Appendix B
Panel Testing Protocol

1. INTRODUCTION

The Port of San Diego (Port) and the Institute for Research and Technical Assistance (IRTA) were recently awarded an EPA Pollution Prevention Grant to identify alternatives to copper hull paint. The goal of this project is to identify viable alternatives to copper-based hull paint and work collectively to encourage the transition to these paints. The project aims to find replacements for copper hull paints that will minimize environmental impacts from hull coatings to the greatest extent possible while keeping performance and cost at a level equal or greater than that of copper paints. The selection and determination of viable alternatives will take into consideration the following criteria, 1) environmental impacts from the paints, 2) cost effectiveness, 3) the ability to control fouling, and 4) the ease of cleaning/maintenance.

The project is comprised of ten tasks and will occur for a two year period between January 2008 and June 2010. The primary tasks include testing alternative coatings on panels and on boat hulls. Phase One of the study, the panel testing, will be conducted during the summer of 2008, while Phase Two, boat hull testing, will occur the following summer (2009). The development of paint testing protocols are necessary for both the panel testing and boat hull testing to document the project's procedures, ensure consistency and to ensure that the end results can be reproduced.

Phase One of this project will focus on assessing fouling growth and cleaning effectiveness and as such, only addresses criteria 3 and 4, above. Test coatings that are able to demonstrate that they are effective in repelling growth and/or are relatively easy to clean will be moved into Phase Two. This protocol will be based on American Society for Testing and Materials (ASTM) D 3623-78a, the Standard Test Method for Testing Antifouling Panels in Shallow Submergence and ASTM D 6990-05, Evaluating Biofouling Resistance and Physical Performance of Marine Coating Systems. Information on materials and methods used for applying coatings, maintenance and cleaning procedures, as well as a detailed description of the assessment measures and analyses are included in this protocol. Use of copper-based coatings and commonly used cleaning methods will provide a reference from which to compare test coatings. Selection measures are also included in this protocol to identify how paints will be selected for Phase Two of this project. It should be noted that environmental impacts and cost effectiveness will not be used as eligibility criteria for moving paints into Phase Two. A full evaluation of all four project criteria will be assessed during the boat hull testing in which the testing process will more closely mimic current recreational boater use.

2. MATERIALS AND METHODS

2.1. Panel Preparation

This project will test hull paint coatings on fiberglass panels. The Project Team decided to use fiberglass panels because most of the pleasure craft in the San Diego region have

fiberglass hulls. All of the panels that will be tested in the project will be 12 inches by 12 inches. Hull coatings are routinely applied by boat yards and the team wanted to represent the field application as closely as possible. The team has decided that the fiberglass panels will be prepared and coated in a uniform manner and that no pre-painted panels will be used.

Several of the boat yards in the area have volunteered to apply the reference controls and alternative coatings to the panels. The panels will be prepared in local San Diego Bay boat yards. One-half inch diameter holes will be drilled in the panels three-fourths inch from the sides of each corner so they can be attached to PVC frames (Section 2.4). A gel coat will be applied; the panels will be sanded and cleaned to remove any contaminants. Once all of the panels have been prepped in this manner, both sides of the panels will be painted with the appropriate coating systems, following the methods described in section 2.3 of this protocol.

2.2. Test Coating Categories

The Project Team will test alternative non-copper coatings in the panel testing. The team decided to distinguish the coatings based upon the presence/absence of an active antifouling ingredient to better understand the differences in the coatings that contain biocides and the coatings that do not contain biocides. These coatings were classified into three categories including:

- Zinc Coatings
- Non-Zinc Organic Biocide Coatings
- Non-Biocide Coatings

The zinc coatings generally contain various zinc compounds like zinc oxide or zinc pyrithione. The industry has been developing low (<30%) zinc content coatings and most of the coatings in this category have fairly low zinc content. Non-zinc biocide coatings often contain an organic biocide like Econea™. The non-biocide coatings are generally foul release coatings which means they rely on a smooth surface to prevent or reduce fouling.

Table 1 shows the coatings that will be tested on panels. The table shows the coating supplier, and the alternative coatings classified by the categories above, and the coatings to be used as reference control coatings. As indicated, the reference control coatings contain copper. It is estimated that there will be up to a total of 50 alternative coatings included in Phase I of this evaluation. Twenty-eight of the coatings contain no biocide. Seventeen of the coatings contain zinc and five of the coatings contain a non-zinc biocide.

Coatings containing biocides must be registered before they can be used. Suppliers with such coatings must submit data to EPA and secure registration before the coating can be used. After the coating is registered by EPA, the coatings must be registered by the California Department of Pesticide Regulation (DPR). Table 2 summarizes the registration status of each of the coatings. The two copper coatings have been used for many years and are registered by EPA and the state. Many of the coatings that will be tested in the project contain no biocides and do not require registration. This is indicated in the table by NA or not applicable. The other coatings may contain biocides of various types and some of the suppliers have started the registration process; in other cases, the suppliers have not yet begun the registration process.

In order to test the biocide containing coatings, the Project Team must apply to DPR for a Pesticide Research Authorization to test the unregistered coatings. The Project Team submitted the request on April 15, 2008 and expects to receive authorization for the testing shortly.

2.3. Test Coating Application

The details of the application procedure vary greatly for the test coatings. The boat yards will assist the team in applying each coating in the manner specified by the supplier or manufacturer. In all cases, the suppliers have been invited to be present when their coatings are applied. Most suppliers have expressed an interest in attending. During the application process, the project team will record initial coating information on the coating tracking forms. This information will include the color of the test coating to enable detection of physical alterations or blemishes to the coating surfaces over the project period.

Table 3 presents general information on the application procedures for the alternative coatings. The first two columns show the supplier and the name of the coating respectively. For each coating, the third column specifies an application method. Some of the coatings will be sprayed. Spraying provides a smoother surface. It can be important to have a smooth surface to prevent or reduce attachment, particularly in the case of the foul release non-biocide coatings. The fourth column indicates whether undercoats need to be applied. In several cases, suppliers specify primers or tie coats which must be used under the test coating top coat. The fifth column indicates whether thinner is required. Generally, thinner is not used when coatings are rolled on. Thinners may be used when coatings are sprayed depending on the temperature and humidity during the application. The sixth column shows the cure time for the coating before it can be placed in the water.

2.4. Site Location

Once the panels have been painted and cured, they will be placed in the water for static immersion testing. It is important to conduct the immersion testing during the summer because it is the time of the year where the highest fouling will occur. All of the panels will be placed in the water starting the week of June 2 and will remain in the water through the week of October 6, 2008. The Project Team may reconsider and extend the period past the October date if a longer testing interval is warranted. If a longer test duration is deemed necessary, this will not impact the assessment or protocols used to evaluate these paints for this study.

The panels will be placed within two marinas located within the La Playa Cove area of the Shelter Island Yacht Basin. The panels will be placed in boat slips so that the side of the panel to be examined will be southerly facing. These panel locations and orientation are important so the panels to minimize the variations in exposure levels of sunlight, water temperature and circulation.

Some workgroup members have expressed concern about cross contamination. They have a concern that the copper or zinc coatings which are designed to leach their metals may influence other panels in the same vicinity that may be foul release coatings. This could influence the results of the performance evaluation. To address this concern, the Project Team will separate the panels containing active ingredients (metals or non-zinc

organic biocides) from the non-biocide coatings as follows. Designated slips have been identified within each marina that will be populated with a specific coating category (i.e., metals, biocides, or non-biocides). The designated slips are spaced out on different dock fingers allowing the Project Team to separate the non-biocides from the coatings containing active ingredients.

PVC frames for holding the coatings will be constructed. An example of the type of frame to be used is shown in Figure 1. Each PVC frame will hold three panels. Each panel will be attached to the PVC frame with nylon tie wraps on either side. The PVC frames will then be attached to floating docks and submerged, with the top of each panel 12 inches under the surface of the water. This will account for tidal variation and leave the panels submerged at a constant depth. PVC poles attached to the PVC frame will connect the frame to the floating dock.

Figure 1. View of Panels and PVC Frame (Photo: Swain, FIT)

Prior to immersion, each frame and the associated panels will be assigned a unique alpha-numeric code number corresponding to the coating applied to the panel, the marina, dock and slip numbers, and the cleaning method (described in Section 2.5 below). The code number will be clearly marked on each frame for ease of identification in the field and in photographs. The identification numbers will be tracked and documented during all inspections and cleaning efforts.

2.5. Cleaning

A key element of this project is to identify the effort needed to clean the test coatings. This will enable the project team to compare the effectiveness of alternative coatings (in terms of cleaning and cleaning costs) to commonly used copper paints. To accomplish this, the project team intends to investigate the effect of different cleaning regimes during this study. Each test coating will be comprised of a set of three panels which will evaluate two cleaning regimes as well as a non-cleaned panel. One panel is intended to

mimic standard hull cleaning practices[1], and will be cleaned using a pre-determined frequency and method. It will be cleaned every three weeks with a soft, medium to long shag carpet (CPDA BMP Manual, 2008). Another panel will be cleaned according to the paint supplier specifications. This regime is included to evaluate whether the suppliers recommended cleaning efforts are effective in removing the typical fouling growth expected during local summertime conditions. The cleaning methods and frequencies used on this panel will vary, as the team will be following suppliers' recommendations. A final panel will not be cleaned for the entire four month period it is submerged. This panel will only be cleaned at the completion of the test period (October) to determine whether infrequent cleaning is able to remove a large build up of fouling growth. Cleaning of this final panel will utilize a soft carpet and, if necessary, a green pad. The project team will document the specific mechanism(s) used.

The PVC frames will be lifted out of the water and placed on the dock for cleaning. The frame will be placed on a base during cleaning and assessment so that it maintains a vertical position. While one member of the Project Team is actively cleaning a panel, another team member will be lightly pouring seawater over the panel. The seawater used to rinse the panels will be taken from the site where the panels are immersed. Prior to cleaning the panels, the project team will receive training on proper cleaning procedures and assessment techniques to ensure consistency in reporting results. The Project Team will perform all of the cleaning during this study.

2.6. Quality Assurance/Quality Control

Quality Assurance and Quality Control mechanisms provide quantitative measures of test conditions and ensure that accuracy and precision can be documented throughout a project. Replication of QA/QC mechanisms will document overall precision during the study. The variability of results obtained from the replicate testing of QA/QC mechanisms will provide a measure of the variability of the sampling design. Blanks will also be used to provide precision during the study by ensuring the similarity of the fouling community within the test location. Accuracy will be obtained by including standards, or references, into the project. There will be three mechanisms incorporated into this project to ensure quality results are obtained and can be reproduced. The use of reference coatings and cleaning methods, negative controls, and a cleaning control will aid the interpretation of results during data analysis. These QA/QC mechanisms are discussed within this section.

