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Marine Engineering Inspection Report

Fisher Island Mainland Terminal and Residential Ferry Landing

Fisher Island, Florida

March 2021

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Fisher Island Mainland Terminal and Residential Ferry Landing, Fisher Island, Florida

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TABLE OF CONTENTS

APPENDICES

1.0 INTRODUCTION

1.1 Background

Cummins Cederberg, Inc. was retained by Fisher Island Community Association (Client) to perform a marine engineering inspection of the Mainland Terminal and Residential Ferry Landing for Fisher Island, Miami-Dade County, Florida (Project). The purpose of the inspection was to determine the present condition of the Mainland Terminal wharf, bulkhead, and piling as well as the Residential Ferry Landing bulkhead and piling. This report summarizes the inspection process and results, identifies areas requiring maintenance or replacement and provides recommendations for rehabilitation, as applicable. Quantities of repair/replacement recommendations will also be provided to facilitate the proposed repair efforts for the project site.

1.2 Scope and Objective

The Scope of Work is characterized as an engineering inspection of the marine structures. Specifically, the inspection included visual assessment of the above- and below-water components of the Mainland Terminal Wharf, western bulkhead immediately below the over-water platform, and piling, as well as the Residential Ferry Landing bulkhead elements and piling. This included visual inspection of the bulkhead elements (cap and sheet piles), the wharf elements (piles, pile caps, bridge seat, and hoist dolphins), as well as the piling elements (berthing dolphins and dolphin piling clusters) to identify cracking, damage, displacement, deterioration, corrosion, scour, sediment transport and/or undermining.

The engineering inspection of the Project Site was conducted to determine the present condition of the structures and understand the magnitude of deterioration, as well as identify areas requiring rehabilitation. The report presented herein was developed to document the existing conditions, provide an estimate of remaining service life, and provide guidance for waterfront improvements. Service life is defined as the amount of time a structure performs adequately under its environmental and design loads. Based on the results of the inspection, recommendations for rehabilitation are provided, as applicable.

1.3 Site Location

The Mainland Ferry Terminal and Residential Ferry Landing are located on the north and south shoreline, respectively, of Government Cut Channel in Miami Beach, as illustrated in Figure B-1.0 (Appendix B). The site is subject to moderate current and average tidal variation of approximately 2 feet, with seasonal higher tides (referenced tidal station NOAA tide station 8723178 Miami Beach, Government Cut, FL). Both shorelines receive moderate wave action from vessel and ferry operations and significant wave action only during storm events. The ferry terminals also receive heavy propellor wash from the ferries when vehicles enter and exit the vessel.

2.0 METHOD OF INVESTIGATION

2.1 General

The marine engineering inspection for the Mainland Terminal was conducted on February 16th, 2021 and for the Residential Ferry Landing on February 24th, 2021, in which a marine engineering dive-team visually evaluated the above-water and underwater components of the marine structural elements. The inspection was performed generally following methods presented within the *American Society of Civil Engineers (ASCE) Manual on Engineering Practice No 130: Waterfront Facilities Inspection and Assessment* as a Level I (visual) evaluation (refer to Appendix C for Inspection Level of Efforts). Photographs were obtained to further document the inspection, which are provided with descriptions in Appendix A. For inspection reference, marine structures can be divided into the following zones, in order of descending elevation:

- Atmospheric zone: region of structure that is typically exposed only to marine salt-laden air, not water.
- Splash zone: exposed to water splash from wave action, typically the area of greatest deterioration.
- Tidal zone: region between low and high tide levels, next greatest level of deterioration.
- Low water zone: zone just below the low tide level, where the water column is highly oxygenated. Higher oxygen levels accelerate deterioration by corrosion.
- Mudline: interface between structure and submerged grade, typically subject to scour.
- Embedded zone: that portion of the marine structure below the mudline, typically protected from deterioration. However, certain soil conditions can accelerate deterioration, particularly with timber members from certain marine organisms.

2.2 Procedure

The Mainland Terminal inspection commenced along the northeast bulkhead of the wharf and continued west to include the 3 western-most pile bents, the bridge seat, and the dolphin piling. The pile bents are labeled one through nine, east to west, respectively, as illustrated in Appendix B. The bulkhead inspection consisted of the bulkhead commencing at pile bent 4, and continuing west along the wharf, approximately 115 feet. The inspection of the piling commenced at the eastern end of the wharf and continued west, approximately 175 linear feet, to encompass pile bends 1 through 7. It is our understanding the older portion of the bulkhead, which spans from the east to pile bent four, is to be replaced and therefore was not inspected for its current condition.

The Residential Ferry Landing inspection commenced along the western portion of the bulkhead and continued to inspect the northeast and southeast sections of the bulkhead. The concrete hoist dolphins, distinguished as north and south, and berthing dolphins, also north and south, were

inspected along with the ferry ramp and ramp wall. The final inspection item was the timber dolphin pile at the at the western end of the ferry landing. An illustration of the inspection items is included in Appendix B of this report.

Subject to visibility and access, structural elements were inspected at the seabed for undermining or scour. Throughout the underwater inspection for the Mainland Terminal and Residential Ferry Landing, visibility was marginal, up to 10 feet, due to poor weather conditions and ferry operations. The Mainland Terminal Inspection underwater inspection began after low tide and ended on the incoming tide. The Residential Ferry Landing underwater inspection began and ended at low tide.

2.3 Signs of Deterioration

The inspection identified signs of deterioration to the waterfront structures caused by over-stressing, exposure to the marine environment, and normal service. Deterioration to the concrete, timber, and steel members was observed.

2.3.1 Concrete Deterioration

Concrete deterioration is generally a chemical or physical process resulting in cracking and spalling of individual members. Cracking can occur in multiple forms and from different causes, such as shrinkage cracking, subgrade settlement, and/or overloading. Cracks that develop prior to concrete hardening are referred to as plastic-shrinkage cracks or surface cracking. This occurs during the curing process of concrete in which the internal mass bleeds water to the surface and the surface water evaporates quicker than the bleed water. This differential curing produces stresses greater than the tensile strength of the concrete, causing cracking. Settlement cracking occurs when the concrete members settle or subside due to the consolidation of the supporting subgrade. Cracking can also occur when the concrete mix is over-saturated or insufficient concrete is provided over internal reinforcing steel. Proper mix design, curing methods and reinforcement will limit the shrinkage to micro-cracking.

Width of concrete cracking is also taken into consideration to determine severity, cause of cracking, and repair options. Typically, cracks with a width up to 1/16” are not considered structural and may be sealed to prevent saltwater (chlorides) from entering the crack. Tidal and wave action on the bulkhead facilitates chloride intrusion into the concrete through cracks or spalls. Over time, the chlorides corrode the embedded reinforcing steel, causing further deterioration.

Concrete spalling is the delamination and loosening of concrete, typically due to corrosion of embedded reinforcing steel. The corroding steel expands and breaks the concrete bond, a process which takes place after initial surface cracking and exposure to saltwater. Closed spalls are typically pre- to mid-delamination of the concrete. Open spalls are post-delamination of the concrete exposing the internal corroded reinforcing steel.

Concrete chemical deterioration or 'necking' is a form of deformation or decrease in cross-sectional area of concrete due to tidal or wave erosion.

2.3.2 Wood Deterioration

Wood deterioration can be caused by chemical, physical, or biological means. Wet rot caused by continuous wetting and drying, or salt spray can cause chemical deterioration, a phenomenon commonly referred to as "salt-kill". This process involves the absorption of chlorides from the saltwater into the wood which softens the fibers and creates the fuzzy or rotting appearance.

Splitting of wood framing members is typically the result of over-stressing, which typically occurs when a load greater than the ultimate design load is applied on the structure. Splitting often occurs at bolted connections if the members are constructed with insufficient bolt edge distance and there is not enough wood material to adequately resist the applied loads, or when the wood decays from prolonged environmental exposure.

Checking is the separation of the grains of the wood that occurs across the annual rings which can typically be seen along the ends of the wood members.

Timber decay is a process by which a fungus penetrates timber through split sections. The fungus creates a chemical alteration (or decay) of the timber by releasing enzymes into the wood which deteriorate the grain, creating nutrients for the fungus. While decay can occur in both freshwater and saltwater structures, saltwater structures can also experience the deterioration process known as "salt-kill", as explained above, and destruction by marine borers (e.g., shipworms). Much like termites, marine borers eat into timber members. Biological deterioration is caused by marine borers, which are small organisms that eat wood in the tidal zone causing a reduction of structural capacity.

Warping, weathering, and abrasion can impact timber by wear-and-tear over time. Prolonged exposure to sunlight dries wood members and causes shrinkage, which causes warping in deck boards. Prolonged exposure to moisture causes rot in timber members, reducing their load-carrying capacity. Abrasion in timber piles usually occurs from adjacent moored vessels rubbing against the pile under tidal action. Eventually, abrasion can significantly reduce the section – and associated capacity - of the pile.

2.3.3 Steel Deterioration

Corrosion is the process by which a steel component is exposed to moisture and oxygen, producing iron-oxide, or rust. Saltwater structures have a much higher rate of corrosion due to the constant exposure to chlorides in seawater or salt-laden air. The salt accelerates the corrosion process by facilitating the reaction between iron and oxygen. Resistance to corrosion can be accomplished by

using stainless-steel on smaller steel elements or coating structural steel members with a coal-tar-epoxy coating material.

3.0 OBSERVATIONS & ASSESSMENTS

The amount of time a structure is expected to meet its original functional intent under assumed design environmental and loading conditions is referred to as its service life. The typical service life of a waterfront structure is approximately 30-40 years. The actual life may be extended with proper maintenance. The ratings presented below do not consider the potential for additional damage which may be caused by a severe storm event, over-loading, or continued deterioration.

Based on these field observations and the criteria established in the ASCE Manual, the existing structures were assigned the following condition ratings and are further described below. An overall map illustrating condition is provided in Attachment C.

3.1 Mainland Ferry Terminal – Inspection Overview

The Mainland Ferry Terminal typically consists of a steel sheet pile bulkhead with a concrete cap connected to the over-water wharf deck, which is supported by concrete piling with a continuous pile cap for each bent. The western end of the wharf, which receives the ferry traffic, features a bridge seat connected to the over-water platform. This deeper cap also serves to dissipate propeller wash generated by the ferry. The wharf ramp is flanged by north and south hoist dolphins fronted by berthing dolphins to support ferry access, along with two timber dolphin piling clusters to the north. Refer to Photos Appendix A-1.0.

3.1.1 Mainland Ferry Terminal – Bulkhead

The Mainland Ferry Terminal bulkhead consists of a Z shaped steel sheet pile connected to the over-water wharf deck through a concrete cap and tied back with anchor rods. The inspected bulkhead commences at the 4th pile bent and continues west along the length of the wharf. The bulkhead east of pile bent four consists of older and perhaps original construction. The terminal bulkhead is accordingly categorized as East and West. Expansion joints were noted at the 5th and 7th pile bents. The anchor rods were measured to be 2-inches in diameter with a 7-inch x4 ½-inch plate and located approximately 1-foot on center below the concrete cap soffit. No significant undermining or seabed scour was observed along the bulkhead. Undermining or seabed scour is a result of water turbulence against or along the wall. This can be caused by current, waves or vessel propeller wash.

The **Main Ferry Terminal Bulkhead West** of pile bent 4 was observed to be in **Fair** condition (refer to Appendix D for ASCE Condition Ratings). The bulkhead generally appeared to be plumb within the inspection scope. Typical deficiencies noted consisted of:

- Concrete cracking and delamination at the cap soffit and wet face
- Corrosion staining at the cap soffit and top of concrete cap
- Concrete spalling along soffit of the concrete cap
- Moderate corrosion of anchor heads
- Minor corrosion in the splash zone of the steel sheet pile
- Minor chemical deterioration in the atmospheric zone of the concrete cap

Concrete cracking, spalling, corrosion staining, and evidence of pre-delamination of the concrete, was observed along the soffit of the concrete cap and appeared typical along the length of the bulkhead. Minor vertical cracking and concrete delamination were noted on the wet face of the concrete cap. The concrete cap is primarily in the atmospheric zone and was noted to have minor concrete chemical deterioration. Corrosion of the tiebacks and remaining concrete formwork bolts was noted throughout the bulkhead. The sheet pile generally appeared to be plumb throughout the inspection scope with minor corrosion in the splash zone.

The **Main Ferry Terminal Bulkhead East** of pile bent 4 was observed to be in **Poor** condition.

Deficiencies observed included:

- Advanced corrosion of the steel sheet piling in the splash zone
- Widespread cracking in the concrete cap, with localized areas of corrosion staining
- Spalling along the cap soffit
- Failed anchor heads
- Discontinuous waler

3.1.2 Mainland Terminal – Wharf

The wharf is constructed of a concrete deck slab approximately 230’ x 48’ supported by 18” x 18” square concrete piles connected through a concrete pile cap as illustrated in Appendix B. The over-water deck has nine pile bents numbered one through nine, east to west, respectively. The pile bents are spaced approximately at 30’ on center. Pile bents 1, and 3 through 8, consist of a continuous concrete cap with seven piles per bent, spaced approximately evenly along the pile cap. Pile bent 2 has an additional plumb pile at the southernmost pile in the bent, for a total of 8 piles. Each pile within the bent is labeled numerically from north to south. The 9th pile bent has a discontinuous concrete pile cap to allow for the ferry access bridge between the two pile caps. Each pile cap at the 9th pile bent has 3 piles for a total of 6 piles for the bent. The discontinuity of the 9th pile bent allows for wash created by the ferry to continue uninterrupted to the bridge seat, which dissipates most of the energy before it reaches bent 8 (refer to Figure B-2.0 for the bent plan). The bridge seat consists of an independent lower concrete cap on typical precast piles. The bridge is constructed of steel grating over structural steel framing. The wharf is estimated at 36 years of age, based on concrete pile stamps, which also indicate 60’ pile lengths. The wharf deck appeared to have been recently resurfaced with asphalt.

The **Mainland Terminal Wharf** was observed to be in **Fair** condition. Typical deficiencies noted consisted of:

- Typical concrete cracking in the pile heads
- Pile head spalling
- Spot cracking and spalling in concrete deck soffit
- Moderate concrete chemical deterioration in the tidal zone
- Spalling of concrete caps along southern face
- Corrosion of steel framing on access bridge

Typical observed conditions for the wharf included concrete cracking, measuring approximately 2', at the pile heads with moderate cracking in the cap soffit throughout the inspection scope. Minor cracking along the east and west face of the concrete pile cap was observed and appeared typical. Concrete delamination within the splash and tidal zones was typically observed along with corrosion staining and minor concrete chemical deterioration of the piles. Spalling along the southern face of the concrete cap was also observed at pile bent 1, and pile bents 3 through 5.

The following deterioration items were observed at each pile bent along the wharf:

Pile bent 1:

- Minor cracking at the cap soffit.
- Moderate vertical cracking along the west face of the pile cap.
- Moderate spalling at the soffit between piles 4 and 5, and between piles 6 and 7.
- Concrete spalling at the southeast corner of the pile cap.

