Equipment | 2018 | 2018Other General Industrial Equipment15 | 15 | 1.1544 | 4.97857 | 5.82717 | 0.4137 | 0.3806 | 0.0054 | 546.6385 | 0.1702 | 0.014003 |
| Other General Industrial Equipment | 2018 | 2018Other General Industrial Equipment25 | 25 | 1.1544 | 4.97857 | 5.82717 | 0.4137 | 0.3806 | 0.0054 | 546.6385 | 0.1702 | 0.014003 |
| Other General Industrial Equipment | 2018 | 2018Other General Industrial Equipment50 | 50 | 1.1544 | 4.97857 | 5.82717 | 0.4137 | 0.3806 | 0.0054 | 546.6385 | 0.1702 | 0.014003 |
| Other General Industrial Equipment | 2018 | 2018Other General Industrial Equipment120 | 120 | 0.5573 | 4.95455 | 3.87633 | 0.3917 | 0.3604 | 0.0048 | 488.2775 | 0.152 | 0.012508 |
| Other General Industrial Equipment | 2018 | 2018Other General Industrial Equipment175 | 175 | 0.3176 | 3.23673 | 3.23662 | 0.172 | 0.1582 | 0.0049 | 490.1999 | 0.1526 | 0.012557 |
| Other General Industrial Equipment | 2018 | 2018Other General Industrial Equipment250 | 250 | 0.3031 | 3.64819 | 1.45525 | 0.1348 | 0.124 | 0.0049 | 491.6263 | 0.153 | 0.012593 |
| Other General Industrial Equipment | 2018 | 2018Other General Industrial Equipment500 | 500 | 0.2536 | 2.90735 | 1.58301 | 0.1036 | 0.0953 | 0.0049 | 491.3207 | 0.153 | 0.012586 |
| Other General Industrial Equipment | 2018 | 2018Other General Industrial Equipment750 | 750 | 0.2165 | 2.41933 | 1.48303 | 0.0826 | 0.076 | 0.0049 | 491.8763 | 0.1531 | 0.0126 |
| Other General Industrial Equipment | 2018 | 2018Other General Industrial Equipment1000 | 1000 | 0.2573 | 4.81007 | 1.06646 | 0.1159 | 0.1066 | 0.0049 | 490.4122 | 0.1527 | 0.012562 |
| Other General Industrial Equipment | 2019 | 2019Other General Industrial Equipment15 | 15 | 1.0422 | 4.80683 | 5.66186 | 0.3737 | 0.3438 | 0.0054 | 537.8689 | 0.1702 | 0.013778 |
| Other General Industrial Equipment | 2019 | 2019Other General Industrial Equipment25 | 25 | 1.0422 | 4.80683 | 5.66186 | 0.3737 | 0.3438 | 0.0054 | 537.8689 | 0.1702 | 0.013778 |
| Other General Industrial Equipment | 2019 | 2019Other General Industrial Equipment50 | 50 | 1.0422 | 4.80683 | 5.66186 | 0.3737 | 0.3438 | 0.0054 | 537.8689 | 0.1702 | 0.013778 |
| Other General Industrial Equipment | 2019 | 2019Other General Industrial Equipment120 | 120 | 0.4997 | 4.49674 | 3.82128 | 0.3429 | 0.3155 | 0.0048 | 480.4442 | 0.152 | 0.012307 |
| Other General Industrial Equipment | 2019 | 2019Other General Industrial Equipment175 | 175 | 0.3017 | 2.99891 | 3.24129 | 0.1565 | 0.144 | 0.0049 | 482.3357 | 0.1526 | 0.012355 |
| Other General Industrial Equipment | 2019 | 2019Other General Industrial Equipment250 | 250 | 0.2585 | 3.01996 | 1.29893 | 0.1058 | 0.0973 | 0.0049 | 483.7392 | 0.153 | 0.012391 |
| Other General Industrial Equipment | 2019 | 2019Other General Industrial Equipment500 | 500 | 0.2385 | 2.57531 | 1.56115 | 0.0923 | 0.0849 | 0.0049 | 483.4385 | 0.153 | 0.012384 |
| Other General Industrial Equipment | 2019 | 2019Other General Industrial Equipment750 | 750 | 0.1989 | 2.11518 | 1.47441 | 0.0758 | 0.0697 | 0.0049 | 483.9852 | 0.1531 | 0.012398 |
| Other General Industrial Equipment | 2019 | 2019Other General Industrial Equipment1000 | 1000 | 0.264 | 4.83364 | 1.07573 | 0.1172 | 0.1079 | 0.0049 | 482.5446 | 0.1527 | 0.012361 |
| Other General Industrial Equipment | 2020 | 2020Other General Industrial Equipment15 | 15 | 0.946 | 4.62219 | 5.50397 | 0.334 | 0.3073 | 0.0054 | 526.1761 | 0.1702 | 0.013478 |
| Other General Industrial Equipment | 2020 | 2020Other General Industrial Equipment25 | 25 | 0.946 | 4.62219 | 5.50397 | 0.334 | 0.3073 | 0.0054 | 526.1761 | 0.1702 | 0.013478 |
| Other General Industrial Equipment | 2020 | 2020Other General Industrial Equipment50 | 50 | 0.946 | 4.62219 | 5.50397 | 0.334 | 0.3073 | 0.0054 | 526.1761 | 0.1702 | 0.013478 |
| Other General Industrial Equipment | 2020 | 2020Other General Industrial Equipment120 | 120 | 0.446 | 4.06079 | 3.77073 | 0.2959 | 0.2722 | 0.0048 | 469.9998 | 0.152 | 0.012039 |
| Other General Industrial Equipment | 2020 | 2020Other General Industrial Equipment175 | 175 | 0.2683 | 2.57503 | 3.22922 | 0.135 | 0.1242 | 0.0049 | 471.8502 | 0.1526 | 0.012087 |
| Other General Industrial Equipment | 2020 | 2020Other General Industrial Equipment250 | 250 | 0.2368 | 2.66782 | 1.23914 | 0.0902 | 0.083 | 0.0049 | 473.2231 | 0.153 | 0.012122 |
| Other General Industrial Equipment | 2020 | 2020Other General Industrial Equipment500 | 500 | 0.2076 | 2.06187 | 1.34424 | 0.0724 | 0.0666 | 0.0049 | 472.929 | 0.153 | 0.012114 |
| Other General Industrial Equipment | 2020 | 2020Other General Industrial Equipment750 | 750 | 0.1746 | 1.67591 | 1.46184 | 0.0622 | 0.0572 | 0.0049 | 473.4638 | 0.1531 | 0.012128 |
| Other General Industrial Equipment | 2020 | 2020Other General Industrial Equipment1000 | 1000 | 0.2707 | 4.85721 | 1.085 | 0.1186 | 0.1092 | 0.0049 | 472.0545 | 0.1527 | 0.012092 |
| Other General Industrial Equipment | 2021 | 2021Other General Industrial Equipment15 | 15 | 0.8314 | 4.42532 | 5.31354 | 0.2889 | 0.2658 | 0.0054 | 526.1761 | 0.1702 | 0.013478 |
| Other General Industrial Equipment | 2021 | 2021Other General Industrial Equipment25 | 25 | 0.8314 | 4.42532 | 5.31354 | 0.2889 | 0.2658 | 0.0054 | 526.1761 | 0.1702 | 0.013478 |
| Other General Industrial Equipment | 2021 | 2021Other General Industrial Equipment50 | 50 | 0.8314 | 4.42532 | 5.31354 | 0.2889 | 0.2658 | 0.0054 | 526.1761 | 0.1702 | 0.013478 |
| Other General Industrial Equipment | 2021 | 2021Other General Industrial Equipment120 | 120 | 0.4037 | 3.7177 | 3.74029 | 0.2559 | 0.2354 | 0.0049 | 469.9998 | 0.152 | 0.012039 |
| Other General Industrial Equipment | 2021 | 2021Other General Industrial Equipment175 | 175 | 0.2541 | 2.34745 | 3.23421 | 0.1209 | 0.1113 | 0.0049 | 471.8502 | 0.1526 | 0.012087 |
| Other General Industrial Equipment | 2021 | 2021Other General Industrial Equipment250 | 250 | 0.2037 | 2.0939 | 1.17138 | 0.0696 | 0.0641 | 0.0049 | 473.2231 | 0.153 | 0.012122 |
| Other General Industrial Equipment | 2021 | 2021Other General Industrial Equipment500 | 500 | 0.1954 | 1.79624 | 1.32956 | 0.0642 | 0.059 | 0.0049 | 472.929 | 0.153 | 0.012114 |
| Other General Industrial Equipment | 2021 | 2021Other General Industrial Equipment750 | 750 | 0.166 | 1.38672 | 1.46305 | 0.0544 | 0.05 | 0.0049 | 473.4638 | 0.1531 | 0.012128 |
| Other General Industrial Equipment | 2021 | 2021Other General Industrial Equipment1000 | 1000 | 0.2761 | 4.87557 | 1.09291 | 0.1196 | 0.1101 | 0.0049 | 472.0545 | 0.1527 | 0.012092 |
| Other Material Handling Equipment | 2018 | 2018Other Material Handling Equipment50 | 50 | 1.2894 | 5.18225 | 6.06083 | 0.4567 | 0.4201 | 0.0054 | 544.0753 | 0.1694 | 0.013937 |
| Other Material Handling Equipment | 2018 | 2018Other Material Handling Equipment120 | 120 | 0.4072 | 3.9436 | 3.67482 | 0.2711 | 0.2494 | 0.0049 | 492.0058 | 0.1532 | 0.012603 |
| Other Material Handling Equipment | 2018 | 2018Other Material Handling Equipment175 | 175 | 0.3265 | 3.33231 | 3.21803 | 0.1725 | 0.1587 | 0.0049 | 490.5834 | 0.1527 | 0.012567 |
| Other Material Handling Equipment | 2018 | 2018Other Material Handling Equipment250 | 250 | 0.3161 | 4.09187 | 1.3884 | 0.135 | 0.1242 | 0.0049 | 489.8174 | 0.1525 | 0.012547 |
| Other Material Handling Equipment | 2018 | 2018Other Material Handling Equipment500 | 500 | 0.2959 | 3.52439 | 1.63271 | 0.1335 | 0.1228 | 0.0049 | 488.5866 | 0.1521 | 0.012516 |
| Other Material Handling Equipment | 2018 | 2018Other Material Handling Equipment9999 | 9999 | 0.1795 | 3.55146 | 1.02319 | 0.0742 | 0.0683 | 0.0049 | 490.4122 | 0.1527 | 0.012562 |
| Other Material Handling Equipment | 2019 | 2019Other Material Handling Equipment50 | 50 | 1.2753 | 5.17904 | 6.13945 | 0.4519 | 0.4158 | 0.0054 | 535.3468 | 0.1694 | 0.013713 |
| Other Material Handling Equipment | 2019 | 2019Other Material Handling Equipment120 | 120 | 0.3602 | 3.56573 | 3.63634 | 0.2307 | 0.2123 | 0.0049 | 484.1126 | 0.1532 | 0.012401 |
| Other Material Handling Equipment | 2019 | 2019Other Material Handling Equipment175 | 175 | 0.2796 | 2.77369 | 3.1852 | 0.1388 | 0.1277 | 0.0049 | 482.7131 | 0.1527 | 0.012365 |
| Other Material Handling Equipment | 2019 | 2019Other Material Handling Equipment250 | 250 | 0.3 | 3.81716 | 1.34052 | 0.1231 | 0.1133 | 0.0049 | 481.9594 | 0.1525 | 0.012346 |
| Other Material Handling Equipment | 2019 | 2019Other Material Handling Equipment500 | 500 | 0.2909 | 3.37078 | 1.61951 | 0.1278 | 0.1175 | 0.0049 | 480.7483 | 0.1521 | 0.012315 |
| Other Material Handling Equipment | 2019 | 2019Other Material Handling Equipment9999 | 9999 | 0.1899 | 3.58277 | 1.03609 | 0.0763 | 0.0702 | 0.0049 | 482.5446 | 0.1527 | 0.012361 |
| Other Material Handling Equipment | 2020 | 2020Other Material Handling Equipment50 | 50 | 1.2452 | 5.13925 | 6.1671 | 0.4392 | 0.4041 | 0.0054 | 523.7088 | 0.1694 | 0.013415 |
| Other Material Handling Equipment | 2020 | 2020Other Material Handling Equipment120 | 120 | 0.3065 | 3.10396 | 3.58938 | 0.1823 | 0.1677 | 0.0049 | 473.5884 | 0.1532 | 0.012131 |
| Other Material Handling Equipment | 2020 | 2020Other Material Handling Equipment175 | 175 | 0.252 | 2.36653 | 3.17089 | 0.1181 | 0.1086 | 0.0049 | 472.2193 | 0.1527 | 0.012096 |
| Other Material Handling Equipment | 2020 | 2020Other Material Handling Equipment250 | 250 | 0.2908 | 3.59889 | 1.31882 | 0.1152 | 0.106 | 0.0049 | 471.482 | 0.1525 | 0.012077 |
| Other Material Handling Equipment | 2020 | 2020Other Material Handling Equipment500 | 500 | 0.2825 | 3.20974 | 1.52346 | 0.1198 | 0.1102 | 0.0049 | 470.2972 | 0.1521 | 0.012047 |
| Other Material Handling Equipment | 2020 | 2020Other Material Handling Equipment9999 | 9999 | 0.2004 | 3.61407 | 1.04898 | 0.0783 | 0.072 | 0.0049 | 472.0545 | 0.1527 | 0.012092 |
| Other Material Handling Equipment | 2021 | 2021Other Material Handling Equipment50 | 50 | 1.1079 | 4.96638 | 5.95956 | 0.3956 | 0.364 | 0.0054 | 523.7088 | 0.1694 | 0.013415 |
| Other Material Handling Equipment | 2021 | 2021Other Material Handling Equipment120 | 120 | 0.2941 | 2.95622 | 3.60203 | 0.1657 | 0.1524 | 0.0049 | 473.5884 | 0.1532 | 0.012131 |
| Other Material Handling Equipment | 2021 | 2021Other Material Handling Equipment175 | 175 | 0.2488 | 2.24633 | 3.19638 | 0.1138 | 0.1047 | 0.0049 | 472.2193 | 0.1527 | 0.012096 |
| Other Material Handling Equipment | 2021 | 2021Other Material Handling Equipment250 | 250 | 0.2694 | 3.08193 | 1.30911 | 0.1024 | 0.0942 | 0.0049 | 471.482 | 0.1525 | 0.012077 |
| Other Material Handling Equipment | 2021 | 2021Other Material Handling Equipment500 | 500 | 0.2541 | 2.60166 | 1.44188 | 0.1011 | 0.093 | 0.0049 | 470.2972 | 0.1521 | 0.012047 |
| Other Material Handling Equipment | 2021 | 2021Other Material Handling Equipment9999 | 9999 | 0.0725 | 2.3179 | 0.97159 | 0.0195 | 0.0179 | 0.0049 | 472.0545 | 0.1527 | 0.012092 |
| Pavers | 2018 | 2018Pavers25 | 25 | 1.5386 | 5.12103 | 5.8493 | 0.4782 | 0.4399 | 0.0054 | 547.0785 | 0.1703 | 0.014014 |
| Pavers | 2018 | 2018Pavers50 | 50 | 1.5386 | 5.12103 | 5.8493 | 0.4782 | 0.4399 | 0.0054 | 547.0785 | 0.1703 | 0.014014 |
| Pavers | 2018 | 2018Pavers120 | 120 | 0.5356 | 5.01936 | 3.66032 | 0.3752 | 0.3452 | 0.0048 | 488.1812 | 0.152 | 0.012505 |
| Pavers | 2018 | 2018Pavers175 | 175 | 0.3387 | 3.7472 | 3.03913 | 0.1831 | 0.1684 | 0.0049 | 491.322 | 0.153 | 0.012586 |
| Pavers | 2018 | 2018Pavers250 | 250 | 0.1982 | 3.47438 | 1.03446 | 0.0922 | 0.0848 | 0.0049 | 491.543 | 0.153 | 0.012591 |
| Pavers | 2018 | 2018Pavers500 | 500 | 0.1643 | 2.32002 | 0.98125 | 0.0826 | 0.076 | 0.0048 | 484.2774 | 0.1508 | 0.012405 |
| Pavers | 2019 | 2019Pavers25 | 25 | 1.4176 | 4.91634 | 5.65687 | 0.4361 | 0.4012 | 0.0054 | 538.3246 | 0.1703 | 0.01379 |
| Pavers | 2019 | 2019Pavers50 | 50 | 1.4176 | 4.91634 | 5.65687 | 0.4361 | 0.4012 | 0.0054 | 538.3246 | 0.1703 | 0.01379 |

| Equipment Type | Year | Concatenate | HP | ROG | NOX | CO | PM10 | PM2.5 | SO2 | CO2 | CH4 | N2O |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pavers | 2019 | 2019Pavers120 | 120 | 0.4957 | 4.67048 | 3.62215 | 0.3455 | 0.3178 | 0.0048 | 480.2509 | 0.1519 | 0.012302 |
| Pavers | 2019 | 2019Pavers175 | 175 | 0.2988 | 3.24473 | 3.01323 | 0.1589 | 0.1462 | 0.0049 | 483.3938 | 0.1529 | 0.012383 |
| Pavers | 2019 | 2019Pavers250 | 250 | 0.1868 | 3.11084 | 1.03181 | 0.0842 | 0.0774 | 0.0049 | 483.5743 | 0.153 | 0.012387 |
| Pavers | 2019 | 2019Pavers500 | 500 | 0.1665 | 2.26992 | 0.98586 | 0.081 | 0.0746 | 0.0048 | 476.9707 | 0.1509 | 0.012218 |
| Pavers | 2020 | 2020Pavers25 | 25 | 1.3182 | 4.76401 | 5.52345 | 0.4022 | 0.37 | 0.0054 | 526.2098 | 0.1702 | 0.013479 |
| Pavers | 2020 | 2020Pavers50 | 50 | 1.3182 | 4.76401 | 5.52345 | 0.4022 | 0.37 | 0.0054 | 526.2098 | 0.1702 | 0.013479 |
| Pavers | 2020 | 2020Pavers120 | 120 | 0.4697 | 4.42718 | 3.60405 | 0.3249 | 0.2989 | 0.0048 | 469.8815 | 0.152 | 0.012036 |
| Pavers | 2020 | 2020Pavers175 | 175 | 0.2728 | 2.91833 | 3.0097 | 0.1419 | 0.1305 | 0.0049 | 472.7746 | 0.1529 | 0.01211 |
| Pavers | 2020 | 2020Pavers250 | 250 | 0.1756 | 2.77699 | 1.02834 | 0.076 | 0.0699 | 0.0049 | 472.8337 | 0.1529 | 0.012112 |
| Pavers | 2020 | 2020Pavers500 | 500 | 0.1647 | 2.13394 | 0.98677 | 0.0772 | 0.071 | 0.0048 | 466.2059 | 0.1508 | 0.011942 |
| Pavers | 2021 | 2021Pavers25 | 25 | 1.2075 | 4.60183 | 5.30162 | 0.3699 | 0.3403 | 0.0054 | 526.5153 | 0.1703 | 0.013487 |
| Pavers | 2021 | 2021Pavers50 | 50 | 1.2075 | 4.60183 | 5.30162 | 0.3699 | 0.3403 | 0.0054 | 526.5153 | 0.1703 | 0.013487 |
| Pavers | 2021 | 2021Pavers120 | 120 | 0.4196 | 4.02622 | 3.56251 | 0.2853 | 0.2625 | 0.0048 | 469.7736 | 0.1519 | 0.012034 |
| Pavers | 2021 | 2021Pavers175 | 175 | 0.2557 | 2.6948 | 3.01647 | 0.1302 | 0.1198 | 0.0049 | 472.5552 | 0.1528 | 0.012105 |
| Pavers | 2021 | 2021Pavers250 | 250 | 0.1655 | 2.4844 | 1.02422 | 0.0697 | 0.0642 | 0.0049 | 472.4765 | 0.1528 | 0.012103 |
| Pavers | 2021 | 2021Pavers500 | 500 | 0.1639 | 2.05298 | 0.9877 | 0.074 | 0.068 | 0.0048 | 465.5908 | 0.1506 | 0.011926 |
| Paving Equipment | 2018 | 2018Paving Equipment25 | 25 | 0.7374 | 4.31244 | 4.41578 | 0.286 | 0.2632 | 0.0054 | 540.6115 | 0.1683 | 0.013848 |
| Paving Equipment | 2018 | 2018Paving Equipment50 | 50 | 0.7374 | 4.31244 | 4.41578 | 0.286 | 0.2632 | 0.0054 | 540.6115 | 0.1683 | 0.013848 |
| Paving Equipment | 2018 | 2018Paving Equipment120 | 120 | 0.4494 | 4.27034 | 3.60743 | 0.3021 | 0.278 | 0.0049 | 492.1184 | 0.1532 | 0.012606 |
| Paving Equipment | 2018 | 2018Paving Equipment175 | 175 | 0.2837 | 3.17208 | 3.02602 | 0.1553 | 0.1429 | 0.0049 | 489.2024 | 0.1523 | 0.012531 |
| Paving Equipment | 2018 | 2018Paving Equipment250 | 250 | 0.2583 | 3.58656 | 1.28117 | 0.1229 | 0.1131 | 0.0049 | 490.6833 | 0.1528 | 0.012569 |
| Paving Equipment | 2019 | 2019Paving Equipment25 | 25 | 0.7046 | 4.23779 | 4.40798 | 0.2697 | 0.2481 | 0.0054 | 531.8612 | 0.1683 | 0.013624 |
| Paving Equipment | 2019 | 2019Paving Equipment50 | 50 | 0.7046 | 4.23779 | 4.40798 | 0.2697 | 0.2481 | 0.0054 | 531.8612 | 0.1683 | 0.013624 |
| Paving Equipment | 2019 | 2019Paving Equipment120 | 120 | 0.4251 | 4.04152 | 3.59849 | 0.2808 | 0.2584 | 0.0049 | 484.387 | 0.1533 | 0.012408 |
| Paving Equipment | 2019 | 2019Paving Equipment175 | 175 | 0.2541 | 2.6924 | 3.0109 | 0.1336 | 0.1229 | 0.0049 | 481.2251 | 0.1523 | 0.012327 |
| Paving Equipment | 2019 | 2019Paving Equipment250 | 250 | 0.2408 | 3.25106 | 1.24449 | 0.1116 | 0.1027 | 0.0049 | 482.6441 | 0.1527 | 0.012363 |
| Paving Equipment | 2020 | 2020Paving Equipment25 | 25 | 0.6214 | 3.9519 | 4.22322 | 0.2169 | 0.1996 | 0.0054 | 520.1235 | 0.1682 | 0.013323 |
| Paving Equipment | 2020 | 2020Paving Equipment50 | 50 | 0.6214 | 3.9519 | 4.22322 | 0.2169 | 0.1996 | 0.0054 | 520.1235 | 0.1682 | 0.013323 |
| Paving Equipment | 2020 | 2020Paving Equipment120 | 120 | 0.3974 | 3.78064 | 3.58172 | 0.2558 | 0.2353 | 0.0049 | 473.3249 | 0.1531 | 0.012125 |
| Paving Equipment | 2020 | 2020Paving Equipment175 | 175 | 0.2475 | 2.55498 | 3.02393 | 0.1278 | 0.1176 | 0.0049 | 470.7359 | 0.1522 | 0.012058 |
| Paving Equipment | 2020 | 2020Paving Equipment250 | 250 | 0.2435 | 3.2202 | 1.25215 | 0.1107 | 0.1018 | 0.0049 | 472.1514 | 0.1527 | 0.012095 |
| Paving Equipment | 2021 | 2021Paving Equipment25 | 25 | 0.5865 | 3.88226 | 4.21072 | 0.2004 | 0.1843 | 0.0054 | 520.3965 | 0.1683 | 0.01333 |
| Paving Equipment | 2021 | 2021Paving Equipment50 | 50 | 0.5865 | 3.88226 | 4.21072 | 0.2004 | 0.1843 | 0.0054 | 520.3965 | 0.1683 | 0.01333 |
| Paving Equipment | 2021 | 2021Paving Equipment120 | 120 | 0.3551 | 3.45065 | 3.5537 | 0.219 | 0.2015 | 0.0049 | 473.2205 | 0.153 | 0.012122 |
| Paving Equipment | 2021 | 2021Paving Equipment175 | 175 | 0.2291 | 2.31505 | 3.03229 | 0.1143 | 0.1052 | 0.0049 | 470.6495 | 0.1522 | 0.012056 |
| Paving Equipment | 2021 | 2021Paving Equipment250 | 250 | 0.2106 | 2.58202 | 1.20904 | 0.0921 | 0.0848 | 0.0049 | 472.151 | 0.1527 | 0.012095 |
| Plate Compactors | 2018 | 2018Plate Compactors15 | 15 | 0.661 | 4.142 | 3.47 | 0.161 | 0.161 | 0.008 | 568.3 | 0.059 | 0.014557 |
| Plate Compactors | 2019 | 2019Plate Compactors15 | 15 | 0.661 | 4.142 | 3.469 | 0.161 | 0.161 | 0.008 | 568.299 | 0.059 | 0.014557 |
| Plate Compactors | 2020 | 2020Plate Compactors15 | 15 | 0.661 | 4.142 | 3.469 | 0.161 | 0.161 | 0.008 | 568.299 | 0.059 | 0.014557 |
| Plate Compactors | 2021 | 2021Plate Compactors15 | 15 | 0.661 | 4.142 | 3.469 | 0.161 | 0.161 | 0.008 | 568.299 | 0.059 | 0.014557 |
| Pressure Washers | 2018 | 2018Pressure Washers15 | 15 | 0.679 | 4.728 | 3.58 | 0.237 | 0.237 | 0.008 | 568.299 | 0.061 | 0.014557 |
| Pressure Washers | 2018 | 2018Pressure Washers25 | 25 | 0.744 | 4.661 | 2.531 | 0.224 | 0.224 | 0.007 | 568.299 | 0.067 | 0.014557 |
| Pressure Washers | 2018 | 2018Pressure Washers50 | 50 | 0.661 | 4.202 | 3.542 | 0.212 | 0.212 | 0.007 | 568.299 | 0.059 | 0.014557 |
| Pressure Washers | 2018 | 2018Pressure Washers120 | 120 | 0.388 | 3.584 | 3.26 | 0.203 | 0.203 | 0.006 | 568.299 | 0.035 | 0.014557 |
| Pressure Washers | 2018 | 2018Pressure Washers175 | 175 | 0.309 | 2.989 | 2.908 | 0.132 | 0.132 | 0.006 | 568.299 | 0.027 | 0.014557 |
| Pressure Washers | 2018 | 2018Pressure Washers250 | 250 | 0.099 | 0.277 | 0.986 | 0.009 | 0.009 | 0.006 | 568.299 | 0.008 | 0.014557 |
| Pressure Washers | 2019 | 2019Pressure Washers15 | 15 | 0.662 | 4.617 | 3.562 | 0.224 | 0.224 | 0.008 | 568.299 | 0.059 | 0.014557 |
| Pressure Washers | 2019 | 2019Pressure Washers25 | 25 | 0.731 | 4.596 | 2.501 | 0.214 | 0.214 | 0.007 | 568.299 | 0.066 | 0.014557 |
| Pressure Washers | 2019 | 2019Pressure Washers50 | 50 | 0.569 | 4.053 | 3.457 | 0.184 | 0.184 | 0.007 | 568.299 | 0.051 | 0.014557 |
| Pressure Washers | 2019 | 2019Pressure Washers120 | 120 | 0.337 | 3.295 | 3.24 | 0.174 | 0.174 | 0.006 | 568.299 | 0.03 | 0.014557 |
| Pressure Washers | 2019 | 2019Pressure Washers175 | 175 | 0.28 | 2.67 | 2.907 | 0.117 | 0.117 | 0.006 | 568.299 | 0.025 | 0.014557 |
| Pressure Washers | 2019 | 2019Pressure Washers250 | 250 | 0.098 | 0.265 | 0.986 | 0.009 | 0.009 | 0.006 | 568.299 | 0.008 | 0.014557 |
| Pressure Washers | 2020 | 2020Pressure Washers15 | 15 | 0.646 | 4.516 | 3.546 | 0.212 | 0.212 | 0.008 | 568.299 | 0.058 | 0.014557 |
| Pressure Washers | 2020 | 2020Pressure Washers25 | 25 | 0.721 | 4.538 | 2.473 | 0.205 | 0.205 | 0.007 | 568.299 | 0.065 | 0.014557 |
| Pressure Washers | 2020 | 2020Pressure Washers50 | 50 | 0.499 | 3.917 | 3.393 | 0.161 | 0.161 | 0.007 | 568.299 | 0.045 | 0.014557 |
| Pressure Washers | 2020 | 2020Pressure Washers120 | 120 | 0.298 | 3.036 | 3.225 | 0.151 | 0.151 | 0.006 | 568.299 | 0.026 | 0.014557 |
| Pressure Washers | 2020 | 2020Pressure Washers175 | 175 | 0.258 | 2.383 | 2.907 | 0.104 | 0.104 | 0.006 | 568.299 | 0.023 | 0.014557 |
| Pressure Washers | 2020 | 2020Pressure Washers250 | 250 | 0.098 | 0.265 | 0.986 | 0.009 | 0.009 | 0.006 | 568.299 | 0.008 | 0.014557 |
| Pressure Washers | 2021 | 2021Pressure Washers15 | 15 | 0.634 | 4.441 | 3.531 | 0.201 | 0.201 | 0.008 | 568.299 | 0.057 | 0.014557 |
| Pressure Washers | 2021 | 2021Pressure Washers25 | 25 | 0.712 | 4.497 | 2.446 | 0.196 | 0.196 | 0.007 | 568.299 | 0.064 | 0.014557 |
| Pressure Washers | 2021 | 2021Pressure Washers50 | 50 | 0.439 | 3.765 | 3.329 | 0.136 | 0.136 | 0.007 | 568.299 | 0.039 | 0.014557 |
| Pressure Washers | 2021 | 2021Pressure Washers120 | 120 | 0.264 | 2.766 | 3.21 | 0.129 | 0.129 | 0.006 | 568.299 | 0.023 | 0.014557 |
| Pressure Washers | 2021 | 2021Pressure Washers175 | 175 | 0.238 | 2.118 | 2.907 | 0.093 | 0.093 | 0.006 | 568.299 | 0.021 | 0.014557 |
| Pressure Washers | 2021 | 2021Pressure Washers250 | 250 | 0.098 | 0.265 | 0.986 | 0.009 | 0.009 | 0.006 | 568.299 | 0.008 | 0.014557 |
| Pumps | 2018 | 2018Pumps15 | 15 | 0.766 | 4.762 | 3.58 | 0.256 | 0.256 | 0.008 | 568.299 | 0.069 | 0.014557 |
| Pumps | 2018 | 2018Pumps25 | 25 | 0.807 | 4.661 | 2.531 | 0.232 | 0.232 | 0.007 | 568.299 | 0.072 | 0.014557 |
| Pumps | 2018 | 2018Pumps50 | 50 | 0.973 | 4.422 | 4.397 | 0.267 | 0.267 | 0.007 | 568.299 | 0.087 | 0.014557 |
| Pumps | 2018 | 2018Pumps120 | 120 | 0.485 | 3.808 | 3.471 | 0.252 | 0.252 | 0.006 | 568.299 | 0.043 | 0.014557 |
| Pumps | 2018 | 2018Pumps175 | 175 | 0.338 | 3.035 | 2.974 | 0.14 | 0.14 | 0.006 | 568.299 | 0.03 | 0.014557 |
| Pumps | 2018 | 2018Pumps250 | 250 | 0.242 | 2.624 | 1.065 | 0.075 | 0.075 | 0.006 | 568.299 | 0.021 | 0.014557 |
| Pumps | 2018 | 2018Pumps500 | 500 | 0.226 | 2.34 | 1.041 | 0.071 | 0.071 | 0.005 | 568.299 | 0.02 | 0.014557 |
| Pumps | 2018 | 2018Pumps750 | 750 | 0.23 | 2.401 | 1.041 | 0.072 | 0.072 | 0.005 | 568.299 | 0.02 | 0.014557 |
| Pumps | 2018 | 2018Pumps9999 | 9999 | 0.293 | 4.105 | 1.144 | 0.098 | 0.098 | 0.005 | 568.299 | 0.026 | 0.014557 |
| Pumps | 2019 | 2019Pumps15 | 15 | 0.748 | 4.647 | 3.562 | 0.241 | 0.241 | 0.008 | 568.3 | 0.067 | 0.014557 |
| Pumps | 2019 | 2019Pumps25 | 25 | 0.787 | 4.596 | 2.501 | 0.222 | 0.222 | 0.007 | 568.3 | 0.071 | 0.014557 |

| Equipment Type | Year | Concatenate | HP | ROG | NOX | CO | PM10 | PM2.5 | SO2 | CO2 | CH4 | N2O |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pumps | 2019 | 2019Pumps50 | 50 | 0.849 | 4.269 | 4.284 | 0.235 | 0.235 | 0.007 | 568.299 | 0.076 | 0.014557 |
| Pumps | 2019 | 2019Pumps120 | 120 | 0.429 | 3.497 | 3.449 | 0.217 | 0.217 | 0.006 | 568.299 | 0.038 | 0.014557 |
| Pumps | 2019 | 2019Pumps175 | 175 | 0.309 | 2.711 | 2.974 | 0.124 | 0.124 | 0.006 | 568.299 | 0.027 | 0.014557 |
| Pumps | 2019 | 2019Pumps250 | 250 | 0.226 | 2.323 | 1.052 | 0.067 | 0.067 | 0.006 | 568.299 | 0.02 | 0.014557 |
| Pumps | 2019 | 2019Pumps500 | 500 | 0.214 | 2.084 | 1.027 | 0.064 | 0.064 | 0.005 | 568.3 | 0.019 | 0.014557 |
| Pumps | 2019 | 2019Pumps750 | 750 | 0.217 | 2.133 | 1.027 | 0.065 | 0.065 | 0.005 | 568.299 | 0.019 | 0.014557 |
| Pumps | 2019 | 2019Pumps9999 | 9999 | 0.273 | 3.873 | 1.118 | 0.089 | 0.089 | 0.005 | 568.299 | 0.024 | 0.014557 |
| Pumps | 2020 | 2020Pumps15 | 15 | 0.731 | 4.542 | 3.546 | 0.227 | 0.227 | 0.008 | 568.299 | 0.066 | 0.014557 |
| Pumps | 2020 | 2020Pumps25 | 25 | 0.769 | 4.538 | 2.473 | 0.212 | 0.212 | 0.007 | 568.299 | 0.069 | 0.014557 |
| Pumps | 2020 | 2020Pumps50 | 50 | 0.755 | 4.128 | 4.197 | 0.206 | 0.206 | 0.007 | 568.299 | 0.068 | 0.014557 |
| Pumps | 2020 | 2020Pumps120 | 120 | 0.386 | 3.219 | 3.432 | 0.189 | 0.189 | 0.006 | 568.299 | 0.034 | 0.014557 |
| Pumps | 2020 | 2020Pumps175 | 175 | 0.285 | 2.418 | 2.974 | 0.111 | 0.111 | 0.006 | 568.299 | 0.025 | 0.014557 |
| Pumps | 2020 | 2020Pumps250 | 250 | 0.212 | 2.050 | 1.042 | 0.060 | 0.060 | 0.006 | ###### | 0.019 | 0.015 |
| Pumps | 2020 | 2020Pumps500 | 500 | 0.203 | 1.841 | 1.017 | 0.057 | 0.057 | 0.005 | ###### | 0.018 | 0.015 |
| Pumps | 2020 | 2020Pumps750 | 750 | 0.205 | 1.884 | 1.017 | 0.058 | 0.058 | 0.005 | 568.299 | 0.018 | 0.015 |
| Pumps | 2020 | 2020Pumps9999 | 9999 | 0.255 | 3.649 | 1.096 | 0.081 | 0.081 | 0.005 | 568.3 | 0.023 | 0.015 |
| Pumps | 2021 | 2021Pumps15 | 15 | 0.717 | 4.462 | 3.531 | 0.214 | 0.214 | 0.008 | 568.299 | 0.064 | 0.015 |
| Pumps | 2021 | 2021Pumps25 | 25 | 0.752 | 4.497 | 2.446 | 0.201 | 0.201 | 0.007 | 568.299 | 0.067 | 0.015 |
| Pumps | 2021 | 2021Pumps50 | 50 | 0.671 | 3.966 | 4.099 | 0.175 | 0.175 | 0.007 | 568.299 | 0.06 | 0.015 |
| Pumps | 2021 | 2021Pumps120 | 120 | 0.347 | 2.928 | 3.412 | 0.162 | 0.162 | 0.006 | 568.3 | 0.031 | 0.015 |
| Pumps | 2021 | 2021Pumps175 | 175 | 0.26 | 2.101 | 2.968 | 0.096 | 0.096 | 0.006 | 568.299 | 0.023 | 0.015 |
| Pumps | 2021 | 2021Pumps250 | 250 | 0.197 | 1.759 | 1.031 | 0.052 | 0.052 | 0.006 | 568.299 | 0.017 | 0.015 |
| Pumps | 2021 | 2021Pumps500 | 500 | 0.189 | 1.584 | 1.007 | 0.05 | 0.05 | 0.005 | 568.299 | 0.017 | 0.015 |
| Pumps | 2021 | 2021Pumps750 | 750 | 0.191 | 1.618 | 1.007 | 0.05 | 0.05 | 0.005 | 568.299 | 0.017 | 0.015 |
| Pumps | 2021 | 2021Pumps9999 | 9999 | 0.233 | 3.409 | 1.074 | 0.072 | 0.072 | 0.005 | 568.3 | 0.021 | 0.015 |
| Rollers | 2018 | 2018Rollers15 | 15 | 1.0644 | 4.8416 | 4.92335 | 0.3867 | 0.3557 | 0.0054 | 546.2905 | 0.1701 | 0.014 |
| Rollers | 2018 | 2018Rollers25 | 25 | 1.0644 | 4.8416 | 4.92335 | 0.3867 | 0.3557 | 0.0054 | 546.2905 | 0.1701 | 0.014 |
| Rollers | 2018 | 2018Rollers50 | 50 | 1.0644 | 4.8416 | 4.92335 | 0.3867 | 0.3557 | 0.0054 | 546.2905 | 0.1701 | 0.014 |
| Rollers | 2018 | 2018Rollers120 | 120 | 0.481 | 4.65049 | 3.60981 | 0.32 | 0.2944 | 0.0049 | 492.2118 | 0.1532 | 0.013 |
| Rollers | 2018 | 2018Rollers175 | 175 | 0.2652 | 3.18126 | 2.94895 | 0.1472 | 0.1355 | 0.0049 | 490.1805 | 0.1526 | 0.013 |
| Rollers | 2018 | 2018Rollers250 | 250 | 0.2113 | 2.99492 | 1.24341 | 0.0938 | 0.0863 | 0.0049 | 491.6643 | 0.1531 | 0.013 |
| Rollers | 2018 | 2018Rollers500 | 500 | 0.2448 | 3.09814 | 2.23145 | 0.1191 | 0.1095 | 0.005 | 497.9962 | 0.155 | 0.013 |
| Rollers | 2019 | 2019Rollers15 | 15 | 0.9719 | 4.64491 | 4.77841 | 0.3493 | 0.3213 | 0.0054 | 537.546 | 0.1701 | 0.014 |
| Rollers | 2019 | 2019Rollers25 | 25 | 0.9719 | 4.64491 | 4.77841 | 0.3493 | 0.3213 | 0.0054 | 537.546 | 0.1701 | 0.014 |
| Rollers | 2019 | 2019Rollers50 | 50 | 0.9719 | 4.64491 | 4.77841 | 0.3493 | 0.3213 | 0.0054 | 537.546 | 0.1701 | 0.014 |
| Rollers | 2019 | 2019Rollers120 | 120 | 0.4225 | 4.17949 | 3.55726 | 0.2748 | 0.2528 | 0.0049 | 484.3362 | 0.1532 | 0.012 |
| Rollers | 2019 | 2019Rollers175 | 175 | 0.2309 | 2.69941 | 2.93251 | 0.1239 | 0.114 | 0.0049 | 482.4531 | 0.1526 | 0.012 |
| Rollers | 2019 | 2019Rollers250 | 250 | 0.2105 | 2.88327 | 1.24854 | 0.0918 | 0.0844 | 0.0049 | 483.7769 | 0.1531 | 0.012 |
| Rollers | 2019 | 2019Rollers500 | 500 | 0.2341 | 2.90839 | 2.10142 | 0.1109 | 0.102 | 0.005 | 489.9774 | 0.155 | 0.013 |
| Rollers | 2020 | 2020Rollers15 | 15 | 0.9261 | 4.53426 | 4.72504 | 0.3289 | 0.3026 | 0.0054 | 525.8798 | 0.1701 | 0.013 |
| Rollers | 2020 | 2020Rollers25 | 25 | 0.9261 | 4.53426 | 4.72504 | 0.3289 | 0.3026 | 0.0054 | 525.8798 | 0.1701 | 0.013 |
| Rollers | 2020 | 2020Rollers50 | 50 | 0.9261 | 4.53426 | 4.72504 | 0.3289 | 0.3026 | 0.0054 | 525.8798 | 0.1701 | 0.013 |
| Rollers | 2020 | 2020Rollers120 | 120 | 0.3882 | 3.88153 | 3.53135 | 0.2475 | 0.2277 | 0.0049 | 473.8594 | 0.1533 | 0.012 |
| Rollers | 2020 | 2020Rollers175 | 175 | 0.2152 | 2.45176 | 2.93333 | 0.1126 | 0.1036 | 0.0049 | 471.9177 | 0.1526 | 0.012 |
| Rollers | 2020 | 2020Rollers250 | 250 | 0.2085 | 2.75095 | 1.25343 | 0.0892 | 0.082 | 0.0049 | 473.3669 | 0.1531 | 0.012 |
| Rollers | 2020 | 2020Rollers500 | 500 | 0.235 | 2.82823 | 2.11346 | 0.1094 | 0.1007 | 0.005 | 479.3254 | 0.155 | 0.012 |
| Rollers | 2021 | 2021Rollers15 | 15 | 0.8475 | 4.35097 | 4.59681 | 0.2938 | 0.2703 | 0.0054 | 525.7908 | 0.1701 | 0.013 |
| Rollers | 2021 | 2021Rollers25 | 25 | 0.8475 | 4.35097 | 4.59681 | 0.2938 | 0.2703 | 0.0054 | 525.7908 | 0.1701 | 0.013 |
| Rollers | 2021 | 2021Rollers50 | 50 | 0.8475 | 4.35097 | 4.59681 | 0.2938 | 0.2703 | 0.0054 | 525.7908 | 0.1701 | 0.013 |
| Rollers | 2021 | 2021Rollers120 | 120 | 0.3534 | 3.5889 | 3.50719 | 0.2194 | 0.2018 | 0.0049 | 473.9012 | 0.1533 | 0.012 |
| Rollers | 2021 | 2021Rollers175 | 175 | 0.1929 | 2.11691 | 2.9256 | 0.0973 | 0.0895 | 0.0049 | 471.9799 | 0.1526 | 0.012 |
| Rollers | 2021 | 2021Rollers250 | 250 | 0.1965 | 2.49332 | 1.22849 | 0.081 | 0.0746 | 0.0049 | 473.4704 | 0.1531 | 0.012 |
| Rollers | 2021 | 2021Rollers500 | 500 | 0.2205 | 2.58936 | 1.94995 | 0.0997 | 0.0918 | 0.005 | 479.3294 | 0.155 | 0.012 |
| Rough Terrain Forklifts | 2018 | 2018Rough Terrain Forklifts50 | 50 | 1.0698 | 4.73469 | 4.76839 | 0.3585 | 0.3298 | 0.0054 | 545.8693 | 0.1699 | 0.014 |
| Rough Terrain Forklifts | 2018 | 2018Rough Terrain Forklifts120 | 120 | 0.2222 | 2.84496 | 3.26976 | 0.136 | 0.1251 | 0.0049 | 491.2107 | 0.1529 | 0.013 |
| Rough Terrain Forklifts | 2018 | 2018Rough Terrain Forklifts175 | 175 | 0.1637 | 2.34168 | 2.84245 | 0.0876 | 0.0806 | 0.0049 | 489.9869 | 0.1525 | 0.013 |
| Rough Terrain Forklifts | 2018 | 2018Rough Terrain Forklifts250 | 250 | 0.1521 | 2.48748 | 1.02948 | 0.0598 | 0.055 | 0.0049 | 491.0997 | 0.1529 | 0.013 |
| Rough Terrain Forklifts | 2018 | 2018Rough Terrain Forklifts500 | 500 | 0.1452 | 2.70063 | 0.95802 | 0.0599 | 0.0551 | 0.0048 | 485.9543 | 0.1513 | 0.012 |
| Rough Terrain Forklifts | 2019 | 2019Rough Terrain Forklifts50 | 50 | 1.009 | 4.55745 | 4.67405 | 0.3277 | 0.3015 | 0.0054 | 537.3287 | 0.17 | 0.014 |
| Rough Terrain Forklifts | 2019 | 2019Rough Terrain Forklifts120 | 120 | 0.2019 | 2.6222 | 3.25848 | 0.1168 | 0.1075 | 0.0049 | 483.3105 | 0.1529 | 0.012 |
| Rough Terrain Forklifts | 2019 | 2019Rough Terrain Forklifts175 | 175 | 0.1493 | 2.05752 | 2.84092 | 0.0753 | 0.0693 | 0.0049 | 482.1188 | 0.1525 | 0.012 |
| Rough Terrain Forklifts | 2019 | 2019Rough Terrain Forklifts250 | 250 | 0.1094 | 1.63905 | 0.97423 | 0.0364 | 0.0335 | 0.0049 | 483.0882 | 0.1528 | 0.012 |
| Rough Terrain Forklifts | 2019 | 2019Rough Terrain Forklifts500 | 500 | 0.1162 | 1.96109 | 0.95034 | 0.0429 | 0.0395 | 0.0048 | 477.2539 | 0.151 | 0.012 |
| Rough Terrain Forklifts | 2020 | 2020Rough Terrain Forklifts50 | 50 | 0.9987 | 4.4946 | 4.68594 | 0.3164 | 0.2911 | 0.0054 | 525.6222 | 0.17 | 0.013 |
| Rough Terrain Forklifts | 2020 | 2020Rough Terrain Forklifts120 | 120 | 0.1892 | 2.45218 | 3.25575 | 0.1026 | 0.0944 | 0.0049 | 472.9842 | 0.153 | 0.012 |
| Rough Terrain Forklifts | 2020 | 2020Rough Terrain Forklifts175 | 175 | 0.1429 | 1.86888 | 2.84466 | 0.0684 | 0.0629 | 0.0049 | 471.7152 | 0.1526 | 0.012 |
| Rough Terrain Forklifts | 2020 | 2020Rough Terrain Forklifts250 | 250 | 0.1115 | 1.60906 | 0.97848 | 0.0366 | 0.0337 | 0.0049 | 472.5671 | 0.1528 | 0.012 |
| Rough Terrain Forklifts | 2020 | 2020Rough Terrain Forklifts500 | 500 | 0.0886 | 1.30199 | 0.94184 | 0.0281 | 0.0258 | 0.0048 | 465.7709 | 0.1506 | 0.012 |
| Rough Terrain Forklifts | 2021 | 2021Rough Terrain Forklifts50 | 50 | 0.9685 | 4.41145 | 4.65658 | 0.3038 | 0.2795 | 0.0054 | 525.3844 | 0.1699 | 0.013 |
| Rough Terrain Forklifts | 2021 | 2021Rough Terrain Forklifts120 | 120 | 0.1746 | 2.28534 | 3.25191 | 0.0885 | 0.0815 | 0.0049 | 473.11 | 0.153 | 0.012 |
| Rough Terrain Forklifts | 2021 | 2021Rough Terrain Forklifts175 | 175 | 0.1302 | 1.61661 | 2.8447 | 0.0596 | 0.0548 | 0.0049 | 471.7575 | 0.1526 | 0.012 |
| Rough Terrain Forklifts | 2021 | 2021Rough Terrain Forklifts250 | 250 | 0.115 | 1.61186 | 0.98379 | 0.0368 | 0.0339 | 0.0049 | 472.5469 | 0.1528 | 0.012 |
| Rough Terrain Forklifts | 2021 | 2021Rough Terrain Forklifts500 | 500 | 0.0917 | 1.30199 | 0.94604 | 0.0282 | 0.026 | 0.0048 | 465.7442 | 0.1506 | 0.012 |
| Rubber Tired Dozers | 2018 | 2018Rubber Tired Dozers175 | 175 | 0.8023 | 8.02079 | 3.98965 | 0.4605 | 0.4236 | 0.0049 | 491.4921 | 0.153 | 0.013 |
| Rubber Tired Dozers | 2018 | 2018Rubber Tired Dozers250 | 250 | 0.6692 | 7.20787 | 2.51156 | 0.3504 | 0.3224 | 0.0049 | 493.6337 | 0.1537 | 0.013 |

| Equipment Type | Year | Concatenate | HP | ROG | NOX | CO | PM10 | PM2.5 | SO2 | CO2 | CH4 | N2O |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rubber Tired Dozers | 2018 | 2018Rubber Tired Dozers500 | 500 | 0.5981 | 6.50184 | 4.98205 | 0.3002 | 0.2762 | 0.0049 | 498.1862 | 0.1551 | 0.013 |
| Rubber Tired Dozers | 2018 | 2018Rubber Tired Dozers750 | 750 | 0.5064 | 6.72652 | 2.75902 | 0.248 | 0.2282 | 0.0049 | 491.4726 | 0.153 | 0.013 |
| Rubber Tired Dozers | 2018 | 2018Rubber Tired Dozers1000 | 1000 | 0.574 | 5.764 | 2.413 | 0.183 | 0.183 | 0.005 | 568.299 | 0.051 | 0.015 |
| Rubber Tired Dozers | 2019 | 2019Rubber Tired Dozers175 | 175 | 0.7589 | 7.52037 | 3.94854 | 0.4326 | 0.398 | 0.0049 | 483.5585 | 0.153 | 0.012 |
| Rubber Tired Dozers | 2019 | 2019Rubber Tired Dozers250 | 250 | 0.6511 | 6.92923 | 2.45855 | 0.3379 | 0.3108 | 0.0049 | 485.172 | 0.1535 | 0.012 |
| Rubber Tired Dozers | 2019 | 2019Rubber Tired Dozers500 | 500 | 0.5721 | 6.14335 | 4.74309 | 0.2828 | 0.2602 | 0.0049 | 490.383 | 0.1552 | 0.013 |
| Rubber Tired Dozers | 2019 | 2019Rubber Tired Dozers750 | 750 | 0.4547 | 6.12249 | 2.59814 | 0.2181 | 0.2007 | 0.0049 | 483.5786 | 0.153 | 0.012 |
| Rubber Tired Dozers | 2019 | 2019Rubber Tired Dozers1000 | 1000 | 0.547 | 5.528 | 2.281 | 0.171 | 0.171 | 0.005 | 568.299 | 0.049 | 0.015 |
| Rubber Tired Dozers | 2020 | 2020Rubber Tired Dozers175 | 175 | 0.7264 | 7.18525 | 3.89288 | 0.4107 | 0.3778 | 0.0049 | 473.0116 | 0.153 | 0.012 |
| Rubber Tired Dozers | 2020 | 2020Rubber Tired Dozers250 | 250 | 0.6195 | 6.50332 | 2.37104 | 0.3185 | 0.293 | 0.0049 | 474.7928 | 0.1536 | 0.012 |
| Rubber Tired Dozers | 2020 | 2020Rubber Tired Dozers500 | 500 | 0.5349 | 5.64089 | 4.41134 | 0.2591 | 0.2384 | 0.0049 | 479.7569 | 0.1552 | 0.012 |
| Rubber Tired Dozers | 2020 | 2020Rubber Tired Dozers750 | 750 | 0.4565 | 6.12255 | 2.60108 | 0.2181 | 0.2007 | 0.0049 | 473.0562 | 0.153 | 0.012 |
| Rubber Tired Dozers | 2020 | 2020Rubber Tired Dozers1000 | 1000 | 0.522 | 5.306 | 2.164 | 0.16 | 0.16 | 0.005 | 568.299 | 0.047 | 0.015 |
| Rubber Tired Dozers | 2021 | 2021Rubber Tired Dozers175 | 175 | 0.6912 | 6.79037 | 3.84814 | 0.3864 | 0.3555 | 0.0049 | 472.9751 | 0.153 | 0.012 |
| Rubber Tired Dozers | 2021 | 2021Rubber Tired Dozers250 | 250 | 0.6005 | 6.29617 | 2.31719 | 0.3056 | 0.2811 | 0.0049 | 474.7984 | 0.1536 | 0.012 |
| Rubber Tired Dozers | 2021 | 2021Rubber Tired Dozers500 | 500 | 0.4922 | 5.081 | 4.04107 | 0.2321 | 0.2135 | 0.0049 | 478.9868 | 0.1549 | 0.012 |
| Rubber Tired Dozers | 2021 | 2021Rubber Tired Dozers750 | 750 | 0.4582 | 6.12254 | 2.60396 | 0.2182 | 0.2007 | 0.0049 | 473.0459 | 0.153 | 0.012 |
| Rubber Tired Dozers | 2021 | 2021Rubber Tired Dozers1000 | 1000 | 0.497 | 5.095 | 2.057 | 0.15 | 0.15 | 0.005 | 568.299 | 0.044 | 0.015 |
| Rubber Tired Loaders | 2018 | 2018Rubber Tired Loaders25 | 25 | 1.765 | 5.67925 | 7.29915 | 0.5758 | 0.5297 | 0.0054 | 545.0529 | 0.1697 | 0.014 |
| Rubber Tired Loaders | 2018 | 2018Rubber Tired Loaders50 | 50 | 1.765 | 5.67925 | 7.29915 | 0.5758 | 0.5297 | 0.0054 | 545.0529 | 0.1697 | 0.014 |
| Rubber Tired Loaders | 2018 | 2018Rubber Tired Loaders120 | 120 | 0.6553 | 5.47032 | 4.04742 | 0.4518 | 0.4156 | 0.0048 | 484.0931 | 0.1507 | 0.012 |
| Rubber Tired Loaders | 2018 | 2018Rubber Tired Loaders175 | 175 | 0.448 | 4.36814 | 3.42332 | 0.2423 | 0.2229 | 0.0049 | 489.5114 | 0.1524 | 0.013 |
| Rubber Tired Loaders | 2018 | 2018Rubber Tired Loaders250 | 250 | 0.3335 | 4.13133 | 1.34644 | 0.1401 | 0.1289 | 0.0048 | 487.9023 | 0.1519 | 0.012 |
| Rubber Tired Loaders | 2018 | 2018Rubber Tired Loaders500 | 500 | 0.3339 | 3.72607 | 1.86807 | 0.1395 | 0.1283 | 0.0048 | 484.5709 | 0.1509 | 0.012 |
| Rubber Tired Loaders | 2018 | 2018Rubber Tired Loaders750 | 750 | 0.3306 | 3.5437 | 1.55549 | 0.14 | 0.1288 | 0.0047 | 476.5663 | 0.1484 | 0.012 |
| Rubber Tired Loaders | 2018 | 2018Rubber Tired Loaders1000 | 1000 | 0.3359 | 5.67315 | 1.21289 | 0.1541 | 0.1418 | 0.0049 | 488.4037 | 0.152 | 0.013 |
| Rubber Tired Loaders | 2019 | 2019Rubber Tired Loaders25 | 25 | 1.6017 | 5.43193 | 6.97769 | 0.5176 | 0.4762 | 0.0054 | 536.2254 | 0.1697 | 0.014 |
| Rubber Tired Loaders | 2019 | 2019Rubber Tired Loaders50 | 50 | 1.6017 | 5.43193 | 6.97769 | 0.5176 | 0.4762 | 0.0054 | 536.2254 | 0.1697 | 0.014 |
| Rubber Tired Loaders | 2019 | 2019Rubber Tired Loaders120 | 120 | 0.5947 | 5.00611 | 3.97887 | 0.402 | 0.3698 | 0.0048 | 475.8636 | 0.1506 | 0.012 |
| Rubber Tired Loaders | 2019 | 2019Rubber Tired Loaders175 | 175 | 0.4051 | 3.85918 | 3.38084 | 0.2133 | 0.1962 | 0.0049 | 481.7364 | 0.1524 | 0.012 |
| Rubber Tired Loaders | 2019 | 2019Rubber Tired Loaders250 | 250 | 0.3094 | 3.74452 | 1.30248 | 0.1255 | 0.1155 | 0.0048 | 480.0997 | 0.1519 | 0.012 |
| Rubber Tired Loaders | 2019 | 2019Rubber Tired Loaders500 | 500 | 0.3057 | 3.28755 | 1.7248 | 0.1227 | 0.1129 | 0.0048 | 477.0415 | 0.1509 | 0.012 |
| Rubber Tired Loaders | 2019 | 2019Rubber Tired Loaders750 | 750 | 0.2932 | 3.01875 | 1.45157 | 0.1184 | 0.109 | 0.0048 | 471.1874 | 0.1491 | 0.012 |
| Rubber Tired Loaders | 2019 | 2019Rubber Tired Loaders1000 | 1000 | 0.3234 | 5.45926 | 1.20834 | 0.1462 | 0.1345 | 0.0049 | 480.523 | 0.152 | 0.012 |
| Rubber Tired Loaders | 2020 | 2020Rubber Tired Loaders25 | 25 | 1.4805 | 5.25369 | 6.76793 | 0.4741 | 0.4362 | 0.0054 | 524.6967 | 0.1697 | 0.013 |
| Rubber Tired Loaders | 2020 | 2020Rubber Tired Loaders50 | 50 | 1.4805 | 5.25369 | 6.76793 | 0.4741 | 0.4362 | 0.0054 | 524.6967 | 0.1697 | 0.013 |
| Rubber Tired Loaders | 2020 | 2020Rubber Tired Loaders120 | 120 | 0.5555 | 4.68644 | 3.94839 | 0.367 | 0.3376 | 0.0048 | 465.6735 | 0.1506 | 0.012 |
| Rubber Tired Loaders | 2020 | 2020Rubber Tired Loaders175 | 175 | 0.3787 | 3.51735 | 3.36809 | 0.1936 | 0.1781 | 0.0049 | 471.2135 | 0.1524 | 0.012 |
| Rubber Tired Loaders | 2020 | 2020Rubber Tired Loaders250 | 250 | 0.2902 | 3.42116 | 1.26885 | 0.1136 | 0.1045 | 0.0048 | 469.5127 | 0.1518 | 0.012 |
| Rubber Tired Loaders | 2020 | 2020Rubber Tired Loaders500 | 500 | 0.289 | 3.01666 | 1.6304 | 0.1122 | 0.1032 | 0.0048 | 466.7831 | 0.151 | 0.012 |
| Rubber Tired Loaders | 2020 | 2020Rubber Tired Loaders750 | 750 | 0.2768 | 2.76722 | 1.39991 | 0.1075 | 0.0989 | 0.0048 | 462.193 | 0.1495 | 0.012 |
| Rubber Tired Loaders | 2020 | 2020Rubber Tired Loaders1000 | 1000 | 0.3115 | 5.25309 | 1.20366 | 0.1385 | 0.1274 | 0.0049 | 469.9352 | 0.152 | 0.012 |
| Rubber Tired Loaders | 2021 | 2021Rubber Tired Loaders25 | 25 | 1.3255 | 4.97419 | 6.44855 | 0.4092 | 0.3765 | 0.0054 | 524.5505 | 0.1697 | 0.013 |
| Rubber Tired Loaders | 2021 | 2021Rubber Tired Loaders50 | 50 | 1.3255 | 4.97419 | 6.44855 | 0.4092 | 0.3765 | 0.0054 | 524.5505 | 0.1697 | 0.013 |
| Rubber Tired Loaders | 2021 | 2021Rubber Tired Loaders120 | 120 | 0.4979 | 4.21491 | 3.8917 | 0.3163 | 0.291 | 0.0048 | 466.4213 | 0.1509 | 0.012 |
| Rubber Tired Loaders | 2021 | 2021Rubber Tired Loaders175 | 175 | 0.3461 | 3.11886 | 3.35381 | 0.1706 | 0.1569 | 0.0049 | 471.0804 | 0.1524 | 0.012 |
| Rubber Tired Loaders | 2021 | 2021Rubber Tired Loaders250 | 250 | 0.2661 | 2.9977 | 1.24034 | 0.1 | 0.092 | 0.0048 | 469.5642 | 0.1519 | 0.012 |
| Rubber Tired Loaders | 2021 | 2021Rubber Tired Loaders500 | 500 | 0.2643 | 2.61037 | 1.52922 | 0.0974 | 0.0896 | 0.0048 | 467.9277 | 0.1513 | 0.012 |
| Rubber Tired Loaders | 2021 | 2021Rubber Tired Loaders750 | 750 | 0.2714 | 2.64092 | 1.39703 | 0.1023 | 0.0942 | 0.0048 | 462.0548 | 0.1494 | 0.012 |
| Rubber Tired Loaders | 2021 | 2021Rubber Tired Loaders1000 | 1000 | 0.2942 | 4.97489 | 1.2055 | 0.1279 | 0.1176 | 0.0049 | 471.2577 | 0.1524 | 0.012 |
| Scrapers | 2018 | 2018Scrapers120 | 120 | 0.7403 | 7.03577 | 4.20429 | 0.5425 | 0.4991 | 0.005 | 502.8288 | 0.1565 | 0.013 |
| Scrapers | 2018 | 2018Scrapers175 | 175 | 0.5385 | 5.64105 | 3.56847 | 0.3029 | 0.2787 | 0.0049 | 497.3396 | 0.1548 | 0.013 |
| Scrapers | 2018 | 2018Scrapers250 | 250 | 0.5566 | 6.56304 | 2.40704 | 0.2901 | 0.2669 | 0.0048 | 486.9908 | 0.1516 | 0.012 |
| Scrapers | 2018 | 2018Scrapers500 | 500 | 0.3691 | 4.56771 | 2.82811 | 0.18 | 0.1656 | 0.0049 | 490.7734 | 0.1528 | 0.013 |
| Scrapers | 2018 | 2018Scrapers750 | 750 | 0.2938 | 3.74582 | 1.96493 | 0.135 | 0.1242 | 0.0049 | 490.5775 | 0.1527 | 0.013 |
| Scrapers | 2019 | 2019Scrapers120 | 120 | 0.718 | 6.84136 | 4.19661 | 0.5255 | 0.4834 | 0.005 | 494.1 | 0.1563 | 0.013 |
| Scrapers | 2019 | 2019Scrapers175 | 175 | 0.51 | 5.26356 | 3.53297 | 0.2833 | 0.2606 | 0.0049 | 489.2546 | 0.1548 | 0.013 |
| Scrapers | 2019 | 2019Scrapers250 | 250 | 0.5013 | 5.83102 | 2.23321 | 0.2567 | 0.2361 | 0.0048 | 479.0317 | 0.1516 | 0.012 |
| Scrapers | 2019 | 2019Scrapers500 | 500 | 0.3429 | 4.15646 | 2.59466 | 0.1629 | 0.1498 | 0.0049 | 482.7319 | 0.1527 | 0.012 |
| Scrapers | 2019 | 2019Scrapers750 | 750 | 0.2768 | 3.43103 | 1.82903 | 0.1232 | 0.1133 | 0.0049 | 482.5963 | 0.1527 | 0.012 |
| Scrapers | 2020 | 2020Scrapers120 | 120 | 0.7009 | 6.6767 | 4.19756 | 0.5101 | 0.4693 | 0.005 | 483.745 | 0.1565 | 0.012 |
| Scrapers | 2020 | 2020Scrapers175 | 175 | 0.4777 | 4.86851 | 3.50114 | 0.262 | 0.241 | 0.0049 | 478.6077 | 0.1548 | 0.012 |
| Scrapers | 2020 | 2020Scrapers250 | 250 | 0.4462 | 5.089 | 2.06469 | 0.2232 | 0.2054 | 0.0048 | 468.9883 | 0.1517 | 0.012 |
| Scrapers | 2020 | 2020Scrapers500 | 500 | 0.3196 | 3.78254 | 2.40063 | 0.1475 | 0.1357 | 0.0049 | 472.1751 | 0.1527 | 0.012 |
| Scrapers | 2020 | 2020Scrapers750 | 750 | 0.2622 | 3.12592 | 1.72502 | 0.1132 | 0.1042 | 0.0049 | 471.7776 | 0.1526 | 0.012 |
| Scrapers | 2021 | 2021Scrapers120 | 120 | 0.7041 | 6.65882 | 4.21819 | 0.5124 | 0.4714 | 0.005 | 483.7128 | 0.1564 | 0.012 |
| Scrapers | 2021 | 2021Scrapers175 | 175 | 0.4319 | 4.34133 | 3.45599 | 0.2318 | 0.2133 | 0.0049 | 478.654 | 0.1548 | 0.012 |
| Scrapers | 2021 | 2021Scrapers250 | 250 | 0.3906 | 4.36706 | 1.88374 | 0.1891 | 0.174 | 0.0048 | 469.1258 | 0.1517 | 0.012 |
| Scrapers | 2021 | 2021Scrapers500 | 500 | 0.2992 | 3.44481 | 2.25454 | 0.134 | 0.1233 | 0.0049 | 472.4636 | 0.1528 | 0.012 |
| Scrapers | 2021 | 2021Scrapers750 | 750 | 0.2504 | 2.88702 | 1.65772 | 0.1053 | 0.0968 | 0.0049 | 471.7859 | 0.1526 | 0.012 |
| Signal Boards | 2018 | 2018Signal Boards15 | 15 | 0.661 | 4.142 | 3.469 | 0.161 | 0.161 | 0.008 | 568.299 | 0.059 | 0.015 |
| Signal Boards | 2018 | 2018Signal Boards50 | 50 | 1.018 | 4.427 | 4.657 | 0.27 | 0.27 | 0.007 | 568.299 | 0.091 | 0.015 |
| Signal Boards | 2018 | 2018Signal Boards120 | 120 | 0.492 | 3.723 | 3.541 | 0.252 | 0.252 | 0.006 | 568.299 | 0.044 | 0.015 |
| Signal Boards | 2018 | 2018Signal Boards175 | 175 | 0.351 | 2.93 | 3.043 | 0.141 | 0.141 | 0.006 | 568.299 | 0.031 | 0.015 |
| Signal Boards | 2018 | 2018Signal Boards250 | 250 | 0.309 | 3.04 | 1.306 | 0.09 | 0.09 | 0.007 | 686.695 | 0.027 | 0.018 |

| Equipment Type | Year | Concatenate | HP | ROG | NOX | CO | PM10 | PM2.5 | SO2 | CO2 | CH4 | N2O |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Signal Boards | 2019 | 2019Signal Boards15 | 15 | 0.661 | 4.142 | 3.47 | 0.161 | 0.161 | 0.008 | 568.299 | 0.059 | 0.015 |
| Signal Boards | 2019 | 2019Signal Boards50 | 50 | 0.887 | 4.272 | 4.538 | 0.236 | 0.236 | 0.007 | 568.3 | 0.08 | 0.015 |
| Signal Boards | 2019 | 2019Signal Boards120 | 120 | 0.437 | 3.41 | 3.519 | 0.216 | 0.216 | 0.006 | 568.299 | 0.039 | 0.015 |
| Signal Boards | 2019 | 2019Signal Boards175 | 175 | 0.321 | 2.601 | 3.043 | 0.125 | 0.125 | 0.006 | 568.299 | 0.029 | 0.015 |
| Signal Boards | 2019 | 2019Signal Boards250 | 250 | 0.291 | 2.676 | 1.292 | 0.08 | 0.08 | 0.007 | 686.695 | 0.026 | 0.018 |
| Signal Boards | 2020 | 2020Signal Boards15 | 15 | 0.661 | 4.142 | 3.469 | 0.161 | 0.161 | 0.008 | 568.299 | 0.059 | 0.015 |
| Signal Boards | 2020 | 2020Signal Boards50 | 50 | 0.788 | 4.132 | 4.448 | 0.206 | 0.206 | 0.007 | 568.299 | 0.071 | 0.015 |
| Signal Boards | 2020 | 2020Signal Boards120 | 120 | 0.395 | 3.134 | 3.504 | 0.187 | 0.187 | 0.006 | 568.299 | 0.035 | 0.015 |
| Signal Boards | 2020 | 2020Signal Boards175 | 175 | 0.298 | 2.309 | 3.043 | 0.11 | 0.11 | 0.006 | 568.299 | 0.026 | 0.015 |
| Signal Boards | 2020 | 2020Signal Boards250 | 250 | 0.274 | 2.35 | 1.281 | 0.071 | 0.071 | 0.007 | 686.695 | 0.024 | 0.018 |
| Signal Boards | 2021 | 2021Signal Boards15 | 15 | 0.661 | 4.142 | 3.469 | 0.161 | 0.161 | 0.008 | 568.299 | 0.059 | 0.015 |
| Signal Boards | 2021 | 2021Signal Boards50 | 50 | 0.714 | 4.002 | 4.38 | 0.179 | 0.179 | 0.007 | 568.299 | 0.064 | 0.015 |
| Signal Boards | 2021 | 2021Signal Boards120 | 120 | 0.363 | 2.889 | 3.493 | 0.162 | 0.162 | 0.006 | 568.299 | 0.032 | 0.015 |
| Signal Boards | 2021 | 2021Signal Boards175 | 175 | 0.278 | 2.043 | 3.043 | 0.098 | 0.098 | 0.006 | 568.299 | 0.025 | 0.015 |
| Signal Boards | 2021 | 2021Signal Boards250 | 250 | 0.26 | 2.053 | 1.273 | 0.063 | 0.063 | 0.007 | 686.695 | 0.023 | 0.018 |
| Skid Steer Loaders | 2018 | 2018Skid Steer Loaders25 | 25 | 0.4871 | 3.88962 | 3.78725 | 0.1783 | 0.164 | 0.0054 | 547.5575 | 0.1705 | 0.014 |
| Skid Steer Loaders | 2018 | 2018Skid Steer Loaders50 | 50 | 0.4871 | 3.88962 | 3.78725 | 0.1783 | 0.164 | 0.0054 | 547.5575 | 0.1705 | 0.014 |
| Skid Steer Loaders | 2018 | 2018Skid Steer Loaders120 | 120 | 0.2158 | 2.86 | 3.28204 | 0.1398 | 0.1286 | 0.0049 | 490.0935 | 0.1526 | 0.013 |
| Skid Steer Loaders | 2019 | 2019Skid Steer Loaders25 | 25 | 0.4464 | 3.75009 | 3.73957 | 0.1536 | 0.1413 | 0.0054 | 539.2667 | 0.1706 | 0.014 |
| Skid Steer Loaders | 2019 | 2019Skid Steer Loaders50 | 50 | 0.4464 | 3.75009 | 3.73957 | 0.1536 | 0.1413 | 0.0054 | 539.2667 | 0.1706 | 0.014 |
| Skid Steer Loaders | 2019 | 2019Skid Steer Loaders120 | 120 | 0.1994 | 2.65586 | 3.27736 | 0.1217 | 0.1119 | 0.0049 | 482.3844 | 0.1526 | 0.012 |
| Skid Steer Loaders | 2020 | 2020Skid Steer Loaders25 | 25 | 0.4393 | 3.69113 | 3.76397 | 0.1447 | 0.1331 | 0.0054 | 527.7577 | 0.1707 | 0.014 |
| Skid Steer Loaders | 2020 | 2020Skid Steer Loaders50 | 50 | 0.4393 | 3.69113 | 3.76397 | 0.1447 | 0.1331 | 0.0054 | 527.7577 | 0.1707 | 0.014 |
| Skid Steer Loaders | 2020 | 2020Skid Steer Loaders120 | 120 | 0.1884 | 2.5046 | 3.2771 | 0.1084 | 0.0997 | 0.0049 | 471.9075 | 0.1526 | 0.012 |
| Skid Steer Loaders | 2021 | 2021Skid Steer Loaders25 | 25 | 0.4088 | 3.57304 | 3.73158 | 0.1263 | 0.1162 | 0.0054 | 527.4501 | 0.1706 | 0.014 |
| Skid Steer Loaders | 2021 | 2021Skid Steer Loaders50 | 50 | 0.4088 | 3.57304 | 3.73158 | 0.1263 | 0.1162 | 0.0054 | 527.4501 | 0.1706 | 0.014 |
| Skid Steer Loaders | 2021 | 2021Skid Steer Loaders120 | 120 | 0.178 | 2.36588 | 3.27687 | 0.0963 | 0.0886 | 0.0049 | 471.9774 | 0.1526 | 0.012 |
| Surfacing Equipment | 2018 | 2018Surfacing Equipment50 | 50 | 0.779 | 4.81982 | 4.35302 | 0.3198 | 0.2942 | 0.0055 | 555.7363 | 0.173 | 0.014 |
| Surfacing Equipment | 2018 | 2018Surfacing Equipment120 | 120 | 0.4141 | 4.28388 | 3.48871 | 0.2685 | 0.247 | 0.0049 | 491.3172 | 0.153 | 0.013 |
| Surfacing Equipment | 2018 | 2018Surfacing Equipment175 | 175 | 0.375 | 4.47527 | 2.97609 | 0.2151 | 0.1979 | 0.0049 | 488.4406 | 0.1521 | 0.013 |
| Surfacing Equipment | 2018 | 2018Surfacing Equipment250 | 250 | 0.241 | 3.98866 | 1.234 | 0.1127 | 0.1037 | 0.0049 | 494.1388 | 0.1538 | 0.013 |
| Surfacing Equipment | 2018 | 2018Surfacing Equipment500 | 500 | 0.1574 | 2.20389 | 1.22557 | 0.0761 | 0.07 | 0.0049 | 487.8722 | 0.1519 | 0.012 |
| Surfacing Equipment | 2018 | 2018Surfacing Equipment750 | 750 | 0.1425 | 2.26863 | 0.99347 | 0.0783 | 0.072 | 0.0049 | 488.86 | 0.1522 | 0.013 |
| Surfacing Equipment | 2019 | 2019Surfacing Equipment50 | 50 | 0.6431 | 4.41999 | 4.0998 | 0.2503 | 0.2303 | 0.0055 | 547.0462 | 0.1731 | 0.014 |
| Surfacing Equipment | 2019 | 2019Surfacing Equipment120 | 120 | 0.3553 | 3.82306 | 3.44856 | 0.2256 | 0.2076 | 0.0049 | 484.0757 | 0.1532 | 0.012 |
| Surfacing Equipment | 2019 | 2019Surfacing Equipment175 | 175 | 0.3571 | 4.23866 | 2.97177 | 0.2036 | 0.1873 | 0.0048 | 479.6717 | 0.1518 | 0.012 |
| Surfacing Equipment | 2019 | 2019Surfacing Equipment250 | 250 | 0.2165 | 3.39993 | 1.21576 | 0.1007 | 0.0927 | 0.0049 | 486.8417 | 0.154 | 0.012 |
| Surfacing Equipment | 2019 | 2019Surfacing Equipment500 | 500 | 0.1455 | 1.89944 | 1.2143 | 0.0681 | 0.0626 | 0.0049 | 481.8965 | 0.1525 | 0.012 |
| Surfacing Equipment | 2019 | 2019Surfacing Equipment750 | 750 | 0.1419 | 2.17879 | 0.99372 | 0.0763 | 0.0702 | 0.0049 | 480.166 | 0.1519 | 0.012 |
| Surfacing Equipment | 2020 | 2020Surfacing Equipment50 | 50 | 0.5356 | 4.23906 | 3.93357 | 0.2164 | 0.1991 | 0.0055 | 535.5275 | 0.1732 | 0.014 |
| Surfacing Equipment | 2020 | 2020Surfacing Equipment120 | 120 | 0.3297 | 3.61216 | 3.43932 | 0.2063 | 0.1898 | 0.0049 | 473.8188 | 0.1532 | 0.012 |
| Surfacing Equipment | 2020 | 2020Surfacing Equipment175 | 175 | 0.3075 | 3.67232 | 2.93068 | 0.1745 | 0.1606 | 0.0048 | 469.2079 | 0.1518 | 0.012 |
| Surfacing Equipment | 2020 | 2020Surfacing Equipment250 | 250 | 0.2119 | 3.22243 | 1.21774 | 0.0972 | 0.0894 | 0.0049 | 476.4261 | 0.1541 | 0.012 |
| Surfacing Equipment | 2020 | 2020Surfacing Equipment500 | 500 | 0.1455 | 1.83755 | 1.21902 | 0.0669 | 0.0615 | 0.0049 | 471.6331 | 0.1525 | 0.012 |
| Surfacing Equipment | 2020 | 2020Surfacing Equipment750 | 750 | 0.1419 | 2.09374 | 0.99569 | 0.0744 | 0.0684 | 0.0049 | 469.6252 | 0.1519 | 0.012 |
| Surfacing Equipment | 2021 | 2021Surfacing Equipment50 | 50 | 0.5068 | 4.18875 | 3.93231 | 0.204 | 0.1876 | 0.0055 | 535.784 | 0.1733 | 0.014 |
| Surfacing Equipment | 2021 | 2021Surfacing Equipment120 | 120 | 0.3117 | 3.46112 | 3.43619 | 0.1905 | 0.1753 | 0.0049 | 474.0906 | 0.1533 | 0.012 |
| Surfacing Equipment | 2021 | 2021Surfacing Equipment175 | 175 | 0.2581 | 3.09858 | 2.91895 | 0.1454 | 0.1337 | 0.0048 | 469.1687 | 0.1517 | 0.012 |
| Surfacing Equipment | 2021 | 2021Surfacing Equipment250 | 250 | 0.2067 | 2.99364 | 1.21854 | 0.0923 | 0.0849 | 0.0049 | 476.8023 | 0.1542 | 0.012 |
| Surfacing Equipment | 2021 | 2021Surfacing Equipment500 | 500 | 0.1408 | 1.75282 | 1.20226 | 0.0635 | 0.0584 | 0.0049 | 471.7484 | 0.1526 | 0.012 |
| Surfacing Equipment | 2021 | 2021Surfacing Equipment750 | 750 | 0.1251 | 1.59712 | 0.99181 | 0.0615 | 0.0566 | 0.0049 | 470.4087 | 0.1521 | 0.012 |
| Sweepers/Scrubbers | 2018 | 2018Sweepers/Scrubbers15 | 15 | 1.5449 | 5.39866 | 6.4442 | 0.5307 | 0.4882 | 0.0054 | 545.7578 | 0.1699 | 0.014 |
| Sweepers/Scrubbers | 2018 | 2018Sweepers/Scrubbers25 | 25 | 1.5449 | 5.39866 | 6.4442 | 0.5307 | 0.4882 | 0.0054 | 545.7578 | 0.1699 | 0.014 |
| Sweepers/Scrubbers | 2018 | 2018Sweepers/Scrubbers50 | 50 | 1.5449 | 5.39866 | 6.4442 | 0.5307 | 0.4882 | 0.0054 | 545.7578 | 0.1699 | 0.014 |
| Sweepers/Scrubbers | 2018 | 2018Sweepers/Scrubbers120 | 120 | 0.5995 | 5.13595 | 3.88173 | 0.4283 | 0.3941 | 0.0049 | 492.5536 | 0.1533 | 0.013 |
| Sweepers/Scrubbers | 2018 | 2018Sweepers/Scrubbers175 | 175 | 0.5889 | 6.07101 | 3.58832 | 0.3197 | 0.2942 | 0.0049 | 491.5213 | 0.153 | 0.013 |
| Sweepers/Scrubbers | 2018 | 2018Sweepers/Scrubbers250 | 250 | 0.3495 | 4.30158 | 1.60478 | 0.1691 | 0.1556 | 0.0049 | 488.409 | 0.152 | 0.013 |
| Sweepers/Scrubbers | 2019 | 2019Sweepers/Scrubbers15 | 15 | 1.431 | 5.22487 | 6.26782 | 0.4912 | 0.4519 | 0.0054 | 537.0023 | 0.1699 | 0.014 |
| Sweepers/Scrubbers | 2019 | 2019Sweepers/Scrubbers25 | 25 | 1.431 | 5.22487 | 6.26782 | 0.4912 | 0.4519 | 0.0054 | 537.0023 | 0.1699 | 0.014 |
| Sweepers/Scrubbers | 2019 | 2019Sweepers/Scrubbers50 | 50 | 1.431 | 5.22487 | 6.26782 | 0.4912 | 0.4519 | 0.0054 | 537.0023 | 0.1699 | 0.014 |
| Sweepers/Scrubbers | 2019 | 2019Sweepers/Scrubbers120 | 120 | 0.5496 | 4.77259 | 3.84602 | 0.3872 | 0.3563 | 0.0049 | 484.6516 | 0.1533 | 0.012 |
| Sweepers/Scrubbers | 2019 | 2019Sweepers/Scrubbers175 | 175 | 0.5233 | 5.30082 | 3.4491 | 0.2772 | 0.255 | 0.0049 | 483.6359 | 0.153 | 0.012 |
| Sweepers/Scrubbers | 2019 | 2019Sweepers/Scrubbers250 | 250 | 0.2347 | 2.86598 | 1.23013 | 0.0989 | 0.091 | 0.0049 | 480.5735 | 0.152 | 0.012 |
| Sweepers/Scrubbers | 2020 | 2020Sweepers/Scrubbers15 | 15 | 1.3438 | 5.09515 | 6.1554 | 0.4629 | 0.4259 | 0.0054 | 525.3284 | 0.1699 | 0.013 |
| Sweepers/Scrubbers | 2020 | 2020Sweepers/Scrubbers25 | 25 | 1.3438 | 5.09515 | 6.1554 | 0.4629 | 0.4259 | 0.0054 | 525.3284 | 0.1699 | 0.013 |
| Sweepers/Scrubbers | 2020 | 2020Sweepers/Scrubbers50 | 50 | 1.3438 | 5.09515 | 6.1554 | 0.4629 | 0.4259 | 0.0054 | 525.3284 | 0.1699 | 0.013 |
| Sweepers/Scrubbers | 2020 | 2020Sweepers/Scrubbers120 | 120 | 0.5199 | 4.4821 | 3.82752 | 0.3601 | 0.3313 | 0.0049 | 474.1157 | 0.1533 | 0.012 |
| Sweepers/Scrubbers | 2020 | 2020Sweepers/Scrubbers175 | 175 | 0.4616 | 4.60809 | 3.35909 | 0.2371 | 0.2181 | 0.0049 | 473.1221 | 0.153 | 0.012 |
| Sweepers/Scrubbers | 2020 | 2020Sweepers/Scrubbers250 | 250 | 0.2071 | 2.4856 | 1.13655 | 0.079 | 0.0727 | 0.0049 | 470.1263 | 0.152 | 0.012 |
| Sweepers/Scrubbers | 2021 | 2021Sweepers/Scrubbers15 | 15 | 1.2191 | 4.84946 | 5.89996 | 0.4117 | 0.3788 | 0.0054 | 525.3284 | 0.1699 | 0.013 |
| Sweepers/Scrubbers | 2021 | 2021Sweepers/Scrubbers25 | 25 | 1.2191 | 4.84946 | 5.89996 | 0.4117 | 0.3788 | 0.0054 | 525.3284 | 0.1699 | 0.013 |
| Sweepers/Scrubbers | 2021 | 2021Sweepers/Scrubbers50 | 50 | 1.2191 | 4.84946 | 5.89996 | 0.4117 | 0.3788 | 0.0054 | 525.3284 | 0.1699 | 0.013 |
| Sweepers/Scrubbers | 2021 | 2021Sweepers/Scrubbers120 | 120 | 0.4402 | 3.96194 | 3.75746 | 0.2914 | 0.2681 | 0.0049 | 474.1157 | 0.1533 | 0.012 |
| Sweepers/Scrubbers | 2021 | 2021Sweepers/Scrubbers175 | 175 | 0.3848 | 3.70723 | 3.24726 | 0.1872 | 0.1722 | 0.0049 | 473.1221 | 0.153 | 0.012 |
| Sweepers/Scrubbers | 2021 | 2021Sweepers/Scrubbers250 | 250 | 0.1642 | 1.75821 | 1.1084 | 0.055 | 0.0506 | 0.0049 | 470.1263 | 0.152 | 0.012 |

| Equipment Type | Year | Concatenate | HP | ROG | NOX | CO | PM10 | PM2.5 | SO2 | CO2 | CH4 | **N2O** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tractors/Loaders/Backhoes | 2018 | 2018Tractors/Loaders/Backhoes25 | 25 | 0.9921 | 4.76441 | 5.31043 | 0.3625 | 0.3335 | 0.0053 | 536.1115 | 0.1669 | 0.014 |
| Tractors/Loaders/Backhoes | 2018 | 2018Tractors/Loaders/Backhoes50 | 50 | 0.9921 | 4.76441 | 5.31043 | 0.3625 | 0.3335 | 0.0053 | 536.1115 | 0.1669 | 0.014 |
| Tractors/Loaders/Backhoes | 2018 | 2018Tractors/Loaders/Backhoes120 | 120 | 0.4204 | 4.15444 | 3.69155 | 0.2943 | 0.2708 | 0.0049 | 494.1237 | 0.1538 | 0.013 |
| Tractors/Loaders/Backhoes | 2018 | 2018Tractors/Loaders/Backhoes175 | 175 | 0.297 | 3.16806 | 3.13727 | 0.1595 | 0.1467 | 0.0048 | 485.7754 | 0.1512 | 0.012 |
| Tractors/Loaders/Backhoes | 2018 | 2018Tractors/Loaders/Backhoes250 | 250 | 0.2589 | 3.45965 | 1.24197 | 0.1116 | 0.1027 | 0.0049 | 489.4562 | 0.1524 | 0.013 |
| Tractors/Loaders/Backhoes | 2018 | 2018Tractors/Loaders/Backhoes500 | 500 | 0.2222 | 2.66877 | 1.44545 | 0.0922 | 0.0848 | 0.0048 | 486.2939 | 0.1514 | 0.012 |
| Tractors/Loaders/Backhoes | 2018 | 2018Tractors/Loaders/Backhoes750 | 750 | 0.2712 | 3.40235 | 1.60068 | 0.1243 | 0.1143 | 0.0048 | 485.0099 | 0.151 | 0.012 |
| Tractors/Loaders/Backhoes | 2019 | 2019Tractors/Loaders/Backhoes25 | 25 | 0.9202 | 4.60928 | 5.20327 | 0.33 | 0.3036 | 0.0053 | 527.6843 | 0.167 | 0.014 |
| Tractors/Loaders/Backhoes | 2019 | 2019Tractors/Loaders/Backhoes50 | 50 | 0.9202 | 4.60928 | 5.20327 | 0.33 | 0.3036 | 0.0053 | 527.6843 | 0.167 | 0.014 |
| Tractors/Loaders/Backhoes | 2019 | 2019Tractors/Loaders/Backhoes120 | 120 | 0.3678 | 3.69257 | 3.63777 | 0.2465 | 0.2268 | 0.0049 | 485.8548 | 0.1537 | 0.012 |
| Tractors/Loaders/Backhoes | 2019 | 2019Tractors/Loaders/Backhoes175 | 175 | 0.2704 | 2.78412 | 3.12158 | 0.1401 | 0.1289 | 0.0048 | 477.9151 | 0.1512 | 0.012 |
| Tractors/Loaders/Backhoes | 2019 | 2019Tractors/Loaders/Backhoes250 | 250 | 0.2449 | 3.14683 | 1.22027 | 0.102 | 0.0938 | 0.0049 | 481.4206 | 0.1523 | 0.012 |
| Tractors/Loaders/Backhoes | 2019 | 2019Tractors/Loaders/Backhoes500 | 500 | 0.206 | 2.34458 | 1.38918 | 0.0816 | 0.0751 | 0.0048 | 479.0826 | 0.1516 | 0.012 |
| Tractors/Loaders/Backhoes | 2019 | 2019Tractors/Loaders/Backhoes750 | 750 | 0.2621 | 3.12046 | 1.6025 | 0.1168 | 0.1074 | 0.0048 | 478.9216 | 0.1515 | 0.012 |
| Tractors/Loaders/Backhoes | 2020 | 2020Tractors/Loaders/Backhoes25 | 25 | 0.8296 | 4.39784 | 5.03491 | 0.2878 | 0.2648 | 0.0053 | 515.874 | 0.1668 | 0.013 |
| Tractors/Loaders/Backhoes | 2020 | 2020Tractors/Loaders/Backhoes50 | 50 | 0.8296 | 4.39784 | 5.03491 | 0.2878 | 0.2648 | 0.0053 | 515.874 | 0.1668 | 0.013 |
| Tractors/Loaders/Backhoes | 2020 | 2020Tractors/Loaders/Backhoes120 | 120 | 0.331 | 3.32571 | 3.60147 | 0.2103 | 0.1935 | 0.0049 | 475.1543 | 0.1537 | 0.012 |
| Tractors/Loaders/Backhoes | 2020 | 2020Tractors/Loaders/Backhoes175 | 175 | 0.2455 | 2.41467 | 3.10518 | 0.1217 | 0.1119 | 0.0048 | 467.5132 | 0.1512 | 0.012 |
| Tractors/Loaders/Backhoes | 2020 | 2020Tractors/Loaders/Backhoes250 | 250 | 0.2252 | 2.73794 | 1.19592 | 0.0898 | 0.0826 | 0.0049 | 470.4998 | 0.1522 | 0.012 |
| Tractors/Loaders/Backhoes | 2020 | 2020Tractors/Loaders/Backhoes500 | 500 | 0.1937 | 2.07976 | 1.35815 | 0.073 | 0.0672 | 0.0048 | 468.2447 | 0.1514 | 0.012 |
| Tractors/Loaders/Backhoes | 2020 | 2020Tractors/Loaders/Backhoes750 | 750 | 0.2678 | 3.11926 | 1.60984 | 0.1174 | 0.108 | 0.0048 | 468.6602 | 0.1516 | 0.012 |
| Tractors/Loaders/Backhoes | 2021 | 2021Tractors/Loaders/Backhoes25 | 25 | 0.756 | 4.22643 | 4.90172 | 0.2545 | 0.2341 | 0.0053 | 515.1213 | 0.1666 | 0.013 |
| Tractors/Loaders/Backhoes | 2021 | 2021Tractors/Loaders/Backhoes50 | 50 | 0.756 | 4.22643 | 4.90172 | 0.2545 | 0.2341 | 0.0053 | 515.1213 | 0.1666 | 0.013 |
| Tractors/Loaders/Backhoes | 2021 | 2021Tractors/Loaders/Backhoes120 | 120 | 0.2959 | 2.995 | 3.57072 | 0.1766 | 0.1625 | 0.0049 | 475.3621 | 0.1537 | 0.012 |
| Tractors/Loaders/Backhoes | 2021 | 2021Tractors/Loaders/Backhoes175 | 175 | 0.221 | 2.06221 | 3.0907 | 0.1041 | 0.0958 | 0.0048 | 467.5285 | 0.1512 | 0.012 |
| Tractors/Loaders/Backhoes | 2021 | 2021Tractors/Loaders/Backhoes250 | 250 | 0.2094 | 2.36922 | 1.18606 | 0.08 | 0.0736 | 0.0049 | 470.5716 | 0.1522 | 0.012 |
| Tractors/Loaders/Backhoes | 2021 | 2021Tractors/Loaders/Backhoes500 | 500 | 0.1794 | 1.776 | 1.34147 | 0.064 | 0.0589 | 0.0048 | 469.3025 | 0.1518 | 0.012 |
| Tractors/Loaders/Backhoes | 2021 | 2021Tractors/Loaders/Backhoes750 | 750 | 0.2474 | 2.75417 | 1.43254 | 0.1041 | 0.0958 | 0.0048 | 466.4564 | 0.1509 | 0.012 |
| Trenchers | 2018 | 2018Trenchers15 | 15 | 1.0387 | 4.95997 | 5.01831 | 0.4093 | 0.3766 | 0.0054 | 548.3607 | 0.1707 | 0.014 |
| Trenchers | 2018 | 2018Trenchers25 | 25 | 1.0387 | 4.95997 | 5.01831 | 0.4093 | 0.3766 | 0.0054 | 548.3607 | 0.1707 | 0.014 |
| Trenchers | 2018 | 2018Trenchers50 | 50 | 1.0387 | 4.95997 | 5.01831 | 0.4093 | 0.3766 | 0.0054 | 548.3607 | 0.1707 | 0.014 |
| Trenchers | 2018 | 2018Trenchers120 | 120 | 0.6581 | 5.91527 | 3.85487 | 0.45 | 0.414 | 0.0049 | 493.715 | 0.1537 | 0.013 |
| Trenchers | 2018 | 2018Trenchers175 | 175 | 0.4704 | 5.12742 | 3.33134 | 0.2613 | 0.2404 | 0.0048 | 485.9254 | 0.1513 | 0.012 |
| Trenchers | 2018 | 2018Trenchers250 | 250 | 0.419 | 5.29554 | 1.84856 | 0.2119 | 0.1949 | 0.0049 | 491.5649 | 0.153 | 0.013 |
| Trenchers | 2018 | 2018Trenchers500 | 500 | 0.256 | 3.21114 | 1.97444 | 0.1212 | 0.1115 | 0.0049 | 489.6281 | 0.1524 | 0.013 |
| Trenchers | 2018 | 2018Trenchers750 | 750 | 0.094 | 1.02523 | 0.96632 | 0.0286 | 0.0263 | 0.0049 | 494.6426 | 0.154 | 0.013 |
| Trenchers | 2019 | 2019Trenchers15 | 15 | 0.9551 | 4.78464 | 4.89183 | 0.3767 | 0.3466 | 0.0054 | 539.1037 | 0.1706 | 0.014 |
| Trenchers | 2019 | 2019Trenchers25 | 25 | 0.9551 | 4.78464 | 4.89183 | 0.3767 | 0.3466 | 0.0054 | 539.1037 | 0.1706 | 0.014 |
| Trenchers | 2019 | 2019Trenchers50 | 50 | 0.9551 | 4.78464 | 4.89183 | 0.3767 | 0.3466 | 0.0054 | 539.1037 | 0.1706 | 0.014 |
| Trenchers | 2019 | 2019Trenchers120 | 120 | 0.6314 | 5.69508 | 3.83677 | 0.4306 | 0.3961 | 0.0049 | 485.3635 | 0.1536 | 0.012 |
| Trenchers | 2019 | 2019Trenchers175 | 175 | 0.4598 | 4.95976 | 3.34151 | 0.2547 | 0.2343 | 0.0048 | 478.1294 | 0.1513 | 0.012 |
| Trenchers | 2019 | 2019Trenchers250 | 250 | 0.4048 | 5.04653 | 1.81019 | 0.2032 | 0.187 | 0.0049 | 484.1167 | 0.1532 | 0.012 |
| Trenchers | 2019 | 2019Trenchers500 | 500 | 0.2544 | 3.12824 | 1.98689 | 0.1181 | 0.1086 | 0.0049 | 482.1648 | 0.1526 | 0.012 |
| Trenchers | 2019 | 2019Trenchers750 | 750 | 0.0781 | 0.70662 | 0.95644 | 0.0152 | 0.014 | 0.0049 | 484.5422 | 0.1533 | 0.012 |
| Trenchers | 2020 | 2020Trenchers15 | 15 | 0.9049 | 4.67651 | 4.8331 | 0.3561 | 0.3276 | 0.0054 | 527.0962 | 0.1705 | 0.014 |
| Trenchers | 2020 | 2020Trenchers25 | 25 | 0.9049 | 4.67651 | 4.8331 | 0.3561 | 0.3276 | 0.0054 | 527.0962 | 0.1705 | 0.014 |
| Trenchers | 2020 | 2020Trenchers50 | 50 | 0.9049 | 4.67651 | 4.8331 | 0.3561 | 0.3276 | 0.0054 | 527.0962 | 0.1705 | 0.014 |
| Trenchers | 2020 | 2020Trenchers120 | 120 | 0.6102 | 5.51952 | 3.83272 | 0.4132 | 0.3802 | 0.0049 | 475.1265 | 0.1537 | 0.012 |
| Trenchers | 2020 | 2020Trenchers175 | 175 | 0.4207 | 4.46042 | 3.32968 | 0.2281 | 0.2098 | 0.0048 | 467.7348 | 0.1513 | 0.012 |
| Trenchers | 2020 | 2020Trenchers250 | 250 | 0.392 | 4.8091 | 1.77405 | 0.1949 | 0.1793 | 0.0049 | 473.5951 | 0.1532 | 0.012 |
| Trenchers | 2020 | 2020Trenchers500 | 500 | 0.2325 | 2.775 | 1.85932 | 0.1052 | 0.0968 | 0.0049 | 470.6367 | 0.1522 | 0.012 |
| Trenchers | 2020 | 2020Trenchers750 | 750 | 0.0701 | 0.56006 | 0.95004 | 0.009 | 0.0083 | 0.0049 | 472.6556 | 0.1529 | 0.012 |
| Trenchers | 2021 | 2021Trenchers15 | 15 | 0.809 | 4.45891 | 4.66576 | 0.3133 | 0.2882 | 0.0054 | 527.0165 | 0.1704 | 0.013 |
| Trenchers | 2021 | 2021Trenchers25 | 25 | 0.809 | 4.45891 | 4.66576 | 0.3133 | 0.2882 | 0.0054 | 527.0165 | 0.1704 | 0.013 |
| Trenchers | 2021 | 2021Trenchers50 | 50 | 0.809 | 4.45891 | 4.66576 | 0.3133 | 0.2882 | 0.0054 | 527.0165 | 0.1704 | 0.013 |
| Trenchers | 2021 | 2021Trenchers120 | 120 | 0.556 | 5.10594 | 3.78912 | 0.3707 | 0.3411 | 0.0049 | 475.287 | 0.1537 | 0.012 |
| Trenchers | 2021 | 2021Trenchers175 | 175 | 0.4066 | 4.27237 | 3.30363 | 0.2188 | 0.2013 | 0.0048 | 467.7343 | 0.1513 | 0.012 |
| Trenchers | 2021 | 2021Trenchers250 | 250 | 0.3563 | 4.36036 | 1.66826 | 0.1718 | 0.1581 | 0.0049 | 473.8538 | 0.1533 | 0.012 |
| Trenchers | 2021 | 2021Trenchers500 | 500 | 0.2213 | 2.49105 | 1.86493 | 0.1002 | 0.0922 | 0.0049 | 470.701 | 0.1522 | 0.012 |
| Trenchers | 2021 | 2021Trenchers750 | 750 | 0.0658 | 0.47513 | 0.94677 | 0.009 | 0.0083 | 0.0049 | 472.5289 | 0.1528 | 0.012 |
| Welders | 2018 | 2018Welders15 | 15 | 0.766 | 4.762 | 3.58 | 0.256 | 0.256 | 0.008 | 568.3 | 0.069 | 0.015 |
| Welders | 2018 | 2018Welders25 | 25 | 0.807 | 4.661 | 2.531 | 0.232 | 0.232 | 0.007 | 568.299 | 0.072 | 0.015 |
| Welders | 2018 | 2018Welders50 | 50 | 1.21 | 4.607 | 5.092 | 0.311 | 0.311 | 0.007 | 568.299 | 0.109 | 0.015 |
| Welders | 2018 | 2018Welders120 | 120 | 0.564 | 3.98 | 3.648 | 0.29 | 0.29 | 0.006 | 568.299 | 0.05 | 0.015 |
| Welders | 2018 | 2018Welders175 | 175 | 0.402 | 3.176 | 3.123 | 0.162 | 0.162 | 0.006 | 568.299 | 0.036 | 0.015 |
| Welders | 2018 | 2018Welders250 | 250 | 0.292 | 2.751 | 1.118 | 0.084 | 0.084 | 0.006 | 568.299 | 0.026 | 0.015 |
| Welders | 2018 | 2018Welders500 | 500 | 0.277 | 2.43 | 1.08 | 0.08 | 0.08 | 0.005 | 568.299 | 0.025 | 0.015 |
| Welders | 2019 | 2019Welders15 | 15 | 0.748 | 4.647 | 3.562 | 0.241 | 0.241 | 0.008 | 568.299 | 0.067 | 0.015 |
| Welders | 2019 | 2019Welders25 | 25 | 0.787 | 4.596 | 2.501 | 0.222 | 0.222 | 0.007 | 568.299 | 0.071 | 0.015 |
| Welders | 2019 | 2019Welders50 | 50 | 1.055 | 4.449 | 4.95 | 0.273 | 0.273 | 0.007 | 568.299 | 0.095 | 0.015 |
| Welders | 2019 | 2019Welders120 | 120 | 0.503 | 3.648 | 3.623 | 0.25 | 0.25 | 0.006 | 568.299 | 0.045 | 0.015 |
| Welders | 2019 | 2019Welders175 | 175 | 0.37 | 2.832 | 3.122 | 0.143 | 0.143 | 0.006 | 568.3 | 0.033 | 0.015 |
| Welders | 2019 | 2019Welders250 | 250 | 0.276 | 2.432 | 1.104 | 0.075 | 0.075 | 0.006 | 568.299 | 0.024 | 0.015 |
| Welders | 2019 | 2019Welders500 | 500 | 0.264 | 2.163 | 1.065 | 0.072 | 0.072 | 0.005 | 568.3 | 0.023 | 0.015 |
| Welders | 2020 | 2020Welders15 | 15 | 0.731 | 4.542 | 3.546 | 0.227 | 0.227 | 0.008 | 568.299 | 0.066 | 0.015 |

| Equipment Type | Year | Concatenate | HP | ROG | NOX | CO | PM10 | PM2.5 | SO2 | CO2 | CH4 | N2O |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Welders | 2020 | 2020Welders25 | 25 | 0.769 | 4.538 | 2.473 | 0.212 | 0.212 | 0.007 | 568.299 | 0.069 | 0.015 |
| Welders | 2020 | 2020Welders50 | 50 | 0.937 | 4.304 | 4.84 | 0.238 | 0.238 | 0.007 | 568.299 | 0.084 | 0.015 |
| Welders | 2020 | 2020Welders120 | 120 | 0.455 | 3.351 | 3.605 | 0.216 | 0.216 | 0.006 | 568.299 | 0.041 | 0.015 |
| Welders | 2020 | 2020Welders175 | 175 | 0.344 | 2.523 | 3.122 | 0.127 | 0.127 | 0.006 | 568.299 | 0.031 | 0.015 |
| Welders | 2020 | 2020Welders250 | 250 | 0.261 | 2.143 | 1.093 | 0.066 | 0.066 | 0.006 | 568.299 | 0.023 | 0.015 |
| Welders | 2020 | 2020Welders500 | 500 | 0.252 | 1.91 | 1.055 | 0.064 | 0.064 | 0.005 | 568.299 | 0.022 | 0.015 |
| Welders | 2021 | 2021Welders15 | 15 | 0.717 | 4.462 | 3.531 | 0.214 | 0.214 | 0.008 | 568.299 | 0.064 | 0.015 |
| Welders | 2021 | 2021Welders25 | 25 | 0.752 | 4.497 | 2.446 | 0.201 | 0.201 | 0.007 | 568.299 | 0.067 | 0.015 |
| Welders | 2021 | 2021Welders50 | 50 | 0.829 | 4.133 | 4.708 | 0.203 | 0.203 | 0.007 | 568.299 | 0.074 | 0.015 |
| Welders | 2021 | 2021Welders120 | 120 | 0.411 | 3.042 | 3.579 | 0.184 | 0.184 | 0.006 | 568.299 | 0.037 | 0.015 |
| Welders | 2021 | 2021Welders175 | 175 | 0.315 | 2.189 | 3.112 | 0.11 | 0.11 | 0.006 | 568.299 | 0.028 | 0.015 |
| Welders | 2021 | 2021Welders250 | 250 | 0.243 | 1.836 | 1.081 | 0.057 | 0.057 | 0.006 | 568.299 | 0.021 | 0.015 |
| Welders | 2021 | 2021Welders500 | 500 | 0.236 | 1.642 | 1.044 | 0.055 | 0.055 | 0.005 | 568.299 | 0.021 | 0.015 |

## EMFAC

| Model | Year | Concat | ROG | NOX | CO | PM10 | PM2.5 | PM10 BWTW | PM2.5 BWTW | SO2 | CO2(pav) | CH4 | N2O | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LDA/LDT1/LDT2 | 2018 | LDA/LDT1/LDT22018 | 0.03 | 0.12 | 1.10 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 347 | 0.005 | 0.01 | |
| T6Heavy | 2018 | T6Heavy2018 | 0.09 | 2.92 | 0.30 | 0.01 | 0.01 | 0.14 | 0.02 | 0.01 | 1214 | 0.07 | 0.03 | |
| T7SC | 2018 | T7SC2018 | 0.14 | 5.38 | 0.54 | 0.04 | 0.04 | 0.10 | 0.14 | 0.02 | 1664 | 0.10 | 0.04 | |
| LDA/LDT1/LDT2 | 2019 | LDA/LDT1/LDT22019 | 0.02 | 0.11 | 0.99 | 0.00 | 0.00 | 0.04 | 0.02 | 0.00 | 337 | 0.004 | 0.00 | |
| T6Heavy | 2019 | T6Heavy2019 | 0.08 | 2.83 | 0.30 | 0.01 | 0.01 | 0.14 | 0.06 | 0.01 | 1211 | 0.07 | 0.03 | |
| T7SC | 2019 | T7SC2019 | 0.13 | 4.95 | 0.52 | 0.03 | 0.03 | 0.10 | 0.04 | 0.02 | 1647 | 0.09 | 0.04 | regional travel - aggregated rates |
| LDA/LDT1/LDT2 | 2020 | LDA/LDT1/LDT22020 | 0.02 | 0.10 | 0.91 | 0.00 | 0.00 | 0.04 | 0.02 | 0.00 | 326 | 0.004 | 0.00 | |
| T6Heavy | 2020 | T6Heavy2020 | 0.08 | 2.72 | 0.31 | 0.01 | 0.01 | 0.14 | 0.06 | 0.01 | 1205 | 0.07 | 0.03 | |
| T7SC | 2020 | T7SC2020 | 0.11 | 4.11 | 0.44 | 0.02 | 0.02 | 0.10 | 0.04 | 0.02 | 1632 | 0.09 | 0.04 | |
| LDA/LDT1/LDT2 | 2021 | LDA/LDT1/LDT22021 | 0.02 | 0.09 | 0.85 | 0.00 | 0.00 | 0.04 | 0.02 | 0.00 | 315 | 0.004 | 0.00 | |
| T6Heavy | 2021 | T6Heavy2021 | 0.08 | 2.47 | 0.30 | 0.01 | 0.01 | 0.14 | 0.06 | 0.01 | 1202 | 0.07 | 0.03 | |
| T7SC | 2021 | T7SC2021 | 0.10 | 3.63 | 0.43 | 0.02 | 0.02 | 0.10 | 0.04 | 0.02 | 1614 | 0.09 | 0.04 | |
| T6Heavy_5 | 2018 | T6Heavy_52018 | 0.48 | 9.67 | 1.59 | 0.03 | 0.03 | 0.14 | 0.14 | 0.02 | 2280 | 0.13 | 0.06 | water trucks-5mph |
| T6Heavy_5 | 2019 | T6Heavy_52019 | 0.47 | 9.84 | 1.62 | 0.03 | 0.02 | 0.14 | 0.14 | 0.02 | 2272 | 0.13 | 0.06 | water trucks-5mph |
| T6Heavy_5 | 2020 | T6Heavy_52020 | 0.46 | 9.98 | 1.63 | 0.023 | 0.022 | 0.14 | 0.14 | 0.02 | 2261 | 0.13 | 0.06 | water trucks-5mph |
| T6Heavy_5 | 2021 | T6Heavy_52021 | 0.43 | 9.90 | 1.62 | 0.019 | 0.018 | 0.14 | 0.14 | 0.02 | 2248 | 0.13 | 0.06 | water trucks-5mph |
| T7SC_5 | 2018 | T7SC_52018 | 1.263 | 18.894 | 3.365 | 0.134 | 0.128 | 0.14 | 0.14 | 0.02 | 3273 | 0.19 | 0.08 | end dumps-5mph |
| T7SC_5 | 2019 | T7SC_52019 | 1.167 | 18.371 | 3.306 | 0.115 | 0.110 | 0.14 | 0.14 | 0.02 | 3231 | 0.18 | 0.08 | end dumps-5mph |
| T7SC_5 | 2020 | T7SC_52020 | 0.837 | 16.880 | 3.009 | 0.049 | 0.046 | 0.14 | 0.14 | 0.02 | 3182 | 0.18 | 0.08 | end dumps-5mph |
| T7SC_5 | 2021 | T7SC_52021 | 0.795 | 16.312 | 3.025 | 0.041 | 0.039 | 0.14 | 0.14 | 0.02 | 3138 | 0.18 | 0.08 | end dumps-5mph |

EMFAC web tool for all but CH4 and N2O

EMFAC-PL for gas CH4; ran just LDA/LDT; weighted by 50/25/25 split

GRP for diesel CH4 and N2O (ratio to CO2 per gallon)

| OFFROAD Equipment Type | Horsepower | CMOD High | Load Factor |
|---|---|---|---|
| Aerial Lifts | 63 | 50 | 0.31 |
| Air Compressors | 78 | 120 | 0.48 |
| Bore/Drill Rigs | 221 | 250 | 0.50 |
| Cement and Mortar Mixers | 9 | 15 | 0.56 |
| Concrete/Industrial Saws | 81 | 120 | 0.73 |
| Cranes | 231 | 250 | 0.29 |
| Crawler Tractors | 212 | 250 | 0.43 |
| Crushing/Proc. Equipment | 85 | 120 | 0.78 |
| Dumpers/Tenders | 16 | 15 | 0.38 |
| Excavators | 158 | 175 | 0.38 |
| Forklifts | 89 | 120 | 0.20 |
| Generator Sets | 84 | 120 | 0.74 |
| Graders | 187 | 175 | 0.41 |
| Off-Highway Tractors | 124 | 120 | 0.44 |
| Off-Highway Trucks | 402 | 500 | 0.38 |
| Other Construction Equipment | 172 | 175 | 0.42 |
| Other General Industrial Equipment | 88 | 120 | 0.34 |
| Other Material Handling Equipment | 168 | 175 | 0.40 |
| Pavers | 130 | 120 | 0.42 |
| Paving Equipment | 132 | 120 | 0.36 |
| Plate Compactors | 8 | 15 | 0.43 |
| Pressure Washers | 13 | 15 | 0.30 |
| Pumps | 84 | 120 | 0.74 |
| Rollers | 80 | 120 | 0.38 |
| Rough Terrain Forklifts | 100 | 120 | 0.40 |
| Rubber Tired Dozers | 247 | 250 | 0.40 |
| Rubber Tired Loaders | 203 | 250 | 0.36 |
| Scrapers | 367 | 500 | 0.48 |
| Signal Boards | 6 | 15 | 0.82 |
| Skid Steer Loaders | 65 | 120 | 0.37 |
| Surfacing Equipment | 263 | 250 | 0.30 |
| Sweepers/Scrubbers | 64 | 75 | 0.46 |
| Tractors/Loaders/Backhoes | 97 | 120 | 0.37 |
| Trenchers | 78 | 120 | 0.50 |
| Welders | 46 | 50 | 0.45 |

Source: CalEEMOd Users Guide (2016.3.1)

|  | HP | kW | LF |
|---|---|---|---|
| dewater pumps | 6.711409396 | 5 | 0.75 |
| tower crane | 100.6711409 | 75 | 0.25 |
| crane low-rise | 80.53691275 | 60 | 0.25 |
| concrete pump | 80.53691275 | 60 | 0.75 |
| man/mtl tower | 13.42281879 | 10 | 0.5 |
| man/mtl low rise | 13.42281879 | 10 | 0.5 |
| man/mtl public low rise | 13.42281879 | 10 | 0.5 |

AC Cold Planer 225 other construction

http://www.cat.com/en_US/products/new/equipment/cold-planers/cold-planer/18252346.html

## VOC emissions from Architectural Coatings - MITIGATED!!!!

Emissions based on Calculation Details in CalEEMod Users Guide, Appendix A, pages 15-16

Eac = Efac x F x Apaint
EFac = Cvoc / 454 (g/lb) x 3.875 (L/GAL) / 180 (sqft)

| **Unmitigated** | Phase 2.6 | Phase 3.4 | Phase 4.4 | *description* |
|---|---|---|---|---|
| VOC Emissions (lbs/day) | 21 | 3 | 12 | pounds of VOC per day; unmitigated |
| VOC Emissions (ton/year) | 3 | 0 | 0 | |
| Eexterior (day) | 15 | 2 | 9 | |
| Einterior (day) | 5 | 1 | 3 | |
| Eexterior (annual) | 4,251 | 481 | 702 | |
| Einterior (annual) | 1,417 | 160 | 234 | |
| EF -exterior | 0.00356 | 0.00356 | 0.00356 | emission factor (lbs per sq. ft.) |
| EF - interior | 0.00356 | 0.00356 | 0.00356 | emission factor (lbs per sq. ft.) |
| New construction (sf) | 796,000 | 90,000 | 131,415 | The hotel tower, including the associated retail and public access plaza, would be approximat |
| Days of coatings | 276 | 211 | 81 | |
| Construction SF per day | 2,884 | 427 | 1,622 | ft2 |
| Fraction exterior | 75% | 75% | 75% | exterior fraction of surface area. Default is 75% of area is exterior surface and 25% interior |
| Fraction interior | 25% | 25% | 25% | interior fraction of surface area. Default is 75% of area is exterior surface and 25% interior |
| **Cext** | 75 | 75 | 75 | **Exterior VOC content (g/L)** |
| **Cint** | 75 | 75 | 75 | **Interior VOC content (g/L)** |
| scaling factor for A - surface painting | 2 | 2 | 2 | |
| g/lb | 453.59236 | 453.59236 | 453.59236 | |
| liters per gallon | 3.87541178 | 3.87541178 | 3.87541178 | |
| | 180 | 180 | 180 | |

# Waterside Construction Sheets

## Waterside Calculations for Marina

| | | | | | | | Engine Specs | | | | Pounds per Day | | | | | | | | | Total Tons | | | | | | Metric Tons Total | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | # | distance (mi) | time to anchor barge (hr) | travel speed (knot) | engine | kw (or hp | load | time (hrs) | days | ROG | NOX | CO | DPM | PM2.5 | SOx | CO2 | CH4 | N2O | ROG | NOX | CO | DPM | PM2.5 | SOx | CO2 | CH4 | N2O | CO2e |
| tugs | barge drop-off | 1 | 4 | 1 | 6 | main | 1491 | 0.31 | 1.6 | 1 | 1.4 | 8.8 | 8.9 | 0.2 | 0.2 | 0.0 | 1049.6 | 0.0 | 0.0 | 0.00 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.48 | 0.00 | 0.00 | 0.48 |
| | barge removal | 1 | 4 | 1 | 6 | main | 1491 | 0.31 | 1.6 | 1 | 1.4 | 8.8 | 8.9 | 0.2 | 0.2 | 0.0 | 1049.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.48 | 0.00 | 0.00 | 0.48 |
| | barge drop-off | 1 | 4 | 1 | 6 | aux | 132 | 0.43 | 1.6 | 1 | 0.3 | 1.4 | 1.0 | 0.1 | 0.0 | 0.0 | 128.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.06 | 0.00 | 0.00 | 0.06 |
| | barge removal | 1 | 4 | 1 | 6 | aux | 132 | 0.43 | 1.6 | 1 | 0.3 | 1.4 | 1.0 | 0.1 | 0.0 | 0.0 | 128.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.06 | 0.00 | 0.00 | 0.06 |
| skiff | arrival | 2 | 4 | | 6 | main | 44.7 | 0.45 | 1.2 | 1 | 1.3 | 0.3 | 18.2 | 0.0 | 0.0 | 0.0 | 66.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.03 | 0.00 | 0.00 | 0.03 |
| | depart | 2 | 4 | | 6 | main | 44.7 | 0.45 | 1.2 | 1 | 1.3 | 0.3 | 18.2 | 0.0 | 0.0 | 0.0 | 66.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.03 | 0.00 | 0.00 | 0.03 |
| | dock movements | 2 | | 1 | | main | 44.7 | 0.45 | 2 | 198 | 2.2 | 0.6 | 31.3 | 0.0 | 0.0 | 0.0 | 114.1 | 0.0 | 0.0 | 0.2 | 0.1 | 3.1 | 0.0 | 0.0 | 0.0 | 10.25 | 0.00 | 0.00 | 10.39 |
| Push Boat | arrival | 1 | 4 | | 6 | main | 335.6 | 0.45 | 0.6 | 1 | 0.2 | 3.1 | 2.8 | 0.1 | 0.1 | 0.0 | 251.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.11 | 0.00 | 0.00 | 0.12 |
| | depart | 1 | 4 | | 6 | main | 335.6 | 0.45 | 0.6 | 1 | 0.2 | 3.1 | 2.8 | 0.1 | 0.1 | 0.0 | 251.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.11 | 0.00 | 0.00 | 0.12 |
| | barge movements | 1 | | 1 | | main | 335.6 | 0.45 | 2 | 39 | 0.7 | 5.3 | 4.9 | 0.2 | 0.2 | 0.0 | 434.1 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 7.68 | 0.00 | 0.00 | 7.75 |
| | arrival | | 4 | | 6 | aux | 39.7 | 0.43 | 0.6 | 1 | 0.0 | 0.2 | 0.1 | 0.0 | 0.0 | 0.0 | 14.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.01 | 0.00 | 0.00 | 0.01 |
| | depart | | 4 | | 6 | aux | 39.7 | 0.43 | 0.6 | 1 | 0.0 | 0.2 | 0.1 | 0.0 | 0.0 | 0.0 | 14.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.01 | 0.00 | 0.00 | 0.01 |
| | barge movements | | | 1 | | aux | 39.7 | 0.43 | 2 | 39 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.00 | 0.00 | 0.00 | 0.00 |
| Crane | on barge | 1 | | | | - | 275 | 0.2881 | 8 | 198 | 0.1 | 0.4 | 2.5 | 0.0 | 0.0 | 0.0 | 660.9 | 0.2 | 0.0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 59.35 | 0.02 | 0.00 | 60.29 |
| Jet Pump | on barge | 1 | | | | - | 350 | 0.74 | 8 | 198 | 0.3 | 1.2 | 4.6 | 0.0 | 0.0 | 0.0 | 2596.0 | 0.1 | 0.1 | 0.0 | 0.1 | 0.5 | 0.0 | 0.0 | 0.0 | 233.15 | 0.01 | 0.01 | 235.12 |
| | | | | | | | | | | **Maximum Day** | | | | | | | | | | | | | | | | | | | |
| | | Crane&Pump active, skiff/pushboat arrival, and skiff/push boat move barge | | | | | | | | | **4.7** | **10.9** | **64.4** | **0.4** | **0.3** | **0.0** | **4136.9** | **0.3** | **0.1** | | | | | | | | | | |
| | | Barge arrival or removal plus workboats | | | | | | | | | 3.2 | 13.7 | 31.1 | 0.4 | 0.3 | 0.0 | 1510.2 | 0.0 | 0.1 | | | | | | | | | | (phase 1 only) |
| | | | | | | | | | | max | 4.7 | 13.7 | 64.4 | 0.4 | 0.3 | 0.0 | 4136.9 | 0.3 | 0.1 | 0.3 | 0.3 | 3.9 | 0.0 | 0.0 | 0.0 | 311.8 | 0.0 | 0.0 | 314.9 |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | Phase 2 = | 314.93 |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | Phase 1+2 Total= | 629.86 |

## Emission Factor Summary

| Vessel | engine | unit | NOx | DPM | PM2.5 | ROG | CO | SOx | CO2 | CH4 | N2O |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Tug | Main | g/kwh | 5.47 | 0.11 | 0.10 | 0.88 | 5.55 | 0.01 | 652.00 | 0.01 | 0.03 |
|  | Aux | g/kwh | 6.96 | 0.27 | 0.25 | 1.49 | 5.29 | 0.01 | 652.00 | 0.01 | 0.03 |
| Skiff | Main | g/kwh | 3.28 | 0.06 | 0.06 | 12.25 | 176.46 | 0.01 | 642.77 | 0.01 | 0.03 |
| Pushboat | Main | g/kwh | 7.91 | 0.27 | 0.25 | 1.05 | 7.30 | 0.01 | 652.00 | 0.02 | 0.02 |
|  | Aux | g/kwh | 7.42 | 0.45 | 0.32 | 1.60 | 5.97 | 0.01 | 652.00 | 0.02 | 0.03 |
| Crane | - | g/hphr | 7.42 | 0.45 | 0.32 | 1.60 | 5.97 | 0.01 | 652.00 | 0.02 | 0.03 |
| JetPump | - | g/hphr | 7.42 | 0.45 | 0.32 | 1.60 | 5.97 | 0.01 | 652.00 | 0.02 | 0.03 |

## Tug Emission Factor

Tug size and tier from applicant
Assumes tug is "Assist Tug" characteristics (i.e., load and cumulative hours)

|  |  |  |  |
|---|---|---|---|
| model year | 2012 (Tier 3) |  |  |
| Propulsion | 1491 kW | 2000 hp | from Applicant |
| Auxiliary | 132 kW | 177 hp | est. based on average Assist Tug aux to main engine proportion in Maritime Inventory (in progress) |

Method taken from 2013 Port of Long Beach Inventory
Assumes tugs are fully deteriorated
Tugs are Tier 3 per Applicant

**Emission Factor (g/kwh)**

|  |  | NOx | DPM | PM2.5 | ROG | CO | SOx | CO2 | CH4 | N2O | Useful Life | Annual Hours | Det Cap Years |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Main | ZH | 5.48 | 0.11 | 0.10 | 1.15 | 5.00 | 0.17 | 652 | 0.018 | 0.031 | 21 | 2274 | 5.28 |
|  | FCF | 0.948 | 0.852 | 0.852 | 0.72 | 1 | 0.043 | 1 | 0.72 | 0.95 |  |  |  |
|  | ZH, ULSD-corrected | 5.2 | 0.1 | 0.1 | 0.8 | 5.0 | 0.01 | 652 | 0.0 | 0.0 |  |  |  |
|  | DR & Cumulative Hours |  |  |  |  |  |  |  |  |  |  |  |  |
|  | DF | 0.21 | 0.67 | 0.67 | 0.25 | 0.44 | - | - | - | - |  |  |  |
|  | EF, fuel-corrected | 5.47 | 0.11 | 0.10 | 0.88 | 5.55 | 0.01 | 652 | 0.01 | 0.03 |  |  |  |
| Aux | ZH | 7.13 | 0.29 | 0.27 | 2.00 | 5.00 | 0.17 | 652.00 | 0.018 | 0.031 | 23 | 2486 | 4.83 |
|  | FCF | 0.948 | 0.852 | 0.852 | 0.72 | 1 | 0.043 | 1 | 0.72 | 0.948 |  |  |  |
|  | ZH, ULSD-corrected | 6.8 | 0.2 | 0.2 | 1.4 | 5.0 | 0.01 | 652 | 0.0 | 0.0 |  |  |  |
|  | DR & Cumulative Hours |  |  |  |  |  |  |  |  |  |  |  |  |
|  | DF | 0.14 | 0.44 | 0.44 | 0.16 | 0.28 | - | - | - | - |  |  |  |
|  | EF, fuel-corrected | 6.96 | 0.27 | 0.25 | 1.49 | 5.29 | 0.01 | 652 | 0.01 | 0.03 |  |  |  |

## Skiff and Pushboat Emission Factor

Skiff and Push Boat size and non-tiered from applicant
Assumes outboard rec engine for skiff; diesel inboard for pushboat

| | | skiff | push |
|---|---|---|---|
| model year | | 1999 | 2007 |
| Propulsion | kw | 56 | 336 |
| Auxiliary | kw | 0 | 40 |

**Deteriorated Emission Factors or Skiff (from PWC model), g/hp-hr**

| | ME ROG | ME CO | ME NOx | ME PM | AE ROG | AE CO | AE NOx | AE PM | CO2 | SO2 | ME CH4 | ME N2O | AE CH4 | AE N2O |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| for lookup --> | ROG | CO | NOX | DPM | | | | | CO2 | SOX | CH4 | N2O | | |
| skiff (g/hphr) | 9.135628 | 131.5855018 | 2.444249 | 0.047844 | 8.996636 | 68.87169 | 3.03182598 | 0.060368 | 479.3132 | 0.006997 | 0.009664 | 0.021915 | 0.01557 | 0.023117 |

**Emission Factor for Push Boat (g/kwhr)**

| | | NOx | DPM | PM2.5 | ROG | CO | SOx | CO2 | CH4 | N2O | Useful Life | Annual Hours | Det Cap Years |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Main | ZH | 6.84 | 0.20 | 0.18 | 1.15 | 5.00 | 0.17 | 652 | 0.03 | 0.02 | | | |
| | FCF | 0.948 | 0.8 | 0.8 | 0.72 | 1 | 0.043 | 1 | 0.72 | 0.95 | | | |
| | ZH, ULSD-corrected | 6.5 | 0.2 | 0.1 | 0.8 | 5.0 | 0.01 | 652 | 0.0 | 0.0 | | | |
| | DR & Cumulative Hours | | | | | | | | | | 17 | 675 | 17.78 |
| | DF | 0.21 | 0.67 | 0.67 | 0.25 | 0.44 | - | - | - | - | | | |
| | EF, fuel-corrected | 7.91 | 0.27 | 0.25 | 1.05 | 7.30 | 0.01 | 652 | 0.02 | 0.02 | | | |
| Aux | ZH | 7.13 | 0.40 | 0.29 | 2.00 | 5.00 | 0.17 | 652.00 | 0.031 | 0.032 | | | |
| | FCF | 0.948 | 0.852 | 0.852 | 0.72 | 1 | 0.043 | 1 | 0.72 | 0.948 | | | |
| | ZH, ULSD-corrected | 6.8 | 0.3 | 0.2 | 1.4 | 5.0 | 0.01 | 652 | 0.0 | 0.0 | | | |
| | DR & Cumulative Hours | | | | | | | | | | 23 | 750 | 16 |
| | DF | 0.14 | 0.44 | 0.44 | 0.16 | 0.28 | - | - | - | - | | | |
| | EF, fuel-corrected | 7.42 | 0.45 | 0.32 | 1.60 | 5.97 | 0.01 | 652 | 0.02 | 0.03 | | | |

## Crane and Jet Pump emission rates

Carl Moyer, Table D-12

Controlled Off-Road Diesel Engines Emission Factors (g/bhp-hr)(a)

| Horsepower | Tier | NOx | ROG | PM10 | | |
|---|---|---|---|---|---|---|
| 25-49 | 1 | 5.26 | 1.74 | 0.480 | | |
| | 2 | 4.63 | 0.29 | 0.280 | | |
| | 4 Interim | 4.55 | 0.12 | 0.128 | | |
| | 4f | 2.75 | 0.12 | 0.008 | | |
| 50-74 | 1 | 6.54 | 1.19 | 0.552 | | |
| | 2 | 4.75 | 0.23 | 0.192 | | |
| | 3(b) | 2.74 | 0.12 | 0.192 | | |
| | 4 Interim | 2.74 | 0.12 | 0.112 | | |
| | 4f | 2.74 | 0.12 | 0.008 | | |
| 75-99 | 1 | 6.54 | 1.19 | 0.552 | | |
| | 2 | 4.75 | 0.23 | 0.192 | | |
| | 3 | 2.74 | 0.12 | 0.192 | | |
| | 4 Phase-Out | 2.74 | 0.12 | 0.008 | | |
| | 4 Phase-In/ Alternate NOx | 2.14 | 0.11 | 0.008 | | |
| | 4f | 0.26 | 0.06 | 0.008 | | |
| 100-174 | 1 | 6.54 | 0.82 | 0.274 | | |
| | 2 | 4.17 | 0.19 | 0.128 | | |
| | 3 | 2.32 | 0.12 | 0.112 | | |
| | 4 Phase-Out | 2.32 | 0.12 | 0.008 | | |
| | 4 Phase-In/ Alternate NOx | 2.15 | 0.06 | 0.008 | | |
| | 4f | 0.26 | 0.06 | 0.008 | | |
| 175-299 | 1 | 5.93 | 0.38 | 0.108 | | |
| | 2 | 4.15 | 0.12 | 0.088 | | |
| | 3 | 2.32 | 0.12 | 0.088 | | |
| | 4 Phase-Out | 2.32 | 0.12 | 0.008 | | |
| | 4 Phase-In/ Alternate NOx | 1.29 | 0.08 | 0.008 | | |
| | 4f | 0.26 | 0.06 | 0.008 | Crane | CO, SOX, GHGs same as unmtigiated |
| 300-750 | 1 | 5.93 | 0.38 | 0.108 | | |
| | 2 | 3.79 | 0.12 | 0.088 | | |
| | 3 | 2.32 | 0.12 | 0.088 | | |
| | 4 Phase-Out | 2.32 | 0.12 | 0.008 | | |
| | 4 Phase-In/ Alternate NOx | 1.29 | 0.08 | 0.008 | | |
| | 4f | 0.26 | 0.06 | 0.008 | Jet Pump | |
| 751+ | 1 | 5.93 | 0.38 | 0.108 | | |
| | 2 | 3.79 | 0.12 | 0.088 | | |
| | 4 Interim | 2.24 | 0.12 | 0.048 | | |
| | 4f | 2.24 | 0.06 | 0.016 | | |

Loads (From Caleemod)

| | |
|---|---|
| Crane | 0.2881 |
| Pumps | 0.74 |

Caleemod Efs

| Equipment Type | Year | **Concatenate** | HP | ROG | NOX | CO | PM10 | PM2.5 | SO2 | CO2 | CH4 | **N2O** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cranes | 2020 | 2020Cranes250 | 250 | 0.38 | 4.56 | 1.79 | 0.19 | 0.17 | 0.00 | 472.95 | 0.15 | 0.01 |
| Cranes | 2020 | 2020Cranes500 | 500 | 0.32 | 3.86 | 2.66 | 0.15 | 0.14 | 0.00 | 472.56 | 0.15 | 0.01 |
| Pumps | 2020 | 2020Pumps250 | 250 | 0.21 | 2.05 | 1.04 | 0.06 | 0.06 | 0.01 | 568.30 | 0.02 | 0.01 |
| Pumps | 2020 | 2020Pumps500 | 500 | 0.20 | 1.84 | 1.02 | 0.06 | 0.06 | 0.01 | 568.30 | 0.02 | 0.01 |

**Replace NOX, ROG< and PM with Tier 4 rates (use for calcs)**

| Equipment Type | Year | **Concatenate** | HP | ROG | NOX | CO | DPM | PM2.5 | SOx | CO2 | CH4 | **N2O** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cranes | 2020 | 2020Cranes250 | 250 | 0.06 | 0.26 | 1.79 | 0.01 | 0.01 | 0.00 | 472.95 | 0.15 | 0.01 |
| Pumps | 2020 | 2020Pumps500 | 500 | 0.06 | 0.26 | 1.02 | 0.01 | 0.01 | 0.01 | 568.30 | 0.02 | 0.01 |

🟩 changed to tier 4

**Vessel Type Specific Factors, ARB, from 2010 updated CHC model**

| Vessel_Type | mber of ma | umber auxi | in Engine L | iary Engine | nnual Hour | Annual Ho | ne Useful L | gine Useful |
|---|---|---|---|---|---|---|---|---|
| Tow Boats | 2.1 | 1.17 | 0.68 | 0.43 | 1,993.00 | 2,964.62 | 26 | 25 |
| Tug Boats | 1.92 | 1.59 | 0.5 | 0.31 | 2,274.06 | 2,486.21 | 21 | 22.5 |
| Ferries | 2.01 | 1.23 | 0.42 | 0.43 | 1,842.64 | 1,254.17 | 20 | 20 |
| Others | 1.11 | 0.46 | 0.52 | 0.43 | 778.71 | 805.39 | 23 | 22 |
| Work Boats | 1.46 | 0.32 | 0.45 | 0.43 | 674.99 | 750.00 | 17 | 23 |
| Pilot Vessels | 1.7 | 0.14 | 0.51 | 0.43 | 1,030.71 | 994.00 | 19 | 25 |
| Crew and Supply | 2.5 | 1.1 | 0.45 | 0.43 | 787.52 | 3,035.80 | 22 | 22 |
| Charter Fishing | 1.77 | 0.75 | 0.52 | 0.43 | 1,622.28 | 2,077.00 | 16 | 15 |
| Commercial Fishing | 1.12 | 0.46 | 0.27 | 0.43 | 1,249.86 | 1,633.45 | 21 | 15 |

**Harborcraft ULSD Correction Factors**

| Years | ROG | CO | NOx | PM2.5 | SOx | CO2 | CH4 | N2O |
|---|---|---|---|---|---|---|---|---|
| Pre-1995 | 0.720 | 1.000 | 0.930 | 0.720 | 0.043 | 1.000 | 0.720 | 0.930 |
| 1996-2010 | 0.720 | 1.000 | 0.948 | 0.800 | 0.043 | 1.000 | 0.720 | 0.948 |
| 2011 + | 0.720 | 1.000 | 0.948 | 0.852 | 0.043 | 1.000 | 0.720 | 0.948 |

ae to me ratio, 2016 ei

workboats 0.507923

450 ho

|  | hp | kw |
|---|---|---|
| main | 450 | 336 |
| aux | 53.29944 | 40 |

2007 my

annual use

# Carbon Monoxide Hotspot Sheets

```
                                          1




            CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                     JUNE 1989 VERSION
                     PAGE   1

                JOB: POSD FAL
                RUN: CALINE4 RUN      (WORST CASE ANGLE)
          POLLUTANT: Carbon Monoxide

    I.  SITE VARIABLES

           U=   0.5 M/S             Z0= 100. CM            ALT=     0. (M)
         BRG= WORST CASE            VD=  0.0 CM/S
        CLAS=     7 (G)             VS=  0.0 CM/S
        MIXH= 1000. M              AMB=  0.0 PPM
       SIGTH=   15. DEGREES       TEMP= 13.9 DEGREE (C)


    II.  LINK VARIABLES

        LINK      *  LINK COORDINATES (M)   *              EF      H     W
     DESCRIPTION  *   X1    Y1    X2    Y2  * TYPE  VPH  (G/MI)  (M)   (M)
  ----------------*-------------------------*-------------------------------
  A. WBA          *  1000     5     0     5 *  AG   1150   4.0    0.0  17.0
  B. SBA          *    -7  1000    -7     0 *  AG   1878   4.0    0.0  20.6
  C. SBD          *    -7     0    -7 -1000 *  AG   1990   4.0    0.0  20.6
  D. NBA          *     5 -1000     5     0 *  AG    601   4.0    0.0  17.0
  E. NBD          *     5     0     5  1000 *  AG   1639   4.0    0.0  17.0


  III.  RECEPTOR LOCATIONS

              *    COORDINATES (M)
    RECEPTOR  *    X      Y      Z
  ------------*---------------------
  1. R_001    *    -18     14   1.8
  2. R_002    *     14     14   1.8
  3. R_003    *    -18     -4   1.8
  4. R_004    *     14     -3   1.8


   IV.  MODEL RESULTS (WORST CASE WIND ANGLE )

              *       * PRED  *         CONC/LINK
              *  BRG  * CONC  *           (PPM)
   RECEPTOR   * (DEG) * (PPM) *   A    B    C    D    E
 -------------*-------*-------*-------------------------
  1. R_001    *    9. *   1.3 *  0.0  0.9  0.0  0.0  0.4
  2. R_002    *  351. *   1.4 *  0.0  0.5  0.0  0.0  0.9
  3. R_003    *    9. *   1.3 *  0.0  0.9  0.1  0.0  0.4
  4. R_004    *  351. *   1.6 *  0.3  0.5  0.0  0.0  0.8


1
EXIT
```

```
        CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
            JUNE 1989 VERSION
            PAGE   1

          JOB: POSD FAL
          RUN: CALINE4 RUN      (WORST CASE ANGLE)
       POLLUTANT: Carbon Monoxide


 I.  SITE VARIABLES

       U=   0.5 M/S           Z0= 100. CM          ALT=     0. (M)
     BRG= WORST CASE          VD=  0.0 CM/S
    CLAS=     7 (G)          VS=  0.0 CM/S
    MIXH= 1000. M            AMB=  0.0 PPM
   SIGTH=   15. DEGREES      TEMP= 13.9 DEGREE (C)


 II.  LINK VARIABLES

    LINK      *  LINK COORDINATES (M)   *             EF     H     W
  DESCRIPTION  *   X1    Y1    X2    Y2  * TYPE  VPH  (G/MI)  (M)   (M)
----------------*-------------------------*------------------------------
 A. WBA          *  1000     5     0     5 *  AG   1150   4.0    0.0  17.0
 B. SBA          *    -7  1000    -7     0 *  AG   1959   4.0    0.0  20.6
 C. SBD          *    -7     0    -7 -1000 *  AG   2071   4.0    0.0  20.6
 D. NBA          *     5 -1000     5     0 *  AG    656   4.0    0.0  17.0
 E. NBD          *     5     0     5  1000 *  AG   1694   4.0    0.0  17.0


 III.  RECEPTOR LOCATIONS

           *    COORDINATES (M)
  RECEPTOR  *    X      Y      Z
-------------*---------------------
 1. R_001   *    -18     14   1.8
 2. R_002   *     14     14   1.8
 3. R_003   *    -18     -4   1.8
 4. R_004   *     14     -3   1.8


 IV.  MODEL RESULTS (WORST CASE WIND ANGLE )

           *        * PRED  *         CONC/LINK
           *  BRG   * CONC  *           (PPM)
 RECEPTOR   * (DEG) * (PPM) *    A    B    C    D    E
-------------*-------*-------*-------------------------
```

```
  1. R_001    *    9. *   1.4 *  0.0  1.0  0.0  0.0  0.4
  2. R_002    *  351. *   1.4 *  0.0  0.5  0.0  0.0  0.9
  3. R_003    *    9. *   1.4 *  0.0  0.9  0.1  0.0  0.4
  4. R_004    *  351. *   1.7 *  0.3  0.5  0.0  0.0  0.9


1
EXIT
```

```
       CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
              JUNE 1989 VERSION
              PAGE   1

          JOB: POSD FAL
          RUN: CALINE4 RUN     (WORST CASE ANGLE)
      POLLUTANT: Carbon Monoxide


  I.  SITE VARIABLES

       U=   0.5 M/S           Z0= 100. CM           ALT=     0. (M)
     BRG= WORST CASE          VD=  0.0 CM/S
    CLAS=    7 (G)           VS=  0.0 CM/S
    MIXH= 1000. M             AMB=  0.0 PPM
   SIGTH=   15. DEGREES      TEMP= 13.9 DEGREE (C)


  II.  LINK VARIABLES

    LINK     *  LINK COORDINATES (M)   *            EF     H     W
  DESCRIPTION  *   X1    Y1    X2    Y2  * TYPE  VPH  (G/MI)  (M)   (M)
-----------------*-------------------------*------------------------------
 A. WBA         *  1000     5     0     5 *  AG   1705   3.0    0.0  17.0
 B. SBA         *   -7  1000    -7     0 *  AG   2400   3.0    0.0  20.6
 C. SBD         *   -7     0    -7 -1000 *  AG   2605   3.0    0.0  20.6
 D. NBA         *    5 -1000     5     0 *  AG    700   3.0    0.0  17.0
 E. NBD         *    5     0     5  1000 *  AG   2200   3.0    0.0  17.0


 III.  RECEPTOR LOCATIONS

         *   COORDINATES (M)
  RECEPTOR *   X      Y     Z
-------------*---------------------
 1. R_001   *   -18    14   1.8
 2. R_002   *    14    14   1.8
 3. R_003   *   -18    -4   1.8
 4. R_004   *    14    -3   1.8


  IV.  MODEL RESULTS (WORST CASE WIND ANGLE )

         *      * PRED  *       CONC/LINK
         *  BRG  * CONC  *          (PPM)
  RECEPTOR   * (DEG) * (PPM) *   A    B    C    D    E
-------------*-------*-------*-------------------------
```

```
  1. R_001    *    9. *   1.2 *  0.0  0.9  0.0  0.0  0.4
  2. R_002    *  351. *   1.3 *  0.0  0.4  0.0  0.0  0.9
  3. R_003    *    9. *   1.2 *  0.0  0.8  0.0  0.0  0.4
  4. R_004    *  351. *   1.6 *  0.3  0.4  0.0  0.0  0.8


1
EXIT
```

```
         CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
              JUNE 1989 VERSION
              PAGE   1

           JOB: POSD FAL
           RUN: CALINE4 RUN     (WORST CASE ANGLE)
     POLLUTANT: Carbon Monoxide


  I.  SITE VARIABLES

       U=   0.5 M/S          Z0= 100. CM          ALT=     0. (M)
     BRG= WORST CASE          VD=  0.0 CM/S
    CLAS=    7 (G)          VS=  0.0 CM/S
    MIXH= 1000. M            AMB=  0.0 PPM
   SIGTH=   15. DEGREES      TEMP= 13.9 DEGREE (C)


  II.  LINK VARIABLES

     LINK     *  LINK COORDINATES (M)   *            EF     H     W
  DESCRIPTION  *   X1    Y1    X2    Y2  * TYPE  VPH  (G/MI)  (M)   (M)
 ----------------*-------------------------*------------------------------
 A. WBA          * 1000     5     0     5 *  AG   1705   3.0    0.0  17.0
 B. SBA          *   -7  1000    -7     0 *  AG   2480   3.0    0.0  20.6
 C. SBD          *   -7     0    -7 -1000 *  AG   2685   3.0    0.0  20.6
 D. NBA          *    5 -1000     5     0 *  AG    755   3.0    0.0  17.0
 E. NBD          *    5     0     5  1000 *  AG   2255   3.0    0.0  17.0


 III.  RECEPTOR LOCATIONS

             *    COORDINATES (M)
  RECEPTOR  *    X      Y      Z
 ------------*---------------------
 1. R_001    *   -18     14   1.8
 2. R_002    *    14     14   1.8
 3. R_003    *   -18     -4   1.8
 4. R_004    *    14     -3   1.8


  IV.  MODEL RESULTS (WORST CASE WIND ANGLE )

             *       * PRED  *        CONC/LINK
             *  BRG  * CONC  *          (PPM)
  RECEPTOR   * (DEG) * (PPM) *   A    B    C    D    E
 ------------*-------*-------*-------------------------
```

```
  1. R_001    *    9. *   1.3 *  0.0  0.9  0.0  0.0  0.4
  2. R_002    *  351. *   1.3 *  0.0  0.5  0.0  0.0  0.9
  3. R_003    *    9. *   1.3 *  0.0  0.8  0.1  0.0  0.4
  4. R_004    *  351. *   1.6 *  0.3  0.5  0.0  0.0  0.8


1
EXIT
```

```
      CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
           JUNE 1989 VERSION
           PAGE   1

        JOB: POSD FAL
        RUN: CALINE4 RUN     (WORST CASE ANGLE)
    POLLUTANT: Carbon Monoxide


  I.  SITE VARIABLES

       U=   0.5 M/S          Z0= 100. CM          ALT=     0. (M)
     BRG= WORST CASE          VD=  0.0 CM/S
    CLAS=     7 (G)          VS=  0.0 CM/S
    MIXH= 1000. M            AMB=  0.0 PPM
   SIGTH=   15. DEGREES      TEMP= 13.9 DEGREE (C)


  II.  LINK VARIABLES

    LINK      *  LINK COORDINATES (M)   *             EF     H     W
  DESCRIPTION  *   X1    Y1    X2    Y2  * TYPE  VPH  (G/MI)  (M)   (M)
 ----------------*-------------------------*------------------------------
 A. WBA         * 1000     5     0     5 *  AG   2480   1.3    0.0  17.0
 B. SBA         *   -7  1000    -7     0 *  AG   3120   1.3    0.0  20.6
 C. SBD         *   -7     0    -7 -1000 *  AG   3630   1.3    0.0  20.6
 D. NBA         *    5 -1000     5     0 *  AG    860   1.3    0.0  17.0
 E. NBD         *    5     0     5  1000 *  AG   2830   1.3    0.0  17.0


 III.  RECEPTOR LOCATIONS

         *   COORDINATES (M)
  RECEPTOR  *    X     Y     Z
 -------------*---------------------
 1. R_001   *   -18    14   1.8
 2. R_002   *    14    14   1.8
 3. R_003   *   -18    -4   1.8
 4. R_004   *    14    -3   1.8


  IV.  MODEL RESULTS (WORST CASE WIND ANGLE )

          *       * PRED  *        CONC/LINK
          *  BRG  * CONC  *           (PPM)
  RECEPTOR   * (DEG) * (PPM) *   A    B    C    D    E
 -------------*-------*-------*-------------------------
```

```
  1. R_001    *    9. *   0.6 *  0.0  0.5  0.0  0.0  0.2
  2. R_002    *  191. *   0.7 *  0.2  0.0  0.3  0.1  0.1
  3. R_003    *    9. *   0.7 *  0.0  0.4  0.0  0.0  0.2
  4. R_004    *  350. *   0.9 *  0.2  0.2  0.0  0.0  0.4


1
EXIT
```

```
      CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
           JUNE 1989 VERSION
           PAGE   1

        JOB: POSD FAL
        RUN: CALINE4 RUN     (WORST CASE ANGLE)
    POLLUTANT: Carbon Monoxide


 I.  SITE VARIABLES

     U=   0.5 M/S           Z0= 100. CM          ALT=     0. (M)
    BRG= WORST CASE          VD=  0.0 CM/S
   CLAS=    7 (G)           VS=  0.0 CM/S
   MIXH= 1000. M             AMB=  0.0 PPM
  SIGTH=   15. DEGREES      TEMP= 13.9 DEGREE (C)


 II.  LINK VARIABLES

   LINK     *  LINK COORDINATES (M)   *            EF    H    W
 DESCRIPTION  *   X1    Y1    X2    Y2  * TYPE  VPH  (G/MI)  (M)   (M)
----------------*-------------------------*------------------------------
A. WBA        * 1000     5     0     5 *  AG   2480   1.3    0.0  17.0
B. SBA        *   -7  1000    -7     0 *  AG   3200   1.3    0.0  20.6
C. SBD        *   -7     0    -7 -1000 *  AG   3710   1.3    0.0  20.6
D. NBA        *    5 -1000     5     0 *  AG    915   1.3    0.0  17.0
E. NBD        *    5     0     5  1000 *  AG   2885   1.3    0.0  17.0


 III.  RECEPTOR LOCATIONS

          *    COORDINATES (M)
 RECEPTOR *    X      Y     Z
------------*---------------------
1. R_001  *   -18     14   1.8
2. R_002  *    14     14   1.8
3. R_003  *   -18     -4   1.8
4. R_004  *    14     -3   1.8


 IV.  MODEL RESULTS (WORST CASE WIND ANGLE )

          *       * PRED  *        CONC/LINK
          *  BRG  * CONC  *          (PPM)
 RECEPTOR   * (DEG) * (PPM) *    A    B    C    D    E
-------------*-------*-------*-------------------------
```

```
  1. R_001    *   9. *  0.7 *  0.0  0.5  0.0  0.0  0.2
  2. R_002    * 191. *   0.7 *  0.2  0.0  0.3  0.1  0.1
  3. R_003    *   9. *  0.7 *  0.0  0.4  0.0  0.0  0.2
  4. R_004    * 350. *   0.9 *  0.2  0.2  0.0  0.0  0.4


1
EXIT
```

# Appendix E-1

# Marine Taxonomic Services Fifth Avenue Landing Marine Biological Resources Report

MARINE TAXONOMIC SERVICES, LTD.

# Fifth Avenue Landing Marine Biological Resources Report

Prepared for
ICF
525 B St. #1700
San Diego, CA 92101

and

The Unified Port of San Diego
3165 Pacific Highway
San Diego, CA 92101

Prepared by
Robert Mooney, Ph.D.
Marine Taxonomic Services, Ltd.
920 Rancheros Drive, Suite F-1
San Marcos, CA 92069

February 21, 2017 (revised May 15, 2017)

Page Intentionally Blank

# Contents

# Appendices

# List of Figures and Tables

# Fifth Avenue Landing Marine Biological Resources Report

February 21, 2016 (Revised May 15, 217)

## Introduction

Marine Taxonomic Services (MTS) was contracted by ICF to provide a marine biological survey and Essential Fish Habitat Assessment (EFH) for the Fifth Avenue Landing Project (Project). MTS has completed the survey and analysis of the resources at Fifth Avenue Landing and has prepared the following report on the findings with support from ICF. The survey was intended to support the environmental planning associated with Project's construction and operation. As such the results of the inventory are discussed relative to potential impacts associated with planned construction activities and proposed facilities that are part of the Project plans.

Fifth Avenue Landing is located in the central portion of San Diego Bay along the northeastern shoreline approximately 1 mile (1.6 kilometers) northwest of the Coronado Bridge (Figure 1). Over land, the Project entails redevelopment of approximately 5 acres of land. Over the water, the Project will expand the existing marina from the current 3.568-acres (1.444 hectare) parcel to include an additional 3.913 acres (1.584 hectare) parcel. The Project would construct an approximately 850-room hotel, an approximately 565-bed lower-cost visitor-serving hotel, retail development along the promenade, 2.1 acres (0.85 hectare) of public access plaza space, approximately 213 parking spaces, a connecting bridge to the San Diego Convention Center, and expansion of the marina to allow for an additional 40-55 small and large vessel slips.

The Project components with the greatest potential to impact marine biological resources are the marina expansion and the hotels. The marina expansion could change water circulation patterns and potentially cause shading that restricts growth of plants and algae that provide primary productivity to support beneficial uses associated with wildlife and recreational fishing. The hotel buildings can also cause shading over water and similarly impact marine species. The results of the biological assessment are discussed relative to potential impacts from specific Project components.

Source: ESRI StreetMap North America (2014)

K:\San Diego\projects\Port of San Diego\00518 16 FifthAveLanding\mapdoc\1 Regional Location.mxd Date: 11/4/2016 35528

**Figure 1**
**Project Vicinity Map**
**Fifth Avenue Landing Project**

## Methods

MTS staff Dr. Robert Mooney and Grace Keller performed a side-scan sonar survey of the Project water area on October 6, 2016. The purpose of the side-scan sonar survey was to detect and map any eelgrass (*Zostera marina*) and to identify any other potential subtidal habitat types present within the Project's water area. The sonar survey was performed by navigating a small vessel along a series of transects through the Project area and areas immediately adjacent to the Project area. The vessel was fitted with a pole-mounted side-scan sonar operating at 450 kHz. The sonar was set to scan 30 meters on both the port and starboard channels for a total scanning swath of 60 meters. Survey transects were navigated such that adjacent sonar swaths overlapped, providing complete bottom coverage within the surveyed area.

Following the side-scan sonar survey, the collected side-scan sonar files were geographically registered using the vessel's navigation data collected during the survey. The side-scan files were then compiled to create a contiguous view of the seafloor across the entirety of the survey area. The boundaries of the eelgrass and other habitats present were then digitized from the compiled data set using ESRI ArcView software and plotted on a geographically registered image of the project area.

On October 12, 2016, MTS staff Robert Mooney and Kees Schipper further inspected the survey area using SCUBA. Each habitat type in the survey area was visually inspected for qualitative characterization and to document the dominant flora and fauna present. Notes were made on the occurrence, or potential for occurrence, of sensitive species that could be impacted by the proposed Project. In addition to the visual verification data, this report relies on other existing information and personal observations over numerous past surveys within central San Diego Bay.


*MTS diver Kees Schipper prepares to dive to inspect the Project area habitats.*

To determine the potential for noise from pile driving to impact sensitive species, ICF staff Jonathan Higginson performed an analysis of potential noise levels. The analysis used the compendium of pile driving noise data from Buchler et al. (2015) to establish potential noise levels at the source of pile driving. The potential for generated noise to cause Level A (injury) and Level B (behavioral) Harassment of marine mammals was then evaluated by calculating isopleths over which noise would attenuate to thresholds established by NOAA (NMFS 2016a and NMFS 2016b). Isopleth calculations for Level A Harassment were performed using the NOAA companion spreadsheet for NMFS (2016a); the isopleths for Level B Harassment were calculated with direct application of the practical spreading loss model (refer to MTS and ICF 2016). Analysis of potential impacts to fish used the NOAA developed spreadsheet and associated thresholds for injury and behavioral effects on fishes (refer to *https://www.wsdot.wa.gov/NR/rdonlyres/1C4DD9F8.../BA_NMFSpileDrivCalcs.xls*).

Due to the potential of impacts to eelgrass associated with shading, a shading analysis was performed to identify areas with the greatest likelihood of being impacted by shading introduced from proposed structures (Gensler and Robert Green Company 2017). The shading analysis developed shadows from existing and proposed structures for four dates: March 21, June 21, September 21, and December 21. These dates incorporate data from all seasons and since they include the summer and winter solstice, they include data using the most extreme sun angles. On each of the target dates, shadows were modeled at 8am, 10am, 12pm, 2pm, 4pm, 6pm, and sunset. The shading data associated with new shading from proposed structures were then overlaid on eelgrass maps to determine the extent of potential shading impacts.

## Results

The results below present the findings of the side-scan sonar survey, SCUBA surveys of the marine habitat survey area, the analysis of essential fish habitat, and noise impact analysis. The provided figures showing the results of the biological resources survey have overlays for Project phase I (Figure 2) and Project phase II (Figure 3).

### Marine Habitats

The natural and man-made habitats observed and surveyed within the survey area were unvegetated soft bottom, vegetated soft bottom, docks and pilings, armored rocky bottom, intertidal riprap, intertidal seawall, and open water. Each marine habitat is discussed below.

#### *Unvegetated Soft Bottom*

The majority of the surveyed area is soft bottom, ranging in depth from intertidal to -30-feet mean lower low water (MLLW). The intertidal portions are mostly shoreline rip-rap and concrete seawall, but there are areas with intertidal soft bottom at the toe of rip-rap and areas with shoaled intertidal sand on the northwest side of the Joe's Crab Shack in the northwest corner of the survey area (Figure 2 and Figure 3). Shallow shoreline areas typically have a greater content of fine sands that quickly give way to mud moving toward deeper water.

*Typical soft bottom observed during the survey with signs of burrowing invertebrates and a juvenile barred sand bass.*

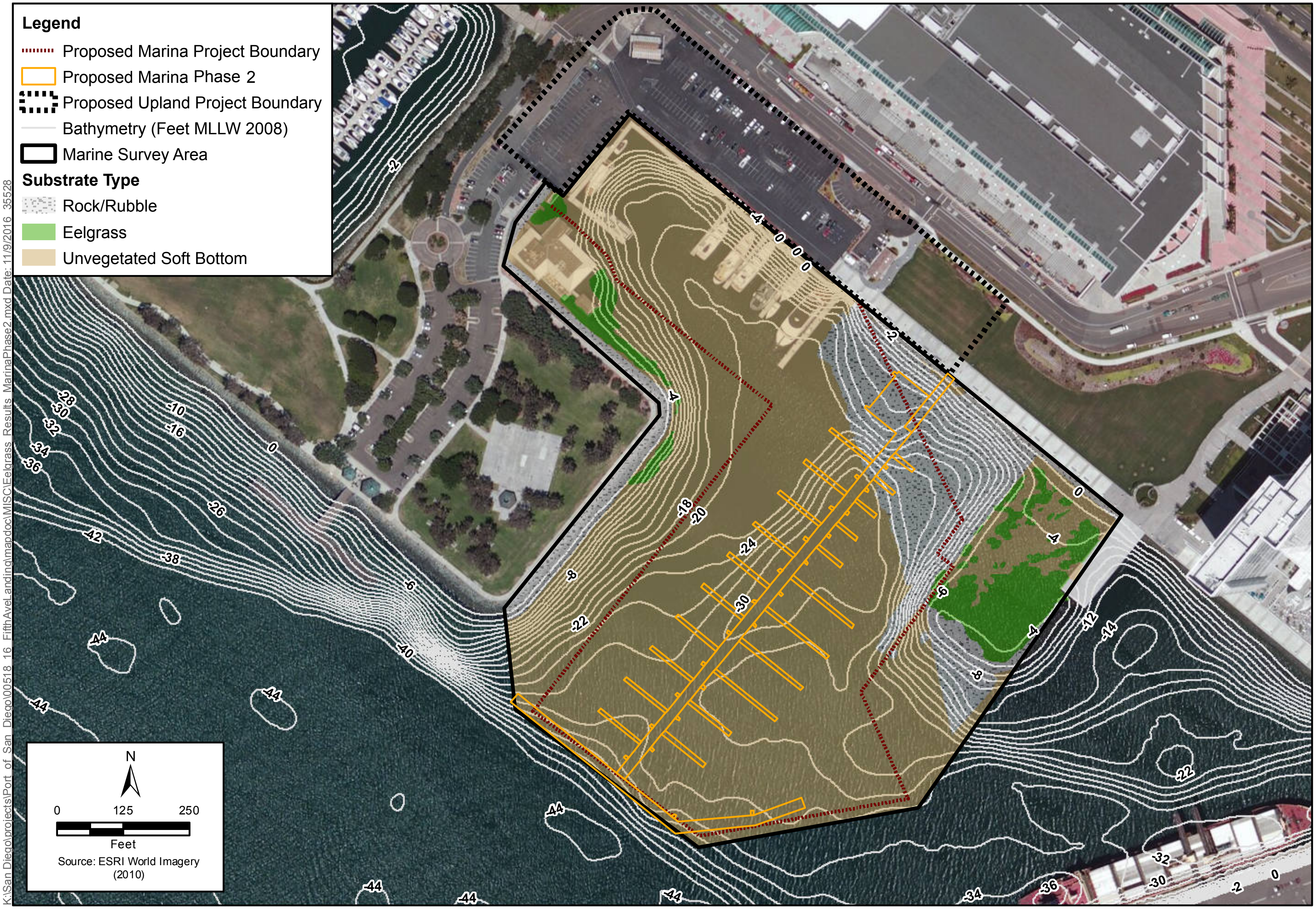
The most common invertebrate observed over unvegetated soft bottom areas was the tube-dwelling anemone (*Pachycerianthus fimbriatus*). Additionally, the mud showed evidence of numerous burrowing invertebrates, likely including bivalves, burrowing anemones, and amphipods. A core of mud representative of the unvegetated soft bottom habitat was collected and processed through a sieve. Inspection of the macrofauna retained by the sieve revealed a variety of infaunal polychaetes. Additionally, the exotic colonial bryozoan, *Zoobotryon verticillatum* was found in occasional clumps over soft bottom.

Source: ESRI World Imagery (2010)

K:\San Diego\projects\Port_of_San_Diego\00518_16_FifthAveLanding\mapdoc\MISC\Eelgrass_Results_MarinaPhase1.mxd Date: 11/9/2016 35528

**Figure 2**
**Proposed Marina Phase 1**
**Fifth Avenue Landing Project**

K:\San Diego\projects\Port of San Diego\00518 16 FifthAveLanding\mapdoc\MISC\Eelgrass Results MarinaPhase2.mxd Date: 11/9/2016 35528



Source: ESRI World Imagery (2010)

**Figure 3**
**Proposed Marina Phase 2**
**Fifth Avenue Landing Project**

Common motile invertebrates observed on the mud bottom included spiny lobster (*Panulirus interruptus*), California aglaja (*Navanax inermis*), and cloudy bubble snails (*Bulla gouldiana*). The observed lobsters were associated with debris items.

Fish species observed over unvegetated soft bottom included numerous round stingrays (*Urobatis halleri*). Fleeing flatfish were observed that were difficult to identify but likely included diamond turbot (*Hypsopsetta guttulata*) and California halibut (*Paralichthys californicus*). Barred sand bass (*Paralabrax nebulifer*) and spotted sand bass (*Paralabrax maculatofaciatus*) were also observed over unvegetated soft bottom.

### *Vegetated Soft Bottom*

*The upper boundary of a shoreline fringing eelgrass bed with a juvenile barred sand bass.*

Eelgrass occurs in localized portions of the un-shaded soft bottom habitats in areas adjacent to the Project area. Mapping of the side-scan sonar record identified 1.239 acre (0.502 hectare) of eelgrass within the survey area. Most of the eelgrass was outside of the current marina lease area; of the mapped eelgrass, there were approximately 1,238 square feet (115 square meters) of eelgrass within the current marina lease area. Eelgrass was found growing at depths ranging from approximately +1 to -8-feet MLLW (Figure 2 and Figure 3). Most of the eelgrass was located in two general areas. The first was the eelgrass mitigation site at the former Campbell Shipyard sediment remediation site. That is a 1.58-acre (0.64 hectare) shallow-water habitat site that was created as part of the sediment remediation project; the site is located southeast of the Project area and adjacent to the concrete mole pier that can be seen extending into the water in Figure 2 and Figure 3. The second area is the shoreline fringing eelgrass located northwest of the Project area. Shoreline eelgrass occurs at the toe of the rip-rap shoreline around Embarcadero Marina Park South and is interrupted by Joe's Crabshack. The eelgrass occurred in moderate density across much of the observed area. The eelgrass generally appeared to be healthy with minimal epiphyte loading. Eelgrass growing in shallow water along shore was typically shorter (less than 30 centimeters tall) relative to eelgrass in deeper water that was typically greater than 40-centimeters long.

In addition to eelgrass, there were small amounts of a Gracilarioid red alga (Family Gracilariaceae) observed within eelgrass beds. There were also minor amounts of the exotic bryozoan, *Zoobotryon verticillatum*, found within eelgrass beds.

Fish observed within the eelgrass included round stingrays, barred sand bass, and spotted sand bass. It is likely that the eelgrass beds support numerous other fish species not observed during the survey.

The most common invertebrate observed within eelgrass was the tube-dwelling anemone. The soft bottom associated with eelgrass was generally similar to unvegetated areas with evidence of numerous burrowing invertebrates, likely including bivalves, burrowing anemones, and amphipods. Common motile invertebrates observed included the California aglaja and cloudy bubble snails.

### *Docks and Piles*

*Mid-water view of the encrusting community on a concrete pile.*

A portion of the surveyed area is covered by existing floating docks and their associated piles. The upper reaches of the piles (approximately +2 to -2-feet MLLW) were generally colonized by a fouling community dominated by barnacles (*Balanus glandula* and *Chthamalus* sp.) and Pacific oyster (*Ostrea lurida*). the shallow sub-tidal portions of the piles were similar to the dock floats and were dominated by tunicates (*Styela clava, Ciona* sp. *Botrylloides* spp*.,* and others), various sponges (Porifera), *Z. verticillatum,* and encrusting bryozoans (*Eurystomella* sp.). There were minor amounts of algae associated with the dock floats and shallow sub-tidal portions of the piles including *Corallina spp*., *Dictyota flabellata,* sea lettuce (*Ulva lactuca*), *Mazzaella splendens,* and various foliose red algae (Rhodophyta). Moving toward deeper water on the piles, sponges, tunicates and bryozoans became dominant.

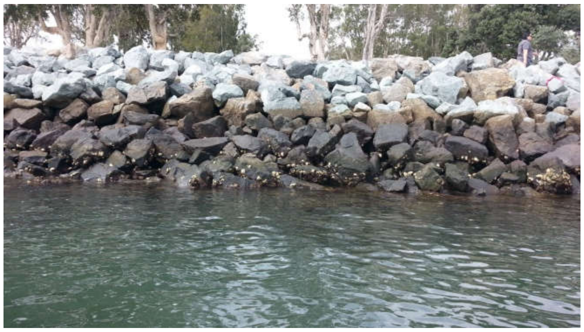
Fish observed around the piles and dock floats included giant kelpfish (*Heterostichus rostratus*), kelp bass (*Paralabrax clathratus*), opaleye (*Girella nigricans*), and barred sand bass. Schools of topsmelt (*Atherinops affinis*) were observed nearby while inspecting the docks.

### *Armored Rocky Bottom*

A portion of the surveyed area includes seafloor that was armored with rock rip-rap to prevent disturbance to the bottom after remediation associated with the former Campbell Shipyard. The rip-rap was placed on the bottom at a depth of approximately -30-feet MLLW and rises to intertidal depths where it protects the seawall. In the subtidal areas where the rip-rap was placed the rip-rap is mixed with soft sediments that have settled since the placement. The rip-rap mud complex provides a habitat that is relatively diverse.

The armored rocky bottom supported many invertebrates including tunicates, sponges, various nudibranchs (Nudibranchia), lobster, and California aglaja. Fishes observed included round stingray, kelp bass, and barred sand bass. The only notable alga was the invasive *Sargassum muticum*.

### *Intertidal Rip-rap and Seawall*



*Intertidal rip-rap on the Embarcadero Marina Park South shoreline. Small white "dots" on rocks are oyster.*

The rip-rap revetment along the northern shoreline was the same material used to armor the bottom as part of the Campbell Shipyard sediment remediation project. Larger rip-rap was observed on the shoreline around Embarcadero Marina Park South. All rocky intertidal rip-rap habitat supported oyster at higher elevations. The growth of green algae, primarily sea lettuce and the filamentous *U. intestinalis* was considerable on the high intertidal rip-rap along the northern seawall. Moving toward deeper intertidal and shallow subtidal depths lobster and two-spot octopus (*Octopus bimaculoides*) were observed and the alga, *S. muticum* was common. Multiple opaleye were observed while surveying along the shoreline rip-rap.

### *Open Water*

Schools of topsmelt were observed in the open water around and between the boat docks. It is likely that other schooling bait fish frequent the open waters of the marina, including slough anchovy (*Anchoa delicatissima*) and deepbody anchovy (*Anchoa compressa*) (Pondella and Williams 2009). These fish are important prey items for sea birds that can be expected to forage in the marina, including brown pelicans (*Pelecanus occidentalis californicus*), double-crested cormorants (*Phalacrocorax auritus*), grebes, and terns. While pelicans and terns were not observed during the survey, double-crested cormorants, and eared grebes (*Podiceps nigricollis*) were observed.

## Sensitive Species

Protected, rare, threatened, or endangered species that may occur within the region include east Pacific green sea turtle (*Chelonia mydas*) (Federal Threatened), California least tern (*Sternula antillarum browni*) (State Endangered and Federal Endangered), and California brown pelican (California Department of Fish and Wildlife Fully Protected). Mammals protected under the Marine Mammal Protection Act and likely to occur in central San Diego Bay include harbor seal (*Phoca vitulina*), California sea lion (*Zalophus californianus californianus*), common dolphin (*Delphinus spp.*), and coastal bottlenose dolphin (*Tursiops truncatus*). None of the above species were observed during the survey, though their likelihood of occurrence is as follows.

Individuals from the green sea turtle population that live in San Diego Bay are typically observed in south San Diego Bay. They are found throughout San Diego Bay and individuals have been tracked between San Diego and Mexico. Thus, animals may occasionally be found in the project footprint but most observations are in south San Diego Bay.

The California least tern is seasonally present in San Diego Bay, from April to September. The two closest nesting areas are Lindbergh Field and Naval Base Coronado. The Lindbergh Field nest site is approximately 2 miles (3.2 kilometers) away from the Project area; the Naval Base Coronado nest site is approximately 2.8 miles (4.4 kilometers) away from the Project area. Estimates of foraging distance vary by location and have been summarized by Harvey and Associates (2012). Atwood and Minsky found that 60% of foraging trips were limited to within 2 miles of nesting sites. Steinbeck et al. found 91% of surveyed birds within 3.5 miles of the colony and 98% within 4 miles. Due to the proximity of the Project area to local nesting sites in California least tern management area V (refer to USFWS 2006) it is likely that least terns occasionally forage within the Project area. However, California least tern usage of the marina area is likely negligible given the amount of open water foraging area between the Project area and the nesting sites. It is likely that California least terns foraging in San Diego Bay would find forage closer to the nesting sites. In other words, when considering that area increases faster than distance moving away from nest sites and birds are typically found foraging relatively close to nest sites, the likelihood of any significant foraging activity at the Project area is negligible.

California brown pelicans do not nest in San Diego Bay, but frequently loaf and forage in marina habitats. Harbor seals and California sea lions do not breed in San Diego Bay, but forage in the bay year round. Harbor seals and California sea lions are likely to be found occasionally using the Project area. The dolphin species commonly transit through central San Diego Bay, but are rarely observed within marina environments (personal observation R. Mooney).

## Essential Fish Habitat Assessment

The following assessment of Essential Fish Habitat (EFH) for Fifth Avenue Landing is provided in accordance with the 1996 amendments to the Magnuson-Stevens Fishery Management and Conservation Act (Code of Federal Regulations (CFR) Title 50, Chapter VI, Part 600). The amendments require the delineation of “essential fish habitat” for all managed species. Federal action agencies which fund, permit, or carry out activities that may adversely impact EFH are required to consult with the National Marine Fisheries Service (NMFS) regarding the potential effects of their actions on EFH, and respond in writing to the NMFS’s recommendations.

The CFR defines EFH as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. For the purpose of interpreting the definition of essential fish habitat: “Waters” include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; “substrate” includes sediment, hard bottom, structures underlying the waters, and associated biological communities; “necessary” means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and “spawning, breeding, feeding, or growth to maturity” covers a species' full life cycle.” A healthy ecosystem is defined under the CFR as, “an ecosystem where ecological productive capacity is maintained, diversity of the flora and fauna is preserved, and the ecosystem retains the ability to regulate itself. Such an ecosystem should be similar to comparable, undisturbed ecosystems with regard to standing crop, productivity, nutrient dynamics, trophic structure, species richness, stability, resilience, contamination levels, and the frequency of diseased organisms."

### *NMFS Managed Ichthyofauna Present in San Diego Bay*

To adequately address EFH at the project site, the federally managed fish species that are known or expected to exist at the project site need to be identified. The means of determining the presence of managed fish species in this document is through evaluation of the fish species identified during fisheries inventories of San Diego Bay. The San Diego Bay ichthyofauna have been thoroughly studied (Allen 1999, Pondella et al. 2006, Pondella and Williams 2009a, 2009b, 2011, Williams and Pondella 2012, Williams et al. 2015, 2016). Of the species identified within San Diego Bay during fisheries inventories, six are managed by the NMFS under two Fishery Management Plans (FMPs)-the Coastal Pelagics and Pacific Groundfish Management Plans (Table 1; NMFS 1998 and 2008). The fish species managed under the Coastal Pelagics FMP include northern anchovy, Pacific sardine, Pacific mackerel, and jack mackerel. The fish managed under the Pacific Groundfish FMP and found in San Diego Bay include California scorpionfish and English sole.

**Table 1. The federally managed coastal pelagic fish species and pacific groundfish species previously identified in San Diego Bay.**

| Common Name | Scientific Name |
|---|---|
| **Coastal Pelagics FMP** | |
| Northern Anchovy | *Engraulis mordax* |
| Pacific Sardine | *Sardinops sagax* |
| Pacific Mackerel | *Scomber japonicus* |
| Jack Mackerel | *Trachurus symmetricus* |
| **Pacific Groundfish FMP** | |
| California Scorpionfish | *Scorpaena guttata* |
| English Sole | *Parophrys vetulus* |

Henderson and Mooney (2001) developed life histories relative to evaluation of EFH for the managed fish species found in San Diego Bay using available literature. The following descriptions of the life histories of the six-managed species listed above provide the background information required to make a determination of the suitability of the project area to support and provide essential habitat for these species.

#### *Northern Anchovy*

Northern anchovy historically ranged from the Queen Charlotte Islands, British Columbia south to Cape San Lucas, Baja California. More recently, populations have moved into the Gulf of California, Mexico. Larvae and juveniles are often abundant in nearshore areas and estuaries with adults being more oceanic. However, adults can be abundant in shallow nearshore areas and well-circulated estuaries, and eggs and larvae have been found offshore. Northern anchovy are non-migratory but do make extensive inshore-offshore movements and along-shore movements. In some populations, juveniles and adults are observed moving into estuaries during spring and summer and then back out during the fall. Spawning occurs throughout the year dependent upon the population. In southern California, spawning occurs between January and May. Larvae consume copepod eggs and nauplii, naked dinoflagellates, rotifers, ciliates, and foraminiferans. Adults and juveniles typically consume phytoplankton, planktonic crustaceans, and fish larvae. Northern anchovy are one of the most abundant fish in the California current and are important prey for a variety of fish, birds, and marine mammals. Finally, they are considered an indicator of environmental stress, being affected by low dissolved oxygen and water-soluble fractions of crude oil (Emmett et al. 1991).

### Pacific Sardine

Pacific sardine is a pelagic species. Individuals can be found in estuaries, but are most common in open coastal habitats and offshore. The Pacific sardine is wide ranging with sardines in the Alguhas, Benguela, California, Kuroshio, and Peru currents, and off New Zealand and Australia being considered the same species. Changes in distribution are common and linked to environmental conditions. In California, sardines are highly mobile and move seasonally. Older adults move from southern California and northern Baja spawning grounds to feeding grounds off the Pacific Northwest and Canada. Younger individuals (two to four years old) migrate to feeding grounds in central and northern California. Juveniles occur in nearshore habitats off northern Baja and southern California. Although numbers vary greatly, at times sardines are the most abundant fish species in the California current. In southern populations spawning occurs year-round with a peak from April to August between Point Conception and Magdalena Bay. Eggs and larva are found everywhere adults are found. Sardines are planktivores consuming both phytoplankton and zooplankton. They are themselves prey for a variety of predators. Eggs and larvae are consumed by numerous planktivores with juvenile and adults being consumed by a variety of fish, birds, and mammals (NMFS 1998).

### *Pacific Mackerel*

Pacific mackerel is a pelagic species. In the northeastern Pacific, Pacific mackerel range from Banderas Bay, Mexico to southeastern Alaska. As a group they are the same species as mackerel of a variety of names occurring elsewhere in the Pacific, Atlantic, and Indian oceans. Pacific mackerel usually occur within 20 miles of shore. Local populations spawn from Eureka, California south to Cabo San Lucas, Baja California between 2 and 200 miles from shore with peak spawning occurring between late April and July. However, fecundity is more closely tied to sufficient food and environmental conditions than to season. Pacific mackerel larvae eat zooplankton including copepods and fish larvae. Juveniles and adults consume small fishes, fish larvae, squid and pelagic crustaceans. Pacific mackerel larvae are predated by numerous invertebrate and vertebrate planktivores. Juveniles and adults are important prey for many large fishes, marine mammals, and birds. Due to their larger size, they are likely less important as forage than Pacific sardine or northern anchovy which are available to a wider variety of predators and are more abundant (NMFS 1998).

### *Jack Mackerel*

Jack mackerel is a schooling fish that ranges widely throughout the northeastern Pacific.

Individuals are found along the mainland coasts to an offshore limit approximated by a line running from Cabo San Lucas, Baja California, to the eastern Aleutian Islands, Alaska. Typically, small jack mackerel (< 6 years of age) are most abundant near the mainland coast and islands in the Southern California Bight. Older individuals fill out the geographic range and are generally found offshore in deep water and along the coastline north of Point Conception, California. Jack mackerel spawn in nearshore oceanic waters between February and October in California, with peak spawning activity between March and July. Larvae eat primarily copepods with the small jack mackerel found off southern California consuming large zooplankton, juvenile squid and anchovy. Jack mackerel are prey items for large predators such as tunas and billfish.

#### *California Scorpionfish*

The California scorpionfish ranges from Santa Cruz, California south to Uncle Sam Bank, Baja California. It is a benthic species found in both sandy and rocky habitats. Individuals are predominantly solitary, but are known to aggregate near prominent features both natural and man-made. Young fish live in shallow habitats typically hidden within dense algae and bottom-encrusting organisms. Spawning occurs between May and September and peaks in July. Eggs are laid in a gelatinous mass that floats near the surface. The primary food items include juvenile crabs, small fishes (e.g. northern anchovy), octopus, isopods, and shrimp (Core Team 1998).

#### *English Sole*

English sole range from central Baja California to Unimak Island, Alaska. They occur in greatest numbers north of Point Conception, California. Juveniles are found in all Pacific coast estuaries from San Pedro Bay, California to Puget Sound with Elkhorn Slough, California being the southernmost estuary where they are abundant. Adults make limited movements with a northward migration in the spring to summer feeding grounds, returning in the fall. Spawning occurs over soft-bottom substrates at depths of 165-230 feet. Spawning occurs between December and April for southern stocks. Eggs are buoyant and larvae are pelagic. Adults and juveniles prefer soft sand and mud bottoms generally in less than 12 m of water. Larvae are planktivorous eating different life stages of copepods and other small planktonic organisms. Juveniles feed on copepods, gammaridean amphipods, cumaceans, mysids, polychaetes, small bivalves, clam siphons, and other benthic invertebrates. Adults eat a variety of benthic organisms, but particularly polychaetes, amphipods, molluscs, ophiuroids, and crustaceans. Larvae are likely eaten by larger fishes, with juveniles falling prey to larger fishes, marine mammals, and birds. Adults may be eaten by marine mammals, sharks and other large fishes. English sole are an indicator of environmental stress, accumulating contaminants and developing cancerous tumors as a result (Emmett et al. 1991).

### *Habitat Areas of Particular Concern*

In addition to provisions and definitions relating to EFH in general, the MSA encourages regional management councils to specify habitat areas of particular concern (HAPC) in their region. HAPC are defined for regionally important and potentially rare habitats that may be sensitive to environmental degradation.

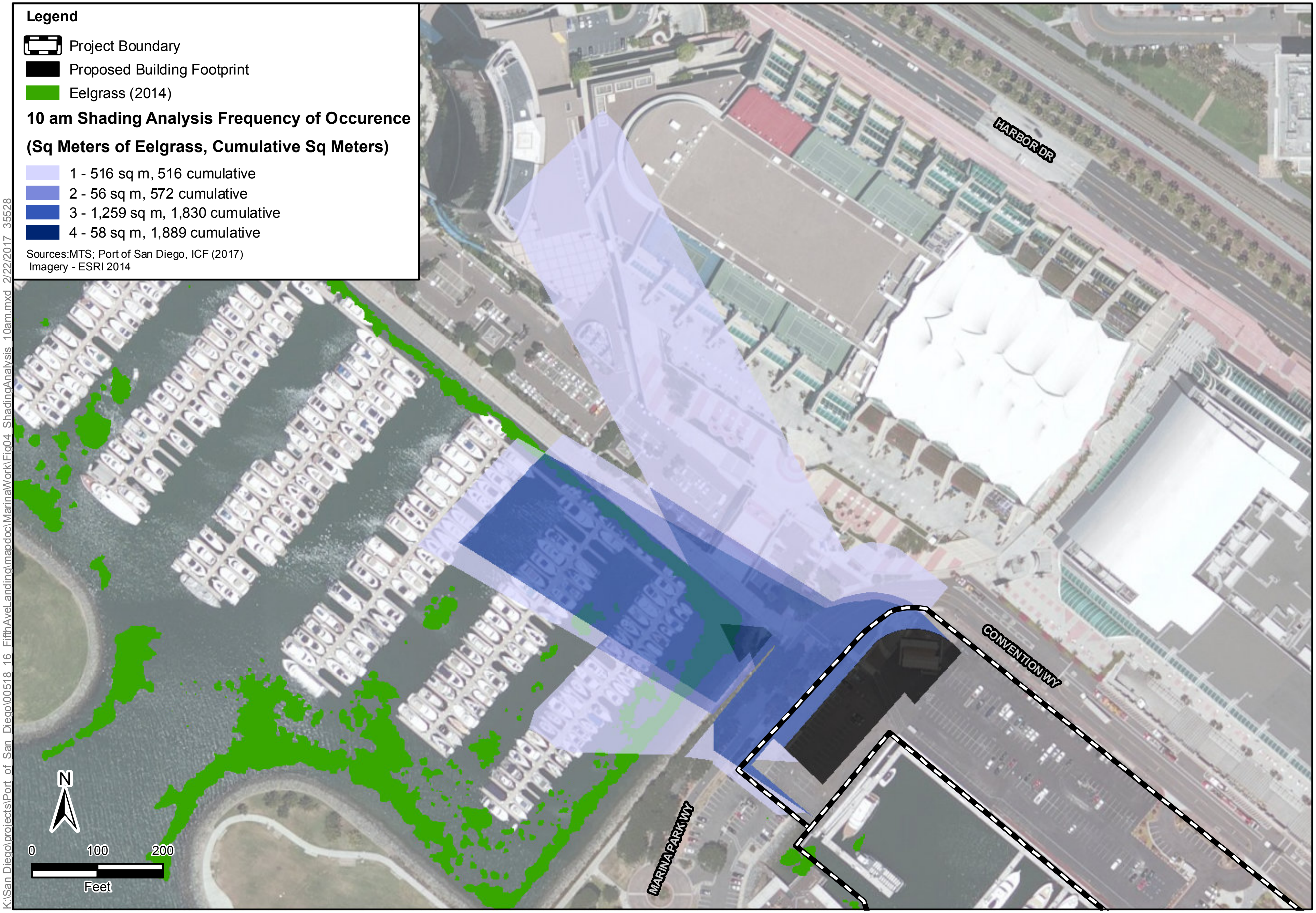
Seagrass habitat is present in the waters immediately adjacent to the Fifth Avenue Landing Project area and is designated as HAPC by the National Marine Fisheries Service (NMFS; NMFS 1999). The seagrass present at the marina is known as eelgrass (*Zostera marina*). Mooney and Woodfield (2009) summarized eelgrass functions and contributions to ecological processes:

> Eelgrass plays many important roles in estuarine systems. It clarifies water through sediment trapping and stabilization (de Boer 2007). It also provides the benefits of nutrient transformation and water oxygenation (Yarbro and Carlson 2008). Eelgrass serves as a primary producer in detritus-based food webs (Thresher et al. 1992) and is further directly grazed upon by invertebrates, fish, and birds (Valentine and Heck 1999), thus contributing to eco-system health at multiple trophic levels. Additionally, it provides physical structure in the form of habitat to the community and supports epiphytic plants and animals, which are in turn grazed upon by other invertebrates, fish, and birds. Eelgrass is also a nursery area for many commercially and recreationally important finfish and shellfish (Heck et al. 2003), including both those that are resident within the bays and estuaries, as well as oceanic species that enter the estuaries to breed or spawn. Among recreationally important species, sand basses and lobster make use of eelgrass beds as habitat. Besides providing important habitat for fish, eelgrass and associated invertebrates provide important food resources, supporting migratory birds during critical life stages, including migratory periods.

## Shading Analysis

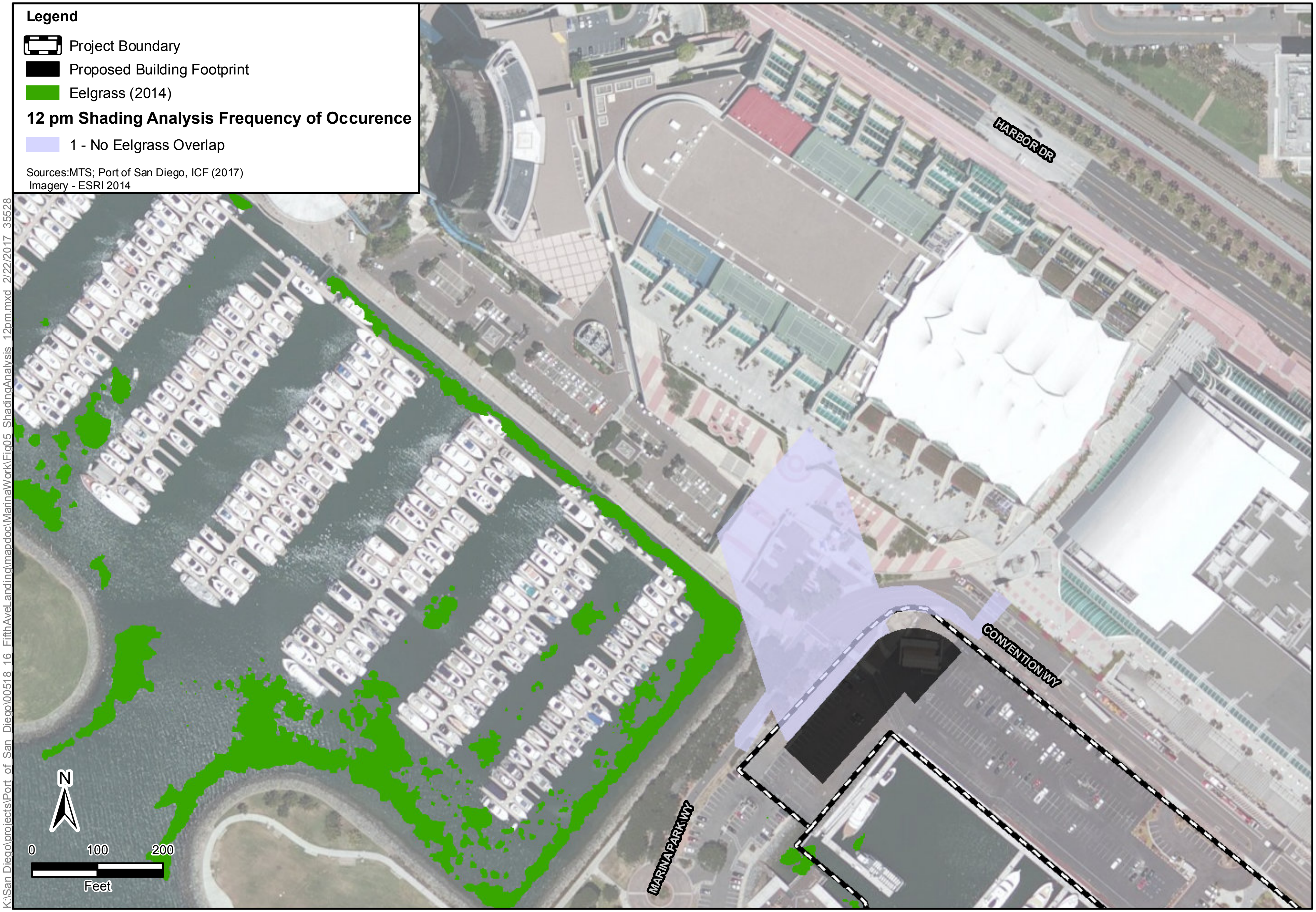
The results of the shading analysis show that morning sun aspect will produce areas with new over-water shading associated with the Project proposed buildings (Figure 4 and Figure 5). The evaluation relative to eelgrass shading did not evaluate shadows relative to early morning (sunrise and 8am). These time periods were ignored because the morning sun angle is so low on the horizon that changes in the amount of sunlight reaching the seafloor is likely negligible relative to the distribution of eelgrass at the site.

The results show that the only time period with the potential for meaningful new shading over eelgrass is 10 a.m. (Figure 4). Moreover, the newly shaded areas only intercept eelgrass in the adjacent Marriott Marina to the north of the Project site. By 12 p.m. the sun is high enough in the sky during all seasons such that there is no new shading associated with new structures over eelgrass beds. There is no shading over eelgrass in any time period or season after 12 p.m. The full shading analysis is provided as Appendix A.



K:\San Diego\projects\Port of San Diego\00518 16 FifthAveLanding\mapdoc\MarinaWork\Fig04 ShadingAnalysis 10am.mxd 2/22/2017 35528

Figure 4
10 am Eelgrass Shading Analysis
Fifth Avenue Landing Project



Sources:MTS; Port of San Diego, ICF (2017)
Imagery - ESRI 2014

K:\San Diego\projects\Port of San Diego\00518 16 FifthAveLanding\mapdoc\MarinaWork\Fig05 ShadingAnalysis 12pm.mxd 2/22/2017 35528

ICF

Figure 5
12 pm Eelgrass Shading Analysis
Fifth Avenue Landing Project

Although the amount of shading over eelgrass is temporally limited to the morning hours during all seasons, the potential extent of shading over eelgrass is spatially extensive. The shading analysis attempts to bracket the range of potential impacts by showing the shading at 10 a.m. across the seasons and plotting areas with shading in multiple seasons with increasingly darker shades of blue. Eelgrass beds that are shaded across multiple seasons are more likely to be impacted. The maximum eelgrass area covered by the 10 a.m. shadows is 1,889 square meters. There are 516 square meters of eelgrass predicted to be shaded during a single season, 56 square meters during two seasons, 1,259 square meters during three seasons, and 58 square meters shaded during all four seasons at 10 a.m. (Figure 4). The potential for impacts associated with these shaded areas is evaluated in the discussion section.

## Analysis of Pile Driving Noise

The analysis of in-water noise used peak ($L_{PK}$), root mean square (RMS), and sound exposure level (SEL) values of 188 decibels (dB), 176 dB, and 166 dB, respectively. These values were determined to be the potential worst case sound energy levels associated with driving 24-inch concrete piles after review of Buchler et al. (2015). The calculation of isopleths used assumptions of 75 strikes per pile and installation of 10 piles per day.

The results of the noise analysis relative to marine mammals found that all Level A isopleths relative to $L_{PK}$ thresholds were 1.2 meters or less for all marine mammal hearing groups (Table 2). The cumulative exposure isopleths for Level A ranged from a low of 2.2 meters for mid-frequency cetaceans to a high of 72.2 meters for high-frequency cetaceans (Table 2).

The isopleth for in-water behavioral disruption (Level B) to marine mammals was calculated at 117 meters using the NOAA threshold of 160 dB RMS and worst case selection of 176 dB RMS at source. In air, the 90 dB RMS threshold for harbor seals is achieved at 100 meters from source. For non-harbor seal pinnipeds, the 100 dB RMS threshold's isopleth is 32 meters from source (Table 3).

**Table 2. NMFS thresholds and calculated isopleths to thresholds for Level A harassment of marine mammals for each of the marine mammal hearing groups. Isopleths are in meters and thresholds are in dB.**

| Hearing Group | Low-Frequency Cetaceans | Mid-Frequency Cetaceans | High-Frequency Cetaceans | Phocid Pinnipeds | Otariid Pinnipeds |
|---|---|---|---|---|---|
| **$L_E$ Threshold** | 183 | 185 | 155 | 185 | 203 |
| **PTS Isopleth to $L_E$ Threshold** | 60.6 | 2.2 | 72.2 | 32.5 | 2.4 |
| **$L_{pk}$ Threshold** | 219 | 230 | 202 | 218 | 232 |
| **PTS Isopleth to $L_{pk}$ Threshold** | 0.1 | 0.0 | 1.2 | 0.1 | 0.0 |
| **Worst Case Threshold** | 60.6 | 2.2 | 72.2 | 32.5 | 2.4 |

**Table 3. NMFS thresholds and calculated isopleths to thresholds for Level B Harassment of marine mammals relating to "in air" and "in water" noise. Isopleths are in meters and thresholds are in dB RMS.**

| | In Water | In Air | |
|---|---|---|---|
| | All Marine Mammals | Harbor Seals | Non Harbor Seal |
| **Level B Threshold (dB RMS)** | 160 | 90 | 100 |
| **Level B Isopleth (meters)** | 117 | 100 | 32 |

The results of noise analysis relative to fishes used the same worst case scenarios and assumptions as those used for marine mammals. Applying the NOAA thresholds for physical injury and behavioral modification for fishes, allowed calculation of isopleths within which injury or behavioral modification may occur. Peak sound levels are not anticipated to result in physical injury to fishes given that peak sound levels are anticipated to be lower than the threshold for injury based on peak sound levels (Table 4). Worst case sound levels are anticipated to be high enough to result in the potential for physical injury to fishes due to cumulative sound exposure levels. Fishes greater than or equal to 2 grams are expected to be injured when they occur within 33 meters of pile driving. Fish less than 2 grams may be injured if they remain within 61 meters of pile driving (Table 4). Behavioral modification may occur for all fish occurring within 541 meters of pile driving (Table 4).

**Table 4. NMFS thresholds and calculated isopleths to thresholds for physical injury and behavioral effects in fishes. Physical injury for all fishes can occur if peak sound levels are above 206 dB or is cumulative sound exposure levels exceed 187 dB for fish ≥ 2 grams or 183 dB for fish < 2 grams. Behavioral modification is assumed to affect all fish at above 150 dB RMS.**

| | Onset of Physical Injury | | | Behavior |
|---|---|---|---|---|
| | Peak | Cumulative SEL dB | | RMS |
| | dB | Fish ≥ 2 g | Fish < 2 g | dB |
| **Threshold** | 206 | 187 | 183 | 150 |
| **Isopleth** | 1 | 33 | 61 | 541 |

## Discussion

The biological communities present at the Fifth Avenue Landing Project area are generally typical of the inner reaches of bays and harbors in the region and are not notably diverse, unique, or sensitive. The one exception is the expanse of relatively deep rip-rap. Rip-rap associated communities are typically found along the shoreline. The proposed changes to the dock layout pose no major biological constraints. However, the following are biological and permitting issues to consider across the entire Project for planning purposes.

The presence of eelgrass poses the greatest constraint to development activities. Eelgrass creates a unique marine habitat that serves many important functions in the bay environment, and is therefore given special status under the Clean Water Act, 1972 (as amended), Section 404(b)(10). The proposed Project has the potential to cause impacts to eelgrass that are difficult to quantify.

There are three areas of concern relative to eelgrass impacts associated with the Project features or the long-term use of the marina site. The first two areas include eelgrass beds that occur on northwest and southeast sides of the proposed phase 1 marina area. The design of the marina will mean that vessels will transit close to existing eelgrass resources located along the shore near Embarcadero Marina South and at the eelgrass habitat cap at the former Campbell Shipyard eelgrass mitigation site. Vessels transiting near these eelgrass beds may occasionally disturb eelgrass beds directly through contact with the bottom or with propeller wash as vessels transit over or adjacent to eelgrass. Mitigation measures along the Embarcadero Marina Park South shoreline could include installation of navigation aids noting the presence of shallow water. Protection of eelgrass resources at the former Campbell Shipyard eelgrass mitigation site requires additional evaluation. Given that the orientation of slips will require vessels to direct propeller wash toward the Campbell Shipyard eelgrass mitigation site, the potential range of velocities and associated scour should be modeled based on vessels likely to use the marina and at variable distances from the eelgrass mitigation site. This information can then be used to develop recommendations with regards to mitigation measures that can be implemented to avoid impacts if necessary.

The final area of concern with regards to eelgrass is the Marriott Marina to the north. The currently proposed buildings were modeled relative to shading and shown to cast morning shadows over eelgrass beds in the eastern corner of the Marriott Marina. The maximum extent of shading covers an estimated area of 1,889 square meters of eelgrass. The eelgrass data used to evaluate shading in the Marriott Marina was provided by the Port of San Diego and was collected as part of the 2014 baywide eelgrass inventory. It is unlikely that the shading associated with the Project will impact the maximum area shaded. The actual impact from shading is dependent upon the current light regime within the eelgrass beds and the extent to which current conditions may approach or exceed the saturating light levels for photosynthesis in eelgrass. Additionally, eelgrass can adapt somewhat to differences in light levels across its habitat (Park et al. 2016); however, leaf production rates under shaded conditions have shown to be reduced in deep water relative to shallow waters (Dennison and Alberte 1982). Hence, it is likely that given the minimal shading relative to daily photoperiod, eelgrass will adapt and still cover much of the area within the influence of the proposed structures. However, given the uncertainty with which eelgrass may respond, the Project proponents should work with NMFS to plan for some level of eelgrass impact. This should include monitoring for impacts after the Project implementation to help show any potential eelgrass cover and density loss within the shaded area. Moreover, development of an eelgrass mitigation plan prior to construction will provide the actions to be taken in the event the project results in impacts to eelgrass.

The greatest potential for the Project to impact eelgrass relates to water quality and potential scouring from increased vessel usage. The proposed marina facilities include a break water. The breakwater, as well as the draft of relatively large vessels in the marina, will restrict water circulation. The restriction in circulation would likely have a minimal but unpredictable impact to eelgrass beds in the areas inside of the breakwater. The same monitoring proposed above will allow analysis of any potential impacts following Project implementation.

Given the potential for long-term but unpredictable impacts to eelgrass, a monitoring plan will likely be required by the NMFS. The CEMP requires that pre-construction and post-construction eelgrass surveys be performed to evaluate projects that have the potential to impact eelgrass. In cases where impacts cannot be predicted or where the potential exists for protracted impacts that might not be present at the time of the post-construction survey, the typical requirement is for two years of post-construction monitoring data. This allows determination of impacts when there is long-term potential for impacts that cannot be determined from the post-construction eelgrass survey. Implementation of a 2-year (or longer) eelgrass monitoring program and development of a mitigation plan should be sufficient mitigation for this Project to proceed with an understanding that if monitoring shows that impacts occurred, then the mitigation plan would be implemented in accordance with the California Eelgrass Mitigation Policy (CEMP) (NMFS 2014).

In addition to design considerations, the Project should seek to avoid impacting eelgrass during construction. Indirect impacts may arise due to disturbance by construction vessels, pile installation, or increased turbidity. To avoid these impacts, Project implementation should minimize shading associated with staging of vessels or dock structures. Construction crews should incorporate techniques that avoid suspension of sediments that could reduce light transmittance through the water or settle on eelgrass directly.

Due to the known presence of eelgrass in areas adjacent to the Project area, state and federal permits will require pre- and post-construction eelgrass surveys be performed, whether or not impacts are anticipated. Surveys and any mitigation must be performed in accordance with the CEMP. If impacts cannot be avoided, the permitee will be required to prepare and implement an Eelgrass Mitigation Plan per the CEMP, which involves a compensatory restoration of lost eelgrass at a 1.2:1 ratio and a five-year monitoring and reporting program.

The eelgrass data presented in this report were collected as part of a broad program to characterize the marina habitats and as part of a baywide eelgrass inventory. As such, it should be used for planning and permitting purposes; not as a surrogate for a pre-construction eelgrass survey. The Project's pre-construction eelgrass survey should make use of extensive diver transect data to ensure mapping accuracy.

Another biological constraint to consider is a potential impact to California least terns from turbidity generated by Project activities such as dredging or pile jetting. This arises from concerns that elevated turbidity reduces visibility in the water and could impair foraging terns, which view prey fish from above and dive to catch them in surface waters. Most projects with such elements are required to utilize best management practices to mitigate turbidity and may only be permitted to perform certain work elements (e.g. pile driving) outside of least tern nesting season (April to September), allowing a work period from October to March. Although the potential for Project construction to impact California least terns is considered negligible due to proximity to nesting sites, most projects in southern California bays and harbors where California least terns occur are restricted to pile driving outside of the nesting season. Adherence to a construction schedule that prevents pile driving and bottom disturbing activities during the nesting season will help ensure that impacts are negligible.

An additional concern raised regionally by resource agencies reviewing similarly proposed projects is the increase in over-water coverage associated with Project structures (e.g. boat docks). This can lead to lower primary productivity due to shading and loss of open water for foraging by California least terns and other piscivorous birds. Given the proposed dock reconfiguration, this Project will have an increase in over-water cover. The increase in over-water coverage will require a mitigation action that is approved by regulatory agencies prior to implementation of the Project. Suitable mitigation might include restoration of upland riparian habitats, restoration of submerged aquatic vegetation (e.g. eelgrass), proposing ways to improve water quality, restoring other soft-bottom habitats such as mud flats, or paying an *in lieu* fee (once a program is developed).

It is not anticipated that the green sea turtle and other sensitive species noted above would be significantly impacted by the marina improvements or construction activities. The occurrence of the sea turtle and marine mammals in central San Diego Bay marina environments is low and the marina environment does not provide any notable habitat for these species. Thus, the potential for operational impacts is negligible. However, the pile driving associated with installation of additional docks may produce noise levels that can cause behavioral disruption of marine mammals and green sea turtles. Construction monitoring for these species within the maximum calculated isopleth (Level B, in water) for disruption of marine mammals during pile driving would reduce the potential to cause harm to all sensitive species to negligible.

The four-managed coastal pelagic fish species that occur in San Diego Bay are generally open water schooling species that would only occasionally be found in a marina environment in San Diego Bay. All of these species are highly mobile and not specifically dependent upon any particular habitat areas within the marina. Therefore, they would either flee construction activities or take advantage of potential prey opportunities due to disturbance during construction. Thus, the potential of dock reconfiguration and replacement to impact this fish community is considered to be negligible.

The two-managed pacific groundfish species occur in low numbers in San Diego Bay and are not likely to be common within the marina area. If the demersal species noted were to occur in the Project area, they would likely flee any immediate construction activities but may benefit from exposure of prey items over disturbed bottom following certain construction activities. Given there is minimal chance the species can be found in the area, the fact that critical life stages are not tied to habitat in the area, the potential for Project activities to cause harm to EFH for pacific groundfish is considered to be negligible.

The potential to impact the managed fish species and associated habitats is arguably negligible based on the managed fish species in San Diego Bay and their habitat usage for foraging, breeding, and spawning. However, NMFS identifies cumulative impacts associated with over-water structures. The most significant impacts cited by NMFS relate to losses of primary productivity, the potential to distribute invasive species, and increases in associated uses such as vessels which increase potential for bottom scarring and release of contaminants NMFS 2013. For these reasons, mitigation relating to the increase in over-water cover is warranted even though impacts at the scale of the project may not be measurable. However, the mitigation measure implemented in relation to over-water coverage mentioned above in relation to sensitive avian species should be developed in a manner that also provides benefits to fisheries. In other words, the mitigation for increased overwater coverage should be developed in a manner that is suitable to resource agencies responsible for management of avian species and fisheries.

The greatest potential for direct harm to fishes from the Project will occur during pile driving. Sounds associated with pile driving will exceed NOAA established thresholds and can cause injury due to cumulative effects of sound exposure. However, for these impacts to occur, fish must remain within the calculated 61-meter isopleth for an equivalent 24-hour exposure period. It is unlikely for fish to remain within such a narrow zone throughout a day of pile driving if the sound levels are truly impactful. Procedures such as soft starts can further reduce potential impacts by allowing fish to flee areas adjacent to pile driving before full impact energy is applied. Behavioral impacts to fishes may also occur; however, such impacts would be temporary.

## References

Allen, L.G. 1999. Fisheries inventory and utilization of San Diego Bay, San Diego, California. Final report. Nearshore Marine Fish Research Program, Department of Biology, California State University, Northridge.

Atwood, J.L. and D.E. Minsky. 1983. Least tern foraging ecology at three major California breeding colonies. Western Birds 14:57-72.

de Boer, W.F. 2007. Seagrass-sediment interactions, positive feedbacks and critical thresholds for occurrence: a review. Hydrobiologia 591 (1): 5-24.

Dennison, W.C. and R.S. Alberte. 1985. Role of daily light period in the depth distribution of *Zostera marina* (eelgrass). Marine Ecology Progress Series 25: 51-61.

Harvey & Associates. 2012. Least Tern Literature Review and Study Plan Development, Final Report. Prepared for U.S. Army Corps of Engineers, February 2012.

Heck, K.L., G. Hays, and R.J. Orth. 2003. Critical evaluation of the nursery role hypothesis for seagrass meadows. Marine ecology progress series 253:123-136.

Henderson, H.D. and R.C. Mooney. 2001. Essential fish habitat assessment for the Port of San Diego Harbor Police and transient vessel dock replacement project, Shelter Island, San Diego, California. Prepared for Port of San Diego. 12 pp.

[MTS and ICF] Marine Taxonomic Services and ICF International. 2016. Acoustic Monitoring Plan for the Shelter Island Boat Launch Facility Improvements Project. Prepared for the Port of San Diego Environmental and Land use Management Department. October 2016.

Mooney, R.C. and R.A. Woodfield. 2009. Eelgrass and cordgrass (Chapter 4). *In, Batiquitos Lagoon long-term biological monitoring program final report 2009.* Prepared by Merkel & Associates. Prepared for City of Carlsbad Planning Department and The Port of Los Angeles Environmental Management Division.

[NMFS] National Marine Fisheries Service, Southwest Region. 2013. Essential Fish Habitat Programmatic Consultation for Overwater Structures between the National Oceanic and Atmospheric Administration's National Marine Fisheries Service and the United States Army Corps of Engineers, South Coast Branch, Los Angeles District. Available at http://www.westcoast.fisheries.noaa.gov/habitat/fish_habitat/efh_consultations_go.html

[NMFS] National Marine Fisheries Service, Southwest Region. 2014. California Eelgrass Mitigation Policy.

[NMFS] National Marine Fisheries Service. 2016a. Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing: Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts. U.S. Department of Commerce, NOAA. NOAA Technical Memorandum NMFS-OPR-55, 178 p.

[NMFS] National Marine Fisheries Service. 2016b. Interim Sound Threshold Guidance. Available online at: http://www.westcoast.fisheries.noaa.gov/protected_species/marine_mammals/threshold_guidance.html.

Park, S.R., S. Kim, Y.K. Kim, C.K. Kang, and K.S. Lee. 2016. Photoacclimatory responses of *Zostera marina* in the intertidal and subtidal zones. PLoS ONE 11(5): e0156214. Doi: 10.1371/journal.pone.0156214.

Pondella, D.J., II, J. Froeschke, and B. Young. 2006. Fisheries Inventory and Utilization of San Diego Bay, San Diego California for surveys conducted in April and July 2005. February 2006. 103 pp.

Pondella, D. J. and J. P. Williams. 2009a. Fisheries Inventory and Utilization of San Diego Bay, San Diego, California for Surveys Conducted in June 2009. Prepared for the Port of San Diego. 29 pp.

Pondella, D. J. and J. P. Williams. 2009b. Fisheries Inventory and Utilization of San Diego Bay, San Diego, California for Surveys Conducted in April and July 2008. Prepared for the Port of San Diego. 68 pp.

Steinbeck, J.R., C.P. Ehler, J.E. Roth, M.L. Elliot, A. Abraham, W.J. Sydeman, and A. Ziodis. 2005. Oakland Harbor Deepening Project (-50'): Least Tern, Fish, and Plume Monitoring Final Report, Project Year 2004. Tetra Tech, Inc., San Francisco, California. March 2005.

Thresher, R.E., P.D. Nichols, J.S. Gunn, B.D. Bruce, and D.M. Furlani. 1992. Seagrass detritus as the basis of a coastal planktonic food chain. Limnology and oceanography 37(8):1754-1758.

[USFWS] United States Fish and Wildlife Service. 2006. California least tern (Sternula antillarum browni) 5-year review summary and evaluation. Prepared by U.S. Fish and Wildlife Service Carlsbad Fish and Wildlife Office. Carlsbad, California. Sept 2006.

Valentine, J.F., and K.L. Heck. 1999. Seagrass herbivory: Evidence for the continued grazing of marine grasses. Marine ecology progress series 176:291-302.

Williams, J.P. and D.J. Pondella. 2012. Fisheries Inventory and Utilization of San Diego Bay, San Diego, California for Surveys Conducted in April and July 2012. Prepared for the Port of San Diego. September 2012. 66 pp.

Williams, J.P., D.J. Pondella, C.M. Williams, S. Schwab. 2015. Fisheries Inventory and Utilization of San Diego Bay, San Diego, California for Surveys Conducted in April and July 2015. Prepared for the Port of San Diego. September 2015. 64 pp.

Williams, J.P., D.J. Pondella, C.M. Williams, M.J. Robart. 2016. Fisheries Inventory and Utilization of San Diego Bay, San Diego, California for Surveys Conducted in April and July 2016. Prepared for the Port of San Diego. November 2016. 68 pp.

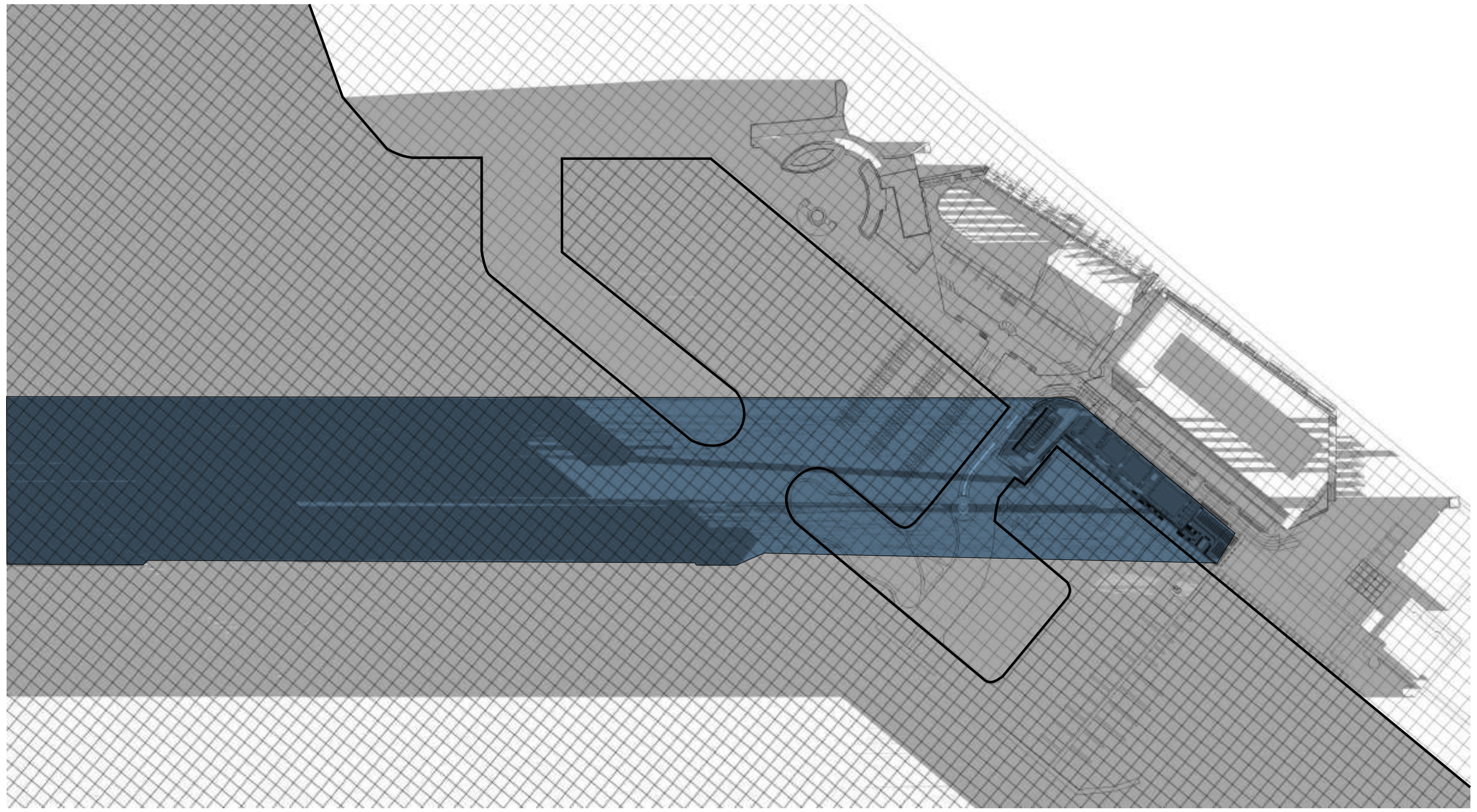
Yarbro, L.A., and P.R. Carlson. 2008. Community oxygen and nutrient fluxes in seagrass beds of Florida Bay, USA. Estuaries and coasts 31(5):877-897.

# Appendix A

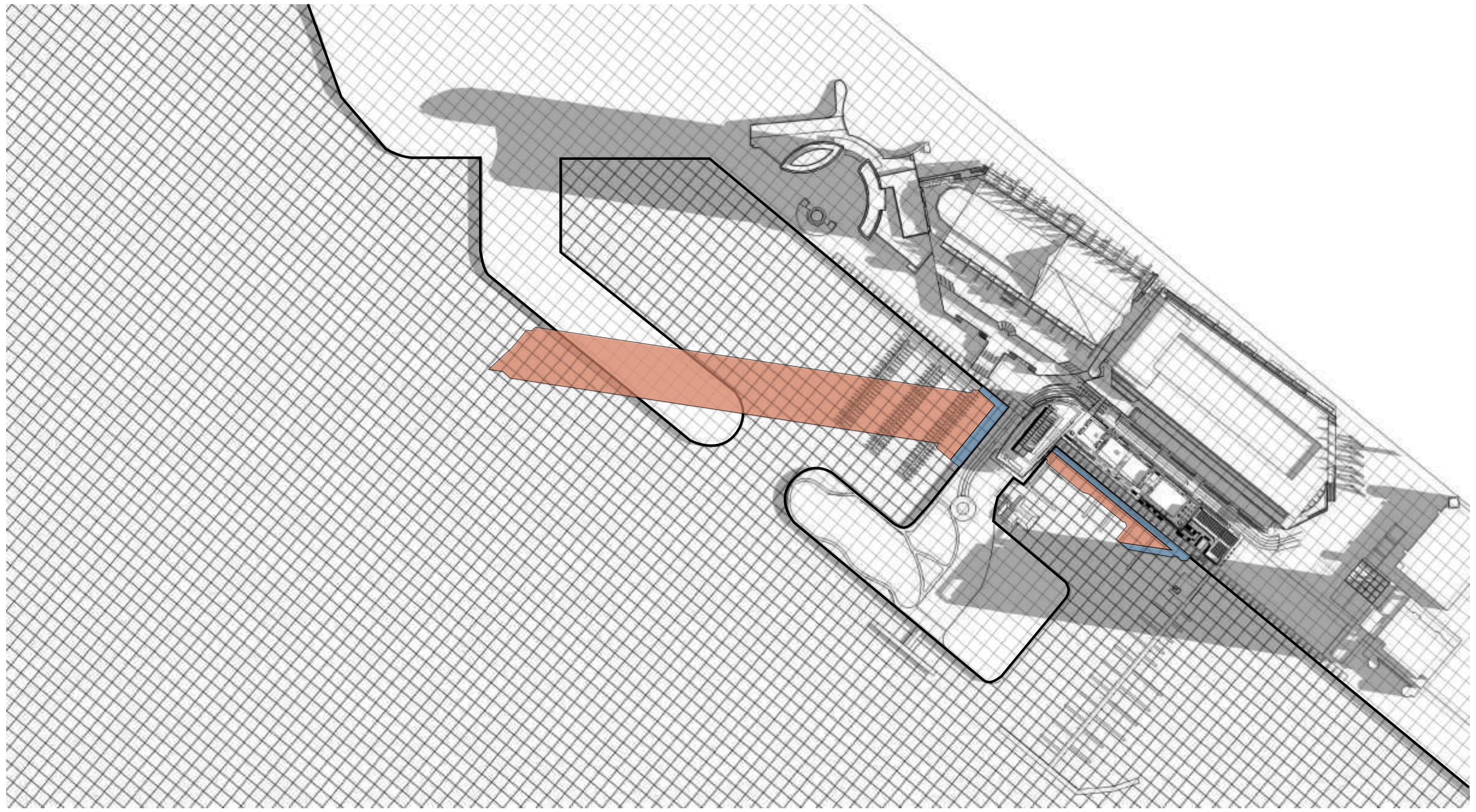
## Shading Analysis

# 5TH AVENUE LANDING
# WATER SHADOW STUDY

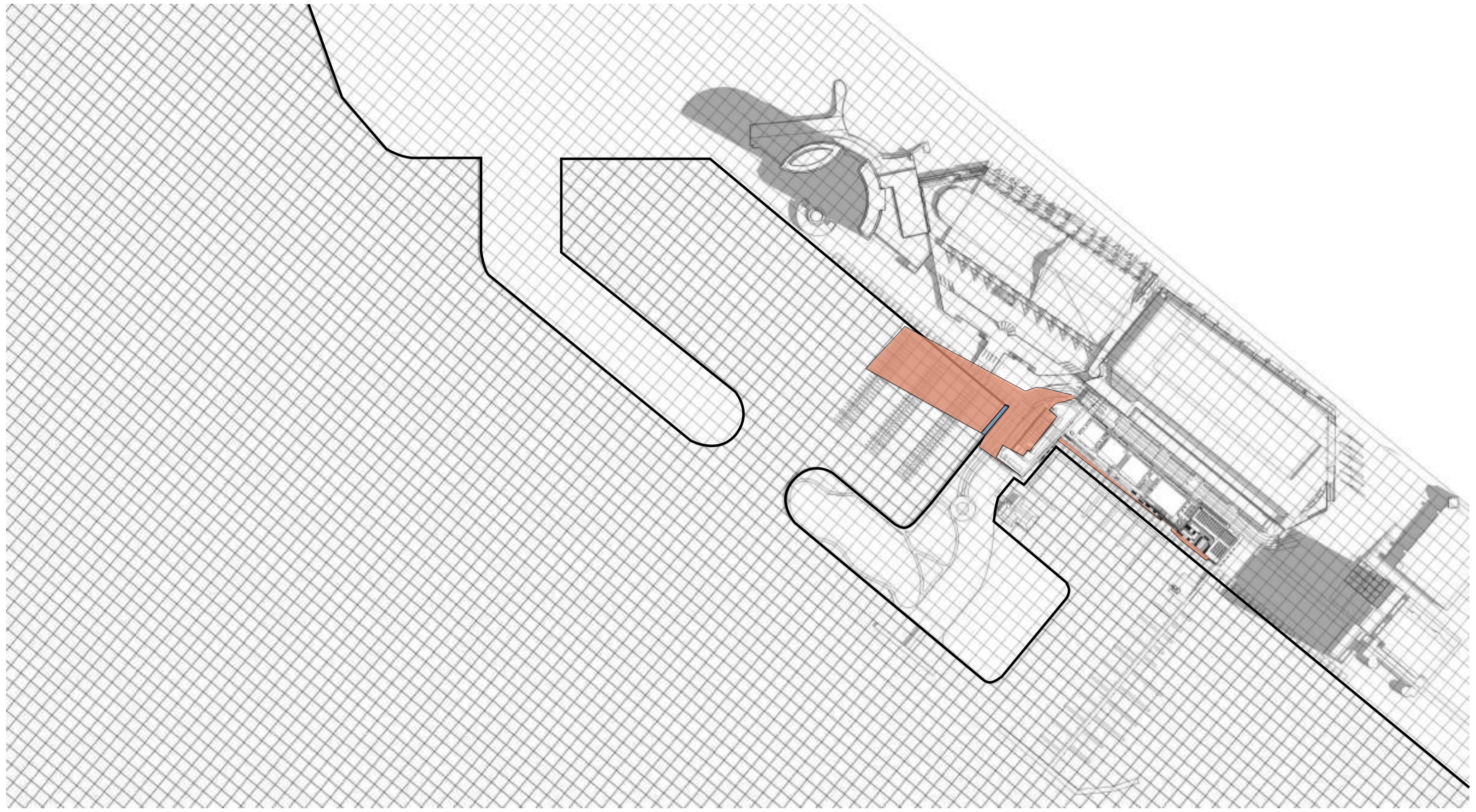
SAN DIEGO, CA 01.04.2017



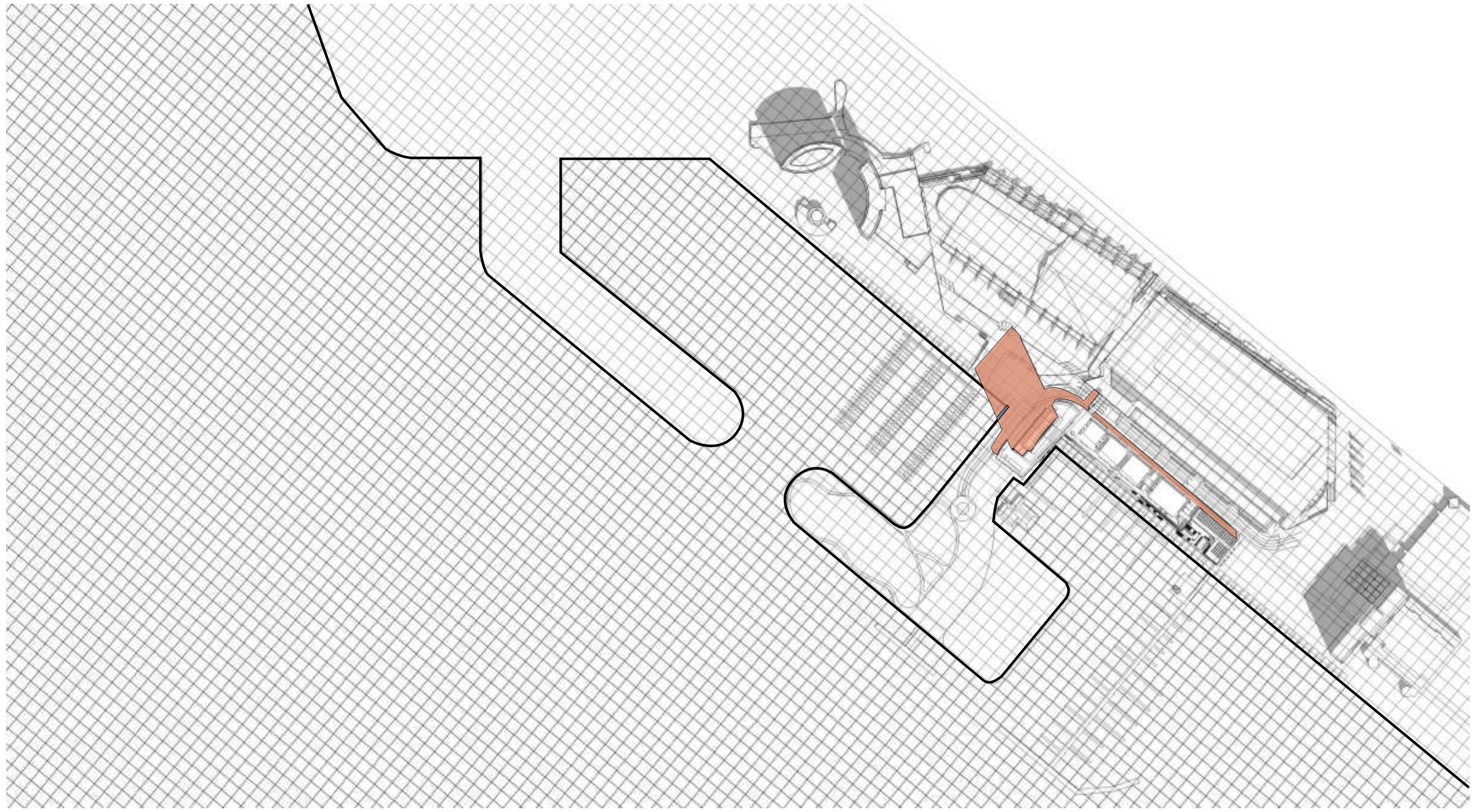
SUNRISE



8 AM



10 AM



12 PM

# SHADOW STUDY: **MAR 21** *//UTC -7_PDT//*

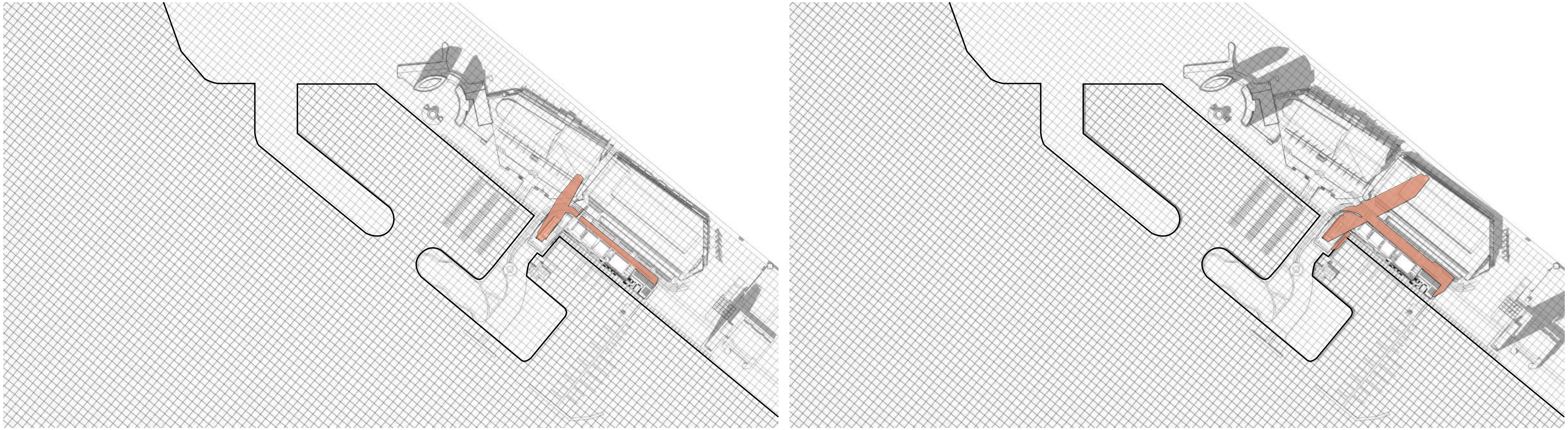
55.7553.000 01.04.2017

- N 50' X 50' GRID
- 🟧 NEW SHADED AREA
- 🟦 OVERLAP EXISTING SHADED AREA
- ⬜ EXISTING SHADED AREA
- ╱ SHORELINE

FIFTH AVENUE LANDING
HOTEL & MARINA

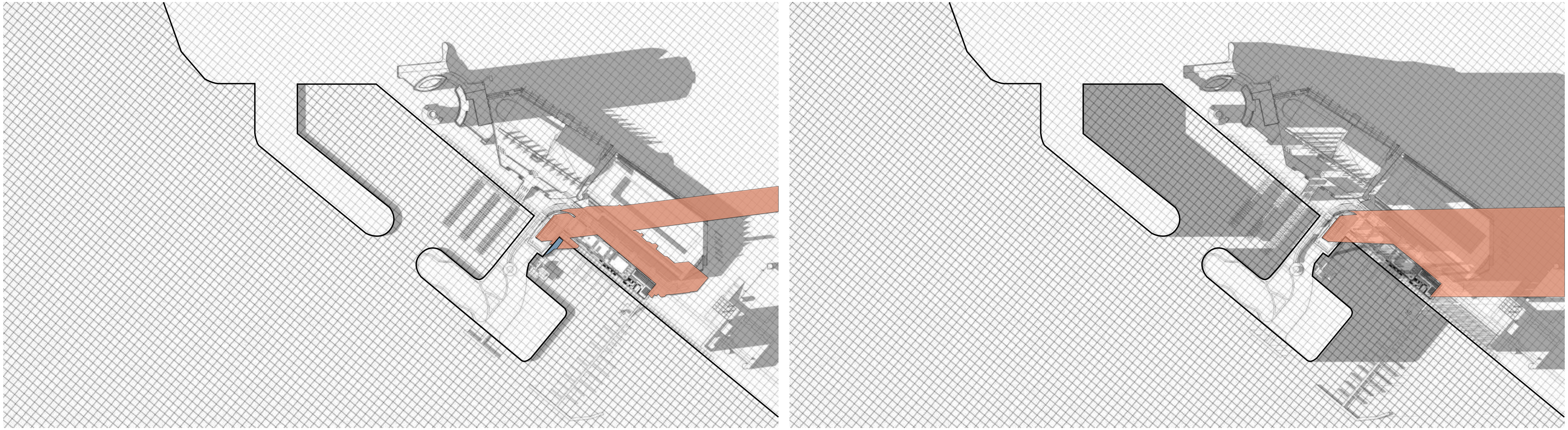
THE ROBERT GREEN COMPANY

Gensler



2 PM

4 PM



6 PM

SUNSET

# SHADOW STUDY: **MAR 21** *//UTC -7_PDT//*

55.7553.000 01.04.2017

N 50' X 50' GRID

🟥 NEW SHADED AREA

🟦 OVERLAP EXISTING SHADED AREA

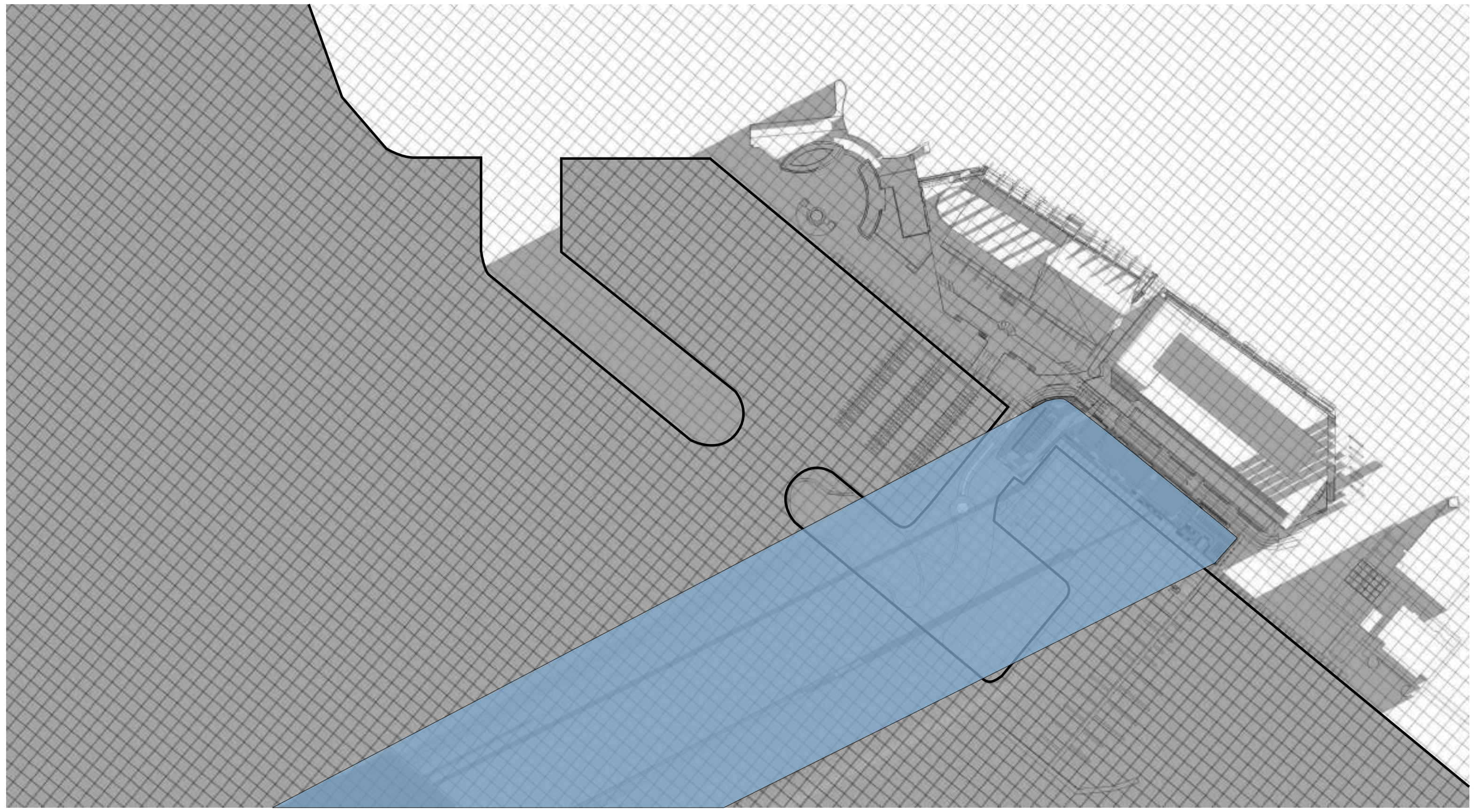
⬜ EXISTING SHADED AREA

/ SHORELINE

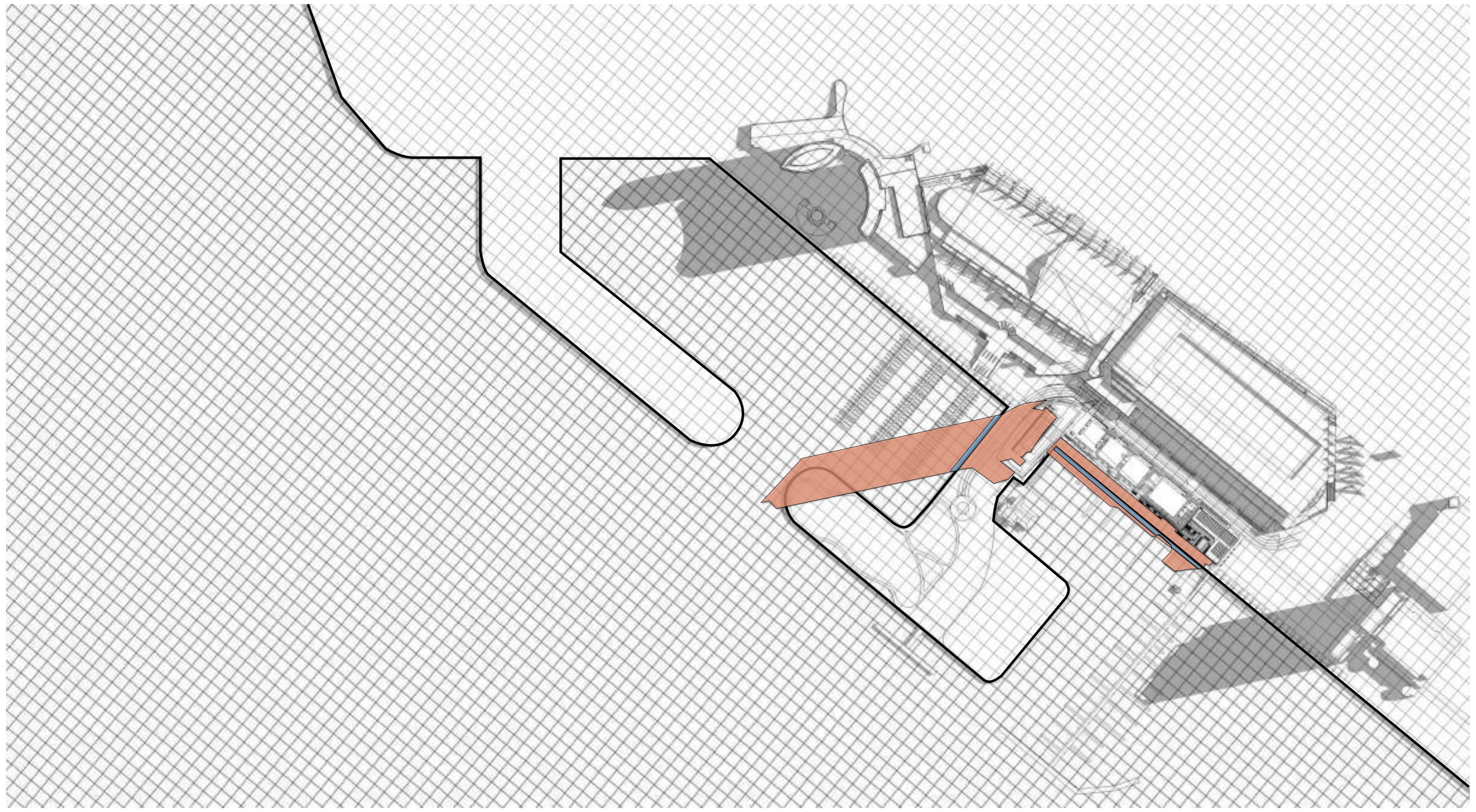
FIFTH AVENUE LANDING HOTEL & MARINA

THE ROBERT GREEN COMPANY

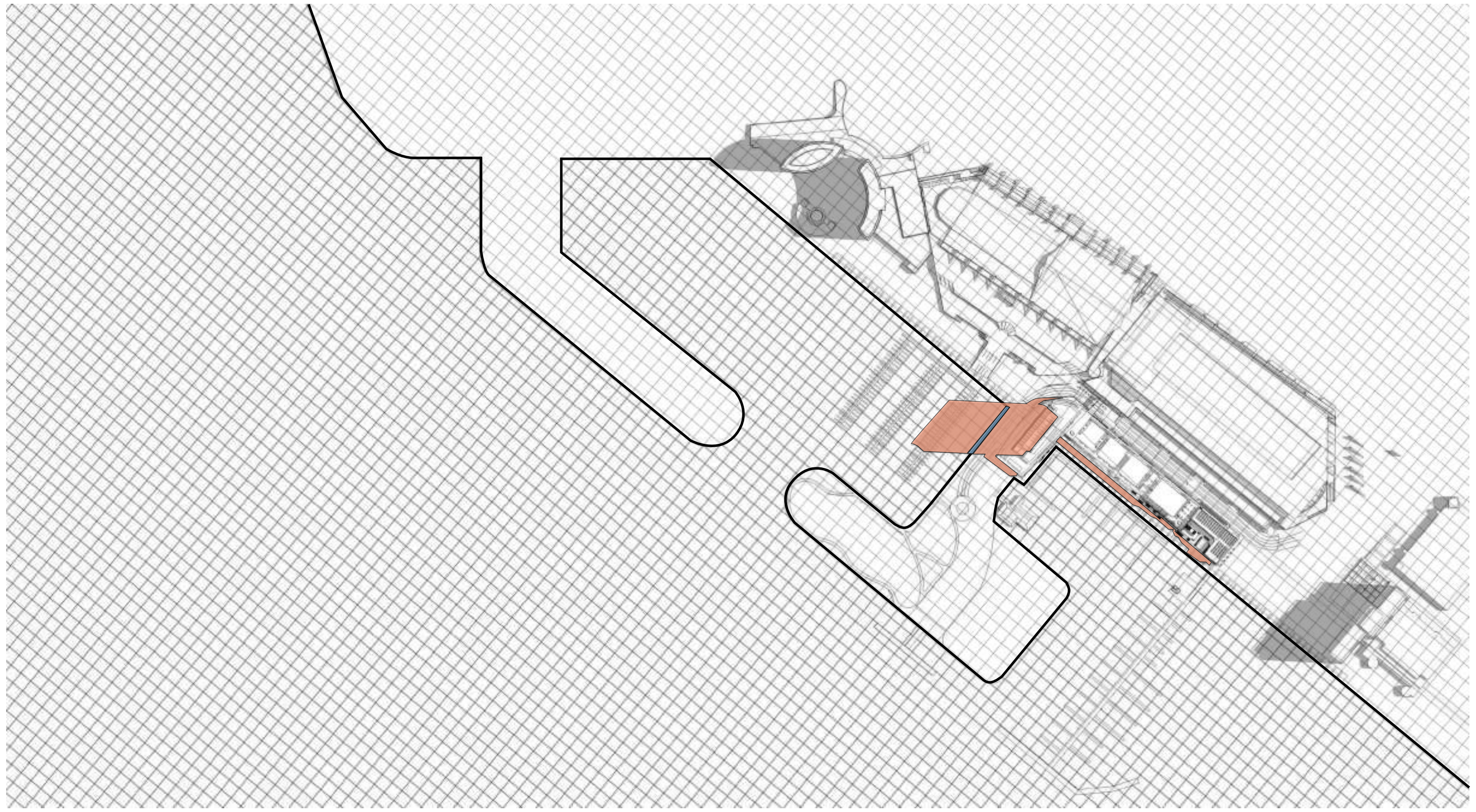
Gensler



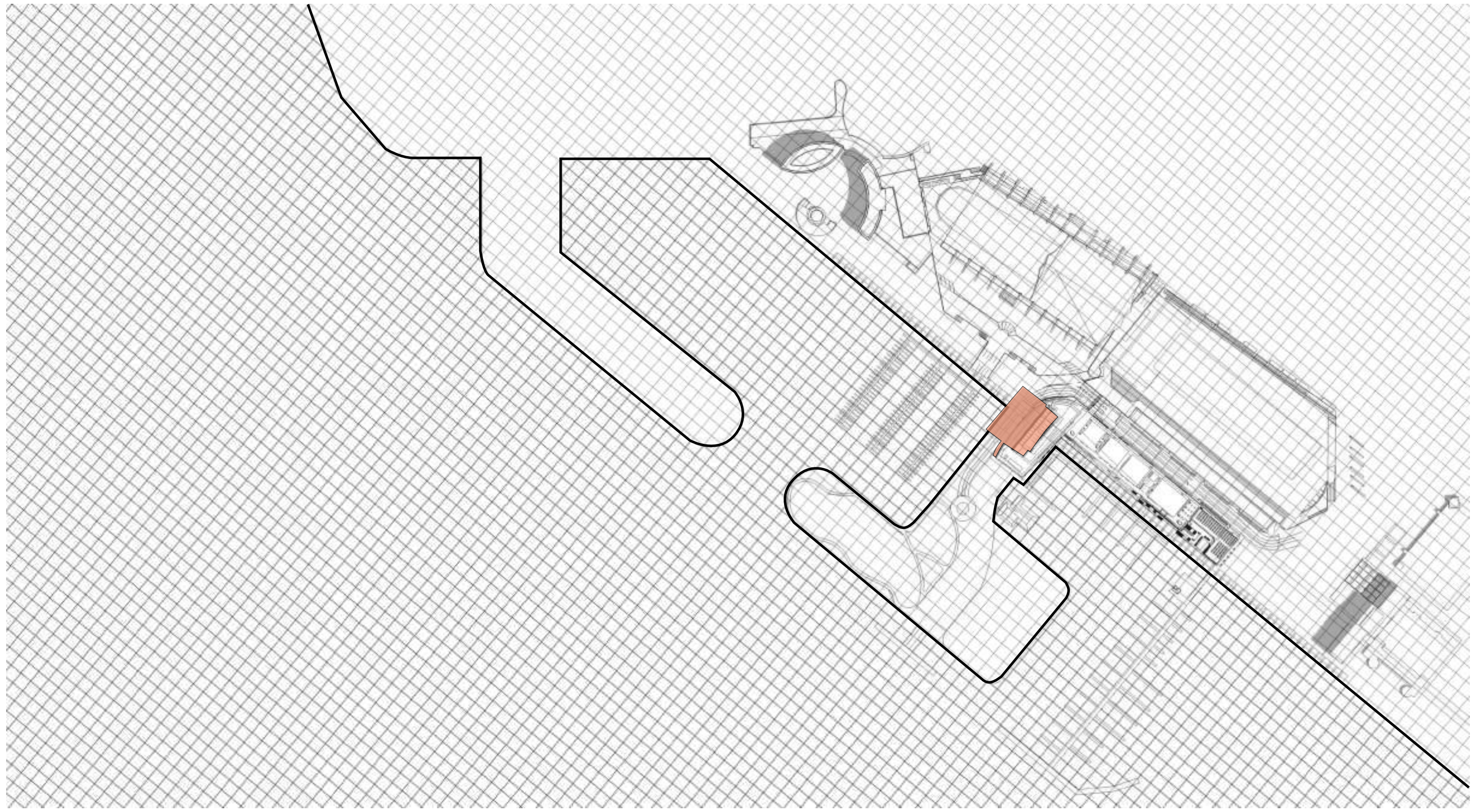
SUNRISE



8 AM



10 AM



12 PM

# SHADOW STUDY: **JUN21** *//UTC -7_PDT//*

55.7553.000 01.04.2017

- ⊕ 50’ X 50’ GRID
- 🟧 NEW SHADED AREA
- 🟦 OVERLAP EXISTING SHADED AREA
- ▨ EXISTING SHADED AREA
- / SHORELINE

FIFTH AVENUE LANDING HOTEL & MARINA

THE ROBERT GREEN COMPANY

Gensler

2 PM

4 PM

6 PM

SUNSET

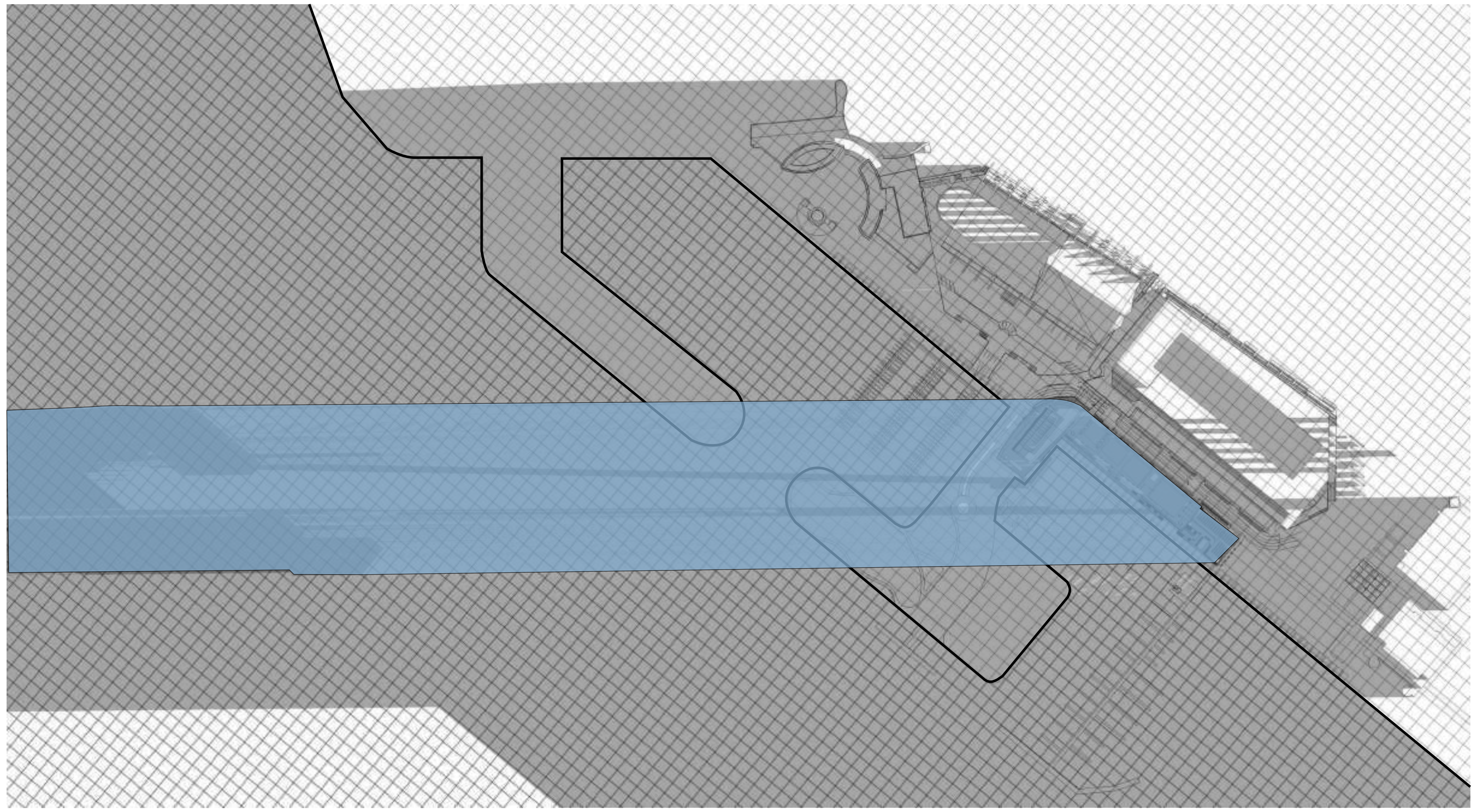
## SHADOW STUDY: **JUN21** *//UTC -7_PDT//*

- N 50' X 50' GRID
- 🟧 NEW SHADED AREA
- 🟦 OVERLAP EXISTING SHADED AREA
- ⬜ EXISTING SHADED AREA
- / SHORELINE

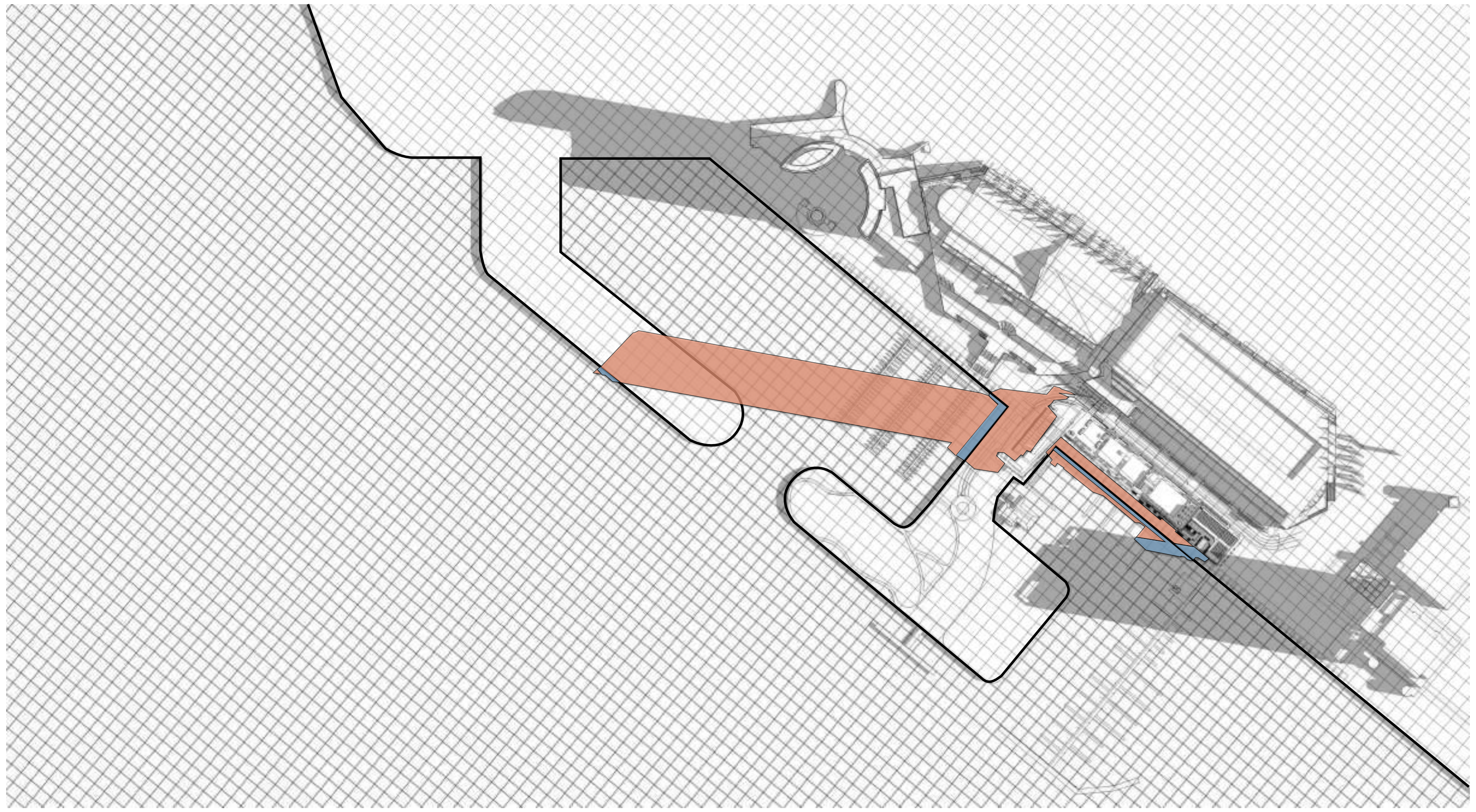
FIFTH AVENUE LANDING HOTEL & MARINA

THE ROBERT GREEN COMPANY

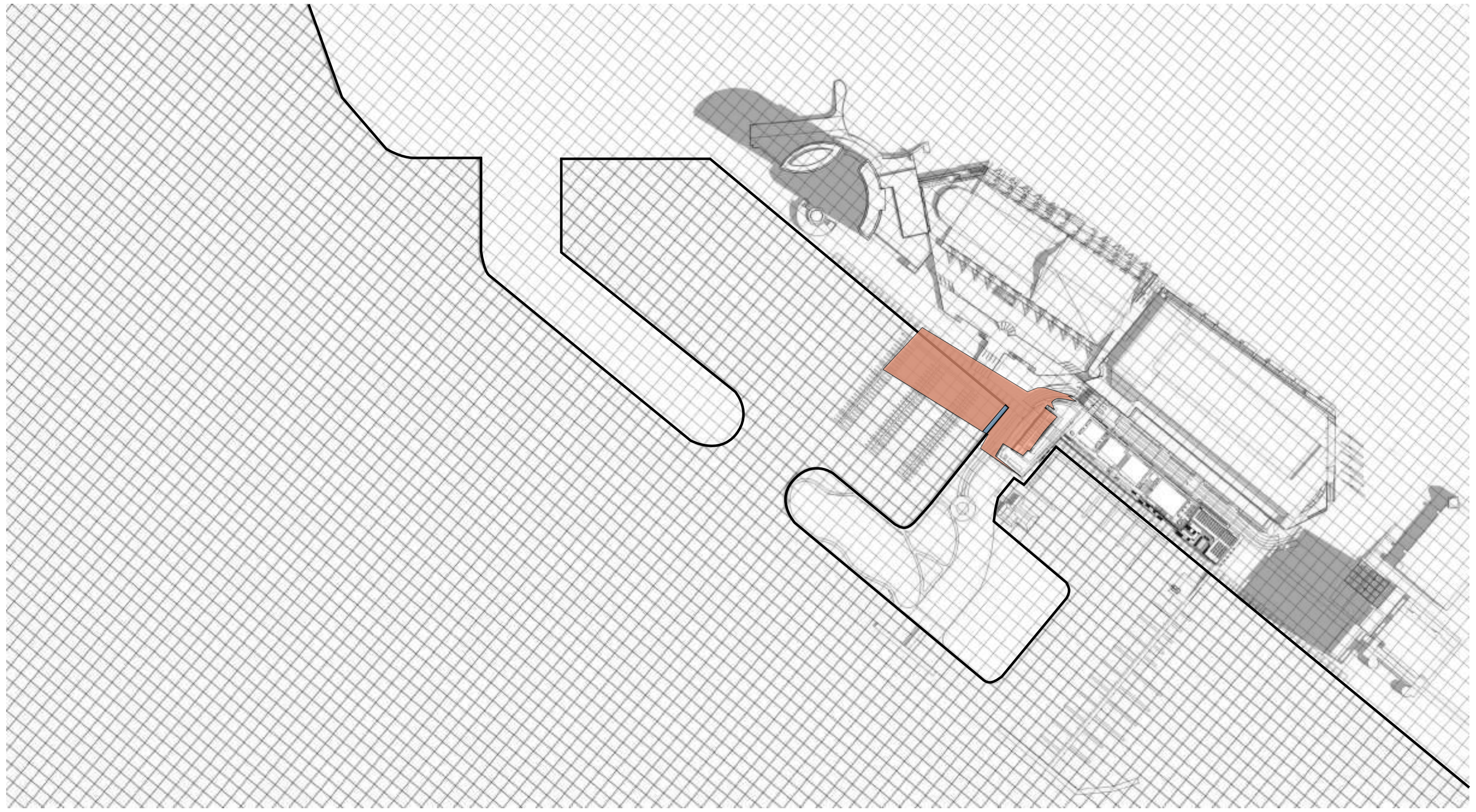
Gensler



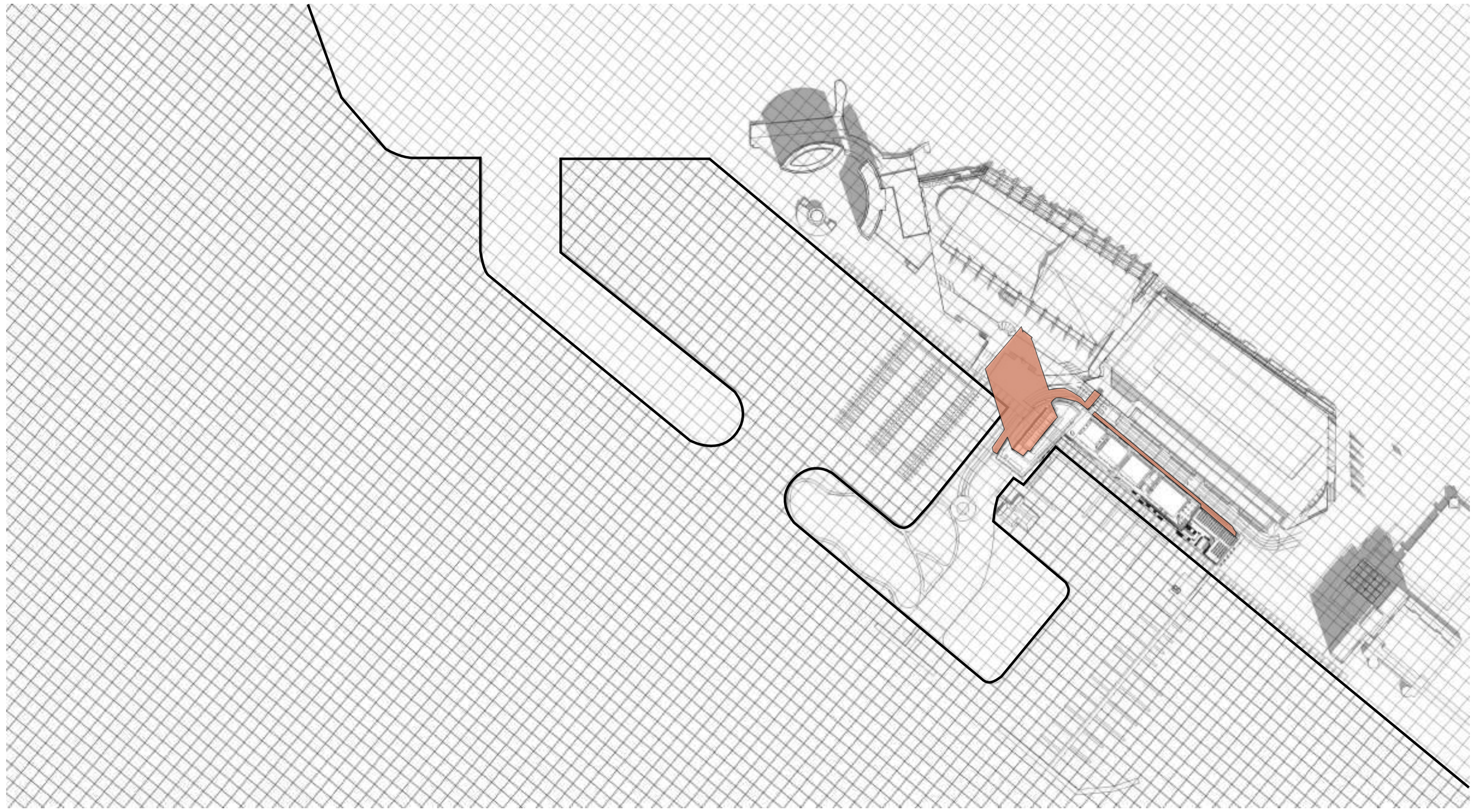
SUNRISE



8 AM



10 AM



12 PM

# SHADOW STUDY: **SEP 21** *//UTC -7_PDT//*

50' X 50' GRID

🟧 NEW SHADED AREA

🟦 OVERLAP EXISTING SHADED AREA

⬜ EXISTING SHADED AREA

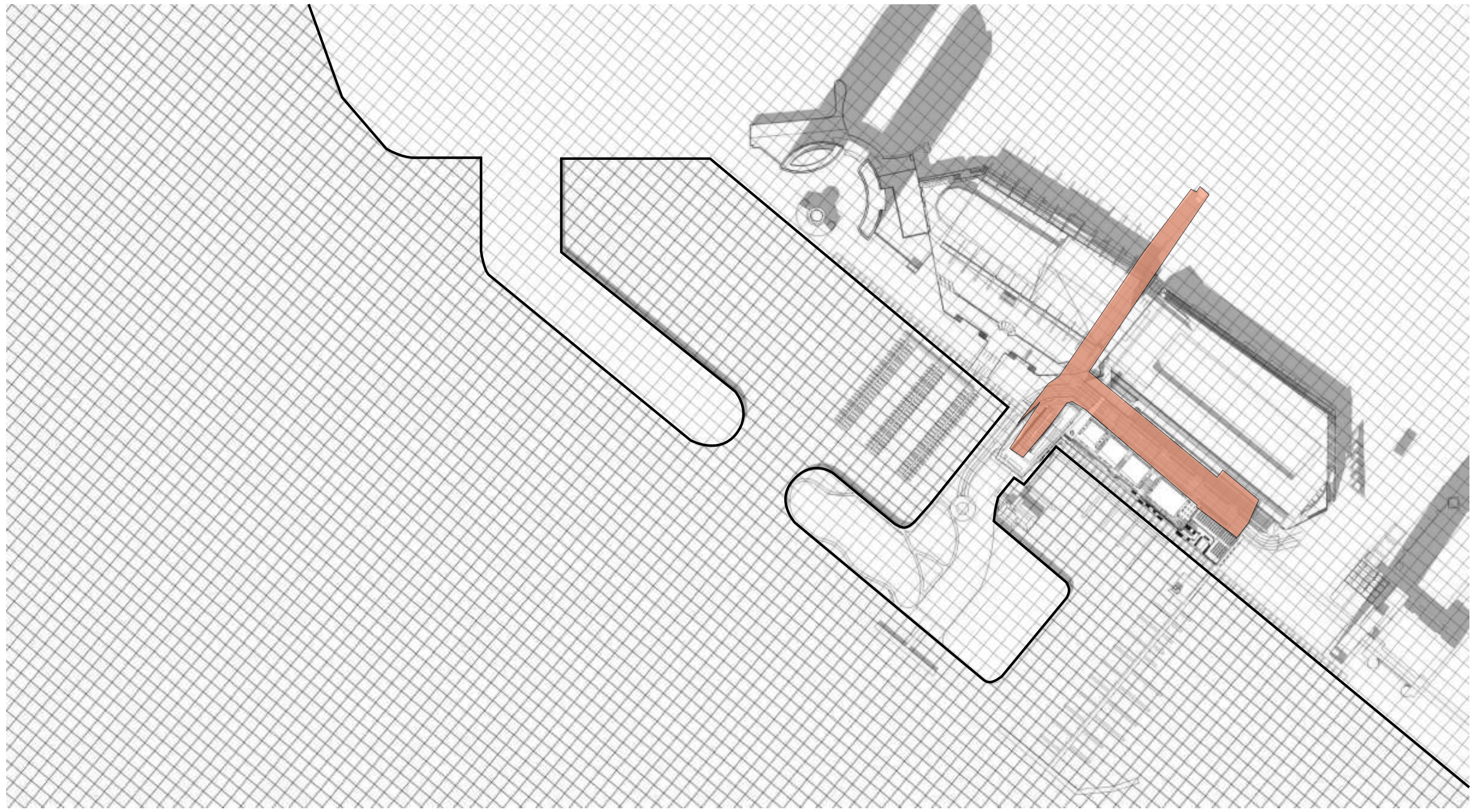
/ SHORELINE

55.7553.000 01.04.2017

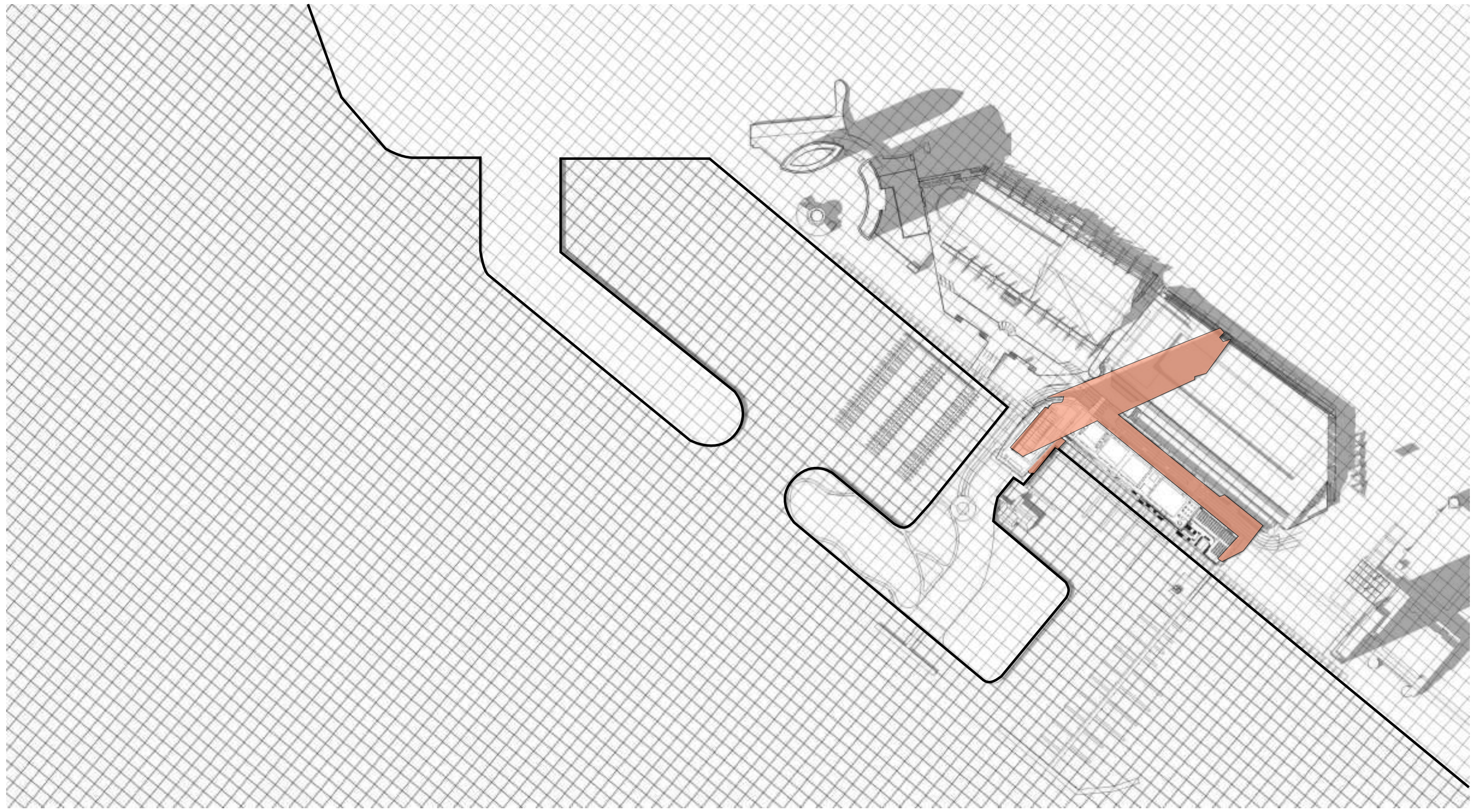
FIFTH AVENUE LANDING HOTEL & MARINA

THE ROBERT GREEN COMPANY

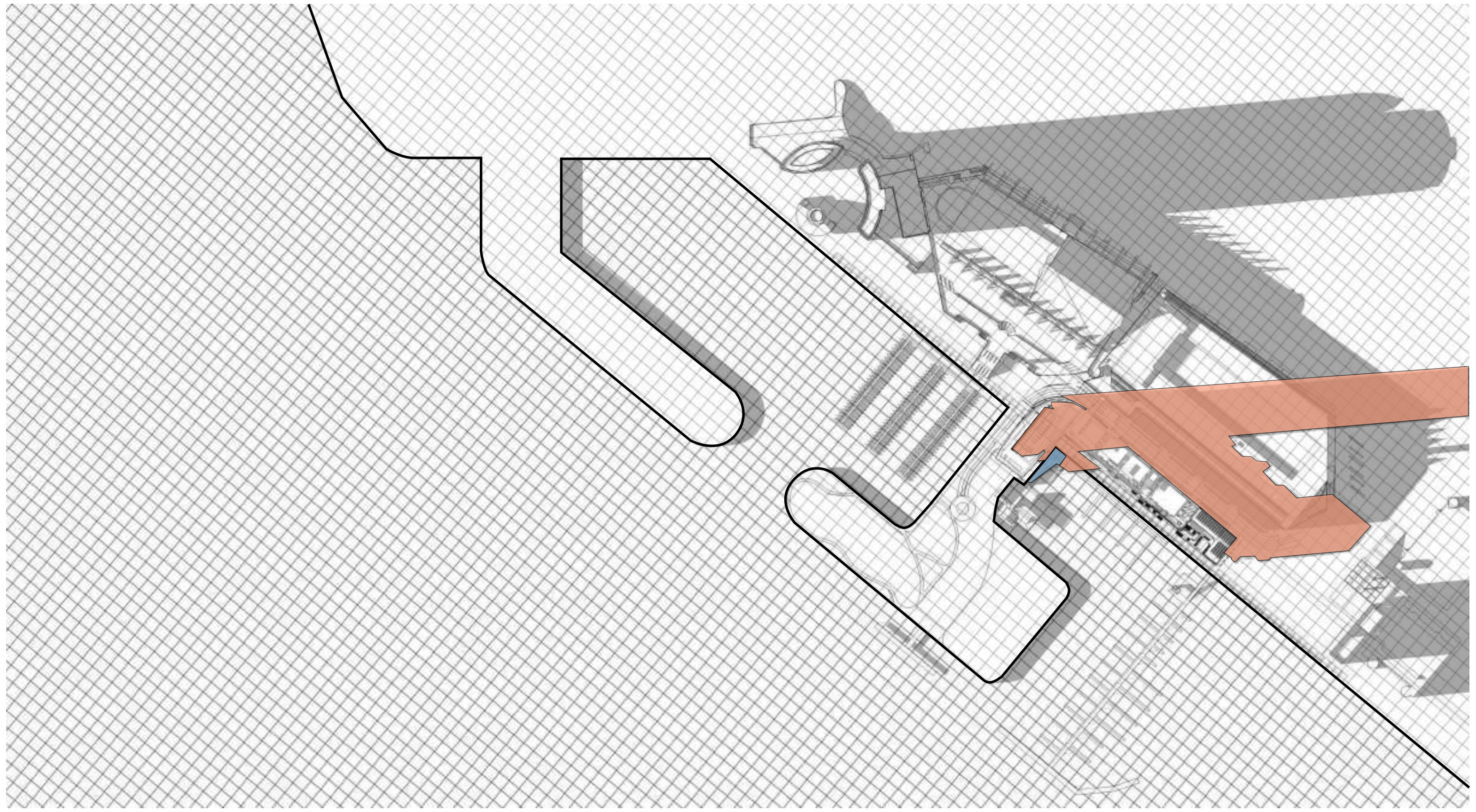
**Gensler**



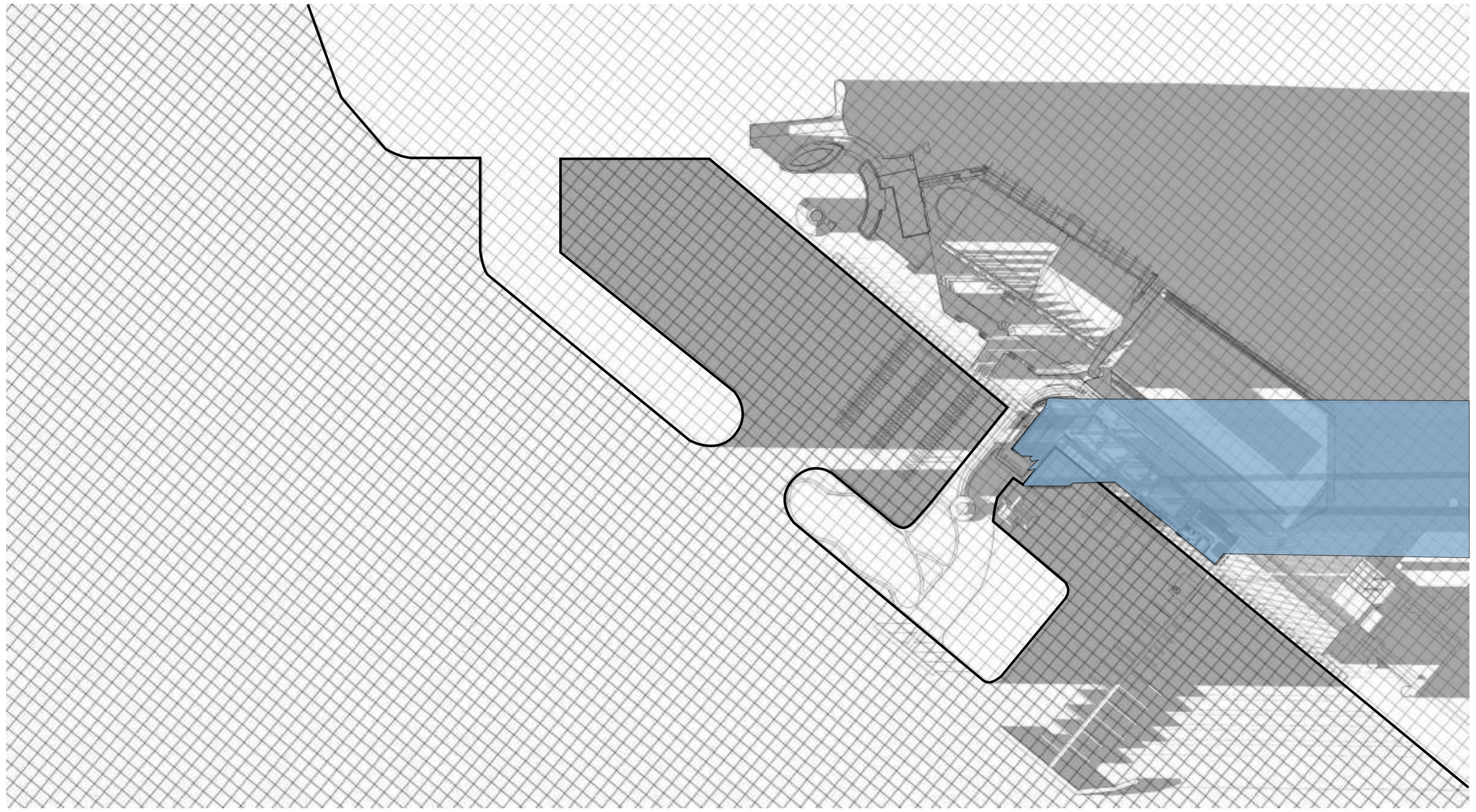
2 PM



4 PM



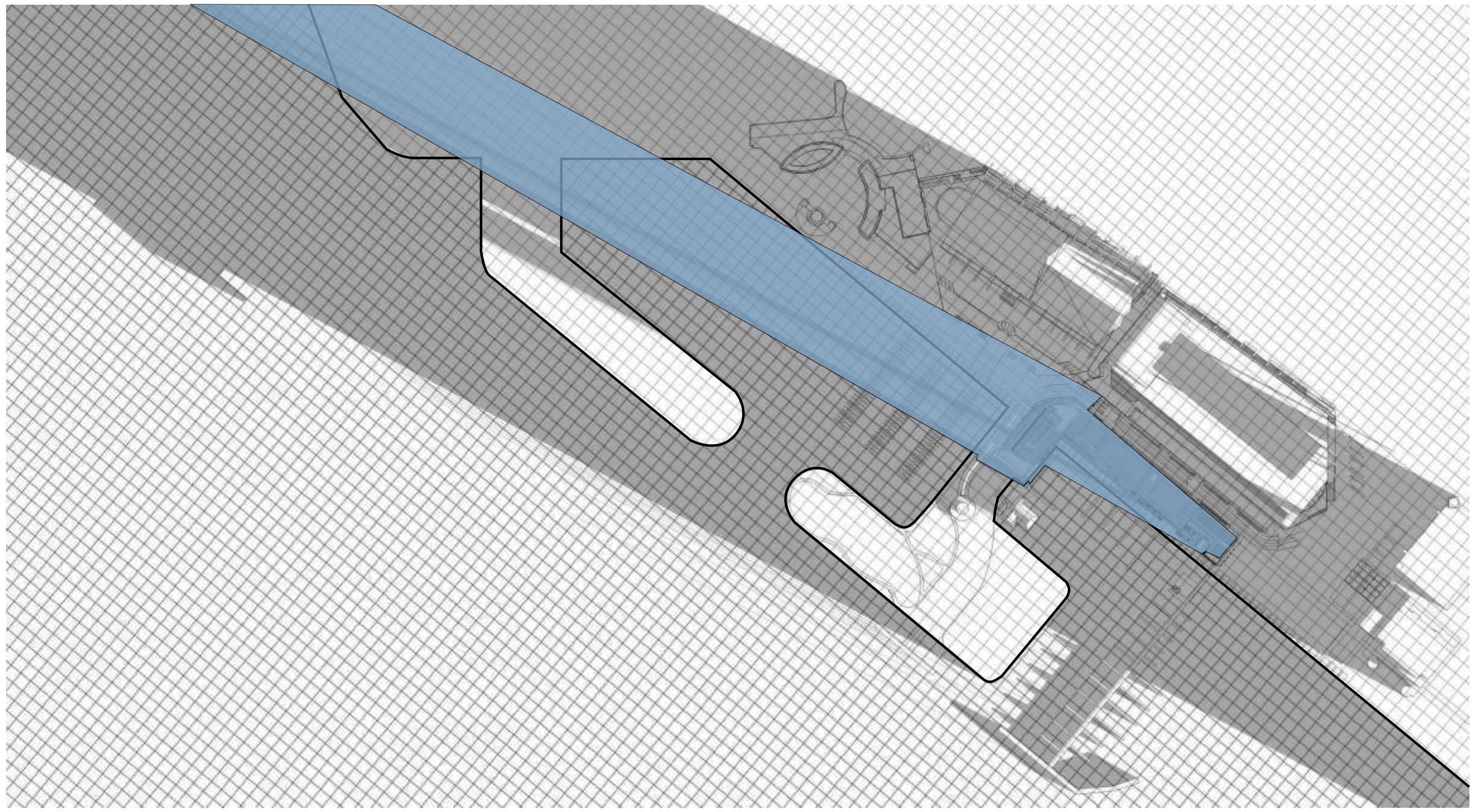
6 PM



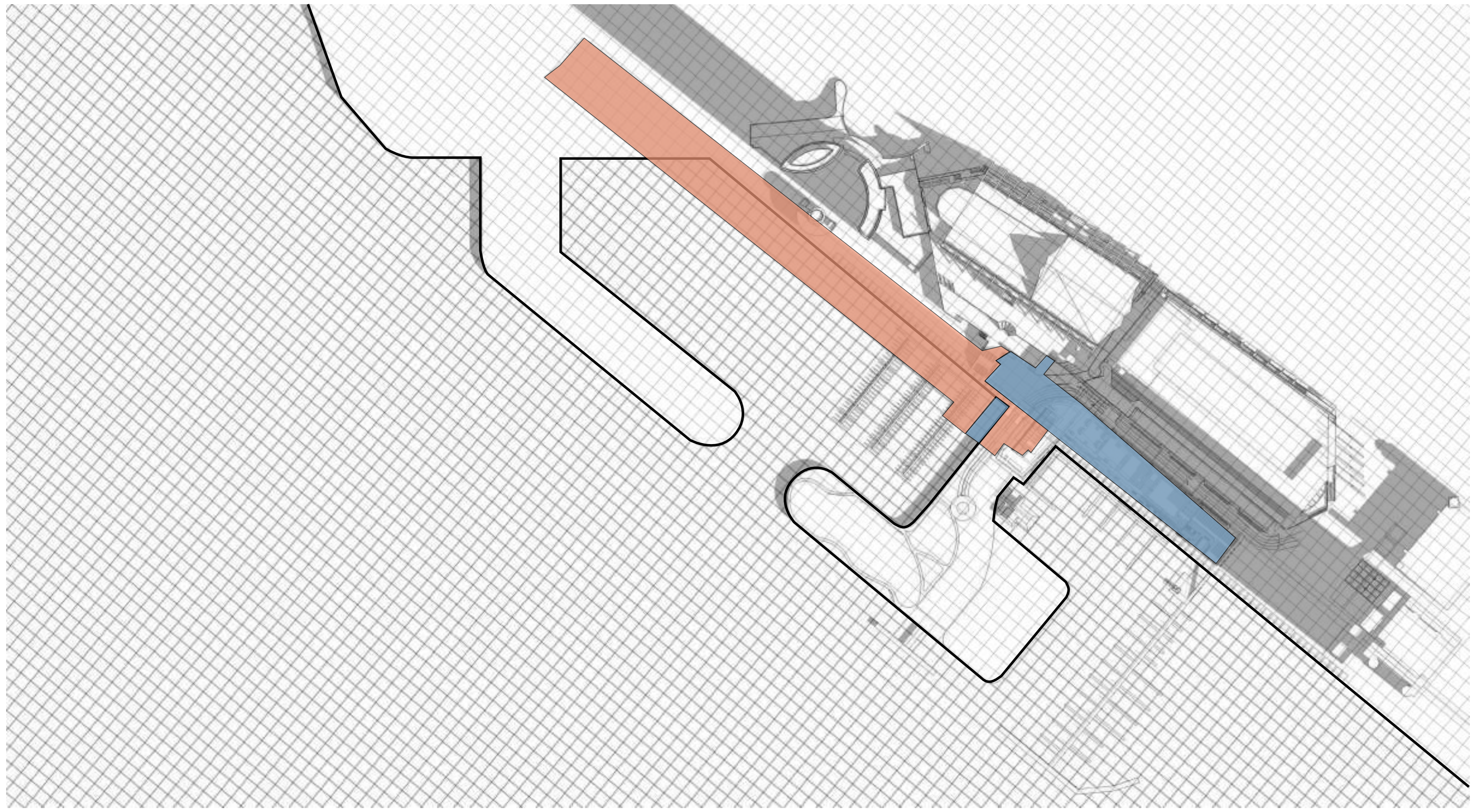
SUNSET

# SHADOW STUDY: **SEP 21** *//UTC -7_PDT//*

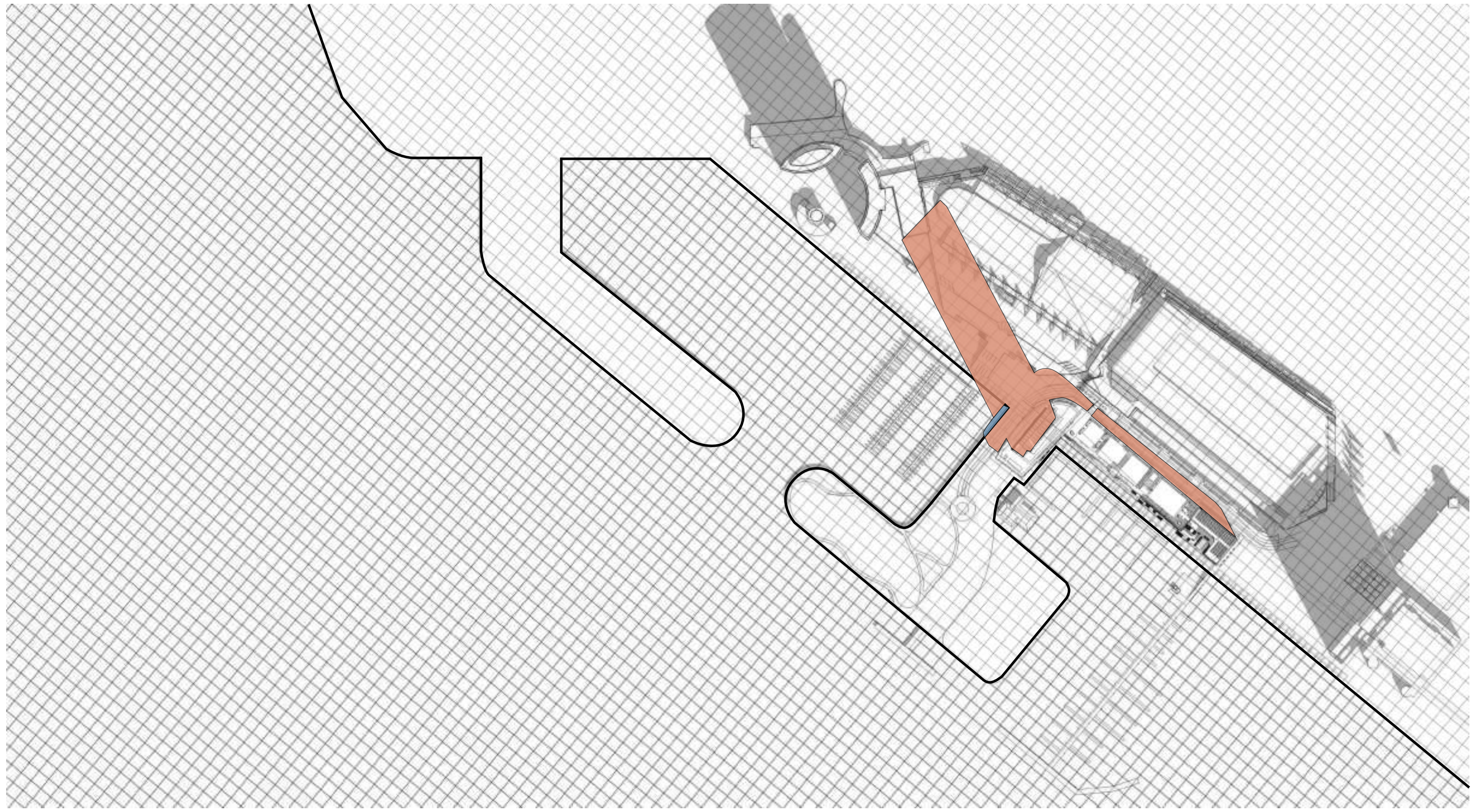
- ⊕ 50' X 50' GRID
- 🟧 NEW SHADED AREA
- 🟦 OVERLAP EXISTING SHADED AREA
- ⬜ EXISTING SHADED AREA
- / SHORELINE



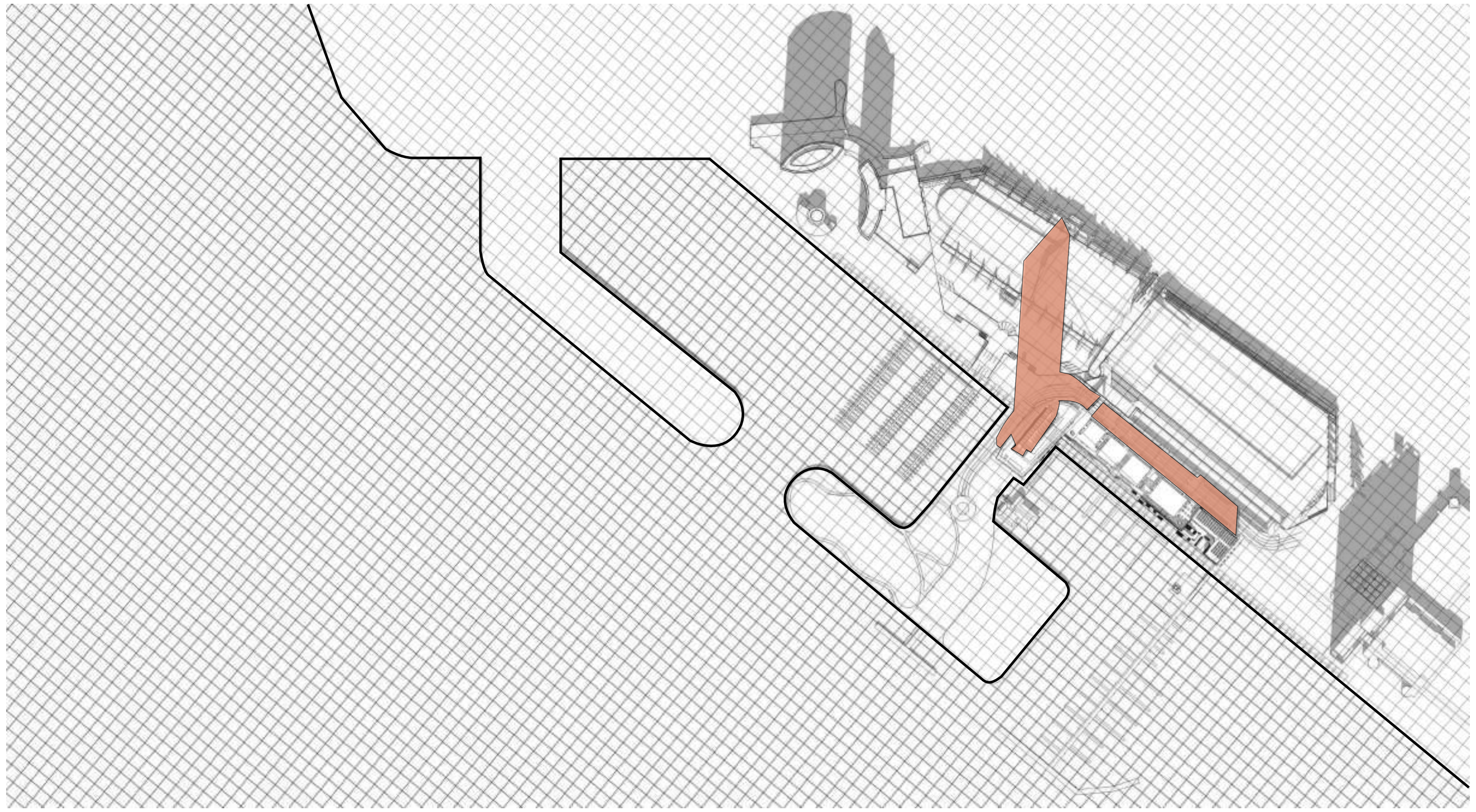
SUNRISE



8 AM



10 AM



12 PM

# SHADOW STUDY: **DEC 21** *//UTC -8_PST//*

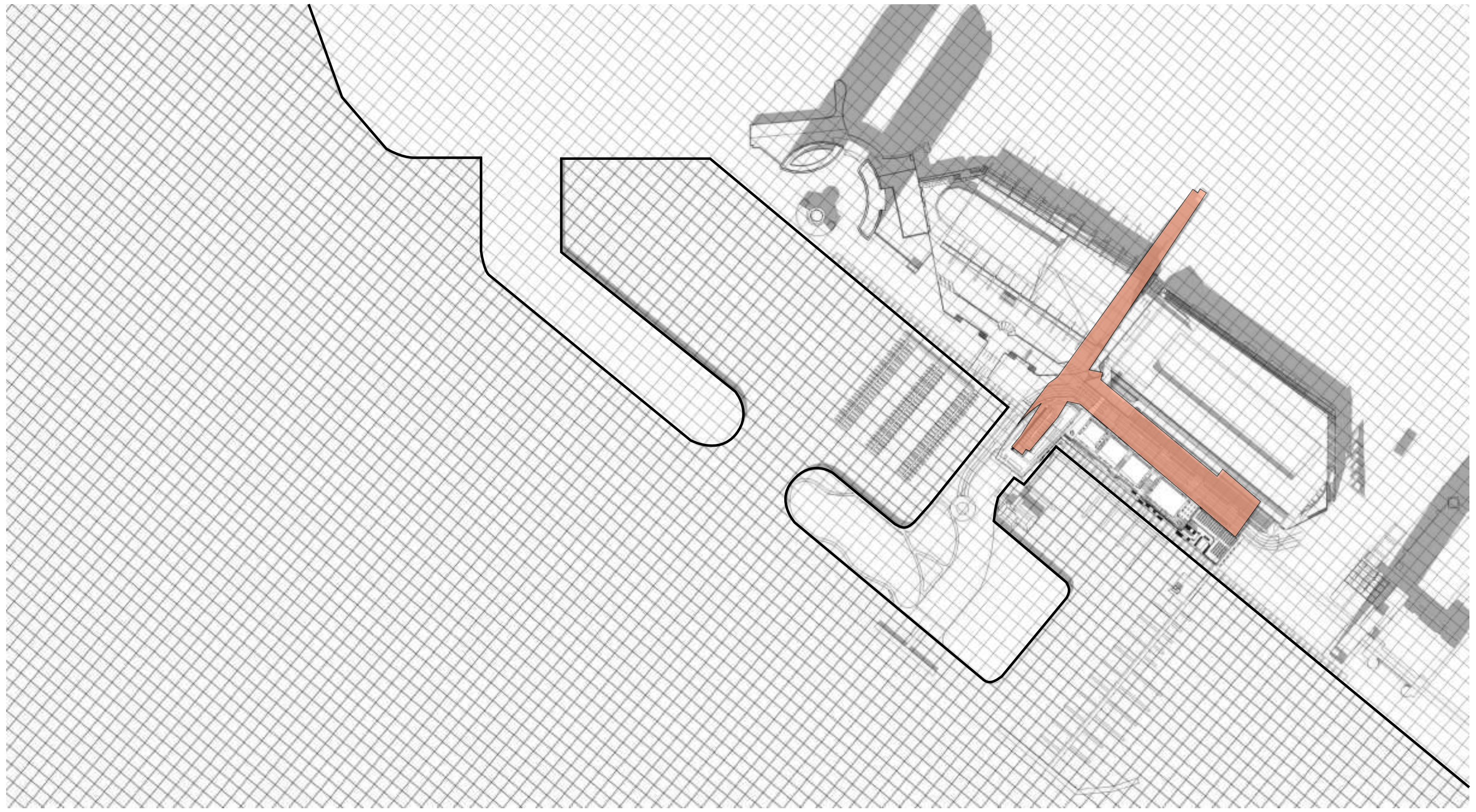
55.7553.000 01.04.2017

- N 50' X 50' GRID
- 🟧 NEW SHADED AREA
- 🟦 OVERLAP EXISTING SHADED AREA
- ⬜ EXISTING SHADED AREA
- / SHORELINE

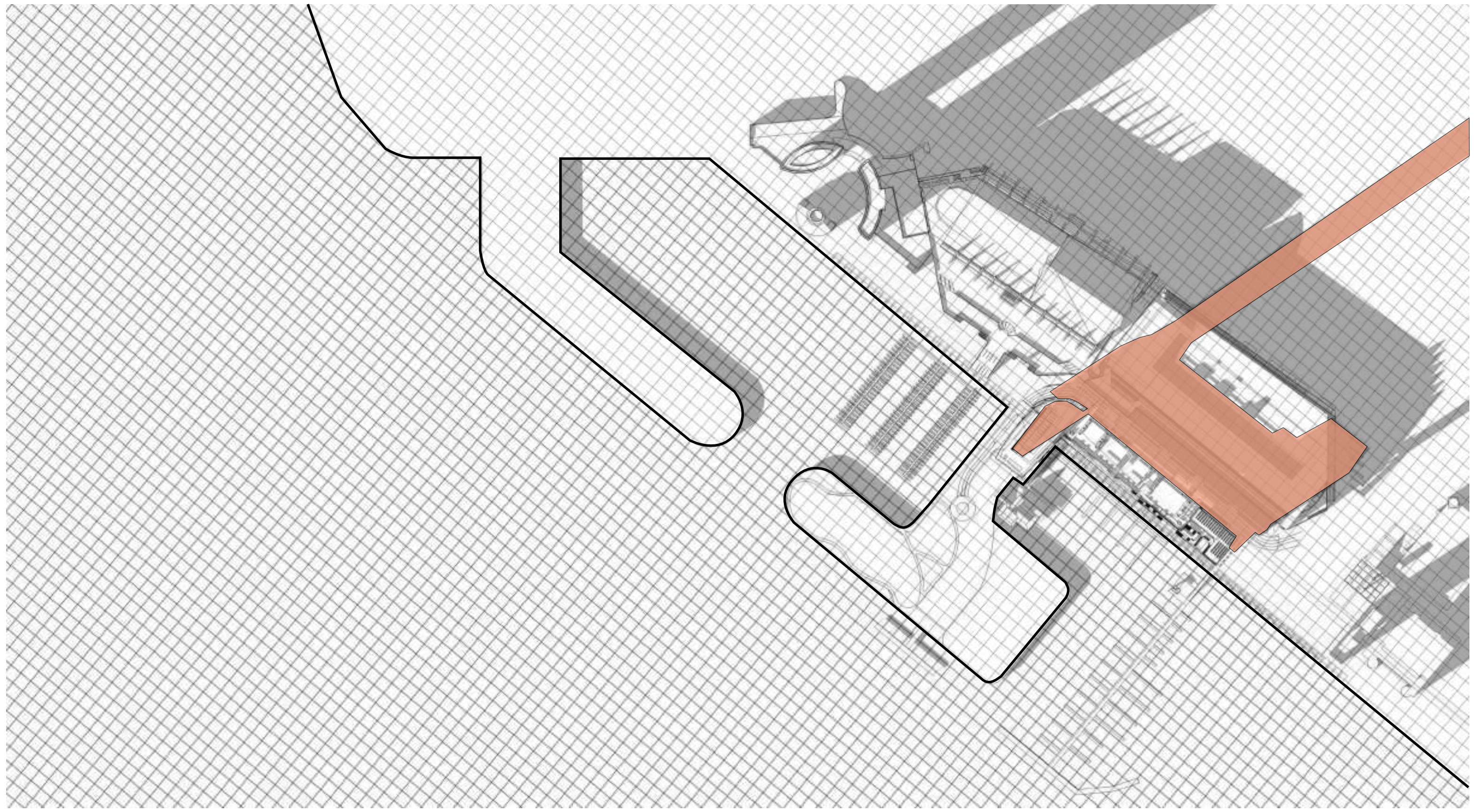
FIFTH AVENUE LANDING HOTEL & MARINA

THE ROBERT GREEN COMPANY

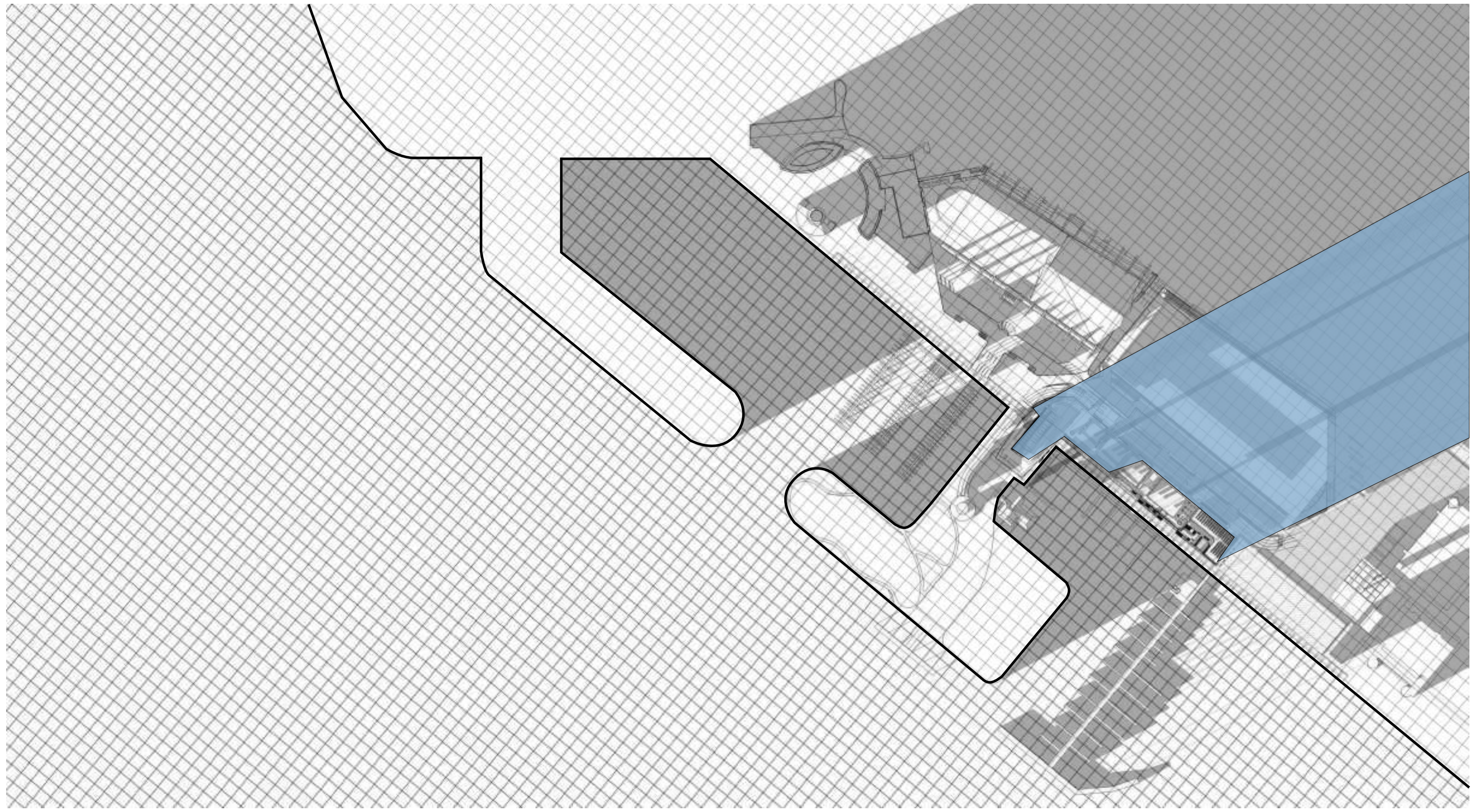
Gensler



2 PM



4 PM



SUNSET

## SHADOW STUDY: **DEC 21** *//UTC -8_PST//*

N 50' X 50' GRID

🟧 NEW SHADED AREA

🟦 OVERLAP EXISTING SHADED AREA

▒ EXISTING SHADED AREA

/ SHORELINE

FIFTH AVENUE LANDING HOTEL & MARINA

THE ROBERT GREEN COMPANY

**Gensler**

# Appendix E-2

# Everest International Consultants San Diego Bay Fifth Ave Landing Marina Propwash Analysis Memorandum

# Memorandum

**Everest International Consultants, Inc.**
444 West Ocean Boulevard, Suite 1104, Long Beach, CA 90802
TEL (562) 435-9305, FAX (562) 435-9310

**To:** Kathie Washington, ICF
**From:** Ying Poon
**Copy to:** -
**Date:** April 19, 2017
**Project Number:** P2228
**Re:** San Diego Bay Fifth Ave Landing Marina Propwash Analysis

## 1. OVERVIEW

This technical memorandum summarizes the results of a propwash (or propeller induced currents) analysis for a proposed marina at the Fifth Avenue Landing at San Diego Bay. As shown in Figure 1, the proposed marina is adjacent to (with some overlapping of) the Engineered Cap of the Campbell Shipyard Mitigation Cap Site, and close to an existing eelgrass habitat area. Vessel traffic at the proposed marina may affect the armor stability of the Engineered Cap and the adjacent eelgrass habitat area. Vessels up to 150 feet in length will travel into and out of the proposed marina, and pass over or adjacent to the Engineered Cap. Hence, propwash jets from vessels up to 150 feet in length may act on the bed at the Engineered Cap. Vessels 50 feet and smaller in length will travel into and out of, and dock at the smaller boat slips bordering the eelgrass habitat area. Surface wash from the propwash jets of these vessels, measuring 50 feet and smaller in length, may act on the eelgrass.