1. **Standards** Standards, referred to in this project as reference controls, typically provide accuracy by enabling test subject data to be compared to a known standard. Two types of standards will be used in this project, reference coatings and cleaning standards. Reference coatings will be used during this project to provide a means of comparing the effectiveness of test coatings to hull paints commonly used by the local boating community. Copper-based antifouling

[1] Standard hull cleaning practices incorporate Best Management Practices using less-abrasive cleaning methods and typical diver cleaning frequencies found to be commonly used during the summer months in southern California.

coatings will be selected as reference coatings and evaluated in the same manner as the test coatings. While copper antifouling paints should not be construed as a defined standard for hull paints, we have elected to use them as a standard in this project because copper antifouling paint is the most accepted and commonly used coating and thus the most "cost/performance effective" standard currently available.

Two copper coatings will be used as reference coatings for this project. These coatings were selected by the Project Team after visiting the local boat yards and receiving information on the most commonly used copper coatings. The first, Super KL made by International Paint, is a high copper content coating containing between 50% and 75% copper. The second coating, AF-33 made by Sea Hawk, is a low copper content coating containing about 33% copper.

Both the high and low copper content references will use the same set up procedure as used for the test coatings. A PVC frame holding a set of three panels will be constructed for each reference coating. The reference coatings will be applied with a roller. This application method is consistent with that used currently by boatyards for all copper paints. A brush is often also used for detail, and as such, will be similarly used in this project. The reference coatings will be applied according to supplier specifications and the suppliers will be present to oversee the operation. To ensure precision within this project, replicates of each reference coating will be placed within each marina.

Cleaning standards will also be used to compare the test coatings to the commonly practiced cleaning regime for boats having copper antifouling paint. The standard cleaned panel will utilize a pre-determined cleaning frequency and method as described in Section 2.5, above. This practice mimics the standard summer hull cleaning frequency and mechanisms that hull cleaners using environmentally conscious BMPs implement. Each frame for test coatings, reference controls, and gel coat controls will include a cleaning standard panel.

2. **Negative Controls** Negative controls will consist of both blank panels with no coating applied and non-painted gel coated panels. Blank panels will be used to document overall precision during the study by monitoring unchecked growth and comparing the fouling community structure throughout the test site. These panels will be important when assessing whether the test coatings are actually preventing the attachment of particular types of fouling growth, or whether the type of biofouling organisms are not observed on a panel because they are simply not present in the environment during the study period. Because there is no antifouling coating applied, the blank panels should show heavy fouling in comparison to the reference coatings. Four blank frames will be placed in various locations in the test site to see if differences in the biofouling community and/or growth rates within the entire test site boundary are occurring. No cleaning will occur on the blank panels during the entire test period.

There will also be panels with only gel coat applied. These panels will act as a negative control by evaluating whether the proposed cleaning methods on their own can adequately control fouling in the absence of a hull coating. A triplicate set of gel coat frames will be used to provide some measure of the inherent variability of surface fouling and cleaning efficacy of a given coating. In addition to the overall variability, the average mean of the gel coat triplicates will provide a better estimate of the type/quantity of fouling and effectiveness of cleaning methods.

It is proposed that the gel coat-only panels be cleaned following the approach described above in Section 2.5, with the following exception. Similar to the test coatings, the gel coat-only panels will be housed in a PVC frame holding a set of three panels. One panel will not be cleaned, while a second panel will be cleaned with a soft carpet every three weeks. Because there are no supplier instructions for cleaning, the project team made the decision to clean the final panel with a green scotch brite pad on a six week frequency. Both of the negative controls will undergo the same assessment and evaluation as all other coated panels.

3. **Cleaning Controls** For each coating tested, one of the three panels will not be cleaned during the entire four month test period. This panel will serve as a cleaning control and will be used to evaluate how effectively the coating can control fouling without the aid of cleaning, and compare it to how the different cleaning regimes may influence the performance of the test coating. Cleaning of this final panel will occur at the end of the four month test period and will utilize a soft carpet and, if necessary, a green pad. The project team will document the specific mechanism(s) used during the final cleaning of this panel.

3. PANEL TESTING ASSESSMENT MEASURES

This section will describe how the Project Team intends to evaluate the panels utilized in the Project and assess the relative antifouling performance and cleaning effort needed for each coating. The type and degree of fouling on panels, as well as the effectiveness of the specified cleaning regime (method and frequency) will be examined regularly throughout the four-month period (June through October). Visual and numeric assessments will be used to identify the degree and type of biofouling, coating surface condition, and the appropriateness of each cleaning method and/or frequency for each type of test paint. The methodology described in this section presents guidance for quantitative analysis and consistent evaluation of the performance of test coatings. Using this information, the Project Team will be able to estimate the relative effectiveness of the test coatings against fouling and assess the cleaning efforts required.

The Project Team will inspect the panels to note, document and photograph the biofouling growth. During weeks when cleaning is required, the panels will be cleaned in the manner described in Section 2.5 of this document, and the cleaning assessment discussed below in Section 3.2 will also be conducted.

As discussed earlier, each set of panels of a particular test coating within a PVC frame will be assessed. The first step of every inspection will be to note the presence of silt on the panel. When silt is observed, the panel will be gently agitated in the water to remove the loose or unattached materials that may cover fouling organisms. This will reduce interference in observing attached organisms on the panels. The panels will be retrieved from the water one frame at a time. The test panels will not be allowed to dry during the inspection period and the length of time the panels are out of the water will be minimized; only allowing time for photographs and data documentation. The date of immersion, time and date of inspection, as well weather and other general environmental conditions will be recorded. The Project Team will also minimize contact with the panel surface during this time, taking care to handle the panel set by the frame.

3.1 Fouling Assessment

The field evaluation of the amount and type of biofouling present during the study will follow the procedures outlined in ASTM standards D 3623-78a and D 6990-05. These procedures provide a quantitative and consistent approach to evaluate coating performance of antifouling coatings using panels in immersion testing. During each inspection, biofouling will be recorded in tabular form and with digital imagery. Biofouling attachment occurring within ½ inch of the edges of test panels will not be included in the assessment. Photographs of the panels throughout the project will be taken, as these have been shown to be useful method from which to compare the performance of test surfaces. A size scale will be placed in each photograph to assist in assessing fouling organism size and panel condition.

The fouling assessment will focus on the type and density of primary biofouling settlement. The term primary foulers refer to the biofouling attached directly to the coating surface. The types of primary biofouling typically observed can be generally classified into one of the following three categories:

1. **Soft fouling:** Includes slime, algae and grasses. The term slime refers to a range of components such as absorbed organic and inorganic chemicals, trapped silt and detritus, diatoms, initial algal germination, and low form algae. Soft fouling usually has minimum effect on coating systems and performance of craft.
2. **Hard fouling:** Refers to calcareous structures, such as barnacles, serpulid tube worms (locally referred to as coral), and calcareous deposits. This fouling form may be detrimental to performance of coating systems.
3. **Composite fouling:** Occurs in the advanced stages of fouling, and contains both hard and soft fouling organisms. Mature barnacles and tube worms are present, along with hyroids with calcareous cellular structure such as anenomes. Slime, grass, soft shell-less animal forms such as hydroids, tunicates, and other soft fouling organisms may also be present. Composite fouling is extremely detrimental to a boat's performance, coating, and machinery systems.

Only primary biofoulers will be recorded and used in the antifouling performance rating. Organisms that attach to other organisms, or secondary fouling, will be noted but not

included in the calculation of the antifouling performance rating. It will also be noted if a fouling organism is found to be growing into the paint film. Immature or unidentifiable foulers will be recorded as "incipient fouling" while macrofouling organisms will be documented under their appropriate group.

The Fouling Resistance (FR) of the coatings reflects the portion of the panel area that is intact or the non-fouled area. The FR will be calculated through the ASTM method D 3623-78a. A positive feature of this format is that it can be used independent of coating type, thereby providing the Project Team a consistent method and format for fouling assessment. The fouling evaluation will be completed once prior to cleaning (pre-cleaning assessment) and then again after cleaning (post-cleaning assessment) for those panels on which cleaning is scheduled.

The method entails each type of fouling organism that is directly attached to the panel surface be reported by the percentage of the panel area covered by that type of fouling. The percent cover, the number of individuals, and size range of barnacles, mussels, and tubeworms will be recorded during inspections. The area covered by the holdfast or area of attachment for algae or arborescent bryozoans will be the only area used to determine the percent cover of these organisms. The FR also takes into account the percent cover of bryozoans, hydroids, tunicates, and each type of sponge present. In calculating the FR percent coverage, the test coatings will be given a score ranging from 0 to 100, assigning 0 to the worst or most heavily fouled and 100 assigned to test coatings with no fouling growth. The FR for panels of each test coating is derived through the following calculations.

- Those test coating surfaces free of fouling except for the presence of algal spores and other biological slimes will be given an FR rating of 100.
- If there are no macrofouling organisms, but the panel is partially covered by adherent slime, an FR rating of 99 will be given.
- If incipient fouling is present, the FR rating will be reduced to 95.
- If mature forms of fouling are present, an FR rating will be obtained by subtracting from 95 the percent cover of the macrofouling individuals present (such as barnacles, mussels, or oysters) and the percent surface covered by colonial forms.

The following example will demonstrate how the calculations would be completed. Assuming macrofouling organisms are present, the FR will start at 95. The percent cover for barnacles and tubeworms is 20% and green algae is present on 10% of the surface. Therefore, the equation to determine FR would be: 95 – (20+10) = 65.

For guidance on estimating percent cover, the Project Team will utilize Figures X1.1 through X1.4 in Appendix X1 of ASTM standard D6990-05. These figures provide visual examples of estimating the relative surface area covered by biofouling. The Project Team may also consider using the software Photogrid to supplement the visual assessments. Photogrid is a point intercept method using a stratified random point grid

for quantifying percent cover of organisms on test panels through the use of photographic imagery.

By identifying the type of biofouling present and the percent coverage of each biofouling type observed during an inspection, the Project Team will be able to analyze the static performance for an individual test coating, as well as compare the results to other test coatings within the same test coating category, i.e., zinc, organic biocide, and non-biocide.

Numeric ratings will be used to assess fouling growth for each coating. This will enable the Project Team to evaluate the coating's ability to repel or prevent. Table 4 describes the fouling performance rating criteria, primarily based on fouling resistance ratings, used by the Project Team in the determination of test coatings that will move to the next phase. The fouling performance ratings range from 1-5, with 1 representing little to no fouling and 5 indicative of high levels of fouling.

