Ecological Assessment of Proposed Design for CSAH 101

Prepared for
Minnehaha Creek Watershed District

February 3, 2011
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### Table of Contents

1.0 Introduction .................................................................................................................. 1

1.1 Background .................................................................................................................. 1

1.2 Project Purpose .......................................................................................................... 4

1.3 Process ....................................................................................................................... 5

1.4 Design Issues ............................................................................................................. 6

1.4.1 Traffic and Traffic Forecasts .................................................................................. 6

1.4.2 Road Function ....................................................................................................... 7

1.4.3 Railroad Bridge ..................................................................................................... 7

2.0 Design Alternatives ................................................................................................... 9

2.1 Approach Used........................................................................................................... 9

2.1.1 Impacts on Trees and Areas of High Ecological Quality ..................................... 11

2.1.2 Impervious Surface .............................................................................................. 11

2.1.3 Wetlands ............................................................................................................ 13

2.1.4 Retaining Walls ................................................................................................... 13

2.1.5 Assumptions ....................................................................................................... 14

2.2 Design Alternatives Evaluated .................................................................................. 14

2.2.1 Do Nothing .......................................................................................................... 14

2.2.2 Reduce Drive Lanes to 10 Feet .......................................................................... 15

2.2.3 Reduce Shoulders to Four Feet .......................................................................... 15

2.2.4 Eliminate Separate Trail .................................................................................... 18

2.2.5 Stormwater Mitigation from the Trail ................................................................. 19

2.3 Alternatives Reviewed and Eliminated from Consideration .................................. 21

2.3.1 Elimination of through Truck Traffic ................................................................. 21

2.3.2 Lowering the Rail Bed ....................................................................................... 21

2.3.3 Eliminate Right-Turn Lanes at the McGinty Intersection .................................. 21

2.3.4 Eliminate Left-Turn Lanes at the McGinty Intersection .................................... 21

2.3.5 Alternative Interchange at the McGinty Intersection ........................................ 21

2.3.6 Create an at-grade Crossing at Railroad Tracks .............................................. 22

2.3.7 Eliminate the Multi-purpose Trail and Reduce Shoulders to Four Feet .......... 22

2.3.8 Reduce the Six-foot Clear Zone to Two Feet on West Side ............................... 22

2.3.9 Reduce the Design Speed from 35 to 30 mph .................................................. 22

2.3.10 Eliminate Concrete Curb and Gutter ............................................................... 23
List of Tables

Table 1  CSAH 101 Project Design History (CSAH 101 through Wayzata) ..................................................3
Table 2  Ecological Benefits and Transportation Cost Assessment for Design Alternatives, City of Wayzata Only (north of Grays Bay Bridge to 1394) ..................................................10
Table 3  Shoulder Options .........................................................................................................................17
Table 4  Stormwater Mitigation Options for Multipurpose Trail ..............................................................20

List of Figures

Figure 1  Project Context, CSAH 101 Ecological Review .................................................................2
Figure 2  Ecological Resources ..............................................................................................................12
Figure 3  Stormwater Management Concept – Non Locust Hills .........................................................26
Figure 4  Stormwater Management Concept – Locust Hills .................................................................27

List of Appendices

Appendix A  Shaver’s Lake Evaluation (to be completed)
Appendix B  VRSS Evaluation

DRAFT
1.0 Introduction

1.1 Background

Hennepin County (County) is proposing to reconstruct the section of County State Aid Highway (CSAH) 101 within the City of Wayzata. CSAH 101 is a two-lane road that winds its way through a low-density area of the City containing wetlands and significant tree cover (Figure 1). The road is a remnant of Lake Minnetonka’s early development and contains a variety of historical features. The road carries approximately 13,000 vehicles per day. The road is classified as an “A” Minor Arterial by the County. This means that the road is intended to primarily provide mobility for short to medium-length trips (2 to 6 miles). The road is considered a “reliever” or an alternative to Interstate 494. The road’s historic character and ecological elements are highly valued by the community.

The road pavement has broken down to the point where patching and spot repairs are no longer financially feasible. It is recognized that the existing road surface needs to be replaced. Some utilities also need to be replaced. The City water main under the road is old and breaks are a common occurrence in the corridor. Repairs often require closing one lane of traffic, causing significant traffic delays. Replacement of the large sewer forcemain under the road is a priority for the Metropolitan Council.

The current County plan for rebuilding CSAH 101 is the fifth design iteration. The first design proposed in 2005 was 76 feet wide and provided a typical Hennepin County design. The road width has been reduced with each subsequent design in response to requests by residents and the City of Wayzata. The proposed roadway width at 36 feet is approximately the same as the average width of the existing roadway if the gravel shoulders are included. The current plan dated April 28, 2010 includes a multi-use trail. The total width of the roadway and trail is 52 feet. Table 1 shows the width and design components for each design iteration. The City must provide municipal consent to the County and its proposed plans before the County may proceed with road construction.

A city/neighborhood task force has attended meetings held by the County and provided comments on the County’s various proposed plans. In December of 2008, the City Council passed a resolution stating points of disagreement with the proposed plans. The current plan has addressed some of those issues; however, the task force remains unsatisfied with the current proposed plan. The major objections concern the overall project footprint (width of the road and trail), including construction impacts that would remove trees and affect the historic character of the corridor. There is also
<table>
<thead>
<tr>
<th>Design/Year</th>
<th>West Berm* Clear Zone</th>
<th>Total Curb Face to Curb Face Width</th>
<th>Shoulder</th>
<th>Drive Lane</th>
<th>Center Turn Lane</th>
<th>Drive Lane</th>
<th>Shoulder</th>
<th>Trail Width</th>
<th>Trail Clear Zones (left and right of trail)</th>
<th>Total Footprint (west berm to right trail clear zone)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre design by Hennepin County</td>
<td>10 ft</td>
<td>54 ft</td>
<td>8</td>
<td>12</td>
<td>14</td>
<td>12</td>
<td>8</td>
<td>8 ft</td>
<td>2 ft/2 ft</td>
<td>76 ft (includes 12 ft natural)</td>
</tr>
<tr>
<td>(2005)</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preliminary Engineering Design</td>
<td>10 ft</td>
<td>54 ft</td>
<td>8</td>
<td>12</td>
<td>14</td>
<td>12</td>
<td>8</td>
<td>8 ft</td>
<td>2 ft/2 ft</td>
<td>76 ft (includes 12 ft natural)</td>
</tr>
<tr>
<td>(2006)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design Refinement (2007-2008)</td>
<td>10 ft</td>
<td>49 ft</td>
<td>8</td>
<td>11</td>
<td>11</td>
<td>11</td>
<td>8</td>
<td>8 ft</td>
<td>2 ft/2 ft</td>
<td>71 ft (includes 12 ft natural)</td>
</tr>
<tr>
<td>Design Refinement (2009)</td>
<td>6 ft</td>
<td>38 ft</td>
<td>8</td>
<td>11</td>
<td>None</td>
<td>11</td>
<td>8</td>
<td>8 ft</td>
<td>2 ft/2 ft</td>
<td>56 ft (includes 8 ft natural)</td>
</tr>
<tr>
<td>Design Refinement (2010)</td>
<td>6 ft</td>
<td>36 ft</td>
<td>7</td>
<td>11</td>
<td>None</td>
<td>11</td>
<td>7</td>
<td>8 ft</td>
<td>0 ft/2 ft</td>
<td>52 ft (includes 8 ft natural)</td>
</tr>
</tbody>
</table>
dissatisfaction with the proposed footprint of the McGinty Road intersection and height of the bridge over the BNSF railroad tracks.

