

2017 UNDERWATER BRIDGE INSPECTION REPORT



BRIDGE # L9181 CR 67 over WILLOW RIVER

DISTRICT: District 3

COUNTY: Aitkin

CITY/TOWNSHIP: T - 52 R - 27

STATE: Minnesota

Date of Inspection: 09/26/2016

Equipment Used:

Owner: County Highway Agency

Inspected By: Stromberg, Dan

Report Written By: Dan Stromberg

Report Reviewed By:

Final Report Date:



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UNDERWATER INSPECTION

REPORT SUMMARY

The substructure units inspected at Bride No. L9181, Piers 1 through 3 and the East Abutment, were found to be in satisfactory to fair condition with no defects of structural significance below water. The timber piles exhibited random checking typically 1/8 inch wide, and up to 1/4 inch wide throughout. At multiple locations splits were noted in timber cross braces and at two locations the connections have failed. Moderate to heavy timber debris accumulations were present at the upstream fascia and the east sides of Piers 2 and 3. Overall, the channel bottom configuration appeared to be in stable condition with no notable scour depressions observed.

INSPECTION FINDINGS

1. Channel bottom material west of Pier 1 consisted of mud allowing 9 inches of probe rod penetration.
2. Channel bottom material typically consisted of sand and organics allowing 6 inches of probe penetration.
3. Channel bottom material along the entire face of the East Abutment and extending 5 feet into the channel consisted of sand and gravel allowing 1 inch of probe rod penetration.
4. Light timber debris consisting of branches extended from the channel bottom up 2 feet along the east side of Piers 2 and 3 from Pile 3 to Pile 6.
5. Timber debris consisting of branches up to 9 inches in diameter extended from the channel bottom to the waterline for a width of 5 feet along the entire upstream fascia of the bridge.
6. All timber piles typically exhibited minor decay and checking up to 1/8 inch wide.
7. Loss of section from the waterline up 2 feet measured 3 inches wide by 1/2 inch deep on Piles 1 and 2 at Pier 3.
8. Minor timber rot was observed at the waterline on Pile 1 at the upstream end of Pier 3.
9. Timber cross brace was split at the connection at Pile 2 on the west side of Pier 1.
10. Timber cross brace connection was failed at Pile 7 on the west side of Pier 3.
11. Timber cross brace was split at Pile 3 and not connected along the east side of Pier 3 from Pile 3 to the downstream end of the pier.

RECOMMENDATIONS

(A) Remove timber debris accumulations at upstream fascia and along east sides of Piers 2 and 3. Removal of the timber debris will reduce excessive lateral loads on the pier, limit further debris accumulation, and reduce the likelihood of channel bottom degradation resulting from obstructed flow. Until the timber debris can be removed, monitor for any significant increases in accumulation and/or scour at the bridge.

(B) Reinspect the submerged substructure units at the normal maximum recommended (NBIS) interval of sixty (60) months.

Contractor: Collins Engineers, Inc.

Contractor Job Number: 9687

UNDERWATER INSPECTION

1. BRIDGE DATA

Bridge #: L9181
Feature Intersected: WILLOW RIVER
Facility Carried: CR 67
District: District 3
County: 001 - Aitkin
Bridge Description:

The bridge superstructure consists of four spans of timber deck and stringers that are supported by two timber pile bent piers and two timber pile abutments. The substructure units are designated at the West Abutment, Piers 1 through 3 and the East Abutment starting from the west side of the bridge.

2. INSPECTION DATA

Professional Engineer/Team Leader: Garrett R. Owens
Inspection Diver: Garrett R. Owens
Date of Underwater Inspection: 09/26/2016
Weather Conditions: Sunny, 50°F
Underwater Visibility (feet): 1 foot
Waterway Velocity (ft/sec): 0.5 ft/sec

3. SUBSTRUCTURE INSPECTION DATA

Substructure(s) Inspected: Piers 1 through 3 and the East Abutment

General Shape:

Each pier consists of a timber pier cap supported by a single row of seven timber piles. Timber cross bracing interconnects the piles. The abutments consist of a timber pile cap supported by seven timber piles with horizontal backwall planking.