Table 4 Fouling Performance Rating

Rating	**Fouling Performance**
1	No to low levels of fouling growth; FR is 90-100; incipient fouling may be present; if macrofouling forms present, are few in number or spread out across panel; paint surface still visible beneath fouling
2	Low levels of fouling; FR is 70-90; macrofoulers present; painted surface may be obscured by fouling
3	Medium levels of fouling; FR is 50-70; primary foulers may be densely grouped and may include large individuals; secondary fouling may be present
4	Medium to high levels of fouling; FR is 30-50; macrofoulers include mature forms that may be densely grouped; secondary fouling attached (i.e. barnacles on barnacles or tunicates attached to barnacle) but still able to distinguish primary and secondary fouling
5	High levels of fouling; FR is <30; macrofoulers densely grouped and may completely cover panel surface; secondary fouling present; may be hard to distinguish primary from secondary fouling; paint surface no longer visible beneath fouling

3.2 Cleaning Assessment

Once the fouling assessment has been completed, coatings requiring cleaning during that week will be cleaned using the procedures discussed in Section 2.5. Pre-cleaning fouling information recorded during the fouling assessment (Section 3.1) will be considered the starting point from which to compare cleaning efforts. During cleaning, a cleaning assessment will be used to correlate the relative cleaning effort required to remove the fouling growth from the panels. If the specified cleaning regime is not able to thoroughly remove the fouling growth, even with a vigorous cleaning effort, the information will be

documented as such for that panel. A post-cleaning fouling performance rating will also be recorded to provide a means for comparison to the pre-cleaning rating. Cleaning efforts for each panel will follow the specified cleaning regimes (method and frequency) for each panel. In addition to the photographs taken as part of the fouling assessment, photographs will also be taken after cleaning to provide verification of how well the cleaning method is working. Similar to the fouling ratings, cleaning efforts will be rated numerically to determine the effort needed to clean each panel. Table 5 describes the factors utilized in the cleaning assessment rating which result in a rating scale ranging from 1-5. If a panel is unable to be cleaned completely (i.e., adequate removal of all of the fouling growth), the cleaning assessment will be given a 5 rating.

Table 5 Cleaning Assessment Rating

	Cleaning Effort
1	Light effort: very easy to remove growth with one wipe
2	Light to medium effort: still easy to remove growth but may require two or more passes in some areas to remove growth
3	Firm effort: firm scrubbing and continuous passes required to remove fouling growth
4	Hard effort: With very hard physical effort, growth presented a challenge to remove but could be removed using specified cleaning mechanism.
5	Using specified cleaning mechanism and hard effort, growth was unable to be removed.

The evaluation of each test panel for physical defects is based on ASTM D 6990-05. During the post-cleaning inspection of each panel, any physical failures in the condition of the test coating, such as wearing, blistering, cracking, chipping, flaking or other damage will be noted. The color of the test coating will also be compared to what was recorded during the application process (Section 2.3) to enable detection of physical alterations or failures to the coating surfaces over the project period. Overall physical deterioration will be reported as percent surface area affected by surface defects, which is estimated based on the visible area of the coating. Coating condition assessment criteria for is identified in Table 6. To the extent possible, the Project Team will note the type of failure (i.e. cracking or blistering) that occurred during the assessment.

Table 6 Post-Cleaning Coating Condition

Rating	Coating Condition
1	New, slick finish, still shiny if appropriate to type of coating
2	Shine is gone or surface is lightly etched on all of coating, no physical failure detected
3	Physical failure detected in coating less than 20% of panel
4	Some defects. Physical failure detected in coating on 20%-50% of panel
5	Physical failure detected on over 50% of panel

4. DATA ANALYSIS

The goal of the panel testing is to identify coatings that are 1) effective in repelling or preventing fouling growth, or 2) relatively easy to clean. Test coatings meeting either, or both of these criteria will be eligible to continue on to the next phase of the project. Additionally, test coatings continuing into the next phase of the project must also prove to be effective relative to the QC standards. The Project Team will be able to objectively evaluate the test coatings and take into account the variability due to different types of antifouling properties (i.e., biocide versus non-biocide, ablative versus fouling release) through the project's assessment measures. The Project Team will consider the data generated from the fouling and cleaning assessments in the following manner.

Effectiveness in repelling or preventing fouling growth

By analyzing the type and density (% surface area) of biofouling growth on the test coatings and the negative controls, the Project Team will be able to determine the coatings that appear effective in preventing or repelling growth. Effective coatings will show a lower percentage of growth both in terms of biofouling type and density than the negative controls.

Panels identified as having a pre-cleaning Fouling Performance rating of 1 or 2 for the entire test panel set (including the no-clean panel) throughout the duration of the project will automatically be included in the next phase. Coatings achieving these ratings indicate only a minor amount of growth is adhering to the panel and as such hull deterioration and/or performance are not being jeopardized.

Test coatings having a rating of 3 or higher on the no-clean panel, yet are able to regularly maintain a 1 or 2 pre-cleaning fouling rating on either of the cleaning regime panels will also automatically be moved through to the next phase of this study. These panels indicate that the frequency of cleaning is keeping biofouling growth at an acceptable level. It is speculated this is representative of the scenario that will be observed for many of the nonbiocide test coatings.

Test coatings that regularly receive a pre-cleaning Fouling Performance rating of 3 or higher on either of the cleaning regime panels indicate that the coating is continuing to accumulate large amounts of fouling growth. These panels will be further assessed on the ease of cleaning to determine whether they will pass on to the next phase of testing.

Relative ease in cleaning efforts

The Cleaning Assessment rating and post cleaning coating conditions are intended to provide an indication of the level of effort needed to clean the coating. It is important to understand this, as an important element for any successful hull coating is the cost required to maintain it. The specified cleaning regime should be able to regularly provide cleaning ratings of 1 - 3 to be considered effective. This means that the method and frequency are appropriate to assume that cleaning can be accomplished in a timely manner and without considerable effort. Ideally, the specified cleaning regime should be able to return the panel to the optimal 1 or 2 fouling performance condition described in Section 3.1 above, with a minimal to moderate cleaning effort. An important distinction to make is whether the coating condition is only observed immediately after cleaning, or if the panel remains relatively free of fouling until the next scheduled cleaning.

Test coatings comparing to, or performing better than the reference coatings will automatically be moved in to the next phase. This means that the test coating must regularly receive Fouling Performance ratings (pre- and post-cleaning) identical to, or better than the reference coatings. Additionally, the cleaning assessment ratings, particularly for the standard hull cleaning practices panel must perform at, or better than the reference coating's standard hull cleaning practices panel. This indicates that the coating is performing in the same manner as the common practice today, and as such, consumers will not have to make many efforts in terms of maintenance efforts and/or costs.

As stated in Section 3.1, those test coatings given pre-cleaning Fouling Performance ratings from 3-5 may also move on to the next phase of testing, provided they meet qualifying cleaning criteria. Panels with a 3 or higher pre-cleaning fouling rating that, can achieve a 1 or 2 post-cleaning fouling rating AND have a cleaning rating ranging from 1-3 will be considered for inclusion in the boat hull phase. This situation indicates that the cleaning method appears effective although the frequency may need to be increased to reduce the level of fouling occurring between cleanings. As such, alterations to the cleaning frequency for the boat hull phase may be considered by the Project Team.

Panels receiving Cleaning Assessment ratings of 4 indicate that, while the specified cleaning method may remove growth, the identified frequency is not effective at controlling the level of fouling. Panels regularly receiving cleaning assessments of 4, may enable the coating to be included in the next phase, provided that the coating condition ratings do not exceed a level 2. If the coating is moved in to the next phase, the cleaning frequency will be increased and noted as such. This determination will be at the project team's discretion.

Panels receiving Cleaning Assessment ratings of 5 indicate that the specified cleaning method and stated frequency are not effective at controlling fouling. In these cases, it would be assumed that either the frequency of cleaning would have to be increased or more abrasive cleaning methods would be required; each having its own negative impacts (increased cost to boater, environmental impacts, or impacts to the boat hull). Panels regularly receiving a 5 on the cleaning assessments will not move on to the next phase.

Using the process established above, the Project Team should also be able to provide a rank to those paints moving through to the next phase. While this ranking will not play a major role in identifying the list of paints for boat hull testing, it will be critical to the overall outcome of the study, as the higher performing coatings (i.e. those that can reduce fouling growth without impacting the environment and are easy to clean) will be the ones recommended as preferred alternatives.

List of Test Coatings for Port of San Diego Alternative Coatings Project

Contact Information		Test Coatings			
Company	Contact	Copper	Zinc	Non-Zinc Organic Biocide	Non-Biocide
Blue Water Marine	Jack Hickey		Blue Water Shelter Island (ZnP, ZnO)	Experimental Metal Free (E)	
				Experimental Metal Free Plus (E)	
Creative Coatings Corp.	Marlan Hoffman				Photo Finish
					Photo Finish Plus
Ecological Coatings, LLC	Nick Patenaude				EC-4300
E-Paint Co.	Kimberly Goodwin, Alex Walsh, Mike Goodwin		ePaint Eco (ZnP, ZnO, E)		
			EP-2000 (ZnP, ZnO)		
			Ecominder (ZnP, ZnO)		
			E Paint SN-1 (ZnO, Org)		
			EP-21 Release Coating (ZnO)		
			SUNWAVE (ZnO)		
Harbor Engineering Services	Jack Hickey		B49 (ZnP, ZnO, E)		
			B69 (ZnO, E)		
Innovative Marine	Al Hamilton				Hempasil XA-112
International Paint	Rusty Rutherford	Super KL	Pacifica (ZnP, ZnO)	Trilux Copper Free	Intersleek 900
			Pacifica Plus (ZnP, ZnO)		VC Performance Epoxy
Jones Marketing Services / Hyperseal	Loch Jones		Hyper Zinc Marine		Hyperglass
			Hyperseal X		
KISS Polymers, LLC	Keith Kent				KISS Ultra Concentrated Gel
					MegaGuard Ultra LiquiCote
Microphase	Brad Leinhart				Phase Coat Bare Bottom
New Nautical Coatings, Inc.	Erik Norrie		Mission Bay (ZnP, ZnO)	Seahawk Smart Solution (E)	
Oceanic Surfaces International, LLC	Mark Sammons, Christine Blake				ECO-5
Petit Paint (Kop-Coat Specialty Coatings)	John Ludgate, Harvey Wills, Frank Winkleman		Vivid Free (ZnP, ZnO)		Klear n'Klean
			Vivid SPC (ZnP, ZnO, E)		
			Hydrocoat ECO (ZnP, E)		
Propspeed	Barth Hudiburgh				Propspeed
Ram Protective Coatings	Bill Kraus				Ceram-Kote 99M
Seacoat Technology, LLC	John Bowlin Al Hamilton				Sea-Speed GC V4
Sea Hawk	Barth Hudiburgh	AF-33			
Seashell Technology	David Schultz				SeashellST5000
					SeashellST5100
Sherwin Williams	Tom Vahle, Michael Silva, Manuel Pimental		Seaguard HMF (ZnP, ZnO)		
Sound Specialty Coatings Corp.	Nancy Pierson				AQUAPLY M
Specialty Products, Inc.	Doug Kleweno				PTU- 200
					Polyshield HT
Water Tight, LLC	Bill Rashick				Water Tight
Xurex Nano-Coating	Graeme Marsh				ProGlide
					ProGlide Plus
					HabraCoat

