Bridge L8503 carries Seven Bridges Road (also known as Snively Boulevard or East Skyline Parkway) over Amity Creek in Duluth. Constructed in 1912, it was one of the eight stone-faced bridges along the boulevard that were designed by the Minneapolis firm of Morell and Nichols. Four of the historic bridges, including L8503, remain and are owned by the City of Duluth. Bridge L8503 is significant for aesthetics and is a contributing resource of the National Register-eligible Skyline Parkway Historic District.

Bridge L8503 is a single span, Neoclassical style, concrete arch bridge. The structural arch is comprised of reinforced concrete and spans approximately 28 feet. The railings, headwalls and wingwalls are constructed of locally quarried gabbro stone. The arch rises from concrete spread footing abutments faced with stone. The earth-filled arches are topped with a 17-foot-6-inch-wide bituminous roadway.

Bridge L8503 underwent a major rehabilitation in 1996 where the entire bridge was repointed, missing stones were replaced, and the non-historic concrete caps on the rail were removed and replaced with stone caps. The bridge suffered some damage due to a June 2012 flood event. A repair plan has been prepared and the work will be conducted in the summer of 2014. During this project, the northeast concrete wingwall will be removed and replaced and underpin walls will be placed along each abutment.

Bridge L8503 is in fair condition overall and appears to adequately serve its purpose of carrying vehicular and pedestrian traffic. With proper maintenance, stabilization and preservation activities it is believed Bridge L8503 could continue to serve in its present capacity for 20 years or longer.

Any work on Bridge L8503 should proceed according to the Secretary of the Interior’s Standards for the Treatment of Historic Properties (Standards) [36 CFR part 67] and The Secretary’s Standards with Regard to Repair, Rehabilitation, and Replacement Situations, as adapted by the Virginia Transportation Research Council (Guidelines).
Bridge Location

BR. NO. L8503

ge L8503 – E SKYLINE/MUN 712 over AMITY CREEK

PROJECT LOCATION
ST. LOUIS COUNTY
SEC. 32, TO 051NN, R 13W
UTM ZONE: 15           NAD: 27
USGS QUAD NAME: DULUTH
EASTING: 1887607 ft.
NORTHING: 17025448 ft.

JUNE 2014
Executive Summary

Bridge Location

I. Project Introduction
II. Historic Data
III. Bridge Data
IV. Existing Conditions/Recommendations
V. Projected Costs

Appendices

A. Glossary
B. Guidelines for Bridge Maintenance and Rehabilitation based on the Secretary of the Interior’s Standards
C. Documents
This Bridge Report is a product of a comprehensive study performed for approximately 140 historic bridges owned by county, city, township, private and other state agencies besides MnDOT. The study is the second phase of a multi-phased process developed and executed in partnership with representatives from the Federal Highway Administration (FHWA); State Historic Preservation Office (SHPO); MnDOT State Aid; MnDOT Cultural Resources Unit (CRU); the US Army Corps of Engineers (USACE); local public works and county highway departments; county and township boards and city councils; the preservation community and the general public. To perform the study, MnDOT retained the consultant team of LHB Inc., Mead & Hunt Inc., and The 106 Group.

The general goals of the study include:

- Gathering and compiling the existing historic and bridge condition data and other relevant information on the bridges in the study group into bridge reports.
- National Register nominations for a select number of bridges within the study group which the bridge owner may request a nomination to be prepared.
- Updating MnDOT’s *Management Plan for Historic Bridges in Minnesota* based on the study’s findings.
- Producing a narrative for the MnDOT Historic Bridge Website to disseminate information regarding locally owned historic bridges in Minnesota.
- Investigating and preparing a summary regarding how other states have funded historic bridge programs and structured Programmatic Agreements when multiple non-state entities are the owners of historic bridges.

The Bridge Reports compile and summarize the historic and engineering information concerning the structures. The reports also document the existing use and condition of the bridges along with assessments of the maintenance, stabilization and preservation needs of each structure, including cost estimates. The maintenance activities, along with regular structural inspections and anticipated bridge component replacement activities are routine practices directed toward continued structure serviceability. Stabilization activities address immediate needs identified as necessary to maintain a bridge’s structural and historic integrity and serviceability. Preservation activities are near term or long term steps that need to be taken to preserve and in some cases restore a bridge’s structural and historic integrity and serviceability. In assessing preservation activities, a design life of 20 years or longer is typically considered. In addition to general restoration activities and dependent on the severity of deterioration, preservation activities may include spot repair, disassembly and reassembly or replacement of specific bridge components.

Recommendations within the Bridge Reports are consistent with the Secretary of the Interior’s Standards for the Treatment of Historic Properties (Standards). The Standards are basic principles created to help preserve the distinct character of a historic property and its site, while allowing for reasonable change to meet new engineering standards and codes. The Standards recommend repairing, rather than replacing deteriorated features whenever possible. The Standards apply to historic properties of all periods, styles, types, materials and sizes and encompass the property’s location and surrounding environment.
I – Project Introduction

The Standards were developed with historic buildings in mind and cannot be easily applied to historic bridges. The Virginia Transportation Research Council (Council) adapted the Standards to address the special requirements of historic bridges. They were published in the Council’s 2001 Final Report: A Management Plan for Historic Bridges in Virginia, *The Secretary’s Standards with Regard to Repair, Rehabilitation, and Replacement Situations*, provide useful direction for undertaking maintenance, repair, rehabilitation, and replacement of historic bridges and are included in the Appendix to this report.

