July 31, 2019

INSPECTION REPORT

General Cargo International Terminal

JMT Project No: 18-02353

Submitted to:
CLEVELAND - CUYAHOGA COUNTY PORT AUTHORITY

Photo by Port of Cleveland.com

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Executive Summary

This report summarizes the inspection and condition assessment of the waterfront infrastructure along the General Cargo Terminal from Dock 22 to Dock 28. Specifically, the inspection included the following infrastructure assets:

1) Sheet piling bulkheads
2) Piling caps
3) Fender systems
4) Timber curbing
5) Mooring bollards and connections
6) Outfall penetrations
7) Pavement adjacent to bulkheads

Additional items that were completed with this scope of work includes creation of a Maritime GIS database and webmap, hydrographic survey and construction repair details for bulkhead breaches. The inspection assessment condition of the infrastructure listed above is contained in the GIS webmap and can be accessed through ArcGIS credentials that have been provided to the Port Authority.

The age of the docks varies from the 50's, 60's and 90's and exhibit various signs of degradation over the relative time periods, but also some docks are used more frequently causing repair needs due to the volume of ships and landside cranes and vehicles loading and unloading payloads. The infrastructure that will require short- and long-term investments per dock is summarized below. Short-term repairs should be completed within a two-year time period and long-term improvements completed within a five-year time period.

Dock 22 – Constructed in 1998 is in good condition with minor repair items required.
Short Term Repairs: $ 82,100
Long Term Improvements: $ 95,200

Dock 24 – Constructed in 1965 is in adequate condition with minimal repairs given the age and volume of traffic.
Short Term Repairs: $ 114,900
Long Term Improvements: $ 1,285,900

Dock 26 – Constructed in 1958 is in marginal condition with a significant investment repair required due to multiple breach locations along the west bulkhead at the mudline elevation.
Short Term Repairs: $ 118,400
Long Term Improvements: $ 4,056,600

Dock 28 – Constructed in 1956 is in adequate condition given the age of the dock. There are several short term maintenance repairs that can extend the life expectancy of this bulkhead.
Short Term Repairs: $ 66,500
Long Term Improvements: $ 647,900

Inspection and Assessment

The above and below water inspection started on October 15, 2018 and was completed on February 17, 2019. The above water inspection consisted of a visual and hands-on inspection with GPS photography that has been incorporated into the GIS webmap. The inspection assessment consists of a numerical rating, as used by the Maryland Port Authority for the Port of Baltimore Facility, which is also displayed on the webmap by the specific asset layer. If an asset is rated a 1 (Poor Condition) the item requires complete replacement because it is missing or is no longer functioning per the original design intent. A rating of 2 means the asset requires repair within the short term maintenance plan of one to five years. An asset that is rated 3 shows sign of degradation and should be included in the longer term maintenance plan of five to ten years. A rating of 4 indicates that the item is currently in good condition but do to the nature of the asset it will more than likely require repair/replacement after ten years. If an asset is functioning as designed and it appears the material will last it's anticipated life cycle it is rated as a 5.

Good		Fair		Poor
5 Excellent	4 Good	3 Adequate	2 Marginal	1 Poor

The below water inspection consisted of a hands-on inspection with steel thickness measurements obtained on 25' intervals at the top of the water, mid-height and at the mudline. The 25' interval inspection was supplemented with an underwater sonar using a Sea Scan Arc Explorer towfish with a resolution of a ½" across the sonar scan. An example of the sonar scan output for Dock 26W is included below in Figure 9. Breaches and defects that were noticed in the output of the sonar scans on Dock 26 W and Dock 28 W were field verified by an underwater hands-on inspection. The steel thickness measurement readings are included in Appendix B.

A hydrographic survey of the lake bottom was also completed using Trimble sonar receiver and HYDROpro software to generate a contour map at 1' intervals that is colored coded and displayed in the webmap. The color codes correspond to the following water depths and an image of the contour model is included in Appendix A.

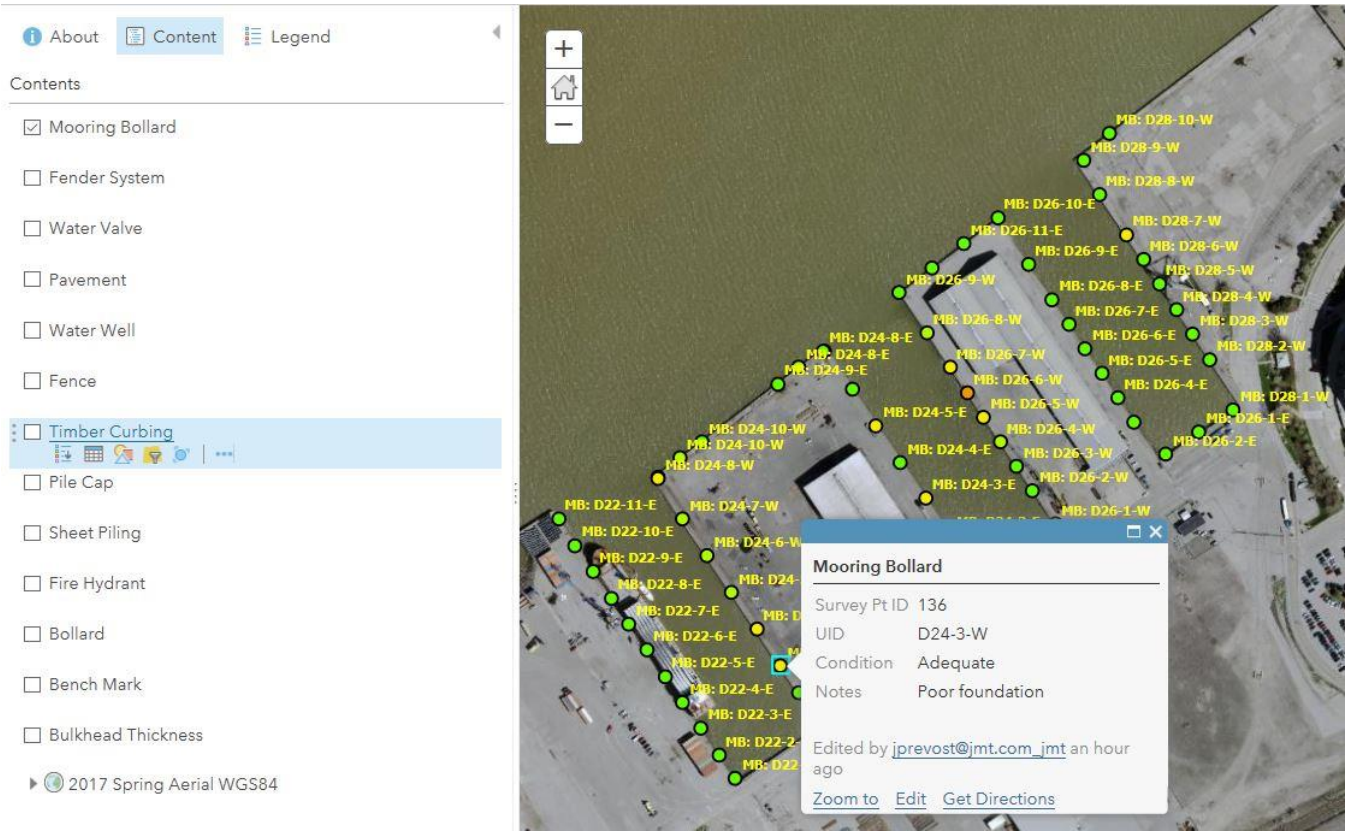
Blue:	30' – 25'
Green:	25' – 20'
Yellow:	20' – 10'
Orange:	10' – 5'
Dark Orange:	4' or less