Maximum Water Depth at Substructure(s) Inspected (feet): 5.0 feet

4. WATERLINE DATUM

Water Level Reference: Top of the pile cap at the downstream end of Pier 3.
Waterline Elevation (feet): 94.6 feet
Description: The waterline was located approximately 5.4 feet below the reference

5. NBIS CODING INFORMATION

(Minnesota specific codes are used for 92B and 113)

Item 60: Substructure: Code: 5
Item 61: Channel and Channel Protection: Code: 6
Item 62: Culvert: Code:
Item 92B: Underwater Inspection: Code: Y 48 09/2016

Item 113: Scour Critical Bridge:

Code: L

Bridge is scour critical because abutment or pier foundation is rated as unstable due to observed scour at bridge site.

Yes

No

(Mark your selection with an X)

6. STRUCTURAL ELEMENT CONDITION RATING

ELEM #	Element Description	Quantity	Unit	Conditions			
				CS1	CS2	CS3	CS4
216	Timber Abutment	52	LF		52		
228	Timber Piling	28	EA		27	1	
885	Scour	1	EA	1			

UNDERWATER INSPECTION

INSPECTION PROCEDURES

The routine underwater inspection of Bridge L9181 (CR 67 over Willow River) was completed on September 26, 2016. The underwater inspection was conducted from the shore. The inspection was conducted by a team consisting of a Professional Engineer Diver with a valid MnDOT Team Leader certification, a backup diver and dive tender. The inspection utilized commercial dive equipment and techniques (SSA and/or SCUBA) in accordance with OSHA regulations. Profiles were taken along the upstream and downstream faces of the bridge and around the periphery of substructure units to determine the presence, location, and area of scour.

The bridge elements inspected consisted of three timber pile bent piers and one timber pile abutment. According to design drawings, the substructure units are designated as the West Abutment, Piers 1 through 3, and the East Abutment from west to east. Inspection procedures followed FHWA guidance and the MnDOT Bridge and Structure Inspection Program Manual with channel bottom probing to search for foundations. The maximum routine underwater inspection frequency is recommended to remain at 60 months based on those findings and risk factors. Also, inspection procedures should continue to follow the above approach and standard guidance with 100% Level I and 10% Level II intensity efforts.

MINNESOTA BRIDGE INSPECTION REPORT

02/13/2017

BRIDGE L9181 CR 67 OVER WILLOW RIVER

County: Aitkin Location: 0.1 MI E OF JCT CSAH 68 Length: 72.0 ft.
 City: Route: 07 - CNTY 67 Ref. Pt.: 000+00.130 Deck Width: 28.0 ft.
 Township: 01048 - T - 52 R - 27 Control Section: Rdwy. Area/ Pct. Unsnd: 1948 sq. ft. / %
 Section: 33 Township: 052N Range: 27W Maint. Area: Paint Area/ Pct. Unsnd: sq. ft. / %
 Span Type: 7 - Wood or Timber 1 - Slab Local Agency Bridge Nbr.: Culvert: N/A
 List: Postings:
 NBI Deck: 6 Super: 6 Sub: 5 Chan: 6 Culv: N
 Open, Posted, Closed: A - Open
 MN Scour Code: L - STBL - LOW RISK
 Appraisal Ratings - Approach: 5 Waterway: 4 Unofficial Structurally Deficient N
 Required Bridge Signs - Load Posting: 0 - Not Required Traffic: 0 - Not Required Unofficial Functionally Obsolete N
 Horizontal: 1 - Object Markers Vertical: N - Not Applicable Unofficial Sufficiency Rating 86.0

