OSWEGO CANAL CORRIDOR BOA

APPENDIX Q: WESTSIDE COAL PIER STRUCTURAL ASSESSMENT

NOVEMBER 2019

Oswego Canal Corridor
Brownfield Opportunity Area
Step III Implementation Strategy
City of Oswego, New York

Westside Coal Pier
Condition Inspection and Structural Assessment

Prepared for:
Bergmann Associates
March 23, 2017
(Revised May 26, 2017)

RAVI ENGINEERING & LAND SURVEYING, P.C.
2110 S. Clinton Avenue, Suite 1
Rochester, New York 14618
(585)223-3660

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PURPOSE

This Structural Assessment of the Westside Coal Pier was conducted as part of the Oswego Canal Corridor, BOA Step III Implementation, for the City of Oswego, NY.

The purpose of this Structural Assessment is to assess structural conditions to help evaluate the viability of future development using this structure. The following tasks were undertaken for this report:

- Determine feasibility of future construction and redevelopment on the coal pier
- Determine the load bearing potential and limitations
- Provide recommendations for future development on, adjacent to and around the pier structure
- Provide planning level cost estimates for various alternatives to help understand development implications and expected return on investment (to be coordinated with other team members)

Ravi Engineering & Land Surveying, P.C. performed a visual inspection of the Westside Coal Pier in Oswego Harbor, in the City of Oswego, New York. The field inspection was performed by Glenn Klein, PE, and Andrew Machaby on December 21, 2016. Access was accomplished by walking and using a rowboat.

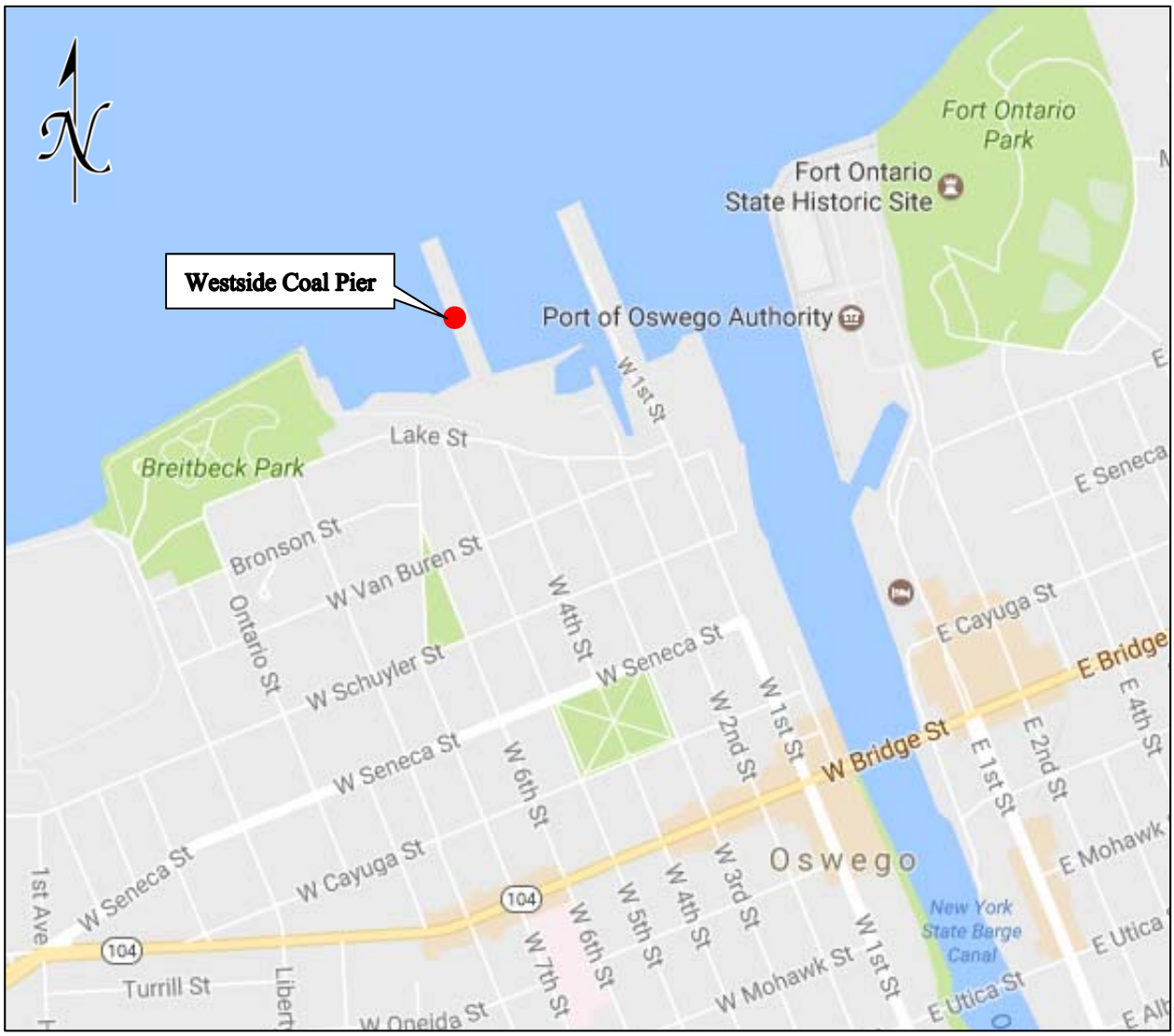
BACKGROUND

The Westside Coal Pier was constructed in 1883 by the Delaware Lackawanna and Western Railroad. The structure originally consisted of timber cribbing retaining walls and a large timber trestle superstructure. The trestle supported elevated railroad tracks that were used to load coal onto ships and barges. Record plans are not available.

Around 1900, an enclosure was constructed on top of the trestle to shelter workers and permit around the clock operation. In 1935, the timber trestle superstructure was removed and replaced with at-grade tracks and a coal conveyor loading system. Around 1940, portions of the timber cribbing walls on the east side and north end were lined with steel sheet piles. A cellular steel sheet pile wall was also constructed to lengthen the east side of the pier toward the shore. USACOE records from the 1930s and early 1940s indicate the channel on the east side of the pier was dredged to a depth of 21’ to 22’ below the low-water level.

Operations on the west side of the pier were discontinued in the 1940s due to difficulties maneuvering large vessels on that side of the pier. The timber cribbing along the west side was replaced with sloped heavy stone fill in the late 1940s or early 1950s. The coal pier ceased operations in 1963.

