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David L. Porter, P.E.
President

Craig D. Sams, P.E.
Vice President

June 18, 2015

Chris Gardner
Eastport Port Authority
3 Madison Street
PO Box 278
Eastport, ME 04631

Re: Fish Pier Inspection and Assessment Report

Dear Mr. Gardner:

From June 1st through June 4th, 2015, Childs Engineering Corporation performed a topside and underwater inspection of the Fish Pier in Eastport, Maine. The purpose of the inspection was to assess the existing general conditions through visual inspection and determine the structural condition and recommendations for repair. This letter report documents the observed conditions of the pier and provides photos of representative conditions. Appendix A, B, C and D contain the condition rating system, structural defect notes, ultrasonic thickness readings, and drawing plans, respectively.

INSPECTION PROCEDURE

The underwater inspection was performed using scuba equipment in accordance with OSHA guidelines for commercial diving by a crew of 4 engineer divers. A visual inspection of the steel sheet pile cells, timber fender piles and associated bracing members, and a timber pile supported access trestle was conducted from the mudline to the tops of the piles. The level of investigation used to perform the underwater inspection is defined by the American Society of Civil Engineers (ASCE) underwater investigations manual as Level-I Inspection, general full-length swim-by, and modified Level-III Inspections which consist of various elevation cleanings and steel thickness measurements taken along the steel sheet pile cells. The timber piles were also probed with a hammer to sound the piles. The topside inspection included investigation of the above decks, timber fender system, and mooring hardware. Lead line soundings were also taken to determine the existing water depths at the berthing face.

STRUCTURE DESCRIPTION

The Fish Pier is a steel sheet pile cell structure configured as five large diameter circles connected together by arcs of smaller diameter with a concrete deck measuring approximately 198 feet in length by 37 feet wide. The pier has a timber fender system integrated with steel low water bracing on the north and east face, timber rub strips on the south face, and a concrete deck topside. The pier is accessed by a timber pile supported trestle with a total of 4 bents with 5 piles in each bent and a concrete abutment at the shoreline. The trestle measures approximately 120 feet long by 20 feet wide and is comprised of timber members. Attached to the inshore cells are two steel platforms connected to gangways and floating docks along the north and south sides that are not within the scope of this project. The average mean tide range is approximately 18 feet. Final design submission plans titled *Eastport Fish Pier Project*, dated November 1981, were referenced for use.

Below is an overall view of the north side of the Fish Pier.

OBSERVED CONDITIONS & RECOMMENDATIONS

Based on the inspection and assessment of the conditions noted, the Fish Pier is in *satisfactory* condition overall, with the exception of the north face fender system which is in *poor* condition due to broken and missing components. See Appendix A for condition rating system.

Steel Sheet Pile Cells

The sheet pile cells are in *satisfactory* condition overall with minor to moderate defects and deterioration observed, but no significant reduction in structural capacity. See Photos 1 through 4 in this section. The cells are PS 28 steel sheeting, measuring 15 inches long knuckle to knuckle, and 3/8 inch thick. The steel sheets have light marine growth below water and barnacles located in the tidal zone. The exposed sheets are coated with a coal tar epoxy and have sacrificial anodes to protect the steel from corroding. Below low water the coating is typically 80% intact with isolated locations of pitting measuring approximately 1/2 inch in diameter and 1/8th inch deep on

5% of the structure (below water). The majority of anodes are 100% depleted with loose and missing connection bolts. The coating within the tidal zone is approximately 75% intact, and at compromised coating locations the steel was found to be pitted with maximum depths of 1/8th inch. Also observed within the tidal zone is blistering of the coating indicating pending failure. Above high water, on the top 8 feet of the sheets, the coating is typically gone with moderate corrosion and scale found. Ultrasonic thickness measurements were taken at various depths and locations along the cells. Assuming an original ⅜ inch wall thickness from the referenced plans, readings yielded 72% to 100% of the steel sheet thickness remains, with the lower percentages on the top 8 feet.

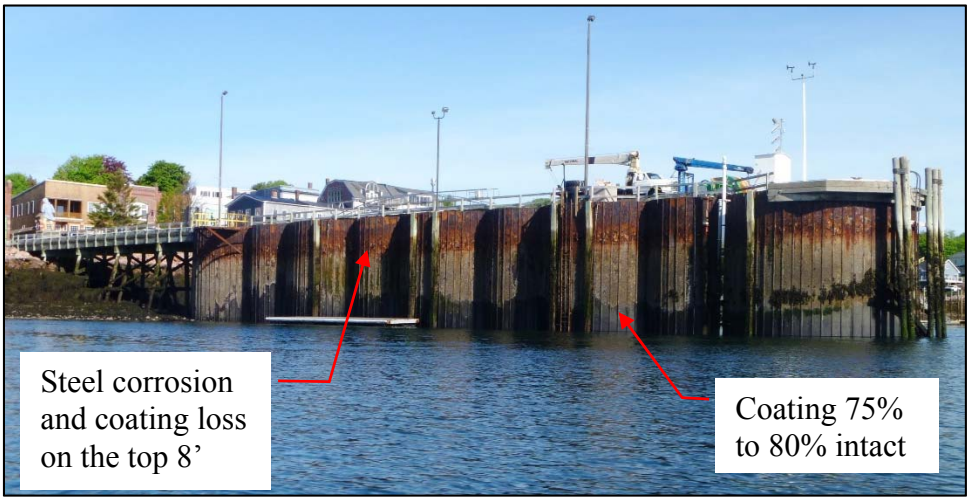


Photo 1 – Overall view of the south face sheet pile cells and vertical timber fenders.

Photo 2 – Overall view of the north face of the pier with fender system and floating dock.

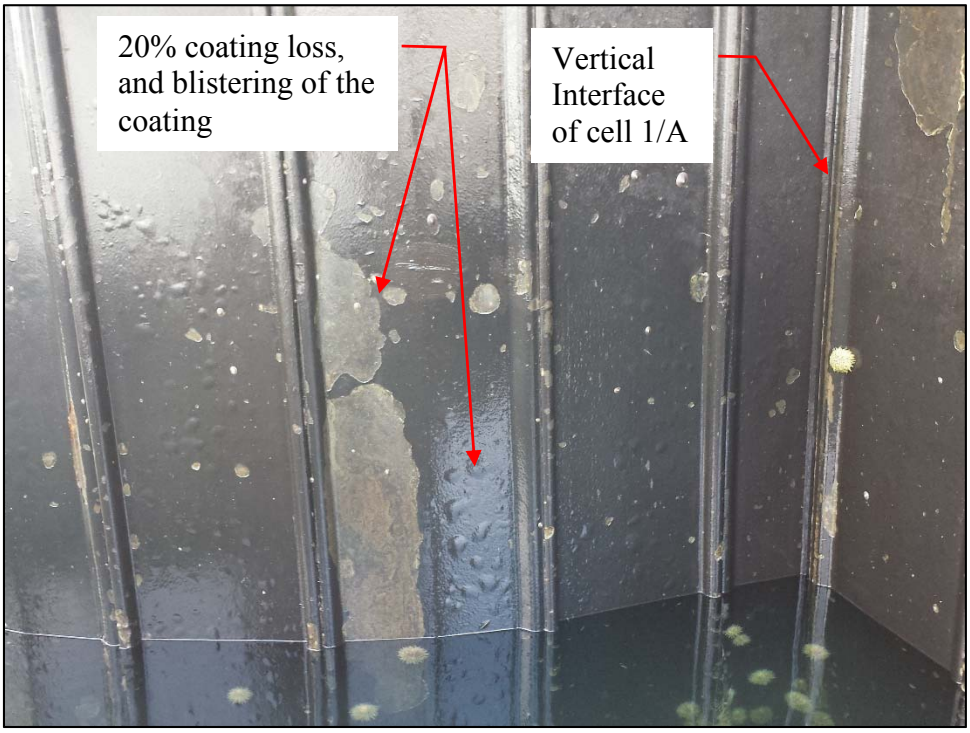


Photo 3 – Interface of sheet pile cell 1/A on north face at low water.

