

UNDERWATER BRIDGE INSPECTION REPORT

STRUCTURE NO. 7826

GOODELL ROAD

OVER THE

RICE RIVER

ST. LOUIS COUNTY



SEPTEMBER 19, 2012

PREPARED FOR THE

MINNESOTA DEPARTMENT OF TRANSPORTATION

BY

COLLINS ENGINEERS, INC.

JOB NO. 7423

MINNESOTA DEPARTMENT OF TRANSPORTATION
UNDERWATER BRIDGE INSPECTION

REPORT SUMMARY:

The substructure units inspected at Bridge No. 7826, the East and West Abutments and Bent 1, were found to be in very poor condition, with defects of structural significance. Several piles of Bent 1 exhibited a hollow sound suggesting internal timber decay extending from 3 to 5 feet below the pile cap. Pile C of Bent 1 had a vertical split, 1 inch wide on the east and west faces. The pile cap at the East Abutment has rotated approximately 25° to the east. Due to the rotation, a gap was observed between the bottom of the west corner of the pile cap and the top of the pile ranging from 2 inches at Pile A to 5 and 6 inches at Piles E and B respectively. Piles C and D appeared to have heaved upward 4 to 6 inches causing little to no bearing at Piles B and E. The East Abutment pile cap above Pile D and E is heavily split and crushed due to apparent overload. The shims at Piles A and B are no longer effective indicating that the piles have moved since the shims were placed. Due to the rotation, the pile cap is bearing on the 3 inch by 12 inch backwall boards. The pile cap is not bearing on Pile C of Bent 1.

INSPECTION FINDINGS:

- (A) The channel bottom material typically consisted of scattered rocks, gravel and sand.
- (B) Unless otherwise noted, the timber piles were typically sound with random splits or checks up to 1/4 inch wide and 1/2 inch deep.
- (C) The north cross-brace of Bent 1 exhibited a split from Pile D to Pile F that is adversely affecting the pile connections.
- (D) Piles B, C, D, and F of Bent 1 exhibited a hollow sound suggesting some internal deterioration or decay extending from 3 feet to 5 feet below the pile cap.
- (E) Pile C of Bent 1 had a vertical split on the east and west faces extending from the pile cap down 3 feet. The split was typically 1 inch wide and 2 inches deep.

- (F) An accumulation of timber debris, consisting of a 10-inch-diameter tree and smaller branches, was observed across the entire upstream channel. The accumulation is causing a minor damming (flow obstruction) effect.
- (G) A loss of fill material was noted below the bottom backwall board at the East Abutment. No voids could be seen behind the boards, however, there was a depression in the gravel roadway adjacent to the East Abutment.
- (H) The pile cap at the East Abutment has rotated approximately 25° to the east. Due to the rotation, a gap was observed between the bottom of the west corner of the pile cap and the top of the piles ranging from 2 inches at Pile A to 5 and 6 inches at Piles E and B respectively. Piles C and D appeared to have heaved upward 4 to 6 inches causing little to no bearing at Piles B and E. The pile cap above Pile D and E is heavily split and crushed due to apparent overload. The shims at Piles A and B are no longer effective indicating that the piles have moved since the shims were placed. Due to the rotation, the pile cap is bearing on the 3 inch by 12 inch backwall boards.
- (I) Pile C of Bent 1 exhibited a 1/2 inch gap between the pile cap and the top of the pile resulting in no bearing at Pile C.

RECOMMENDATIONS:

- (A) An above water inspection should be conducted as soon as possible at the East Abutment, and based on that inspection and further evaluation, the appropriate remedial measures for abutment and backfill stability should be implemented.
- (B) Shim Pile C of Bent 1 to restore bearing and monitor during future inspections.
- (C) Repair/replace the split cross-brace at Bent 1.
- (D) The timber debris accumulation across the upstream channel did not significantly affect the channel flow, and as a result, does not require removal at this time. If the debris accumulation increases in size or density, it may be necessary to remove the debris to reduce excessive lateral loads on the pier, limit further debris accumulation, and reduce the likelihood of channel bottom degradation resulting from obstructed flow.