The purpose of the propwash analysis reported in this memorandum is to assess the potential impact of the marina to the Engineered Cap and the eelgrass habitat area.

## 2. PROPWASH ANALYSIS

Propwash velocity values are estimated using the same calibrated propwash model from previous Campbell Shipyard analyses (Anchor 2004). This model is based on methods from Blaauw and van de Kaa (1978), Blaauw et al. (1984), and Verhey (1983). The model predicts the velocity field behind a propeller jet based on the momentum theory by assuming that the propeller thrust equals the change of the fluid momentum caused by the propeller. It also predicts the laws of free jet turbulence for submerged jets by assuming that flow is steady, uniform, and frictionless. Specifically, the model calculates propwash velocity for a given vessel at a distance, x, from the propeller and a radial distance, r, from the propeller axis using several variables including engine operating power, propeller diameter, and number of propellers.

$$V_{x,r} = M \cdot 9.72 \cdot \left(\frac{P_d}{{D_p}^2}\right)^{1/3} \cdot \left(1.4 \cdot \frac{D_p}{x}\right)^{0.85} \cdot exp\left(-8 \cdot \frac{r^2}{x^2}\right) \qquad \text{(Eqn. 1)}$$

Where:

$V_{x,r}$ = Velocity of propeller jet at longitudinal distance, x, and radial distance, r; ft/s
x = Longitudinal distance behind vessel, ft
r = Radial distance from propeller shaft to bed, ft
M = Multi-propeller factor, unitless (1.52 for multiple propellers, 1.0 for single propeller)
$P_d$ = Engine operating power, hp
$D_p$ = Propeller diameter, ft

A schematic of the propeller-induced velocities behind a vessel at the project location is shown in Figure 2. Propwash effects will be different at the Engineered Cap and the eelgrass habitat area, due to the presence of the revetment surrounding the eelgrass habitat area and the elevation of the eelgrass habitat area above the bed level. While the Engineered Cap will be impacted by velocities acting at the bed, the eelgrass habitat area will be impacted by velocities directly behind a vessel near its propeller(s) and the water surface. As such, velocities at the Engineered Cap (or at the bed) are particularly dependent on water depth and vessel draft, and velocities at the eelgrass habitat area are particularly dependent on vessel draft.

## 3. IMPACT TO EXISTING CAP

This section provides an analysis of propwash velocities and evaluates the potential impact of such velocities to the armor rock layer using the same methods from the design of the Cap Site. Publicly available data for yachts measuring 100 to 150 feet in length were analyzed to determine their typical characteristics, which are summarized in Table 1. Yachts less than 100 feet in length were excluded from this part of the analysis, since propwash effects from larger yachts will exceed and govern over those of smaller yachts. Yachts are generally categorized into two types - motor yachts and sailing yachts. Motor yachts typically have greater total engine power and more main propellers (i.e., two rather than one) compared with sailing yachts of a similar length, while sailing yachts typically have larger vessel drafts. As mentioned in Section 2, the propeller-induced velocity at the bed depends on both engine power and vessel draft.  To determine the governing propwash velocities of yachts measuring 100 to 150 feet in length, both types of yachts are included in this analysis.

**Table 1. Typical Characteristics of Yachts 100 to 150 ft in Length**

| YACHT TYPE & MODEL | TYPICAL VESSEL PROPERTIES | | | | |
|---|---|---|---|---|---|
| | VESSEL LENGTH[1] (FT) | PROPELLER DIAMETER (FT) | NUMBER OF PROPELLERS/ ENGINES | TOTAL ENGINE POWER (HP) | VESSEL DRAFT[2] (FT) |
| ***Motor Yachts*** | | | | | |
| Trinity 150 | 150 | 4.7 | 2 | 4,290 | 7.4 |
| Hatteras 100 Raised Pilothouse | 100 | 4.5 | 2 | 3,160 | 6.0 |
| ***Sailing Yachts*** | | | | | |
| Mondomarine SM45 | 147 | 4.5 | 1 | 1,270 | 14.0 |
| Billy Budd II, Royal Huisman | 112 | 3.2 | 1 | 330 | 12.8 |

1. Length overall (LOA)
2. Average value (e.g., average of maximum and minimum draft values)

Water depths at the project location are governed by tidal conditions. The closest National Oceanic and Atmospheric Administration (NOAA) tide station to the project location is located at San Diego Bay (Station no. 9410170). Tidal datums from the 1983-2001 tidal epoch for this station are summarized in Table 2.

**Table 2. Tidal Datums for San Diego Bay**

| TIDAL DATUM | ELEVATION (FT, MLLW) |
|---|---|
| Highest Observed Water Level (1/27/1983) | 8.14 |
| Mean Higher High Water (MHHW) | 5.72 |
| Mean High Water (MHW) | 4.98 |
| Mean Sea Level (MSL) | 2.94 |
| Mean Low Water (MLW) | 0.94 |
| Mean Lower Low Water (MLLW) | 0 |
| Lowest Observed Water Level (12/17/1937) | -3.09 |

*Source: NOAA 2003*

Three representative tidal conditions (i.e., MLLW, MSL, and MHHW) were used for the propwash analysis. Based on the Campbell Shipyard analyses (Anchor 2004), bathymetric elevation of the Engineering Cap is at -20 ft, MLLW at the Engineering Cap. Although a 2016 survey showed some as-built bathymetric elevations to be lower than -20 ft, MLLW at the Engineering Cap, -20 ft, MLLW is selected for this analysis since it represents the average condition and will yield more conservative results than selecting a lower elevation. As such, water depths used for this propwash analysis range from approximately 20 to 25.7 feet for the selected tidal conditions.

Bed velocities on the Engineered Cap were calculated using Equation 1 for the range of yacht types listed in Table 1 and the selected tidal conditions (i.e., MLLW, MSL, and MHHW). Similar to the previous Campbell Shipyard analyses (Anchor 2004), yachts are assumed to operate at half of their total engine power for these propwash calculations since yacht operating power levels within the proposed marina are expected to be restricted by posted speed limits.

## 3.1 RESULTS AND FINDINGS

Plots of propwash model-predicted centerline bed velocity for each yacht listed in Table 1 are provided in Figures 3a-b and 4a-b. Based on these results, motor yachts measuring 100 to 150 feet in length induce higher bed velocities than sailing yachts of a similar length. As expected, the highest bed velocities for each vessel occur under the shallowest water depths. Additionally, bed velocities decrease with increasing distances behind the vessel. The maximum bed velocities from each of the selected scenarios are summarized in Table 3. As shown in this table, depending on tidal conditions, yachts 150 ft in length can generate maximum bed velocities ranging from approximately 3.8 to 5.0 ft/s.

**Table 3. Predicted Maximum Bed Velocities of Yachts 100 to 150 ft in Length**

| YACHT TYPE, LENGTH, & MODEL | MAXIMUM BED VELOCITY (FT/S) | | |
|---|---|---|---|
| | MLLW[1] | MSL | MHHW |
| ***Motor Yachts*** | | | |
| 150 ft, Trinity 150 | 5.0 | 4.3 | 3.8 |
| 100 ft, Hatteras 100 Raised Pilothouse | 4.2 | 3.6 | 3.2 |
| ***Sailing Yachts*** | | | |
| 147 ft, Mondomarine SM45 | 4.5 | 3.5 | 2.9 |
| 112 ft, Billy Budd II, Royal Huisman | 2.6 | 2.0 | 1.7 |

---

1. MLLW – Mean lower low water
   MSL – Mean sea level
   MHHW – Mean higher high water

For the stability analysis, two methods - the same as those used in the design of the Cap Site - were used to determine the recommended stone size for the Engineered Cap based on the selected design velocity presented above. Method 1 is based on the EPA guidance for armor layer design of in-situ capping of contaminated sediments (EPA 1998). Method 2 is based on the USACE guidance for riprap sizing for the prevention of channel bottom erosion, which has been used in a published guideline for the design of armored protection against propwash (USACE 1970, PIANC 1997).

### *Method 1 (EPA 1998)*

Under this method, the median stone size ($d_{50}$) to resist movement due to water velocity is based on the following equation by Blaauw et al. (1984):

$$d_{50} = V_{x,r^2}/(C_{3^2} \cdot g \cdot \Delta) \qquad \text{(Eqn. 2)}$$

Where:

$d_{50}$ = median bottom grain size diameter
$g$ = gravitational acceleration
$\Delta$ = $[(\rho_s-\rho_w)/\rho_w]$
$\rho_s$ = sediment density
$\rho_w$ = water density
$C_3$ = dimensionless coefficient; 0.55 for no movement, 0.70 for small transport or 0.65 for design purposes where infrequent attack is expected (EPA 1998)

Data from Maynord (1984) show that $C_3$ =0.55 provides good agreement with experimental results for no transport and should be used in harbor areas where repeated attack can be expected and no movement can be allowed. For channel protection where infrequent attack can be expected, $C_3$ =0.6 to 0.7 should be used in design.

### *Method 2 (USACE 1970)*

Under this method, the basic equation for the movement of stone in flowing water is:

$$V = C\left[2g\left(\frac{\gamma_s-\gamma_w}{\gamma_w}\right)\right]^{0.5}(d_{50})^{0.5} \qquad \text{(Eqn. 3)}$$

Where:

V = velocity, ft/s
$\gamma_s$ = specific stone weight, lb/ft$^3$
$\gamma_w$ = specific weight of water, 62.5 lb/ft$^3$
$d_{50}$ = spherical diameter of stone having same weight as $W_{50}$
C = Isbash constant (0.86 for high turbulence level flow and 1.2 for low turbulence level flow
g = gravitational acceleration, ft/s$^2$

Based on the two above methods and using the maximum velocity of 5.0 ft/s shown in Table 3, the capping stone dimension ($d_{50}$) required to resist erosion by propwash at the project location (shown in Figure 1) is between approximately 0.3 and 1.1 feet in diameter. Method 1 recommends the use of larger armor stones than does Method 2. Averaging the capping stone dimensions recommended by Method 1 and Method 2 results in a value of 0.7 feet, which is satisfied by the existing one-foot diameter stone that was specified for the design of the Engineered Cap (Anchor 2004). In the original design of the Engineered Cap, the design velocity for the Engineering Cap ranged from 5.6 to 5.8 ft/s, higher than the predicted maximum velocity due to vessel traffic at the proposed marina.

## 4. IMPACT TO THE EELGRASS HABITAT AREA

During the ingress and egress of vessels near the eelgrass habitat area at the proposed marina, the propwash-induced velocities from these vessels may impact the eelgrass in two different ways. Figure 5 shows a hypothetical vessel path and four example vessel locations near the eelgrass habitat area during docking. From locations 1 to 2, vessels travel along the eelgrass habitat area near the buoy line, and the edge of the propwash jet behind the vessel may impact the edge of the eelgrass habitat area (shown as a red dotted line between Points A and B in the figure). From locations 2 to 3, vessels slow down and turn in preparation for docking at a boat slip bordering the eelgrass habitat area. At location 3, vessels are oriented perpendicular to the eelgrass habitat area, and the propwash behind the vessel will directly impact the eelgrass area - with maximum velocity at the edge of the eelgrass area (marked as Point B in the figure). Figure 6 shows a schematic of how a vessel at location 3 may impact the eelgrass habitat area under MLLW, MSL, and MHHW conditions. As shown in this figure, the impacts of propwash to the eelgrass habitat area are most severe during MLLW conditions, when the highest velocity portion of the vessel's propwash jet (directly behind the propeller[s]) acts at an elevation that is closest to that of the top of the eelgrass habitat area. During MSL and MHHW conditions, the highest velocity portion of the vessel's propwash jet acts at higher elevations; this is expected to prevent the greatest impact of the propwash jets from making direct contact with the eelgrass habitat area.

While vessels entering or exiting the marina (e.g., moving between locations 1 and 2) may generally be assumed to operate at half their engine power, consistent with the propwash analysis in the previous section, vessels docking at the boat slips bordering the eelgrass habitat area must slow down considerably (around location 3) when turning into those slips before coming to a complete stop (at location 4), and are thus assumed to operate at one fifth (20%) their engine power during this time (e.g., between locations 3 and 4).

Based on the proposed boat slip dimensions adjacent to the eelgrass habitat area, only smaller vessels measuring up to 50 feet in length will be able to access to this area. Yachts ranging from 30 to 50 feet in length were considered in this analysis. Velocities from the motor yacht will govern over those of the sailing yacht because motor yachts generally have much higher engine power (as discussed in Section 3). Therefore, only motor yachts will be assessed for their impacts to the eelgrass habitat area. Publicly available data for yachts ranging from approximately 30 to 50 feet, were analyzed to determine their typical characteristics, which are summarized in Table 4.

**Table 4. Typical Characteristics of Yachts 50 and 30 ft in Length**

| YACHT TYPE | YACHT MODEL | TYPICAL VESSEL PROPERTIES | | | | |
|---|---|---|---|---|---|---|
| | | VESSEL LENGTH[1] (FT) | PROPELLER DIAMETER (FT) | NUMBER OF PROPELLERS | TOTAL ENGINE POWER (HP) | VESSEL DRAFT[2] (FT) |
| Motor | Azimut 50/52 Flybridge | 50 | 2.4 | 2 | 1,300 | 4.0 |
| Motor | Carver 300 | 30 | 1.4 | 2 | 525 | 2.8 |

1. Length overall (LOA)
2. Average value (e.g., average of maximum and minimum draft values)

Figure 7 shows a diagram of the extent of propwash impact during vessel maneuvers between locations 1 and 2 (or near Point A, shown in Figure 5), from a typical 50 foot motor yacht at the eelgrass habitat area. As shown in the figure, the maximum velocities entering the eelgrass habitat area are estimated to be less than 1 ft/s.

For the worst-case scenario of vessels at location 3 before docking, and taking into account the propeller elevations at the selected tidal conditions and the elevation of the eelgrass habitat area, corresponding maximum velocities at the bed surface of the eelgrass habitat area (along the edge at Point B in Figure 6) were estimated and are summarized in Table 5. As expected, the highest maximum bed velocities shown in this table occur under lower tide conditions - when velocities from directly behind the vessel propeller(s) act at an elevation that is closest to that of the bed surface. During high tide, velocities from directly behind the vessel propeller(s) act at an elevation that is farther away from the bed surface, thus resulting in the lowest maximum bed velocities. Note that the maximum propwash velocities shown in Table 5 are at the edge of the eelgrass habitat area, and that propwash velocities decrease as the effect of the propwash jets propagates beyond the edge of and into the eelgrass habitat area.

**Table 5. Predicted Maximum Bed Velocities at Eelgrass Habitat Area**

| TIDAL CONDITION[1] | R, RADIAL DISTANCE FROM PROPELLER SHAFT TO BED (FT) | MAXIMUM BED VELOCITY (FT/S) |
|---|---|---|
| ***50-ft Motor Yacht: Azimut 50/52 Flybridge (Draft = 4.0 ft)*** | | |
| MLLW | 1.0 | 2.8 |
| MSL | 3.9 | 2.8 |
| MHHW | 6.7 | 2.7 |
| ***30-ft Motor Yacht: Carver 300 (Draft = 2.8 ft)*** | | |
| MLLW | 2.2 | 1.9 |
| MSL | 5.1 | 1.8 |
| MHHW | 7.9 | 1.7 |

1. MLLW – Mean lower low water
MSL – Mean sea level
MHHW – Mean higher high water

For the design of the eelgrass habitat area (Anchor 2004), the critical velocity for the initiation of motion of the capping material at the eelgrass habitat area was estimated to be approximately 1.1 ft/s. For the proposed marina, velocities induced over the eelgrass that may exceed 1.1 ft/s are expected to occur only when vessels slow down and turn in preparation for docking, and the eelgrass habitat area is exposed to the direct impact of propwash jets. Even though the maximum propwash velocities along the edge of the habitat area are higher than the critical velocity of the capping material for the initiation of motion, they are unlikely to result in any significant erosion of the capping material because erosion of bed material requires prolonged suspension of sediment particles, not just the temporary uplift of particles caused by intermittent high velocities. The maximum propwash velocities during vessel docking would be localized, infrequent and short in duration, and may result in some initiation of motion of some sediment particles, though these particles will quickly settle out once the vessel is docked. Hence, there may be some minor localized shifting of the capping material at the eelgrass habitat areas experiencing these infrequent high propwash velocities, but there would be no significant bed erosion or sediment transport at those areas.

## 5. SUMMARY OF FINDINGS

Under high and low tide conditions, typical yachts measuring up to 150 feet that would use the proposed marina at the Fifth Avenue Landing are not expected to impact the stability of the existing armor rock layer of the Engineered Cap. Only larger yachts with atypically high engine power and deep drafts and/or extreme low water level conditions may result in impacts to the stability of the armor rock layer.

Typical yachts measuring up to 50 feet, that would be able to use the portion of the proposed marina bordering the eelgrass habitat area, are generally not expected to impact the eelgrass even though large yachts (e.g., 50 feet) may cause velocities exceeding the original criteria of 1.1 ft/s (for initiation of motion of the capping material at the eelgrass habitat area) at the eelgrass habitat area when making their final turn towards a boat slip. These high propwash velocities experienced during vessel docking would be localized, infrequent, short in duration, and may result in some initiation of motion of some sediment particles, though these particles will quickly settle out once the vessel is docked. Hence, there may be some minor localized shifting of the capping material at eelgrass habitat areas which experience these high yet infrequent propwash velocities, but there would be no significant bed erosion or sediment transport in such areas.

## 6. REFERENCES

Anchor 2004. Basis of Design Report, Campbell Shipyard Aquatic Remediation Project. Prepared by Anchor Environmental (Anchor) in association with Blaylock Engineering Group, Everest International Consultants, Merkel and Associates, Ninyo and Moore, and TerraCosta Consulting. Prepared for San Diego Unified Port District. November 2004.

Blaauw, H.G. and van de Kaa, E.J. 1978. Erosion of bottom and sloping banks caused by the screw race of maneuvering ships. Paper presented at the *7th International Harbour Congress*, Antwerp, Belgium. May 22-26, 1978.

Blaauw H.G. et al. 1984. Design of Bank Protection of Inland Navigation Fairways. Publication No. 320, Delft Hydraulics Laboratory. Prepared by Blaauw H.G., Ivan der Knaap, F.C.M., de Groot, M.T., and Pilarcyk, K.W.

EPA 1998. Guidance for In-Situ Capping of Contaminated Sediments: Appendix A – Armor Layer Design.

PIANC 1997. Guidelines for the Design of Armoured Slopes under Open Piled Quay Walls. Report of Working Group 22. Supplement to Bulletin 96. Prepared by the Permanent International Association of Navigation Congress (PIANC), Brussels, Belgium. October 1997.

USACE 1970. Hydraulic Design Criteria, Sheet 712-1 (Revised 1970). Stone Stability Velocity vs. Stone Diameter. Prepared by U.S. Army Corps of Engineers (USACE).

Verhey, H.J. 1983. The stability of bottom and bank subjected to the velocities in the propeller jet behind ships. Paper presented at the *8th International Harbour Congress*, Antwerp, Belgium, June 13-17, 1983.

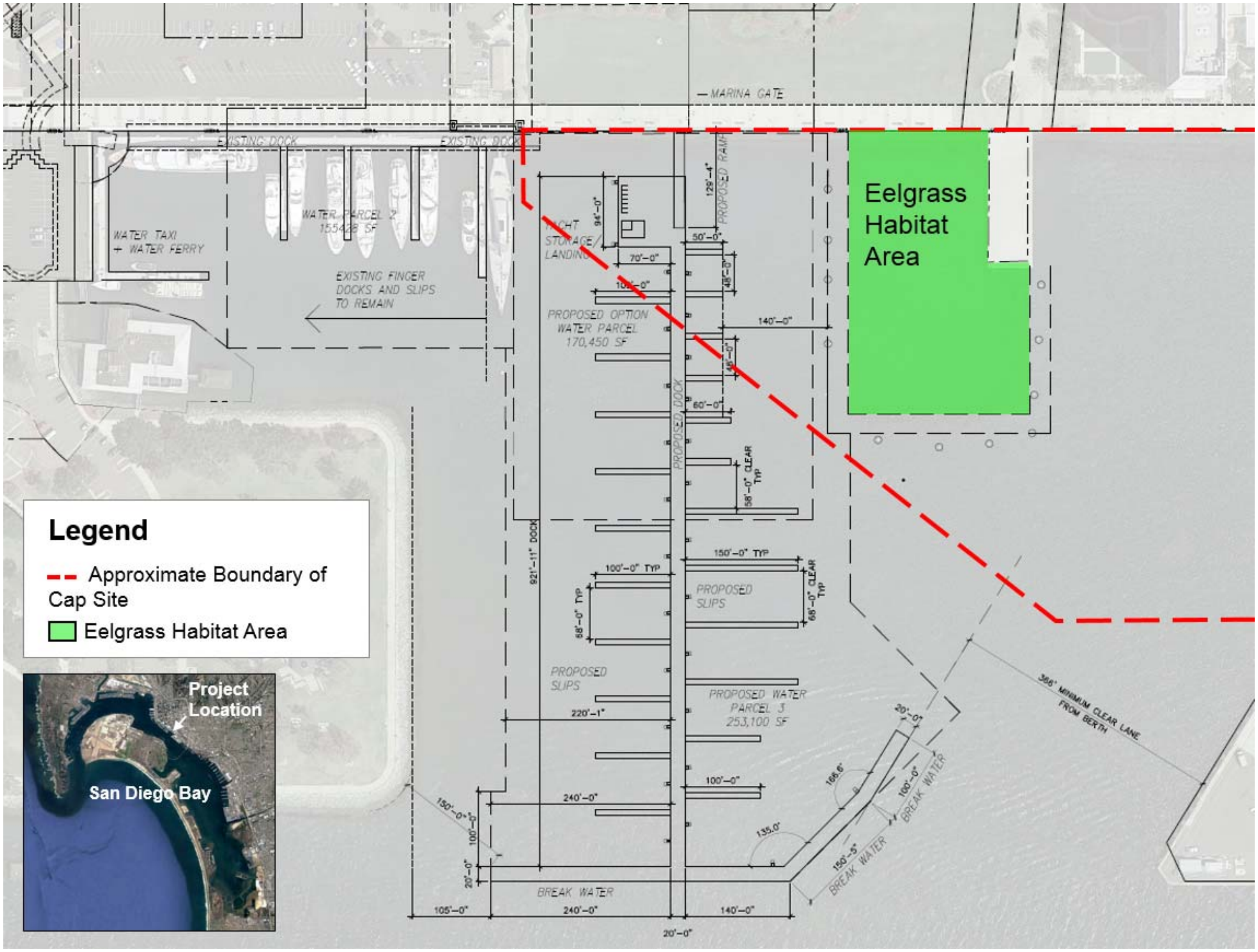


**Figure 1.** **Project Location – Fifth Avenue Landing, San Diego**

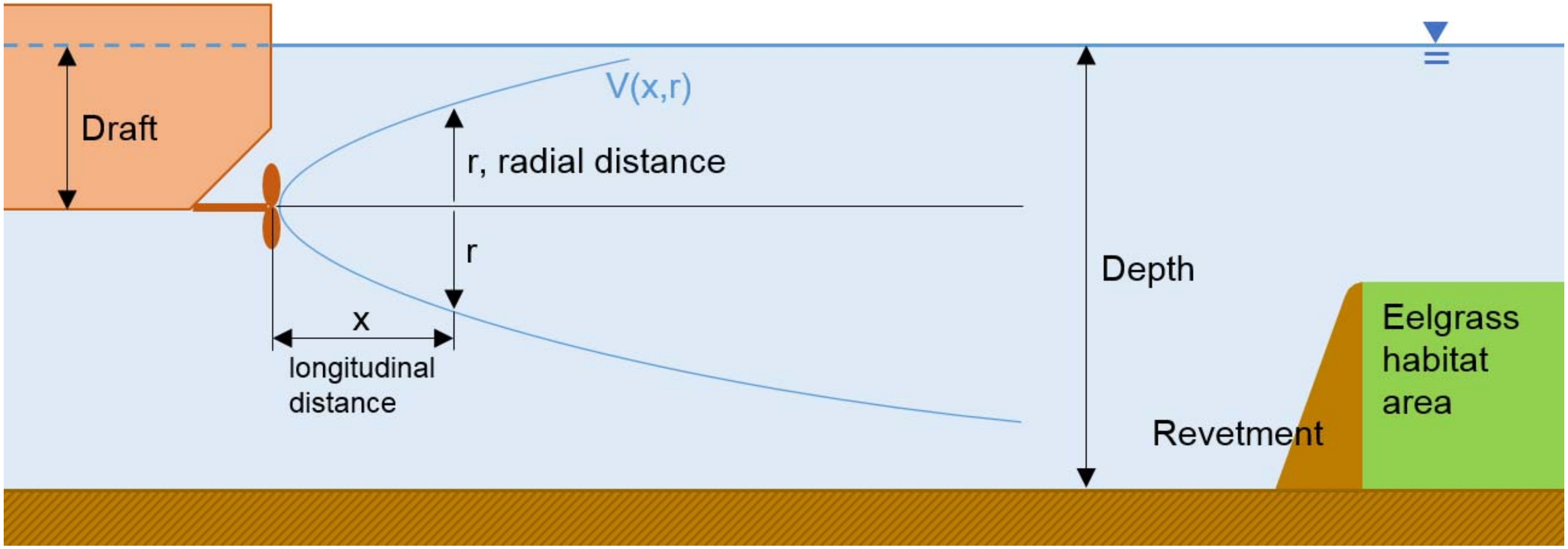


**Figure 2. Schematic of Propeller Induced Velocities behind a Vessel at the Project Location *(not to scale)***

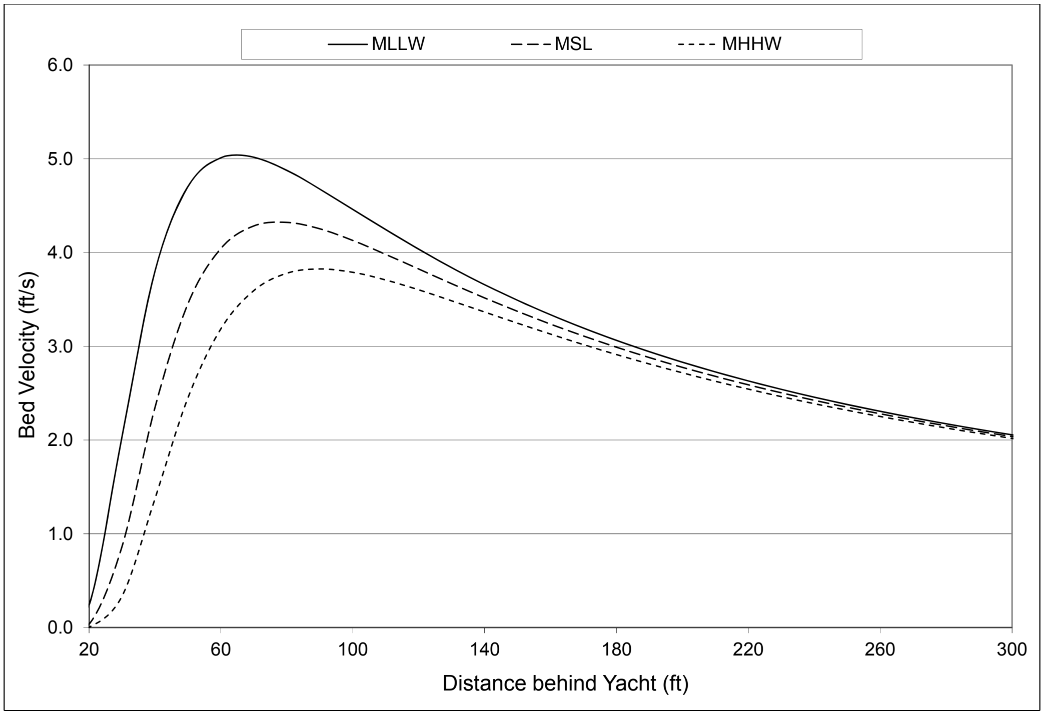


**Figure 3a.** 150ft Motor Yacht – Predicted Centerline Bed Velocity for Trinity 150

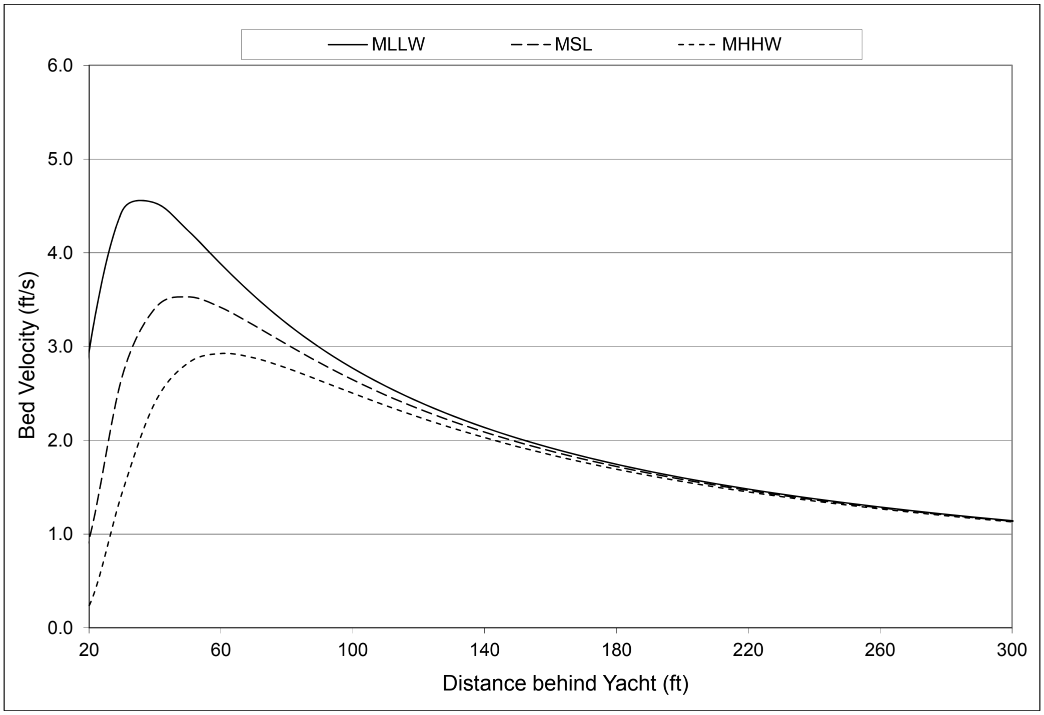


**Figure 3b.** 147ft Sailing Yacht – Predicted Centerline Bed Velocity for Mondomarine SM45

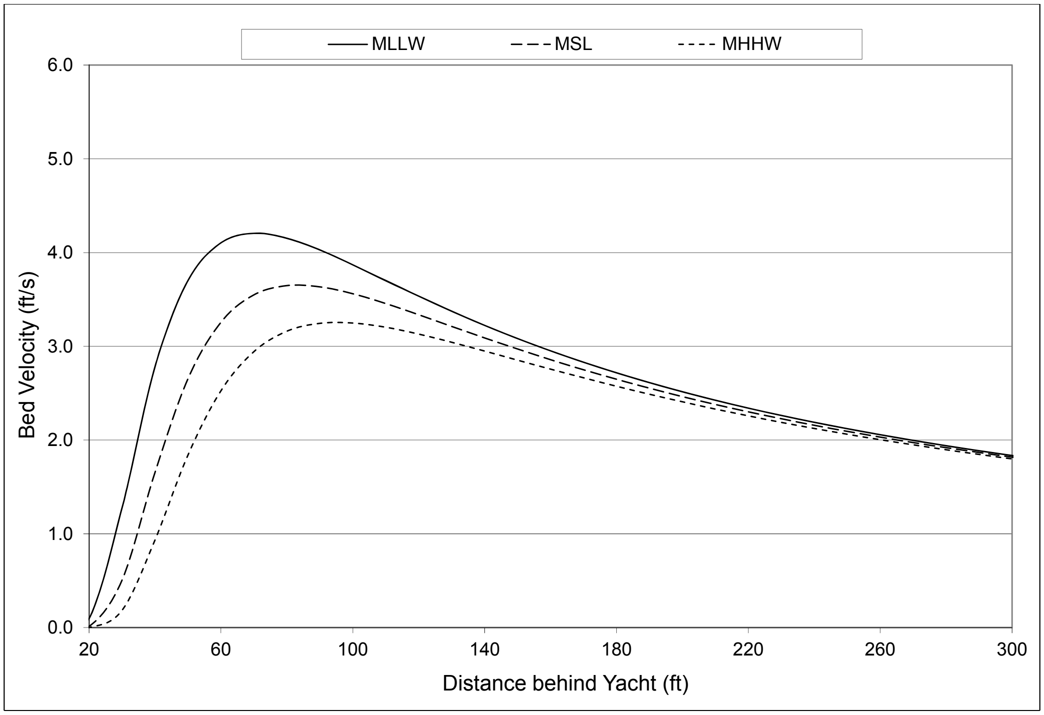


**Figure 4a.** **100ft Motor Yacht – Predicted Centerline Bed Velocity for Hatteras 100 Raised Pilothouse**

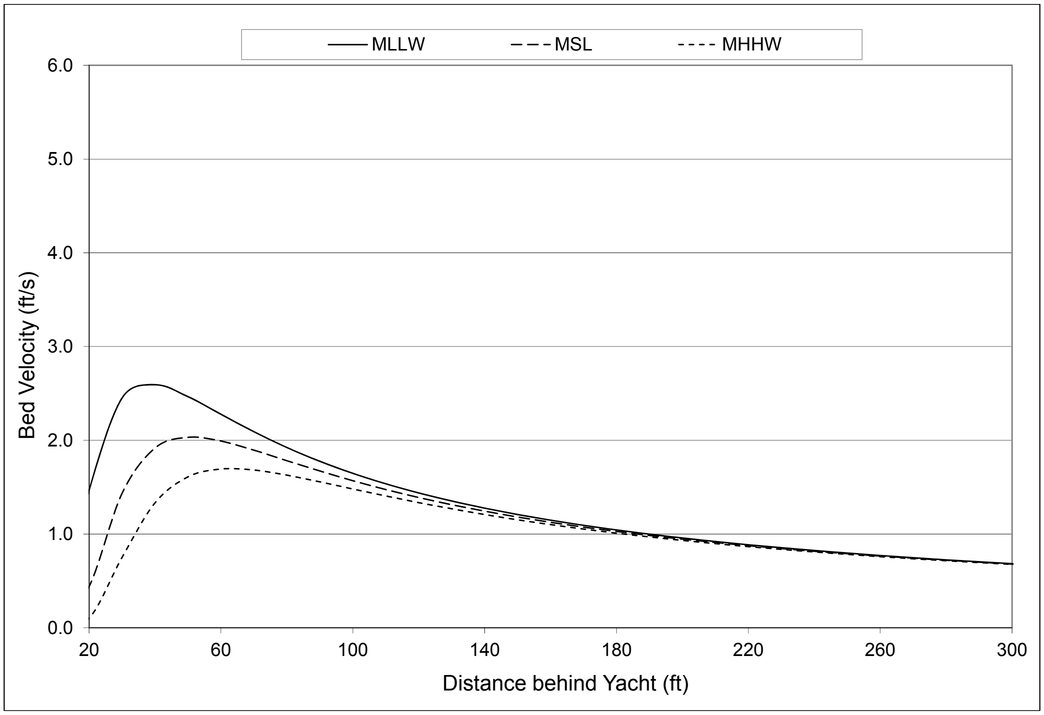


**Figure 4b.** **112ft Sailing Yacht – Predicted Centerline Bed Velocity for Billy Budd II, Royal Huisman**

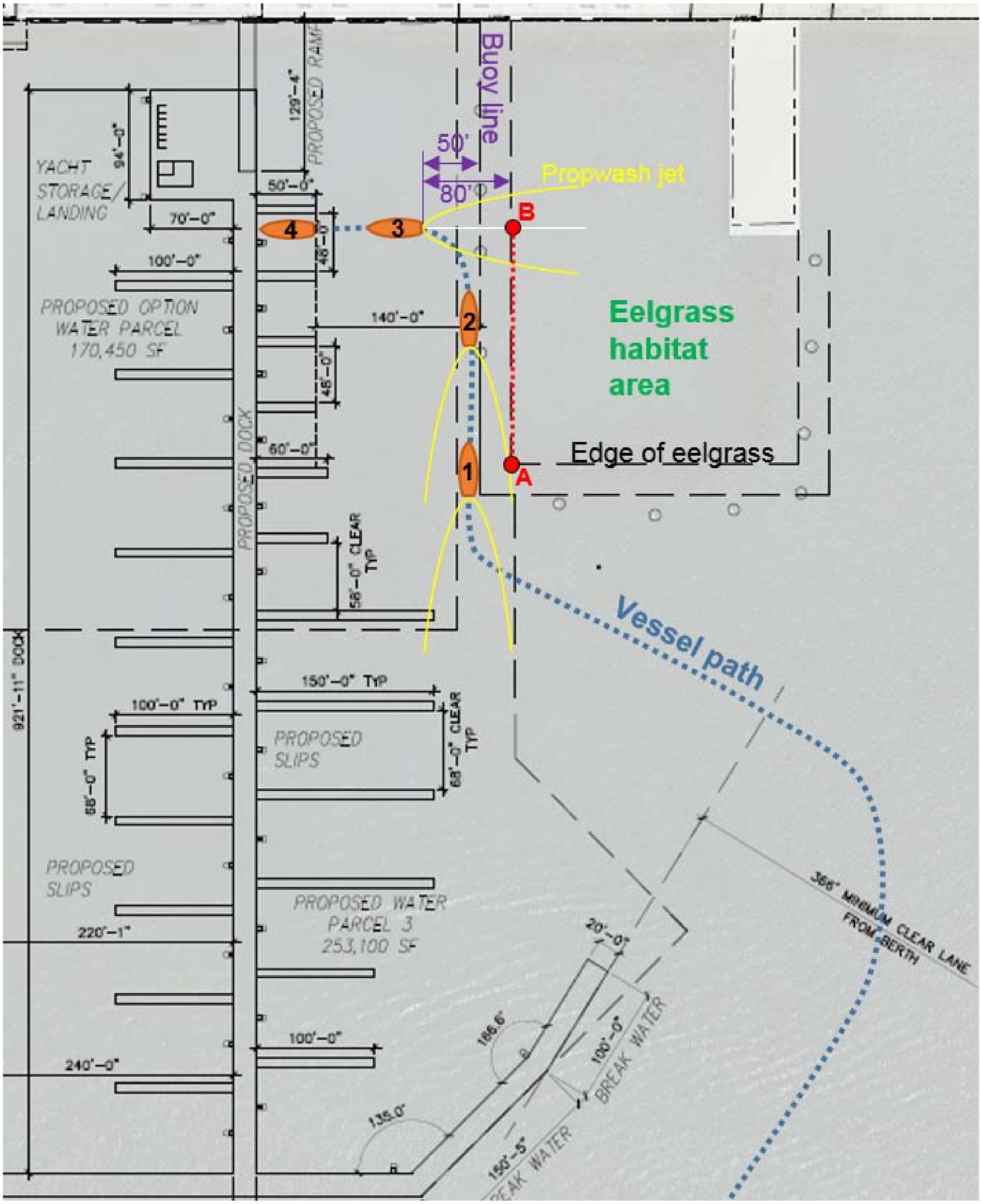
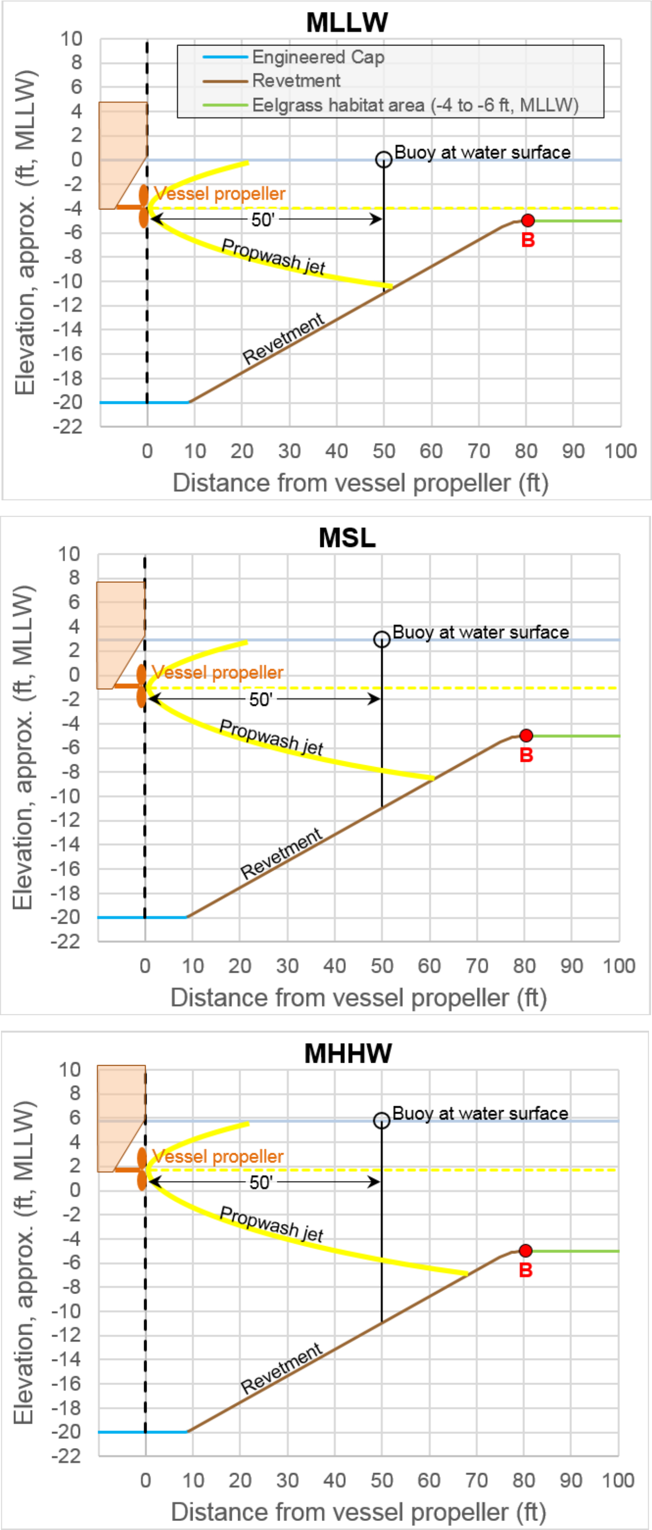


**Figure 5.** **Example Vessel Path and Propwash at Eelgrass Habitat Area**
***(measurements are approximate)***



*Refer to Figure 5 for location of Point B (aerial view)*

**Figure 6. Example Propwash Scenario at Eelgrass Habitat Area *(measurements are approximate)***

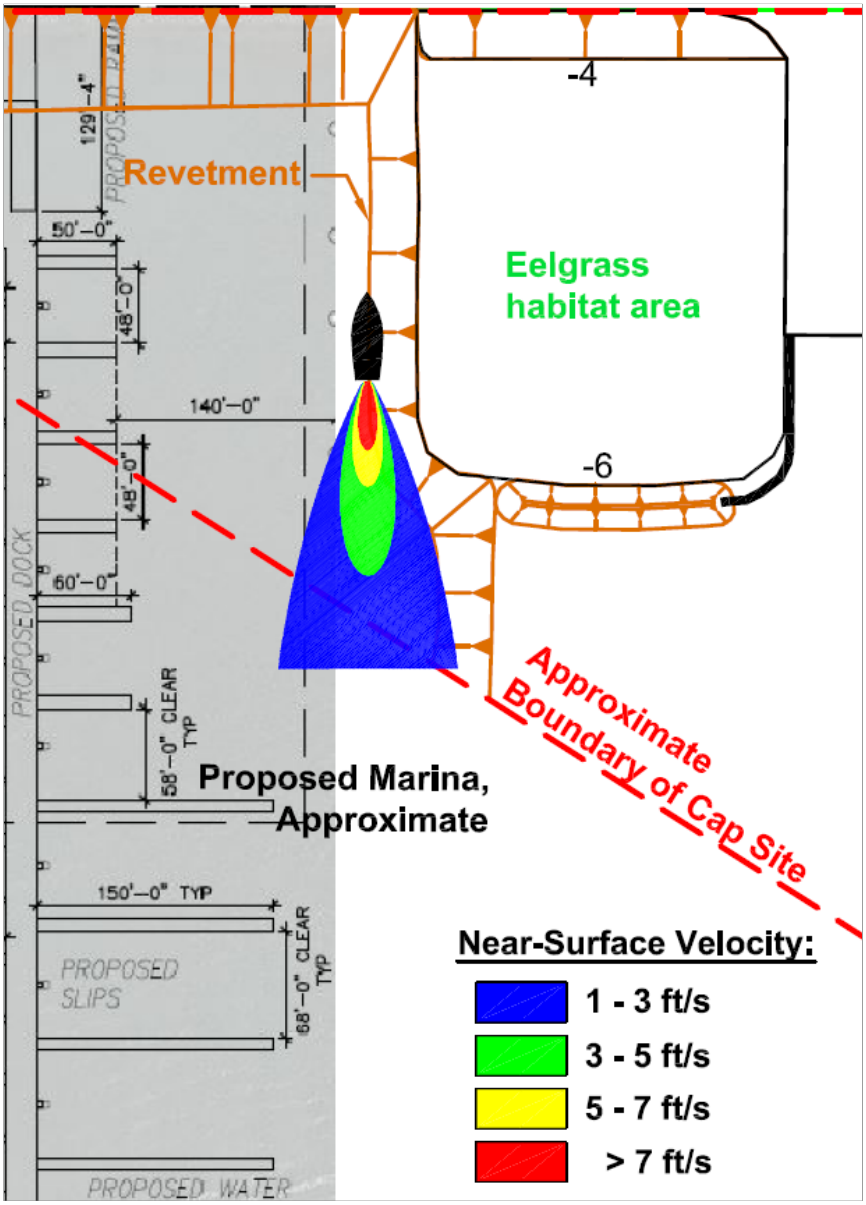


**Figure 7.** **Near-Surface Propwash Velocity at Eelgrass Habitat Area – Typical 50ft Motor Yacht Operating at Half Power *(not to scale)***

# Appendix E-3
# Marine Taxonomic Services Propwash Analysis and Potential Eelgrass Impacts Memorandum

# Memorandum

**To:** Kathie Washington

**From:** Robert Mooney

**Date:** April 24, 2017

**Marine Taxonomic Services, Ltd.**
920 Rancheros Drive, Suite F-1
San Marcos, CA 92069

**Re:** San Diego Bay Fifth Avenue Landing Marina Propwash Analysis and Potential Eelgrass Impacts

---

The below memo provides notes relative to the interpretation of how the results of the propwash model performed by Everest International Consultants (memo dated April 19, 2017) relate to potential for eelgrass impacts at the adjacent eelgrass mitigation bank.

The analysis found that 30 to 50 foot Yachts can produce current velocities capable of initiating motion of sediment particles at the eelgrass mitigation bank when those vessels are berthing at proposed FAL slips. However, the memo mentions that the velocities are low enough and without sufficient consistency in terms of direction and duration to cause any significant erosion.

We agree with the memo given the scenarios modeled and believe that if vessels operate in a manner similar to the scenarios modeled, there will likely be no impacts due to propwash on the eelgrass resources at the mitigation bank. Where eelgrass occurs, it will tend to further buffer the effects of propwash. Where eelgrass does not occur, the Everest results suggest that there will be insufficient duration and direction of propwash to transport sediment. This means that areas where eelgrass does not occur would still be suitable to future eelgrass growth.

The only potential concern that remains relative to eelgrass and propwash is that vessel operators may not always perform in ways that reflect maneuvers shown in the memo. There could be scenarios where smaller vessels associated with the marina are maneuvered over the eelgrass mitigation bank because operators do not see the potential harm. There could also be scenarios where vessels get pushed off course due to wind while trying to berth at, or exit from, FAL and end up operating closer than anticipated to the habitat cap. In any instance where vessels get closer than modeled, or otherwise end up direction over eelgrass, impacts could occur. Such impacts can be mitigated.

The above concerns could be mitigated by installing protective measures and monitoring the eelgrass mitigation site. Protective measures that help notify mariners or otherwise ensure that vessels remain at safe distances include installation of a floating barrier that makes it clear that the area is to be avoided. A float and rope barrier installed between existing buoys that currently are marked with "keep out" would ensure vessels stay away from the eelgrass mitigation site. More prominent measures could involve placement of piles with signs, or increased density of existing navigation aids along the FAL side of the eelgrass mitigation bank.

In addition to bolstering barriers to entrance, a monitoring program would ensure the mitigation measure is adequate. Currently, eelgrass resources are mapped annually as part of the mitigation bank monitoring. During the first 3 years of operations at the FAL expansion area, the eelgrass mitigation bank should be visually inspected along its boundary with FAL in addition to the areal extent mapping that is currently performed. Sediment depth probing at permanent stations during the visual inspection could also be implemented to help identify any potential erosion of surface sediments.

# Appendix E-4
# American Bird Conservancy Bird-Friendly Building Design

# Bird-Friendly Building Design

AMERICAN BIRD CONSERVANCY

NEW YORK CITY AUDUBON

Vassar's Bridge for Laboratory Sciences, shown here under construction in October 2015. The building is scheduled to open in January 2016. Cover rendering and photos courtesy of Ennead Architects

Exterior glass detail

Glass detail, showing frit pattern

**Cover rendering and photo this page:** The new Bridge for Laboratory Sciences building at Vassar College, designed by Richard Olcott/Ennead Architects, redefines the identity of the sciences on the College's historic campus and provides technologically advanced facilities for students, faculty, and researchers.

Fundamental to the building's design is its seamless integration with the natural landscape, scale, and campus aesthetic of the College. In this natural wooded setting, the need for strategies to reduce bird collisions with the building was apparent. In response, the building was designed to comply with LEED Pilot Credit 55: Bird Collision Deterrence.

Ennead managing partner Guy Maxwell is a nationally recognized champion of bird-friendly design and has led Ennead's innovative approach to make the building's glazing safer for birds, employing patterned glass, screens and sunshades, and Ornilux glass, a specialty glass product that uses a UV coating visible to birds but not humans.

By framing and showcasing views of the landscape, the building celebrates and connects students with the surrounding environment, while the overall development of the precinct repurposes an underutilized sector of campus.

# Table of Contents

The area of glass on a façade is the strongest predictor of threat to birds. There are also other reasons to limit glass. Skidmore Owings Merril's Bronx, New York, Emergency Call Center is a handsome example of creative design with restricted glass, for a building intended to be both secure and blast-resistant. Photo by Chris Sheppard, ABC

For updates and new information, see **collisions.abcbirds.org**

# Executive Summary

A bird, probably a dove, hit the window of an Indiana home hard enough to leave this ghostly image on the glass. Photo by David Fancher

Collision with glass claims the lives of hundreds of millions of birds each year in the United States. It is second only to domestic cats as a source of mortality linked directly to human action. Birds that have successfully flown thousands of miles on migration can die in seconds on a pane of glass; impacts kill fledglings before they can truly fly. Because glass is dangerous for strong, healthy, breeding adults, as well as sick or young birds, it can have a particularly serious impact on populations.

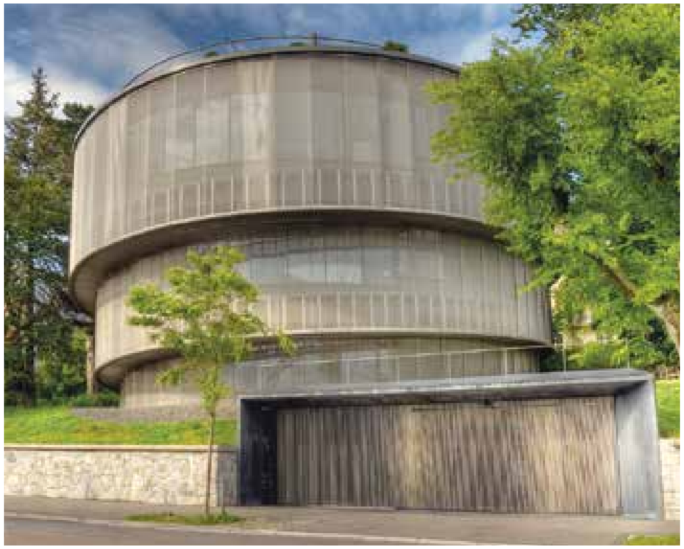
Bird kills occur at buildings across the United States and around the world. We know most about mortality patterns in cities, because that is where most monitoring takes place, but virtually any building with glass poses a threat wherever it is. The dead birds documented by monitoring programs or provided to museums constitute merely a fraction of the birds actually killed. The magnitude of this problem can be discouraging, but there are already effective solutions and an increasing commercial commitment to developing new solutions, if people can be convinced to adopt them.

That artificial lighting at night plays a significant part in mortality from glass is widely accepted, but often misunderstood. The majority of collisions with buildings take place during daylight. There are many well-documented instances of bright lights at night disorienting large numbers of birds—usually night-migrating passerines but also seabirds—some of which may circle in the light, sometimes until dawn. Nocturnal mortality associated with circulation events is caused by collision with guy wires and other structures. Such events were described starting in the late 19th century at lighthouses, and later at the Washington Monument, Statue of Liberty, and Empire State Building, which were the only brightly lit structures in their areas. Today, such events occur mostly at offshore drilling platforms and communication towers. These situations have in common bright light surrounded by darkness, and their frequency has decreased in cities as areas of darkness around bright structures have also become lit. However, there are strong indications that birds are still being disoriented by urban lights and that lights are linked to mortality, even though mortality patterns have changed.

Advances in glass technology and production since the mid-twentieth century have made it possible to construct skyscrapers with all-glass walls, homes with huge picture windows, and miles of transparent noise-barriers on highways. There has been a general increase in the amount of glass used in construction—and the amount of glass on a building is the best predictor of

Newhouse III, designed by Polshek Partnership Architects, is part of Syracuse University's S.I. Newhouse School of Public Communications. This building incorporates an undulating, fritted glass façade with the words of the first amendment etched in letters six feet high along the base. Photo by Christine Sheppard, ABC the number of birds it will kill. However, while glass is important for bringing light into buildings, a façade with over 30-40% glass dramatically increases energy use for heating and cooling. Bird-friendly design is becoming recognized as part of sustainable design, required increasingly by legislation across North America.

New construction can incorporate from the beginning bird-friendly design strategies that are cost neutral. There are many ways to reduce mortality from existing buildings, with more solutions being developed all the time. Because the science is constantly evolving, and because we will always wish for more information than we have, the temptation is to postpone action in the hope that a panacea is just around the corner. But we can't wait to act. We have the tools and the strategies to make a difference now. Architects, designers, city planners, and legislators are key to solving this problem. They not only have access to the latest building construction materials and concepts; they are also thought leaders and trend setters in the way we build our communities and prioritize building design issues.



The steel mesh enveloping Zurich's Cocoon in Switzerland, designed by Camenzind Evolution, Ltd, provides privacy, reduces heating and cooling costs, and protects birds, but still permits occupants to see out. Photo by Anton Volgger

This publication aims to provide planners, architects, and designers, bird advocates, and local, municipal, and federal authorities, as well as the general public, with a clear understanding of the nature and magnitude of the threat glass poses to birds. Since the first edition, in 2011, there has been increased awareness of collisions, evidenced by new ordinances and guidelines for bird-friendly construction, new materials to retrofit existing buildings, and promotion by the glass industry of bird-friendly materials.

This edition includes an updated review of the underlying science, examples of solutions that can be applied to both new construction and existing buildings, and an explanation of what information is still needed. We hope it will spur individuals, businesses, communities, scientists, and governments to address this issue and make their buildings safer for birds. Constructing bird-friendly buildings and eliminating the worst existing threats require only imaginative design, effective retrofits, and recognition that birds have intrinsic and cultural as well as economic and ecological value to humanity.

American Bird Conservancy's Collisions Program works at the national level to reduce bird mortality by coordinating with organizations and governments, developing educational programs and tools, evaluating and developing solutions, creating centralized resources, and generating awareness.

The façade of Sauerbruch Hutton's Brandhorst Museum is a brilliant example of mixing glass and non-glass materials. Photo by Tony Brady

# INTRODUCTION

## Why Birds Matter

For many people, birds and nature have intrinsic worth. Birds have been important to humans throughout history, often symbolizing cultural values such as peace, freedom, and fidelity. In addition to the pleasure they can bring to people, we depend on them for critical ecological functions. Birds consume vast quantities of insects and control rodent populations, reducing damage to crops and forests and helping limit the transmission of diseases such as West Nile virus, dengue fever, and malaria. Birds play a vital role in regenerating habitats by pollinating plants and dispersing seeds. Birds are also a direct economic resource. According to the U.S. Fish and Wildlife Service, bird watching is one of the fastest growing leisure activities in North America, an over $40 billion industry accounting for many jobs.

## The Legal Landscape

At the start of the 20th century, following the extinction of the Passenger Pigeon and the near extinction of other bird species due to unregulated hunting, laws were passed to protect bird populations. Among them was the Migratory Bird Treaty Act (MBTA), which made it illegal to kill a migratory bird without a permit. The scope of this law, which is still in effect today, extends beyond hunting, such that anyone causing the death of a migratory bird, even if unintentionally, can be prosecuted if that death is deemed to have been foreseeable. At present, the scope of the MBTA is under challenge in federal court and it is impossible to say whether it will ever be used to curb glass collisions. However, courts in Canada have ruled that building owners are responsible for mortality caused by glass.

Violations of the MBTA can result in fines of up to $500 per incident and up to six months in prison. The Bald and Golden Eagle Protection Act (originally the Bald Eagle Protection Act of 1940), the Endangered Species Act (1973), and the Wild Bird Conservation Act (1992) provide further protections for birds that may apply to building collisions. Recent legislation, primarily at the city and state levels, has addressed the problem of mortality from building collisions and light pollution. Starting with Toronto, Canada, in 2009 and San Francisco, California, in 2010 an increasing number of states and municipalities have passed laws mandating bird-friendly design, while other authorities have passed voluntary measures.

## Glass: The Invisible Threat

Glass is invisible to both birds and humans. Humans learn to see glass through a combination of experience and visual cues like mullions and even dirt, but birds are unable to use these signals. Most birds' first encounters with glass are fatal when they collide with it at full flight speed. Aspects of bird vision contribute to the problem. Whereas humans have eyes in the front of their heads and good depth perception, most birds' eyes are placed at the sides of their heads. Birds thus have little depth perception beyond the range of their bills but extensive fields of view to the side and behind. They judge their flight speed by the passing of objects to their sides, so their focus in flight is not necessarily ahead. Besides simply using designs with less glass, we can protect birds by using screens, shutters, and details that partly obscure glass while still providing a view, or by using two-dimensional patterns that birds perceive as actual barriers. However, birds have poor contrast sensitivity compared to humans: shapes at a distance merge into a blur at closer range for birds. This means that most signals that make glass safe for birds will probably be readily visible to people.

Reflections on home windows are a significant source of bird mortality. The partially opened vertical blinds here may break up the reflection enough to reduce the hazard to birds. Photo by Christine Sheppard, ABC

Birds may try to reach vegetation seen through two or more glass walls or windows; the single decal here is not enough to solve the problem, but two or three could do the trick. Photo by Christine Sheppard, ABC

(Opposite) The White-throated Sparrow is the most frequent victim of collisions reported by urban monitoring programs. Photo by Robert Royse

## Lighting: Exacerbating the Threat

Most birds, with obvious exceptions, are active by day, with eyes best adapted for daylight sight. However, many bird species migrate by night, allowing them to use daylight hours for feeding. We still don't know everything about how night-flying birds navigate. We do know that birds probably have two special senses that allow them to determine location and direction using the Earth's magnetic field. One of these, located in the eye, may allow birds to "see" magnetic lines in the presence of dim blue light. Star maps, landmarks, and other mechanisms are also involved.

Artificial night lighting seemingly disrupts orientation mechanisms evolved to work with dimmer, natural light sources and can cause birds to deviate from their flight paths. The problem is compounded for birds flying in mist or cloud, which can cause them to fly lower and closer to artificial light sources, depriving them of celestial and magnetic cues. As birds fly near light sources, they may become disoriented and eventually land in the built environment.

Light at night can disorient birds, and the problem is not restricted to tall buildings. This scene of Las Vegas by night depicts a threat to any bird migrating nearby at night. Photo by BrendelSignature, Wikipedia

The majority of collisions with buildings actually take place by day. As birds seek food to fuel their next migratory flight, they face a maze of structures, and many, unable to distinguish between habitat and reflections, hit glass. The amount of light emitted by a building is a strong predictor of the number of collisions it will cause, more so than building height. Patterns of light intensity across a nocturnal landscape may influence the pattern of birds landing in that landscape at the end of migration stages. Thus, reducing light trespass from all levels of buildings and their surroundings is an important part of a strategy to reduce collisions with glass. There is some recent evidence that electromagnetic radiation outside the visible spectrum may also disorient birds.

## Birds and the Built Environment

Humans first began using glass in Egypt around 3500 BCE. Glass blowing, invented by the Romans in the early first century CE, greatly increased the ways glass could be used, including the first crude glass windows. The 17th century saw the development of the float process, enabling production of large sheets of glass. This technology became more sophisticated, eventually making glass windows available on a large scale by the 1960s. In the 1980s, development of new production and construction technologies culminated in today's glass skyscrapers and increasing use of glass in all types of construction.

Sprawling land-use patterns and intensified urbanization degrade the quality and quantity of bird habitat across the globe. Cities and towns encroach on riverbanks and shorelines. Suburbs, farms, and recreation areas increasingly infringe upon wetlands and woodlands. Some bird species simply abandon disturbed habitat. For resident species that can tolerate disturbance, glass is a constant threat, as these birds are seldom far from human structures. Migrating birds are often forced to land in trees lining our sidewalks, city parks, waterfront business districts, and other urban green patches that have replaced their traditional stopover sites.

The amount of glass in a building is the strongest predictor of how dangerous it is to birds. However, even small areas of glass can be lethal. While bird kills at homes are estimated at one to 10 birds per home per year, the large number of homes multiplies that loss to millions of birds per year in the United States, representing over 46% of the total problem. Other factors can increase or decrease a building's impact, including the density and species composition of local bird populations; local geography; the type, location, and extent of landscaping and nearby habitat; prevailing wind and weather; and patterns of migration through the area. All must be considered when planning bird-friendly buildings.

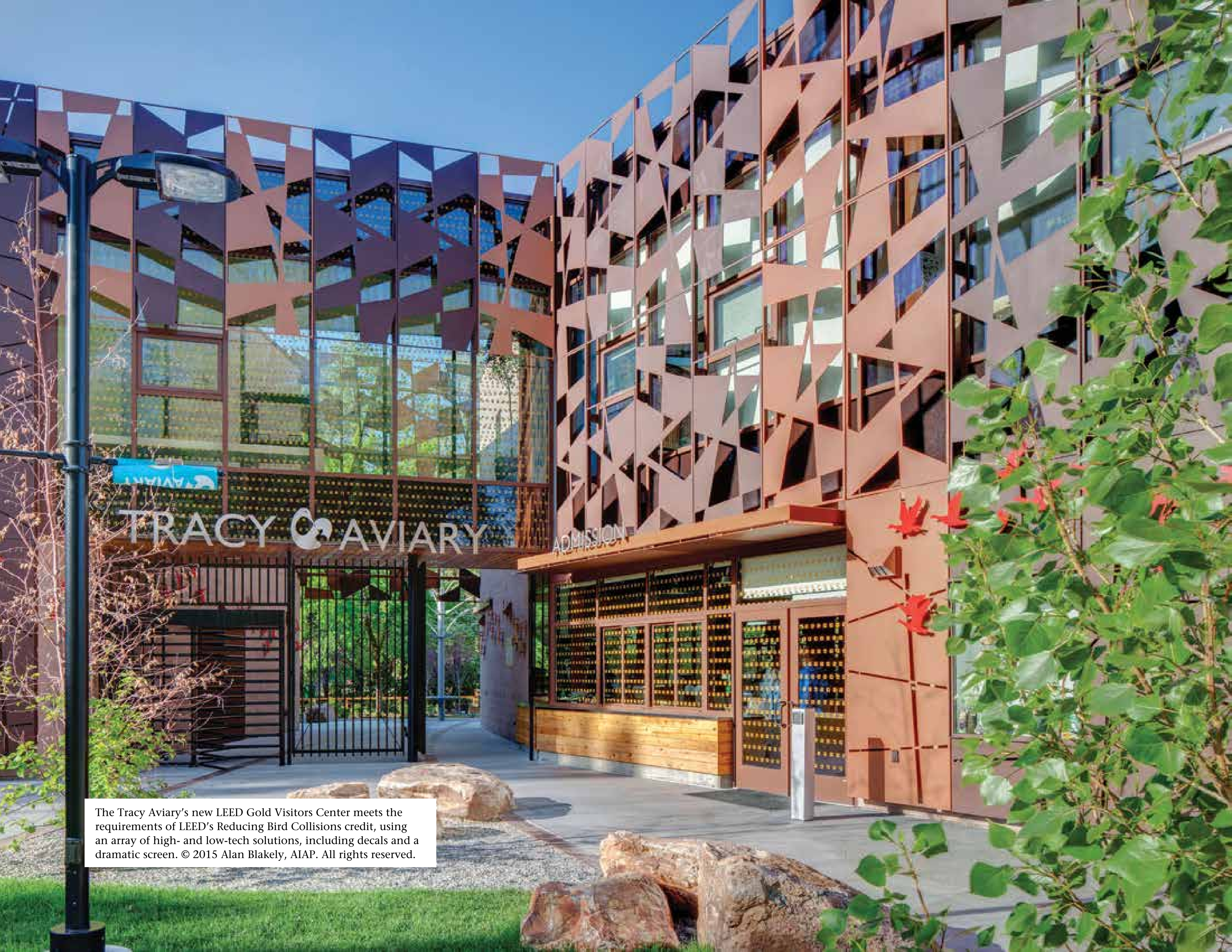
## Impact of Collisions on Bird Populations

About 25% of species are now on the U.S. Watch List of birds of conservation concern (abcbirds.org/birds/watchlist/), and even many common species are in decline. Habitat destruction or alteration of both breeding and wintering grounds remains the most serious man-made problem, but collisions with buildings are second only to domestic cats as direct fatality threats. Nearly one-third of the bird species found in the United States—more than 258 species, from hummingbirds to falcons—are documented as victims of collisions. Unlike natural hazards that predominantly kill weaker individuals, collisions kill all categories of birds, including some of the strongest, healthiest birds that would otherwise survive to produce offspring. Without action, the cumulative effect of these deaths will result in significant population declines. Most of the mortality is avoidable. This document is one piece of a strategy to keep building collisions from increasing and, ultimately, to reduce them.

## Bird Collisions and Sustainable Architecture

In recent decades, advances in glass technology and production have made it possible to construct tall buildings with all-glass walls, and we have seen a general increase in the amount of glass used in all types of construction. This is manifest in an increase in picture windows in private homes, glass balconies and railings, bus shelters, and gazebos. New applications for glass are being developed all the time. Unfortunately, as the amount of glass increases, so does the incidence of bird collisions.

The Cape May campus of Atlantic Cape Community College inherited a building with large areas of glass that did not have coatings or film to control temperature and glare—and there were many collisions. The addition of Collidescape has eliminated the threat to birds while reducing heating and cooling costs. Photo by Lisa Apel-Gendron



The Tracy Aviary's new LEED Gold Visitors Center meets the requirements of LEED's Reducing Bird Collisions credit, using an array of high- and low-tech solutions, including decals and a dramatic screen. © 2015 Alan Blakely, AIAP. All rights reserved.

In recent decades, growing concern for the environment has stimulated the creation of "green" standards and rating systems for development. The best known is the U.S. Green Building Council (USGBC) Leadership in Energy and Environmental Design, or LEED. While the USGBC concurred that sustainable buildings should not kill birds, it was initially difficult to create recommendations within the LEED credit system. The solution was based on a technique called "tunnel testing," a non-lethal method using live birds that permits a relative threat score to be assigned to patterned glass and other materials. (The section on Research in Chapter 6 reviews the work underlying the assignment of threat scores.)

On October 14, 2011, USGBC added Pilot Credit 55: Bird Collision Deterrence to its Pilot Credit Library. The credit was drafted by American Bird Conservancy (ABC), members of the Bird-Safe Glass Foundation, and the USGBC Site Subcommittee. Building developers that wish to earn this credit must quantify the threat level to birds posed by various materials and design details. These threat factors are used to calculate an index, or weighted average, representing the building's façade; that index must be below a standard value to earn the credit. The index is intended to provide wide latitude in creating designs that meet the criteria. The credit also requires adopting interior and exterior lighting plans and post-construction monitoring.

Pilot Credit 55 has been the most widely used credit in the pilot library. A revised version of the credit, posted in the fall of 2015, expands its availability to all LEED rating systems except "neighborhoods."

ABC is a registered provider of the American Institute of Architects (AIA) Continuing Education System, offering classes on bird-friendly design and LEED Pilot Credit 55 in face-to-face and webinar formats. Contact Christine Sheppard, csheppard@abcbirds.org, for more information.

## Defining What's Good for Birds

It is increasingly common to see the term "bird-friendly" used in a variety of situations to demonstrate that a particular product, building, legislation, etc., is not harmful to birds. All too often, however, this term is unaccompanied by a clear definition and lacks a sound scientific foundation to underpin its use. Ultimately, defining "bird-friendly" is a subjective task. Is bird-friendliness a continuum, and if so, where does friendly become unfriendly? Is "bird-friendly" the same as "bird-safe?" How does the definition change from use to use, situation to situation? It is impossible to know exactly how many birds a particular building will kill before it is built, and so, realistically, we cannot declare a building to be bird-friendly before it has been carefully monitored for several years.

There are factors that can help us predict whether a building will be particularly harmful to birds or generally benign, and we can accordingly define simple "bird-friendly building standards" that, if followed, significantly reduce potential hazard to birds. That said, a 75% reduction of mortality at a structure that kills 400 birds a year means that structure will still kill 100 birds a year. Because window kills affect reproductively active adult birds, the cumulative effect of saving some birds is amplified by their reproductive output. Because a 100% reduction in mortality may be difficult to achieve, ABC takes the position that it is better to take reasonable available actions immediately than to put off taking action until a perfect solution is possible or to take no action at all.

Hariri Pontarini Architects with Robbie/Young + Wright Architects used botanical imagery in 3M laminates to depict the plants that produce many of the compounds used by students at the University of Waterloo School of Pharmacy, Canada. Photo by Christine Sheppard, ABC

# Problem: Glass

The glass in this Washington, D.C., atrium poses a double hazard, drawing birds to plants inside as well as reflecting sky above. Photo by Christine Sheppard, ABC

## Properties of Glass

Glass, as a structural material, can range in appearance from transparent to mirrored to opaque. Its surface can completely reflect light or let virtually 100% of light pass through. A particular piece of glass will change appearance depending on environmental factors, including position relative to the sun, the difference between exterior and interior light levels, what may be reflected, and the angle at which it is viewed. Combinations of these factors can cause glass to look like a mirror or a dark passageway, or be completely invisible. Humans do not actually "see" clear glass, but are cued by context such as mullions, dirt, or window frames. Birds, however, do not perceive right angles and other architectural signals as indicators of obstacles or artificial environments: they take what they see literally. While local birds may become familiar with individual pieces of glass, they do not ever grasp the concept "glass."

The glass-walled towers of the Time Warner Center in New York City appear to birds as just another piece of the sky. Photo by Christine Sheppard, ABC

## Reflection

Under the right conditions, even transparent glass on buildings can form a mirror, reflecting sky, clouds, or nearby habitat attractive to birds. When birds try to fly to the reflected habitat, they hit the glass. Reflected vegetation is the most dangerous, but birds also attempt to fly past reflected buildings or through reflected passageways, with fatal results.

## Transparency

Birds strike transparent windows as they attempt to access potential perches, plants, food or water sources, or other lures seen through the glass, whether inside or outside. Large planted atria are frequent problems, as are glass balcony railings  and "skywalks" joining buildings. The increasing trend toward glass used in landscapes, as walls around roof gardens, as handrails or walkway dividers and even gazebos is dangerous because birds perceive an unobstructed route through them to habitat beyond.

## Black Hole or Passage Effect

Birds often fly through small gaps, such as spaces between leaves or branches, into nest cavities, or through other small openings that they encounter. In some light, the space behind glass can appear black, creating the appearance of just such a cavity or "passage" with unobstructed access through which birds try to fly.

Transparent handrails are a dangerous trend for birds, especially when they front vegetation. Photo by Christine Sheppard, ABC

Large facing panes of glass can appear to be a clear pathway. Photo by Christine Sheppard, ABC

The same glass can appear transparent or highly reflective, depending on weather or time of day.

Photos by Christine Sheppard, ABC

## Factors Affecting Rates of Bird Collisions for a Particular Building

Every site and every building can be characterized as a unique combination of risk factors for collisions. Some of these, particularly aspects of a building's design, are very building-specific. Many problem design features can be readily improved, or, in new construction, avoided. Others of these—for example, a building's location relative to migration stopover sites, regional ecology, and geography—are difficult if not impossible to modify.

## Building Design

People like glass and it has become a popular building material. All-glass buildings have become more and more common as glass has become a low-cost material for construction. Glass causes virtually all bird collisions with buildings. Studies based on monitoring data have shown a direct relationship between the amount of glass on a building and the number of collisions at that site—the more glass, the more bird deaths.

Mirrored glass is often used intentionally to make a building "blend" into a vegetated area by reflecting its surroundings, making those buildings especially deadly to birds. However, all-glass buildings are coming increasingly into question. According to groups like the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) and the International Code Council, when there is more than 30-40% glass on a façade, heating and cooling costs begin to increase.

## Building Size

Glass skyscrapers, because of their height and visibility, are often the main focus of collision documentation, and they do account for more collisions per building than smaller structures. However, because there are many more homes and low-rise buildings, the latter account for more total mortality. A study published by scientists at the Smithsonian in 2014 estimated 508,000 annual bird deaths for high-rises, 339 million for low-rises, and 253 million for homes. More collisions probably occur at glass on lower floors, where most bird activity takes place, but when monitors have had access to setbacks and roofs, they have consistently found at least some carcasses, indicating that glass at any level can be a threat.

## Orientation and Siting

Because migrating birds are frequent collision victims, it is often assumed that more collisions will occur on north- and south-facing façades. However, most building collisions take place during the day, and building orientation in relation to compass direction has not been implicated as a factor. Siting of buildings with respect to surrounding habitat and landscaping has more

Birds flying from a meadow on the left are channeled toward the glass doors of this building by a rocky outcrop to the right of the path. Photo by Christine Sheppard, ABC

Mirrored glass is dangerous at all times of day, whether it reflects vegetation, sky, or simply open space through which a bird might try to fly. Photo by Christine Sheppard, ABC

Plantings on setbacks and rooftops can attract birds to glass they might otherwise avoid. Chris Sheppard, ABC

implications. Physical features like walkways that provide an open flight path through vegetated landscape, or obstacles like outcrops of rock or berms, can channel birds toward or away from glass and should be considered early in the design phase. Movement patterns of birds within surrounding habitat may cause unanticipated collisions. Birds often fly between landscape features, for example, between two stands of trees, and may be at risk from structures along their route.

Glass that reflects shrubs and trees causes more collisions than glass that reflects pavement or grass. Studies that measured vegetation within only 15 to 50 feet of a façade have led to the misconception that plantings beyond a certain distance don't influence collisions, but vegetation at much greater distances can easily be visible in reflections. Vegetation around buildings will bring more birds into the vicinity of the building; the reflection of that vegetation brings more birds into the glass. Taller trees and shrubs correlate with more collisions. It should be kept in mind that vegetation on slopes near a building will reflect in windows above ground level. Studies using bird feeders (Klem *et al.* 1991) have shown that fatal collisions result when birds fly toward glass from more than a few feet away.

## Time of Day

Collisions tend to happen most when birds are most active. Many studies have documented that although collisions peak during the early morning, they can happen at almost any time of day. Most monitoring programs have focused on early morning before cleaning crews have swept sidewalks because of the increased likelihood of finding birds and because it is easier to obtain volunteer searchers in the pre-work hours.

## Green Roofs and Walls

Green roofs bring elements attractive to birds to higher levels, but often they are built in close proximity to glass. However, recent work shows that well-designed green roofs can become functional ecosystems, providing food and even nest sites for birds. Siting of green roofs, as well as green walls and rooftop gardens, should therefore be carefully considered, and glass adjacent to these features should have protection for birds.

Green roofs and walls can provide food and other resources to birds, but they can also attract birds to glass that they might not otherwise encounter. Emilio Ambasz's ACROS building in Fukuoka, Japan, is an interesting example. Photo by Kenta Mobuchi

This atrium has more plants than anywhere nearby on surrounding streets, making the glass deadly for birds seeking food or shelter in this area. Photo by Christine Sheppard, ABC

# Solutions: Glass

It is possible to design buildings that can reasonably be expected to kill few or no birds. Numerous examples already exist, not necessarily designed with birds in mind but simply to be functional and attractive. These buildings may have many windows, but their screens, latticework, louvers, and other devices outside, or patterns integrated into the glass, warn birds before they collide. Finding glass treatments that can eliminate or greatly reduce bird mortality, while minimally obscuring the glass itself, has been the goal of several researchers, including Martin Rössler, Daniel Klem, and Christine Sheppard. Their work, discussed in more detail in the Science chapter, has focused primarily on the spacing, length, width, opacity, color, and orientation of elements marked on glass, and has shown that patterns covering as little as 5% of the total glass surface can deter most strikes under experimental conditions. They have shown that as a general rule, most songbirds will not attempt to fly through horizontal spaces less than 2 inches high or through vertical spaces 4 inches wide or less. We refer to this as the 2 x 4 rule, and it is clearly related to the size and shape of birds in flight. (See chart on page 47).

Designing a new structure to be bird-friendly does not require restricting the imagination or adding to the cost of construction. Architects around the globe have created fascinating and important structures that incorporate little or no dangerous glass. In some cases, inspiration has been borne out of functional needs, such as shading in hot climates; in others, from aesthetics. Being bird-friendly usually has been incidental. Now, however, buildings are being designed with birds in mind, and materials designed for this purpose are multiplying. Until recently, retrofitting existing buildings has been more difficult and costly than it is today. However, new materials are appearing and costs can be controlled by targeting problem areas rather than entire buildings.

Bird-friendly materials and design features often overlap in function with materials to control heat and light, security measures, and decorative design details. Bird-friendly building-design strategies also fall into three general categories, although all three could be combined in a single structure. These are:

1. Using minimal glass (Bronx Call Center, U.S. Mission to the United Nations)
2. Placing glass behind some type of screening (de Young Museum, Cooper Union)
3. Using glass with inherent properties that reduce collisions (Brooklyn Botanic Garden Visitors Center; Student Center at Ryerson University, Toronto; and Cathedral of Christ the Light)

## Netting, Screens, Grilles, Shutters, Exterior Shades

There are many ways to combine the benefits of glass with bird-friendly design by incorporating elements that preclude collisions while providing light and views. Some architects have designed decorative façades that wrap entire structures. Decorative grilles are also part of many architectural traditions. Exterior, motorized solar screens and shades are effective at controlling heat and light, increase security, and can be adjusted to maximize view or bird and sun protection at different times. Netting, grilles, and shutters are common elements that can make glass safe for birds on buildings of any scale. They can be used in retrofit or be an integral part of an original design and can significantly reduce bird mortality.

(Opposite) The external glass screen on the GSA Regional Field Office in Houston, Texas, designed by Page Southerland Page, helps control heat but also reduces the likelihood of collisions. Photo by Timothy Hursley

The Brooklyn Botanic Garden's Visitors Center, designed by Weiss/Manfredi, was intended to be bird-friendly from its inception—a challenge, as it makes extensive use of glass. Photo @ Alber Vecerka, ESTO

Glass walls and doors at the Brooklyn Botanic Garden's Visitors Center include a custom fritting pattern that meets bird-friendly criteria. Monitoring for collisions after the building opened indicates that the design was successful. Photo by Christine Sheppard, ABC

Overhangs block viewing of glass from some angles, but do not necessarily eliminate reflections. Photo by Christine Sheppard, ABC

Reflections in this angled façade can be seen clearly over a long distance, and birds can approach the glass from any angle. Photo by Christine Sheppard, ABC

Before the current age of unopenable windows, screens protected birds in addition to serving their primary purpose of keeping bugs out. Screens are still among the most cost-effective methods for protecting birds, and, if insects are not an issue, nearly invisible netting can often be installed. Screens and netting should be installed at some remove from the window so that the impact of a strike does not carry birds into the glass. Several companies sell screens that can be attached with suction cups or eye hooks for small areas of glass. Others specialize in much larger installations. (Find sources at collisions.abcbirds.org).

## Awnings and Overhangs

Overhangs have been frequently recommended to reduce collisions. However, there are many situations in which overhangs do not eliminate reflections and only block glass from the view of birds flying above. They are thus of limited effectiveness as a general strategy. Overhangs work best when glass is shadowed from all sides. Functional elements such as balconies and balustrades can block the view of glass, protecting birds while providing an amenity for residents.

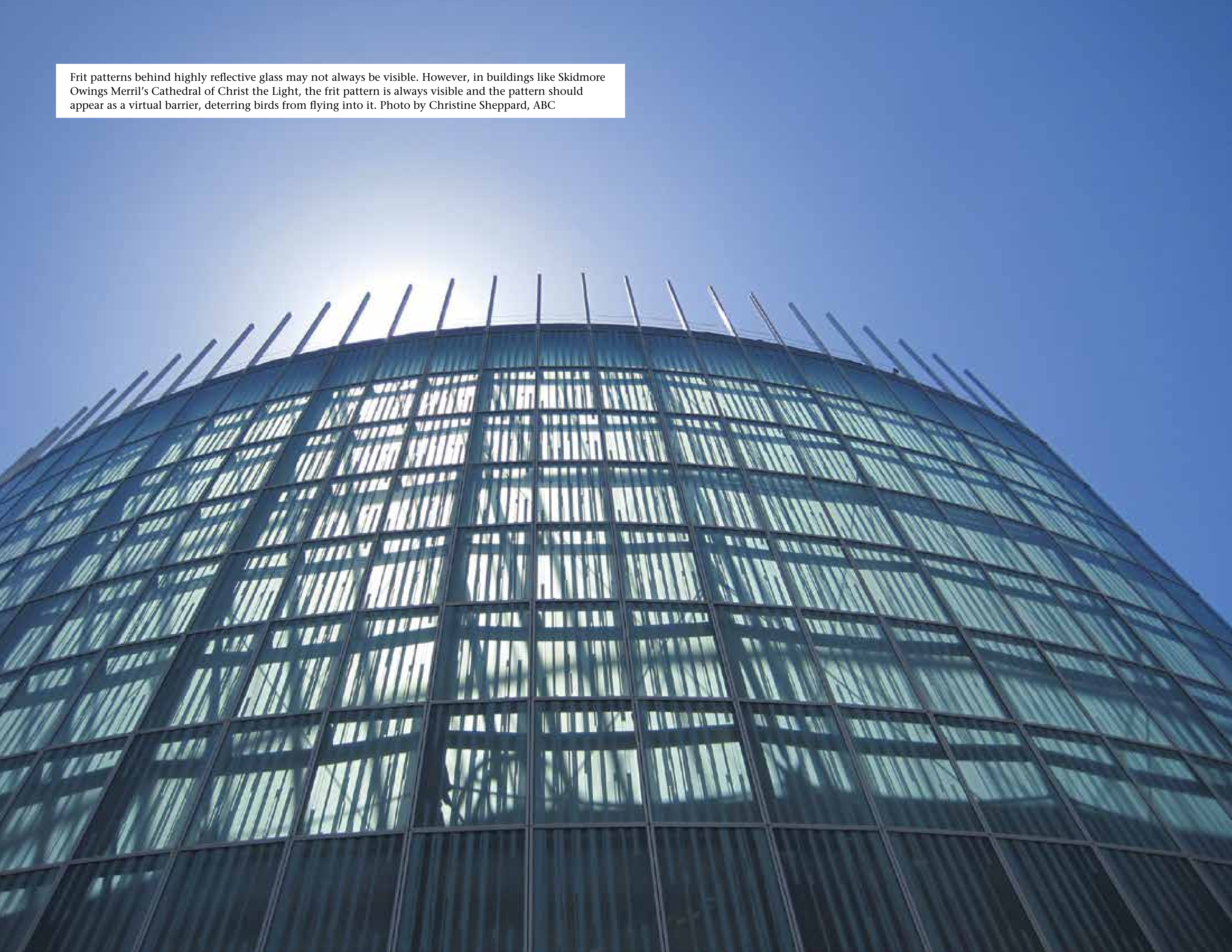
## Angled Glass

In a study (Klem et al., 2004) comparing bird collisions with vertical panes of glass to those tilted 20 or 40 degrees, the angled glass resulted in less mortality. Klem speculated that this was because the glass reflected the ground, not vegetation. Using angled glass has become a common recommendation as a bird-friendly feature. However, while angled glass may be useful in special circumstances, the birds in the study were flying parallel to the ground from nearby feeders, hitting the glass at acute angles, with less force than a perpendicular strike. In most situations, however, birds may approach glass from any angle.

## Patterns on Glass

Ceramic dots, other types of "frits," and other materials can be screened, printed, or otherwise applied to glass surfaces. This is often done to reduce the transmission of light and heat and can also provide design detail. In some cases, frit patterns are hardly visible, but when designed according to the 2 x 4 rule (see p. 47), patterns on glass can also prevent bird strikes. Patterns on the outside surface of glass deter collisions most effectively because they are always visible, even with strong reflections. This type of design, useful primarily for new construction, is currently more common in Europe and

A custom frit pattern was designed by Ennead Architects for Vassar College's Bridge for Laboratory Sciences building. Elements of the pattern occur on two separate surfaces, increasing visibility to birds in flight, who will see a constantly changing pattern that may appear to move. Photo by Christine Sheppard, ABC



Frit patterns behind highly reflective glass may not always be visible. However, in buildings like Skidmore Owings Merril's Cathedral of Christ the Light, the frit pattern is always visible and the pattern should appear as a virtual barrier, deterring birds from flying into it. Photo by Christine Sheppard, ABC

While some internal fritted glass patterns can be overcome by reflections, Frank Gehry's IAC headquarters in Manhattan is so dense that the glass appears opaque. Photo by Christine Sheppard, ABC

Ornilux Mikado's pattern reflects UV wavelengths. The spiderweb effect is visible only from very limited viewing angles. Photo courtesy of Arnold Glass

Asia, but is being offered by an increasing number of manufacturers in the United States. New technologies allowing printing of ceramic inks on the outside surface of glass may greatly increase options for bird-friendly design in the U.S.

More commonly, frit is applied to an internal surface of insulated glass units. This type of design may not be visible if the amount of light reflected by the frit is insufficient to overcome reflections on the outside surface of the glass or if frit is applied as dots below the visual threshold of birds. Some internal frits may only help break up reflections when viewed from some angles and in certain light conditions. However, with the right combination of surface reflectivity and frit application, a pattern on an inside surface can still be effective. The headquarters of the internet company IAC in New York City, designed by Frank Gehry, is composed entirely of fritted glass, most of high density and always visible. No collision mortalities have been reported at this building after two years of monitoring by New York City Audubon. FXFOWLE's Jacob Javits Center, also in Manhattan, reduced collisions by as much as 90% with a renovation that eliminated some dangerous glass and replaced other glass with a visible frit pattern. Another example of a visible internal frit pattern is seen in Skidmore Owings Merril's Cathedral of Christ the Light in Oakland, California.

## UV Patterned Glass

Songbirds, gulls, parrots, and other birds can see into the ultraviolet (UV) spectrum of light, a range largely invisible to humans (see page 41). Other bird types, including raptors, kingfishers, hummingbirds, and pigeons, are less sensitive to UV. Ultraviolet reflective and/or absorbing patterns "invisible to humans but visible to birds" are frequently suggested as the optimal solution for many bird collision problems, but few such products are available commercially as of 2015. Progress in development of bird-friendly UV glass has been slow, but with legislation in multiple locations mandating bird-friendly design, glass manufacturers and distributors, as well as window-film manufacturers, are taking an active role in developing new solutions for this application. Research indicates that UV patterns need strong contrast to be effective, especially in the early morning and late afternoon, when UV in sunlight is at low levels. However, UV patterns may be ineffective for many species that have been reported as victims of collisions with glass, including hummingbirds, flycatchers, American Woodcock, and woodpeckers.

## Opaque and Translucent Glass

Opaque, etched, stained, or frosted glass and glass block are excellent options to reduce or eliminate collisions, and many attractive architectural applications exist. They can be used in retrofits but are more commonly used in new construction. Frosted glass is created by acid etching or sandblasting transparent glass. Frosted areas are translucent, but various finishes are available with differing levels of light transmission. An entire surface can be frosted, or frosted patterns can be applied. Patterns should conform to the 2 x 4 rule described on page 47. For retrofits, glass also can be frosted by sandblasting on site. Stained glass is typically seen in relatively small areas but can be extremely attractive and is not conducive to collisions. Glass block is versatile, can be used as a design detail or primary construction material, and is also unlikely to cause collisions. Another promising material is photovoltaic glass, which has been used in stained-glass windows and highway noise barriers. This solution is especially interesting, because

The Wexford Science and Technology Building in Philadelphia, designed by Zimmer, Gunsul, Frasca, uses translucent glass to provide light without glare, making it safe for birds. Photo courtesy of Walker Glass transparent highway noise barriers can cause collisions, and such barriers are beginning to be installed in the United States.

## Window Films

Most patterned window films were initially intended for use inside structures as design elements or for privacy. Now, outside surface applications intended to reduce bird collisions are coming onto the market, and some have proved highly effective and popular. The oldest such product creates an opaque white surface on the outside of glass that still permits viewing from the inside. Patterns can be printed on this material, although images of trees and other habitat are not recommended.

A film with a pattern of narrow, horizontal stripes has eliminated collisions at the Philadelphia Zoo Bear Country exhibit for over five years (see photo opposite) and has been similarly successful in other installations when applied to outside surfaces of glass. In these cases, the response has been positive. Another option is to apply vinyl patterns like window film but with the transparent backing removed.

## Solutions Applied to Interior Glass

Light colored shades have been recommended as a way to deter collisions. However, when visible, they do not effectively reduce reflections, and reflections may make them completely invisible. Closed blinds have the same problems, but if visible and partly open, they can produce the appearance of a 2 x 4 pattern. If an exterior solution is not possible and tape or sticky notes are applied to the inside of windows, be sure to check the windows several times a day to ensure that these materials are visible.

## Decals and Tape

Decals are probably the most familiar solution to bird collisions, but their effectiveness is widely misunderstood. Birds do not recognize decals as

A Zen Wind Curtain is an inexpensive but extremely effective way to deter collisions. Lengths of parachute cord or similar materials are strung vertically, every four inches, in front of problem glass, creating both a visual and a physical barrier. Photo by Glenn Phillips, ABC

This window at the Philadelphia Zoo Bear Country exhibit was the site of frequent bird collisions until window film was applied. Collisions have been eliminated for over five years, with no complaints from visitors about visibility of bears! Photo courtesy of the Philadelphia Zoo silhouettes of falcons, spiderwebs, or other natural objects, but simply as obstacles that they may try to fly around. Decals can be very effective if applied following the 2 x 4 rule on the outside of glass, but in general, they must be replaced frequently, at least annually. Tape is generally more cost effective and quicker to apply, but most household tapes don't stand up well to the elements. Tape intended to last for several years on the outside of windows has become commercially available and is effective when applied following the 2 x 4 guide.

ABC BirdTape was effective at the Forest Beach Migratory Reserve in Wisconsin (left), and also performed well in tunnel tests conducted in Austria. Photo by Christine Sheppard, ABC

The Consilium Towers, a mirror-glass complex in Toronto, once killed thousands of birds each year. After being taken to court, its owners retrofitted the lower 60 feet of glass with a Feather Friendly dot pattern that has greatly reduced bird mortality.

Reflected in this glass is Michael Mesure, the founder of Toronto's Fatal Light Awareness Program. Photos by Christine Sheppard, ABC

## Temporary Solutions

In some circumstances, especially for homes and small buildings, quick, low-cost, temporary solutions, such as making patterns on glass with paint, stickers, or even post-its, can be very effective in the short term. Even a modest effort can reduce collisions. Such measures can be applied when needed and are most effective following the 2 x 4 rule. (For more information, see ABC's flyer "You Can Save Birds from Flying into Windows" and other sources at collisions.abcbirds.org).

## ABC BirdTape

ABC, with support from the Rusinow Family Foundation, has produced ABC BirdTape to make home windows safer for birds. This easy-to-apply tape lets birds see glass while letting you see out, is easily applied, and lasts up to four years. For more information, visit abcbirdtape.org

Photos by Dariusz Zdziebkowski, ABC

# REMEDIATION CASE STUDY: Javits Center

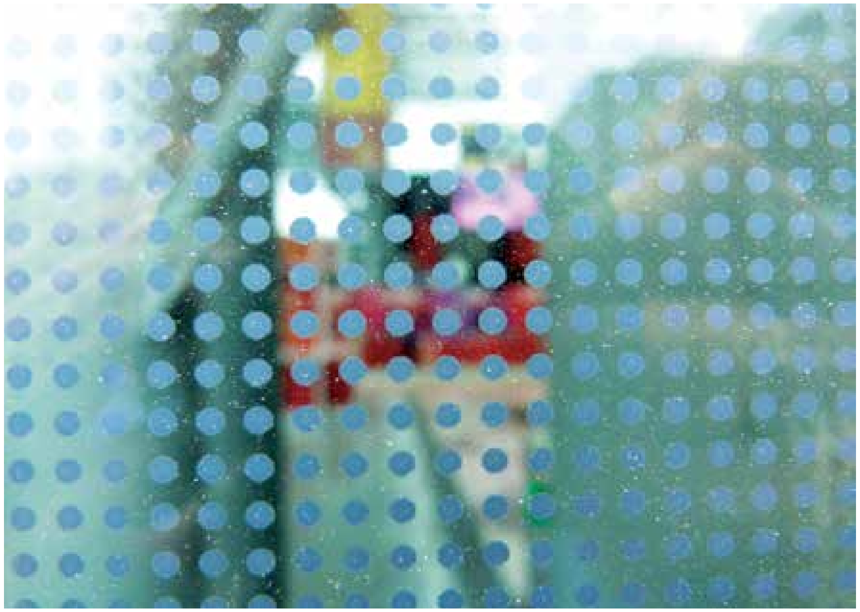
In 2009, the New York City Audubon Society identified the Jacob K. Javits Convention Center as having one of the highest bird-collision mortality rates in New York City.

A major renovation and expansion, designed by the bird-friendly architectural firm of FXFOWLE, was completed in 2014. Some especially deadly glass at street level was replaced with opaque panels. Large panes of clear fritted glass with varying surface characteristics were brought to the site and compared to find the right combination for birds and people.

A 6.75-acre green roof, with adjacent translucent glass, crowns the building and is already providing resources for birds.

Best of all, collisions at the now much larger site have been reduced by 90%.

From a distance, the Javits Center looks like a potential threat to birds.



At close range, a visible pattern of frit dots breaks up reflections, making the glass safe for birds.
Photos by Glenn Phillips, ABC

# Light: Problems and Solutions

Fixtures such as these reduce light pollution, saving energy and money and reducing negative impacts on birds. Photo by Dariusz Zdziebkowski, ABC

Birds evolved complex complementary systems for orientation and vision long before humans developed artificial light. We still have much more to learn, but recent science has begun to clarify how artificial light poses a threat to birds, especially nocturnal migrants. Although most glass collisions take place during daylight hours, artificial lighting at night plays a role in the number and distribution of collisions across the built environment. Unfortunately, the details of how birds respond to night lighting are less well understood than has been commonly believed.

Many collision victims, especially songbirds, are ordinarily active by day and have eyes specialized for color vision and bright light. But although they migrate at night, these birds have poor night vision. Instead, they have magnetic senses that allow them to navigate using the Earth's magnetic field. One of these is located in the retina and requires dim blue natural light to function. Red wavelengths found in most artificial light have been shown to disrupt that magnetic sense. Studies in Germany and Russia have documented birds flying through beams of light and diverting from their course anywhere from a few degrees to a full circle. Areas with significant light pollution may be completely disorienting to birds.

Birds are attracted to relative brightness, and by day often orient toward the sun. If a songbird flies into a home, darkening the room and opening a bright window is the best way to release it. Birds are thought to be attracted to artificial light at night, but we don't know what light level at what distance is sufficient to cause attraction or other behavioral impacts. Gauthreaux and Belser, discussing impacts of night lighting on birds, speculated that in fact, birds affected by night lighting may simply be on course to pass over the lights, not necessarily attracted from a distance. Marquenie and Van de Laar, studying birds and lights on a drilling rig in the North Sea, estimated that when all the lights on the platform were lit, they affected birds up to 3 to 5 kilometers away, causing many to circle the platform.

The science is inconclusive: Lights may only impact birds as they end a migratory stage and come down close to the built environment, or lights may divert birds that would ordinarily pass by. Bad weather can cause birds to fly lower and closer to lights, while also eliminating any visual cues. The interactions that produce correlations between building light emissions and collisions may take place at relatively close range. Once birds come close to a light source, the electromagnetic radiation actively interferes with their magnetic orientation mechanism.

Overly lit buildings waste electricity and increase greenhouse gas emissions and air pollution levels. They also pose a threat to birds. Photo by Matthew Haines

Houston skyline at night. Photo by Jeff Woodman

## Examples of Acceptable/Unacceptable Lighting Fixtures

Reprinted courtesy of DarkSkySociety.org

Some combination of attraction and disorientation may result in larger numbers of birds in the vicinity of brighter buildings and thus, by day, in more collisions. Interestingly, there seem to be no reports of lights attracting or disorienting migrants as they take off on a new migratory stage.

There has been a tendency to associate collision events with very tall structures, though published reports clearly document impact from light at all levels. Early reports of this phenomenon came from lighthouses. Contemporary reports of light-associated circling events are common at oceanic drilling rigs, and disoriented birds have been reported at night skiing sites. A study in Toronto, using the number of lighted windows on a series of buildings as an index of emitted light, found that the amount of light emitted, not the height of the building, was the best predictor of bird mortality.

## Solutions

Poorly designed or improperly installed outdoor fixtures add over $1 billion to electrical costs in the United States every year, according to the International Dark Skies Association. Recent studies estimate that over two-thirds of the world's population can no longer see the Milky Way, just one of the nighttime wonders that connect people with nature. Glare from poorly shielded outdoor light fixtures decreases visibility and can create dangerous conditions, especially for older people, and recent studies suggest that long-term exposure to night lighting can increase the risk of breast cancer, depression, diabetes, obesity, and sleep disorders. Together, the ecological, financial, and cultural impacts of excessive building lighting are compelling reasons to reduce and refine light usage.

Reducing exterior building and site lighting has proven effective at reducing mortality of night migrants at individual buildings, but achieving overall reduction in collisions will require applying those principles on a wider scale. At the same time, these measures reduce building energy costs and decrease air and light pollution. Efficient design of lighting systems plus operational strategies to reduce light trespass or “spill light” from buildings while maximizing useful light are both important strategies. In addition, an increasing body of evidence shows that red light and white light (which contains red wavelengths) particularly confuse birds, while green and blue light may have far less impact.

Light pollution is largely a result of inefficient exterior lighting, and improving lighting design usually produces savings greater than the cost of changes. For example, globe fixtures permit little control of light, which shines in all directions, resulting in a loss of as much as 50% of energy, as well as poor illumination. Cut-off shields can reduce lighting loss and permit use of lower powered bulbs. Most “vanity lighting” is unnecessary. However, when it is used, down-lighting causes less trespass than up-lighting. Where light is needed for safety and security, reducing the amount of light trespass outside of the needed areas can help by eliminating shadows. Spotlights and searchlights should not be used during bird migration. Communities that have implemented programs to reduce light pollution have not found an increase in crime.

Using automatic controls, including timers, photosensors, and infrared and motion detectors, is far more effective than relying on employees turning off lights. These devices generally pay for themselves in energy savings in less than a year. Workspace lighting should be installed where needed, rather than in large areas. In areas where indoor lights will be on at night, minimize perimeter lighting and/or draw shades after dark. Switching to daytime cleaning of office buildings is a simple way to reduce lighting while also reducing costs.

## Lights Out Programs

Despite the complexity of reducing bird collisions with glass, there is one simple way to decrease mortality: turn lights off. Across the United States and Canada, “Lights Out” programs at the municipal and state levels encourage building owners and occupants to turn out lights visible from outside during spring and fall migration. The first of these, Lights Out Chicago, was started in 1995, followed by Toronto in 1997. The programs themselves are diverse. Some are directed by environmental groups, others by government departments, and still others by partnerships of organizations. Participation in most, such as Houston’s, is voluntary. Minnesota mandates turning off lights in state-owned and leased buildings.

Many jurisdictions have monitoring components. Monitoring programs can provide important information in addition to quantifying collision levels and documenting solutions. Ideally, lights-out programs would be in effect year-round and be applied widely, saving birds and energy costs and reducing emissions of greenhouse gases. ABC stands ready to help develop new programs and to support and expand existing programs.

Powerful beams of light, even in a landscape of urban light pollution, can entrap migrating birds, seen here circling in the beams of the 9/11 Memorial Tribute in Light in New York City. Because birds may circle for hours, monitors watch all night, and the light beams are temporarily turned off to release large accumulations of birds. Photo by Jason Napolitano

# Solutions: Policy

## Legislation

Changing human behavior is generally a slow process, even when the change is uncontroversial. Legislation can be a powerful tool for modifying behavior. Conservation legislation has created reserves, reduced pollution, and protected threatened species and ecosystems. Policies that promote bird-friendly design and reduction of light pollution have recently proliferated across the United States and Canada, following the early examples of Toronto and San Francisco. They vary considerably in scope and detail, often reflecting local politics. (A real-time database of ordinances and other instruments mandating or promoting bird-friendly action, including links to source language, can be found at collisions.abcbirds.org).

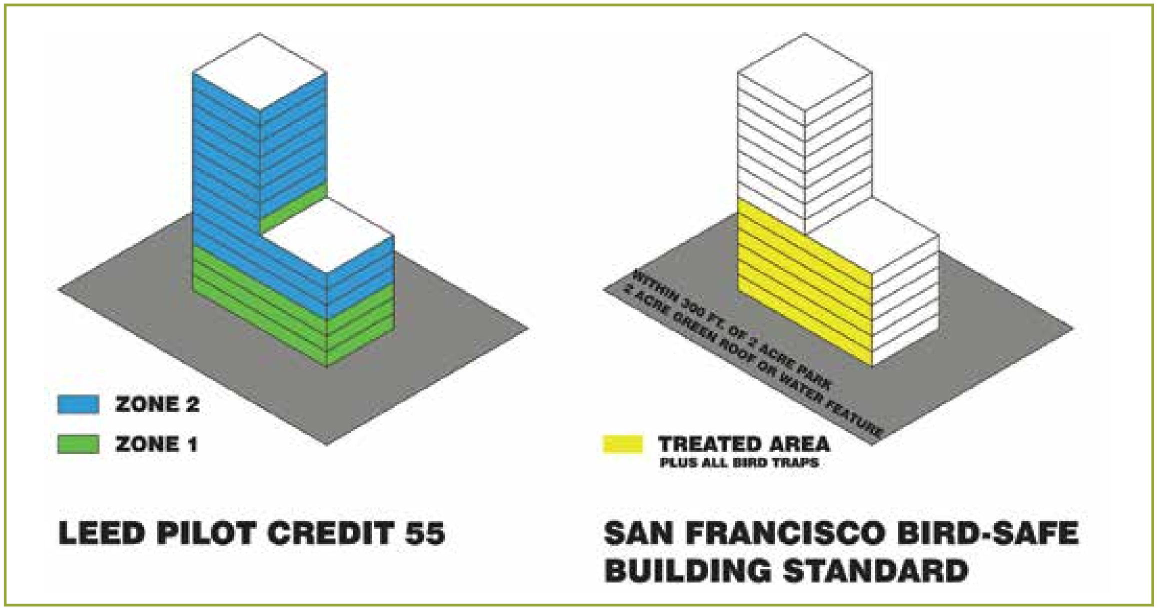
An early challenge in creating effective legislation was the lack of objective measures that architects could use to accomplish their task. For example, a common recommendation, to "increase visual noise," because it was unquantified and undefined, made it difficult for architects and planners to know whether a particular design complied with requirements. Material testing (see p. 45) has made it possible to assign relative threat factors to various building façade materials and to use those scores to create quantitative guidelines and mandates.

The illustration to the right broadly compares San Francisco's Bird-safe Building Standard with LEED Pilot Credit 55, both based on the use of materials with quantified threat levels. San Francisco's standard applies generally to new construction and is restricted to façades within 300 feet of a two-acre park or pond. The LEED credit is intentionally very flexible. It applies to all building facades and allows for restricted amounts of high-threat glass, or larger amounts of bird-friendly glass. Because birds are found throughout the built environment, ABC prefers the LEED model. (ABC's model legislation can be found on page 35.)

Bird lovers across the country are proposing bird-friendly design ordinances at both local and state levels. ABC is ready to actively support such efforts. Both mandatory and voluntary instruments can be effective. Voluntary guidelines are easier to modify if they prove to have unintended consequences and can lead to a mandate, but can also be ignored. Generally ABC recommends mandatory guidelines, beginning with a small subset of buildings and expanding as community support increases and resistance decreases.

Incorporating bird-friendly design issues into local sustainability policies is another way to drive change. An interesting example of this is the Fairfax County, Virginia, proffer system. New construction projects are required to address a series of sustainability issues, including potential bird mortality, and either to describe

The design of the Grange Insurance Audubon Center in Columbus, Ohio, includes many panels of glass, fitted with the silhouettes of species of birds in flight. Photo by Christine Sheppard, ABC



courtesy of Deborah Laurel

(Opposite) United States Capitol, Washington, D.C. Photo by stock.xchng

For its new Visitors Center in Sempach, opened in May 2015, the Swiss Ornithological Institute designed a mandala from bird silhouettes (below) that was applied on the inside of all glass using digital printing. The design provides 40-50% coverage and generates much discussion among visitors, an achievement second only to preventing bird collisions.

Photos by Hans Schmid

how these will be addressed by the project or explain why such action is not possible.

## Priorities for Policy Directives

ABC generally recommends against attempting to map locations where bird-friendly design is required because birds can be found in almost every environment, even in seemingly inhospitable ones. However, there may be occasions when it is necessary to compromise on the scope of legislation. In such cases, it must be recognized that proximity to undeveloped land, agricultural areas, parks, and water often correspond to increased bird populations and therefore increased risk of collisions. In addition, areas located in between landscape features desirable to birds may also pose higher risks. For example, in New York City some evidence suggests that birds approach Central Park from due south during spring migration, creating a greater risk zone directly south of the park. Also, building features such as green roofs should be considered when determining greater risk zones for policy purposes.

## Sustainability Rating Programs

Another driver of bird-friendly policies consists of sustainability rating programs like the Green Building Council's LEED program, Green Globes, Living Building Challenge, and others. There is general agreement that sustainable buildings should not kill birds. This tenet appears with differing levels of robustness in different systems, with the most specific being the LEED program, which grants Pilot Credit 55: Bird Collision Deterrence. The credit is calculated using a weighted average of the relative threat rating of each material on a building's façade. The credit has attracted a lot of attention, with many projects applying for it. The new Vassar Bridge for Laboratory Sciences on the cover of this publication was one of the first to be designed with the credit in mind and to earn the credit.

Because a number of glass-walled buildings have been awarded LEED certification at the highest level, at one point there was concern that sustainable design was not compatible with bird-friendly design. This was ironic, as in addition to providing natural light, glass on sustainable buildings is intended to link people inside with the natural world outside. However, according to both ASHRAE and ICC, costs for heating and cooling increase when total glass surface exceeds 30-40% of the total building envelope, depending on climate. This is more than sufficient for providing light and views when glass placement is considered thoughtfully. This is a great place to start the design of a bird-friendly structure.

The façade of the WÜRTH Building in Switzerland is mostly glass, laminated with a fabric that is black on the inside but aluminium-coated outside. The inner surface delivers good visibility, and the fabric provides shade and interesting visual effects outside. Preliminary studies by the Swiss Ornithological Institute suggest that the materials used in this building may also deter bird collisions. Photo by Hans Schmid

# Model Ordinance for Bird-Friendly Construction

[ORDINANCE Name] Sponsored by:
[list names ]

WHEREAS, birds provide valuable and important ecological services,

WHEREAS, [location] has recorded [ ] species of resident and migratory bird species,

WHEREAS, birding is a hobby enjoyed by 64 million Americans and generates more than $40 billion a year in economic activity in the United States,

WHEREAS, as many as one billion birds may be killed by collisions with windows every year in the United States,

WHEREAS, reducing light pollution has been shown to reduce bird deaths from collisions with windows,

WHEREAS, new buildings can be designed to reduce bird deaths from collisions without additional cost,

WHEREAS, there exist strategies to mitigate collisions on existing buildings,

WHEREAS, more than 30% glass on a façade usually increases costs for heating and cooling

WHEREAS, bird-friendly practices often go hand-in-hand with energy efficiency improvements,

And WHEREAS [any additions specific to the particular location]

NOW, THEREFORE, BE IT ORDAINED, by [acting agency] [title of legislation and other necessary language]

(a) In this section the term "Leadership in Energy and Environmental Design (LEED)" means a green building rating system promulgated by the United States Green Building Council (USGBC) that provides specific principles and practices, some mandatory but the majority discretionary, that may be applied during the design, construction, and operation phases, which enable the building to be awarded points from reaching present standards of environmental efficiency so that it may achieve LEED certification from the USGBC as a "green" building.

b) [acting agency] does hereby order [acting department] to take the steps necessary to assure that all newly constructed buildings and all buildings scheduled for capital improvement are designed, built, and operated in accordance with the standards and requirements of the LEED Green Building Rating System Pilot Credit 55: Bird Collision Deterrence.

(c) The USGBC releases revised versions of the LEED Green Building Rating System on a regular basis; and [acting department] shall refer to the most current version of the LEED when beginning a new building construction permit project or renovation.

(d) New construction and major renovation projects shall incorporate bird-friendly building materials and design features, including, but not limited to, those recommended by the American Bird Conservancy publication *Bird-Friendly Building Design*.

(e) [acting department] shall make existing buildings bird-friendly where practicable.

The Studio Gang's Aqua Tower in Chicago was designed with birds in mind. Strategies included fritted glass and balcony balustrades. Photo by Tim Bloomquist

# The Science of Bird Collisions

Hundreds of species of birds are killed by collisions. These birds were collected by monitors with FLAP in Toronto, Canada. Photo by Kenneth Herdy

## Magnitude of Collision Deaths

The number of birds killed by collisions with glass every year is astronomical. Quantifying mortality levels and impacts on populations has been difficult, however. Until recently, local mortality studies—despite producing valuable information—aimed more at documenting mortality than quantifying it, and did not follow rigorous protocols. Loss *et al.* (2012) created methodology and techniques of analysis to determine the magnitude of anthropogenic mortality, using existing data sets. The authors comprehensively acquired published and unpublished data sets on collisions with buildings (Loss *et al.*, 2013). Data sets were filtered using a variety of criteria to ensure that they could be used in single analyses. Loss *et al.* (2014b) have also comprehensively described how to collect meaningful data on collisions.

The authors calculated the median annual mortality at homes at 253 million, or 2.1 birds per structure. Urban residences without feeders account for 33% of this mortality cumulatively, as there are more such residences, even though residences with feeders produce more collisions individually. Rural residences without feeders account for 31% of residential mortality, followed by urban residences with feeders (19%) and rural residences with feeders (17%). Median mortality at low-rise buildings (4 to 11 stories), calculated from two data sets, was averaged as 339 million, or 21.7 birds per building. High-rises, although collectively causing the least mortality (508,000), individually had the highest median rate of 24.3 bird collisions per building. Combining all building classes produces an estimate of 365 and 988 (median 599) million birds killed annually in the United States.

Machtans, *et al.* (2013) estimated that about 25 million (ranging from 16 to 42 million) birds are killed by colliding with windows in Canada annually, with 90% of building-related mortalities caused by houses, slightly less than 10% by low-rise buildings, and approximately 1% by tall buildings. In both cases, the total mortality caused by houses is a function of their large number compared to the two other classes of buildings.

Previously, Dunn (1993) surveyed 5,500 people who fed birds at their homes and recorded window collisions. She derived an estimate of 0.65-7.7 bird deaths per home per year for North America. Klem (1990) estimated that each building in the United States kills one to 10 birds per year. Using 1986 U.S. census data, he combined numbers of homes, schools, and commercial buildings for a maximum total of 97,563,626 buildings, producing an estimate of 100 million to one billion birds killed annually.

Klem *et al.* (2009a) used data from New York City Audubon's monitoring of 73 Manhattan building façades to estimate 0.5 collision deaths per acre per year in urban environments, for a total of about 34 million migratory birds annually colliding with city buildings in the

This Barn Swallow illustrates the type of acrobatic flying that may keep swallows from being frequent collision victims. If birds do identify glass as a barrier at close range, perhaps by sound or air movements, most species may be unable to react fast enough to avoid striking the surface. Photo by Keith Ringland

A sample of collision victims from Baltimore.
Photo by Daniel J. Lebbin, ABC

Sharp-shinned Hawk. Photo by Ted Ardley

United States. However, there could be major differences in collision patterns in cities across the United States, and these numbers should be confirmed using data from additional locations.

In *The American Bird Conservancy Guide to Bird Conservation* (Lebbin *et al.*, 2010) the authors state "…we have reached a point in history when the impacts of human activities are so profound and far-reaching that from now on, it will always be impossible to untangle the completely natural declines from those that are partially or completely anthropogenic. From a conservation standpoint, it is largely irrelevant, anyway. Any human-caused stress that we can alleviate from a declining species can potentially benefit its population, and we should take action to lessen that stress if we can." This is abundantly true for bird mortality from glass because there are actions that many, if not most, individuals can take themselves, directly, to reduce the toll taken by existing glass.

## Patterns of Mortality

It is difficult to get a complete and accurate picture of avian mortality from collisions with glass. Collision deaths can occur at any time of day or year. Monitoring programs focus on cities, and even intensive monitoring programs cover only a portion of a city, usually visiting the ground level of a given site at most once a day and often only during migration seasons. Many city buildings have stepped roof setbacks that are inaccessible to monitoring teams. Some studies have focused on reports from homeowners on backyard birds (Klem, 1989; Dunn, 1993) or on mortality of migrants in an urban environment (Gelb and Delacretaz, 2009; Klem *et al.*, 2009a; Newton, 1999). Others have analyzed collision victims produced by single, large-magnitude incidents (Sealy, 1985) or that have become part of museum collections (Snyder, 1946; Blem *et al.*, 1998; Codoner, 1995). There is general support for the fact that birds killed in collisions are not distinguished by age, sex, size, or health (for example: Blem and Willis, 1998; Codoner, 1995; Fink and French, 1971; Hager *et al.*, 2008; Klem, 1989), but the majority of work has focused on data taken during migratory periods, primarily east of the Mississippi River.

## Species at Risk

Snyder (1946), examining window collision fatalities at the Royal Ontario Museum, noted that the majority were migrants and "tunnel flyers"—species that frequently fly through small spaces in dense, understory habitat. Conversely, resident species well adapted to and common in urban areas, such as the House Sparrow and European Starling, are not prominent on lists of fatalities, possibly because individuals surviving their first collision may teach offspring to avoid windows.

It is well known that zoo birds in exhibits with glass walls can and do learn about specific pieces of glass, but birds do not learn about glass as a general concept.

Dr. Daniel Klem maintains running totals of the number of species reported in collision events in countries around the world. (This information can be found at http://tinyurl.com/ob3nc4s). In 2015, the site identifies 868 species globally, with 274 from the United States. The intensity of monitoring and reporting programs varies widely from country to country, however.

Hager *et al.* (2008) compared the number of species and individual birds killed at buildings at Augustana College in Illinois with the density and diversity of bird species in the surrounding area. The authors concluded that the total window area, the habitat immediately adjacent to windows, and behavioral differences among species were the best predictors of mortality patterns, rather than the mere size and composition of the local bird population. Kahle *et al.* (2015) reached similar conclusions in an analysis of five years of data at the California Academy of Sciences, also finding that migrants do not make up the preponderance of birds killed and that males are overrepresented relative to their abundance in habitats adjacent to the museum. Dunn (1993), analyzing winter data from homes with bird feeders, found that the frequency distribution of birds at the feeders closely paralleled the distribution of species killed by nearby windows. Dunn found few collisions on windows of less than one square meter, and an increase in collisions with an increase in window size.

Species such as the White-throated Sparrow, Ovenbird, and Common Yellowthroat appear consistently on top 10 lists from urban areas. It is possible that these species respond more readily to light and thus are more likely to end migratory stages in the built environment, but this needs to be confirmed. Additionally, Loss *et al.* (2013) noted that Golden-winged Warbler, Painted Bunting, Canada Warbler, Wood Thrush), Kentucky Warbler, and Worm-eating Warbler—species identified as birds of conservation concern—were also disproportionately represented in building kills. Hager (2009) noted that window-strike mortality was reported for 45% of raptor species found frequently in urban areas of the United States and was the leading source of mortality for Sharp-shinned Hawks, Cooper's Hawks, Merlins, and Peregrine Falcons. Because most data on glass collisions are from the eastern half of the United States, these lists are presumably biased toward species occurring in that range.

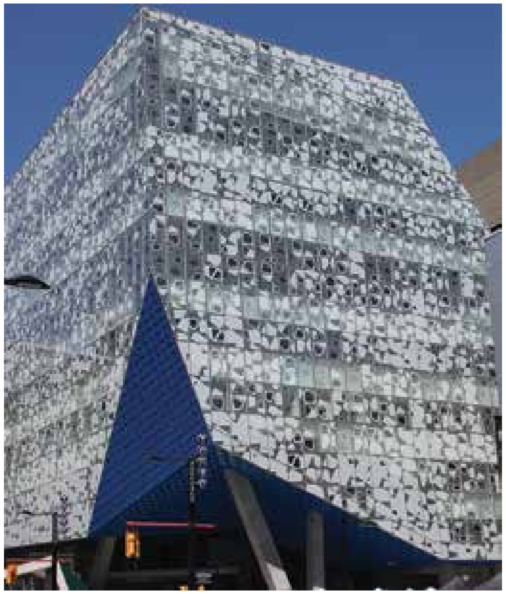

Common Yellowthroat. Photo by Owen Deutsch

# Characteristics of Buildings

## Amount of Glass

From a study of multiple buildings in Manhattan, Klem *et al.* (2009a) concluded that both the proportion and absolute amount of glass on a building façade best predict mortality rates, calculating that every increase of 10% in the expanse of glass correlates to a 19% increase in bird mortality in spring and 32% in fall. How well these equations predict mortality in other cities remains to be tested. Collins and Horn (2008), studying collisions at Millikin University in Illinois, concluded that total glass area and the presence/absence of large expanses of glass predicted mortality level. Hager *et al.* (2008, 2014) came to the same conclusion, as did Dunn (1993) and Kahle *et al.* (2015). However, the "patchiness" of glass across a façade—how many pieces, their size, how they are separated, etc. (another way of saying "visual noise")—has not yet been explored in detail but could be important.

The façade of the New York Times building, by FXFOWLE and Renzo Piano, is composed of ceramic rods, spaced to let occupants see out while minimizing the extent of exposed glass—good for controlling heat and light, and safe for birds. Photo by Christine Sheppard, ABC



Snohetta's Student Learning Centre at Ryerson University is one of the first constructed under Toronto's design law. Photo by Rick Ligthelm

## Time of Day

Most monitoring programs focus on early morning hours to document mortality during migration, often starting monitoring routes at dawn, before sidewalks are cleared. This can, however, lead to the misperception that night-flying migrants are crashing into lighted buildings at night, or only in early morning, whereas in fact most collisions take place during the day. It should be noted that "dawn" is a time that varies among species (Thomas *et al*. (2002), with some bird species active before humans start to see light in the sky.

Hager and Craig (2014), in a study of resident population collisions in northwestern Illinois between June and early August, found that 66% of birds died between sunrise and 4:00 p.m., with no collisions between 4:00 p.m. and sunset. Delacretaz and Gelb (2006) found collisions from early morning until mid-afternoon, but with a peak during morning hours. This finding is confirmed by monitoring programs like that of Pennsylvania Audubon, where routes were followed three times in succession early each day, with birds found at each pass (Keith Russell, pers. comm.) and where people living or working in buildings report window strikes through afternoon hours (Olson, pers. comm).

## Local Landscape

Gelb and Delacretaz (2006, 2009) evaluated data from collision mortality at Manhattan building façades. They found that sites where glass reflected extensive vegetation were associated with more collisions than glass reflecting little or no vegetation. Of the 10 buildings responsible for the most collisions, four were "low-rise." Klem (2009) measured variables in the space immediately associated with building façades in Manhattan as risk factors for collisions. Both increased height of trees and increased height of vegetation increased the risk of collisions in fall. Ten percent increases in tree height and the height of vegetation corresponded to 30% and 13% increases in collisions in fall. In spring, only tree height had a significant influence, with a 10% increase corresponding to a 22% increase in collisions. Confusingly, increasing "facing area," defined as the distance to the nearest structure, corresponded strongly with increased collisions in spring and with reduced collisions in fall. Presumably, vegetation increases risk both by attracting more birds to an area and by being reflected in glass.

Bayne *et al*. (2012) confirmed that the risk of bird–window collisions varies according to location (urban versus rural, home versus apartment, with or without feeders, and age of neighborhood). They used online surveys and determined that rural residences had more collisions than urban ones and residences with feeders had almost twice as many collisions as those without feeders. For urban dwellings, incidence of collisions increased with age of neighborhood, associated with presence of mature trees. Frequency of collisions varied seasonally: 24% in fall, 35% summer, 25% spring, 16% winter. Mortality patterns were similar: 26% fall, 31% summer, 26% spring, 17% winter. Forty-eight species were reported.

Hager *et al*. (2013) noted that estimates of bird-collision mortality often postulate a relatively constant range of collisions at all buildings (for example, Klem, 1990). However, they suggested that each building in a landscape has its own mortality "signature," based not only on characteristics of the structure but also on the distribution of resources throughout the local landscape, including land cover, habitat type, water, and pavement. Their protocol selected buildings at random and has recently been expanded to multiple other sites across North America.

## Avian Vision and Collisions

Bird species like falcons are famous for their acute vision, but taking a "bird's-eye view" is much more complicated than it sounds. To start with, where human color vision relies on three types of sensors, birds have four, plus an array of color filters that together allow birds to discriminate between many more colors than people (Varela *et al.* 1993) (see figure this page).

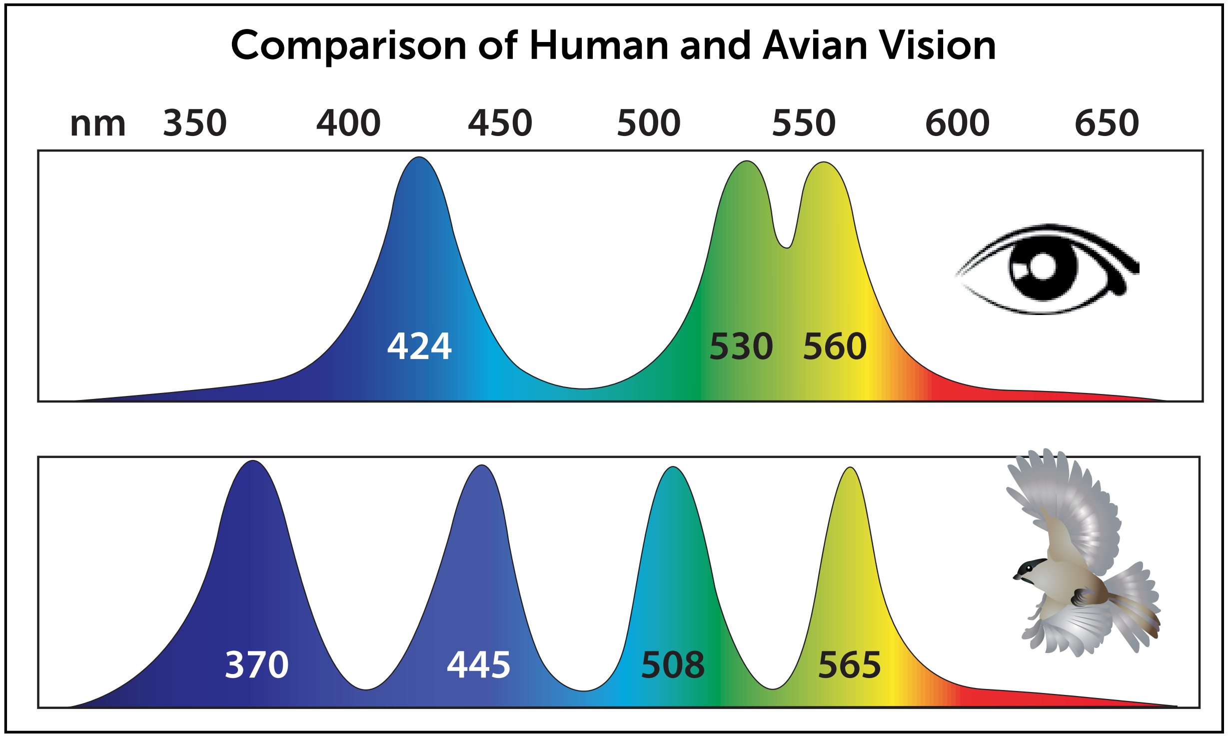
There is also variation in vision among different groups of birds. While some birds see only into the violet range of light, many birds, including most passerines (Ödeen and Håstad, 2003, 2013) see into the ultraviolet spectrum (UVS species).

Ultraviolet can be a component of any color (Cuthill *et al.* 2000). Whereas humans see red, yellow, or red + yellow, birds may see red + yellow, but also red + ultraviolet, yellow + ultraviolet, and red + yellow + ultraviolet—colors for which we have no names. Every object absorbs, reflects, and transmits ultraviolet light along with the other wavelengths in the visible spectrum. UV patterns on glass are often cited as desirable solutions to collisions—visible to birds but not to humans. However, aside from manufacturing complexities, many bird taxa that collide frequently with glass, including raptors, pigeons, woodpeckers, and hummingbirds, may not be able to perceive UV patterns (Håstad and Ödeen, 2014). Additionally, birds are often active in early morning, when UV light levels are low.

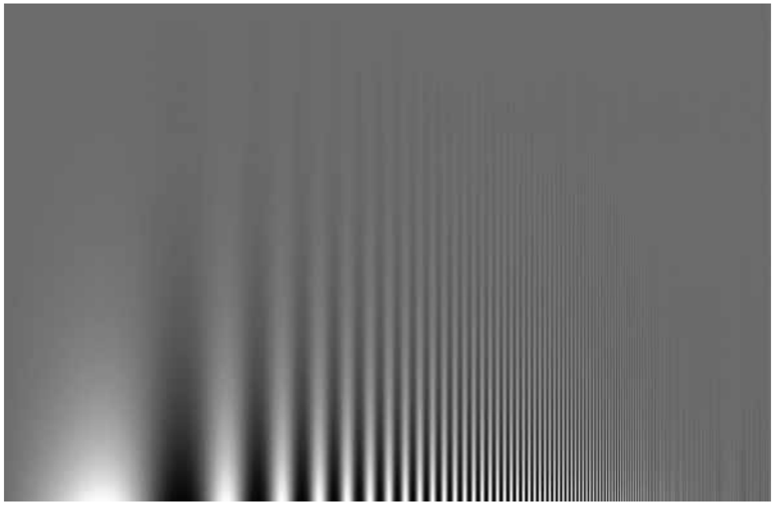
Humans and other primates have relatively flat faces, with eyes close together. The overlap of visual fields means that humans have good depth perception and a tendency to focus on what is ahead. Most birds have eyes at the sides of their heads, giving them excellent peripheral vision but poor depth perception, often limited to the length of their beaks, presumably to judge potential food items. They may be much less intent on what is in front of them (Martin 2011, 2012) but able to watch for potential predators to the side or behind them. Many species' most acute vision is to the side. Without much 3D vision, birds use a mechanism called "visual flow fields" to judge their speed and rate of progress in flight by the passage of environmental features to their sides (Bhagavatula *et al.* 2011). Collisions with glass may be partly a result of birds expecting open air ahead, combined with relatively poor forward vision.

Birds process images faster than humans; where we see continuous motion in a movie, birds would see flickering images (D'Eath, 1998; Greenwood *et al.* 2004; Evans *et al.* 2006). This speed helps many birds maneuver quickly in

Painted Bunting. Photo by Ted Ardley



Based on artwork by Sheri Williamson



Contrast sensitivity is a measure of the limit of visibility for low-contrast patterns. Each person's contrast sensitivity can be measured by the extent to which he or she can see the bars that form an arch in this photograph. The exact location of the peak of the curve varies with one's distance from the image; the area within the arch is larger when one is closer. For a given distance, the area under the arch is smaller for birds. Image courtesy of Izumi Ozawa, Berkeley Neuroscience Laboratory

response to unexpected obstacles as they fly through complex habitats. In one respect however—spatial contrast sensitivity—human vision outperforms avian (Ghim and Hodos, 2006). Contrast sensitivity is "the ability of the observer to discriminate between adjacent stimuli on the basis of their differences in relative luminosity (contrast) rather than their absolute luminances." Birds' lack of contrast sensitivity may be an impediment to creating signals to prevent collisions that are effective for birds but not visually intrusive to humans.

## Avian Orientation and the Earth's Magnetic Field

In the 1960s, it was discovered that migrating birds possess the ability to orient themselves using cues from the sun, polarized light, stars, the Earth's magnetic field, visual landmarks, and possibly even odors to find their way. Exactly how this works—and it likely varies among species—is still being investigated. (For a comprehensive review of the mechanisms involved in avian orientation, see Wiltschko and Wiltschko, 2009).

The Earth's magnetic field can provide both directional and positional information. It appears that night-flying migrants, and perhaps all bird species, have magnetic field-detecting structures in the retina of the eye that depend on light for function and provide compass orientation. This magnetic sense is wavelength-dependent. Experiments have shown that the compass is disrupted by long wavelength light but requires low-intensity short wavelength light (Wiltschko *et al.* 2007). This research has taken place only in laboratories, and it is important to determine how it translates to the real world.

In addition, anthropogenic electronic noise, found throughout urban environments, has recently been shown to disrupt magnetic compass orientation in European Robins at very low intensities (Engels *et al.* 2014). This finding may have serious implications for strategies aimed at reducing collisions by reducing artificial night lighting alone and should be a priority for additional work.

A second magnetic mechanism, providing birds with positional information, has been postulated, but its details have not been determined. (For a review of magnetoreception and its use in avian migration, see Mouritsen, 2015.)

## Birds and Light Pollution

The earliest reports of mass avian mortality caused by lights were from lighthouses, but this source of mortality essentially disappeared when steady-burning lights were replaced by rotating beams (Jones and Francis, 2003). Flashing or interrupted beams apparently allowed birds to continue to navigate, which has also been found more recently at cell towers with strobe lighting (Gehring *et al.* 2009). The emphasis on tall structures by Lights Out programs ignores the fact that light from many sources, from urban sprawl to parking lots, can affect bird behavior and potentially strand birds in the built environment (Gauthreaux and Belser, 2006). Evans-Ogden (2002) showed that light emission levels of 16 buildings, ranging in height from 8 to 72 floors and indexed by the number of lighted windows observed at night, correlated directly with bird mortality, and that the amount of light emitted by a structure was a better predictor of mortality level than building height, although height was a factor. Parkins *et al.* (2015) made similar findings.

Mass collision events of migrants associated with light and often with fog or storms have been frequently reported (Weir, 1976; Avery *et al.* 1977; Avery *et al.* 1978; Crawford, 1981a, 1981b; Gauthreaux and Belser, 2006; Newton, 2007). But these are no longer the predominant sources of mortality, possibly because the night landscape has changed radically since early reports of mass collision events at tall structures like the Washington Monument and Statue of Liberty. These and other structures were once beacons in areas of relative darkness, but are now surrounded by square miles of light pollution. While collisions at structures like cell towers continue to take place at night, the majority of collisions with buildings now take place during the day. (Hager, 2014; Kahle *et al.*, 2015; Olson, pers. comm.)

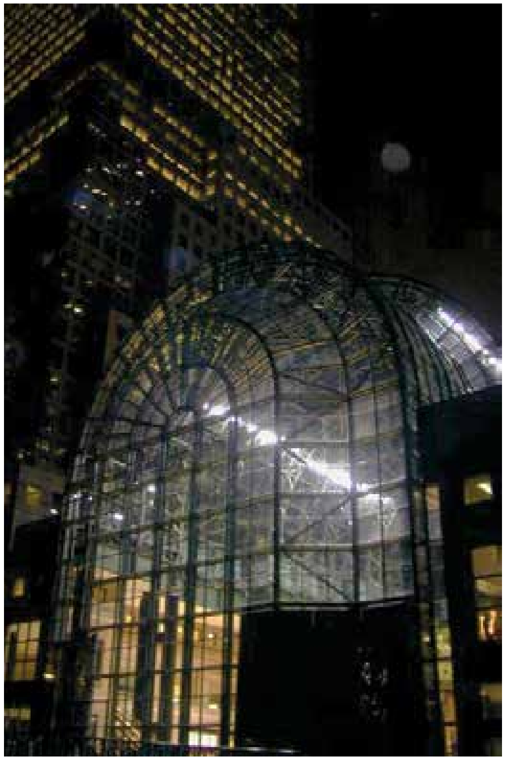
Patterns of light intensity seem to play a role in the distribution of collisions in the built environment, however. Birds may land in patterns dictated by the pattern of light intensity in an area, so the brightest buildings are the most likely to cause collisions early in the day. As birds move through the landscape seeking food, patterns related to distribution of vegetation appear. Studies using radar to map movement of birds through the built environment are starting to appear, but we need information at the level of species and individuals to truly understand how light is impacting birds.

It is often said that birds are attracted to lights at night (Gauthreaux and Belser, 2006; Poot *et al.* 2008). However, we do not have direct evidence that birds are, in fact, attracted to lights; they may simply *respond* to lights they encounter. Gauthreaux and Belser quote Verheijen as suggesting that "capture" might be a better word for birds' response to night lighting. While "capture" does seem appropriate to describe the phenomenon of birds circling drilling platforms, or in the lights of the 9/11 Memorial's Tribute in Light in Manhattan, "disorientation" is a term that covers more of the spectrum of behaviors seen when birds interact with light at night. Gauthreaux and Belser (2006), reporting unpublished data, stated that "exposure to a light field causes alteration of a straight flight path (for example hovering, slowing down, shifting direction, or circling)," and this has been reported by other authors.

Larkin and Frase (1988, in Gauthreaux and Belser, 2006) used portable tracking radar to record flight paths of birds near a broadcast tower in Michigan. Birds showed a range of response, from circling to arcs to linear flight. Haupt and Schillemeit (2011) described the paths of 213 birds flying through up-lighting from several different outdoor lighting schemes. Only 7.5% showed no change in behavior, while the remainder deviated from their courses by varying degrees, from minimal course deviation through circling. It is not known whether response differences are species related.

Bolshakov *et al.* (2010) developed the Optical-Electronic Device to study nocturnal migration behaviors of songbirds. Inspired by the more limited techniques of moon watching and watching birds cross ceilometer light beams, the device uses searchlights to illuminate birds from the ground, while a recording unit documents the birds' movements. With this technique, they can study 1) ground- and airspeed; 2) compensation for wind drift on the basis of direct measurements of headings and track directions of individual birds; 3) wing-beat pattern and its variation depending on

Swainson's Thrush. Photo by Owen Deutsch



The glass walls of this atrium, coupled with nighttime illumination, create an extreme collision hazard for birds. Photo courtesy of New York City Audubon

Canada Warbler. Photo by Ted Ardley

wind direction and velocity. In some cases, species can be identified. Bolshakov *et al.* (2013) examined the effects of wind conditions on numbers of birds aloft and flight trajectories of birds crossing the light beam from the apparatus. They determined that numbers of birds do differ with wind strength, but that birds may be attracted to the light beam under calm conditions. They also found that the light beam disturbs straight flight trajectories, especially in calm wind conditions. Regression models suggest that the probability of curved flight trajectories is greater for small birds, especially when there is little or no moon.

Bulyuk *et al.* (2014) used the same device to compare behaviors of night-migrating passerines under natural nocturnal illumination (at the Courish Spit of the Baltic Sea) with birds passing through an urban light environment (inside the city limits of St. Petersburg, Russia). Songbirds were distinguished as either small passerines or thrushes. The illuminated background caused a decrease in image quality. The shape of flight tracks was compared for the two groups, and a larger proportion of small songbirds changed flight path while crossing the light. This could be explained by flight type or flight speed. The proportion of songbirds changing flight trajectory in the lighted condition was much smaller than under the dark condition.

To understand exactly how light affects birds and what actions must be taken to reduce those effects, we need to know much more. For example, at what range (horizontal and vertical) and under what conditions do birds feel disruption from light, and of what intensity and wavelength composition? How do these factors change their behavior? Does night lighting have any effect on birds departing at the beginning of migratory stages? Do we ever actually see birds changing course to move toward a bright light source?

## Light Color and Avian Orientation

Starting in the 1940s, ceilometers—powerful beams of light used to measure the height of cloud cover—came into use and were associated with significant bird kills. Filtering out long (red) wavelengths and using the blue/green range greatly reduced mortality, although we don't know whether the intensities of these two colors of lights were equal. Later, replacement of fixed-beam ceilometers with rotating beams essentially eliminated the impact on migrating birds (Laskey, 1960). A complex series of laboratory studies in the 1990s demonstrated that birds required light in order to sense the Earth's magnetic field. Birds could orient correctly under monochromatic blue or green light, but longer wavelengths (yellow and red) caused disorientation (Rappli *et al.,* 2000; Wiltschko *et al.,*1993, 2003, 2007). Wiltschko *et al.* (2007) showed that above intensity thresholds that decrease from green to UV, birds showed disorientation. Disorientation occurs at light levels that are still relatively low, equivalent to less than half an hour before sunrise under clear sky.

Poot *et al.* (2008) demonstrated that migrating birds exposed to various colored lights in the field responded the same way as they do in the laboratory. Birds responded strongly to white and red lights and appeared disoriented by them, especially under overcast skies. Green light provoked less response and minimal disorientation; blue light attracted few birds and did not disorient those that it did attract. Birds were not attracted to infrared light. Evans *et al.* (2007) also tested different light colors but did not see aggregation under red light. However, they subsequently determined that the intensity of red light used was less than for other wavelengths, and when they repeated the trial with higher intensity red, they did see aggregation (Evans, pers. comm. 2011).

Scientists working in the Gulf of Mexico (Russell, 2005), the North Atlantic (Wiese *et al.* 2001), and the North Sea (Poot *et al.* 2008) report that bright lights of oceanic drilling rigs induce circling behavior and mortality in birds at night. Working on a rig in the North Sea, Marquenie *et al.* (2013), estimated that birds were affected up to five kilometers away. Replacing about half the lights with new bulbs emitting minimal red light reduced circling behavior by about 50%. The authors speculate that completely re-lamping the platform would reduce bird aggregation by 90%. Gehring *et al.* (2009) demonstrated that mortality at communication towers was greatly reduced if strobe lighting was used as opposed to steady-burning white, or especially red lights. At the 9/11 Memorial Tribute in Light in Manhattan, when birds aggregate and circle in the beams, monitors turn the lights out briefly, releasing the birds (Elbin, 2015, pers. comm.). Regular, short intervals of darkness, or replacement of steady-burning warning lights with intermittent lights, are excellent options for protecting birds, and manipulating light color also has promise, although additional field trials for colored lights are needed.

## Research: Deterring Collisions

Systematic efforts to identify signals that can be used to make glass visible to birds began with the work of Dr. Daniel Klem in 1989. Testing glass panes in the field and using a dichotomous choice protocol in an aviary, Klem (1990) demonstrated that popular devices like "diving falcon" silhouettes were effective only if they were applied densely, spaced two to four inches apart. Owl decoys, blinking holiday lights, and pictures of vertebrate eyes were among items found to be ineffective. Grid and stripe patterns made from white material, one inch wide, were tested at different spacing intervals. Only three were effective: a 3 x 4-inch grid; vertical stripes spaced four inches apart; and horizontal


Glass panes are being tested at the Powdermill Tunnel, as seen from the outside. Photo by Christine Sheppard, ABC


Susan Elbin tests a bird in the tunnel at the Carnegie Museum's Powdermill Banding Station in southwestern Pennsylvania. Photo by Christine Sheppard, ABC


The tunnel: an apparatus for safely testing effectiveness of materials and designs for deterring bird collisions. Photo by Christine Sheppard, ABC


A bird's-eye view of glass in the tunnel. Photo by Christine Sheppard, ABC

stripes spaced about an inch apart across the entire surface. (A summary of Klem's results can be found at collisions.abcbirds.org).

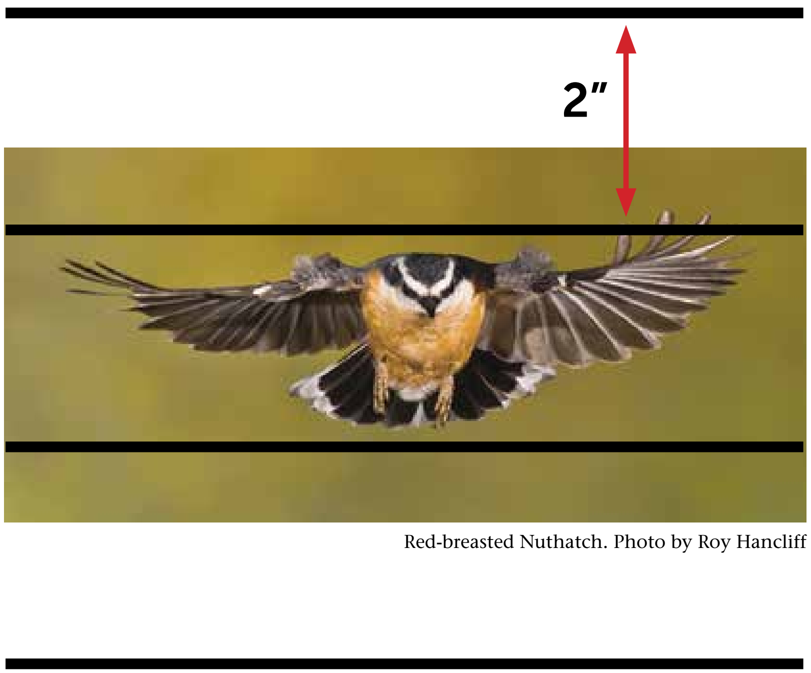
Building on Klem's findings, Rössler developed a testing program in Austria starting in 2004 and continuing to the present (Rössler and Zuna-Kratky, 2004; Rössler, 2005; Rössler, *et al.,* 2007; Rössler and Laube, 2008; Rössler, 2010; Rössler, 2012; Rössler, 2013). The banding center at the Hohenau Ringelsdorf Biological Station outside Vienna, Austria, offered a large sampling of birds for each test, in some instances permitting comparisons of a particular pattern under differing intensities of lighting. This program has focused primarily on geometric patterns, evaluating the impact of spacing, orientation, and dimensions. Birds are placed in a "tunnel," where they can view two pieces of glass: one unmodified (the control) and the other with the pattern to be tested. Birds fly down the tunnel and are scored according to whether they try to exit through the control or the patterned glass. A mist net keeps the bird from hitting the glass, and it is then released. The project focuses not only on finding patterns effective for deterring collisions, but also on effective patterns that cover a minimal part of the glass surface. To date, some patterns that cover only 5% of the glass have been found to be highly effective. (A summary of Rössler's results can be found at collisions.abcbirds.org).

The tunnel at Powdermill, showing the framework where the background will be mounted. Photo by Christine Sheppard, ABC

Building on Rössler's work, ABC collaborated with the Wildlife Conservation Society, New York City Audubon, and the Carnegie Museum to construct a tunnel at Powdermill Nature Reserve's banding station, primarily to test commercially available materials. Results from the first season showed that making an entire surface UV-reflective was not an effective way to deter birds. With UV materials, contrast seems to be important. Glass fritted in patterns conforming to the 2 x 4 rule, however, scored well as deterrents. (A summary of results from Powdermill can be found at collisions.abcbirds.org).

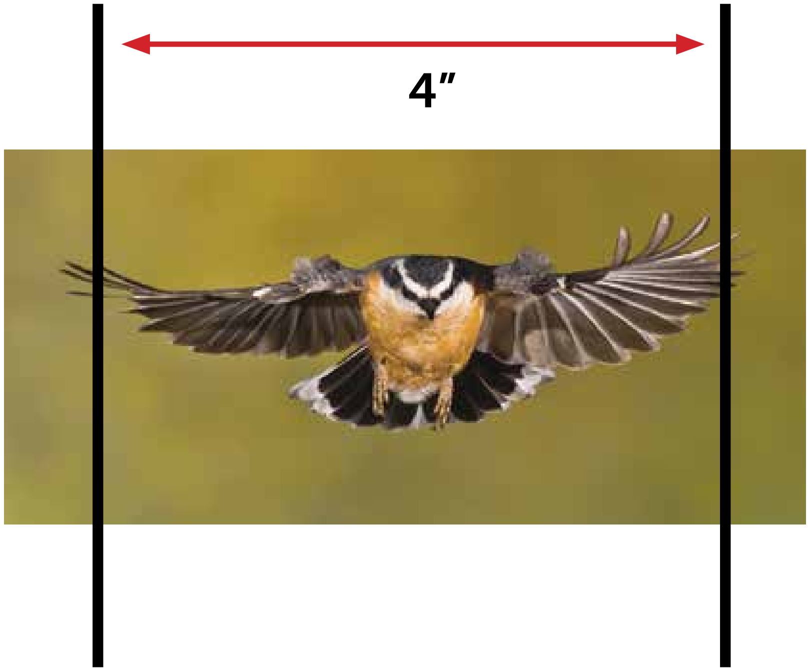
Most clear glass made in the United States transmits about 96% and reflects about 4% of light falling perpendicular to the outside surface. The amount of light reflected increases at sharper angles: clear glass reflects about 50% of incident light at angles over 70 degrees. Light on the inside of the glass is also partly reflected and partly transmitted. The relative intensities of light transmitted from the inside and reflected from the outside surfaces of glass combined with the viewing angle determine whether the glass appears transparent or mirrors the surrounding environment. Patterns on the inside surfaces of glass and objects inside the glass may not always be visible. These changeable optical properties support the argument that patterns applied to the outer surface of glass are more effective than patterns applied to the inner surface. Efforts have been made to model freestanding glass, glass installed on a building, and reflections on glass in some trials. (The testing protocol for freestanding glass, developed at Hohenau, and the testing protocols used at Powdermill can be found at collisions.abcbirds.org).

Horizontal lines with a maximum spacing of 2 inches



Red-breasted Nuthatch. Photo by Roy Hancliff

Vertical lines with a maximum spacing of 4 inches



## The 2 x 4 Rule

Research on songbirds, the most numerous victims of collisions, has shown that horizontal lines must be two or fewer inches apart to deter the majority of birds. Vertical spaces must be four or fewer inches apart. This difference presumably has to do with the shape of a flying bird. (Narrower spacing is required to deter collisions by hummingbirds.) Schiffner *et al.* (2014) showed that budgies have a very precise understanding of their own physical dimensions. Trained to fly in a tunnel, the birds were then challenged to pass through ever narrowing gaps. They were able to assess the width of the gaps relative to their body size and adjust their flight behavior accordingly. It seems likely that this is a general avian trait, useful for navigating complex environments at flight speed. Bhagavatula *et al.* (2011) used the same tunnel setup to investigate how optical flow cues guide flight. It appears that birds balance the speeds of images perceived by both eyes, in this case, images to the birds' sides. This reinforces the suggestion of Martin (2011) that humans experience the world as something ahead of them, while for birds in flight, what is ahead of them is not necessarily their primary focus.

# Evaluating Collision Problems—A Toolkit for Building Owners

American Woodcock are often victims of collisions. This bird hit a window in Washington, D.C., in March, 2011, and was recovered by ABC's Jason Berry. Photo by Dariusz Zdziebkowski, ABC

Often, only part of a building is responsible for causing most of the collisions. Evaluation and documentation can help in the development of a program of remediation targeting that area. Remediation can be almost as effective as modifying the entire building, as well as less expensive. Documentation of patterns of mortality and environmental features that may be contributing to collisions is essential. Operations personnel are often good sources of information for commercial buildings, as they may come across bird carcasses while performing regular maintenance activities. People who work near windows are often aware of birds hitting them.

Regular monitoring not only produces data on the magnitude and patterns of mortality, but also provides a baseline for demonstrating improvement. The best monitoring programs feature consistent effort, careful documentation of collision locations, and accurate identification of victims. Effective monitoring should document at least 18 months of collisions before mitigation is attempted, unless collision rates are especially high. (Resources for monitoring, from simple to sophisticated, can be found at collisions.abcbirds.org).

## Solutions

Many factors come into play in selecting how to make glass safe for birds. The table below compares common solutions according to their effectiveness, appearance, relative cost, ease of application, longevity, and required maintenance. Effective patterns on the exterior surface of glass will combat reflection, transparency, and passage effect. Within the 2 x 4 guidelines, however, considerable variation is possible when devising bird-friendly patterns. We recommend that lines be at least ¼-inch wide, but it is not necessary that they be only vertical or horizontal. Contrast between pattern and background is important, however, and designers should be aware that the background—building interior, sky, vegetation—may change in appearance throughout the day.

### COMPARISON OF RETROFIT OPTIONS

| Material | Effectiveness | Cost | Application | Appearance | Longevity | Upkeep |
|---|---|---|---|---|---|---|
| Seasonal, temporary solutions | ***** | $ | * | * | na | na |
| Netting | ***** | $$ | ** | *** | **** | *** |
| Window film | ***** | $$$ | **** | ***** | *** | **** |
| Screens | ***** | $$ | *** | **** | ***** | **** |
| Shutters | ***** | $$$ | *** | **** | ***** | **** |
| Grilles | ***** | $$$ | **** | ***** | ***** | **** |
| Replace glass | ***** | $$$$$ | ***** | ***** | ***** | **** |
| **5 stars/dollars =** | **highly effective** | **expensive** | **easy** | **attractive** | **long-lasting** | **minimal** |

This security grille creates a pattern that will deter birds from flying to reflections. Photo by Christine Sheppard, ABC

The following questions can guide the evaluation and documentation process by helping to identify features likely to cause collisions and other important factors.

## Seasonal Timing

Do collisions happen mostly during migration or fledging periods, in winter, or year round? If collisions happen only during a short time period, it may be possible to apply inexpensive, temporary solutions during that time and remove them for the rest of the year. Some birds will attack their own reflections, especially in spring. This is not a true collision. Territorial males, especially American Robins and Northern Cardinals, perceive their reflection as a rival male. They are unlikely to injure themselves, and temporarily blocking reflections in the offending window (and those nearby) from the outside should resolve the problem. Taping up paper and smearing a soap paste can both be effective.

## Weather

Do collisions coincide with particular weather conditions, such as foggy or overcast days? Such collisions may be light-related, in which case an email notification system, asking building personnel to turn off lights when bad weather is forecast, is advisable.

Fog increases the danger of light both by causing birds to fly lower and by refracting light so it is visible over a larger area. Photo by Christine Sheppard, ABC

## Diurnal Timing

Do collisions happen at a particular time of day? The appearance of glass can change significantly with different light levels, direct or indirect illumination, and sun angles. It may be possible to simply use shades or shutters during critical times.

Lower-floor windows are thought to be more dangerous to birds because they are more likely to reflect vegetation. Photo by Christine Sheppard, ABC

## Location

Are there particular windows, groups of windows, or building façades that account for most collisions? If so, it may be cost effective to modify only those sections of glass. Is glass located where birds fly between roosting or nesting and feeding sites? Are there areas where plants can be seen through glass—for example, an atrium, courtyard, or glass building connectors?

Are there architectural or landscaping features that tend to direct birds toward glass? Such features might include a wall or rock outcropping or a pathway bordered by dense vegetation. Solutions include using a screen or trellis to divert flight paths. Are there fruit trees, berry bushes, or other plants near windows that are likely to attract birds closer to glass? These windows should be a high priority for remediation. The glass itself can be modified, but it may also be possible to use live or inanimate landscaping elements to block the view between food sources and windows.

## Local Bird Populations

What types of birds are usually found in an area? Local bird groups or volunteers may be able to help characterize local and transitory bird populations, as well as the most likely routes for birds making short flights around the area. The American Birding Association, *Bird Watchers Digest*, Audubon chapters, and Birding.com are good places to start finding such resources. Universities, colleges, and museums may also be helpful.

## Post-Mitigation Monitoring

Monitoring efforts should continue for at least 18 months after mitigation efforts are made, and for at least two peak collision seasons (often the fall in urban areas, but spring and summer may also be peak seasons in more rural locations). Collision rates vary along with local bird populations, so a year of high population and high collisions may be followed by a year of low populations and low collisions, regardless of the effectiveness of any mitigation.

This Ovenbird survived a collision and was recovered alive during a Lights Out monitoring effort in Baltimore, Maryland. Photo by Daniel J. Lebbin, ABC

Use of glass with a highly effective horizontal frit pattern, together with sunshades, earned this retrofitted building on the SUNY Brockport campus the LEED “collision deterrence” credit. Photo by Paul Tankel

# References

A dramatic use of glass block characterizes the Hecht Warehouse in Washington, D.C., designed by Abbott and Merkt. Photo by Sandra Cohen-Rose/Colin Rose

Avery, M.L., P.F. Springer and J.F. Cassel, 1977. Weather influences on nocturnal bird mortality at a North Dakota tower. *Wilson Bulletin* 89(2):291-299.

Avery, M.L., P.F. Springer and N. S. Daily, 1978. Avian mortality at man-made structures, an annotated bibliography. Fish and Wildlife Service, U.S. Dept. of the Interior: Washington, D.C. 108 pp.

Bayne, Erin M., Corey A. Scobie and Michael Rawson, 2012. Factors influencing the annual risk of bird–window collisions at residential structures in Alberta, Canada. *Wildlife Research* http://dx.doi.org/10.1071/WR11179

Bhagavatula, Partha S., Charles Claudianos, Michael R. Ibbotson and Mandyam V. Srinivasan, 2011. Optic Flow Cues Guide Flight in Birds. *Current Biology* 21:1794-1799.

Blem, C.R. and B.A.Willis.1998. Seasonal variation of human-caused mortality of birds in the Richmond area. *Raven* 69(1):3-8.

Bolshakov, Casimir V., Michael V. Vorotkov, Alexandra Y. Sinelschikova, Victor N. Bulyuk and Martin Griffiths, 2010. Application of the Optical-Electronic Device for the study of specific aspects of nocturnal passerine migration. *Avian Ecol. Behav.* 18: 23-51.

Bolshakov, Casimir V., Victor N. Bulyuk, Alexandra Y. Sinelschikova and Michael V. Vorotkov, 2013. Influence of the vertical light beam on numbers and flight trajectories of night-migrating songbirds. *Avian Ecol. Behav.* 24: 35-49.

Bulyuk, Victor N., Casimir V. Bolshakov, Alexandra Y. Sinelschikova and Michael V. Vorotkov, 2014. Does the reaction of nocturnally migrating songbirds to the local light source depend on backlighting of the sky? *Avian Ecol. Behav.* 25:21-26.

Codoner, N.A. 1995. Mortality of Connecticut birds on roads and at buildings. *Connecticut Warbler* 15(3):89-98.

Collins and Horn, 2008. Bird-window collisions and factors influencing their frequency at Millikin University in Decatur, Illinois. *Transactions of the Illinois State Academy of Science* 101(supplement):50.

Crawford, R.L, 1981a. Bird kills at a lighted man-made structure: often on nights close to a full moon. *American Birds* (35):913-914.

Crawford, R.L, 1981b. Weather, migration and autumn bird kills at a North Florida TV tower. *Wison Bulletin*, 93(2):189-195.

Cuthill, I.C., J.C. Partridge, A.T.D. Bennett, C.D. Church, N.S. Hart and S. Hunt, 2000. Ultraviolet vision in birds. *Advances in the Study of Behavior* 29:159-215.

Davila, A.F., G. Fleissner, M. Winklhofer and N. Petersen, 2003. A new model for a magnetoreceptor in homing pigeons based on interacting clusters of superparamagnetic magnetite. *Physics and Chemistry of the Earth*, Parts A/B/C 28: 647-652.

Dunn, E.H. 1993. Bird mortality from striking residential windows in winter. *Journal of Field Ornithology* 64(3):302-309.

D'Eath, R.B., 1998. Can video images imitate real stimuli in animal behaviour experiments? *Biological Review* 73(3):267–292.

Elbin, Susan, 2015. Pers. comm.

Evans, W.R., Y. Akashi, N.S. Altman, A.M. Manville II, 2007. Response of night-migrating songbirds in cloud to colored and flashing light. *North American Birds* 60, 476-488.

Evans, W.R., 2011 Pers. comm.

Evans, J.E., I.C. and A.T. Cuthill, D. Bennett, 2006. The effect of flicker from fluorescent lights on mate choice in captive birds. *Animal Behaviour* 72:393-400.

Evans-Ogden, 2002. Effect of Light Reduction on Collision of Migratory Birds. Special Report for the Fatal Light Awareness Program (FLAP).

Fink, L.C. and T.W. French. 1971. Birds in downtown Atlanta—Fall, 1970. *Oriole* 36(2):13-20.

Fleissner, G., E.Holtkamp-Rötzler, M. Hanzlik, M. Winklhofer, G. Fleissner, N. Petersen and W. Wiltschko, 2003. Ultrastructural analysis of a putative magnetoreceptor in the beak of homing pigeons. *The Journal of Comparative Neurology* 458(4):350-360.

Fleissner, G., B. Stahl, P. Thalau, G. Falkenberg and G. Fleissner, 2007. A novel concept of Fe-mineral-based magnetoreception: histological and physicochemical data from the upper beak of homing pigeons. *Naturwissenschaften* 94(8): 631-642.

Gauthreaux, S.A. and C.G. Belser, 2006. Effects of Artificial Night Light on Migrating Birds in Rich, C. and T. Longcore, eds, 2006. *Ecological Consequences of Artificial Night Lighting*. Island Press. Washington, DC. 259 pp.

Gauthreaux, Sidney A. Jr. and Carroll G. Belser, 2006. Effects of Artificial Night Lighting on Migrating Birds in Ecological Consequences of Artificial Night Lighting, Catherine Rich and Travis Longcore eds. Island Press, Washington, D.C. 458 pages.

Gehring, J., P. Kerlinger, and A.M. Manville. 2009. Communication towers, lights, and birds: successful methods of reducing the frequency of avian collisions. *Ecological Applications* 19:505–514.

Gelb, Y. and N. Delacretaz. 2006. Avian window strike mortality at an urban office building. *Kingbird* 56(3):190-198.

Ghim, Mimi M., and William J. Hodos, 2006. Spatial contrast sensitivity of birds. *J Comp Physiol A* 192: 523–534

Gochfeld , M.,1973. Confused nocturnal behavior of a flock of migrating yellow wagtails. *Condor* 75(2):252-253.

Greenwood, V., E.L. Smith, A.R. Goldsmith, I.C. Cuthill, L.H. Crisp, M.B.W. Swan and A.T.D. Bennett, 2004. Does the flicker frequency of fluorescent lighting affect the welfare of captive European starlings? *Applied Animal Behaviour Science* 86: 145-159.

Hager, S.B., H. Trudell, K.J. McKay, S.M. Crandall, L. Mayer. 2008. Bird density and mortality at windows. *Wilson Journal of Ornithology* 120(3):550-564.

Hager, Stephen B., 2009. Human-related threats to urban raptors. *J. Raptor Res.* 43(3):210–226.

Hager S.B., Cosentino B.J., McKay K.J., Monson C., Zuurdeeg W., and B. Blevins, 2013. Window Area and Development Drive Spatial Variation in Bird-Window Collisions in an Urban Landscape. *PLoS ONE* 8(1): e53371. doi:10.1371/journal.pone.0053371

Download at: http://people.hws.edu/cosentino/publications_files/PLoS%20ONE%202013%20Hager.pdf

Hager S.B., Craig M.E. (2014). Bird-window collisions in the summer breeding season. *Peer J 2:* e460 https://dx.doi.org/10.7717/peerj.460

Haupt, H. and U. Schillemeit, 2011. Skybeamer und Gebäudeanstrahlungen bringen Zugvögel vom Kurs ab: Neue Untersuchungen und eine rechtliche Bewertung dieser Lichtanlagen. NuL 43 (6), 2011, 165-170.

(Search/spot Lights and Building Lighting Divert Migratory Birds Off Course: New investigations and a legal evaluation of these lighting systems)

Herbert, A.D., 1970. Spatial Disorientation in Birds. *Wilson Bulletin* 82(4):400-419.

Jones, J. and C. M. Francis, 2003. The effects of light characteristics on avian mortality at lighthouses. *Journal of Avian Biology* 34: 328–333.

Kahle, Logan Q., Maureen E. Flannery and John P. Dumbacher, 2015. Bird-window collisions at a west coast urban parkland: analyses of bird biology and window attributes from Golden Gate Park, San Francisco. In press, *PLOS One*.

Kerlinger, P., 2009. How Birds Migrate, second edition, revisions by Ingrid Johnson. Stackpole Books, Mechanicsville, PA. 230 pp.

Klem, D., Jr., 1990. Collisions between birds and windows: Mortality and prevention. *Journal of Field Ornithology* 61(1):120-128.

Klem, D., Jr., 1989. Bird-window collisions. *Wilson Bulletin* 101(4):606-620.

Klem, D., Jr., 1991. Glass and bird kills: An overview and suggested planning and design methods of preventing a fatal hazard. Pp. 99-104 in L. W. Adams and D. L. Leedy (Eds.), Wildlife Conservation in Metropolitan Environments. Natl. Inst. Urban Wildl. Symp. Ser. 2, Columbia, MD.

Klem, Daniel Jr., and Peter G. Saenger, 2013. Evaluating the Effectiveness of Select Visual Signals to Prevent Bird-window Collisions. *The Wilson Journal of Ornithology* 125(2):406–41.

Download at: http://www.muhlenberg.edu/main/academics/biology/faculty/klem/aco/Bird-window.html

Klem, D. Jr., D.C. Keck, K.L. Marty, A.J. Miller Ball, E.E. Niciu, C.T. Platt. 2004. Effects of window angling, feeder placement, and scavengers on avian mortality at plate glass. *Wilson Bulletin* 116(1):69-73.

Klem, D. Jr., C.J. Farmer, N. Delacretaz, Y. Gelb and P.G. Saenger, 2009a. Architectural and Landscape Risk Factors Associated with Bird-Glass Collisions in an Urban Environment. *Wilson Journal of Ornithology* 121(1):126-134.

Klem, D. Jr., 2009. Preventing Bird-Window Collisions. *Wilson Journal of Ornithology* 121(2):314–321.

Laskey, A.,1960. Bird migration casualties and weather conditions, Autumns 1958, 1959, 1960. *The Migrant* 31(4): 61-65.

Lebbin, Daniel J., Michael J. Parr and George H. Fenwick, 2010. *The American Bird Conservancy Guide to Bird Conservation*. University of Chicago Press, Chicago. 447 pages.

Longcore, Travis, Catherine Rich, Pierre Mineau, Beau MacDonald, Daniel G. Bert, Lauren M. Sullivan, Erin Mutrie, Sidney A. Gauthreaux Jr, Michael L. Avery, Robert L. Crawford, Albert M. Manville II, Emilie R. Travis and David Drake, 2012. An estimate of avian mortality at communication towers in the United States and Canada.

Longcore, Travis, Catherine Rich, Pierre Mineau, Beau MacDonald, Daniel G. Bert, Lauren M. Sullivan, Erin Mutrie, Sidney A. Gauthreaux Jr., Michael L. Avery, Robert L. Crawford, Albert M. Manville II, Emilie R. Travis, and David Drake, 2013. Avian mortality at communication towers

The World Trade Center of New Orleans, designed by Edward Durrell Stone, uses a simple bird-friendly strategy; almost all windows have exterior shutters. Photo by Christine Sheppard, ABC

in the United States and Canada: which species, how many, and where? *Biological Conservation* 158:410–419.

Loss, Scott R., Tom Will and Peter P. Marra, 2012. Direct human-caused mortality of birds: improving quantification of magnitude and assessment of population impact. *Frontiers in Ecology and the Environment*, September, Vol. 10, No. 7: 357-364

Loss, Scott R., Tom Will, Sara S. Loss and Peter P. Marra, 2014. Bird–building collisions in the United States: Estimates of annual mortality and species vulnerability. *Condor* 116:8-23.

Loss, S.R., Loss, S.S., Will, T., Marra, P.P. 2014. *Best practices for data collection in studies of bird-window collisions*. Available at http://abcbirds.org/?p=10399

Machtans, Craig S., Christopher H.R. Wedeles and Erin M. Bayne, 2013. A First Estimate for Canada of the Number of Birds Killed by Colliding with Building Windows. *Avian Conservation and Ecology* 8(2): 6. http://dx.doi.org/10.5751/ACE-00568-080206

Muheim, R., J.B. Phillips and S. Akesson, 2006. Polarized Light Cues Underlie Compass Calibration in Migratory Songbirds. *Science* 313 no. 5788 pp. 837-839.

Muheim, R., 2011. Behavioural and physiological mechanisms of polarized light sensitivity in birds. Phil Trans R Soc B 12 March 2011: 763-77.

Marquenie, J., and F.J.T. van de Laar, 2004. Protecting migrating birds from offshore production. Shell E&P Newsletter: January issue.

Marquenie, J.M., M. Donners, H. Poot and Steckel, 2013. Adapting the Spectral Composition of Artificial Lighting to Safeguard the Environment. *Industry Applications Magazine*, IEEE 19(2):56-62.

Mouritsen, H., 2015. Magnetoreception in Birds and Its Use for Long-Distance Migration. Pp. 113-133 in *Sturkie's Avian Physiology*, sixth edition, Colin G. Scanes ed. Academic Press, Waltham, MA, 1028 pp.

Newton, I., 2007. Weather-related mass-mortality events in migrants. *Ibis* 149:453-467.

Newton, I., I. Wyllie, and L. Dale, 1999. Trends in the numbers and mortality patterns of Sparrowhawks (*Accipiter nisus*) and Kestrels (*Falco tinnunculus*) in Britain, as revealed by carcass analyses. *Journal of Zoology* 248:139-147.

Ödeen and Håstad, 2003. Complex Distribution of Avian Color Vision Systems Revealed by Sequencing the SWS1 Opsin from *Total DNA. Mol. Biol. Evol.* 20(6):855–861. 2003.

Ödeen and Håstad, BMC Evolutionary Biology 2013, 13:36. The Phylogenetic Distribution of Ultraviolet Vision in Birds www.biomedcentral.com/1471-2148/13/36

Håstad and Ödeen (2014), A vision physiological estimation of ultraviolet window marking visibility to birds. PeerJ 2:e621; DOI 10.7717/peerj.621

O'Connell, T. J. 2001. Avian window strike mortality at a suburban office park. *Raven* 72(2):141-149.

Parkins, Kaitlyn L, Susan B. Elbin and Elle Barnes, 2015. Light, Glass, and Bird–building Collisions in an Urban Park. *Northeastern Naturalist* 22(1): 84-94. http://dx.doi.org/10.1656/045.022.0113

Poot, H., B.J. Ens, H. de Vries, M.A.H. Donners, M.R. Wernand, and J. M. Marquenie, 2008. Green light for nocturnally migrating birds. *Ecology and Society* 13(2): 47.

Rappli,, R., R. Wiltschko, P. Weindler, P. Berthold, and W. Wiltschko, 2000. Orientation behavior of Garden Warblers (*Sylvia borin*) under monochromatic light of various wavelengths. *The Auk* 117(1):256-260.

Rich, C. and T. Longcore, eds, 2006. *Ecological Consequences of Artificial Night Lighting*. Island Press. Washington, DC.

Richardson, W.J., 1978. Timing and amount of bird migration in relation to weather: a review. *Oikos* 30:224-272.

Rössler and Zuna-Kratky, 2004 Vermeidung von Vogelanprall an Glasflächen. Experimentelle Versuche zur Wirksamkeit verschiedener Glas-Markierungen bei Wildvögeln. Bilogische Station Hohenau-Ringelsdorf [available for download from www.windowcollisions.info].

Rössler, M. and T. Zuna-Kratky. 2004. Avoidance of bird impacts on glass: Experimental investigation, with wild birds, of the effectiveness of different patterns applied to glass. Hohenau-Ringelsdorf Biological Station, unpublished report. (English translation: available from ABC.)

Rössler, 2005. Vermeidung von Vogelanprall an Glasflächen. Weitere Experimente mit 9 Markierungstypen im unbeleuchteten Versuchstunnel. Wiener Umweltanwaltschaft. Bilogische Station Hohenau-Ringelsdorf [available for download from www.windowcollisions.info].

Rössler, M. 2005. Avoidance of bird impact at glass areas: Further experiments with nine marking types in the unlighted tunnel. Hohenau-Ringelsdorf Biological Station, unpublished report. (English translation available from ABC.)

Rössler, M., W. Laube, and P. Weihs. 2007. Investigations of the effectiveness of patterns on glass, on avoidance of bird strikes, under natural light conditions in Flight Tunnel II. Hohenau-Ringelsdorf Biological Station, unpublished report. English translation available for download from www.windowcollisions.info

Rössler, M. and W. Laube. 2008. Vermeidung von Vogelanprall an Glasflächen. Farben, Glasdekorfolie, getöntes Plexiglas: 12 weitere Experimente im Flugtunnel II. Bilogische Station Hohenau-Ringelsdorf (available for download at www.windowcollisions.info).

Rössler M. and W. Laube. 2008. Avoidance of bird impacts on glass. Colors, decorative window-film, and noise-damping plexiglass: Twelve further experiments in flight tunnel II. Hohenau-Ringelsdorf Biological Station, unpublished report. (English translation available from ABC.)

Rössler, M., 2010. Vermeidung von Vogelanprall an Glasflächen: Schwarze Punkte, Schwarz-orange Markierungen, Eckelt 4Bird®, Evonik Soundstop® , XT BirdGuard. (available for download from www.windowcollisions.info).

Russell, K., 2009. Pers comm.

Russell, Keith, 2015. Conversation on August 13.

Russell, R.W. 2005. Interactions between migrating birds and offshore oil and gas platforms in the northern Gulf of Mexico: Final Report. U.S. Dept. of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study MMS 2005-009. 348 pp. www.data.boem.gov/PI/PDFImages/ESPIS/2/2955.pdf

Schiffner, Ingo, Hong, D Vo, Panna S. Bhagavatula and Mandyam V Srinivasan, 2014. Minding the gap: in-flight body awareness in birds. *Frontiers in Zoology* 2014, 11:64 http://www.frontiersinzoology.com/content/11/1/64

Sealy, S.G.,1985. Analysis of a sample of Tennessee Warblers window-killed during spring migration in Manitoba. *North American Bird Bander* 10(4):121-124.

Snyder, L.L., 1946. “Tunnel fliers” and window fatalities. *Condor* 48(6):278.

Thomas, Robert J., Tamas Szekely, Innes C. Cuthill, David G. C. Harper, Stuart E. Newson, Tim D. Frayling and Paul D. Wallis, 2002. Eye size in birds and the timing of song at dawn. *Proc. R. Soc. Lond. B* (2002) 269, 831-837. DOI 10.1098/rspb.2001.1941

Van De Laar, F.J.T., 2007. Green Light to Birds, Investigation into the Effect of Bird-friendly Lighting. Nederlandse Aardolie Maatschappij, The Netherlands. 24pp.

Varela, F.J., A.G. Palacios and T.H. Goldsmith, 1993. Color vision of birds. In *Vision, Brain, and Behavior in Birds*, H. P. Zeigler and H. Bischof eds., chapter 5.

Weir, R.D.,1976. Annotated bibliography of bird kills at man-made obstacles: a review of the state of the art and solutions. Department of Fisheries and the Environment, Canadian Wildlife Service, Ontario Region, 1976.

Wiese, Francis K., W.A. Montevecchi, G.K. Davoren, F. Huettman, A.W. Diamond and J. Linke, 2001. Seabirds at Risk around Off-shore Oil Platforms in the North-west Atlantic. *Marine Pollution Bulletin* 42(12):1285-1290.

Wiltschko, W., R. Wiltschko and U. Munro, 2000. Light-dependent magnetoreception in birds: the effect of intensity of 565-nm green light. *Naturwissenschaften* 87:366-369.

Wiltschko, W.,U. Monro, H. Ford and R. Wiltschko, 2003. Magnetic orientation in birds: non-compass responses under monochromatic light of increased intensity. *Proc. R. Soc. Lond.* B:270, 2133–2140.

Wiltschko, W.,U. Monro, H. Ford and R. Wiltschko, 2006. Bird navigation: what type of information does the magnetite-based receptor provide? *Proc. R. Soc. B* 22 November 2006 vol. 273 no. 1603 2815-2820.

Wiltschko, W. and R. Wiltschko, 2007.Magnetoreception in birds: two receptors for two different tasks. *J. Ornithology* 148, Supplement 1:61-76.

Wiltschko, R., K. Stapput, H. Bischof and W.Wiltschko, 2007. Light-dependent magnetoreception in birds: increasing intensity of monochromatic light changes the nature of the response. *Frontiers in Zoology* 2007 4:5. doi: 10.1186/1742-9994-4-5

Wiltschko, R., U. Monro, H. Ford, K. Stapput and W. Wiltschko, 2008. Light-dependent magnetoreception: orientation behaviour of migratory birds under dim red light. *The Journal of Experimental Biology* 211, 3344-3350.

Wiltschko, R. and W. Wiltschko, 2009. Avian Navigation. *The Auk* 126(4):717–743.

For the Langley Academy in Berkshire, U.K., Foster + Partners used louvers to control light and ventilation, also making the building safe for birds. Photo by Chris Phippen Ofis

## Authors and Editors

Written by Dr. Christine Sheppard, Bird Collisions Campaign Manager and Glenn Phillips, Bird Collisions and Development Officer

Additional contributions by: Anne Law, and Mike Parr.
Edited by: George Fenwick, Clare Nielsen, Mike Parr, Darin Schroeder, Mary Jane Kaplan, Barbara Kancelbaum
Designed by: Gemma Radko

## Recommended Citation

Christine Sheppard and Glenn Phillips. *Bird-Friendly Building Design,* 2nd Ed. (The Plains, VA: American Bird Conservancy, 2015)

## Acknowledgments

**American Bird Conservancy (ABC) would like to thank the following for their help in bringing this document to fruition:** Susan Elbin and the staff of New York City Audubon, the Wildlife Conservation Society, Bird-safe Glass Foundation, International Dark Skies Association, Fatal Light Awareness Program, Joanna Eckles, Deborah Laurel, Guy Maxwell, Dan Piselli, Bruce Fowle, Marcia Fowle, and Stefan Knust.

We are especially grateful to the Leon Levy Foundation for its ongoing support for ABC's Collisions Program.

This document is based on guidelines published by the New York City Audubon Society, Inc., May 2007, with support from the U.S. Fish & Wildlife Service through the Neotropical Migratory Bird Conservation Act.

## Disclaimer

*This publication is presented in good faith and is intended for general guidance only. The material was drawn from many sources; every effort was made to cite those sources, and any omissions are inadvertent. The contents of this publication are not intended as professional advice. ABC, the authors, and New York City Audubon make no representation or warranty, either expressly or implied, as to the completeness or accuracy of the contents. Users of these guidelines must make independent determinations as to the suitability or applicability of the information for their own situation or purposes; the information is not intended to be a substitute for specific, technical, or professional advice or services. In no event will the publishers or authors be responsible or liable for damages of any nature or kind whatsoever resulting from the distribution of, use of, or reliance on the contents of this publication.*

The Institut Arabe du Monde in Paris, France, provides light to the building interior without using glass. Photo by Joseph Radko, Jr.

**American Bird Conservancy** is the Western Hemisphere's bird conservation specialist—the only organization with a single and steadfast commitment to achieving conservation results for native birds and their habitats throughout the Americas. With a focus on efficiency and working in partnership, we take on the toughest problems facing birds today, innovating and building on sound science to halt extinctions, protect habitats, eliminate threats, and build capacity for bird conservation.

AMERICAN BIRD CONSERVANCY

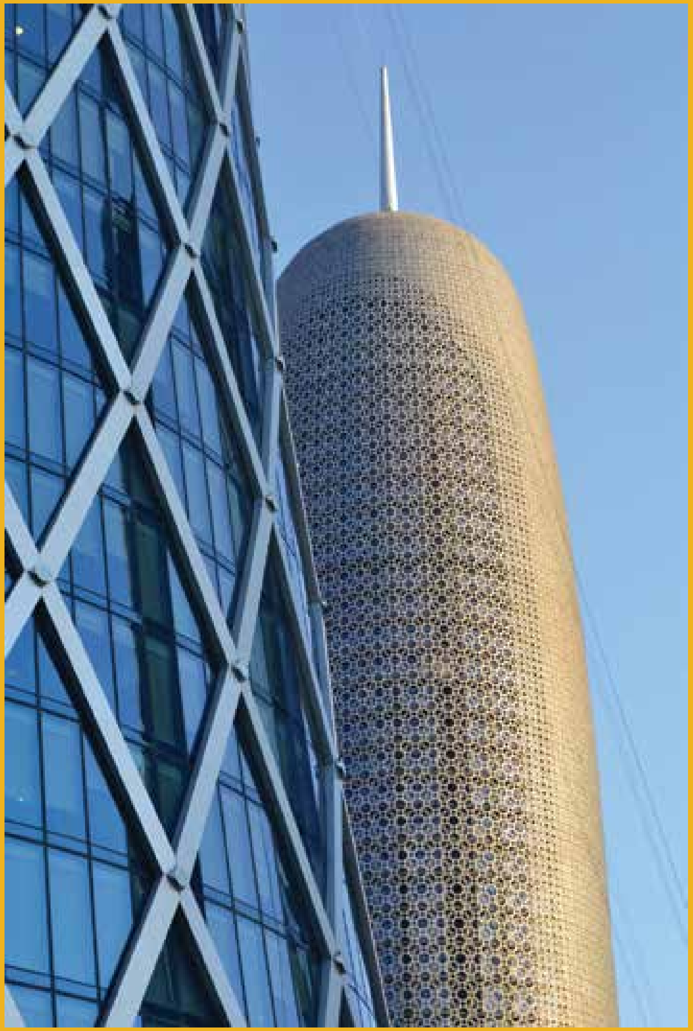
**American Bird Conservancy**
4249 Loudoun Avenue, P.O. Box 249
The Plains, VA  20198
540-253-5780
**abcbirds.org**

The Orange Cube, a commercial and cultural complex, was designed by Jacob + McFarlane Architects as part of redevelopment of the harbor in Lyons, France. The external skin virtually eliminates threats to birds while permitting natural illumination of the interior and sightlines for those inside. Photo © Nicolas Borel

# American Bird Conservancy's Bird-Friendly Building Standard

The U.S. Green Building Council's LEED Pilot Credit 55 represents the best current understanding of what constitutes a bird-friendly building. Briefly, a bird-friendly building is one where:

- At least 90% of the material in the exposed façade from ground level to 40 feet (the primary bird collision zone) has a threat score of 30 or less, derived from controlled experiments.
- At least 60% of material in the exposed façade above the collision zone meets the above standard.
- All glass surrounding atria or courtyards meets the above standard.
- There are no "see through" passageways or corners.
- Outside lighting is appropriately shielded and directed to minimize attraction to night migrating or nocturnal birds.
- Interior lighting is turned off at night if not in use and designed to minimize light escaping through windows during night operation.
- Landscaping is designed without features known to increase collisions.
- Actual bird mortality is monitored and compensated for (for example, in the form of habitat preserved or created elsewhere, mortality from other sources reduced, etc.).



The Burj Qatar, designed by Jean Nouvel, was named Best Tall Building Worldwide in 2012. The façade, created with multi-layered screens, expresses local culture while providing protection from high temperatures and sand. Photo by Marc Desbordes

*Printing costs for this publication have been kindly covered by an anonymous donor*

David Chipperfield's expansion of the Anchorage Museum has a surface of mirror glass, made bird-friendly by a frit pattern that conforms with 2 x 4 recommendations. Museum staff confirm that while collisions do occur in the area, the museum sees few, if any. Photo by Larry Vincent

$11.95
ISBN 978-1-4951-8039-2
51195>
9 781495 180392

# Appendix E-5
# NOAA Fisheries California Eelgrass Mitigation Policy and Implementing Guidelines

NOAA FISHERIES
West Coast Region

# California Eelgrass Mitigation Policy and Implementing Guidelines

October 2014

Photo credit: www.Lorenz-Avelar.com

## Table of Contents

# I. National Marine Fisheries Service's (NMFS) California Eelgrass Mitigation Policy

## A. Policy Statement

It is NMFS' policy to recommend **no net loss of eelgrass habitat function** in California.

For all of California, compensatory mitigation should be recommended for the loss of existing eelgrass habitat function, but only after avoidance and minimization of effects to eelgrass have been pursued to the maximum extent practicable. Our approach is congruous with the approach taken in the federal Clean Water Act guidelines under section 404(b)(1) (40 CFR 230). In absence of a complete functional assessment, eelgrass distribution and density should serve as a proxy for eelgrass habitat function. Compensatory mitigation options include comprehensive management plans, in-kind mitigation, mitigation banks and in-lieu-fee programs, and out-of-kind mitigation. While in-kind mitigation is preferred, the most appropriate form of compensatory mitigation should be determined on a case-by-case basis.

Further, it is the intent of this policy to ensure that there is no loss associated with delays in establishing compensatory mitigation. This should be accomplished by creating a greater amount of eelgrass than is lost, if the mitigation is performed contemporaneously or after the impacts occur. To achieve this, NMFS, in most instances, should recommend compensatory mitigation for vegetated and unvegetated eelgrass habitat be successfully completed at a ratio of at least 1.2:1 mitigation area to impact area. This ratio is based on present value calculation[1] using a discount rate of 0.03 (NOAA-DARP 1999). This ratio assumes that restored eelgrass habitat achieves habitat function comparable to existing eelgrass habitat within a period of three years or less (Hoffman 1986, Evans & Short 2005, Fonseca *et al.* 1990).

For ongoing projects, once mitigation has been successfully implemented to compensate for the loss of eelgrass habitat function within a specified footprint, NMFS should not recommend additional mitigation for subsequent loss of eelgrass habitat if 1) ongoing project activities result in subsequent loss of eelgrass habitat function within the same footprint for which mitigation was completed and 2) the project applicant can document that no new area of eelgrass habitat is impacted by project activities.

This policy does not address mitigation for potential eelgrass habitat. NMFS recognizes impacts to potential eelgrass habitat may preclude eelgrass movement or expansion to suitable unvegetated areas in the future, potentially resulting in declines in eelgrass abundance over time. In addition, it does not address other shallow water habitats. Regulatory protections in the estuarine/marine realm typically focus on wetlands and submerged aquatic vegetation. Mudflats, sandflats, and other superficially bare habitats do not garner the same degree of recognition and

---

[1] Present Value (PV) is a calculation used in finance to determine the present day value of an amount that is received at a future date. The premise of the equation is that receiving something today is worth more than receiving the same item at a future date; $PV = C_1/(1+r)^n$ where $C_1$= resource at period 1, r= interest or discount rate, n=number of periods.

concern, even though these are some of the most productive and fragile ecosystems (Reilly *et al*. 1999). NMFS will continue to collaborate with federal and state partners on these issues.

### B. Eelgrass Background and Information

Eelgrass species (*Zostera marina* L. and *Z. pacifica*) are seagrasses that occur in the temperate unconsolidated substrate of shallow coastal environments, enclosed bays, and estuaries. Eelgrass is a highly productive species and is considered to be a "foundation" or habitat forming species. Eelgrass contributes to ecosystem functions at multiple levels as a primary and secondary producer, as a habitat structuring element, as a substrate for epiphytes and epifauna, and as sediment stabilizer and nutrient cycling facilitator. Eelgrass provides important foraging areas and shelter to young fish and invertebrates, food for migratory waterfowl and sea turtles, and spawning surfaces for invertebrates and fish such as the Pacific herring. Eelgrass also provides a significant source of carbon to the detrital pool which provides important organic matter in sometimes food-limited environments (*e.g.*, submarine canyons). In addition, eelgrass has the capacity to sequester carbon in the underlying sediments and may help offset carbon emissions. Given the significance and diversity of the functions and services provided by seagrass, Costanza *et al.* (2007) determined seagrass ecosystems to be one of Earth's most valuable.

California supports dynamic eelgrass habitats that range in extent from less than 11,000 acres to possibly as much as 15,000 acres statewide. This is inclusive of estimates for poorly documented beds in smaller coastal systems as well as open coastal and insular areas. While among the most productive of habitats, the overall low statewide abundance makes eelgrass one of the rarest habitats in California. Collectively just five systems, Humboldt Bay, San Francisco Bay, San Diego Bay, Mission Bay and Tomales Bay support over 80 percent of the known eelgrass in the state. The uneven distribution of eelgrass resources increases the risk to this habitat and also contributes to its dynamic nature. Further, the narrow depth range within which eelgrass can occur further places this habitat at risk in the face of global climate change and sea level rise predictions.

Seagrass habitat has been lost from temperate estuaries worldwide (Duarte 2002, Lotze *et al.* 2006, Orth *et al.* 2006). While both natural and human-induced mechanisms have contributed to these losses, impacts from human population expansion and associated pollution and upland development is the primary cause (Short and Wyllie-Echeverria 1996). Human activities that affect eelgrass habitat distribution and abundance, including, but not limited to, urban development, harbor development, aquaculture, agricultural runoff, effluent discharges, and upland land use associated sediment discharge (Duarte 2008) occur throughout California. For example, dredging and filling; shading and alteration of circulation patterns; and watershed inputs of sediment, nutrients, and unnaturally concentrated or directed freshwater flows can directly and indirectly destroy eelgrass habitats. Conversely, in many areas great strides have been made at restoring water quality and expanding eelgrass resources through directed efforts at environmental improvements and resource enhancement. While improvements in eelgrass management have occurred overall, the importance of eelgrass both ecologically and economically, coupled with ongoing human pressure and potentially increasing degradation and losses associated with climate change, highlight the need to protect, maintain, and where feasible, enhance eelgrass habitat.

### C. Purpose and Need for Eelgrass Mitigation Policy

Eelgrass warrants a strong protection strategy because of the important biological, physical, and economic values it provides, as well as its importance to managed species under the Magnuson-Stevens Fishery Conservation and Management Act (MSA). Vegetated shallows that support eelgrass are also considered special aquatic sites under the 404(b)(1) guidelines of the Clean Water Act (40 C.F.R. § 230.43). The National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS) developed this policy to establish and support a goal of protecting this resource and its habitat functions, including spatial coverage and density of eelgrass habitats. This NMFS policy and implementing guidelines are being shared with agencies and the public to ensure there is a clear and transparent process for developing eelgrass mitigation recommendations.

Pursuant to the MSA, eelgrass is designated as an essential fish habitat (EFH) habitat area of particular concern (HAPC) for various federally-managed fish species within the Pacific Coast Groundfish Fishery Management Plan (FMP) (PFMC 2008). An HAPC is a subset of EFH that is rare, particularly susceptible to human-induced degradation, especially ecologically important, and/or located in an environmentally stressed area. HAPC designations are used to provide additional focus for conservation efforts.

This policy and guidelines support but do not expand upon existing NMFS authorities under the MSA, the Fish and Wildlife Coordination Act (FWCA), and the National Environmental Policy Act (NEPA). Pursuant to the EFH provisions of the MSA, FWCA, and obligations under the NEPA as a responsible agency, NMFS annually reviews and provides recommendations on numerous actions that may affect eelgrass resources throughout California. Section 305(b)(1)(D) of the MSA requires NMFS to coordinate with, and provide information to, other federal agencies regarding the conservation and enhancement of EFH. Section 305(b)(2) requires all federal agencies to consult with NMFS on all actions or proposed actions authorized, funded, or undertaken by the agency that may adversely affect EFH. Under section 305(b)(4) of the MSA, NMFS is required to provide EFH Conservation Recommendations to federal and state agencies for actions that would adversely affect EFH (50 C.F.R. § 600.925). NMFS makes its recommendations with the goal of avoiding, minimizing, or otherwise compensating for adverse effects to EFH. When impacts to NMFS trust resources are unavoidable, NMFS may recommend compensatory mitigation to offset those impacts. In order to fulfill its consultative role, NMFS may also recommend, among other things, the development of mitigation plans, habitat distribution maps, surveys and survey reports, progress milestones, monitoring programs, and reports verifying the completion of mitigation activities.

Eelgrass impact management and mitigation throughout California has historically been undertaken without a statewide strategy. Federal actions with impacts to eelgrass require considerable NMFS staff time for project review, coordination and development of conservation recommendations. As federal staff resources vary with budgets, and threats to aquatic resources remain steady or increase, regulatory streamlining and increased efficiency are crucial for continued protection of important coastal habitats, including eelgrass. The California Eelgrass Mitigation Policy (CEMP) is meant to increase efficiency of existing regulatory authorities in a programmatic manner, provide transparency to federal agencies and action proponents, and ensure that unavoidable impacts to eelgrass habitat are fully and appropriately mitigated. It is the intent of NMFS to collaborate with other federal, state, and local agencies charged with the protection of marine resources to seek a unified approach to actions affecting eelgrass such that consistency across agencies with respect to this resource may be enhanced.

## D. Relevance to Other Federal and State Policies

Based on our understanding of existing federal and state policies regarding aquatic resource conservation, the CEMP does not conflict with existing policies and complements the federal and state wetland policies as described below. NMFS does not intend to make any recommendations, which, if adopted by the action agency and carried out, would violate other federal, state, or local laws. The CEMP also complements the NOAA Aquaculture Policy and National Shellfish Initiative and builds upon the NOAA Seagrass Conservation Guidelines and the Southern California Eelgrass Mitigation Policy.

### 1. Corps/EPA Mitigation Rule and supporting guidance

In 2008, the Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers (Corps) issued revised regulations governing compensatory mitigation for authorized impacts to wetlands, streams, and other waters of the U.S. under Section 404 of the Clean Water Act. The regulations emphasize avoiding impacts to wetlands and other water resources. For unavoidable impacts, the rule incorporates Natural Resource Council recommendations to improve planning, implementing and managing wetland replacement projects, including: science-based assessment of impacts and compensation measures, watershed assessments to drive mitigation sites and plans, measurable and enforceable ecological performance standards for evaluating mitigation projects, mitigation monitoring to document whether the mitigation employed meets ecological performance standards, and complete compensation plans. The regulations also encourage the expansion of mitigation banking and in lieu fee agreements to improve the quality and success of compensatory mitigation projects.

The NMFS policy to recommend no net loss of eelgrass function and the eelgrass mitigation guidelines offered herein align with the provisions of the EPA and Corps mitigation rule, but provide more specific recommendations on how to avoid and minimize impacts to eelgrass and how to implement eelgrass surveys, assessments, mitigation, and monitoring.

### 2. State of California Wetland Conservation Policies

The 1993 State of California Wetlands Conservation Policy established a framework and strategy to ensure no overall net loss and long-term gain in the quantity, quality, and permanence of wetlands acreage and values in California in a manner that fosters creativity, stewardship, and respect for private property, reduce procedural complexity in administration of state and federal wetlands conservation programs, and encourage partnerships to make landowner incentive programs and cooperative planning efforts the primary focus of wetlands conservation and restoration.

The State of California is also developing a Wetland and Riparian Area Protection Policy. The first phase of this effort was published as the "Preliminary Draft Wetland Area Protection Policy" with the purpose of protecting all waters of the State, including wetlands, from dredge and fill discharges. It includes a wetland definition and associated delineation methods, an assessment framework for collecting and reporting aquatic resource information, and requirements applicable to discharges of dredged or fill material. The draft specifies that dredge or fill projects will provide for replacement of existing beneficial uses through compensatory mitigation. The preliminary policy includes a determination that compensatory mitigation will sustain and improve the overall abundance, diversity and condition of aquatic resources in a project watershed area.

Based on the definition of wetlands included in these state wetland policies, the policies do not directly apply to subtidal eelgrass habitat, but may apply to intertidal eelgrass habitat. The NMFS policy of recommending no net loss to eelgrass habitat function and recommendations for compensatory mitigation for eelgrass impacts complement the state protection policies for wetlands.

### 3. NOAA Aquaculture Policy and National Shellfish Initiative

In 2011, NOAA released the National Marine Aquaculture Policy and the National Shellfish Initiative. The Policy encourages and fosters sustainable aquaculture development that provides domestic jobs, products, and services and that is in harmony with healthy, productive, and resilient marine ecosystems, compatible with other uses of the marine environment, and consistent with the National Policy for the Stewardship of the Ocean, our Coasts, and the Great Lakes (National Ocean Policy). The goal of the Initiative is to increase populations of bivalve shellfish in our nation's coastal waters—including oysters, clams, abalone, and mussels—through both sustainable commercial production and restoration activities. The Initiative supports shellfish industry jobs and business opportunities to meet the growing demand for seafood, while protecting and enhancing habitat for important commercial, recreational, and endangered and threatened species and species recovery. The Initiative also highlights improved water quality, nutrient removal, and shoreline protection as benefits from shellfish production and restoration. Both the Policy and the Initiative seek to improve interagency coordination for permitting commercial and restoration shellfish projects, as well as support research and other data collection to assess and refine conservation strategies and priorities.

The regulatory efficiencies, transparency, and compensation for impacts to eelgrass promoted by the CEMP directly support the National Aquaculture Policy statements and National Shellfish Initiative through: (1) protection of eelgrass, an important component of productive and resilient coastal ecosystems in California and habitat for wild species, and (2) improved coordination with federal partners regarding planning and permitting for commercial shellfish projects. Furthermore, research conducted under the direction of the National Shellfish Initiative could be informed by and also inform NMFS consultations regarding eelgrass impacts and mitigation in California.

### 4. NOAA Seagrass Conservation Guidelines

The NOAA publication, “Guidelines for the Conservation and Restoration of Seagrasses in the United States and Adjacent Waters” (1998) was developed by Mark Fonseca of NOAA’s Beaufort Laboratory along with Jud Kenworthy and Gordon Thayer and was funded by NOAA’s Coastal Ocean Program. The document presents an overview of seagrass conservation and restoration in the United States, discusses important issues that should be addressed in planning seagrass restoration projects, describes different planting methodologies, proposes monitoring criteria and means for evaluation success, and discusses issues faced by resource managers. The CEMP considers information presented in the Fonseca *et al*. document, but deviates in some cases in order to provide reasonable and practicable guidelines for eelgrass conservation in California.

### 5. Southern California Eelgrass Mitigation Policy

In southern and central California, eelgrass mitigation has been addressed in accordance with the Southern California Eelgrass Mitigation Policy applied by NMFS, US Fish & Wildlife Service, California Department of Fish and Wildlife, California Coastal Commission, US Army Corps of Engineers, and other resource and regulatory agencies since 1991, and which has generally been effective at ensuring eelgrass impacts are mitigated in most circumstances. Given the success of the Southern California Eelgrass Mitigation Policy over its 20-year history, this policy reflects an expansion of the application of the Southern California policy with minor modifications to ensure a high standard of statewide eelgrass management and protection. This policy will supersede the Southern California Eelgrass Mitigation Policy for all areas of California upon its adoption.

## II. Implementing Guidelines for California

This policy and guidelines will serve as the guidance for staff and managers within NMFS for developing recommendations concerning eelgrass issues through EFH and FWCA consultations and NEPA reviews throughout California. This policy will inform NMFS’s position on eelgrass issues for California in other roles as a responsible, advisory, or funding agency or trustee. In addition, this document provides guidance to assist NMFS in performing its consultative role under the statutes described above. Finally, pursuant to NMFS obligation to provide information to federal agencies under Section 305(b)(1)(D) of the MSA, this policy serves that role by providing information intended to further the conservation and enhancement of EFH. Should this policy or guidelines be inconsistent with any formally-promulgated NMFS regulations, those formally-promulgated regulations will take precedence over any inconsistent provisions of this policy.

While many of the activities impacting eelgrass are similar across California, eelgrass stressors and growth characteristics differ between southern California (U.S./Mexico border to Pt. Conception), central California (Point Conception to San Francisco Bay entrance), San Francisco Bay, and northern California (San Francisco Bay to the California/Oregon border). The amount of scientific information available to base management decisions on also differs among areas within California, with considerably more information and history with eelgrass habitat management in southern California than the other regions. Gaps in region-specific scientific information do not override the need to be protective of eelgrass habitat while relying on the best information currently available from areas within and outside of California. Although the primary orientation of this policy is toward statewide use, where indicated below, specific elements of this policy may differ between southern California, central California, northern California and San Francisco Bay.

NMFS will continue to explore the science of eelgrass habitat and improve our understanding of eelgrass habitat function, impacts, assessment techniques, and mitigation efficacy. Approximately every 5 years, NMFS intends to evaluate monitoring and survey data collected by federal agencies and action proponents per the recommendations of these guidelines. NMFS managers will determine if updates to these guidelines are appropriate based on information evaluated during the 5-year review. Updates to these guidelines and supporting technical information will be available on the NMFS website.

The information below serves as a common starting place for NMFS recommendations to achieve no net loss of eelgrass habitat function. NMFS employees should not depart from the guidelines provided herein without appropriate justification and supervisory concurrence. However, the recommendations that NMFS ultimately makes should be provided on a case-by-case basis to provide flexibility when site specific conditions dictate. In the EFH context, NMFS recommendations are provided to the action agency, which has final approval of the action; in accordance with the MSA, the action agency may take up NMFS recommendations or articulate its reasons for not following the recommendations. In the FWCA context, NMFS makes recommendations which must be considered, but the action agency is ultimately responsible for the wildlife protective measures it adopts (if any). For these reasons, neither this policy nor its implementing guidelines are to be interpreted as binding on the public.

### A. Eelgrass Habitat Definition

Eelgrass distribution fluctuates and can expand, contract, disappear, and recolonize areas within suitable environments. Vegetated eelgrass areas can expand by as much as 5 meters (m) and contract by as much as 4 m annually (Donoghue 2011). Within eelgrass habitat, eelgrass is expected to fluctuate in density and patch extent based on prevailing environmental factors (*e.g.*, turbidity, freshwater flows, wave and current energy, bioturbation, temperature, etc.). To account for seagrass fluctuation, Fonseca *et al.* (1998) recommends that seagrass habitat include the vegetated areas as well as presently unvegetated spaces between seagrass patches.

In addition, there is an area of functional influence, where the habitat function provided by the vegetated cover extends out into adjacent unvegetated areas. Those functions include detrital enrichment, energy dampening and sediment trapping, primary productivity, alteration of current or wave patterns, and fish and invertebrate use, among other functions. The influence of eelgrass on the local environment can extend up to 10 m from individual eelgrass patches, with the distance being a function of the extent and density of eelgrass comprising the bed as well as local biologic, hydrographic, and bathymetric conditions (Bostrom and Bonsdorff 2000, Bostrom *et al.* 2001, Ferrell and Bell 1991, Peterson *et al.* 2004, Smith *et al.* 2008, van Houte-Howes *et al.* 2004, Webster *et al.* 1998). Detrital enrichment will generally extend laterally as well as down slope from the beds, while fish and invertebrates that utilize eelgrass beds may move away from the eelgrass core to areas around the bed margins for foraging and in response to tides or diurnal cycles (Smith *et al*. 2008).

To encompass fluctuating eelgrass distribution and functional influence around eelgrass cover, for the purposes of this policy and guidelines, eelgrass habitat is defined as areas of vegetated eelgrass cover (any eelgrass within 1 $m^2$ quadrat and within 1 m of another shoot) bounded by a 5 m wide perimeter of unvegetated area (See Attachment 1 for a graphical depiction of this definition). Unvegetated areas may have eelgrass shoots a distance greater than 1 m from another shoot, and may be internal as well as external to areas of vegetated cover. For isolated patches and on a case-by-case basis, it may be acceptable to include an unvegetated area boundary less than or greater than 5 m wide. The definition excludes areas of unsuitable environmental conditions such as hard bottom substrates, shaded locations, or areas that extend to depths below those supporting eelgrass. Suitable depths can vary substantially depending upon site-specific conditions. In general, eelgrass does not extend deeper than 12 feet mean lower low water (MLLW) in most protected bays and harbors in Southern California, and is more limited in Central and Northern California embayments. However, eelgrass can grow much deeper in entrance channels and offshore areas

## B. Surveying Eelgrass

NMFS may recommend action agencies conduct surveys of eelgrass habitat to evaluate effects of a proposed action. Eelgrass habitat should be surveyed using visual or acoustic methods and mapping technologies and scales appropriate to the action, scale, and area of work. Surveys should document both vegetated eelgrass cover as well as unvegetated areas within eelgrass habitat (See section II.A. for definition). Assessing impacts to eelgrass habitat relies on the completion of quality surveys and mapping. As such, inferior quality of surveys and mapping (*e.g.*, completed at an inappropriate scale or using inappropriate methods) may make proper evaluation of impacts impossible, and may result in a recommendation from NMFS to re-survey and re-map project areas. Also, to account for fluctuations in eelgrass habitat due to environmental variations, a reference site(s) should be incorporated into the survey (See section V.B.4 below for more details).

### 1. Survey Parameters

Because eelgrass growth conditions in California vary, eelgrass mapping techniques will also vary. Diver transects or boundary mapping may be suited to very small scale mapping efforts, while aerial and/or acoustic survey with ground-truthing may be more suited to larger survey areas. Aerial and above-water visual survey methods should be employed only where the lower limit of eelgrass is clearly visible or in combination with methods that adequately inventory eelgrass in deeper waters.

The survey area should be scaled as appropriate to the size of the potential action and the potential extent and distribution of eelgrass impacts, including both direct and indirect effects. The resolution of mapping should be adequate to address the scale of effects reasonably expected to occur. For small projects, such as individual boat docks, higher mapping resolution is appropriate in order to detect actual effects to eelgrass at a scale meaningful to the project size. At larger scales, the mapping resolution may be less refined over a larger area, assuming that minor errors in mapping will balance out over the larger scale. Survey reports should provide a detailed description of the survey coverage (*e.g.*, number, location, and type of samples) and any interpolation methods used in the mapping.

While many parameters may be useful to describe eelgrass habitat condition (*e.g.*, plant biomass, leaf length, shoot:root ratios, epiphytic loading), many are labor intensive and may be impractical for resource management applications on a day-to-day basis. For this reason, four parameters have been identified for use in eelgrass habitat surveys and assessment of effects of an action on eelgrass. These parameters that should be articulated in eelgrass surveys are: 1) spatial distribution, 2) areal extent, 3) percentage of vegetated cover, and 4) the turion (shoot) density.

### *a) Spatial Distribution*

The spatial distribution of eelgrass habitat should be delineated by a contiguous boundary around all areas of vegetated eelgrass cover extending outward a distance of 5 m, excluding gaps within the vegetated cover that have individual plants greater than 10 m from neighboring plants. Where such separations occur, either a separate area should be defined, or a gap in the area should be defined by extending a line around the void along a boundary defined by adjacent plants and including the 5 meter perimeter. The boundary of the eelgrass habitat should not extend into areas where depth, substrate, or existing structures are unsuited to supporting eelgrass habitat.

### *b) Aerial Extent*

The eelgrass habitat aerial extent is the quantitative area (*e.g.*, square meters) of the spatial distribution boundary polygon of the eelgrass habitat. The total aerial extent should be broken down into extent of vegetated cover and extent of unvegetated habitat. Areal extent should be determined using commercially available geo-spatial analysis software. For small projects, coordinate data for polygon vertices could be entered into a spreadsheet format, and area could be calculated using simple geometry.

### *c) Percent Vegetated Cover*

Eelgrass vegetated cover exists when one or more leaf shoots (turions) per square meter is present. The percent bottom cover within eelgrass habitat should be determined by totaling the area of vegetated eelgrass cover and dividing this by the total eelgrass habitat area. Where substantial differences in bottom cover occur across portions of the eelgrass habitat, the habitat could be subdivided into cover classes (*e.g.*, 20% cover, 50% cover, 75% cover).

### *d) Turion (Shoot) Density*

Turion density is the mean number of eelgrass leaf shoots per square meter within mapped eelgrass vegetated cover. Turion density should be reported as a mean ± the standard deviation of replicate measurements. The number of replicate measurements (n) should be reported along with the mean and deviation. Turion densities are determined only within vegetated areas of eelgrass habitat and therefore, it is not possible to measure a turion density equal to zero. If different cover classes are used, a turion density should be determined for each cover class.

### 2. Eelgrass Mapping

For all actions that may directly or indirectly affect eelgrass habitat, an eelgrass habitat distribution map should be prepared on an accurate bathymetric chart with contour intervals of not greater than 1 foot (local vertical datum of MLLW). Exceptions to the detailed bathymetry could be made for small projects or for projects where detailed bathymetry may be infeasible. Unless region-specific mapping format and protocols are developed by NMFS (in which case such region-specific mapping guidance should be used), the mapping should utilize the following format and protocols:

#### *a) Bounding Coordinates*

Horizontal datum - Universal Transverse Mercator (UTM), NAD 83 meters, Zone 11 (for southern California) or Zone 10 (for central, San Francisco Bay, and northern California) is the preferred projection and datum. Another projection or datum may be used; however, the map and spatial data should include metadata that accurately defines the projection and datum.

Vertical datum - Mean Lower Low Water (MLLW), depth in feet.

#### *b) Units*

Transects, grids, or scale bars should be expressed in meters. Area measurements should be in square meters.

#### *c) File Format*

A spatial data layer compatible with readily available commercial geographic information system software producing file formats compatible with ESRI® ArcGIS software should be sent to NMFS when the area mapped supports at least 10 square meters of eelgrass. For those areas supporting less than 10 square meters of eelgrass, a table may alternatively be provided giving the vertices bounding x, y coordinates of the eelgrass areas in a spreadsheet or an ASCII file format. In addition to a spatial layer and/or table, a hard-copy map should be included with the survey report. The projection and datum should be clearly defined in the metadata and/or an associated text file.

Eelgrass maps should, at a minimum, include the following:

- A graphic scale bar, north arrow, legend, horizontal datum and vertical datum;
- A boundary illustrating the limits of the area surveyed;
- Bathymetric contours for the survey area, including both the action area(s) and reference site(s) in increments of not more than 1 foot;
- An overlay of proposed action improvements and construction limits;
- The boundary of the defined eelgrass habitat including an identification of area exclusions based on physical unsuitability to support eelgrass habitat; and

- The existing eelgrass cover within the defined eelgrass habitat at the time of the survey.

### 3. Survey Period

All mapping efforts should be completed during the active growth period for eelgrass (typically March through October for southern California, April through October for central California, April through October for San Francisco Bay, and May through September for northern California) and should be considered valid for a period of 60 days to ensure significant changes in eelgrass distribution and density do not occur between survey date and the project start date. The 60 day period is particularly important for eelgrass habitat survey conducted at the very beginning of the growing season, if eelgrass habitat expansion occurs as the growing season progresses. A period other than 60 days could be warranted and should be evaluated on a case-by-case basis, particularly for surveys completed in the middle of the growing season. However, when the end of the 60-day validity period falls outside of the region-specific active growth period, the survey could be considered valid until the beginning of the next active growth period. For example, a survey completed in southern California in the August-October time frame would be valid until the resumption of the active growth phase (i.e., in most instances, March 1). In some cases, NMFS and the action agency may agree to surveys being completed outside of the active growth period. For surveys completed during or after unusual climatic events (*e.g.*, high fluvial discharge periods, El Niño conditions), NMFS staff should be contacted to determine if any modifications to the common survey period are warranted.

### 4. Reference Site Selection

Eelgrass habitat spatial extent, aerial extent, percent cover and turion density are expected to naturally fluctuate through time in response to natural environmental variables. As a result, it is necessary to correct for natural variability when conducting surveys for the purpose of evaluating action effects on eelgrass or performance of mitigation areas. This is generally accomplished through the use of a reference site(s), which is expected to respond similarly to the action area in response to natural environmental variability. It is beneficial to select and monitor multiple reference sites rather than a single site and to utilize the average reference site condition as a metric for environmental fluctuations. This is especially true when a mitigation site is located within an area of known environmental gradients, and reference sites may be selected on both sides of the mitigation site along the gradient. Environmental conditions (*e.g.*, sediment, currents, proximity to action area, shoot density, light availability, depth, onshore and watershed influences) at the reference site(s) should be representative of the environmental conditions at the impact area (Fonseca *et al*. 1998). Where practical, the reference site(s) should be at least the size of the anticipated impact and/or mitigation area to limit the potential for minor changes in a reference site (*e.g.*, propeller scarring or ray foraging damage) overly affecting mitigation needs. The logic for site(s) selection should be documented in the eelgrass mitigation planning documents.

## C. Avoiding and Minimizing Impacts to Eelgrass

This section describes measures to avoid and minimize impacts to eelgrass caused by turbidity, shading, nutrient loading, sedimentation and alteration of circulation patterns. Not all measures are equally suited to a particular project or condition. Measures to avoid or minimize impacts should be focused on stressors where the source and control are within the purview of the permittee and action agency. Action agencies in coordination with NMFS should evaluate and establish impact avoidance and minimization measures on a case-by-case basis depending on the action and site-specific information, including prevailing current patterns, sediment source, characteristics, and quantity, as well as the nature and duration of work.

### 1. Turbidity

To avoid and minimize potential turbidity-related impacts to eelgrass:

- Where practical, actions should be located as far as possible from existing eelgrass; and
- In-water work should occur as quickly as possible such that the duration of impacts is minimized.

Where proposed turbidity generating activities must occur in proximity to eelgrass and increased turbidity will occur at a magnitude and duration that may affect eelgrass habitat, measures to control turbidity levels should be employed when practical considering physical and biological constraints and impacts. Measures may include:

- Use of turbidity curtains where appropriate and feasible;
- Use of low impact equipment and methods (*e.g.*, environmental buckets, or a hydraulic suction dredge instead of clamshell or hopper dredge, provided the discharge may be located away from the eelgrass habitat and appropriate turbidity controls can be provided at the discharge point);
- Limiting activities by tide or day-night windows to limit light degradation within eelgrass habitat;
- Utilizing 24-hour dredging to reduce the overall duration of work and to take advantage of dredging during dark periods when photosynthesis is not occurring; or
- Other measures that an action party may propose and be able to employ to minimize potential for adverse turbidity effects to eelgrass.

NMFS developed a flowchart for a stepwise decision making process as guidance for action agencies to determine when to implement best management practices (BMPs) for minimizing turbidity from dredging actions as part of a programmatic EFH consultation in San Francisco Bay. The parameters considered in the flow chart are relevant to all marine areas of California. This document is posted on the NMFS West Coast Region web page (http://www.westcoast.fisheries.noaa.gov/habitat/habitat_types/seagrass_info/california_eelgrass.html) and may be used to evaluate avoidance and minimization measures for any project that generates increased turbidity.

### 2. Shading

A number of potential design modifications may be used to minimize effects of shading on eelgrass. Boat docks, ramps, gangways, and similar structures should avoid eelgrass habitat to the maximum extent feasible. If avoidance of eelgrass or habitat is infeasible, impacts should be minimized by utilizing, to the maximum extent feasible, design modifications and construction materials that allow for greater light penetration. Action modifications should include, but are not limited to:

- Avoid siting over-water or landside structures in areas where shading of eelgrass habitat would occur;
- Maximizing the north-south orientation of the structure;
- Maximizing the height of the structure above the water;
- Minimizing the width and supporting structure mass to decrease shade effects;
- Relocating the structure in deeper water and limiting the placement of structures in shallow areas where eelgrass occurs to the extent feasible; and
- Utilizing light transmitting materials in structure design.

Construction materials used to increase light passage beneath the structures may include, but are not limited to, open grating or adequate spacing between deck boards to allow for effective illumination to support eelgrass habitat. The use of these shade reducing options may be appropriate where they do not conflict with safety, ADA compliance, or structure utility objectives.

NMFS developed a stepwise key as guidance for action agencies to determine which combination of modifications are best suited for minimizing shading effects from overwater structures on eelgrass as part of a programmatic EFH consultation in San Francisco Bay. The parameters considered in the flow chart are relevant to all marine areas of California. This document is posted on the West Coast Region web page (http://www.westcoast.fisheries.noaa.gov/habitat/habitat_types/seagrass_info/california_eelgrass.html) and may be used to evaluate avoidance and minimization measures for any project that results in shading.

### 3. Circulation patterns

Where appropriate to the scale and nature of potential eelgrass impacts, action parties should evaluate if and how the action may alter the hydrodynamics of the action area such that eelgrass habitat within or in proximity to the action area may be adversely affected. To maintain good water flow and low residence time of water within eelgrass habitat, action agencies should ensure actions:

- Minimize scouring velocities near or within eelgrass beds;
- Maintain wind and tidal circulation to the extent practical by considering orientation of piers and docks to maintain predominant wind effects;
- Incorporate setbacks on the order of 15 to 50 meters from eelgrass habitat where practical to allow for greater circulation and reduced impact from boat maneuvering, grounding, and propeller damage, and to address shading impacts; and
- Minimize the number of piles and maximize pile spacing to the extent practical, where piles are needed to support structures.

For large-scale actions in the proximity of eelgrass habitats, NMFS may request specific modeling and/or field hydrodynamic assessments of the potential effects of work on characteristics of circulation within eelgrass habitat.

### 4. Nutrient loading

Where appropriate to the scale and nature of potential eelgrass impacts, the following measures should be considered for implementation to reduce the potential for excessive nutrient loading to eelgrass habitat:

- diverting site runoff from landscaped areas away from discharges around eelgrass habitat;
- implementation of fertilizer reduction program;
- reduction of watershed nutrient loading;
- controlling local sources of nutrients such as animal wastes and leach fields; and
- maintaining good circulation and flushing conditions within the water body.

Reducing nutrient loading may also provide opportunities for establishing eelgrass as mitigation for project impacts.

### 5. Sediment loading

Watershed development and changes in land use may increase soil erosion and increase sedimentation to downstream embayments and lagoons.

- To the extent practicable, maintain riparian vegetation buffers along all streams in the watershed.
- Incorporate watershed analysis into agricultural, ranching, and residential/commercial development projects.
- Increase resistance to soil erosion and runoff. Sediment basins, contour farming, and grazing management are examples of key practices.
- Implement best management practices for sediment control during construction and maintenance operations (*e.g.,* Caltrans 2003).

Reducing sediment loading may also provide opportunities for establishing eelgrass as mitigation for project impacts in systems for which sedimentation is a demonstrable limiting factor to eelgrass.

## D. Assessing Impacts to Eelgrass Habitat

If appropriate to the statute under which the consultation occurs, NMFS should consider both direct and indirect effects of the project in order to assess whether a project may impact eelgrass. NMFS is aware that many of the statutes and regulations it administers may have more specific meanings for certain terms, including "direct effect" and "indirect effect", and will use the statutory or regulatory meaning of those terms when conducting consultations under those statutes.[2] Nevertheless, it is useful for NMFS to consider effects experienced

---

[2] In the EFH context, adverse effects include any impact that reduces quality and/or quantity of EFH, including direct or indirect physical, chemical, or biological alterations of the waters or substrate (50 CFR 600.910). The Council of Environmental Quality (CEQ) regulations regarding NEPA implementation (40 CFR 1508.8(a)) define direct and indirect impacts of an action for the purposes of NEPA. Other NMFS statutes provide their own definitions regarding effects.

contemporaneously with project actions (both at the project site and away from the project site) and which might occur later in time.

Generally, effects to eelgrass habitat should be assessed using pre- and post-project surveys of the impact area and appropriate reference site(s) conducted during the time period of maximum eelgrass growth (typically March through October for southern California, April through October for central California, April through October for San Francisco Bay, and May through September for northern California). NMFS should consider the likelihood that the effects would occur before recommending pre- and post-project eelgrass surveys. The pre-construction survey of the eelgrass habitat in the action area and an appropriate reference site(s) should be completed within 60 days before start of construction. After construction, a post-action survey of the eelgrass habitat in the action area and at an appropriate reference site(s) should be completed within 30 days of completion of construction, or within the first 30 days of the next active growth period following completion of construction that occurs outside of the active growth period. Copies of all surveys should be provided to the lead federal agency, NMFS, and other interested regulatory and/or resource agencies within 30 days of completing the survey. The recommended timing of surveys is intended to minimize changes in eelgrass habitat distribution and abundance during the period between survey completion and construction initiation and completion. For example, a post-action survey completed beyond 30 days following construction or outside of the active growing season may show declines in eelgrass habitat as a result of natural senescence rather than the action.

The lead federal agency and NMFS should consider reference area eelgrass performance, physical evidence of impact, turbidity and construction activities monitoring data, as well as other documentation in the determination of the impacts of the action undertaken. Impact analyses should document whether the impacts are anticipated to be complete at the time of the assessment, or whether there is an anticipation of continuing eelgrass impacts due to chronic or intermittent effects. Where eelgrass at the impact site declines coincident with and similarly to decline at the reference site(s), the percentage of decline at the reference site should be deducted from the decline at the impact site. However, if eelgrass expands within the reference site(s), the impact site should only be evaluated against the pre-construction condition of the reference site and not the expanded condition. If an action results in increased eelgrass habitat relative to the reference sites, this increase could potentially be considered (subject to the caveats identified herein) by NMFS and the action agency as potential compensation for impacts to eelgrass habitat that occur in the future (see Section II. E. 3). An assessment should also be made as to whether impacts or portions of the impact are anticipated to be temporary. Information supporting this determination may be derived from the permittee, NMFS, and other resource and regulatory agencies, as well as other eelgrass experts.

For some projects, environmental planning and permitting may take longer than 60 days. To accommodate longer planning schedules, it may also be necessary to do a preliminary eelgrass survey prior to the pre-construction survey. This preliminary survey can be used to anticipate potential impacts to eelgrass for the purposes of mitigation planning during the permitting process. In some cases, preliminary surveys may focus on spatial distribution of eelgrass habitat only or may be a qualitative reconnaissance to allow permittees to incorporate avoidance and minimization measures into their proposed action or to plan for future mitigation needs. The pre-and post- project surveys should then verify whether impacts occur as anticipated, and if planned mitigation is adequate. In some cases, a preliminary survey could be completed a year or more in advance of the project action.

### 1. Direct Effects

Biologists should consider the potential for localized losses of eelgrass from dredging or filling, construction-associated damage, and similar spatially and temporally proximate impacts (these effects could be termed “direct”). The actual area of the impact should be determined from an analysis that compares the pre-action condition of eelgrass habitat with the post-action conditions from this survey, relative to eelgrass habitat change at the reference site(s).

### 2. Indirect Effects

Biologists should also consider effects caused by the action which occur away from the project site; furthermore, effects occurring later in time (whether at or away from the project site) should also be considered. Biologists should consider the potential for project actions to alter conditions of the physical environment in a manner that, in turn, reduce eelgrass habitat distribution or density (*e.g.*, elevated turbidity from the initial implementation or later operations of an action, increased shading, changes to circulation patterns, changes to vessel traffic that lead to greater groundings or wake damage, increased rates of erosion or deposition).

For actions where the impact cannot be fully determined until a substantial period after an action is taken, an estimate of likely impacts should be made prior to implementation of the proposed action based on the best available information (*e.g.*, shading analyses, wave and current modeling). A monitoring program consisting of a pre-construction eelgrass survey and three post-construction eelgrass surveys at the impact site and appropriate reference site(s) should be performed. The action party should complete the first post-construction eelgrass survey within 30 days following completion of construction to evaluate any immediate effects to eelgrass habitat. The second post-construction survey should be performed approximately one year after the first post-construction survey during the appropriate growing season. The third post-construction survey should be performed approximately two years after the first post-construction survey during the appropriate growing season. The second and third post-construction surveys will be used to evaluate if indirect effects resulted later in time due to altered physical conditions; the time frames identified above are aligned with growing season (attempting a survey outside of the growing season would show inaccurate results).

A final determination regarding the actual impact and amount of mitigation needed, if any, to offset impacts should be made based upon the results of two annual post-construction surveys, which document the changes in the eelgrass habitat (areal extent, bottom coverage, and shoot density within eelgrass) in the vicinity of the action, compared to eelgrass habitat change at the reference site(s). Any impacts determined by these monitoring surveys should be mitigated. In the event that monitoring demonstrates the action to have resulted in greater eelgrass habitat impacts than initially estimated, additional mitigation should be implemented in a manner consistent with these guidelines. In some cases, adaptive management may allow for increased success in eelgrass mitigation without the need for additional mitigation.

## E. Mitigation Options

The term mitigation is defined differently by various federal and State laws, regulations and policies. In a broad sense, mitigation may include a range of measures from complete avoidance of adverse effects to compensation for adverse effects by preserving, restoring or creating similar resources at onsite or offsite locations. The Corps and EPA issued regulations governing compensatory mitigation to offset unavoidable adverse effects to waters of the United States authorized by Clean Water Act section 404 permits and other permits issued by the Corps (73 FR 19594; April 10, 2008). For those regulations (33 CFR 332.2 and 40 CFR 230.92, respectively), the Corps and EPA, define "compensatory mitigation" as "the restoration (re-establishment or rehabilitation), establishment (creation), enhancement, and/or in certain circumstances preservation of aquatic resources for the purposes of offsetting unavoidable adverse effects which remain after all appropriate and practicable avoidance and minimization has been achieved."

When impacts to eelgrass would occur, the action agency should develop a mitigation plan to achieve no net loss in eelgrass function following the recommended steps in this policy. If NMFS determines a mitigation plan is needed, and it was not included with the EFH Assessment for the proposed action, NMFS may recommend, either as comments on the EFH Assessment or as an EFH Conservation Recommendation, that one be provided. Potential mitigation options are described below. The action agency should consider site specific conditions when determining the most appropriate mitigation option for an action.

### 1. Comprehensive management plans

NMFS supports the development of comprehensive management plans (CMPs) that protect eelgrass resources within the context of broader ecosystem needs and management objectives. Recommendations different from specific elements described below for in-kind mitigation may be appropriate where a CMP (*e.g.,* an enforceable programmatic permit, Special Area Management Plan, harbor plan, or ecosystem-based management plan) exists that is considered to provide adequate population-level and local resource distribution protections to eelgrass. One such CMP under development at the time these guidelines were developed is *City of Newport Beach Eelgrass Protection Mitigation Plan for Shallow Water in Lower Newport Bay: An Ecosystem Based Management Plan.* If satisfactorily completed and adopted, it is anticipated the protection measures for eelgrass within this area would be adequate to meet the objectives of this policy.

In general, it is anticipated that CMPs may be most appropriate in situations where a project or collection of similar projects will result in incremental but recurrent impacts to a small portion of local eelgrass populations through time (*e.g.*, lagoon mouth maintenance dredging, maintenance dredging of channels and slips within established marinas, navigational hazard removal of recurrent shoals, shellfish farming, and restoration or enhancement actions). In order to ensure that these alternatives provide adequate population-level and local resource distribution protections to eelgrass and that the plan is consistent with the overall conservation objectives of this policy, NMFS should be involved early in the plan's development.

### 2. In-kind mitigation

In-kind compensatory mitigation is the creation, restoration, or enhancement of habitat to mitigate for adverse impacts to the same type of habitat. In most cases in-kind mitigation is the preferred option to compensate for impacts to eelgrass. Generally, in-kind mitigation should achieve a final mitigation ratio of 1.2:1 across all areas of the state, independent of starting mitigation ratios. A starting mitigation ratio is the ratio of mitigation area to impact area when mitigation is initiated. The final mitigation ratio is the ratio of mitigation area to impact area once mitigation is complete. The 1.2:1 ratio assumes: (1) there is no eelgrass function at the mitigation site prior to mitigation efforts, (2) eelgrass function at the mitigation site is achieved within three years, (3) mitigation efforts are successful, and (4) there are no landscape differences (*e.g.*, degree of urban influence, proximity to freshwater source), between the impact site and the mitigation site. Variations from these assumptions may warrant higher or lower mitigation ratios. For example, a higher ratio would be appropriate for an enhancement project where the mitigation site has some level of eelgrass function prior to the mitigation action.

Typically, in-kind eelgrass mitigation involves transplanting or seeding of eelgrass into unvegetated habitat. Successful in-kind mitigation may also warrant modification of physical conditions at the mitigation site to prepare for transplants (*e.g.*, alter sediment composition, depth, etc.). In some areas, other in-kind mitigation options such as removing artificial structures that preclude eelgrass growth may be feasible. If in-kind mitigation that does not include transplants or seeding is proposed, post-mitigation monitoring as described below should be implemented to verify that mitigation is successful.

Information provided below in Section II.F includes specific recommendations for in-kind mitigation, including site selection, reference sites, starting mitigation ratios, mitigation methods, mitigation monitoring and performance criteria. Many of the recommendations provided in these guidelines for eelgrass assessments, surveys, and mitigation may apply throughout the state even if a non-transplant mitigation option is proposed.

### 3. Mitigation banks and in-lieu-fee programs

In 2006 and 2011, the NMFS Southwest Region (merged with the Northwest Region in 2013 to form the West Coast Region) signed interagency Memorandum of Understandings that established and refined a framework for developing and using combined or coordinated approaches to mitigation and conservation banking and in-lieu-fee programs in California. Other signatory agencies include: the California Resources Agency, California Department of Fish and Wildlife, the Corps, the US Fish &Wildlife Service, the EPA, the Natural Resource Conservation Service, and the State Water Resources Control Board.

Under this eelgrass policy, NMFS supports the use of mitigation bank and in-lieu fee programs to compensate for impacts to eelgrass habitat, where such instruments are available and where such programs are appropriate to the statutory structure under which mitigation is recommended. Mitigation banks and in-lieu fee conservation programs are highly encouraged by NMFS in heavily urbanized waters. Credits should be used at a ratio of 1:1 if those credits have been established for a full three-year period prior to use. If the bank credits have been in place for a period less than three years, credits should be used at a ratio determined through application of the wetland mitigation calculator (King and Price 2004).

At the request of the action party, and only with approval of NMFS and other appropriate resource agencies and subject to the caveats below, surplus eelgrass area that, after 60-months, exceeds the mitigation needs, as defined in section II.F.6 Mitigation Monitoring and Performance Milestones, has the potential to be considered for future mitigation needs. Additionally, only with the approval of NMFS and other appropriate resource agencies and subject to the caveats below, eelgrass habitat expansion resulting from project activities, and that otherwise would not have occurred, has the potential to be considered for future mitigation needs. Exceeding mitigation needs does not guarantee or entitle the action party or action agency to credit such mitigation to future projects, since every future project must be considered on a case-by-case basis (including the location and type of impact) and viewed in light of the relevant statutory authorities.

#### 4. Out-of-kind mitigation

Out-of-kind compensatory mitigation means the adverse impacts to one habitat type are mitigated through the creation, restoration, or enhancement of another habitat type. In most cases, out-of-kind mitigation is discouraged, because eelgrass is a rare, special-status habitat in California. There may be some scenarios, however, where out-of-kind mitigation for eelgrass impacts is ecologically desirable or when in-kind mitigation is not feasible. This determination should be made based on an established ecosystem plan that considers ecosystem function and services relevant to the geographic area and specific habitat being impacted. Any proposal for out-of-kind mitigation should demonstrate that the proposed mitigation will compensate for the loss of eelgrass habitat function within the ecosystem. Out-of-kind mitigation that generates services similar to eelgrass habitat or improves conditions for establishment of eelgrass should be considered first. NMFS and the federal action agency should be consulted early when out-of-kind mitigation is being proposed in order to determine if out-of-kind mitigation is appropriate, in coordination with other relevant resource agencies (e.g., California Department of Fish and Wildlife, California Coastal Commission, U.S. Fish and Wildlife Service)

### F. In-kind Mitigation for Impacts to Eelgrass

As all mitigation project specifics will be determined on a case-by-case basis, circumstances may exist where NMFS staff will need to modify or deviate from the recommended measures described below before providing their recommendation to action agencies.

#### 1. Mitigation Site Selection

Eelgrass habitat mitigation sites should be similar to the impact site. Site selection should consider distance from action, depth, sediment type, distance from ocean connection, water quality, and currents. Where eelgrass that is impacted occurs in marginally suitable environments, it may be necessary to conduct mitigation in a preferable location and/or modify the site to be better suited to support eelgrass habitat creation. Mitigation site modification should be fully coordinated with NMFS staff and other appropriate resource and regulatory agencies. To the extent feasible, mitigation should occur within the same hydrologic system (*e.g.*, bay, estuary, lagoon) as the impacts and should be appropriately distributed within the same ecological subdivision of larger systems (*e.g.*, San Pablo Bay or Richardson Bay in San Francisco Bay), unless NMFS and the action agency concur that good justification exists for altering the distribution based on valued ecosystem functions and services.

In identifying potentially suitable mitigation sites, it is advisable to consider the current habitat functions of the mitigation site prior to mitigation use. In general, conversion of unvegetated subtidal areas or disturbed uplands to eelgrass habitats may be considered appropriate means to mitigate eelgrass losses, while conversion of other special aquatic sites (*e.g.*, salt marsh, intertidal mudflats, and reefs) is unlikely to be considered suitable. It may be necessary to develop suitable environmental conditions at a site prior to being able to effectively transplant eelgrass into a mitigation area. Mitigation sites may need physical modification, including increasing or lowering elevation, changing substrate, removing shading or debris, adding wave protection or removing impediments to circulation.

