

2016 UNDERWATER BRIDGE INSPECTION REPORT



BRIDGE # 18506 CSAH 31 over RABBIT LAKE NARROWS

DISTRICT: District 3 COUNTY: Crow Wing CITY/TOWNSHIP: RABBIT LAKE
STATE: Minnesota

Date of Inspection: 06/06/2016

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 Bridge No. 18506, the North and South Abutments, were found to be in satisfactory condition with no defects of structural significance below water. The timber bents exhibited minor checking and there was some light to moderate corrosion on the steel sheeting backwalls and wingwalls from 1 foot above to 1.5 feet below the waterline. The channel bottom around the substructure units consisted of scattered 1 foot diameter and smaller rock and silty sand with no evidence of notable scour observed.

INSPECTION FINDINGS

(A) The channel bottom consisted of scattered 1 foot diameter and smaller rock with silty sand infill allowing 2 to 4 inches of probe rod penetration.

(B) The timber members exhibited random minor checking up to 1/4 inch wide.

(C) Light aquatic growth was observed on the steel sheeting below the waterline.

(D) The steel sheeting exhibited coating failure and surface corrosion on 50 to 100 percent of its surface area from 1 foot above to 1.5 feet below the waterline with minor rust delaminations and section loss up to 1/32 inch in depth. From 1.5 feet below the waterline to the channel bottom the steel sheeting exhibited random rust nodules with up to 1/16 inch deep pitting on less than 15 percent of its surface area.

(E) The south upstream and south downstream piles exhibited a 1/2 inch split from the top of the pile down 4 feet allowing 3 to 4 inches of penetration.

RECOMMENDATIONS

(A) 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 #: 18506
Feature Intersected: RABBIT LAKE NARROWS
Facility Carried: CSAH 31
District: District 3
County: 018 - Crow Wing

Bridge Description:

The bridge superstructure consists of one span of multiple steel beams supporting a reinforced concrete deck. The superstructure is supported by two timber pile abutments. The abutments consist of timber piles with a timber pile cap and cross bracing. The backwall and wingwalls of each abutment consist of steel sheeting.

2. INSPECTION DATA

Professional Engineer/Team Leader: Daniel G. Stromberg
Inspection Diver: Daniel G. Stromberg
Date of Underwater Inspection: 06/06/2016
Weather Conditions: Cloudy, 70°F
Underwater Visibility (feet): 4.0 feet
Waterway Velocity (ft/sec): Negligible

3. SUBSTRUCTURE INSPECTION DATA

Substructure(s) Inspected: North and South Abutments

General Shape:

Each abutment consists of five timber piles interconnected with timber cross bracing and a timber pile cap. The timber piles are in front of steel sheet piling which form the backwall and two skewed wingwalls at each abutment.

Maximum Water Depth at Substructure(s) Inspected (feet): 14.0 feet

4. WATERLINE DATUM

Water Level Reference: The top of the pier cap at the upstream end of the North Abutment
Waterline Elevation (feet): 93.9 feet
Description: The waterline was located approximately 6.1 feet below the reference.

5. NBIS CODING INFORMATION

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

Item 60: Substructure: Code: 6
Item 61: Channel and Channel Protection: Code: 8
Item 62: Culvert: Code:
Item 92B: Underwater Inspection: Code: Y 48 06/2016

Item 113: Scour Critical Bridge:

Code: I

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
228	Timber Piling	10	EA	8	2		
885	Scour	1	EA	1			

UNDERWATER INSPECTION

INSPECTION PROCEDURES

The routine underwater inspection of Bridge 18506 (CSAH 31 over Rabbit Lake Narrows) was completed on June 6, 2016. The underwater inspection was conducted from 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. Channel bottom 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 two timber abutments. According to the bridge inventory, the North and South Abutments are founded on timber piles with steel sheeting walls. 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

