

# UNDERWATER INSPECTION REPORT

for

**Klinger & Associates**

Quinsippi Island Bridge  
Over the Mississippi River  
Near Quincy, IL

Inspection Date: October 8, 2015



Prepared By:

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**Disclaimer:** The information provided herein is for the limited administrative and operational use of Klinger & Associates and their contractors. Other requests for this document shall be referred to J.F. Brennan, Company, Inc. The accuracy of the information provided is limited to the conditions of the site and to the day of inspection.

## 1. Introduction/Background

J.F. Brennan Company, Inc. (Brennan) performed a routine underwater inspection of the exterior surface of the underwater portions of the in-water substructures of the Quinsippi Island Bridge located in Quincy, Illinois. Additional acoustic imaging was conducted on the underwater portions of the structure in order to provide a visual representation of any discovered deficiencies. Environmental conditions, such as channel bed material, biological growth, and drift/debris, were generally noted. The structures were also inspected to determine if foundation elements were exposed and/or if scour or undermining was present.

### Structure Data

Owner:	Quincy Park Authority
Location:	Quincy, IL
Waterway Crossing:	Mississippi River
Bridge Orientation:	East / West
River Orientation:	North to South (at bridge)

Existing/Previous Information: Refer to the section entitled 'Structure Description'

The previous underwater inspection conducted in 2014 by Mainstream Commercial Diving was consulted for this inspection.

No inspection was performed on the following: any substructure elements out of the channel, any superstructure elements, or any other bridge or approach/surrounding elements.

## 2. Structure Description

The Quinsippi Island Bridge was orientated in an East/West direction. For this report Brennan labeled the substructures in conjunction with the provided design drawings and the previous inspection report.

- The length of the bridge over the inspected structures was approximately 525 feet.
- The bridge was a steel deck on girder design, supporting vehicular traffic.
- The bridge had six (6) in-water masonry stone substructures.

## 3. Method of Investigation

A FHWA Level I visual and tactile inspection of the structure and surrounding riverbed was used to observe signs of distress and deterioration including, but not limited to: movement, cracks, honeycombing, scaling, spalling, exposed reinforcing steel, and collision damage. More in-depth inspection techniques were used on any discovered areas of undermining in order to more accurately assess the remaining load bearing integrity of the structures in question.

- Date of Inspection: October 8, 2015
- Brennan Dive Team:

Jacob Rodgers	Dive Supervisor
Andy Giblin	Inspection Diver
Ryan Olson	Standby Diver / Tender
Spencer Cossalter	Note Technician / Acoustic Imaging Specialist
- A Brennan owned aluminum flat bottom boat was used as the dive platform.
  - Boat Launch: Downstream of bridge, 823 Bonansinga Dr. Quincy, IL 62301.
- The diver used surface supplied air. The dive equipment included a Kirby Morgan dive helmet with full diver-to-surface communications; and a helmet-mounted Outland Video Camera and light with a monitor and a recorder on the dive platform.
- A Kongsberg-Mesotech MS 1000 sector scan was used for the below water acoustic imaging.
- The depth soundings were taken using a survey measuring pole and/or the boat mounted Hummingbird depth finder.
- All measurements were approximate.

#### 4. Inspection Findings

Overall and at the time of the inspection, the inspected in-water structures were in Poor condition at and below the waterline according to the National Bridge Inspection Standards (NBIS) due to the presence of undermining on one (1) of the structures. Other than the area of undermining, only minor deficiencies were found on the structures having little to no impact on the structural integrity of the bridge. Additional and specific information can be seen below and in 'Appendix A – Graphical Data and CAD Drawings' and 'Appendix B – Photographs'.

##### Water

- Water Elevation: 10.4 feet below the top of the pier cap on Pier 21  
470.20 feet (USACE gauge 'Mississippi River at Quincy, IL')
- Water Depths: 32 feet maximum measured river depth
- Visibility: ± 6 inches
- Water Velocity: Light
- Marine Growth: Light
- Weather: Partly cloudy

##### Pier 21

- Overall condition: Satisfactory.
- The general condition of the pier had not significantly changed since the last inspection.
- Light weathering and freeze-thaw damage was noted on the masonry stone and the mortar joints surrounding the waterline.
- The water depth ranged from two (2) to five (5) feet surrounding the structure. The shallow depths prevented acoustic imaging of the structure.
- The bottom substrate consisted of very soft mud/silt. Minor timber drift accumulation was located around the upstream bullnose of the pier.
- Probing was conducted around the perimeter of the structure with no indication of the pier footing or any undermining.

##### Pier 22

- Overall condition: Poor.
- Light weathering and freeze-thaw damage was noted on the masonry stone and the mortar joints surrounding the waterline.
- The water depth ranged from 12 feet to 20 feet surrounding the structure and dropped off significantly deeper downstream of the structure. Local scour was present starting at the upstream bullnose and continued around the entire pier.
- Exposed timber cribbing and undermining were located along the downstream portions of the structure. The timber cribbing was found to be 15 feet wide along the downstream face of the structure and was located approximately 15 feet below the waterline. Undermining was present across the entire width of the cribbing foundation, extended four (4) feet up the West face of the pier, two (2) feet up the East face, and was four (4) feet tall beneath the cribbing at its deepest point. There were three (3) vertical timber piles exposed within the area of undermining.
- The areas of exposed timber (cribbing and piles) appeared to be in sound condition. Sporadic penetration tests were conducted across the exposed areas of timber with an average penetration of approximately 1/8 inch.
- The bottom substrate consisted of very soft mud/silt. Probing was conducted throughout the area of undermining and around the pier. On the downstream side of the pier, in the deepest part of the undermining, probing resulted in approximately 18 inches of soft substrate before encountering hard pack. On the East and West sides of the pier, where the pier no longer became undermined, probing indicated approximately five (5) feet of soft substrate before encountering hard pack.
- Timber drift was accumulated approximately three (3) to four (4) feet tall surrounding the upstream bullnose of the pier.

Pier 23

- Overall condition: Satisfactory.
- The general condition of the pier had not significantly changed since the last inspection.
- Moderate weathering and freeze-thaw damage was noted on the masonry stone and the mortar joints surrounding the waterline. Typical pockets of stone loss measured approximately five (5) inches by five (5) inches and were up to two (2) inches deep. Cracking was evident in several of the masonry stones. The cracking also appeared to be a result from weathering / freeze-thaw rather than from settling / shear stress as the cracks were contained to individual stones and were not observed to extend across multiple courses of the stone structure.
- The water depth ranged from four (4) to 10 feet surrounding the structure.
- The bottom substrate was found to be primarily soft mud/silt. Accumulated areas of river rock or possible rip rap were found on the East side of the structure. Sporadic large stone debris was also located in the vicinity of the structure.
- Probing was conducted around the perimeter of the structure with no indication of the pier footing or any undermining.

Pier 24

- Overall condition: Satisfactory.
- The general condition of the pier had not significantly changed since the last inspection.
- Light weathering and freeze-thaw damage was noted on the masonry stone and the mortar joints surrounding the waterline. Additional light cracking was noted in several individual stones.
- The water depth was approximately 12 feet surrounding the structure.
- The bottom substrate consisted primarily of soft mud/silt. Minor timber drift accumulation was located around the upstream bullnose of the pier.
- Probing was conducted around the perimeter of the structure with no indication of the pier footing or any undermining.

Pier 25

- Overall condition: Satisfactory.
- The general condition of the pier had not significantly changed since the last inspection.
- Moderate weathering and freeze-thaw damage was noted on the masonry stone and the mortar joints surrounding the waterline.
- The water depth ranged from six (6) to 10 feet surrounding the structure.
- The bottom substrate consisted of very soft mud/silt. Accumulated areas of river rock or possible rip rap were found on the East side of the structure. Moderate timber drift accumulation was located around the majority of the pier.
- Probing was conducted around the perimeter of the structure with no indication of the pier footing or any undermining.

Pier 26

- Overall condition: Satisfactory.
- The general condition of the pier had not significantly changed since the last inspection.
- Light weathering and freeze-thaw damage was noted on the masonry stone and the mortar joints surrounding the waterline.
- The water depth was less than 18 inches surrounding the structure.
- The bottom substrate consisted of rip rap soft mud. Moderate timber debris accumulation was located in the vicinity.
- Probing was conducted around the perimeter of the structure with no indication of the pier footing or any undermining.

## 5. Channel Bottom and Scour Assessment

At the time of the inspection, the Mississippi River was experiencing relatively normal flow and the channel bottom appeared to be stable for the type of material. The channel bottom consisted primarily of soft mud and silt and would be very susceptible to scour. Pier 22 had a significant area of localized scour and had undermining beneath approximately 25 percent of its foundation at the time of the inspection. In comparison to the report from the previous inspection conducted one (1) year ago, the area of undermining beneath Pier 22 has fluctuated significantly in both size and orientation. This fluctuation could indicate that much of the soft bottom substrate surrounding Pier 22 is likely to be sedimentation during slack water, filling in a seemingly larger area of undermining beneath the structure. Channel depths on the downstream side of Pier 22 dropped off even further with a maximum depth of 32 feet measured. Based on the cross-channel depths that were taken on each side of the bridge it can be inferred that the main channel flow appears to cut diagonally across river from the East bank to the West bank at the bridge location. This angle of approach would result in an increased scour potential surrounding the structures. See 'Appendix A – CAD Drawings' for additional details. Accumulated areas of river rock / rip rap were located beneath the East half of the bridge but were not extensive enough to provide any significant scour protection to the in-water structures. No additional scour, undermining, or scour countermeasures were found.

## 6. Evaluation and Recommendations

Based on the underwater inspection findings at the time of the inspection, the Quinsippi Island Bridge was considered to be in Poor condition with several deficiencies that need be addressed in order to maintain a good working condition of the bridge. The primary item to be addressed is the scour and undermining of Pier 22. Additional items that should be monitored are; the channel bottom condition and scour potential surrounding the remaining in-water structures, the typical deterioration of the masonry stone and mortar joints within the freeze-thaw zone on all of the in-water structures, and timber drift accumulation surrounding the bridge.