In addition to the sonar readings, depth soundings were also collected at 25' intervals along the bulkhead and can be viewed on the webmap with the bulkhead thickness measurements. The survey data conforms to Ohio State Plane (Ohio North) Grid and 1985 vertical International Great Lakes Datum.

Findings

The infrastructure items that were inspected were also surveyed using Ohio State Plane Ground Coordinates and assigned an inspection code rating. This enabled the data to be uploaded to the GIS webmap with the correct coordinate location and condition rating. Per the example below, each mooring bollard was surveyed with a specific survey point identification number and color coding, which corresponds to the legend in the GIS webmap and the assessment chart above. When an item is re-inspected, the assessment code can be directly edited in the GIS webmap in the field via laptop or tablet. After any repair or construction project, the GIS webmap should be updated with new survey and code rating information.

The findings of the inspection are described below per dock with a summary table of deficiencies for each asset. The inspection assessment and deficiencies can also be viewed in the GIS webmap as shown below with the mooring bollard layer turned on.



DOCK 22

Dock 22 was constructed in 1998 in close conformance to the original construction plans. In lieu of a 45-degree bend in the northwest corner of the bulkhead, it was constructed as a perpendicular corner providing more area at the north end of the dock. Also, the bulkhead was constructed using the AZ-48

sheet piling (73’ max. length) instead of the ZH-9.5 sheeting section with the series of HZ-775A piles. Overall, the sheet piling, fender system, mooring bollards and steel pile cap are in good condition. There are minor repairs required on the pile cap, timber curbing and fender system and moderate pavement replacement areas. Quantities for each asset that require repair or replacement are summarized in the table below.

Table 1 – Dock 22 Asset Deficiencies

Asset	Deficiency	Quantity
Fender system	Connection failure	2 each
Fender system	Damaged	12 ft
Pavement	Settled and damaged	180 sf
Timber curbing	Missing	30 ft
Pile cap	Damaged	20 ft
Fire hydrant bollard	Damaged/bent	2 each

Fig. 1 - Pavement settled and damaged (drainage outlet)

Fig. 2 – Break in timber curbing

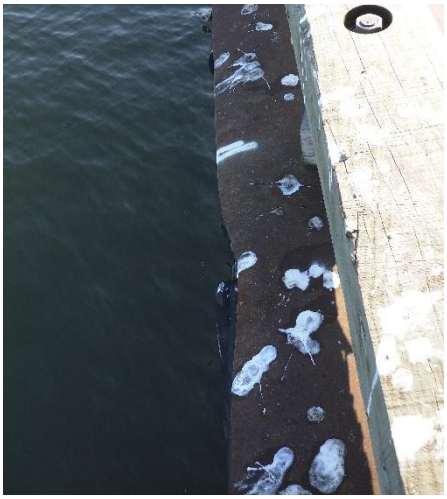


Fig. 3 – Damaged pile cap

Fig. 4 – Damaged fender (1) and failed connection (2)

DOCK 24

It appears that Dock 24 was constructed per the 1965 construction plans. The sheet piling used for the dock was a mixture of reinforced and unreinforced MZ38 at 80' and 70' lengths respectively. The unreinforced sheets were used at the south headwalls and reinforced sheets for the dock. The difference in material types of a reinforced and unreinforced sheeting section is a higher yield strength of 50 ksi versus 36 ksi, which saved steel weight for an increase in section modulus. Steel thickness measurements obtained on Dock 24 exhibit minimal section loss.

Along the south headwall between Docks 24 and 26, there is a 24" outfall with corrugated metal pipe (CMP) that has deteriorated behind the bulkhead causing loss of backfill material and pavement as shown below.

Fig. 5 – Sinkhole at CMP Outfall

Fig. 6 – Section loss at outfall (underwater)

The Port will be completing repairs on the outfall shown in Figures 5 and 6 under a 2019 repair contract.

The dock is in adequate condition given the high traffic and live load conditions that are subjected to the infrastructure. Short term repairs are needed on the timber curbing, fender system and mooring bollard/cleat foundations. Long term repairs are required on the cast in place concrete pile cap. Quantities for each asset that require repair or replacement are summarized in the table below.

Table 2 – Dock 24 Asset Deficiencies

Asset	Deficiency	Quantity
Mooring bollard/cleat	Deteriorated foundation	5 each
Mooring bollard	Corroded anchor bolts	2 each
Fender system	Missing/not functioning as designed	400 ft
Timber curbing	Missing	15 ft
Pile cap	Damaged	1100 ft
Fire hydrant bollard	Damaged/bent	1 each

Fig. 7 – Deteriorated pile cap

Fig. 8 – Deteriorated pile cap and break in timber curbing

Fig. 9 – Deteriorated mooring cleat foundation

Fig. 10 – Corroded anchor bolts

DOCK 26

Dock 26 was formerly called the West 6th Street Pier and it appears that it was constructed in 1958 over a river confluence to Lake Erie per the original construction drawings. The sheet piling used for the dock is a mixture of reinforced and unreinforced MZ38 at 70’ and 60’ lengths respectively. The reinforced sheets are strengthened with 6”x 7/8” Plate, 25’ in length starting 18’ below the top of the piling. Per the original plans, the reinforced sheets were primarily used along the west dock face and approximately 222’ on the south corner of the east dock. For the sheet piling that was inspected on the east dock that contained the plates, most of the steel thickness measurements were taken adjacent to

the plate so that the sheeting thickness could be obtained. Steel thickness measurements obtained on Dock 26 East exhibit minimal section loss. However, there are numerous locations of section loss along the mudline on Dock 26 West that were identified in the sonar scan (image below) and field confirmed in four locations.