### 2. Mitigation Area Needs

In-kind mitigation plans should address the components described below to ensure mitigation actions achieve no net loss of eelgrass habitat function. Alternative contingent mitigation should be specified and included in the mitigation plan to address situations where performance milestones are not met.

#### *a) Impacts to Areal Extent of Eelgrass Habitat*

Generally, mitigation of eelgrass habitat should be based on replacing eelgrass habitat extent at a 1.2 (mitigation) to 1 (impact) mitigation ratio for eelgrass throughout all regions of California. However, given variable degrees of success across regions and potential for delays and mitigation failure, NMFS calculated *starting* mitigation ratios using “The Five-Step Wetland Mitigation Ratio Calculator” (King and Price 2004) developed for NMFS Office of Habitat Conservation. The calculator utilizes methodology similar to Habitat Equivalency Analysis (HEA), which is an accepted method to determine the amount of compensatory restoration needed to provide natural resource services that are equivalent to loss of natural resource services following an injury (http://www.darrp.noaa.gov/economics/pdf/heaoverv.pdf). HEA is commonly used by NOAA during damage assessment cases, including those involving seagrass. Similar to HEA, the mitigation calculator is based on the “net present value” approach to asset valuation, an economics concept used to compare values of all types of investments, and then modified to incorporate natural resource services. Using the calculator allows for consistency in methodology for all areas within California, avoids arbitrary identification of size of the mitigation area, and avoids cumulative loss to eelgrass habitat that would likely occur with a standard 1:1 ratio (because of the complexity of eelgrass mitigation and the time for created eelgrass to achieve full habitat function).

The calculator includes a number of metrics to determine appropriate ratios that focus on comparisons of quality and quantity of function of the mitigation relative to the site of impact to ensure full compensation of lost function. (see Attachment 4). Among other metrics, the calculator employs a metric of likelihood of failure within the mitigation site based on regional mitigation failure history. As such, the mitigation calculator identifies a recommended starting mitigation ratio (the mitigation area to eelgrass impact area) based on regional history of success in eelgrass mitigation. Increased initial mitigation site size should be considered to provide greater assurance that the performance milestones, as specified in Section II.F.6, will be met. This is a common practice in the eelgrass mitigation field to reduce risk of falling short of mitigation needs (Thom 1990). Independent of starting mitigation ratio utilized for a given mitigation action, mitigation success should generally be evaluated against a ratio of 1.2:1.

The elevated starting mitigation ratio should be applied to the area of impact to vegetated eelgrass cover only. For unvegetated eelgrass habitat, a starting mitigation ratio of 1.2:1 is appropriate.

To determine the recommended starting mitigation ratio for each region, the percentage of transplant successes and failures was examined over the history of transplanting in the region. NMFS staff examined transplants projects over the past 25 years in all mitigation regions (see Attachment 6). Eelgrass mitigation in Southern California has a 35-year history with 66 transplants performed over that period. In the past 25 years, a total of 47 eelgrass transplants for mitigation purposes have been conducted in Southern California. Forty-three of these were established long enough to evaluate success for these transplants. The overall failure rate, with failure defined as not meeting success criteria established for the project, was 13 percent. Eelgrass mitigation within central California has a better history of successful completion than within southern California, San Francisco Bay, and northern California. However, the number of eelgrass mitigation actions conducted in this region is low and limited to areas within Morro Bay. While the success of eelgrass mitigation in central California has been high, the low number of attempts makes mitigation in this region uncertain. Eelgrass habitat creation/restoration in San Francisco Bay and in northern California has had varied success.

In all cases, best information available at the time of this policy's development was used to determine the parameter values entered into the calculator formula. As regional eelgrass mitigation success changes and the results of ongoing projects become available, the starting mitigation ratio may be updated. Updates in mitigation calculator inputs should not be made on an individual action basis, because the success or lack of success of an individual mitigation project may not reflect overall mitigation success for the region. Rather NMFS should re-evaluate the regional transplant history approximately every 5 years, increasing the record of transplant success in 5 year increments for new projects implemented after NMFS' adoption of these guidelines. If the 5-year review shows that new efforts are more successful than those from the beginning of the 25-year period, NMFS staff should consider removing early projects (*e.g.*, those completed 20 years prior) from the analysis.

On a case-by-case basis and in consultation with action agencies, NMFS may consider proposals with different starting mitigation ratios where sufficient justification is provided that indicates the mitigation site would achieve the no net loss goal. In addition, CMPs could consider different starting mitigation ratios, or other mitigation elements and techniques, as appropriate to the geographic area addressed by the CMP.

Regardless of starting mitigation ratio, eelgrass mitigation should be considered successful, if it meets eelgrass habitat coverage over an area that is 1.2 times the impact area with comparable eelgrass density as impacted habitat. Please note, delayed implementation, supplemental transplant needs, or NMFS and action agency agreement may result in an altered mitigation area. In the EFH consultation context, NMFS may recommend an altered mitigation area during implementation of the federal agency's mitigation plan following EFH consultation or NEPA review, or as an EFH Conservation Recommendation if the federal agency re-initiates EFH consultation.

(1) Southern California (Mexico border to Pt. Conception)

For mitigation activities that occur concurrent to the action resulting in damage to existing eelgrass habitat, a starting ratio of 1.38 to 1 (transplant area to vegetated cover impact area) should be recommended to counter the regional failure risk. That is, for each square meter of vegetated eelgrass cover adversely impacted, 1.38 square meters of new habitat with suitable conditions to support eelgrass should be planted with a comparable bottom coverage and eelgrass density as impacted habitat.

(2) Central California (Point Conception to mouth of San Francisco Bay).

For mitigation activities that occur concurrent to the action resulting in damage to existing eelgrass habitat, a starting ratio of 1.20 to 1 (transplant area to vegetated cover impact area) should be recommended based on a 0 percent failure rate over the past 25 years (4 transplant actions). It should however be noted that all of these successful transplants included a greater area of planting than was necessary to achieve success such that the full mitigation area would be achieved, even with areas of minor transplant failure.

(3) San Francisco Bay (including south, central, San Pablo and Suisun Bays).

For mitigation activities that occur concurrent to the action resulting in damage to the existing eelgrass bed resource, a ratio of 3.01 to 1 (transplant area to vegetated cover impact area) should be recommended based on a 60 percent failure rate over the past 25 years (10 transplant actions). That is, for each square meter adversely impacted, 3.01 square meters of new habitat with suitable conditions to support eelgrass should be planted with a comparable bottom coverage and eelgrass density as impacted habitat.

(4) Northern California (mouth of San Francisco Bay to Oregon border).

For mitigation activities that occur concurrent to the action resulting in damage to the existing eelgrass habitat, a starting ratio of 4.82 to 1 (transplant area to vegetated cover impact area) should be recommended based on a 75 percent failure rate over the past 25 years (4 transplant actions). That is, for each square meter of eelgrass habitat adversely impacted, 4.82 square meters of new habitat with suitable conditions to support eelgrass should be planted with a comparable bottom coverage and eelgrass density as impacted habitat.

### b) *Impacts to Density of Eelgrass Beds*

Degradation of existing eelgrass habitat that results in a permanent reduction of eelgrass turion density greater than 25 percent, and that is a statistically significant difference from pre-impact density, should be mitigated based on an equivalent area basis. The 25 percent and statistically significant threshold is believed reasonable based on supporting information (Fonseca *et al.* 1998, WDFW 2008), and professional practice under SCEMP. In these cases, eelgrass remains present at the action site, but density may be potentially affected by long-term chronic or intermittent effects of the action. Reduction of density should be determined to have occurred when the mean turion density of the impact site is found to be statistically different ($\alpha$=0.10 and $\beta$=0.10) from the density of a reference and at least 25 percent below the reference mean during two annual sampling events following implementation of an action. The number of samples taken to describe density at each site (*e.g.*, impact and reference) should be sufficient to provide for appropriate statistical power. For small impact areas that do not allow for a sample size that provides statistical power, alternative methods for pre- and post- density comparisons could be considered. Mitigation for reduction of turion density without change in eelgrass habitat area should be on a one-for-one basis either by augmenting eelgrass density at the impact site or by establishing new eelgrass habitat comparable to the change in density at the impact site. For example, a 25 percent reduction in density of 100-square meters (100 turions/square meter) of eelgrass habitat to 75 turions/square meter should be mitigated by the establishing 25 square meters of new eelgrass habitat with a density at or above the 100 turions/square meter pre-impact density.

## 3. Mitigation Technique

In-kind mitigation technique should be determined on a case-by-case basis. Techniques for eelgrass mitigation should be consistent with the best available technology at the time of mitigation implementation and should be tailored to the specific needs of the mitigation site. Eelgrass transplants have been highly successful in southern and central California, but have had mixed results in San Francisco Bay and northern California. Bare-root bundles and seed buoys have been utilized with some mixed success in northern portions of the state. Transplants using frames have also been used with some limited success. For transplants in southern California, plantings consisting of bare-root bundles consisting of 8-12 individual turions each have proven to be most successful (Merkel 1988).

Donor material should be taken from the area of direct impact whenever practical, unless the action resulted in reduced density of eelgrass at the area of impact. Site selections should consider the similarity of physical environments between the donor site and the transplant receiver site and should also consider the size, stability, and history of the donor site (*e.g.*, how long has it persisted and is it a transplant site). Plants harvested should be taken in a manner to thin an existing bed without leaving any noticeable bare areas. For all geographic areas, no more than 10 percent of an existing donor bed should be harvested for transplanting purposes. Ten percent is reasonable based on recommendations in Thom *et al.* (2008) and professional practice under SCEMP. Harvesting of flowering shoots for seed buoy techniques should occur only from widely separated plants.

It is important for action agencies to note that state laws and regulations affect the harvesting and transplantation of donor plants and permission from the state, where required, should be obtained; for example, California Department of Fish and Wildlife may need to provide written authorization for harvesting and transplanting donor plants and/or flowering shoots.

### 4. Mitigation Plan

NMFS should recommend that a mitigation plan be developed for in-kind mitigation efforts. During consultation, NMFS biologists should request that mitigation plans be provided at least 60 days prior to initiation of project activities to allow for NMFS review. When feasible, mitigation plans should be developed based on preliminary or pre-project eelgrass surveys. When there is uncertainty regarding whether impacts to eelgrass will occur, and the need for mitigation is based on comparison of pre- and post-project eelgrass surveys, NMFS biologists should request that the mitigation plan be provided no more than 60 days following the post-project survey to allow for NMFS review and minimize any delay in mitigation implementation.

At a minimum, the mitigation plan should include:

- Description of the project area
- Results of preliminary eelgrass survey and pre/post-project eelgrass surveys if available (see Section II.B.1 and II.B.2)
- Description of projected and/or documented eelgrass impacts
- Description of proposed mitigation site and reference site(s) (see Section II.B.4)
- Description of proposed mitigation methods (see Section II.F.3)
- Construction schedule, including specific starting and ending dates for all work including mitigation activities. (see Section II.F.5)
- Schedule and description of proposed post-project monitoring and when results will be provided to NMFS
- Schedule and description of process for continued coordination with NMFS through mitigation implementation
- Description of alternative contingent mitigation or adaptive management should proposed mitigation fail to achieve performance measures (see Section II.F.6)

### 5. Mitigation Timing

Mitigation should commence within 135 days following the initiation of the in-water construction resulting in impact to the eelgrass habitat, such that mitigation commences within the same eelgrass growing season as impacts occur. If possible, mitigation should be initiated prior to or concurrent with impacts. For impacts initiated within 90 days prior to, or during, the low-growth period for the region, mitigation may be delayed to within 30 days after the start of the following growing season, or 90 days following impacts, whichever is longer, without the need for additional mitigation as described below. This timing avoids survey completion during the low growth season, when results may misrepresent progress towards performance milestones.

Delays in eelgrass mitigation result in delays in ultimate reestablishment of eelgrass habitat functions, increasing the duration and magnitude of project impacts to eelgrass. To offset loss of eelgrass habitat function that accumulates through delay, an increase in successful eelgrass mitigation is needed to achieve the same compensatory habitat function. Because habitat function is accumulated over time once the mitigation habitat is in place, the longer the delay in initiation of mitigation, the greater the additional habitat area needed (i.e., mitigation ratio increasingly greater than 1.2:1) to offset losses. Unless a specific delay is authorized or dictated by the initial schedule of work, federal action agencies should determine whether delays in mitigation initiation in excess of 135 days warrant an increased final mitigation ratio. If increased mitigation ratios are warranted, NMFS should recommend higher mitigation ratios (see Attachment 7). Where delayed implementation is authorized by the action agency, the increased mitigation ratio may be determined by utilizing the Wetlands Mitigation Calculator (King and Price 2004) with an appropriate value for parameter D (See Attachment 4). Examples of delay multipliers generated using the Wetlands Mitigation Calculator are provided in Attachment 5.

Conversely, implementing mitigation ahead of impacts can be used to reduce the mitigation needs by achieving replacement of eelgrass function and services ahead of eelgrass losses. If eelgrass is successfully transplanted three years ahead of impacts, the mitigation ratio would drop from 1.2:1 to 1:1. If mitigation is completed less than three years ahead of impacts, the mitigation calculator can be used to determine the appropriate intermediate mitigation ratio.

### 6. Mitigation Monitoring and Performance Milestones

In order to document progress and persistence of eelgrass habitat at the mitigation site through and beyond the initial establishment period, which generally is three years, monitoring should be completed for a period of five years at both the mitigation site and at an appropriate reference site(s) (Section II.B.4. Reference Site Selection). Monitoring at a reference site(s) may account for any natural changes or fluctuations in habitat area or density. Monitoring should determine the area of eelgrass and density of plants at 0, 12, 24, 36, 48, and 60 months after completing the mitigation. These intervals will provide yearly updates on the establishment and persistence of eelgrass during the growing season. These monitoring recommendations are consistent with findings of the National Research Council (NRC 2001), the Corps requirements for compensatory mitigation (33 CFR 332.6(b)), and other regional resource policies (Corps 2010, Evans and Leschen 2010, SFWMD 2007).

All monitoring work should be conducted during the active eelgrass growth period and should avoid the recognized low growth season for the region to the maximum extent practicable (typically November through February for southern California, November through March for central California, November through March for San Francisco Bay, and October through April for northern California). Sufficient flexibility in the scheduling of the 6 month surveys should be allowed in order to ensure the work is completed during this active growth period. Additional monitoring beyond the 60-month period may be warranted in those instances where the stability of the proposed mitigation site is questionable, where the performance of the habitat relative to reference sites is erratic, or where other factors may influence the long-term success of mitigation. Mitigation plans should include a monitoring schedule that indicates when each of the monitoring events will be completed.

The monitoring and performance milestones described below are included as eelgrass transplant success criteria in the SCEMP. These numbers represent milestones and associated timelines typical of successful eelgrass habitat development based on NMFS' experience with: (1) conducting eelgrass surveys and monitoring and (2) reviewing mitigation monitoring results for projects implemented under SCEMP. Restored eelgrass habitat is expected to develop through an initial 3 year monitoring period such that, within 36 months following planting, it meets or exceeds the full coverage and not less than 85 percent of the density relative to the initial condition of affected eelgrass habitat. Restored eelgrass habitat is expected to sustain this condition for at least 2 additional years.

Monitoring events should evaluate the following performance milestones:

Month 0 – Monitoring should confirm the full coverage distribution of planting units over the initial mitigation site as appropriate to the geographic region.

Month 6 – Persistence and growth of eelgrass within the initial mitigation area should be confirmed, and there should be a survival of at least 50 percent of the initial planting units with well-distributed coverage over the initial mitigation site. For seed buoys, there should be demonstrated recruitment of seedlings at a density of not less than one seedling per four (4) square meters with a distribution over the extent of the initial planting area. The timing of this monitoring event should be flexible to ensure work is completed during the active growth period.

Month 12– The mitigation site should achieve a minimum of 40 percent coverage of eelgrass and 20 percent density of reference site(s) over not less than 1.2 times the area of the impact site.

Month 24– The mitigation site should achieve a minimum of 85 percent coverage of eelgrass and 70 percent density of reference site(s) over not less than 1.2 times the area of the impact site.

Month 36– The mitigation site should achieve a minimum of 100 percent coverage of eelgrass and 85 percent density of reference site(s) over not less than 1.2 times the area of the impact site.

Month 48– The mitigation site should achieve a minimum of 100 percent coverage of eelgrass and 85 percent density of reference site(s) over not less than 1.2 times the area of the impact site.

Month 60– The mitigation site should achieve a minimum of 100 percent coverage of eelgrass and 85 percent density of reference site(s) over not less than 1.2 times the area of the impact site.

Performance milestones may be re-evaluated or modified if declines at a mitigation site are also demonstrated at the reference site, and therefore, may be a result of natural environmental stressors that are unrelated to the intrinsic suitability of the mitigation site. In the EFH consultation context, NMFS should provide recommendations regarding modification of performance milestones as technical assistance during interagency coordination as described in the mitigation plan or as EFH Conservation Recommendations if the federal action agency re-initiates EFH consultation.

### 7. Mitigation Reporting

NMFS biologists should request monitoring reports and spatial data for each monitoring event in both hard copy and electronic version, to be provided within 30 days after the completion of each monitoring period to allow timely review and feedback from NMFS. These reports should clearly identify the action, the action party, mitigation consultants, relevant points of contact, and any relevant permits. The size of permitted eelgrass impact estimates, actual eelgrass impacts, and eelgrass mitigation needs should be identified, as should appropriate information describing the location of activities. The report should include a detailed description of eelgrass habitat survey methods, donor harvest methods and transplant methods used. The reports should also document mitigation performance milestone progress (see II.F.6. Mitigation Monitoring and Performance Milestones). The first report (for the 0-month post-planting monitoring) should document any variances from the mitigation plan, document the sources of donor materials, and document the full area of planting. The final mitigation monitoring report should provide the action agency and NMFS with an overall assessment of the performance of the eelgrass mitigation site relative to natural variability of the reference site to evaluate if mitigation responsibilities were met. An example summary is provided in Attachment 3.

### 8. Supplemental Mitigation

Where development of the eelgrass habitat at the mitigation site falls short of achieving performance milestones during any interim survey, the monitoring period should be extended and supplemental mitigation may be recommended to ensure that adequate mitigation is achieved. In the EFH consultation context, NMFS should provide recommendations regarding extended monitoring as technical assistance during interagency coordination as described in the mitigation plan or as EFH Conservation Recommendations if the federal action agency re-initiates EFH consultation. In some instances, an adaptive management corrective action to the existing mitigation area may be appropriate. In the event of a mitigation failure, the action agency should convene a meeting with the action party, NMFS, and applicable regulatory and/or resource agencies to review the specific circumstances and develop a solution to achieve no net loss in eelgrass habitat function.

As indicated previously, while in-kind mitigation is preferred, the most appropriate form of compensatory mitigation should be determined on a case-by-case basis. In cases where it is demonstrated that in-kind replacement is infeasible, out-of-kind mitigation may be appropriate over completion of additional in-kind mitigation. The determination that an out-of-kind mitigation is appropriate will be made by NMFS, the action agency, and the applicable regulatory agencies, where a regulatory action is involved.

## G. Special Circumstances

Depending on the circumstances of each individual project, NMFS may make recommendations different from those described above on a case by case basis. For the scenarios described below, for example, NMFS could recommend a mitigation ratio or 1:1 or for use of out-of-kind mitigation. Because NMFS needs a proper understanding of eelgrass habitat in the project area and potential impacts of the proposed project to evaluate the full effects of authorized activities, NMFS should not make recommendations that diverge from these guidelines if they would result in surveys, assessments or reports inferior to those which might be obtained through the guidance in Section II. The area thresholds described below are taken from the SCEMP and/or reflect recommendations NMFS staff have repeatedly made during individual EFH consultations. These thresholds minimize impacts to eelgrass habitat quality and quantity, based on NMFS' experience with: (1) conducting eelgrass surveys and monitoring and (2) reviewing project monitoring results for projects implemented under SCEMP. The special circumstance included for shellfish aquaculture longlines is supported by Rumrill and Poulton (2004) and the NMFS Office of Aquaculture.

### 1. Localized Temporary Impacts

NMFS may consider modified target mitigation ratios for localized temporary impacts wherein the damage results in impacts of less than 100 square meters and eelgrass habitat is fully restored within the damage footprint within one year of the initial impact (e.g., placement of temporary recreational facilities, shading by construction equipment, or damage sustained through vessel groundings or environmental clean-up operations). In such cases, the 1.2:1 mitigation ratio should not apply, and a 1:1 ratio of impact to recovery would apply. A monitoring program consisting of a pre-construction eelgrass survey and three post-construction eelgrass surveys at the impact site and appropriate reference site(s) should be completed in order to demonstrate the temporary nature of the impacts. NMFS should recommend that surveys be completed as follows: 1) the first post-construction eelgrass survey should be completed within 30 days following completion of construction to evaluate direct effects of construction, 2) the second and third post-construction surveys should be performed approximately one year after the first post-construction survey, and approximately two years after the first post-construction survey, respectively, during the appropriate growing season to confirm no indirect, or longer term effects resulted from construction. A compelling reason should be demonstrated before any reduced monitoring and reporting recommendations are made.

### 2. Localized Permanent Impacts

a) If both NMFS and the authorizing action agencies concur, the compensatory mitigation elements of this policy may not be necessary for the placement of a single pipeline, cable, or other similar utility line across existing eelgrass habitat with an impact corridor of no more than 1 meter wide. NMFS should recommend the completion of pre- and post-action surveys as described in section II.B. and II.D. The actual area of impact should be determined from the post-action survey. NMFS should recommend the completion of an additional survey (after 1 year) to ensure that the action or impacts attributable to the action have not exceeded the 1-meter corridor width. NMFS should recommend that, if the post-action or 1 year survey demonstrates a loss of eelgrass habitat greater than the 1-meter wide corridor, mitigation should be undertaken.

b) ) If both NMFS and the authorizing action agencies concur that the spacing of shellfish aquaculture longlines does not result in a measurable net loss of eelgrass habitat in the project area, then mitigation associated with local losses under longlines may not be necessary. NMFS should recommend the completion of pre- and post-action surveys as described in section II.B. and II.D. NMFS should recommend the completion of additional post-action monitoring surveys (to be completed approximately 1 year and 2 years following implementation of the action) to ensure that the action or impacts attributable to the action have not resulted in net adverse impacts to eelgrass habitat. NMFS should recommend that, if the 1-year or 2-year survey demonstrates measurable impact to eelgrass habitat, mitigation should be undertaken. c) NMFS should consider mitigation on a 1:1 basis for impacts less than 10 square meters to eelgrass patches where impacts are limited to small portions of well-established eelgrass habitat or eelgrass habitat that, despite highly variable conditions, generally retain extensive eelgrass, even during poor years. A reduced mitigation ratio should not be considered where impacts would occur to isolated or small eelgrass habitat areas within which the impacted area constitutes more than 1% of the eelgrass habitat in the local area during poor years.

c) If NMFS concurs and suitable out-of-kind mitigation is proposed, compensatory mitigation may not be necessary for actions impacting less than 10 square meters of eelgrass.

## III. Glossary of Terms

Except where otherwise specified, the explanations of the following terms are provided for informational purposes only and are described solely for the purposes of this policy; where a NMFS statute, regulation, or agreement requires a different understanding of the relevant term, that understanding of the term will supplant these explanations provided below.

Compensatory mitigation – restoration, establishment, or enhancement of aquatic resources for the purposes of offsetting unavoidable authorized adverse impacts which remain after all appropriate and practicable avoidance and minimization has been achieved.

Ecosystem – a geographically specified system of organisms, the environment, and the processes that control its dynamics. Humans are an integral part of an ecosystem.

Ecosystem function – ecological role or process provided by a given ecosystem.

Ecosystem services – contributions that a biological community and its habitat provide to the physical and mental well-being of the human population (*e.g.*, recreational and commercial opportunities, aesthetic benefits, flood regulation).

Eelgrass habitat – areas of vegetated eelgrass cover (any eelgrass within 1 square meter quadrat and within 1 m of another shoot) bounded by a 5 m wide perimeter of unvegetated area

Essential fish habitat (EFH) – EFH is defined in the MSA as "...those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity."

EFH Assessment – An assessment as further explained in 50 C.F.R. § 600.920(e).

EFH Consultation – The process explained in 50 C.F.R. § 600.920

EFH Conservation Recommendation – provided by the National Marine Fisheries Service (NMFS) to a federal or state agency pursuant to section 305(b)(4)(A) of the Magnuson-Stevens Act regarding measures that can be taken by that agency to conserve EFH. As further explained in 50 C.F.R. § 600.925, EFH Conservation Recommendations may be provided as part of an EFH consultation with a federal agency, or may be provided by NMFS to any federal or state agency whose actions would adversely affect EFH .

Habitat – environment in which an organism(s) lives, including everything that surrounds and affects its life, including biological, chemical and physical processes.

Habitat function – ecological role or process provided by a given habitat (*e.g.*, primary production, cover, food, shoreline protection, oxygenates water and sediments, etc.).

In lieu fee program – a program involving the restoration, establishment, and/or enhancement of aquatic resources through funds paid to a governmental or non-profit natural resources management entity to satisfy compensatory mitigation needs; an in lieu fee program works like a mitigation bank, however, fees to compensate for impacts to habitat function are collected prior to establishing an on-the-ground conservation/restoration project.

In-kind mitigation – mitigation where the adverse impacts to a habitat are mitigated through the creation, restoration, or enhancement of the same type of habitat.

Mitigation – action or project undertaken to offset impacts to an existing natural resource.

Mitigation bank – a parcel of land containing natural resource functions/values that are conserved, restored, created and managed in perpetuity and used to offset unavoidable impacts to comparable resource functions/values occurring elsewhere. The resource functions/values contained within the bank are translated into quantified credits that may be sold by the banker to parties that need to compensate for the adverse effects of their activities.

Out-of-kind mitigation – mitigation where the adverse impacts to one habitat type are mitigated through the creation, restoration, or enhancement of another habitat type

## IV. Literature Cited

Bostrom, C. and E. Bonsdorff. 2000. Zoobenthic community establishment and habitat complexity–the importance of seagrass shoot density, orphology and physical disturbance for faunal recruitment. Marine Ecology Progress Series 205:123-138.

Bostrom, C., E. Bonsdorff, P. Kangas, and A. Norkko. 2002. Long-term changes of a Brackish-water eelgrass (Zostera marina L.) community indicate effects of coastal eutrophication. Estuarine, Coastal and Shelf Science 55: 795-804.

California Department of Transportation. 2003. Storm Water Quality Handbooks: Construction Site Best Management Practices (BMPs) Manual.

Costanza, R., d'Arge, R., de Groot, R., Farber, S., Grasso, M, Hannon, B., Limburg, K., Naeem, S., O'Neill, R.V.O., Paruelo, J., Raskin, R.G., Sutton, P., and M. van den Belt. 1997. The value of the world's ecosystem services and natural capital. Nature 387: 253-260.

Council on Environmental Quality (CEQ). Regulations 1508 – National Environmental Policy Act (40 CFR 1508).

Donoghue, C. 2011. Technical Memorandum: Operational Definition of an Eelgrass (*Zostera marina*) Bed. A Summary of a Workgroup Discussion and Related Analysis. Washington State Department of Natural Resources. October 2011.

Duarte, C. M. 2002. The future of seagrass meadows. Environmental Conservation 29(2):192-206.

Duarte, C.M., Dennison, W.C., Orth, R.J.W. and T.J.B. Carruthers. 2008. The charisma of coastal ecosystems: addressing the imbalance. Estuaries and Coasts: J CERF 31:233–238.

Evans, N.T. and Leschen, A. 2010. Technical guidelines for the delineation, restoration, and monitoring of eelgrass (*Zostera marina*) in Massachusetts coastal waters. Massachusetts Division of Marine Fisheries Technical Report TR-43. 8 p.

Evans, N. T., and F. T. Short. 2005. Functional trajectory models for assessment of transplanted eelgrass, Zostera marina L., in the Great Bay Estuary, New Hampshire. Estuaries 28(6):936-947.

Ferrell, D. J., and J.D. Bell. 1991. Differences among assemblages of fish associated with *Zostera capricorni* and bare sand over a large spatial scale. Marine Ecology Progress Series 72:15-24.

Fonseca, M.S., Kenworthy, W.J., Thayer, G.W. 1998. Guidelines for the conservation and restoration of seagrasses in the United Stated and adjacent waters. NOAA Coastal Ocean Program Decision Analysis Series, No. 12. NOAA Coastal Ocean Office, Silver Spring, MD. 222 p.

Fonseca, M. S., W. J. Kenworthy, D. R. Colby, K. A. Rittmaster, and G. W. Thayer. 1990. Comparisons of fauna among natural and transplanted eelgrass Zostera marina meadows: criteria for mitigation. Marine Ecology Progress Series 65:251-264

Hoffman, R. S. 1986. Fishery Utilization of Eelgrass (Zostera marina) Beds and Non-vegetated Shallow Water Areas in San Diego Bay. SWR-86-4, NMFS/SWR.

King, D. M., and E. W. Price. 2004. Developing Defensible Wetland Mitigation Ratios: A Companion to "The Five-step Wetland Mitigation Ratio Calculator." Prepared by King and Associates, Inc. for NOAA, Office of Habitat Conservation, Habitat Protection Division.

Lotze, H. K., H. S. Lenihan, B. J. Bourque, R. H. Bradbury, R. G. Cooke, M. C. Kay, S. M. Kidwell, M. X. Kirby, C. H. Peterson, and J. B. C. Jackson. 2006. Depletion, degradation, and recovery potential of estuaries and coastal seas. Science 312:1806-1809.

Merkel, K. W. 1988. Growth and survival of transplanted eelgrass: The importance of planting unit size and spacing. In: Proceedings of the California Eelgrass Symposium. Chula Vista, CA.

National Oceanic and Atmospheric Administration-Damage Assessment and Restoration Program (NOAA-DARP). 1999. Discounting and the treatment of uncertainty in natural resource damage assessment. *Technical Paper 99-1.*

National Research Council. 2001. Compensating for Wetlands Losses under the Clean Water Act. National Academy Press, Washington DC, USA.

Orth, R. J., T. J. B. Carruthers, W. C. Dennison, C. M. Duarte, J. W. Fourqurean, K. L. Heck, Jr., A. R. Hughes, G. A. Kendrick, W. J. Kenworthy, S. Olyarnik, F. T. Short, M. Waycott, and S. L. Williams. 2006. A global crisis for seagrass ecosystems. BioScience 56(12):987-996.

Pacific Fishery Management Council (PFMC). 2008. Pacific Coast Groundfish Fishery Management Plan for the California, Oregon, and Washington Groundfish Fishery as Amended Through Amendment 19.

Peterson, C.H., R.A. Luttich Jr., F. Micheli, and G.A. Skilleter. 2004. Attenuation of water flow inside seagrass canopies of differing structure. Marine Ecology Progress Series 268: 81-92.

Rumrill, S.S. and V.K. Poulton. 2004. Ecological role and potential impacts of molluscan shellfish culture in the estuarine environment of Humboldt Bay, CA. http://hdl.handle.net/1794/3798

Short, F. T., and S. Wyllie-Echeverria. 1996. Natural and human-induced disturbance of seagrasses. Environmental Conservation 23(1):17-27.

Smith, Timothy M., J. S. Hindell, G. P. Jenkins, and R. M. Connolly. 2008. Edge effects on fish associated with seagrass and sand patches. Marine Ecology Progress Series 359:203-213.

South Florida Water Management District. 2007. Environmental Monitoring Report Guidelines. Environmental Resource Regulation Department. 18 p.

Thom, R.N. 1990. A review of eelgrass (*Zostera marina L.*) transplanting projects in the Pacific Northwest. The Northwest Environmental Journal 6:121-137.

Thom, R.N., J. Gaeckle, A. Borde, M. Anderson, M. Boyle, C. Durance, M. Kyte, P. Schlenger, J. Stutes, D. Weitkamp, S. Wyllie-Echeverria, and S. Rumrill. 2008. Eelgrass (*Zostera marina L.*) restoration in the Pacific Northwest: recommendations to improve project success. U.S. Department of Energy. Technical Report WA-RD 706.1.

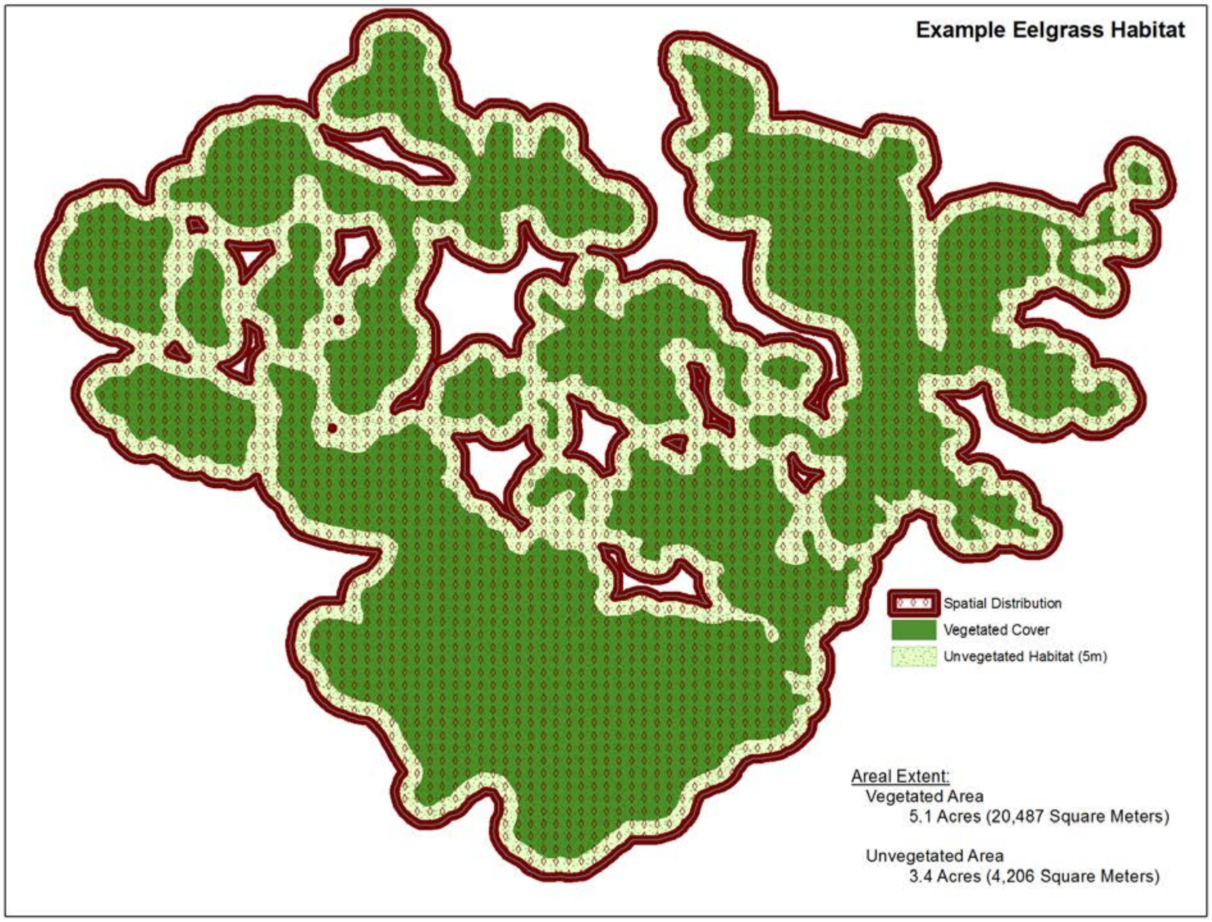
United States Army Corps of Engineers. 2010. New England District Compensatory Mitigation Guidance. 94 p.

van Houte-Howes, S.J. Turner, and C. A. Pilditch. 2004. Spatial Differences in Macroinvertebrate Communities in Intertidal Seagrass Habitats and Unvegetated Sediment in Three New Zealand Estuaries. Estuaries 27(6):945-957.

Washington Department of Fish and Wildlife. 2008. Eelgrass/macroalgae habitat interim survey guidelines (http://wdfw.wa.gov/publications/00714/).

Webster, P.J., A.A. Rowden, and M.J. Attrill. 1998. Effect of shoot density on the infaunal macro-invertebrate community within a *Zostera marina* seagrass bed. Estuarine, Coastal and Shelf Science 47: 351-357.

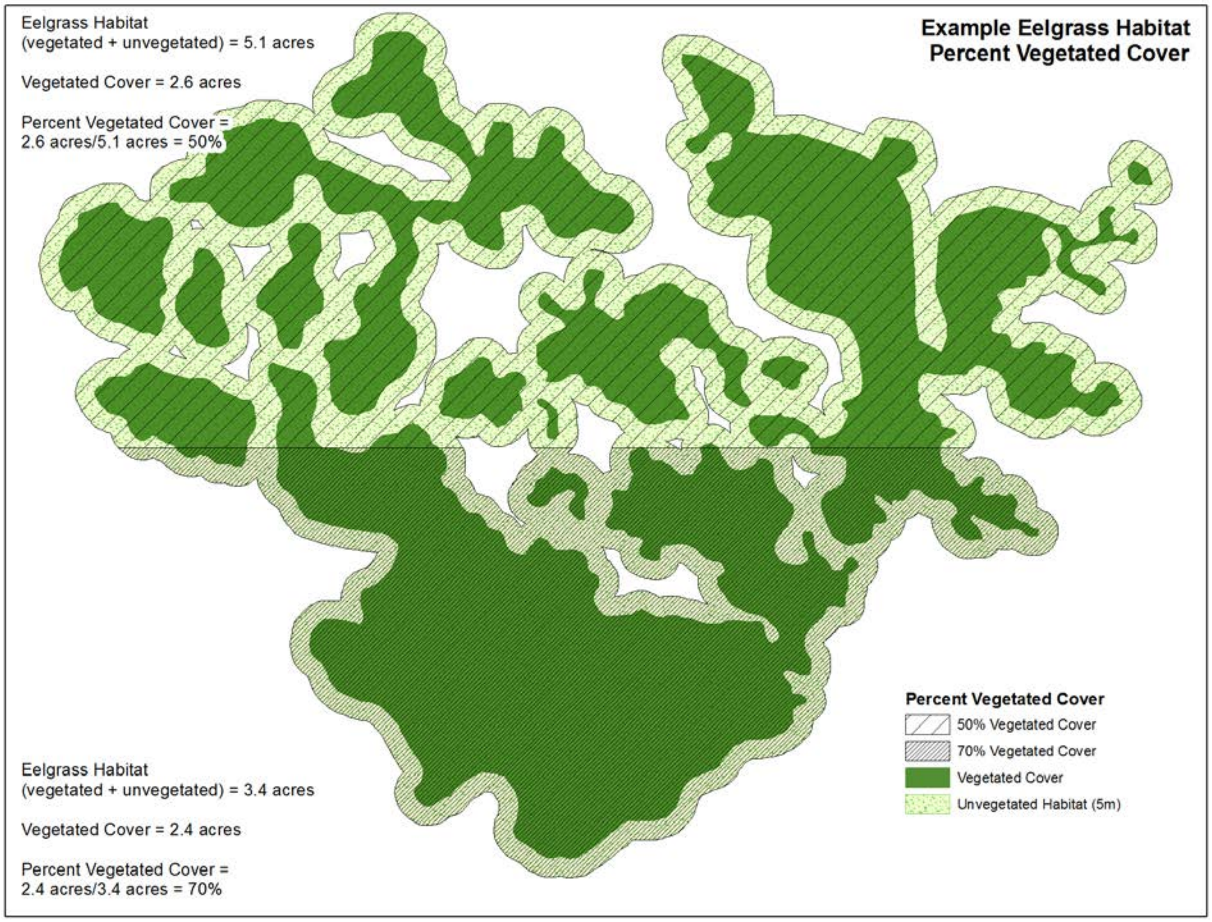
**ATTACHMENT 1. Graphic depiction of eelgrass habitat definition including spatial distribution and aerial coverage of vegetated cover and unvegetated eelgrass habitat.**



Areal Extent:
Vegetated Area
5.1 Acres (20,487 Square Meters)

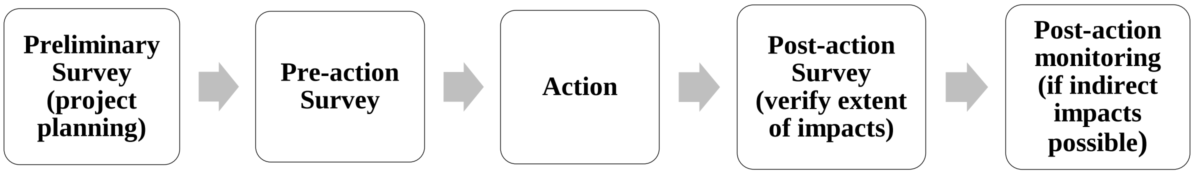
Unvegetated Area
3.4 Acres (4,206 Square Meters)

## ATTACHMENT 2. Example Eelgrass Habitat Percent Vegetated Cover.



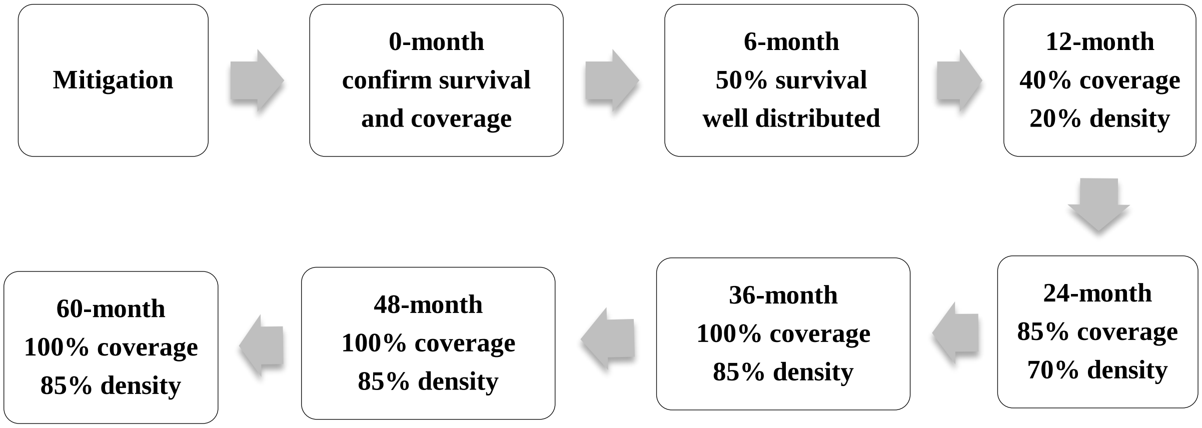
## ATTACHMENT 3. Flow chart depicting timing of surveys and monitoring.

a) Eelgrass impact surveys



- All surveys should be completed during the growing season
- Surveys should be completed at the impact site and an appropriate reference site(s)
- A preliminary survey completed for planning purposes may be completed a year or more in advance of the action.
- Pre-action and post-action surveys should be completed within 60 days of the action.
- A survey is good for 60 days, or if that 60 day period extends beyond the end of growing season, until start of next growing season
- Two years of monitoring following the initial post-action monitoring event may be needed to verify lack or extent of indirect effects.
- Survey reports should be provided to NMFS and the federal action agency within 30 days of completion of each survey event

b) Eelgrass mitigation monitoring



- Mitigation should occur coincident or prior to the action
- All monitoring should be completed during the growing season
- Performance metrics for each monitoring event are compared to the 1.2:1 mitigation ratio
- Monitoring reports should be provided to NMFS and the federal action agency 30 days of completion of each monitoring event
- NMFS and action agency will evaluate if performance metrics met, and decide if supplemental mitigation or other adaptive management measures are needed

## ATTACHMENT 4. Eelgrass transplant monitoring report.

In order to ensure that NMFS is aware of the status of eelgrass transplants, action agencies should provide or ensure that NMFS is provided a monitoring report summary with each monitoring report. For illustrative purposes only, an example of a monitoring report summary is provided below.

### ACTION PARTY CONTACT INFORMATION:

| |
|---|
| Action Name (same as permit reference): |

*(a) Action party Information*

| | | | |
|---|---|---|---|
| Name | | Address | |
| Contact Name | | City, State, Zip | |
| Phone | | Fax | |
| Email | | | |

### MITIGATION CONSULTANT

| | | | |
|---|---|---|---|
| Name | | Address | |
| Contact Name | | City, State, Zip | |
| Phone | | Fax | |
| Email | | | |

### PERMIT DATA:

| **Permit** | **Issuance Date** | **Expiration Date** | **Agency Contact** |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

### EELGRASS IMPACT AND MITIGATION NEEDS SUMMARY:

| | | | |
|---|---|---|---|
| Permitted Eelgrass Impact Estimate ($m^2$): | | | |
| Actual Eelgrass Impact ($m^2$): | | On (post-construction date): | |
| Eelgrass Mitigation Needs ($m^2$): | | Mitigation Plan Reference: | |
| Impact Site Location: | | | |
| Impact Site Center Coordinates (actionion & | | | |

| | |
|---|---|
| datum): | |
| Mitigation Site Location: | |
| Mitigation Site Center Coordinates (actionion & datum): | |

### ACTION ACTIVITY DATA:

| Activity | Start Date | End Date | Reference Information |
|---|---|---|---|
| Eelgrass Impact | | | |
| Installation of Eelgrass Mitigation | | | |
| Initiation of Mitigation Monitoring | | | |

### MITIGATION STATUS DATA:

| | Mitigation Milestone | Scheduled Survey | Survey Date | Eelgrass Habitat Area (m$^2$) | Bottom Coverage (Percent) | Eelgrass Density (turions/m$^2$) | Reference Information |
|---|---|---|---|---|---|---|---|
| **Month** | **0** | | | | | | |
| | **6** | | | | | | |
| | **12** | | | | | | |
| | **24** | | | | | | |
| | **36** | | | | | | |
| | **48** | | | | | | |
| | **60** | | | | | | |

### FINAL ASSESSMENT:

| | |
|---|---|
| **Was mitigation met?** | |
| **Were mitigation and monitoring performed timely?** | |
| **Were mitigation delay increases needed or were supplemental mitigation programs necessary?** | |

## ATTACHMENT 5. Wetlands mitigation calculator formula and parameters.

Starting mitigation ratios for each region within California were calculated using “The Five-Step Wetland Mitigation Ratio Calculator” (King and Price 2004) developed for NMFS Office of Habitat Conservation. The discrete time equation this method uses to solve for the appropriate mitigation ratio is as follows:

$$R = \frac{\sum_{t=0}^{T_{\max}} (1+r)^{-t}}{\left(B(1-E)(1+L)-A\right)\left[\sum_{t=-D}^{C-D-1} \frac{(t+D)}{C(1+r)^{t}} + \sum_{C-D}^{T_{\max}} (1+r)^{-t}\right] + \left[\sum_{t=-D}^{T_{\max}} \frac{\left(1-(1-k)^{(t+D)}\right)}{(1+r)^{(t+D)}}\right]\left(A(1+L)\right)}$$

The calculator parameters in the above equation and values used to calculate starting mitigation ratios for CEMP are as follows:

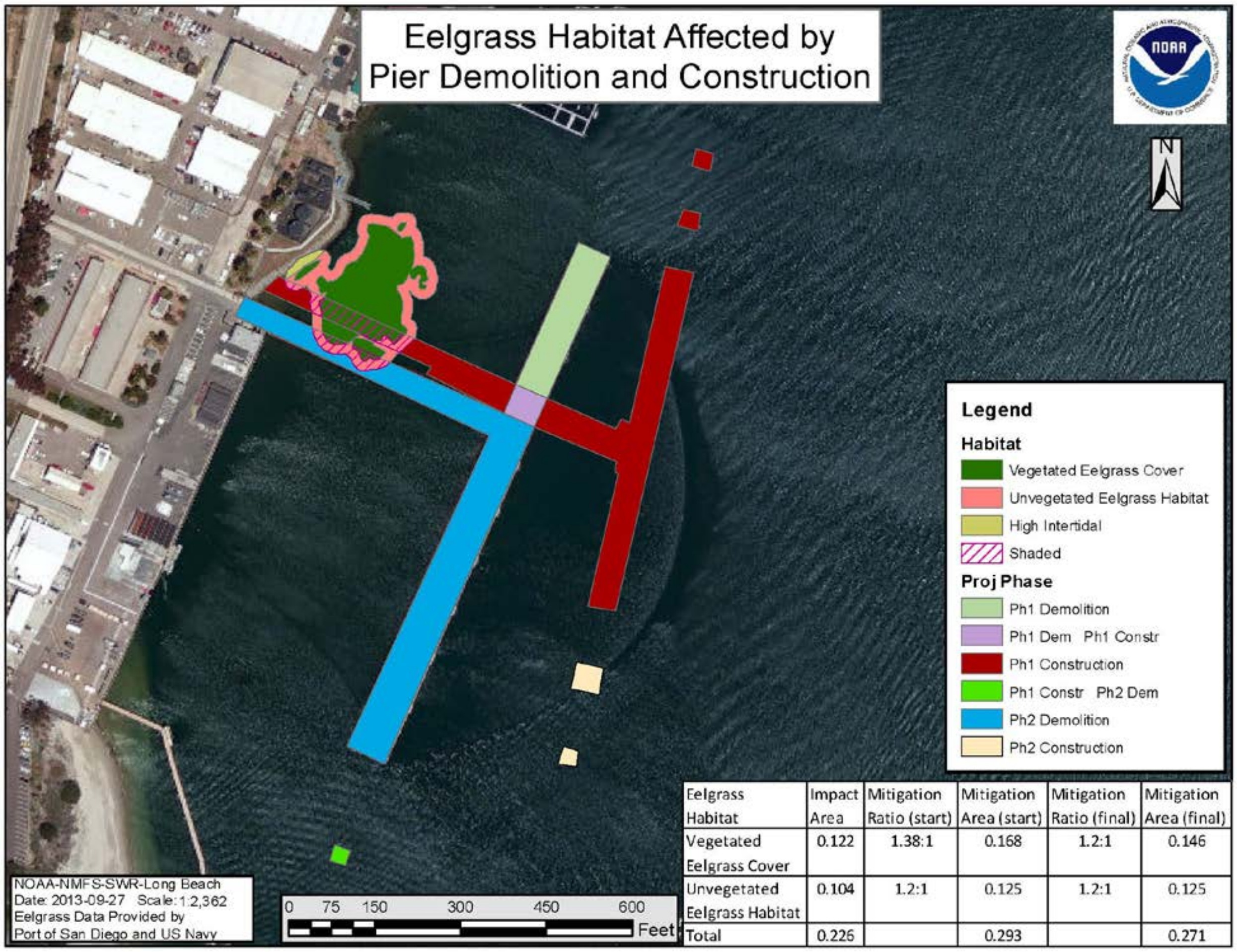
| Symbol | Calculator Parameter | Value |
|---|---|---|
| A | The level of habitat function provided at the mitigation site prior to the mitigation project | 0% |
| B | The maximum level of habitat function that mitigation is expected to attain, if it is successful | 100% |
| C | The number of years after construction that the mitigation project is expected to achieve maximum function | 3 yrs |
| D | The number of years before destruction of the impacted wetland that the mitigation project begins to generate habitat function | 0 yrs |
| E | The percent likelihood that the mitigation project will fail and provide none of the anticipated benefits | various* |
| L | The percent difference in expected habitat function based on differences in landscape context of the mitigation site when compared with the impacted wetland | 0% |
| k | The percent likelihood that the mitigation site, in the absence purchase or easement would be developed in any future year | 0% |
| r | The discount rate used for comparing gains and losses that accrue at different times in terms of their present value | 3%** |
| Tmax | The time horizon used in the analysis (chosen to maintain 1.2:1 ratio at E=100% and other parameter values listed above). | 13 yrs |

* The value for E was based on regional history of success in eelgrass mitigation and varied between regions (see Attachment X).

** NOAA suggests the use of a 3 percent real discount rate for discounting interim service losses and restoration gains, unless a different proxy for the social rate of time preference is more appropriate. (NOAA-DARP 1999) We use this value here, because it is based on best available information and is consistent with the NOAA Damage Assessment and Restoration Program.

## ATTACHMENT 6. Example calculations for application of starting and final mitigation ratios for impacts to eelgrass habitat in southern California.

In this example, a pier demolition and construction would impact 0.122 acres of vegetated eelgrass habitat (dark green) and 0.104 acres of unvegetated habitat (pink). Area of impact is indicated by purple hatch mark. Application of recommended starting mitigation ratio for southern California (1.38:1) and final mitigation ratio (1.2:1) to compute starting and final mitigation area for this example are shown in the table.



| Eelgrass Habitat | Impact Area | Mitigation Ratio (start) | Mitigation Area (start) | Mitigation Ratio (final) | Mitigation Area (final) |
|---|---|---|---|---|---|
| Vegetated Eelgrass Cover | 0.122 | 1.38:1 | 0.168 | 1.2:1 | 0.146 |
| Unvegetated Eelgrass Habitat | 0.104 | 1.2:1 | 0.125 | 1.2:1 | 0.125 |
| Total | 0.226 | | 0.293 | | 0.271 |

## ATTACHMENT 7. Example mitigation area multipliers for delay in initiation of mitigation activities.

Delays in eelgrass transplantation result in delays in ultimate reestablishment of eelgrass habitat values, increasing the duration and magnitude of project effects to eelgrass. The delay multipliers in the table below have been generated by altering the implementation start time within "The Five-Step Wetland Mitigation Ratio Calculator" (King and Price 2004).

| **MONTHS POST-IMPACT** | **DELAY MULTIPLIER (Percent of Initial Mitigation Area Needed)** |
|---|---|
| 0-3 mo | 100% |
| 4-6 mo | 107% |
| 7-12 mo | 117% |
| 13-18 mo | 127% |
| 19-24 mo. | 138% |
| 25-30 mo. | 150% |
| 31-36 mo | 163% |
| 37-42 mo. | 176% |
| 43-48 mo. | 190% |
| 49-54 mo. | 206% |
| 55-60 mo. | 222% |

## ATTACHMENT 8.  Summary of Eelgrass Transplant Actions in California

*See table starting next page.*

## SUMMARY OF EELGRASS (*ZOSTERA MARINA*) TRANSPLANT PROJECTS IN CALIFORNIA

| No. | Region | System | Location | Year | Size* | Type** | Consistent with Permit Conditions | Success Status*** | Net Result**** |
|---|---|---|---|---|---|---|---|---|---|
| Southern California Eelgrass Restoration History | | | | | | | | | |
| | Southern | San Diego Bay | North Island | 1976 | <0.1 | SP | yes | no | - |
| | Southern | San Diego Bay | "Delta" Beach | 1977 | 1.6 | SP | yes | partial | - |
| | Southern | San Diego Bay | North Island | 1978 | <0.1 | SP | yes | yes | + |
| | Southern | Newport Bay | Carnation Cove | 1978 | <0.1 | SP | no | no | - |
| | Southern | Newport Bay | West Jetty | 1980 | <0.1 | SP | yes | partial | 0 |
| | Southern | Mission Bay | multiple beaches | 1982 | <0.1 | SP | no | partial | 0 |
| | Southern | LA/LB Harbor | Cabrillo Beach | 1985 | <0.1 | BR | yes | yes | + |
| | Southern | Alamitos Bay | Peninsula | 1985 | <0.1 | BR | yes | yes | + |
| | Southern | Huntington Hbr. | Main Channel | 1985 | <0.1 | BR | yes | no | 0 |
| | Southern | Newport Bay | Upper | 1985 | <0.1 | BR | yes | no | 0 |
| | Southern | Mission Bay | Sail Bay | 1986 | 2.7 | BR | yes | yes | + |
| | Southern | San Diego Bay | NEMS I | 1987 | 3.8 | BR | no | yes | + |
| | Southern | San Diego Bay | Chula Vista Wildlife Reserve | 1987 | <0.1 | BR | yes | no | +[1] |
| | Southern | San Diego Bay | Harbor Island | 1988 | 0.1 | BR | yes | yes | + |
| | Southern | Huntington Harbour | Entrance Channel | 1989 | 0.1 | BR | no | yes | + |
| | Southern | San Diego Bay | Le Meridien Hotel | 1990 | <0.1 | BR | yes | yes | + |
| | Southern | San Diego Bay | Embarcadero | 1991 | <0.1 | BR | yes | yes | +[2] |
| | Southern | Mission Bay | Sea World Lagoon | 1991 | <0.1 | BR | yes | yes | + |
| | Southern | San Diego Bay | Loew's Marina | 1991 | <0.1 | BR | yes | yes | + |
| | Southern | San Diego Bay | NEMS 2 | 1993 | <0.1 | BR | yes | yes | + |
| | Southern | San Diego Bay | Sea Grant Study | 1993 | <0.1 | BR | yes | yes | + |
| | Southern | Agua Hedionda Lagoon | Outer Lagoon | 1993 | <0.1 | BR | yes | yes | + |
| | Southern | San Diego Bay | NEMS 5 | 1994 | 0.4 | BR | yes | yes | + |
| | Southern | Mission Bay | South Shores Basin | 1994 | 2.9 | BR | yes | yes | + |
| | Southern | Talbert Marsh | Talbert Channel | 1995 | <0.1 | BR | na | yes | +[4] |
| | Southern | Mission Bay | various sites | 1995 | 4.8 | BR | yes | yes | + |
| | Southern | Mission Bay | Ventura Cove[5] | 1996 | 0.5 | BR | yes | yes | +[6] |
| | Southern | Mission Bay | Santa Clara Cove | 1996 | <0.1 | BR | yes | no | 0[10] |
| | Southern | Mission Bay | West Mission Bay Drive Bridge | 1996 | <0.1 | BR | no | yes | 0[10] |
| | Southern | Mission Bay | De Anza Cove | 1996 | <0.1 | BR | yes | yes | + |
| | Southern | Batiquitos Lagoon | all basins | 1997 | 21.6 [7] | BR | yes | yes | +[4] |
| | Southern | San Diego Bay | NEMS 5 | 1997 | 7.1 | BR | yes | yes | + |
| | Southern | San Diego Bay | Convair Lagoon | 1998 | 2.5 | BR | yes | no | -[12] |
| | Southern | San Diego Bay | NEMS 6 | 1999 | 0.3 | BR | yes | yes | + |
| | Southern | Aqua Hedionda | Bristol Cove | 1999 | 0.3 | BR | yes | yes | + |
| | Southern | Aqua Hedionda | Middle Lagoon and Inner Lagoon | 1999 | 4 | BR | yes | yes | + |
| | Southern | Newport Bay | Balboa Is.Grand Cana | 1999 | <0.1 | BR | yes | yes | + |
| | Southern | Mission Bay | West Ski Island | 2001 | 0.2 | BR | yes | yes | + |

| No. | Region | System | Location | Year | Size* | Type** | Consistent with Permit Conditions | Success Status*** | Net Result**** |
|---|---|---|---|---|---|---|---|---|---|
| | Southern | San Diego Bay | Expanded NEMS 6 | 2001 | 0.6 | BR | yes | yes | + |
| | Southern | Newport Bay | USCG Corona del Mar | 2002 | <0.1 | BR | yes | yes | + |
| | Southern | Huntington Harbour | Sunset Bay | 2002 | <0.1 | BR | yes | yes | + |
| | Southern | San Diego Bay | Navy Enhancement Is. | 2002 | 1 | BR | yes | yes | + |
| | Southern | San Diego Bay | Coronado Bay Bridge | 2003 | 0.3 | BR | no | no | 0 |
| | Southern | LA Harbor | P300 Expansion Area | 2003 | 5.9 | BR | yes | partial | -[9] |
| | Southern | Newport Bay | Newport Bay Channel Dredging | 2004 | 0.4 | BR | yes | no | - |
| | Southern | San Diego Bay | South Bay Borrow Pit | 2004 | 4.2 | BR | yes | yes | pending[8] |
| | Southern | San Diego Bay | USCG ATC Pier | 2004 | 0.1 | BR | yes | yes | + |
| | Southern | San Diego Bay | South Bay Borrow Pit Sup. | 2006 | 4.2 | BR | yes | yes | pending[8] |
| | Southern | San Diego Bay | D Street Marsh | 2006 | 0.3 | BR | yes | pending | pending |
| | Southern | LA Harbor | P300 Supplement | 2007 | 0.8 | BR | yes | yes | pending |
| | Southern | San Diego Bay | Glorietta Bay Shoreline Park | 2007 | 0.2 | BR | yes | yes | pending |
| | Southern | Bolsa Chica | Pilot Eelgrass Restoration | 2007 | 0.5 | BR | yes | yes | +[4] |
| | Southern | San Diego Bay | Borrow Pit Supplement | 2007 | 4.2 | BR | yes | yes | pending[8] |
| | Southern | San Diego Bay | Sweetwater Silvergate Frac-out | 2008 | <0.1 | BR | yes | yes | 0[11] |
| | Southern | San Diego Bay | Harbor Drive Bridge/NTC Channel | 2009 | <0.1 | BR | yes | pending | pending |
| **Southern California Eelgrass Success Rate (1989-2009, Last 20 Years)** | | | | | | | | **87%** | **n=43** |
| **Central California Eelgrass Restoration History** | | | | | | | | | |
| | Central | Morro Bay | Anchorage Area | 1985 | <0.1 | BR | no | yes | + |
| | Central | Morro Bay | Target Rock | 1997 | <0.1 | BR | no | yes | + |
| | Central | Morro Bay | Morro Bay Launch Ramp | 2000 | <0.1 | BR | yes | yes | + |
| | Central | Morro Bay | Mooring Area A1 | 2002 | 0.3 | BR | yes | yes | + |
| | Central | Morro Bay | Western Shoal | 2010 | 0.8 | BR | yes | pending | pending |
| **Central California Eelgrass Success Rate (1985-2009, Inadequate History to Exclude Older Projects)** | | | | | | | | **100%** | **n=4** |
| **San Francisco Bay Eelgrass Restoration History** | | | | | | | | | |
| | San Francisco Bay | San Francisco Bay | Richmond Training Wall | 1985 | <0.1 | BR | NA | no | NA[4] |
| | San Francisco Bay | San Francisco Bay | Keil Cove and Paradise Cove | 1989 | 0.1 | Plugs | NA | partial | NA[4] |
| | San Francisco Bay | San Francisco Bay | Bayfarm Island/Middle Harbor Shoal | 1998 | 0.1 | BR and Plugs | NA | partial | NA[4] |
| | San Francisco Bay | San Francisco Bay | Bayfarm Island | 1999 | 0.1 | BR | NA | partial | NA[4] |
| | San Francisco Bay | San Francisco Bay | Brickyard Cove, Berkeley | 2002 | 0.2 | BR | yes | yes | +[13] |
| | San Francisco Bay | San Francisco Bay | Emeryville Shoals | 2002 | 0.1 | Mixed Test | NA | no | NA[4] |
| | San Francisco Bay | San Francisco Bay | Marin CDay, R&GC, Audubon | 2006 | 0.6 | Seed Bouy | NA | partial | pending[4] |
| | San Francisco Bay | San Francisco Bay | Marin CDay, R&GC, Audubon | 2006 | <0.1 | mod. TERFS | NA | partial | pending[4] |
| | San Francisco Bay | San Francisco Bay | Marin CDay, R&GC, Audubon | 2006 | <0.1 | Seeding | NA | no | NA[4] |
| | San Francisco Bay | San Francisco Bay | Clipper Yacht Harbor, Sausalito | 2007 | <0.1 | Frames | yes | pending | pending |
| | San Francisco Bay | San Francisco Bay | Albany, Emeryville, San Rafael | 2007 | <0.1 | BR | NA | partial | pending[4] |
| | San Francisco Bay | San Francisco Bay | Belvedere | 2008 | <0.1 | Frames | yes | pending | pending |
| **San Francisco Bay Eelgrass Success Rate (1985-2009, Inadequate History to Exclude Older Projects)** | | | | | | | | **40%** | **n=10** |

| No. | Region | System | Location | Year | Size* | Type** | Consistent with Permit Conditions | Success Status*** | Net Result**** |
|---|---|---|---|---|---|---|---|---|---|
| **Northern California Eelgrass Restoration History** | | | | | | | | | |
| | Northern | Humboldt Bay | Indian Island | 1982 | unknown | BR | unknown | no | - |
| | Northern | Bodega Harbor | Spud Point Marina | 1984 | 1.3 | BR | yes | no | - |
| | Northern | Humboldt Bay | Indian Island | 1986 | <0.1 | BR | yes | no | - |
| | Northern | Humboldt Bay | | 1986 | 0.2 | unknown | unknown | no | - |
| | Northern | Humboldt Bay | SR255 Bridge | 2004 | <0.1 | BR | yes | no | - |
| | Northern | Humboldt Bay | Maintenance Dredging Project | 2005 | <0.1 | BR | yes | yes | + |
| **Northern California Eelgrass Success Rate (1982-2009, Inadequate History to Exclude Older Projects)** | | | | | | | | **25%** | **n=4** |

* size in hectares
SP = sediment laden plug
** BR = bare root
*** success status is measured as yes, no, partial, pending, or unknown. Success rate is reported as percentage of sucessful over total completed within the past 25 years.
yes = 1, partial = 0.5, no = 0, and pending or unknown are not counted in either the numerator or denominator in determining success percentage.
**** + = net increase in eelgrass coverage, 0 = no change in eelgrass coverage, - = net decrease in eelgrass coverage
1 Transplant was initially adversely impacted by an unknown source of sediment and was deemed unsuitable.
2 The transplant declined initially and later recovered from what was determined to be a one time sedimentation event.
3 Transplant was experimental due to dense beds of the exotic muscle *Musculista senhousia*
which inhibited the growth of the transplant. Replacement transplant done elsewhere.
Transplant was completed in an area deemed unsuitable. Insufficient coverage required the construction of a remedial site.
Monitoring continues at both the initial and remedial sites.
4 Transplant was experimental.
5 Multiple sites.
6 Mitigation for marina at Princess Resort, project not built
7 Amount of eelgrass present within all basins as of 2000 mapping.
8 Regional eelgrass decline has resulted in die-offs both within restoration and reference areas equally full recovery had not occurred at the time of evaluation, yet project exceeds control-corrected requ
9 Original site was constructed as a plateau that was underfilled and anticipated to fall short of objectives. A supplemental
transplant was therefore completed when development began to exhibit shortfalls in area.
10 Shortfall mitigated by withdraw from established eelgrass mitigation bank.
11 Exception conditions from SCEMP requiring only replacement in place for unanticipated damage
12 Mitigated out-of-kind with non-eelgrass to satisfy permit requirements after shortfall in eelgrass mitigation.

# Appendix F-1
# Native American Outreach

**STATE OF CALIFORNIA** **Edmund G. Brown, Jr., *Governor***

**NATIVE AMERICAN HERITAGE COMMISSION**
**1550 Harbor Blvd., Suite 100**
**West Sacramento, CA 95691**
**(916) 373-3710**
**(916) 373-5471 FAX**

September 29, 2016

Karolina Chmiel
ICF

Sent by E-mail: Karolina.chmiel@icf.com

RE: Proposed Fifth Avenue Landing Project, City of San Diego; Point Loma USGS Quadrangle, San Diego County, California

Dear Ms. Chmiel:

Attached is a contact list of tribes with traditional lands or cultural places located within the boundaries of the above referenced counties. A search of the SFL was completed for the USGS quadrangle information provided with negative results.

**Our records indicate that the lead agency for this project has not requested a Native American Consultation List for the purposes of formal consultation.** Lists for cultural resource assessments are different than consultation lists. Please note that the intent of the referenced codes below is to avoid or mitigate impacts to tribal cultural resources, as defined, for California Environmental Quality Act (CEQA) projects under AB-52.

As of July 1, 2015, Public Resources Code Sections 21080.3.1 and 21080.3.2 **require public agencies** to consult with California Native American tribes identified by the Native American Heritage Commission (NAHC) for the purpose mitigating impacts to tribal cultural resources:

> **Within 14 days** of determining that an application for a project is complete or a decision by a public agency to undertake a project, the lead agency shall provide formal notification to the designated contact of, or a tribal representative of, traditionally and culturally affiliated California Native American tribes that have requested notice, which shall be accomplished by means of at least one written notification that includes a brief description of the proposed project and its location, the lead agency contact information, and a notification that the California Native American tribe has 30 days to request consultation pursuant to this section. (Public Resources Code Section 21080.3.1(d))

The law does not preclude agencies from initiating consultation with the tribes that are culturally and traditionally affiliated with their jurisdictions. The NAHC believes that in fact that this is the best practice to ensure that tribes are consulted commensurate with the intent of the law.

In accordance with Public Resources Code Section 21080.3.1(d), formal notification must include a brief description of the proposed project and its location, the lead agency contact information, and a notification that the California Native American tribe has 30 days to request consultation. The NAHC believes that agencies should also include with their notification letters information regarding any cultural resources assessment that has been completed on the APE, such as:

1. The results of any record search that may have been conducted at an Information Center of the California Historical Resources Information System (CHRIS), including, but not limited to:
    - A listing of any and all known cultural resources have already been recorded on or adjacent to the APE;
    - Copies of any and all cultural resource records and study reports that may have been provided by the Information Center as part of the records search response;
    - If the probability is low, moderate, or high that cultural resources are located in the APE.

- Whether the records search indicates a low, moderate or high probability that unrecorded cultural resources are located in the potential APE; and
- If a survey is recommended by the Information Center to determine whether previously unrecorded cultural resources are present.

2. The results of any archaeological inventory survey that was conducted, including:

   - Any report that may contain site forms, site significance, and suggested mitigation measurers.
   - 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 pubic disclosure in accordance with Government Code Section 6254.10.

3. The results of any Sacred Lands File (SFL) check conducted through Native American Heritage Commission.

4. Any ethnographic studies conducted for any area including all or part of the potential APE; and

5. Any geotechnical reports regarding all or part of the potential APE.

Lead agencies should be aware that records maintained by the NAHC and CHRIS is not exhaustive, and a negative response to these searches does not preclude the existence of a cultural place. A tribe may be the only source of information regarding the existence of a tribal cultural resource.

This information will aid tribes in determining whether to request formal consultation. In the case that they do, having the information beforehand well help to facilitate the consultation process.

The results of these searches and surveys should be included in the "Tribal Cultural Resources" subsection of the Cultural Resources section of the environmental document submitted for review.

If you receive notification of change of addresses and phone numbers from tribes, please notify me. With your assistance we are able to assure that our consultation list contains current information.

If you have any questions, please contact me at my email address: gayle.totton@nahc.ca.gov.

Sincerely,

Gayle Totton

Gayle Totton, M.A., PhD.
Associate Governmental Program Analyst

# Native American Heritage Commission
# Native American Contact List
# San Diego County
# 9/29/2016

***Barona Group of the Capitan Grande***
Clifford LaChappa, Chairperson
1095 Barona Road Kumeyaay
Lakeside, CA, 92040
Phone: (619)443-6612
Fax: (619)443-0681
cloyd@barona-nsn.gov

***Campo Band of Mission Indians***
Ralph Goff, Chairperson
36190 Church Road, Suite 1 Kumeyaay
Campo, CA, 91906
Phone: (619)478-9046
Fax: (619)478-5818
rgoff@campo-nsn.gov

***Ewiiaapaayp Tribal Office***
Michael Garcia, Vice Chairperson
4054 Willows Road Kumeyaay
Alpine, CA, 91901
Phone: (619) 445 - 6315
Fax: (619) 445-9126
michaelg@leaningrock.net

***Ewiiaapaayp Tribal Office***
Robert Pinto, Chairperson
4054 Willows Road Kumeyaay
Alpine, CA, 91901
Phone: (619)445-6315
Fax: (619)445-9126

***Iipay Nation of Santa Ysabel***
Virgil Perez, Chairperson
P.O. Box 130 Kumeyaay
Santa Ysabel, CA, 92070
Phone: (760)765-0845
Fax: (760)765-0320

***Iipay Nation of Santa Ysabel***
Clint Linton, Director of Cultural Resources
P.O. Box 507 Kumeyaay
Santa Ysabel, CA, 92070
Phone: (760) 803 - 5694
cjlinton73@aol.com

***Inaja Band of Mission Indians***
Rebecca Osuna, Chairperson
2005 S. Escondido Blvd. Kumeyaay
Escondido, CA, 92025
Phone: (760)737-7628
Fax: (760)747-8568

***Jamul Indian Village***
Erica Pinto, Chairperson
P.O. Box 612 Kumeyaay
Jamul, CA, 91935
Phone: (619)669-4785
Fax: (619)669-4817

***Kwaaymii Laguna Band of Mission Indians***
Carmen Lucas,
P.O. Box 775 Kumeyaay
Pine Valley, CA, 91962
Phone: (619)709-4207

***La Posta Band of Mission Indians***
Gwendolyn Parada, Chairperson
8 Crestwood Road Kumeyaay
Boulevard, CA, 91905
Phone: (619)478-2113
Fax: (619)478-2125
LP13boots@aol.com

***La Posta Band of Mission Indians***
Javaughn Miller, Tribal Administrator
8 Crestwood Road Kumeyaay
Boulevard, CA, 91905
Phone: (619)478-2113
Fax: (619)478-2125
jmiller@Lapostatribe.net

***Manzanita Band of Kumeyaay Nation***
Angela Elliott Santos, Chairperson
P.O. Box 1302 Kumeyaay
Boulevard, CA, 91905
Phone: (619) 766 - 4930
Fax: (619) 766-4957

This list is current only as of the date of this document. Distribution of this list does not relieve any person of statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resource Section 5097.98 of the Public Resources Code.

This list is only applicable for contacting local Native Americans with regard to cultural resources assessment for the proposed Fifth Avenue Landing, San Diego County.

## Native American Heritage Commission
## Native American Contact List
## San Diego County
## 9/29/2016

***Manzanita Band of Kumeyaay Nation***
Nick Elliott, Cultural Resources Coordinator
P. O. Box 1302 Kumeyaay
Boulevard, CA, 91905
Phone: (619) 766 - 4930
Fax: (619) 766-4957
nickmepa@yahoo.com

***Mesa Grande Band of Mission Indians***
Virgil Oyos, Chairperson
P.O Box 270 Kumeyaay
Santa Ysabel, CA, 92070
Phone: (760)782-3818
Fax: (760)782-9092
mesagrandeband@msn.com

***San Pasqual Band of Mission Indians***
Allen E. Lawson, Chairperson
P.O. Box 365 Kumeyaay
Valley Center, CA, 92082
Phone: (760)749-3200
Fax: (760)749-3876
allenl@sanpasqualtribe.org

***San Pasqual Band of Mission Indians***
John Flores, Environmental Coordinator
P. O. Box 365 Kumeyaay
Valley Center, CA, 92082
Phone: (760) 749 - 3200
Fax: (760) 749-3876
johnf@sanpasqualtribe.org

***Sycuan Band of the Kumeyaay Nation***
Cody J. Martinez, Chairperson
1 Kwaaypaay Court Kumeyaay
El Cajon, CA, 92019
Phone: (619)445-2613
Fax: (619)445-1927
ssilva@sycuan-nsn.gov

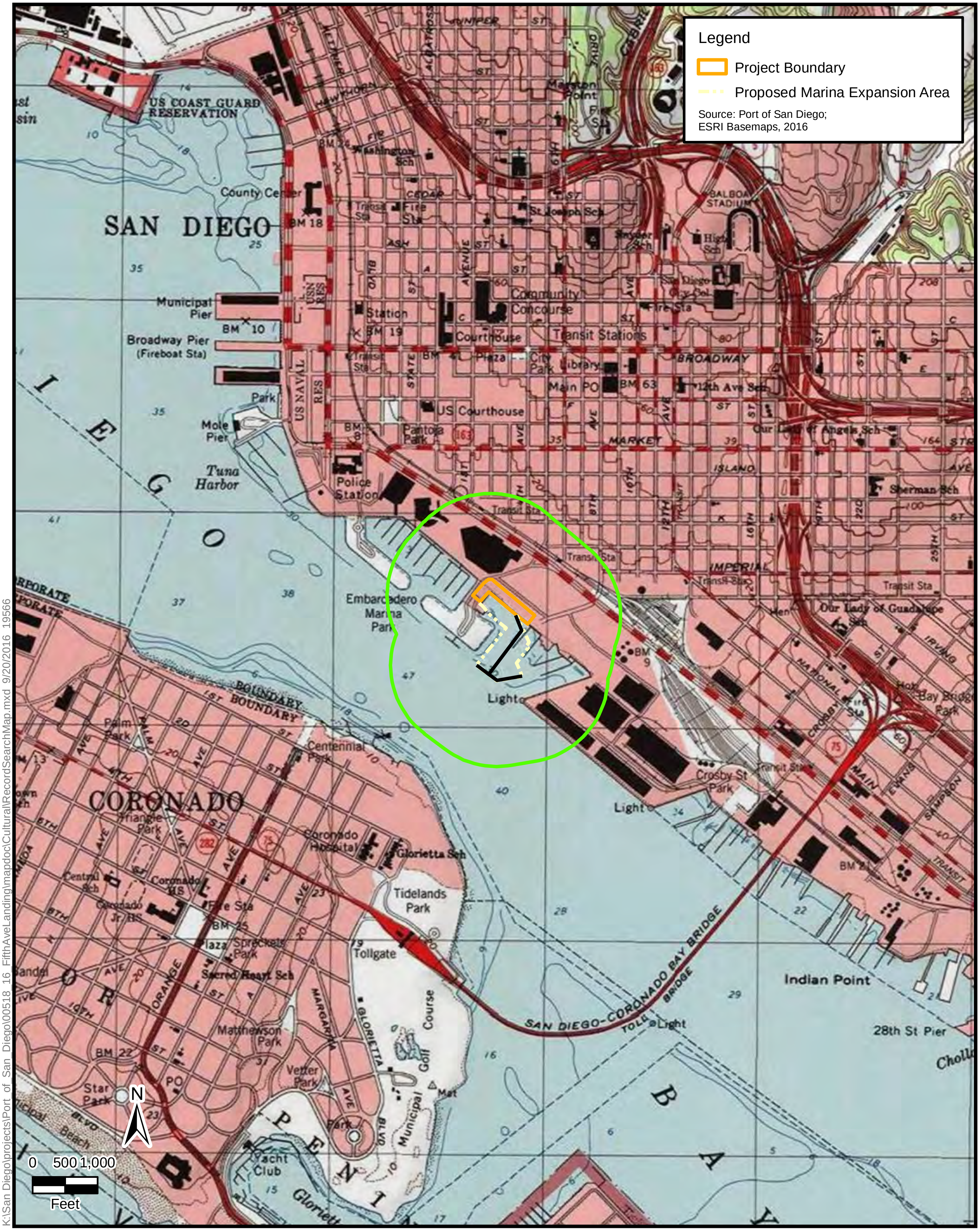
***Sycuan Band of the Kumeyaay Nation***
Lisa Haws, Cultural Resources Manager
1 Kwaaypaay Court Kumeyaay
El Cajon, CA, 92019
Phone: (619) 445 - 4564

***Viejas Band of Kumeyaay Indians***
Julie Hagen,
1 Viejas Grade Road Kumeyaay
Alpine, CA, 91901
Phone: (619) 445 - 3810
Fax: (619) 445-5337
jhagen@viejas-nsn.gov

***Viejas Band of Kumeyaay Indians***
Robert J. Welch, Chairperson
1 Viejas Grade Road Kumeyaay
Alpine, CA, 91901
Phone: (619)445-3810
Fax: (619)445-5337
jhagen@viejas-nsn.gov

This list is current only as of the date of this document. Distribution of this list does not relieve any person of statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resource Section 5097.98 of the Public Resources Code.

This list is only applicable for contacting local Native Americans with regard to cultural resources assessment for the proposed Fifth Avenue Landing, San Diego County.



K:\San Diego\projects\Port of San Diego\00518 16 FifthAveLanding\mapdoc\Cultural\RecordSearchMap.mxd 9/20/2016 19566

## Figure 1
## Project Location Map
## Fifth Avenue Landing Project

October 4, 2016

Manzanita Band of Kumeyaay Nation
Nick Elliot, Cultural Resources Coordinator
P.O. Box 1302
Boulevard, CA 91905

**Subject:** **Fifth Avenue Landing Project and Port Maser Plan Amendment, San Diego, San Diego County**

Dear Mr. Elliot:

I am writing to inform you that the San Diego Unified Port District ("Port District") is proposing to redevelop a downtown site, including an area within the San Diego Harbor, as part of the Fifth Avenue Landing Project and Port Maser Plan Amendment. The project site currently consists of a temporary parking lot, water transportation office, public restrooms, a segment of the 35-foot-wide Bayfront Promenade, and an existing large vessel slip marina located on the waterside portion of the site. The project site is located southeast of Marina Park Way and Embarcadero Marina Park South, and southwest of Convention Way. The project site is within Township 17 South, Range 3 West, Section 11 of the *Point Loma, California*, U.S. Geological Survey (USGS) 7.5-minute topographic map quadrangle.

The proposed project would construct an approximately 850-room hotel tower, an approximately 565-bed lower-cost visitor-serving hotel, retail development along the promenade, approximately 2.1 acres of public access plaza space, approximately 213 onsite parking spaces, a connecting bridge from the hotel public access plaza to the San Diego Convention Center, and a marina expansion. The project would also include the potential use of approximately 110 offsite parking spaces in the Convention Center garage and maintain the existing public in-bay water transportation system, including a water ferry service.

ICF International has been retained to conduct a record search and cultural resources assessment of the site to support an Environmental Impact Report on the proposed project. No archaeological survey was conducted as the property is fully developed and built over, or within the waters of San Diego Harbor.

A records search completed by the South Coastal Information Center (SCIC) indicated that no prehistoric archaeological sites have been previously recorded within or adjacent to the school. The Native America Heritage Commission completed a search of the Sacred Lands File which failed to indicate the presence of Native American cultural resources in the area. The NAHC identified you as a person who may have concerns or knowledge of cultural resources in the project area. Any information you might be able to share about the project area would greatly enhance the study and

would be most appreciated. This consultation is part of ICF's due diligence and not part of the AB52 consultation process.

If you have any recommendations regarding the proposed project, please address them to me so that I can incorporate them into our report. As required by State law, all site data and other culturally sensitive information will not be released to the general public and will be kept strictly confidential. I can be reached at 858-444-3936, or by email at Karolina.chmiel@icfi.com.

Sincerely,

Karolina Chmiel, MA
Archaeologist

**Encl. Figure 1 –Project Location**

October 4, 2016

San Pasqual Band of Mission Indians
John Flores, Environmental Coordinator
P.O. Box 365
Valley Center, CA 92082

**Subject:** **Fifth Avenue Landing Project and Port Maser Plan Amendment, San Diego, San Diego County**

Dear Mr. Flores:

I am writing to inform you that the San Diego Unified Port District ("Port District") is proposing to redevelop a downtown site, including an area within the San Diego Harbor, as part of the Fifth Avenue Landing Project and Port Maser Plan Amendment. The project site currently consists of a temporary parking lot, water transportation office, public restrooms, a segment of the 35-foot-wide Bayfront Promenade, and an existing large vessel slip marina located on the waterside portion of the site. The project site is located southeast of Marina Park Way and Embarcadero Marina Park South, and southwest of Convention Way. The project site is within Township 17 South, Range 3 West, Section 11 of the *Point Loma, California*, U.S. Geological Survey (USGS) 7.5-minute topographic map quadrangle.

The proposed project would construct an approximately 850-room hotel tower, an approximately 565-bed lower-cost visitor-serving hotel, retail development along the promenade, approximately 2.1 acres of public access plaza space, approximately 213 onsite parking spaces, a connecting bridge from the hotel public access plaza to the San Diego Convention Center, and a marina expansion. The project would also include the potential use of approximately 110 offsite parking spaces in the Convention Center garage and maintain the existing public in-bay water transportation system, including a water ferry service.

ICF International has been retained to conduct a record search and cultural resources assessment of the site to support an Environmental Impact Report on the proposed project. No archaeological survey was conducted as the property is fully developed and built over, or within the waters of San Diego Harbor.

A records search completed by the South Coastal Information Center (SCIC) indicated that no prehistoric archaeological sites have been previously recorded within or adjacent to the school. The Native America Heritage Commission completed a search of the Sacred Lands File which failed to indicate the presence of Native American cultural resources in the area. The NAHC identified you as a person who may have concerns or knowledge of cultural resources in the project area. Any information you might be able to share about the project area would greatly enhance the study and

would be most appreciated. This consultation is part of ICF's due diligence and not part of the AB52 consultation process.

If you have any recommendations regarding the proposed project, please address them to me so that I can incorporate them into our report. As required by State law, all site data and other culturally sensitive information will not be released to the general public and will be kept strictly confidential. I can be reached at 858-444-3936, or by email at Karolina.chmiel@icfi.com.

Sincerely,

Karolina Chmiel, MA
Archaeologist

**Encl. Figure 1 –Project Location**

October 4, 2016

Ewiiaapaayp Tribal Office
Michael Garcia, Vice Chairperson
4054 Willows Road
Alpine, CA 91901

**Subject:** **Fifth Avenue Landing Project and Port Maser Plan Amendment, San Diego, San Diego County**

Dear Mr. Garcia:

I am writing to inform you that the San Diego Unified Port District ("Port District") is proposing to redevelop a downtown site, including an area within the San Diego Harbor, as part of the Fifth Avenue Landing Project and Port Maser Plan Amendment. The project site currently consists of a temporary parking lot, water transportation office, public restrooms, a segment of the 35-foot-wide Bayfront Promenade, and an existing large vessel slip marina located on the waterside portion of the site. The project site is located southeast of Marina Park Way and Embarcadero Marina Park South, and southwest of Convention Way. The project site is within Township 17 South, Range 3 West, Section 11 of the *Point Loma, California*, U.S. Geological Survey (USGS) 7.5-minute topographic map quadrangle.

The proposed project would construct an approximately 850-room hotel tower, an approximately 565-bed lower-cost visitor-serving hotel, retail development along the promenade, approximately 2.1 acres of public access plaza space, approximately 213 onsite parking spaces, a connecting bridge from the hotel public access plaza to the San Diego Convention Center, and a marina expansion. The project would also include the potential use of approximately 110 offsite parking spaces in the Convention Center garage and maintain the existing public in-bay water transportation system, including a water ferry service.

ICF International has been retained to conduct a record search and cultural resources assessment of the site to support an Environmental Impact Report on the proposed project. No archaeological survey was conducted as the property is fully developed and built over, or within the waters of San Diego Harbor.

A records search completed by the South Coastal Information Center (SCIC) indicated that no prehistoric archaeological sites have been previously recorded within or adjacent to the school. The Native America Heritage Commission completed a search of the Sacred Lands File which failed to indicate the presence of Native American cultural resources in the area. The NAHC identified you as a person who may have concerns or knowledge of cultural resources in the project area. Any information you might be able to share about the project area would greatly enhance the study and

would be most appreciated. This consultation is part of ICF's due diligence and not part of the AB52 consultation process.

If you have any recommendations regarding the proposed project, please address them to me so that I can incorporate them into our report. As required by State law, all site data and other culturally sensitive information will not be released to the general public and will be kept strictly confidential. I can be reached at 858-444-3936, or by email at Karolina.chmiel@icfi.com.

Sincerely,

Karolina Chmiel, MA
Archaeologist

**Encl. Figure 1 –Project Location**

October 4, 2016

Campo Band of Mission Indians
Ralph Goff, Chairperson
36190 Church Road Suite 1
Campo, CA 91906

**Subject:** **Fifth Avenue Landing Project and Port Maser Plan Amendment, San Diego, San Diego County**

Dear Mr. Goff:

I am writing to inform you that the San Diego Unified Port District ("Port District") is proposing to redevelop a downtown site, including an area within the San Diego Harbor, as part of the Fifth Avenue Landing Project and Port Maser Plan Amendment. The project site currently consists of a temporary parking lot, water transportation office, public restrooms, a segment of the 35-foot-wide Bayfront Promenade, and an existing large vessel slip marina located on the waterside portion of the site. The project site is located southeast of Marina Park Way and Embarcadero Marina Park South, and southwest of Convention Way. The project site is within Township 17 South, Range 3 West, Section 11 of the *Point Loma, California*, U.S. Geological Survey (USGS) 7.5-minute topographic map quadrangle.

The proposed project would construct an approximately 850-room hotel tower, an approximately 565-bed lower-cost visitor-serving hotel, retail development along the promenade, approximately 2.1 acres of public access plaza space, approximately 213 onsite parking spaces, a connecting bridge from the hotel public access plaza to the San Diego Convention Center, and a marina expansion. The project would also include the potential use of approximately 110 offsite parking spaces in the Convention Center garage and maintain the existing public in-bay water transportation system, including a water ferry service.

ICF International has been retained to conduct a record search and cultural resources assessment of the site to support an Environmental Impact Report on the proposed project. No archaeological survey was conducted as the property is fully developed and built over, or within the waters of San Diego Harbor.

A records search completed by the South Coastal Information Center (SCIC) indicated that no prehistoric archaeological sites have been previously recorded within or adjacent to the school. The Native America Heritage Commission completed a search of the Sacred Lands File which failed to indicate the presence of Native American cultural resources in the area. The NAHC identified you as a person who may have concerns or knowledge of cultural resources in the project area. Any information you might be able to share about the project area would greatly enhance the study and

would be most appreciated. This consultation is part of ICF's due diligence and not part of the AB52 consultation process.

If you have any recommendations regarding the proposed project, please address them to me so that I can incorporate them into our report. As required by State law, all site data and other culturally sensitive information will not be released to the general public and will be kept strictly confidential. I can be reached at 858-444-3936, or by email at Karolina.chmiel@icfi.com.

Sincerely,

Karolina Chmiel, MA
Archaeologist

**Encl. Figure 1 –Project Location**

October 4, 2016

Viejas Band of Kumeyaay Indians
Julie Hagen
1 Vejas Grade Road
Alpine, CA 91901

**Subject:** **Fifth Avenue Landing Project and Port Maser Plan Amendment, San Diego, San Diego County**

Dear Ms. Hagen:

I am writing to inform you that the San Diego Unified Port District ("Port District") is proposing to redevelop a downtown site, including an area within the San Diego Harbor, as part of the Fifth Avenue Landing Project and Port Maser Plan Amendment. The project site currently consists of a temporary parking lot, water transportation office, public restrooms, a segment of the 35-foot-wide Bayfront Promenade, and an existing large vessel slip marina located on the waterside portion of the site. The project site is located southeast of Marina Park Way and Embarcadero Marina Park South, and southwest of Convention Way. The project site is within Township 17 South, Range 3 West, Section 11 of the *Point Loma, California*, U.S. Geological Survey (USGS) 7.5-minute topographic map quadrangle.

The proposed project would construct an approximately 850-room hotel tower, an approximately 565-bed lower-cost visitor-serving hotel, retail development along the promenade, approximately 2.1 acres of public access plaza space, approximately 213 onsite parking spaces, a connecting bridge from the hotel public access plaza to the San Diego Convention Center, and a marina expansion. The project would also include the potential use of approximately 110 offsite parking spaces in the Convention Center garage and maintain the existing public in-bay water transportation system, including a water ferry service.

ICF International has been retained to conduct a record search and cultural resources assessment of the site to support an Environmental Impact Report on the proposed project. No archaeological survey was conducted as the property is fully developed and built over, or within the waters of San Diego Harbor.

A records search completed by the South Coastal Information Center (SCIC) indicated that no prehistoric archaeological sites have been previously recorded within or adjacent to the school. The Native America Heritage Commission completed a search of the Sacred Lands File which failed to indicate the presence of Native American cultural resources in the area. The NAHC identified you as a person who may have concerns or knowledge of cultural resources in the project area. Any information you might be able to share about the project area would greatly enhance the study and

would be most appreciated. This consultation is part of ICF’s due diligence and not part of the AB52 consultation process.

If you have any recommendations regarding the proposed project, please address them to me so that I can incorporate them into our report. As required by State law, all site data and other culturally sensitive information will not be released to the general public and will be kept strictly confidential. I can be reached at 858-444-3936, or by email at Karolina.chmiel@icfi.com.

Sincerely,

Karolina Chmiel, MA
Archaeologist

**Encl. Figure 1 –Project Location**

October 4, 2016

Sycuan Band of the Kumeyaay Nation
Lisa Haws, Cultural Resources Manager
1 Kwaaypaay Court
El Cajon, CA 92019

**Subject:** **Fifth Avenue Landing Project and Port Maser Plan Amendment, San Diego, San Diego County**

Dear Ms. Haws:

I am writing to inform you that the San Diego Unified Port District ("Port District") is proposing to redevelop a downtown site, including an area within the San Diego Harbor, as part of the Fifth Avenue Landing Project and Port Maser Plan Amendment. The project site currently consists of a temporary parking lot, water transportation office, public restrooms, a segment of the 35-foot-wide Bayfront Promenade, and an existing large vessel slip marina located on the waterside portion of the site. The project site is located southeast of Marina Park Way and Embarcadero Marina Park South, and southwest of Convention Way. The project site is within Township 17 South, Range 3 West, Section 11 of the *Point Loma, California*, U.S. Geological Survey (USGS) 7.5-minute topographic map quadrangle.

The proposed project would construct an approximately 850-room hotel tower, an approximately 565-bed lower-cost visitor-serving hotel, retail development along the promenade, approximately 2.1 acres of public access plaza space, approximately 213 onsite parking spaces, a connecting bridge from the hotel public access plaza to the San Diego Convention Center, and a marina expansion. The project would also include the potential use of approximately 110 offsite parking spaces in the Convention Center garage and maintain the existing public in-bay water transportation system, including a water ferry service.

ICF International has been retained to conduct a record search and cultural resources assessment of the site to support an Environmental Impact Report on the proposed project. No archaeological survey was conducted as the property is fully developed and built over, or within the waters of San Diego Harbor.

A records search completed by the South Coastal Information Center (SCIC) indicated that no prehistoric archaeological sites have been previously recorded within or adjacent to the school. The Native America Heritage Commission completed a search of the Sacred Lands File which failed to indicate the presence of Native American cultural resources in the area. The NAHC identified you as a person who may have concerns or knowledge of cultural resources in the project area. Any information you might be able to share about the project area would greatly enhance the study and

would be most appreciated. This consultation is part of ICF's due diligence and not part of the AB52 consultation process.

If you have any recommendations regarding the proposed project, please address them to me so that I can incorporate them into our report. As required by State law, all site data and other culturally sensitive information will not be released to the general public and will be kept strictly confidential. I can be reached at 858-444-3936, or by email at Karolina.chmiel@icfi.com.

Sincerely,

Karolina Chmiel, MA
Archaeologist

**Encl. Figure 1 –Project Location**

ICF INTERNATIONAL

October 4, 2016

Barona Group of the Capitan Grande
Clifford LaChappa, Chairperson
1095 Barona Road
Lakeside, CA 92040

**Subject:** **Fifth Avenue Landing Project and Port Maser Plan Amendment, San Diego, San Diego County**

Dear Mr. LaChappa:

I am writing to inform you that the San Diego Unified Port District ("Port District") is proposing to redevelop a downtown site, including an area within the San Diego Harbor, as part of the Fifth Avenue Landing Project and Port Maser Plan Amendment. The project site currently consists of a temporary parking lot, water transportation office, public restrooms, a segment of the 35-foot-wide Bayfront Promenade, and an existing large vessel slip marina located on the waterside portion of the site. The project site is located southeast of Marina Park Way and Embarcadero Marina Park South, and southwest of Convention Way. The project site is within Township 17 South, Range 3 West, Section 11 of the *Point Loma, California*, U.S. Geological Survey (USGS) 7.5-minute topographic map quadrangle.

The proposed project would construct an approximately 850-room hotel tower, an approximately 565-bed lower-cost visitor-serving hotel, retail development along the promenade, approximately 2.1 acres of public access plaza space, approximately 213 onsite parking spaces, a connecting bridge from the hotel public access plaza to the San Diego Convention Center, and a marina expansion. The project would also include the potential use of approximately 110 offsite parking spaces in the Convention Center garage and maintain the existing public in-bay water transportation system, including a water ferry service.

ICF International has been retained to conduct a record search and cultural resources assessment of the site to support an Environmental Impact Report on the proposed project. No archaeological survey was conducted as the property is fully developed and built over, or within the waters of San Diego Harbor.

A records search completed by the South Coastal Information Center (SCIC) indicated that no prehistoric archaeological sites have been previously recorded within or adjacent to the school. The Native America Heritage Commission completed a search of the Sacred Lands File which failed to indicate the presence of Native American cultural resources in the area. The NAHC identified you as a person who may have concerns or knowledge of cultural resources in the project area. Any information you might be able to share about the project area would greatly enhance the study and

would be most appreciated. This consultation is part of ICF's due diligence and not part of the AB52 consultation process.

If you have any recommendations regarding the proposed project, please address them to me so that I can incorporate them into our report. As required by State law, all site data and other culturally sensitive information will not be released to the general public and will be kept strictly confidential. I can be reached at 858-444-3936, or by email at Karolina.chmiel@icfi.com.

Sincerely,

Karolina Chmiel, MA
Archaeologist

**Encl. Figure 1 –Project Location**

ICF INTERNATIONAL

October 4, 2016

San Pasqual Band of Mission Indians
Allen E. Lawson, Chairperson
P.O. Box 365
Valley Center, CA 92082

**Subject:** **Fifth Avenue Landing Project and Port Maser Plan Amendment, San Diego, San Diego County**

Dear Mr. Lawson:

I am writing to inform you that the San Diego Unified Port District ("Port District") is proposing to redevelop a downtown site, including an area within the San Diego Harbor, as part of the Fifth Avenue Landing Project and Port Maser Plan Amendment. The project site currently consists of a temporary parking lot, water transportation office, public restrooms, a segment of the 35-foot-wide Bayfront Promenade, and an existing large vessel slip marina located on the waterside portion of the site. The project site is located southeast of Marina Park Way and Embarcadero Marina Park South, and southwest of Convention Way. The project site is within Township 17 South, Range 3 West, Section 11 of the *Point Loma, California*, U.S. Geological Survey (USGS) 7.5-minute topographic map quadrangle.

The proposed project would construct an approximately 850-room hotel tower, an approximately 565-bed lower-cost visitor-serving hotel, retail development along the promenade, approximately 2.1 acres of public access plaza space, approximately 213 onsite parking spaces, a connecting bridge from the hotel public access plaza to the San Diego Convention Center, and a marina expansion. The project would also include the potential use of approximately 110 offsite parking spaces in the Convention Center garage and maintain the existing public in-bay water transportation system, including a water ferry service.

ICF International has been retained to conduct a record search and cultural resources assessment of the site to support an Environmental Impact Report on the proposed project. No archaeological survey was conducted as the property is fully developed and built over, or within the waters of San Diego Harbor.

A records search completed by the South Coastal Information Center (SCIC) indicated that no prehistoric archaeological sites have been previously recorded within or adjacent to the school.  The Native America Heritage Commission completed a search of the Sacred Lands File which failed to indicate the presence of Native American cultural resources in the area. The NAHC identified you as a person who may have concerns or knowledge of cultural resources in the project area. Any information you might be able to share about the project area would greatly enhance the study and

would be most appreciated. This consultation is part of ICF's due diligence and not part of the AB52 consultation process.

If you have any recommendations regarding the proposed project, please address them to me so that I can incorporate them into our report.  As required by State law, all site data and other culturally sensitive information will not be released to the general public and will be kept strictly confidential. I can be reached at 858-444-3936, or by email at Karolina.chmiel@icfi.com.

Sincerely,

Karolina Chmiel, MA
Archaeologist

**Encl. Figure 1 –Project Location**

October 4, 2016

Iipay Nation of Santa Ysabel
Clint Linton, Director of Cultural Resources
P.O. Box 507
Santa Ysabel, CA 92070

**Subject:** **Fifth Avenue Landing Project and Port Maser Plan Amendment, San Diego, San Diego County**

Dear Mr. Linton:

I am writing to inform you that the San Diego Unified Port District ("Port District") is proposing to redevelop a downtown site, including an area within the San Diego Harbor, as part of the Fifth Avenue Landing Project and Port Maser Plan Amendment. The project site currently consists of a temporary parking lot, water transportation office, public restrooms, a segment of the 35-foot-wide Bayfront Promenade, and an existing large vessel slip marina located on the waterside portion of the site. The project site is located southeast of Marina Park Way and Embarcadero Marina Park South, and southwest of Convention Way. The project site is within Township 17 South, Range 3 West, Section 11 of the *Point Loma, California*, U.S. Geological Survey (USGS) 7.5-minute topographic map quadrangle.

The proposed project would construct an approximately 850-room hotel tower, an approximately 565-bed lower-cost visitor-serving hotel, retail development along the promenade, approximately 2.1 acres of public access plaza space, approximately 213 onsite parking spaces, a connecting bridge from the hotel public access plaza to the San Diego Convention Center, and a marina expansion. The project would also include the potential use of approximately 110 offsite parking spaces in the Convention Center garage and maintain the existing public in-bay water transportation system, including a water ferry service.

ICF International has been retained to conduct a record search and cultural resources assessment of the site to support an Environmental Impact Report on the proposed project. No archaeological survey was conducted as the property is fully developed and built over, or within the waters of San Diego Harbor.

A records search completed by the South Coastal Information Center (SCIC) indicated that no prehistoric archaeological sites have been previously recorded within or adjacent to the school. The Native America Heritage Commission completed a search of the Sacred Lands File which failed to indicate the presence of Native American cultural resources in the area. The NAHC identified you as a person who may have concerns or knowledge of cultural resources in the project area. Any information you might be able to share about the project area would greatly enhance the study and

would be most appreciated. This consultation is part of ICF's due diligence and not part of the AB52 consultation process.

If you have any recommendations regarding the proposed project, please address them to me so that I can incorporate them into our report. As required by State law, all site data and other culturally sensitive information will not be released to the general public and will be kept strictly confidential. I can be reached at 858-444-3936, or by email at Karolina.chmiel@icfi.com.

Sincerely,

Karolina Chmiel, MA
Archaeologist

**Encl. Figure 1 –Project Location**

October 4, 2016

Kwaaymii Laguna Band of Mission Indians
Carmen Lucas
P.O. Box 775
Pine Valley, CA 91962

**Subject:** **Fifth Avenue Landing Project and Port Maser Plan Amendment, San Diego, San Diego County**

Dear Ms. Lucas:

I am writing to inform you that the San Diego Unified Port District ("Port District") is proposing to redevelop a downtown site, including an area within the San Diego Harbor, as part of the Fifth Avenue Landing Project and Port Maser Plan Amendment. The project site currently consists of a temporary parking lot, water transportation office, public restrooms, a segment of the 35-foot-wide Bayfront Promenade, and an existing large vessel slip marina located on the waterside portion of the site. The project site is located southeast of Marina Park Way and Embarcadero Marina Park South, and southwest of Convention Way. The project site is within Township 17 South, Range 3 West, Section 11 of the *Point Loma, California*, U.S. Geological Survey (USGS) 7.5-minute topographic map quadrangle.

The proposed project would construct an approximately 850-room hotel tower, an approximately 565-bed lower-cost visitor-serving hotel, retail development along the promenade, approximately 2.1 acres of public access plaza space, approximately 213 onsite parking spaces, a connecting bridge from the hotel public access plaza to the San Diego Convention Center, and a marina expansion. The project would also include the potential use of approximately 110 offsite parking spaces in the Convention Center garage and maintain the existing public in-bay water transportation system, including a water ferry service.

ICF International has been retained to conduct a record search and cultural resources assessment of the site to support an Environmental Impact Report on the proposed project. No archaeological survey was conducted as the property is fully developed and built over, or within the waters of San Diego Harbor.

A records search completed by the South Coastal Information Center (SCIC) indicated that no prehistoric archaeological sites have been previously recorded within or adjacent to the school. The Native America Heritage Commission completed a search of the Sacred Lands File which failed to indicate the presence of Native American cultural resources in the area. The NAHC identified you as a person who may have concerns or knowledge of cultural resources in the project area. Any information you might be able to share about the project area would greatly enhance the study and

would be most appreciated. This consultation is part of ICF's due diligence and not part of the AB52 consultation process.

If you have any recommendations regarding the proposed project, please address them to me so that I can incorporate them into our report. As required by State law, all site data and other culturally sensitive information will not be released to the general public and will be kept strictly confidential. I can be reached at 858-444-3936, or by email at Karolina.chmiel@icfi.com.

Sincerely,

Karolina Chmiel, MA
Archaeologist

**Encl. Figure 1 –Project Location**

October 4, 2016

Sycuan Band of the Kumeyaay Nation
Cody J. Martinez, Chairperson
1 Kwaaypaay Court
El Cajon, CA 92019

**Subject:** **Fifth Avenue Landing Project and Port Maser Plan Amendment, San Diego, San Diego County**

Dear Mr. Martinez:

I am writing to inform you that the San Diego Unified Port District ("Port District") is proposing to redevelop a downtown site, including an area within the San Diego Harbor, as part of the Fifth Avenue Landing Project and Port Maser Plan Amendment. The project site currently consists of a temporary parking lot, water transportation office, public restrooms, a segment of the 35-foot-wide Bayfront Promenade, and an existing large vessel slip marina located on the waterside portion of the site. The project site is located southeast of Marina Park Way and Embarcadero Marina Park South, and southwest of Convention Way. The project site is within Township 17 South, Range 3 West, Section 11 of the *Point Loma, California*, U.S. Geological Survey (USGS) 7.5-minute topographic map quadrangle.

The proposed project would construct an approximately 850-room hotel tower, an approximately 565-bed lower-cost visitor-serving hotel, retail development along the promenade, approximately 2.1 acres of public access plaza space, approximately 213 onsite parking spaces, a connecting bridge from the hotel public access plaza to the San Diego Convention Center, and a marina expansion. The project would also include the potential use of approximately 110 offsite parking spaces in the Convention Center garage and maintain the existing public in-bay water transportation system, including a water ferry service.

ICF International has been retained to conduct a record search and cultural resources assessment of the site to support an Environmental Impact Report on the proposed project. No archaeological survey was conducted as the property is fully developed and built over, or within the waters of San Diego Harbor.

A records search completed by the South Coastal Information Center (SCIC) indicated that no prehistoric archaeological sites have been previously recorded within or adjacent to the school. The Native America Heritage Commission completed a search of the Sacred Lands File which failed to indicate the presence of Native American cultural resources in the area. The NAHC identified you as a person who may have concerns or knowledge of cultural resources in the project area. Any information you might be able to share about the project area would greatly enhance the study and

would be most appreciated. This consultation is part of ICF's due diligence and not part of the AB52 consultation process.

If you have any recommendations regarding the proposed project, please address them to me so that I can incorporate them into our report. As required by State law, all site data and other culturally sensitive information will not be released to the general public and will be kept strictly confidential. I can be reached at 858-444-3936, or by email at Karolina.chmiel@icfi.com.

Sincerely,

Karolina Chmiel, MA
Archaeologist

**Encl. Figure 1 –Project Location**

October 4, 2016

La Posta Band of Mission Indians
Javaughn Miller, Tribal Administrator
8 Crestwood Road
Boulevard, CA 91905

**Subject:** **Fifth Avenue Landing Project and Port Maser Plan Amendment, San Diego, San Diego County**

Dear Mr. Miller:

I am writing to inform you that the San Diego Unified Port District ("Port District") is proposing to redevelop a downtown site, including an area within the San Diego Harbor, as part of the Fifth Avenue Landing Project and Port Maser Plan Amendment. The project site currently consists of a temporary parking lot, water transportation office, public restrooms, a segment of the 35-foot-wide Bayfront Promenade, and an existing large vessel slip marina located on the waterside portion of the site. The project site is located southeast of Marina Park Way and Embarcadero Marina Park South, and southwest of Convention Way. The project site is within Township 17 South, Range 3 West, Section 11 of the *Point Loma, California*, U.S. Geological Survey (USGS) 7.5-minute topographic map quadrangle.

The proposed project would construct an approximately 850-room hotel tower, an approximately 565-bed lower-cost visitor-serving hotel, retail development along the promenade, approximately 2.1 acres of public access plaza space, approximately 213 onsite parking spaces, a connecting bridge from the hotel public access plaza to the San Diego Convention Center, and a marina expansion. The project would also include the potential use of approximately 110 offsite parking spaces in the Convention Center garage and maintain the existing public in-bay water transportation system, including a water ferry service.

ICF International has been retained to conduct a record search and cultural resources assessment of the site to support an Environmental Impact Report on the proposed project. No archaeological survey was conducted as the property is fully developed and built over, or within the waters of San Diego Harbor.

A records search completed by the South Coastal Information Center (SCIC) indicated that no prehistoric archaeological sites have been previously recorded within or adjacent to the school. The Native America Heritage Commission completed a search of the Sacred Lands File which failed to indicate the presence of Native American cultural resources in the area. The NAHC identified you as a person who may have concerns or knowledge of cultural resources in the project area. Any information you might be able to share about the project area would greatly enhance the study and

would be most appreciated. This consultation is part of ICF's due diligence and not part of the AB52 consultation process.

If you have any recommendations regarding the proposed project, please address them to me so that I can incorporate them into our report. As required by State law, all site data and other culturally sensitive information will not be released to the general public and will be kept strictly confidential. I can be reached at 858-444-3936, or by email at Karolina.chmiel@icfi.com.

Sincerely,

Karolina Chmiel, MA
Archaeologist

**Encl. Figure 1 –Project Location**

October 4, 2016

Inaja Band of Mission Indians
Rebecca Osuna, Chairperson
2005 S. Escondido Blvd.
Escondido, CA 92025

**Subject:** **Fifth Avenue Landing Project and Port Maser Plan Amendment, San Diego, San Diego County**

Dear Ms. Osuna:

I am writing to inform you that the San Diego Unified Port District ("Port District") is proposing to redevelop a downtown site, including an area within the San Diego Harbor, as part of the Fifth Avenue Landing Project and Port Maser Plan Amendment. The project site currently consists of a temporary parking lot, water transportation office, public restrooms, a segment of the 35-foot-wide Bayfront Promenade, and an existing large vessel slip marina located on the waterside portion of the site. The project site is located southeast of Marina Park Way and Embarcadero Marina Park South, and southwest of Convention Way. The project site is within Township 17 South, Range 3 West, Section 11 of the *Point Loma, California*, U.S. Geological Survey (USGS) 7.5-minute topographic map quadrangle.

The proposed project would construct an approximately 850-room hotel tower, an approximately 565-bed lower-cost visitor-serving hotel, retail development along the promenade, approximately 2.1 acres of public access plaza space, approximately 213 onsite parking spaces, a connecting bridge from the hotel public access plaza to the San Diego Convention Center, and a marina expansion. The project would also include the potential use of approximately 110 offsite parking spaces in the Convention Center garage and maintain the existing public in-bay water transportation system, including a water ferry service.

ICF International has been retained to conduct a record search and cultural resources assessment of the site to support an Environmental Impact Report on the proposed project. No archaeological survey was conducted as the property is fully developed and built over, or within the waters of San Diego Harbor.

A records search completed by the South Coastal Information Center (SCIC) indicated that no prehistoric archaeological sites have been previously recorded within or adjacent to the school.  The Native America Heritage Commission completed a search of the Sacred Lands File which failed to indicate the presence of Native American cultural resources in the area. The NAHC identified you as a person who may have concerns or knowledge of cultural resources in the project area. Any information you might be able to share about the project area would greatly enhance the study and

would be most appreciated. This consultation is part of ICF's due diligence and not part of the AB52 consultation process.

If you have any recommendations regarding the proposed project, please address them to me so that I can incorporate them into our report. As required by State law, all site data and other culturally sensitive information will not be released to the general public and will be kept strictly confidential. I can be reached at 858-444-3936, or by email at Karolina.chmiel@icfi.com.

Sincerely,

Karolina Chmiel, MA
Archaeologist

**Encl. Figure 1 –Project Location**

ICF INTERNATIONAL

October 4, 2016

Mesa Grande Band of Mission Indians
Virgil Oyos, Chairperson
P.O. Box 270
Santa Ysabel, CA 92070

**Subject:** **Fifth Avenue Landing Project and Port Maser Plan Amendment, San Diego, San Diego County**

Dear Mr. Oyos:

I am writing to inform you that the San Diego Unified Port District ("Port District") is proposing to redevelop a downtown site, including an area within the San Diego Harbor, as part of the Fifth Avenue Landing Project and Port Maser Plan Amendment. The project site currently consists of a temporary parking lot, water transportation office, public restrooms, a segment of the 35-foot-wide Bayfront Promenade, and an existing large vessel slip marina located on the waterside portion of the site. The project site is located southeast of Marina Park Way and Embarcadero Marina Park South, and southwest of Convention Way. The project site is within Township 17 South, Range 3 West, Section 11 of the *Point Loma, California*, U.S. Geological Survey (USGS) 7.5-minute topographic map quadrangle.

The proposed project would construct an approximately 850-room hotel tower, an approximately 565-bed lower-cost visitor-serving hotel, retail development along the promenade, approximately 2.1 acres of public access plaza space, approximately 213 onsite parking spaces, a connecting bridge from the hotel public access plaza to the San Diego Convention Center, and a marina expansion. The project would also include the potential use of approximately 110 offsite parking spaces in the Convention Center garage and maintain the existing public in-bay water transportation system, including a water ferry service.

ICF International has been retained to conduct a record search and cultural resources assessment of the site to support an Environmental Impact Report on the proposed project. No archaeological survey was conducted as the property is fully developed and built over, or within the waters of San Diego Harbor.

A records search completed by the South Coastal Information Center (SCIC) indicated that no prehistoric archaeological sites have been previously recorded within or adjacent to the school. The Native America Heritage Commission completed a search of the Sacred Lands File which failed to indicate the presence of Native American cultural resources in the area. The NAHC identified you as a person who may have concerns or knowledge of cultural resources in the project area. Any information you might be able to share about the project area would greatly enhance the study and

would be most appreciated. This consultation is part of ICF's due diligence and not part of the AB52 consultation process.

If you have any recommendations regarding the proposed project, please address them to me so that I can incorporate them into our report. As required by State law, all site data and other culturally sensitive information will not be released to the general public and will be kept strictly confidential. I can be reached at 858-444-3936, or by email at Karolina.chmiel@icfi.com.

Sincerely,

Karolina Chmiel, MA
Archaeologist

**Encl. Figure 1 –Project Location**

October 4, 2016

La Posta Band of Mission Indians
Gwendolyn Parada, Chairperson
8 Crestwood Road
Boulevard, CA 91905

**Subject: Fifth Avenue Landing Project and Port Maser Plan Amendment, San Diego, San Diego County**

Dear Ms. Parada:

I am writing to inform you that the San Diego Unified Port District ("Port District") is proposing to redevelop a downtown site, including an area within the San Diego Harbor, as part of the Fifth Avenue Landing Project and Port Maser Plan Amendment. The project site currently consists of a temporary parking lot, water transportation office, public restrooms, a segment of the 35-foot-wide Bayfront Promenade, and an existing large vessel slip marina located on the waterside portion of the site. The project site is located southeast of Marina Park Way and Embarcadero Marina Park South, and southwest of Convention Way. The project site is within Township 17 South, Range 3 West, Section 11 of the *Point Loma, California*, U.S. Geological Survey (USGS) 7.5-minute topographic map quadrangle.

The proposed project would construct an approximately 850-room hotel tower, an approximately 565-bed lower-cost visitor-serving hotel, retail development along the promenade, approximately 2.1 acres of public access plaza space, approximately 213 onsite parking spaces, a connecting bridge from the hotel public access plaza to the San Diego Convention Center, and a marina expansion. The project would also include the potential use of approximately 110 offsite parking spaces in the Convention Center garage and maintain the existing public in-bay water transportation system, including a water ferry service.

ICF International has been retained to conduct a record search and cultural resources assessment of the site to support an Environmental Impact Report on the proposed project. No archaeological survey was conducted as the property is fully developed and built over, or within the waters of San Diego Harbor.

A records search completed by the South Coastal Information Center (SCIC) indicated that no prehistoric archaeological sites have been previously recorded within or adjacent to the school. The Native America Heritage Commission completed a search of the Sacred Lands File which failed to indicate the presence of Native American cultural resources in the area. The NAHC identified you as a person who may have concerns or knowledge of cultural resources in the project area. Any information you might be able to share about the project area would greatly enhance the study and

would be most appreciated. This consultation is part of ICF's due diligence and not part of the AB52 consultation process.

If you have any recommendations regarding the proposed project, please address them to me so that I can incorporate them into our report. As required by State law, all site data and other culturally sensitive information will not be released to the general public and will be kept strictly confidential. I can be reached at 858-444-3936, or by email at Karolina.chmiel@icfi.com.

Sincerely,

Karolina Chmiel, MA
Archaeologist

**Encl. Figure 1 –Project Location**

October 4, 2016

Iipay Nation of Santa Ysabel
Virgil Perez, Chairperson
P.O. Box 130
Santa Ysabel, CA 92070

**Subject:** **Fifth Avenue Landing Project and Port Maser Plan Amendment, San Diego, San Diego County**

Dear Mr. Perez:

I am writing to inform you that the San Diego Unified Port District ("Port District") is proposing to redevelop a downtown site, including an area within the San Diego Harbor, as part of the Fifth Avenue Landing Project and Port Maser Plan Amendment. The project site currently consists of a temporary parking lot, water transportation office, public restrooms, a segment of the 35-foot-wide Bayfront Promenade, and an existing large vessel slip marina located on the waterside portion of the site. The project site is located southeast of Marina Park Way and Embarcadero Marina Park South, and southwest of Convention Way. The project site is within Township 17 South, Range 3 West, Section 11 of the *Point Loma, California*, U.S. Geological Survey (USGS) 7.5-minute topographic map quadrangle.

The proposed project would construct an approximately 850-room hotel tower, an approximately 565-bed lower-cost visitor-serving hotel, retail development along the promenade, approximately 2.1 acres of public access plaza space, approximately 213 onsite parking spaces, a connecting bridge from the hotel public access plaza to the San Diego Convention Center, and a marina expansion. The project would also include the potential use of approximately 110 offsite parking spaces in the Convention Center garage and maintain the existing public in-bay water transportation system, including a water ferry service.

ICF International has been retained to conduct a record search and cultural resources assessment of the site to support an Environmental Impact Report on the proposed project. No archaeological survey was conducted as the property is fully developed and built over, or within the waters of San Diego Harbor.

A records search completed by the South Coastal Information Center (SCIC) indicated that no prehistoric archaeological sites have been previously recorded within or adjacent to the school.  The Native America Heritage Commission completed a search of the Sacred Lands File which failed to indicate the presence of Native American cultural resources in the area. The NAHC identified you as a person who may have concerns or knowledge of cultural resources in the project area. Any information you might be able to share about the project area would greatly enhance the study and

would be most appreciated. This consultation is part of ICF's due diligence and not part of the AB52 consultation process.

If you have any recommendations regarding the proposed project, please address them to me so that I can incorporate them into our report. As required by State law, all site data and other culturally sensitive information will not be released to the general public and will be kept strictly confidential. I can be reached at 858-444-3936, or by email at Karolina.chmiel@icfi.com.

Sincerely,

Karolina Chmiel, MA
Archaeologist

**Encl. Figure 1 –Project Location**

October 4, 2016

Jamul Indian Village
Erica Pinto, Chairperson
P.O. Box 612
Jamul, CA 91935

**Subject:** **Fifth Avenue Landing Project and Port Maser Plan Amendment, San Diego, San Diego County**

Dear Ms. Pinto:

I am writing to inform you that the San Diego Unified Port District ("Port District") is proposing to redevelop a downtown site, including an area within the San Diego Harbor, as part of the Fifth Avenue Landing Project and Port Maser Plan Amendment. The project site currently consists of a temporary parking lot, water transportation office, public restrooms, a segment of the 35-foot-wide Bayfront Promenade, and an existing large vessel slip marina located on the waterside portion of the site. The project site is located southeast of Marina Park Way and Embarcadero Marina Park South, and southwest of Convention Way. The project site is within Township 17 South, Range 3 West, Section 11 of the *Point Loma, California*, U.S. Geological Survey (USGS) 7.5-minute topographic map quadrangle.

The proposed project would construct an approximately 850-room hotel tower, an approximately 565-bed lower-cost visitor-serving hotel, retail development along the promenade, approximately 2.1 acres of public access plaza space, approximately 213 onsite parking spaces, a connecting bridge from the hotel public access plaza to the San Diego Convention Center, and a marina expansion. The project would also include the potential use of approximately 110 offsite parking spaces in the Convention Center garage and maintain the existing public in-bay water transportation system, including a water ferry service.

ICF International has been retained to conduct a record search and cultural resources assessment of the site to support an Environmental Impact Report on the proposed project. No archaeological survey was conducted as the property is fully developed and built over, or within the waters of San Diego Harbor.

A records search completed by the South Coastal Information Center (SCIC) indicated that no prehistoric archaeological sites have been previously recorded within or adjacent to the school. The Native America Heritage Commission completed a search of the Sacred Lands File which failed to indicate the presence of Native American cultural resources in the area. The NAHC identified you as a person who may have concerns or knowledge of cultural resources in the project area. Any information you might be able to share about the project area would greatly enhance the study and

would be most appreciated. This consultation is part of ICF's due diligence and not part of the AB52 consultation process.

If you have any recommendations regarding the proposed project, please address them to me so that I can incorporate them into our report. As required by State law, all site data and other culturally sensitive information will not be released to the general public and will be kept strictly confidential. I can be reached at 858-444-3936, or by email at Karolina.chmiel@icfi.com.

Sincerely,

Karolina Chmiel, MA
Archaeologist

**Encl. Figure 1 –Project Location**

October 4, 2016

Ewiiaapaayp Tribal Office
Robert Pinto, Chairperson
4054 Willows Road
Alpine, CA 91901

**Subject:** **Fifth Avenue Landing Project and Port Maser Plan Amendment, San Diego, San Diego County**

Dear Mr. Pinto:

I am writing to inform you that the San Diego Unified Port District (“Port District”) is proposing to redevelop a downtown site, including an area within the San Diego Harbor, as part of the Fifth Avenue Landing Project and Port Maser Plan Amendment. The project site currently consists of a temporary parking lot, water transportation office, public restrooms, a segment of the 35-foot-wide Bayfront Promenade, and an existing large vessel slip marina located on the waterside portion of the site. The project site is located southeast of Marina Park Way and Embarcadero Marina Park South, and southwest of Convention Way. The project site is within Township 17 South, Range 3 West, Section 11 of the *Point Loma, California*, U.S. Geological Survey (USGS) 7.5-minute topographic map quadrangle.

The proposed project would construct an approximately 850-room hotel tower, an approximately 565-bed lower-cost visitor-serving hotel, retail development along the promenade, approximately 2.1 acres of public access plaza space, approximately 213 onsite parking spaces, a connecting bridge from the hotel public access plaza to the San Diego Convention Center, and a marina expansion. The project would also include the potential use of approximately 110 offsite parking spaces in the Convention Center garage and maintain the existing public in-bay water transportation system, including a water ferry service.

ICF International has been retained to conduct a record search and cultural resources assessment of the site to support an Environmental Impact Report on the proposed project. No archaeological survey was conducted as the property is fully developed and built over, or within the waters of San Diego Harbor.

A records search completed by the South Coastal Information Center (SCIC) indicated that no prehistoric archaeological sites have been previously recorded within or adjacent to the school. The Native America Heritage Commission completed a search of the Sacred Lands File which failed to indicate the presence of Native American cultural resources in the area. The NAHC identified you as a person who may have concerns or knowledge of cultural resources in the project area. Any information you might be able to share about the project area would greatly enhance the study and

would be most appreciated. This consultation is part of ICF's due diligence and not part of the AB52 consultation process.

If you have any recommendations regarding the proposed project, please address them to me so that I can incorporate them into our report.  As required by State law, all site data and other culturally sensitive information will not be released to the general public and will be kept strictly confidential. I can be reached at 858-444-3936, or by email at Karolina.chmiel@icfi.com.

Sincerely,

Karolina Chmiel, MA
Archaeologist

**Encl. Figure 1 –Project Location**

October 4, 2016

Viejas Band of Kumeyaay Indians
Robert J. Welch, Chairperson
1 Viejas Grade Road
Alpine, CA 91901

**Subject:** **Fifth Avenue Landing Project and Port Maser Plan Amendment, San Diego, San Diego County**

Dear Mr. Welch:

I am writing to inform you that the San Diego Unified Port District ("Port District") is proposing to redevelop a downtown site, including an area within the San Diego Harbor, as part of the Fifth Avenue Landing Project and Port Maser Plan Amendment. The project site currently consists of a temporary parking lot, water transportation office, public restrooms, a segment of the 35-foot-wide Bayfront Promenade, and an existing large vessel slip marina located on the waterside portion of the site. The project site is located southeast of Marina Park Way and Embarcadero Marina Park South, and southwest of Convention Way. The project site is within Township 17 South, Range 3 West, Section 11 of the *Point Loma, California*, U.S. Geological Survey (USGS) 7.5-minute topographic map quadrangle.

The proposed project would construct an approximately 850-room hotel tower, an approximately 565-bed lower-cost visitor-serving hotel, retail development along the promenade, approximately 2.1 acres of public access plaza space, approximately 213 onsite parking spaces, a connecting bridge from the hotel public access plaza to the San Diego Convention Center, and a marina expansion. The project would also include the potential use of approximately 110 offsite parking spaces in the Convention Center garage and maintain the existing public in-bay water transportation system, including a water ferry service.

ICF International has been retained to conduct a record search and cultural resources assessment of the site to support an Environmental Impact Report on the proposed project. No archaeological survey was conducted as the property is fully developed and built over, or within the waters of San Diego Harbor.

A records search completed by the South Coastal Information Center (SCIC) indicated that no prehistoric archaeological sites have been previously recorded within or adjacent to the school. The Native America Heritage Commission completed a search of the Sacred Lands File which failed to indicate the presence of Native American cultural resources in the area. The NAHC identified you as a person who may have concerns or knowledge of cultural resources in the project area. Any information you might be able to share about the project area would greatly enhance the study and

would be most appreciated. This consultation is part of ICF's due diligence and not part of the AB52 consultation process.

If you have any recommendations regarding the proposed project, please address them to me so that I can incorporate them into our report. As required by State law, all site data and other culturally sensitive information will not be released to the general public and will be kept strictly confidential. I can be reached at 858-444-3936, or by email at Karolina.chmiel@icfi.com.

Sincerely,

Karolina Chmiel, MA
Archaeologist

**Encl. Figure 1 –Project Location**

October 4, 2016

Manzanita Band of Kumeyaay
Angela Elliott Santos, Chairperson
P. O. Box 1302,
Boulevard, CA 91905

**Subject:** **Fifth Avenue Landing Project and Port Maser Plan Amendment, San Diego, San Diego County**

Dear Ms. Santos:

I am writing to inform you that the San Diego Unified Port District ("Port District") is proposing to redevelop a downtown site, including an area within the San Diego Harbor, as part of the Fifth Avenue Landing Project and Port Maser Plan Amendment. The project site currently consists of a temporary parking lot, water transportation office, public restrooms, a segment of the 35-foot-wide Bayfront Promenade, and an existing large vessel slip marina located on the waterside portion of the site. The project site is located southeast of Marina Park Way and Embarcadero Marina Park South, and southwest of Convention Way. The project site is within Township 17 South, Range 3 West, Section 11 of the *Point Loma, California*, U.S. Geological Survey (USGS) 7.5-minute topographic map quadrangle.

The proposed project would construct an approximately 850-room hotel tower, an approximately 565-bed lower-cost visitor-serving hotel, retail development along the promenade, approximately 2.1 acres of public access plaza space, approximately 213 onsite parking spaces, a connecting bridge from the hotel public access plaza to the San Diego Convention Center, and a marina expansion. The project would also include the potential use of approximately 110 offsite parking spaces in the Convention Center garage and maintain the existing public in-bay water transportation system, including a water ferry service.

ICF International has been retained to conduct a record search and cultural resources assessment of the site to support an Environmental Impact Report on the proposed project. No archaeological survey was conducted as the property is fully developed and built over, or within the waters of San Diego Harbor.

A records search completed by the South Coastal Information Center (SCIC) indicated that no prehistoric archaeological sites have been previously recorded within or adjacent to the school. The Native America Heritage Commission completed a search of the Sacred Lands File which failed to indicate the presence of Native American cultural resources in the area. The NAHC identified you as a person who may have concerns or knowledge of cultural resources in the project area. Any information you might be able to share about the project area would greatly enhance the study and

would be most appreciated. This consultation is part of ICF's due diligence and not part of the AB52 consultation process.

If you have any recommendations regarding the proposed project, please address them to me so that I can incorporate them into our report. As required by State law, all site data and other culturally sensitive information will not be released to the general public and will be kept strictly confidential. I can be reached at 858-444-3936, or by email at Karolina.chmiel@icfi.com.

Sincerely,

Karolina Chmiel, MA
Archaeologist

**Encl. Figure 1 –Project Location**

# Appendix F-2
# San Diego Rowing Club DPR 523L Update Form

**Page** 1 of 4 ***Resource Name or #:** San Diego Rowing Club

***Recorded by**: Timothy Yates ***Date**: 10/24/2016 ☐ **Continuation** ☒ **Update**

**P1. Other Identifier:** 525 East Harbor Drive, San Diego, 92101
**e. Other Locational Data**: Assessor Parcel Number: 7601070300

***P3a. Description:**
An ICF architectural historian field checked the San Diego Rowing Club (SDRC) building on October 24, 2016. The resource continues to exist at the location where it stood in 1978, when it was listed in the National Register of Historic Places (NRHP). At that time the building stood adjacent to fill land introduced to the setting in the mid-1970s (now a park and parking lot), which replaced open bay waters at the resource's southwest and a wharf at the northwest and north to which the building was originally connected by a gangway. Today, as a result of restoration and rehabilitation undertaken after the property was listed in the NRHP, the front portion of the building more closely resembles its appearance circa 1900 than it did in 1978. Present-day photographs of the resource are included below and referenced parenthetically in this description ("Photo 1," for example). Also referenced parenthetically for the purposes of historical comparison are photographs included with the NRHP nomination form for the property ("NRHP Photo 1" for example), which is attached to this DPR 523L Update form.

Irregular in plan, with a multi-ridged cross-gabled roof, the vernacular wood-framed building faces northwest and remains raised above harbor waters by non-original concrete pilings or piling caps instead of exposed wood pilings. The building's main original volume has the highest roof ridge and forms the west portion of the building's current footprint (Photo 1, NRHP Photo 1). A lower gabled wing extending to the northeast originally formed a boat launch at its northeast end when constructed in 1905 (Photos 1 and 2, NRHP Photo 2). Today, these northerly volumes more closely resemble the building's appearance in 1905 than the appearance it had by the 1930s, following several additions. A rear, intersecting gable-roofed volume extending to the southeast is a product of alterations since 1978, though the building did extend to the southeast with various gabled, flat and shed roof additions beginning in 1905 (Photo 3, NRHP Photos 2, 5, 13, and 19).

The building is approached from a parking lot to the northwest and a park to the southwest by piling-supported wood gangways. Exterior walls are clad in replacement board-and-batten that may be synthetic, but sensitively resembles the building's original board-and-batten cladding. Not present in 1978 when the building was nominated for NRHP listing, a restored veranda wraps from the main entrance at the west end of the front (northwest) elevation's lower gabled wing, across the higher gabled volume to the west, and across the southwest elevation. The veranda has exposed rafter tails, squared wood supports, and cross-braced wood railing, features which were part of the building's veranda during the first decade of the twentieth century (NRHP Photos 1-2). Although not part of the original building design, the wood cross-braced railing now lines both gangways and has been extended across the entirety of the building perimeter, including the building's non-original southeasterly wing. The northeast wing constructed in 1905 and originally incorporating a boat launch has been altered to accommodate perimeter circulation. Fenestration consists mainly of six-light wood-framed casement windows. Many are in non-original openings. Although the building has more windows than it did historically, the windows fit well with the property's historic vernacular design aesthetic. Entries are secured by wood doors with multi-light glazing. One of the building's most distinctive historical features occurs at the central ridge of its highest, main gabled volume. There, a cupola-like structure with board-and-batten cladding and four-light wood-framed windows forms the base of an observation deck resembling a widow's walk and incorporating wood cross-braced railing. At the northwest slope of the roof is a restored platform access consisting of a dormer-like structure clad in board and batten, stairs, and wood cross-braced railing. Present during the early twentieth century but not in 1978, the platform access was restored after the building was listed in the NRHP. Finally, at the rear of the building a gangway extends southeast to a replica of a boat launch that was positioned at the northeast side of the building circa 1900 (Photo 3, NRHP Photo 1). Like the original boat launch, the replica has a Dutch gable roof with exposed rafter tails supported by four pilings.

In addition to the heavily altered southeasterly rear portion of the building and the modified end of the northeast wing, other changes since 1978 include installation of "Joe's Crab Shack" signage at two locations on the building exterior and slightly raised skylights visible across several roof slopes.

***P3b. Resource Attributes:** HP13-Community Center/Social Hall; HP39-Other (Recreational Facility)

***P8. Recorded by:** Timothy Yates, Ph.D., ICF, 525 B Street, Suite B, San Diego, CA, 92111.

***P11. Report Citation:** Draft. ICF. 2017. *Fifth Avenue Landing Project EIR, Port of San Diego, San Diego, California*. Prepared for the San Diego Unified Port District, San Diego, California
(see page 2 continuation sheet)

**Page** 2 of 4 ***Resource Name or #:** San Diego Rowing Club

***Recorded by**: Timothy Yates ***Date**: 10/24/2016 ☐ **Continuation** ☒ **Update**

***B10. Significance:**
The SDRC was designated as a local historical landmark by the City of San Diego's Historical Resources Board and listed in the City's Register of Historical Resources in July 1975. The nomination for local designation is attached to this DPR 523L form. In January 1978, club members and local preservationists finally succeeded in their efforts to have the club building listed on the NRHP (Seymour 2011:18) (see page 2 continuation sheet). The NRHP nomination form for the resource did not specify any of the four NRHP Significance Criteria (see continuation sheet). It identified the resource's area of significance as "other, Sports" and emphasized its importance to San Diego's history of recreation generally and aquatic recreation specifically. As explained in the nomination,

> The SDRC is one of the oldest such clubs in California. Organized in 1888 as the Excelsior Rowing and Swimming Club, the club has been a major aquatic athletic organization in San Diego since its founding. Its membership included many civic leaders and important local persons. It was the major center of activity for aquatic sports in the City of San Diego throughout much of its history. It also was a leader in local social activities, sponsoring one of the earliest Sea Scout ship companies in California. Today it remains as the last surviving recreational boathouses in the city of San Diego, one of the last two on San Diego Bay, and the last to continue functioning in its original use (Unnamed Author 1978:8-1).

Accordingly, the SDRC should be considered significant under NRHP Criteria A, at the local level, for its importance within the context of recreational sports and aquatic athletics in San Diego history. As a property listed in the NRHP and in the City of San Diego's Register of Historical Resources, the SDRC qualifies as a historical resource under the California Environmental Quality Act (CEQA).

At the time the SDRC was listed in the NRHP, the building stood in a state of disrepair and under threat of demolition. The NRHP nomination noted that an engineering firm had evaluated the building's structural integrity and recommended "repair to the support piling and strengthening the building to resist contemporary design earthquake and wind loads" (Unnamed Author 1978:7-1). During the early 1980s a restaurant company, Chart House Enterprises, Inc. saved the building. As author Joey Seymour has explained in a history of the SDRC:

> A surprising 5-1 vote by the port commissioners on June 2, 1981, approved plans for the Chart House to move in and renovate SDRC's clubhouse. The Evening Tribune reported on July 3, 1981, 'Chart House says it will save as much of the old building as possible. It wants the real thing, not a replica. It says it will get to work as soon as a lease is signed and permits granted.' Goddard [vice president of Chart House Restaurants] dedicated $1.5 million to the project and, in June 1983, the clubhouse of the San Diego Rowing Club was reopened as the Chart House Restaurant. A dedication ceremony, much like the one held in 1900, took place on January 1, 1984. Members of the SDRC gathered at the restaurant for their annual dip into San Diego Bay (Seymour 2011:19).

The $1.5 million investment made by the Chart House included construction of a parking lot and bulkhead, but also substantial construction involving the SDRC building and its piling foundation. Wood pilings were either replaced or fitted with concrete jackets. The building was reduced in size from approximately 14,000 square feet to approximately 12,600 feet. Construction involving the building included "shoring and/or reinforcement of structural members, removal of debris from the water, and temporary removal of parts of the structure to gain access to, and to relieve structural loads on, adjacent and subjacent structures." Construction work on the building was conducted in accordance with "the State of California Historical Building Code, the Secretary of the Interior's 'Standards for Rehabilitation and Guidelines for Rehabilitating Restored Buildings,' and the Secretary of the Interior's 'Standards for Historic Preservation Projects'" (Chart House Enterprises 1981; Stoddard 1981 [quoted]).

The work undertaken by the Chart House changed building so that it would more strongly resemble its appearance during the first decade of the twentieth century. The SDRC's historical integrity of association was diminished by its adaptive reuse as a restaurant and the severing of its direct association with aquatic recreation. However, with respect to the resource's original 1899-1905 appearance, the improvements undertaken by Chart House Restaurants during the early 1980s actually improved the integrity of design, workmanship, and materials at the northern, front portions of the building. Despite the heavily altered southeasterly rear portion of the building, the modified end of the northeast wing, and the installation of "Joe's Crab Shack" signage and new skylights, the building better resembles its 1899-1905 appearance than it did when listed on the NRHP in 1978. Certainly the setting of the SDRC building has changed over the years. By 1978, former bay waters and a wharf to the north, west, and south of the building had been replaced by fill land that was eventually developed into a park and parking lots. Handball courts and other club facilities located on a small island created as a result of dredging activity in 1934, and connected to the club building by a gangway, were also eliminated by the 1970s fill project. Since 1978, development associated with the Civic Center, new recreational infrastructure, and construction of numerous high-rise hotels have replaced the earlier industrial harbor-front built environment in the vicinity of the SDRC (see page 3 continuation sheet).

**Page** 3 of 4 ***Resource Name or #** San Diego Rowing Club

***Recorded by**: Timothy Yates ***Date**: 10/24/2016 ☐ **Continuation** ☒ **Update**

***B10. Significance (cont.):**
However, the building continues to stand on pilings that raise it above tideland harbor waters . It thereby maintains a close spatial relationship to the water, which comprises the most important aspect of its integrity of setting. Overall, therefore, the SDRC building retains sufficient historical integrity to convey its historical significance.

***B12. References:**

Chart House Enterprises, Inc. 1981. Application for Department of the Army Permit. September 28. Port of San Diego, Chart House Inc., Part I, 019-1014. On file at the Port of San Diego.

Seymour, Joey. 2011. The History of the Resilient San Diego Rowing Club. *Journal of San Diego History*, 57 (Winter/Spring): 1-24.

Stoddard, Patrick E [Executive Vice President, Chart House Enterprises, Inc.]. 1981. Plans for Emergency Protective Measures for San Diego Rowing Clubhouse. September 21. Attachment A of Port of San Diego Costal Development Permit for San Diego Rowing Club—Emergency Repairs. October 2, 1981. Port of San Diego, Chart House Inc., Part I, 019-1014. On file at the Port of San Diego.

Unnamed Author. 1978. San Diego Rowing Club NRHP Nomination Form. Available: <http://focus.nps.gov/GetAsset?assetID=ea8f8e17-2c3e-4c89-babc-6e84bf884730>. Accessed October 29, 2016.

***B14. Evaluator:** Timothy Yates, Ph.D., ICF International, 525 B Street, Suite B, San Diego, CA, 92111

***Date of Evaluation:** November 29, 2016

***P5a. Photographs:**

Photograph 1. View to southeast toward front of San Diego Rowing Club. October 25, 2016

***Resource Name or #** San Diego Rowing Club

***Recorded by**: Timothy Yates ***Date**: 10/24/2016 ☐ **Continuation** ☒ **Update**

Photograph 2. View to southwest. October 24, 2016

Photograph 3. View northwest toward rear of building. October 24, 2016

Form No. 10-300 (Rev. 10-7[illegible] DATA SHEET

PH0692981

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

S.I.

# NATIONAL REGISTER OF HISTORIC PLACES INVENTORY -- NOMINATION FORM

FOR NPS USE ONLY
RECEIVED DEC 5 1978
DATE ENTERED AUG 30 1979

SEE INSTRUCTIONS IN *HOW TO COMPLETE NATIONAL REGISTER FORMS*
TYPE ALL ENTRIES -- COMPLETE APPLICABLE SECTIONS

## 1 NAME

MAY 22 1978
OHP

HISTORIC SAN DIEGO ROWING CLUB (Known originally as "Excelsior Rowing and Swimming Club")

AND/OR COMMON "

## LOCATION

STREET & NUMBER 525 E. Harbor Drive
__NOT FOR PUBLICATION

CITY, TOWN San Diego __VICINITY OF
CONGRESSIONAL DISTRICT 42

STATE California CODE 06 COUNTY San Diego CODE 073

## CLASSIFICATION

**CATEGORY**
- __DISTRICT
- X BUILDING(S)
- __STRUCTURE
- __SITE
- __OBJECT

**OWNERSHIP**
- __PUBLIC
- X PRIVATE
- __BOTH

**PUBLIC ACQUISITION**
- __IN PROCESS
- __BEING CONSIDERED

**STATUS**
- X OCCUPIED
- __UNOCCUPIED
- __WORK IN PROGRESS

**ACCESSIBLE**
- __YES: RESTRICTED
- X YES: UNRESTRICTED
- __NO

**PRESENT USE**
- __AGRICULTURE
- __COMMERCIAL
- __EDUCATIONAL
- __ENTERTAINMENT
- __GOVERNMENT
- __INDUSTRIAL
- __MILITARY
- __MUSEUM
- __PARK
- __PRIVATE RESIDENCE
- __RELIGIOUS
- __SCIENTIFIC
- __TRANSPORTATION
- X OTHER: Private Club

## OWNER OF PROPERTY

NAME San Diego Rowing Club (Building only. Lease is on tidelands)

STREET & NUMBER 525 E. Harbor Drive

CITY, TOWN San Diego __ VICINITY OF Fifth & Harbor Drive

STATE California (CONT.)

## LOCATION OF LEGAL DESCRIPTION

COURTHOUSE, REGISTRY OF DEEDS, ETC. County Recorder's Office

STREET & NUMBER 1222 First Avenue

CITY, TOWN San Diego STATE California

## 6 REPRESENTATION IN EXISTING SURVEYS

TITLE San Diego Historical Site No. 105, July 1975
(Site designation removed January 1977)

DATE July 11, 1975 __FEDERAL __STATE __COUNTY X LOCAL

DEPOSITORY FOR SURVEY RECORDS City Administration Building, Historical Site Board

CITY, TOWN San Diego STATE California

## 7 DESCRIPTION

**CONDITION**

__EXCELLENT
X_GOOD
__FAIR

__DETERIORATED
__RUINS
__UNEXPOSED

**CHECK ONE**

__UNALTERED
X_ALTERED

**CHECK ONE**

X_ORIGINAL SITE
__MOVED DATE________

DESCRIBE THE PRESENT AND ORIGINAL (IF KNOWN) PHYSICAL APPEARANCE

See page 3 (attached)
" Photos ( " )

The original structure of the Club House was built in 1899. This "Early Shingle Style" Architecture was executed in heavy wood timber and concrete piles construction. (see photo 1 and phase 1 as indicated in plan).

Description of the physical appearance in 1899 - San Diego Union dated January 1, 1900

The house rests on twenty-four 12x12 square pine timbers 24 feet long, which were driven about eight feet into the mud with a 2,300-pound pile-driver hammer. The caps, or girders, on which the joists of the house rests, are 2x18 (?) timbers let into the head of the piles on either side and bolted across through the head. The outside walls of the house are of boards and batten, and measure 45 feet in width and 82 feet in extreme length, with verandas 75 feet along and 6 and 3 feet in width, respectively on either side.

"The roof of the house projects over those verandas and rises at the ridgepoint twenty feet above the floor of the house, sloping to about eight feet at the walls. The house is approached from the steamship wharf by a short gangway. Fourteen feet from the wharf end of house a partition runs across the entire width. The space is subdivided into two ladies' club rooms, each about 14 feet square, that are divided by a sliding door, so that the two can be thrown into one large room. Beyond them are seven ladies' dressing rooms, each 4½ x 5 feet, and a room fitted up with a cement floor for a ladies' shower bath. Next is an office, 10x12 feet and a ladies' dressing room, 6x10 feet. A stairway leads from the office to the roof, leading out by a door and outside stairway on the roof to an observation platform, with railing, and a flagpole in the center and one on either corner. It is intended that the club pennant shall float from the center flag pole and the ladies' club pennants from the corner-poles".

"The main boat room of the club is 30x25 feet in size. The club at present owns nine single shells, one double, two four-oared shells, one eight-oared barge and one four-oared barge. It is proposed to purchase additional boats at an early date, and these, except the barges, will be stored in the main boat room".

"The men's dressing room adjoins the boat room, and is 16x45 feet containing four individual dressing-rooms and one general dressing-room with sixty lockers arranged in tiers across the width of the room. A man's shower-room, 8x12 feet, a sun room, 12x20 feet and a diving platform with springboard complete the accommodations of the house, which are not excelled by those of any other on the coast. Two barges are suspended from slings under a hood roof which rests on four piles adjoining the house. Between the piles is a divided float, approached from the house by a gangway, leading direct from the boat room and two stairways at either end of the house lead from the floor level to the water.

"The house is painted red, with roof and trimmings white, and presents a very handsome appearance. The lattice work in the windows, which cuts off much of the sun and air from the interior, will probably be removed. To a great extent the house depends upon skylights in the roof for its light."

Description of the physical appearance in 1905 - (see photo 2 and phase 2 of the Architectural plan).

Major addition was constructed in 1905, and adds approximately 5,000 sq. ft. to the existing Club House. The Reception room was completed for use of members and their guests. The small high windows were lowered and enlarged to become fine observation windows, affording a view of the bay in both directions. The roof of the House has been recovered over the Reception Room. The hand ball court has been moved from the north side to the south side of the boat room for the greater convenience of the players and those desiring to use boats. It also adds a new porch and two new steps for the swimmers and one new step for boats opposite the carpenter shop. The float piles were re-cemented and all piles cement washed and a new beacon light was put on the roof.

Description of the physical appearance in 1913.- (see photo 3 and phase 3 of Architectural plan).

During 1911 to 1913, the Club House had been greatly enlarged, making a larger sun room, boat house lunch room and gym room for wrestling and boxing with weight machines and rowing machines. Three new showers were added and a larger swimming porch with two spring boards. The roof was re-shingled, gravelled and tarred and a new sky-light was re-enforced with glass. The hand ball courts walls were extended making four walled courts.

From time to time there has been proper maintenance to the building.

The building is structurally sound and in an excellent location. We feel that it is important to preserve,as it reflects the early cultural development of San Diego.

## 8 SIGNIFICANCE

PERIOD

AREAS OF SIGNIFICANCE -- CHECK AND JUSTIFY BELOW

_PREHISTORIC
_1400-1499
_1500-1599
_1600-1699
_1700-1799
X 1800-1899
XX 1900-

_ARCHEOLOGY-PREHISTORIC
_ARCHEOLOGY-HISTORIC
_AGRICULTURE
_ARCHITECTURE
_ART
_COMMERCE
_COMMUNICATIONS

_COMMUNITY PLANNING
_CONSERVATION
_ECONOMICS
_EDUCATION
_ENGINEERING
_EXPLORATION/SETTLEMENT
_INDUSTRY
_INVENTION

_LANDSCAPE ARCHITECTURE
_LAW
_LITERATURE
_MILITARY
_MUSIC
_PHILOSOPHY
_POLITICS/GOVERNMENT

_RELIGION
_SCIENCE
_SCULPTURE
_SOCIAL/HUMANITARIAN
_THEATER
_TRANSPORTATION
X OTHER (SPECIFY)
Sports

SPECIFIC DATES 1899

BUILDER/ARCHITECT Architect unknown
J. H. Cassidy, Contractor

STATEMENT OF SIGNIFICANCE

Historical Significance: The San Diego Rowing Club was organized on June 1, 1888 by Charter Members Emanuel J. Lewis, George Marston (early mercantilist, philanthropist) Dr. F. R. Burnham (early physician) Captain Paul Hemus, and W. W. Whitson (first San Diego County Coroner). For many years it was the most important men's club in San Diego as well as being San Diego's first rowing club. Early records show that there was great interest in rowing and swimming and the club, first known as the Excelsior Rowing and Swimming Club was organized to further these interests. The Club came to be known as the "Father of Aquatic Sports" in San Diego. Rowing still concerns the Club and approximately 300 hours are still rowed per month. The name was changed to the present title on September 2, 1891 as the Club wished to be geographically identified in competition. On September 14, 1895, it incorporated. Originally the Club was affiliated with the Pacific Association of Amateur Oarsmen, competing with California and Canadian teams and in national competition with Philadelphia and Chicago. Since the mid forties, the Club has been a member of the National Association of Amateur Oarsman; it competes today on a limited basis.

Competition Sports: Rowing. In competition rowing teams took first place consistently. In 1964, Jim Storm took second place winning a silver medal at Olympics in Tokyo. In 1966, the Club placed second in the rowing championships at Bled, Yugoslavia. In 1974, Kearney Johnston, the Club's Chief Rowing Instructor since 1935, won a gold medal at the International Veteran's Rowing Regatta at Bern, Switzerland; he also competed in Mexico in 1977, placing fourth in the Veteran's Singles. Johnston epitomizes the philosophy of the club which is that all coaching is volunteer. He has guided rowers and estimates he has taught near 5000 men to row. At the turn of the century, the Club extended its facilities to the early women's clubs: the La Sienas, Oceanids, Nerids and the Columbias; Handball: Handball was begun in 1902 for the San Diego area as a conditioning adjunct for rowing. Competition today is in the Lefty Cowle Open Tournament which began in 1974. It is open to national competition. Swimming: Swimming was part of the earliest sport and early pictures show extensive sun bathing. The Club competed in swim metes. In 1902, Howard Brewer, nationally known, broke his own open water record at the SDRC. In 1920, Clarence Pinkston was a champion Olympic diver; he trained at the club. Beginning in the mid 1890's the Club sponsored the New Year Dip to advertise San Diego's "salubrious climate" and it continues today. Early Chamber of Commerce brochures used pictures from these events. Bowling: The SDRC League, consisting of 8 teams, was organized in 1920 and still meets today

Service To The Community: In national competition, the Club has been the emissary of San Diego. The local universities of UCSD, SDSU, and USD as well as the local highschools have used the facilities of the Club. The Sea Scouts a branch of the Boy Scouts of America, have quartered here since 1922. Since

## 9 MAJOR BIBLIOGRAPHICAL REFERENCES

1. San Diego Rowing Club Private Papers
2. Archival Material: San Diego Historical Society Library & Manuscripts Coll
3. " " The San Diego Public Library, The California Room
4. Interviews with early members

## 10 GEOGRAPHICAL DATA

ACREAGE OF NOMINATED PROPERTY 3.67 acre

UTM REFERENCES

| | ZONE | EASTING | NORTHING | | ZONE | EASTING | NORTHING |
|---|---|---|---|---|---|---|---|
| A | 1 1 | 4 8 4 8 0 0 | 3 6 1 8 3 4 0 | B | | | |
| C | | | | D | | | |

VERBAL BOUNDARY DESCRIPTION

The SDRC is located on the tidelands of San Diego Bay east of the in-proces Marina Park, north of the Campbell Industries, south of the Police Station and west of Harbor Drive. at 525 East Harbor Drive, San Diego, California. The nominated property occupies a 400' by 400' square adjacent to the U.S. Bulkhead line (seawall) as shown on attached site plan.

LIST ALL STATES AND COUNTIES FOR PROPERTIES OVERLAPPING STATE OR COUNTY BOUNDARIES

| STATE | CODE | COUNTY | CODE |
|---|---|---|---|
| N/A | | | |
| | | | |

## 11 FORM PREPARED BY

NAME / TITLE Pat Schaelchlin, Historical Researcher
Frank Wong, Architectural Research & Preparation

ORGANIZATION San Diego Rowing Club

DATE May 17, 1978

STREET & NUMBER 525 E. Harbor Drive

TELEPHONE (714) 232-1898

CITY OR TOWN San Diego,

STATE California

## 12 STATE HISTORIC PRESERVATION OFFICER CERTIFICATION

THE EVALUATED SIGNIFICANCE OF THIS PROPERTY WITHIN THE STATE IS:

NATIONAL ___ STATE ___ LOCAL ✓

As the designated State Historic Preservation Officer for the National Historic Preservation Act of 1966 (Public Law 89-665), I hereby nominate this property for inclusion in the National Register and certify that it has been evaluated according to the criteria and procedures set forth by the National Park Service.

STATE HISTORIC PRESERVATION OFFICER SIGNATURE Knox Mellon 11-29-78

TITLE

DATE

FOR NPS USE ONLY

I HEREBY CERTIFY THAT THIS PROPERTY IS INCLUDED IN THE NATIONAL REGISTER

Carol Shull

DATE 8-30-79

~~DIRECTOR, OFFICE OF ARCHEOLOGY AND HISTORIC PRESERVATION~~ [illegible]

ATTEST:

DATE 8-29-79

KEEPER OF THE NATIONAL REGISTER

Form No. 10-300a
(Rev. 10-74)

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

# NATIONAL REGISTER OF HISTORIC PLACES INVENTORY -- NOMINATION FORM

DEC 5 1978
AUG 30 1979

**CONTINUATION SHEET** **ITEM NUMBER** 4 **PAGE** 2

Owners of Property, cont.

~~Port of San Diego~~
~~P.O. Box 488~~
~~San Diego, CA 92112~~

All tidelands are the property of the State of California. The San Diego Unified Port District is a non-profit corporation whose Board of Commissioners are appointed to administer the district in accordance with State Public Law 41 for the benefit of the people.

1937, they have used one end of the Brennan Island facility to store their gear and as their headquarters. Philosophy of the Club: In the words of early members, the Club was a "plain club, minus frills, offering fellowship and a stimulating life to its members". It "aspired to be an organization giving service to the young men of the community to compete in a clean decent place without any particular sectarian dedication". Early prominent members: Mayors James E. Wadham, Harley Knox, John Butler, Percy Benbough, Charles Dail; San Diego County Supervisor and SDRC Secretary for many years DeGraff Austin; Real estate Developer Charles F. O'Neall; Doctors H E. Andrews, Howard Bard, Clarence Reese; Banker Andy Borthwick; Fire Chiefs George Courser and Louis Almgren; Police Chief Elmer Jansen; Marshall McComb of the State Supreme Court; Judge William A. Sloane, Associate Justice of the Supreme Court; and current Judges Ben Hamrick and Earl Maas; Early merchantilists Melville Klauber and the three brothers Dick, George and Joe Jessop. These are only a few of the city's decision makers who enjoyed the Club's downtown location. At one time it boasted a membership of over 1000; today its membership is not as high but a new revitalization has taken place.

FHR-8-300A
(11/78)

UNITED STATES DEPARTMENT OF THE INTERIOR
HERITAGE CONSERVATION AND RECREATION SERVICE

FOR HCRS USE ONLY
RECEIVED AUG 1 1979
DATE ENTERED AUG 30 1979

# NATIONAL REGISTER OF HISTORIC PLACES INVENTORY -- NOMINATION FORM

**CONTINUATION SHEET** **ITEM NUMBER** 7 **PAGE** Addendum page 1

## ADDENDUM

The San Diego Rowing Club is located on the northeastern shore of San Diego Bay near the foot of Fifth Street. The building originally stood on pilings over open water several hundred feet from shore, connected to land by a narrow wooden causeway. Recent land fill operations have enclosed the westerly and southerly sides of the building and have eradicated the open aspect of the building's original appearance. This area is to become parking space for a public park.

The original building was a board and batten single-wall wooden structure approximately 45 by 82 feet in size. It had open verandas on two sides, a medium gabled roof with a walkway and observation platform in the center of the roof. The original building contained two club rooms, dressing rooms, showers, office, sun room, and a large boat room. In 1905 the building was extended to the northeast and northwest with a 5000 square foot addition. As the club grew, it was necessary to expand again. Between 1911 and 1913, the building was enlarged on the southeast side, adding a larger sun-room, boat house lunch room and gym. New showers were added. Interior modifications were made throughout the building to accommodate the club's needs. The northeast exterior wall was resided to unify the 1905 and 1913 additions into a single surface. Later in 1932, an 8 foot extension leading to the boat dock was added to this wall to accommodate the first 8 oared shells bought by the club. With this final addition, the building archieved its present configuration. Other subsequent alterations have been minor and have been restricted primarily to window modifications, a small addition to the entrance, and the replacement of the window pane screen around the sundeck with a solid wooden fence. The historic barn red paint scheme has been replaced by white paint. Supporting pilings show advanced deterioration.

The San Diego Rowing Club building on San Diego Bay was recently reviewed by a Structural Engineering Firm to evaluate the feasibility of restoring its structural integrity. Briefly, themodifications necessary to restore its structural integrity consist of repair to the support piling and strengthening the building to resist contemporary design earthquake and wind loads. The piling repair would require cutting off the existing piles at the mud line, and splicing new pole tops to the existing lower portions. The building would be strengthened by adding either plywood or horizontal bracing to the existing roof, and adding selected wall sheathing as required. These strengthening operations are considered feasible and can be accomplished while preserving the historical architectural attributes.

A later facility, the Brennan Island handball court was constructed in 1937, and was connected to the San Diego Rowing Club by a wooden causeway. This facility has now been surrounded by landfill and is no longer part of the Rowing Club. It is not included in this nomination.

At present the facility is in limited use. Major activities have been moved to Mission Bay, 10 miles to the northwest. The club is retaining some rowing activities

FHR-8-300A
(11/78)

UNITED STATES DEPARTMENT OF THE INTERIOR
HERITAGE CONSERVATION AND RECREATION SERVICE

# NATIONAL REGISTER OF HISTORIC PLACES INVENTORY -- NOMINATION FORM

FOR HCRS USE ONLY
RECEIVED AUG 1 1979
DATE ENTERED MAR 30 1979

**CONTINUATION SHEET** **ITEM NUMBER** 7 **PAGE** Addendum page 2

at this site, and hopes to continue this use of the property, providing that the threat of demolition can be removed.

Piling repair has been halted until the Register application has been reviewed. The posture of the San Diego Harbor commissioners is one of antagonism toward restoration efforts. However, the club has not been boarded up and the building continues in daily use for rowing. No other uses can be made of the premises, since a fire inspector's declaration that the building is hazardous for occupancy. This ruling pertains mostly to restaurant operations, consequently rowing is permissible. Among current possibilities are the rejuvenation of the building and its rental to waterfront-oriented businesses. One engineering firm has declared its interest for thie purpose. Another propect is to use a portion of the building for rowing and use the remainder as a public museum. A third route--but remote--is a wholesale overhaul of the bulding by popular support. However, the atmosphere created by United Port District policy among the business community continues to mitigate against this endeavor.

FHR-8-300A
(11/78)

UNITED STATES DEPARTMENT OF THE INTERIOR
HERITAGE CONSERVATION AND RECREATION SERVICE

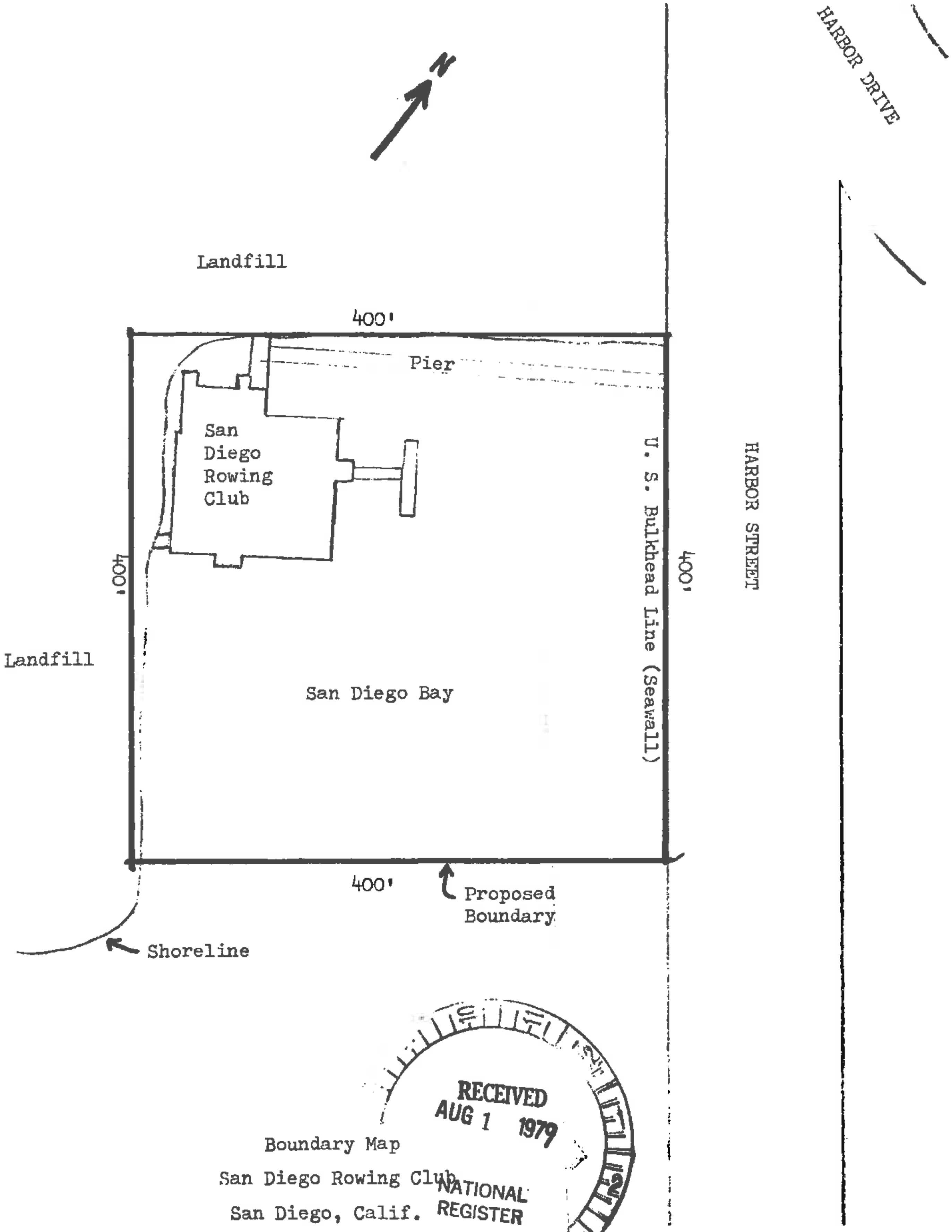
# NATIONAL REGISTER OF HISTORIC PLACES INVENTORY -- NOMINATION FORM

FOR HCRS USE ONLY
RECEIVED AUG 1 1979
DATE ENTERED [illegible] 1979

**CONTINUATION SHEET** **ITEM NUMBER** 8 **PAGE** Addendum page 1

## ADDENDUM

The San Diego Rowing Club is one of the oldest such clubs in California. Organized in 1888 as the Excelsior Rowing and Swimming Club, the club has been a major acquatic athletic organization in San Diego since its founding. Its membership included many civic leaders and important local persons. It was the major center of activity for acquatic sports in the City of San Diego throughout much of its history. It also was a leader in local social activities, sponsoring one of the earliest Sea Scout ship companies in California. Today it remains as the last surviving repreational boathouse in the city of San Diego, one of the last two on San Diego Bay, and the last to continue functioning in its original use.



Boundary Map
San Diego Rowing Club
San Diego, Calif.

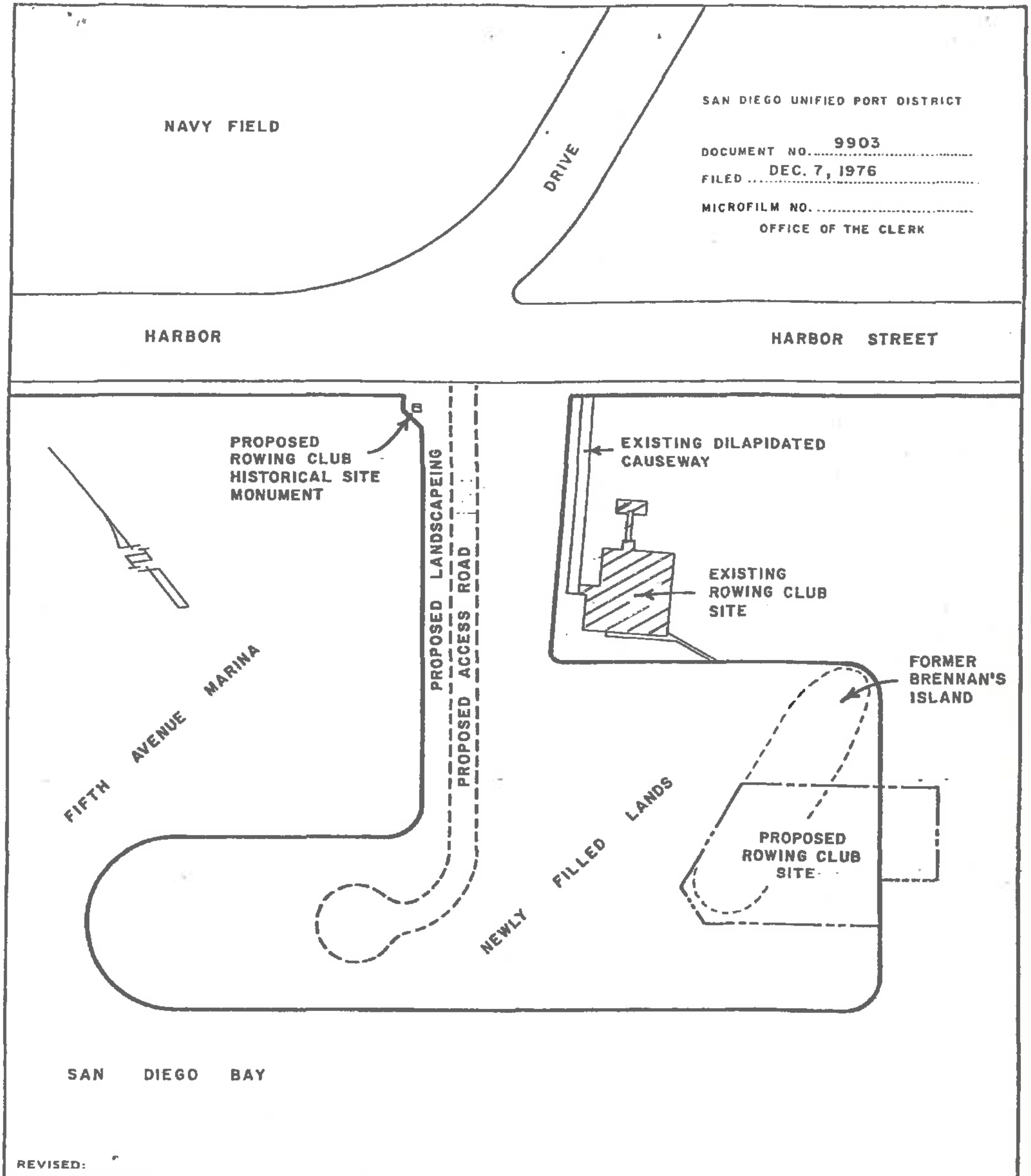
SAN DIEGO UNIFIED PORT DISTRICT

DOCUMENT NO. 9903

FILED DEC. 7, 1976

MICROFILM NO.

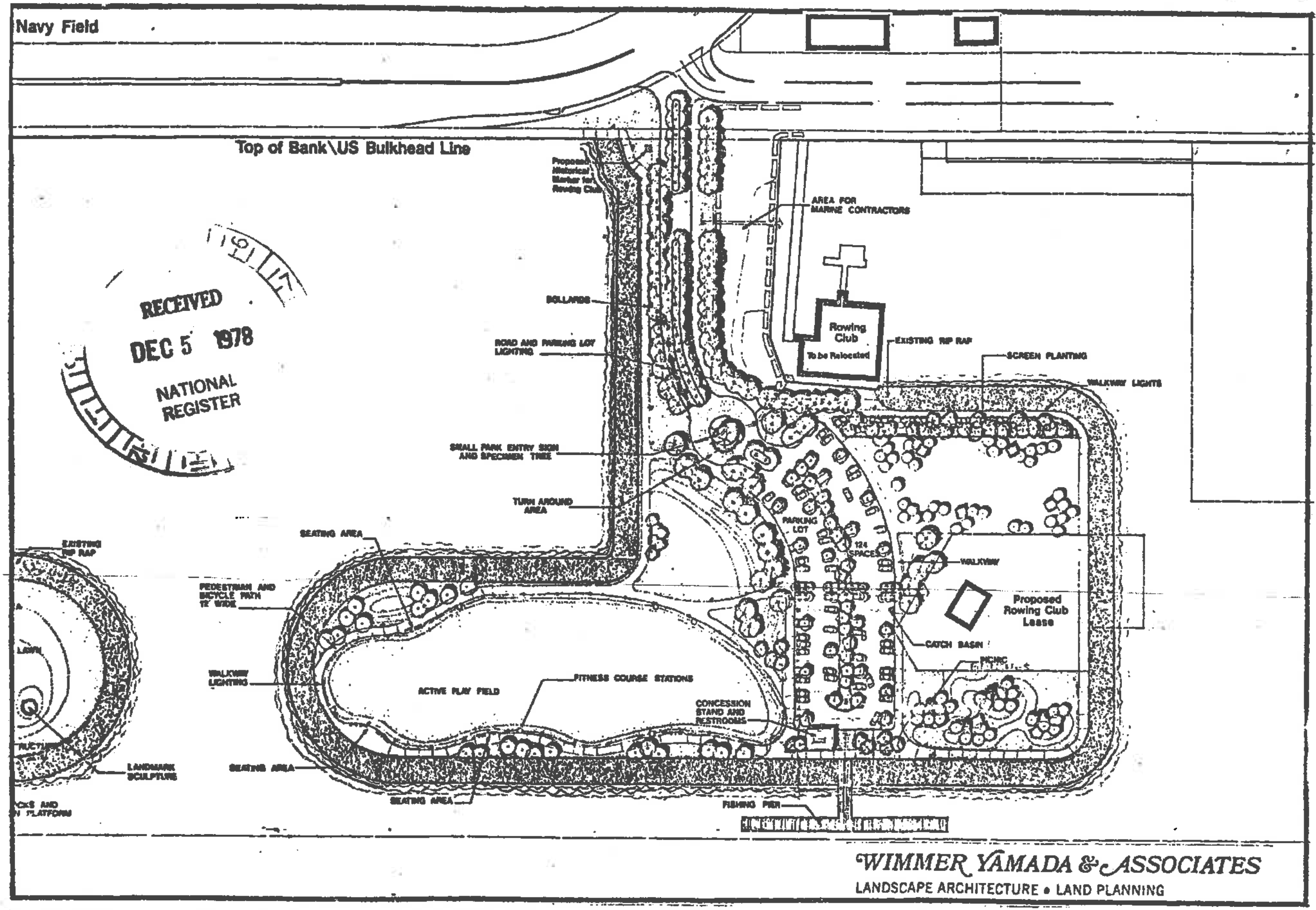
OFFICE OF THE CLERK



REVISED:

| | | |
|---|---|---|
| DRAWN ANDRECHT<br>CHECKED<br>REVIEWED | SAN DIEGO UNIFIED PORT DISTRICT | DATE 7 DEC. 1976<br>SCALE NONE<br>REF. |
| APPROVED<br><br>CHIEF ENGINEER | MARINA PARK<br>SOUTH PENINSULA | DRAWING NO.<br>550 - MB |

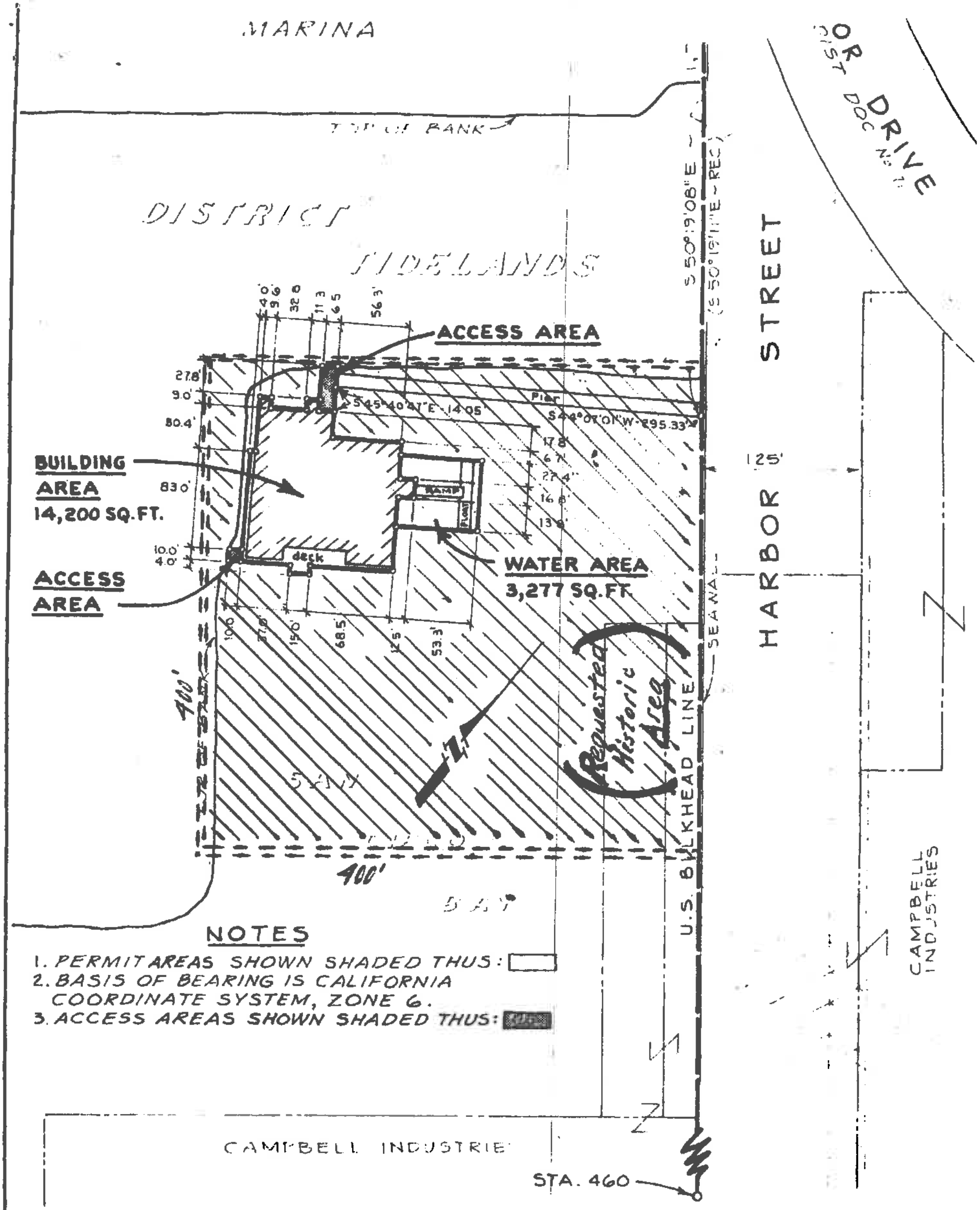
RECEIVED
DEC 5 1978
NATIONAL REGISTER



scale
0 50 100'
planning department

Planning District 3
CENTER CITY
EMBARCADERO

# Embarcadero Marina Park South



## NOTES

1. PERMIT AREAS SHOWN SHADED THUS: ☐
2. BASIS OF BEARING IS CALIFORNIA COORDINATE SYSTEM, ZONE 6.
3. ACCESS AREAS SHOWN SHADED THUS: ■

REVISED: FROM 1965-B, 13 SEPT 1978, BY K.A., APPROVED BY CHIEF ENGINEER:

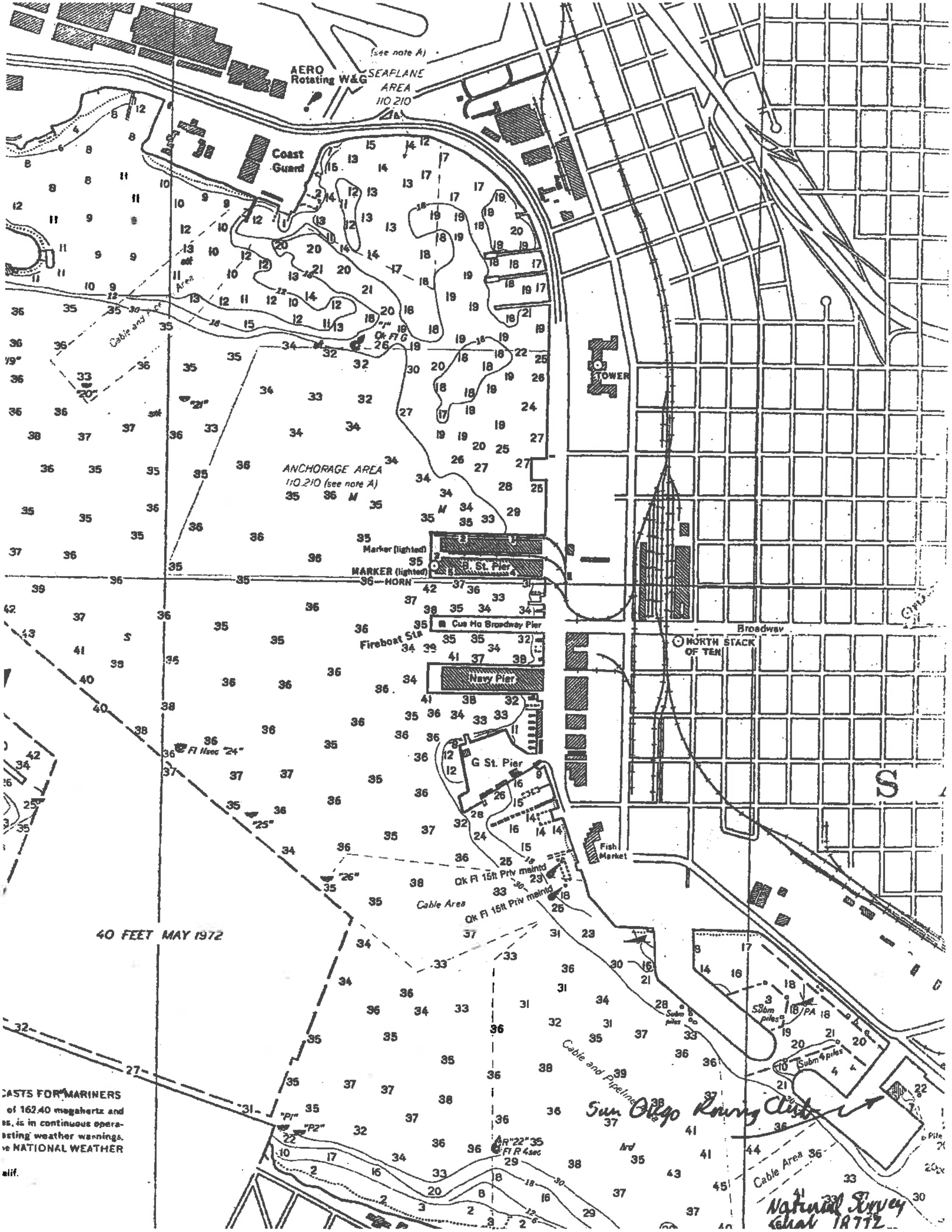
DRAWN BOHNENKAMP
CHECKED
REVIEWED

APPROVED

**SAN DIEGO UNIFIED PORT DISTRICT**
TIDELAND USE AND OCCUPANCY PERMIT
WITHIN CORPORATE LIMITS OF SAN DIEGO

DATE 24 APRIL 19
SCALE 1" = 100'
REF. F.B. 318, 2E-

DRAWING NO.



San Diego Rowing Club

National Survey Chart 18772

San Diego Rowing Club
San Diego, California
Photographer Unknown  C. 1900
Location of negative unknown
West view
No. 1

San Diego County

[illegible] 30 [illegible]

DEC 5 19[illegible]

AUG 27 1979

SAN DIEGO
ROWING CLUB
August 1908

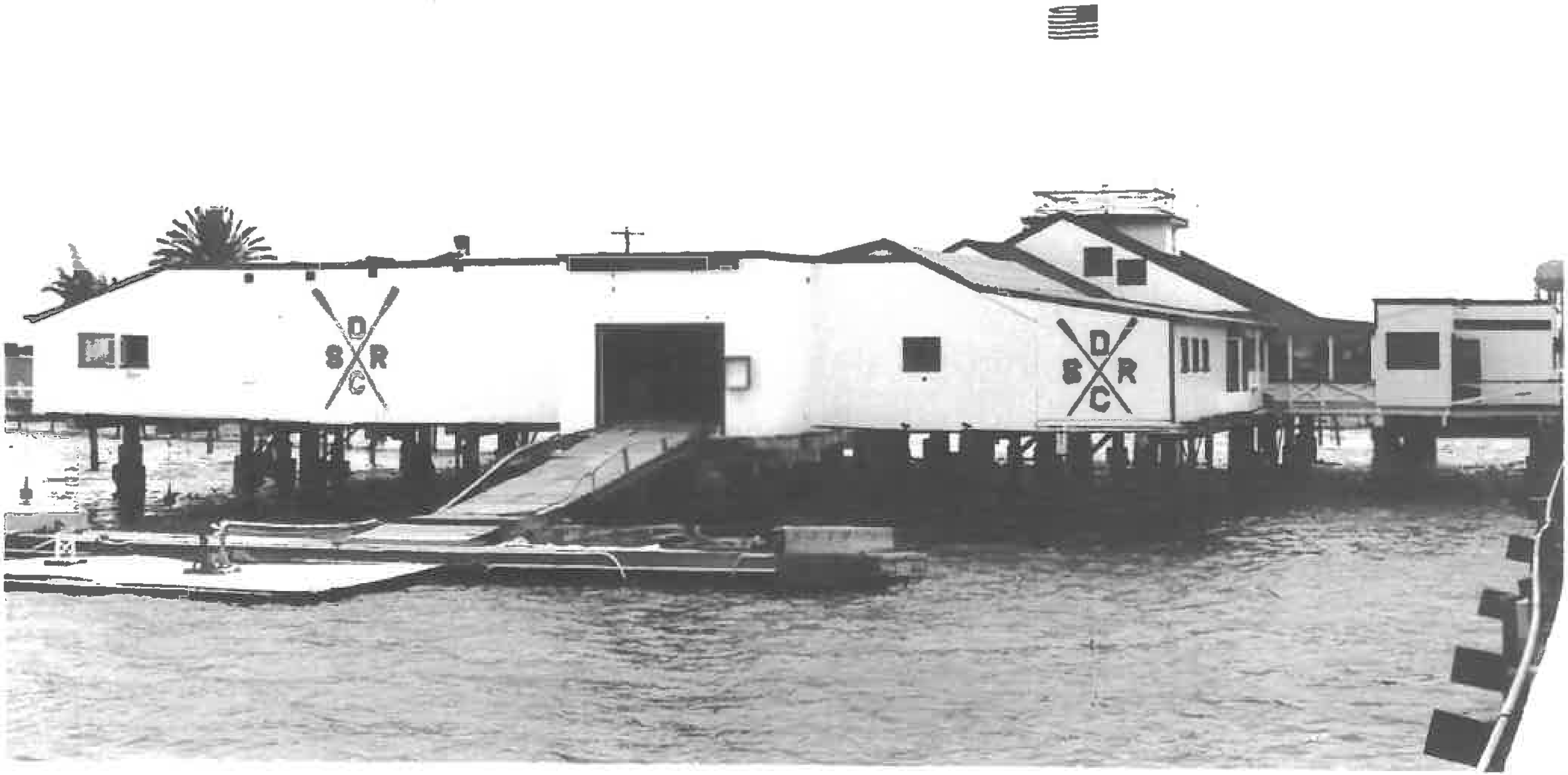
San Diego Rowing Club
San Diego, California
Photographer Unknown C. 1908
Location of negative unknown
West view
No. 2

[illegible] 30 [illegible]

DEC 5 1978

AUG 27 1979

SAN DIEGO COUNTY


S D R C
S D R C

[illegible] 30 [illegible]

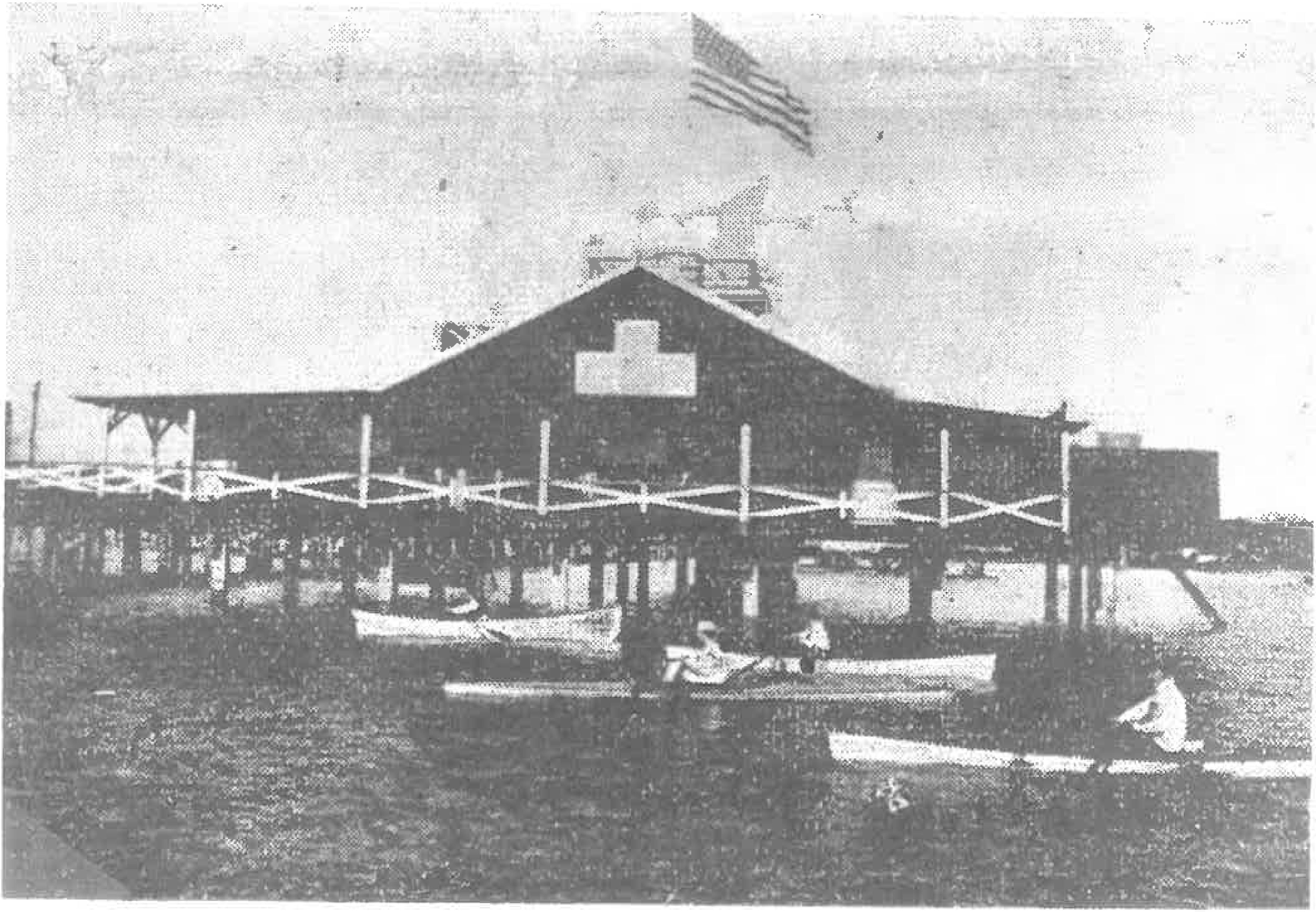
AUG 30 1979

AUG 27 1979

San Diego Rowing Club
San Diego, California
Photographer Unknown 1978
Location of negative unknown
West view
No. 3

DEC 5 1978

SAN DIEGO CO.



SAN DIEGO COUNTY

San Diego Rowing Club
San Diego, California
Photographer Unknown c. 1900
Location of negative unknown
East view
No. 4


SAN DIEGO ROWING CLUB

SAN DIEGO ROWING CLUB

SAN DIEGO COUNTY

PHOTO 5

1915

SAN DIEGO ROWING CLUB

SAN DIEGO COUNTY

PHOTO 6

1977 New Year's Day Swim

STEPHEN BLAKE PHOTO
326 Broadway, Rm. 201
San Diego, C  2101
(714) [illegible]-8088
Order Reprints Anytime

San Diego Rowing Club
252 E. Harbor Drive, San Diego, CA
Photographer: Stephen Blake
Negative at 326 Broadway, Room 201, San Diego, CA 92101
January 1, 1977
Southeast face of bulding. Annual New Year's Day swim.

Photo No. 701001

AUG 30 1979

7

AUG 1 1979

San Diego County


S. D. ROWING CLUB

This photo (dated July 12, 1936) shows the 8' extension built in 1932 to accommodate the first 8-oared shells bought by the Club.

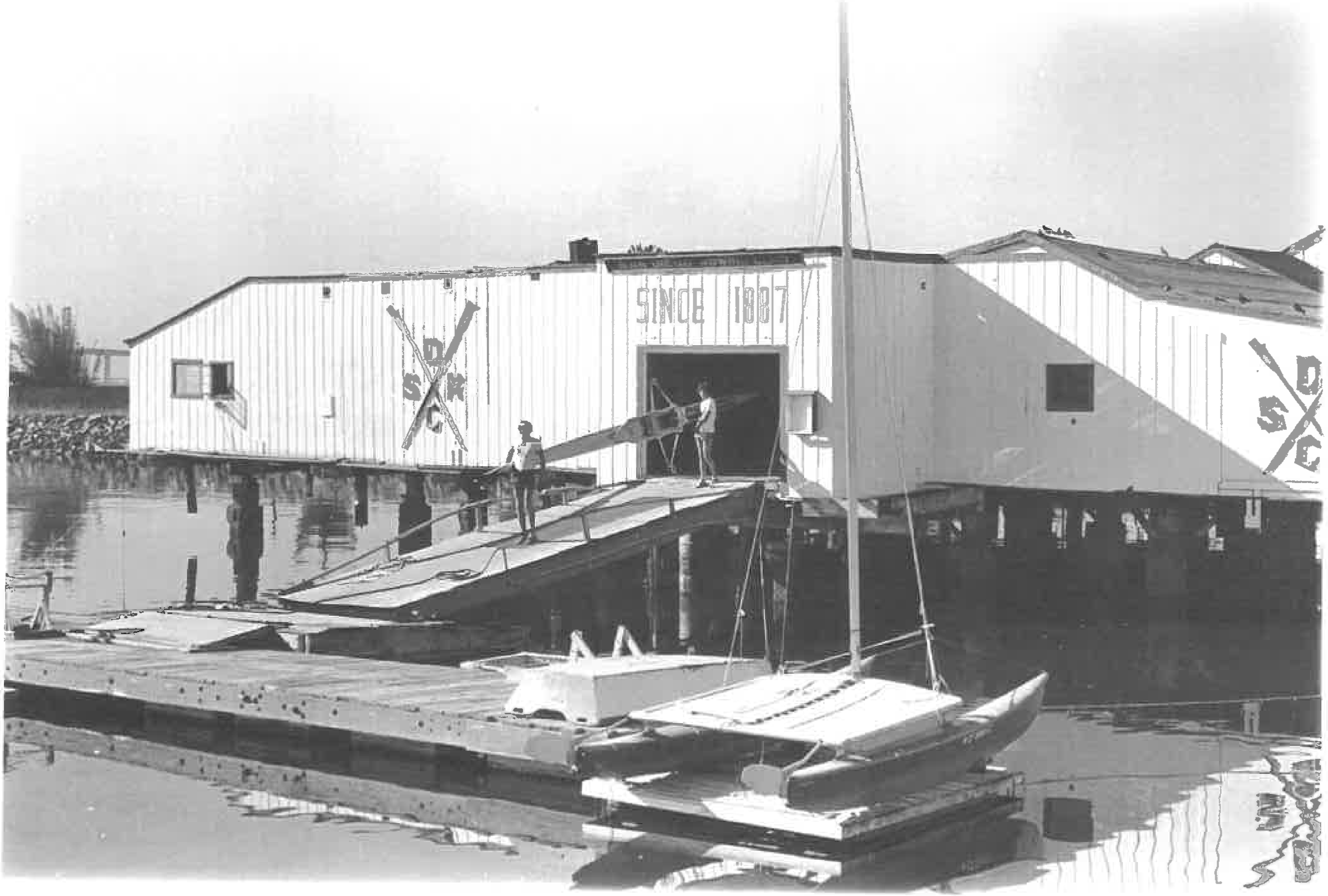
San Diego Rowing Club
252 E. Harbor Drive, San Diego, CA
Photographer not given
negative at San Diego Rowing Club
July 12, 1936
Historic photograph.= Close up of northeast side showing 8' extension built in 1932 to accommodate the first 8-oared shells bought by

Photo No. 8

AUG 30 1979

San Diego County

AUG 1 1979


SINCE 1887
D
S R
C
D
S
C

San Diego Rowing Club San Diego Co.
252 E. Harbor Drive, San Diego, CA
Photographer not given
negative at San Diego Rowing Club
1978
View of northeast side
Photo No. 806553
9

AUG 30 1979

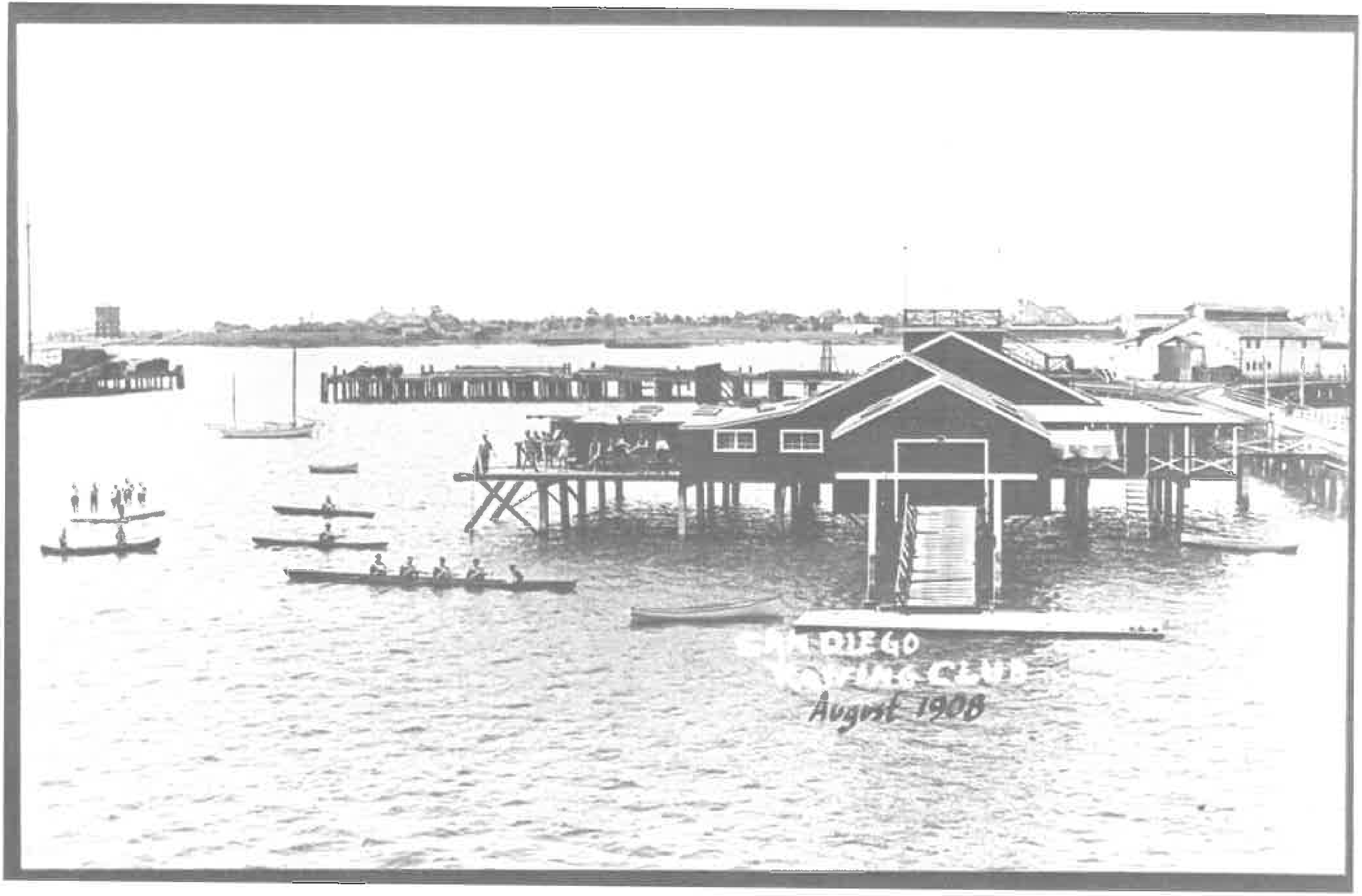
AUG 1 979


SAN DIEGO ROWING CLUB

Aaron:

This photo (1929-1930) shows the Clubhouse virtually unchanged since the 1913 addition (Phase III). The next change (1932) added the 8' extension to the boat entrance.

San Diego Rowing Club San Diego Co.
252 E. Harbor Drive, San Diego, CA
Photographer not given AUG 30 1979
negative at San Diego Rowing Club
Approximately 1929 or 1930
Historic photo showing northeast side of
Rowing Club AUG 1 1979
Photo No. 10


DIEGO
WING CLUB
August 1908

August 1978

Photo 506341

(This was reproduced from an original photograph, which was assigned the same serial.)

This is the north face of the SD Rowing Club. The central foreground portion containing the racing boats, which are still handled from the float. The outdoor boxing area is now enclosed. Skylights illuminate clothing locker spaces today. Administrative & carpenter shop areas are on the right (west) side of the building.

The pier structures in the background are today occupied by land fill, as is shown on the property maps, Sheet 19 of 2E

San Diego Rowing Club San Diego Co.
252 E. Harbor Drive, San Diego, CA
Photographer not given
negative at San Diego Rowing Club AUG 30 1979
August 1908
Historic view showing northeast side of building.
Photo No. 506341 AUG 1 1979

San Diego Rowing Club
252 E. Harbor Drive, San Diego, CA
Photographer not given
negative at San Diego Rowing Club
June 1978
Southeast corner
Photo No. 812340

12

San Diego County

AUG 30 1979

AUG 1 1979


SINCE 1887
D
S R
C
D
S R
C

708007 Aug 1977 San Diego Rowing Club

San Diego Rowing Club San Diego Co.
252 E. Harbor Drive, San Diego, CA
Photographer not given
negative at San Diego Rowing Club
August 1978
Northeast side. View similar to historic photo (506341) of 1908.
Photo No. 708007
23

AUG 30 1979

AUG 1 1979


SAN DIEGO ROWING

708010 Aug 1977

San Diego Rowing Club

San Diego Rowing Club San Diego Co.
252 E. Harbor Drive, San Diego, CA
Photographer not given
negative at San Diego Rowing Club
August 1977
Southwest side, prior to replacement of fence.
New landfill shows in foreground.
Photo No. 708010
74

AUG 30 1979

AUG 1 1979


UNION BANK

708009 Aug 1977 San Diego Rowing Club

San Diego Rowing Club San Diego Co.
252 E. Harbor Drive, San Diego, CA
Photographer not given
negative at San Diego Rowing Club
August 1977
southeast side, used as swimming area. Card & exercise rooms on right. Locker rooms on left.
Photo No. 708009

AUG 1 1979

AUG 30 1979

15

708002 Aug 1977 San Diego Rowing Club

San Diego Rowing Club
252 E. Harbor Drive, San Diego, CA
Photographer not given
negative at San Diego Rowing Club
August 1977
Northwest side with entrance hall in center
Photo No. 708002

AUG 30 1979

San Diego County

AUG 1 1979

16

708004 Aug 1977 San Diego Rowing Club

AUG 30 1979

AUG 1 1979

San Diego Rowing Club
252 E. Harbor Drive, San Diego, CA
Photogrpher not given
negative at San Diego Rowing Club
August 1977
Northwest corner. Office windows are to left of main entrance, where men are standing.
Photo No. 708004

17 San Diego County

708011 Aug 1977

San Diego Rowing Club
252 E. Harbor Drive, San Diego, CA
Photographer not given
negative at San Diego Rowing Club
August 1977
Southeast side, prior to replacement of fence.
Photo No. 708011

San Diego County

AUG 30 1979

18

AUG 1 1979


SAN DIEGO ROWING

8/1966
608001

San Diego Rowing Club

San Diego Rowing Club
525 E. Harbor Drive, San Diego, CA
Photographer not given
negative at San Diego Rowing Club
August 1966
Southeast face of building. Enclosed sundeck on left. Locker rooms behind blue wall. Two rooms are on the right.

San Diego Co.

Photo No. 608001

19

AUG 30 1979

AUG 1 1979


R

708019 Aug 1977

San Diego Rowing Club

San Diego Rowing Club San Diego Co,
252wE. Harbor Drive, San Diego, CA
Photographer Not given
negative at San Diego Rowing Club
August 1977
Northwest corner at the main entrance. Carpenter shop and office windows at left.
Photo No. 708019

AUG 30 1979

G 30 1979

AUG 1 1979

20

708001 Aug 1977 San Diego Rowing Club

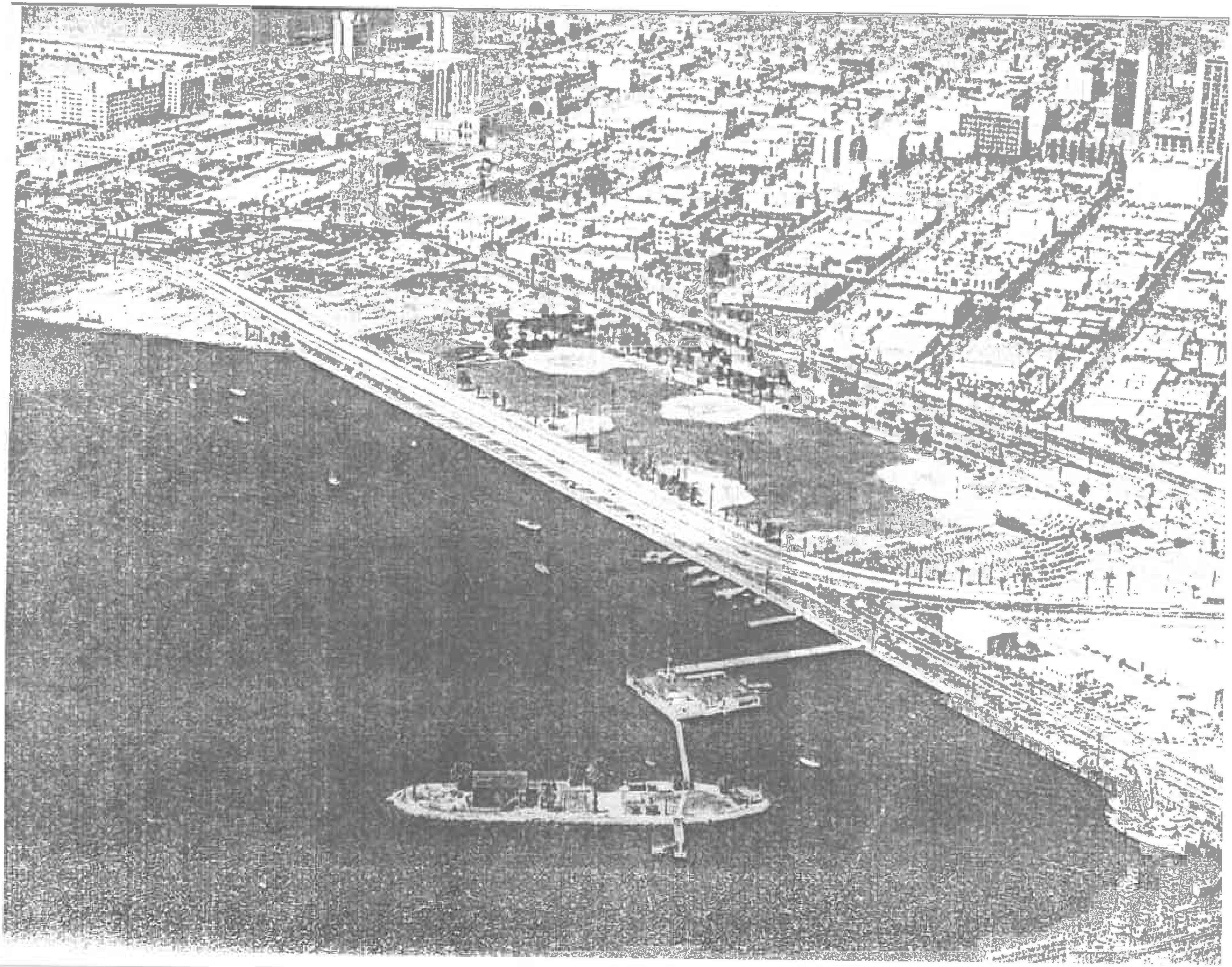
San Diego Co.

San Diego Rowing Club
525 E. Harbor Drive, San Diego, CA
Photographer not given
negative at San Diego Rowing Club
August 1977
Southwest corner. Glass pane area looks into dining/dance room. Ladies' locker space has two small windows. Exterior glass panes enclose sundeck on right
Photo No. 708001

AUG 30 1979

21

AUG 1 1979



505575

15 March 1979

Copied from Serial 505575, dated 1975.

The view shown here is the San Diego Rowing Club boat house, which has been nominated for application & designation in the National Register Inventory, and Brennan Island handball courts building as they appeared in 1975. Land fill has completed the enclosure of these buildings as can be seen by examining Marina Park South Peninsula Drawing 550-MB of December-1976

At the present time, the buildings are entirely (Brennan Island) or partially (club building) surrounded by landfill. See Drawing 550-MB and Xerox copy of National Ocean Survey Chart 18772.

San Diego Rowing Club
252 E. Harbor Drive, San Diego, CA
Photographer not given
negative at San Diego Rowing Club
1975
Aerial view from south prior to construction of landfill. Brennans Island appears in foreground, this facility is now entirely surrounded by landfill. Landfill abuts northwest and southwest sides of Rowing Club.
Photo No. 505575

SAN DIEGO CO.

SDET (21 Mar)1978 B1 # 883021

Photo 883021

San Diego Rowing Club

SAN DIEGO CO.

252 E. Harbor Drive, San Diego, CA
Photographer not given
negative at San Diego Rowing Club
March 1978
Northeast side, showing approach causeway.
Photo No. 803021

State of California - The Resource Agency
DEPARTMENT OF PARKS AND RECREATION

# PRIMARY RECORD

Survey #:
DOE #:

Primary #:
HRI #:
Trinomial:
NRHP Status Code:
Other Listings:
Review Code: Reviewer:
Date: -/-/-

*Resource Name or #: San Diego Rowing Club

**P1. Other Identifier:**

***P2. Location:** ☐ not for publication ☒ unrestricted ***a. County**

**and** (P2c, P2e, and P2b or P2d. Attach a Location Map as Necessary)

**b. USGS 7.5' Quad:** YEAR: T ;R ; of of Sec ; B.M.

**c. Address:** 525 E Harbor Dr City: San Diego State: CA Zip Code: 92101

**d. UTM:** (Give more than one for large and/or linear resources) Zone: ;-117.16361 mE/ 32.704761 mN

**e. Other Locational Data:** (e.g., parcel #, directions to resource, elevation, etc., as appropriate)
APN = 7600170300

***P3a. Description:** (Describe resource and its major elements. Include design, materials, condition, alterations, size, setting, and boundaries)
See Continuation Sheet

***P3b. Resource Attributes:** (List attributes and codes)

***P4. Resources Present:** ☒ Building ☐ Structure ☐ Object ☐ Site ☐ District ☐ Element of a District ☐ Other

**P5a. Photograph or Drawing** (Photograph required for buildings, structures, and objects.)

**P5b. Description of Photo:**

***P6. Date Constructed/Age and Source:**
☒ Historic ☐ PreHistoric
☐ Both
☐ Neither
**Year Built:** 1900 - Estimated

***P7. Owner and Address:**
Name:
Address:
,

***P8. Recorded By:**

***P9. Date Recorded:** 01/01/1900

***P10. Survey Type:**
**Survey Title:**

***P11. Report Citation:** (Cite survey report and other sources, or enter "none.")

***Attachments:**
- ☐ NONE
- ☐ Building, Structure, and Ojbect Record
- ☐ Milling Station Record
- ☐ Location Map
- ☐ Archaeological Record
- ☐ Rock Art Record
- ☐ Sketch Map
- ☐ District Record
- ☐ Artifact Record
- ☐ Continuation Sheet
- ☐ Linear Feature Record
- ☐ Photograph Record

Other:

State of California - The Resource Agency
DEPARTMENT OF PARKS AND RECREATION
CONTINUATION SHEET

Primary #:
HRI #:
Trinomial:

**P3a.Description (continued):**

**STYLE:**
**PLAN:**
**STORIES:**
**ROOF FORM:**
**ROOF MATERIAL:**
**ROOF PITCH:**
**EAVES:**
**CLADDING:**
**WINDOW TYPES:**
**WINDOW MATERIAL:**
**WINDOW DETAILING:**

**EXTRA DESCRIPTION:**
**DISTRICT:**

**FOUNDATION:**
**PORCH:**
**CHIMNEY MATERIALS:**
**GARAGE:**
**ALTERATIONS:**
**ORIGINAL SUBDIVISION:**
**SUBDIVISION BLOCK:**
**INTEGRITY:**
**STATUS:** Designated

# San Diego Rowing Club

San Diego, California.

## CITY OF SAN DIEGO HISTORICAL SITE BOARD REGISTER NO. 105

**1. LOCATION DESCRIPTION**

Street No. 525 E. Harbor Drive

Legal Description ---

Other Identification

**2. NAME OF SITE**

San Diego Rowing Club

**3. OWNERSHIP DATA**

Original San Diego Rowing Club

Present San Diego Rowing Club

Address 525 E. Harbor Drive
San Diego, Calif.

**4. FACTUAL DETAILS**

Original Use Rowing and Swimming Club

Present Use " " "

Architect Not known

Builder J. H. Cassidy, Contractor

Date or Period 1899/1900

Other --

**5. PHYSICAL DETAILS**

Style Boathouse

No. of Stories One

Wall Construction Wood, single walled construction

Condition Good

Exterior Good Interior Good

**6. OTHER COMMENTS**

Brennan's Island, having a two-storied handball court, is part of the Club.

**7. SUMMARY: HISTORICAL SIGNIFICANCE AND NOTABLE FEATURES**

The San Diego Rowing Club Clubhouse was built in 1899-1900 as a facility for their members. The Club was organized in 1888 and has continuously operated since then. The Boathouse is single-walled construction, made popular by the Greene Brothers architects, and has a clapboard exterior. The interior consists of the focsle for boat storage and trophy and picture exhibits, a lounge, offices, lunch bar, handball courts, gymnasium, showers and dressing rooms. Both the boathouse and the island are accessible by foot bridge. It is located in the tidelands at the foot of 7th Avenue and is rented from the Port Authority.

**8. LOCATION MAP** (Optional)

**9. PHOTOGRAPH**

**10. TRANSMITTAL RECORD**

| | Date | | Date |
|---|---|---|---|
| Bldg. Insp. | | Site Owner | |
| Community Dev. | | Fire Dept. | |
| Engineering | | Prks. & Pub. Bldg. | |
| | | Planning | |

**11. NAME AND ADDRESS OF RECORD OWNER**

San Diego Rowing Club
525 E. Harbor Drive
San Diego, Calif.

The San Diego Rowing Club

Submitted: June 6, 1975

Pat Schaelchlin
Historical Researcher
Save Our Heritage Organisation

The San Diego Rowing Club
525 E. Harbor Drive
San Diego, California

Dates of Acceptance By Municipal Agencies

| | Page |
|---|---|
| San Diego Historical Site Board | |
| State of California | |
| The National Register | |

## Table of Contents

Appendix

Cover is a copy of SDRC insignia 1908

## Introduction

The city and people of San Diego lose a little bit of history each and every time an old structure is torn down. The visual memory of the past, built by men who fathered San Diego, once gone can never be recreated; you can no longer touch or feel them, maybe a picture remains. Most Victorian houses were lived in by men who came to San Diego by choice, who entertained and created a city and had families and passed the heritage on. A hundred years ago, from 1875 to 1900, San Diego was experiencing one of its phenominal growths. Houses and business structures were being built rapidly and Alonzo E. Horton's dream of a city was coming true.

The Florence Hotel, known later as the Casa Loma, located between Fir and Grape Streets and Second and Third Avenues, was built in 1883 by W. W. Bowers, a brother-in-law of Horton, and on January 24, 1884, opened its door with a grand ball. It was a lovely hacienda, created to serve the tourists who were beginning to come. There were large rooms, complete with fireplace, four poster beds, with views of the city and flower gardens and even small cottages for those who preferred privacy. The tourists came and many remained, becoming permanent residents. For decades, the Florence Hotel was the social meeting place for the elite of San Diego. In 1948, the structure was torn down, victim to the fire ordinance law. It would cost $100,000 to bring it up to code and it was judged economically not feasible. No-one tried to save it then. The "tony but free of shoddy-aristocracy hotel" was to be replaced by a new building.

In 1971, City College began its long needed expansion program. Students were crowding the class rooms and there was a great need for a larger campus. There was a row of Victorian houses around the then small college. The two and half storied houses, with their leaded glass windows and ornate hardware and fireplaces, their gabled fronts and bay windows were in the way. No one doubted the need for more class rooms but they did hate to see the old structures come down. Because it was all that could be done, all of the Victoriania that could be saved was taken from the houses. People were beginning to care but nothing could be done then. Where could a row of Victorian houses, in 1971, be put? And so, they were torn down and lost.

In 1914, the train depot built in 1887 came down and the semi-Spanish train depot was constructed. Some were dismayed that the historic structure was doomed but others hailed the large new depot as a significant advancement and others were glad that it would be operating in time for the Panama California Exposition. In 1972, the semi-Spanish train depot was to be torn down. It was no longer functional; trains weren't coming to San Diego as often any more and the owners wanted the building demolished. The "timeless reflection of Mission architecture" was obsolete. But this time, someone fought to save the building. Someone cared and something was done and the building was saved.

The San Diego Rowing Club, located in the tidelands of San Diego Bay is threatened. In April, 1975, the Board of Directors were given notice by the San Diego Port Authority that a new luxury marina would be started soon. The dredging, according to a newspaper article on June 3, 1975, would begin in September or October, 1975, and would be completed in about 28 months. The San Diego Rowing Club has only those 28 months in which to relocate.

~~It is not possible. Even should another~~ location be available, the cost of constructing another boathouse, an estimated $250,000, is beyond the financial capacity of the Club.

No mention of early San Diego can be made without reference to the historical past of the San Diego Rowing Club. It is intricately woven into our history, not just as a structure perched on its pilings but as a reflection of the attitude of all of the thousands of members who have belonged to it. It has been a part of San Diego and it still is. If it is lost, another bit of history will be lost. Someone has to care and someone has to do something.

> "The Rowing Club is dear to our hearts because it is different from other clubs - truly a plain club, minus frills, and offering fellowship and a stimulating life to its members."[1]

Young men entering the Club for the first time as members were awed by the simple statement made by Neil Brown who was the Secretary for the San Diego Rowing Club from 1900 to 1917. He stated the position and attitude of the club, simply, as it was then and as it remains today. A third generation member since 1915, DeGraff Austin recently said: "We always aspired to be an organization giving a service to the young men of the community to learn the lessons of an amateur sport in a clean decent place and without any particular sectarian dedication and it worked splendidly."

The San Diego Rowing Club was known as the Excelsior Rowing and Swimming Club when it began in 1888. Among the charter members were Emanuel J. Lewis, George Marston, Dr. F. R. Burnham and Captain Paul Hemus. They were men who believed in the value of strong physical exercise and the club was organized for that purpose, to promote rowing, swimming and gymnastics.

In 1891, feeling that the Excelsior Rowing and Swimming Club would be competing on a national level and

---

[1] "The Clubhouse On Steamship Wharf" by Dick Barthelmess San Diego Historical Society Quarterly, Oct. 1960

that it should be identifiable geographically, the name was changed to the San Diego Rowing Club. That same year, the Club moved its quarters to the Chandler Boat House which was situated on the south side of the Pacific Steam Ship Company wharf. They built an annex there, with $300 which was the Club's Treasury and entered into an agreement with Chandler that the cost of the addition would be taken out in rent. As President E. J. Louis, a prudent man, said at the time of his annual report "--I think I am justified in claiming that no member has reason to feel ashamed of our present home and its facilities..."; he further stated "---with the adoption of the new by-laws, I consider none was of more importance than the one providing that saloon keepers are non-eligible.."

The Chandler Boat House was home to the San Diego Rowing Club until 1900, when they moved only 250 feet westward and built a single walled constructed clap-boarded typical boat house with the assistance of contractor J. H. Cassidy. A bond issue had been floated and its members had subscribed to units of $10.00 (which had been retired by 1902) and the necessary $2,000 had been raised. (See Appendix for the initial bond holders) The new club house[1] rested on 28 12x12 square pine timbers 24 feet long; the timbers were driven 8 feet into the mud.

---

[1] The San Diego Union, October 11, 1899

The girders on which the floor joists of the house rested were 2x16 timbers let into the head of the pile on either side and bolted across through the head. The outside walls were of boards and battons and measured 45 feet in width and 32 feet in extreme length, with verandas 76 feet long and 6 and 3 feet in width. Entry to the Club house was by gangway from the Pacific Steam Ship Company's wharf The interior was divided into ladies club rooms, about 14 feet square and divided by a sliding door and dressing rooms and a stairway went from the office to the roof to an observation platform with railing and flagpole in the center and at either end. The club pennant floated from the center flagpole and the ladies' club pennants, from the two side poles.

The main boat room, the foc'sle was 30 x 45 feet with a workshop 10 x 25 feet and there was storage for 12 of the 13 boats and there would be ample storage for the future. There were men's dressing rooms with sixty lockers, showers, and a sun room 12 x 20 feet and there was a gymnasium with punching bags and dumbbells and indian clubs and other such apparatus. A handball court was added for this was important for the winter conditioning of the men. A diving platform with springboard completed the accommodations of the house, which are not excelled by any on the west coast, they said. The boat house was painted red and the roof and trimmings were white and the members all agreed that it had a very handsome appearance.

The clapboarded sided typical boat house, standing on its many pilings, the water moving beneath and its wide doors opening to launch the boats, its panelled walls covered with pictures ("each one with a story") of past events, has had many additions and alterations through the years. In 1903, lockers were built because the borrowed lockers had to be returned to the Navy and in 1905, the reception room was completed, the windows were lowered and made larger to give a better view and the handball court was moved from the north side to the south side of the boat house and in 1906, more lockers were needed because the membership had still grown larger and there weren't enough lockers. The reception room was rewired, a new float was built, a front porch added and changes were made to the handball court. President John Akerman said in his yearly report that the quarters must be enlarged or the membership limited.

There was need for a trophy cabinet because the competition was favorable so one was built in 1909, along with a new floor in the parlor and the handball court was divided. In 1912, a tobaggen slide was built from the roof of the club down into the water. In 1913, it was obvious that the facilities were too small so it was enlarged to include a lunch room and the sun room was made bigger and a gym room was added for wrestling and boxing and still more lockers were needed and a handball court was added.

In 1935, Brennans Island was built and a two-story "best in the country" handball court was built in 1937. The island had been created by the silt from the dredging of the harbor (at the same time, Shelter Island had been created). A member, Joe Brennan, the first Port Director and who was responsible for the building of the port at the end of W.W. I, thought it would be an attractive addition to the Club. DeGraff Austin and Joe Brennan made arrangements for a WPA work party and the island was shored up and trees were planted and top soil was brought in. Badminton courts were added and ~~Richard Buell came regularly carrying flats of flowers~~ and with volunteers, planted the asters and zinnias and snapdragons and the island was a flowery oasis in the ocean

Regattas were a part of the Rowing Club life from the beginning, becoming most active in 1913-14. There were reaces with the Coast League, the Los Angeles, San Francisco, Vancouver, Portland and the Navy and the Pacific Coast Championship was eagerly sought. Kearney

Johnston, the Club's Chief Rowing instructor, recently won a gold medal at an International Veteran's Rowing Regatta at Bern, Switzerland. All the oarsmen were trained by volunteer coaches, they were not college trained and this was a handicap in that other coastal teams recruited college trained men. The life of an oarsman was vigorous and most retired from active competition by about 35 years of age.

The regattas weren't just rowing contests for men; there were manuevers by the ladies club, who had by now joined the popular sport. The Columbias, the Oceanics, the La Sienas, all were active and all were quartered at the Rowing Club.

Along with the races, there were swimming and fishing contests. Howard Brewer, the national champion in swimming, broke his own record for the quarter mile and J. Wilbur Kyle who raced against him that year, matched him. President Akerman in his annual message in 1902 said "---Had it not been for the efforts of some of the officers and directors of the Club, Brewer would not have come to San Diego, the course would not have been measured and the amateur athletic association would not have allowed and established his record..."

At the regattas, other entertainments were offered. There was the greased pole contest, a round smooth pole would be projected out from the gallery on the east side of the boathouse having a small stick or flag fastened to the far end which bore a prize. Handball tournaments would continue and the competition would be strong for the club's men excelled in the sport; it was from its beginning in 1902 (begun in San Diego at the Rowing Club) a part of the triad of rowing, handball and swimming. There would be picnics on the island and sunbathing and horseshoes would clang and there would be challenges for badminton.

Winning the rowing championships was usual for the Club. They worked hard, a group of amateur sportsmen who wanted to win, their coaches as much a part of them as their oars. Coaches Bill Fisher and Andy Borthwick and Louis Almgren and DeGraff Austin and Harley Knox were only a few of the dedicated men who gave of their time out of fellowship. Long hours were spent, volunteer time for both the coaches and the oarsmen, for there was a fetish that everyone would give of his time, no one was paid and only in very special events like a swimming and diving contest would there be a hired coach. Charlie Stetson gave supplementary coaching for Charles Pinkston in 1920 and Pinkston was the first American to win the Olympic fancy high dive championship in Antwerp.

They were Coast Champions in 1919 and again in

1925, when they rowed against the Olympic Championship team from Vancouver and they took every event except the Senior Singles and in 1926, 1927, 1928 (when they went to Philadelphia for the Olympic contest and won) and in 1930, they won.

There are off site activities, too. There is the 1922 organized bowling team which still meets regularly and there is basketball and baseball. There is golf and shuffle-board and fishing and cross country track - almost every kind of competitive sport was initiated by the members and because of their interest, continued. Even today, you can feel the spirit of competition, it permeates the building as surely as the whack of the handball as it hits the walls and the friends who gather around the lunch bar, for a moment or an hour. And in the back room, a gin rummy tournament is being waged, something new this year.

There was social activity too, not much because the men really preferred to keep the club exclusively for competitive sports. Many years ago, there were evening rowing parties across the Bay to Tent City and maybe to Pt. Loma for a clam bake and there were trips to visit war ships and water picnics.

There is the January 1st dip in the ocean each year and it isn't just fun to be one of the dippers, years ago, it was a requirement And sometimes the members would have to search the streets and encourage their less adventuresome brothers to join them for it was, by custom, a rallying time. Originally, the dip had begun to publicize San Diego's "salubrious climate" and their yearly pictures appeared in the early Chamber of Commerce booklets.

People made the San Diego Rowing Club unique, men who added significantly to early San Diego. There were the mayors James E. Wadham, Charles F. O'Neill, Percy Benbough, John Bacon, Dr. Howard Bard, John Butler, Harley Knox and Charles Dail and there were the champions Andy Borthwick, one of the all time greats in rowing and handball and there was DeGraff Austin who probably epitomizes the very essence of the club spirit for he has loved and been part of it since 1915 and even before for his ~~grandfather, Dr. H. E. Andrews, brought him to~~ the club when he was just a child. There was Elwyn J. Gould, the Jessops Brothers, Caesar Pastori, Junior Todd, Alex Trompas, Nelson Roberts, C. Arnholt Smith, Willard Hage, Dick Barthelmess, H. F. Luce, Kearney Johnston and A. F. Coggeshall and Marshall McComb, of the State Supreme Court and Judge Sloan who became an Associate Justice of the Supreme Court and physician Clarence Reese and Melville Klauber and Max Miller and I. L. Leszynsky.

To name all of the great athletes and members who have passed over the gangplank to enter the club would be to number them in the thousands. They have all contributed to the mystique that is the San Diego Rowing Club.

The San Diego Rowing Club always has offered a service to the community. Publicity has come to the City because of the championships the Club has won. Pictures of the January 1st dip appear all over the country. Schools and universities have used the club's facilities and without them, could not operate a rowing program. (See Appendix) About 1922, a Mr. Adams, principal of an elementary school in National City and a member of the Boy Scout Council, approached the Club about sponsoring a Sea Scout ship company and this was accomplished About 5 year s later, Eugene Storm, vice-principal of Memorial Junior High, because the skipper and remained as committee man until his death in 1970. Mr. Storm, too, had recognized the great need for a scouting group in his school district, that the young men too old for scouting and too young for military training, needed another kind of outlet. Three companies were formed and sponsored by the Club, one later moving to Coronado. As the Sea Scouts grew in number, there was need for equipment and DeGraff Austin and Bill Fisher met with Captain Nimitz of the Navy and from this contact three sailing launches and much sailing equipment loaned on receipt from the Navy was obtained for Sea Scout use.

The Sea Scouts were just beginning to be recognized in the west and this was the only one active in Southern California. In 1927, the Star of India was moored alongside the Rowing Club and the Sea Scouts Ship Company was listed as the crew at this time and for a time, was billeted there. The back rooms of the upper story of the two storied Brennan Island building was used as a sailing loft, assigned to the Sea Scouts and they store their gear there.

The possible loss of billet at the San Diego Rowing Club will pose a serious question as to the future of the Sea Scouts. (See Appendix)

There has always been concern for permanent quarters; from the beginning, from time immemorial, the need for permancy has concerned the club. Many times, they have considered other locations but the members have chosen to remain at the foot of 7th Street where they have been since 1891. Today, as it was then, it is still close enough to run down for a fast game of handball and some lunch.

The Rowing Club is many things. You cannot point to the Club house and say that is it; you cannot quote the roster for that isn't the Club. It isn't because it has existed for 87 years or because there is a club spirit or because the members enjoy the physical exercise, or even because it offers a service to the community, much needed. It is all of these things, combined, and being where it is, in the tidelands where its history is.

If it is demolished, the last of the many boat houses which were located in the bay will be gone. The dredging must be done, there is no question, and it is logical that the silt be used for the creation of a marina. The San Diego Rowing Club boathouse could be preserved by a simple change in plan. It could be included in the Tidelands Master Plan and would indeed, enhance it.

As part of San Diego history, it must be saved. We cannot live totally in the present or the future or the past. They can be combined. The area can be shared by all times, for the enjoyment of the people. For "Who does it belong to? How much money does the commercial enterprise bring in as compared with the interest of the people who pay all this bill anyway?" DeGraff Austin said it very well.

## Appendix A
## Bond Issue - 1899

---

TO WHOM IT MAY CONCERN:

Whereas the San Diego Rowing Club is proposing to issue its bonds in denominations of $10 each, bearing 6 per cent interest, payable semi-annually, for the purpose of building a boat house:

Now therefore, the undersigned subscribes for the number and amount of such bonds set opposite the name of the subscriber and agrees to pay one half of said subscription on the first of August and one fourth on the first of September and one fourth on the first of October, 1899.

| | | |
|---|---|---|
| I. L. Leszynsky | 10 | One Hundred dollars |
| V. G. Matthews | 5 | Fifty dollars |
| Frank L. Sargent | 5 | Fifty dollars |
| Edward Grove | 5 | Fifty dollars |
| D. F. Garrettson | 5 | Fifty dollars |
| N. Watts | 5 | Fifty dollars |
| Thos. C. McConkey | 5 | Fifty dollars |
| J. S. Akerman | 5 | Fifty dollars |
| J. Price | 5 | Fifty dollars |
| E. O. Hodge | 5 | Fifty dollars |
| H. E. Doolittle | 5 | Fifty dollars |
| Arthur Cosgrove | 5 | Fifty dollars |
| J. D. Burks | 5 | Fifty dollars |
| W. R. Rogers | 5 | Fifty dollars |
| J. A. Pauly | 3 | Thirty dollars |
| Oscar A. Trippett | 5 | Fifty dollars |
| * --- O'Leary | 1 | Ten dollars |
| H. E. Anthony | 1 | Ten dollars |
| F. P. Davidson | 1 | Ten dollars |
| Ford Carpenter | 2 | Twenty dollars |
| J. E. Wadham | 5 | Fifty dollars |
| M. A. Graham | 5 | Fifty dollars |
| Walter Carnes | 5 | Fifty dollars |
| * --- Powers | 10 | One hundred dollars |
| F. W. Garretson | 1 | Ten dollars |
| Harry L. Titus | 10 | One hundred dollars |
| T. C. McConkey | 5 | Fifty dollars additional |
| *J. E. Auldzing | 2 | Twenty dollars |
| N. B. Livermore | 5 | Fifty dollars |
| W. R. Rogers | 5 | Fifty dollars additional |
| Geo. G. Garrettson | 5 | Fifty dollars |
| A. L. Ross | 5 | Fifty dollars |
| Jas. MacMullen | 5 | Fifty dollars |
| Geo. S. Bates | 2 | Twenty dollars |
| H. P. Wood | 5 | Fifty dollars |
| David P. Barrows - State Normal School per Burks & Barrows | 2 | Twenty dollars |

* Signature not legible

Appendix A - continued

---

TO WHOM IT MAY CONCERN:

Whereas the San Diego Rowing Club is proposing to issue its bonds in denomination of $10 each, bearing 6 per cent interest, payable semi-annually, for the purpose of building a boat house:

Now therefore, the undersigned subscribes for the number and amount of such bonds set opposite the name of the subscriber and agrees to pay one half of said subscription on the first of August, and one fourth on the first of September and one fourth on the first of October, 1899.

| | | |
|---|---|---|
| Herbert A. Croghan | 3 | Thirty dollars |
| Henry H Palmer | 10 | One hundred dollars |
| Philip Morse | 10 | One hundred dollars |
| | | $2,000.00 |

UNIVERSITY OF CALIFORNIA, SAN DIEGO

BERKELEY • DAVIS • IRVINE • LOS ANGELES • RIVERSIDE • SAN DIEGO • SAN FRANCISCO SANTA BARBARA • SANTA CRUZ

DEPARTMENT OF PHYSICAL EDUCATION

POST OFFICE BOX 109
LA JOLLA, CALIFORNIA 92037

June 2, 1975

Historical Site Board
1257 Virginia Way
La Jolla, Ca., 92037

Gentlemen:

I understand that discussions are taking place concerning plans to eliminate from the San Diego scene the historical San Diego Rowing Club. I would like to lend my support to those who strongly support rowing in San Diego, and traditionally the San Diego Rowing Club represents the epitomy of oarsmanship. It would be a loss to the community to see this fine and historical facility eliminated from the San Diego scene, especially at a time when rowing is gaining new membership and increased supporters throughout the entire San Diego community.

I call your attention to the fact that, while plans are being developed at Santa Clara Point for the growth of rowing, this involves a limited number of collegians and cannot replace in any way the old traditions carried on by the Rowing Club.

Therefore, I call on you to continue maintaining this site as not only historical in its use, but as a facility which will serve the needs of many San Diegans, not just the collegians. San Diego has many marinas, many beaches, many parks and other recreation areas, but it has only one Rowing Club. I urge the City Fathers to consider keeping some of the old historically interesting sites, and certainly the San Diego Rowing Club is all of that, and more.

Cordially,

Howard F. Hunt
Director of Intercollegiate Athletics

HFH:mb

University of San Diego
DEPARTMENT OF ATHLETICS & RECREATION

May 30, 1975

Historical Site Board
San Diego, California

Dear Sirs:

The University of San Diego is presently in the process of forming a crew team in hopes of competing by 1976. The San Diego Rowing Club has been extremely helpful in offering its facilities to USD for practices and individual workouts. Our students are enthusiastic about the prospects of competing in the tremendous sport of Crew.

Since rowing shells are so very costly, it would be impossible for our team to continue without the use of loan equipment provided by the San Diego Rowing Club.

Therefore, it would be devastating to our program if the Rowing Club ceased to exist.

It is our sincere hope that the San Diego Rowing Club be allowed to remain at its present location so it can continue to aid programs such as ours.

Sincerely,

A. Jackson Muecke
Recreation Director

AJM:pcl

ALCALA PARK • SAN DIEGO, CALIFORNIA 92110 • (714) 291-6480 Ext. 367

SEA EXPLORER SHIP STAR OF INDIA
SHIP 294, SAN DIEGO, CALIFORNIA

2 June, 1975

San Diego Historical Site Board
℅ Mrs. Pat Schaelchlin
1257 Virginia Way
La Jolla Ca. 92037

To the Board Members,

The Sea Explorer Ship 294 has been in operation according to best information since about 1924. It was first organized in Coronado as the "Sea Hawk" but transfered sponsorship to the San Diego Rowing Club about 1925. When the Bark Star Of India was brought to San Diego about 1927, the ship moved its meeting place aboard the "Star" but maintained sponsorship with the San Diego Rowing Club. The Rowing Club provided periodic use of it's gym, canoes, and handball courts.

The explorer ship was asked to leave the Star Of India in 1961 when plans for refurbishing the "Star" were completed. Ship 294 returned to the San Diego Rowing Club and established a sea base on space provided by the Rowing Club on Joe Brennan Island.

The facilities provided by the San Diego Rowing Club to the Sea Explorers include a mooring area for a 30 foot Navy built pulling cutter rigged for sailing, a mooring area for a 14 foot sloop, a meeting place on Joe Brennan Island, space on the island to store the sloop when it is not in the water and to store 5 13.5 foot sailing dingies built by the explorers. The club also allows the explorers the use of much of the island on Saturday afternoons for training, camping, and equipment maintenance.

Utilizing these facilities, the ship trains the sea explorers in rowing, sailing, sailing racing, seamanship, and throughout the program, good citizenship. Only last summer the Rowing Club and Ship 294 hosted all the Sea Explorers in San Diego County to a four day training session on the island teaching about 30 youth and 6 adults in small boat handling, rigging and knot tying.

Currently the ship has 15 boys and girls actively participating in the program. Six adults are registered to advise these youth in various capacities. We expect to add five additional members this summer when they reach the admittance age. According to our records, the ship has had approximately 750 youth affiliated with it since being sponsored by the Rowing Club.

In the event that the San Diego Rowing Club must abandon it'S present site, Sea Explorer Ship 294 will have to find a new sponsor, probably abandon the 30 foot cutter and 14 foot sloop (no free protected anchorage for them) and move to a meeting place remote from the water. Such a move will seriously reduce our ability to provide a meaningful aquatic experience to the youth of San Diego. It is impossible to estimate the true value of the facilities provided by the Rowing Club to the Sea Explorers but all the ships in the San Diego area benefit from our unique sea base.

Sincerely

S. G. Hulbert
Skipper

KFMB began in 1949.
1974 marks our silver anniversary—the first television station in the San Diego area to achieve 25 years of broadcasting.

June 4, 1975

Save Our Heritage Organization
P.O. Box 3571
San Diego, California 92103

Dear Sirs:

I would like to add my voice to those I'm sure you've already heard supporting your efforts to save the San Diego Rowing Club. In this day of throw-away, and sleekness, it's nice to be able to enjoy a facility like the Rowing Club, steeped in tradition and yes, a little old.

There are enough plastic and glass structures along the bayfront! I applaud your effort to preserve this fine old building for myself and my family directly, but even more importantly, the whole of San Diego.

Best regards,

Weldon Donaldson
Assistant Sales Manager

WD/lb

KFMB-TV 1405 Fifth Avenue San Diego, California 92112 (714) 232-2114
Midwest Television, Inc. Other Midwest Radio and Television Stations in Champaign and Peoria, Illinois

SAN DIEGO ROWING CLUB

525 EAST HARBOR DRIVE
SAN DIEGO, CALIFORNIA 92101
TELEPHONE 232-1898

June 4, 1975

Dear Sirs:

I am an active member of the San Diego Rowing Club and am very much interested in its future. My family and I utilize the club and its facilities quite frequently, and would all feel a deep personal loss should the club become inactive or have to be relocated because of so-called Tideland Beautification. I hope to see my children grow up with the club as I have seen so many members my age whose fathers are still active in club activities. Without question, the SDRC is a very dear part of San Diego and its community and is as steeped in tradition as is so much of San Diego itself.

I implore you to give consideration to the good that has been benefited by the community, not only members of the SDRC who helped build this great city, but of the club itself who has done so much for the youth of our fair city.

Sincerely,

John R Tyler

John R. Tyler

JRT:br

ON SAN DIEGO BAY SINCE 1887

SOHO
PO Box 3571
San Diego CA.

SUBJECT: San Diego Rowing Club.

Gentlemen:

May I express my good feeling to you on finding that you, SOHO, are taking an active interest to save the Club.

As a new resident in San Diego last year, living in temporary quarters at a construction site, I came across this distinctive structure and inquired as to its purpose. A most enthusiastic and pleasant Mike Neal, (who was killed last week) gave me a tour and pointed out the esoteric history in pictures back to the 1800s. The setting, the unique structure and the type of people at the Club have made it my second home.

I

# Bibliography

Black, Samuel J.
"Clubs of San Diego" Page 289
SAN DIEGO COUNTY, CALIFORNIA, A RECORD OF SETTLEMENT
ORGANIZATION, PROGRESS AND ACHIEVEMENT
S. J. Clarke Publishing, Chicago 1913
Vol. 1 and Vol. 2

SAN DIEGO ROWING CLUB 1888-1947
(Privately Published)

San Diego Rowing Club Records

Minutes of the Meetings of the Board of Directors
Annual Reports of the Officers
Miscellaneous papers

Interviews:

With DeGraff Austin, May 1975, Pat Schaelchlin
With DeGraff Austin, April, 1960, Edgar F. Hastings for
San Diego Historical Society

Magazine Articles:

"The Clubhouse on Steamship Wharf" by Dick Barthelmess
San Diego Historical Society Quarterly, Vol. VI, No. 4
October, 1960

<u>San Diego Magazine</u>:

~~"Multiplying Towers By The Sea" by Martin Stern, April~~ 1965

"The Council's Tragic Decision on La Jolla High Rise"
an editorial by Gloria Self, November 1965

"Cabrillo Freeway Fight" by Harold Keen September 1966

"The Grand Illusion" and "Preserving El Prado: The
Fifty Years War" by Marilyn Hagberg November 1967

"El Prado" by Marilyn Hagberg February 1968

"Palace or Parking?" and "Saving Our Greatest Man-Made
Wonder" by Marilyn Hagberg, May 1968

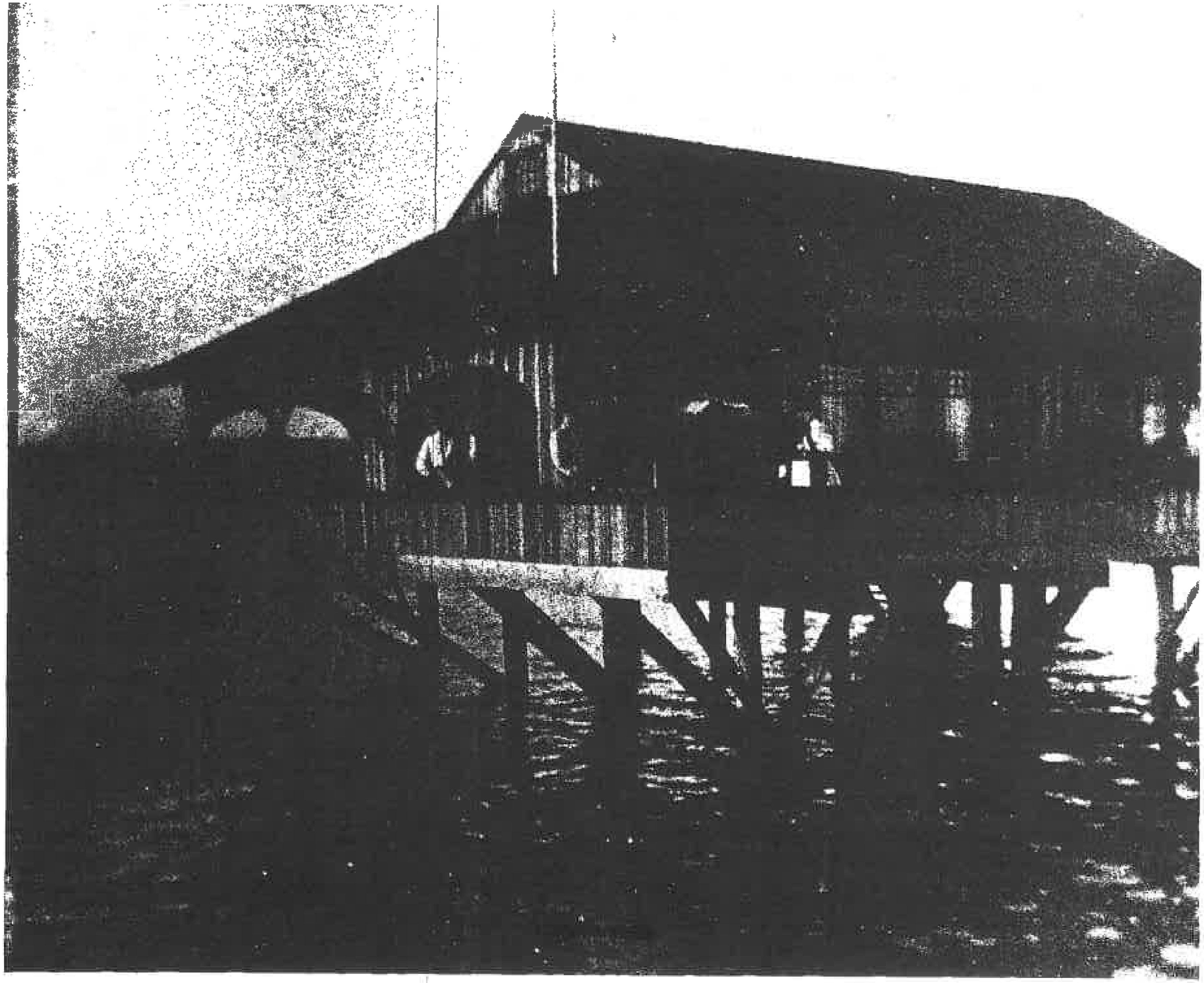
"Is The Santa Fe Station Worth Saving?" by Syd Love,
April, 1972

"The Rowing Club In Jeopardy" September 1972

Newspaper Articles:

San Diego Union

| | |
|---|---|
| 10-11-99 | "The Clubs New Home" |
| 1-1-1900 | "Boating, Swimming and Bicycling" |
| 1-1-1902 | "Incomparable Bay For Aquatic Sports" |
| 11-5-1899 | "Aquatic And Other Sports" |
| 5-7-1903 | "Promise of Prosperity" |
| 5-8-1902 | "The Rowing Club Annual" |
| 7-5-1902 | "Afternoon On Glorietta Bay" |
| 9-1-1902 | "Yesterday's Celebration Was A Big Success" |



# Appendix G-1

# Geotechnical and Environmental Reconnaissance Report for the San Diego Convention Center Expansion

# GEOTECHNICAL AND ENVIRONMENTAL RECONNAISSANCE REPORT

## SAN DIEGO CONVENTION CENTER EXPANSION SAN DIEGO, CALIFORNIA

GEOCON
INCORPORATED

GEOTECHNICAL
CONSULTANTS

**PREPARED FOR**

**SAN DIEGO CONVENTION CENTER**
**SAN DIEGO, CALIFORNIA**

**MARCH 15, 2009**
**PROJECT NO. G1077-52-01**

GEOCON
INCORPORATED

GEOTECHNICAL CONSULTANTS

Project No. G1077-52-01
March 15, 2009

San Diego Convention Center
111 West Harbor Drive
San Diego, California 92101

Attention: Ms. Stephanie Chen

Subject: SAN DIEGO CONVENTION CENTER EXPANSION
SAN DIEGO, CALIFORNIA
GEOTECHNICAL AND ENVIRONMENTAL RECONNAISSANCE REPORT

Dear Ms. Chen:

In accordance with your authorization of our Proposal No. LG-09002 dated January 8, 2009, Geocon Incorporated performed this geotechnical and environmental reconnaissance report for the proposed expansion of the San Diego Convention Center located in downtown San Diego, California. We performed our study to assess the underlying soil, geologic, and environmental conditions and the potential for geologic hazards or hazardous materials affecting the proposed improvements. The accompanying report presents the results of our study and conclusions pertaining to the geotechnical and environmental aspects of the proposed development.

Should you have questions regarding this report, or if we may be of further service, please contact the undersigned at your convenience.

Very truly yours,

GEOCON INCORPORATED

Shawn Weedon
GE 2714

John Hoobs
CEG 1524

Jack Keener
Environmental Manager

REGISTERED PROFESSIONAL ENGINEER
SHAWN WEEDON
No. 2714
Exp.06/30/11
GEOTECHNICAL
STATE OF CALIFORNIA

PROFESSIONAL GEOLOGIST
JOHN HOOBS
No. 1524
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

SW:JH:JK:dmc

(1) Addressee
(1) Dealy Development Inc.
Attention: Ms. Alva Whetton

6960 Flanders Drive ■ San Diego, California 92121-2974 ■ Telephone (858) 558-6900 ■ Fax (858) 558-6159

## TABLE OF CONTENTS

# GEOTECHNICAL AND ENVIRONMENTAL RECONNAISSANCE REPORT

## 1. PURPOSE AND SCOPE

This report presents the results of a geotechnical and environmental reconnaissance for the proposed expansion of the San Diego Convention Center located southwest of Convention Center Drive and south of Marina Park Way in the downtown area of San Diego, California (see Vicinity Map, Figure 1). The purpose of the study is to evaluate the surface and subsurface soil conditions and general site geology, to provide a review of existing environmental documents, to identify geotechnical constraints (if any) that may impact development of the property, and to provide recommendations for future geotechnical investigations and environmental monitoring at the site. The site is situated within the City of San Diego Downtown Special Fault Zone; therefore, a detailed fault evaluation will be required to satisfy the City of San Diego Building Department requirements.

The scope of this investigation included a review of stereoscopic aerial photographs and readily available published and unpublished geologic literature, previous geotechnical reports, and available environmental documents (see *List of References*). Information from previous studies has been included in this investigation. Geocon and other consultants performed geotechnical borings, seismic reflection surveys, and Cone Penetrometer Test (CPT) soundings. The approximate locations of the exploratory borings, seismic survey lines, and CPT's are presented on the Geologic Map, Figure 2 (map pocket). The logs of previous borings and CPTs by Geocon and other consultants which were used for this study are presented in Appendix A.

## 2. SITE AND PROJECT DESCRIPTION

The site of the proposed San Diego Convention Center Expansion is located southwest of the existing convention center, between Convention Center Way and San Diego Bay, south of Marina Park Way in San Diego, California. A Vicinity Map is shown on Figure 1. The approximately 5.7-acre site is currently being used as a parking lot, a Harbor Excursion terminal on the southern portion of the property, and a storage area on the northern portion of the property. A private wharf and docks extend from the existing seawall into San Diego Bay. The site was graded by filling in San Diego Bay during development in the 1920's for the previously existing Campbell Shipyard and surrounding properties. The site has previously been used as a service station and storage yard for marine equipment. Site elevations range from approximately 9 to 12 feet above Mean Sea Level (MSL). According to as-built structural drawings (SDUPD, 2005), the existing sheet pile seawall retains approximately 10 feet of soil and was constructed using a timber and concrete "deadman" anchoring system. The deadmen extend from the face of the seawall, landward approximately 25 feet toward the property.

Based on preliminary design concepts provided by you, we understand that the site is being considered for a multiple story expansion of the current convention center complex. The approximate development area is presented on the Geologic Map, Figure 2. We expect that the finish grade for the proposed addition will be near existing grade. The expansion would likely extend from the existing structure southwestward to within approximately 35 feet of the bayfront to allow development of a pedestrian promenade. Improvements to the existing seawall, piers, or boat moorages, are not planned. The site description and proposed development are based on a site reconnaissance and discussions with you. If development plans differ from those described herein, Geocon should be contacted for possible revisions to this report. Grading plans, civil plans, or architectural drawings have not been available for our review at the time of this report.

## 3. SOIL AND GEOLOGIC CONDITIONS

Based on our review of previous geotechnical investigations for the site and nearby properties, the site is underlain by two surficial soil units overlying marine terrace deposits. The surficial units consist of fill material and Bay Deposits. Quaternary-age marine terrace deposits identified as Bay Point Formation (also known as Old Paralic Deposits) underlies the surficial soil to the total depths explored. The Bay Point Formation and surficial units are discussed below in order of increasing age. The occurrence and distribution of the various units underlying the site, including descriptions of the units, are shown on the exploratory boring logs in Appendix A. The approximate elevation at the base of the fill material, estimated elevations of the top of the Bay Point Formation, and the approximate groundwater elevation at the exploratory excavation locations are presented on the Geologic Map, Figure 2. The interpreted subsurface relationship between the geologic units is presented on the Geologic Cross-Section, Figure 3 (map pocket).

### 3.1 Undocumented Fill (Qudf)

Based on our review of the referenced background information, the project site is underlain by fill material placed during previous improvements to the bayfront in the 1920's. The majority of the fill was likely derived from material obtained during dredging of the neighboring areas of the bay. The upper several feet was likely capped with terrestrial fill imported to the site. The fill was not observed or tested during placement and is not considered to be engineered, structural fill. We expect the fill to be approximately 10 to 35 feet thick (elevations 0 to -25 feet MSL), increasing toward the bayfront. The fill material generally consists of loose to medium dense, saturated sand and silty sand. The fill material may be left in place depending on the type of foundation system selected to support the structure; however, the fill is compressible and not considered suitable to support the planned structures.

### 3.2 Bay Deposits (Qbd)

Based on our review of the referenced background information, the fill material is underlain by Bay Deposits extending to elevations ranging between approximately 19 to 32 feet below MSL. Bay

Deposits consist of loose to medium dense, black to dark gray and olive gray, clayey and sandy silt and soft to firm, silty and sandy clay. We expect the Bay Deposits will be left in place during the development of the property. The Bay Deposits are compressible and not considered suitable to support the planned structures. A deep foundation system or soil mitigation will be required to support the planned improvements.

### 3.3 Old Paralic Deposits (Qop$_6$)

Quaternary-age Old Paralic Deposits (previously called Bay Point Formation) are marine terrace deposits that exist below the surficial soil at depths of ranging between approximately 40 feet to 45 feet below the existing grade (approximately 30 to 35 feet below MSL). The Old Paralic Deposits consist of layers of medium dense to very dense, uncemented sand and stiff to hard clay and is generally suitable for the support of or structural loads. Foundations for high load structures should extend through the overlying surficial soil and be founded within the Old Paralic Deposits.

## 4. GROUNDWATER

We expect groundwater at approximately 9 to 14 feet below the ground surface (elevation 0 to -5 feet MSL), roughly corresponding to the water level in San Diego Bay. Groundwater depths increase toward the northwest, in the direction of the original portion of the San Diego Convention Center due to ongoing dewatering operations for the subterranean level of the structure. Groundwater will likely be a factor in development especially in remedial grading, design and construction of deep foundations, and installation of deep utilities. Groundwater elevations should be expected to vary according to tidal fluctuations. Proper surface drainage will be important to future performance of the project.

## 5. PREVIOUS GEOTECHNICAL INVESTIGATIONS

As a part of this study we have reviewed numerous geotechnical reports, maps, plans, and historic photographs associated with the proposed expansion site and the surrounding properties. The reports used to prepare this study are listed in the *List of References* section at the end of the report. Citations of the various studies are included within the text. Geotechnical studies of particular use to this report have included those for the San Diego Convention Center (Woodward-Clyde, 1984), San Diego Convention Center Expansion (Woodward-Clyde, 1994 and 1995), the Chart House Restaurant (Geocon, 1981) [now Joe's Crab Shack], the proposed Spinnaker Hotel Project (TerraCosta, 2004), and the Hyatt Hotel (MACTEC, 2004) and Parking Garage (Ninyo & Moore, 2003).

Numerous exploratory borings and Cone Penetrometer Test (CPT) sounding have been advanced on the neighboring properties. The approximate locations of the exploratory excavations are presented on the Geologic Map, Figure 2 and logs of the borings and CPT soundings are presented in Appendix A. The project area for the proposed Convention Center Expansion is the site of the former Campbell

Shipyard. The Campbell Shipyard was demolished in the late 1990's, and an environmental remediation and bayfront enhancement program was undertaken. Previous site development associated with landfilling of the former bay and tidal shoals has resulted in bringing the project area to the existing grade using hydraulic dredge fill and capped with imported, terrestrial fill. We have not reviewed compaction reports associated with the placement of fill underlying the site and the fill is considered non-structural. The current seawall was also constructed in the 1920's as part of the bayfront maritime improvements. The portions of the bay southwest of the existing seawall were dredged to provide access to the current wharf and moorages. Based on our review of the structural plans for the existing seawall (SDUPD, 2005), we understand that the wall was constructed as a steel sheetpile wall with "deadman" supports approximately 25 feet landward of the existing wall face at a horizontal spacing of approximately 10 feet.

The study area is the site formerly proposed for the development of the Spinnaker Hotel project. TerraCosta (2004) performed a draft-level geotechnical investigation for a proposed 275-foot high tower and a 35-foot high ballroom/convention center with a water transportation center, docks, and wharfs. The geotechnical investigation did not include subsurface investigation and relied on available data, the majority of which has been utilized in this study. The TerraCosta report presented preliminary recommendations for site grading, seismic ground improvement (wick drains or stone columns), shallow mat foundations, and precast driven piles.

The geotechnical investigations for the existing convention center were performed by Woodward-Clyde (1984 and 1995). According to the recommendations of the geotechnical reports, the convention center structures are supported on deep driven piles and grade beams with structurally separated floor slabs.

## 6. SUMMARY OF ENVIRONMENTAL DOCUMENT REVIEW

Geocon has reviewed numerous documents related to the existing environmental conditions at the subject site and provided the following summary. A listing of the environmental documents we reviewed is presented in the *List of References*. According to our background research, Campbell Industries Marine Construction and Design Company operated a shipyard at the site from the early 1900's to approximately 1990. The project area was leased by Campbell to General Petroleum, which operated a fueling wharf on the property. An above-ground storage tank farm was located on the southern portion and above- and below-ground fuel pipelines extended along the bulkhead from the tank farm and fueling wharf. An approximately 2,000 gallon underground gasoline storage tank (UST) was located near the fueling wharf. The California Regional Water Quality Control Board San Diego Region (RWQCB) issued a Cleanup and Abatement Order (CAO No. 95-21) to Campbell establishing contaminants of concern and associated cleanup levels for on-shore soil and groundwater, and offshore bay sediments (Bodhi Group, 2008).

The areas of the former 2,000 gallon UST, bulk storage tanks, and bulkhead pipelines were found to be impacted by petroleum hydrocarbon releases and, in 2001, a remediation program was instituted by the RWQCB based on investigations and a remedial action work plan prepared by Kleinfelder (2000) on behalf of the San Diego Unified Port District. The impacted areas were remediated by excavating the impacted soil, stabilizing the contaminated soil with cement, and backfilling the excavations above the groundwater table with the cement-stabilized soil.

After the 2001 cleanup operation, the San Diego Unified Port District instituted a groundwater monitoring program to evaluate the long-term effectiveness of the remediation activities. The groundwater was found by Ninyo & Moore (2003) and Environ (2004) to contain phase separated hydrocarbons (PSH) exceeding the groundwater cleanup levels established by the RWQCB. In 2004, the RWQCB approved a remedial action work plan to remediate the groundwater contaminated areas. The remedial work was performed in 2004 and included the removal and off-site transportation of approximately 7,200 tons of petroleum-impacted soil and 10,500 gallons of free product and petroleum-impacted groundwater from two excavation locations. The excavations were backfilled with clean fill and paved to the pre-remediation condition. After a year of monitoring to evaluate the effectiveness of the remedial action, in 2006, the RWQCB accepted the recommendation of Ninyo & Moore that no further remediation action was required. The groundwater monitoring wells have subsequently been removed and the site is considered by the RWQCB to have been remediated.

To comply with the off-shore bay sediment cleanup levels established by the RWQCB in order CAO 95-21, the contaminated bay sediments were remediated by placement of an engineered soil cap-in-place alternative in 2005. The RWQCB also instituted Monitoring and Reporting Program (MRP) requirements for a short- and long-term monitoring and maintenance program to evaluate the effectiveness of the engineered soil cap. The MRP is ongoing at the time of this report.

Based on the proposed site improvements described herein, we understand that the majority of the structures will be constructed at or near the existing site grade. We expect that earthwork associated with site development will consist of removal and recompaction of several feet of the existing soil, with possible placement of additional fill material to achieve proposed grades. We do not expect that site development would result in the export of significant volumes of soil from the site. The structures would likely be founded on driven piles and grade beams with slabs on grade or with shallow mat foundations. To mitigate the potential for seismic liquefaction and settlement, ground improvement may be required, possibly consisting of the installation of stone columns or by ground densification. Although likely to be a slight risk, the exposed soil should be evaluated for the presence and impacts of soil vapor during project development and mitigation recommendations should be provided, if necessary. Development plans do not indicate improvements are planned within San Diego Bay and we do not expect that the engineered soil cap would be affected by the proposed development.

# 7. GEOLOGIC HAZARDS

## 7.1 Geologic Hazard Category

The City of San Diego Seismic Safety Study, Geologic Hazards and Faults, Sheet 17 defines the site with a *Hazard Category 13: Downtown Special Fault Zone*. In addition, the California Geological Survey has issued a revised Earthquake Fault Zone Map for the Point Loma Quadrangle (CGS, 2003) that includes portions of the downtown San Diego area. The property is not within one of these Earthquake Fault Zones but is approximately 1,500 feet from an active strand of the Rose Canyon Fault. The location of known, active faults and the Earthquake Fault Zones in relation to the site is presented on Figure 4 (map pocket).

## 7.2 Regional Faulting

The site is located within the southern portion of the Rose Canyon Fault Zone. The Rose Canyon Fault Zone represents the most significant seismic hazard to the San Diego area. The tectonic setting of the San Diego region is dominated by right-lateral, strike-slip faults. The Rose Canyon Fault Zone is a complex series of anastomizing and *en echelon* fault segments that strike generally north-northwest through San Diego. Within San Diego Bay the fault zone splays into multiple, subparallel strands. The onshore portion of the downtown San Diego area is a transitional zone between the right-lateral strike-slip faulting characteristic of the faults north of the downtown area and the predominantly dip slip faulting characteristic of faults making up the southern portion of the Rose Canyon Fault Zone (Treiman, 1993). The major faults that compose the southern end of the Rose Canyon Fault Zone within the San Diego Bay area are the Spanish Bight, Coronado, and Silver Strand Faults. The east side of this zone is represented by the La Nacion Fault (Treiman, 1993). Together, these faults define a wide and complexly faulted basin occupied by San Diego Bay and a narrow section of the continental shelf west of the Silver Strand.

Trenching by Lindvall and others (1990) on the Rose Canyon Fault in Rose Canyon several miles northeast of the site and by Owen Consultants (reported by ICG, 1990) have shown that Holocene soils (soils 11,000 years old or less) have been displaced by faulting in the downtown area. The Rose Canyon Fault has been mapped by the California Geologic Survey (CGS, 2003) as "active" and a State of California Earthquake Fault Zone has been established for several areas of downtown San Diego, Coronado, and San Diego Bay. The subject site is not located with an Earthquake Fault Zone.

The California Division of Mines and Geology prepared an analysis of faulting in San Diego Bay (CDMG, 1999) which incorporated seismic reflection data. The report concluded that San Diego Bay is underlain by a complex series of discontinuous fault strands associated with the Rose Canyon Fault system. These fault strands are considered to be active based on work done by Rockwell, Lindvall, Kennedy, and others.

The fault pattern around San Diego Bay suggests that tension between right-stepping or bending fault strands has created a structural depression or "pull apart" basin where the strike-slip fault strands of the Rose Canyon Fault system step over toward the east. The western margins of the "pull-apart" basin are characterized by east-downthrown, oblique, listric normal faults. The Spanish Bight and Coronado Faults have created down-dropped graben structures which may have formed the so-called Spanish Bight channel which existed between North Island and Coronado Island, prior to landfilling associated with construction of the naval base. Several discontinuous fault strands were observed in seismic reflection surveys conducted by Woodward-Clyde (1994) and the California Geological Survey (1999) offshore from property. The nearest strand is approximately ⅓-mile southwest of the property and does not trend toward the site.

## 7.3 Summary of Previous Fault Investigations

Other consultants have performed fault hazard investigations related to the development of the San Diego Convention Center (Woodward-Clyde, 1984), San Diego Convention Center Expansion (Woodward-Clyde, 1994), and the Hyatt Hotel and Parking Garage (MACTEC, 2004 and Ninyo & Moore, 2003). Due to the existence of deep fill, shallow groundwater, and the depth to pre-Holocene materials, fault trenching has not been performed at the project site or on the neighboring properties. Previous fault hazard investigations have relied on information from exploratory borings, CPT's, and seismic reflection surveys to evaluate the presence and location of faulting in the site vicinity. Woodward-Clyde (1994) performed numerous seismic reflection survey lines within San Diego Bay extending from southeast of the 10th Avenue Marine Terminal to northwest of the Marriott Marina. These seismic surveys provide coverage of the subject site in relation to the known trends of the Rose Canyon Fault strands mapped in the downtown San Diego area. The approximate locations of fault strands encountered during the Woodward-Clyde (1994) seismic surveys are presented on the Earthquake Fault Zone Map, Figure 4.

Fault trenching studies have been performed on properties to the north and east of the site where the Bay Point Formation exists nearer the surface and the groundwater table is deeper. The approximate locations of previous trenching investigations performed by Geocon and other consultants and the known locations of active and potentially active faults in the downtown San Diego area are presented on the Earthquake Fault Zone Map.

## 7.4 On-Site Faulting and Ground Surface Rupture

Based on a review of the fault hazard investigations performed for the site vicinity and our interpretation of the existing data, there do not appear to be active fault strands underlying the site. We consider the potential for fault ground rupture hazards to be low. While the site is included in the City of San Diego's Downtown Special Fault Zone, it is not included in the State of California Earthquake Fault Zone and fault strands have not been mapped at the site in the literature reviewed for this project.

The nearest Earthquake Fault Zone is located approximately 1,350 feet north of the site along J Street and the identified, active fault trace trends roughly in the direction of the site. Another Earthquake Fault Zone exists approximately 1,500 feet east of the site, but the fault trace does not trend toward the site. We have used the available information to prepare the Geologic Cross-Section presented on Figure 3. The Geologic Cross-Section suggests that a correlative stratigraphic unit (marker bed) is present within the Old Paralic Deposits (Bay Point Formation) extending the length of the cross-section at an elevation of approximately 30 feet below MSL. The marker bed does not appear to have been offset by subsurface faulting.

Based on our discussions with the City of San Diego LDR-Geology, we understand that additional fieldwork will be necessary within the project boundaries, as part of a future fault hazard investigation in order to satisfy building code requirements. We propose that we perform an additional CPT test sounding array extending across the property at the appropriate alignment, depths, and frequency to correlate the underlying stratigraphy along the array and with stratigraphic information for the surrounding properties.

### 7.5 Seismicity

The instrumental seismic record indicates that there have been numerous moderate earthquakes in the San Diego Bay area, including a cluster of events in 1964 and 1985 between M3 and 4+ (Treiman, 1993). Surface rupture has not been recorded with any of the seismic activity. Anderson and others (1989) indicate that the greatest peak acceleration recorded in the downtown area (at San Diego Light and Power) was 34 cm/sec (0.03g) produced by an offshore earthquake in 1964 (M = 5.6).

Anderson and others (1989) have also estimated recurrence times for major earthquakes that may affect the San Diego Region. By combining geologic data with their model for ground motion attenuation for each earthquake event, they have provided an estimate for the recurrence rate of various levels of peak ground acceleration in downtown San Diego. The results of their work indicate that peak accelerations of 10 to 20 percent gravity (g) are expected approximately once every 100 years (Anderson and others, 1989). Higher peak accelerations will also occur but with a lower probability of occurrence or return period.

Lindvall and Rockwell (1995) have postulated a maximum likely slip rate of about 2 mm/yr and a best estimate of about 1.5 mm/yr, based on recent three-dimensional trenching on the Rose Canyon Fault in Rose Canyon several miles north of the site. They found stratigraphic evidence of at least three events during the past 8,100 years. The most recent surface rupture displaces the modern “A horizon” (topsoil), suggesting that this event probably occurred within the past 500 years.