ELEM NBR	ELEMENT NAME	REPORT TYPE	INSP. DATE	QUANTITY	QTY CS 1	QTY CS 2	QTY CS 3	QTY CS 4
54	Timber Slab	Underwater	02/13/2017	2016 SF	1800	216	0	0
		Routine	10/11/2016	2016 SF	1800	216	0	0
Notes: [2016] Minor deterioration of outside deck planks. Estimated outside 1.5' = 216 SF CS 2 for minor decay. [2010] There is some green stain on the north side of the deck plank indicating minor decay. [2014] Bituminous overlay is in poor condition, but timber planks are sound. Planks appear to distribute load uniformly. [2013] Deck pins have worked up through cracks in bituminous wearing surface. Sand was dug out and pins pounded back down. Deck leaks water onto caps and between slab planks								
510	Wearing Surfaces	Underwater	02/13/2017	1948 SF	0	1918	14	16
		Routine	10/11/2016	1948 SF	0	1918	14	16
Notes: [2016] 3 transverse cracks up to 0.2' wide: 16 SF CS 4 for exposed deck. 2 longitudinal cracks up to 0.1' wide: 14 SF CS 3 for significant unsealed cracks. Remaining deck at CS 2 for moderate wearing and unsealed minor cracks. [2015] No changes. [2014] Bituminous overlay is in poor condition, but timber planks are sound. Planks appear to distribute load uniformly. [2013] Deck pins have worked up through cracks in bituminous wearing surface. Sand was dug out and pins pounded back down. Deck leaks water onto caps and between slab planks. [2011] There are various size cracks in the bituminous wearing surface, east span 1" wide. In the south wheel path 1-1/2 to 2". In the north wheel path, span 2, 1-1/4 " crack in the south wheel path and 1/2 " in the north wheel path. Span 3, 1-1/2 to 1-3/4" crack in the south wheel path and 1/2" in the north wheel path. West span 1/2 to 3/4" crack in the south wheel path and 1-1/2 to 2" in the north wheel path. [2010] There is 1 in longitudinal crack and 3 to 4 in wide cracks in the bituminous over the piers. [2009] Deck moved into condition 2 for the cracking. [2008] PARTIALLY SNOW COVERED. CRACKS APPEAR TO BE 3-4 INCHES WIDE OVER THE PIER. [2006] CRACKS HAVE DEVELOPED OVER THE PIER CAPS AND ALONG SOME OF THE LONGITUDINAL JOINTS 1/2in. WIDE. SAND IS OVER THE ENTIRE DECK AND APPROACHES.								
156	Timber Floor Beam	Underwater	02/13/2017	112 LF	104	8	0	0
		Routine	10/11/2016	112 LF	104	8	0	0
Notes: [2015-2016] No changes. [2013-2014] Full height vertical cracking on N 3-4' of Span 2 and 3 at bolts. 8 LF CS 2.								
216	Timber Abutment	Underwater	02/13/2017	103 LF	0	103	0	0
		Routine	10/11/2016	103 LF	0	103	0	0
Notes: [2016] Added 44 LF to abutment quantity to account for wingwalls (CS1:0 CS2:44 CS3:0 CS4:0). [2015] No changes. [2013-2014] No changes in condition. Moved to CS 2 due to minor decay present on planks and repairs on each abutment. [2012] E abut repair work by county forces included new bottom plank and geo-textile fabric placed behind abut wall to stop washing behind abutment. [2010] Planks have initial green stain indicating minor decay. The east abutment has some washing from behind the planking. Wingwall notes: [2015] Wingwall planks have been cleaned off. [2013-2014] Moderate deterioration in all wingwalls. CS 2. SE wingwall has a piling that has been cut with a saw all the way through. Top of piling is ineffective. [2012] NE plank split-appears to be equipment damage. [2009] MOWER CUT THE TOP PLANK ON THE SOUTH WEST WING WALL. LOTS OF DIRT ON ALL THE WING CAPS CAUSING INITIAL DECAY.								

