



520 Lafayette Road  
St. Paul, MN 55155-4194

## MINNESOTA ENVIRONMENTAL QUALITY BOARD

Phone: 651-757-2873  
Fax: 651-297-2343  
[www.eqb.state.mn.us](http://www.eqb.state.mn.us)

**September 21, 2016**

**Meeting Location: MPCA Board Room  
St. Paul, Minnesota  
1:00 p.m. – 4:00 p.m.**

### AGENDA

#### **General**

This month's meeting will take place in the Minnesota Pollution Control Agency board room at 520 Lafayette Road in St. Paul. The Environmental Quality Board (EQB or Board) meeting will be available via live webcast on September 21 from 1:00 p.m. to 4:00 p.m. You will be able to access the webcast on our website: [www.eqb.state.mn.us](http://www.eqb.state.mn.us)

*The Jupiter Parking Lot is for all day visitors and is located across from the Law Enforcement Center on Grove Street. The Blue Parking Lot is also available for all day visitors and is located off of University and Olive Streets.*

- I. \*Adoption of Consent Agenda**  
Proposed Agenda for September 21, 2016 Board Meeting  
June Meeting Minutes
- II. Introductions**
- III. Chair's Report**
- IV. Executive Director's Report**
- V. \*\*Designation of the Responsible Governmental Unit for Environmental Review**
- VI. Interagency Pollinator Coordination Team Update**
- VII. Clean Power Plan in Minnesota: Public Engagement and Input**
- VIII. Incorporating Climate Change into Environmental Review**
- VIX. Update: Environmental Review of North Dakota Pipeline Company LLC's proposed Sandpiper Pipeline and Enbridge Energy, Limited Partnership's proposed Line 3 Replacement Pipeline**
- X. Adjourn**

---

\* Items requiring discussion may be removed from the Consent Agenda

\*\* Denotes action may be taken





520 Lafayette Road  
St. Paul, MN 55155-4194

## MINNESOTA ENVIRONMENTAL QUALITY BOARD

Phone: 651-757-2873  
Fax: 651-297-2343  
[www.eqb.state.mn.us](http://www.eqb.state.mn.us)

**September 21, 2016**

**Meeting Location: MPCA Board Room  
St. Paul, Minnesota  
1:00 p.m. – 4:00 p.m.**

### ANNOTATED AGENDA

#### **General**

This month's meeting will take place in the Minnesota Pollution Control Agency board room at 520 Lafayette Road in St. Paul. The Environmental Quality Board (EQB or Board) meeting will be available via live webcast on September 21 from 1:00 p.m. to 4:00 p.m. You will be able to access the webcast on our website: [www.eqb.state.mn.us](http://www.eqb.state.mn.us)

*The Jupiter Parking Lot is for all day visitors and is located across from the Law Enforcement Center on Grove Street. The Blue Parking Lot is also available for all day visitors and is located off of University and Olive Streets.*

#### **I. \*Adoption of Consent Agenda**

Proposed Agenda for September 21, 2016 Board Meeting  
June Meeting Minutes

#### **II. Introductions**

#### **III. Chair's Report**

#### **IV. Executive Director's Report**

#### **V. \*\*Designation of the Responsible Governmental Unit for Environmental Review**

**Presenter:** Courtney Ahlers-Nelson  
Planning Director, Environmental Review  
Environmental Quality Board (651-757-2183)

#### **Materials enclosed:**

- Resolution, Findings, Conclusions and Order
- Spider Creek Mitigation Plan
- Letter from St. Louis County – Request to be relieved of RGU status
- Letter from the Department of Natural Resources – Acceptance of RGU status

---

\* Items requiring discussion may be removed from the Consent Agenda

\*\* Denotes action may be taken

**Issue before the Board:**

Designation of a different responsible governmental unit (RGU) for environmental review for the Spider Creek Mitigation Project by United States Steel Corporation.

**Background:**

United States Steel Corporation (U.S. Steel), Minnesota Ore Operations – Minntac (Minntac) received a United States Army Corps of Engineers (USACE) permit for the Minntac Mine Pit Extension project, which includes progression of the Minntac East Pit in Mountain Iron, Minnesota. The Mine Pit Extension project will impact 3,697 linear feet of Parkville Creek. Special Condition 11 of the USACE permit requires that U.S. Steel mitigate for the loss of Parkville Creek. The proposed Spider Creek Mitigation Project (project), located in St. Louis County, will be completed by restoring a minimum of 3,697 linear feet of Spider Creek to its original pattern, profile, and dimension. The proposed project will fulfill the requirements of a 1:1 compensatory mitigation ratio for the proposed Parkville Creek impacts. The proposed Spider Creek Mitigation Project has benefits such as ensuring a sustainable stream characteristics and improving riparian and floodplain vegetation.

Consequently, the proposed project meets or exceeds the threshold for a mandatory environmental assessment worksheet (EAW) category, Minnesota Rules, part 4410.4300, subpart 26, stream diversion. The subpart requires that a mandatory EAW be completed for the proposed project and identifies the responsible governmental unit (RGU) as the local governmental unit.

**Discussion:**

On August 1, 2016, EQB staff received a letter from St. Louis County requesting that the EQB designate a different RGU for the EAW for the proposed Spider Creek Mitigation Project. In its letter, St. Louis County suggested that the Minnesota Department of Natural Resources (DNR) is the more appropriate RGU due to the DNR's expertise in public waters, including ecological function of aquatic habitats and ecological effects to the flora and fauna.

On August 17, 2016, the DNR sent a letter to the EQB indicating that DNR staff had been in communication with St. Louis County and U.S. Steel representatives, and that the DNR would be willing to serve as RGU for the proposed mitigation project.

Pursuant to Minnesota Statutes chapter 116D and Minnesota Rules 4410, EQB has jurisdiction over RGU selection and more specifically, in accordance with part 4410.0500, subpart 6 the EQB may designate a designee that has greater expertise in analyzing the potential impacts of the proposed project. Therefore, to address the request before the Board, the draft Resolution, Findings of Fact, and Conclusions of Law and Order focuses on the criteria in Minnesota Rules 4410.0500, subpart 6. EQB staff find that the DNR has greater expertise than St. Louis County in analyzing the potential for environmental impacts of projects involving work in public waters and preparing EAWs.

**Staff Recommendation:**

Staff recommends adoption of the resolution and approving the Findings, Conclusions, and Order assigning RGU duties to the DNR.



## VI. Interagency Pollinator Coordination Team Update

**Presenter:** Matt Wohlman  
Assistant Commissioner, Minnesota Department of Agriculture  
(651-201-6551)

**Materials Enclosed:**

- Executive Order 16-07
- Special Registration Review of Neonicotinoid Pesticides
- Pollinators Summit Outcomes Report

**Issue before the Board:** Informational Item

**Background:** On August 26, Governor Dayton issued Executive Order 16-07, directing state agencies to take specific actions to reverse the decline of pollinator populations that play a crucial role in agriculture and food production. This action follows the publication of a legislatively mandated study completed by the Minnesota Department of Agriculture (MDA), *Special Registration Review of Neonicotinoid Pesticides*, as well as the Pollinators Summit, which brought together hundreds of Minnesotans, experts and stakeholders to discuss and collaborate on policy and program ideas to protect and support Minnesota's insect pollinators. MDA Assistant Commissioner Matt Wohlman will present the findings from the Special Registration Review and discuss MDA's response under Executive Order 16-07. Others may be added to the agenda as well.

## VII. Clean Power Plan in Minnesota: Public Engagement and Input

**Presenter(s):** Melissa Kuskie  
Minnesota Pollution Control Agency Staff (651-757-2512)

**Materials enclosed:**

- Clean Power Plan Community Listening Sessions: Common Themes

**Issue before the Board:** Informational Item

**Background:** In February and March 2016, the Minnesota Pollution Control Agency (MPCA) conducted public listening sessions around the state to seek input on the development of a state Clean Power Plan. Meeting attendees shared a number of varied concerns ranging from climate and health protections to compliance costs. Generally, though many Minnesotans are very concerned with potential increased costs – primarily in the form of higher electricity bills – associated with reducing greenhouse gas emissions, there is considerable support for a plan that maximizes emissions reductions and develops economic opportunities in an ongoing transition to cleaner energy. Many stakeholders also made clear the need to address environmental justice and ensure that vulnerable communities are provided an active voice in a fair and just plan development process. Finally, most participants supported the need for broad coordination across states in developing a sensible and effective Clean Power Plan. Listening session follow up requires us to address the question: *How will the state of Minnesota respond to stakeholder input on clean energy planning, public health, energy sector jobs, ratepayer impacts, climate justice, etc., given the multiple agencies working on such issues?*

## **VIII. Incorporating Climate Change into Environmental Review**

**Presenter(s):** Mark Riegel  
Planner, Environmental Quality Board (651-757-2472)

Sam Radermacher  
Environmental Quality Board Environmental Review Intern

**Materials enclosed:** Incorporating Climate Change into Minnesota's Environmental Review Program (Draft Summary Document)

**Issue before the Board:** Informational Item

### **Background:**

As part of an ongoing youth engagement effort and partnership with the University of Minnesota, EQB staff partnered with an undergraduate environmental review class to offer a policy internship opportunity. EQB Environmental Review staff presented to the class in April to discuss the role that the EQB plays, and the importance of environmental review. Shortly thereafter, Sam Radermacher joined the EQB as an Environmental Review intern to conduct policy research. Sam is utilizing her knowledge from the environmental review class, experiences with EQB staff and the EQB Technical Representatives, as well as policy research, to compile a summary document of the opportunities for incorporating climate change into environmental review. The final summary report will be used as a starting point for future discussions on the opportunities to address climate change through environmental review. Board members may discuss the document and provide recommendations and feedback to Environmental Review staff and the Environmental Review intern.

## **VIX. Update: Environmental Review of North Dakota Pipeline Company LLC's proposed Sandpiper Pipeline and Enbridge Energy, Limited Partnership's proposed Line 3 Replacement Pipeline**

**Presenter(s):** Bill Grant  
Deputy Commissioner of Division of Energy Resources, Department of Commerce (651-539-1801)

Barb Naramore  
Assistant Commissioner, Department of Natural Resources (651-259-5033)

Michelle Beeman  
Deputy Commissioner, Minnesota Pollution Control Agency (651-757-2013)

**Materials enclosed:** None

**Issue before the Board:** Informational Item

**Background:** The Department of Commerce, the Department of Natural Resources and the Minnesota Pollution Control Agency have been using an interdisciplinary approach under a Memorandum of Understanding (MOU) as directed by the Public Utilities Commission, to coordinate the development of the environmental impact statements for the North Dakota

Pipeline Company LLC's proposed Sandpiper Pipeline and Enbridge Energy, Limited Partnership's proposed Line 3 Replacement Pipeline. The three state agencies identified in the MOU play a unique and coordinated role in the environmental review of the proposed pipelines. The agencies will provide a status update to the Board.

**X. Adjourn**



**MINNESOTA ENVIRONMENTAL QUALITY BOARD  
MEETING MINUTES**

**Wednesday, June 15 2016  
MPCA Room Board Room  
520 Lafayette Road North, St. Paul**

**EQB Members Present:** Mike Rothman, John Saxhaug, Charlie Zelle, Tom Landwehr, Julie Goehring, Kate Knuth, John Linc Stine, Kristin Eide-Tollefson, Shawntera Hardy

**EQB Members Absent:** Dr. Ed Ehlinger, Matt Massman, Dave Frederickson, Brian Napstad, Tom Moibi, Adam Duininck

**Staff Present:** Will Seuffert, Courtney Ahlers-Nelson, Erik Dahl, Mark Riegel, Anna Henderson

**I. Adoption of Consent Agenda and Minutes**

**II. Introductions**

**III. Chair's Report** – John Linc Stine chaired the meeting.

**IV. Executive Director's Report**

Recognized and presented Erik Tomlinson with a plaque as a thank you for his service and contributions to the EQB Board. He has served on the Board since 2009.

The EQB recently filled the Communications vacancy position. Katie Pratt will start work on July 25<sup>th</sup>.

July 3-10 Commissioner Stine and Will Seuffert will be traveling to Germany with a delegation of local leaders to collaboratively explore and advance economically beneficial climate smart energy strategies.

By close of business on Monday, June 20<sup>th</sup>, a preliminary rule language with changes to Minn. Rules 4410.0200, 4300, 4400, 4600 will be released. The preliminary rule changes will be posted to the Mandatory Categories webpage, which can be accessed from the EQB home page. There will be a comment period from June 20, 2016 to July 20, 2016. Will be hosting a workshop on June 28<sup>th</sup> from 12:30-4:30 p.m.

In place of the July Board Meeting, we will be working with Environmental Initiative to host a meeting on climate action planning; the CSEO results will be presented as well.

Beginning work on planning the 2017 Environmental Congress to be held Friday, February 3, 2017.

Received a letter from Minnesota Association of Family Physicians requesting that the Board consider amending EIS categories for non-ferrous mining to require an HIA. EQB staff is in the process of asking for more information about the request before we bring it forward to the Board to better understand and hear presentations.

**V. Administrative Law Judge Recommendation on Social Cost of Carbon**

Presenter: Leigh Currie, Minnesota Center for Environmental Advocacy

Ms. Currie gave a presentation on the Social Cost of Carbon. Discussion followed.

- Andy Brown gave verbal testimony.

**VI. Environmental Review: Data Collection Update**

Presenter: Mark Riegel, EQB Staff

Mark updated the Board on EQB's progress on the data collection and shared information on the new survey software designed to collect information from both RGUs and citizens involved in the Environmental Review process. Discussion followed.

**VII. Metrics in the Environment and Energy Report**

Presenters: Erik Dahl and Anna Henderson, EQB Staff

A 2017 Environment and Energy Report card is being prepared pursuant to executive order 11-32, "The EQB shall prepare an environmental and energy report card that identifies metrics which the State of Minnesota can use to measure its performance and progress protecting Minnesota's valuable air, water and land resources." An interagency team has been working to develop metrics and content for the report. Discussion followed.

- Mahyer Sorour gave verbal testimony.

The audio recording of the meeting is the official record and can be found at this link:

[ftp://files.pca.state.mn.us/pub/EQB\\_Board/](ftp://files.pca.state.mn.us/pub/EQB_Board/)

Webcast is also available on the EQB website: <https://www.eqb.state.mn.us/>

**RESOLUTION OF THE  
MINNESOTA ENVIRONMENTAL QUALITY BOARD**

Designation of a Different Responsible Governmental Unit for the Environmental Review of United States Steel Corporation's proposed Spider Creek Mitigation Project.

BE IT RESOLVED, that the Minnesota Environmental Quality Board approves and adopts the Findings of Fact, Conclusions and Order; and

BE IT FURTHER RESOLVED, that David J. Frederickson, Chair of the Board, is authorized to sign the adopted Findings of Fact, Conclusions and Order.

**STATE OF MINNESOTA  
ENVIRONMENTAL QUALITY BOARD**

In the Matter of the Request to Designate a  
Different Responsible Governmental Unit  
for the Environmental Review of United  
States Steel Corporation's proposed Spider  
Creek Mitigation Project

**FINDINGS OF FACT,  
CONCLUSIONS OF LAW,  
AND ORDER**

---

---

**FINDINGS OF FACT**

1. United States Steel Corporation (U.S. Steel), Minnesota Ore Operations – Minntac (Minntac) received a United States Army Corps of Engineers (USACE) permit for the Minntac Mine Pit Extension project, which includes progression of the Minntac East Pit in Mountain Iron, Minnesota.
2. The Mine Pit Extension project will impact 3,697 linear feet of Parkville Creek.
3. Special Condition 11 of the USACE permit requires that U.S. Steel mitigate for the loss of Parkville Creek.
4. U.S. Steel proposes that mitigation occur entirely on Spider Creek, which is located in the northeast quarter of Section 24, Township 52 North, Range 19 West, St. Louis County, Minnesota.
5. The “Spider Creek Restoration Plan: Minntac Mine Extension Project” prepared in December 2015, states that the proposed Spider Creek Mitigation Project (project) is to restore the pattern, profile, and dimension of a minimum of 3,697 linear feet of Spider Creek.
6. The “Spider Creek Restoration Plan: Minntac Mine Extension Project” states that the proposed project will include additional benefits to ensure sustainable stream characteristics and to improve riparian and floodplain vegetation.
7. The “Spider Creek Restoration Plan: Minntac Mine Extension Project” also states that the proposed project requires a Public Waters Work Permit administered by the Minnesota Department of Natural Resources (DNR) and a National Pollution Discharge Elimination System (NPDES) Construction Stormwater Permit issued by the Minnesota Pollution Control Agency (PCA).
8. Minnesota Rule 4410.0200, subpart 33 reads:

**Governmental action.** "Governmental action" means activities including projects wholly or partially conducted, permitted, assisted, financed, regulated, or approved by governmental units, including the federal government.



Minn. R. 4410.0200, subpart 33.

9. Minnesota Rule 4410.0200, subpart 65 reads:

**Project.** "Project" means a governmental action, the results of which would cause physical manipulation of the environment, directly or indirectly. The determination of whether a project requires environmental documents shall be made by reference to the physical activity to be undertaken and not to the governmental process of approving the project.

Minn. R. 4410.0200, subpart 65.

10. The EQB finds that the proposed project requires a "governmental action" under Minnesota Rule 4410.0200, subpart 33.

11. The EQB finds that the proposed project is a "project" under Minnesota Rule 4410.0200, subpart. 65 and that the restoration will result in the physical manipulation of a minimum of 3,697 linear feet of Spider Creek.

12. Minnesota Rule 4410.4300 establishes mandatory categories for the preparation of an environmental assessment worksheet (EAW). Subpart 26 reads:

**Stream diversion.** For a diversion, realignment, or channelization of any designated trout stream, or affecting greater than 500 feet of natural watercourse with a total drainage area of ten or more square miles unless exempted by part 4410. 4600, subpart 14, item E, or 17, the local governmental unit shall be the RGU.

Minn. R. 4410.4300, subpart 26.

13. The EQB finds that Minnesota Rules 4410.4300, subpart 26 requires that for the mitigation of Spider Creek an EAW must be completed.

14. The EQB finds that Minnesota Rules 4410.4300, subpart 26 also designates the local governmental unit as the responsible governmental unit (RGU) for the EAW.