- (E) The bridge is currently posted for 20 tons. Based on a further evaluation of the above water conditions, determine a safe operating load for the bridge until repairs are implemented.

- (F) The inspection of the submerged substructure units of Structure No. 7826 can most likely be accomplished in the future without using a dive team. To perform the underwater inspection, a properly equipped qualified inspector will have to enter the water during a period of low flow. As channel bottom contours and depths of flow can change quickly, it is recommended that lead line soundings of water depth be taken along the upstream and downstream fascias to determine whether wading is possible prior to beginning the inspection. If conditions are unsafe for inspection by wading, then an underwater inspection with the use of a dive team will be required.

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

Inspection Team Leader:



Nicholas R. Triandafilou, P.E.

Respectfully submitted,

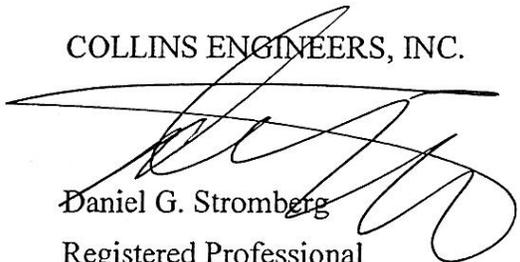
PROFESSIONAL ENGINEER

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

Daniel G. Stromberg

Date 6/30/14 License # 21491

COLLINS ENGINEERS, INC.



Daniel G. Stromberg

Registered Professional

Engineer, State of Minnesota

MINNESOTA DEPARTMENT OF TRANSPORTATION
UNDERWATER BRIDGE INSPECTION

1. BRIDGE DATA

Bridge Number: 7826

Feature Crossed: Rice River

Feature Carried: Goodell Road

Location: St. Louis County

Bridge Description: The superstructure consists of a timber deck supported by timber beams. The superstructure is supported by two abutments consisting of five 12-inch-diameter timber piles and a pile bent consisting of six 12-inch-diameter timber piles.

2. INSPECTION DATA

Professional Engineer Diver: Nicholas R. Triandafilou, P.E.

Dive Team: Marc B. Parker, Clay G. Brookins

Date: September 19, 2012

Weather Conditions: Cloudy, 50° F

Underwater Visibility: 2 feet

Waterway Velocity: 0.5 ft/sec

3. SUBSTRUCTURE INSPECTION DATA

Substructure Inspected: The West and East Abutments and Bent 1

General Shape: The West and East Abutments each consist of five timber 12-inch-diameter piles with a 12 inch by 12 inch timber pile cap. The backwall and wingwalls were comprised of 3 inch by 12 inch timber boards. Bent 1 consisted of six timber 12-inch-diameter piles with a 12 inch by 12 inch timber pile cap and two 3 inch by 12 inch diagonal cross-brace boards.

Maximum Water Depth at Substructure Inspected: Approximately 1.9 feet.

4. WATERLINE DATUM

Water Level Reference: Top of the pile cap at the downstream end of Bent 1.

Water Surface: The waterline was approximately 7.3 feet below the reference.
Waterline Elevation 92.7.

5. NBIS CODING INFORMATION (Minnesota specific codes are used for 92B and 113)

Item 60: Substructure: Code 3

Item 61: Channel and Channel Protection: Code 5

Item 92B: Underwater Inspection: Code A/09/12

Item 113: Scour Critical Bridges: Code I/12

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

 Yes X No

6. STRUCTURAL ELEMENT CONDITION RATING

Item #	Element Description	Quantity	Unit	Conditions				
				1	2	3	4	5
206	Timber Piles	16	EA	0	7	4	5	n/a
216	Timber Abutment	46	LF	0	23	0	23	n/a
360	Settlement	1	EA	0	0	1	n/a	n/a
985	Slopes and Slope Protection	1	EA	0	0	1	n/a	n/a



Photograph 1. Overall View of Structure, Looking Northeast



Photograph 2. View of roadway at bridge, Looking East. Note the Northeast Corner is elevated in relation to the rest of the roadway.