The project design process has been characterized by frustration and difficulty in achieving a mutually-agreeable design. The City of Wayzata requested assistance from the Minnehaha Creek Watershed District (District) to review the project from an ecological perspective and help find solutions that would be acceptable to both the City and County. The District offered to explore potential solutions that could reduce the ecological impact of the road and minimize impacts on the water quality of adjacent wetlands and Lake Minnetonka.

1.2 Project Purpose

The objectives of this project support the District’s mission of protecting, improving and managing surface waters and their related ecosystems. The project was designed to address three objectives:

1. Identify road design alternatives that reduce ecological impact of the road through the City of Wayzata.
2. Develop a stormwater management concept that showcases innovative approaches to stormwater management and exceeds District requirements for the road corridor in the City of Wayzata.
3. Identify stormwater measures to reduce impacts to Shavers Lake in the City of Minnetonka.

A primary purpose of this project is to identify design alternatives for the corridor within the City of Wayzata that minimize ecological impacts of road reconstruction while maintaining the multi-purpose trail. Identifying design alternatives to minimize ecological impacts are focused on preserving trees and reducing impervious surface. Reducing impervious surface has a direct impact on reducing the volume of stormwater and hence the amount of pollution that is discharged into adjacent wetlands and Lake Minnetonka. Phosphorous is the main pollutant of concern and is responsible for algae growth and poor water quality in area surface waters. Minimizing direct impacts to wetlands and wooded areas of high ecological quality were also considered in developing design alternatives.

There is currently no sidewalk or trail within this road corridor. The current plan includes a multi-purpose trail which increases the ecological impact of the proposed design through an expanded footprint. Despite this impact, the trail is included in all alternatives considered. The trail is an important element providing safe and comfortable access for pedestrians and bicyclists using the corridor. Retaining the multi-purpose trail is also important for consistency with Hennepin County’s
Complete Streets policy and the State Complete Streets policy being advanced by MnDOT. The City of Minnetonka has accepted the current design of CSAH 101 within their City boundary. This ecological review examines only the portion of CSAH 101 through the City of Wayzata.

The other primary objective of the project was to develop a stormwater management concept that exceeds District stormwater treatment requirements and to show how stormwater treatment can be an aesthetic amenity to road projects. The concept was developed for the Wayzata portion of the corridor.

The third objective includes an assessment of opportunities for reducing the impact of stormwater runoff on Shavers Lake in the City of Minnetonka. The City is interested in assessing the feasibility of a parcel of land for locating stormwater facilities for treating runoff prior to its discharge to Shavers Lake. A memo addressing this objective is included in the Appendix.

This project provides conceptual alternatives for the corridor generally. The design concepts may be more or less applicable depending on the physical conditions of specific locations in the corridor. The project scope did not include developing design solutions for specific parcels or locations in the corridor. The design alternatives and stormwater management concept may be used by the District, City of Wayzata and County to explore opportunities that may lead to a final decision. The alternatives are presented as a list of options, each with a benefit and a cost. No one alternative is recommended. Some of the presented alternatives may be combined with others.

1.3 Process

Project work has included discussion with District and County design staff. Highlights of key project steps include:

- A review of current Hennepin County plans and documents to understand basic design and environmental impact.

- A review of Bushaway Task Force documents to review project history and neighborhood objectives.

- A field inspection of the CSAH 101 corridor through the Cities of Minnetonka, Woodland and Wayzata.
• An initial meeting with the Hennepin County project design team to ask questions about traffic forecasts, design details, design standards and requirements, as well as County design policies being applied to the project.

• Identification and evaluation of preliminary road design alternatives.

• A meeting with District Staff to review the preliminary evaluation of design alternatives.

• A meeting with District Staff and neighborhood contacts to review preliminary alternatives. This meeting identified additional issues to evaluate (30-mph design speed, vertical alignment/grade changes).

• Completion of the design alternatives evaluation and development of a stormwater concept.

• A meeting to review all alternatives and the stormwater management concept with District Staff.

• A meeting with County staff to review and solicit feedback on alternatives and SW concept.

• A presentation to the District’s Board subcommittee to review the alternatives and the stormwater management concept.

• A presentation to the District’s Board to review project results.

1.4 Design Issues
Rebuilding CSAH 101 is a transportation project. An understanding of the fundamentals of transportation planning and design form the basis for evaluating the transportation costs or tradeoffs for each design alternative. The key transportation issues are described below.

1.4.1 Traffic and Traffic Forecasts
Hennepin County collected existing traffic data along the corridor and at key intersections. This data, with historical traffic volume data within the corridor, was used to forecast the expected traffic volumes within the corridor in the Year 2030. These 2030 traffic forecasts were used in the capacity analyses that determined the design of the corridor.
The CSAH 101 corridor occupies a mature area of the Twin Cities that expects limited
development/renovation activity. This is reflected in the relatively flat growth in the historical
traffic data. The corridor has been carrying about 13,000 vehicles per day for more than twenty years.

1.4.2 Road Function

The road is designated as an “A” Minor Arterial road with a posted speed of 35 mph. “A” Minor Arterials are intended to move motorists two to six miles so they can access the broader Principal Arterial system for long trips, but they often provide continuous routes for traversing longer distances. The CSAH 101/Highway 55/CSAH 13 corridor provides a continuous north/south route through Hennepin County, providing mobility between communities.

The level of service is currently “D” or better within the CSAH 101 corridor in Wayzata. Traffic operations within corridors and at individual intersections are graded “A” through “F” based on how much delay is experienced by motorists. Operation at level of service “D” or better is considered acceptable within the Twin Cities.

Generally, two-lane corridors, such as the existing and the proposed CSAH 101 corridor, can accommodate 13,000 to 15,000 vehicles per day before experiencing significant congestion (based on calculations from the Highway Capacity Manual). Since limited traffic growth is expected in the CSAH 101 corridor, the two-lane design with turn lanes at key intersections is appropriate. The proposed design will accommodate the existing traffic levels, but not a significant growth in traffic. The corridor is not proposed to be built to attract more traffic volumes as a regular reliever to I-494.

The CSAH 101/McGinty Road intersection provides left and right turns for key movements. With these turn lanes, the intersection will operate at level of service “D” or better with the 2030 forecasts in the morning and evening rush hours. The turn-lane lengths have been designed to store the expected stacking during normal rush hours in 2030.

1.4.3 Railroad Bridge

As part of this project, the BNSF requires that the existing temporary bridge over the railroad tracks be replaced with a new bridge that provides an additional two feet of clearance in order to meet their bridge clearance standards. This additional height significantly changes the vertical alignment of CSAH 101 as it approaches the bridge. Managing the additional height requires large retaining walls adjacent to the road as it approaches the railroad bridge to minimize the footprint of the roadway embankment. The wall is considered a negative impact according to the adjacent property owners. The proposed vertical profile of CSAH 101 closely matches the existing profile except on the
approaches to the railroad bridge where the profile needs to be raised two feet to provide the BNSF required clearance.
2.0 Design Alternatives

2.1 Approach Used

The overall approach for minimizing ecological impacts was to identify design opportunities for reducing the project width or footprint. These opportunities included reducing lane and shoulder width and placement of the multi-purpose trail. Options for minimizing the need for treating stormwater from the multi-purpose trail were also evaluated as opportunities for minimizing ecological impact. Stormwater treatment facilities require land area which is limited within the narrow corridor.