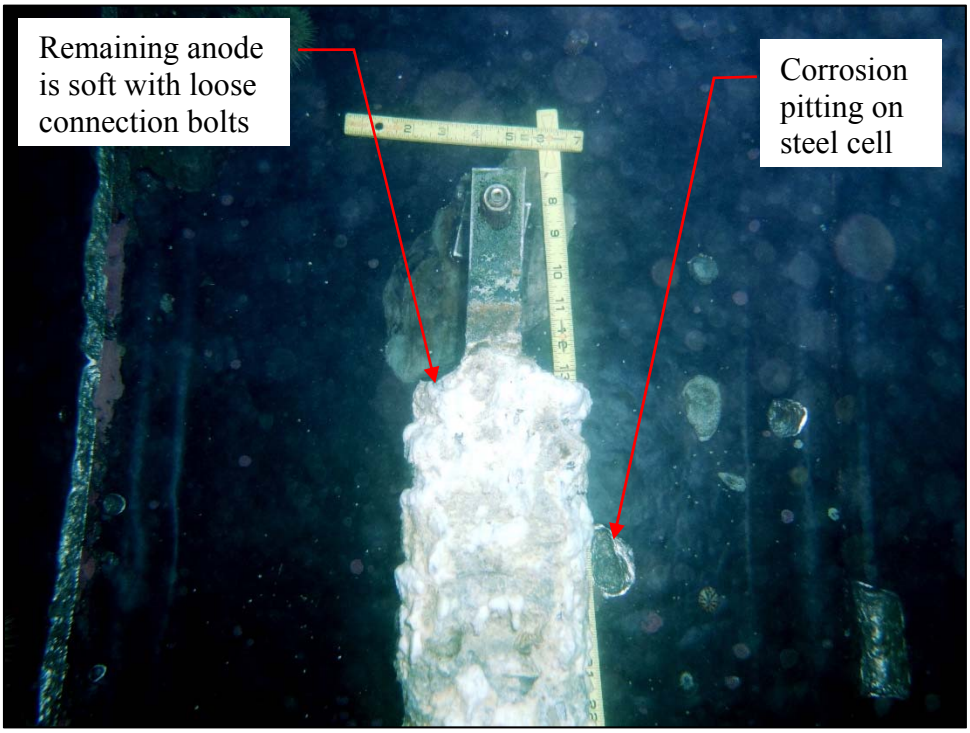


Photo 4 – Sacrificial anode on north face sheet pile, cell 2, below water.

Short term recommendations for repair and maintenance of the steel sheet piles include cleaning and recoating the steel from low water to the top of the sheets, and replacing the sacrificial anodes below water. From prior experience, we have had good luck using the following coating systems, provided the surfaces are prepared and the coatings are applied according to manufacturer recommendations:

Wasser High Tech Coatings Inc.
Primer Coat – MC Miozinc @ 3.0 – 5.0 mils dft,
Intermediate Coat – MC Tar @ 5.0 – 7.0 mils dft,
Top coat – MC Tar @ 5.0 – 7.0 mils dft,
Total system dft: 13.0 – 19.0 mils, Ave. dft shall be 16 mils

Sherwin-Williams Company
Primer Coat – Corothane I Mio-Zinc Primer @ 3.0 – 4.0 mils dft,
Intermediate Coat – Corothane I Coal Tar @ 5.0 – 7.0 mils dft,
Top coat – Corothane I Coal Tar @ 5.0 – 7.0 mils dft,
Total system dft: 13.0 – 18.0 mils, Average dft shall be 16 mils.

There are no long term repairs recommended at this time.

Concrete Deck and Mooring Hardware

The concrete deck is in *satisfactory* condition with moderate cracking and settlement found throughout the south side of the pier. See Photos 5 through 8 in this section. The concrete deck is divided into two sections along the north and south. According to the referenced plans, the north and east side of the pier is a 12 inch thick, 10 foot wide steel reinforced concrete deck with an integrated pile cap and wheel stop. The remaining southern area is an 8 inch thick concrete deck reinforced with welded wire fabric. The cells are filled from the bottom with dredge spoils, rock borrow, and compacted gravel borrow providing a base for the reinforced concrete deck which slopes six inches from north to south for drainage.

The southern deck has isolated locations of transverse and longitudinal cracking throughout with maximum crack widths of 1/8 inch wide. Settlement was also noted at crack locations and adjacent to the northern deck by as much as 3 inches. There is horizontal separation between the concrete deck and sheet pile measuring 1/2 to 1 inch wide with one isolated location of a 2 inch separation at the cell 1/A interface. The separation and cracking are due to settlement of the cell fill material. Although there is cracking and settlement present, this does not significantly reduce the intended structural capacity.

The northern portion of the deck is supported by the cells and does not exhibit settlement. The northern portion of the deck has hairline cracking throughout the underside edge of the deck, most likely from drying shrinkage cracks, which are not of concern. Cell 4 has a 3 square foot fracture spall with exposed reinforcing steel on the bottom corner below the timber chock.

The mooring hardware consists of 3 - 18 inch cleats on the north and east sides of the pier. The moorings are in *satisfactory* condition with 100% coating loss and minor surface corrosion. The cleats are securely fastened to the concrete bases which have no significant defects found.

Photo 5 – Concrete deck looking east with settlement and cracking.