ZnO = Zinc Oxide; ZnP = Zinc Pyrithione; E = Econea; Org = Other Organic Biocide

Table 2
Test Coatings Registration Status

Company	Test Coatings	Registration Status With EPA	Registration Status With California
Blue Water Marine	Blue Water Shelter Island (ZnP, ZnO)	not registered	not registered
	Experimental Metal Free (E)	not registered	not registered
	Experimental Metal Free Plus (E)	not registered	not registered
Creative Coatings Corp.	Photo Finish	NA	NA
	Photo Finish Plus	NA	NA
Ecological Coatings, LLC	EC-4300	NA	NA
E-Paint Co.	ePaint Eco (ZnP, ZnO, E)	not registered	not registered
	EP-2000 (ZnP, ZnO)	registered	registered
	Ecominder (ZnP, ZnO)	registered	registered
	E Paint SN-1 (ZnO, Org)	registered	registered
	EP-21 Release Coating (ZnO)	NA	NA
	SUNWAVE (ZnO)	NA	NA
Harbor Engineering Services	B49 (ZnP, ZnO, E)	not registered	not registered
	B69 (ZnO, E)	not registered	not registered
Innovative Marine	Hempasil XA-112	NA	NA
International Paint	Pacifica (ZnP, ZnO)	registered	registered
	Pacifica Plus (ZnP, ZnO)	not registered	not registered
	Trilux Copper Free	not registered	not registered
	Intersleek 900	NA	NA
	VC Performance Epoxy	NA	NA
Jones Marketing Services / Hyperseal	Hyper Zinc Marine	not registered	not registered
	Hyperglass	NA	NA
	Hyperseal X	not registered	not registered
KISS Polymers, LLC	KISS Ultra Concentrated Gel	NA	NA
	MegaGuard Ultra LiquiCote	NA	NA
Microphase	Phase Coat Bare Bottom	NA	NA
New Nautical Coatings, Inc.	Mission Bay (ZnP, ZnO)	registered	registered
	Seahawk Smart Solution (E)	submitted	not registered
Oceanic Surfaces International, LLC	ECO-5	NA	NA
Petit Paint (Kop-Coat Specialty Coatings)	Vivid Free (ZnP, ZnO)	registered	registered
	Vivid SPC (ZnP, ZnO, E)	not registered	not registered
	Hydrocoat ECO (ZnP, E)	not registered	not registered
	Klear n'Klean	not registered	not registered
Propspeed	Propspeed	NA	NA
Ram Protective Coatings	Ceram-Kote 99M	NA	NA
Seacoat Technology, LLC	Sea-Speed GC V4	NA	NA
Seashell Technology	SeashellST5000	NA	NA
	SeashellST5100	NA	NA
Sherwin Williams	Seaguard HMF (ZnP, ZnO)	EPA registration imminent	not registered
Sound Specialty Coatings Corp.	AQUAPLY M	NA	NA
Specialty Products, Inc.	PTU- 200	NA	NA
	Polyshield HT	NA	NA
Water Tight, LLC	Water Tight	NA	NA
Xurex Nano-Coating	ProGlide	NA	NA
	Pro Glide Plus	NA	NA
	HabraCoat	NA	NA

ZnO = Zinc Oxide; ZnP = Zinc Pyrithione; E = Econea; Org = Other Organic Biocide

NA = Not Applicable

Table 3
Test Coatings Application Procedures for Panels

Company	Test Coatings	Application Method	Undercoats	Thinner	Water Cure Time
Blue Water Marine	Blue Water Shelter Island (ZnP, ZnO)	roll	one	no	16 hours
	Experimental Metal Free (E)	roll	one	no	16 hours
	Experimental Metal Free Plus (E)	roll	one	no	16 hours
Creative Coatings Corp.	Photo Finish	roll	one	no	24 hours
	Photo Finish Plus	roll	none	no	24 hours
Ecological Coatings, LLC.	EC-4300	roll	none	no	5 Days
E-Paint Co.	ePaint Eco (ZnP, ZnO, E)	roll	none	no	24 hours
	EP-2000 (ZnP, ZnO)	roll	none	no	24 hours
	Ecominder (ZnP, ZnO)	roll	none	no	24 hours
	E Paint SN-1 (ZnO, Org)	roll	none	no	24 hours
	EP-21 Release Coating (ZnO)	roll	none	no	24 hours
	SUNWAVE (ZnO)	roll	none	no	24 hours
Harbor Engineering Services	B49 (ZnP, ZnO, E)	roll	one	no	8 - 48 hours
	B69 (ZnO, E)	roll	one	no	8 - 48 hours
Innovative Marine	Hempasil XA-112	roll	one	no	24 hours
International Paint	Pacifica (ZnP, ZnO)	roll	none	no	24 hours
	Pacifica Plus (ZnP, ZnO)	roll	none	no	24 hours
	Trilux Copper Free	roll	none	no	24 hours
	Intersleek 900	roll	two	no	24 hours
	VC Performance Epoxy	roll	none	no	24 hours
Jones Marketing Services / Hyperseal	Hyper Zinc Marine	brush	none	no	24 hours
	Hyperglass	brush	one	no	24 hours
	Hyperseal X	brush	none	no	24 hours
KISS Polymers, LLC	KISS Ultra Concentrated Gel	cloth	none	no	none
	MegaGuard Ultra LiquiCote	cloth	none	no	none
Microphase	Phase Coat Bare Bottom	roll	one	no	24 hours
New Nautical Coatings, Inc.	Mission Bay (ZnP, ZnO)	roll	none	no	24 hours
	Seahawk Smart Solution (E)	roll	none	no	24 hours
Oceanic Surfaces International, LLC	ECO-5	roll	none	no	6 hours
Petit Paint (Kop-Coat Specialty coatings)	Vivid Free (ZnP, ZnO)	roll	none	no	48 hours
	Vivid SPC (ZnP, ZnO, E)	roll	none	no	48 hours
	Hydrocoat ECO (ZnP, E)	roll	none	no	48 hours
	Klear n'Klean	roll	one	no	48 hours
Ram Protective Coatings	Ceram-Kote 99M	spray	none	no	24 hours
Propspeed	Propspeed	roll	one	no	24 hours
Seacoat Technology, LLC	Sea-Speed GC V4	roll	none	no	24 hours
Seashell Technology	SeashellST5000	spray (will bring)	none	no	48 hours
	SeashellST5100	spray (will bring)	none	no	48 hours
Sherwin Williams	Seaguard HMF (ZnP, ZnO)	roll	none	no	24 hours
Sound Specialty Coatings Corp.	AQUAPLY M	roll	none	no	24 hours
Specialty Products, Inc.	PTU- 200	spray (will bring)	none	no	24 hours
	Polyshield HT	spray (will bring)	none	no	24 hours
Water Tight, LLC	Water Tight	brush then squeegee	none	no	24 hours
Xurex Nano-Coating	ProGlide	spray	none	no	72 hours
	ProGlide Plus	spray	none	no	72 hours
	HabraCoat	spray	one	no	72 hours

ZnCr = Zinc Chromate; ZnO = Zinc Oxide; ZnP = Zinc Pyrithione; E = Econea; Org = Other Organic Biocide

Appendix C
Panel Test Field Data

Coating Name	Date	NC Fouling Rating	NC Coating Cond Rating	Pre-Clean SC Fouling Rating	Post-Clean SC Fouling Rating	SC Cleaning Rating	SC Coating Cond Rating	Pre-Clean MC Fouling Rating	Post-Clean MC Fouling Rating	MC Cleaning Rating	MC Coating Cond Rating
Photo Finish Plus	6/17/2008	1						1	1	1	1
	6/24/2008	1	1	1	1	4	1	1	1	2	1
	7/15/2008	2	1	2	1	4	2	2	1	4	2
	8/6/2008	3	1	2	1	2	1	2	1	2	2
	8/25/2008	2	1	1	1	3	2	1	1	2	1
	9/16/2008	2	1	1	1	3	2	1	1	2	2
	10/7/2008	2	2	1	1	3	2	2	1	2	2
EC-4300	6/25/2008	2	2	2	1	3	2				
	7/16/2008	3	2	2	1	4	1	2	1	3	1
	8/7/2008	3	1	3	1	4	2				
	8/26/2008	3	1	2	1	5	2	3	2	5	2
	9/17/2008	3	2	2	1	5	2				
	10/8/2008	2	2	2	1	5	2	2	2	5	2
EP-21 Release Coating	6/25/2008	1	1	1	1	1	1				
	7/16/2008	1	1	1	1	1	1				
	8/7/2008	1	1	1	1	1	1				
	8/26/2008	1	1	1	1	1	1	1	1	1	1
	9/17/2008	1	1	1	1	1	1				
	10/8/2008	1	1	1	1	1	1				
Hempasil X3	6/24/2008	1	1	1	1	1	1				
	7/15/2008	1	1	1	1	1	1	1	1	1	1
	8/6/2008	2	1	2	1	1	1				
	8/25/2008	1	1	1	1	1	1	2	1	1	1
	9/16/2008	2	1	2	1	1	1				
	10/7/2008	2	1	2	1	2	1	3	1	1	1
Intersleek 900	6/24/2008	1	1	1	1	1	1				
	7/2/2008	1	1					1	1	2	1
	7/15/2008	2	1	1	1	1	1				
	7/30/2008	1	1					1	1	1	1
	8/6/2008	2	1	1	1	1	1				
	8/25/2008	2	1	1	1	1	1	1	1	1	1
	9/16/2008	2	1	1	1	1	1				
	9/25/2008	2	2					2	1	2	1
	10/7/2008	2	2	1	1	2	1				
VC Performance Epoxy	6/17/2008	1	1					1	1	2	1
	6/24/2008	2	1	1	1	3	1				
	7/2/2008	2	1					1	1	3	1
	7/15/2008	2	1	1	1	4	2	1	1	2	2
	7/30/2008	2	1					2	1	2	2
	8/6/2008	2	1	1	1	3	2				
	8/12/2008	3	1					1	1	2	1
	8/25/2008	3	1	1	1	3	1	1	1	2	1
	9/9/2008	2	2					1	1	2	2
	9/16/2008	2	1	2	1	2	1				
	9/25/2008	2	1					1	1	2	2
	10/7/2008	2	2	2	1	3	2	2	1	2	2