In 1995, the east wall was repaired and capped with the concrete walkway, and the yacht club building was constructed on the pier. Historic photos are included in Appendix B.



Location Map

INSPECTION FINDINGS

The coal pier is approximately 850' long. For inspection purposes, stationing along the east wall was established beginning at the corner of the concrete walkway slab at the shore. Site photos are included in Appendix A, and the existing Plan and Elevation Sketch SK-1 is included at the end of the Inspection Findings section.

Cellular steel sheet pile from STA 9 to 129:

Beginning near the shoreline, a cellular steel sheet pile wall extends approximately 120' from STA 9 to 129. This section of the wall consists of five 24' lengths of cellular sheet pile wall systems having a circular appearance constructed of 16" wide x 3/8" thick flat sheet piles (PSA23 or similar), and most likely dates from the 1930s or 1940s. The wall height varies, with a maximum expose height of 23.9' above the harbor bottom, and water depth up to 17.7'. The exposed piles are heavily corroded near the water level with numerous small rust holes. The

top of the piles are in good condition, and the cells remain well aligned. The concrete walkway and a small crane founded above this portion of the wall are in good condition with no indications of settlement. Refer to Photos 2 through 7.

Timber cribbing wall from STA 129 to 344:

An old timber cribbing wall extends approximately 215' from STA 129 to 344. This portion of the wall is in very poor condition. The wall height is approximately 20' to 22' above the harbor bottom, and the water depth is approximately 14' to 16'. The timbers have widespread severe decay above the water level. Portions of the wall are severely displaced and settled from STA 135 to 160 and from STA 300 to 344. Shallower water depth measurements in these areas suggest that substantial amounts of backfill may have spilled from behind the wall. In areas where the timber cribbing is displaced, settlement of the concrete walkway is also evident, which indicates that movement has occurred fairly recently. Refer to Photos 8 through 15.

Steel sheet pile wall from STA 344 to 857:

A steel sheet pile wall extends from STA 344 to 857, and the sheeting continues approximately 110' across the north end of the pier (Photos 16 through 20). The wall height is approximately 21' to 25' above the harbor bottom, the water depth is approximately 14' to 17', and the pile embedment depth is unknown. This portion of the wall consists of 16" wide x 5" deep x 3/8" thick U-shaped sheet piles (PDA27 or similar), and most likely dates from the 1930s (Photo 33). The top of the sheets are anchored to a horizontal waler and tie-backs behind the sheeting. The piles are severely corroded with large rust holes near the water level. Overall pile section loss varies and is estimated in the range of 60% to 90% (Photos 21 and 23). Probing through several holes with a survey rod, timber could be felt about 1' to 2' behind the sheeting. The sheeting appears to have been placed immediately in front of an older timber wall. The timber wall remnants appear to be limiting the loss of backfill through the holes in the steel sheeting, but settlement of sidewalk slabs behind the wall suggests that active erosion is occurring as wave action constantly flushes water in and out of the holes (Photo 38).

Other serious defects on this portion of the wall include:

- A portion of 1 pile is missing above the water level at STA 425 (Photo 22).
- Three piles are badly torn and deformed near STA 560 (Photo 24).
- There is moderate misalignment and deformation of piles from STA 580 to 600 (Photo 19).
- From STA 730 to 830, the top 3.5' of the sheeting was cut off and new piles were welded on. The splices are very irregular and poorly aligned. From STA 790 to 830, different size piles and some flat plates were set on top of the cut off piles without proper connections (Photos 25 through 29).
- At the northwest corner of the pier, the piles are leaning up to 20 degrees and the bottom of the wall appears to be displaced toward the lake (Photos 31 and 32).

The concrete walkway is cantilevered approximately 5' beyond the sheeting from STA. 446 to 857. A large two-story wood framed deck is also supported by the sheet pile wall at the east

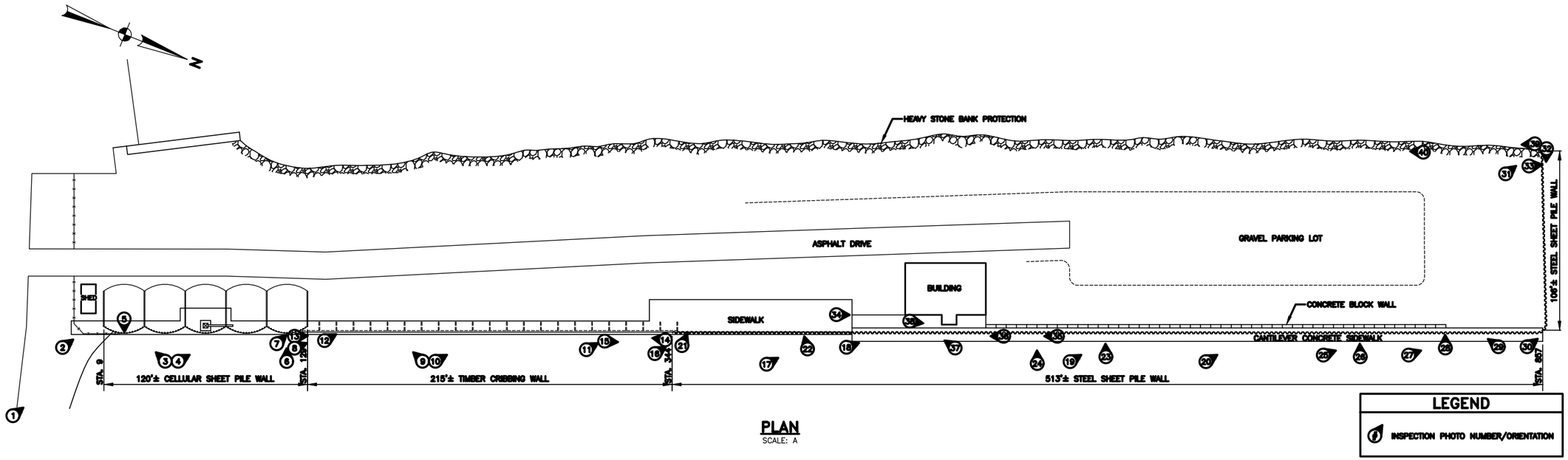
side of the Yacht Club Building (Photos 17, 18, and 34 through 36). The support brackets for the cantilevered walkway and the wood deck are in good structural condition, but these supports are dependent on the stability of the severely deteriorated sheet piles beneath it (Photos 18 and 37). There is no visible settlement or distress in the sheet piles at this time.