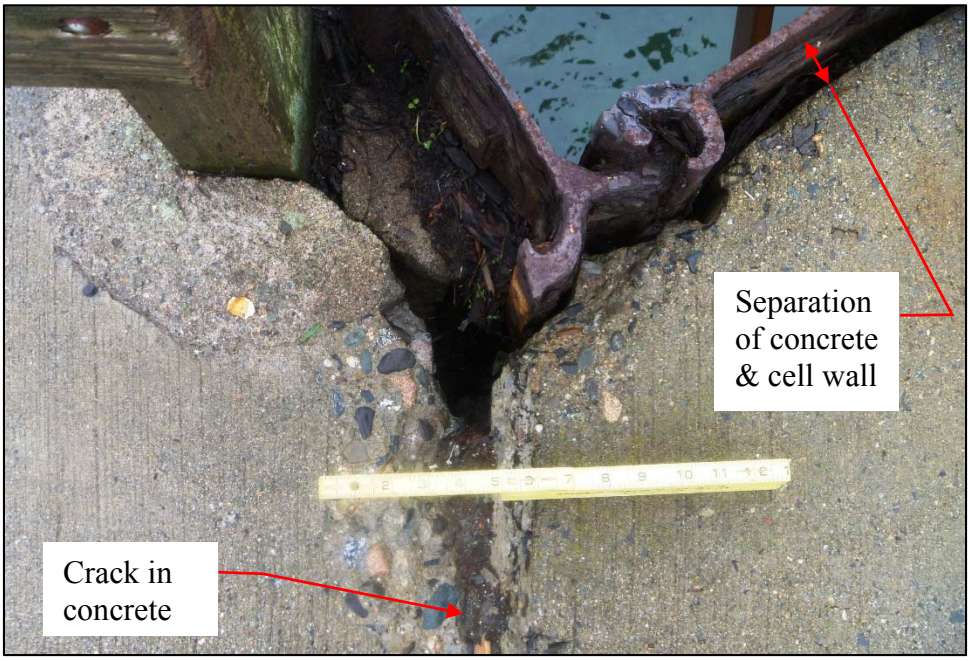


Photo 6 – Separation and cracking at cell 1/A interface, due to settlement.

Photo 7 – Concrete impact spall with exposed rebar below top chock on cell 4.

Photo 8 – Underside of concrete deck with typical hairline cracking.

Short term recommendations for the concrete superstructure include repairs to the fracture spall due to the exposed reinforcing steel, which if left unrepaired will continue to corrode and increase the spall area. The concrete spall area should be chipped back to sound concrete and then cleaned with high pressure water. All corroded reinforcement should be cleaned, or replaced if significantly deteriorated, before new concrete is added. A marine grade concrete should then be installed.

Long term recommendations include removing the existing concrete deck, placing a level compacted graded base, and installing a new reinforced concrete deck.

Recommendations for mooring hardware include cleaning and recoating the mooring hardware.

Timber Fender Piles and Associated Fender System

The timber fender system varies on the north and south face of the pier. The south face consists of vertical treated timber rub strips attached to the cells from the top of the sheets to below low water. The rub strips are in *good* condition with no significant defect found and are securely attached to the steel sheets. See Photos 9 through 13 in this section.

The fender system on the north face consists of 14 inch diameter treated timber piles with steel bracing and timber chocks and wales. The piles and chocks are securely bolted to the concrete wheel stop above deck, at elevation 17+ feet. The lower portion of the fender system is located at mean sea level elevation 0 feet, which includes steel bracing attached to the sheet cells integrated with timber wales and chocks.

The fender system is in *poor* condition due to broken piles, and missing and broken bracing components at low water. The majority of timber fender piles are found to be in *satisfactory* condition with minor abrasion and ice damage in the tidal zone. Six of the piles have significant defects found including 3 broken piles, 1 missing pile, 1 pile with 20% section loss due to marine borer activity, and 2 piles with heavy abrasion and approximately 50% section loss. The low water bracing is made up of steel angles and beams with 100% coating loss, minor surface corrosion, and typically has failed bolted connections and missing components. There are loose connection bolts, missing steel bracing, and missing timber chocks and wales throughout. A few repairs have been made to replace the bolted connection with a welded connection at the steel sheet and are in *satisfactory* condition. Along the tops of the piles, approximately 50% have a fiberglass cap to protect the pile top from decay and the rest are missing.

Lead line soundings were taken along the berthing face of the pier and depths (reference to MLLW = 0.0 feet) measured 0 to -10 feet respectively from inshore to outshore on the north side, and were approximately 2 feet higher on the south side.

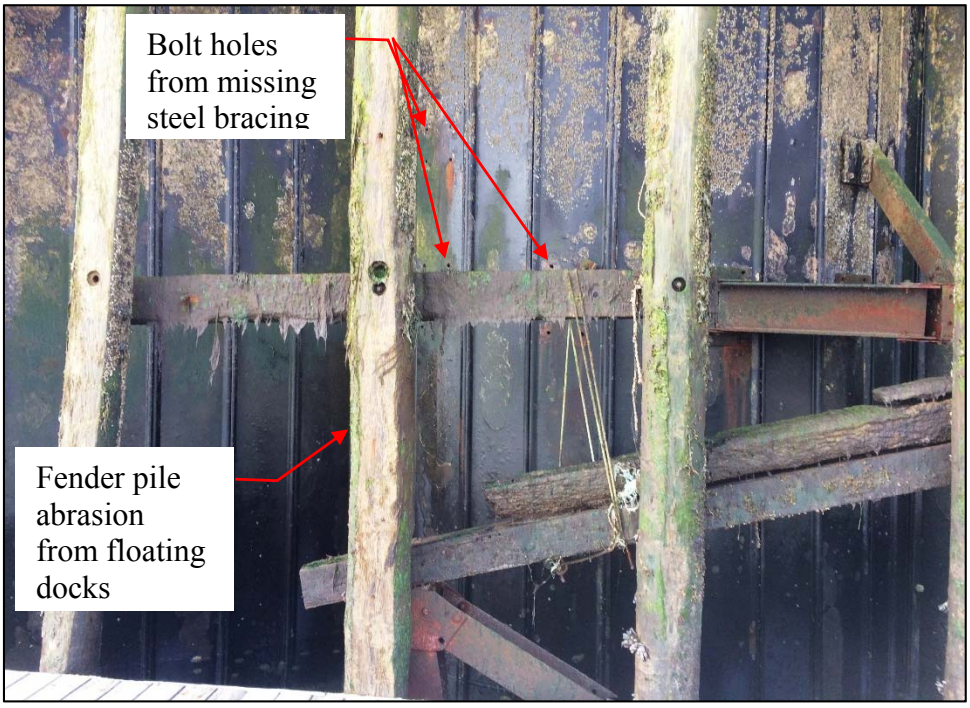


Photo 9 – Low water bracing in typically in poor condition.

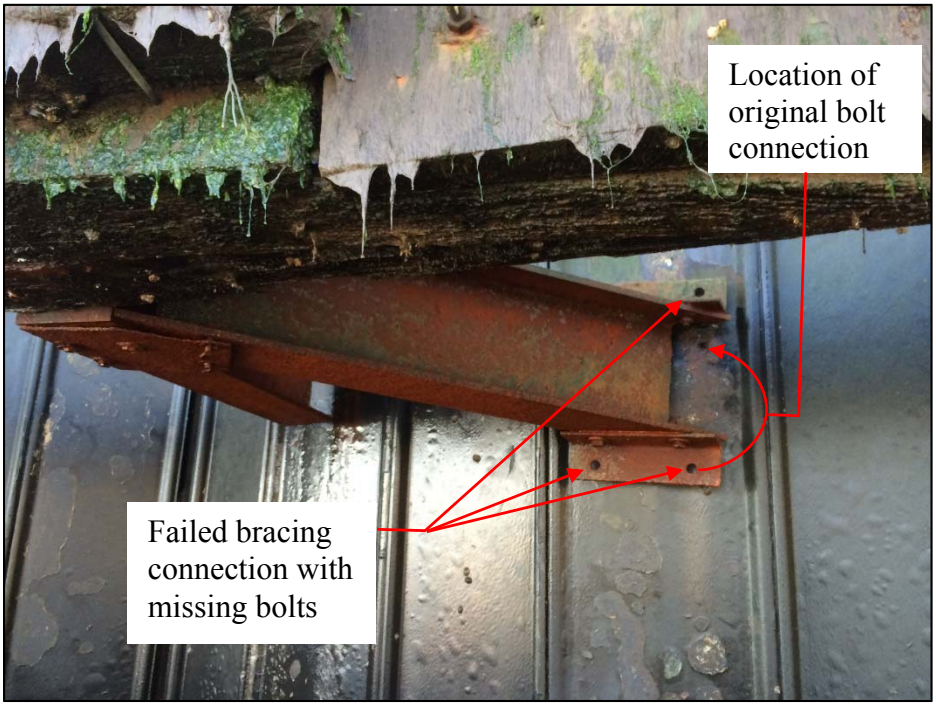


Photo 10 – Low water bracing with missing bolted connections to sheet pile cell.