15. On August 1, 2016, EQB staff received a letter from St. Louis County requesting that the EQB designate a different RGU for the EAW for the proposed project.

16. The August 1, 2016 letter from St. Louis County was also sent to the DNR Environmental Review Program.

17. On August 17, 2016, the DNR sent a letter to the EQB indicating DNR staff had been in communication with St. Louis County and U.S. Steel representatives, and that the DNR would be willing to serve as RGU for the proposed mitigation project.

18. Minnesota Rule 4410.0500, subpart 6 reads:

**Exception.** Notwithstanding subparts 1 to 5, the EQB may designate, within five days of receipt of the completed data portions of the EAW, a different RGU for the project if the EQB determines the designee has greater expertise in analyzing the potential impacts of the project.

Minn. R. 4410.0500, subpart 6.

19. The EQB finds that in its history of applying Minnesota Rules 4410.0500, subpart 6, the designation of a different RGU has not been completed “within five day of receipt of the completed data portion of the EAW” and that rarely is a data submittal made prior to EQB’s decision.
20. The EQB finds that there are several examples of the EQB processing requests to designate a different RGU without a data submittal nor within five days of the data submittal. For example, the following projects did not have data submittals submitted prior to an EQB decision:
  - a. Living Word Bible Camp – proposed recreational development, 2013
  - b. Minnesota Sands, LLC – proposed silica sand projects, 2013
  - c. Lock and Dam Number 1 – proposed courting project, 2015
21. The EQB finds that making a decision within the five days of the EAW data submittal is not practical for RGU or project proposers to plan for the environmental review.
22. The EQB believes that it was never the intent of the five day limitation to limit public planning or collaboration between the RGU and the project proposer before the EAW data submittal.
23. The EQB finds that to designate a different RGU other than St. Louis County under Minnesota Rules 4410.0500, subpart 6, that the EQB must determine that such a designee has greater expertise in analyzing the potential impacts of the proposed project.
24. The August 1, 2016 letter from St. Louis County also suggested that the DNR is the more appropriate RGU for the proposed project because of DNR’s expertise in public waters, including ecological function of aquatic habitats, ecological effects to the flora and fauna and expertize in preparing joint state-federal environmental review documents.
25. The August 17, 2016 letter from DNR states: “MNDNR’s expertise in work in public waters and ecosystems functions and effects of aquatic ecosystems would assist in assessment of the project.”
26. The EQB finds that the DNR has more experience in analyzing the potential impacts associated with stream mitigation.

27. The EQB finds that the DNR has more experience in analyzing the potential impacts associated with stream mitigation as they are responsible for permitting the work done in Spider Creek, a public water.
28. The EQB finds that the DNR has greater expertise than St. Louis County in analyzing the potential for environmental impacts of projects involving work in public waters and preparing EAWs and Environmental Impact Statements (EIS) for such projects.

DRAFT

Based on the foregoing Findings of Fact, the Minnesota Environmental Quality Board makes the following:

### **CONCLUSIONS OF LAW**

1. Any of the foregoing Findings of Fact more properly designated as Conclusions of Law are hereby adopted as such.
2. The EQB concludes that pursuant to Minnesota Statutes chapter 116D and Minnesota Rules 4410, the EQB has jurisdiction over RGU designation.
3. The EQB concludes that the proposed Spider Creek Mitigation Project requires environmental review pursuant to Minnesota Rules 4410.
4. The EQB concludes the request for the EQB to decide the question whether to designate a different RGU for the proposed project was properly brought to the EQB Board.
5. The EQB concludes that the DNR has greater expertise in analyzing the potential for environmental impacts of the proposed Spider Creek Mitigation Project than St. Louis County, and is therefore better suited as RGU to conduct the environmental review for the project.

Based on the Findings of Fact, Conclusions and the entire record of this proceeding, the Minnesota Environmental Quality Board hereby makes the following:

### **ORDER**

The Environmental Quality Board hereby orders and designates the Minnesota Department of Natural Resources as the responsible governmental unit for environmental review of the proposed Spider Creek Mitigation Project by the United States Steel Company.

Approved and adopted this 21<sup>st</sup> day of September, 2016.

---

David J. Frederickson, Chair  
Minnesota Environmental Quality Board



# Spider Creek Restoration Plan

## *Minntac Mine Extension Project*

Prepared for  
U. S. Steel, Minnesota Ore Operations -- Minntac

December 2015

# Spider Creek Restoration Plan

December 2015

## Contents

1.0	Introduction .....	1
1.1	Regulatory Background .....	1
1.2	Restoration Benefits .....	2
1.3	Permitting and Additional Site Considerations.....	3
2.0	Impacts Stream—Parkville Creek.....	5
2.1	Geomorphology .....	5
2.2	Biology.....	6
2.3	Water Chemistry .....	9
2.4	Hydrology .....	10
2.5	Impaired Waters .....	10
3.0	Spider Creek Characterization .....	12
3.1	Restoration and Reference Reach Differences .....	12
3.2	Drainage Area and Stream Hydrology .....	12
3.3	Geology and Soils .....	14
3.4	Biology.....	14
3.5	Habitat Assessments.....	17
3.6	Water Temperature, Chemistry and Classification.....	17
3.7	Impaired Waters .....	18
4.0	Restoration (Channelized) Reach Characteristics.....	18
4.1	Site Constraints .....	19
4.2	Project Area Existing Conditions.....	20
4.3	Geomorphology .....	20
5.0	Reference Streams.....	21
5.1	Reference Reach #1 – Spider Creek.....	21
5.2	Additional Reference Streams.....	22
5.3	Description.....	23
6.0	Restoration Plan .....	27
6.1	Restoration Objectives.....	27

6.2	Development of the Restoration Plan .....	28
6.3	Restoration Plan Summary.....	34
6.4	Construction Methods and Phases.....	35
6.5	Invasive Species Control.....	36
6.6	Construction Site Monitoring.....	37
7.0	Analysis of Restoration Benefits.....	38
7.1	Measures of Stream Habitat.....	38
7.2	Functional Mitigation of Lost Stream Functions.....	40
7.3	Measures of Success.....	40
8.0	Maintenance and Monitoring.....	41
8.1	Construction – Fall/Winter 2016 (Year 0).....	41
8.2	Monitoring and Construction – Summer/Fall 2017 (Year 1).....	41
8.3	2018 Monitoring and As-built (Year 2).....	41
8.4	2019 through 2022 Monitoring (Years 3 through 5) .....	41
8.5	2022 Post-Restoration Surveys (Year 5).....	41
8.6	Monitoring Completion and Project Success .....	42
8.7	Adaptive Management Plan .....	42
8.8	Long-Term Management Plan.....	43
9.0	Site Protection Instrument.....	44
10.0	References .....	45

### List of Tables

Table 2-1	2012 Baseline Conditions in Parkville Creek.....	6
Table 2-2	Parkville Creek Fish Community.....	7
Table 2-3	Parkville Creek Macroinvertebrate Community .....	8
Table 2-4	Parkville Creek Laboratory Analyses and Field Parameter Measurement Results.....	9
Table 2-5	Minimum, Maximum, and Mean of Field parameters Measured at 15-minute Intervals in Parkville Creek, 9/20/12 through 10/8/12.....	9
Table 3-1	Flow Data Summary .....	14
Table 3-2	Spider Creek Fish Data—1998 and 2009 .....	15
Table 3-3	Spider Creek MPCA Invertebrate Data—1998 and 2009 .....	16
Table 3-4	Spider Creek Water Chemistry, Downstream of Channelized Reach—1998 and 2009.....	18
Table 4-1	Spider Creek Channelized Reach Rosgen Natural Channel Design Parameters.....	19

Table 5-1	Reference Reach #1 – Spider Creek Modified Pfankuch Assessment (Rosgen, 2006) .....	22
Table 5-2	Reference Stream Bankfull Cross-Sectional Areas.....	23
Table 5-3	Rosgen Natural Channel Design Classification Data for Reference Streams .....	24
Table 5-4	Reference Reach Bankfull Discharge Evaluation.....	26
Table 6-1	Design Riffle and Pool Characteristics .....	30
Table 6-2	Spider Creek Reference and Design Planform Characteristics.....	30
Table 7-1	Comparison of Average Stream Habitat Units for Pre- and Post-Mitigation .....	40

### List of Figures

Figure 1	Project Location and Drainage Area
Figure 2	Channelized Reach Proposed for Restoration
Figure 3	Proposed Restoration Channel Layout
Figure 4	Project Drainage Areas
Figure 5	Ref #1 – Spider Creek Existing Conditions
Figure 6	National Wetland Inventory
Figure 7	Reference Stream Section Quarternary Geology
Figure 8	Reference Stream Section Location Map
Figure 9	Meander Scars

### List of Appendices

Appendix A	Public Waters Work General Permit Issued to St. Louis County
Appendix B	Proposed Stream Restoration Plans
Appendix C	Natural Channel Design Dimensions
Appendix D	Spider Creek Conservation Easement
Appendix E	Particle Distributions



---

## 1.0 Introduction

United States Steel Corporation (U. S. Steel), Minnesota Ore Operations – Minntac (Minntac) has received U. S. Army Corps of Engineers (USACE) authorization (MVP-2012-00415-JCB) for the Minntac Mine Pit Extension project, which includes progression of the Minntac East Pit in Mountain Iron, Minnesota. The project will impact 3,697 linear feet of Parkville Creek. Special Condition 11 of the USACE permit requires that U. S. Steel provide mitigation for the unavoidable loss of Parkville Creek. The proposed stream mitigation is located in the northeast quarter of Section 24, Township 52 North, Range 19 West, St. Louis County, near Alborn, Minnesota (Figure 1). The mitigation would occur entirely on Spider Creek within parcels owned by the State of Minnesota (tax-forfeited real estate) and Spider Creek Hunting Association, Parcel Identification numbers 470-0010-03830 and 470-0010-03850, respectively.

### 1.1 Regulatory Background

This document describes the compensatory mitigation for the loss of 3,697 linear feet of Parkville Creek (the impact stream). Stream mitigation will be completed by restoring a segment of Spider Creek (the restoration reach) as described in this plan. Additional information on Parkville Creek is summarized in Section 2.0. Compensatory stream mitigation is required for the Extension project by the USACE as part of the Clean Water Act (CWA) Section 404 authorization (2012-00415-JCB) and by the Minnesota Pollution Control Agency (MPCA) as part of the CWA Section 401 certification. The USACE stated that the basis for the stream mitigation requirement is provided in the *Compensatory Mitigation for Losses of Aquatic Resources* final rule (33 CFR 332) which describes the requirements needed in a mitigation plan.

Special Condition 11 of the USACE permit states:

*As compensation for the unavoidable loss of 3,697 linear feet of Parkville Creek, USS [U. S. Steel] shall restore 3,697 linear feet of Mission Creek.... In the event that the Mission Creek restoration cannot be completed... USS shall... propose an alternative source of compensatory mitigation by submitting a revised stream mitigation plan.*

U. S. Steel is proposing restoration of Spider Creek as the alternative source of mitigation as described in this revised stream mitigation plan.

The MPCA provided an amended 401 Certification for the project (MPCA, 2015b) on May 29, 2015. The certification provides a timeline for completion of the stream mitigation, which states that a preliminary stream restoration plan shall be completed by July 31, 2015. However, in an August 14, 2015, email, the MPCA provided a revision to the May 29 certification to allow for review by staff from the Minnesota Department of Natural Resources (MDNR). The revision provides additional scheduling flexibility to ensure that the plan is properly developed (MPCA, 2015c).

---

### 1.1.1 Site selection

On April 19, 2013, the USACE concurred that the mitigation requirement for impacts to Parkville Creek could be fulfilled within the St. Louis River 8-digit HUC watershed (04010201) (USACE, 2013). Several options for potentially restorable streams had been identified in the St. Louis River watershed as part of a search for mitigation streams, including Mission Creek and Spider Creek. U. S. Steel began the process to study the feasibility of Mission Creek, but determined that a restoration project on that stream would be complicated by infrastructure and dwellings on numerous parcels of privately held land, which would likely lead to project delay and limit the potential for full channel restoration. Several other streams identified for potential restoration within the St. Louis River watershed flow through expansive wetland complexes that may make new channel construction more difficult. Therefore, U. S. Steel decided to pursue Spider Creek for additional feasibility assessments for a restoration project.

### 1.1.2 Feasibility and Design Planning

Barr Engineering Co. (Barr), on behalf of U. S. Steel, completed an initial survey and feasibility assessment on Spider Creek to determine if it was appropriate for a stream restoration project (Barr, 2015a). The feasibility assessment stated that U. S. Steel would propose a project that would restore at least 3,697 linear feet of Spider Creek (Figure 2). According to the USACE, stream restoration is defined as follows:

*The process of converting an unstable, altered, or degraded stream corridor, including adjacent riparian zone (buffers) and flood-prone areas, to its natural stable condition considering recent and future watershed conditions.*

The USACE determined that the proposed Spider Creek project would provide adequate functional replacement for the loss of 3,697 linear feet of Parkville Creek (USACE, 2015a).

The USACE stated several concerns related to the project. Additional information was provided to the USACE and other agencies (Barr, 2015b and c). Furthermore, Barr has provided preliminary design, survey, and planning data to MDNR staff to ensure the design properly incorporates natural stream channel design as recommended by USACE staff. A meeting was held with Karl Koller and Mike Harris with the MDNR on July 23, 2015. The MDNR had several suggestions for the design, which have been incorporated through the design presented in this report.

## 1.2 Restoration Benefits

The proposed compensatory mitigation project is planned to restore the pattern, profile, and dimension of a minimum of 3,697 linear feet of Spider Creek to fulfill the requirements of a 1:1 compensatory mitigation ratio for the proposed Parkville Creek impacts. This mitigation ratio applies to the proposed restoration because the selected reach of Spider Creek is an altered, unstable stream corridor (Barr, 2015b, 2015c) that will be converted to its natural, stable condition, as required by the USACE for a restoration project. The project design is described in Section 5 and is based on Natural Channel Design (Rosgen, 1996) methods. The restoration has been designed by professional engineers with training in Natural Channel Design and in collaboration with MDNR. Therefore, the project design is based on the best available information to restore the channel to a natural, stable condition.

---

The proposed stream restoration plan will include additional benefits to ensure sustainable stream characteristics and to improve riparian and floodplain vegetation. The reach of Spider Creek to be restored is visibly straightened and ditched. The floodplain contains remnants of the historical meandering channel, which are visible in historical aerial photographs and from the ground. The former channels serve as references for channel pattern and function and are incorporated into the proposed restored channel pattern. The proposed layout of the restored stream channel is shown in Figure 3.

The restoration will improve hydrologic connectivity between the stream and the floodplain and will provide increased floodplain storage. Presently, the channelized stream is confined between a high berm on the south side and the existing county road (CR 167) on the north side, though the majority of the floodplain lies along the north side of the road. The stream restoration will re-meander the stream on the north and south sides of the road, within the broader floodplain, yet maintain some connection to the floodplain area on the south side of the county road through floodplain equalizing culverts.

Additional analyses of the benefits of the proposed restoration project are provided in Section 7.0.

## 1.3 Permitting and Additional Site Considerations

### 1.3.1 County

St. Louis County was contacted in late July 2015 to determine if installation of new culverts beneath CR 167 is feasible. In an email response to Barr, Steve Krasaway, Resident Engineer for St. Louis County, stated that the county would be happy to provide assistance on this project, and that any new culverts or culvert modifications must be designed to meet criteria required by St. Louis County's General Permit issued by MDNR (General Permit 1996-2091) [Appendix A](#). U. S. Steel will submit culvert designs and descriptions of the road modifications to the county for their review and approval.

The majority of the property surrounding Spider Creek is tax-forfeit land and alterations to the stream require approval from St. Louis County. In May 2015, U. S. Steel contacted the St. Louis County land manager to request permission for the project. The Area Land Manager stated that county land management team supported the project and would request an authorization from the county Land Commissioner.

### 1.3.2 Private Landowner

A portion of the land affected by the project is owned by a private landowner, the Spider Creek Hunting Association. U. S. Steel has been in discussion with the board members of the club, received initial positive responses on the proposed project, and will acquire the necessary permissions for work on their property.

### 1.3.3 State Aquatic Management Area (AMA)

Spider Creek currently has a perpetual conservation easement for an AMA that is held by the State of Minnesota and applies to all land within 60 feet from the top edge of the stream banks on either side. The AMA is tied to the stream banks, so the project will automatically effect a change to the easement boundary. These properties are managed by the MDNR to maintain access for fishing and other recreational uses along these streams. U. S. Steel will provide documentation from the MDNR that the

---

MDNR is willing to continue site management along Spider Creek after all conditions of this plan and the agreement between the MDNR and U. S. Steel are met.

### 1.3.4 Regulatory approvals needed

A Minnesota Environmental Assessment Worksheet (EAW) may be required. According to Minnesota Rules 4410.4300 Mandatory EAW Categories (Subp. 26). An EAW is required for “[D]iversion, realignment or channelization of any trout stream, or affecting greater than 500 feet of natural watercourse with a total drainage area of 10 or more square miles ...”. The proposed project is expected to change approximately one acre of Spider Creek, which is considered a Public Water. However, the project is meant to restore functions to the stream and, therefore, is not expected to have adverse environmental effects.

The permits listed below are expected to be required and will be obtained prior to construction. Preparation and submittal of permit applications will be completed upon approval of this mitigation plan from the MPCA and USACE.

- The project is expected to be exempt or qualify as “No Loss” under the Minnesota Wetland Conservation Act (WCA) administered by St. Louis County. An application for approval of the exemption of “No Loss” determination would be submitted.
- Work in Public Waters permit administered by the MDNR.
- National Pollution Discharge Elimination System (NPDES) Construction Stormwater Permit.

---

## 2.0 Impacts Stream—Parkville Creek

The proposed Extension project will impact 3,697 linear feet of Parkville Creek. This section contains available information regarding the existing stream excerpted from the *2013 Draft Parkville Creek Stream Geomorphology and Aquatic Biota Assessment* (Barr, 2013).