Brennan recommends that the undermining of Pier 22 be repaired in order to return full load bearing capacity to the structure. Scour countermeasures should then be placed around the structure in order to protect the pier from further scour potential. The soft bottom substrate should be taken into account when evaluating any scour countermeasures as some of that material may need to be removed in order to prevent the countermeasure devices themselves becoming undermined. Due to the high susceptibility of the bottom substrate to scour, Brennan also recommends placing scour countermeasures around the other in-water piers before the scour and undermining has the chance to develop in those areas.

Continued monitoring and removal of the timber drift accumulation around the bridge is recommended as well. Timber drift accumulation between any of the in-water substructures will further constrict the cross-sectional area of the waterway and increase the scour potential around the bridge.

In accordance with the National Bridge Inspection Standards (NBIS) and accepted standard practice, Brennan recommends the entire bridge structure should be inspected underwater within a 60-month maximum interval. Brennan also recommends flow and depths be monitored periodically and when superstructure inspections are conducted. In the interim, if significant high water or other adverse conditions are experienced, substructure monitoring with water depth soundings and/or underwater inspections may be warranted.

An immediate post-event inspection should be conducted on the structure after any significant or unusual event, including, but not limited to: flood, earthquake, storm, vessel impact, or other event that has potential to cause damage to the structure. Drift and debris material should be cleared to prevent scour and undermining of the substructure and further damage to the structure.

Refer to 'Routine Underwater Condition Assessment Rating Descriptions' below for explanations of above noted condition ratings.

**Routine Underwater Condition Assessment Rating Descriptions**

**Good:** No visible or only minor damage was noted. Structural elements may show very minor deterioration but no overstressing was observed. No repairs are required.

**Satisfactory:** Limited minor to moderate defects or deterioration are observed, but no overstressing was observed. No repairs are required.

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

**Poor:** Advanced deterioration or overstressing was observed on the 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.

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

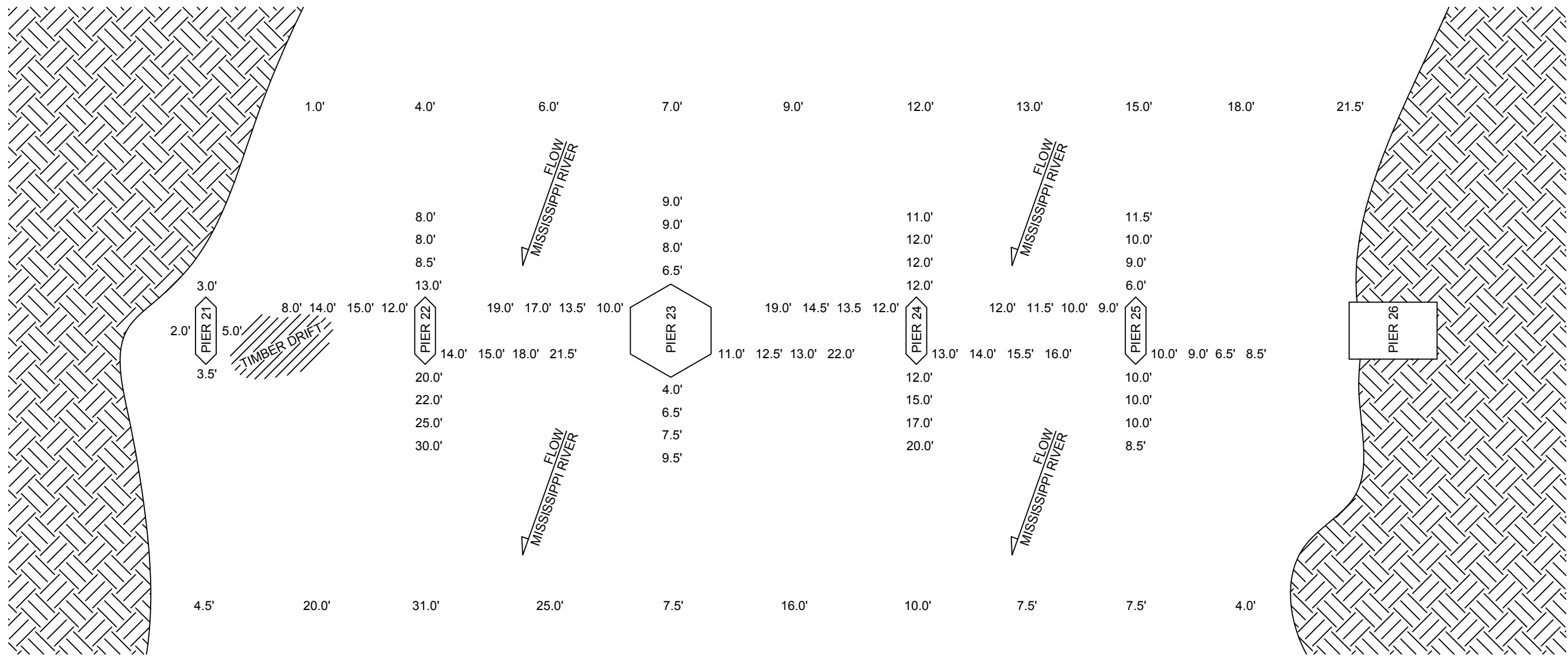
**Critical:** Very advanced deterioration, overstressing or breakage has resulted in localized failure(s) of primary structure components. More widespread failures are possible or likely to occur, and load restriction should be implemented as necessary. Repairs may need to be carried out on a very high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

## Appendix A – CAD Drawings

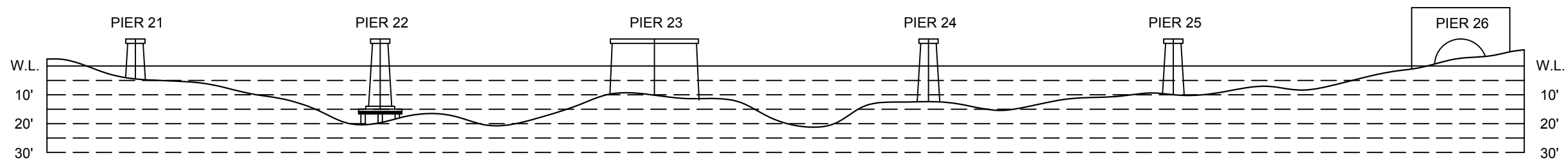
### List of Figures

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- Drawing A-5 PIER 23 ELEVATIONS
- Drawing A-6 PIER 24 E ELEVATIONS
- Drawing A-7 PIER 25 ELEVATIONS





CROSS-SECTION CENTER ALIGNMENT

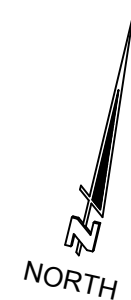


PLAN VIEW AND RIVER DEPTHS  
N.T.S.

**GENERAL NOTES:**

WATERLINE WAS MEASURED AT 10.4 FEET BELOW THE TOP OF THE PIER CAP ON PIER 21. ADDITIONALLY, THE USACE RIVER GAUGE 'MISSISSIPPI RIVER AT QUINCY, IL' MEASURED A WATER ELEVATION OF 470.20 FEET AT 0600 ON 10/08/2015.

DEPTH SOUNDINGS TAKEN AT 0 FEET, 5 FEET, 10 FEET, AND 15 FEET FROM THE STRUCTURE FACE(S) AND 75 FEET UPSTREAM AND DOWNSTREAM OF THE STRUCTURE PARALLEL TO THE TRACKS. (NOTE: THE SOUNDING MEASUREMENTS ARE NOT TO SCALE WITH THE ACTUAL DISTANCE BETWEEN THE STRUCTURES.)



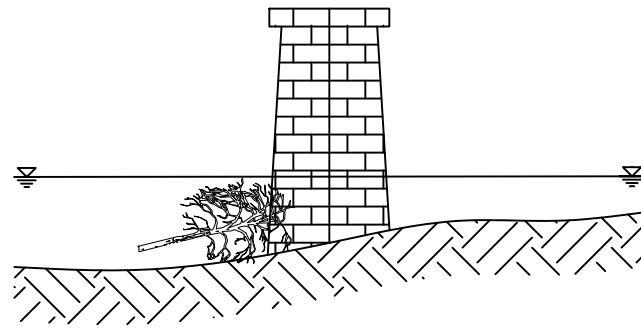
INSPECTION DATE:	OCTOBER 8, 2015
DRAWN BY:	SPENCER COSSALTER
REVISOR:	
REVISION DATE:	
REVISION BY:	
OWNER:	QUINCY PARK AUTHORITY
LOCATION:	QUINCY, ILLINOIS
BRIDGE TYPE:	VEHICULAR
WATERWAY:	MISSISSIPPI RIVER
SUBSTRUCTURES:	6 (IN-WATER)
LENGTH, FEET:	~ 525 OVER WATER

PREPARED FOR:  
**KLINGER & ASSOCIATES**  
 616 N. 24TH STREET  
 QUINCY, ILLINOIS 62301

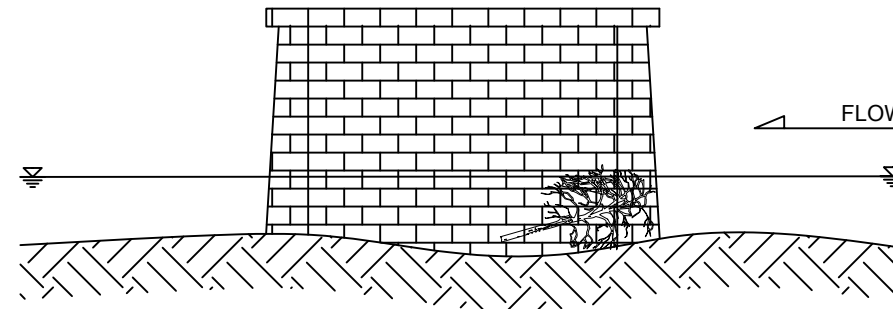
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PROJECT:  
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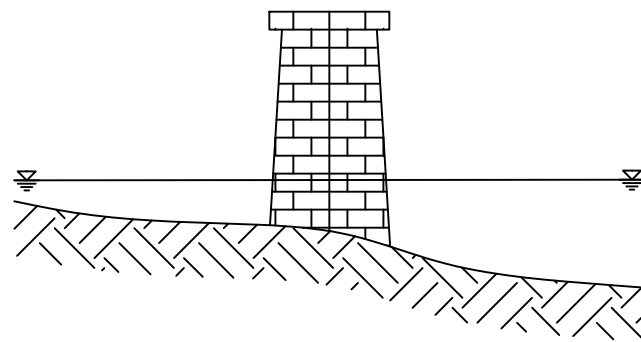
FIGURE NUMBER  
**PLAN VIEW AND RIVER DEPTHS**