Coating Name	Date	NC Fouling Rating	NC Coating Cond Rating	Pre-Clean SC Fouling Rating	Post-Clean SC Fouling Rating	SC Cleaning Rating	SC Coating Cond Rating	Pre-Clean MC Fouling Rating	Post-Clean MC Fouling Rating	MC Cleaning Rating	MC Coating Cond Rating
Hyperglass	6/24/2008	2	1	2	1	4	1				
	7/15/2008	3	1	2	1	4	2	3	1	4	2
	8/6/2008	3	1	2	1	4	3				
	8/25/2008	3	1	2	1	4	3	3	1	4	2
	9/16/2008	4	2	2	1	4	2				
	10/7/2008	5	1	2	1	4	3	3	2	5	2
	6/25/2008	1	1	1	1	4	3	2	1	5	1
	7/16/2008	2	1	1	1	4	2	2	1	5	2
	8/7/2008	3	1	2	1	4	2	2	1	5	1
	8/26/2008	3	1	2	1	2	2	2	2	5	2
	9/17/2008	3	1	2	1	3	2	2	2	5	2
	10/8/2008	3	1	2	1	3	2	2	2	5	2
MegaGuard Ultra LiquiCote	6/24/2008	2	1	2	1	4	1	2	1	5	1
	7/15/2008	2	1	2	1	3	1	2	2	5	2
	8/6/2008	4	2	2	1	3	2	2	1	5	2
	8/25/2008	4	1	2	1	2	1	3	2	5	2
	9/16/2008	3	1	2	1	3	2	2	2	5	2
	10/7/2008	2	1	2	1	3	2	3	2	5	2
Phase Coat Bare Bottom	6/24/2008	1	1	1	1	1	1				
	7/15/2008	1	1	2	1	2	3				
	7/30/2008	1	1					1	1	3	2
	8/6/2008	1	1	2	1	4	2				
	8/25/2008	2	1	1	1	2	2				
	9/16/2008	2	1	2	1	3	2				
	9/25/2008	2	2					2	2	5	2
	10/7/2008	3	1	2	1	3	2				
ECO-5	6/24/2008	2	1	2	1	4	1				
	7/2/2008	2	1					1	1	5	2
	7/15/2008	2	1	2	1	3	3	2	1	5	2
	7/30/2008	2	1					1	1	4	2
	8/6/2008	3	1	2	1	4	3				
	8/12/2008	3	1					2	1	4	2
	8/25/2008	4	1	3	1	4	2	3	1	4	2
	9/9/2008	3	1					2	1	3	2
	9/16/2008	3	1	2	1	2	2				
	9/25/2008	3	2					2	1	3	2
	10/7/2008	3	1	2	1	2	2	1	1	3	2
Klear n'Klean	6/24/2008	2	1	1	1	1	1				
	7/8/2008	2	1					1	1	2	1
	7/15/2008	2	1	1	1	1	1				
	8/6/2008	2	2	2	1	1	1				
	8/12/2008	2	1					2	1	2	1
	8/25/2008	3	1	1	1	1	1				
	9/16/2008	4	1	1	1	1	1	2	1	1	1
	10/7/2008	5	2	2	1	2	2				

Coating Name	Date	NC Fouling Rating	NC Coating Cond Rating	Pre-Clean SC Fouling Rating	Post-Clean SC Fouling Rating	SC Cleaning Rating	SC Coating Cond Rating	Pre-Clean MC Fouling Rating	Post-Clean MC Fouling Rating	MC Cleaning Rating	MC Coating Cond Rating	
Photo Finish	6/17/2008	2	1					1	1	3	1	
	6/24/2008	2	1	2	1	3	1					
	7/2/2008	3	2	1	1	4	2			4		
	7/15/2008	2	1	2	1	4	3	1	1	2	1	
	7/30/2008	2	2					1	1	2	2	
	8/6/2008	3	1	2	1	3	2					
	8/12/2008	3	1					1	1	1	1	
	8/25/2008	3	1	1	1	3	2	1	1	1	2	
	9/9/2008	3	1					2	1	1	2	
	9/16/2008	3	1	2	1	2	2					
	9/25/2008	3	2					2	1	2	2	
	10/7/2008	3	2	2	1	3	2	1	1	1	2	
KISS Ultra Concentrated Gel	9/25/2008	4	1					2	1	3	2	
	6/17/2008	2	2					1	1	3	2	
	6/25/2008	2	1	3	1	5	1					
	7/2/2008	2	1					1	1	4	3	
	7/16/2008	3	1	2	1	5	2	2	1	4	2	
	7/30/2008	3	1					1	1	1	2	
	8/7/2008	3	1	2	1	4	2					
	8/12/2008	3	1					1	1	3	2	
	8/26/2008	4	2	2	1	3	2	2	1	3	3	
	9/9/2008	4	1					2	1	3	2	
	9/17/2008	4	1	3	1	4	3					
	10/8/2008	4	1	2	1	4	2	2	1	4	2	
Sea-Speed GC V4	6/25/2008	1	1	2	1	2	1	1	1	2	1	
	7/16/2008	2	1	2	1	2	2	2	1	1	1	
	8/7/2008	2	1	1	1	3	1	1	1	2	1	
	8/26/2008	3	1	1	1	2	1	1	1	2	1	
	9/17/2008	2	1	2	1	2	2	2	1	3	2	
	10/8/2008	3	1	2	1	3	1	2	1	3	1	
SeashellST5000	6/24/2008	1	1	1	1	1	1	1	1	5	1	
	7/15/2008	2	1	2	1	4	1	2	1	5	2	
	8/6/2008	2	1	1	1	4	2	2	2	5	2	
	8/25/2008	2	1	1	1	4	2	3	2	5	2	
	9/16/2008	2	1	2	1	2	2	2	2	5	2	
	10/7/2008	2	2	2	1	4	2	2	2	5	2	
SeashellST5100	6/24/2008	1	1	1	1	2	1	2	1	5	1	
	7/15/2008	3	1	2	1	2	2	2	1	5	1	
	8/6/2008	3	1	2	1	4	2	2	2	5	2	
	8/25/2008	3	2	2	1	3	2	2	2	5	2	
	9/16/2008	2	1	2	1	2	1	2	2	5	2	
	10/7/2008	3	2	2	1	3	2	2	2	5	2	
	Average	2.5	1.33	1.83	1	2.67	1.67	2	1.67	5	1.67	3.83
AQUAPLY M	6/24/2008	1	1	2	1	3	1	2	1	2	1	
	7/15/2008	2	1	1	1	3	3	2	1	3	1	
	8/6/2008	2	1	1	1	3	2	2	1	2	1	
	8/25/2008	2	1	2	1	3	2	1	1	2	2	
	9/16/2008	3	1	1	1	2	1	2	1	2	2	
	10/7/2008	3	2	2	1	3	2	2	1	3	2	

Coating Name	Date	NC Fouling Rating	NC Coating Cond Rating	Pre-Clean SC Fouling Rating	Post-Clean SC Fouling Rating	SC Cleaning Rating	SC Coating Cond Rating	Pre-Clean MC Fouling Rating	Post-Clean MC Fouling Rating	MC Cleaning Rating	MC Coating Cond Rating	
PTU-200	6/25/2008	3	1	3	1	5	2					
	7/15/2008	3	1	2	1	5	2	4	1	4	2	
	8/7/2008	4	1	3	2	5	2					
	8/26/2008	4	2	2	1	5	2	3	1	5	2	
	9/17/2008	4	2	2	1	4	2					
	10/8/2008	4	1	2	1	4	2	2	1	4	2	
	Average	3.67	1.33	2.33	1.17	4.67	2	3	1	4.33	2	4.50
Polyshield HT	6/24/2008	2	1	2	1	4	1					
	7/15/2008	3	2	2	1	4	2	2	1	4	2	
	8/6/2008	3	1	2	1	4	3					
	8/25/2008	3	2	2	1	4	2	3	1	4	2	
	9/16/2008	4	1	2	1	3	2					
	10/7/2008	4	2	2	1	3	2	3	1	3	2	
SUNWAVE	6/25/2008	1	1	1	1	1	1					
	7/2/2008	1	1					1	1	1	1	
	7/16/2008	1	1	1	1	1	1					
	7/30/2008	1	1					1	1	1	1	
	8/7/2008	1	1	1	1	1	1					
	8/26/2008	1	1	1	1	1	1	1	1	1	1	
	9/17/2008	1	1	1	1	1	1					
	9/25/2008	1	1					1	1	1	1	
	10/8/2008	1	1	1	1	1	1					
Water Tight	6/24/2008	1	1	1	1	5	1	1	1	4	1	
	7/15/2008	1	1	2	1	4	2	2	1	4	2	
	8/6/2008	2	1	2	1	4	2	1	1	3	2	
	8/25/2008	2	1	1	1	2	1	2	1	2	2	
	9/16/2008	3	1	1	1	2	2	2	1	2	2	
	10/7/2008	2	2	2	1	3	2	2	1	3	2	
ProGlide	7/2/2008	2	1					2	1	4	2	
	6/24/2008	2	1	2	1	5	1					
	7/15/2008	2	1	2	1	4	3					
	7/30/2008	3	1					2	1	4	2	
	8/6/2008	3	1	2	1	4	3					
	8/25/2008	3	2	2	1	4	2	2	1	4	2	
	9/16/2008	3	2	2	1	3	3					
	9/25/2008	3	2					2	1	5	3	
	10/7/2008	3	2	2	1	4	2					
HabraCoat	6/24/2008	2	1	2	1	4	1					
	7/2/2008	2	1					2	1	4	1	
	7/15/2008	2	1	1	1	4	1					
	7/30/2008	2	1					2	1	4	2	
	8/6/2008	3	1	2	1	4	2					
	8/25/2008	3	1	2	1	4	2	2	1	4	3	
	9/16/2008	3	1	2	1	3	2					
	9/25/2008	3	2					2	1	4	2	
	10/7/2008	3	2	2	1	3	2					

Coating Name	Date	NC Fouling Rating	NC Coating Cond Rating	Pre-Clean SC Fouling Rating	Post-Clean SC Fouling Rating	SC Cleaning Rating	SC Coating Cond Rating	Pre-Clean MC Fouling Rating	Post-Clean MC Fouling Rating	MC Cleaning Rating	MC Coating Cond Rating
Proglide Plus	6/25/2008	2	1	2	1	4	1				
	7/2/2008	2	1					1	1	4	1
	7/16/2008	2	1	1	1	4	2				
	7/30/2008	3	1					1	1	4	2
	8/7/2008	3	1	2	1	4	2				
	8/26/2008	3	2	1	1	3	2	2	1	5	2
	9/17/2008	2	2	2	1	4	2				
	9/25/2008	3	1					2	2	5	2
	10/8/2008	3	2	2	1	5	2				