### 2.1 Geomorphology

On September 18, 2012, Barr surveyed three cross sections, including two riffles and one pool, on Parkville Creek and generally characterized the channel. Parkville Creek is listed as a first-order perennial stream on the National Hydrography Dataset. Barr staff surveyed a reach with stable meander patterns and pool-riffle sequences. Though this reach is outside of the proposed Extension project area, it was selected as it was more representative of the creek as a whole and exhibited clear, stable meander patterns and riffle-pool sequences. The collected data were entered into a Mecklenburg Reference Reach spreadsheet (Mecklenburg, 2004), summarized, and the critical bankfull channel dimensions and characteristics were determined. The summary data are presented in Table 2-1 and described below.

Within the study reach, the Parkville Creek channel bottom is primarily comprised of gravel and sand. The channel is slightly entrenched and has a high width-depth ratio. According to the Rosgen stream classification method (Rosgen, 1996) it is classified as a Type "C" stream, which typically have a wide, shallow channel and well-developed floodplain, located in broad, gently sloped valleys. Type C streams have gentle channel gradients; Parkville Creek has a channel slope of 0.94%. Type C streams composed of gravel and sand are typically sensitive to stream flow disturbances, but tend to recover well once instability problems are corrected. Although Type C streams have very high erosion potential, only minimal levels of bank erosion were observed in the field, likely because the banks are well vegetated.

Table 2-1 2012 Baseline Conditions in Parkville Creek

Measured Parameter	2012 Result
Bankfull Cross Section Area (ft <sup>2</sup> )	7.2
Bankfull flow (cfs)	2.1
Width-Depth ratio	26.4
Entrenchment ratio	4.5
Channel slope (%)	0.94%
Water surface slope (%)	1.3%
Sediment D <sub>16</sub> (mm)	0.062
Sediment D <sub>50</sub> (mm)	6.9
Sediment D <sub>84</sub> (mm)	86
Sinuosity	1.2
Rosgen Classification (Rosgen, 1996)	C
Data collected from outside steam impact area, downstream of wetland complex	

## 2.2 Biology

Barr performed aquatic biota surveys at one reach of Parkville Creek. The fish survey was conducted on August 21, 2012, and the macroinvertebrate survey was conducted on September 20, 2012.

### 2.2.1 Fish Survey Results

The fish community sampled in Parkville Creek on August 21, 2012, consisted of 77 individuals representing five taxa, as shown in Table 2-2. The observed taxa were compared to the MPCA's tolerance ratings for fish taxa (MPCA, 2012f). The tolerance rating represents the taxa's sensitivity to stressors. One of the taxa observed, the mottled sculpin (*Cottus bairdii*), has a tolerance rating of sensitive (intolerant); the other four taxa are rated as tolerant or very tolerant.

Table 2-2 Parkville Creek Fish Community

Common Name	Tolerance	Number	Length range (mm)	Total Weight (g)
White sucker ( <i>Catostomus commersonii</i> )	Tolerant	2	45-100	10
Creek chub ( <i>Semolitus atromaculatus</i> )	Tolerant	1	120	15
Brook stickleback ( <i>Culaea inconstans</i> )	Tolerant	48	34-50	53
Fathead minnow ( <i>Pemephales promelas</i> )	Very Tolerant	3	40-60	5
Mottled sculpin ( <i>Cottus bairdii</i> )	Sensitive	23	75-100	151
Summary				
Taxa Richness (number of species)		5		
Sensitive Taxa (number of species)		1		
Sensitive Individuals (%)		30%		
Number of Tolerant and Very Tolerant Taxa		4		
Tolerant Individuals (%)		70%		

### 2.2.2 Macroinvertebrate Survey Results

Habitat within the aquatic biota survey reach consisted of rock riffles, overhanging vegetation, and woody debris. A total of 20 sampling efforts were spread across the three habitat types: 7 sampling efforts of rock riffles, 7 sampling efforts of overhanging vegetation, and 6 sampling efforts of woody debris. The macroinvertebrate community sampled on September 20, 2012, included 72 individuals representing 19 taxa (Table 2-3). The observed taxa were compared to the MPCA's macroinvertebrate tolerance ratings (MPCA, 2012b), as shown in Table 2-3. The tolerance rating represents the taxa's sensitivity to stressors.

One sensitive (intolerant) taxon was identified within the order Trichoptera (caddisflies). Ten of the observed taxa are considered tolerant or very tolerant. The tolerance ratings of the remaining 8 taxa are unknown or are not rated. The majority (67%) of the individuals belonged to the insect order Diptera (flies) including 48 individuals from 9 separate genera. The second most numerous insect order was Coleoptera (beetles), with 7 individuals representing a single genus. The remaining insects included a single individual from the order Plecoptera (stoneflies), and two individuals representing two separate genera of the order Trichoptera (caddisflies). Insects represented 81 percent of all individuals collected. The remaining 19 percent of organisms collected consisted of aquatic worms, snails, and slugs.

Table 2-3 Parkville Creek Macroinvertebrate Community

Phylum or Class	Order	Genus	MPCA Tolerance Rating	Number of Specimens
Insecta	Coleoptera	<i>Optioservus</i>	unknown	7
	Diptera	<i>Dicrotendipes</i>	very tolerant	1
		<i>Micropsectra</i>	tolerant	16
		<i>Cricotopus</i>	very tolerant	6
		<i>Eukiefferiella</i>	unknown	1
		<i>Limnophyes</i>	very tolerant	2
		<i>Bezzia/Palpomyia</i>	tolerant	6
		<i>Pericoma/Telmatoscopus</i>	tolerant	6
		<i>Tipula</i>	tolerant	1
		<i>Dicranota</i>	unknown	9
	Plecoptera	<i>Amphinemura</i>	unknown	1
	Trichoptera	<i>Glossosoma</i>	intolerant	1
		<i>Limnephilus</i>	unknown	1
Annelida	Oligochaeta	<i>Aquatic earthworm</i>	tolerant	4
	Arhynchobdellia	<i>Erpobdella</i>	unknown	1
Mollusca	Gastropoda	<i>Aplexa</i>	very tolerant	1
		<i>Pseudosuccinea</i>	very tolerant	5
		Undetermined slug	tolerant	3
<b>Summary</b>				
Total Specimens				72
Taxa Richness (number of genus)				19
Intolerant Taxa (number of genus)				1
Tolerant Taxa (number of genus)				6
Very Tolerant Taxa (number of genus)				5
% Ephemeroptera, Plecoptera, and Trichoptera (%EPT)				4.2%
% EPT and Odonata (%EPTO)				4.2%
% Insects				81%
% Non-insects				19%

### 2.2.3 Habitat Assessment

The MPCA habitat assessment worksheets were completed for the aquatic biota survey reach. The habitat assessment worksheets are part of the MPCA's stream habitat assessment protocol (MPCA, 2012a). Parkville Creek received an overall stream habitat assessment score of 60.5 out of 100 possible points. The relatively low score is due to surrounding urban/industrial (mine and roads) uses, sparse vegetation cover for fish and limited substrate types to provide diverse fish and macroinvertebrate habitats.



## 2.3 Water Chemistry

Water quality measurements were collected during fish and macroinvertebrate surveys. A water quality probe measured field parameters from September 20 to October 8, 2012 (Barr, 2013). Water chemistry field parameter measurements and results of laboratory analyses of water samples are included in Table 2-4. The minimum, maximum, mean, and standard deviation of data from the water quality probe measured from September 20 through October 8, 2012, are summarized in Table 2-5.

Table 2-4 Parkville Creek Laboratory Analyses and Field Parameter Measurement Results

	Date and Time of Measurement Collection		
	8/21/2012 14:12	9/20/2012 16:00	10/8/2012 14:30
<b>Laboratory Analytical</b>			
Ammonia (mg/L N)	NM	0.24	0.21
Nitrate + Nitrite (mg/L N)	NM	5.1	1.8
Total Phosphorus (mg/L P)	NM	0.015	0.017
Total Suspended Solids (mg/L)	NM	< 5.0	4.5 J
Volatile Suspended Solids (mg/L)	NM	< 5.0	4.0 J
<b>Field Measurements</b>			
Temperature (°C)	13.9	10.0	7.5
Dissolved Oxygen (mg/L)	8.6	7.8	9.1
pH	6.80	7.82	7.65
Specific Conductance (µS/cm)	1,511	1,460	1,455
Turbidity (NTU)	4.0	0.80	NM
Flow (cubic feet per second)	0.82	3.6	3.7
<b>Notes:</b> < 5.0 – Value is less than the method detection limit. 4.5 J – Detected but below the Method Reporting Limit; therefore, result is an estimated concentration. NM – Not measured Data collected from within impact area, near County State Aid Highway 102			

Table 2-5 Minimum, Maximum, and Mean of Field parameters Measured at 15-minute Intervals in Parkville Creek, 9/20/12 through 10/8/12

Field Parameter	Minimum	Maximum	Mean	Standard Deviation
Temperature (°C)	5.2	11.0	8.4	1.4
Dissolved Oxygen (mg/L)	7.1	11.2	8.3	0.7
pH	7.71	7.98	7.82	0.03
Specific Conductance (µS/cm)	1,175	1,573	1,469	73

---

## 2.4 Hydrology

Stream flow measurements were also collected during Barr's fish and macroinvertebrate surveys, and are shown above in Table 2-4. Parkville Creek receives nearly all of its water flow from an artificial source, mine water pumping operations. It is reasonable to consider that, if mine water pumping operations stopped, Parkville Creek would also cease to exist as a perennial stream.

### 2.4.1 Connectivity

Parkville Creek historically had a drainage area of approximately 4.1 square miles. As mine operations and other development actions in the region increased, Parkville Creek has become disconnected from its natural watershed. Based on an analysis completed in 2012 (Liesch Associates, Inc., 2012), 3.8 square miles (99%) of the historical watershed had been eliminated before the proposed mine extension. Water flow in Parkville Creek has been maintained by mine pit dewatering, which will continue after mining impacts to the creek.

Mine Pit discharge from the Prindle Sump (SD004) into the remaining segment of Parkville Creek is expected to result in an overall incremental increase in volume as the surface area of the mine increases, thereby increasing surface water flow in Parkville Creek. However, the incremental flow increases would be lost within the normal fluctuation in discharge as pumping rates are varied to match local meteorological events and runoff. Current limits within Minntac's water appropriation and National Pollutant Discharge Elimination System and State Disposal System (NPDES/SDS) discharge permits allow significantly more mine dewatering discharge than what is pumped on an average basis to provide for unusually large precipitation events. Any increases are expected to be within the volumes allowed by the MDNR water appropriations permits and the discharge rates described by the NPDES/SDS permit for Minntac's mining area. Furthermore, increases in surface water flow as a result of these incremental dewatering increases would not be expected to be significant relative to current conditions for the reasons provided above. Increased dewatering rates are not expected to be sufficient to alter in-stream habitat or the composition of a small stream fishery that may be present.

In-pit stockpiling will continue to be utilized as much as possible. In-pit disposal of mine waste materials will continue to be maximized to limit the overall mining area footprint. Increased in-pit disposal may result in dewatering discharges with elevated concentrations of certain dissolved constituents (e.g., sulfate, hardness, alkalinity, chloride). This could result in an increase of these constituents in downstream receiving waters, with concentrations decreasing with distance from the point of discharge. Levels of these constituents in mine pit dewatering discharges will be taken into account in future NPDES/SDS permitting. It is expected that the incremental impact of the increased pit dewatering discharges and stream loss on the water quality of the remaining segment of Parkville Creek will be negligible.

## 2.5 Impaired Waters

The nearest impaired water downstream from the impacted segment of Parkville Creek is the West Two Rivers Reservoir, located approximately 3.8 miles downstream. According to the MPCA's 2012 Impaired

---

Waters List, the West Two Rivers Reservoir is impaired for nutrients/eutrophication and mercury in fish tissue (MPCA, 2012c)

Discharges from the Prindle Sump (SD004) into Parkville Creek have been monitored for mercury on a quarterly basis over the past several years, as per requirements of NPDES/SDS Permit MN0052493. Mercury discharges through SD004 are consistently at or below the Great Lakes standard of 1.3 ng/L. U. S. Steel will continue to comply with NPDES/SDS requirements and will update their permit, as needed, for the Mine Extension project. Changes to volume and/or chemistry of the discharge from the Prindle Sump are not expected to significantly increase the concentration of mercury in the West Two Rivers Reservoir.

The discharge from the mine extension into the remaining segment of Parkville Creek is not expected to increase nutrients or eutrophication in the West Two River Reservoir since the nutrient concentration in the discharge water is negligible and is not expected to be changed.

---

## 3.0 Spider Creek Characterization

The stream mitigation site is located near Alborn, Minnesota (St. Louis County) (Figure 1). A restoration project is proposed entirely on Spider Creek, which is located within the St. Louis River Watershed (8-digit HUC Code 04010201, major watershed #3) and within the Great Lakes Drainage Basin. Spider Creek is a second order perennial stream, with only small perennial tributaries feeding the channelized segment. The creek is a tributary of the Little Whiteface River, located in St. Louis County, Minnesota.

Two reaches of Spider Creek have been surveyed and characterized using the Level I and Level II Rosgen stream assessment methodologies (Barr, 2015a, b, c): a channelized reach that is proposed for restoration and a reach that appears to have a natural meander pattern that is proposed as a reference reach (Reference Reach #1 – Spider Creek). Most of the data and information provided below, including the existing data for stream biology, water chemistry, and watershed conditions apply to the Spider Creek channelized and reference reaches. Additional information on the reach proposed for restoration is provided in Section 4.0 and additional information about the reference reach is provided in [Section 5.0](#).

### 3.1 Restoration and Reference Reach Differences

The proposed restoration reach begins in Section 24, Township 52 North, Range 19 West (Figure 3), at approximate station 95+00 downstream (westerly) of County Road 166 (CR166) and ends at approximate station 117+00. This channelized reach identified above within the surveyed area was selected for restoration because it is adjacent to the upstream unchannelized reach and is the segment that had the least channel incision. The channelized reach proposed for restoration is confined along the south side of CR 167 without a direct connection to the majority of the natural floodplain, which primarily lies on the opposite (north) side of the road. The reach is confined between the road (CR167) on the north side and a spoil berm on the south side, creating an entrenched channel, disconnected from its floodplain and unable to form a natural meandering pattern. (Barr 2015a)

Reference Reach #1 – Spider Creek begins in Section 19, Township 52 North, Range 18 West (Figure 4, Figure 5), just upstream (southeast) of the restoration reach. This reach begins at approximate station 71+00 upstream (easterly) of County Road 166 (CR166) and ends at approximate station 78+00. This reference reach was selected due to its proximity to the restoration reach and the similar watershed and flow characteristics. The reference reach appears to have a natural meander pattern with connection to a natural floodplain. In order to verify bankfull dimensions and applicability of this portion of Spider Creek as a reference reach, additional reference reaches from nearby watersheds were also evaluated. The additional reference reaches are characterized in Section 5.0.

### 3.2 Drainage Area and Stream Hydrology

Spider Creek is located within the Spider Creek watershed (MDNR Level 7 Minor Watershed #3036) and the St. Louis River major watershed (#3). The creek begins approximately 4 miles to the east of the channelized segment in a wetland complex associated with Muskrat Lake near the town of Alborn,

---

Minnesota, and flows north and west to the Little Whiteface River, a tributary of the St. Louis River (Figure 1). The drainage area of Spider Creek to the proposed restoration reach encompasses 15.6 square miles. Stream and watershed delineations were derived from 2012 LiDAR, using an ArcGIS tool that calculates flow direction and flow accumulation based on Digital Elevation Model (DEM) elevations as well as defined contributing channel sizes. The tool creates a stream network that allows the user to select a “pour point” and determine which streams and associated watersheds contribute flow to that point.

The majority of this drainage area is forested rolling hills and wetlands. Most of the drainage area is undeveloped and undisturbed by human activity other than logging, some pastures or hay fields with ditching, and a few roads through the area. About a quarter of the watershed was historically ditched, presumably for farming purposes. The existing immediate floodplain along Spider Creek is low-gradient, consisting primarily of grasses and shrubs. The surrounding landscape is primarily forested wetland with some homes and small farms (Figure 6). The land in the area is primarily tax-forfeit properties that are managed by the MDNR.

### 3.2.1 Stream Flow Data

Currently, there are limited flow data available for Spider Creek. One flow measurement was completed August 19, 1998, as part of a biological condition assessment of Spider Creek conducted by the MPCA approximately 2 miles downstream of the project reach; the measured discharge was 3.74 ft<sup>3</sup>/s. The flow rate of the channelized reach and Reference Reach #1 within Spider Creek was measured by Barr in May, August, and September 2015. The channelized reach flow rate ranged from 1 ft<sup>3</sup>/s in August to 13.4 ft<sup>3</sup>/s in September. The measured reference reach (78+00) flow rate ranged between 1.1 ft<sup>3</sup>/s in August and 3 ft<sup>3</sup>/s in May. The lowest flow measurement for both reaches was measured in August and likely approximates baseflow conditions.

Flow data from the Swan River Gage, located about 13.5 miles northwesterly of the project site, also indicates low-flow conditions in August; it is likely that Spider Creek would show low flow in a similar timeframe. A summary of measured flow data is shown in Table 3-1. Since the flow measurements in Table 3-1 were not taken during the cross section measurements, the water surface elevation is assumed to be equal to the elevation of the thalweg during the survey plus the deepest depth recorded during the flow measurement. The calculations of water surface elevations (WSE) and their corresponding flow rates are summarized in the table below.

Table 3-1 Flow Data Summary

Station	5-6-15		8-6-2015		9-18-2015	
	Q, cfs	Estimated WSE, ft	Q, cfs	Estimated WSE, ft	Q, cfs	Estimated WSE, ft
110+50 (channelized reach)	--	--	0.95	1271.2	13.4	1272.7
78+00 (reference reach)	3.01	1276.1	1.13	1275.8	--	--

U. S. Steel’s proposed project would mitigate the impacts of mining in a stream within the same major watershed (St. Louis River Watershed), but not in the immediate minor watershed of the impacted stream (Parkville Creek in the West Two River Watershed). Should there be the need to conduct a connectivity assessment following restoration activities; U. S. Steel will conduct one. However, because no land use or watershed area changes will result from the project, it is not clear what useful information such an assessment would provide.