Pile bent 2:

- Minor to moderate cracking at the pile heads.
- Major cracking along the pile cap soffit between piles 1 and 2.
- Minor cracking at the pile heads and pile cap soffit between piles 4 and 5.
- Pile 6 was observed to be spliced.

Pile bent 3:

- Minor to moderate spalling at pile 1 with soffit cracking measuring approximately 3 feet.
- Length of cracking at pile to soffit connection measured between 2' and 5'.
- Pile cap chemical deterioration along the east face extending vertically approximately 1 from the bottom of the cap.
- Minor to moderate cracking along the western face of the cap were approximately 3 feet.
- Concrete spalling along the bottom of the southern face of the concrete pile cap.

Pile bent 4:

- Minor concrete chemical deterioration at the slab to cap connection.
- Minor cracking along the eastern edge of the pile cap measuring approximately 16’ at piles 1 through 3.
- Minor cracking, measuring approximately 3’ at pile 3 along the northern face.
- Minor cracking, measuring approximately 2’ to 3’ at pile 5 along the cap soffit.
- Concrete spalling on the bottom of the southern face was observed on the concrete pile cap.

Pile bent 5:

- Cracking along the cap soffit between piles 1 and 2, measuring approximately 8 feet.
- Minor cracking measuring approximately 2’ at the pile heads of piles 3, 6 and 7.
- Closed spalls with minor concrete delamination at pile 6.
- Minor concrete spalling along the bottom of the southern face of the concrete pile cap.

Pile bent 6:

- Minor to moderate cracking along the northern face of the pile cap, measuring approximately 4’.
- Minor spalling at the northeast corner of pile 3.
- Vertical cracking along the southern face and southwest corner of pile 4, measuring approximately 3’.
- Vertical cracking measuring approximately 3’, spalling and concrete delamination at the eastern and northern face of pile 5.

Pile bent 7:

- Minor to moderate cracking along the cap soffit between piles 1 and 4.
- Minor to moderate cracking along the east and west cap soffit corners along the length of the pile bent.
- Moderate spalling with delaminated concrete measuring approximately 4’ x 2’ at the western face of pile 5.

Pile bent 8:

- Concrete deterioration at the northeast corner in the tidal zone at piles 1 and 5.
- Minor cracking along the western and eastern face of the cap.

Pile bent 9:

- Minor cracking along the length of the pile cap.
- Minor cracking at the pile heads of pile 3 and 4.
- Cracking and concrete deterioration at the northwest corner of Pile 5.

The underside of the concrete slabs along the wharf typically exhibit minor cracking and spalling at the slab joints. Moderate to major open spalling was observed at the deck slab soffit between

pile bents 6 and 7. The observed spalling measured approximately 15’ long x 1’ wide x 6” deep with exposed reinforcing steel.

The bridge seat typically exhibited minor to moderate cracking and spalling at the cap with concrete deterioration on the western face of the seat, likely from ferry wash. The steel seat gussets, bridge deck beams, and cross-bracing exhibited moderate to severe corrosion.

3.1.3 Mainland Terminal – Berthing Dolphins

The western end of the wharf has concrete berthing dolphin pilings with a timber fendering system on either side of the bridge. The berthing dolphins consist of 12 typical concrete piles per cap, with the back row (4 piles) battered. The fender system consists of an extruded rubber horizontal fender hung from the dolphin and fronted by five 12”x12” horizontal timbers enclosing 14” diameter steel pipe piles on both sides. Composite face pads are bolted to the exterior timber framing. To the north and south side of the ferry ramp connection are concrete hoist dolphins, each with 4 concrete piles per cap.

The **Mainland Terminal Berthing Dolphins** were observed to be in **Fair** condition.

Typical deficiencies noted consisted of:

- Concrete cracking, chemical deterioration and spalling of concrete dolphin pile cap.
- Minor cracks and spalling in concrete pile heads.
- Steel pipe pile corrosion.
- Fender fascia plate wear/deterioration.
- Moderate fastener corrosion.

Concrete cracking and deterioration were typically observed on the eastern face along with concrete spalling on the northeast corner and at the soffit of the northern berthing dolphin. The south berthing dolphin was observed to have 10’ cracks on its north and east faces of the concrete pile cap and minor spalling on the southeast corner. Typical concrete cracking was observed at the hoist dolphin pile cap. Typical cracking at the pile head was also noted for the berthing and hoist dolphins. The steel pipe piles were observed to be corroded in the splash zone.

3.1.4 Mainland Terminal - Timber Dolphins

Two timber pile dolphins, east and west, exist at the northern shoreline to support ferry access to the over-water platform. The eastern timber dolphin consists of 12 timber piles with rubber fenders attached along the southern face of the dolphin pile cluster. On the northern face of the eastern dolphin piling cluster, 2 of the 12 external piles are steel pipe piles. The western timber dolphin consists of 12 timber piles, 1 of which timber pile was fractured and dismembered along the south face of the dolphin cluster. The timber piles were noted to be Greenheart.

The **Mainland Terminal Timber Dolphins** were observed to be in **Serious** condition.

Deficiencies noted consisted of:

- Advanced section loss in the timber piling below the splash zone.
- Timber pile wear and rupture.
- Moderate corrosion of steel piling.
- Fender pad wear and rupture.
- Loose cable wrap.

The timber piles were noted to have up to 50% section loss within the tidal zone of the pile. Further section loss was noted toward the seabed. The western timber pile cluster exhibited one outer pile completely ruptured within the vessel impact zone, with the lower portion of the pile missing. The composite fender pads were also noted to be damaged within the impact zone. The steel piles were noted to be corroded within the splash zone.

3.2 Residential Ferry Terminal – Inspection Overview

The Residential Ferry Terminal inspection scope includes an anchored steel sheet pile bulkhead with a concrete cap. The ferry landing includes concrete hoist and berthing dolphins and a steel ramp connection. One timber dolphin pile cluster exists on the western side of the ferry landing. Refer to Photos in Appendix A-2.0.

3.2.1 Residential Ferry Terminal – Bulkhead

The Residential Ferry Terminal Bulkhead consists of a Z shaped sheet pile, 45” between outer ribs center-to-center and 12” deep in section. The bulkhead is connected through a 24” wide by 18” deep concrete cap with a 7” cap overhang from the sheet pile wet face. Anchor heads were apparent along the length of the wall.

The **Residential Ferry Terminal Bulkhead** was observed to be in **Poor** condition. Typical deficiencies noted consisted of:

- Bulkhead toe kick-out under the north hoist dolphin
- Advanced sheet pile corrosion
- Holes in steel sheet piling
- Concrete cap cracking and spalling

The sheet pile was typically observed to have advanced corrosion in the splash zone. Damage to the sheet piles was noted in spot locations along the wall. The areas of notable damage were at the westernmost corner of the bulkhead and about 75 feet - or the 20th sheet pile pair - east of the west corner. At the northern hoist dolphin, waterward rotation of the wall toe was observed. South of the northern hoist dolphin a 2’x8” spall was noted in the sheet pile wall, approximately halfway down the wall. Three other cavities in the bulkhead were noted at the connection of the northern

hoist dolphin to the ramp wall, likely due to an improper seal. Section loss with soft chemical deterioration were noted at spot locations of the sheet pile wall including: the 4th and 5th sheet pile pairs south of the southern hoist dolphin; and the 4th through 6th sheet pile pairs west of the most southeast corner of the basin.

The concrete cap exhibited the greatest deterioration along the west bulkhead, spanning from the west corner approximately 140 feet east to existing on-land fence line or at the 38th sheet pile pair from the west corner. The west bulkhead cap was typically observed to have deep concrete spalling exposing reinforcement with cracking and corrosion staining. The fence line approximately 140 feet east of the most west corner marks the start of a painted cap, which is the same construction type as the previous western cap but was noted to be less deteriorated and have only spot locations of cap spalling. A deep spall in the cap was noted along concrete cap soffit at the 47th pair of sheet piles from the most west corner. Other deep cap spalls were noted a the most northeast corner of the bulkhead and at the 2nd pair of sheet piles north of the ladder on the eastern face of the bulkhead. The eastern extend of the concrete cap was noted to be in better condition than the western section of the bulkhead, with spalls and cracks as spot conditions rather than typical condition.

3.2.2 Residential Ferry Terminal – Hoist Dolphins

The Residential Ferry Terminal has a pair of concrete hoist dolphins on the north and south sides of the ferry landing. The hoist dolphins are of concrete construction with four concrete piles per wing wall connected by a concrete cap. The concrete piles were observed to be jacketed to approximately 6 feet below the high tide line.

The **Residential Ferry Terminal Hoist Dolphins** were observed to be in **Satisfactory** condition. The pile jackets appear to be functioning as intended and the piles were noted to be in good condition below the jackets. Minor deficiencies included:

- Minor cracking with corrosion staining
- Honeycombing in the cap soffit. This is a condition where the fine aggregate is not present in the concrete, creating small voids at the surface. This can be caused by improper consolidation during casting or weathering over time. The implication is reduced cover to the reinforcing steel and accelerated corrosion. However, there is no sign of corrosion at the hoist dolphin soffits, likely due to their elevated location.
- Corrosion of connection hardware to the bulkhead

3.2.3 Residential Ferry Terminal – Ramp

The Residential Ferry Terminal Ramp is located between the two concrete wing walls which flank the ferry landing inlet. The ramp is constructed with steel grating over structural steel framing, similar to the mainland terminal. The bulkhead steps down to allow the lowering of the ramp to meet the ferry.

The **Residential Ferry Terminal Ramp** was observed to be in **Poor** condition, due to significant corrosion of the steel framing. The cross bracing exhibited the most corrosion, as the lowest level of framing on the bridge. No significant deterioration was noted on the grating. It should be noted that a top-side inspection of the terminal was not performed, due to restricted access.

3.2.4 Residential Ferry Terminal – Berthing Dolphins

The Residential Ferry Terminal Berthing Dolphins are on the north and south side of the ferry landing. The north and south dolphins are of the same construction: (2) large (approx. 48" dia.) steel pipe piles laterally supporting a timber fendering system by means of large rubber arch fenders. The fendering system consisted of 6 spiral-weld steel pipe piles (approx. 12" dia.) spaced with aluminum channels between each steel pile. The steel piles were noted to be enclosed by timber beams on the east and west, with 4 beams on front and 5 on back, both secured by steel fasteners. The steel piles were noted to be connected by an aluminum beam with steel fasteners at the top. The front face of the dolphin has composite panels over the timber fender system. The berthing dolphins have two 48" diameter steel pipe piles on their rear side connected through a steel beam to the horizontal timbers.

The **Residential Ferry Terminal Berthing Dolphins** were observed to be in **Fair** condition. Typical deficiencies noted consisted of:

- Steel pipe piles corroded in the splash zone
- Timber decay on the lower beams
- Corrosion of fasteners/connections

The steel pipes typically exhibited moderate corrosion in the splash zone. The aluminum channels displayed local flange buckling. This could be a result of vessel impact, or overtightening of the connection bolts during installation. The dolphin fasteners typically exhibited minor to moderate corrosion. The steel mounting plates between the arch and timber fenders exhibited advanced corrosion. The bottom timbers on the front fender walls exhibited severe decay.

3.2.5 Residential Ferry Landing – Timber Dolphin

On the southwest side of the ferry basin there is one timber dolphin piling cluster. The cluster is compromised of Greenheart piles with metal caps and steel cable wrapping at the top. No fender pads were present at the slip face.

The **Residential Ferry Terminal Timber Dolphin** was observed to be in **Serious** condition. Typical deficiencies consist of:

- Flexural failure of the timber piles on the slip face, just below the impact zone
- Moderate timber pile decay in the tidal zone
- Advanced wear on the timber piles at the slip face in the impact zone

4.0 SUMMARY EVALUATION AND RECOMMENDATIONS

Quantities of all recommended repairs and replacements are provided in Appendix E.

4.1 Mainland Ferry Terminal

4.1.1 Mainland Ferry Terminal - Bulkhead

Overall, the **Mainland Ferry Terminal Bulkhead** was observed to be in **Fair** to **Poor** condition. In summary, the deterioration presented at the bulkhead and most relevant to the condition rating of the bulkhead include the following:

- Cracking with corrosion staining along the wet face and soffit of the concrete cap.
- Spalling at the wet face and soffit corner of the concrete cap.
- Corrosion of the steel sheet pile and anchor heads.
- Failed anchors and waler sections

The expected service life of bulkheads in this application is approximately 40 years. Based on its construction, condition and the age of the adjacent wharf, the age of the West bulkhead may be 40 years, while the age of the East bulkhead is estimated at over 40 years.

The **Mainland Ferry Terminal West Bulkhead** is recommended for **repairs** at this time to extend the useful life of the bulkhead. Recommended repairs consist of:

- Concrete repairs to spalls and cracks along the bulkhead cap.
- Clean and recoat sheet piling above mean high water line.

The **Mainland Ferry Terminal East Bulkhead** is recommended for **replacement** at this time, due to advanced corrosion of the steel sheet piling and the deterioration of the concrete cap. The new bulkhead would likely be placed in the same footprint of the existing, to avoid partial demolition of the wharf structure. The new construction could be similar to existing, with steel sheet piling stabilized by either soil anchors or concrete batter piling. Refer to Appendix B for a schematic section of the replacement bulkhead.

4.1.2 Mainland Ferry Terminal – Wharf

Overall, the **Mainland Ferry Terminal Wharf** was observed to be in **Fair** condition. The deterioration presented at the wharf and most relevant to the condition rating of the wharf include the following:

- Cracking and spalling at the pile heads.

- Cracking along the concrete pile cap soffit.
- Cracking and spalling along the deck soffit at localized areas.
- Concrete chemical deterioration in the tidal and splash zones.
- Spalling at the exposed (south) ends of the concrete cap ends.

The **Mainland Ferry Terminal Wharf** is recommended for **repairs** at this time to extend their useful life. Recommended repairs consist of:

- Concrete repairs to cracking and spalling at the pile heads.
- Concrete repairs to cracking at the concrete pile cap soffit.
- Concrete repairs to spalling and cracking the deck soffit at localized areas.
- Concrete repairs of cracking and spalling in exposed concrete cap ends

4.1.3 Mainland Ferry Terminal – Bridge and Bridge Seat

Overall, the **Mainland Ferry Terminal Bridge and Bridge Seat** were observed to be in **Fair** condition. The deterioration presented at the bridge and bridge seat and most relevant to the condition rating include the following:

- Corrosion at the bridge deck cross-bracing.
- Corrosion at the bridge seat steel gussets.
- Cracking and spalling at the bridge seat pile cap.
- Cracking at the bridge seat pile heads.

The **Mainland Terminal Bridge and Seat** are recommended for **repairs** at this time to extend their useful life. Recommended repairs consist of:

- Replacement of the steel cross bracing at the bridge deck.
- Concrete repairs to cracking at the concrete piles and concrete pile cap.
- Clean and coat the steel gussets at the bridge seat.
- Clean and coat the steel framing at the bridge deck.