Although some faults in the downtown area have been determined to have been active in Holocene time, these faults are probably not capable of generating large magnitude earthquakes because of their relatively short fault length. In addition, the style of faulting suggests that slip during earthquakes in the downtown area will likely be distributed over a relatively wide fault zone. Therefore, the San Diego Segment of the Rose Canyon Fault Zone has been chosen as the segment believed capable of generating the most damaging ground motions at the site.

According to the computer program *EZ-FRISK* (Version 7.31), 7 known active faults are located within a search radius of 50 miles from the property. The nearest known active fault is the Rose Canyon Fault, located approximately  miles east of the site and is the dominant source of potential ground motion. Earthquakes that might occur on the Rose Canyon Fault Zone or other faults within the southern California and northern Baja California area are potential generators of significant ground motion at the site. The estimated deterministic maximum earthquake magnitude and peak ground acceleration for the Rose Canyon Fault are 7.2 and 0.45g, respectively. Table 7.5.1 lists the estimated maximum earthquake magnitude and peak ground acceleration for the most dominant faults in relationship to the site location. We calculated peak ground acceleration (PGA) using Boore-Atkinson (2008) NGA USGS2008, Campbell-Bozorgnia (2008) NGA USGS, and Chiou-Youngs (2008) NGA acceleration-attenuation relationships.

**TABLE 7.5.1**
**DETERMINISTIC SPECTRA SITE PARAMETERS**

| **Fault Name** | **Distance from Site (miles)** | **Maximum Earthquake Magnitude (Mw)** | **Peak Ground Acceleration** | | |
|---|---|---|---|---|---|
| | | | **Boore-Atkinson 2008 (g)** | **Campbell-Bozorgnia 2008 (g)** | **Chiou-Youngs 2008 (g)** |
| Rose Canyon | <¼ | 7.2 | 0.33 | 0.32 | 0.45 |
| Coronado Bank | 13 | 7.7 | 0.24 | 0.18 | 0.25 |
| Newport-Inglewood (offshore) | 35 | 7.2 | 0.16 | 0.09 | 0.10 |
| Elsinore (Julian) | 42 | 7.5 | 0.16 | 0.09 | 0.11 |
| Earthquake Valley | 47 | 6.9 | 0.12 | 0.06 | 0.06 |
| Elsinore (Temecula) | 47 | 7.2 | 0.14 | 0.07 | 0.08 |
| Elsinore (Coyote Mountain) | 50 | 7.2 | 0.13 | 0.07 | 0.07 |

We used the computer program *EZ-FRISK* to perform a probablilistic seismic hazard analysis. The computer program *EZ-FRISK* operates under the assumption that the occurrence rate of earthquakes on each mappable Quaternary fault is proportional to the faults slip rate. The program accounts for fault rupture length as a function of earthquake magnitude, and site acceleration estimates are made using the earthquake magnitude and distance from the site to the rupture zone. The program also accounts for uncertainty in each of following: (1) earthquake magnitude, (2) rupture length for a given magnitude, (3) location of the rupture zone, (4) maximum possible magnitude of a given earthquake, and (5) acceleration at the site from a given earthquake along each fault. By calculating the expected accelerations from considered earthquake sources, the program calculates the total average annual expected number of occurrences of site acceleration greater than a specified value. We utilized acceleration-attenuation relationships suggested by Boore-Atkinson (2008) NGA USGS, Campbell-Bozorgnia (2008) NGA USGS, and Chiou-Youngs (2008) in the analysis. Table 7.5.2 presents the site-specific probabilistic seismic hazard parameters including acceleration-attenuation relationships and the probability of exceedence.

### TABLE 7.5.2
### PROBABILISTIC SEISMIC HAZARD PARAMETERS

| Probability of Exceedence | Peak Ground Acceleration | | |
|---|---|---|---|
| | Boore-Atkinson, 2007 (g) | Campbell-Bozorgnia, 2008 (g) | Chiou-Youngs, 2008 (g) |
| 2% in a 50 Year Period | 0.62 | 0.46 | 0.57 |
| 5% in a 50 Year Period | 0.48 | 0.35 | 0.44 |
| 10% in a 50 Year Period | 0.39 | 0.28 | 0.34 |

The California Geologic Survey (CGS) has a program that calculates the ground motion for a 10 percent of probability of exceedence in 50 years based on an average of several attenuation relationships. Table 7.5.3 presents the calculated results from the *Probabilistic Seismic Hazards Mapping Ground Motion* Page from the CGS website.

### TABLE 7.5.3
### PROBABILISTIC SITE PARAMETERS FOR SELECTED FAULTS
### CALIFORNIA GEOLOGIC SURVEY

| Calculated Acceleration (g) Firm Rock | Calculated Acceleration (g) Soft Rock | Calculated Acceleration (g) Alluvium |
|---|---|---|
| 0.27 | 0.29 | 0.33 |

While listing peak accelerations is useful for comparison of potential effects of fault activity in a region, other considerations are important in seismic design, including the frequency and duration of motion and the soil conditions underlying the site. Seismic design of the structures should be evaluated in accordance with the California Building Code (CBC) guidelines currently adopted by the City of San Diego.

## 7.6 Liquefaction, Lateral Spreading, and Seismically Induced Settlement

Liquefaction typically occurs when a site is located in a zone with seismic activity, on-site soils are cohesionless, groundwater is encountered within 50 feet of the surface, and soil relative densities are less than about 70 percent. If the four previous criteria are met, a seismic event could result in a rapid pore-water pressure increase from the earthquake-generated ground accelerations. The material is a free flowing material that does not allow for increased pore-water pressure. Seismically induced settlement is settlement that may occur whether the potential for liquefaction exists or not.

The potential for liquefaction and seismically induced settlement occurring within the site soil is considered to be high due to the relatively low density of the underlying loose to medium dense sands and silty sands and the shallow groundwater table. As a part of future geotechnical investigations, Geocon should perform site specific liquefaction, lateral spreading/flow slide, and seismically induced settlement analyses for the proposed structures to evaluate the potential for hazards associated with these seismic effects and to provide geotechnical engineering recommendations for mitigation. Mitigation of the potential for soil liquefaction could include the use of ground improvement techniques (stone columns or ground densification) or the design of foundation systems to resist differential settlement such as deep foundations or mat foundations.

## 7.7 Effects of Liquefaction

The result of previous analyses indicates that liquefaction could occur within the soils below the groundwater table for the levels of ground shaking assumed for the site. Adverse impacts associated with liquefaction include lateral spreading, ground rupture and/or sand boils, and settlement of the liquefiable layers.

Lateral spreading occurs when liquefiable soil is in the immediate vicinity of a free face such as a slope. Factors controlling lateral displacement include earthquake magnitude, distance from the earthquake epicenter, thickness of liquefiable soil layer, grain size characteristics, fines contents of the soil and SPT blow counts. Bartlett and Youd (1995) have concluded that lateral spreading is restricted to sediments with corrected SPT blowcounts of 15 or less for earthquake magnitudes less than or equal to 8.0. The proposed improvements may be located as near as 35 feet from the existing seawall which retains saturated, loose to medium dense sands and silty sands. According to TerraCosta (2004), the potential for significant lateral deformations associated with the lateral spreading of the near bank areas of the bay is considered to be high. Preliminary estimates by TerraCosta (2004) suggest that the lateral deformations could be on the order of 5 to 10 feet and that the potential for lateral spreading could extend more that 200 to 600 feet from the edge of the bay.

Surface manifestation due to liquefaction may consist of surface rupture and/or sand boils, and surface settlement. Sand boils occur where liquefiable soil is extruded upward through the soil deposit to the ground surface. Providing an increase in overburden pressure and a compacted fill mat can mitigate surface manifestation.

Seismically-induced settlement could occur within the liquefied soil layer and/or layers after seismic shaking stops due to rearrangement of the sand particles. Calculated settlement due to liquefaction is has been estimated by TerraCosta (2004) to be approximately 4 to 8 inches without site improvements. Geocon Incorporated should perform additional geotechnical investigations to evaluate the potential of liquefaction.

## 7.8 Landslides

Examination of aerial photographs in our files, the results of previous field exploration, and review of available geotechnical reports for the site vicinity indicate that landslides are not present at the property or at a location that could impact the subject site.

## 7.9 Storm Surge, Tsunami, and Seiche

Storm surges are large ocean waves that sweep across coastal areas where storms make landfall. Storm surges can cause inundation, severe erosion, and backwater flooding. A tsunami is a series of long period waves generated in the ocean by a sudden displacement of large volumes of water. Causes of tsunamis include underwater earthquakes, volcanic eruptions, or offshore slope failures. The first order driving force for locally generated tsunamis offshore southern California is expected to be tectonic deformation from large earthquakes (Legg, *et al.*, 2002). Historically, tsunami wave heights have ranged up to approximately 4 feet in the San Diego area (URS, 2004) from the May 1960 Chilean earthquake event. The County of San Diego Hazard Mitigation Plan (2005) maps zones of high risk for tsunami run-up for coastal areas throughout the county. The site is included within one of these high risk hazard areas. The proposed elevations at the site are on the order of 10 feet above MSL and the site is located along San Diego Bay. The potential for tsunami run-up at the neighboring Hyatt Hotel site (MACTEC, 2004) was estimated to range up to approximately 6 feet for a 100-year tsunami event and approximately 12 feet for a 500-year tsunami event. A seiche is a run-up of water within a lake or embayment triggered by fault- or landslide-induced ground displacement. San Diego Bay could be affected by an earthquake-triggered seiche, but the risk at the project site is no greater than the surrounding developments. Based on historic and predicated tsunami or seiche run-ups, it is our opinion that the proposed site elevation is sufficient to mitigate the risk. Therefore, the potential of storm surges, tsunamis, or seiches affecting the site can be considered low.

### 7.10 Consolidation and Settlement

Loose to medium dense, saturated sands and soft clays within the underlying fill and bay deposits at the subject site may be subject to consolidation settlement (densification by the removal of water within the soil) under loads imposed by placement of fill or structure loads. The amount of settlement that could occur is a function of how thick the layer is, how compressible the layer is, and the magnitude of the new vertical load (weight of new fill or future building loads). Mitigation of the settlement may consist of placement of surcharge fills (additional fill placed above proposed grade to decrease the settlement period) within building areas, or the use of ground improvement techniques such as stone columns or wick drains. As a part of future geotechnical investigations, Geocon should perform site specific consolidation settlement analyses for the proposed structures to evaluate and quantify the potential for differential settlement and provide mitigation recommendations, if necessary.

# 8. CONCLUSIONS

## 8.1 General

8.1.1 This geotechnical reconnaissance report is intended to provide preliminary information on the underlying geologic conditions and the potential for geologic hazards at the site. A site-specific geotechnical and geologic fault hazard investigation should be prepared when development plans have been prepared. The future investigation should include subsurface exploration, laboratory testing, engineering analyses, and preparation of geotechnical design recommendations.

8.1.2 The site is located within the City of San Diego Downtown Special Studies Zone, but is not within a State of California Earthquake Fault Zone. The nearest active fault to the site is the Rose Canyon Fault Zone. The nearest active fault strand is located approximately 1,500 feet from the site. Evidence of active faults was not encountered during previous fault hazard evaluations for neighboring properties. A site specific fault hazard investigation should be prepared in compliance with the City of San Diego Building Department guidelines and the *City of San Diego Seismic Safety Study, Geologic Hazards and Faults, 2008.*

8.1.3 Significant geologic hazards associated with an earthquake event include possible strong seismic shaking, liquefaction, lateral spreading, and seismically induced settlement. A site specific evaluation of the potential hazards and mitigation measures should be prepared as a part of future geotechnical investigations.

8.1.4 Subsurface information from previous investigations indicates that the site is underlain by fill material, bay deposits, and the Old Paralic Deposits (formerly Bay Point Formation). The fill material and Bay Deposits are unsuitable for the support of structural loads. The Old Paralic Deposits are considered suitable for support of proposed structures.

8.1.5 The groundwater table was encountered in previous exploratory borings at a depth of approximately 9 to 14 feet (approximate elevation of 0 to -5 feet MSL) A static groundwater table of approximately sea level should be used for design.

8.1.6 We expect the planned improvements will be supported on a deep foundation system founded in Old Paralic Deposits. Geotechnical recommendations for foundations and soil mitigation would be presented in future geotechnical investigations.

8.1.7 The site has been subject to environmental assessment and remediation actions associated with soil and groundwater contamination. No further action has been recommended by the RWQCB. We do not expect that the proposed development will be impacted by the presence of soil or groundwater contaminants. Environmental monitoring of volatile organic compounds (VOCs) in soil vapor should be provided for soil exposed during site development.

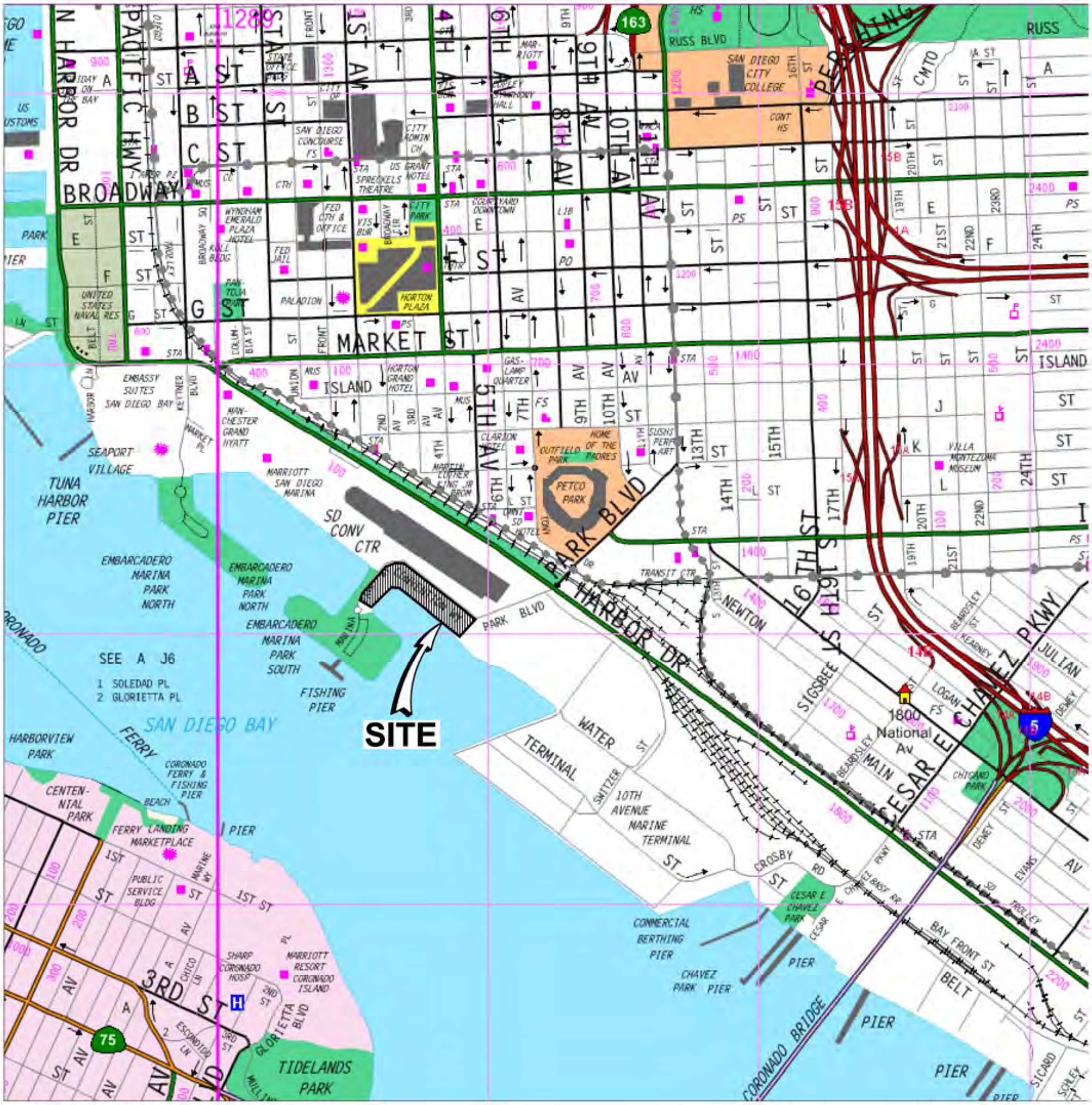
## LIMITATIONS AND UNIFORMITY OF CONDITIONS

1. The recommendations of this report pertain only to the site investigated and are based upon the assumption that the soil conditions do not deviate from those disclosed in the investigation. If any variations or undesirable conditions are encountered during construction, or if the proposed construction will differ from that anticipated herein, Geocon Incorporated should be notified so that supplemental recommendations can be given. The evaluation or identification of the potential presence of hazardous or corrosive materials was not part of the scope of services provided by Geocon Incorporated.

2. This report is issued with the understanding that it is the responsibility of the owner or his representative to ensure that the information and recommendations contained herein are brought to the attention of the architect and engineer for the project and incorporated into the plans, and that the necessary steps are taken to see that the contractor and subcontractors carry out such recommendations in the field.

3. The findings of this report are valid as of the present date. However, changes in the conditions of a property can occur with the passage of time, whether due to natural processes or the works of man on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and should not be relied upon after a period of three years.

4. The firm that performed the geotechnical investigation for the project should be retained to provide testing and observation services during construction to provide continuity of geotechnical interpretation and to check that the recommendations presented for geotechnical aspects of site development are incorporated during site grading, construction of improvements, and excavation of foundations. If another geotechnical firm is selected to perform the testing and observation services during construction operations, that firm should prepare a letter indicating their intent to assume the responsibilities of project geotechnical engineer of record. A copy of the letter should be provided to the regulatory agency for their records. In addition, that firm should provide revised recommendations concerning the geotechnical aspects of the proposed development, or a written acknowledgement of their concurrence with the recommendations presented in our report. They should also perform additional analyses deemed necessary to assume the role of Geotechnical Engineer of Record.



SOURCE: 2007 THOMAS BROTHERS MAP
SAN DIEGO COUNTY, CALIFORNIA

N
NO SCALE

**GEOCON**
**INCORPORATED**

GEOTECHNICAL CONSULTANTS
6960 FLANDERS DRIVE - SAN DIEGO, CALIFORNIA 92121 - 2974
PHONE 858 558-6900 - FAX 858 558-6159

| JW / AML | | DSK/GTYPD |
|---|---|---|

## VICINITY MAP

SAN DIEGO CONVENTION CENTER EXPANSION
SAN DIEGO, CALIFORNIA

| DATE 03 - 15 - 2009 | PROJECT NO. G1077 - 52 - 01 | FIG. 1 |
|---|---|---|

Vicinity Map

C:\Geocon\GEO_2009\Geotech\G1077-52-01\GEOCON\Gvicmp.dwg, 8/6/2009 3:13:40 PM, Ladrillono A

GRAPHIC SCALE
0' 50' 100' 150' 200' 300' 400'
SCALE 1" = 100'

GEOCON LEGEND

Qudf ........UNDOCUMENTED FILL

Qbd ........BAY DEPOSITS (Dotted Where Buried)

$Qop_6$ ........OLD PARALIC DEPOSITS, FORMALLY BAY POINT FORMATION (Dotted Where Buried)

B-4 ........APPROX. LOCATION OF BORING (Geocon, 1981)

B-12 ⊕ ........APPROX. LOCATION OF BORING (Woodward-Clyde, 1982)

B-19 ........APPROX. LOCATION OF BORING (Woodward-Clyde, 1984)

B-107 ◉ ........APPROX. LOCATION OF BORING (Woodward-Clyde, 1994)

B-213 ........APPROX. LOCATION OF BORING (Ninyo & Moore, 2003)

B-4 ........APPROX. LOCATION OF BORING (Mactec, 2004)

MW-10 ........APPROX. LOCATION OF MONITORING WELL (Woodward-Clyde, 1993)

MW-1 ◐ ........APPROX. LOCATION OF MONITORING WELL (Ninyo & Moore, 1993)

CPT-3 ▲ ........APPROX. LOCATION OF CONE PENETROMETER TEST (Woodward-Clyde, 1984)

CPT-117 ........APPROX. LOCATION OF CONE PENETROMETER TEST (Woodward-Clyde, 1995)

CPT-4 ● ........APPROX. LOCATION OF CONE PENETROMETER TEST (Ninyo & Moore, 2003)

CPT-14 ........APPROX. LOCATION OF CONE PENETROMETER TEST (Mactec, 2004)

........APPROX. LOCATION OF SEISMIC REFLECTION PROFILES (Woodward-Clyde, 1995)

A A' ........APPROX. LOCATION OF GEOLOGIC CROSS-SECTION

-3 ........ELEVATION AT BASE OF FILL (Mean Sea Level, MSL)
-7 ........ELEVATION AT BASE OF BAY DEPOSITS / TOP OF BAY POINT FORMATION (MSL)
-3 ........ELEVATION OF GROUNDWATER (MSL)

# GEOLOGIC MAP

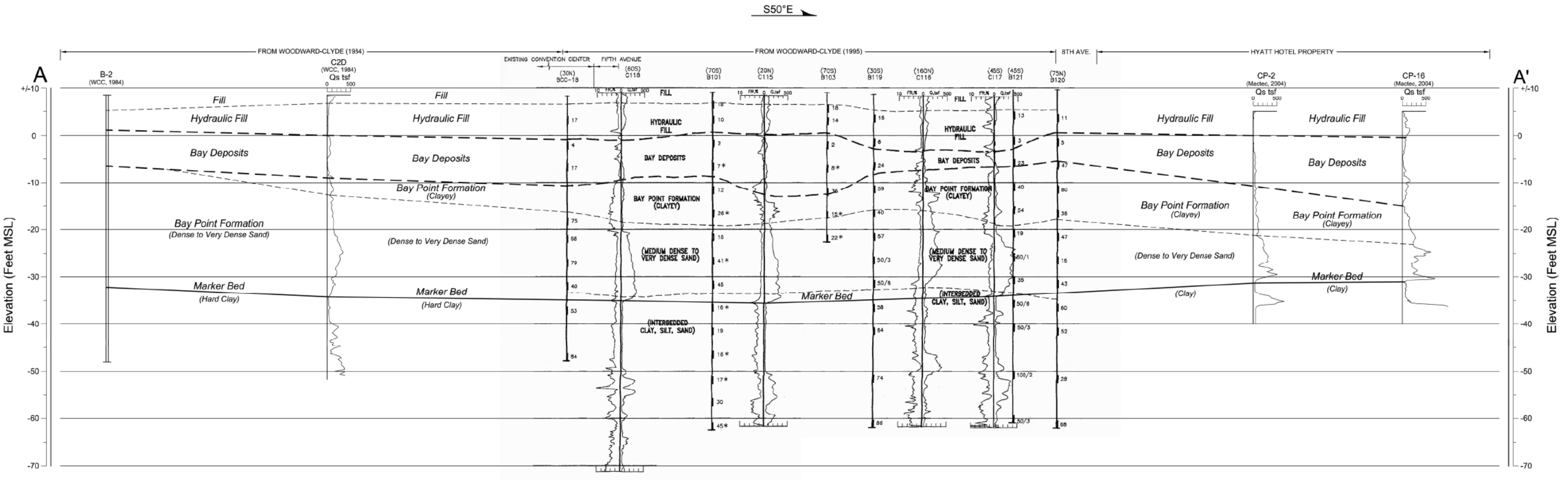
SAN DIEGO CONVENTION CENTER EXPANSION
SAN DIEGO, CALIFORNIA

GEOCON
INCORPORATED
GEOTECHNICAL CONSULTANTS
6960 FLANDERS DRIVE - SAN DIEGO, CALIFORNIA 92121 - 2974
PHONE 858 558-6900 - FAX 858 558-6159

| | |
|---|---|
| SCALE 1" = 100' | DATE 03 - 15 - 2009 |
| PROJECT NO. G1077 - 52 - 01 | FIGURE 2 |
| SHEET 1 OF 1 | |

24X36.DWG/LADRILLONO

C:\Geocon\GEO_2009\Geotech\G1077-52-01\G1077_MA12.dwg, 8/6/2009 3:06:46 PM, Ladrillono A



## CROSS-SECTION A-A'

SCALE
VERTICAL: 1" = 10'
HORIZONTAL: 1" = 100'

LEGEND

B-2, BCC-18, B121 ........APPROX. LOCATION OF EXPLORATORY BORING

C118, CP-16 ........APPROX. LOCATION OF CONE PENETRATION TEST (CPT)

50/6*▌ ........DRIVE SAMPLE LOCATION AND NUMBER OF BLOWS PER 12 INCHES, ASTERISK DENOTES STANDARD PENETRATION TEST

— — — ........APPROX. LOCATION OF GEOLOGIC CONTACT

# INTERPRETIVE GEOLOGIC CROSS - SECTION

SAN DIEGO CONVENTION CENTER EXPANSION
SAN DIEGO, CALIFORNIA

GEOCON
INCORPORATED
GEOTECHNICAL CONSULTANTS
6960 FLANDERS DRIVE - SAN DIEGO, CALIFORNIA 92121 - 2974
PHONE 858 558-6900 - FAX 858 558-6159

| | | |
|---|---|---|
| SCALE SEE MAP | DATE 03 - 15 - 2009 | |
| PROJECT NO. G1077 - 52 - 01 | | FIGURE 3 |
| SHEET 1 OF 1 | | |

C:\Geocon\GED_2009\Geotech\G1077-52-01\G1077_XSections.dwg, 8/6/2009 3:09:42 PM, Ladrillono

24X36.DWG/LADRILLONO

LEGEND

- ........APPROX. LOCATION OF EXPLORATORY TRENCH, COMPANY THAT PERFORMED THE TRENCH (Year Reported)
- ........APPROX. LOCATION OF STATE OF CALIFORNIA FAULT ZONE
- ........APPROX. LOCATION OF MAPPED ACTIVE FAULTS; CALIFORNIA GEOLOGIC SURVEY, May 1, 2003 (Queried Where Uncertain)
- ........APPROX. LOCATION OF ENCOUNTERED FAULT (Queried Where Uncertain)

# FAULT MAP

SAN DIEGO CONVENTION CENTER EXPANSION
SAN DIEGO, CALIFORNIA

GEOCON
INCORPORATED
GEOTECHNICAL CONSULTANTS
6960 FLANDERS DRIVE - SAN DIEGO, CALIFORNIA 92121 - 2974
PHONE 858 558-6900 - FAX 858 558-6159

| | |
|---|---|
| SCALE 1" = 200' | DATE 03 - 15 - 2009 |
| PROJECT NO. G1077 - 52 - 01 | FIGURE 4 |
| SHEET 1 OF 1 | |

24X36.DWG/LADRILLONO

C:\Geocon\GEO_2009\Geotech\G1077-52-01\G1077_Fault Map.dwg, 8/6/2009 3:11:21 PM, Ladrillono A

A

# APPENDIX A

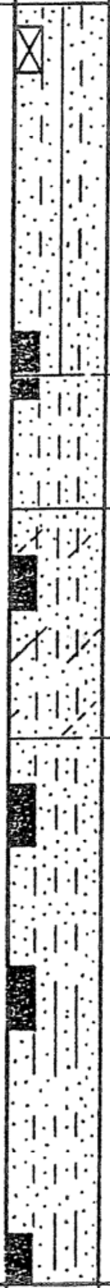
## EXPLORATORY BORING LOGS AND CONE PENETROMETER TEST (CPT) SOUNDINGS FROM PREVIOUS INVESTIGATIONS

FOR

## SAN DIEGO
## CONVENTION CENTER EXPANSION
## SAN DIEGO, CALIFORNIA

## PROJECT NO. G1077-52-01

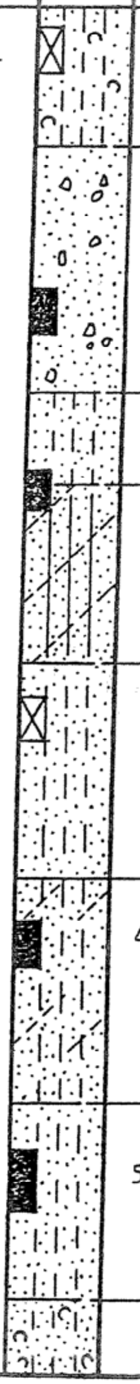
File No. D-2607-J02
December 9, 1981

| DEPTH IN FEET | SAMPLE NUMBER | LOG & LOCATION OF SAMPLE | Penetration Resistance Blows/ft | DESCRIPTION | IN-PLACE DRY DENSITY p.c.f | IN-PLACE MOISTURE CONTENT % dry wt |
|---|---|---|---|---|---|---|
| 0 | | | | BORING B-1 (Elev. - 5± ft. MLLW) | | |
| | | | | BAY SEDIMENTS/DREDGED FILL | | |
| | 1-1 |  | 5 | Silty SAND-Sandy SILT, predominantly fine, micaceous, very soft to soft, dark gray-black (shell fragments) | Sample Disturbed | |
| 2 | | | | | | |
| 4 | | | | | | |
| 6 | | | | | | |
| 8 | 1-2 A | | 10 | | 112.4 | 18.4 |
| | B | | | Clayey SAND, fine to medium, slightly Silty, loose to medium dense, brown | 121.0 | 14.6 |
| 10 | | | | | | |
| | | | | QUATERNARY SEDIMENTS | | |
| 12 | | | | | | |
| | 1-3 | | 50+ | Silty SAND, predominantly fine, slightly Clayey, moderately cemented, dense, brown; interbedded with thin layers SAND/CLAY-Clayey SAND, dense, greenish-brown | 119.3 | 14.5 |
| 14 | | | | | | |
| 16 | | | | | | |
| 18 | 1-4 | | 50+ | SAND, predominantly fine, Silty, micaceous, dense, greenish-brown | 106.4 | 21.5 |
| 20 | | | | | | |
| 22 | 1-5 | | 29 | interbedded below 21' with lenses of Sandy SILT, fine, medium dense, brown | 102.0 | 24.4 |
| 24 | | | | | | |
| 26 | | | | | | |
| 28 | 1-6 | | 49 | | 106.7 | 21.6 |
| | | | | BORING TERMINATED AT 28.0 FEET<br>(Elev. -35± ft. MLLW) | | |

Log of Test Boring B-1

Figure A-1

File No. D-2607-J02
December 9, 1981

| DEPTH IN FEET | SAMPLE NUMBER | LOG & LOCATION OF SAMPLE | Penetration Resistance Blows/ft | DESCRIPTION | IN-PLACE DRY DENSITY p.c.f | IN-PLACE MOISTURE CONTENT % dry wt |
|---|---|---|---|---|---|---|
| 0 | |  | | BORING B-2 (Elev. -8± ft. MLLW) | | |
| 2 | 2-1 | | | BAY SEDIMENTS/DREDGED FILL<br>Silty SAND, predominantly fine, very soft to soft, black (shell fragments) | Sample Disturbed | |
| 4<br>6<br>8 | 2-2 | | 53 | SAND, medium to coarse, occasional fine gravel, dense, black (shell fragments) | 114.3 | 15.5 |
| 10 | 2-3 | | 3 | Silty SAND, predominantly fine, micaceous, loose, greenish-brown | 91.7 | 31.6 |
| 12<br>14 | | | | Clayey SILT, some fine SAND, very soft to soft, greenish-gray | | |
| 16<br>18 | 2-4 | | 9 | Silty SAND, predominantly fine, loose, black-dark gray | Sample Disturbed | |
| 20<br>22<br>24 | 2-5 | | 44 | QUATERNARY SEDIMENTS<br>Silty SAND, fine to medium, slightly Clayey, dense, greenish-brown | 97.1 | 27.4 |
| 26<br>28 | 2-6 | | 50+ | SAND, fine to medium, slightly Silty, micaceous, dense, greenish-gray, (grading medium to coarse below 26') | 106.5 | 18.9 |
| 30 | | | | Silty SAND, fine to medium dense, light brown-tan (occasional shell fragments) | | |

Log of Test Boring B-2

Continued next page

Figure A-2

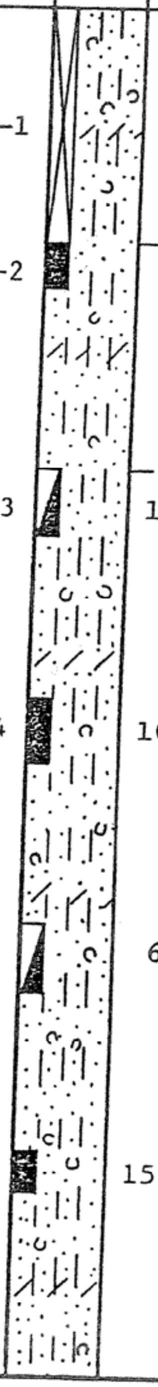
File No. D-2607-J02
December 9, 1981

| DEPTH IN FEET | SAMPLE NUMBER | LOG & LOCATION OF SAMPLE | Penetration Resistance Blows/ft | DESCRIPTION | IN-PLACE DRY DENSITY p.c.f | IN-PLACE MOISTURE CONTENT % dry wt |
|---|---|---|---|---|---|---|
| 30 | | | | BORING NO. B-2 CONTINUED | | |
| | 2-7 | ▨ | 50+ | Silty SAND, fine to medium dense, light brown-tan (occasional shell fragments) | 100.6 | 24.9 |
| 32 | | | | | | |
| | | | | BORING TERMINATED AT 31.5 FEET<br>(Elev. - 39.5± ft. MLLW) | | |

Log of Test Boring B-2

Figure A-2

File No. D-2607-J02
December 8, 1981

| DEPTH IN FEET | SAMPLE NUMBER | LOG & LOCATION OF SAMPLE | Penetration Resistance Blows/ft | DESCRIPTION | IN-PLACE DRY DENSITY p.c.f | IN-PLACE MOISTURE CONTENT % dry wt |
|---|---|---|---|---|---|---|
| 0 | |  | | BORING B-3 (Elev. 10.5± ft. MLLW) | | |
| | | | | DREDGED FILL<br>Silty SAND, well-graded, damp to moist, occasional shell fragments, loose to medium dense brown; occasional thin lenses, Silty Sandy CLAY, moist, soft, brown | | |
| 2 | 3-1 | | | | BULK | SAMPLE |
| 4 | | | | | | |
| 6 | 3-2 | | 7 | ▽ | 103.9 | 22.9 |
| 8 | | | | | | |
| 10 | | | | (clay lense thinly interbedded below 10 feet) | | |
| | 3-3 | | 14 | | | 20.6 |
| 12 | | | | | | |
| 14 | | | | | | |
| 16 | 3-4 | | 10 | | 103.2 | 23.9 |
| 18 | | | | | | |
| 20 | | | | | | |
| | 3-5 | | 6 | | | 22.2 |
| 22 | | | | | | |
| 24 | | | | | | |
| | 3-6 | | 15 | | 107.2 | 21.0 |
| 26 | | | | | | |
| 28 | | | | | | |

Log of Test Boring B-3

Continued next page

Figure A-3

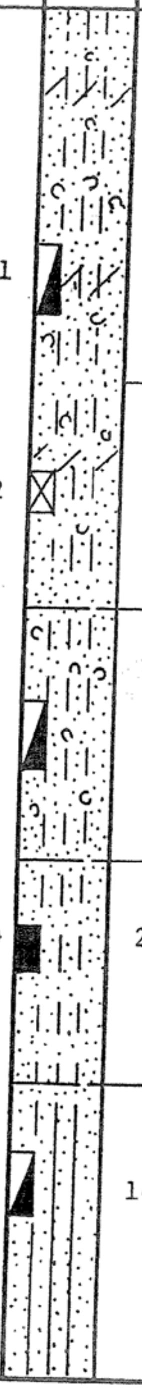
File No. D-2607-J02
December 9, 1981

| DEPTH IN FEET | SAMPLE NUMBER | LOG & LOCATION OF SAMPLE | Penetration Resistance Blows/ft | DESCRIPTION | IN-PLACE | |
|---|---|---|---|---|---|---|
| | | | | | DRY DENSITY p.c.f | MOISTURE CONTENT % dry wt |
| 30 | | | | BORING B-3 CONTINUED | | |
| | 3-7 | | 9 | | | 21.5 |
| 32 | | | | | | |
| 34 | | | | BAY SEDIMENTS<br>Sandy, Clayey SILT, saturated, soft to moderately firm, dark gray-black | | |
| 36 | 3-8 | | 10 | | 90.1 | 32.0 |
| 38 | | | | QUATERNARY SEDIMENTS<br>Clayey, Silty SAND, well-graded, occasional fine shell fragments, saturated, dense, brown | | |
| 40 | 3-9 | | 45 | | | 15.4 |
| 42 | | | | | | |
| 44 | | | | | | |
| 46 | 3-10 | | 50/6" | Grading to Silty SAND, slightly Clayey, predominantly fine, saturated, dense, orangish-tan-gray<br>(becoming well-graded below 48 feet) | 108.0 | 18.6 |
| 48 | | | | | | |
| 50 | 3-11 | | 48 | | | 15.8 |
| | | | | BORING TERMINATED AT 51.0 FEET<br>NOTE:<br>◪ Denotes Standard Penetration Sampling | | |

Log of Test Boring B-3

Figure A-3

File No. D-2607-J02
December 9, 1981

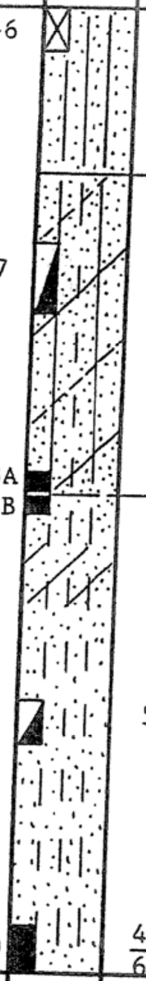
| DEPTH IN FEET | SAMPLE NUMBER | LOG & LOCATION OF SAMPLE | Penetration Resistance Blows/ft | DESCRIPTION | IN-PLACE DRY DENSITY p.c.f | IN-PLACE MOISTURE CONTENT % dry wt |
|---|---|---|---|---|---|---|
| 0 | |  | | BORING B-4 (Elev. 11.5± ft. MLLW) | | |
| 2 | | | | DREDGED FILL<br>Silty SAND, well-graded, damp to moist, loose occasional shwll fragments, brown; occasional thin lenses of Silty Sandy CLAY, moist, soft, brown | | |
| 4 | | | | | | |
| 6 | 4-1 | | 7 | | | 4.2 |
| 8 | | | | ▽ | | |
| 10 | 4-2 | | 6 | | Sample Disturbed | |
| 12 | | | | | | |
| 14 | | | | grading to Silty SAND, very fine, with shall fragments, saturated, loose, gray-brown | | |
| 16 | 4-3 | | 4 | | | 21.7 |
| 18 | | | | | | |
| 20 | 4-4 | | 22 | grading to Silty SAND, fine to medium, saturated, medium dense, gray | 102.6 | 23.5 |
| 22 | | | | | | |
| 24 | | | | grading to SAND, fine to medium, saturated, medium dense, gray-brown | | |
| 26 | 4-5 | | 14 | | | 20.0 |
| 28 | | | | | | |

Log of Test Boring B-4

Continued next page

Figure A-4

File No. D-2607-J02
December 9, 1981

| DEPTH IN FEET | SAMPLE NUMBER | LOG & LOCATION OF SAMPLE | Penetration Resistance Blows/ft | DESCRIPTION | IN-PLACE DRY DENSITY p.c.f | IN-PLACE MOISTURE CONTENT % dry wt |
|---|---|---|---|---|---|---|
| 30 | |  | | BORING B-4 CONTINUED | | |
| | 4-6 | | 9 | | Sample Disturbed | |
| 32 | | | | | | |
| 34 | | | | BAY SEDIMENTS<br>Sandy Clayey SILT - Silty CLAY, saturated, soft to moderately firm, black, pungent odor | | |
| 36 | 4-7 | | 10 | | | 32.2 |
| 38 | | | | | | |
| 40 | 4-8A<br>4-8B | | 26 | | 102.1<br>97.6 | 23.9<br>26.9 |
| 42 | | | | QUATERNARY SEDIMENTS<br>Silty SAND, slightly Clayey, predominantly fine, micaceous, saturated, dense, greenish-gray-brown<br>(interbedded with Silty SAND, fine to medium, saturated, dense, gray below 43 ft.) | | |
| 44 | | | | | | |
| 46 | 4-9 | | 50 | | | 16.4 |
| 48 | | | | | | |
| 50 | 4-10 | | 40/6" | | 111.3 | 18.9 |

BORING TERMINATED AT 51.0 FEET

(Elev. 39.5± ft. MLLW)

NOTE:

◪ Denotes Standard Penetration Sampling

Log of Test Boring B-4

Figure A-4

Boring 2

Approximate El. 8.62'

| DEPTH IN FEET | TEST DATA *MC | *DD | *BC | *OTHER TESTS | SAMPLE NUMBER | SOIL DESCRIPTION |
|---|---|---|---|---|---|---|
| | | | | | | Damp to moist, light gray, light gray brown and red brown, clayey sand and sandy clay with scattered shells FILL |
| 5 | 14 | 91 | 2 | | 2-1* | Moist to wet, light gray and light gray brown, silty sand with shells HYDRAULIC FILL |
| 10 | 28 | 93 | 2 | | 2-2* | ∇ Loose to medium dense, saturated, dark gray to black, silty sand and silty clay (SM-CH) BAY DEPOSITS |
| 15 | | | 3 | | 2-3* | |
| | 21 | 107 | 6 | | 2-4* | Dense to very dense, saturated, light gray and light brown, silty sand (SM-SP) with shells BAY POINT FORMATION |
| 20 | | | 9 | | 2-5* | |
| | 31 | 92 | 23 | | 2-6* | |
| 25 | 31 | 91 | 27 | GS | 2-7* | |
| 30 | | | 40 | | 2-8* | ← Scattered gravel layers |
| 35 | 28 | 94 | 27 | | 2-9* | |
| 40 | | | | | | |

*For description of symbols, see Figure A-1

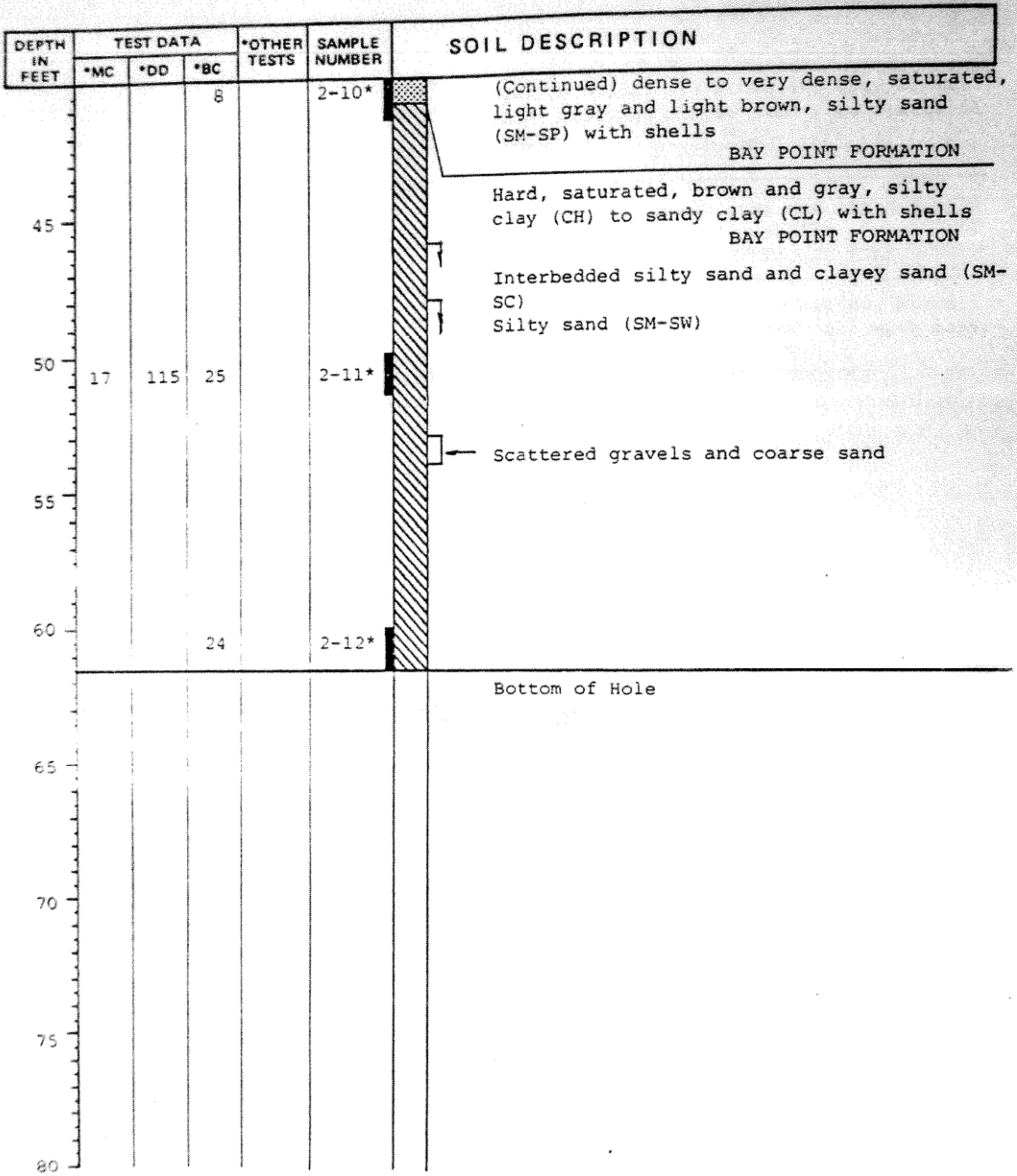
LOG OF TEST BORING 2
SAN DIEGO CONVENTION CENTER

| | | | | |
|---|---|---|---|---|
| DRAWN BY: ch | CHECKED BY: | PROJECT NO: 54217V-SI01 | DATE: 10-8-84 | FIGURE NO: |

**WOODWARD-CLYDE CONSULTANTS**

Figure A-5

Boring 2 (Cont'd)



| DEPTH IN FEET | TEST DATA *MC | *DD | *BC | *OTHER TESTS | SAMPLE NUMBER | SOIL DESCRIPTION |
|---|---|---|---|---|---|---|
| | | | 8 | | 2-10* | (Continued) dense to very dense, saturated, light gray and light brown, silty sand (SM-SP) with shells<br>BAY POINT FORMATION |
| | | | | | | Hard, saturated, brown and gray, silty clay (CH) to sandy clay (CL) with shells<br>BAY POINT FORMATION |
| 45 | | | | | | Interbedded silty sand and clayey sand (SM-SC)<br>Silty sand (SM-SW) |
| 50 | 17 | 115 | 25 | | 2-11* | |
| | | | | | | Scattered gravels and coarse sand |
| 55 | | | | | | |
| 60 | | | 24 | | 2-12* | |
| | | | | | | Bottom of Hole |
| 65 | | | | | | |
| 70 | | | | | | |
| 75 | | | | | | |
| 80 | | | | | | |

*For description of symbols, see Figure A-1

LOG OF TEST BORING 2 (CONT'D)
SAN DIEGO CONVENTION CENTER

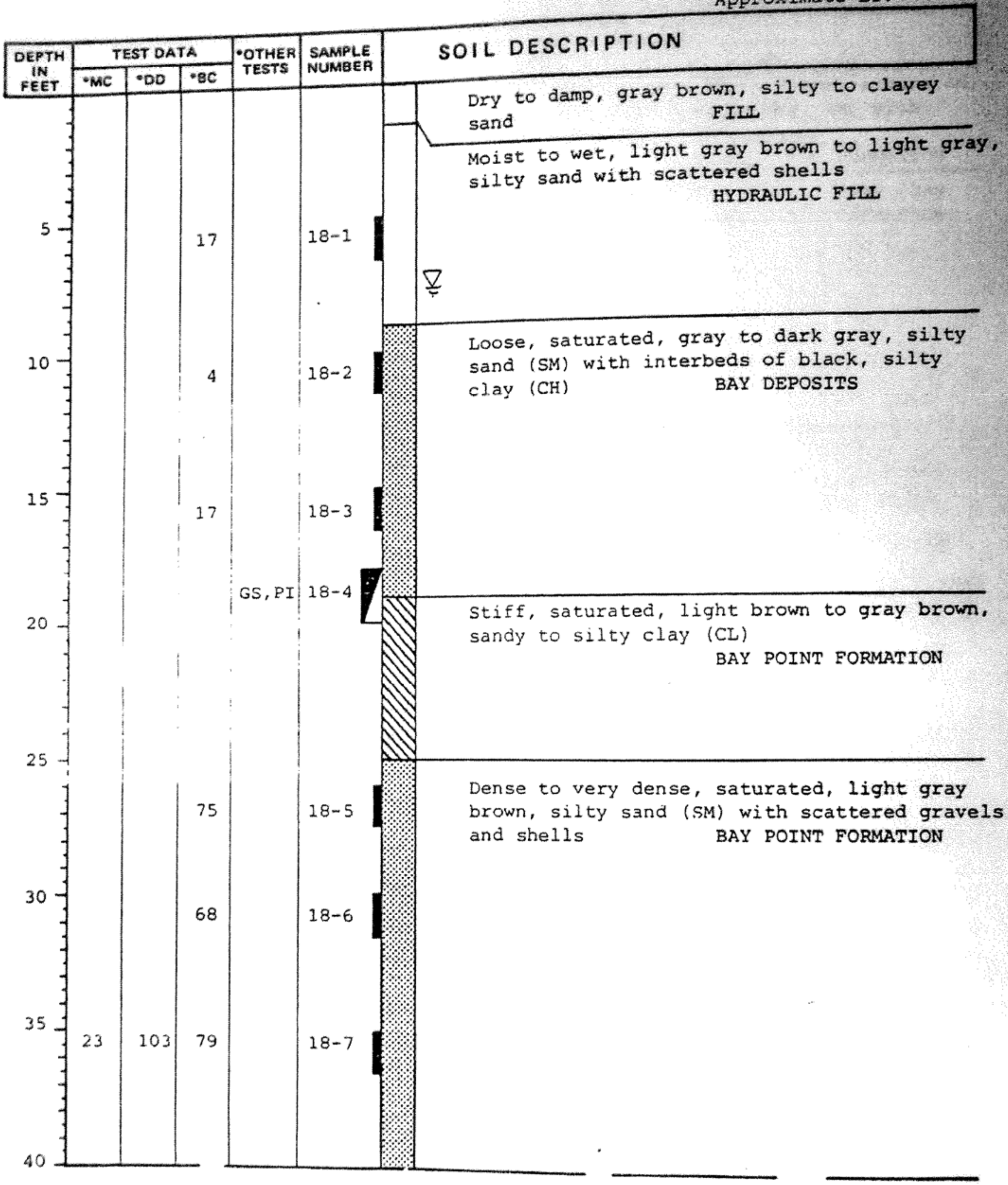
| | | | | |
|---|---|---|---|---|
| DRAWN BY: ch | CHECKED BY: | PROJECT NO: 54217V-SI01 | DATE: 10-8-84 | FIGURE NO: |

WOODWARD-CLYDE CONSULTANTS

Figure A-5

Boring 18

Approximate El. 8.02'



| DEPTH IN FEET | TEST DATA *MC | TEST DATA *DD | TEST DATA *BC | *OTHER TESTS | SAMPLE NUMBER | SOIL DESCRIPTION |
|---|---|---|---|---|---|---|
| 0 | | | | | | Dry to damp, gray brown, silty to clayey sand FILL |
| | | | | | | Moist to wet, light gray brown to light gray, silty sand with scattered shells HYDRAULIC FILL |
| 5 | | | 17 | | 18-1 | |
| 10 | | | 4 | | 18-2 | Loose, saturated, gray to dark gray, silty sand (SM) with interbeds of black, silty clay (CH) BAY DEPOSITS |
| 15 | | | 17 | | 18-3 | |
| | | | | GS,PI | 18-4 | |
| 20 | | | | | | Stiff, saturated, light brown to gray brown, sandy to silty clay (CL) BAY POINT FORMATION |
| 25 | | | 75 | | 18-5 | Dense to very dense, saturated, light gray brown, silty sand (SM) with scattered gravels and shells BAY POINT FORMATION |
| 30 | | | 68 | | 18-6 | |
| 35 | 23 | 103 | 79 | | 18-7 | |
| 40 | | | | | | |

*For description of symbols, see Figure A-1

Continued on next page

LOG OF TEST BORING 18
SAN DIEGO CONVENTION CENTER

| | | | | |
|---|---|---|---|---|
| DRAWN BY: ch | CHECKED BY: | PROJECT NO: 54217V-SI01 | DATE: 10-10-84 | FIGURE NO: |

**WOODWARD-CLYDE CONSULTANTS**

Figure A-6

Boring 18 (Cont'd)

| DEPTH IN FEET | TEST DATA *MC | TEST DATA *DD | TEST DATA *BC | *OTHER TESTS | SAMPLE NUMBER | SOIL DESCRIPTION |
|---|---|---|---|---|---|---|
| | | | 40 | | 18-8 | (Continued) dense to very dense, saturated, light gray brown, silty sand (SM) with scattered gravels and shells<br>BAY POINT FORMATION |
| | | | | | | Stiff, saturated, gray brown, silty clay (CH)<br>BAY POINT FORMATION |
| 45 | | | 53 | | 18-9 | |
| 50 | | | | | 18-10 | |
| 55 | | | | | 18-11 | Very dense, saturated, light gray brown and brown, silty fine sand (SM)<br>BAY POINT FORMATION |
| | | | 84 | | 18-12 | |
| | | | | | | Bottom of Hole |
| 60 | | | | | | |
| 65 | | | | | | |
| 70 | | | | | | |
| 75 | | | | | | |
| 80 | | | | | | |

*For description of symbols, see Figure A-1

LOG OF TEST BORING 18 (CONT'D)
SAN DIEGO CONVENTION CENTER

DRAWN BY: ch | CHECKED BY: | PROJECT NO: 54217V-SI01 | DATE: 10-10-84 | FIGURE NO:

**WOODWARD-CLYDE CONSULTANTS**

Figure A-6

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| DATE STARTED | 5/3/94 | DATE FINISHED | 5/3/94 | TOTAL DEPTH DRILLED (feet) | 31.5 | DIAMETER OF BORING (inches) | 8 |
| HAMMER WEIGHT (lbs) | 140 | HAMMER DROP (inches) | 30 | GROUNDWATER DEPTH (feet) | 14 | DATE MEASURED | ATD |
| DRILLING COMPANY | Tri-County Drilling | | | DRILLING EQUIPMENT | CME 75 | | |
| DRILLING METHOD | Hollow-stem auger | | | BOREHOLE BACKFILL | Bentonite-cement grout | LOGGED BY | S. Fitzwilliam |
| APPROXIMATE SURFACE ELEVATION (feet, MSL) | 9.0 | | | BORING LOCATION | See Figure in Text | | |

| DEPTH, feet | SAMPLES | BLOWS/ft | GRAPHIC LOG | DESCRIPTION | MOISTURE CONTENT, % | DRY DENSITY, pcf | OTHER TESTS/ NOTES |
|---|---|---|---|---|---|---|---|
| | | | | FILL<br>2" asphalt concrete over moist, dark brown, poorly graded sand with silt and gravels with trace clay | | | |
| | 103-1 ⧗ | 18 | | HYDRAULIC FILL<br>Moist, light brown, poorly graded fine to coarse sand and gravels | | | |
| 5 | 103-2 ⧗ | 14 | | With abundant shell fragments | | | |
| | | | ▨ | BAY DEPOSITS<br>Very soft, wet, dark gray, silty fat clay (CH) (decaying organic odor) | | | |
| 10 | 103-3 ⧗ | 2 | ▨ | | 68 | 59 | <200 (99%) |
| 15 | 103-4 ▯ | 8 | ▨ | | | | <200 (20%) |
| | | | ▒ | ▽ Loose, wet, dark gray, clayey fine to coarse sand (SC) with gravels and shell fragments (decaying organic odor) | | | |
| 20 | 103-5 ⧗ | 35 | ▒ | | | | |
| | | | ▨ | BAY POINT FORMATION<br>Medium dense to dense, wet, gray brown, sandy lean clay (CL) | | | |
| 25 | 103-6 ▯ | 15 | ▨ | | 26 | | <200 (88%) |
| | | | ▨ | Increasing clay content | | | |
| 30 | 103-7 ▯ | 22 | ▨ | 3" layer of moist, very light brown, sandy clay (CL) | 26 | 99 | <200 (80%) |
| | | | | Bottom of boring at 31.5 feet<br>Hole was backfilled with bentonite-cement grout. The top of the hole was backfilled with 2.5 inches of rapid set concrete overlying 6 inches of bentonite chips and capped with a 2 inch asphalt concrete coldpatch. | | | |
| 35 | | | | | | | |

**Project: Convention Center Expansion**

**Project Number: 9351114H-SI02**

# LOG OF BORING B-103

1 of 1

**Woodward-Clyde Consultants**

Figure A-7

| DEPTH, feet | SAMPLES | BLOWS/ft | GRAPHIC LOG | DESCRIPTION | MOISTURE CONTENT, % | DRY DENSITY, pcf | OTHER TESTS/ NOTES |
|---|---|---|---|---|---|---|---|
|  | 101-9 | 45 |  | Interbedded clay layers (clay in shoe) |  |  |  |
| 45 | 101<br>-10 | 16 |  |  |  |  |  |
| 50 | 101<br>-11 | 19 |  |  |  |  |  |
|  |  |  |  | Medium dense, wet, brown, lean clay with sand (CL) |  |  |  |
| 55 | 101<br>-12 | 16 |  |  |  |  | SA, HYD |
| 60 | 101<br>-13 | 17 |  |  |  |  | SA, HYD |
| 65 | 101<br>-14 | 30 |  | Dense, wet, gray and brown, clayey fine sand (SC) and sandy clay (CL) |  |  |  |
| 70 | 101<br>-15 | 45 |  |  |  |  | <200 (54%) |
|  |  |  |  | Bottom of boring at 71.5 feet<br>Hole was backfilled with a bentonite-cement grout. The top of the hole was backfilled with 2.5 inches at rapid set concrete overlying 6 inches of bentonite chips and capped with a 2 inch asphalt concrete coldpatch. |  |  |  |
| 75 |  |  |  |  |  |  |  |
| 80 |  |  |  |  |  |  |  |
| 85 |  |  |  |  |  |  |  |

**Project:** Convention Center Expansion
**Project Number:** 9351114H-SI02

## LOG OF BORING B-101

Woodward-Clyde Consultants

Figure A-7

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| DATE STARTED | 5/3/94 | DATE FINISHED | 5/3/94 | TOTAL DEPTH DRILLED (feet) | 71.5 | DIAMETER OF BORING (inches) | 8 |
| HAMMER WEIGHT (lbs) | 140 | HAMMER DROP (inches) | 30 | GROUNDWATER DEPTH (feet) | 10.5 | DATE MEASURED | ATD |
| DRILLING COMPANY | Tri-County Drilling | | | DRILLING EQUIPMENT | CME 75 | | |
| DRILLING METHOD | Hollow-stem auger | | | BOREHOLE BACKFILL | Bentonite-cement grout | LOGGED BY | S. Fitzwilliam |
| APPROXIMATE SURFACE ELEVATION (feet, MSL) | 9.0 | | | BORING LOCATION | See Figure in Text | | |

| DEPTH, feet | SAMPLES | BLOWS/ft | GRAPHIC LOG | DESCRIPTION | MOISTURE CONTENT, % | DRY DENSITY, pcf | OTHER TESTS/ NOTES |
|---|---|---|---|---|---|---|---|
| | | | | **FILL**<br>2" asphalt concrete over moist, dark brown, poorly graded sand with silt and gravels | | | |
| | 101-1 | 18 | | **HYDRAULIC FILL**<br>Moist, light brown, poorly graded fine to medium sand with shell fragments and gravels | | | |
| 5 | 101-2 | 10 | | Moist, very light brown, poorly graded fine to medium sand | 11 | 87 | |
| | | | ▨ | **BAY DEPOSITS**<br>Very soft, wet, dark gray, silty lean to fat clay (CL-CH) (decaying organic odor) | | | |
| 10 | 101-3 | 2 | ▨ ∇ | | | | |
| | | | ░ | Very loose, wet, dark gray, clayey sand (SC) with shell fragments and gravels | | | |
| 15 | 101-4 | 7 | ░ | | | | <200 (18%) |
| | | | ▨ | **BAY POINT FORMATION**<br>Firm, wet, light brown, lean clay with fine sand (CL) | | | |
| 20 | 101-5 | 12 | ▨ | | 19 | 110 | <200 (91%)<br>DS |
| | | | ▨ | Hard, wet, brown, lean clay (CL) with fine sand | | | |
| 25 | 101-6 | 26 | ▨ | | | | <200 (54%) |
| | | | ░ | Medium dense, wet, brown, poorly graded fine to coarse sand with clay (SP-SC) | | | |
| 30 | 101-7 | 18 | ░ | | | | <200 (9%) |
| 35 | 101-8 | 41 | ░ | | | | |

**Project: Convention Center Expansion**
**Project Number: 9351114H-SI02**

## LOG OF BORING B-101

1 of 2

6/26/95 BGLOG 1114H

| | | | |
|---|---|---|---|
| DATE STARTED 5/2/95 | DATE FINISHED 5/2/95 | TOTAL DEPTH DRILLED (feet) 71.5 | DIAMETER OF BORING (inches) 8 |
| HAMMER WEIGHT (lbs) 140 | HAMMER DROP (inches) 30 | GROUNDWATER DEPTH (feet) 9 | DATE MEASURED ATD |
| DRILLING COMPANY Tri-County Drilling | | DRILLING EQUIPMENT CME 75 | |
| DRILLING METHOD Hollow stem auger | | BOREHOLE BACKFILL Grouted backfill | LOGGED BY S. Fitzwilliam |
| APPROXIMATE SURFACE ELEVATION (feet, MSL) 9.5 | | BORING LOCATION See Figure in Text | |

| DEPTH, feet | SAMPLES | BLOWS/ft | GRAPHIC LOG | DESCRIPTION | MOISTURE CONTENT, % | DRY DENSITY, pcf | OTHER TESTS/ NOTES |
|---|---|---|---|---|---|---|---|
| | | | | FILL<br>2" asphalt concrete over moist, dark reddish brown, silty fine sand with gravels | | | |
| | | | | Some ash at 4' | | | |
| 5 | 120-1 | 11 | | HYDRAULIC FILL<br>Moist, light brown, poorly graded fine sand with silty and shell fragments<br>3" brown, fat clay layer<br>Some ash at 5'<br>With clay layers | 5 | 95 | <200(8), DS |
| | | | | ▽ | | | |
| 10 | 120-2 | 5 | ▨ | BAY DEPOSITS<br>Very soft, wet, brown, fine sandy clay (CL) | | | |
| 15 | 120-3 | 47 | ▨ | BAY POINT FORMATION<br>Hard, wet, gray, lean clay (CL) with fine sand | 42 | | PI=24,<br>LL=38 |
| 20 | 120-4 | 80 | ▨ | | 29 | 95 | |
| | | | ░ | Very dense, wet, brown, poorly graded medium to fine sand (SP-SM) with some silt | | | |
| | | | ▨ | Hard, wet, brown, sandy lean clay (CL) | | | |
| 25 | 120-5 | 35 | ▨ | | 15 | 117 | <200(52)<br>PI=19,<br>LL=33 |
| 30 | 120-6 | 47 | ▨ | | | | DS |
| | | | ░ | Dense, wet, gray brown, poorly graded medium to fine sand with silt (SP-SM) with gravels and few cobbles | | | |
| 35 | 120-7 | 16** | ░ | | 26 | | |

**Project: Convention Center Expansion**
**Project Number: 9351114H-SI02**

## LOG OF BORING B-120

| DEPTH, feet | SAMPLES | BLOWS/ft | GRAPHIC LOG | DESCRIPTION | MOISTURE CONTENT, % | DRY DENSITY, pcf | OTHER TESTS/ NOTES |
|---|---|---|---|---|---|---|---|
|  | 120-8 | 43 | ▨ | Hard, wet, brown, silty lean clay (CL) with gravels | 26 | 99 | SA(91)<br>PI=31,<br>LL=49 |
| 45 | 120-9 | 60 | ▨ |  |  |  |  |
|  |  |  | ░ | Very dense, wet, poorly graded coarse to medium sand (SP) with gravels | 18 |  |  |
|  |  |  | ▨ | Hard, wet, brown, coarse sandy clay (CL) with few gravels |  |  |  |
| 50 | 120-10 | 52 | ▥ | Very dense, wet, brown, sandy silt (ML) | 23 |  | <200(59) |
| 55 |  |  | ▨ | Hard, wet, brown, sandy lean to fat clay (CL/CH) |  |  |  |
| 60 | 120-11 | 28 | ▨ |  | 24 | 102 | <200(70)<br>PI=37,<br>LL=50<br>CON |
| 65 |  |  | ░ | Interbedded, very dense, wet, reddish brown, clayey medium to fine sand (SC), silty fine sand (SM) and sandy silt (ML) with few gravels |  |  |  |
| 70 | 120-12 | 68 | ░ |  |  |  |  |
|  |  |  |  | Bottom of boring at 71.5 feet<br>Hole was backfilled with bentonite-cement grout. The top of the hole was backfilled with 2.5 inches of rapid set concrete overlying 6 inches of bentonite chips and capped with a 2 inch asphalt concrete coldpatch. |  |  |  |
| 75 |  |  |  |  |  |  |  |
| 80 |  |  |  |  |  |  |  |
| 85 |  |  |  |  |  |  |  |

**Project:** Convention Center Expansion
**Project Number:** 9351114H-SI02

## LOG OF BORING B-120

2 of 2

6/26/95 BGLOG 1114H

**Woodward-Clyde Consultants**

Figure A-9

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| DATE STARTED | 5/1/95 | DATE FINISHED | 5/1/95 | TOTAL DEPTH DRILLED (feet) | 71.0 | DIAMETER OF BORING (inches) | 8 |
| HAMMER WEIGHT (lbs) | 140 | HAMMER DROP (inches) | 30 | GROUNDWATER DEPTH (feet) | 9 | DATE MEASURED | ATD |
| DRILLING COMPANY | Tri-County Drilling | | | DRILLING EQUIPMENT | CME 75 | | |
| DRILLING METHOD | Hollow stem auger | | | BOREHOLE BACKFILL | Grouted backfill | LOGGED BY | S. Fitzwilliam |
| APPROXIMATE SURFACE ELEVATION (feet, MSL) | 9.0 | | | BORING LOCATION | See Figure in Text | | |

| DEPTH, feet | SAMPLES | BLOWS/ft | GRAPHIC LOG | DESCRIPTION | MOISTURE CONTENT, % | DRY DENSITY, pcf | OTHER TESTS/ NOTES |
|---|---|---|---|---|---|---|---|
| | 121-1a | | | **FILL**<br>Asphalt concrete over moist, dark reddish brown, silty fine sand with gravels | | | |
| | | | | Moist, dark reddish brown, clayey fine sand with few shell fragments | | | SA(29), LC CORR, 'R' |
| 5 | 121-1 | 13 | | **HYDRAULIC FILL**<br>Moist, red brown, silty to poorly graded sand with shell fragments and occasional layers of brown, lean to fat clay | 23 | 92 | |
| | | | | ▽ Moist to wet, brown, poorly graded fine sand with some shell fragments | | | |
| 10 | 121-2 | 3 | | | | | |
| | | | | **BAY DEPOSITS**<br>Medium dense, wet, poorly graded sand (SP) with shell fragments and organic odor | | | |
| 15 | 121-3 | 23 | | Medium dense, wet, gray brown, clayey fine sand (SC) with shell fragments (organic odor) | 17 | 113 | <200(38) |
| | | | | **BAY POINT FORMATION**<br>Dense, wet, brown, sandy lean clay (CL) | | | |
| 20 | 121-4 | 40 | | | 19 | 110 | SA(68) |
| 25 | 121-5 | 54 | | Very dense, wet, brown, silty fine sand (SM) | 18 | 112 | <200(33) |
| 30 | 121-6 | 19 | | Layer of stiff, brown, fat clay (CH) | 21 | | |
| | | | | Medium dense to dense, wet, brown, poorly graded sand with silt (SP-SM) with clay | | | |
| 35 | 121-7 | 50/1" | | Very dense, wet, brown, clayey fine sand (SC) | | | |

**Project: Convention Center Expansion**
**Project Number:** 9351114H-SI02

## LOG OF BORING B-121

1 of 2

6/26/95 BGLOG 1114H

**Woodward-Clyde Consultants**

Figure A-10

| DEPTH, feet | SAMPLES | BLOWS/ft | GRAPHIC LOG | DESCRIPTION | MOISTURE CONTENT, % | DRY DENSITY, pcf | OTHER TESTS/ NOTES |
|---|---|---|---|---|---|---|---|
|  | 121-8 | 35 | ░ | Dense to very dense, wet, brown, silty fine sand (SM) | 25 | 97 | SA(21), DS |
| 45 | 121-9 | 50/6" | ░ |  |  |  |  |
|  |  |  | ░▨ | Very dense, wet, brown, clayey medium to fine sand (SC) and sandy lean clay (CL) |  |  |  |
| 50 | 121-10 | 50/3" | ░▨ |  | 21 |  |  |
| 55 |  |  | ░▨ |  |  |  |  |
| 60 | 121-11 | 100/2" | ▨ | Hard, wet, light brown, fat clay (CH) |  |  |  |
| 65 |  |  | ▨ |  |  |  |  |
| 70 | 121-12 | 50/3" | ▨ |  |  |  |  |
|  |  |  |  | Bottom of boring at 71 feet<br>Hole was backfilled with bentonite-cement grout. The top of the hole was backfilled with 2.5 inches of rapid set concrete overlying 6 inches of bentonite chips and capped with a 2 inch asphalt concrete coldpatch. |  |  |  |
| 75 |  |  |  |  |  |  |  |
| 80 |  |  |  |  |  |  |  |
| 85 |  |  |  |  |  |  |  |

**Project:** Convention Center Expansion
**Project Number:** 9351114H-SI02

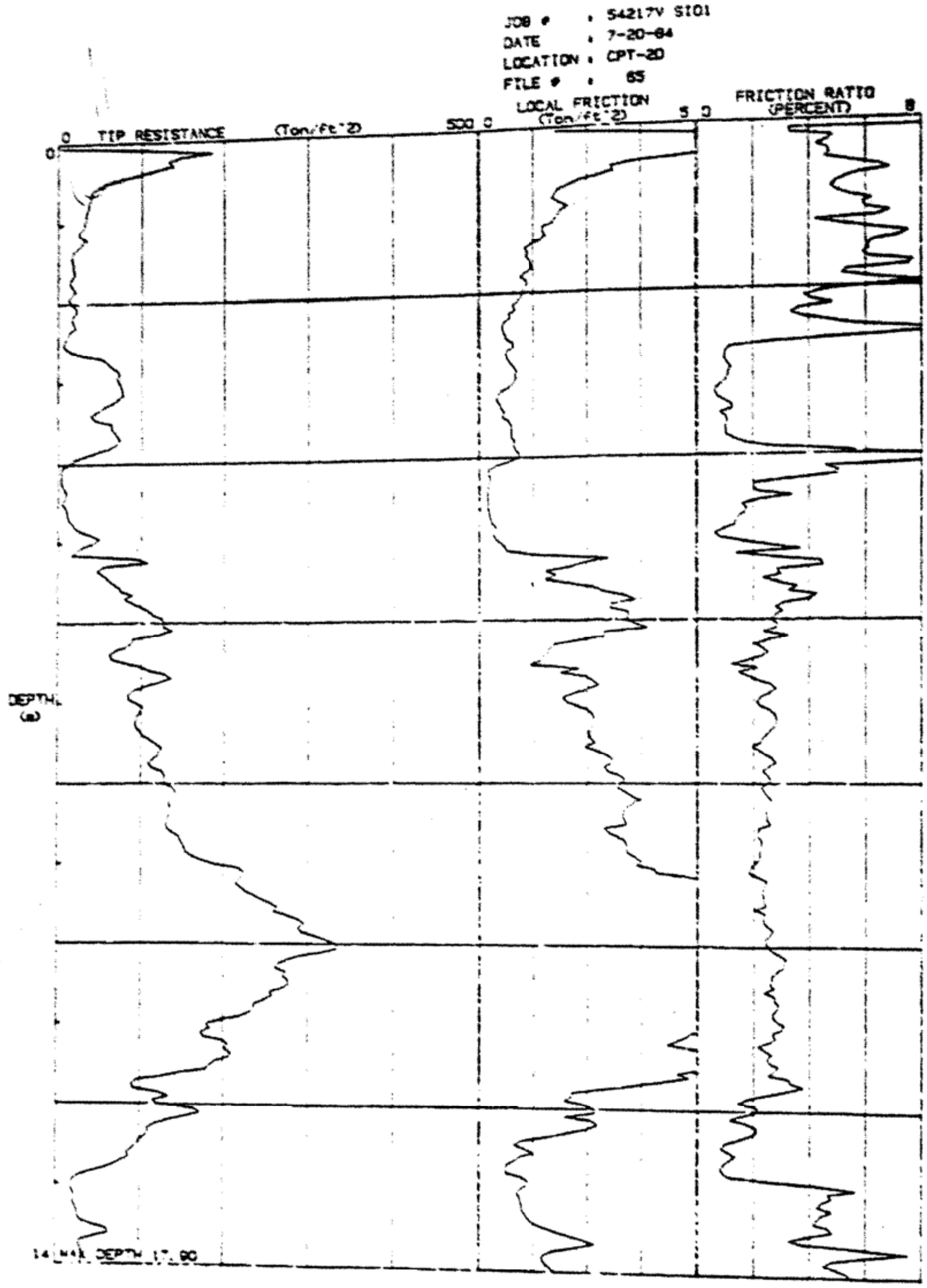
## LOG OF BORING B-121

2 of 2

6/26/95 BGLOG 1114H

**Woodward-Clyde Consultants**

Figure A-10

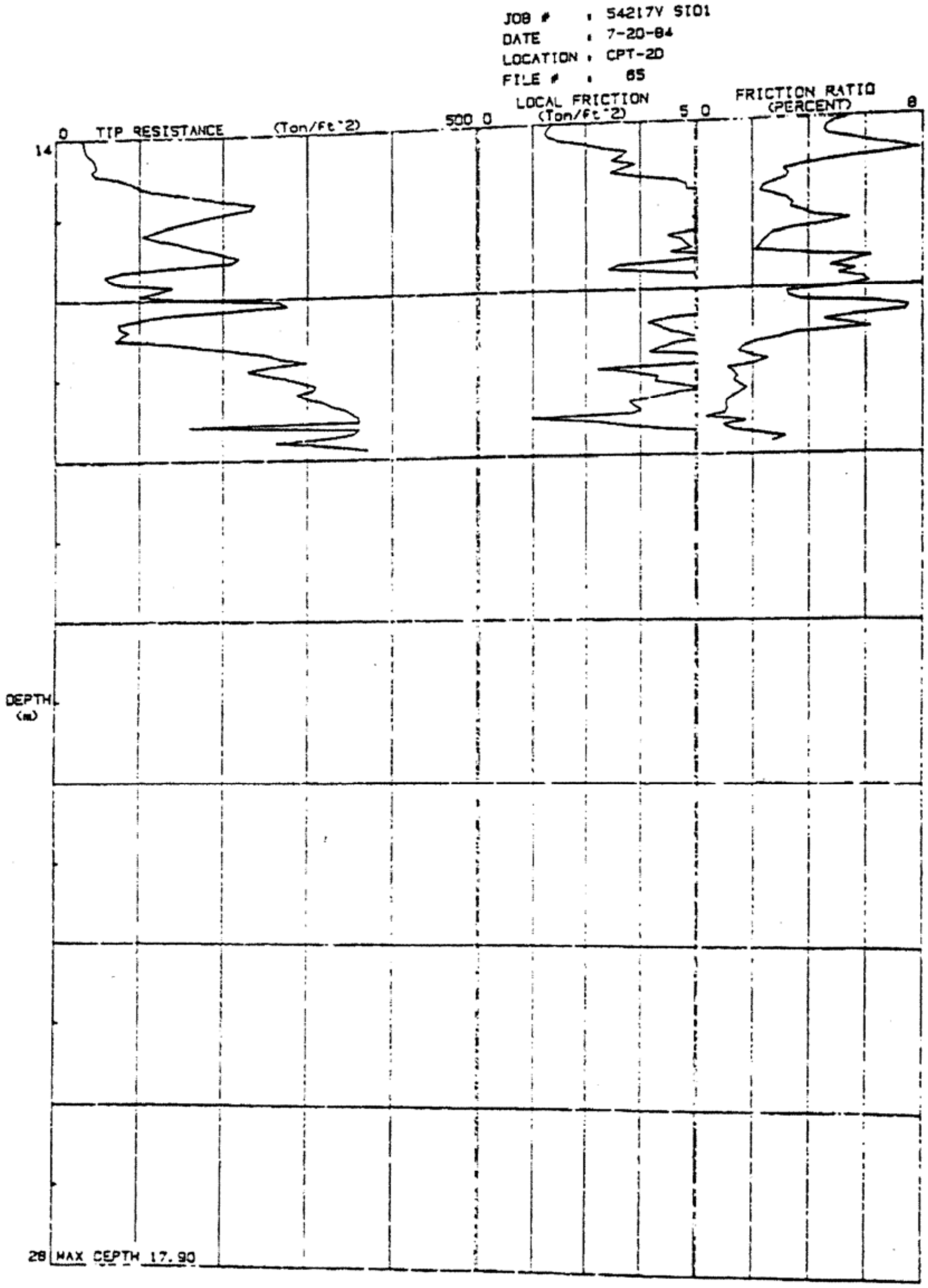


CONE PENTROMETER TEST 2D
SAN DIEGO CONVENTION CENTER

**DRAWN BY:** ch
**CHECKED BY:**
**PROJECT NO:** 54217V-SIO1
**DATE:** 10-12-84
**FIGURE NO:**

**WOODWARD-CLYDE CONSULTANTS**

Figure A-11



CONE PENTROMETER TEST 2D (CONT'D)
SAN DIEGO CONVENTION CENTER

**DRAWN BY:** ch | **CHECKED BY:** | **PROJECT NO:** 54217V-SIO1 | **DATE:** 10-12-84 | **FIGURE NO:**

**WOODWARD-CLYDE CONSULTANTS**

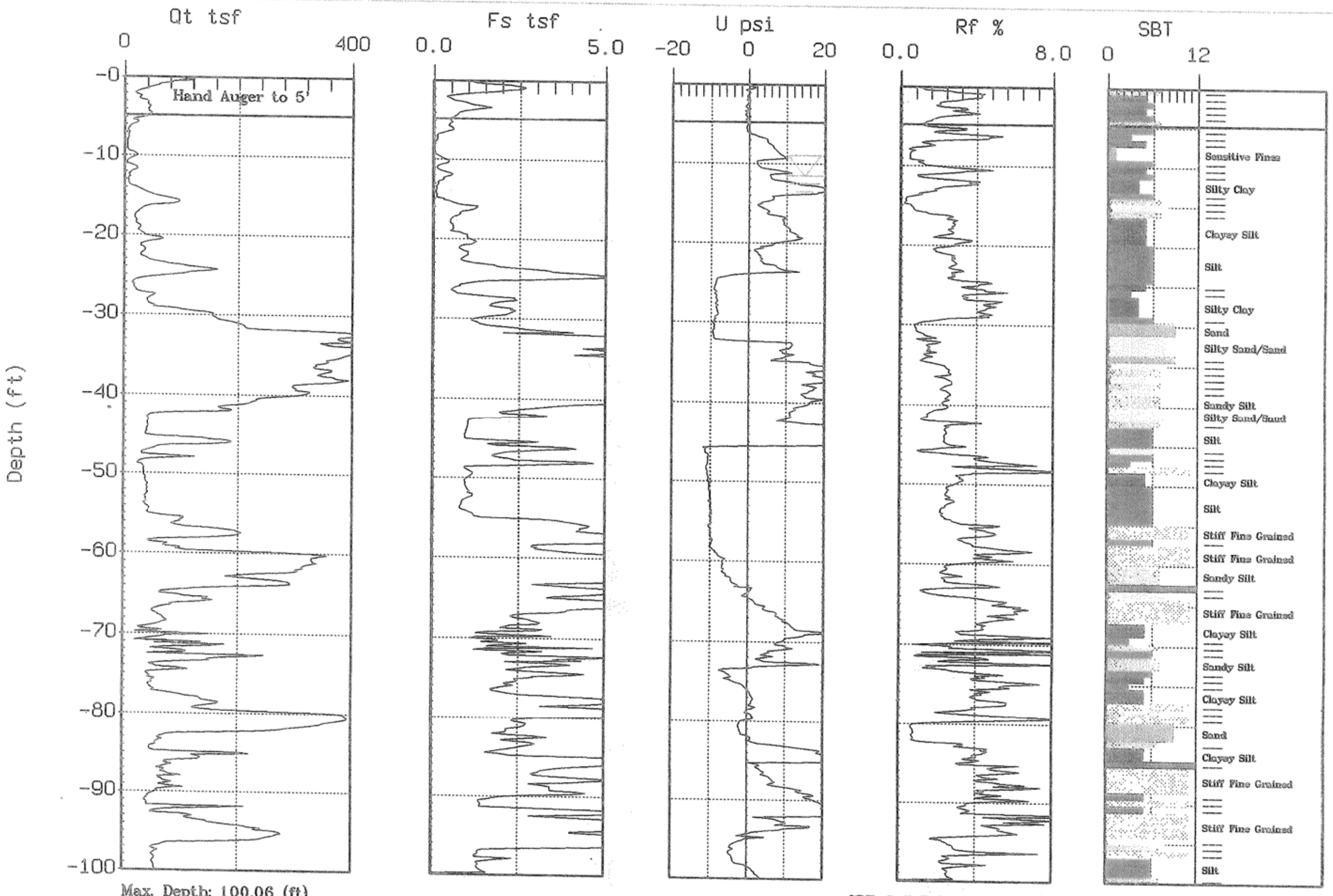
Figure A-11

GREGG

**WOODWARD CLYDE**

Date : 04/28/95
Location : CPT-117

Engineer : S. FITZWILLIAM
Contractor : GREGG IN SITU



Max. Depth: 100.06 (ft)
Depth Inc.: 0.164 (ft)

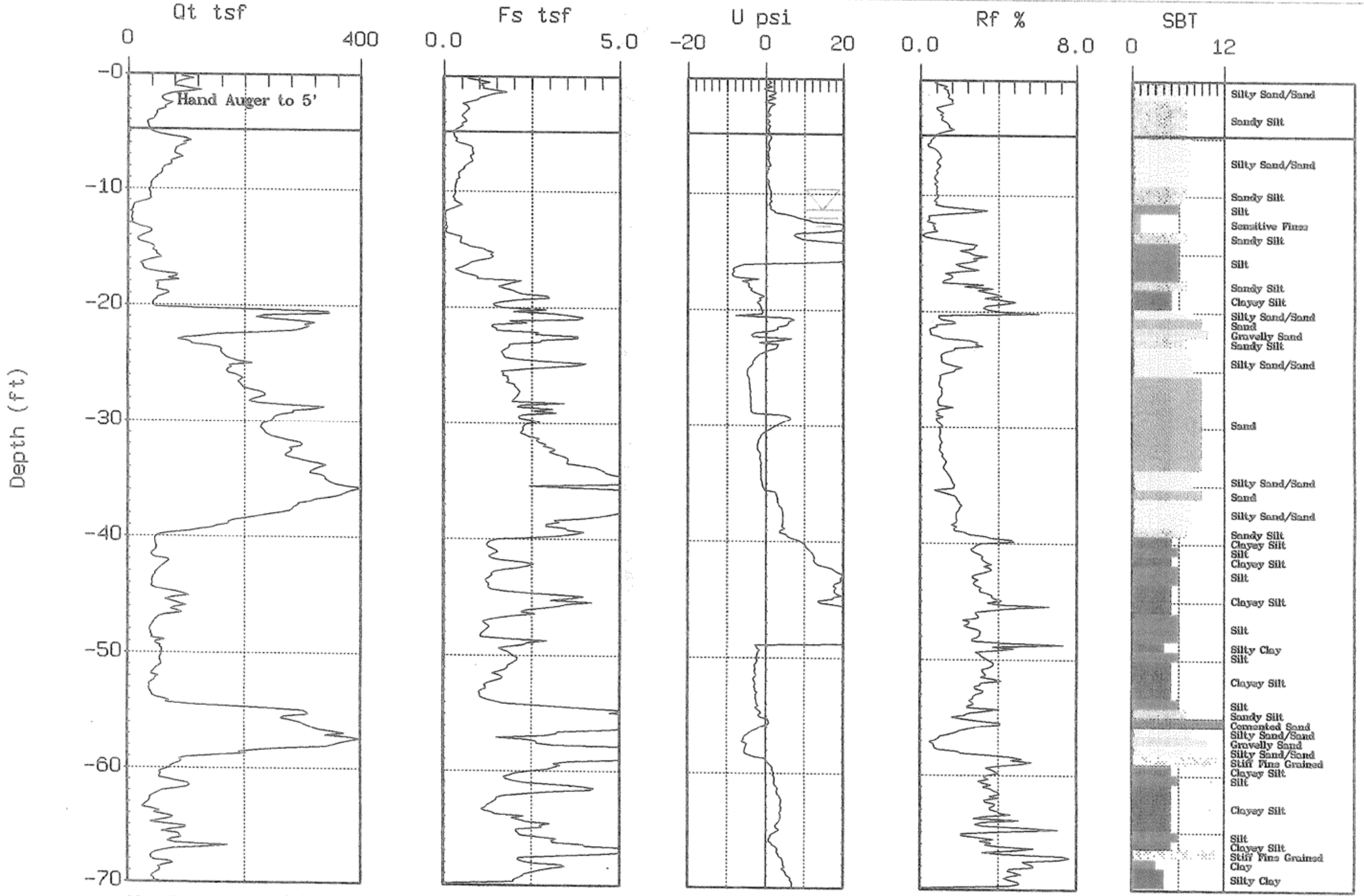
SBT: Soil Behavior Type (Robertson and Campanella 1988)
⊽ Estimated Phreatic Surface

Figure A-12

WOODWARD CLYDE

Date : 04/27/95
Location : CPT-116

Engineer : S. FITZWILLIAM
Contractor : GREGG IN SITU



Max. Depth: 70.05 (ft)

Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson and Campanella 1988)

⊽ Estimated Phreatic Surface

Figure A-13

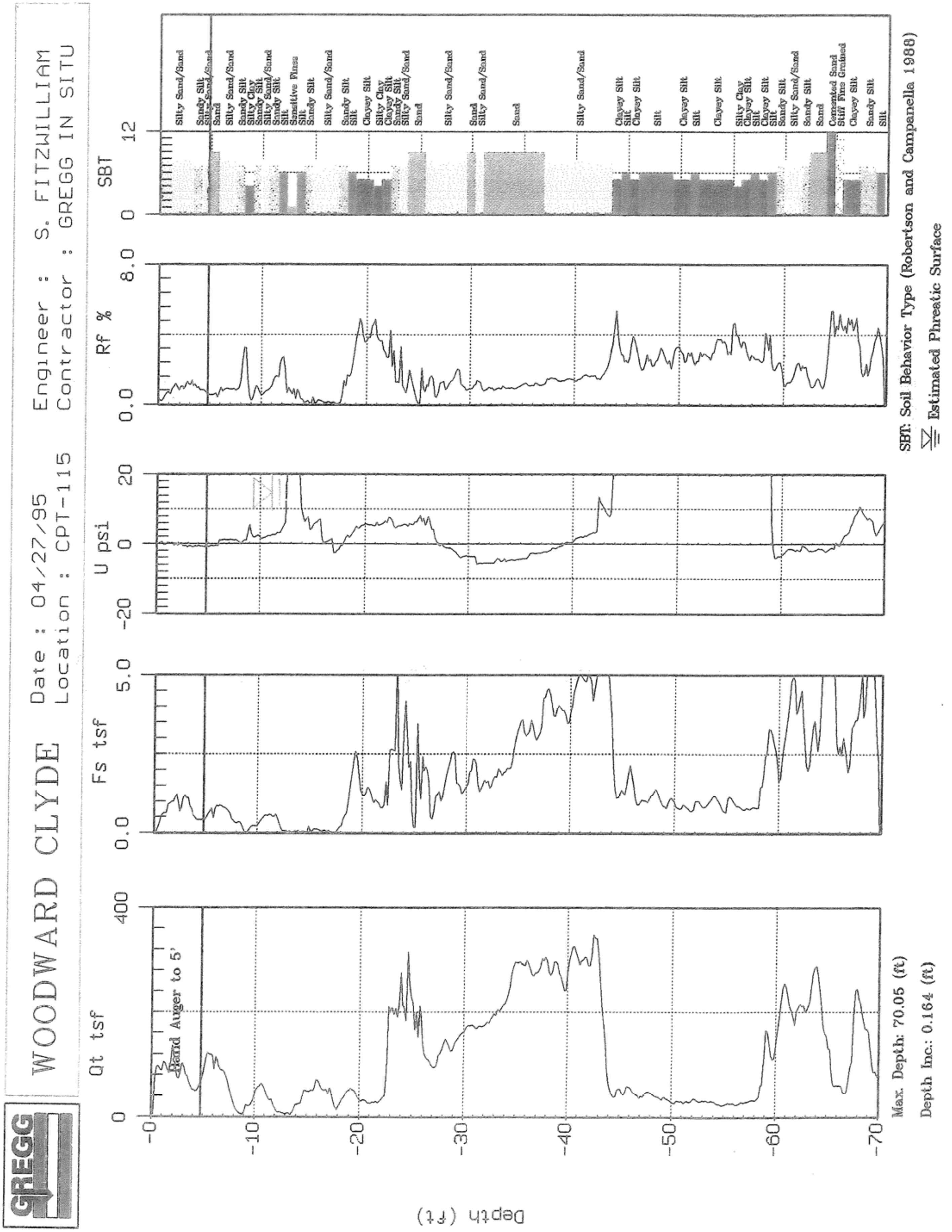
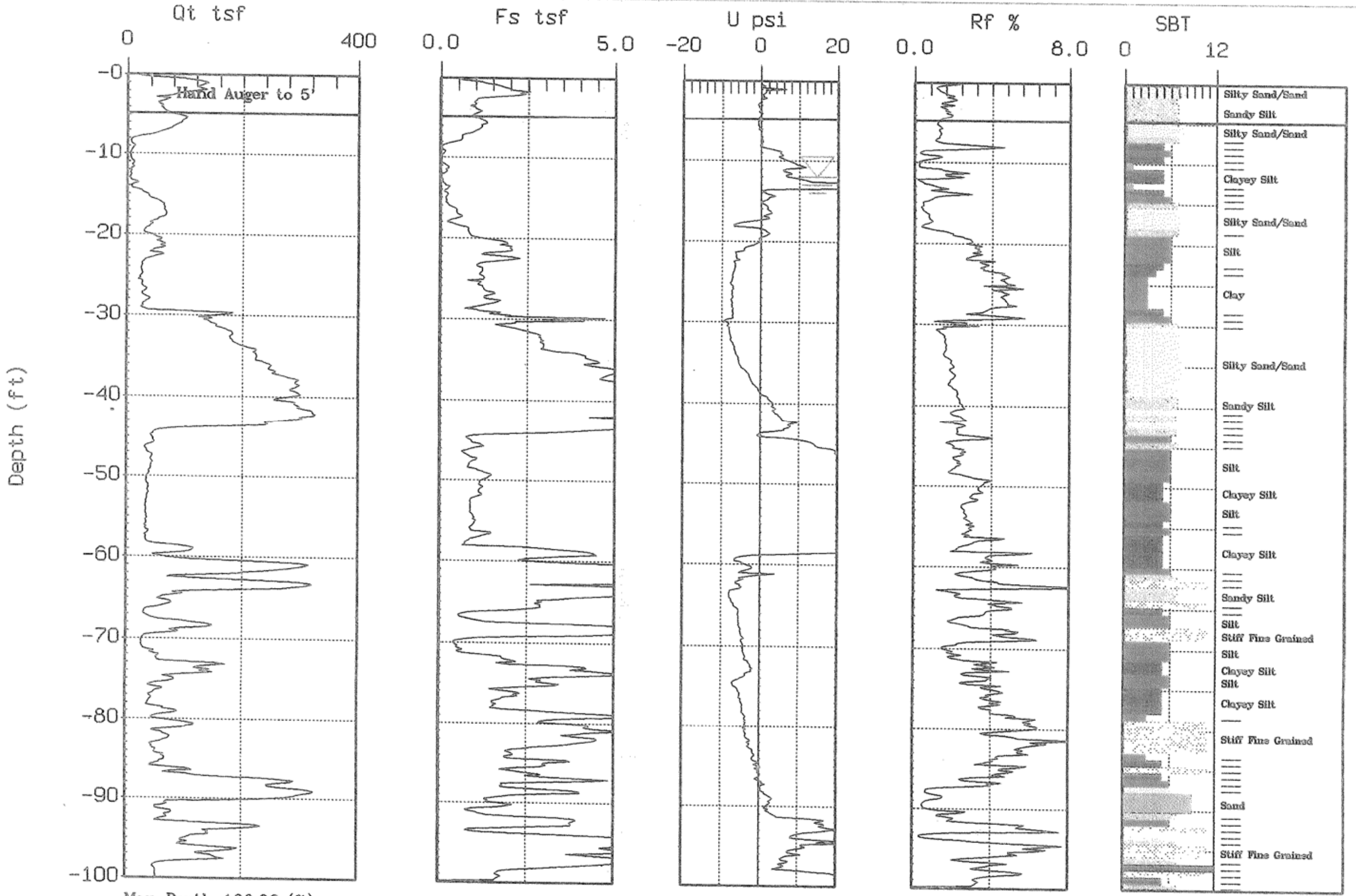

GREGG
WOODWARD CLYDE
Date : 04/27/95
Location : CPT-115
Engineer : S. FITZWILLIAM
Contractor : GREGG IN SITU
Qt tsf
0
400
Hand Auger to 5'
Fs tsf
0.0
5.0
U psi
-20
0
20
Rf %
0.0
8.0
SBT
0
12
Silty Sand/Sand
Sandy Silt
Silty Sand/Sand
Sand
Silty Sand/Sand
Sandy Silt
Silty Clay
Sandy Silt
Silty Sand/Sand
Sandy Silt
Silt
Sensitive Fines
Silt
Sandy Silt
Silty Sand/Sand
Sandy Silt
Silt
Clayey Silt
Silty Clay
Clayey Silt
Sandy Silt
Silty Sand/Sand
Sand
Silty Sand/Sand
Sand
Silty Sand/Sand
Sand
Silty Sand/Sand
Clayey Silt
Silt
Clayey Silt
Silt
Clayey Silt
Silt
Clayey Silt
Silty Clay
Clayey Silt
Silt
Clayey Silt
Silt
Sandy Silt
Silty Sand/Sand
Sandy Silt
Sand
Cemented Sand
Stiff Fine Grained
Clayey Silt
Sandy Silt
Silt
-0
-10
-20
-30
-40
-50
-60
-70
Depth (ft)
Max. Depth: 70.05 (ft)
Depth Inc.: 0.164 (ft)
SBT: Soil Behavior Type (Robertson and Campanella 1988)
Estimated Phreatic Surface

Figure A-14

WOODWARD CLYDE

Date : 04/28/95
Location : CPT-118

Engineer : S. FITZWILLIAM
Contractor : GREGG IN SITU

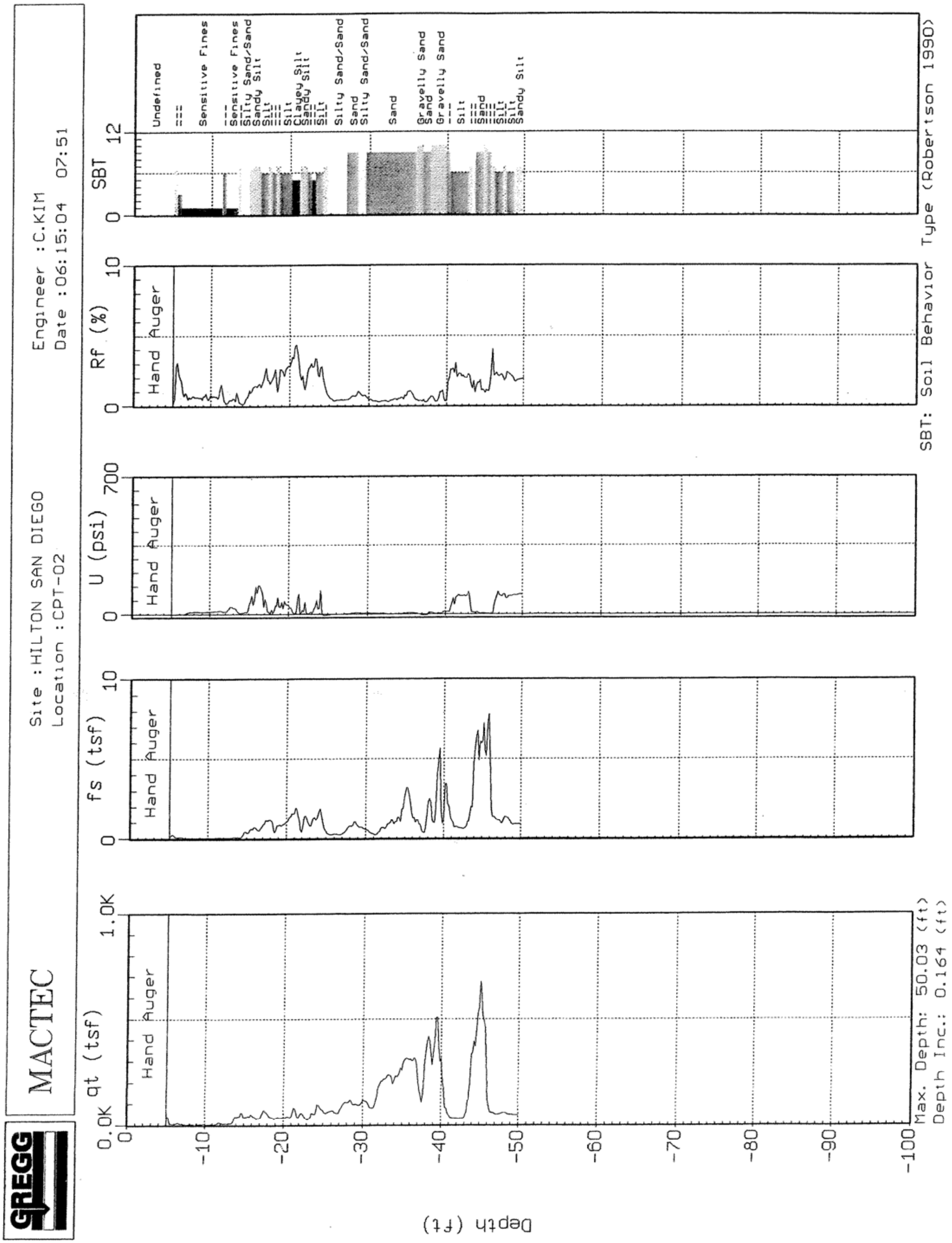


Max. Depth: 100.06 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson and Campanella 1988)

▽ Estimated Phreatic Surface

Figure A-15



GREGG
MACTEC
Site : HILTON SAN DIEGO
Location : CPT-02
Engineer : C.KIM
Date : 06:15:04 07:51
qt (tsf)
0.0K
1.0K
fs (tsf)
0
10
U (psi)
0
700
Rf (%)
0
10
SBT
0
12
Hand Auger
Hand Auger
Hand Auger
Hand Auger
Undefined
===
Sensitive Fines
---
Sensitive Fines
Silty Sand/Sand
Sandy Silt
Silt
Silt
Clayey Silt
Sandy Silt
Silt
Silty Sand/Sand
Sand
Silty Sand/Sand
Sand
Gravelly Sand
Sand
Gravelly Sand
---
Silt
Sand
Silt
Silt
Sandy Silt
Depth (ft)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
Max. Depth: 50.03 (ft)
Depth Inc.: 0.164 (ft)
SBT: Soil Behavior Type (Robertson 1990)

Figure A-16

GREGG MACTEC

Site :HILTON SAN DIEGO
Location :CPT-16

Engineer :C.KIM
Date :06:14:04 16:14

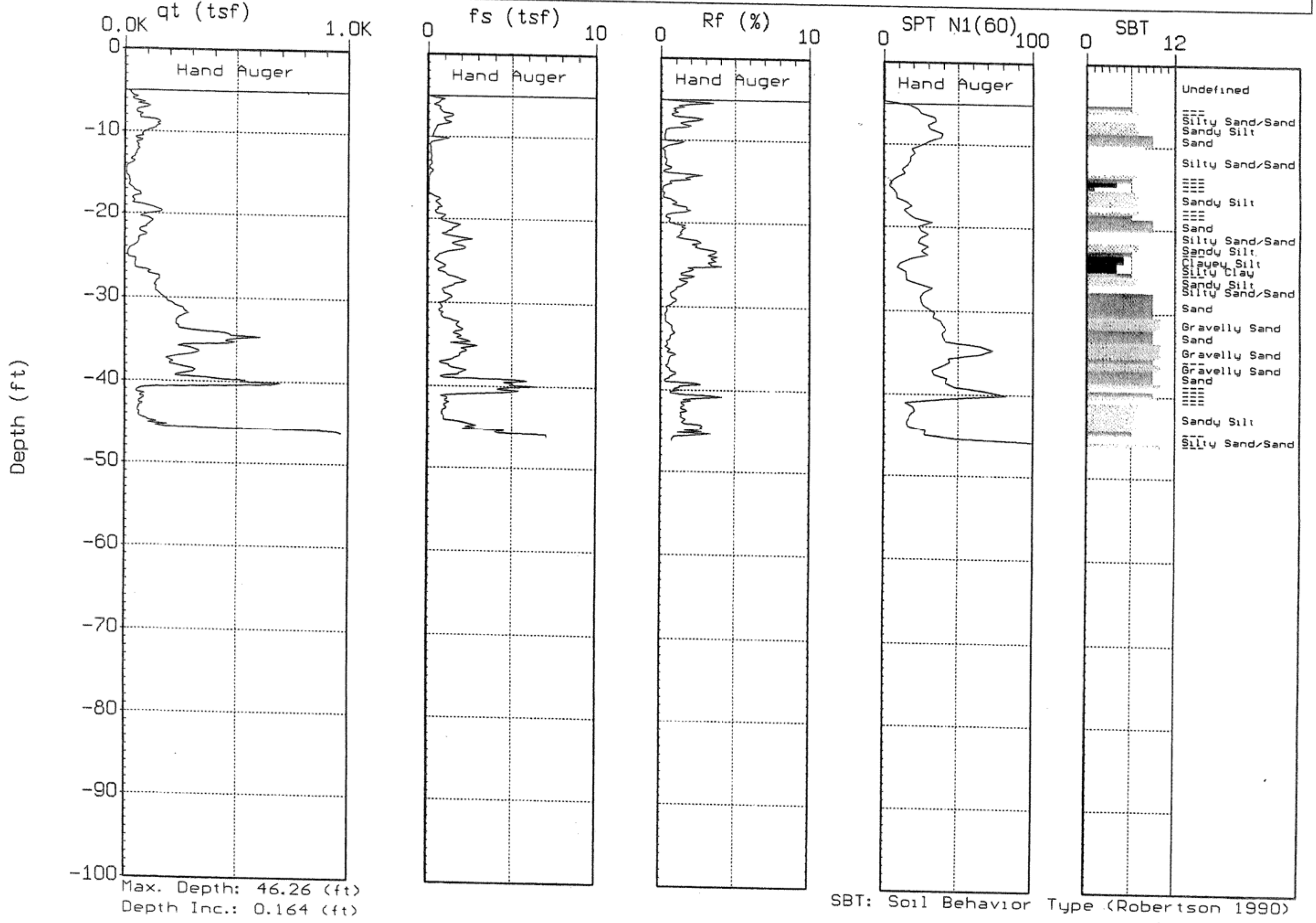


Figure A-17

## LIST OF REFERENCES

1. Anderson, J. G., T. K. Rockwell, and D. C. Agnew, 1989, *Past and Possible Future Earthquakes of Significance to the San Diego Region*: Earthquake Spectra, 1989, v.5, no. 2, p.299-333.

2. Bodhi Group, 2008, *Summary of Environmental Conditions, Spinnaker Landside and Waterside Parcels, San Diego, California,* dated March 5.

3. California Department of Conservation – Division of Mines and Geology, 1999, *Analysis of Late Quaternary Faulting in San Diego Bay and Hazards to the Coronado Bridge,* DMG Open File Report 97-10A.

4. California Department of Conservation, 2003, *California Geological Survey, Maps of Proposed Earthquake Fault Zones, Point Loma Quadrangle,* dated May 1.

5. California Regional Water Quality Control Board (RWQCB), San Diego Region, 2004, *Revised Remedial Action Work Plan, Spinnaker Hotel Site and Former Campbell Shipyard, 8th Avenue and Harbor Drive, San Diego, California*, dated September 22.

6. California Regional Water Quality Control Board (RWQCB), San Diego Region, 2005, *Project Close-out Report, Spinnaker Hotel Site and Former Campbell Shipyard, 8th Avenue and Harbor Drive, San Diego, California*, dated April 28.

7. California Regional Water Quality Control Board (RWQCB), San Diego Region, 2005, *Post-Remediation Groundwater Monitoring Work Plan, Spinnaker Hotel Site and Former Campbell Shipyard, 8th Avenue and Harbor Drive, San Diego, California*, dated July 28.

8. California Regional Water Quality Control Board (RWQCB), San Diego Region, 2006, *Post-Remediation Groundwater Monitoring Report, Spinnaker Hotel Site and Former Campbell Shipyard, 8th Avenue and Harbor Drive, San Diego, California*, dated June 21.

9. *City of San Diego Seismic Safety Study, Geologic Hazards and Faults*, 2008 edition.

10. County of San Diego, *1929 Stereoscopic Aerial Photographs, San Diego, California,* Photo Nos. 66-F6 and 66-F7.

11. Environ, 2004, *Revised Remedial Action Approach and Remedial Action Plan, Spinnaker Hotel Site (Former UST Area) – Area 3, Former Campbell Shipyard, Port of San Diego, San Diego, California,* dated April.

12. Geocon Incorporated, 1981, *Soil Investigation – Final Report, The Chart House Restaurant, San Diego, California,* dated December 9 (Project No. D-2607-J02).

13. IVI International, 2003, *Phase I Environmental Site Assessment, Proposed Conrad Spinnaker Hotel, Marina Park Way and Convention Way, San Diego, California, 92101*, dated December 30.

14. Kennedy, M. P., 1975, *Geology of San Diego Metropolitan Area, California,* California Division of Mines and Geology, Bulletin 200.

## LIST OF REFERENCES (Continued)

15. Kennedy, M. P. and S. S. Tan, 2005, *Geologic Map of the San Diego 30'x60' Quadrangle, California*, USGS Regional Map Series Map No. 3, Scale 1:100,000.

16. Kleinfelder, 2000, *Remedial Action Workplan, San Diego Unified Port District, Campbell Shipyard, San Diego, California*, dated December 6.

17. Legg, M. R., J. C. Borrero, and C. E. Synolakis, 2002, *Evaluation of Tsunami Risk to Southern California Coastal Cities*, 2002 NEHRP Professional Fellowship Report, dated January.

18. Lindvall, S.C., T. K. Rockwell, and C. E. Lindvall, 1990, *The Seismic Hazard of San Diego Revised: New Evidence for Magnitude 6+ Holocene* Earthquakes *on the Rose Canyon Fault Zone*: Proceedings of the Fourth U.S. National Conference on Earthquake Engineering, Vol. 1, pp. 679 – 688.

19. MACTEC, 2004, *Report of Geotechnical Investigation, Proposed Hilton Convention Center Hotel, South of Intersection of Convention Way and Gull Street, San Diego, California,* dated November 10 (Project No. 4953-04-1351).

20. Ninyo & Moore, 1994, *Draft Geologic Reconnaissance and Limited Geotechnical Investigation, San Diego Convention Center Expansion, San Diego California,* dated November 23.

21. Ninyo & Moore, 2003, *Geotechnical Engineering Evaluation, Proposed Parking Facility, 8th Avenue and Harbor Drive, San Diego, California,* dated January 16 (Project No. 104594005).

22. Ninyo & Moore, 2003, *Additional Environmental Site Assessment, Spinnaker Hotel Site, Former Campbell Shipyard, San Diego, California*, dated November 25.

23. Ninyo & Moore, 2003, *Limited Subsurface Assessment, Spinnaker Hotel Site, Former Campbell Shipyard, San Diego, California*, dated July 31.

24. San Diego Unified Port District (SDUPD), 2005, *Sediment Remediation and Aquatic Enhancement, Former Campbell Shipyard Site, San Diego, California*, dated May 3.

25. Risk Engineering, *EZ-FRISK*, 2008.

26. Rockwell, T. K., S. C. Lindvall, C. K. Haraden, K. Hirabayashi, and E. Baker, 1991, *Minimum Holocene Slip Rate for the Rose Canyon Fault in San Diego, California,* in Environmental Perils, San Diego region, ed. P. L. Abbott and W. J. Elliot, p. 37-46., San Diego Association of Geologists.

27. Sadigh, *et al.*, 1997, *Attenuation relationships for Shallow Crustal Earthquakes Based on California Strong Motion Data*, Seismological Research Letters, Vol. 68, No. 1, January/ February, pp. 180 - 189.

28. Streiff, D., D. Elder-Mills, E. A. Artim, 1982, *The Rose Canyon Fault Zone, Downtown San Diego and Coronado*, Geologic Studies in San Diego, San Diego Association of Geologists Field Trip Guide, dated April.

## LIST OF REFERENCES (Continued)

29. Southern California Soil and Testing, 1989, *Report of Geotechnical Investigation, Proposed Warehouse and Office Building, 505 West Harbor Drive, San Diego, California*, dated January 12 (Project No. 8811418).

30. TerraCosta, 2004, *Draft Geotechnical Investigation, Spinnaker Hotel, San Diego, California,* dated December 6 (Project No. 2301).

31. Treiman, Jerome A., 1993, *The Rose Canyon Fault Zone Southern California,* California Division of Mines and Geology Publication.

32. United States Department of Agriculture, *1953 Stereoscopic Aerial Photographs, Flight AXN-3M,* Photos Nos. 197 and 198.

33. United States Geological Survey, *7.5 Minute Quadrangle Series* Point Loma Quadrangle, 1967, photo revised 1975.

34. Unpublished reports, aerial photographs and maps on file with Geocon Incorporated.

35. Woodward-Clyde, 1984, *Final Geotechnical Investigation Report for the Proposed San Diego Convention Center, Harbor Drive and Fifth Avenue Extension, San Diego, California*, dated December 18 (Project No. 54217V-SI01).

36. Woodward-Clyde, 1993, *Volume I: Assessment of Dewatering Influence, Volume II: History of Land Use within the Dewatering Zone of Influence, San Diego Convention Center,* dated December 16.

37. Woodward-Clyde, 1994, *Geotechnical Considerations, Preliminary Soil Investigation, San Diego Convention Center Expansion, San Diego, California*, dated July 22.

38. Woodward-Clyde, 1995, *Geotechnical Investigation, San Diego Convention Center Expansion, San Diego, California,* dated July 28 (Project No. 9351114H-SI02).

39. Woodward-Clyde, 1995, *Fault Hazard Investigation, San Diego Convention Center Expansion, San Diego, California,* dated February 3 (Project No 9351114H-FH01.

# Appendix G-2
# Preliminary Geotechnical Evaluation
# Hilton Bayfront Hotel Tower Expansion

Ninyo & Moore
Geotechnical and Environmental Sciences Consultants

# PRELIMINARY
# GEOTECHNICAL EVALUATION
# HILTON BAYFRONT HOTEL
# TOWER EXPANSION
# SAN DIEGO, CALIFORNIA

**PREPARED FOR:**
John Portman & Associates
303 Peachtree Street N.E., Suite 575
Atlanta, Georgia 30303

**PREPARED BY:**
Ninyo & Moore
Geotechnical and Environmental Sciences Consultants
5710 Ruffin Road
San Diego, California 92123

November 16, 2011
Project No. 107214001

**Ninyo & Moore**
Geotechnical and Environmental Sciences Consultants

November 16, 2011
Project No. 107214001

Mr. Brian Keele
John Portman & Associates
303 Peachtree Street N.E., Suite 575
Atlanta, Georgia 30303

Subject: Preliminary Geotechnical Evaluation
Hilton Bayfront Hotel Tower Expansion
San Diego, California

Dear Mr. Keele:

In accordance with your authorization, we have performed a preliminary geotechnical evaluation for the proposed Hilton Bayfront (Convention Center) Hotel Tower Expansion project. This evaluation was conducted in general accordance with our proposal dated October 12, 2011. The project involves an addition of a multi-story hotel structure adjacent to an existing multi-story reinforced concrete parking garage. This report summarizes our findings and conclusions regarding the geotechnical conditions at the site, and provides preliminary geotechnical recommendations for design of foundations for the project.

We appreciate the opportunity to be of service on this project.

Sincerely,
**NINYO & MOORE**

Emil Rudolph, PE, GE
Senior Engineer

EMIL RUDOLPH
No. 2757
Exp. 6/30/13

Ronald D. Hallum

Ronald D. Hallum, PG, CEG
Senior Geologist

RONALD D. HALLUM
Exp. 11-30-11
No. 1484
CERTIFIED ENGINEERING GEOLOGIST

Soumitra Guha

Soumitra Guha, PhD, GE
Principal Engineer

SOUMITRA GUHA
NO. GE 2632
EXP. 6/30/13

MJG/ER/RDH/SG/gg

Distribution: (1) Addressee

5710 Ruffin Road ▪ San Diego, California 92123 ▪ Phone (858) 576-1000 ▪ Fax (858) 576-9600
San Diego ▪ Irvine ▪ Los Angeles ▪ Rancho Cucamonga ▪ Oakland ▪ San Francisco ▪ Sacramento
Las Vegas ▪ Phoenix ▪ Tucson ▪ Prescott Valley ▪ Denver ▪ El Paso ▪ Houston
25 YEAR ANNIVERSARY 1986 2011 Ninyo & Moore

## TABLE OF CONTENTS

**Table**

**Figures**

**Appendices**

## 1. INTRODUCTION

In accordance with your authorization, we have performed a preliminary geotechnical evaluation for the proposed Hilton Convention Center Hotel Tower Expansion project located in the city of San Diego. We understand that the project consists of the construction of a new multi-story hotel tower adjacent to an existing parking garage. The purpose of this study was to conduct a preliminary evaluation of the subsurface soils and adjacent foundations based on available data to provide recommendations for the preliminary design of foundations to support the proposed tower. The information from this study will be used for planning and early cost estimating purposes.

## 2. SCOPE OF SERVICES

The scope of our geotechnical services included the following:

- Review and compilation of available background information including geotechnical reports, pile driving logs, as-graded geotechnical reports, and building and schematic drawings.
- Evaluation of alternative foundation systems (such as mat foundation, driven pile foundations, and drilled pile foundations) to support the new tower.
- Preparation of this report discussing subsurface conditions, geologic hazards, seismic design coefficients, and foundation recommendations.

## 3. SITE AND PROJECT DESCRIPTION

The project area consists of a narrow landscaped parcel bounded by site paving and Harbor Drive to the (project) north (assuming project north is magnetic northeast), Gull Street and the Hilton Convention Center Hotel to the south, a reinforced concrete vehicle ramp immediately to the west, and a multi-story parking garage immediately to the east (Figure 2). A pedestrian bridge crossing Harbor Drive is connected to the northeastern corner of the parking garage. The surrounding ground is generally considered to be approximately 10 feet above mean sea level (MSL).

Environmental studies by our office revealed the presence of hazardous materials, contaminated soils, groundwater and debris at the site. A remediation was performed for these soils in the vicinity of the project. As part of the remediation, existing fill was partially removed and replaced as compacted fill to support the parking garage floor. Contaminated spoils from excavations on site were exported and disposed of as both hazardous and non-hazardous waste.

The adjacent parking garage is founded on pre-stressed concrete piles driven to depths between -25 and -32 feet MSL. The design capacities of the piles were based on the results of an instrumented indicator pile program. Driving logs were collected during the production pile driving operation, which recorded blow counts per foot. Foundation details for the vehicle ramp to the north are not known.

## 4. SUBSURFACE EVALUATIONS

Several subsurface geotechnical evaluation reports were available for review in the vicinity of the subject project. Those reviewed as part of this evaluation included reports for the existing parking garage, adjacent hotel, and pedestrian bridge, as discussed below. Other geotechnical reports for the existing Hilton Convention Center Hotel were not available at the time of this evaluation. These included a geotechnical report published by Mactec Engineering and Consulting September 9, 2005, as well as as-built driven pile and stone column reports anticipated to have been prepared for the hotel development.

### 4.1. Borings and CPT Soundings (Ninyo & Moore, 2003a)

The subsurface exploration program for the existing parking garage was conducted in November 2002. Five exploratory borings were drilled to depths of up to 67 feet below the existing ground surface with a truck-mounted CME 95 drill rig using an 8-inch diameter continuous-flight hollow-stem auger. The rig was equipped with a 140-pound, automatic trip hammer with a free fall height of 30 inches. Bulk, relatively undisturbed, SPT samples and environmental samples were obtained from the borings at selected intervals. The sampling methodology, description of samplers, and the boring logs are presented in Appendix A. Five cone penetration tests (CPT) soundings were advanced to depths of up to 75 feet using a 25-ton CPT rig. The CPT plots are included in Appendix A. The approximate locations of the previous exploratory borings and CPT soundings are shown on Figure 2. Boring B-214 and CPT-2 were advanced approximately 20 feet east of the proposed tower location.

### 4.2. Other Borings and CPT Soundings

Other nearby subsurface exploration results were reviewed as part of our analysis. Exploratory boring and CPTs up to approximately 100 feet deep were performed for the development of the Hilton Convention Center Hotel to the west of the project (Mactec, 2005). Exploratory borings up to approximately 130 feet deep and CPTs up to approximately 90 feet deep were performed for the development of the Harbor Drive Pedestrian Bridge to the north of the project (Ninyo & Moore, 2007). As part of CPT soundings for these developments, seismic velocity measurements were collected and reviewed. Selected exploratory borings and CPTs from these studies are shown on Figure 2 and the logs are presented in Appendix A.

### 4.3. Indicator Pile Program

A pre-production indicator pile program was performed for the proposed parking garage (Earthspectives, 2003). Five instrumented piles were driven up to 47 feet below grade as part of a dynamic monitoring analyses test program. Pile dynamic analysis using the Case Method evaluated pile capacity, hammer energy transfer, driving stresses and pile integrity. Processing of the dynamic analysis was performed using wave analysis (CAPWAP) methods. Field results were recorded during the pile driving and were compiled to provide a correlation between blow count and an estimated pile resistance. Earthspectives provided both tabulated and graphical summaries of the data correlations.

## 5. GEOTECHNICAL LABORATORY TESTING

The samples obtained during our previous subsurface exploration (Ninyo & Moore, 2003a) were transported to the Ninyo & Moore laboratory for analysis. Laboratory testing of selected sample from the subsurface exploration included: in-situ moisture content and dry density, sieve analysis, Atterberg limits, direct shear, consolidation, expansion index, R-value, and corrosivity (minimum resistivity, soluble sulfate content, chlorides and pH). The results of the in-situ moisture content and dry density testing are presented on the boring logs in Appendix A. Descriptions of test methods and the other laboratory results are presented in Appendix B.

## 6. GEOLOGY AND SUBSURFACE CONDITIONS

Our findings regarding regional and local geology, including faulting and seismicity, liquefaction, lateral spreading, and groundwater conditions at the subject site are provided in the following sections. Our findings are based on our background review of the referenced geotechnical reports, review of the attached logs, and our knowledge and experience with the site vicinity.

### 6.1. Regional Geologic Conditions

The project area is situated in the coastal section of the Peninsular Ranges Geomorphic Province. This geomorphic province encompasses an area that extends approximately 900 miles from the Transverse Ranges and the Los Angeles Basin south to the southern tip of Baja California (Norris and Webb, 1990). The province varies in width from approximately 30 to 100 miles. In general, the province consists of rugged mountains underlain by Jurassic-age metavolcanic and metasedimentary rocks, and Cretaceous-age igneous rock of what is known as the southern California batholith. The westernmost portion of the province in San Diego County, which includes the project area, consists generally of a dissected coastal plain underlain by Upper Cretaceous-, Tertiary-, and Quaternary-age sediments.

The Peninsular Ranges Province is traversed by a group of sub-parallel faults and fault zones trending roughly northwest. Several of these faults are major active faults. The Elsinore, San Jacinto, and San Andreas faults are major active fault systems located northeast of the study area and the Coronado Bank, San Diego Trough, and San Clemente faults are active faults located west of the project area. In addition, the project area, like much of downtown San Diego, is located near the active Rose Canyon fault zone. Major tectonic activity associated with these and other faults within this regional tectonic framework consists primarily of right-lateral, strike-slip movement.

## 6.2. Subsurface Conditions

Geologic units encountered during our 2003 subsurface evaluation included fill material underlain by bay deposits and old paralic deposits (previously designated as the Quaternary-age Bay Point Formation or terrace deposits). Generalized descriptions of the earth units encountered are provided below.

### 6.2.1. Fill Materials

Fill materials were encountered in each of the exploratory borings to depths ranging from approximately 9 to 14 feet below the existing ground surface. Fill materials are associated with various dumping and burning of debris, which filled in this formerly shallow bay area (tidelands limits are mapped northwest of Harbor Drive). As encountered, the fill material generally consisted of light brown, reddish brown, brown, light to dark gray and black, damp to saturated, very loose to dense, silty to clayey fine to medium sand. In some areas, the fill contained coal tar, clay lumps, shell fragments, and construction debris. Grading during the development of the parking garage and environmental remediation efforts removed the upper portions of these fill materials, and replaced them with compacted fill consisting of generally granular import materials (Ninyo & Moore, 2005). Based on photos collected during construction, the underlying materials were surcharged by temporary stockpiles of soil on the order of 10 feet high west of the parking garage. This area west of the parking garage was also used as a borrow pit during grading and was backfilled with approximately 10 feet of uncontrolled fill materials due to the proposed landscaping.

#### 6.2.2. Bay Deposits

Recent bay deposits were observed underlying the fill in borings B-212, B-213, B-214, and B-215. These deposits extended to depths of approximately 14 to 23-1/2 feet below the existing ground surface. These materials were observed to generally consist of inter-layered gray, saturated, very loose, fine silty sand with shell fragments; dark gray to brown, saturated, stiff to very stiff, sandy clay with some fine to medium sand; and dark gray to black, saturated, loose, fine sandy silt with localized shell fragments.

#### 6.2.3. Old Paralic Deposits

Old paralic deposits were encountered underlying the fill and bay deposits in the exploratory borings to the total depth explored, and these deposits underlie the site at depth. The old paralic deposits explored generally consisted of light brown, reddish brown, light gray to gray and dark olive, saturated, medium dense to very dense, fine to coarse sand, silty sand, and clayey sand with iron oxide staining and shell fragments; light olive to olive, light brown and reddish brown, saturated, very stiff to hard, silty and sandy clay with iron oxide staining; and light brown, saturated, medium dense, sandy silt.

### 6.3. Groundwater

Groundwater was encountered during our subsurface exploration at depths of approximately 5 to 9 feet below ground surface. Groundwater can fluctuate due to tidal influences, seasonal variations, irrigation, groundwater withdrawal or injection, and other factors.

### 6.4. Seismic Hazards

The project site is located in a seismically active area. The seismic hazards considered in this study include the potential for ground rupture and ground shaking due to seismic activity, seismically induced liquefaction and landslides, dynamic settlement, and lateral spreading. These potential hazards are discussed in the following subsections.

### 6.4.1. Faulting and Seismicity

The subject site is considered to be in a seismically active area. Our review of readily available published geological maps and literature indicates that the subject site is not underlain by known active (i.e., faults that exhibit evidence of ground displacement within the last 11,000 years) or potentially active (i.e., faults that exhibit evidence of ground displacement between the last 11,000 and 2,000,000 years) faults. Figure 3 shows the approximate location of the site with respect to the regional active faults.

Based on recent mapping, the seismic event that is likely to affect the proposed facilities significantly would be a Moment Magnitude 7.2 earthquake on the Rose Canyon fault (Cao, et al., 2003) located approximately 1.3 miles east of the site.

### 6.4.2. Ground Surface Rupture

Our background review does not indicate the presence of known active faults underlying the site. Therefore, the probability of damage due to ground rupture is considered low. Lurching or cracking of the ground related to shaking from events on nearby active faults is not considered a significant hazard; however, it is a possibility.

### 6.4.3. Ground Shaking

The 2010 California Building Code (CBC) (CBSC, 2010) recommends that the design of structures be based on the peak horizontal ground acceleration (PGA) having a 2 percent probability of exceedance in 50 years which is defined as the Maximum Considered Earthquake (MCE). The statistical return period for $PGA_{MCE}$ is approximately 2,475 years. The Design Earthquake ($PGA_{DE}$) corresponds to two-thirds of the $PGA_{MCE}$. The site modified $PGA_{MCE}$ was estimated to be 0.63g using the United States Geological Survey (USGS) (USGS, 2011) ground motion calculator (web-based) and the corresponding $PGA_{DE}$ for the site is 0.42g.

### 6.4.4. Seismic Design Parameters

Based on the distance from the site to the nearest active fault, the site is within a Near-Source Zone. Based on subsurface information and shear wave velocity measurements of the upper approximately 100 feet of the site materials, Table 1 presents the seismic design parameters for the site in accordance with CBC (2010) guidelines and mapped spectral acceleration parameters (USGS, 2011).

**Table 1 – Seismic Design Parameters**

| Parameter | Value |
|---|---|
| Site Class | D |
| Site Coefficient, $F_a$ | 1.000 |
| Site Coefficient, $F_v$ | 1.500 |
| Mapped Short Period Spectral Acceleration, $S_S$ | 1.583g |
| Mapped One-Second Period Spectral Acceleration, $S_1$ | 0.626g |
| Short Period Spectral Acceleration Adjusted For Site Class, $S_{MS}$ | 1.583g |
| One-Second Period Spectral Acceleration Adjusted For Site Class, $S_{M1}$ | 0.939g |
| Design Short Period Spectral Acceleration, $S_{DS}$ | 1.055g |
| Design One-Second Period Spectral Acceleration, $S_{D1}$ | 0.626g |

### 6.4.5. Liquefaction and Seismically Induced Settlement

Liquefaction is the phenomenon in which loosely deposited, saturated granular soils (located below the water table) with clay contents (particles less than 0.005 mm) of less than 15 percent, liquid limit of less than 35 percent, and natural moisture content greater than 90 percent of the liquid limit undergo rapid loss of shear strength due to development of excess pore pressure during strong earthquake-induced ground shaking. Ground shaking of sufficient duration results in the loss of grain-to-grain contact due to rapid rise in pore water pressure, and it eventually causes the soil to behave as a fluid for a short period of time. Liquefaction is known generally to occur in saturated or near-saturated cohesionless soils at depths shallower than approximately 50 feet below grade. Factors known to influence liquefaction potential include composition and thickness of soil layers, grain size, relative density, groundwater level, degree of saturation, and both intensity and duration of ground shaking.

We evaluated the liquefaction potential of the site using the CPT results and the procedure recommended by Youd et al. (Youd et al, 2001) during our evaluation for the parking garage development (Ninyo & Moore, 2003a). For analysis purposes, peak ground accelerations of 0.29g and 0.44g were considered for design seismic events with 10 percent and 5 percent probabilities of exceedance in 50 years, respectively (Ninyo & Moore, 2003a). Groundwater level was assumed to be at approximately 5 feet below the ground surface, which was based on the approximate high groundwater level encountered during our exploration. Based on the analysis and the subsurface conditions encountered, potentially liquefiable soils are present beneath the site.

We estimated that dynamic settlement of approximately 2 to 6 inches could occur as the result of a major earthquake. Due to the relatively shallow proximity of the liquefiable soils, surface manifestations of liquefaction, including ground cracking and sand ,boils are considered likely in the event of a major earthquake. These findings generally agree with those of geotechnical evaluations of the adjacent site (Mactec, 2005). The liquefaction potential at the project site was re-evaluated using previous Boring B-214 (Appendix A) and updated faulting information. Digital data for CPTs were not available from archived files, and therefore, re-evaluation of CPT results were not performed. Our evaluation of Boring B-214 indicated that layers of relatively granular subsurface soils located below the historic high groundwater table are potentially liquefiable and approximately 2 inches of dynamic settlement could occur at this location during the design event, which considers a peak ground acceleration of 0.42g.

### 6.4.6. Lateral Spreading

Lateral spreading of ground surface during an earthquake usually takes place along weak shear zones that have formed within a liquefiable soil layer. Lateral spread has generally been observed to take place in the direction of a free-face (i.e., retaining wall, slope or channel) but has also been observed to a lesser extent on ground surfaces with very gentle slopes. An empirical model, developed by Youd et al. (2002), is typically used to predict the amount of horizontal ground displacement within a site. For sites located in proximity to a free-face, the amount of lateral ground displacement is strongly correlated with the distance of the site from the free-face. Other factors such as earthquake magnitude, distance from the earthquake epicenter, thickness of the liquefiable layers, and the fines content and particle sizes of the liquefiable layers also affect the amount of lateral ground displacement. Due to the distance to a free face and the ground improvements performed at the adjacent hotel development, the potential for lateral spread at the site is not a planning consideration.

## 7. CONCLUSIONS AND RECOMMENDATIONS

Based on our understanding of the project and the results of our preliminary evaluation, the proposed project is feasible from a geotechnical perspective. There are no known geotechnical conditions that would preclude the construction of the proposed project, provided the recommendations of this preliminary report and the recommendations of a site-specific geotechnical and fault evaluation are incorporated into the design and construction practices of the proposed development. In general, the following conclusions were made based on our preliminary evaluation:

- The tower site is underlain by loose fill materials and potentially debris, saturated bay deposits and old paralic deposits (formerly terrace deposits). The upper portion of the old paralic deposits represent a relatively dense granular zone favorable for bearing pile foundations. The deposit below the relatively dense granular zone is less dense and more fine-grained. This lower portion of the deposit at the subject site does not contain dense gravel layers as encountered at depth at the existing hotel site and pedestrian bridge site, which are favorable for deeper pile bearing. The characteristics of the old paralic deposits are, therefore, spatially variable at the site, and should be explored further with deeper exploratory borings.

- The adjacent parking garage is founded on pre-stressed concrete piles driven to depths between -25 and -32 feet MSL, representing the relatively dense granular zone in the upper portion of the old paralic deposits. Based on pile driving resistance, the deposit is generally more resistant at tip elevations towards the project south (towards the existing hotel). The piles were predrilled and driven using a Delmag 30-32 diesel hammer. The piles have a design downward service capacity of 230 kips and uplift capacity of 125 kips, based on the results of an instrumented indicator pile program. Foundation details for the vehicle ramp to the north are not known.

- Temporary shoring may be needed to support soil materials adjacent to and beneath the parking garage and vehicle ramp, based on the anticipated depth of excavation of nearly 10 feet for the foundation mat or pile cap.

- Groundwater was encountered at approximately 10 feet below grade during nearby field explorations. However, groundwater was measured as shallow as 5 feet in a nearby boring, and fluctuations in the groundwater level may occur due to variations in ground surface topography, subsurface geologic conditions and structure, rainfall, irrigation, and other factors not evident at the time of the referenced subsurface evaluations. Dewatering and/or a concrete waste slab may be needed to maintain a working surface at the bottom of the foundation excavation.

- Hazardous materials, contaminated soils, groundwater and debris should be anticipated in the proposed excavations for the project (i.e., drilling shoring, pile predrilling, pile cap excavation and over-excavation for a waste slab). Consideration should be given during planning to costs and procedures involved in the handling and disposal of such materials.

- Based on our review of published geologic maps, no known active or potentially active faults underlie the site. The project site is, however, located relatively close to major active faults (e.g., 1.3 miles from the Rose Canyon fault). Accordingly, the potential for relatively strong seismic accelerations will need to be considered in the design of the proposed improvements. In addition, the potential for active faulting underlying the site should be evaluated in a site-specific fault evaluation.

- Loose granular materials subject to liquefaction are present below the water table. These materials are considered liquefiable in the event of a major earthquake. Our analysis indicates that liquefaction at the site could induce dynamic settlements between approximately 2 and 6 inches at the site as the result of a major earthquake (Ninyo & Moore, 2003a).

- Based on the relatively loose nature of the soil materials above the terrace deposits (i.e., the upper approximately 25 feet) and the fact that existing parking garage structure is supported on pile foundations, we recommend that planning assume a structure supported by pile foundations. However, based on potentially liquefiable soils, downdrag loading on piles at the tower site results in very long piles to meet the loading demands. For planning purposes, it should be assumed that ground improvement is needed in conjunction with pile foundations until further subsurface exploration data could substantiate a conclusion otherwise.

- Based on the results of the corrosivity tests, the existing on-site soils are potentially corrosive to ferrous materials. Given the importance of the project, the operating environment, and the anticipated service lifetime, a corrosion engineer should be consulted to provide site- and project-specific recommendations for the protection of structures against corrosion.

The following sections present our geotechnical recommendations for the planning and preliminary design of the proposed tower expansion. We anticipate that site earthwork will include temporary shoring, excavation of site materials and stabilization of excavation bottoms. The purpose of our study was to also provide preliminary recommendations for planning and early cost estimating purposes. These preliminary recommendations should be reviewed once a subsurface evaluation is performed to evaluate site-specific geotechnical data at the site. Requirements of the governing jurisdictions and applicable building codes should also be considered in the preliminary design of the proposed foundations.

### 7.1. Temporary Excavations, Braced Excavations and Shoring

We recommend that trenches and excavations be designed and constructed in accordance with Occupational Safety and Health Administration (OSHA) regulations. These regulations provide trench sloping and shoring design parameters for trenches up to 20 feet (6 m) deep based on the soil types encountered. Loose fill materials may be present in the upper 10 feet of the site based on previous grading activities. We recommend that a Type C OSHA soil classification be used for excavations in site soils. Upon making the excavations, the soil classifications and excavation performance should be evaluated in the field by the contractor and our offices in accordance with OSHA regulations.

Based on anticipated pile cap thicknesses, excavations of up to approximately 10 feet deep are expected. Based on the expected depth and presence of nearby structures, we anticipate that excavation depths will be accomplished in some areas by installing a shoring system, particularly a braced system. We anticipate that settlement of the ground surface will occur behind the shoring wall during excavation. The amount of settlement depends heavily on the type of shoring system, the shoring contractor's workmanship, and soil conditions. We recommend that structures/improvements in the vicinity of the planned shoring installation be reviewed with regard to foundation support and tolerance to settlement. To reduce the potential for distress to adjacent improvements, we recommend that the shoring system be designed to reduce the shoring movement to 1/2 inch. Possible causes of settlement that should be addressed include settlement during shoring installation, excavations, construction vibrations, dewatering, and removal of the support system.

It is anticipated that an internally braced cofferdam or tieback-anchored soldier pile or sheet pile wall will be used to provide the excavation shoring. A tieback anchored soldier pile shoring wall may consist of steel “H” piles installed in drilled shafts at a typical spacing of 8 feet on center and restrained with tiebacks. Drilling may be difficult if the drilled shaft collapses due to loose saturated soil conditions. However, vibratory methods should not be used. The shoring may be designed to support an earth pressure represented by a triangular distribution of 45H pounds per square foot (psf) for cantilever shoring and a rectangular distribution of 29H psf for braced shoring, where H is the retained height in feet. Passive resistance below the excavation waste slab may be represented by an equivalent fluid pressure of 300 pounds per cubic foot (pcf) in materials above the water table and 175 pcf in saturated materials. Tieback anchors, if needed, should develop their resistance in terrace deposits. Disposal of potentially contaminated spoils from temporary excavations and drill cuttings should be considered in the cost of pile installation.

### 7.2. Construction Dewatering

Groundwater was encountered near the planned excavation depths. Considerations for construction dewatering should include wellpoint or other extraction locations, anticipated drawdown, volume of pumping, potential for settlement, and groundwater discharge. Disposal of groundwater should be performed in accordance with guidelines of the Regional Water Quality Control Board. Whether or not construction dewatering is selected, a concrete waste slab should be planned at the bottom of the excavation to provide a working surface for foundation construction.

### 7.3. Ground Improvement

Ground improvement techniques may be selected to mitigate the potential for liquefaction and dynamic settlement on a mat foundation, or the effect of downdrag on pile foundations. Based on the proximity of sensitive foundations to the proposed area of construction, vibratory-based ground improvement methods (e.g., stone columns) are not recommended. Methods of ground improvement which could improve site soils with less impact to adjacent foundations include deep soil mixing and compaction grouting. These methods can be performed from the current ground surface before foundation construction with relatively little disruption.

For planning purposes, improvement to a depth of 40 feet should be assumed with a spacing of 6 feet in order to mitigate the potential for liquefaction and resulting downdrag loading on pile foundations. The footprint of such ground improvement would conceivably be beyond the structure footprint typically by two rows of soil mixing or compaction grouting columns, which may be assumed for planning and costing purposes. However, due to the proximity of adjacent improvements, further analysis would be needed to design an improvement program to meet the needs of the foundation system without adverse effects on existing foundations.

### 7.4. Foundations

We considered several foundations to support the proposed tower construction. The selection of foundations considered the relatively poor bearing materials anticipated in the upper approximately 25 feet of the site, as well as potentially liquefiable materials below that depth. In order to support the structure with a mat foundation, specialized ground improvement would be needed, which would consider a target allowable bearing capacity, liquefaction mitigation, induced settlements of fine-grained materials beneath and adjacent to the surrounding improvements, and long-term settlement potential of the improved ground. These factors would need to be evaluated in more detail with additional subsurface data before feasibility conclusions could be provided. Still, it is unlikely that target allowable bearing capacities or settlements could be achieved. Alternatively, cast-in-drilled-hole (CIDH) piles could be utilized, as these have been constructed nearby to support relatively heavy improvements (Ninyo & Moore, 2007). For example, 48-inch diameter piles approximately 80 feet deep may provide allowable downward capacities on the order of 400 kips. For higher capacities, however, drilled piles are generally less efficient in site deposits than driven pile. Thus it is likely that drilled piles would need to be very long, and hence, not cost effective. Steel pile elements are less desirable due to the aggressive corrosive environment.

Based on the performance of the surrounding driven pile supported structures, driven piles are preferred for design and construction in site soils. However, due to the increased load demand of the proposed structure, limited footprint, and the reduced resistance of the soils at depth when compared to the soils underlying the existing hotel, there are still challenges to meeting the loading demands with driven pile. In addition, relatively few and shallow subsurface information are available near the proposed site. Therefore, design capacities of deep piles cannot be substantiated at this point in the evaluation. Estimates of deep pile capacities for the requested capacity are considered preliminary and could change based on the results of further subsurface exploration. For planning purposes, ground improvement, as discussed earlier in this report, should be considered needed to achieve the target design pile capacities.

Preliminary driven pile capacities are estimated on Figure C-1 in Appendix C for 14-inch and 16-inch square piles. These service capacities may be used for design of seismic demands where ground improvement is performed. Uplift capacities can be assumed to be one-half the capacities provided on Figure C-1.

Pile settlements are anticipated to occur quickly as the materials are predominantly granular and the piles were driven into relatively dense sands. Differential settlements of driven piles are considered to be tolerable for this type of construction.

Lateral load capacity for the proposed piles was evaluated using AllPile (CivilTech Software, 2007) assuming both fixed-head and free-head conditions, as well as 0.25 and 0.5 inches of allowable deflection. A summary of our evaluation of lateral capacity is presented in Tables 2 and 3.

**Table 2 – Single Pile Lateral Load Capacity (14-inch Square)**

| **Pile Design Parameters** | **Fixed Head Condition** | | **Free-Head Condition** | |
|---|---|---|---|---|
| **Lateral Pile Head Deflection, in** | **0.25** | **0.5** | **0.25** | **0.5** |
| Allowable Lateral Load, (kips) | 22 | 28 | 11 | 13 |
| Maximum Positive Moment, (kip-ft) | 30.5 | 47.7 | 37.3 | 53.0 |
| Maximum Negative Moment, (kip-ft) | -83.3 | -128.3 | -1.6 | -1.5 |
| Depth to Maximum Positive Moment, (ft) | 8.7 | 10.2 | 5.1 | 5.8 |
| Depth to Maximum Negative Moment, (ft) | 0 | 0 | 13.8 | 14.5 |
| Depth to Zero Deflection, (ft) | 10.9 | 13.1 | 8 | 9.5 |

**Table 3 – Single Pile Lateral Load Capacity (16-inch Square)**

| Pile Design Parameters | Fixed Head Condition | | Free-Head Condition | |
|---|---|---|---|---|
| **Lateral Pile Head Deflection, in** | **0.25** | **0.5** | **0.25** | **0.5** |
| Allowable Lateral Load, (kips) | 28 | 36 | 14 | 17 |
| Maximum Positive Moment, (kip-ft) | 41.8 | 66.3 | 50.4 | 74.1 |
| Maximum Negative Moment, (kip-ft) | -116.7 | -181.7 | -1.7 | -2.0 |
| Depth to Maximum Positive Moment, (ft) | 9.5 | 11.6 | 5.8 | 6.5 |
| Depth to Maximum Negative Moment, (ft) | 0 | 0 | 14.5 | 19.6 |
| Depth to Zero Deflection, (ft) | 11.6 | 14.5 | 8.7 | 10.9 |

For lateral loading, piles in a pile group may be considered to act individually when the center-to-center spacing is greater than 2.5B (where B is the least dimension of the pile) in the direction normal to loading and greater than 8B in the direction parallel (in-line) to loading. Table 4 presents the lateral load reduction factors to be applied for various pile spacings for in-line loading.

**Table 4 – Lateral Load Reduction Factors**

| Center-To-Center Pile Spacing for In-Line Loading in Diameters | Ratio of Lateral Resistance of Shaft in Group to Single Shaft | Subgrade Reaction Reduction Factor |
|---|---|---|
| 8 | 1.00 | 1.00 |
| 6 | 0.81 | 0.70 |
| 4 | 0.58 | 0.40 |
| 2 | 0.44 | 0.25 |

## 7.5. Lateral Resistance

For resistance of the pile cap or shallow ancillary foundations to lateral loads, we recommend an allowable passive pressure exerted by an equivalent fluid weight of 250 pcf be used for planning with a value of up to 2,500 psf. This value assumes that the ground is horizontal for a distance of 10 feet or more, or three times the height generating the passive pressure, whichever is greater. We recommend that the upper one-foot of soil not protected by pavement or a concrete slab be neglected when calculating passive resistance. Further subsurface exploration may conclude higher resistance, however, loose fill materials may be present in the upper 10 feet of the site.

For frictional resistance to lateral loads, we recommend a coefficient of friction of 0.30 be used between soil and concrete. The allowable lateral resistance can be taken as the sum of the frictional resistance and passive resistance provided the passive resistance does not exceed one-half of the total allowable resistance. The passive resistance values may be increased by one-third when considering loads of short duration such as wind or seismic forces.

### 7.6. Uplift Resistance

As the proposed piles may not provide uplift needed to meet the demands of the structure, we have provided below geotechnical parameters for various anchor options. An anticipated option to perform this function include grouted tiedown soil anchors.

Soil anchors can be used to resist uplift by anchoring at depths in the old paralic deposits. Generally, tiedown soil anchors consist of a high strength steel tendon (bar or multiple strand cable), with a stressing anchor at the structure end and a grouted anchor zone permitting force transfer to the soil. The anchors are inserted into a pre-drilled hole. The tendon has the specified capacity in tension, and is secured to the anchor and structure to withstand loads up to its capacity.

For planning purposes, an ultimate bond stress of 20 pounds per square inch (psi) may be used. Development of the capacity may be increased by increasing the bond length and/or using pressure grouting. A percentage of the ultimate bond of the steel tendon can be mobilized if appropriate design and construction are implemented and appropriate materials are used.

Anchor spacing (center to center) should be four times the anchor diameter or 4 feet, whichever is greater. The anchor spacing may be reduced by staggering the depth of the bonded zone (i.e., by varying the unbonded length).

Soil anchors should be designed with a corrosion protection system designed to provide corrosion protection for the life of the structure. Design and locations of the anchors should be compared with underground support elements of adjacent structures, utilities, or other underground obstructions.

Other proprietary soil anchors may be used upon the review of the geotechnical consultant. For example, the use of helical screw anchors may be considered as an alternative to grouted soil anchors. Selection of the materials and the anchor installation technique, however, should be left to the contractor. The selected system shall be subject to performance testing and proof testing to assess design capacities. The testing criteria shall be provided once the soil anchor is chosen.

Due to the difficulties encountered while drilling exploratory borings at depths for nearby projects, we anticipate that uncased excavations (wet method) may not provide adequate resistance against drilled hole collapse. We recommend that the contractor be prepared to take appropriate measures during construction to reduce the potential for caving of the drilled holes, including the use of casing.

### 7.7. Corrosion

Laboratory testing was performed during our previous study on representative samples of the site materials in nearby borings to evaluate pH and electrical resistivity, as well as chloride and sulfate contents (Ninyo & Moore, 2003a). The pH and electrical resistivity tests were performed in accordance with the California Test (CT) 643, and the sulfate and chloride content tests were performed in accordance with CT 417 and 422, respectively. These laboratory test results are presented in Appendix B.

The results of the corrosivity testing from our previous evaluation indicated electrical resistivities of approximately 220 ohm-cm and 730 ohm-cm, soil pH values of 7.4 and 8.2, chloride contents of about 650 parts per million (ppm) and 1180 ppm, and sulfate contents of 0.02 percent (i.e., 200 ppm) and 0.04 percent for the site (Ninyo & Moore, 2003a). Based on the Caltrans (2003) criteria, the project site would be classified as corrosive, which is defined as a site having soils with more than 500 ppm of chlorides, more than 0.2 percent sulfates, a pH less than 5.5, or a resistivity of less than 1,000 ohm-cm.

## 8. LIMITATIONS

The evaluation presented in this geotechnical report have been conducted in general accordance with current practice and the standard of care exercised by geotechnical consultants performing similar tasks in the project area. No warranty, expressed or implied, is made regarding the conclusions, recommendations, and opinions presented in this report. There is no evaluation detailed enough to reveal every subsurface condition. Variations may exist and conditions not observed or described in this report may be encountered during construction. Uncertainties relative to subsurface conditions can be reduced through additional subsurface exploration. Additional subsurface evaluation will be performed upon request. Please also note that our evaluation was limited to assessment of the geotechnical aspects of the project, and did not include evaluation of structural issues, environmental concerns, or the presence of hazardous materials.

This document is intended to be used only in its entirety. No portion of the document, by itself, is designed to completely represent any aspect of the project described herein. Ninyo & Moore should be contacted if the reader requires additional information or has questions regarding the content, interpretations presented, or completeness of this document.

This report is intended for planning purposes only. It does not provide sufficient data to prepare construction drawings or provide an accurate bid by contractors. It is suggested that the bidders and their geotechnical consultant perform an independent evaluation of the subsurface conditions in the project areas. The independent evaluations may include, but not be limited to, review of other geotechnical reports prepared for the adjacent areas, site reconnaissance, and additional exploration and laboratory testing.

Our conclusions, recommendations, and opinions are based on an analysis of the observed site conditions. If geotechnical conditions different from those described in this report are encountered, our office should be notified and additional recommendations, if warranted, will be provided upon request. It should be understood that the conditions of a site could change with time as a result of natural processes or the activities of man at the subject site or nearby sites. In addition, changes to the applicable laws, regulations, codes, and standards of practice may occur due to government action or the broadening of knowledge. The findings of this report may, therefore, be invalidated over time, in part or in whole, by changes over which Ninyo & Moore has no control.

This report is intended exclusively for use by the client. Any use or reuse of the findings, conclusions, and/or recommendations of this report by parties other than the client is undertaken at said parties' sole risk.

## 9. REFERENCES

American Concrete Institute (ACI), 2010, Building Code Requirements for Structural Concrete (ACI 318-10) and Commentary (ACI 318R-10).

American Society of Civil Engineers, 2006, Minimum Design Loads for Buildings and Other Structures, ASCE Standard 7-05.

Bowles, J.E., 1988, Foundation Analysis and Design, Forth Edition, McGraw Hill.

Building Seismic Safety Council, 2009, National Earthquake Hazards Reduction Program (NEHRP) Recommended Seismic Provisions for New Buildings and Other Structures (FEMA P-750).

California Building Standards Commission (CBSC), 2010, California Building Code (CBC), Title 24, Part 2, Volumes 1 and 2.

California Department of Transportation (Caltrans), 2003, Corrosion Guidelines (Version 1.0), Division of Engineering and Testing Services, Corrosion Technology Branch: dated September.

California Division of Mines and Geology (CDMG), 1997, Guidelines for Evaluating and Mitigating Seismic Hazards in California, CDMG Special Publication 117.

California Division of Mines and Geology (CDMG), 1999, Seismic Shaking Hazards Maps of California: Map Sheet 48.

California Geological Survey, 2003, State of California Special Studies Zones Map, Point Loma Quadrangle: effective May 1.

Campbell, K.W., and Bozorgnia, Y., 2008, NGA Ground Motion Model for the Geometric Mean Horizontal Component of PGA, PGV, PGD and 5% Damped Linear Elastic Response Spectra for Periods Ranging from 0.01 to 10 s, Earthquake Spectra Volume 24, Issue 1, pp. 139-172: dated February.

Cao, T., Bryant, W.A., Rowshandel, B., Branum, D., and Wills, C. J., 2003, The revised 2002 California Probabilistic Seismic Hazard Maps, California, USGS/CGS: dated June.

Chiou, B. S.-J., and Youngs, R.R., 2008, An NGA Model for the Average Horizontal Component of Peak Ground Motion and Response Spectra, Earthquake Spectra Volume 24, Issue 1, pp. 173-216: dated February.

CivilTech Software, 2007, AllPile (Version 7.8a), A Computer Program for Lateral, Downward (compression), Uplift, Settlement, Group Analysis of Piles.

CWP Geosciences, 1995, Geotechnical Investigation, San Diego International Airport, Lindbergh Field – IAP Project, Project No. 94-363-A: dated April 7.

Department of the Navy, 1986, Naval Facilities Engineering Command (NAVFAC), DM-7.1, Soil Mechanics: dated September.

Department of the Navy, 1986, Naval Facilities Engineering Command (NAVFAC), DM-7.2 Foundations and Earth Structures: dated September.

Earthspectives, 2003, Indicator Pile Dynamic Monitoring (PDA), Convention Center Hotel Parking Facility, San Diego, California, ES Project No. 030502-168: dated May 29.

Electric Power Research Institute, 1990, Manual on Estimating Soil Properties for Foundation Design: dated August.

Geosyntec, Inc., 2011, Evaluation and Summary of Geotechnical and Seismic Hazards, San Diego Convention Center Phase III Expansion and Expansion Hotel, 111 West Harbor Drive, San Diego, California: dated March 25.

Hart, E.W., and Bryant, W.A., 1997, Fault-Rupture Hazard Zones in California, Alquist-Priolo Earthquake Fault Zoning Act with Index to Earthquake Fault Zone Maps: California Department of Conservation, Division of Mines and Geology, Special Publication 42, with Supplements 1 and 2 added in 1999.

Ishihara, K., 1995, Effects of At-Depth Liquefaction on Embedded Foundations During Earthquakes, Proceedings of the Tenth Asian Regional Conference on Soil Mechanics and Foundation Engineering, August 29 through September 2, Beijing, China, Vol. 2, pp. 16-25.

Jennings, C.W. and Bryant, W.A., 2010, Fault Activity Map of California: California Geological Survey, Geologic Data Map 6, Scale 1:750,000.

Kennedy, M.P., and Peterson, G.L., 1975, Geology of the San Diego Metropolitan Area, California: California Division of Mines and Geology, Bulletin 200.

Kennedy, M.P. and Tan, S.S., 2008, Geologic Map of San Diego, 30’ x 60’ Quadrangle, California (digital database): California Geological Survey, Scale 1:100,000

Mactec Engineering & Consultation, Inc. (Mactec), 2005, Report of Geotechnical Investigation, Proposed Hilton Convention Center Hotel, South of Intersection of Convention Center Way and Gull Street, San Diego, California: dated November 10.

Ninyo & Moore, In-house Proprietary Information.

Ninyo & Moore, 2003a, Geotechnical Engineering Evaluation, Proposed Parking Facility 8th Avenue and Harbor Drive, San Diego, California, Project No. 104594005: dated January 16.

Ninyo & Moore, 2003b, Geotechnical Services During Indicator Test Pile Installation, Convention Center Parking Garage, 8th Avenue and Harbor Drive, San Diego, California, Project No. 104970001: dated May 19.

Ninyo & Moore, 2003c, Revised Foundation Recommendations, Geotechnical Services During Indicator Test Pile Installation, Convention Center Parking Garage, 8th Avenue and Harbor Drive, San Diego, California, Project No. 104970001: revised June 13.

Ninyo & Moore, 2005, Summary of Geotechnical Observation and Compaction Testing Results, Convention Center Hotel Parking Facility, San Diego, California: dated January 20.

Ninyo & Moore, 2007, Final Foundation Report, Harbor Drive Pedestrian Bridge, San Diego, California: dated November 28.

Norris, R.M., and Webb, R.W., 1990, Geology of California, Second Edition: John Wiley & Sons, Inc.

Petersen, M.D., Bryant, W.A., Cramer, C.H., Cao, T., Reichle, M.S., Frankel, A.D., Lienkaemper, J.J., McCrory, P.A., and Schwartz, D.P., 1996, Probabilistic Seismic Hazard Assessment for the State of California: California Department of Conservation, Division of Mines and Geology, Open-File Report 96-08.

Public Works Standards, Inc., 2009, “Greenbook,” Standard Specifications for Public Works Construction.

Seed, H.B., and Idriss, I.M., 1982, Ground Motions and Soil Liquefaction During Earthquakes, Earthquake Engineering Research Institute Monograph, Oakland, California.

Southern California Earthquake Center, (SCEC), 1999, Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Liquefaction Hazards in California: dated March.

Tokimatsu, K., and Seed, H.B., 1987, Evaluation of Settlements in Sands Due to Earthquake Shaking, Journal of the Geotechnical Engineering Division, ASCE, Vol. 113, No. 8, pp. 861-878.

Treiman, J.A., 1993, The Rose Canyon Fault Zone, Southern California: California Division of Mines and Geology, Open-File Report 93-02.

United States Geological Survey, 2011, Earthquake Ground Motion Parameter Java Application, Java Ground Motion Parameter Calculator – Version 5.0.9; Hhttp://earthquake.usgs.gov/ research/hazmaps/design/.

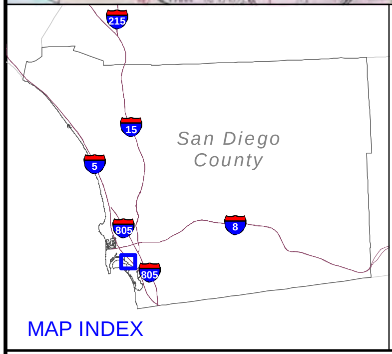
Youd, T.L. et al, 2001, Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils: Journal of Geotechnical and Geoenvironmental Engineering, Vol. 127, No. 10, p. 817-833.

Youd, T.L., Hansen, C.M., and Bartlett, S.F., 2002, Revised Multilinear Regression Equations for Prediction of Lateral Spread Displacement: Journal of Geotechnical and Geoenvironmental Engineering, Vol. 128, No. 12, p. 1007-1017.

**AERIAL PHOTOGRAPHS**

| Source | Date | Flight | Numbers | Scale |
|---|---|---|---|---|
| USDA | 3-31-53 | AXN-3M | 196 & 197 | 1:20,000 |

SOURCE: 2008 Thomas Guide for San Diego County, Street Guide and Directory; Map © Rand McNally, R.L.07-S-129



SCALE IN FEET

0 1,200 2,400 4,800

NOTE: DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE

**Ninyo & Moore**

# SITE LOCATION

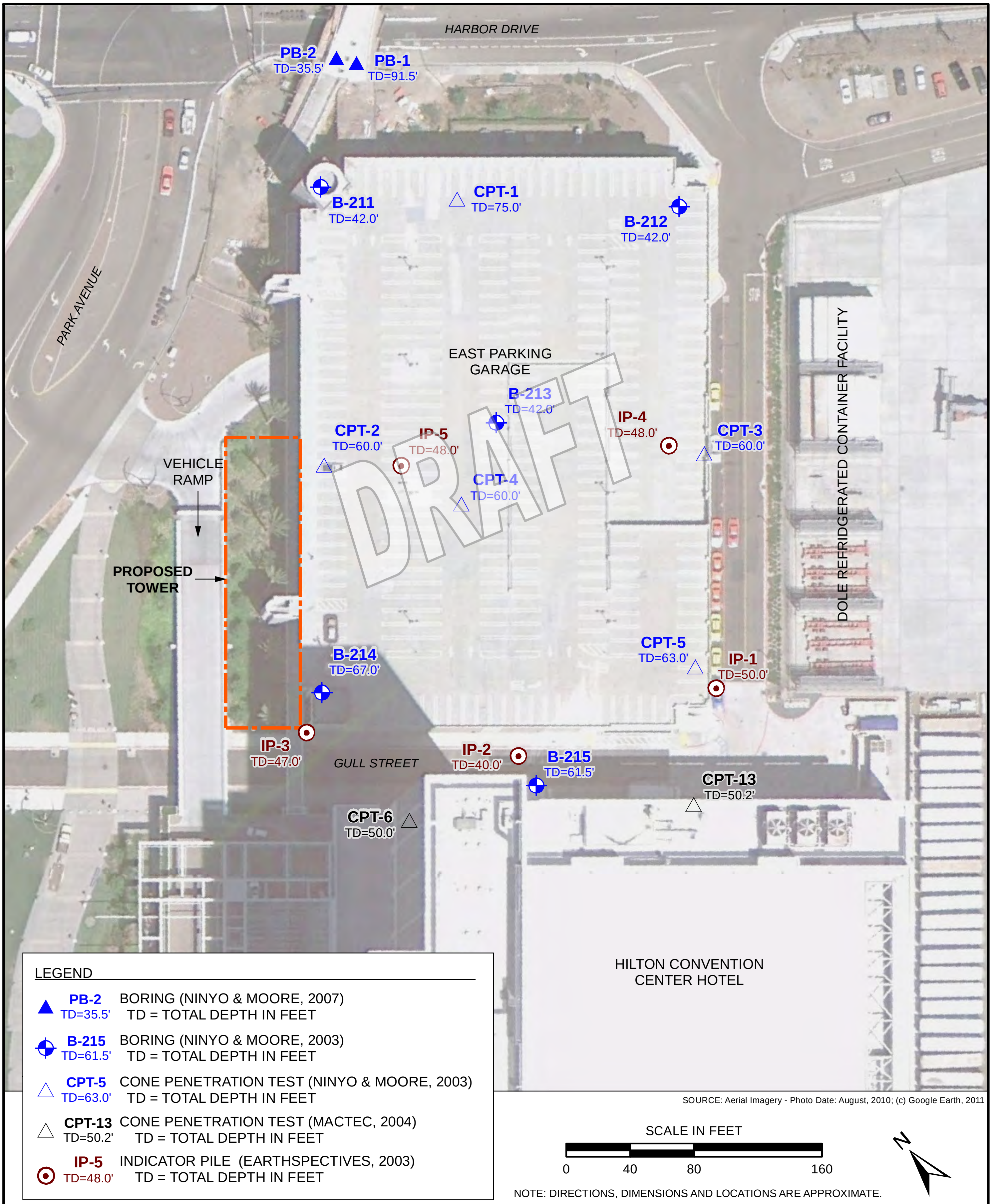
HILTON BAYFRONT HOTEL TOWER EXPANSION
SAN DIEGO, CALIFORNIA

| PROJECT NO. | DATE |
|---|---|
| 107214001 | 11/11 |

FIGURE

1

J:\Projects\100000_SD\107200_107249\107214\001_hilton_bayfront\GIS\fig1_107214001_sl_tower.mxd 11/11/2011 5:10:26 PM JDL



LEGEND

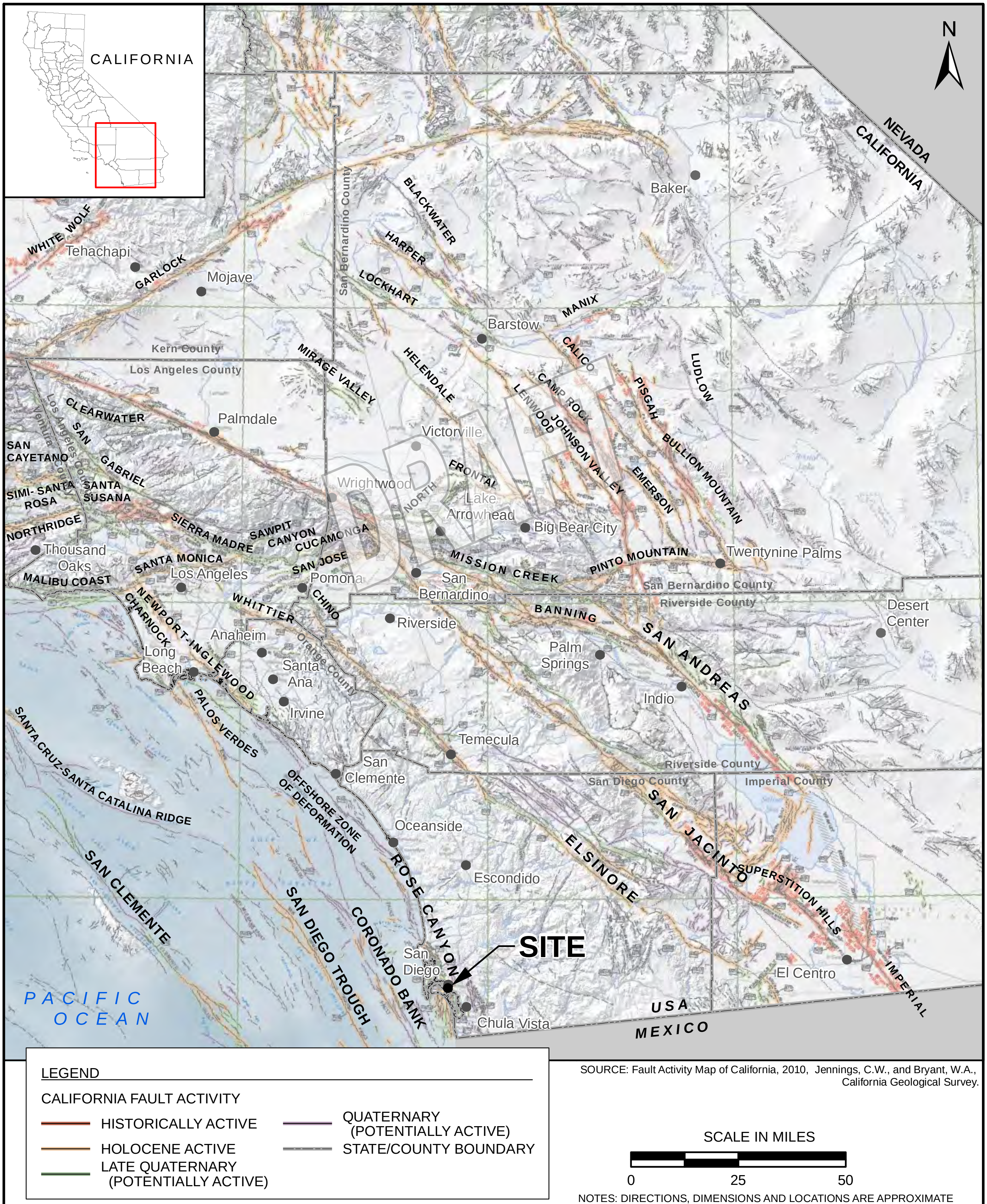
| | | |
|---|---|---|
| ▲ | **PB-2**<br>TD=35.5' | BORING (NINYO & MOORE, 2007)<br>TD = TOTAL DEPTH IN FEET |
| ⊕ | **B-215**<br>TD=61.5' | BORING (NINYO & MOORE, 2003)<br>TD = TOTAL DEPTH IN FEET |
| △ | **CPT-5**<br>TD=63.0' | CONE PENETRATION TEST (NINYO & MOORE, 2003)<br>TD = TOTAL DEPTH IN FEET |
| △ | **CPT-13**<br>TD=50.2' | CONE PENETRATION TEST (MACTEC, 2004)<br>TD = TOTAL DEPTH IN FEET |
| ⊙ | **IP-5**<br>TD=48.0' | INDICATOR PILE (EARTHSPECTIVES, 2003)<br>TD = TOTAL DEPTH IN FEET |

SOURCE: Aerial Imagery - Photo Date: August, 2010; (c) Google Earth, 2011

NOTE: DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE.

| Ninyo & Moore | SITE PLAN | FIGURE |
|---|---|---|
| PROJECT NO. / DATE | HILTON BAYFRONT HOTEL TOWER EXPANSION<br>SAN DIEGO, CALIFORNIA | 2 |
| 107214001 / 11/11 | | |

J:\Projects\100000_SD\107200_107249\107214\001_hilton_bayfront\GIS\fig2_107214001_sp_tower_A.mxd 11/11/2011 4:51:35 PM JDL



LEGEND

CALIFORNIA FAULT ACTIVITY

HISTORICALLY ACTIVE

HOLOCENE ACTIVE

LATE QUATERNARY (POTENTIALLY ACTIVE)

QUATERNARY (POTENTIALLY ACTIVE)

STATE/COUNTY BOUNDARY

SOURCE: Fault Activity Map of California, 2010, Jennings, C.W., and Bryant, W.A., California Geological Survey.

SCALE IN MILES

0 25 50

NOTES: DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE

J:\Projects\100000_SD\107200_107249\107214001_hilton_bayfront\GIS\fig3_107214001_fl_tower.mxd 11/11/2011 5:10:25 PM JDL

**Ninyo & Moore**

# FAULT LOCATIONS

| PROJECT NO. | DATE |
|---|---|
| 107214001 | 11/11 |

HILTON BAYFRONT HOTEL TOWER EXPANSION
SAN DIEGO, CALIFORNIA

FIGURE

3

# APPENDIX A

## CPT AND BORING LOGS (NINYO & MOORE, 2003a)

## APPENDIX A

## BORING LOGS

### Field Procedure for the Collection of Disturbed Samples

Disturbed soil samples were obtained in the field using the following methods.

#### Bulk Samples

Bulk samples of representative earth materials were obtained from the exploratory excavations. The samples were bagged and transported to the laboratory for testing.

#### The Standard Penetration Test Spoon

Disturbed drive samples of earth materials were obtained by means of a Standard Penetration Test spoon sampler. The sampler is composed of a split barrel with an external diameter of 2 inches and an unlined internal diameter of 1-3/8 inches. The spoon was driven up to 18 inches into the ground with a 140-pound hammer free-falling from a height of 30 inches in general accordance with ASTM D 1586-84. The blow counts were recorded for every 6 inches of penetration; the blow counts reported on the logs are those for the last 12 inches of penetration. Soil samples were observed and removed from the spoon, bagged, sealed and transported to the laboratory for testing.

### Field Procedure for the Collection of Relatively Undisturbed Samples

Relatively undisturbed soil samples were obtained in the field using the following methods.

#### The Modified Split-Barrel Drive Sampler

The sampler, with an external diameter of 3.0 inches, was lined with 1-inch long, thin brass rings with inside diameters of approximately 2.4 inches. The sample barrel was driven into the ground with the weight of a hammer or the kelly bar of the drill rig in general accordance with ASTM D 3550-01. The driving weight was permitted to fall freely. The approximate length of the fall, the weight of the hammer or bar, and the number of blows per foot of driving are presented on the boring logs as an index to the relative resistance of the materials sampled. The samples were removed from the sample barrel in the brass rings, sealed, and transported to the laboratory for testing.

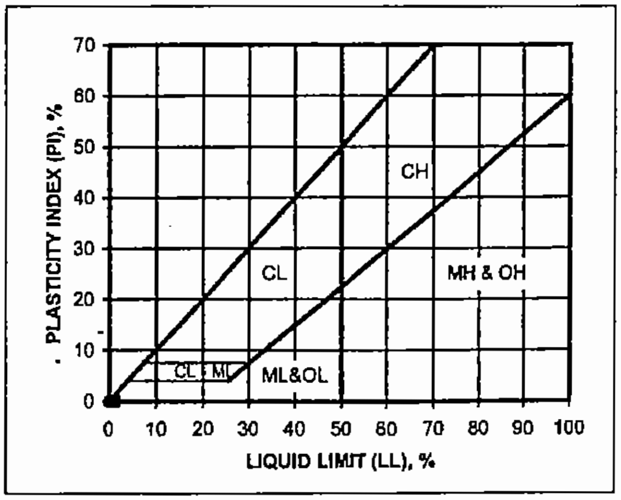
# U.S.C.S. METHOD OF SOIL CLASSIFICATION

| MAJOR DIVISIONS | | SYMBOL | TYPICAL NAMES |
|---|---|---|---|
| COARSE-GRAINED SOILS (More than 1/2 of soil >No. 200 sieve size) | **GRAVELS** (More than 1/2 of coarse fraction > No. 4 sieve size) | GW | Well graded gravels or gravel-sand mixtures little or no fines |
| | | GP | Poorly graded gravels or gravel-sand mixtures, little or no fines |
| | | GM | Silty gravels, gravel-sand-silt mixtures |
| | | GC | Clayey gravels, gravel-sand-clay mixtures |
| | **SANDS** (More than 1/2 of coarse fraction <No. 4 sieve size) | SW | Well graded sands or gravelly sands, little or no fines |
| | | SP | Poorly graded sands or gravelly sands, little or no fines |
| | | SM | Silty sands, sand-silt mixtures |
| | | SC | Clayey sands, sand-clay mixtures |
| FINE-GRAINED SOILS (More than 1/2 of soil <No. 200 sieve size) | **SILTS & CLAYS** Liquid Limit <50 | ML | Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity |
| | | CL | Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays |
| | | OL | Organic silts and organic silty clays of low plasticity |
| | **SILTS & CLAYS** Liquid Limit >50 | MH | Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts |
| | | CH | Inorganic clays of high plasticity, fat clays |
| | | OH | Organic clays of medium to high plasticity, organic silty clays, organic silts |
| **HIGHLY ORGANIC SOILS** | | Pt | Peat and other highly organic soils |

## CLASSIFICATION CHART (Unified Soil Classification System)

| CLASSIFICATION | RANGE OF GRAIN SIZES | |
|---|---|---|
| | U.S. Standard Sieve Size | Grain Size in Millimeters |
| BOULDERS | Above 12" | Above 305 |
| COBBLES | 12" to 3" | 305 to 76.2 |
| GRAVEL<br>Coarse<br>Fine | 3" to No.4<br>3" to 3/4"<br>3/4" to No. 4 | 76.2 to 4.76<br>76.2 to 19.1<br>19.1 to 4.76 |
| SAND<br>Coarse<br>Medium<br>Fine | No. 4 to No. 200<br>No. 4 to No. 10<br>No. 10 to No. 40<br>No. 40 to No. 200 | 4.76 to 0.074<br>4.76 to 2.00<br>2.00 to 0.420<br>0.420 to 0.074 |
| SILT & CLAY | Below No. 200 | Below 0.074 |

GRAIN SIZE CHART



PLASTICITY CHART

**Ninyo & Moore** | U.S.C.S. METHOD OF SOIL CLASSIFICATION

DATE DRILLED ______ BORING NO. SYMBOL SAMPLES

GROUND ELEVATION ______ SHEET 1 OF 1

METHOD OF DRILLING ______

DRIVE WEIGHT ______ DROP ______

SAMPLED BY ______ LOGGED BY ______ REVIEWED BY ______

| DEPTH (feet) | SAMPLES Bulk | SAMPLES Driven | BLOWS/FOOT | MOISTURE (%) | DRY DENSITY (PCF) | SYMBOL | CLASSIFICATION U.S.C.S. | DESCRIPTION/INTERPRETATION |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | Solid line denotes unit change. |
| | | | | | | | | Dashed line denotes material change. |
| | | ■ | | | | | | Modified split-barrel drive sampler. |
| | | ⊠ | | | | | | No recovery with modified split-barrel drive sampler. |
| 5 | | | | ♀ | | | | Seepage. |
| | | | | ▽ | | | | Groundwater encountered during drilling. |
| | | | | ▼ | | | | Groundwater measured after drilling. |
| | | ▌ | | | | | | Sample retained by others. |
| | | ◣ | | | | | | Standard Penetration Test (SPT). |
| 10 | | ◸ | | | | | | No recovery with a SPT. |
| | | ▯ | XX/XX | | | | | Shelby tube sample. Distance pushed in inches/length of sample recovered in inches. |
| | | ⊠ | | | | | | No recovery with Shelby tube sampler. |
| 15 | ■ | | | | | | | Bulk sample. |
| | | ▥ | | | | | | Continuous Push Sample. |
| 20 | | | | | | | | The total depth line is a solid line that is drawn at the bottom of the boring. |

**Ninyo & Moore**

## BORING LOG

EXPLANATION OF BORING LOG SYMBOLS

| PROJECT NO. | DATE | FIGURE |
|---|---|---|
| SYMSAMP | Rev. 10/01 | A-1 |

DATE DRILLED 11/22/02 BORING NO. B-211
GROUND ELEVATION 10'± (MSL) SHEET 1 OF 2
METHOD OF DRILLING 8" Diameter Hollow-Stem Auger
DRIVE WEIGHT 140 lbs. (Auto Trip Hammer) DROP 30"
SAMPLED BY EP/RDH LOGGED BY EP REVIEWED BY RI

| DEPTH (feet) | BLOWS/FOOT | MOISTURE (%) | DRY DENSITY (PCF) | PID READING (PPM) | CLASSIFICATION U.S.C.S. | DESCRIPTION/INTERPRETATION |
|---|---|---|---|---|---|---|
| 0 | | | | | | ASPHALT CONCRETE: Approximately 4" thick. |
| | | | | | SM | AGGREGATE BASE: Approximately 5" thick. |
| | 13 | | | 21.0 | | FILL:<br>Brown to black, moist, medium dense, silty SAND; with black coal tar/lamp black dust; vitrified; becoming gooey and increasing strong odor of moth balls with depth. |
| | | ∇ | | | | Very loose. |
| | 4 | | | 130 | | Black material with debris; saturated. |
| 10 | 4 | | | 100 | | Pieces of glass. |
| | | | | | SP | TERRACE DEPOSITS:<br>Brown, saturated, medium dense, silty fine SAND. |
| | 16 | | | 20 | | |
| 20 | 20 | | | | | |
| | | | | | SM | Olive and reddish brown, saturated, dense, silty fine SAND; iron oxide staining. |
| | 45 | 26.6 | 95.8 | | | |
| | | | | | | Light brown with shiny fine sand granules (glitter); scattered shell fragments. |
| 30 | 38 | 24.0 | 107.2 | | | Pinkish brown, reddish brown, brown; medium dense; coarse-grained. |
| | 46 | | | | | Brown; very dense; fine-grained; increasing clay content. |
| | | | | | CL | Olive and reddish brown (mottled), saturated, hard, silty fine sandy CLAY; iron oxide staining. |
| 40 | | | | | | |

**Ninyo & Moore**

## BORING LOG

PROPOSED PARKING FACILITY
SAN DIEGO, CALIFORNIA

| PROJECT NO. | DATE | FIGURE |
|---|---|---|
| 104594005 | 12/02 | A-1 |

DATE DRILLED 11/22/02 BORING NO. B-211

GROUND ELEVATION 10'± (MSL) SHEET 2 OF 2

METHOD OF DRILLING 8" Diameter Hollow-Stem Auger

DRIVE WEIGHT 140 lbs. (Auto Trip Hammer) DROP 30"

SAMPLED BY EP/RDH LOGGED BY EP REVIEWED BY RI

| DEPTH (feet) | SAMPLES Bulk | SAMPLES Driven | BLOWS/FOOT | MOISTURE (%) | DRY DENSITY (PCF) | PID READING (PPM) | SYMBOL | CLASSIFICATION U.S.C.S. | DESCRIPTION/INTERPRETATION |
|---|---|---|---|---|---|---|---|---|---|
| 40 | | ■ | 27 | 27.5 | 98.8 | | ▨ | CL | <u>TERRACE DEPOSITS</u>: (Continued)<br>Olive and reddish brown (mottled), saturated, hard, silty fine sandy CLAY; iron oxide staining. |
| | | | | | | | | | Total Depth = 42 feet.<br>Groundwater encountered during drilling at 5 feet.<br>Backfilled with approximately 105 gallons of bentonite grout by tremie method and patched with concrete on 11/22/02. |
| 50 | | | | | | | | | |
| 60 | | | | | | | | | |
| 70 | | | | | | | | | |
| 80 | | | | | | | | | |

Ninyo & Moore

## BORING LOG

PROPOSED PARKING FACILITY
SAN DIEGO, CALIFORNIA

| PROJECT NO. | DATE | FIGURE |
|---|---|---|
| 104594005 | 12/02 | A-2 |

| | | | | |
|---|---|---|---|---|
| DATE DRILLED | 11/22/02 | BORING NO. | B-212 | |
| GROUND ELEVATION | 10'± (MSL) | SHEET 1 OF 2 | | |
| METHOD OF DRILLING | 8" Diameter Hollow-Stem Auger | | | |
| DRIVE WEIGHT | 140 lbs. (Auto Trip Hammer) | DROP | 30" | |
| SAMPLED BY | EP/RDH | LOGGED BY | EP | REVIEWED BY RI |

| DEPTH (feet) | SAMPLES Bulk | SAMPLES Driven | BLOWS/FOOT | MOISTURE (%) | DRY DENSITY (PCF) | PID READING (PPM) | SYMBOL | CLASSIFICATION U.S.C.S. | DESCRIPTION/INTERPRETATION |
|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | | <u>ASPHALT CONCRETE</u>: Approximately 3" thick. |
| | | | | | | | | SM | <u>AGGREGATE BASE</u>: Approximately 4" thick. |
| | ■ | ◤ | 4 | | | 0.3 | | | <u>FILL</u>:<br>Black to brown, moist, loose, silty clayey fine SAND. |
| | | ◸ | 2 | | | | | | Pieces of glass and debris; very loose. |
| | | | | ▽ | | | | | |
| 10 | | ◤ | 2 | | | 1.3 | | SM | <u>BAY DEPOSITS</u>:<br>Gray, saturated, very loose, fine silty SAND; shell fragments. |
| | | ■ | 28 | | | | | SM | <u>TERRACE DEPOSITS</u>:<br>Gray to brown, saturated, medium dense, silty SAND. |
| 20 | | ◤ | 23 | | | 0.7 | | | |
| | | ■ | 27 | 26.8 | 100.3 | | | | Olive and reddish brown (mottled); some clay; fine- to medium-grained; iron oxide staining. |
| 30 | | ■ | 36 | 27.9 | 97.4 | | | | |
| | | | | | | | | SC | Dark olive to gray, saturated, very dense, silty clayey medium to coarse SAND; few gravel. |
| | | ◤ | 52 | | | | | | |
| 40 | | | | | | | | | |

Ninyo & Moore

## BORING LOG

PROPOSED PARKING FACILITY
SAN DIEGO, CALIFORNIA

| PROJECT NO. | DATE | FIGURE |
|---|---|---|
| 104594005 | 12/02 | A-3 |

DATE DRILLED 11/22/02 BORING NO. B-212
GROUND ELEVATION 10'± (MSL) SHEET 2 OF 2
METHOD OF DRILLING 8" Diameter Hollow-Stem Auger
DRIVE WEIGHT 140 lbs. (Auto Trip Hammer) DROP 30"
SAMPLED BY EP/RDH LOGGED BY EP REVIEWED BY RI

| DEPTH (feet) | SAMPLES Bulk | SAMPLES Driven | BLOWS/FOOT | MOISTURE (%) | DRY DENSITY (PCF) | PID READING (PPM) | SYMBOL | CLASSIFICATION U.S.C.S. | DESCRIPTION/INTERPRETATION |
|---|---|---|---|---|---|---|---|---|---|
| 40 | | ▼ | 42 | | | | ▨ | SC | <u>TERRACE DEPOSITS</u>: (Continued)<br>Dark olive to gray, saturated, very dense, silty clayey medium to coarse SAND; few gravel. |
| | | | | | | | | | Total Depth = 42 feet.<br>Groundwater encountered during drilling at 9 feet.<br>Backfilled with approximately 105 gallons of bentonite grout by tremie method and patched with concrete on 11/22/02. |
| 50 | | | | | | | | | |
| 60 | | | | | | | | | |
| 70 | | | | | | | | | |
| 80 | | | | | | | | | |

**Ninyo & Moore**

## BORING LOG

PROPOSED PARKING FACILITY
SAN DIEGO, CALIFORNIA

| PROJECT NO. | DATE | FIGURE |
|---|---|---|
| 104594005 | 12/02 | A-4 |

DATE DRILLED 11/22/02 BORING NO. B-213

GROUND ELEVATION 10'± (MSL) SHEET 1 OF 2

METHOD OF DRILLING 8" Diameter Hollow-Stem Auger

DRIVE WEIGHT 140 lbs. (Auto Trip Hammer) DROP 30"

SAMPLED BY EP/RDH LOGGED BY EP REVIEWED BY RI

| DEPTH (feet) | SAMPLES Bulk | SAMPLES Driven | BLOWS/FOOT | MOISTURE (%) | DRY DENSITY (PCF) | PID READING (PPM) | SYMBOL | CLASSIFICATION U.S.C.S. | DESCRIPTION/INTERPRETATION |
|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | | ASPHALT CONCRETE: Approximately 3" thick. |
| | | | | | | | | SM | AGGREGATE BASE: Approximately 4" thick. |
| | | ◣ | 9 | | | 0.1 | | | FILL:<br>Brown, light gray, and reddish brown, moist, medium dense, silty SAND. |
| | | ◣ | 4 | | | 0.2 | | | Brown; loose; little shell fragments. |
| | | | | ▽ | | | | | |
| 10 | | ■ | 8 | 32.0 | 101.6 | | | | Saturated; medium dense; little clay lumps; coal tar (moth ball odor); few pieces of glass. |
| | | ◣ | 3 | | | 0.7 | | | Loose. |
| | | ◣ | 5 | | | 0.3 | | | |
| | | | | | | | ▨ | CL | BAY DEPOSITS:<br>Dark gray, saturated, stiff, sandy CLAY. |
| 20 | | ◣ | 7 | | | 0.3 | | SP-SM | TERRACE DEPOSITS:<br>Light brown to olive, saturated, medium dense, silty fine SAND. |
| | | ■ | 14 | | | | | | Abundant shell fragments. |
| 30 | | ◣ | 21 | | | | | | Gray and brown; medium dense; abundant shell fragments; some clay. |
| | | ■ | 34 | 17.6 | 111.4 | | | | |
| 40 | | | | | | | | | |

Ninyo & Moore

**BORING LOG**

PROPOSED PARKING FACILITY
SAN DIEGO, CALIFORNIA

| PROJECT NO. | DATE | FIGURE |
|---|---|---|
| 104594005 | 12/02 | A-5 |

DATE DRILLED 11/22/02 BORING NO. B-213

GROUND ELEVATION 10'± (MSL) SHEET 2 OF 2

METHOD OF DRILLING 8" Diameter Hollow-Stem Auger

DRIVE WEIGHT 140 lbs. (Auto Trip Hammer) DROP 30"

SAMPLED BY EP/RDH LOGGED BY EP REVIEWED BY RI

| DEPTH (feet) | SAMPLES Bulk | SAMPLES Driven | BLOWS/FOOT | MOISTURE (%) | DRY DENSITY (PCF) | PID READING (PPM) | SYMBOL | CLASSIFICATION U.S.C.S. | DESCRIPTION/INTERPRETATION |
|---|---|---|---|---|---|---|---|---|---|
| 40 | | ◣ | 26 | | | | ▨ | CL | <u>TERRACE DEPOSITS</u>: (Continued)<br>Light olive, saturated, hard, sandy CLAY. |
| | | | | | | | | | Total Depth = 42 feet.<br>Groundwater encountered during drilling at 9 feet.<br>Backfilled with approximately 105 gallons of bentonite grout by tremie method and patched with concrete on 11/22/02. |
| 50 | | | | | | | | | |
| 60 | | | | | | | | | |
| 70 | | | | | | | | | |
| 80 | | | | | | | | | |

Ninyo & Moore

## BORING LOG

PROPOSED PARKING FACILITY
SAN DIEGO, CALIFORNIA

| PROJECT NO. | DATE | FIGURE |
|---|---|---|
| 104594005 | 12/02 | A-6 |

DATE DRILLED 11/21/02 BORING NO. B-214
GROUND ELEVATION 10'± (MSL) SHEET 1 OF 2
METHOD OF DRILLING 8" Diameter Hollow-Stem Auger
DRIVE WEIGHT 140 lbs. (Auto Trip Hammer) DROP 30"
SAMPLED BY EP/RDH LOGGED BY EP REVIEWED BY RI

| DEPTH (feet) | SAMPLES Bulk | SAMPLES Driven | BLOWS/FOOT | MOISTURE (%) | DRY DENSITY (PCF) | PID READING (PPM) | SYMBOL | CLASSIFICATION U.S.C.S. | DESCRIPTION/INTERPRETATION |
|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | | ASPHALT CONCRETE: Approximately 3" thick. |
| | | | | | | | | SM | AGGREGATE BASE: Approximately 4" thick. |
| | | | | | | | | | FILL:<br>Light to dark gray, reddish brown, brown, damp, dense, silty fine to medium SAND. |
| | | ◩ | 25 | | | | | | |
| | | ◩ | 11 | | | 0.1 | | | Light brown to reddish brown; medium dense; scattered shell fragments. |
| | | | | ▽ | | | | | |
| | | | | | | | | CL | BAY DEPOSITS:<br>Dark gray, saturated, stiff, fine sandy CLAY. |
| 10 | | ◩ | 6 | | | 0.0 | | | |
| | | ■ | 18 | 21.7 | 106.0 | 7.0 | | | Hydrocarbon odor; very stiff. |
| 20 | | ◩ | 17 | | | 0.6 | | | Brown; some fine to medium sand. |
| | | | | | | | | SP-SM | TERRACE DEPOSITS:<br>Brown and light gray, saturated, medium dense, slightly silty fine to medium SAND; hydrocarbon odor. |
| | | ■ | 31 | 19.1 | 108.8 | 0.1 | | | |
| 30 | | ◩ | 33 | | | | | | Light brown; dense; medium- to coarse-grained. |
| | | ■ | 42 | 22.3 | 98.4 | | | | |
| 40 | | | | | | | | | |

Ninyo & Moore

## BORING LOG

PROPOSED PARKING FACILITY
SAN DIEGO, CALIFORNIA

| PROJECT NO. | DATE | FIGURE |
|---|---|---|
| 104594005 | 12/02 | A-7 |

DATE DRILLED 11/21/02 BORING NO. B-214

GROUND ELEVATION 10'± (MSL) SHEET 2 OF 2

METHOD OF DRILLING 8" Diameter Hollow-Stem Auger

DRIVE WEIGHT 140 lbs. (Auto Trip Hammer) DROP 30"

SAMPLED BY EP/RDH LOGGED BY EP REVIEWED BY RI

| DEPTH (feet) | SAMPLES Bulk | SAMPLES Driven | BLOWS/FOOT | MOISTURE (%) | DRY DENSITY (PCF) | PID READING (PPM) | SYMBOL | CLASSIFICATION U.S.C.S. | DESCRIPTION/INTERPRETATION |
|---|---|---|---|---|---|---|---|---|---|
| 40 | | | | | | | ▥ | SM | <u>TERRACE DEPOSITS</u>: (Continued)<br>Light brown, saturated, dense, silty medium- to coarse-grained SAND. |
| | | | | | | | ▨ | CL | Light brown, saturated, very stiff, fine sandy silty CLAY; iron oxide staining. |
| | | ◤ | 17 | | | | ▨ | | |
| 50 | | | | | | | ▨ | | |
| | | | | | | | ▩ | SC | Light gray to light brown, saturated, dense, clayey SAND; abundant bi-valve shells. |
| | | ◤ | 33 | | | | ▩ | | |
| 60 | | | | | | | ▩ | | |
| | | | | | | | ▩ | | Brown. |
| | | ◤ | 22 | | | | ▩ | | |
| | | | | | | | | | Total Depth = 67 feet.<br>Groundwater encountered during drilling at 9 feet.<br>Backfilled with approximately 170 gallons of bentonite grout by tremie method and patched with concrete on 11/21/02. |
| 70 | | | | | | | | | |
| 80 | | | | | | | | | |

Ninyo & Moore

## BORING LOG

PROPOSED PARKING FACILITY
SAN DIEGO, CALIFORNIA

| PROJECT NO. | DATE | FIGURE |
|---|---|---|
| 104594005 | 12/02 | A-8 |

DATE DRILLED 11/21/02 BORING NO. B-215

GROUND ELEVATION 10'± (MSL) SHEET 1 OF 2

METHOD OF DRILLING 8" Diameter Hollow-Stem Auger

DRIVE WEIGHT 140 lbs. (Auto Trip Hammer) DROP 30"

SAMPLED BY EP/RDH LOGGED BY EP REVIEWED BY RI

| DEPTH (feet) | SAMPLES Bulk | SAMPLES Driven | BLOWS/FOOT | MOISTURE (%) | DRY DENSITY (PCF) | PID READING (PPM) | SYMBOL | CLASSIFICATION U.S.C.S. | DESCRIPTION/INTERPRETATION |
|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | | ASPHALT CONCRETE: Approximately 3" thick. |
| | | | | | | | | SM | AGGREGATE BASE: Approximately 4" thick. |
| | | | 21 | | | 2.5 | | | FILL:<br>Gray to black, moist, medium dense, silty SAND; with black coal and hydrocarbon odor. |
| | | | 4 | | | 1.0 | | | Loose; few clay clumps; scattered shell fragments. |
| | | | 5 | 16.6 | 104.6 | | | | |
| | | | | ▽ | | | | | |
| | | | 30 | | | | | | Saturated; medium dense. |
| 10 | | | 19 | | | | | | |
| | | | | | | | | ML | BAY DEPOSITS:<br>Dark gray to black, saturated, loose, fine sandy SILT; few shell fragments. |
| | | | 6 | | | 0.2 | | | |
| | | | 9 | 19.0 | 109.4 | | | | |
| | | | | | | | | ML | TERRACE DEPOSITS:<br>Light brown, saturated, medium dense, sandy SILT. |
| | | | 14 | | | 0.1 | | | |
| 20 | | | 27 | | | | | | Big piece of wire; increasing sand content. |
| | | | 20 | | | | | SP | Light brown to gray, saturated, medium dense, fine to medium SAND. |
| | | | | | | | | SM | Brown, saturated, loose, silty fine to medium SAND; trace shell fragments. |
| 30 | | | 5 | | | | | | |
| | | | 11 | | | | | | |
| 40 | | | | | | | | | |

Ninyo & Moore

## BORING LOG

PROPOSED PARKING FACILITY
SAN DIEGO, CALIFORNIA

| PROJECT NO. | DATE | FIGURE |
|---|---|---|
| 104594005 | 12/02 | A-9 |

DATE DRILLED 11/21/02 BORING NO. B-215

GROUND ELEVATION 10'± (MSL) SHEET 2 OF 2

METHOD OF DRILLING 8" Diameter Hollow-Stem Auger

DRIVE WEIGHT 140 lbs. (Auto Trip Hammer) DROP 30"

SAMPLED BY EP/RDH LOGGED BY EP REVIEWED BY RI

| DEPTH (feet) | SAMPLES Bulk | SAMPLES Driven | BLOWS/FOOT | MOISTURE (%) | DRY DENSITY (PCF) | PID READING (PPM) | SYMBOL | CLASSIFICATION U.S.C.S. | DESCRIPTION/INTERPRETATION |
|---|---|---|---|---|---|---|---|---|---|
| 40 | | ◤ | 50/5" | | | | ▥ | SP-SM | TERRACE DEPOSITS: (Continued)<br>Brown, saturated, very dense, silty fine to medium SAND; trace shell fragments; few gravel. |
| 50 | | ◤ | 50/6" | | | | ▥ | | Little fine gravel. |
| 60 | | ◤ | 40 | | | | ▥ | | Light gray and reddish brown; silty fine sand; some iron oxide staining. |
| | | | | | | | | | Total Depth = 61.5 feet.<br>Groundwater encountered during drilling at 9 feet.<br>Backfilled with approximately 155 gallons of bentonite grout by tremie method and patched with concrete on 11/21/02. |
| 70 | | | | | | | | | |
| 80 | | | | | | | | | |

Ninyo & Moore

## BORING LOG

PROPOSED PARKING FACILITY
SAN DIEGO, CALIFORNIA

| PROJECT NO. | DATE | FIGURE |
|---|---|---|
| 104594005 | 12/02 | A-10 |

DATE DRILLED 11/11/04 BORING NO. PB-1

GROUND ELEVATION 9.0' ± (MSL) SHEET 1 OF 3

METHOD OF DRILLING 8" Diameter Hollow Stem Auger (CME-95)

DRIVE WEIGHT 140 lbs. (Auto-Trip Hammer) DROP 30"

SAMPLED BY DRR LOGGED BY DRR REVIEWED BY RJ

| DEPTH (feet) | SAMPLES Bulk | SAMPLES Driven | BLOWS/FOOT | MOISTURE (%) | DRY DENSITY (PCF) | SYMBOL | CLASSIFICATION U.S.C.S. | DESCRIPTION/INTERPRETATION |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | ▒ | SM | FILL:<br>Dark brown to black, moist, loose, silty fine to medium SAND. |
| | | ■ | 9 | | | ▒ | | Olive brown. |
| | | | | ▽ | | ▒ | | Saturated. |
| 10 | | ■ | 3 | | | ▒ | | Very loose. |
| | | | | | | ▒ | SM | TERRACE DEPOSITS:<br>Light brown to brown, saturated, medium dense, silty fine SAND. |
| | | ■ | 42 | | | ▒ | | |
| | | | | | | ▨ | CL | Olive brown, saturated, very stiff, sandy CLAY; with iron oxide staining. |
| 20 | | ◣ | 19 | | | ▨ | | |
| | | | | | | ▒ | SM | Grayish brown to light brown, saturated, dense, silty fine SAND. |
| | | ◣ | 33 | | | ▒ | | |
| 30 | | ◣ | 25 | | | ▒ | | Light brown to brown. |

Ninyo & Moore

**BORING LOG**

HARBOR DRIVE PEDESTRIAN BRIDGE
SAN DIEGO, CALIFORNIA

| PROJECT NO. | DATE | FIGURE |
|---|---|---|
| 105288001 | 11/07 | A-1 |

DATE DRILLED 11/11/04 BORING NO. PB-1

GROUND ELEVATION 9.0' ± (MSL) SHEET 2 OF 3

METHOD OF DRILLING 8" Diameter Hollow Stem Auger (CME-95)

DRIVE WEIGHT 140 lbs. (Auto-Trip Hammer) DROP 30"

SAMPLED BY DRR LOGGED BY DRR REVIEWED BY RJ

| DEPTH (feet) | SAMPLES Bulk | SAMPLES Driven | BLOWS/FOOT | MOISTURE (%) | DRY DENSITY (PCF) | SYMBOL | CLASSIFICATION U.S.C.S. | DESCRIPTION/INTERPRETATION |
|---|---|---|---|---|---|---|---|---|
| | | | | | | ░ | SM | TERRACE DEPOSITS: (Continued)<br>Light brown to brown, saturated, dense, silty fine SAND. |
| 40 | | ◥ | 33 | | | ▨ | CL | Olive brown, hard, sandy CLAY; with iron oxide staining. |
| | | | | | | ░ | SM | Light brown to brown, saturated, dense, silty fine SAND. |
| 50 | | ◥ | 45 | | | ░ | | Olive brown to reddish brown, saturated, very dense, silty fine SAND; no iron oxide staining. |
| 60 | | ◥ | 54 | | | ░ | | Olive brown to brown. |

Ninyo & Moore

**BORING LOG**

HARBOR DRIVE PEDESTRIAN BRIDGE
SAN DIEGO, CALIFORNIA

| PROJECT NO. | DATE | FIGURE |
|---|---|---|
| 105288001 | 11/07 | A-2 |

DATE DRILLED 11/11/04 BORING NO. PB-1

GROUND ELEVATION 9.0' ± (MSL) SHEET 3 OF 3

METHOD OF DRILLING 8" Diameter Hollow Stem Auger (CME-95)

DRIVE WEIGHT 140 lbs. (Auto-Trip Hammer) DROP 30"

SAMPLED BY DRR LOGGED BY DRR REVIEWED BY RI

| DEPTH (feet) | SAMPLES Bulk | SAMPLES Driven | BLOWS/FOOT | MOISTURE (%) | DRY DENSITY (PCF) | SYMBOL | CLASSIFICATION U.S.C.S. | DESCRIPTION/INTERPRETATION |
|---|---|---|---|---|---|---|---|---|
| | | | | | | ▦ | SM | <u>TERRACE DEPOSITS</u>: (Continued)<br>Olive brown to brown, saturated, very dense, silty fine SAND. |
| 70 | | ■ | 38 | | | ▨ | CL | Reddish brown to brown, saturated, hard, sandy CLAY. |
| 80 | | ■ | 34 | | | ▨ | | Olive brown to brown. |
| 90 | | □ | 48 | | | ▨ | | |
| | | | | | | | | Total Depth = 27.9 m (91.5 feet).<br>Groundwater encountered at approximately 2.7 m (9 feet) one hour after drilling.<br>Backfilled with 0.9 cubic meters (32 cubic feet) of bentonite on 11/11/04.<br>Cuttings placed in 55-gallon drums. |
| 100 | | | | | | | | |

Ninyo & Moore

## BORING LOG

HARBOR DRIVE PEDESTRIAN BRIDGE
SAN DIEGO, CALIFORNIA

| PROJECT NO. | DATE | FIGURE |
|---|---|---|
| 105288001 | 11/07 | A-3 |

# PRESENTATION OF CONE PENETRATION TEST DATA

## CONVENTION CENTER HOTEL PARKING FACILITY

## SAN DIEGO, CALIFORNIA

**Prepared for:**
NINYO & MOORE
San Diego, State

**Prepared by:**

GREGG

GREGG IN SITU, INC.
Signal Hill, California
02-307sh

**Prepared on:**

December 2, 2002

# TABLE OF CONTENTS

# PRESENTATION OF CONE PENETRATION TEST DATA

## 1.0 INTRODUCTION

This report presents the results of a Cone Penetration Testing (CPT) program carried out at the Convention Center Hotel Parking Facility site located in San Diego, CA. The work was performed on November 22nd, 2002. The work is part of a geotechnical program being carried out by Ninyo & Moore. The enclosed information consists of the CPT data from the referenced project. We recommend that all data be carefully reviewed by qualified personnel to verify the data and make appropriate recommendations.

## 2.0 FIELD EQUIPMENT & PROCEDURES

### 2.1 Electronic Cone Penetration Testing

The Cone Penetration Tests (CPT) were carried out by GREGG IN SITU, INC. of Signal Hill, CA using an integrated electronic cone system. The CPT soundings were performed in accordance with ASTM standards (D 5778-95). A 20 ton capacity cone was used for the soundings. This cone has a tip area of 15 $cm^2$ and friction sleeve area of 225$cm^2$. A piezometer element of 5 mm. thickness is located immediately behind the cone tip. The cone used has an equal end area friction sleeve and a tip end area ratio of 0.85 (Refer to Figure 1).

The cone used during the program was capable of recording the following parameters at 5 cm depth intervals:

- Tip Resistance (qc)
- Sleeve Friction (fs)
- Dynamic Pore Pressure (U)

The above parameters, excluding the seismic wave velocities were printed simultaneously on a printer and stored on a computer diskette for future analysis and reference. CPT logs are included as well as interpreted parameters based on the CPT measurements.

A complete set of baseline readings was taken prior to and at the completion of the sounding to determine temperature shifts and any zero load offsets. Establishing temperature shifts and load offsets enables the engineer to make corrections to the cone data if necessary. The cone was hydraulically pushed using an integrated 25-ton cone rig.

Five CPT soundings were performed to a depth of 75 feet below the ground surface. Downhole seismic measurements were taken at SCPT-01 and SCPT-05 at approximately 5 foot intervals. The CPT sounding locations were specified by Ninyo & Moore personnel.

### 2.2 Seismic Cone Penetration Testing

The seismic equipment and procedures used in this investigation, in general, were as developed at UBC and reported by Rice, 1984, Laing, 1985 and Robertson et al, 1986. The procedure was incorporated within the cone penetration test (CPT) and conducted when the cone penetration test was stopped at the desired test depth.

For shear wave generation, the beam was struck using a 10 lb. sledge hammer in a horizontal direction, parallel to the active axis of the transducer, first from one end and then the other. The wave traces were recorded using a digital oscilloscope card within our Pentium II on board computer. Each wave was inspected and the procedure was repeated, if necessary. A contact trigger between the beam and the hammer produced accurate triggering times and allowed for the accurate timing of shear wave markers (figure 2).

After each pair of shear wave traces was recorded, inspected and saved, the two traces were overlaid on a digital oscilloscope screen and the arrival times were selected. Each of the wave traces are presented in the Appendix. Some judgment is required on deciding the time of seismic wave arrival. A summary of the seismic wave data is presented in tabular form following the text of the report. We recommend qualified personnel review the wave arrival times and make any appropriate corrections.

## 3.0 CONE PENETRATION TEST DATA & INTERPRETATION

The cone penetration test data is presented in graphical form. Penetration depths are referenced to existing ground surface. This data includes CPT logs of measured soil parameters and a computer tabulation of interpreted soil types along with additional geotechnical parameters and pore pressure dissipation data.

The stratigraphic interpretation is based on relationships between cone bearing (qc), sleeve friction (fs), and penetration pore pressure (U). The friction ratio (Rf), which is sleeve friction divided by cone bearing, is a calculated parameter which is used to infer soil behavior type. Generally, cohesive soils (clays) have high friction ratios, low cone bearing and generate large excess pore water pressures. Cohesionless soils (sands) have lower friction ratios, high cone bearing and generate little in the way of excess pore water pressures.

**GREGG IN SITU, INC.**
02-307sh
December 2, 2002

Ninyo & Moore
Convention Center
San Diego, Ca.

The interpretation of soils encountered on this project was carried out using recent correlations developed by Robertson et al, 1990. It should be noted that it is not always possible to clearly identify a soil type based on qc, fs and U. In these situations, experience and judgment and an assessment of the pore pressure dissipation data should be used to infer the soil behavior type. The soil classification chart used to interpret soil types based on qc and Rf is provided in the Appendix (figure 3).

Pore Pressure Dissipation Tests (PPDT's) were taken at various intervals in order to measure hydrostatic water pressures and approximate depth to groundwater table. In addition, the PPDT data can be used to estimate the horizontal permeability ($k_h$) of the soil. The correlation to permeability is based on the time required for 50 percent of the measured dynamic pore pressure to dissipate ($t_{50}$). The PPDT plots and correlation figure (figure 4) is provided in the Appendix.

Interpreted output requires that depth of water be entered for calculation purposes, where depth to water is unknown an arbitrary depth in excess of 10 feet of the deepest sounding is entered as the groundwater depth.

We hope the information presented is sufficient for your purposes. If you have any questions, please do not hesitate to contact our office at (562) 427-6899.

Sincerely,
GREGG IN SITU, INC.

Brian Savela
Operations Manager

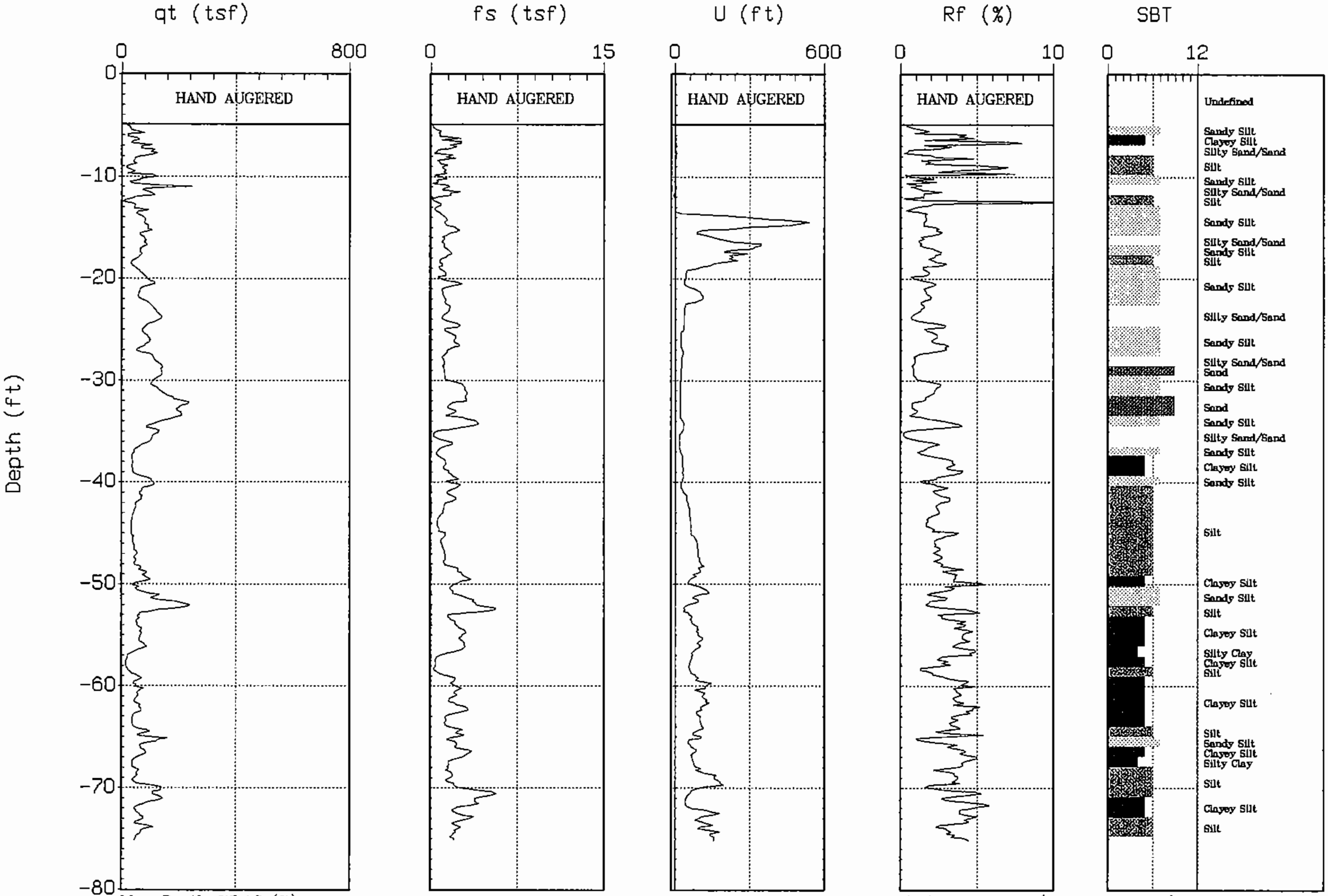
# 3.1 CPT Plots

GREGG

NINYO & MOORE

Site : CONVENTION CTR.
Location : SCPT-01

Engineer : E. PRENCKE
Date : 11:22:02 10:45



Max. Depth: 75.13 (ft)

Depth Inc.: 0.164 (ft)

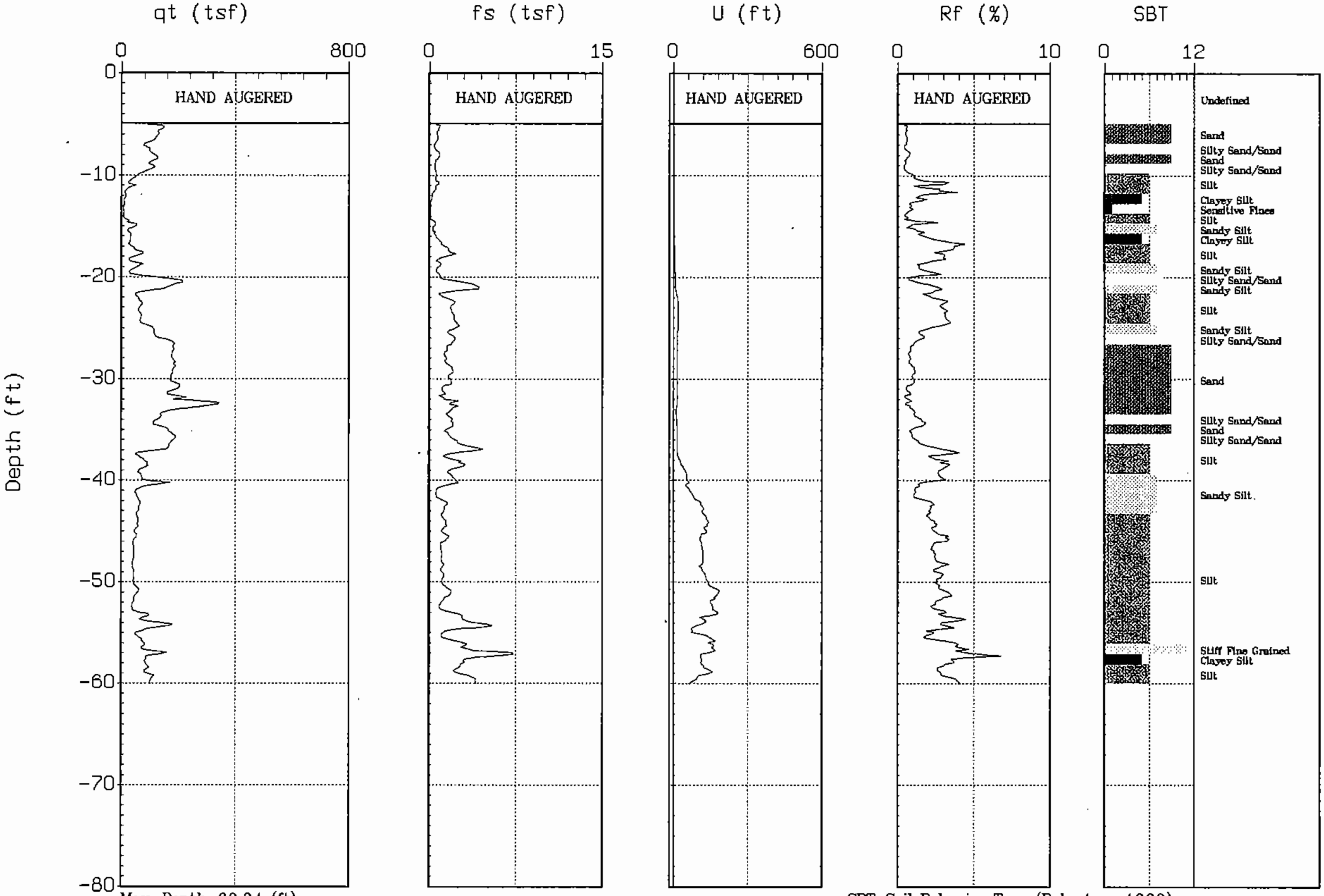
SBT: Soil Behavior Type (Robertson 1990)

GREGG

NINYO & MOORE

Site : CONVENTION CTR.
Location : CPT-02

Engineer : E. PRENCKE
Date : 11:22:02 12:22



Max. Depth: 60.04 (ft)

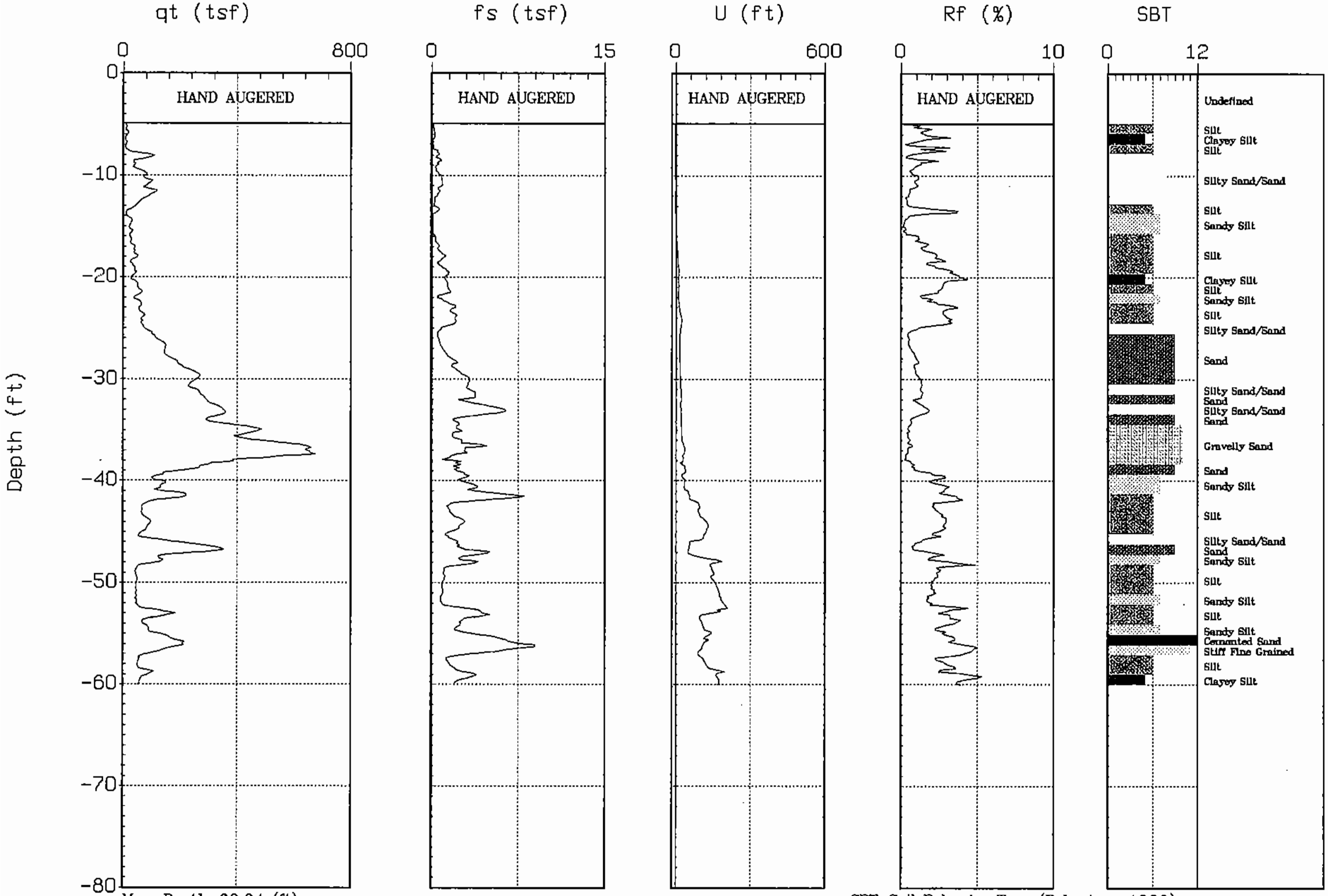
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

**NINYO & MOORE**

Site : CONVENTION CTR.
Location : CPT-03

Engineer : E. PRENCKE
Date : 11:22:02 12:53



Max. Depth: 60.04 (ft)

Depth Inc.: 0.164 (ft)

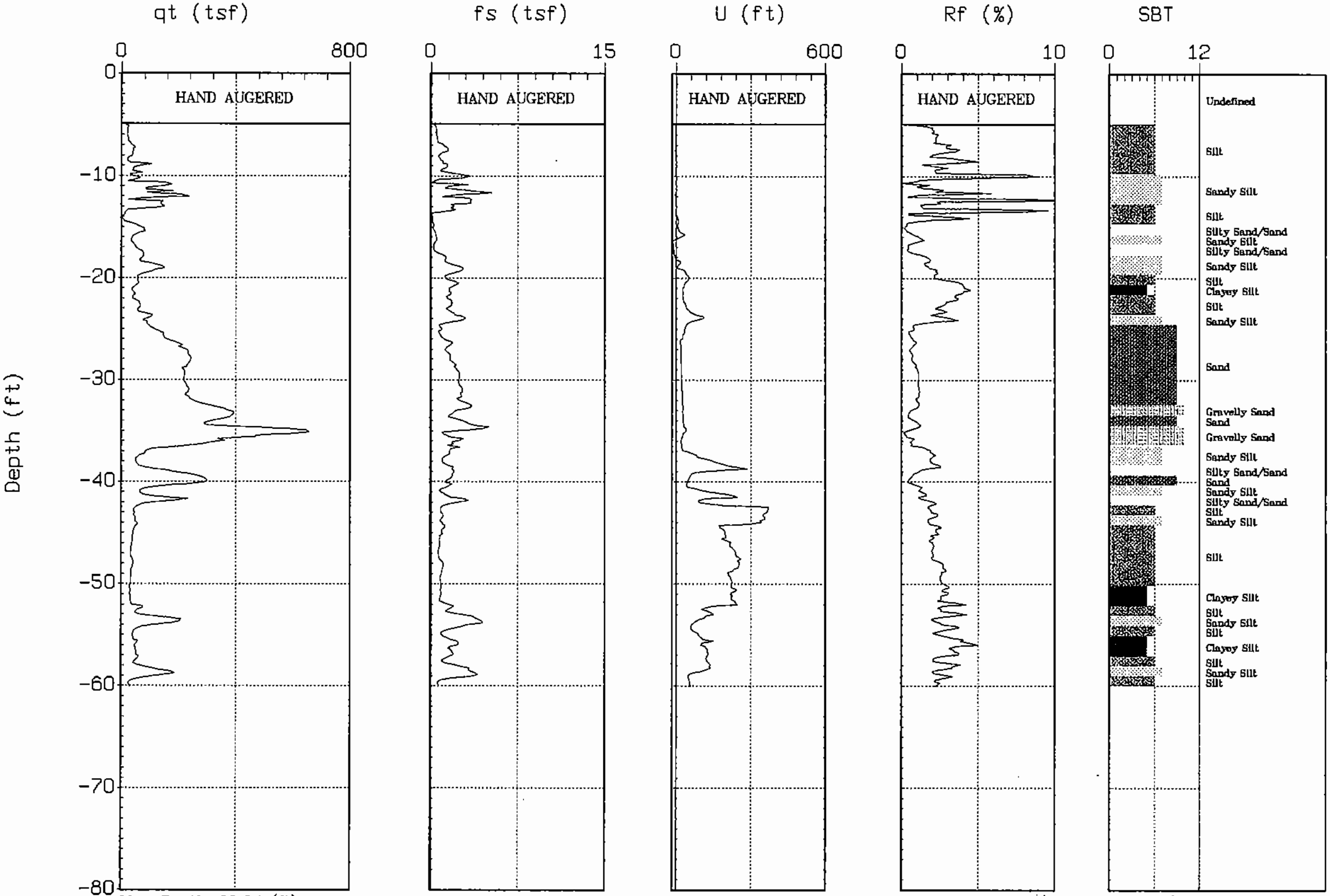
SBT: Soil Behavior Type (Robertson 1990)

GREGG

NINYO & MOORE

Site : CONVENTION CTR.
Location : CPT-04

Engineer : E. PRENCKE
Date : 11:22:02 11:43



Max. Depth: 60.04 (ft)

Depth Inc.: 0.164 (ft)

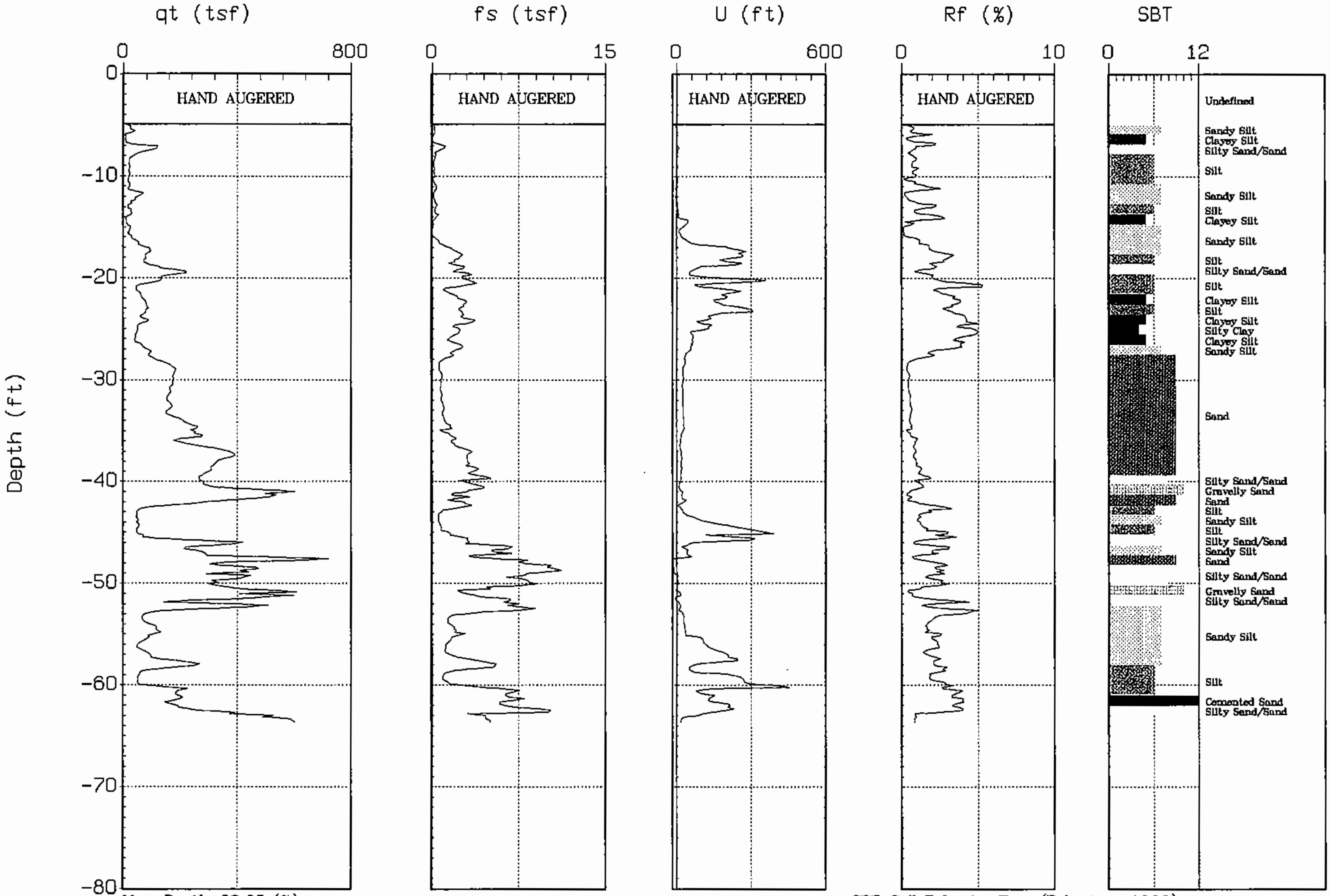
SBT: Soil Behavior Type (Robertson 1990)

GREGG

NINYO & MOORE

Site : CONVENTION CTR.
Location : SCPT-05

Engineer : E. PRENCKE
Date : 11:22:02 09:36



Max. Depth: 63.65 (ft)

Depth Inc.: 0.164 (ft)

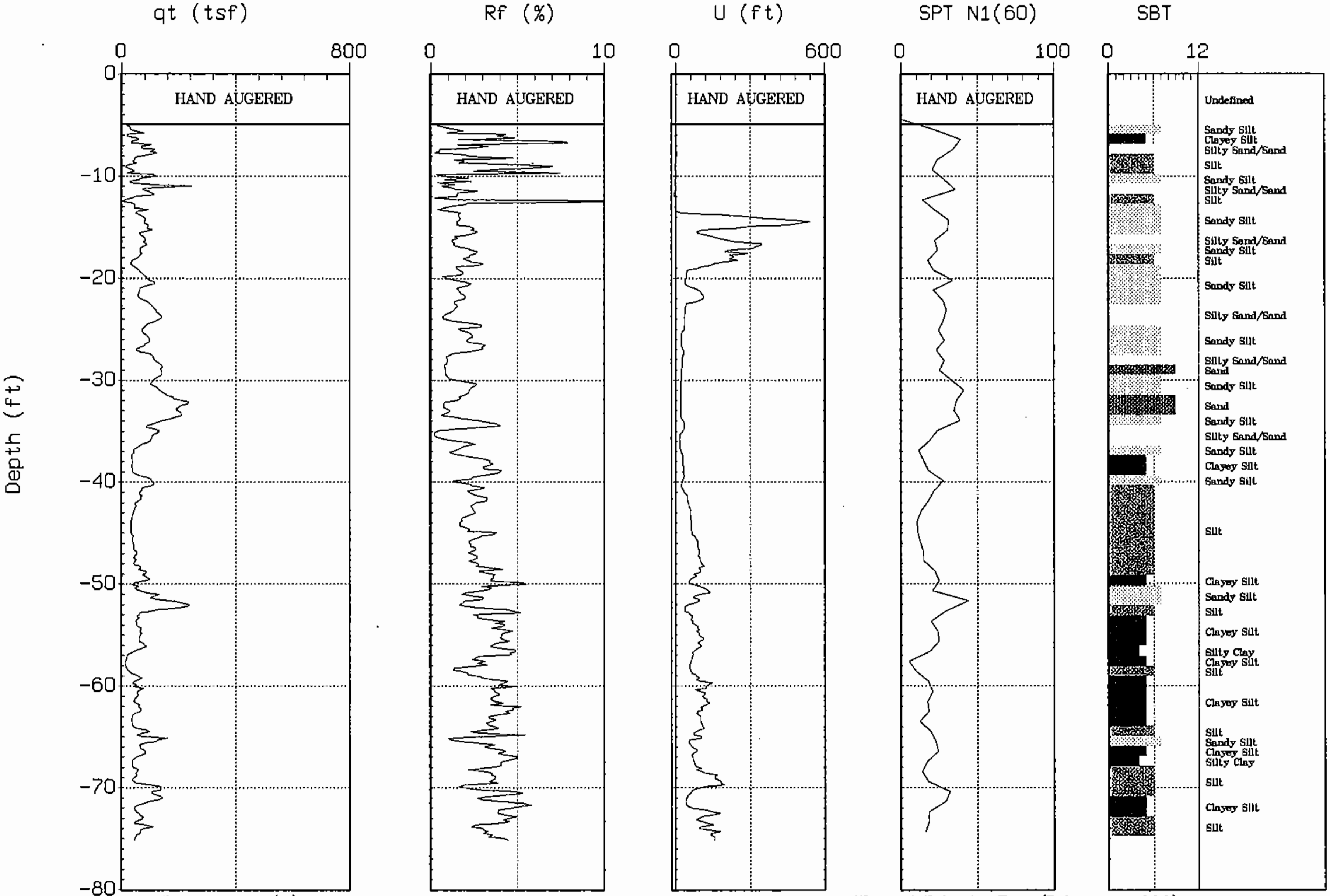
SBT: Soil Behavior Type (Robertson 1990)

GREGG

NINYO & MOORE

Site : CONVENTION CTR.
Location : SCPT-01

Engineer : E. PRENCKE
Date : 11:22:02 10:45



Max. Depth: 75.13 (ft)

Depth Inc.: 0.164 (ft)

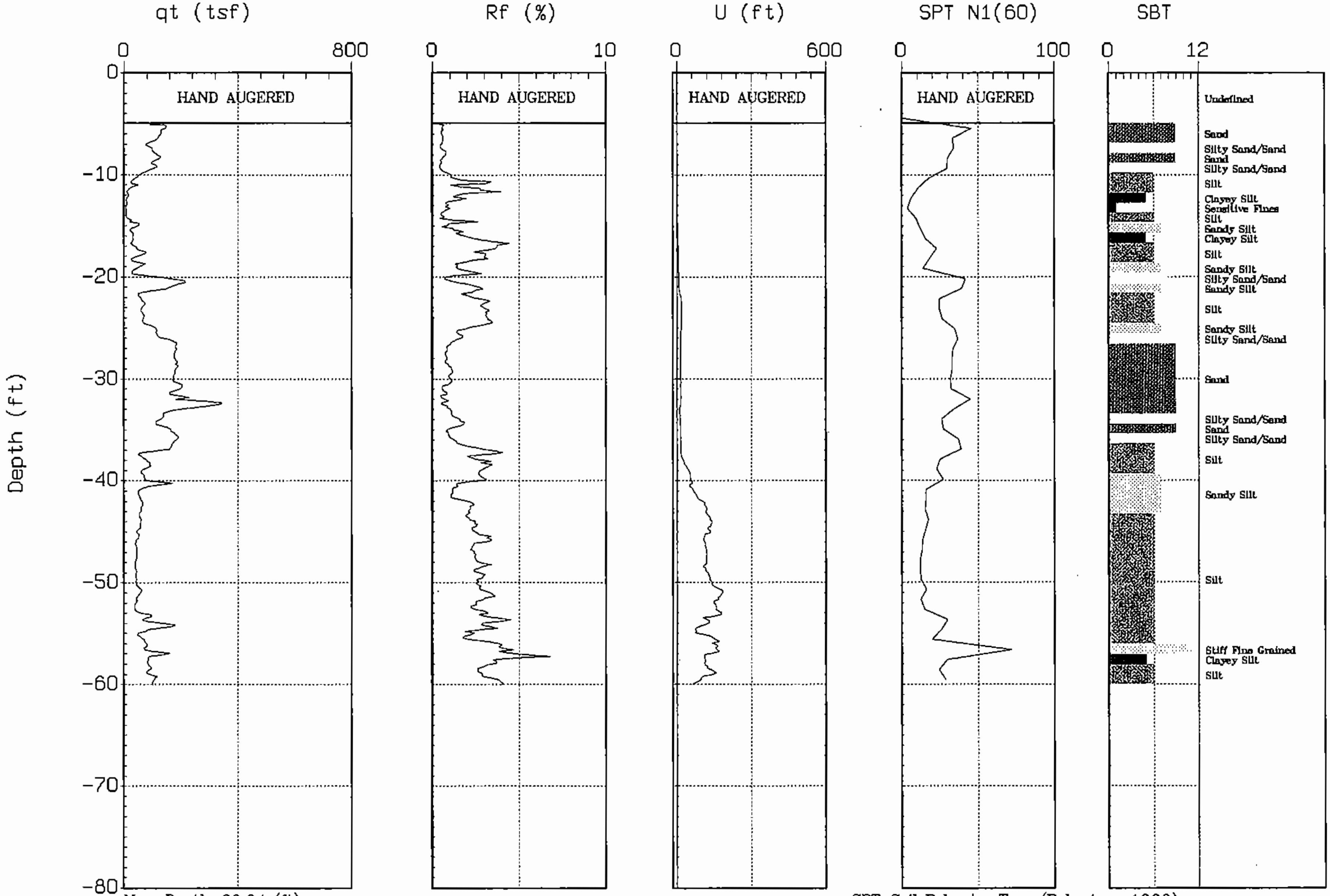
SBT: Soil Behavior Type (Robertson 1990)

GREGG

NINYO & MOORE

Site : CONVENTION CTR.
Location : CPT-02

Engineer : E. PRENCKE
Date : 11:22:02 12:22



Max. Depth: 60.04 (ft)

Depth Inc.: 0.164 (ft)

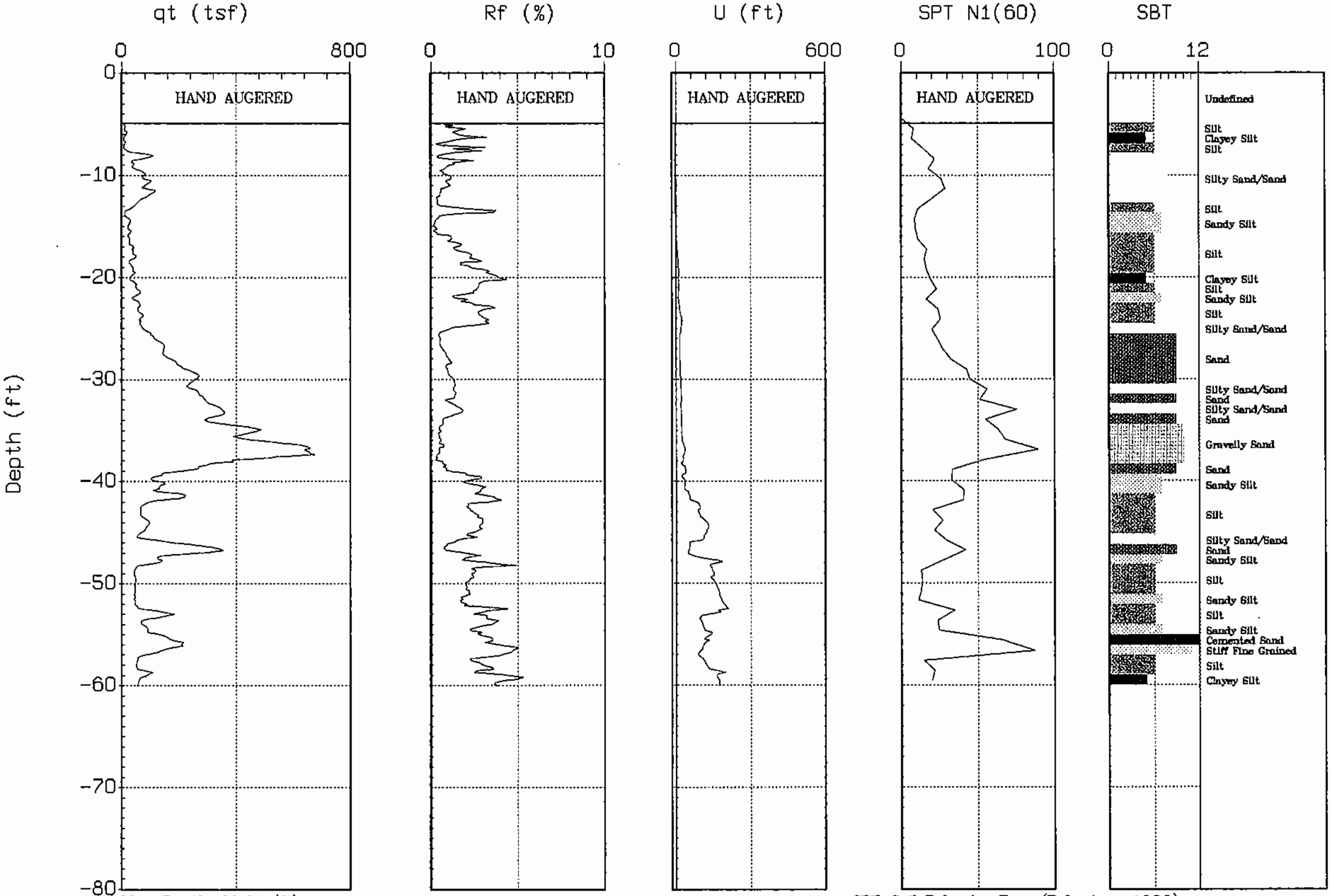
SBT: Soil Behavior Type (Robertson 1990)

GREGG

# NINYO & MOORE

Site : CONVENTION CTR.
Location : CPT-03

Engineer : E. PRENCKE
Date : 11:22:02 12:53



Max. Depth: 60.04 (ft)

Depth Inc.: 0.164 (ft)

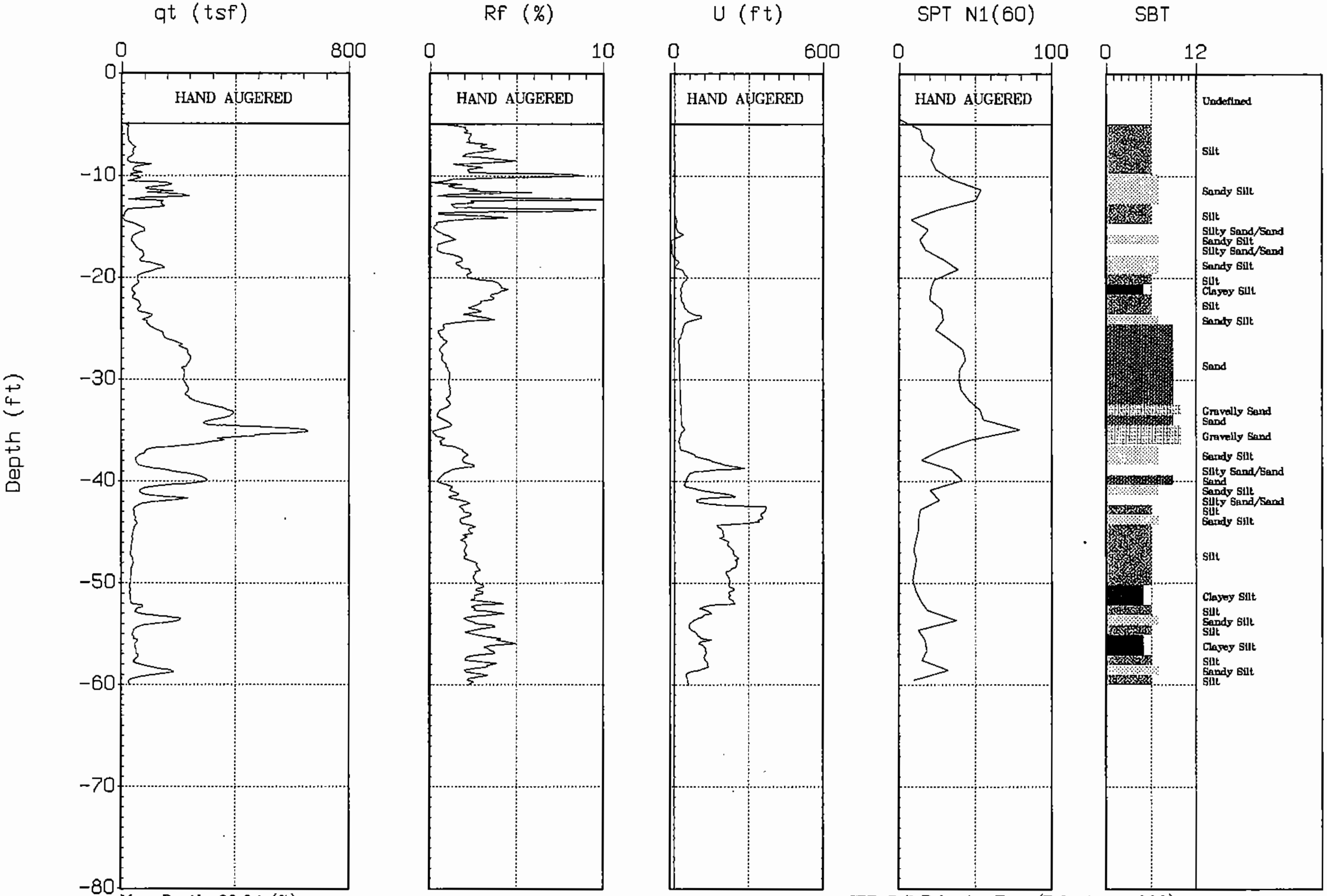
SBT: Soil Behavior Type (Robertson 1990)

**GREGG**

**NINYO & MOORE**

Site : CONVENTION CTR.
Location : CPT-04

Engineer : E. PRENCKE
Date : 11:22:02 11:43



Max. Depth: 60.04 (ft)

Depth Inc.: 0.164 (ft)

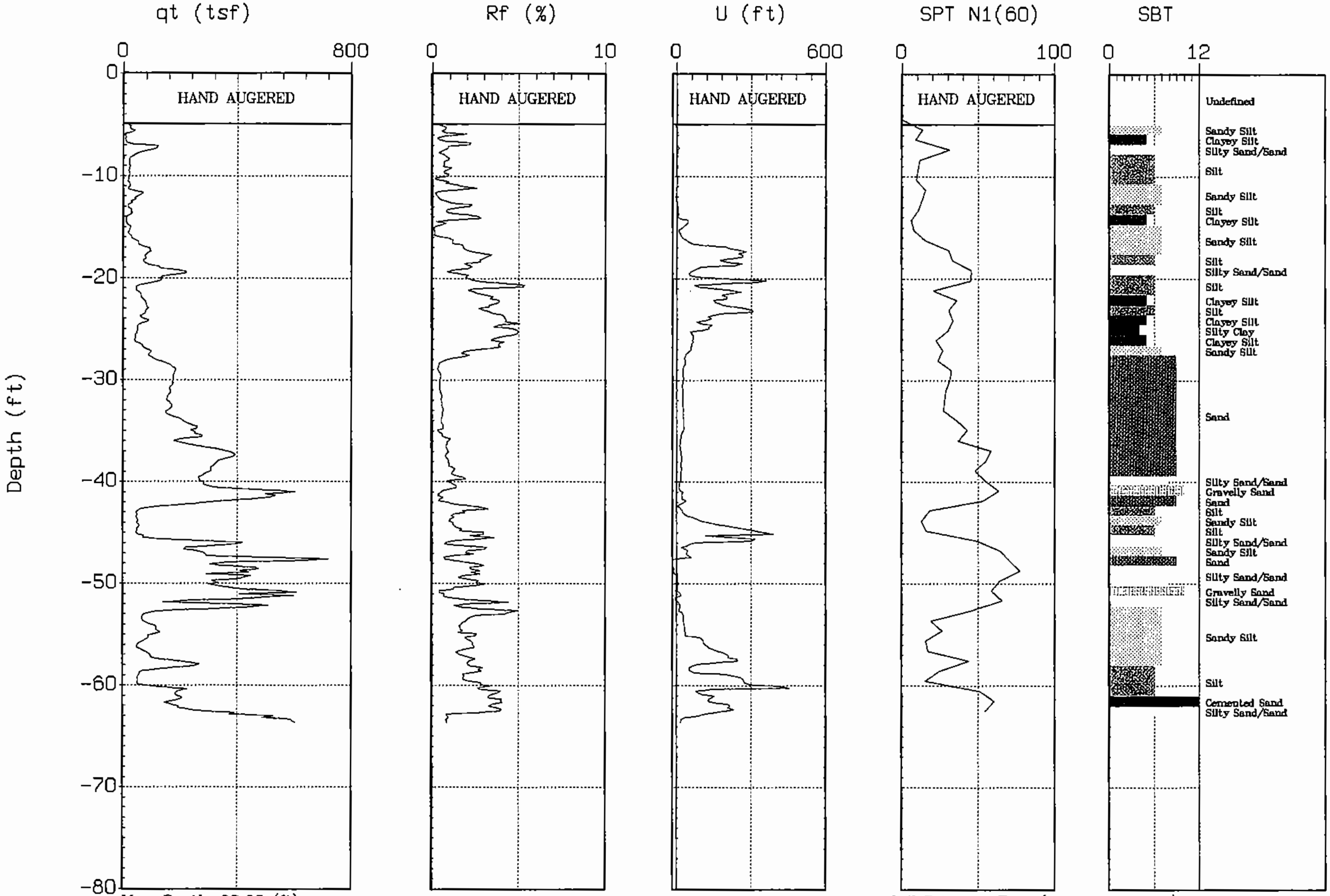
SBT: Soil Behavior Type (Robertson 1990)

GREGG

NINYO & MOORE

Site : CONVENTION CTR.
Location : SCPT-05

Engineer : E. PRENCKE
Date : 11:22:02 09:36



Max. Depth: 63.65 (ft)

Depth Inc.: 0.164 (ft)

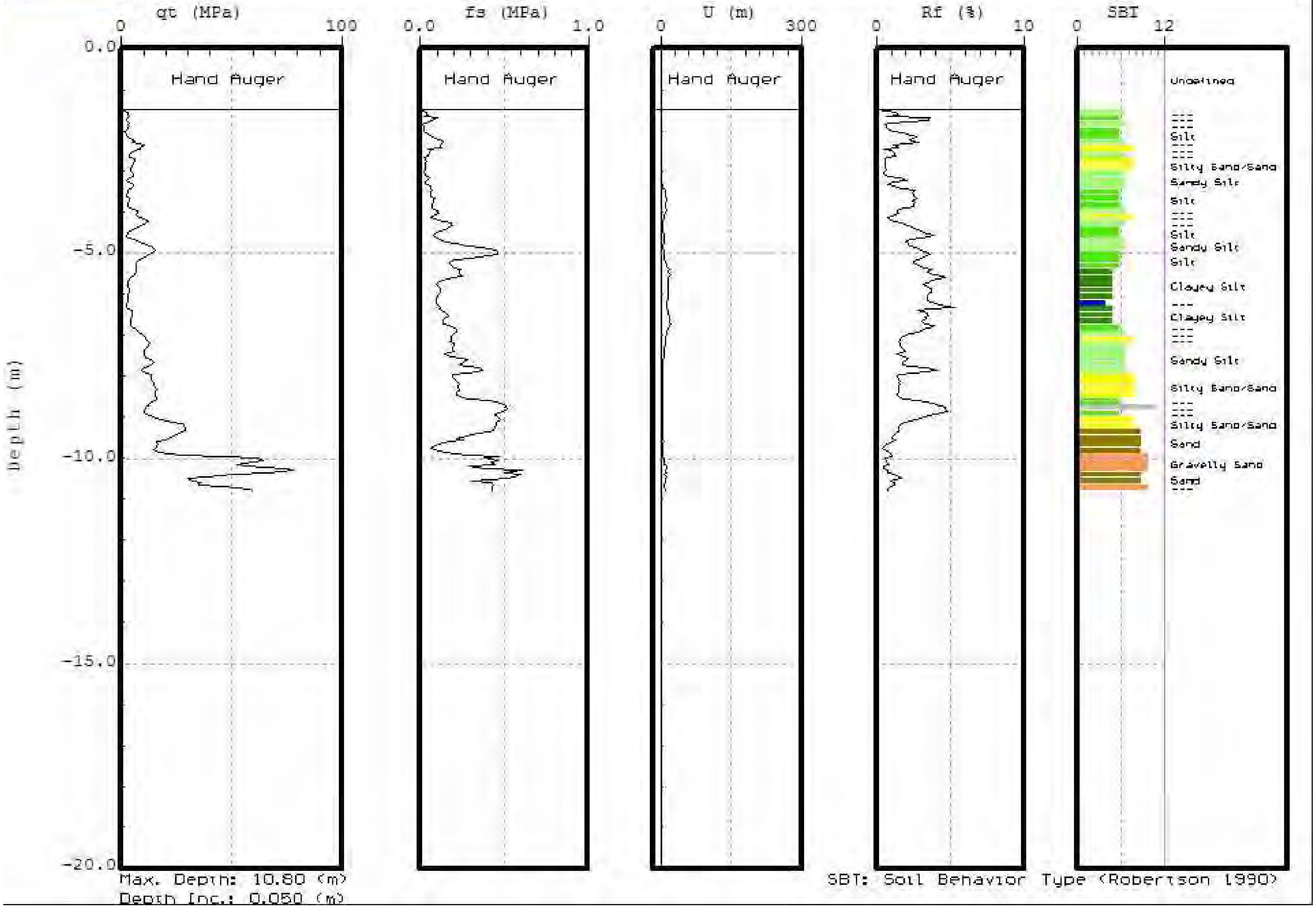
SBT: Soil Behavior Type (Robertson 1990)

GREGG

NINYO & MOORE

Site : HARBOR DR. PED. BRIDGE
Location : PB-2

Engineer : E.RUDOLPH
Date : 10:13:04 09:41



Max. Depth: 10.80 (m)
Depth Inc.: 0.050 (m)

SBT: Soil Behavior Type (Robertson 1990)

NOTE: ALL DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

**Ninyo & Moore**

## CPT LOG - PB-2

| PROJECT NO. | DATE |
|---|---|
| 105288001 | 11/07 |

HARBOR DRIVE PEDESTRIAN BRIDGE
SAN DIEGO, CALIFORNIA

FIGURE

**C-1**

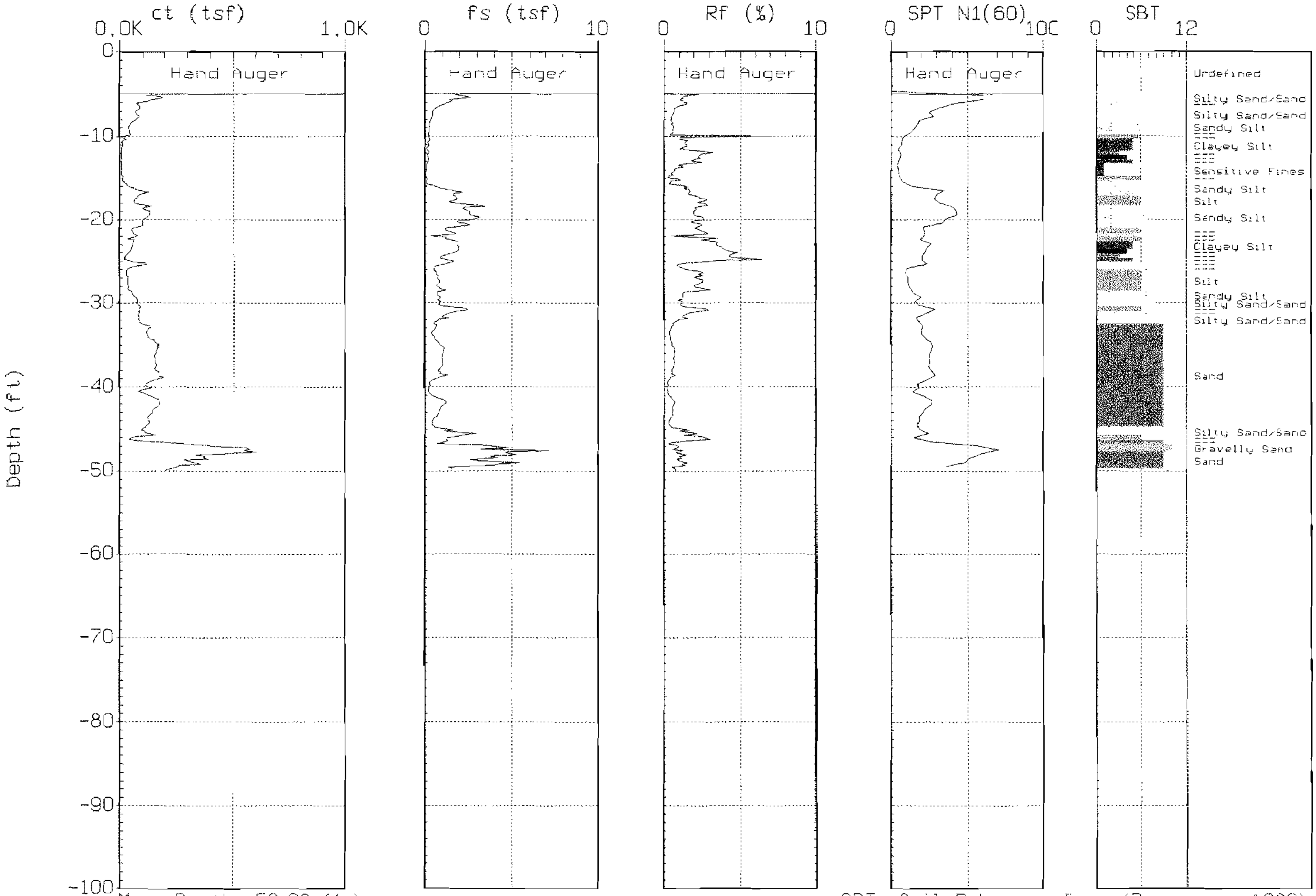
105288001 cpt c1.cdr

GREGG

MACTEC

Site :HILTON SAN DIEGO
Location :CPT-06

Engineer :C.KIM
Date :06:15:04 07:21



Max. Depth: 50.03 (ft)
Depth Inc.: 0.164 (ft)

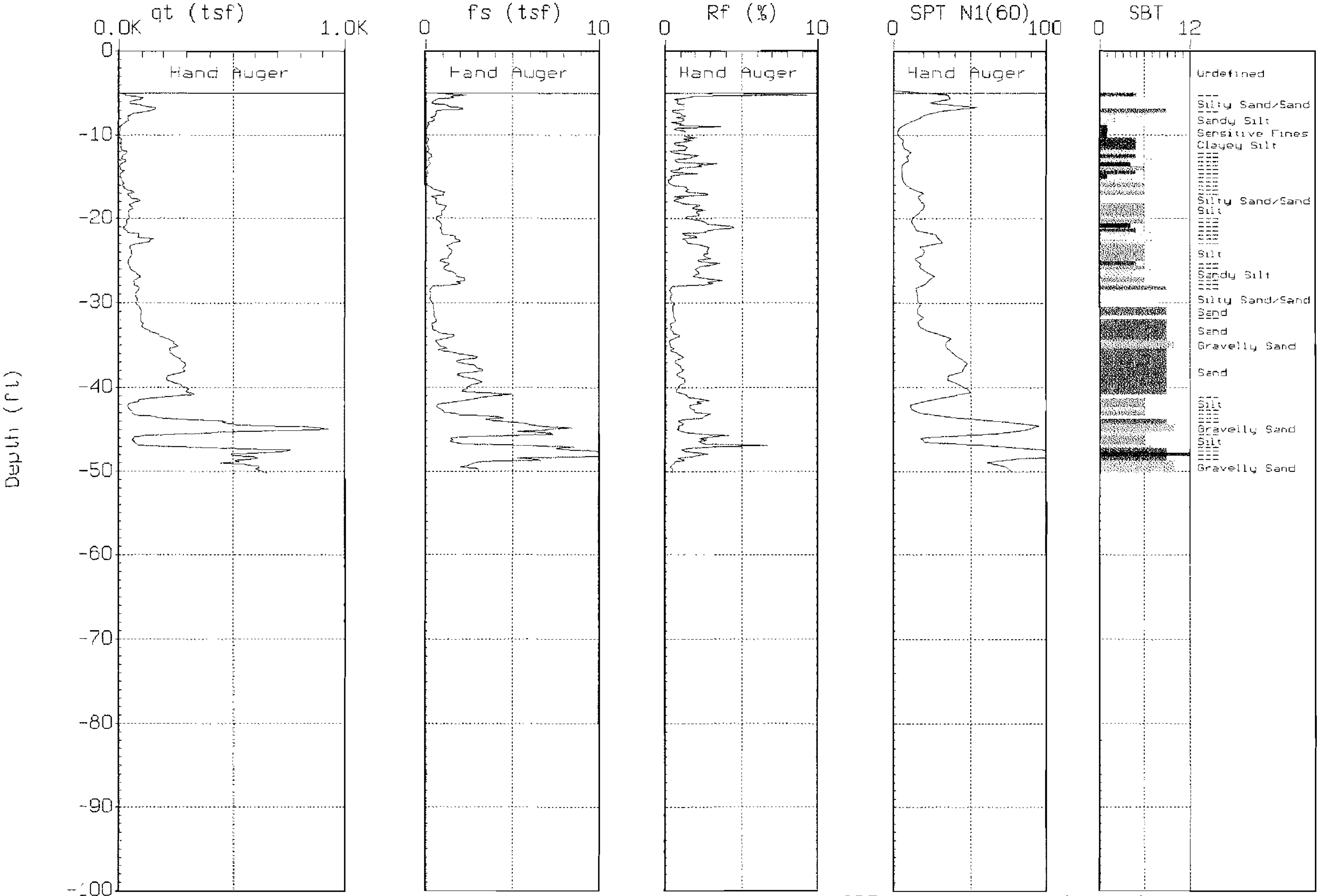
SBT: Soil Behavior Type (Robertson 1990)

GREGG

MACTEC

Site :HILTON SAN DIEGO
Location :CPT-13

Engineer :C.KIM
Date :06:14:04 15:24



Max. Depth: 50.20 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

# APPENDIX B

## LABORATORY TESTING (NINYO & MOORE, 2003a)

## APPENDIX B

## LABORATORY TESTING

### Classification

Soils were visually and texturally classified in accordance with the Unified Soil Classification System (USCS) in general accordance with ASTM D 2488-00. Soil classifications are indicated on the logs of the exploratory excavations in Appendix A.

### In-Place Moisture and Density Tests

The moisture content and dry density of relatively undisturbed samples obtained from the exploratory excavations were evaluated in general accordance with ASTM D 2937-00. The test results are presented on the logs of the exploratory excavations in Appendix A.

### Gradation Analysis

Gradation analysis tests were performed on selected representative soil samples in general accordance with ASTM D 422-63. The grain-size distribution curves are shown on Figures C-1 through C-12. These test results were utilized in evaluating the soil classifications in accordance with the Unified Soil Classification System.

### Atterberg Limits

Tests were performed on selected representative fine-grained soil samples to evaluate the liquid limit, plastic limit, and plasticity index in general accordance with ASTM D 4318-00. These test results were utilized to evaluate the soil classification in accordance with the Unified Soil Classification System. The test results and classifications are shown on Figure C-13.

### Consolidation Tests

Consolidation tests were performed on selected relatively undisturbed soil samples in general accordance with ASTM D 2435-96. The samples were inundated during testing to represent adverse field conditions. The percent of consolidation for each load cycle was recorded as a ratio of the amount of vertical compression to the original height of the sample. The results of the tests are summarized on Figures C-14 through C-17.

### Direct Shear Tests

Direct shear tests were performed on undisturbed samples in general accordance with ASTM D 3080-98 to evaluate the shear strength characteristics of selected materials. The samples were inundated during shearing to represent adverse field conditions. The results are shown on Figures C-18 through C-21.

**Expansion Index Tests**

The expansion index of selected materials was evaluated in general accordance with UBC Standard No. 18-2 (Expansion Index Test [CBSC, 2001]). Specimens were molded under a specified compactive energy at approximately 50 percent saturation (plus or minus 1 percent). The prepared 1-inch thick by 4-inch diameter specimens were loaded with a surcharge of 144 pounds per square foot and were inundated with tap water. Readings of volumetric swell were made for a period of 24 hours. The results of these tests are presented on Figure C-22.

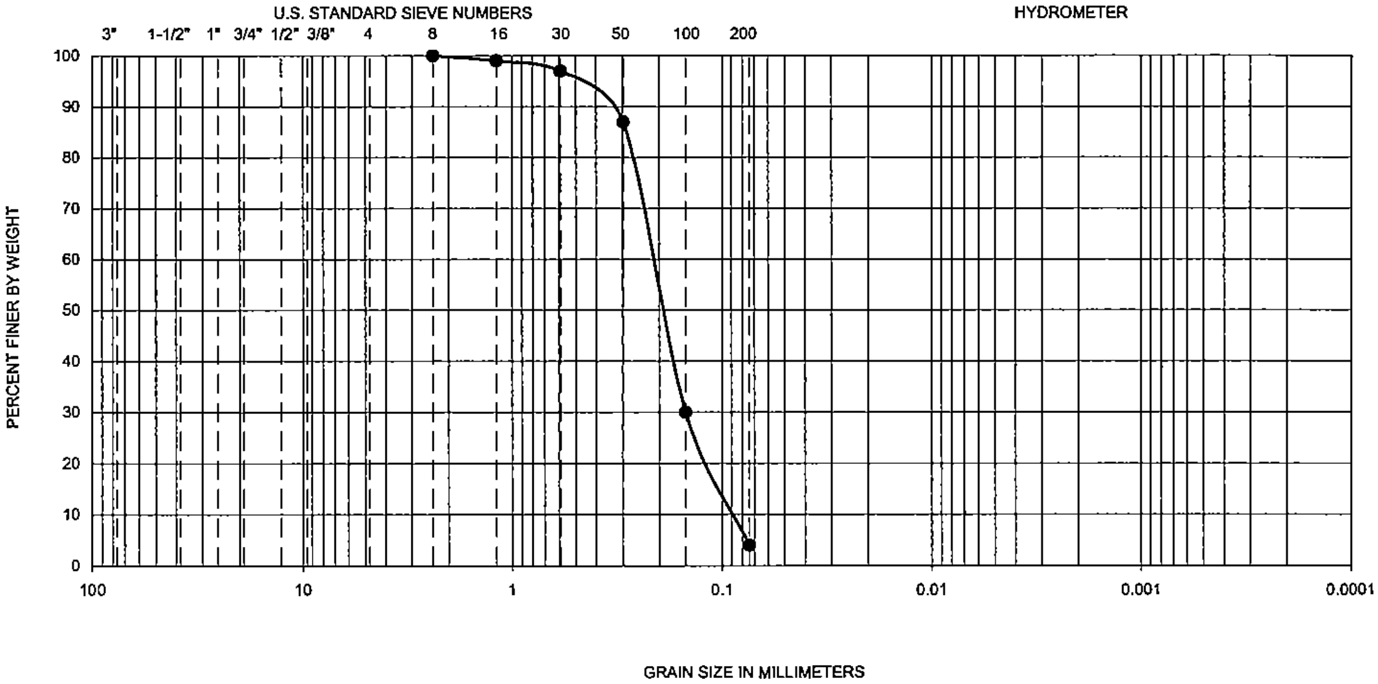
**Soil Corrosivity Tests**

Soil pH, and minimum resistivity tests were performed on representative samples in general accordance with California Test (CT) 643. The chloride content of selected samples was evaluated in general accordance with CT 422. The sulfate content of selected samples was evaluated in general accordance with CT 417. The test results are presented on Figure C-23.