Photograph 3. View of the West Abutment, Looking Southwest.



Photograph 4. View of the Bent 1, Looking Southwest.



Photograph 5. View of the East Abutment, Looking Southeast.



Photograph 6. View of the Typical Timber Pile Condition at the Waterline, Looking Southwest.



Photograph 7. View of the Split on the East Face of Pile C of Bent 1, Looking West.



Photograph 8. View of the Loss of Fill Under the Bottom Backwall Board at the East Abutment, Looking Southeast.



Photograph 9. View of the Pile Cap Rotation at the East Abutment, Looking South.



Photograph 10. View of Pile A of the East Abutment, Looking Southeast.



Photograph 11. View of Pile B of the East Abutment, Looking Southeast.



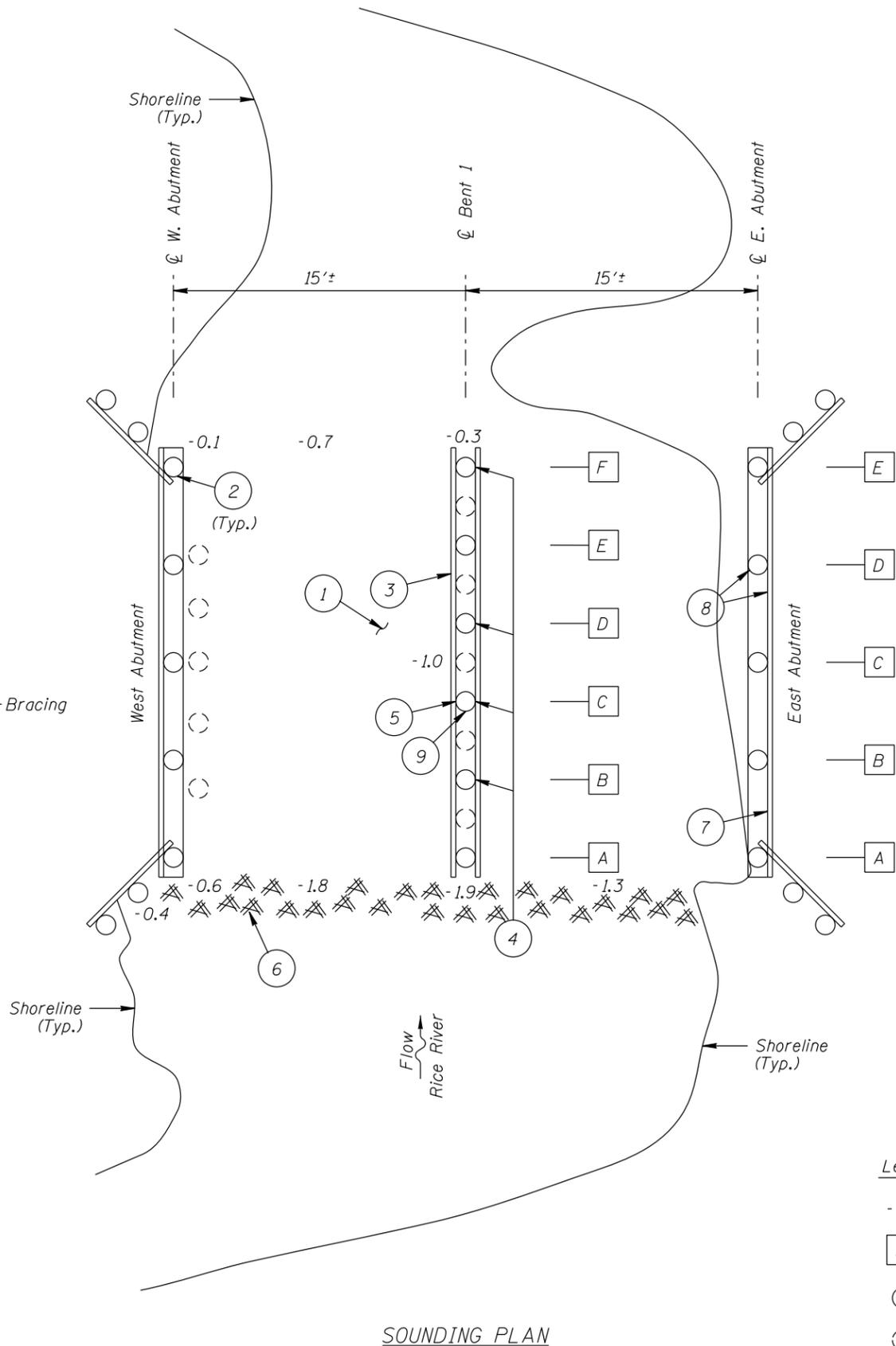
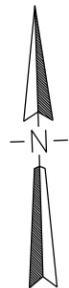
Photograph 12. View of Pile C of the East Abutment, Looking Southeast.



