ECHELON ENGINEERING, INC.

Civil/Marine Consulting Engineers

DRAFT

Underwater Inspection & Assessment of Piles & Floats Fidalgo Marina Anacortes, WA

Prepared For:

PND Engineers
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Prepared By:

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21-2604

Echelon
Engineering

Civil / Marine
Consulting Engineers

June 29, 2021

PND Engineers, Inc.
1736 Fourth Avenue S, Suite A
Seattle, WA 98134

ATTN: Mr. Jon Keiser, PE, P Eng.
Vice President

RE: Underwater Inspection & Assessment of Piles & Floats
Fidalgo Marina, Anacortes, Washington

Dear Mr. Keiser:

This report documents the findings of both our recent Phase 1 and follow-on Phase II underwater inspections at the Fidalgo Marina in Anacortes, WA. The Phase I effort included a sample inspection covering approximately 25% of the marina float anchor piles, concrete floats and the steel pile and concrete panel breakwaters. The emergency Phase II effort included underwater inspection of the remaining 75% of the steel piles and concrete panels which make-up the North and East Breakwaters. The inspection was carried out in support of your comprehensive evaluation and assessment of the Fidalgo Marina's existing seaward structures.

INTRODUCTION

The Fidalgo Marina is located on the southwestern shore of Fidalgo Bay, south of downtown Anacortes, WA. The marina consists of primarily covered moorage slips for large motor yachts. A small number of uncovered slips are available at the north end and the south end of the marina. The marina floats are constructed using foam filled concrete pontoons secured together with treated timber wales. The marina consists of a main central walkway extending in a north – south direction with shore access at the southern end. Multiple finger piers extending off the main float to the east and to the west. The concrete floats are secured by prestressed concrete piles. An uncovered moorage float, also constructed with concrete pontoons is located at the south end of the marina and is secured with timber piling.

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The moorage slips are protected by three steel pile and concrete panel breakwaters located on the north and east sides of the facility. The three breakwaters have been identified as the Northwest, North and East Breakwaters. The Northwest Breakwater is owned by the City of Anacortes and was not included within the scope of this investigation. The North and East Breakwaters are the property of the Fidalgo Marina and were included within this investigation.

The breakwaters are constructed with vertical steel H-piles and steel pipe batter piles. Design drawings indicate that the majority of the H-piles are HP 14 x 89, with an original flange and web thickness of 0.615 inches. A steel 12.75" dia. x 3/8" battered pipe pile is welded to each vertical pile. The pipe piles are secured to the H-piles using a larger diameter pipe pile socket and welded connection. These batter piles also have a 40 ft. minimum length of HP 14 x 79 H-pile welded to the bottom most embedded portion of the pile. All of the breakwater piles are protected with a galvanized coating. There is no cathodic protection system on the breakwaters. Pre-cast concrete panels have been installed within the channels of the adjacent H-piles. The panels have been secured in place with bolted restraint plates and bolted connections. Refer to the attached design drawings for details.

For the purpose of this investigation the breakwater subsections have been identified as follows:

The **Northwest Breakwater** is located at the NW corner of the marina. This City owned structure is constructed with 11 pairs of vertical H-piles and pipe pile batters and 10 concrete wave barrier panels. The piles in this section have been numbered consecutively 1 – 11 from the west. This structure, although providing some amount of protection to the marina, was not included within the scope of this investigation.

The **North Breakwater** is located at the northern end of the marina floats. Vessels entering into the marina pass this breakwater either to the west or east. This structure is also constructed with 11 pairs of vertical H-piles and pipe pile batters and 10 concrete wave barrier panels. The piles in this section have been numbered consecutively 1 – 11 from the west.

The **East Breakwater** is the largest section of the breakwater and provides protection for the entire eastern side of the marina. This section is constructed with 79 pairs of vertical H-piles and pipe pile batters and 78 concrete wave barrier panels. The piles in this section are numbered consecutively 1 – 79 from the north.

The marina floats are stryro-foam filled concrete pontoons of varying sizes that are secured together with treated timber wales along the perimeter of the pontoons. The majority of the pontoons support a roof system that provides covered moorage for the motor vessels. The remaining floats are exterior to the building and provide available moorage slips for sailing vessels. The mooring floats are secured in-place by a total of 62 octagonal prestressed concrete float anchor piles. The float anchor piles have been identified numerically 1 – 62

as shown on the accompanying pile plan. Access to the marina floats is provided by a tidally adjustable ramp located at the southwest corner of the marina.

The original Phase I scope of this investigation included a sample inspection of approximate 25% the piling (i.e. 52 piles) and the associated concrete panels (i.e. 26 panels) within the two Fidalgo Marina owned sections of the Breakwater. Additionally, an approximate 25% sample inspection of the concrete float anchor piles (i.e. 16 piles) and adjacent concrete pontoons within the marina was included. Areas of damage were recorded, including the location and quantification of specific deterioration encountered.

The sample inspection revealed significant levels of corrosive section loss specifically to the battered pipe piling supporting the breakwaters. Based on this finding emergency inspection of the remaining piles within the North and East Breakwaters was authorized and conducted. This work was conducted as Phase II of the project.

The results of both investigations are presented within this report. The findings of the project are discussed in the Observed Conditions section of this report. Photographs illustrating typical conditions encountered are presented in Appendix A. Appendix B provides a pile plan showing the location and identification of the inspected piling. Specific information on the condition of the inspected piling is presented in tabular format in Appendix C.

QUALIFICATIONS OF INSPECTORS

The investigation was conducted by a crew composed of professional and technical personnel capable and experienced in both the underwater and topside inspection and assessment of structural members. The personnel utilized on this project included the following Echelon Engineering staff:

S.D. Sommerfeld, P.E.	Project Manager/Engineer - Diver Licensed Professional Engineer - WA, AK, Guam 35 Years' Experience in Marine Structures Inspection and Design
D.B. Beattie	Inspection Technician – Diver 4 Years' Experience in Marine Structures Inspection
B.A. Rohrig	Inspection Technician – Diver 2 Year' Experience in Marine Structures Inspection
G.Y. Tzortzis	Inspection Technician – Diver 0.5 Year' Experience in Marine Structures Inspection

METHODOLOGY AND RATING SYSTEM

The project was conducted diligently, with properly qualified personnel and in conformance with the usual standards of similar companies performing similar services under similar

circumstances. The inspection was conducted as a modified Routine Inspection as outlined in the *ASCE Manuals and Reports on Engineering Practice No. 130* (MOP 130)*; Waterfront Facilities Inspection and Assessment*. For this project the inspected members were subjected to Level I, II, and III inspection techniques.

The combined scope of this project, including the Phase 1 sample inspection and the Phase II emergency inspection provided for the investigation of the following items;

- North Breakwater –Inspection of 11 H piles and 11 pipe pile batters and 10 concrete wave break panels.
- East Breakwater –Inspection of 79 H piles and 79 pipe pile batters and 78 concrete wave break panels.
- Mooring Floats – A sample inspection of 16 float anchor piles, the adjacent concrete pontoon and the hardware securing the floats to the piles.

