DAMES POINT MARINE TERMINAL
BERTHS 16 AND 17
JACKSONVILLE, FLORIDA

BOND INSPECTION REPORT

DECEMBER 17, 2020

TraPac

Jacobs

TRAPAC

DAMES POINT MARINE TERMINAL BERTHS 16 AND 17 JACKSONVILLE, FLORIDA

BOND INSPECTION REPORT

DECEMBER 17, 2020

Submitted by:

Jacobs Engineering Group, Inc.
245 Riverside Avenue, Suite 300
Jacksonville, Florida 32202

EXECUTIVE SUMMARY

Jacobs Engineering Group, Inc. (Jacobs) was contracted by TraPac to perform an above and underwater inspection of the Jacksonville Port Authority (JAXPORT) Dames Point Marine Terminal Berths 16 and 17, located along the eastern shore of the St. Johns River in Jacksonville, Florida. The inspection included an assessment of the facility's bulkhead structure to identify defects, deterioration, or damage and to develop repair recommendations and associated order of magnitude cost estimates for repair work. Jacobs performed the 5-day inspection between November 6^{th}, 2020 and November 10^{th}, 2020, with the primary purpose of the inspection being to satisfy the requirements of a bond report. This inspection report is prepared in accordance with the guidelines set forth in the American Society of Civil Engineers (ASCE) *Waterfront Facilities Inspection and Assessment Manual*.

Definitions of condition assessment criteria are described in Section 1.3. Overall, the Dames Point Marine Terminal Berths 16 and 17 Bulkhead is in **Satisfactory** structural condition. The steel combination sheet pile wall is in **Good** condition with only isolated coating loss observed during the inspection. The cathodic protection sacrificial anode system is in **Poor** condition due to missing anodes and associated deterioration of remaining anodes. The concrete pile cap is in **Good** condition with only minor defects noted. The mooring bollards are in **Satisfactory** condition due to coating loss and minor to moderate corrosion. The fenders are in **Fair** condition due to minor abrasion damage on the fender panel facing, moderate corrosion on the fender panel backing, and one missing fender unit. The asphalt pavement is in **Satisfactory** condition with only minor defects noted.

As defined by the bond report requirements, there are no Critical repair actions recommended for the Dames Point Marine Terminal Berths 16 and 17 bulkhead. A Less-Critical repair action is to repair the cathodic protection system, recommended to be performed in the next one to two years. Non-Critical actions include re-coating of the mooring bollards, replacement of the missing fender unit, and replacement of the broken UHMW facing panels on the fenders. The total order of magnitude opinion of probable cost for these recommended repair actions is $935,040. It is expected that performing the recommended repairs would upgrade the condition of the structure to **Good**.

DAMES POINT MARINE TERMINAL
BERTHS 16 AND 17

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF PHOTOGRAPHS

LIST OF PHOTOGRAPHS *(Cont'd)*

1. INTRODUCTION

Jacobs Engineering Group, Inc. (Jacobs) was contracted by TraPac to perform an above and underwater inspection of the Jacksonville Port Authority (JAXPORT) Dames Point Marine Terminal Berths 16 and 17, located along the eastern shore of the St. Johns River in Jacksonville, Florida. Jacobs performed the 5-day inspection between November 6^{th}, 2020 and November 10^{th}, 2020. This inspection report is prepared in accordance with the guidelines set forth in the American Society of Civil Engineers (ASCE) *Waterfront Facilities Inspection and Assessment Manual.*

1.1 PURPOSE

The primary purpose of the inspection was to fulfill the requirements of a bond report. The bond inspection included an above and underwater assessment of the overall conditions of the facility and documented any structural or non-structural defects, deterioration, or damage. Repair actions are recommended with associated order-of-magnitude cost estimates, where applicable. All notable observations identified during the inspection are documented using photographs or figures, and comments are made on their location on the bulkhead and the associated severity. Inspection findings are arranged in a logical format to describe each component and its existing physical condition, and sufficient detail is presented to identify structural or non-structural defects. In addition, typical photographs of each structural and non-structural element (component) are provided to show the broader general condition of the bulkhead.

1.2 METHODOLOGY

The bond inspection was conducted by a three-person team comprising a Professional Engineer-Diver (Team Leader), a Diving Supervisor, and an Engineer-Diver. All work was performed in accordance with the guidelines set forth in ASCE's *Waterfront Facilities Inspection and Assessment Manual*. Dive operations were staged from a van using a portable dive system and met all guidelines governing commercial safe diving practices. All diving operations were conducted using surface-supplied diving equipment including a Superlite 27 diving helmet, a three-part umbilical with continuous hard-wire communications, and all associated commercial diving equipment.

A Level I inspection effort, consisting of a close visual/tactile examination, was performed on 100 percent of all accessible structural elements, from mean low water (MLW) to the mudline in order to detect major and obvious damage and deterioration. During the Level I inspection, the diver also noted mudline depths and bottom conditions at regular intervals, so that future comparisons can be made.

In addition to the Level I inspection, the steel sheet pile combination wall was further subjected to Level II and Level III inspection efforts at approximately 100 ft intervals along the wall. The purpose of the Level II and III inspections was to identify any defects hidden by marine growth, to identify surface conditions, and to identify any loss of cross-sectional area (section loss) of the steel due to corrosion. This included the removal of marine growth for a more detailed examination of the underlying surface at three elevations: MLW; mid-water or approximately midway between MLW and the mudline; and just above the mudline.

The Berth 16 and 17 bulkhead is a combination wall consisting of H-shaped steel HZ975B king piles linked with AZ26 sheet piles between each king pile. Each Level II cleaning area was 12-in high and encompassed the inner flange, web, and outer flange of the steel sheet piles (as defined in Figure 1) as well as the outer flange of the king pile. At each Level II cleaning area additional Level III measurements were taken. Level III measurements included measuring the cross-sectional thickness of the existing steel using an ultrasonic thickness meter. A silver-silver chloride electrical potential meter was also used to assess the activity of the cathodic protection system.

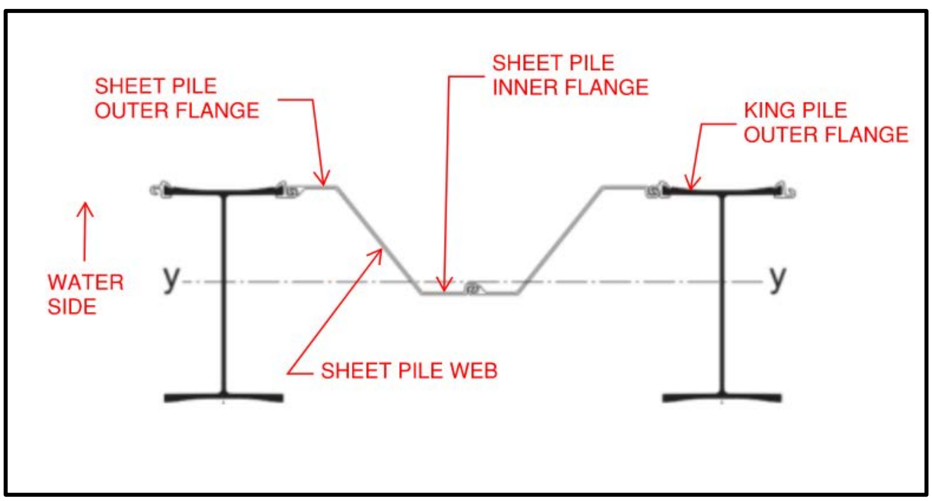

Figure 1-1: Combination wall terminology

Inspection findings presented herein are supplemented by photographs and tables to provide a detailed description of observed conditions, including the extent and severity of the deterioration found, and repair recommendations accompanied by order of magnitude opinions of probable costs.

1.3 CONDITION ASSESSMENT CRITERIA

The inspection and condition assessment is based on a standardized approach using predefined criteria to enable deficiencies to be recorded consistently, and to evaluate the relative severity of defects when determining a facility's overall condition. The benefit of a standardized approach ensures that any future facility inspections have a benchmark as a basis of comparison for defects or deterioration in any future inspections. Consistent reporting criteria allows engineers to develop an accurate rate of deterioration and degradation based on plotted curves or direct comparison.

Each structural element or group of elements inspected within a facility is given a condition assessment rating based on the predefined criteria. The ratings provide guidance regarding the recommended priorities of follow-up actions to be taken by the owner. The condition assessment rating of the overall structure and elements comprising the structure is established using the information gathered during the inspection process. The severity, type, and quantity of damage, defects, and deterioration on a structure, as well as the overall impact that a set of conditions has on the facility, are processed to derive the defined condition assessment ratings.

The general condition assessment ratings for the inspected structure, element, or component groups are based on a six-point assessment scale developed by the American Society of Civil Engineers (ASCE) and are described below.

6 Good No visible damage or only minor damage is noted. Structural elements may show very minor deterioration, but no overstressing is observed. No repairs are required.

5 Satisfactory Limited minor to moderate defects or deterioration are observed, but no overstressing is observed. No repairs are required.

4 Fair All primary structural elements are sound, but minor to moderate defects or deterioration are observed. Localized areas of moderate to advanced deterioration may be present but do not significantly reduce the load-bearing capacity of the structure. Repairs are recommended, but the priority of the recommended repairs is low.

3 Poor Advanced deterioration or overstressing is observed on widespread portions of the structure but does not significantly reduce the load-bearing capacity of the structure. Repairs may be carried out with moderate urgency.

2 Serious Advanced deterioration, overstressing, or breakage may have significantly affected the load-bearing capacity of primary structural components. Local failures are possible and loading restrictions may be necessary. Repairs may need to be carried out on a high-priority basis with urgency.