Existing bridge data sources typically available for Minnesota bridges were gathered for the study. These sources include:

- PONTIS, a bridge management system formerly used by MnDOT to manage its inventory of bridges statewide, and its replacement system, SIMS (Structure Information Management System)
- The current MnDOT Structure Inventory Report and MnDOT Bridge Inspection Report. Reports are available for the majority of the bridges (not available for bridges in private ownership)
- Database and inventory forms resulting from the 2012 Minnesota Local Historic Bridge Study and other prior historic bridge studies as incorporated into the database
- Existing Minnesota historic contexts studies for bridges in Minnesota, including *Reinforced-Concrete Highway Bridges in Minnesota, 1900-1945*, *Minnesota Masonry-Arch Highway Bridges, 1870-1945*, *Iron and Steel Bridges in Minnesota, 1873-1945* and *Minnesota Bridges 1955-1970*
- Field investigations documenting the general structural condition and determining character-defining features

Additional data sources researched and gathered for some of the bridges as available also included:

- Files and records at MnDOT offices
- Original bridge construction plans, rehabilitation plans, and maintenance records of local owners
- Files and documents available at the SHPO office, including previous inventory forms, determinations of eligibility, studies, and compliance documents
- Existing historic and documentary material related to the National Register-eligible bridges

The Appendix contains the following: a Glossary explaining structural and historic preservation terms used in the report, the Guidelines for Bridge Maintenance and Rehabilitation based on the Secretary of the Interior’s Standards, a list of engineering and historic documents available for this bridge, and copies of the MnDOT Structure Inventory and Bridge Inspection Reports current at the time of the report preparation.

The Bridge Report will provide the bridge owner and other interested parties with a comprehensive summary of the bridge condition and detailed information related to the historic nature of the bridge. This information will enable historic bridge owners to make informed decisions when planning for their historic properties.
This narrative is drawn from previous documents, as available for the subject bridge, which may include determination of eligibility (also known as Phase II evaluation), Minnesota Architecture/History Inventory Form, National Register nomination, Multiple Property Documentation Form, and/or applicable historic contexts. See Sources for details on which documents were used in compiling this Historic Data section.

Contractor Unknown

Designer/Engineer Morell and Nichols

Description
Bridge L8503 is a single-span, filled-spandrel, reinforced-concrete barrel arch bridge. It carries Seven Bridges Road over Amity Creek in rural Amity Park in Duluth. The two-lane vehicular road is bordered by mixed forest, park, and residential lands. As the name of this segment suggests, it is characterized by a series of stone-faced bridges crossing the Amity Creek. The winding nature of the roadway, mostly closed in by forest with glimpses of Amity Creek, defines the character of this segment. The surface is paved with a bituminous surfacing, with gravel and grass verges.

Constructed in 1912 on an east-west axis, the overall structure is 28 feet and deck width is 21 feet. The masonry of the bridge is pitch-faced, rough-ashlar with a defined arch ring. The headwalls, wingwalls, and railings are solid native gabbro stone, and the abutments are stone faced with a concrete core. Formwork is visible on the arch barrel, and spalling has exposed some re-bar. Stylistic details consist of cap stones along the railing. A horizontal stringcourse also extends along the length of the bridge at the base of the railing. The pilasters, coursing, and accentuated architectural details results an overall formal and refined appearance indicative of the Neoclassical style. The bridge rests on concrete footings and has U-shaped abutments; the southern abutment is elongated with stone-faced retaining walls on both sides.

In 1996 the bridge underwent rehabilitation; the bridge’s railings were reconstructed and restored. This included the removal of the concrete railing caps and replacing them with stone, as per the original design. The majority of the original cap stones were retrieved from the stream and bridge slopes and placed back on the bridge. The pilaster caps were replaced with new stones. Additionally, the stonework was repointed along the railings, wingwalls, headwalls and abutments of the bridge. Following a flood event in 2012, concrete underpinnings were added to the bottom of both abutments and spot repointing of stone masonry was completed.

Significance
Bridge L8503 is one of the original eight stone-faced bridges located on Seven Bridges Road, which is a contributing segment of the National Register-eligible Skyline Parkway Historic District. The Parkway generally extends in a southwest-northwest direction from the southern part of St. Louis County, along the bluff on Duluth’s western periphery, to the unincorporated townships of Duluth and Midway at the shore of Lake Superior located northeast of downtown Duluth. The Parkway connects each segments and has both urban and natural settings with a variety of associated resources.
Seven Bridges Road is also known as Snively Boulevard. Samuel Snively, a local attorney and developer, assembled land with the intention of building a picturesque parkway that would meet with the extension of Rogers Parkway. Snively constructed the scenic roadway between 1899 and 1903. The road was difficult and costly to build due to its location in the steep Lester River valley, and the need for construction of 10 rustic bridges over Amity Creek.

In 1909 Snively donated the road and bridges to the city. By the time Snively Boulevard was transferred to the Park Board, it had become overgrown, and the original wooden bridges had fallen into ruin. The Park Board announced that money from the bond issue for the western extension of Rogers Parkway would also be used to upgrade Snively Boulevard. Eight stone bridges, including Bridge L8503, were constructed over the next two years on the road. Officially opened in 1912, the roadway was constructed as a scenic byway. In 1927 a 5-mile addition along Amity Creek was built connecting Snively's original drive with Vermillion Road. By 1930 it was included in the Park Department’s annual report as a 5.82-mile segment from 62nd Avenue East and Superior Street to Jean Duluth Road, indicating that at that time the Amity Creek Segment was included as part of Snively Boulevard.

The new stone bridges were designed by the Minneapolis landscape architectural firm of Morell and Nichols. Though named “Seven Bridges Road,” the roadway actually crossed eight bridges. Each bridge was made of reinforced-concrete and faced with rustic native gabbro stone, blasted from cliffs in the vicinity and collected from the creek bed. Six-inch cap stones made of pink opal granite quarried near St. Cloud detailed the length of the bridge retaining walls, abutments and railings. Each bridge featured similar Neoclassical details such as defined abutment pilasters, defined stringcourse that separate the railings, and heavy cap stones, done in native gabbro stone. The Neoclassical design of each bridge reflected the natural setting and location within the parkway. Over time, the bridges became a distinctive characteristic of the parkway that enhanced the rustic, winding, and forested setting of the road.