10/03/2016

Inspector: CO Bridge

BRIDGE 18506 CSAH 31 OVER RABBIT LAKE NARROWS

County: Crow Wing	Location: 3.0 MI N OF JCT TH 210-6	Length: 24.0 ft.
City:	Route: 04 - CSAH 31 Ref. Pt.: 003+00.510	Deck Width: 33.2 ft.
Township: 18024 - RABBIT LAKE	Control Section:	Rdwy. Area/ Pct. Unsnd: 743 sq. ft. / %
Section: 30 Township: 047N Range: 28W Maint. Area:		Paint Area/ Pct. Unsnd: sq. ft. / %
Span Type: 3 - Steel 2 - Stringer/Multi-beam or Girder	Local Agency Bridge Nbr.:	Culvert: N/A
List:		Postings:
NBI Deck: 6 Super: 5 Sub: 6 Chan: 8 Culv: N	Open, Posted, Closed: A - Open	
	MN Scour Code: I - LOW RISK	

Appraisal Ratings - Approach: 8 Waterway: 8		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 80.2

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	08/05/2016	797 SF	797	0	0	0
		Migrated Values		797 SF	797	0	0	0
	Notes: [2016] Migrator assumed CS1.							
510	Wearing Surfaces	Underwater	08/05/2016	743 SF	743	0	0	0
		Migrated Values		743 SF	743	0	0	0
	Notes: 11/04/14: 2 Longitudinal cracks in the deck with smaller cracks developing. The deck need to be rubber sealed. 10/02/12: Minor cracks in bituminous overlay in outside wheel path. All cracks have been sealed. 10/28/10: Bit. wearing surface was removed and replaced in kind fall 2010. 11/03/08: Moderate cracking in the bit. overlay, No pot holes All cracks have been routed and sealed.							
107	Steel Open Girder/Beam	Underwater	08/05/2016	115 LF	0	0	115	0
		Migrated Values		115 LF	0	0	115	0
	Notes: 01/22/16: Met Rick Pickar (MNDOT) on the bridge site and measured the webs of the beams for section loss. We found an 1/8 of an inch section loss across the entire beam on beams 1 and 5 behind the wooden spacer used for the bridge railing. The original section is 1/2 inch wide. Also found a 1/8 inch of section loss in the webs in the lower 2 to 3 inches of the webs of all of the beams over the bridge seats. Checked the flange thicknesses and found they measure 13/16 in most areas, (13/16 is the original thickness). 1 isolated area was found in the top flange in the middle of the #5 beam where the thickness measured 3/4 of an inch. 11/04/14: All of the bridge beams have flaking & pack rust along the top of the top flanges. Paint on the east (#5) beam has completely failed. Flaking rust is prevalent along the majority of beam #5, with section loss in the web and lower flange on the SE end of the beam. The estimated section loss is less than 10% in beam #5. The paint on the west (#1) beam has failed. There is flaking rust in the low web and top of the lower flange along the complete beam on the westerly exposed surface with a limited amount of section loss in the lower flange and web. Beams 2,3 and 4 have flaking rust & section loss at the beam ends. 11/02/12: Flaking rust across the bottom of the east fascia beam. Flaking rust is present in both fascia beams and at the bridge seat on all of the beams. Rust at beam ends and top of the bottom flanges. 50% of paint gone both fascia beams. 11/03/08: Flaking rust is present in both fascia beams and at the bridge seat on all of the beams. Rust at beam ends and top of the bottom flanges. 50% of paint gone both fascia beams. 11/02/06: Rust at beam ends and top of the bottom flanges. 50% of paint gone & rusting on both fascia beams. 10/08/04: 5% of beams rusted at girder ends. 20% of beams rusted w/corrosion (both fascia beams)							
	Pack Rust Notes: 11/04/14: Pack rust is occurring at the beam ends, throughout the east beam and in isolated areas at the top of the top flanges of beams 1 through 4 and in isolated bolted locations of the floor beams.							
515	Steel Protective Coating	Underwater	08/05/2016	999 SF	0	0	0	999
		Migrated Values		999 SF	0	0	0	999
	Notes: [2016] Migrator assumed quantity of 999 SF and estimated the condition states.							