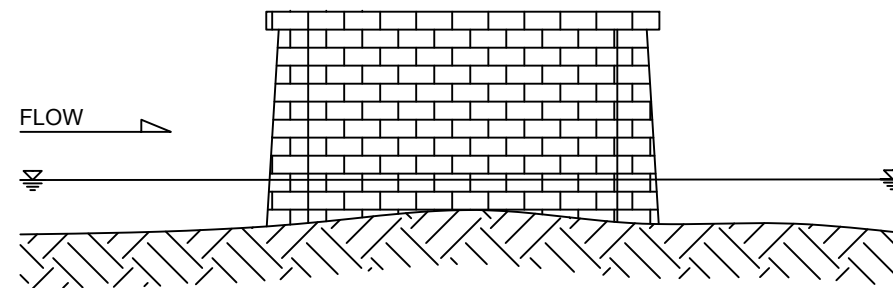
PIER 21 NORTH ELEVATION



PIER 21 EAST ELEVATION



PIER 21 SOUTH ELEVATION



PIER 21 WEST ELEVATION

**GENERAL NOTES:**

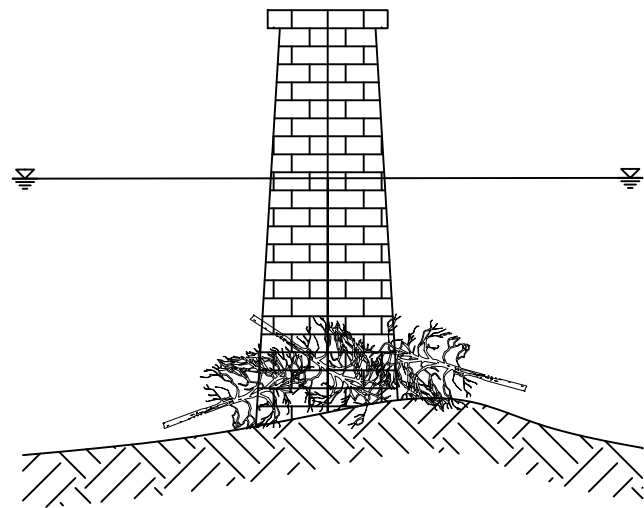
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- x TIMBER DRIFT WAS ACCUMULATED AROUND THE NORTHEAST CORNER OF THE PIER.
- x SOFT MUD / SILT MADE UP THE MAJORITY OF THE RIVER BOTTOM SUBSTRATE.

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LOCATION:	QUINCY, ILLINOIS	DRAWN BY:	SPENCER COSSALTER
BRIDGE TYPE:	VEHICULAR	REVISED DATE:	
WATERWAY:	MISSISSIPPI RIVER	REVISED BY:	
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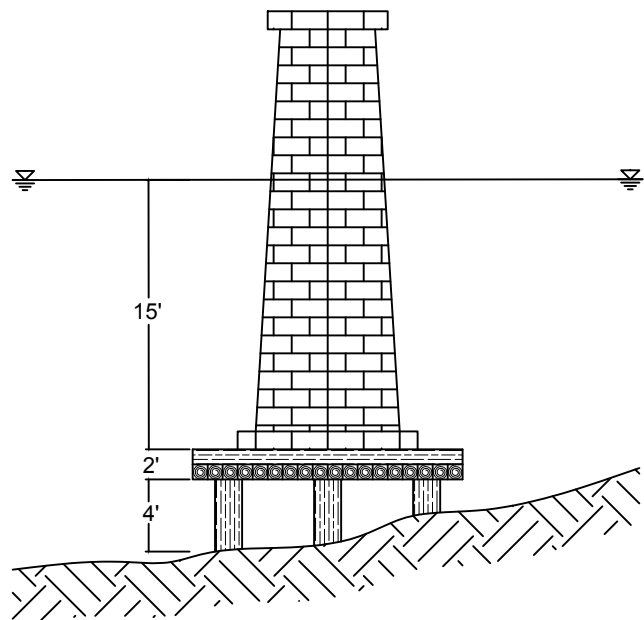
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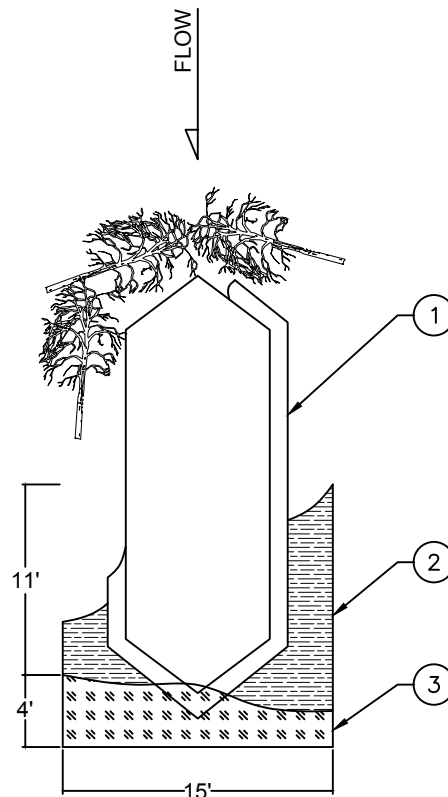
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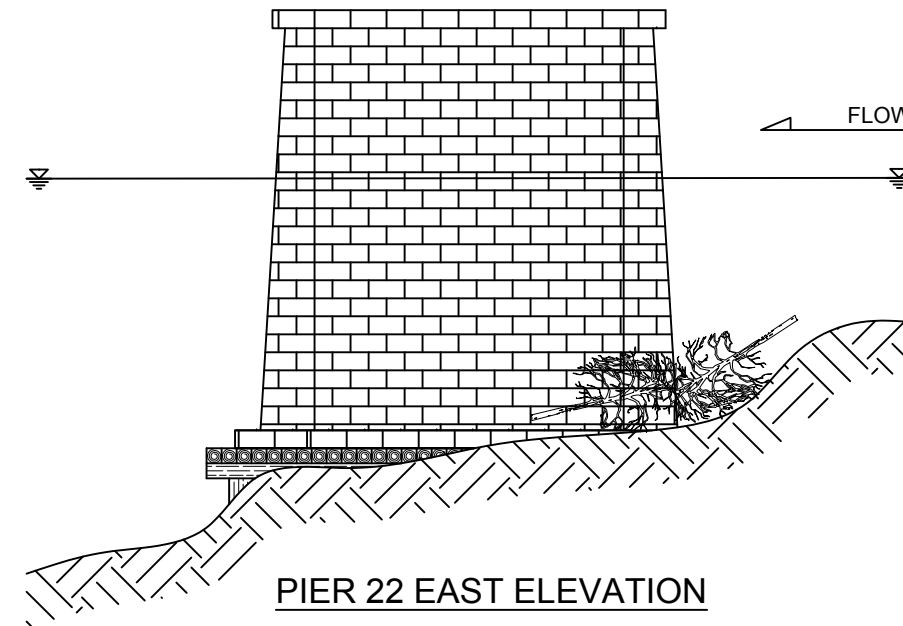
PIER 22 NORTH ELEVATION