All design alternatives were evaluated in comparison to the current County plan (Alternative 2 in Table 2). Due to measurement conventions used for this analysis, the dimensions for some design elements of the County plan shown in Table 2 vary slightly from those in County documents. The County is proposing a 53-foot-wide project. Major design elements of the plan include two 11-foot drive lanes, two seven-foot shoulders, an eight-foot multipurpose trail and a six-foot clear zone. The design does not include a two-foot clear zone between the curb and trail as required by State Aid standards, hence a variance for this design will be required. The proposed design is intended to achieve the following goals:

- Maintain capacity of the road segment which is at capacity while allowing stalled vehicles, garbage trucks, etc. to pull off the corridor without blocking through traffic.
- Improve safety during icy/snowy conditions by rebuilding the intersection with McGinty in order to reduce the slope at the intersection.
- Improve safety and comfort for pedestrians and bicyclists by adding the multi-purpose trail.

Each identified design alternative was evaluated in comparison to the current County plan. The key evaluative criteria included impact on trees and reduction in impervious surface. The results of the evaluation on these factors is described for each design alternative below and summarized in Table 2. Other criteria evaluated included impacts to wetlands, areas of high ecological value and size of retaining walls. A description of each evaluative criterion follows.
### Table 2.0 Ecological Benefits and Transportation Cost Assessment for Design Alternatives

**City of Wayzata only (north of bridge to I394)**

**[Draft 12.14.10]**

<table>
<thead>
<tr>
<th>Design Alternatives</th>
<th>Road Section</th>
<th>Net change in width*</th>
<th>Ecological and other benefits compared to county design dated 4/28/10 (see note at end of table)</th>
<th>Transportation cost/trade-off</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Do nothing – Keep existing road</td>
<td>Typical for corridor—compare to section D-D (non-Locust Hills) in County design dated 4/28/10. Construction/grading limits extend at least 10 feet beyond shown road section.</td>
<td>N/A</td>
<td>Very High Conditions will remain unchanged, however, there is no stormwater treatment</td>
<td>2-lane road with minimal turn lanes is at capacity</td>
</tr>
<tr>
<td>Existing road has 9.5 acres of impervious surface in Wayzata</td>
<td></td>
<td></td>
<td></td>
<td>The intersection at McGinty is on a steeper slope than preferred with current design standards. Intersections should be designed to be on a flat “table” instead of on a grade. Intersections on steep sections provide safety challenges during icy/snowy conditions.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lack of trails/sidewalks/shoulders makes corridor unsafe &amp; unwelcoming for pedestrians &amp; bicyclists</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Is a bottleneck between the improved portions of CR 101 to the north and to the south</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Pavement/road bed has broken down; no longer feasible to repair</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Utilities need replacement (water, sewer, etc.)</td>
</tr>
<tr>
<td>2. County design (dated 4/28/10)</td>
<td>Proposed design (road and multipurpose trail) has 12.1 acres (10.2 acres for road, 1.9 acres for trail) of impervious surface in Wayzata; this is an increase of 2.6 acres or a 27% increase from the existing road. Most of this increase is due to addition of trail. (Design Alternative 1)</td>
<td>N/A</td>
<td></td>
<td>Design addresses issues identified under the “do nothing” alternative</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Requires variance for elimination of the 2-foot clear zone between road and trail</td>
</tr>
<tr>
<td>3. Reduce drive lanes to 10 feet</td>
<td></td>
<td></td>
<td></td>
<td>Has been successfully done in other regions</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Slightly lowers driving speeds and roadway capacity</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Research is inconclusive on adverse safety impacts</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Would require a variance from State Aid road design standards</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Functional only with 7-foot shoulders</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>May cause lane drifting on curves, an unsafe condition</td>
</tr>
</tbody>
</table>

*Note: Net change in width for design alternatives (except alternative 1), compared to County design (alternative 2)*
<table>
<thead>
<tr>
<th>Design Alternatives</th>
<th>Road Section</th>
<th>Net change in width</th>
<th>Ecological and other benefits compared to county design dated 4/28/10 (see note at end of table)</th>
<th>Transportation cost/trade-off</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternatives 3-7 are evaluated in comparison to Alternative 2</td>
<td>Typical for corridor—compare to section D-D (non-Locust Hills) in County design dated 4/28/10. Construction/grading limits extend at least 10 feet beyond shown road section.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| 4. All shoulders reduced to 4 feet (see Table 3 for shoulder options) | WEST | 6-foot reduction | Medium - High
Significant amount of impervious surface reduction; many trees saved
0.9 acres impervious surface reduced; 49 trees saved | Provides fully multi-modal corridor
No pull-offs for garbage trucks, buses, or broken down vehicles which can cause significant delay and safety problems
Does not accommodate "Type A" bicyclists |
| EAST | | | | |
| 5. Eliminate separate trail and place it within 7-foot shoulders | A. For entire length of corridor | 8-foot reduction | Medium - High
Large amount of impervious surface reduction; many trees saved
1.8 acres impervious surface reduced; 36 trees saved | Does not provide inviting, segregated transportation system for pedestrians and bicyclists
Pedestrians and bicyclists are more at risk because they are not protected by barrier curb
2-foot clear zone must be expanded by 4 feet to create 6-foot clear zone for buried utilities |
| WEST | | | | |
| EAST | | | | |
| B. Only where trail is directly behind the curb (off-road trail through Locust Hills remains) | 8-foot reduction for part of corridor | Medium - High
Large amount of impervious surface reduction; many trees potentially saved
1.4 acres impervious surface reduced; 36 trees saved | Does not provide inviting, segregated transportation system for pedestrians and bicyclists
Pedestrians and bicyclists are more at risk because they are not protected by barrier curb
Weaving of pedestrians and bicyclists on and off trails may cause safety issues
2-foot clear zone must be expanded by 4 feet to create 6-foot clear zone for buried utilities |
2.1.1 Impacts on Trees and Areas of High Ecological Quality

A major impact of rebuilding CSAH 101 is the removal of a significant number of trees. The County estimates that the project will remove 394 trees. In determining this number, the County counted the number of trees within the construction limits of the proposed project (plan dated April 28, 2010). Construction limits are shown on Figures 1 and 2. Construction limits extend a minimum of six feet behind each proposed wall. The tree count included any tree at or above three inches in diameter. While this is a preliminary estimate, the actual number of trees lost to construction will likely be higher. Other factors such as the size and species of tree, relationship and magnitude of cuts and fills near tree drip lines, utility and drainage infrastructure construction and proximity of pavement to trees will affect the final impact on trees lost to the project. The final impact may not be known until a few years after construction is complete. The arborist hired by the Bushaway Task Force estimates that 713 tree will be removed.

In assessing the impact on trees for each of the design alternatives, we used County plans (in AutoCAD) showing the location of trees and construction limits. Each design alternative was layered on the existing plan and construction limits were adjusted according to changes in footprint width. For example, if an alternative reduced the drive lanes by one foot, the construction limits were brought inward by one foot. Trees that moved outside of the construction limits were then counted as trees saved. The evaluation is intended to assess the relative impact on trees for each of the design alternatives compared to the existing plan. The project scope did not include an independent tree inventory.

The undeveloped property northeast of the intersection of CSAH 101 and McGinty Road contains a high quality stand of remnant maple-basswood forest (Figure 2). The proposed project will have a minor impact on these resources where construction limits affect the western boundary of this area along CSAH 101. It is likely this property will be developed at some point in the future, which would have a larger impact on this forest than the roadway project.

2.1.2 Impervious Surface

The other major evaluative criterion is impervious surface. Impervious surface generates stormwater runoff. Runoff contains phosphorus and other pollutants which negatively impact area surface waters. Each design alternative reduced pavement width which, in turn, reduces impervious surface. Like the tree assessment, this evaluation is intended to assess the relative impact on impervious surface for each of the design alternatives compared to the existing County plan. The reduction in footprint width for each design alternative was applied to the length of the corridor within the City of
Wayzata, approximately 7,000 feet. This was calculated to determine the area, in acres, of reduced impervious surface.