1 Critical Very advanced deterioration, overstressing, or breakage has resulted in localized failure(s) of primary structural components. More widespread failures are possible or likely to occur, and load restrictions should be implemented as necessary. Repairs may need to be carried out on a high priority basis with strong urgency.

1.4 DAMAGE GRADE ASSESSMENT

The damage grades presented in this report assess the physical condition of each observed defect or deficiency. Typical damage observed during waterfront facility inspections is categorized using four damage grades: Severe, Major, Moderate, and Minor. An assigned damage grade is assessed based on the type and size observed and is independent of the overall condition and structural impact of the deteriorated element. However, damage grades can feed into the overall condition assessments when examining section loss at structural components.

1.4.1 Concrete Elements

In-service deterioration of concrete components is often the result of exposure to a hostile marine environment or unusual loading conditions causing cracking. Several factors may affect concrete integrity, leading to deterioration and failure, such as excessive operational loads, construction defects, temperature, chemical reactions, and mechanical (impact) damage. Concrete deterioration commonly occurs when concrete degrades, internal reinforcing steel corrodes, overstress of members, construction deficiencies, or a combination thereof.

The damage grade of an individual concrete element is based on a four-point assessment scale as defined below:

Minor Mechanical abrasion or impact dents up to 1 in.; occasional corrosion stains or small pop-out corrosion spalls.

Moderate Structural cracks up to 1/16 in. wide; corrosion cracks up to 1/4 in. wide; chemical deterioration: Random cracks up to 1/16 in. wide; “Soft” concrete and rounding of corners up to 1 in. deep.

Major Structural cracks between 1/16 in. to 1/4 in. wide and partial breakages (structural spalls); Corrosion cracks wider than 1/4 in. and open spalls (excluding pop-outs); multiple cracking and disintegration of surface layer due to chemical deterioration.

Severe Structural cracks wider than 1/4 in. or complete breakage. Loss of bearing and displacement at connections; complete loss of concrete cover due to corrosion of reinforcing steel with over 30 percent of diameter loss for any main reinforcing bar; loss of concrete cover (exposed steel) due to chemical deterioration; loss of over 30 percent of cross section due to any cause described above.

1.4.2 Steel Elements

The deterioration of steel components in the marine environment is typically caused by corrosion, fatigue cracking, and impact or overload damage. Often, two or more of these destructive agents occur simultaneously. Steel corrosion is the general thinning of the structural metal section due to the reaction between the non-coated material and its environment, and in a marine (salt water/ brackish) environment is very common. Chemically, it is the transformation of a metal to its oxide through a reaction involving oxygen, water, and other agents. Corrosion is most common in the splash and tidal zones but also may be found in the submerged zone of the component, particularly near the mudline. Pitting is a localized corrosion attack that causes the formation of deep circular penetrations into the steel surface. Pitting is caused by chemical variations in the steel or physical differences, such as imperfections in the steel beneath its surface. The damage grade of an individual steel defect is based on a four-point assessment scale as quantified below:

Minor Protective coating partially or no longer intact; less than 50 percent of perimeter or circumference affected by corrosion at any elevation or cross section; loss of thickness up to 15 percent of nominal at any location.

Moderate Over 50 percent of perimeter or circumference affected by corrosion at any elevation or cross section; loss of nominal thickness 15 to 30 percent at any location.

Major 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.

Severe Structural bends or buckling, breakage and displacement at supports, loose or lost connections; perforations or loss of wall thickness exceeding 50 percent of nominal at any location.

1.5 RECOMMENDED ACTIONS AND ESTIMATED COSTS

Per the bond report guidelines, recommended actions should be categorized into the following three action types: Critical, Less Critical, and Non-critical. Based on the overall condition assessments of the structures and the individual component groups, and the structural impacts of the observed defects or deterioration, recommended actions are assigned to either prevent unsafe conditions or to determine order-of-magnitude cost estimates for future actions including rehabilitation, design, and inspection work.

Critical Actions require immediate attention to avoid accelerated deterioration and higher future repair costs. Critical repairs should be addressed in 0-1 years.

Less Critical Actions are for elements that currently function satisfactorily but will need repair or replacement within two years. Less Critical repairs should be addressed in 1-2 years.

Non-critical Actions are for elements whose repair can be deferred beyond 3 years without consequence. Non-critical repairs should be addressed in 3 or more years.

Additional investigations and/or engineering analyses may be recommended when more information is needed to better determine the overall structural condition, the cause or significance of non-typical defects or deterioration, or an appropriate repair method. No action is recommended when a facility is relatively new and does not exhibit any defects or deterioration warranting repair, or when no further action is necessary at a facility until the next scheduled inspection.

An opinion of probable repair cost associated with each recommended action is typically developed with the intention of providing a conceptual order-of-magnitude dollar value for budgeting and comparison purposes and should be considered accurate to within +30/- 20 percent. Costs are presented in US dollars based on the best information available at the time of writing the report. The estimated costs include markups for contractor indirect costs, as well as design and construction management costs and an overall project contingency.

2. BERTH 16 AND 17 BULKHEAD INSPECTION

2.1 DESCRIPTION OF STRUCTURE

The Dames Point Marine Terminal bulkhead consists of a 2,925-ft-long HZ-AZ king-pile combination bulkhead wall located on the eastern bank of the St. Johns River in Jacksonville, Florida (Photo 2-1). The bulkhead forms two berths with Berth 16 along the northern half of the structure (Photo 2-2) and Berth 17 along the southern half of the structure (Photo 2-3). Each berth is 1,200 feet long and 40 ft deep. Approximately 252 linear feet of bulkhead wall transitions to shallow depth to the north of Berth 16 and 276 linear feet of bulkhead wall transitions to shallow depth to the south of Berth 17. According to the as-built drawings, each berth was dredged to -40 ft MLW and was originally designed for a dredge depth of -45 ft MLW plus a 2 ft over-dredge allowance.

The bulkhead wall is steel combination wall, consisting of HZ975B steel king piles with 14AZ/26 steel sheet piles between them (Photo 2-4). Each king pile is also tied back with a 3.5 in. diameter high yield steel tie rod to an anchor wall located approximately 87 ft inshore from the bulkhead centerline. The waterside face of the steel combination wall is fully coated with a modified phenyl alkyl amine cured epoxy compound which was specified for its adhesion properties. Additionally, each steel AZ sheet pile recess has a 120-lb aluminum alloy sacrificial anode welded to one of the sheet pile webs (Photo 2-5). Per the as-built drawings, the anode installation elevation alternates between approximately 10 ft below MLW and 30 ft below MLW in each bay for the full length of both berths.

The top of the combination wall is bound together with a rigid cast-in-place reinforced concrete capping beam. The soffit of the capping beam has an elevation approximately 3.9 ft above MLW and top of the capping beam has an elevation 11.48 ft above MLW. A 10-in.-high by 12-in.-wide concrete curb is located on top of the pile cap with 150-ton double bit bollards spaced at 64.6 ft center-to-center for the length of the structure (Photo 2-6). Mounted to the offshore face of the pile cap are multiple pairs of leg fenders with 9.5-ft-high by 7.2-ft-wide UHMW fender panels (Photo 2-7). Each pair of fenders is spaced at 64.6 ft center-to-center. Inshore of the pile cap is a Panzerbelt protected cable trench, crane rails, and asphalt pavement. The crane rails have gauge of 100 ft and are supported by 30-in.-diameter pipe piles independent of the bulkhead structure. Presently, there are a total of six cranes operating at Berths 16 and 17.

The terminal is operated by TraPac, Inc. and the property is owned by JAXPORT. Construction of the terminal was completed in 2009 and it is currently the largest container terminal in Florida.

A Location Plan, Berths 16 and 17 Plan, and Berths 16 and 17 Typical Section are presented in Figure 2-1 through Figure 2-3.

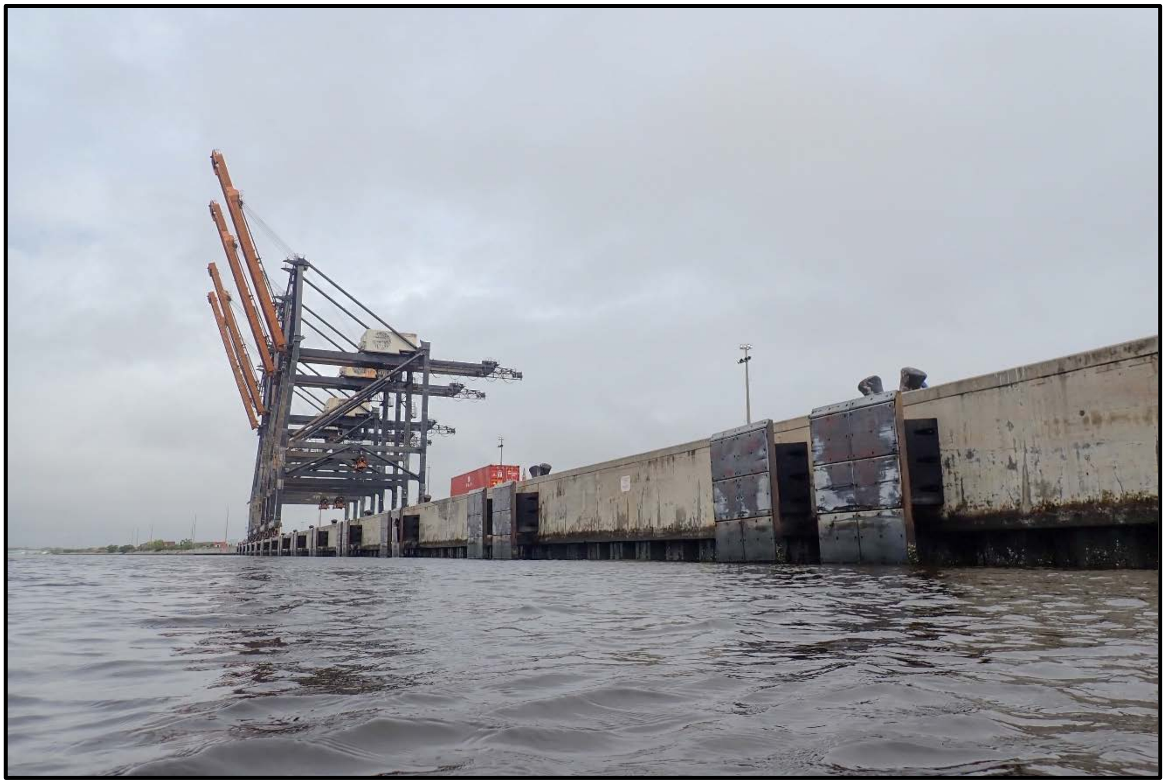

PHOTO 2-1 Overall view of Berths 16 and 17 looking northeast.