BRIDGE L9181 CR 67 OVER WILLOW RIVER

ELEM NBR	ELEMENT NAME	REPORT TYPE	INSP. DATE	QUANTITY	QTY CS 1	QTY CS 2	QTY CS 3	QTY CS 4
228	Timber Pile	Underwater	02/13/2017	35 EA	0	34	1	0
		Routine	10/11/2016	35 EA	0	34	1	0
Notes: [2015-2016] No changes. [2013-2014] Moved Pier 3, Pile 2 to CS 3 due to decay and slight crushing. Monitor Pier 2 piles 1,2 for future deterioration. [2011] 2nd pier from the west south pile looks worse but will leave in condition 2. [2010] There are some vertical cracks in many of the piling at the water level. [2009] Piling are showing signs of decay and /or shake, need to have tested. Moved all piling to condition 2. SOME DINGS IN THE NORTH 2 PILING IN THE EAST PIER and E abutment FROM DEBRIS REMOVAL. Minor section loss.								
235	Timber Pier Cap	Underwater	02/13/2017	151 LF	151	0	0	0
		Routine	10/11/2016	151 LF	151	0	0	0
Notes: [2016] No changes. [2013-2015] Caps consist of doubled timber members. Water appears to be leaking through deck cracks, onto caps and is flowing between timber members of cap, then out the side. Photo 11. Timber elements appear sound at this time. [2012] A plank has been lag bolted to the w abutment. The plank has minor cracks 1/8" wide mostly at lag bolts. W abutment cap has 1/8" cracks at bolt line. [2010] Some green staining (decay). [2008] SOME SPLITS ON THE CAP ENDS 1/8" WIDE.								
330	Metal Bridge Railing	Underwater	02/13/2017	144 LF	144	0	0	0
		Routine	10/11/2016	144 LF	144	0	0	0
Notes: [2016] Metal rail/timber post combination type rail. [20xx-2016] THE RAILING IS A STEEL W BEAM GUARD RAIL ON WOOD POSTS. OK condition.								
515	Steel Protective Coating	Underwater	02/13/2017	461 SF	0	461	0	0
		Routine	10/11/2016	461 SF	0	461	0	0
Notes: [2016] Computed 461 SF surface area. All CS 2 for chalking of galvanized coating.								
332	Timber Bridge Railing	Underwater	02/13/2017	144 LF	144	0	0	0
		Routine	10/11/2016	144 LF	144	0	0	0
Notes: [2016] Bridge owner includes timber curb as part of the rail. 144 LF timber bridge railing. Minor weathering. CS 1. [2016] Migrator assumed metal rail/timber post combination type rail. Post spacing assumed to be 5LF, each post 1LF. [20xx-2015] THE RAILING IS A STEEL W BEAM GUARD RAIL ON WOOD POSTS. OK condition.								
800	Critical Deficiencies or Safety Hazards	Underwater	02/13/2017	1 EA	1	0	0	0
		Routine	10/11/2016	1 EA	1	0	0	0
Notes: No critical structural deficiencies or serious safety hazards are present on this structure.								
823	Gravel Approach Roadway	Underwater	02/13/2017	2 EA	0	2	0	0
		Routine	10/11/2016	2 EA	0	2	0	0
Notes: [2016] Some bituminous pavement exists off the ends of the slab, but repair projects have removed portions of the approach. In effect, approaches are gravel. Still CS 2. [2015] CS 2 for both approaches having settlement and deterioration of bituminous. [2010-2014] The 8 ft on the east and 5 ft on the west, full width, adjacent to the deck has settled and been covered with gravel, the east settlement may be due to washing from behind the abutment planking . [2008] 1 IN. SETTLEMENT AT THE EAST END. [2007] SOME SETTLEMENT AND AREAS OF PATCHING. THE BITUMINOUS ONLY EXTENDS FOR 25 TO 30 FEET OFF THE ENDS OF THE DECK.								
856	Secondary Members (Substructure)	Underwater	02/13/2017	1 EA	0	1	0	0
		Routine	10/11/2016	1 EA	0	1	0	0
Notes: [2013-2016] No changes. [2012] Moved to a cond 2. Pic [2011] Sway braces. East span the bottom of the north brace is broken off. West span broken and cracked brace.								
891	Other Bridge Signing	Underwater	02/13/2017	1 EA	1	0	0	0
		Routine	10/11/2016	1 EA	1	0	0	0
Notes: [2014-2016] New sign panels. CS 1. [2010-2013] NE SIGN IS BENT. The faces of the signs have cracking.								