Photograph 13. View of Pile D of the East Abutment, Looking Southeast.



Photograph 14. View of Pile E of the East Abutment, Looking Southeast.



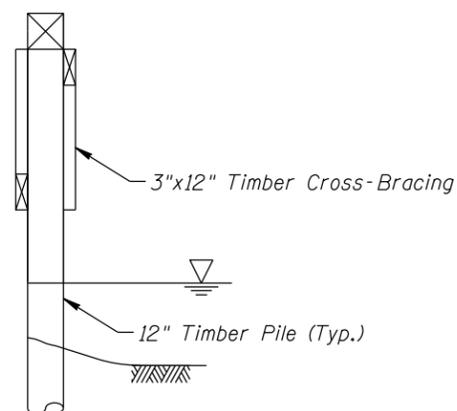
INSPECTION NOTES:

- 1 The channel bottom material typically consisted scattered rocks, gravel and sand.
- 2 Unless otherwise noted the timber piles were typically sound with random splits or checks up to 1/4 inch wide and 1/2 inch deep.
- 3 The north cross-brace of Bent 1 exhibited a split from Pile D to Pile F that is adversely affecting the pile connections.
- 4 Piles B, C, D, and F of Bent 1 exhibited a hollow sound suggesting some internal deterioration or decay extending from 3 feet to 5 feet below the pile cap.
- 5 Pile C of Bent 1 had a vertical split on the east and west faces extending from the pile cap down 3 feet. The split was typically 1 inch wide and 2 inches deep.
- 6 An accumulation of timber debris, consisting of a 10-inch-diameter tree and smaller branches, was observed across the entire upstream channel. The accumulation is causing a minor damming (flow obstruction) effect.
- 7 A loss of fill material was noted below the bottom backwall board at the East Abutment. No voids could be seen behind the boards, however, there was a depression in the gravel roadway adjacent to the East Abutment.
- 8 The pile cap at the East Abutment has rotated approximately 25° to the east. Due to the rotation, a gap was observed between the bottom of the west corner of the pile cap and the top of the piles ranging from 2 inches at Pile A to 5 and 6 inches at Piles E and B respectively. Piles C and D appeared to have heaved upward 4 to 6 inches causing little to no bearing at Piles B and E. The pile cap above Pile D and E is heavily split and crushed due to apparent overload. The shims at Piles A and B are no longer effective indicating that the piles have moved since the shims were placed. Due to the rotation, the pile cap is bearing on the 3 inch by 12 inch backwall boards.
- 9 Pile C of Bent 1 exhibited a 1/2 inch gap between the pile cap and the top of the pile resulting in no bearing at Pile C.