BRIDGE 18506 CSAH 31 OVER RABBIT LAKE NARROWS

ELEM NBR	ELEMENT NAME	REPORT TYPE	INSP. DATE	QUANTITY	QTY CS 1	QTY CS 2	QTY CS 3	QTY CS 4
152	Steel Floor Beam	Underwater	08/05/2016	256 LF	0	256	0	0
		Migrated Values		256 LF	0	256	0	0
Notes: 11/04/14 - 11/03/08: Freckled rust throughout and rusting on the top of the bottom flanges. 11/02/06: Rusting on the top of the bottom flanges.								
515 -	Steel Protective Coating	Underwater	08/05/2016	999 SF	0	0	999	0
		Migrated Values		999 SF	0	0	999	0
Notes: [2016] Migrator assumed quantity of 999 SF and estimated the condition states.								
156	Timber Floor Beam	Underwater	08/05/2016	33 LF	33	0	0	0
		Migrated Values		33 LF	33	0	0	0
Notes: [2016] Migrator assumed the presence of one timber floorbeam in CS1.								
217	Masonry Abutment	Underwater	08/05/2016	106 LF	19	73	14	0
		Migrated Values		106 LF	19	73	14	0
Notes: [2016] Migrator added 40 LF to abutment quantity to account for wingwalls (CS1:0 CS2:40 CS3:0 CS4:0). 11/04/14: There is a broken bolt that connects to the abutment stiffener in the north abutment. The bolted connections in the sheet-piling are tipping and pulling through in isolated locations. The paint has failing at the waterline and 3 tie backs are broke off on the N abutment and 1 tie back is broken on the S abutment. 10/28/10: The bolted connections in the sheet-piling are tipping and pulling through in isolated locations. The paint has failing at the waterline and 3 tie backs are broke off on the N abutment and 1 tie back is broken on the S abutment. 11/03/08: Paint has failed at the water line. 3 tie backs are broke off and missing on the N abutment and 1 tie back is gone from the S abutment. 11/02/06: Paint has failed at the water line. 3 tie backs are broke off and missing on the N abutment and 1 tie back is gone from the S abutment. Wingwall notes: 01/22/16: Found cracks in the lower corner of the weld on the NE wingwall where a piece was welded on to increase the height. 11/04/14: The SE stiffener at the waterline has completely failed. The NE upper stiffener has advanced deterioration. The NE and NW wingwalls have large voids behind them. The void behind the NW wingwall has partially collapsed. 11/02/12: Voids in the fill beneath the stiffener beam form the outer edge to the bridge at all 4 wingwalls. There is advanced deterioration (rusting) of the stiffener beam. 10/28/10: Paint has failed at the waterline. The bolts in bolted connection to the horizontal stiffener are pushing out of the piling and tipping down. Wingwalls remain straight w/ no bulges at this time.								
228	Timber Pile	Underwater	08/05/2016	10 EA	9	1	0	0
		Migrated Values		10 EA	9	1	0	0
Notes: 11/04/14 - 11/03/08: SW outside pile has a deep check & is questionable when sounded w/ a hammer.								
235	Timber Pier Cap	Underwater	08/05/2016	72 LF	36	36	0	0
		Migrated Values		72 LF	36	36	0	0
Notes: 11/04/14 - 11/03/08: Checks in the N cap.								
332	Timber Bridge Railing	Underwater	08/05/2016	46 LF	41	0	0	5
		Migrated Values		46 LF	41	0	0	5
Notes: 11/04/14: Does not meet current standards. NW corner at the bolted connection to the curb has been crushed and the bolted connection has failed and should be repaired. Bolted connections need to be tightened. 10/28/10: Does not meet current standards. NW corner at the bolted connection to the curb has been crushed. Bolted connections need to be tightened. 11/03/08: Does not meet current standards.								
800	Critical Deficiencies or Safety Hazards	Underwater	08/05/2016	1 EA	1	0	0	0
		Migrated Values		1 EA	1	0	0	0
Notes: NO CRITICAL FINDINGS OBSERVED DURING THE LAST INSPECTION.								