All piling received Level I visual examination for their accessible length. Level II examination including spot cleaning, hammer sounding, and probing was also conducted at suspect areas along the inspected length of the concrete and steel members. Additionally, six steel piles selected in the Phase I work, as well as an additional 12 piles which were selected in the Phase II work, were subjected to Level II cleaning and detailed inspection at three elevations including the intertidal zone the mudline and at an elevation midway between the two. These sixteen steel piles also received Level III ultrasonic thickness measurements at the elevation of Level II cleaning. No Level III testing of the concrete components was conducted.

Throughout the discussion the overall condition of the inspected members is described as good, fair, or poor in accordance with the following definitions:

- A member in **good condition** has no damage or has sustained only minor damage.
- A member in **fair condition** has sustained minor to moderate damage, with no evidence of overstressing.
- A member in **poor condition** has sustained major to severe damage that affects the member's load bearing capacity. This damage may be evident as advanced deterioration, overstressing or breakage.

Prestressed Concrete Piling

The condition of the inspected concrete piles is based on the overall damage noted along the length of the member by visual inspection and as augmented by various testing techniques. A breakdown of the member rating classifications is as follows:

- Members identified as **Undamaged** were found to have no damage or were noted to have minor blemishes.
- Members identified as having **Minor damage** were noted to have:
  - good original section and hard / sound concrete
  - hairline cracking without rust bleeding
  - surface spalling ≤1 inch deep and/or ≤6 in. diameter
  - no rust staining or rust bleeding
  - no exposure of reinforcing steel or prestressing strands
- Members identified as having **Moderate damage** were noted to have:
  - good original section and hard / sound concrete
  - cracking ≤1/32 inch wide without rust bleeding
  - spalling >1 inch deep and/or >6 in. diameter
  - softening or loss of concrete to a depth of ≤1 inch deep
  - exposure of reinforcing steel or prestressing strands without rust bleeding or steel section loss
- Members identified as having **Major damage** were noted to have:
  - softening or loss of concrete due to wear or abrasion to a depth of >1 inch
  - cracking >1/32 inch and ≤1/8 inch wide, with or without rust bleeding
  - large areas of softening or loss of concrete >1 inch deep
  - exposure and corrosion of reinforcing steel without steel section loss
- Members identified as having **Severe damage** were noted to have:
  - extensive softening or loss of concrete
  - large, deep spalls with exposed reinforcing steel or prestressing strands
  - cracking >1/8 inch wide with heavy build-up of efflorescence and rust bleeding
  - exposure and corrosion of reinforcing steel with steel section loss

Steel Piling

The condition of the steel H-piles and steel pipe piles is based on the overall damage noted along the length of the member by visual inspection and as augmented by various testing techniques. A breakdown of the member rating classifications is as follows:

- Members identified as **Undamaged** were found to have no damage or were noted to have minor blemishes such as:
  - protective coating or wrap intact
  - light surface rust
  - no apparent loss of material
- Members identified as having **Minor damage** were noted to have:
  - Protective coating or wrap damaged and loss of thickness up to 15 percent of nominal at any location

  - Less than 50 percent of perimeter or circumference affected by light corrosion at any elevation or cross section
  - Loss of thickness up to 15 percent of nominal at any location
- Members identified as having **Moderate damage** were noted to have:
  - Protective coating or wrap damaged and loss of thickness 15 to 30 percent of nominal at any location
  - Over 50 percent of perimeter or circumference affected by corrosion at any elevation or cross section
  - Loss of thickness 15 to 30 percent of nominal at any location
- Members identified as having **Major damage** were noted to have:
  - Protective coating or wrap damaged and loss of nominal thickness 30 to 50 percent at any location
  - Partial loss of flange edges or visible reduction of wall thickness on pipe piles
  - Loss of nominal thickness 30 to 50 percent at any location
- Members identified as having **Severe damage** were noted to have:
  - Protective coating or wrap damaged and loss of wall thickness exceeding 50 percent of nominal at any location

OBSERVED CONDITIONS

The field investigation was carried out over the period of May 27 to June 18, 2021. Weather was seasonal with variable skies and times of heavy breezes, as well as calm conditions. Weather did not impact the investigation. The tide level during the inspection fluctuated between a low of -3.4 feet and a high of +4.6 feet (Chart Datum). Underwater visibility was poor ranging from approximately one to three feet. These conditions negatively impacted the quality/resolution of the underwater photos included in this report. No currents were encountered during the investigation. Findings of the investigation are as follows:

Marina Floats & Float Anchor Piles

1. Refer to Appendix C, Table 1 for Level I inspection results.
2. The float anchor piles were found to be in overall good condition. Of the 16 piles selected for Level I and II inspection, all were found to be undamaged. No evidence of any visible cracking, spalling, rust bleeding or other defect was noted on any of the inspected members. Refer to Photos No. 2, 3, 5, 6 and 7.
3. Inspection of the concrete floats found the overall condition to be generally good. The floats that make up the covered moorage areas, as well as the floats that are located in the open marina slips were all noted to be in good condition. No evidence of significant cracking, spalling, rust bleeding or other defects were noted on any of the inspected members. Refer to Photo No 8.

4. Cursory observation noted that the pontoons are floating level with good freeboard. No evidence of supplemental floatation was observed under any of the sampled floats. Refer to Photos No. 4 and 5.

5. The timber wales securing the individual pontoons that make up both the central walkway, as well as the individual finger floats were noted to be in good condition with no significant damage to the timbers or to the bolted connections observed. Refer to Photo No. 4.

6. Visual inspection of the restraint hoops that secure the floats to float anchor piles found them to be in good condition. No evidence of significant corrosive section loss was noted on any of the sampled members. The HDPE rub strips located within the hoops were also noted to be in generally good condition. Refer to Photo No. 6.

North Breakwater

1. Refer to Appendix C, Table 2 and Table 3 for detailed Level I and Level III inspection results, respectively.

2. The overall condition of the North Breakwater is poor. Evidence of significant corrosive section loss was found on the majority of the piles. The galvanized coating which appears to be in good condition above the splash zone on the members, was found to be in poor condition in the lower intertidal to mudline zones. The galvanized coating at these elevations is effectively consumed and the piles are actively corroding as evidenced by large patches of bright orange active corrosion and visible loss of section.

3. The overall condition of the vertical H piles was found to be fair. Based on the design drawings these piles are HP 14 x 89 members with nominal flange and web thicknesses of 0.615 inches. The original thicknesses of the flanges were obtained by taking thickness measurements in the splash zone in areas of undamaged coating. Although no evidence of perforation of the pile flanges on either the interior or exterior faces of the breakwater was found, the majority of the piles exhibit bright orange active corrosion and visible section loss of the flange ends from the intertidal zone to the mudline. Refer to Photo No. 19.