Bridge L8503 has undergone few alterations since its construction in 1912 and none that severely diminish its overall integrity. Bridge L8503 underwent rehabilitation in 1996 following Morrell and Nichols original plan. Rehabilitation efforts included the reconstruction and restoration of the railing cap stones with the original stone design, masonry repointing, and other masonry repairs. Additionally, a new wingwall at the northwest corner of the bridge was installed. The 1996 rehabilitation work was conducted with an emphasis on maintaining integrity to the original design. Isolated areas of concrete mortar replacement are compatible with the original mortar in terms of color, texture, and thickness and do not result in a loss of integrity. The top of the retaining wall sits well below the top of the railing and does not change the overall elevation appearance of the main span; the retaining wall is also relatively small in scale compared to the rest of the bridge. In addition, concrete underpinnings added below the arch at each abutment within the past year do not detract from the significant architectural features or alter view sheds of the bridge in a manner that diminishes integrity of feeling or design. Section 106 compliance files were not located at the State Historic Preservation Office; however, the rehabilitation appears to have been guided by the Secretary of the Interior’s Standards. As such, Bridge L8503 retains integrity of location, setting, design, workmanship, materials, feeling, and association. The period of significance is 1912 to correspond with its date of construction.
The bridge is eligible for the National Register within the Multiple Property Documentation Form “Reinforced-Concrete Highway Bridges in Minnesota, 1900-1945,” under Criterion C in the area of Engineering. The bridge displays notable high artistic value as represented in its Neoclassical design features and ornamentation. Additionally Bridge L8503 is a contributing resource to the National Register-eligible Skyline Parkway Historic District.

**Historic Context**
- Reinforced-Concrete Highway Bridges in Minnesota, 1900-1945; Urban Centers 1870-1940

**National Register Status**
- Eligible (Individually); Contributing to Eligible Historic District

**Criterion A Significance**
- N/A

**Criterion C Significance**
- Engineering: High artistic value

**Historic District**
- Skyline Parkway

**SHPO inventory number**
- SL-DUL-2399

**Sources Used to Compile Section II – Historic Data**

“Bridge L8503.” Structure Inventory Sheet & related documents, MnDOT files, St. Paul.


Stark Preservation Planning. Skyline Parkway Cultural Resources Inventory. 2011.

Field Investigation by LHB, Inc. and Mead & Hunt, Inc. 28 August 2013.
Character-Defining Features

Character-defining features are prominent or distinctive aspects, qualities, or characteristics of a historic property that contribute significantly to its physical character. Features may include materials, engineering design, and structural and decorative details. Often, the character-defining features include important historic fabric. However, historic fabric can also be found on other elements of a bridge that have not been noted as character-defining. For this reason, it is important to consider both character-defining features and the bridge’s historic fabric when planning any work.

Feature 1: Neoclassical architectural details found on the reinforced-concrete arch with stone masonry headwalls, wingwalls and railings. The bridge features Neoclassical stylistic treatment as seen in the defined abutment pilasters, stringcourse defining the bottom of the railing, and heavy stone caps atop the railing and pilasters.

![Image of bridge](image-url)
Feature 2: Skyline Parkway setting. The bridge is located along the Seven Bridges Road, part of the National Register-eligible Skyline Parkway.
Minnesota Department of Transportation (MnDOT)
Local Historic Bridge Report

### Bridge Number: L8503

#### III – Bridge Data

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<tr>
<th>Date of Construction (remodel)</th>
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<td>Common Name (if any)</td>
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**Location**
- Feature Carried: E SKYLINE
- Feature Crossed: Amity Creek
- County: St. Louis
- Ownership: City of Duluth

**MnDOT Structure Data**
- *Data Current (as of):* Sep 2013
- Main Span Type: 112 CONC ARCH
- Main Span detail: SPANDREL FILLED ARCH
- Substructure Type - Foundation Type: 1-Concrete - 2-Spread/Rock
- Abutment: N-Not Applicable - N-Not Applicable
- Piers: N-Not Applicable - N-Not Applicable
- Total Length: 28.2 ft
- Main Span Length: 28.2 ft
- Total Number of Span(s): 1
- Skew (degrees): 0
- Structure Flared: No Flare
- Roadway Function: Urban, Local
- Custodian/Maintenance Type: City

**Reported Owner Inspection Date**
- 10/25/2011

**Sufficiency Rating**
- 86.5

**Operating Rating**
- HS 30

**Inventory Rating**
- HS 20

**Structure Status**
- A - Open

**Posting**
- VEH: SEMI: DBL:

**Design Load**
- UNKN

**Current Condition Code**
- Deck: N
- Superstructure: 7
- Substructure: 7
- Channel and Protection: 5
- Culvert: N

**Current Appraisal Rating**
- Structural Evaluation: 7
- Deck Geometry: 3
- Underclearances: N
- Waterway Adequacy: 8
- Approach Alignment: 7

**Fracture Critical**
- No

**Deficient Status**
- F.O.

**Roadway Clearances**
- Roadway Width:
- Vert. Clearance Over Rdwy: 17.5 ft
- Vert. Clearance Under Rdwy: N/A
- Lat. Clearance Right: 0 ft
- Lat. Clearance Left: 0 ft

**Roadway Data**
- ADT Total: 77 (1985)
- Truck ADT Percentage: Not given
- Bypass Detour length: 7 miles
- Number of Lanes: 1

**Waterway Data**
- Scour Code: I-LOW RISK

**Non-MnDOT Data**

**Approach Roadway Characteristics**
- Lane Widths: 9 ft
- Shoulder Width: 1 ft
- Shoulders Paved or Unpaved: Unpaved
- Roadway Surfacing: Bituminous

**Number of Crashes reported in MnMCAT within 500 feet of Bridge Site**
- 1

**Location of Plans**
- City of Duluth

**Plans Available**
- Original Plan Excerpts, 1996 Rehab Plan, & 2013 Flood Repair Plan

* Non-MnDOT data collected during field survey. All other fields of data collected from MnDOT September of 2013. See Appendix C for MnDOT inventory and inspection report data.