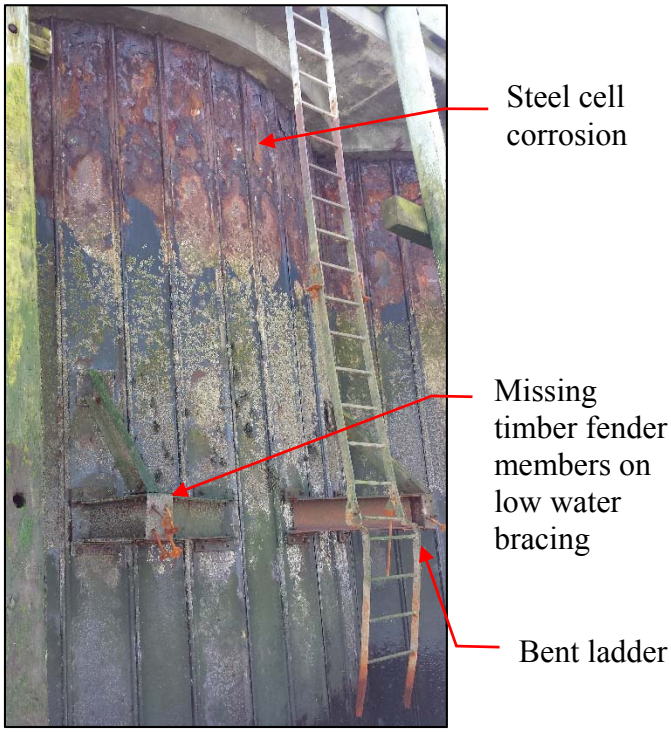


Photo 11 – Broken steel bracing with missing timber wale and damaged ladder.

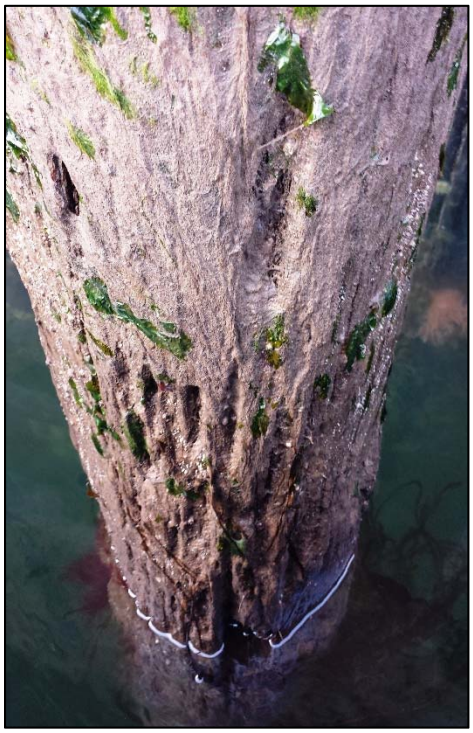


Photo 12 – Fender pile with marine borer activity and section loss.

Photo 13 – Broken fender pile at low water.

A fully functional fender system performs the vital function of protecting the pier from berthing vessels. The fender piles are susceptible to breakage when vessels are berthed against them as they cannot resist the intended horizontal loads.

Short term recommendations are to replace the 6 damaged fender piles in-kind that are broken, missing, and heavily abraded, wrap the pile with marine borer to prevent further section loss, and to install protective covers on the pile tops. To prevent continued damage to the piles we recommended replacing the lower steel bracing system as well as the timber wale and chocks. The bracing should be redesigned with welded connections to facilitate installation. Typical replacement bracing would consist of 10 inch diameter thick walled steel pipe welded to 1/2 inch thick steel plates on either end. The end plate would then be welded to the sheet pile between knuckles and the opposite end plate would have timber wale and chocks bolted between piles. As an alternative consideration should be given to replacing timber fender system with a new system consisting of steel pipe piles, wales and chocks.

Timber Access Trestle

The timber access trestle is in *satisfactory* condition overall with minor to moderate defects and deterioration observed, but no significant reduction in structural capacity. The structure is located completely above water at low tide. See Photos 13 through 18 in this section.

Below deck, the 14 inch diameter treated timber piles are typically in *good* condition overall with 2 defects found near the mudline on bent 4; 1 pile has light marine borer activity and another pile has a 5 foot long split, 4 inches deep. The concrete abutment foundation located at the shoreline is also in *good* condition with no significant defects found. All the timber bracing located within the tidal zone is in *poor* condition with fungal decay, marine borer activity, and missing and broken members. The superstructure components including the horizontal cross bracing, pile caps, pier caps, and stringers are in *good* condition with no significant defects found.

Above deck, the timber deck planks, wheel stops, and safety rails have minor defects including 5 locations of fungal decay on the tops of the rail posts measuring up to 6 inches deep, and 2 locations of fungal decay on the deck planks measuring 4 to 6 feet long and 3 inches deep. All connection hardware is in *good* condition with light surface corrosion located within the tidal zone.

Photo 13 – Overall view of timber access pier below deck.

Photo 14 – Lower bracing with severe marine borer activity and fungal decay.

Photo 15 – Deteriorated lower transverse bracing with connection bolt in good condition.