**R-Value**

The resistance value, or R-value, for base, subbase, and basement soils was evaluated in general accordance with ASTM D 2844-94. Samples were prepared and each was tested for exudation pressure and R-value. The graphically evaluated R-value at an exudation pressure of 300 pounds per square inch is reported. The test results are shown on Figure C-24.

| GRAVEL | | SAND | | | FINES | |
|---|---|---|---|---|---|---|
| Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |



| Symbol | Hole No. | Depth (ft) | Liquid Limit | Plastic Limit | Plasticity Index | $D_{10}$ | $D_{30}$ | $D_{60}$ | $C_u$ | $C_c$ | Passing No. 200 (%) | U.S.C.S |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ● | B-211 | 20.0-22.0 | -- | -- | -- | 0.09 | 0.16 | 0.21 | 2.3 | 1.4 | 4 | SP |

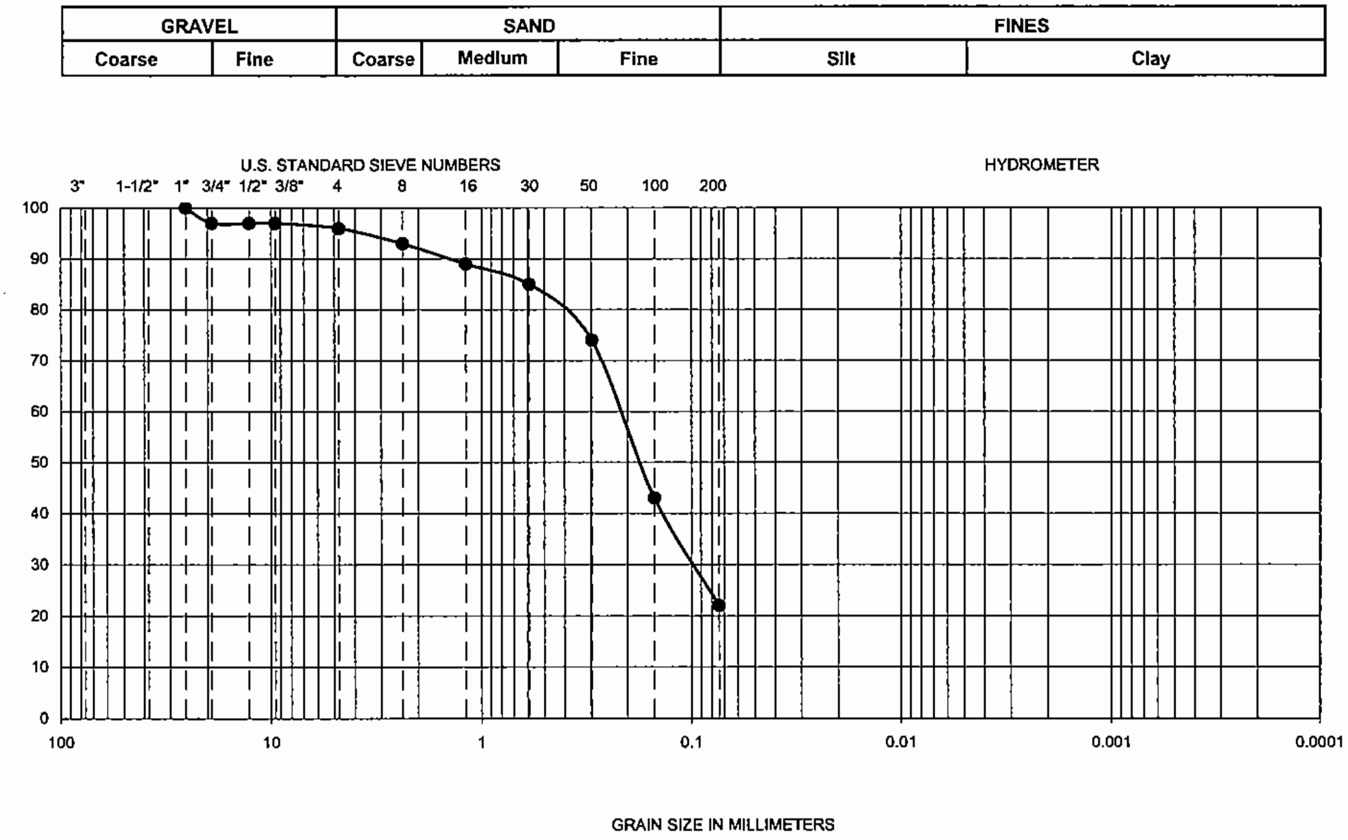
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63

**Ninyo & Moore**

# GRADATION TEST RESULTS

**Proposed Parking Facility**
**San Diego, California**

| PROJECT NO. | DATE | FIGURE |
|---|---|---|
| 104594005 | 1/03 | C-1 |



| Symbol | Hole No. | Depth (ft) | Liquid Limit | Plastic Limit | Plasticity Index | $D_{10}$ | $D_{30}$ | $D_{60}$ | $C_u$ | $C_c$ | Passing No. 200 (%) | U.S.C.S |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ● | B-212 | 10.0-12.0 | -- | -- | -- | -- | -- | -- | -- | -- | 22 | SM |

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63

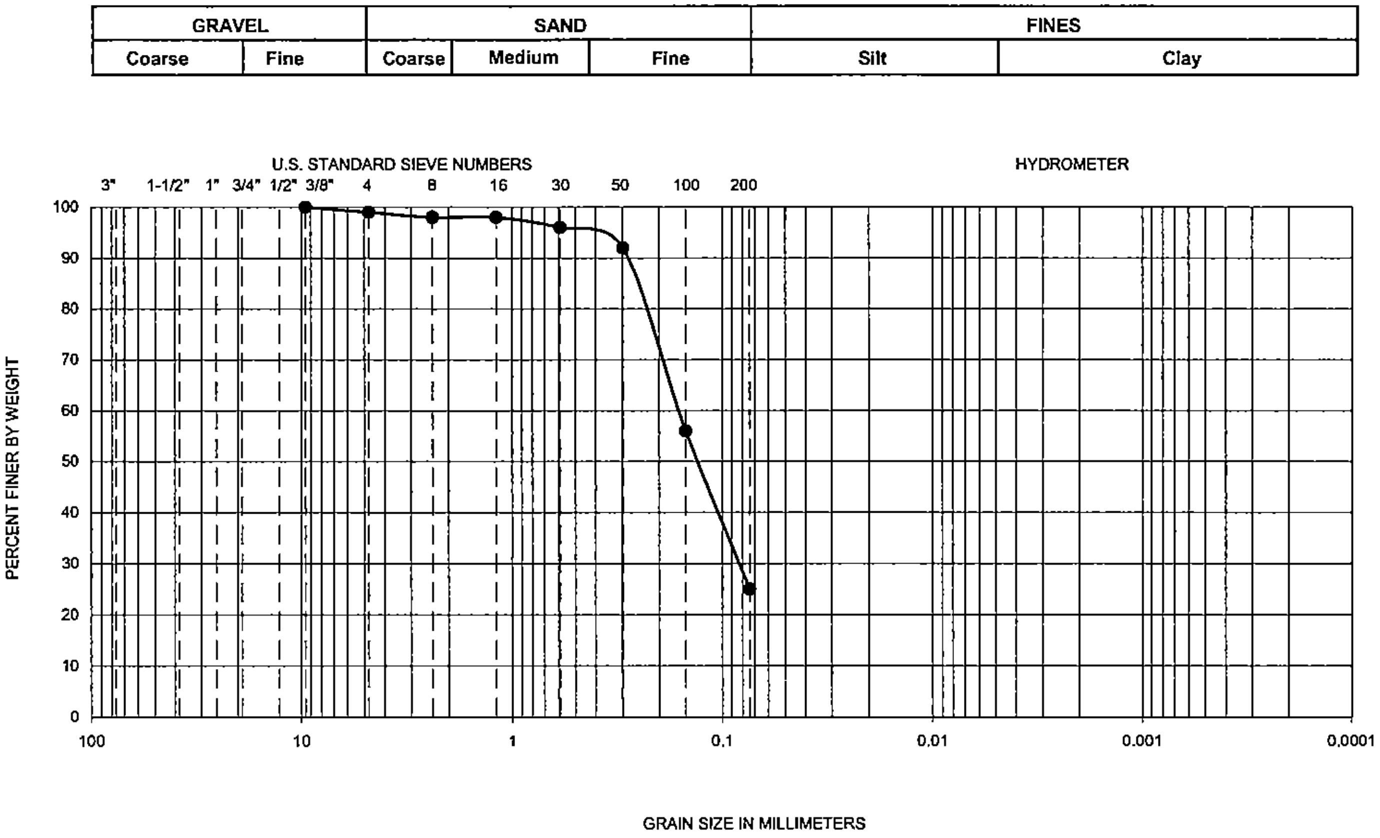
**Ninyo & Moore**

## GRADATION TEST RESULTS

**Proposed Parking Facility**
**San Diego, California**

| PROJECT NO. | DATE | FIGURE |
|---|---|---|
| 104594005 | 1/03 | C-2 |

SVB212@10.xls



| Symbol | Hole No. | Depth (ft) | Liquid Limit | Plastic Limit | Plasticity Index | $D_{10}$ | $D_{30}$ | $D_{60}$ | $C_u$ | $C_c$ | Passing No. 200 (%) | U.S.C.S |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ● | B-212 | 20.0-22.0 | -- | -- | -- | -- | -- | -- | -- | -- | 25 | SM |

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63

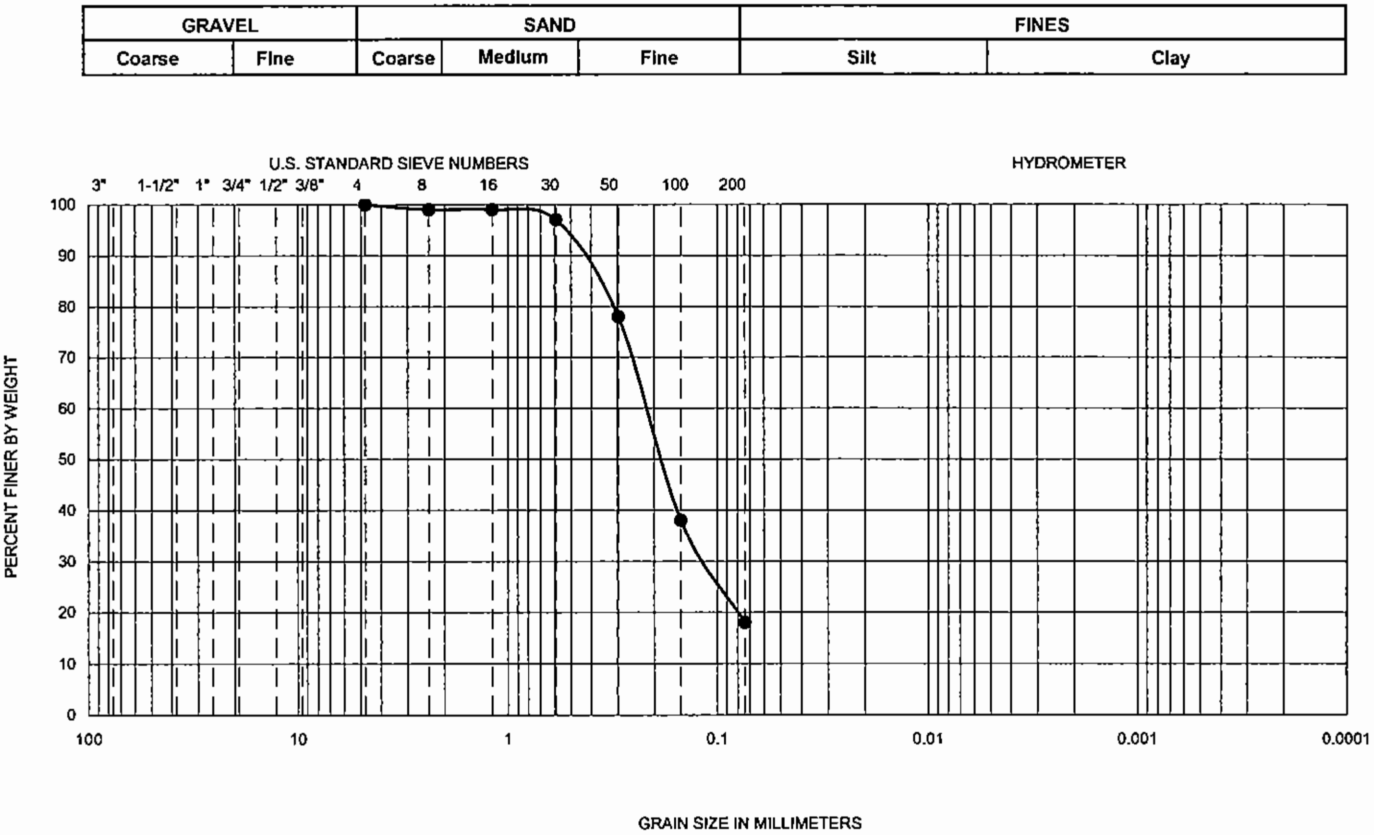
Ninyo & Moore

# GRADATION TEST RESULTS

**Proposed Parking Facility**
**San Diego, California**

| PROJECT NO. | DATE | FIGURE |
|---|---|---|
| 104594005 | 1/03 | C-3 |

SVB212@20.xls



| Symbol | Hole No. | Depth (ft) | Liquid Limit | Plastic Limit | Plasticity Index | $D_{10}$ | $D_{30}$ | $D_{60}$ | $C_u$ | $C_c$ | Passing No. 200 (%) | U.S.C.S |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ● | B-212 | 35.0-36.5 | 22 | 16 | 6 | -- | – | – | – | – | 18 | SC |

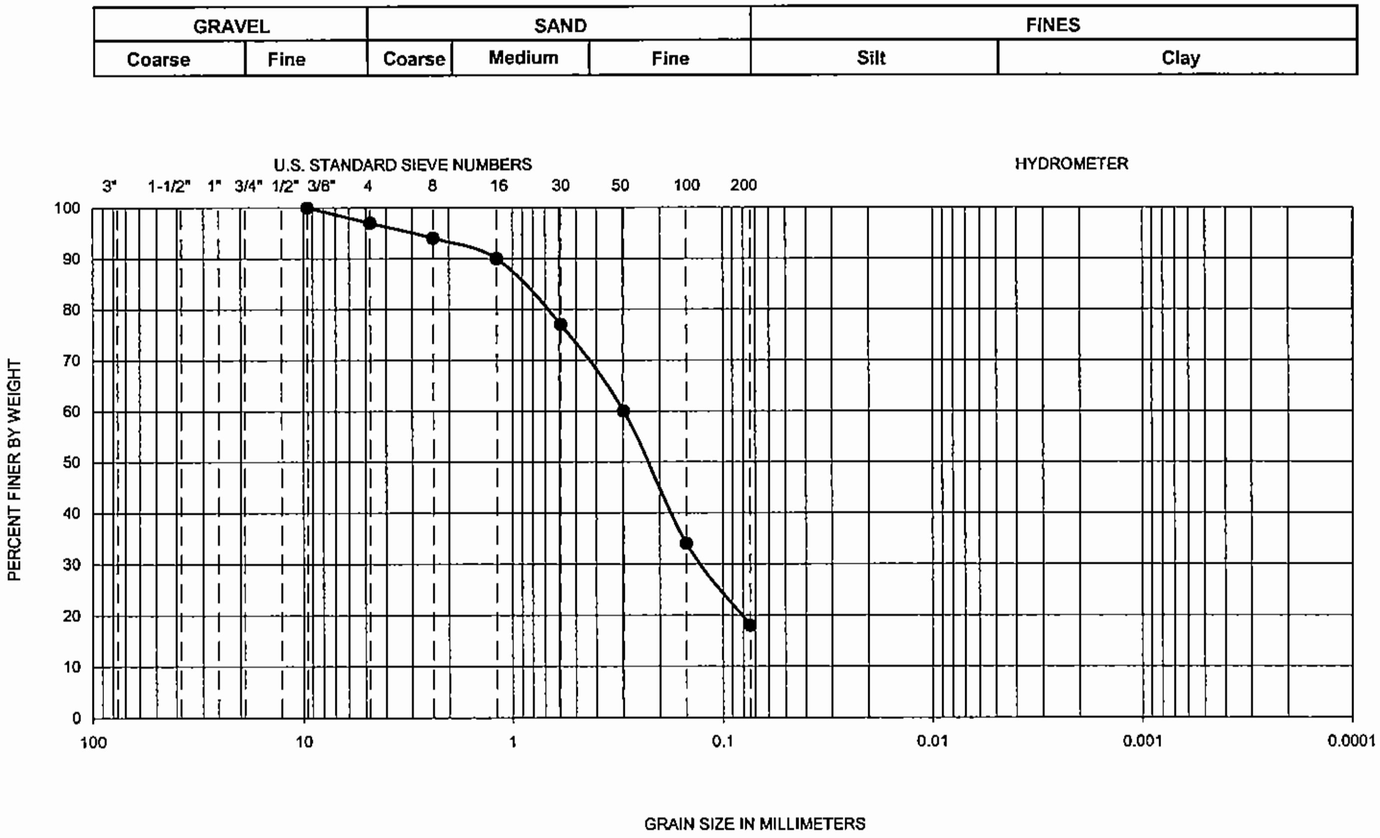
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63

Ninyo & Moore

## GRADATION TEST RESULTS

**Proposed Parking Facility**
**San Diego, California**

| PROJECT NO. | DATE | FIGURE |
|---|---|---|
| 104594005 | 1/03 | C-4 |



| Symbol | Hole No. | Depth (ft) | Liquid Limit | Plastic Limit | Plasticity Index | $D_{10}$ | $D_{30}$ | $D_{60}$ | $C_u$ | $C_c$ | Passing No. 200 (%) | U.S.C.S |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ● | B-213 | 15.0-17.0 | -- | – | – | – | -- | -- | -- | – | 18 | SM |

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63

**Ninyo & Moore**

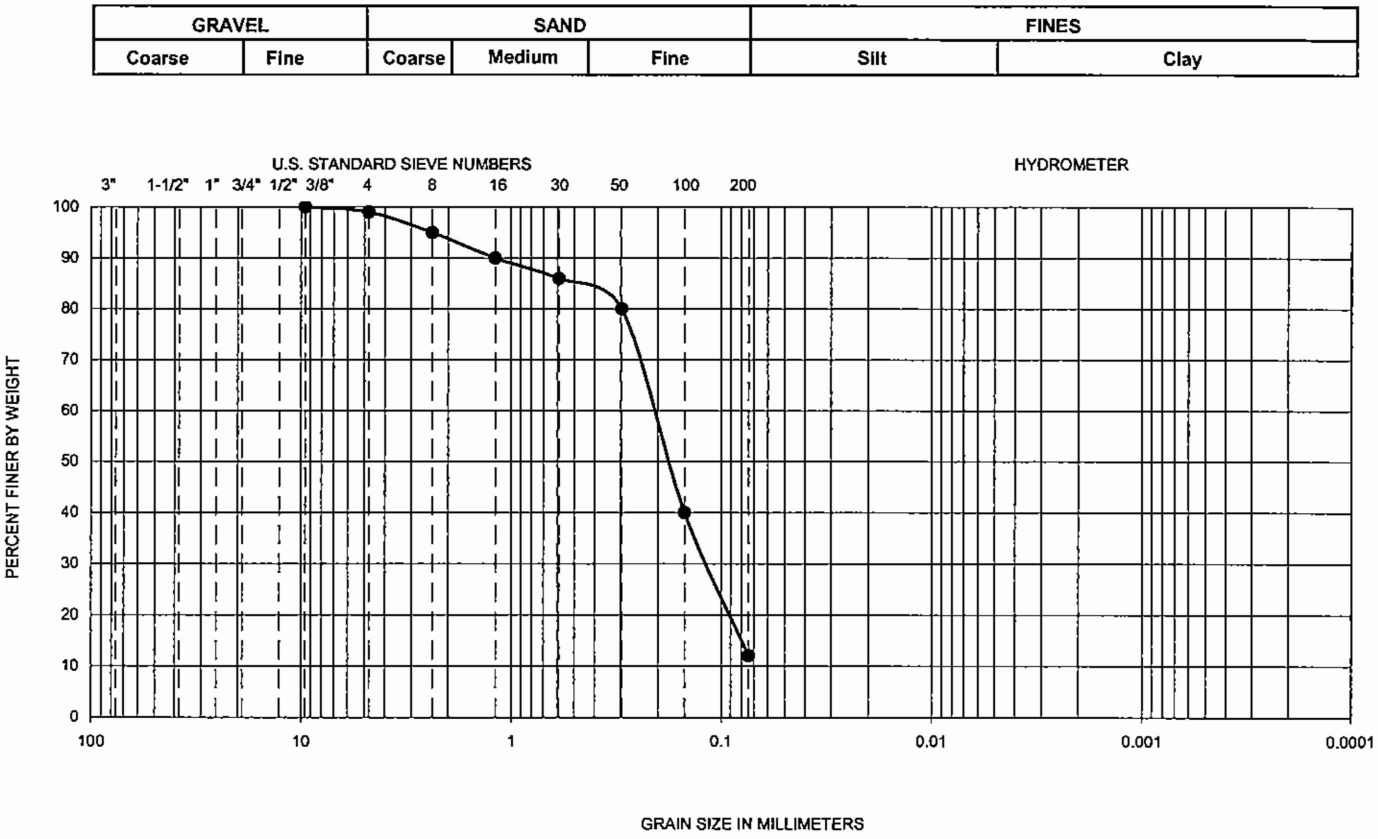
## GRADATION TEST RESULTS

**Proposed Parking Facility**
**San Diego, California**

| PROJECT NO. | DATE |
|---|---|
| 104594005 | 1/03 |

**FIGURE**
**C-5**

SVB213@15.xls



| Symbol | Hole No. | Depth (ft) | Liquid Limit | Plastic Limit | Plasticity Index | $D_{10}$ | $D_{30}$ | $D_{60}$ | $C_u$ | $C_c$ | Passing No. 200 (%) | U.S.C.S |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ● | B-213 | 30.0-32.0 | -- | -- | -- | 0.07 | 0.15 | 0.21 | 3.0 | 1.5 | 12 | SP-SM |

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63

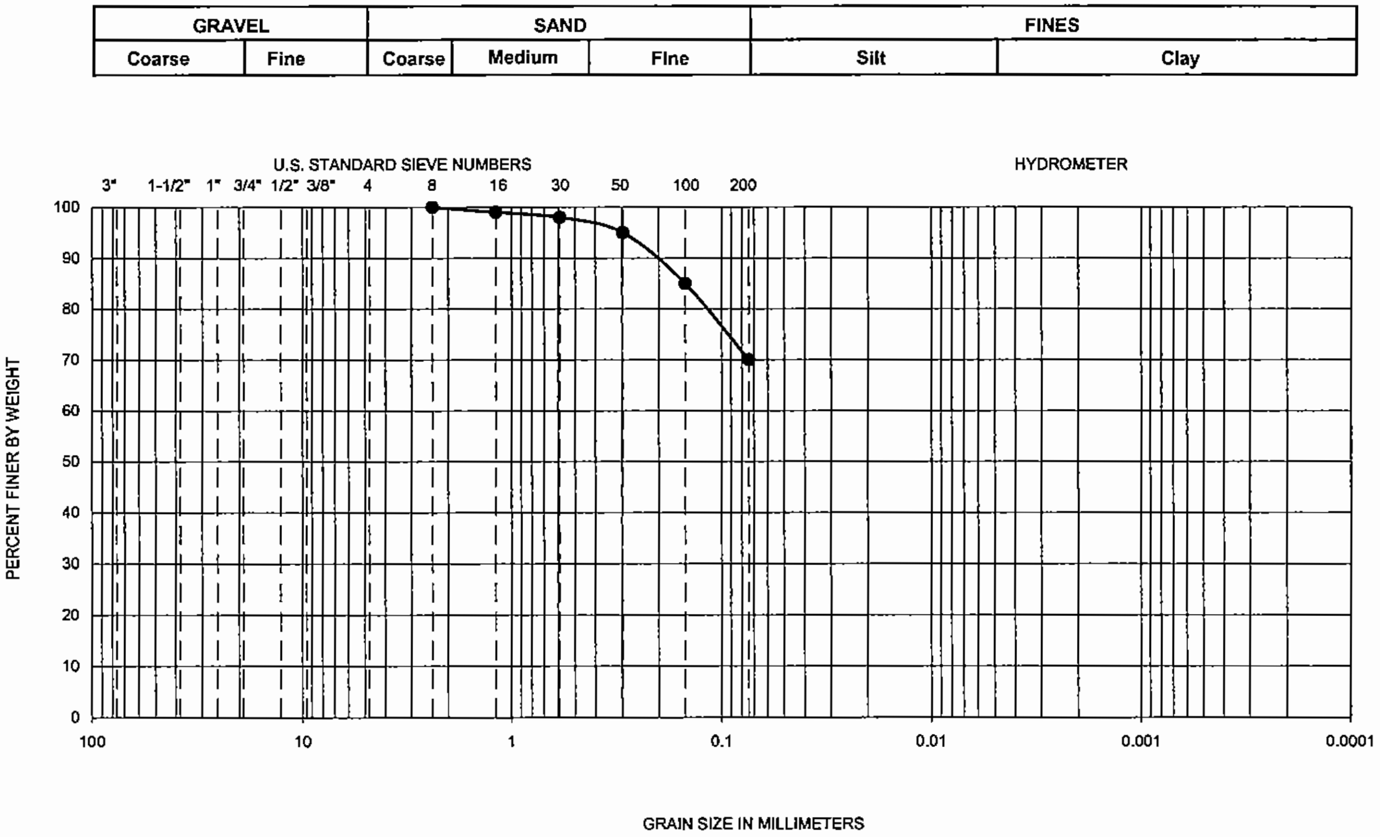
**Ninyo & Moore**

# GRADATION TEST RESULTS

**Proposed Parking Facility**
**San Diego, California**

| PROJECT NO. | DATE | FIGURE |
|---|---|---|
| 104594005 | 1/03 | C-6 |

SVB213@30.xls



| Symbol | Hole No. | Depth (ft) | Liquid Limit | Plastic Limit | Plasticity Index | $D_{10}$ | $D_{30}$ | $D_{60}$ | $C_u$ | $C_c$ | Passing No. 200 (%) | U.S.C.S |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ● | B-213 | 40.0-42.0 | 30 | 15 | 15 | -- | -- | -- | -- | -- | 70 | CL |

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63

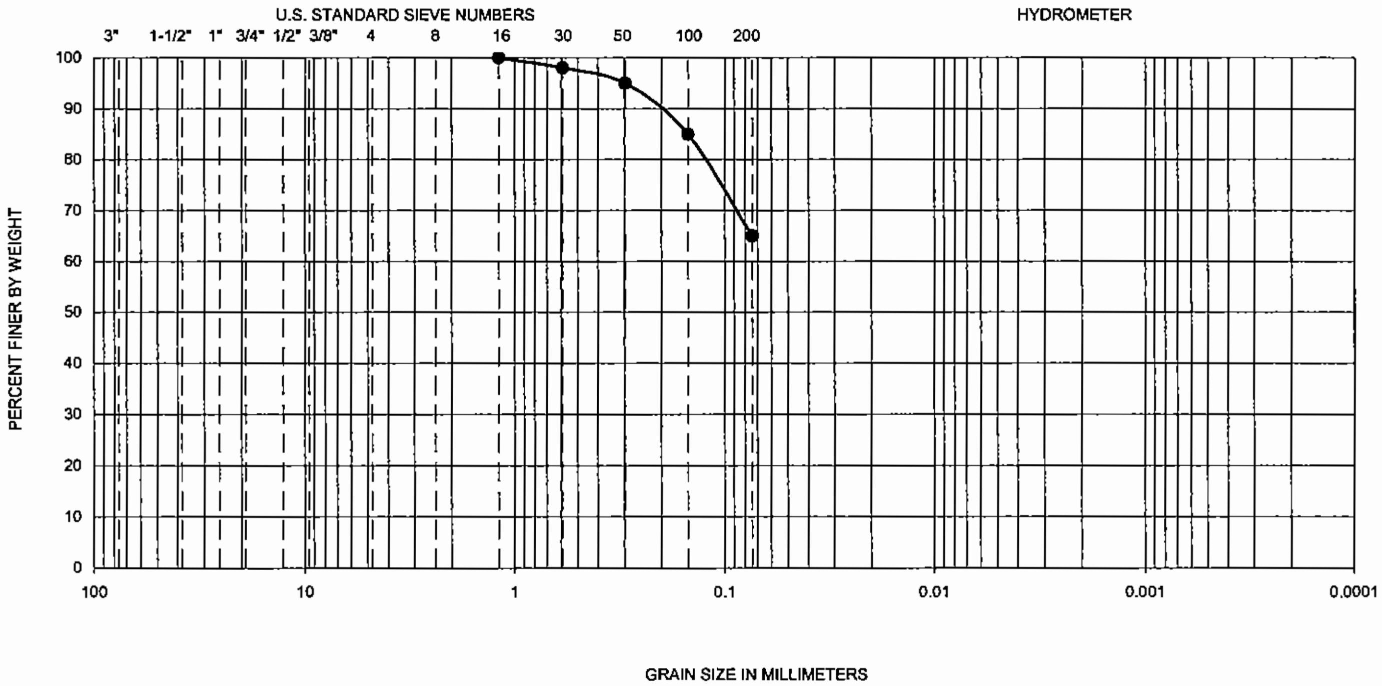
**Ninyo & Moore**

# GRADATION TEST RESULTS

**Proposed Parking Facility**
**San Diego, California**

| PROJECT NO. | DATE | FIGURE |
|---|---|---|
| 104594005 | 1/03 | C-7 |

| GRAVEL | | SAND | | | FINES | |
|---|---|---|---|---|---|---|
| Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |



| Symbol | Hole No. | Depth (ft) | Liquid Limit | Plastic Limit | Plasticity Index | $D_{10}$ | $D_{30}$ | $D_{60}$ | $C_u$ | $C_c$ | Passing No. 200 (%) | U.S.C.S |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ● | B-214 | 20.0-22.0 | -- | -- | -- | -- | -- | -- | -- | -- | 65 | CL |

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63

**Ninyo & Moore**

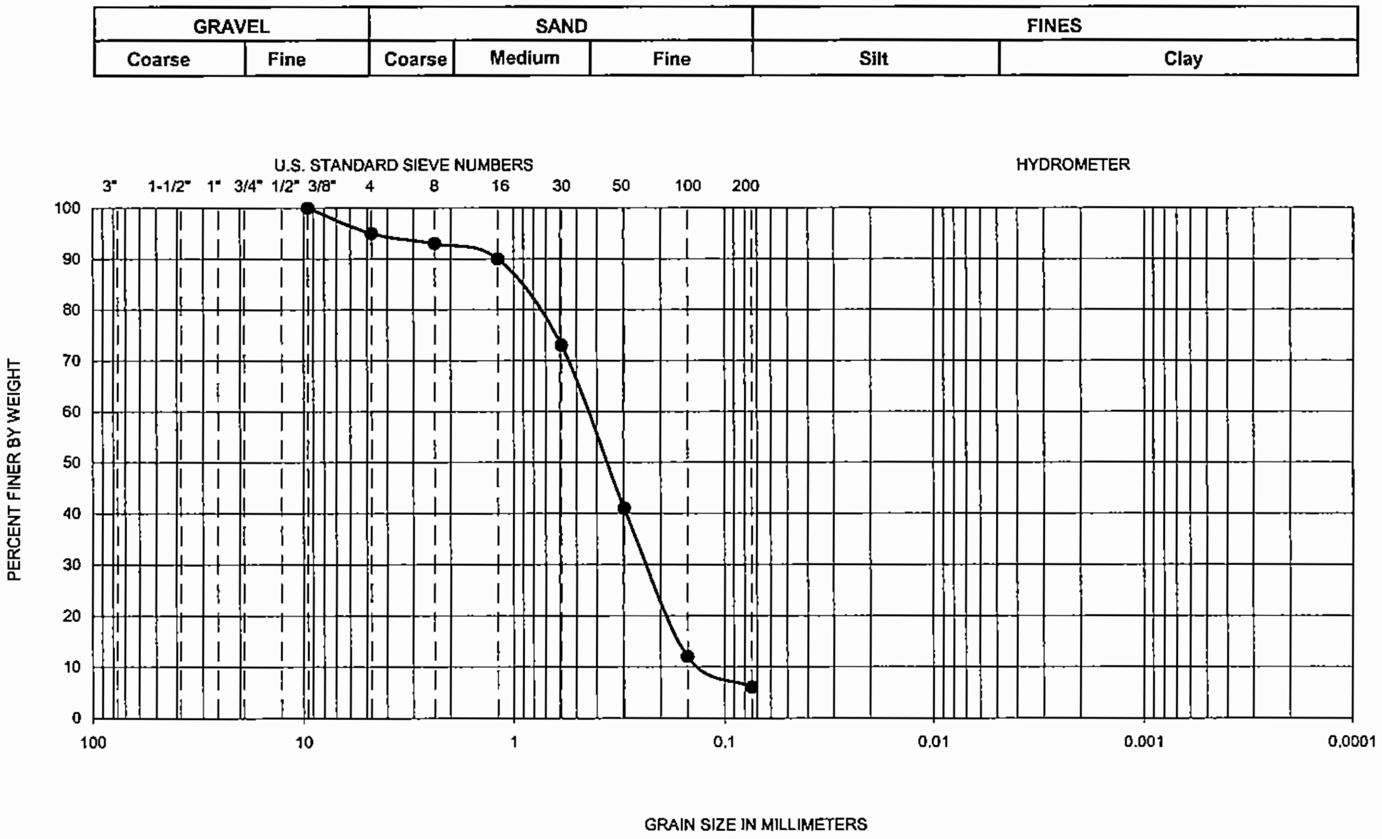
## GRADATION TEST RESULTS

**Proposed Parking Facility**
**San Diego, California**

| PROJECT NO. | DATE |
|---|---|
| 104594005 | 1/03 |

**FIGURE**
**C-8**

SVB214@20.xls



| Symbol | Hole No. | Depth (ft) | Liquid Limit | Plastic Limit | Plasticity Index | $D_{10}$ | $D_{30}$ | $D_{60}$ | $C_u$ | $C_c$ | Passing No. 200 (%) | U.S.C.S |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ● | B-214 | 30.0-32.0 | -- | -- | -- | 0.14 | 0.25 | 0.45 | 3.2 | 1.0 | 6 | SP-SM |

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63

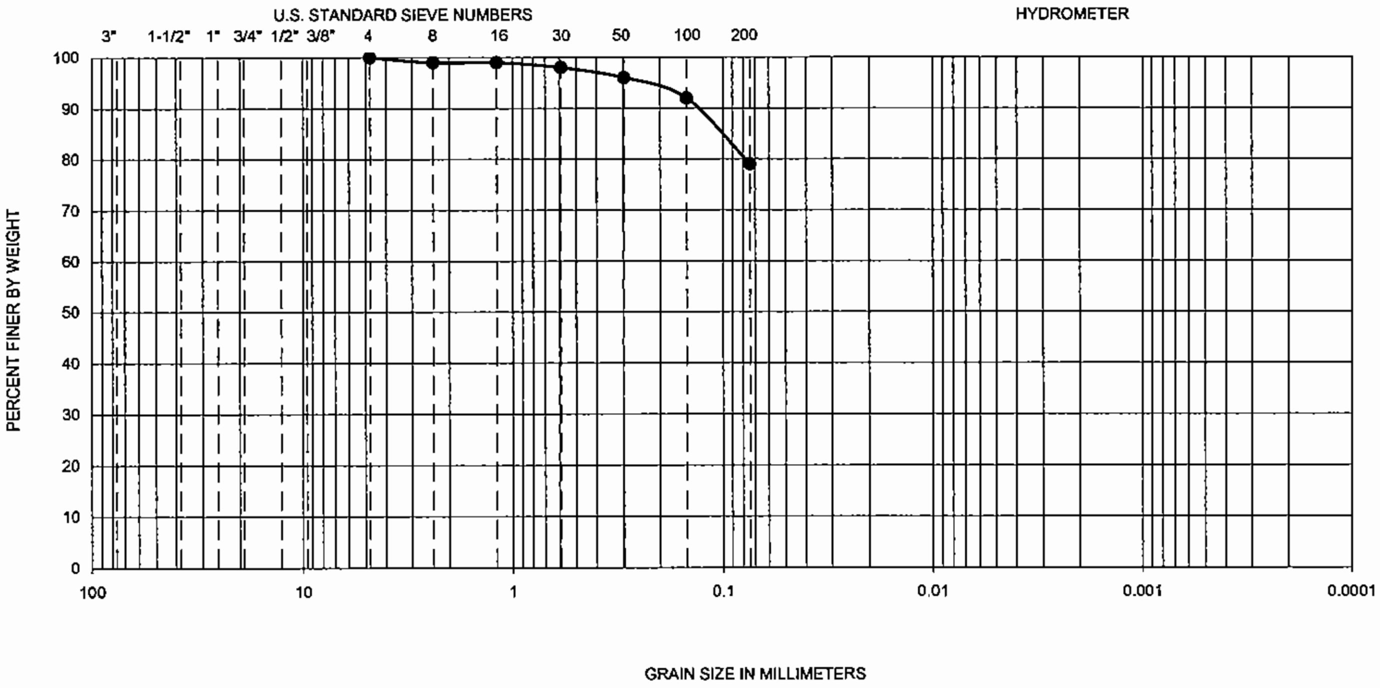
**Ninyo & Moore**

# GRADATION TEST RESULTS

**Proposed Parking Facility**
**San Diego, California**

| PROJECT NO. | DATE | FIGURE |
|---|---|---|
| 104594005 | 1/03 | C-9 |

| GRAVEL | | SAND | | | FINES | |
|---|---|---|---|---|---|---|
| Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |



| Symbol | Hole No. | Depth (ft) | Liquid Limit | Plastic Limit | Plasticity Index | $D_{10}$ | $D_{30}$ | $D_{60}$ | $C_u$ | $C_c$ | Passing No. 200 (%) | U.S.C.S |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ● | B-214 | 45.0-47.0 | 28 | 16 | 12 | – | – | – | -- | -- | 79 | CL |

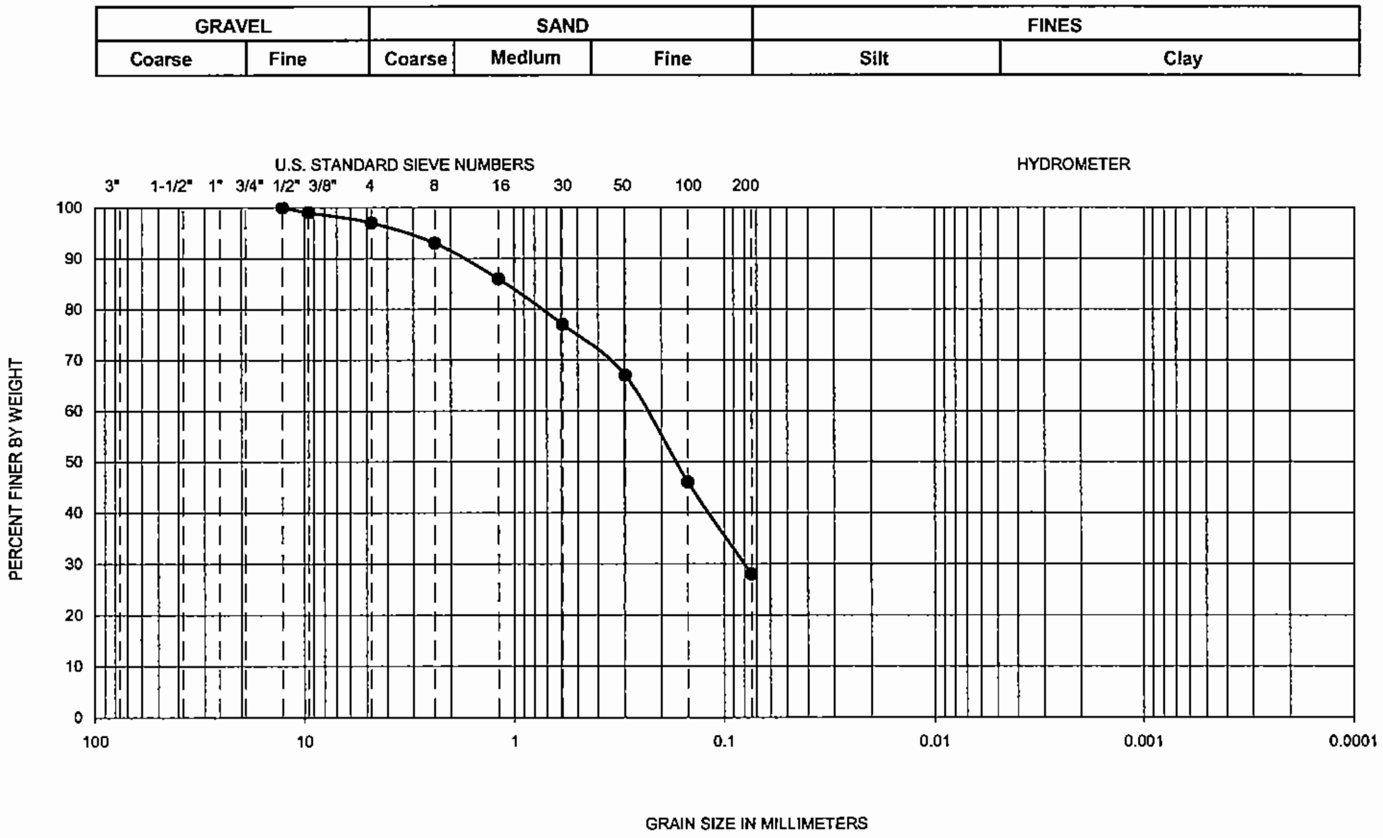
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63

**Ninyo & Moore**

## GRADATION TEST RESULTS

**Proposed Parking Facility**
**San Diego, California**

| PROJECT NO. | DATE | FIGURE |
|---|---|---|
| 104594005 | 1/03 | C-10 |



| Symbol | Hole No. | Depth (ft) | Liquid Limit | Plastic Limit | Plasticity Index | $D_{10}$ | $D_{30}$ | $D_{60}$ | $C_u$ | $C_c$ | Passing No. 200 (%) | U.S.C.S |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ● | B-214 | 65.0-67.0 | 26 | 18 | 8 | -- | -- | -- | -- | -- | 28 | SC |

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63

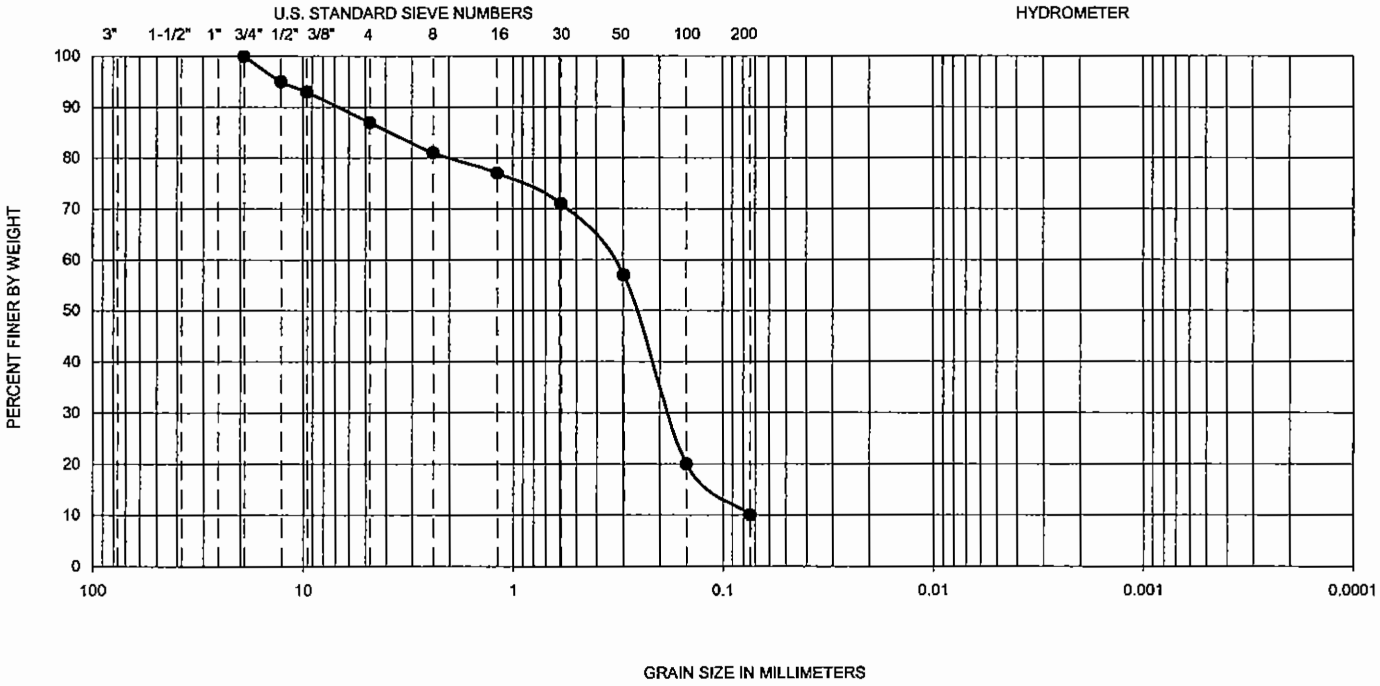
**Ninyo & Moore**

# GRADATION TEST RESULTS

**Proposed Parking Facility**
**San Diego, California**

| PROJECT NO. | DATE | FIGURE |
|---|---|---|
| 104594005 | 1/03 | C-11 |

| GRAVEL | | SAND | | | FINES | |
|---|---|---|---|---|---|---|
| Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |



| Symbol | Hole No. | Depth (ft) | Liquid Limit | Plastic Limit | Plasticity Index | $D_{10}$ | $D_{30}$ | $D_{60}$ | $C_u$ | $C_c$ | Passing No. 200 (%) | U.S.C.S |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ● | B-215 | 40.0-41.0 | -- | -- | -- | 0.08 | 0.19 | 0.33 | 4.4 | 1.5 | 10 | SP-SM |

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63

**Ninyo & Moore**

# GRADATION TEST RESULTS

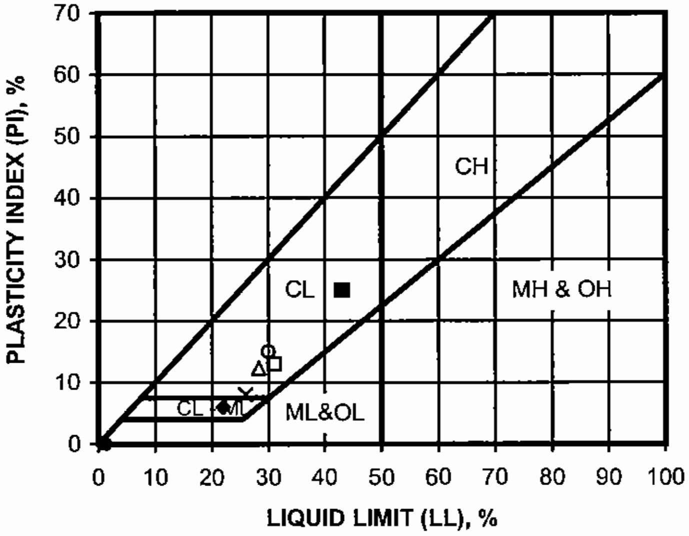
**Proposed Parking Facility**
**San Diego, California**

| PROJECT NO. | DATE | FIGURE |
|---|---|---|
| 104594005 | 1/03 | C-12 |

SVB215@40.xls

| SYMBOL | LOCATION | DEPTH (FT) | LL (%) | PL (%) | PI (%) | U.S.C.S. CLASSIFICATION (Minus No. 40 Sieve Fraction) | U.S.C.S. (Entire Sample) |
|---|---|---|---|---|---|---|---|
| ● | B-211 | 20.0-22.0 | -- | -- | -- | NP | NP |
| ■ | B-211 | 40.0-41.5 | 43 | 18 | 25 | CL | CL |
| ◆ | B-212 | 35.0-36.5 | 22 | 16 | 6 | CL-ML | SC |
| ○ | B-213 | 40.0-42.0 | 30 | 15 | 15 | CL | CL |
| □ | B-214 | 10.0-11.5 | 31 | 18 | 13 | CL | CL |
| △ | B-214 | 45.0-47.0 | 28 | 16 | 12 | CL | CL |
| X | B-214 | 65.0-67 | 26 | 18 | 8 | CL | SC |

NP - Indicates non-plastic



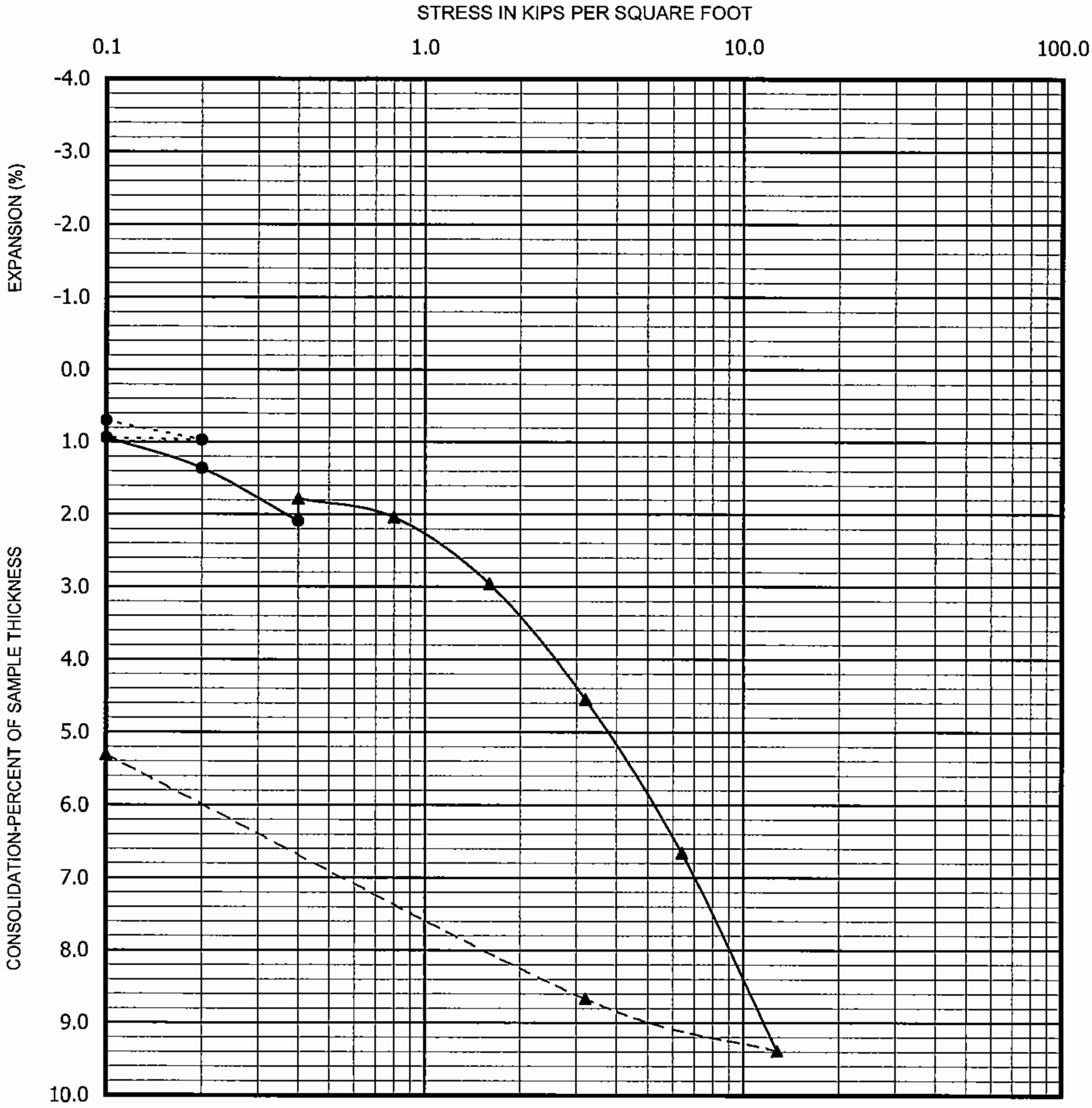
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4318-00

**Ninyo & Moore**

## ATTERBERG LIMITS TEST RESULTS

**Proposed Parking Facility**
**San Diego, California**

| PROJECT NO. | DATE | FIGURE |
|---|---|---|
| 104594005 | 1/03 | C-13 |



- - -●- - - Seating Cycle
—●— Loading Prior to Inundation
—▲— Loading After Inundation
- - -▲- - - Rebound Cycle

| | |
|---|---|
| Boring No. | B-211 |
| Depth (ft.) | 40.0-41.5 |
| Soil Type | CL |

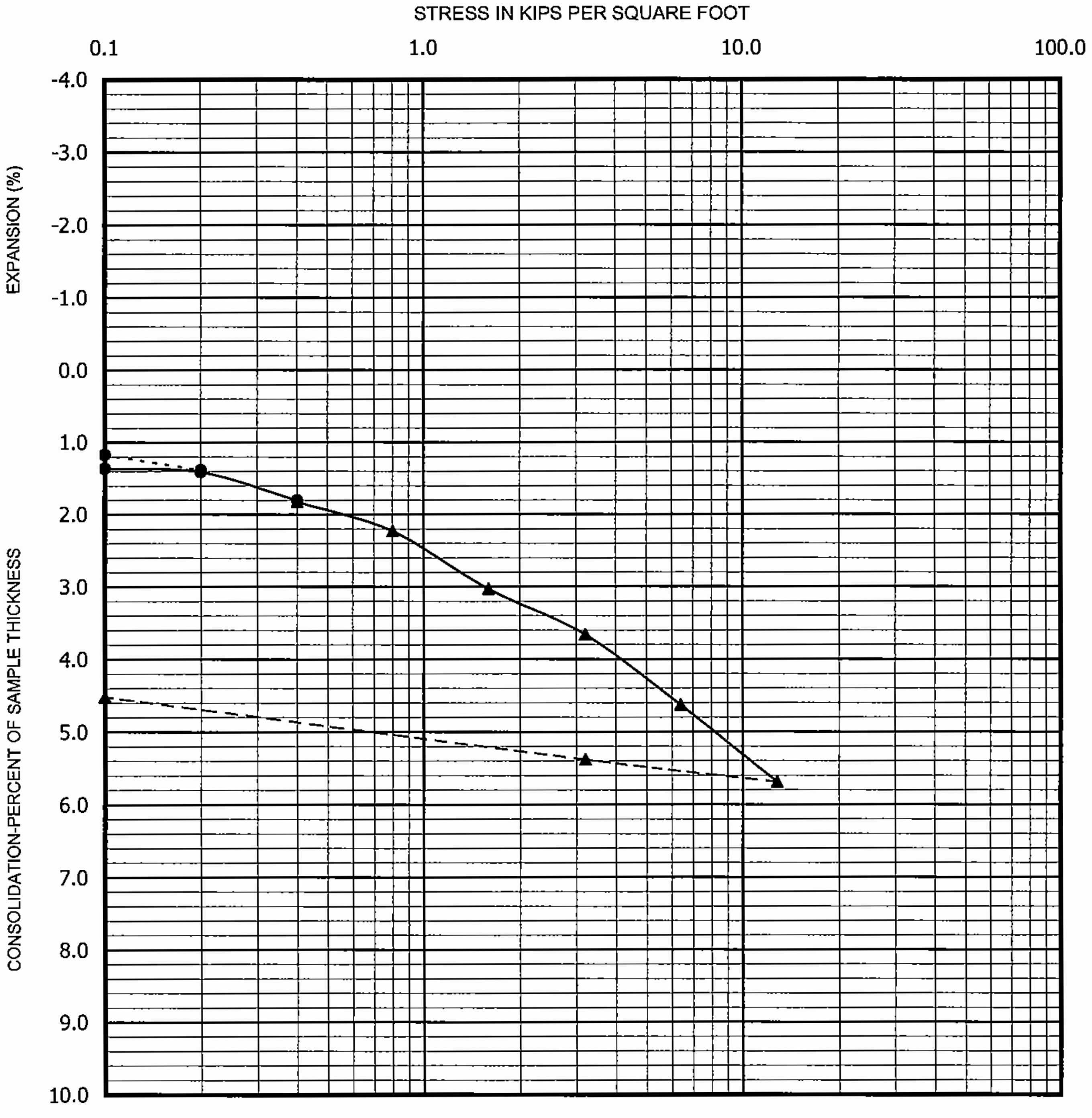
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2435-96

**Ninyo & Moore**

## CONSOLIDATION TEST RESULTS

**Proposed Parking Facility**
**San Diego, California**

| PROJECT NO. | DATE | FIGURE |
|---|---|---|
| 104594005 | 1/03 | C-14 |



Boring No. B-212
Depth (ft.) 25.0-26.5
Soil Type SM

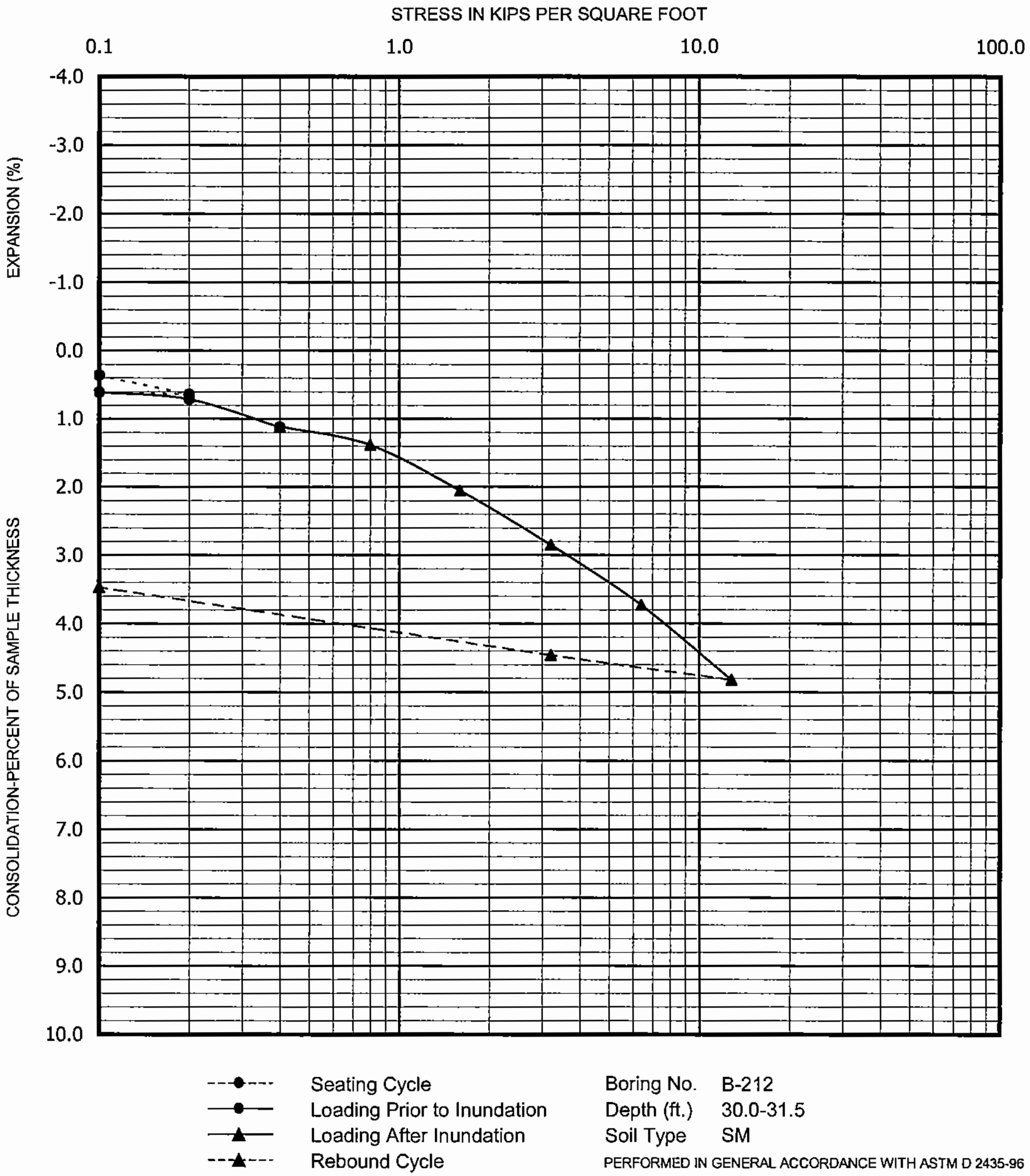
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2435-96

**Ninyo & Moore**

## CONSOLIDATION TEST RESULTS

**Proposed Parking Facility**
**San Diego, California**

| PROJECT NO. | DATE | FIGURE |
|---|---|---|
| 104594005 | 1/03 | C-15 |



Boring No. B-212
Depth (ft.) 30.0-31.5
Soil Type SM

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2435-96

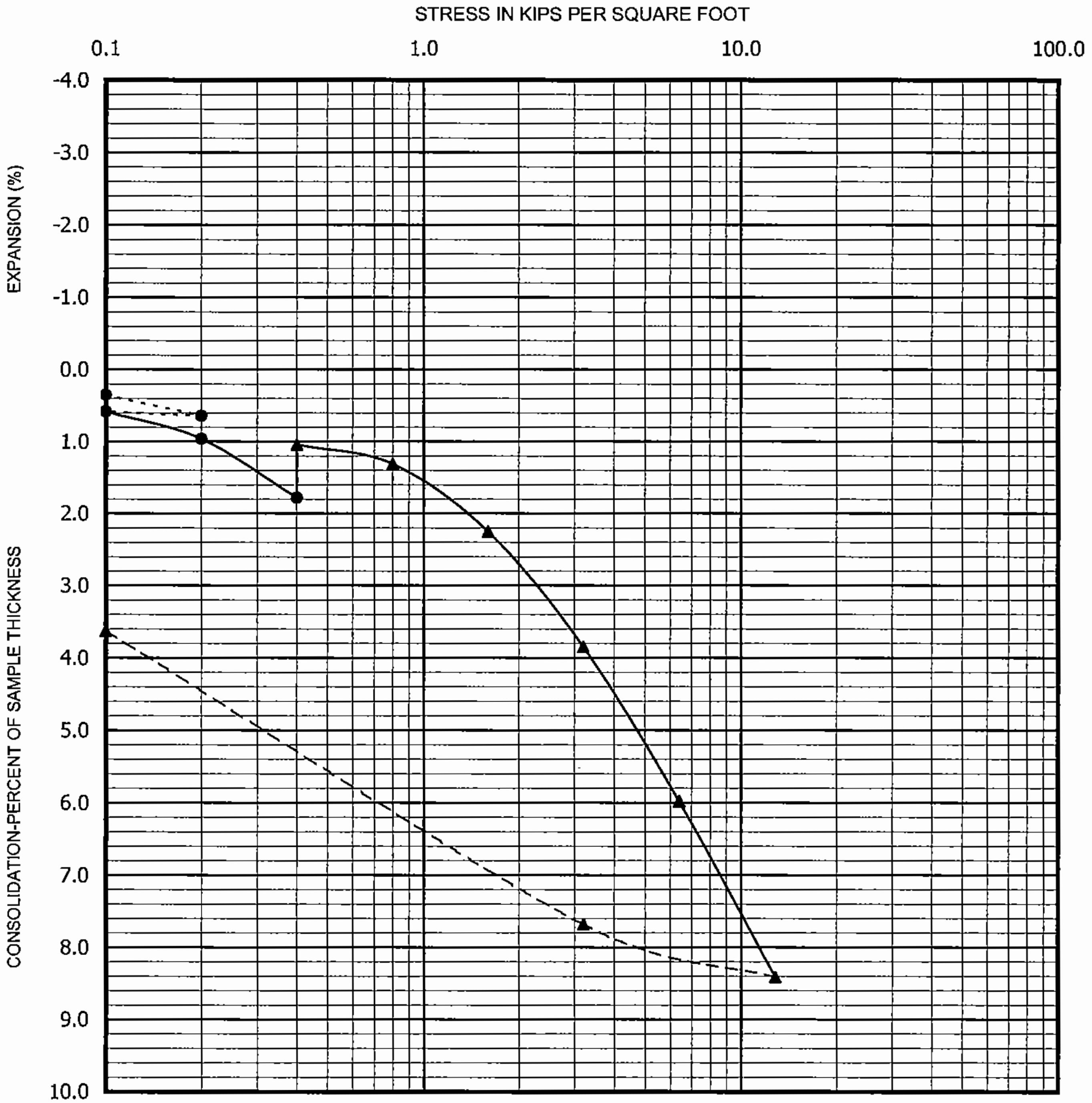
**Ninyo & Moore**

## CONSOLIDATION TEST RESULTS

**Proposed Parking Facility**
**San Diego, California**

| PROJECT NO. | DATE | FIGURE |
|---|---|---|
| 104594005 | 1/03 | C-16 |

CNB212@30.xls



| | | | |
|---|---|---|---|
| ---●--- | Seating Cycle | Boring No. | CB |
| —●— | Loading Prior to Inundation | Depth (ft.) | 15.0-16.5 |
| —▲— | Loading After Inundation | Soil Type | CL |
| ---▲--- | Rebound Cycle | | |

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2435-96

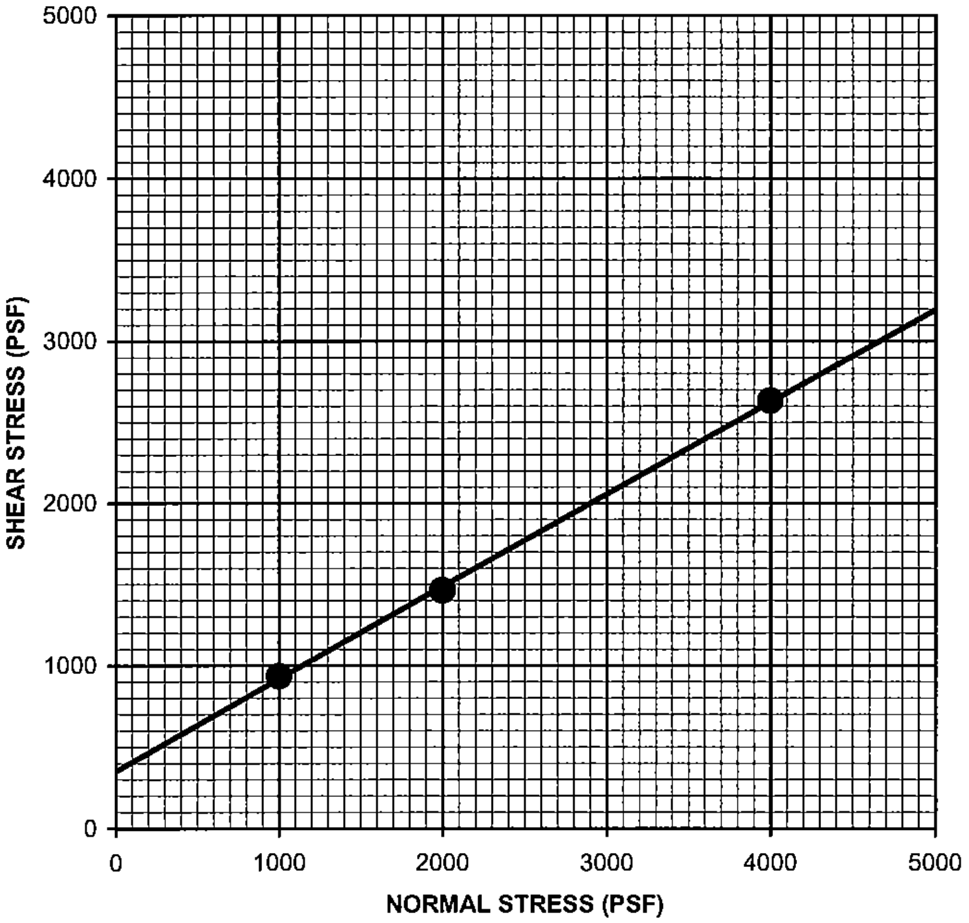
**Ninyo & Moore**

# CONSOLIDATION TEST RESULTS

**Proposed Parking Facility**
**San Diego, California**

| PROJECT NO. | DATE | FIGURE |
|---|---|---|
| 104594005 | 1/03 | C-17 |

CNB214@15.xls



| Description | Symbol | Boring Number | Depth (ft) | Shear Strength | Cohesion (psf) | Friction Angle (deg) | Soil Type |
|---|---|---|---|---|---|---|---|
| Silty Fine SAND | —●— | B-211 | 25.0-26.5 | Peak | 350 | 30 | SM |

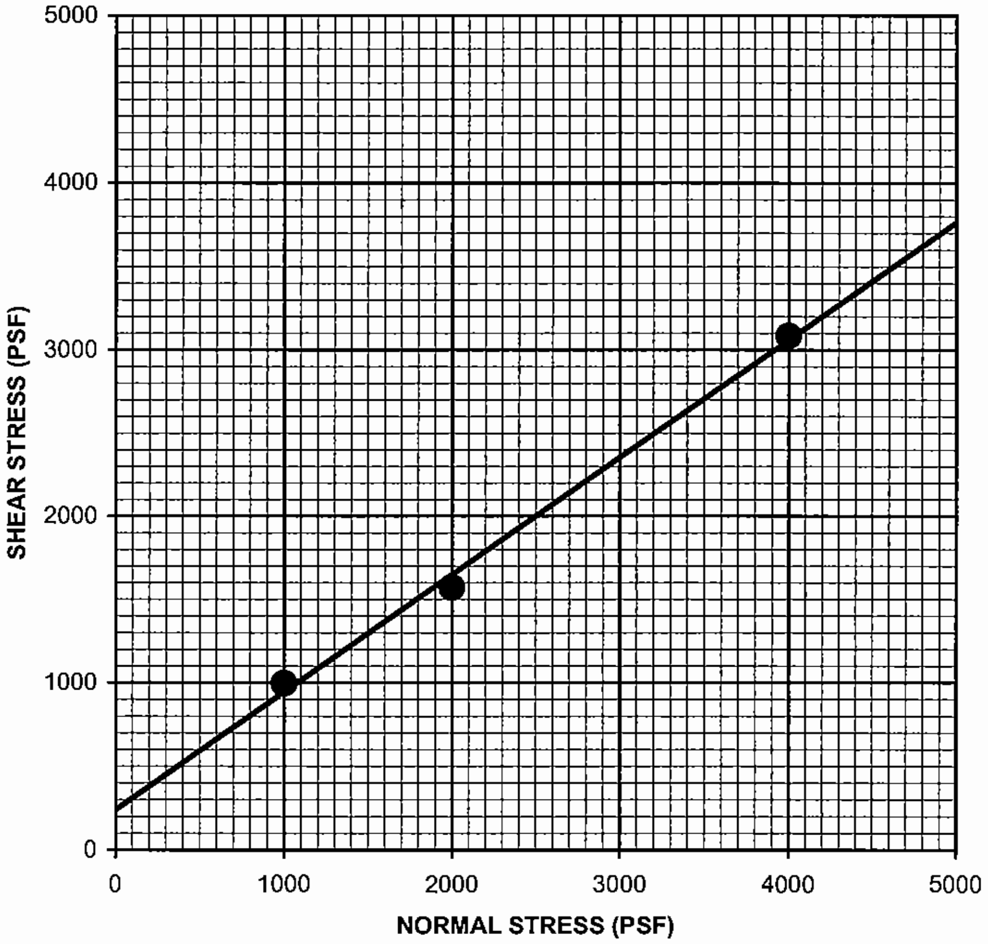
**Ninyo & Moore**

## DIRECT SHEAR TEST RESULTS

**Proposed Parking Facility**
**San Diego, California**

| PROJECT NO. | DATE |
|---|---|
| 104594005 | 1/03 |

**FIGURE**
**C-18**



| Description | Symbol | Boring Number | Depth (ft) | Shear Strength | Cohesion (psf) | Friction Angle (deg) | Soil Type |
|---|---|---|---|---|---|---|---|
| Silty SAND | —●— | B-212 | 25.0-26.5 | Peak | 240 | 35 | SM |

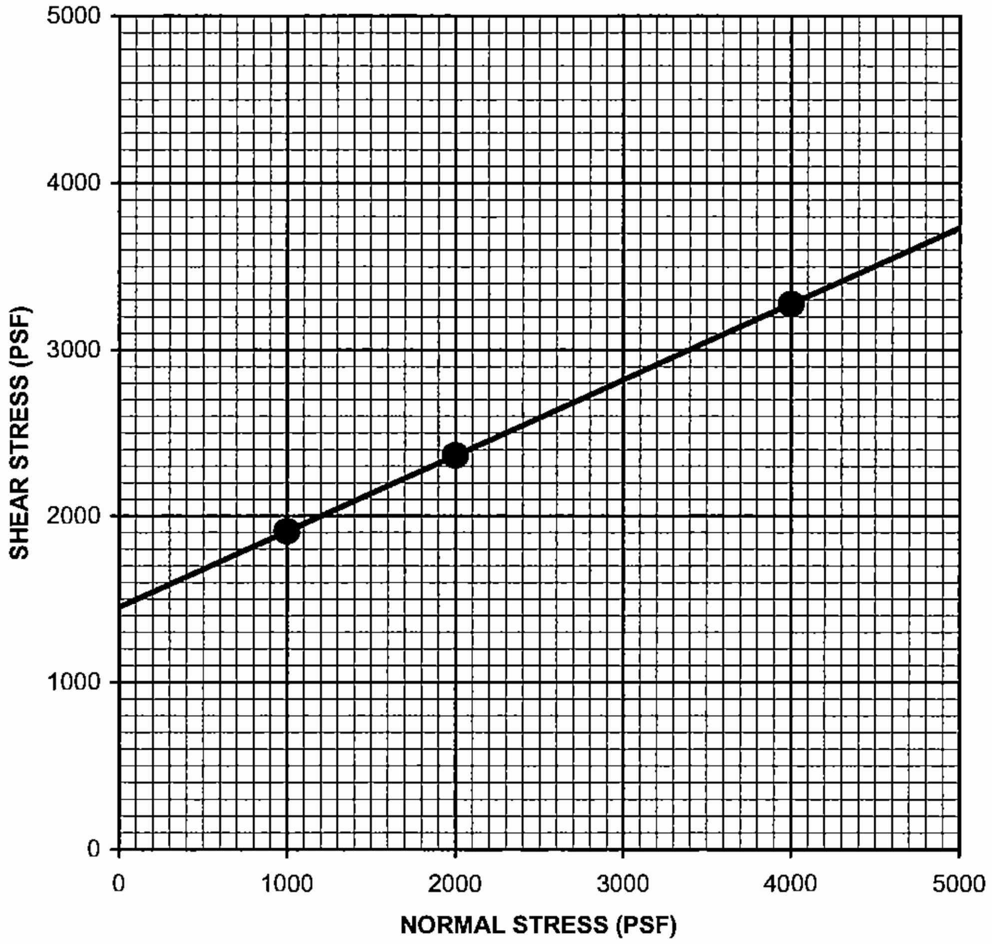
Ninyo & Moore

# DIRECT SHEAR TEST RESULTS

**Proposed Parking Facility**
**San Diego, California**

| PROJECT NO. | DATE | FIGURE |
|---|---|---|
| 104594005 | 1/03 | C-19 |

DSB212@25.xls



| Description | Symbol | Boring Number | Depth (ft) | Shear Strength | Cohesion (psf) | Friction Angle (deg) | Soil Type |
|---|---|---|---|---|---|---|---|
| Silty Fine to Medium SAND | —●— | B-214 | 25.0-26.5 | Peak | 1450 | 25 | SP-SM |

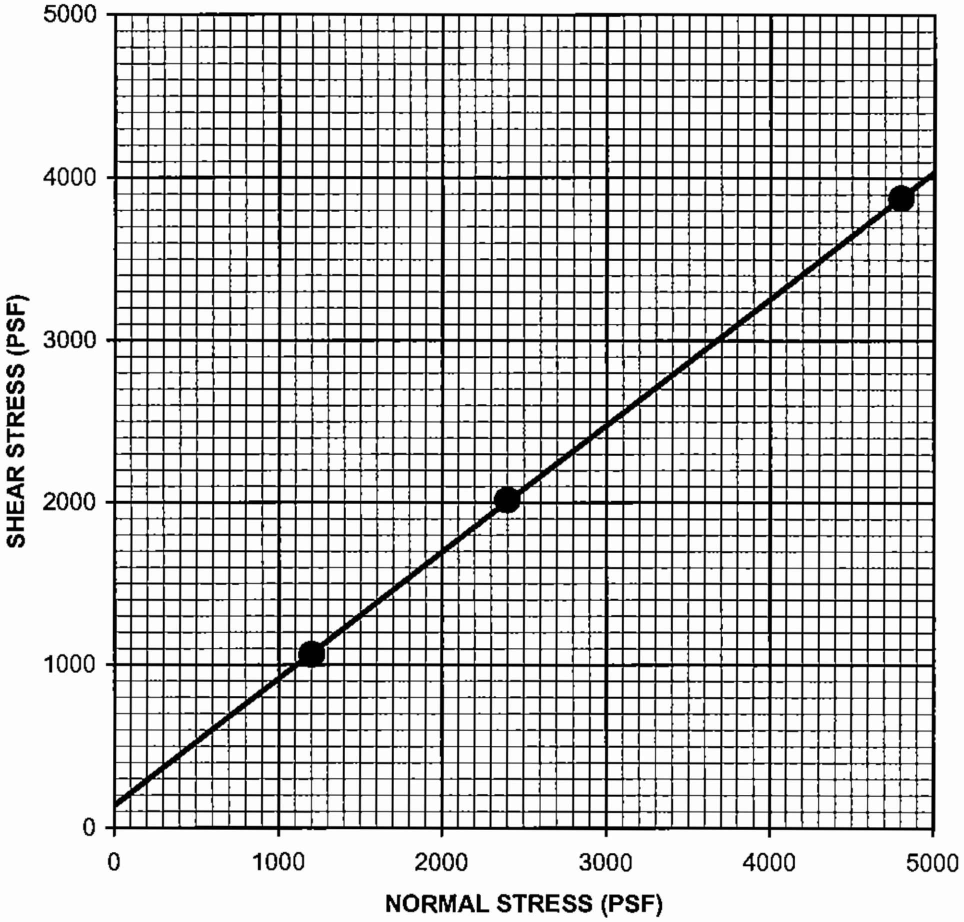
**Ninyo & Moore**

# DIRECT SHEAR TEST RESULTS

**Proposed Parking Facility**
**San Diego, California**

| PROJECT NO. | DATE | FIGURE |
|---|---|---|
| 104594005 | 1/03 | C-20 |

DSB214@25.xls



| Description | Symbol | Boring Number | Depth (ft) | Shear Strength | Cohesion (psf) | Friction Angle (deg) | Soil Type |
|---|---|---|---|---|---|---|---|
| Silty Medium to Coarse SAND | —●— | B-214 | 35-36.5 | Peak | 130 | 38 | SP-SM |

**Ninyo & Moore**

# DIRECT SHEAR TEST RESULTS

**Proposed Parking Facility**
**San Diego, California**

| PROJECT NO. | DATE | FIGURE |
|---|---|---|
| 104594005 | 1/03 | C-21 |

DSB214@35.xls

# EXPANSION INDEX TEST RESULTS

| SAMPLE LOCATION | SAMPLE DEPTH (FT) | INITIAL MOISTURE (%) | COMPACTED DRY DENSITY (PCF) | FINAL MOISTURE (%) | VOLUMETRIC SWELL (IN) | EXPANSION INDEX | EXPANSION POTENTIAL |
|---|---|---|---|---|---|---|---|
| B-212 | 2.0-5.0 | 9.7 | 109.7 | 20.8 | 0.0065 | 7 | Very Low |
| PL | Surface | 8.9 | 112.0 | 16.4 | 0.0028 | 3 | Very Low |

PERFORMED IN GENERAL ACCORDANCE WITH UBC STANDARD 18-2
PERFORMED IN GENERAL ACCORDANCE WITH D 4829-95

Ninyo & Moore

## EXPANSION INDEX TEST RESULTS

**Proposed Parking Facility**
**San Diego, California**

| PROJECT NO. | DATE | FIGURE |
|---|---|---|
| 104594005 | 1/03 | C-22 |

# CORROSIVITY TEST RESULTS

| SAMPLE LOCATION | SAMPLE DEPTH (FT) | pH * | RESISTIVITY * (ohm-cm) | WATER-SOLUBLE SULFATE CONTENT IN SOIL ** (%) | CHLORIDE CONTENT *** (ppm) |
|---|---|---|---|---|---|
| B-211 | 2.0-7.0 | 7.4 | 220 | 0.02 | 1180 |
| B-215 | 5.0-21.5 | 8.2 | 730 | 0.04 | 650 |

* PERFORMED IN GENERAL ACCORDANCE WITH CALIFORNIA TEST METHOD 643

** PERFORMED IN GENERAL ACCORDANCE WITH CALIFORNIA TEST METHOD 417

*** PERFORMED IN GENERAL ACCORDANCE WITH CALIFORNIA TEST METHOD 422

# R-VALUE TEST RESULTS

| SAMPLE LOCATION | SAMPLE DEPTH (FT) | SOIL TYPE | R-VALUE |
|---|---|---|---|
| B-212 | 2.0-5.0 | SM | 38 |
| PL | SURFACE | SM | 56 |

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2844-94

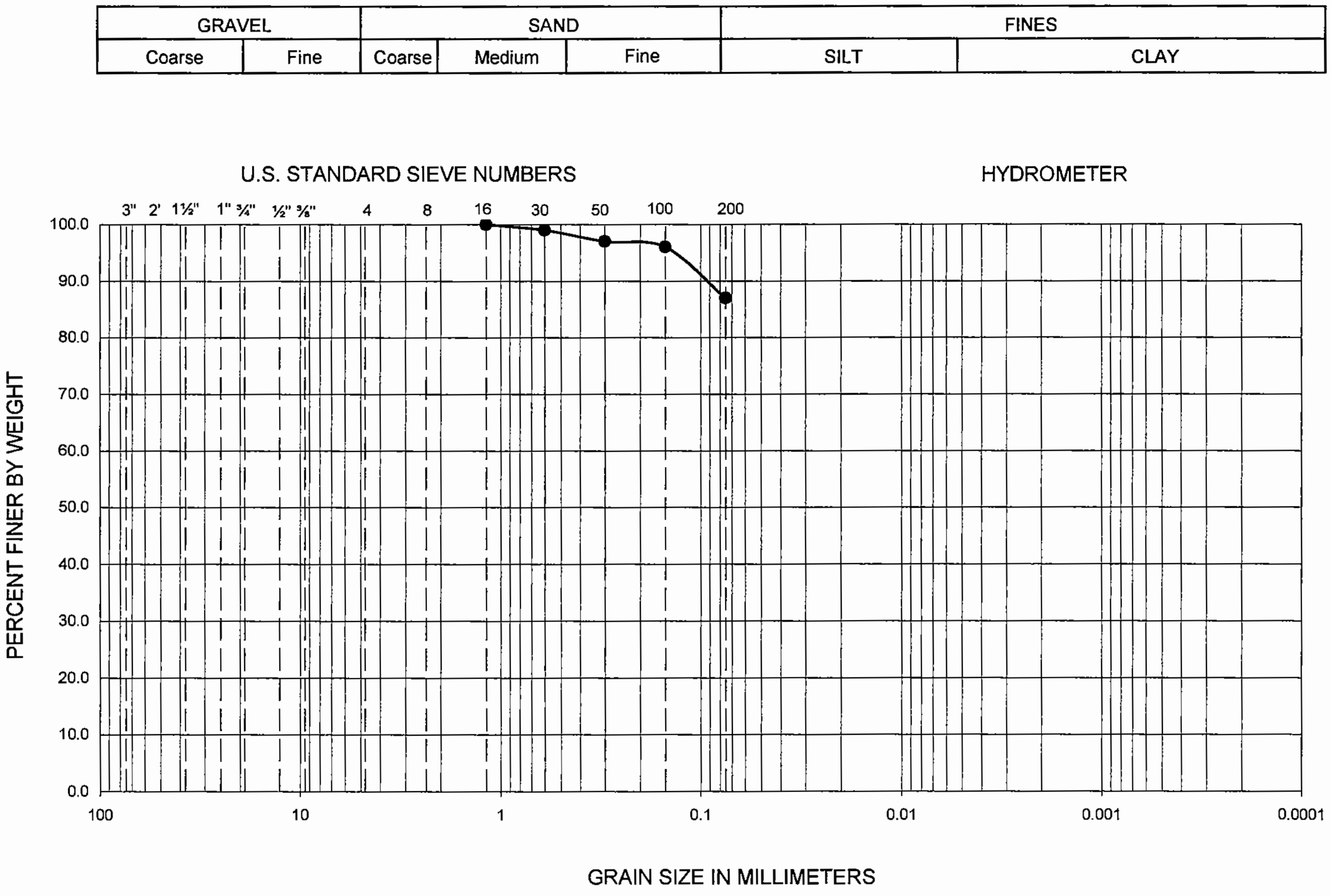
**Ninyo & Moore**

**R-VALUE TEST RESULTS**

**Proposed Parking Facility**
**San Diego California**

| PROJECT NO. | DATE | FIGURE |
|---|---|---|
| 104594005 | 1/03 | C-24 |

RVtable.xls



| Symbol | Sample Location | Depth (ft) | Liquid Limit | Plastic Limit | Plasticity Index | $D_{10}$ | $D_{30}$ | $D_{60}$ | $C_u$ | $C_c$ | Passing No. 200 (%) | USCS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ● | PB-1 | 39.5-41.0 | 38 | 20 | 18 | -- | -- | -- | -- | -- | 87 | CL |

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63 (02)

**Ninyo & Moore**

# GRADATION TEST RESULTS

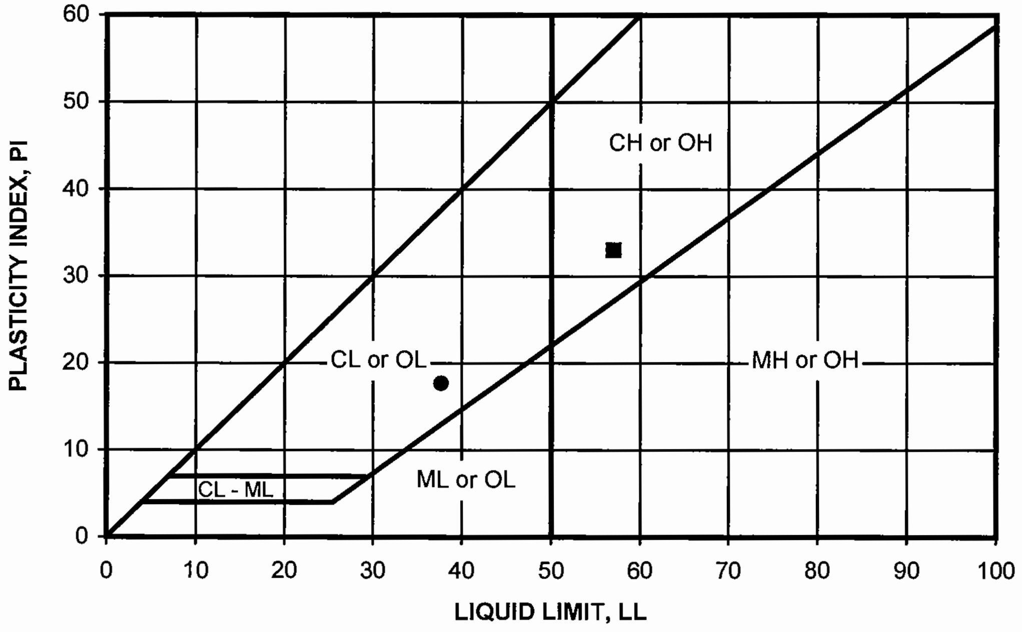
| PROJECT NO. | DATE |
|---|---|
| 105288001 | 11/07 |

HARBOR DRIVE PEDESTRIAN BRIDGE
SAN DIEGO, CALIFORNIA

FIGURE
**B-1**

| SYMBOL | LOCATION | DEPTH (FT) | LIQUID LIMIT, LL | PLASTIC LIMIT, PL | PLASTICITY INDEX, PI | USCS CLASSIFICATION (Fraction Finer Than No. 40 Sieve) | USCS (Entire Sample) |
|---|---|---|---|---|---|---|---|
| ● | PB-1 | 39.5-41.0 | 38 | 20 | 18 | CL | CL |
| ■ | PB-6 | 120-121.5 | 57 | 24 | 33 | CH | CH |

NP - INDICATES NON-PLASTIC



PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4318-05

| | | | |
|---|---|---|---|
| **Ninyo & Moore** | | **ATTERBERG LIMITS TEST RESULTS** | FIGURE |
| PROJECT NO. | DATE | HARBOR DRIVE PEDESTRIAN BRIDGE<br>SAN DIEGO, CALIFORNIA | **B-5** |
| 105288001 | 11/07 | | |

# APPENDIX C

# DRIVEN PILE ANALYSIS

# Preliminary Downward Capacities
# Square Concrete Driven Pile

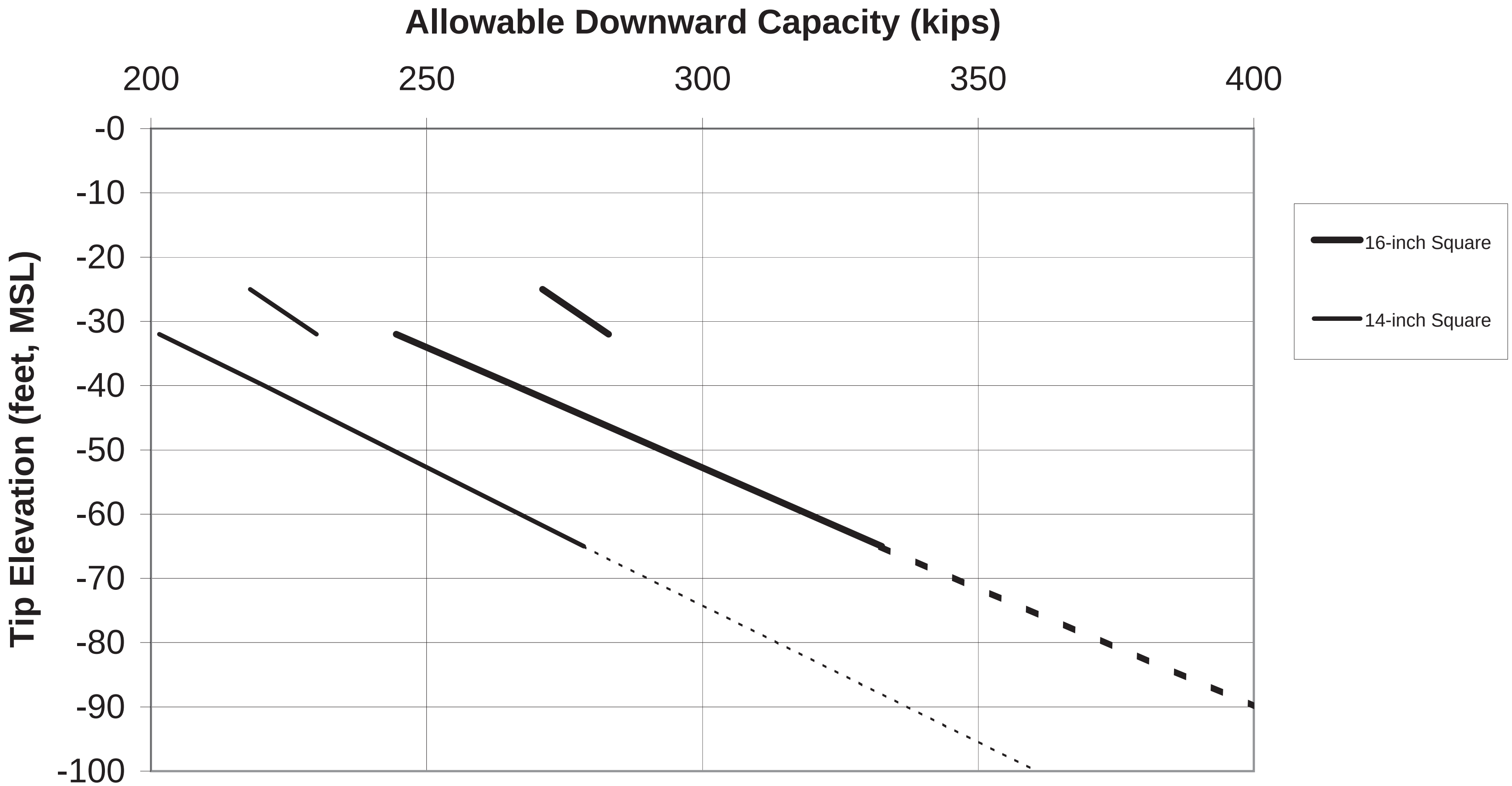


FIGURE C-1

# Appendix H
# EDR Radius Map with Geocheck Inquiry Number 4760830.2s

---

Appendix H, *EDR Radius Map with Geocheck Inquiry Number 4760830.2s*, is available for review at the San Diego Unified Port District Office of the District Clerk.

# Appendix I-1
# Stormwater Quality Management Plan

# PORT OF SAN DIEGO
# STORMWATER QUALITY MANAGEMENT PLAN
## FOR PRIORITY DEVELOPMENT PROJECT (PDP)

PROJECT NAME: 5TH AVENUE LANDING
PROJECT NUMBER:
PROJECT ADDRESS: CONVENTION WAY, SAN DIEGO, CA 92101

DATE: DECEMBER 22ND 2016

PREPARED FOR:
Fifth Avenue Landing, LLC
225 Broadway, Suite 1600
San Diego, CA 92101

REGISTERED PROFESSIONAL ENGINEER
DEBBY SUE REECE
No. C56148
EXP. 12-31-18
CIVIL
STATE OF CALIFORNIA

PREPARED BY:
C. Pack + C.Bell
Project Design Consultants
701 B St., Suite 800
San Diego, CA 92101

**TABLE OF CONTENTS**

## ACRONYM SHEET

| | |
|---|---|
| BMP | Best Management Practice |
| HMP | Hydromodification Management Plan |
| HSG | Hydrologic Soil Group |
| MS4 | Municipal Separate Storm Sewer System |
| N/A | Not Applicable |
| NRCS | Natural Resources Conservation Service |
| PDP | Priority Development Project |
| PE | Professional Engineer |
| SC | Source Control |
| SD | Site Design |
| SDRWQCB | San Diego Regional Water Quality Control Board |
| SIC | Standard Industrial Classification |
| SWQMP | Storm Water Quality Management Plan |

## PDP SWQMP PREPARER'S CERTIFICATION PAGE

**Project Name: 5th Avenue Landing**
**Permit Application Number:**

## PREPARER'S CERTIFICATION

I hereby declare that I am the Engineer in Responsible Charge of design of storm water best management practices (BMPs) for this project, and that I have exercised responsible charge over the design of the BMPs as defined in Section 6703 of the Business and Professions Code, and that the design is consistent with the PDP requirements of the Port of San Diego BMP Design Manual, which is a design manual for compliance with local Port of San Diego and regional MS4 Permit (California Regional Water Quality Control Board San Diego Region Order No. R9-2015-0100) requirements for storm water management.

I have read and understand that the Port of San Diego has adopted minimum requirements for managing urban runoff, including storm water, from land development activities, as described in the Port of San Diego BMP Design Manual. I certify that this PDP SWQMP has been completed to the best of my ability and accurately reflects the project being proposed and the applicable BMPs proposed to minimize the potentially negative impacts of this project's land development activities on water quality. I understand and acknowledge that the plan check review of this PDP SWQMP by the Port of San Diego is confined to a review and does not relieve me, as the Engineer in Responsible Charge of design of storm water BMPs for this project, of my responsibilities for project design.

_______________________________________________________
Engineer of Work's Signature, PE Number & Expiration Date

_______________________________________________________
Print Name

_______________________________________________________
Company

____________________________
Date

Engineer's Seal:

## PDP SWQMP PROJECT APPLICANT CERTIFICATION PAGE

**Project Name: 5th Avenue Landing**
**Permit Application Number:**

## PROJECT APPLICANT'S CERTIFICATION

This PDP SWQMP has been prepared for Fifth Avenue Landing, LLC by PROJECT DESIGN CONSULTANTS. The PDP SWQMP is intended to comply with the PDP requirements of the Port of San Diego BMP Design Manual, which is a design manual for compliance with local Port of San Diego and regional MS4 Permit (California Regional Water Quality Control Board San Diego Region Order No. 2013-0001, as amended by Orders No. R9-2015-0001 and No. R9-2015-0100) requirements for storm water management.

The undersigned, while it owns the subject project, is responsible for the implementation of the provisions of this plan. This includes:

- **Installation of storm water BMPs,**
- **Verification of installed BMPs pursuant to the Port of San Diego's project closeout procedures,**
- **Maintenance of BMPs annually or more frequently when necessary to maintain BMP capacity,**
- **Annual verification of BMP maintenance pursuant to the Port of San Diego's maintenance documentation/verification requirements.**

If the undersigned transfers its interests in the property, its successor-in-interest shall bear the aforementioned responsibility to implement the best management practices (BMPs) described within this plan, including ensuring on-going operation and maintenance of structural BMPs. A signed copy of this document shall be available on the subject property into perpetuity.

| | | |
|---|---|---|
| **Signature 1: Pre-Construction**<br>*Project applicant's signature is required prior to approval of the SWQMP.* | | |
| Project Applicant's Signature: | | |
| Print Project Applicant's Name: | Company Name: | Date: |

| | | |
|---|---|---|
| **Signature 2: Post-Construction**<br>*Project applicant's signature is required for project closeout.* | | |
| Project Applicant's Signature: | | |
| Print Project Applicant's Name: | Company Name: | Date: |

## CONSTRUCTION CHANGE RECORD

During construction of the project, any changes that affect the design of storm water management features must be reviewed and approved by the Port of San Diego. This might include changes to drainage patterns that occurred based on actual site grading and construction of storm water conveyance structures, or substitutions to storm water management features. The storm water management design must be revisited to ensure the revised project layout and features meet the requirements of the BMP Design Manual and the MS4 Permit.

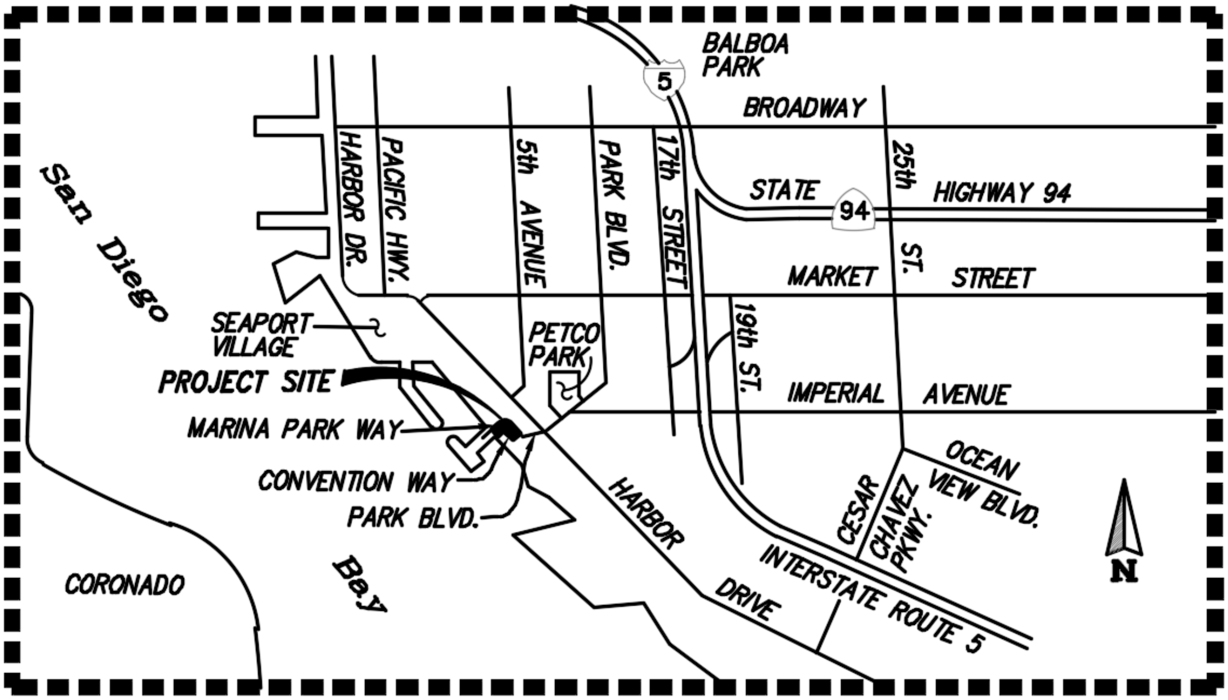
Design changes must be reviewed and approved by the Engineer of Record and the Port of San Diego prior to continuing construction.

Use this Table to keep a record of changes that occur during construction.

| **Construction Change Number** | **Date of Approval** | **Summary of Changes** |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |

## PROJECT VICINITY MAP

**Project Name: 5th Avenue Landing**
**Permit Application Number:**



**Vicinity Map Checklist**

The Vicinity Map must identify:

☒ Major roadways, geographic features or landmarks

☒ Site perimeter

☒ Geographic features

☒ General topography

☒ Downstream receiving water body

☒ Scale

☒ North arrow

| | | |
|---|---|---|
| **Applicability of Permanent, Post-Construction Storm Water BMP Requirements**<br>**(Storm Water Intake Form for all Development Permit Applications)** | | **Form I-1** |
| **Project Identification** | | |
| Project Name: 5th Avenue Landing | | |
| Permit Application Number: | | Date: 12/22/16 |
| Project Address: Convention Way, San Diego, CA 92101 | | |
| **Determination of Permanent, Post-Construction Requirements** | | |
| The purpose of this form is to identify permanent, post-construction requirements that apply to the project. This form serves as a short summary of applicable requirements, in some cases referencing separate forms that will serve as the backup for the determination of requirements.<br>Answer each step below, starting with Step 1 and progressing through each step until reaching "Stop". **Upon reaching a Stop, do not complete further Steps beyond the Stop.**<br>Refer to Port BMP Design Manual sections and/or separate forms referenced in each step below. | | |
| **Step** | **Answer** | **Progression** |
| **Step 1:** Is the project a "development project"?<br>See Section 1.3 of the BMP Design Manual for guidance. | ☒Yes | Go to Step 2. |
| | ☐ No | Stop.<br>Permanent BMP requirements do not apply. No SWQMP will be required. Provide discussion below. |
| Discussion / justification if the project is not a "development project" (e.g., the project includes *only* interior remodels within an existing building): | | |
| **Step 2:** Is the project a Standard Project, Priority Development Project (PDP), or exception to PDP definitions?<br>To answer this item, see Section 1.4 of the BMP Design Manual *in its entirety* for guidance, AND complete Form I-2, Project Type Determination. | ☐ Standard Project | Stop.<br>Only Standard Project requirements apply, including Standard Project SWQMP. |
| | ☒PDP | Standard and PDP requirements apply, including PDP SWQMP.<br>Go to Step 3. |
| | ☐ Exception to PDP definitions | Stop.<br>Standard Project requirements apply, and any additional requirements specific to the type of project. Provide discussion and list any additional requirements below. Prepare Standard Project SWQMP. |

| Form I-1 | | |
|---|---|---|
| **[Step 2 Continued from Page 1]** Discussion / justification, and additional requirements for exceptions to PDP definitions, if applicable: | | |
| **Step 3 (PDPs only).** Is the project subject to earlier PDP requirements due to a prior lawful approval?<br>See Section 1.10 of the BMP Design Manual for guidance. | ☐ Yes | Consult the Port of San Diego to determine requirements. Provide discussion and identify requirements below.<br>Go to Step 4. |
| | ☒ No | BMP Design Manual PDP requirements apply.<br>Go to Step 4. |
| Discussion / justification of prior lawful approval, and identify requirements (*not required if prior lawful approval does not apply*): | | |
| **Step 4 (PDPs only).** Do hydromodification flow control requirements apply?<br>See Section 1.6 of the BMP Design Manual for guidance. | ☐ Yes | PDP structural BMPs required for pollutant control (Chapter 5) and hydromodification flow control (Chapter 6).<br>Stop. |
| | ☒ No | Stop.<br>PDP structural BMPs required for pollutant control (Chapter 5) only.<br>Provide brief discussion of exemption to hydromodification control below. |
| Discussion / justification if hydromodification control requirements do not apply:<br>Onsite flows will discharge to an exempt water body (San Diego Bay) by either overland flow or through an existing underground storm drain system. | | |
| Note: No potential critical coarse sediment yield areas have been identified within Port of San Diego jurisdiction. Therefore when hydromodification management requirements apply, only the flow control requirements apply. | | |

| | |
|---|---|
| **Applicability of Construction Phase Storm Water Requirements**<br>**(Storm Water Intake Form for all Development Permit Applications)** | **Form I-1b** |
| **Project Identification** | |
| Project Name: 5th Avenue Landing | |
| Permit Application Number: | Date: 12/22/16 |
| Project Address: Convention Way, San Diego, CA 92101 | |

**Determination of Requirements**

The purpose of this form is to identify construction phase storm water requirements that apply to the project.

If the answer to question 1 below is “Yes”, your project is subject to the General Construction Activities Permit and will be required to submit Permit fees, a completed Notice of Intent to comply with the Permit and submit a **Storm Water Pollution Prevention Plan (SWPPP) for Projects Greater Than 1 Acre** to the Port. If the answer to question 1 below is “No”, but the answer to question 2 or 3 is “yes”, you must prepare a Port Construction BMP Plan for projects less than 1 acre. If the answer to questions 4 or 5 is “Yes” then BMPs will be required but a document submittal will not be required. If every question below is answered “No”, no additional storm water documentation is required.

| **Would the project meet any of these criteria during construction?** | | |
|---|---|---|
| 1. Will this project include clearing, grading, disturbances to ground such as stockpiling, or excavation that results in soil disturbances of at least one acre total land area? | ☒ Yes | ☐ No |
| 2. Does the project propose pavement resurfacing, grading or soil disturbance greater than 100 square feet? | ☒Yes | ☐ No |
| 3. Will the project occur over or within a receiving water? | ☒Yes | ☐ No |
| 4. Would storm water or urban runoff have the potential to contact any portion of the construction area, including washing and staging areas? | ☒Yes | ☐ No |
| 5. Would the project use any construction materials that could negatively affect water quality if discharged from the site (such as paints, solvents, concrete, and stucco)? | ☒Yes | ☐ No |

Note: The Port requires the use of Port SWPPP and Construction BMP Plan templates. The templates are available on the Port website http://www.portofsandiego.org/environment/stormwater/838-swppp-templates.html or, to request a copy, please contact Planning & Green Port at (619) 686-6254.

## Project Type Determination Checklist

**Form I-2**

**Project Information**

Project Name:5th Avenue Landing

Permit Application Number:

Date:12/22/16

Project Address: Convention Way, San Diego, CA 92101

**Project Type Determination: Standard Project or Priority Development Project (PDP)**

The project is (select one): ☐ New Development ☒ Redevelopment

The total proposed newly created or replaced impervious area is: 193,840 ft$^2$ ( 4.45 ) acres

Is the project in any of the following categories, (a) through (f)?

| | | | |
|---|---|---|---|
| Yes<br>☐ | No<br>☒ | (a) | New development projects that create 10,000 square feet or more of impervious surfaces (collectively over the entire project site). This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land. |
| Yes<br>☒ | No<br>☐ | (b) | Redevelopment projects that create and/or replace 5,000 square feet or more of impervious surface (collectively over the entire project site on an existing site of 10,000 square feet or more of impervious surfaces). This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land. |
| Yes<br>☒ | No<br>☐ | (c) | New and redevelopment projects that create and/or replace 5,000 square feet or more of impervious surface (collectively over the entire project site), and support one or more of the following uses:<br>(i) Restaurants. This category is defined as a facility that sells prepared foods and drinks for consumption, including stationary lunch counters and refreshment stands selling prepared foods and drinks for immediate consumption (Standard Industrial Classification (SIC) code 5812).<br>(ii) Hillside development projects. This category includes development on any natural slope that is twenty-five percent or greater.<br>(iii) Parking lots. This category is defined as a land area or facility for the temporary parking or storage of motor vehicles used personally, for business, or for commerce.<br>(iv) Streets, roads, highways, freeways, and driveways. This category is defined as any paved impervious surface used for the transportation of automobiles, trucks, motorcycles, and other vehicles. |

| Form I-2 | | | |
|---|---|---|---|
| Yes<br>☐ | No<br>☒ | (d) | New or redevelopment projects that create and/or replace 2,500 square feet or more of impervious surface (collectively over the entire project site), and discharging directly to an Environmentally Sensitive Area (ESA). "Discharging directly to" includes flow that is conveyed overland a distance of 200 feet or less from the project to the ESA, or conveyed in a pipe or open channel any distance as an isolated flow from the project to the ESA (i.e. not commingled with flows from adjacent lands).<br>*Note: ESAs are areas that include but are not limited to all Clean Water Act Section 303(d) impaired water bodies; areas designated as Areas of Special Biological Significance by the State Water Board and San Diego Water Board; State Water Quality Protected Areas; water bodies designated with the RARE beneficial use by the State Water Board and San Diego Water Board; and any other equivalent environmentally sensitive areas which have been identified by the Copermittees. See BMP Design Manual Section 1.4.2 for additional guidance.* |
| Yes<br>☐ | No<br>☒ | (e) | New development projects, or redevelopment projects that create and/or replace 5,000 square feet or more of impervious surface, that support one or more of the following uses:<br>(i) Automotive repair shops. This category is defined as a facility that is categorized in any one of the following SIC codes: 5013, 5014, 5541, 7532-7534, or 7536-7539.<br>(ii) Retail gasoline outlets (RGOs). This category includes RGOs that meet the following criteria: (a) 5,000 square feet or more or (b) a projected Average Daily Traffic (ADT) of 100 or more vehicles per day. |
| Yes<br>☐ | No<br>☒ | (f) | New or redevelopment projects that result in the disturbance of one or more acres of land and are expected to generate pollutants post construction.<br>*Note: See BMP Design Manual Section 1.4.2 for additional guidance.* |

Does the project meet the definition of one or more of the Priority Development Project categories (a) through (f) listed above?

☐ No – the project is not a Priority Development Project (Standard Project).

☒ Yes – the project is a Priority Development Project (PDP).

The following is for redevelopment PDPs only:

The area of existing (pre-project) impervious area at the project site is: 175,300 ft$^2$ (A)
The total proposed newly created or replaced impervious area is 193,840 ft$^2$ (B)
Percent impervious surface created or replaced (B/A)*100: 111 %
The percent impervious surface created or replaced is (select one based on the above calculation):

☐ less than or equal to fifty percent (50%) – only new impervious areas are considered PDP
OR

☒ greater than fifty percent (50%) – the entire project site is a PDP

| Site Information Checklist For PDPs | | Form I-3B (PDPs) |
|---|---|---|
| **Project Summary Information** | | |
| Project Name | 5th Avenue Landing | |
| Project Address | Convention Way, San Diego, CA 92101 | |
| Permit Application Number | | |
| Project Hydrologic Unit Select One: | Project Hydrologic Area Select One: | Project Hydrologic Subarea Select One When Applicable: |
| ☒ Pueblo San Diego 908 | ☐ 908.10 Point Loma | |
| | ☒ 908.20 San Diego Mesa | ☒ 908.21 Lindbergh |
| | | ☐ 908.22 Chollas |
| | ☐ 908.30 National City | ☐ 908.31 El Toyon |
| | | ☐ 908.32 Paradise |
| ☐ Sweetwater 909 | ☐ 909.10 Lower Sweetwater | ☐ 909.11 Telegraph |
| | | ☐ 909.12 La Nacion |
| ☐ Otay 910 | ☐ 910.10 Coronado | |
| | ☐ 910.20 Otay Valley | |
| Port Parcel Area<br>(total area of Parcel(s) associated with the project) | 5.074 Acres ( 221,023 Square Feet) | |
| Area to be Disturbed by the Project<br>(Project Area) | 5.07 Acres ( 220,849 Square Feet) | |
| Project Proposed Impervious Area<br>(subset of Project Area) | 4.45 Acres ( 193,840 Square Feet) | |
| Project Proposed Pervious Area<br>(subset of Project Area) | 0.57 Acres ( 24,630 Square Feet) | |
| Note: Proposed Impervious Area + Proposed Pervious Area = Area to be Disturbed by the Project. This may be less than the Parcel Area. | | |

| Form I-3B Page 2 of 10 |
|---|
| **Description of Existing Site Condition** |
| Current Status of the Site (select all that apply):<br>☒ Existing development<br>☐ Previously graded but not built out<br>☐ Demolition completed without new construction<br>☐ Agricultural or other non-impervious use<br>☐ Vacant, undeveloped/natural<br>Description / Additional Information:<br>Under existing conditions, the project site consists of asphalt parking lots, concrete walkways, landscaped areas, a public washroom building and a one-story building for a security staffing business. |
| Existing Land Cover Includes (select all that apply):<br>☒ Vegetative Cover<br>☒ Non-Vegetated Pervious Areas<br>☒ Impervious Areas<br>Description / Additional Information:<br>Existing landscaping is located in three distinct areas. The first existing landscaping is located in three distinct areas. The first is a plaza area near the southeast corner of the existing Convention Center, consisting of landscaped strips. The second is a series of landscape areas adjacent to and near the existing parking garage, and there is a large landscape area north and west of the existing Hilton Hotel. These landscape areas equate to approximately 26% of the site. |
| Underlying Soil belongs to Hydrologic Soil Group (select all that apply):<br>☐ NRCS Type A<br>☐ NRCS Type B<br>☐ NRCS Type C<br>☒ NRCS Type D<br>Soil type data for the project area is not available from the USDA web soil survey, however it is expected that soils in this area would be classified as Soil Type D. |

Approximate Depth to Groundwater (GW):

☐ GW Depth < 5 feet

☒ 5 feet < GW Depth < 10 feet

☒ 10 feet < GW Depth < 20 feet

☐ GW Depth > 20 feet

The groundwater depth varies from 6-8' below existing ground elevations per Terracosta's Draft Geotechnical Report for the Spinnaker Hotel dated December 6, 2004.

Existing Natural Hydrologic Features (select all that apply):

☐ Watercourses

☐ Seeps

☐ Springs

☐ Wetlands

☒ None

Description / Additional Information:

| Form I-3B Page 3 of 10 |
|---|
| **Description of Existing Site Drainage Patterns** |

How is storm water runoff conveyed from the site? At a minimum, this description should answer:
(1) whether existing drainage conveyance is natural or urban;
(2) Is runoff from offsite conveyed through the site? if yes, quantify all offsite drainage areas, design flows, and locations where offsite flows enter the project site, and summarize how such flows are conveyed through the site;
(3)Provide details regarding existing project site drainage conveyance network, including any existing storm drains, concrete channels, swales, detention facilities, storm water treatment facilities, natural or constructed channels; and
(4) Identify all discharge locations from the existing project site along with a summary of conveyance system size and capacity for each of the discharge locations. Provide summary of the pre-project drainage areas and design flows to each of the existing runoff discharge locations.

Describe existing site drainage patterns:

1) The existing drainage conveyance is urban.
2) Under existing conditions, a small portion of run-on from the Hilton Hotel's grassy landscaped area drains west towards the project property. The offsite run-on commingles with onsite flows and either drains into three grate area drains or sheet flows directly into the San Diego Bay.
3) There are three existing storm drains on site and a series of area drains within the project footprint. One storm drain line (one 15-inch reinforced concrete pipe (RCP)) discharges onsite flows into the San Diego Bay, while the rest of the onsite runoff is drained towards the Bay via overland flow.
4) The majority of onsite runoff sheetflows directly into the San Diego Bay (System 700). A small portion of onsite runoff from the south parking lot (Parcel 1) drains southwesterly towards a cross gutter on Marina Park Way. These onsite flows commingle with upstream offsite flows (from Convention Way and Marina Park Way) before draining into a storm drain inlet. This runoff is then conveyed through an existing 15-inch RCP storm drain before discharging directly into the San Diego Bay (System 200). Refer to the Existing Condition Drainage Map in the Drainage Report (prepared by Project Design Consultants under a separate cover, dated December 2016).

| Form I-3B Page 4 of 10 |
|---|
| **Description of Proposed Site Development** |
| Project Description / Proposed Land Use and/or Activities:<br>The project will entail the construction of two hotels. The project will also include a public plaza on top of a proposed on-grade parking structure. |
| List/describe proposed impervious features of the project (e.g., buildings, roadways, parking lots, courtyards, athletic courts, other impervious features):<br>The impervious features will include buildings, hardscaped plaza, and astro-turf landscaping on the event space on the deck of the parking structure. |
| List/describe proposed pervious features of the project (e.g., landscape areas):<br>The project will feature landscaped areas, both on the podium and at ground-level. |
| Does the project include grading and changes to site topography?<br>☒ Yes<br>☐ No<br>Description / Additional Information: |

| Form I-3B Page 5 of 10 |
|---|
| **Description of Proposed Site Drainage Patterns** |
| |
| Does the project include changes to site drainage (e.g., installation of new storm water conveyance systems)?<br>☒ Yes<br>☐ No<br>If yes, provide details regarding the proposed project site drainage conveyance network, including storm drains, concrete channels, swales, detention facilities, storm water treatment facilities, natural or constructed channels, and the method for conveying offsite flows through or around the proposed project site. Identify all discharge locations from the proposed project site along with a summary of the conveyance system size and capacity for each of the discharge locations. Provide a summary of pre- and post-project drainage areas and design flows to each of the runoff discharge locations. Reference the drainage study for detailed calculations.<br>Describe proposed site drainage patterns:<br>For the proposed conditions drainage will remain generally the same as existing conditions, with two major changes. The outfall for System 200 will be demolished during the construction of the hotel and these drainage areas will be absorbed into System 100. The proposed hotel will be broken up into segments for treatment purposes with these pieces then routed into the respective systems after treatment as depicted in the DMA exhibit and further demonstrate by the drainage exhibit in the Drainage Report prepared by Project Design Consultants. |

**Form I-3B Page 6 of 10**

Identify whether any of the following features, activities, and/or pollutant source areas will be present (select all that apply):

☒ On-site storm drain inlets

☒ Interior floor drains and elevator shaft sump pumps

☐ Interior parking garages

☒ Need for future indoor & structural pest control

☒ Landscape/Outdoor Pesticide Use

☐ Pools, spas, ponds, decorative fountains, and other water features

☒ Food service

☒ Refuse areas

☐ Industrial processes
☐ Outdoor storage of equipment or materials
☐ Vehicle and Equipment Cleaning
☐ Vehicle/Equipment Repair and Maintenance
☐ Fuel Dispensing Areas
☐ Loading Docks
☐ Fire Sprinkler Test Water
☐ Miscellaneous Drain or Wash Water

☒ Plazas, sidewalks, and parking lots

Description / Additional Information:

## Form I-3B Page 7 of 10

### Identification and Narrative of Receiving Water and Pollutants of Concern

Describe flow path of storm water from the project site discharge location(s), through urban storm conveyance systems as applicable, to receiving creeks, rivers, and lagoons as applicable, and ultimate discharge to the Pacific Ocean (or bay, lagoon, lake or reservoir, as applicable):
General trend of surface flows is toward the San Diego Bay. Runoff drains into the Bay via overland flow or through storm drain conveyance after runoff is captured by an inlet.

List any 303(d) impaired water bodies within the path of storm water from the project site to the Pacific Ocean (or bay, lagoon, lake or reservoir, as applicable), identify the pollutant(s)/stressor(s) causing impairment, and identify any TMDLs and/or Highest Priority Pollutants from the WQIP for the impaired water bodies:

| 303(d) Impaired Water Body | Pollutant(s)/Stressor(s) | TMDLs / WQIP Highest Priority Pollutant |
|---|---|---|
| San Diego Bay | Organics | Organic Compounds (PCBs) |
| Switzer Creek (mouth) | Organics and pesticides | Organic Compounds (PAHs, PCBs), pesticides (Chlordane, Lindane) |
| San Diego Bay Shoreline – Marriot Marina | Metals (Copper) | Copper |
| San Diego Bay Shoreline – Switzer Creek | Pesticides and Organic Compounds | PCBs., PAHs, Chlordane, sediment toxicity |

### Identification of Project Site Pollutants*

***Identification of project site pollutants is only required if flow-thru treatment BMPs are implemented onsite in lieu of retention or biofiltration BMPs (note the project must also participate in an alternative compliance program unless prior lawful approval to meet earlier PDP requirements is demonstrated)**

Identify pollutants expected from the project site based on all proposed use(s) of the site (see BMP Design Manual Appendix B.6):

| Pollutant | Not Applicable to the Project Site | Expected from the Project Site | Also a Receiving Water Pollutant of Concern |
|---|---|---|---|
| Sediment | | X | |
| Nutrients | | X | |
| Heavy Metals | | X | X |
| Organic Compounds | | X | X |
| Trash & Debris | | X | |
| Oxygen Demanding Substances | | X | |
| Oil & Grease | | X | |
| Bacteria & Viruses | | X | |
| Pesticides | | X | X |

| Form I-3B Page 8 of 10 |
|---|
| **Hydromodification Management Requirements** |
| Do hydromodification management requirements apply (see Section 1.6 of the BMP Design Manual)?<br>☐ Yes, hydromodification management flow control structural BMPs required.<br>☒ No, the project will discharge runoff directly to existing underground storm drains discharging directly to water storage reservoirs, lakes, enclosed embayments, or the Pacific Ocean.<br>☐ No, the project will discharge runoff directly to conveyance channels whose bed and bank are concrete-lined all the way from the point of discharge to water storage reservoirs, lakes, enclosed embayments, or the Pacific Ocean.<br>☐ No, the project will discharge runoff directly to an area identified as appropriate for an exemption by the WMAA for the watershed in which the project resides.<br>Note: No potential critical coarse sediment yield areas have been identified within Port of San Diego jurisdiction. Therefore when hydromodification management requirements apply, only the flow control requirements apply.<br>Description / Additional Information (to be provided if a 'No' answer has been selected above):<br>Project discharges directly to San Diego Bay. The DMA exhibit depicts the outfall stormdrains connecting to the San Diego Bay. |

| Form I-3B Page 9 of 10 |
|---|
| **Flow Control for Post-Project Runoff***<br>***This Section only required if hydromodification management requirements apply** |
| List and describe point(s) of compliance (POCs) for flow control for hydromodification management (see Section 6.3.1). For each POC, provide a POC identification name or number correlating to the project's HMP Exhibit and a receiving channel identification name or number correlating to the project's HMP Exhibit. |
| Has a geomorphic assessment been performed for the receiving channel(s)?<br>☐ No, the low flow threshold is 0.1Q2 (default low flow threshold)<br>☐ Yes, the result is the low flow threshold is 0.1Q2<br>☐ Yes, the result is the low flow threshold is 0.3Q2<br>☐ Yes, the result is the low flow threshold is 0.5Q2<br><br>If a geomorphic assessment has been performed, provide title, date, and preparer:<br><br>Discussion / Additional Information: (optional) |

| Form I-3B Page 10 of 10 |
|---|
| **Other Site Requirements and Constraints** |
| When applicable, list other site requirements or constraints that will influence storm water management design, such as zoning requirements including setbacks and open space, or local codes governing minimum street width, sidewalk construction, allowable pavement types, and drainage requirements. |
| **Optional Additional Information or Continuation of Previous Sections As Needed** |
| This space provided for additional information or continuation of information from previous sections as needed. |

| | |
|---|---|
| **Source Control BMP Checklist for All Development Projects (Standard Projects and Priority Development Projects)** | **Form I-4** |

| | | | |
|---|---|---|---|
| **Project Identification** | | | |
| Project Name: 5th Avenue Landing | | | |
| Permit Application Number | | | |
| **Source Control BMPs** | | | |
| All development projects must implement source control BMPs SC-1 through SC-6 where applicable and feasible. See Chapter 4 and Appendix E of the BMP Design Manual for information to implement source control BMPs shown in this checklist.<br>Answer each category below pursuant to the following.<br>• "Yes" means the project will implement the source control BMP as described in Chapter 4 and/or Appendix E of the BMP Design Manual. Discussion / justification is not required.<br>• "No" means the BMP is applicable to the project but it is not feasible to implement. Discussion / justification must be provided.<br>• "N/A" means the BMP is not applicable at the project site because the project does not include the feature that is addressed by the BMP (e.g., the project has no outdoor materials storage areas). Discussion / justification may be provided. | | | |
| **Source Control Requirement** | **Applied?** | | |
| **SC-1** Prevention of Illicit Discharges into the MS4 | ☒ Yes | ☐ No | ☐ N/A |
| Discussion / justification if SC-1 not implemented: | | | |
| **SC-2** Storm Drain Stenciling or Signage | ☒ Yes | ☐ No | ☐ N/A |
| Discussion / justification if SC-2 not implemented: | | | |
| **SC-3** Protect Outdoor Materials Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal | ☒ Yes | ☐ No | ☐ N/A |
| Discussion / justification if SC-3 not implemented: | | | |
| **SC-4** Protect Materials Stored in Outdoor Work Areas from Rainfall, Run-On, Runoff, and Wind Dispersal | ☐ Yes | ☐ No | ☒ N/A |
| Discussion / justification if SC-4 not implemented: | | | |

| Form I-4 Page 2 of 2 | | | |
|---|---|---|---|
| **Source Control Requirement** | **Applied?** | | |
| **SC-5** Protect Trash Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal | ☒ Yes | ☐ No | ☐ N/A |
| Discussion / justification if SC-5 not implemented: | | | |
| **SC-6** Additional BMPs Based on Potential Sources of Runoff Pollutants (must answer for each source listed below) | | | |
| ☒ On-site storm drain inlets | ☒ Yes | ☐ No | ☐ N/A |
| ☒ Interior floor drains and elevator shaft sump pumps | ☒ Yes | ☐ No | ☐ N/A |
| ☐ Interior parking garages | ☐ Yes | ☐ No | ☒ N/A |
| ☒ Need for future indoor & structural pest control | ☒ Yes | ☐ No | ☐ N/A |
| ☒ Landscape/Outdoor Pesticide Use | ☒ Yes | ☐ No | ☐ N/A |
| ☐ Pools, spas, ponds, decorative fountains, and other water features | ☐ Yes | ☐ No | ☒ N/A |
| ☒ Food service | ☒ Yes | ☐ No | ☐ N/A |
| ☒ Refuse areas | ☒ Yes | ☐ No | ☐ N/A |
| ☐ Industrial processes | ☐ Yes | ☐ No | ☒ N/A |
| ☒ Outdoor storage of equipment or materials | ☒ Yes | ☐ No | ☐ N/A |
| ☐ Vehicle and Equipment Cleaning | ☐ Yes | ☐ No | ☒ N/A |
| ☐ Vehicle/Equipment Repair and Maintenance | ☐ Yes | ☐ No | ☒ N/A |
| ☐ Fuel Dispensing Areas | ☐ Yes | ☐ No | ☒ N/A |
| ☐ Loading Docks | ☐ Yes | ☐ No | ☒ N/A |
| ☒ Fire Sprinkler Test Water | ☒ Yes | ☐ No | ☐ N/A |
| ☐Miscellaneous Drain or Wash Water | ☐ Yes | ☐ No | ☒ N/A |
| ☒ Plazas, sidewalks, and parking lots | ☒ Yes | ☐ No | ☐ N/A |
| Discussion / justification if SC-6 not implemented. Clearly identify which sources of runoff pollutants are discussed. Justification must be provided for <u>all</u> "No" answers shown above. | | | |

| | |
|---|---|
| **Site Design BMP Checklist<br>for All Development Projects<br>(Standard Projects and Priority Development Projects)** | **Form I-5** |
| **Project Identification** | |
| Project Name: 5th Avenue Landing | |
| Permit Application Number | |
| **Site Design BMPs** | |

All development projects must implement site design BMPs SD-1 through SD-8 where applicable and feasible. See Chapter 4 and Appendix E of the BMP Design Manual for information to implement site design BMPs shown in this checklist.

Answer each category below pursuant to the following.

- "Yes" means the project will implement the site design BMP as described in Chapter 4 and/or Appendix E of the BMP Design Manual. Discussion / justification is not required.
- "No" means the BMP is applicable to the project but it is not feasible to implement. Discussion / justification must be provided.
- "N/A" means the BMP is not applicable at the project site because the project does not include the feature that is addressed by the BMP (e.g., the project site has no existing natural areas to conserve). Discussion / justification may be provided.

| **Site Design Requirement** | **Applied?** | | |
|---|---|---|---|
| **SD-1** Maintain Natural Drainage Pathways and Hydrologic Features | ☐ Yes | ☐ No | ☒ N/A |
| Discussion / justification if SD-1 not implemented:<br>No existing natural drainage pathways to conserve. | | | |
| **SD-2** Conserve Natural Areas, Soils, and Vegetation | ☐ Yes | ☐ No | ☒ N/A |
| Discussion / justification if SD-2 not implemented:<br>No existing natural areas to conserve. | | | |
| **SD-3** Minimize Impervious Area | ☒ Yes | ☐ No | ☐ N/A |
| Discussion / justification if SD-3 not implemented:<br>Site will include significant landscaped areas. | | | |
| **SD-4** Minimize Soil Compaction | ☐ Yes | ☐ No | ☒ N/A |
| Discussion / justification if SD-4 not implemented:<br>Site is ultra-urban and adjacent to the San Diego Bay therefore site must be properly compacted. | | | |
| **SD-5** Impervious Area Dispersion | ☒ Yes | ☐ No | ☐ N/A |

|  |
|---|
| Discussion / justification if SD-5 not implemented: |

| Form I-5 Page 2 of 2 | | | |
|---|---|---|---|
| **Site Design Requirement** | **Applied?** | | |
| **SD-6** Runoff Collection | ☒ Yes | ☐ No | ☐ N/A |
| Discussion / justification if SD-6 not implemented:<br>Treatment BMPs and landscaping are dispersed throughout the site to minimize overland travel time. | | | |
| **SD-7** Landscaping with Native or Drought Tolerant Species | ☒ Yes | ☐ No | ☐ N/A |
| Discussion / justification if SD-7 not implemented: | | | |
| **SD-8** Harvesting and Using Precipitation | ☐ Yes | ☒ No | ☐ N/A |
| Discussion / justification if SD-8 not implemented:<br>Based on harvest and reuse feasibility study calculations, harvest and use of precipitation is not feasible. | | | |

| **Summary of PDP Structural BMPs** | **Form I-6 (PDPs)** |
|---|---|
| **Project Identification** | |
| Project Name: 5th Avenue Landing | |
| Permit Application Number | |
| **PDP Structural BMPs** | |
| All PDPs must implement structural BMPs for storm water pollutant control (see Chapter 5 of the Port BMP Design Manual). Selection of PDP structural BMPs for storm water pollutant control must be based on the selection process described in Chapter 5. PDPs subject to hydromodification management requirements must also implement structural BMPs for flow control for hydromodification management (see Chapter 6 of the BMP Design Manual). Both storm water pollutant control and flow control for hydromodification management can be achieved within the same structural BMP(s).<br>PDP structural BMPs must be verified by the local jurisdiction at the completion of construction. This may include requiring the project applicant or project applicant's representative and engineer of record to certify construction of the structural BMPs (see Section 1.12 of the BMP Design Manual). PDP structural BMPs must be maintained in perpetuity and the local jurisdiction is required to confirm the maintenance (see Section 7 of the BMP Design Manual).<br>Use this form to provide narrative description of the general strategy for structural BMP implementation at the project site in the box below. Then complete the PDP structural BMP summary information sheet (page 3 of this form) for each structural BMP within the project (copy the BMP summary information page as many times as needed to provide summary information for each individual structural BMP). | |

Describe the general strategy for structural BMP implementation at the site. This information must describe how the steps for selecting and designing storm water pollutant control BMPs presented in Section 5.1 of the BMP Design Manual were followed, and the results (type of BMPs selected). For projects requiring hydromodification flow control BMPs, indicate whether pollutant control and flow control BMPs are integrated or separate.

The site is in a no infiltration conditions given the adjacency to the Bay, depth of groundwater, and the need to maintain the integrity of the foundation and bulk head. The project will attempt to retain as much runoff as possible within the green roof and the significant amount of landscaping along the plaza. In order to ensure maximal area is retained for public space in the plaza and the hotels, Modular Wetland proprietary biofiltration units will be utilized to ensure proper treatment

(Continue on page 2 as necessary.)

| |
|---|
| **Form I-6 Page 2 of 7 (Copy as many as needed)** |
| **Structural BMP Summary Information**<br>**(Copy this page as needed to provide information for each individual proposed structural BMP)** |
| Structural BMP ID No. 100 |
| Construction Plan Sheet No. |
| Type of structural BMP:<br>☐ Retention by harvest and use (HU-1)<br>☐ Retention by infiltration basin (INF-1)<br>☐ Retention by bioretention (INF-2)<br>☐ Retention by permeable pavement (INF-3)<br>☐ Partial retention by biofiltration with partial retention (PR-1)<br>☐ Biofiltration (BF-1)<br>☐ Biofiltration with Nutrient Sensitive Media Design (BF-2)<br>☒ Proprietary Biofiltration (BF-3) meeting all requirements of Appendix F<br>☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below)<br>☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below)<br>☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below)<br>☐ Detention pond or vault for hydromodification management<br>☐ Other (describe in discussion section below) |
| Purpose:<br>☐ Pollutant control only<br>☐ Hydromodification control only<br>☐ Combined pollutant control and hydromodification control<br>☐ Pre-treatment/forebay for another structural BMP<br>☐ Other (describe in discussion section below) |

| | |
|---|---|
| Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification forms | Project Design Conultants |
| Who will be the final owner of this BMP? | 5th Ave Landing LLC |
| Who will maintain this BMP into perpetuity? | 5th Ave Landing LLC |
| What is the funding mechanism for maintenance? | Revenue from Project |

| |
|---|
| **Form I-6 Page 3 of 7 (Copy as many as needed)** |
| **Structural BMP Summary Information**<br>**(Copy this page as needed to provide information for each individual proposed structural BMP)** |
| Structural BMP ID No. 300 |
| Construction Plan Sheet No. |
| Type of structural BMP:<br>☐ Retention by harvest and use (HU-1)<br>☐ Retention by infiltration basin (INF-1)<br>☐ Retention by bioretention (INF-2)<br>☐ Retention by permeable pavement (INF-3)<br>☐ Partial retention by biofiltration with partial retention (PR-1)<br>☐ Biofiltration (BF-1)<br>☐ Biofiltration with Nutrient Sensitive Media Design (BF-2)<br>☒ Proprietary Biofiltration (BF-3) meeting all requirements of Appendix F<br>☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below)<br>☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below)<br>☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below)<br>☐ Detention pond or vault for hydromodification management<br>☐ Other (describe in discussion section below) |
| Purpose:<br>☐ Pollutant control only<br>☐ Hydromodification control only<br>☐ Combined pollutant control and hydromodification control<br>☐ Pre-treatment/forebay for another structural BMP<br>☐ Other (describe in discussion section below) |

| | |
|---|---|
| Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification forms | Project Design Conultants |
| Who will be the final owner of this BMP? | 5th Ave Landing LLC |
| Who will maintain this BMP into perpetuity? | 5th Ave Landing LLC |
| What is the funding mechanism for maintenance? | Revenue from Project |

**Form I-6 Page 4 of 7 (Copy as many as needed)**

**Structural BMP Summary Information**
**(Copy this page as needed to provide information for each individual proposed structural BMP)**

Structural BMP ID No. 400

Construction Plan Sheet No.

Type of structural BMP:

☐ Retention by harvest and use (HU-1)
☐ Retention by infiltration basin (INF-1)
☐ Retention by bioretention (INF-2)
☐ Retention by permeable pavement (INF-3)
☐ Partial retention by biofiltration with partial retention (PR-1)
☐ Biofiltration (BF-1)
☐ Biofiltration with Nutrient Sensitive Media Design (BF-2)
☒ Proprietary Biofiltration (BF-3) meeting all requirements of Appendix F
☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below)
☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below)
☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below)
☐ Detention pond or vault for hydromodification management
☐ Other (describe in discussion section below)

Purpose:

☐ Pollutant control only
☐ Hydromodification control only
☐ Combined pollutant control and hydromodification control
☐ Pre-treatment/forebay for another structural BMP
☐ Other (describe in discussion section below)

| | |
|---|---|
| Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification forms | Project Design Conultants |
| Who will be the final owner of this BMP? | 5th Ave Landing LLC |
| Who will maintain this BMP into perpetuity? | 5th Ave Landing LLC |
| What is the funding mechanism for maintenance? | Revenue from Project |

**Form I-6 Page 6 of 7 (Copy as many as needed)**

**Structural BMP Summary Information**
**(Copy this page as needed to provide information for each individual proposed structural BMP)**

Structural BMP ID No. 500

Construction Plan Sheet No.

Type of structural BMP:
☐ Retention by harvest and use (HU-1)
☐ Retention by infiltration basin (INF-1)
☐ Retention by bioretention (INF-2)
☐ Retention by permeable pavement (INF-3)
☐ Partial retention by biofiltration with partial retention (PR-1)
☐ Biofiltration (BF-1)
☐ Biofiltration with Nutrient Sensitive Media Design (BF-2)
☒ Proprietary Biofiltration (BF-3) meeting all requirements of Appendix F
☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below)
☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below)
☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below)
☐ Detention pond or vault for hydromodification management
☐ Other (describe in discussion section below)

Purpose:
☐ Pollutant control only
☐ Hydromodification control only
☐ Combined pollutant control and hydromodification control
☐ Pre-treatment/forebay for another structural BMP
☐ Other (describe in discussion section below)

| | |
|---|---|
| Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification forms | Project Design Conultants |
| Who will be the final owner of this BMP? | 5th Ave Landing LLC |
| Who will maintain this BMP into perpetuity? | 5th Ave Landing LLC |
| What is the funding mechanism for maintenance? | Revenue from Project |

**Form I-6 Page 7 of 7 (Copy as many as needed)**

**Structural BMP Summary Information**
**(Copy this page as needed to provide information for each individual proposed structural BMP)**

Structural BMP ID No. 600

Construction Plan Sheet No.

Type of structural BMP:
☐ Retention by harvest and use (HU-1)
☐ Retention by infiltration basin (INF-1)
☐ Retention by bioretention (INF-2)
☐ Retention by permeable pavement (INF-3)
☐ Partial retention by biofiltration with partial retention (PR-1)
☐ Biofiltration (BF-1)
☐ Biofiltration with Nutrient Sensitive Media Design (BF-2)
☒ Proprietary Biofiltration (BF-3) meeting all requirements of Appendix F
☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below)
☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below)
☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below)
☐ Detention pond or vault for hydromodification management
☐ Other (describe in discussion section below)

Purpose:
☐ Pollutant control only
☐ Hydromodification control only
☐ Combined pollutant control and hydromodification control
☐ Pre-treatment/forebay for another structural BMP
☐ Other (describe in discussion section below)

| | |
|---|---|
| Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification forms | Project Design Conultants |
| Who will be the final owner of this BMP? | 5th Ave Landing LLC |
| Who will maintain this BMP into perpetuity? | 5th Ave Landing LLC |
| What is the funding mechanism for maintenance? | Revenue from Project |

# ATTACHMENT 1
# BACKUP FOR PDP POLLUTANT CONTROL BMPS

This is the cover sheet for Attachment 1.

**Indicate which Items are Included behind this cover sheet:**

| | **Attachment Sequence** | **Contents** | **Checklist** |
|---|---|---|---|
| REQUIRED | Attachment 1a | DMA Exhibit<br>See DMA Exhibit Checklist on the back of this Attachment cover sheet. | ☒ Included |
| REQUIRED | Attachment 1b | Tabular Summary* of DMAs Showing DMA ID matching DMA Exhibit, DMA Area, and DMA Type<br>*Provide table in this Attachment OR on DMA Exhibit in Attachment 1a | ☒ Included on DMA Exhibit in Attachment 1a<br>☐ Included as Attachment 1b, separate from DMA Exhibit |
| REQUIRED *(unless the entire project will use infiltration BMPs)* | Attachment 1c | Form I-7, Harvest and Use Feasibility Screening Checklist<br>Refer to Appendix B.3-1 of the BMP Design Manual to complete Form I-7. | ☒ Included<br>☐ Not included because the entire project will use infiltration BMPs |
| REQUIRED *(unless the project will use harvest and use BMPs)* | Attachment 1d | Form I-8, Categorization of Infiltration Feasibility Condition<br>Refer to Appendices C and D of the BMP Design Manual to complete Form I-8. | ☐ Included<br>☒ Not included, geotech study has not been performed at this preliminary stage yet |
| REQUIRED | Attachment 1e | Pollutant Control BMP Design Worksheets / Calculations<br>Refer to Appendices B and E of the BMP Design Manual for structural pollutant control BMP design guidelines | ☒ Included |

# ATTACHMENT 1a,b

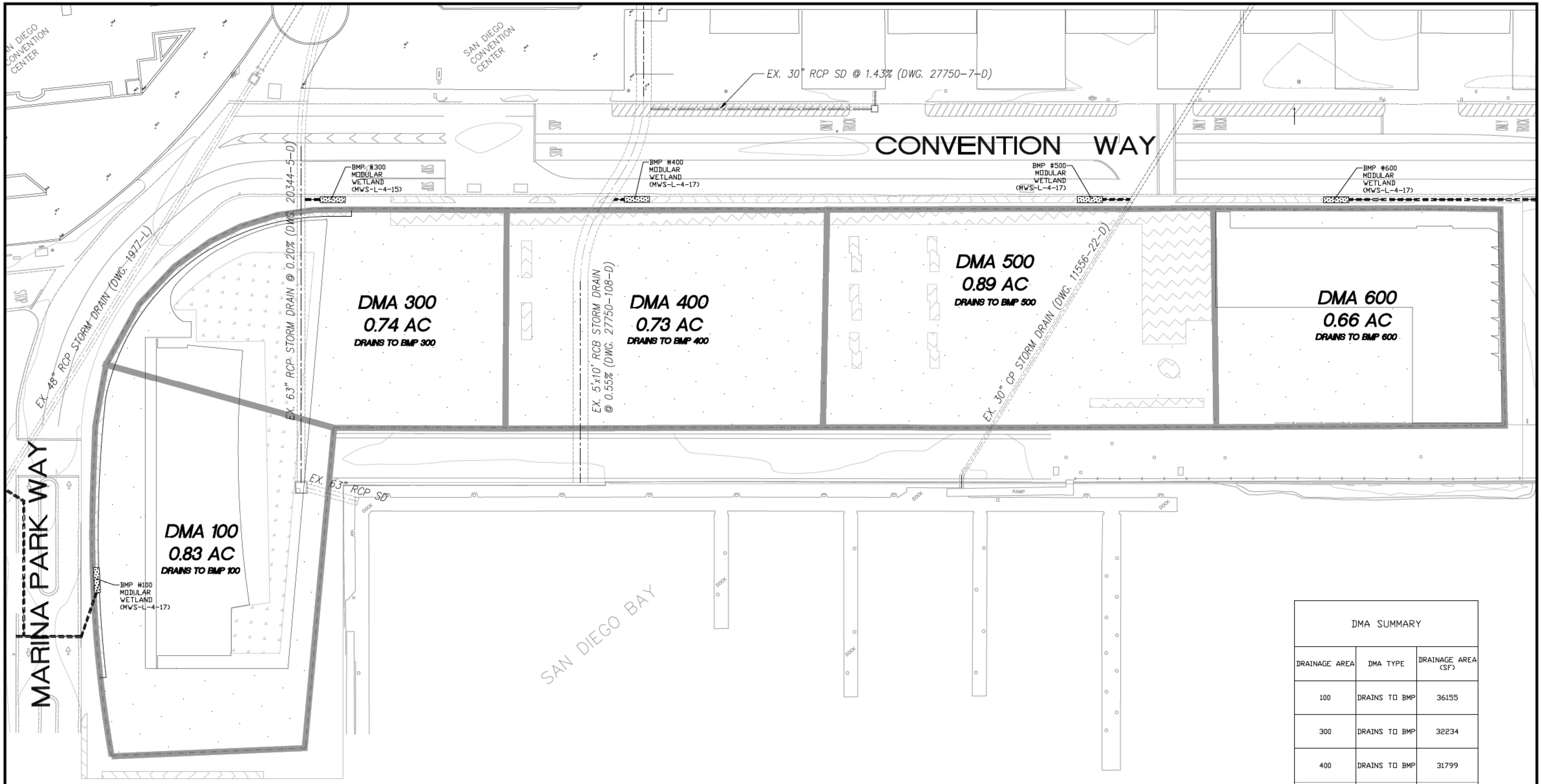
## DMA EXHIBIT

## TABULAR SUMMARY

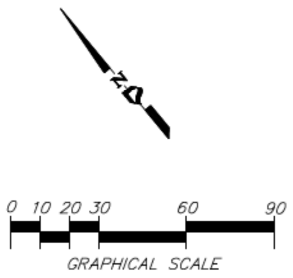
**Use this checklist to ensure the required information has been included on the DMA Exhibit:**

The DMA Exhibit must identify:

☐ Entire property included on one map (use key map if multi-sheets)
☐ BMP Sheet which includes the following (BMP type, size, dimensions for location, cross section and elevation detail); global positioning system coordinates of property
☐ Drainage areas and direction of flow
☐ Storm drain system(s)
☐ Nearby water bodies and municipal storm drain inlets
☐ Location and details of storm water conveyance systems (ditches, inlets, outlets, storm drains, overflow structures, etc.)
☐ Location of existing and proposed storm water controls
☐ Location of "impervious" areas – paved areas, buildings, covered areas
☐ Locations where materials would be directly exposed to storm water
☐ Location of building and activity areas (e.g., fueling islands, garages, waste container area, wash racks, hazardous material storage areas, etc.)
☐ Areas of potential soil erosion (including areas downstream of the project)
☐ Location of existing drinking water wells
☐ Location of existing vegetation to be preserved
☐ Location of LID landscaping features, site design BMPs
☐ Underlying hydrologic soil group
☐ Approximate depth to groundwater
☐ Existing natural hydrologic features ( watercourses, seeps, springs, wetlands)
☐ Existing topography and impervious areas
☐ Existing and proposed site drainage network and connections to drainage offsite
☐ Proposed demolition
☐ Proposed grading
☐ Proposed impervious features
☐ Proposed design features and surface treatments used to minimize imperviousness
☐ Drainage management area (DMA) boundaries, DMA ID numbers, and DMA areas (square footage or acreage), and DMA type (i.e., drains to BMP, self-retaining, or self-mitigating)
☐ Potential pollutant source areas and corresponding required source controls (see BMP Design Manual Chapter 4 and Appendix E.1)
☐ Structural BMPs (identify location, type of BMP, and size/detail)



| DMA SUMMARY | | |
|---|---|---|
| DRAINAGE AREA | DMA TYPE | DRAINAGE AREA (SF) |
| 100 | DRAINS TO BMP | 36155 |
| 300 | DRAINS TO BMP | 32234 |
| 400 | DRAINS TO BMP | 31799 |
| 500 | DRAINS TO BMP | 38768 |
| 600 | DRAINS TO BMP | 2870 |



## LEGEND

| | |
|---|---|
| DRAINAGE AREA FOR INDIVIDUAL OUTFALLS | ▬ |
| PLAZA EXTENTS | —·—·— |
| HOTEL FOOTPRINTS | — |
| ONSITE AREAS OF HARDSCAPING/IMPERVIOUS COVER | ▭ ▭ |
| ONSITE AREAS OF LANDSCAPING/PERVIOUS COVER | ▨ |
| GREEN ROOF | ▭ |
| MODULAR WETLAND UNIT | ▨ |

## BMP NOTES:

1. SITE DESIGN BMPS INCLUDE:
   - GREEN ROOF
   - MINIMIZATION OF IMPERVIOUS FOOTPRINT
   - STREET TREES
   - RUNOFF COLLECTION
   - IMPERVIOUS AREA DISPERSION

2. SOURCE CONTROL BMPs FOR PROJECT INCLUDE:
   - INTEGRATED PEST MANAGEMENT PRINCIPLES
   - EFFICIENT LANDSCAPE AND IRRIGATION DESIGN
   - COVERED PARKING
   - STORMWATER EDUCATION
   - BUILDING MANAGEMENT PRACTICES (MANAGEMENT OF FIRE SPRINKLER SYSTEM DISCHARGES, AIR CONDITIONING CONDENSATE DISCHARGES, AND THE USE OF NON-TOXIC ROOFING MATERIALS.)

3. THE TREATMENT BMPS SELECTED FOR THIS PROJECT ARE MULTIPLE MODULAR WETLAND UNITS (PROPRIETARY BIOFILTRATION). BMP IS PRIVATE AND WILL BE PRIVATELY MAINTAINED.

4. PROJECT IS EXEMPT FROM HYDROMODIFICATION REQUIREMENTS, SITE DRAINS DIRECTLY TO SAN DIEGO BAY AS DEPICTED.

5. NRCS SOIL INFORMATION IS UNAVAILABLE (CLASSIFIED AS URBAN LAND), BUT IT IS EXPECTED TO BE SOIL TYPE D. SITE IS CLASSIFIED AS THE "NO ALLOWABLE INFILTRATION" CONDITION DUE TO THE POOR SOILS AND THE ULTRA-URBAN DEVELOPMENT AND HIGH GROUNDWATER.

SCALE: 1"=30'
JOB #: 4263
CREATED: 12/21/16

**PROJECT DESIGN CONSULTANTS**
Planning | Landscape Architecture | Engineering | Survey

701 B Street, Suite 800
San Diego, CA 92101
619.235.6471 Tel
619.234.0349 Fax

**PORT OF SAN DIEGO**
**5th Avenue Landing**
SWQMP ATTACHMENT 1A
PROPOSED CONDITIONS
DMA EXHIBIT

# ATTACHMENT 1c

## FORM I-7

## Harvest and Use Feasibility Checklist — Form I-7

1. Is there a demand for harvested water (check all that apply) at the project site that is reliably present during the wet season?

☒ Toilet and urinal flushing
☒ Landscape irrigation
☐ Other:______________

2. If there is a demand; estimate the anticipated average wet season demand over a period of 36 hours. Guidance for planning level demand calculations for toilet/urinal flushing and landscape irrigation is provided in Section B.3.2.
[Provide a summary of calculations here]

- REFER TO NEXT PAGE FOR TOILET/URINAL FLUSHING 36-HOUR DEMAND.
  = 1224CF
- LANDSCAPE IRRIGATION ⇒ PERVIOUS = 11%. (0.57AC)
  MODERATE PLANT WATER USE = 1470 GAL/36HRS (0.57AC) = 838 GAL$\left(\frac{CF}{7.48\ GAL}\right)$
  = 112CF

1124 + 112 = $\boxed{1236\ CF}$ COMBINED

3. Calculate the DCV using worksheet B-2.1. DCV = C x d x A x 43560 SF/AC x 1/12 IN/FT
DCV = 7520 (cubic feet)

| 3a. Is the 36 hour demand greater than or equal to the DCV? | 3b. Is the 36 hour demand greater than 0.25DCV but less than the full DCV? | 3c. Is the 36 hour demand less than 0.25DCV? |
|---|---|---|
| ☐ Yes / ☒ No ⇨<br>⇩ | ☐ Yes / ☒ No ⇨<br>⇩<br>0.25(7520)<br>= 1880 | ☒ Yes<br>⇩ |
| Harvest and use appears to be feasible. Conduct more detailed evaluation and sizing calculations to confirm that DCV can be used at an adequate rate to meet drawdown criteria. | Harvest and use may be feasible. Conduct more detailed evaluation and sizing calculations to determine feasibility. Harvest and use may only be able to be used for a portion of the site, or (optionally) the storage may need to be upsized to meet long term capture targets while draining in longer than 36 hours. | Harvest and use is considered to be infeasible. |

Is harvest and use feasible based on further evaluation?
☐ Yes, refer to Appendix E to select and size harvest and use BMPs.
☒ No, select alternate BMPs.

## 5th Avenue Landing Toilet & Urinal Flushing - Harvest and Reuse Feasibility Calculations

| Commercial & Office | Area (SF) | Area (AC) | Assumed persons/AC[1] | Total users |
|---|---|---|---|---|
| Parcel A - Hotel | 796336 | 18.28 | 43.7 | 798.9 |
| Parcel B - Low Cost Hotel | 72777 | 1.67 | 43.7 | 73.0 |
| Total | 869113 | 19.95 | | 871.9 |
| Notes: 1) Based on City of San Diego Sewer Design Guide, Feb 2013, Table 1-1 | | | | |

**Toilet and Urinal Flushing 36-hour demand:**

| Category: | Vol/36hour period |
|---|---|
| Commercial/Hotel | 1224 CF (Per Table B.3-1 per capita usage rates) |

**Design Capture Volume, DCV**

| | | |
|---|---|---|
| A= | 5.07 | AC |
| Pervious Area= | 0.57 | AC |
| Impervious Area= | 4.45 | AC |
| Composite C= | 0.80 | |
| 85th Percentile Depth= | 0.51 | in |
| DCV= | 0.17 | AF |
| DCV= | **7520** | CF |
| 0.25 * DCV= | 1880.0 | CF |
| % Demand/DCV= | 16.3% | |

**RESULTS:**

| | |
|---|---|
| Is 36 hour demand > DCV? | No |
| Is 36 hour demand > 0.25*DCV? | **No** |

**Discussion/Summary of Feasibility:**

**Although the above numerical analysis indicated that indoor stormwater reuse would be potentially feasible, based on further analysis, this is not allowable per the County Department of Health regulations. They currently do not allow or permit indoor water reuse. Therefore, the final harvest and reuse calculations (on the next page) eliminated the indoor water reuse component and only evaluated feasibility based on the outdoor water reuse feasibility.**

# ATTACHMENT 1e

## BMP CALCULATIONS

# 5th Ave Landing Modular Wetland Sizing Calculations

| DMA-ID | A (sf) | Impervious (sf) | %IMP | C | 1.5 x Q (cfs) | MWS Qdesign | MWS Model |
|---|---|---|---|---|---|---|---|
| 100 | 36,155 | 31,799 | 88% | 0.80 | 0.200 | 0.206 | MWS-L-4-17 |
| 300 | 32,234 | 25,700 | 80% | 0.74 | 0.164 | 0.175 | MWS-L-4-15 |
| 400 | 31,799 | 29,185 | 92% | 0.83 | 0.183 | 0.206 | MWS-L-4-17 |
| 500 | 38,768 | 30,056 | 78% | 0.72 | 0.192 | 0.206 | MWS-L-4-17 |
| 600 | 28,750 | 28,750 | 100% | 0.90 | 0.178 | 0.206 | MWS-L-4-17 |

## ATTACHMENT 2
## BACKUP FOR PDP HYDROMODIFICATION CONTROL MEASURES

This is the cover sheet for Attachment 2.

☐ Mark this box if this attachment is empty because the project is exempt from PDP hydromodification management requirements.

**Indicate which Items are Included behind this cover sheet:**

| **Attachment Sequence** | **Contents** | **Checklist** |
|---|---|---|
| Attachment 2a | Hydromodification Management Exhibit (Required) | ☐ Included<br>See Hydromodification Management Exhibit Checklist on the back of this Attachment cover sheet. |
| Attachment 2b | Management of Critical Coarse Sediment Yield Areas (Section 6.2 of the BMP Design Manual) | Not Applicable<br>No Potential Critical Coarse Sediment Yield Areas have been identified within Port of San Diego jurisdiction |
| Attachment 2c | Geomorphic Assessment of Receiving Channels (Optional)<br>See Section 6.3.4 of the BMP Design Manual. | ☐ Not performed<br>☐ Included<br>☐ Submitted as separate stand-alone document |
| Attachment 2d | Flow Control Facility Design, including Structural BMP Drawdown Calculations and Overflow Design Summary (Required)<br>See Chapter 6 and Appendix G of the BMP Design Manual | ☐ Included<br>☐ Submitted as separate stand-alone document |
| Attachment 2e | Vector Control Plan (Required when structural BMPs will not drain in 96 hours) | ☐ Included<br>☐ Not required because BMPs will drain in less than 96 hours |

**Use this checklist to ensure the required information has been included on the Hydromodification Management Exhibit:**

The Hydromodification Management Exhibit must identify:

☐ Underlying hydrologic soil group
☐ Approximate depth to groundwater
☐ Existing natural hydrologic features (watercourses, seeps, springs, wetlands)
☐ Existing topography
☐ Existing and proposed site drainage network and connections to drainage offsite
☐ Proposed grading
☐ Proposed impervious features
☐ Proposed design features and surface treatments used to minimize imperviousness
☐ Point(s) of Compliance (POC) for Hydromodification Management
☐ Existing and proposed drainage boundary and drainage area to each POC (when necessary, create separate exhibits for pre-development and post-project conditions)
☐ Structural BMPs for hydromodification management (identify location, type of BMP, and size/detail)

# ATTACHMENT 3
## Structural BMP Maintenance Information

This is the cover sheet for Attachment 3.

**Indicate which Items are Included behind this cover sheet:**

| **Attachment Sequence** | **Contents** | **Checklist** |
|---|---|---|
| Attachment 3a | Structural BMP Maintenance Information | ☐ Included<br>See Structural BMP Maintenance Information Checklist on the back of this Attachment cover sheet. |
| Attachment 3b | Port of San Diego O&M Agreement (when applicable) | ☐ Included<br>☐ Not Applicable |

**Use this checklist to ensure the required information has been included in the Structural BMP Maintenance Information Attachment:**

**Attachment 3a must identify:**

☐ Designated responsible party to manage the storm water BMP(s)
☐ Any necessary employee training and duties
☐ When applicable, necessary special training or certification requirements for inspection and maintenance personnel such as confined space entry or hazardous waste management
☐ Operating schedule
☐ Maintenance frequency
☐ Specific maintenance indicators and actions for proposed structural BMP(s). This shall be based on Section 7.7 of the BMP Design Manual and enhanced to reflect actual proposed components of the structural BMP(s)
☐ How to access the structural BMP(s) to inspect and perform maintenance
☐ Features that are provided to facilitate inspection (e.g., observation ports, cleanouts, silt posts, or other features that allow the inspector to view necessary components of the structural BMP and compare to maintenance thresholds)
☐ Manufacturer and part number for proprietary parts of structural BMP(s) when applicable
☐ Maintenance thresholds specific to the structural BMP(s), with a location-specific frame of reference (e.g., level of accumulated materials that triggers removal of the materials, to be identified based on viewing marks on silt posts or measured with a survey rod with respect to a fixed benchmark within the BMP)
☐ Recommended equipment to perform maintenance
☐ Copies of resource agency permits (when applicable)

The Port’s O&M Template shall be used to fulfill the O&M planning requirement. The O&M Plan preparer is responsible to ensure all required elements listed above are included.

## ATTACHMENT 4
## Copy of Plan Sheets Showing Permanent Storm Water BMPs

This is the cover sheet for Attachment 4.

**Use this checklist to ensure the required information has been included on the plans:**

**The plans must identify:**

☐ Structural BMP(s) with ID numbers matching Form I-6 Summary of PDP Structural BMPs
☐ The grading and drainage design shown on the plans must be consistent with the delineation of DMAs shown on the DMA exhibit
☐ Details and specifications for construction of structural BMP(s)
☐ Signage indicating the location and boundary of structural BMP(s)
☐ How to access the structural BMP(s) to inspect and perform maintenance
☐ Features that are provided to facilitate inspection (e.g., observation ports, cleanouts, silt posts, or other features that allow the inspector to view necessary components of the structural BMP and compare to maintenance thresholds)
☐ Manufacturer and part number for proprietary parts of structural BMP(s) when applicable
☐ Maintenance thresholds specific to the structural BMP(s), with a location-specific frame of reference (e.g., level of accumulated materials that triggers removal of the materials, to be identified based on viewing marks on silt posts or measured with a survey rod with respect to a fixed benchmark within the BMP)
☐ Recommended equipment to perform maintenance
☐ When applicable, necessary special training or certification requirements for inspection and maintenance personnel such as confined space entry or hazardous waste management
☐ Include landscaping plan sheets showing vegetation requirements for vegetated structural BMP(s)
☐ All BMPs must be fully dimensioned on the plans
☐ When proprietary BMPs are used, site-specific cross section with outflow, inflow, and model number shall be provided. Photocopies of general brochures are not acceptable.

Page intentionally blank

# ATTACHMENT 5
## Project Closeout Documentation

This is the cover sheet for Attachment 5.

**Indicate which Items are Included behind this cover sheet:**

| **Attachment Sequence** | **Contents** | **Checklist** |
|---|---|---|
| Attachment 5a | Copy of Review and Acceptance of SWQMP from Adjacent Jurisdiction (When Applicable*)<br>*Required for projects along jurisdictional boundaries when portions of the project are within other jurisdiction | ☐ Not Applicable<br>☐ Pending<br>☐ Included |
| Attachment 5b | SWQMP Changes During Construction<br>See SWQMP Construction Change Documentation Checklist on the back of this cover sheet for required documentation | ☐ Not Applicable<br>☐ Included |
| Attachment 5c | Port of San Diego Verification Closeout Form | ☐ Blank Form Included (Construction not complete)<br>☐ Completed and Signed |

**Use this checklist to ensure the required information is provided for construction change documentation:**

**When applicable, Attachment 5b must:**

☐ Describe the construction change
☐ Describe the impact to the storm water management design
☐ Describe how the project will maintain compliance with storm water requirements
☐ Provide a revised DMA map

# Appendix I-2
# Preliminary Drainage Report

# PRELIMINARY DRAINAGE REPORT
# $5^{TH}$ AVENUE LANDING - EIR
## City of San Diego, CA
## December 22, 2016

APN #: 760-017-38-00, 760-017-39-00
Project Address: 111 West Harbor Drive, San Diego, CA

Prepared For:

**Fifth Avenue Landing, LLC**
225 Broadway, Suite 1600
San Diego, CA 92101

Prepared By:

**PROJECT DESIGN CONSULTANTS**
**Planning | Landscape Architecture | Engineering | Survey**

701 B Street, Suite 800
San Diego, CA 92101
619.235.6471 Tel
619.234.0349 Fax

PDC Job No. 4263

REGISTERED PROFESSIONAL ENGINEER
DEBBY SUE REECE
No. C56148
EXP. 12-31-18
CIVIL
STATE OF CALIFORNIA

Prepared by: C. Pack, P.E. & C. Bell, EIT

*Under the supervision of:*

Debby Reece, PE RCE 56148
Registration Expires 12/31/16

# TABLE OF CONTENTS

## TABLES

## APPENDICES

1 Supplemental Information (IDF Curve, Runoff Coefficients, and FIRM Panel)

2 Preliminary Rational Method Calculations

3 Reduced Scale Copies of Select Storm Drain As-builts

4 Drainage Exhibits

A – Existing Conditions Hydrology Map

B – Proposed Conditions Hydrology Map

## 1. INTRODUCTION

This drainage report has been prepared in support of the storm drain improvements associated with the proposed 5th Avenue Landing redevelopment project (Project). The project involves the redevelopment of approximately 5.07 acres of port tidelands consisting of a 43-story hotel, a 6-story low cost hotel, a 4-story indoor plaza, outdoor plaza, public improvements, and one level of at grade parking. The project is located in the Marina District City of Downtown San Diego. The project is not subject to the Clean Water Act (CWA) Sections 401 and 404 as there will be no fill or dredging discharged into an aquatic environment since the project is located in urban land. This redevelopment will replace the existing parking lots, one-level buildings (2), and landscaped areas that are located southwest of Convention Way, east of Marina Park Way, southwest of the existing Hilton Bayfront Hotel, and northeast of the San Diego Bay. Refer to the Vicinity Map below: Figure 1 for the Project location.

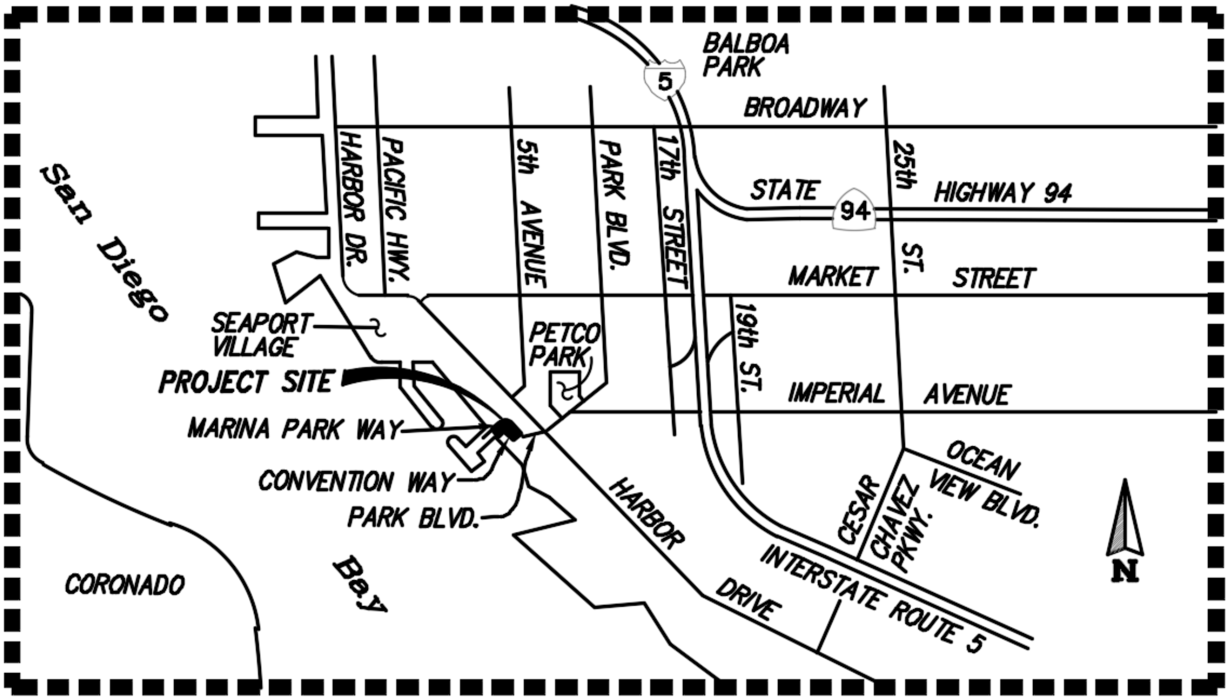


Figure 1: Vicinity Map

The existing site development consists of asphalt parking lots, concrete pathways, landscaped areas, a public washroom facility, and a one-story commercial building for a security staffing business.

Presently the existing project runoff drains towards the San Diego Bay via overland flow or through an existing underground storm drain system. Refer to the Storm Water Quality Management Plan (SWQMP) prepared by Project Design Consultants for the proposed pollutant treatment BMPs. A portion of the site is located within a Special Flood Hazard Area or a FEMA flood area per FIRM panel 06073C1885G. Refer to the FIRMette in Appendix 1, which shows the Project site in relation to the nearest FEMA floodplain. The project will need to address both City and FEMA requirements in order to address the encroachment into the Special Flood Hazard Area.

## 2. EXISTING AND PROPOSED DRAINAGE PATTERNS AND IMPROVEMENTS

The following sections provide descriptions of the existing and proposed drainage patterns and improvements for the project.

### 2.1 Existing Drainage Patterns

Under existing conditions, on-site drainage facilities consist of several underground storm drain systems. Only one of the systems (a 15-inch SD) discharges onsite drainage from a portion of Parcel 1's parking area. This area drains southwesterly towards a cross gutter on Marina Park Way which commingles with offsite flows before being intercepted in an inlet tied to the existing 15-inch storm drain line. This 15-inch storm drain heads easterly (approximately 172') and has an outfall (System 200) directly into the San Diego Bay where onsite and offsite flows are discharged. The rest of the project site (System 700) drains as overland flow into the Bay. Refer to the Existing Drainage Exhibit in Appendix 4. All other systems (100, 300-600) indicated in the exhibit have a description below:

<u>System 100:</u> System 100 represents the portion of the project that drains to the 48-inch RCP per Drawing 1977-L located near the northwest corner of the Phase II Convention Center building. Note that with the Phase II expansion per Drawing 27750-108-D, a 48-inch and a 63-inch RCP were abandoned underneath the building. However, the portion of the 48-inch pipe downstream of the building footprint (including the outfall) is still operational. Per the information provided by the mechanical engineer for the previous convention center expansion, a portion of the existing northwest corner of the roof from the Phase II expansion drains into the downstream portion of the 48-inch RCP. It is unknown whether any of the roof drainage from the Phase I building or podium structure surrounding the Phase I building drains into this 48-inch line under existing conditions, so it was assumed that no other connection exists and that the only drainage into the pipe under existing conditions is from Phase II.

System 300: System 300 represents the outfall of the 63-inch RCP storm drain built per Drawing 20344-5-D. The portion of this storm drain within the Phase II building footprint has been abandoned. No information could be found showing any connection to this system downstream of the building so it is assumed that no drainage collects in this pipe in the existing condition. This pipe is much deeper than the nearby 48-inch pipe. In fact, the outlet elevation is so low that the soffit is below mean sea level.

System 400: System 400 represents the area that drains into the box culvert built per the Phase II expansion (Drawing 27750-108-D). The box culvert alignment is actually underneath the Phase II expansion building footprint and outlets to the Bay in a perpendicular fashion. Per the City of San Diego as-built drawing, the 100-year peak flow from this system is 335.2 cfs. The system collects a significant amount of runoff from areas north of the Harbor Drive/5th Avenue intersection.

System 500: System 500 represents the outfall of the 30-inch RCP storm drain built per Drawing 11556-22-D. The main portion of this storm drain was abandoned during the Phase II expansion. It is assumed that currently there are no storm drain connections into the pipe.

System 600: System 600 represents the area that drains into the 30-inch Park Boulevard storm drain and outlets to the Bay. The existing storm drain parallels the existing alignment of Park Boulevard and includes several small laterals. The two largest drainage systems that tie into the existing 30-inch storm drain near the Convention Center include the storm drain in Gull Street (which collects runoff from the parking structure and portions of the Hilton), and the 24-inch HDPE pipe per Drawing 33970-12-D (which collects runoff from portions of the Hilton and the surrounding park areas adjacent to the Bay). The 24-inch HDPE runs parallel to the seawall and drains into the 30-inch pipe approximately 57 feet upstream of the Bay outfall. The 24-inch drains into a CDS unit and then into two RCBs in series with a 6-inch orifice regulating the outflow. The Hilton Drainage Report, prepared by Flores Lund Consultants dated August 2006, was reviewed for further information. However, no detention calculations were provided in the report for the RCBs. Given the small volume provided in the RCB basins and the relative short distance to the Bay, it is assumed that, if required for the proposed site plans (due to conflicts with proposed utilities), these basins may be relocated or eliminated.

### 2.2 Proposed Drainage Improvements

The overall proposed drainage strategy includes draining the proposed roof drains toward the inland side of the building. The roof drainage will tie into the existing storm drains via new proposed storm drain connections and laterals. For the proposed conditions, drainage will remain generally the same with two major changes. The outfall for System 200 will be demolished during the construction of the hotel and these drainage areas will be re-routed into the System 100 storm drain. The proposed hotel will be broken up into segments for treatment purposes with these portions then routed into the respective systems after treatment as depicted in the proposed drainage conditions map in Appendix 4.

For all of the existing storm drains (except the existing 15-inch that will be removed), the hotel and parking lot development will be built on top of the existing storm drains that cross the site. This is consistent with the approach that was used for the Phase II Convention Center expansion. The building foundations will be designed to accommodate leaving the existing storm drains in place. The 5’x10’ RCB (System 400) will be underneath the proposed at-grade parking structure, which can be designed to accommodate additional access manholes if necessary.

## 3. HYDROLOGY CRITERIA, METHODOLOGY, AND RESULTS

### 3.1 Hydrology Criteria

Table 1 summarizes the hydrology assumptions and criteria used for the hydrologic modeling.

*Table 1: Hydrology Criteria*

| | |
|---|---|
| Existing and Proposed Hydrology: | 100-year storm frequency |
| Soil Type: | City of San Diego Drainage Manual requires the use of Hydrologic Soil Group D for peak flow calculations. Actual Soil Group per NRCS Web Soil Survey is undefined since it is undocumented Urban Land. |
| Land Use / Runoff Coefficients: | Assigned based on assumed percent imperviousness of each sub-area. For detailed information, see Rational Method calculations. |
| Rainfall intensity: | Based on intensity duration frequency relationships presented in the 1984 City of San Diego Drainage Design Manual |

### 3.2 Hydrologic Methodology

The Rational Method was used to determine the peak discharge flows for the evaluation of the storm drain improvements. The drainage basins were delineated using available topography and as-built information, information from the other consultants in the project team, as well as observations from a field visit to the project area. Due to the inherent uncertainty of some of the drainage area delineations, the drainage basin delineations will be reviewed and edited as necessary as the design progresses. Therefore, the analysis included herein is very preliminary and is subject to change. For example, no grading scheme or roof drainage plans have been developed for the proposed condition of the project to date. Therefore, the proposed condition evaluated in this report was developed using assumptions of where the drainage divides would occur and where the roof drain point of connections will be. The mechanical engineer will design the roof connections for the building as the building design progresses and the drainage analysis will be revised to match the proposed storm drain layout.

For this preliminary EIR stage of the project, no routing calculations with the Rational Method were performed since it is likely that the site drainage areas will shift and be re-routed as the design progresses. Therefore, the intensity corresponding to a minimum 5-minute time of concentration was used for the analysis. This is the most conservative estimate possible. The goal of the Project hydrologic analysis was to:

- Determine relative difference in peak flows for the existing and proposed condition for each outfall.
- Verify that the Project will not adversely impact the existing storm drain improvements, and determine alternatives for the proposed condition design.

### 3.3 Hydrology Results and Recommendations

Refer to Exhibit A for the Existing Condition Hydrology Map and Exhibit B for the Proposed Condition Hydrology Map. The exhibits show the overall drainage areas that were assumed for each outfall. Appendix 2 contains the summary table for the preliminary Rational Method Hydrology calculations for existing and proposed conditions. Based on the table of results, the total peak flow from the proposed project is expected to be similar to existing conditions. The proposed green roof and other site landscaping will add additional landscaping to reduce the percentage of rainfall that becomes runoff.

Since the project has a large number of outfalls and the proposed roof drainage will likely need to tie into several different outfalls, pipe capacity calculations for each pipe system are more critical to the analysis of project impacts than the overall peak flow. During previous investigations of the pipe capacities during the work associated with the Convention Center Phase III EIR, PDC did not find any existing storm drains that were significantly under capacity in the Fifth Avenue Landing project area. Because the site has several existing storm drains to drain to, there is flexibility for the project for the proposed storm drain design.

## 4. CONCLUSION

This drainage report has been prepared in support of the planning-level EIR for the Fifth Avenue Landing project. The purpose of this report is to provide peak discharges for use in evaluating the storm drain systems for the project and to verify that the project will not cause drainage-related impacts that cannot be mitigated. Because the site is already developed, the post-project drainage conditions are similar to the existing condition drainage conditions.

# APPENDIX 1

## Supplemental Information (IDF Curve, Runoff Coefficients, and FIRM Panel)

## TABLE 2

## RUNOFF COEFFICIENTS (RATIONAL METHOD)

### DEVELOPED AREAS (URBAN)

| Land Use | Coefficient, C<br>Soil Type (1) |
|---|---|
| Residential: | D |
| Single Family | .55 |
| Multi-Units | .70 |
| Mobile Homes | .65 |
| Rural (lots greater than 1/2 acre) | .45 |
| Commercial (2)<br>80% Impervious | .85 |
| Industrial (2)<br>90% Impervious | .95 |

NOTES:

(1) Type D soil to be used for all areas.

(2) Where actual conditions deviate significantly from the tabulated imperviousness values of 80% or 90%, the values given for coefficient C, may be revised by multiplying 80% or 90% by the ratio of actual imperviousness to the tabulated imperviousness. However, in no case shall the final coefficient be less than 0.50. For example: Consider commercial property on D soil.

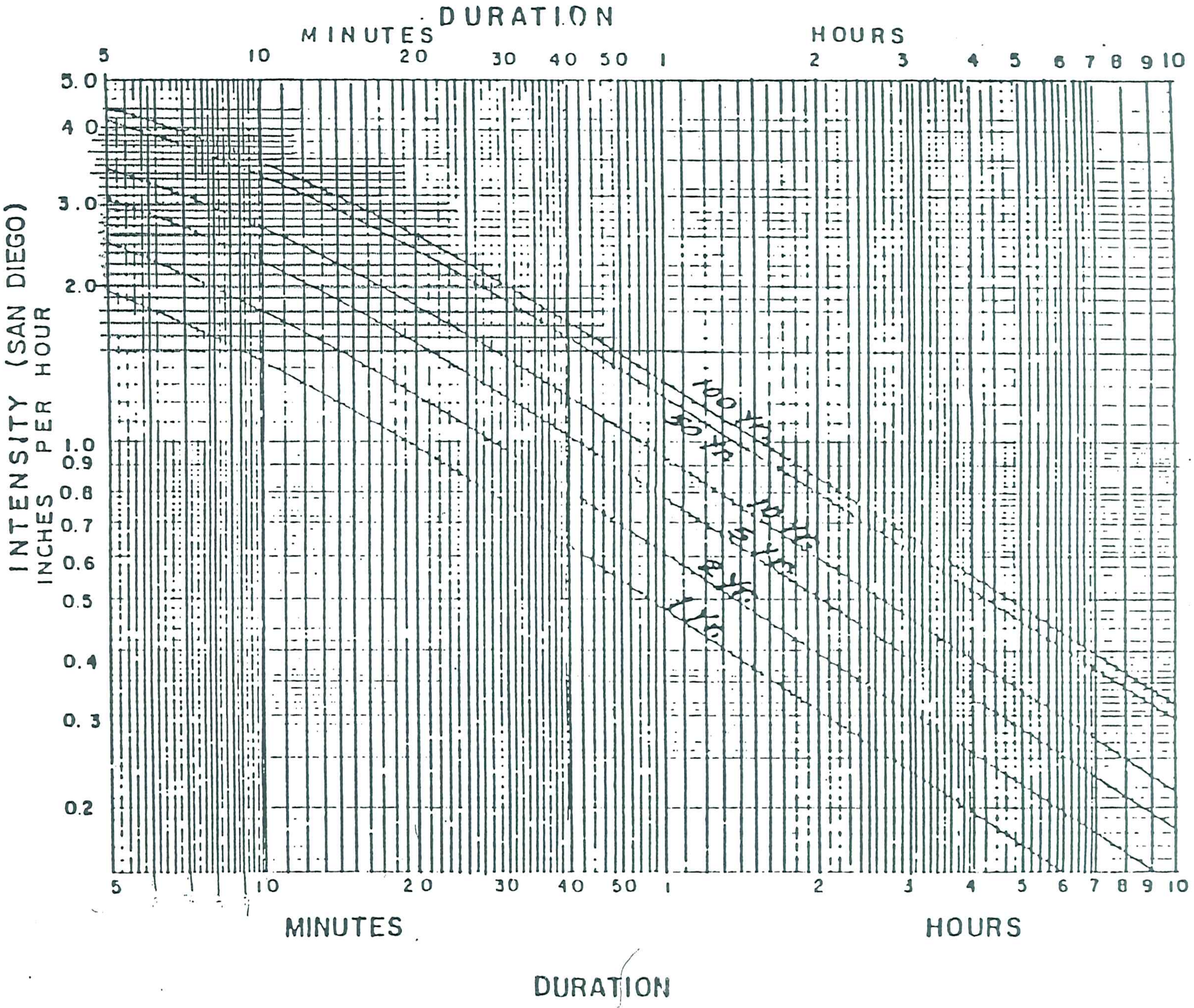
Actual imperviousness = 50%

Tabulated imperviousness = 80%

$$\text{Revised C} = \frac{50}{80} \times 0.85 = 0.53$$

| ELEV. | FACTOR |
|---|---|
| 0–1500 | 1.00 |
| 1500–3000 | 1.25 |
| 3000–4000 | 1.42 |
| 4000–5000 | 1.60 |
| 5000–6000 | 1.70 |
| DESERT | 1.25 |

To obtain correct intensity, multiply intensity on chart by factor for design elevation.



# RAINFALL
# INTENSITY – DURATION – FREQUEN
# CURVES
# for
# COUNTY OF SAN DIEGO

APPENDIX

rance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'

0 500 1,000 1,500 2,000 FEET

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1885G

# FIRM

## FLOOD INSURANCE RATE MAP

## SAN DIEGO COUNTY, CALIFORNIA

## AND INCORPORATED AREAS

PANEL 1885 OF 2375

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

| COMMUNITY | NUMBER | PANEL | SUFFIX |
|---|---|---|---|
| CORONADO, CITY OF | 060287 | 1885 | G |
| SAN DIEGO, CITY OF | 060295 | 1885 | 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.

U.S. DEPARTMENT OF HOMELAND SECURITY

**MAP NUMBER**
**06073C1885G**

**MAP REVISED**
**MAY 16, 2012**

**Federal Emergency Management Agency**

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

# APPENDIX 2

## Preliminary Rational Method Calculations

# Conceptual Rational Method Calculations

## PRELIMINARY PEAK RUNOFF CALCULATIONS FOR 5th AVENUE LANDING

Rational Method Input Parameters:

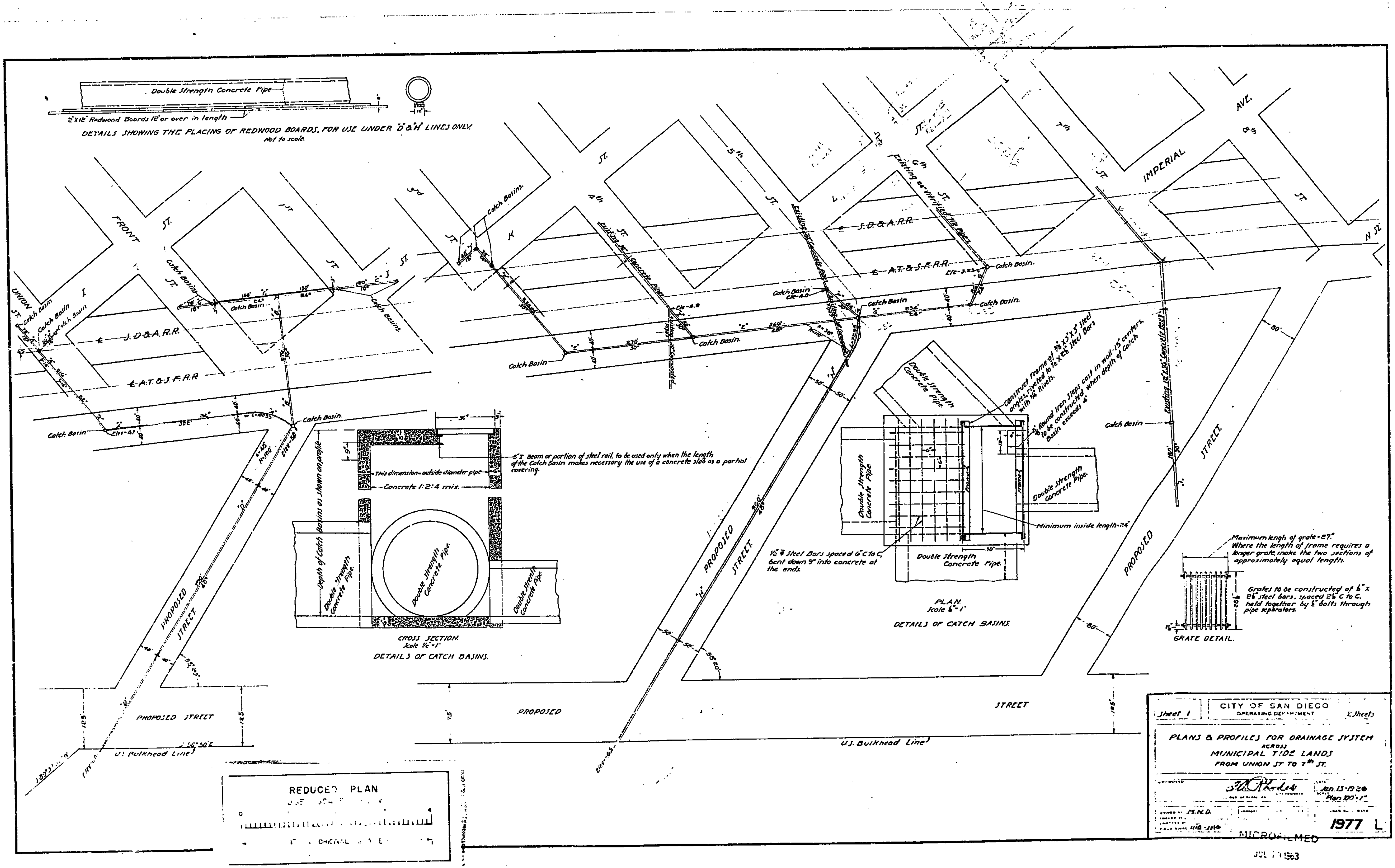
C_pervious= 0.45 (Used for landscaping and green roof areas. Runoff coefficient corresponds to "rural", per City of San Diego Drainage Design Manual)
C_impervious= 0.95 (Used for impervious areas. Runoff coefficient corresponds to "industrial", per City of San Diego Drainage Design Manual)
Intensity = 4.4 in/hr (assuming minimum time of concentration of 5 minutes)

Rational Method Results:

| | | **EXISTING CONDITIONS** | | | | | **PROPOSED CONDITIONS** | | | | | **DESIGN CONSIDERATIONS** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Outfall of Interest | System | Pervious Area (ac) | Impervious Area (ac) | Contrib. Area (acres) | Composite C | Q100 (cfs) | Pervious Area (ac) | Impervious Area (ac) | Contrib. Area (acres) | Composite C | Q100 (cfs) | Governing Condition for Design | Q_capacity (if capacity is governing condition) | Notes |
| Connection to 48" RCP | System 100 | 0 | 1.21 | 1.21 | 0.95 | 5.1 | 0.1 | 3.40 | 3.5 | 0.94 | 14.4 | Q_PR<Q_Capacity | 64.2 | (Assume normal depth, S=0.2%) |
| Connection to 15" RCP | System 200 | 0 | 1.73 | 1.73 | 0.95 | 7.2 | Storm Drain Demolished | | | | | | | |
| Connection to 63" RCP | System 300 | 0 | 0 | 0 | N/A | 0.0 | 0.15 | 0.59 | 0.74 | 0.85 | 2.8 | Q_PR<Q_Capacity | 132.7 | (Assume normal depth, S=0.2%) |
| Connection to RCB | System 400 | 1.02 | 13.26 | 14.28 | 0.91 | 57.4 | 1.17 | 13.85 | 15.02 | 0.91 | 60.21 | Q_PR<Q_Capacity | | |
| Connection to Abandoned 30" RCP | System 500 | 0 | 0 | 0 | N/A | 0.0 | 0.2 | 0.69 | 0.89 | 0.84 | 3.3 | Q_PR<Q_Capacity | 18.3 | (Assume normal depth, S=0.2%) |
| Connection to Park Blvd 30" RCP | System 600 | 3.35 | 14.31 | 17.66 | 0.86 | 66.4 | 3.35 | 14.97 | 18.32 | 0.86 | 69.2 | Q_PR<Q_EX | | |
| Overland flow to Bay | System 700 | 0.78 | 5.24 | 6.02 | 0.89 | 23.4 | 0 | 2.43 | 2.43 | 0.95 | 10.2 | None | | |
| **Total** | | **5.15** | **35.75** | **40.90** | | **159.6** | **4.97** | **35.93** | **40.90** | | **160.0** | **Pre and Post Conditions within 1 cfs** | | |

# APPENDIX 3

## Reduced Scale Copies of Select Storm Drain As-builts



Sheet 1

CITY OF SAN DIEGO
OPERATING DEPARTMENT

2 Sheets

PLANS & PROFILES FOR DRAINAGE SYSTEM
ACROSS
MUNICIPAL TIDE LANDS
FROM UNION ST TO 7th ST.

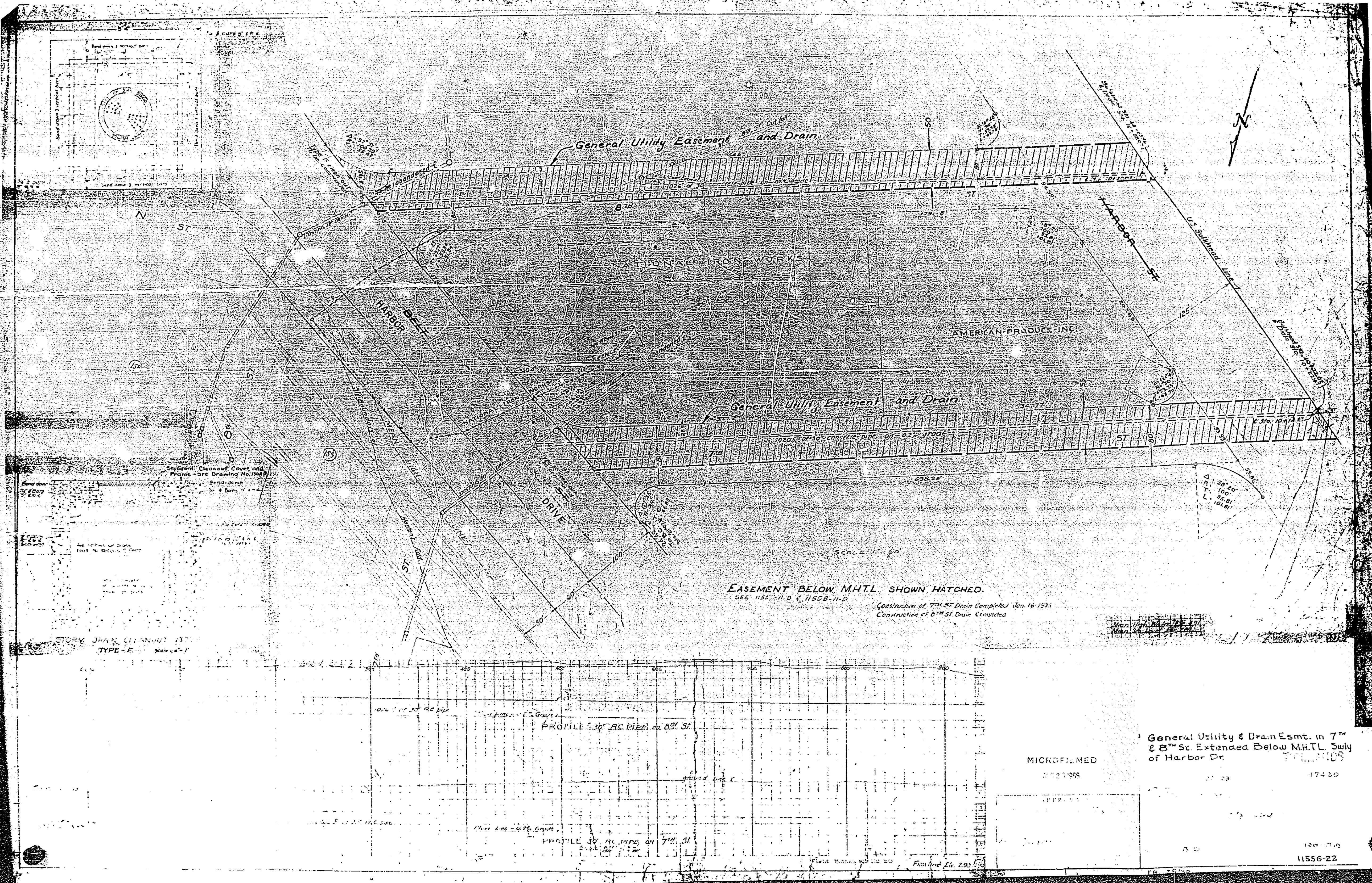
APPROVED F. H. Rhodes

DATE Jan. 15 - 1920
SCALE Plan 100' = 1"

DRAWN BY M.N.D.
FIELD BOOK 118-124

1977 L

REDUCED PLAN



EASEMENT BELOW M.H.T.L. SHOWN HATCHED.
SEE 1155?-11-D & 11558-11-D

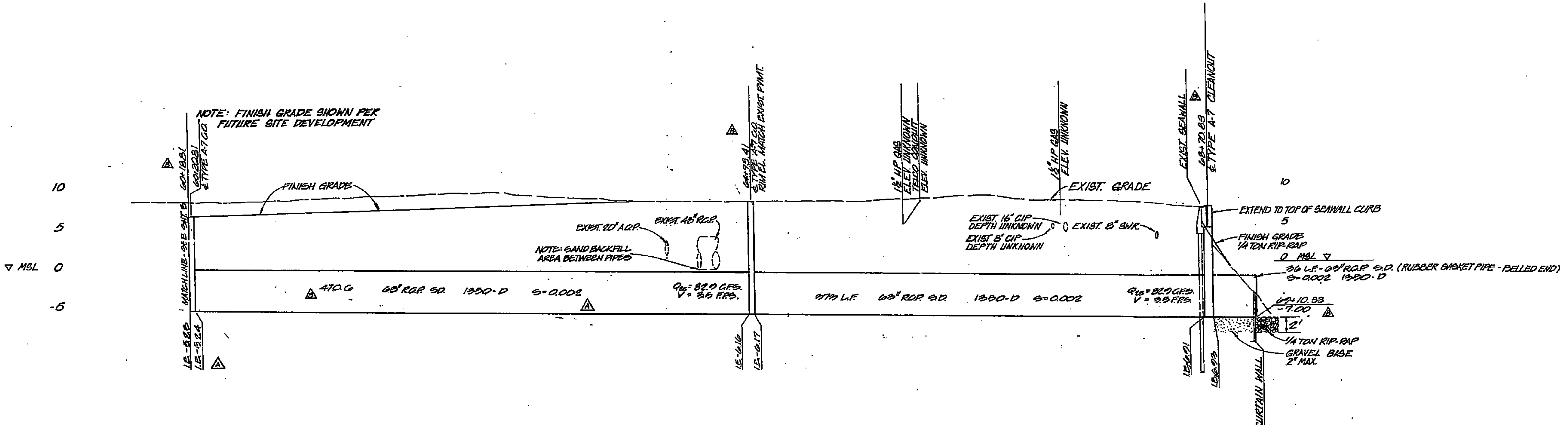
Construction of 7th St Drain Completed Jun. 16 1935
Construction of 8th St Drain Completed

MICROFILMED

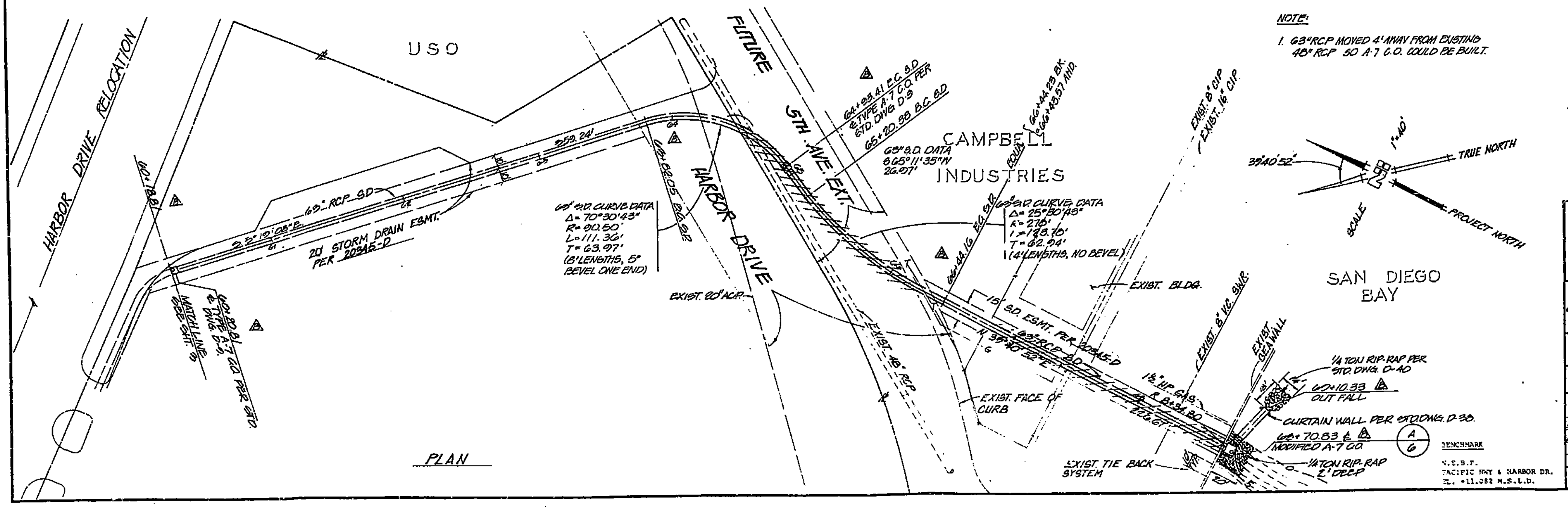
General Utility & Drain Esmt. in 7th
& 8th St. Extended Below M.H.T.L. Swly
of Harbor Dr.

17430

11556-22



PROFILE
HORIZ. 1"=40'
VERT. 1"=6'



NOTE:

1. 63" RCP MOVED 4' AWAY FROM EXISTING 48" RCP SO A-7 C.O. COULD BE BUILT.

BENCHMARK
N.E.B.F.
PACIFIC HWY & HARBOR DR.
EL. +11.082 M.S.L.D.

**HOPE CONSULTING GROUP**
**SAN DIEGO**
ARCHITECTURE / PLANNING / ENGINEERING
1475 Sixth Avenue, P.O. Box 2488, San Diego, CA 92112 USA
Telephone. 714/233-5251, Telex 910-335-1677 HOPECO SDG

NOTE:
HARBOR DEPT. TRAVERSE & TIES PER ANDRECHT 4-8-77, 2-23-80 (FROM 1241-B)
CONTRACTOR TO VERIFY BEFORE BEGINNING CONSTRUCTION

GEORGE S. NOLTE AND ASSOCIATES
san jose · sacramento · san diego · walnut creek
9455 RIDGEHAVEN CT. SAN DIEGO, CA 92123
ENGINEER OF WORK. PHONE 278-9392
Allen P. Boothe 2/9/82
ALLEN P. BOOTHE RCE. 18156 DATE

DESIGNED PED
DRAWN A.C.
CHECKED APB
JOB NO 8500-81

PLANS FOR THE IMPROVEMENT OF:
**NAVY FIELD** UTILITY RELOCATION AND STORM DRAIN
HARBOR DRIVE E/O KETTNER PLAN AND PROFILE

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING DEPARTMENT
SHEET 5 OF 9 SHEETS
W.O. NO. 700017

FOR CITY ENGINEER 3-29-82 DATE

| DESCRIPTION | BY | APPROVED | DATE | FILMED |
|---|---|---|---|---|
| ORIGINAL | | | | |
| ▲A MODIFY STORM DRAIN | GSN/CA | | 4-19-82 | |
| ▲B STATION ADJ | GSN/CA | | 5-6-82 | |
| A. BUILT | GSN | | | |

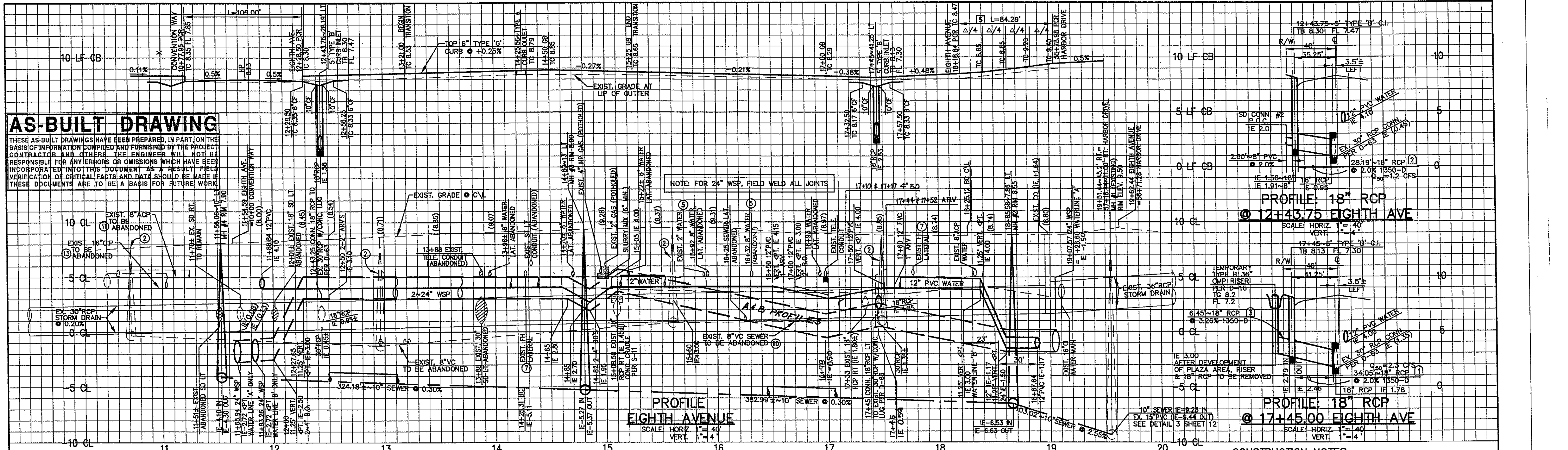
CONTROL CERTIFICATION
196-1717
LAMBERT COORDINATES

CONTRACTOR H H N DATE STARTED 6-82
INSPECTOR JC HENRY DATE COMPLETED 4-11-84

20344-5-D

## AS-BUILT DRAWING

THESE AS-BUILT DRAWINGS HAVE BEEN PREPARED, IN PART, ON THE BASIS OF INFORMATION COMPILED AND FURNISHED BY THE PROJECT CONTRACTOR AND OTHERS. THE ENGINEER WILL NOT BE RESPONSIBLE FOR ANY ERRORS OR OMISSIONS WHICH HAVE BEEN INCORPORATED INTO THIS DOCUMENT AS A RESULT. FIELD VERIFICATION OF CRITICAL FACTS AND DATA SHOULD BE MADE IF THESE DOCUMENTS ARE TO BE A BASIS FOR FUTURE WORK.



### PROFILE EIGHTH AVENUE

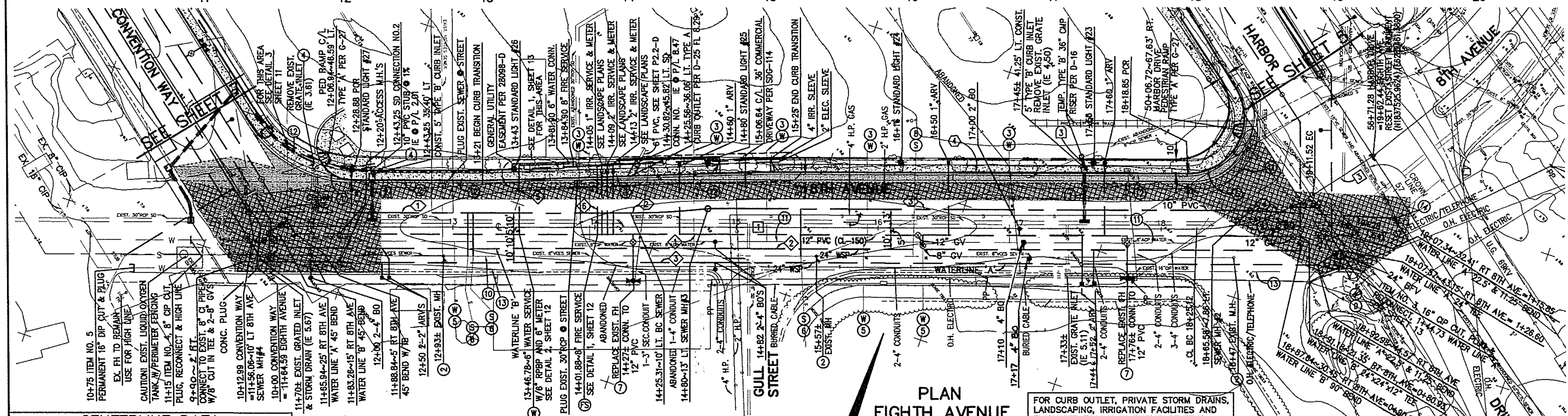
SCALE HORIZ. 1"= 40'
VERT. 1"= 4'

### PROFILE: 18" RCP @ 12+43.75 EIGHTH AVE

SCALE: HORIZ. 1"= 40'
VERT. 1"= 4'

### PROFILE: 18" RCP @ 17+45.00 EIGHTH AVE

SCALE: HORIZ. 1"= 40'
VERT. 1"= 4'



### PLAN EIGHTH AVENUE

SCALE: 1"= 40'

FOR CURB OUTLET, PRIVATE STORM DRAINS, LANDSCAPING, IRRIGATION FACILITIES AND ENHANCED PAVING IN PUBLIC GENERAL UTILITY EASEMENT, SEE ENCROACHMENT REMOVAL AGREEMENT NO. 370100-4

EASEMENTS AND RIGHT OF WAY:
FOR CLARIFICATION SEE SHEET 2 & 28098-D

NOTE: CONTRACTOR TO POTHOLE AND VERIFY LOCATION OF ALL EXISTING UTILITIES AND STRUCTURES PRIOR TO CONSTRUCTION. CONTRACTOR TO ENSURE ALL EXISTING SEVICES NOT BEING ABANDONED ARE KEPT IN SERVICE.

### CENTERLINE DATA

| NO. | DELTA/BRG | RADIUS | LENGTH | REMARKS |
|---|---|---|---|---|
| 1 | N71°24'29"E | -- | 660.53' | -- |
| 2 | △ = 33°00'02" | 150.00' | 86.40' | -- |
| 3 | N38°24'27"E | -- | 50.92' | -- |

### STORM DRAIN DATA

| NO. | DELTA/BRG | RADIUS | LENGTH | REMARKS |
|---|---|---|---|---|
| ① | N18°35'31"W | -- | 34.05' | 18"RCP (1350-D) |
| ② | N18°35'31"W | -- | 28.19' | " " |
| ③ | N32°17'24"W | -- | 6.45' | " " |
| ④ | N18°35'31"W | -- | 2.60' | 10" PVC |

### WATER DATA

| NO. | DELTA/BRG | RADIUS | LENGTH | REMARKS |
|---|---|---|---|---|
| 1 | N71°24'29"E | -- | 709.33' | 12" PVC (231) CL-150 |
| 2 | N71°24'29"E | -- | 714.90' | 24" WSP (231) CL-150 |
| 3 | N71°24'29"E | -- | 744.23' | 24" WSP (390) CL-200 |
| 4 | N38°24'27"E | -- | 18.91 ' | 24" WSP (390) CL-200 |
| 5 | N18°35'31"W | -- | 48.61' | 6" PVC (231) CL-150 |
| 6 | N18°35'31"W | -- | 48.45' | 8" PVC (231) CL-150 |

### SEWER DATA

| NO. | DELTA/BRG | RADIUS | LENGTH | REMARKS |
|---|---|---|---|---|
| 1 | N71°24'29"E | -- | 269.25' | 10" SEWER |
| 2 | △ = 06°16'47" | 500.00' | 54.80' | " " |
| 3 | N71°24'29"E | -- | 382.99' | " " |
| 4 | N74°10'38"E | -- | 102.02' | " " |

### CURB DATA

| NO. | DELTA/BRG | RADIUS | LENGTH | REMARKS |
|---|---|---|---|---|
| ① | △= 63°32'43" | 24.50' | 27.17' | 6" TYPE G |
| ② | N71°24'29"E | -- | 92.12' | " " |
| ③ | N69°43'24"E | -- | 204.09' | " " |
| ④ | N71°24'29"E | -- | 293.85' | " " |
| ⑤ | △= 120°44'28" | 40.00' | 84.29' | " " |

### CONSTRUCTION NOTES

① OMITTED

② CONTRACTOR TO LOWER TOP 3 FEET AND FILL WITH SAND.

③ LOCATION OF EXISTING WATER SERVICE IS PER RECORD INFO. CONTRACTOR TO VERIFY LOCATION, ABANDON SERVICE.

④ CONTRACTOR TO PLUG EXISTING 18" RCP STORM DRAIN AND REMOVE INLET.

⑤ LOCATION OF EXISTING WATER SERVICE IS PER RECORD INFORMATION. CONTRACTOR TO POTHOLE AND VERIFY LOCATION AND SIZE. CONTRACTOR TO EXTEND EXIST. SEVICE TO 12" PVC MAIN.

⑥ LOCATION OF EXISTING WATER SERVICE IS PER RECORD INFORMATION. CONTRACTOR TO POTHOLE AND VERIFY LOCATION AND SIZE. CONTRACTOR TO EXTEND EXIST. SEVICE TO 10" PVC MAIN.

⑦ REPLACE FIRE HYDRANT & ASSEMBLY AND CONNECT TO 12" PVC.

⑧ LOCATION OF EXISTING SEWER LATERAL IS PER RECORD INFORMATION. CONTRACTOR TO POTHOLE AND VERIFY LOCATION. CUT AND PLUG AT PROPERTY LINE.

⑨ LOCATION OF EXISTING WATER SERVICE IS PER RECORD INFO. CONTRACTOR TO POTHOLE AND VERIFY LOCATION. CONTRACTOR TO ENSURE SERVICE IS NOT AFFECTED DURING CONSTRUCTION.

⑩ EXIST. 8" VCES SEWER TO BE ABANDONED.

⑪ EXIST. 8" WATER TO BE ABANDONED.

⑫ REMOVE EXISTING CURB, GUTTER AND SIDEWALK

⑬ EXIST. 16" CI WATER TO BE ABANDONED.

⑭ 19+51.44~45.2 RT. CONNECT TO EXIST. MANHOLE, RESHAPE BOTTOM.

PROFESSIONAL ENGINEER
PHILIP R. KERN
R.C.E. 40831
EXP. 3-31-99
STATE OF CALIFORNIA

Prepared in the office of :
J K & A
JOHN KNUTZEN & ASSOCIATES, Inc.
CIVIL ENGINEERS / SURVEYORS
9666 Business Park Ave. - San Diego, CA 92131 - (619)537-3880
6/2/97
Engineer of Work R.C.E. No. 40831 Date

CITY CONTRACT

PLANS FOR THE IMPROVEMENT OF:
EIGHTH AVENUE
(PORT DISTRICT STREET)
FOR CONVENTION CENTER EXPANSION PROJECT

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING DEPARTMENT
SHEET 6 OF 121 SHEETS

W.O. NO. 370100

M. Kimmak 6/25/97
FOR CITY ENGINEER DATE

| DESCRIPTION | BY | APPROVED | DATE | FILMED |
|---|---|---|---|---|
| ORIGINAL | JK&A | | | DEC 11 98 |
| | | | | |
| | | | | |
| | | | | |
| AS BUILT | MF | R. Fergus | 2/6/03 | APR 9 '03 |

CONTRACTOR Turner Const. DATE STARTED 8/15/98
INSPECTOR M. Fenertigez DATE COMPLETED 4/9/02

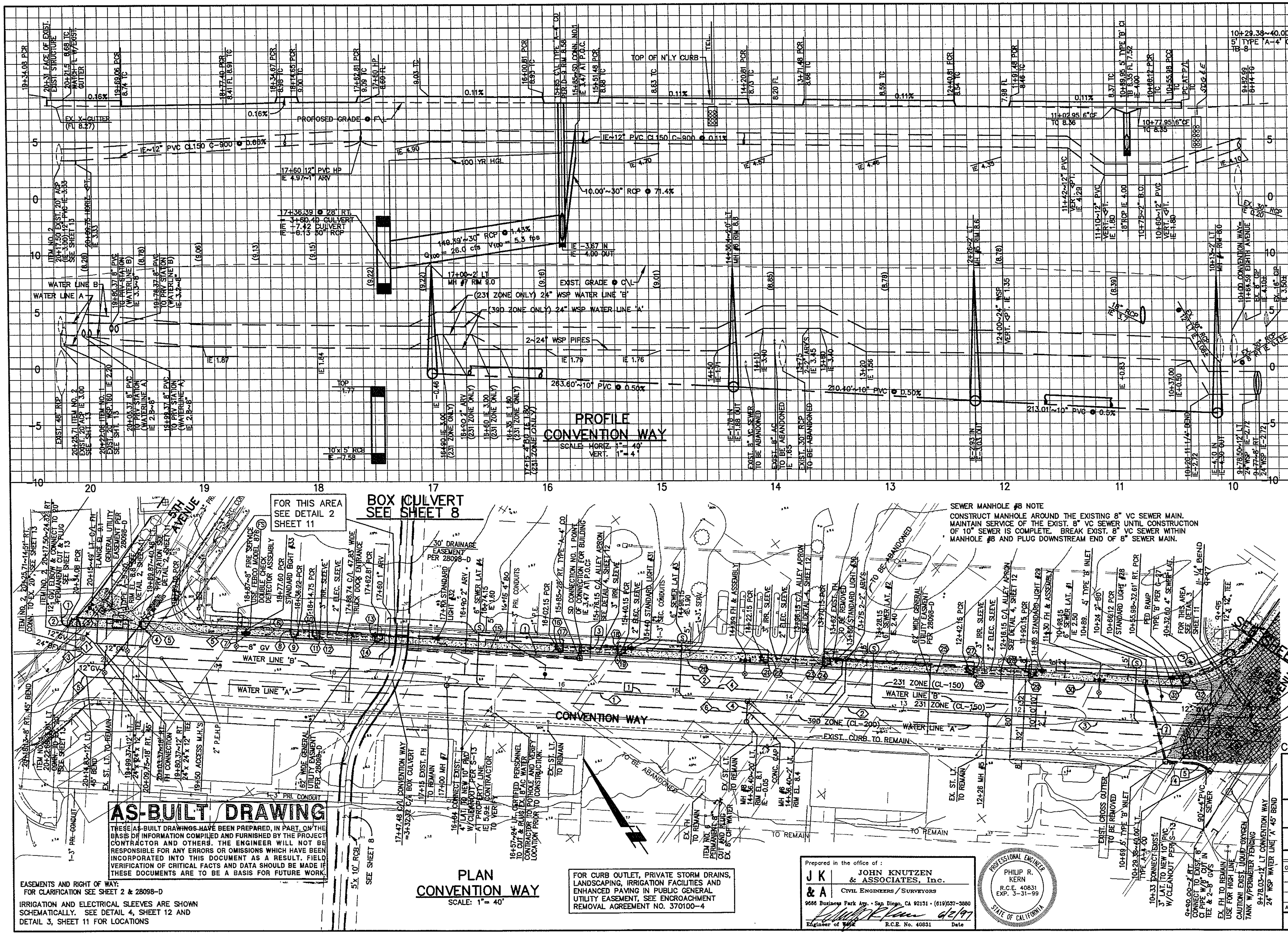
1836-6277
NAD 83 COORDINATES

196-1717
LAMBERT COORDINATES

27750-6-D

AS-BUILT

JN: 1062-94-00
DRAWING: 27750-6.dwg
PLOT DATE: 05-28-97



SEWER MANHOLE #8 NOTE

CONSTRUCT MANHOLE AROUND THE EXISTING 8" VC SEWER MAIN. MAINTAIN SERVICE OF THE EXIST. 8" VC SEWER UNTIL CONSTRUCTION OF 10" SEWER IS COMPLETE. BREAK EXIST. 8" VC SEWER WITHIN MANHOLE #8 AND PLUG DOWNSTREAM END OF 8" SEWER MAIN.

## AS-BUILT DRAWING

THESE AS-BUILT DRAWINGS HAVE BEEN PREPARED, IN PART, ON THE BASIS OF INFORMATION COMPILED AND FURNISHED BY THE PROJECT CONTRACTOR AND OTHERS. THE ENGINEER WILL NOT BE RESPONSIBLE FOR ANY ERRORS OR OMISSIONS WHICH HAVE BEEN INCORPORATED INTO THIS DOCUMENT AS A RESULT. FIELD VERIFICATION OF CRITICAL FACTS AND DATA SHOULD BE MADE IF THESE DOCUMENTS ARE TO BE A BASIS FOR FUTURE WORK.

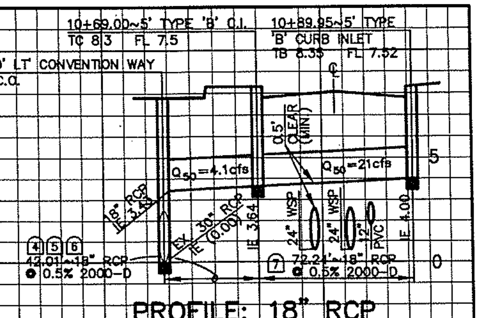
EASEMENTS AND RIGHT OF WAY:
FOR CLARIFICATION SEE SHEET 2 & 28098-D

IRRIGATION AND ELECTRICAL SLEEVES ARE SHOWN SCHEMATICALLY. SEE DETAIL 4, SHEET 12 AND DETAIL 3, SHEET 11 FOR LOCATIONS

FOR CURB OUTLET, PRIVATE STORM DRAINS, LANDSCAPING, IRRIGATION FACILITIES AND ENHANCED PAVING IN PUBLIC GENERAL UTILITY EASEMENT, SEE ENCROACHMENT REMOVAL AGREEMENT NO. 370100-4

Prepared in the office of :
JK&A
JOHN KNUTZEN
& ASSOCIATES, Inc.
CIVIL ENGINEERS / SURVEYORS
9666 Business Park Ave. • San Diego, CA 92131 • (619)537-3880
6/2/97
Engineer of Work R.C.E. No. 40831 Date

PROFESSIONAL ENGINEER
PHILIP R. KERN
R.C.E. 40831
EXP. 3-31-99
STATE OF CALIFORNIA



## PROFILE: 18" RCP @ 10+89.95 EIGHTH AVE

SCALE: HORIZ. 1"= 40'
VERT. 1"= 4'

### CENTERLINE DATA

| NO. | DELTA/BRG | RADIUS | LENGTH | REMARKS |
|---|---|---|---|---|
| 1 | N50°19'08"W | -- | 1023.04' | " " |

### STORM DRAIN DATA

| NO. | DELTA/BRG | RADIUS | LENGTH | REMARKS |
|---|---|---|---|---|
| 1 | N50°19'08"W | -- | 149.39' | 30"RCP 1350-D |
| 2 | NOT USED | -- | -- | -- |
| 3 | N39°40'52"E | -- | 10.00' | 30" RCP 1350-D |
| 4 | N18°35'31"W | -- | 2.67' | 18"RCP 1350-D |
| 5 | 31°43'37" | 22.50' | 12.46' | 18"RCP 1350-D |
| 6 | N50°19'08"W | -- | 21.88' | 18"RCP 1350-D |
| 7 | N21°43'11"E | -- | 67.74' | 18"RCP 1350-D |

### WATER DATA

| NO. | DELTA/BRG | RADIUS | LENGTH | REMARKS |
|---|---|---|---|---|
| 1 | N11°05'06"W | -- | 10.00' | 12" PVC CL-150 |
| 2 | N50°19'08"W | -- | 1026.76' | " " |
| 3 | N09°40'30"W | (CL-150) | 10.00' | 24" WSP (231) |
| 4 | N50°19'08"W | (CL-150) | 1040.71' | " " |
| 5 | N12°03'22"W | (CL-200) | 10.00' | 24" WSP (390) |
| 6 | N50°19'08"W | (CL-200) | 1036.80' | " " |
| 7 | N39°40'52"E | -- | 36.00' | 8" PVC CL-150 |
| 8 | N18°35'31"W | -- | 19.76' | " " |

### SEWER DATA

| NO. | DELTA/BRG | RADIUS | LENGTH | REMARKS |
|---|---|---|---|---|
| 1 | N50°19'08"W | -- | 263.60' | 10" PVC |
| 2 | N50°19'08"W | -- | 210.40' | " " |
| 3 | N50°19'08"W | -- | 213.01' | " " |
| 4 | N39°40'52"E | -- | 17.98' | 8" PVC |

FOR CURB DATA SEE SHEET 13
FOR CONSTRUCTION NOTES SEE SHEET 5

NOTE: CONTRACTOR TO POTHOLE AND VERIFY LOCATION OF ALL EXISTING UTILITIES, STRUCTURES AND GAS MAINS IN PRESENCE OF S.D.G. & E. STANDBY IN AREAS OF UTILITIES CROSSINGS AND OTHER CONFLICTS, PRIOR TO CONSTRUCTION. CONTRACTOR TO ENSURE ALL EXISTING SERVICES NOT BEING ABANDONED ARE KEPT IN SERVICE.

11+88.84~5' RT 8TH AVENUE = 9+82.99~18' RT. CONVENTION WAY
12" PVC 45° BEND W/TB

11+83.26~15' RT 8TH AVENUE = 9+77.42~8' RT. CONVENTION WAY
24" WSP 45° BEND W/TB

10+00 CONVENTION WAY = 11+64.59 EIGHTH AVE.

CITY CONTRACT

PLANS FOR THE IMPROVEMENT OF:
**CONVENTION WAY**
(PORT DISTRICT STREET)
FOR CONVENTION CENTER EXPANSION PROJECT

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING DEPARTMENT
SHEET 7 OF 121 SHEETS

W.O. NO. 370100

M. Kammak
FOR CITY ENGINEER
6/25/97
DATE

| DESCRIPTION | BY | APPROVED | DATE | FILMED |
|---|---|---|---|---|
| ORIGINAL | JK&A | | | DEC 11 98 |
| | | | | |
| | | | | |
| | | | | |
| AS BUILT | MF | M. Fevergy | 2/6/03 | APR 9 03 |

1836-6277
NAD 83 COORDINATES

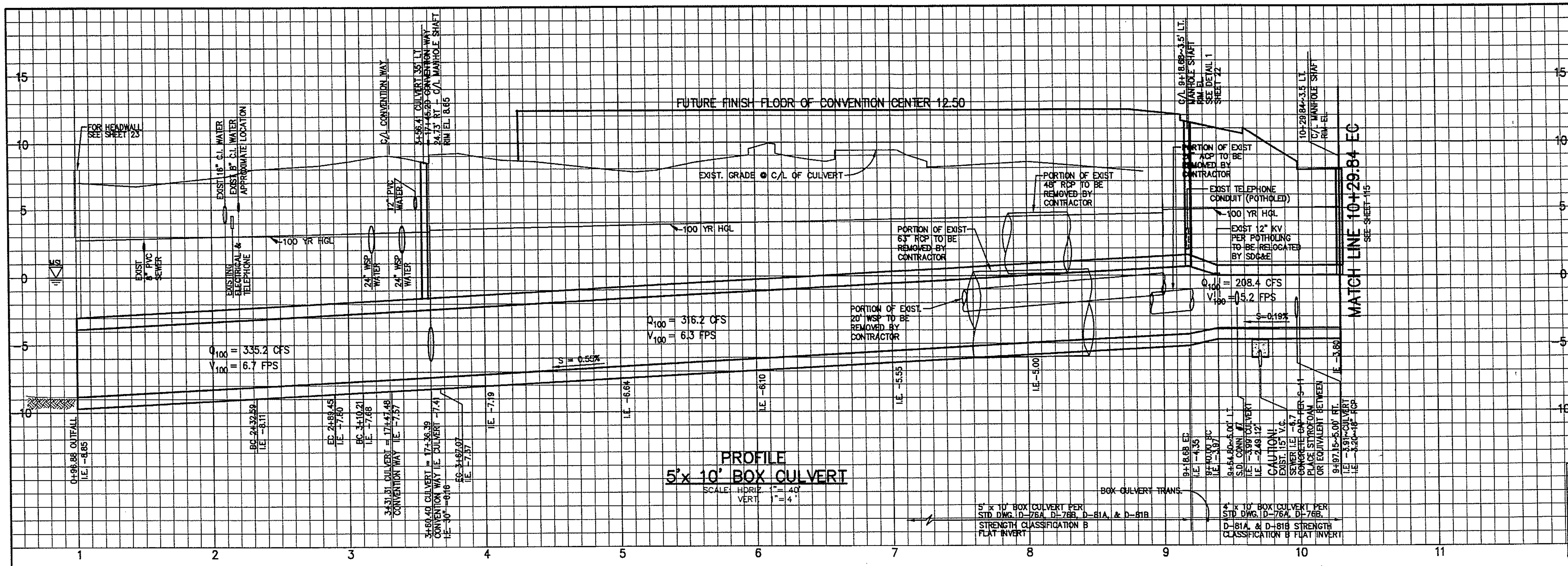
196-1717
LAMBERT COORDINATES

CONTRACTOR Turner Const DATE STARTED 9/15/98
INSPECTOR M. Feverguson DATE COMPLETED 4/9/02

27750-7-D

AS-BUILT

JN: 1062-94-00
DRAWING: 27750-7.dwg
PLOT DATE: 05-28-97



## PROFILE
## 5'x 10' BOX CULVERT

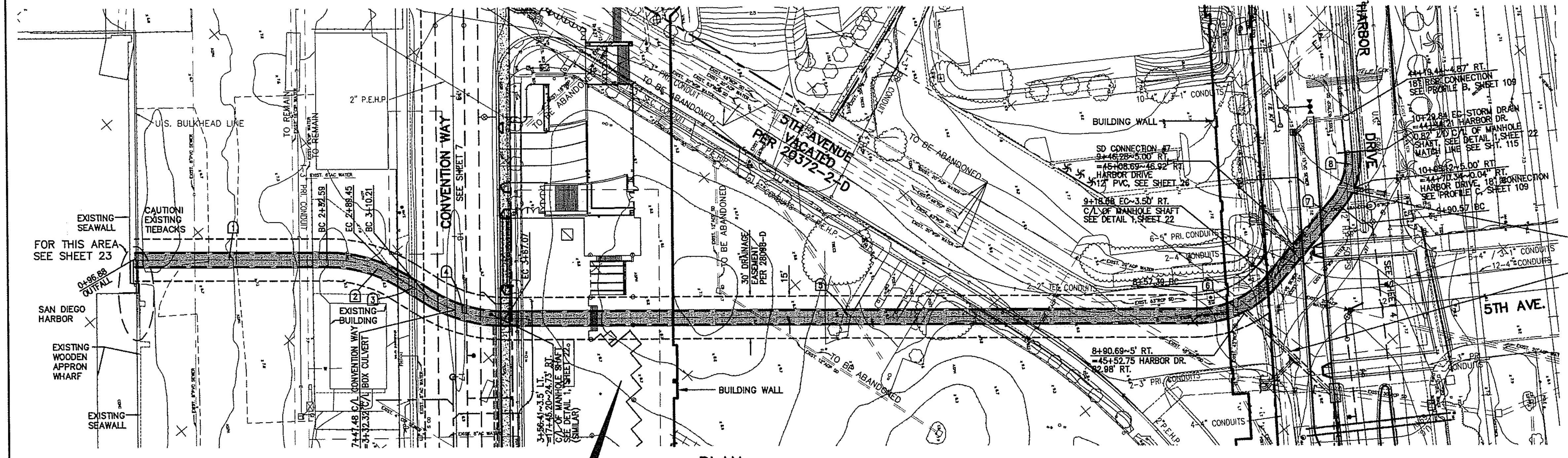
SCALE: HORIZ. 1"= 40'
VERT. 1"= 4'

# AS-BUILT DRAWING

THESE AS-BUILT DRAWINGS HAVE BEEN PREPARED, IN PART, ON THE BASIS OF INFORMATION COMPILED AND FURNISHED BY THE PROJECT CONTRACTOR AND OTHERS. THE ENGINEER WILL NOT BE RESPONSIBLE FOR ANY ERRORS OR OMISSIONS WHICH HAVE BEEN INCORPORATED INTO THIS DOCUMENT AS A RESULT. FIELD VERIFICATION OF CRITICAL FACTS AND DATA SHOULD BE MADE IF THESE DOCUMENTS ARE TO BE A BASIS FOR FUTURE WORK.

### STORM DRAIN DATA

| NO. | DELTA/BRG | RADIUS | LENGTH | REMARKS |
|---|---|---|---|---|
| 1 | N39°40'52"E | --- | 135.71' | 5'x 10' RCB |
| 2 | △= 32°34'42" | 100.00' | 56.86' | " " |
| 3 | N72°15'34"E | --- | 20.76' | " " |
| 4 | △= 32°34'42" | 100.00' | 56.86' | " " |
| 5 | N39°40'52"E | --- | 490.32' | " " |
| 6 | △= 50°09'39" | 70.00' | 61.28' | " " |
| 7 | N10°28'47"W | --- | 71.89' | 4'x 10' RCB |
| 8 | △= 45°00'00" | 50.00' | 39.27' | " " |



FOR STORM DRAIN PLAN & PROFILE SEE SHEET 109

SEE SHEET 22 FOR ADDITIONAL DETAILS AND NOTES

## PLAN
## 5'x 10' BOX CULVERT

SCALE: 1"= 40'

▨ -------INDICATES BOX CULVERT

EASEMENTS AND RIGHT OF WAY:
FOR CLARIFICATION SEE SHEET 2 & 28098-D

FOR BUILDING STRUCTURE IN PUBLIC DRAINAGE EASEMENT, SEE ENCROACHMENT REMOVAL AGREEMENT NO. 370100-5

PHILIP R. KERN
R.C.E. 40831
EXP. 3-31-03

Prepared in the office of :
WINZLER & KELLY
CONSULTING ENGINEERS
9666 Business Park Ave. • San Diego, CA 92131 • (619)537-3880
5/4/99
Engineer of Work R.C.E. No. 40831 Date

CITY CONTRACT
PLANS FOR THE IMPROVEMENT OF:
# FIFTH AVENUE BOX CULVERT
FOR CONVENTION CENTER EXPANSION PROJECT

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING DEPARTMENT
SHEET 108 OF 121 SHEETS

W.O. NO. 370100

5/15/99
FOR CITY ENGINEER DATE

| DESCRIPTION | BY | APPROVED | DATE | FILMED |
|---|---|---|---|---|
| ORIGINAL | JK&A | | | MAY 26 '99 |
| | | | | |
| | | | | |
| | | | | |
| AS BUILT | MF | | 2/11/03 | APR 8 '03 |

CONTRACTOR Turner Const DATE STARTED 8/13/98
INSPECTOR M. Fergerson DATE COMPLETED 4/9/02

1836-6277
NAD 83 COORDINATES

196-1717
LAMBERT COORDINATES

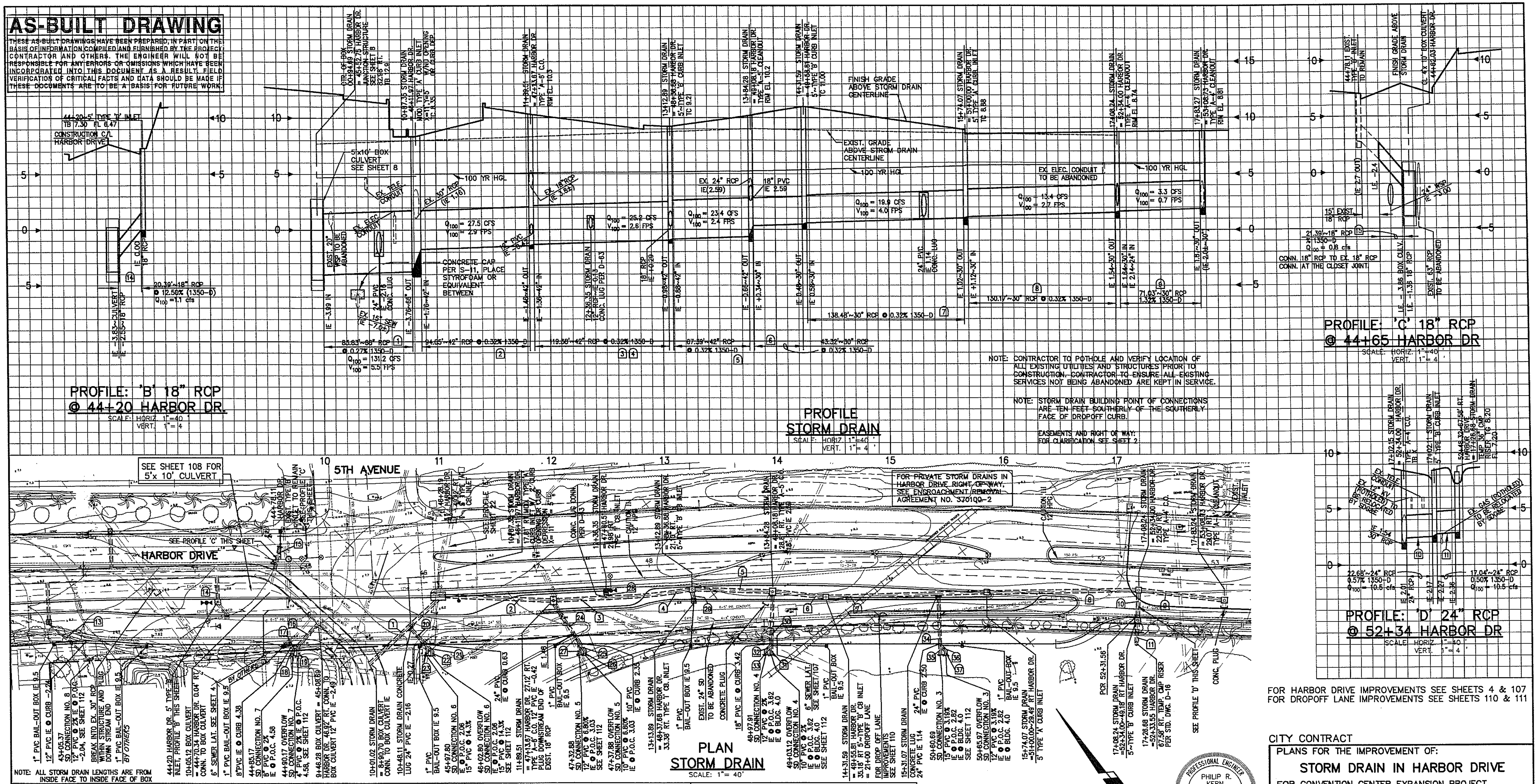
27750-108-D

NEW SHEET AS-BUILT

JN: 1062-94-00
DRAWING: 27750-8.dwg
PLOT DATE: 05-03-99

# AS-BUILT DRAWING

THESE AS-BUILT DRAWINGS HAVE BEEN PREPARED, IN PART, ON THE BASIS OF INFORMATION COMPILED AND FURNISHED BY THE PROJECT CONTRACTOR AND OTHERS. THE ENGINEER WILL NOT BE RESPONSIBLE FOR ANY ERRORS OR OMISSIONS WHICH HAVE BEEN INCORPORATED INTO THIS DOCUMENT AS A RESULT. FIELD VERIFICATION OF CRITICAL FACTS AND DATA SHOULD BE MADE IF THESE DOCUMENTS ARE TO BE A BASIS FOR FUTURE WORK.



NOTE: ALL STORM DRAIN LENGTHS ARE FROM INSIDE FACE TO INSIDE FACE OF BOX

| NO. | DELTA/BRG | RADIUS | LENGTH | REMARKS |
|---|---|---|---|---|
| ① | N83°28'46"E | -- | 83.83' | 66" RCP (1350-D) |
| ② | N50°49'16"W | -- | 94.65' | 42" RCP (1350-D) |
| ③ | N56°23'42"W | -- | 64.23' | 42" RCP (1350-D) |
| ④ | 07°45'47" | 407.05' | 55.15' | " " |
| ⑤ | N51°50'27"W | -- | 67.39' | 30" RCP (1350-D) |
| ⑥ | N47°10'53"W | -- | 43.32' | " " |
| ⑦ | N55°17'12"W | -- | 138.48' | " " |
| ⑧ | N54°34'24"W | -- | 130.17' | " " |
| ⑨ | N46°17'02"W | -- | 71.03' | " " |
| ⑩ | N38°25'11"E | -- | 22.68' | 24" RCP (1350-D) |
| ⑪ | N39°32'20"E | -- | 17.04' | 24"RCP(1350-D)(PVT.) |
| ⑫ | NOT USED | -- | -- | -- |
| ⑬ | ~~N33°36'20"E~~ | -- | ~~63.11'~~ | 12" PVC (PVT.) |
| ⑭ | N34°31'13"E | -- | 20.39' | 18" RCP (1350-D) |
| ⑮ | N49°31'08"E | -- | 21.39' | " " |
| ⑯ | N79°31'13"E | -- | 26.69' | 12" PVC |
| ⑰ | N79°31'13"E | -- | 7.32' | 8" PVC (PVT.) |
| ⑱ | N36°27'10"E | -- | 3.65' | " " |
| ⑲ | N36°27'10"E | -- | 12.45' | 4" PVC (PVT.) |
| ⑳ | N06°31'14"W | -- | 19.85' | 24" PVC (PVT.) |
| ㉑ | N06°31'14"W | -- | 7.34' | 15" PVC (PVT.) |
| ㉒ | N36°27'10"E | -- | 3.65' | " " |
| ㉓ | N36°27'10"E | -- | 9.00' | " " |
| ㉔ | N02°55'06"E | -- | 40.68' | 12" PVC (PVT.) |
| ㉕ | N02°55'06"E | -- | 9.05' | 10" PVC (PVT.) |
| ㉖ | N36°27'10"E | -- | 3.65' | " " |
| ㉗ | N36°27'10"E | -- | 11.20' | 12" PVC (PVT.) |
| ㉘ | N33°36'18"E | -- | 3.71' | 12" RCP (PVT.) |
| ㉙ | N26°44'18"E | -- | 7.60' | 18" RCP (1350-D) |
| ㉚ | N38°11'26"E | -- | 44.93' | 18" PVC (PVT.) |
| ㉛ | N36°27'10"E | -- | 8.65' | 10" PVC (PVT.) |
| ㉜ | N81°27'10"E | -- | 7.07' | 12" PVC (PVT.) |
| ㉝ | N36°27'10"E | -- | 3.65' | " " |
| ㉞ | N34°42'48"E | -- | 44.10' | 24" PVC (PVT.) |
| ㉟ | N36°27'10"E | -- | 8.65' | 15" PVC (PVT.) |
| ㊱ | N08°32'50"W | -- | 7.07' | 12" PVC (PVT.) |
| ㊲ | N36°27'10"E | -- | 3.65' | " " |
| ㊳ | NOT USED | -- | -- | -- |

FOR HARBOR DRIVE IMPROVEMENTS SEE SHEETS 4 & 107
FOR DROPOFF LANE IMPROVEMENTS SEE SHEETS 110 & 111

PHILIP R. KERN
R.C.E. 40831
EXP. 3-31-03

Prepared in the office of :
WINZLER & KELLY
CONSULTING ENGINEERS
9666 Business Park Ave. • San Diego, CA 92131 • (619)537-3880
Philip R Kern 5/14/99
Engineer of Work R.C.E. No. 40831 Date

CITY CONTRACT
PLANS FOR THE IMPROVEMENT OF:
## STORM DRAIN IN HARBOR DRIVE
FOR CONVENTION CENTER EXPANSION PROJECT

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING DEPARTMENT
SHEET 109 OF 121 SHEETS
W.O. NO. 370100

M. Jammak 5/15/99
FOR CITY ENGINEER DATE

| DESCRIPTION | BY | APPROVED | DATE | FILMED |
|---|---|---|---|---|
| ORIGINAL | JK&A | | | MAY 26 '99 |
| | | | | |
| | | | | |
| | | | | |
| AS BUILT | M.F. McTeague | | 2/11/03 | APR 9 '03 |

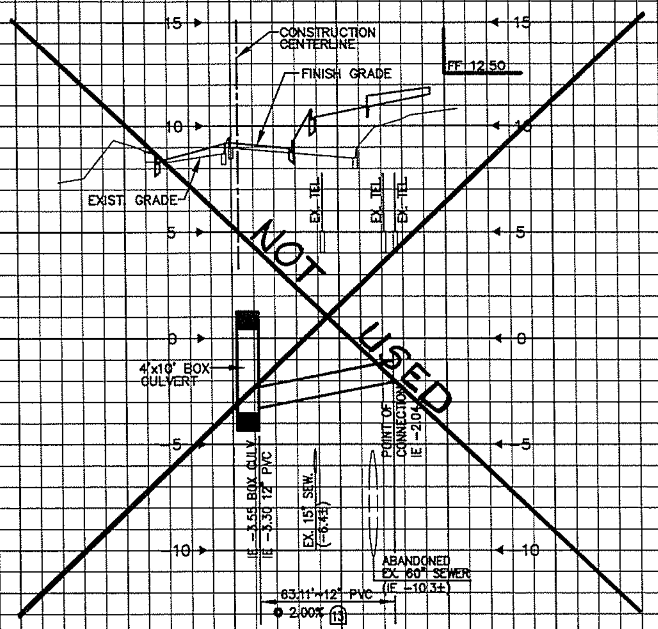
1836-6277
NAD 83 COORDINATES
196-1717
LAMBERT COORDINATES

CONTRACTOR Tucker Const. DATE STARTED 8/15/98
INSPECTOR M. Feverinow DATE COMPLETED 4/9/02

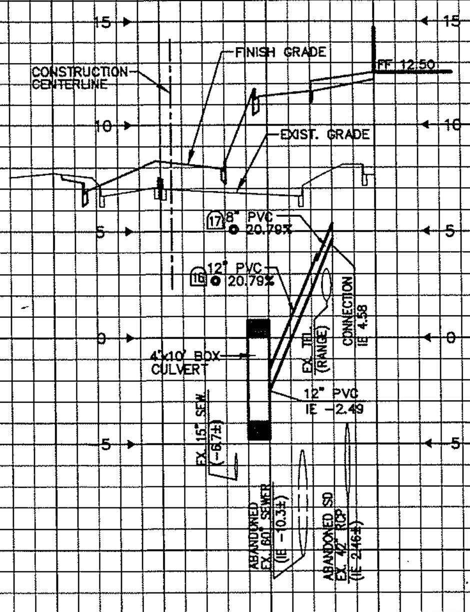
27750-109-D

NEW SHEET AS-BUILT

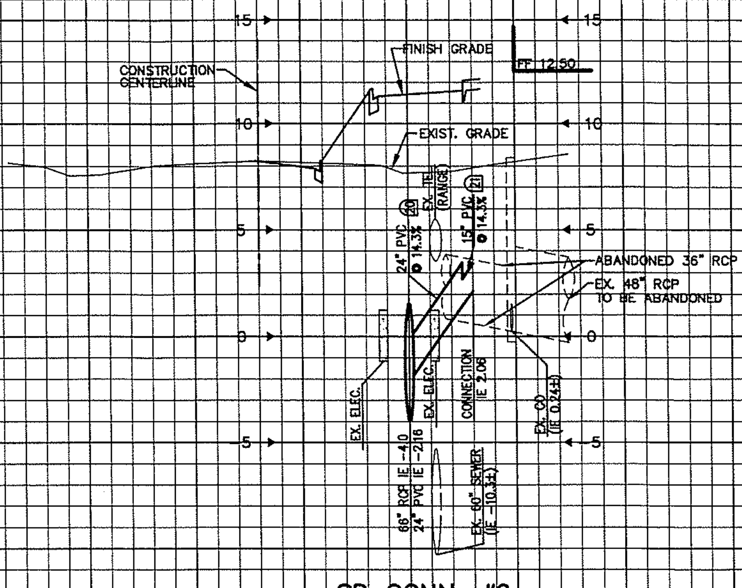
JN: 1062-94-00
DRAWING: 27750-9.dwg
PLOT DATE: 05-03-99



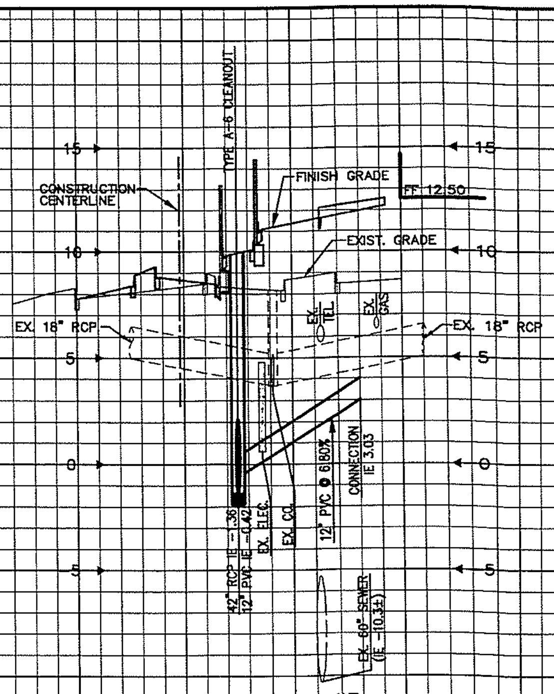
SD CONN. #8
@ 43+05±
SCALE: HORIZ. 1"= 40'
VERT. 1"= 4'
FOR PLAN SEE SHT. 9



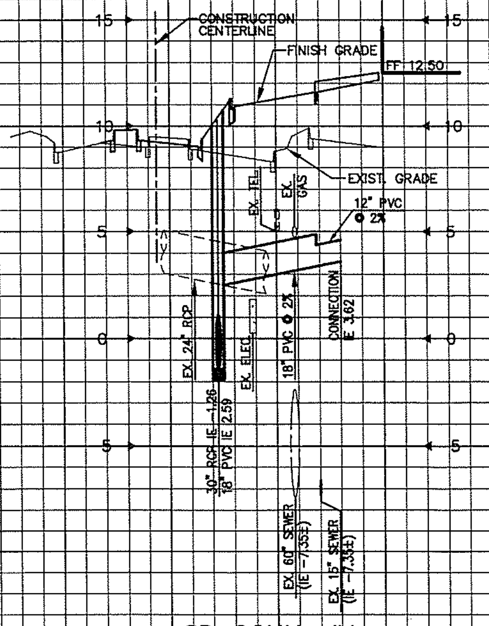
SD CONN. #7
@ 44+90±
SCALE: HORIZ. 1"= 40'
VERT. 1"= 4'
FOR PLAN SEE SHT. 9



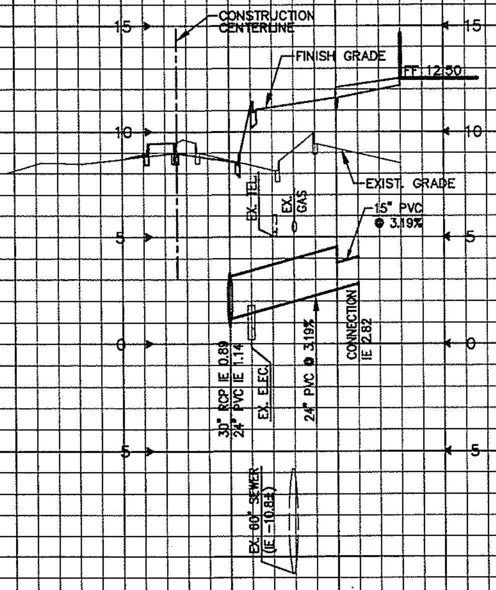
SD CONN. #6
@ 45+97±
SCALE: HORIZ. 1"= 40'
VERT. 1"= 4'
FOR PLAN SEE SHT. 9



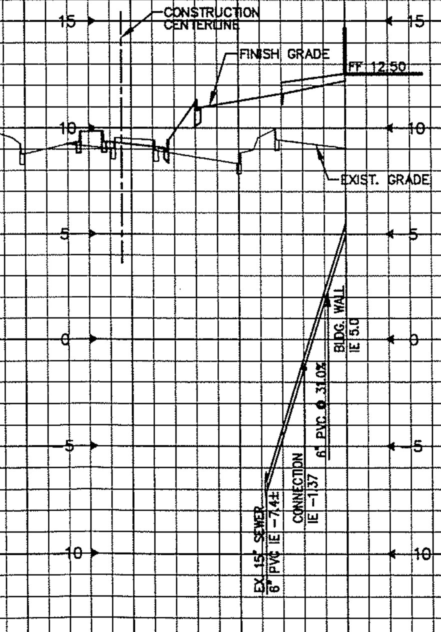
SD CONN. #5
@ 47+32±
SCALE: HORIZ. 1"= 40'
VERT. 1"= 4'



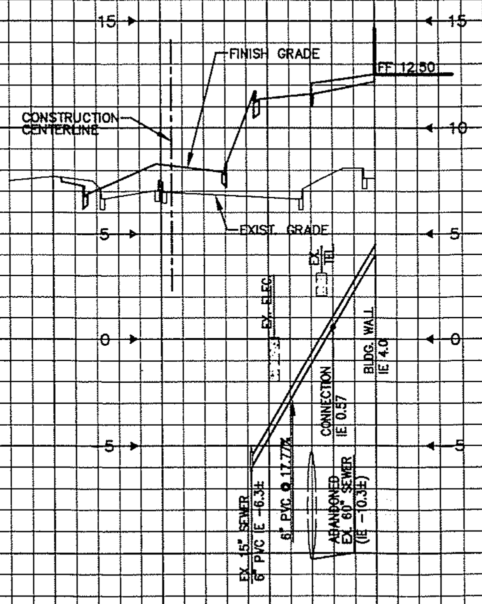
SD CONN. #4
@ 49+03±
SCALE: HORIZ. 1"= 40'
VERT. 1"= 4'



SD CONN. #3
@ 50+60±
SCALE: HORIZ. 1"= 40'
VERT. 1"= 4'



SEWER LATERAL #5
@ 49+11±
SCALE: HORIZ. 1"= 40'
VERT. 1"= 4'



SEWER LATERAL #6
@ 44+60±
SCALE: HORIZ. 1"= 40'
VERT. 1"= 4'

SEE SHEETS 4,107 & 109 FOR LOCATIONS

## AS-BUILT DRAWING

THESE AS-BUILT DRAWINGS HAVE BEEN PREPARED, IN PART, ON THE BASIS OF INFORMATION COMPILED AND FURNISHED BY THE PROJECT CONTRACTOR AND OTHERS. THE ENGINEER WILL NOT BE RESPONSIBLE FOR ANY ERRORS OR OMISSIONS WHICH HAVE BEEN INCORPORATED INTO THIS DOCUMENT AS A RESULT. FIELD VERIFICATION OF CRITICAL FACTS AND DATA SHOULD BE MADE IF THESE DOCUMENTS ARE TO BE A BASIS FOR FUTURE WORK.

FOR ENHANCED PAVING, PRIVATE RETAINING WALLS, LANDSCAPING, IRRIGATION FACILITIES, PRIVATE SIGNAGE AND PRIVATE STREET LIGHTING IN HARBOR DRIVE RIGHT OF WAY, SEE ENCROACHMENT REMOVAL AGREEMENT NO. 370100-2

PHILIP R.
KERN
R.C.E. 40831
EXP. 3-31-03

Prepared in the office of :
WINZLER & KELLY
CONSULTING ENGINEERS
9666 Business Park Ave. • San Diego, CA 92131 • (619)537-3880
Philip R Kern 5/4/99
Engineer of Work R.C.E. No. 40831 Date

CITY CONTRACT

PLANS FOR THE IMPROVEMENT OF:
PRIVATE STORM DRAIN
AND SEWER LATERAL PROFILES
FOR CONVENTION CENTER EXPANSION PROJECT

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING DEPARTMENT
SHEET 112 OF 121 SHEETS

W.O. NO. 370100

FOR CITY ENGINEER 5/15/99 DATE

| DESCRIPTION | BY | APPROVED | DATE | FILMED |
|---|---|---|---|---|
| ORIGINAL | JK&A | | | MAY 06 99 |
| | | | | |
| | | | | |
| | | | | |
| AS BUILT | M F McFargen | | 2/11/03 | APR 0 03 |

CONTRACTOR Tanner Const DATE STARTED 8/15/98
INSPECTOR M. Peluergou DATE COMPLETED 4/9/02

1836-6277
1836-6277
196-1717
196-1717
27750-112-D

NEW SHEET AS-BUILT

JN: 1062-94-00
DRAWING: 27750-26.dwg
PLOT DATE: 05-03-99

## EASEMENT TABLE

| | |
|---|---|
| AA | SDG&E CO. ELECTRICAL EASEMENT, ADJACENT TO 8TH AVENUE WITH PARCEL 2 DELINEATED AS "EASEMENT NO. 12" ON SDUPD DRAWING NO. 019-044, DATED OCT. 11, 2005 |
| BB | EASEMENT FOR SDUPD / PUBLIC ACCESS, UTILITIES, LANDSCAPING, AND SIGNAGE OVER THE ENTIRE ABOVE DESCRIBED PARCEL NO. 2 DELINEATED AS "EASEMENT NO. 7" ON SDUPD DRAWING NO. 019-044, DATED OCT. 11, 2005 |
| CC | LANDSCAPING EASEMENT WITHIN PARCELS 1 AND 2, 12 FEET IN WIDTH, ADJACENT TO 8TH AVENUE DELINEATED AS "EASEMENT NO. 5" ON SDUPD DRAWING NO. 019-044, DATED OCT. 11, 2005 |
| DD | VIEW CORRIDOR EASEMENT, 120 FEET IN WIDTH ACROSS PARCELS 1 AND 2, CENTERED ON THE PROLONGATION OF THE CENTER LINE OF PARK BOULEVARD EXTENDING TO THE SAN DIEGO BAY DELINEATED AS "EASEMENT NO. 8" ON SDUPD DRAWING NO. 019-044, DATED OCT. 11, 2005 |
| EE | PUBLIC PEDESTRIAN ACCESS EASEMENT, 20 FEET IN WIDTH, WITHIN PARCELS 1 AND 2 ADJACENT TO THE ABOVE DESCRIBED LANDING EASEMENT, DELINEATED AS "EASEMENT NO. 6" ON SDUPD DRAWING NO. 019-044, DATED OCT. 11, 2005 |
| FF | PUBLIC PEDESTRIAN AND LANDSCAPING EASEMENT IN THE NORTHWESTERLY PORTION OF PARCEL NO. 1 ALONG CONVENTION WAY DELINEATED AS "EASEMENT NO. 4" ON SDUPD DRAWING NO. 019-044, DATED OCT. 11, 2005 |
| GG | WATER EASEMENT, 15 FEET IN WIDTH, IN THE NORTHERLY PORTION OF PARCEL NO. 1 DELINEATED AS "EASEMENT NO. 3" ON SDUPD DRAWING NO. 019-044, DATED OCT. 11, 2005 |
| HH | WATER EASEMENT 30 FEET IN WIDTH IN THE NORTHWESTERLY PORTION OF PARCEL NO. 1 DELINEATED AS "EASEMENT NO. 2" ON SDUPD DRAWING NO. 019-044, DATED OCT. 11, 2005 |
| II | GENERAL UTILITY EASEMENT AT THE CORNER OF 8TH AVENUE AND HARBOR DRIVE DELINEATED AS "EASEMENT NO. 1" ON SDUPD DRAWING NO. 019-044, DATED OCT. 11, 2005 |
| JJ | 36 FOOT PUBLIC PEDESTRIAN ACCESS EASEMENT ALONG THE SOUTHEASTERLY LINE OF PARCEL NO. 1 ADJACENT TO SAN DIEGO BAY DELINEATED AS "EASEMENT NO. 13" ON SDUPD DRAWING NO. 019-044, DATED OCT. 11, 2005 |

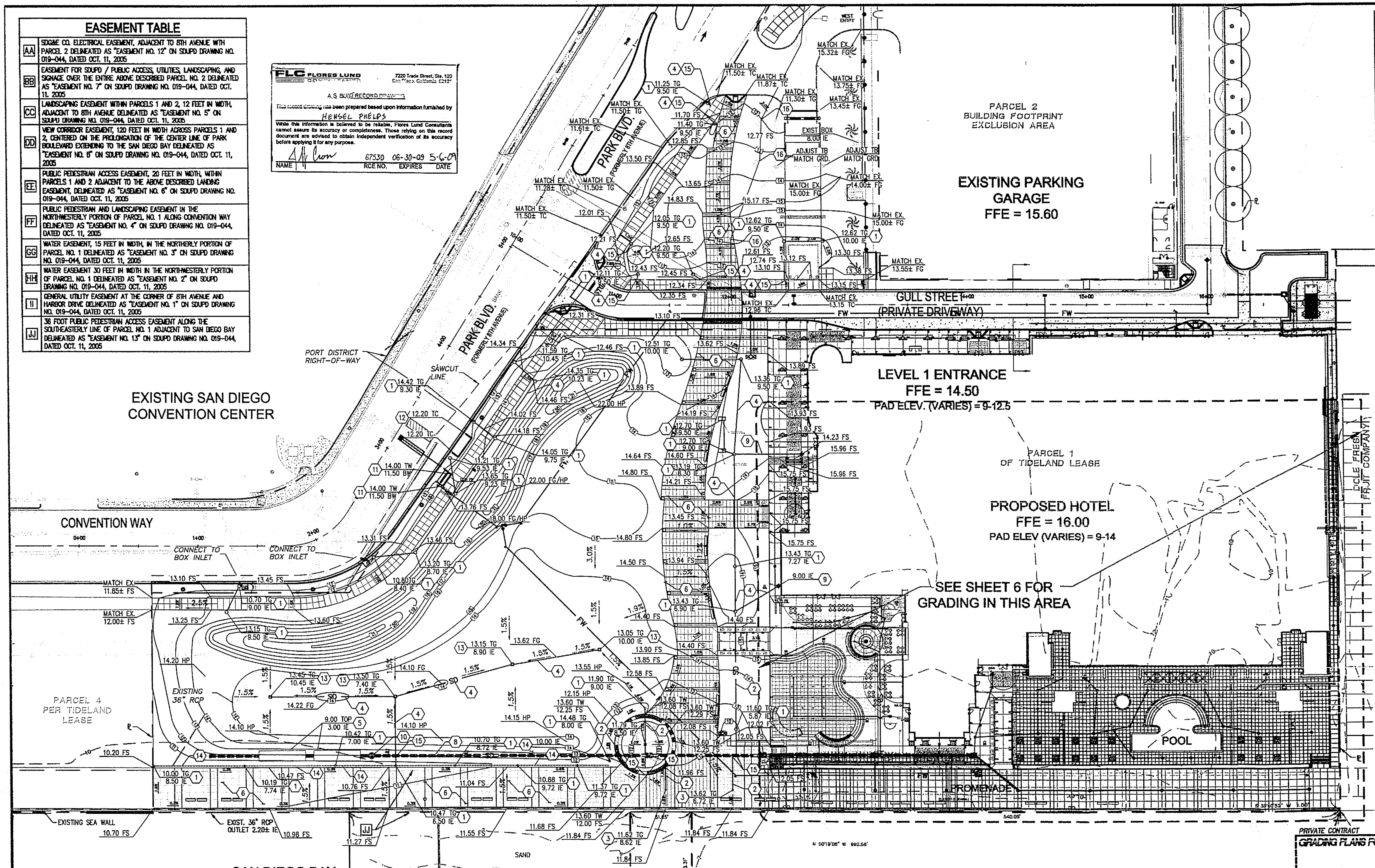
**FLC FLORES LUND CONSULTANTS**
7220 Trade Street, Ste. 120
San Diego, California 92121

AS BUILT RECORD DRAWING

This record drawing has been prepared based upon information furnished by
HENSEL PHELPS

While this information is believed to be reliable, Flores Lund Consultants cannot assure its accuracy or completeness. Those relying on this record document are advised to obtain independent verification of its accuracy before applying it for any purpose.

| NAME | RCE NO. | EXPIRES | DATE |
|---|---|---|---|
| J R Cross | 67530 | 06-30-09 | 5-6-09 |



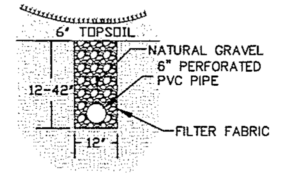
FOR PRIVATE STORM DRAIN, LANDSCAPING, IRRAGATIONS LOCATED WITHIN PUBLIC EASEMENT SEE EMRA APPROVAL #376862

NO WORK ALLOWED OFFSITE UNLESS A LETTER OF PERMISSION IS OBTAINED. SEE LETTER DATED

J R Cross
NAME R.C.E. NO. 67530 EXP. 06-30-07

9-5-06
DATE

JEFF R. CROSS NO. 67530 Expires 6/30/2007 CIVIL



6" PERFORATED PIPE DRAIN (FRENCH DRAIN) DETAIL

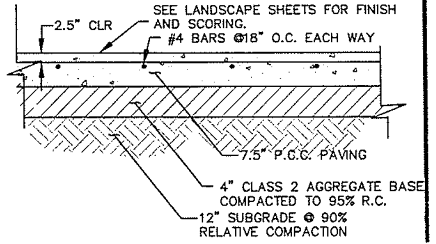
## GENERAL NOTES

| | |
|---|---|
| 1. | THE CONTRACTOR SHALL RETAIN PRIVATE UTILITY LOCATOR SERVICE PRIOR TO STARTING WORK AND SHALL ARRANGE FOR AND COORDINATE SHUT DOWN, DISCONNECTION AND CAPPING OF EXISTING UTILITIES WITH THE APPROPRIATE UTILITY OWNERS PRIOR TO COMMENCING THE WORK. |
| 2. | THE LOCATION AND EXISTENCE OF EXISTING UNDERGROUND FACILITIES SHOWN ON THE DRAWINGS WERE OBTAINED FROM A SEARCH OF AVAILABLE RECORD DRAWINGS. THE CONTRACTOR SHALL TAKE PRECAUTIONARY MEASURES TO PROTECT ANY EXISTING FACILITY SHOWN ON THE DRAWINGS, AND ANY OTHER WHICH IS NOT OF RECORD OR NOT SHOWN ON THE DRAWINGS. THE CONTRACTOR SHALL POTHOLE EXISTING UTILITIES AT POINTS OF CONNECTION AND ALL UTILITY CROSSINGS TO DETERMINE EXACT LOCATION PRIOR TO STARTING WORK. |
| 3. | REFER TO SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS. |
| 4. | COORDINATE LOCATION OF ALL UNDERGROUND UTILITIES AND STORM DRAINS WITH TREE LOCATIONS AND MECHANICAL / ELECTRICAL FACILITIES. REFER TO LANDSCAPE, PLUMBING AND ELECTRICAL DRAWINGS FOR ADDITIONAL INFORMATION. |

## GRADING / DRAINAGE KEY NOTES

| | |
|---|---|
| 1 | INSTALL 12" GRATE AND CATCH BASIN. (PVT) |
| 2 | INSTALL 12" PVC SDR-35 STORM DRAIN PIPE. (PVT) |
| 3 | INSTALL 12" HEAVY DUTY DRAIN WITH TRACTOR GRATE BY JR SMITH (MODEL 2140 HP-NB-G) (PVT) |
| 4 | INSTALL 8" PVC SDR-35 STORM DRAIN PIPE. (PVT) |
| 5 | INSTALL 40'X10'X6' PRECAST CONCRETE BOX (DETENTION BASINS FOR STORM WATER). (PVT) ADJUST MANHOLES TO NEW FINISH GRADE. |
| 6 | INSTALL ENHANCED PAVING PER DETAIL BELOW, SEE LANDSCAPE SHEETS FOR FINISH |
| 7 | STORM DRAIN POINT OF CONNECTION SEE PLUMBING DRAWINGS FOR CONTINUATION INSIDE BUILDING. |
| 8 | INSTALL 24" HDPE (BLUE SEAL WATERTIGHT BY HANCOR OR EQUAL) STORM DRAIN (PVT). |
| 9 | INSTALL 6" OUTLET ORIFACE WITH TIDEFLEX BACKFLOW PROTECTOR. |
| 10 | INSTALL CDS HYDRODYNAMIC SEPERATOR UNIT (MODEL PMSU 20_20). ADJUST MANHOLES TO NEW FINISH GRADE AT SURFACE. |
| 11 | INSTALL 2.5' HIGH RETAINING WALL PER CITY OF SAN DIEGO INFORMATION BULLETIN 221. |
| 12 | INSTALL 8" HIGH CONCRETE CURB PER SDRSD G-1. |
| 13 | INSTALL 18" GRATE AND CATCH BASIN. (PVT) |
| 14 | INSTALL 6" PERFORATED PVC FRENCH DRAIN PER DETAIL BELOW. |
| 15 | CONNECT STORM DRAIN LINE INTO 24 INCH STORM DRAIN. |

## PROMENADE/VIEW CORRIDOR PAVING DETAIL



NOTE: FINAL PAVING SECTION SHALL BE BASED ON ADDITIONAL R-VALUE TESTING AT FINE GRADING.

GRAPHIC SCALE
40 0 40 80
( IN FEET )
1 INCH = 40 FT

**FLC FLORES LUND CONSULTANTS**
PROFESSIONAL ENGINEERS
7220 TRADE STREET, SUITE 120, SAN DIEGO, CALIFORNIA 92121
(858) 566-0626 FAX (858) 566-0627

| | |
|---|---|
| DATE: | 08/31/06 |
| FLC PROJECT NO. | C0407 |
| DESIGN BY: | JRC |
| DRAWN BY: | JCC |
| REVIEWED BY: | WRL |

PRIVATE CONTRACT
GRADING PLANS FOR

# HILTON SAN DIEGO CONVENTION CENTER HOTEL

CITY OF SAN DIEGO, CALIFORNIA
DEVELOPMENT SERVICES DEPARTMENT
SHEET 5 OF 21 SHEETS

W.O. NO. 425983
P.T.S NO. 95181

FOR CITY ENGINEER 9/14/06 DATE

V.T.M.

| DESCRIPTION | BY | APPROVED | DATE | FILMED |
|---|---|---|---|---|
| ORIGINAL | FLC | | | SEP 28 '06 |
| | | | | |
| | | | | |
| | | | | |
| AS-BUILTS | FLC | | 5/11/09 | JUN 8 09 |

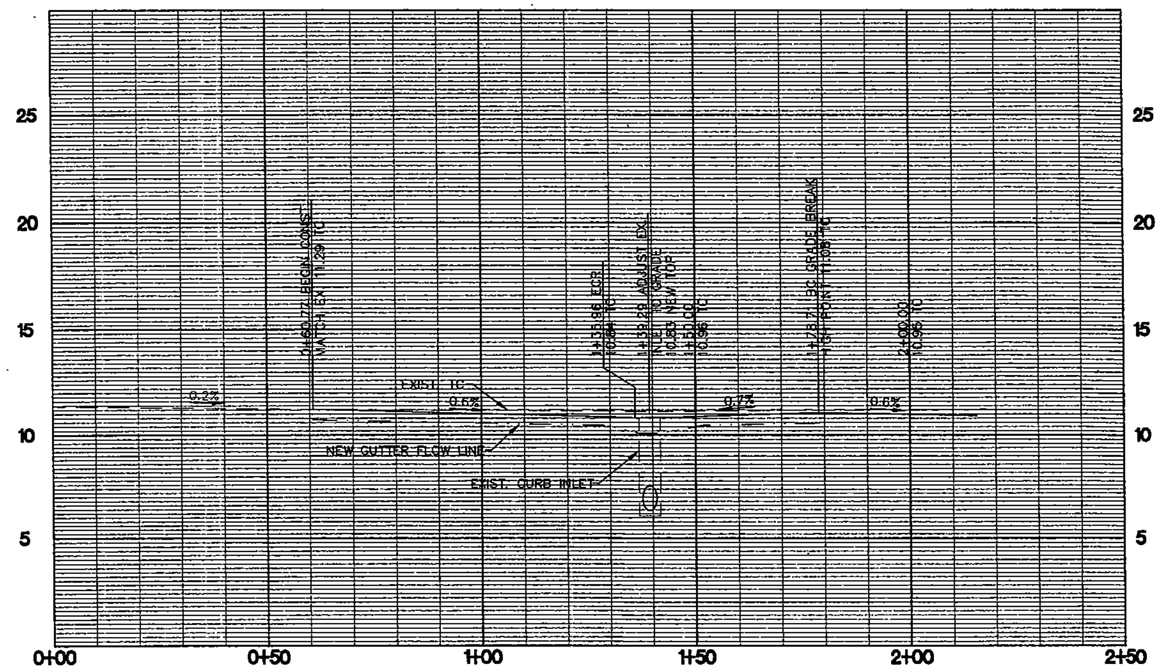
1836-6279 NAD83 COORDINATES

196-1719 LAMBERT COORDINATES

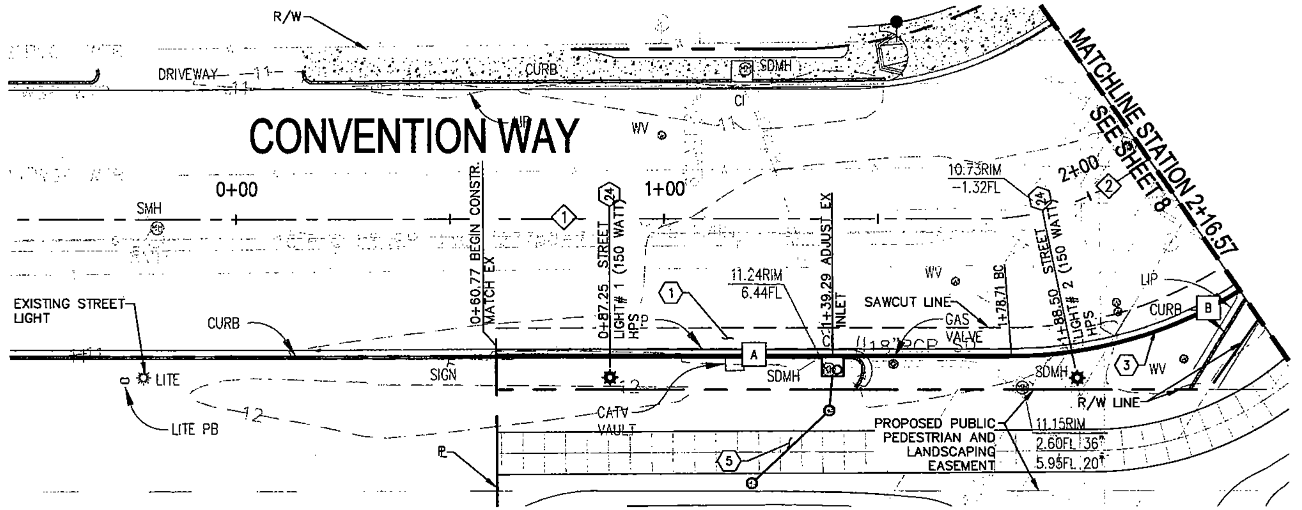
CONTRACTOR HENSEL PHELPS DATE STARTED 9-19-06
INSPECTOR MANUEL GONZALEZ DATE COMPLETED 4-23-09

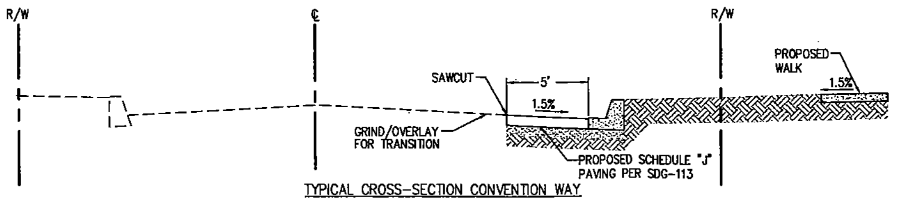
33970- 5 -D

AS BUILT



**PROFILE**
**CONVENTION WAY**
SCALE: HORIZONTAL: 1" = 20'
VERTICAL: 1" = 4'





TYPICAL CROSS-SECTION CONVENTION WAY

NAME Jeff R. Cross R.C.E. NO. 67530 EXP. 06-30-07 9-5-06 DATE

## CURB DATA TABLE

| SYMBOL | BEARING OR DELTA | DISTANCE (FT.) | RADIUS (FT.) | SPECIFICATION |
|---|---|---|---|---|
| A | S50°15'04"E | 120.12 | – | TYPE G (SDRSD G-2) |
| B | 23°15'04" | 95.70 | 100 | TYPE G (SDRSD G-2) |

## CENTERLINE DATA TABLE

| SYMBOL | BEARING OR DELTA | DISTANCE (FT.) | RADIUS (FT.) | STREET NAME |
|---|---|---|---|---|
| 1 | S50°19'08"E | 174.61 | – | CONVENTION WAY |
| 2 | 23°19'08" | 61.02 | 60 | CONVENTION WAY |

## GENERAL NOTES

1. THE CONTRACTOR SHALL NOTIFY DIGALERT (1-800-227-2600) AT LEAST TWO DAYS PRIOR TO STARTING WORK AND SHALL ARRANGE FOR AND COORDINATE SHUT DOWN, DISCONNECTION AND CAPPING OF EXISTING UTILITIES WITH THE APPROPRIATE UTILITY OWNERS PRIOR TO COMMENCING THE WORK.
2. PROTECT IN PLACE ALL EXISTING IMPROVEMENTS, STRUCTURES AND UNDERGROUND UTILITIES WHICH ARE TO REMAIN. MAINTAIN UTILITY SERVICES TO ALL EXISTING FACILITIES AT ALL TIMES, UNLESS OTHERWISE SPECIFIED.
3. THE LOCATION AND EXISTENCE OF EXISTING UNDERGROUND FACILITIES SHOWN ON THE DRAWINGS WERE OBTAINED FROM A SEARCH OF AVAILABLE RECORD DRAWINGS. THE CONTRACTOR SHALL POTHOLE EXISTING UTILITIES AT POINTS OF CONNECTIONS AND ALL UTILITY CROSSINGS TO DETERMINE EXACT LOCATION PRIOR TO STARTING ANY WORK.
4. COORDINATE LOCATION OF ALL UNDERGROUND UTILITIES AND STORM DRAINS WITH NEW TREE LOCATIONS, MECHANICAL/ELECTRICAL FACILITIES, AND OTHER INSTALLATIONS. REFER TO LANDSCAPE, PLUMBING, ARCHITECTURAL AND ELECTRICAL DRAWINGS FOR ADDITIONAL INFORMATION.
5. ALL EXISTING "DRY" UTILITIES SHOWN HEREON ARE FOR INFORMATION PURPOSES ONLY. REFER TO ELECTRICAL PLANS AND APPROPRIATE UTILITY COMPANY PLANS FOR ANY WORK ON OR WITH THESE UTILITIES.
6. REFER TO SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.