   Level III ultrasonic thickness readings taken on a representative H-pile in the breakwater were found to range from 0.495 inches to 0.565 inches with an average thickness of 0.533 inches (~13.3% loss). The most significant loss was measured in the intertidal zone resulting in ~19.5% loss. Due to the design of the breakwater with concrete panel inserts, inspection of the H-pile webs was not possible.

4. The overall condition of the pipe pile batters is poor. Based on the design drawings these piles are 12.75 inch dia. X 3/8 inch pipe piles (i.e. nominal thickness = 0.375 in.) Nine of the 11 piles inspected (81.8%) were found to have sustained heavy corrosive section loss to the point of perforation. Six of these piles were found to have large perforations,(i.e. >1'x6"). On three piles the perforations are smaller (i.e. 2 – 4 inches in diameter). The perforations were found to range from the lower intertidal zone to the mudline, with the majority noted from ~El. -5 feet to – 10 feet. In several locations where Level II cleaning was conducted the pipe wall thickness was found to be severely reduce to near perforation.

   Level III ultrasonic thickness readings taken on a representative pipe pile in the breakwater were found to range from 0.130 inches to 0.200 inches with an average thickness of 0.165 inches (~56.0% loss). The most significant measured loss was obtained in the intertidal zone on Pile No. 2 Br, resulting in ~65.3% loss. It should be noted that this pile has ultimately failed with >60% of the section lost in the submerged zone. Refer to Photo No. 22.

5. Inspection of the concrete wave break panels found them to be in fair to good condition. Although minor cracking was evident above water, no evidence of any significant deterioration or damage was found. The galvanized hardware securing the panels to the H-piles was noted to range in condition from fair to good. Typically, the hardware at the top of the breakwater and in the splash zone was in good condition with minimal loss of galvanized coating. Hardware located in the intertidal, submerged and mudline zones was found to range from fair to good with deterioration of the protective coating and an estimated 5-15% loss of section noted on several of the members. Refer to Photo No. 9.

East Breakwater

1. Refer to Appendix C, Table 2 and Table 3 for detailed Level I and Level III inspection results, respectively.

2. The East Breakwater was found to be in slightly better condition than the North Breakwater. However, it was noted to be in generally fair to poor condition with evidence of significant corrosive section loss found on the majority of the piles. The galvanized coating which appears to be in good condition above the splash zone on the members, was found to be in poor condition in the lower intertidal to mudline zones. The galvanized coating at these elevations is effectively consumed and the piles are actively corroding as evidenced by medium to large patches of bright orange active corrosion and visible loss of section.

3. The overall condition of the vertical H piles was found to be fair. Based on the design drawings these piles are HP 14 x 89 members with nominal flange and web thicknesses

of 0.615 inches. The original thicknesses of the flanges were obtained by taking thickness measurements in the splash zone in areas of undamaged coating. Although no evidence of perforation of the pile flanges on either the interior or exterior faces of the breakwater was found, the majority of the piles exhibit bright orange active corrosion and visible section loss of the flange ends from the intertidal zone to the mudline. Refer to Photos No. 13, 14 and 19

Level III ultrasonic thickness readings taken on eight representative H-piles in the breakwater found them to range from 0.595 inches to 0.655 inches with an average thickness of 0.596 inches (~3.1% loss). The most significant losses were measured throughout the submerged length of the piles. Due to the design of the breakwater with concrete panel inserts, inspection of the H-pile webs was not possible.

4. The overall condition of the pipe pile batters is poor. Based on the design drawings these piles are 12.75 inch dia. X 3/8 inch pipe piles (i.e. nominal thickness = 0.375 in.) Ten of the 79 piles inspected (12.7%) were found to have sustained heavy corrosive section loss to the point of perforation. Two of these piles were found to have large perforations,(i.e. >1'x6"). On eight piles the perforations are smaller (i.e. 1.5 – 8 inches in diameter) with several piles having multiple perforations. The perforations were found to range from the lower intertidal zone to the mudline. In several locations where Level II cleaning was conducted the pipe wall thickness was found to be severely reduce to near perforation.

   Level III ultrasonic thickness readings taken on eight representative pipe piles in the breakwater found the remaining thicknesses to range from 0.180 inches to 0.390 inches with an average thickness of 0.305 inches (~18.8% loss). The most significant losses were measured throughout the submerged length of the piles. Refer to Photos No. 20 – 22.

5. Inspection of the concrete wave break panels found to be in fair to good condition. Although minor cracking was evident above water, no evidence of any significant deterioration or damage was found. One panel located between Piles No. 24 and 25 was noted to have a repair patch likely dating back to the time of original construction. No evidence of deterioration or damage was associated with this anomaly. Refer to Photo No. 10.

   The galvanized hardware securing the panels to the H-piles was noted to range in condition from fair to good. Typically, the hardware at the top of the breakwater and in the splash zone was in good condition with minimal loss of galvanized coating. Hardware located in the intertidal, submerged and mudline zones was found to range from fair to good with deterioration of the protective coating and an estimated 5-15% loss of section noted on several of the members. Refer to Photos No. 12, 15 and 16.

Miscellaneous

1. Although not intended for inclusion within the scope of this investigation, a cursory swim-by inspection of the Northwest Breakwater (owned by the City of Anacortes) was conducted. That inspection found that this breakwater is in similarly poor, but slightly better condition as that reported for the North Breakwater above. Extensive levels of bright orange active corrosion and perforation of the members was observed from the lower intertidal zone to the mudline of these piles.

SUMMARY

This section to be developed after the corrosion potential survey information is obtained.

We recommend that … Additionally, based on the findings of this inspection, and ASCE guidelines, it is recommended that periodic re-inspections of the entire facility be carried out on a five to six-year schedule. These inspections will help to monitor the condition of the facility and will, as in the case of the current inspection, identify any specific members that may require maintenance. Such an approach will help to ensure the structural integrity and longevity of the facility.

It has been a pleasure to have worked with you on this project. Should you have any questions concerning this report, or if we can assist you further in your inspection and maintenance program for the facility, please do not hesitate to contact our office.

Yours Truly,
Echelon Engineering, Inc.

Ms. Shelley D. Sommerfeld, P.E.
President

SDS:ebv
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PHOTO No. 1: Fidalgo Marina, Looking Southwest - The marina moorage consists primarily of covered slips constructed with concrete floats that are secured in place by prestressed concrete piles. The marina is protected by a steel pile supported concrete panel breakwater.

PHOTO No. 2: Marina Moorages, West Edge, Looking North - Note the overall good condition of the prestressed concrete float anchor piles, as well as the steel column and roof support system which bears directly on the floats.

PHOTO No. 3: Marina Moorages, West Edge, Looking North - Note the good condition of the concrete piles and floats in this area. Also note the north end of the East Breakwater visible in the background.