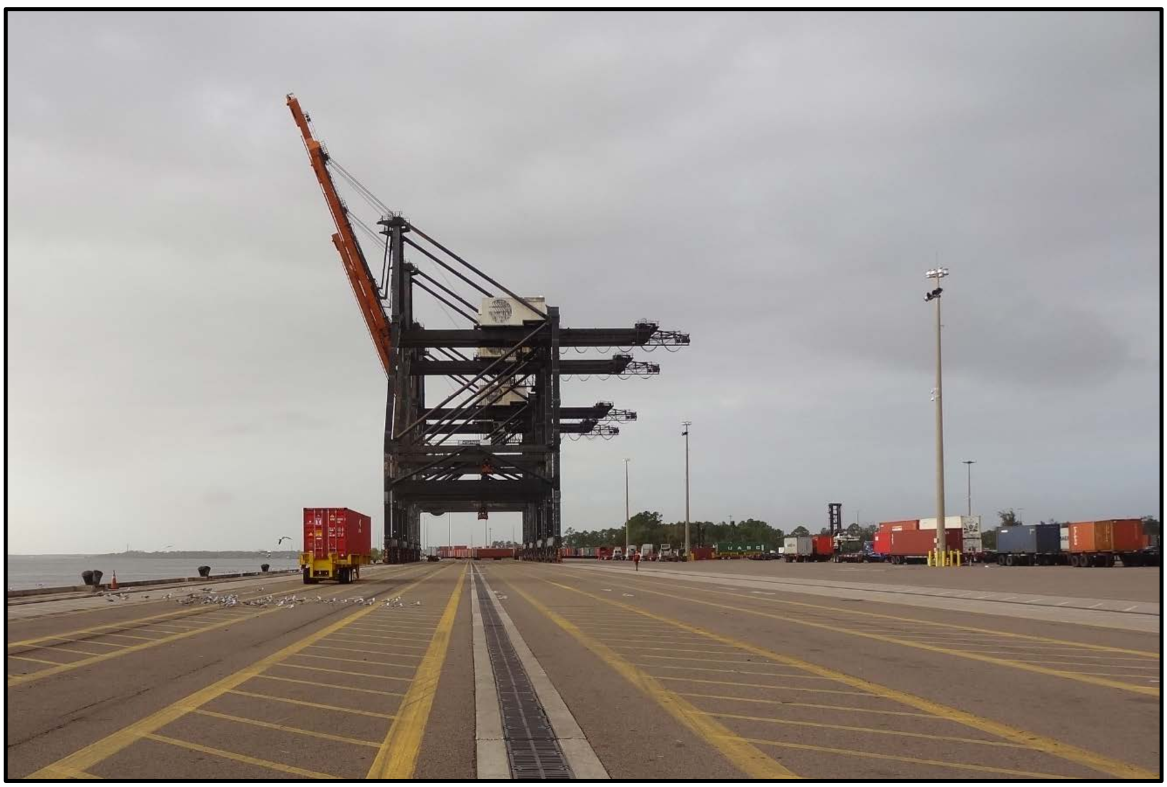

PHOTO 2-2 Topside view of Berth 16, looking north.

PHOTO 2-3 Topside view of Berth 17, looking south.

PHOTO 2-4 Typical view of bulkhead wall, looking south.

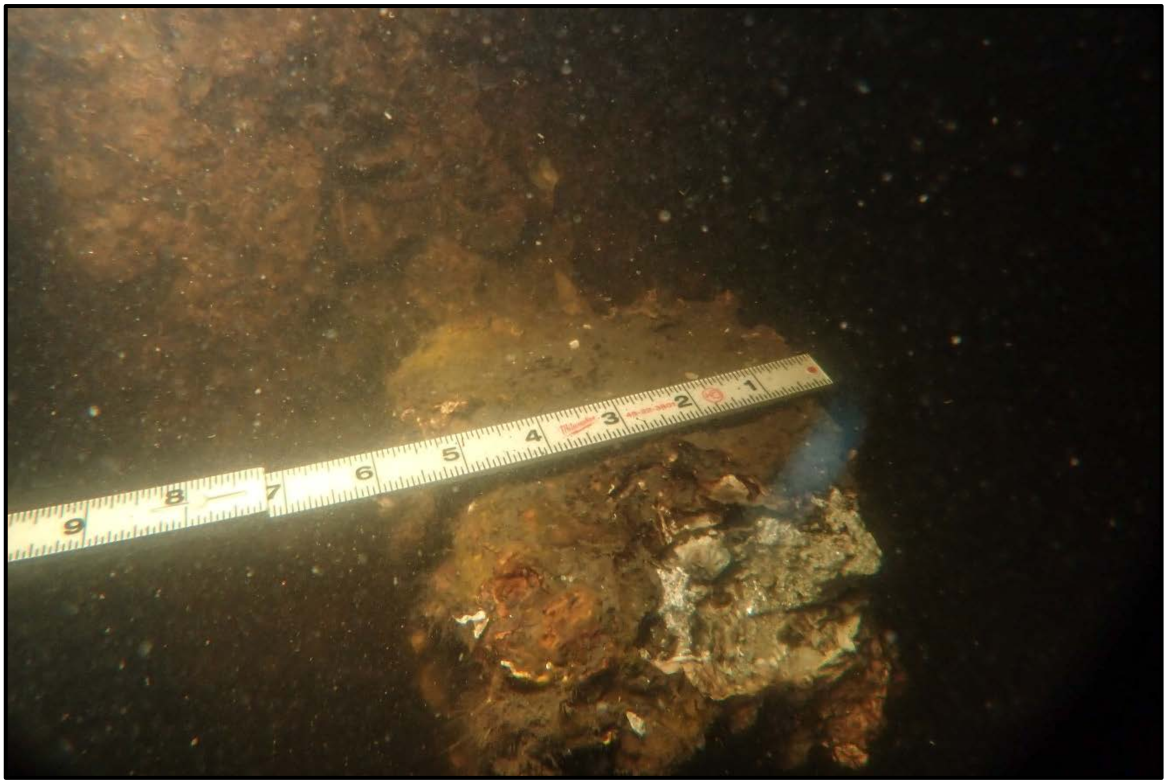

PHOTO 2-5 Typical 120 lb. aluminum alloy anode.

PHOTO 2-6 Typical 150-ton double-bit bollard.

PHOTO 2-7 Typical pair of fender units.

FIGURE 2-1 LOCATION PLAN

FIGURE 2-2 BERTHS 16 AND 17 - PLAN

FIGURE 2-3 BERTHS 16 AND 17 – TYPICAL SECTION

2.2 OBSERVED CONDITIONS

The bulkhead at Berths 16 and 17 is in **Satisfactory** condition overall, but its longevity may be compromised due to a significant number of missing sacrificial anodes coupled with minor coating loss on the steel combination wall. There are minor mechanical spalls on the concrete pile cap that are not expected to affect the integrity of the structure. The structure exhibits no signs of overstress due to marine operations.

2.2.1 STEEL COMBINATION WALL

The steel combination wall (combi-wall) is in **Good** condition with a thick, rubber-like, epoxy coating covering the full exposed height of the wall (Photo 2-8). In isolated locations, the coating is torn and the underlying steel is exposed (Photo 2-9). The tears are minimal and observed on less than 5 percent of the sheet pile wall area, typically at the sheet pile interlocks and corners (Photo 2-10). Where exposed, the steel is in good condition with no corrosion observed. In addition to tears in the coating, there are areas where the coating has delaminated from the steel most notably along the top 2 ft of exposed wall below the pile cap (Photo 2-11). In total, approximately 5 percent of the sheet pile wall area is torn or delaminated.

During the inspection, ultrasonic thickness (UT) measurements were collected every 100 ft along the wall. A summary of those measurements is presented below in Table 2-1TABLE 2-1. The full UT results are provided in Appendix A. It should be noted that some Level III inspection elements show no record ("NR") rather than a measured thickness. At these elements, the modified phenyl alkyl amine cured epoxy coating was too thick to enable UT measurement.

TABLE 2-1
ULTRASONIC THICKNESS MEASUREMENTS SUMMARY– BERTHS 16 AND 17 BULKHEAD

Elements	Design Thickness	Average Measurement		Minimum Measurement		Mill Tolerance*
		(in.)	% Loss	(in.)	% Loss	
King Pile Flange	0.750	0.745	0.72%	0.680	9.3%	8%
AZ Outer Flange	0.512	0.502	2.04%	0.478	6.6%	6%
AZ Web	0.480	0.467	2.81%	0.450	6.2%	6%
AZ Inner Flange	0.512	0.509	0.68%	0.478	6.6%	6%

*Per Acelor Mittal/EN10248

The UT results show minimal section loss along the full length of the wall. These measurements are consistent at all three measurement elevations; MLW; mid-water or approximately midway between MLW and the mudline; and just above the mudline. The average section loss percentages at the HZ king pile flanges and AZ sheet pile outer flanges, webs, and inner flanges are between 0 and 3 percent and the minimum measurements are all within 1.3 percent of the mill tolerances for each component. At approximately 10 percent of Level III elements inspected, the epoxy coating prevented UT measurements. Based on the obtainable section loss measurements, it is assumed that the steel is at, or very close to, its original thickness beneath the epoxy coating.