## KEY NOTES

| | |
|---|---|
| 1 | INSTALL SCHEDULE "J" PAVING, PER SDSD SDG-113. |
| 3 | INSTALL PCC CURB PER CURB DATA TABLE ABOVE.<br>PAINT CURB RED ALONG PARK BLVD AND CONVENTION WAY. |
| 21 | INSTALL PED RAMP PER SDG-135.. |
| 24 | INSTALL 12' HIGH TYPE C (ACORN) STREET LIGHT PER LIGHTING AND ELECTRICAL PLANS. |

FOR UTILITY PLAN SEE SHEET 10

THE PRIVATE WATER SYSTEM IS DESIGNED IN ACCORDANCE WITH THE CALIFORNIA PLUMBING CODE AND IS SHOWN ON THESE PLANS AS 'INFORMATION ONLY.'
A SEPARATE PLUMBING PERMIT IS REQUIRED FOR CONSTRUCTION AND INSPECTION OF THE SYSTEM.

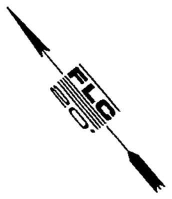
ALL PLANS FOR PRIVATE FIRE SERVICE MAINS AND PRIVATE FIRE HYDRANTS MUST BE SUBMITTED SEPARATELY TO FIRE PLAN CHECK FOR APPROVAL PRIOR TO INSTALLATION.
ALL PRIVATE FIRE SYSTEMS WILL BE DESIGNED IN ACCORDANCE WITH CALIFORNIA BUILDING CODE; CALIFORNIA FIRE CODE; AND NFPA 24, PRIVATE FIRE SERVICE MAINS AND THEIR APPURTENANCES. PLANS SHALL BE SINGLE LINE DRAWINGS SHOWING ALL OF THE APPLICABLE REQUIREMENTS OF CODES SPECIFIED ABOVE.

FLC FLORES LUND CONSULTANTS
7220 Trade Street, Ste. 120
San Diego, California 92121

"AS-BUILT" RECORD DRAWING

This record drawing has been prepared based upon information furnished by HENSEL PHELPS
While this information is believed to be reliable, Flores Lund Consultants cannot assure its accuracy or completeness. Those relying on this record document are advised to obtain independent verification of its accuracy before applying it for any purpose.

NAME Jeff R. Cross RCE NO. 67530 EXPIRES 06-30-09 DATE 5-6-09



GRAPHIC SCALE
20 0 20 40
( IN FEET )
1 INCH = 20 FT

PRIVATE CONTRACT

IMPROVEMENT PLANS FOR:
HILTON SAN DIEGO
CONVENTION CENTER HOTEL
CONVENTION WAY STA: 0+00 TO STA: 2+16.57

FLC FLORES LUND CONSULTANTS
PROFESSIONAL ENGINEERS
7220 TRADE STREET, SUITE 120, SAN DIEGO, CALIFORNIA 92121
(858) 566-0626 FAX (858) 566-0627

| | |
|---|---|
| DATE: | 08/31/06 |
| FLC PROJECT NO. | C0407 |
| DESIGN BY: | JRC |
| DRAWN BY: | JCC |
| REVIEWED BY: | WRL |

JEFF R. CROSS NO. 67530 Expires 6/30/2007 CIVIL

CITY OF SAN DIEGO, CALIFORNIA
DEVELOPMENT SERVICES DEPARTMENT
SHEET 7 OF 21 SHEETS

FOR CITY ENGINEER 9/14/06 DATE

W.O. NO. 425983
P.T.S NO. 95181
V.T.M.

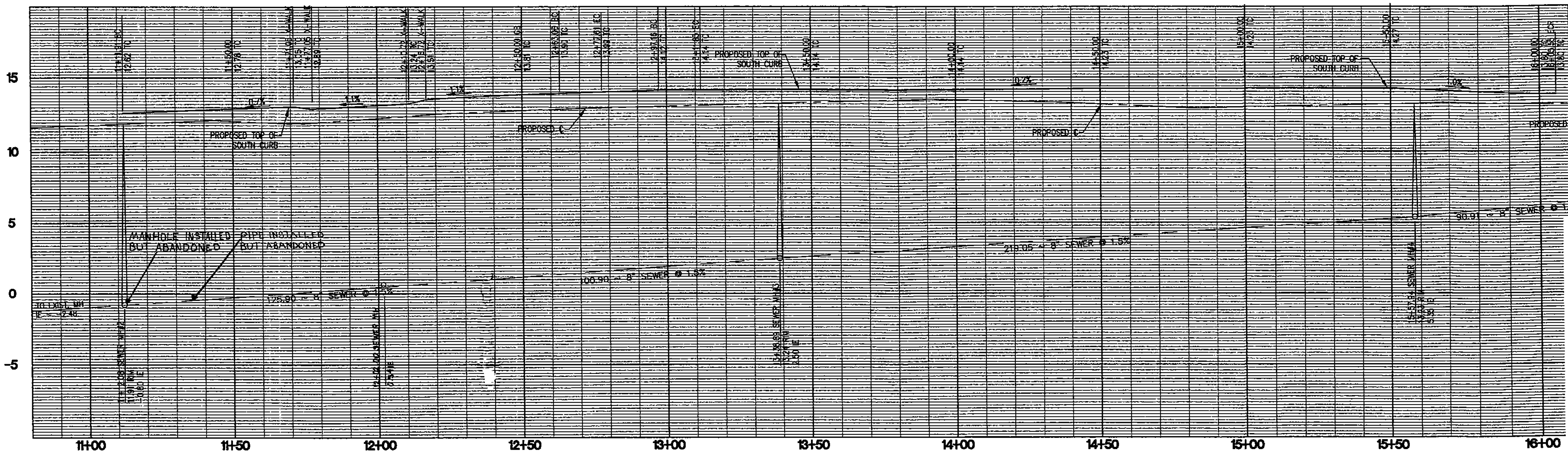
| DESCRIPTION | BY | APPROVED | DATE | FILMED |
|---|---|---|---|---|
| ORIGINAL | FLC | | | SEP 28 '06 |
| | | | | |
| | | | | |
| | | | | |
| AS-BUILTS | FLC | M.L.G. | 5/11/09 | JUN 9 '09 |

1836-6279
NAD83 COORDINATES
196-1719
LAMBERT COORDINATES

CONTRACTOR HENSEL PHELPS DATE STARTED 9-19-06
INSPECTOR MANUEL GONZALEZ DATE COMPLETED 4-23-09

33970- 7 -D

**AS-BUILT**



## KEY NOTES

| | |
|---|---|
| ⟨1⟩ | INSTALL ASPHALT CONCRETE PAVING PER DETAIL BELOW. |
| ⟨3⟩ | INSTALL PCC CURB & GUTTER PER SDRSD G-2 (TYPE G). |
| ⟨4⟩ | INSTALL CONCRETE PAVING PER SDRSD SDG-113. |
| ⟨5⟩ | INSTALL 10" PVC SDR-35 STORM DRAIN PIPE. |
| ⟨8⟩ | INSTALL SEWER MANHOLE PER SDRSD S-2. |
| ⟨9⟩ | INSTALL 18" RCP (D-1350 LOADING) STORM DRAIN. |
| ⟨10⟩ | INSTALL CONCRETE LUG CONNECTION PER SDRSD D-63. |
| ⟨11⟩ | INSTALL 8" PVC C-900 CLASS 200 FIRE WATER LINE. (PRIVATE BY SEPARATE PERMIT) |
| ⟨12⟩ | PIPE BEDDING AND TRENCH BACKFILL FOR ALL WATER LINES PER SDRSD W-21. |
| ⟨13⟩ | INSTALL 8" PVC (CLASS 200) DOMESTIC WATER PIPE. (PRIVATE BY SEPARATE PERMIT) |
| ⟨14⟩ | INSTALL 8" PVC SDR-35 SEWER LINE @ 2% MIN. SLOPE. (PRIVATE) |
| ⟨15⟩ | PIPE BEDDING AND TRENCH BACKFILL FOR ALL SEWER LINES PER SDRSD S-4A. |
| ⟨16⟩ | INSTALL 8" G.V. WITH VALVE BOX AND COVER. (PRIVATE BY SEPARATE PERMIT) |
| ⟨17⟩ | INSTALL CURB INLET PER SDRSD D-1, TYPE A MODIFIED, Y=4' AND SECTION A-A WIDTH MODIFIED TO 7.3 FEET. |
| ⟨18⟩ | INSTALL STORM DRAIN CLEANOUT (TYPE A4) PER SDRSD D-9. |
| ⟨19⟩ | INSTALL PCC CROSS GUTTER PER SDRSD G-13. |
| ⟨20⟩ | INSTALL DRIVEWAY PER SDRSD G-14D (W/O GUTTER). ADD 2' WIDE TRUNCATED DOMES AT LOCATION SHOWN PER SDG-130. |
| ⟨21⟩ | INSTALL PED RAMP PER SDSD SDG-132. |

THE PRIVATE WATER SYSTEM IS DESIGNED IN ACCORDANCE WITH THE CALIFORNIA PLUMBING CODE AND IS SHOWN ON THESE PLANS AS "INFORMATION ONLY."
A SEPARATE PLUMBING PERMIT IS REQUIRED FOR CONSTRUCTION AND INSPECTION OF THE SYSTEM.

ALL PLANS FOR PRIVATE FIRE SERVICE MAINS AND PRIVATE FIRE HYDRANTS MUST BE SUBMITTED SEPARATELY TO FIRE PLAN CHECK FOR APPROVAL PRIOR TO INSTALLATION.
ALL PRIVATE FIRE SYSTEMS WILL BE DESIGNED IN ACCORDANCE WITH CALIFORNIA BUILDING CODE; CALIFORNIA FIRE CODE; AND NFPA 24, PRIVATE FIRE SERVICE MAINS AND THEIR APPURTENANCES. PLANS SHALL BE SINGLE LINE DRAWINGS SHOWING ALL OF THE APPLICABLE REQUIREMENTS OF CODES SPECIFIED ABOVE.

## CENTERLINE DATA TABLE

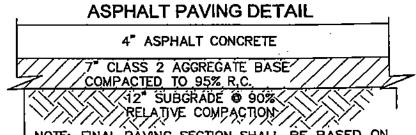
| SYMBOL | BEARING OR DELTA | DISTANCE (FT.) | RADIUS (FT.) | STREET NAME |
|---|---|---|---|---|
| ⟨5⟩ | 199° | 24.92 | 45 | GULL STREET |
| ⟨6⟩ | S50°00'00"E | 484.81 | – | GULL STREET |

### PROFILE
### GULL STREET
SCALE: HORIZONTAL: 1" = 20'
VERTICAL: 1" = 4'

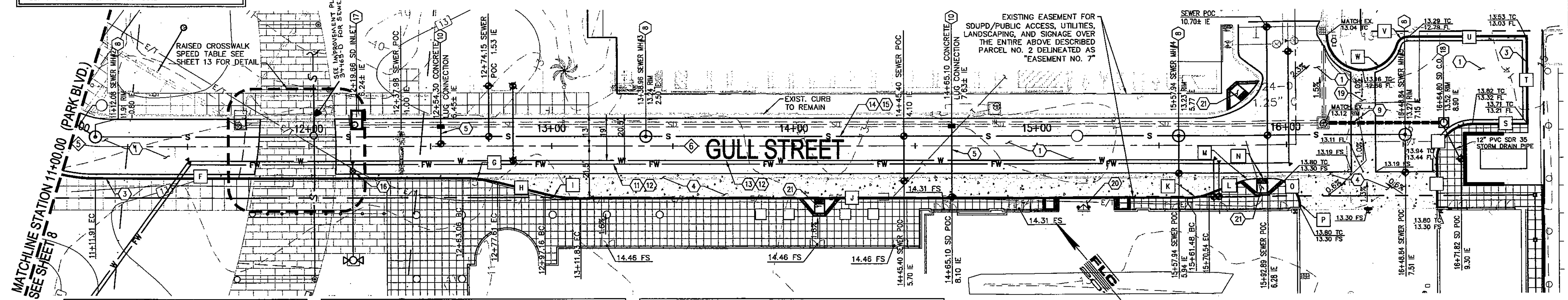
## SEWER DATA TABLE (PRIVATE)

| SYMBOL | BEARING OR DELTA | DISTANCE (FT.) | RADIUS (FT.) | SPECIFICATION |
|---|---|---|---|---|
| ① | S17°00'00"E | 117.93 | – | 8" PVC SDR-35 |
| ② | S50°00'00"E | 536.77 | – | 8" PVC SDR-35 |

## ASPHALT PAVING DETAIL



NOTE: FINAL PAVING SECTION SHALL BE BASED ON ADDITIONAL R-VALUE TESTING AT FINE GRADING.



## GENERAL NOTES

| | |
|---|---|
| 1. | THE CONTRACTOR SHALL NOTIFY DIGALERT (1-800-227-2600) AT LEAST TWO DAYS PRIOR TO STARTING WORK AND SHALL ARRANGE FOR AND COORDINATE SHUT DOWN, DISCONNECTION AND CAPPING OF EXISTING UTILITIES WITH THE APPROPRIATE UTILITY OWNERS PRIOR TO COMMENCING THE WORK. |
| 2. | PROTECT IN PLACE ALL EXISTING IMPROVEMENTS, STRUCTURES AND UNDERGROUND UTILITIES WHICH ARE TO REMAIN. MAINTAIN UTILITY SERVICES TO ALL EXISTING FACILITIES AT ALL TIMES, UNLESS OTHERWISE SPECIFIED. |
| 3. | THE LOCATION AND EXISTENCE OF EXISTING UNDERGROUND FACILITIES SHOWN ON THE DRAWINGS WERE OBTAINED FROM A SEARCH OF AVAILABLE RECORD DRAWINGS. THE CONTRACTOR SHALL POTHOLE EXISTING UTILITIES AT POINTS OF CONNECTIONS AND ALL UTILITY CROSSINGS TO DETERMINE EXACT LOCATION PRIOR TO STARTING ANY WORK. |
| 4. | COORDINATE LOCATION OF ALL UNDERGROUND UTILITIES AND STORM DRAINS WITH NEW TREE LOCATIONS, MECHANICAL/ELECTRICAL FACILITIES, AND OTHER INSTALLATIONS. REFER TO LANDSCAPE, PLUMBING, ARCHITECTURAL AND ELECTRICAL DRAWINGS FOR ADDITIONAL INFORMATION. |
| 5. | ALL EXISTING "DRY" UTILITIES SHOWN HEREON ARE FOR INFORMATION PURPOSES ONLY. REFER TO ELECTRICAL PLANS AND APPROPRIATE UTILITY COMPANY PLANS FOR ANY WORK ON OR WITH THESE UTILITIES. |
| 6. | REFER TO SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS. |

FLC FLORES LUND CONSULTANTS
7220 Trade Street, Ste. 120
San Diego, California 92121

"AS-BUILT" RECORD DRAWING

This record drawing has been prepared based upon information furnished by HENSEL PHELPS

While this information is believed to be reliable, Flores Lund Consultants cannot assure its accuracy or completeness. Those relying on the record document are advised to obtain independent verification of its accuracy before applying it for any purpose.

NAME 67530 RCE NO. 06-30-09 EXPIRES 5-6-09 DATE

## CURB DATA TABLE (PVT)

| SYMBOL | BEARING OR DELTA | DISTANCE (FT.) | RADIUS (FT.) | SPECIFICATION |
|---|---|---|---|---|
| F | S50°00'00"E | 151.14 | – | TYPE G (SDRSD G-2) |
| G | 50° | 14.70 | 60 | SDRSD G-1 |
| H | S36°00'00"E | 20.27 | – | SDRSD G-1 |
| I | 216° | 14.70 | 60 | SDRSD G-1 |
| J | S50°00'00"E | 249.66 | – | SDRSD G-1 |
| K | 230° | 9.27 | 25 | SDRSD G-1 |
| L | S72°00'00"E | 12.99 | – | SDRSD G-1 |
| M | 72° | 5.62 | 15 | SDRSD G-1 |
| N | S50°00'00"E | 5.93 | – | SDRSD G-1 |

## CURB DATA TABLE CONTINUED (PVT)

| SYMBOL | BEARING OR DELTA | DISTANCE (FT.) | RADIUS (FT.) | SPECIFICATION |
|---|---|---|---|---|
| O | 50° | 18.06 | 11.50 | SDRSD G-1 |
| P | S40°00'00"W | .62 | – | SDRSD G-1 |
| Q | N40°00'00"E | 19.68 | – | TYPE G (SDRSD G-2) |
| R | 140° | 23.56 | 15 | TYPE G (SDRSD G-2) |
| S | S50°00'00"E | 22.17 | – | TYPE G (SDRSD G-2) |
| T | N40°00'00"E | 35.88 | – | SDRSD G-1 |
| U | S50°00'00"E | 48.54 | – | TYPE G (SDRSD G-2) |
| V | 50° | 5.75 | 4.50 | TYPE G (SDRSD G-2) |
| W | 304° | 42.73 | 15 | TYPE G (SDRSD G-2) |

GRAPHIC SCALE

( IN FEET )
1 INCH = 20 FT

FLC FLORES LUND CONSULTANTS
PROFESSIONAL ENGINEERS
7220 TRADE STREET, SUITE 120, SAN DIEGO, CALIFORNIA 92121
(858) 566-0626 FAX (858) 566-0627

| | |
|---|---|
| DATE: | 08/31/06 |
| FLC PROJECT NO. | C0407 |
| DESIGN BY: | JRC |
| DRAWN BY: | JCC |
| REVIEWED BY: | WRL |

NAME Jeff R. Cross R.C.E. NO. 67530 EXP. 06-30-07 9-5-06 DATE

JEFF R. CROSS
NO. 67530
Expires 6/30/2007

PRIVATE CONTRACT

IMPROVEMENT PLANS FOR:
# HILTON SAN DIEGO CONVENTION CENTER HOTEL
GULL STREET STA: 11+00.00 TO STA: 16+00.00

CITY OF SAN DIEGO, CALIFORNIA
DEVELOPMENT SERVICES DEPARTMENT
SHEET 9 OF 21 SHEETS

FOR CITY ENGINEER 9/14/06 DATE

W.O. NO. 425983
P.T.S NO. 95181
V.T.M.

| DESCRIPTION | BY | APPROVED | DATE | FILMED |
|---|---|---|---|---|
| ORIGINAL | FLC | | | SEP 28 '06 |
| | | | | |
| | | | | |
| | | | | |
| AS-BUILTS | FLC | | 5/11/09 | |

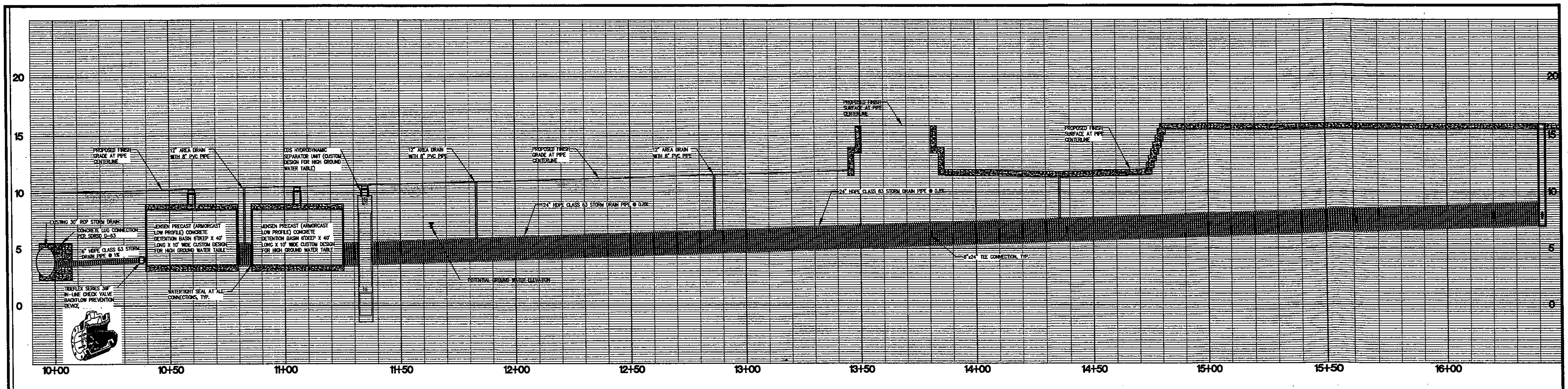
1836-6279
NAD83 COORDINATES

196-1719
LAMBERT COORDINATES

CONTRACTOR HENSEL PHELPS DATE STARTED 9-19-06
INSPECTOR MANUEL GONZALEZ DATE COMPLETED 4-23-09

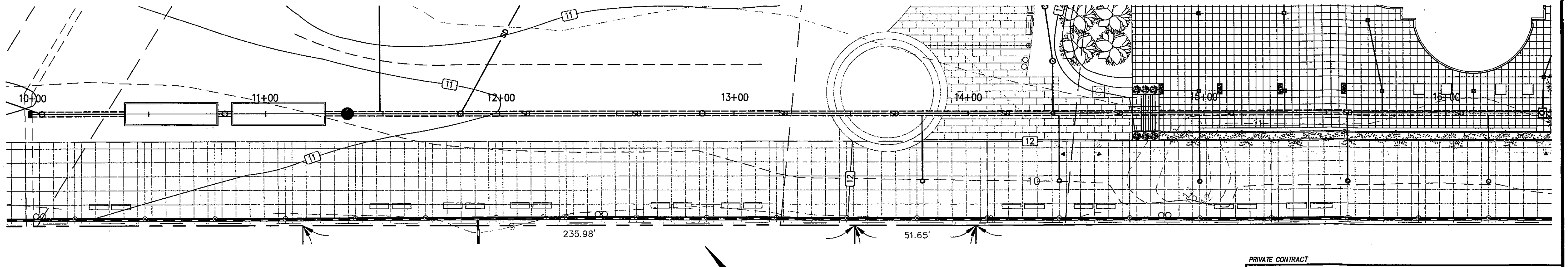
33970- 9 -D

AS-BUILT



## 24" STORM DRAIN PIPE (PRIVATE)

SCALE: HORIZONTAL: 1" = 20'
VERTICAL: 1" = 4'



FLC

GRAPHIC SCALE
20 0 20 40
( IN FEET )
1 INCH = 20 FT

**FLC FLORES LUND CONSULTANTS** 7220 Trade Street, Ste. 120 San Diego, California 92121

"AS-BUILT" RECORD DRAWING

This record drawing has been prepared based upon information furnished by HENSEL PHELPS

While this information is believed to be reliable, Flores Lund Consultants cannot assure its accuracy or completeness. Those relying on this record document are advised to obtain independent verification of its accuracy before applying it for any purpose.

| NAME | RCE NO. | EXPIRES | DATE |
|---|---|---|---|
| | 67530 | 06-30-09 | 5-6-09 |

NAME Jeff R. Cross R.C.E. NO. 67530 EXP. 06-30-07

9-5-06
DATE

NO WORK ALLOWED OFFSITE UNLESS A LETTER OF PERMISSION IS OBTAINED. SEE LETTER DATED

JEFF R.CROSS
NO. 67530
Expires 6/30/2007

**FLC FLORES LUND CONSULTANTS**
PROFESSIONAL ENGINEERS
7220 TRADE STREET, SUITE 120, SAN DIEGO, CALIFORNIA 92121
(858) 566-0628 FAX (858) 566-0627

| | |
|---|---|
| DATE: | 08/31/06 |
| FLC PROJECT NO. | C0407 |
| DESIGN BY: | JRC |
| DRAWN BY: | JCC |
| REVIEWED BY: | WRL |

PRIVATE CONTRACT

STORM DRAIN PROFILE FOR:
# HILTON SAN DIEGO CONVENTION CENTER HOTEL

CITY OF SAN DIEGO, CALIFORNIA
DEVELOPMENT SERVICES DEPARTMENT
SHEET 12 OF 21 SHEETS

W.O. NO. 425983
P.T.S NO. 95181

FOR CITY ENGINEER 9/14/06 DATE

V.T.M.

| DESCRIPTION | BY | APPROVED | DATE | FILMED |
|---|---|---|---|---|
| ORIGINAL | FLC | | | SEP 26 '06 |
| | | | | |
| | | | | |
| | | | | |
| AS-BUILTS | FLC | | 5/11/09 | [illegible] |

1836-6279
NAD83 COORDINATES

196-1719
LAMBERT COORDINATES

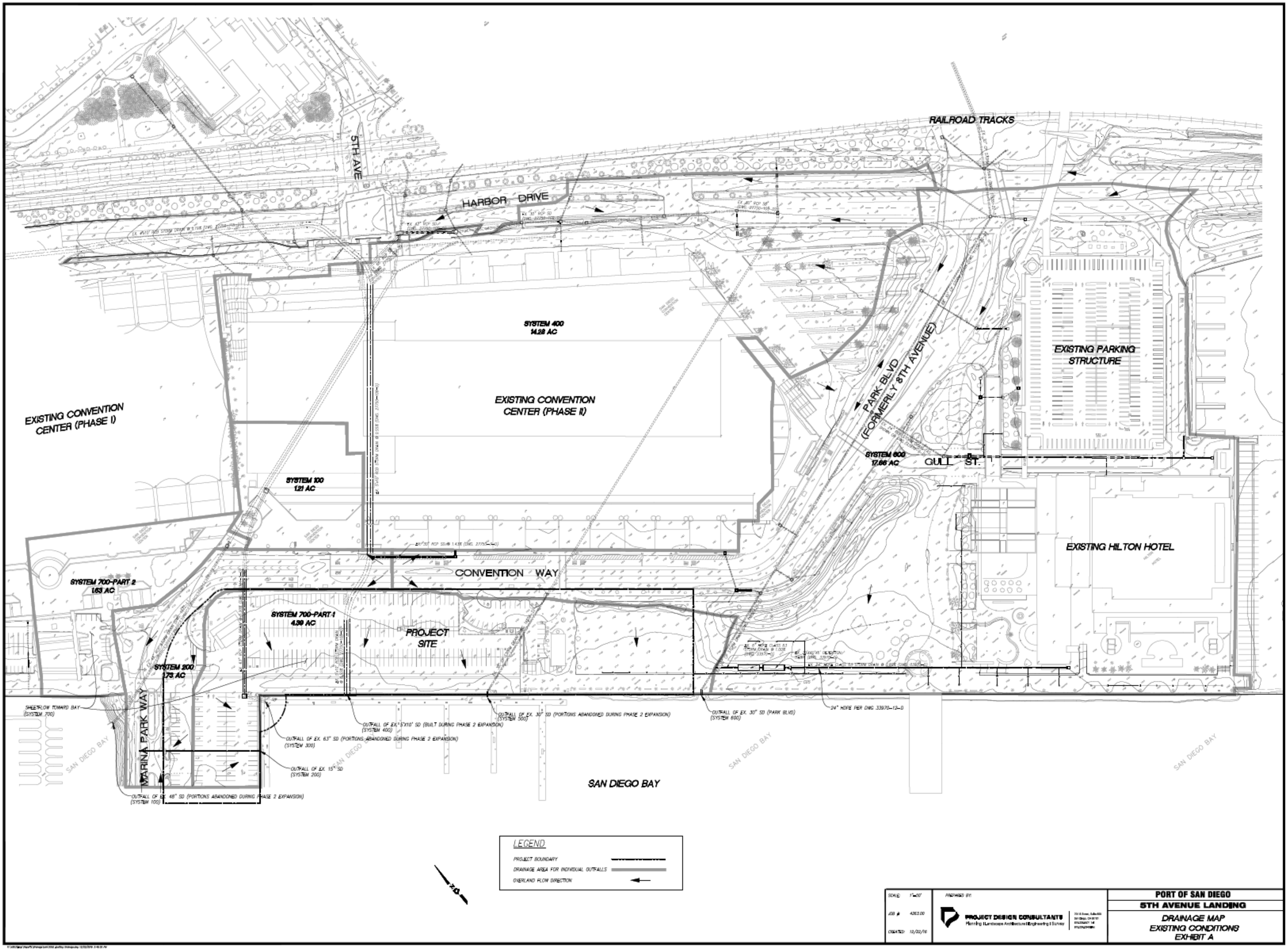
CONTRACTOR HENSEL PHELPS DATE STARTED 9-19-06
INSPECTOR MANUEL GONZALEZ DATE COMPLETED 4-23-09

33970- 12 -D

**AS-BUILT**

# APPENDIX 4

# Drainage Exhibits



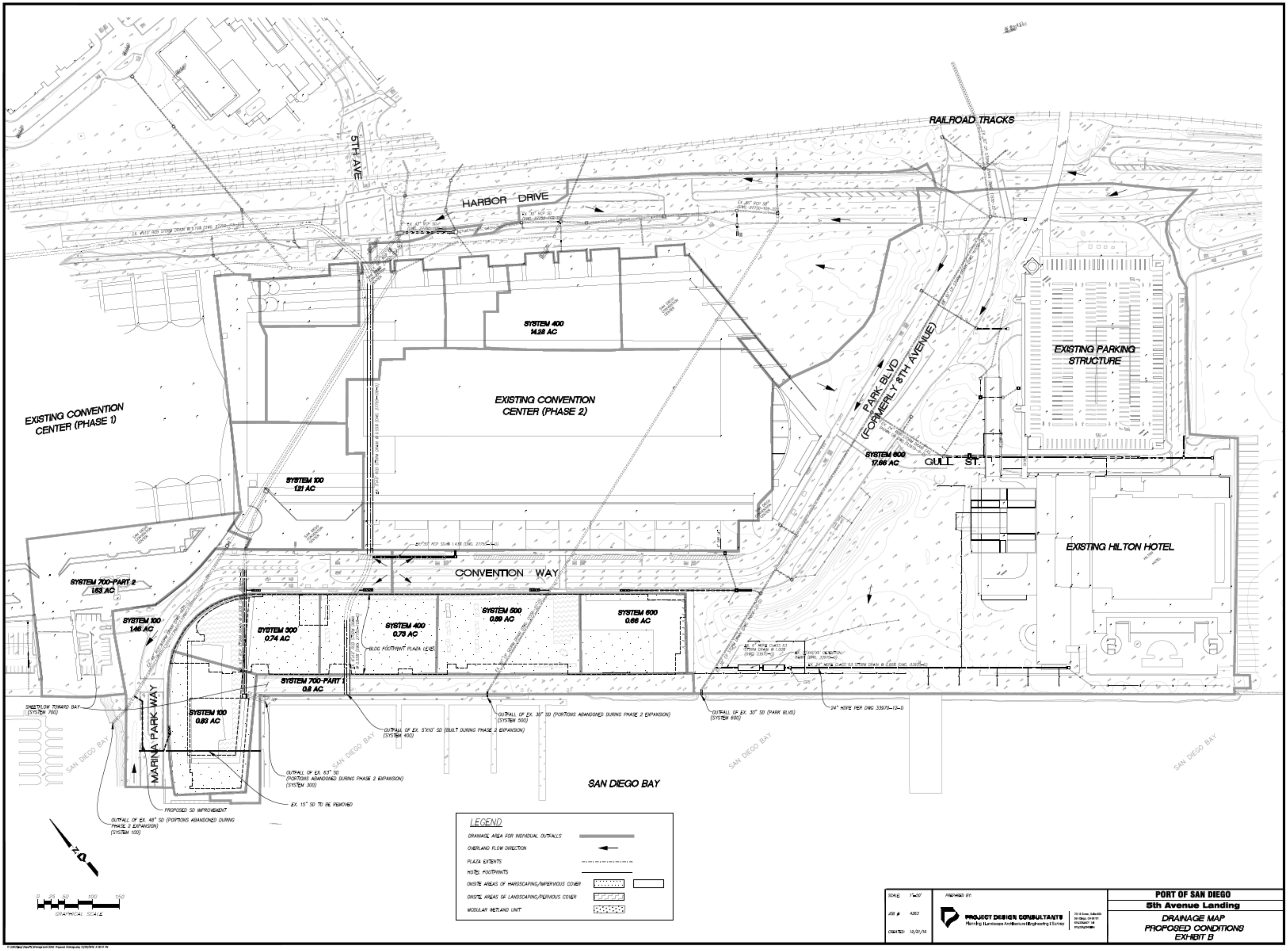
LEGEND

| | |
|---|---|
| PROJECT BOUNDARY | ▬ ▬ ▬ |
| DRAINAGE AREA FOR INDIVIDUAL OUTFALLS | ▬ |
| OVERLAND FLOW DIRECTION | ← |

SCALE: 1"=60'
JOB #: 4263.00
CREATED: 12/22/16

PREPARED BY:
**PROJECT DESIGN CONSULTANTS**
Planning | Landscape Architecture | Engineering | Survey

**PORT OF SAN DIEGO**
**5TH AVENUE LANDING**
*DRAINAGE MAP*
*EXISTING CONDITIONS*
*EXHIBIT A*



LEGEND

| | |
|---|---|
| DRAINAGE AREA FOR INDIVIDUAL OUTFALLS | ▬ |
| OVERLAND FLOW DIRECTION | ← |
| PLAZA EXTENTS | - - - - |
| HOTEL FOOTPRINTS | — |
| ONSITE AREAS OF HARDSCAPING/IMPERVIOUS COVER | ▨ ☐ |
| ONSITE AREAS OF LANDSCAPING/PERVIOUS COVER | ▨ |
| MODULAR WETLAND UNIT | ▨ |

SCALE: 1"=60'
JOB #: 4263
CREATED: 12/21/16

PREPARED BY:
PROJECT DESIGN CONSULTANTS
Planning | Landscape Architecture | Engineering | Survey

**PORT OF SAN DIEGO**

**5th Avenue Landing**

DRAINAGE MAP
PROPOSED CONDITIONS
EXHIBIT B

# Appendix J
# Noise Calculations

# FIELD NOISE MEASUREMENT DATA

PROJECT: Fifth Avenue Landing PROJ. # 518.16

**SITE IDENTIFICATION:** Marriott Marquis San Diego Hotel + Marina
OBSERVER(S): JGM LTI
ADDRESS:
START DATE / TIME: 9:00 am 10/20/2016
END DATE / TIME: 12:17pm 10/24/2016

**METEROLOGICAL CONDITIONS:**
TEMP: °F HUMIDITY: %R.H. WIND: CALM LIGHT MODERATE VARIABLE
WINDSPEED: MPH DIR: N NE E SE S SW W NW STEADY GUSTY
SKY: SUNNY CLEAR OVRCST PRTLY CLOUDY FOG RAIN OTHER:

**ACOUSTIC MEASUREMENTS:**
INSTRUMENT: Piccolo #6 TYPE: 1 [✓ 2] SERIAL #: 150320018
CALIBRATOR: SERIAL #: 6645
CALIBRATION CHECK, BEFORE: 93.9 AFTER 94.0 WINDSCREEN ✓

SETTINGS: [✓ A-WEIGHTED] [✓ SLOW] FAST FRONTAL [✓ RANDOM] [✓ ANSI] OTHER:

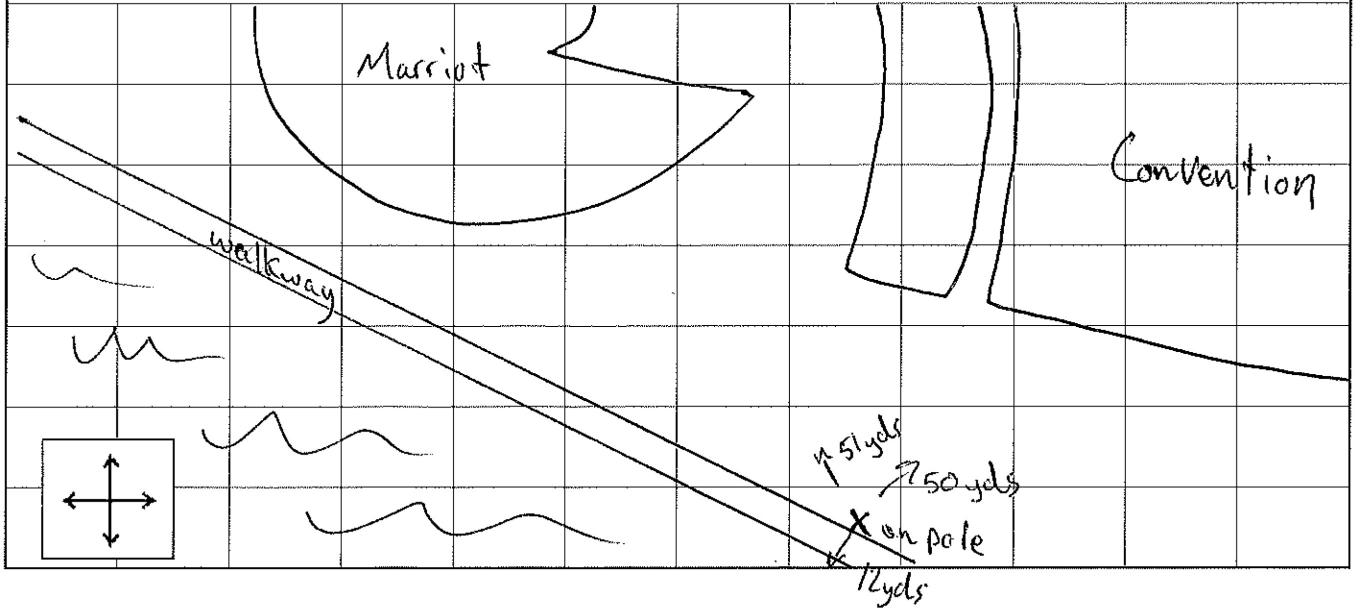
| FILE / MEAS # | START TIME | END TIME | $L_{eq}$ | L max | 1.67 | 8.33 | 10 | 25 | 50 | 90 | min |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

COMMENTS:

Depart: 10:55 am

**NOISE SOURCE INFO:**
PRIMARY NOISE SOURCE: TRAFFIC AIRCRAFT RAIL INDUSTRIAL AMBIENT OTHER:
ROADWAY TYPE:
OTHER SOURCES: DIST. AIRCRAFT / RUSTLING LEAVES / DIST. BARKING DOGS / BIRDS / DIST. INDUSTRIAL
DIST. CHILDREN PLAYING / DIST. TRAFFIC / DIST. LANDSCAPING ACTIVITIES / OTHER:

**DESCRIPTION / SKETCH:**
TERRAIN: HARD SOFT MIXED FLAT OTHER: 9ft high
PHOTOS:
OTHER COMMENTS / SKETCH:



# FIELD NOISE MEASUREMENT DATA

PROJECT: Fifth Avenue Landing PROJ. # 518.16

**SITE IDENTIFICATION:** Harbor Club San Diego LT2 OBSERVER(S): JGM
ADDRESS:
START DATE / TIME: 9:00 am 10/20/2016 END DATE / TIME: 12:55 pm 10/24/2016

**METEROLOGICAL CONDITIONS:**
TEMP: °F HUMIDITY: %R.H. WIND: CALM LIGHT MODERATE VARIABLE
WINDSPEED: MPH DIR: N NE E SE S SW W NW STEADY GUSTY
SKY: SUNNY CLEAR OVRCST PRTLY CLOUDY FOG RAIN OTHER:

**ACOUSTIC MEASUREMENTS:**
INSTRUMENT: Piccolo #3 TYPE: 1 [✓ 2] SERIAL #: 14051J018
CALIBRATOR: LD Cal 200 SERIAL #: 6645
CALIBRATION CHECK, BEFORE: 94.0 AFTER 93.9 WINDSCREEN ✓

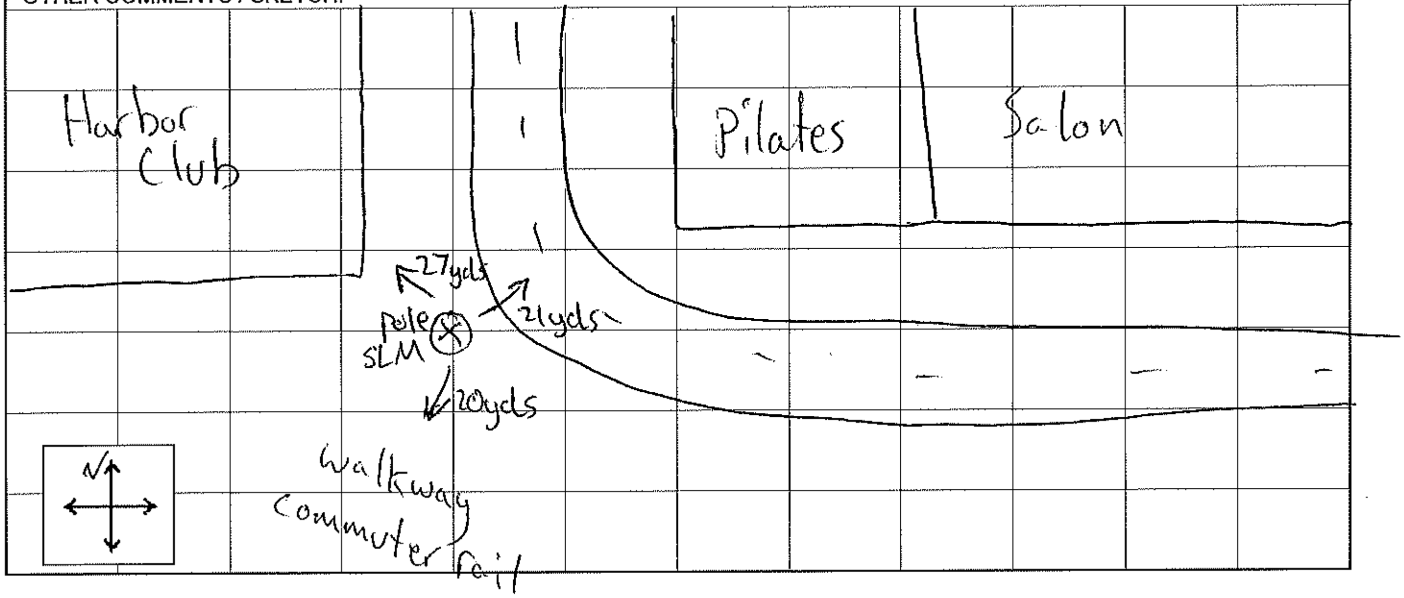
SETTINGS: [✓ A-WEIGHTED] [✓ SLOW] FAST FRONTAL [✓ RANDOM] [✓ ANSI] OTHER:

| FILE / MEAS # | START TIME | END TIME | $L_{eq}$ | max | 1.67 | 8.33 | 10 | L 25 | 50 | 90 | min |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

COMMENTS:

**NOISE SOURCE INFO:**
PRIMARY NOISE SOURCE: [✓ TRAFFIC] AIRCRAFT [✓ RAIL] INDUSTRIAL AMBIENT OTHER:
ROADWAY TYPE:
OTHER SOURCES: DIST. AIRCRAFT / RUSTLING LEAVES / DIST. BARKING DOGS / BIRDS / DIST. INDUSTRIAL
DIST. CHILDREN PLAYING / DIST. TRAFFIC / DIST. LANDSCAPING ACTIVITIES / OTHER:
Depart: 10:15am

**DESCRIPTION / SKETCH:**
TERRAIN: HARD SOFT MIXED FLAT OTHER: 9ft high
PHOTOS:
OTHER COMMENTS / SKETCH:



# FIELD NOISE MEASUREMENT DATA

PROJECT: Fifth Avenue Landing PROJ. # 518.16

**SITE IDENTIFICATION:** Embarcadero Marina Park South OBSERVER(S): JGM
ADDRESS: LT3
START DATE / TIME: 9:00am 10/20/2016 END DATE / TIME: 12:02pm 10/24/2016

**METEROLOGICAL CONDITIONS:**
TEMP: °F HUMIDITY: %R.H. WIND: CALM LIGHT MODERATE VARIABLE
WINDSPEED: MPH DIR: N NE E SE S SW W NW STEADY GUSTY
SKY: SUNNY CLEAR OVRCST PRTLY CLOUDY FOG RAIN OTHER:

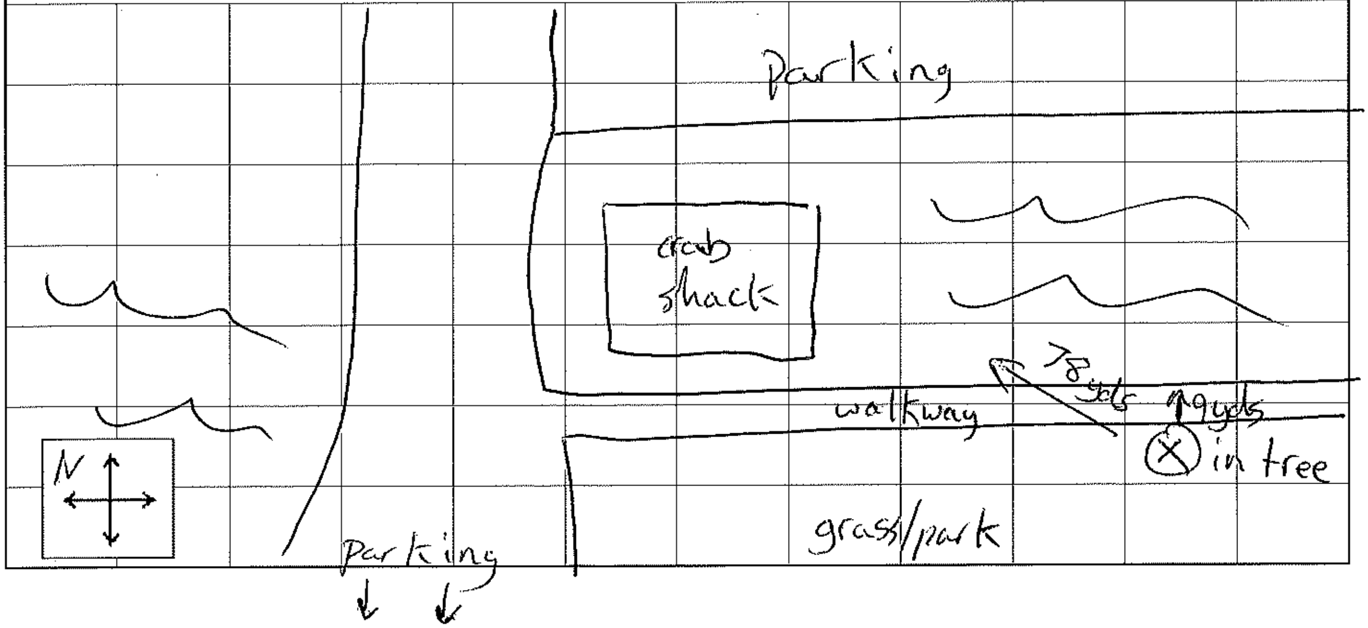
**ACOUSTIC MEASUREMENTS:**
INSTRUMENT: Piccolo #5 TYPE: 1 [✓ 2] SERIAL #: 15032016
CALIBRATOR: LD Cal 200 SERIAL #: 6645
CALIBRATION CHECK, BEFORE: 94.0 AFTER 94.1 WINDSCREEN ✓
SETTINGS: [✓ A-WEIGHTED] [✓ SLOW] FAST FRONTAL [✓ RANDOM] [✓ ANSI] OTHER:

| FILE / MEAS # | START TIME | END TIME | $L_{eq}$ | max | L 1.67 | 8.33 | 10 | 25 | 50 | 90 | min |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

COMMENTS:
Depart: 10:35am

**NOISE SOURCE INFO:**
PRIMARY NOISE SOURCE: TRAFFIC [✓ AIRCRAFT] RAIL [✓ INDUSTRIAL] AMBIENT OTHER: possible watercraft
ROADWAY TYPE: convention loading
OTHER SOURCES: DIST. AIRCRAFT / RUSTLING LEAVES / DIST. BARKING DOGS / BIRDS / DIST. INDUSTRIAL
DIST. CHILDREN PLAYING / DIST. TRAFFIC / DIST. LANDSCAPING ACTIVITIES / OTHER:

**DESCRIPTION / SKETCH:**
TERRAIN: HARD SOFT MIXED FLAT OTHER: 7ft high
PHOTOS:
OTHER COMMENTS / SKETCH:



# FIELD NOISE MEASUREMENT DATA

PROJECT: Fifth Avenue Landing PROJ. # 518.16

**SITE IDENTIFICATION:** Centennial Park, Coronado ST1 OBSERVER(S): JGM
ADDRESS: San Diego Skyline Viewpoint
START DATE / TIME: 1:25pm 10/24/2016 END DATE / TIME: 1:56pm 10/24/2016

**METEROLOGICAL CONDITIONS:**
TEMP: 74 °F HUMIDITY: 64 %R.H. WIND: [✓ CALM] LIGHT MODERATE VARIABLE
WINDSPEED: 0-2 MPH DIR: towards N NE [✓ E] SE S SW W NW STEADY GUSTY
SKY: SUNNY CLEAR [✓ OVRCST] PRTLY CLOUDY FOG RAIN OTHER:

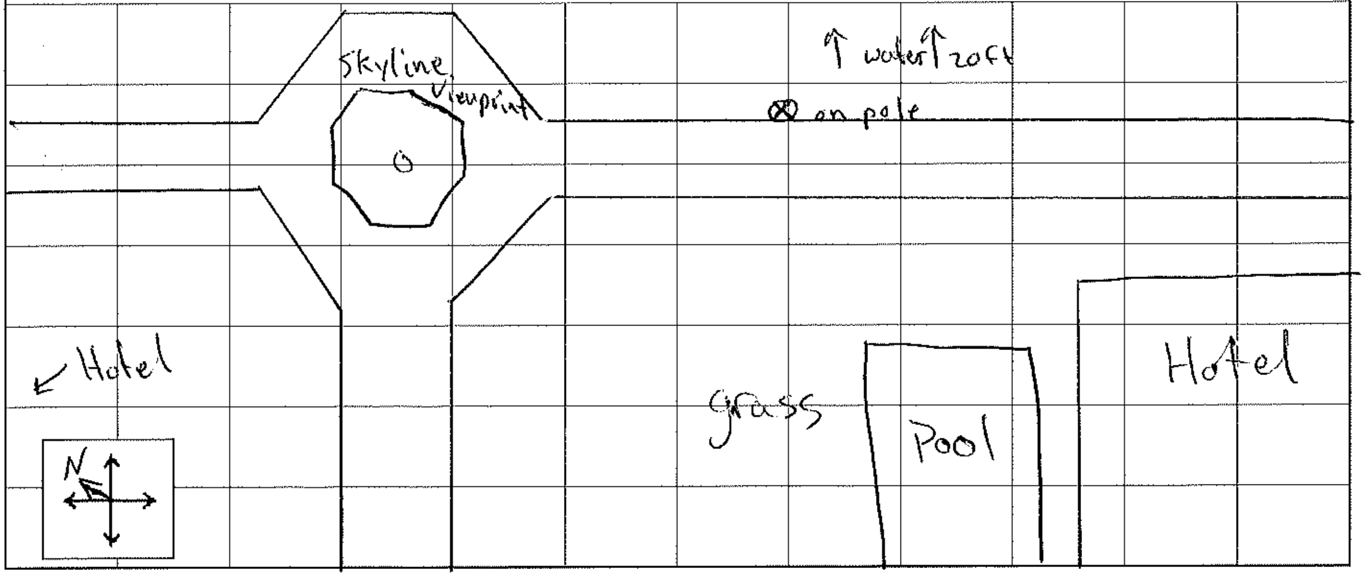
**ACOUSTIC MEASUREMENTS:**
INSTRUMENT: Piccolo #6 TYPE: 1 [✓ 2] SERIAL #: 150320018
CALIBRATOR: LD Cal 200 SERIAL #: 6645
CALIBRATION CHECK, BEFORE: 94.0 AFTER 94.0 WINDSCREEN ✓
SETTINGS: [✓ A-WEIGHTED] [✓ SLOW] FAST FRONTAL [✓ RANDOM] [✓ ANSI] OTHER:

| FILE / MEAS # | START TIME | END TIME | $L_{eq}$ | max | L 1.67 (2%) | L 8.33 (8%) | L 10 | L 25 | L 50 | L 90 | min |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Rec 3 | 1:25 | 1:56 | 59.9 | 77.8 | 68.0 | 62.5 | 62.0 | 58.5 | 54.5 | 49.0 | 46.9 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

COMMENTS: 1:40 -> Helicopter
Moderate foot-traffic around park during measurement

**NOISE SOURCE INFO:**
PRIMARY NOISE SOURCE: TRAFFIC [✓ AIRCRAFT] RAIL INDUSTRIAL AMBIENT OTHER: watercraft
ROADWAY TYPE:
OTHER SOURCES: DIST. AIRCRAFT / RUSTLING LEAVES / DIST. BARKING DOGS / Distant [✓ BIRDS] / DIST. INDUSTRIAL
DIST. CHILDREN PLAYING / DIST. TRAFFIC / DIST. LANDSCAPING ACTIVITIES / OTHER:

**DESCRIPTION / SKETCH:**
TERRAIN: HARD SOFT MIXED FLAT OTHER: 5ft high, 25 yards to pool
PHOTOS:
OTHER COMMENTS / SKETCH:



# FIELD NOISE MEASUREMENT DATA

PROJECT: Fifth Avenue Landing PROJ. # 518.16

**SITE IDENTIFICATION:** Fifth Avenue Landing Park ST2 OBSERVER(S): JGM
ADDRESS: Beside Convention Center
START DATE / TIME: 11:35 am 10/20/2016 END DATE / TIME: 12:01pm 10/20/2016

**METEROLOGICAL CONDITIONS:**
TEMP: 86 °F HUMIDITY: 29 %R.H. towards WIND: [✓ CALM] LIGHT MODERATE VARIABLE
WINDSPEED: 2 MPH DIR: N NE [✓ E] SE S SW W NW STEADY GUSTY
SKY: [✓ SUNNY] CLEAR OVRCST PRTLY CLOUDY FOG RAIN OTHER:

**ACOUSTIC MEASUREMENTS:**
INSTRUMENT: LD 831 TYPE: [✓ 1] 2 SERIAL #: 3786
CALIBRATOR: LD Cal 200 SERIAL #: 6645
CALIBRATION CHECK, BEFORE: 114.0 AFTER 114.06 WINDSCREEN ✓

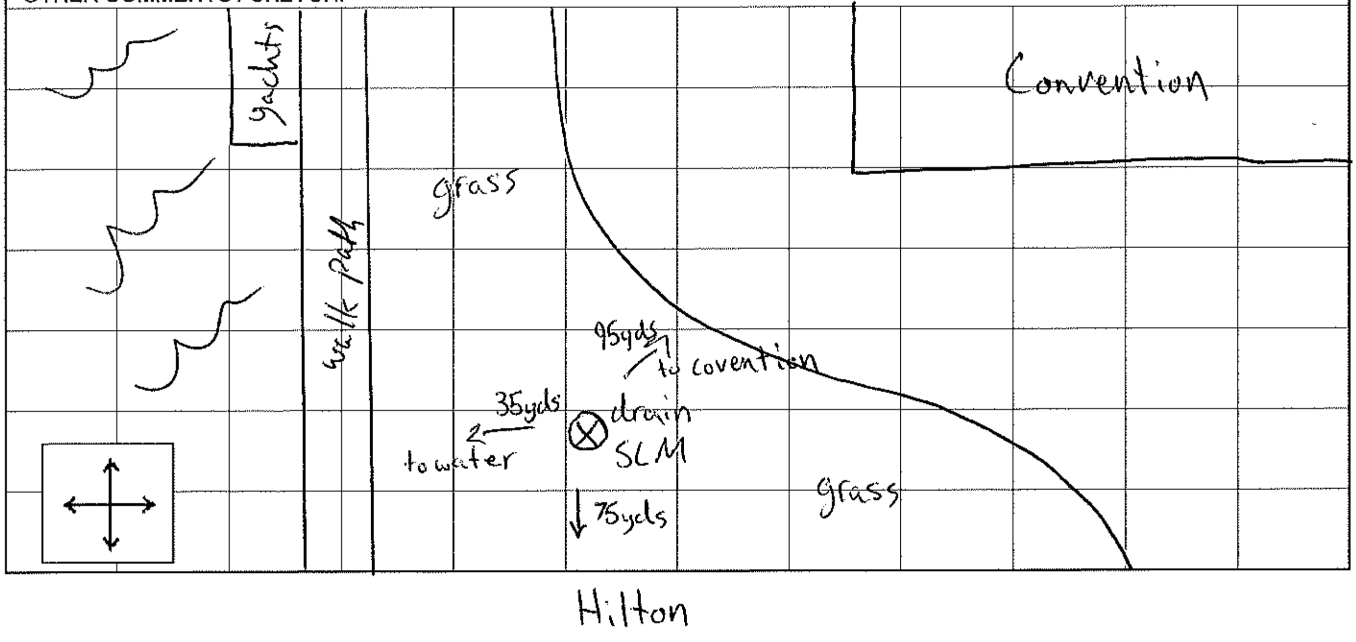
SETTINGS: [✓ A-WEIGHTED] [✓ SLOW] FAST FRONTAL [✓ RANDOM] [✓ ANSI] OTHER:

| FILE / MEAS # | START TIME | END TIME | $L_{eq}$ | L max | L 1.67 | L 8.33 | L 10 | L 25 | L 50 | L 90 | L min |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 230 | 11:35 | 12:01 | 54.4 | 72.1 | 58.3 | 55.9 | 55.6 | 53.8 | 52.5 | 51.0 | 49.4 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

COMMENTS: Aircraft circling overhead, measurement paused when aligned with aircraft. Several military aircraft/ships making noise.

**NOISE SOURCE INFO:**
PRIMARY NOISE SOURCE: TRAFFIC [✓ AIRCRAFT] RAIL INDUSTRIAL AMBIENT OTHER:
ROADWAY TYPE:
OTHER SOURCES: [✓ DIST. AIRCRAFT] / RUSTLING LEAVES / DIST. BARKING DOGS / BIRDS / DIST. INDUSTRIAL
DIST. CHILDREN PLAYING / DIST. TRAFFIC / [✓ DIST. LANDSCAPING] ACTIVITIES / OTHER:

**DESCRIPTION / SKETCH:**
TERRAIN: HARD [✓ SOFT] MIXED FLAT OTHER: 5ft high
PHOTOS:
OTHER COMMENTS / SKETCH:



## FIELD NOISE MEASUREMENT DATA

PROJECT: Fifth Avenue Landing PROJ. # 518.16

**SITE IDENTIFICATION:** Hilton Bayfront Hotel ST3 OBSERVER(S): JGM
ADDRESS: 1 Park Blvd. San Diego
START DATE / TIME: 12:10pm 10/20/2016 END DATE / TIME: 12:26pm 10/20/2016

**METEROLOGICAL CONDITIONS:**
TEMP: 87 °F HUMIDITY: 15 %R.H. WIND: CALM LIGHT [✓ MODERATE] VARIABLE
WINDSPEED: 6-10 MPH DIR: N NE E [✓ SE] S SW W NW STEADY GUSTY
SKY: [✓ SUNNY] CLEAR OVRCST PRTLY CLOUDY FOG RAIN OTHER:

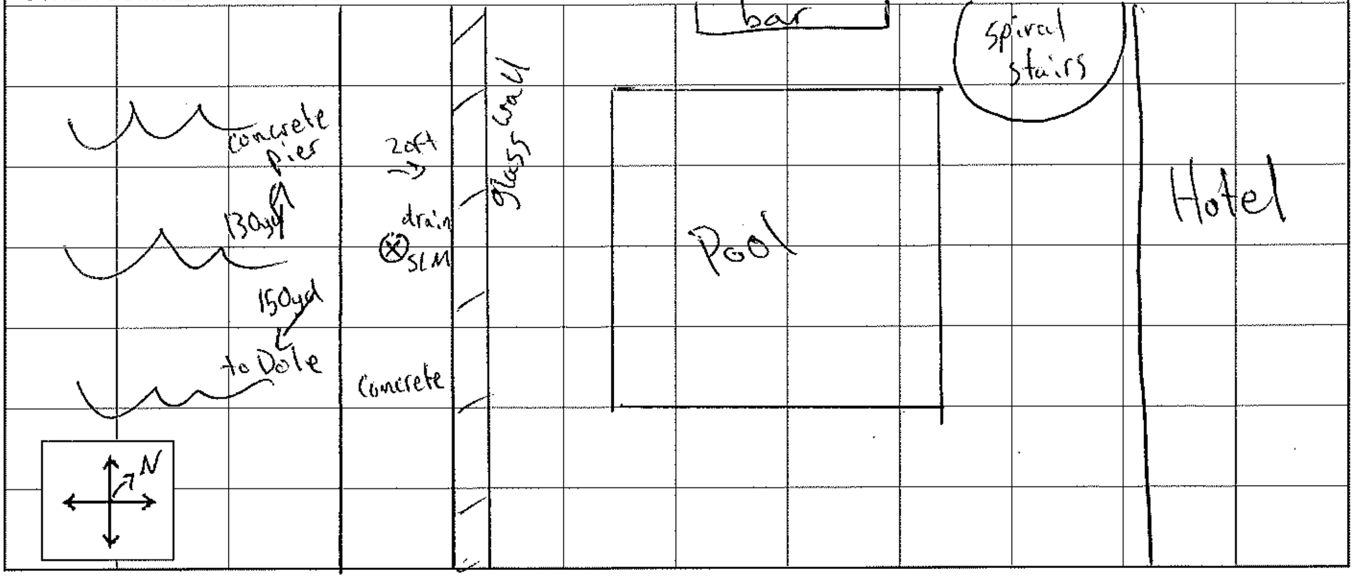
**ACOUSTIC MEASUREMENTS:**
INSTRUMENT: LD 831 TYPE: [✓ 1] 2 SERIAL #: 3786
CALIBRATOR: LD Cal 200 SERIAL #: 6645
CALIBRATION CHECK, BEFORE: 114.0 AFTER 113.90 WINDSCREEN ✓
SETTINGS: [✓ A-WEIGHTED] [✓ SLOW] FAST FRONTAL [✓ RANDOM] [✓ ANSI] OTHER:

| FILE / MEAS # | START TIME | END TIME | $L_{eq}$ | max | L 1.67 | L 8.33 | L 10 | L 25 | L 50 | L 90 | min |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 231 | 12:10 | 12:26 | 59.9 | 71.2 | 67.3 | 61.8 | 61.0 | 59.1 | 58.5 | 57.6 | 56.6 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

COMMENTS: Hotel building probably sheilds noise from pool. Dole plant is constant noise source.

**NOISE SOURCE INFO:**
PRIMARY NOISE SOURCE: TRAFFIC AIRCRAFT RAIL [✓ INDUSTRIAL] AMBIENT OTHER: Dole plant
ROADWAY TYPE:
OTHER SOURCES: [✓ DIST. AIRCRAFT] / RUSTLING LEAVES / DIST. BARKING DOGS / BIRDS / DIST. INDUSTRIAL / DIST. CHILDREN PLAYING / DIST. TRAFFIC / DIST. LANDSCAPING ACTIVITIES / OTHER:
Distant music from hotel bar/restaurant/lounge
wind gusts ~12 mph may exaggerate measurements 13 min in.

**DESCRIPTION / SKETCH:**
TERRAIN: [✓ HARD] SOFT MIXED FLAT OTHER:
PHOTOS:
OTHER COMMENTS / SKETCH:



## Construction Noise Analysis by Phase

| Equipment | | Typical Level @ 50', dBA[1] | Usage Factor[1,2] | Number of Units | Hour Per Day | Distance to Receiver, ft. | Hard or Soft Site? | Barrier Attenuation, dB | Leq(h), dBA |
|---|---|---|---|---|---|---|---|---|---|
| Item No. | Description | | | | | | | | |
| 1.1 Mobilization/Demolition | | | | | | | | | |
| 72 | AC Cold Planer (est. from doze | 81.7 | 0.4 | 1 | 12 | 50 | hard | 0 | 77.7 |
| 29 | Loader (Front End Loader) | 79.1 | 0.4 | 1 | 12 | 50 | hard | 0 | 75.1 |
| 61 | Truck, Dump | 76.5 | 0.4 | 2 | 12 | 50 | hard | 0 | 75.5 |
| 2 | Backhoe | 77.6 | 0.4 | 1 | 12 | 50 | hard | 0 | 73.6 |
| 73 | Water Truck (est. from dump tr | 76.5 | 0.4 | 1 | 12 | 50 | hard | 0 | 72.5 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | ***Combined Equipment*** | | | | | | | | ***82.3*** |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
"Transit Noise and Vibration Impact Assessment", FTA, (FTA-VA-90-1003-06), May 2006; and/or
"Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances;" BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

**Construction Noise Analysis by Phase**

| Equipment | | Typical Level @ 50', dBA[1] | Usage Factor[1,2] | Number of Units | Hour Per Day | Distance to Receiver, ft. | Hard or Soft Site? | Barrier Attenuation, dB | Leq(h), dBA |
|---|---|---|---|---|---|---|---|---|---|
| Item No. | Description | | | | | | | | |
| 1.2 Dewatering/Shoring | | | | | | | | | |
| 15 | Drill Rig, Auger | 84.4 | 0.2 | 1 | 12 | 50 | hard | 0 | 77.4 |
| 61 | Truck, Dump | 76.5 | 0.4 | 2 | 12 | 50 | hard | 0 | 75.5 |
| 29 | Loader (Front End Loader) | 79.1 | 0.4 | 1 | 12 | 50 | hard | 0 | 75.1 |
| 73 | Water Truck (est. from dump tr | 76.5 | 0.4 | 1 | 12 | 50 | hard | 0 | 72.5 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | ***Combined Equipment*** | | | | | | | | ***81.5*** |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
"Transit Noise and Vibration Impact Assessment", FTA, (FTA-VA-90-1003-06), May 2006; and/or
"Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances;" BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

## Construction Noise Analysis by Phase

| Equipment | | Typical Level @ 50', dBA[1] | Usage Factor[1,2] | Number of Units | Hour Per Day | Distance to Receiver, ft. | Hard or Soft Site? | Barrier Attenuation, dB | Leq(h), dBA |
|---|---|---|---|---|---|---|---|---|---|
| Item No. | Description | | | | | | | | |
| 2.1 Excavation and Foundation | | | | | | | | | |
| 35 | Pile-driver (Impact) | 101.3 | 0.2 | 2 | 12 | 50 | hard | 0 | 97.3 |
| 23 | Grader | 85 | 0.4 | 1 | 12 | 50 | hard | 0 | 81.0 |
| 18 | Excavator | 80.7 | 0.4 | 2 | 12 | 50 | hard | 0 | 79.7 |
| 29 | Loader (Front End Loader) | 79.1 | 0.4 | 2 | 12 | 50 | hard | 0 | 78.1 |
| 61 | Truck, Dump | 76.5 | 0.4 | 5 | 12 | 50 | hard | 0 | 79.5 |
| 2 | Backhoe | 77.6 | 0.4 | 2 | 12 | 50 | hard | 0 | 76.6 |
| 73 | Water Truck (est. from dump tr | 76.5 | 0.4 | 1 | 12 | 50 | hard | 0 | 72.5 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | ***Combined Equipment*** | | | | | | | | ***97.7*** |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
"Transit Noise and Vibration Impact Assessment", FTA, (FTA-VA-90-1003-06), May 2006; and/or
"Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances;" BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

## Construction Noise Analysis by Phase

| Equipment | | Typical Level @ 50', dBA[1] | Usage Factor[1,2] | Number of Units | Hour Per Day | Distance to Receiver, ft. | Hard or Soft Site? | Barrier Attenuation, dB | Leq(h), dBA |
|---|---|---|---|---|---|---|---|---|---|
| Item No. | Description | | | | | | | | |
| 2.2 Structural Frame | | | | | | | | | |
| 12 | Crane | 80.6 | 0.16 | 2 | 12 | 50 | hard | 0 | 75.7 |
| 41 | Pump, Concrete (or concrete p | 81.4 | 0.2 | 2 | 12 | 50 | hard | 0 | 77.4 |
| 70 | Forklift (est. from backhoe) | 77.6 | 0.4 | 2 | 12 | 50 | hard | 0 | 76.6 |
| 2 | Backhoe | 77.6 | 0.4 | 1 | 12 | 50 | hard | 0 | 73.6 |
| 73 | Water Truck (est. from dump tr | 76.5 | 0.4 | 1 | 12 | 50 | hard | 0 | 72.5 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | ***Combined Equipment*** | | | | | | | | ***82.5*** |

1. Obtained or estimated from:
   FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
   "Transit Noise and Vibration Impact Assessment", FTA, (FTA-VA-90-1003-06), May 2006; and/or
   "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances;" BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

**Construction Noise Analysis by Phase**

| Equipment | | Typical Level @ 50', dBA[1] | Usage Factor[1,2] | Number of Units | Hour Per Day | Distance to Receiver, ft. | Hard or Soft Site? | Barrier Attenuation, dB | Leq(h), dBA |
|---|---|---|---|---|---|---|---|---|---|
| **Item No.** | **Description** | | | | | | | | |
| 2.3 Exterior Closure and Roofing | | | | | | | | | |
| 30 | Man Lift | 74.7 | 0.2 | 6 | 12 | 50 | hard | 0 | 75.5 |
| 70 | Forklift (est. from backhoe) | 77.6 | 0.4 | 2 | 12 | 50 | hard | 0 | 76.6 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | ***Combined Equipment*** | | | | | | | | ***79.1*** |

1. Obtained or estimated from:
   FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
   "Transit Noise and Vibration Impact Assessment", FTA, (FTA-VA-90-1003-06), May 2006; and/or
   "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances;" BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

**Construction Noise Analysis by Phase**

| Equipment | | Typical Level @ 50', dBA[1] | Usage Factor[1,2] | Number of Units | Hour Per Day | Distance to Receiver, ft. | Hard or Soft Site? | Barrier Attenuation, dB | Leq(h), dBA |
|---|---|---|---|---|---|---|---|---|---|
| Item No. | Description | | | | | | | | |
| 2.6 Interior Construction/Finishes | | | | | | | | | |
| 70 | Forklift (est. from backhoe) | 77.6 | 0.4 | 1 | 12 | 50 | hard | 0 | 73.6 |
| 30 | Man Lift | 74.7 | 0.2 | 6 | 12 | 50 | hard | 0 | 75.5 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | ***Combined Equipment*** | | | | | | | | ***77.7*** |

1. Obtained or estimated from:
   FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
   "Transit Noise and Vibration Impact Assessment", FTA, (FTA-VA-90-1003-06), May 2006; and/or
   "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances;" BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

## Construction Noise Analysis by Phase

| Equipment | | Typical Level @ 50', dBA[1] | Usage Factor[1,2] | Number of Units | Hour Per Day | Distance to Receiver, ft. | Hard or Soft Site? | Barrier Attenuation, dB | Leq(h), dBA |
|---|---|---|---|---|---|---|---|---|---|
| Item No. | Description | | | | | | | | |
| 2.7 MEP Systems | | | | | | | | | |
| 70 | Forklift (est. from backhoe) | 77.6 | 0.4 | 1 | 12 | 50 | hard | 0 | 73.6 |
| 30 | Man Lift | 74.7 | 0.2 | 6 | 12 | 50 | hard | 0 | 75.5 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | ***Combined Equipment*** | | | | | | | | ***77.7*** |

1. Obtained or estimated from:
   FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
   "Transit Noise and Vibration Impact Assessment", FTA, (FTA-VA-90-1003-06), May 2006; and/or
   "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances;" BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

**Construction Noise Analysis by Phase**

| Equipment | | Typical Level @ 50', dBA[1] | Usage Factor[1,2] | Number of Units | Hour Per Day | Distance to Receiver, ft. | Hard or Soft Site? | Barrier Attenuation, dB | Leq(h), dBA |
|---|---|---|---|---|---|---|---|---|---|
| Item No. | Description | | | | | | | | |
| 3.1 Foundations | | | | | | | | | |
| 35 | Pile-driver (Impact) | 101.3 | 0.2 | 1 | 12 | 50 | hard | 0 | 94.3 |
| 41 | Pump, Concrete (or concrete p | 81.4 | 0.2 | 1 | 12 | 50 | hard | 0 | 74.4 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | ***Combined Equipment*** | | | | | | | | ***94.4*** |

1. Obtained or estimated from:
   FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
   "Transit Noise and Vibration Impact Assessment", FTA, (FTA-VA-90-1003-06), May 2006; and/or
   "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances;" BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

## Construction Noise Analysis by Phase

| Equipment | | Typical Level @ 50', dBA[1] | Usage Factor[1,2] | Number of Units | Hour Per Day | Distance to Receiver, ft. | Hard or Soft Site? | Barrier Attenuation, dB | Leq(h), dBA |
|---|---|---|---|---|---|---|---|---|---|
| Item No. | Description | | | | | | | | |
| 3.2 Structural Frame | | | | | | | | | |
| 12 | Crane | 80.6 | 0.16 | 1 | 12 | 50 | hard | 0 | 72.6 |
| 41 | Pump, Concrete (or concrete p | 81.4 | 0.2 | 1 | 12 | 50 | hard | 0 | 74.4 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | ***Combined Equipment*** | | | | | | | | ***76.6*** |

1. Obtained or estimated from:
   FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
   "Transit Noise and Vibration Impact Assessment", FTA, (FTA-VA-90-1003-06), May 2006; and/or
   "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances;" BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

## Construction Noise Analysis by Phase

| Equipment | | Typical Level @ 50', dBA[1] | Usage Factor[1,2] | Number of Units | Hour Per Day | Distance to Receiver, ft. | Hard or Soft Site? | Barrier Attenuation, dB | Leq(h), dBA |
|---|---|---|---|---|---|---|---|---|---|
| Item No. | Description | | | | | | | | |
| 3.3 Exterior Closure | | | | | | | | | |
| 30 | Man Lift | 74.7 | 0.2 | 4 | 12 | 50 | hard | 0 | 73.7 |
| 70 | Forklift (est. from backhoe) | 77.6 | 0.4 | 1 | 12 | 50 | hard | 0 | 73.6 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | *Combined Equipment* | | | | | | | | ***76.7*** |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
"Transit Noise and Vibration Impact Assessment", FTA, (FTA-VA-90-1003-06), May 2006; and/or
"Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances;" BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

## Construction Noise Analysis by Phase

| Equipment | | Typical Level @ 50', dBA[1] | Usage Factor[1,2] | Number of Units | Hour Per Day | Distance to Receiver, ft. | Hard or Soft Site? | Barrier Attenuation, dB | Leq(h), dBA |
|---|---|---|---|---|---|---|---|---|---|
| **Item No.** | **Description** | | | | | | | | |
| 3.4 Interior Construction/Finishes | | | | | | | | | |
| 30 | Man Lift | 74.7 | 0.2 | 6 | 12 | 50 | hard | 0 | 75.5 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | ***Combined Equipment*** | | | | | | | | ***75.5*** |

1. Obtained or estimated from:
   FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
   "Transit Noise and Vibration Impact Assessment", FTA, (FTA-VA-90-1003-06), May 2006; and/or
   "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances;" BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

**Construction Noise Analysis by Phase**

| Equipment | | Typical Level @ 50', dBA[1] | Usage Factor[1,2] | Number of Units | Hour Per Day | Distance to Receiver, ft. | Hard or Soft Site? | Barrier Attenuation, dB | Leq(h), dBA |
|---|---|---|---|---|---|---|---|---|---|
| Item No. | Description | | | | | | | | |
| 3.5 Phase Completion Work | | | | | | | | | |
| 30 | Man Lift | 74.7 | 0.2 | 6 | 12 | 50 | hard | 0 | 75.5 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | ***Combined Equipment*** | | | | | | | | ***75.5*** |

1. Obtained or estimated from:
   FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
   "Transit Noise and Vibration Impact Assessment", FTA, (FTA-VA-90-1003-06), May 2006; and/or
   "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances;" BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

## Construction Noise Analysis by Phase

| Equipment | | Typical Level @ 50', dBA[1] | Usage Factor[1,2] | Number of Units | Hour Per Day | Distance to Receiver, ft. | Hard or Soft Site? | Barrier Attenuation, dB | Leq(h), dBA |
|---|---|---|---|---|---|---|---|---|---|
| Item No. | Description | | | | | | | | |
| 4.1 Offsite Demolition/Grading/Utilities | | | | | | | | | |
| 29 | Loader (Front End Loader) | 79.1 | 0.4 | 1 | 12 | 50 | hard | 0 | 75.1 |
| 61 | Truck, Dump | 76.5 | 0.4 | 2 | 12 | 50 | hard | 0 | 75.5 |
| 2 | Backhoe | 77.6 | 0.4 | 2 | 12 | 50 | hard | 0 | 76.6 |
| 73 | Water Truck (est. from dump tr | 76.5 | 0.4 | 1 | 12 | 50 | hard | 0 | 72.5 |
| 75 | Skid Steer (est. from backhoe) | 77.6 | 0.4 | 2 | 12 | 50 | hard | 0 | 76.6 |
| 74 | Bobcat (est. from backhoe) | 77.6 | 0.4 | 2 | 12 | 50 | hard | 0 | 76.6 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | ***Combined Equipment*** | | | | | | | | ***83.5*** |

1. Obtained or estimated from:
   FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
   "Transit Noise and Vibration Impact Assessment", FTA, (FTA-VA-90-1003-06), May 2006; and/or
   "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances;" BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

## Construction Noise Analysis by Phase

| Equipment | | Typical Level @ 50', dBA$^1$ | Usage Factor$^{1,2}$ | Number of Units | Hour Per Day | Distance to Receiver, ft. | Hard or Soft Site? | Barrier Attenuation, dB | Leq(h), dBA |
|---|---|---|---|---|---|---|---|---|---|
| Item No. | Description | | | | | | | | |
| 4.4 Site Improvements | | | | | | | | | |
| 34 | Paver | 77.2 | 0.5 | 1 | 12 | 50 | hard | 0 | 74.2 |
| 44 | Roller | 80 | 0.2 | 2 | 12 | 50 | hard | 0 | 76.0 |
| 61 | Truck, Dump | 76.5 | 0.4 | 2 | 12 | 50 | hard | 0 | 75.5 |
| 73 | Water Truck (est. from dump tr | 76.5 | 0.4 | 2 | 12 | 50 | hard | 0 | 75.5 |
| 2 | Backhoe | 77.6 | 0.4 | 3 | 12 | 50 | hard | 0 | 78.4 |
| 18 | Excavator | 80.7 | 0.4 | 1 | 12 | 50 | hard | 0 | 76.7 |
| 74 | Bobcat (est. from backhoe) | 77.6 | 0.4 | 2 | 12 | 50 | hard | 0 | 76.6 |
| 70 | Forklift (est. from backhoe) | 77.6 | 0.4 | 1 | 12 | 50 | hard | 0 | 73.6 |
| 41 | Pump, Concrete (or concrete p | 81.4 | 0.2 | 1 | 12 | 50 | hard | 0 | 74.4 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | ***Combined Equipment*** | | | | | | | | ***85.4*** |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
"Transit Noise and Vibration Impact Assessment", FTA, (FTA-VA-90-1003-06), May 2006; and/or
"Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances;" BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

## Construction Noise Analysis by Phase

| Equipment | | Typical Level @ 50', dBA[1] | Usage Factor[1,2] | Number of Units | Hour Per Day | Distance to Receiver, ft. | Hard or Soft Site? | Barrier Attenuation, dB | Leq(h), dBA |
|---|---|---|---|---|---|---|---|---|---|
| Item No. | Description | | | | | | | | |
| I.1 & II.1 Marina Without Pile Driving | | | | | | | | | |
| 70 | Forklift (est. from backhoe) | 77.6 | 0.4 | 1 | 12 | 50 | Hard | 0 | 73.6 |
| 12 | Crane | 80.6 | 0.16 | 1 | 12 | 50 | Hard | 0 | 72.6 |
| 76 | Barge | 80 | 1 | 1 | 12 | 50 | Hard | 0 | 80.0 |
| 77 | Push Boat | 80 | 0.5 | 1 | 2 | 50 | Hard | 0 | 69.2 |
| 78 | Skiff | 80 | 0.5 | 2 | 12 | 50 | Hard | 0 | 80.0 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | ***Combined Equipment*** | | | | | | | | ***84.0*** |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
"Transit Noise and Vibration Impact Assessment", FTA, (FTA-VA-90-1003-06), May 2006; and/or
"Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances;" BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

**Construction Noise Analysis by Phase**

| Equipment | | Typical Level @ 50', dBA[1] | Usage Factor[1,2] | Number of Units | Hour Per Day | Distance to Receiver, ft. | Hard or Soft Site? | Barrier Attenuation, dB | Leq(h), dBA |
|---|---|---|---|---|---|---|---|---|---|
| Item No. | Description | | | | | | | | |
| I.2 & II.2 Marina With Pile Driving | | | | | | | | | |
| 70 | Forklift (est. from backhoe) | 77.6 | 0.4 | 1 | 12 | 50 | Hard | 0 | 73.6 |
| 12 | Crane | 80.6 | 0.16 | 1 | 12 | 50 | Hard | 0 | 72.6 |
| 76 | Barge | 80 | 1 | 1 | 12 | 50 | Hard | 0 | 80.0 |
| 77 | Push Boat | 80 | 0.5 | 1 | 2 | 50 | Hard | 0 | 69.2 |
| 78 | Skiff | 80 | 0.5 | 2 | 12 | 50 | Hard | 0 | 80.0 |
| 35 | Pile-driver (Impact) | 101.3 | 0.2 | 1 | 12 | 50 | Hard | 0 | 94.3 |
| 40 | Pumps | 80.9 | 0.5 | 1 | 12 | 50 | Hard | 0 | 77.9 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | ***Combined Equipment*** | | | | | | | | ***94.8*** |

1. Obtained or estimated from:
   FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
   "Transit Noise and Vibration Impact Assessment", FTA, (FTA-VA-90-1003-06), May 2006; and/or
   "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances;" BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

**Source/Receiver Distances Used in Analysis (all values in feet)**

| Construction Phase / Activity | 12-hour Leq at 50' | Assumed Work Location | R1: Marriott Marquis San Diego Marina Hotel | | | R2: Homes on E Harbor Drive | | | R4: Embarcadero Park North | | | R6: Embarcadero Park South | | | R7: Fifth Avenue Landing Park | | | R8: Hilton San Diego Bayfront Hotel | | | R9: Homes on Coronado | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Closest | Farthest | Acoustical Average | Closest | Farthest | Acoustical Average | Closest | Farthest | Acoustical Average | Closest | Farthest | Acoustical Average | Closest | Farthest | Acoustical Average | Closest | Farthest | Acoustical Average | Closest | Farthest | Acoustical Average |
| **Phase 1 - Mobilization and Site Preparation** | | | | | | | | | | | | | | | | | | | | | | | |
| 1.1 Mobilization/ Demolition | 82.3 | Whole site | 650 | 1,600 | 1,020 | 950 | 1,370 | 1,141 | 1,000 | 2,400 | 1,549 | 200 | 950 | 436 | 25 | 1,000 | 158 | 520 | 1,540 | 895 | 2,870 | 3,250 | 3,054 |
| 1.2 Dewatering/ Shoring | 81.5 | Whole site | 650 | 1,600 | 1,020 | 950 | 1,370 | 1,141 | 1,000 | 2,400 | 1,549 | 200 | 950 | 436 | 25 | 1,000 | 158 | 520 | 1,540 | 895 | 2,870 | 3,250 | 3,054 |
| **Phase 2 - Hotel Tower & Meeting Areas** | | | | | | | | | | | | | | | | | | | | | | | |
| 2.1 Excavation and Foundation | 97.7 | Hotel & plaza | 650 | 1,380 | 947 | 950 | 1,370 | 1,141 | 1,000 | 1,840 | 1,356 | 200 | 700 | 374 | 220 | 1,000 | 469 | 740 | 1,540 | 1,068 | 2,870 | 3,250 | 3,054 |
| 2.2 Structural Frame | 82.5 | Hotel & plaza | 650 | 1,380 | 947 | 950 | 1,370 | 1,141 | 1,000 | 1,840 | 1,356 | 200 | 700 | 374 | 220 | 1,000 | 469 | 740 | 1,540 | 1,068 | 2,870 | 3,250 | 3,054 |
| 2.3 Exterior Closure and Roofing | 79.1 | Hotel & plaza | 650 | 1,380 | 947 | 950 | 1,370 | 1,141 | 1,000 | 1,840 | 1,356 | 200 | 700 | 374 | 220 | 1,000 | 469 | 740 | 1,540 | 1,068 | 2,870 | 3,250 | 3,054 |
| 2.6 Interior Construction/ Finishes | 77.7 | Hotel & plaza | 650 | 1,380 | 947 | 950 | 1,370 | 1,141 | 1,000 | 1,840 | 1,356 | 200 | 700 | 374 | 220 | 1,000 | 469 | 740 | 1,540 | 1,068 | 2,870 | 3,250 | 3,054 |
| 2.7 MEP Systems | 79.1 | Hotel & plaza | 650 | 1,380 | 947 | 950 | 1,370 | 1,141 | 1,000 | 1,840 | 1,356 | 200 | 700 | 374 | 220 | 1,000 | 469 | 740 | 1,540 | 1,068 | 2,870 | 3,250 | 3,054 |
| **Phase 3 - Low Cost Hotel** | | | | | | | | | | | | | | | | | | | | | | | |
| 3.1 Foundations | 94.4 | East end / low cost hotel | 1,380 | 1,600 | 1,486 | 1,000 | 1,230 | 1,109 | 1,770 | 2,400 | 2,061 | 480 | 720 | 588 | 25 | 220 | 74 | 520 | 750 | 624 | 2,950 | 3,110 | 3,029 |
| 3.2 Structural Frame | 76.6 | East end / low cost hotel | 1,380 | 1,600 | 1,486 | 1,000 | 1,230 | 1,109 | 1,770 | 2,400 | 2,061 | 480 | 720 | 588 | 25 | 220 | 74 | 520 | 750 | 624 | 2,950 | 3,110 | 3,029 |
| 3.3 Exterior Closure | 76.7 | East end / low cost hotel | 1,380 | 1,600 | 1,486 | 1,000 | 1,230 | 1,109 | 1,770 | 2,400 | 2,061 | 480 | 720 | 588 | 25 | 220 | 74 | 520 | 750 | 624 | 2,950 | 3,110 | 3,029 |
| 3.4 Interior Construction/ Finishes | 75.5 | East end / low cost hotel | 1,380 | 1,600 | 1,486 | 1,000 | 1,230 | 1,109 | 1,770 | 2,400 | 2,061 | 480 | 720 | 588 | 25 | 220 | 74 | 520 | 750 | 624 | 2,950 | 3,110 | 3,029 |
| 3.5 Phase Completion Work | 75.5 | East end / low cost hotel | 1,380 | 1,600 | 1,486 | 1,000 | 1,230 | 1,109 | 1,770 | 2,400 | 2,061 | 480 | 720 | 588 | 25 | 220 | 74 | 520 | 750 | 624 | 2,950 | 3,110 | 3,029 |
| **Phase 4 - Site Work** | | | | | | | | | | | | | | | | | | | | | | | |
| 4.1 Offsite Demolition / Grading / Utilities | 83.5 | In adjacent streets | 620 | 2,260 | 1,184 | 620 | 1,500 | 964 | 1,140 | 2,880 | 1,812 | 600 | 1,770 | 1,031 | 60 | 1,000 | 245 | 250 | 1,500 | 612 | 3,100 | 3,830 | 3,446 |
| 4.4 Site Improvements | 85.4 | Whole site | 650 | 1,600 | 1,020 | 950 | 1,370 | 1,141 | 1,000 | 2,400 | 1,549 | 200 | 950 | 436 | 25 | 1,000 | 158 | 520 | 1,540 | 895 | 2,870 | 3,250 | 3,054 |
| **Marina** | | | | | | | | | | | | | | | | | | | | | | | |
| Phase I.1 Marina, No Pile Driving | 84.0 | Marina Phase I | 1,530 | 1,900 | 1,705 | 1,270 | 1,800 | 1,512 | 1,580 | 2,000 | 1,778 | 150 | 630 | 307 | 50 | 620 | 176 | 600 | 1,040 | 790 | 2,390 | 2,900 | 2,633 |
| Phase I.2 Marina, With Pile Driving | 94.8 | Marina Phase I | 1,530 | 1,900 | 1,705 | 1,270 | 1,800 | 1,512 | 1,580 | 2,000 | 1,778 | 150 | 630 | 307 | 50 | 620 | 176 | 600 | 1,040 | 790 | 2,390 | 2,900 | 2,633 |
| Phase I.1 Marina, No Pile Driving | 84.0 | Marina Phase II | 1,640 | 2,140 | 1,873 | 1,700 | 2,260 | 1,960 | 1,540 | 2,100 | 1,798 | 160 | 690 | 332 | 590 | 1,090 | 802 | 750 | 1,400 | 1,025 | 1,890 | 2,390 | 2,125 |
| Phase I.2 Marina, With Pile Driving | 94.8 | Marina Phase II | 1,640 | 2,140 | 1,873 | 1,700 | 2,260 | 1,960 | 1,540 | 2,100 | 1,798 | 160 | 690 | 332 | 590 | 1,090 | 802 | 750 | 1,400 | 1,025 | 1,890 | 2,390 | 2,125 |

**Construction Noise Levels by Phase and Overlapping Phases (all values are 12-hour Leq, dBA)**

| Construction Phase / Activity | 12-hour Leq at 50' | R1: Marriott Marquis San Diego Marina Hotel | R2: Homes on E Harbor Drive | R4: Embarcadero Park North | R6: Embarcadero Park South | R7: Fifth Avenue Landing Park | R8: Hilton San Diego Bayfront Hotel | R9: Homes on Coronado |
|---|---|---|---|---|---|---|---|---|
| **Phase 1 - Mobilization and Site Preparation** | | | | | | | | |
| 1.1 Mobilization/ Demolition | 82.3 | 56.1 | 50.1 | 52.4 | 63.5 | 72.3 | 57.2 | 46.5 |
| 1.2 Dewatering/ Shoring | 81.5 | 55.3 | 49.3 | 51.7 | 62.7 | 71.5 | 56.4 | 45.8 |
| **Phase 2 - Hotel Tower & Meeting Areas** | | | | | | | | |
| 2.1 Excavation and Foundation | 97.7 | 72.1 | 65.5 | 69.0 | 80.2 | 78.2 | 71.1 | 61.9 |
| 2.2 Structural Frame | 82.5 | 57.0 | 50.4 | 53.9 | 65.0 | 63.1 | 55.9 | 46.8 |
| 2.3 Exterior Closure and Roofing | 79.1 | 53.6 | 46.9 | 50.4 | 61.6 | 59.7 | 52.5 | 43.4 |
| 2.6 Interior Construction/ Finishes | 77.7 | 52.1 | 45.5 | 49.0 | 60.2 | 58.2 | 51.1 | 41.9 |
| 2.7 MEP Systems | 79.1 | 53.6 | 46.9 | 50.4 | 61.6 | 59.7 | 52.5 | 43.4 |
| **Phase 3 - Low Cost Hotel** | | | | | | | | |
| 3.1 Foundations | 94.4 | 64.9 | 62.4 | 62.1 | 72.9 | 90.9 | 72.4 | 58.7 |
| 3.2 Structural Frame | 76.6 | 47.2 | 44.7 | 44.3 | 55.2 | 73.2 | 54.7 | 41.0 |
| 3.3 Exterior Closure | 76.7 | 47.2 | 44.8 | 44.4 | 55.3 | 73.3 | 54.8 | 41.0 |
| 3.4 Interior Construction/ Finishes | 75.5 | 46.0 | 43.6 | 43.2 | 54.1 | 72.1 | 53.6 | 39.8 |
| 3.5 Phase Completion Work | 75.5 | 46.0 | 43.6 | 43.2 | 54.1 | 72.1 | 53.6 | 39.8 |
| **Phase 4 - Site Work** | | | | | | | | |
| 4.1 Offsite Demolition / Grading / Utilities | 83.5 | 56.0 | 52.8 | 52.3 | 57.2 | 69.7 | 61.7 | 46.7 |
| 4.4 Site Improvements | 85.4 | 59.3 | 53.3 | 55.6 | 66.6 | 75.4 | 60.4 | 49.7 |
| Overlap 1 1.2 + 2.1 | 97.8 | 72.2 | 65.6 | 69.1 | 80.3 | 79.2 | 71.2 | 62.1 |
| Overlap 2 2.1 + 3.1 | 99.3 | 72.9 | 67.2 | 69.8 | 80.9 | 91.2 | 74.8 | 63.6 |
| Overlap 3 2.2 + 3.1 | 94.6 | 65.5 | 62.7 | 62.7 | 73.6 | 90.9 | 72.5 | 59.0 |
| Overlap 4 2.2 + 2.7 + 3.1 | 94.8 | 65.8 | 62.8 | 62.9 | 73.9 | 90.9 | 72.6 | 59.1 |
| Overlap 5 2.2 + 2.5 + 2.7 + 3.1 | 94.8 | 65.8 | 62.8 | 62.9 | 73.9 | 90.9 | 72.6 | 59.1 |
| Overlap 6 2.2 + 2.5 + 2.7 + 3.1 + 3.2 | 94.8 | 65.9 | 62.9 | 63.0 | 73.9 | 91.0 | 72.6 | 59.2 |
| Overlap 7 2.2 + 2.3 + 2.5 + 2.7 + 3.1 + 3.2 | 94.9 | 66.1 | 63.0 | 63.2 | 74.2 | 91.0 | 72.7 | 59.3 |
| Overlap 8 2.2 + 2.3 + 2.5 + 2.7 + 3.1 + 3.2 + 4.1 | 95.2 | 66.5 | 63.4 | 63.6 | 74.3 | 91.0 | 73.0 | 59.5 |
| Overlap 9 2.2 + 2.3 + 2.5 + 2.7 + 3.1 + 3.2 + 3.3 + 4.1 | 95.3 | 66.6 | 63.4 | 63.6 | 74.3 | 91.1 | 73.1 | 59.6 |
| Overlap 10 2.2 + 2.3 + 2.5 + 2.6 + 2.7 + 3.1 + 3.2 + 3.3 + 4.1 | 95.4 | 66.7 | 63.5 | 63.8 | 74.5 | 91.1 | 73.1 | 59.6 |
| Overlap 11 2.2 + 2.3 + 2.5 + 2.6 + 2.7 + 3.1 + 3.2 + 3.3 + 3.4 + 4.1 | 95.4 | 66.8 | 63.6 | 63.8 | 74.5 | 91.2 | 73.2 | 59.7 |
| Overlap 12 2.3 + 2.5 + 2.6 + 2.7 + 3.3 + 3.4 + 4.1 | 87.2 | 60.5 | 55.8 | 57.2 | 67.1 | 76.9 | 64.0 | 51.1 |
| Overlap 13 2.3 + 2.6 + 2.7 + 3.3 + 3.4 + 4.1 | 87.2 | 60.5 | 55.8 | 57.2 | 67.1 | 76.9 | 64.0 | 51.1 |
| Overlap 14 2.3 + 2.6 + 3.3 + 3.4 + 4.1 | 86.5 | 59.5 | 55.2 | 56.1 | 65.6 | 76.8 | 63.7 | 50.3 |
| Overlap 15 2.3 + 2.6 + 3.3 + 3.4 + 4.4 | 87.6 | 61.2 | 55.4 | 57.8 | 68.9 | 78.7 | 62.8 | 51.9 |
| **Marina Pile Driving** | | | | | | | | |
| Phase I.1 Marina, No Pile Driving | 84.0 | 53.3 | 49.4 | 53.0 | 68.2 | 73.0 | 60.0 | 49.5 |
| Phase I.2 Marina, With Pile Driving | 94.8 | 64.1 | 60.2 | 63.8 | 79.0 | 83.9 | 70.8 | 60.4 |
| Phase I.1 Marina, No Pile Driving | 84.0 | 52.5 | 47.1 | 52.9 | 67.5 | 59.9 | 57.7 | 51.4 |
| Phase I.2 Marina, With Pile Driving | 94.8 | 63.3 | 57.9 | 63.7 | 78.3 | 70.7 | 68.6 | 62.2 |

**Construction Noise Increases at Sensitive Receptors**

| | Combined Construction & Ambient | | | | | Increase Due to Construction | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Construction Phase / Activity | R2: Homes on E Harbor Drive | R4: Embarcadero Park North | R6: Embarcadero Park South | R7: Fifth Avenue Landing Park | R9: Homes on Coronado | R2: Homes on E Harbor Drive | R4: Embarcadero Park North | R6: Embarcadero Park South | R7: Fifth Avenue Landing Park | R9: Homes on Coronado |
| **Ambient Noise Level** | **63.0** | **58** | **58** | **54.4** | **60.7** | | | | | |
| **Phase 1 - Mobilization and Site Preparation** | | | | | | | | | | |
| 1.1 Mobilization/ Demolition | 63.2 | 59.1 | 64.5 | 72.3 | 60.9 | 0.2 | 1.1 | 6.5 | 17.9 | 0.2 |
| 1.2 Dewatering/ Shoring | 63.2 | 58.9 | 64.0 | 71.6 | 60.8 | 0.2 | 0.9 | 6.0 | 17.2 | 0.1 |
| **Phase 2 - Hotel Tower & Meeting Areas** | | | | | | | | | | |
| 2.1 Excavation and Foundation | 67.4 | 69.3 | 80.2 | 78.2 | 64.4 | 4.4 | 11.3 | 22.2 | 23.8 | 3.7 |
| 2.2 Structural Frame | 63.2 | 59.4 | 65.8 | 63.6 | 60.9 | 0.2 | 1.4 | 7.8 | 9.2 | 0.2 |
| 2.3 Exterior Closure and Roofing | 63.1 | 58.7 | 63.2 | 60.8 | 60.8 | 0.1 | 0.7 | 5.2 | 6.4 | 0.1 |
| 2.6 Interior Construction/ Finishes | 63.1 | 58.5 | 62.2 | 59.7 | 60.8 | 0.1 | 0.5 | 4.2 | 5.3 | 0.1 |
| 2.7 MEP Systems | 63.1 | 58.7 | 63.2 | 60.8 | 60.8 | 0.1 | 0.7 | 5.2 | 6.4 | 0.1 |
| **Phase 3 - Low Cost Hotel** | | | | | | | | | | |
| 3.1 Foundations | 65.7 | 63.5 | 73.1 | 90.9 | 62.8 | 2.7 | 5.5 | 15.1 | 36.5 | 2.1 |
| 3.2 Structural Frame | 63.1 | 58.2 | 59.8 | 73.3 | 60.7 | 0.1 | 0.2 | 1.8 | 18.9 | 0.0 |
| 3.3 Exterior Closure | 63.1 | 58.2 | 59.9 | 73.3 | 60.7 | 0.1 | 0.2 | 1.9 | 18.9 | 0.0 |
| 3.4 Interior Construction/ Finishes | 63.0 | 58.1 | 59.5 | 72.1 | 60.7 | 0.0 | 0.1 | 1.5 | 17.7 | 0.0 |
| 3.5 Phase Completion Work | 63.0 | 58.1 | 59.5 | 72.1 | 60.7 | 0.0 | 0.1 | 1.5 | 17.7 | 0.0 |
| **Phase 4 - Site Work** | | | | | | | | | | |
| 4.1 Offsite Demolition / Grading / Utilities | 63.4 | 59.0 | 60.6 | 69.8 | 60.9 | 0.4 | 1.0 | 2.6 | 15.4 | 0.2 |
| 4.4 Site Improvements | 63.4 | 60.0 | 67.2 | 75.5 | 61.0 | 0.4 | 2.0 | 9.2 | 21.1 | 0.3 |
| Overlap 1 1.2 + 2.1 | 67.5 | 69.4 | 80.3 | 79.2 | 64.4 | 4.5 | 11.4 | 22.3 | 24.8 | 3.7 |
| Overlap 2 2.1 + 3.1 | 68.6 | 70.1 | 81.0 | 91.2 | 65.4 | 5.6 | 12.1 | 23.0 | 36.8 | 4.7 |
| Overlap 3 2.2 + 3.1 | 65.9 | 63.9 | 73.7 | 90.9 | 62.9 | 2.9 | 5.9 | 15.7 | 36.5 | 2.2 |
| Overlap 4 2.2 + 2.7 + 3.1 | 65.9 | 64.1 | 74.0 | 90.9 | 63.0 | 2.9 | 6.1 | 16.0 | 36.5 | 2.3 |
| Overlap 5 2.2 + 2.5 + 2.7 + 3.1 | 65.9 | 64.1 | 74.0 | 90.9 | 63.0 | 2.9 | 6.1 | 16.0 | 36.5 | 2.3 |
| Overlap 6 2.2 + 2.5 + 2.7 + 3.1 + 3.2 | 65.9 | 64.2 | 74.0 | 91.0 | 63.0 | 2.9 | 6.2 | 16.0 | 36.6 | 2.3 |
| Overlap 7 2.2 + 2.3 + 2.5 + 2.7 + 3.1 + 3.2 | 66.0 | 64.4 | 74.3 | 91.0 | 63.1 | 3.0 | 6.4 | 16.3 | 36.6 | 2.4 |
| Overlap 8 2.2 + 2.3 + 2.5 + 2.7 + 3.1 + 3.2 + 4.1 | 66.2 | 64.6 | 74.4 | 91.0 | 63.2 | 3.2 | 6.6 | 16.4 | 36.6 | 2.5 |
| Overlap 9 2.2 + 2.3 + 2.5 + 2.7 + 3.1 + 3.2 + 3.3 + 4.1 | 66.2 | 64.7 | 74.4 | 91.1 | 63.2 | 3.2 | 6.7 | 16.4 | 36.7 | 2.5 |
| Overlap 10 2.2 + 2.3 + 2.5 + 2.6 + 2.7 + 3.1 + 3.2 + 3.3 + 4.1 | 66.3 | 64.8 | 74.6 | 91.1 | 63.2 | 3.3 | 6.8 | 16.6 | 36.7 | 2.5 |
| Overlap 11 2.2 + 2.3 + 2.5 + 2.6 + 2.7 + 3.1 + 3.2 + 3.3 + 3.4 + 4.1 | 66.3 | 64.8 | 74.6 | 91.2 | 63.2 | 3.3 | 6.8 | 16.6 | 36.8 | 2.5 |
| Overlap 12 2.3 + 2.5 + 2.6 + 2.7 + 3.3 + 3.4 + 4.1 | 63.8 | 60.6 | 67.6 | 76.9 | 61.2 | 0.8 | 2.6 | 9.6 | 22.5 | 0.5 |
| Overlap 13 2.3 + 2.6 + 2.7 + 3.3 + 3.4 + 4.1 | 63.8 | 60.6 | 67.6 | 76.9 | 61.2 | 0.8 | 2.6 | 9.6 | 22.5 | 0.5 |
| Overlap 14 2.3 + 2.6 + 3.3 + 3.4 + 4.1 | 63.7 | 60.2 | 66.3 | 76.9 | 61.1 | 0.7 | 2.2 | 8.3 | 22.5 | 0.4 |
| Overlap 15 2.3 + 2.6 + 3.3 + 3.4 + 4.4 | 63.7 | 60.9 | 69.2 | 78.7 | 61.2 | 0.7 | 2.9 | 11.2 | 24.3 | 0.5 |
| **Marina Pile Driving** | | | | | | | | | | |
| Phase I.1 Marina, No Pile Driving | 63.2 | 59.2 | 68.6 | 73.1 | 61.0 | 0.2 | 1.2 | 10.6 | 18.7 | 0.3 |
| Phase I.2 Marina, With Pile Driving | 64.8 | 64.8 | 79.0 | 83.9 | 63.5 | 1.8 | 6.8 | 21.0 | 29.5 | 2.8 |
| Phase I.1 Marina, No Pile Driving | 63.1 | 59.2 | 68.0 | 61.0 | 61.2 | 0.1 | 1.2 | 10.0 | 6.6 | 0.5 |
| Phase I.2 Marina, With Pile Driving | 64.2 | 64.7 | 78.4 | 70.8 | 64.5 | 1.2 | 6.7 | 20.4 | 16.4 | 3.8 |

**This spreadsheet calculates traffic noise levels based on TNM Version 2.5 Lookup Tables.**

**** Type in yellow cells only.**

**Traffic Data:**

● **Enter ADT Traffic**

○ **Enter Loudest-hour Traffic**

**Units:**

○ **Metric**

● **English**

**Calculate**

| Link | Roadway | Segment Location | Hard or Soft Ground (H or S) | BARRIER | | | Total Daily Traffic Volumes (ADT) | Traffic Mix | | Vehicle Speed | Sound Levels at Receiver Locations | | Distance to CNEL Noise Contour (feet) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Present 1=yes | Height min. 7 ft. max. 32 ft. | Distance 35 ft. or 100 ft. | | Number # | Description | mph max. 80 | Distance feet, min. 33 max. 1000 | dB CNEL | 75 dB | 70 dB | 65 dB | 60 dB |
| 1 | Harbor Drive (existing) | Laurel St to Hawthorn St | H | | | | 53,507 | 10 | County of Orange, Arterials | 40 | 50 | 73.3 | | 103 | 303 | 746 |
| 2 | Harbor Drive (existing) | Pacific Highway to Kettner Blvd | H | | | | 16,750 | 10 | County of Orange, Arterials | 25 | 50 | 63.4 | | | | 108 |
| 3 | Harbor Drive (existing) | Kettner Blvd to Market St | H | | | | 18,622 | 10 | County of Orange, Arterials | 40 | 50 | 68.7 | | 36 | 115 | 330 |
| 4 | Harbor Drive (existing) | Market St to Front St | H | | | | 17,779 | 10 | County of Orange, Arterials | 40 | 50 | 68.5 | | 34 | 110 | 317 |
| 5 | Harbor Drive (existing) | Front St to First Ave | H | | | | 19,129 | 10 | County of Orange, Arterials | 40 | 50 | 68.8 | | 37 | 118 | 337 |
| 6 | Harbor Drive (existing) | First Ave to Convention Center Court | H | | | | 18,643 | 10 | County of Orange, Arterials | 40 | 50 | 68.7 | | 36 | 115 | 330 |
| 7 | Harbor Drive (existing) | Convention Center Court to Fifth Ave | H | | | | 18,668 | 10 | County of Orange, Arterials | 40 | 50 | 68.7 | | 36 | 115 | 330 |
| 8 | Harbor Drive (existing) | Fifth Ave to Park Blvd | H | | | | 19,877 | 10 | County of Orange, Arterials | 40 | 50 | 69.0 | | 39 | 122 | 348 |
| 9 | Harbor Drive (existing) | South of Park Blvd | H | | | | 22,801 | 10 | County of Orange, Arterials | 40 | 50 | 69.6 | | 46 | 140 | 388 |
| 10 | Pacific Highway (existing) | Juniper St to Hawthorn St | H | | | | 8,676 | 10 | County of Orange, Arterials | 35 | 50 | 63.8 | | | 37 | 119 |
| 11 | Pacific Highway (existing) | Broadway to Harbor Drive | H | | | | 9,432 | 10 | County of Orange, Arterials | 35 | 50 | 64.2 | | | 41 | 129 |
| 12 | Park Boulevard (existing) | Harbor Drive to Gull St | H | | | | 6,800 | 10 | County of Orange, Arterials | 25 | 50 | 59.5 | | | | 45 |
| 13 | Harbor Drive (existing + project) | Laurel St to Hawthorn St | H | | | | 55,201 | 10 | County of Orange, Arterials | 40 | 50 | 73.4 | 33 | 107 | 311 | 764 |
| 14 | Harbor Drive (existing + project) | Pacific Highway to Kettner Blvd | H | | | | 19,291 | 10 | County of Orange, Arterials | 25 | 50 | 64.0 | | | 39 | 125 |
| 15 | Harbor Drive (existing + project) | Kettner Blvd to Market St | H | | | | 21,163 | 10 | County of Orange, Arterials | 40 | 50 | 69.3 | | 42 | 130 | 366 |
| 16 | Harbor Drive (existing + project) | Market St to Front St | H | | | | 20,320 | 10 | County of Orange, Arterials | 40 | 50 | 69.1 | | 40 | 125 | 354 |
| 17 | Harbor Drive (existing + project) | Front St to First Ave | H | | | | 22,941 | 10 | County of Orange, Arterials | 40 | 50 | 69.6 | | 46 | 141 | 390 |
| 18 | Harbor Drive (existing + project) | First Ave to Convention Center Court | H | | | | 24,149 | 10 | County of Orange, Arterials | 40 | 50 | 69.9 | | 48 | 148 | 407 |
| 19 | Harbor Drive (existing + project) | Convention Center Court to Fifth Ave | H | | | | 24,174 | 10 | County of Orange, Arterials | 40 | 50 | 69.9 | | 48 | 148 | 407 |
| 20 | Harbor Drive (existing + project) | Fifth Ave to Park Blvd | H | | | | 27,924 | 10 | County of Orange, Arterials | 40 | 50 | 70.5 | | 55 | 170 | 458 |
| 21 | Harbor Drive (existing + project) | South of Park Blvd | H | | | | 23,225 | 10 | County of Orange, Arterials | 40 | 50 | 69.7 | | 47 | 142 | 393 |
| 22 | Pacific Highway (existing + project) | Juniper St to Hawthorn St | H | | | | 9,523 | 10 | County of Orange, Arterials | 35 | 50 | 64.2 | | | 42 | 130 |
| 23 | Pacific Highway (existing + project) | Broadway to Harbor Drive | H | | | | 10,279 | 10 | County of Orange, Arterials | 35 | 50 | 64.6 | | | 45 | 141 |
| 24 | Park Boulevard (existing + project) | Harbor Drive to Gull St | H | | | | 15,270 | 10 | County of Orange, Arterials | 25 | 50 | 63.0 | | | | 98 |
| 25 | Harbor Drive (2021 base conditions) | Laurel St to Hawthorn St | H | | | | 65,300 | 10 | County of Orange, Arterials | 40 | 50 | 74.2 | 41 | 126 | 358 | 858 |
| 26 | Harbor Drive (2021 base conditions) | Pacific Highway to Kettner Blvd | H | | | | 25,800 | 10 | County of Orange, Arterials | 25 | 50 | 65.2 | | | 53 | 165 |
| 27 | Harbor Drive (2021 base conditions) | Kettner Blvd to Market St | H | | | | 28,700 | 10 | County of Orange, Arterials | 40 | 50 | 70.6 | | 57 | 175 | 468 |
| 28 | Harbor Drive (2021 base conditions) | Market St to Front St | H | | | | 23,000 | 10 | County of Orange, Arterials | 40 | 50 | 69.6 | | 46 | 141 | 390 |
| 29 | Harbor Drive (2021 base conditions) | Front St to First Ave | H | | | | 24,700 | 10 | County of Orange, Arterials | 40 | 50 | 70.0 | | 49 | 151 | 415 |
| 30 | Harbor Drive (2021 base conditions) | First Ave to Convention Center Court | H | | | | 24,100 | 10 | County of Orange, Arterials | 40 | 50 | 69.8 | | 48 | 148 | 406 |
| 31 | Harbor Drive (2021 base conditions) | Convention Center Court to Fifth Ave | H | | | | 24,100 | 10 | County of Orange, Arterials | 40 | 50 | 69.8 | | 48 | 148 | 406 |
| 32 | Harbor Drive (2021 base conditions) | Fifth Ave to Park Blvd | H | | | | 25,700 | 10 | County of Orange, Arterials | 40 | 50 | 70.1 | | 51 | 157 | 429 |
| 33 | Harbor Drive (2021 base conditions) | South of Park Blvd | H | | | | 23,300 | 10 | County of Orange, Arterials | 40 | 50 | 69.7 | | 47 | 143 | 394 |
| 34 | Pacific Highway (2021 base conditions) | Juniper St to Hawthorn St | H | | | | 10,100 | 10 | County of Orange, Arterials | 35 | 50 | 64.5 | | | 44 | 138 |
| 35 | Pacific Highway (2021 base conditions) | Broadway to Harbor Drive | H | | | | 9,900 | 10 | County of Orange, Arterials | 35 | 50 | 64.4 | | | 43 | 136 |
| 36 | Park Boulevard (2021 base conditions) | Harbor Drive to Gull St | H | | | | 8,700 | 10 | County of Orange, Arterials | 25 | 50 | 60.6 | | | | 56 |
| 37 | Harbor Drive (2021 + project) | Laurel St to Hawthorn St | H | | | | 66,994 | 10 | County of Orange, Arterials | 40 | 50 | 74.3 | 42 | 129 | 366 | 875 |
| 38 | Harbor Drive (2021 + project) | Pacific Highway to Kettner Blvd | H | | | | 28,341 | 10 | County of Orange, Arterials | 25 | 50 | 65.6 | | | 57 | 181 |
| 39 | Harbor Drive (2021 + project) | Kettner Blvd to Market St | H | | | | 31,241 | 10 | County of Orange, Arterials | 40 | 50 | 71.0 | | 61 | 190 | 499 |
| 40 | Harbor Drive (2021 + project) | Market St to Front St | H | | | | 25,541 | 10 | County of Orange, Arterials | 40 | 50 | 70.1 | | 51 | 156 | 426 |
| 41 | Harbor Drive (2021 + project) | Front St to First Ave | H | | | | 28,512 | 10 | County of Orange, Arterials | 40 | 50 | 70.6 | | 56 | 174 | 466 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 42 | **Harbor Drive (2021 + project)** | **First Ave to Convention Center Court** | H | | 29,606 | 10 | County of Orange, Arterials | 40 | 50 | **70.7** | | **58** | **180** | **480** |
| 43 | **Harbor Drive (2021 + project)** | **Convention Center Court to Fifth Ave** | H | | 29,606 | 10 | County of Orange, Arterials | 40 | 50 | **70.7** | | **58** | **180** | **480** |
| 44 | **Harbor Drive (2021 + project)** | **Fifth Ave to Park Blvd** | H | | 33,747 | 10 | County of Orange, Arterials | 40 | 50 | **71.3** | | **64** | **203** | **528** |
| 45 | **Harbor Drive (2021 + project)** | **South of Park Blvd** | H | | 23,724 | 10 | County of Orange, Arterials | 40 | 50 | **69.8** | | **48** | **145** | **401** |
| 46 | **Pacific Highway (2021 + project)** | **Juniper St to Hawthorn St** | H | | 10,947 | 10 | County of Orange, Arterials | 35 | 50 | **64.8** | | | **48** | **150** |
| 47 | **Pacific Highway (2021 + project)** | **Broadway to Harbor Drive** | H | | 10,747 | 10 | County of Orange, Arterials | 35 | 50 | **64.8** | | | **47** | **147** |
| 48 | **Park Boulevard (2021 + project)** | **Harbor Drive to Gull St** | H | | 17,170 | 10 | County of Orange, Arterials | 25 | 50 | **63.5** | | | **33** | **111** |
| 49 | **Harbor Drive (2035 base conditions)** | **Laurel St to Hawthorn St** | H | | 62,700 | 10 | County of Orange, Arterials | 40 | 50 | **74.0** | **39** | **122** | **347** | **834** |
| 50 | **Harbor Drive (2035 base conditions)** | **Pacific Highway to Kettner Blvd** | H | | 25,800 | 10 | County of Orange, Arterials | 25 | 50 | **65.2** | | | **53** | **165** |
| 51 | **Harbor Drive (2035 base conditions)** | **Kettner Blvd to Market St** | H | | 28,700 | 10 | County of Orange, Arterials | 40 | 50 | **70.6** | | **57** | **175** | **468** |
| 52 | **Harbor Drive (2035 base conditions)** | **Market St to Front St** | H | | 26,000 | 10 | County of Orange, Arterials | 40 | 50 | **70.2** | | **52** | **159** | **433** |
| 53 | **Harbor Drive (2035 base conditions)** | **Front St to First Ave** | H | | 28,000 | 10 | County of Orange, Arterials | 40 | 50 | **70.5** | | **55** | **170** | **459** |
| 54 | **Harbor Drive (2035 base conditions)** | **First Ave to Convention Center Court** | H | | 27,300 | 10 | County of Orange, Arterials | 40 | 50 | **70.4** | | **54** | **166** | **450** |
| 55 | **Harbor Drive (2035 base conditions)** | **Convention Center Court to Fifth Ave** | H | | 27,300 | 10 | County of Orange, Arterials | 40 | 50 | **70.4** | | **54** | **166** | **450** |
| 56 | **Harbor Drive (2035 base conditions)** | **Fifth Ave to Park Blvd** | H | | 29,100 | 10 | County of Orange, Arterials | 40 | 50 | **70.7** | | **57** | **177** | **473** |
| 57 | **Harbor Drive (2035 base conditions)** | **South of Park Blvd** | H | | 27,400 | 10 | County of Orange, Arterials | 40 | 50 | **70.4** | | **54** | **167** | **451** |
| 58 | **Pacific Highway (2035 base conditions)** | **Juniper St to Hawthorn St** | H | | 12,400 | 10 | County of Orange, Arterials | 35 | 50 | **65.4** | | | **54** | **168** |
| 59 | **Pacific Highway (2035 base conditions)** | **Broadway to Harbor Drive** | H | | 10,000 | 10 | County of Orange, Arterials | 35 | 50 | **64.4** | | | **44** | **137** |
| 60 | **Park Boulevard (2035 base conditions)** | **Harbor Dr to Gull St** | H | | 10,900 | 10 | County of Orange, Arterials | 25 | 50 | **61.5** | | | | **68** |
| 61 | **Park Boulevard (2035 base conditions)** | **Harbor Dr to Imperial Ave** | H | | 16,400 | 10 | County of Orange, Arterials | 25 | 50 | **63.3** | | | | **106** |
| 62 | **Imperial Avenue (2035 base conditions)** | **Park Blvd to 16th St** | H | | 16,200 | 10 | County of Orange, Arterials | 25 | 50 | **63.2** | | | | **104** |
| 63 | **Harbor Drive (2035 + project)** | **Laurel St to Hawthorn St** | H | | 64,394 | 10 | County of Orange, Arterials | 40 | 50 | **74.1** | **40** | **125** | **354** | **849** |
| 64 | **Harbor Drive (2035 + project)** | **Pacific Highway to Kettner Blvd** | H | | 28,341 | 10 | County of Orange, Arterials | 25 | 50 | **65.6** | | | **57** | **181** |
| 65 | **Harbor Drive (2035 + project)** | **Kettner Blvd to Market St** | H | | 31,241 | 10 | County of Orange, Arterials | 40 | 50 | **71.0** | | **61** | **190** | **499** |
| 66 | **Harbor Drive (2035 + project)** | **Market St to Front St** | H | | 28,541 | 10 | County of Orange, Arterials | 40 | 50 | **70.6** | | **56** | **174** | **466** |
| 67 | **Harbor Drive (2035 + project)** | **Front St to First Ave** | H | | 30,541 | 10 | County of Orange, Arterials | 40 | 50 | **70.9** | | **60** | **186** | **491** |
| 68 | **Harbor Drive (2035 + project)** | **First Ave to Convention Center Court** | H | | 29,841 | 10 | County of Orange, Arterials | 40 | 50 | **70.8** | | **58** | **182** | **483** |
| 69 | **Harbor Drive (2035 + project)** | **Convention Center Court to Fifth Ave** | H | | 29,841 | 10 | County of Orange, Arterials | 40 | 50 | **70.8** | | **58** | **182** | **483** |
| 70 | **Harbor Drive (2035 + project)** | **Fifth Ave to Park Blvd** | H | | 32,065 | 10 | County of Orange, Arterials | 40 | 50 | **71.1** | | **62** | **194** | **509** |
| 71 | **Harbor Drive (2035 + project)** | **South of Park Blvd** | H | | 27,400 | 10 | County of Orange, Arterials | 40 | 50 | **70.4** | | **54** | **167** | **451** |
| 72 | **Pacific Highway (2035 + project)** | **Juniper St to Hawthorn St** | H | | 13,247 | 10 | County of Orange, Arterials | 35 | 50 | **65.7** | | | **57** | **179** |
| 73 | **Pacific Highway (2035 + project)** | **Broadway to Harbor Drive** | H | | 10,847 | 10 | County of Orange, Arterials | 35 | 50 | **64.8** | | | **48** | **149** |
| 74 | **Park Boulevard (2035 + project)** | **Harbor Dr to Gull St** | H | | 19,370 | 10 | County of Orange, Arterials | 25 | 50 | **64.0** | | | **39** | **125** |
| 75 | **Park Boulevard (2035 + project)** | **Harbor Dr to Imperial Ave** | H | | 22,329 | 10 | County of Orange, Arterials | 25 | 50 | **64.6** | | | **46** | **144** |
| 76 | **Imperial Avenue (2035 + project)** | **Park Blvd to 16th St** | H | | 18,318 | 10 | County of Orange, Arterials | 25 | 50 | **63.8** | | | **36** | **119** |
| 77 | **Park Boulevard (during construction)** | **Harbor Dr to Gull St** | H | | 188 | 13 | Daytime construction traffic | 25 | 50 | **54.0** | | | | |
| 78 | **Park Boulevard (during construction)** | **Other** | H | | 188 | 13 | Daytime construction traffic | 45 | 50 | **56.9** | | | | |

## Construction Vibration Analysis

| | Reference PPV at 25 ft (in/sec) | R1: Marriott Marquis San Diego Marina Hotel (NW of site) | | R2: Homes on E Harbor Drive (NE beyond Conv. Ctr.) | | R3: San Diego Convention Center | | R4: Embarcadero Park North (W of site) | | R5: Joe's Crab Shack | | R6: Embarcadero Park South (SW of site) | | R7: Fifth Avenue Landing Park | | R8: Hilton San Diego Bayfront Hotel (SE of site) | | R9: Homes on Coronado (SW of site) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Impact Criteria** | | | | | | | | | | | | | | | | | | | |
| Potential building damage | | 0.5 | | 0.5 | | 0.5 | | N/A | | 0.25 | | N/A | | N/A | | 0.5 | | 0.3 | |
| Annoyance/interference | | N/A | | 0.04 | | N/A | | 0.1 | | N/A | | 0.1 | | 0.1 | | N/A | | 0.04 | |
| **Estimated Vibration Levels** | | | | | | | | | | | | | | | | | | | |
| **Phase/Equipment** | | **Distance** | **PPV, in/s** | **Distance** | **PPV, in/s** | **Distance** | **PPV, in/s** | **Distance** | **PPV, in/s** | **Distance** | **PPV, in/s** | **Distance** | **PPV, in/s** | **Distance** | **PPV, in/s** | **Distance** | **PPV, in/s** | **Distance** | **PPV, in/s** |
| Pile driving - Marina Phase I | 0.65 | 1530 | 0.007 | 1270 | 0.009 | 270 | 0.047 | 1580 | 0.007 | 485 | 0.025 | 150 | 0.091 | 50 | 0.303 | 600 | 0.020 | 2390 | 0.004 |
| Pile driving - Marina Phase II | 0.65 | 1640 | 0.007 | 1700 | 0.006 | 780 | 0.015 | 1540 | 0.007 | 520 | 0.023 | 160 | 0.084 | 590 | 0.020 | 750 | 0.015 | 1890 | 0.006 |
| Pile driving - Hotel/ meeting areas | 0.65 | 650 | 0.018 | 950 | 0.012 | 70 | 0.209 | 1000 | 0.011 | 80 | 0.181 | 200 | 0.066 | 220 | 0.059 | 740 | 0.016 | 2870 | 0.004 |
| Pile driving - Lower Cost Hotel | 0.65 | 1380 | 0.008 | 1000 | 0.011 | 90 | 0.159 | 1770 | 0.006 | 520 | 0.023 | 480 | 0.025 | 25 | 0.650 | 520 | 0.023 | 2950 | 0.003 |
| Heavy earthmoving equipment | 0.089 | 620 | 0.003 | 620 | 0.003 | 25 | 0.089 | 1000 | 0.002 | 50 | 0.042 | 200 | 0.009 | 25 | 0.089 | 250 | 0.007 | 2870 | 0.000 |
| Vibratory roller | 0.21 | 650 | 0.006 | 950 | 0.004 | 50 | 0.098 | 1000 | 0.004 | 50 | 0.098 | 200 | 0.021 | 25 | 0.210 | 520 | 0.007 | 2870 | 0.001 |

# Appendix K-1
# Transportation Impact Analysis

# Transportation Impact Analysis

## Fifth Avenue Landing

## DRAFT REPORT

***Prepared for:***

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

**ICF International**
525 B St. Suite 1700
San Diego, CA 92101

***Prepared by:***

CHEN RYAN
3900 5th Avenue, Suite 210
San Diego, CA 92103

September 11, 2017

# Executive Summary

The purpose of this Transportation Impact Analysis (TIA) is to identify and document potential transportation related impacts associated with the implementation of the Fifth Avenue Landing Project (Proposed Project), as well as to recommend mitigation measures, as necessary, for any identified transportation related impacts associated with the Proposed Project.

## ES.1 Study Purpose and Project Description

The Fifth Avenue Landing Project is located along Convention Way in Downtown San Diego, directly behind the San Diego Convention Center truck loading docks, along an existing Bayfront promenade and the Fifth Avenue Landing Super Mega Yacht marina. The Proposed Project involves the repositioning of the 218,875-square foot property and includes construction of an 850-room market-rate hotel tower, up to 565-bed "Low Cost Visitor Serving Hotel," promenade retail, 85,490 square feet of public plaza space, onsite parking, a connecting bridge from the hotel tower to the Convention Center, and a marina expansion.

## ES.2 Project Trip Generation and Study Area

The Proposed Project is anticipated to generate a total of 8,486 daily trips, including 499 (298-in / 201-out) AM peak hour trips, and 679 (405-in / 274-out) PM peak hour trips.

### Study Roadway Segments

Based on the project trip assignment and input from District staff, the following key study area roadway segments were analyzed:

**Harbor Drive between:**

- Laurel Street & Hawthorn Street
- Pacific Highway & Kettner Boulevard
- Kettner Boulevard & Market Street
- Market Street & Front Street
- Front Street & First Avenue
- First Avenue & Convention Center Court
- Convention Center Court & Fifth Avenue
- Fifth Avenue & Park Boulevard
- South of Park Boulevard

**Pacific Highway between:**

- Juniper Street & Hawthorn Street
- Broadway & Harbor Drive

### Study Intersections

Based on the project trip assignment, the following fifty-nine (59) key study area intersections were analyzed:

1: Harbor Drive & Laurel Street
2: Harbor Drive & Hawthorn Street
3: Harbor Drive & Grape St
4: Harbor Drive & Ash Street
5: Harbor Drive & Broadway
6: Harbor Drive & Kettner Boulevard
7: Harbor Drive & Market Street
8: Harbor Drive & Front Street
9: First Street & Harbor Drive
10: Harbor Drive & Fifth Avenue
11: Park Boulevard & Harbor Drive
12: Cesar Chavez Parkway & Harbor Drive
13: Pacific Highway & Laurel Street
14: Pacific Highway & Juniper Street
15: Pacific Highway & Hawthorn Street
16: Pacific Highway & Grape Street
17: Pacific Highway & Cedar Street
18: Pacific Highway & Ash Street
19: Pacific Highway & Grand Palm Court
20: Pacific Highway & Broadway
21: Pacific Highway & Harbor Drive
22: Front Street & Beech Street
23: Front Street & A Street
24: Front Street & Broadway
25: First Street & I-5 NB On-Ramp/Elm Street
26: First Street & Cedar Street
27: First Street & Beech Street
28: First Street & A Street
29: First Street & Broadway
30: Fifth Avenue & Cedar Street
31: Fifth Avenue & Beech Street
32: Fifth Avenue & Broadway
33: Sixth Avenue & Elm Street/I-5 NB Off-Ramp
34: Sixth Avenue & Cedar Street
35: Ninth Street & Ash Street
36: Tenth Avenue & A Street
37: Eleventh Avenue & A Street
38: Eleventh Avenue & Broadway
39: Eleventh Avenue & F Street
40: Eleventh Avenue & G Street
41: Eleventh Avenue & Market Street
42: Park Boulevard & G Street
43: 13th Street & G Street
44: 14th Street & G Street
45: 15th Street & F Street
46: 16th Street & E Street
47: 16th Street & F Street
48: 16th Street & G Street
49: 16th Street & Market Street
50: 16th Street & Island Avenue
51: 16th Street & K Street
52: Imperial Avenue & 16th Street
53: 17th Street & G Street
54: 17th Street & J Street
55: Imperial Avenue & 17th Street
56: 19th Street & J Street
57: Imperial Avenue & 19th Street
58: Logan Avenue & I-5 SB Off-Ramp
59: Logan Avenue & I-5 SB On-Ramp

### Freeway

The Proposed Project is anticipated to contribute more than 50 peak hour trips on Interstate 5 (I-5) in either direction. Therefore, a freeway impact analysis was conducted for I-5 between Grape Street and SR-75.

## ES.3 Project Impacts and Mitigation Measures

### Direct Impacts and Mitigation Measures

**Roadway Segments**

No roadway segments were identified as being directly impacted by the Proposed Project.

**Intersections**

The following intersections were identified to be directly impacted by the Proposed Project under Existing Plus Project Conditions. The recommended mitigation measure for the corresponding impact is also provided:

45. *15th Street & F Street* - Signalization of the intersection is recommended by the Downtown Community Plan. This improvement ultimately serves as a partial mitigation for the intersection under build out of the plan, with no feasible mitigation identified. Therefore, to remain consistent with the Downtown Community Plan it is recommended that the project implement this improvement as mitigation for this impact. However, the intersection is controlled by the City of San Diego and the District does not have jurisdiction over it; therefore, the impact is considered significant and unavoidable.
53. *17th Street & G Street* - Signalization of the intersection is recommended by the Downtown Community Plan. This improvement ultimately serves as a partial mitigation for the intersection under build out of the plan, with no feasible mitigation identified. Therefore, to remain consistent with the Downtown Community Plan it is recommended that the project pay its fair-share of the improvement cost as its mitigation. However, the intersection is controlled by the City of San Diego and the District does not have jurisdiction over it; therefore, the impact is considered significant and unavoidable.
56. *19th Street & J Street* – Restriping the northbound left turn lane into a northbound left turn and through shared lane is recommended at this intersection by the Downtown Community Plan. This improvement was identified to fully mitigate the intersection performance under build out of the plan. Therefore, to remain consistent with the Downtown Community Plan it is recommended that the project pay its fair-share of the improvement cost as its mitigation. However, the intersection is controlled by the City of San Diego and the District does not have jurisdiction over it; therefore, the impact is considered significant and unavoidable.

**Freeway**

Based on the City of San Diego's Significance Criteria, outlined in Section 2.5, the traffic associated with the Proposed Project would cause a significant change in the V/C ratio (add more than 0.010 for LOS E or 0.005 for LOS F) to the following key study mainline freeway mainline segment:

- I-5 Northbound, between Grape Street and First Avenue.

The San Diego Forward Plan includes a series of operational improvements along I-5 between I-15 and I-8, which would encompass this segment. However, these improvements are not scheduled until Year 2050. These improvements are also subject to budget availability and coordination with Caltrans. At the moment, there is no program in place into which the Project Applicant could pay its fair-share towards the cost of such improvements. Therefore, improvements are considered infeasible and the impacts along I-5 and would remain significant and unavoidable.

### Cumulative Impacts and Mitigation Measures - Near-Term Year 2021 Conditions

**Roadway Segments**

Harbor Drive between Laurel Street and Hawthorn Street would be significantly impacted by the Proposed Project under Near-Term Year 2021 Base Plus Project Conditions. To reduce this impact to less than significant conditions, Harbor Drive would need to be widened from a six-lane major facility to an eight-lane facility. However, this improvement is not feasible due to right-of-way constraints within the corridor. Therefore, this impact is considered to be significant and unavoidable.

**Intersections**

The following intersections were identified to be cumulatively impacted by the Proposed Project under Near-Term Year 2021 Plus Project Conditions. The recommended mitigation measure for the corresponding impact is also provided:

27. *First Street & Beech Street* – This intersection was identified as failing in the Downtown Community Plan with no feasible mitigation identified to improve operations. Therefore, the Downtown Community Plan EIR identified the future impacts to this intersection to be significant and unavoidable. To maintain consistency with the vision of the Downtown Community Plan no project related improvements are recommended at this intersection. It should be noted that this impact will become less than significant with the extension of Park Boulevard to Harbor Drive, as shown under Future Year 2035 conditions. This new connection will reroute project traffic coming to/from I-5 from the First Street Ramp to the Imperial Avenue Ramps.
44. *14th Street & G Street* – Converting the on-street parking to a travel lane on G Street between 11th Avenue and 17th Street during the PM peak hour is recommended at this intersection by the Downtown Community Plan. This improvement ultimately serves as a partial mitigation for the intersection under build out of the plan, with no feasible mitigation identified. Therefore, to remain consistent with the Downtown Community Plan it is recommended that the project pay its fair-share (3%) of the improvement cost as its mitigation. However, the intersection is controlled by the City of San Diego and the District does not have jurisdiction over it; therefore, the impact is considered significant and unavoidable.
45. *15th Street & F Street* – Signalization of the intersection is recommended by the Downtown Community Plan. This improvement ultimately serves as a partial mitigation for the intersection under build out of the plan, with no feasible mitigation identified. Therefore, to remain consistent with the Downtown Community Plan it is recommended that the project pay its fair-share (4%) of the improvement cost as its mitigation.

However, the intersection is controlled by the City of San Diego and the District does not have jurisdiction over it; therefore, the impact is considered significant and unavoidable.

47. *16th Street & F Street* – This intersection was identified as failing in the Downtown Community Plan with no feasible mitigation identified to improve operations. Therefore, the Downtown Community Plan EIR identified the future impacts to this intersection to be significant and unavoidable. To maintain consistency with the vision of the Downtown Community Plan no project related improvements are recommended at this intersection.

48. *16th Street & G Street* – Convert on-street parking to a travel lane on G Street between 11th Avenue and 17th Street during the PM peak hour is recommended at this intersection by the Downtown Community Plan. This improvement ultimately serves as a partial mitigation for the intersection under build out of the plan, with no feasible mitigation identified. Therefore, to remain consistent with the Downtown Community Plan it is recommended that the project pay its fair-share (2%) of the improvement cost as its mitigation. However, the intersection is controlled by the City of San Diego and the District does not have jurisdiction over it; therefore, the impact is considered significant and unavoidable.

50. *16th Street & Island Avenue* – Signalization of the intersection is recommended by the Downtown Community Plan. This improvement ultimately serves as a partial mitigation for the intersection under build out of the plan, with no feasible mitigation identified. Therefore, to remain consistent with the Downtown Community Plan it is recommended that the project pay its fair-share (18%) of the improvement cost as its mitigation. However, the intersection is controlled by the City of San Diego and the District does not have jurisdiction over it; therefore, the impact is considered significant and unavoidable.

51 *16th Street & K Street* – Signalization at this intersection is recommended by the Downtown Community Plan. This improvement was identified to fully mitigate the intersection performance under build out of the plan. Therefore, to remain consistent with the Downtown Community Plan it is recommended that the project pay its fair-share (9%) of the improvement cost as its mitigation. However, the intersection is controlled by the City of San Diego and the District does not have jurisdiction over it; therefore, the impact is considered significant and unavoidable.

53. *17th Street & G Street* – Signalization of the intersection is recommended by the Downtown Community Plan. This improvement ultimately serves as a partial mitigation for the intersection under build out of the plan, with no feasible mitigation identified. Therefore, to remain consistent with the Downtown Community Plan it is recommended that the project pay its fair-share (2%) of the improvement cost as its mitigation. However, the intersection is controlled by the City of San Diego and the District does not have jurisdiction over it; therefore, the impact is considered significant and unavoidable.

56. *19th Street & J Street* – Restriping the northbound left turn lane into a northbound left turn and through shared lane is recommended at this intersection by the Downtown Community Plan. This improvement was identified to fully mitigate the intersection performance under build out of the plan. Therefore, to remain consistent with the Downtown Community Plan it is recommended that the project pay its fair-share (20%)

of the improvement cost as its mitigation. However, the intersection is controlled by the City of San Diego and the District does not have jurisdiction over it; therefore, the impact is considered significant and unavoidable.

58. *Logan Avenue & I-5 SB Off-Ramp* – Signalization at this intersection is recommended by the Downtown Community Plan. This improvement was identified to fully mitigate the intersection performance under build out of the plan. Therefore, to remain consistent with the Downtown Community Plan it is recommended that the project pay its fair-share (22%) of the improvement cost as its mitigation. It should be noted that this impact will become less than significant with the extension of Park Boulevard to Harbor Drive, as shown under Future Year 2035 conditions. This new connection will reroute project traffic coming to/from I-5 from the Logan Avenue Ramps to the Imperial Avenue Ramps. The intersection is controlled by Caltrans and the District does not have jurisdiction over it; therefore, the impact is considered significant and unavoidable.

59. *Logan Avenue & I-5 SB On-Ramp* – Signalization of the intersection will reduce the project related impact to less than significant. The Proposed Project would have a fair-share responsibility for this improvement of 6%. However, the intersection is controlled by Caltrans and the Port District does not have jurisdiction over it; therefore, the impact is considered significant and unavoidable. It should be noted that this impact will become less than significant with the extension of Park Boulevard to Harbor Drive, as shown under Future Year 2035 conditions. This new connection will reroute project traffic coming to/from I-5 from the Logan Avenue Ramps to the Imperial Avenue Ramps.

**Freeway**

Based on the City of San Diego's Significance Criteria, outlined in Section 2.5, the traffic associated with the Proposed Project would cause a significant change in the V/C ratio (add more than 0.010 for LOS E or 0.005 for LOS F) to the following key study mainline freeway mainline segment:

- I-5 Northbound, between Grape Street and First Avenue.

The San Diego Forward Plan includes a series of operational improvements along I-5 between I-15 and I-8, which would encompass this segment. However, these improvements are not scheduled until Year 2050. These improvements are also subject to budget availability and coordination with Caltrans. The Proposed Project could provide a fair-share contribution towards a program or plan for the aforementioned freeway facility improvements to be constructed:

- I-5 Northbound, between Grape Street and First Avenue – 34% of the total cost for the relevant improvements to this segment.

At the moment, there is no program in place into which the District could pay its fair-share towards the cost of such improvements. Therefore, improvements are considered infeasible and the impacts along I-5 and would remain significant and unavoidable.

## Cumulative Impacts and Mitigation Measures - Future Year 2035 Conditions

### Roadway Segments

Harbor Drive between Laurel Street and Hawthorn Street would be significantly impacted by the Proposed Project under Future Year 2035 Base Plus Project Conditions. To reduce this impact to less than significant conditions, Harbor Drive would need to be widened from a six-lane major facility to an eight-lane facility. However, this improvement is not feasible due to right-of-way constraints within the corridor. Therefore, this impact is considered to be significant and unavoidable.

### Intersections

The following intersections were identified to be cumulatively impacted by the Proposed Project under Future Year 2035 Plus Project Conditions. The recommended mitigation measure for the corresponding impact is also provided:

24. *Front Street & Broadway* – This intersection was identified as failing in the Downtown Community Plan with no feasible mitigation identified to improve operations. Therefore, the Downtown Community Plan EIR identified the future impacts to this intersection to be significant and unavoidable. To maintain consistency with the vision of the Downtown Community Plan no project related improvements are recommended at this intersection.

29. *First Street & Broadway* – This intersection was identified as failing in the Downtown Community Plan with no feasible mitigation identified to improve operations. Therefore, the Downtown Community Plan EIR identified the future impacts to this intersection to be significant and unavoidable. To maintain consistency with the vision of the Downtown Community Plan no project related improvements are recommended at this intersection.

38. *Eleventh Avenue & Broadway* – This intersection was identified as failing in the Downtown Community Plan with no feasible mitigation identified to improve operations. Therefore, the Downtown Community Plan EIR identified the future impacts to this intersection to be significant and unavoidable. To maintain consistency with the vision of the Downtown Community Plan no project related improvements are recommended at this intersection.

40. *Eleventh Avenue & G Street* – Convert on-street parking to a travel lane on G Street between 11th Avenue and 17th Street during the PM peak hour. This improvement ultimately serves as a partial mitigation for the intersection under build out of the plan, with no feasible mitigation identified. Therefore, to remain consistent with the Downtown Community Plan it is recommended that the project pay its fair-share (1%) of the improvement cost as its mitigation. However, the intersection is controlled by the City of San Diego and the District does not have jurisdiction over it; therefore, the impact is considered significant and unavoidable.

41. *Eleventh Avenue & Market Street* – This intersection was identified as failing in the Downtown Community Plan with no feasible mitigation identified to improve operations. Therefore, the Downtown Community Plan EIR identified the future impacts to this intersection to be significant and unavoidable. To maintain consistency with the vision of the Downtown Community Plan no project related improvements are recommended at this intersection.

42. *Park Boulevard & G Street* – Convert on-street parking to a travel lane on G Street between 11th Avenue and 17th Street during the PM peak hour. This improvement was identified to fully mitigate the intersection performance under build out of the plan. Therefore, to remain consistent with the Downtown Community Plan it is recommended that the project pay its fair-share (2%) of the improvement cost as its mitigation. However, the intersection is controlled by the City of San Diego and the District does not have jurisdiction over it; therefore, the impact is considered significant and unavoidable.

43. *13th Street & G Street* – Convert on-street parking to a travel lane on G Street between 11th Avenue and 17th Street during the PM peak hour. This improvement ultimately serves as a partial mitigation for the intersection under build out of the plan, with no feasible mitigation identified. Therefore, to remain consistent with the Downtown Community Plan it is recommended that the project pay its fair-share (1%) of the improvement cost as its mitigation. However, the intersection is controlled by the City of San Diego and the District does not have jurisdiction over it; therefore, the impact is considered significant and unavoidable.

44. *14th Street & G Street* – Converting the on-street parking to a travel lane on G Street between 11th Avenue and 17th Street during the PM peak hour is recommended at this intersection by the Downtown Community Plan. This improvement ultimately serves as a partial mitigation for the intersection under build out of the plan, with no feasible mitigation identified. Therefore, to remain consistent with the Downtown Community Plan it is recommended that the project pay its fair-share (3% based on the Near-Term impact) of the improvement cost as its mitigation. However, the intersection is controlled by the City of San Diego and the District does not have jurisdiction over it; therefore, the impact is considered significant and unavoidable.

45. *15th Street & F Street* – Signalization of the intersection is recommended by the Downtown Community Plan. This improvement ultimately serves as a partial mitigation for the intersection under build out of the plan, with no feasible mitigation identified. Therefore, to remain consistent with the Downtown Community Plan it is recommended that the project pay its fair-share (4% based on the Near-Term impact) of the improvement cost as its mitigation. However, the intersection is controlled by the City of San Diego and the District does not have jurisdiction over it; therefore, the impact is considered significant and unavoidable.

47. *16th Street & F Street* – This intersection was identified as failing in the Downtown Community Plan with no feasible mitigation identified to improve operations. Therefore, the Downtown Community Plan EIR identified the future impacts to this intersection to be significant and unavoidable. To maintain consistency with the vision of the Downtown Community Plan no project related improvements are recommended at this intersection.

*48.* *16th Street & G Street* – Convert on-street parking to a travel lane on G Street between 11th Avenue and 17th Street during the PM peak hour is recommended at this intersection by the Downtown Community Plan. This improvement ultimately serves as a partial mitigation for the intersection under build out of the plan, with no feasible mitigation identified. Therefore, to remain consistent with the Downtown Community Plan it is recommended that the project pay its fair-share (2% Based on the Near-Term Impact) of the improvement cost as its mitigation. However, the intersection is controlled by the City of San Diego and the District does not have jurisdiction over it; therefore, the impact is considered significant and unavoidable.

51 *16th Street & K Street* – Signalization at this intersection is recommended by the Downtown Community Plan. This improvement was identified to fully mitigate the intersection performance under build out of the plan. Therefore, to remain consistent with the Downtown Community Plan it is recommended that the project pay its fair-share (9% based on the Near-Term impact) of the improvement cost as its mitigation. However, the intersection is controlled by the City of San Diego and the District does not have jurisdiction over it; therefore, the impact is considered significant and unavoidable.

52. *Imperial & 16th Street* – Re-stripe the northbound and southbound approaches of the intersection to include an exclusive right turn-lane in each direction. This improvement will reduce the intersection delay to 74.8 seconds and the intersection will operate at acceptable LOS E, during the PM peak hour, reducing the impact to less than significant conditions. The Proposed Project would have a fair-share responsibility for this improvement of 18%. However, the intersection is controlled by the City of San Diego and the Port District does not have jurisdiction over it; therefore, the impact is considered significant and unavoidable. It should also be noted that this improvement is not included in the Downtown Community Plan. However, the intersection is controlled by the City of San Diego and the District does not have jurisdiction over it; therefore, the impact is considered significant and unavoidable.

53. *17th Street & G Street* – Signalization of the intersection is recommended by the Downtown Community Plan. This improvement ultimately serves as a partial mitigation for the intersection under build out of the plan, with no feasible mitigation identified. Therefore, to remain consistent with the Downtown Community Plan it is recommended that the project pay its fair-share (2% based on the Near-Term impact) of the improvement cost as its mitigation. However, the intersection is controlled by the City of San Diego and the District does not have jurisdiction over it; therefore, the impact is considered significant and unavoidable.

**Freeway**

Based on the City of San Diego's Significance Criteria, outlined in Section 2.5, the traffic associated with the Proposed Project would cause a significant change in the V/C ratio (add more than 0.010 for LOS E or 0.005 for LOS F) to the following key study mainline freeway mainline segment:

- I-5 Northbound, between Grape Street and First Avenue
- I-5 Northbound, between First Avenue and SR-163
- I-5 Northbound, between B Street and SR-94
- I-5 Southbound, between B Street and SR-94
- I-5 Northbound, between SR-94 to Imperial Avenue

The San Diego Forward Plan includes a series of operational improvements along I-5 between I-15 and I-8, which would encompass this segment. However, these improvements are not scheduled until Year 2050. These improvements are also subject to budget availability and coordination with Caltrans. The Proposed Project could provide a fair-share contribution towards a program or plan for the aforementioned freeway facility improvements to be constructed:

- I-5 Northbound, between Grape Street and First Avenue – 34% (based on the Near-Term Impact) of the total cost for improvements to this segment.
- I-5 Northbound, between First Avenue and SR-163 – 5% of the total cost for improvements to this segment.
- I-5 Northbound, between B Street and SR-94 – 7% of the total cost for improvements to this segment.
- I-5 Southbound, between B Street and SR-94 – 7% of the total cost for improvements to this segment.
- I-5 Northbound, between SR-94 to Imperial Avenue – 4% of the total cost for improvements to this segment.

At the moment, there is no program in place into which the District could pay its fair-share towards the cost of such improvements. Therefore, improvements are considered infeasible and the impacts along I-5 and would remain significant and unavoidable.

### Active Transportation and Transit

Potential impacts related to pedestrian, bicycle and transit circulation would be considered significant if the Proposed Project would substantially increase hazards due to a design feature, or would conflict with the adopted policies, plans, or programs supporting alternative transportation, as outlined in Appendix G of the *California Environmental Quality Act (CEQA) Guidelines*. The project is not proposing to make any improvements to roadways or other transportation related facilities. Therefore, the Proposed Project would not conflict with or generate any significant impacts to the existing pedestrian, bicycle or transit facilities, nor the planned facilities and policies.

## ES.4 Site Access

Access to the Proposed Project will be primarily by combination of on foot and by car. Visitors or employees who park in the areas immediately adjacent to the Proposed Project site will access and exit the proposed parking structure by driving along Convention Way. Pedestrian arrivals are anticipated to use the proposed pedestrian bridge linking the project to the Convention Center and Harbor Drive.

## ES.5 Parking

A two-level parking structure will be constructed, located between the hotel tower and low-cost visitor serving hotel, providing approximately 263 parking spaces using a combination of valet and striped parking spaces. Based on the rates and methods outlined in the *Tidelands Parking Guidelines – San Diego Unified Port District January 5, 2001,* the Proposed Project will have a parking demand of 472 spaces. This results in a total deficit of 209 parking spaces.

As displayed in Chapter 8.0, the parking demand at hotels adjacent to the Proposed Project site were observed to be below the rates contained in the Tideland Parking Guidelines (0.23 spaces per room compared to 0.5 spaces per room). When using the lower hotel parking demand, the Proposed Project would require 248 on-site parking spaces, resulting in no deficit of parking spaces due to the 263 on-site parking spaces proposed by the project.

However, it is recommended that the project implements a Parking Management Plan that provides parking management strategies to help reduce its overall demand.

## ES.6 Project Construction

### Existing Plus Construction Conditions

**Segments**

The following roadway segment was identified to be significantly impacted with the addition of the project construction traffic under Existing Plus Project Construction Conditions:

- 28th Street, between National Avenue and Boston Avenue.

**Intersections**

The following intersections were identified to be significantly impacted with the addition of the project construction traffic under Existing Plus Project Construction Conditions:

**AM Peak:**

- Sampson Street & Harbor Drive

**PM Peak:**

- I-5 SB On-Ramp & Boston Avenue
- Sampson Street & Harbor Drive

**Freeway Segments**

None.

### Near-Term Year 2021 Base Plus Construction Conditions

**Segments**

The following roadway segment was identified to be significantly impacted with the addition of the project construction traffic under Near-Term Year 2021 Base Plus Project Construction Conditions:

- 28th Street, between National Avenue and Boston Avenue.

## Intersections

The following intersections were identified to be significantly impacted with the addition of the project construction traffic under Near-Term Year 2021 Base Plus Project Construction Conditions:

| **AM Peak:** | **PM Peak:** |
|---|---|
| • Sampson Street & Harbor Drive | • I-5 SB On-Ramp & Boston Avenue<br>• Sampson Street & Harbor Drive |

## Freeway Segments

None.

## Mitigation

Since project construction conditions are temporary, no physical mitigation measures are recommended. Instead, it is recommended that a Transportation Demand Management Plan is developed to limit the number of construction worker trips that travel through the impacted intersection during peak periods. The following lists a series of TDM strategies that would be appropriate during project construction:

- Implementation of a ride-sharing program to encourage carpooling amongst workers;
- Restrict workers from accessing the project site during the AM and PM peak periods, 7:00 AM – 9:00 AM and 4:00 PM – 6:00 PM;
- Provide off-site parking locations for workers outside of the area with shuttle services to bring them on-site; and
- Provide subsidized transit passes for construction workers.

## Construction Parking Conditions

In order to reduce temporary parking impacts during construction, construction workers will be incentivized to use public transit, and workers arriving by car shall be required to park in an off-site parking facility, located on Belt Street with access at the intersection of Harbor Drive and Sampson Street.

The identified construction impacts are projected to occur during peak hours, therefore, restricting workers from accessing the project site during the peak hours will reduce the identified impacts to a less than significant level. Also, on-street signage should be provided to direct visitors to available parking facilities during the construction period.

# Table of Contents

## Appendices

## List of Figures

## List of Tables

# 1.0 Introduction

## 1.1 Purpose of the Report

The purpose of this Transportation Impact Analysis (TIA) is to identify and document potential transportation related impacts associated with the implementation of the Fifth Avenue Landing Project (Proposed Project), as well as to recommend mitigation measures, as necessary, for any identified transportation related impacts associated with the Proposed Project.

## 1.2 Project Background

The Fifth Avenue Landing Project is located along Convention Way in Downtown San Diego, spanning approximately 5 acres of landside area and 13 acres of waterside area. The Proposed Project involves the following:

- An 850-room market-rate hotel tower,
- Up to 565-bed lower cost visitor serving hotel,
- Approximately 6,000 square feet of retail along the Embarcadero Promenade,
- Approximately 1.96 acres (85,490 square feet) of public plaza and park areas to replace the current 0.7 acre (30,300 square feet) of public access space located on the site proposed for the lower cost visitor serving hotel,
- Approximately 263 onsite parking spaces,
- A two-phase expanded marina with up to 50 slips (approximately 23 to be constructed in Phase I and 27 to be constructed in Phase II), which would combine with the existing 12 slips to total up to 62 slips, and
- An optional connecting bridge from the hotel rooftop public plaza and park area to the San Diego Convention Center, that would require concurrence of the City of San Diego and an amendment to the existing Convention Center Management Agreement for the San Diego Convention Center by and between the City of San Diego and San Diego Unified Port District prior to implementation.

The project site is located in San Diego, California. The regional location of the Proposed Project is displayed in **Figure 1-1**.

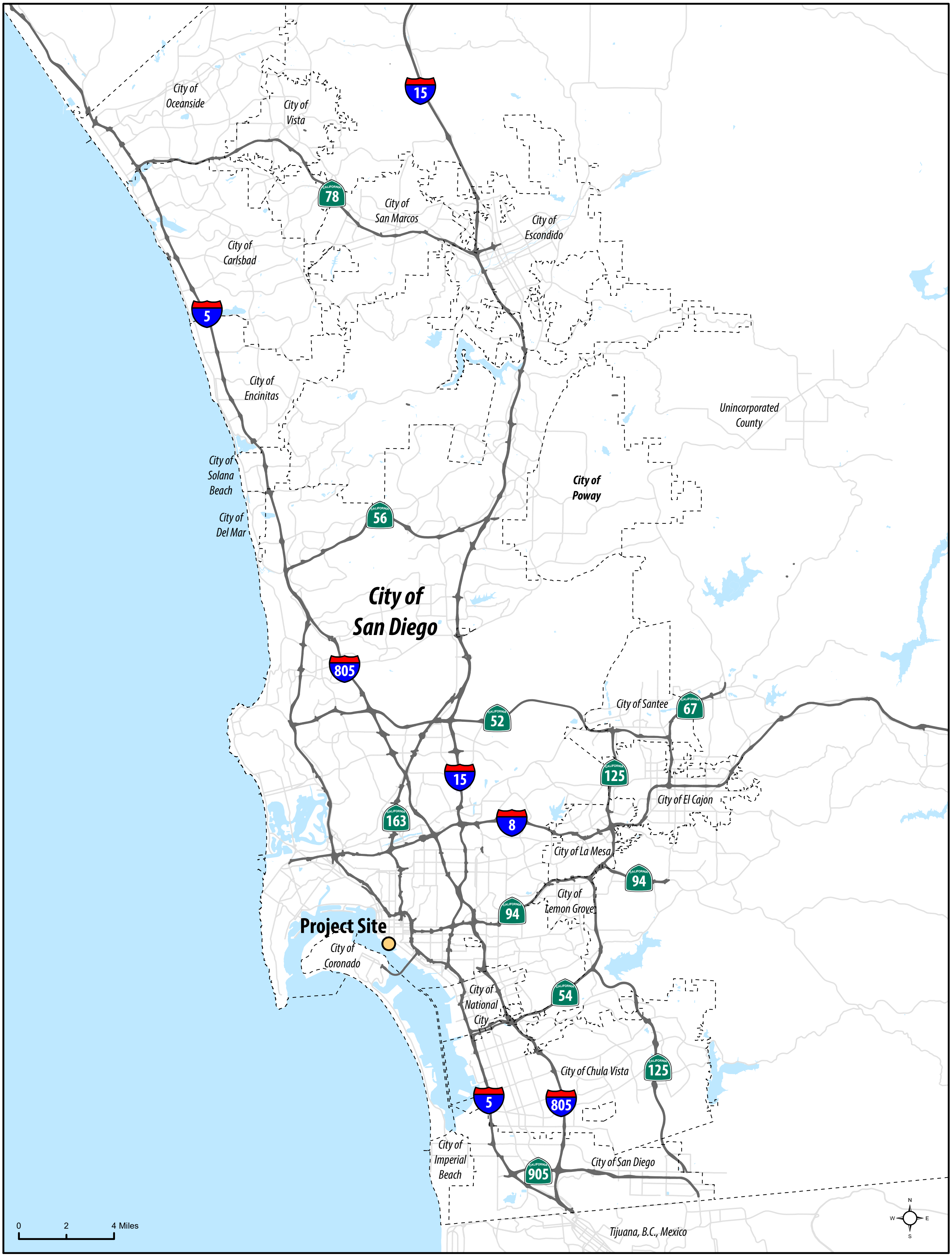
## 1.3 Report Organization

Following this introduction chapter, this report is organized into the following chapters:

2.0 *Analysis Methodology* – This chapter describes the methodologies and standards utilized to analyze roadway and intersection traffic conditions.

3.0 *Project Description* – This chapter describes the Proposed Project including project trip generation, trip distribution patterns, and project trip assignments.

4.0 *Existing Conditions* – This chapter describes the existing traffic operations both with and without the Proposed Project. Mitigation measures, if necessary, for project-related impacts are also identified.



*Fifth Avenue Landing Project*
*Transportation Impact Analysis*
CHEN ✚ RYAN

**Figure 1-1**
**Project Regional Location**

5.0 *Near-Term Traffic Conditions* – This chapter describes projected traffic conditions associated with the project's opening year, both with and without project traffic. Mitigation measures for project-related impacts are identified for Near-Term Year 2021 Base Plus Project Conditions, if necessary.

6.0 *Future Year 2035* – This chapter describes projected long-range traffic conditions both with and without project traffic. Mitigation measures for project-related impacts are identified for Future Year 2035 Year Base Plus Project Conditions, if necessary.

7.0 *Pedestrian, Bicycle and Transit Assessment* – This chapter focuses on alternative modes of travel to and from the project (walking, bicycling and transit).

8.0 *Site Access and Parking* – This chapter addresses access to the project site, and discusses the required parking within the project site.

9.0 *Project Construction* – This chapter describes forecast traffic operations during project construction.

# 2.0 Analysis Methodology

This TIA was performed in accordance with the requirements of the City of San Diego *Traffic Impact Study Manual*, and the District's California Environmental Quality Act (CEQA) project review process. Detailed information on roadway segment and intersection analysis methodologies, standards, and thresholds are discussed in the following sections.

## 2.1 Level of Service Definition

Level of Service (LOS) is a quantitative measure describing operational conditions within a traffic stream, and the motorist's and/or passengers' perception of operations. A LOS definition generally describes these conditions in terms of such factors as delay, speed, travel time, freedom to maneuver, interruptions in traffic flow, queuing, comfort, and convenience. **Table 2.1** describes generalized definitions of the various LOS categories (A through F) as applied to roadway operations.

Table 2.1 LOS Definitions

| LOS Category | Definition of Operation |
|---|---|
| A | This LOS represents a completely free-flow condition, where the operation of vehicles is virtually unaffected by the presence of other vehicles and only constrained by the geometric features of the highway and by driver preferences. |
| B | This LOS represents a relatively free-flow condition, although the presence of other vehicles becomes noticeable. Average travel speeds are the same as in LOS A, but drivers have slightly less freedom to maneuver. |
| C | At this LOS the influence of traffic density on operations becomes marked. The ability to maneuver within the traffic stream is clearly affected by other vehicles. |
| D | At this LOS, the ability to maneuver is notably restricted due to traffic congestion, and only minor disruptions can be absorbed without extensive queues forming and the service deteriorating. |
| E | This LOS represents operations at or near capacity. LOS E is an unstable level, with vehicles operating with minimum spacing for maintaining uniform flow. At LOS E, disruptions cannot be dissipated readily thus causing deterioration down to LOS F. |
| F | At this LOS, forced or breakdown of traffic flow occurs, although operations appear to be at capacity, queues form behind these breakdowns. Operations within queues are highly unstable, with vehicles experiencing brief periods of movement followed by stoppages. |

*Source: Highway Capacity Manual 2000*

## 2.2 Roadway Segment LOS Standards and Thresholds

Roadway segment LOS standards and thresholds provide the basis for analysis of arterial roadway segment performance. The analysis of roadway segment LOS is based on the functional classification of the roadway, the maximum capacity, roadway geometrics, and existing or forecast Average Daily Traffic (ADT) volumes. **Table 2.2** presents the roadway segment capacity and LOS standards utilized to analyze roadways evaluated in this report.

Table 2.2 City of San Diego Roadway Classifications and LOS Standards

| Roadway Classification | LOS A | LOS B | LOS C | LOS D | LOS E |
|---|---|---|---|---|---|
| Expressway | 30,000 | 42,000 | 60,000 | 70,000 | 80,000 |
| Prime Arterial | 25,000 | 35,000 | 50,000 | 55,000 | 60,000 |
| Major Arterial (7-lane, divided)* | <23,333 | < 32,667 | < 46,667 | < 52,500 | < 58,333 |
| Major Arterial (6-lane, divided) | < 20,000 | < 28,000 | < 40,000 | < 45,000 | < 50,000 |
| Major Arterial (5-lane, divided)* | <16,667 | <23,333 | <33,333 | <37,500 | <41,667 |
| Major Arterial (4-lane, divided) | < 15,000 | < 21,000 | < 30,000 | < 35,000 | < 40,000 |
| Collector (5-lane w/center lane) | < 12,500 | < 17,500 | < 25,000 | < 31,250 | < 37,500 |
| Collector (4-lane w/ center lane) | < 10,000 | < 14,000 | < 20,000 | < 25,000 | < 30,000 |
| Collector (4-lane w/o center lane) | < 5,000 | < 10,000 | < 13,000 | < 15,000 | < 20,000 |
| Collector (2-lane w/ continuous left-turn lane) | < 5,000 | < 10,000 | < 13,000 | < 15,000 | < 20,000 |
| Collector (2-lane no fronting property) | < 4,000 | < 5,500 | < 7,500 | < 9,000 | < 10,000 |
| Collector (2-lane commercial-industrial fronting) | <2,500 | < 3,500 | < 5,000 | < 6,500 | < 8,000 |
| Collector (2-lane multi-family) | <2,500 | < 3,500 | < 5000 | < 6,500 | < 8,000 |
| Sub-Collector (2-lane single family) | - | - | 2,200 | - | - |

*Source: City of San Diego, Traffic Impact Study Manual, July 1998*

These standards are generally used as long-range planning guidelines to determine the functional classification of roadways. The actual capacity of a roadway facility varies according to its physical attributes. Typically, the performance and LOS of a roadway segment is heavily influenced by the ability of its intersections to accommodate peak hour traffic volumes.

## 2.3 Peak Hour Intersection LOS Standards and Thresholds

This section presents the methodologies used to perform peak hour intersection capacity analysis for signalized intersections. The following assumptions were utilized in conducting all intersection LOS analyses:

- *Pedestrian Calls per Hour:* 10 calls per hour for each pedestrian movement was assumed.
- *Signal Timing:* Based on existing signal timing plans (as of December, 2016), provided in **Appendix A.**
- *Peak Hour Factor*: Based on existing peak hour count data for existing conditions included in Appendix A, and 0.92 for all future conditions.

### Signalized Intersection Analysis

The analysis of signalized intersections utilized the procedures outlined in the *2000 Highway Capacity Manual (HCM)*. This method defines LOS in terms of delay, or more specifically, average stopped delay per vehicle. Delay is a measure of driver and/or passenger discomfort, frustration, fuel consumption and lost travel time. This technique uses 1,900 vehicles per hour per lane (VPHPL) as the maximum saturation volume of an intersection. This saturation volume is adjusted to account for lane width, on-street parking, pedestrians, traffic composition (i.e., percentage trucks) and shared lane movements (i.e. through and right-turn movements originating from the same lane). The LOS criteria used for this technique are described in **Table 2.3**. The computerized analysis of intersection operations was performed utilizing *Synchro 8.0* traffic analysis software.

Table 2.3 Signalized Intersection LOS Criteria

| Average Stopped Delay Per Vehicle (seconds) | Level of Service (LOS) Characteristics |
|---|---|
| <10.0 | *LOS A* describes operations with very low delay. This occurs when progression is extremely favorable, and most vehicles do not stop at all. Short cycle lengths may also contribute to low delay. |
| 10.1 – 20.0 | *LOS B* describes operations with generally good progression and/or short cycle lengths. More vehicles stop than for LOS A, causing higher levels of average delay. |
| 20.1 – 35.0 | *LOS C* describes operations with higher delays, which may result from fair progression and/or longer cycle lengths. Individual cycle failures may begin to appear at this level. The number of vehicles stopping is significant at this level, although many still pass through the intersection without stopping. |
| 35.1 – 55.0 | *LOS D* describes operations with high delay, resulting from some combination of unfavorable progression, long cycle lengths, or high volumes. The influence of congestion becomes more noticeable, and individual cycle failures are noticeable. |
| 55.1 – 80.0 | *LOS E* is considered the limit of acceptable delay. Individual cycle failures are frequent occurrences. |
| >80.0 | *LOS F* describes a condition of excessively high delay, considered unacceptable to most drivers. This condition often occurs when arrival flow rates exceed the LOS D capacity of the intersection. Poor progression and long cycle lengths may also be major contributing causes to such delay. |

*Source: Highway Capacity Manual 2000*

### Unsignalized Intersection Analysis

Unsignalized intersections, including two-way and all-way stop controlled intersections, were analyzed using the 2000 Highway Capacity Manual unsignalized intersection analysis methodology. The Synchro Traffic Analysis software supports this methodology and was utilized to produce LOS results. The LOS for a side street stop controlled (SSSC) intersection is determined by the computed control delay and is defined for each minor movement.

**Table 2.4** summarizes the LOS criteria for unsignalized intersections. The City of San Diego considers LOS E or better during the AM and PM peak hours to be acceptable for intersection LOS in the Downtown area.

Table2.4 Unsignalized Intersection LOS Criteria

| Average Control Delay (sec/veh) | Level of Service (LOS) |
|---|---|
| <u><</u>10 | A |
| >10 and <u><</u>15 | B |
| >15 and <u><</u>25 | C |
| >25 and <u><</u>35 | D |
| >35 and <u><</u>50 | E |
| >50 | F |

*Source: 2000 Highway Capacity Manual*

## 2.4 Freeway Level of Service Standards and Thresholds

Freeway level of service analysis is based upon procedures developed by the California Department of Transportation (Caltrans). The procedure for calculating freeway level of service involves estimating a peak hour volume to capacity (V/C) ratio. Peak hour volumes are estimated from the application of design hour (“K”), directional (“D”) and truck (“T”) factors to Average Daily Traffic (ADT) volumes. The base capacities for Interstate 5 were assumed to be 2,350 passenger-car per hour per main lane (pc/h/ln) and 1,410 pc/h/ln (60% of the main lane capacity) for auxiliary lane, respectively.

The resulting V/C ratio is then compared to acceptable ranges of V/C values corresponding to the various levels of service for each facility classification, as shown in **Table 2.5**. The corresponding level of service represents an approximation of existing or anticipated future freeway operating conditions in the peak direction of travel during the peak hour. For the purpose of this study, LOS D is considered as the threshold for acceptable freeway operations. LOS D is the level at which speeds begin to decline slightly with increasing flows and density begins to increase somewhat more quickly. Freedom to maneuver within the traffic stream is more noticeably limited, and the driver experiences reduced physical and psychological comfort levels.

Table 2.5 Freeway mainline segment LOS Definitions

| LOS | V/C | Congestion/Delay | Traffic Description |
|---|---|---|---|
| *Used for freeways, expressways and conventional highways* | | | |
| "A" | <0.30 | None | Free flow. |
| "B" | 0.31-0.50 | None | Free to stable flow, light to moderate volumes. |
| "C" | 0.51-0.71 | None to minimal | Stable flow, moderate volumes, freedom to maneuver noticeably restricted. |
| "D" | 0.71-0.89 | Minimal to substantial | Approaches unstable flow, heavy volumes, very limited freedom to maneuver. |
| "E" | 0.90-1.00 | Significant | Extremely unstable flow, maneuverability and psychological comfort extremely poor. |
| *Used for conventional highways* | | | |
| "F" | >1.00 | Considerable | Forced or breakdown flow. Delay measured in average travel speed (MPH). Signalized segments experience delays >60.0 seconds/vehicle. |

Source: Caltrans – Guide for the Preparation of Traffic Impact Studies; December 2002

## 2.5 Determination of Significant Impacts

### Intersections located within the Downtown Area

A project within the Centre City (Downtown San Diego) community is considered to have a significant impact on the traffic operations of an intersection when one of the following occurs:

- The addition of project traffic results in a LOS dropping from LOS E or better to LOS F. Under this condition, the project is determined to have a direct impact and mitigation measures would be necessary to restore the intersection LOS to LOS E conditions or better;

- If an intersection is operating at LOS under base conditions and the project adds more than an additional 2 seconds of average vehicle delay, the project is determined to have a cumulatively significant impact and mitigation measures would be necessary to bring the intersection LOS to pre-development conditions or better.

The impact standards listed above were established in the *Downtown San Diego Traffic Impact Assessment (TIA) Methodology Evaluation of New Projects* (June 2007), and deviate from the traffic impact thresholds outlined in the *City of San Diego Significance Determination Thresholds* (January 2011). It should be noted that these impact standards are only applicable within the Centre City area.

### Other Transportation Facilities

The City of San Diego Significance Determination Thresholds, January 2011 defines project impact thresholds by facility type. These thresholds are generally based upon an acceptable increase in the Volume / Capacity (V/C) ratio for roadway and freeway mainline segments, and upon increases in vehicle delays for intersections and ramps.

Within the City of San Diego's jurisdiction, LOS D is considered acceptable for roadway and intersection operations. A project is considered to have a significant impact if it degrades the operations of a roadway or intersection from an acceptable LOS (D or better) to an unacceptable LOS (E or F), or if it adds additional delay to a facility already operating an unacceptable level. **Table 2.6** summarizes the impact significant thresholds as identified within the City of San Diego's guidelines beyond which mitigation measures are required.

Table 2.6 City of San Diego Measure of Significant Project Traffic Impacts

| LOS with Project | Allowable Change Due to Impact | | | | | |
|---|---|---|---|---|---|---|
| | Freeways | | Roadway Segments | | Intersections[1] | Ramp Metering |
| | V/C | Speed (mph) | V/C | Speed (mph) | Delay (sec) | Delay (min.) |
| E<br>(or ramp meter delays above 15 min.) | 0.01 | 1.0 | 0.02 | 1.0 | 2.0 | 2.0 |
| F<br>(or ramp meter delays above 15 min.) | 0.005 | 0.5 | 0.01 | 0.5 | 1.0 | 1.0 |

*Source: City of San Diego, Significance Determination Thresholds, January 2011*

Note:

[1] These standards only apply to intersections located outside of the Downtown Area

# 3.0 Proposed Project

This section describes the Proposed Project, including land uses and estimated trip generation, trip distribution, trip assignment, and project study area.

## 3.1 Project Description

The Fifth Avenue Landing Project is located along Convention Way in Downtown San Diego, spanning approximately 5 acres, or 218,875 square feet. The Proposed Project includes the following:

- An 850-room hotel tower,
- A 565-bed lower cost visitor serving hotel,
- Approximately 6,000 square feet of promenade retail,
- Approximately 2.1 acres (92,143 square feet) of public plaza space to replace the current 1.05 acre (45,590 square feet) of public access space located on the site proposed for the lower cost visitor serving hotel,
- Approximately 263 onsite parking spaces,
- A two-phase expanded marina with up to 52 slips (approximately 23 to be constructed in Phase I and 29 to be constructed in Phase II), which would combine with the existing 12 slips to total up to 64 slips, and
- An optional connecting bridge from the hotel public access plaza to the San Diego Convention Center, that would require concurrence of the San Diego Convention Center prior to implementation.

**Figure 3-1** displays the project site layout.

## 3.2 Project Trip Generation, Distribution, and Assignment

### Project Trip Generation

Trip generation rates for the Proposed Project were developed utilizing *Table 5: Centre City Cumulative Trip Generation Rates* from the City of San Diego's Trip Generation Manual (City of San Diego, May 2003). **Table 3.1** displays daily, as well as, AM and PM peak hour project trip generation.

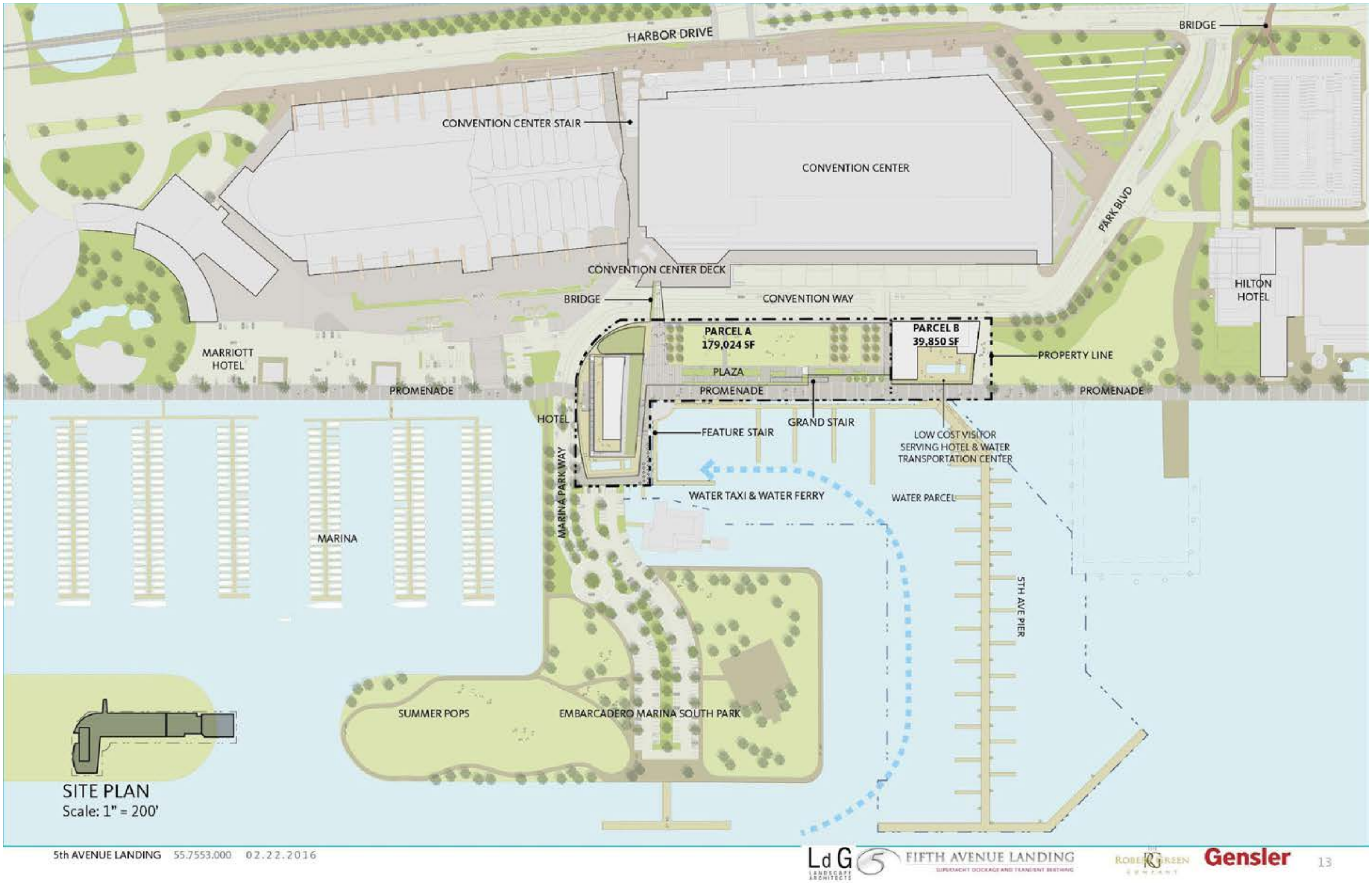


**Figure 3-1**
**Site Layout**

Table 3.1 Project Trip Generation

| | | | | AM | | | | | PM | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Land Use | Units | Trip Rate | ADT | % | Trips | Split | In | Out | % | Trips | Split | In | Out |
| Hotel (w/convention facilities/restaurant) | 850 Rooms | 9/Room | 7,650 | 6% | 459 | (6:4) | 275 | 184 | 8% | 612 | (6:4) | 367 | 245 |
| Lower Cost Visitor Serving Hotel | 565 Beds | 1/Bed[1] | 565 | 6% | 34 | (6:4) | 20 | 14 | 8% | 46 | (6:4) | 28 | 18 |
| Marina | 52 Slips | 4/Slips | 208 | 3% | 6 | (5:5) | 3 | 3 | 7% | 14 | (5:5) | 7 | 7 |
| Public Open Space | 1.05 Acres | 60/Acres[2] | 63 | 0% | 0 | N/A | 0 | 0 | 11% | 7 | (4:6) | 3 | 4 |
| | | Total | 8,486 | | 499 | | 298 | 201 | | 679 | | 405 | 274 |

*Source: City of San Diego Trip Generation Manual, May 2003*

Notes:

The 6,000 sf of retail is anticipated to serve hotel guests and not attract outside patrons. Therefore, it was not included in the project trip generation.

[1] Lower Cost Visitor Serving Hotel trip generation rate was based on the rate provided in the Fort Ord Youth Hostel Initial Study, July 17, 2015

[2] The City of San Diego Trip Generation Rate for Beach, Ocean or Bay was utilized for this land use

As shown, the Proposed Project would generate a total of 8,486 daily trips, including 499 (298-in / 201-out) AM peak hour trips, and 679 (405-in / 274-out) PM peak hour trips.

### Project Trip Distribution

Trip distribution for the Proposed Project was developed based on the approved distribution assumed for the hotel uses in the *San Diego Convention Center Phase III Expansion and Hotel Expansion EIR*. **Figure 3-2** displays the assumed trip distribution patterns associated with the Proposed Project.

### Project Trip Assignment

Based upon the assumed project trip distribution (Figure 3-2), as well as the anticipated project trip generation (Table 3.1), daily and AM/PM peak hour project trips were assigned to the adjacent roadway network, as displayed in **Figures 3-3a and b.**

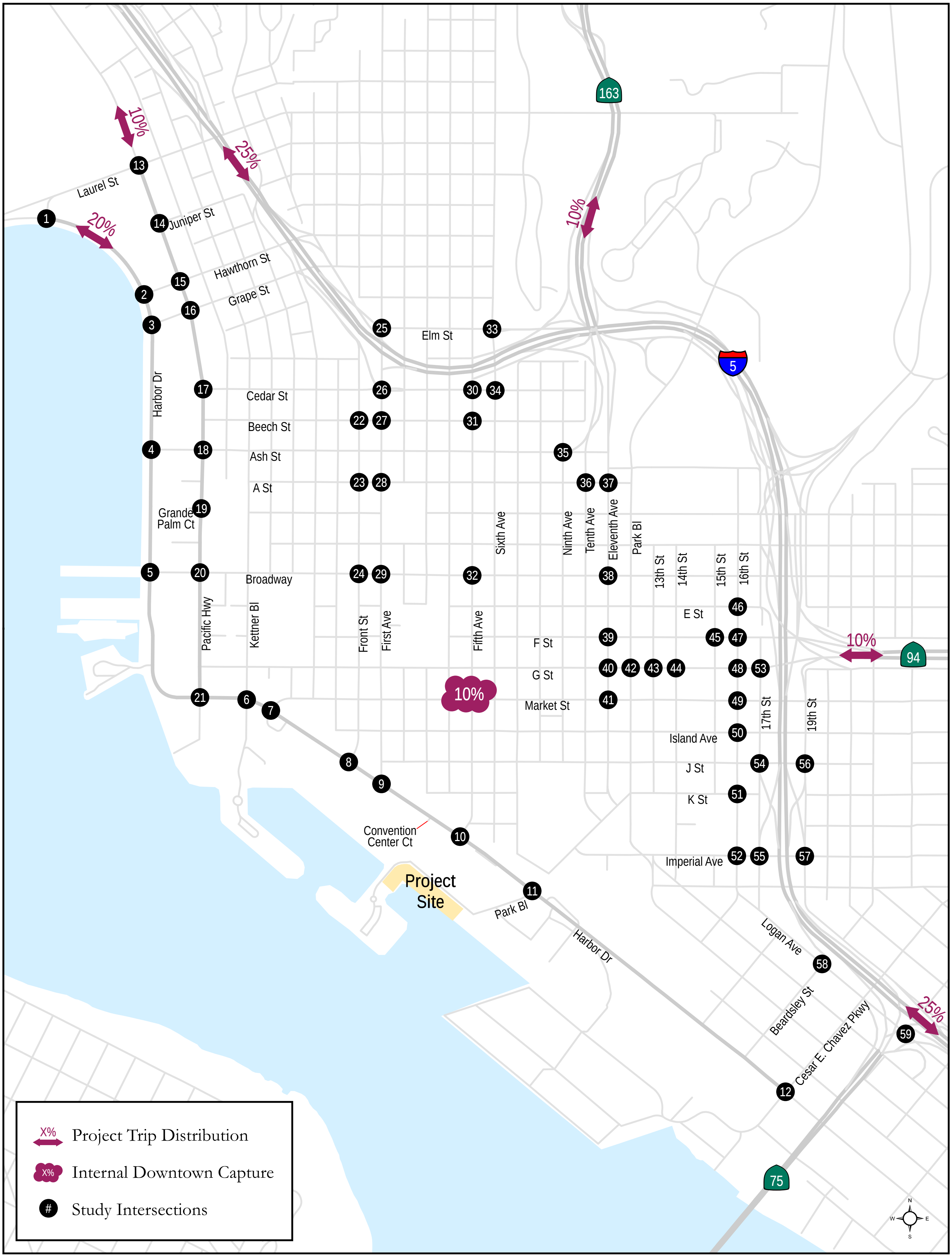
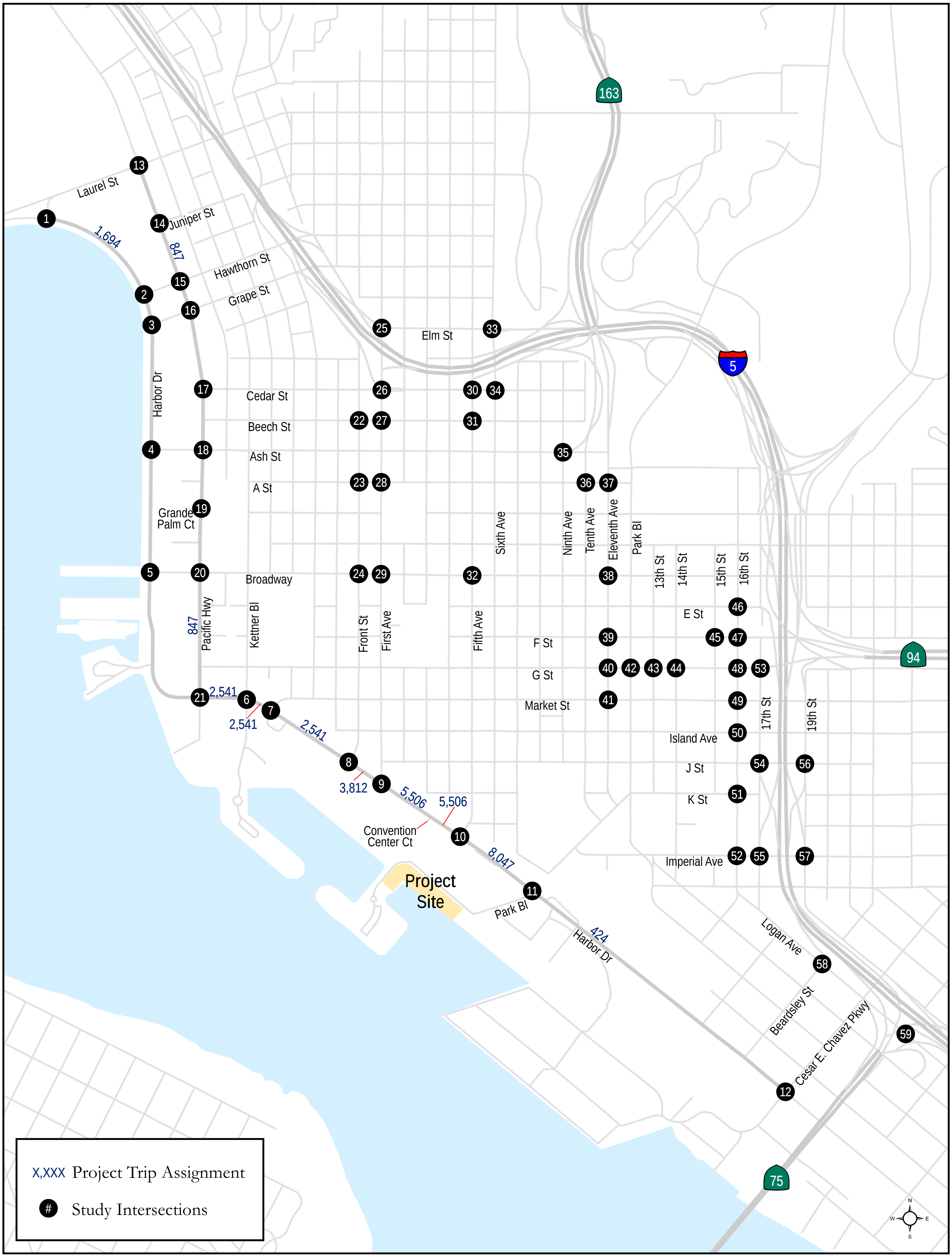


**Figure 3-2**
**Project Trip Distribution**



*Fifth Avenue Landing Project*
*Transportation Impact Analysis*

CHEN RYAN

**Figure 3-3A**
**Daily Roadway Segment Project Trip Assignment - Existing and Near-Term Year 2021 Conditions**

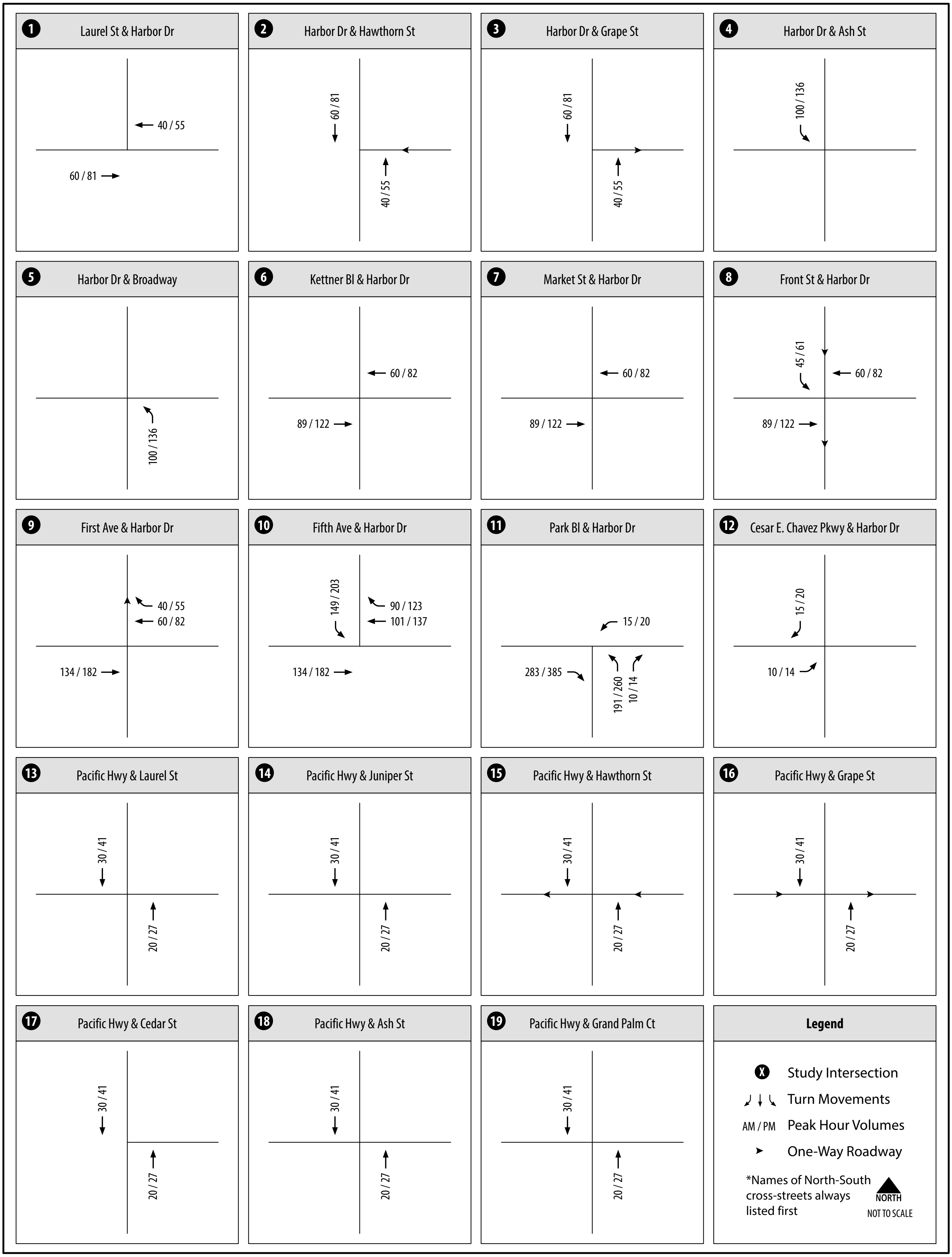


**Figure 3-3B**

**Peak Hour Intersection Project Trip Assignment - Existing and Near-Term Year 2021 Conditions (Intersections 1-19)**

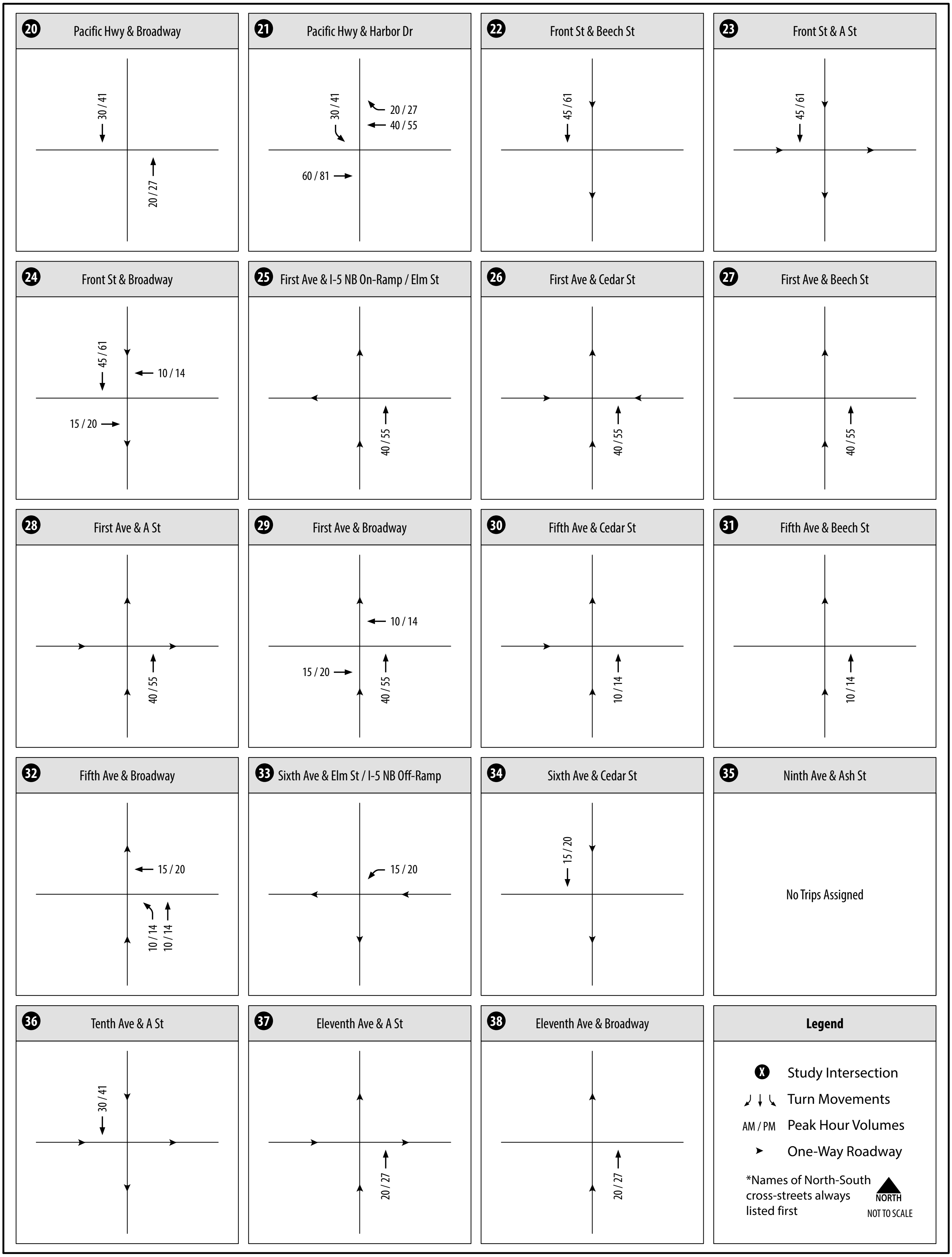


**Figure 3-3B**
**Peak Hour Intersection Project Trip Assignment -**
**Existing and Near-Term Year 2021 Conditions (Intersections 20-38)**

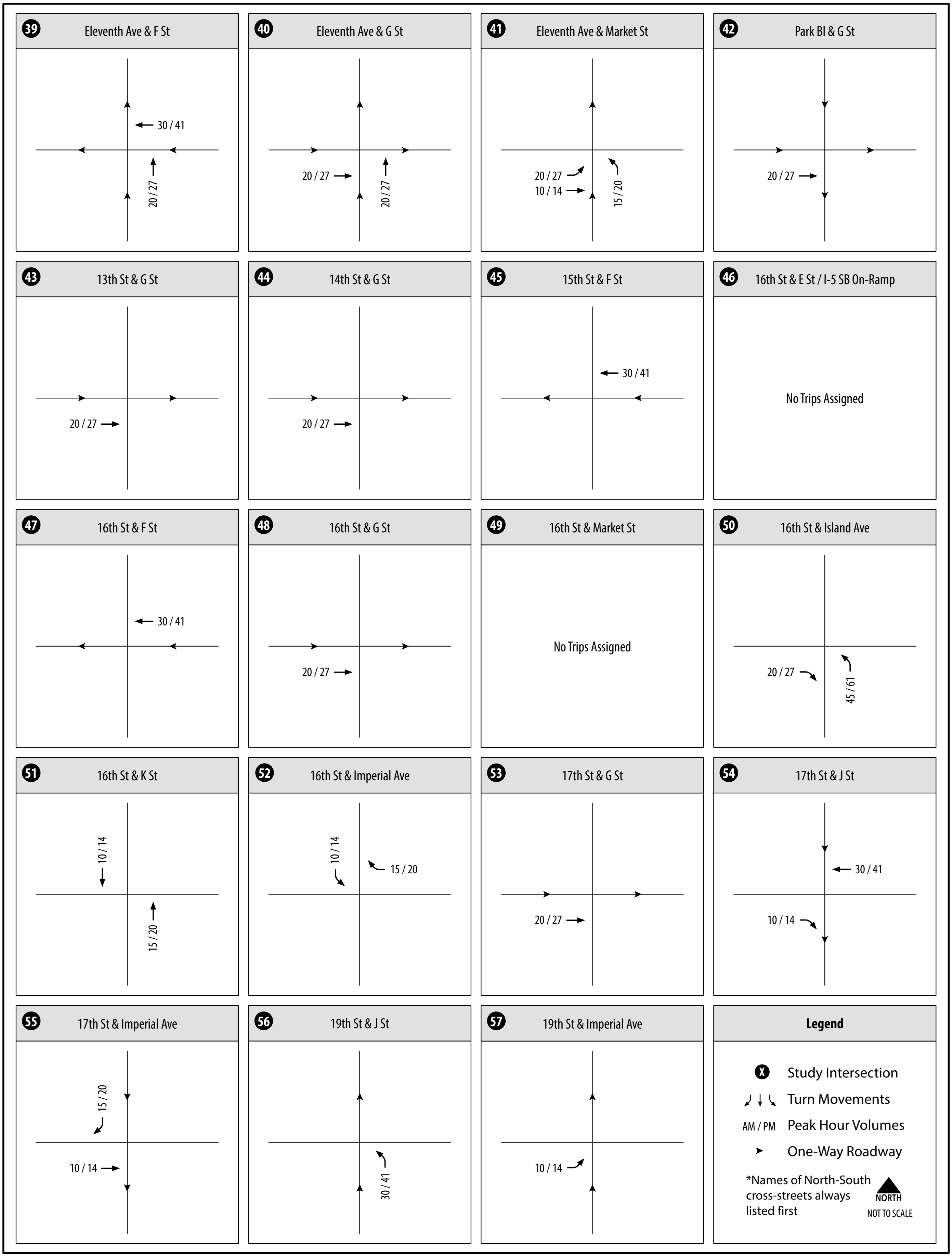


**Figure 3-3B**
**Peak Hour Intersection Project Trip Assignment - Existing and Near-Term Year 2021 (Intersections 39-57)**

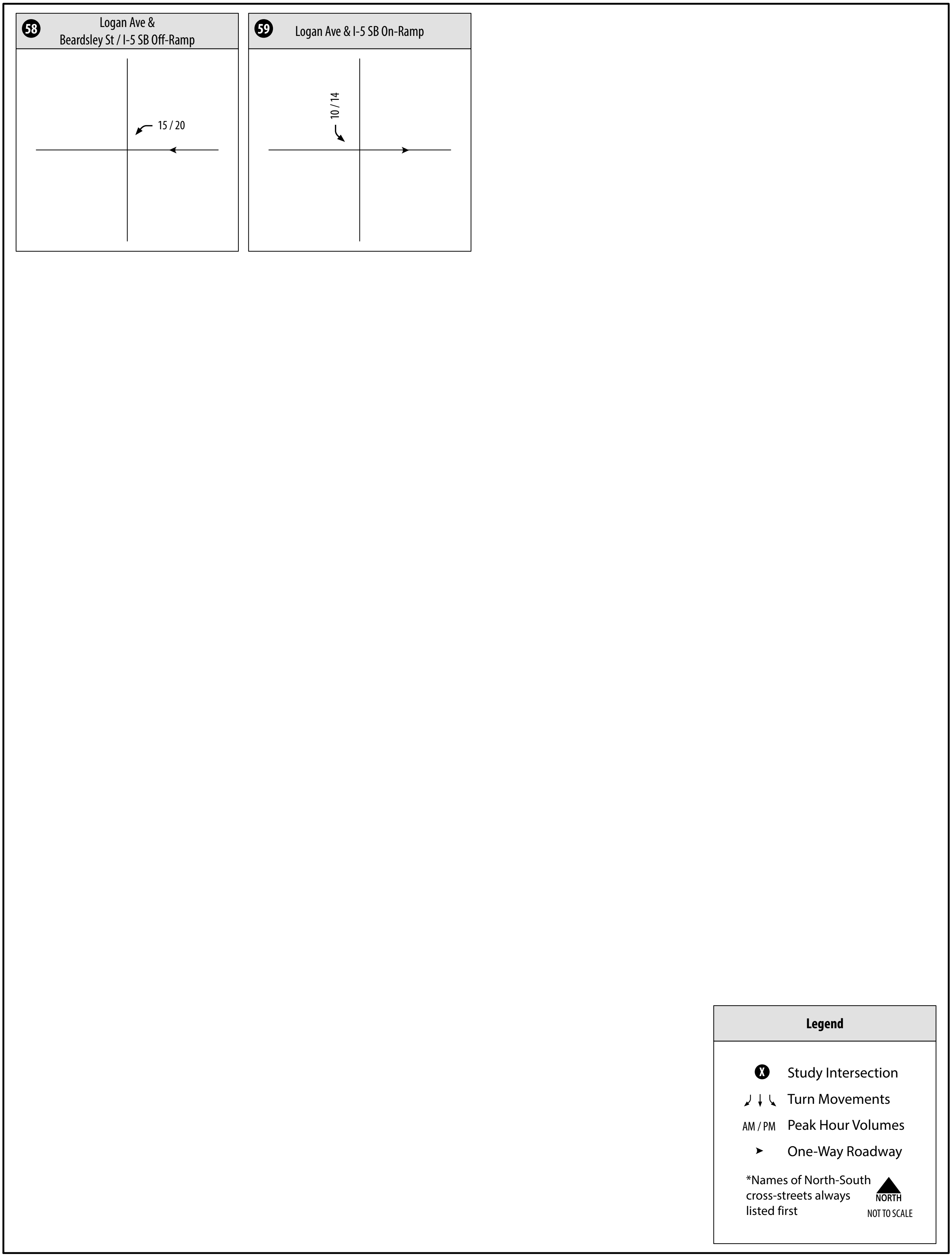


**Figure 3-3B**
**Peak Hour Intersection Project Trip Assignment - Existing and Near-Term Year 2021 Conditions (Intersections 58 and 59)**

## 3.3 Project Study Area

### Study Roadway Segments

Based on the project trip assignment and input from District staff, the following key study area roadway segments were analyzed:

**Harbor Drive between:**

- Laurel Street & Hawthorn Street
- Pacific Highway & Kettner Boulevard
- Kettner Boulevard & Market Street
- Market Street & Front Street
- Front Street & First Avenue
- First Avenue & Convention Center Court
- Convention Center Court & Fifth Avenue
- Fifth Avenue & Park Boulevard
- South of Park Boulevard

**Pacific Highway between:**

- Juniper Street & Hawthorn Street
- Broadway & Harbor Drive

### Study Intersections

Similar to the *San Diego Convention Center Phase III Expansion and Hotel Expansion EIR/Traffic Impact Study*, due to the tight density of intersections within Downtown San Diego and the off-peak nature of trips generated by the Proposed Project, it is assumed that not all intersections in which the project will add 50 or more peak hour trips within the downtown area will required for analysis, as per City of San Diego standards. Instead the TIA will focus on the following intersection types:

1. Intersections identified as operating at LOS D, E or F under Downtown San Diego Mobility Plan EIR buildout conditions;
2. Signalized intersections along Harbor; and
3. Freeway Ramp Intersections.

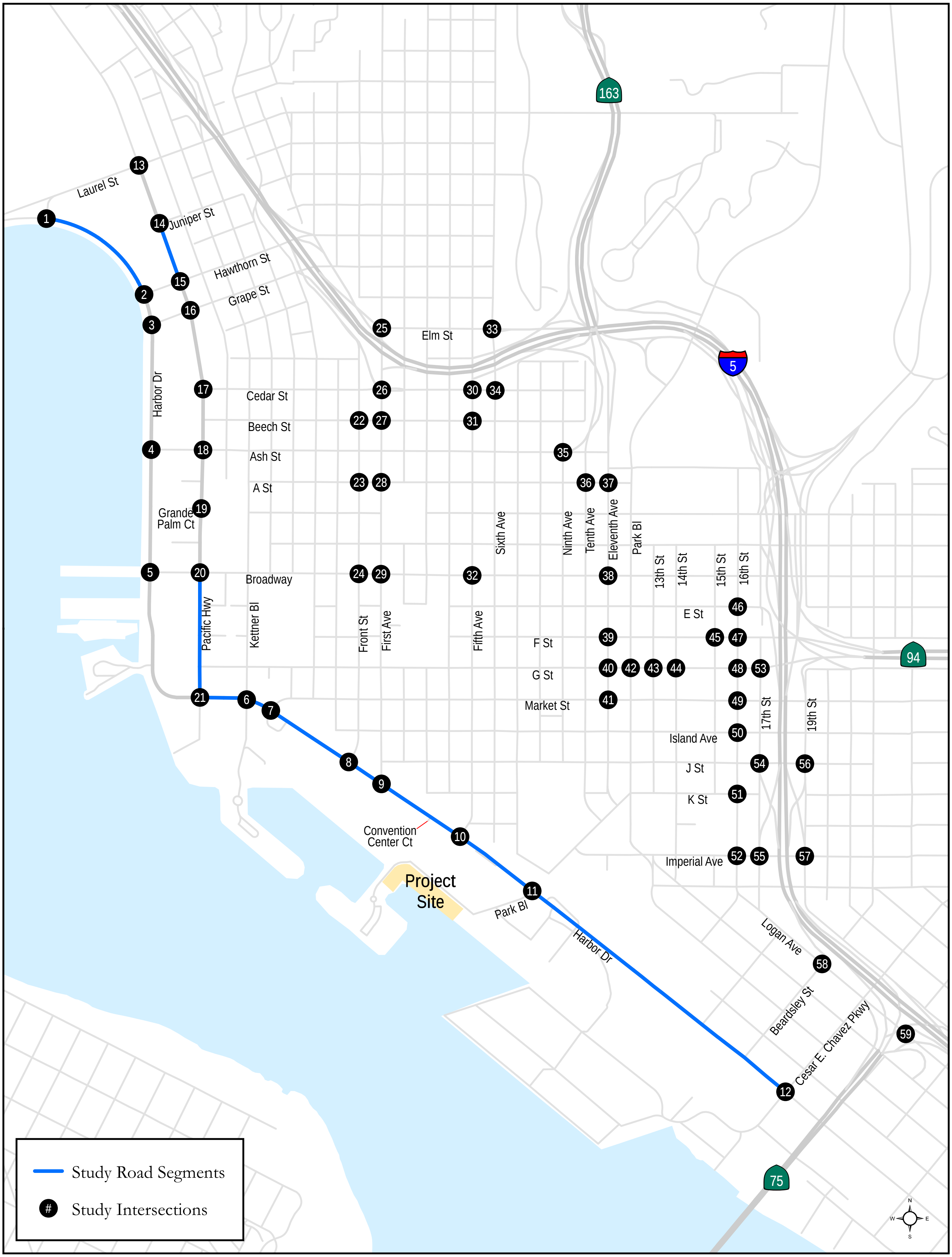
Based on the project trip assignment, the following fifty-one (59) key study area intersections were analyzed:

1: Harbor Drive & Laurel Street
2: Harbor Drive & Hawthorn Street
3: Harbor Drive & Grape St
4: Harbor Drive & Ash Street
5: Harbor Drive & Broadway
6: Harbor Drive & Kettner Boulevard
7: Harbor Drive & Market Street
8: Harbor Drive & Front Street
9: First Street & Harbor Drive
10: Harbor Drive & Fifth Avenue
11: Park Boulevard & Harbor Drive
12: Cesar Chavez Parkway & Harbor Drive
13: Pacific Highway & Laurel Street
14: Pacific Highway & Juniper Street
15: Pacific Highway & Hawthorn Street
16: Pacific Highway & Grape Street
17: Pacific Highway & Cedar Street
18: Pacific Highway & Ash Street
19: Pacific Highway & Grand Palm Court
21: Pacific Highway & Harbor Drive
22: Front Street & Beech Street
23: Front Street & A Street
24: Front Street & Broadway
25: First Street & I-5 NB On-Ramp/Elm Street
26: First Street & Cedar Street
27: First Street & Beech Street
28: First Street & A Street
29: First Street & Broadway
30: Fifth Avenue & Cedar Street
31: Fifth Avenue & Beech Street
32: Fifth Avenue & Broadway
33: Sixth Avenue & Elm Street/I-5 NB Off-Ramp
34: Sixth Avenue & Cedar Street
35: Ninth Street & Ash Street
36: Tenth Avenue & A Street
37: Eleventh Avenue & A Street
38: Eleventh Avenue & Broadway
39: Eleventh Avenue & F Street
40: Eleventh Avenue & G Street
41: Eleventh Avenue & Market Street
42: Park Boulevard & G Street
43: 13th Street & G Street
44: 14th Street & G Street
45: 15th Street & F Street
46: 16th Street & E Street
47: 16th Street & F Street
48: 16th Street & G Street
49: 16th Street & Market Street
50: 16th Street & Island Avenue
51: 16th Street & K Street
52: Imperial Avenue & 16th Street
53: 17th Street & G Street
54: 17th Street & J Street
55: Imperial Avenue & 17th Street
56: 19th Street & J Street
57: Imperial Avenue & 19th Street
58: Logan Avenue & I-5 SB Off-Ramp
59: Logan Avenue & I-5 SB On-Ramp

### Freeway

The Proposed Project is anticipated to contribute more than 50 peak hour trips on Interstate 5 (I-5) in either direction. Therefore, a freeway impact analysis was conducted for I-5 between Grape Street and SR-75. There are currently no ramp meters within the project study area.

**Figure 3-4** displays the project study area. All key study facilities are located within the City of San Diego.



*Fifth Avenue Landing Project*
*Transportation Impact Analysis*
CHEN✚RYAN

**Figure 3-4**
**Project Study Area**

# 4.0 Existing Conditions

This section provides an analysis of the current traffic conditions both with and without the Proposed Project. The scenarios analyzed in this section include:

- Existing Conditions
- Existing Plus Project Conditions

## 4.1 Existing Roadway Network

Two locally significant roadways traverse the study area. Each of the key roadways included in the study area are discussed below.

Harbor Drive – Within the project study area Harbor Drive has the following characteristics:

- Laurel Street to Grape Street: Six-lane roadway with a raised median and a posted speed limit of 40 mph.
- Grape Street to Broadway: Four Lane roadway with a rained median and a posted speed limit of 25 mph.
- Broadway to Pacific Highway: Two-lane roadway with a continuous left-turn lane and a posted speed limit of 25 mph.
- Pacific Highway to Kettner Boulevard: Six-lane roadway with a raised median and a posted speed limit of 25 mph.
- Kettner Boulevard to Market Street: Six-lane roadway with a raised median and a posted speed limit of 40 mph.
- Market Street to Front Street: Six-lane roadway with a raised median and a posted speed limit of 40 mph.
- Front Street to First Avenue: Four-lane roadway with a striped median, no posted speed limit.
- First Avenue to Convention Center Court: Four-lane roadway with a raised median and a posted speed limit of 40 mph.
- Convention Center Court to Fifth Avenue: Four-lane roadway with a striped median and a posted speed limit of 40 mph.
- Fifth Avenue to Park Boulevard: Four-lane roadway with a raised median and a posted speed limit of 40 mph.
- South of Park Boulevard: Four-lane roadway with a raised median and a posted speed limit of 40 mph.

Paved widths along Harbor Drive range from 63 to 110 feet. Within the project study area, pedestrian facilities are present on both sides of the roadway, including a Class II path along the west side of the roadway between Laurel Street and Hawthorn Street. South of Market Street, the Martin Luther King Promenade is present between the Burlington Northern Santa Fe and San Diego Trolley rights-of-way in lieu of a sidewalk along the east side of the roadway. A Class II bicycle lane is present in both direction south of Fifth Avenue.

Pacific Highway – Within the project study area Pacific Highway has the following characteristics:

- Juniper Street to Hawthorn Street: Six-lane roadway with a raised median and a posted speed limit of 35 mph.
- Broadway to Harbor Drive: Four to Six-lane roadway with a raised median and a posted speed limit of 35 mph.

Paved widths along Pacific Highway range from 86 to 106 feet. On-street parallel parking is intermittently permitted within the study area, with the exception of a segment along the west side of the roadway between Hawthorn and Juniper Streets and segments along portions of both sides of the roadway south of Broadway. Within the project study area, pedestrian facilities are present on both sides of the roadway. Signs indicating that Pacific Highway is a Class III bicycle route facility are posted along the roadway.

## 4.2 Existing Intersection and Roadway Volumes

**Figure 4-1a** and **4-1b** display the existing roadway and intersection geometrics for the key study area roadway segments and intersections, respectively. Existing traffic volumes for key study area roadway segments as well as for intersections are displayed in **Figures 4-2a and 4-2b.** Roadway segment and study area intersection traffic counts were conducted in September 2016. Count worksheets are provided in **Appendix A**.

## 4.3 Existing Level of Service Analysis

Level of service (LOS) analyses under Existing Conditions were conducted using the methodologies described in Chapter 2.0. Roadway segment analysis, intersection LOS analysis, and freeway mainline analysis results are discussed separately below.

### Roadway Segment Analysis

**Table 4.1** displays the LOS analysis results for key study area roadway segments under Existing Conditions.

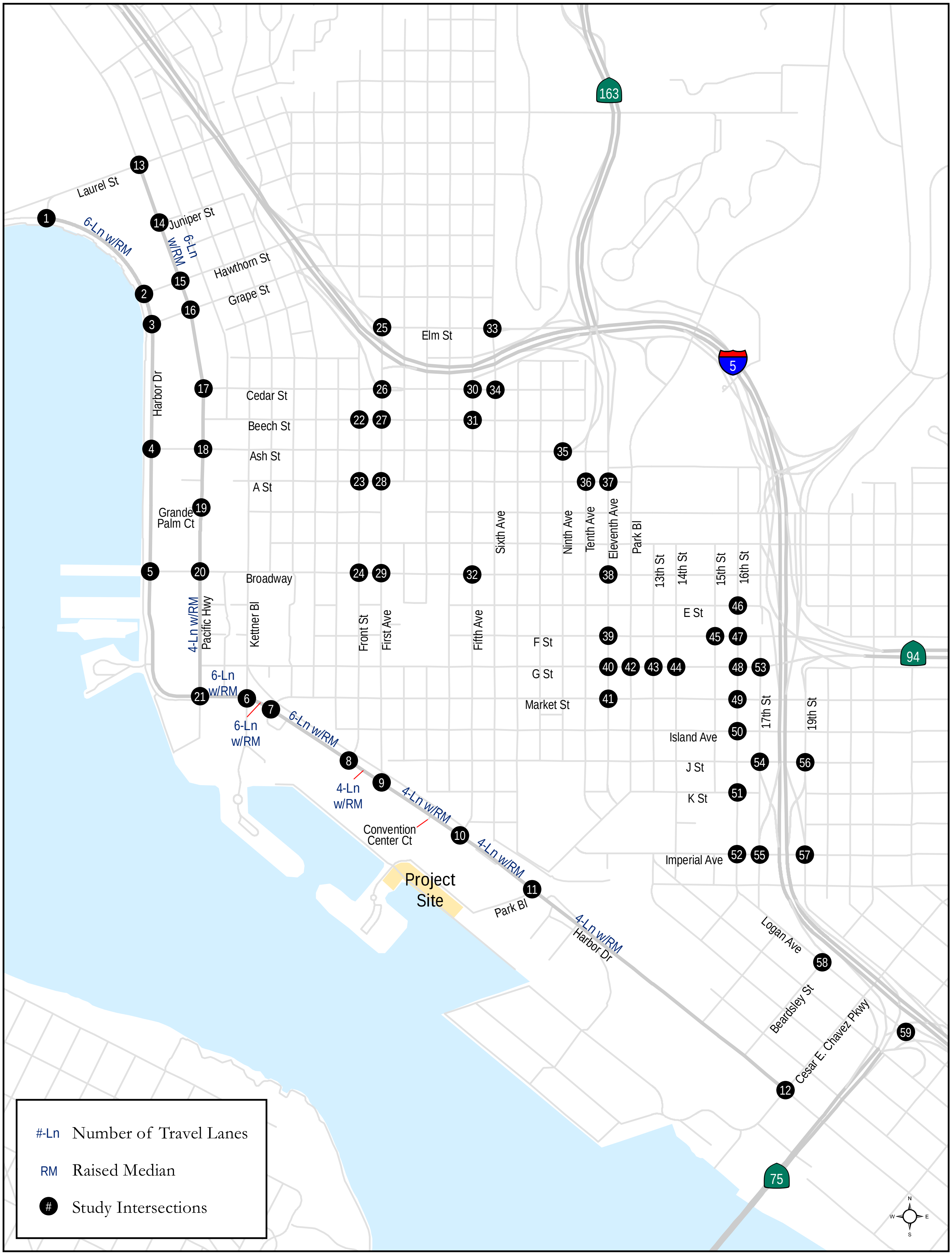


**Figure 4-1A**
**Roadway Segment Geometrics - Existing Conditions**

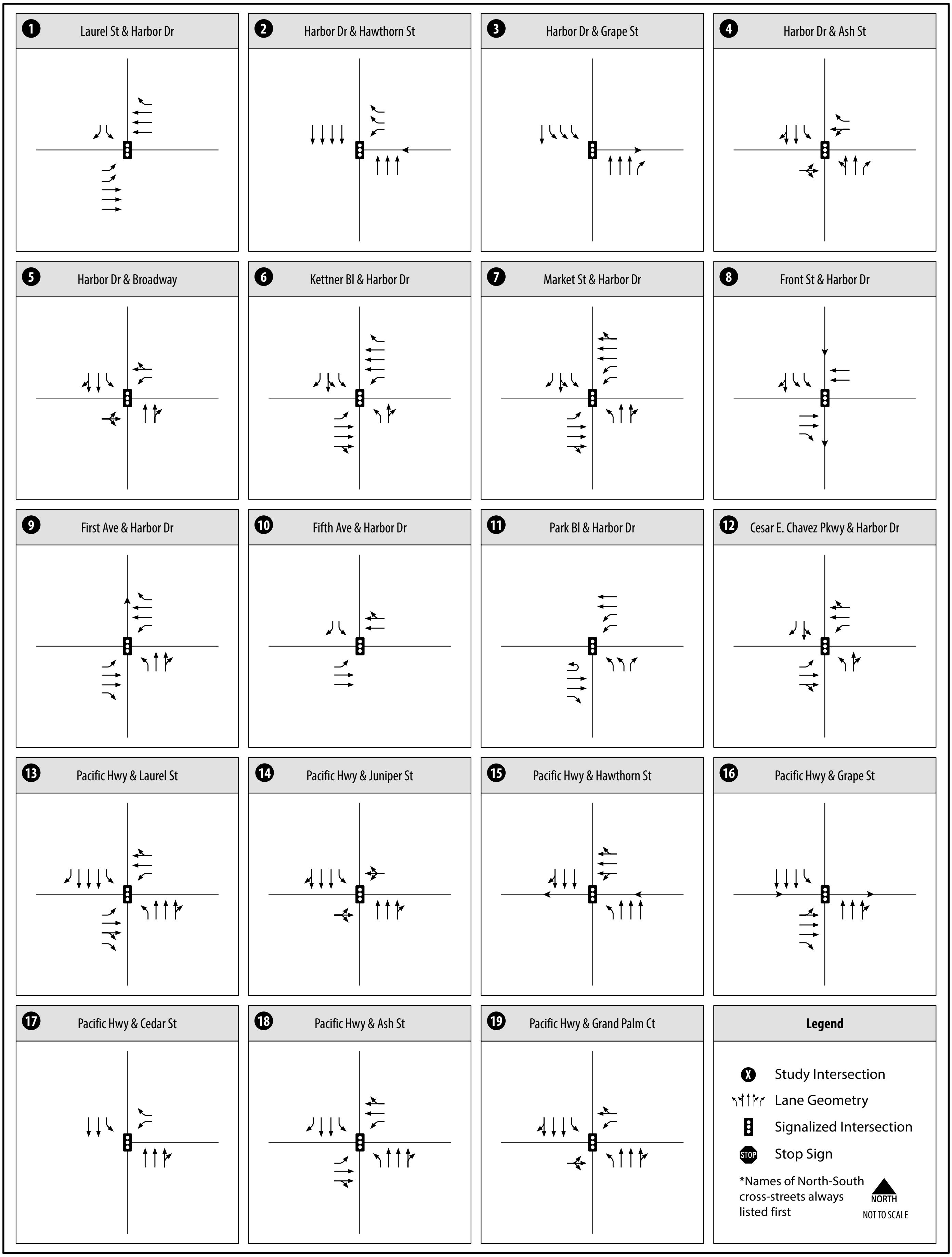
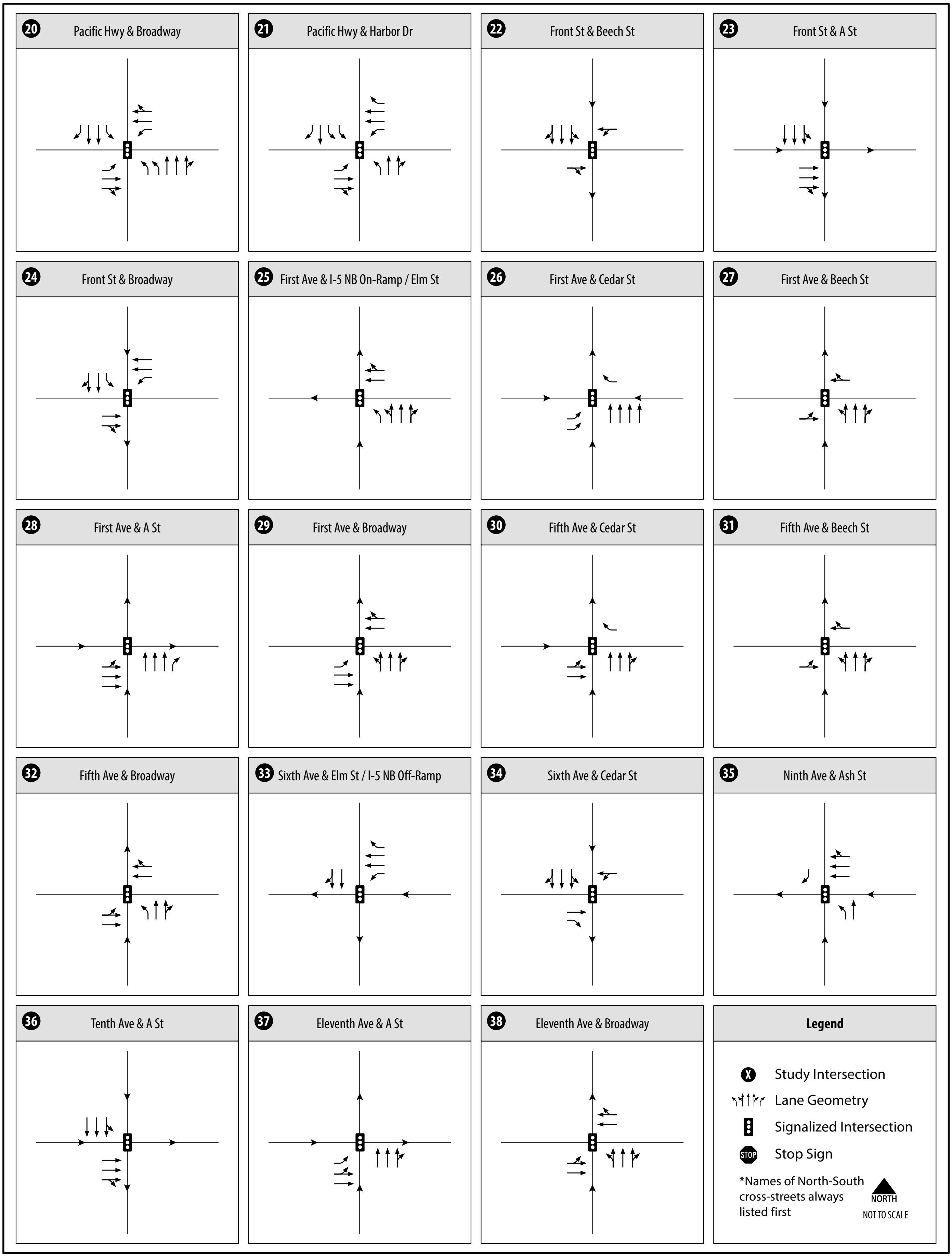


**Figure 4-1B**
**Intersection Geometrics - Existing Conditions**
**(Intersections 1-19)**



*Fifth Avenue Landing Project*
*Transportation Impact Analysis*
CHEN RYAN

**Figure 4-1B**
**Intersection Geometrics - Existing Conditions**
**(Intersections 20-38)**

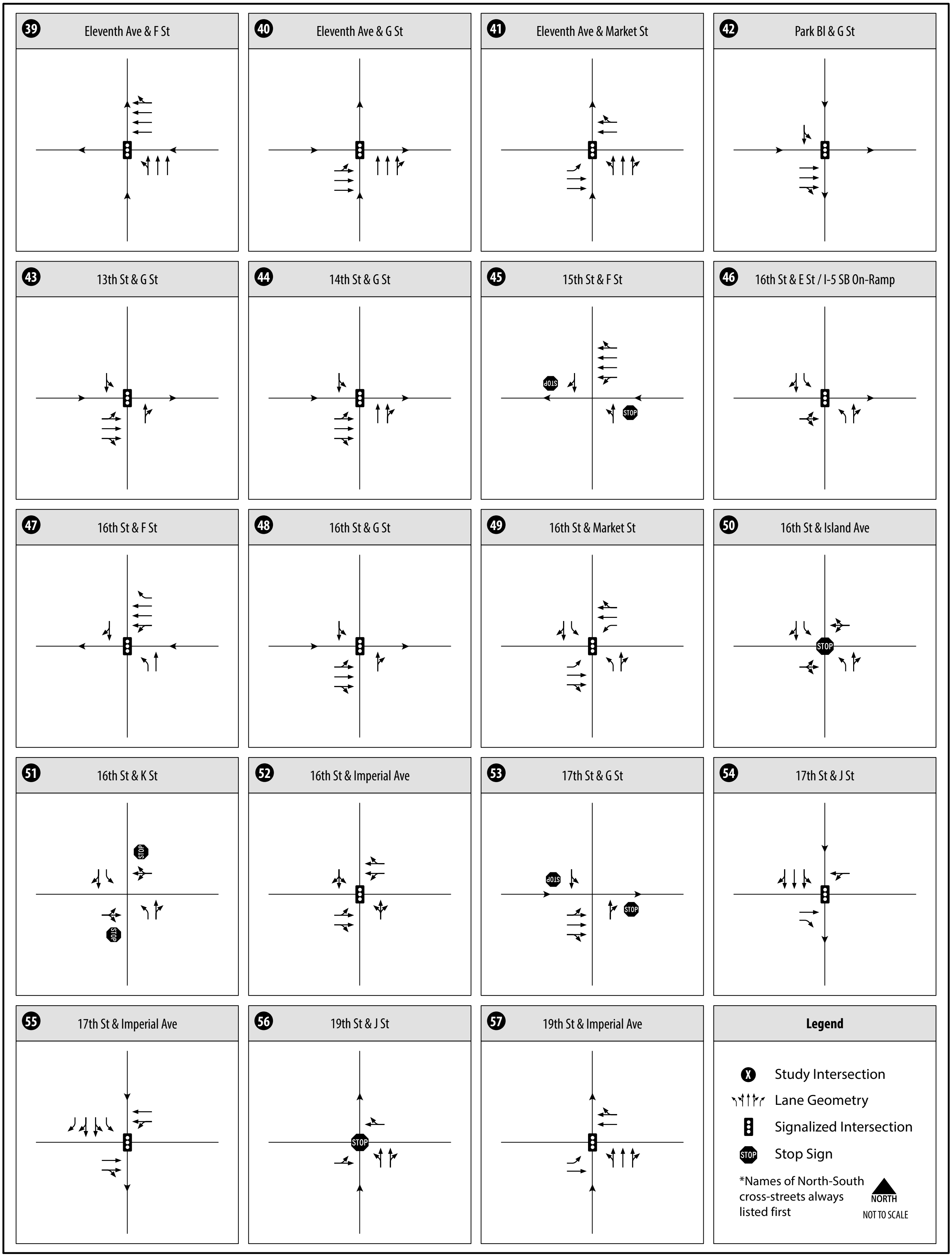
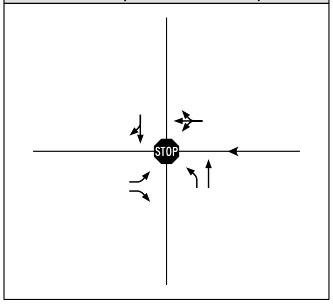
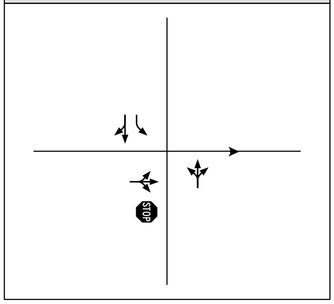


**Figure 4-1B**
**Intersection Geometrics - Existing Conditions**
**(Intersections 39-57)**

**58** Logan Ave &
Beardsley St / I-5 SB Off-Ramp



**59** Logan Ave & I-5 SB On-Ramp



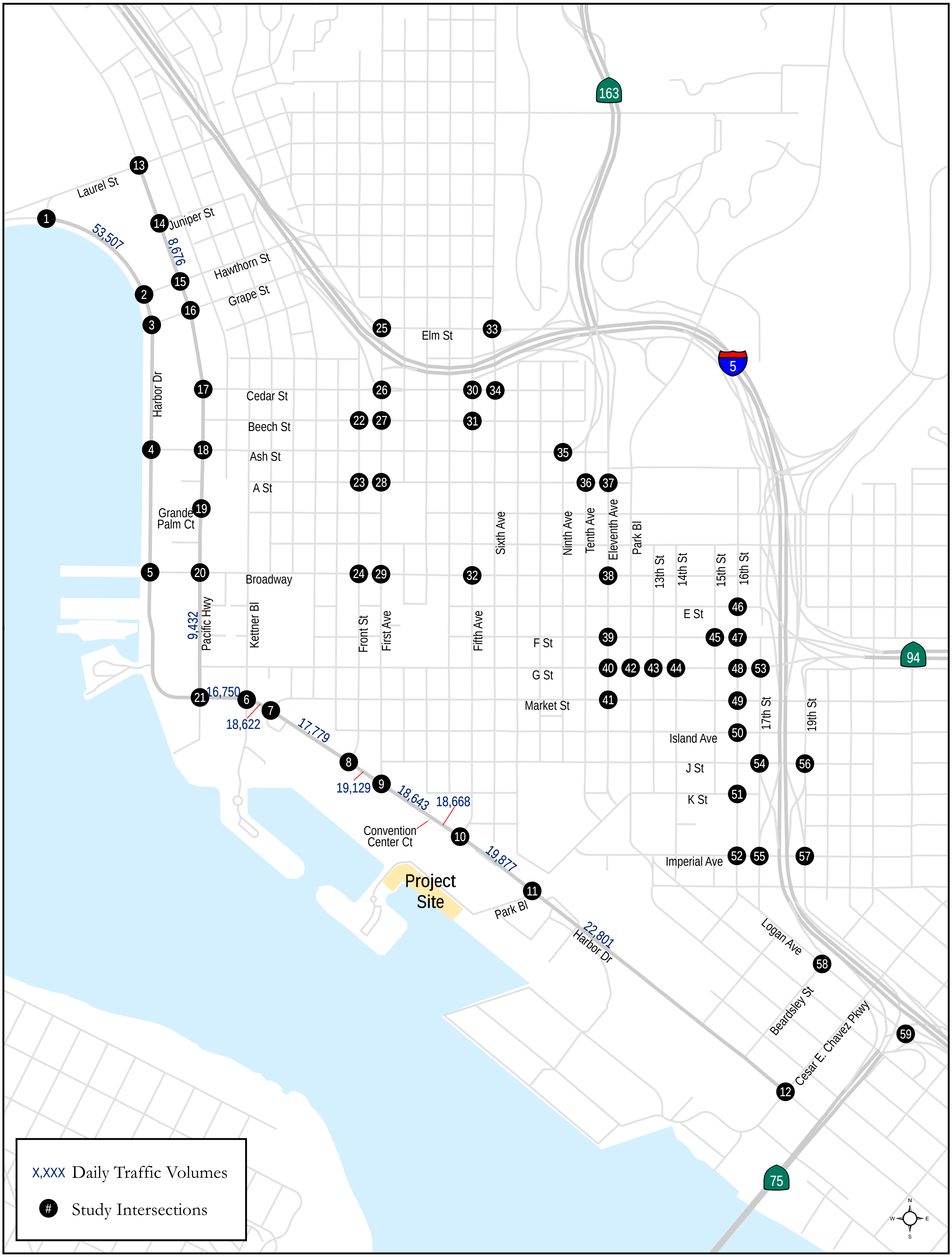
**Legend**

- Ⓧ Study Intersection
- ↰↑↑↱ Lane Geometry
- ⁝ Signalized Intersection
- STOP Stop Sign

*Names of North-South
cross-streets always
listed first

▲ NORTH
NOT TO SCALE

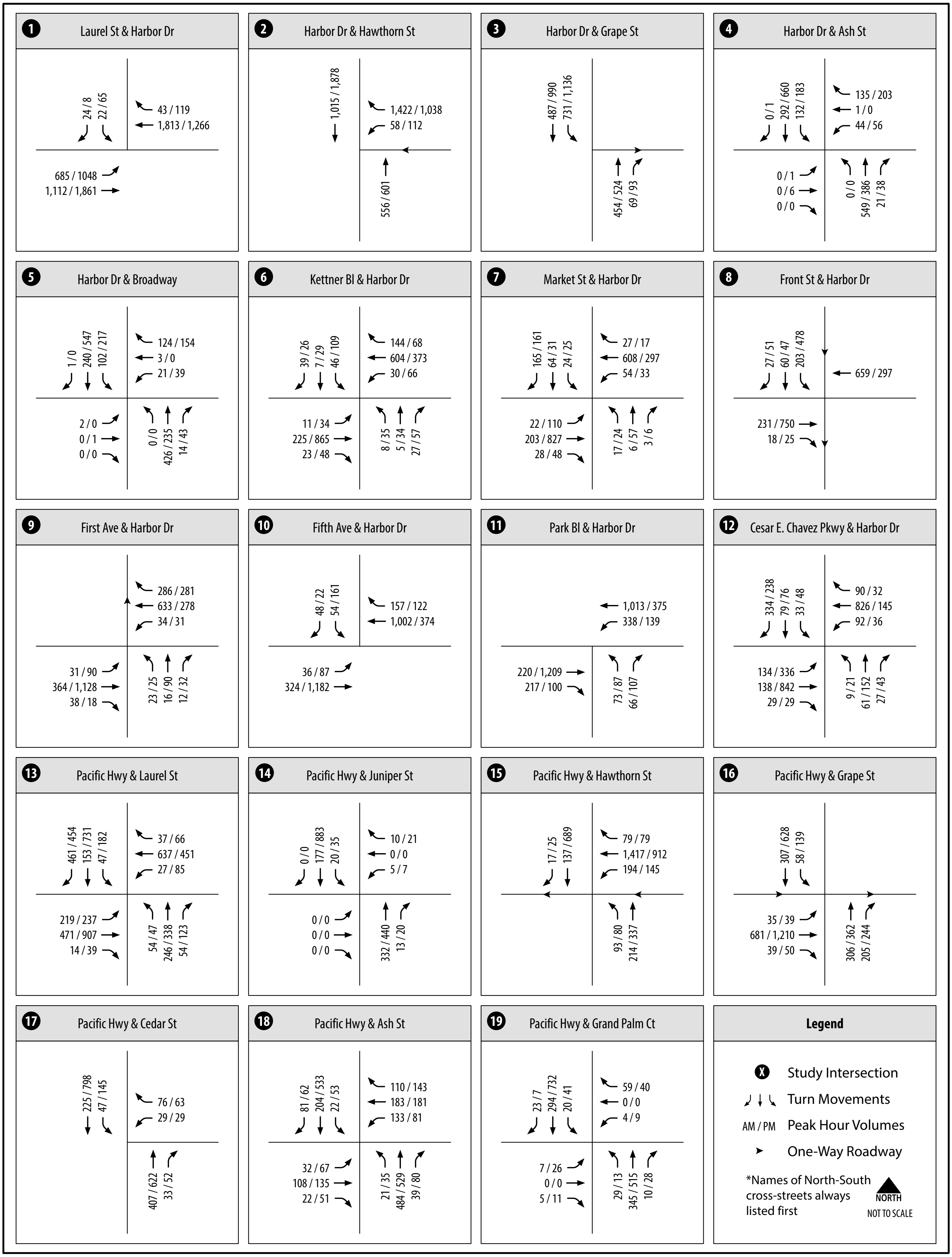
**Figure 4-1B**
**Intersection Geometrics - Existing Conditions**
**(Intersections 58 and 59)**



*Fifth Avenue Landing Project*
*Transportation Impact Analysis*

CHEN✚RYAN

**Figure 4-2A**
**Daily Roadway Segment Traffic Volumes - Existing Conditions**



*Fifth Avenue Landing Project*
*Transportation Impact Analysis*
CHEN✚RYAN

**Figure 4-2B**
**Peak Hour Intersection Traffic Volumes - Existing Conditions (Intersections 1-19)**

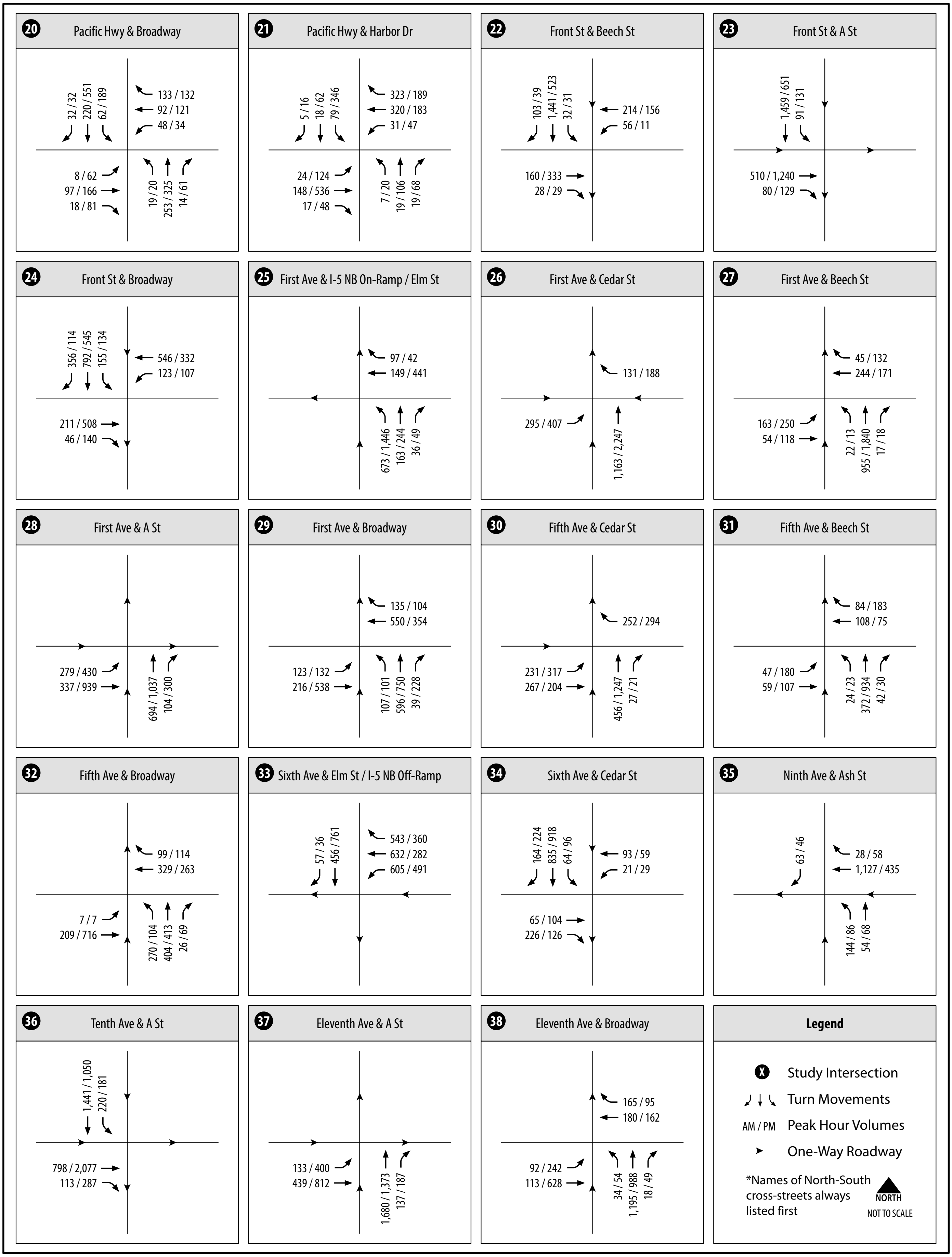


**Figure 4-2B**

**Peak Hour Intersection Traffic Volumes - Existing Conditions (Intersections 20-38)**

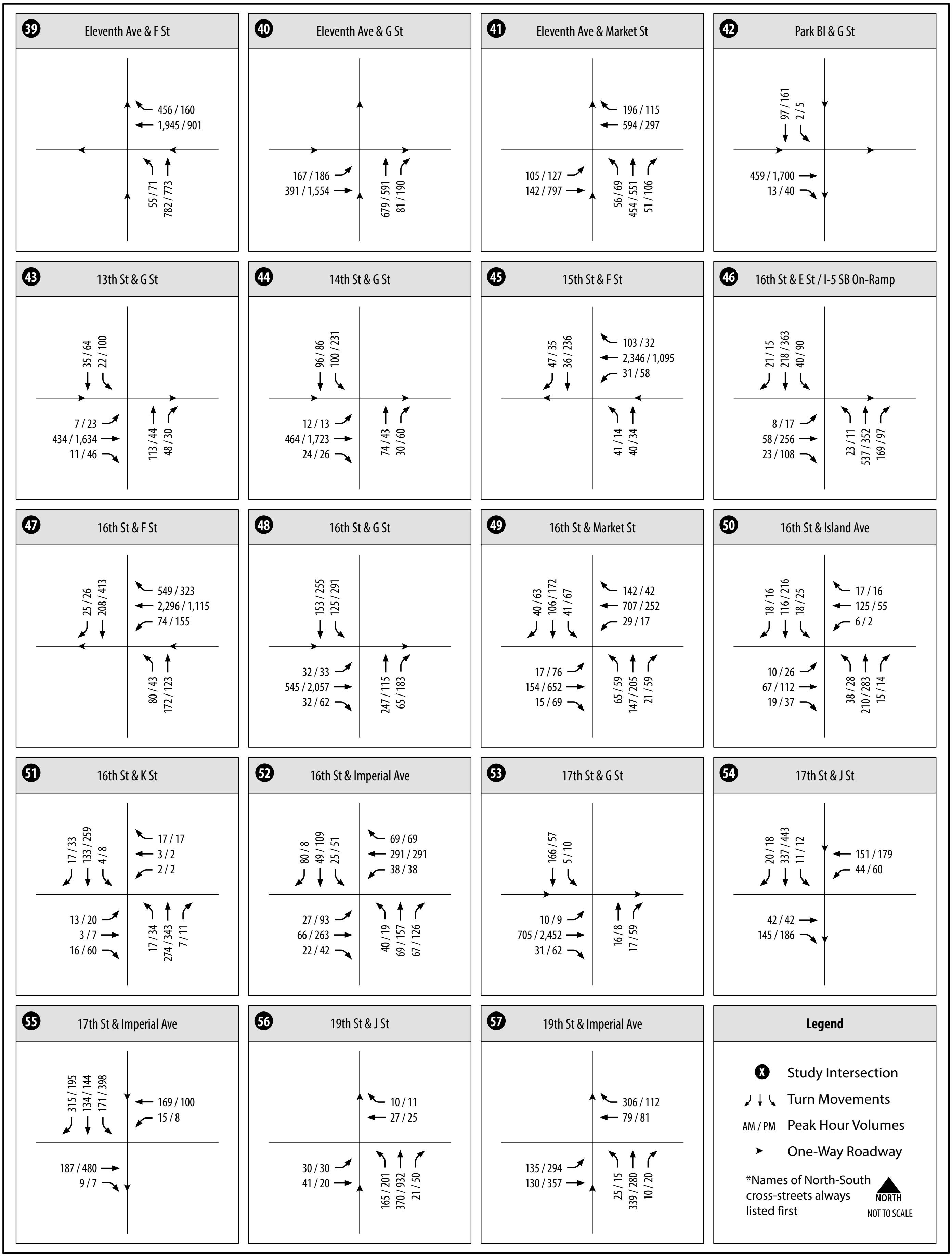
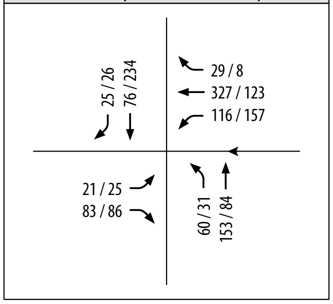
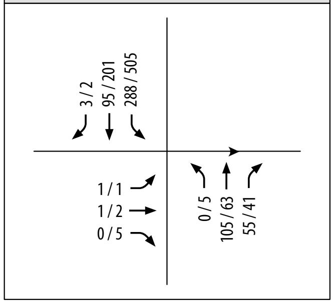


**Figure 4-2B**
**Peak Hour Intersection Traffic Volumes - Existing Conditions (Intersections 39-57)**

**58** Logan Ave & Beardsley St / I-5 SB Off-Ramp



**59** Logan Ave & I-5 SB On-Ramp



**Legend**

| | |
|---|---|
| X | Study Intersection |
| ↲ ↓ ↳ | Turn Movements |
| AM / PM | Peak Hour Volumes |
| ➤ | One-Way Roadway |

*Names of North-South cross-streets always listed first

▲ NORTH
NOT TO SCALE

**Figure 4-2B**
**Peak Hour Intersection Traffic Volumes - Existing Conditions**
**(Intersections 58 and 59)**

Table 4.1 Roadway Segment LOS Results - Existing Conditions

| Roadway Segment | Segment | Cross-section | Threshold (LOS E) | ADT | V/C | LOS |
|---|---|---|---|---|---|---|
| Harbor Drive | Between Laurel Street & Hawthorn Street | 6-Ln w/ RM | 60,000 | 53,507 | 0.892 | D |
| | Between Pacific Highway and Kettner Boulevard | 6-Ln w/ RM | <50,000 | 16,750 | 0.335 | A |
| | Between Kettner Boulevard & Market Street | 6-Ln w/ RM | <50,000 | 18,622 | 0.372 | A |
| | Between Market Street and Front Street | 6-Ln w/ RM | <50,000 | 17,779 | 0.356 | A |
| | Between Front Street and First Avenue | 4-Ln w/ SM | <40,000 | 19,129 | 0.479 | B |
| | Between First Avenue & Convention Center Court | 4-Ln w/ RM | <40,000 | 18,643 | 0.466 | B |
| | Between Convention Center Court & Fifth Avenue | 4-Ln w/ SM | <40,000 | 18,668 | 0.467 | B |
| | Between Fifth Avenue and Park Boulevard | 4-Ln w/ RM | <40,000 | 19,877 | 0.497 | B |
| | South of Park Boulevard | 4-Ln w/ RM | <40,000 | 22,801 | 0.570 | C |
| Pacific Highway | Between Juniper Street & Hawthorn Street | 6-Ln w/ RM | <50,000 | 8,676 | 0.174 | A |
| | Between Broadway & Harbor Drive | 4-Ln w/ SM | <40,000 | 9,432 | 0.236 | A |

*Source: NDS, Chen Ryan Associates; February 2017*

Notes:
V/C = Volume to Capacity Ratio
RM = Raised Median
SM = Striped Median

As shown in the table above, all the key study area roadway segments currently operate at acceptable LOS D or better.

### Intersection Analysis

**Table 4.2** displays intersection LOS and average vehicle delay results for the key study area intersections under Existing Conditions. LOS calculation worksheets for Existing Conditions are provided in **Appendix B**.

Table 4.2 Peak Hour Intersection LOS Results - Existing Conditions

| # | Intersection | AM Peak Hour | | PM Peak Hour | |
|---|---|---|---|---|---|
| | | Avg. Delay (sec.) | LOS | Avg. Delay (sec.) | LOS |
| 1 | Harbor Drive & Laurel Street | 17.4 | B | 46.2 | D |
| 2 | Harbor Drive & Hawthorn Street | 24.4 | C | 11.5 | B |
| 3 | Harbor Drive & Grape St | 17.7 | B | 17.1 | B |
| 4 | Harbor Drive & Ash Street | 11.1 | B | 11.0 | B |
| 5 | Harbor Drive & Broadway | 13.5 | B | 47.5 | D |
| 6 | Harbor Drive & Kettner Boulevard | 20.0 | C | 20.9 | C |
| 7 | Harbor Drive & Market Street | 30.8 | C | 20.6 | C |
| 8 | Harbor Drive & Front Street | 23.6 | C | 26.5 | C |
| 9 | First Street & Harbor Drive | 8.8 | A | 18.0 | B |

## Table 4.2 Peak Hour Intersection LOS Results - Existing Conditions

| # | Intersection | AM Peak Hour |  | PM Peak Hour |  |
|---|---|---|---|---|---|
|  |  | Avg. Delay (sec.) | LOS | Avg. Delay (sec.) | LOS |
| 10 | Harbor Drive & Fifth Avenue | 12.0 | B | 20.7 | C |
| 11 | Park Boulevard & Harbor Drive | 21.2 | C | 14.6 | B |
| 12 | Cesar Chavez Parkway & Harbor Drive | 19.9 | B | 25.4 | C |
| 13 | Pacific Highway & Laurel Street | 41.2 | D | 53.3 | D |
| 14 | Pacific Highway & Juniper Street | 15.1 | B | 7.1 | A |
| 15 | Pacific Highway & Hawthorn Street | 16.6 | B | 30.1 | C |
| 16 | Pacific Highway & Grape Street | 35.1 | D | 48.9 | D |
| 17 | Pacific Highway & Cedar Street | 9.6 | A | 11.5 | B |
| 18 | Pacific Highway & Ash Street | 20.2 | C | 20.1 | C |
| 19 | Pacific Highway & Grand Palm Court | 13.2 | B | 18.8 | B |
| 20 | Pacific Highway & Broadway | 26.7 | C | 31.1 | C |
| 21 | Pacific Highway & Harbor Drive | 22.8 | C | 30.3 | C |
| 22 | Front Street & Beech Street | 14.1 | B | 15.3 | B |
| 23 | Front Street & A Street | 13.1 | B | 18.8 | B |
| 24 | Front Street & Broadway | 15.8 | B | 20.3 | C |
| 25 | First Avenue & I-5 NB On-Ramp/Elm Street | 6.2 | A | 36.1 | D |
| 26 | First Avenue & Cedar Street | 16.8 | B | 17.7 | B |
| 27 | First Avenue & Beech Street | 21.8 | C | 58.1 | E |
| 28 | First Avenue & A Street | 12.3 | B | 17.4 | B |
| 29 | First Avenue & Broadway | 20.9 | C | 19.6 | B |
| 30 | Fifth Avenue & Cedar Street | 12.6 | B | 14.9 | B |
| 31 | Fifth Avenue & Beech Street | 12.6 | B | 15.2 | B |
| 32 | Fifth Avenue & Broadway | 13.0 | B | 16.4 | B |
| 33 | Sixth Avenue & Elm Street/I-5 NB Off-Ramp | 7.9 | A | 10.1 | B |
| 34 | Sixth Avenue & Cedar Street | 14.1 | B | 18.7 | B |
| 35 | Ninth Street & Ash Street | 10.9 | B | 11.0 | B |
| 36 | Tenth Avenue & A Street | 19.6 | B | 22.0 | C |
| 37 | Eleventh Avenue & A Street | 27.8 | C | 20.4 | C |
| 38 | Eleventh Avenue & Broadway | 12.3 | B | 10.6 | B |
| 39 | Eleventh Avenue & F Street | 6.0 | A | 8.2 | A |
| 40 | Eleventh Avenue & G Street | 11.4 | B | 18.8 | B |
| 41 | Eleventh Avenue & Market Street | 18.3 | B | 13.3 | B |
| 42 | Park Boulevard & G Street | 6.8 | A | 5.0 | A |
| 43 | 13th Street & G Street | 6.5 | A | 5.2 | A |
| 44 | 14th Street & G Street | 10.7 | B | 11.5 | B |
| 45 | 15th Street & F Street | 18.5 | C | 149.3 | F |
| 46 | 16th Street & E Street | 78.9 | E | 25.0 | C |

Table 4.2 Peak Hour Intersection LOS Results - Existing Conditions

| # | Intersection | AM Peak Hour |  | PM Peak Hour |  |
|---|---|---|---|---|---|
|  |  | Avg. Delay (sec.) | LOS | Avg. Delay (sec.) | LOS |
| 47 | 16th Street & F Street | 17.4 | B | 15.9 | B |
| 48 | 16th Street & G Street | 12.0 | B | 46.1 | D |
| 49 | 16th Street & Market Street | 11.4 | B | 18.9 | B |
| 50 | 16th Street & Island Avenue | 10.3 | B | 13.3 | B |
| 51 | 16th Street & K Street | 13.2 | B | 17.7 | C |
| 52 | Imperial Avenue & 16th Street | 12.5 | B | 14.1 | B |
| 53 | 17th Street & G Street | 21.6 | C | 185.3 | F |
| 54 | 17th Street & J Street | 10.5 | B | 9.9 | A |
| 55 | Imperial Avenue & 17th Street | 12.2 | B | 11.5 | B |
| 56 | 19th Street & J Street | 11.1 | B | 52.2 | F |
| 57 | Imperial Avenue & 19th Street | 17.9 | B | 24.9 | C |
| 58 | Logan Avenue & I-5 SB Off-Ramp | 38.5 | E | 15.8 | C |
| 59 | Logan Avenue & I-5 SB On-Ramp | 23.4 | C | 40.5 | E |

*Source: NDS, Chen Ryan Associates; February 2017*

Note:
Failing LOS of F is denoted in **bold** text.

As shown, all key study intersections currently operate at LOS E or better with the exception of the following:

- 15th Street & F Street (PM peak hour)
- 17th Street & G Street (PM peak hour)
- 19th Street & J Street (PM peak hour)

**Freeway Analysis**

**Table 4.3** displays the LOS results from the freeway mainline segment analysis under Existing Conditions.

Table 4.3 Freeway Mainline Analysis – Existing Conditions

| Freeway / State Highway | Segment | ADT[1] | Direction | # of Lanes | Capacity[2] | HV % | AM Peak Hour | | | PM Peak Hour | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Peak Hour Volume | V/C Ratio | LOS | Peak Hour Volume | V/C Ratio | LOS |
| I-5 | Grape Street to First Avenue | 169,000 | NB | 4M | 9,400 | 4.1% | 9,070 | 0.965 | E | 5,300 | 0.564 | C |
| | | | SB | 4M | 9,400 | 4.1% | 5,370 | 0.571 | C | 7,910 | 0.841 | D |
| | First Avenue to SR-163 | 213,000 | NB | 4M | 9,400 | 4.1% | 11,430 | 1.216 | F | 6,680 | 0.711 | D |
| | | | SB | 5M | 11,750 | 4.1% | 6,760 | 0.575 | C | 9,970 | 0.849 | D |
| | SR-163 and B Street | 223,000 | NB | 6M | 14,100 | 3.7% | 11,910 | 0.845 | D | 6,960 | 0.494 | B |
| | | | SB | 6M | 14,100 | 3.7% | 7,050 | 0.500 | C | 10,390 | 0.737 | D |
| | B Street to SR-94 | 223,000 | NB | 4M | 9,400 | 4.0% | 11,950 | 1.271 | F | 6,980 | 0.743 | D |
| | | | SB | 4M | 9,400 | 4.0% | 7,070 | 0.752 | D | 10,430 | 1.110 | F |
| | SR-94 to Imperial Avenue | 173,000 | NB | 5M | 11,750 | 3.8% | 9,250 | 0.787 | D | 5,410 | 0.460 | B |
| | | | SB | 5M | 11,750 | 3.8% | 5,480 | 0.466 | B | 8,070 | 0.687 | C |
| | Imperial Avenue to SR-75 | 169,000 | NB | 5M | 11,750 | 4.0% | 9,060 | 0.771 | D | 5,290 | 0.450 | B |
| | | | SB | 5M | 11,750 | 4.0% | 5,360 | 0.456 | B | 7,900 | 0.672 | C |

*Source: Chen Ryan Associates; February 2017*

Notes:
**Bold** letter indicates LOS E or F.
M = Mainline lane.
[1] Traffic volumes provided by Caltrans (2015).
[2] The capacity is calculated as 2,350 ADT per main lane and 1,410 ADT (60% of the main lane capacity) per auxiliary lane.
AM Splits: Directional split.= 68.2% in the NB | Peak hour %.=7.8%, provided by Caltrans (2015)
PM Splits: Directional split.= 59.9% in the SB | Peak hour %.=7.1%, provided by Caltrans (2015)
HV = Heavy vehicle %

As shown, all study area freeway mainline segments operate at LOS D or better, with the exception of the following:

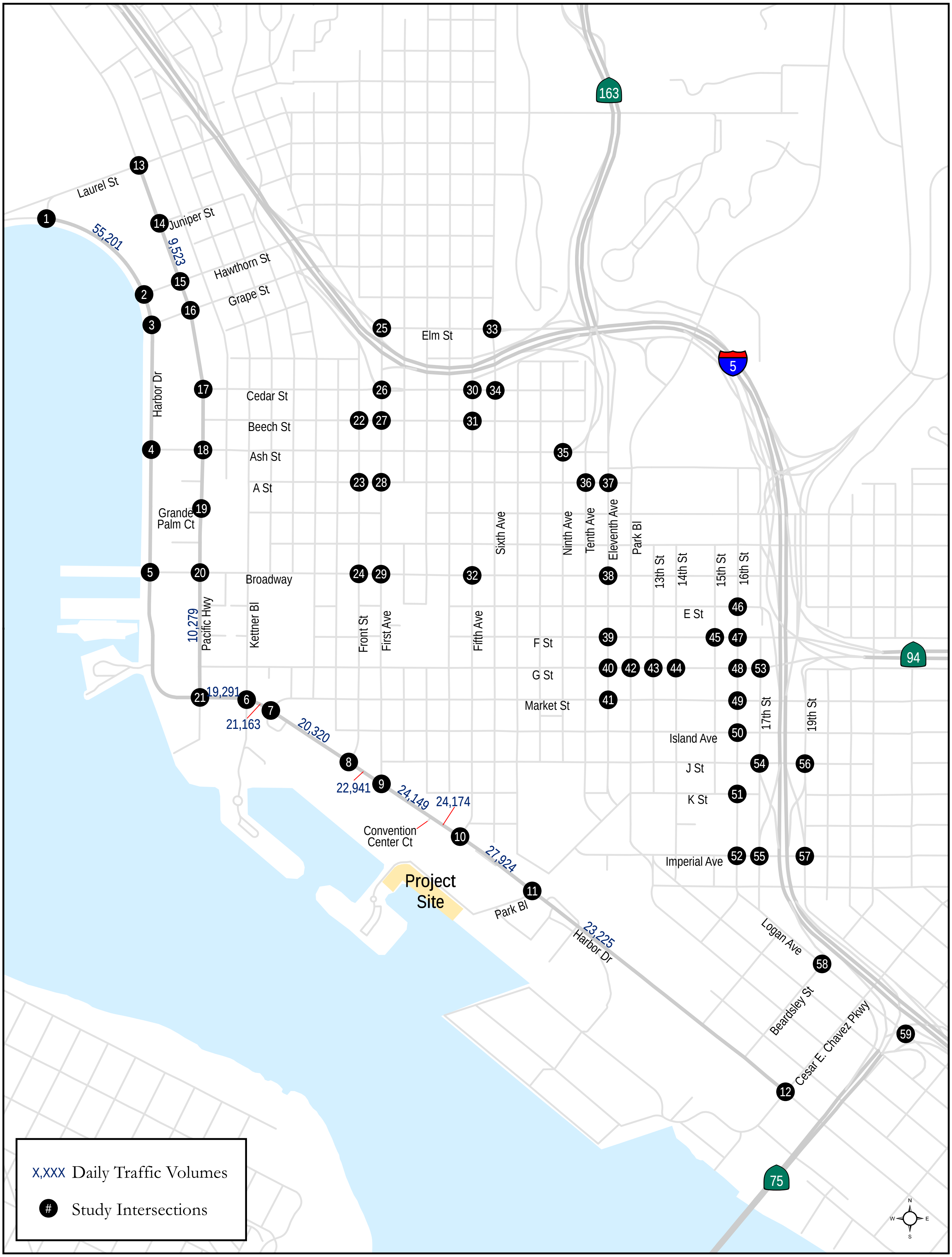
- I-5 Northbound, between Grape Street and First Avenue (LOS E, AM Peak)
- I-5 Northbound, between First Avenue and SR-163 (LOS F, AM Peak)
- I-5 Northbound, between B Street and SR-94 (LOS F, AM Peak)
- I-5 Southbound, between B Street and SR-94 (LOS F, PM Peak)

## 4.4 Existing Plus Project Roadway Network and Traffic Volumes

Existing Plus Project traffic volumes were derived by combining the existing traffic volumes (displayed in Figure 4-2) with the project trip assignment volumes (displayed in Figure 3-3). Daily roadway and peak hour intersection volumes are displayed in **Figures 4-3a and 4-3b.**

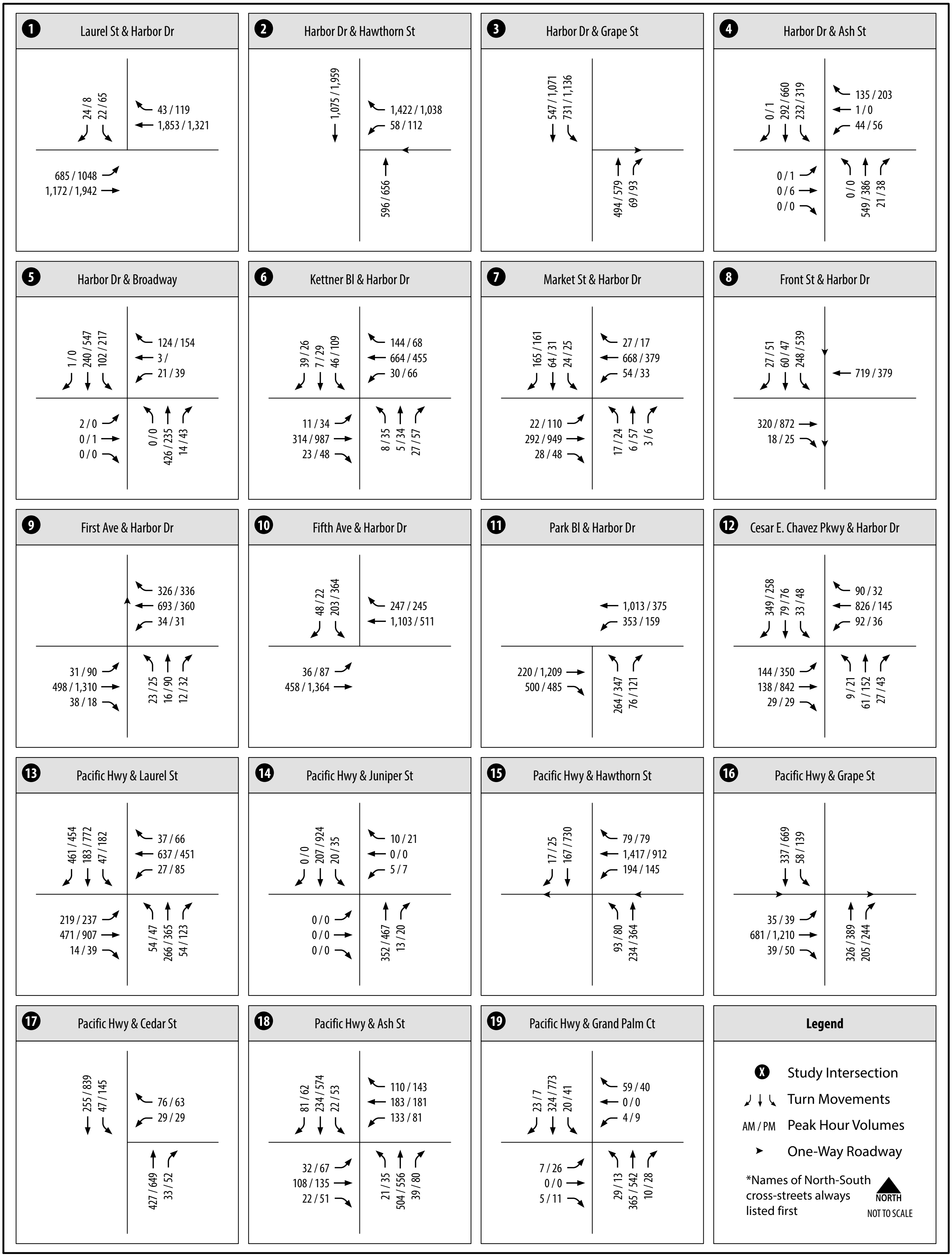
## 4.5 Existing Plus Project Traffic Conditions

Analyses were conducted using the methodologies described in Chapter 2.0. Roadway segment analysis, intersection LOS analysis, and freeway mainline analysis results are discussed separately below.