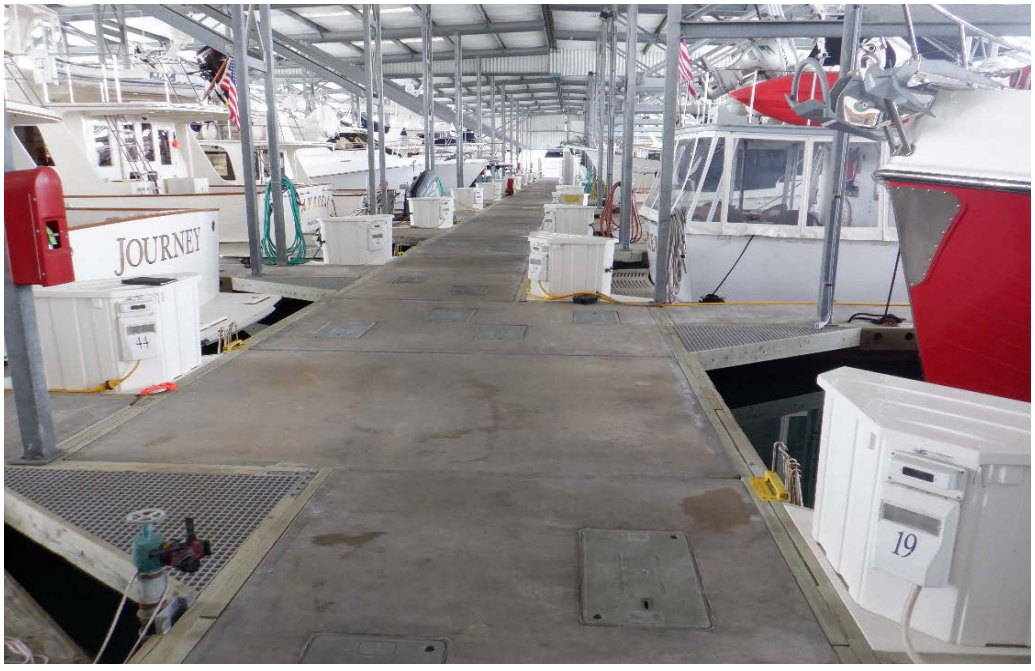

PHOTO No. 4: Marina Float, Main Access, Looking North - Note the overall good condition of the concrete pontoons which are floating level and with good freeboard. Also note the overall good condition of the timber wales securing the individual pontoons together.

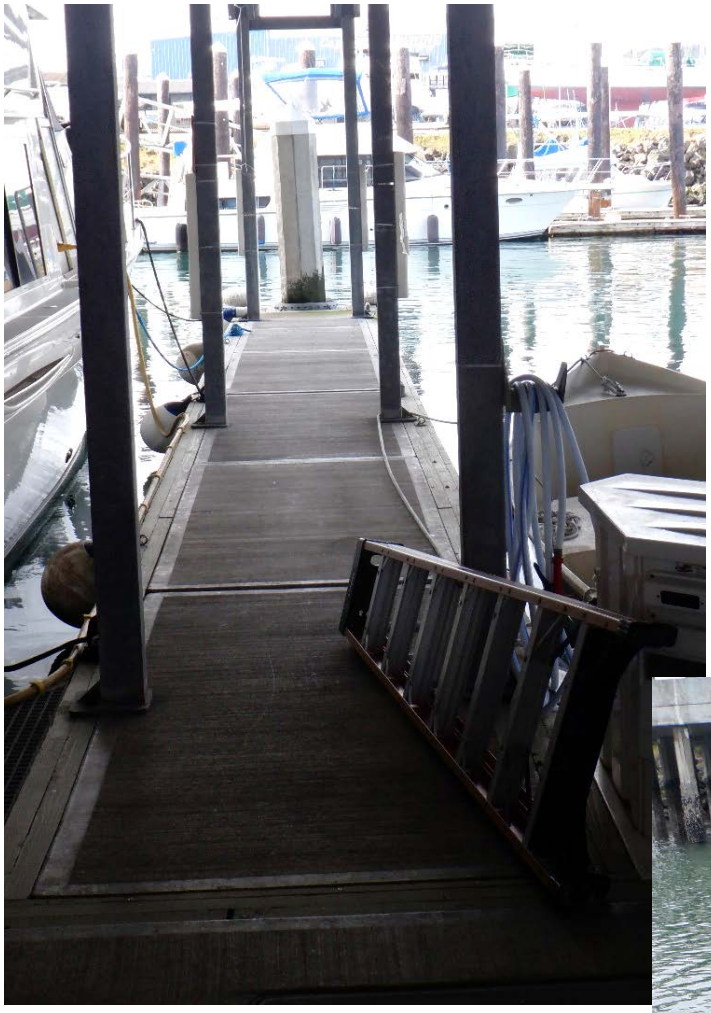

PHOTO No. 5: Float Anchor Pile No. 54, Looking West - Note the overall good condition of the prestressed pile and the individual concrete pontoons which make up the floats. Also note the pontoons are level with good freeboard.

PHOTO No. 6: Float Anchor Pile No. 48, Looking West - Note the area of Level II cleaning visible in the intertidal zone just above the deck. Level II cleaning and detailed inspection was performed on a sampling of the concrete float anchor piles throughout the marina. Also note the typical good condition of the pile hoop and the HDPE rub strips.

PHOTO No. 7: Float Anchor Pile No. 10 - Note the overall good condition of the concrete pile with well defined corners and no evidence of any cracking, spalling or rust bleeding. Also note the silty-sand and gravel composition of the mudline. Both of these conditions were found to be typical of the float anchor piles throughout the marina.

PHOTO No. 8: Concrete Float, Near Pile No. 10 - Note the well defined corners of the concrete pontoon, with no evidence of any cracking, spalling, or rust bleeding visible. No supplemental floatation was noted during our inspection, and the sampling of inspected floats were found to be floating level with good freeboard.

PHOTO No. 9: North Breakwater, Looking West - This is one of two smaller breakwaters that protect the entrance to the marina. Both are constructed with 11 sets of vertical steel H-piles with a steel pipe pile batter, with inset concrete panels extending from the top of the breakwater to the mudline.