Sloped stone bank at west side of pier:

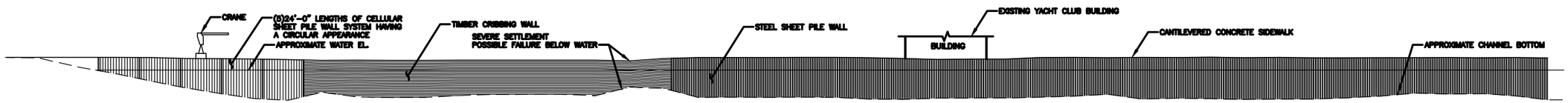
The sheet pile wall terminates at the northwest corner of the pier, and a steeply sloped bank lined with heavy stone bank protection extends along the west side of the pier. Remnants of the original timber cribbing are still visible in the stone slope near the northwest corner. The stone bank protection is in good condition and appears stable (Photos 39 and 40).

Yacht Club Building:

The yacht club building appears to be in good structural condition (Photos 17, and 34 through 36). The building is set back approximately 5’ to 10’ behind the sheet pile retaining wall, which is approximately 23’ to 24’ high in this area. Based on discussion with a contractor that was involved during construction of the building (Jim Tabor of J. D. Taber Masonry Inc.), the foundation is believed to be a spread concrete footing on the pier fill material. The footing is located approximately 4’ below finished grade. A concrete walkway slab located between the building and the retaining wall is settled up to 2” (Photo 38), which may indicate loss of backfill in this area. There is no significant cracking or distress in the concrete block building itself.



PLAN
SCALE: A



STATION	0	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380	400	420	440	460	480	500	520	540	560	580	600	620	640	660	680	700	720	740	760	780	800	820	840	857
*WALL HEIGHT	–	9.8	13.9	17.2	20.4	23.2	23.9	18.7	21.6	21.8	21.7	20.8	20.4	20.1	20.2	20.9	15.4	17.6	23.4	23.3	23.4	23.4	23.5	24.3	24.1	22.8	22.9	22.9	23.3	22.8	21.5	24.5	23.9	24.4	24.5	24.5	24.2	23.5	22.5	20.8	21.5	21.0	22.7	24.5
*WATER DEPTH	–	2.3	6.5	10.4	13.7	16.7	17.7	13.0	15.7	16.1	16.0	14.9	14.3	14.2	14.3	15.0	10.0	10.7	16.0	15.9	16.0	15.9	16.0	17.0	17.2	16.5	16.4	16.4	15.9	15.3	14.2	17.0	16.5	16.8	17.2	17.0	17.0	16.3	15.2	13.5	14.1	13.8	15.3	17.4

* MEASUREMENTS WERE TAKEN DURING FIELD INSPECTION ON 12/21/2016.

ELEVATION
SCALE: A

WESTSIDE COAL PIER EXISTING PLAN AND ELEVATION

30 0 30 60 FT.
SCALE A

OSWEGO CANAL CORRIDOR
BROWNFIELD OPPORTUNITY AREA
STEP III IMPLEMENTATION STRATEGY
CITY OF OSWEGO, NEW YORK

PROJECT NO: 40-16-175
DATE: MAY 2017
SCALE: AS NOTED
DRAWING NO: SK-1

RAVI ENGINEERING & LAND SURVEYING, P.C.
2110 SOUTH CLINTON AVENUE, SUITE 1
ROCHESTER, NEW YORK 14618
TL: (585) 223-3660 FX: (585) 223-4250

CONCLUSIONS

The Westside Coal Pier structure is in very poor structural condition. There are indications that portions of the timber retaining wall may have already failed. These failures represent an imminent danger in that portions of the wall could collapse. The existing steel sheet pile walls are in poor condition and vulnerable to failure too, though it does not appear there is any deformation yet. These conditions warrant the consideration of immediate closure of the pier structure and further evaluation of how the yacht club foundations have been constructed.

Any future development plans utilizing the pier should include replacement of the existing retaining wall along the east side and north end. There was no information available regarding the existing backfill materials. Prior to designing replacement walls for the existing retaining walls, complete and in-depth geotechnical investigations are required. Additional discussion of these summarizations is provided below.

The existing wall is also vulnerable to erosion of the existing backfill materials through holes in the sheeting, which could potentially affect the yacht club building.

Based on observations above the water level, the current safety and stability of portions of the pier wall is questionable. The old timber wall from STA 129 to 344 has large areas of severe misalignment and settlement which suggest that failures may have already occurred below water.

The steel sheet pile retaining walls are approximately 70 to 80 years old. From STA 344 to 857 and continuing along the north end, the sheeting is severely corroded with large holes near the water level. The tied-back wall configuration relies on the flexural strength of the sheet piles, which have been compromised by section loss in the high stress region near the water level. The weight of the concrete walkway and the wood deck at the yacht club building also induce axial stress on the sheet piles. Considering the severity of section loss without serious deformation of the sheet pile wall, it is suspected that remnants of the original timber cribbing behind the wall may be resisting a substantial portion of the lateral earth pressure on the wall.

The cellular steel sheet pile wall systems near the shoreline (STA 9 to 129) remain stable and functional. This type of wall relies on lateral tension and interlock between the piles in the cellular ring to retain the mass of backfill, which functions as a gravity structure. The localized section loss near the water level is not perceived to be a serious structural concern at this time. However, there is potential for long-term erosion and settlement behind the wall, especially as the size of rust holes gradually increase.

RECOMMENDATIONS:

A. Feasibility of future construction and redevelopment on the coal pier –

1. Prior to any future construction or redevelopment on the coal pier replacement of the existing retaining wall systems is strongly recommended. This can be accomplished by increasing the width and length of the pier as shown in the sketch SK-2, included at the

end of the "Recommendations" section. It includes the addition of a steel sheet pile wall system located outside the existing wall system and with concrete infill between the existing and added walls systems. It is also the intent of the added wall system and concrete infill to provide support for the existing cantilevered concrete walkway.

2. The rehabilitation of the existing pier structure is not recommended. Its removal is only recommended as required for assuring the structural integrity and construction of the replacement retaining wall. Reference items 3 through 6 below for further discussions concerning this recommendation.