2.1.3 Wetlands
There are a number of wetlands of varying quality in the corridor (Figure 2). High quality wetlands classified as “preserve” predominate. The District’s goal for these wetlands is to avoid and preserve. The wetland classifications shown on Figure 2 are based on a Functional Assessment of Wetlands completed for the District in 2003 by Barr Engineering. The purpose of the study was to identify and evaluate the quality of wetlands within the watershed. This study estimated the location of wetlands through aerial photos and some field verification. A wetland delineation being completed as part of the CSAH 101 project will provide specific information on wetland locations within the corridor, their boundaries and types. The preliminary results of the delineation show minor impacts on wetlands due to the project. It is estimated that the project will directly impact (e.g., remove) 6,500 square feet of wetlands. This impact is primarily the result of construction limits, due to the trail, extending slightly into the “preserve” wetland complex located on the east side of the road in the Locust Hills Development. None of the alternatives would change this impact, except for Alternative 5A in Table 2. This alternative eliminates the separate trail and places it within the road shoulder, which is a significant negative trade-off for pedestrians and bicyclists using the corridor. The impact could be reduced or eliminated by moving the trail westward.

In addition to direct impacts, indirect impacts may occur when stormwater flows into or is discharged to wetlands without any treatment. Stormwater runoff from the existing road is not managed or treated. It is likely that some runoff from the existing road is entering wetlands adjacent to the road.

Excavation in the wetland requires a permit from the District and triggers the establishment of a wetland buffer. Requirements address buffer width and vegetation.

2.1.4 Retaining Walls
Retaining walls will continue to be used in all design alternatives because they have a footprint wider than the existing road. All alternatives include clear zones and a trail which increase the footprint over the existing condition. All of the design alternatives provide a reduction in the overall footprint compared to the current County plan. The length and height of proposed retaining walls are related to the width of the proposed plan and any design alternatives compared to existing conditions. It can be assumed that any reduction in the project footprint width would result in a reduction in the length and height of the retaining walls. To this effect, we can assume that any percentage reduction in the
overall project footprint (the design elements shown in the sections in Table 2) will result in a corresponding reduction in retaining wall length and height. It is important to keep in mind that this is an assumption for analytical purposes. More precise estimates can be made when a grading plan is completed. The project also explored the use of vegetated reinforced soil slopes (VRSS) as an alternative to retaining walls using interlocking block systems. A memo addressing this topic is included in Appendix B.

2.1.5 Assumptions

- Utilities will be placed under both the clear zone (boulevard) on the west side of the road and under the trail on the east side of the road. It is anticipated that a high-pressure gas main will be placed on the west side and low-pressure gas service, along with electrical, phone and cable service, will be placed on the east side. Placing utilities underground will protect future tree growth and canopy. Trees growing over the right-of-way will not need to be trimmed to protect line utilities.
- A six-foot clear zone is required behind the curb for utility and signage placement. The multipurpose trail also serves this function.
- A two-foot clear zone is required next to the multipurpose trail for trail signage and to keep vegetation from obstructing trail users.
- The proposed project and all identified design alternatives still have construction impacts of at least 10 feet beyond the road/trail footprint.
- Construction of the trail through Locust Hills remains located in the alignment approved during the platting of Locust Hills. This area was graded and trees removed in preparation for trail construction.

2.2 Design Alternatives Evaluated

The following sections discuss each alternative evaluated. A summary of each alternative is included in Table 2. The table includes a summary of each alternative, along with the ecological benefit and the transportation costs and benefits. Other alternatives were reviewed but not considered viable. These are discussed in Section 2.3.

2.2.1 Do Nothing

This alternative leaves the road as-is. The average weighted width of the existing road is 37 feet, including gravel shoulders. The width of the road varies throughout the corridor. At its narrowest, the pavement is approximately 26 feet with four-foot shoulders, for a total width of 34 feet. The pavement is relatively wide near the entrance to Locust Hills at approximately 40 feet. The existing
road has 9.5 acres of impervious surface. For most of its length, the road uses ditches for drainage. In many areas the ditches are shallow or nonexistent. There does not appear to be any flooding problems in the corridor. Stormwater runoff from the road infiltrates in the roadside ditch and/or is conveyed to low spots for discharge into adjacent wetlands, low spots or Lake Minnetonka.

The ecological benefits to doing nothing are very high as there will be no impact to trees and areas of high ecological quality. There will also be no direct wetland impacts. However, indirect impacts to wetlands and Lake Minnetonka will continue as there is no stormwater treatment.

Doing nothing does not provide capacity and safety benefits to vehicles or a safe mode of transportation for bicyclists and walkers. Additionally, local and through traffic will continue to experience periodic congestion due to repairs to water main leaks. The Metropolitan Council is likely to proceed with the replacement of a sewer trunk line in this corridor, whether the road is reconstructed or not. This will be a significant construction project and may affect trees.

2.2.2 Reduce Drive Lanes to 10 Feet
This alternative reduces drive lanes from 11 feet to 10 feet for a modest two-foot reduction in overall footprint. Reducing drive lanes to 10 feet has been successfully done on arterial roads in other regions successfully.

With only a 0.3-acre reduction in impervious surface and no additional trees saved, this alternative provides very little ecological benefit.

Transportation research is inconclusive on the affects of 10-foot drive lanes on safety. There is concern that 10-foot drive lanes in this corridor, with its curves, may cause vehicles to drift out of the lane and cause an unsafe condition. Ten-foot lanes will result in slightly lower driving speeds and roadway capacity. This alternative would require a variance from State Aid road design standards from MnDOT. Maintaining seven-foot shoulders is recommended to provide for safety.

2.2.3 Reduce Shoulders to Four Feet
Shoulders provide access space for a variety of functions. In this corridor, these include traffic enforcement, mail delivery and garbage pick-up. The shoulder also provides space for school bus pick-up and drop off. However, there is relatively low demand for school bus service in this corridor, both currently and historically. The Wayzata Public School District and Breck School operate bus service based on demand. Blake School does not offer bus service in this corridor. In the current school year, the Wayzata School District operates a mini-bus south of McGinty. This bus pulls into
the student’s driveway for pick-up and drop-off and does not use the shoulder. Last year, Breck School operated one bus stop in the corridor. Prior to that, there was one stop ten years ago.

In this alternative, the shoulders are reduced from seven feet to four feet for the length of the corridor. This reduces the overall footprint by six feet. This alternative includes 11-foot drive lanes. Four-foot shoulders are the minimum permitted width for this road class per State Aid standards. This alternative reduced impervious surface by 0.9 acres and saves approximately 49 trees and provides a relatively high ecological benefit.

This alternative does not accommodate “Type A” bicyclists. These bicyclists generally prefer to ride on the road despite an off-road alternative. “Type A” bicyclists will generally use the shoulder area regardless of width. A smaller shoulder increases the safety risk to these bikers and may affect traffic flow as cars move out of their drive lane to give adequate space when passing bicyclists. This alternative also does not provide sufficient shoulder space for the above-described uses without impacting traffic flow.

In order to provide space for these functions and minimize impact on traffic flow, a couple of options were considered (Table 3). In the first option, shoulders are reduced to four feet in constrained areas and areas where there are few residential access points. Use of the shoulder for mail delivery, garbage pick-up and school bus stops are related to these residential access points. Where these points don’t exist (e.g., the causeway) or in areas where they are relatively scarce (e.g., frontage along Locust Hills), there will be little use of the shoulder other than an occasional enforcement stop. With only a 0.3-acre reduction in impervious surface and no additional trees saved, this alternative provides very little ecological benefit. This option would also make it more challenging for snow removal and street sweeping due to an inconsistent shoulder width.