It is recommended to inspect the steel elements to remain after cleaning of corrosion to confirm no reinforcing is required.

4.1.4 Mainland Ferry Terminal – Berthing Dolphins

Overall, the **Mainland Ferry Terminal Berthing Dolphins** was observed to be in **Fair** condition. The deterioration presented at the berthing dolphins and most relevant to the condition rating of the piling include the following:

- Concrete cracking and spalling at the concrete pile cap.

- Cracks and spalling in concrete pile heads.
- Corrosion at the steel pipe piles.

The **Mainland Terminal Berthing Dolphins** are recommended for **repairs** at this time to extend their useful life. Recommended repairs consist of:

- Concrete repairs to spalling at the concrete cap.
- Concrete repairs to cracking at the concrete piles and concrete pile cap.
- Steel piles to be cleaned of corrosion and recoated

4.1.5 Mainland Ferry Terminal – Timber Dolphins

The **Mainland Terminal Timber Dolphins** were observed to be in **Serious** condition. The deterioration presented at the timber dolphins and most relevant to the condition rating of the dolphins consist of:

- Section loss below the splash zone of the timber piles.
- Corrosion of the steel pipe piles.

The **Mainland Ferry Terminal Timber Dolphins** are recommended for **repairs and replacement of select structural members** at this time to extend their useful life. Recommended repairs and replacements consist of:

- Timber pile replacement.
- Steel piles to be cleaned of corrosion and recoated.

4.2 Residential Ferry Landing

4.2.1 Residential Ferry Landing – Bulkhead

The **Residential Ferry Landing Bulkhead** was observed to be in **Poor** condition. Most relevant to the bulkhead condition rating are:

- Sheet pile corrosion and section loss
- Sheet pile voids
- Concrete cap spalls

The **Residential Ferry Landing Bulkhead** is recommended for **replacement** at this time. It is evident that prior repairs have been undertaken on the concrete cap. It is our professional opinion that the bulkhead is nearing the end of its service life.

4.2.2 Residential Ferry Landing – Ramp

The **Residential Ferry Landing Ramp** was noted to have advanced corrosion on **the cross-bracing system**, which was observed to be in **Poor** condition.

The **Residential Ferry Landing Ramp** recommended **repairs** at this time consists of:

- Cross-bracing replacement
- Clean and coat the steel framing at the bridge deck.

It is recommended to inspect the steel elements to remain after cleaning of corrosion to confirm no reinforcing is required.

4.2.3 Residential Ferry Landing – Berthing Dolphins

The **Residential Ferry Landing Berthing Dolphins** were observed to be in **Fair** condition.
Most relevant to the berthing dolphins condition rating are:

- Steel pipe piles corroded in the splash zone
- Aluminum channel corrosion
- Timber rot
- Corrosion of fasteners/connections

The **Residential Ferry Landing Berthing Dolphins** are recommended for **repairs and select replacements** at this time to extend their useful life. Recommended repairs consist of:

- Steel pipe piles to be cleaned and recoated
- Steel connections to be cleaned and recoated
- Aluminum channels to be cleaned
- Bottom timber and timber fascia to be replaced

4.2.4 Residential Ferry Landing – Timber Dolphin

The **Residential Ferry Landing Timber Dolphin** was observed to be in **Fair** condition. Typical deficiencies consist of:

- Flexural failure in the splash/impact zone
- Spilt timber piles

The **Residential Ferry Landing Timber Dolphin** are recommended for **repairs** with select timber pile replacement at this time consisting of:

- Four timber piles, one interior pile and three northern face piles, to be replaced

4.3 Summary

Overall, marine structures are of mixed conditions ranging from Satisfactory to Serious. Replacement is recommended for all marine structures in Poor condition or worse, while repairs are recommended for the remaining elements. If no remedial work is performed, routine

inspections should be performed at the following intervals, or after a major storm event: 1 year (Serious), 2 years (Poor), 10 years (Fair).

Bulkhead failure could impact adjacent landscaping, hardscaping and utilities. A common failure mechanism for older bulkhead is tie rod rupture. Tie rods provide lateral support with anchors back from the wall. For bulkhead requiring replacement or significant repairs, the top elevation of the bulkhead will need to be increased to +5.7' NAVD to be in accordance with Miami Beach ordinance for anticipated sea level rise. The repairs recommended could potentially require the top elevation of the bulkhead to be elevated. Cummins Cederberg is available to evaluate potential sea level rise impacts to the property.

Marine engineering for repairs or replacement was excluded from this inspection scope. Cummins Cederberg is available to perform this service under a separate scope. Any improvement to waterfront structures will need to meet strict regulatory permitting requirements from local, county and state agencies prior to construction. Cummins Cederberg is also available for environmental permitting services and planning.

Our assessment and recommendations are based on the data obtained from the field observations. This report may not account for unseen variations among the existing conditions, due to the limit of underwater visibility, marine growth or hidden features of the marine structures. The services performed by Cummins Cederberg are consistent with the degree of care and skill ordinarily exercised by, and consistent with, the standards of the engineering profession, practicing at the same time, under similar circumstances and in a similar location as the Project. No other warranty, expressed or implied, is herewith made.

Cummins Cederberg appreciates the opportunity to assist with the marine engineering aspects of the Fisher Island Mainland Terminal and Residential Ferry Landing. If you have any questions or concerns on the above observations and recommendations, please do not hesitate to contact us at (305) 741-6155 or jtaylor@cumminscederberg.com.

Appendix A – Photographs

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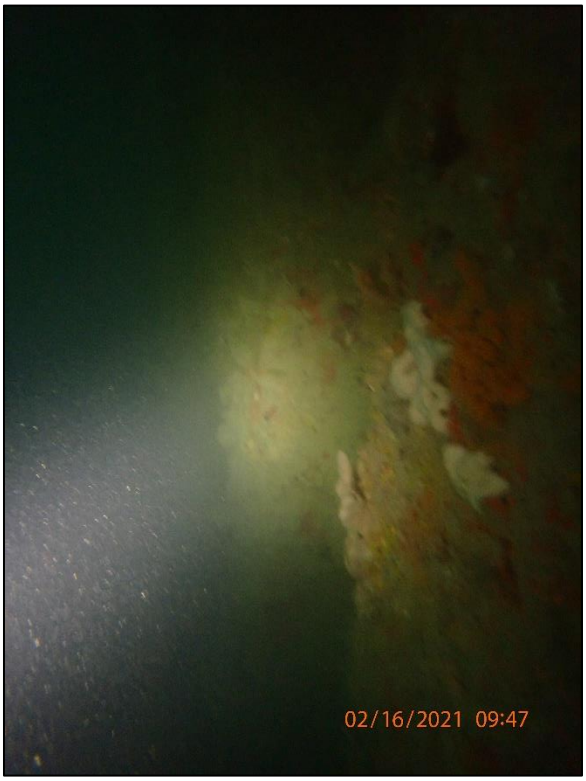
A-1.0 MAINLAND TERMINAL:

A.1: View of steel sheet pile exhibiting minor corrosion at the steel sheet pile and anchor heads.

A.2: Typical concrete cracking along the wet face and soffit of the bulkhead cap.

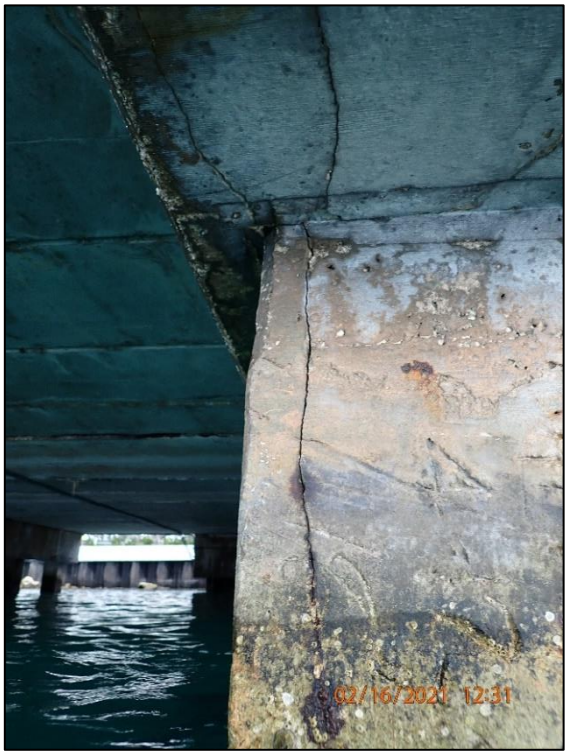
A.3: View of concrete spall and cracks in bulkhead cap adjacent to pile bent 4.



A.4: View of sheet pile bulkhead within tidal zone. Note sheets appear plumb and heavy marine growth was observed.

A.5: View of sheet pile bulkhead at the mudline. Note remnants of construction material and debris along the toe of the bulkhead.

A.6: Concrete delamination along pile cap soffit between piles 7 and 8 at pile bent 1.



A.7 Typical cracking at concrete pile head and concrete cap soffit connection.

A.8: Typical concrete pile within tidal and submerged zone. Note minimal section loss.

A.9: Typical cracking at cap soffit observed adjacent to concrete pile head connection to cap.

A.10: Spalling at concrete pile cap observed on the south face of pile bent one.

A.11: Typical cracking along pile cap soffit with minor concrete delamination.

A.12: View of concrete pile at the mudline. Note tires at the base of piles and minimal scour at the base of the pile.

A.13: View of corrosion at the steel gussets at the wharf bridge seat.

A.14: View of steel framing at wharf bridge with severe corrosion at the cross-bracing.

A.15: Concrete chemical deterioration, spalling, and corrosion staining at the bridge seat. Note steel beams from ramp secure to top of bridge seat.

A.16: View of bridge seat pile cap within tidal zone. Note marine growth on concrete and minor corrosion staining.

A.17: Concrete delamination on northern face of north hoist dolphin.

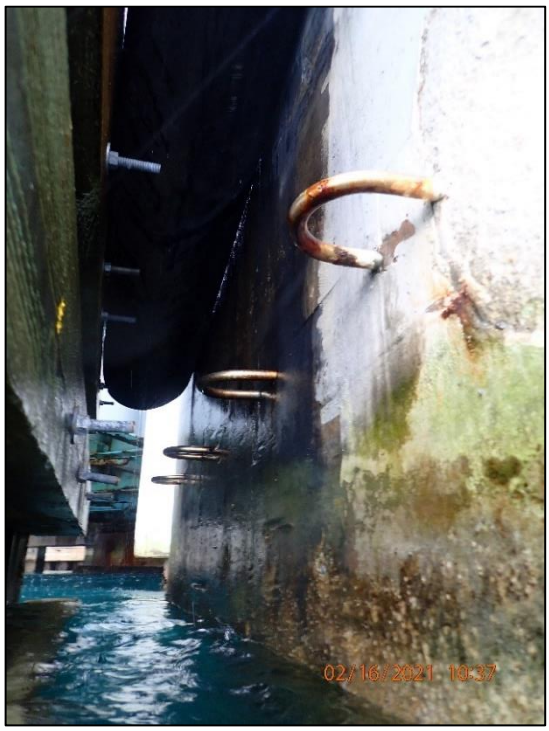
A.18: Typical hoist dolphin concrete pile in the tidal zone. Note minimal section loss of piles.

A.19: View of concrete cap soffit at hoist dolphin with typical concrete cracking.

A.20: View of concrete spall on southern face of south berthing dolphin.

A.21: View berthing dolphins within the tidal and submerged zones. Note minor cap soffit spall and corrosion staining of concrete.

A.22: View of berthing dolphin concrete pile connection to pile cap. Note marine growth on concrete piles. Piles observed to have minimal section loss.



A.23: View of berthing dolphin timber fender system within the splash zone. Note concrete chemical deterioration. Note corrosion of steel elements.

A.24: View of berthing dolphin timber fender system. Note corroded steel pipe piles.

A.25: View bottom row of berthing dolphin timbers within tidal zone. Note no timber rot and minor marine growth.

A.26: View steel pipe piles of berthing dolphins within tidal and submerged zone. Note steel corrosion and marine growth.

A.27: View of spalling at the concrete deck soffit.

A.28: View of cracking along concrete deck soffit.

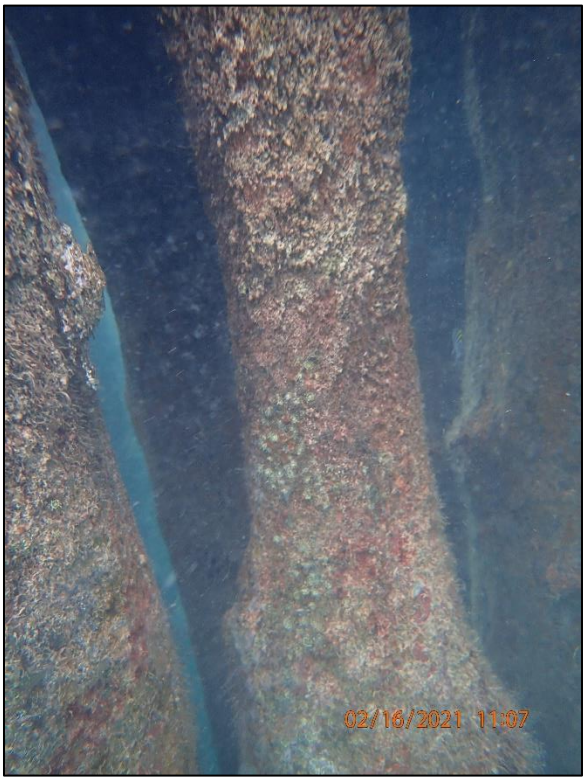
A.29: View of pile cap cracking at spanning across multiple piles in the bent.

A.30: Typical concrete cracking of berthing dolphins piling.

A.31: Typical concrete cracking at the berthing dolphin cap soffit.

A.32: Typical concrete cracking of berthing dolphin pile cap edges.

A.33: Corrosion at the steel pipe piles in splash zone at eastern timber dolphins.



A.34: Section loss in tidal zone of timber piles at the east timber dolphin, typical condition. Approximately 50% section loss.

A.35: View of timber dolphin piling at mudline. Note typical section loss of about 50% near mudline.

A.36: Southern face of west timber dolphin piling. Rubber fender pile damage and spilt pile observed within the ferry impact zone.