### 3.3 Geology and Soils

The bedrock geology in the area is mapped as the early proterozoic Animikie Group, where the primary rocks are shale and siltstone (Morey and Meints, 2000). The depth to bedrock is approximately 150 to 200 feet along this reach of Spider Creek (Minnesota Geological Survey, 2012). The glacial deposits in the area are mapped as lake-modified till of the Des Moines Lobe, specifically associated with the Culver moraine. The stream flows, generally, within an old outwash channel, typically composed of unsorted coarser materials (Figure 7) (Hobbs and Goebel, 1982).

Soils along the creek channel, within the floodplain, are mapped as Bowstring and Fluvaquents, loamy, 0 to 2 percent slopes, frequently flooded. Adjacent to the floodplain, soils are mapped predominantly as Dinham-Dusler complex, 1 to 8 percent slopes, Melrude-Schilser-Baden, depressional, complex, 0 to 2 percent slopes, Schisler-Ellsburg-Baden, depressional, complex, 0 to 2 percent slopes, and Hellwig-Ellsburg-Baden, depressional, complex, 0 to 2 percent slopes (Natural Resources Conservation Service [NRCS], 2015).

### 3.4 Biology

#### 3.4.1 Fisheries

Spider Creek was considered a designated trout stream until 2008, when the MDNR de-listed it. The MPCA is proposing to reclassify Spider Creek as a Class 2B (warm water/cool water) stream (MPCA, 2014).

It is currently classified as a Class 2A (cold water) stream. Fish surveys were conducted in 1998 and 2009 by the MPCA, approximately 2 miles downstream from the project location (Figure 1). Those surveys revealed gamefish, such as the burbot, northern pike, and white sucker (Table 3-2). The Fish Index of Biological Integrity (IBI) scores for the MPCA biological assessment efforts were 80 in 1998, 69 in June 2009, and 71 in July 2009 (Table 3-2).

**Table 3-2 Spider Creek Fish Data—1998 and 2009**

<b>Species</b>	<b>Spider Creek 1998 Count</b>	<b>Spider Creek 2009 Count</b>	<b>Spider Creek 2009 (2<sup>nd</sup> Visit) Count</b>
Black Bullhead	0	1	0
Blacknose Shiner	0	0	1
Bluegill	10	0	0
Brassy Minnow	0	1	0
Burbot	2	8	0
Central Mudminnow	3	4	6
Common Shiner	0	3	0
Creek Chub	0	5	3
Johnny Darter	12	11	10
Longnose Dace	57	23	15
Mottled Sculpin	22	15	14
Northern Pike	1	0	0
Northern Redbelly Dace	0	0	2
Trout-Perch	3	0	0
White Sucker	3	0	30
Fish IBI	80	69	71
Data from MPCA, 2015a.			

Barr completed a fish community sampling within the proposed restoration reach and reference reach in August 2015; the results will be summarized and presented separately.

### 3.4.2 Macroinvertebrates

As part of the biological criteria development by the MPCA, macroinvertebrate data were also collected during the 1998 and 2009 monitoring. The macroinvertebrate IBI scores for the MPCA biological condition assessment efforts were 91 in 1998 and 66 in 2009, as shown in Table 3-3.

Table 3-3 Spider Creek MPCA Invertebrate Data—1998 and 2009

Species	1998 Presence	2009 Presence
Balloon Flies	Yes	Yes
Biddies	Yes	Yes
Biting Midges	Yes	Yes
Black Flies	Yes	Yes
Broad-Winged Damselflies	Yes	Yes
Caddisflies	Yes	Yes
Chiggers	Yes	Yes
Circular-Seamed Flies	Yes	Yes
Clubtails	Yes	Yes
Common Stoneflies	Yes	Yes
Crane Flies	Yes	Yes
Darners	Yes	Yes
Dobsonflies	Yes	Yes
Electric Light Bugs	Yes	Yes
Finger-Net Caddisflies	Yes	Yes
Fingernail Clam	Yes	Yes
Flatworms	Yes	Yes
Gastropods	Yes	Yes
Giant Stoneflies	Yes	Yes
Green-Eyed Skimmers	Yes	Yes
Long-Horn Caddisflies	Yes	Yes
Mayflies	Yes	Yes
Micro-Caddisflies	Yes	Yes
Midges	Yes	Yes
Net-Spinning Caddisflies	Yes	Yes
Northern Caddisflies	No	Yes
Oligochaeta	Yes	Yes
Perlodid Stoneflies	Yes	Yes
Primitive Caddisflies	Yes	Yes
Riffle Beetles	Yes	Yes
Stoneflies	Yes	Yes
<i>Thienemannimyia</i> Gr.	Yes	Yes
Trumpet-Net Caddisflies	Yes	Yes
<b>Invertebrate IBI</b>	<b>91</b>	<b>66</b>
Data from MPCA, 2015a.		



---

Barr collected macroinvertebrate data in 2015 within both the channelized reach and the reference reach within Spider Creek. Data will be summarized and provided separately.

### 3.5 Habitat Assessments

Barr completed an assessment of the stream habitat within the project area in 2015 when the invertebrate sampling was completed. Results of the assessment will be summarized and provided separately. A similar assessment will be conducted after restoration activities are complete to document habitat change.

### 3.6 Water Temperature, Chemistry and Classification

In a draft document from January 2014, the MPCA (2014) proposed re-classifying the aquatic life use of Spider Creek and its tributaries to a warm water/cool water community (Class 2B) instead of a cold-water community (Class 2A). According to the MPCA (2014), the MDNR de-listed Spider Creek as a trout stream in 2008 for two main reasons: (1) three years (2003-2005) of temperature logger data indicate that it was not able to support a cold water fish assemblage; and (2) since its designation in the 1960's there has been no evidence of trout ever reproducing or having any return from stocking efforts. Data collected by the MPCA in 2009 echo the MDNR's sampling data, with no trout identified in any visits from 1947 to 2009. Based upon this information MPCA proposes to remove the Class 1B (domestic consumption with appropriate disinfection or equivalent), 2A (supports a cold water fishery), and 3B (industrial uses with a moderate degree of treatment) classifications assigned to Spider Creek. The MPCA's new classifications will be Class 2B (warm water/cool water fishery) and 3C (industrial cooling and materials transport without a high degree of treatment); such uses are typically assigned to non-trout waters.

The water chemistry in Spider Creek was sampled in 1998 and 2009 by the MPCA (2015) as a monitoring site for a Biological Criteria Development used to develop indices of biological integrity. Water chemistry parameters are depicted in Table 3-4. The monitoring site is located approximately 2 miles downstream of the proposed restoration project area (Figure 1).

Table 3-4 Spider Creek Water Chemistry, Downstream of Channelized Reach—1998 and 2009

Parameter	8/19/1998	6/11/2009	7/2/2009
Temperature (°C)	18.7	15.6	15.1
Flow (cfs)	3.74	NA	NA
pH	8.23	7.86	7.62
Specific Conductance (µmhos/cm)	373.6	215.1	271
Field Turbidity (NTU)	3.1	NA	NA
Dissolved Oxygen (mg/L)	7.8	8.93	7.62
Nitrate + Nitrite (mg/L N)	<0.05	<0.05	<0.05
Total Phosphorus (mg/L)	0.051	0.071	0.124
Total Suspended Solids (mg/L)	11	5.5	14.4
Total Volatile Suspended Solids (mg/L)	NA	NA	NA
Ammonia (mg/L N)	<0.02	<0.1	<0.1
<b>Notes</b> NA - Not Available <x.xx - Result was below indicated reporting limit. Data from MPCA, 2015a.			

Barr collected water temperature and chemistry data during the summer of 2015 within Spider Creek. These data will be summarized and provided separately.

### 3.7 Impaired Waters

Spider Creek flows into the Whiteface River, which is impaired for Mercury in Fish Tissue. Spider Creek is not listed as an impaired waterbody. The Whiteface River flows into the St. Louis River, portions of which are listed as impaired for DDT, dieldrin, mercury in fish tissue, mercury in the water column, PCB in fish tissue, and PCB in the water column. (MPCA, 2015d)

## 4.0 Restoration (Channelized) Reach Characteristics

The proposed restoration (channelized) reach of Spider Creek is visibly straightened, as shown in aerial photographs, and the disconnected floodplain to the north contains remnants of the historically meandering channel (Figure 2). These historical channel remnants are visible in aerial photographs dating from 1940 (earlier aerial photography was not available) and from the ground. The earthen banks that constrain the channel in the channelized reach are steep and likely consist of spoil piles from when the

creek was originally straightened. These banks are approximately 8-10 feet above the water surface in many portions of the channelized reach and approximately 3-5 feet higher than the adjacent landscape. Steep slopes of the spoil piles have confined the creek and disconnected it from the original floodplain. These banks are actively eroding and are undercut, particularly along the outside of bends. (Barr, 2015a)

The sinuosity of the channelized reach is estimated at 1.09, indicating that the channel is very straight, highly altered from the expected natural state. The channel is also entrenched; tributaries flowing into Spider Creek were observed to be at least a foot higher than the current channel water surface elevation. Many of these tributary channels appeared to be actively eroding and/or headcutting near the ditched channel. (Barr, 2015a)

**Table 4-1 Spider Creek Channelized Reach Rosgen Natural Channel Design Parameters**

Measured Parameter	2015 Result
Bankfull Cross Section Area (ft <sup>2</sup> )	38.06
Bankfull flow (cfs)	130
Width-Depth ratio	9.88
Entrenchment ratio	1.67
Channel slope (%)	0.11%
Water surface slope (%)	0.11%
Sediment D <sub>16</sub> (mm)	0.09
Sediment D <sub>50</sub> (mm)	0.54
Sediment D <sub>84</sub> (mm)	6.85
Sinuosity	1.09
Rosgen Classification (Rosgen, 1996)	B5 <sub>c</sub>

## 4.1 Site Constraints

### 4.1.1 Roads and Culverts

There is an existing county road (CR 167) along the north side of the ditched channel, which will provide good construction access but limits the location of the restored channel and floodplain connections. The ditched channel crosses beneath two roads near the reach proposed for restoration. At the upstream end of the proposed restoration reach, there are two 6-foot diameter corrugated metal culverts running east to west beneath CR 166, just south of the intersection with CR 167. An existing 8-foot-high bottomless arch culvert is located near the proposed downstream end of the restoration beneath an existing driveway. New culverts are proposed beneath CR 167 to facilitate the re-meandering of the stream on the north side of CR 167. The culverts will be sized using the Federal Highway Administration’s (FHWA) Hydraulic Engineering Circular No. 26, Culvert Design for Aquatic Organism Passage. The design will

---

include maintaining at least the bankfull width through the main culvert, natural stream substrate through the culvert, and installing additional culvert(s) to facilitate floodplain connections.

#### **4.1.2 Construction Access**

Access for construction will likely be constrained by soft soils along the creek making late summer or winter construction the most suitable times, when soils are driest or frozen. The county roads will be used for access to the degree possible without damaging the roads and while minimizing access restrictions for the neighboring landowners and for people accessing public land for hunting or other recreation.

### **4.2 Project Area Existing Conditions**

The area surrounding Spider Creek has been logged and used for some agriculture in the past, mostly pasture and hay land. A review of historical aerial photos indicates that the project reach of Spider Creek was first channelized prior to 1940. The reach between the project site and the Whiteface River has been ditched to some degree for approximately half of its length to its confluence with the Whiteface River.

Agricultural use of this area has been mostly eliminated, and the surrounding area is primarily used for recreation (hunting) and logging. This area is unlikely to be further developed.

### **4.3 Geomorphology**

Spider Creek is a second order perennial stream throughout the proposed project area. Based on topographic data and field observations, it is estimated that the valley type varies between Unconfined Lacustrine (U-LA-LD) and Unconfined Alluvial Fluvial (U-AL-FL). The drainage system is generally wide and low-gradient. (Rosgen, 2014, Barr, 2015a)

A Natural Channel Design Level II (Rosgen, 1996) stream assessment was conducted on the Spider Creek restoration area (Barr, 2015b and c). The stream has been classified as a B5<sub>C</sub>, with accelerated bank erosion and channel incision occurring through the reach.

---

## 5.0 Reference Streams

Multiple reference reaches have been selected to help determine design parameters for the restoration reach in Spider Creek. The first reference reach selected was a portion of Spider Creek just upstream of the restoration (Reference Reach #1 – Spider Creek). In order to verify that this was an appropriate reference reach, additional reaches were evaluated to help determine the design parameters, including cross-section dimensions, planform pattern and longitudinal profile.

### 5.1 Reference Reach #1 – Spider Creek

Upstream of CR 166, Spider Creek is not channelized and is in a relatively stable state, with very little evidence of bank erosion or stream incision. A modified Pfankuch stability assessment (Rosgen, 2006) indicates that the stream is in good condition, with a rating of 72 (Table 5-1). This reach is in a similar landscape position to the restoration reach; it is located within a broad, level valley with adjacent floodplain wetlands. The wetlands are primarily vegetated with grasses and sedges with some shrubs; the edge of the wetlands is forested. A location map with cross-section locations of Reference Reach #1 – Spider Creek is included in Figure 5.

The valley type of Reference Reach #1 – Spider Creek upstream of CR166 is similar to the proposed project area, and serves as a good reference for planform dimensions for the new restored channel. Thus, the approximate 1,400-linear foot section of Spider Creek will be used as the planform reference reach, located between stations 64+00 and 78+00 (Figure 5).

Design parameters associated with bankfull width and depth were measured and determined to be within an acceptable range of expected dimensions based on the Eastern Minnesota Regional Curve (Rosgen, 2014) and additional reference reaches, as described in Section 5.2. The Eastern Minnesota Regional Curve was developed by MDNR using information from measured streams in eastern Minnesota to relate bankfull dimensions to streamflow and watershed size. Note that although additional regional curve data is available for the Duluth area, the stream represented in the Duluth data set are high-gradient North Shore streams that are not geologically similar to Spider Creek; therefore the more general Eastern Minnesota curve has been used for this analysis. Based on this comparison to the regional curve data, this reach of Spider Creek appears to be a suitable reference reach for the restoration project.

Table 5-1 Reference Reach #1 – Spider Creek Modified Pfankuch Assessment (Rosgen, 2006)

Measured Parameter	2015 Rating Score
<b>Upper Bank Metrics</b>	
Landform Slope	1
Mass Wasting	5
Debris Jam Potential	5
Vegetative Protection	2
<b>Lower Bank Metrics</b>	
Channel Capacity	2
Bank Rock Content	7
Obstructions to Flow	1
Cutting	7
Deposition	3
<b>Channel Bottom Metrics</b>	
Rock Angularity	4
Brightness	2
Consolidation of Particles	3
Bottom Size Distribution	11
Scouring and Deposition	16
Aquatic Vegetation	3
<b>Channel Stability Evaluation</b>	
Stream Type	E4
Total Rating Score	72
Condition	Good

## 5.2 Additional Reference Streams

Additional reference reaches in the area were evaluated to verify that Reference Reach #1 – Spider Creek is not incised, which could skew the bankfull channel dimensions away from those of a stable reference stream. These reaches were selected from streams in the area that appeared to have natural meandering patterns, occurred in relatively undisturbed watersheds and had drainage areas of similar size to the Spider Creek watershed. These streams were surveyed in the field to capture several cross-sections.

Reference Reach #2 – Bear Trap Creek was surveyed at a location approximately 11 miles southeast of the project location to obtain dimensionless ratios related to geomorphic features for comparison with Reference Reach #1 – Spider Creek. Bear Trap Creek has a similar geologic setting to Spider Creek, is highly sinuous and relatively low gradient, and also has similar geology and valley type to Spider Creek. The cross-sectional area of the stream is lower than might be expected for the drainage area based on Eastern Minnesota Regional Curves and the additional surveyed cross-sections of nearby E-channels described below. The small cross-sectional area may be explained by a high proportion of lakes in this watershed; this tends to provide storage for precipitation and snowmelt events that can reduce the peak stream flows resulting from each discrete event.

Three additional stable E-type stream riffle cross-sections were surveyed in July 2015 within similar geologic settings to Spider Creek, to obtain additional regional reference data for confirming bankfull dimensions for the design (Figure 7, Figure 8). The streams were located within the same physiographic region as Spider Creek, with drainage areas varying between 11.7 and 32.2 mi<sup>2</sup>. Table 5-2 includes information related to these streams, as well as dimensions generated by the Eastern Minnesota Regional Curve for the same drainage areas (Rosgen, 2014).

**Table 5-2 Reference Stream Bankfull Cross-Sectional Areas**

<b>Reference Stream</b>	<b>Drainage Area (square miles)</b>	<b>Measured Cross-Sectional Area (square feet)</b>	<b>Eastern Minnesota Regional Curve Cross-Sectional Area for Listed Drainage Area (square feet)</b>
Reference Reach #1- Spider Creek	13.2	38.7	32.7
Reference Reach #2 – Bear Trap Creek	20.4	31.7	44.5
Reference Reach #3 Unnamed Creek – Hwy 5	11.7	30.5	30.1
Reference Reach #4 - Hellwig Creek	22.6	49.4	47.8
Reference Reach #5- Bug Creek	32.2	74.6	61.4

### 5.3 Description

The reference reaches described above were evaluated and classified as part of the restoration design process. Both Reference Reach #1 – Spider Creek and Reference Reach #2 – Bear Trap Creek were

evaluated using the full Rosgen Level II assessment. The reference cross-sections were measured at riffles to obtain bankfull dimensions. Slightly entrenched streams with high sinuosity and low gradients are generally classified as C or E types. The main differentiator between the two stream types is the ratio of bankfull width to bankfull mean depth (W/D). Streams with W/D ratios greater than 12 are classified as C channels, and W/D ratios less than 12 indicate E channels. Four of the five reference streams were classified as Type E channels, with W/D ratios ranging from 6.9 to 9.7.