2.2.2 CATHODIC PROTECTION SYSTEM

The Cathodic Protection System is in **Poor** condition. Overall, the sacrificial anodes exhibit an average section loss (depletion) of 20 to 25 percent over the length of the wall (Photo 2-12), however the level of deterioration varies between 5 and 50 percent. Additionally, significantly less anodes were observed on the wall than the as-built drawings indicate. While a detailed inspection of every anode is outside the scope of this inspection, based on the number of anodes observed by the divers, approximately two-thirds of the anodes are estimated to be missing including at least one test station anode (Photo 2-13). Among the existing anodes, one of the two anode mounting brackets are broken at eight locations along the wall (Photo 2-14). At these broken mounting brackets, the weld between the bracket and the sheet pile web is typically the failure point. Additionally, the sheet pile webs exhibit rectangular cutouts in the protective coating at multiple locations (Photo 2-15). These cutouts typically have remnants of Splash Zone epoxy and weld material, possibly indicating that anodes were previously installed at these locations, which would be consistent with the anode locations shown on the as-built drawings.

While the inspection found that a significant number of anodes are missing, electric potential measurements taken at regular intervals as part of the Level III effort show an average electrical potential of -906 millivolts (mV) on the bulkhead wall. Typically, electrical potential measurements of approximately -800 mV or lower (i.e. more negative) in seawater indicate good cathodic protection. Therefore, the anodes continue to provide good corrosion protection for the bulkhead. A complete set of electric potential readings are provided in Appendix A.

2.2.3 CONCRETE CAPPING BEAM

The concrete capping beam is in **Good** condition with only minor defects noted. The concrete is sound with minor hairline cracks typically on its waterside face as well as the concrete curb above (Photo 2-16) and minor spalling along the bottom corner of the capping beam, typically throughout its length (Photo 2-17). There is one minor spall on the bottom corner of the capping beam, approximately 3 in. wide by 4 in. long by 2 in. deep exposing one bar with minor corrosion. Additionally, there are several minor mechanical spalls, which may be the result of impact damage, on the top and bottom corners of the capping beam, none of which expose steel reinforcing (Photo 2-18).

2.2.4 MOORING BOLLARDS

The mooring bollards are in **Satisfactory** condition. Typically, the bollards have 0 to 5 percent coating loss (Photo 2-19), however, some bollards have up to 30 percent coating loss and isolated 1/8 in. pitting (Photo 2-20). The mooring bollard foundations typically have hairline cracking and minor mechanical spalling. At Station 24+60 the bollard foundation has a large open spall exposing two steel reinforcing bars with severe corrosion (Photo 2-21). At all bollard components, the anchor hardware is typically covered with protective sealant and is not accessible. However, at isolated locations, individual bolts are exposed and exhibit moderate to major corrosion (Photo 2-22).

2.2.5 FENDERS

The fenders are in **Fair** condition. There is typically moderate cracking and gouging of the UHMW facing (Photo 2-23) and isolated panels are broken or missing (Photo 2-24). The panel backing frames typically display 15 to 20 percent coating loss with moderate corrosion, where uncoated (Photo 2-25). The rubber fender legs typically have minor to moderate defects. Isolated legs are beginning to crack and sag at the pile cap connections (Photo 2-26). At Station 7+80 the fender unit is missing (Photo 2-27) and the adjacent fender, at 7+90, has a large crack at its connection with the pile cap, and is beginning to rotate offshore. Additionally, the fender unit at Station 18+20 is missing an anchor bolt and is sagging. A summary of fender defects is presented below in Table 2-2.

TABLE 2-2
FENDER DEFECTS – BERTHS 16 AND 17

Location (Station)	Description
4+50	1 UHMW Panel missing, north fender
7+85	North fender unit missing
7+85	Crack in north fender leg, south fender
11+00	2 broken UHMW panels, south fender
13+60	1 broken UHMW panel, north fender

18+20	Anchor bolt missing on north leg, south fender
22+65	1 broken UHMW panel, north fender
23+30	1 broken UHMW panel, north fender
23+95	1 missing UHMW panel, south fender
24+60	1 broken UHMW panel, north fender

2.2.6 ASPHALT PAVEMENT

The asphalt pavement is in **Satisfactory** condition. There are minor potholes in the pavement, typical throughout the loading area under the cranes (Photo 2-28). There is an approximately 2.5-ft-wide concrete slab between the bulkhead capping beam and the waterside crane beam. It was noted that a 0.5 in. to 1.5 in. differential settlement was observed between the top of the capping beam and the concrete slab from Station 9+00 to Station 23+00 (Photo 2-29). The settlement of the slab is noted as being structurally independent of both the bulkhead and the cranes beams. No other settlements or evidence of movement were observed on the crane beams or crane rail during the inspection, indicating that the observed settlement is not due to any structural defects. No large depressions or evidence of fill loss or global movement of the fill material behind the bulkhead were observed during the inspection.

PHOTO 2-8 Bulkhead wall with intact epoxy coating.

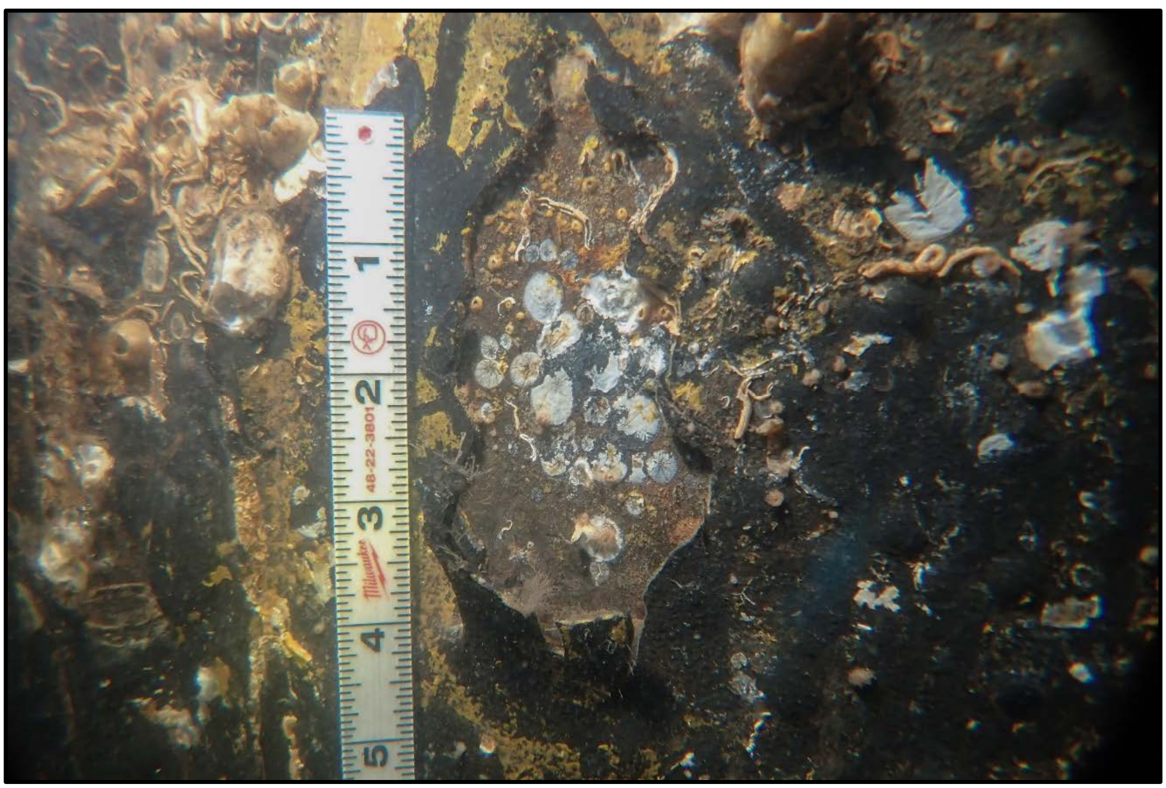

PHOTO 2-9 Isolated tear in epoxy coating on bulkhead wall.