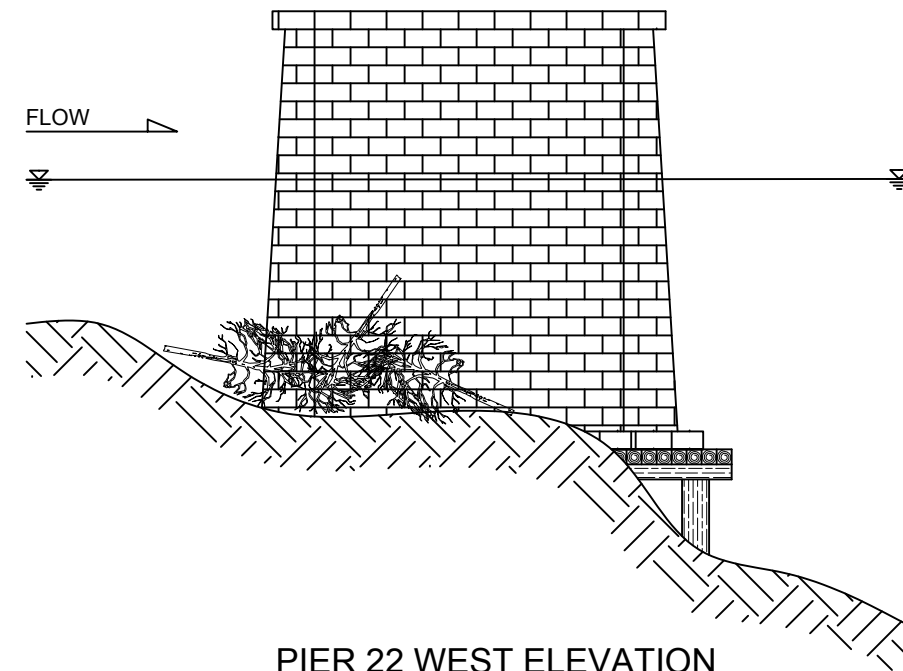
PIER 22 SOUTH ELEVATION



PIER 22 TOP VIEW



PIER 22 EAST ELEVATION



PIER 22 WEST ELEVATION

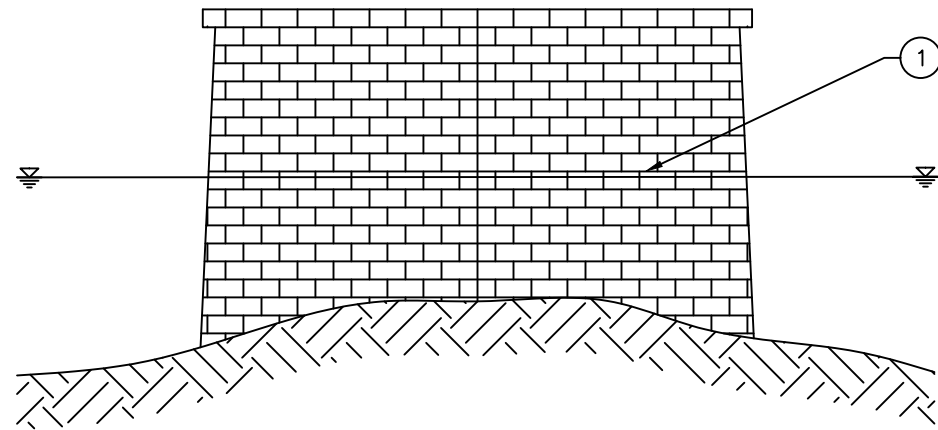
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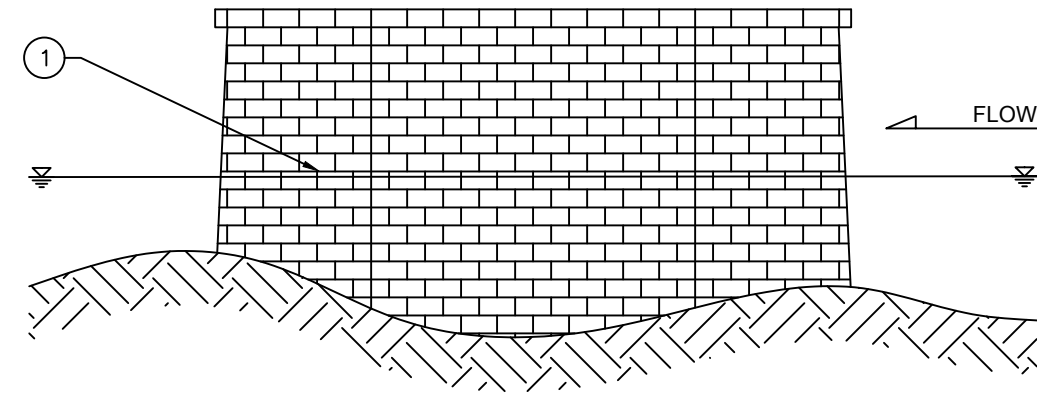
1. EXPOSED MASONRY STONE PIER FOOTING.
2. EXPOSED TIMBER CRIBBING. ALL OF THE EXPOSED TIMBER APPEARED TO BE IN SOUND CONDITION WITH NO INDICATION OF SPLITTING OR ROTTING.
3. UNDERMINING BENEATH THE TIMBER CRIBBING ON THE DOWNSTREAM SIDE OF THE PIER EXPOSING SEVERAL VERTICAL TIMBER PILES. THE UNDERMINING EXTENDED APPROXIMATELY FOUR (4) FEET ALONG THE WEST FACE OF THE PIER AND APPROXIMATELY TWO (2) FEET ALONG THE EAST FACE.

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PROJECT:	UNDERWATER INSPECTION REPORT QUINCY ISLAND BRIDGE QUINCY, ILLINOIS		
FIGURE NUMBER:	PIER 22 ELEVATION		

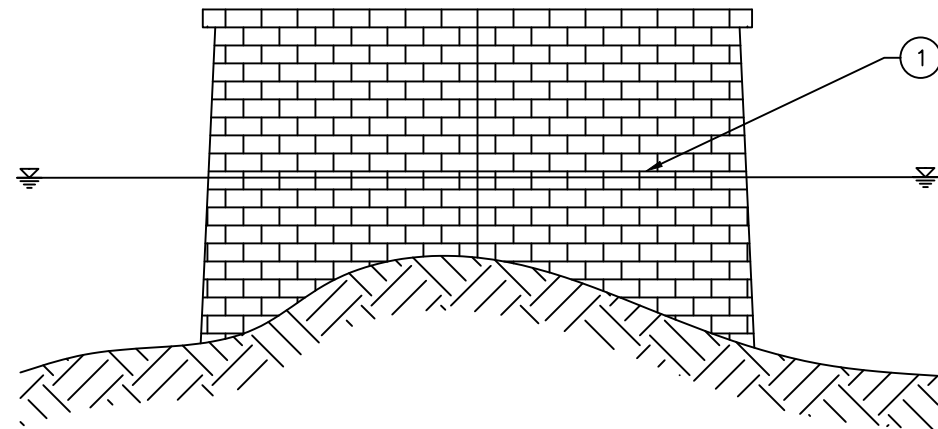
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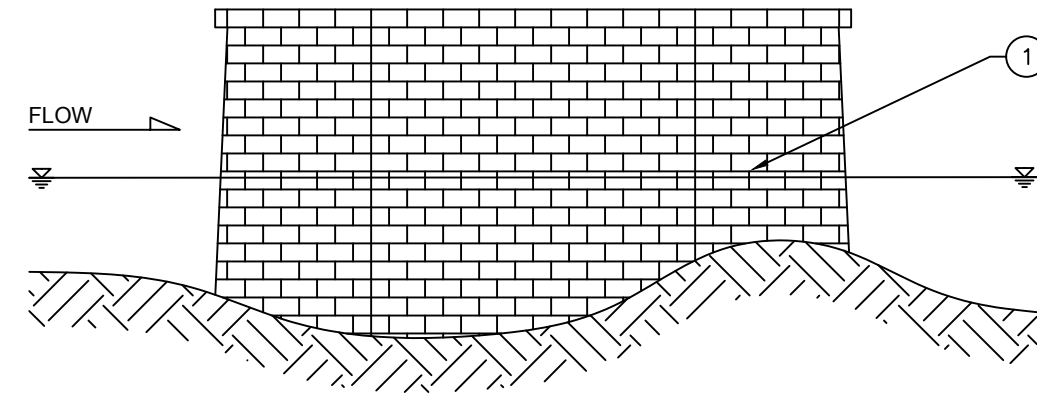
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PIER 23 EAST ELEVATION



PIER 23 SOUTH ELEVATION



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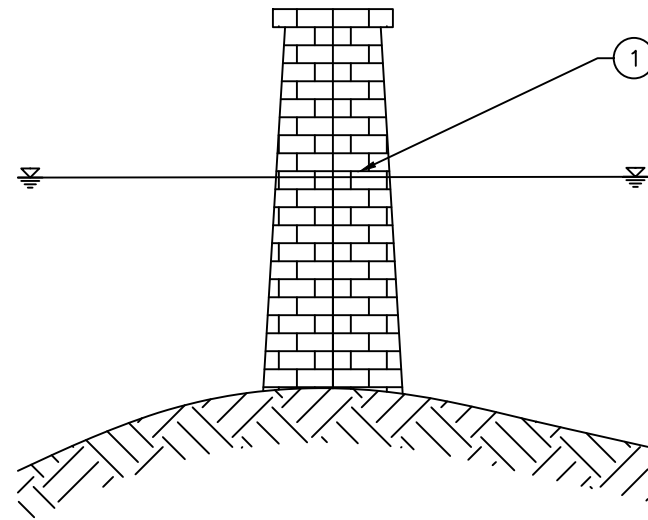
1. MODERATE MORTAR JOINT LOSS WAS LOCATED WITHIN THE FREEZE-THAW ZONE AROUND THE PERIMETER OF THE PIER. ADDITIONAL AREAS OF STONE LOSS AND MINOR CRACKING WITHIN INDIVIDUAL STONES WAS PRESENT SURROUNDING THE WATERLINE AS WELL.