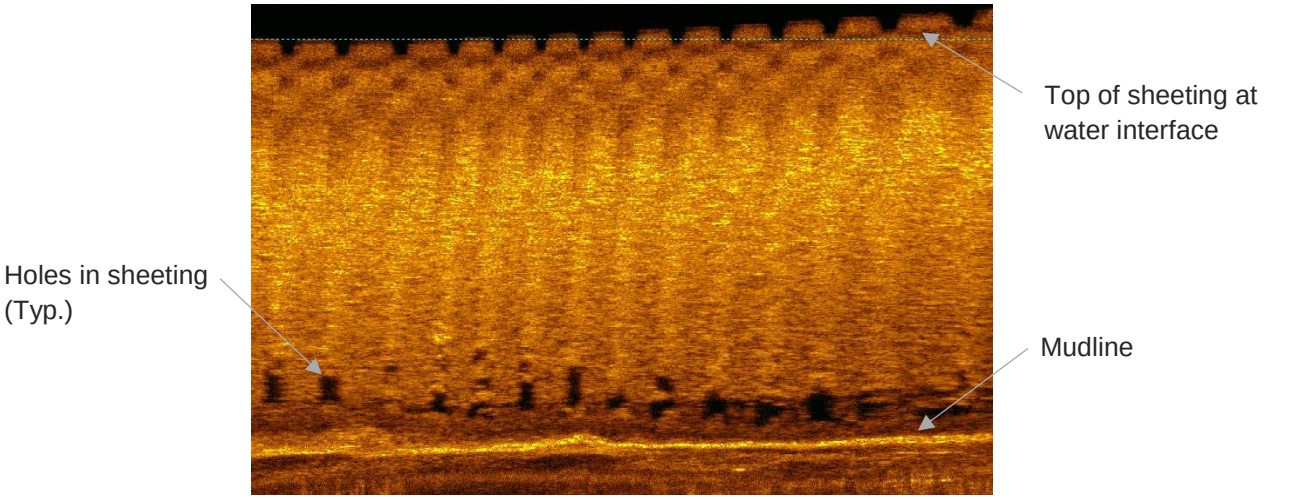


Fig. 11 – Holes along mudline of Dock 26 West

There are approximately 58 locations over 550' of bulkhead on the west dock that are similar to the holes in Figure 11. Most of the holes are along the mudline and there are a few that are close to mid-height of the exposed sheeting. The first area of section loss was noticed 130' from the south end of the dock. From that point to the north end of the dock they are sporadically located with a high concentration around the mid-length of the dock and the north end, 400' and 590' from the south headwall respectively. The average hole size is 1.5' x 1.0'. Within this area, there was a repair project completed in 1999 to strengthen a section of wall, approximately 40' in length that was deflected outward at the mudline. The fact that the deflection was at the mudline indicates that the failure is at or below the mudline opposed to a top surcharge load or tieback failure. Below is a plan view detail of the repair, note the mention of "punctures, rips and tears" in the sheeting.

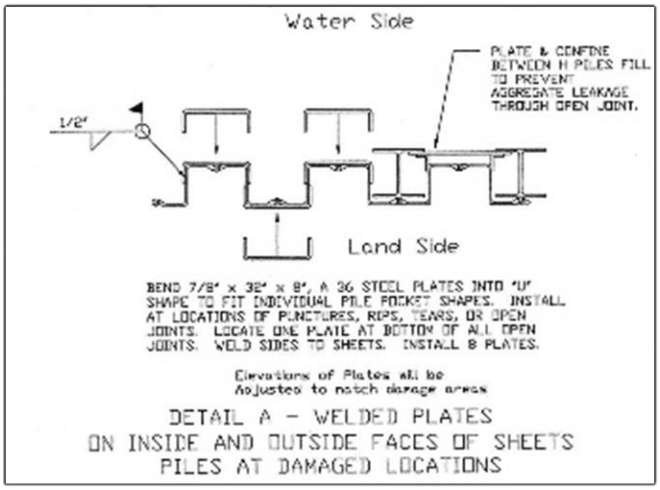


Fig. 12 – Plan view of 1999 sheeting repair

Given the quantity of breaches along the west dock, the bulkhead is in poor condition. On average, the dock as an infrastructure asset is in marginal condition. There are a high number of repairs required currently on the fender system and timber curbing, however these items might be replaced with the replacement of the existing bulkhead. Quantities for each asset that require repair or replacement are summarized in the table below.

Table 3 – Dock 26 Asset Deficiencies		
Asset	**Deficiency**	**Quantity**
Sheet piling	Section Loss	550 ft
Mooring bollard/cleat	Deteriorated foundation	3 each
Fender system	Missing/not functioning as designed	1200 ft
Timber curbing	Missing	40 ft
Timber curbing	Damaged	120 ft
Pavement/Drainage repair	Damaged/settled	80 sf

Fig. 13 – Damaged fender system

Fig. 14 – Break in timber curbing

Fig. 15 – Damaged timber curbing and settled pavement

Fig. 16 – Sink hole behind south headwall

DOCK 28

Dock 28 was constructed in 1956 and was designed by the same company that designed Dock 26, therefore there are similar details that were used for both docks. The bulkhead for Dock 28 is constructed with the same sheet piling as Dock 26, MZ38, however it was not reinforced with steel plates or higher yield stress material. The sheet piling length is 60' and it is tied back to a deadman system 80' behind the wall.

The tieback system is a critical component for the wall stability, therefore it was exposed behind the bulkhead to inspect and verify the existing condition. Based upon available records, this is the first inspection to uncover the tieback system for evaluation. The condition of the steel tieback, waler and concrete deadman was in very good condition with little to no section loss observed. The elevation of the tieback system is approximately 1'-2' below the groundwater elevation (at the date of exposure, January 2019). Below are photographs of the exposed tieback and top portion of the deadman. Based upon the condition of the system, it is not warranted to complete an inspection of the tiebacks until either a repair of the bulkhead is required or the system is still in use in 10 years, 2029.

Fig. 17 – Tieback and Deadman Exposure

Fig. 18 – Tieback and Waler Exposure

Steel thickness measurements obtained on Dock 28 exhibit minimal section loss. However, there is one relatively large breach in the bulkhead 80' south of the north corner. The size of the breach is approximately 10' x 2' at the maximum ellipsoid shape of the opening (see Figure 20 below) and there is a sinkhole behind the bulkhead in this location that is approximately 80 sf. A repair was made behind the breach by installing a line of sheet piling, however the ends of the sheet piling run were not closed or sealed. The open ends allow backfill to escape and creates a void behind the wall and depression in the asphalt pavement. The Port will be backfilling this area as needed. Additionally, the walls of

Fig. 19 – Section Loss in CMP Outfall

the 12” CMP outfall at the North end of the dock has deteriorated much like the outfall between Docks 24 and 26.