BRIDGE L9181 CR 67 OVER WILLOW RIVER

ELEM NBR	ELEMENT NAME	REPORT TYPE	INSP. DATE	QUANTITY	QTY CS 1	QTY CS 2	QTY CS 3	QTY CS 4
892	Slopes & Slope Protection	Underwater	02/13/2017	1 EA	0	1	0	0
		Routine	10/11/2016	1 EA	0	1	0	0
Notes: [2015-2016] Brush is growing on the SW corner. [2010-2014] West abutment has dirt against the planks. The east doesn't. [2007] THERE IS NO RIP-RAP PROTECTION AT THE ABUTMENTS.								
894	Deck & Approach Drainage	Underwater	02/13/2017	1 EA	0	1	0	0
		Routine	10/11/2016	1 EA	0	1	0	0
Notes: [2016] No changes. [2015] Deck and scuppers cleaned in 2015. Approach shoulders are higher than the road, so element remains at CS 2. [2012-2014] Scuppers plugged. Moved to cond 2. Moisture retaining on the deck edges is causing moss to grow. [2010] The berm is mostly gone but the scuppers remain plugged. [2009] There is a berm of dirt against the curbing. [2007-2008] THE SCUPPERS ARE PLUGGED WITH SAND AND GRAVEL.								
900	Protected Species	Underwater	02/13/2017	1 EA	1	0	0	0
		Routine	10/11/2016	1 EA	1	0	0	0

Notes: [2016] None visible.

General Notes: [2012] 6/12 high water was up to, but not over, the deck.

[2010] There is an access area at the SE corner that has had the brush cut.

The bridge was originally constructed as a timber stringer beam span bridge in 1971. The superstructure was replaced with a slab span and additional pier cap spacers in about 1977.

58. Deck NBI: Moderate weathering. Wearing surface is in poor condition with wide unsealed cracks and connecting pins working upward. Timber has minor deterioration, especially at outside planks.

36A. Brdg Railings NBI: Type 37.

36B. Transitions NBI: Bridge surface is wider than approaches. Low ADT.

36C. Appr Guardrail NBI: Bridge surface is wider than approaches. Low ADT.

36D. Appr Guardrail Terminal NBI: Bridge surface is wider than approaches. Low ADT.

59. Superstructure NBI: Moderate weathering. Wearing surface is in poor condition with wide unsealed cracks and connecting pins working upward. Timber has minor deterioration, especially at outside planks.

60. Substructure NBI: Isolated moderate decay in 1 pile, remainder show extensive weathering.

61. Channel NBI: [2016] Moderate restrictions. Logs are jammed at piers. Frequent debris that has potential to accelerate scour. Bank protection on E abutment is limited, but W abutment has good protection.
 [2010-2015] Minor restrictions. Debris accumulates on old piles from a previous bridge.
 [2009] There are logs across the channel.
 [2007-2008] MOST OF THE DEBRIS IS GONE FROM THE STREAM.
 Minor drift in stream.

62. Culvert NBI:

71. Waterway Adeq NBI: Flooding of approaches is not uncommon.

72. Appr Roadway Alignment NBI:

Inspector's Signature

Reviewer's Signature

Pictures



Photo 1 - Overall View of Downstream Fascia, Looking North.



Photo 2 - Overall View of Upstream Fascia, Looking Southwest.

Pictures



Photo 3 - View of Pier 1, Looking Northwest.



Photo 4 - View of Pier 2, Looking Northwest.