** Unless a significant number of crashes are noted on or near a bridge, the accident data is not detailed in this report.
Available information, as detailed in the Project Introduction section, concerning Bridge L8503 was reviewed prior to visiting the bridge site. The site visit was conducted to establish the following:

1. General condition of structure
2. Conformation to available extant plans
3. Current use of structure
4. Roadway/pedestrian trail geometry and alignment (as applicable)
5. Bridge geometry, clearances and notable site issues

**General Bridge Description**

Bridge L8503 is a single span concrete arch bridge, in Duluth, Minnesota. It is one of eight bridges that carry East Skyline Parkway (a.k.a. Seven Bridges Road) over Amity Creek. It is the third bridge from the south. The structural arch is comprised of reinforced concrete and spans approximately 28 feet. The railings, headwalls and wingwalls are constructed of locally quarried gabbro stone. The arch rises from concrete spread footing abutments faced with stones which bear on bedrock. The underside of the arch reaches a height of 13 feet above Amity Creek. The earth-filled arches are topped with a 17-foot-6-inch-wide bituminous roadway.

Bridge L8503 is in fair condition overall. It underwent a major rehabilitation in 1996 where the entire bridge was repointed, missing stones were replaced (particularly at the top of the south rail over the arch), and the non-historic concrete caps on the rail (which had replaced the fallen original stone caps) were removed and replaced with stone caps. Prior to this rehabilitation, a concrete wingwall was placed at the northeast corner of the bridge and a concrete underpin wall was placed along the north abutment. It is unknown what year these repairs were completed. The bridge suffered some damage due to the June 2012 flood event. A repair plan has been prepared and the work will be conducted in the summer of 2014. During this project, the northeast concrete wingwall will be removed and replaced and underpin walls will be placed along each abutment.

**Serviceability Observations**

The bridge is currently open to vehicular and pedestrian traffic with no apparent load posting restrictions from legal loads.

**Condition Observations**

**Bridge Railings**

The bridge railings are in fair condition. Presently, some of the joints between the cap stones are beginning to fail. Also, mortar from the repointed joints on the interior face of the railing is beginning to fail just over the roadway.

**Roadway Slab**

The roadway over the bridge is in good condition overall. The roadway is free of cracks and settlement. There are two small scour holes forming at each end of the concrete wingwall on the northeast corner of the bridge. Also, there is vegetation growing along the edges of the roadway at the rail interface. This joint does not appear to be sealed. This roadway was overlaid with new bituminous in 2011.
Headwalls and Wingwalls
The masonry headwalls and wingwalls are in fair condition. In 1996, they were 100 percent repointed and several missing stones were replaced with stones to match the original stone. The walls are plumb. The mortared joints are showing signs of cracking and separation from the stones. The northeast pilaster edge is in poor condition where it meets the concrete wingwall with failed mortar joints and several voids at the wingwall interface. The non-historic northeast concrete wingwall was further displaced and cracked during the June 2012 flood. It is planned to be removed and replaced in the summer of 2014. The new wingwall will be a concrete core with stone veneer. The wingwall will resemble the original wingwalls with a stone rail and stone rail cap. The northeast pilaster voids will be repaired during the upcoming replacement of the wingwall.

Concrete Arch
The concrete arch is in fair condition. According to the 1996 rehabilitation plans it was not repaired. However, it does appear that some areas of the arch were repaired prior to 1995. Currently, there are small areas of spalled concrete and exposed reinforcing, but the overall surface is in fair condition overall.

Abutments
The abutments are in fair to poor condition. At an undetermined date, a concrete underpin wall was placed over the north abutment. Currently, this underpin wall is undermined by the creek. This condition was accelerated by the June 2012 flood event. The south abutment is also scoured and is missing stones. Both abutments are to receive a new concrete underpin wall in front of the existing surface during a repair project planned for the summer of 2014.

Approach/Waterway Observations
The bridge slopes are in good condition in the vicinity of the bridge. Upstream of the bridge, the banks were severely scoured by the June 2012 flood; however, they are not threatening the bridge structure. The roadway approaches atop the bridge are in good condition, however the delineator signs at each bridge corner are missing.

Date of Engineering Site Visit by LHB
August 28, 2013
Condition 1: East elevation, looking west

Condition 2: North approach, looking south
**Condition 3:** Typical condition of road (note vegetation at road/rail interface)

**Condition 4:** Rail mortar near roadway
Condition 5: Non-historic pilaster caps

Condition 6: Northwest wingwall and scour in roadway
Condition 7: Northwest wingwall (non-historic)

Condition 8: Southeast abutment/wing (note moisture in mortared joints)
Condition 9: Typical condition of mortared joint (note cracking and separation)

Condition 10: North abutment
Condition 11: South abutment

Condition 12: Arch underside – typical condition
Overall Recommendations
The bridge is currently open to vehicular and pedestrian traffic. The recommendations which follow assume the structure’s use will remain the same.

Recommended Stabilization Activities
No stabilization activities are programmed.

Recommended Preservation Activities

Bridge Railings
The railings were rehabilitated in 1996; however, there were some deficiencies noted. The mortar is beginning to fail near the roadway and the mortared joints between the cap stones are also beginning to fail. Approximately 200 square feet of rail should be repointed. Prior to repointing work, a mortar study should be performed to ensure selection of a mortar that is compatible in composition, strength, color, texture and tooling. To maintain historic integrity it will also be necessary for the project construction details to fully define the repointing requirements including but not limited to such items as joint preparation, mortar finish and tooling, mortar curing, and preparation of repointing test panels. In order to protect this region of the rail which is vulnerable to runoff water and moisture from piled up snow against the road edge, it is recommended that a silane sealer be applied to the railing surface to halt the deterioration of the mortared joints. Sealers should be investigated and a product chosen that does not significantly alter the original appearance of the stone. Silane sealers were applied to the Lester River Bridge to help with road salts, and its use was found to meet the Secretary of the Interior’s Standards, since the gabbro stone is hard and the sealer would not degrade the stone. The mortar on the bridge is all non-historic.

Roadway Slab
The roadway is in good condition, therefore no repair is recommended.