The dock is in fair condition given the age of the infrastructure, the breach in the bulkhead and the needed repairs on the fender system. The mooring bollards are in good condition and the timber curbing is aged, but a majority of the curbing is functioning as designed. Quantities for each asset that require repair or replacement are summarized in the table below.

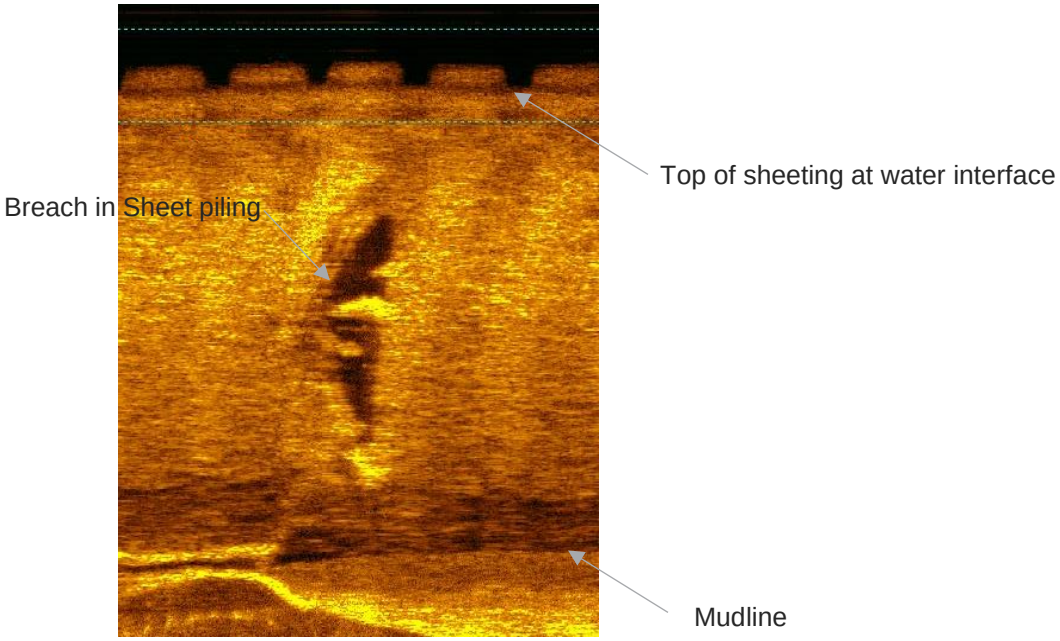


Fig. 20 – Breach in Dock 28

Table 4 – Dock 28 Asset Deficiencies		
Asset	**Deficiency**	**Quantity**
Sheet piling	Breach	25 ft
Mooring bollard	Broken ear cleat	1 each
Fender system	Missing/not functioning as designed	180 ft
Fender system	Damaged	640 ft
Timber curbing	Damaged	110 ft
Pavement and backfill	Damaged	80 sf

Recommendations

The recommended repairs are based on maintaining the docks in their current role and function, and information garnered from review of the existing plans, inspection observations and engineering judgement. The anticipated remaining useful life is based on the life design expectancy of the infrastructure item and subtracting the age of that item. The basis of the life design expectancy that has been set for the sheet piling bulkhead is 70 years. The life design expectancy of an item can vary depending on maintenance, frequency of use and the environmental surroundings. All of these factors could decrease or increase the life expectancy and that is why implementing a routine inspection period, especially nearing the end of the life expectancy of an infrastructure asset, is an important step to take when evaluating safety, costs and budgets for repair versus replacement.

The estimated construction costs for the recommended repairs below include design, construction, construction inspection and a contingency cost of 20%. It is anticipated that the short term repair items would be funded through an annual maintenance budget and the larger financial and long term items would need to be included in future capital investment budgets.

Dock 22
Anticipated Remaining Useful Life: 40 years
Preventative Maintenance Plan:
- Timber Curbing = $ 12,600
- Pavement Repairs = $ 26,400
- Pile Cap Repairs = $ 33,700
- Bollard Repairs = $ 9,400

Capital Investments:
- Fender System Repairs = $ 95,200

Inspection Frequency: 5 years

Dock 24
Anticipated Remaining Useful Life: 10 years
Preventative Maintenance Plan:
- Timber Curbing Repairs = $ 14,400
- Mooring Bollard Repairs = $ 100,500

Capital Investments:
- Concrete Pile Cap Repairs = $ 1,087,100
- Fender System Repairs = $ 198,800

Inspection Frequency: 5 years

Dock 26
Anticipated Remaining Useful Life: 2-5 years
Preventative Maintenance Plan:
- Timber Curbing Repairs = $ 45,600

Mooring Bollard Repairs = $ 46,600
Pavement Repairs = $ 26,200

Capital Investments:
Sheet Piling Bulkhead = $ 3,525,300
Fender System Repairs = $ 531,300