*Fifth Avenue Landing Project*
*Transportation Impact Analysis*
CHEN✚RYAN

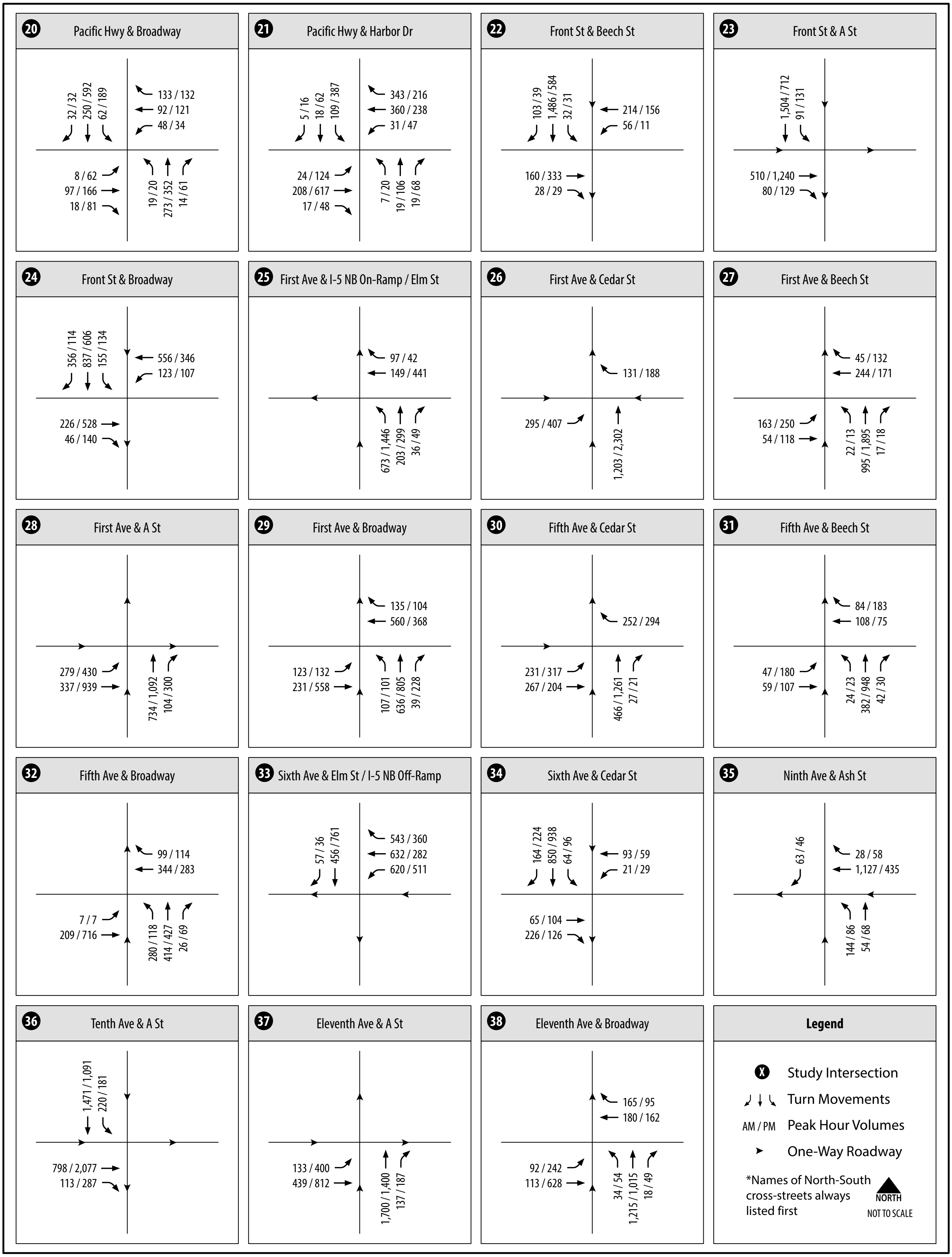
**Figure 4-3A**
**Daily Roadway Segment Traffic Volumes -**
**Existing Plus Project Conditions**



*Fifth Avenue Landing Project*
*Transportation Impact Analysis*

CHEN RYAN

**Figure 4-3B**
**Peak Hour Intersection Traffic Volumes -**
**Existing Plus Project Conditions (Intersections 1-19)**



20 Pacific Hwy & Broadway

21 Pacific Hwy & Harbor Dr

22 Front St & Beech St

23 Front St & A St

24 Front St & Broadway

25 First Ave & I-5 NB On-Ramp / Elm St

26 First Ave & Cedar St

27 First Ave & Beech St

28 First Ave & A St

29 First Ave & Broadway

30 Fifth Ave & Cedar St

31 Fifth Ave & Beech St

32 Fifth Ave & Broadway

33 Sixth Ave & Elm St / I-5 NB Off-Ramp

34 Sixth Ave & Cedar St

35 Ninth Ave & Ash St

36 Tenth Ave & A St

37 Eleventh Ave & A St

38 Eleventh Ave & Broadway

**Figure 4-3B**
**Peak Hour Intersection Traffic Volumes -**
**Existing Plus Project Conditions (Intersections 20-38)**

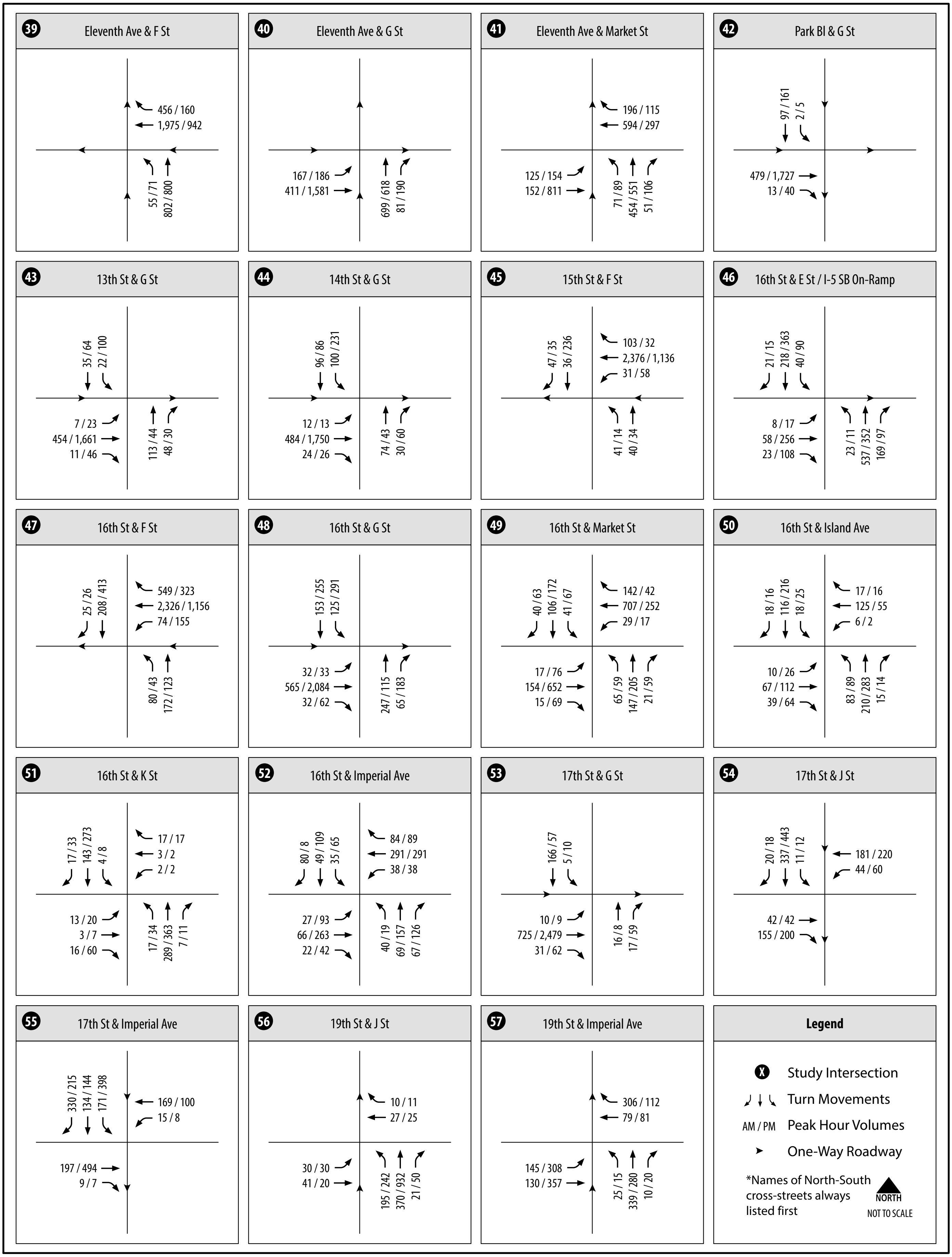
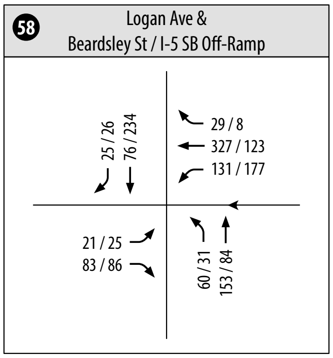
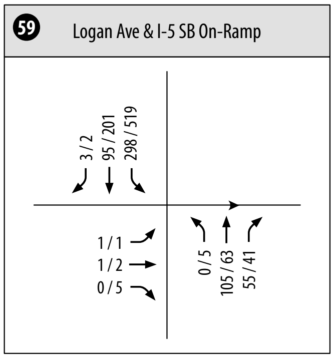


**Figure 4-3B**

**Peak Hour Intersection Traffic Volumes - Existing Plus Project Conditions (Intersections 39-57)**





**Legend**

| | |
|---|---|
| X | Study Intersection |
| ↲ ↓ ↳ | Turn Movements |
| AM / PM | Peak Hour Volumes |
| ➤ | One-Way Roadway |

*Names of North-South cross-streets always listed first

▲ NORTH

NOT TO SCALE

**Figure 4-3B**
**Peak Hour Intersection Traffic Volumes -**
**Existing Plus Project Conditions (Intersections 58 and 59)**

### Roadway Segment Analysis

**Table 4.4** displays the LOS analysis results for key roadway segments under Existing Plus Project Conditions.

Table 4.4 Roadway Segment LOS Results - Existing Plus Project Conditions

| Roadway | Segment | Cross-Section | Threshold (LOS E) | Existing + Project | | | Existing | Δ | Sig? |
|---|---|---|---|---|---|---|---|---|---|
| | | | | ADT | V/C | LOS | ADT / V/C / LOS | | |
| Harbor Drive | Between Laurel Street & Hawthorn Street | 6-Ln w/ RM | <60,000 | 55,201 | 0.920 | D | 53,507 / 0.892 / D | 0.028 | N |
| | Between Pacific Highway and Kettner Boulevard | 6-Ln w/ RM | <50,000 | 19,291 | 0.386 | A | 16,750 / 0.335 / A | 0.051 | N |
| | Between Kettner Boulevard & Market Street | 6-Ln w/ RM | <50,000 | 21,163 | 0.423 | A | 18,622 / 0.372 / A | 0.051 | N |
| | Between Market Street and Front Street | 6-Ln w/ RM | <50,000 | 20,320 | 0.406 | A | 17,779 / 0.356 / A | 0.051 | N |
| | Between Front Street and First Avenue | 4-Ln w/ SM | <40,000 | 22,941 | 0.574 | B | 19,129 / 0.478 / B | 0.095 | N |
| | Between First Avenue & Convention Center Court | 4-Ln w/ RM | <40,000 | 24,149 | 0.604 | B | 18,643 / 0.466 / B | 0.138 | N |
| | Between Convention Center Court & Fifth Avenue | 4-Ln w/ SM | <40,000 | 24,174 | 0.604 | B | 18,668 / 0.467 / B | 0.138 | N |
| | Between Fifth Avenue and Park Boulevard | 4-Ln w/ RM | <40,000 | 27,924 | 0.698 | B | 19,877 / 0.497 / B | 0.201 | N |
| | South of Park Boulevard | 4-Ln w/ RM | <40,000 | 23,225 | 0.581 | C | 22,801 / 0.570 / C | 0.011 | N |
| Pacific Highway | Between Juniper Street & Hawthorn Street | 6-Ln w/ RM | <50,000 | 9,523 | 0.190 | A | 8,676 / 0.174 / A | 0.017 | N |
| | Between Broadway & Harbor Drive | 4-Ln w/ SM | <40,000 | 10,279 | 0.257 | A | 9,432 / 0.236 / A | 0.021 | N |

*Source: Chen Ryan Associates; February 2017*

Notes:
V/C = Volume to Capacity Ratio
RM = Raised Median
SM = Striped Median

As shown, all of the roadways within the study area are projected to continue operating at acceptable LOS D or better under Existing Plus Project Conditions.

### Intersection Analysis

**Table 4.5** displays intersection LOS and average vehicle delay results under Existing Plus Project Conditions. LOS calculation worksheets for the Existing Plus Project Conditions are provided in **Appendix C**.

Table 4.5 Peak Hour Intersection LOS Results - Existing Plus Project Conditions

| # | Intersection | AM Peak Hour |  | PM Peak Hour |  | Delay w/o Project (sec.) AM/PM | LOS w/o Project AM/PM | Change in Delay (sec.) AM/PM | Significant Impact? |
|---|---|---|---|---|---|---|---|---|---|
|  |  | Avg. Delay (sec.) | LOS | Avg. Delay (sec.) | LOS |  |  |  |  |
| 1 | Harbor Drive & Laurel Street | 17.6 | B | 46.2 | D | 17.4 / 46.2 | B / D | 0.2 / 0.0 | N / N |
| 2 | Harbor Drive & Hawthorn Street | 24.4 | C | 11.5 | B | 24.4 / 11.5 | C / B | 0.0 / 0.0 | N / N |
| 3 | Harbor Drive & Grape St | 17.7 | B | 17.1 | B | 17.7 / 17.1 | B / B | 0.0 / 0.0 | N / N |
| 4 | Harbor Drive & Ash Street | 12.9 | B | 15.3 | B | 11.1 / 11.0 | B / B | 1.8 / 4.3 | N / N |
| 5 | Harbor Drive & Broadway | 13.5 | B | 47.5 | D | 13.5 / 47.5 | B / D | 0.0 / 0.0 | N / N |
| 6 | Harbor Drive & Kettner Boulevard | 20.0 | B | 21.1 | C | 20.0 / 20.9 | C / C | 0.0 / 0.2 | N / N |
| 7 | Harbor Drive & Market Street | 31.0 | C | 20.6 | C | 30.8 / 20.6 | C / C | 0.2 / 0.0 | N / N |
| 8 | Harbor Drive & Front Street | 24.8 | C | 39.5 | D | 23.6 / 26.5 | C / C | 1.2 / 13.0 | N / N |
| 9 | First Street & Harbor Drive | 8.8 | A | 19.0 | B | 8.8 / 18.0 | A / B | 0.0 / 1.0 | N / N |
| 10 | Harbor Drive & Fifth Avenue | 19.1 | B | 30.1 | C | 12.0 / 20.7 | B / C | 7.1 / 9.4 | N / N |
| 11 | Park Boulevard & Harbor Drive | 29.6 | C | 17.6 | B | 21.2 / 14.6 | C / B | 8.4 / 3.0 | N / N |
| 12 | Cesar Chavez Parkway & Harbor Drive | 21.2 | C | 26.9 | C | 19.9 / 25.4 | B / C | 1.3 / 1.5 | N / N |
| 13 | Pacific Highway & Laurel Street | 41.2 | D | 53.3 | D | 41.2 / 53.3 | D / D | 0.0 / 0.0 | N / N |
| 14 | Pacific Highway & Juniper Street | 14.0 | B | 7.1 | A | 15.1 / 7.1 | B / A | -1.1 / 0.0 | N / N |
| 15 | Pacific Highway & Hawthorn Street | 17.3 | B | 30.7 | C | 16.6 / 30.1 | B / C | 0.7 / 0.6 | N / N |
| 16 | Pacific Highway & Grape Street | 35.1 | C | 49.5 | D | 35.1 / 48.9 | D / D | 0.0 / 0.6 | N / N |
| 17 | Pacific Highway & Cedar Street | 9.6 | A | 11.5 | B | 9.6 / 11.5 | A / B | 0.0 / 0.0 | N / N |
| 18 | Pacific Highway & Ash Street | 20.2 | C | 20.1 | C | 20.2 / 20.1 | C / C | 0.0 / 0.0 | N / N |
| 19 | Pacific Highway & Grand Palm Court | 13.2 | B | 18.8 | B | 13.2 / 18.8 | B / B | 0.0 / 0.0 | N / N |
| 20 | Pacific Highway & Broadway | 26.7 | C | 31.1 | C | 26.7 / 31.1 | C / C | 0.0 / 0.0 | N / N |
| 21 | Pacific Highway & Harbor Drive | 22.8 | C | 32.1 | C | 22.8 / 30.3 | C / C | 0.0 / 1.8 | N / N |
| 22 | Front Street & Beech Street | 14.3 | B | 15.3 | B | 14.1 / 15.3 | B / B | 0.2 / 0.0 | N / N |
| 23 | Front Street & A Street | 13.2 | B | 18.8 | B | 13.1 / 18.8 | B / B | 0.1 / 0.0 | N / N |
| 24 | Front Street & Broadway | 16.2 | B | 20.9 | C | 15.8 / 20.3 | B / C | 0.4 / 0.6 | N / N |
| 25 | First Avenue & I-5 NB On-Ramp/Elm Street | 6.2 | A | 36.1 | D | 6.2 / 36.1 | A / D | 0.0 / 0.0 | N / N |
| 26 | First Avenue & Cedar Street | 16.9 | B | 17.7 | B | 16.8 / 17.7 | B / B | 0.1 / 0.0 | N / N |
| 27 | First Avenue & Beech Street | 22.1 | C | 58.1 | E | 21.8 / 58.1 | C / E | 0.3 / 0.0 | N / N |
| 28 | First Avenue & A Street | 12.3 | B | 17.5 | B | 12.3 / 17.4 | B / B | 0.0 / 0.1 | N / N |
| 29 | First Avenue & Broadway | 21.3 | C | 20.0 | B | 20.9 / 19.6 | C / B | 0.4 / 0.4 | N / N |
| 30 | Fifth Avenue & Cedar Street | 12.7 | B | 15.0 | B | 12.6 / 14.9 | B / B | 0.1 / 0.1 | N / N |

## Table 4.5 Peak Hour Intersection LOS Results - Existing Plus Project Conditions

| # | Intersection | AM Peak Hour | | PM Peak Hour | | Delay w/o Project (sec.) AM/PM | LOS w/o Project AM/PM | Change in Delay (sec.) AM/PM | Significant Impact? |
|---|---|---|---|---|---|---|---|---|---|
| | | Avg. Delay (sec.) | LOS | Avg. Delay (sec.) | LOS | | | | |
| 31 | Fifth Avenue & Beech Street | 12.6 | B | 15.2 | B | 12.6 / 15.2 | B / B | 0.0 / 0.0 | N / N |
| 32 | Fifth Avenue & Broadway | 13.1 | B | 17.4 | B | 13.0 / 16.4 | B / B | 0.1 / 1.0 | N / N |
| 33 | Sixth Avenue & Elm Street/I-5 NB Off-Ramp | 7.9 | A | 10.1 | B | 7.9 / 10.1 | A / B | 0.0 / 0.0 | N / N |
| 34 | Sixth Avenue & Cedar Street | 14.2 | B | 18.8 | B | 14.1 / 18.7 | B / B | 0.1 / 0.1 | N / N |
| 35 | Ninth Street & Ash Street | 10.9 | B | 11.0 | B | 10.9 / 11.0 | B / B | 0.0 / 0.0 | N / N |
| 36 | Tenth Avenue & A Street | 20.1 | C | 22.1 | C | 19.6 / 22.0 | B / C | 0.5 / 0.1 | N / N |
| 37 | Eleventh Avenue & A Street | 28.1 | C | 20.7 | C | 27.8 / 20.4 | C / C | 0.3 / 0.3 | N / N |
| 38 | Eleventh Avenue & Broadway | 12.4 | B | 10.6 | B | 12.3 / 10.6 | B / B | 0.1 / 0.0 | N / N |
| 39 | Eleventh Avenue & F Street | 6.1 | A | 8.2 | A | 6.0 / 8.2 | A / A | 0.1 / 0.0 | N / N |
| 40 | Eleventh Avenue & G Street | 11.5 | B | 19.4 | B | 11.4 / 18.8 | B / B | 0.1 / 0.6 | N / N |
| 41 | Eleventh Avenue & Market Street | 18.7 | B | 13.5 | B | 18.3 / 13.3 | B / B | 0.4 / 0.2 | N / N |
| 42 | Park Boulevard & G Street | 6.8 | A | 5.0 | A | 6.8 / 5.0 | A / A | 0.0 / 0.0 | N / N |
| 43 | 13th Street & G Street | 6.5 | A | 5.3 | A | 6.5 / 5.2 | A / A | 0.0 / 0.1 | N / N |
| 44 | 14th Street & G Street | 10.7 | B | 11.5 | B | 10.7 / 11.5 | B / B | 0.0 / 0.0 | N / N |
| 45 | 15th Street & F Street | 18.5 | C | 165.1 | F | 18.5 / 149.3 | C / F | 0.0 / 15.8 | N / Y |
| 46 | 16th Street & E Street | 78.9 | E | 25.0 | C | 78.9 / 25.0 | E / C | 0.0 / 0.0 | N / N |
| 47 | 16th Street & F Street | 17.8 | B | 15.9 | B | 17.4 / 15.9 | B / B | 0.4 / 0.0 | N / N |
| 48 | 16th Street & G Street | 12.0 | B | 49.6 | D | 12.0 / 46.1 | B / D | 0.0 / 3.5 | N / N |
| 49 | 16th Street & Market Street | 11.4 | B | 18.9 | B | 11.4 / 18.9 | B / B | 0.0 / 0.0 | N / N |
| 50 | 16th Street & Island Avenue | 10.8 | B | 14.0 | B | 10.3 / 13.3 | B / B | 0.5 / 0.7 | N / N |
| 51 | 16th Street & K Street | 13.5 | B | 18.6 | C | 13.2 / 17.7 | B / C | 0.3 / 0.9 | N / N |
| 52 | Imperial Avenue & 16th Street | 12.6 | B | 14.3 | B | 12.5 / 14.1 | B / B | 0.1 / 0.2 | N / N |
| 53 | 17th Street & G Street | 21.9 | C | 213.3 | F | 21.6 / 185.3 | C / F | 0.3 / 28.0 | N / Y |
| 54 | 17th Street & J Street | 10.5 | A | 10.5 | B | 10.5 / 9.9 | B / A | 0.0 / 0.6 | N / N |
| 55 | Imperial Avenue & 17th Street | 12.3 | B | 11.7 | B | 12.2 / 11.5 | B / B | 0.1 / 0.2 | N / N |
| 56 | 19th Street & J Street | 11.9 | B | 70.8 | F | 11.1 / 52.2 | B / F | 0.8 / 18.6 | N / Y |
| 57 | Imperial Avenue & 19th Street | 18.4 | B | 27.3 | C | 17.9 / 24.9 | B / C | 0.5 / 2.4 | N / N |
| 58 | Logan Avenue & I-5 SB Off-Ramp | 43.5 | E | 16.9 | C | 38.5 / 15.8 | E / C | 5.0 / 1.1 | N / N |
| 59 | Logan Avenue & I-5 SB On-Ramp | 24.2 | C | 43.1 | E | 23.4 / 40.5 | C / E | 0.8 / 2.6 | N / N |

*Source: Chen Ryan Associates; February 2017*

Note:
Failing LOS of F is denoted in **bold** text.

As shown in Table 4.4, the following intersections are projected to operate at LOS F under Existing Plus Project Conditions, all during the PM peak period:

- 15th Street & F Street
- 17th Street & G Street
- 19th Street & J Street

Based upon the significance criteria presented in Section 2.5 of this report, significant traffic related impacts are associated with the Proposed Project at all three intersections listed above, under Existing Plus Project Conditions (intersections operating at LOS F which the project adds more than 2.0 seconds of delay to).

### Freeway Analysis

**Table 4.6** displays the LOS results from the freeway mainline segment analysis under Existing Plus Project Conditions.

Table 4.6 Freeway Mainline Analysis – Existing Plus Project Conditions

| Freeway / State Highway | Segment | ADT | Direction | AM Peak Hour | | | | | PM Peak Hour | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Peak Hour Volume | V/C Ratio | LOS | Δ | S? | Peak Hour Volume | V/C Ratio | LOS | Δ | S? |
| I-5 | Grape Street to First Avenue | 171,100 | NB | 9,180 | 0.977 | E | 0.012 | Y | 5,360 | 0.570 | C | 0.006 | N |
| | | | SB | 5,430 | 0.578 | C | 0.007 | N | 8,010 | 0.852 | D | 0.011 | N |
| | First Avenue to SR-163 | 213,400 | NB | 11,450 | 1.218 | F | 0.002 | N | 6,690 | 0.712 | D | 0.001 | N |
| | | | SB | 6,780 | 0.577 | C | 0.002 | N | 9,990 | 0.850 | D | 0.001 | N |
| | SR-163 and B Street | 223,400 | NB | 11,930 | 0.846 | D | 0.001 | N | 6,970 | 0.494 | B | 0.000 | N |
| | | | SB | 7,060 | 0.501 | C | 0.001 | N | 10,410 | 0.738 | D | 0.001 | N |
| | B Street to SR-94 | 223,400 | NB | 11,970 | 1.273 | F | 0.002 | N | 7,000 | 0.745 | D | 0.002 | N |
| | | | SB | 7,090 | 0.754 | D | 0.002 | N | 10,450 | 1.112 | F | 0.002 | N |
| | SR-94 to Imperial Avenue | 173,400 | NB | 9,270 | 0.789 | D | 0.002 | N | 5,420 | 0.461 | B | 0.001 | N |
| | | | SB | 5,490 | 0.467 | B | 0.001 | N | 8,090 | 0.689 | C | 0.002 | N |
| | Imperial Avenue to SR-75 | 170,300 | NB | 9,130 | 0.777 | D | 0.006 | N | 5,330 | 0.454 | B | 0.004 | N |
| | | | SB | 5,400 | 0.460 | B | 0.004 | N | 7,960 | 0.677 | C | 0.005 | N |

*Source: Chen Ryan Associates; February 2017*

Notes:
The capacity, Directional split, Peak hour % and Heavy vehicle % are assumed to be the same as Existing Conditions.
**Bold** letter indicates substandard LOS E or F.
Δ = Change in V/C Ratio.
S? = Indicates if change in V/C ratio is significant

As shown, all study area freeway mainline segments are projected to operate at LOS D or better, with the exception of the following:

- I-5 Northbound, between Grape Street and First Avenue (LOS E, AM Peak)
- I-5 Northbound, between First Avenue and SR-163 (LOS F, AM Peak)
- I-5 Northbound, between B Street and SR-94 (LOS F, AM Peak)

- I-5 Southbound, between B Street and SR-94 (LOS F, PM Peak)

Based on the City of San Diego's Significance Criteria, outlined in Section 2.5, the traffic associated with the Proposed Project would cause a significant change in the V/C ratio (add more than 0.010 for LOS E) to the segment of I-5 Northbound, between Grape Street and First Avenue. Therefore, the project would significantly impact this segment of mainline freeway.

## 4.6 Impact Significance and Mitigation

**Roadway Segments**

Based upon the significance criteria presented in Section 2.5 of this report, no daily roadway segments were identified to be impacts by the Proposed Project under Existing Conditions (Roadway operating at LOS E which the Proposed Project increases the V/C ration be more than 0.02 or operating at LOS F which the Proposed Project increases the V/C ratio by 0.01).

**Intersections**

The following intersections were identified to be directly impacted by the Proposed Project under Existing Plus Project Conditions. The recommended mitigation measure for the corresponding impact is also provided:

45. *15th Street & F Street* - Signalization of the intersection is recommended by the Downtown Community Plan. This improvement ultimately serves as a partial mitigation for the intersection under build out of the plan, with no feasible mitigation identified. Therefore, to remain consistent with the Downtown Community Plan it is recommended that the project implement this improvement as mitigation for this impact. However, the intersection is controlled by the City of San Diego and the District does not have jurisdiction over it; therefore, the impact is considered significant and unavoidable.

53. *17th Street & G Street* - Signalization of the intersection is recommended by the Downtown Community Plan. This improvement ultimately serves as a partial mitigation for the intersection under build out of the plan, with no feasible mitigation identified. Therefore, to remain consistent with the Downtown Community Plan it is recommended that the project pay its fair-share of the improvement cost as its mitigation. However, the intersection is controlled by the City of San Diego and the District does not have jurisdiction over it; therefore, the impact is considered significant and unavoidable.

56. *19th Street & J Street* – Restriping the northbound left turn lane into a northbound left turn and through shared lane is recommended at this intersection by the Downtown Community Plan. This improvement was identified to fully mitigate the intersection performance under build out of the plan. Therefore, to remain consistent with the Downtown Community Plan it is recommended that the project pay its fair-share of the improvement cost as its mitigation. However, the intersection is controlled by the City of San Diego and the District does not have jurisdiction over it; therefore, the impact is considered significant and unavoidable.

**Freeway**

Based on the City of San Diego's Significance Criteria, outlined in Section 2.5, the traffic associated with the Proposed Project would cause a significant change in the V/C ratio (add more than 0.010 for LOS E or 0.005 for LOS F) to the following key study mainline freeway mainline segment:

- I-5 Northbound, between Grape Street and First Avenue (AM peak hour).

The San Diego Forward Plan includes a series of operational improvements along I-5 between I-15 and I-8, which would encompass this segment. However, these improvements are not scheduled until Year 2050. These improvements are also subject to budget availability and coordination with Caltrans. At the moment, there is no program in place into which the Project Applicant could pay its fair-share towards the cost of such improvements. Therefore, improvements are considered infeasible and the impacts along I-5 and would remain significant and unavoidable.

# 5.0 Near-Term Year 2021 Traffic Conditions

This section provides an analysis of Near-Term traffic conditions both with and without the Proposed Project. Scenarios analyzed in this section include:

- Near-Term Year 2021 Base Conditions
- Near-Term Year 2021 Base Plus Project Conditions

## 5.1 Near-Term Year 2021 Base Roadway Network and Traffic Volumes

It is assumed that under Near-Term Year 2021 Base Conditions the roadway and intersection geometrics would be identical to those under Existing Conditions, as previously displayed in in Figure 4-1.

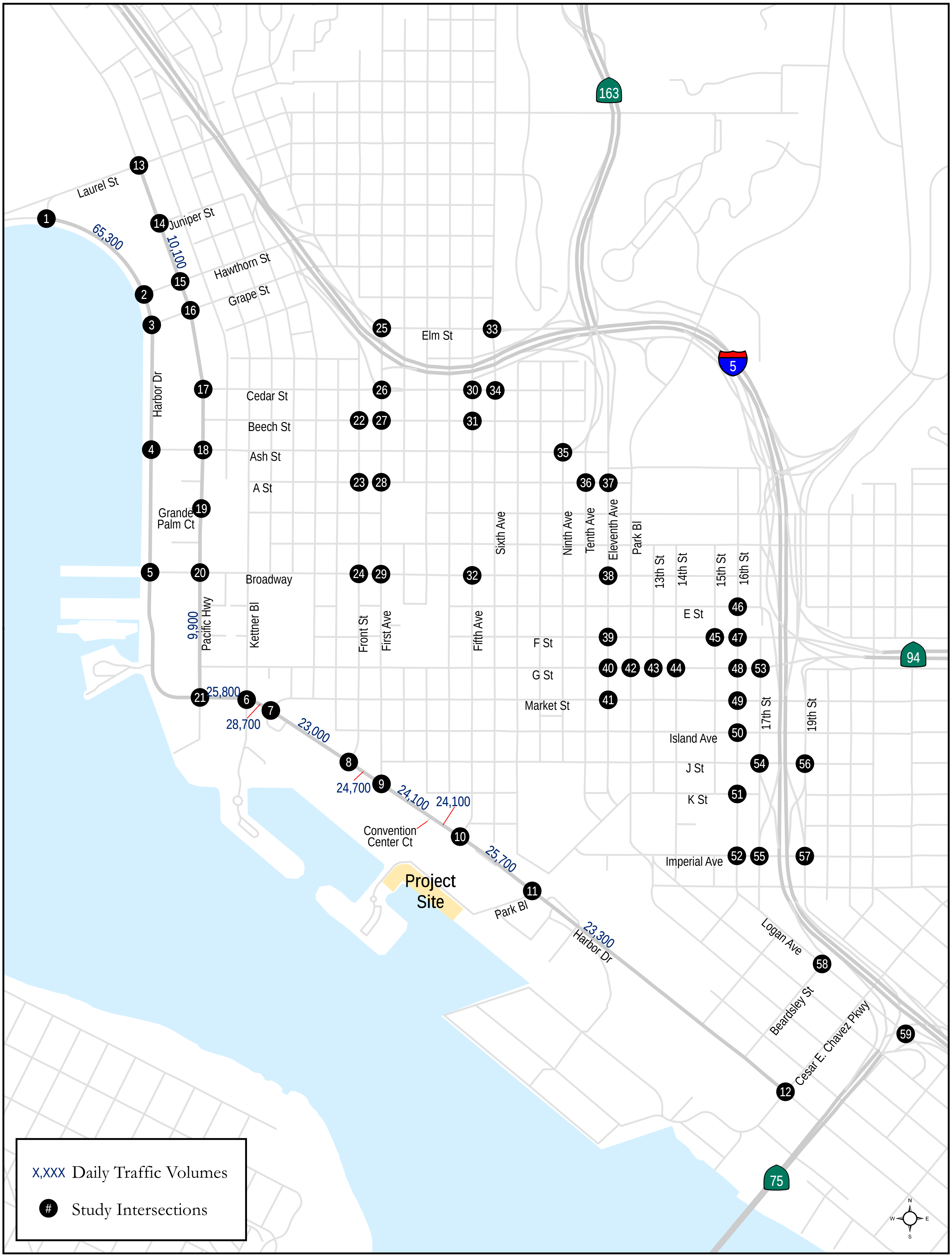
Near-Term Year 2021 Base intersection volumes were developed using the same modeling techniques employed for the Downtown San Diego Near-Term Year 2021 Traffic Assessment Report (Chen Ryan Associates, August 2015). The model was updated to include the projects provided in **Appendix D** to replicate 2021 conditions**.** **Figures 5-1a and b** display average daily roadway and peak hour intersection volumes for the study roadway segments and intersections under the Near-Term Year 2021 Base Conditions.

## 5.2 Near-Term Year 2021 Base Traffic Conditions

LOS analyses for Near-Term Year 2021 Base Conditions were conducted using the methodologies described in Chapter 2.0. Roadway segment analysis, intersection LOS analysis, and freeway mainline analysis results are discussed separately below.

### Roadway Segment Analysis

**Table 5.1** displays the LOS analysis results for key roadway segments under the Near-Term Year 2021 Base Conditions.



*Fifth Avenue Landing Project*
*Transportation Impact Analysis*

CHEN ✚ RYAN

**Figure 5-1A**
**Daily Roadway Segment Traffic Volumes - Near-Term Year 2021 Base Conditions**

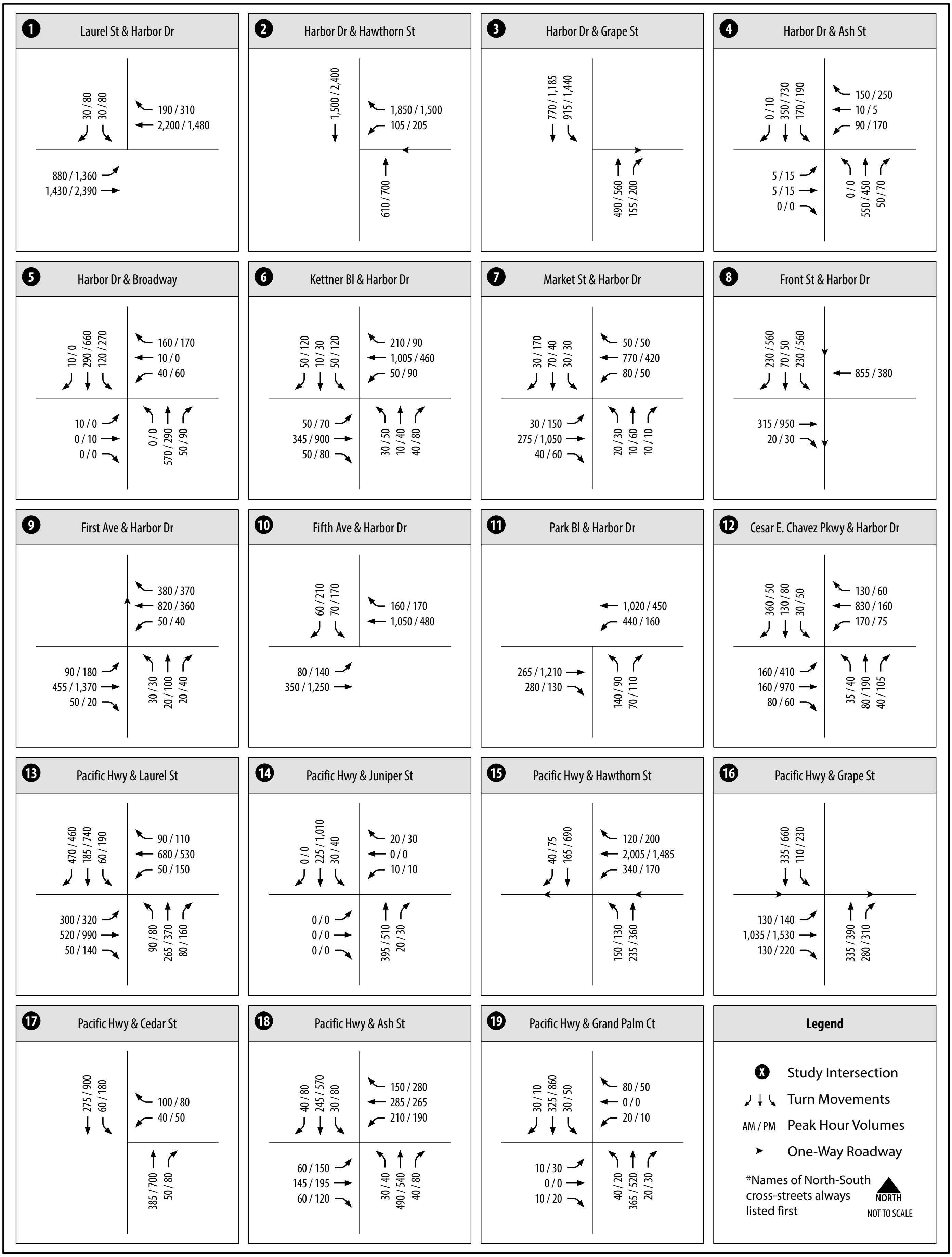


**Figure 5-1B**

**Peak Hour Intersection Traffic Volumes - Near-Term Year 2021 Base Conditions (Intersections 1-19)**

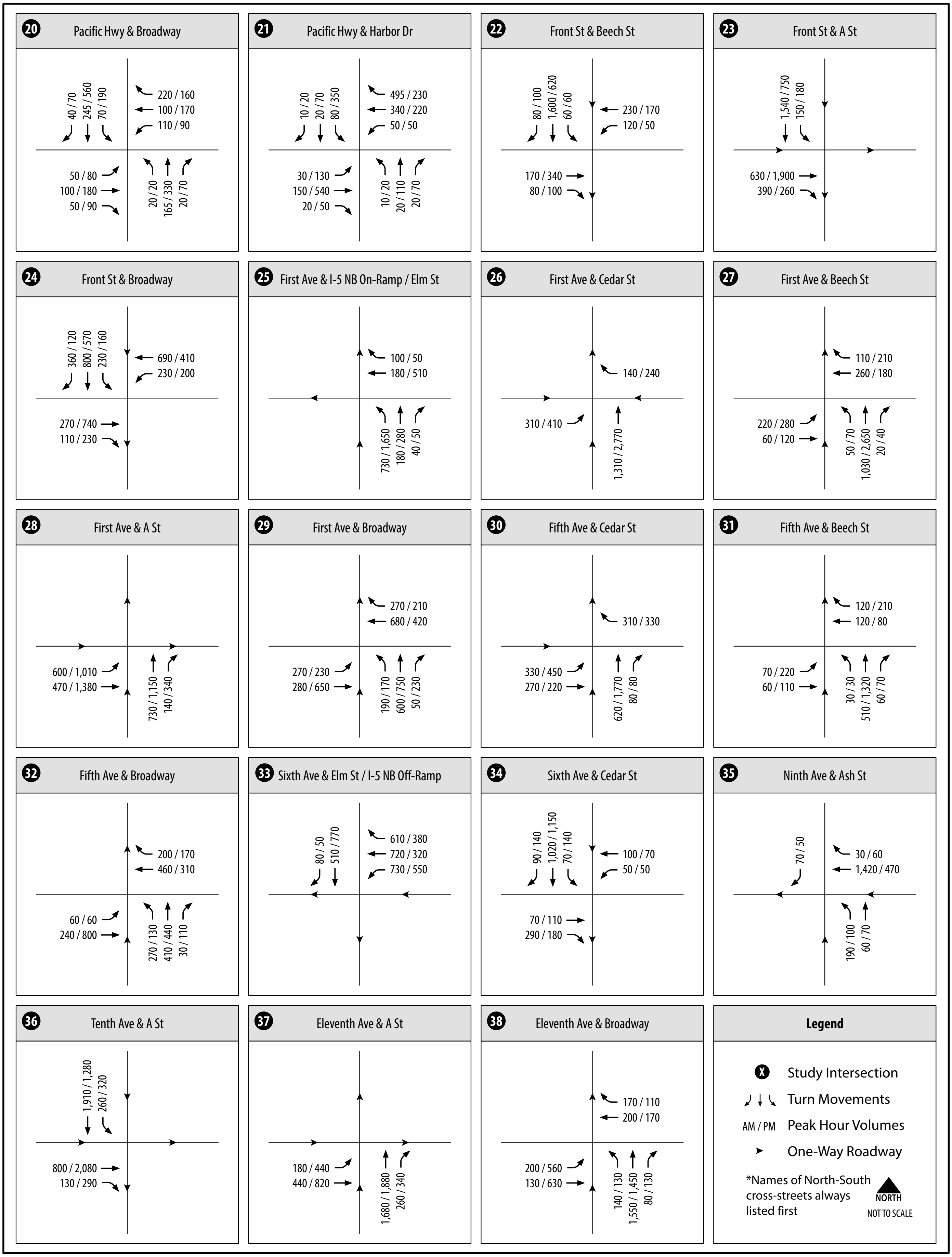


**Figure 5-1B**

**Peak Hour Intersection Traffic Volumes - Near-Term Year 2021 Base Conditions (Intersections 20-38)**

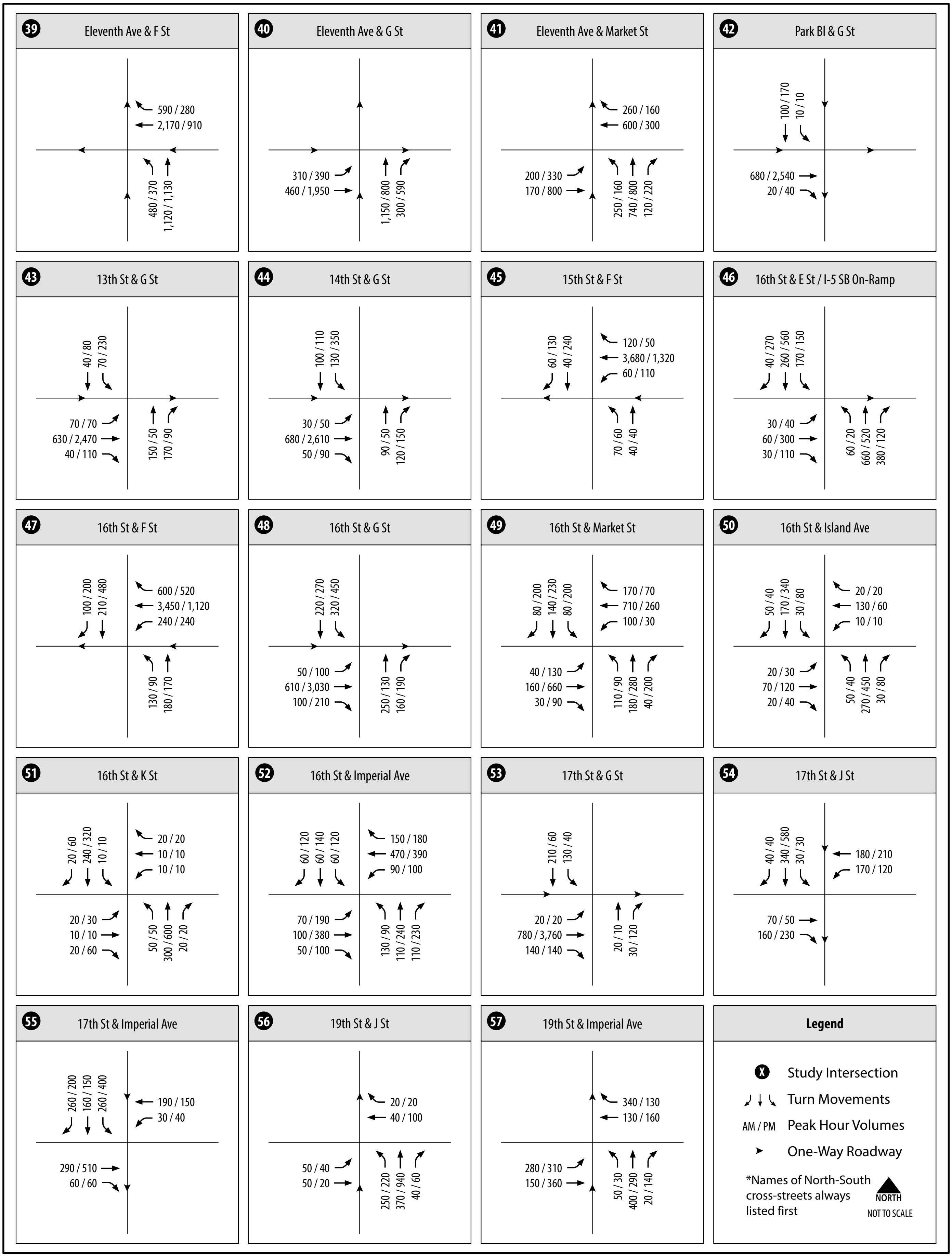
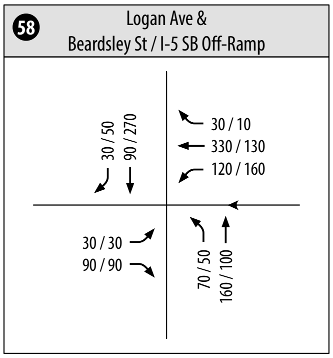
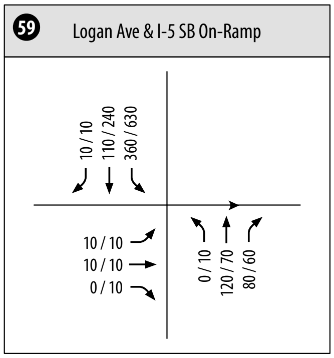


**Figure 5-1B**

**Peak Hour Intersection Traffic Volumes - Near-Term Year 2021 Base Conditions (Intersections 39-57)**





**Legend**

Ⓧ Study Intersection
↲ ↓ ↳ Turn Movements
AM / PM Peak Hour Volumes
➤ One-Way Roadway

*Names of North-South cross-streets always listed first

▲ NORTH
NOT TO SCALE

**Figure 5-1B**
**Peak Hour Intersection Traffic Volumes -**
**Near-Term Year 2021 Base Conditions (Intersections 58 and 59)**

Table 5.1 Roadway Segment LOS Results - Near-Term Year 2021 Base Conditions

| Roadway Segment | Segment | Cross-section | Threshold (LOS E) | ADT | V/C | LOS |
|---|---|---|---|---|---|---|
| Harbor Drive | Between Laurel Street & Hawthorn Street | 6-Ln w/ RM | <60,000 | 65,300 | 1.088 | F |
| | Between Pacific Highway and Kettner Boulevard | 6-Ln w/ RM | <50,000 | 25,800 | 0.516 | B |
| | Between Kettner Boulevard & Market Street | 6-Ln w/ RM | <50,000 | 28,700 | 0.574 | C |
| | Between Market Street and Front Street | 6-Ln w/ RM | <50,000 | 23,000 | 0.460 | B |
| | Between Front Street and First Avenue | 4-Ln w/ SM | <40,000 | 24,700 | 0.618 | C |
| | Between First Avenue & Convention Center Court | 4-Ln w/ RM | <40,000 | 24,100 | 0.603 | C |
| | Between Convention Center Court & Fifth Avenue | 4-Ln w/ SM | <40,000 | 24,100 | 0.603 | C |
| | Between Fifth Avenue and Park Boulevard | 4-Ln w/ RM | <40,000 | 25,700 | 0.643 | C |
| | South of Park Boulevard | 4-Ln w/ RM | <40,000 | 23,300 | 0.583 | C |
| Pacific Highway | Between Juniper Street & Hawthorn Street | 6-Ln w/ RM | <50,000 | 10,100 | 0.202 | A |
| | Between Broadway & Harbor Drive | 4-Ln w/ SM | <40,000 | 9,900 | 0.248 | A |

*Source: Chen Ryan Associates; February 2017*

Notes:
V/C = Volume to Capacity Ratio.
RM = Raised Median
SM = Striped Median

As shown, all study roadway segments are projected to operate at LOS C or better under Near-Term Year 2021 Base Conditions, with the exception of Harbor Drive between Laurel Street and Hawthorn Street which is projected to operate at LOS F under Near-Term Year 2021 Base Conditions.

### Intersection Analysis

**Table 5.2** displays intersection LOS and average vehicle delay results under Near-Term Year 2021 Base Conditions. LOS calculation worksheets are provided in **Appendix E**.

Table 5.2 Peak Hour Intersection LOS Results – Near-Term Year 2021 Base Conditions

| # | Intersection | AM Peak Hour | | PM Peak Hour | |
|---|---|---|---|---|---|
| | | Avg. Delay (sec.) | LOS | Avg. Delay (sec.) | LOS |
| 1 | Harbor Drive & Laurel Street | 41.2 | D | 36.1 | D |
| 2 | Harbor Drive & Hawthorn Street | 54.6 | D | 14.9 | B |
| 3 | Harbor Drive & Grape St | 15.7 | B | 15.9 | B |
| 4 | Harbor Drive & Ash Street | 13.8 | B | 15.4 | B |
| 5 | Harbor Drive & Broadway | 14.8 | B | 72.1 | E |
| 6 | Harbor Drive & Kettner Boulevard | 18.0 | B | 27.1 | C |
| 7 | Harbor Drive & Market Street | 27.1 | C | 21.5 | C |
| 8 | Harbor Drive & Front Street | 32.2 | C | 36.6 | D |
| 9 | First Street & Harbor Drive | 13.0 | B | 24.3 | C |

## Table 5.2 Peak Hour Intersection LOS Results – Near-Term Year 2021 Base Conditions

| # | Intersection | AM Peak Hour |  | PM Peak Hour |  |
|---|---|---|---|---|---|
|  |  | Avg. Delay (sec.) | LOS | Avg. Delay (sec.) | LOS |
| 10 | Harbor Drive & Fifth Avenue | 13.5 | B | 26.8 | C |
| 11 | Park Boulevard & Harbor Drive | 52.0 | D | 14.5 | B |
| 12 | Cesar Chavez Parkway & Harbor Drive | 28.9 | C | 47.8 | D |
| 13 | Pacific Highway & Laurel Street | 49.8 | D | 53.5 | D |
| 14 | Pacific Highway & Juniper Street | 9.8 | A | 6.2 | A |
| 15 | Pacific Highway & Hawthorn Street | 21.4 | C | 37.9 | D |
| 16 | Pacific Highway & Grape Street | 41.6 | D | 93.8 | F |
| 17 | Pacific Highway & Cedar Street | 10.8 | B | 16.9 | B |
| 18 | Pacific Highway & Ash Street | 32.4 | C | 56.5 | E |
| 19 | Pacific Highway & Grand Palm Court | 15.5 | B | 19.6 | B |
| 20 | Pacific Highway & Broadway | 36.7 | D | 36.4 | D |
| 21 | Pacific Highway & Harbor Drive | 25.1 | C | 30.8 | C |
| 22 | Front Street & Beech Street | 32.8 | C | 16.0 | B |
| 23 | Front Street & A Street | 19.5 | B | 15.3 | B |
| 24 | Front Street & Broadway | 23.4 | C | 42.7 | D |
| 25 | First Avenue & I-5 NB On-Ramp/Elm Street | 7.4 | A | 17.5 | B |
| 26 | First Avenue & Cedar Street | 17.6 | B | 12.4 | B |
| 27 | First Avenue & Beech Street | 39.6 | D | 138.6 | F |
| 28 | First Avenue & A Street | 16.6 | B | 36.0 | D |
| 29 | First Avenue & Broadway | 56.5 | E | 26.2 | C |
| 30 | Fifth Avenue & Cedar Street | 14.6 | B | 18.7 | B |
| 31 | Fifth Avenue & Beech Street | 13.7 | B | 21.6 | C |
| 32 | Fifth Avenue & Broadway | 15.1 | B | 18.7 | B |
| 33 | Sixth Avenue & Elm Street/I-5 NB Off-Ramp | 8.4 | A | 10.2 | B |
| 34 | Sixth Avenue & Cedar Street | 14.9 | B | 18.6 | B |
| 35 | Ninth Street & Ash Street | 12.0 | B | 11.1 | B |
| 36 | Tenth Avenue & A Street | 19.8 | B | 21.9 | C |
| 37 | Eleventh Avenue & A Street | 20.9 | C | 32.7 | C |
| 38 | Eleventh Avenue & Broadway | 12.5 | B | 70.0 | E |
| 39 | Eleventh Avenue & F Street | 40.9 | D | 62.0 | E |
| 40 | Eleventh Avenue & G Street | 15.7 | B | 74.2 | E |
| 41 | Eleventh Avenue & Market Street | 30.8 | C | 19.9 | B |
| 42 | Park Boulevard & G Street | 9.5 | A | 7.3 | A |
| 43 | 13th Street & G Street | 10.4 | B | 34.7 | C |
| 44 | 14th Street & G Street | 14.1 | B | 159.9 | F |
| 45 | 15th Street & F Street | 0.2 | 0.0 | 435.6 | F |
| 46 | 16th Street & E Street | 103.8 | F | 53.1 | D |
| 47 | 16th Street & F Street | 291.8 | F | 22.6 | C |

Table 5.2 Peak Hour Intersection LOS Results – Near-Term Year 2021 Base Conditions

| # | Intersection | AM Peak Hour | | PM Peak Hour | |
|---|---|---|---|---|---|
| | | Avg. Delay (sec.) | LOS | Avg. Delay (sec.) | LOS |
| 48 | 16th Street & G Street | 15.9 | B | 286.4 | F |
| 49 | 16th Street & Market Street | 15.4 | B | 25.2 | C |
| 50 | 16th Street & Island Avenue | 13.5 | B | 67.2 | F |
| 51 | 16th Street & K Street | 27.5 | D | 78.5 | F |
| 52 | Imperial Avenue & 16th Street | 15.5 | B | 32.2 | C |
| 53 | 17th Street & G Street | 94.8 | F | >500 | F |
| 54 | 17th Street & J Street | 12.9 | B | 12.0 | B |
| 55 | Imperial Avenue & 17th Street | 12.6 | B | 12.9 | B |
| 56 | 19th Street & J Street | 15.0 | B | 76.4 | F |
| 57 | Imperial Avenue & 19th Street | 21.4 | C | 17.0 | B |
| 58 | Logan Avenue & I-5 SB Off-Ramp | 45.5 | E | 21.6 | C |
| 59 | Logan Avenue & I-5 SB On-Ramp | 65.2 | F | >500 | F |

*Source: Chen Ryan Associates; February 2017*

Note: Failing LOS of F is denoted in **bold** text.

As shown, all study area intersections are projected to operate at acceptable LOS E or better under Near-Term Year 2021 Base Conditions, with the exception of the following:

**AM Peak:**

- 15th Street & F Street
- 16th Street & E Street
- 16th Street & F Street
- 17th Street & G Street
- Logan Avenue & 1-5 SB On-Ramp

**PM Peak:**

- Pacific Highway & Grape Street
- First Avenue & Beech Street
- 14th Street & G Street
- 15th Street & F Street
- 16th Street & Island Avenue
- 16th Street & G Street
- 16th Street & K Street
- 17th Street & G Street
- 19th Street & J Street
- Logan Avenue & I-5 SB On-Ramp

## Freeway Analysis

**Table 5.3** displays the LOS results from the freeway mainline segment analysis under Near-Term Year 2021 Base Conditions.

Table 5.3 Freeway Mainline Analysis – Near-Term Year 2021 Base Conditions

| Freeway / State Highway | Segment | ADT | Direction | # of Lanes | Capacity | HV % | AM Peak Hour |  |  | PM Peak Hour |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  |  |  |  |  | Peak Hour Volume | V/C Ratio | LOS | Peak Hour Volume | V/C Ratio | LOS |
| I-5 | Grape Street to First Avenue | 173,100 | NB | 4M | 9,400 | 4.1% | 9,290 | 0.988 | E | 5,430 | 0.578 | C |
|  |  |  | SB | 4M | 9,400 | 4.1% | 5,500 | 0.585 | C | 8,100 | 0.862 | D |
|  | First Avenue to SR-163 | 224,900 | NB | 4M | 9,400 | 4.1% | 12,060 | 1.283 | F | 7,050 | 0.750 | D |
|  |  |  | SB | 5M | 11,750 | 4.1% | 7,140 | 0.608 | C | 10,530 | 0.896 | E |
|  | SR-163 and B Street | 231,900 | NB | 6M | 14,100 | 3.7% | 12,390 | 0.879 | D | 7,240 | 0.513 | C |
|  |  |  | SB | 6M | 14,100 | 3.7% | 7,330 | 0.520 | C | 10,810 | 0.767 | D |
|  | B Street to SR-94 | 231,900 | NB | 4M | 9,400 | 4.0% | 12,430 | 1.322 | F | 7,260 | 0.772 | D |
|  |  |  | SB | 4M | 9,400 | 4.0% | 7,360 | 0.783 | D | 10,840 | 1.153 | F |
|  | SR-94 to Imperial Avenue | 189,100 | NB | 5M | 11,750 | 3.8% | 10,110 | 0.860 | D | 5,910 | 0.503 | C |
|  |  |  | SB | 5M | 11,750 | 3.8% | 5,990 | 0.510 | C | 8,820 | 0.751 | D |
|  | Imperial Avenue to SR-75 | 185,200 | NB | 5M | 11,750 | 4.0% | 9,920 | 0.844 | D | 5,800 | 0.494 | B |
|  |  |  | SB | 5M | 11,750 | 4.0% | 5,870 | 0.500 | C | 8,660 | 0.737 | D |

*Source: Chen Ryan Associates; February 2017*

Notes:
**Bold** letter indicates LOS E or F.
M = Mainline lane.
The capacity, Directional split, Peak hour % and Heavy vehicle % are assumed to be the same as Existing Conditions.
**Bold** letter indicates substandard LOS E or F.
HV = Heavy vehicle %

As shown, all study area freeway mainline segments operate at LOS D or better, with the exception of the following:

- I-5 Northbound, between Grape Street and First Avenue (LOS E, AM Peak)
- I-5 Northbound, between First Avenue and SR-163 (LOS F, AM Peak)
- I-5 Northbound, between First Avenue and SR-163 (LOS E, PM Peak)
- I-5 Northbound, between B Street and SR-94 (LOS F, AM Peak)
- I-5 Southbound, between B Street and SR-94 (LOS F, PM Peak)

## 5.3 Near-Term Year 2021 Base Plus Project Roadway Network and Traffic Volumes

Roadway and intersection geometrics under Near-Term Year 2021 Base Plus Project Conditions were assumed to be identical to Existing Conditions geometrics, as shown in Figure 4-1.

Near-Term Year 2021 Base Plus Project traffic volumes were derived by combining the Near-Term Year 2021 Base traffic volumes (displayed in Figure 5-1) and the project trip assignment volumes (displayed in Figures 3-3). Daily and peak hour intersection volumes for this scenario are displayed in **Figure 5-2.**

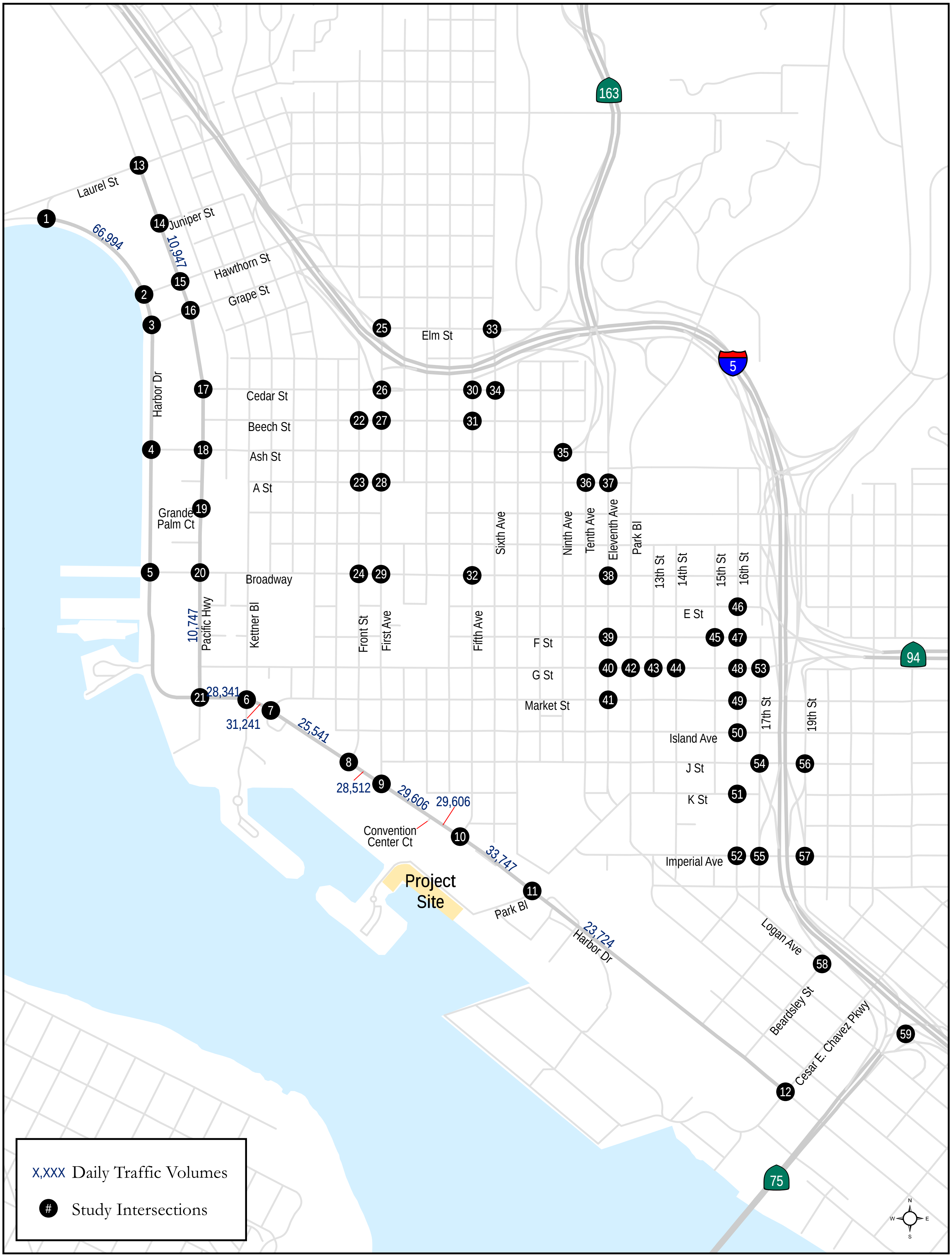


**Figure 5-2A**
**Daily Roadway Segment Traffic Volumes -**
**Near-Term Year 2021 Base Plus Project Conditions**

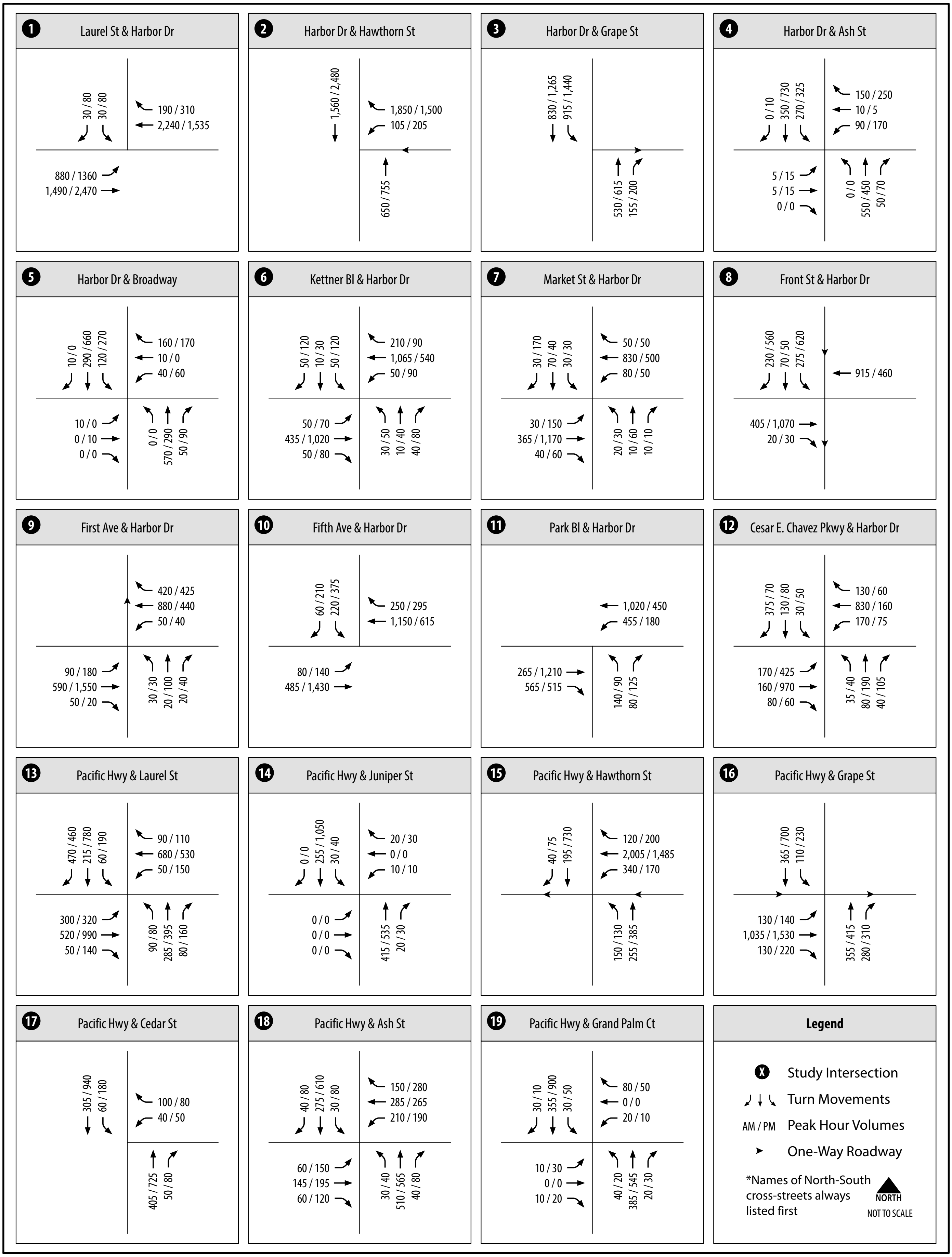


**Figure 5-2B**
**Peak Hour Intersection Traffic Volumes -**
**Near-Term Year 2021 Base Plus Project Conditions (Intersections 1-19)**

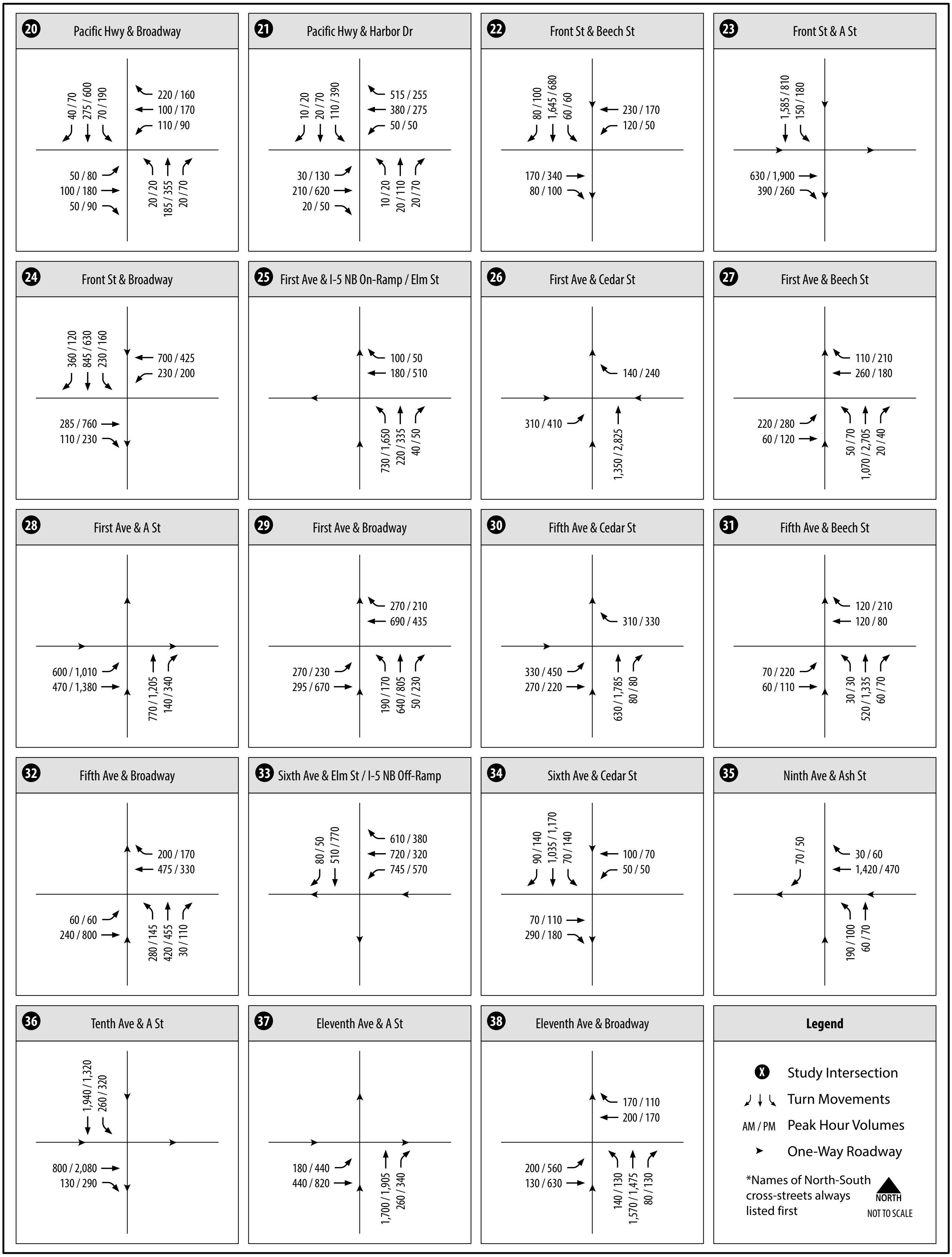


**Figure 5-2B**

**Peak Hour Intersection Traffic Volumes - Near-Term Year 2021 Base Plus Project Conditions (Intersections 20-38)**

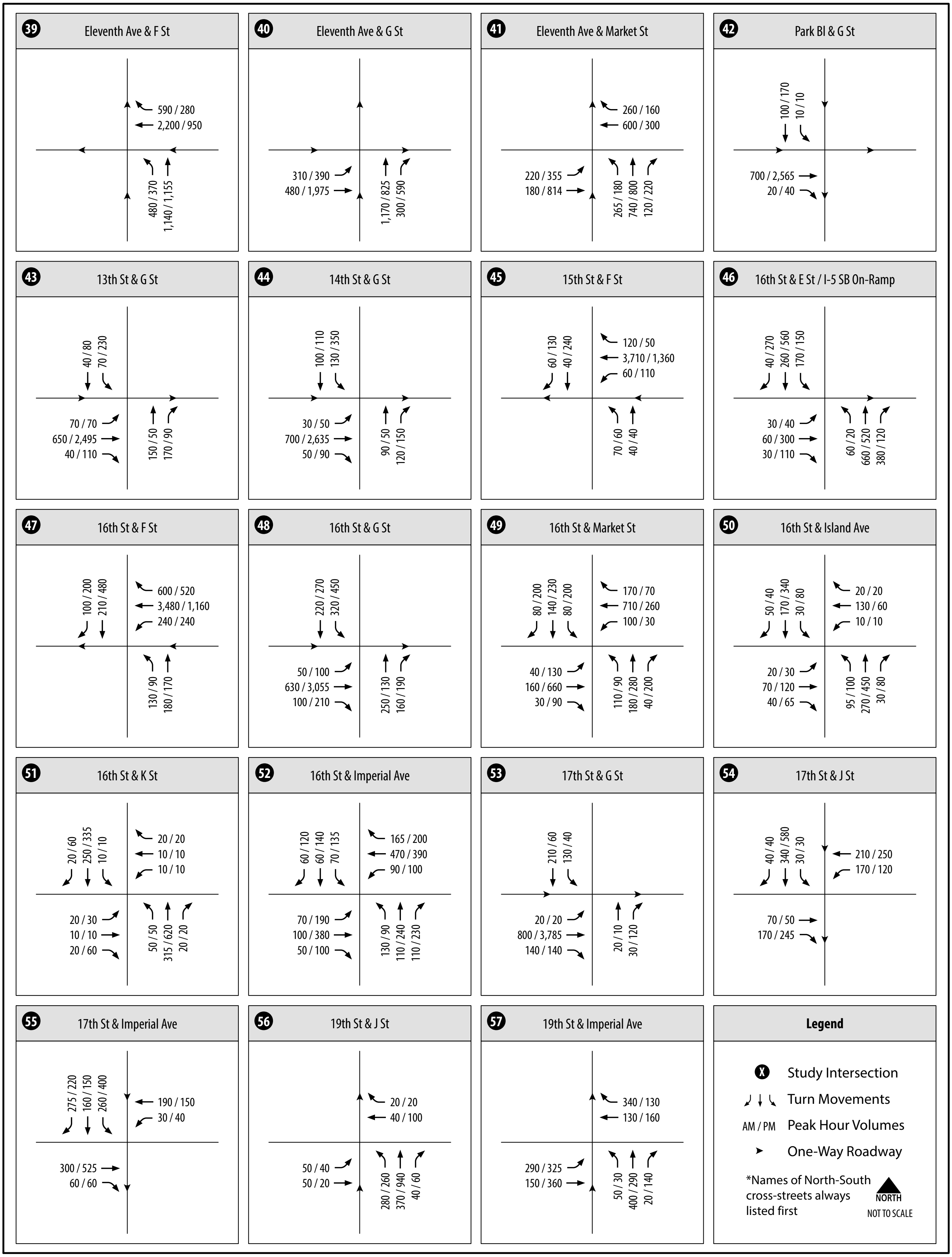
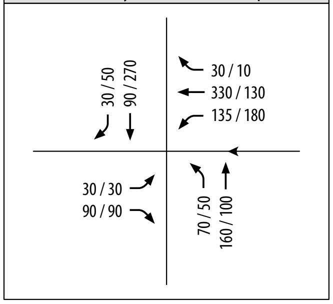


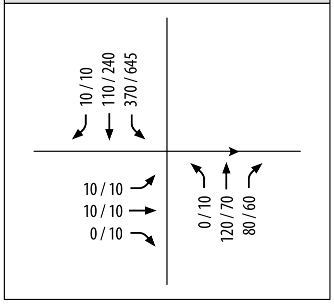
**Figure 5-2B**

**Peak Hour Intersection Traffic Volumes - Near-Term Year 2021 Base Plus Project Conditions (Intersections 39-57)**

58 Logan Ave & Beardsley St / I-5 SB Off-Ramp



59 Logan Ave & I-5 SB On-Ramp



**Legend**

| | |
|---|---|
| X | Study Intersection |
| ↲ ↓ ↳ | Turn Movements |
| AM / PM | Peak Hour Volumes |
| ➤ | One-Way Roadway |

*Names of North-South cross-streets always listed first

NORTH
NOT TO SCALE

**Figure 5-2B**
**Peak Hour Intersection Traffic Volumes - Near-Term Year 2021 Base Plus Project Conditions (Intersections 58 and 59)**

## 5.4 Near-Term Year 2021 Base Plus Project Traffic Conditions

LOS analyses were conducted using the methodologies described in Chapter 2.0. Roadway segment analysis, intersection LOS analysis, and freeway mainline analysis results are discussed separately below.

### Roadway Segment Analysis

**Table 5.4** displays the LOS analysis results for key roadway segments under Near-Term Year 2021 Base Plus Project Conditions.

Table 5.4 Roadway Segment LOS Results – Near-Term Year 2021 Base Plus Project Conditions

| Roadway | Segment | Cross-Section | Threshold (LOS E) | Near-Term Year 2021 Base + Project | | | Near-Term Year 2021 Base | Δ | Sig? |
|---|---|---|---|---|---|---|---|---|---|
| | | | | ADT | V/C | LOS | ADT / V/C / LOS | | |
| Harbor Drive | Between Laurel Street & Hawthorn Street | 6-Ln w/ RM | 60,000 | 66,994 | 1.117 | F | 65,300 / 1.088 / F | 0.028 | Y |
| | Between Pacific Highway and Kettner Boulevard | 6-Ln w/ RM | <50,000 | 28,341 | 0.567 | B | 25,800 / 0.516 / B | 0.051 | N |
| | Between Kettner Boulevard & Market Street | 6-Ln w/ RM | <50,000 | 31,241 | 0.625 | C | 28,700 / 0.574 / C | 0.051 | N |
| | Between Market Street and Front Street | 6-Ln w/ RM | <50,000 | 25,541 | 0.511 | B | 23,000 / 0.460 / B | 0.051 | N |
| | Between Front Street and First Avenue | 4-Ln w/ SM | <40,000 | 28,512 | 0.713 | C | 24,700 / 0.618 / C | 0.095 | N |
| | Between First Avenue & Convention Center Court | 4-Ln w/ RM | <40,000 | 29,606 | 0.740 | C | 24,100 / 0.603 / C | 0.138 | N |
| | Between Convention Center Court & Fifth Avenue | 4-Ln w/ SM | <40,000 | 29,606 | 0.740 | C | 24,100 / 0.603 / C | 0.138 | N |
| | Between Fifth Avenue and Park Boulevard | 4-Ln w/ RM | <40,000 | 33,747 | 0.844 | D | 25,700 / 0.643 / C | 0.201 | N |
| | South of Park Boulevard | 4-Ln w/ RM | <40,000 | 23,724 | 0.593 | C | 23,300 / 0.583 / C | 0.011 | N |
| Pacific Highway | Between Juniper Street & Hawthorn Street | 6-Ln w/ RM | <50,000 | 10,947 | 0.219 | A | 10,100 / 0.202 / A | 0.017 | N |
| | Between Broadway & Harbor Drive | 4-Ln w/ SM | <40,000 | 10,747 | 0.269 | A | 9,900 / 0.248 / A | 0.021 | N |

*Source: Chen Ryan Associates; February 2017*

Notes:
V/C = Volume to Capacity Ratio.
RM = Raised Median
SM = Striped Median

As shown in Table 5.4, all study roadway segments are projected to operate at LOS C or better under Near-Term Year 2021 Base Plus Project Conditions, with the exception of Harbor Drive, between Laurel Street and Hawthorn Street which is projected to operate at LOS F under Near-Term Year 2021 Base Plus Project Conditions.

Based upon the significance criteria presented in Section 2.5 of this report, Harbor Drive between Laurel Street and Hawthorn Street would be significantly impacted by the Proposed Project under Near-Term Year 2021 Base Plus Project Conditions (Roadway operating at LOS E which the Proposed Project increases the V/C ration be more than 0.02 or operating at LOS F which the Proposed Project increases the V/C ratio by 0.01).

### Intersection Analysis

**Table 5.5** displays intersection LOS and average vehicle delay results under Near-Term Year 2021 Base Plus Project Conditions. Calculation worksheets are provided in **Appendix F**.

Table 5.5 Peak Hour Intersection LOS Results – Near-Term Year 2021 Base Plus Project Conditions

| # | Intersection | AM Peak Hour | | PM Peak Hour | | Delay w/o Project (sec.) AM/PM | LOS w/o Project AM/PM | Change in Delay (sec.) AM/PM | Significant Impact? |
|---|---|---|---|---|---|---|---|---|---|
| | | Avg. Delay (sec.) | LOS | Avg. Delay (sec.) | LOS | | | | |
| 1 | Harbor Drive & Laurel Street | 43.8 | D | 37.7 | D | 41.2 / 36.1 | D / D | 2.6 / 1.6 | N / N |
| 2 | Harbor Drive & Hawthorn Street | 54.6 | D | 15.3 | B | 54.6 / 14.9 | D / B | 0.0 / 0.4 | N / N |
| 3 | Harbor Drive & Grape St | 15.7 | B | 15.9 | B | 15.7 / 15.9 | B / B | 0.0 / 0.0 | N / N |
| 4 | Harbor Drive & Ash Street | 18.6 | B | 24.1 | C | 13.8 / 15.4 | B / B | 4.8 / 8.7 | N / N |
| 5 | Harbor Drive & Broadway | 14.8 | B | 72.1 | E | 14.8 / 72.1 | B / E | 0.0 / 0.0 | N / N |
| 6 | Harbor Drive & Kettner Boulevard | 18.1 | B | 27.2 | C | 18.0 / 27.1 | B / C | 0.1 / 0.1 | N / N |
| 7 | Harbor Drive & Market Street | 27.1 | C | 21.5 | C | 27.1 / 21.5 | C / C | 0.0 / 0.0 | N / N |
| 8 | Harbor Drive & Front Street | 38.4 | D | 48.7 | D | 32.2 / 36.6 | C / D | 6.2 / 12.1 | N / N |
| 9 | First Street & Harbor Drive | 13.0 | B | 27.0 | C | 13.0 / 24.3 | B / C | 0.0 / 2.7 | N / N |
| 10 | Harbor Drive & Fifth Avenue | 29.5 | C | 52.0 | D | 13.5 / 26.8 | B / C | 16.0 / 25.2 | N / N |
| 11 | Park Boulevard & Harbor Drive | 52.1 | D | 14.5 | B | 52.0 / 14.5 | D / B | 0.1 / 0.0 | N / N |
| 12 | Cesar Chavez Parkway & Harbor Drive | 30.8 | C | 38.1 | D | 28.9 / 47.8 | C / D | 1.9 / 11.1 | N / N |
| 13 | Pacific Highway & Laurel Street | 49.8 | D | 53.7 | D | 49.8 / 53.5 | D / D | 0.0 / 0.2 | N / N |
| 14 | Pacific Highway & Juniper Street | 9.8 | A | 6.2 | A | 9.8 / 6.2 | A / A | 0.0 / 0.0 | N / N |
| 15 | Pacific Highway & Hawthorn Street | 22.1 | C | 43.1 | D | 21.4 / 37.9 | C / D | 0.7 / 5.2 | N / N |
| 16 | Pacific Highway & Grape Street | 41.6 | D | 91.9 | F | 41.6 / 93.8 | D / F | 0.0 / -1.9 | N / N |
| 17 | Pacific Highway & Cedar Street | 10.8 | B | 16.9 | B | 10.8 / 16.9 | B / B | 0.0 / 0.0 | N / N |
| 18 | Pacific Highway & Ash Street | 32.4 | C | 56.5 | E | 32.4 / 56.5 | C / E | 0.0 / 0.0 | N / N |
| 19 | Pacific Highway & Grand Palm Court | 15.5 | B | 19.7 | B | 15.5 / 19.6 | B / B | 0.0 / 0.1 | N / N |
| 20 | Pacific Highway & Broadway | 36.7 | D | 36.4 | D | 36.7 / 36.4 | D / D | 0.0 / 0.0 | N / N |
| 21 | Pacific Highway & Harbor Drive | 25.1 | C | 31.6 | C | 25.1 / 30.8 | C / C | 0.0 / 0.8 | N / N |
| 22 | Front Street & Beech Street | 32.8 | C | 16.5 | B | 32.8 / 16.0 | C / B | 0.0 / 0.5 | N / N |

Table 5.5 Peak Hour Intersection LOS Results – Near-Term Year 2021 Base Plus Project Conditions

| # | Intersection | AM Peak Hour | | PM Peak Hour | | Delay w/o Project (sec.) AM/PM | LOS w/o Project AM/PM | Change in Delay (sec.) AM/PM | Significant Impact? |
|---|---|---|---|---|---|---|---|---|---|
| | | Avg. Delay (sec.) | LOS | Avg. Delay (sec.) | LOS | | | | |
| 23 | Front Street & A Street | 19.6 | B | 15.6 | B | 19.5 / 15.3 | B / B | 0.1 / 0.3 | N / N |
| 24 | Front Street & Broadway | 26.8 | C | 45.0 | D | 23.4 / 42.7 | C / D | 3.4 / 2.3 | N / N |
| 25 | First Avenue & I-5 NB On-Ramp/Elm Street | 7.4 | A | 17.5 | B | 7.4 / 17.5 | A / B | 0.0 / 0.0 | N / N |
| 26 | First Avenue & Cedar Street | 17.7 | B | 12.5 | B | 17.6 / 12.4 | B / B | 0.1 / 0.1 | N / N |
| 27 | First Avenue & Beech Street | 39.6 | D | 147.6 | F | 39.6 / 138.6 | D / F | 0.0 / 9.0 | N / Y |
| 28 | First Avenue & A Street | 16.6 | B | 36.0 | D | 16.6 / 36.0 | B / D | 0.0 / 0.0 | N / N |
| 29 | First Avenue & Broadway | 59.1 | E | 27.3 | C | 56.5 / 26.2 | E / C | 2.6 / 1.1 | N / N |
| 30 | Fifth Avenue & Cedar Street | 14.8 | B | 18.9 | B | 14.6 / 18.7 | B / B | 0.2 / 0.2 | N / N |
| 31 | Fifth Avenue & Beech Street | 13.7 | B | 21.6 | C | 13.7 / 21.6 | B / C | 0.0 / 0.0 | N / N |
| 32 | Fifth Avenue & Broadway | 15.3 | B | 18.8 | B | 15.1 / 18.7 | B / B | 0.2 / 0.1 | N / N |
| 33 | Sixth Avenue & Elm Street/I-5 NB Off-Ramp | 8.4 | A | 10.2 | B | 8.4 / 10.2 | A / B | 0.0 / 0.0 | N / N |
| 34 | Sixth Avenue & Cedar Street | 14.9 | B | 18.7 | B | 14.9 / 18.6 | B / B | 0.0 / 0.1 | N / N |
| 35 | Ninth Street & Ash Street | 12.0 | B | 11.1 | B | 12.0 / 11.1 | B / B | 0.0 / 0.0 | N / N |
| 36 | Tenth Avenue & A Street | 20.2 | C | 22.7 | C | 19.8 / 21.9 | B / C | 0.4 / 0.8 | N / N |
| 37 | Eleventh Avenue & A Street | 21.0 | C | 35.8 | D | 20.9 / 32.7 | C / C | 0.1 / 3.1 | N / N |
| 38 | Eleventh Avenue & Broadway | 12.5 | B | 73.5 | E | 12.5 / 70.0 | B / E | 0.0 / 3.5 | N / N |
| 39 | Eleventh Avenue & F Street | 43.3 | D | 66.9 | E | 40.9 / 62.0 | D / E | 2.4 / 4.9 | N / N |
| 40 | Eleventh Avenue & G Street | 16.0 | B | 77.9 | E | 15.7 / 74.2 | B / E | 0.3 / 3.7 | N / N |
| 41 | Eleventh Avenue & Market Street | 35.7 | D | 21.4 | C | 30.8 / 19.9 | C / B | 4.9 / 1.5 | N / N |
| 42 | Park Boulevard & G Street | 9.5 | A | 7.7 | A | 9.5 / 7.3 | A / A | 0.0 / 0.4 | N / N |
| 43 | 13th Street & G Street | 10.4 | B | 37.7 | D | 10.4 / 34.7 | B / C | 0.0 / 3.0 | N / N |
| 44 | 14th Street & G Street | 14.1 | B | 164.3 | F | 14.1 / 159.9 | B / F | 0.0 / 4.4 | N / Y |
| 45 | 15th Street & F Street | 0.2 | A | 455.5 | F | 0.2 / 435.6 | 0 / F | 0.0 / 19.9 | N / Y |
| 46 | 16th Street & E Street | 103.8 | F | 53.1 | D | 103.8 / 53.1 | F / D | 0.0 / 0.0 | N / N |
| 47 | 16th Street & F Street | 297.1 | F | 22.8 | C | 291.8 / 22.6 | F / C | 5.3 / 0.2 | Y / N |
| 48 | 16th Street & G Street | 16.0 | B | 290.7 | F | 15.9 / 286.4 | B / F | 0.1 / 4.3 | N / Y |
| 49 | 16th Street & Market Street | 15.4 | B | 25.2 | C | 15.4 / 25.2 | B / C | 0.0 / 0.0 | N / N |
| 50 | 16th Street & Island Avenue | 14.3 | B | 71.5 | F | 13.5 / 67.2 | B / F | 0.8 / 4.3 | N / Y |
| 51 | 16th Street & K Street | 29.2 | D | 93.5 | F | 27.5 / 78.5 | D / F | 1.7 / 15.0 | N / Y |
| 52 | Imperial Avenue & 16th Street | 15.8 | B | 34.7 | C | 15.5 / 32.2 | B / C | 0.3 / 2.5 | N / N |
| 53 | 17th Street & G Street | 96.2 | F | >500 | F | 94.8 / >500 | F / F | 1.4 / N/A | N / Y |
| 54 | 17th Street & J Street | 13.6 | B | 12.9 | B | 12.9 / 12.0 | B / B | 0.7 / 0.9 | N / N |
| 55 | Imperial Avenue & 17th Street | 12.6 | B | 12.9 | B | 12.6 / 12.9 | B / B | 0.0 / 0.0 | N / N |
| 56 | 19th Street & J Street | 17.0 | C | 97.0 | F | 15.0 / 76.4 | B / F | 2.0 / 20.6 | N / Y |
| 57 | Imperial Avenue & 19th Street | 22.9 | C | 17.6 | B | 21.4 / 17.0 | C / B | 1.5 / 0.6 | N / N |
| 58 | Logan Avenue & I-5 SB Off-Ramp | 51.1 | F | 23.6 | C | 45.5 / 21.6 | E / C | 5.6 / 2.0 | Y / N |

Table 5.5 Peak Hour Intersection LOS Results – Near-Term Year 2021 Base Plus Project Conditions

| # | Intersection | AM Peak Hour | | PM Peak Hour | | Delay w/o Project (sec.) AM/PM | LOS w/o Project AM/PM | Change in Delay (sec.) AM/PM | Significant Impact? |
|---|---|---|---|---|---|---|---|---|---|
| | | Avg. Delay (sec.) | LOS | Avg. Delay (sec.) | LOS | | | | |
| 59 | Logan Avenue & I-5 SB On-Ramp | 70.7 | F | >500 | F | 65.2 / >500 | F / F | 5.5 / N/A | Y / Y |

*Source: Chen Ryan Associates; February 2017*

As show in Table 5.4, al key study intersections are projected to operate at acceptable LOS E or better under Near-Term Year 2021 Base Plus Project Conditions, with the exception of the following:

**AM Peak:**
- 16th Street & E Street
- 16th Street & F Street
- 17th Street & G Street
- Logan Avenue & 1-5 SB Off-Ramp
- Logan Avenue & 1-5 SB On-Ramp

**PM Peak:**
- Pacific Highway & Grape Street
- First Avenue & Beech Street
- 14th Street & G Street
- 15th Street & F Street
- 16th Street & G Street
- 16th Street & Island Avenue
- 16th Street & K Street
- 17th Street & G Street
- 19th Street & J Street
- Logan Avenue & I-5 SB On-Ramp

Based upon the significance criteria presented in Section 2.5 of this report, significant traffic related impacts are associated with the Proposed Project under Near-Term Year 2021 Base Plus Project Conditions at the following intersections (Intersections operating at LOS F which the Proposed Project will add more than 2.0 of delay to):

**AM Peak:**
- 16th Street & F Street
- Logan Avenue & 1-5 SB Off-Ramp
- Logan Avenue & 1-5 SB On-Ramp

**PM Peak:**
- First Avenue & Beech Street
- 14th Street & G Street
- 15th Street & F Street
- 16th Street & G Street
- 16th Street & Island Avenue
- 16th Street & K Street
- 19th Street & J Street
- Logan Avenue & I-5 SB On-Ramp

### Freeway Analysis

**Table 5.6** displays the LOS results from the freeway mainline segment analysis under Near-Term Year 2021 Base Plus Project Conditions.

### Table 5.6 Freeway Mainline Analysis – Near-Term Year 2021 Base Plus Project Conditions

| Freeway / State Highway | Segment | ADT | Direction | AM Peak Hour |  |  |  |  | PM Peak Hour |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  |  | Peak Hour Volume | V/C Ratio | LOS | Δ | S? | Peak Hour Volume | V/C Ratio | LOS | Δ | S? |
| I-5 | Grape Street to First Avenue | 175,200 | NB | 9,400 | 1.000 | E | 0.012 | Y | 5,490 | 0.584 | C | 0.006 | N |
|  |  |  | SB | 5,560 | 0.591 | C | 0.006 | N | 8,200 | 0.872 | D | 0.010 | N |
|  | First Avenue to SR-163 | 225,300 | NB | 12,090 | 1.286 | F | 0.003 | N | 7,060 | 0.751 | D | 0.001 | N |
|  |  |  | SB | 7,150 | 0.609 | C | 0.001 | N | 10,550 | 0.898 | E | 0.002 | N |
|  | SR-163 and B Street | 232,300 | NB | 12,410 | 0.880 | D | 0.001 | N | 7,250 | 0.514 | C | 0.001 | N |
|  |  |  | SB | 7,340 | 0.521 | C | 0.001 | N | 10,830 | 0.768 | D | 0.001 | N |
|  | B Street to SR-94 | 232,300 | NB | 12,450 | 1.324 | F | 0.002 | N | 7,270 | 0.773 | D | 0.001 | N |
|  |  |  | SB | 7,370 | 0.784 | D | 0.001 | N | 10,860 | 1.155 | F | 0.002 | N |
|  | SR-94 to Imperial Avenue | 189,500 | NB | 10,130 | 0.862 | D | 0.002 | N | 5,920 | 0.504 | C | 0.001 | N |
|  |  |  | SB | 6,000 | 0.511 | C | 0.001 | N | 8,840 | 0.752 | D | 0.001 | N |
|  | Imperial Avenue to SR-75 | 186,500 | NB | 9,990 | 0.850 | D | 0.006 | N | 5,840 | 0.497 | B | 0.003 | N |
|  |  |  | SB | 5,920 | 0.504 | C | 0.004 | N | 8,720 | 0.742 | D | 0.005 | N |

*Source: Chen Ryan Associates; February 2017*

Notes:
The capacity, Directional split, Peak hour % and Heavy vehicle % are assumed to be the same as Existing Conditions.
**Bold** letter indicates substandard LOS E or F.
Δ = Change in V/C Ratio.
S? = Indicates if change in V/C ratio is significant

As shown, all study area freeway mainline segments operate at LOS D or better, with the exception of the following:

- I-5 Northbound, between Grape Street and First Avenue (LOS E, AM Peak)
- I-5 Northbound, between First Avenue and SR-163 (LOS F, AM Peak)
- I-5 Southbound, between First Avenue and SR-163 (LOS E, PM Peak)
- I-5 Northbound, between B Street and SR-94 (LOS F, AM Peak)
- I-5 Southbound, between B Street and SR-94 (LOS F, PM Peak)

Based on the City of San Diego's Significance Criteria, outlined in Section 2.5, the traffic associated with the Proposed Project would cause a significant change in the V/C ratio (add more than 0.010 for LOS E) to the segment of I-5 Northbound, between Grape Street and First Avenue. Therefore, the project would significantly impact this segment of mainline freeway.

## 5.5 Impact Significance and Mitigation

### Roadway Segments

Harbor Drive between Laurel Street and Hawthorn Street would be significantly impacted by the Proposed Project under Near-Term Year 2021 Base Plus Project Conditions. To reduce this impact to less than significant conditions, Harbor Drive would need to be widened from a six-lane major facility to an eight-lane facility. However, this improvement is not feasible due to right-of-way constraints within the corridor. Therefore, this impact is considered to be significant and unavoidable.

**Intersections**

The following mitigation measures are proposed at the intersections impacted by the Proposed Project under Near-Term Year 2021 Plus Project Conditions.

27. *First Street & Beech Street* – This intersection was identified as failing in the Downtown Community Plan with no feasible mitigation identified to improve operations. Therefore, the Downtown Community Plan EIR identified the future impacts to this intersection to be significant and unavoidable. To maintain consistency with the vision of the Downtown Community Plan no project related improvements are recommended at this intersection. It should be noted that this impact will become less than significant with the extension of Park Boulevard to Harbor Drive, as shown under Future Year 2035 conditions. This new connection will reroute project traffic coming to/from I-5 from the First Street Ramp to the Imperial Avenue Ramps.

44. *14th Street & G Street* – Converting the on-street parking to a travel lane on G Street between 11th Avenue and 17th Street during the PM peak hour is recommended at this intersection by the Downtown Community Plan. This improvement ultimately serves as a partial mitigation for the intersection under build out of the plan, with no feasible mitigation identified. Therefore, to remain consistent with the Downtown Community Plan it is recommended that the project pay its fair-share (3%) of the improvement cost as its mitigation. However, the intersection is controlled by the City of San Diego and the District does not have jurisdiction over it; therefore, the impact is considered significant and unavoidable.

45. *15th Street & F Street* - Signalization of the intersection is recommended by the Downtown Community Plan. This improvement ultimately serves as a partial mitigation for the intersection under build out of the plan, with no feasible mitigation identified. Therefore, to remain consistent with the Downtown Community Plan it is recommended that the project pay its fair-share (4%) of the improvement cost as its mitigation. However, the intersection is controlled by the City of San Diego and the District does not have jurisdiction over it; therefore, the impact is considered significant and unavoidable.

47. *16th Street & F Street* – This intersection was identified as failing in the Downtown Community Plan with no feasible mitigation identified to improve operations. Therefore, the Downtown Community Plan EIR identified the future impacts to this intersection to be significant and unavoidable. To maintain consistency with the vision of the Downtown Community Plan no project related improvements are recommended at this intersection.

48. *16th Street & G Street* - Convert on-street parking to a travel lane on G Street between 11th Avenue and 17th Street during the PM peak hour is recommended at this intersection by the Downtown Community Plan. This improvement ultimately serves as a partial mitigation for the intersection under build out of the plan, with no feasible mitigation identified. Therefore, to remain consistent with the Downtown Community Plan it is recommended that the project pay its fair-share (2%) of the improvement cost as its

mitigation. However, the intersection is controlled by the City of San Diego and the District does not have jurisdiction over it; therefore, the impact is considered significant and unavoidable.

50. *16th Street & Island Avenue* - Signalization of the intersection is recommended by the Downtown Community Plan. This improvement ultimately serves as a partial mitigation for the intersection under build out of the plan, with no feasible mitigation identified. Therefore, to remain consistent with the Downtown Community Plan it is recommended that the project pay its fair-share (18%) of the improvement cost as its mitigation. However, the intersection is controlled by the City of San Diego and the District does not have jurisdiction over it; therefore, the impact is considered significant and unavoidable.

51 *16th Street & K Street* - Signalization at this intersection is recommended by the Downtown Community Plan. This improvement was identified to fully mitigate the intersection performance under build out of the plan. Therefore, to remain consistent with the Downtown Community Plan it is recommended that the project pay its fair-share (9%) of the improvement cost as its mitigation. However, the intersection is controlled by the City of San Diego and the District does not have jurisdiction over it; therefore, the impact is considered significant and unavoidable.

53. *17th Street & G Street* - Signalization of the intersection is recommended by the Downtown Community Plan. This improvement ultimately serves as a partial mitigation for the intersection under build out of the plan, with no feasible mitigation identified. Therefore, to remain consistent with the Downtown Community Plan it is recommended that the project pay its fair-share (2%) of the improvement cost as its mitigation. However, the intersection is controlled by the City of San Diego and the District does not have jurisdiction over it; therefore, the impact is considered significant and unavoidable.

56. *19th Street & J Street* - Restriping the northbound left turn lane into a northbound left turn and through shared lane is recommended at this intersection by the Downtown Community Plan. This improvement was identified to fully mitigate the intersection performance under build out of the plan. Therefore, to remain consistent with the Downtown Community Plan it is recommended that the project pay its fair-share (20%) of the improvement cost as its mitigation. However, the intersection is controlled by the City of San Diego and the District does not have jurisdiction over it; therefore, the impact is considered significant and unavoidable.

58. *Logan Avenue & I-5 SB Off-Ramp* - Signalization at this intersection is recommended by the Downtown Community Plan. This improvement was identified to fully mitigate the intersection performance under build out of the plan. Therefore, to remain consistent with the Downtown Community Plan it is recommended that the project pay its fair-share (22%) of the improvement cost as its mitigation. It should be noted that this impact will become less than significant with the extension of Park Boulevard to Harbor Drive, as shown under Future Year 2035 conditions. This new connection will reroute project traffic coming to/from I-5 from the Logan Avenue Ramps to the Imperial Avenue Ramps. However, the intersection is controlled by Caltrans and the District does not have jurisdiction over it; therefore, the impact is considered significant and unavoidable.

59. *Logan Avenue & I-5 SB On-Ramp* - Signalization of the intersection will reduce the project related impact to less than significant. The Proposed Project would have a fair-share responsibility for this improvement of 6%. However, the intersection is controlled by Caltrans and the Port District does not have jurisdiction over it; therefore, the impact is considered significant and unavoidable. It should be noted that this impact will become less than significant with the extension of Park Boulevard to Harbor Drive, as shown under Future Year 2035 conditions. This new connection will reroute project traffic coming to/from I-5 from the Logan Avenue Ramps to the Imperial Avenue Ramps.

**Freeway**

Based on the City of San Diego's Significance Criteria, outlined in Section 2.5, the traffic associated with the Proposed Project would cause a significant change in the V/C ratio (add more than 0.010 for LOS E or 0.005 for LOS F) to the following key study mainline freeway mainline segment:

- I-5 Northbound, between Grape Street and First Avenue.

The San Diego Forward Plan includes a series of operational improvements along I-5 between I-15 and I-8, which would encompass this segment. However, these improvements are not scheduled until Year 2050. These improvements are also subject to budget availability and coordination with Caltrans. The Proposed Project could provide a fair-share contribution towards a program or plan for the aforementioned freeway facility improvements to be constructed:

- I-5 Northbound, between Grape Street and First Avenue – 34% of the total cost for the relevant improvements to this segment.

At the moment, there is no program in place into which the District could pay its fair-share towards the cost of such improvements. Therefore, improvements are considered infeasible and the impacts along I-5 and would remain significant and unavoidable.

# 6.0 Future Year 2035 Traffic Conditions

This section provides a description of Future Year 2035 traffic conditions both with and without the Proposed Project. Scenarios analyzed in this section included:

- Future Year 2035 Base Conditions
- Future Year 2035 Base Plus Project Conditions

## 6.1 Future Year 2035 Base Roadway Network and Traffic Volumes

Future Year 2035 roadway and intersection geometrics are assumed to be identical to those under Existing Conditions, as previously displayed in in Figure 4-1 and 4-2, with the exception of the following modifications identified in the Downtown San Diego Mobility Plan Technical Report (April 2016):

- Connect the two segments of Park Boulevard that currently terminate at Harbor Drive and Tony Gwynn Drive, enabling northbound-southbound movements through the Park Boulevard / Harbor Drive intersection.
- Reduce Pacific Highway from a 6-lane roadway with raised median to a 4-lane roadway with a raised median.
- Closure of Park Boulevard to vehicular traffic between E street and Market Street.

**Figure 6-1a** and **6-1b** displays the assumed roadway and intersection geometrics under Year 2035 conditions.

Future Year 2035 Base intersection volumes were obtained from the *Downtown San Diego Mobility Plan (Chen Ryan Associates, April 2016),* while roadway segment volumes were derived from the increase in intersection volumes when compared to the corresponding existing roadway segment volumes. **Figures 6-2a** and **b** display average daily roadway and peak hour intersection volumes for the study roadway segments and intersections under the Future Year 2035 Base Conditions. Relevant pages from the *Downtown San Diego Mobility Plan are provided* in **Appendix G**.

## 6.2 Future Year 2035 Base Traffic Conditions

LOS analyses for Future Year 2035 Base Conditions were conducted using the methodologies described in Chapter 2.0. Roadway segment analysis, intersection LOS analysis, and freeway mainline analysis results are discussed separately below.

### Roadway Segment Analysis

**Table 6.1** displays the LOS analysis results for key roadway segments under the Future Year 2035 Base Conditions.

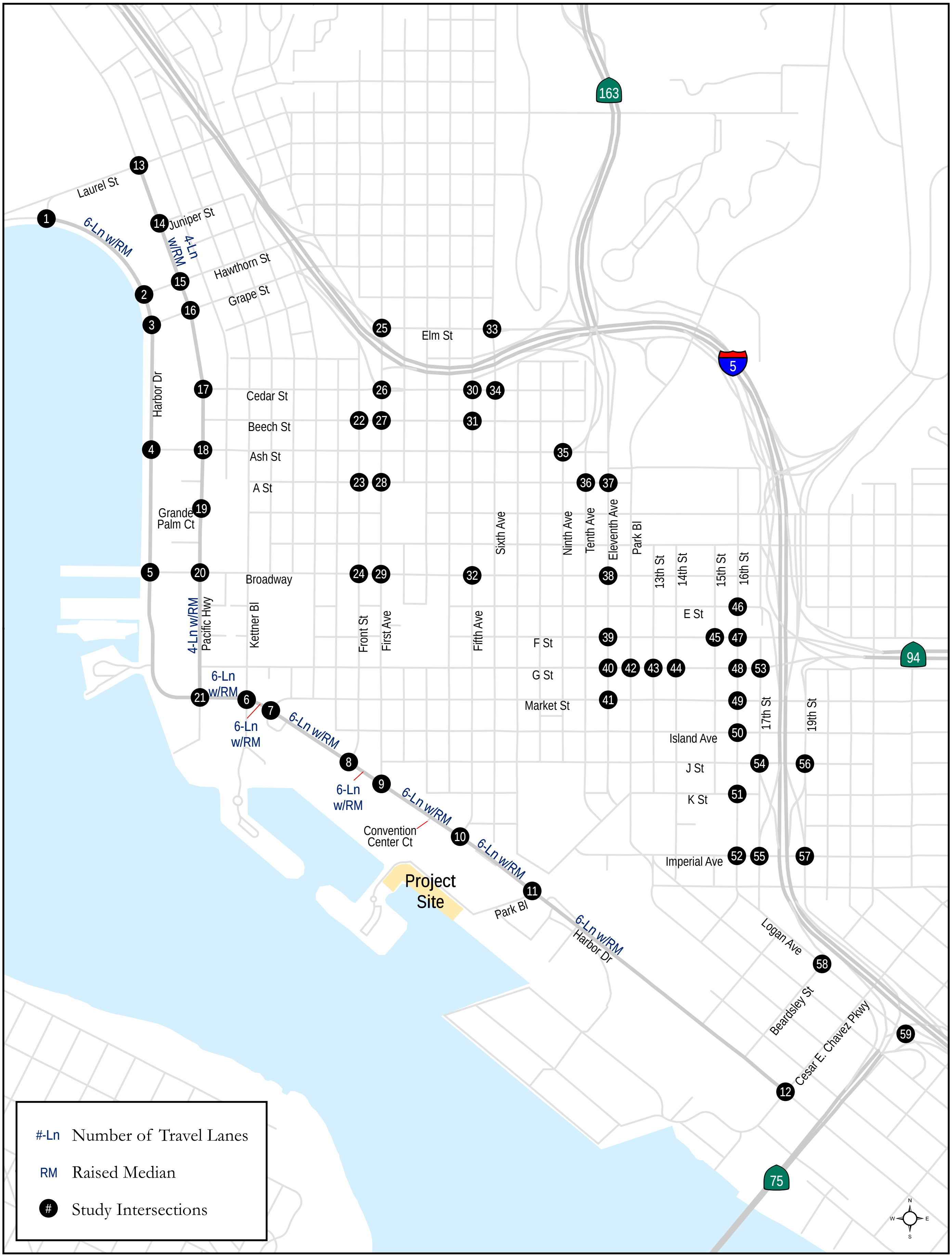


**Figure 6-1A**

**Roadway Segment Geometrics - Future Year 2035 Base Conditions**

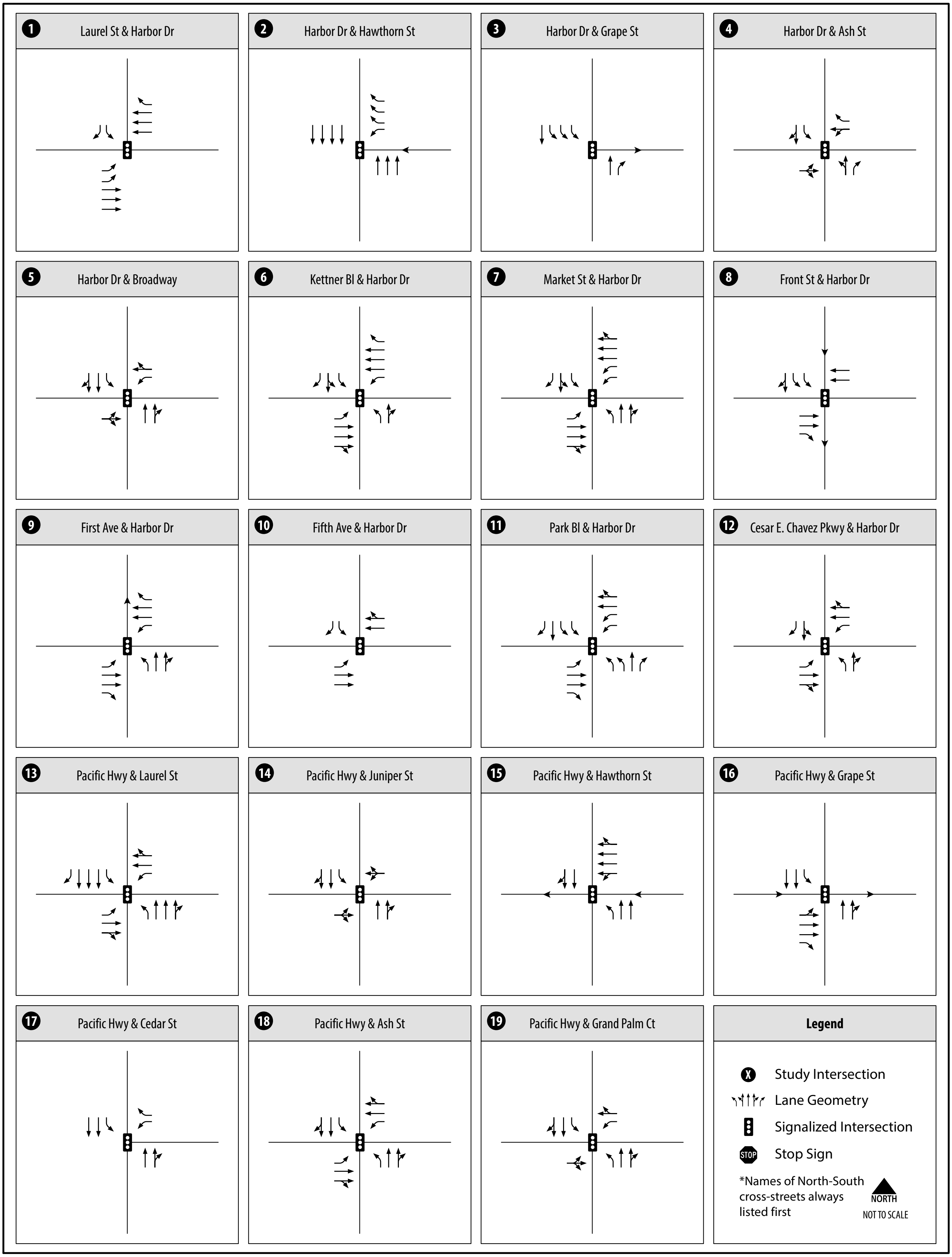


**Figure 6-1B**
**Intersection Geometrics - Future Year 2035 Base Conditions**
**(Intersections 1-19)**

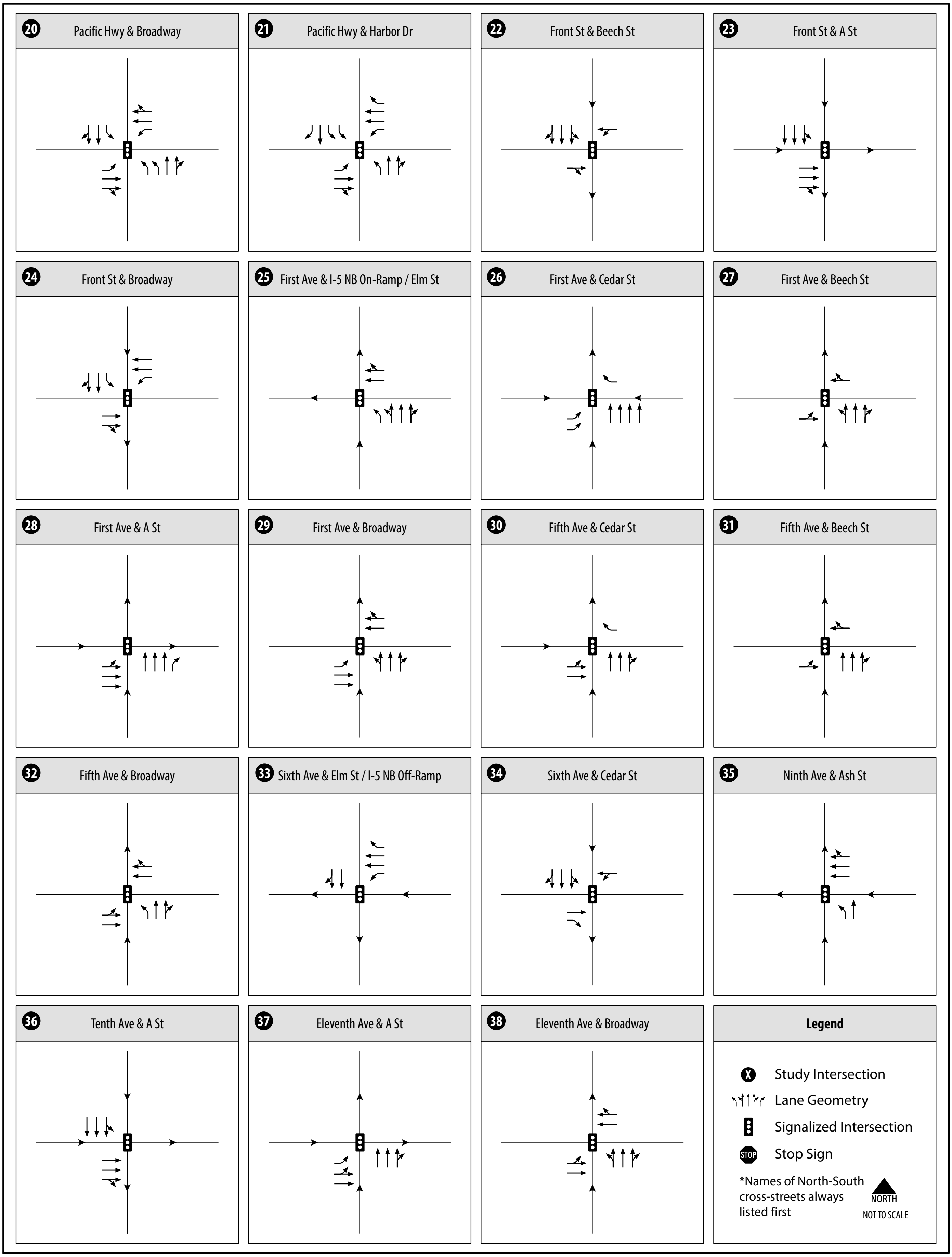
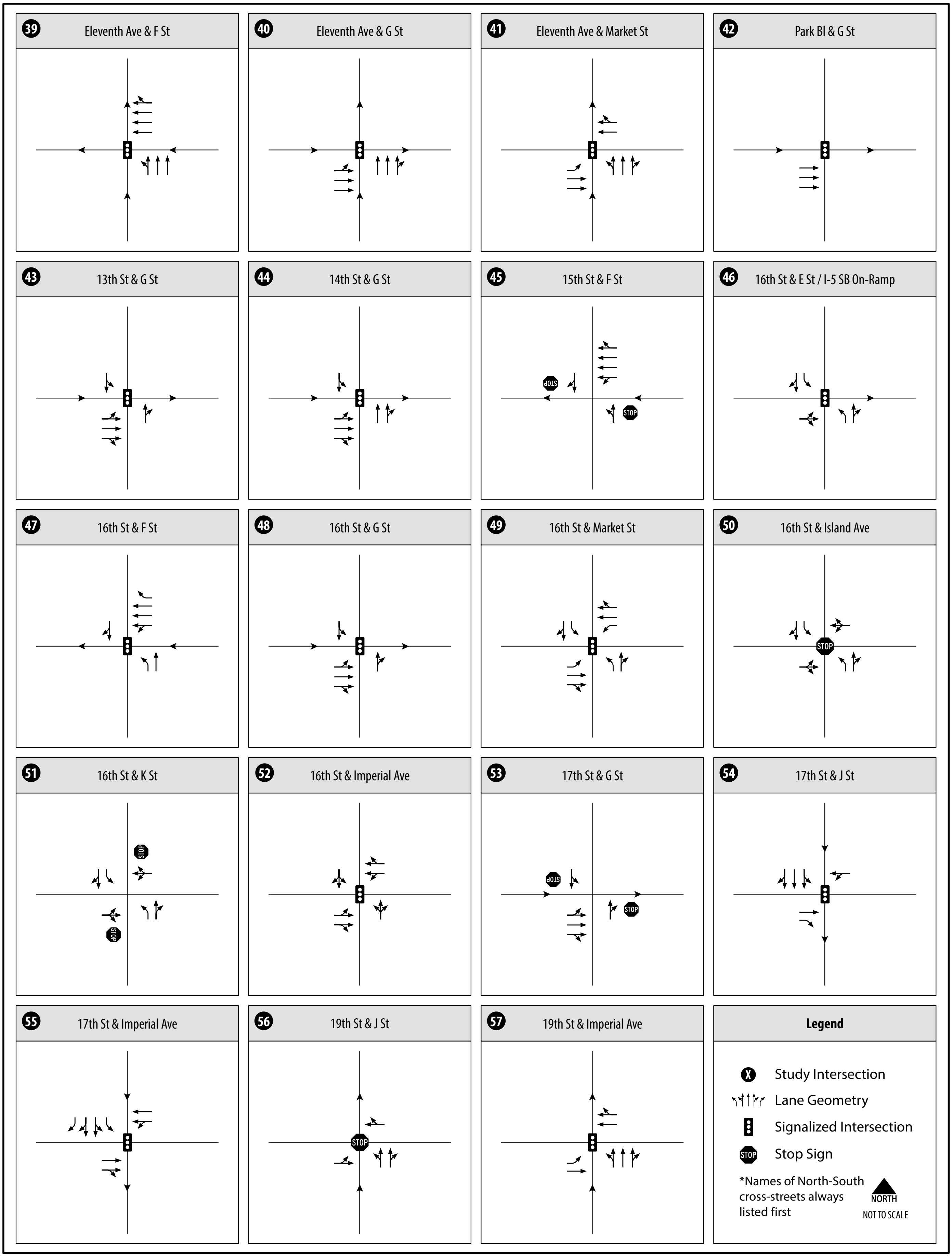


**Figure 6-1B**
**Intersection Geometrics - Future Year 2035 Base Conditions**
**(Intersections 20-38)**


39 Eleventh Ave & F St

40 Eleventh Ave & G St

41 Eleventh Ave & Market St

42 Park Bl & G St

43 13th St & G St

44 14th St & G St

45 15th St & F St

46 16th St & E St / I-5 SB On-Ramp

47 16th St & F St

48 16th St & G St

49 16th St & Market St

50 16th St & Island Ave

51 16th St & K St

52 16th St & Imperial Ave

53 17th St & G St

54 17th St & J St

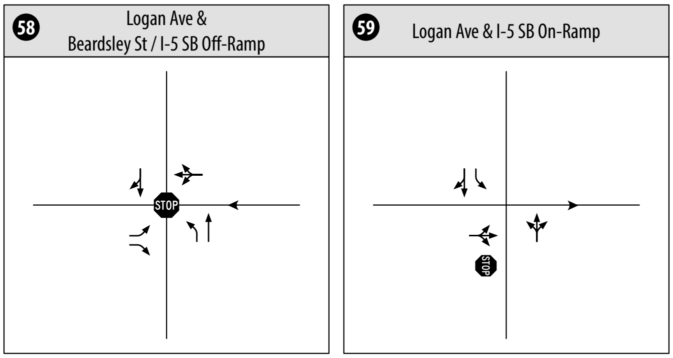
55 17th St & Imperial Ave

56 19th St & J St

57 19th St & Imperial Ave

**Legend**

**Figure 6-1B**
**Intersection Geometrics - Future Year 2035 Base Conditions**
**(Intersections 39-57)**



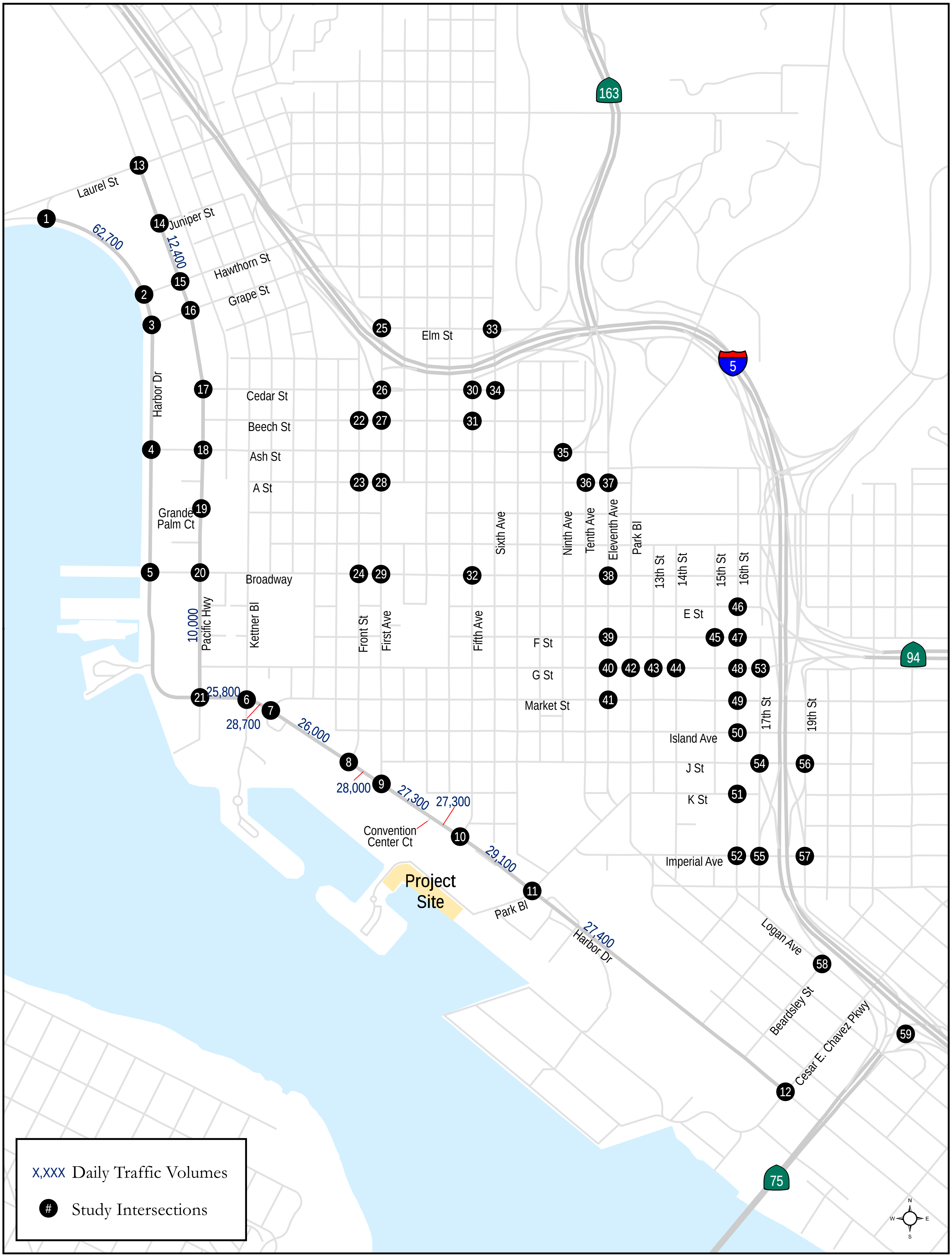
**Legend**

- X Study Intersection
- ↰↑↑↱ Lane Geometry
- ⋮ Signalized Intersection
- STOP Stop Sign

*Names of North-South cross-streets always listed first

NORTH
NOT TO SCALE

**Figure 6-1B**
**Intersection Geometrics - Future Year 2035 Base Conditions**
**(Intersections 58 and 59)**



*Fifth Avenue Landing Project*
*Transportation Impact Analysis*

CHEN✚RYAN

**Figure 6-2A**
**Daily Roadway Segment Traffic Volumes - Future Year 2035 Conditions**

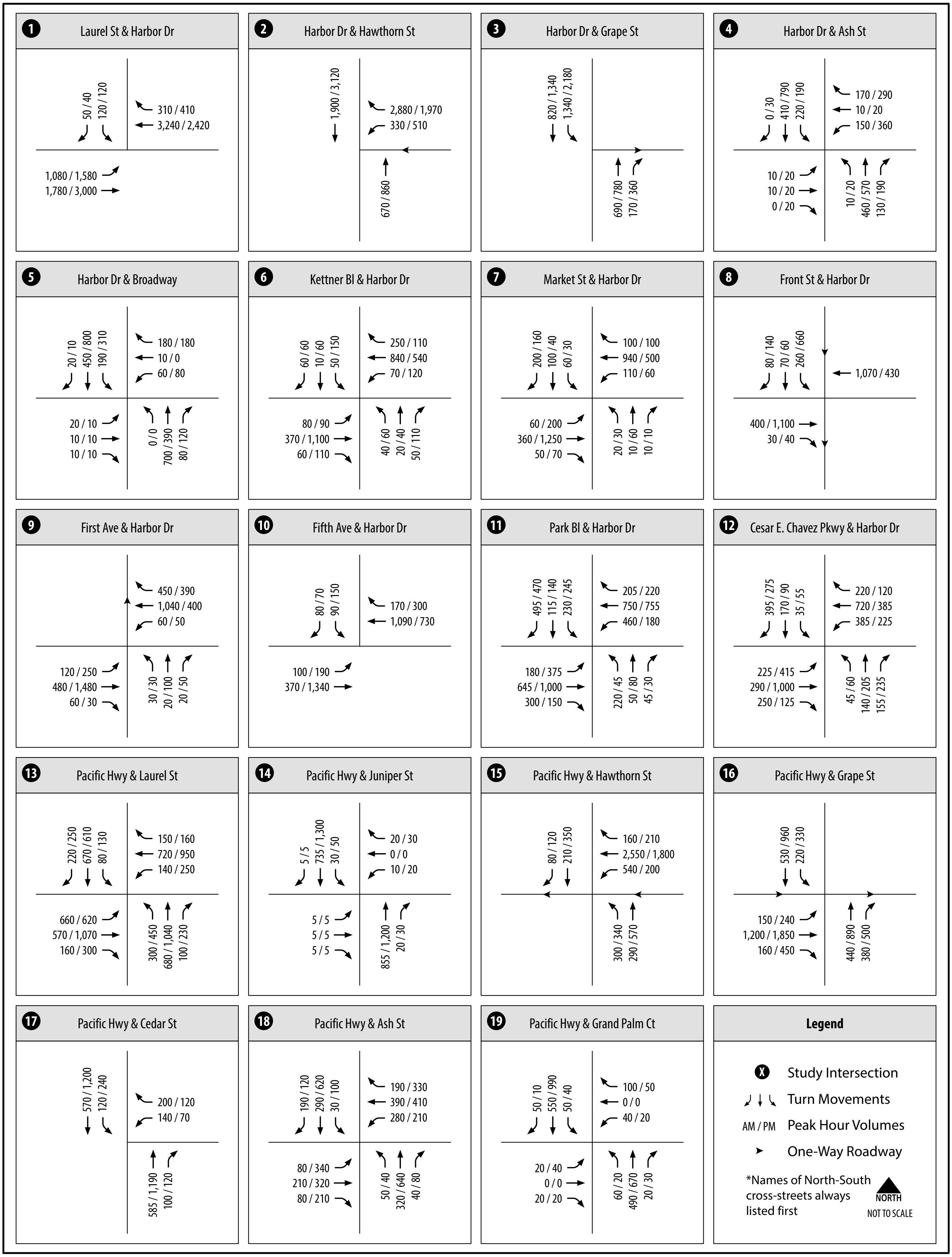


**Figure 6-2B**
**Peak Hour Intersection Traffic Volumes -**
**Future Year 2035 Base Conditions (Intersections 1-19)**

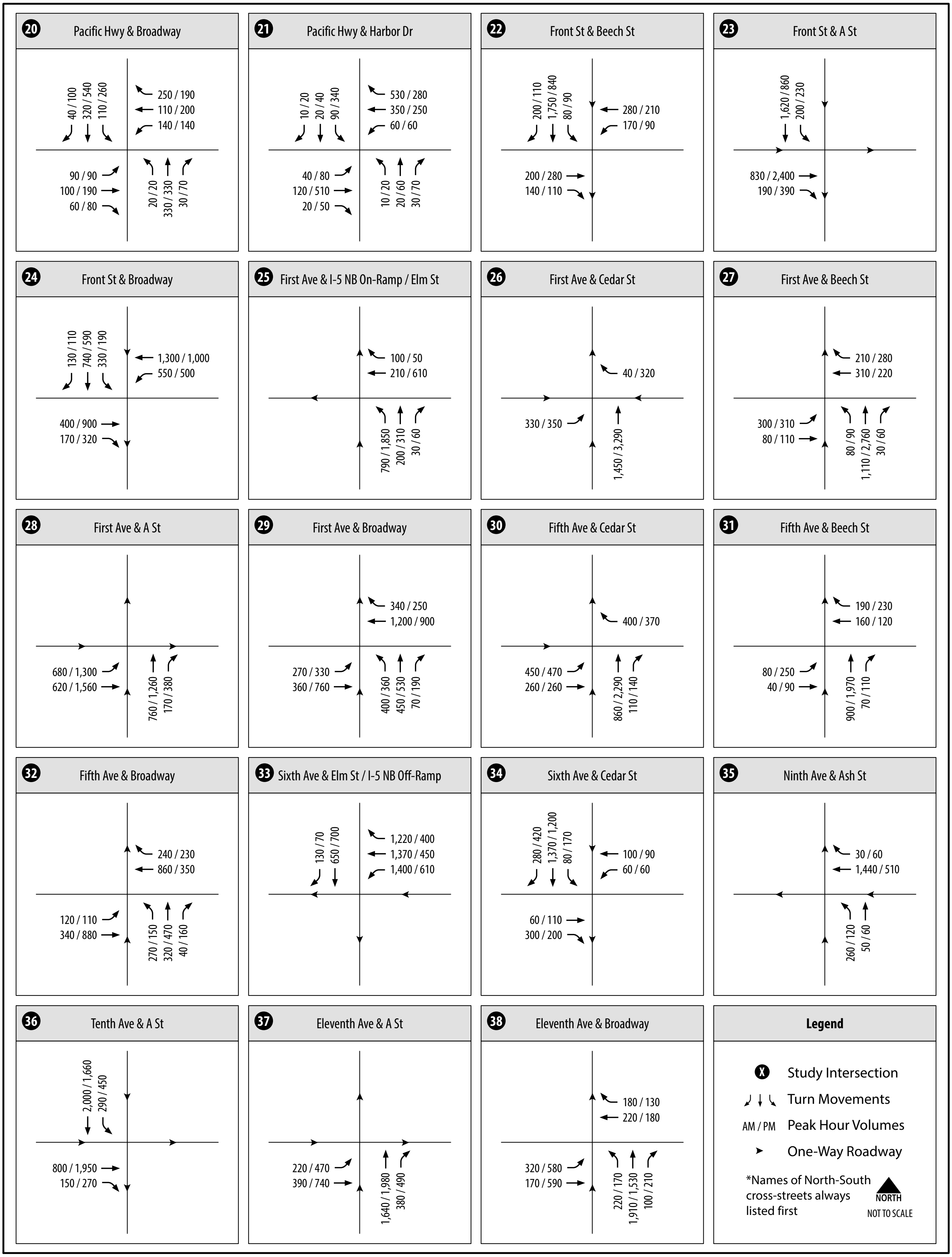
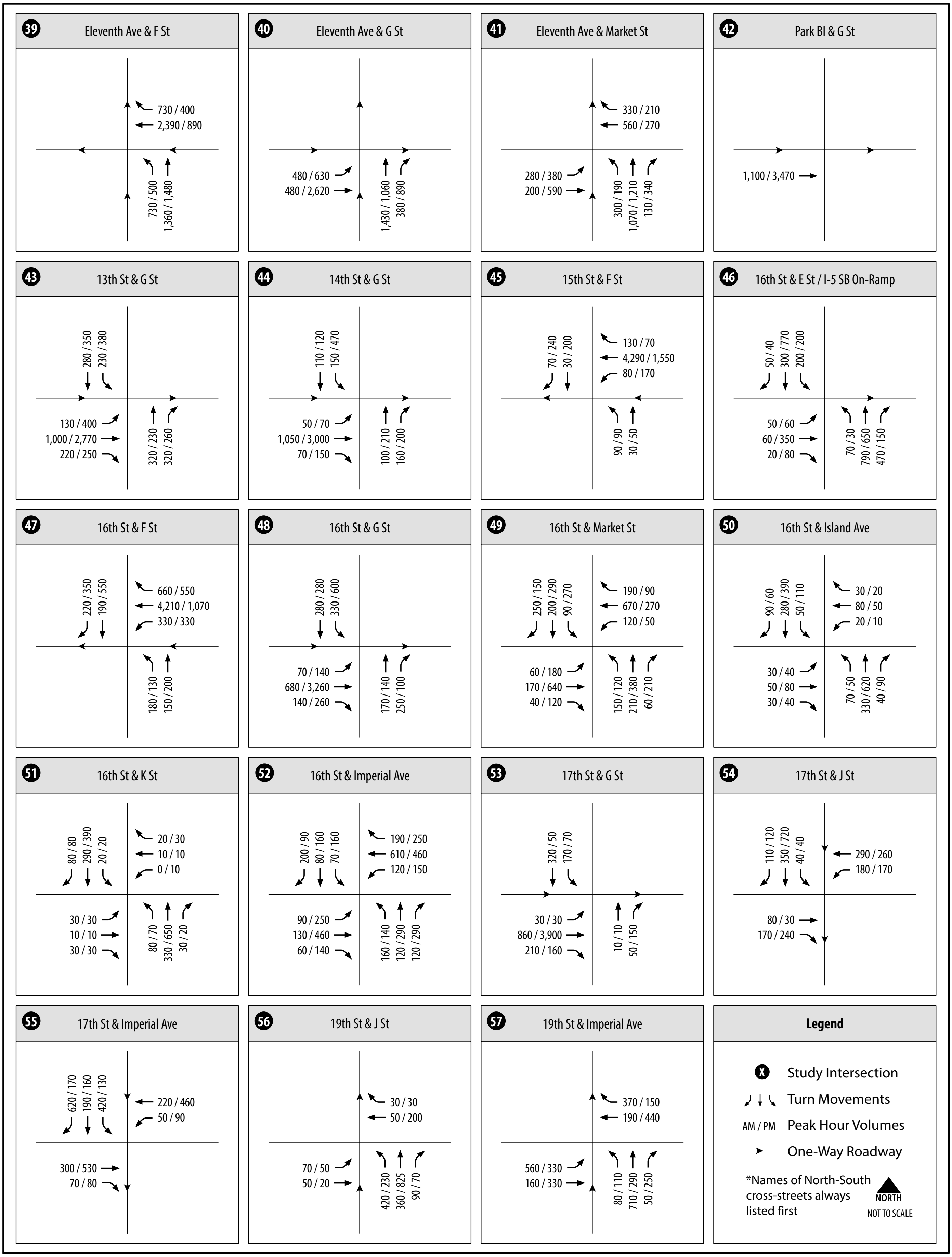


**Figure 6-2B**

**Peak Hour Intersection Traffic Volumes - Future Year 2035 Base Conditions (Intersections 20-38)**



*Fifth Avenue Landing Project*
*Transportation Impact Analysis*
CHEN RYAN

**Figure 6-2B**
**Peak Hour Intersection Traffic Volumes -**
**Future Year 2035 Base Conditions (Intersections 39-57)**

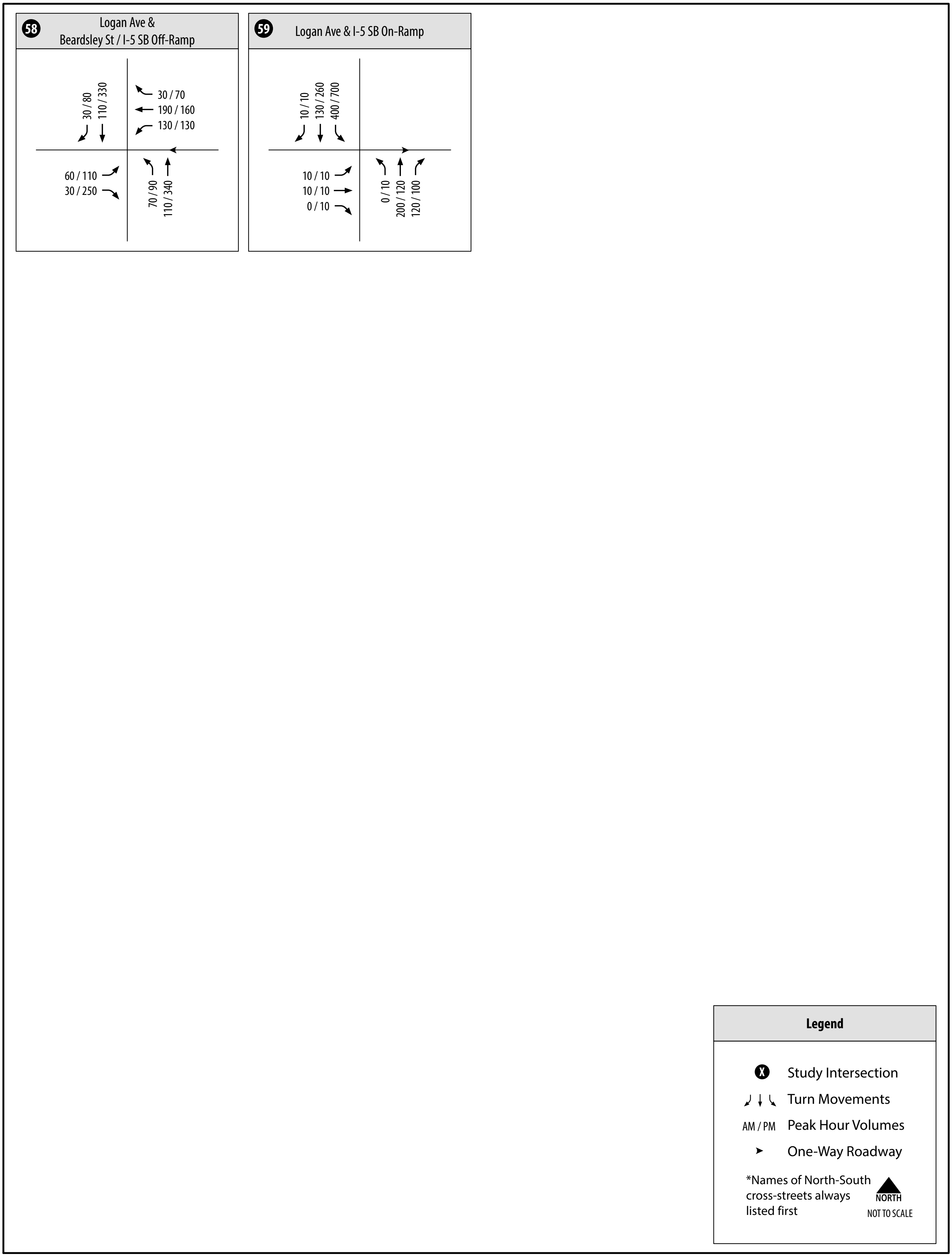


**Figure 6-2B**
**Peak Hour Intersection Traffic Volumes -**
**Future Year 2035 Base Conditions (Intersections 58 and 59)**

Table 6.1 Roadway Segment LOS Results - Future Year 2035 Base Conditions

| Roadway Segment | Segment | Cross-section | Threshold (LOS E) | ADT | V/C | LOS |
|---|---|---|---|---|---|---|
| Harbor Drive | Between Laurel Street & Hawthorn Street | 6-Ln w/ RM | 60,000 | 62,700 | 1.045 | F |
| | Between Pacific Highway and Kettner Boulevard | 6-Ln w/ RM | <50,000 | 25,800 | 0.516 | B |
| | Between Kettner Boulevard & Market Street | 6-Ln w/ RM | <50,000 | 28,700 | 0.574 | B |
| | Between Market Street and Front Street | 6-Ln w/ RM | <50,000 | 26,000 | 0.520 | B |
| | Between Front Street and First Avenue | 4-Ln w/ SM | <40,000 | 28,000 | 0.700 | C |
| | Between First Avenue & Convention Center Court | 4-Ln w/ RM | <40,000 | 27,300 | 0.683 | C |
| | Between Convention Center Court & Fifth Avenue | 4-Ln w/ SM | <40,000 | 27,300 | 0.683 | C |
| | Between Fifth Avenue and Park Boulevard | 4-Ln w/ RM | <40,000 | 29,100 | 0.728 | C |
| | South of Park Boulevard | 4-Ln w/ RM | <40,000 | 27,400 | 0.685 | C |
| Pacific Highway | Between Juniper Street & Hawthorn Street | 4-Ln w/ RM | <40,000 | 12,400 | 0.310 | A |
| | Between Broadway & Harbor Drive | 4-Ln w/ SM | <40,000 | 10,000 | 0.250 | A |

*Source: Chen Ryan Associates; February 2017*

Notes:
V/C = Volume to Capacity Ratio.
RM = Raised Median
SM = Striped Median

As shown, all key study roadway segments are projected to operate at LOS C or better under Future Year 2035 Base Conditions, with the exception of Harbor Drive, between Laurel Street and Hawthorn Street, which is projected to operate at LOS F.

## Intersection Analysis

**Table 6.2** displays intersection LOS and average vehicle delay results under Future Year 2035 Base Conditions. LOS calculation worksheets are provided in **Appendix H**.

Table 6.2 Peak Hour Intersection LOS Results – Future Year 2035 Base Conditions

| # | Intersection | AM Peak Hour | | PM Peak Hour | |
|---|---|---|---|---|---|
| | | Avg. Delay (sec.) | LOS | Avg. Delay (sec.) | LOS |
| 1 | Harbor Drive & Laurel Street | 132.2 | F | 109.0 | F |
| 2 | Harbor Drive & Hawthorn Street | 52.1 | D | 31.5 | C |
| 3 | Harbor Drive & Grape St | 20.0 | B | 62.5 | E |
| 4 | Harbor Drive & Ash Street | 19.1 | B | 50.5 | D |
| 5 | Harbor Drive & Broadway | 31.3 | C | 87.6 | F |
| 6 | Harbor Drive & Kettner Boulevard | 20.5 | C | 40.4 | D |
| 7 | Harbor Drive & Market Street | 34.3 | C | 22.4 | C |
| 8 | Harbor Drive & Front Street | 30.6 | C | 15.7 | B |
| 9 | First Street & Harbor Drive | 18.7 | B | 37.9 | D |
| 10 | Harbor Drive & Fifth Avenue | 21.3 | C | 24.6 | C |

### Table 6.2 Peak Hour Intersection LOS Results – Future Year 2035 Base Conditions

| # | Intersection | AM Peak Hour | | PM Peak Hour | |
|---|---|---|---|---|---|
| | | Avg. Delay (sec.) | LOS | Avg. Delay (sec.) | LOS |
| 11 | Park Boulevard & Harbor Drive | 49.4 | D | 42.7 | D |
| 12 | Cesar Chavez Parkway & Harbor Drive | 32.3 | C | 134.0 | F |
| 13 | Pacific Highway & Laurel Street | 101.9 | F | 143.5 | F |
| 14 | Pacific Highway & Juniper Street | 8.3 | A | 8.6 | A |
| 15 | Pacific Highway & Hawthorn Street | 44.6 | D | 31.4 | C |
| 16 | Pacific Highway & Grape Street | 51.2 | D | 79.7 | E |
| 17 | Pacific Highway & Cedar Street | 13.9 | B | 40.6 | D |
| 18 | Pacific Highway & Ash Street | 66.7 | E | 50.1 | D |
| 19 | Pacific Highway & Grand Palm Court | 17.9 | B | 24.9 | C |
| 20 | Pacific Highway & Broadway | 32.9 | C | 38.8 | D |
| 21 | Pacific Highway & Harbor Drive | 22.8 | C | 25.9 | C |
| 22 | Front Street & Beech Street | 162.1 | F | 25.4 | C |
| 23 | Front Street & A Street | 21.5 | C | 62.7 | E |
| 24 | Front Street & Broadway | 52.5 | D | 140.2 | F |
| 25 | First Avenue & I-5 NB On-Ramp/Elm Street | 7.0 | A | 6.4 | A |
| 26 | First Avenue & Cedar Street | 7.3 | A | 8.1 | A |
| 27 | First Avenue & Beech Street | 32.3 | C | 125.4 | F |
| 28 | First Avenue & A Street | 10.1 | B | 92.3 | F |
| 29 | First Avenue & Broadway | 147.3 | F | 84.5 | F |
| 30 | Fifth Avenue & Cedar Street | 23.1 | C | 19.9 | B |
| 31 | Fifth Avenue & Beech Street | 17.5 | B | 39.4 | D |
| 32 | Fifth Avenue & Broadway | 19.8 | B | 47.2 | D |
| 33 | Sixth Avenue & Elm Street/I-5 NB Off-Ramp | 15.6 | B | 8.5 | A |
| 34 | Sixth Avenue & Cedar Street | 57.4 | E | 19.5 | B |
| 35 | Ninth Street & Ash Street | 12.8 | B | 10.3 | B |
| 36 | Tenth Avenue & A Street | 24.2 | C | 42.8 | D |
| 37 | Eleventh Avenue & A Street | 26.7 | C | 34.3 | C |
| 38 | Eleventh Avenue & Broadway | 29.9 | C | 95.9 | F |
| 39 | Eleventh Avenue & F Street | 70.7 | E | 38.7 | D |
| 40 | Eleventh Avenue & G Street | 13.2 | B | 152.6 | F |
| 41 | Eleventh Avenue & Market Street | 48.8 | D | 88.6 | F |
| 42 | Park Boulevard & G Street | 9.2 | A | 130.8 | F |
| 43 | 13th Street & G Street | 59.5 | E | 369.3 | F |
| 44 | 14th Street & G Street | 10.8 | B | 297.6 | F |
| 45 | 15th Street & F Street | >500 | F | >500 | F |
| 46 | 16th Street & E Street | 188.5 | F | 60.8 | E |
| 47 | 16th Street & F Street | 153.5 | F | 52.6 | D |
| 48 | 16th Street & G Street | 13.1 | B | 286.7 | F |
| 49 | 16th Street & Market Street | 17.1 | B | 35.6 | D |
| 50 | 16th Street & Island Avenue | 15.2 | C | 89.5 | F |

Table 6.2 Peak Hour Intersection LOS Results – Future Year 2035 Base Conditions

| # | Intersection | AM Peak Hour | | PM Peak Hour | |
|---|---|---|---|---|---|
| | | Avg. Delay (sec.) | LOS | Avg. Delay (sec.) | LOS |
| 51 | 16th Street & K Street | 21.5 | C | 47.7 | E |
| 52 | Imperial Avenue & 16th Street | 21.9 | C | 80.5 | F |
| 53 | 17th Street & G Street | 263.2 | F | >500 | F |
| 54 | 17th Street & J Street | 13.5 | B | 17.1 | B |
| 55 | Imperial Avenue & 17th Street | 14.0 | B | 10.6 | B |
| 56 | 19th Street & J Street | 16.3 | C | 140.7 | F |
| 57 | Imperial Avenue & 19th Street | 23.3 | C | 22.0 | C |
| 58 | Logan Avenue & I-5 SB Off-Ramp | 13.0 | B | 79.5 | F |
| 59 | Logan Avenue & I-5 SB On-Ramp | 169.8 | F | >500 | F |

*Source: Chen Ryan Associates; February 2017*

As shown, the following study intersections are projected to operate at LOS F under Future Year 2035 Base Conditions:

**AM Peak**

- Harbor Drive & Laurel Street
- Park Boulevard & Harbor Drive
- Pacific Highway & Laurel Street
- Front Street & Beech Street
- First Avenue & Broadway
- 15th Street & F Street
- 16th Street & E Street
- 16th Street & F Street
- 17th Street & G Street
- Logan Avenue & I-5 SB On-Ramp

**PM Peak**

- Harbor Drive & Laurel Street
- Harbor Drive & Broadway
- Caesar Chavez Parkway & Harbor Drive
- Pacific Highway & Laurel Street
- Front Street & Broadway
- First Avenue & Beech Street
- First Avenue & A Street
- First Avenue & Broadway
- Eleventh Avenue & Broadway
- Eleventh Avenue & G Street
- Eleventh Avenue & Market Street
- Park Boulevard & G Street
- 13th Street & G Street
- 14th Street & G Street
- 15th Street & F Street
- 16th Street & G Street
- 16th Street & Island Avenue
- Imperial Avenue & 16th Street
- 17th Street & G Street
- 19th Street & J Street
- Logan Avenue & I-5 SB Off-Ramp

## Freeway Analysis

**Table 6.3** displays the LOS results from the freeway mainline segment analysis under Future Year 2035 Base Conditions.

Table 6.3 Freeway Mainline Analysis – Future Year 2035 Base Conditions

| Freeway / State Highway | Segment | ADT | Direction | # of Lanes | Capacity | HV % | AM Peak Hour |  |  | PM Peak Hour |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  |  |  |  |  | Peak Hour Volume | V/C Ratio | LOS | Peak Hour Volume | V/C Ratio | LOS |
| I-5 | Grape Street to First Avenue | 182,800 | NB | 4M | 9,400 | 4.1% | 9,810 | 1.044 | F | 5,730 | 0.610 | C |
|  |  |  | SB | 4M | 9,400 | 4.1% | 5,800 | 0.617 | C | 8,560 | 0.911 | E |
|  | First Avenue to SR-163 | 252,500 | NB | 4M | 9,400 | 4.1% | 13,550 | 1.441 | F | 7,920 | 0.843 | D |
|  |  |  | SB | 5M | 11,750 | 4.1% | 8,020 | 0.683 | C | 11,820 | 1.006 | E |
|  | SR-163 and B Street | 252,700 | NB | 6M | 14,100 | 3.7% | 13,500 | 0.957 | E | 7,890 | 0.560 | C |
|  |  |  | SB | 6M | 14,100 | 3.7% | 7,990 | 0.567 | C | 11,780 | 0.835 | D |
|  | B Street to SR-94 | 252,700 | NB | 4M | 9,400 | 4.0% | 13,540 | 1.440 | F | 7,910 | 0.841 | D |
|  |  |  | SB | 4M | 9,400 | 4.0% | 8,010 | 0.852 | D | 11,820 | 1.257 | F |
|  | SR-94 to Imperial Avenue | 226,600 | NB | 5M | 11,750 | 3.8% | 12,120 | 1.031 | F | 7,080 | 0.603 | C |
|  |  |  | SB | 5M | 11,750 | 3.8% | 7,170 | 0.610 | C | 10,570 | 0.900 | E |
|  | Imperial Avenue to SR-75 | 222,900 | NB | 5M | 11,750 | 4.0% | 11,950 | 1.017 | F | 6,980 | 0.594 | C |
|  |  |  | SB | 5M | 11,750 | 4.0% | 7,070 | 0.602 | C | 10,420 | 0.887 | D |

*Source: Chen Ryan Associates; February 2017*

Notes:
**Bold** letter indicates LOS E or F.
M = Mainline lane.
The capacity, Directional split, Peak hour % and Heavy vehicle % are assumed to be the same as Existing Conditions.
**Bold** letter indicates substandard LOS E or F.
HV = Heavy vehicle %

As shown, all study area freeway mainline segments operate at LOS D or better, with the exception of the following:

- I-5 Northbound, between Grape Street and First Avenue (LOS F, AM Peak)
- I-5 Southbound, between Grape Street and First Avenue (LOS E, PM Peak)
- I-5 Northbound, between First Avenue and SR-163 (LOS F, AM Peak)
- I-5 Southbound, between First Avenue and SR-163 (LOS E, PM Peak)
- I-5 Northbound, between SR-163 and B Street (LOS E, AM Peak)
- I-5 Northbound, between B Street and SR-94 (LOS F, AM Peak)
- I-5 Southbound, between B Street and SR-94 (LOS F, PM Peak)
- I-5 Northbound, between SR-94 to Imperial Avenue (LOS F, AM Peak)
- I-5 Southbound, between SR-94 to Imperial Avenue (LOS E, PM Peak)
- I-5 Northbound, between Imperial Avenue to SR-75 (LOS F, AM Peak)

## 6.3 Future Year 2035 Base Plus Project Traffic Volumes

As noted in Section 6.1, it is assumed that Park Boulevard will be extended to connect with Harbor Drive under Future Year 2035 Plus Project Conditions. This assumed roadway connection will have a substantial effect on the Proposed Project trip assignment. It will be much easier for motorists to travel from the project site to the I-5 / Imperial Avenue and I-5 / J Street Ramps instead of the I-5 / First Street and Front Street Ramps, as well as the I-5 Logan Avenue Ramps.

Therefore, under Future Year 2035 Plus Project Conditions it is assumed that the traffic coming to/from the Proposed Project to/from I-5 will use the Imperial and J Street Ramps exclusively. **Figures 6-3a** and **b** displays the Proposed Project Trip Assignment under Future Year 2035 conditions.

Future Year 2035 Base Plus Project traffic volumes were derived by combining the Future Year 2035 Base traffic volumes (displayed in Figure 6-1) and the project trip assignment volumes (displayed in Figures 6-3). Daily and peak hour intersection volumes for this scenario are displayed in **Figures 6-4a** and **b.**

## 6.4 Future Year 2035 Base Plus Project Traffic Conditions

LOS analyses were conducted using the methodologies described in Chapter 2.0. Roadway segment analysis, intersection LOS analysis, and freeway mainline analysis results are discussed separately below.

### Roadway Segment Analysis

**Table 6.4** displays the LOS analysis results for key roadway segments under Future Year 2035 Base Plus Project Conditions.

Table 6.4 Roadway Segment LOS Results – Future Year 2035 Base Plus Project Conditions

| Roadway | Segment | Cross-Section | Threshold (LOS E) | Future Year 2035 Base + Project | | | Future Year 2035 Base | Δ | Sig? |
|---|---|---|---|---|---|---|---|---|---|
| | | | | ADT | V/C | LOS | ADT / V/C / LOS | | |
| Harbor Drive | Between Laurel Street & Hawthorn Street | 6-Ln w/ RM | <60,000 | 64,394 | 1.073 | F | 62,700 / 1.045 / F | 0.028 | Y |
| | Between Pacific Highway and Kettner Boulevard | 6-Ln w/ RM | <50,000 | 28,341 | 0.567 | B | 25,800 / 0.516 / B | 0.051 | N |
| | Between Kettner Boulevard & Market Street | 6-Ln w/ RM | <50,000 | 31,241 | 0.625 | B | 28,700 / 0.574 / C | 0.051 | N |
| | Between Market Street and Front Street | 6-Ln w/ RM | <50,000 | 28,541 | 0.571 | B | 26,000 / 0.520 / B | 0.051 | N |
| | Between Front Street and First Avenue | 4-Ln w/ SM | <40,000 | 30,541 | 0.764 | C | 28,000 / 0.700 / C | 0.064 | N |
| | Between First Avenue & Convention Center Court | 4-Ln w/ RM | <40,000 | 29,841 | 0.746 | C | 27,300 / 0.683 / C | 0.064 | N |
| | Between Convention Center Court & Fifth Avenue | 4-Ln w/ SM | <40,000 | 29,841 | 0.746 | C | 27,300 / 0.683 / C | 0.064 | N |
| | Between Fifth Avenue and Park Boulevard | 4-Ln w/ RM | <40,000 | 32,065 | 0.802 | C | 29,100 / 0.728 / C | 0.074 | N |
| | South of Park Boulevard | 4-Ln w/ RM | <40,000 | 27,400 | 0.685 | C | 27,400 / 0.685 / C | 0.000 | N |
| Pacific Highway | Between Juniper Street & Hawthorn Street | 4-Ln w/ RM | <40,000 | 13,247 | 0.331 | A | 12,400 / 0.310 / A | 0.021 | N |
| | Between Broadway & Harbor Drive | 4-Ln w/ SM | <40,000 | 10,847 | 0.271 | A | 10,000 / 0.250 / A | 0.021 | N |

*Source: Chen Ryan Associates; February 2017*

Notes:
V/C = Volume to Capacity Ratio.
RM = Raised Median
SM = Striped Median

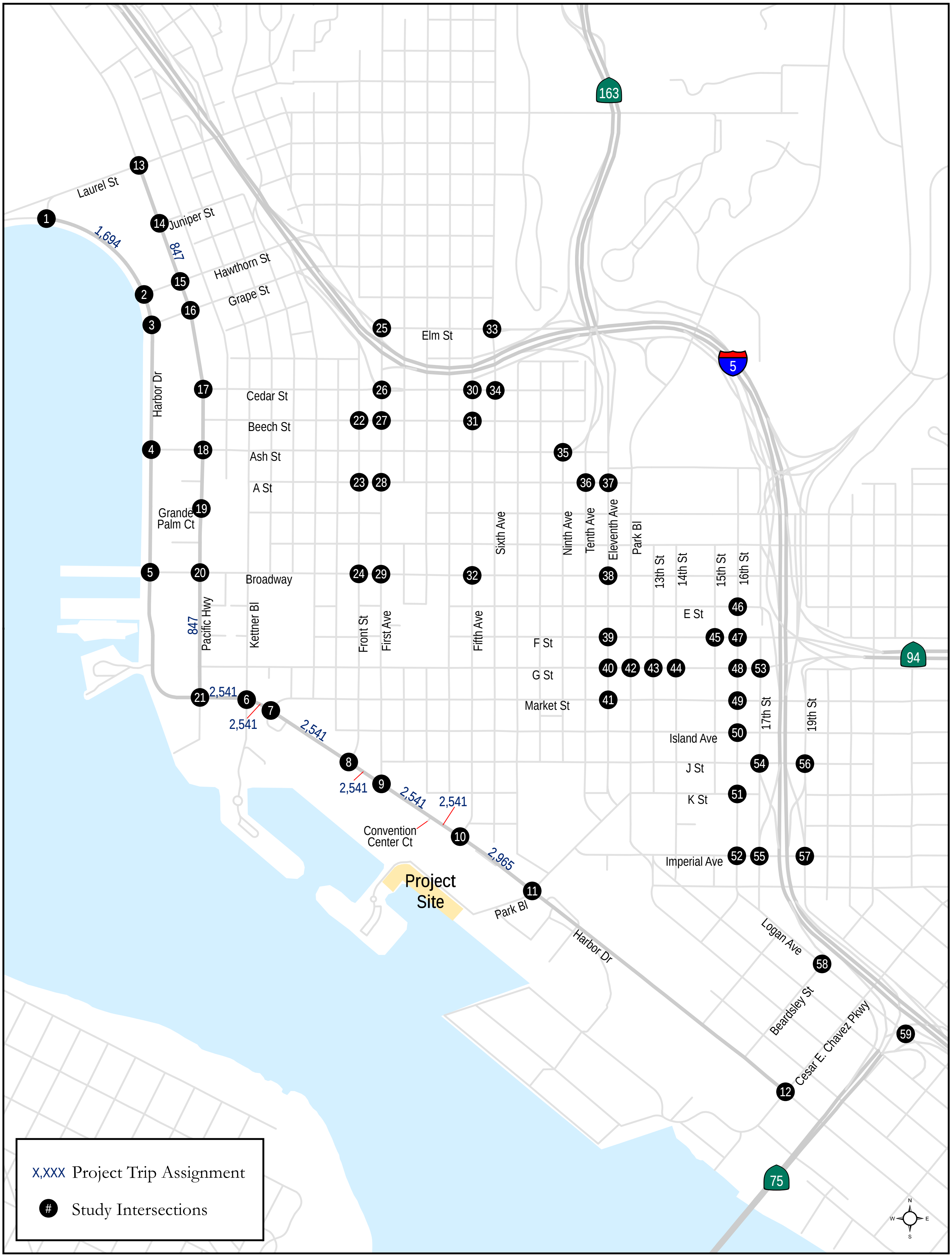


**Figure 6-3A**

**Daily Roadway Segment Project Trip Assignment - Future Year 2035 Conditions**

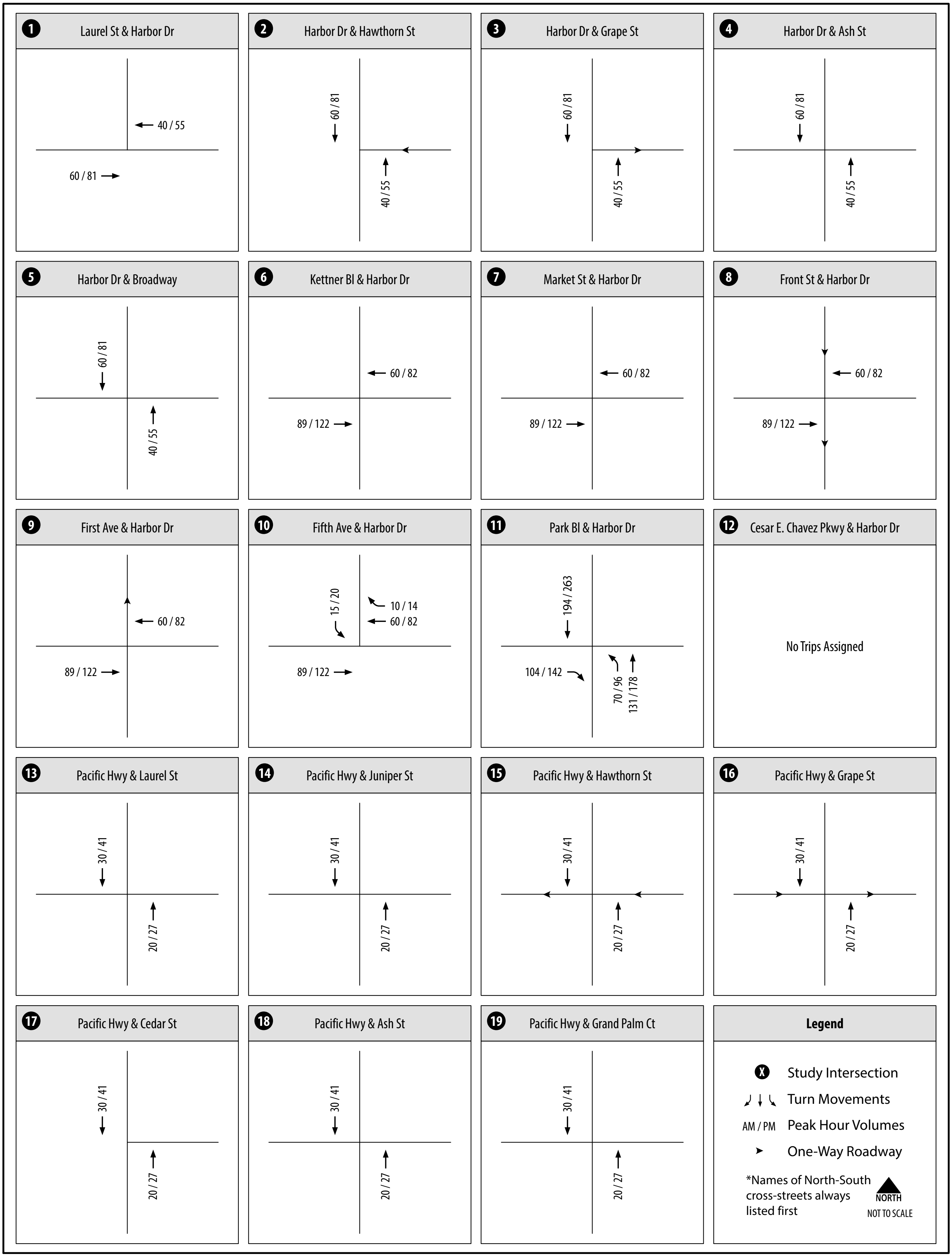


**Figure 6-3B**

**Peak Hour Intersection Project Trip Assignment - Future Year 2035 Conditions (Intersections 1-19)**

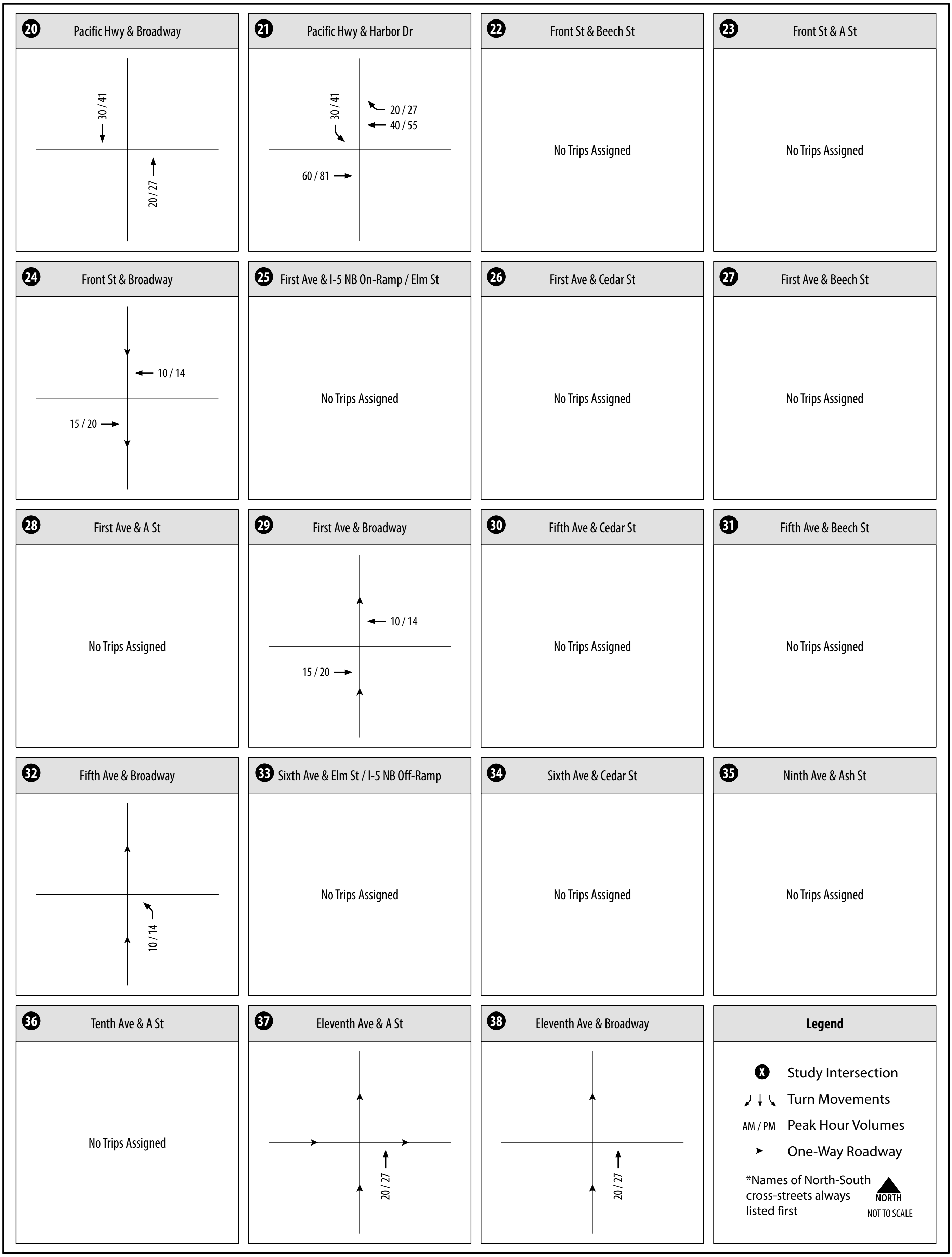


**Figure 6-3B**

**Peak Hour Intersection Project Trip Assignment - Future Year 2035 Conditions (Intersections 20-38)**

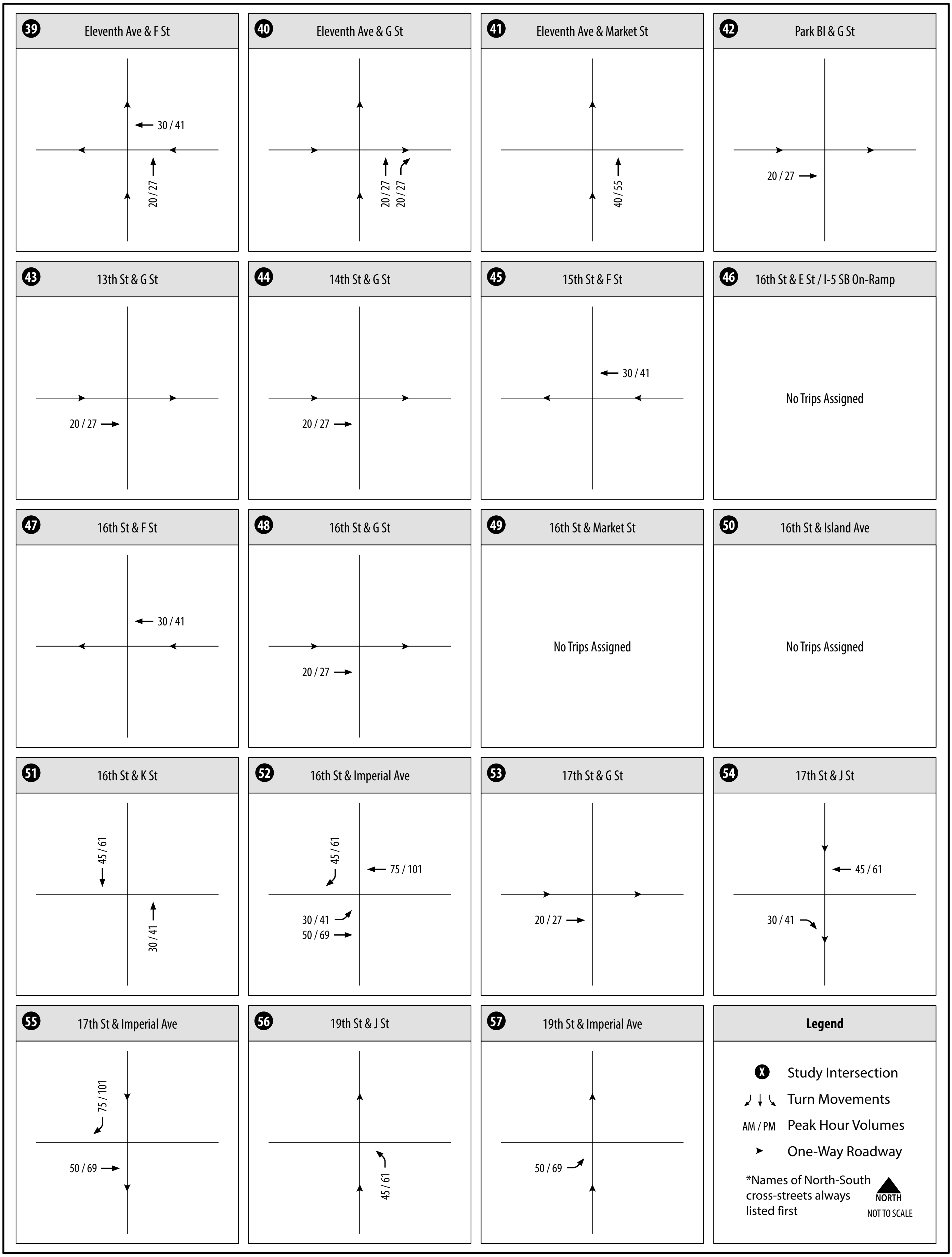


**Figure 6-3B**

**Peak Hour Intersection Project Trip Assignment - Future Year 2035 Conditions (Intersections 39-57)**

**58** Logan Ave &
Beardsley St / I-5 SB Off-Ramp

No Trips Assigned

**59** Logan Ave & I-5 SB On-Ramp

No Trips Assigned

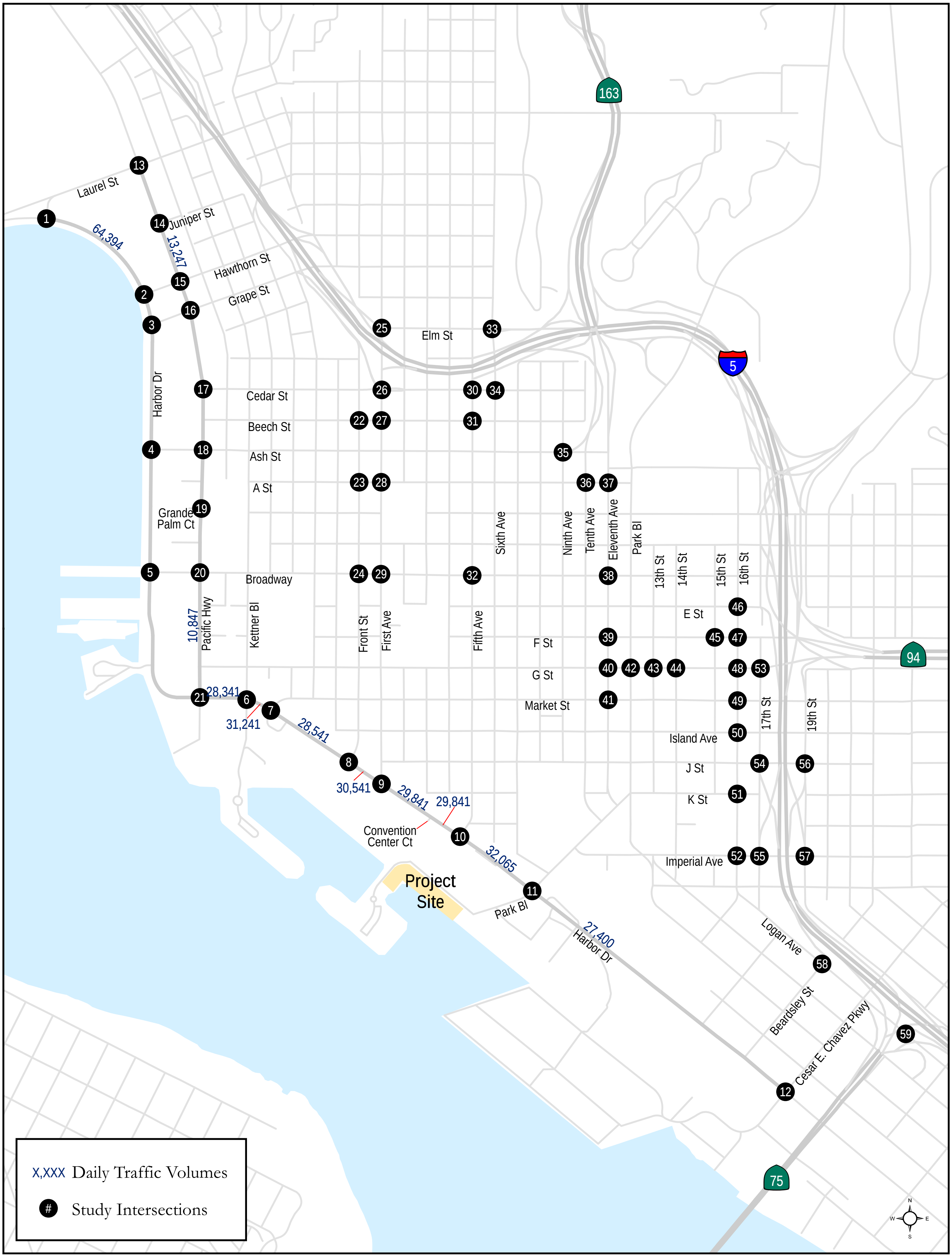
**Legend**

| | |
|---|---|
| Ⓧ | Study Intersection |
| ↲ ↓ ↳ | Turn Movements |
| AM / PM | Peak Hour Volumes |
| ➤ | One-Way Roadway |

*Names of North-South cross-streets always listed first

▲ NORTH
NOT TO SCALE

**Figure 6-3B**
**Peak Hour Intersection Project Trip Assignment - Future Year 2035 Conditions (Intersections 58 and 59)**



*Fifth Avenue Landing Project*
*Transportation Impact Analysis*
CHEN RYAN

**Figure 6-4A**
**Daily Roadway Segment Traffic Volumes - Future Year 2035 Plus Project Conditions**

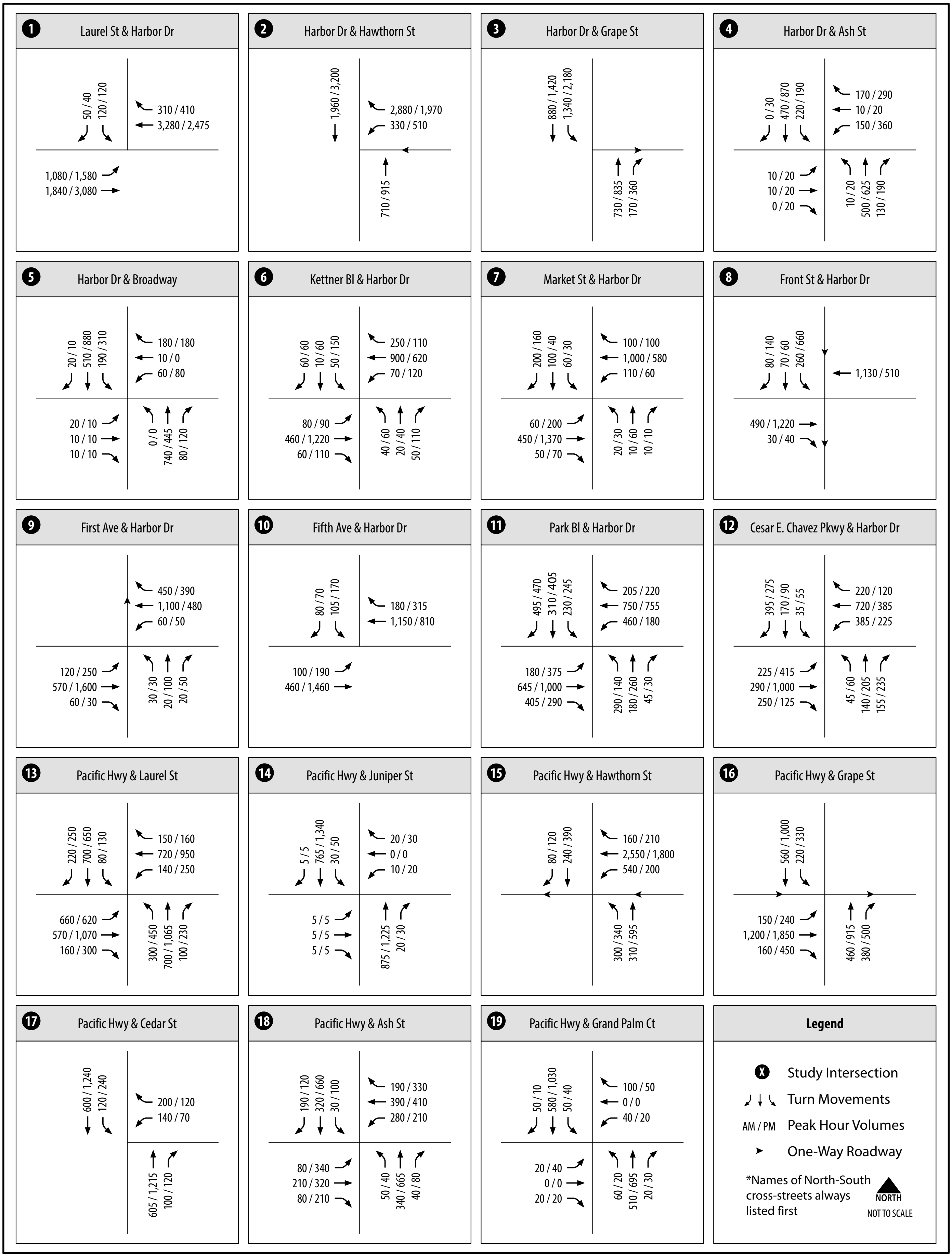


**Figure 6-4B**

**Peak Hour Intersection Traffic Volumes - Future Year 2035 Base Plus Project Conditions (Intersections 1-19)**

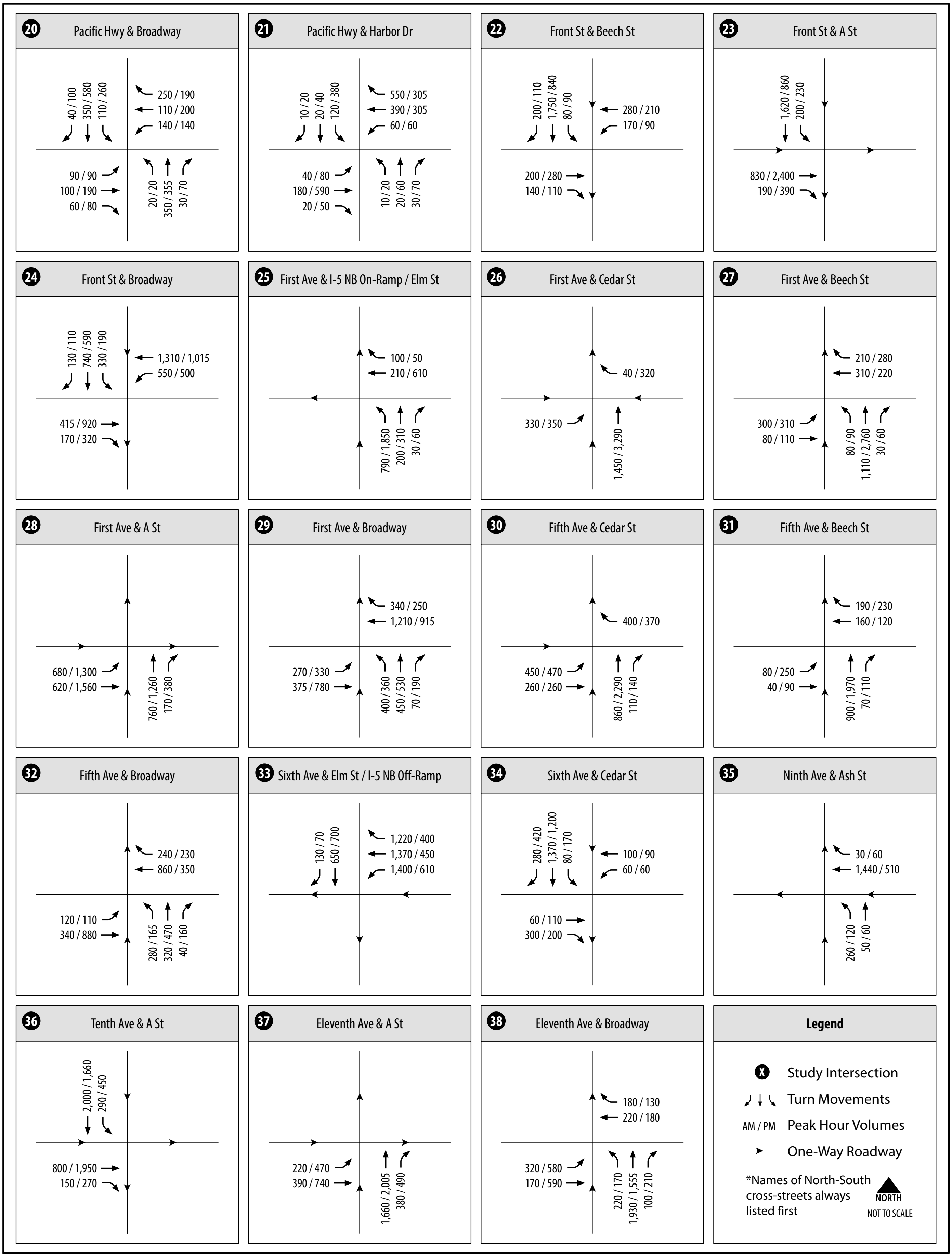


**Figure 6-4B**

**Peak Hour Intersection Traffic Volumes - Future Year 2035 Base Plus Project Conditions (Intersections 20-38)**

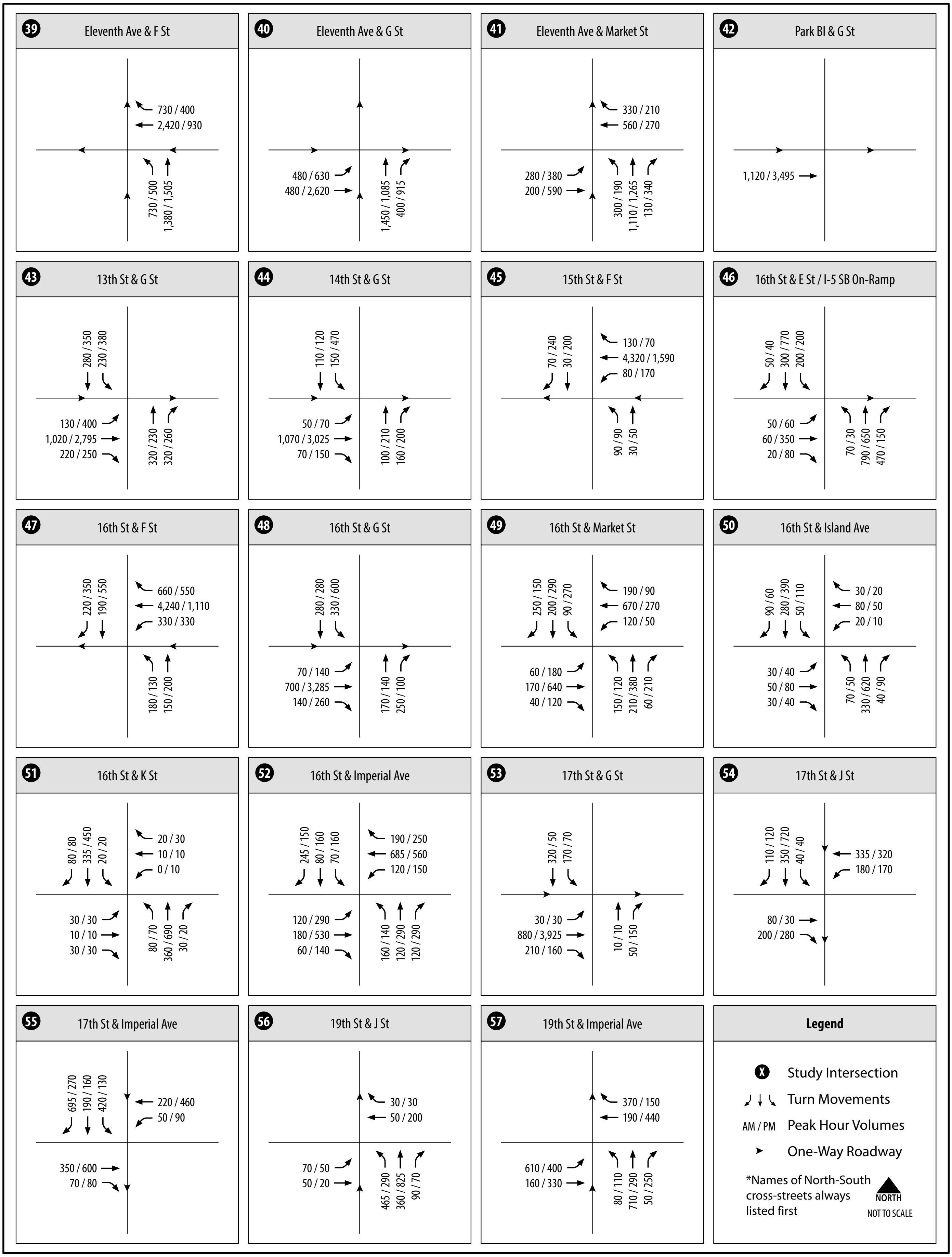
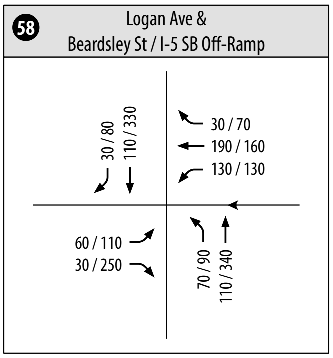
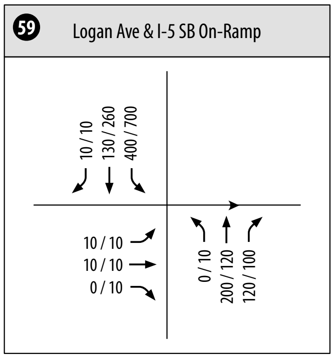


**Figure 6-4B**

**Peak Hour Intersection Traffic Volumes - Future Year 2035 Base Plus Project Conditions (Intersections 39-57)**





**Legend**

Ⓧ Study Intersection

↲ ↓ ↳ Turn Movements

AM / PM Peak Hour Volumes

➤ One-Way Roadway

*Names of North-South cross-streets always listed first

▲ NORTH
NOT TO SCALE

**Figure 6-4B**
**Peak Hour Intersection Traffic Volumes -**
**Future Year 2035 Base Plus Project Conditions (Intersections 58 and 59)**

As shown in Table 6.4, all key study roadway segments are projected to operate at LOS C or better under Future Year 2035 Base Plus Project Conditions, with the exception of Harbor Drive, between Laurel Street and Hawthorn Street, which is projected to operate at LOS F.

Harbor Drive between Laurel Street and Hawthorn Street would be significantly impacted by the Proposed Project under Near-Term Year 2021 Base Plus Project Conditions. To reduce this impact to less than significant conditions, Harbor Drive would need to be widened from a six-lane major facility to an eight-lane facility. However, this improvement is not feasible due to right-of-way constraints within the corridor. Therefore, this impact is considered to be significant and unavoidable.

### Intersection Analysis

**Table 6.5** displays intersection LOS and average vehicle delay results under Future Year 2035 Base Plus Project Conditions. LOS calculation worksheets for this scenario are provided in **Appendix I**.

Table 6.5 Peak Hour Intersection LOS Results – Future Year 2035 Base Plus Project Conditions

| # | Intersection | AM Peak Hour |  | PM Peak Hour |  | Delay w/o Project (sec) AM/PM | LOS w/o Project AM/PM | Change in Delay (sec) AM/PM | Significant Impact? |
|---|---|---|---|---|---|---|---|---|---|
|  |  | Avg. Delay (sec.) | LOS | Avg. Delay (sec.) | LOS |  |  |  |  |
| 1 | Harbor Drive & Laurel Street | 133.4 | F | 109.8 | F | 132.2 / 109.0 | F / F | 1.2 / 0.8 | N / N |
| 2 | Harbor Drive & Hawthorn Street | 52.2 | D | 33.4 | C | 52.1 / 31.5 | D / C | 0.1 / 1.9 | N / N |
| 3 | Harbor Drive & Grape St | 20.2 | C | 73.5 | E | 20.0 / 62.5 | B / E | 0.2 / 11.0 | N / N |
| 4 | Harbor Drive & Ash Street | 19.1 | B | 50.5 | D | 19.1 / 50.5 | B / D | 0.0 / 0.0 | N / N |
| 5 | Harbor Drive & Broadway | 30.2 | C | 82.9 | F | 31.3 / 87.6 | C / F | -1.1 / -4.7 | N / N |
| 6 | Harbor Drive & Kettner Boulevard | 20.5 | C | 41.4 | D | 20.5 / 40.4 | C / D | 0.0 / 1.0 | N / N |
| 7 | Harbor Drive & Market Street | 34.5 | C | 23.4 | C | 34.3 / 22.4 | C / C | 0.2 / 1.0 | N / N |
| 8 | Harbor Drive & Front Street | 33.6 | C | 16.5 | B | 30.6 / 15.7 | C / B | 3.0 / 0.8 | N / N |
| 9 | First Street & Harbor Drive | 18.7 | B | 40.3 | D | 18.7 / 37.9 | B / D | 0.0 / 2.4 | N / N |
| 10 | Harbor Drive & Fifth Avenue | 21.6 | C | 26.0 | C | 21.3 / 24.6 | C / C | 0.3 / 1.4 | N / N |
| 11 | Park Boulevard & Harbor Drive | 58.3 | E | 62.3 | E | 49.4 / 42.7 | D / D | 8.9 / 19.6 | N / N |
| 12 | Cesar Chavez Parkway & Harbor Drive | 35.9 | D | 119.1 | F | 23.3 / 134.0 | C / F | 3.6 / -14.9 | N / N |
| 13 | Pacific Highway & Laurel Street | 101.9 | F | 143.5 | F | 101.9 / 143.5 | F / F | 0.0 / 0.0 | N / N |
| 14 | Pacific Highway & Juniper Street | 8.3 | A | 8.6 | A | 8.3 / 8.6 | A / A | 0.0 / 0.0 | N / N |
| 15 | Pacific Highway & Hawthorn Street | 45.3 | D | 32.4 | C | 44.6 / 31.4 | D / C | 0.7 / 1.0 | N / N |
| 16 | Pacific Highway & Grape Street | 51.2 | D | 80.5 | F | 51.2 / 79.7 | D / E | 0.0 / 0.8 | N / N |
| 17 | Pacific Highway & Cedar Street | 13.9 | B | 43.0 | D | 13.9 / 40.6 | B / D | 0.0 / 2.4 | N / N |
| 18 | Pacific Highway & Ash Street | 65.7 | E | 50.2 | D | 66.7 / 50.1 | E / D | -1.0 / 0.1 | N / N |

Table 6.5 Peak Hour Intersection LOS Results – Future Year 2035 Base Plus Project Conditions

| # | Intersection | AM Peak Hour |  | PM Peak Hour |  | Delay w/o Project (sec) AM/PM | LOS w/o Project AM/PM | Change in Delay (sec) AM/PM | Significant Impact? |
|---|---|---|---|---|---|---|---|---|---|
|  |  | Avg. Delay (sec.) | LOS | Avg. Delay (sec.) | LOS |  |  |  |  |
| 19 | Pacific Highway & Grand Palm Court | 17.9 | B | 25.8 | C | 17.9 / 24.9 | B / C | 0.0 / 0.9 | N / N |
| 20 | Pacific Highway & Broadway | 32.9 | C | 38.8 | D | 32.9 / 38.8 | C / D | 0.0 / 0.0 | N / N |
| 21 | Pacific Highway & Harbor Drive | 22.8 | C | 27.0 | C | 22.8 / 25.9 | C / C | 0.0 / 1.1 | N / N |
| 22 | Front Street & Beech Street | 162.1 | F | 25.4 | C | 162.1 / 25.4 | F / C | 0.0 / 0.0 | N / N |
| 23 | Front Street & A Street | 21.5 | C | 62.7 | E | 21.5 / 62.7 | C / E | 0.0 / 0.0 | N / N |
| 24 | Front Street & Broadway | 55.5 | E | 144.3 | F | 52.5 / 140.2 | D / F | 3.0 / 4.1 | N / Y |
| 25 | First Avenue & I-5 NB On-Ramp/Elm Street | 7.0 | A | 6.4 | A | 7.0 / 6.4 | A / A | 0.0 / 0.0 | N / N |
| 26 | First Avenue & Cedar Street | 7.3 | A | 8.1 | A | 7.3 / 8.1 | A / A | 0.0 / 0.0 | N / N |
| 27 | First Avenue & Beech Street | 32.3 | C | 125.4 | F | 32.3 / 125.4 | C / F | 0.0 / 0.0 | N / N |
| 28 | First Avenue & A Street | 10.1 | B | 92.3 | F | 10.1 / 92.3 | B / F | 0.0 / 0.0 | N / N |
| 29 | First Avenue & Broadway | 148.8 | F | 86.7 | F | 147.3 / 84.5 | F / F | 1.5 / 2.2 | N / Y |
| 30 | Fifth Avenue & Cedar Street | 23.1 | C | 19.9 | B | 23.1 / 19.9 | C / B | 0.0 / 0.0 | N / N |
| 31 | Fifth Avenue & Beech Street | 17.5 | B | 39.4 | D | 17.5 / 39.4 | B / D | 0.0 / 0.0 | N / N |
| 32 | Fifth Avenue & Broadway | 19.9 | B | 47.2 | D | 19.8 / 47.2 | B / D | 0.1 / 0.0 | N / N |
| 33 | Sixth Avenue & Elm Street/I-5 NB Off-Ramp | 15.6 | B | 8.5 | A | 15.6 / 8.5 | B / A | 0.0 / 0.0 | N / N |
| 34 | Sixth Avenue & Cedar Street | 57.4 | E | 19.5 | B | 57.4 / 19.5 | E / B | 0.0 / 0.0 | N / N |
| 35 | Ninth Street & Ash Street | 12.8 | B | 10.3 | B | 12.8 / 10.3 | B / B | 0.0 / 0.0 | N / N |
| 36 | Tenth Avenue & A Street | 24.2 | C | 42.8 | D | 24.2 / 42.8 | C / D | 0.0 / 0.0 | N / N |
| 37 | Eleventh Avenue & A Street | 26.9 | C | 37.6 | D | 26.7 / 34.3 | C / C | 0.2 / 3.3 | N / N |
| 38 | Eleventh Avenue & Broadway | 32.6 | C | 100.3 | F | 29.9 / 95.9 | C / F | 2.7 / 4.4 | N / Y |
| 39 | Eleventh Avenue & F Street | 75.2 | E | 42.8 | D | 70.7 / 38.7 | E / D | 4.5 / 4.1 | N / N |
| 40 | Eleventh Avenue & G Street | 13.2 | B | 157.6 | F | 13.2 / 152.6 | B / F | 0.0 / 5.0 | N / Y |
| 41 | Eleventh Avenue & Market Street | 54.3 | D | 100.0 | F | 48.8 / 88.6 | D / F | 5.5 / 11.4 | N / Y |
| 42 | Park Boulevard & G Street | 9.4 | A | 134.8 | F | 9.2 / 130.8 | A / F | 0.2 / 4.0 | N / Y |
| 43 | 13th Street & G Street | 62.1 | E | 373.7 | F | 59.5 / 369.3 | E / F | 2.6 / 4.4 | N / Y |
| 44 | 14th Street & G Street | 10.8 | B | 302.2 | F | 10.8 / 297.6 | B / F | 0.0 / 4.6 | N / Y |
| 45 | 15th Street & F Street | >500 | F | 606.4 | F | >500 / 554.6 | F / F | N/A / 51.8 | Y / Y |
| 46 | 16th Street & E Street | 188.5 | F | 60.8 | E | 188.5 / 60.8 | F / E | 0.0 / 0.0 | N / N |
| 47 | 16th Street & F Street | 156.7 | F | 58.0 | E | 153.5 / 52.6 | F / D | 3.2 / 5.4 | Y / N |
| 48 | 16th Street & G Street | 13.3 | B | 290.3 | F | 13.1 / 286.7 | B / F | 0.2 / 3.6 | N / Y |
| 49 | 16th Street & Market Street | 17.1 | B | 35.6 | D | 17.1 / 35.6 | B / D | 0.0 / 0.0 | N / N |
| 50 | 16th Street & Island Avenue | 15.2 | C | 89.5 | F | 15.2 / 89.5 | C / F | 0.0 / 0.0 | N / N |
| 51 | 16th Street & K Street | 24.4 | C | 63.4 | F | 21.5 / 47.7 | C / E | 2.9 / 15.7 | N / Y |
| 52 | Imperial Avenue & 16th Street | 26.0 | C | 126.7 | F | 21.9 / 80.5 | C / F | 4.1 / 46.2 | N / Y |
| 53 | 17th Street & G Street | 263.2 | F | >500 | F | 263.2 / >500 | F / F | 0.0 / N/A | N / Y |

Table 6.5 Peak Hour Intersection LOS Results – Future Year 2035 Base Plus Project Conditions

| # | Intersection | AM Peak Hour Avg. Delay (sec.) | AM Peak Hour LOS | PM Peak Hour Avg. Delay (sec.) | PM Peak Hour LOS | Delay w/o Project (sec) AM/PM | LOS w/o Project AM/PM | Change in Delay (sec) AM/PM | Significant Impact? |
|---|---|---|---|---|---|---|---|---|---|
| 54 | 17th Street & J Street | 14.2 | B | 18.9 | B | 13.5 / 17.1 | B / B | 0.7 / 1.8 | N / N |
| 55 | Imperial Avenue & 17th Street | 14.8 | B | 11.0 | B | 14.0 / 10.6 | B / B | 0.8 / 0.4 | N / N |
| 56 | 19th Street & J Street | 18.3 | C | 135.9 | F | 16.3 / 140.7 | C / F | 2.0 / -4.8 | N / N |
| 57 | Imperial Avenue & 19th Street | 26.7 | C | 22.0 | C | 23.3 / 22.0 | C / C | 3.4 / 0.0 | N / N |
| 58 | Logan Avenue & I-5 SB Off-Ramp | 13.0 | B | 79.5 | F | 13.0 / 79.5 | B / F | 0.0 / 0.0 | N / N |
| 59 | Logan Avenue & I-5 SB On-Ramp | 169.8 | F | >500 | F | 169.8 / >500 | F / F | 0.0 / 0.0 | N / N |

*Source: Chen Ryan Associates; February 2017*

As shown, the following intersections are projected to operate at LOS F conditions under Future Year 2035 Base Plus Project Conditions:

**AM Peak**

- Harbor Drive & Laurel Street
- Harbor Drive & Ash Street
- Park Boulevard & Harbor Drive
- Pacific Highway & Laurel Street
- Front Street & Beech Street
- First Avenue & Broadway
- 15th Street & F Street
- 16th Street & E Street
- 16th Street & F Street
- 17th Street & G Street
- Logan Avenue & I-5 SB On-Ramp

**PM Peak**

- Harbor Drive & Laurel Street
- Harbor Drive & Broadway
- Caesar Chavez Parkway & Harbor Drive
- Pacific Highway & Laurel Street
- Pacific Highway & Grape Street
- Front Street & Broadway
- First Avenue & Beech Street
- First Avenue & A Street
- First Avenue & Broadway
- Eleventh Avenue & Broadway
- Eleventh Avenue & G Street
- Eleventh Avenue & Market Street
- Park Boulevard & G Street
- 13th Street & G Street
- 14th Street & G Street
- 15th Street & F Street
- 16th Street & G Street
- 16th Street & Island Avenue
- 16th Street & K Street
- Imperial Avenue & 16th Street
- 17th Street & G Street
- 19th Street & J Street
- Logan Avenue & I-5 SB Off-Ramp
- Logan Avenue & I-5 SB On-Ramp

Based upon the significance criteria presented in Section 2.5 of this report, significant traffic related impacts are associated with the Proposed Project under Future Year 2035 Base Plus Project Conditions at the following intersections (Intersections operating at LOS F which the Proposed Project will add more than 2.0 seconds of delay to):

**AM Peak**

- Harbor Drive & Laurel Street
- Harbor Drive & Ash Street
- Park Boulevard & Harbor Drive
- 16th Street & F Street
- 17th Street & G Street

**PM Peak**

- Harbor Drive & Laurel Street
- Front Street & Broadway
- First Avenue & Broadway
- Eleventh Avenue & Broadway
- Eleventh Avenue & G Street
- Eleventh Avenue & Market Street
- 16th Street & Island Avenue
- 16th Street & K Street
- Imperial Avenue & 16th Street

At the following intersections, delay is longer than the calculation capacity of the traffic analysis software. However, the addition of project traffic will likely result in a significant impact:

**AM Peak**

- 15th Street & F Street

**PM Peak**

- 17th Street & G Street

### Freeway Analysis

**Table 6.6** displays the LOS results from the freeway mainline segment analysis under Future Year 2035 Base Plus Project Conditions.

Table 6.6 Freeway Mainline Analysis – Future Year 2035 Base Plus Project Conditions

| Freeway / State Highway | Segment | ADT | Direction | AM Peak Hour | | | | | PM Peak Hour | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Peak Hour Volume | V/C Ratio | LOS | Δ | S? | Peak Hour Volume | V/C Ratio | LOS | Δ | S? |
| I-5 | Grape Street to First Avenue | 175,200 | NB | 9,920 | 1.055 | F | 0.011 | Y | 5,800 | 0.617 | C | 0.007 | N |
| | | | SB | 5,870 | 0.624 | C | 0.007 | N | 8,650 | 0.920 | E | 0.009 | N |
| | First Avenue to SR-163 | 225,300 | NB | 13,660 | 1.453 | F | 0.012 | Y | 7,980 | 0.849 | D | 0.006 | N |
| | | | SB | 8,080 | 0.688 | C | 0.005 | N | 11,920 | 1.014 | F | 0.008 | Y |
| | SR-163 and B Street | 232,300 | NB | 13,610 | 0.965 | E | 0.008 | N | 7,950 | 0.564 | C | 0.004 | N |
| | | | SB | 8,060 | 0.572 | C | 0.005 | N | 11,880 | 0.843 | D | 0.008 | N |
| | B Street to SR-94 | 232,300 | NB | 13,650 | 1.452 | F | 0.012 | Y | 7,980 | 0.849 | D | 0.008 | N |
| | | | SB | 8,080 | 0.860 | D | 0.008 | N | 11,910 | 1.267 | F | 0.010 | Y |
| | SR-94 to Imperial Avenue | 189,500 | NB | 12,230 | 1.041 | F | 0.010 | Y | 7,150 | 0.609 | C | 0.006 | N |
| | | | SB | 7,240 | 0.616 | C | 0.006 | N | 10,670 | 0.908 | E | 0.008 | N |
| | Imperial Avenue to SR-75 | 186,500 | NB | 12,010 | 1.022 | F | 0.005 | N | 7,020 | 0.597 | C | 0.003 | N |
| | | | SB | 7,110 | 0.605 | C | 0.003 | N | 10,480 | 0.892 | E | 0.005 | N |

*Source: Chen Ryan Associates; February 2017*

Notes:
The capacity, Directional split, Peak hour % and Heavy vehicle % are assumed to be the same as Existing Conditions.
**Bold** letter indicates substandard LOS E or F.
Δ = Change in V/C Ratio.
S? = Indicates if change in V/C ratio is significant

As shown, all study area freeway mainline segments operate at LOS D or better, with the exception of the following:

- I-5 Northbound, between Grape Street and First Avenue (LOS F, AM Peak)
- I-5 Southbound, between Grape Street and First Avenue (LOS E, PM Peak)
- I-5 Northbound, between First Avenue and SR-163 (LOS F, AM Peak)
- I-5 Southbound, between First Avenue and SR-163 (LOS E, PM Peak)
- I-5 Northbound, between SR-163 and B Street (LOS E, AM Peak)
- I-5 Northbound, between B Street and SR-94 (LOS F, AM Peak)
- I-5 Southbound, between B Street and SR-94 (LOS F, PM Peak)
- I-5 Northbound, between SR-94 to Imperial Avenue (LOS F, AM Peak)
- I-5 Southbound, between SR-94 to Imperial Avenue (LOS E, PM Peak)
- I-5 Northbound, between Imperial Avenue to SR-75 (LOS F, AM Peak)
- I-5 Southbound, between Imperial Avenue to SR-75 (LOS E, PM Peak)

Based on the City of San Diego's Significance Criteria, outlined in Section 2.5, the traffic associated with the Proposed Project would cause a significant change in the V/C ratio (add more than 0.010 for LOS E or 0.005 for LOS F) to the following segments would be impacted by the Proposed Project:

- I-5 Northbound, between Grape Street and First Avenue (LOS F, AM Peak)

- I-5 Northbound, between First Avenue and SR-163 (LOS F, AM Peak)
- I-5 Northbound, between B Street and SR-94 (LOS F, AM Peak)
- I-5 Southbound, between B Street and SR-94 (LOS F, PM Peak)
- I-5 Northbound, between SR-94 to Imperial Avenue (LOS F, AM Peak)

## 6.5 Impact Significance and Mitigation

**Roadway Segments**

Harbor Drive between Laurel Street and Hawthorn Street would be significantly impacted by the Proposed Project under Near-Term Year 2021 Base Plus Project Conditions. To reduce this impact to less than significant conditions, Harbor Drive would need to be widened from a six-lane major facility to an eight-lane facility. However, this improvement is not feasible due to right-of-way constraints within the corridor. Therefore, this impact is considered to be significant and unavoidable.

**Intersections**

The following mitigation measures are proposed at the intersections impacted by the Proposed Project under Future Year 2035 Base Plus Project Conditions.

24. *Front Street & Broadway* – This intersection was identified as failing in the Downtown Community Plan with no feasible mitigation identified to improve operations. Therefore, the Downtown Community Plan EIR identified the future impacts to this intersection to be significant and unavoidable. To maintain consistency with the vision of the Downtown Community Plan no project related improvements are recommended at this intersection.

29. *First Street & Broadway* – This intersection was identified as failing in the Downtown Community Plan with no feasible mitigation identified to improve operations. Therefore, the Downtown Community Plan EIR identified the future impacts to this intersection to be significant and unavoidable. To maintain consistency with the vision of the Downtown Community Plan no project related improvements are recommended at this intersection.

38. *Eleventh Avenue & Broadway* – This intersection was identified as failing in the Downtown Community Plan with no feasible mitigation identified to improve operations. Therefore, the Downtown Community Plan EIR identified the future impacts to this intersection to be significant and unavoidable. To maintain consistency with the vision of the Downtown Community Plan no project related improvements are recommended at this intersection.

40. *Eleventh Avenue & G Street* – Convert on-street parking to a travel lane on G Street between 11th Avenue and 17th Street during the PM peak hour. This improvement ultimately serves as a partial mitigation for the intersection under build out of the plan, with no feasible mitigation identified. Therefore, to remain consistent with the Downtown Community Plan it is recommended that the project pay its fair-share (1%) of the improvement cost as its mitigation. However, the intersection is controlled by the City of San Diego and the District does not have jurisdiction over it; therefore, the impact is considered significant and unavoidable.

41. *Eleventh Avenue & Market Street* – This intersection was identified as failing in the Downtown Community Plan with no feasible mitigation identified to improve operations. Therefore, the Downtown Community Plan EIR identified the future impacts to this intersection to be significant and unavoidable. To maintain consistency with the vision of the Downtown Community Plan no project related improvements are recommended at this intersection.

42. *Park Boulevard & G Street* – Convert on-street parking to a travel lane on G Street between 11th Avenue and 17th Street during the PM peak hour. This improvement was identified to fully mitigate the intersection performance under build out of the plan. Therefore, to remain consistent with the Downtown Community Plan it is recommended that the project pay its fair-share (2%) of the improvement cost as its mitigation. However, the intersection is controlled by the City of San Diego and the District does not have jurisdiction over it; therefore, the impact is considered significant and unavoidable.

43. *13th Street & G Street* – Convert on-street parking to a travel lane on G Street between 11th Avenue and 17th Street during the PM peak hour. This improvement ultimately serves as a partial mitigation for the intersection under build out of the plan, with no feasible mitigation identified. Therefore, to remain consistent with the Downtown Community Plan it is recommended that the project pay its fair-share (1%) of the improvement cost as its mitigation. However, the intersection is controlled by the City of San Diego and the District does not have jurisdiction over it; therefore, the impact is considered significant and unavoidable.

44. *14th Street & G Street* – Converting the on-street parking to a travel lane on G Street between 11th Avenue and 17th Street during the PM peak hour is recommended at this intersection by the Downtown Community plan. This improvement ultimately serves as a partial mitigation for the intersection under build out of the plan, with no feasible mitigation identified. Therefore, to remain consistent with the Downtown Community Plan it is recommended that the project pay its fair-share (3% based on the Near-Term Impact) of the improvement cost as its mitigation. However, the intersection is controlled by the City of San Diego and the District does not have jurisdiction over it; therefore, the impact is considered significant and unavoidable.

45. *15th Street & F Street* – Signalization of the intersection is recommended by the Downtown Community plan. This improvement ultimately serves as a partial mitigation for the intersection under build out of the plan, with no feasible mitigation identified. Therefore, to remain consistent with the Downtown Community Plan it is recommended that the project pay its fair-share (4% based on the Near-Term Impact) of the improvement cost as its mitigation. However, the intersection is controlled by the City of San Diego and the District does not have jurisdiction over it; therefore, the impact is considered significant and unavoidable.

47. *16th Street & F Street* – This intersection was identified as failing in the Downtown Community Plan with no feasible mitigation identified to improve operations. Therefore, the Downtown Community Plan EIR identified the future impacts to this intersection to be significant and unavoidable. To maintain consistency with the vision of the Downtown Community Plan no project related improvements are recommended at this intersection.

48. *16th Street & G Street* - Convert on-street parking to a travel lane on G Street between 11th Avenue and 17th Street during the PM peak hour is recommended at this intersection by the Downtown Community Plan. This improvement ultimately serves as a partial mitigation for the intersection under build out of the plan, with no feasible mitigation identified. Therefore, to remain consistent with the Downtown Community Plan it is recommended that the project pay its fair-share (2% Based on the Near-Term Impact) of the improvement cost as its mitigation. However, the intersection is controlled by The City of San Diego and the District does not have jurisdiction over it; therefore, the impact is considered significant and unavoidable.

51 *16th Street & K Street* - Signalization at this intersection is recommended by the Downtown Community Plan. This improvement was identified to fully mitigate the intersection performance under build out of the plan. Therefore, to remain consistent with the Downtown Community Plan it is recommended that the project pay its fair-share (9% based on the Near-Term impact) of the improvement cost as its mitigation. However, the intersection is controlled by the City of San Diego and the District does not have jurisdiction over it; therefore, the impact is considered significant and unavoidable.

52. *Imperial & 16th Street* – Re-stripe the northbound and southbound approaches of the intersection to include an exclusive right turn-lane in each direction. This improvement will reduce the intersection delay to 74.8 seconds and the intersection will operate at acceptable LOS E, during the PM peak hour, reducing the impact to less than significant conditions. The Proposed Project would have a fair-share responsibility for this improvement of 18%. However, the intersection is controlled by the City of San Diego and the Port District does not have jurisdiction over it; therefore, the impact is considered significant and unavoidable. It should also be noted that this improvement is not included in the Downtown Community Plan. However, the intersection is controlled by the City of San Diego and the District does not have jurisdiction over it; therefore, the impact is considered significant and unavoidable.

53. *17th Street & G Street* - Signalization of the intersection is recommended by the Downtown Community Plan. This improvement ultimately serves as a partial mitigation for the intersection under build out of the plan, with no feasible mitigation identified. Therefore, to remain consistent with the Downtown Community Plan it is recommended that the project pay its fair-share (2% based on the Near-Term impact) of the improvement cost as its mitigation. However, the intersection is controlled by the City of San Diego and the District does not have jurisdiction over it; therefore, the impact is considered significant and unavoidable.

**Freeway**

Based on the City of San Diego's Significance Criteria, outlined in Section 2.5, the traffic associated with the Proposed Project would cause a significant change in the V/C ratio (add more than 0.010 for LOS E or 0.005 for LOS F) to the following key study mainline freeway mainline segment:

- I-5 Northbound, between Grape Street and First Avenue
- I-5 Northbound, between First Avenue and SR-163
- I-5 Northbound, between B Street and SR-94

- I-5 Southbound, between B Street and SR-94
- I-5 Northbound, between SR-94 to Imperial Avenue

The San Diego Forward Plan includes a series of operational improvements along I-5 between I-15 and I-8, which would encompass this segment. However, these improvements are not scheduled until Year 2050. These improvements are also subject to budget availability and coordination with Caltrans. The Proposed Project could provide a fair-share contribution towards a program or plan for the aforementioned freeway facility improvements to be constructed:

- I-5 Northbound, between Grape Street and First Avenue – 34% (based on the Near-Term Impact) of the total cost for improvements to this segment.
- I-5 Northbound, between First Avenue and SR-163 – 5% of the total cost for improvements to this segment.
- I-5 Northbound, between B Street and SR-94 – 7% of the total cost for improvements to this segment.
- I-5 Southbound, between B Street and SR-94 – 7% of the total cost for improvements to this segment.
- I-5 Northbound, between SR-94 to Imperial Avenue – 4% of the total cost for improvements to this segment.

At the moment, there is no program in place into which the District could pay its fair-share towards the cost of such improvements. Therefore, improvements are considered infeasible and the impacts along I-5 and would remain significant and unavoidable.

# 7.0 Pedestrian, Bicycle and Transit Assessment

This chapter discusses the project's potential impacts to active transportation modes (bicycling and walking) and transit.

## 7.1 Pedestrians

Pedestrian facilities along study roadway segments include the following:

- Harbor Drive, between West G Street and Pacific Highway – Sidewalks and a pedestrian promenade run along the west side of this segment; however, sidewalks are intermittent along the east side.
- Harbor Drive, between Pacific Highway and Kettner Boulevard – Sidewalks are present along both sides of this segment.
- Harbor Drive, between Market Street and Front Street – A sidewalk is present along the south side of this segment. The Martin Luther King Promenade runs parallel to Harbor Drive along the north side of this segment.
- Harbor Drive, between First Avenue and Convention Center Court – A sidewalk is present along the Convention Center frontage road, just south of Harbor Drive. The Martin Luther King Promenade runs parallel to Harbor Drive along the north side of this segment.
- Harbor Drive, between Fifth Avenue and Park Boulevard - A sidewalk is present along the Convention Center frontage road, just south of Harbor Drive. East of the Convention Center, a sidewalk is present along the south side of Harbor Drive. The Martin Luther King Promenade runs parallel to Harbor Drive along the north side of this segment.
- Harbor Drive, south of Park Boulevard – Intermittent sidewalks are present along both sides of Harbor Drive, south of Park Boulevard.
- Pacific Highway, between W. G Street and Harbor Drive – Sidewalks are present along both sides of this segment.

## 7.2 Bicyclists

As shown in the figure to the right, a Class I bicycle path runs through the project site, between the waterfront and the west side of the Convention Center. A second Class I facility is located to the east of the project site, along the railroad right-of-way. Harbor Drive carries a Class III bike route between Pacific Highway and 4th Avenue, before transitioning to a pair of Class II bicycle lanes to the south. In the northern portion of the project study area, a Class II bicycle path runs along the San Diego Bayfront adjacent to Harbor Drive, connecting Point Loma to Pacific Highway, while a Class III bike route runs along Pacific Highway north of Harbor Drive.

## 7.3 Transit

There are currently two transit stations located near the project study area:

- Convention Center Station
- Gaslamp Quarter Station

These stations provide service for the MTS Green Line, Blue Line and Orange Line Trollies. The following four MTS Bus Routes also serve the project study area: 4, 11, 901, and 929.

In addition to the aforementioned transit services, the following services are provided within the project study area:

**Ferry** – provides service between the City of Coronado and the Convention Center.

**Water Taxi** – provides services in the areas of Downtown San Diego, Coronado, and Point Loma in the San Diego Bay.

## 7.4 Impact Significance and Mitigation

Potential impacts relating to pedestrian, bicycle and transit circulation would be considered significant if the Proposed Project would substantially increase hazards due to a design feature, or would conflict with the adopted policies, plans, or programs supporting alternative transportation, as outlined in Appendix G of the *California Environmental Quality Act (CEQA) Guidelines*. The project is not proposing to make any improvements to roadways or other transportation related facilities. Therefore, the Proposed Project would not conflict with or generate any significant impacts to existing pedestrian, bicycle or transit facilities, nor to planned facilities and policies included in the following documents:

- San Diego Forward Plan
- Downtown Mobility Plan
- The City of San Diego Bicycle Master Plan
- The City of San Diego Pedestrian Master Plan
- 2050 Regional Transportation Plan
- Riding to 2050, the San Diego Regional Bike Plan

# 8.0 Site Access and Parking

This chapter addresses access to the project site and assesses the projected parking demand of the Proposed Project.

## 8.1 Site Access

The project site shall have one access point along Convention Way. The access point is shared with an adjacent hotel (Hilton), as well as service access to the San Diego Convention Center. The Fifth Avenue Landing project proposes to create two new driveways to access a planned parking structure, which shall replace the three driveways in its current location. The relocation of the project driveways will not impact the access to the adjacent hotel or San Diego Convention Center since it will still provide full access to both project sites. Based upon review of the project site plan and conditions in the field, the following comment on site access is offered:

- The Proposed Project driveway location is acceptable and sight distance at this driveway would be adequate.

On-site circulation was reviewed to determine whether any elements of the site design would cause operational or safety issues. This includes a review of parking lots, circulating aisles and potential conflict points between various travel modes.

The proposed hotel site will be bordered to the north by a single internal roadway that connects the project land uses. The internal roadway provides access to a parking structure located between the proposed hotel and low-cost visor serving hotel, and will offer approximately 263 onsite parking spaces. Access to the parking structure will be via two driveways located on the north side of the structure.

Based upon an initial review of the project circulation plan, the main conflict points between vehicular and bicycle/pedestrian traffic will occur at the two project driveway locations and within the pick-up/drop off area. Minimal conflicts will also occur within the east parking lot and in the subterranean structure, as hotel patrons walk from their car to the hotel. These conflicts are not substantial and therefore no further recommendations are provided.

## 8.2 Parking

Per the *Tidelands Parking Guidelines, San Diego Unified Port District, January 5, 2001*, regarding hotel land uses, the minimum parking requirement is 0.5 spaces per room. Based on the 850 proposed hotel rooms, the project is required to provide 425 on-site parking stalls. Hostel land uses are shown to require a total of 0.0625 spaces per bed[1]. Based on the 565 beds proposed for the lower-cost visitor serving hotel, a total of 36 parking spaces are required. Marina land uses, which require a 0.33 parking spaces per slip, shall require an additional 20 parking spaces.

---

[1] Hostel parking rate based on City of San Francisco Municipal Code.

**Table 8.1** summarizes the required number of parking spaces in which the Proposed Project must provide for automobiles.

Table 8.1 Unadjusted Parking Spaces Required

| Land Use | Units | Rate | Min # of Auto Spaces (Base) |
|---|---|---|---|
| Hotel | 850 Rooms | 0.5 / Room | 425 |
| Hostel | 565 Beds | 0.0625 / Bed[1] | 36 |
| Marina | 64 slips | 0.33 / Slip | 21 |
| | | Total | 482 |

Source: Tidelands Parking Guidelines, San Diego Unified Port District, January 5, 2001

Note:

[1]Rate from City of San Francisco Municipal code

As shown, a total of 482 parking spaces are required, prior to the application of further adjustment factors from the Tidelands Parking Guidelines.

### Parking Demand Rate

Further adjustment factors were applied to the parking demand rate for the Proposed Project based on Tables 1 and 2 of the *Tidelands Parking Guidelines – San Diego Unified Port District January 5, 2001*. **Table 8.2** displays the unadjusted demand rate for a hotel, hostel, and marina land use, as well as the assumed adjustment factors used to develop the final adjusted parking demand rate. The adjustment factors are based on Proposed Project features as well as the Proposed Project location.

Table 8.2 Parking Rate Adjustments

| Adjustment | Adjustment Reason | Percent | Change (Spaces) |
|---|---|---|---|
| Parking Rate (Unadjusted) | Per Table 1 of the Tidelands Parking Guidelines | 100% | 482 |
| Proximity to Transit | The Proposed Project is located within 0.25 miles of the Gaslamp Quarter Trolley Station. | -12% | -58 |
| Access to Airport | The Proposed Project does not have access the airport. | 0% | 0 |
| Shared Parking Potential | The Proposed Project does not intend to rely on outside parking options. | 0% | 0 |
| Proximity to Public Waterfront Amenities for Public Access | The Proposed Project is located along the waterfront and has direct access to the Embarcadero Promenade. | 20% | 96 |
| Displacement of Existing Parking | The Proposed Project will not displace any existing parking. | 0% | 0 |
| Existing Parking Shortfall/Surplus | This will be determined via this parking analysis. | 0% | 0 |
| Employee Trip Reduction Programs | The project proposed to park all employees off site. | 0% | 0 |

Table 8.2 Parking Rate Adjustments

| Adjustment | Adjustment Reason | Percent | Change (Spaces) |
|---|---|---|---|
| Dedicated Airport Shuttle Service | An airport shuttle is not proposed. | 0% | 0 |
| Dedicated Water Transportation Service | 48 additional boat slips will be added as a project feature. | -10% | -48 |
| | | Total Adjusted Rate | 472 |

*Source: Tidelands Parking Guidelines – San Diego Unified Port District January 5, 2001*

As shown, based on the project location and proposed features, the parking demand rate reduced by 10 spaces to 472 spaces required.

### Reduced Hotel Parking Demand

With the recent developments in ride-share and transportation technology such Uber and Lyft, the Downtown area has experienced an overall decrease in parking demand for Hotels and other visitor serving uses over the past few years. These technologies and changes in travel patterns could not be accounted for in the Tidelands Parking Guidelines, which was developed in 2001. Therefore, to gain a better understanding of the actual parking demand for hotels within the area, ACE Parking provided the total and average overnight parking demand for five similar hotels adjacent to the project site. **Table 8.3** displays the hotels that were included in the study, their total number of rooms, the average overnight parking demand (based on Year 2015) and the correlating parking demand per room. The parking information provided by ACE Parking is included in **Appendix J**.

Table 8.3 Adjacent Hotel Parking Demand

| Hotel | Number of Rooms | Average Overnight Parking Demand | Spaces Needed Per Room |
|---|---|---|---|
| Hilton Bayfront | 1,190 | 314 | 0.26 |
| Marriott Marquis | 1,362 | 355 | 0.26 |
| Grand Hyatt | 1,625 | 364 | 0.22 |
| Omni | 511 | 78 | 0.15 |
| Hard Rock | 418 | 70 | 0.17 |
| Total | 5,106 | 1,182 | 0.23 |

*Source: Ace Parking, November 2016*

As shown in Table 8.3, the hotels adjacent to the project site experienced a parking demand rate of 0.23 spaces per hotel room during year 2015. This is less than half of what is required by the Tidelands Parking Guidelines. Therefore, a subsequent parking analysis was performed for the project site using this lower parking demand rate. **Table 8.4** summarizes the required number of parking spaces in which the Proposed Project must provide for automobiles, assuming the reduced hotel parking demand rate.

Table 8.4 Unadjusted Parking Spaces Required – Reduced Hotel Parking Demand

| Land Use | Units | Rate | Min # of Auto Spaces (Base) |
|---|---|---|---|
| Hotel | 850 Rooms | 0.23 / Room | 196 |
| Hostel | 565 Beds | 0.0625 / Bed[1] | 36 |
| Marina | 64 slips | 0.33 / Slip | 21 |
| | | Total | 253 |

Source: Tidelands Parking Guidelines, San Diego Unified Port District, January 5, 2001

Note:

[1] Rate from City of San Francisco Municipal code

**Table 8.5** displays the unadjusted demand rate for a hotel, hostel, and marina land use, as well as the assumed adjustment factors used to develop the final adjusted parking demand rate. The adjustment factors are based on Proposed Project features as well as the Proposed Project location.

Table 8.5 Parking Rate Adjustments – Reduced Hotel Parking Demand

| Adjustment | | Percent | Change |
|---|---|---|---|
| Parking Rate (Unadjusted) | Per Table 1 of the Tidelands Parking Guidelines | 100% | 253 |
| Proximity to Transit | The Proposed Project is located within 0.25 miles of the Gaslamp Quarter Trolley Station. | -12% | -30 |
| Access to Airport | The Proposed Project does not have access the airport. | 0% | 0 |
| Shared Parking Potential | The Proposed Project does not intend to rely on outside parking options. | 0% | 0 |
| Proximity to Public Waterfront Amenities for Public Access | The Proposed Project is located along the waterfront and has direct access to the Embarcadero Promenade. | 20% | 50 |
| Displacement of Existing Parking | The Proposed Project will not displace any existing parking. | 0% | 0 |
| Existing Parking Shortfall/Surplus | This will be determined via this parking analysis. | 0% | 0 |
| Employee Trip Reduction Programs | The project proposed to park all employees off site. | 0% | 0 |
| Dedicated Airport Shuttle Service | An airport shuttle is not proposed. | 0% | 0 |
| Dedicated Water Transportation Service | 48 additional boat slips will be added as a project feature. | -10% | -25 |
| | | Total Adjusted Rate | 248 |

*Source: Tidelands Parking Guidelines – San Diego Unified Port District January 5, 2001*

### Impact Significance and Mitigation

Based on the rates and methods outlined in the *Tidelands Parking Guidelines – San Diego Unified Port District January 5, 2001,* the Proposed Project will have a parking demand of 472 spaces. This results in a total parking deficit of 209 parking spaces during its highest demand period.

As displayed in Table 8.3, the parking demand at hotels adjacent to the Proposed Project site was observed to be below the rates contained in the Tideland Parking Guidelines (0.23 spaces per room compared to 0.5 spaces per room). When using the lower hotel parking demand, the Proposed Project would require 248 on-site parking spaces, resulting in no deficit of parking spaces due to the 263 on-site parking spaces proposed by the project.

However, it is recommended that the project implements a Parking Management Plan that provides parking management strategies to help reduce its overall demand. The following additional measures should be considered to help reduce the parking demand of the Proposed Project:

- Transportation Network Companies – Coordinate with companies (such as Lyft, Uber, etc.) and permit them to pickup/drop-off near the project entrance, to encourage patrons to utilize this mode of transportation as an alternative to driving their personal vehicle.

- Valet Parking – Secure additional parking spaces and provide this service in order to avoid overflow in the immediate surrounding parking areas.

- Water Taxi –Applicant shall coordinatewith a water taxi company to encourage patrons to utilize water taxis as an alternative to driving their personal vehicle.

- Bike Racks – Provide bike racks on the Proposed Project site or adjacent thereto on the promenade to encourage employees/patrons to bike to the Proposed Project.

- Bike Share Stations – Coordinate with companies like DECOBIKE to ensure a bike share station is maintained within walking distance (approximately 1,000 feet) to the Proposed Project.

- Public Transit Subsidies for Employees – Provide reimbursement or subsidies for public transportation costs for all employees.

- Big Bay Shuttle – Participate in the District's on-going shuttle program.

# 9.0 Project Construction

Construction of the Proposed Project is anticipated to begin in Year 2019 and to occur over a 24 to 30-month period. The peak of construction is anticipated to occur between May and June of Year 2020 (with Construction Phases 2.2, 2.3, 2.5, 2.6, 2.7, 3.1, 3.2, 3.3, 3.4 and 4.1 all overlapping). Analyses are provided for Existing Plus Construction Conditions and Near-Term Year 2021 Base Plus Construction Conditions, including peak roadway segment LOS and peak hour intersection LOS analyses. A freeway analysis was prepared as the construction traffic associated with the Proposed Project will generate enough traffic to trigger (150 peak hour trips along a single freeway segment) the need for a freeway analysis.

As a worst-case scenario, it was assumed that all workers would drive individual vehicles to the staging area, located on Belt Street with access at the intersection of Harbor Drive and Sampson Street, and would arrive and depart during the AM and PM peak hours, respectively. It was also assumed that the 28 delivery trucks/vans would also drive to the staging area to unload and be evenly distributed throughout the 8-hour work day (3.5 trucks to each hour, rounded to 4 trucks per hour to be conservative). **Table 9.1** displays the assumed vehicle trip generation during the peak of project construction.

Table 9.1 Project Construction Trip Generation

| Use | Units | Vehicle Conversion Rate | Rate | Daily Vehicle Trips | AM Peak Hour In | AM Peak Hour Out | PM Peak Hour In | PM Peak Hour Out |
|---|---|---|---|---|---|---|---|---|
| Construction Worker Traffic | 495 | 1 | 2 / Worker | 990 | 495 | 0 | 0 | 495 |
| Delivery Truck/van Traffic | 28 | 3 | 2 / Truck | 168 | 12 | 12 | 12 | 12 |
| | | | Total | 1,158 | 507 | 12 | 12 | 507 |

*Source: Chen Ryan Associates; February 2017*

As shown, the Proposed Project construction is anticipated to generate approximately 1,158 daily trips including 519 trips during the AM and PM peak hours.

Additionally, it is assumed that once all workers arrive to the staging area, shuttles would transport them to the project site via Harbor Drive. Also, the same amount of delivery trucks/vans that would transport construction material to the staging area was assumed to transport it to the project site. **Table 9.2** displays the assumed vehicle trip generation for the staging area during the peak of project construction.

Table 9.2 Staging Area Trip Generation

| Use | Units | Vehicle Conversion Rate | Rate | Daily Vehicle Trips | AM Peak Hour | | PM Peak Hour | |
|---|---|---|---|---|---|---|---|---|
| | | | | | In | Out | In | Out |
| Shuttles | 33[1] | 1.5 | 4 / Worker | 198 | 50 | 50 | 50 | 50 |
| Delivery Truck/van Traffic | 28 | 3 | 2 / Truck | 168 | 12 | 12 | 12 | 12 |
| Total | | | | 366 | 62 | 62 | 62 | 62 |

*Source: Chen Ryan Associates; August 2017*

*Note:*

*[1] It is assumed that 1 shuttle can accommodate 15 workers = 495 workers / 15 = 33 shuttles.*

As shown, the Proposed Project construction is anticipated to generate approximately 366 daily trips including 124 trips during the AM and PM peak hours. These trips would be added to the roadway segments along Harbor Drive between Park Boulevard and Sampson Street.

The construction traffic trip distribution is displayed in **Figure 9-1**. Construction trip distribution is based on SANDAG's *San Diego Region Major Statistical Areas*, with information provided in **Appendix K**. Project construction traffic was assigned to the roadway network based on the assumed project distribution patterns displayed in Figure 9-1. Construction trip assignment is displayed in **Figure 9-2**.

Additional traffic counts were taken in support of the construction analysis considering the use of the construction staging area for employees and equipment. Count worksheets are provided in **Appendix L**.

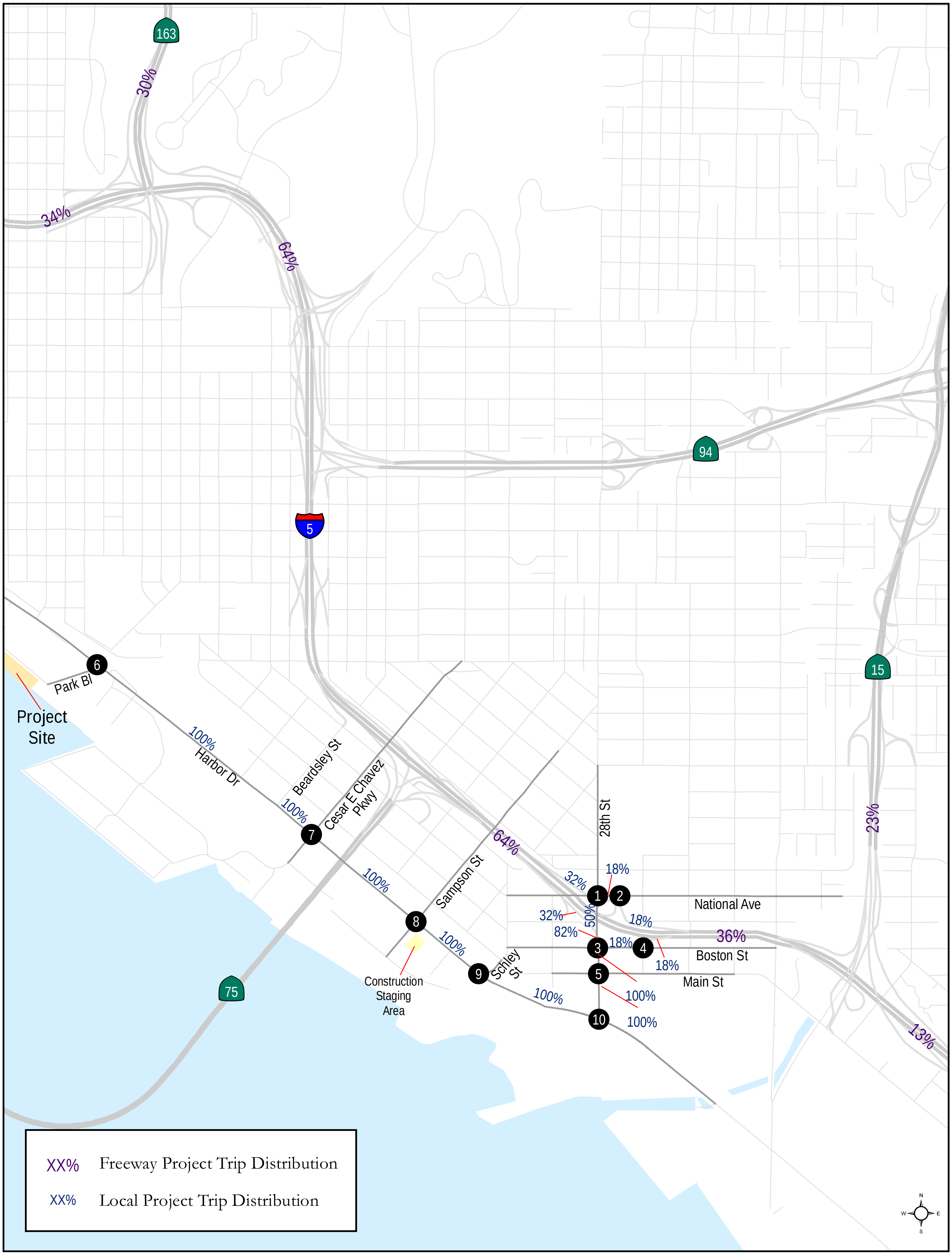
The construction analysis study area, along with Existing Conditions roadway segment and intersection geometry is displayed in **Figure 9-3**. Traffic volumes for segments and intersections under Existing Conditions are displayed in **Figure 9-4**.

### Construction Analysis – Existing Plus Construction Conditions

Roadway segment and intersection geometry under Existing Plus Construction Conditions is assumed to be identical to Existing Conditions, as depicted in Figure 9-3. Existing Plus Construction Conditions traffic volumes were developed by combining the Existing Conditions traffic volumes (Figure 9-4) with the construction trip assignment volumes (Figure 9-2). Existing Plus Construction Conditions traffic volumes for roadway segments and intersections are displayed in **Figure 9-5**.

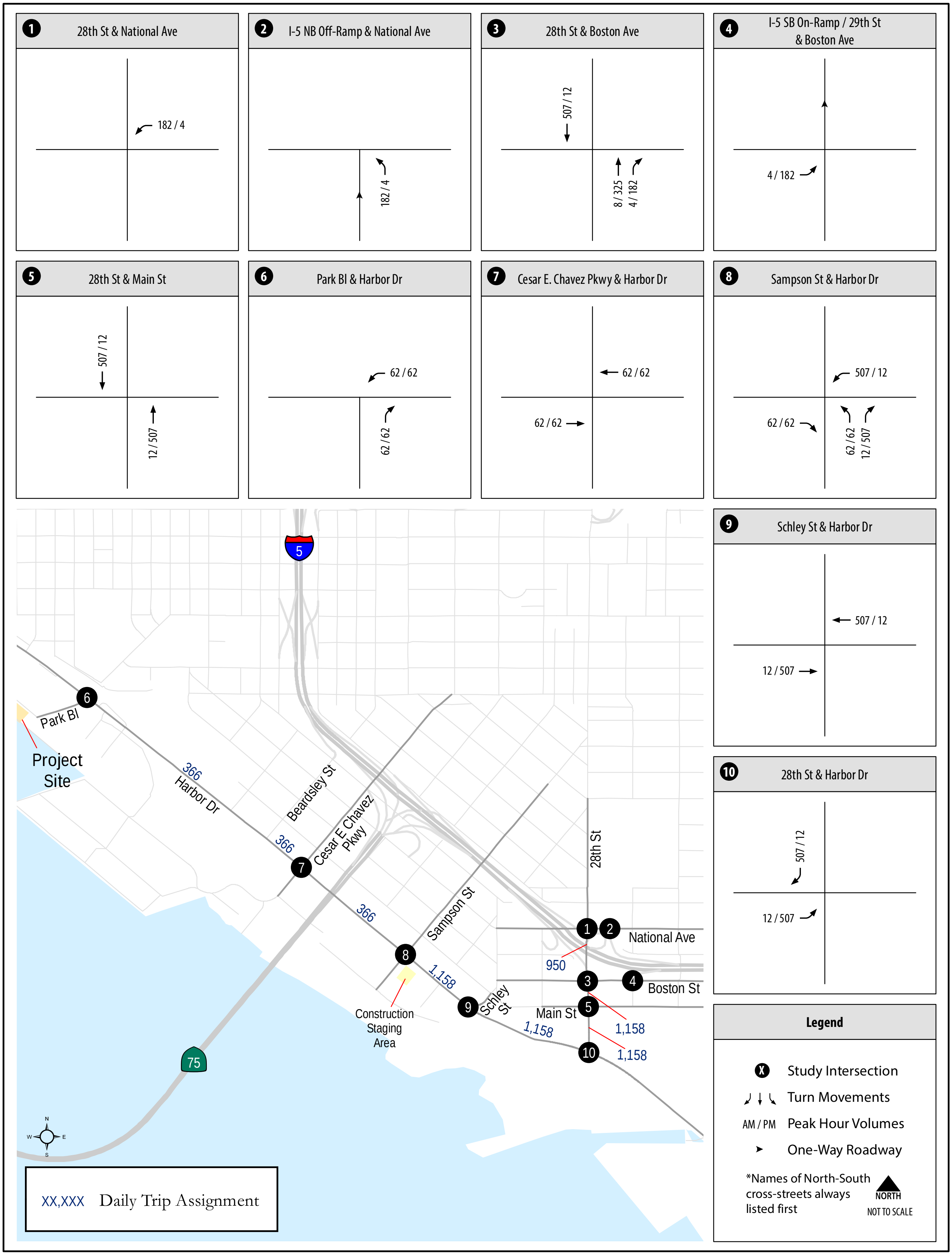
Level of service analyses with construction traffic was performed using the segment, intersection, and freeway analysis methodologies described in Chapter 2.

**Table 9.3** displays the daily roadway segment LOS results for Existing Conditions and Existing Plus Construction Conditions. As shown, all study roadway segments are projected to operate at LOS D or better under Existing Plus Construction Conditions with the exception of the roadway segment of 28th Street, between National Avenue and Boston Avenue.



*Fifth Avenue Landing Project*
*Transportation Impact Analysis*
CHEN RYAN

**Figure 9-1**
**Construction Trip Distribution**



*Fifth Avenue Landing Project*
*Transportation Impact Analysis*

CHEN✚RYAN

**Figure 9-2**
**Construction Trip Assignment**

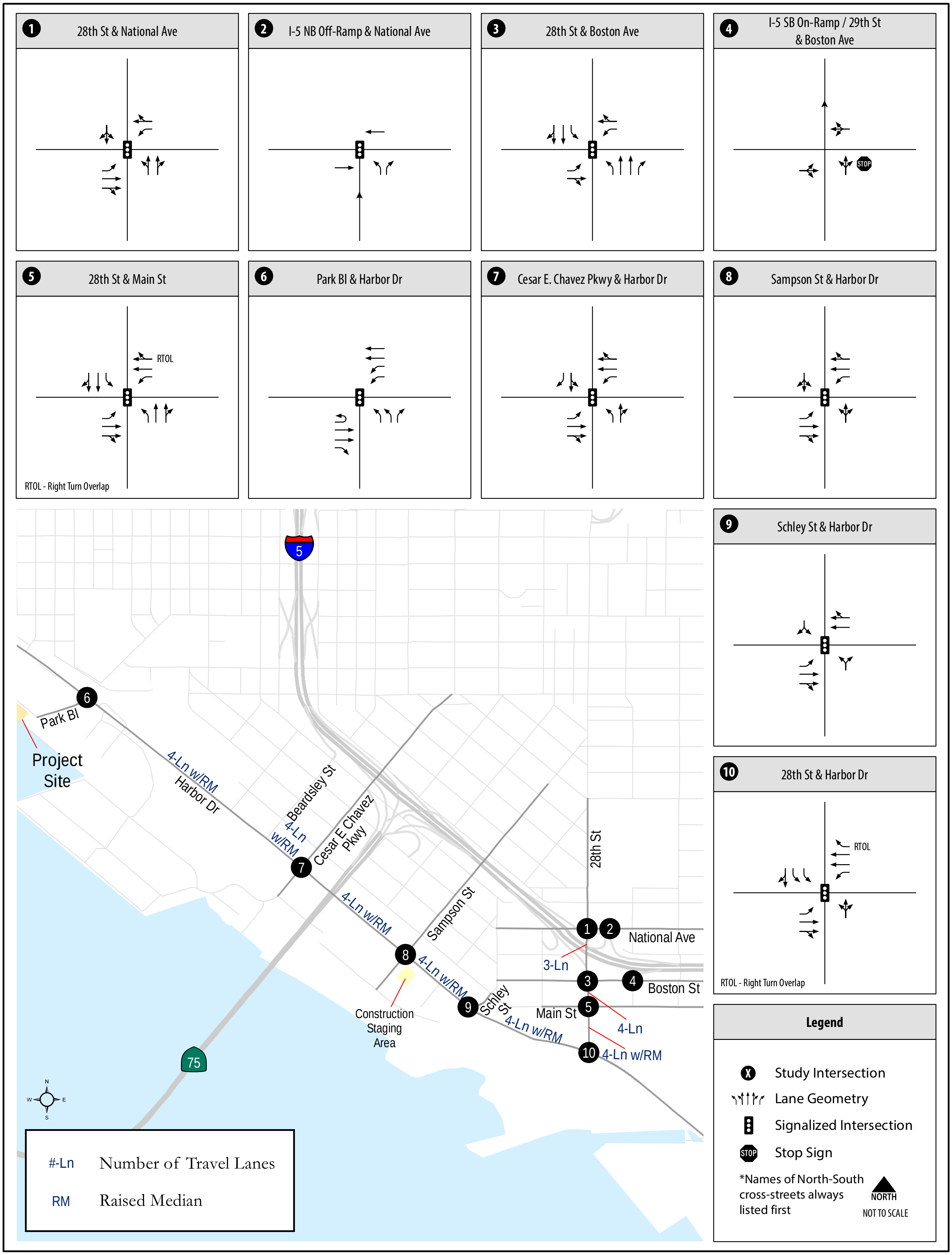


**Figure 9-3**
**Existing Roadway and Intersection Geometrics**

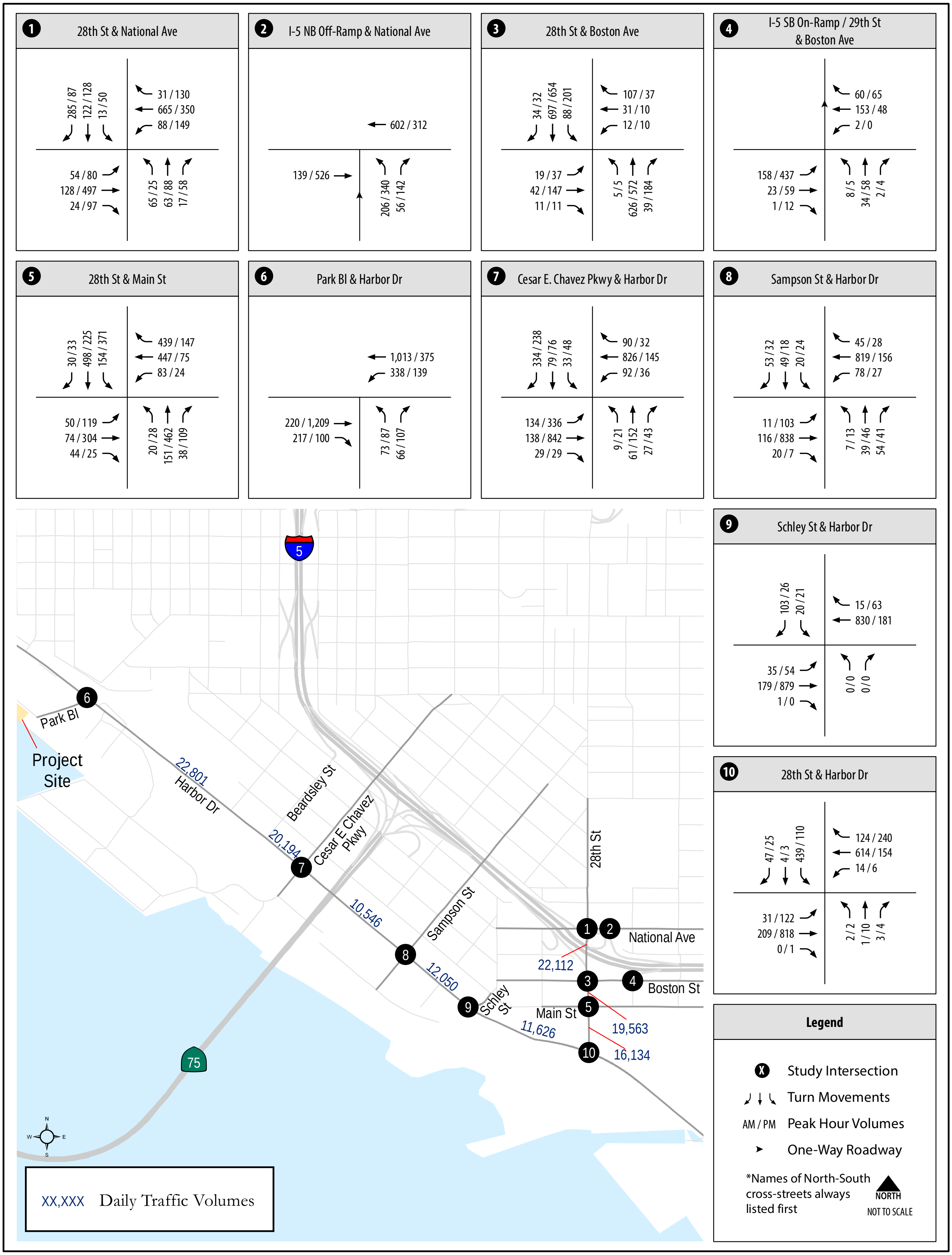
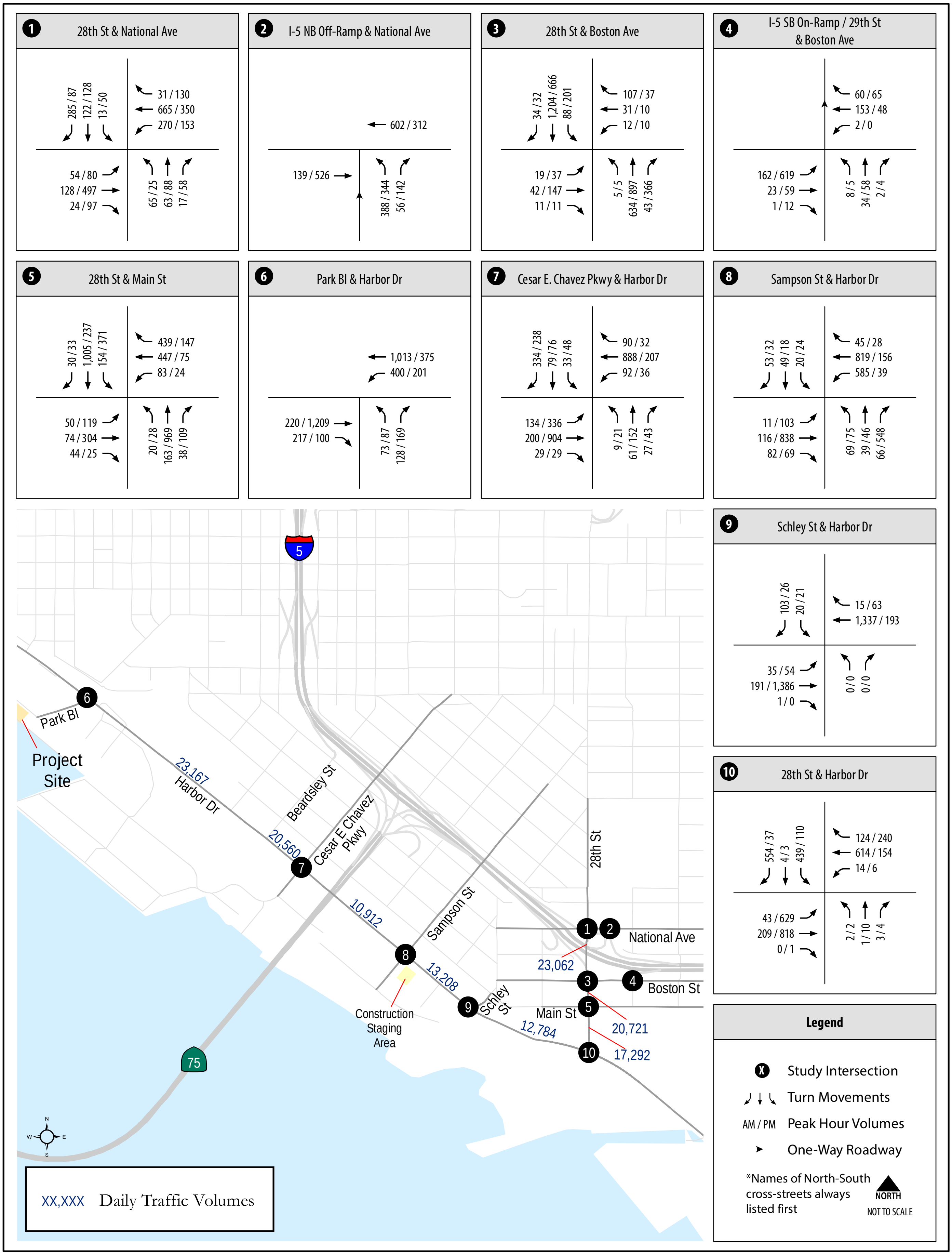


**Figure 9-4**

**Traffic Volumes - Existing Conditions**



*Fifth Avenue Landing Project*
*Transportation Impact Analysis*
CHEN RYAN

**Figure 9-5**
**Traffic Volumes - Existing Plus Construction Conditions**

Table 9.3 Roadway Segment LOS Results – Existing Plus Construction Conditions

| Roadway | Segment | Cross-Section | Threshold (LOS E) | Existing Conditions + Construction | | | Existing Conditions | Δ | Sig? |
|---|---|---|---|---|---|---|---|---|---|
| | | | | ADT | V/C | LOS | ADT / V/C / LOS | | |
| Harbor Drive | Between Park Boulevard and Beardsley Street | 4-Ln w/ RM | <40,000 | 23,167 | 0.580 | C | 22,801 / 0.570 / C | 0.010 | N |
| | Between Beardsley Street and Cesar Chavez Parkway | 4-Ln w/ RM | <40,000 | 20,560 | 0.514 | B | 20,194 / 0.505 / B | 0.009 | N |
| | Between Cesar Chavez Parkway and Sampson Street | 4-Ln w/ RM | <40,000 | 10,912 | 0.273 | A | 10,546 / 0.264 / A | 0.009 | N |
| | Between Sampson Street and Schley Street | 4-Ln w/ RM | <40,000 | 13,208 | 0.330 | A | 12,050 / 0.301 / A | 0.029 | N |
| | Between Schley Street and 28th Street | 4-Ln w/ RM | <40,000 | 12,784 | 0.320 | A | 11,626 / 0.291 / A | 0.029 | N |
| 28th Street | Between National Avenue and Boston Avenue | 3-Ln | <22,500 | 23,062 | 1.025 | F | 22,112 / 0.983 / E | 0.042 | Y |
| | Between Boston Avenue and Main Street | 4-Ln | <30,000 | 20,721 | 0.691 | D | 19,563 / 0.652 / C | 0.039 | N |
| | Between Main Street and Harbor Drive | 4-Ln w/RM | <40,000 | 17,292 | 0.432 | B | 16,134 / 0.403 / B | 0.029 | N |

*Source: Chen Ryan Associates; February 2017*

Notes:
V/C = Volume to Capacity Ratio.
RM = Raised Median
SM = Striped Median

Based upon the significance criteria presented in Section 2.5 of this report, significant traffic related impacts are associated with the Proposed Project under Existing Plus Construction Conditions at the following roadway segment (Roadway Segments operating at LOS E or F which the Proposed Project will increase its v/c ratio by more than 0.02 or 0.01, respectively:

- 28th Street, between National Avenue and Boston Avenue.

**Table 9.4** displays intersection LOS and average vehicle delay results for both Existing Conditions and Existing Plus Construction Conditions. LOS calculation worksheets are provided in **Appendix M**.

### Table 9.4 Peak Hour Intersection LOS Results – Existing Plus Construction Conditions

| # | Intersection | AM Peak Hour Avg. Delay (sec.) | AM Peak Hour LOS | PM Peak Hour Avg. Delay (sec.) | PM Peak Hour LOS | Existing Delay (sec.) AM/PM | Existing LOS AM/PM | Change in Delay (sec.) AM/PM | Significant Impact? |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 28th Street & National Avenue | 34.4 | C | 19.9 | B | 32.9 / 19.6 | C / B | 1.5 / 0.3 | N / N |
| 2 | I-5 NB Off-Ramp & National Avenue | 50.2 | D | 37.2 | D | 32.3 / 36.8 | C / D | 17.9 / 0.4 | N / N |
| 3 | 28th Street & Boston Avenue | 11.2 | B | 14.8 | B | 10.2 / 13.2 | B / B | 1.0 / 1.6 | N / N |
| 4 | I-5 SB On-Ramp & Boston Avenue | 21.6 | C | 324.8 | F | 21.2 / 61.1 | C / F | 0.4 / 263.7 | N / Y |
| 5 | 28th Street & Main Street | 21.0 | C | 34.9 | C | 16.9 / 24.7 | B / C | 4.1 / 10.2 | N / N |
| 6 | Park Boulevard & Harbor Drive | 39.6 | D | 16.0 | B | 21.2 / 14.5 | C / B | 18.4 / 1.5 | N / N |
| 7 | Cesar Chavez Parkway & Harbor Drive | 20.4 | C | 21.4 | C | 19.9 / 20.7 | B / C | 0.5 / 0.7 | N / N |
| 8 | Sampson Street & Harbor Drive | 70.7 | E | 99.0 | F | 18.6 / 17.6 | B / B | 52.1 / 81.4 | Y / Y |
| 9 | Schley Street & Harbor Drive | 10.7 | B | 5.6 | A | 9.7 / 4.8 | A / A | 1.0 / 0.8 | N / N |
| 10 | 28th Street & Harbor Drive | 19.7 | B | 27.9 | C | 18.0 / 15.3 | B / B | 1.7 / 12.6 | N / N |

*Source: Chen Ryan Associates; August 2017*

As shown in Table 9.4, all key study intersections are projected to operate at acceptable LOS D or better under Existing Plus Construction Conditions, with the exception of the following:

**AM Peak:**

- Sampson Street & Harbor Drive

**PM Peak:**

- I-5 SB On-Ramp & Boston Avenue
- Sampson Street & Harbor Drive

Based upon the significance criteria presented in Section 2.5 of this report, significant traffic related impacts are associated with the Proposed Project under Existing Plus Construction Conditions at the following intersections (Intersections operating at LOS F which the Proposed Project will add more than 2.0 of delay to):

**AM Peak:**

- Sampson Street & Harbor Drive

**PM Peak:**

- I-5 SB On-Ramp & Boston Avenue
- Sampson Street & Harbor Drive

**Table 9.5** displays the LOS results from the freeway mainline segment analysis under Existing Plus Project Construction Conditions. As shown in Table 9.5, all study area freeway mainline segments operate at LOS D or better, with the exception of the following:

- I-5 Northbound, between Grape Street and First Avenue (LOS E, AM Peak)
- I-5 Northbound, between First Avenue and SR-163 (LOS F, AM Peak)
- I-5 Northbound, between B Street and SR-94 (LOS F, AM Peak)
- I-5 Southbound, between B Street and SR-94 (LOS F, PM Peak)
- SR-163 Northbound, South of Robinson Avenue (LOS E, AM Peak)
- SR-163 Northbound, South of Robinson Avenue (LOS F, PM Peak)
- SR-163 Southbound, South of Robinson Avenue (LOS F, AM Peak)

### Table 9.5 Freeway Mainline Analysis – Existing Plus Project Construction Conditions

| Freeway / State Highway | Segment | Existing ADT | E+P ADT | Direction | AM Peak Hour | | | | | PM Peak Hour | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Peak Hour Volume | V/C Ratio | LOS | Δ | S? | Peak Hour Volume | V/C Ratio | LOS | Δ | S? |
| I-5 | Grape Street to First Avenue | 169,000 | 169,400 | NB | 8,720 | 0.928 | E | 0.002 | N | 5,090 | 0.541 | C | 0.001 | N |
| | | | | SB | 5,160 | 0.549 | C | 0.001 | N | 7,610 | 0.810 | D | 0.003 | N |
| | First Avenue to SR-163 | 213,000 | 213,400 | NB | 10,980 | 1.168 | F | 0.002 | N | 6,420 | 0.683 | C | 0.001 | N |
| | | | | SB | 6,500 | 0.553 | C | 0.001 | N | 9,580 | 0.815 | D | 0.001 | N |
| | SR-163 and B Street | 223,000 | 223,700 | NB | 11,510 | 0.816 | D | 0.002 | N | 6,730 | 0.477 | B | 0.001 | N |
| | | | | SB | 6,810 | 0.483 | B | 0.001 | N | 10,040 | 0.712 | D | 0.002 | N |
| | B Street to SR-94 | 223,000 | 223,700 | NB | 11,510 | 1.224 | F | 0.003 | N | 6,730 | 0.716 | D | 0.002 | N |
| | | | | SB | 6,810 | 0.724 | D | 0.002 | N | 10,050 | 1.069 | F | 0.004 | N |
| | SR-94 to Imperial Avenue | 173,000 | 173,700 | NB | 8,940 | 0.761 | D | 0.004 | N | 5,220 | 0.444 | B | 0.001 | N |
| | | | | SB | 5,290 | 0.450 | B | 0.001 | N | 7,800 | 0.664 | C | 0.003 | N |
| | Imperial Avenue to SR-75 | 169,000 | 169,700 | NB | 8,730 | 0.743 | D | 0.003 | N | 5,100 | 0.434 | B | 0.002 | N |
| | | | | SB | 5,170 | 0.440 | B | 0.002 | N | 7,620 | 0.649 | C | 0.003 | N |
| | SR-75 to 28th Street | 167,000 | 167,700 | NB | 9,440 | 0.773 | D | 0.004 | N | 8,490 | 0.695 | C | 0.004 | N |
| | | | | SB | 2,600 | 0.241 | A | 0.004 | N | 5,290 | 0.489 | B | 0.001 | N |
| | 28th Street to I-15 | 163,000 | 163,400 | NB | 7,900 | 0.840 | D | 0.004 | N | 8,230 | 0.876 | D | 0.003 | N |
| | | | | SB | 3,140 | 0.334 | B | 0.001 | N | 5,880 | 0.626 | C | 0.002 | N |
| SR-163 | South of Robinson Avenue | 114,000 | 114,300 | NB | 4400 | 0.936 | E | 0.002 | N | 6400 | 1.362 | F | 0.002 | N |
| | | | | SB | 6470 | 1.377 | F | 0.005 | N | 3820 | 0.813 | D | 0.002 | N |

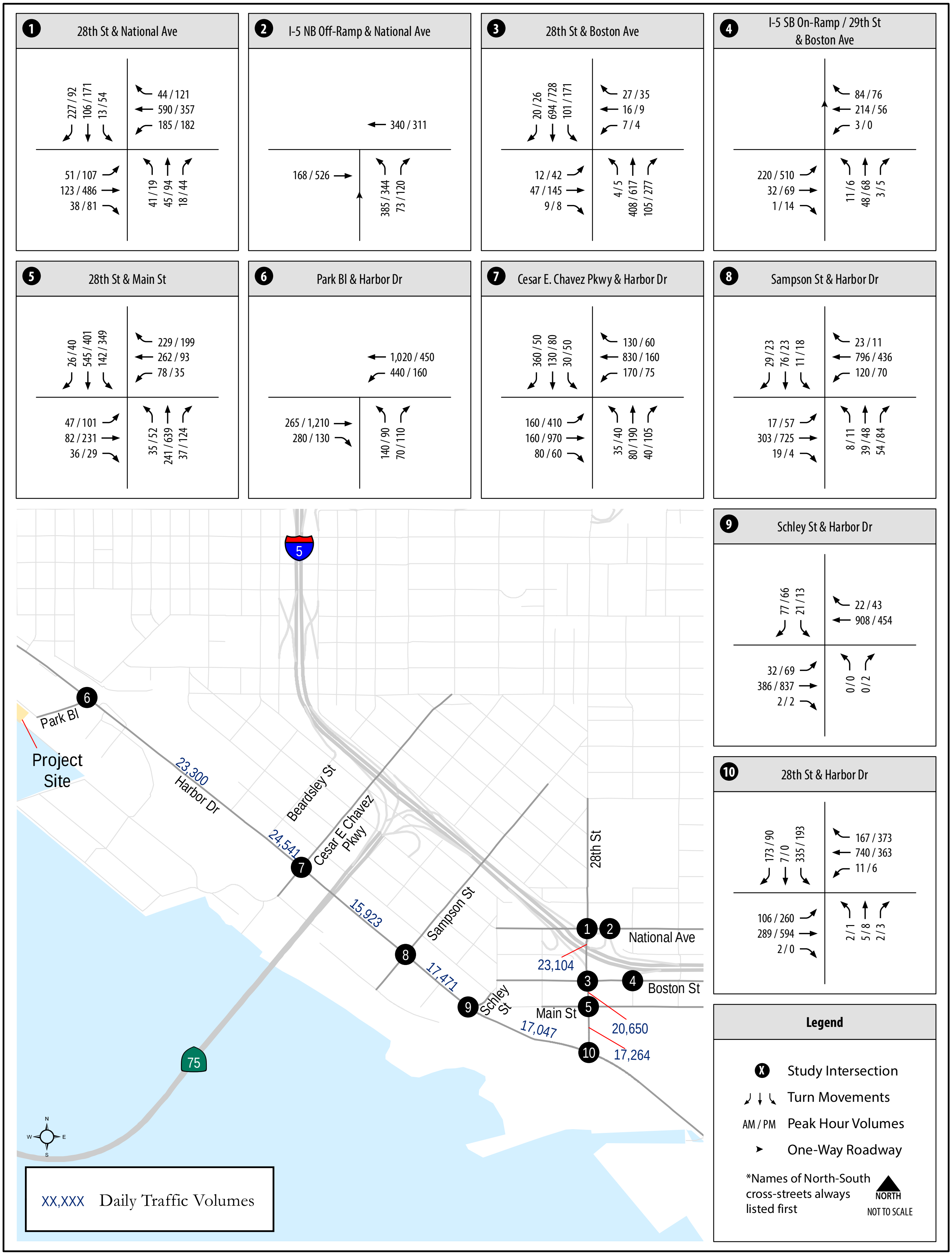
*Source: Chen Ryan Associates; August 2017*

Based on the City of San Diego's Significance Criteria, outlined in Section 2.5, the traffic associated with the Proposed Project would not cause a significant change in the V/C ratio (add more than 0.010 for LOS E or 0.005 for LOS F) to any of the analyzed freeway segments.