Pictures



Photo 5 - View of Pier 3, Looking Northwest.

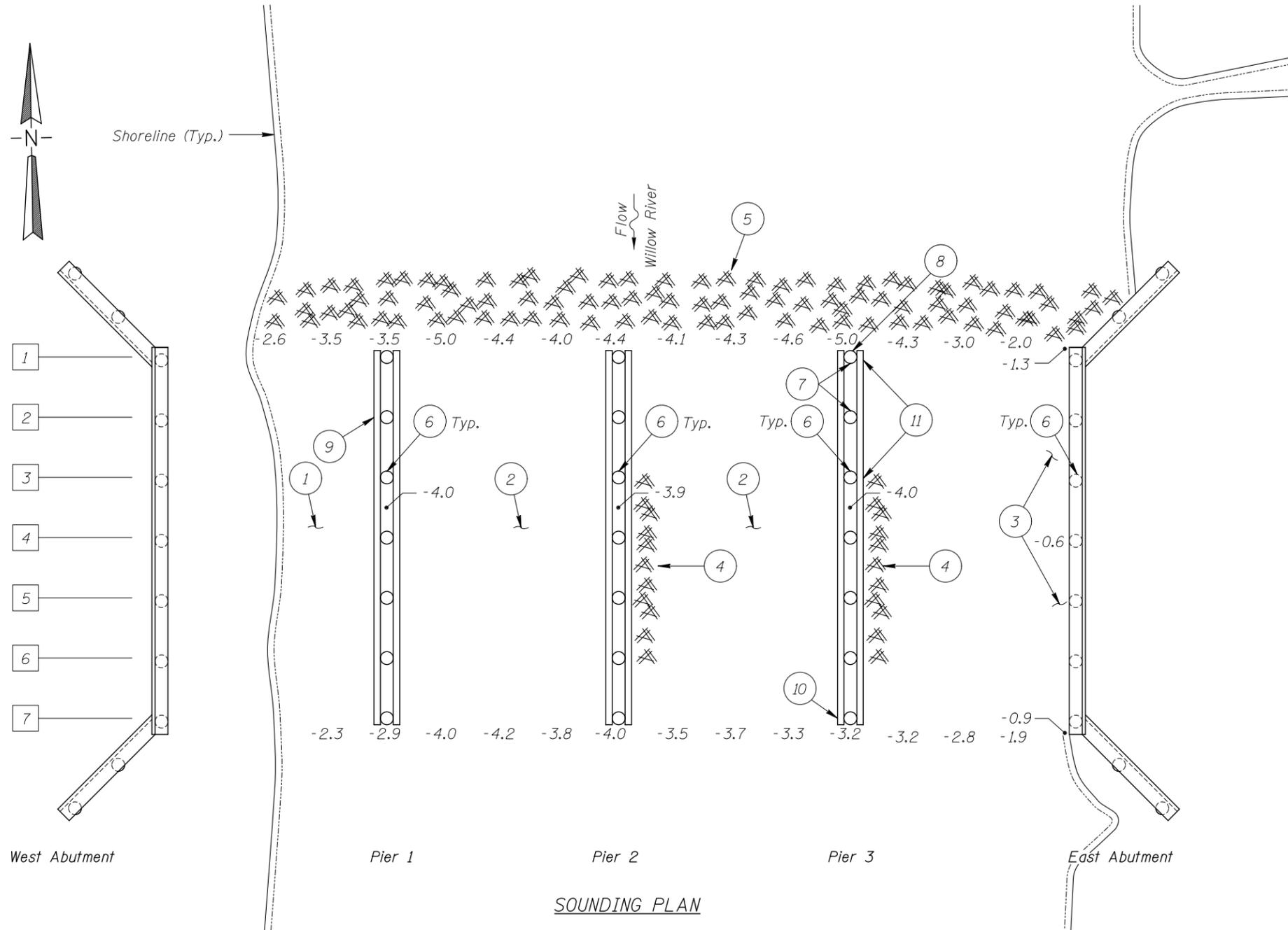


Photo 6 - View of East Abutment, Looking Northeast.