Inspection Frequency: 5 years

Dock 28

Anticipated Remaining Useful Life: 5-10 years

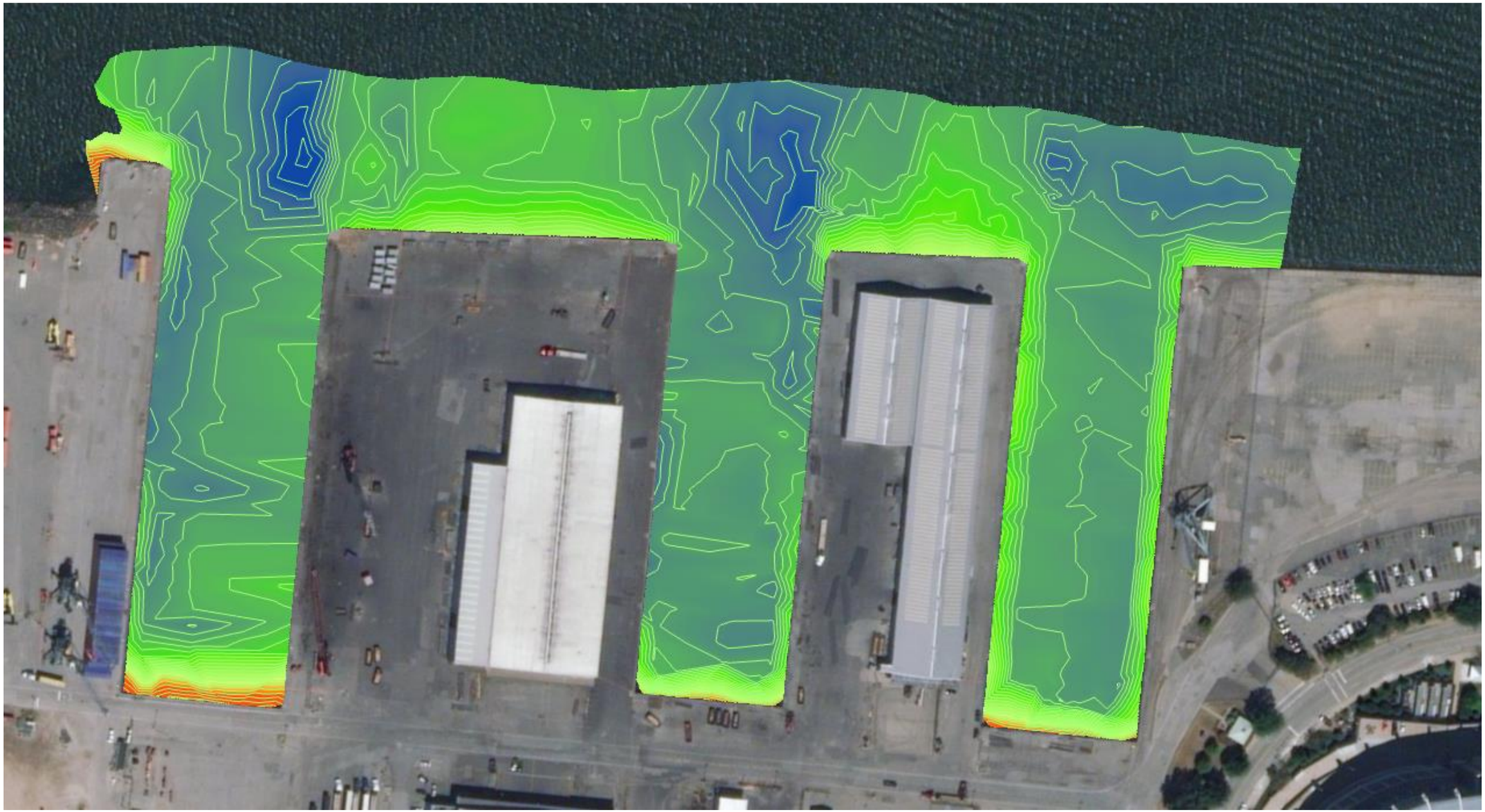
Preventative Maintenance Plan:
Pavement Repairs = $ 18,200
Mooring Bollard Repairs = $ 7,700
Timber Curbing Repairs = $ 27,100
Bulkhead Sinkhole Fill = $ 13,500

Capital Investments:
Fender System Repairs = $ 647,900

Inspection Frequency: 5 years

Appendix A

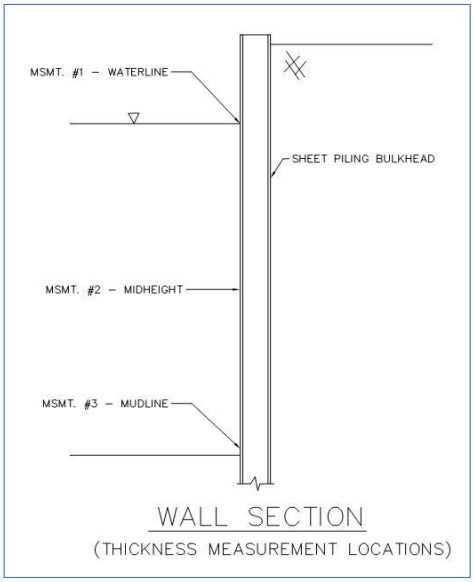
Bathymetric Survey Image



Appendix B

Bulkhead Steel Thickness Measurements

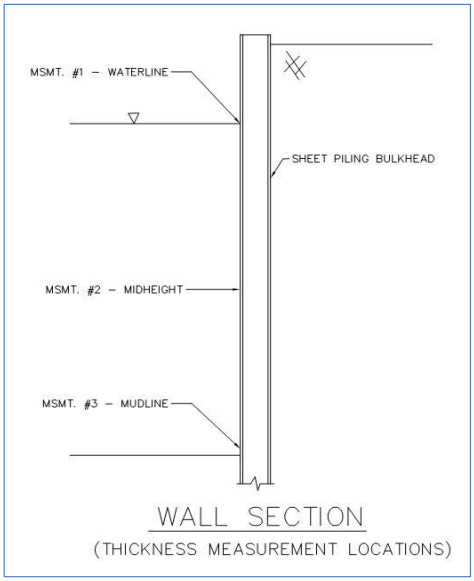
DOCK 22						
Survey Point	Lat	Long	Wall thickness (in)			Original Wall Thickness (*)
	North	East	Top	Middle	Bottom	(in.)
103	670679.894	2185326.869	0.86	0.76	0.74	0.748
104	670699.837	2185312.563	0.862	0.668	0.684	0.748
105	670720.224	2185297.822	0.858	0.736	0.664	0.748
106	670736.827	2185302.334	0.865	0.624	0.676	0.748
107	670750.5	2185323.153	0.887	0.878	0.862	0.748
108	670764.252	2185343.998	0.886	0.901	0.889	0.748
109	670778.105	2185364.967	0.891	0.89	0.857	0.748
110	670781.073	2185386.554	0.835	0.885	0.878	0.748
111	670761.056	2185400.592	0.825	0.87	0.892	0.748
112	670740.115	2185414.847	0.841	0.875	0.902	0.748
113	670719.722	2185429.292	0.816	0.812	0.824	0.748
114	670699.247	2185443.827	0.815	0.625	0.664	0.748
115	670679.137	2185457.841	0.82	0.812	0.896	0.748
116	670658.113	2185472.563	0.795	0.767	0.794	0.748
117	670638.354	2185485.414	0.798	0.792	0.78	0.748
118	670617.091	2185500.579	0.809	0.792	0.782	0.748
119	670596.062	2185515.257	0.797	0.788	0.86	0.748
120	670575.976	2185529.039	0.802	0.776	0.814	0.748
121	670555.097	2185543.469	0.768	0.66	0.656	0.748
122	670534.731	2185557.444	0.846	0.704	0.665	0.748
123	670514.456	2185571.26	0.798	0.616	0.636	0.748
124	670493.795	2185585.132	0.825	0.66	0.632	0.748
125	670472.919	2185600.099	0.793	0.652	0.636	0.748
126	670454.724	2185612.587	0.835	0.65	0.648	0.748
127	670432.037	2185628.058	0.799	0.632	0.72	0.748
128	670411.442	2185642.404	0.825	0.616	0.688	0.748
129	670390.787	2185656.26	0.815	0.663	0.644	0.748
130	670369.945	2185670.763	0.798	0.684	0.628	0.748
131	670349.814	2185684.48	0.789	0.672	0.642	0.748
132	670328.805	2185698.514	0.81	0.632	0.624	0.748
133	670308.199	2185712.793	0.801	0.68	0.684	0.748
134	670287.701	2185727.294	0.798	0.628	0.644	0.748
135	670267.371	2185740.933	0.857	0.628	0.672	0.748
136	670246.628	2185755.892	0.821	0.638	0.644	0.748
137	670226.633	2185769.554	0.818	0.76	0.796	0.748
138	670205.429	2185784.241	0.823	0.788	0.782	0.748
139	670186.189	2185798.152	0.809	0.792	0.76	0.748
140	670164.662	2185812.748	0.799	0.58	0.844	0.748
141	670144.109	2185827.092	0.798	0.74	0.44	0.748