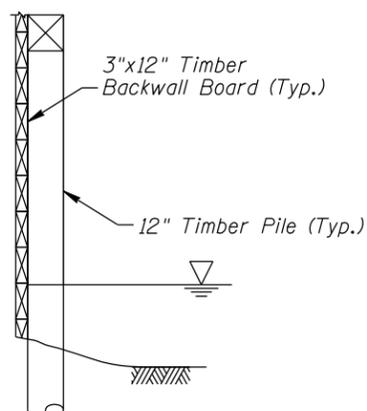
GENERAL NOTES:

1. The West and East Abutments and Bent 1 were inspected during the underwater inspection.
2. At the time of inspection on September 19, 2012, the waterline was located approximately 7.3 feet below the top of the pile cap at the downstream end of the Bent 1. Since elevation information was not available a reference elevation of 100.0 was assumed. Based on the assumed reference the waterline elevation was 94.3.
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 1/2 point intervals between the substructure units.

TYPICAL END VIEW OF BENT



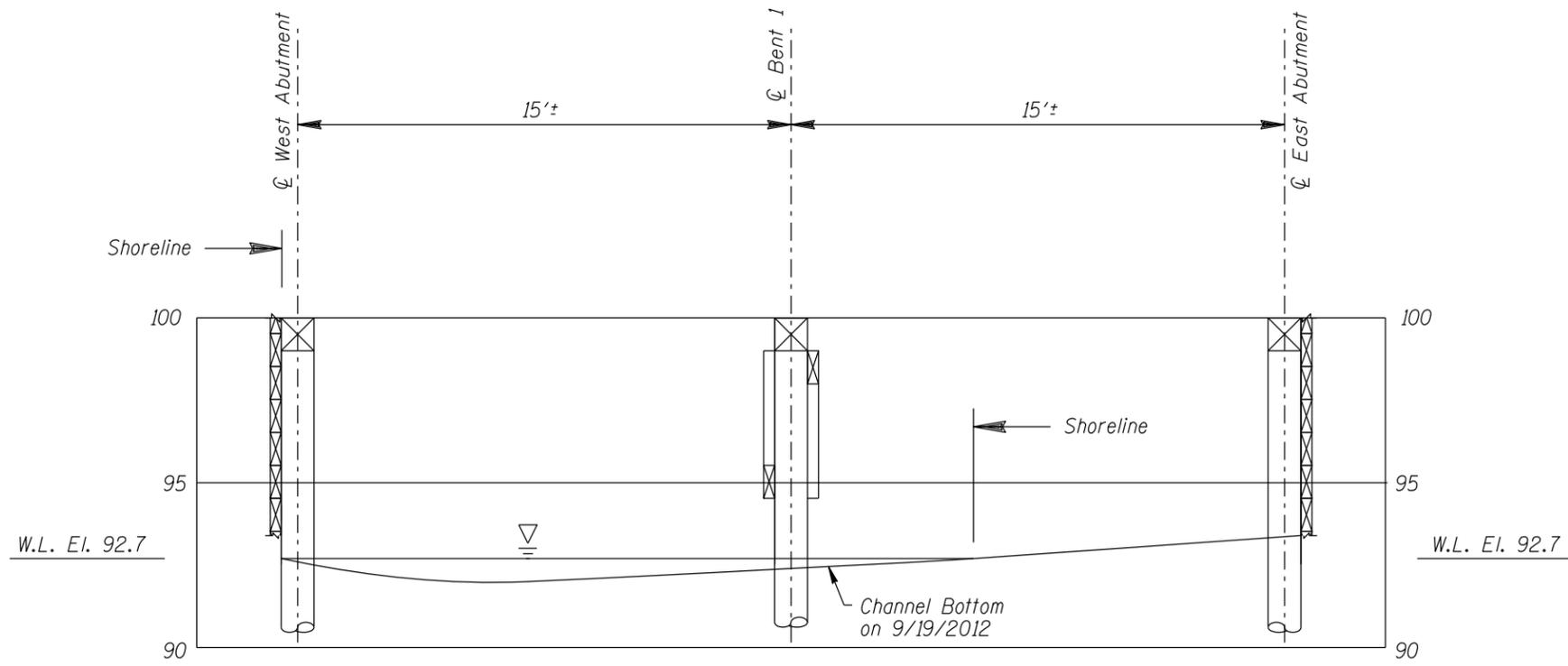
TYPICAL END VIEW OF ABUTMENTS



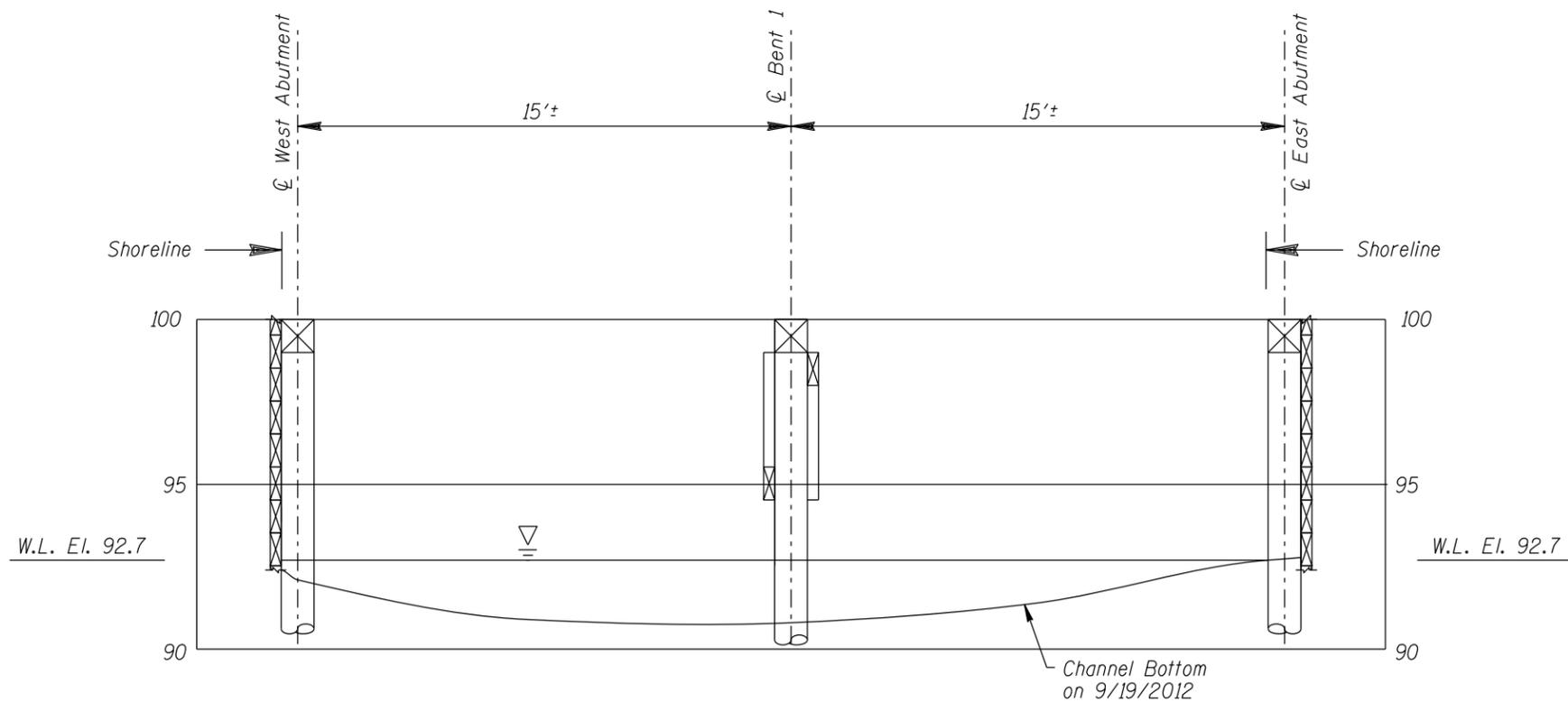
Legend

- 17.0 Sounding Depth from Waterline (9/17/2012)
- A Pile Identification Designation
- 12-inch Diameter Timber Pile
- Abandoned 12-inch Diameter Timber Pile
- ⊗ Timber Debris
- ① Inspection Note Number