BRIDGE 18506 CSAH 31 OVER RABBIT LAKE NARROWS

ELEM NBR	ELEMENT NAME	REPORT TYPE	INSP. DATE	QUANTITY	QTY CS 1	QTY CS 2	QTY CS 3	QTY CS 4
822	Bituminous Approach Roadway	Underwater	08/05/2016	2 EA	0	2	0	0
		Migrated Values		2 EA	0	2	0	0
<p>Notes: 11/04/14: Slight settlement occurring in both approaches, but traffic impact on the bridge has not been significantly increased. 11/02/12: No notable settlement in approaches. 10/28/10: New approaches installed fall 2010. Joint over the abutments was sawn and sealed. 11/03/08: Has been dura-patched, but that may have made the conditions worse. Settlement continues. 11/08/06: Settlement is occurring in both approaches and moving loads are impacting the bridge.</p>								
881	Steel Section Loss	Underwater	08/05/2016	1 EA	1	0	0	0
		Migrated Values		1 EA	1	0	0	0
<p>Notes: 11/04/14: All of the bridge beams have flaking & pack rust along the top of the top flanges. Flaking rust is prevalent along the majority of beam #5, with section loss in the web and lower flange on the SE end of the beam. The estimated section loss is less than 10% in beam #5. The paint on the west (#1) beam has failed. There is flaking rust in the low web and top of the lower flange along the complete beam on the westerly exposed surface with a limited amount of section loss in the lower flange and web. Beams 2,3 and 4 have flaking rust & section loss at the beam ends. 11/03/08: Flaking rust is present in both fascia beams and at the bridge seat on all of the beams.</p>								
884	Substructure Settlement & Movement	Underwater	08/05/2016	1 EA	1	0	0	0
		Migrated Values		1 EA	1	0	0	0
<p>Notes: 11/04/14: There is slight settlement of the fills at the approaches and behind the wingwalls, but there is no new evidence of movement in the substructures themselves. 10/28/10: Approaches have been fixed. New wearing surface installed fall 2010. 11/03/08: Occurring at the approaches. 11/02/06: Occurring at the approaches.</p>								
885	Scour	Underwater	08/05/2016	1 EA	1	0	0	0
891	Other Bridge Signing	Underwater	08/05/2016	1 EA	1	0	0	0
		Migrated Values		1 EA	1	0	0	0
<p>Notes: 11/04/14: Signing has been moved. Marker signs should be moved to the guard rail.</p>								
892	Slopes & Slope Protection	Underwater	08/05/2016	1 EA	1	0	0	0
		Migrated Values		1 EA	1	0	0	0
<p>Notes: 11/04/14: Minor erosion occurring under the guardrail and behind the wingwalls. 10/28/10: Repaired w/ the approach paving. 11/03/08: Washouts at the SE, NE & NW corners. 11/02/06: Washouts at the NE & NW corners.</p>								
893	Guardrail	Underwater	08/05/2016	1 EA	1	0	0	0
		Migrated Values		1 EA	1	0	0	0
<p>Notes: 11/04/14: Bolt missing at the SE corner in transition between the bridge and guardrail connection. Guardrail post in the NE terminal, at the splice, needs to be pulled forward.</p>								
894	Deck & Approach Drainage	Underwater	08/05/2016	1 EA	1	0	0	0
		Migrated Values		1 EA	1	0	0	0
<p>Notes: 11/04/14: Minor erosion occurring under the guardrail and behind the wingwalls. 10/28/10: Bit. flumes paved behind the wingwalls w/ the approach paving. 11/03/08: Contributing to the erosion behind the wingwalls.</p>								
895	Sidewalk, Curb, & Median	Underwater	08/05/2016	1 EA	0	1	0	0
		Migrated Values		1 EA	0	1	0	0
<p>Notes: 11/04/14: . NW corner at the bolted connection to the curb has been crushed and the bolted connection has failed and should be repaired. 10/28/10: NW corner of the curb is crushed.</p>								

BRIDGE 18506 CSAH 31 OVER RABBIT LAKE NARROWS

ELEM NBR	ELEMENT NAME	REPORT TYPE	INSP. DATE	QUANTITY	QTY CS 1	QTY CS 2	QTY CS 3	QTY CS 4
900	Protected Species	Underwater	08/05/2016	1 EA	1	0	0	0
		Migrated Values		1 EA	1	0	0	0

Notes: Use this element to track the presence of protected species living on this structure.