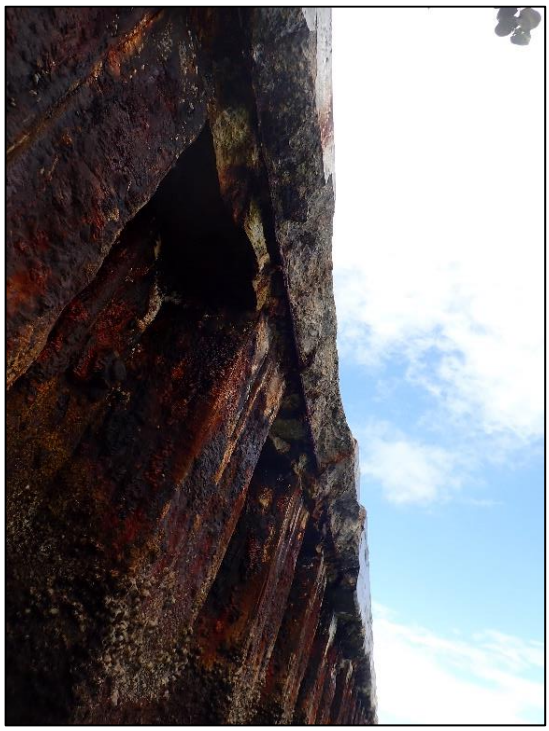
A-2.0 RESIDENTIAL FERRY LANDING:

A.37: View of western-most corner of bulkhead within inspection scope. Note deep cap spalls exposing reinforcing steel and corroded steel sheet pile.

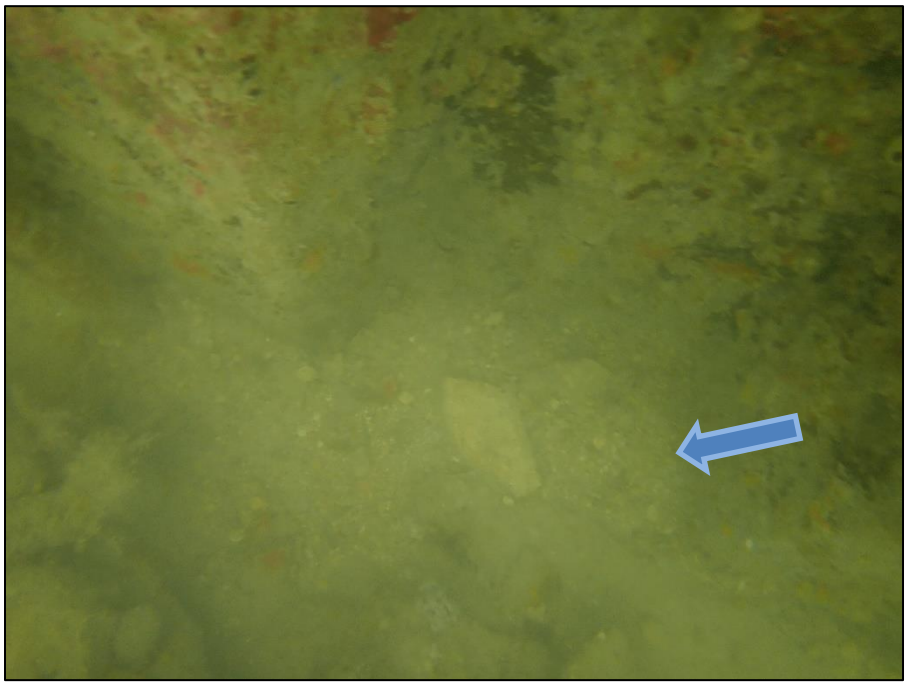
A.38: View of western-most corner of bulkhead within inspection scope. Note damage to steel sheet just below concrete cap, corrosion and marine growth in the splash zone.

A.39: View of western bulkhead at 20th sheet pair or approximately 75 feet east of the most west bulkhead corner. Note damage in sheet pile causing void in sheet. Note cap spalled off.

A.40: View of western bulkhead. Note minor corrosion holes in sheet pile, anchor rod plate and outfall, and cracking in the concrete cap soffit.



A.41: View of western bulkhead cap at the approximately 47th sheet pair from the west corner or 175 feet east of the west corner. Continuous spalling along the cap soffit exposing reinforcing steel.



A.42: View of western bulkhead toe of wall. Note moderate sediment accumulation at toe of wall, suggesting possible undermining.

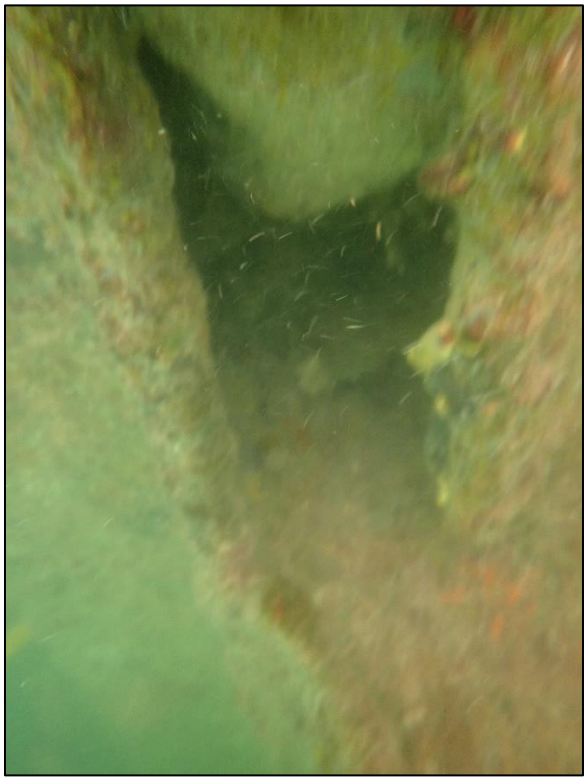
A.43: View of western bulkhead within tidal and submerged zone. Note corrosion of sheet piles and marine growth.

A.44: Eastern bulkhead at hoist dolphin connection to the concrete cap. Note cracking along the concrete soffit.

A.45: View of void through steel sheet pile wall approximately 2’x8” located halfway down the wall at the where the northern hoist dolphin meets the ferry ramp.

A.46: View of cavity through steel sheet pile at the connection between the sheet pile wall at northern start of the ferry ramp wall.

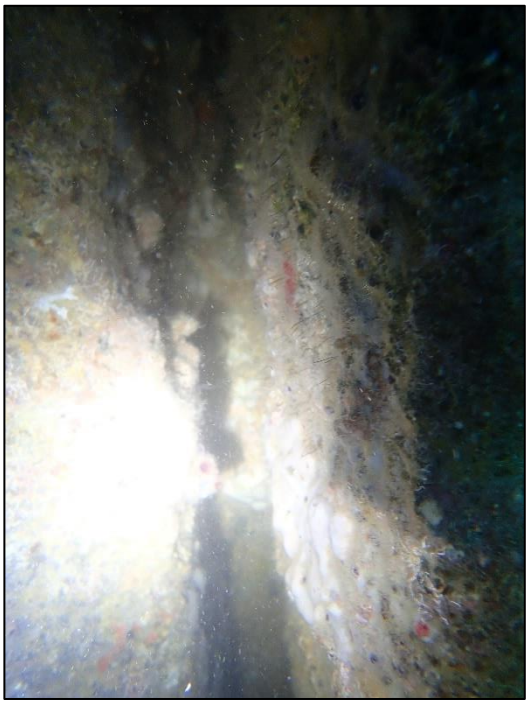
A.47: View of cavity through steel sheet pile located where the northern hoist dolphin and ferry ramp meet.



A.48: Cavity through steel sheet pile located at northern hoist dolphin and ferry ramp connection.

A.49: View of ferry ramp support. Note corrosion of steel beams and cross-bracing. Cross-bracing severely corroded.

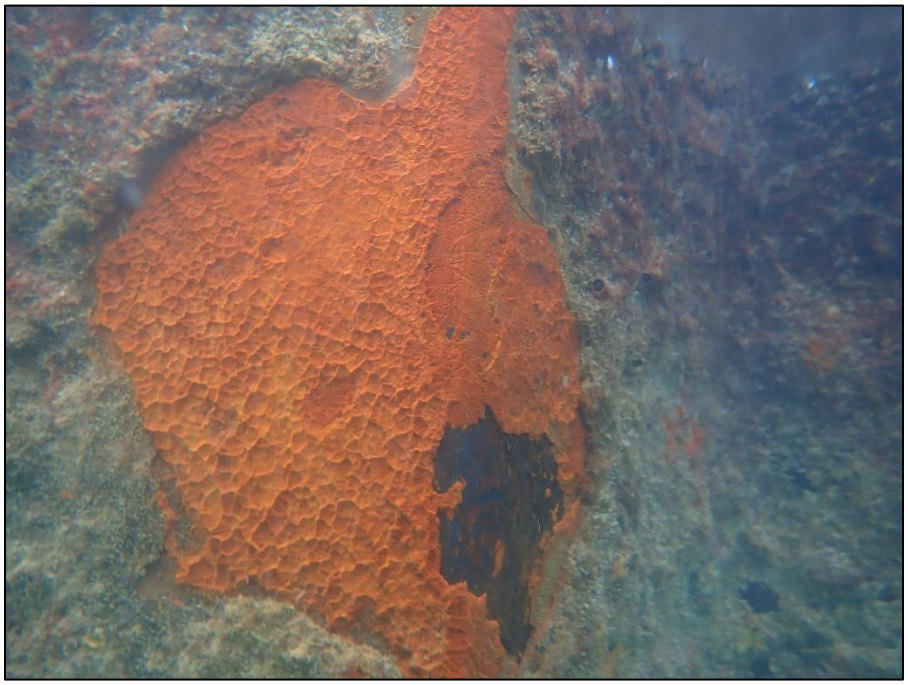
A.50: View of eastern sheet pile connection to southern hoist dolphin. Note connection appears generally intact.



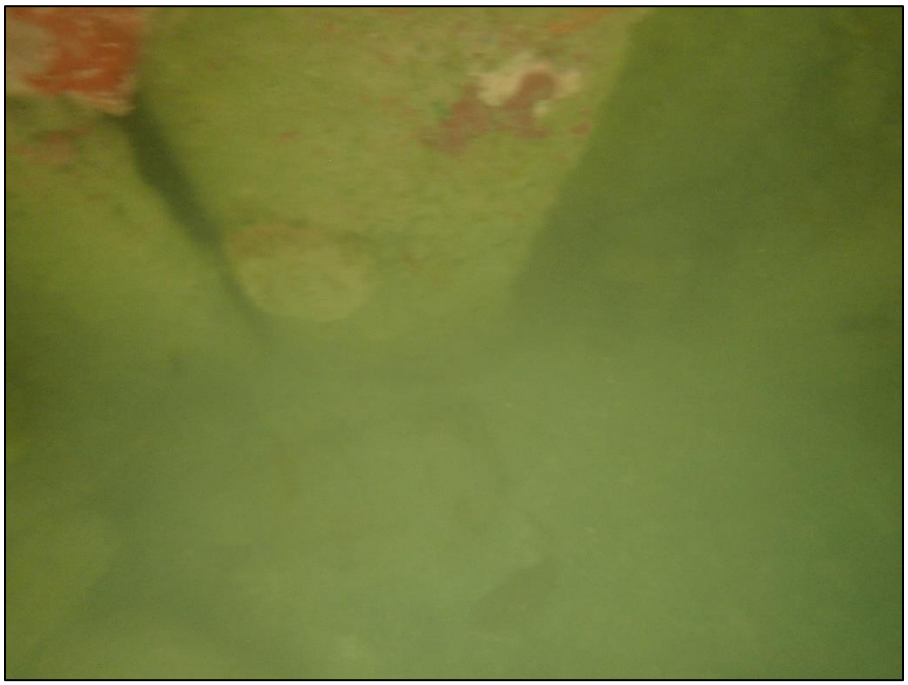
A.51: Underwater view of sheet pile wall connection with ramp wall at the southern hoist dolphin. Note seal appears to be generally intact and cavities were not observed at the time of inspection in this location, unlike the northern hoist dolphin sheet pile and ramp wall connection.

A.52: View of eastern bulkhead past southern hoist dolphin. Note soft erosion and section loss. Typical condition observed at the 4th and 5th sheet pile pairs south of the southern hoist dolphin and the 4th-6th sheet pile pairs west of the southeast corner of the bulkhead.

A.53: View of sheet pile wall void within the splash zone.

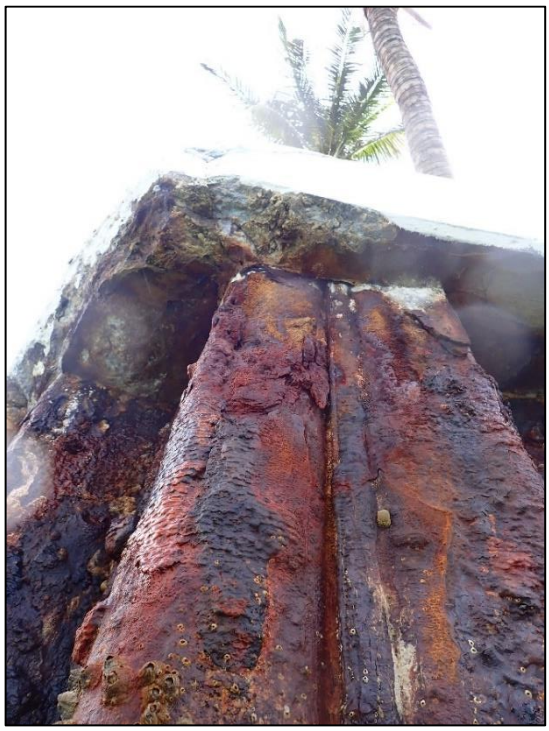


A.54: View of soft chemical deterioration and section loss of sheet pile within the tidal and low water zones.

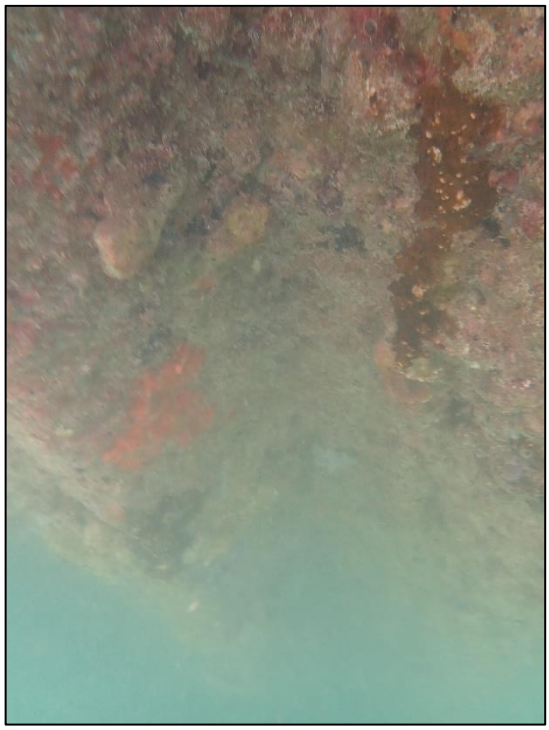


A.55: View of eastern bulkhead toe near southeast corner of ferry landing basin. Note areas of soft chemical deterioration on sheets and sediment accumulation at toe of wall.

A.56: View of spalling along the concrete cap soffit along the eastern bulkhead at the 2nd sheet pile pair from the ladder. Note sheet pile corrosion scaling, typical within inspection scope.