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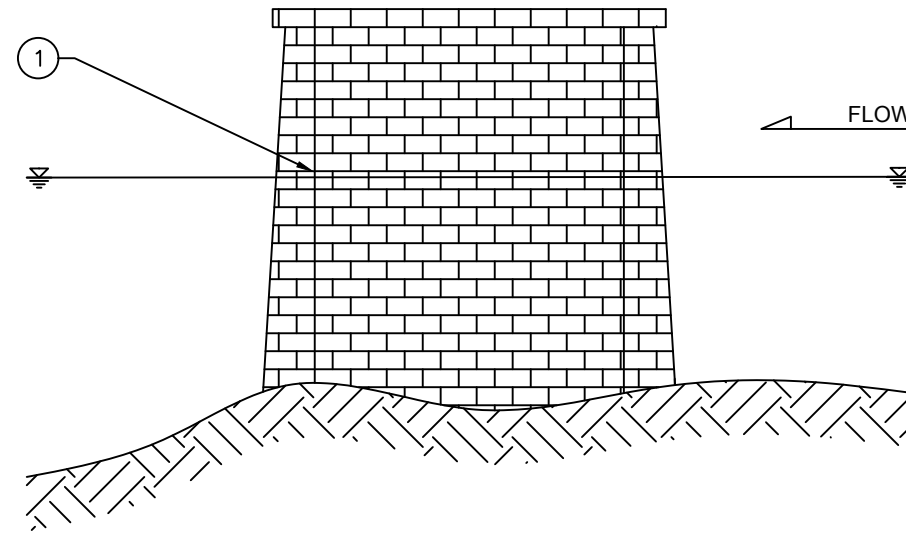
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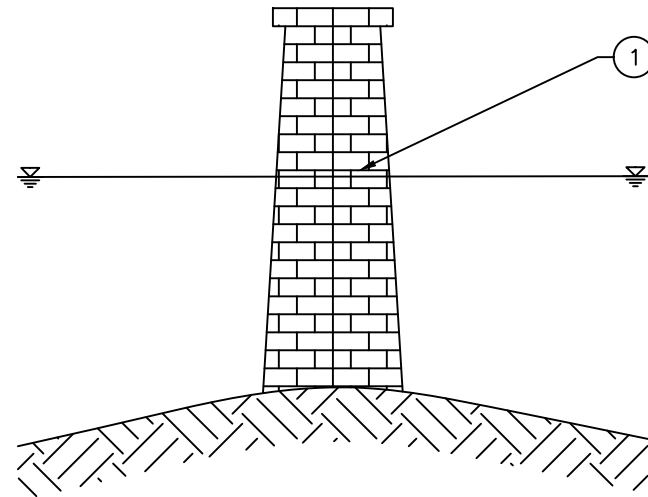
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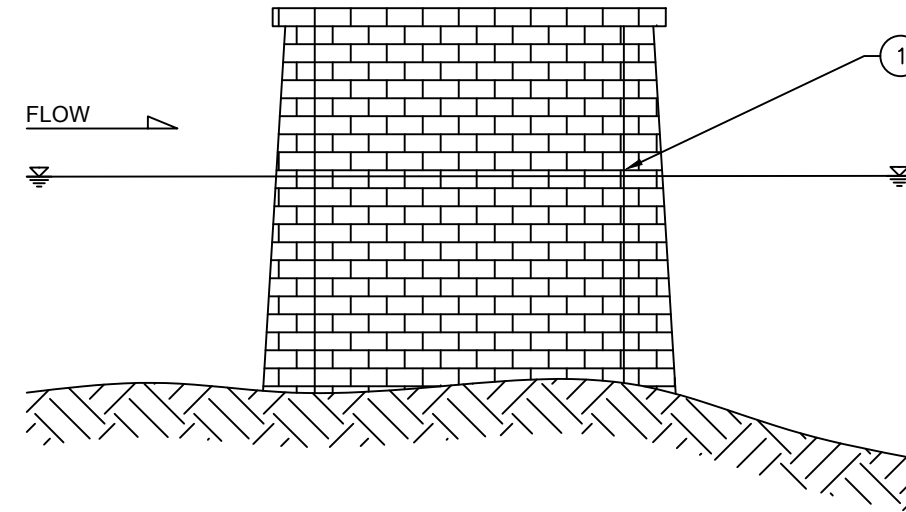
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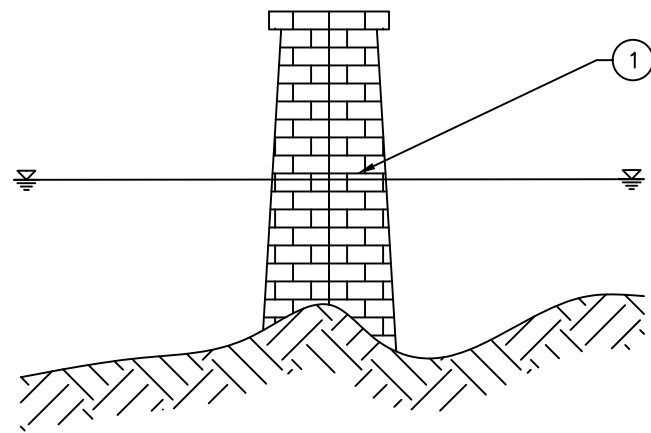
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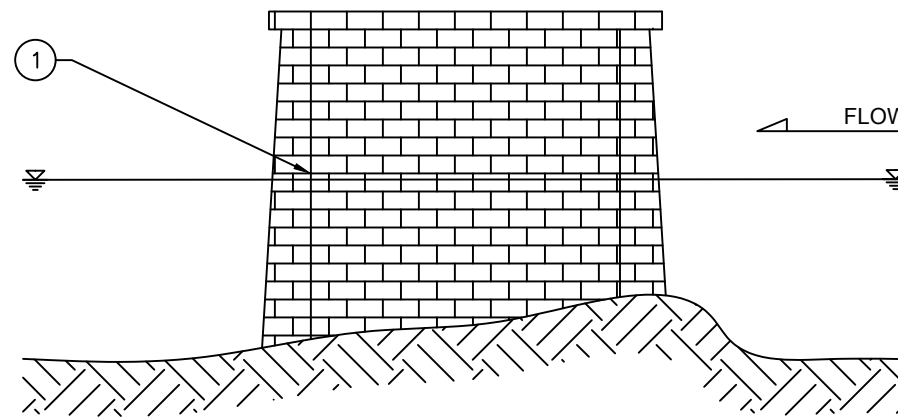
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**KLINGER & ASSOCIATES**  
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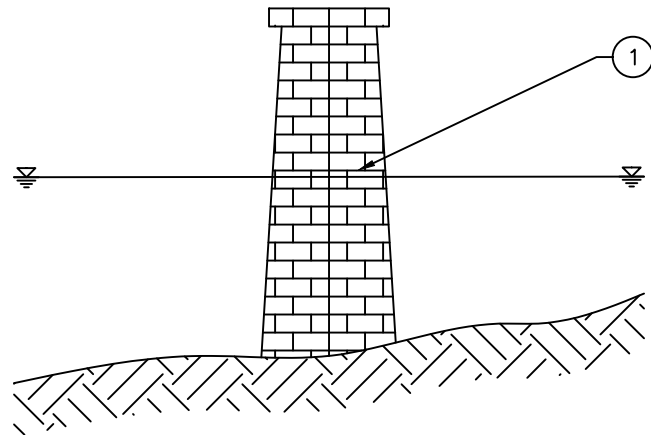
PROJECT:  
**UNDERWATER INSPECTION REPORT**  
**QUINCY ISLAND BRIDGE**  
 QUINCY, ILLINOIS  
**PIER 24 ELEVATION**



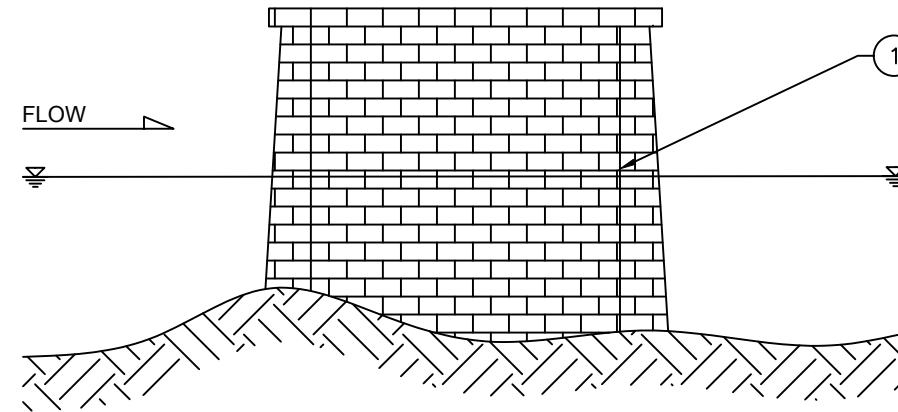
PIER 25 NORTH ELEVATION



PIER 25 EAST ELEVATION



PIER 25 SOUTH ELEVATION



PIER 25 WEST ELEVATION

**GENERAL NOTES:**

- x WATERLINE WAS MEASURED AT 10.4 FEET BELOW THE TOP OF THE PIER CAP ON PIER 21. ADDITIONALLY, THE USACE RIVER GAUGE 'MISSISSIPPI RIVER AT QUINCY, IL' MEASURED A WATER ELEVATION OF 470.20 FEET AT 0600 ON 10/08/2015.
- x TIMBER DRIFT WAS ACCUMULATED AROUND THE NORTHEAST CORNER OF THE PIER.
- x SOFT MUD / SILT MADE UP THE MAJORITY OF THE RIVER BOTTOM SUBSTRATE WITH SCATTERED AREA OF RIVER ROCK / RIP RAP APPROACHING THE EAST BANK OF THE RIVER.

1. MODERATE MORTAR JOINT LOSS WAS LOCATED WITHIN THE FREEZE-THAW ZONE AROUND THE PERIMETER OF THE PIER. ADDITIONAL AREAS OF STONE LOSS AND MINOR CRACKING WITHIN INDIVIDUAL STONES WAS PRESENT SURROUNDING THE WATERLINE AS WELL.

INSPECTION DATE:	OCTOBER 8, 2015
DRAWN BY:	SPENCER COSSALTER
REVISER DATE:	
REVISER BY:	
QUINCY PARK AUTHORITY:	QUINCY, ILLINOIS
LOCATION:	VEHICULAR
BRIDGE TYPE:	MISSISSIPPI RIVER
WATERWAY:	6 (IN-WATER)
SUBSTRUCTURES:	~ 525 OVER WATER
LENGTH, FEET:	

PREPARED FOR:  
**KLINGER & ASSOCIATES**  
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PROJECT:  
**UNDERWATER INSPECTION REPORT**  
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**PIER 25 ELEVATION**

## Appendix B – Photographs

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\*Note: The concentric rings in all of the sector scan images represent six (6) foot intervals from the origin.



Photo 1 – Bridge profile – Downstream



Photo 2 – Pier 21 – East face





Photo 3 – Pier 21 – South face



Photo 4 – Pier 22 – North face

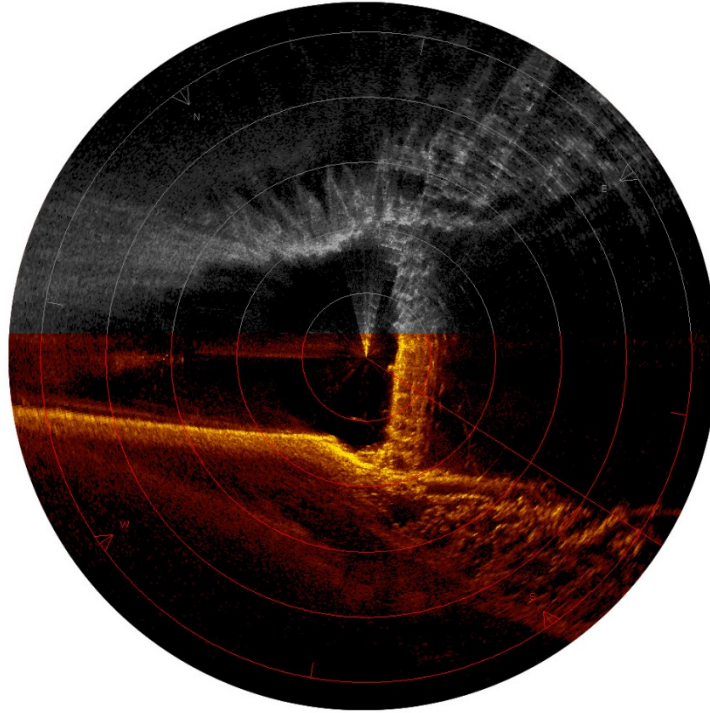


Photo 5 – Pier 22 – Upstream bullnose, facing East  
Note: Scour starting in front of the bullnose