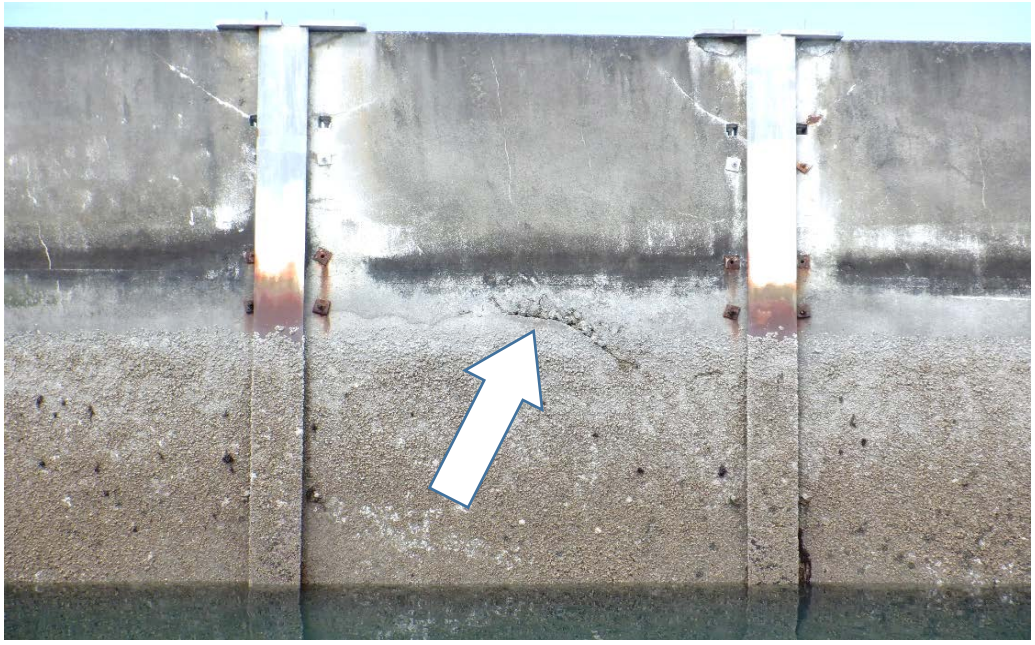

PHOTO No. 10: East Breakwater, Exterior Face, Piles No. 24 and No. 25 - Inspection noted this apparent form void in the center of the concrete panel. Close examination found that the area has been repaired in the past with grout. Partial dis-bondment of the grout was evident, however no exposed reinforcing or rust bleeding was noted.

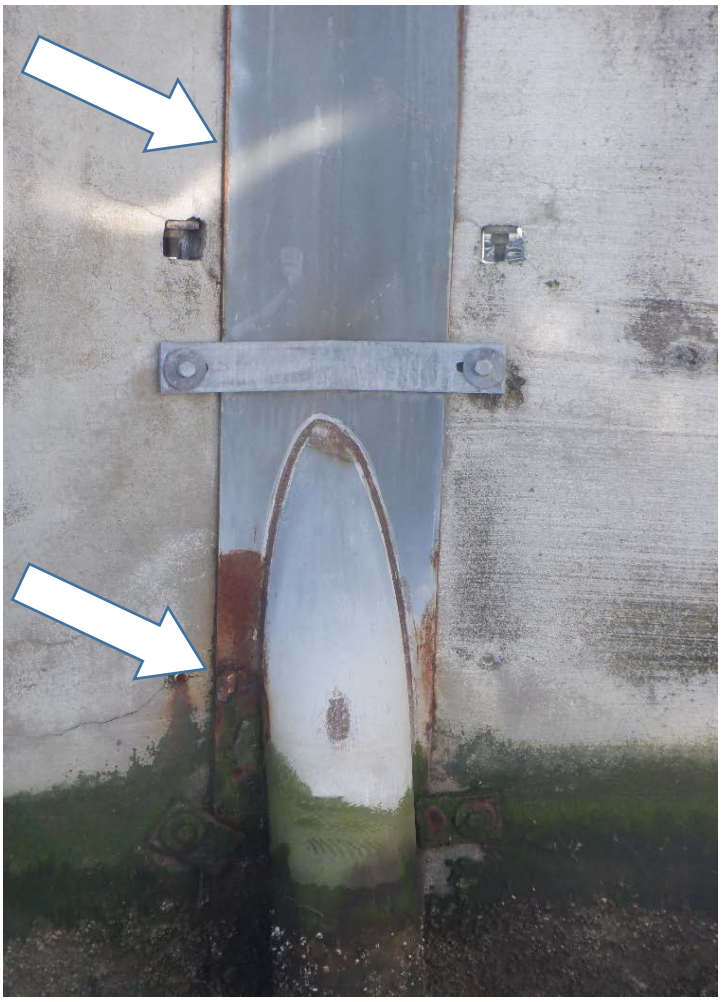

PHOTO No. 11: East Breakwater, Interior Face, Pile No. 72 - Note the generally good condition of the galvanized steel above high tide. The galvanized protective coating was found to be primarily intact on the upper portions of the piles. However, deterioration of the coating was evident on the H-Pile flange ends (refer to upper arrow), on the welds, and on the piles in the lower splash and upper intertidal zone (refer to lower arrow).

PHOTO No. 12: Breakwater, Exterior Face, Typical Condition - Note the corrosion evident on the connection hardware which secures the concrete panel (refer to arrow). Also note the overall good condition of the protective coating on the H-Pile in the splash zone.

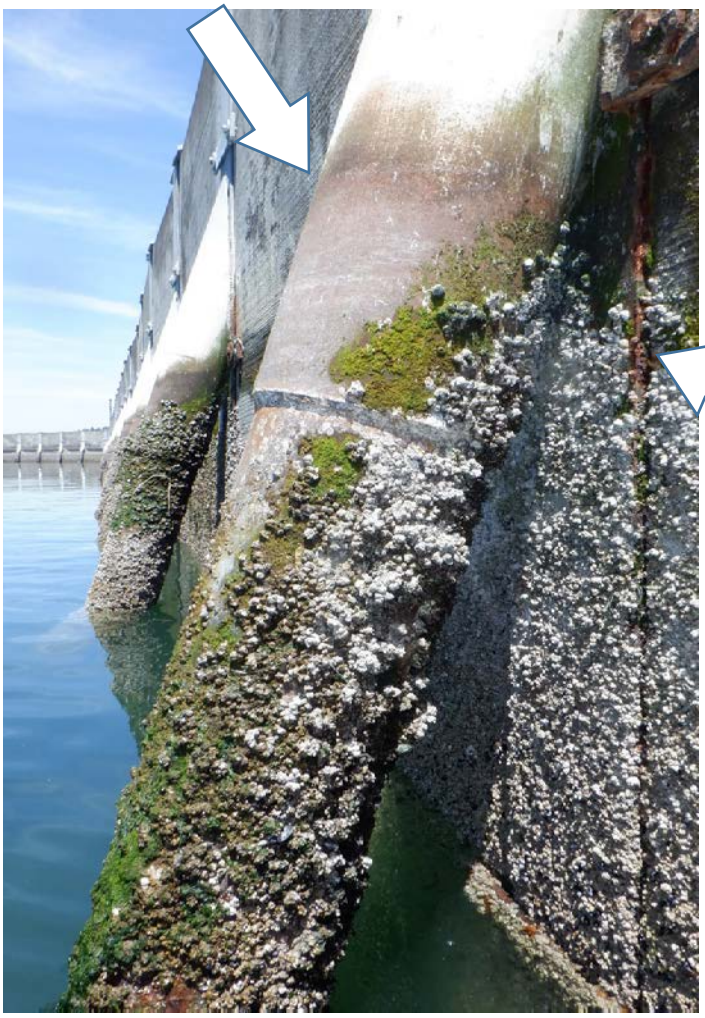

PHOTO No. 13: East Breakwater, Looking North - Note the overall good condition of the protective coating on the piles above the high water mark (background). Also note the deterioration of the coating and corrosion of the base metal on both the pipe pile sleeve and on the H-pile flange edge in the intertidal zone. (refer to arrows).