General Notes: 06/06/16 Underwater Inspection - Collins Engineers
 01/22/16: Met Rick Pickar (MNDoT) on the bridge site and measured the webs of the beams for section loss. We found an 1/8 of an inch section loss on beams 1 and 5 behind the wooden spacer used for the bridge railing. The original section is 1/2 inch wide. Also found a 1/8 inch of section loss in the webs in the lower 2 to 3 inches of the webs of all of the beams over the bridge seats.
 11/04/14: Was able to inspect w/ a boat. Section loss is occurring in the bridge beams. Deck should be rubber sealed.
 11/02/12: Was able to inspect w/ a boat and see all elements. Latest underwater inspection done on 09/09/12.
 10/28/10: Was able to inspect w/ a boat and see all elements. Removed and replaced the bituminous wearing surface fall 2010.
 11/03/08: Was able to inspect w/ a boat and see all elements. The underwater inspection was performed in 2007.
 11/02/06: Was able to inspect with a boat. Paint system on the steel is failing. No structural problem apparent.
 10-08-2004: NO STRUCTURAL PROBLEMS APPARENT.
 11-01-2002: NO STRUCTURAL PROBLEMS APPARENT.
 06-20-1999: THERE ARE STILL THREE TIE BACK ROD ENDS BROKEN OFF AT NORTH ABUTMENT, ONE AT THE SOUTH ABUTMENT. NO STRUCTURAL PROBLEMS APPARENT.

58. Deck NBI: 11/04/14: Some minor cracking in the bituminous surfacing and rusting and deterioration of the deck anchor clips.

36A. Brdg Railings NBI: Railing height is too short to meet crash standards.

36B. Transitions NBI:

36C. Appr Guardrail NBI:

36D. Appr Guardrail Terminal NBI:

59. Superstructure NBI: 01/22/16: 1/8 of an inch section loss across the entire beam on beams 1 and 5 behind the wooden spacer used for the bridge railing. The original section is 1/2 inch wide. 1/8 inch of section loss in the webs in the lower 2 to 3 inches of the webs of all of the beams over the bridge seats.
 11/04/14: Flaking rust and paint failure throughout.

60. Substructure NBI: From underwater inspection report on 09/09/12. Minor checking observed on all timber piles. Steel sheeting - coating failure and rust scale from 1 foot above the waterline to 1.5 feet below. Below 1.5 feet below the waterline the sheeting has rust nodules over less than 5 percent of the surface area with 1/16 inch deep pitting.

61. Channel NBI:

62. Culvert NBI:

71. Waterway Adeq NBI:

72. Appr Roadway Alignment NBI:

Inventory Notes:

 Inspector's Signature

 Reviewer's Signature

Pictures



Photo 1 - Upstream Fascia, Looking Northeast



Photo 2 - Downstream Fascia, Looking Northwest

Pictures



Photo 3 - North Abutment, Looking Northwest



Photo 4 - South Abutment, Looking Southeast

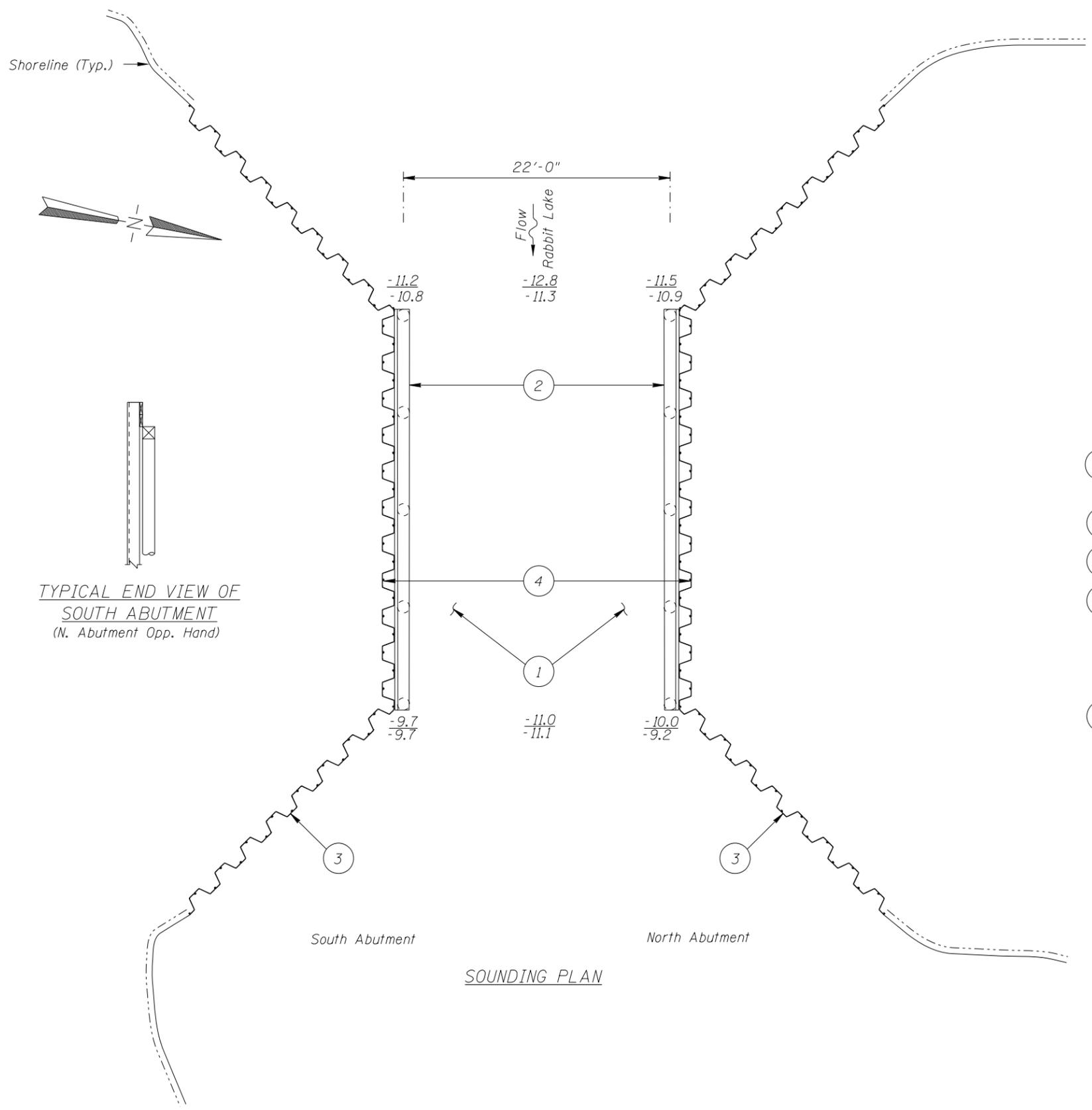
Pictures



Photo 5 - South Abutment Downstream Pile Split, Looking Southwest



Photo 6 - Typical Backwall Rust Nodules and Pitting (South Backwall Shown), Looking South



GENERAL NOTES:

1. The North and South Abutments were inspected underwater.
2. At the time of inspection on June 6, 2016, the waterline was located approximately 6.1 feet below the top of the pile cap at the upstream end of the North Abutment. Since insufficient bridge elevation information was available, a reference elevation of 100.0 was assumed. Based on the assumed reference the waterline elevation was 93.9.
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 the mid point intervals between the substructure units.

INSPECTION NOTES:

- 1 The channel bottom consisted of scattered 1 foot diameter and smaller rock with silty sand infill allowing 2 to 4 inches of probe rod penetration.
- 2 The timber members exhibited random minor checking up to 1/4 inch wide.
- 3 Light aquatic growth was observed on the steel sheeting below the waterline.
- 4 The steel sheeting exhibited coating failure and surface corrosion on 50 to 100 percent of its surface area from 1 foot above to 1.5 feet below the waterline with minor rust delaminations and section loss up to 1/32 inch in depth. From 1.5 feet below the waterline to the channel bottom the steel sheeting exhibited random rust nodules with up to 1/16 inch deep pitting on less than 15 percent of its surface area.
- 5 The south upstream and south downstream piles exhibited a 1/2 inch split from the top of the pile down 4 feet allowing 3 to 4 inches of penetration.