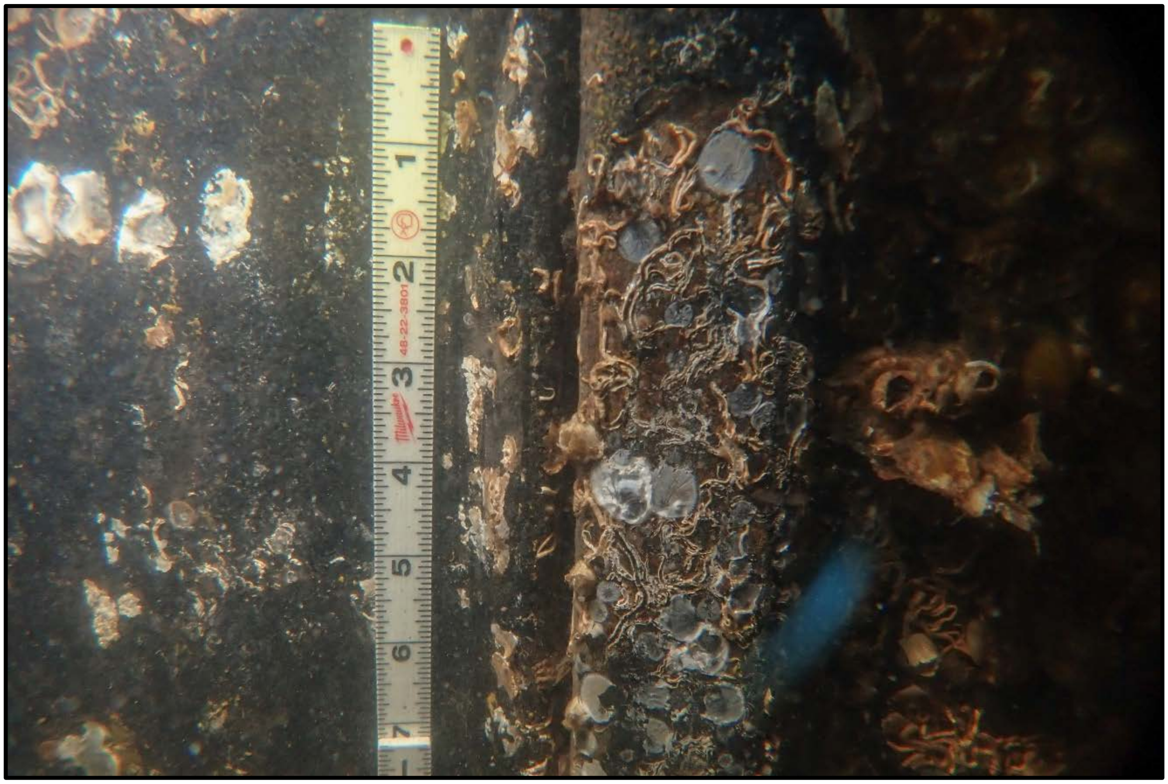

PHOTO 2-10 Tear in epoxy coating at interlock in combination wall.

PHOTO 2-11 Delaminating epoxy coating with bubbles forming on the outer flange of the king pile.

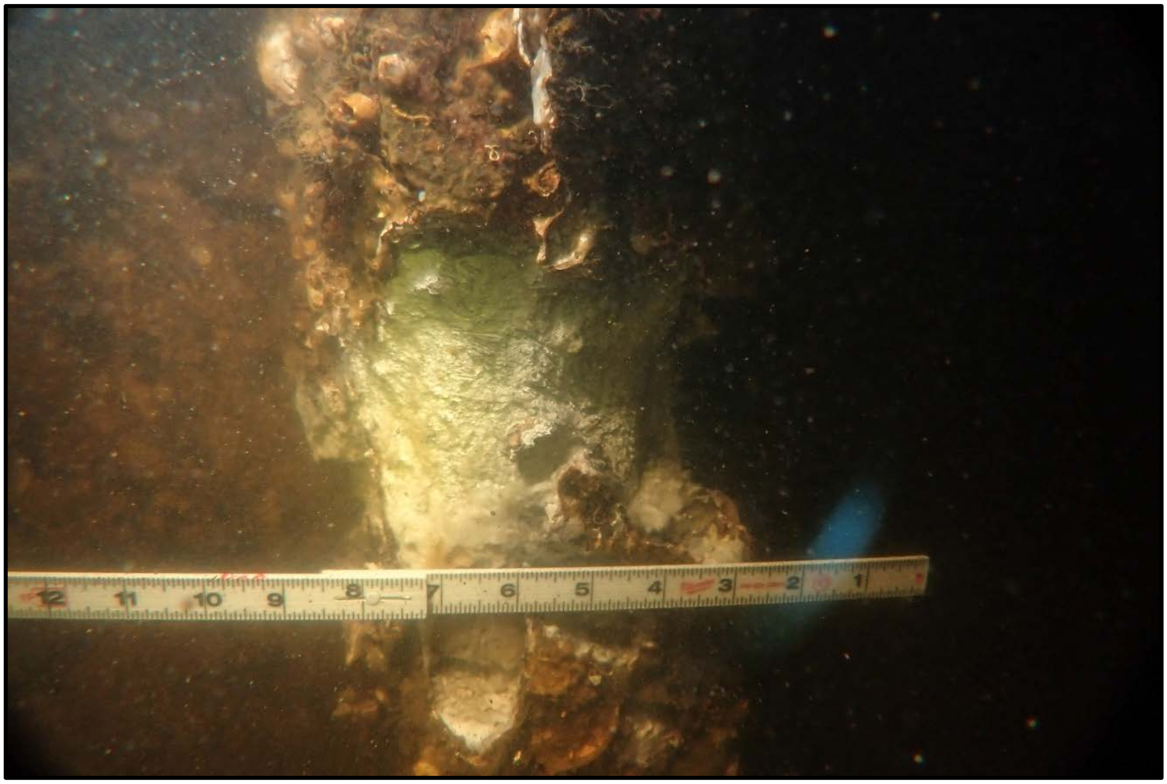

PHOTO 2-12 Aluminum alloy anode with approximately 30 percent section loss.

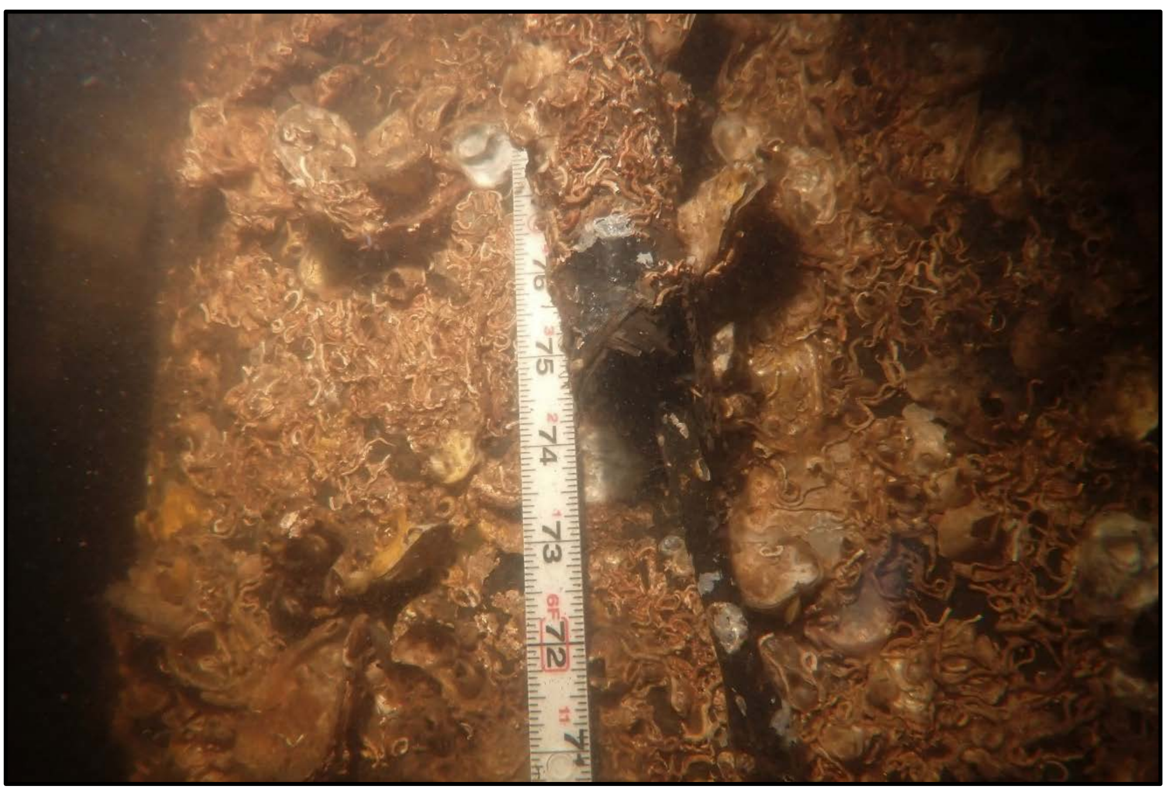

PHOTO 2-13 Broken anode test cable disconnected from test anode. Test anode missing.

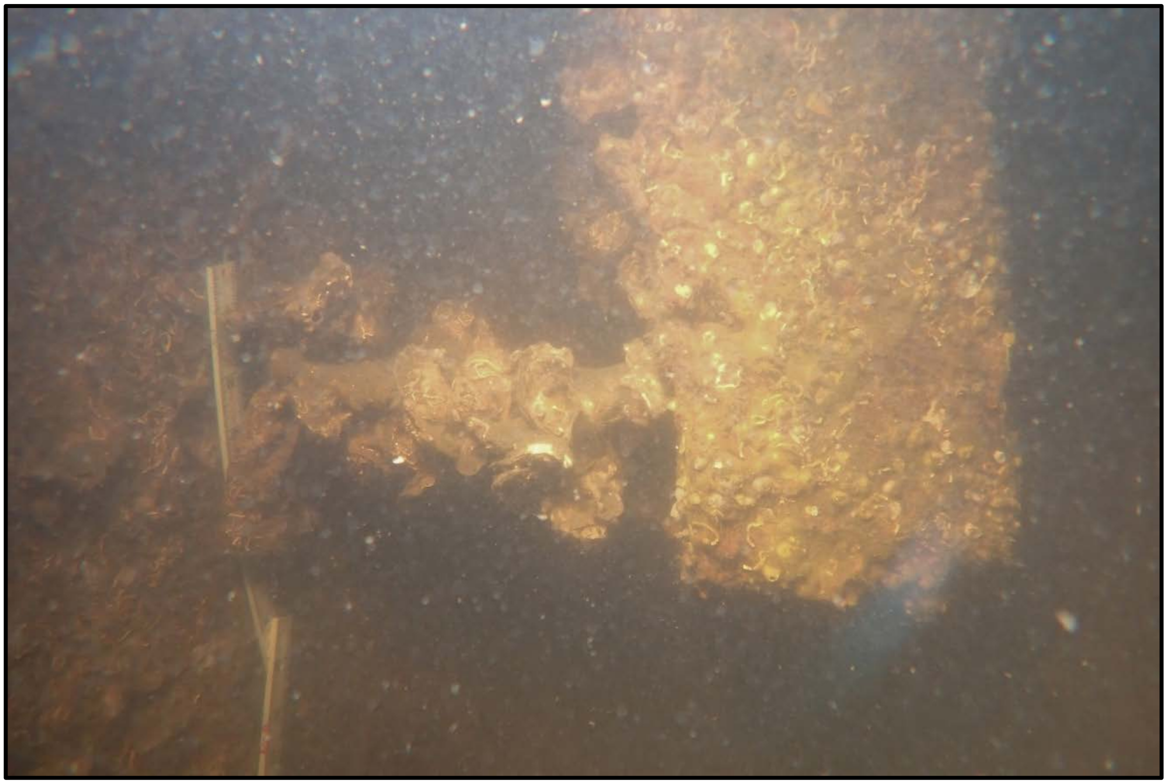

PHOTO 2-14 Aluminum alloy anode with broken lower bracket connection to sheet pile web.