PHOTO No. 14:

East Breakwater, Sleeve / Socket Weld - Level II cleaning of the Pipe Sleeve to Pipe Pile socket connection found the welds to be in overall good condition. Also note the corrosion of the H-pile flange (refer to arrow) and the overall good condition of the concrete panel on the left.

PHOTO No. 15: Breakwater, Exterior Face, Typical Condition - Note the moderate to heavy corrosion and scale of the attachment hardware which serves to secure the concrete panels to the H-Piles (refer to arrow). Also note the failed coating and corrosion of the pile from the high tide down and the overall good condition of the coating above. This was found to be typical of the piles throughout both breakwaters.

PHOTO No. 16: Breakwater, Exterior Face, Typical Condition - Close up of connection bolt, plate washer and nut shown in Photo No.15 above. Note the moderate to heavy corrosive section loss visible on the hardware. This condition was found to be typical of many of the bolted connections located in the intertidal and submerged zones.

PHOTO No. 17: North Breakwater, Exterior Face, Pile No. 2 - Note the Level II cleaned area on the steel H-Pile at the water surface showing localized failure of the galvanized coating. Also note the gap between the concrete panels and the flanges of the H-Pile (refer to arrow). The concrete panels are flush with the H-Pile flanges on the inside face of the breakwater.

PHOTO No. 18: North Breakwater, Interior Face, Concrete Panel Connection Plate - Note the Level II cleaning of the concrete panel and the steel plate connection bracket. The concrete was found to be in overall good condition, while moderate surface corrosion is visible on the steel plate and hardware.

PHOTO No. 19:

Breakwater, Exterior Face, Typical H-Pile - Note the large area of active corrosion evidenced by the bright orange coloration. A localized area has been subjected to Level II cleaning (refer to arrow). Pit depth measurements in this area indicate an average depth of ~1/8 inch. This is typical of many of the piles in the lower intertidal, submerged and mudline zones.

PHOTO No. 20: East Breakwater, Pipe Pile No. 2 Br - Note the bright orange, active corrosion and heavy scale visible on the pile in the lower intertidal zone. This level of active corrosion was found to be typical of the majority of the batter piles within both the North and East Breakwaters.

PHOTO No. 21: East Breakwater, Pipe Pile No. 2 Br - Note the bright orange, active corrosion and heavy scale visible on the pile in the lower intertidal zone. Level II cleaning and detailed inspection noted that the base metal is rough with areas of localized pitting.

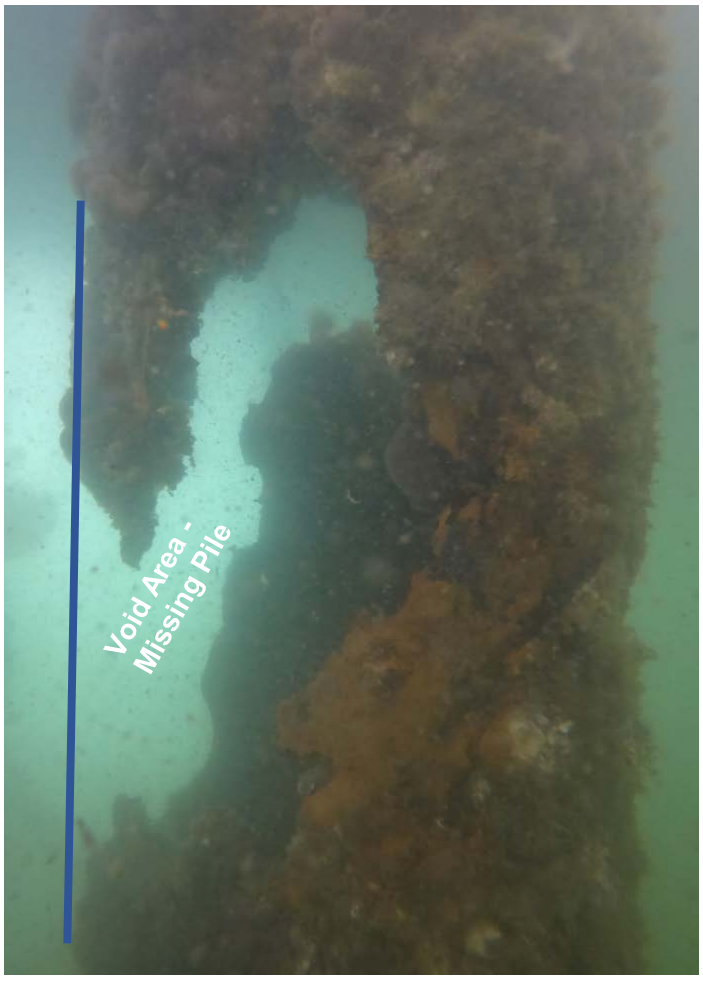

PHOTO No. 22: North Breakwater, Pipe Pile No. 2 Br - Inspection found extensive corrosion, perforation and loss of section on this batter pile. Note the blue line indicating the location of the original pipe pile wall which is now missing. Inspection found nine of the eleven batter piles in the North Breakwater and ten of the 79 batter piles in the East Breakwater to have sustained corrosion to the point of perforation.