Coating Name	Date	NC Fouling Rating	NC Coating Cond Rating	Pre-Clean SC Fouling Rating	Post-Clean SC Fouling Rating	SC Cleaning Rating	SC Coating Cond Rating	Pre-Clean MC Fouling Rating	Post-Clean MC Fouling Rating	MC Cleaning Rating	MC Coating Cond Rating
Blue Water Shelter Island (ZnO and ZnP)	6/25/2008	1	2	1	1	1	2				
	7/16/2008	1	1	1	1	1	2				
	7/30/2008	1	1					1	1	1	1
	8/7/2008	1	1	1	1	1	2				
	8/26/2008	1	1	1	1	1	1				
	9/17/2008	1	1	1	1	1	1				
	9/25/2008	1	1					1	1	1	1
	10/8/2008	1	1	1	1	1	1				
ePaint Eco (ZnP)	6/24/2008	1	1	1	1	1	1				
	7/15/2008	1	1	1	1	1	1				
	8/6/2008	1	1	1	1	1	1				
	8/25/2008	1	1	1	1	1	1	1	1	1	1
	9/16/2008	1	3	1	1	2	3				
	10/7/2008	1	1	1	1	1	1				
EP-2000 (ZnP)	6/24/2008	1	1	1	1	1	2				
	7/15/2008	1	1	1	1	1	1				
	7/30/2008	1	1					1	1	1	1
	8/6/2008	1	1	1	1	1	1				
	8/25/2008	1	1	1	1	1	1				
	9/16/2008	1	1		1	1	1				
	9/25/2008	1	1					1	1	1	1
B49 (ZnO and ZnP and E)	6/25/2008	1	1	1	1	1	1				
	7/15/2008	1	1	1	1	1	1				
	7/30/2008	1	1					1	1	1	1
	8/7/2008	1	1	1	1	1	1				
	8/26/2008	1	1	1	1	1	1				
	9/17/2008	1	1	1	1	1	1				
	9/25/2008	1	1					1	1	1	1
	10/8/2008	1	1	1	1	1	1				
B69 (ZnO and E)	6/24/2008	1	1	1	1	1	1				
	7/15/2008	1	1	1	1	1	1				
	7/30/2008	1	1					1	1	1	1
	8/6/2008	1	1	1	1	1	1				
	8/25/2008	1	1	1	1	1	1				
	9/16/2008	1	1	1	1	1	1				
	9/25/2008	1	1					1	1	1	1
	10/7/2008	1	1	1	1	1	1				

Coating Name	Date	NC Fouling Rating	NC Coating Cond Rating	Pre-Clean SC Fouling Rating	Post-Clean SC Fouling Rating	SC Cleaning Rating	SC Coating Cond Rating	Pre-Clean MC Fouling Rating	Post-Clean MC Fouling Rating	MC Cleaning Rating	MC Coating Cond Rating
Hyperseal X	6/24/2008	1	2	2	1	4	3				
	7/15/2008	2	1	2	1	4	4	2	1	4	3
	8/6/2008	3	1	1	1	4	3				
	8/25/2008	3	1	1	1	2	4	2	1	4	4
	9/16/2008	4	2	2	1	3	4				
	10/7/2008	4	2	3	1	4	4	4	1	4	3
Pacifica (ZnO and ZnP)	6/25/2008	1	1	1	1	1	1				
	7/16/2008	1	1	1	1	1	1				
	7/30/2008	1	1					1	1	1	1
	8/7/2008	1	1	1	1	1	1				
	8/26/2008	1	1	1	1	1	1				
	9/17/2008	1	1	1	1	1	3				
	9/25/2008	1	1					1	1	1	2
	10/8/2008	1	1	1	1	1	3				
Pacifica Plus (ZnO and ZnP)	6/25/2008	1	1	1	1	1	1				
	7/16/2008	1	1	1	1	1	1				
	7/30/2008	1	1					1	1	1	1
	8/7/2008	1	1	1	1	1	1				
	8/26/2008	1	1	1	1	1	1				
	9/17/2008	1	1	1	1	1	3				
	9/25/2008	1	1					1	1	1	1
	10/8/2008	1	1	1	1	1	3				
Hyper Zinc Marine	6/25/2008	1	1	1	1	4	3				
	7/15/2008	1	3	1	1	4	3	1	1	5	3
	8/7/2008	3	1	2	1	5	3				
	8/26/2008	3	2	2	1	3	3	3	1	3	3
	9/17/2008	3	3	2	1	2	3				
	10/8/2008	3	3	2	1	3	4	2	1	3	3
Mission Bay (ZnO and ZnP)	6/25/2008	1	1	1	1	1	1				
	7/2/2008	1	1					1	1	1	1
	7/16/2008	1	1	1	1	1	1				
	7/30/2008	1	1					1	1	1	1
	8/7/2008	1	1	1	1	1	2				
	8/26/2008	1	1	1	1	1	1	1	1	1	1
	9/17/2008	1	1	1	1	1	1				
	9/25/2008	1	1					1	1	1	1
	10/8/2008	1	1	1	1	1	1				

Coating Name	Date	NC Fouling Rating	NC Coating Cond Rating	Pre-Clean SC Fouling Rating	Post-Clean SC Fouling Rating	SC Cleaning Rating	SC Coating Cond Rating	Pre-Clean MC Fouling Rating	Post-Clean MC Fouling Rating	MC Cleaning Rating	MC Coating Cond Rating
Vivid Free (ZnO and ZnP)	6/25/2008	1	1	1	1	1	1				
	7/8/2008	1	1					1	1	1	1
	7/16/2008	1	1	1	1	1	1				
	8/7/2008	1	1	1	1	1	1				
	8/12/2008	1	1					1	1	1	1
	8/26/2008	1	1	1	1	1	1				
	9/17/2008	1	1	1	1	2	1	1	1	1	1
	10/8/2008	1	1	1	1	1	1				
Vivid SPC (ZnO and ZnP and E)	6/25/2008	1	1	1	1	1	1				
	7/8/2008	1	1					1	1	1	3
	7/16/2008	1	1	1	1	1	2				
	8/7/2008	1	1	1	1	1	1				
	8/12/2008	1	1					1	1	1	1
	8/26/2008	1	1	1	1	1	1				
	9/17/2008	1	2	1	1	1	3	1	1	1	3
	10/8/2008	1	1	1	1	1	1				
Hydrocoat ECO (ZnP and E)	6/25/2008	1	1	1	1	1	1				
	7/8/2008	1	1					1	1	1	1
	7/16/2008	1	1	1	1	1	1				
	8/7/2008	1	1	1	1	1	1				
	8/12/2008	1	1					1	1	1	1
	8/26/2008	1	1	1	1	1	1				
	9/17/2008	1	2	1	1	1	1	1	1	1	1
	10/8/2008	1	1	2	1	2	2				
Propspeed (ZnCr)	6/25/2008	1	1	2	1	1	1				
	7/16/2008	2	1	1	1	1	1				
	7/30/2008	2	1					2	1	1	1
	8/7/2008	2	1	2	1	1	1				
	8/26/2008	2	1	1	1	1	1				
	9/17/2008	2	1	1	1	1	1				
	9/25/2008	2	1					1	1	1	1
	10/8/2008	2	1	1	1	1	1				
Seaguard HMF (ZnO and ZnP)	6/25/2008	1	1	1	1	1	1				
	7/16/2008	1	1	1	1	1	1				
	7/30/2008	1	1					1	1	1	1
	8/7/2008	1	1	1	1	1	1				
	8/26/2008	1	1	1	1	1	1				
	9/17/2008	1	1	1	1	1	1				
	9/25/2008	1	1					1	1	1	1
	10/8/2008	1	1	1	1	1	1				

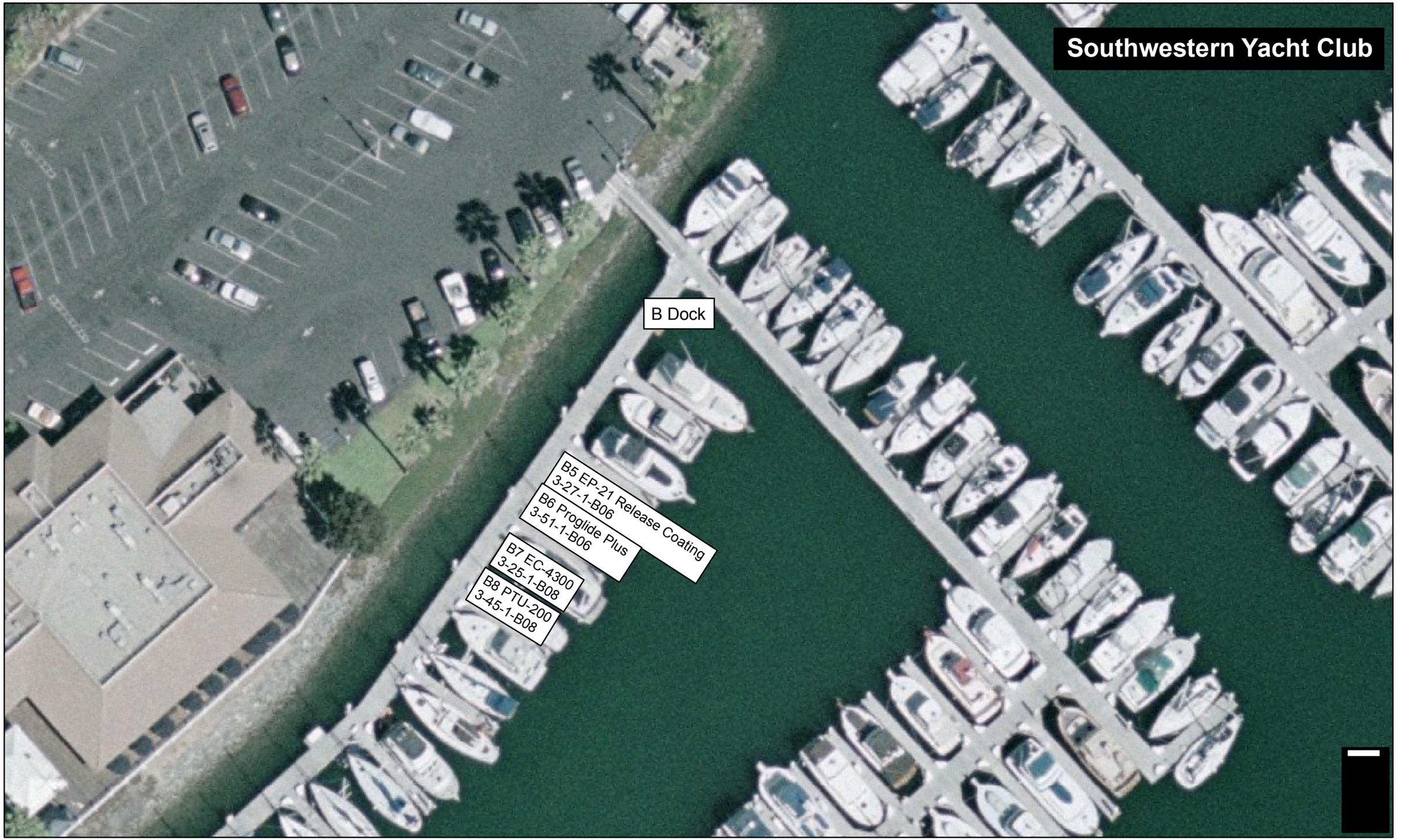
Coating Name	Date	NC Fouling Rating	NC Coating Cond Rating	Pre-Clean SC Fouling Rating	Post-Clean SC Fouling Rating	SC Cleaning Rating	SC Coating Cond Rating	Pre-Clean MC Fouling Rating	Post-Clean MC Fouling Rating	MC Cleaning Rating	MC Coating Cond Rating
Experimental Metal Free (E)	6/24/2008	1	1	1	1	1	1				
	7/15/2008	1	1	1	1	1	1				
	7/30/2008	1	1					1	1	1	1
	8/6/2008	1	1	1	1	1	1				
	8/25/2008	1	1	1	1	1	1				
	9/16/2008	1	1	1	1	1	1				
	9/25/2008	1	1					1	1	1	2
	10/7/2008	1	1	1	1	1	1				
Experimental Metal Free Plus (E)	6/24/2008	1	1	1	1	1	2				
	7/15/2008	1	1	1	1	1	1				
	7/30/2008	1	1					1	1	1	1
	8/6/2008	1	1	1	1	1	1				
	8/25/2008	1	1	1	1	1	1				
	9/16/2008	1	1	1	1	1	1				
	9/25/2008	1	1					1	1	1	1
	10/7/2008	1	2	1	1	1	1				
Ecominder	6/24/2008	1	1	1	1	1	1				
	7/15/2008	1	1	1	1	1	1				
	7/30/2008	1	1					1	1	1	1
	8/6/2008	1	1	1	1	1	1				
	8/25/2008	1	1	1	1	1	1				
	9/16/2008	1	1	1	1	1	1				
	9/25/2008	1	1					1	1	1	1
	10/7/2008	1	1	1	1	1	1				
E Paint SN-1	6/24/2008	1	1	1	1	1	1				
	7/15/2008	1	1	1	1	1	1				
	8/6/2008	1	1	1	1	1	1				
	8/25/2008	1	1	1	1	1	1	1	1	1	1
	9/16/2008	1	1	1	1	1	1				
	10/7/2008	1	1	1	1	1	1				