The Bear Trap Creek reference stream has a width/depth (W/D) ratio between 13.2 and 21.7, which means it can be classified as a Type C channel. Pebble counts completed on the Bear Trap Creek and Spider Creek reference reaches further classified as the streams as C5 (sand-bed) and E4 (gravel-bed) channels, respectively. In an undisturbed state, E-channels contain a consistent series of riffle/pool reaches, resulting in more pool areas than other channel types. The Spider Creek reference channel classification was determined to be consistent with the historical condition of the stream mitigation reach. (Barr, 2015b and 2015c)

**Table 5-3 Rosgen Natural Channel Design Classification Data for Reference Streams**

	<b>Reference Reach #1 – Spider Creek</b>	<b>Reference Reach #2 – Bear Trap Creek</b>	<b>Reference Reach #3 - Unnamed Creek</b>	<b>Reference Reach #4 - Hellwig Creek</b>	<b>Reference Reach #5 - Bug Creek</b>
Bankfull Cross Section Area (ft <sup>2</sup> )	38.7	31.7	30.5	49.4	68.6
Width-Depth ratio	7.4	21.7	8.9	6.9	9.7
Entrenchment ratio	41.8	12.6	8.8	8.7	10.1
Water surface slope (%)	0.11	0.08	0.06	0.01	0.04
Sinuosity	1.4	1.8	1.5	1.8	1.6
Rosgen Classification <sup>1</sup> (Rosgen, 1996)	E4	C5c-	E	E	E

<sup>1</sup> Pebble counts were not performed at Reference Reaches 3, 4 and 5, so bed material classification was not completed.



---

Reference Reach #1 – Spider Creek and Reference Reach #2 – Bear Trap Creek are naturally meandering streams that drain through wet meadow wetland areas. The drainage area to Reference Reach #1 – Spider Creek is approximately 13.2 square miles, comprised of large wetland complexes and deciduous and coniferous forests (Figure 6). The drainage area to Reference Reach #2 – Bear Trap Creek is 20.4 square miles, comprised of agricultural land, wetland complexes, lakes, and some coniferous forests. Reference Reach #2 – Bear Trap Creek has evidence of historical beaver activity, but no active dams in or near the surveyed reaches. There is a high level of beaver activity throughout Spider Creek, and portions of the channel upstream of Reference Reach #1 – Spider Creek area have dams in various states of functionality. The Spider Creek surveyed reference reach includes one visible breached (inactive) beaver dam. The nearest intact, active beaver dam is located approximately 300 feet upstream of the surveyed reference reach.

Bankfull discharge estimates were compared in all reference reaches using MDNR-developed regional curves, USGS National Streamflow Statistics, and scaled estimates of flood frequency analyses from nearby gaged basins (Swan River and Stoney Brook) (Table 5-4). In this region, USGS regression relationships indicate hydrologic sensitivity to drainage area, area in lakes, and the amount of type A hydric soils in a basin (Lorenz et al., 2010). Comparing these additional features for each of the reference streams shows that Reference Reach #2 – Bear Trap Creek has a higher percent of the basin area in lakes (17%) compared with other reference streams (0 – 4%) and the project site (0.4%) as well as the highest fraction of soils in hydric soil class A. For this reason, we expect Reference Reach #2 – Bear Trap Creek to have a lower bankfull discharge for the same drainage area, as was seen in  $Q_{1.5}$  and  $Q_2$  estimates made with USGS regression relationships. This reduced bankfull discharge drives a much lower bankfull cross-sectional area in Reference Reach #2 than would be predicted from the Eastern Minnesota Regional Curve. Reference Reach # 5 – Bug Creek had the lowest percent of the basin area in lakes and thus had higher predicted peak flows, as well as a larger bankfull cross-sectional area for the same drainage area than was predicted by the Eastern Minnesota Regional Curve.

Table 5-4 Reference Reach Bankfull Discharge Evaluation

	<b>Drainage Area, (sq. mi.)</b>	<b>2-yr flow, scaled from Swan River gage (cfs)</b>	<b>2-yr flow, scaled from Stoney Brook gage (cfs)</b>	<b>2-yr flow, Streamstats (cfs)</b>	<b>1.5-yr flow, Streamstats (cfs)</b>	<b>Eastern Minnesota Regional Curve, Bankfull Q (cfs)</b>
Reference Reach #1 - Spider Creek	13.2	111.8	60.1	211	156	77.3
Reference Reach #2 - Bear Trap Creek	20.4	177.8	92.8	81	67	112.9
Reference Reach #3 - Unnamed Creek	11.7	99.1	53.2	103	80	69.6
Reference Reach #4 - Helwig Creek	22.6	191.4	102.8	192	149	123.5
Reference Reach #5 - Bug Creek	32.2	271.9	146.1	414	308	168

Barr collected fish, macroinvertebrate, water temperature, and water chemistry data in the Spider Creek reference reach during the summer of 2015. Surveys were completed separately in the channelized reach and in the Spider Creek reference reach to provide a comparison and for future monitoring purposes. These data will be summarized and provided in a separate document.

---

## 6.0 Restoration Plan

### 6.1 Restoration Objectives

The primary goals of the Spider Creek restoration include bank stabilization, restoration of a naturally-sustainable stream channel, maintenance of aquatic habitat, and restoration of the natural characteristics of the stream ecosystem, as appropriate for this landscape and watershed. Re-establishing the natural meander pattern, feature distribution, and stream connectivity to the floodplain will result in a more stable system with natural in-stream habitat. Connecting the channel to floodplain wetlands will help the system maintain a higher and more consistent base flow than the current system allows, which has extremely limited floodplain connectivity. A secondary benefit of the restoration will be increased fish, waterfowl and reptile/amphibian habitat in the floodplain and adjacent wetland communities, where the natural hydrology will be restored.

The preliminary objectives for the proposed stream restoration include the following:

1. Hydrology
  - a. Restore groundwater connectivity of the system, which will improve baseflow conditions for aquatic habitat.
  - b. Reduce peak flow velocities through more effective floodplain connectivity and reduced channel slope.
2. Geomorphology
  - a. Restore Spider Creek's historical pattern, profile, and dimension to the degree practicable; restoring a sustainable stream channel that maintains its form without aggradation or degradation, and moves its bedload during high flow events in a way that approximates its historical condition.
3. Connectivity
  - a. Reconnect the channel to the surrounding floodplain.
4. Vegetation diversity
  - a. Preserve existing floodplain vegetation and restore disturbed areas with diverse native vegetation.
5. Water Quality
  - a. Reduce sediment loading by stabilizing bank erosion and vertical down-cutting.
  - b. Improve base flow conditions; potentially reduce water temperatures.
6. Biology
  - a. Maintain aquatic and floodplain habitat.
  - b. Restore the natural characteristics of the stream ecosystem, appropriate for this landscape and watershed.
  - c. Elevate groundwater levels in the reconnected floodplain to promote wetland plant communities, increase the occurrence of vernal pools and thus improve reptile and amphibian habitat value.

---

## 6.2 Development of the Restoration Plan

The proposed stream restoration plans are provided in [Appendix B](#). The restoration plans show the existing and proposed channel alignments and dimensions, locations of riffles and pools, typical cross-sections, and typical plan and profile of riffle and pool features. Additionally, cross-sections of the current and proposed channel and floodplain are included in the plans.

### 6.2.1 Historical Channel

A series of historical aerial photos were analyzed to identify the approximate historical stream position prior to channelization to determine feasibility for restoration. Historical meander scars through the project area are visible on Figure 9. A topographic survey of the site also located portions of the historical channel, in addition to the current ditched area ([Appendix B](#), Sheet C-01).

### 6.2.2 Comparisons with Stable Reference Channels

Reference Reach #1 – Spider Creek was identified upstream of the channelized section of Spider Creek and was characterized to assist with project design and monitoring success as described in [Section 5.0](#). Additionally, Reference Reach #2 – Bear Trap Creek, located approximately 11 miles southeast of the restoration site, was surveyed and characterized for dimensionless ratios associated with bankfull area. Data obtained from this reference reach are also included in [Section 5.0](#). The restoration design also relied upon USGS regional regression curves, the Eastern Minnesota Regional Curve, and cross-section data obtained from three nearby E-type channels with similar geology and valley types, described in [Section 5.0](#). Reference watershed locations are shown in [Figure 7](#) and [8](#).

#### 6.2.2.1 Detailed Topographic Survey of Reference Channels

A detailed topographic survey combined with LiDAR contours was used in characterizing Reference Reach #1 – Spider Creek and Reference Reach #2 – Bear Trap Creek. Additionally, a laser level and contours derived from LiDAR data were used to obtain cross-section information for Reference Reaches #3, #4, and #5.

#### 6.2.2.2 Pebble Counts of Existing Channel and Reference Reaches

Pebble counts were part of the stream survey during the Level 1 and Level 2 Rosgen assessments in 2014 and 2015. Two pebble counts were conducted in the existing channel, one representative count for the entire wetted cross section, and one for an active bed riffle. The representative count was conducted on May 22, 2015, and the active bed riffle count was conducted on July 19, 2015. Flow conditions in May were higher than in July, when flows approximated low-flow conditions.

Three pebble counts were conducted in Reference Reach #1 – Spider Creek; one representative count for the entire cross section, one for an active bed riffle, and one for a point bar. The representative and active bed counts were conducted on May 6, 2015 and the bar count was conducted on August 12, 2015. Flow conditions were similar in May and August.

---

Two pebble counts were conducted in Reference Reach #2 – Bear Trap Creek, one representative count for the entire wetted cross section, and one for an active bed riffle. Both counts were conducted during the survey on September 22, 2015.

Appendix E contains particle size distributions from the various pebble counts described above. The existing channel substrate is composed of mostly sand and gravel particles with some smaller material and some cobbles. In both Reference Reach #1 – Spider Creek and Reference Reach #2 – Bear Trap Creek, the substrate consists of generally smaller materials: a blend of silt and clay-sized particles in pools with some sands and gravels, with riffles having more sand and gravel and fewer fines. Substrate conditions for the new constructed channel should be similar to those obtained in the Spider Creek reference reach, immediately upstream of the project site, as stream slope and shear stresses will be similar in the new constructed channel. The Reference Reach #1 – Spider Creek stream location in a geologic setting of glacial till outwash will provide a replenishing bed material source.

### **6.2.2.3 Cross-Sections and Profiles of Existing and New Channels**

Preliminary cross-sections showing existing and proposed channel conditions are included on Sheets C-08 and C-09 and the location of the cross-sections are shown in plan view on Sheets C-02 through C-07, [Appendix B](#). The proposed channel profile is shown on Sheets C-02 through C-07, [Appendix B](#).

## **6.2.3 Proposed Restoration Design Details**

### **6.2.3.1 Detailed Design of the New Channel Including Design of Riffle and Pool Habitat Structure to Mimic Natural Channel**

The step-wise Natural Channel Design table (NRCS, 2007) was used to calculate channel design values based on reference reach dimensionless ratios and proposed bankfull design values. Bankfull design values were established through comparison of the MDNR Eastern Minnesota Regional Curve, USGS regional regression equations (Lorenz et al., 2010), five reference streams located in similar physiographic settings, as well as typical E-channel parameters. [Appendix C](#) summarizes bankfull design dimensions.

The Reference Reach #1 - Spider Creek reference reach riffle width to depth ratios ranged from 6.9 to 7.4, which is in the expected range for an E-channel. The Reference Reach #2 - Bear Trap Creek width to depth ratio ranged from 13.2 to 20.7, which is more typical of a C-channel. Assuming some existing floodplain vegetation can be maintained adjacent to the re-meandered stream channel, and the new excavated channel has a full growing season to establish vegetation before inundation, an E-channel with a riffle width-to-depth ratio of 6.9 to 7.4 is proposed. Therefore, design dimensions, pattern and profile have been obtained from the Spider Creek reference reach and not the Bear Trap Creek reference reach.

The Reference Reach #1 - Spider Creek pool width to depth ratios ranged from 7.5 to 14.6, with pool areas to riffle area ratios ranging from 1.4 to 2.0. The Reference Reach #2 – Bear Trap Creek pool area to riffle area ratios ranged from 1.4 to 2.5. Design pool dimensions are based on the Spider Creek ratios.

**Table 6-1 Design Riffle and Pool Characteristics**

Dimension	Spider Creek – Reference #1 Dimensions			Proposed Design
	Average (ft)	Minimum (ft)	Maximum (ft)	Value range (ft)
Riffle Width	16.7	16.5	17.0	16.8-17.4 (Mean: 17.1)
Riffle Mean Depth	2.33	2.28	2.38	2.34-2.43 (Mean: 2.38)
Riffle Maximum Depth	3.62	3.43	3.80	3.43-3.97 (Mean: 3.7)
Riffle to Riffle Spacing	125	65	154	67-158 (Mean: 127.8)
Pool Width	26.6	19.9	31.0	20.4-31.7 (Mean: 27.2)
Pool Mean Depth	2.37	2.13	2.66	2.18-2.72 (Mean: 2.42)
Pool Maximum Depth	4.26	4.06	4.60	4.17-4.70 (Mean: 4.35)

The riffle design was determined from the cross-sectional design area of 40.7 square feet and width to depth ratio of 7.2. The riffle to pool (or in effect, the riffle to riffle) spacing was based on the planform statistics obtained from the reference reach of Spider Creek located upstream of the project area ([Appendix C](#)). The planform characteristics include radius of curvature, meander belt width, meander length, and linear wavelength, all of which are provided in Table 6-2. The riffle to riffle spacing was then designed based on the characteristics of the natural channel of Reference Reach #2, as well as the meander pattern associated with the historical stream position on the land.

The proposed restoration meander design was developed to reestablish the historical meanders to the extent practicable along with matching the characteristics of Reference Reach #1 – Spider Creek.

**Table 6-2 Spider Creek Reference and Design Planform Characteristics**

Planform	Spider Creek Reference #1 Dimension			Proposed Spider Creek Design Value Range
	Average (ft)	Minimum (ft)	Maximum (ft)	Value Range (ft)
Radius of Curvature	66.0	16.0	286.0	16.4-292.4 (Mean: 67.5)
Meander Belt Width	88.0	17.0	195.0	17.4-199.4 (Mean: 90.0)
Meander Length	164.0	51.0	504.0	52.1-515.3 (Mean: 167.7)
Linear Wavelength	219.0	60.0	383.0	61.3-391.6 (Mean: 223.9)

### 6.2.3.2 Sediment Transport Calculations on New Channel

The bankfull flow for the proposed new channel was estimated to be approximately 130 cfs based on the USGS regional regression equation values for the 1.5-year flow event, HEC-RAS models of flows related to field-estimated channel bankfull elevations, and the Eastern Minnesota Regional Curve bankfull flow (Rosgen, 2014). Existing bankfull cross-sectional areas for the reference reach were estimated to range from 38.7 to 39.2 square feet (see [Appendix C](#) for more details). Sediment transport in the new stream should be maintained without aggradation or degradation due to the matching of its dimension, pattern, and profile to design parameters based on a well-established reference reach. Two riffle types are proposed for construction: grade-control riffles and mobile bed riffles. Grade-control riffle sections will be constructed with gravel- to cobble-sized material to withstand the shear stress created by bankfull flow and to maintain the planned channel slope. Riffles not designed especially for grade control will contain a bed that is designed to be mobile during large flow events.

### 6.2.3.3 Proposed Design Structures

One 8-ft high bottomless arch culvert currently passes flow beneath a driveway near the downstream end of the proposed project. The restoration design proposes to remove the existing arch culvert and place new box culverts at two locations along the creek to allow for re-establishment of a natural stream meander pattern. The proposed locations are shown on Sheets C-01, C-04, and C-07 ([Appendix B](#)). Culverts will be sized and designed based on Aquatic Organism Passage design principles (FHWA, 2010). In addition to the proposed box culverts, smaller floodplain culverts are being considered to allow for additional floodplain connectivity.

The culvert sizing and placement approach will ideally match the culvert width with the natural stream dimensions while maintaining sediment balance, including burying the culverts below the streambed and providing a low-flow channel for late season fish migrations (typically August to November). This approach also minimizes the need for maintenance by reducing scour and aggradation. The larger culverts would be more than adequate hydraulically for design flows, and would benefit the stability of the stream and the aquatic wildlife functions.

In addition to the two new box culverts, 1-2 smaller floodplain culverts are proposed to be placed beneath the county road at each box culvert location, as well as beneath the new county road segment proposed to be routed southerly at the western end of the restoration. These culverts will remain above water level for events lower than bankfull, but will act as floodplain connectors during large events

The meandering channel design includes the placement of toe wood, vegetated reinforced soil slopes (VRSS) and live shrub stakes along the outer banks of meander bends where the shear stress will be the greatest (see Sheets D-02 and D-03, [Appendix B](#)). The toe wood will be placed below the typical baseflow elevation to ensure that the wood will be preserved through consistent submersion. VRSS will be placed above the wood, incorporating sod mats and/or erosion control blanket secured with live shrub stakes. Toe wood material (including root wads) is proposed to be obtained from adjacent property, in coordination with property owners. Woody material collection for the project will follow the guidelines of the Minnesota Forest Resources Council (2005, Part III, pages 29-67). In addition to those guidelines, no

---

wood will be harvested within 50 feet of the proposed stream alignment and shrub cuttings collected from live plants will be limited to that which will allow for continued growth of existing shrubs.

#### 6.2.3.4 Floodplain and Existing Channel Restoration

The floodplain vegetation and contours are proposed to be maintained to the extent feasible. Additionally, some existing depressions within the floodplain will be deepened to create additional wetland areas along the stream (Sheets C-01 through C-07, [Appendix B](#)).

The existing channel is proposed to be filled in with material excavated from the new channel. The final fill design elevations will vary to mimic natural undulations in the floodplain; it is expected that lower locations will serve as temporary wetlands. Low berms will be placed periodically across the fill to route runoff away from the filled channel and prevent overland flow from concentrating at the filled area. Channel fill will be placed higher than the final design elevation to account for material settlement over time (Sheet C-08 and C-09, [Appendix B](#)).

#### 6.2.3.5 Future Watershed Characteristics

While there have been historical land use changes in the watershed, there appears to be a general trend towards a return to a more forested condition with some hay and pasture with little to no intensive agricultural practices. Therefore, it appears that the design characteristics are consistent with future land uses.

### 6.2.4 Vegetative Restoration, Erosion Control, Stabilization, and Sequencing

#### 6.2.4.1 Vegetative Restoration and Stabilization

The constructed streambank slopes will be seeded with a native seed mix, composed of species such as rice cut grass (*Leersia oryzoides*), blue joint grass (*Calamagrostis canadensis*), woolgrass (*Scirpus cypernius*) and cord grass (*Spartina pectinatus*) or similar species. Disturbed floodplain areas will also be seeded with a native wet meadow/sedge meadow seed mix. Following seeding of streambank slopes, coir erosion control blanket with natural netting will be staked in place. All disturbed areas will be seeded within 5 days of completing site work in that area, typically at the end of each week during construction.