3. Furthermore, prior to starting the design for the replacement wall to be placed in front of the existing wall and in addition to the timber wall as discussed below, due to the corroded and structurally unsound conditions of the existing pier structure, a diving inspection is recommended to assess below-water conditions for full length of all walls at the perimeter of the pier structure. The purpose of this assessment would be to provide an evaluation for the feasibility of considering the existing wall as a temporary structure during the pier renovation construction.

4. The 120' long portion of the cellular steel sheet pile wall systems near the shoreline (STA 9 to 129) could conceivably be rehabilitated, but replacement/replacement may be more practical and cost-effective, since the rest of the wall needs replacement.

5. A diving inspection is recommended to assess below-water conditions for full length of wall, given widespread poor condition. In the meantime, the owner should prevent vessels from docking along this portion of the wall, and temporary fencing should be erected behind the wall to restrict pedestrian access. The timber wall appears to be at the end of its service life and should be programmed for replacement. Based upon information gathered from the diving inspection the removal of the existing wall's timber may be required, however this should not be done prior to the placement of added steel sheet piling reinforcement wall and concrete fill.

6. The tied-back sheet pile wall appears to be at the end of its service life and should be programmed for replacement.

B. Load bearing potential and limitations -

1. If the removal and replacement of the pier's existing backfill materials is not considered an economically feasible option, prior to design of the recommended replacement retaining wall and addition of future structures on the existing pier area additional information will be required for those backfill materials. A certified geotechnical report to determine the load bearing potential and limitations of the existing pier for future structural foundation and retaining wall design requirements is needed, and shall include:

    Soil density (PCF) – for all designs

Internal soil PHI angle (Angle of Repose) – all designs

Equivalent lateral force (ELF) Active soil Coefficient (K_a) - retaining walls

Equivalent lateral force (ELF) Passive soil Coefficient (K_p) - retaining walls

Equivalent lateral force (ELF) At-Rest soil Coefficient (K_o) -retaining walls

Allowable sliding Coefficient (Mu) – all designs

Allowable soil bearing pressures (PSF) – all designs

Anticipated settlement under a given load (inches) – all designs

Listing of hazardous materials in the existing backfill soils

C. Recommendations for future development options –

All options for future development must include replacement of the steel sheet pile retaining wall as well as proper guiderail meeting current standards.

Additional loading, or changes to finished grade, associated with any new structures would need to be considered as well. A Certified Geotechnical Report prepared by a NYS Licensed P.E. is needed to define soil design parameters of the existing backfill material.

Options include:

a. Temporary and mobile type structures which are generally light frame structures.

- May not require improvement to backfill subgrade soils (i.e., site could be used "as is") because minor settlements would not be a concern.

b. Permanent Structure (s).

- May require use of more flexible and non-brittle materials
- May require surcharging of pier subgrade soils, inducing anticipated settlements, prior to construction.

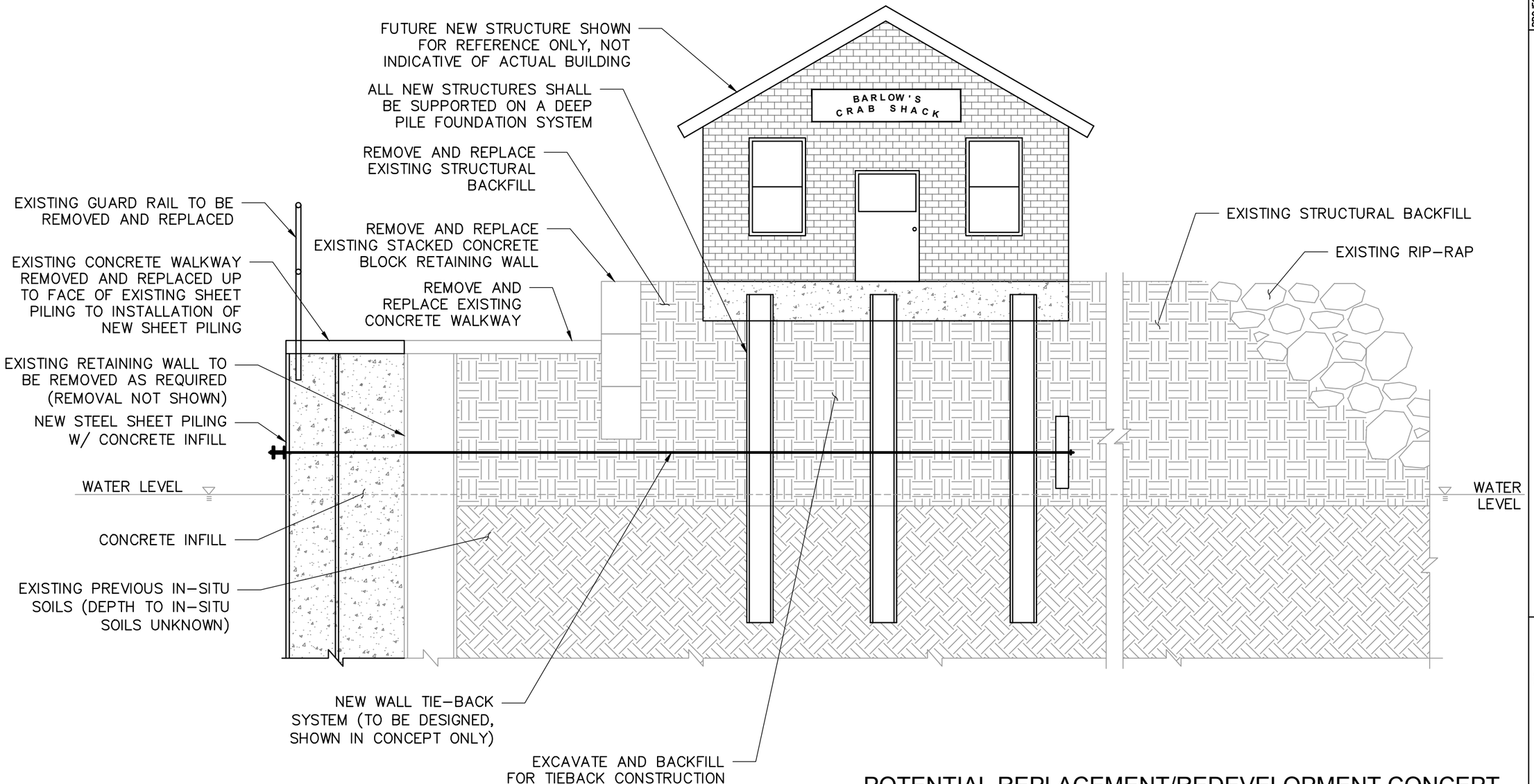
c. Multi-story, masonry (brittle) structures, or structures using vibrating equipment.