## Construction Analysis – Near-Term Year 2021 Base Plus Construction Conditions

Roadway segment and intersection geometry under Near-Term Year 2021 Base Plus Construction Conditions is assumed to be identical to Existing Conditions, as depicted in Figure 9-3. Near-Term Year 2021 Base traffic volumes were obtained from the *Tenth Avenue Marine Terminal Redevelopment Plan TIA* (August 2016), and are shown in **Figure 9-6**.

Near-Term Year 2021 Base Plus Construction Conditions volumes were developed by combining the Near-Term Year 2021 Base Plus Project traffic volumes (Figure 9-6), with the construction trip assignment volumes displayed in Figure 9-2. **Figure 9-7** displays Near-Term Year 2021 Base Plus Construction Conditions volumes for segments and intersections.



*Fifth Avenue Landing Project*
*Transportation Impact Analysis*

CHEN RYAN

**Figure 9-6**

**Traffic Volumes - Near-Term Year 2021 Base Conditions**

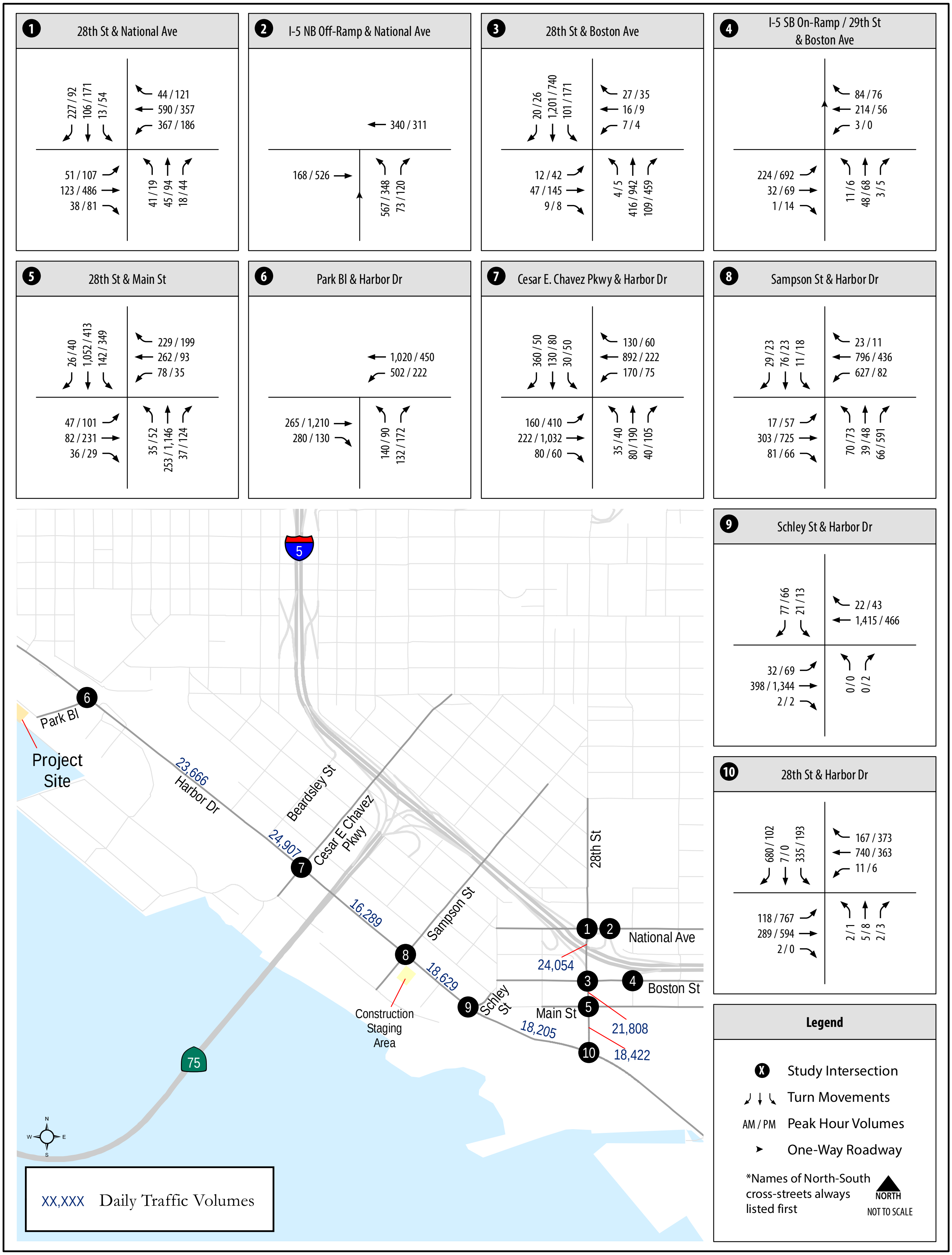


**Figure 9-7**
**Traffic Volumes -**
**Near-Term Year 2021 Base Plus Construction Conditions**

Level of service analyses with construction traffic was performed using the segment and intersection analysis methodologies described in Chapter 2. **Table 9.6** displays the daily roadway segment LOS results for Near-Term Year 2021 Base and Near-Term Year 2021 Base Plus Construction Conditions.

Table 9.6 Roadway Segment LOS Results – Near-Term Year 2021 Base Plus Construction Conditions

| Roadway | Segment | Cross-Section | Threshold (LOS E) | Near-Term Base + Construction | | | Near-Term Base Conditions | Δ | Sig? |
|---|---|---|---|---|---|---|---|---|---|
| | | | | ADT | V/C | LOS | ADT / V/C / LOS | | |
| Harbor Drive | Between Park Boulevard and Beardsley Street | 4-Ln w/ RM | <40,000 | 23,666 | 0.592 | C | 23,300 / 0.583 / C | 0.010 | N |
| | Between Beardsley Street and Cesar Chavez Parkway | 4-Ln w/ RM | <40,000 | 25,144 | 0.629 | C | 24,541 / 0.614 / C | 0.009 | N |
| | Between Cesar Chavez Parkway and Sampson Street | 4-Ln w/ RM | <40,000 | 16,289 | 0.407 | B | 15,923 / 0.398 / B | 0.009 | N |
| | Between Sampson Street and Schley Street | 4-Ln w/ RM | <40,000 | 18,629 | 0.466 | B | 17,471 / 0.437 / B | 0.029 | N |
| | Between Schley Street and 28th Street | 4-Ln w/ RM | <40,000 | 18,205 | 0.455 | B | 17,047 / 0.426 / B | 0.029 | N |
| 28th Street | Between National Avenue and Boston Avenue | 3-Ln | <22,500 | 24,054 | 1.069 | F | 23,104 / 1.027 / E | 0.042 | Y |
| | Between Boston Avenue and Main Street | 4-Ln | <30,000 | 21,808 | 0.727 | D | 20,650 / 0.688 / D | 0.039 | N |
| | Between Main Street and Harbor Drive | 4-Ln w/RM | <40,000 | 18,422 | 0.461 | B | 17,264 / 0.432 / B | 0.029 | N |

*Source: Chen Ryan Associates; August 2017*

Notes:
V/C = Volume to Capacity Ratio.
RM = Raised Median
SM = Striped Median

As shown in Table 9.4, all study roadway segments are projected to operate at LOS C or better under Near-Term Year 2021 Base Plus Construction Conditions with the exception of the roadway segment of 28th Street, between National Avenue and Boston Avenue.

Based upon the significance criteria presented in Section 2.5 of this report, significant traffic related impacts are associated with the Proposed Project under Near-Term Year 2021 Base Plus Construction Conditions at the following roadway segment (Roadway Segments operating at LOS E or F which the Proposed Project will increase its v/c ratio by more than 0.02 or 0.01, respectively):

- 28th Street, between National Avenue and Boston Avenue.

**Table 9.7** displays intersection LOS and average vehicle delay results for both Near-Term Year 2021 Base and Near-Term Year 2021 Base Plus Construction Conditions. LOS calculation worksheets are provided in **Appendix N**.

Table 9.7 Peak Hour Intersection LOS Results – Near-Term Year 2021 Base Plus Construction Conditions

| # | Intersection | AM Peak Hour | | PM Peak Hour | | Near-Term Base Delay (sec.) AM/PM | Near-Term Base LOS AM/PM | Change in Delay (sec.) AM/PM | Significant Impact? |
|---|---|---|---|---|---|---|---|---|---|
| | | Avg. Delay (sec.) | LOS | Avg. Delay (sec.) | LOS | | | | |
| 1 | 28th Street & National Avenue | 28.5 | C | 22.7 | C | 25.5 / 22.6 | C / C | 3.0 / 0.1 | N / N |
| 2 | I-5 NB Off-Ramp & National Avenue | 49.5 | D | 37.9 | D | 33.3 / 37.5 | C / D | 16.2 / 0.4 | N / N |
| 3 | 28th Street & Boston Avenue | 8.9 | A | 13.9 | B | 8.3 / 12.2 | A / B | 0.6 / 1.7 | N / N |
| 4 | I-5 SB On-Ramp & Boston Avenue | 48.6 | E | 814.0 | F | 46.8 / 165.9 | E / F | 1.8 / 648.1 | N / Y |
| 5 | 28th Street & Main Street | 15.6 | B | 41.9 | D | 13.6 / 41.0 | B / D | 2.0 / 0.9 | N / N |
| 6 | Park Boulevard & Harbor Drive | 17.4 | B | 16.2 | B | 16.3 / 14.3 | B / B | 1.1 / 1.9 | N / N |
| 7 | Cesar Chavez Parkway & Harbor Drive | 23.9 | C | 35.4 | D | 23.4 / 32.4 | C / C | 0.5 / 3.0 | N / N |
| 8 | Sampson Street & Harbor Drive | 130.5 | F | 101.8 | F | 18.5 / 19.2 | B / B | 112.0 / 82.6 | Y / Y |
| 9 | Schley Street & Harbor Drive | 9.8 | A | 7.1 | A | 7.9 / 6.8 | A / A | 1.9 / 0.3 | N / N |
| 10 | 28th Street & Harbor Drive | 30.1 | C | 54.6 | D | 21.3 / 19.2 | C / B | 8.8 / 35.4 | N / N |

*Source: Chen Ryan Associates; August 2017*

As shown in Table 9.7, all key study intersections are projected to operate at acceptable LOS D or better under Existing Plus Construction Conditions, with the exception of the following:

**AM Peak:**

- I-5 SB On-Ramp & Boston Avenue
- Sampson Street & Harbor Drive

**PM Peak:**

- I-5 SB On-Ramp & Boston Avenue
- Sampson Street & Harbor Drive

Based upon the significance criteria presented in Section 2.5 of this report, significant traffic related impacts are associated with the Proposed Project under Near-Term Year 2021 Base Plus Construction Conditions at the following intersections (Intersections operating at LOS F which the Proposed Project will add more than 2.0 of delay to):

**AM Peak:**

- Sampson Street & Harbor Drive

**PM Peak:**

- I-5 SB On-Ramp & Boston Avenue
- Sampson Street & Harbor Drive

**Table 9.8** displays the LOS results from the freeway mainline segment analysis under Near-Term Year 2021 Base Plus Project Construction Conditions.

## Table 9.8 Freeway Mainline Analysis – Near-Term Year 2021 Base Plus Project Construction Conditions

| Freeway / State Highway | Segment | NT ADT | NT + P ADT | Direction | AM Peak Hour | | | | | PM Peak Hour | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Peak Hour Volume | V/C Ratio | LOS | Δ | S? | Peak Hour Volume | V/C Ratio | LOS | Δ | S? |
| I-5 | Grape Street to First Avenue | 173,100 | 173,500 | NB | 8,930 | 0.950 | E | 0.002 | N | 5,220 | 0.555 | C | 0.001 | N |
| | | | | SB | 5,280 | 0.562 | C | 0.001 | N | 7,790 | 0.829 | D | 0.002 | N |
| | First Avenue to SR-163 | 224,900 | 225,300 | NB | 11,600 | 1.234 | F | 0.002 | N | 6,780 | 0.721 | D | 0.002 | N |
| | | | | SB | 6,860 | 0.584 | C | 0.001 | N | 10,120 | 0.861 | D | 0.001 | N |
| | SR-163 and B Street | 231,900 | 232,600 | NB | 11,970 | 0.849 | D | 0.003 | N | 6,990 | 0.496 | B | 0.002 | N |
| | | | | SB | 7,080 | 0.502 | C | 0.001 | N | 10,440 | 0.740 | D | 0.002 | N |
| | B Street to SR-94 | 231,900 | 232,600 | NB | 11,970 | 1.273 | F | 0.003 | N | 7,000 | 0.745 | D | 0.004 | N |
| | | | | SB | 7,090 | 0.754 | D | 0.003 | N | 10,440 | 1.111 | F | 0.004 | N |
| | SR-94 to Imperial Avenue | 189,100 | 189,800 | NB | 9,770 | 0.831 | D | 0.003 | N | 5,710 | 0.486 | B | 0.002 | N |
| | | | | SB | 5,780 | 0.492 | B | 0.002 | N | 8,520 | 0.725 | D | 0.002 | N |
| | Imperial Avenue to SR-75 | 185,200 | 185,900 | NB | 9,570 | 0.814 | D | 0.003 | N | 5,590 | 0.476 | B | 0.002 | N |
| | | | | SB | 5,660 | 0.482 | B | 0.002 | N | 8,350 | 0.711 | D | 0.003 | N |
| | SR-75 to 28th Street | 167,200 | 167,900 | NB | 9,450 | 0.773 | D | 0.003 | N | 8,500 | 0.696 | C | 0.004 | N |
| | | | | SB | 2,570 | 0.238 | A | 0.001 | N | 5,300 | 0.490 | B | 0.002 | N |
| | 28th Street to I-15 | 165,900 | 166,300 | NB | 8,010 | 0.852 | D | 0.001 | N | 8,370 | 0.890 | E | 0.002 | N |
| | | | | SB | 3,190 | 0.339 | B | 0.000 | N | 5,990 | 0.637 | C | 0.002 | N |
| SR-163 | South of Robinson Avenue | 118,800 | 119,100 | NB | 4,580 | 0.974 | E | 0.002 | N | 6,670 | 1.419 | F | 0.004 | N |
| | | | | SB | 6,740 | 1.434 | F | 0.002 | N | 3,980 | 0.847 | D | 0.002 | N |

*Source: Chen Ryan Associates; August 2017*

As shown in Table 9.8, all study area freeway mainline segments operate at LOS D or better, with the exception of the following:

- I-5 Northbound, between Grape Street and First Avenue (LOS E, AM Peak)
- I-5 Northbound, between First Avenue and SR-163 (LOS F, AM Peak)
- I-5 Northbound, between B Street and SR-94 (LOS F, AM Peak)
- I-5 Southbound, between B Street and SR-94 (LOS F, PM Peak)
- I-5 Northbound, between 28th Street and I-15 (LOS E, PM Peak)
- SR-163 Northbound, South of Robinson Avenue (LOS E, AM Peak)
- SR-163 Northbound, South of Robinson Avenue (LOS F, PM Peak)
- SR-163 Southbound, South of Robinson Avenue (LOS F, AM Peak)

Based on the City of San Diego's Significance Criteria, outlined in Section 2.5, the traffic associated with the Proposed Project would not cause a significant change in the V/C ratio (add more than 0.010 for LOS E or 0.005 for LOS F) to any of the analyzed freeway segments.

## Impact Significance and Mitigation

### Existing Plus Project Construction Conditions

#### Segments

The following roadway segment was identified to be significantly impacted with the addition of the project construction traffic under Existing Plus Project Construction Conditions:

- 28th Street, between National Avenue and Boston Avenue.

#### Intersections

The following intersections were identified to be significantly impacted with the addition of the project construction traffic under Existing Plus Project Construction Conditions:

**AM Peak:**

- Sampson Street & Harbor Drive

**PM Peak:**

- I-5 SB On-Ramp & Boston Avenue
- Sampson Street & Harbor Drive

The traffic related impacts associated with the construction of the proposed project would occur when the construction traffic reaches the following trip generation thresholds:

**AM Peak:**

- Sampson Street & Harbor Drive (when project reaches **90%** of its construction traffic trip generation)

**PM Peak:**

- I-5 SB On-Ramp & Boston Avenue (when project reaches **3%** of its construction traffic trip generation)
- Sampson Street & Harbor Drive (when project reaches **65%** of its construction traffic trip generation)

Since project construction conditions are temporary, no physical mitigation measures are recommended. Instead, it is recommended that a Transportation Demand Management Plan is developed to limit the number of construction worker trips that travel through the impacted intersections during peak periods. The following lists a series of TDM strategies that would be appropriate during project construction:

- Implementation of a ride-sharing program to encourage carpooling amongst workers;
- Restrict workers from accessing the project site during the AM and PM peak periods, 7:00 AM – 9:00 AM and 4:00 PM – 6:00 PM;
- Provide off-site parking locations, for staging and workers, outside of the area with shuttle services to bring them on-site; and
- Provide subsidized transit passes for construction workers.

#### Freeway Segments

None.

### Near-Term Year 2021 Base Plus Project Construction Conditions

**Segments**

The following roadway segment was identified to be significantly impacted with the addition of the project construction traffic under Near-Term Year 2021 Base Plus Project Construction Conditions:

- 28th Street, between National Avenue and Boston Avenue.

**Intersections**

The following intersections were identified to be significantly impacted with the addition of the project construction traffic under Near-Term Year 2021 Base Plus Project Construction Conditions:

**AM Peak:**

- Sampson Street & Harbor Drive

**PM Peak:**

- I-5 SB On-Ramp & Boston Avenue
- Sampson Street & Harbor Drive

The traffic related impacts associated with the construction of the proposed project would occur when the construction traffic reaches the following trip generation thresholds:

**AM Peak:**

- Sampson Street & Harbor Drive (when project reaches **66%** of its construction traffic trip generation)

**PM Peak:**

- Sampson Street & Harbor Drive (when project reaches **64%** of its construction traffic trip generation)

Since project construction conditions are temporary, no physical mitigation measures are recommended. Instead, it is recommended that a Transportation Demand Management Plan is developed to limit the number of construction worker trips that travel through the impacted intersection during peak periods. The following lists a series of TDM strategies that would be appropriate during project construction:

- Implementation of a ride-sharing program to encourage carpooling amongst workers;
- Restrict workers from accessing the project site during the AM and PM peak periods, 7:00 AM – 9:00 AM and 4:00 PM – 6:00 PM;
- Provide off-site parking locations, for staging and workers, outside of the area with shuttle services to bring them on-site; and
- Provide subsidized transit passes for construction workers.

**Freeway Segments**

None

### Construction Parking Conditions

In order to reduce temporary parking impacts during construction, construction workers will be incentivized to use public transit, and workers arriving by car shall be required to park in an off-site parking facility, located on Belt Street with access at the intersection of Harbor Drive and Sampson Street.

The identified construction impacts are projected to occur during peak hours, therefore, restricting workers from accessing the project site during the peak hours will reduce the identified impacts to a less than significant level. Also, on-street signage should be provided to direct visitors to available parking facilities during the construction period.

Technical appendices to Appendix K-1, Transportation Impact Analysis, are available for review at the San Diego Unified Port District Office of the District Clerk.

# Appendix K-2

# Below Grade Parking Alternative Trip Generation and Parking Analysis

CHEN RYAN

**TO:** Kathy Washington, ICF

**FROM:** Stephen Cook & Andrew Prescott, Chen Ryan Associates

**DATE:** 10/17/2017

**RE:** Fifth Avenue Landing – Below Grade Parking Alternative Trip Generation & Parking Analysis

---

## Overview

Construction of the Proposed Project is anticipated to begin in Year 2019 and will occur over a 24 to 30-month period. The peak of construction is anticipated to occur between May and June of Year 2020 (with Construction Phases 2.2, 2.3, 2.5, 2.6, 2.7, 3.1, 3.2, 3.3, 3.4 and 4.1 all overlapping). However, a Below Grade Parking Alternative is also proposed, which would result in changes to construction related trip generation, as well as changes to the total number of parking spaces provided. The Proposed Project requires 472 parking spaces. The Below Grade Parking Alternative will bring the total number of parking spaces to 478, resulting in a surplus of 6 spaces. The additional spaces provided by the Below Grade Parking Alternative will eliminate the parking impact disclosed in the Draft Fifth Avenue Landing TIA, no longer requiring a Parking Management Plan as a mitigation measure.

Under the Below Grade Parking Alternative, only the Excavation and Foundation Phase would experience changes to the number of trips resulting from construction. Therefore, a trip generation analysis was prepared for the Excavation and Foundation Phase to account for additional delivery and haul truck traffic associated with the Below Grade Parking Alternative. Consistent with the Draft Fifth Avenue Landing TIA construction analysis approach, all workers and trucks will initially be routed to a staging area located on Belt Street, with access at the intersection of Harbor Drive and Sampson Street. Workers will then consolidate into shuttles to be transported to the project site. Trucks will be directed to the project site when needed.

The trip generation analysis, documented in the following sections, found the Excavation and Foundation Phase will generate a total of 1,152 daily trips, which is less than the 1,524 trips generated during the previously analyzed construction phases shown to be the peak of construction (overlap of phases 2.2, 2.3, 2.5, 2.6, 2.7, 3.1, 3.2, 3.3, 3.4, and 4.1). Therefore, it can be concluded, the construction phases previously analyzed and documented in the Draft Fifth Avenue Landing TIA still represents the peak of construction, and no additional traffic analysis is required.

## Trip Generation: Previously Analyzed Peak of Construction

As a worst-case scenario, it was assumed that all workers would drive individual vehicles to the staging area, located on Belt Street with access at the intersection of Harbor Drive and Sampson Street, and would arrive and depart during the AM and PM peak hours, respectively. It was also assumed that the 28 delivery trucks/vans would be evenly distributed throughout the 8-hour work day (3.5 trucks to each hour, rounded to 4 trucks per hour to be conservative). **Table 1** displays the assumed vehicle trip generation to the staging area during the peak of project construction (with Construction Phases 2.2, 2.3, 2.5, 2.6, 2.7, 3.1, 3.2, 3.3, 3.4 and 4.1 all overlapping). As shown, the total number of daily vehicle trips generated to the staging area during the peak of project construction was found to be 1,158.

**Table 1 Proposed Project Construction Trip Generation: Origin to Staging Area**

| Use | Units | Vehicle Conversion Rate | Rate | Daily Vehicle Trips | AM Peak Hour | | PM Peak Hour | |
|---|---|---|---|---|---|---|---|---|
| | | | | | In | Out | In | Out |
| Construction Worker Traffic | 495 | 1 | 2 / Worker | 990 | 495 | 0 | 0 | 495 |
| Delivery and Haul Truck Traffic | 28 | 3 | 2 / Truck | 168 | 12 | 12 | 12 | 12 |
| **Total** | | | | **1,158** | **507** | **12** | **12** | **507** |

Source: Chen Ryan Associates (2017)

Additionally, it is assumed that all workers will arrive at the staging area, where shuttles would transport them to the project site via Harbor Drive. All delivery and haul truck traffic will initially be routed to the staging area, prior to being directed to the project site. Table 2 displays the assumed total Proposed Project vehicle trip generation, accounting for worker and truck trips to the staging area, and shuttle and truck trips between the staging area and the project site.

**Table 2 Proposed Project Construction Trip Generation**

| Use | Units | Vehicle Conversion Rate | Rate | Daily Vehicle Trips | AM Peak Hour | | PM Peak Hour | |
|---|---|---|---|---|---|---|---|---|
| | | | | | In | Out | In | Out |
| **Origin-Staging Area Trips** | | | | | | | | |
| Construction Worker Traffic | 495 | 1 | 2 / Worker | 990 | 495 | 0 | 0 | 495 |
| Delivery and Haul Truck Traffic | 28 | 3 | 2 / Truck | 168 | 12 | 12 | 12 | 12 |
| **Staging Area-Project Site Trips** | | | | | | | | |
| Shuttles | 33[1] | 1.5 | 4 / Worker | 198 | 50 | 50 | 50 | 50 |
| Delivery and Haul Truck Traffic | 28 | 3 | 2 / Truck | 168 | 12 | 12 | 12 | 12 |
| **Total** | | | | **1,524** | **569** | **74** | **74** | **569** |

Source: Chen Ryan Associates (2017)

Note:
[1] It is assumed that one shuttle can accommodate 15 workers. 495 workers / 15 = 33 shuttles

As shown, Proposed Project construction is anticipated to generate approximately 366 additional daily trips between the staging area and project site, including 124 trips during the AM and PM peak hours. These trips would be added to the roadway segments along Harbor Drive between Park Boulevard and Sampson Street. In total, the Proposed Project generates approximately 1,524 daily vehicle trips during the peak of construction.

## Trip Generation: Below Grade Parking Alternative – Excavation and Foundation Phase

As a worst-case scenario, it was assumed that all workers would drive individual vehicles to the staging area, and would arrive and depart during the AM and PM peak hours, respectively. It was also assumed that the 85 haul truck trips and 5 delivery trucks/vans would be evenly distributed throughout the 8-hour work day (11.25 trucks to each hour, rounded to 12 trucks per hour to be conservative). Table 3 displays the assumed vehicle trip generation to the staging area during the Excavation and Foundation Phase under Below Grade Parking Alternative conditions. As shown, the total number of daily vehicle trips generated to the staging area during the Excavation and Foundation Phase under Below Grade Parking Alternative conditions was found to be 600.

### Table 3 Proposed Project Construction Trip Generation: Origin to Staging Area – Below Grade Parking Alternative

| Use | Units | Vehicle Conversion Rate | Rate | Daily Vehicle Trips | AM Peak Hour | | PM Peak Hour | |
|---|---|---|---|---|---|---|---|---|
| | | | | | In | Out | In | Out |
| Construction Worker Traffic | 30 | 1 | 2 / Worker | 60 | 30 | 0 | 0 | 30 |
| Delivery and Haul Truck Traffic | 90 | 3 | 2 / Truck | 540 | 36 | 36 | 36 | 36 |
| | | | **Total** | **600** | **66** | **36** | **36** | **66** |

Source: Chen Ryan Associates (2017)

Consistent with construction of the Proposed Project, it is assumed that all workers arrive at the staging area, where shuttles would transport them to the project site via Harbor Drive. All delivery and haul truck traffic will initially be routed to the staging area, prior to being directed to the project site. Table 4 displays the assumed Below Grade Parking Alternative Excavation and Foundation Phase vehicle trip generation, accounting for worker and truck trips to the staging area, and shuttle and truck trips between the staging area and the project site.

### Table 4 Proposed Project Trip Generation – Below Grade Parking Alternative

| Use | Units | Vehicle Conversion Rate | Rate | Daily Vehicle Trips | AM Peak Hour | | PM Peak Hour | |
|---|---|---|---|---|---|---|---|---|
| | | | | | In | Out | In | Out |
| **Origin-Staging Area Trips** | | | | | | | | |
| Construction Worker Traffic | 30 | 1 | 2 / Worker | 60 | 30 | 0 | 0 | 30 |
| Delivery and Haul Truck Traffic | 90 | 3 | 2 / Truck | 540 | 36 | 36 | 36 | 36 |
| **Staging Area-Project Site Trips** | | | | | | | | |
| Shuttles | 2[1] | 1.5 | 4 / Worker | 12 | 3 | 3 | 3 | 3 |
| Delivery and Haul Truck Traffic | 90 | 3 | 2 / Truck | 540 | 36 | 36 | 36 | 36 |
| | | | **Total** | **1,152** | **105** | **75** | **75** | **105** |

Source: Chen Ryan Associates (2017)

Note:

[1] It is assumed that one shuttle can accommodate 15 workers. 30 workers / 15 = 2 shuttles

As shown, the Below Grade Parking Alternative Excavation and Foundation Phase is anticipated to generate approximately 552 additional trips between the staging area and project site, including 78 trips during the AM and PM peak hours. These trips would be added to the roadway segments along Harbor Drive between Park Boulevard and Sampson Street. In total, the Below Grade Parking Alternative Excavation and Foundation Phase generates approximately 1,152 daily vehicle trips during the peak.

## Trip Generation Comparison

Table 5 provides a summary comparison of the total trips generated by the Proposed Project and the Below Grade Parking Alternative. As shown, the Proposed Project is estimated to generate a total of 1,524 daily trips during the peak of construction, whereas the Below Grade Parking Alternative will generate 1,152 daily trips during the peak of the Excavation and Foundation Phase. Therefore, the construction related impacts would be identical for the Proposed Project and the Below Grade Parking

Alternative as the peak of construction period previously analyzed would also represent the peak of construction under the Below Grade Parking Alternative.

**Table 5 Trip Generation Comparison**

| Use | Proposed Project | Below Grade Parking Alternative |
|---|---|---|
| Project (Workers & Delivery and Haul Truck Traffic) | 1,158 | 600 |
| Staging Area (Shuttles & Delivery and Haul Truck Traffic) | 366 | 552 |
| **Total** | **1,524** | **1,152** |

Source: Chen Ryan Associates (2017)

## Parking

As shown in the Draft Fifth Avenue Landing TIA, the Proposed Project requires 472 parking spaces after applying adjustment factors from the San Diego Unified Port District *Tidelands Parking Guidelines* (2001). The Proposed Project will provide 263 parking spaces; however, the Below Grade Parking Alternative will provide an additional 215 parking spaces, bringing the total to 478. Therefore, the Below Grade Parking Alternative will provide sufficient parking, resulting a surplus of 6 parking spaces during the highest demand period, effectively eliminating the parking impact disclosed in the Draft Fifth Avenue Landing TIA, and no longer require a Parking Management Plan as a mitigation measure.

# Appendix L-1
# Preliminary Sewer Study

# PRELIMINARY SEWER STUDY

# FIFTH AVENUE LANDING HOTEL PROJECT

## February 2017

Prepared For:
**Fifth Avenue Landing LLC**
San Diego, CA 92101

Prepared By:

**PROJECT DESIGN CONSULTANTS**
Planning | Landscape Architecture | Environmental | Engineering | Survey

701 B Street, Suite 800
San Diego, CA 92101
619.235.6471 Tel
619.234.0349 Fax

Greg Shields, PE RCE 42951
Registration Expires 3/31/14

Prepared By: MG
Checked By: RR

# TABLE OF CONTENTS

**Section** **Page**

**Exhibits**

**Appendices**

## FIFTH AVENUE LANDING HOTEL
## PRELIMINARY SEWER STUDY

# SECTION 1

# INTRODUCTION

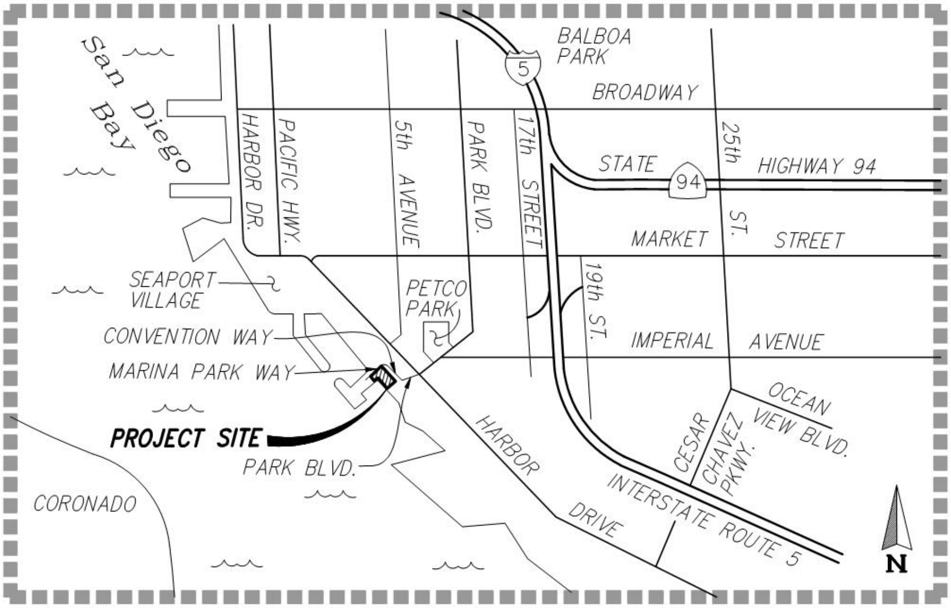
The purpose of this study is to analyze the impacts of the proposed Fifth Avenue Landing Hotel project on the local sewer infrastructure. The project site is located within the Marina District of the City of San Diego. The project area is approximately 5.07 acres, and its limits are approximately defined by: the San Diego bay to the southwest, Marina Park Way to the northwest, the Convention Way to the northeast, and the existing Hilton Bayfront Hotel to the southeast. Currently, the land uses within the footprint of proposed Fifth Avenue Landing Hotel project consist of existing paved parking lots.

Per Appendix III: “Fifth Ave Landing Hotel EIR Reporting Needs Memorandum” dated February 7, 2017 by Mitchell Dec from Glumac, a Mechanical Engineering firm, the Fifth Avenue Landing development is proposing a 850 room hotel on Parcel A’s portion of the project boundary, and a 565 room hotel on Parcel B’s portion of the project boundary. The annual wastewater generated from the proposed development was used for the calculations in this study. This information was received by Project Design Consultants (PDC) from Glumac via an email dated February 7, 2017.

As part of the proposed Fifth Avenue Landing development the existing sewer infrastructure under the paved parking lots will be relocated closer to the roadway of Marina Park Way and Convention Way in order to accommodate the new proposed development.

This sewer study is based on design criteria outlined in the *City of San Diego Sewer Design Guide* by the City of San Diego Public Utilities Department dated May 2015

# FIFTH AVENUE LANDING HOTEL
# PRELIMINARY SEWER STUDY



**VICINITY MAP**

NO SCALE

# SECTION 2

# EXISTING SEWER IMPROVEMENTS & SEWAGE FLOWS

Please refer to Exhibit A (*Existing and Proposed Sewer Improvements*) in order to better understand the existing sewer conditions described below. Copies of the City record drawings cited below can be found in Appendix II: City Record Drawings of Existing Sewer Improvements.

## Marina Way, Convention Way, & Park Boulevard sewer:

Existing Sewer Improvements: Per available City record drawing (19021-D), there is an existing 8-inch polyvinylchloride (PVC) sewer main approximately 43 feet landward of the San Diego Bay bulkhead. The 8-inch PVC sewer main was constructed in 1979 and maintains an approximate pipe slope of 0.5%. This sewer main collects sewage from the existing Marina Park facilities via a 4-inch PVC force main in Marina Park Way. The existing 8-inch PVC sewer main parallel to the bulkhead turns landward and traverses the existing parking lot until it ultimately discharges into an existing 10-inch PVC sewer in Convention Way. Per available City record drawing (27750-7-D), the 10-inch PVC sewer main was constructed between 1998 and 2002 as part of the Phase II expansion of the convention center. The 10-inch PVC sewer maintains a pipe slope of 0.5% as it flows southeast and ultimately discharges into the existing 10-inch PVC sewer in Park Boulevard. Per available City record drawing (27750-6-D), the existing 10-inch PVC in Park Boulevard was built between 1998 and 2002 as part of the Phase II expansion of the convention center. The 10-inch PVC sewer main maintains a pipe slope of 0.3% until it ultimately discharges into an existing 15-inch PVC sewer main in West Harbor Drive.

The existing sewer mains in Convention Way and Park Boulevard (southwest of West Harbor Drive) provide sewer service to the Phase II expansion of the convention center. Per available City record drawings; there are no sewer laterals from the Phase II portion of the convention center which discharge directly into the Harbor Drive trunk sewer.

Existing On-site Sewer Flow: The most accurate way of ascertaining the flow rates in existing sewers is to install monitoring meters for a period of time long enough to capture the varying characteristics inherent in sewer flow rates. To this end, PDC requested ADS Environmental Services, Inc to install a meter at the downstream side of the existing 10-inch PVC sewer main in Park Boulevard (southwest of West Harbor Drive) just prior to its terminus in West Harbor Drive. Metering in this location allows the flow entering the 15-inch Harbor Drive trunk sewer from the existing 10-inch sewer main in Park Boulevard to be isolated and accurately measured. PDC requested the metering run continuously for one week duration from March 23, 2011 to April 1, 2011. This week was chosen for the monitoring in order to ‘capture’ the effects of some of the larger conventions scheduled for the month of March. Please see Appendix I: “Convention Center Expansion Sewer Flow Verification Report- Location PDC_1” dated April 14, 2011 for the results of the flow monitoring of this sewer. From Page 8 of the ADS report, the **average flow rate was 0.157 MGD (0.24 CFS) and the maximum peak flow was 0.583 MGD**

**( 0.90 CFS)** during the week of the monitoring. The maximum flow depth recorded was 4.11 inches. The d/D ratio for this maximum flow depth is: **$d/D_{\text{Max Depth}}$ = 4.11 in / 10 in = 0.41** which is less than the permitted maximum of 0.5 per the City of San Diego Sewer Design Guide. The average flow depth was 1.88 inches which equates to a d/D ratio of 0.18.

## West Harbor Drive Trunk Sewer:

Existing West Harbor Drive Sewer Improvements: Per available City record drawing (18366-D), there is an existing 15-inch polyvinylchloride (PVC) Harbor Drive trunk sewer in West Harbor Drive adjacent to the convention center. The 15-inch PVC Harbor Drive trunk sewer was constructed between 1979 and 1981 and maintains a pipe slope of 0.2%. This sewer is encased in concrete to provide structural stability and prohibit ground water intrusion since the invert of this sewer main is approximately 10 feet below mean sea level in the vicinity of the convention center.

At the intersection of West Harbor Drive and Park Boulevard, the 15-inch Harbor Drive trunk sewer intercepts sewage from an existing 12-inch PVC sewer main in Park Boulevard (northeast of West Harbor Drive) and the existing 10-inch PVC sewer main in Park Boulevard (southwest of West Harbor Drive) serving the Phase II convention center expansion and described in the "Marina Way, Convention Way, and Park Boulevard sewer" section above.

The existing 15-inch Harbor Drive trunk sewer continues to flow to the southeast along West Harbor Drive for approximately 225 LF where it transitions into a 15-inch reinforced plastic material (RPM) pipe. The existing 15-inch RPM Harbor Drive trunk sewer continues to flow southeast for approximately 640 LF where it transitions into an existing 18-inch RPM sewer pipe. Similarly, the existing 18-inch RPM sewer main flows southeast along West Harbor Drive for approximately 388 LF where it transitions to an existing 24-inch RPM pipe. This is the downstream limit of analysis for this preliminary sewer study. The entire 1255 LF length of the Harbor Drive trunk sewer described above is encased in a 60-inch diameter pipe full of concrete to provide structural stability and prohibit ground water intrusion.

Comic-Con Event 2012: The City of San Diego monitored the 15-inch Harbor Drive sewer main during the Comic-Con Event 2012. This event is traditionally the largest convention of the year hosted by the San Diego Convention Center. The peak flow discharged from the Comic-Con Event 2012 was approximately **0.870+ MGD**. For this study we are assuming that no more than 25% of the amount discharged from the Convention Center is discharged into Convention Way, resulting in a peak flow discharged to the 10" sewer main of Convention Way from Comic-Con Event 2012 of approximately **0.218 MGD (0.34 CFS).** Please see Appendix V: "Sewer Pump Station No. 5 – Comic-Con Event 2012" for the peak flow value.

## SECTION 3

## ANALYSIS & PROPOSED SEWER FLOW CALCULATIONS

Please refer to Exhibit A (*On-site Existing and Proposed Sewer Improvements*) and Appendix IV (*FlowMaster Calculations*) in order to better understand the analysis and calculations presented below.

As noted in the introduction, the proposed Fifth Avenue Landing Hotel project intends to route 100% of the development's sewage to the sewer mains under the portions of Marina Way, Convention Way, and Park Boulevard. Ultimately, all of the sewage from the convention center and hotel expansion will be discharged into the Harbor Drive trunk sewer at the intersection of West Harbor Drive and Park Boulevard. The expected *increase* in the peak sewer flows for the proposed development is calculated below. The sewage flows from the existing Convention Center and facilities adjacent to Marina Park Way, Convention Way, and Park Boulevard (southwest of West Harbor Drive) were recorded during the sewer metering described in Section 2.

### Proposed Flows:

Fifth Avenue Landing Hotel: At the time of the composition of this study, the project's Mechanical Engineer provided an estimate of the additional sewage expected to be generated by the proposed hotel and marina expansion, which was 53,284,560 gallons of wastewater per year. Their preliminary fixture unit counts and calculations show the convention center expansion would generate an additional **0.145 MGD (0.22 CFS)**. This information was cited from Appendix III: "Proposed Developments EIR Reporting Needs Memorandum" prepared by Glumac and dated February 7, 2017.

**Total Additional Sewage Flow From Fifth Avenue Landing Hotel and Marina Expansion = 0.145 MGD (0.22 CFS)**

### Proposed On-Site Sewer Improvements:

As discussed earlier in this study, the proposed Phase Fifth Avenue Landing Hotel will convey its sewage flows into the sewer mains in Marina Way, Convention Way, and Park Boulevard (southwest of West Harbor Drive). However, the elevations of the existing upstream and downstream sewer manholes (at Marina Park Way and at the intersection of West Harbor Drive and Park Boulevard respectively) to which the realigned sewers need to reconnect are fixed. The new alignment of the relocated sewers would require approximately 550 LF of sewer pipe. The manhole in Marina Park Way and the manhole in Convention Way, which the project would connect to have invert elevations of 3.69 feet and -0.46 respectively. If the realigned sewer maintained a constant slope between these manholes, the slope would be **0.78%.** This calculated pipe slope does not account for invert drops across any new sewer manholes installed as part of the relocated sewer improvements.

For the purpose of this study and in order to conservatively estimate the pipe diameter required for the realigned sewer mains, it is assumed that a sewer pump station will not be required and vertical conflicts between the sewer main and other existing and proposed improvements will be adequately addressed.

To determine what size sewer main would be required to convey the total sewage from the proposed Fifth Avenue Landing Hotel into the sewer main in Marina Way, Convention Way, and Park Boulevard, Project Design Consultants used "FlowMaster" to perform the hydraulic culvert calculations. Please see Appendix IV for details about the culvert calculations. Input data for the culvert calculations is listed below:

| | |
|---|---|
| **Total Additional Peak Sewage Flow From Fifth Avenue Landing Hotel and Marina Expansion** | **= 0.145 MGD (0.22 CFS)** |
| **Total Existing Peak Sewage Flow from 1/4th Convention Center and Marina Park Facilities as Stated in ADS' Sewer Monitoring Study** | **= 0.583 MGD (0.90 CFS)** |
| **Total Peak Sewage Flow (Post Development)** | **= 0.728 MGD (1.12 CFS)** |

**Sizing On-Site Sewer Mains for Flow Rate = 0.728 MGD (1.12 CFS)**

| Size | Slope | Velocity | d/D |
|---|---|---|---|
| 10 in | 0.78% | 3.67 ft/s | 0.55 |
| **12 in** | **0.78%** | **3.66 ft/s** | **0.41** |

For a pipe conveying 0.728 MGD (1.12 CFS) and with a slope of 0.78%, the pipe diameter required to achieve a d/D ratio < 0.5 is: **12-inches.**

A 12-Inch diameter sewer main is required to convey the total post development peak flow from the Marina Park, Convention Center, and Fifth Avenue Landing Hotel to the Harbor Drive trunk sewer. It is likely that segments of the proposed realigned sewers near the upstream manhole in Marina Park Way will not need to be this large as they are less likely to be conveying the total post development peak flow. As new sewer laterals from the Convention Center and Hotel subsequently discharge sewage into the realigned sewer mains, the diameter of the realigned sewer mains will most likely need to progressively increase to 12-inches. Sizing the pipe diameter of the various pipe segments of the realigned sewer main cannot be determined until a final site design for the Fifth Avenue Landing Hotel is known and is beyond the scope of this study.

<u>Existing Convention Center:</u> There are a few sewer laterals emanating from the convention center's property, and while a majority of sewage appears to discharge into the trunk sewer main on Harbor Drive, this study will assume that a quarter of the amount being discharged by the

Convention Center is also being discharged into the sewer main on Convention Way. The values for this assumption are being taken form: Appendix V: “Sewer Pump Station No. 5 – Comic-Con Event 2012”, and an assumption that no more than a quarter of the total amount discharged could be discharged in to the Convention Way sewer main. A quarter of the existing development produces a sewage flow of **0.218 MGD**.

**Total Additional Sewage Flow From a quarter of the Convention Center discharge = 0.218 MGD (0.34 CFS)**

Ballpark Village: KettlerLeweck Engineering has recently processed plans for the Ball Park Village development. Per the project’s design and coordination with the City of San Diego staff, specifically Leonard Wilson of the Public Utilities Department, it was determined that an upgrade of the existing sewer system infrastructure to a 30” pipe would be required. This sewer main upgrade will increase the capacity of the downstream sewer system from the proposed site significantly. The sizing of the pipe was based on the proposed flows for the Ballpark Village development and existing city flows.

**Total Additional Sewage Flow From Ballpark Village = 0.782 MGD (1.21 CFS)**

For a combined total of estimated additional sewage from the Fifth Avenue Landing Hotel, Convention Center, Ballpark Village into Harbor Drive trunk sewer.

**Total Additional Sewage Flow From Fifth Avenue Landing Hotel, Convention Center, Ballpark Village into Harbor Drive trunk main = 1.728 MGD (2.67 CFS)**

## Off-Site Sewer Improvements:

PDC was informed that the Ballpark Village project, drawing No. _______-D will increase the current 15-inch Harbor Drive trunk sewer (downstream of Park Boulevard) to a 30-inch trunk sewer main which conveys all of the sewage from the Convention Center, Ballpark Village, Petco Park, Marriott Hotel, and the Fifth Avenue Landing Hotel under both the existing and proposed conditions. In order to confirm the capacity of the 30-inch trunk sewer, the total peak sewage flow under post development conditions must be calculated. The total peak sewage flow for the 30-inch Harbor Drive sewer under post development conditions is based on the approved report from the Ball Park Village Project:

Fifth Avenue Landing Hotel and Total Post Future Development Peak Flow

Total Peak Flow in 30-inch Harbor Drive Trunk Sewer Under Post Development Conditions =

| | | |
|---|---|---|
| | Typical flow in Harbor Drive per Ballpark Village Study | **(1.573 MGD)** |
| + | Petco Park Flow per Ballpark Village Study | **(1.520 MGD)** |
| + | Peak Comic-Con Event 2012 Flow as provided by the City's PUD | **(0.872 MGD)** |
| + | Peak Fifth Avenue Landing Hotel and Marina Expansion | **(0.145 MGD)** |
| + | Peak Ballpark Village Development from Ballpark Village study | **(0.782 MGD)** |

**Harbor Drive Trunk Sewer: Total (Post Development)**
**Peak Sewage Flow = 4.892 MGD (7.56 CFS)**

The City of San Diego has provided the engineer of work (KettlerLeweck Engineering) the required trunk sewer main size. Approved plans are out to bid and the construction should be completed by the end of 2017

To determine if the Fifth Avenue Landing Project would have an adverse effect on the 30-inch trunk sewer main including future developments, Project Design Consultants used "FlowMaster" to perform a hydraulic culvert calculations. Please see Appendix IV for details about the culvert calculations. Input data for the culvert calculations is listed below:

From City of San Diego record drawing (18366-D), the pipe slope for the existing Harbor Drive trunk sewer downstream of Park Boulevard is maintained at **0.2%**.

Total Post Future Development Peak Flow in Harbor Drive Trunk Sewer:

For a pipe conveying 4.892 MGD (7.56 CFS) at a slope of 0.2%, the minimum pipe diameter required to achieve a d/D ratio < 0.75 is: **30-inches**

**Sizing Harbor Drive Trunk Sewer for Flow Rate = 4.892 MGD (7.56 CFS)**

| Size | Slope | Velocity | d/D |
|---|---|---|---|
| **30 in** | **0.2%** | **3.55 ft/s** | **0.44** |

The culvert calculations show that a 30-inch diameter pipe will be sufficient in order to achieve the City's design requirement stating the ratio between the depth of flow and the pipe diameter shall be less than 0.75 (d/D < 0.75) for trunk sewer mains. This result would require no additional upgrades downstream from the intersection of West Harbor Drive and Park Boulevard.

# SECTION 4

## CONCLUSIONS

The proposed Fifth Avenue Landing Hotel and Marina expansion will generate an additional **0.145 MGD (0.22 CFS)** of sewage to the existing conditions. The total sewage flow rate for the existing convention center to the sewer mains in Convention Way and Park Boulevard is **0.583 MGD (0.90 CFS)**. Therefore, the total expected sewage flow rate after the proposed development has been constructed will be **0.728 MGD (1.12 CFS)**.

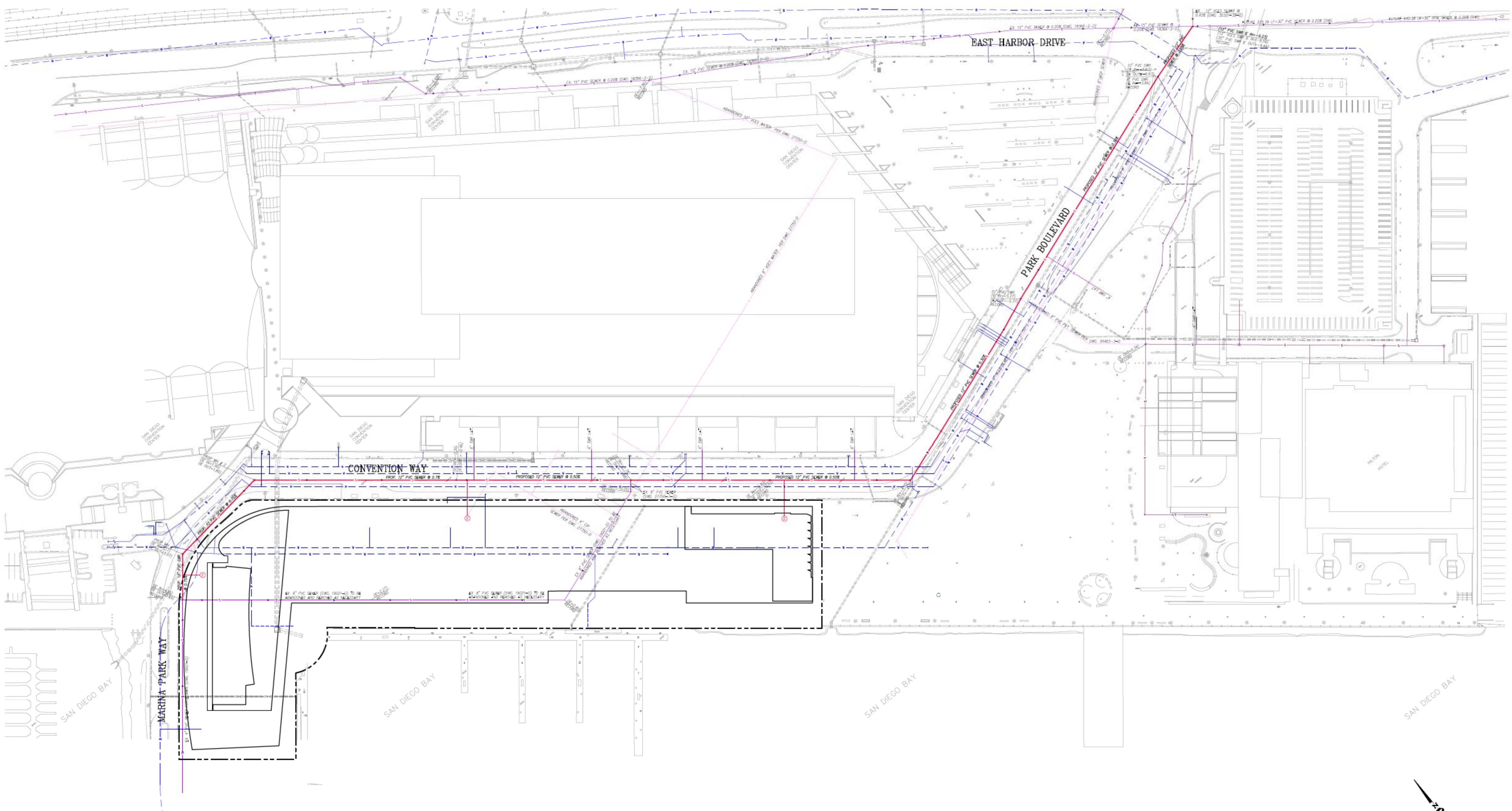
The proposed Fifth Avenue Landing Hotel will require a realignment of pipe along Convention Way and a replacement of the pipe along Park Boulevard (southwest of West Harbor Drive). The proposed sewers for the development would be routed away from the property into the adjacent road. These sewers will need to continue to provide service to the existing facilities in Marina Park and to ultimately discharge into the existing Harbor Drive trunk sewer. Due to these factors, the invert elevations of the upstream and downstream sewer manholes for the relocated sewers are fixed.

Assuming the relocated sewer mains will be under the realigned streets the average pipe slope for the on-site sewers would be approximately 0.78%, while the replaced pipes would maintain the existing pipe slopes. The pipe slope combined with the expected sewage flow rate of 0.728 MGD dictates the new sewer mains would require a minimum pipe diameter of 12 inches in order to meet City design standards. Depending on the locations of the future sewer laterals emanating from the Fifth Avenue Landing Hotel, not all of the on-site sewer mains may need to be 12-inches. The pipes may be able to start at smaller diameters and progressively increase in size to 12-inches near the downstream side of the proposed project.

The results of this preliminary sewer study indicate the future 30-inch Harbor Drive trunk sewer proposed in the Ballpark Village project, drawing number ______-D, will have enough capacity to accommodate the additional sewage expected from the proposed development. That project currently expects to be completed in 2017, which would be in place prior to the construction on the proposed Fifth Avenue Landing Hotel.

# EXHIBIT A

# ON-SITE EXISTING AND PROPOSED SEWER IMPROVEMENTS



# EXHIBIT 'A': EXISTING AND PROPOSED SEWER IMPROVEMENTS

**LEGEND:**

| | |
|---|---|
| —— S —— | ABANDONED SEWER |
| —— S —— | EXISTING SEWER |
| —— S —— | EXISTING SEWER (PER HILTON SAN DIEGO CONVENTION HOTEL PLANS) |
| — — W — — | EXISTING WATER |
| - - - - - - | EXISTING STORM DRAIN PIPE |
| —— — — —— | PROJECT BOUNDARY LINE |
| ———— | PROPOSED BUILDING FOOTPRINT |
| —— S —— | PROPOSED 15" PVC SEWER MAIN REPLACEMENT |
| ———— Ⓢ | PROPOSED SEWER LATERAL |

**PROJECT DESIGN CONSULTANTS**
Planning | Landscape Architecture | Engineering | Survey

P:\4263\Engr\Reports\Sewer\Exhibits\Exhibit A - Site utilities\EXUT Exhibit A.dwg 12/14/2016 12:50 PM

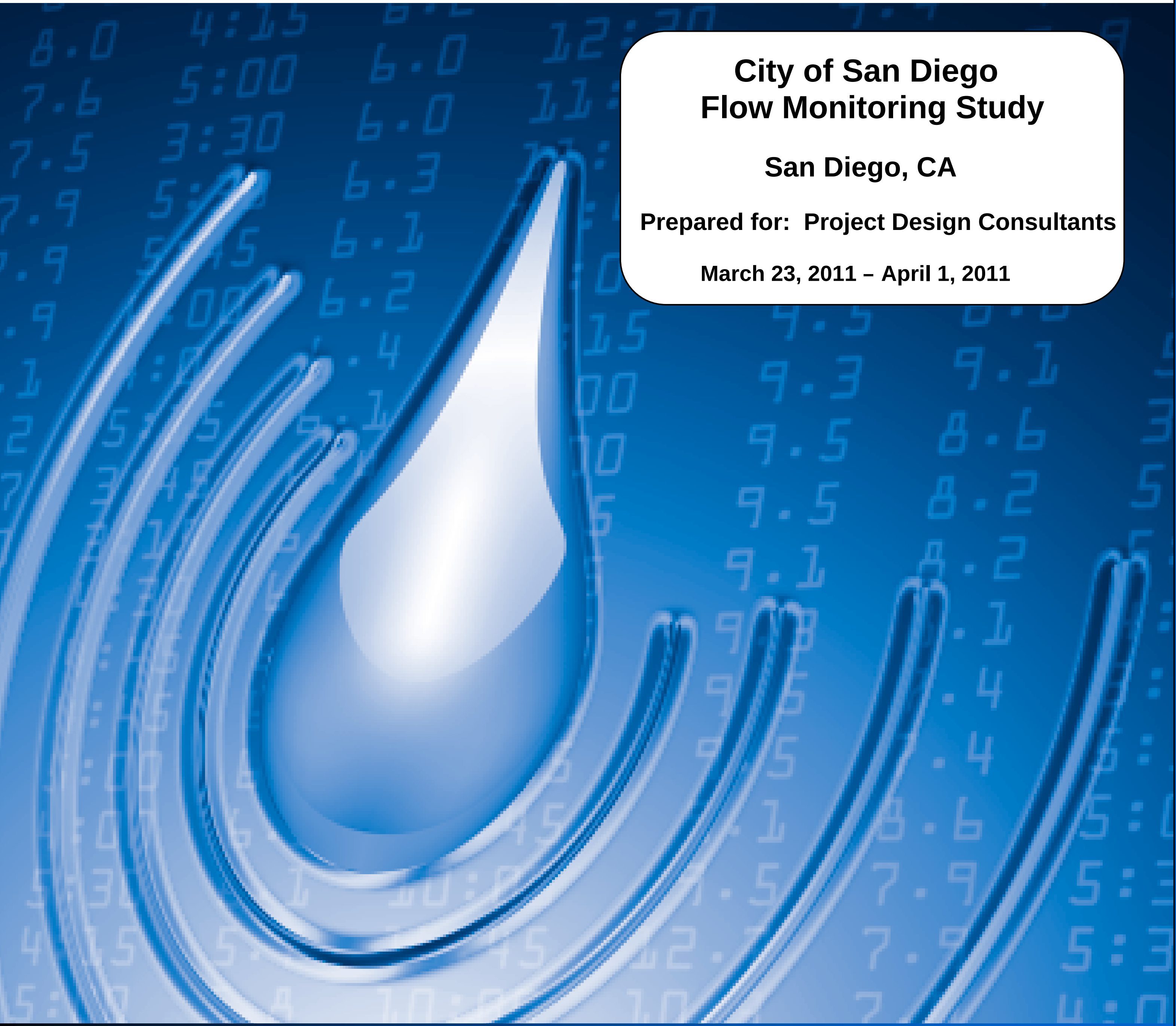
# APPENDIX I

# ADS SEWER FLOW VERIFICATION REPORT

FLOWVIEW™

UNDERGROUND INTELLIGENCE®
FOR ENHANCED COLLECTION SYSTEM PERFORMANCE

ADS ENVIRONMENTAL SERVICES®



# City of San Diego
# Flow Monitoring Study

## San Diego, CA

**Prepared for: Project Design Consultants**

**March 23, 2011 – April 1, 2011**

Home Page

America's Finest City

THE CITY OF SAN DIEGO

# Convention Center Expansion
# Sewer Flow Verification Report

Prepared for:

Project Design Consultants
San Diego , CA 92101

Prepared by:

ADS Environmental Services, Inc.
4820 Mercury Street, Suite C
San Diego, CA 92111

## Letter of Transmittal

4820 Mercury Street, Suite C
San Diego, CA 92111

April 14, 2011

Mr. Sean Mulcahy
Project Design Consultants
701 B Street, Suite 800
San Diego, CA 92101

SUBJECT: Convention Center Expansion Flow Verification Report

Dear Mr. Mulcahy,

ADS is pleased to submit the Convention Center Expansion Flow Verification Report conducted for Project Design Consultants. This data submittal includes two copies of the report. Included in the report are depth, velocity and quantity hydrographs beginning Wednesday, March 23, 2011 through Friday, April 01, 2011 .

Also included with this report is a CD, which contains data for the report in Excel and PDF format. The Excel file contains Depth, Quantity, and Velocity entities for each flow monitoring location in 15-minute format. Please note the minimum and maximum rates recorded on the daily tabular data are absolute versus average 15-minute data as provided in the Excel tabular files.

In addition, we would be happy to further explain any details about the report that may seem unclear. Should you have any questions or comments, you may contact the Project Manager, Neil Volk at (858) 571-0045 ext 227.

Thank you for choosing ADS products and services to meet your flow monitoring needs.

Sincerely,

Kristen Daye

Senior Data Analyst

An IDEX Fluid & Metering Business
Accusonic
ADS Environmental Services
Hydra-Stop

# Table of Content

# Methodology

## Introduction

### Background

Project Design Consultants entered into agreement with ADS LLC to conduct flow monitoring at two (2) locations within the City of San Diego's collection system. The contract required data collection for a 7-day period. As part of the Convention Center Expansion Flow Verification Study, the meters were installed to allow measurement of flows in the designated area of the Collection System. The objective of this study was to measure depth, velocity and to quantify flows.

### Project Scope

The scope of this study involved using a temporary flow monitor to quantify wastewater flow at the designated location. Specifically, the study included the following key components.

- Investigate the proposed flow-monitoring site for adequate hydraulic conditions.
- Flow monitor installation.
- Flow monitor confirmations and data collections.
- Flow data analysis.

Equipment installation was accomplished on March 23, 2011. Monitoring was conducted during the period of March 23, 2011 through April 01, 2011 .

## Equipment & Methodology

### Flow Quantification Methods

There are two main equations used to measure open channel flow: the Continuity Equation and the Manning Equation. The Continuity Equation, which is considered the most accurate, can be used if both depth of flow and velocity are available. In cases where velocity measurements are not available or not practical to obtain, the Manning Equation can be used to estimate velocity from the depth data based on certain physical characteristics of the pipe (i.e. the slope and roughness of the pipe being measured). However, the Manning equation assumes uniform, steady flow hydraulic conditions with non-varying roughness, which are typically invalid assumptions in most sanitary sewers. The Continuity Equation was used exclusively for this study.

<u>Continuity Equation</u>

The Continuity Equation states that the flow quantity (Q) is equal to the wetted area (A) multiplied by the average velocity (V) of the flow.

$$\mathbf{Q = A * V}$$

This equation is applicable in a variety of conditions including backwater, surcharge, and reverse flow. Most modern flow monitoring equipment, including the ADS Models, measure both depth and velocity and therefore use the Continuity Equation to calculate flow quantities.

## Flow Monitoring Equipment

The monitor selected for this project was the ADS Model 1502-flow monitor. This flow monitor is an area velocity flow monitor that uses both the Continuity and Manning's equations to measure flow.

The ADS Model 1502-flow monitor consists of data acquisition sensors and a battery-powered microcomputer. The microcomputer includes a processor unit, data storage, and an on-board clock to control and synchronize the sensor recordings. The monitor was programmed to acquire and store depth of flow and velocity readings at 5-minute intervals. A laptop computer was used in the field to retrieve and store data from the monitor.

Three types of data acquisition sensors are available for the Model 1502 flow monitor. The primary depth measurement device is the ADS quad-redundant ultrasonic level sensor. This sensor uses four independent ultrasonic transceivers in pairs to measure the distance from the face of the transceiver housing to the water surface (air range) with up to four transceiver pairs, of the available ones, active at one time. The elapsed time between transmitting and receiving the ultrasonic waves is used to calculate the air range between the sensor and flow surface based on the speed of sound in air. Sensors in the transceiver housing measure temperature, which is used to compensate the ultrasonic signal travel time. The speed of sound will vary with temperature. Since the ultrasonic level sensor is mounted out of the flow, it creates no disturbance to normal flow patterns and does not affect site hydraulics.

Redundant flow depth data can be provided by a pressure depth sensor, and is independent from the ultrasonic level sensor. This sensor uses a piezo-resistive crystal to determine the difference between hydrostatic and atmospheric pressure. The pressure sensor is temperature compensated and vented to the atmosphere through a desiccant filled breather tube. Pressure depth sensors are typically used in large size channels and applications where surcharging is anticipated. Its streamlined shape minimizes flow distortion.

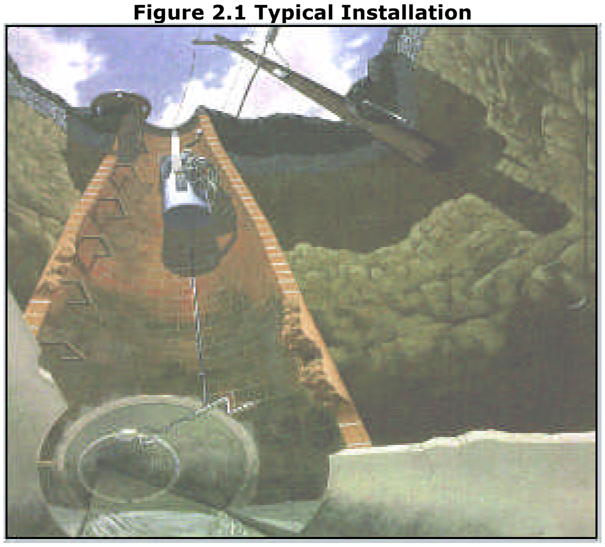
Velocity is measured using the ADS V-3 digital Doppler velocity sensor. This sensor measures velocity in the cross-sectional area of flow. An ultrasonic carrier is transmitted upstream into the flow, and is reflected by suspended particles, air bubbles, or organic matter with a frequency shift proportional to the velocity of the reflecting objects. The reflected signal is received by the sensor and processed using digital spectrum analysis to determine the peak flow velocity. Collected peak velocity information is filtered and processed using field confirmation information and proprietary software to determine the average velocity, which is used to calculate flow quantities. The sensor's small profile, measuring 1.5 inches by 1.15 inches by 0.50 inches thick, minimizes the affects on flow patterns and site hydraulics.

## Installation

Installation of flow monitoring equipment typically proceeds in four steps. First, the site is investigated for safety and to determine physical and hydraulic suitability for the flow monitoring equipment. Second, the equipment is physically installed at the selected location. Third, the monitor is tested to assure proper operation of the velocity and depth of flow sensors and verify that the monitor clock is operational and synchronized to the master computer clock. Fourth, the depth and velocity sensors are confirmed and line confirmations are performed. A typical flow monitor installation is shown in Figure 2.1.

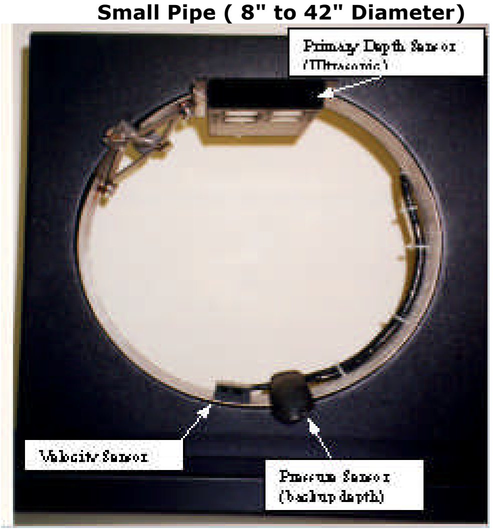
The installations depicted in Figures 2.1 are typical for circular or oval pipes up to approximately 104-inches in diameter or height. In installations into pipes 42-inches or less in diameter, depth and velocity sensors are mounted on an expandable stainless steel ring and installed one to two pipe diameters upstream of the pipe/manhole connection in the incoming sewer pipe. This reduces the affects of turbulence and backwater caused by the connection. In pipes larger than 42 inches in diameter, a special installation is made using two sections of the ring installed one to two feet upstream of the pipe/manhole connection; one bolted to the crown of the pipe for the depth sensor, and the other bolted to the bottom of the pipe (bolts are usually placed just above the water line) to hold the velocity sensor.

**Figure 2.1 Typical Installation**



**Large Pipe ( > 42" Diameter)**

**Small Pipe ( 8" to 42" Diameter)**



## Data Collection, Confirmation, and Quality Assurance

During the monitoring period, field crews visit each monitoring location to retrieve data, verify proper monitor operation, and document field conditions. The following quality assurance steps are taken to assure the integrity of the data collected:

- **Measure Power Supply:** The monitor is powered by a dry cell battery pack. Power levels are recorded and battery packs replaced, if necessary. A separate battery provides back-up power to memory, which allows the primary battery to be replaced without the loss of data.

- **Perform Pipe Line Confirmations and Confirm Depth and Velocity:** Once equipment and sensor installation is accomplished, a member of the field crew descends into the manhole to perform a field measurement of flow rate, depth and velocity to confirm they are in agreement with the monitor. Since the ADS V-3 velocity sensor measures peak velocity in the wetted cross-sectional area of flow, velocity profiles are also taken to develop a relationship between peak and average velocity in lines that meet the hydraulic criteria.

- **Measure Silt Level:** During site confirmation, a member of the field crew descends into the manhole and measures and records the depth of silt at the bottom of the pipe. This data is used to compute the true area of flow.

- **Confirm Monitor Synchronization:** The field crew checks the flow monitor's clock for accuracy.

- **Upload and Review Data:** Data collected by the monitor is uploaded and reviewed for comparison with previous data. All readings are checked for consistency and screened for deviations in the flow patterns, which indicate system anomalies or equipment failure.

## Data Analysis & Presentation

### Data Analysis

A flow monitor is typically programmed to collect data at either 15-minute or 5-minute intervals throughout the monitoring period. The monitor stores raw data consisting of (1) the air range (distance from sensor to top of flow) for each active ultrasonic depth sensor pair and (2) the peak velocity. If the monitor is equipped with a pressure sensor, then a depth reading from this sensor may also be stored. When the field personnel collects the data, the air range is converted to depth data based on the pipe height and physical offset (distance from the top of the pipe to the surface of the ultrasonic sensor). The data is imported into ADS's proprietary software and is examined by a data analyst to verify its integrity. The data analyst also reviews the daily field reports and site visit records to identify conditions that would affect the collected data.

Velocity profiles and the line confirmation data developed by the field personnel are reviewed by the data analyst to identify inconsistencies and verify data integrity. Velocity profiles are reviewed and an average to peak velocity ratio is calculated for the site. This ratio is used in converting the peak velocity measured by the sensor to the average velocity used in the Continuity equation. The data analyst selects which ultrasonic pairs and/or depth sensor entity will be used to calculate the final depth information. Silt levels present at each site visit are reviewed and representative silt levels established.

Selections for the above parameters can be constant or can change during the monitoring period. While the data analysis process is described in a linear manner, it often requires an iterative approach to accurately complete.

### Data Presentation

This type of flow monitoring project generates a large volume of data. To facilitate review of the data, results have been provided in graphical and tabular formats. The flow data is presented graphically in the form of scattergraphs and hydrographs. Tables are provided in daily average format. These tables show the flow rate for each day, along with the daily minimum and maximums, the times they were observed, the total daily flow, and total flow for the month (or monitoring period). The following explanation of terms may aid in interpretation of the tables and hydrographs.

**DFINAL** - Final calculated depth measurement (in inches)

**MAX FLOW -** The maximum observed flow rate during the reporting period (in MGD)

**MIN FLOW** - The minimum observed flow rate during the reporting period (in MGD)

**QFINAL** - Final calculated flow rate (in MGD)

**VFINAL** - Final calculated flow velocity (in feet per second)

**TOT FLOW** - Total volume of flow recorded for the indicated time period (in MG)

# Site Commentary

## Site Information

| PDC_1 | |
|---|---|
| Pipe Dimensions | 8" x 8 " |
| Silt Level | 0.00" |

## Overview

Site PDC_1 functioned under normal free flow conditions during the period Wednesday, March 23, 2011 to Friday, April 01, 2011 . Flow depth and velocity measurements recorded by the flow monitor are consistent with field confirmations conducted to date and support the relative accuracy of the flow monitor at this location.

## Observations

Average flow depth, velocity, and quantity data observed during Wednesday, March 23, 2011 to Friday, April 01, 2011 , along with observed minimum and maximum data, are provided in the following table. The maximum and minimum flow rate recorded in the table herein may vary from those recorded in the enclosed Excel data files. The minimum and maximum rates recorded in the tables are based on 5-minute data intervals whereas the data provided in the Excel files are 15-minute averaged data.

**Observed Flow Conditions**

| Item | Depth (in) | Velocity (ft/s) | Quantity (MGD) |
|---|---|---|---|
| Average | 1.88 | 3.63 | 0.157 |
| Minimum | 0.75 | 1.77 | 0.021 |
| Maximum | 4.11 | 5.61 | 0.583 |
| Time of Minimum | 3/31/2011 3:00 AM | 4/1/2011 3:00 AM | 3/31/2011 3:00 AM |
| Time of Maximum | 3/23/2011 7:15 AM | 3/23/2011 6:45 AM | 3/23/2011 7:15 AM |

## Data Quality

Data uptime observed during the Wednesday, March 23, 2011 to the Friday, April 01, 2011 monitoring period is provided in the table below. Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

| Percent Uptime | |
|---|---|
| Depth (in) | 93.01 |
| Velocity (ft/s) | 93.01 |
| Quantity (MGD) | 93.01 |

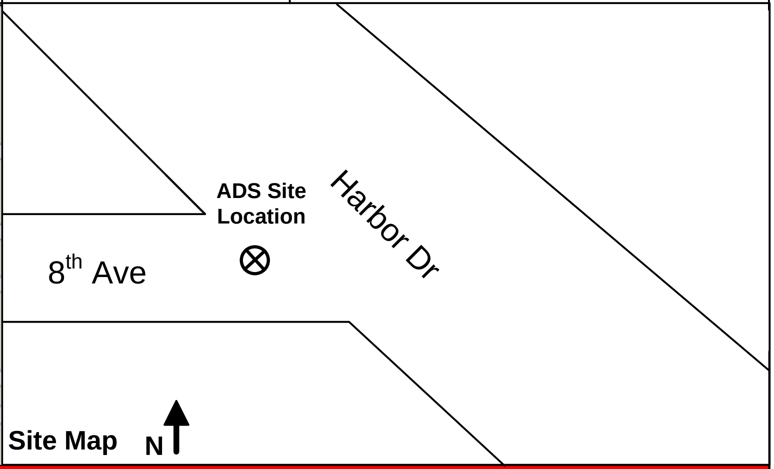
ADS ENVIRONMENTAL SERVICES®

# ADS Site Report

## Quality Form

| | | | |
|---|---|---|---|
| **Project Name:** San Diego Conv.PDC | **City / State:** San Diego, Ca | **Date Installed:** 3-23-11 | **FM Initials:** SK |

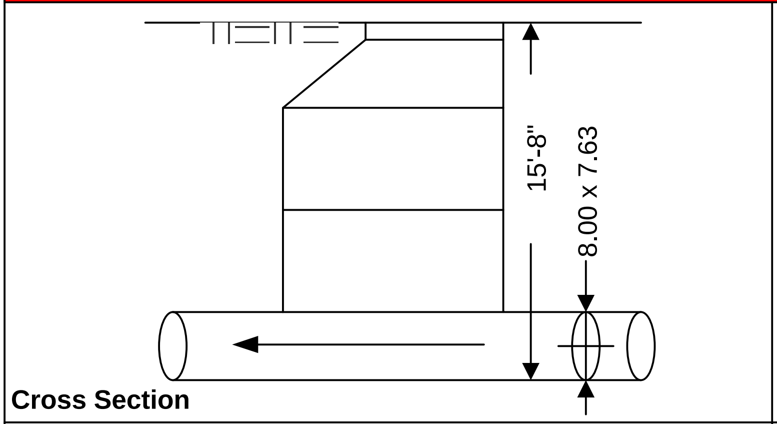
| | | | |
|---|---|---|---|
| **Site Name:** PDC_1 | **Monitor Series:** 3600 | **Monitor S/N:** | 2726 |
| **Address/Location:** 8th Ave & Harbor Dr. | | **Manhole #** | |
| | | **Thomas Bros Map Page:** | 1289-B4 |
| | | **Pipe Height:** | 8.00 " |
| **Access:** Drive | **Type of System:** Sanitary ☒ Storm ☐ Combined ☐ | **Pipe Width:** | 7.63 " |
| | | **IP Address:** | N/A |

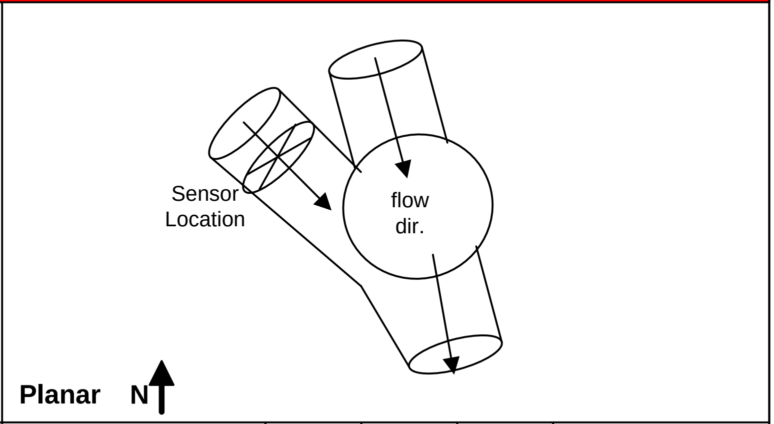


| **Investigation Information:** | | | |
|---|---|---|---|
| **Date/Time of Investigation:** | 3-23-11@ 4:00AM | | |
| **Site Hydraulics:** | Good Straight Through Flow | | |
| **Upstream Input: (L/S, P/S)** | DNI | | |
| **Upstream Manhole:** | Did Not Investigate | | |
| **Downstream Manhole:** | DNI | | |
| **Depth of Flow:** | 1.50 | +/- | 0.13 " |
| **Range (Air DOF):** | | +/- | 0.25 " |
| **Peak Velocity:** | 4.76 | fps | |
| **Silt:** | 0.00" | Inches | |

| **Manhole Information:** | | |
|---|---|---|
| **Manhole Depth:** | 15'-8" | Feet |
| **Manhole Material / Condition** | Precast /Fair | |
| **Pipe Material / Condition:** | PVC / Good | |
| **Mini System Character:** | Residential ☒ Commercial ☐ Industrial ☐ Trunk ☐ | |
| **Telephone Information:** | N/A | |
| **Access Pole #:** | N/A | |
| **Distance From Manhole:** | N/A | Feet |
| **Road Cut Length:** | N/A | Feet |
| **Trench Length:** | N/A | Feet |

## Other Information:





| **Installation Information** | |
|---|---|
| Installation Type: | Standard |
| Sensors Devices: | Ultrasonic Depth / Velocity |
| Surcharge Height: | None Feet |
| Rain Gauge Zone: | N/A |

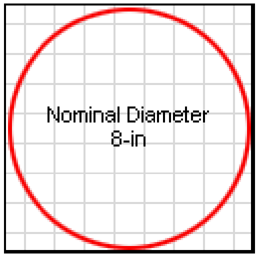
| **Backup** | **Yes** | **No** | **?** | **Distance** |
|---|---|---|---|---|
| Trunk | ☐ | ☒ | ☐ | |
| Lift / Pump Station | ☐ | ☒ | ☐ | |
| WWTP | ☐ | ☒ | ☐ | |
| Other | ☒ | ☐ | ☐ | |

## Additional Site Information / Comments:

No safety concerns; standard traffic control. Good site for flow monitoring.

**Flow Monitor**

# PDC_1



**Report Period**

3/22/2011
To
4/1/2011

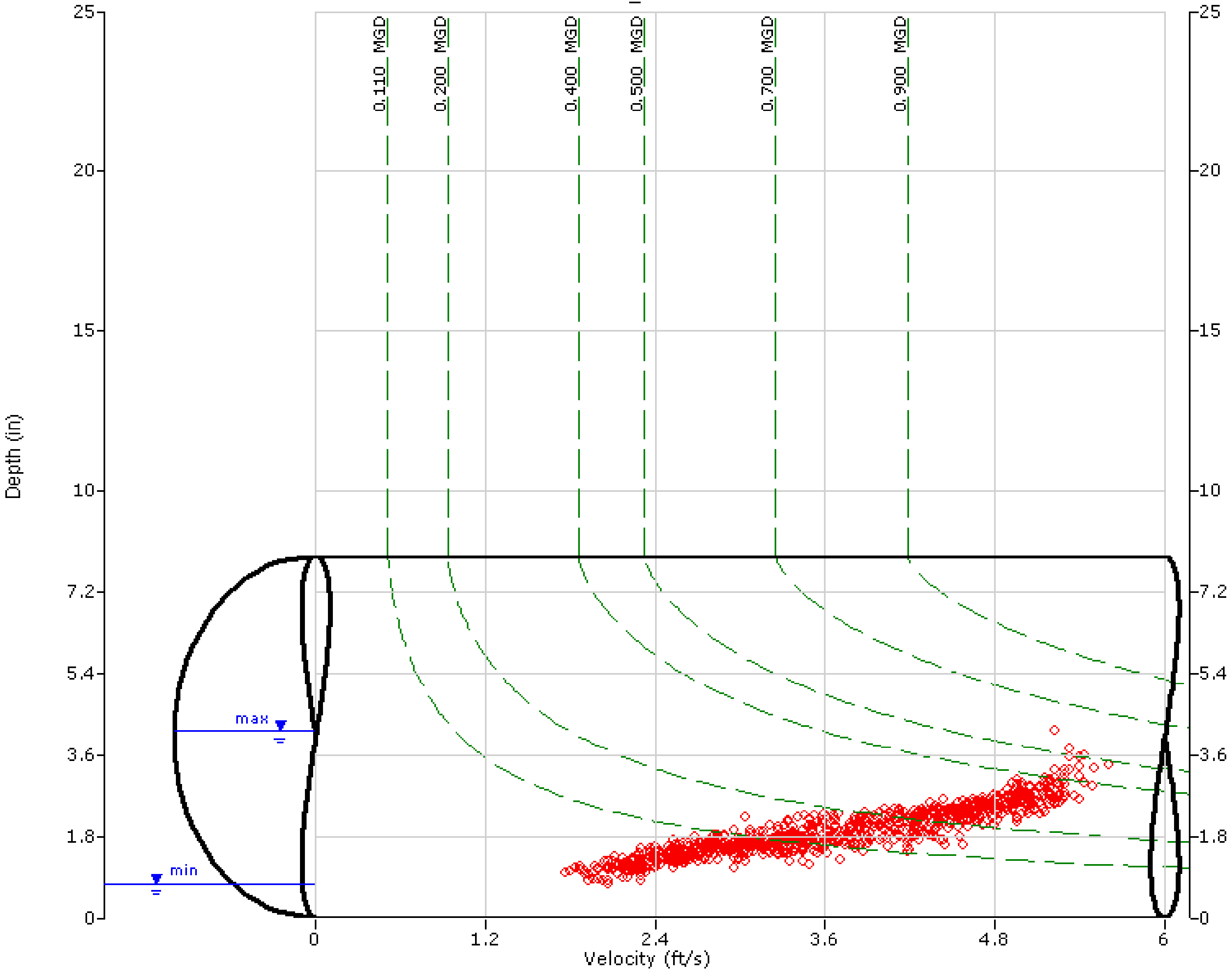
**Legend**

- ○ Depth - Velocity
- 🟩 Iso-Q™
- 🟥 Silt
- ▼ Min-Max Depth

ADS ENVIRONMENTAL SERVICES

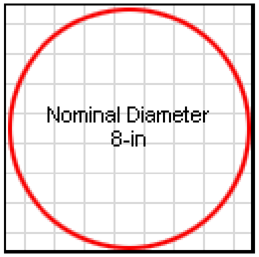
## SCATTERGRAPH REPORT

PDC_1



**Flow Monitor**

# PDC_1



**Report Period**

3/22/2011
To
4/1/2011

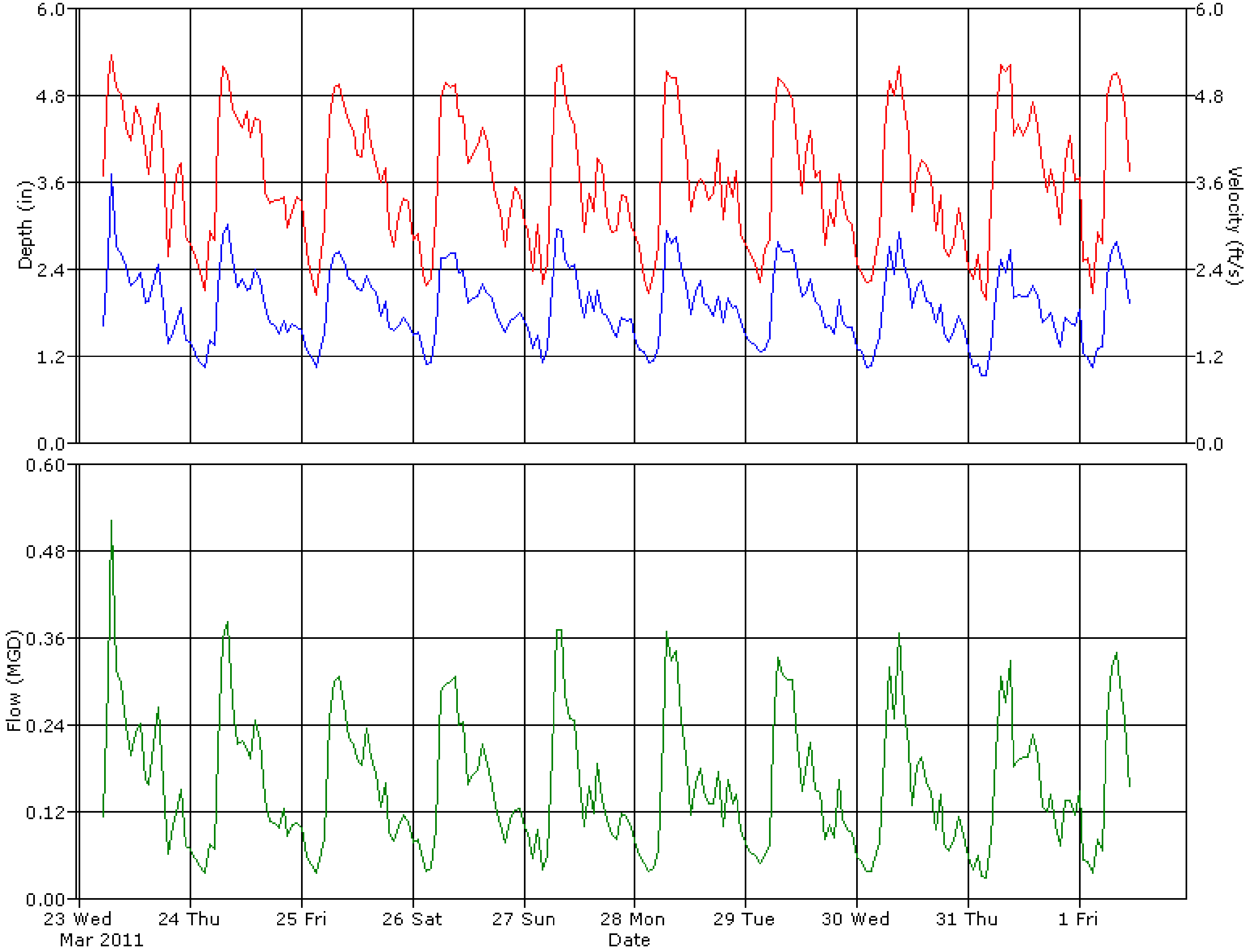
**Legend**

- — Depth
- — Velocity
- — Quantity

ADS ENVIRONMENTAL SERVICES

## HYDROGRAPH REPORT

PDC_1



# Project Design Consultants

**Daily Tabular Report For The Period 3/22/2011 - 4/1/2011**

**PDC_1, Pipe Height: 8"**

## Daily Tabular Report

Depth (in) Velocity (ft/s) Quantity (MGD - Total MG) Rain (in)

| Date | Depth | | | | | Velocity | | | | | Quantity | | | | | | Rain |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Time | Min | Time | Max | Avg | Time | Min | Time | Max | Avg | Time | Min | Time | Max | Avg | Total | Total |
| 3/22/2011 | | | | | | | | | | | | | | | | | |
| 3/23/2011 | 19:45 | 1.25 | 07:15 | 4.11 | 2.14 | 19:15 | 2.27 | 06:45 | 5.61 | 4.13 | 19:15 | 0.055 | 07:15 | 0.583 | 0.206 | 0.163 | |
| 3/24/2011 | 03:30 | 0.95 | 08:00 | 3.73 | 1.85 | 03:15 | 1.88 | 07:30 | 5.40 | 3.65 | 03:30 | 0.028 | 08:00 | 0.525 | 0.154 | 0.154 | |
| 3/25/2011 | 03:15 | 0.94 | 12:15 | 2.99 | 1.87 | 03:45 | 1.91 | 06:45 | 5.26 | 3.61 | 03:15 | 0.027 | 12:15 | 0.380 | 0.153 | 0.153 | |
| 3/26/2011 | 03:15 | 0.91 | 09:00 | 2.95 | 1.89 | 03:30 | 1.88 | 07:15 | 5.30 | 3.65 | 03:15 | 0.031 | 09:00 | 0.378 | 0.156 | 0.156 | |
| 3/27/2011 | 05:00 | 1.07 | 08:45 | 3.15 | 1.88 | 03:00 | 2.00 | 08:30 | 5.30 | 3.50 | 03:00 | 0.034 | 08:45 | 0.416 | 0.150 | 0.150 | |
| 3/28/2011 | 04:00 | 1.06 | 07:45 | 3.30 | 1.90 | 03:30 | 1.84 | 07:45 | 5.51 | 3.52 | 03:30 | 0.033 | 07:45 | 0.460 | 0.155 | 0.155 | |
| 3/29/2011 | 03:45 | 1.14 | 10:00 | 3.25 | 1.88 | 03:30 | 2.05 | 10:00 | 5.33 | 3.53 | 03:45 | 0.043 | 10:00 | 0.438 | 0.151 | 0.151 | |
| 3/30/2011 | 02:45 | 0.95 | 09:00 | 3.26 | 1.81 | 01:45 | 2.10 | 09:00 | 5.23 | 3.40 | 02:45 | 0.031 | 09:00 | 0.432 | 0.141 | 0.141 | |
| 3/31/2011 | 03:00 | 0.75 | 09:00 | 3.33 | 1.73 | 04:00 | 1.81 | 07:45 | 5.49 | 3.76 | 03:00 | 0.021 | 09:00 | 0.458 | 0.147 | 0.147 | |
| 4/1/2011 | 04:00 | 0.90 | 07:45 | 3.06 | 1.87 | 03:00 | 1.77 | 08:00 | 5.44 | 3.72 | 03:00 | 0.027 | 07:45 | 0.401 | 0.169 | 0.085 | |

## Report Summary For The Period 3/22/2011 - 4/1/2011

Depth (in) : D Velocity (ft/s) : V Quantity (MGD - Total MG) : Q Rain (in) : Rain

| | D | V | Q |
|---|---|---|---|
| Report Total | | | 1.455 |
| Report Avg | 1.88 | 3.63 | 0.157 |

# Site Commentary

## Site Information

| PDC_2 | |
|---|---|
| Pipe Dimensions | 14.88" x 14.88 " |
| Silt Level | 0.00" |

## Overview

Site PDC_2 functioned under normal free flow conditions during the period Wednesday, March 23, 2011 to Friday, April 01, 2011 . Flow depth and velocity measurements recorded by the flow monitor are consistent with field confirmations conducted to date and support the relative accuracy of the flow monitor at this location.

## Observations

Average flow depth, velocity, and quantity data observed during Wednesday, March 23, 2011 to Friday, April 01, 2011 , along with observed minimum and maximum data, are provided in the following table. The maximum and minimum flow rate recorded in the table herein may vary from those recorded in the enclosed Excel data files. The minimum and maximum rates recorded in the tables are based on 5-minute data intervals whereas the data provided in the Excel files are 15-minute averaged data.

**Observed Flow Conditions**

| Item | Depth (in) | Velocity (ft/s) | Quantity (MGD) |
|---|---|---|---|
| Average | 10.27 | 1.69 | 0.984 |
| Minimum | 8.60 | 1.14 | 0.567 |
| Maximum | 12.58 | 2.25 | 1.573 |
| Time of Minimum | 4/1/2011 3:45 AM | 3/31/2011 3:15 AM | 3/31/2011 3:15 AM |
| Time of Maximum | 3/23/2011 7:45 AM | 3/29/2011 10:00 AM | 3/23/2011 7:45 AM |

## Data Quality

Data uptime observed during the Wednesday, March 23, 2011 to the Friday, April 01, 2011 monitoring period is provided in the table below. Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

| Percent Uptime | |
|---|---|
| Depth (in) | 92.39 |
| Velocity (ft/s) | 92.39 |
| Quantity (MGD) | 92.39 |

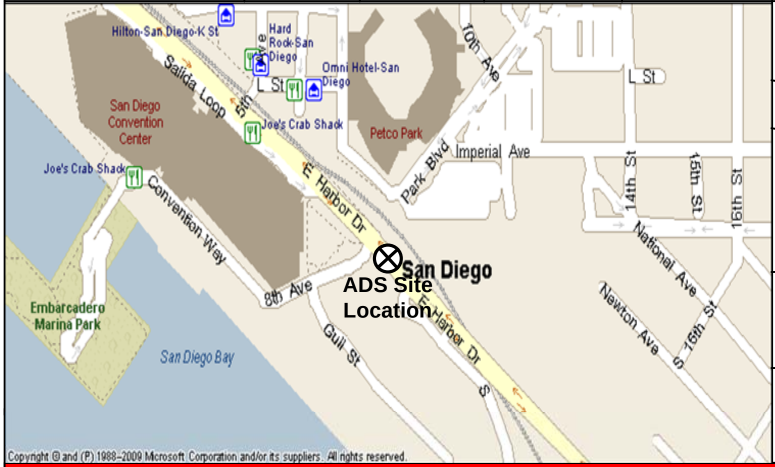
ADS ENVIRONMENTAL SERVICES®

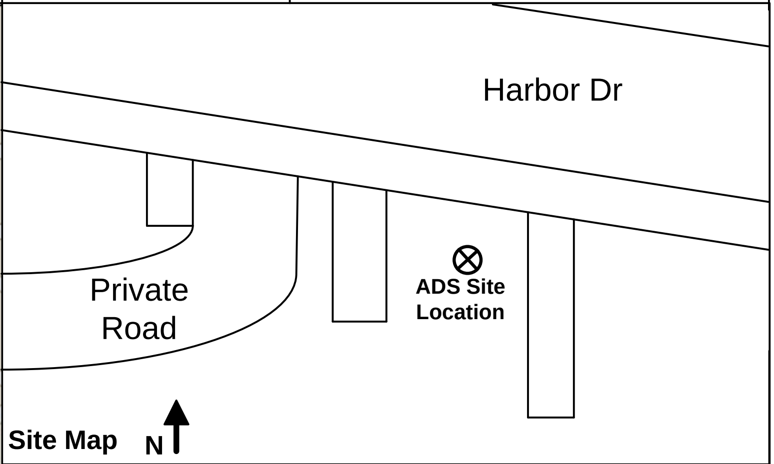
# ADS Site Report

**Quality Form**

| | | | |
|---|---|---|---|
| **Project Name:** San Diego Conv.PDC | **City / State:** San Diego, Ca | **Date Installed:** 3-23-11 | **FM Initials:** SK |

| | | | |
|---|---|---|---|
| **Site Name:** PDC_2 | **Monitor Series:** 3600 | **Monitor S/N:** | 2869 |
| **Address/Location:** Located In Dole Truck parking area under Harbor Dr. | | **Manhole #** | 44 |
| | | **Thomas Bros Map Page:** | 1289-B4 |
| | | **Pipe Height:** | 14.88 " |
| **Access:** Drive | **Type of System:** Sanitary ☒ Storm ☐ Combined ☐ | **Pipe Width:** | 15.00 " |
| | | **IP Address:** | N/A |





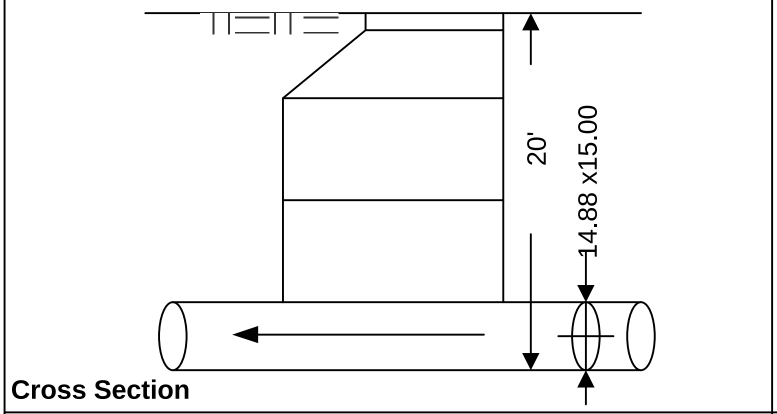
## Investigation Information:

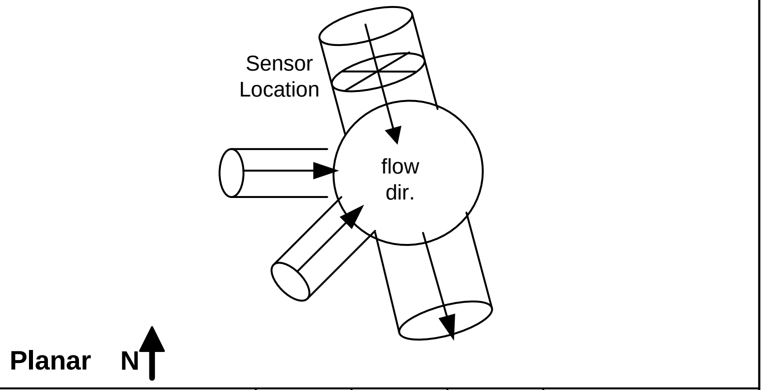
| | | | |
|---|---|---|---|
| **Date/Time of Investigation:** | 3-23-11@ 5:00AM | | |
| **Site Hydraulics:** | Good Straight Through Flow | | |
| **Upstream Input: (L/S, P/S)** | DNI | | |
| **Upstream Manhole:** | Did Not Investigate | | |
| **Downstream Manhole:** | DNI | | |
| **Depth of Flow:** | 11.00 | +/- | 0.13 " |
| **Range (Air DOF):** | | +/- | 0.25 " |
| **Peak Velocity:** | 2.18 | fps | |
| **Silt:** | 0.00" | Inches | |

## Manhole Information:

| | | |
|---|---|---|
| **Manhole Depth:** | 20' | Feet |
| **Manhole Material / Condition** | Brick /Fair | |
| **Pipe Material / Condition:** | PVC / Good | |
| **Mini System Character:** | Residential ☒ Commercial ☐ Industrial ☐ Trunk ☐ | |
| **Telephone Information:** | N/A | |
| **Access Pole #:** | N/A | |
| **Distance From Manhole:** | N/A | Feet |
| **Road Cut Length:** | N/A | Feet |
| **Trench Length:** | N/A | Feet |

## Other Information:





| **Installation Information** | |
|---|---|
| Installation Type: | Standard |
| Sensors Devices: | Ultrasonic Depth / Velocity/ Pressure |
| Surcharge Height: | None Feet |
| Rain Gauge Zone: | N/A |

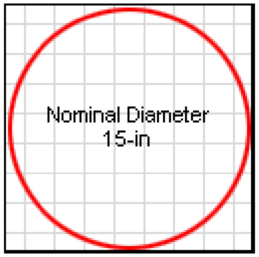
| **Backup** | **Yes** | **No** | **?** | **Distance** |
|---|---|---|---|---|
| Trunk | ☐ | ☒ | ☐ | |
| Lift / Pump Station | ☐ | ☒ | ☐ | |
| WWTP | ☐ | ☒ | ☐ | |
| Other | ☒ | ☐ | ☐ | |

## Additional Site Information / Comments:

No safety concerns; standard traffic control. Good site for flow monitoring.

**Flow Monitor**

**PDC_2**



**Report Period**

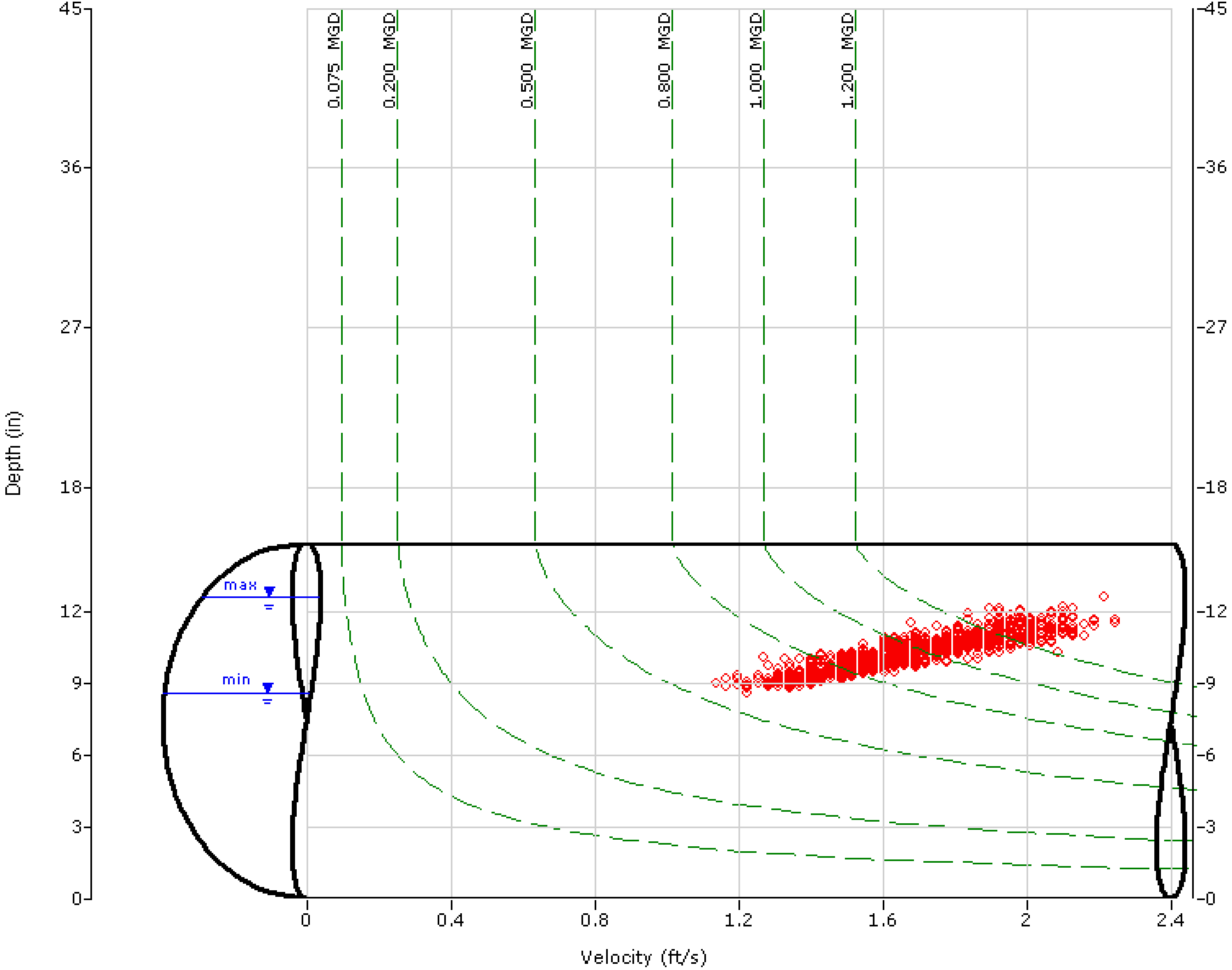
3/22/2011
To
4/1/2011

**Legend**

- ○ Depth - Velocity
- --- Iso-Q™
- --- Silt
- ▼ Min-Max Depth

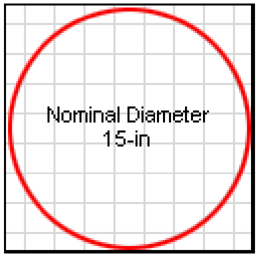
# SCATTERGRAPH REPORT

PDC_2



**Flow Monitor**

**PDC_2**



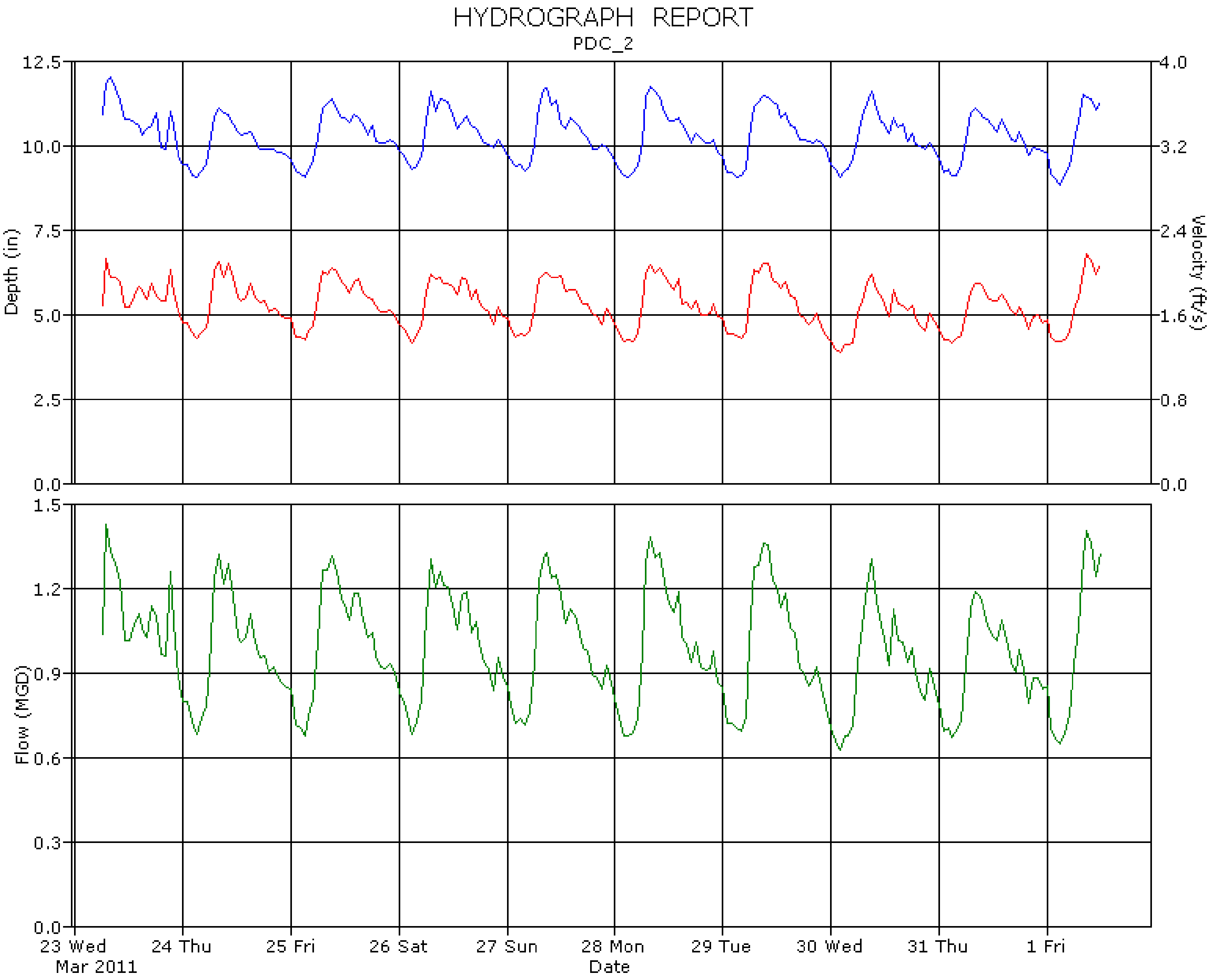
**Report Period**

3/22/2011
To
4/1/2011

**Legend**

- 🟦 Depth
- 🟥 Velocity
- 🟩 Quantity

ADS ENVIRONMENTAL SERVICES



# Project Design Consultants

**Daily Tabular Report For The Period 3/22/2011 - 4/1/2011**

**PDC_2, Pipe Height: 15"**

## Daily Tabular Report

Depth (in) Velocity (ft/s) Quantity (MGD - Total MG) Rain (in)

| Date | Depth | | | | | Velocity | | | | | Quantity | | | | | | Rain |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Time | Min | Time | Max | Avg | Time | Min | Time | Max | Avg | Time | Min | Time | Max | Avg | Total | Total |
| 3/22/2011 | | | | | | | | | | | | | | | | | |
| 3/23/2011 | 20:00 | 9.54 | 07:45 | 12.58 | 10.76 | 11:15 | 1.55 | 07:45 | 2.22 | 1.82 | 20:00 | 0.839 | 07:45 | 1.573 | 1.113 | 0.800 | |
| 3/24/2011 | 03:30 | 8.93 | 08:15 | 11.43 | 10.02 | 03:45 | 1.28 | 08:15 | 2.16 | 1.70 | 03:45 | 0.640 | 08:15 | 1.399 | 0.966 | 0.966 | |
| 3/25/2011 | 03:45 | 8.74 | 09:00 | 11.65 | 10.28 | 01:45 | 1.23 | 08:00 | 2.13 | 1.72 | 01:45 | 0.599 | 09:00 | 1.388 | 1.005 | 1.005 | |
| 3/26/2011 | 03:45 | 9.11 | 07:30 | 11.93 | 10.37 | 03:00 | 1.25 | 15:15 | 2.10 | 1.70 | 03:00 | 0.640 | 07:30 | 1.401 | 1.002 | 1.002 | |
| 3/27/2011 | 02:45 | 9.09 | 08:45 | 12.16 | 10.29 | 02:45 | 1.31 | 09:30 | 2.13 | 1.69 | 02:45 | 0.661 | 08:45 | 1.446 | 0.990 | 0.990 | |
| 3/28/2011 | 02:45 | 8.86 | 09:00 | 11.99 | 10.28 | 02:15 | 1.25 | 08:15 | 2.13 | 1.69 | 02:15 | 0.639 | 09:00 | 1.427 | 0.991 | 0.991 | |
| 3/29/2011 | 05:00 | 8.75 | 09:00 | 11.99 | 10.29 | 05:00 | 1.23 | 10:00 | 2.25 | 1.68 | 05:00 | 0.589 | 10:00 | 1.461 | 0.984 | 0.984 | |
| 3/30/2011 | 02:00 | 8.87 | 09:00 | 12.08 | 10.20 | 01:45 | 1.17 | 09:30 | 2.07 | 1.59 | 02:00 | 0.571 | 09:00 | 1.357 | 0.920 | 0.920 | |
| 3/31/2011 | 01:45 | 8.90 | 08:45 | 11.40 | 10.12 | 03:15 | 1.14 | 10:00 | 1.98 | 1.61 | 03:15 | 0.567 | 10:00 | 1.227 | 0.924 | 0.924 | |
| 4/1/2011 | 03:45 | 8.60 | 08:30 | 11.80 | 10.14 | 03:45 | 1.23 | 09:00 | 2.25 | 1.68 | 03:45 | 0.577 | 09:00 | 1.487 | 0.974 | 0.497 | |

## Report Summary For The Period 3/22/2011 - 4/1/2011

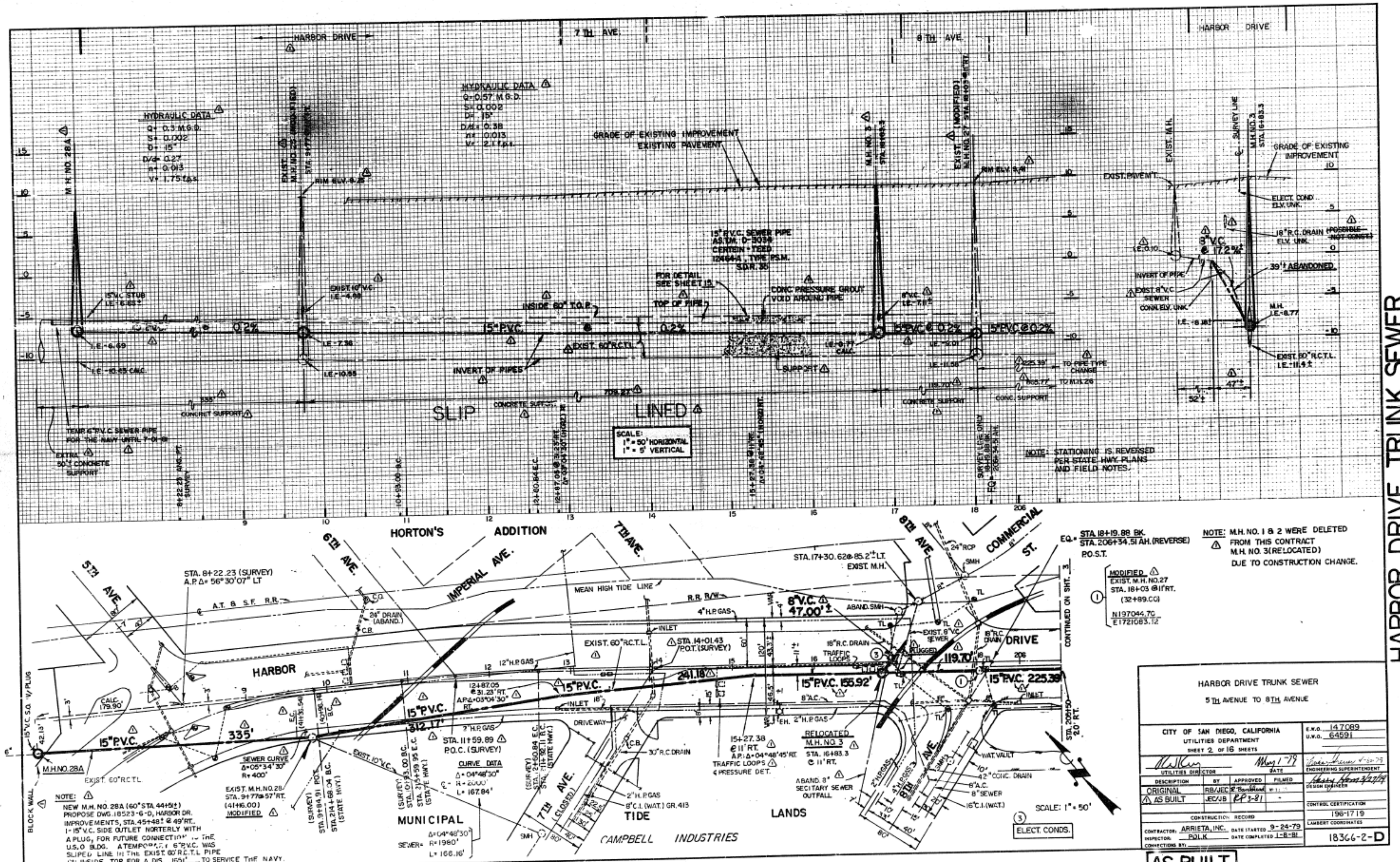
Depth (in) : D Velocity (ft/s) : V Quantity (MGD - Total MG) : Q Rain (in) : Rain

| | D | V | Q |
|---|---|---|---|
| Report Total | | | 9.079 |
| Report Avg | 10.27 | 1.69 | 0.984 |

# APPENDIX II

# CITY RECORD DRAWINGS OF EXISTING SEWER IMPROVEMENTS

# HARBOR DRIVE TRUNK SEWER



NOTE: ⚠ NEW M.H. NO. 28A (60" STA. 44+51±) PROPOSE DWG. 18523-6-D, HARBOR DR. IMPROVEMENTS, STA. 45+48± @ 49' RT. 1-15" V.C. SIDE OUTLET NORTERLY WITH A PLUG, FOR FUTURE CONNECTION TO THE U.S.O. BLDG. A TEMPORARY 6" P.V.C. WAS SLIPED LINE IN THE EXIST. 60" R.C.T.L. PIPE ON INSIDE TOP FOR A DIS. 165±' TO SERVICE THE NAVY. TEMP. UNTIL JULY 1, 1981.

EQ. = STA. 18+19.88 BK. / STA. 206+34.51 AH. (REVERSE) P.O.S.T.

NOTE: ⚠ M.H. NO. 1 & 2 WERE DELETED FROM THIS CONTRACT M.H. NO. 3 (RELOCATED) DUE TO CONSTRUCTION CHANGE.

① MODIFIED ⚠
EXIST. M.H. NO. 27
STA. 18+03 @ 11' RT.
(32+89.00)
N 197044.70
E 1721083.12

HARBOR DRIVE TRUNK SEWER
5TH AVENUE TO 8TH AVENUE

CITY OF SAN DIEGO, CALIFORNIA
UTILITIES DEPARTMENT
SHEET 2 OF 16 SHEETS

UTILITIES DIRECTOR — May 1-79 DATE

| DESCRIPTION | BY | APPROVED | FILMED |
|---|---|---|---|
| ORIGINAL | RB/JEC | R. Barkhead |  |
| ⚠ AS BUILT | JEC/JB | RP 3-81 | - |

CONSTRUCTION RECORD
CONTRACTOR: ARRIETA, INC. DATE STARTED 9-24-79
INSPECTOR: POLK DATE COMPLETED 1-8-81
CONNECTIONS BY:

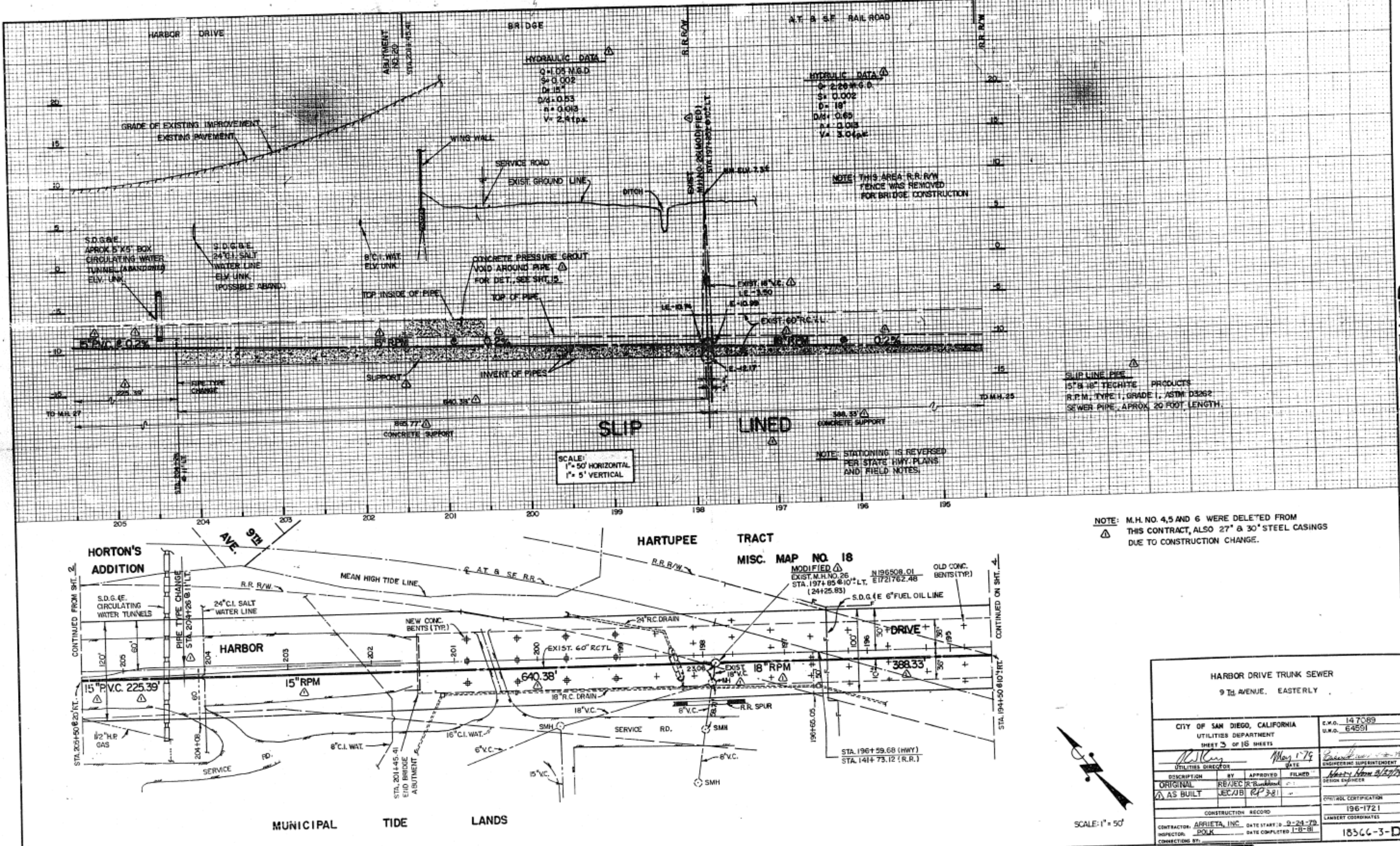
E.W.O. 147089
U.W.O. 64591

4-30-79
ENGINEERING SUPERINTENDENT
3/27/79
DESIGN ENGINEER
CONTROL CERTIFICATION
198-1719
LAMBERT COORDINATES

18366-2-D

AS BUILT

# HARBOR DRIVE TRUNK SEWER



**NOTE:** ⚠ M.H. NO. 4,5 AND 6 WERE DELETED FROM THIS CONTRACT, ALSO 27" & 30" STEEL CASINGS DUE TO CONSTRUCTION CHANGE.

HARBOR DRIVE TRUNK SEWER
9 TH AVENUE. EASTERLY

CITY OF SAN DIEGO, CALIFORNIA
UTILITIES DEPARTMENT
SHEET 3 OF 16 SHEETS

C.W.O. 147089
U.W.O. 64591

UTILITIES DIRECTOR
DATE May 1-79

ENGINEERING SUPERINTENDENT
DESIGN ENGINEER 3/27/79

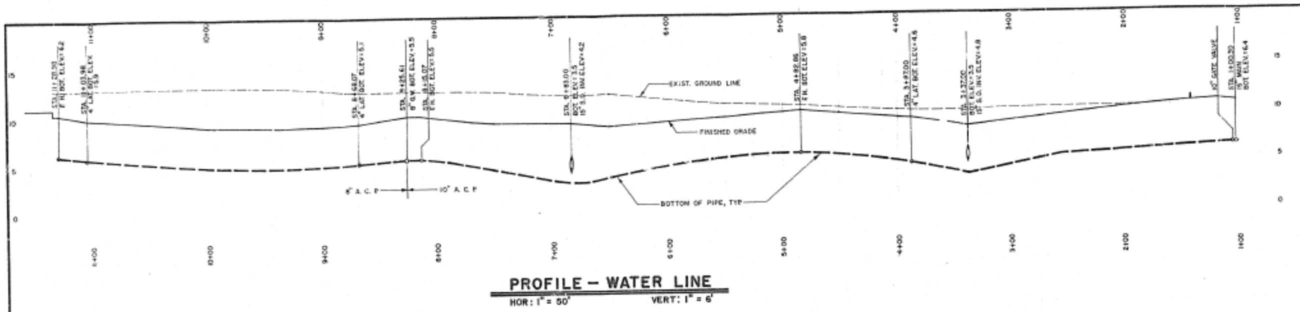
| DESCRIPTION | BY | APPROVED | FILMED |
|---|---|---|---|
| ORIGINAL | RB/JEC | R. Burkhard | |
| ⚠ AS BUILT | JEC/JB | RP 3-81 | |

CONTROL CERTIFICATION
196-1721
LAMBERT COORDINATES

CONSTRUCTION RECORD
CONTRACTOR: ARRIETA, INC. DATE STARTED 9-24-79
INSPECTOR: POLK DATE COMPLETED 1-8-81
CONNECTIONS BY:

18366-3-D

AS BUILT



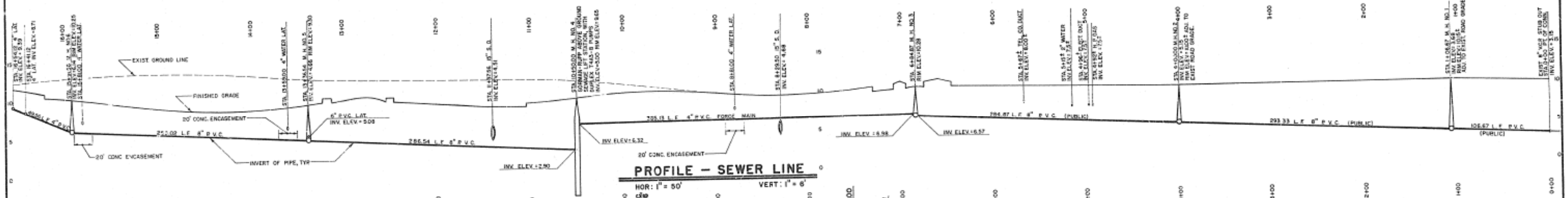
## PROFILE – WATER LINE

HOR: 1" = 50'  VERT: 1" = 6'

## LEGEND

| IMPROVEMENT | STANDARD DRAWING | SYMBOL |
|---|---|---|
| WATER MAIN, 10" & 8" A.C. | W-17, W-18, W-21 | |
| GATE VALVES | W-12B, W-19A | |
| FIRE HYDRANTS, 3-WAY | W-10, W-11B | |
| WATER SERVICE, 4" A.C. | W-17, W-18, W-21 | |
| METER VAULT | SEE DETAIL (B/1) | |
| SEWER MAIN | S-4 | 8" P.V.C. (PUBLIC) |
| MANHOLES | S-1 | |
| PRIVATE SEWER | | LAT. |
| PUBLIC FORCE MAIN | | 4" PVC. FORCE MAIN |
| CURBS | G-2 | |
| SUBGRADE, BASE & PVMT. | SEE SECTION (A/1) | |
| SIDEWALK | G-7 | |

PREPARED BY:
SAN DIEGO UNIFIED PORT DISTRICT
ENGINEERING DEPARTMENT
APPROVED BY: John B. Wieber
CHIEF ENGINEER



## PROFILE – SEWER LINE

HOR: 1" = 50'  VERT: 1" = 6'

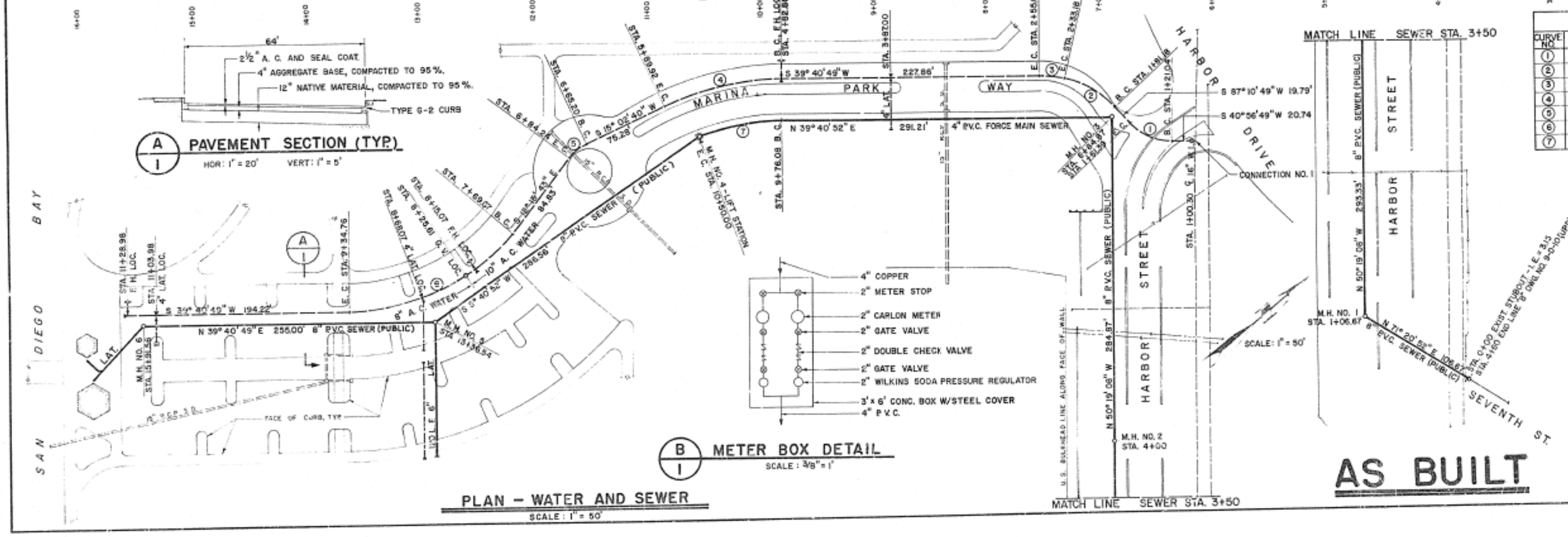
| CURVE NO. | △ | RADIUS | TANGENT | LENGTH | STATION B.C. | STATION E.C. |
|---|---|---|---|---|---|---|
| ① | 46° 14' 00" | 50.00' | 21.34' | 40.35' | 1+21.04 | 1+61.39 |
| ② | 38° 00' 00" | 85.12' | 26.84' | 52.00' | 1+81.18 | 2+33.18 |
| ③ | 12° 30' 00" | 100.00' | 10.95' | 21.82' | 2+33.18 | 2+55.00 |
| ④ | 24° 38' 09" | 249.00' | 54.37' | 107.06' | 4+82.86 | 5+89.92 |
| ⑤ | 27° 18' 23" | 39.95' | 9.70' | 19.04' | 6+65.20 | 6+84.24 |
| ⑥ | 49° 42' 09" | 191.00' | 88.46' | 165.69' | 7+69.07 | 9+34.76 |
| ⑦ | 19° 58' 39" | 212.00' | 37.39' | 73.92' | 9+76.08 | 10+50.00 |

CURVE DATA TABLE

CONNECTION NO. 1: $ 210.00 (CONTRACTOR-FURNISHED TAPPING VALVE AND SADDLE ASSEMBLY).

REF. DRAWINGS:
16" WATER LINE – DRAWING NO. 11558-10-D
SEWER LINE – DRAWING NO. 11559-22-D
STREET IMPROVEMENTS – SAN DIEGO UNIFIED PORT DISTRICT DRAWING NO. 1143

* DATUM: MEAN LOWER LOW WATER.



## PLAN – WATER AND SEWER

SCALE: 1" = 50'

AS BUILT

## IMPROVEMENT PLANS
EMBARCADERO MARINA PARK
SOUTH PENINSULA
SAN DIEGO UNIFIED PORT DISTRICT TIDELANDS

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING DEPARTMENT
SHEET 1 OF 1 SHEETS

W.O. NO. 75004

CITY ENGINEER
DATE
DIVISION HEAD

| DESCRIPTION | BY | APPROVED | DATE | FILMED |
|---|---|---|---|---|
| ORIGINAL | | | | |
| | | | | |
| | | | | |
| | | | | |
| AS BUILT | UPD | | | |

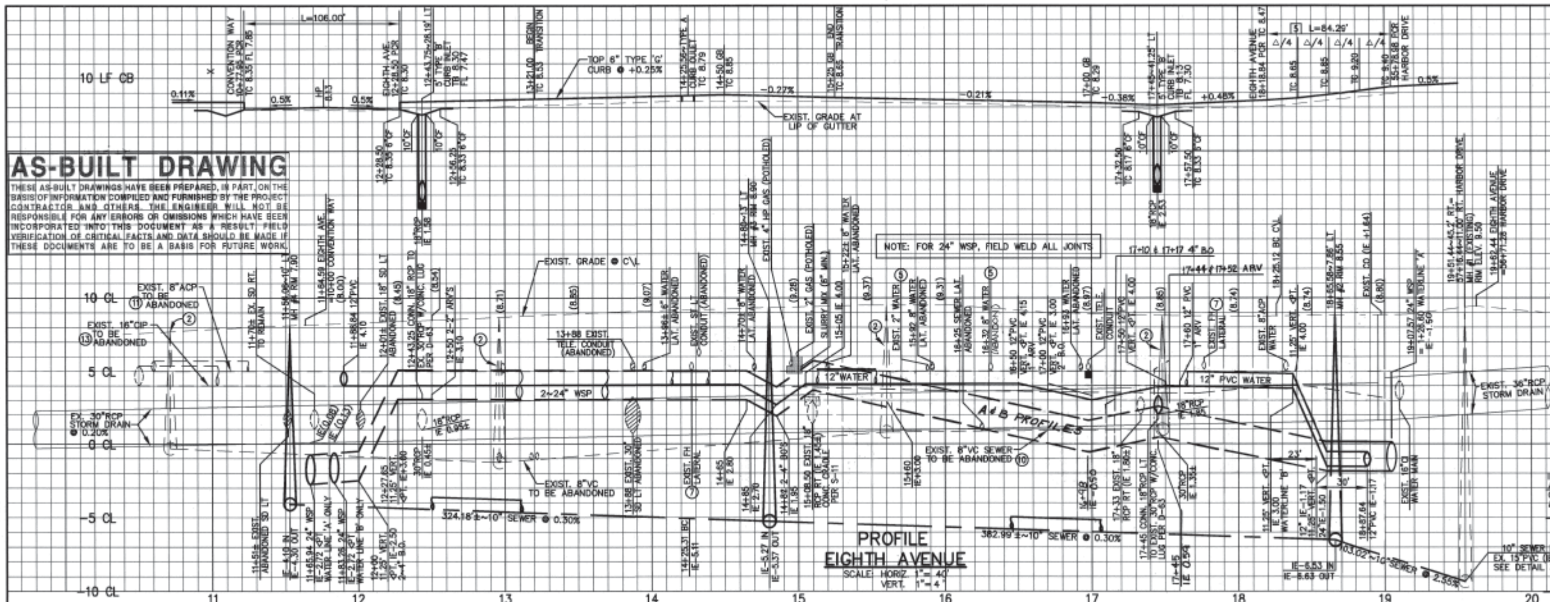
SHOLDERS & SANFORD, INC.
DESIGN ENGINEER
CONTROL CERTIFICATION
196-1719
LAMBERT COORDINATES

CONTRACTOR CALLAHAN BROS.  DATE STARTED 2 MARCH 1979
INSPECTOR  DATE COMPLETED 20 JUNE 1979

19021 -D

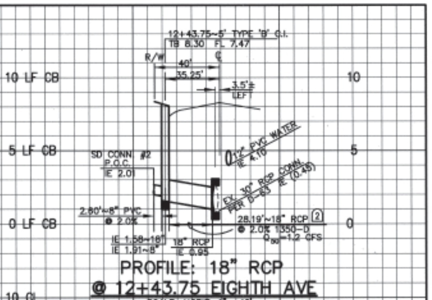
## AS-BUILT DRAWING

THESE AS-BUILT DRAWINGS HAVE BEEN PREPARED, IN PART, ON THE BASIS OF INFORMATION COMPILED AND FURNISHED BY THE PROJECT CONTRACTOR AND OTHERS. THE ENGINEER WILL NOT BE RESPONSIBLE FOR ANY ERRORS OR OMISSIONS WHICH HAVE BEEN INCORPORATED INTO THIS DOCUMENT AS A RESULT. FIELD VERIFICATION OF CRITICAL FACTS AND DATA SHOULD BE MADE IF THESE DOCUMENTS ARE TO BE A BASIS FOR FUTURE WORK.



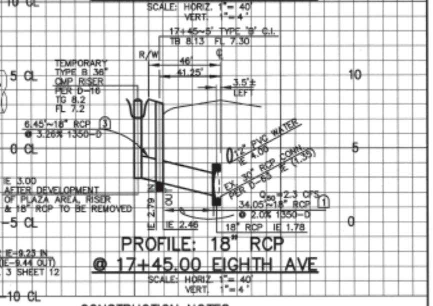
### PROFILE
### EIGHTH AVENUE

SCALE: HORIZ. 1"= 40'
VERT. 1"= 4'



### PROFILE: 18" RCP @ 12+43.75 EIGHTH AVE

SCALE: HORIZ. 1"= 40'
VERT. 1"= 4'

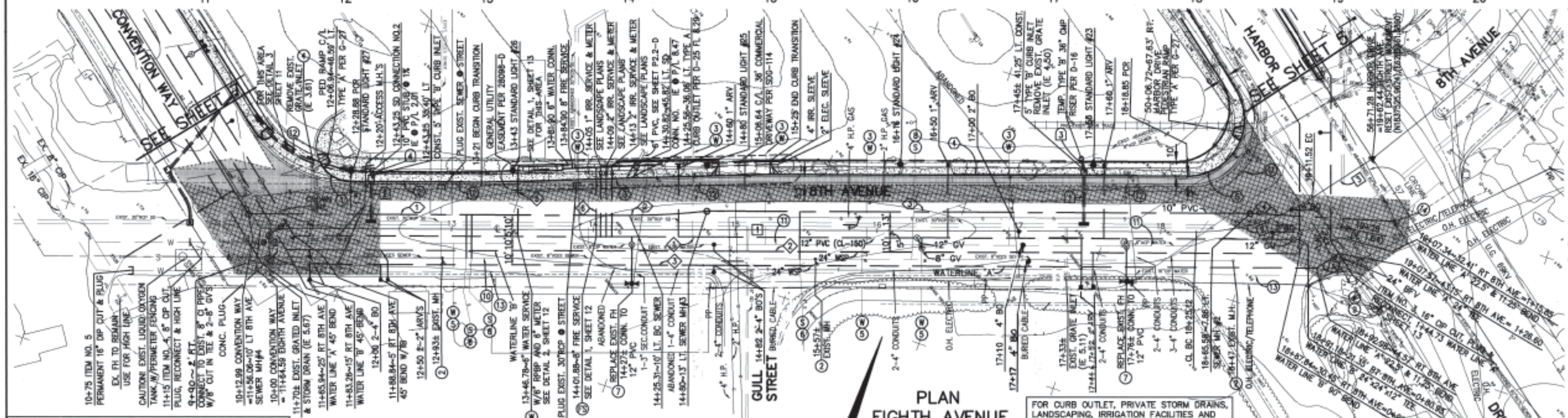


### PROFILE: 18" RCP @ 17+45.00 EIGHTH AVE

SCALE: HORIZ. 1"= 40'
VERT. 1"= 4'

## CONSTRUCTION NOTES

- ① OMITTED
- ② CONTRACTOR TO LOWER TOP 3 FEET AND FILL WITH SAND.
- ③ LOCATION OF EXISTING WATER SERVICE IS PER RECORD INFO. CONTRACTOR TO VERIFY LOCATION, ABANDON SERVICE.
- ④ CONTRACTOR TO PLUG EXISTING 18" RCP STORM DRAIN AND REMOVE INLET.
- ⑤ LOCATION OF EXISTING WATER SERVICE IS PER RECORD INFORMATION. CONTRACTOR TO POTHOLE AND VERIFY LOCATION AND SIZE. CONTRACTOR TO EXTEND EXIST. SEVICE TO 12" PVC MAIN.
- ⑥ LOCATION OF EXISTING WATER SERVICE IS PER RECORD INFORMATION. CONTRACTOR TO POTHOLE AND VERIFY LOCATION AND SIZE. CONTRACTOR TO EXTEND EXIST. SEVICE TO 10" PVC MAIN.
- ⑦ REPLACE FIRE HYDRANT & ASSEMBLY AND CONNECT TO 12" PVC.
- ⑧ LOCATION OF EXISTING SEWER LATERAL IS PER RECORD INFORMATION. CONTRACTOR TO POTHOLE AND VERIFY LOCATION. CUT AND PLUG AT PROPERTY LINE.
- ⑨ LOCATION OF EXISTING WATER SERVICE IS PER RECORD INFO. CONTRACTOR TO POTHOLE AND VERIFY LOCATION. CONTRACTOR TO ENSURE SERVICE IS NOT AFFECTED DURING CONSTRUCTION.
- ⑩ EXIST. 8" VCES SEWER TO BE ABANDONED.
- ⑪ EXIST. 8" WATER TO BE ABANDONED.
- ⑫ REMOVE EXISTING CURB, GUTTER AND SIDEWALK
- ⑬ EXIST. 16" CI WATER TO BE ABANDONED.
- ⑭ 19+51.44~45.2 RT. CONNECT TO EXIST. MANHOLE, RESHAPE BOTTOM.



### PLAN
### EIGHTH AVENUE

SCALE: 1"= 40'

FOR CURB OUTLET, PRIVATE STORM DRAINS, LANDSCAPING, IRRIGATION FACILITIES AND ENHANCED PAVING IN PUBLIC GENERAL UTILITY EASEMENT, SEE ENCROACHMENT REMOVAL AGREEMENT NO. 370100-4

EASEMENTS AND RIGHT OF WAY:
FOR CLARIFICATION SEE SHEET 2 & 28098-D

NOTE: CONTRACTOR TO POTHOLE AND VERIFY LOCATION OF ALL EXISTING UTILITIES AND STRUCTURES PRIOR TO CONSTRUCTION. CONTRACTOR TO ENSURE ALL EXISTING SEVICES NOT BEING ABANDONED ARE KEPT IN SERVICE.

### CENTERLINE DATA

| NO. | DELTA/BRG | RADIUS | LENGTH | REMARKS |
|---|---|---|---|---|
| 1 | N71°24'29"E | -- | 660.53' | -- |
| 2 | △ = 33°00'02" | 150.00' | 86.40' | -- |
| 3 | N38°24'27"E | -- | 50.92' | -- |

### STORM DRAIN DATA

| NO. | DELTA/BRG | RADIUS | LENGTH | REMARKS |
|---|---|---|---|---|
| 1 | N18°35'31"W | -- | 34.05' | 18"RCP (1350-D) |
| 2 | N18°35'31"W | -- | 28.19' | " " |
| 3 | N32°17'24"W | -- | 6.45' | " " |
| 4 | N18°35'31"W | -- | 2.60' | 10" PVC |

### WATER DATA

| NO. | DELTA/BRG | RADIUS | LENGTH | REMARKS |
|---|---|---|---|---|
| 1 | N71°24'29"E | -- | 709.33' | 12" PVC (231) CL-150 |
| 2 | N71°24'29"E | -- | 714.90' | 24" WSP (231) CL-150 |
| 3 | N71°24'29"E | -- | 744.23' | 24" WSP (390) CL-200 |
| 4 | N38°24'27"E | -- | 18.91' | 24" WSP (390) CL-200 |
| 5 | N18°35'31"W | -- | 48.61' | 6" PVC (231) CL-150 |
| 6 | N18°35'31"W | -- | 48.45' | 8" PVC (231) CL-150 |

### SEWER DATA

| NO. | DELTA/BRG | RADIUS | LENGTH | REMARKS |
|---|---|---|---|---|
| 1 | N71°24'29"E | -- | 269.25' | 10" SEWER |
| 2 | △ = 06°16'47" | 500.00' | 54.80' | " " |
| 3 | N71°24'29"E | -- | 382.99' | " " |
| 4 | N74°10'38"E | -- | 102.02' | " " |

### CURB DATA

| NO. | DELTA/BRG | RADIUS | LENGTH | REMARKS |
|---|---|---|---|---|
| 1 | △ = 63°32'43" | 24.50' | 27.17' | 6" TYPE G |
| 2 | N71°24'29"E | -- | 92.12' | " " |
| 3 | N69°43'24"E | -- | 204.09' | " " |
| 4 | N71°24'29"E | -- | 293.85' | " " |
| 5 | △= 120°44'28" | 40.00' | 84.29' | " " |

PHILIP R. KERN
R.C.E. 40831
EXP. 3-31-99

Prepared in the office of :
JK&A
JOHN KNUTZEN & ASSOCIATES, Inc.
CIVIL ENGINEERS / SURVEYORS
9666 Business Park Ave. • San Diego, CA 92131 • (619)537-3880
6/2/97
Engineer of Work R.C.E. No. 40831 Date

CITY CONTRACT

PLANS FOR THE IMPROVEMENT OF:
EIGHTH AVENUE
(PORT DISTRICT STREET)
FOR CONVENTION CENTER EXPANSION PROJECT

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING DEPARTMENT
SHEET 6 OF 121 SHEETS

W.O. NO. 370100

M. Kamoosh 6/25/97
FOR CITY ENGINEER DATE

| DESCRIPTION | BY | APPROVED | DATE | FILMED |
|---|---|---|---|---|
| ORIGINAL | JK&A | | | DEC 11 98 |
| | | | | |
| | | | | |
| AS BUILT | MF | [illegible] | 2/6/03 | |

CONTRACTOR Tumer Const DATE STARTED 8/15/98
INSPECTOR M. Fenertigak DATE COMPLETED 4/9/02

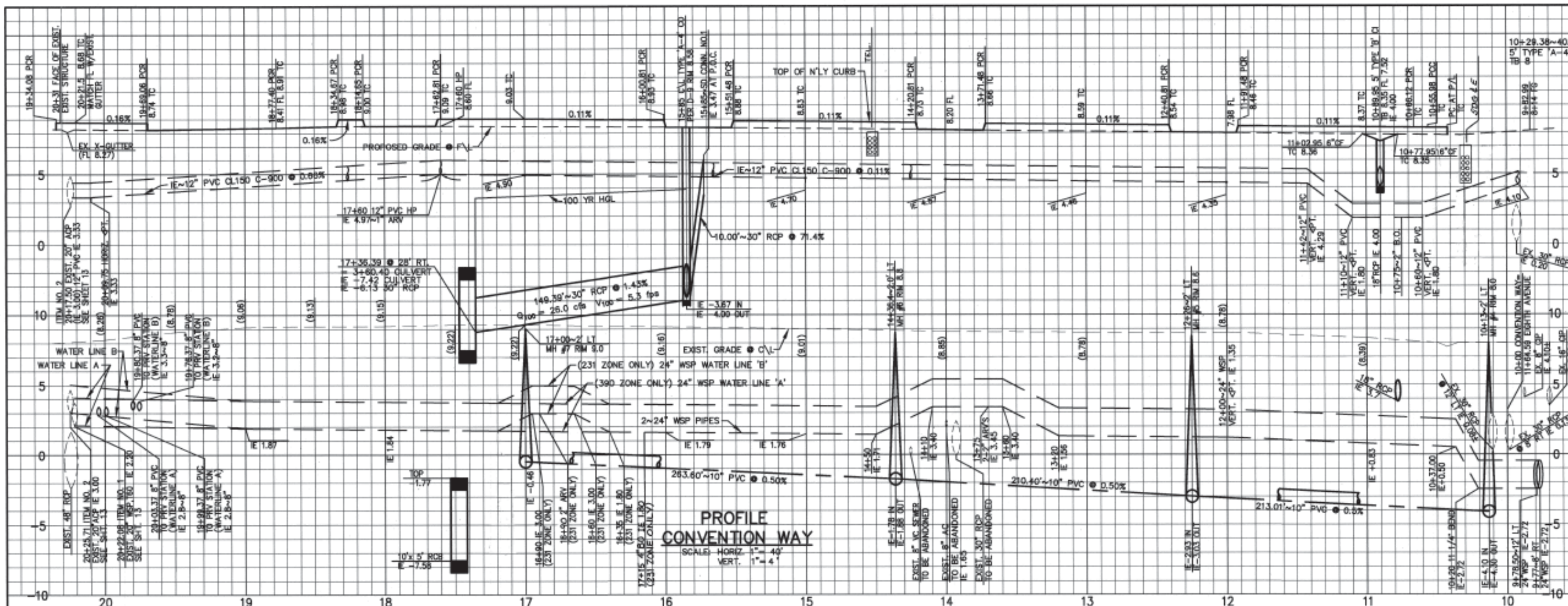
1836-6277
NAD 83 COORDINATES

196-1717
LAMBERT COORDINATES

27750-6-D

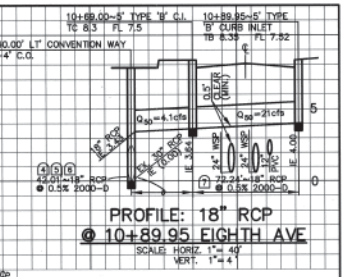
AS-BUILT

JN: 1062-94-00
DRAWING: 27750-6.dwg
PLOT DATE: 05-28-97



## PROFILE CONVENTION WAY

SCALE: HORIZ. 1" = 40'
VERT. 1" = 4'



## PROFILE: 18" RCP @ 10+89.95 EIGHTH AVE

SCALE: HORIZ. 1" = 40'
VERT. 1" = 4'

| CENTERLINE DATA | | | | |
|---|---|---|---|---|
| NO. | DELTA/BRG | RADIUS | LENGTH | REMARKS |
| 1 | N50°19'08"W | -- | 1023.04' | " " |

| STORM DRAIN DATA | | | | |
|---|---|---|---|---|
| NO. | DELTA/BRG | RADIUS | LENGTH | REMARKS |
| 1 | N50°19'08"W | -- | 149.39' | 30"RCP 1350-D |
| 2 | NOT USED | -- | -- | -- |
| 3 | N39°40'52"E | -- | 10.00' | 30" RCP 1350-D |
| 4 | N18°35'31"W | -- | 2.67' | 18"RCP 1350-D |
| 5 | 31°43'37" | 22.50' | 12.46' | 18"RCP 1350-D |
| 6 | N50°19'08"W | -- | 21.88' | 18"RCP 1350-D |
| 7 | N21°43'11"E | -- | 67.74' | 18"RCP 1350-D |

| WATER DATA | | | | |
|---|---|---|---|---|
| NO. | DELTA/BRG | RADIUS | LENGTH | REMARKS |
| 1 | N11°05'06"W | -- | 10.00' | 12" PVC CL-150 |
| 2 | N50°19'08"W | -- | 1026.76' | " " |
| 3 | N09°40'30"W | (CL-150) | 10.00' | 24" WSP (231) |
| 4 | N50°19'08"W | (CL-150) | 1040.71' | " " |
| 5 | N12°03'22"W | (CL-200) | 10.00' | 24" WSP (390) |
| 6 | N50°19'08"W | (CL-200) | 1036.80' | " " |
| 7 | N39°40'52"E | -- | 36.00' | 8" PVC CL-150 |
| 8 | N18°35'31"W | -- | 19.76' | " " |

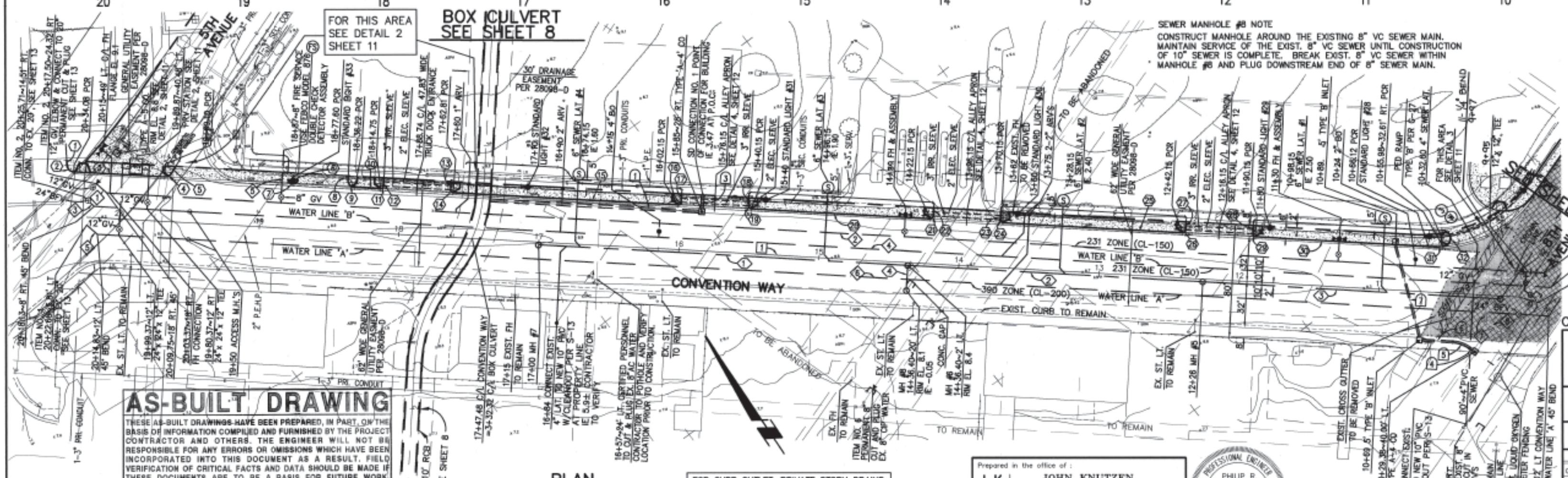
| SEWER DATA | | | | |
|---|---|---|---|---|
| NO. | DELTA/BRG | RADIUS | LENGTH | REMARKS |
| 1 | N50°19'08"W | -- | 263.60' | 10" PVC |
| 2 | N50°19'08"W | -- | 210.40' | " " |
| 3 | N50°19'08"W | -- | 213.01' | " " |
| 4 | N39°40'52"E | -- | 17.98' | 8" PVC |

FOR CURB DATA SEE SHEET 13
FOR CONSTRUCTION NOTES SEE SHEET 5

NOTE: CONTRACTOR TO POTHOLE AND VERIFY LOCATION OF ALL EXISTING UTILITIES, STRUCTURES AND GAS MAINS IN PRESENCE OF S.D.G. & E. STANDBY IN AREAS OF UTILITIES CROSSINGS AND OTHER CONFLICTS, PRIOR TO CONSTRUCTION. CONTRACTOR TO ENSURE ALL EXISTING SERVICES NOT BEING ABANDONED ARE KEPT IN SERVICE.

SEWER MANHOLE #8 NOTE

CONSTRUCT MANHOLE AROUND THE EXISTING 8" VC SEWER MAIN. MAINTAIN SERVICE OF THE EXIST. 8" VC SEWER UNTIL CONSTRUCTION OF 10" SEWER IS COMPLETE. BREAK EXIST. 8" VC SEWER WITHIN MANHOLE #8 AND PLUG DOWNSTREAM END OF 8" SEWER MAIN.



## AS-BUILT DRAWING

THESE AS-BUILT DRAWINGS HAVE BEEN PREPARED, IN PART, ON THE BASIS OF INFORMATION COMPILED AND FURNISHED BY THE PROJECT CONTRACTOR AND OTHERS. THE ENGINEER WILL NOT BE RESPONSIBLE FOR ANY ERRORS OR OMISSIONS WHICH HAVE BEEN INCORPORATED INTO THIS DOCUMENT AS A RESULT. FIELD VERIFICATION OF CRITICAL FACTS AND DATA SHOULD BE MADE IF THESE DOCUMENTS ARE TO BE A BASIS FOR FUTURE WORK.

EASEMENTS AND RIGHT OF WAY:
FOR CLARIFICATION SEE SHEET 2 & 28098-D

IRRIGATION AND ELECTRICAL SLEEVES ARE SHOWN SCHEMATICALLY. SEE DETAIL 4, SHEET 12 AND DETAIL 3, SHEET 11 FOR LOCATIONS

## PLAN CONVENTION WAY

SCALE: 1" = 40'

FOR CURB OUTLET, PRIVATE STORM DRAINS, LANDSCAPING, IRRIGATION FACILITIES AND ENHANCED PAVING IN PUBLIC GENERAL UTILITY EASEMENT, SEE ENCROACHMENT REMOVAL AGREEMENT NO. 370100-4

Prepared in the office of :
J K & A
JOHN KNUTZEN & ASSOCIATES, Inc.
CIVIL ENGINEERS / SURVEYORS
9666 Business Park Ave. • San Diego, CA 92131 • (619)537-3880
6/2/97
Engineer of Work R.C.E. No. 40831 Date

PHILIP R. KERN
R.C.E. 40831
EXP. 3-31-99

CITY CONTRACT

PLANS FOR THE IMPROVEMENT OF:
CONVENTION WAY
(PORT DISTRICT STREET)
FOR CONVENTION CENTER EXPANSION PROJECT

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING DEPARTMENT
SHEET 7 OF 121 SHEETS

W.O. NO. 370100

FOR CITY ENGINEER 6/25/97 DATE

| DESCRIPTION | BY | APPROVED | DATE | FILMED |
|---|---|---|---|---|
| ORIGINAL | JK&A | | | |
| | | | | |
| | | | | |
| | | | | |
| AS BUILT | M F | | 2/6/03 | |

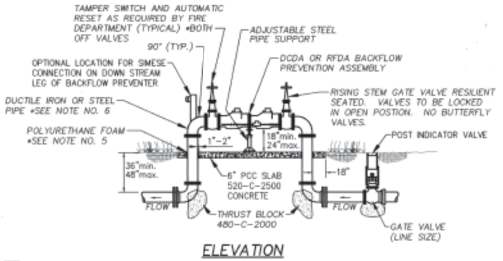
1836-6277
NAD 83 COORDINATES
196-1717
LAMBERT COORDINATES

CONTRACTOR Turner Const DATE STARTED 9/15/98
INSPECTOR M. Fewmeyer DATE COMPLETED 4/9/02

27750-7-D

AS-BUILT

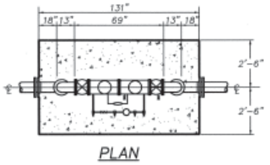
JN: 1062-94-00
DRAWING: 27750-7.dwg
PLOT DATE: 05-28-97



ELEVATION

## NOTE

1. FOR CORROSION CONTROL REQUIREMENTS, CONTACT ENGINEERING CORROSION SECTION.
2. ANY CHANGES MUST HAVE SYSTEMS DIVISION APPROVAL PRIOR TO CONSTRUCTION.
3. CONCRETE SLAB SHALL BE SYMMETRICAL TO PIPING.
4. ALL PIPING PARTS SHALL BE PER CITY SPECIFICATIONS.
5. FOAM SHALL BE POLYURETHANE 1" THICK FOR 1" -3.5" PIPE 2" THICK FOR 4" AND LARGER PIPE.
6. DUCTILE IRON FULLY FORMED OF SPIN ON FLANGES CREOSOTE AND MORTAR LINED OR EPOXY COATED INSIDES AND OUT MIN. 10 MILS. THICK UNI-FLANGES ARE NOT TO BE USED.

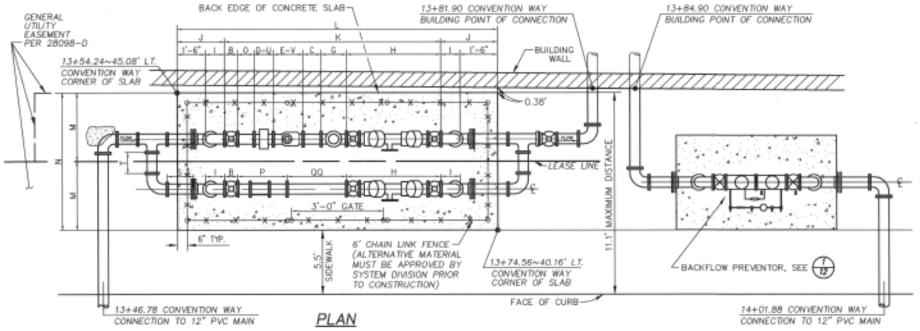


PLAN

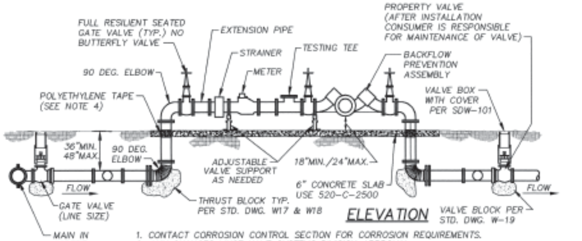
SEE DETAIL 1, SHEET 13 FOR MORE INFORMATION

### REDUCED PRESSURE BACKFLOW PREVENTER/ 8" FIRE DEPT. DOUBLE CHECK DETECTOR ASSEMBLY AND POST INDICATOR VALVE 14+01.88 EIGHTH AVE. 1/12

NO SCALE



PLAN



ELEVATION

1. CONTACT CORROSION CONTROL SECTION FOR CORROSION REQUIREMENTS.
2. ANY CHANGES MUST HAVE SYSTEMS DIVISION APPROVAL.
3. PIPING TO BE SYMMETRICAL TO SLAB CENTERLINE.
4. ALL METAL IN CONTACT WITH CONCRETE SHALL BE POLYETHYLENE WRAPPED USING 2" WIDE PLASTIC BACKED ADHESIVE 8 MILLS THICK WITH 1/2" OVERLAY.

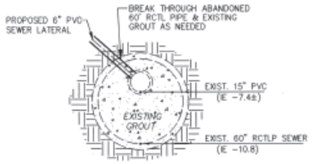
| LTR. CODE | PART DESCRIPTION | 6" |
|---|---|---|
| A | CORP STOP | 1'-0" |
| B | GATE VALVE | 10.5" |
| C | PIPE EXTENSION | 1'-0" |
| D | STRAINER | 9" |
| E | TURBINE WATER METER | 1'-6" |
| F | PIPE EXTENSION | 1'-0" |
| G | TESTING TEE | 1'-4" |
| H | BACKFLOW ASSEMBLY | 5'-6" |
| I | 90 DEG. ELBOW | 12" |
| J | FLANGE TO SLAB | 2'-5" |
| K | OVERALL DIMENSION | 15'-4" |
| L | SLAB LENGTH | 20'-2" |
| M | SLAB TO C/L | 1'-6" |
| N | SLAB WIDTH | 5'-6" |
| O | PIPE EXTENSION | 1'-0" |
| P | FLEX JOINT | VARIES |
| QQ | BYPASS EXTENSION | VARIES |
| R | DETECTOR CHECK | 3'-0" |
| S | PIPE EXTENSION | 1'-6" |
| T | PIPE EXTENSION | 2'-0" |
| U | BASKET STRAINER* | 2'-0" |
| V | COMPOUND METER* | 2'-5" |

NOTES: INDIVIDUAL DIMENSIONS MAY VARY PER MANUFACTURER
* OVERALL DIMENSIONS INCREASE WITH USE OF THESE COMPONENTS.

SEE DETAIL 1, SHEET 13 FOR MORE INFORMATION

### ABOVE GROUND 6" METER WITH BACKFLOW PREVENTION ASSEMBLIES 2/12
### 13+46.78 EIGHTH AVENUE

NO SCALE

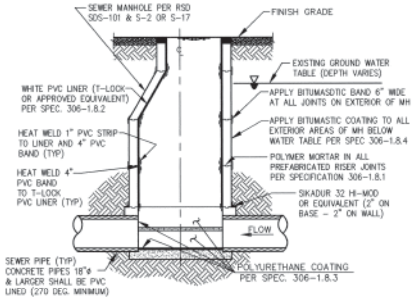


STATION 49+11.36 HARBOR DRIVE

6" PVC SEWER LATERAL CONNECTION

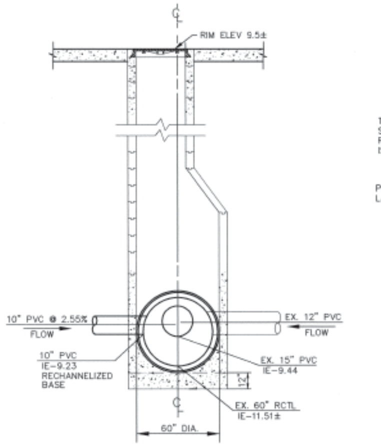
### DETAIL 5/12

NO SCALE



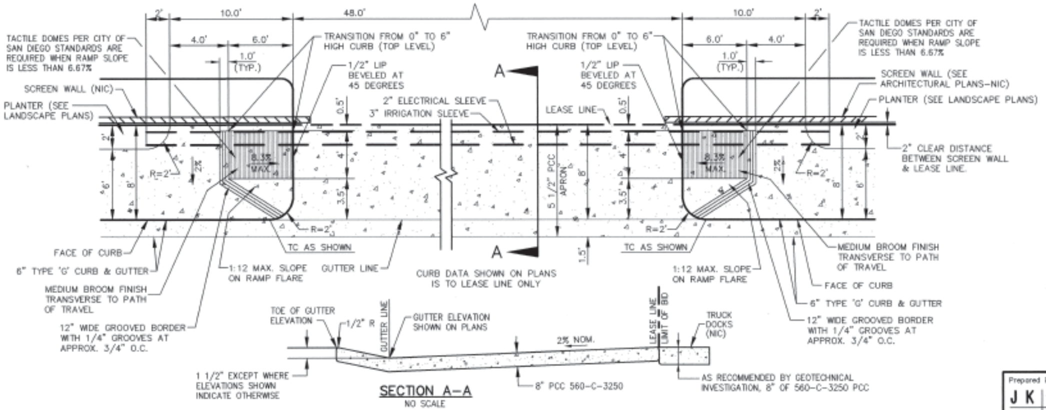
### DETAIL: TYPICAL SEWER MANHOLE COATING & LINING 3/12

NO SCALE



### DETAIL: EXIST. SEWER MANHOLE 19+51.44 8TH AVE. = 57+16.44 11.00' RT., HARBOR DR. 3/12

NO SCALE



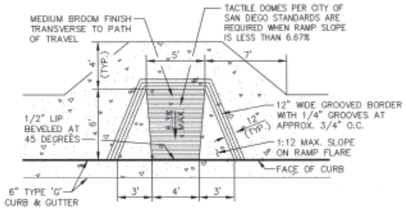
SECTION A-A

NO SCALE

### ALLEY APRON / PEDESTRIAN RAMP TYPE 'D' DETAIL 4/12

PER G-31

NO SCALE



### PEDESTRIAN RAMP TYPE 'A' AND 'B' 6/12

NO SCALE

CITY CONTRACT

PLANS FOR THE IMPROVEMENT OF:

# DETAIL SHEET

FOR CONVENTION CENTER EXPANSION PROJECT

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING DEPARTMENT
SHEET 12 OF 121 SHEETS

W.O. NO. 370100

M. [illegible] FOR CITY ENGINEER — 6/25/97 DATE

| DESCRIPTION | BY | APPROVED | DATE | FILMED |
|---|---|---|---|---|
| ORIGINAL | JK&A | | | [illegible] 11 '98 |
| | | | | |
| | | | | |
| AS BUILT | MF | [illegible] | 2/6/03 | [illegible] |

CONTRACTOR [illegible] DATE STARTED 8/15/98
INSPECTOR M. [illegible] DATE COMPLETED 4/4/02

1836-6277
NAD 83 COORDINATES

196-1717
LAMBERT COORDINATES

27750-12-D

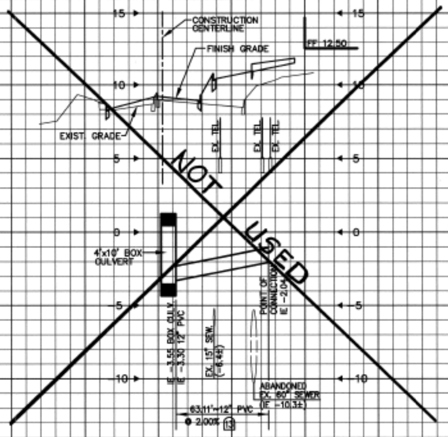
PHILIP R. KERN
R.C.E. 40831
EXP. 3-31-99

Prepared in the office of :
JK & A
JOHN KNUTZEN & ASSOCIATES, Inc.
CIVIL ENGINEERS / SURVEYORS
9888 Business Park Ave. • San Diego, CA 92131 • (619)537-3880

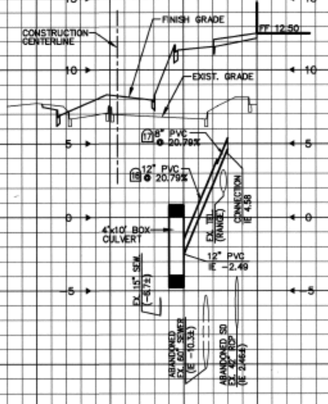
Philip R Kern 6/2/97
Engineer of Work R.C.E. No. 40831 Date

AS-BUILT

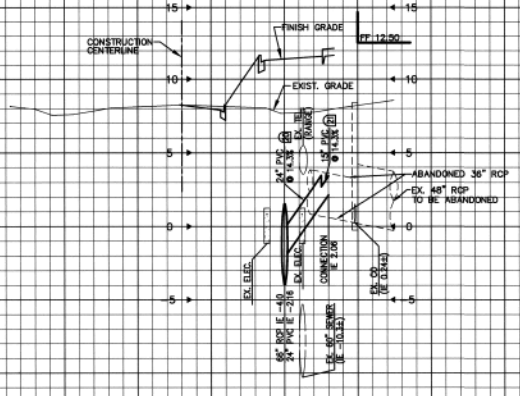
JN: 1062-94-00
DRAWING: 27750-12.dwg
PLOT DATE: 05-28-97



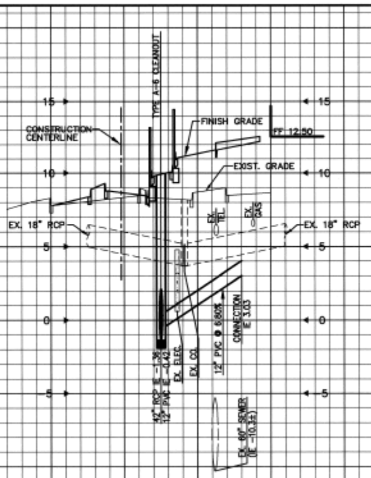
SD CONN. #8
@ 43+05±
SCALE: HORIZ. 1"= 40'
VERT. 1"= 4'
FOR PLAN SEE SHT. 9



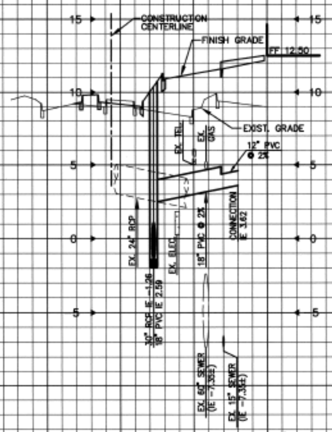
SD CONN. #7
@ 44+90±
SCALE: HORIZ. 1"= 40'
VERT. 1"= 4'
FOR PLAN SEE SHT. 9



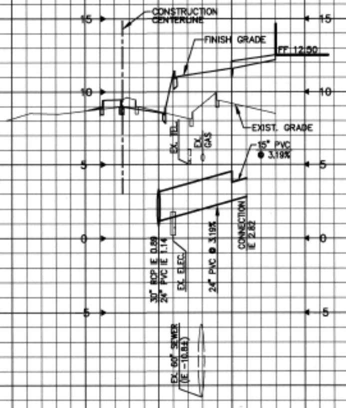
SD CONN. #6
@ 45+97±
SCALE: HORIZ. 1"= 40'
VERT. 1"= 4'
FOR PLAN SEE SHT. 9



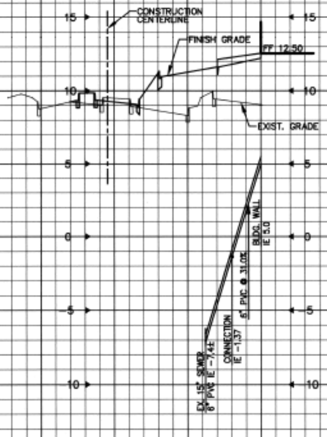
SD CONN. #5
@ 47+32±
SCALE: HORIZ. 1"= 40'
VERT. 1"= 4'



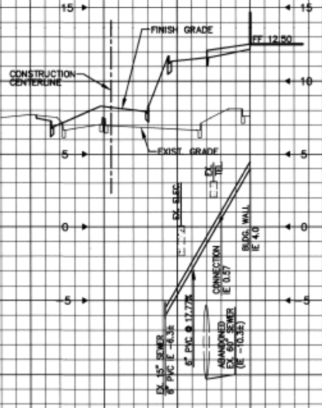
SD CONN. #4
@ 49+03±
SCALE: HORIZ. 1"= 40'
VERT. 1"= 4'



SD CONN. #3
@ 50+60±
SCALE: HORIZ. 1"= 40'
VERT. 1"= 4



SEWER LATERAL #5
@ 49+11±
SCALE: HORIZ. 1"= 40'
VERT. 1"= 4'



SEWER LATERAL #6
@ 44+60±
SCALE: HORIZ. 1"= 40'
VERT. 1"= 4'

SEE SHEETS 4,107 & 109 FOR LOCATIONS

## AS-BUILT DRAWING

THESE AS-BUILT DRAWINGS HAVE BEEN PREPARED, IN PART, ON THE BASIS OF INFORMATION COMPILED AND FURNISHED BY THE PROJECT CONTRACTOR AND OTHERS. THE ENGINEER WILL NOT BE RESPONSIBLE FOR ANY ERRORS OR OMISSIONS WHICH HAVE BEEN INCORPORATED INTO THIS DOCUMENT AS A RESULT. FIELD VERIFICATION OF CRITICAL FACTS AND DATA SHOULD BE MADE IF THESE DOCUMENTS ARE TO BE A BASIS FOR FUTURE WORK.

FOR ENHANCED PAVING, PRIVATE RETAINING WALLS, LANDSCAPING, IRRIGATION FACILITIES, PRIVATE SIGNAGE AND PRIVATE STREET LIGHTING IN HARBOR DRIVE RIGHT OF WAY, SEE ENCROACHMENT REMOVAL AGREEMENT NO. 370100-2

PROFESSIONAL ENGINEER
PHILIP R. KERN
R.C.E. 40831
EXP. 3-31-03
STATE OF CALIFORNIA

Prepared in the office of :
**WINZLER & KELLY**
CONSULTING ENGINEERS
9888 Business Park Ave. • San Diego, CA 92131 • (619)537-3880
Philip R Kern 5/4/99
Engineer of Work R.C.E. No. 40831 Date

CITY CONTRACT

PLANS FOR THE IMPROVEMENT OF:
PRIVATE STORM DRAIN
AND SEWER LATERAL PROFILES
FOR CONVENTION CENTER EXPANSION PROJECT

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING DEPARTMENT
SHEET 112 OF 121 SHEETS

W.O. NO. 370100

FOR CITY ENGINEER 5/15/99 DATE

| DESCRIPTION | BY | APPROVED | DATE | FILMED |
|---|---|---|---|---|
| ORIGINAL | JK&A | | | MAY 10 '99 |
| | | | | |
| | | | | |
| AS BUILT | MF McFarge 2/11/03 | | | |

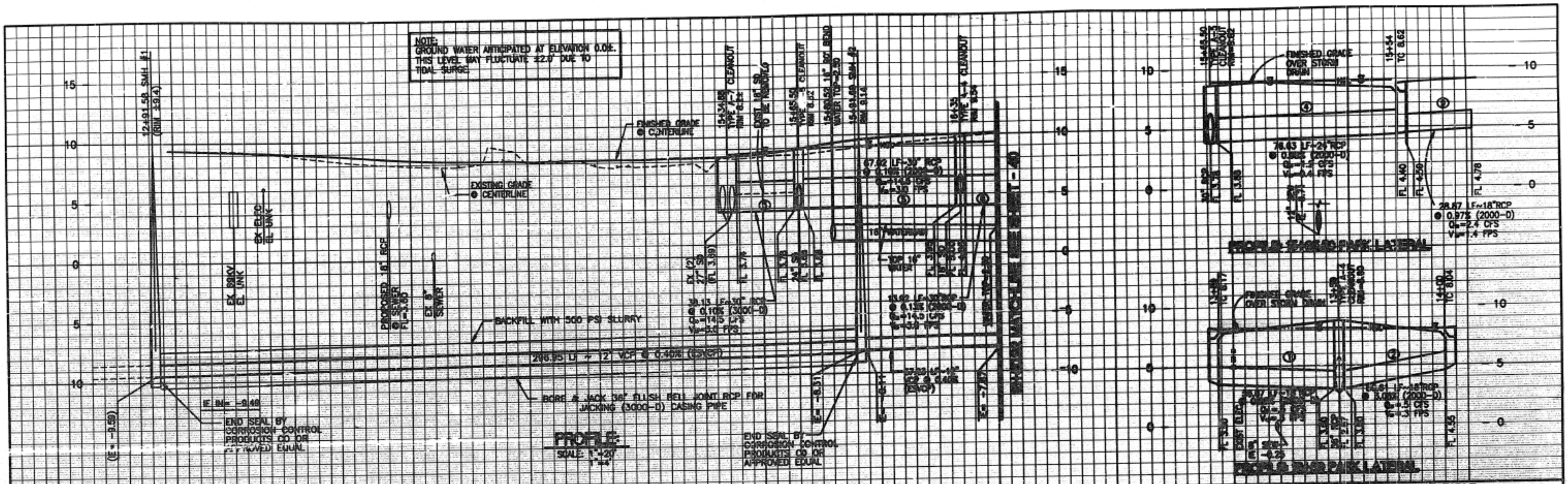
1836-6277
1836-6277
196-1717
196-1717

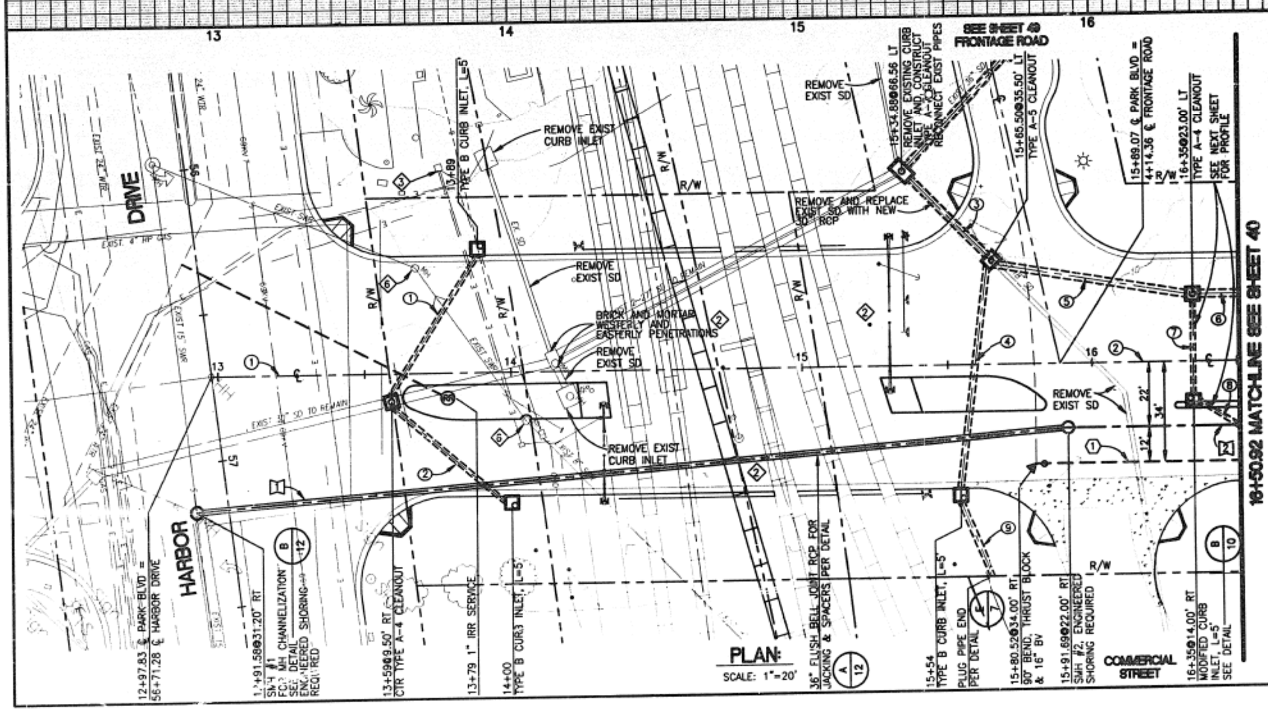
CONTRACTOR Turner Const DATE STARTED 8/15/98
INSPECTOR M. Powerjou DATE COMPLETED 4/9/02

27750-112-D

NEW SHEET AS-BUILT

NOTE:
GROUND WATER ANTICIPATED AT ELEVATION 0.0±.
THIS LEVEL MAY FLUCTUATE ±2.0' DUE TO
TIDAL SURGE.





## CONSTRUCTION NOTES

◇2 - CONTRACTOR SHALL EXERCISE CAUTION WHEN WORKING WITHIN THE SDTI R/W. OVERHEAD TRACTION POWER EXISTS.

◇3 - CONTRACTOR SHALL PROTECT EXIST CONTROLLER AND CONDUIT DURING CONSTRUCTION

◇6 - ADJUST TO GRADE

GRAPHIC SCALE
20 0 20 40
1"=20'

**REFERENCE PLANS:**
24400-10-D
24400-3-D
39-L
15637-2-D
11556-22-D

### ○ CENTERLINE TABLE

| NO. | DELTA/BEARING | RADIUS | LENGTH | REMARKS |
|---|---|---|---|---|
| 1 | N 45°24'05" E | --- | 281.24' | CENTERLINE |
| 2 | N 45°24'05" E | --- | 61.65' | CENTERLINE |

### ○ STORM DRAIN DATA

| NO. | DELTA/BEARING | RADIUS | LENGTH | REMARK |
|---|---|---|---|---|
| 1 | N 12°[illegible]'11" W | ---- | 58.67' | 18" RCP |
| 2 | N [illegible]°24'05" E | ---- | 50.61' | 18" RCP |
| 3 | N [illegible]'02" W | ---- | 38.13' | 30" RCP |
| 4 | N 37°1[illegible]'11" W | ---- | 76.63' | 24" RCP |
| 5 | N 45°[illegible]'38" E | ---- | 67.02' | 30" RCP |
| 6 | N 45°24'05" E | ---- | 13.92' | 30" RCP |
| 7 | N 45°[illegible]'55" W | ---- | 32.67' | 18" RCP |
| 8 | N 78°22'50" E | ---- | 16.59' | 18" RCP |
| 9 | N 67°0[illegible]'10" W | ---- | 27.87' | 18" RCP |

### ⬡ WATER TABLE

| NO. | DELTA/BEARING | RADIUS | LENGTH | REMARKS |
|---|---|---|---|---|
| 1 | N 45°24'05" E | --- | 70.40' | 16" PVC CL235 |
|  |  |  |  |  |

### ☐ SEWER LINE DATA

| NO. | DELTA/BEARING | RADIUS | LENGTH● | REMARK |
|---|---|---|---|---|
| 1 | N 40°47'51" E | ---- | 300.11' | 12" ESVCP SEWER * |
| 2 | N 45°24'05" E | ---- | 59.23' | 12" ESVCP SEWER |

*IN 21" RCP CASING
●DISTANCE MEASURED FROM CENTER OF MANHOLE

CITY CONTRACT
CIP No.39-228.0

KEITH A. GILLETTE
No. 30433
CIVIL
8/06/01

Berryman & Henigar
11590 W. Bernardo Ct., Suite 100
San Diego, CA 92127
TEL: (858)451-6100 FAX: (858)451-2846

CONTRACTOR MUST NOTIFY THE BELOW LISTED AGENCY AT LEAST TWO (2) WORKING DAYS PRIOR TO COMMENCEMENT OF EXCAVATION :

UNDERGROUND SERVICE ALERT (USA) 1-800-422-4133

PLAN FOR THE IMPROVEMENT OF:
EAST VILLAGE REDEVELOPMENT AND BALLPARK INFRASTRUCTURE PROJECT

# PARK BLVD
## 12+97.38 - 16+50.92
## SEWER/WATER/STORM DRAIN

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING CAPITAL PROJECTS DEPARTMENT
SHEET 39 OF 120 SHEETS

FOR CITY ENGINEER — DATE 8/17/01

| DESCRIPTION | BY | APPROVED | DATE | FILMED |
|---|---|---|---|---|
| ORIGINAL | B&H |  |  |  |
| ⚠1 ℄ GRADE | B&H |  |  |  |
| ⚠2 SEWER CASING | B&H |  |  |  |
|  |  |  |  |  |
| AS-BUILT | B&H |  | 11/4/05 |  |

CONTRACTOR Vadnais Corp. DATE STARTED 4/2/0[illegible]
INSPECTOR Mark Spears DATE COMPLETED 4/5/0[illegible]

W.O. NO. 117640
SECTION HEAD
PROJECT MANAGER
1838-6279
NAD 83 COORDINATES
198-1719
LAMBERT COORDINATES
30321-39-D

P:\15400\dwg\plans\100%submittal\039_u_park1.dwg

AS BUILT

FILMED FROM THE ORIGINAL. BEST QUALITY OBTAINABLE. EXCESSIVE GRAY BACKGROUND MAY CAUSE A POOR QUALITY REPRODUCTION.

0 1 2 3 4IN.

# APPENDIX III

# PROPOSED DEVELOPMENT EIR REPROTING NEEDS MEMORANDUM

GLUMAC
engineers for a sustainable future™

# MEMORANDUM

**To:** Andrew Michajlenko
Gensler
225 Broadway, Suite 1600
San Diego, CA 92101
619.557.2527
Andrew_Michajlenko@gensler.com

**Date:** February 7, 2017
**From:** Mitchell Dec
**cc:** Dennis Berlien - Glumac

**Project Name:** Fifth Landing Hotel
**Project Number:** 04.16.00690
**Subject:** EIR Reporting Needs- Energy, Water, Noise

---

Andrew,

Per the environmental impact reporting requirements, we have determined the following in support of the Fifth Landing Hotel project needs for electricity, natural gas, water, wastewater, and noise pollution criteria.

Electricity Use: 18-22 kWh/ft$^2$-yr based on similar high profile projects completed or underway by Glumac. Representative projects used and adjusted for weather include Wilshire Grand Hotel, 3rd & Taylor Hotel, The Allison Inn & Spa, Broadway Crossing, and Hotel Nikko.

- Marina
  - Existing usage: 1,342,558 kWh per year.
  - Projected expansion usage: 5,829,765 kWh per year.
- Parcel A
  - ~~831~~ *850* rooms.
  - 796,000 sq. ft. of occupied space.
  - 14,334,048 to 17,519,392 kWh per year. *Calculation in Figure 1, below, updated for 850 rooms.*
- Parcel B
  - 565 beds.
  - 80,000 sq. ft. of occupied space.
  - 1,309,986 to 1,601,094 kWh per year.
- Total
  - 21,473,799 to 24,950,251 kWh per year.

| Month | Marina Expansion | Market Rate Hotel | Low Cost Hotel | Activating Retail | Water Transportation Center | Total |
|---|---|---|---|---|---|---|
| Jan | 349,675 | 1,245,247 | 111,259 | 11,033 | 7,328 | 1,724,543 |
| Feb | 598,827 | 1,124,739 | 100,492 | 9,965 | 6,619 | 1,840,642 |
| Mar | 855,212 | 1,245,247 | 111,259 | 11,033 | 7,328 | 2,230,080 |
| Apr | 642,362 | 1,205,078 | 107,670 | 10,677 | 7,092 | 1,972,879 |
| May | 352,585 | 1,245,247 | 111,259 | 11,033 | 7,328 | 1,727,452 |
| Jun | 509,966 | 1,205,078 | 107,670 | 10,677 | 7,092 | 1,840,483 |
| Jul | 366,133 | 1,245,247 | 111,259 | 11,033 | 7,328 | 1,741,000 |
| Aug | 342,563 | 1,245,247 | 111,259 | 11,033 | 7,328 | 1,717,430 |
| Sep | 421,106 | 1,205,078 | 107,670 | 10,677 | 7,092 | 1,751,623 |
| Oct | 556,342 | 1,245,247 | 111,259 | 11,033 | 7,328 | 1,931,209 |
| Nov | 627,473 | 1,205,078 | 107,670 | 10,677 | 7,092 | 1,957,990 |
| Dec | 207,522 | 1,245,247 | 111,259 | 11,033 | 7,328 | 1,582,389 |
| Total | 5,829,765 | 14,661,782 | 1,309,986 | 129,906 | 86,280 | 22,017,719 |

**Figure 1 - Estimated Annual Electricity Use, in kWh**

Natural Gas Use: 0.25-0.45 therms/ft$^2$-yr based on similar high profile projects completed or underway by Glumac. Representative projects used and adjusted for weather include Wilshire Grand Hotel, 3rd & Taylor Hotel, The Allison Inn & Spa, Broadway Crossing, and Hotel Nikko.

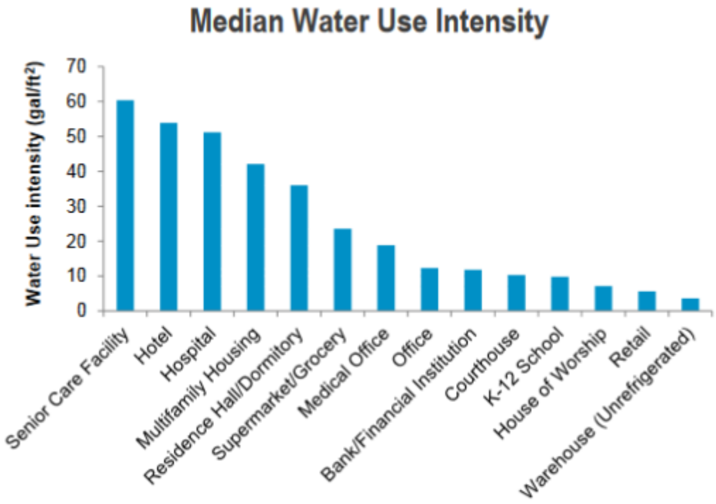
- Marina
    - Existing usage: 24,020 therms per year.
    - Projected expansion usage: 104,302 therms per year.
- Parcel A
    - Space Heating: 0.15 therms/ft$^2$-yr, or 119,451 therms per year.
    - Guestroom Water Heating: 30 gallons of hot water per room per day, at an 80-degree F rise in temperature, assuming an average of 70% occupancy per day. 47,181 therms per year. *Water heating updated for 850 units in Parcel A for Figure 2.*
    - Kitchen: Assuming 3,000 meals per day with 5 gallons of hot water per day. 40,554 therms per year. *Kitchen needs increased due to higher number of average occupants with 850 units for Figure 2.*
    - Spa: Assuming 120 gallons of hot water per treatment with 20 treatments per day. 6,489 therms per year. *Updated occupant load for potential spa use in Figure 2.*
    - Onsite Laundry: Limited laundry assuming about 1 pound of laundry per guestroom per day. 2,247 herms per year. *Laundry increased for 850 units of laundry in Figure 2.*
    - Pool: 14,910 therms per year.
    - Total: 230,072 therms per year.
- Parcel B
    - Space Heating: 0.15 therms/ft$^2$-yr, or 10,917 therms per year.
    - Guestroom Water Heating: 20 gallons of hot water per bed per day, at an 80-degree F rise in temperature, assuming an average of 50% occupancy per day. 15,276 therms per year.
    - Onsite Laundry: Limited laundry assuming about 0.5 pound of laundry per guestroom per day. 635 therms per year.
    - Total: 26,828 therms per year.
- Total
    - ~~281,813~~ *367,345* therms per year.

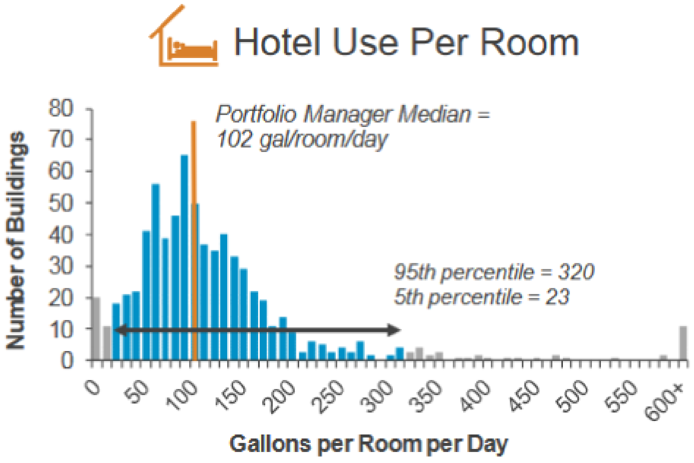
| Month | Marina Expansion | Market Rate Hotel | Low Cost Hotel | Activating Retail | Water Transportation Center | Total |
|---|---|---|---|---|---|---|
| Jan | 6,470 | 19,950 | 2,279 | 72 | 38 | 28,809 |
| Feb | 6,470 | 18,019 | 2,058 | 72 | 38 | 26,657 |
| Mar | 12,658 | 19,950 | 2,279 | 72 | 38 | 34,996 |
| Apr | 12,658 | 19,306 | 2,205 | 72 | 38 | 34,279 |
| May | 6,817 | 19,950 | 2,279 | 72 | 38 | 29,156 |
| Jun | 6,817 | 19,306 | 2,205 | 72 | 38 | 28,439 |
| Jul | 4,038 | 19,950 | 2,279 | 72 | 38 | 26,377 |
| Aug | 4,038 | 19,950 | 2,279 | 72 | 38 | 26,377 |
| Sep | 10,291 | 19,306 | 2,205 | 72 | 38 | 31,913 |
| Oct | 10,291 | 19,950 | 2,279 | 72 | 38 | 32,630 |
| Nov | 11,876 | 19,306 | 2,205 | 72 | 38 | 33,498 |
| Dec | 11,876 | 19,950 | 2,279 | 72 | 38 | 34,215 |
| Total | 104,302 | 234,889 | 26,828 | 866 | 460 | 367,345 |

**Figure 2 - Estimated Annual Natural Gas Use, in therms**

Water Use: Indoor water utilization averages 55 gallons/$ft^2$-yr, and102 gallons/room-day, based on median data from Energy Star Portfolio Manager – each value represents a different metric to approximate total annual water volume. We have used each calculation and took the average of each number for calculating the estimated annual volume of water anticipated for the development. Exterior irrigation water consumption average 0.935 gallons per sq. ft. of landscaping based on historical data from San Diego.

- Marina
    - Existing usage: 1,796,696 gallons per year.
    - Projected expansion usage: 7,801,760 gallons per year.
- Parcel A:
    - 55 gallons per sq. ft. = 43,798,480 gallons per year.
    - 102 gallons per room per day = ~~30,938,130~~ 32,646,910 gallons per year.
    - Total (average of two numbers above): ~~37,368,305~~ 38,222,695 gallons per year.
- Parcel B:
    - 55 gallons per sq. ft. = 4,002,735 gallons per year.
    - 102 gallons per bed per day, and assume 50% bed utilization = 10,517,475 gallons per year.
    - Total (average of two numbers above): 7,260,105 gallons per year.
- Site Irrigation:
    - 218,874 GSF site area.
    - Assume 60% of site area landscaped for green roof and at grade. 131,324 sq. ft. of landscaping.
    - Total: 0.935 gallons per sq. ft. = 122,788 gallons per year.
- Total:
    - ~~46,547,894~~ *53,407,348* gallons per year.





| Month | Marina Expansion | Market Rate Hotel | Low Cost Hotel | Site Irrigation | Activating Retail | Water Transpo | Total |
|---|---|---|---|---|---|---|---|
| Jan | 483,956 | 3,246,311 | 616,612 | 10,232 | Included in Hotel Water Use Calculations | Included in Hotel Water Use Calculations | 4,357,111 |
| Feb | 483,956 | 2,932,152 | 556,940 | 10,232 | | | 3,983,280 |
| Mar | 946,800 | 3,246,311 | 616,612 | 10,232 | | | 4,819,955 |
| Apr | 946,800 | 3,141,591 | 596,721 | 10,232 | | | 4,695,344 |
| May | 509,940 | 3,246,311 | 616,612 | 10,232 | | | 4,383,095 |
| Jun | 509,940 | 3,141,591 | 596,721 | 10,232 | | | 4,258,485 |
| Jul | 302,066 | 3,246,311 | 616,612 | 10,232 | | | 4,175,222 |
| Aug | 302,066 | 3,246,311 | 616,612 | 10,232 | | | 4,175,222 |
| Sep | 769,782 | 3,141,591 | 596,721 | 10,232 | | | 4,518,327 |
| Oct | 769,782 | 3,246,311 | 616,612 | 10,232 | | | 4,642,937 |
| Nov | 888,335 | 3,141,591 | 596,721 | 10,232 | | | 4,636,880 |
| Dec | 888,335 | 3,246,311 | 616,612 | 10,232 | | | 4,761,490 |
| Total | 7,801,760 | 38,222,695 | 7,260,105 | 122,788 | | | 53,407,348 |

**Figure 3 - Estimated Annual Water Consumption, in gallons**

Water Effluent to Sanitary System: Assume building and marina sewer will discharge to sanitary system.

- Marina Water Use Becoming Effluent
  - Existing effluent: 1,796,696 gallons per year.
  - Projected expansion effluent: 7,801,760 gallons per year.
- New Building Use Becoming Effluent
  - Parcel A: 38,222,695 gallons per year.
  - Parcel B: 7,260,105 gallons per year.
  - Total: 45,482,800 gallons per year.
- Total
  - 53,284,560 gallons per year.

| Month | Marina Expansion | Market Rate Hotel | Low Cost Hotel | Activating Retail | Water Transportation Center | Total |
|---|---|---|---|---|---|---|
| Jan | 483,956 | 3,246,311 | 616,612 | Included in Hotel Water Use Calculations | Included in Hotel Water Use Calculations | 4,346,879 |
| Feb | 483,956 | 2,932,152 | 556,940 | | | 3,973,047 |
| Mar | 946,800 | 3,246,311 | 616,612 | | | 4,809,723 |
| Apr | 946,800 | 3,141,591 | 596,721 | | | 4,685,112 |
| May | 509,940 | 3,246,311 | 616,612 | | | 4,372,863 |
| Jun | 509,940 | 3,141,591 | 596,721 | | | 4,248,253 |
| Jul | 302,066 | 3,246,311 | 616,612 | | | 4,164,989 |
| Aug | 302,066 | 3,246,311 | 616,612 | | | 4,164,989 |
| Sep | 769,782 | 3,141,591 | 596,721 | | | 4,508,095 |
| Oct | 769,782 | 3,246,311 | 616,612 | | | 4,632,705 |
| Nov | 888,335 | 3,141,591 | 596,721 | | | 4,626,648 |
| Dec | 888,335 | 3,246,311 | 616,612 | | | 4,751,258 |
| Total | 7,801,760 | 38,222,695 | 7,260,105 | | | 53,284,560 |

Figure 4 – Estimated Annual Water Effluent to Sanitary System, in gallons

Water Effluent to Storm System: Assume stormwater and landscape irrigation water will discharge to storm system.

- Stormwater Becoming Effluent
    - 10 inches of rainfall per year, on 218,874 sq. ft. of site area. 711,341 cubic feet of storm water. 7.48 gallons per cubic foot of water.
    - Total Storm Water: 1,364,315 gallons per year.
- Site Irrigation
    - Total: 122,788 gallons per year
- Total Effluent
    - 1,487,103 gallons per year.

| Month | Site Irrigation | Storm Water | Total |
|---|---|---|---|
| Jan | 10,232 | 113,693 | 123,925 |
| Feb | 10,232 | 113,693 | 123,925 |
| Mar | 10,232 | 113,693 | 123,925 |
| Apr | 10,232 | 113,693 | 123,925 |
| May | 10,232 | 113,693 | 123,925 |
| Jun | 10,232 | 113,693 | 123,925 |
| Jul | 10,232 | 113,693 | 123,925 |
| Aug | 10,232 | 113,693 | 123,925 |
| Sep | 10,232 | 113,693 | 123,925 |
| Oct | 10,232 | 113,693 | 123,925 |
| Nov | 10,232 | 113,693 | 123,925 |
| Dec | 10,232 | 113,693 | 123,925 |
| Total | 122,788 | 1,364,315 | 1,487,103 |

Figure 5 – Estimated Annual Water Effluent to Storm System, in gallons

Noise Pollution: The following equipment will have produce noise from the rooftop with an expected sound level, in dB, projected from the building.

- Generator: Maximum 105 dB with design considerations for muffler and/or location within parking garage to minimize noise to the atmosphere when operating. Sound criteria provided by Tognum Group MTU Onsite Energy generators.
- Rooftop Exhaust Fans: Multiple fans, estimated up to 6 located on the various roofs of the proposed development. Each fan with maximum sound criteria at outlet of: 100 dB 1 foot away, 90 dB 3 feet away, and 86 dB at 5 feet away using perforated liner in exhaust fan acoustical casing. Sound criteria provided by Twin City Fans.
- Air Handling Units: Multiple air handlers, estimated with up to eight (8) air handling units located on various roofs of the development. Air handler sound criteria will range from 90 to 95 dB depending on unit capacity. Sound criteria provided by Energy Labs.
- Cooling Tower: Up to three (3) multiple cell cooling towers. Each tower with maximum sound criteria of 107 dB at 1.5 meters away from tower. Sound criteria provided by Evapco.

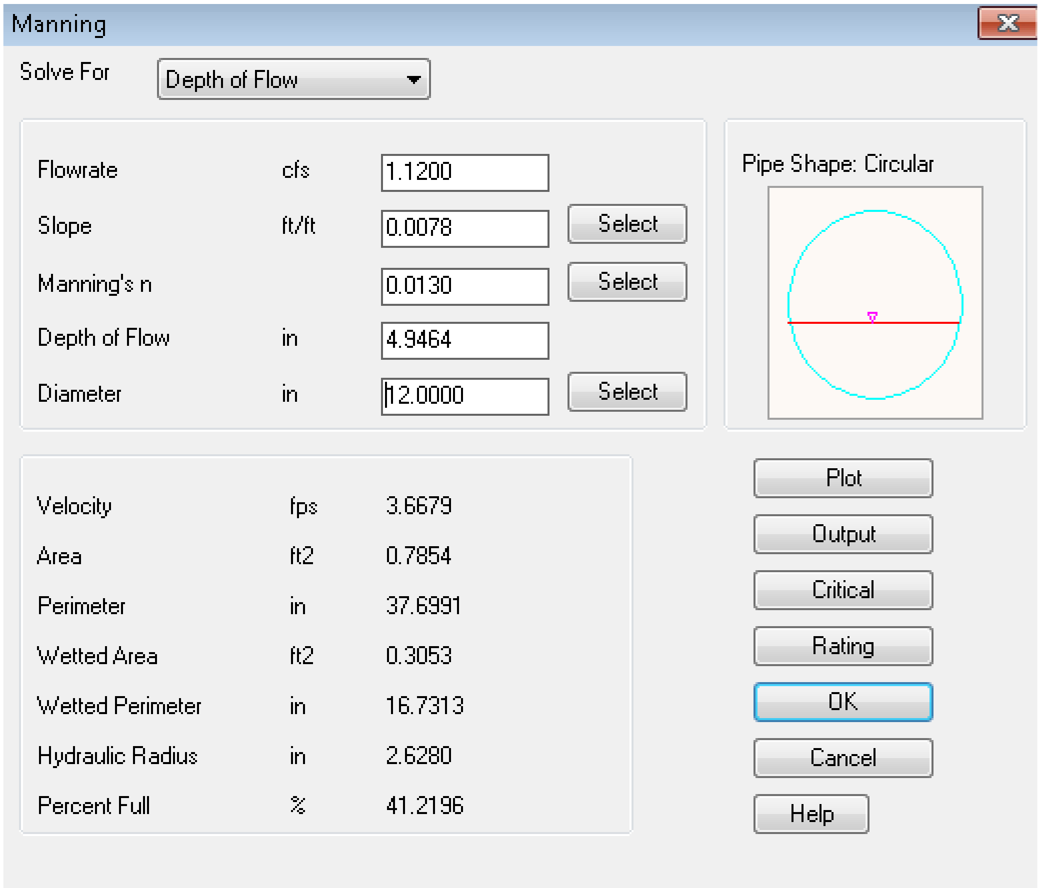
# APPENDIX IV

# FLOWMASTER CALCULATIONS

# APPENDIX IV – PROPOSED SEWER FLOWS
# CALCULATED USING FLOWMASTER

## PROPOSED ON-SITE SEWER IMPROVEMENTS

### 12" PIPE CONVEYING 0.728 MGD (1.12 CFS) WITH 0.78% SLOPE



Solve For: Depth of Flow

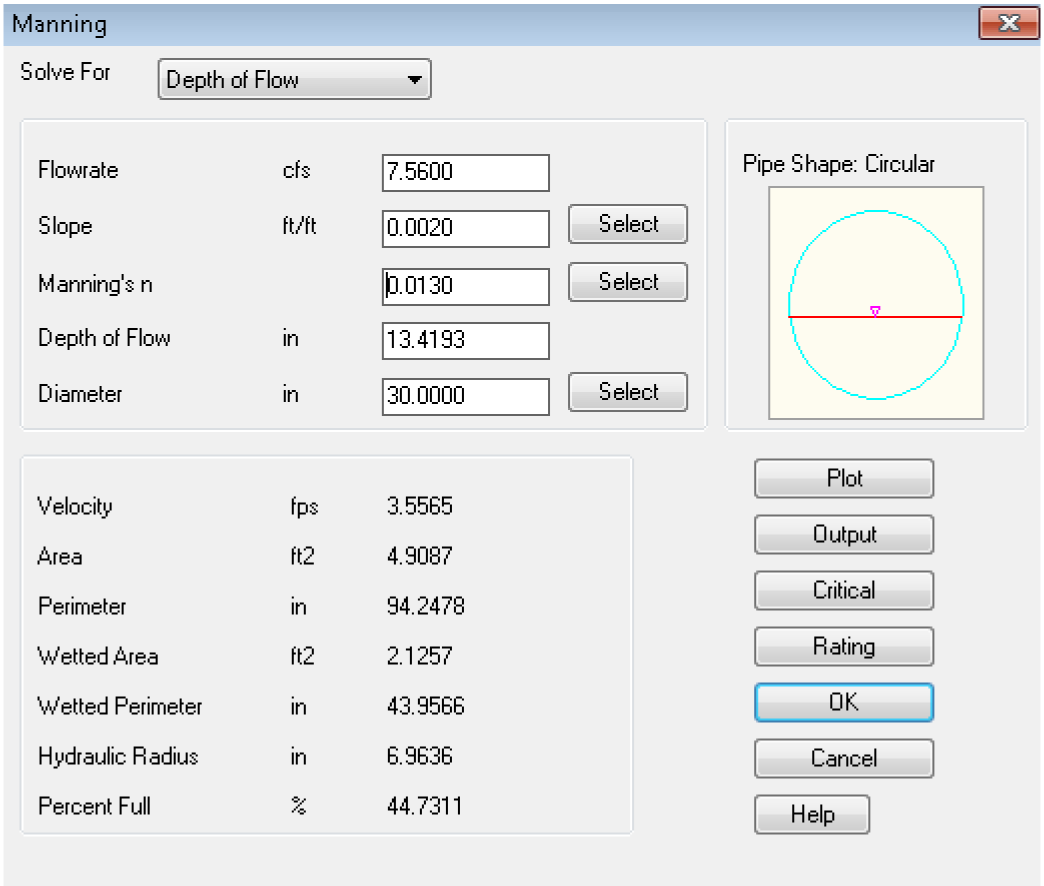
| | | |
|---|---|---|
| Flowrate | cfs | 1.1200 |
| Slope | ft/ft | 0.0078 |
| Manning's n | | 0.0130 |
| Depth of Flow | in | 4.9464 |
| Diameter | in | 12.0000 |

| | | |
|---|---|---|
| Velocity | fps | 3.6679 |
| Area | ft2 | 0.7854 |
| Perimeter | in | 37.6991 |
| Wetted Area | ft2 | 0.3053 |
| Wetted Perimeter | in | 16.7313 |
| Hydraulic Radius | in | 2.6280 |
| Percent Full | % | 41.2196 |

# APPENDIX IV – PROPOSED SEWER FLOWS
# CALCULATED USING FLOWMASTER

## FUTURE HARBOR DRIVE TRUNK SEWER IMPROVEMENTS

## 30” PIPE CONVEYING 4.892 MGD (7.56 CFS) WITH 0.2% SLOPE



Solve For: Depth of Flow

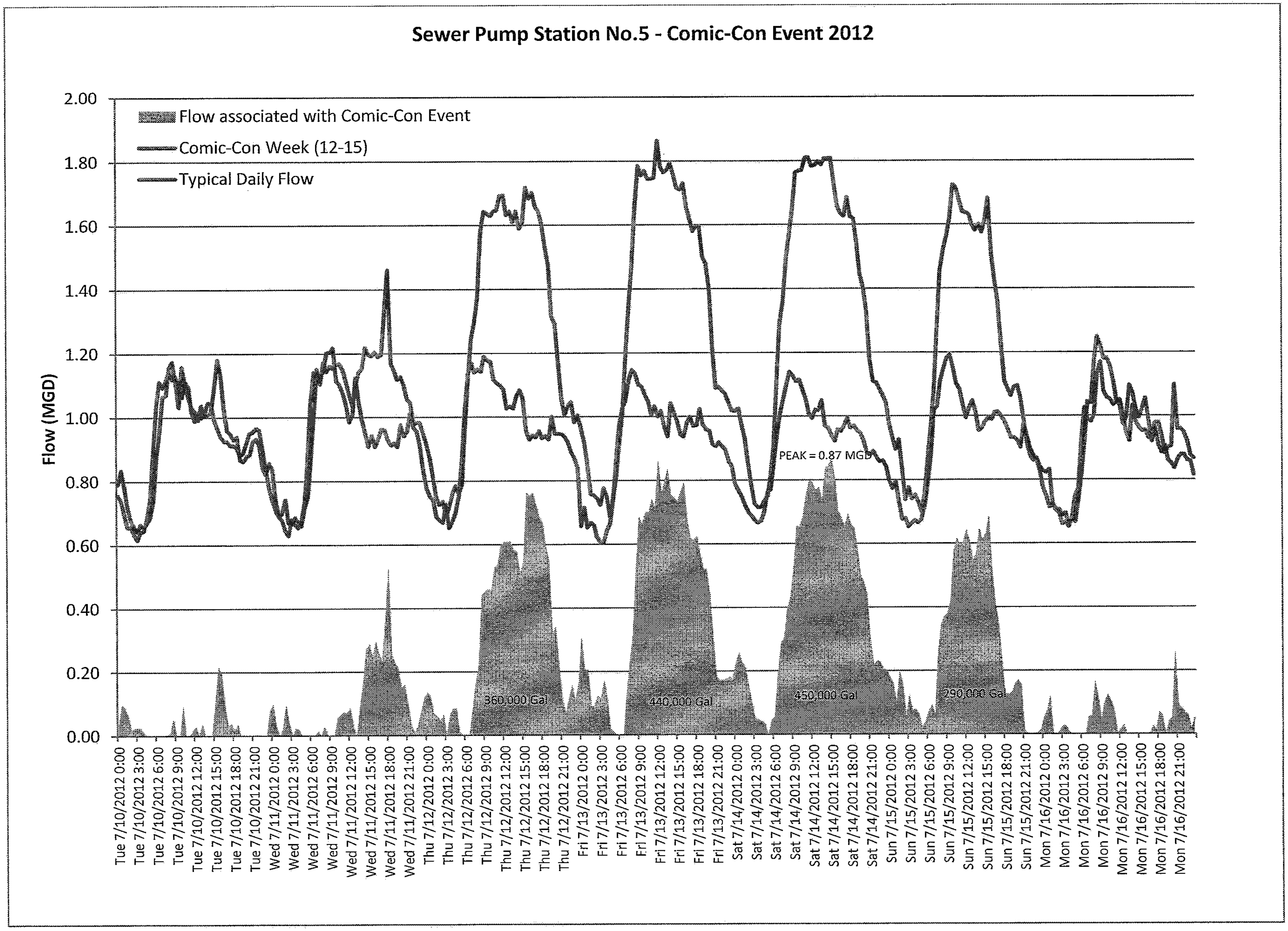
| | | |
|---|---|---|
| Flowrate | cfs | 7.5600 |
| Slope | ft/ft | 0.0020 |
| Manning's n | | 0.0130 |
| Depth of Flow | in | 13.4193 |
| Diameter | in | 30.0000 |

Pipe Shape: Circular

| | | |
|---|---|---|
| Velocity | fps | 3.5565 |
| Area | ft2 | 4.9087 |
| Perimeter | in | 94.2478 |
| Wetted Area | ft2 | 2.1257 |
| Wetted Perimeter | in | 43.9566 |
| Hydraulic Radius | in | 6.9636 |
| Percent Full | % | 44.7311 |

# APPENDIX V

# COMIC-CON EVENT 2012 PEAK FLOW PROVIDED BY CITY OF SAN DIEGO PUBLIC UTILITY DEPARTMENT



Sewer Pump Station No.5 - Comic-Con Event 2012

# Appendix L-2
# EIR Reporting Needs—Energy, Water, Noise

# MEMORANDUM

**To:** Andrew Michajlenko
Gensler
225 Broadway, Suite 1600
San Diego, CA 92101
619.557.2527
Andrew_Michajlenko@gensler.com

**Date:** July 24, 2017
**From:** Kevin Smith
**cc:** Dennis Berlien – Glumac
Mitch Dec - Glumac

**Project Name:** Fifth Landing Hotel
**Project Number:** 04.16.00690
**Subject:** EIR Reporting Needs- Energy, Water, Noise

Andrew,

Per the environmental impact reporting requirements, we have determined the following in support of the Fifth Landing Hotel project needs for electricity, natural gas, water, wastewater, and noise pollution criteria.

Electricity Use: Projections for the future Marina usage (after expansion) based on an increase proportional to the increased slip length (a factor of 6470/1490 = 4.34). Projections for the new buildings were calculated by the Energy Star Target Finder tool, which compares input building characteristics to utility bill data from actual buildings of a similar type in similar climates. Refer to Attachment A for documentation of Target Finder input assumptions and output reports. Table 1 below shows estimated annual electricity use for each building.

- Marina
    - Existing usage: 1,342,558 kWh per year
    - Projected expansion usage: 5,829,765 kWh per year
- Market Rate Hotel
    - 796,000 gsf, 850 room hotel
    - 600 employees
    - 3,000 meals served per year
    - 3,873 gsf Spa
    - 2,214 gsf Fitness Center
- Low Income Hotel
    - 80,000 gsf, 565 room hotel
    - Assumed Target Finder default of 26 employees
- Retail
    - 7,216 gsf total (multiple retail stores)
    - Assumed 105 hours of operation per week and 7 workers
- Water Transportation Center
    - 5,752 gsf
    - Assumed 120 hours of operation per week and 20 workers
- Total
    - 17,284,517 kWh per year

| Month | Marina Expansion | Market Rate Hotel | Low Cost Hotel | Activating Retail | Water Transportation Center | Total |
|---|---|---|---|---|---|---|
| Jan | 349,675 | 710,563 | 242,759 | 14,639 | 4,908 | 1,322,545 |
| Feb | 598,827 | 641,799 | 219,266 | 13,222 | 4,433 | 1,477,547 |
| Mar | 855,212 | 710,563 | 242,759 | 14,639 | 4,908 | 1,828,082 |
| Apr | 642,362 | 687,641 | 234,928 | 14,167 | 4,750 | 1,583,849 |
| May | 352,585 | 710,563 | 242,759 | 14,639 | 4,908 | 1,325,454 |
| Jun | 509,966 | 687,641 | 234,928 | 14,167 | 4,750 | 1,451,453 |
| Jul | 366,133 | 710,563 | 242,759 | 14,639 | 4,908 | 1,339,002 |
| Aug | 342,563 | 710,563 | 242,759 | 14,639 | 4,908 | 1,315,432 |
| Sep | 421,106 | 687,641 | 234,928 | 14,167 | 4,750 | 1,362,592 |
| Oct | 556,342 | 710,563 | 242,759 | 14,639 | 4,908 | 1,529,211 |
| Nov | 627,473 | 687,641 | 234,928 | 14,167 | 4,750 | 1,568,959 |
| Dec | 207,522 | 710,563 | 242,759 | 14,639 | 4,908 | 1,180,391 |
| Total | 5,829,765 | 8,366,304 | 2,858,291 | 172,364 | 57,792 | 17,284,517 |

**Table 1 - Estimated Annual Electricity Use, in kWh**

Natural Gas Use: Projections for the future Marina usage (after expansion) based on an increase proportional to the increased slip length (a factor of 6470/1490 = 4.34). Projections for the new buildings were calculated by the Energy Star Target Finder tool, which compares input building characteristics to utility bill data from actual buildings of a similar type in similar climates. Refer to Attachment A for documentation of Target Finder input assumptions and output reports. Table 2 below shows estimated annual natural gas use for each building.

- Marina
    - Existing usage: 24,020 therms per year
    - Projected expansion usage: 104,302 therms per year
- Market Rate Hotel
    - 796,000 gsf, 850 room hotel
    - Kitchen: Assuming 3,000 meals served per day
    - 3,873 gsf Spa
    - Onsite Laundry: Limited laundry; assuming 1 pound of laundry per guestroom per day (310,250 lbs)
    - Pool: 14,910 therms per year (added to Target Finder projection)
- Low Income Hotel
    - 80,000 gsf, 565 room hotel
    - Onsite Laundry: Limited laundry; assuming about 0.5 pound of laundry per guestroom per day (103,113 lbs)
- Retail
    - 7,216 gsf total (multiple retail stores)
    - Assumed 105 hours of operation per week and 7 workers
- Water Transportation Center
    - 5,752 gsf
    - Assumed 120 hours of operation per week and 20 workers
- Total
    - 536,965 therms per year.

| Month | Marina Expansion | Market Rate Hotel | Low Cost Hotel | Activating Retail | Water Transportation Center | Total |
|---|---|---|---|---|---|---|
| Jan | 6,470 | 27,225 | 8,869 | 525 | 116 | 43,204 |
| Feb | 6,470 | 24,590 | 8,010 | 525 | 116 | 39,712 |
| Mar | 12,658 | 27,225 | 8,869 | 525 | 116 | 49,392 |
| Apr | 12,658 | 26,347 | 8,583 | 525 | 116 | 48,228 |
| May | 6,817 | 27,225 | 8,869 | 525 | 116 | 43,552 |
| Jun | 6,817 | 26,347 | 8,583 | 525 | 116 | 42,388 |
| Jul | 4,038 | 27,225 | 8,869 | 525 | 116 | 40,773 |
| Aug | 4,038 | 27,225 | 8,869 | 525 | 116 | 40,773 |
| Sep | 10,291 | 26,347 | 8,583 | 525 | 116 | 45,861 |
| Oct | 10,291 | 27,225 | 8,869 | 525 | 116 | 47,026 |
| Nov | 11,876 | 26,347 | 8,583 | 525 | 116 | 47,446 |
| Dec | 11,876 | 27,225 | 8,869 | 525 | 116 | 48,611 |
| Total | 104,302 | 320,552 | 104,421 | 6,297 | 1,393 | 536,965 |

**Table 2 - Estimated Annual Natural Gas Use, in therms**

Water Use: Projections for the future Marina usage (after expansion) based on an increase proportional to the increased slip length (a factor of 6470/1490 = 4.34). Projections for indoor water utilization come from 55 gallons/ft$^2$-yr, and 102 gallons/room-day, based on median data from Energy Star Portfolio Manager – each value represents a different metric to approximate total annual water volume. We have used each calculation and took the average of each number for calculating the estimated annual volume of water anticipated for the development. Exterior irrigation water consumption from municipal water averages 0.222 gallons per sq. ft. of landscaping per month based on calculations from "A Guide to Estimating Irrigation Water Needs of Landscape Plantings in California" published by the California Department of Water Resources (see Attachment B for more details). Table 3 below shows the breakdown of estimated water consumption by building.

- Marina
    - Existing usage: 1,796,696 gallons per year
    - Projected expansion usage: 7,801,760 gallons per year
- Parcel A:
    - 55 gallons per sq. ft. = 43,798,480 gallons per year
    - 102 gallons per room per day = 32,646,910 gallons per year
    - Total (average of two numbers above): 38,222,695 gallons per year
- Parcel B:
    - 55 gallons per sq. ft. = 4,002,735 gallons per year.
    - 102 gallons per bed per day, and assume 50% bed utilization = 10,517,475 gallons per year.
    - Total (average of two numbers above): 7,260,105 gallons per year.
- Site Irrigation:
    - 218,874 GSF site area.
    - Assume 60% of site area landscaped for green roof and at grade. 131,324 sq. ft. of landscaping.
    - Total: 5.06 gallons per sq. ft. annually = 350,008 gallons per year based on calculations from the California Department of Water Resources Guide (see Attachment B).
- Total:
    - 53,634,568 gallons per year.

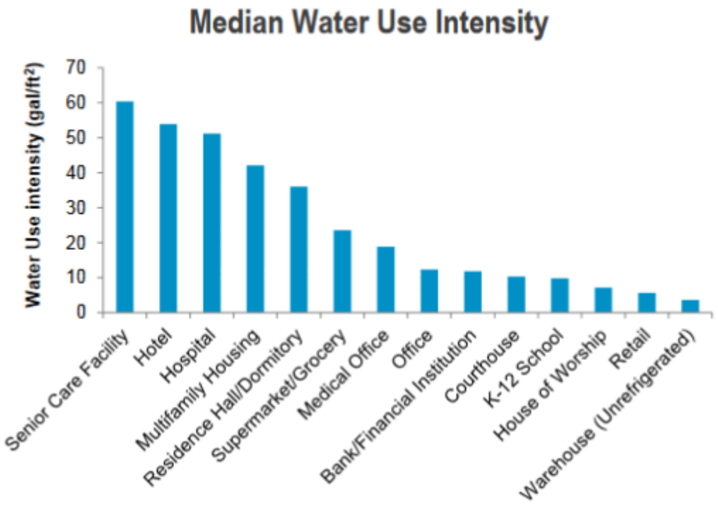


**Figure 1 – Median Water Use Intensity (WUI) from Portfolio Manager (Source: Energy Star)**

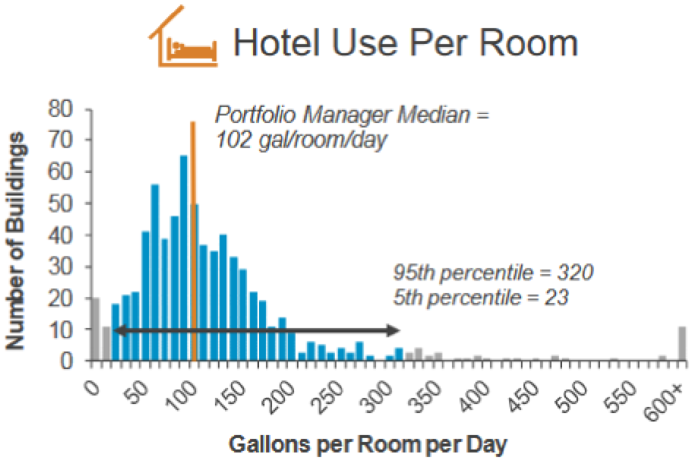


**Figure 2 – Hotel Water Usage from Portfolio Manager (Source: Energy Star)**

| Month | Marina Expansion | Market Rate Hotel | Low Cost Hotel | Site Irrigation | Activating Retail | Water Transportation Center | Total |
|---|---|---|---|---|---|---|---|
| Jan | 483,956 | 3,246,311 | 616,612 | 0 | Included in Hotel Water Use Calculations | Included in Hotel Water Use Calculations | 4,346,879 |
| Feb | 483,956 | 2,932,152 | 556,940 | 0 | | | 3,973,047 |
| Mar | 946,800 | 3,246,311 | 616,612 | 0 | | | 4,809,723 |
| Apr | 946,800 | 3,141,591 | 596,721 | 611 | | | 4,685,723 |
| May | 509,940 | 3,246,311 | 616,612 | 57,992 | | | 4,430,855 |
| Jun | 509,940 | 3,141,591 | 596,721 | 77,146 | | | 4,325,399 |
| Jul | 302,066 | 3,246,311 | 616,612 | 82,296 | | | 4,247,285 |
| Aug | 302,066 | 3,246,311 | 616,612 | 74,622 | | | 4,239,611 |
| Sep | 769,782 | 3,141,591 | 596,721 | 50,277 | | | 4,558,372 |
| Oct | 769,782 | 3,246,311 | 616,612 | 7,063 | | | 4,639,768 |
| Nov | 888,335 | 3,141,591 | 596,721 | 0 | | | 4,626,648 |
| Dec | 888,335 | 3,246,311 | 616,612 | 0 | | | 4,751,258 |
| Total | 7,801,760 | 38,222,695 | 7,260,105 | 350,008 | | | 53,634,568 |

**Table 3 - Estimated Annual Water Consumption, in gallons**

Water Effluent to Sanitary System: Assuming building and marina water will discharge to sanitary system. Table 4 below shows the breakdown of estimated water effluent to the sanitary system by building.

- Marina Water Use Becoming Effluent
    - Existing effluent: 1,796,696 gallons per year.
    - Projected expansion effluent: 7,801,760 gallons per year.
- New Building Use Becoming Effluent
    - Parcel A: 38,222,695 gallons per year.
    - Parcel B: 7,260,105 gallons per year.
    - Total: 45,482,800 gallons per year.
- Total
    - 53,284,560 gallons per year.

| Month | Marina Expansion | Market Rate Hotel | Low Cost Hotel | Activating Retail | Water Transportation Center | Total |
|---|---|---|---|---|---|---|
| Jan | 483,956 | 3,246,311 | 616,612 | Included in Hotel Water Use Calculations | Included in Hotel Water Use Calculations | 4,346,879 |
| Feb | 483,956 | 2,932,152 | 556,940 | | | 3,973,047 |
| Mar | 946,800 | 3,246,311 | 616,612 | | | 4,809,723 |
| Apr | 946,800 | 3,141,591 | 596,721 | | | 4,685,112 |
| May | 509,940 | 3,246,311 | 616,612 | | | 4,372,863 |
| Jun | 509,940 | 3,141,591 | 596,721 | | | 4,248,253 |
| Jul | 302,066 | 3,246,311 | 616,612 | | | 4,164,989 |
| Aug | 302,066 | 3,246,311 | 616,612 | | | 4,164,989 |
| Sep | 769,782 | 3,141,591 | 596,721 | | | 4,508,095 |
| Oct | 769,782 | 3,246,311 | 616,612 | | | 4,632,705 |
| Nov | 888,335 | 3,141,591 | 596,721 | | | 4,626,648 |
| Dec | 888,335 | 3,246,311 | 616,612 | | | 4,751,258 |
| Total | 7,801,760 | 38,222,695 | 7,260,105 | | | 53,284,560 |

**Table 4 – Estimated Annual Water Effluent to Sanitary System, in gallons**

Water Effluent to Storm System: Assume stormwater and landscape irrigation water will discharge to storm system. Table 5 below shows the breakdown of estimated water effluent to the stormwater system by building.

- Site Irrigation
    - Total: 350,008 gallons per year (see Attachment B).
- Stormwater Becoming Effluent
    - 10.34 inches of rainfall per year, on 218,874 sq. ft. of site area. 188,596 cubic feet of storm water. 7.48 gallons per cubic foot of water.
    - Total Storm Water: 1,410,701 gallons per year.
    - Rainfall data referenced from https://rainfall.weatherdb.com/
- Total Effluent
    - 1,760,709 gallons per year.

| Month | Site Irrigation | Storm Water | Total |
|---|---|---|---|
| Jan | 0 | 270,134 | 270,134 |
| Feb | 0 | 309,699 | 309,699 |
| Mar | 0 | 246,941 | 246,941 |
| Apr | 611 | 106,417 | 107,027 |
| May | 57,992 | 16,372 | 74,364 |
| Jun | 77,146 | 9,550 | 86,696 |
| Jul | 82,296 | 4,093 | 86,389 |
| Aug | 74,622 | 2,729 | 77,351 |
| Sep | 50,277 | 20,465 | 70,742 |
| Oct | 7,063 | 77,766 | 84,829 |
| Nov | 0 | 137,796 | 137,796 |
| Dec | 0 | 208,740 | 208,740 |
| Total | 350,008 | 1,410,701 | 1,760,709 |

**Table 5 – Estimated Annual Water Effluent to Storm System, in gallons**

Noise Pollution: The following equipment will have produce noise from the rooftop with an expected sound level, in dB, projected from the building.

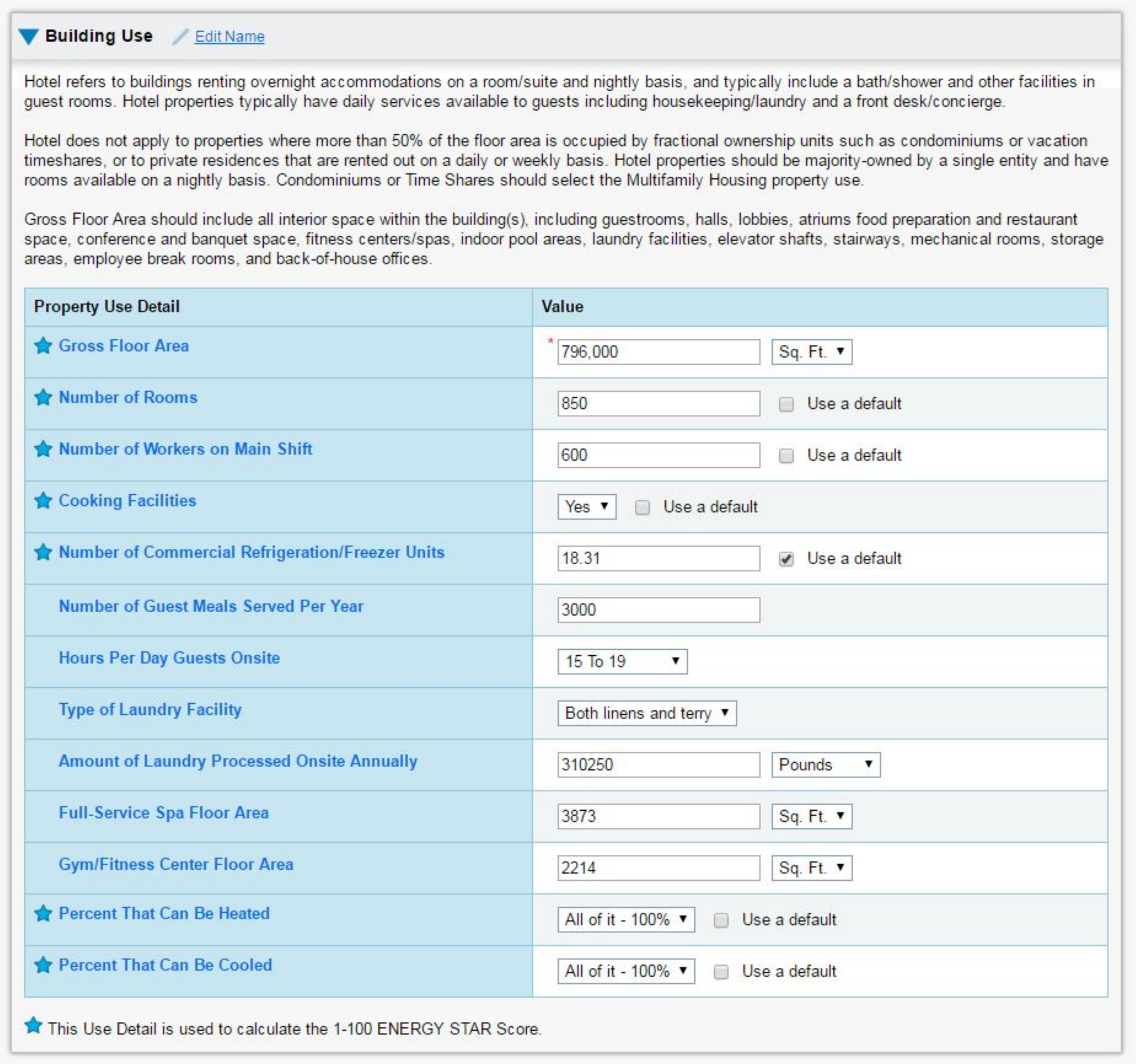
- Generator: Maximum 105 dB with design considerations for muffler and/or location within parking garage to minimize noise to the atmosphere when operating. Sound criteria provided by Tognum Group MTU Onsite Energy generators.
- Rooftop Exhaust Fans: Multiple fans, estimated up to 6 located on the various roofs of the proposed development. Each fan with maximum sound criteria at outlet of: 100 dB 1 foot away, 90 dB 3 feet away, and 86 dB at 5 feet away using perforated liner in exhaust fan acoustical casing. Sound criteria provided by Twin City Fans.
- Air Handling Units: Multiple air handlers, estimated with up to eight (8) air handling units located on various roofs of the development. Air handler sound criteria will range from 90 to 95 dB depending on unit capacity. Sound criteria provided by Energy Labs.
- Cooling Tower: Up to three (3) multiple cell cooling towers. Each tower with maximum sound criteria of 107 dB at 1.5 meters away from tower. Sound criteria provided by Evapco.

# Attachment A

Energy Star Target Finder Inputs and Outputs

Below are Target Finder Output Reports for:

- Market Rate Hotel
- Low Income Hotel
- Retail
- Water Transportation Center



**Building Use** Edit Name

Hotel refers to buildings renting overnight accommodations on a room/suite and nightly basis, and typically include a bath/shower and other facilities in guest rooms. Hotel properties typically have daily services available to guests including housekeeping/laundry and a front desk/concierge.

Hotel does not apply to properties where more than 50% of the floor area is occupied by fractional ownership units such as condominiums or vacation timeshares, or to private residences that are rented out on a daily or weekly basis. Hotel properties should be majority-owned by a single entity and have rooms available on a nightly basis. Condominiums or Time Shares should select the Multifamily Housing property use.

Gross Floor Area should include all interior space within the building(s), including guestrooms, halls, lobbies, atriums food preparation and restaurant space, conference and banquet space, fitness centers/spas, indoor pool areas, laundry facilities, elevator shafts, stairways, mechanical rooms, storage areas, employee break rooms, and back-of-house offices.

| Property Use Detail | Value |
|---|---|
| ★ Gross Floor Area | * 796,000 Sq. Ft. ▾ |
| ★ Number of Rooms | 850 ☐ Use a default |
| ★ Number of Workers on Main Shift | 600 ☐ Use a default |
| ★ Cooking Facilities | Yes ▾ ☐ Use a default |
| ★ Number of Commercial Refrigeration/Freezer Units | 18.31 ☑ Use a default |
| Number of Guest Meals Served Per Year | 3000 |
| Hours Per Day Guests Onsite | 15 To 19 ▾ |
| Type of Laundry Facility | Both linens and terry ▾ |
| Amount of Laundry Processed Onsite Annually | 310250 Pounds ▾ |
| Full-Service Spa Floor Area | 3873 Sq. Ft. ▾ |
| Gym/Fitness Center Floor Area | 2214 Sq. Ft. ▾ |
| ★ Percent That Can Be Heated | All of it - 100% ▾ ☐ Use a default |
| ★ Percent That Can Be Cooled | All of it - 100% ▾ ☐ Use a default |

★ This Use Detail is used to calculate the 1-100 ENERGY STAR Score.

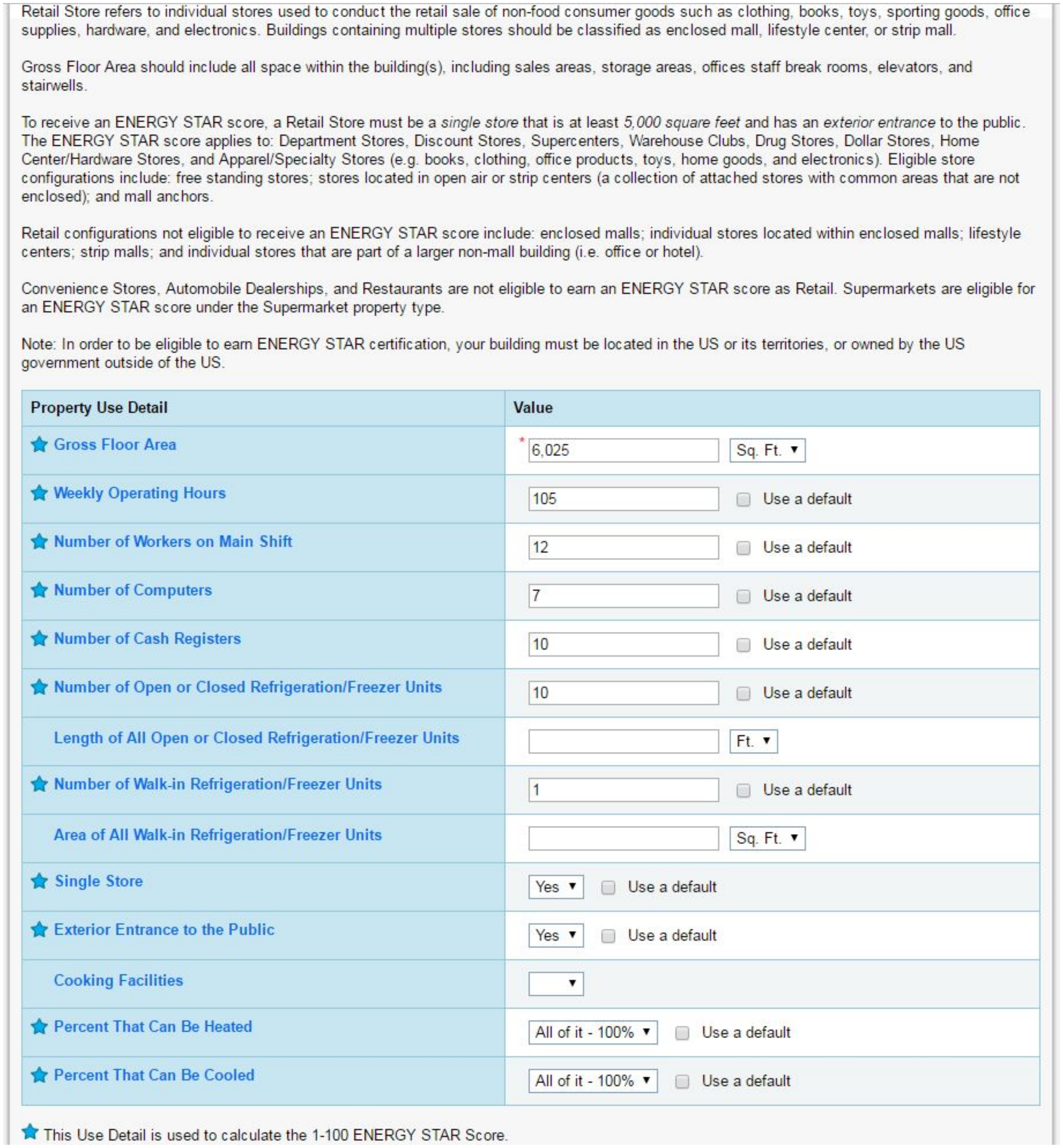
Figure A1 – Target Finder Inputs for the Market Rate Hotel

Metrics Comparison for Your Design and/or Target

| Metric | Design Project | Design Target* | Median Property* |
|---|---|---|---|
| ENERGY STAR score (1-100) | Not Available | 60 | 50 |
| Source EUI (kBtu/ft²) | Not Available | 153.0 | 167.6 |
| Site EUI (kBtu/ft²) | Not Available | 74.3 | 81.4 |
| Source Energy Use (kBtu) | Not Available | 121,766,820.6 | 133,435,890.6 |
| Site Energy Use (kBtu) | Not Available | 59,118,420.0 | 64,783,810.0 |
| Energy Cost ($) | Not Available | 1,387,031.33 | 1,519,952.22 |
| Total GHG Emissions (Metric Tons CO2e) | 0.0 | 4,101.3 | 4,494.3 |

* To perform calculations for your design target, we use the fuel mix that you've entered for your design energy estimates. If you have not entered estimated design energy, we'll use the average for your state. To perform calculations for the national median, we will assume the fuel mix and operational details of your property measurement in use, if available. Otherwise, we will use your design estimates.

Figure A2 – Target Finder Outputs for the Market Rate Hotel



Retail Store refers to individual stores used to conduct the retail sale of non-food consumer goods such as clothing, books, toys, sporting goods, office supplies, hardware, and electronics. Buildings containing multiple stores should be classified as enclosed mall, lifestyle center, or strip mall.

Gross Floor Area should include all space within the building(s), including sales areas, storage areas, offices staff break rooms, elevators, and stairwells.

To receive an ENERGY STAR score, a Retail Store must be a *single store* that is at least *5,000 square feet* and has an *exterior entrance* to the public. The ENERGY STAR score applies to: Department Stores, Discount Stores, Supercenters, Warehouse Clubs, Drug Stores, Dollar Stores, Home Center/Hardware Stores, and Apparel/Specialty Stores (e.g. books, clothing, office products, toys, home goods, and electronics). Eligible store configurations include: free standing stores; stores located in open air or strip centers (a collection of attached stores with common areas that are not enclosed); and mall anchors.

Retail configurations not eligible to receive an ENERGY STAR score include: enclosed malls; individual stores located within enclosed malls; lifestyle centers; strip malls; and individual stores that are part of a larger non-mall building (i.e. office or hotel).

Convenience Stores, Automobile Dealerships, and Restaurants are not eligible to earn an ENERGY STAR score as Retail. Supermarkets are eligible for an ENERGY STAR score under the Supermarket property type.

Note: In order to be eligible to earn ENERGY STAR certification, your building must be located in the US or its territories, or owned by the US government outside of the US.

| Property Use Detail | Value |
|---|---|
| ★ Gross Floor Area | * 6,025 Sq. Ft. ▼ |
| ★ Weekly Operating Hours | 105 ☐ Use a default |
| ★ Number of Workers on Main Shift | 12 ☐ Use a default |
| ★ Number of Computers | 7 ☐ Use a default |
| ★ Number of Cash Registers | 10 ☐ Use a default |
| ★ Number of Open or Closed Refrigeration/Freezer Units | 10 ☐ Use a default |
| Length of All Open or Closed Refrigeration/Freezer Units | Ft. ▼ |
| ★ Number of Walk-in Refrigeration/Freezer Units | 1 ☐ Use a default |
| Area of All Walk-in Refrigeration/Freezer Units | Sq. Ft. ▼ |
| ★ Single Store | Yes ▼ ☐ Use a default |
| ★ Exterior Entrance to the Public | Yes ▼ ☐ Use a default |
| Cooking Facilities | ▼ |
| ★ Percent That Can Be Heated | All of it - 100% ▼ ☐ Use a default |
| ★ Percent That Can Be Cooled | All of it - 100% ▼ ☐ Use a default |

★ This Use Detail is used to calculate the 1-100 ENERGY STAR Score.

Figure A3 – Target Finder Inputs for Retail

Metrics Comparison for Your Design and/or Target

| Metric | Design Project | Design Target* | Median Property* |
|---|---|---|---|
| ENERGY STAR score (1-100) | Not Available | 60 | 50 |
| Source EUI (kBtu/ft²) | Not Available | 543.1 | 617.7 |
| Site EUI (kBtu/ft²) | Not Available | 202.2 | 229.9 |
| Source Energy Use (kBtu) | Not Available | 3,272,252.4 | 3,721,814.9 |
| Site Energy Use (kBtu) | Not Available | 1,217,971.0 | 1,385,304.0 |
| Energy Cost ($) | Not Available | 40,435.22 | 45,990.49 |
| Total GHG Emissions (Metric Tons CO2e) | 0.0 | 96.8 | 110.1 |

* To perform calculations for your design target, we use the fuel mix that you've entered for your design energy estimates. If you have not entered estimated design energy, we'll use the average for your state. To perform calculations for the national median, we will assume the fuel mix and operational details of your property measurement in use, if available. Otherwise, we will use your design estimates.

Figure A4 – Target Finder Output Data for Retail

| Property Use Detail | Value |
|---|---|
| ★ Gross Floor Area | * 80,000 Sq. Ft. ▾ |
| ★ Number of Rooms | 565 ☐ Use a default |
| ★ Number of Workers on Main Shift | 25.6 ☑ Use a default |
| ★ Cooking Facilities | No ▾ ☐ Use a default |
| ★ Number of Commercial Refrigeration/Freezer Units | 0 ☐ Use a default |
| Number of Guest Meals Served Per Year | 0 |
| Hours Per Day Guests Onsite | 15 To 19 ▾ |
| Type of Laundry Facility | Linens only ▾ |
| Amount of Laundry Processed Onsite Annually | 10312.5 Pounds ▾ |
| Full-Service Spa Floor Area | 0 Sq. Ft. ▾ |
| Gym/Fitness Center Floor Area | 0 Sq. Ft. ▾ |
| ★ Percent That Can Be Heated | All of it - 100% ▾ ☐ Use a default |
| ★ Percent That Can Be Cooled | All of it - 100% ▾ ☐ Use a default |

★ This Use Detail is used to calculate the 1-100 ENERGY STAR Score.

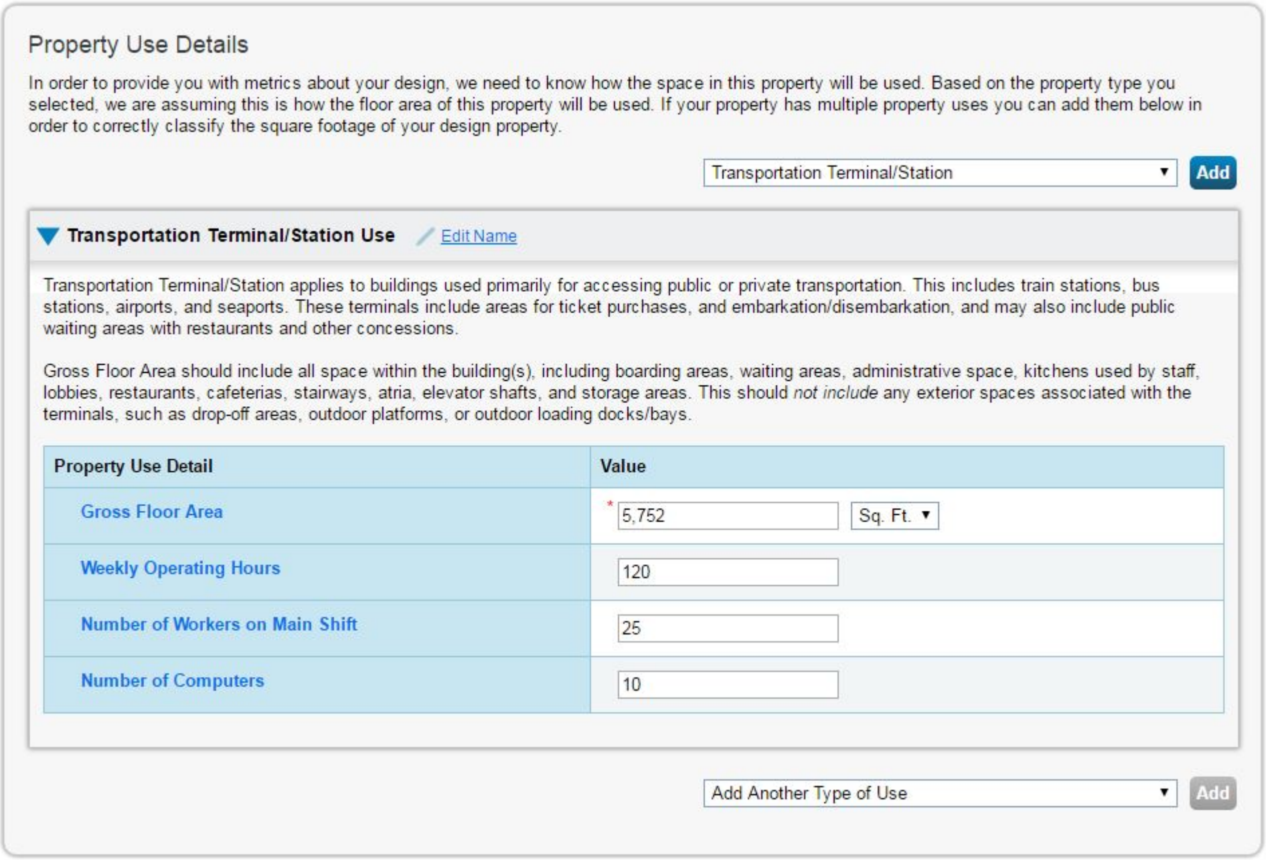
Figure A4 – Target Finder Input for the Low Income Hotel

Metrics Comparison for Your Design and/or Target

| Metric | Design Project | Design Target* | Median Property* |
|---|---|---|---|
| ENERGY STAR score (1-100) | Not Available | 55 | 50 |
| Source EUI (kBtu/ft²) | Not Available | 252.5 | 265.8 |
| Site EUI (kBtu/ft²) | Not Available | 122.6 | 129.0 |
| Source Energy Use (kBtu) | Not Available | 20,197,404.7 | 21,260,426.0 |
| Site Energy Use (kBtu) | Not Available | 9,805,947.5 | 10,322,050.0 |
| Energy Cost ($) | Not Available | 230,066.30 | 242,175.06 |
| Total GHG Emissions (Metric Tons CO2e) | 0.0 | 680.3 | 716.1 |

* To perform calculations for your design target, we use the fuel mix that you've entered for your design energy estimates. If you have not entered estimated design energy, we'll use the average for your state. To perform calculations for the national median, we will assume the fuel mix and operational details of your property measurement in use, if available. Otherwise, we will use your design estimates.

**Figure A5 – Target Finder Output Data for the Low Income Hotel**



Property Use Details

In order to provide you with metrics about your design, we need to know how the space in this property will be used. Based on the property type you selected, we are assuming this is how the floor area of this property will be used. If your property has multiple property uses you can add them below in order to correctly classify the square footage of your design property.

Transportation Terminal/Station ▾ Add

**Transportation Terminal/Station Use** Edit Name

Transportation Terminal/Station applies to buildings used primarily for accessing public or private transportation. This includes train stations, bus stations, airports, and seaports. These terminals include areas for ticket purchases, and embarkation/disembarkation, and may also include public waiting areas with restaurants and other concessions.

Gross Floor Area should include all space within the building(s), including boarding areas, waiting areas, administrative space, kitchens used by staff, lobbies, restaurants, cafeterias, stairways, atria, elevator shafts, and storage areas. This should *not include* any exterior spaces associated with the terminals, such as drop-off areas, outdoor platforms, or outdoor loading docks/bays.

| Property Use Detail | Value |
|---|---|
| Gross Floor Area | * 5,752 Sq. Ft. ▾ |
| Weekly Operating Hours | 120 |
| Number of Workers on Main Shift | 25 |
| Number of Computers | 10 |

Add Another Type of Use ▾ Add

**Figure A6 – Target Finder Input for the Water Transportation Center**

Metrics Comparison for Your Design and/or Target

| Metric | Design Project | Design Target* | Median Property* |
|---|---|---|---|
| ENERGY STAR score (1-100) | Not Available | Not Available | 50 |
| Source EUI (kBtu/ft²) | Not Available | 76.6 | 85.1 |
| Site EUI (kBtu/ft²) | Not Available | 33.7 | 37.4 |
| Source Energy Use (kBtu) | Not Available | 440,585.6 | 489,539.6 |
| Site Energy Use (kBtu) | Not Available | 193,608.4 | 215,120.4 |
| Energy Cost ($) | Not Available | 5,191.76 | 5,768.62 |
| Total GHG Emissions (Metric Tons CO2e) | 0.0 | 14.1 | 15.7 |

* To perform calculations for your design target, we use the fuel mix that you've entered for your design energy estimates. If you have not entered estimated design energy, we'll use the average for your state. To perform calculations for the national median, we will assume the fuel mix and operational details of your property measurement in use, if available. Otherwise, we will use your design estimates.

**Figure A7 – Target Finder Output Data for the Water Transportation Center**

# Attachment B

Water consumption from landscape irrigation was calculated using the methodology from “A Guide to Estimating Irrigation Water Needs of Landscape Plantings in California” published by University of California Cooperative Extension and California Department of Water Resources, August 2000. Available online on the California Department of Water Resources website at:

http://www.water.ca.gov/wateruseefficiency/docs/wucols00.pdf

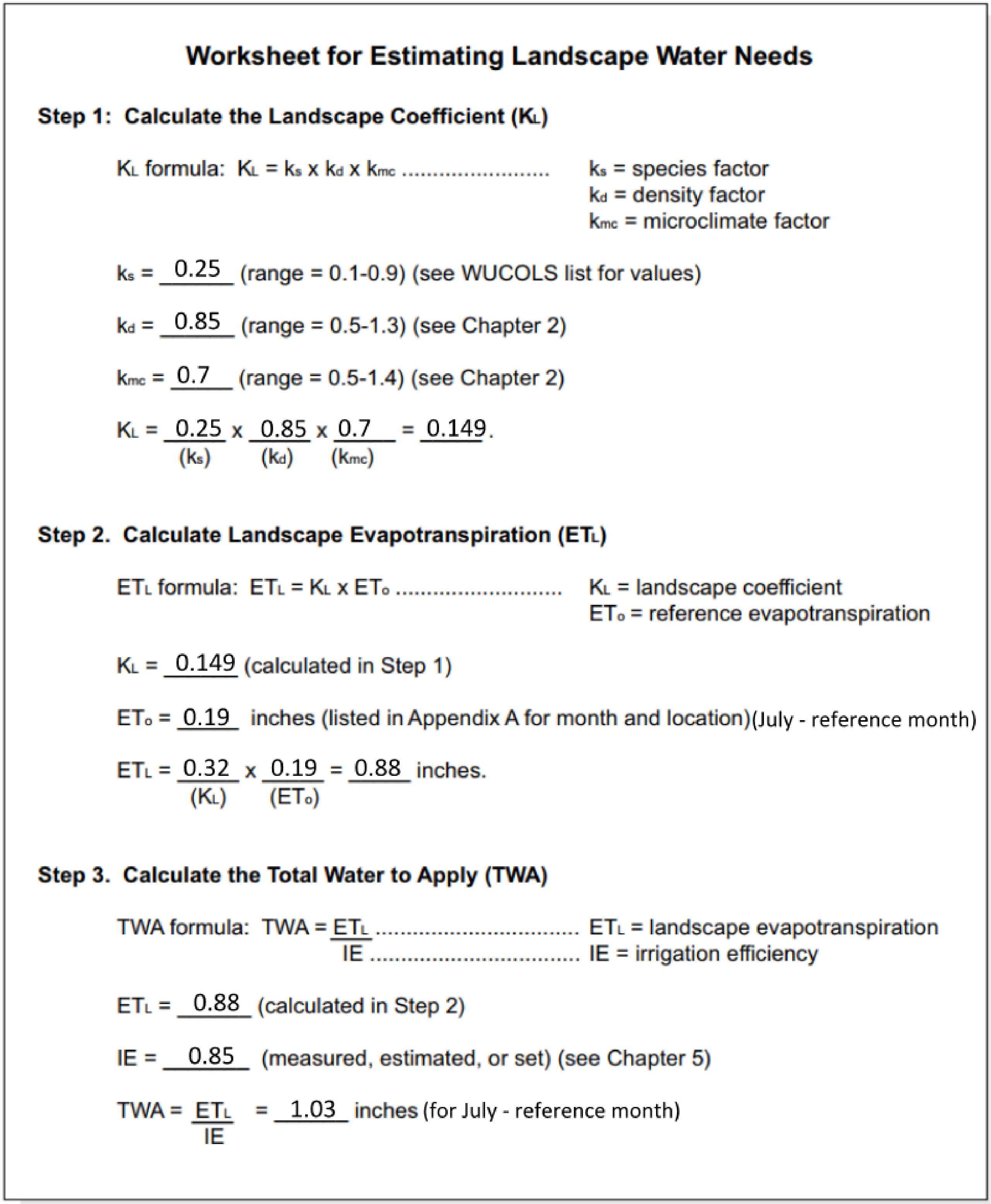
A worksheet is provided in the Guide to simplify the calculation process (see below). Note that the worksheet only calculates the “Total Water to Apply (TWA)” for one month. Table B1 below shows evapotranspiration and TWA for each month for San Diego.

| Month | ET_o | ET_L | TWA (in/mo) | Rainfall (in/mo) | Net TWA (gal/sf/mo) | Total |
|---|---|---|---|---|---|---|
| Jan | 1.86 | 0.28 | 0.33 | 2.00 | 0.00 | 0 |
| Feb | 2.24 | 0.33 | 0.39 | 1.98 | 0.00 | 0 |
| Mar | 3.41 | 0.51 | 0.60 | 1.63 | 0.00 | 0 |
| Apr | 4.50 | 0.67 | 0.79 | 0.78 | 0.00 | 611 |
| May | 5.27 | 0.78 | 0.92 | 0.21 | 0.44 | 57,992 |
| Jun | 5.70 | 0.85 | 1.00 | 0.05 | 0.59 | 77,146 |
| Jul | 5.89 | 0.88 | 1.03 | 0.02 | 0.63 | 82,296 |
| Aug | 5.58 | 0.83 | 0.98 | 0.06 | 0.57 | 74,622 |
| Sep | 4.50 | 0.67 | 0.79 | 0.17 | 0.38 | 50,277 |
| Oct | 3.41 | 0.51 | 0.60 | 0.51 | 0.05 | 7,063 |
| Nov | 2.40 | 0.36 | 0.42 | 0.97 | 0.00 | 0 |
| Dec | 1.86 | 0.28 | 0.33 | 1.77 | 0.00 | 0 |
| Total | 46.62 | 6.93 | 8.16 | 10.15 | 2.67 | 350,008 |

**Table B1 – Landscape Irrigation Water Consumption by Month (gallons)**

The following assumptions were used to determine the variables in the Worksheet:

$k_s$ = species factor = 0.25 – assuming low water consumption plants (drought-tolerant plants to help meet the California Green Building Code “CALGreen”).
$k_d$ = density factor = 0.85 – assuming a mix of plants with an average to low leaf/green coverage
$k_{mc}$ = microclimate factor = 0.7 – assuming some shading from the hotel towers which will reduce evapotranspiration
$ET_o$ = reference evapotranspiration = daily values from Appendix A of the Guide, converted to monthly values for the Worksheet and Table B1.



## Worksheet for Estimating Landscape Water Needs

### Step 1: Calculate the Landscape Coefficient ($K_L$)

$K_L$ formula: $K_L = k_s \times k_d \times k_{mc}$ ........................

$k_s$ = species factor
$k_d$ = density factor
$k_{mc}$ = microclimate factor

$k_s$ = 0.25 (range = 0.1-0.9) (see WUCOLS list for values)

$k_d$ = 0.85 (range = 0.5-1.3) (see Chapter 2)

$k_{mc}$ = 0.7 (range = 0.5-1.4) (see Chapter 2)

$K_L$ = 0.25 ($k_s$) x 0.85 ($k_d$) x 0.7 ($k_{mc}$) = 0.149.

### Step 2. Calculate Landscape Evapotranspiration ($ET_L$)

$ET_L$ formula: $ET_L = K_L \times ET_o$ ...........................

$K_L$ = landscape coefficient
$ET_o$ = reference evapotranspiration

$K_L$ = 0.149 (calculated in Step 1)

$ET_o$ = 0.19 inches (listed in Appendix A for month and location)(July - reference month)

$ET_L$ = 0.32 ($K_L$) x 0.19 ($ET_o$) = 0.88 inches.

### Step 3. Calculate the Total Water to Apply (TWA)

TWA formula: $TWA = \frac{ET_L}{IE}$ ..................................

$ET_L$ = landscape evapotranspiration
IE = irrigation efficiency

$ET_L$ = 0.88 (calculated in Step 2)

IE = 0.85 (measured, estimated, or set) (see Chapter 5)

$TWA = \frac{ET_L}{IE}$ = 1.03 inches (for July - reference month)

Figure B1 – Landscape Irrigation Water Consumption Worksheet

# Utilities - Energy Consumption Analysis

**Energy Metrics**

| | | |
|---|---|---|
| kg/mt | 1000 | Standard |
| kg CO2 per gallon of diesel | 10.24 | GREET 2016 |
| kg CO2 per gallon of gasoline | 8.61 | GREET 2016 |
| Energy - gas | 113,927 | BTU/gal |
| Energy - diesel | 129,488 | BTU/gal |
| BTU_kWh | 3,416 | Argonne 2013 |
| conversion | 1000000 | |

**Energy Calculation** (based off CO2e calculations)

| Diesel | **MTCO2** | Gallons | million BTU |
|---|---|---|---|
| Trucks | 897 | 87,619 | 11,346 |
| Equipment - landside | 1628 | 159,008 | 20,590 |
| Equipment - marina | 585 | 57,130 | 7,398 |
| Boats | 39 | 3,769 | 488 |
| *total* | *3,149* | *307,527* | *39,821* |
| Gasoline | | | |
| Commute | 896 | 104,116 | 11,862 |
| | | | |
| Electricity | kwh | | million BTU |
| Equipment | 3045 | | 10 |
| **Total** | | | **51,693** |

References:

Oak Ridge National Laboratory. 2014. *Transportation Energy Data Book, Edition 33.* July 31.

Argonne National Laboratory. 2013. GREET Model—The Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation Model. Last Revised: October 30, 2013. Accessed: November 25, 2014.

Available: https://greet.es.anl.gov/.

U.S. Energy Information Administration. 2014. *Annual Energy Outlook - Conversion Factors* .

Available: http://www.eia.gov/forecasts/aeo/pdf/appg.pdf.

Climate Registry. 2016 Default Emission Factors.

https://www.theclimateregistry.org/wp-content/uploads/2014/11/2016-Climate-Registry-Default-Emission-Factors.pdf