Within the floodplain, species appropriate for a shrub-carr community will be planted throughout the disturbed floodplain. The shrubs, and a limited number of trees, may be installed from containerized plants, bare-root plants, or live cuttings and will depend on availability. The planting of the trees and shrubs will take place in the first growing season following initial construction. Shrub species selected for planting will include primarily species of willows (*Salix* spp.), red-osier dogwood (*Cornus alba*), speckled alder (*Alnus incana*), and meadowsweet (*Spiraea alba*). Tree species selected for planting may include quaking aspen (*Populus tremuloides*), tamarack (*Larix laricina*), black spruce (*Picea mariana*), and red maple (*Acer rubrum*) among others. Tree plantings will be spaced to match adjacent stand densities (approximately 200 trees/acre) and be located to maximize stream shading. Only native tree species appropriate for this area would be selected. The plants and seeds for the project will come from a source within 200 miles of the site.



### 6.2.4.2 Erosion Control and Stabilization

Construction of the project is planned to be sequenced over two years. The first phase will include excavation of the re-meandered channel on the south and north sides of the road, in addition to excavation of the new proposed off-channel wetland areas. This will occur while the existing channel remains on-line. Silt fence will be placed at the downstream edges of the construction areas to capture any sediment that may runoff during this phase of project construction and prevent it from entering the stream. Any temporary soil stockpiles that will not be utilized within 3 days of placement will be protected from erosion and sedimentation by placing silt fence around the stockpile. Constructed or modified stream banks will be stabilized by several methods depending on the location within the stream:

1. **Outside Bends** – toe wood and VRSS will be placed within some of the planned outside bends as shown on Sheets C-01 through C-07 ([Appendix B](#)).
2. **Pools** – slopes along the planned pools will be stabilized by placing sod mats, erosion control blanket and/or VRSS staked in place with live stakes as shown on Sheet D-03 ([Appendix B](#)).
3. **Grade Control Riffles** – the planned grade-control riffle sections will be lined with rock and anchored into the banks (Sheet D-01, [Appendix B](#)).
4. **Mobile Bed Riffles** – the planned mobile bed riffles will be shaped like the grade-control riffles, but will be lined with cobble and gravel designed to move during large flow events (Sheet D-01, [Appendix B](#)).

During the second phase of construction, the existing on-line channel will be filled and shaped to force stream flow into the re-meandered channel constructed in Phase One. This will occur after one full growing season, so that vegetation in the newly constructed areas can be established before being subject to shear stresses associated with stream flow. A rock riffle structure and/or sediment control stream curtains are planned in the channel at the downstream end of the project to capture sediment that may be generated during construction and limit downstream impacts. The sediment control structures will be monitored throughout the project and sediment will be cleaned out before sediment overtops the structure. Phase Two constructed or modified stream banks will be stabilized by several methods depending on the location within the stream, similar to Phase One:

5. **Outside Bends** – toe wood and VRSS will be placed as shown on Sheets C-01 through C-07 ([Appendix B](#)) within some of the planned outside bends.
6. **Pools** – slopes along the planned pools will be stabilized with seed and erosion control blanket placed during the first phase of construction, so that vegetation is well established one year later when the new channel is inundated, as shown on Sheet D-03 ([Appendix B](#)).
7. **Grade Control Riffles** – the planned grade-control riffle sections will be lined with rock, anchored into the banks ([Sheet D-01, Appendix B](#)).
8. **Mobile Bed Riffles** – the planned mobile bed riffles will be lined with cobble and gravel designed to move during large flow events (Sheet D-01, [Appendix B](#)).

The contractor will be required to obtain a NPDES construction stormwater permit for the project and to follow the requirements of that permit.

---

## 6.3 Restoration Plan Summary

The proposed Spider Creek restoration plan will utilize existing historical meanders and additional excavation to re-establish a channel alignment that is longer and more sinuous than the existing, channelized alignment. The new channel alignment is planned to have entrenchment and W/D ratios suitable for an E channel, and will be connected to existing adjacent floodplain wetlands. Some floodplain shaping is expected to achieve this connection. The preliminary restoration plan drawings are provided in [Appendix B](#).

The upstream terminus of the restoration reach is proposed to be located approximately 450 feet downstream of CR 166. The downstream terminus of the restoration reach is proposed to be approximately 80 feet downstream of where the channel passes through an existing culvert beneath CR 167.

The length of the existing channel in the restoration reach is 2,550 feet. The proposed channel length for this reach is 4,060 feet with a planned sinuosity of 1.5-1.6 (mean 1.54). Most of the additional length will be obtained by directing the restored channel to new and historical meanders that were cut off when Spider Creek was straightened. The elevation of the new stream bed will be approximately 0 to 2 feet higher than the existing stream bed elevation. The new elevation will be established and maintained by installing grade-control rock riffles within the channel at the upstream and downstream ends of the project, as well as at riffle sections throughout the re-aligned channel. The new channel will generally be approximately 17 feet wide through riffle areas, widening through pool areas.

Lateral scour pools will be constructed / established at the bends in the restored stream channel. Compound pools are common throughout Reference Reach #1 – Spider Creek, and will be incorporated in several locations throughout the new project. Pools will range from 4.2 to 4.7 feet deep on the outside of the bend rising at about a 5H:1V slope to the inside of the bend ([Appendix B](#), Sheet D-01). Details on pool profile restoration are shown on Sheets D-01 through D-03 ([Appendix B](#)). Pool edges will be stabilized with toe wood, VRSS and erosion control blanket. For construction of the pools, toe wood will be installed on the outside of the meander bends by layering wood and small branches to counteract the high shear stress in those areas. In less potentially erosive areas of new channel construction, natural sod mats obtained during construction may be utilized along with coir fiber fabric to protect new channel banks and allow for vegetation to become established, which will provide the long term protection.

Grade-control riffles will be constructed to establish the channel profile and mobile-bed riffles will provide spawning habitat. Riffle material sizing will be based on the riffle function and shear stress analysis results.

Some floodplain excavation may occur within the construction limits ([Appendix B](#), Sheet C-01). Disturbed areas of the floodplain and near bank areas will be seeded with an appropriate wetland-type state seed mix. Shrubs and possibly some trees will be planted within the floodplain and along the restored channel banks to increase shading conditions.

---

## 6.4 Construction Methods and Phases

Construction is planned to occur in two phases with monitoring and management to follow, pending any required environmental review and receipt of all required permits. The first phase is expected to begin in late 2016, and the second phase would occur after one complete growing season to allow vegetation planted during Phase One to become established in the newly constructed area. The second phase would likely begin in late 2017 or early 2018, again depending upon permitting and/or environmental review.

Both phases of construction are proposed to take place during late-season low-flow conditions; however, construction may need to occur in frozen conditions due to the wet, soft soil conditions in the project area. In general, project construction methods and sequencing will be planned to minimize the potential for erosion and downstream sedimentation to the extent practicable. Stream restoration construction will be sequenced to limit the area of open soil disturbance during construction. The construction areas will be accessed from CR 166 or CR 167 to the degree possible. The nearby areas of high ground will be utilized for equipment and material staging. The equipment employed is expected to include a tracked excavator, small dozer, and possibly a loader. The equipment will be selected by the chosen contractor with specifications that the contractor shall minimize disturbance to wetlands and other areas to the extent practicable.

The project construction limits are shown on Sheet C-01 ([Appendix B](#)). Perimeter controls are not planned for the entire construction limits, only around temporary soil storage areas. All soil storage areas will be confined within the construction limits. Any soil stockpiles left for more than three days will be seeded and ringed with silt fence. The construction will consist of excavating and re-establishing historical channel meanders, installing grade control to raise the channel elevation, constructing pool and riffle sections, and filling the old channel. Fill will be obtained by using the native, existing material removed by creating the new channel. It is expected that no off-site fill material will be needed except rock and filter materials for the construction of grade control structures and bank protection.

### 6.4.1 Construction - Phase One

Initial construction is expected to take approximately two months. The new channel will likely be constructed in late 2016, depending upon permitting and/or environmental review, and will remain offline (disconnected from stream flow) for one full growing season. Grade control stream riffles will be constructed at the upstream end of the project and downstream of the project to establish and maintain the thalweg through the project area and prevent headcutting within and upstream of the project. The new channel banks, floodplain, and all other disturbed soils will be seeded, and shrubs and trees will be planted within the floodplain.

The new stream meanders that are not coincident with the existing channel will be excavated first and maintained offline from the existing flows for at least one growing season. Soil excavated within the floodplain and for establishment of the new stream meanders will be set aside for storage and utilized to fill the existing channel to the proposed floodplain elevations.

---

All excavated soil will be stored within a nearby upland area and seeded with a quick-growing cover crop for temporary erosion control (species selection based upon season of seeding). Silt fence will be installed around the soil storage site prior to the placement of soil and the silt fence will be maintained until the area is restored to similar existing vegetative cover. The fill will be placed in the old (existing) channel after the new channel has stabilized.

Stream channel excavation and construction are planned to be completed without stream flow present during the first phase, though portions of the new channel are likely to be wet due to the high groundwater table in the area. Excavation of the new channel section will not be connected to the flowing stream until all vegetative restoration features are completed and the vegetation has one full growing season to become established. Stream reaches that are planned to be filled will not be completed until Phase Two, when the reaches can be disconnected from the active, flowing stream.

#### 6.4.2 Construction – Phase Two

Once vegetation is established in and adjacent to the new channel, the second phase of construction will take place. Phase Two will include back-filling the existing channel and connecting flow to the newly-created stream.

The overall soil excavation and fill quantities are expected to be balanced on the site. In general, excavated soils will either be utilized to fill portions of the existing channel or sod mats will be utilized in stabilizing the new streambank slopes. If excess soil is generated during the project, it will be placed in an upland location and will be seeded to stabilize the soils.

Additionally, two concrete box culverts will be installed beneath County Road 167 to allow the restored stream to follow its original meander pattern ([Appendix B](#), Sheet C-01). The culverts will be installed with inverts embedded below the proposed channel grade and will be filled with streambed material to establish a consistent streambed and maintain biological connections.

During the second phase of construction the contractor will be required to pump the flow around the active in-channel work area until all restoration and site stabilization is completed within that reach. Pumped discharges will be discharged downstream utilizing energy dissipation methods to minimize erosion in the channel. Construction work will be sequenced so that any work within the actively flowing stream will be limited to that which can be completed each day.

#### 6.5 Invasive Species Control

The floodplain within the project area is currently dominated by reed canary grass (*Phalaris arundinacea*), an invasive species. The contractor will ensure that equipment brought onto the site is cleaned prior to entering the site to prevent introducing additional non-native or invasive species. All seed and mulch used on the project will be weed free.

---

## 6.6 Construction Site Monitoring

Monitoring and management of the restored stream will be conducted for a period of up to five years following the completion of construction to demonstrate that project objectives have been met. Both the construction and monitoring schedules detailed below are tentative pending completion of required permitting and/or environmental review.

---

## 7.0 Analysis of Restoration Benefits

### 7.1 Measures of Stream Habitat

Recent studies have documented that increases in the physical complexity of fluvial ecosystems leads to increased biological richness (Allen and Castillo, 2007). In streams, the key abiotic factors that contribute to physical complexity are velocity, substrate, and temperature. Channel shape and sinuosity determine most of these abiotic factors. To a lesser degree, water chemistry contributes to habitat complexity, but more often water quality is the primary control of biotic diversity. In stream systems, the “wetted perimeter” (area of water-substrate contact) is a key ecological interface as both flora and fauna are intimately associated with the substrate. The diversity of substrate types and bathymetry in meanders provide the variety in habitat conditions for benthic invertebrates in small spatial area. These habitats are connected via hydraulic pathways. Several lines of evidence indicate that the complex hydrodynamics of meanders favor high biodiversity (Garcia *et al.*, 2012). However, relatively few comprehensive field studies that provide direct confirmation of increased biodiversity due to geomorphic changes are available (Lorenz *et al.*, 2009).

A complex interaction between channel morphology, three-dimensional flow paths, and transported sediments creates a mosaic of geomorphic units. These geomorphic units contain microhabitats with numerous combinations of depth, flow velocity, turbulence, sediment particle size, sediment turnover frequency, and availability of organic matter that can be exploited by benthic invertebrates. Invertebrate species diversity is also favored by the presence of microhabitats that can include woody debris or macrophytes found growing in the shallow parts of the meanders (Garcia *et al.*, 2012).

Re-meandering increases the variety of habitats at macro- and micro-spatial scales, all connected by complex flow pathways. The closeness of microhabitats is important for benthic invertebrates considering their small size; this allows active migration among habitats to suitable niches as necessary following small-scale habitat modification or recovery from dislodgement. These meander habitat features provide high potential for biodiversity hot spots, as well as increased biota resilience toward natural or anthropogenic disturbances (Garcia *et al.*, 2012).

Lateral erosion and resulting meander migration maintain sediment supply and redistribution in streams. This temporal variability in meanders is assumed to be important for habitat diversity and thus biodiversity (Lorenz, *et al.*, 2009). However, few studies have documented positive effects of re-meandering on invertebrate diversity or species abundance; and most restoration studies have not demonstrated any biodiversity differences. Palmer, *et al.* (2014) reported that recovery of biodiversity was rare for the vast majority of stream restoration projects. For the most common type of projects—those implemented using channel or in-stream hydrogeomorphic adjustments— only 16% showed any improvement in biodiversity, even though many showed substantial post-restoration improvements in habitat and geomorphic measures. Jahnig *et al.* (2010) found that in the vast majority of cases restoration of habitat does not lead to biological restoration. One of the most comprehensive studies of restoration

---

outcomes by Tullos *et al.* (2009) reviewed 24 channel reconfiguration projects assessed. The authors reported no significant change in diversity for two-thirds of the projects and only a slight increase in taxa richness for the remainder. Those showing an increase in taxa richness were due to the addition of tolerant taxa characteristic of urban streams.

Some studies of re-meandering have shown increased species richness in comparison to nearby straightened reaches when woody materials and macrophyte patches are present. Lorenz, *et al.* (2009) found total numbers of invertebrate families, genera, and taxa were also higher in the restored reaches than in the anthropogenically-straightened reaches. Sullivan, *et al.* (2004) compared measures of habitat conditions and macroinvertebrate community composition. This paired-study design compared stable and unstable stream reaches in two Vermont watersheds. The authors examined potential associations between ecological measures, geomorphic characteristics and channel adjustment processes. These authors found habitat quality and heterogeneity were closely tied to stream stability, with geomorphically-stable reaches supporting better habitat than unstable reaches, although stable reaches did not support significantly greater macroinvertebrate richness. However, the percent of EPT taxa was significantly correlated with the overall habitat assessment score, individual measures of geomorphic condition, and habitat quality.

Given that current research finds direct measurement of the biotic community does not provide any clear indication of habitat quality due to geomorphic changes, some other means of measures of habitat units is needed to enumerate potential habitat benefits (Palmer, *et al.*, 2014). Re-meandering straightened channels increases the overall channel length and thus in-stream "habitat area" increases for a given valley length as sinuosity ratio increases. Re-meandering also favors a variety of habitats at macro- and micro-spatial scales within the complex flow pathways. The channel cross-sectional shape in straightened channels tends to be trapezoidal and uniform; whereas for meandered streams (sinuosity > 1) the channel cross-sectional shape becomes asymmetrical along the meander wavelength. This asymmetrical configuration increase the variability of water depths and current velocities; creating a larger variation in depths, hydraulic conditions and particle distributions in the sediments (hydraulic habitat). The ditched reach of Spider Creek to be replaced by the mitigation is currently a C5 stream type and the new channel will be an E4 stream type. The proposed mitigation results in slightly more uniform channel shape and depth, but the mitigation increases both stream length and sinuosity.

The area of wetted perimeter thus provides a good surrogate measure of stream habitat units, as does the total water column volume. These two stream ecosystem components, in combination with the overlying physical factors, e.g. particle size and current velocities, in a meandered stream leads to a wider variety of available niches. As the length of stream increases due to increased sinuosity, the total units of wetted perimeter habitat increases in proportion to stream length. Greater sinuosity additionally increases diversity of habitat area due to the changes in cross-sectional shape and velocity distributions as sinuosity increases. A measurement of stream length can be used to directly quantify the increased habitat area due to wetted perimeter over the mitigation reach. Floodplain connectivity is an additional measure of habitat units, related to floodplain habitat quality improvement and increase in areal extent as measured by the flood-prone width.

## 7.2 Functional Mitigation of Lost Stream Functions

The proposed restoration of Spider Creek will adequately replace the stream functions lost due to the impacts to Parkville Creek based on the evaluation of stream habitat units. The habitat units and percent change were calculated for the impacted Parkville Creek reach, the current channelized reach of Spider Creek, and the proposed Spider Creek mitigation reach. A comparison of stream habitat units for each is presented in Table 7-1, which shows an increase in overall stream habitat. These values will vary slightly (+/- 5%) based upon the final design configurations.

Table 7-1 Comparison of Average Stream Habitat Units for Pre- and Post-Mitigation

Habitat Measure	Spider Creek - Pre-mitigation	Spider Creek - Post-mitigation	% Change (Spider pre- to post-mitigation)	Parkville Creek Pre-impact	Spider Creek Post-Mitigation	% Change Parkville / Spider mitigation
Sinuosity ratio	1.10	1.54	40%	1.20	1.54	28%
Stream length (ft.)	2, 635	4,050	54%	3,697	4,050	10%
Average wetted perimeter (ft.)	26.40	20.60	-22%	13.70	20.60	50%
Total wetted perimeter (ft. <sup>2</sup> )	79,200	83,430	20%	50,649	83,430	65%
Bankfull X-sectional area (ft. <sup>2</sup> )	47	41	-13%	7	41	465%
Total channel volume (ft. <sup>3</sup> )	141,000	164,835	33%	26,618	164,835	519%
Flood-prone width (ft.)	137.47	400.00	191%	61.80	400.00	547%
Connected floodplain (ft. <sup>2</sup> )	412,410	1,620,000	347%	228,475	1,620,000	609%

## 7.3 Measures of Success

The standards for project success and completion shall be evidence of successful implementation of the restoration design and stream channel stability. The success of the proposed restoration of Spider Creek is expected to provide improved stream functions in the St. Louis River watershed based on the measures of stream habitat units presented in Table 7-1. The restored stream shall have the planned improvements in sinuosity, total wetted perimeter, channel volume, and effective floodplain. Therefore, post-construction monitoring, discussed in Section 8.0, shall document erosion, vegetative cover, and confirmation of appropriate design implementation.