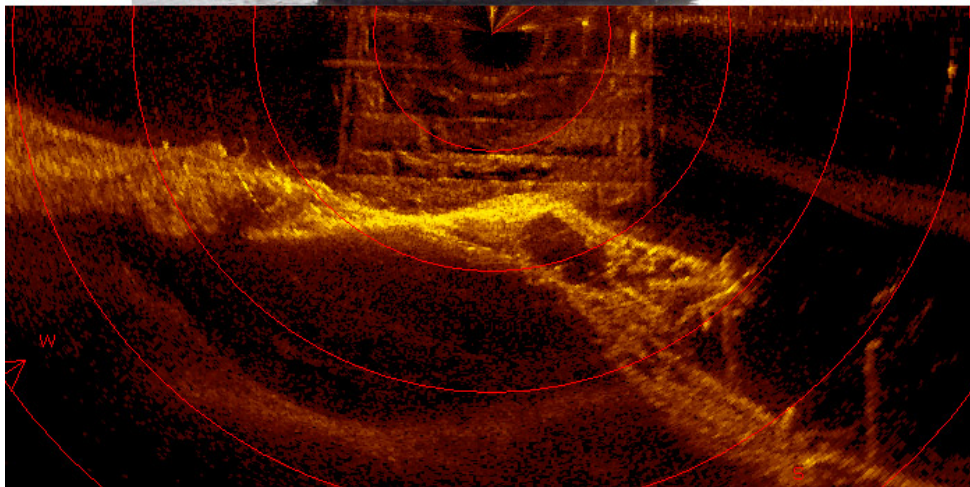


Photo 6 – Pier 22 – West face  
Note: Severe elevation change due to scour between upstream (left) and downstream (right)

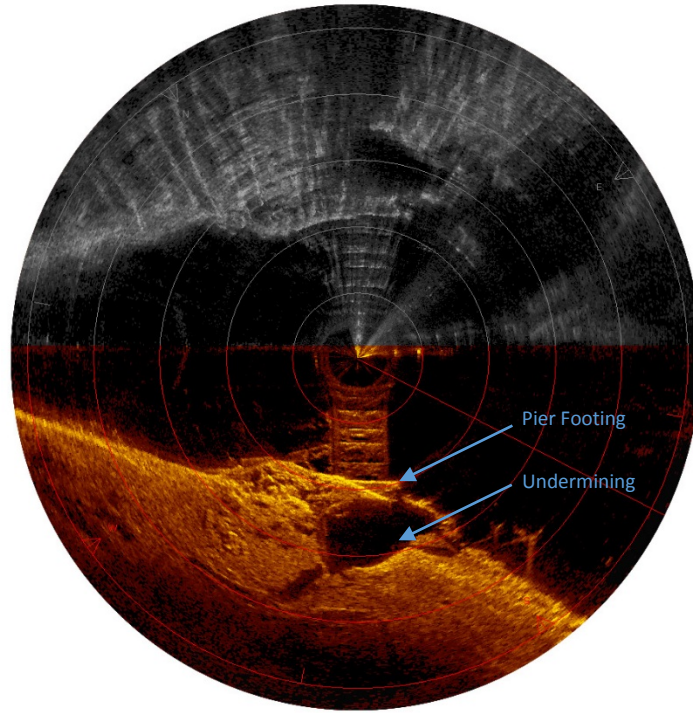


Photo 7 – Pier 22 – Southwest bullnose face  
Note: Exposed footing and subsequent undermining void beneath

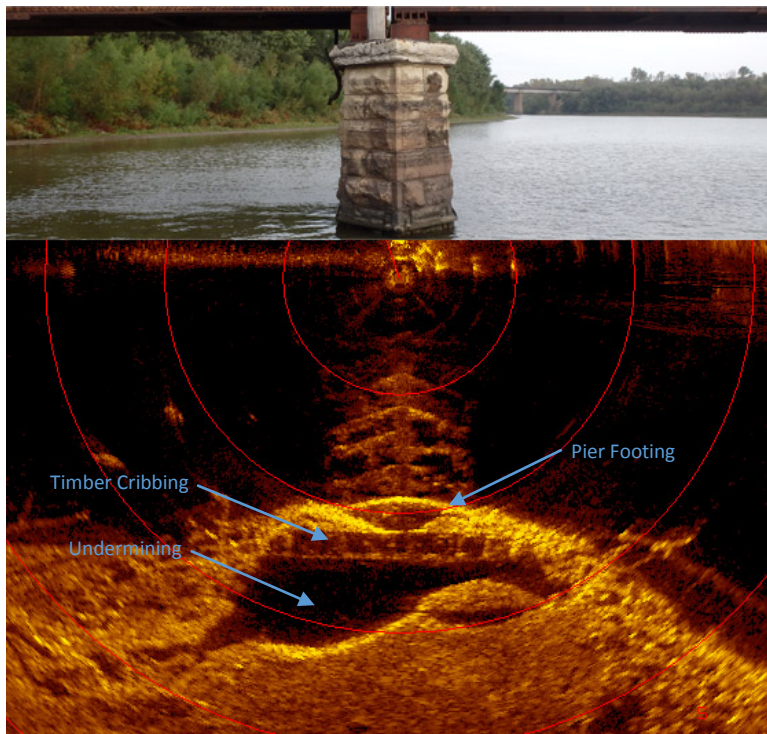


Photo 8 – Pier 22 – South face  
Note: Exposed footing, timber cribbing, and subsequent undermining