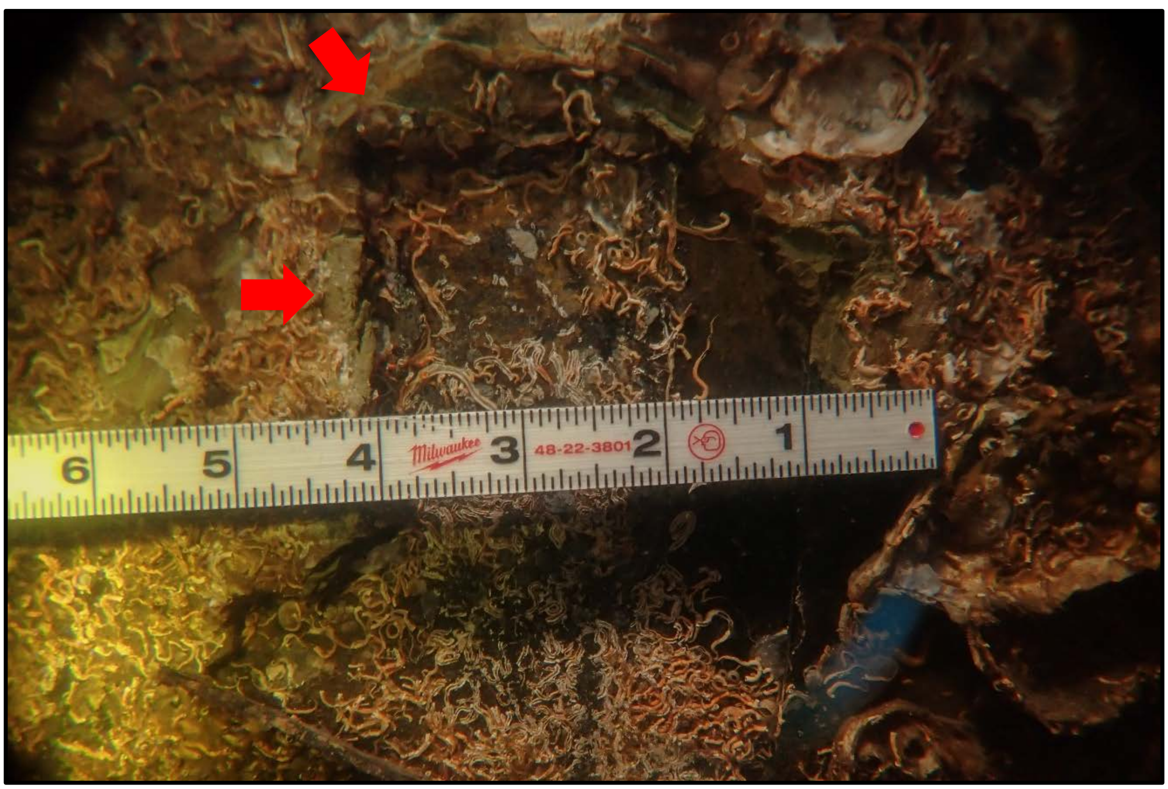

PHOTO 2-15 Sheet pile web with cutout in coating and Splash Zone epoxy where an anode bracket may have been located.

PHOTO 2-16 Typical hairline crack in concrete curb.

PHOTO 2-17 Capping beam with typical mechanical spalling on the bottom corner.

PHOTO 2-18 Mechanical spall in concrete curb at Station 25+40.

PHOTO 2-19 Typical mooring bollard with 5 percent coating loss and minor corrosion.

PHOTO 2-20 Mooring bollard with 25 percent coating loss and moderate corrosion and pitting.

PHOTO 2-21 Mooring bollard foundation with spall exposing two reinforcing bars with severe corrosion.

PHOTO 2-22 Exposed hardware on mooring bollard with major corrosion.


PHOTO 2-23 Typical minor cracking and gouging on the fender UHMW panels.

PHOTO 2-24 Loose and broken UHMW panels.

PHOTO 2-25 Typical coating loss with moderate corrosion and pitting on fender backing frame.

PHOTO 2-26 Rubber fender leg with crack and loose anchor bolt connection.

PHOTO 2-27 Missing fender unit at Station 7+80.

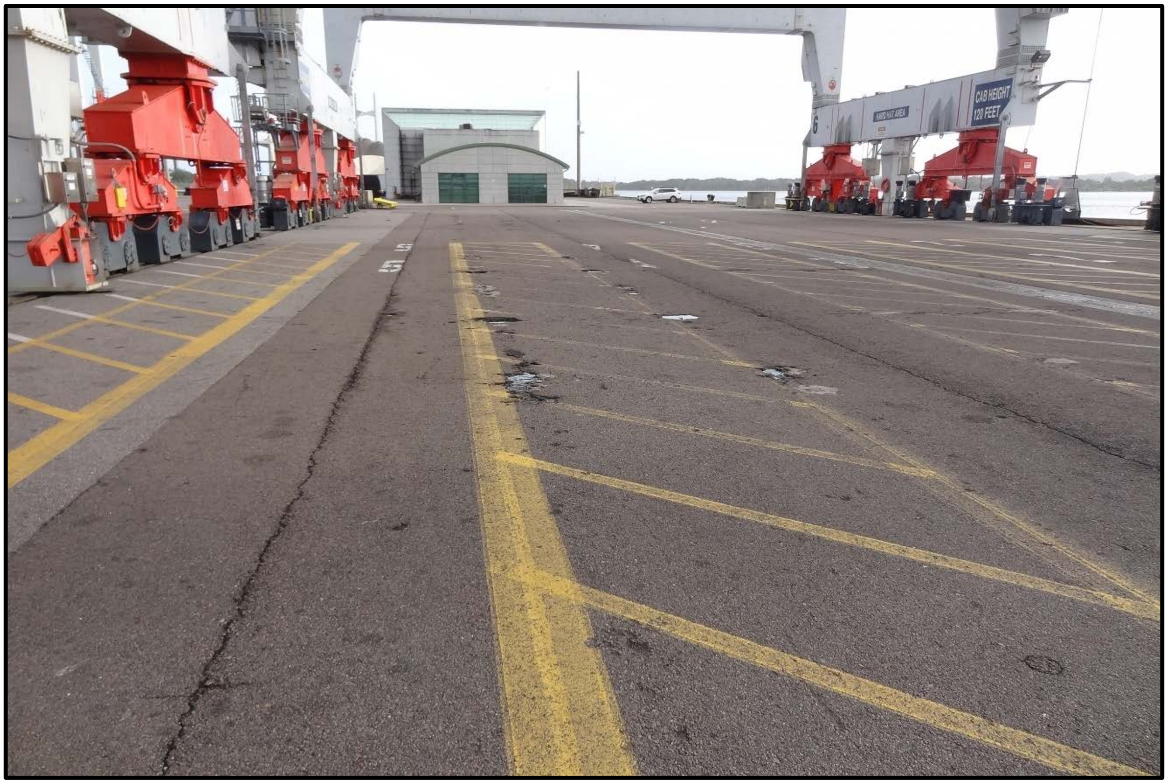

PHOTO 2-28 Typical potholes in pavement at Berth 17.

PHOTO 2-29 Differential settlement between capping beam and concrete slab located between the capping beam and crane rail beam.

Table 2-3 provides a summary of the condition ratings for the elements comprising Berths 16 and 17 at the Dames Point Marine Terminal.

TABLE 2-3
SUMMARY OF CONDITIONS – BERTHS 16 AND 17

Element	Condition Assessment Rating
Steel Combination Wall	Good
Cathodic Protection System	Poor
Concrete Capping Beam	Good
Mooring Bollards	Satisfactory
Fenders	Fair
Asphalt Pavement	Satisfactory

2.3 RECOMMENDED ACTIONS

2.3.1 Critical Actions

Critical Actions are recommended repairs that should be addressed within one year to avoid accelerated deterioration and/or higher costs. There are no Critical Actions recommended.

2.3.2 Less Critical Actions

Less Critical Actions are recommended repairs for items that currently function satisfactorily but should be addressed in one to 2 years to avoid accelerated deterioration and/or higher costs. The repair to the cathodic protection system is recommended as a Less-Critical Action recommended to be performed within one to two years.