Headwalls and Wingwalls
The headwalls and wingwalls are in fair condition. Although the mortar in the stone joints is beginning to crack and separate from the stone in places, it is estimated that it will remain in fair condition for the next ten years. In approximately ten to fifteen years, it will likely be necessary to repoint the entire structure. A mortar study should be performed to ensure selection of a mortar that is compatible in composition, strength, color, texture and tooling. To maintain historic integrity it will also be necessary for the project construction details to fully define the repointing requirements including but not limited to such items as joint preparation, mortar finish and tooling, mortar curing, and preparation of repointing test panels. For purposes of planning, the cost of repointing has been included in the estimate.

Concrete Arch
The concrete arch is currently in fair condition. There were no areas noted to be repaired during the field inspection. However, it is likely that during a future project, concrete surface repair will be required. For purposes of cost estimation, a future area of repair has been assumed.
Abutments
After repairs are performed during the summer of 2014, the masonry of the abutments will be considered to be in good condition. There are no recommendations for additional repair to them at this time.

Approach Roadway
The delineator signs are missing along the approach roadway at each end of the bridge. It is recommended that these signs be replaced to increase the visibility of the bridge at night and reduce the risk of vehicular collisions with the bridge ends. The signage should be replaced as soon as the City is able. For purposes of cost estimating, this item has not been included due to its association with the approach roadway and not the bridge structure.

Recommended Annual Maintenance Activities

1. The railing, headwall, wingwalls, and outside faces of the arch underside should be flushed with water each spring to remove deicing salts. Low pressure spray, less than 400 psi, should be used to ensure there is no damage to surface finishes. Test flushing method and water pressure to ensure it does not damage or abrade the bridge surfaces

2. Repeat application of water repelling silane sealer to masonry bridge railings at intervals appropriate to product used.

3. The joint between the roadway and the railing should be cleaned of vegetation
Summarized Maintenance, Stabilization and Preservation Construction Cost Estimates

It is important to recognize that the work scope and cost estimates presented herein are based on a limited level assessment of the existing structure. In moving forward with future project planning, it will be essential to undertake a detailed structure assessment addressing the proposed work for the structure. It is also important that any future preservation work follow applicable preservation standards with emphasis to rehabilitate and repair in-place structure elements in lieu of replacement. This includes elements which are preliminarily estimated for replacement within the work scope of this report. Only through a thorough review of rehabilitation and repair options and comprehensive structural and historic assessment can a definitive conclusion for replacement of historic fabric be formed.

The opinions of probable construction and administrative costs provided below are presented in 2013 dollars. These costs were developed without benefit of a detailed, thorough bridge inspection, bridge survey or completion of preliminary design for the estimated improvements. The estimated costs represent an opinion based on background knowledge of historic unit prices and comparable work performed on other structures. The opinions of cost are intended to provide a programming level of estimated cost. These costs will require refinement and may require significant adjustments as further analysis is completed in determining the course of action for future structure improvements. A 20 percent contingency and 7 percent mobilization allowance has been included in the construction cost estimates.

Administrative and engineering costs are also presented below. Engineering and administrative costs are also to be interpreted as programming level only. Costs can be highly variable and are dependent on structure condition, intended work scope, project size and level of investigative, testing and documentation work necessary. Additional studies, evaluation, and historic consultation costs not exclusively called out may also be incurred on a case-by-case basis.

Maintenance, Stabilization and Preservation Costs (refer to the work item breakdown on the next page)

- Opinion of Annual Cost- Maintenance Activities: $2,200
- Opinion of Construction Cost- Stabilization Activities: $0
- Opinion of Construction Cost- Preservation Activities: $146,600

Estimated Preliminary Design, Final Design, Construction Administration Costs

- Preliminary Design and Assessment: $3,000
- Final Design and Plans: $15,000
- Construction Administration: $18,000
### Maintenance, Stabilization & Preservation Cost Estimate (2013 Dollars)

**Bridge No. L8503**  
April 13, 2014

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<th>Item No.</th>
<th>Item Description</th>
<th>Unit</th>
<th>Quantity</th>
<th>Unit Cost</th>
<th>Total Estimate</th>
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<td>Flush stone masonry headwalls, railings, wingwalls</td>
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<td><strong>$2,200.00</strong></td>
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**Stabilization Costs**

No stabilization activities are programmed.

**Estimated Stabilization Costs** $0.00

**Preservation Costs**

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<th>Item No.</th>
<th>Item Description</th>
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<th>Unit Cost</th>
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<td>Clean and seal roadway/roadway joint</td>
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**Estimated Quantiites and Cost**

- **Estimated Maintenance Costs**: $2,200.00
- **Estimated Stabilization Costs**: $0.00
- **Estimated Preservation Costs**: $146,600.00
Appendix A.  Glossary
Glossary

**Abutment** – Component of bridge substructure at either end of bridge that transfers load from superstructure to foundation and provides lateral support for the approach roadway embankment.

**Appraisal ratings** – Five National Bridge Inventory (NBI) appraisal ratings (structural evaluation, deck geometry, under-clearances, waterway adequacy, and approach alignment, as defined below), collectively called appraisal ratings, are used to evaluate a bridge’s overall structural condition and load-carrying capacity. The evaluated bridge is compared with a new bridge built to current design standards. Ratings range from a low of 0 (closed bridge) to a high of 9 (superior). Any appraisal item not applicable to a specific bridge is coded N.

**Approach alignment** – One of five NBI inspection ratings. This rating appraises a bridge’s functionality based on the alignment of its approaches. It incorporates a typical motorist’s speed reduction because of the horizontal or vertical alignment of the approach.

**Character-defining features** – Prominent or distinctive aspects, qualities, or characteristics of a historic property that contribute significantly to its physical character. Features may include structural or decorative details and materials.

**Condition, fair** – A bridge or bridge component of which all primary structural elements are sound, but may have minor deterioration, section loss, cracking, spalling, or scour.

**Condition, good** – A bridge or bridge component which may have some minor deficiencies, but all primary structural elements are sound.