The second option considered is to reduce the shoulder throughout the corridor to four feet, but expand driveway aprons to provide a 10-foot-wide shoulder that is 30 to 40 feet in length. This option provides room for mail delivery, garbage pick-up and school bus stops associated with individual residences. It also provides areas for traffic enforcement pullovers throughout the corridor, except on the causeway. The design, length and location of the driveway aprons would depend on a number of factors, including driveway spacing, existing driveway width, existing trees, and topography. This alternative reduced impervious surface by 0.7 acres and saves approximately 49 trees and provides a relatively high ecological benefit. Like the first shoulder option, this one
<table>
<thead>
<tr>
<th>Option</th>
<th>Road Section</th>
<th>Net change in width*</th>
<th>Ecological benefits</th>
<th>Considerations</th>
</tr>
</thead>
</table>
| 1. Shoulders reduced to 4 feet only in designated areas (causeway, Locust Hills, constrained areas) | ![Diagram](image1.png) | 6-foot reduction in designated areas | Low | - A more challenging corridor for snow removal and street sweeping due to inconsistent shoulder width  
- Assumes adequate pull-offs would be provided through corridor |
| 2. All shoulders are reduced to 4 feet; driveway aprons are expanded for pullovers (on both sides of road) | ![Diagram](image2.png) | 6-foot reduction overall; 3-foot increase at expanded aprons | Medium - High | - Provides fully multi-modal corridor  
- Provides more difficult corridor for snow removal and street sweeping due to inconsistent shoulder/driveway apron width  
- 10-foot aprons keep service vehicles and cars safely out of drive lanes, minimizing traffic delay |
would also have inconsistent shoulders making for a more challenging environment for snow removal and street sweeping.

The use of periodically-spaced parking bays or pullovers is a technique that is successfully used on parkways, scenic byways and other roads with unique historical and environmental characteristics. Constructing a large continuous shoulder throughout this corridor will permanently affect the environment and neighborhood character. It seems practical to design the shoulder to handle the relatively infrequent uses of shoulder areas that are site specific. This design would require less pavement and result in a smaller footprint that would minimize the permanent impact on the environment and neighborhood character.

These options negatively impact bicyclists who wish to ride on the shoulder. However, a four-foot shoulder could be designed to better accommodate bicyclists by minimizing pavement joints within the shoulder and alternative catch basins that don’t impact the bicycle path.

2.2.4 Eliminate Separate Trail
This alternative eliminates the separate multi-purpose trail (Table 2, Alternative 5.A). Instead, the seven-foot shoulder is used for the trail with appropriate signage and markings. This alternative reduces the impervious footprint by eight feet and reduces impervious surface by 1.8 acres and saves approximately 36 trees. This provides one of the highest ecological benefits of all alternatives considered.

However, this alternative comes with significant tradeoffs. It does not provide an inviting segregated system for pedestrians and bicyclists who are at a greater safety risk because they are not protected by a barrier curb. While this alternative eliminates the eight-foot trail and two-foot clear zone from behind the curb, a six-foot clear zone would still be required in place of the trail for the location of utilities. This results in a net reduction in project footprint of four feet.

Another alternative (Table 2, Alternative 5.B.) is to eliminate the separate trail in areas where it is located behind the curb in the current plan. These areas tend to be constrained areas. The separate trail would remain in Locust Hills, which is not constrained and where a trail alignment was located with the subdivision plat. This option would reduce the footprint by eight feet throughout much of the corridor and reduce the impervious surface by 1.4 acres and save 36 trees.

This alternative has the same tradeoffs or costs as Alternative 5.A. Additionally, the movement of pedestrians and bicyclists between the on-road and off-road trail increases safety risk.
2.2.5 Stormwater Mitigation from the Trail

The Minnehaha Creek Watershed District rules exempt trails and sidewalks from meeting stormwater management plan performance standards if they are bordered by pervious buffers. A pervious buffer allows stormwater to be filtered and infiltrated through vegetation and soils. There is thus no need to treat this runoff in structural treatment facilities. The trail contributes over 70 percent of the new impervious surface. If trail runoff can be treated with impervious buffers, the area needed for treatment facilities and their cost can be greatly reduced. To meet the District rules for exemption, there would need to be a pervious buffer of at least four feet on each side of the eight-foot trail. Table 4 presents two options that could exempt trail runoff from District performance standards. These options could be applied to any road design; therefore, dimensions for drive lanes and shoulder are not shown.

Option 4.1 (Table 4) meets the District requirements for a four-foot buffer on both sides of the trail. This option assumes that a four-foot buffer is available on the outside of the trail. The buffer may be on private land. This option would exempt the 1.4 acres of trail impervious surface from treatment in a structural management practice. The buffer also provides separation from the road providing a more inviting environment for pedestrians and bicyclists and a clear zone, a safety benefit to walkers and bikers. This design, however, would increase the project footprint by four feet and the buffer would also require maintenance.

Option 4.2 shows the trail with a slope directing runoff away from the road and into a pervious buffer. This buffer is also assumed to be at least four feet. There is ample pervious buffer along this corridor to filter and infiltrate runoff from the trail. This approach would remove 1.4 acres of trail impervious surface from treatment by structural practices, reducing the area needed for treatment facilities. This approach also does not increase the project footprint. This option does not meet the District’s requirements for exemption; however, it could be an option that the District’s Board could consider. Where there is adequate down-slope land to receive the runoff, this approach is as effective as Option 4.1 in treating runoff. This approach would not work where the adjacent land rises. From a safety perspective, it cannot be used on an outside curve. It also provides a less inviting environment for pedestrians and bicyclists compared to Option 4.1.
<table>
<thead>
<tr>
<th>Option</th>
<th>Road Section</th>
<th>Benefits</th>
<th>Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Separate trail from road by a 4-foot buffer; with buffer, the trail is exempt from meeting the stormwater management performance standards (assumed to be a 4-foot buffer on outside edge of trail)</td>
<td><img src="image1" alt="Diagram" /></td>
<td>• 1.4 acres impervious surface exempted from stormwater treatment&lt;br&gt;• Provides more inviting environment for pedestrians and bicyclists&lt;br&gt;• Provides a larger clear zone, which would be a safety benefit</td>
<td>• Increases foot print by 4 feet&lt;br&gt;• Buffer requires maintenance</td>
</tr>
<tr>
<td>2. Slope trail away from road into a vegetated buffer (assumed to be at least 4 feet in width)</td>
<td><img src="image2" alt="Diagram" /></td>
<td>• 1.4 acres impervious surface exempted from stormwater treatment&lt;br&gt;• Does not increase foot print</td>
<td>• Less inviting environment for pedestrians and bicyclists&lt;br&gt;• Potential for drainage claims by private property owners&lt;br&gt;• Depends on existing slope conditions beyond trail&lt;br&gt;• Safety concerns on curves</td>
</tr>
</tbody>
</table>
2.3 Alternatives Reviewed and Eliminated from Consideration

Throughout the course of the review, a variety of alternatives were explored. The following alternatives were reviewed, but not considered viable or appropriate for various reasons.

2.3.1 Elimination of through Truck Traffic

The road geometry needs of local truck traffic are no different than the needs of through truck traffic. There would thus be no change to road design or pavement width and thus no ecological benefit. CSAH 101 also serves as an alternate route to I-494 for all traffic including trucks in case of a crash or construction on the interstate.