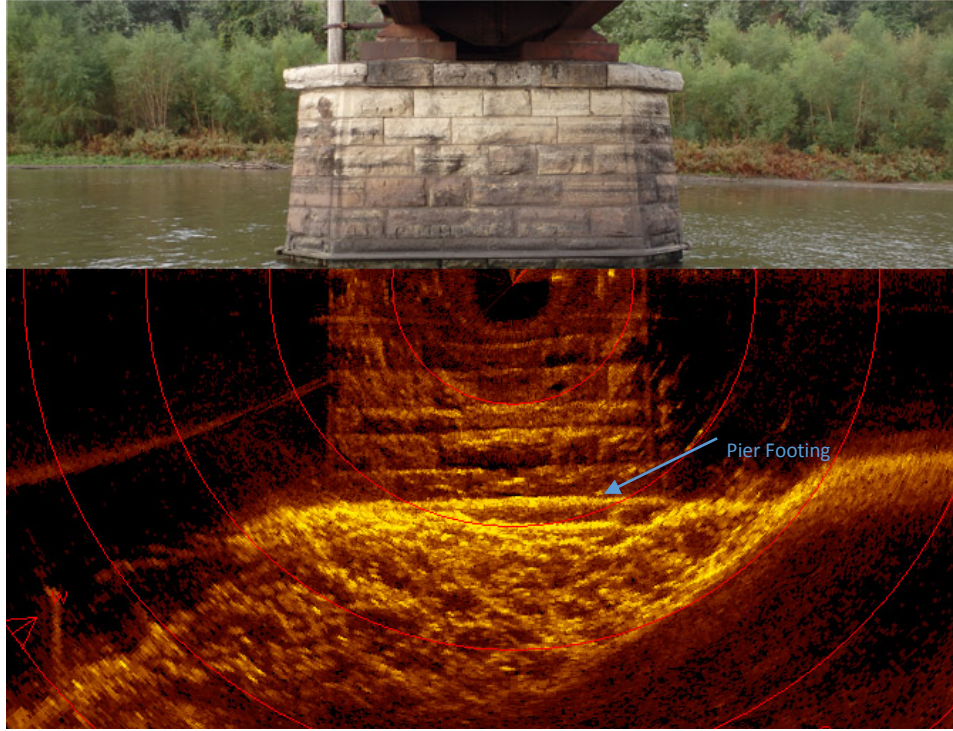


Photo 9 – Pier 22 – East face

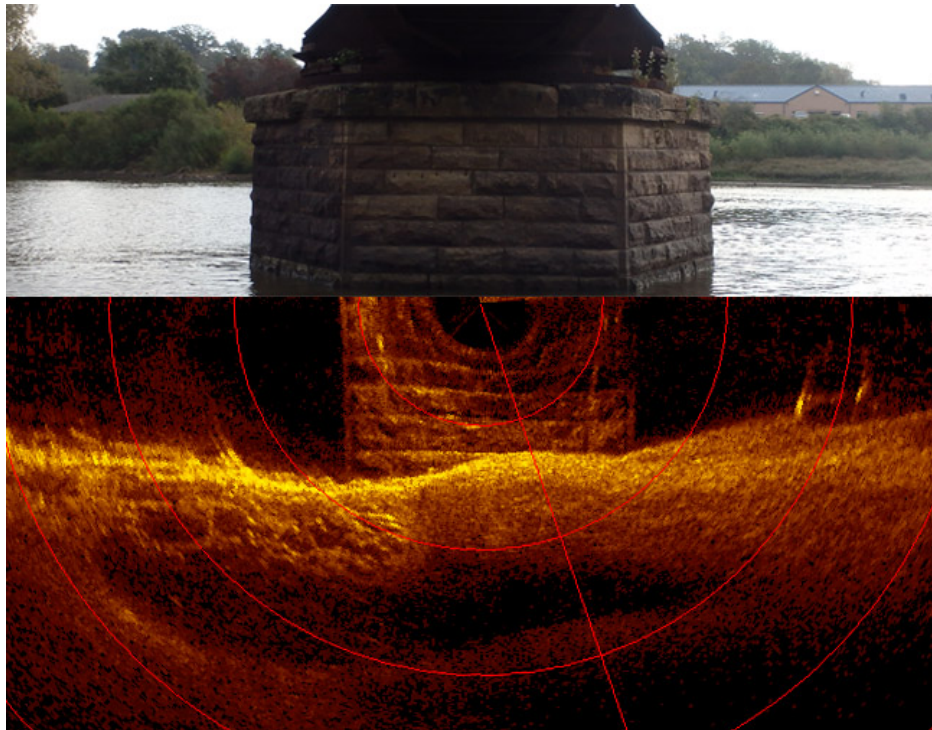


Photo 10 – Pier 23 – West face

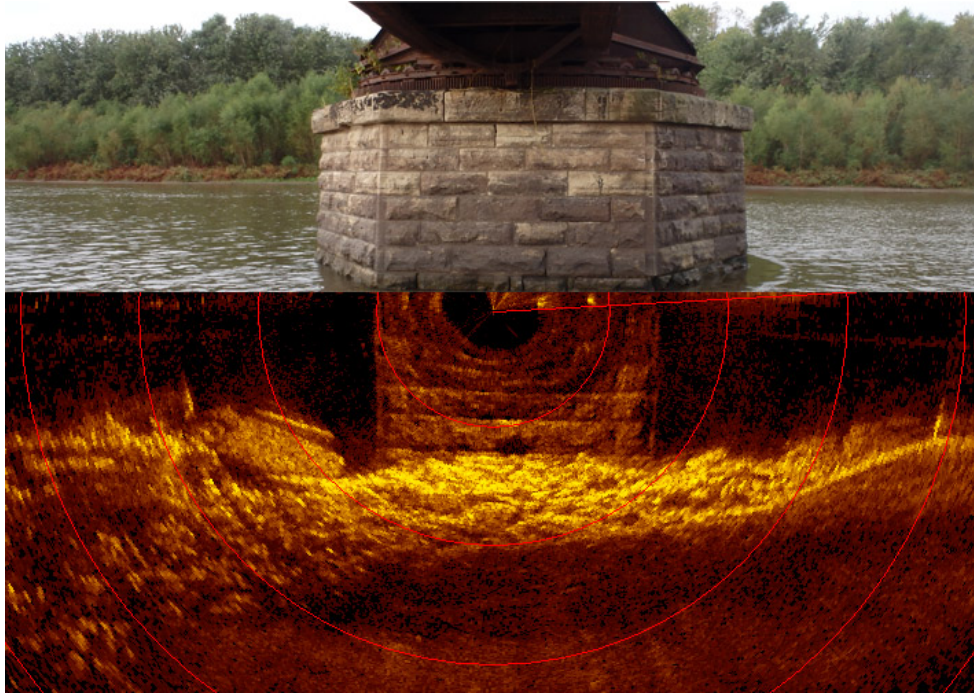


Photo 11 – Pier 23 – East face

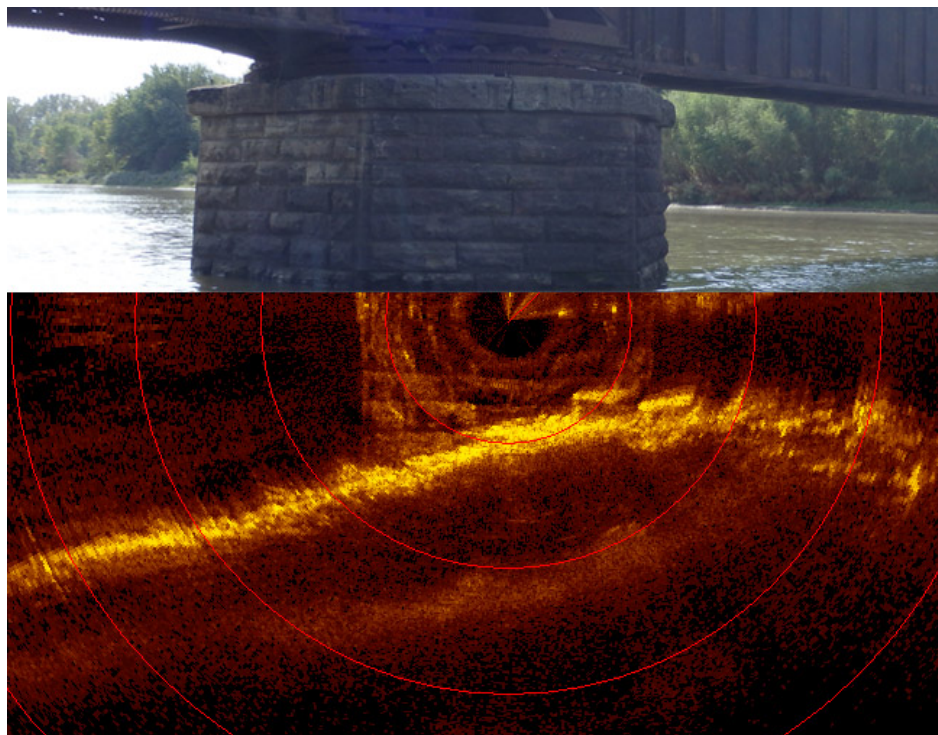


Photo 12 – Pier 23 – Northeast face

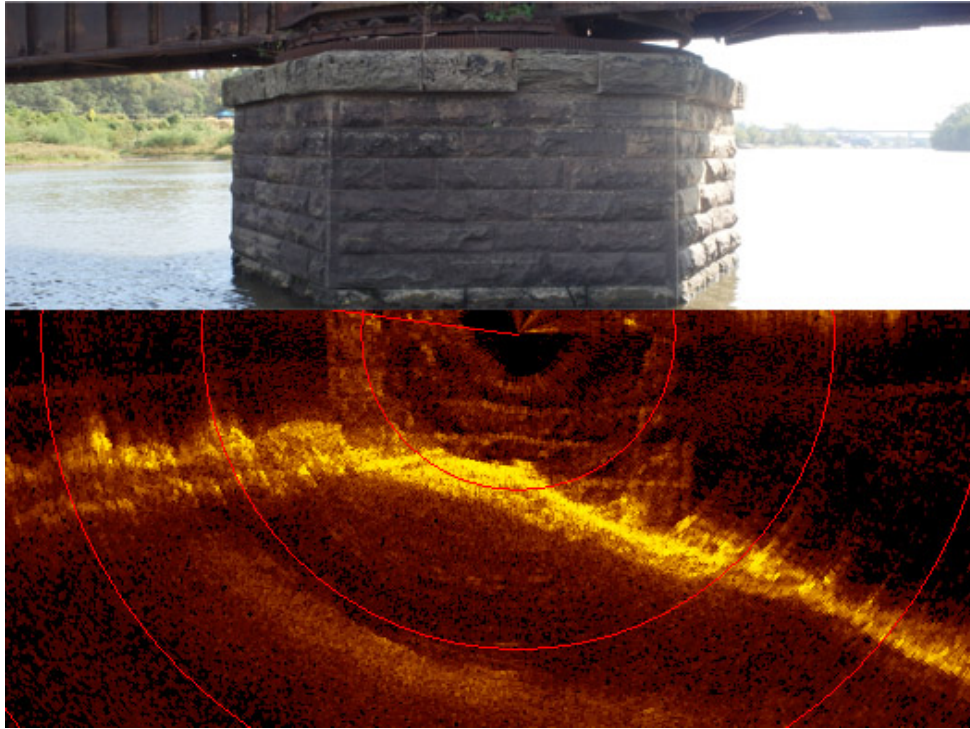


Photo 13 – Pier 23 – Northwest face

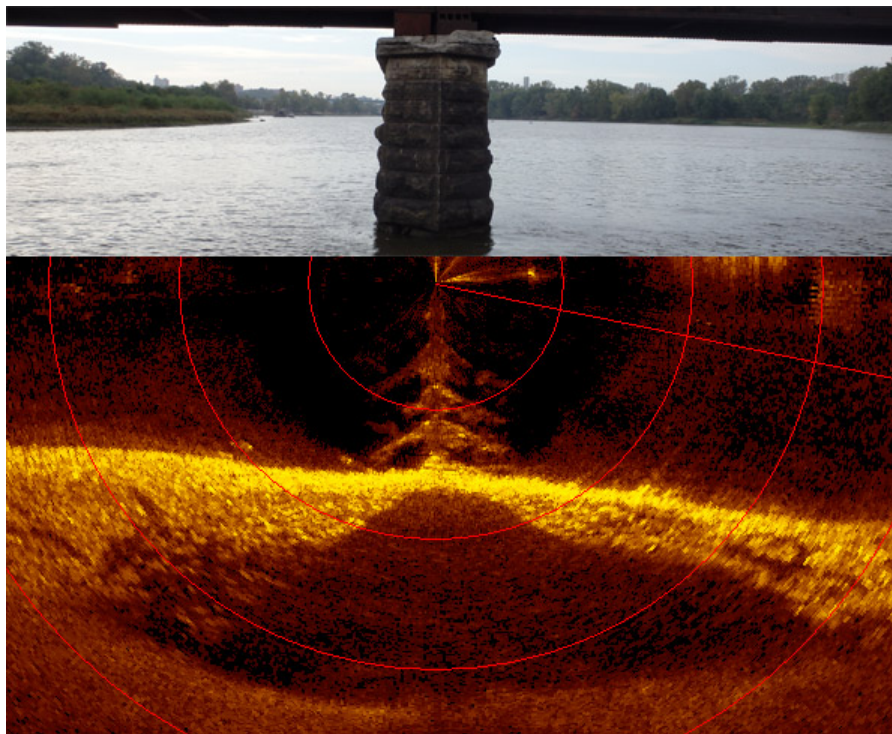


Photo 14 – Pier 24 – North face

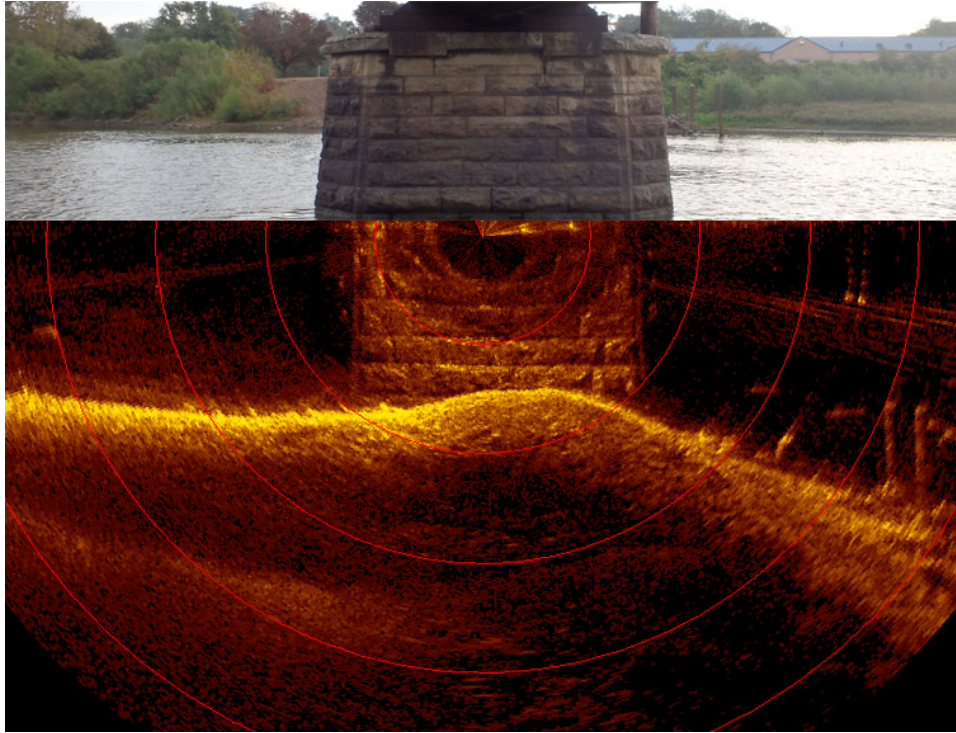


Photo 15 – Pier 24 – West face