---

## 8.0 Maintenance and Monitoring

The schedule provided below includes the timing of construction activities and monitoring for the first five years of the project. The timeline is tentative with an expected start date in the fall of 2016. This start date is dependent on a number of factors including, the need for and timing of environmental review, permit approvals, and appropriate site working conditions, among others.

### 8.1 Construction – Fall/Winter 2016 (Year 0)

Complete the construction of the new stream channel.

### 8.2 Monitoring and Construction – Summer/Fall 2017 (Year 1)

Conduct three site inspections, one following snowmelt, another during July, and again in September. Conduct site inspections following all precipitation events exceeding two inches within 24 hours. Substantial failures or deficiencies will be reported to the USACE.

Complete construction activities within the channelized reach; connect the new stream channel, back-fill the existing channel, and install new culverts. Seed the disturbed areas and include a cover crop to ensure cover over the winter.

### 8.3 2018 Monitoring and As-built (Year 2)

Conduct three site inspections, one following snowmelt, another during July, and again in September. Conduct site inspections following all precipitation events exceeding two inches within 24 hours. Substantial failures or deficiencies will be reported to the USACE.

Complete an as-built survey to document stream conditions after completed construction activities. This shall include a longitudinal profile and cross-sections with sufficient information to complete a Rosgen Level I survey.

### 8.4 2019 through 2022 Monitoring (Years 3 through 5)

Conduct three site inspections annually: one following spring snowmelt, another during July, and again in September. Conduct site inspections following all precipitation events exceeding two inches within 24 hours. Substantial failures or deficiencies will be reported to the USACE.

### 8.5 2022 Post-Restoration Surveys (Year 5)

Complete surveys as required by the MPCA in the 401 Certification in the reference reach and the restored reach of Spider Creek. The surveys and methodologies shall follow similar methods as used in the baseline studies, completed during 2015 to be reported separately. Methods are provided in the MPCA 401 Certification to the Department of Army Permit (2012-00415-JCB). These surveys shall include the following:

- 
- Geomorphology and Physical Habitat
  - Fisheries
  - Invertebrates
  - Water chemistry
  - Hydrology
  - Connectivity

A report summarizing the findings of the surveys will be completed before January 31 following the year of the survey (expected January 31, 2023).

## 8.6 Monitoring Completion and Project Success

The project will be successfully completed when the new channel and all areas of construction meet the following standards and the project design is appropriately implemented according to this plan. The primary standards shall be measures of stability, lack of erosion, fully-established perennial vegetative cover, and conditions that demonstrate proper implementation of the design.

- The restored stream channel must meet the following base standards in the as-built survey. These standards are based on design parameters to confirm appropriate implementation of the design:
  - The length of the restored channel shall be at least 3,697 feet.
  - The sinuosity of the new channel shall be between 1.4 and 1.8.
  - The average riffle bankfull cross-sectional area shall be between 38 and 43 ft.<sup>2</sup>
- After completion of monitoring, proposed for 5 years after construction is complete:
  - A minimum of 80 percent vegetative cover of disturbed areas above bankfull.
  - Bank erosion shall exhibit minimal evidence of undercutting or slumping (Pfankuch rating of 50 or higher).
  - In-stream stabilization features shall remain in place without evidence of deterioration.

If all of the above standards are met, monitoring and post-construction maintenance activities will be considered complete and the mitigation shall be approved and finalized by the USACE. The monitoring period may be extended if the standards are not met and remedial actions shall be completed until the standards are met.

## 8.7 Adaptive Management Plan

The restored stream will be monitored at least three times during the first full growing season following completion of the initial construction to identify and correct failures or problems of the restoration design and construction. Following the completion of construction over the second winter (expected 2017-2018),

---

the new channel will be monitored at least three times during the growing season to identify and correct failures or problems of the restoration design and construction.

During each site inspection, the entire project area will be observed to identify failures or problem areas, particularly focusing on the stability of the stream bed and banks along with the stability of floodplain areas. In addition, the survival and vigor of seeded areas and planted vegetation will be inspected and documented with photographs and field notes. Upon identification of substantial bed aggradation or degradation, erosion, channel stability, and vegetation establishment problems, those features will be documented and communicated to the USACE. U. S. Steel will develop a corrective measures plan for approval by the USACE before implementation.

## 8.8 Long-Term Management Plan

Once the primary maintenance and monitoring period are completed and the mitigation approval is provided, the site will enter into the long-term management phase. It is expected that the restored stream channel would be stable and fully functional and that it would require minimal maintenance or monitoring. Once the channel has been re-located it will remain within a permanent easement held by the MDNR as an Aquatic Management Area (AMA). The AMA is designed to follow the stream banks, so the project will automatically effect a change to the easement boundary. These properties are managed by the MDNR to maintain access for fishing and other recreational uses along these streams. Therefore, the MDNR will continue to manage the site in perpetuity. U. S. Steel will provide documentation from the MDNR that the MDNR is willing to continue site management along Spider Creek after all conditions of this plan and the agreement between the MDNR and U. S. Steel are met.

---

## 9.0 Site Protection Instrument

Perpetual site protection is expected at Spider Creek utilizing an existing perpetual conservation easement for all of the tax-forfeit properties, currently owned and managed by the State of Minnesota. A copy of the existing perpetual conservation easement is provided in [Appendix D](#). The easement applies to properties, including those along Spider Creek in Section 24, Township 52N, Range 19W. The easement includes the “bed of the stream and a strip of land no wider than will be enclosed between the top edge of the stream bank and a line parallel thereto and sixty (60) feet distance therefrom on either side...” and includes access for the employees of the state. Therefore, once the channel has been re-located it will remain within a permanent easement held by the MDNR on those tax-forfeit properties. If, in the future, those properties are purchased by a public or private entity, the conservation easement remains along the stream channel and provides for public access to the stream and 60 feet on each side.

For legal protections along private property, U. S. Steel would form an agreement with the Spider Creek Hunting Association to create a conservation easement or deed restrictions along the new channel of Spider Creek. The deed restriction could be created for the property owners to ensure there is no future development on or near the stream channel. If a conservation easement is created, U. S. Steel would propose that it be held by the MDNR or by a conservation-focused non-governmental organization.

---

## 10.0 References

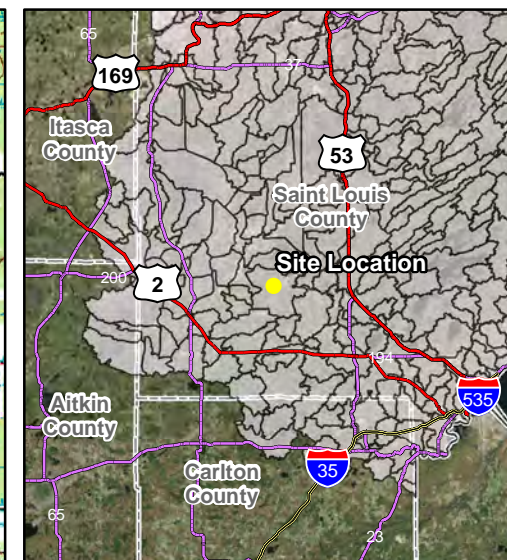
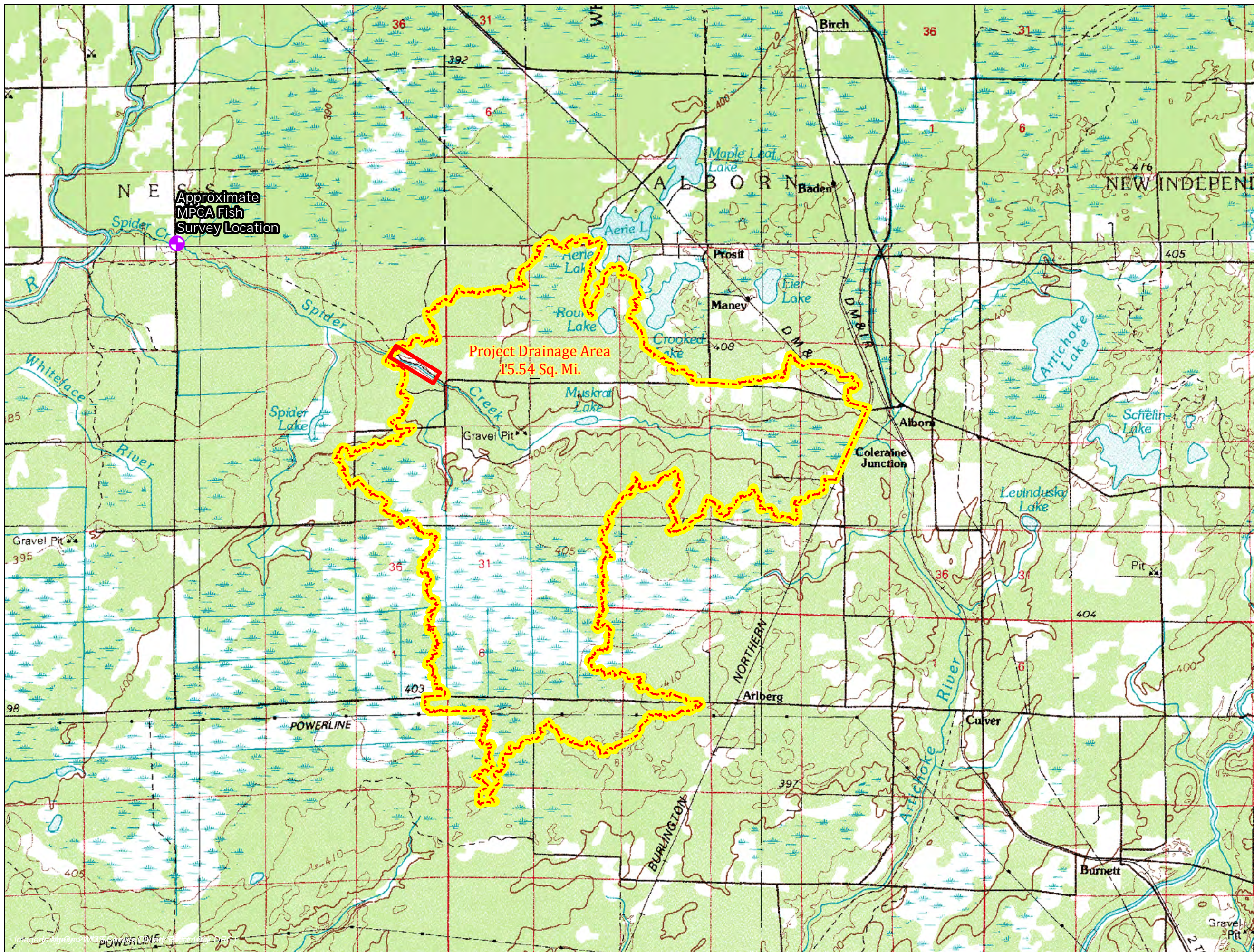
- Allan, J.D. and M. M. Castillo. 2008. *Stream Ecology: Structure and function of running waters*. Springer. Dordrecht, The Netherlands.
- Barr. 2015a. *Spider Creek Mitigation Feasibility Assessment*. Minntac Mine Extension Project. Prepared for Minnesota Ore Operations – Minntac, United States Steel. January 2015
- Barr. 2015b. *Technical Memorandum*. Memo in response to February 26, 2015 USACE letter re: Spider Creek Mitigation Feasibility Assessment. From Jessica Olson, Daniel Tix, Mark Jacobson, and Jeff Lee (Barr) to Thomas Moe and Joshua Zika (U. S. Steel). April 2, 2015.
- Barr. 2015c. *Technical Memorandum*. Spider Creek Rosgen Level II Data. From Jessica Olson, Daniel Tix, Mark Jacobson, and Jeff Lee (Barr) to Thomas Moe and Joshua Zika (U. S. Steel). May 28, 2015.
- Garcia, X. -F, I. Schnauder and M. T. Pusch. 2012. Complex hydromorphology of meanders can support benthic invertebrate diversity in rivers. *Hydrobiologia* 685:49–68
- Hobbs, H. C. and J. E. Goebel. 1982. *Geologic Map of Minnesota, Quaternary geology*. University of Minnesota.
- Jähnig, S. C., K. Brabec, A. Buffagni, S. Erba, A. W. Lorenz, T. Ofenböck, P. F. M. Verdonschot and D. Hering. 2010. A comparative analysis of restoration measures and their effects on hydromorphology and benthic invertebrates in 26 central and southern European rivers. *Journal of Applied Ecology* 47(3):671–680.
- Lindholm, G.F., D.W. Ericson, W.L. Broussard, and M.F. Hult. 1979. *Water Resources of the St. Louis River Watershed, Northeastern Minnesota*. United States Geological Survey. Washington, D.C. Hydrologic Investigations Atlas HA-586.
- Lorenz, A. W., S. C. Jahnig & D. Hering, 2009. Re-meandering German lowland streams: Qualitative and quantitative effects of restoration measures on hydromorphology and macroinvertebrates. *Environmental Management* 44(4): 745–754.
- Lorenz, D.L., C.A. Sanocki, & M.J. Kocian, 2010, Techniques for estimating the magnitude and frequency of peak flows on small streams in Minnesota based on data through Water Year 2005. USGS Scientific Investigations Report 2009-5250.
- Minnesota Geological Survey. 2012. *Online Map Services-Preliminary Versions*, (Note: Changes will occur). Bedrock topography and depth to bedrock webmap. Available at URL: <http://www.mngs.umn.edu/service.htm>
- MPCA. 2014. *Review of Class 2A (Cold Water) and Class 2B (Warm Water/Cool Water) Aquatic Life Use Classifications*. Authors: R. W. Bouchard, Jr. and J. A. Genet. January 2014 Draft. Minnesota Pollution Control Agency, Environmental Analysis and Outcomes Division.
- MPCA. 2015a. Biological Station Information for Spider Muskrat Creek. Station ID 98LS049. Available at URL: [http://www.pca.state.mn.us/customPHP/eda/stationInfo\\_print.php?ID=98LS049&ORG=MPCAB](http://www.pca.state.mn.us/customPHP/eda/stationInfo_print.php?ID=98LS049&ORG=MPCAB)

- MPCA. 2015b. RE: 2012-00415-JCB; Amended 401 Certification for U. S. Steel Corporation – Impacts to wetlands and Parkville Creek for a mine pit extension and access road relocation. Letter from Catherine Neuschler to Tamara Cameron (USACE) and Josh Zika (U. S. Steel). May 29, 2015.
- MPCA. 2015c. Subject: Revision to 5/29/2015 Certification for 2012-00415-JCB. Email from Catherine Neuschler to Tom Moe (U. S. Steel). August 14, 2015.
- MPCA. 2015b. *Minnesota's Impaired Waters and TMDLs: Impaired Waters Viewer*. Available at URL: <http://www.pca.state.mn.us/index.php/water/water-types-and-programs/minnesotas-impaired-waters-and-tmdls/maps-of-minnesotas-impaired-waters-and-tmdls.html>
- NRCS. 2007. *National Engineering Handbook – Part 654, Stream Restoration Design*. Available at URL: <http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/water/manage/restoration/?cid=stelprdb1044707>
- NRCS. 2015. *Web Soil Survey*. Available at URL: <http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx>
- Palmer, M. A., K. L. Hondula and B. J. Koch. 2014. Ecological restoration of streams and rivers: Shifting strategies and shifting goals. *Annual Review of Ecology, Evolution, and Systematics* 45:247-269.
- Rosgen, D. 1996. *Applied River Morphology*. Pagosa Springs, CO: Wildland Hydrology.
- Rosgen, D. 2006. Watershed Assessment of River Stability and Sediment Supply (WARSSS). Pagosa Spring, CO: Wildland Hydrology.
- Rosgen, D. 2014. *River Morphology & Applications*, Fort Collins, CO: Wildland Hydrology.
- Sullivan S. M. P., M. C. Watzin, W. C. Hession. 2004. Understanding stream geomorphic state in relation to ecological integrity: Evidence using habitat assessments and macroinvertebrates. *Environmental Management* 34(5):669-683.
- Tullos, D. D., D. L. Penrose, G. D. Jennings and W. G. Cope. 2009. Analysis of functional traits in reconfigured channels: Implications for the bioassessment and disturbance of river restoration. *Journal of the North American Benthological Society* 28(1):80-92.
- USACE. 2013. Letter from Tamara E. Cameron (USACE, Chief, Regulatory Branch) to Mr. Josh Zika (U. S. Steel) dated April 19, 2013. Operations Regulatory (MVP-2012-00415-JCB)
- USACE. 2015. Letter from Timothy J. Smith (USACE, Chief, Southwest Section) to Mr. Josh Zika (U. S. Steel) dated February 26, 2015. Operations Regulatory (MVP-2012-00415-JCB)




## Figures

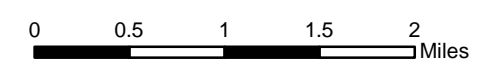






Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

-  Project Reach Location
-  Project Reach Drainage Area
-  MPCA Fish Survey Location



1 inch = 1 miles

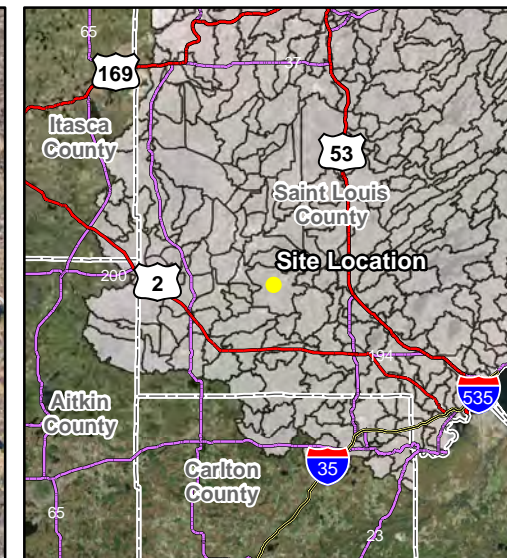
Figure 1

**PROJECT LOCATION AND DRAINAGE AREA**

Spider Creek Restoration  
 Minntac Mine Extension Stream Mitigation  
 U.S. Steel  
 St. Louis County