- Will require a deep pile foundation system (See Sketch SK-2 for concept). These pile foundations would require special design considerations. Parking areas serving these structures could be constructed on the surcharged areas of the pier as discussed in item "b." above. For vibratory type structures it may be necessary to create a means of isolation from the adjacent soil masses to avoid their settlement.

D. Planning level cost estimates (to be coordinated with other team members):

For budgetary purposes, an opinion of estimated cost to replace existing retaining walls is approximately $5.0 - $7.0 million.

This estimate assumes that the replacement wall would consist of steel sheet piling with tie-back system placed in front of the existing retaining wall as shown in Sketch SK-2 with partial removal of the existing retaining wall. This cost includes material and labor for the replacement wall, tie-back system construction, and concrete infill between the two wall systems only. It does not include the certified geotechnical report, the client's preferred guardrail system, or design considerations for the "Future Recommendations" which include either the surcharging of the existing subgrade soils or deep foundation pile systems.



POTENTIAL REPLACEMENT/REDEVELOPMENT CONCEPT

NOT TO SCALE

OSWEGO CANAL CORRIDOR
BROWNFIELD OPPORTUNITY AREA
STEP III IMPLEMENTATION STRATEGY
CITY OF OSWEGO, NEW YORK

PROJECT NO: 40-16-175
DATE: MAY 2017
SCALE: AS NOTED
DRAWING NO: SK-2

RAVI ENGINEERING & LAND SURVEYING, P.C.
2110 SOUTH CLINTON AVENUE, SUITE 1
ROCHESTER, NEW YORK 14618
TL: (585) 223-3660 FX: (585) 223-4250

Appendix A
Site Photos

Photo 1 – East side of pier, looking northwest from shore

Photo 2 - East side of pier at shore, showing STA 0 location at first bollard

Photo 3 – Cellular sheet pile wall near STA 40

Photo 4 - Cellular sheet pile wall near STA 80

Photo 5 – Top of typical cellular wall pile, 1st cell near STA 20 shown.

Photo 6 – Cellular wall near STA 120, showing typical corrosion near water level

Photo 7 - Cellular wall near STA 120, close-up of typical pile corrosion

Photo 8 – Timber cribbing wall, beginning at STA 129

Photo 9 – Timber cribbing wall, looking south near STA 200

Photo 10 - Timber cribbing wall, looking north near STA 200

Photo 11 - Timber cribbing wall, looking north near STA 300

Photo 12 - Timber cribbing wall, close-up of decay near STA 140

Photo 13 – Top of timber cribbing wall, showing settlement between STA 135 and 160

Photo 14 - Top of timber cribbing wall, showing settlement between STA 300 and 344

Photo 15 - Top of timber cribbing wall, showing concrete slab displacement at STA 304

Photo 16 – Beginning of sheet pile wall at STA 344

Photo 17 - Sheet pile wall, looking north near STA 400

Photo 18 - Sheet pile wall, looking north near STA 450

Photo 19 - Sheet pile wall, looking north near STA 580

Photo 20 - Sheet pile wall, looking north near STA 660

Photo 21 – Sheet pile wall, close-up of typical holes near low water level at STA 350

Photo 22 - Sheet pile wall, missing section of pile exposed timber cribbing at STA 425

Photo 23 - Sheet pile wall, close-up of typical holes near low water level at STA 600

Photo 24 - Sheet pile wall, torn piles near at STA 560

Photo 25 - Sheet pile wall, irregular welded splices beginning at STA 730

Photo 26 - Sheet pile wall, irregular welded splices at STA 750

Photo 27 – Sheet pile wall, irregular welded splices near STA 780

Photo 28 - Sheet pile wall, mis-matched pile “splice” near STA 800

Photo 29 – Sheet pile wall, plate repair near STA 830

Photo 30 – Sheet pile wall and timber piles at STA 850

Photo 31 – End of sheet pile wall at northwest corner of pier,

Photo 32 – Leaning sheet piles at northwest corner of pier

Photo 33 – Top of typical sheet pile, at northwest corner of pier

Photo 34 – Yacht Club building, looking north

Photo 35 – Yacht Club building, looking south

Photo 36 – Yacht Club building deck supports, looking south

Photo 37 – Deck column support brackets near STA 500

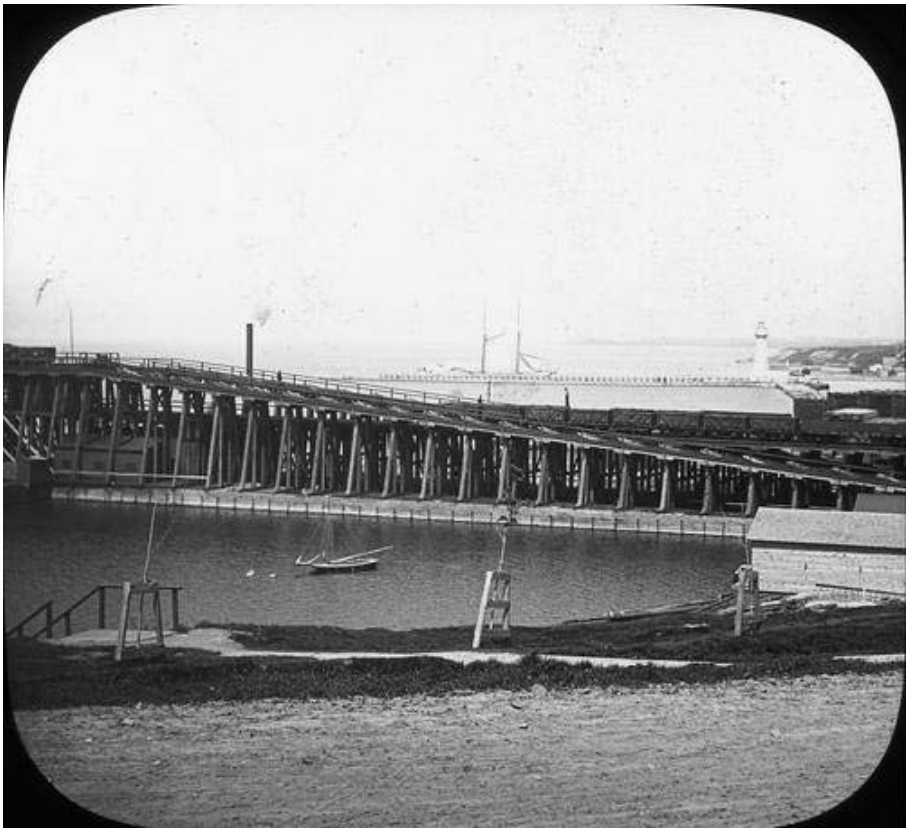
Photo 38 – Settlement of concrete slab behind sheet pile wall near STA 500