MINNESOTA DEPARTMENT OF TRANSPORTATION UNDERWATER BRIDGE INSPECTION		
STRUCTURE NO. 7826 GOODELL OVER THE RICE RIVER ST. LOUIS COUNTY		
INSPECTION AND SOUNDING PLAN		
Drawn By: MBP	COLLINS ENGINEERS <small>123 North Wacker Drive Suite 900 Chicago, IL 60606 (312) 704-9300 www.collinsengr.com</small>	Date: NOVEMBER, 2012
Checked By: LJ		Scale: NTS
Code: 74237826		Figure No.: 1



DOWNSTREAM FASCIA PROFILE



UPSTREAM FASCIA PROFILE

Note:
Refer to Figure 1 for General Notes.

MINNESOTA DEPARTMENT OF TRANSPORTATION UNDERWATER BRIDGE INSPECTION		
STRUCTURE NO. 7826 GOODELL OVER THE RICE RIVER ST. LOUIS COUNTY		
UPSTREAM AND DOWNSTREAM FASCIA PROFILES		
Drawn By: MBP	COLLINS ENGINEERS	Date: NOVEMBER, 2012
Checked By: LJ		Scale: 1"=5'
Code: 74237826		Figure No.: 2

123 North Wacker Drive
Suite 900
Chicago, IL 60606
(312) 704-9300
www.collinsengr.com

MINNESOTA DEPARTMENT OF TRANSPORTATION
OFFICE OF BRIDGES AND STRUCTURES

UNDERWATER INSPECTION CONDITION RATING FORM

BRIDGE NO. 7826
 INSPECTORS Collins Engineers, Inc.
 ON-SITE TEAM LEADER Nicholas R. Triandafilou, P.E.
 WATERWAY CROSSED Rice River

INSPECTION DATE September 19, 2012

NOTE: USE ALL APPLICABLE CONDITION DEFINITIONS AS DEFINED IN THE MINNESOTA RECORDING AND CODING GUIDE INCLUDING GENERAL, SUBSTRUCTURE, CHANNEL AND PROTECTION, AND CULVERTS AND WALL DEFINITIONS TO COMPLETE THIS FORM.

CONDITION RATING

UNIT REFERENCE NO.	UNIT DESCRIPTION	MAXIMUM DEPTH OF WATER	SUBSTRUCTURE					CHANNEL					GENERAL						
			PILING	COLUMNS, SHAFTS, OR FACES*	FOOTINGS	DISPLACEMENT	OTHER (BRACE, BACKWALL)	OVERALL SUBSTRUCTURE CONDITION CODE*	SCOUR	EMBANKMENT EROSION	EMBANKMENT PROTECTION	OTHER (DRIFT/DEBRIS)	OVERALL CHANNEL & PROTECTION CONDITION	CONCRETE	STEEL	TIMBER	LOSS OF SECTION	PREVIOUS REPAIR OR MAINTENANCE	OTHER
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	West Abutment	0.6'	6	N	N	5	5	5	N	5	6	5	5	N	N	6	6	N	N
	Bent 1	1.9'	5	N	N	5	5	5	N	N	N	5	5	N	N	5	5	N	N
	East Abutment	0.1	5	N	N	3	3	3	N	5	4	5	4	N	N	5	6	3	N

*UNDERWATER PORTION ONLY

REMARKS: Overall, the East and West Abutments and Bent 1, were found to be in very poor condition, with defects of structural significance. Several piles of Bent 1 exhibited a hollow sound suggesting internal timber decay extending from 3 to 5 feet below the pile cap. Pile C of Bent 1 had a vertical split, 1 inch wide on the east and west faces. The pile cap at the East Abutment has rotated approximately 25° to the east. Due to the rotation, a gap was observed between the bottom of the west corner of the pile cap and the top of the pile ranging from 2 inches at Pile A to 5 and 6 inches at Piles E and B respectively. Piles C and D appeared to have heaved upward 4 to 6 inches causing little to no bearing at Piles B and E. The East Abutment pile cap above Pile D and E is heavily split and crushed due to apparent overload. The shims at Piles A and B are no longer effective indicating that the piles have moved since the shims were placed. Due to the rotation, the pile cap is bearing on the 3 inch by 12 inch backwall boards. The pile cap is not bearing on Pile C of Bent 1.