**Condition, poor** – A bridge or bridge component that displays advanced section loss, deterioration, cracking, spalling, or scour.

**Condition rating** – Level of deterioration of bridge components and elements expressed on a numerical scale according to the NBI system. Components include the substructure, superstructure, deck, channel, and culvert. Elements are subsets of components, e.g., piers and abutments are elements of the component substructure. The evaluated bridge is compared with a new bridge built to current design standards. Component ratings range from 0 (failure) to 9 (new) or N for (not applicable); elements are rated on a scale of 1-3, 1-4 or 1-5 (depending on the element type and material). In all cases condition state 1 is the best condition with condition state 3, 4 or 5 being the worst condition. In rating a bridge’s condition, MnDOT pairs the NBI system with the newer and more sophisticated Pontis element inspection information, which quantifies bridge elements in different condition states and is the basis for subsequent economic analysis.

**Corrosion** – The general disintegration of metal through oxidation.

**Cutwater** – The wedge-shaped end of a bridge pier, designed to divide the current and break up ice.
Decay – Deterioration of wood as a result of fungi feeding on its cell walls.

Delamination – Surface separation of concrete, steel, glue laminated timber plies etc. into layers.

Deck geometry – One of five NBI appraisal ratings. This rating appraises the functionality of a bridge’s roadway width and vertical clearance, taking into account the type of roadway, number of lanes, and ADT.

Deficiency – The inadequacy of a bridge in terms of structure, serviceability, and/or function. Structural deficiency is determined through periodic inspections and is reflected in the ratings that are assigned to a bridge. Service deficiency is determined by comparing the facilities a bridge provides for vehicular, bicycle, and pedestrian traffic with those that are desired. Functional deficiency is another term for functionally obsolete (see below). Remedial activities may be needed to address any or all of these deficiencies.

Deficiency rating – A nonnumeric code indicating a bridge’s status as structurally deficient (SD) or functionally obsolete (FO). See below for the definitions of SD and FO. The deficiency rating status may be used as a basis for establishing a bridge’s eligibility and priority for replacement or rehabilitation.

Design exception – A deviation from federal design and geometric standards that takes into account environmental, scenic, aesthetic, historic, and community factors that may have bearing upon a transportation project. A design exception is used for federally funded projects where federal standards are not met. Approval requires appropriate justification and documentation that concerns for safety, durability, and economy of maintenance have been met.

Design load – The usable live-load capacity that a bridge was designed to carry, expressed in tons according to the AASHTO allowable stress, load factor, or load resistance factor rating methods. An additional code was recently added to assess design load by a rating factor instead of tons. This code is used to determine if a bridge has sufficient strength to accommodate traffic load demands. A bridge that is posted for load restrictions is not adequate to accommodate present or expected legal truck traffic.

Deterioration – Decline in condition of surfaces or structure over a period of time due to chemical or physical degradation.

Efflorescence – A deposit on concrete or brick caused by crystallization of carbonates brought to the surface by moisture in the masonry or concrete.

Extant – Currently or actually existing.

Extrados – The upper or outer surfaces of the voussoirs which compose the arch ring. Often contrasted with intrados.
**Footing** – The enlarged, lower portion of a substructure which distributes the structure load either to the earth or to supporting piles.

**Fracture Critical Members** – Tension members or tension components of bending members (including those subject to reversal of stress) whose failure would be expected to result in collapse of the bridge.

**Functionally obsolete** – The Federal Highway Administration (FHWA) classification of a bridge that does not meet current or projected traffic needs because of inadequate horizontal or vertical clearance, inadequate load-carrying capacity, and/or insufficient opening to accommodate water flow under the bridge. An appraisal rating of 3 or less for deck geometry, underclearance, approach alignment, structural evaluation or waterway adequacy will designate a bridge as functionally obsolete.

**Gusset plate** – A plate that connects the horizontal and vertical members of a truss structure and holds them in correct position at a joint.

**Helicoidal** – Arranged in or having the approximate shape of a flattened coil or spiral.

**Historic fabric** – The material in a bridge that was part of original construction or a subsequent alteration within the historic period of the bridge (i.e., more than 50 years old). Historic fabric is an important part of the character of the historic bridge and the removal, concealment, or alteration of any historic material or distinctive engineering or architectural feature should be avoided if possible. Often, the character-defining features include important historic fabric. However, historic fabric can also be found on other elements of a bridge that have not been noted as character-defining.

**Historic bridge** – A bridge that is listed in, or eligible for listing in, the National Register of Historic Places.

**Historic integrity** – The authenticity of a bridge’s historic identity, evidenced by the survival and/or restoration of physical characteristics that existed during the bridge’s historic period. A bridge may have integrity of location, design, setting, materials, workmanship, feeling, and association.

**Inspections** – Periodic field assessments and subsequent consideration of the fitness of a structure and the associated approaches and amenities to continue to function safely.

**Intrados** – The inner or lower surface of an arch. Often contrasted with extrados.

**Inventory rating** – The load level a bridge can safely carry for an indefinite amount of time expressed in tons or by the rating factor described in design load (see above). Inventory rating values typically correspond to the original design load for a bridge without deterioration.

**Keystone** – Wedge-shaped stone, or voussoir, at the crown of an arch.
**Load Rating** – The determination of the live load carrying capacity of a bridge using bridge plans and supplemented by field inspection.

**Maintenance** – Work of a routine nature to prevent or control the process of deterioration of a bridge.

**Minnesota Historical Property Record** – A documentary record of an important architectural, engineering, or industrial site, maintained by the Minnesota Historical Society as part of the state’s commitment to historic preservation. MHPR typically includes large-format photographs and written history, and may also include historic photographs, drawings, and/or plans. This state-level documentation program is modeled after a federal program known as the Historic American Buildings Survey/Historic American Engineering Record (HABS/HAER).

**National Bridge Inventory** – Bridge inventory and appraisal data collected by the FHWA to fulfill the requirements of the National Bridge Inspection Standards (NBIS). Each state maintains an inventory of its bridges subject to NBIS and sends an annual update to the FHWA.