A.57: View of spalling at concrete cap at southern corner of bulkhead. Note exposed reinforcement in concrete cap and steel corrosion staining in cap.



A.58: View of steel sheet pile at southern corner of bulkhead within the tidal and submerged zones. Note moderate corrosion and marine growth.

A.59: View of steel pipe pile approximately 48” in diameter at the berthing dolphins. Two piles were observed for each berthing dolphin. Note corrosion in the splash zone.

A.60: View of timber rot at bottom timber and timber fascia on the berthing dolphin. Typical condition for both north and south berthing dolphins.

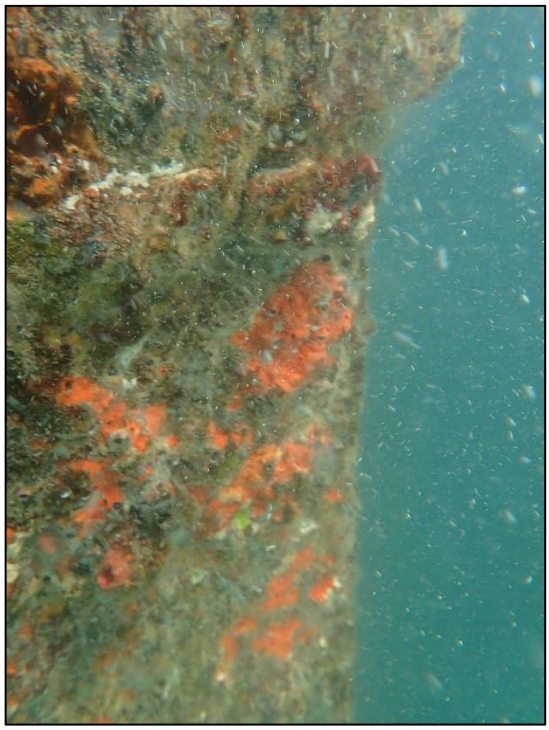
A.61: View of corrosion and marine growth within the splash zone for steel pipe piles and aluminum channels at the berthing dolphins.

A.62: View of berthing dolphin steel pipe pile within the tidal and submerged zone. Note corrosion and marine growth on pile.

A.63: View timber rot surrounding steel fasteners at the aluminum channels to the bottom timber at the berthing dolphins.

A.64: View of hoist dolphin. Note pile jackets on concrete piles.

A.65: View of jacketed hoist dolphin piles within the tidal and submerged zone. Note pile observed in good condition with pile jackets.



A.66: View of jacketed section of hoist dolphin pile end within the submerged zone. Note pile observed to be satisfactory below the pile jackets.

A.67: View of typically observed flexural failure of the timber piles in the timber dolphin. Note northern face damage of piles within the impact zone of the dolphin.

A.68: View of timber dolphin piles within the submerged zone. Minimal section loss of timber piles was observed.

Appendix B – Figures

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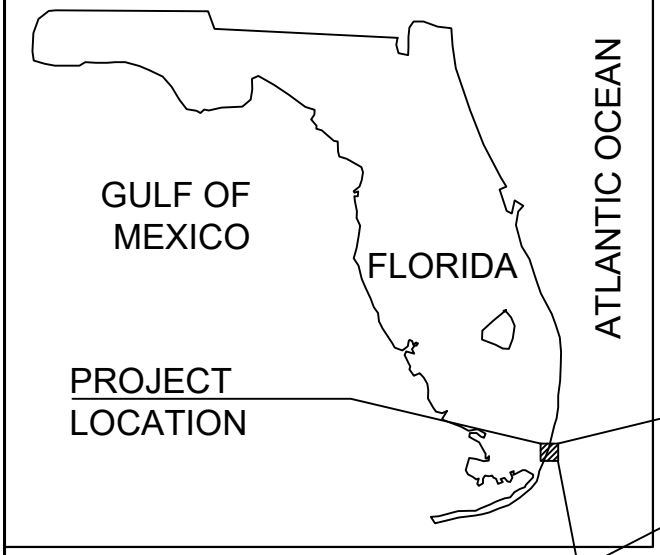
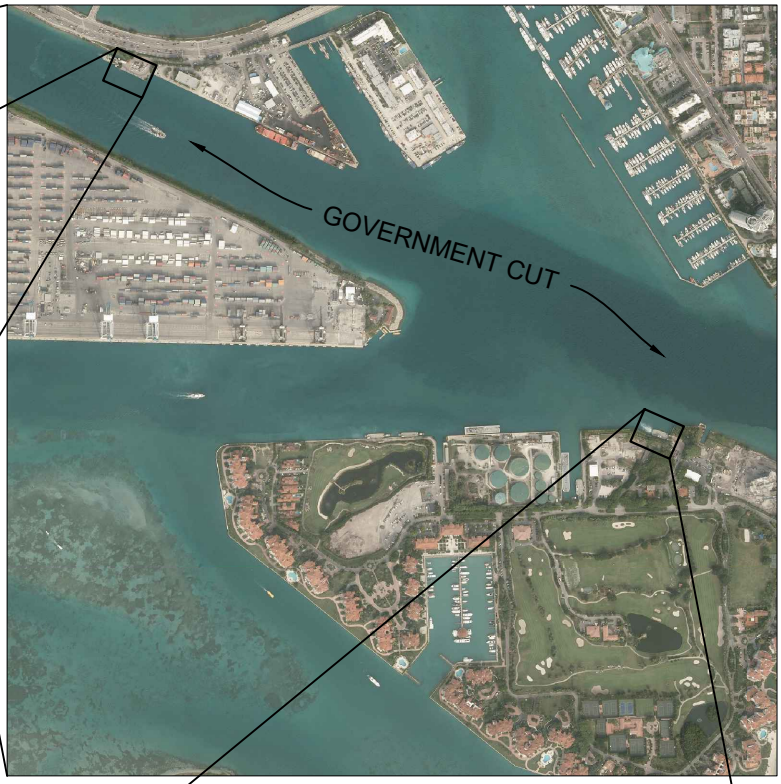
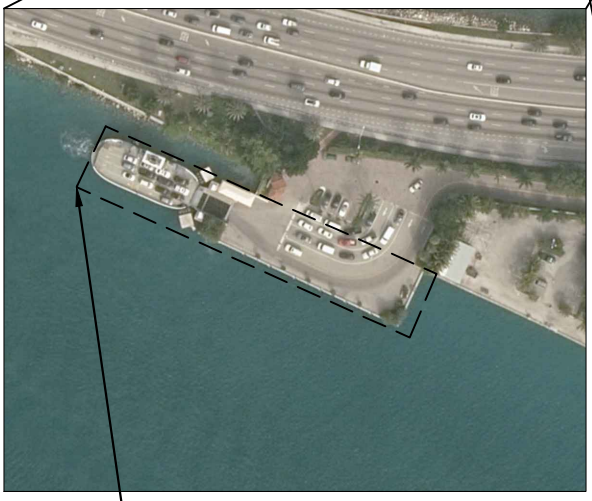


FISHER ISLAND MAINLAND FERRY TERMINAL & RESIDENTIAL FERRY LANDING INSPECTION





LIMITS OF MAINLAND FERRY TERMINAL INSPECTION

LIMITS OF RESIDENTIAL FERRY LANDING INSPECTION

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MAINLAND FERRY TERMINAL & RESIDENTIAL FERRY LANDING, FISHER ISLAND FL

MARINE INSPECTION REPORT

LOCATION MAP

JOB NO:	DATE:
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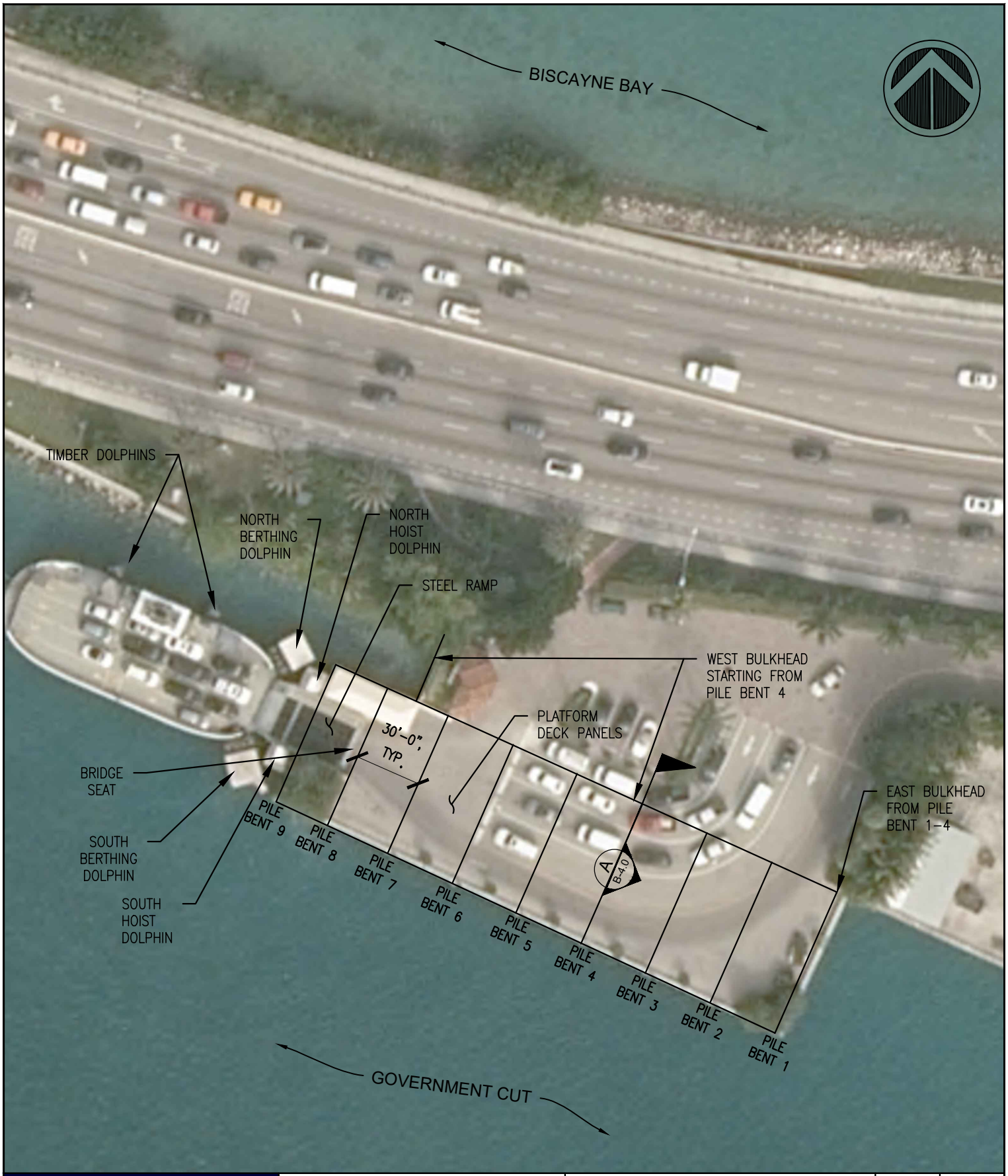

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MAINLAND FERRY TERMINAL INSPECTION SITE PLAN

JOB NO:	DATE:
30504	03/02/21
DRN BY: MG	CHK BY: JT
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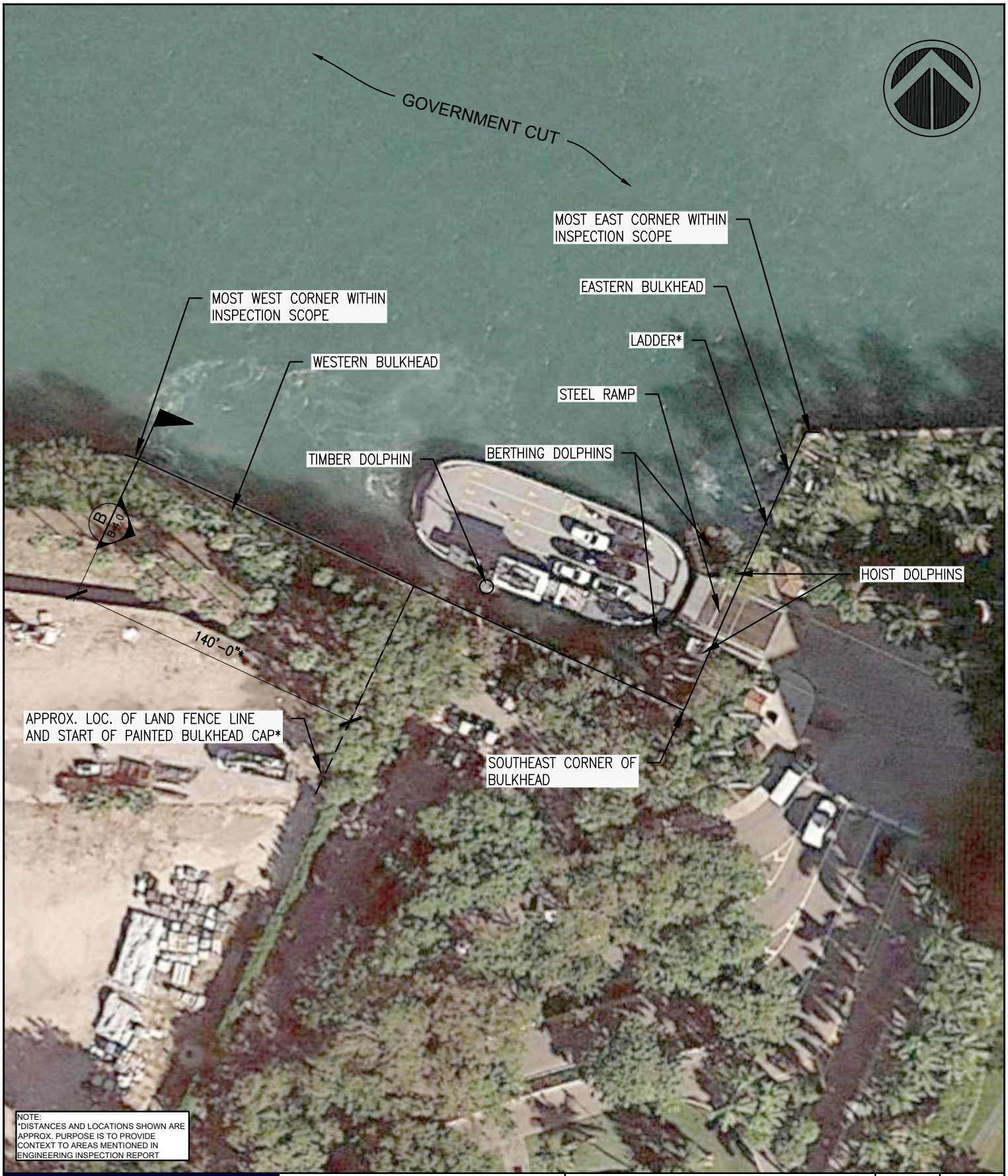