Pictures

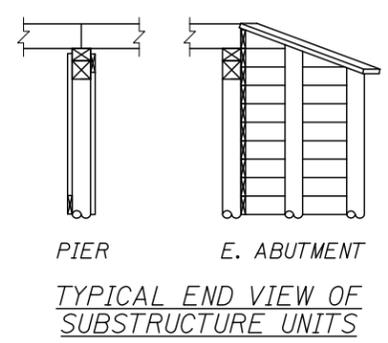


Photo 7 - View of West Abutment, Looking Northwest.



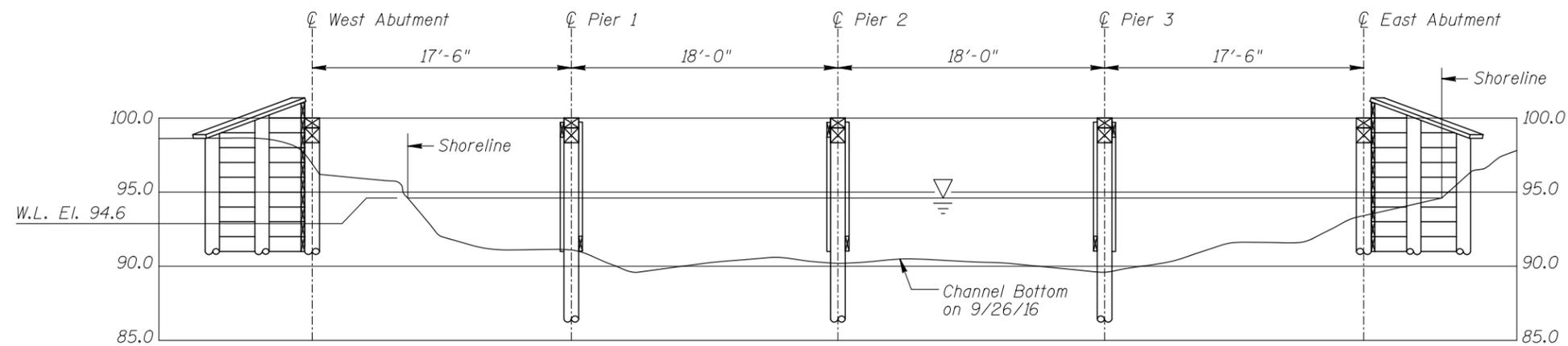
- INSPECTION NOTES:**
- 1 Channel bottom material west of Pier 1 consisted of silt allowing 9 inches of probe rod penetration.
 - 2 Channel bottom material consisted of sand and organics allowing 6 inches of probe penetration.
 - 3 Channel bottom material along the entire face of the East Abutment and extending 5 feet into the channel consisted of sand and gravel allowing 1 inch of probe rod penetration.
 - 4 Light timber debris consisting of branches extended from the channel bottom up 2 feet along the east side of Piers 2 and 3 from Pile 3 to Pile 6.
 - 5 Timber debris consisting of branches up to 9 inches in diameter extended from the channel bottom to the waterline for a width of 6 feet along the entire upstream fascia of the bridge.
 - 6 All timber piles typically exhibited minor decay and checking up to 1/8 inch wide.
 - 7 Loss of section from the waterline up 2 feet measured 3 inches wide by 1/2 inch deep on Piles 1 and 2 at Pier 3.
 - 8 Minor timber rot was observed at the waterline on Pile 1 at the upstream end of Pier 3.
 - 9 Timber cross brace was split at the connection at Pile 2 on the west side of Pier 1.
 - 10 Timber cross brace connection was failed at Pile 7 on the west side of Pier 3.
 - 11 Timber cross brace was split at Pile 3 and not connected along the east side of Pier 3 from Pile 3 to the downstream end of the pier.