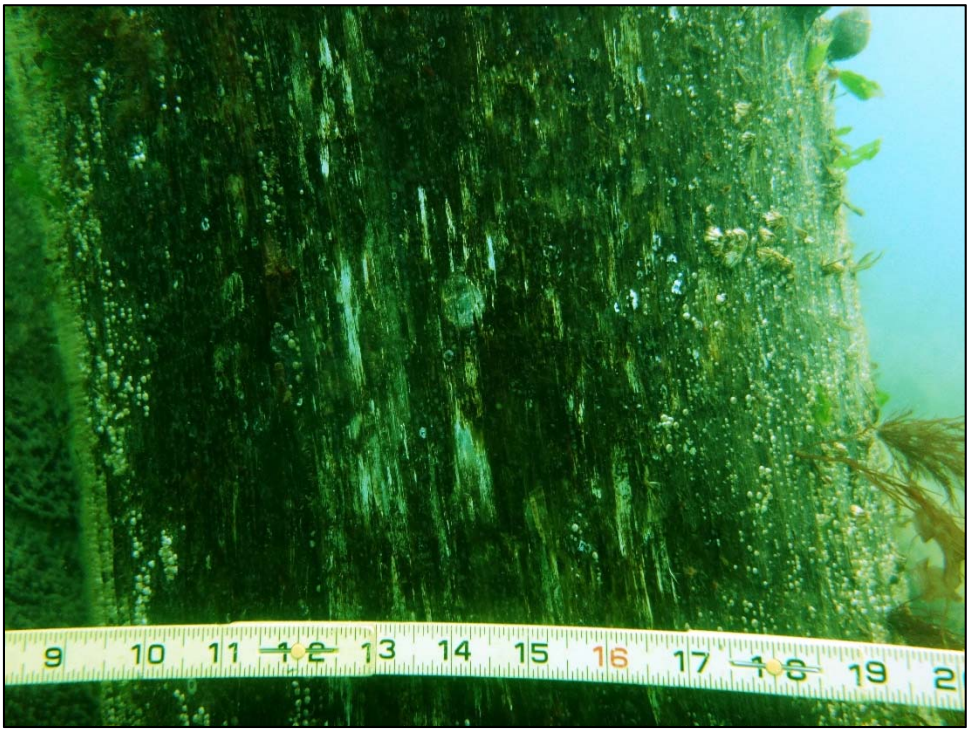


Photo 16 – Timber pile at bent 4 north below water in good condition.

Photo 17 – Timber deck plank with fungal decay.

Photo 18 – Top of timber post with fungal decay 6 inches deep.

Short term recommendations for the access trestle include wrapping the timber pile with marine borer activity to prevent section loss, and replacing the deteriorated timber bracing, rail posts, and deck planks. There are no long term repairs recommended at this time. Although the above mentioned defects do not require a reduction in the certified load capacity, a repair schedule should be established.

We recommend re-inspecting the Fish Pier every 5 years to monitor and document conditions of the cell structures, timber fender systems and access pier to provide repairs and maintenance as needed to maintain the structural integrity of the pier.

If you wish to discuss the results of the inspection or the recommendations, do not hesitate to call.

Respectfully Submitted,

CHILDS ENGINEERING CORPORATION

Craig D. Sams, P.E.

APPENDIX A – CONDITION RATING SYSTEM

The facility condition ratings are based on the table below.

Assessment Rating	Description
"Good"	No problems or only minor problems noted. Structural elements may show some very minor deterioration, but no significant reduction in structural capacity.
"Satisfactory"	Minor to moderate defects and deterioration observed, but no significant reduction in structural capacity.
"Fair"	All primary structural elements are sound; but minor to moderate defects and deterioration observed. Localized areas of moderate to advanced deterioration may be present but do not significantly reduce the structural capacity.
"Poor"	Advanced deterioration or overstressing observed on widespread portions of the structure. Some reduction in structural capacity.
"Serious"	Advanced deterioration, overstressing or breakage may have significantly affected the load bearing capacity of primary structural components. Local failures are possible.
"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.

APPENDIX B – STRUCTURAL DEFECT NOTES

Defect Location		Structural Element	Defect Description
Bent Cell	Row Face		
Pier Cells, Deck, and Fender System			
1 through 5	North & South	Sheet Pile	Top 10 feet coating 40% intact with corrosion and scale, remaining coating 80% intact with isolated pitting and wavy steel.
1 through 5	North & South	Anodes	Majority of anodes 100% depleted.
1 through 5	South	Deck	Cracks throughout up to 1/8 inch wide.
1 through 5	South	Deck	Settlement throughout up to 3 inches deep.
1/A	South	Deck	Separation of concrete and cell up to 1 inch wide.
4	North	Deck edge	Fracture spall with exposed rebar.
1 through 5	North	Cleat	Clean and recoat all 3 cleats.
B	North	Fender Pile	Broken 5 feet below cap.
C	North	Fender Pile	Broken 5 feet below cap.
4	North	Fender Pile	Marine borer activity on bottom 10 feet.
4	North	Fender Piles	Abrasion up to 50% section loss in tidal zone.
D	North	Fender Pile	Missing Pile
5	North	Fender Pile	Broken 28 feet below cap.
1 through 5	North	Fender Pile	Protective covers missing on 18 fender piles.
1 through 5	North	Fender System	Low water bracing and timber members: broken connections, missing members, marine borer activity and fungal decay.
Timber Access Trestle			
4	P1	Pile	Light marine borer activity.
4	P2	Pile	Split 5’ L x 2” W x 4” D
1 through 4	-	Bracing	All bracing in tidal zone has marine borer activity and fungal decay.
1 through 4	-	Bracing	Missing lower longitudinal bracing.
1	South	Rail Post	Fungal decay on top 1 inch deep.
3 & 4	North	Rail Post	Fungal decay on top 6 inch deep max, 4 posts.
4	-	Deck Plank	Fungal decay 6’L x 4.5” W x 3” D
4	-	Deck Plank	Fungal decay 4’L x 4.5” W x 3” D
Note: Gangway on the north side has a broken tension rod, 3 foot long.			

APPENDIX C – ULTRASONIC THICKNESS READINGS

Cell #	Location & Elevation (Ref. to MSL = 0.0 ft.)	Reading (inches)
CELL 5	*East Outshore End*	
	+14	0.312
	+10	0.358
	-1	0.368
	-20	0.372
CELL 4	*South Side*	
	+15	0.354
	+10	0.320
	-1	0.370
	-19	0.374
	North Side	
	+14	0.292
	+11	0.308
	-2	0.350
	-21	0.354
CELL 3	*South Side*	
	+15	0.362
	+14	0.318
	+12	0.284
	+7	0.322
	-1	0.360
	-18	0.368
	North Side	
	+14	0.312
	+11	0.310
	-2	0.371
	-21	0.370
CELL 2	*South Side*	
	+15	0.370
	+12	0.270
CELL A	*North Side*	
	+14	0.312
	+12	0.294
	+5	0.348
	-2	0.370
	-13	0.372

APPENDIX D – DRAWING PLANS

Final design submission plans titled:

Eastport Fish Pier Project,

Dated: November 1981

FINAL DESIGN SUBMISSION

CITY OF EASTPORT

MAINE

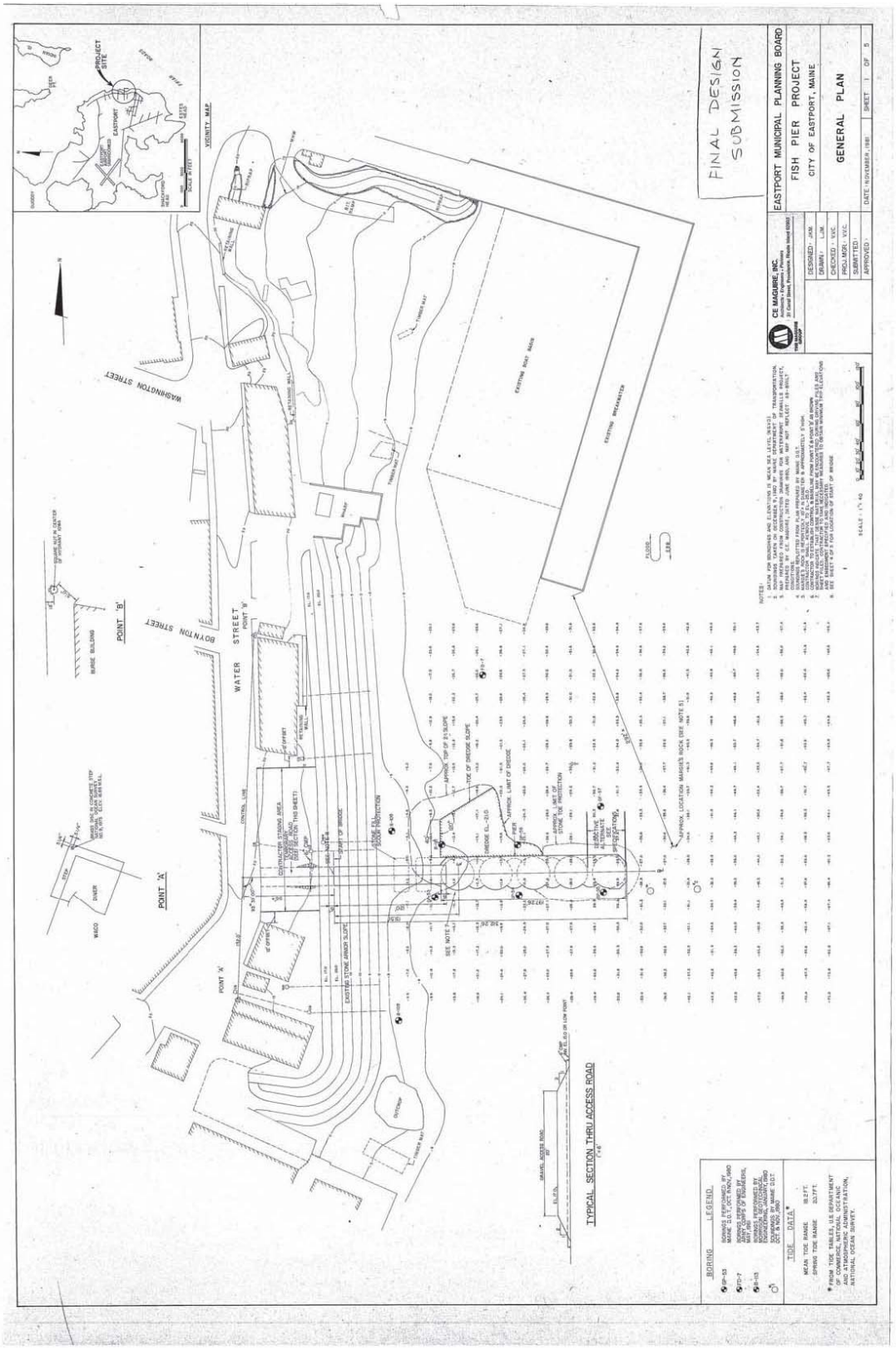
EASTPORT FISH PIER PROJECT

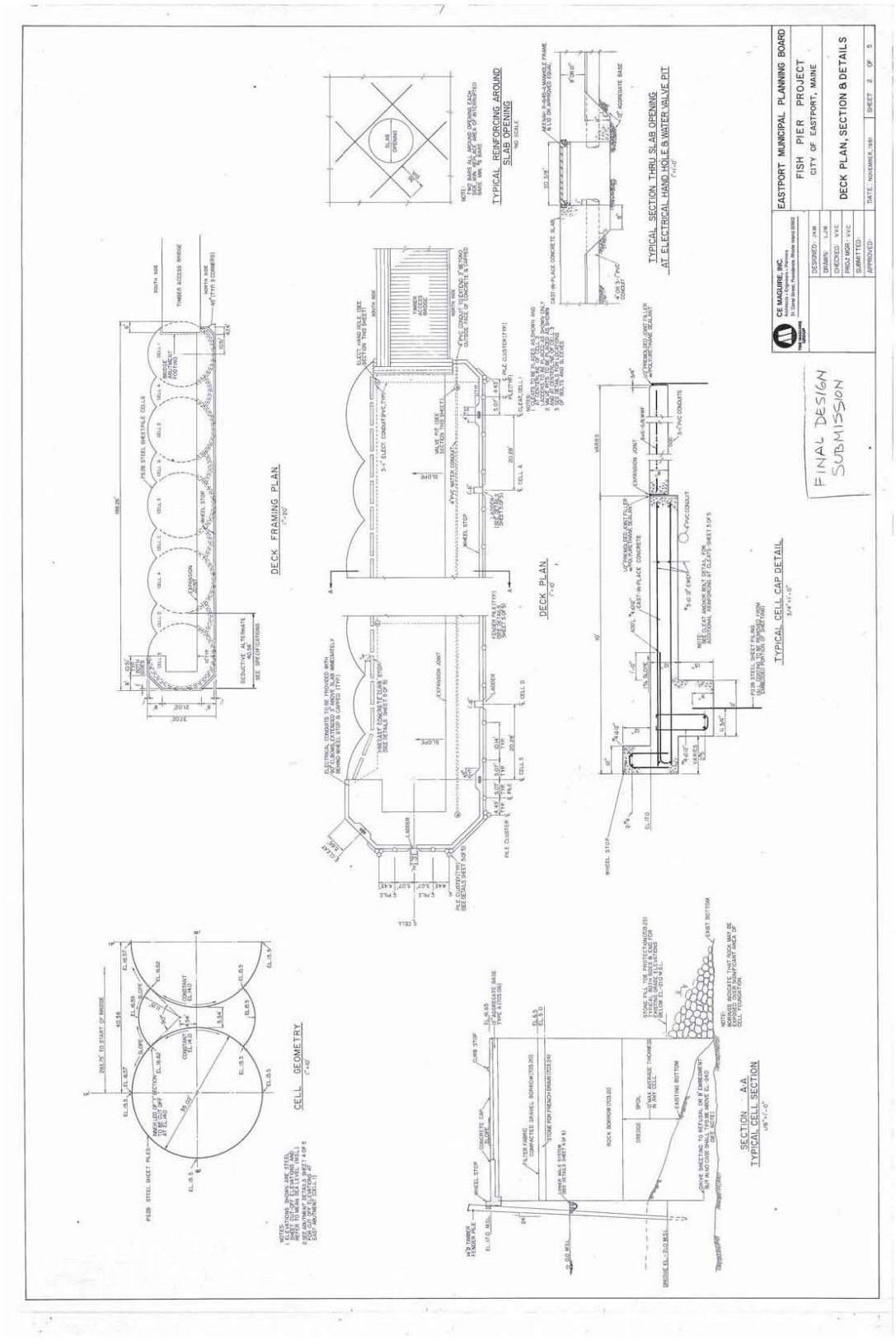