2.3.2 Lowering the Rail Bed

The BNSF Railroad requires any new road project to replace the temporary railroad bridge that crosses the tracks north of McGinty Road. The BNSF requires that the new bridge provide an additional two feet of clearance over the tracks, which increases the height of CSAH over the tracks compared to the current condition. The County is exploring the idea of lowering the rail bed with the BNSF Railroad and hence there was no need for this effort to cover the same ground.

2.3.3 Eliminate Right-Turn Lanes at the McGinty Intersection

This option was explored and evaluated. It has very little ecological benefit; few trees are saved and little impervious surface is reduced. However, eliminating the right-turn lanes does not have many transportation costs. There would be a minor decrease in intersection safety. There would also be some reduction in intersection capacity and an increase in delays. However, the intersection would still operate acceptably at a Level of Service (LOS) D or better with 2032 forecasts. The intersection operates at a LOS of D currently.

2.3.4 Eliminate Left-Turn Lanes at the McGinty Intersection

This option was explored and evaluated. It has very little ecological benefit; few trees are saved and little impervious surface is reduced. However, this would result in a significant reduction in intersection safety and capacity.

2.3.5 Alternative Interchange at the McGinty Intersection

Instead of a four-way intersection at McGinty, an alternative T-intersection was explored. In this scenario, McGinty Road passes under CSAH 101. An access road from McGinty loops up to provide access to CSAH 101 at a T-intersection located south of the current intersection. This concept was attractive because it eliminated the need for many turn lanes associated with the four-way
intersection. This approach, however, would significantly raise the road south of the railroad bridge. This would require additional fill and retaining walls to minimize grading impacts on private property. It would also increase impervious surface, eliminate trees and cut off driveway access for residents located south of the railroad bridge due to the large grade change needed.

2.3.6 Create an at-grade Crossing at Railroad Tracks
The BNSF would not permit a return to an at-grade crossing due to safety. Approximately twelve trains per day use the line.

2.3.7 Eliminate the Multi-purpose Trail and Reduce Shoulders to Four Feet
In this scenario, the pavement width would be 30 feet, smaller than the current condition. This would reduce impervious surface by 2.7 acres and save approximately 49 trees. However, this option does not provide access for pedestrians and bicyclists and thus does not meet the Complete Streets goal of the project.

2.3.8 Reduce the Six-foot Clear Zone to Two Feet on West Side
One approach to reducing the project’s footprint was to consolidate all utilities under the trail. This would allow the clear zone on the west side to be reduced to two feet. This approach, however, does not provide sufficient room for all utilities under the trail. These include: phone, power, cable, low pressure gas lines and a high-pressure gas main.

2.3.9 Reduce the Design Speed from 35 to 30 mph
Reducing the design speed of a road often results in greater design flexibility. It was thought that additional design flexibility could reduce ecological impacts. It was determined that changing the design speed to 30 mph would have no impact. For a road classified as an A-Minor Arterial, changing the design speed to 30 mph from 35 mph does not affect the minimum width for drive lanes, shoulder lanes and clear zones. Reducing design speed allows for sharper horizontal curves and steeper vertical curves. The horizontal curves of the existing road and the proposed design are similar and already large. The curves could be made sharper and comply with either a 30 mph or 35 mph design speed standards. However, sharper curves would change the centerline, impact private property and have ecological impacts. The vertical curves of the existing road and the proposed design are similar for most of the corridor, except for approaches to the bridge. Here, the vertical curves are controlled by the location and height of the bridge and the need to preserve adequate sight distances. Steeper vertical curves are not possible because minimum sight distances cannot be met. Other changes in road grade, compared to the existing condition, are generally made to minimize
grading impacts (and tree loss) associated with a wider footprint and to avoid low points near wetlands.

2.3.10 Eliminate Concrete Curb and Gutter

The elimination of the curb and gutter was suggested to help maintain the character of the roadway and possibly reduce stormwater impacts. A roadway without curb and gutter is considered a rural road section and requires a six-foot clear zone beyond the edge of pavement for safety reasons. A roadway with curb and gutter is considered an urban section and only requires a two-foot clear zone for safety because the curb acts as a physical barrier. The net effect of eliminating curb is a wider roadway footprint. For this reason, this option was eliminated from consideration.
3.0 Stormwater Management Concept

3.1 Purpose
The stormwater management concept was created to provide the District, the City of Wayzata, the County and other interested stakeholders with an innovative approach for treating stormwater within major road corridors. There is a common desire among all stakeholders to protect the ecological and water resources in the corridor, while making the corridor a "complete street." In this context, complete streets not only accommodate the needs of cars and trucks, but the needs of bicyclists and pedestrians as well. The visibility and location of the project provides the District with an opportunity to showcase how innovative stormwater management systems can address water quality goals and enhance a "complete street." The concept goals were to exceed the District’s minimum requirements for water quality, enhance corridor aesthetics and enhance safety and comfort for pedestrian and bicyclists.

The concept is presented as an alternative to traditional methods of stormwater treatment for road projects. Traditional methods typically include treatment of runoff by ponds and sometimes underground structural systems such as grit chambers. Locating ponds within the right-of-way may be challenging due to the limited space and topographical constraints. Construction of ponds and access to them may also result in the potential destruction of existing trees and vegetation.

The County has not developed a stormwater management plan for the proposed project but this is not unusual. Typically the road alignment and geometrics are worked out first and then the stormwater management is designed. The structural facility locations shown on the County plan are placeholders until a plan is finalized.

3.2 Stormwater Requirements
The reconstruction of linear projects (roads, trails, sidewalks) creating more than one acre of new impervious surface must meet the District’s performance standards for the area of increased impervious surface. The proposed project will create approximately 2.6 acres (1.9 acres for the trail, 0.7 for road/intersections) of new impervious surface. The required performance standards for the project are as follows:

- Phosphorus Control: no net increase in phosphorus loading from the site in its existing condition.
- Rate Control: no net increase in the peak runoff rate from the site in its existing condition.
Volume Control: abstraction of the first one inch of rainfall with Type A and B soils, or the first 0.5 inches of rainfall on sites with Type C or D soils. Infiltration methods are the primary means for achieving this standard.

Given these standards, the stormwater management system must, at a minimum, infiltrate the first one inch of rainfall (assuming Type A and B soils) from 2.6 acres of impervious surface (the area of increased impervious surface). This results in a water quality treatment volume of about 9,500 cubic feet. This is a small volume of water in relation to the overall project area. Sizing and locating stormwater treatment facilities for this volume is a manageable task.

The District rules exempt trails and sidewalks from the above performance standards if they are bordered on both sides by a pervious buffer at least half (½) the width of the sidewalk or trail. If runoff from the 1.9 acres of trail were to be treated with pervious buffers meeting this requirement, only 2,600 cubic feet of runoff from the remaining 0.7 acres of new impervious would need to be treated to meet the above performance standards.

3.3 Concept Description

The stormwater management concept treats runoff close to its source. It uses a six-foot-wide linear infiltration/filtration swale in the boulevard and underground storage/filtration system adjacent to the east side of the road (Figure 3). This system treats stormwater runoff from the east half of the road and the trail where a boulevard six feet or wider exists. Stormwater runoff from the west side of the road is captured by catch basins and is treated through mechanical means (e.g., grit chambers). This stormwater concept fits within the footprint of the County’s current proposed design as long as the shoulder width is reduced to four feet from seven feet. This three-foot reduction in shoulder width on both sides provides the six feet of boulevard area needed for the infiltration/filtration swale. Since the footprint required by this concept is the same as that of the current County plan, there would be no change in the amount of trees impacted. The narrowing of the shoulder from four feet to seven feet reduces the amount of impervious surface by about 0.7 acres compared to the current County plan.