**National Bridge Inspection Standards** – Federal requirements for procedures and frequency of inspections, qualifications of personnel, inspection reports, and preparation and maintenance of state bridge inventories. NBIS applies to bridges located on public roads.

**National Register of Historic Places** – The official inventory of districts, sites, buildings, structures, and objects significant in American history, architecture, archaeology, and culture, which is maintained by the Secretary of the Interior under the authority of the National Historic Preservation Act of 1966 (as amended).

**Non-vehicular traffic** – Pedestrians, non-motorized recreational vehicles, and small motorized recreational vehicles moving along a transportation route that does not serve automobiles and trucks. Includes bicycles and snowmobiles.

**Operating rating** – Maximum permissible load level to which a bridge may be subjected based on a specific truck type, expressed in tons or by the rating factor described in design load (see above).

**Pack rust** – Rust forming between adjacent steel surfaces in contact which tends to force the surfaces apart due to the increase in steel volume.

**Pier** – A substructure unit that supports the spans of a multi-span superstructure at an intermediate location between its abutments.

**Pointing** – The compaction of mortar into the outermost portion of a joint and the troweling of its exposed surface to secure water tightness and/ or desired architectural effect (when replacing deteriorated mortar).
**Pony truss** – A through bridge with parallel chords and having no top lateral bracing over the deck between the top chords.

**Posted load** – Legal live-load capacity for a bridge which is associated with the operating rating. A bridge posted for load restrictions is inadequate for legal truck traffic.

**Pontis** – Computer-based bridge management system to store inventory and inspection data and assist in other bridge data management tasks.

**Preservation** – Preservation, as used in this report, refers to historic preservation that is consistent with the Secretary of the Interior’s *Standards for the Treatment of Historic Properties*. Historic preservation means saving from destruction or deterioration old and historic buildings, sites, structures, and objects, and providing for their continued use by means of restoration, rehabilitation, or adaptive reuse. It is the act or process of applying measures to sustain the existing form, integrity, and material of a historic building or structure, and its site and setting. MnDOT’s *Bridge Preservation, Improvement and Replacement Guidelines* describe preservation differently, focusing on repairing or delaying the deterioration of a bridge without significantly improving its function and without considerations for its historic integrity.

**Preventive maintenance** – The planned strategy of cost-effective treatments that preserve a bridge, slow future deterioration, and maintain or improve its functional condition without increasing structural capacity.

**Reconstruction** – The act or process of depicting, by means of new construction, the form, features, and detailing of a non-surviving site, landscape, building, structure, or object for the purpose of replicating its appearance at a specific period of time and in its historic location. Activities should be consistent with the Secretary of the Interior’s *Standards for the Treatment of Historic Properties*.

**Rehabilitation** – The act or process of returning a historic property to a state of utility through repair or alteration which makes possible an efficient contemporary use, while preserving those portions or features of the property that are significant to its historic, architectural, and cultural values. Historic rehabilitation, as used in this report, refers to implementing activities that are consistent with the Secretary of the Interior’s *Standards for the Treatment of Historic Properties*. As such, rehabilitation retains historic fabric and is different from replacement. MnDOT’s *Bridge Preservation, Improvement and Replacement Guidelines* describe rehabilitation and replacement in similar terms.

**Restoration** – The act or process of accurately depicting the form, features, and character of a property as it appeared at a particular period of time. Activities should be consistent with the Secretary of the Interior’s *Standards for the Treatment of Historic Properties*.

**Ring stone** – One of the separate stones of an arch that shows on the face of the headwall, or end of the arch. Also known as a voussoir.
**Scaling** – The gradual distentegration of a concrete surface due to the failure of the cement surface caused by chemical attack or freeze-thaw cycles or rebar too close to the surface and oxidizing from exposure to chlorides.

**Scour** – Removal of material from a river’s bed or bank by flowing water, compromising the strength, stability, and serviceability of a bridge.

**Scour critical rating** – A measure of a bridge’s vulnerability to scour (see above). MnDOT utilizes letter designations to represent specific descriptions of a bridges susceptibility and/or present condition in regards to scour. Range in condition and scour susceptibility does not necessarily correlate alpha numerically to the MnDOT scour code letters so it is important to understand the specific scour description for each MnDOT scour code. The scour codes and descriptions can be found in the "MNDOT Bridge Inspection Field Manual".

**Section loss** – Loss of a member's cross sectional area and resulting strength usually by corrosion or decay.

**Serviceability** – Level of facilities a bridge provides for vehicular, bicycle, and pedestrian traffic, compared with current design standards.

**Smart flag** – Special Pontis inspection element used to report the condition assessment of a deficiency that cannot be modeled, such as cracks, section loss, and steel fatigue.

**Spall** – Depression in concrete caused by a separation of a portion of the surface concrete, revealing a fracture parallel with or slightly inclined to the surface.

**Spring line** – The imaginary horizontal line at which an arch or vault begins to curve. As example, the point of transition from the vertical face of an abutment to the start of arch curvature extending from abutment face.

**Stabilization** – The act or process of stopping or slowing further deterioration of a bridge by means of making minor repairs until a more permanent repair or rehabilitation can be completed.

**Stringcourse** – A horizontal band of masonry, generally narrower than other courses and sometimes projecting, that extends across the structure’s horizontal face as an architectural accent. Also known as belt course.

**Structural evaluation** – Condition rating of a bridge designed to carry vehicular loads, expressed as a numeric value and based on the condition of the superstructure and substructure, the inventory load rating, and the ADT.
**Structurally deficient** – Classification indicating NBI condition rating of 4 or less for any of the following: deck condition, superstructure condition, substructure condition, or culvert condition. A bridge is also classified as structurally deficient if it has an appraisal rating of 2 or less for its structural evaluation or waterway adequacy. A structurally deficient bridge is restricted to lightweight vehicles; requires immediate rehabilitation to remain open to traffic; or requires maintenance, rehabilitation, or replacement.