- Replacement of the missing anodes. Based on the as-built drawings and the inspection findings, it is estimated that approximately two-thirds of the anodes originally installed on the bulkhead wall are missing. A sacrificial anode cathodic protection system design is based on the surface area of an exposed wall in a marine environment and protects the steel wall as its coating deteriorates. It is intended to extend the life of the wall, with regular maintenance and replacement of the anodes, longer than what would be expected with coating alone. Based on the current condition of the wall and the electrical potential measurements obtained, the steel is currently protected. However, since many of the anodes are missing, the deterioration rate of the existing anodes may be accelerated, as they are protecting a larger surface area than designed for. This could increase the required frequency of anode replacement and could reduce the life of the wall if the anodes are not properly maintained.

It is recommended that the missing anodes be replaced in order to restore the full design life of the cathodic protection system and reduce the potential for corrosion damage on the bulkhead wall. Prior to a repair or replacement design, a design level inspection of the cathodic protection system should be performed to fully determine the extent and quantity of the missing anodes and identify the locations of all existing anodes. Upon completion of the design level inspection, a repair design for the cathodic protection system would be prepared.

2.3.3 Non-Critical Actions

Non-Critical Actions are repair recommendations that should be implemented as part of a scheduled maintenance program to maintain the structural integrity of a system and prevent the progression of deterioration. Postponing Non-Critical actions, however, will not compromise the stability of a structure or result in a higher cost of repair if deferred three or more years. The following actions are recommended on a Non-Critical basis:

- Replacement of the missing fender unit at Station 7+80. At this location the connection hardware is in good condition, but the fender unit is missing. Repair should include procurement and replacement of a new fender unit in-kind, utilizing the existing hardware.

- Repair/Replacement of missing and broken UHMW facing panels on the fenders. There are a total of eight individual UHMW facing panels missing or broken on the fenders. Repair should include removing the broken panels and replacing them.

- Re-coating of the mooring bollards. The existing mooring bollards are in Satisfactory condition with relatively few defects. However, there is up to 30 percent coating loss with moderate corrosion and pitting at isolated bollards.

These bollards should be cleaned and re-coated to prevent additional corrosion from occurring.

- Repair of mooring bollard foundation spall at Station 24+60, with exposed steel reinforcing bars. Repair should include chipping to remove all loose and defective concrete and cleaning of the exposed reinforcing bars.

The order-of-magnitude opinion of probable costs for these actions is $935,040. These costs are based on the preliminary findings of the bond inspection. The quantity of anodes to be replaced may need to be adjusted upon completion of a design level inspection. This estimate does not include costs for a design level inspection of the cathodic protection system. It is recommended that these actions be implemented within the three to five years. A detailed breakdown of costs is included in Appendix B.

The ASCE Waterfront Facilities Inspection and Assessment Manual suggests a maximum interval of 5 years between inspections for protected steel structures in **Satisfactory** condition and located in aggressive environments.

2.3.4 Conclusion

The inspection concludes that bulkhead structure is in good condition and retains its original structural properties. The most significant finding from the inspection was that the cathodic protection system is missing approximately 66% of the original anodes. Despite this observation, the cathodic protection system is presently continuing to function as designed, with the electrical potential measured being greater than needed to protect the steel from corrosion. The way a cathodic protection system fueled by sacrificial anodes works is the anodes corrode in preference to the steel. Once the anodes are depleted the steel will begin to corrode, which is undesirable. Based on the observations made during the underwater inspection the reduced number of anodes means that they are depleting more rapidly than intended in the design and the bulkhead will begin to corrode in the near future. Thus, if no action is taken to repair the cathodic protection, Jacobs expects the design life of the bulkhead to be less than the original design life of 50 years. Jacobs strongly recommends that repairs are performed to replace the missing anodes to prevent corrosion to the wall from occurring.

Appendix A - Level III Measurements

Dames Point Marine Terminal - Berths 16 and 17 Level III Measurements												
Station	Mudline Elevation (ft, MLW)	Location	Reading Elevation (ft, MLW)	Average Reading (in.)				Percent Loss				Electric Potential Reading (V)
				King Pile Flange	Outer Flange	Web	Inner Flange	King Pile Flange	Outer Flange	Web	Inner Flange	
1+00	-6.9	Mid	-4.1	0.777	0.517	0.462	0.517	-3.56%	-0.91%	3.82%	-0.91%	0
2+00	-28.3	Top	-1.1	NR	NR	NR	0.510	NR	NR	NR	0.39%	-0.898
		Mid	-9.1	NR	0.510	NR	0.505	NR	0.39%	NR	1.37%	0
		Mud	-26.1	NR	0.513	0.477	0.513	NR	-0.26%	0.69%	-0.26%	0
3+00	-33.9	Top	-0.6	NR	0.510	NR	0.507	NR	0.39%	NR	1.04%	-0.887
		Mid	-12.6	0.748	0.483	NR	NR	0.22%	5.60%	NR	NR	0
		Mud	-28.6	0.778	0.522	NR	0.520	-3.78%	-1.89%	NR	-1.56%	0
4+00	-36.2	Top	0.4	0.720	0.512	0.465	0.522	4.00%	0.07%	3.12%	-1.89%	0
		Mid	-13.6	0.687	0.523	0.468	0.530	8.44%	-2.21%	2.43%	-3.52%	-0.905
		Mud	-34.6	0.700	0.505	0.475	0.520	6.67%	1.37%	1.04%	-1.56%	0
5+00	-41.2	Top	0.9	NR	0.513	NR	NR	NR	-0.26%	NR	NR	0
		Mid	-10.1	0.732	0.510	NR	0.517	2.44%	0.39%	NR	-0.91%	-0.915
		Mud	-34.1	NR	0.485	0.463	0.517	NR	5.27%	3.47%	-0.91%	0
6+00	-41.2	Top	2.9	0.732	0.500	NR	NR	2.44%	2.34%	NR	NR	-0.865
		Mid	-15.1	NR	NR	NR	0.518	NR	NR	NR	-1.24%	0
		Mud	-31.1	NR	NR	0.472	NR	NR	NR	1.74%	NR	-0.882
7+00	-38.1	Top	2.9	0.732	NR	0.460	NR	2.44%	NR	4.17%	NR	0
		Mid	-15.1	NR	0.498	NR	NR	NR	2.67%	NR	NR	0
		Mud	-31.1	NR	0.497	0.475	0.515	NR	2.99%	1.04%	-0.59%	-0.851
8+00	-37.9	Top	2.9	NR	0.495	NR	NR	NR	3.32%	NR	NR	-0.843
		Mid	-17.1	NR	0.517	NR	0.513	NR	-0.91%	NR	-0.26%	-0.847
		Mud	-32.1	0.755	NR	NR	NR	-0.67%	NR	NR	NR	0
9+00	-36.4	Top	2.9	0.712	0.505	0.463	0.502	5.11%	1.37%	3.47%	2.02%	-0.857
		Mid	-14.1	NR	0.493	0.470	0.505	NR	3.65%	2.08%	1.37%	-0.87
		Mud	-32.1	NR	0.503	0.465	0.500	NR	1.69%	3.12%	2.34%	0
10+00	-37.7	Top	0.7	0.765	NR	NR	NR	-2.00%	NR	NR	NR	0
		Mid	-17.4	0.740	0.515	0.470	0.525	1.33%	-0.59%	2.08%	-2.54%	-0.9
		Mud	-30.4	0.730	NR	0.473	0.525	2.67%	NR	1.39%	-2.54%	0

Dames Point Marine Terminal - Berths 16 and 17 Level III Measurements												
Station	Mudline Elevation (ft, MLW)	Location	Reading Elevation (ft, MLW)	Average Reading (in.)				Percent Loss				Electric Potential Reading (V)
				King Pile Flange	Outer Flange	Web	Inner Flange	King Pile Flange	Outer Flange	Web	Inner Flange	
11+00	-41.1	Top	0.4	NR	0.507	NR	0.507	NR	1.04%	NR	1.04%	0
		Mid	-16.6	NR	NR	0.462	NR	NR	NR	3.82%	NR	-0.95
		Mud	-34.6	0.758	0.497	0.463	0.527	-1.11%	2.99%	3.47%	-2.86%	-0.93
12+00	-46.4	Top	1.4	NR	0.500	0.472	0.515	NR	2.34%	1.74%	-0.59%	-0.952
		Mid	-17.6	0.755	NR	0.468	0.513	-0.67%	NR	2.43%	-0.26%	0
		Mud	-34.6	NR	0.497	0.472	0.512	NR	2.99%	1.74%	0.07%	0
13+00	-39.7	Top	-1.6	0.773	0.505	NR	NR	-3.11%	1.37%	NR	NR	-0.98
		Mid	-16.6	NR	NR	0.468	NR	NR	NR	2.43%	NR	0
		Mud	-34.6	NR	NR	NR	0.502	NR	NR	NR	2.02%	0
14+00	-46.5	Top	1.9	NR	0.500	NR	NR	NR	2.34%	NR	NR	-0.95
		Mid	-17.1	0.763	NR	0.450	0.502	-1.78%	NR	6.25%	2.02%	0
		Mud	-33.1	0.773	0.505	NR	NR	-3.11%	1.37%	NR	NR	-0.95
15+00	-44.5	Top	2.9	NR	NR	NR	NR	NR	NR	NR	NR	0
		Mid	-16.1	0.752	0.515	NR	0.522	-0.22%	-0.59%	NR	-1.89%	-0.956
		Mud	-31.1	NR	0.487	NR	0.525	NR	4.95%	NR	-2.54%	0
16+00	-44.7	Top	2.9	NR	NR	NR	NR	NR	NR	NR	NR	0
		Mid	-17.1	NR	0.502	0.472	NR	NR	2.02%	1.74%	NR	-0.958
		Mud	-33.1	NR	NR	NR	NR	NR	NR	NR	NR	0
17+00	-40.7	Top	2.4	NR	0.478	NR	0.478	NR	6.58%	NR	6.58%	0
		Mid	-13.6	NR	NR	NR	NR	NR	NR	NR	NR	0
		Mud	-32.6	NR	NR	0.463	NR	NR	NR	3.47%	NR	-0.939
18+00	-38.2	Top	2.4	0.680	NR	NR	0.502	9.33%	NR	NR	2.02%	0
		Mid	-7.6	NR	0.490	NR	0.507	NR	4.30%	NR	1.04%	-0.885
		Mud	-30.6	NR	0.492	0.462	0.515	NR	3.97%	3.82%	-0.59%	0
19+00	-37.7	Top	1.2	NR	0.497	NR	NR	NR	2.99%	NR	NR	-0.882
		Mid	-14.9	NR	0.508	NR	0.505	NR	0.72%	NR	1.37%	0
		Mud	-31.9	NR	NR	NR	NR	NR	NR	NR	NR	0