Photo 39 – Remnants of timber cribbing at near northwest corner of pier

Photo 40 – Stone bank protection at west side of pier

Appendix B
Historic Photos

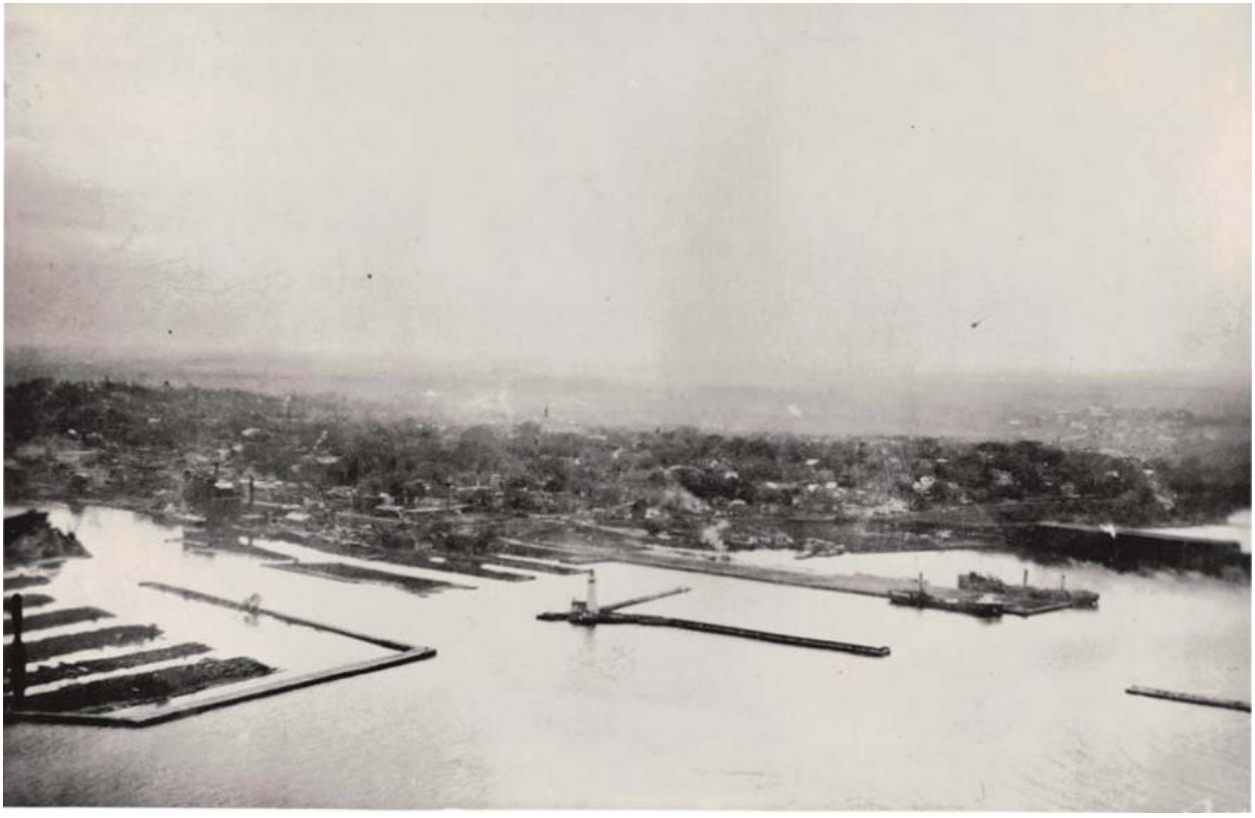
Coal Pier between 1890 and 1901 (looking north at west side of pier)
High resolution image available at www.loc.gov/item/det1994007625/PP/



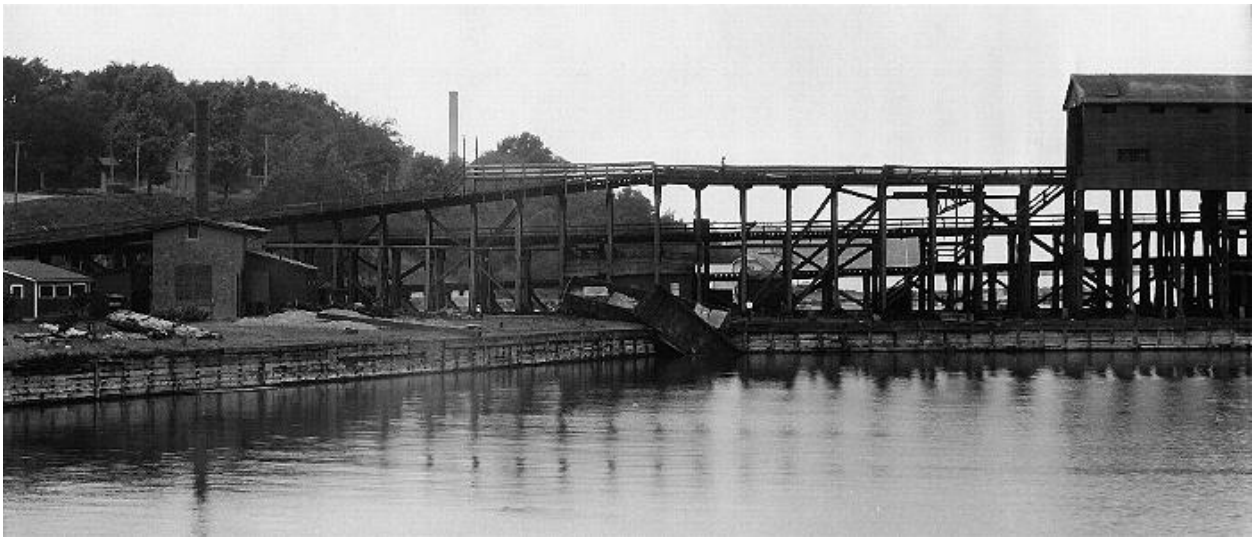
Coal Pier circa 1890 (looking northeast)
www.oswego-history.com