East Breakwater

East Breakwater

East Breakwater

North Breakwater

City Breakwater

Covered Moorage

Covered Moorage

FA 1 FA 2 FA 3 FA 4 FA 5 FA 6 FA 7 FA 8 FA 9 FA 10 FA 11 FA 12 FA 13 FA 14 FA 15 FA 16 FA 17 FA 18 FA 19 FA 20 FA 21 FA 22 FA 23 FA 24 FA 25 FA 26 FA 27 FA 28 FA 29 FA 30 FA 31 FA 32 FA 33 FA 34 FA 35 FA 36 FA 37 FA 38 FA 39 FA 40 FA 41 FA 42 FA 43 FA 44 FA 45 FA 46 FA 47 FA 48 FA 49 FA 50 FA 51 FA 52 FA 53 FA 54 FA 55 FA 56 FA 57 FA 58 FA 59 FA 60 FA 61 FA 62

Approximate Shoreline

LEGEND

- Concrete Float Anchor Pile
- Steel H - Pile
- Steel Pipe Pile Batter

PLAN

SCALE: Not To Scale

PND Engineers

PILE PLAN

Fidalgo Marina
Lynnwood, WA

DATE:	June 2021
PROJECT:	21-2604
SHEET:	1 of 1
DRAWN:	SDS / BAR

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SDS / BAR, Echelon Engineering, Inc. 6/7/2021 10:21 AM 2604-Sht 1.dwg

TABLE 1
FLOAT ANCHOR PILE INSPECTION DATA

DRAFT

PILE NUMBER	MEMBER RATING	CONDITION / DAMAGE	
		Elevation (Chart Datum)	Details / Remarks
FA 1	Undamaged		Prestressed Concrete Pile
FA 4	Undamaged		Prestressed Concrete Pile
FA 10	Undamaged		Prestressed Concrete Pile
FA 14	Undamaged		Prestressed Concrete Pile
FA 17	Undamaged		Prestressed Concrete Pile
FA 21	Undamaged		Prestressed Concrete Pile
FA 26	Undamaged		Prestressed Concrete Pile
FA 29	Undamaged		Prestressed Concrete Pile
FA 39	Undamaged		Prestressed Concrete Pile
FA 40	Undamaged		Prestressed Concrete Pile
FA 41	Undamaged		Prestressed Concrete Pile
FA 49	Undamaged		Prestressed Concrete Pile
FA 48	Undamaged		Prestressed Concrete Pile
FA 57	Undamaged		Prestressed Concrete Pile
FA 58	Undamaged		Prestressed Concrete Pile
FA 62	Undamaged		Prestressed Concrete Pile

TABLE 2
STEEL PILE INSPECTION DATA

DRAFT

PILE IDENTIFICATION		MEMBER RATING	CONDITION / DAMAGE	
Pile Number	Pile Type		Elevation (Chart Datum)	Details / Remarks
NORTH BREAKWATER				
1	Steel H-Pile	Major Damage	Top / SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
1 Br	Steel Pipe Pile	Severe Damage	SPL ITZ / MDL -10'	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface Large Perforation (~1.5' x 1')
2	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
2 Br	Steel Pipe Pile	Severe Damage	SPL ITZ / MDL -5' / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface Multiple Large Perforations (~1" - 1' diameter)
3	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
3 Br	Steel Pipe Pile	Severe Damage	SPL ITZ / MDL -10'	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface Perforation (~2" diameter)
4	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
4 Br	Steel Pipe Pile	Severe Damage	SPL ITZ / MDL -10' MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface Large Perforation (~1.5' x 8") Multiple Perforations (~4" diameter)
5	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface

TABLE 2
STEEL PILE INSPECTION DATA

DRAFT

PILE IDENTIFICATION		MEMBER RATING	CONDITION / DAMAGE	
Pile Number	Pile Type		Elevation (Chart Datum)	Details / Remarks
5 Br	Steel Pipe Pile	Severe Damage	SPL ITZ / MDL -5' / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface Multiple Large Perforations (~1" - 1' diameter)
6	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
6 Br	Steel Pipe Pile	Severe Damage	SPL ITZ / MDL -10' MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface Perforation (~1.5" diameter) Perforation (~1" diameter)
7	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
7 Br	Steel Pipe Pile	Severe Damage	SPL ITZ / MDL -5' -10'	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface Large Perforation (~1.5' x 2") Large Perforation (~1.5' x 8")
8	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
8 Br	Steel Pipe Pile	Severe Damage	SPL ITZ / MDL -5' / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface Multiple Large Perforations (~1" - 1' diameter)
9	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
9 Br	Steel Pipe Pile	Severe Damage	SPL ITZ / MDL -5' -10	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface Perforation (~4" diameter) Perforation (~5" diameter)

TABLE 2
STEEL PILE INSPECTION DATA

DRAFT

PILE IDENTIFICATION		MEMBER RATING	CONDITION / DAMAGE	
Pile Number	Pile Type		Elevation (Chart Datum)	Details / Remarks
10	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
10 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
11	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
11 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
EAST BREAKWATER				
1	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
1 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
2	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
2 Br	Steel Pipe Pile	Severe Damage	SPL ITZ / MDL -5' / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface Multiple Large Perforations (~1" - 1' diameter)
3	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
3 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface

TABLE 2
STEEL PILE INSPECTION DATA

DRAFT

PILE IDENTIFICATION		MEMBER RATING	CONDITION / DAMAGE	
Pile Number	Pile Type		Elevation (Chart Datum)	Details / Remarks
4	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
4 Br	Steel Pipe Pile	Severe Damage	SPL ITZ / MDL -10' -15' MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface Perforation (~1.5" diameter) Perforation (~1.5" diameter) Multiple Perforations from 1" to 1' in Diameter
5	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
5 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
6	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
6 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
7	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
7 Br	Steel Pipe Pile	Severe Damage	SPL ITZ / MDL -15' -5' / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface Perforation (~2.5" diameter) Multiple Perforations from 1" to 1' in Diameter
8	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface

TABLE 2
STEEL PILE INSPECTION DATA

DRAFT

PILE IDENTIFICATION		MEMBER RATING	CONDITION / DAMAGE	
Pile Number	Pile Type		Elevation (Chart Datum)	Details / Remarks
8 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
9	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
9 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
10	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
10 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
11	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
11 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
12	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
12 Br	Steel Pipe Pile	Severe Damage	SPL ITZ / MDL -7' -10'	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface Perforation (~2.5" diameter) Perforation (~2.5" diameter)
13	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface

TABLE 2
STEEL PILE INSPECTION DATA

DRAFT

PILE IDENTIFICATION		MEMBER RATING	CONDITION / DAMAGE	
Pile Number	Pile Type		Elevation (Chart Datum)	Details / Remarks
13 Br	Steel Pipe Pile	Severe Damage	SPL ITZ / MDL -8'	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface Perforation (~1.5" diameter)
14	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
14 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
15	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
15 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
16	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
16 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
17	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
17 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
18	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
18 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface

TABLE 2
STEEL PILE INSPECTION DATA

DRAFT

PILE IDENTIFICATION		MEMBER RATING	CONDITION / DAMAGE	
Pile Number	Pile Type		Elevation (Chart Datum)	Details / Remarks
19	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
19 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
20	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
20 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
21	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
21 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
22	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
22 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
23	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
23 Br	Steel Pipe Pile	Severe Damage	SPL ITZ / MDL -8' -10'	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface Perforation (~2.5" diameter) Perforation (~2.5" diameter)

TABLE 2
STEEL PILE INSPECTION DATA

DRAFT

PILE IDENTIFICATION		MEMBER RATING	CONDITION / DAMAGE	
Pile Number	Pile Type		Elevation (Chart Datum)	Details / Remarks
24	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
24 Br	Steel Pipe Pile	Severe Damage	SPL ITZ / MDL -5'	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface Perforation (~3.5" diameter)
25	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
25 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
26	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
26 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
27	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
27 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
28	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
28 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
29	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface

TABLE 2
STEEL PILE INSPECTION DATA

DRAFT

PILE IDENTIFICATION		MEMBER RATING	CONDITION / DAMAGE	
Pile Number	Pile Type		Elevation (Chart Datum)	Details / Remarks
29 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
30	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
30 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
31	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
31 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
32	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
32 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
33	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
33 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
34	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
34 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface

TABLE 2
STEEL PILE INSPECTION DATA

DRAFT

PILE IDENTIFICATION		MEMBER RATING	CONDITION / DAMAGE	
Pile Number	Pile Type		Elevation (Chart Datum)	Details / Remarks
35	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
35 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
36	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
36 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
37	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
37 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
38	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
38 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
39	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
39 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
40	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface

TABLE 2
STEEL PILE INSPECTION DATA

DRAFT

PILE IDENTIFICATION		MEMBER RATING	CONDITION / DAMAGE	
Pile Number	Pile Type		Elevation (Chart Datum)	Details / Remarks
40 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
41	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
41 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
42	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
42 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
43	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
43 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
44	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
44 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
45	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
45 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface

TABLE 2
STEEL PILE INSPECTION DATA

DRAFT

PILE IDENTIFICATION		MEMBER RATING	CONDITION / DAMAGE	
Pile Number	Pile Type		Elevation (Chart Datum)	Details / Remarks
46	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
46 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
47	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
47 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
48	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
48 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
49	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
49 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
50	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
50 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
51	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface

TABLE 2
STEEL PILE INSPECTION DATA

DRAFT

PILE IDENTIFICATION		MEMBER RATING	CONDITION / DAMAGE	
Pile Number	Pile Type		Elevation (Chart Datum)	Details / Remarks
51 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
52	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
52 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
53	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
53 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
54	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
54 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
55	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
55 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
56	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
56 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface

TABLE 2
STEEL PILE INSPECTION DATA

DRAFT

PILE IDENTIFICATION		MEMBER RATING	CONDITION / DAMAGE	
Pile Number	Pile Type		Elevation (Chart Datum)	Details / Remarks
57	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
57 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
58	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
58 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
59	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
59 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
60	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
60 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
61	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
61 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
62	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface

TABLE 2
STEEL PILE INSPECTION DATA

DRAFT

PILE IDENTIFICATION		MEMBER RATING	CONDITION / DAMAGE	
Pile Number	Pile Type		Elevation (Chart Datum)	Details / Remarks
62 Br	Steel Pipe Pile	Severe Damage	SPL ITZ / MDL -5'	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface Perforation (~3.5" diameter)
63	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
63 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
64	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
64 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
65	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
65 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
66	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
66 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
67	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
67 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface

TABLE 2
STEEL PILE INSPECTION DATA

DRAFT

PILE IDENTIFICATION		MEMBER RATING	CONDITION / DAMAGE	
Pile Number	Pile Type		Elevation (Chart Datum)	Details / Remarks
68	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
68 Br	Steel Pipe Pile	Severe Damage	SPL ITZ / MDL -4'	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface Perforation (~3.5" diameter)
69	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
69 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
70	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
70 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
71	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
71 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
72	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
72 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
73	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface

TABLE 2
STEEL PILE INSPECTION DATA

DRAFT

PILE IDENTIFICATION		MEMBER RATING	CONDITION / DAMAGE	
Pile Number	Pile Type		Elevation (Chart Datum)	Details / Remarks
73 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
74	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
74 Br	Steel Pipe Pile	Severe Damage	SPL ITZ / MDL -2' MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface Perforation (~3.5" diameter) Multiple Perforations (~3"-8" diameter)
75	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
75 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
76	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
76 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
77	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
77 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
78	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface

TABLE 2
STEEL PILE INSPECTION DATA

DRAFT

PILE IDENTIFICATION		MEMBER RATING	CONDITION / DAMAGE	
Pile Number	Pile Type		Elevation (Chart Datum)	Details / Remarks
78 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
79	Steel H-Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 25-50% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface
79 Br	Steel Pipe Pile	Major Damage	SPL ITZ / MDL	95-99% Coating Intact 0-25% Coating Intact, Active Orange Moderate to Heavy Corrosion Covering ~50% of Surface

TABLE 3
STEEL PILES - LEVEL III THICKNESS READINGS

DRAFT

PILE IDENTIFICATION			THICKNESS READINGS, (inches)					
Pile Number	Pile Type	Nominal Thickness (in.)	Splash Zone	Intertidal Zone	Submerged zone	Mudline	Average	Average Percent Loss (%)
NORTH BREAKWATER								
1	H-Pile	0.615	0.635				0.635	0.0%
1 Br	Pipe Pile Sleeve	0.500	0.515				0.515	0.0%
2	H-Pile	0.615	N/A	0.495	0.540	0.565	0.533	13.3%
2 Br	Pipe Pile	0.375	N/A	0.130	0.200	0.165	0.165	56.0%
11	H-Pile	0.615	0.615				0.615	0.0%
11 Br	Pipe Pile Sleeve	0.500	0.500				0.500	0.0%
EAST BREAKWATER								
1	H-Pile	0.615	0.625	0.590	0.570	0.560	0.586	4.7%
1 Br	Pipe Pile Sleeve	0.500	0.515				0.515	0.0%
1 Br	Pipe Pile	0.375	N/A	0.305	---	0.190	0.248	34.0%
9	H-Pile	0.615	0.615	0.620	0.655	0.640	0.633	0.0%
9 Br	Pipe Pile	0.375	0.380	0.360	0.210	0.230	0.295	21.3%
20	H-Pile	0.615	0.615	0.600	0.570	0.565	0.588	4.5%
20 Br	Pipe Pile	0.375	0.375	0.360	0.285	0.265	0.321	14.3%
38	H-Pile	0.615	0.625	0.570	0.560	0.590	0.586	4.7%
38 Br	Pipe Pile	0.375	0.375	0.185	0.285	0.325	0.293	22.0%
45	H-Pile	0.615	0.620	0.590	0.585	0.575	0.593	3.7%
45 Br	Pipe Pile	0.375	0.370	0.370	0.180	0.280	0.300	20.0%
56	H-Pile	0.615	0.615	0.590	0.590	0.560	0.589	4.3%
56 Br	Pipe Pile	0.375	0.370	0.350	0.310	0.350	0.345	8.0%
65	H-Pile	0.615	0.625	0.595	0.590	0.580	0.598	2.8%
65 Br	Pipe Pile	0.375	0.380	0.390	0.310	0.330	0.353	6.0%
79	H-Pile	0.615	N/A	0.595	N/A	0.305	0.450	26.8%
79 Br	Pipe Pile	0.375	N/A	0.335	N/A	0.230	0.283	24.7%