Dames Point Marine Terminal - Berths 16 and 17 Level III Measurements												
Station	Mudline Elevation (ft, MLW)	Location	Reading Elevation (ft, MLW)	Average Reading (in.)				Percent Loss				Electric Potential Reading (V)
				King Pile Flange	Outer Flange	Web	Inner Flange	King Pile Flange	Outer Flange	Web	Inner Flange	
20+00	-41.6	Top	1.7	NR	NR	NR	NR	NR	NR	NR	NR	0
		Mid	-14.3	NR	NR	NR	0.498	NR	NR	NR	2.67%	0
		Mud	-30.3	0.713	NR	NR	0.498	4.89%	NR	NR	2.67%	-0.865
21+00	-38.6	Top	-0.6	NR	0.500	NR	NR	NR	2.34%	NR	NR	0
		Mid	-10.6	NR	0.507	0.468	0.502	NR	1.04%	2.43%	2.02%	-0.868
		Mud	-31.6	0.763	0.502	0.468	NR	-1.78%	2.02%	2.43%	NR	0
22+00	-38.2	Top	0.4	NR	NR	NR	0.492	NR	NR	NR	3.97%	0
		Mid	-9.6	NR	0.493	0.465	NR	NR	3.65%	3.12%	NR	-0.924
		Mud	-31.6	NR	0.490	0.467	0.485	NR	4.30%	2.78%	5.27%	0
23+00	-38.8	Top	0.9	0.780	NR	NR	NR	-4.00%	NR	NR	NR	0
		Mid	-15.1	NR	0.500	NR	0.502	NR	2.34%	NR	2.02%	-0.897
		Mud	-32.1	0.770	0.487	0.468	0.510	-2.67%	4.95%	2.43%	0.39%	0
24+00	-38.6	Top	2.9	0.742	0.487	0.460	0.493	1.11%	4.95%	4.17%	3.65%	-0.906
		Mid	-15.1	0.732	0.492	0.460	0.498	2.44%	3.97%	4.17%	2.67%	0
		Mud	-32.1	0.758	0.488	0.458	0.502	-1.11%	4.62%	4.51%	2.02%	-0.907
25+00	-38.9	Top	2.9	NR	NR	0.472	0.512	NR	NR	1.74%	0.07%	0
		Mid	-7.1	0.765	0.512	0.467	0.518	-2.00%	0.07%	2.78%	-1.24%	-0.94
		Mud	-32.1	NR	0.498	0.460	0.493	NR	2.67%	4.17%	3.65%	0
26+00	-39.1	Top	2.9	0.745	0.508	NR	0.510	0.67%	0.72%	NR	0.39%	0
		Mid	-14.1	NR	NR	0.475	NR	NR	NR	1.04%	NR	0
		Mud	-33.1	NR	NR	0.473	0.522	NR	NR	1.39%	-1.89%	0
27+00	-35.2	Top	3.4	0.735	0.512	0.465	0.515	2.00%	0.07%	3.12%	-0.59%	0
		Mid	-5.1	0.730	0.497	0.465	0.510	2.67%	2.99%	3.12%	0.39%	-0.89
		Mud	-28.1	NR	0.507	0.472	0.498	NR	1.04%	1.74%	2.67%	0
28+00	-24.1	Top	0.9	0.763	0.493	0.457	0.492	-1.78%	3.65%	4.86%	3.97%	0
		Mid	-9.1	NR	0.497	0.463	NR	NR	2.99%	3.47%	NR	-0.937
		Mud	-19.1	NR	0.493	0.462	0.498	NR	3.65%	3.82%	2.67%	0
29+00	-0.5	Mid	1.2	0.758	0.520	0.472	0.502	-1.11%	-1.56%	1.74%	2.02%	0

FL CGC #1517529

UW Inspection Report to Quantify Anode Presence and Condition
Dames Point Marine Terminal Berths 16 & 17
Jacksonville, FL

Submitted to:

TraPac Jacksonville, LLC

April 12, 2021

Submitted by:

EMC Divers, Inc.

1248 Turnbull Bay Road
New Smyrna Beach, FL 32168

FL CGC #1517529

Contents

FL CGC #1517529

Introduction

EMC Divers, Inc. was contracted under the terms and conditions of TraPac, Jacksonville, LLC purchase order number 202101010 on 2/26/2021. The scope of work was defined as the inspection for the presence and quantification of anodes on the seawall at the Dames Point Marine Terminal, Berths 16 & 17. Dive operations to conduct field investigation commenced on April 5, 2021 and completed on April 8, 2021. The following report is provided to document the findings of this inspection.

Executive Summary

Based on design drawings there is supposed to be an anode installed along the entire length of the seawall on every set of sheet piles. The elevation of the anodes is staggered between -10 feet and -30 feet. The river bottom slopes up for approximately 250' at each end of the seawall. The installation pattern of anodes along these sloped sections varies based on bottom depth and available space but continues the pattern of one anode per set of sheet piles.

The inspection revealed that of there are 132 anodes currently attached to the Berth 16 & 17 seawall. Of those 132 anodes 9 have only one end of the anodes core steel weld intact. There are 324 locations that, according to drawings, should have had an anode attached but were not present. There are 105 anodes that remain attached at the -10' elevation and 27 anodes attached at the -30' elevation.

Mechanical impact damage was noted on several anodes. These anodes remain attached but have been bent from the original configuration by some sort of impact. Based on discussions with TraPac personnel dredging via clamshell is periodically performed along the seawall and is a possible source of the impact damage.

The anodes that remain in place are primarily located at the -10' elevation and were located under the seawalls fenders.

Inspection Results

The following table identifies the location of existing and missing anodes. The table utilizes the distance numbers painted on the seawall curb to lay out stationing. Anodes that were present were tagged and numbered by the diver/inspector. These numbers are used to document locations of anodes that exhibit broken welds or impact damage. There is likely additional anodes towards the Northwest end of the seawall that could not be seen. It is assumed that they are buried.

FL CGC #1517529

TraPac - Dames Point Terminal – Seawall Anode Inventory Inspection – EMC Divers, Inc.					
Station	**El -10 Anode Present**	**El -10 Anode Missing**	**El -30 Anode Present**	**El -30 Anode Missing**	**Comments**
0-50	N/A	N/A	N/A	N/A	Above Water – Assume anodes buried
50-100	0	1	N/A	N/A	
100-200	6	2	0	0	Possible buried anodes @-30
200-300	4	4	1	6	#8 Broken Weld. Buried anodes @-30
300-400	3	6	0	8	
400-500	6	2	0	10	#10, 11 Impact Damage
500-600	5	4	2	7	#24 Broken Weld
600-700	2	6	0	7	
700-800	1	7	0	9	
800-900	0	8	0	8	
900-1000	2	8	0	9	#30 Broken Weld
1000-1100	4	5	1	9	#34 Broken Weld, #32 Impact Damage
1100-1200	3	4	0	7	#38 Broken Weld, Impact Damage
1200-1300	7	2	4	4	#40 Broken Weld, Impact Damage
1300-1400	2	7	0	9	
1400-1500	4	4	2	7	
1500-1600	8	1	5	3	
1600-1700	7	1	1	8	#120 Impact Damage
1700-1800	2	6	0	8	#71 Broken Weld
1800-1900	3	6	0	8	
1900-2000	4	5	0	9	Test Wire to lower anode broken
2000-2100	0	7	0	8	
2100-2200	4	5	1	8	
2200-2300	5	4	0	9	#83 Broken Weld, Impact Damage
2300-2400	4	5	2	6	
2400-2500	5	3	0	9	
2500-2600	4	5	1	8	#97 Broken Weld
2600-2700	2	6	3	4	
2700-2800	8	0	4	3	Bottom Slopes up
2800-End	0	9	N/A	N/A	
TOTALS	105	133	27	191	132 anodes present – 324 anodes missing

Conclusions and Recommendations

The following conclusions and recommendations are provided for consideration.

- Based on the inspection it appears that there should have been 456 anodes attached to the seawall not including those that are buried.
- 324 anodes are no longer attached to the seawall.
- 132 anodes remain attached to the seawall.
- 9 of the remaining anodes are attached by only one end of the anodes core steel.
- 6 of the remaining anodes exhibit impact damage.
- Seawall drawings show 5 anodes on the Northeast end that are assumed to be buried.
- Clamshell dredging operations are a possible cause of mechanical damage and or missing anodes.
- When installing new anodes, placement on the flat pan in section of the sheet pair will move the anodes in from the outer plane of the wall and possibly provide better protection from mechanical damage. Corrpro should be consulted to verify that such installation will not affect the ability of the anode to provide the expected cathodic protection.
- Inspection to quantify anode presence immediately prior to and after future dredge operations may be prudent to verify that dredge operations do not cause any damage or removal of anodes.