EASTPORT MUNICIPAL PLANNING BOARD

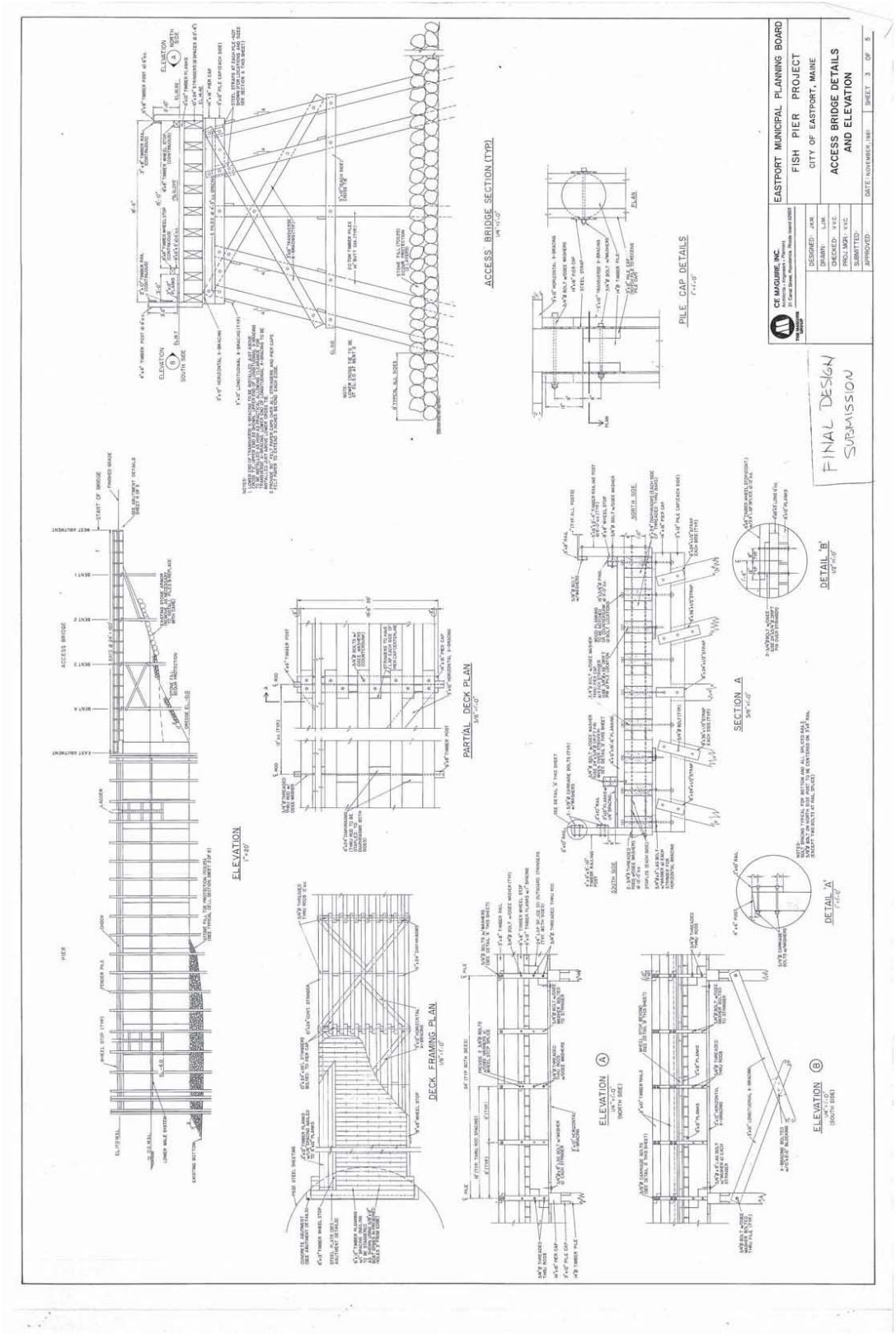
NOVEMBER, 1981

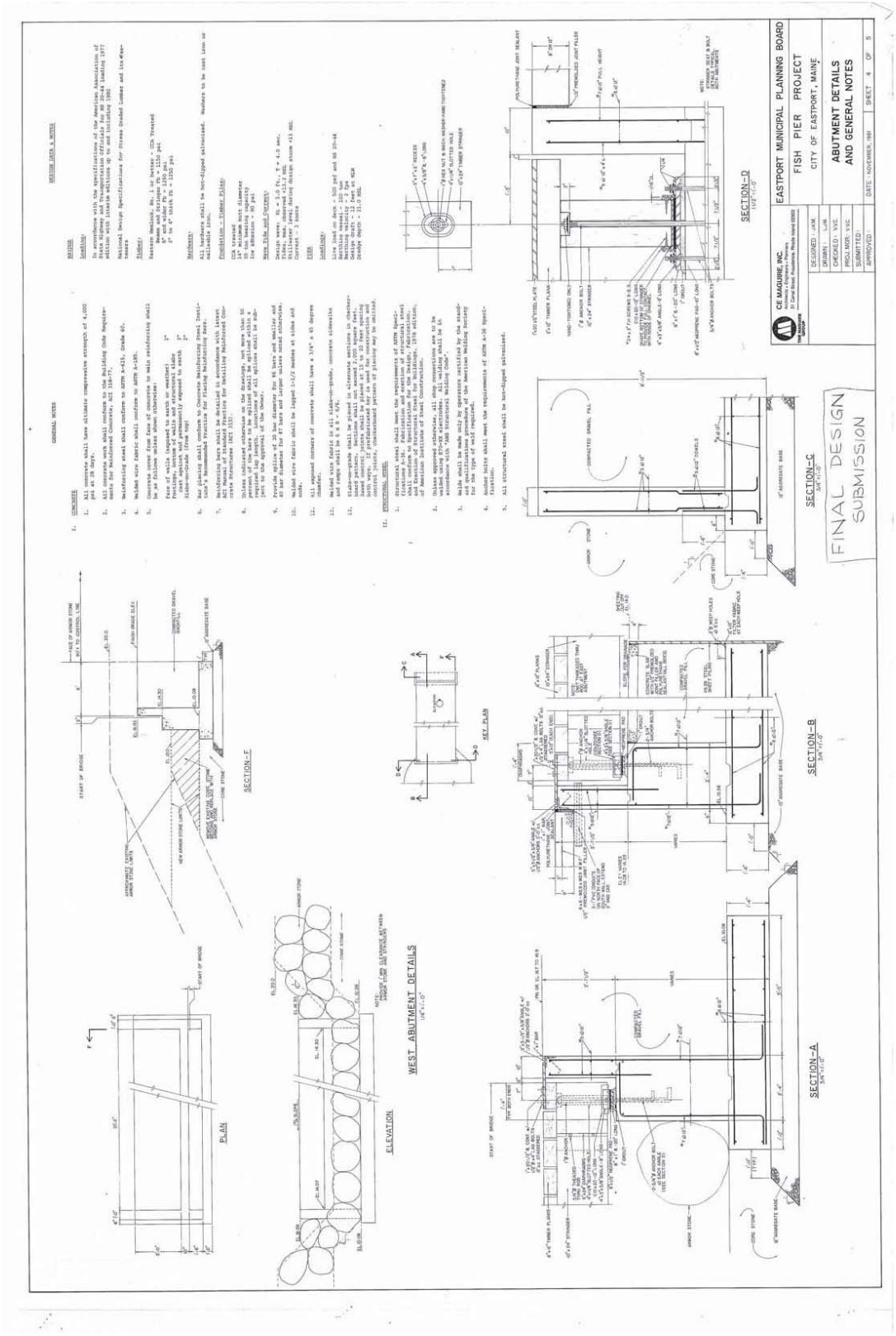
CE MAGUIRE, INC.
Architects · Engineers · Planners
31 Canal Street, Providence, Rhode Island 02903