Coal Pier, early 1900s (looking north at west side of pier)
http://kodtrak.railfan.net/Graphics/oswego

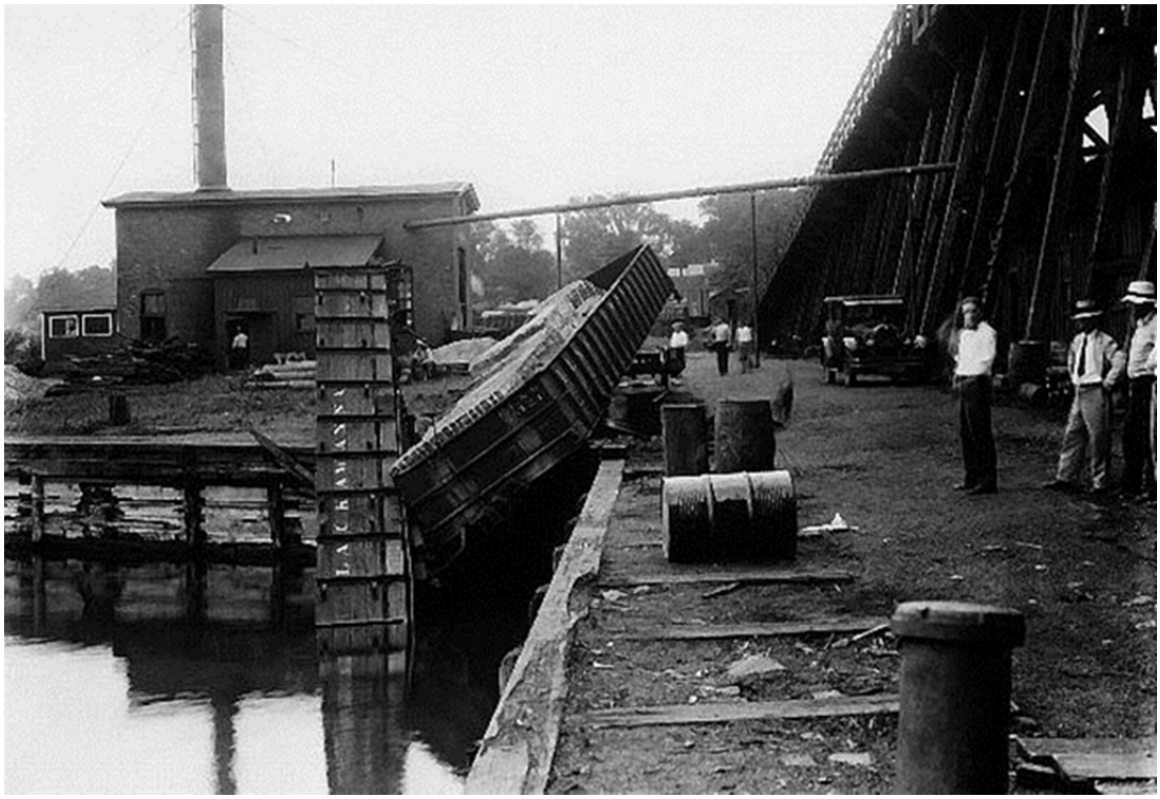
East side of trestle, early 1900s (looking northwest)
www.oswego-history.com



Aerial photo looking southwest, prior to 1925 (coal pier shown at far right).
www.oswego-history.com



Coal Pier, circa 1925 (looking west at east side of pier)
http://kodtrak.railfan.net/Graphics/oswego

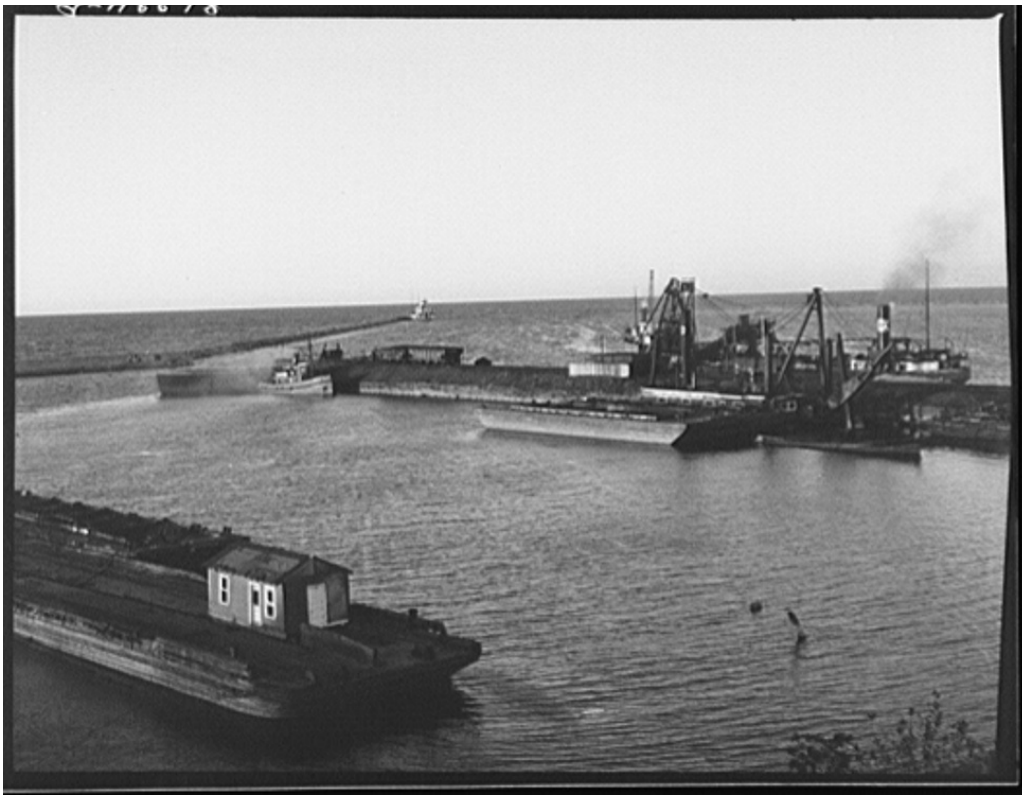


Coal Pier, circa 1925 (looking south on east side of pier)
http://kodtrak.railfan.net/Graphics/oswego