(*) - Ultrasonic measurements may be greater than original wall thickness due to location of reading. If location of reading is near corner or joint it will be greater than the wall thickness

SOUTH BULKHEAD BETWEEN DOCK 22 AND DOCK 24						
Survey Point	Lat North	Long East	Wall thickness (in)			Original Wall Thickness (*) (in.)
			Top	Middle	Bottom	
142	670152.468	2185845.926	0.799	0.536	0.672	0.5
143	670166.865	2185866.367	0.768	0.668	0.744	0.5
144	670181.344	2185887.49	0.485	0.496	0.52	0.5
145	670195.462	2185907.49	0.531	0.484	0.76	0.5
146	670209.661	2185928.283	0.512	0.516	0.56	0.5
147	670223.67	2185948.951	0.537	0.58	0.524	0.5
148	670237.304	2185969.804	0.469	0.412	0.472	0.5
149	670251.271	2185990.168	0.437	0.78	0.58	0.5
150	670265.512	2186011.065	0.485	0.58	0.356	0.5

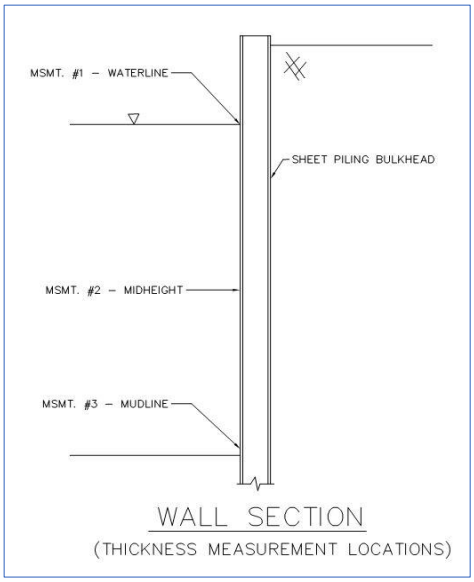
DOCK 24 WEST						
Survey Point	Lat North	Long East	Wall thickness (in)			Original Wall Thickness (*) (in.)
			Top	Middle	Bottom	
151	670281.105	2186020.667	0.679	0.578	0.612	0.5
152	670301.939	2186006.365	0.699	0.528	0.532	0.5
153	670322.529	2185992.081	0.676	0.624	0.584	0.5
154	670343.215	2185977.92	0.704	0.578	0.408	0.5
155	670363.392	2185963.709	0.619	0.486	0.464	0.5
156	670384.089	2185949.267	0.645	0.448	0.388	0.5
157	670404.561	2185935.529	0.668	0.44	0.76	0.5
158	670425.01	2185921.156	0.645	0.412	0.392	0.5
159	670445.305	2185907.278	0.725	0.502	0.519	0.5
160	670466.112	2185892.378	0.658	0.538	0.502	0.5
161	670487.17	2185878.853	0.644	0.528	0.522	0.5
162	670507.68	2185864.545	0.668	0.538	0.512	0.5
163	670528.312	2185850.376	0.652	0.502	0.472	0.5
164	670548.808	2185835.981	0.646	0.58	0.511	0.5
165	670569.646	2185821.602	0.647	0.47	0.48	0.5
166	670590.033	2185807.67	0.651	0.506	0.551	0.5
167	670610.268	2185793.851	0.598	0.512	0.508	0.5
168	670631.731	2185778.893	0.627	0.506	0.504	0.5
169	670652.128	2185765.03	0.654	0.505	0.51	0.5
170	670672.187	2185751.179	0.65	0.501	0.506	0.5
171	670693.074	2185736.728	0.649	0.509	0.507	0.5
172	670713.844	2185722.131	0.529	0.491	0.426	0.5
173	670734.076	2185708.202	0.66	0.52	0.485	0.5
174	670755.965	2185693.545	0.608	0.501	0.487	0.5
175	670775.814	2185679.591	0.603	0.728	0.717	0.5
176	670796.289	2185665.19	0.647	0.708	0.71	0.5
177	670816.907	2185651.089	0.636	0.768	0.763	0.5
178	670836.388	2185637.132	0.64	0.749	0.758	0.5
179	670858.661	2185623.335	0.613	0.645	0.551	0.5



(*) - Ultrasonic measurements may be greater than original wall thickness due to location of reading. If location of reading is near corner or joint it will be greater than the wall thickness

DOCK 24 NORTH						
Survey Point	Lat North	Long East	Wall thickness (in)			Original Wall Thickness (*) (in.)
			Top	Middle	Bottom	
180	670877.985	2185632.985	0.677	0.751	0.704	0.5
181	670893.488	2185653.274	0.627	0.708	0.754	0.5
182	670908.237	2185672.882	0.63	0.695	0.744	0.5
183	670923.639	2185692.826	0.632	0.763	0.768	0.5
184	670938.97	2185712.414	0.645	0.708	0.761	0.5
185	670953.894	2185731.946	0.654	0.72	0.724	0.5
186	670969.39	2185751.837	0.623	0.705	0.702	0.5
187	670984.409	2185771.394	0.63	0.671	0.632	0.5
188	670999.838	2185791.328	0.628	0.721	0.696	0.5
189	671015.313	2185810.989	0.632	0.712	0.71	0.5
190	671030.719	2185830.655	0.585	0.697	0.705	0.5
191	671045.886	2185850.214	0.636	0.574	0.683	0.5
192	671061.492	2185870.079	0.625	0.53	0.531	0.5
193	671077.124	2185889.602	0.691	0.595	0.55	0.5
194	671092.604	2185909.723	0.672	0.686	0.656	0.5
195	671107.936	2185929.025	0.615	0.517	0.619	0.5
196	671123.335	2185948.751	0.605	0.554	0.568	0.5
197	671138.506	2185968.559	0.628	0.639	0.712	0.5
198	671153.586	2185988.304	0.66	0.654	0.628	0.5
199	671169.089	2186008.064	0.603	0.611	0.701	0.5
200	671178.587	2186030.493	614	0.579	0.576	0.5