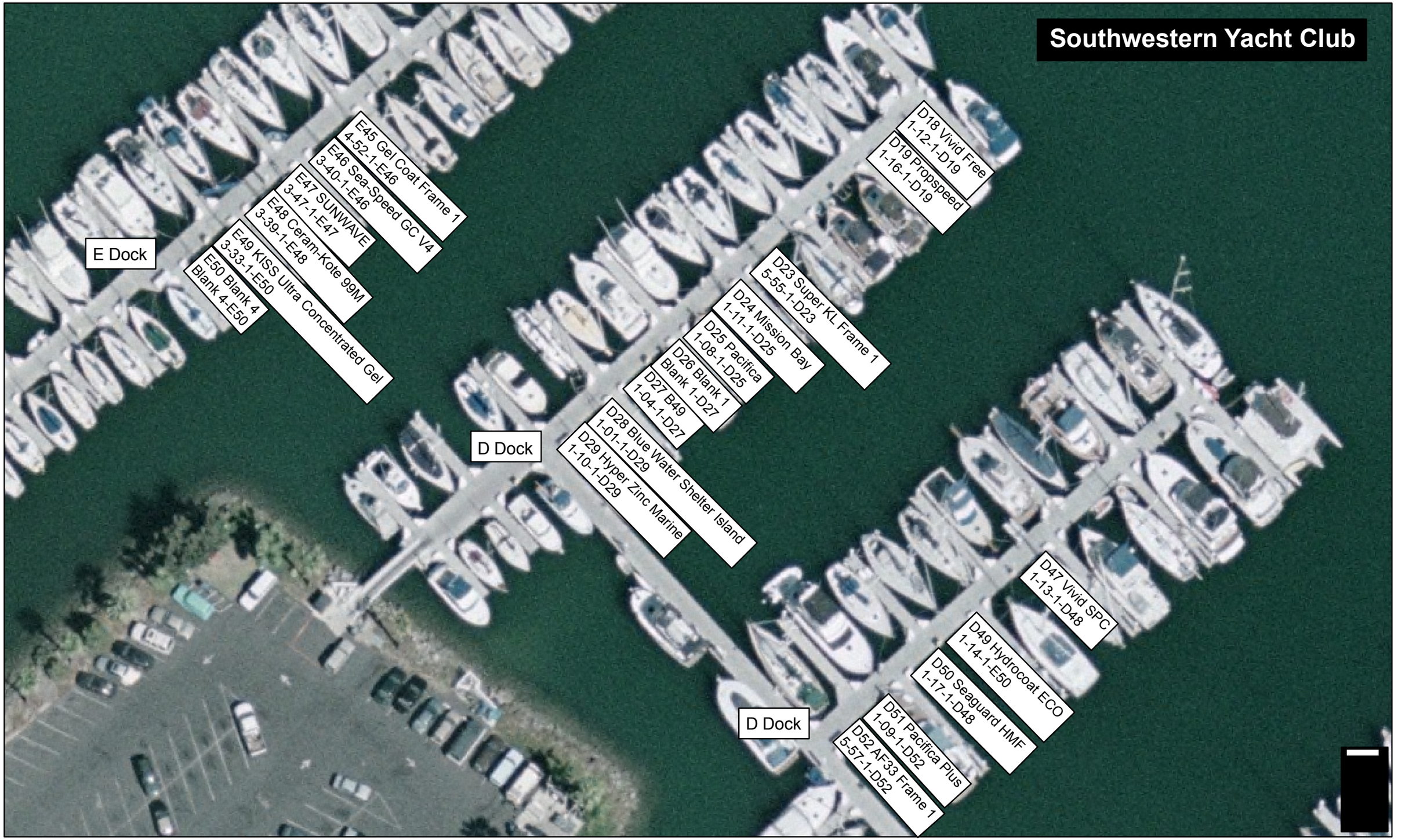
Coating Name	Date	NC Fouling Rating	NC Coating Cond Rating	Pre-Clean SC Fouling Rating	Post-Clean SC Fouling Rating	SC Cleaning Rating	SC Coating Cond Rating	Pre-Clean MC Fouling Rating	Post-Clean MC Fouling Rating	MC Cleaning Rating	MC Coating Cond Rating
Trilux Copper Free	6/24/2008	1	1	1	1	1	1				
	7/15/2008	1	1	1	1	1	1				
	7/30/2008	1	1					1	1	1	1
	8/6/2008	1	1	1	1	1	1				
	8/25/2008	1	1	1	1	1	1				
	9/16/2008	1	1	1	1	1	3				
	9/25/2008	1	2					1	1	1	3
	10/7/2008	1	3	1	1	1	3				
Seahawk Smart Solution (E)	6/24/2008	1	1	1	1	1	2				
	7/2/2008	1	1					1	1	1	2
	7/15/2008	1	1	1	1	1	1				
	7/30/2008	1	1					1	1	1	1
	8/6/2008	1	1	1	1	1	1				
	8/25/2008	1	1	1	1	1	1	1	1	2	3
	9/16/2008	1	1	1	1	1	1				
	9/25/2008	1	1					1	1	2	4
	10/7/2008	1	1	1	1	1	1				

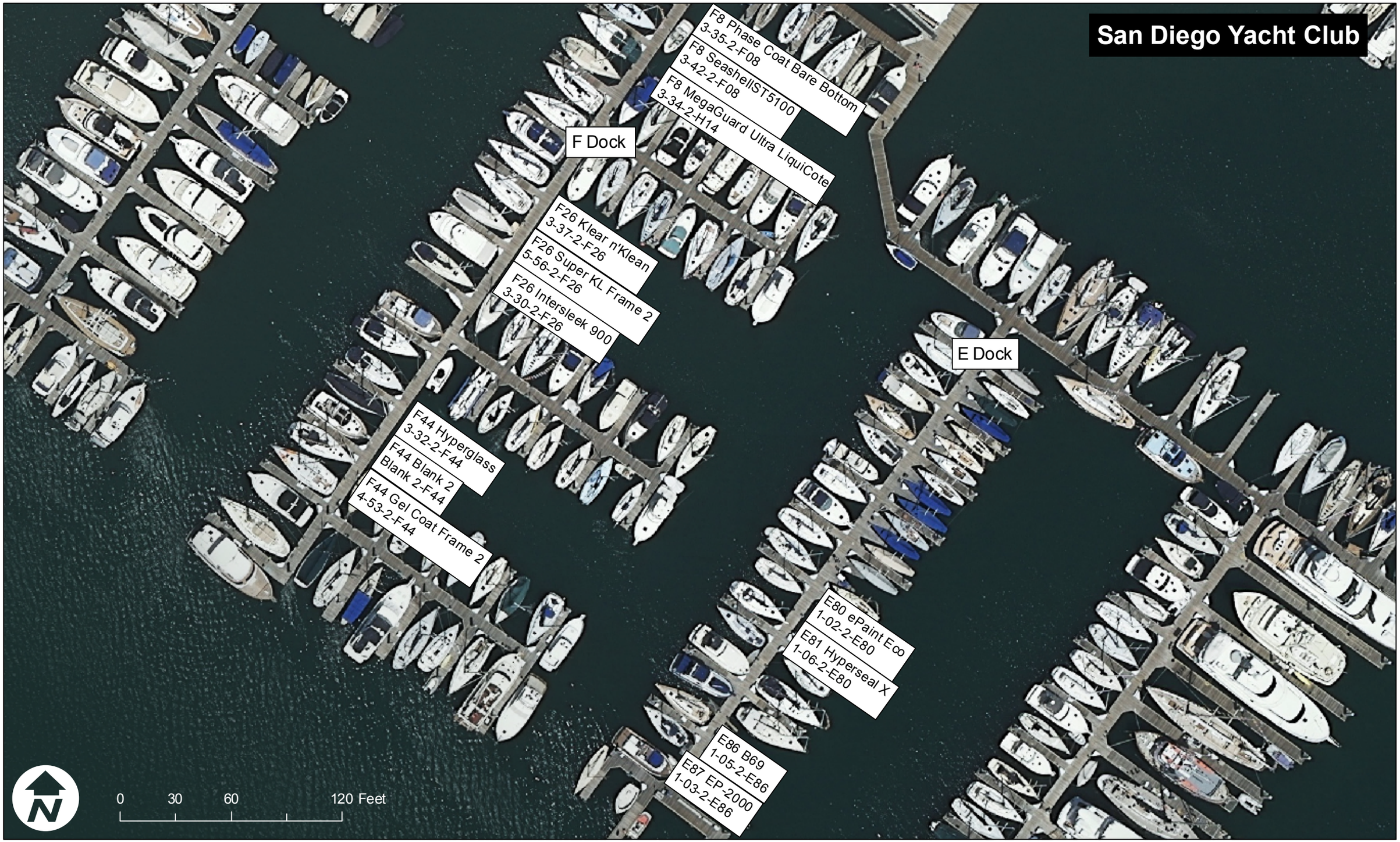
Coating Name	Date	NC Fouling Rating	NC Coating Cond Rating	Pre-Clean SC Fouling Rating	Post-Clean SC Fouling Rating	SC Cleaning Rating	SC Coating Cond Rating	Pre-Clean MC Fouling Rating	Post-Clean MC Fouling Rating	MC Cleaning Rating	MC Coating Cond Rating
Super KL Frame 1	6/25/2008	1	1	1	1	1	1				
	7/16/2008	1	1	1	1	1	1				
	7/30/2008	1	1					1	1	1	1
	8/7/2008	1	1	1	1	1	1				
	8/26/2008	1	1	1	1	1	1				
	9/17/2008	1	1	1	1	1	1				
	9/25/2008	1	1					1	1	1	1
	10/8/2008	1	1	1	1	1	1				
Super KL Frame 2	6/24/2008	1	1	1	1	1	1				
	7/15/2008	1	1	1	1	1	1				
	7/30/2008	1	1					1	1	1	2
	8/6/2008	1	1	1	1	1	1				
	8/25/2008	1	1	1	1	1	1				
	9/16/2008	1	2	1	1	1	2				
	9/25/2008	1	1					1	1	1	2
	10/7/2008	1	1	1	1	1	1				
AF-33 Frame 1	6/25/2008	1	1	1	1	1	3				
	7/16/2008	1	1	1	1	1	1				
	8/7/2008	1	1	1	1	1	1				
	8/26/2008	1	1	1	1	1	1	1	1	1	1
	9/17/2008	1	1	1	1	1	1				
	10/8/2008	1	1	1	1	1	1				
AF-33 Frame 2	6/24/2008	1	1	1	1	1	1				
	7/15/2008	1	1	1	1	1	1				
	8/6/2008	1	1	1	1	1	1				
	8/25/2008	1	1	1	1	1	1				
	9/16/2008	1	1	1	1	1	1				
	10/7/2008	1	1	1	1	1	1				