- GENERAL NOTES:**
1. Piers 1 through 3 and the East Abutment were inspected underwater.
 2. At the time of inspection on September 26, 2016, the waterline was located approximately 5.4 feet below the top of pier cap at the downstream end of Pier 3. Since elevation information was not available a reference elevation of 100.0 feet was assumed. Based on the assumed reference the waterline elevation was 94.6 feet.
 3. Soundings indicate the water depth at the time of inspection and are measured in feet.
 4. Soundings were taken parallel to the bridge at 1/4 point intervals between the substructure units.

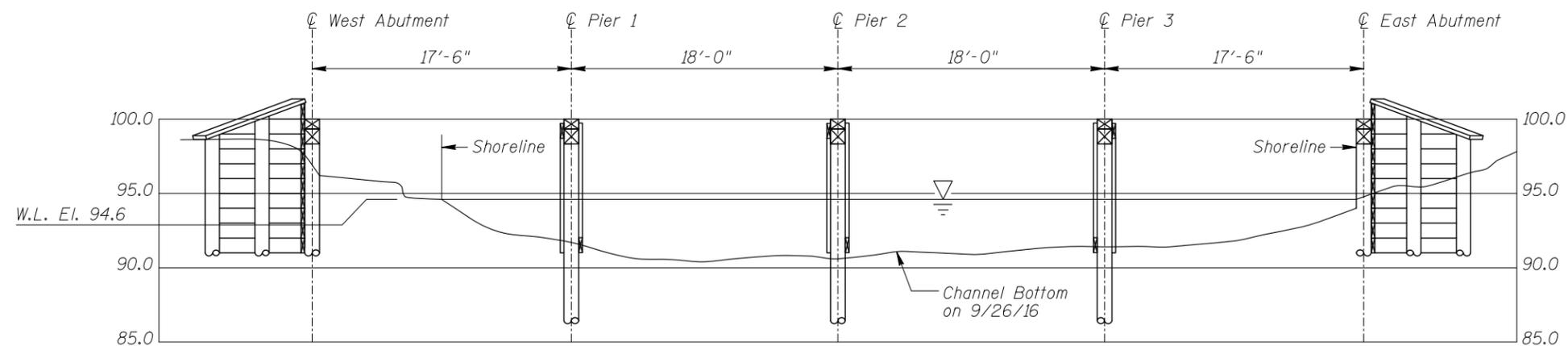


- Legend**
- 3.0 Sounding Depth from Waterline (9/26/16)
 - 12"φ Timber Pile
 - 1 Pile Identification Number
 - Timber Debris

MINNESOTA DEPARTMENT OF TRANSPORTATION UNDERWATER BRIDGE INSPECTION		
STRUCTURE NO. L9181 CR 67 OVER WILLOW RIVER DISTRICT 3, AITKIN COUNTY		
INSPECTION AND SOUNDING PLAN		
Drawn By: PRH	COLLINS ENGINEERS <small>123 North Wacker Drive Suite 900 Chicago, IL 60606 (312) 704-9300 www.collinsengr.com</small>	Date: SEPT., 2016
Checked By: DGS		Scale: NTS
Code: 9687L9181		Figure No.: 1



UPSTREAM FASCIA PROFILE



DOWNSTREAM FASCIA PROFILE

Note:
Refer to Figure 1 for General Notes.

MINNESOTA DEPARTMENT OF TRANSPORTATION UNDERWATER BRIDGE INSPECTION		
STRUCTURE NO. L9181 CR 67 OVER WILLOW RIVER DISTRICT 3, AITKIN COUNTY		
UPSTREAM AND DOWNSTREAM FASCIA PROFILES		
Drawn By: PRH	COLLINS ENGINEERS <small>123 North Wacker Drive Suite 900 Chicago, IL 60606 (312) 704-9300 www.collinsengr.com</small>	Date: SEPT., 2016
Checked By: DGS		Scale: NTS
Code: 9687L9181		Figure No.: 2