DOCK 24 EAST						
Survey Point	Lat North	Long East	Wall thickness (in)			Original Wall Thickness (*) (in.)
			Top	Middle	Bottom	
204	671159.697	2186047.02	0.623	0.64	0.68	0.5
205	671138.11	2186060.59	0.661	0.702	0.78	0.5
206	671116.074	2186075.26	0.66	0.71	0.725	0.5
207	671097.54	2186088.107	0.675	0.715	0.812	0.5
208	671076.087	2186102.718	0.714	0.688	0.602	0.5
209	671054.648	2186117.213	0.698	0.704	1.048	0.5
210	671033.904	2186131.637	0.736	0.668	0.788	0.5
211	671012.924	2186145.23	0.758	0.698	1.02	0.5
212	670993.393	2186159.025	0.718	0.703	0.98	0.5
213	670972.641	2186173.034	0.738	0.663	1.01	0.5
214	670951.601	2186187.195	0.725	0.784	1.04	0.5
215	670932.069	2186201.127	0.687	0.802	0.785	0.5
216	670909.764	2186217.004	0.71	0.89	1.015	0.5
217	670890.19	2186230.559	0.805	0.705	1.002	0.5
218	670869.795	2186244.243	0.79	0.802	1.034	0.5
219	670849.834	2186258.566	0.708	0.738	0.987	0.5
220	670828.855	2186272.963	0.879	0.703	1.023	0.5
221	670808.619	2186286.718	0.79	0.795	1.019	0.5
222	670787.891	2186301.129	0.715	0.668	1.015	0.5
223	670767	2186315.231	0.708	0.72	1.013	0.5
224	670747.203	2186328.892	0.609	0.701	1.021	0.5
225	670726.119	2186342.75	0.705	0.724	0.75	0.5
226	670705.058	2186357.061	0.68	0.694	0.675	0.5
227	670684.991	2186371.233	0.636	0.702	0.689	0.5
228	670664.67	2186385.751	0.61	0.628	0.769	0.5
229	670644.821	2186398.662	0.667	0.479	0.505	0.5

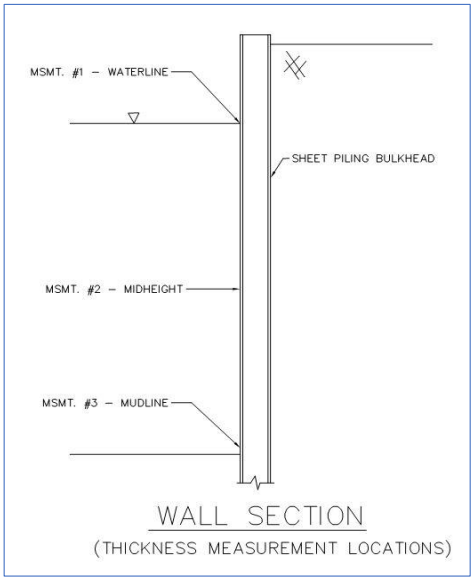


(*) - Ultrasonic measurements may be greater than original wall thickness due to location of reading. If location of reading is near corner or joint it will be greater than the wall thickness

SOUTH BULKHEAD BETWEEN DOCK 24 AND DOCK 26						
Survey Point	Lat	Long	Wall thickness (in)			Original Wall Thickness (*)
	North	East	Top	Middle	Bottom	(in.)
230	670635.098	2186418.15	0.589	0.485	0.477	0.5
231	670646.582	2186434.631	0.54	0.49	0.46	0.5
232	670660.926	2186455.847	0.55	0.517	0.56	0.5
233	670675.212	2186476.036	0.58	0.506	0.521	0.5
234	670689.003	2186496.992	0.59	0.493	0.49	0.5
235	670703.398	2186517.699	0.556	0.535	0.505	0.5
236	670717.838	2186538.505	0.568	0.512	0.516	0.5
237	670731.758	2186558.827	0.598	0.51	0.518	0.5
238	670745.944	2186579.74	0.575	0.508	0.502	0.5

DOCK 26 NORTH						
Survey Point	Lat	Long	Wall thickness (in)			Original Wall Thickness (*)
	North	East	Top	Middle	Bottom	(in.)
266	671318.04	2186211.218	0.601	0.52	0.525	0.5
267	671332.797	2186229.871	0.625	0.54	0.548	0.5
268	671348.055	2186249.741	0.657	0.577	0.526	0.5
269	671362.548	2186269.336	0.638	0.557	0.548	0.5
270	671378.189	2186288.377	0.645	0.58	0.538	0.5
271	671392.842	2186308.789	0.648	0.52	0.53	0.5
272	671408.277	2186328.715	0.653	0.552	0.531	0.5
273	671424.829	2186349.528	0.625	0.566	0.535	0.5
274	671440.185	2186369.369	0.634	0.532	0.534	0.5
275	671455.114	2186389.159	0.621	0.561	0.542	0.5
276	671470.314	2186407.843	0.619	0.553	0.536	0.5
277	671486.514	2186428.975	0.642	0.554	0.573	0.5

DOCK 26 EAST						
Survey Point	Lat	Long	Wall thickness (in)			Original Wall Thickness (*)
	North	East	Top	Middle	Bottom	(in.)
278	671489.423	2186446.91	0.576	0.566	0.553	0.5
279	671467.502	2186461.587	0.562	0.57	0.576	0.5
282	671447.95	2186475.069	0.548	0.568	0.524	0.5
283	671426.826	2186489.957	0.580	0.588	0.592	0.5
284	671406.177	2186503.664	0.558	0.525	0.572	0.5
285	671385.396	2186517.626	0.548	0.588	0.540	0.5
286	671366.063	2186530.88	0.564	0.528	0.598	0.5
287	671345.011	2186545.231	0.584	0.501	0.580	0.5
288	671323.668	2186559.373	0.560	0.540	0.536	0.5
289	671303.3	2186574.025	0.534	0.545	0.520	0.5
290	671282.527	2186588.202	0	0.576	0.495	0.5
291	671261.894	2186601.808	0.556	0.520	0.564	0.5
292	671242.468	2186615.549	0.584	0.520	0.530	0.5
293	671220.055	2186631.069	0.564	0.584	0.596	0.5
294	671200.483	2186644.157	0.560	0.656	0.548	0.5
295	671178.86	2186659.26	0.580	0.552	0.558	0.5
296	671159.408	2186672.452	0.550	0.540	0.634	0.5
297	671136.621	2186688.364	0.562	0.598	0.568	0.5
298	671118.31	2186700.654	0.548	0.576	0.538	0.5
299	671098.504	2186714.012	0.680	0.660	0.710	0.5
300	671077.464	2186728.423	0.572	0.648	0.701	0.5
301	671056.901	2186742.387	0.680	0.617	0.650	0.5
302	671035.991	2186757.047	0.660	0.680	0.690	0.5
303	671014.611	2186771.52	0.684	0.632	0.685	0.5
304	670993.835	2186785.585	0.687	0.662	0.725	0.5
305	670973.58	2186800.5	0.722	0.711	0.702	0.5
306	670952.669	2186813.667	0.552	0.660	0.952	0.5
307	670931.788	2186827.868	0.544	0.496	0.600	0.5