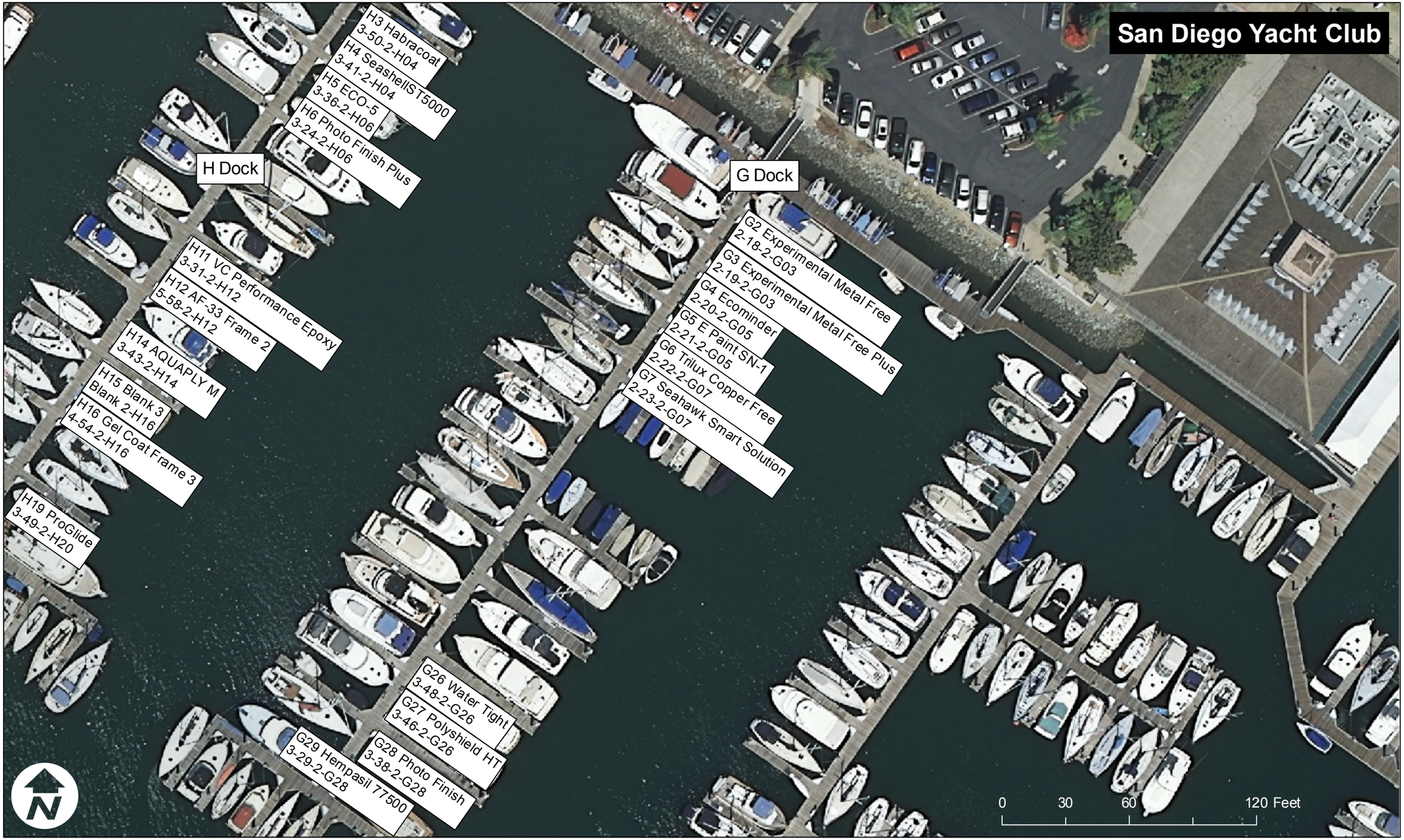
Coating Name	Date	NC Fouling Rating	NC Coating Cond Rating	Pre-Clean SC Fouling Rating	SC Coating Cond Rating	Pre-Clean MC Fouling Rating	MC Coating Cond Rating
Blank 1	6/25/2008	2	1	2		2	
	7/16/2008	3	1	2	1	3	1
	8/7/2008	3	1	3	1	3	1
	8/26/2008	4	1	3	1	3	1
	9/17/2008	4	1	3	1	4	1
	10/8/2008	4	1	3	1	4	1
Blank 2	6/24/2008	2	1	2	1	2	1
	7/15/2008	2	1	2	1	2	1
	8/6/2008	4	1	3	1	3	1
	8/25/2008	4	1	3	1	3	1
	9/16/2008	5	2	4	2	4	2
	10/7/2008	3	1	4	1	3	1
Blank 3	6/24/2008	3	1	2	0	0	0
	7/15/2008	2	1	2	1	2	1
	8/6/2008	2	1	2	1	2	1
	8/25/2008	3	1	3	1	3	1
	9/16/2008	3	1	3	1	2	1
	10/7/2008	3	1	3	2	3	2
Blank 4	6/25/2008	2	1	2	1	2	2
	7/16/2008	2	1	3	1	2	1
	8/7/2008	2	1	2	1	2	1
	8/26/2008	3	1	4	1	3	1
	9/17/2008	3	1	3	1	2	1
	10/8/2008	3	1	4	0	2	1

Coating Name	Date	NC Fouling Rating	NC Coating Cond Rating	Pre-Clean SC Fouling Rating	Post-Clean SC Fouling Rating	SC Cleaning Rating	SC Coating Cond Rating	Pre-Clean MC Fouling Rating	Post-Clean MC Fouling Rating	MC Cleaning Rating	MC Coating Cond Rating
Gel Coat Frame 1	6/25/2008	2	1	2	1	3	2				
	7/16/2008	2	1	1	1	3	1	2	1	5	2
	8/7/2008	2	1	2	1	3	2				
	8/26/2008	2	1	2	1	2	1	2	1	2	2
	9/17/2008	3	2	2	1	2	2				
	10/8/2008	3	1	2	1	3	2	2	1	4	2
Gel Coat Frame 2	6/24/2008	2	1	2	1	3	1				
	7/15/2008	2	1	2	1	4	1	2	1	4	2
	8/6/2008	3	1	2	1	3	2				
	8/25/2008	3	1	2	1	3	2	2	1	3	2
	9/16/2008	4	2	2	1	2	2				
	10/7/2008	4	2	2	1	2	2	2	1	4	2
Gel Coat Frame 3	6/24/2008	2	1	2	1	4	1				
	7/15/2008	3	1	2	1	4	1	2	1	4	3
	8/6/2008	2	1	2	1	3	1				
	8/25/2008	2	2	1	1	3	2	2	1	3	2
	9/16/2008	3	1	2	1	2	2				
	10/7/2008	3	1	1	1	4	2	2	1	4	2


Southwestern Yacht Club
B Dock
B5 EP-21 Release Coating
3-27-1-B06
B6 Proglide Plus
3-51-1-B06
B7 EC-4300
3-25-1-B08
B8 PTU-200
3-45-1-B08


Southwestern Yacht Club
E Dock
E45 Gel Coat Frame 1
4-52-1-E46
E46 Sea-Speed GC V4
3-40-1-E46
E47 SUNWAVE
3-47-1-E47
E48 Ceram-Kote 99M
3-39-1-E48
E49 KISS Ultra Concentrated Gel
3-33-1-E50
E50 Blank 4
Blank 4-E50
D18 Vivid Free
1-12-1-D19
D19 Propspeed
1-16-1-D19
D23 Super KL Frame 1
5-55-1-D23
D24 Mission Bay
1-11-1-D25
D25 Pacifica
1-08-1-D25
D26 Blank 1
Blank 1-D27
D27 B49
1-04-1-D27
D28 Blue Water Shelter Island
1-01-1-D29
D29 Hyper Zinc Marine
1-10-1-D29
D Dock
D Dock
D47 Vivid SPC
1-13-1-D48
D49 Hydrocoat ECO
1-14-1-E50
D50 Seaguard HMF
1-17-1-D48
D51 Pacifica Plus
1-09-1-D52
D52 AF33 Frame 1
5-57-1-D52


San Diego Yacht Club
F Dock
E Dock
F8 Phase Coat Bare Bottom
3-35-2-F08
F8 SeashellST5100
3-42-2-F08
F8 MegaGuard Ultra LiquiCote
3-34-2-H14
F26 Klear n'Klean
3-37-2-F26
F26 Super KL Frame 2
5-56-2-F26
F26 Intersleek 900
3-30-2-F26
F44 Hyperglass
3-32-2-F44
F44 Blank 2
Blank 2-F44
F44 Gel Coat Frame 2
4-53-2-F44
E80 ePaint Eco
1-02-2-E80
E81 Hyperseal X
1-06-2-E80
E86 B69
1-05-2-E86
E87 EP-2000
1-03-2-E86
0
30
60
120 Feet


San Diego Yacht Club
H Dock
G Dock
H3 Habracoat
3-50-2-H04
H4 SeashellST5000
3-41-2-H04
H5 ECO-5
3-36-2-H06
H6 Photo Finish Plus
3-24-2-H06
H11 VC Performance Epoxy
3-31-2-H12
H12 AF-33 Frame 2
5-58-2-H12
H14 AQUAPLY M
3-43-2-H14
H15 Blank 3
Blank 2-H16
H16 Gel Coat Frame 3
4-54-2-H16
H19 ProGlide
3-49-2-H20
G2 Experimental Metal Free
2-18-2-G03
G3 Experimental Metal Free Plus
2-19-2-G03
G4 Ecominder
2-20-2-G05
G5 E Paint SN-1
2-21-2-G05
G6 Trilux Copper Free
2-22-2-G07
G7 Seahawk Smart Solution
2-23-2-G07
G26 Water Tight
3-48-2-G26
G27 Polyshield HT
3-46-2-G26
G28 Photo Finish
3-38-2-G28
G29 Hempasil 77500
3-29-2-G28
N
0
30
60
120 Feet