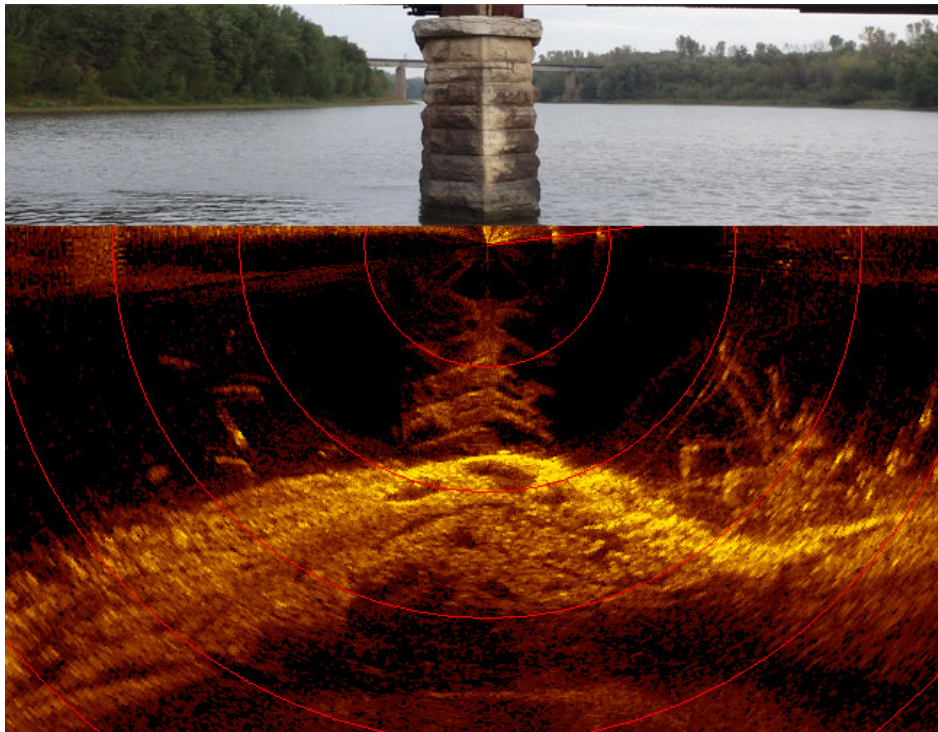


Photo 16 – Pier 24 – South face

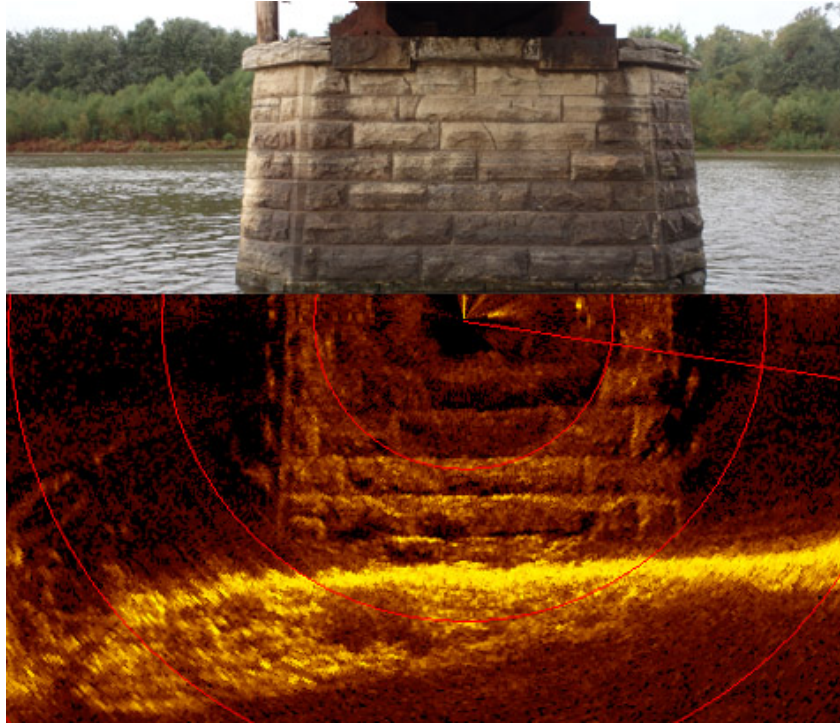


Photo 17 – Pier 24 – East face



Photo 18 – Pier 25 – West face



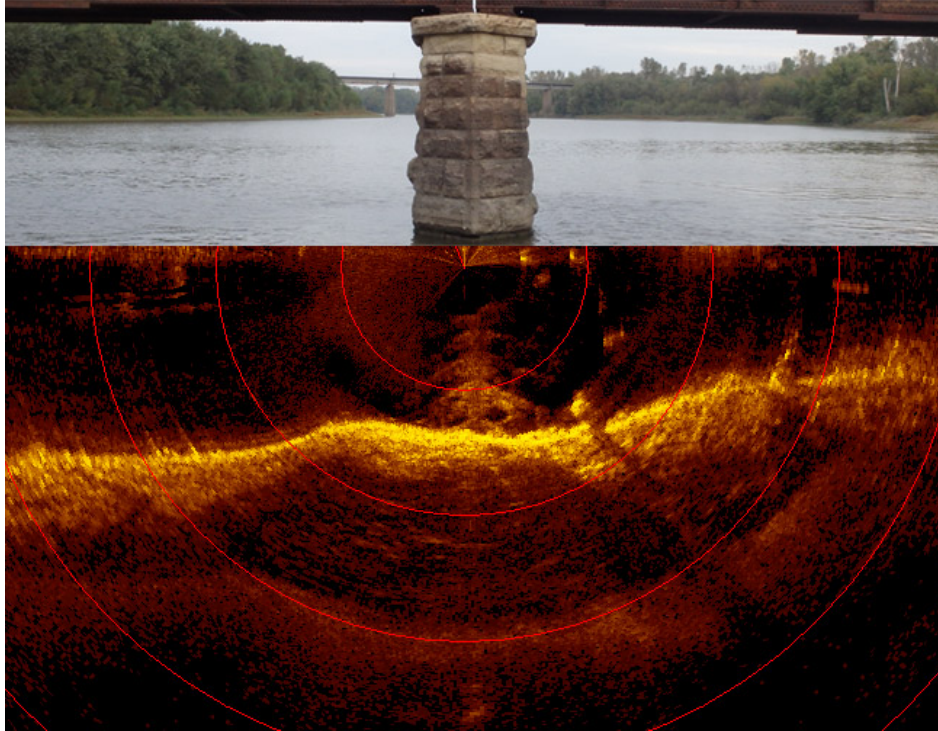


Photo 19 – Pier 25 – South face

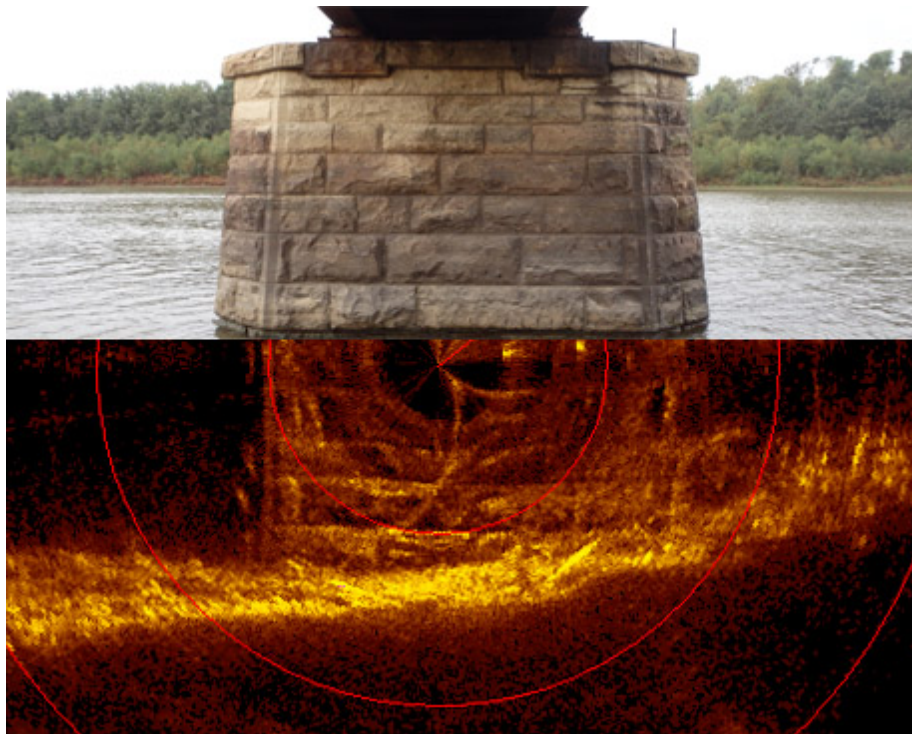


Photo 20 – Pier 25 – East face



Photo 21 – Typical mortar joint loss within the freeze-thaw zone



Photo 22 – Typical masonry stone loss and cracking surrounding the waterline



Photo 23 – Upstream waterway



Photo 24 – Downstream waterway