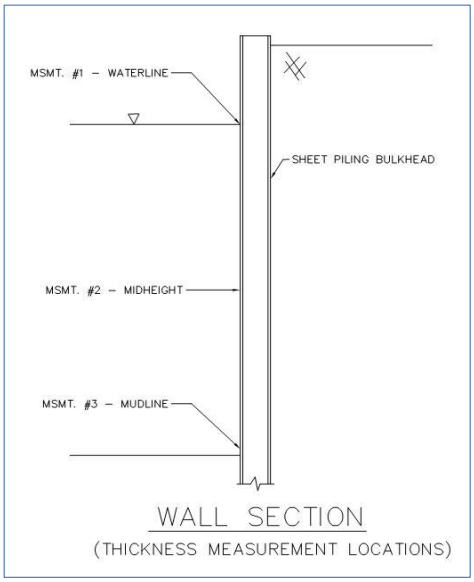


(*) - Ultrasonic measurements may be greater than original wall thickness due to location of reading. If location of reading is near corner or joint it will be greater than the wall thickness

SOUTH BULKHEAD BETWEEN DOCK 26 AND DOCK 28						
Survey Point	Lat North	Long East	Wall thickness (in)			Original Wall Thickness (*) (in.)
			Top	Middle	Bottom	
308	670928.554	2186844.634	0.700	0.544	0.584	0.5
309	670942.324	2186864.807	0.548	0.55	0.528	0.5
310	670956.266	2186885.169	0.55	0.493	0.501	0.5
311	670970.476	2186906.112	0.495	0.568	0.536	0.5
312	670984.602	2186927.52	0.495	0.501	0.497	0.5
313	670998.538	2186947.973	0.530	0.512	0.598	0.5
314	671013.056	2186968.658	0.510	0.522	0.515	0.5
315	671027.434	2186989.093	0.570	0.501	0.489	0.5
316	671040.804	2187009.926	0.595	0.560	0.490	0.5

DOCK 28 WEST						
Survey Point	Lat North	Long East	Wall thickness (in)			Original Wall Thickness (*) (in.)
			Top	Middle	Bottom	
317	671056.305	2187020.913	0.501	0.540	0.525	0.5
318	671076.21	2187007.045	0.540	0.510	0.492	0.5
319	671096.833	2186992.265	0.504	0.550	0.515	0.5
320	671118.067	2186978.044	0.531	0.501	0.528	0.5
321	671138.785	2186964.08	0.520	0.536	0.500	0.5
322	671158.645	2186950.814	0.538	0.504	0.498	0.5
323	671179.913	2186935.851	0.505	0.538	0.501	0.5
324	671200.507	2186922.217	0.535	0.568	0.488	0.5
325	671221.644	2186907.457	0.510	0.520	0.489	0.5
326	671241.818	2186893.367	0.499	0.528	0.505	0.5
327	671263.013	2186879.639	0.528	0.530	0.488	0.5
328	671284.016	2186864.598	0.565	0.454	0.408	0.5
329	671303.649	2186851.291	0.632	0.542	0.428	0.5
330	671324.963	2186836.544	0.545	0.492	0.450	0.5
331	671345.075	2186822.794	0.502	0.524	0.468	0.5
332	671365.464	2186809.361	0.498	0.476	0.456	0.5
333	671386.174	2186794.645	0.505	0.498	0.432	0.5
334	671406.567	2186780.522	0.470	0.468	0.520	0.5
335	671426.776	2186766.414	0.548	0.488	0.508	0.5
336	671447.299	2186752.55	0.564	0.504	0.524	0.5
337	671468.502	2186738.136	0.490	0.528	0.510	0.5
338	671489.294	2186723.52	0.540	0.489	0.496	0.5
339	671509.118	2186709.236	0.532	0.496	0.482	0.5
340	671530.12	2186695.312	0.520	0.515	0.490	0.5
341	671551.279	2186681.386	0.528	0.492	0.418	0.5
342	671572.397	2186667.312	0.510	0.480	0.455	0.5
343	671592.761	2186653.434	0.495	0.496	0.435	0.5

DOCK 28 NORTH						
Survey Point	Lat North	Long East	Wall thickness (in)			Original Wall Thickness (*) (in.)
			Top	Middle	Bottom	
345	671633.334	2186624.871	0.552	0.492	0.425	0.5
346	671650.182	2186640.475	0.489	0.488	0.497	0.5
347	671663.833	2186658.986	0.540	0.484	0.450	0.5
348	671680.055	2186679.646	0.492	0.577	0.489	0.5
349	671694.94	2186699.518	0.552	0.548	0.515	0.5



(*) - Ultrasonic measurements may be greater than original wall thickness due to location of reading. If location of reading is near corner or joint it will be greater than the wall thickness

Appendix C

Construction Cost Estimates

	ESTIMATED MAINTENANCE AND REPAIR COSTS													
	Construction										Design	Inspection	Contigency	Total
Dock 22	Mobilization	Timber	Pavement	Fender	Conc Cap	Sheeting	Bollard	Office	Supervision	Sub-Total	Sub-Total	Sub-Total	Sub-Total	
Short Term	$2,000	$7,400	$15,500		$19,800		$5,500		$5,000	$55,200	$8,000	$5,000	$13,640	**$82,100**
Long Term	$4,000			$25,300					$10,000	$39,300	$25,000	$15,000	$15,860	**$95,200**
Dock 24														
Short Term	$4,000	$5,500					$38,600		$5,000	$53,100	$23,500	$19,000	$19,120	**$114,900**
Long Term	$40,000			$138,900	$759,600			$10,000	$40,000	$988,500	$45,000	$38,000	$214,300	**$1,285,900**
Dock 26														
Short Term	$4,000	$18,100	$10,400				$18,500		$5,000	$56,000	$23,500	$19,000	$19,700	**$118,400**
Long Term	$100,000			$414,400		$2,750,000		$20,000	$80,000	$3,364,400	$10,000	$6,000	$676,080	**$4,056,600**
Dock 28														
Short Term	$2,000	$15,500	$10,400			$6,700	$4,400		$5,000	$44,000	$10,000	$8,000	$12,400	**$66,500**
Long Term	$20,000			$281,400				$7,500	$20,000	$328,900	$115,000	$96,000	$107,980	**$647,900**