In Locust Hills, where the trail meanders more than six feet away from the road (Figure 4) creating a large boulevard area. Because of the large boulevard area in Locust Hills, runoff could be treated by infiltration basins located in the ROW. In this case, the infiltration swale and trench could be eliminated. Through Locust Hills, trail runoff sheet flows into existing pervious vegetative buffers for treatment. This method complies with the requirements for exemption from meeting the District’s performance standards.
Figure 4
Stormwater Management Concept
Locust Hills
The proposed stormwater management concept relies on a six foot wide infiltration/filtration swale and subsurface storage and infiltration/filtration trench that runs nearly continuously along the east side of the road. The current proposed road section does not provide the boulevard space needed for the swale along the full length. Reducing the shoulder with by 3 feet on each side provides the space needed and also reduces the overall impervious area. As it turns out, reducing the shoulders and providing a buffer on both sides of the new trail essentially eliminates the new impervious associated with the project.

- 2.6 acres of new impervious requiring treatment
- Less 1.9 acres of the trail treated by the buffer
- Less 0.7 acres for the reduced shoulder width
- Net increase of impervious requiring treatment equals about zero

All treatment associated with the swale/underground trench concept is treatment that exceeds the District’s requirements. The area tributary to the swale/trench is essentially the east half of the roadway (15 ft. x 7000 ft) or 2.4 acres of impervious.

The concept can be implemented in a flexible manner to deal with constraints within the corridor. Where there are constraints or other locations for treatment (e.g., Locust Hills), the infiltration swale may be eliminated. Eliminating treatment in selected areas does not significantly compromise the overall benefit of the concept. There is ample opportunity to do this and still exceed the minimum requirements for stormwater management.

The stormwater concept consists of several components:

- Inlets (the structural system for receiving stormwater and moving it into a treatment facility)
- Infiltration/filtration swale and engineered soils
- Underground storage trench and infiltration/filtration
- Trees and vegetation

3.3.1 Inlets

There are two alternatives for inlets, curb cuts and sump catch basins with outlet pipes. Curb cuts are spaced at about 30 feet on center. The frequent spacing allows for distributed flow into the swale as water sheet flows off the road. Many small inlets are better than a few large ones. The downside of curb cuts is that they tend to become blocked by sediment and debris and need to be inspected and maintained frequently to keep them functioning. The upside is that they allow runoff to stay on the
surface and flow through the swale versus sending the water directly to the underground storage. The swale provides pretreatment before runoff enters the underground storage. The runoff in the swale also irrigates the trees and other vegetation located in the swale.

The other inlet option is to use sump catch basins and introduce the water directly to the underground storage. The sump catch basins are efficient at capturing runoff and directing it to the underground storage. The sump provides some pretreatment and they are easy to clean with common street maintenance equipment. Sump catch basins generally require less frequent maintenance than curb cuts and they continue to function even if maintenance is neglected. This is not the case with curb cuts.

3.3.2 Infiltration/Filtration Swale and Engineered Soils
The swale is basically a vegetated shallow ditch that follows the slope of the road. The width can vary, depending on the distance between the trail and the back of curb, but is assumed to be six feet for the majority of the road length. The swale may be eliminated in constrained areas of the corridor and still meet the District’s requirements for treatment. Engineered soils will be placed below the swale. These soils will be conducive to infiltrating stormwater and will provide a healthy growing medium for the trees and vegetation. Existing soils in the corridor are variable. In some areas soils are conducive for infiltrating water below the engineered soils and in other areas they are not. With the linear nature of the stormwater management concept, water can be directed to locations where soils are suitable for infiltration.

Throughout most of the corridor, there is sufficient depth to install infiltration and maintain a three-foot separation between the bottom of the infiltration facility and seasonally saturated soils. Maintaining a three-foot separation is a recommended practice of the Minnesota Stormwater Manual in order to maintain the hydraulic capacity of the facility and to provide adequate water quality treatment. In this corridor, the high-water elevation of Lake Minnetonka of 929.4 feet is considered the elevation of the seasonally saturated soils. Infiltration swales are typically one foot to 1.5 feet deep. Therefore, to maintain the three-foot separation, a road elevation of at least 933.4 feet (929.4 + 3 + 1) is required. The proposed road elevation is less than this for approximately 1,300 feet. In these areas, the swales can be designed for filtration only. In this case the infiltration trench is lined with an impermeable barrier to prevent infiltration. A drain tile (under drain) is placed in the bottom of the swale to convey filtered water to safe discharge locations. Alternatively, infiltration swales could be used in these areas due to the relatively low risk of impacting groundwater. The ground-water is not used as a potable water source. Groundwater in this area is highly connected to water in Lake
Minnetonka and area wetlands. Lake Minnetonka water is impaired for phosphorous and total suspended solids (TSS), the main pollutants in stormwater. Currently, stormwater runoff from CSAH 101 does not receive any direct treatment, so any treatment from the engineered soils of the swale and existing soil below the swale would likely be an improvement over the current situation. Another option would be to not treat stormwater in these areas.

The swale provides several benefits:

1. Sediment will settle out in the swale as the water velocity slows as it comes off the road.
2. The swale will store runoff along its length by means of a series of check dams about six inches high. The stored water will infiltrate into the engineered soils and into the underground storage.
3. The swale will irrigate the trees and other vegetation. This water will be taken up by the trees and expelled through evapotranspiration. This, in turn, will reduce the soil moisture and provide for more storage space in the soil, increasing the effectiveness of the swale to reduce volume.
4. The swale will convey excess flows to the underground storage and safe discharge points.

3.3.3 Underground Storage
Additional stormwater storage is provided, as needed, under the trail in trenches filled with crushed rock. Runoff fills the voids (up to 40 percent) of the rock and is stored until it has a chance to infiltrate or be filtered and conveyed to safe discharge points. The placement of the underground storage under the trail eliminates the footprint of this stormwater component and results in no additional disturbance within the road corridor.

3.3.4 Trees and Vegetation
The swale is planted with low maintenance ground vegetation and trees consistent with the maple-basswood forest character of the corridor. A variety of plant species can survive the conditions in the six-foot strip along the road. Species such as blue grama grass, little bluestem, and switchgrass can survive this droughty, salty environment. Soil correction to a depth of 24 inches is recommended for best plant growth. Tree survival along the corridor will be addressed through detailed design of planting pits that will allow vigorous and extensive root growth. Soil correction is a critical component of this design.
The swale and vegetation provide an attractive buffer between the trail and road traffic. It also serves to calm traffic as it is only separated from the northbound traffic lane by a four-foot shoulder. The swale will be planted with over-story trees, thus maintaining a canopy over the road (as the trees mature). This canopy maintains an important characteristic element of the existing road character, as well as providing abstraction benefits for stormwater management.

3.4 Benefits and Costs of the Stormwater Plan

Benefits

- Exceeds the District’s Stormwater requirements.
- Works within the proposed road design footprint.
- No additional treatment areas needed, prevents the destruction of vegetation to construct treatment areas (not considered or shown on County plans).
- Keeps vegetation and trees close to the road and helps to reestablish the tree canopy and the character of the road.
- Adds a landscape amenity to the corridor.
- Irrigates trees and other plants.
- Calms traffic.
- No need to acquire easements for stormwater treatment if treatment basins cannot be sited within ROW.
- Flexible – Stormwater treatment can be eliminated in constrained areas to narrow the project footprint.