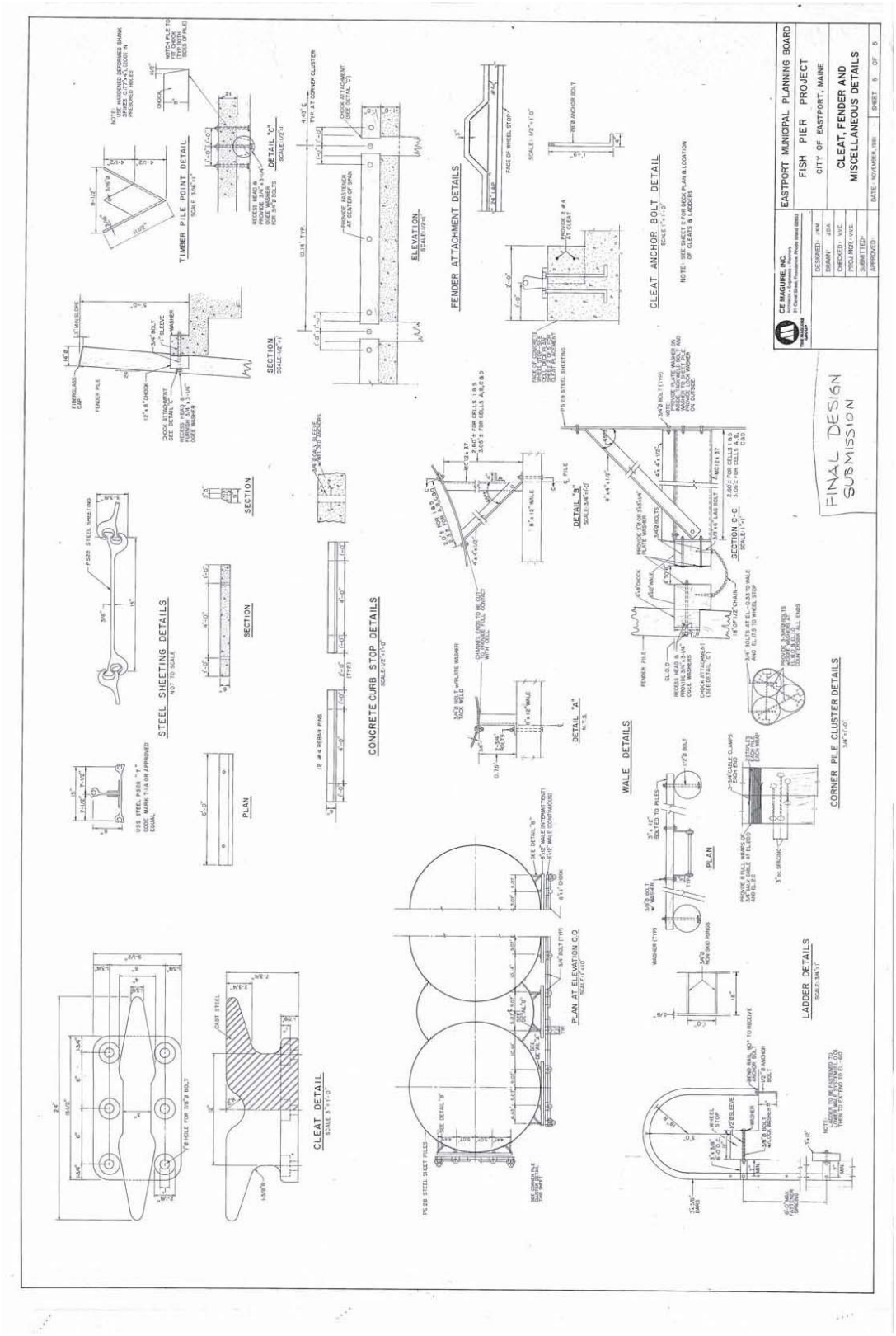
THE MAGUIRE GROUP


FINAL DESIGN SUBMISSION
EASTPORT MUNICIPAL PLANNING BOARD
FISH PIER PROJECT
CITY OF EASTPORT, MAINE
GENERAL PLAN
CE MAGUIRE, INC.
WASHINGTON STREET
BOYNTON STREET
WATER STREET
POINT 'A'
POINT 'B'
TYPICAL SECTION THRU ACCESS ROAD
LEGEND
TIDE DATA


DECK FRAMING PLAN
DECK PLAN
CELL GEOMETRY
SECTION A-A
TYPICAL CELL SECTION
TYPICAL REINFORCING AROUND SLAB OPENING
TYPICAL SECTION THRU SLAB OPENING AT ELECTRICAL HAND HOLE & WATER VALVE PIT
TYPICAL CELL CAP DETAIL
EASTPORT MUNICIPAL PLANNING BOARD
FISH PIER PROJECT
CITY OF EASTPORT, MAINE
DECK PLAN, SECTION & DETAILS
DESIGNED: JCM
DRAWN: JCM
CHECKED: WKC
PROJ MGR: WKC
SUBMITTED:
APPROVED:
DATE: NOVEMBER, 1991
SHEET 2 OF 5
CE MAGUIRE INC.
FINAL DESIGN SUBMISSION


EASTPORT MUNICIPAL PLANNING BOARD
FISH PIER PROJECT
CITY OF EASTPORT, MAINE
ACCESS BRIDGE DETAILS AND ELEVATION
CE MAGUIRE, INC.
FINAL DESIGN SUBMISSION
ACCESS BRIDGE SECTION (TYP)
PILE CAP DETAILS
PARTIAL DECK PLAN
DECK FRAMING PLAN
ELEVATION
SECTION A
DETAIL 'A'
DETAIL 'B'
ELEVATION (A)
ELEVATION (B)


FINAL DESIGN SUBMISSION
EASTPORT MUNICIPAL PLANNING BOARD
FISH PIER PROJECT
CITY OF EASTPORT, MAINE
ABUTMENT DETAILS AND GENERAL NOTES
SECTION-A
SECTION-B
SECTION-C
SECTION-D
SECTION-E
WEST ABUTMENT DETAILS
PLAN
ELEVATION


TIMBER PILE POINT DETAIL
ELEVATION
FENDER ATTACHMENT DETAILS
CLEAT ANCHOR BOLT DETAIL
SECTION
STEEL SHEETING DETAILS
NOT TO SCALE
PLAN
CONCRETE CURB STOP DETAILS
DETAIL "B"
DETAIL "A"
WALE DETAILS
PLAN AT ELEVATION 0.0
CLEAT DETAIL
CORNER PILE CLUSTER DETAILS
LADDER DETAILS
CE MAGUIRE, INC.
EASTPORT MUNICIPAL PLANNING BOARD
FISH PIER PROJECT
CITY OF EASTPORT, MAINE
CLEAT, FENDER AND MISCELLANEOUS DETAILS
DESIGNED: JKW
DRAWN: JSK
CHECKED: WEC
PROJ. MGR.: WEC
SUBMITTED:
APPROVED:
DATE: NOVEMBER, 1991
SHEET 9 OF 9
FINAL DESIGN SUBMISSION