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MARINE INSPECTION REPORT

RESIDENTIAL FERRY LANDING INSPECTION SITE PLAN

JOB NO:	DATE:
30504	03/02/21
DRN BY: MG	CHK BY: JT
SHEET: B-2.1	

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MAINLAND FERRY TERMINAL CONDITION RATING PLAN

JOB NO:	DATE:
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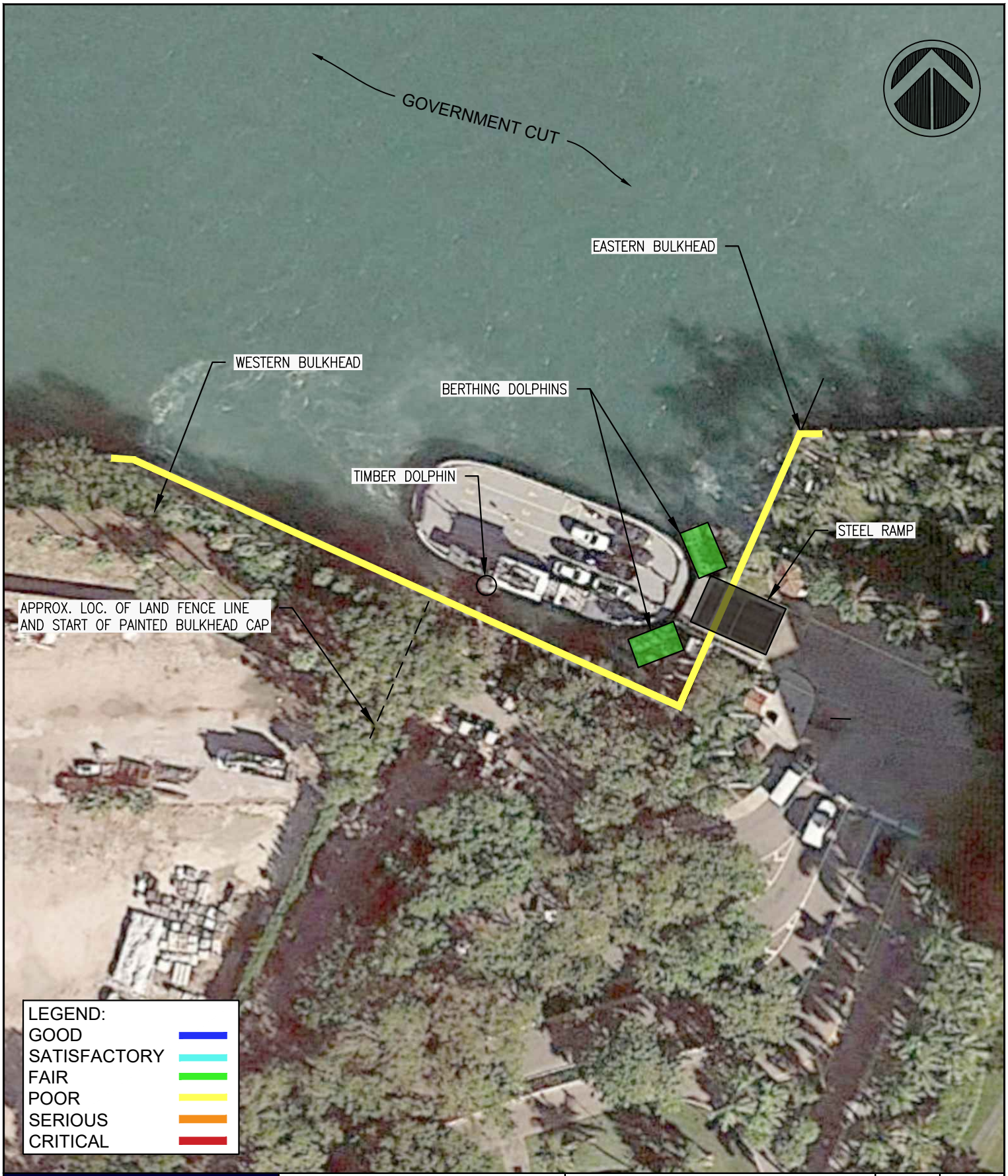

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MARINE INSPECTION REPORT

RESIDENTIAL FERRY LANDING
CONDITION RATING PLAN

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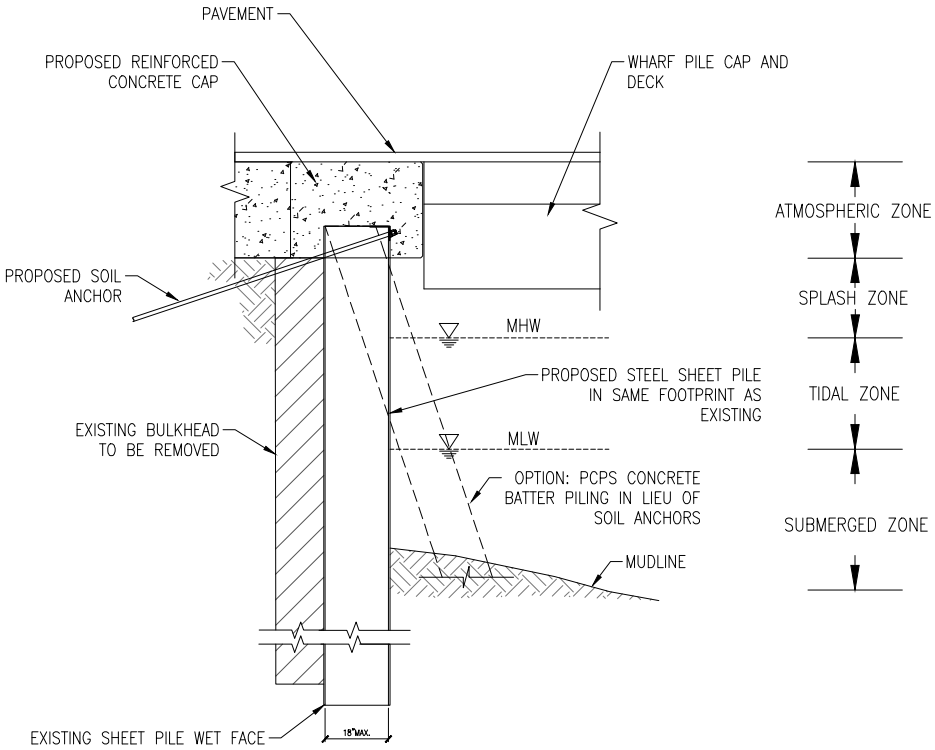
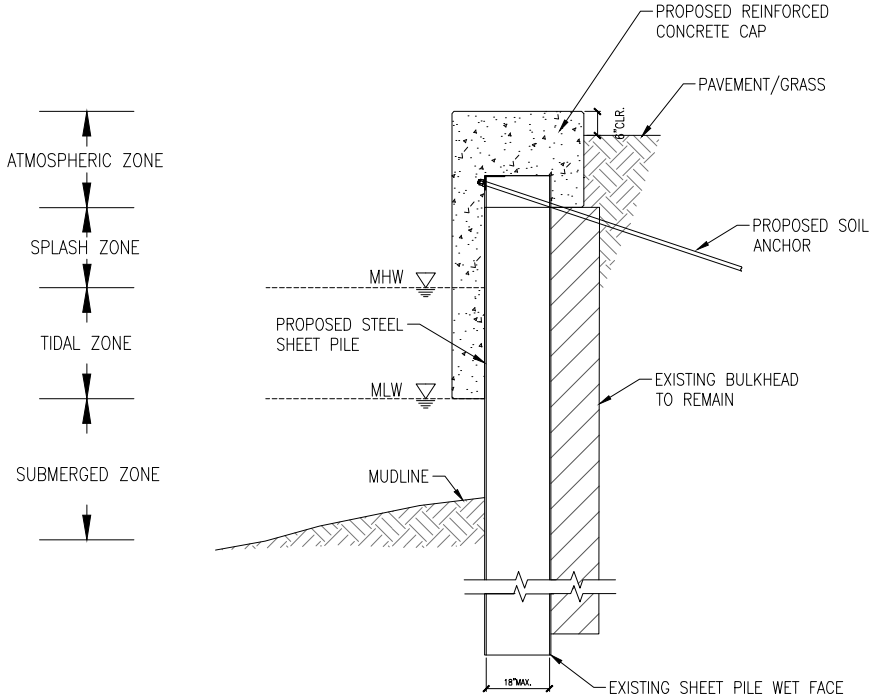


1 / B-2.0 TYP. MAINLAND TERMINAL BULKHEAD REPLACE. SECTION

SCALE: 1" = 4'



2 / B-2.0 TYP. RESIDENTIAL LANDING BULKHEAD REPLACE. SECTION

SCALE: 1" = 4'

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MAINLAND FERRY TERMINAL & RESIDENTIAL FERRY LANDING, FISHER ISLAND FL

MARINE INSPECTION REPORT

TYPICAL BULKHEAD REPLACEMENT SECTIONS

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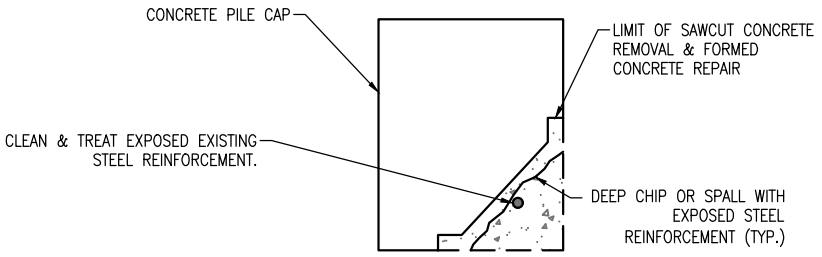
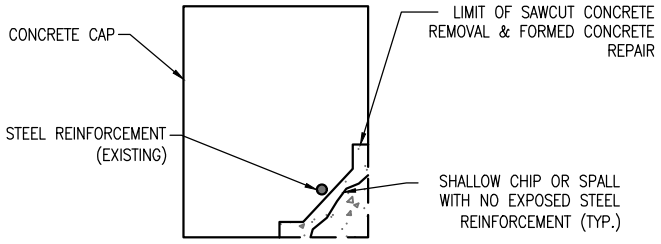
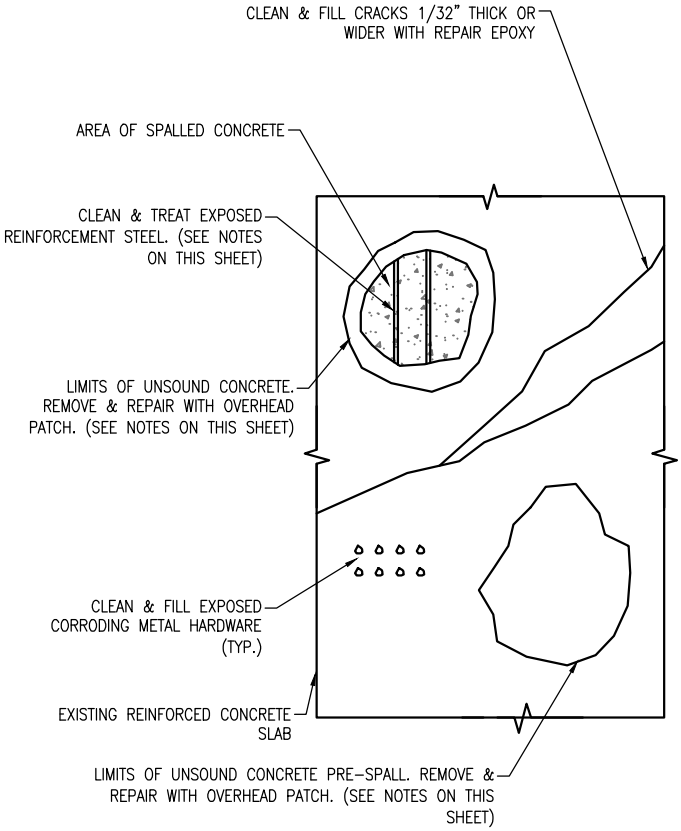


1 B-5.0 CONCRETE CAP/BEAM/PILE TYPE A REPAIR DETAIL (TYP)



2 B-5.0 CONCRETE CAP/BEAM/PILE TYPE B REPAIR DETAIL (TYP)



3 B-5.0 SOFFIT DECK REPAIR (TYP)

CONCRETE SPALL REPAIR NOTES

1. CONTRACTOR TO NOTIFY ENGINEER OF ADDITIONAL DAMAGE AREAS.
2. REMOVE ALL UNSOUND CONCRETE AROUND SPALL AREA BY CHIPPING WITH PICKS OR LIGHTWEIGHT PNEUMATIC IMPACT TOOLS TO EXPOSE SOUND CONCRETE FREE OF LOOSE AND UNSOUND MATERIALS. CARE SHALL BE TAKEN TO AVOID DAMAGE TO SOUND CONCRETE BEYOND THE LIMITS OF THE DEMOLITION AND TO AVOID DISLODGING OR DAMAGING EXPOSED, EXISTING REINFORCING STEEL.
3. SAW CUT EDGES OF REPAIR AREA TO A DEPTH OF AT LEAST 1/2" TO PROVIDE SQUARE EDGE.
4. CLEAN ALL EXPOSED SURFACES, INCLUDING THE EXPOSED SURFACES OF THE REINFORCEMENT STEEL BY POWER WIRE BRUSH. SURFACES SHALL BE FREE OF ANY BOND INHIBITING OR OTHER DELETERIOUS MATERIALS. IF REINFORCING HAS LOST MORE THAN 25% SECTION, SPLICE NEW REINFORCEMENT TO MATCH ORIGINAL. ALL EXPOSED REINFORCEMENT STEEL SHALL BE TREATED WITH APPROVED CORROSIVE INHIBITOR.
5. APPLY THORTEX EPOXY MORTAR (OR EQUIVALENT) IN ACCORDANCE WITH MANUFACTURER INSTRUCTIONS. CONTRACTOR TO SUBMIT SPECIFICATIONS TO ENGINEER FOR APPROVAL.
6. CURE REPAIR MATERIAL IN ACCORDANCE WITH MANUFACTURER INSTRUCTIONS.

CONCRETE CRACK REPAIR NOTES

1. REPAIR CRACKS GREATER THAN 1/32" AT AREAS INDICATED FOR REPAIR.
2. CONCRETE SURROUNDING THE CRACKS SHALL BE TESTED FOR SOUNDNESS BY HAND USING A HAMMER. IN THE EVENT THAT THE CONCRETE SPALLS, PROPER SPALL REPAIRS SHALL BE CONDUCTED.
3. CRACKS SHALL BE CLEANED TO ENSURE THAT CRACKS ARE SOUND, CLEAN, DRY AND FREE OF DELETERIOUS MATERIALS.
4. INJECT REPAIR EPOXY INTO CRACKS IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.