NOTES: ATTACH SKETCHES AS NEEDED, IDENTIFY REMARK BY REFERRING TO UNIT REFERENCE NO. AND REMARK NO. USE GENERAL SECTION TO IDENTIFY OVERALL PRESENCE OF SPALLS, CRACKS, CORROSION, ETC.

MINNESOTA DEPARTMENT OF TRANSPORTATION
OFFICE OF BRIDGES AND STRUCTURES
DAILY DIVING REPORT

INSPECTORS: Collins Engineers, Inc. DATE: September 19, 2012
ON-SITE TEAM LEADER: Nicholas R. Triandafilou, P.E.
BRIDGE NO: 7826 WEATHER: Cloudy, 50° F
WATERWAY CROSSED: Rice River
DIVING OPERATION: _____ SCUBA _____ SURFACE SUPPLIED AIR
X _____ OTHER Inspection by Wadding
PERSONNEL: Marc B. Parker, Clayton G. Brookins
EQUIPMENT: Dry Suit, Commercial Scuba, Probe Rod, Camera, Hand Tools
TIME IN WATER: 12:00 P.M.
TIME OUT OF WATER: 1:00 P.M.
WATERWAY DATA: VELOCITY 0.5 ft/sec
VISIBILITY 2 feet
DEPTH 1.9 feet maximum at the Bent 1

ELEMENTS INSPECTED: The West and East Abutments and Bent 1

REMARKS: Overall, the East and West Abutments and Bent 1, were found to be in very poor condition, with defects of structural significance. Several piles of Bent 1 exhibited a hollow sound suggesting internal timber decay extending from 3 to 5 feet below the pile cap. Pile C of Bent 1 had a vertical split, 1 inch wide on the east and west faces. The pile cap at the East Abutment has rotated approximately 25° to the east. Due to the rotation, a gap was observed between the bottom of the west corner of the pile cap and the top of the pile ranging from 2 inches at Pile A to 5 and 6 inches at Piles E and B respectively. Piles C and D appeared to have heaved upward 4 to 6 inches causing little to no bearing at Piles B and E. The East Abutment pile cap above Pile D and E is heavily split and crushed due to apparent overload. The shims at Piles A and B are no longer effective indicating that the piles have moved since the shims were placed. Due to the rotation, the pile cap is bearing on the 3 inch by 12 inch backwall boards. The pile cap is not bearing on Pile C of Bent 1.

FURTHER ACTION NEEDED: X YES NO

An above water inspection should be conducted as soon as possible at the East Abutment, and based on that inspection and further evaluation, the appropriate remedial measures for abutment and backfill stability should be implemented.

Shim Pile C of Bent 1 to restore bearing and monitor during future inspections.

Repair/replace the split cross-brace at Bent 1.

The timber debris accumulation across the upstream channel did not significantly affect the channel flow, and as a result, does not require removal at this time. If the debris accumulation increases in size or density, it may be necessary to remove the debris to reduce excessive lateral loads on the pier, limit further debris accumulation, and reduce the likelihood of channel bottom degradation resulting from obstructed flow.

The bridge is currently posted for 20 tons. Based on a further evaluation of the above water conditions, determine a safe operating load for the bridge until repairs are implemented.

The inspection of the submerged substructure units of Structure No. 7826 can most likely be accomplished in the future without using a dive team. To perform the underwater inspection, a properly equipped qualified inspector will have to enter the water during a period of low flow. As channel bottom contours and depths of flow can change quickly, it is recommended that lead line soundings of water depth be taken along the upstream and downstream fascias to determine whether wading is possible prior to beginning the inspection. If conditions are unsafe for inspection by wading, then an underwater inspection with the use of a dive team will be required.

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