Costs

- Keeps road footprint as is, no reduction in impacts on private properties.
- The concept could be difficult to implement along the causeway or above retaining walls.
- The structural and nonstructural elements need to be inspected and maintained on a regular basis.
- City or some other entity needs to take maintenance responsibility for treatment system.
4.0 Summary

The road design alternatives and stormwater management concept discussed in this report provide the project stakeholders with additional ideas that may lead to a final design decision for rebuilding CSAH 101. All ideas presented reduce the ecological impact of the road and help make this new “complete street” more of a “complete green street.” The ideas anticipate evolving needs for 21st century transportation infrastructure and expectations for greater resiliency from our built landscapes. These expectations are driven by the changing demographic profile of our communities, changes in energy supplies and prices, and a growing recognition that the carrying capacity of the environment is limited.

Addressing these expectations and creating a new vision for transportation corridors is challenging. With the expectation that our transportation infrastructure perform differently going forward, compromise will be necessary. The provided road design alternatives and stormwater concept offer opportunities for compromise and suggest ways for transforming major road corridors.
Appendix A

Shaver's Lake Evaluation

(to be completed)
Appendix B

VRSS Evaluation
Memorandum

To: Steve Christopher, Minnehaha Creek Watershed District
From: Fred Rozumalski, Amy Mikus - Barr Engineering
Subject: VRSS Analysis for CSAH 101 Corridor in Wayzata
Date: November 17, 2010
Project: 23271140.10, CSAH 101 Ecological Review

Introduction to VRSS Structures

Vegetated Reinforced Soil Slopes (VRSS) are a type of soil bioengineering system which can be used to stabilize and maintain stream banks, cut or filled road banks and other areas which require soil stabilization. A VRSS is an earthen structure in which grasses or live-cut woody plant stems or root pieces serve as structural and mechanical elements on a constructed slope. These materials are typically supplemented with traditional reinforcement systems such as geotextiles or rocks depending on the desired size and outcomes of the project.

This memo compares the benefits and drawbacks of a VRSS to an interlocking retaining wall for use on the CSAH 101 corridor.

Horizontal and Vertical Space Requirements

VRSS systems are adaptable and can be designed for many types and sizes of projects. They can be built in a stepped, sloped or flat-face form, and are typically between 5 and 15 feet high, though some larger systems have been constructed.
VRSS are typically constructed on slopes from 1:2 to 1:0.5. This is a wide range and steeper slopes are only possible with large amounts of reinforcement, therefore, for the CSAH 101 corridor the slope of 1:2 will be assumed. Using this slope, a VRSS system which is 10’ tall will need approximately 20’ of horizontal space. The precise width in final design depends on soil characteristics and the amount and type of anchoring and reinforcement used. For an interlocking retaining wall, the traditional rule is that height equals depth; a 10’ high wall will need to be anchored and backed by compacted fill to a depth of 10’. Assuming a thickness of 1.25 ft for an interlocking retaining wall, a VRSS wall will be much thicker; “blocks” of root-reinforced soil are usually 24”-36” (2-3 feet) in depth. The increased thickness of the structure itself as well as the greater depth required for fill and reinforcement means that a VRSS system may not be possible in all parts of the CSAH 101 corridor.

Plant Selection for Reinforcement

Only a few drought tolerant plant species are suitable for use in VRSS systems, including but not limited to lowbush honeysuckle (Diericilla lonicera), dogwood (Cornus spp.) and Viburnum spp. Some prairie grasses with extensive root systems may also be suitable under full sun exposure conditions. Constructed systems can also be supplementally seeded with cool season grasses to aid in topsoil preservation and improve aesthetics until larger plants and shrubs are firmly established. Under shaded or part shade conditions plant vigor can be unreliable.

Growing Requirements

Water availability is likely to be a critical issue in the suitability of VRSS systems for the CSAH 101 corridor. VRSS systems are frequently used to stabilize and improve stream banks, where they are installed with an invert below the water line to aid in uptake of water to root systems. When VRSS systems are used as retaining walls, their size must be kept proportional to availability of groundwater and/or precipitation as water sources, otherwise they will not reach full design strength.
The amount of natural light will also be a determining factor in plant survival. Plants established in VRSS systems must have vigorous root systems to hold the steep slopes, and light is a critical factor in establishing such root systems. The aspect of the walls and the type of surrounding vegetation are important to consider. CSAH 101 is a north–south corridor, so the aspect of installed VRSS systems would be east and west. This suggests that portions of walls that are not shaded by trees would have only 3–6 hours of direct sunlight per day depending upon the day length during the growing season. If the vegetation in VRSS systems is to survive, it may be necessary to cut back canopy trees or prohibit tree planting along the corridor. No information is currently available on best practices for tree setback, however an assumption of a 20 foot minimum seems reasonable.

The type of soil used in construction should be chosen based on its structural characteristics as well as its ability to support and promote plant life. Because the soil which is held back by a VRSS system is compacted, it is not well-suited for most plants. Along the CSAH 101 corridor this will result in long stretches of road where little more than grass will be successful.

Finally, atomized salt spray from winter traffic on CSAH 101 could coat woody stems on the VRSS system causing plant dessication. This may or may not be a limiting factor for plant growth, but must be considered.

**Aesthetics**

Aesthetic value of soil retaining systems is a matter of personal taste. It is the opinion of this author that vegetated and geotextile systems look nice while foliage is in place during the growing season, but during leaf-off they are unattractive and blocky. They may also become weedy which compounds
unattractiveness. Retaining walls built of natural stone are much more attractive (again in the opinion of this author).

Operations and Maintenance

VRSS have operations and maintenance requirements which are greater than those of traditional slope stabilization measures. If the system is to be utilized at or near its strength capacity, some repairs and replanting may be necessary in the first or second year until root systems have become fully established. If a potential of plant disturbance by animals or people is expected than installation of enclosures for the first two years is recommended. It is also important to keep VRSS systems weeded. Trees such as boxelder could establish, grow large and potentially blow over weakening the structure. Other weeds such a crownvetch could overtop and smoother desirable plants killing them and destabilizing the system. Monthly weeding during the growing season and yearly inspections of VRSS systems are recommended.

Overall Recommendations

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>VRSS</th>
<th>Retaining Wall</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal Space Required</td>
<td>Low</td>
<td>High</td>
<td>Retaining walls use less space in the narrow corridor.</td>
</tr>
<tr>
<td>Vertical Space Required</td>
<td>High</td>
<td>High</td>
<td>Both can be designed to meet needs.</td>
</tr>
<tr>
<td>Water Availability</td>
<td>Questionable</td>
<td>n/a</td>
<td>More information may be needed in order to determine plant success. Drought periods could be risky.</td>
</tr>
<tr>
<td>Sunlight Availability</td>
<td>Medium</td>
<td>n/a</td>
<td>Plants used may vary based on local light conditions; limits on tree planting may be required.</td>
</tr>
<tr>
<td>Aesthetics</td>
<td>Medium</td>
<td>Medium</td>
<td>This is a matter of taste depending upon materials used for retaining walls, and establishment success of VRSS.</td>
</tr>
<tr>
<td>Sound Reduction</td>
<td>Medium</td>
<td>Low</td>
<td>VRSS are more suited where sound reduction is a concern.</td>
</tr>
<tr>
<td>Operations and Maintenance</td>
<td>Medium</td>
<td>High</td>
<td>VRSS requires more maintenance.</td>
</tr>
</tbody>
</table>
VRSS systems, while suited to the CSAH 101 corridor, have limited applicability in this project. Their larger width is the primary issue; in a narrow corridor there simply may not be enough space to install a properly reinforced system. Large VRSS systems also require routine upkeep that would require access by maintenance crews over the life of the system. Maintenance needs are highest during the initial years and off season when aesthetic benefits are at their lowest, so initial community response to the systems could be quite negative. Where the systems can be kept small and will be assured of receiving adequate maintenance, light and water, they are an option and could prove successful in maintaining neighborhood character.