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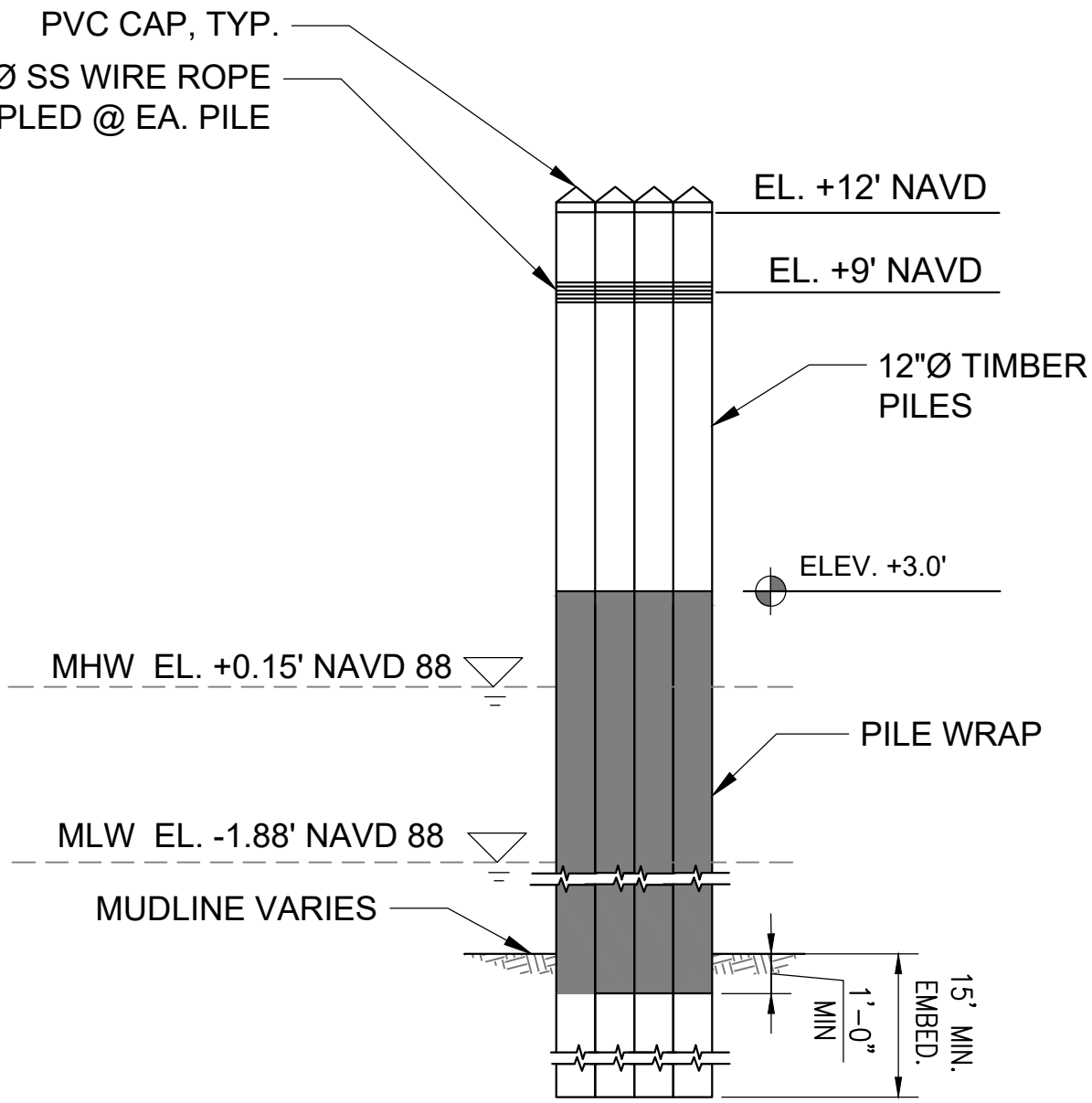
MAINLAND FERRY TERMINAL & RESIDENTIAL FERRY LANDING, FISHER ISLAND FL

MARINE INSPECTION REPORT

TYPICAL CONCRETE REPAIR DETAILS & NOTES

JOB NO:	DATE:
30504	03/02/21
DRN BY: MG	CHK BY: JT
SHEET: B-5.0	



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B-6.0

DOLPHIN PILING DETAIL
(TYP)

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MARINE INSPECTION REPORT

TYPICAL TIMBER DOLPHIN PILE DETAIL

JOB NO:	DATE:
30504	03/02/21
DRN BY: MG	CHK BY: JT
SHEET: B-6.0	

1. GENERAL

1.1. THE WORK CONSISTS OF PROVIDING ALL CONSTRUCTION, LABOR, EQUIPMENT, MATERIAL AND OPERATIONS IN CONNECTION WITH THE REPAIR OF THE BULKHEAD AND RELATED IMPROVEMENTS AS SHOWN ON THESE DRAWINGS.

1.2. ANY DISCREPANCIES IN THE PLANS WITH THE FIELD CONDITIONS SHALL BE BROUGHT TO THE IMMEDIATE ATTENTION OF THE ENGINEER. CONSTRUCTION SHALL NOT CONTINUE UNTIL THE ENGINEER HAS ADDRESSED THE DISCREPANCIES.

1.3. THE CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS TO PROTECT EXISTING STRUCTURES IN THE PROJECT VICINITY. ANY DAMAGE TO PRIVATE OR PUBLIC PROPERTY WITHIN THE PROJECT VICINITY, INCLUDING STAGING SITES, WORK AND ACCESS AREAS SHALL BE REPAIRED PROMPTLY BY THE CONTRACTOR. ANY DAMAGE AS A RESULT OF THE CONTRACTOR'S OPERATIONS SHALL BE REPAIRED AT NO COST TO THE OWNER. ALL ACCESS AND STAGING AREAS SHALL BE KEPT NEAT, ORDERLY AND IN A SAFE MANNER. ALL ACCESS AND STAGING AREAS SHALL BE RESTORED TO THE PRE-CONSTRUCTION CONDITION UPON PROJECT COMPLETION AT THE COST OF THE CONTRACTOR. THE SITE SHALL BE RESTORED BY REMOVING AND FINISHING ALL EVIDENCE FOR CONSTRUCTION. IN THE EVENT INFRASTRUCTURE (SUCH AS WALKWAYS, SIDEWALKS, FENCES, VEGETATION, ETC.) IS TEMPORARILY REMOVED OR RELOCATED OR THERE IS UNAUTHORIZED DAMAGE TO VEGETATION AND/OR FACILITIES BY THE CONTRACTOR, THE CONTRACTOR SHALL RESTORE ALL DAMAGE TO STRUCTURES AND NATURAL FEATURES TO PRE-CONSTRUCTION CONDITIONS OR BETTER.

1.4. UTILITIES ARE NOT SHOWN IN THE PLANS. CONTRACTOR IS RESPONSIBLE FOR LOCATING ALL PRESENT UTILITIES PRIOR TO CONSTRUCTION.

1.5. CONTRACTOR IS RESPONSIBLE FOR PROVIDING PROPER CLEARANCE AND PROTECTION TO ALL OVERHEAD WIRES AND OBSTRUCTIONS.

1.6. THE CONTRACTOR SHALL EXCLUDE THE PUBLIC FROM THE WORK AREAS IN THE IMMEDIATE VICINITY OF OPERATIONS. CONTRACTOR SHALL PROVIDE APPROPRIATE SAFETY MEASURES TO PROTECT THE PUBLIC.

1.7. ALL NEW STRUCTURAL WORK INCLUDING CONCRETE AND REINFORCEMENT SHALL BE ACCURATELY FIELD MEASURED AND DIMENSIONS VERIFIED BY THE CONTRACTOR PRIOR TO ORDERING MATERIALS. CONTRACTOR SHALL BE PREPARED TO MAKE FIELD ADJUSTMENTS TO ACCURATELY FIT THE NEW WORK TO EXISTING CONDITIONS.

1.8. NO CONSTRUCTION SHALL COMMENCE UNTIL ALL REQUIRED PERMITS AND APPROVALS HAVE BEEN SECURED AND THE CONTRACTOR HAS BEEN ISSUED NOTICE TO PROCEED.

1.9. ATTENTION IS DIRECTED TO THE FACT THAT THESE PLANS MAY HAVE BEEN CHANGED IN SIZE BY REPRODUCTION. THIS SHOULD BE CONSIDERED WHEN OBTAINING SCALED DATA.

1.10. CONSTRUCTION WORK SHALL BE EXECUTED IN ACCORDANCE WITH ALL LOCAL, STATE, AND NATIONAL BUILDING CODES AND GOVERNING REGULATIONS. FDEP, USACE, AND MIAMI-DADE COUNTY. CONTRACTOR SHALL ADHERE TO ALL CONDITIONS OF THE PERMITS AND EXEMPTIONS.

2. SURVEY (NOT USED)

3. DEMOLITION

3.1. CONTRACTOR SHALL VERIFY THE EXTENTS, LOCATION AND QUANTITIES OF EXISTING ELEMENTS TO BE REMOVED.

3.2. ALL DEBRIS WITHIN THE LIMITS OF THE PROJECT SHALL BE HAULED OFF SITE BY THE CONTRACTOR, AS DIRECTED BY THE OWNER, AND DISPOSED OF AT AN APPROPRIATE FACILITY.

3.3. CONTRACTOR SHALL NOT DAMAGE ANY STRUCTURAL COMPONENTS BEYOND THE DEMOLITION REQUIREMENTS DEPICTED IN THESE DRAWINGS. ANY DAMAGE SHALL BE REPAIRED AT THE CONTRACTOR'S EXPENSE.

4. TIMBER

4.1. 4.1.ALL TIMBER PIER PILES TO BE SOUTHERN YELLOW PINE (SYP) AND COMPLY WITH ASTM D25-79 AND BE PRESSURE TREATED W/ CCA FEDERAL SPECS TT-W-550D(1) OR TT-W-00550E(1) AND AWFA-P-4.

4.2. PILES SHALL HAVE A MINIMUM DIAMETER OF 12 INCHES MEASURED 3' FR. BUTT.

4.3. PILES DRIVING LOGS SHALL BE RECORDED FOR ALL DRIVEN PILES.

4.4. PILE WRAP SHALL BE DENSO SEA SHIELD SERIES 90 OR APPROVED EQUAL.

5. TIDAL DATA

5.1. CONTRACTOR MAY NEED TO ADJUST HIS WORK PLAN TO ACCOUNT FOR ACTUAL WATER LEVELS AND CHANGING WATER LEVELS. THE SITE MAY BE SUBJECT TO VARIABLE WAVE AND SURGE CONDITIONS AND IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO PROVIDE TEMPORARY SUPPORT FOR MARINE STRUCTURES AND SHORELINE DURING CONSTRUCTION. TIDAL DATA OBTAINED NOAA STATION 8723214.

6. DESIGN CRITERIA (NOT USED)

7. SUBMITTALS (NOT USED)

8. EXCAVATION AND BACKFILL

8.1. EXCAVATED MATERIAL MAY BE TEMPORARILY STOCKPILED IN THE STAGING AREA FOR OFF-SITE DISPOSAL AT AN APPROVED UPLAND FACILITY.

8.2. BACKFILL SHALL BE CLEAN GRAVEL (#57 STONE).

8.3. BACKFILL SHALL BE TOPPED WITH 6" OF CLEAN TOPSOIL AND SODDED TO MEET THE GRADES SPECIFIED HEREIN.

9. HARDWARE

9.1. ALL HARDWARE, BOLTS, AND OTHER MISC. STEEL COMPONENTS SHALL BE STAINLESS STEEL UNLESS OTHERWISE NOTED.

9.2. DOWELS OR ANCHORS EMBEDDED INTO CONCRETE SHALL BE ANCHORED WITH SIMPSON SET TWO-PART EPOXY OR ENGINEER APPROVED EQUIVALENT. ANCHOR HOLES SHALL BE DRIVEN TO MINIMUM DEPTH SHOWN ON THE PLANS, AND SHALL BE THOROUGHLY CLEANED OUT AND DRY PRIOR TO INJECTION OF EPOXY.

10. CONCRETE

10.1. FORMS FOR THIS WORK SHALL BE MADE OF EITHER WOOD OR METAL. THEY SHALL BE STRAIGHT AND FREE OF WARP OR BENDS. THEY SHALL HAVE SUFFICIENT STRENGTH AND RIGIDITY, WHEN STAKED, TO RESIST THE PRESSURE OF THE CONCRETE WITHOUT SPRINGING. IF WOODEN FORMS ARE USED, THEY SHALL BE OF ADEQUATE SECTION AND SHALL HAVE A FLAT SURFACE ON TOP. FORMS SHALL HAVE A DEPTH AT LEAST EQUAL TO THE VERTICAL DIMENSIONS FOR THE DEPTH OF THE CONCRETE BEING DEPOSITED AGAINST THEM. WHEN READY FOR THE CONCRETE TO BE DEPOSITED, THEY SHALL NOT VARY FROM THE APPROVED LINE AND GRADE, AND SHALL BE KEPT SO UNTIL THE CONCRETE HAS SET.

10.2. JUST PRIOR TO PLACING THE CONCRETE ANY WOODEN FORMS SHALL BE MOISTENED AND ALL STEEL REINFORCING SHALL BE RINSED WITH FRESH WATER. THE CONCRETE SHALL BE PLACED IN THE FORMS AND TAMPED IN PLACE SO THAT ALL HONEYCOMBS WILL BE ELIMINATED AND SUFFICIENT MORTAR BROUGHT TO A SMOOTH EVEN FINISH BY MEANS OF A FLOAT.

10.3. CONTRACTOR SHALL BE PREPARED TO PLACE CONCRETE OF LOWER MEMBERS OF THE MARINE STRUCTURES IN SUBMERGED CONDITIONS UTILIZING TREMIE METHODS AT NO ADDITIONAL COST.

10.4. NO CONCRETE SHALL BE POURED DURING UNFAVORABLE WEATHER OR SEA CONDITIONS.

10.5. ALL STEEL SHALL HAVE A MINIMUM OF 3 INCHES CONCRETE COVER, UNLESS OTHERWISE NOTED. NO CHAIRS OR OTHER METAL SHALL PROTRUDE FROM SURFACE OF CONCRETE.

10.6. CAST-IN-PLACE CONCRETE SHALL BE A MINIMUM OF 5,000 PSI COMPRESSIVE STRENGTH AT 28 DAYS. WATER CEMENT RATIO (W/C) SHALL BE LESS THAN OR EQUAL TO 0.4. PROVIDE MIX DESIGN FOR A CLASS IV CONCRETE FOR AN EXTREMELY AGGRESSIVE (MARINE) ENVIRONMENT IN ACCORDANCE WITH FDOT SPECIFICATIONS. PROVIDE SUFFICIENT AMOUNT OF FLY ASH AND SILICA FUME TO THE CEMENT CONTENT. CONTRACTOR SHALL PROVIDE MIX DESIGN TO ENGINEER FOR APPROVAL 10 DAYS PRIOR TO CONCRETE PLACEMENT.