East side of trestle, late 1930s (looking northwest)
http://kodtrak.railfan.net/Graphics/oswego

East side of trestle, late 1930s (looking north)
http://kodtrak.railfan.net/Graphics/oswego

Loading coal at east side of pier, October 1941
https://www.loc.gov/item/fsa2000052315/PP/

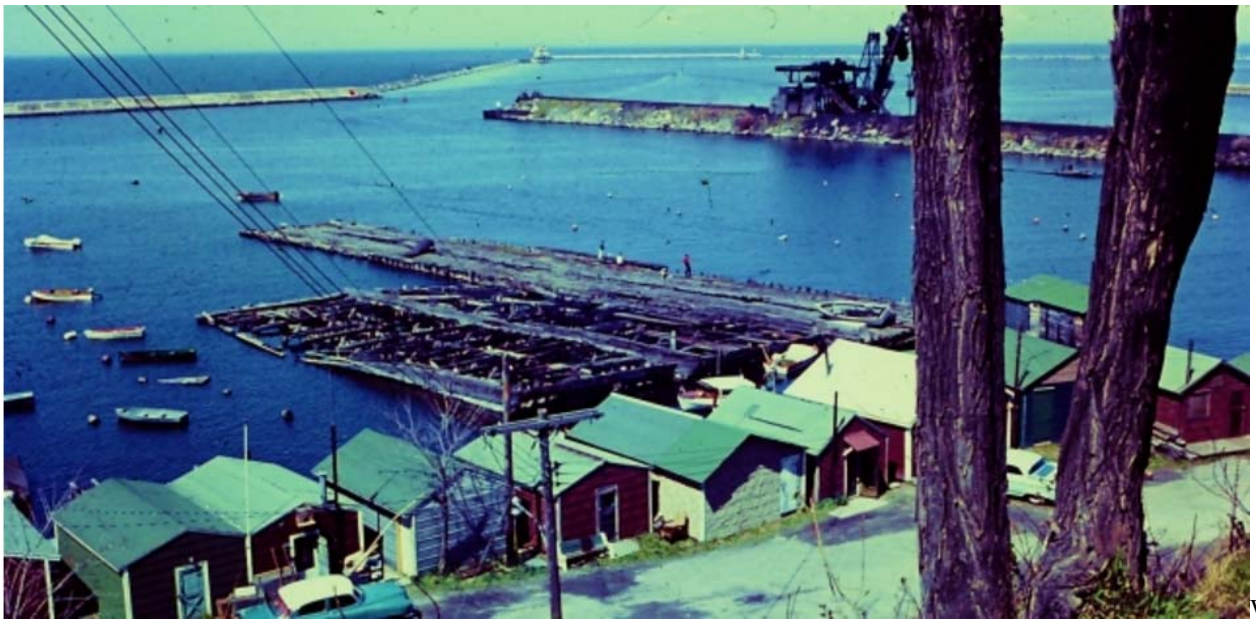


West Side Coal Pier, October 1941 (looking northeast)
https://cdn.loc.gov/service/pnp/fsa/8c26000/8c26000/8c26055v.jpg

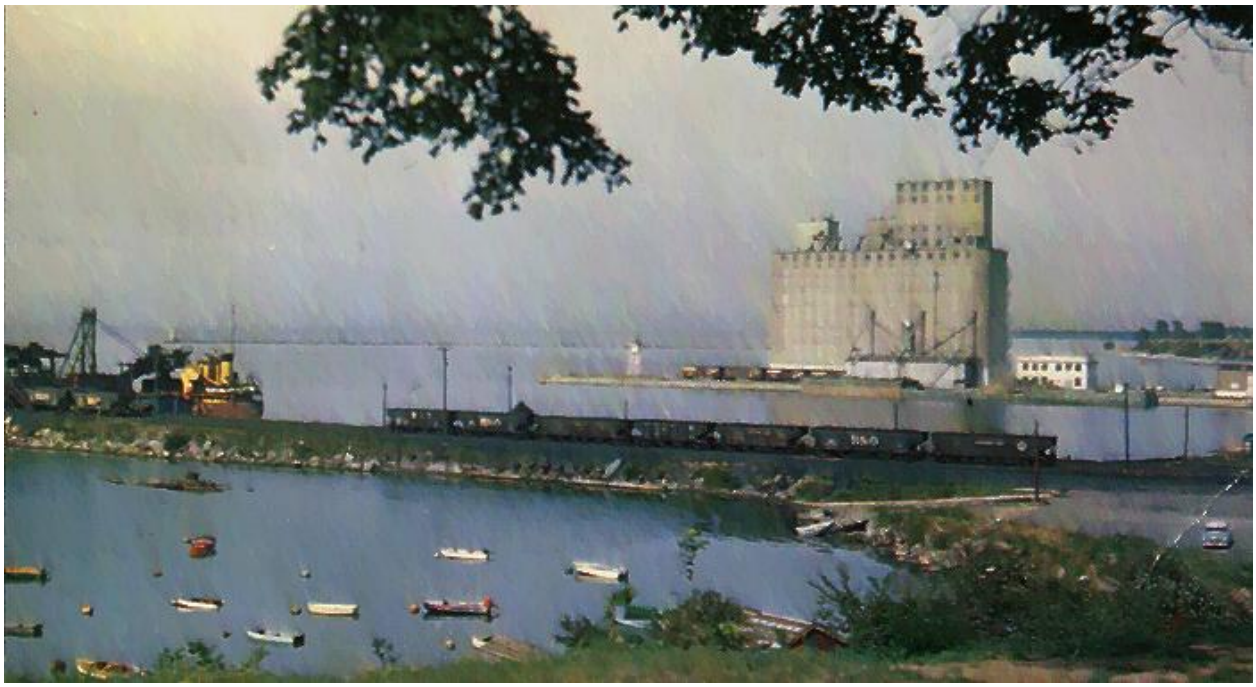
Aerial photo looking west, early 1940s (coal pier shown at top)
http://kodtrak.railfan.net/Graphics/oswego

Aerial photo looking west, mid 1940s
http://kodtrak.railfan.net/Graphics/oswego

West Side Coal Pier, July 1958 (looking northeast)
www.oswego-history.com



West Side Coal Pier, circa 1960 (looking northeast)
www.oswego-history.com



West Side Coal Pier, circa 1960 (looking northeast)
http://kodtrak.railfan.net/Graphics/oswego