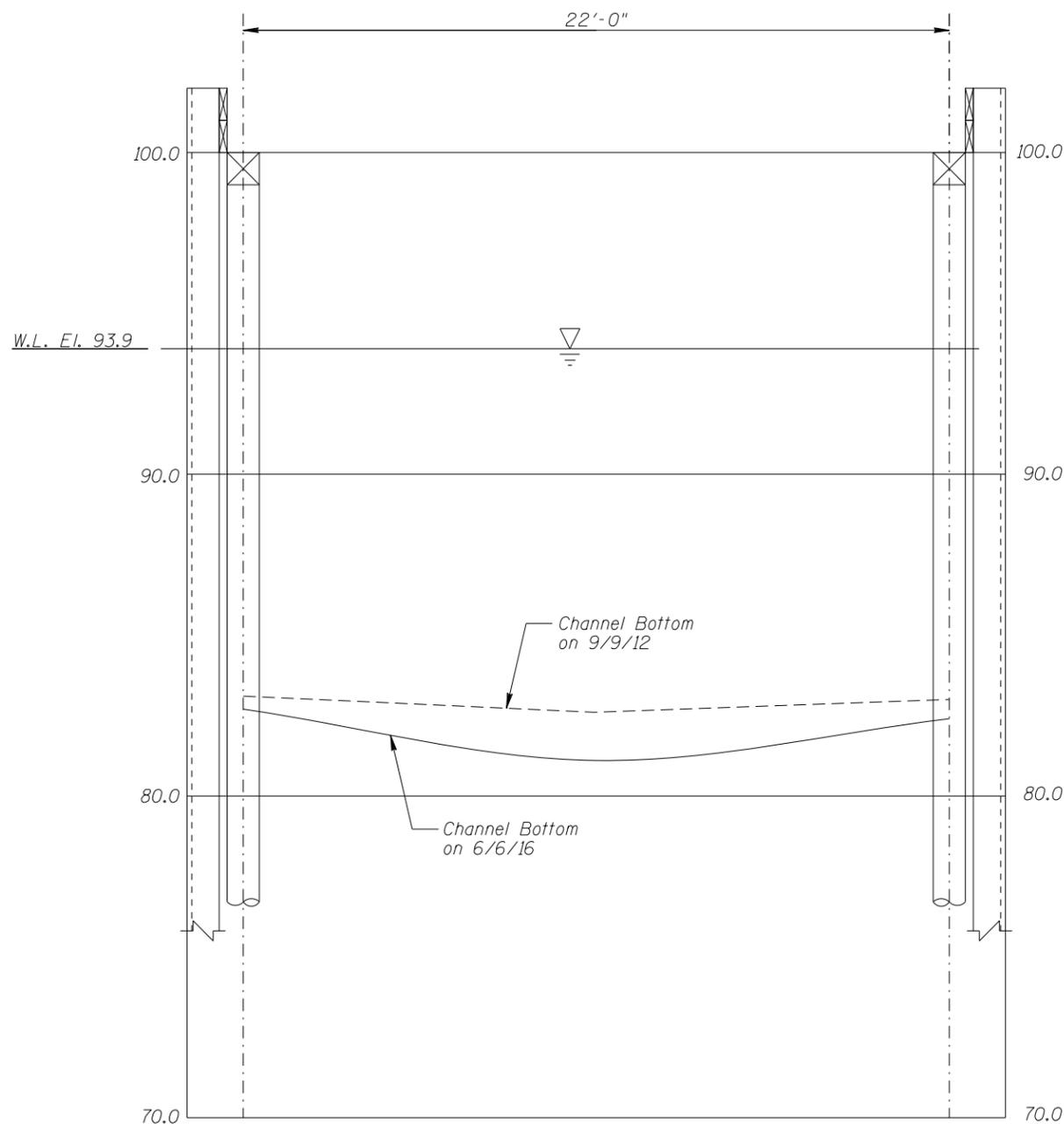
Legend

- 11.5 Sounding Depth (6/6/16)
- 10.9 Sounding Depth (9/9/12)
- (C) Timber Pile

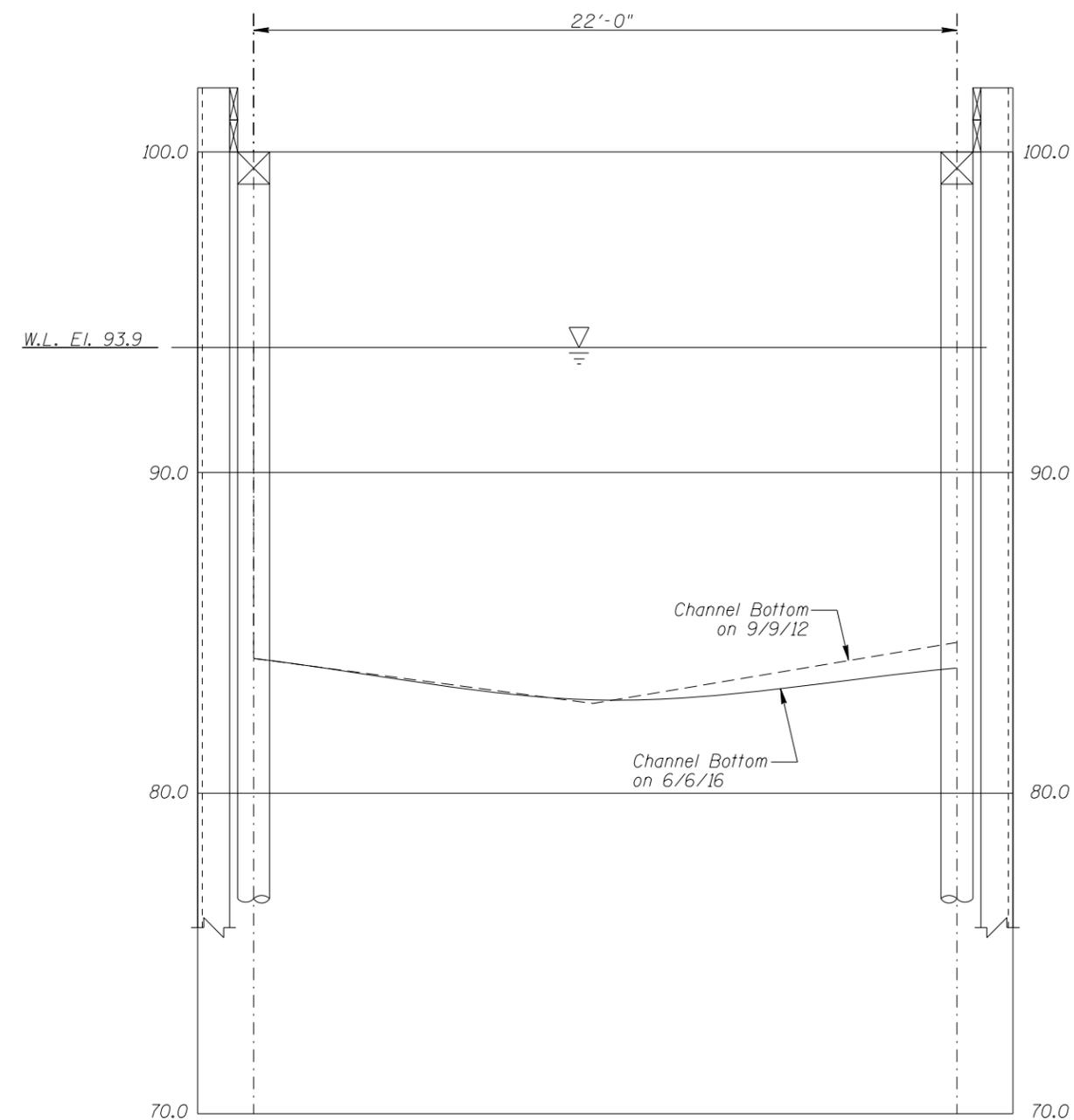
Note:

All soundings based on 2016 waterline location.

MINNESOTA DEPARTMENT OF TRANSPORTATION UNDERWATER BRIDGE INSPECTION		
STRUCTURE NO. 18506 OVER RABBIT LAKE DISTRICT 3, CROW WING COUNTY		
INSPECTION AND SOUNDING PLAN		
DRAWN BY: ELN	COLLINS ENGINEERS	DATE: JUNE 6, 2016
CHECKED BY: DGS	<small>133 North Wacker Drive Suite 300 Chicago, IL 60606 (312) 704-9300 www.collinsengr.com</small>	SCALE: NTS
CODE: 968718501		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. 18506 OVER RABBIT LAKE DISTRICT 3, CROW WING COUNTY UPSTREAM AND DOWNSTREAM FASCIA PROFILES		
DRAWN BY: ELN	COLLINS ENGINEERS	DATE: JUNE 6, 2016
CHECKED BY: DGS		SCALE: 1"=10'
CODE: 968718501		FIGURE NO.: 2