10.7. NO WATER SHALL BE ADDED TO CONCRETE AT THE JOB SITE UNLESS AUTHORIZED BY THE ENGINEER OR SPECIAL INSPECTOR.

10.8. WHEN SURFACE FINISHING IS COMPLETED, THE STRUCTURE SHALL BE PROTECTED AGAINST WAVE SPLASH FOR TWO DAYS AND CURED PER APPLICABLE PARAGRAPHS OF SECTION 400-16 OF THE FDOT STANDARD SPECIFICATIONS. CURING SHALL OCCUR FOR AT LEAST 7 DAYS.

10.9. A SURFACE PENETRANT SEALER OF ALKYL-ALKOXY SILANE CLASSIFICATION, SUCH AS BASF ENVIROSEAL, OR APPROVED EQUAL SHALL BE APPLIED ALL EXPOSED CONCRETE.

10.10. APPLY SIKA ARMATEC 110 BONDING AGENT, OR APPROVED EQUAL, AT CONSTRUCTION JOINTS PRIOR TO PLACEMENT OF NEW CONCRETE.

10.11. COMPONENTS NOT CONSTRUCTED ACCORDING TO THESE SPECIFICATIONS SHALL BE REMOVED AND REPLACED PROPERLY AT THE EXPENSE OF THE CONTRACTOR.

10.12. THE FACES OF THE FINISHED STRUCTURES SHALL BE TRUE, STRAIGHT, AND OF UNIFORM WIDTH, FREE FROM HUMPS, SAGS, OR OTHER IRREGULARITIES EXCEPT AS SPECIFIED IN THE PLANS. THE CONTRACTOR SHALL REPLACE ANY DEFICIENT SEGMENTS.

10.13. CONCRETE FORMWORKERS AND FINISHERS:
THE CONTRACTOR SHALL SUPPLY A SUFFICIENT NUMBER OF EXPERIENCED CONCRETE FORMWORKERS AND FINISHERS IN ORDER TO COMPLETE THE WORK. A CONCRETE FOREMAN WHO HAS A THOROUGH UNDERSTANDING OF THE PLANS, SPECIFICATIONS, AND REFERENCED SPECIFICATIONS SHALL SUPERVISE ALL FORMWORKERS AND FINISHERS. NO SUB-STANDARD WORKMANSHIP WILL BE ACCEPTED.

10.14. CONCRETE TRANSPORTATION:
CONCRETE DELIVERED FROM A READY MIX PLANT SHALL BE TRANSPORTED IN ACCORDANCE TO FDOT SECTION 345-13. CONCRETE THAT IS NOT PLACED IN THE FORM WITHIN THE SPECIFIED TIME LIMITS WILL BE REJECTED AND NOT INCLUDED IN THE WORK. CONTRACTOR SHALL BEAR ALL COSTS FOR REJECTED CONCRETE. CONCRETE SHALL NOT BE PLACED IN THE FORMS UNTIL THE REINFORCING STEEL PLACEMENT HAS BEEN APPROVED BY THE ENGINEER.

10.15. REINFORCED CONCRETE MATERIALS TESTING:
THE CONTRACTOR SHALL HAVE AN INDEPENDENT TESTING LABORATORY TEST THE CONCRETE USED IN THE WORK. THE TEST SHALL INCLUDE 7, 14, AND 28 DAY COMPRESSIVE STRENGTH TESTS. THE RESULTS SHALL BE SUPPLIED TO THE ENGINEER. THE TESTS SHALL BE IN ACCORDANCE WITH ASTM C31, C39, AND C617.

10.16. ADHESIVE BONDED DOWELS SHALL BE INSTALLED IN ACCORDANCE WITH FDOT SECTION 416.

11. STEEL

11.1. ALL REINFORCING STEEL SHALL CONFORM TO ASTM A615, GRADE 60, DEFORMED BARS FREE FROM LOOSE RUST AND SCALE.

11.2. REINFORCING STEEL, SUPPORTS, AND TIE WIRE SHALL BE HOT-DIPPED GALVANIZED IN ACCORDANCE WITH ASTM A767.

11.3. MMFX OR CHROMX 4100 STEEL CAN BE USED AS AN ALTERNATE TO HOT-DIPPED GALVANIZED STEEL AT CONTRACTORS OPTION.

11.4. STEEL SHALL BE PLACED AS SHOWN IN THE PLANS. ALL ACCESSORIES SHALL BE PLASTIC ONLY TO SUPPORT REINFORCING EXPOSED TO WEATHER. ALL REINFORCING STEEL SHALL BE ACCURATELY LOCATED AND FIRMLY HELD IN PLACE BEFORE AND DURING THE PLACEMENT OF CONCRETE.

11.5. CONTRACTOR SHALL ADVISE ENGINEER OF THE REQUIRED REINFORCING STEEL SITE REVIEW AT LEAST 24 HOURS PRIOR TO PLACING OF CONCRETE.

11.6. CONTRACTOR TO ALLOW FOR 5% ADDITIONAL REINFORCING FOR ENGINEER TO USE AT HIS DISCRETION DURING CONSTRUCTION. ANY UNUSED PORTION SHALL BE CREDITED BACK TO OWNER UPON COMPLETION OF PROJECT.

12. ROCK (NOT USED)

13. STEEL SHEET PILING

13.1. STEEL SHEET PILING SHALL BE OF THE SECTIONS INDICATED, AND SHALL BE ASTM A572 GRADE 60 OR HIGHER.

13.2. A THREE-COAT SHOP APPLIED SYSTEM COMPRISED OF AN INORGANIC ZINC PRIMER AND TWO COATS OF COAL TAR-EPOXY IN ACCORDANCE WITH FDOT STANDARD SECTION 560 SHALL BE APPLIED TO THE TOP 8' OF WET FACE OF STEEL SHEET PILE AND H-PILES. FIRST COAT APPLICATION SHALL YIELD DRY FILM THICKNESS OF 8 TO 10 MILS. TOTAL DRY FILM THICKNESS OF THE TWO COATS SHALL BE MINIMUM 16 MILS. ANY DAMAGE TO COATING FROM SHIPPING, HANDLING, INSTALLATION OR OTHER REASONS SHALL BE REPAIRED AT NOT ADDITIONAL COST TO OWNER.

13.3. CONTRACTOR TO DRIVE SHEET PILING IN ACCORDANCE WITH FDOT 455-9.

13.4. ANY DAMAGED COATING DUE TO HANDLING, DRIVING, ETC, SHALL BE REPAIRED IN STRICT ACCORDANCE WITH COATING MANUFACTURER INSTRUCTIONS.

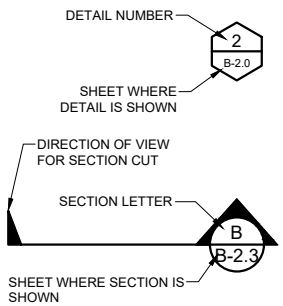
13.5. ALL PILES SHALL BE DRIVEN TO THE MINIMUM TIP ELEVATIONS INDICATED UNLESS OTHERWISE APPROVED BY ENGINEER.

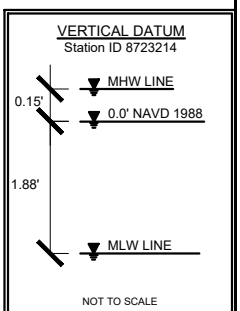
13.6. EXTEND EXISTING DRAINAGE PIPES THROUGH STEEL SHEET PILE AT SAME ELEVATION.

13.7. CONTRACTOR SHALL BE PREPARED TO DRIVE SHEET PILING THROUGH LIMESTONE LAYERS; REFER TO GEOTECHNICAL REPORT.

13.8. INDEPENDENT TESTING LAB TO PERFORM VIBRATION MONITORING THROUGHOUT THE PILE INSTALLATION. MONITORING PLAN SHALL BE SUBMITTED FOR APPROVAL BY ENGINEER AND OWNER.

ABBREVIATIONS	
ACI	AMERICAN CONCRETE INSTITUTE
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS
CONT	CONTINUOUS
CONT'D	CONTINUED
FDEP	FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
FDOT	FLORIDA DEPARTMENT OF TRANSPORTATION
KSI	KIPS PER SQUARE INCH
MHW	MEAN HIGH WATER
MIN	MINIMUM
MLW	MEAN LOW WATER
NAVD	NORTH AMERICAN VERTICAL DATUM
NGVD	NATIONAL GEODETIC VERTICAL DATUM
PERA	PERMITTING, ENVIRONMENT, AND REGULATORY AFFAIRS
PSI	POUNDS PER SQUARE INCH
TYP	TYPICAL
USACE	UNITED STATES ARMY CORPS OF ENGINEERS
W/C	WATER/CEMENT RATIO





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MARINE INSPECTION REPORT

GENERAL NOTES

JOB NO:	DATE:
30504	03/02/21
DRN BY: MG	CHK BY: JT
SHEET: B-7.0	

Appendix C – Inspection Levels of Effort

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Table C-1: Definition of Inspection Levels of Effort

Level	Definition
I	Includes a close visual examination above and underwater or a tactile examination using large sweeping motions of the hands where visibility is limited underwater. Although the Level I effort is often referred to as a "swim by" inspection, it must be detailed enough to detect obvious major damage or deterioration due to overstress or other severe deterioration. It should confirm the continuity of the full length of all members and system components and detect undermining or exposure of normally buried elements. A Level I effort may also include limited probing of the substructure and adjacent channel bottom.
II	A detailed inspection above and underwater that requires wrappings, coatings, corrosion, and/or marine growth to be removed from portions of the structure. Underwater marine growth removal is costly, hence, the need to base the inspection on a representative sampling of components. For piles, a 12-in. high band should be cleaned at designated locations, generally near the low waterline, at the mudline, and midway between the low waterline and the mudline. On a rectangular pile, the marine growth removal should include at least three sides; on an octagonal pile, at least six sides; and on a round pile, at least three-fourths of the perimeter. On large-diameter piles, 3 ft or greater, 1 ft × 1 ft areas should be cleaned at four locations approximately equally spaced around the perimeter, at each elevation. On large solid faced elements, such as retaining structures, 1 ft × 1 ft areas should be cleaned at these three elevations. The Level II effort should also focus on typical areas of weakness such as connections, attachment points, and welds. The Level II effort is intended to detect and identify damaged and deteriorated areas that may be hidden by surface bio-fouling, coating, or corrosion, or that which may not be readily accessible for a Level I inspection effort. The thoroughness of marine growth removal should be governed by what is necessary to discern the condition of the underlying material. Removal of all bio-fouling staining is generally not required. Means and methods for the removal of bio-fouling growth are not typically defined in a scope of work. However, it may be appropriate for owners to specify particular methods based on environmental and site conditions or on concern for maintaining the integrity of coating materials. Methods may include hand scrapers or mechanical systems ranging from high pressure water blasters to barnacle busters and pressurized air bubble devices based on the principles of cavitation.
III	A detailed inspection above and underwater typically involving nondestructive or partially destructive testing conducted to detect hidden or interior damage, or to evaluate material homogeneity. Typical inspection and testing techniques include the use of ultrasonic, coring or boring, physical

material sampling, and in situ hardness testing. Level III testing is generally limited to key structural areas, areas that are suspect or areas that may be representative of the structure or system.

Reference: American Society of Civil Engineers (ASCE) Manual on Engineering Practice No. 130: Waterfront Facilities Inspection and Assessment, 2015

Appendix D – ASCE Underwater Condition Rating System

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Table D-1: Routine Underwater Condition Assessment Ratings[1]

Rating		Description
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 is observed. Localized areas of moderate to advance 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 need to 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 bases 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 very high priority basis with strong urgency.

Reference: American Society of Civil Engineers (ASCE) Manual on Engineering Practice No. 130: Waterfront Facilities Inspection and Assessment, 2015

[1] Ratings are used to describe the existing structure compared with the structure when newly built. The possibility that the structure may have been designed for loads that are lower than the current standards for design should have no influence on the ratings.

Appendix E – Repair and Replacement Quantities

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Table E-1: Mainland Ferry Terminal Repair and Replacement Quantities

Fisher Island Mainland Ferry Terminal Repair and Replacement Quantities				
Element	**Repair**	**Quantity**	**Unit**	**Comments**
Bulkhead				
Bulkhead Cap	Spall Repairs	5	CF	(2) sections of 5' x 1' closed (pre-delaminated) spalls
Bulkhead Cap	Crack Repairs	60	LF	Cracking along wet face and soffit of concrete cap
Sheets	Clean & Coat	125	LF	Clean and coat sheets above MHW line of west bulkhead
Wharf				
Pile Caps	Spall Repairs	74	CF	Open and closed spalls along the concrete pile caps
Pile Caps	Crack Repairs	408	LF	Cracking along the concrete pile caps
Pile Heads	Crack Repairs	158	LF	Cracking at the concrete pile heads ~ average 2' per pile head
Concrete Dolphins				
Pile Caps	Spall Repairs	32	CF	Spalls at the pile cap corners and 'notches' at the bridge deck
Pile Caps	Crack Repairs	40	LF	Soffit - assume 1 ft per pile head; Sides - assume 2 ft per side
Pile Heads	Crack Repairs	48	LF	Cracking at the concrete pile heads ~ average 2' per pile head
Timber Dolphins				
Timber Piles	Replace Pile	13	EA	Replace piles at east dolphin (marine borer damage) 1 pile at west dolphin
Bridge Seat				
Gussets	Clean & Coat	2		Clean and coat (2) steel gussets above MHW Re-inspection recommended after cleaning for further assessment
Pile Cap	Spall Repairs	5	CF	Concrete chemical deterioration
Pile Cap	Crack Repairs	20	LF	Cracking throughout bridge seat pile cap
Piles	Crack Repairs	20	LF	Cracking at the concrete pile heads ~ average 2' per pile head
Bridge Deck				
Framing	Clean & Coat	792	SF	Clean and coat all steel framing members for bridge deck above MHW Re-inspection recommended after cleaning for further assessment
WT 4x10.5 Bracing	Replace	142	LF	Replace WT 4x10.5 steel cross-member bracing

Table E-2: Residential Ferry Landing Repair and Replacement Quantities

Fisher Island Residential Ferry Landing				
Element	**Repair**	**Quantity**	**Unit**	**Comments**
Bulkhead				
Bulkhead Sheet and Cap	Replace	400	LF	Replace existing bulkhead
Ramp				
Framing	Clean & Coat	748	SF	Clean and coat all steel framing members for ferry ramp above MHW Re-inspection recommended after cleaning for further assessment
WT 4x10.5 Bracing	Replace	90	LF	Replace WT 4x10.5 steel cross-member bracing
Berthing Dolphins				
Steel Pile	Clean & Coat	12	EA	Clean and coat (12) steel piles above MHW
Steel Connections	Clean & Coat	ALL	EA	Clean and coat (ALL) steel connections above MHW
Aluminum Channels	Clean	12	EA	Clean (12) aluminum channels
Timber Members	Replace	2	EA	Replace (2) bottom timber members and (2) timber fascia
Timber Dolphins				
Timber Piles	Replace Pile	4	EA	Replace (1) interior and (3) northern facing exterior piles