**Sufficiency rating** – Rating of a bridge’s structural adequacy and safety for public use, and its serviceability and function, expressed on a numeric scale ranging from a low of 0 to a high of 100. It is a relative measure of a bridge’s deterioration, load capacity deficiency, or functional obsolescence. MnDOT may use the rating as a basis for establishing eligibility and priority for replacement or rehabilitation. Typically, bridges which are structurally deficient and have sufficiency ratings between 50 and 80 are eligible for federal rehabilitation funds and those which are structurally deficient with sufficiency ratings of 50 and below are eligible for replacement.

**Through truss** – A bridge with parallel top and bottom chords and top lateral bracing with the deck generally near the bottom chord.

**Under-clearances** – One of five NBI appraisal ratings. This rating appraises the suitability of the horizontal and vertical clearances of a grade-separation structure, taking into account whether traffic beneath the structure is one- or two-way.

**Variance** – A deviation from State Aid Operations Statute Rules that takes into account environmental, scenic, aesthetic, historic, and community factors that may have bearing upon a transportation project. A design variance is used for projects using state aid funds. Approval requires appropriate justification and documentation that concerns for safety, durability and economy of maintenance have been met.

**Vehicular traffic** – The passage of automobiles and trucks along a transportation route.

**Voussoir** – One of the separate stones forming an arch ring; also known as a ring stone.

**Waterway adequacy** – One of five NBI appraisal ratings. This rating appraises a bridge’s waterway opening and passage of flow under or through the bridge, frequency of roadway overtopping, and typical duration of an overtopping event.
Appendices

Appendix B. Guidelines for Bridge Maintenance and Rehabilitation based on the Secretary of the Interior’s Standards
The Secretary's Standards with Regard to Repair, Rehabilitation, and Replacement Situations

Adapted from:

The Secretary of the Interior's Standards for the Treatment of Historic Properties, first codified in 1979 and revised in 1992, have been interpreted and applied largely to buildings rather than engineering structures. In this document, the differences between buildings and structures are recognized and the language of the Standards has been adapted to the special requirements of historic bridges.

1. Every reasonable effort shall be made to continue an historic bridge in useful transportation service. Primary consideration shall be given to rehabilitation of the bridge on site. Only when this option has been fully exhausted shall other alternatives be explored.

2. The original character-defining qualities or elements of a bridge, its site, and its environment should be respected. The removal, concealment, or alteration of any historic material or distinctive engineering or architectural feature should be avoided.

3. All bridges shall be recognized as products of their own time. Alterations that have no historical basis and that seek to create a false historical appearance shall not be undertaken.

4. Most properties change over time; those changes that have acquired historic significance in their own right shall be retained and preserved.

5. Distinctive engineering and stylistic features, finishes, and construction techniques or examples of craftsmanship that characterize an historic property shall be preserved.

6. Deteriorated structural members and architectural features shall be retained and repaired, rather than replaced. Where the severity of deterioration requires replacement of a distinctive element, the new element should match the old in design, texture, and other visual qualities and where possible, materials. Replacement of missing features shall be substantiated by documentary, physical, or pictorial evidence.

7. Chemical and physical treatments that cause damage to historic materials shall not be used. The surface cleaning of structures, if appropriate, shall be undertaken using the most environmentally sensitive means possible.
8. Significant archaeological and cultural resources affected by a project shall be protected and preserved. If such resources must be disturbed, mitigation measures shall be undertaken.

9. New additions, exterior alterations, structural reinforcements, or related new construction shall not destroy historic materials that characterize the property. The new work shall be differentiated from the old and shall be compatible with the massing, size, scale, and architectural features to protect the historic integrity of the property and its environment.

10. New additions and adjacent or related new construction shall be undertaken in such a manner that if removed in the future, the essential form and integrity of the historic property and its environment would be unimpaired.
Appendix C. Documents
Additional Electronic Data

Bridge L8503

Historic Data
- Research

Local Data
- 7 bridges road – 1995 Summary
- Bridges 1-8 Rehab Project Description Report
- L8503 – 1996-97 City Construction Diary
- L8503 Final Payment for Rehab 1997

MnDOT Reports
- Accident Report
- L8503 Condition Sheet 2010
- L8503 Inspection 10-2-13
- L8503 Inspection 10-25-11
- L8503 Inventory 05-30-13
- L8503 Rating Report 2011

Photos
- 2005
- 1995 Photos
- L8503 October 1993 Rehabilitation Photos
- L8503 LHB Photos 2012-13
- L8503 M&H Photos 8-28-13
- Report Photos

Plans
- Bridge 1-3 Rehabilitation Plans 1995
- L8503 Flood Repair Plans 2013
- L8503 Original Elevation
- L8503 Original Plan
- Original 1911 Plan Excerpts
## Mn/DOT Bridge Inspection Report

### Bridge Information
- **Location**: 1.1 Mi N of JCT CSAH12
- **Length**: 28.2 ft
- **Control Section**: MUN 712
- **Ref. Pt.**: 000+00.760
- **Deck Width**: 21.5 ft
- **Rdwy. Area / Pct. Unstd.**: 560 sq ft
- **Local Agency Bridge Nbr.**: CONC ARCH
- **Local Agency Bridge Nbr.**: N/A
- **Open, Posted, Closed**: OPEN
- **Def. Stat.**: F.O.
- **Suff. Rate**: 86.5
- **Appraisal Ratings - Approach**: 7
- **Approach**: 8
- **MN Scour Code**: LOW RISK
- **Risk**: NOT REQUIRED

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### Notes
- **General Notes**:
  - "*1998 Needs signs."
  - "*1999 - No change in the conditions of this bridge."
  - "*2000 Superficial crack RL US 6 ft down from pier cap; RR US corner bottom arch erosion high water."

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Inspector's Signature

Reviewer's Signature / Date
Mn/DOT Structure Inventory Report

Bridge ID: L8503 E SKYLINE over AMITY CREEK

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Date: 05/00/2013