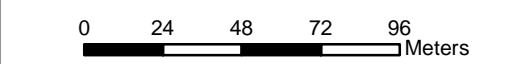
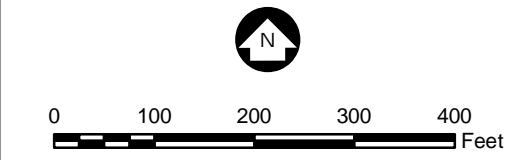




Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

- + Station Points (500 ft Increments)
- Existing Channel
- Parcels (August 2015)
- Topographic Lines**
- Index (10 ft Interval)
- Intermediate (2 ft Interval)

Contours derived from 2012 MN DNR LiDAR

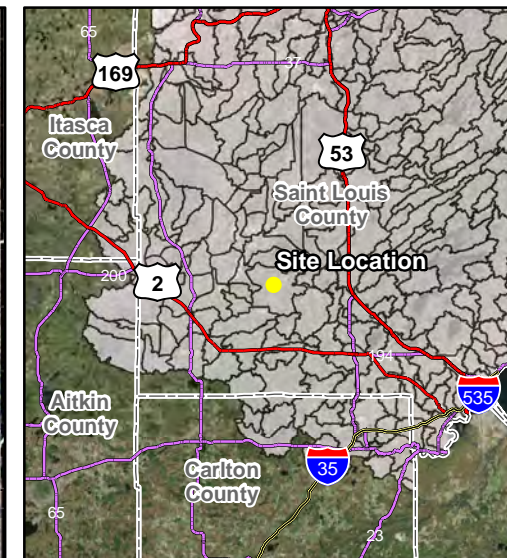
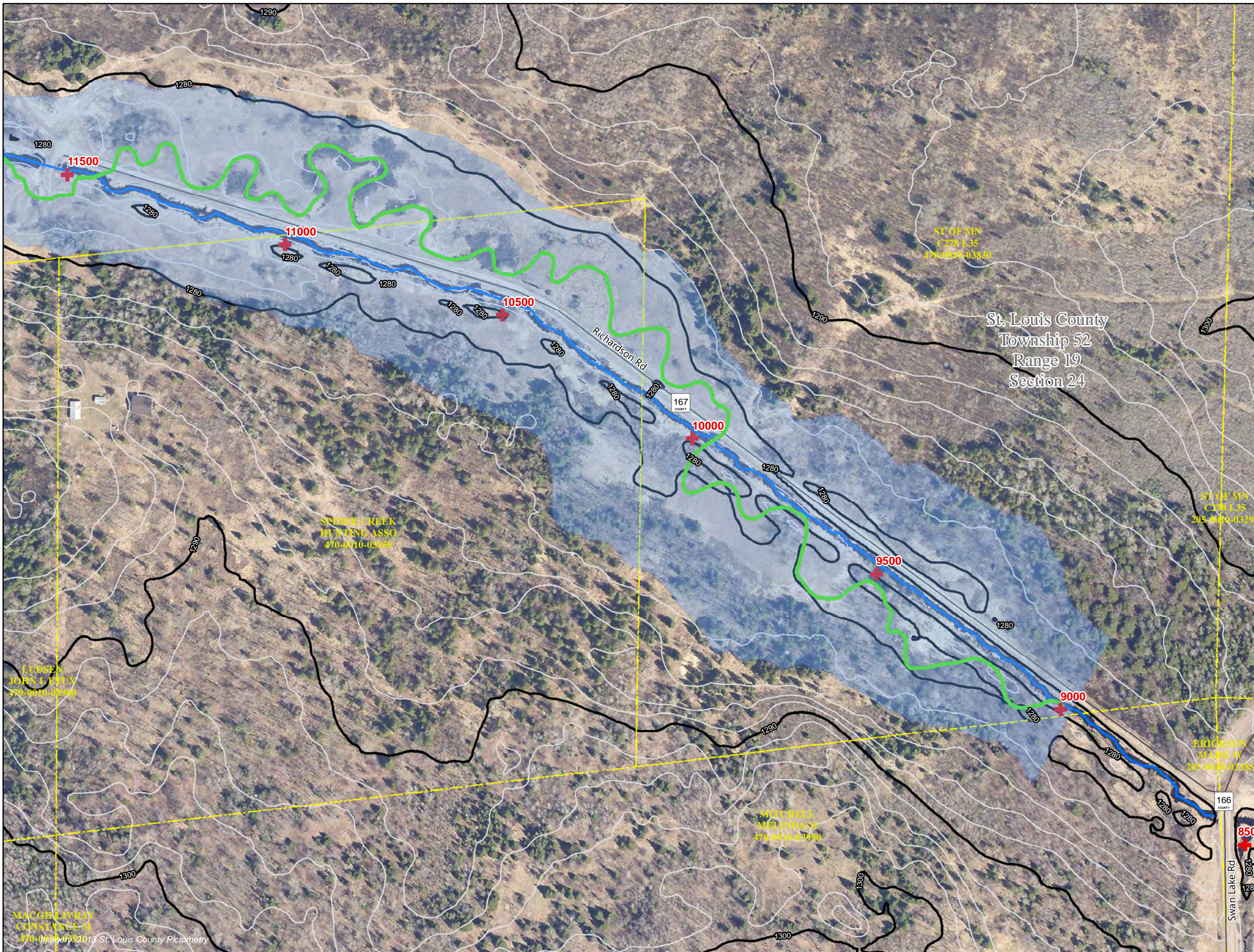


1 inch = 192 feet  
1 centimeter = 23 meters

Figure 2  
90+00 to 115+000  
**CHANNELIZED REACH  
PROPOSED FOR RESTORATION**  
Spider Creek Restoration  
Minnac Mine Extension Stream Mitigation  
U.S. Steel  
St. Louis County





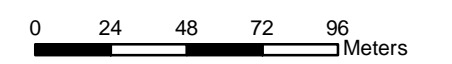
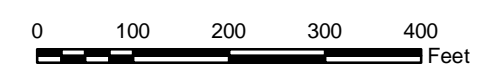


Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

- + Station Points (500 ft Increments)
- Existing Channel
- Proposed Restoration Channel
- Topographic Lines**
- Index (10 ft Interval)
- Intermediate (2 ft Interval)
- Parcels (August 2015)
- Approximate Flood Prone Area\*

Contours derived from 2012 MN DNR LiDAR

\*The flood prone width was estimated as 2 times the Maximum Proposed Stream Bankfull Depth.



1 inch = 200 feet  
1 centimeter = 24 meters

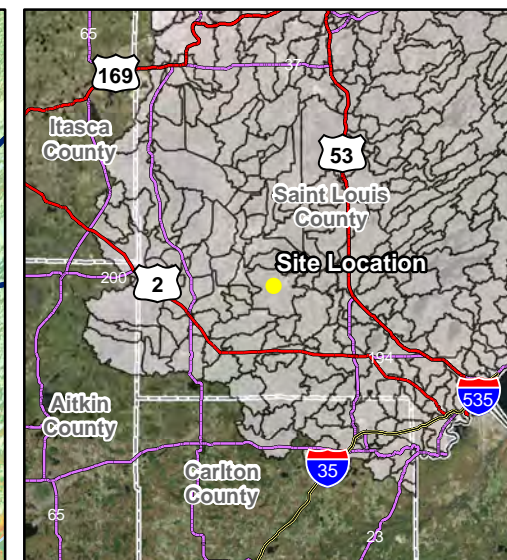
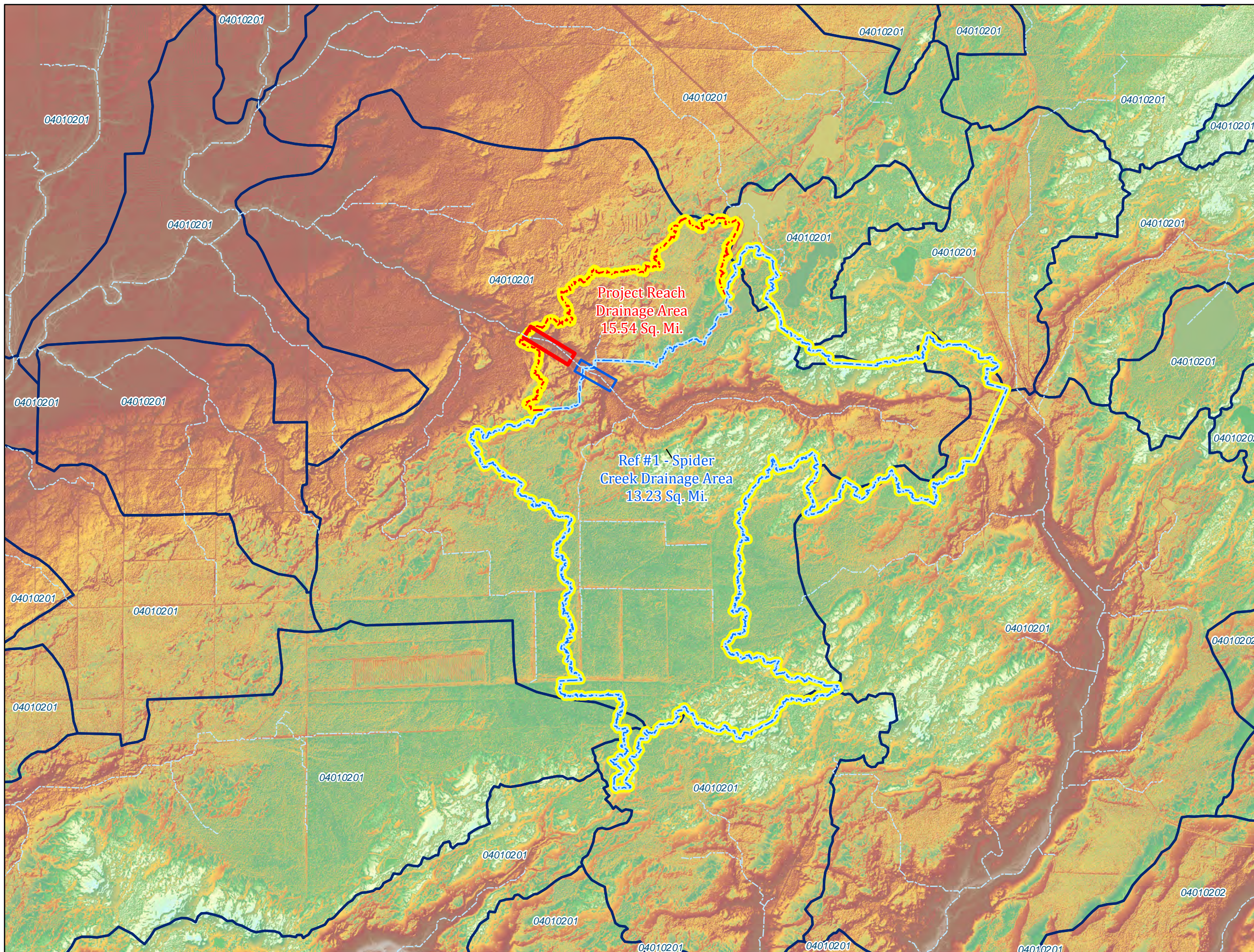
Figure 3  
85+00 to 11+500

**PROPOSED RESTORATION CHANNEL LAYOUT**

Spider Creek Restoration  
Minntac Mine Extension Stream Mitigation  
U.S. Steel  
St. Louis County





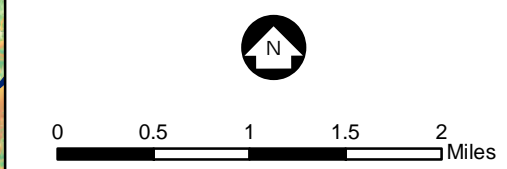


Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

- DNR Level 08 - All Catchments
- Project Reach Location
- Project Reach Drainage Area
- Ref #1 - Spider Creek Location
- Ref #1 - Spider Creek Drainage Area
- Stream Delineation



DEM and Stream Delineation derived from 2012 MN DNR LiDAR

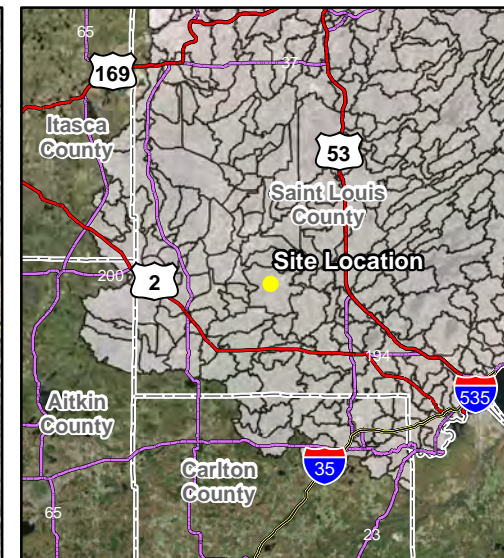
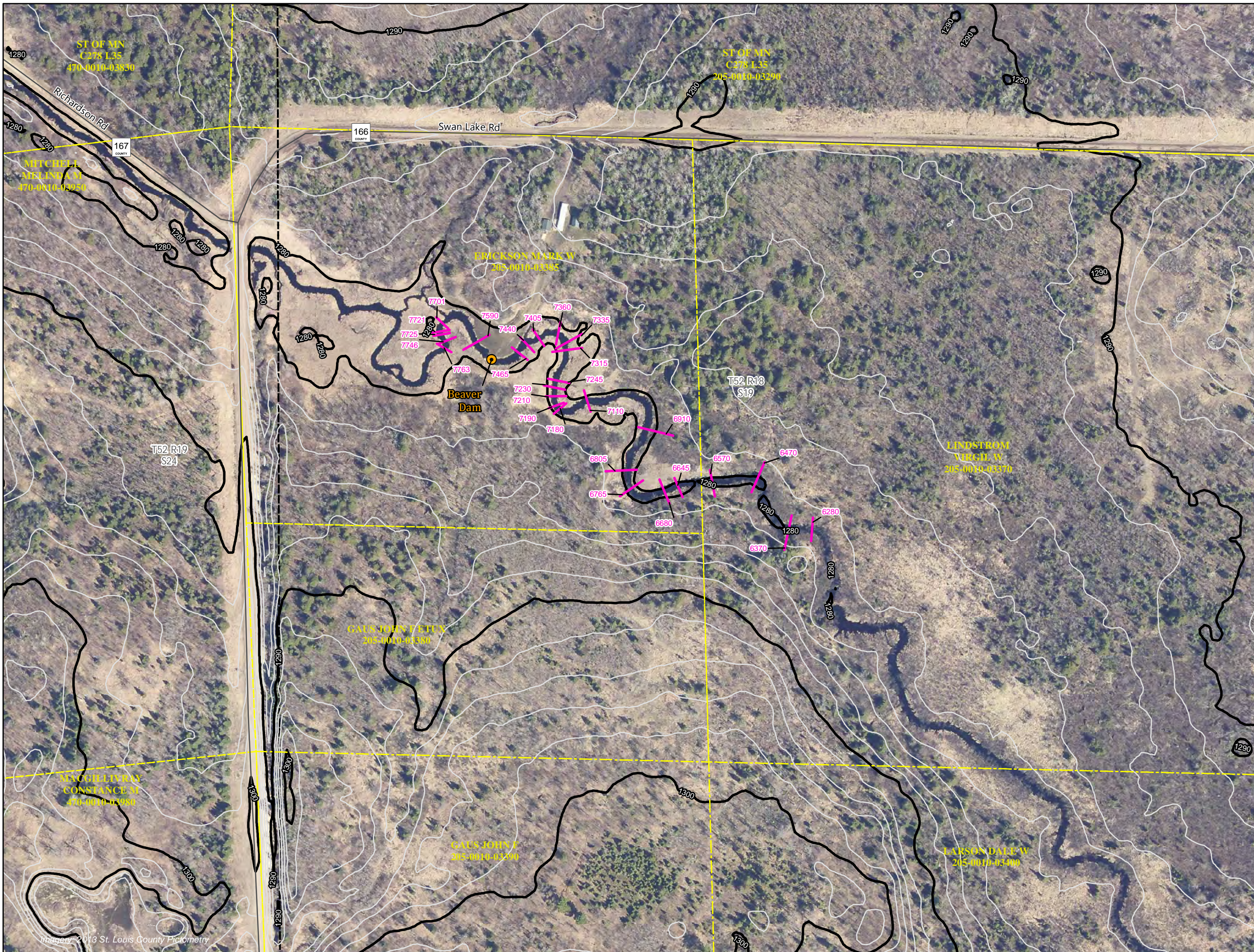


1 inch = 1 miles

Figure 4  
**PROJECT DRAINAGE AREAS**  
 Spider Creek Restoration  
 Minntac Mine Extension Stream Mitigation  
 U.S. Steel  
 St. Louis County





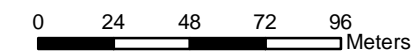
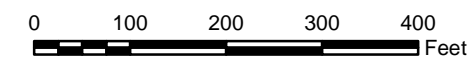


Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community  
 Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA,

- Surveyed Cross Section
- Beaver Dam
- Parcels (August 2015)

- Topographic Lines**
- Index (10 ft Interval)
  - Intermediate (2 ft Interval)

Contours derived from 2012 MN DNR LiDAR



1 inch = 200 feet  
 1 centimeter = 24 meters

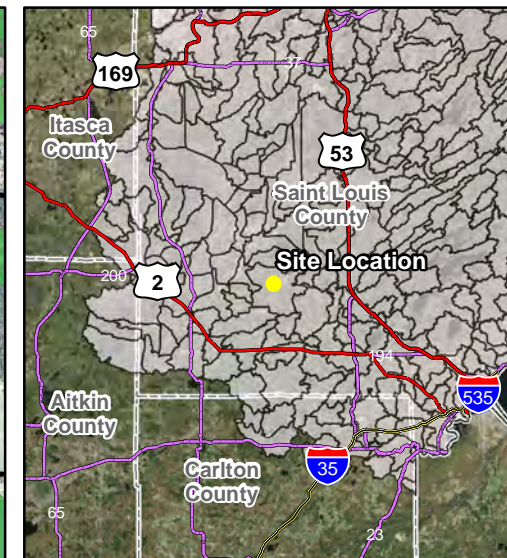
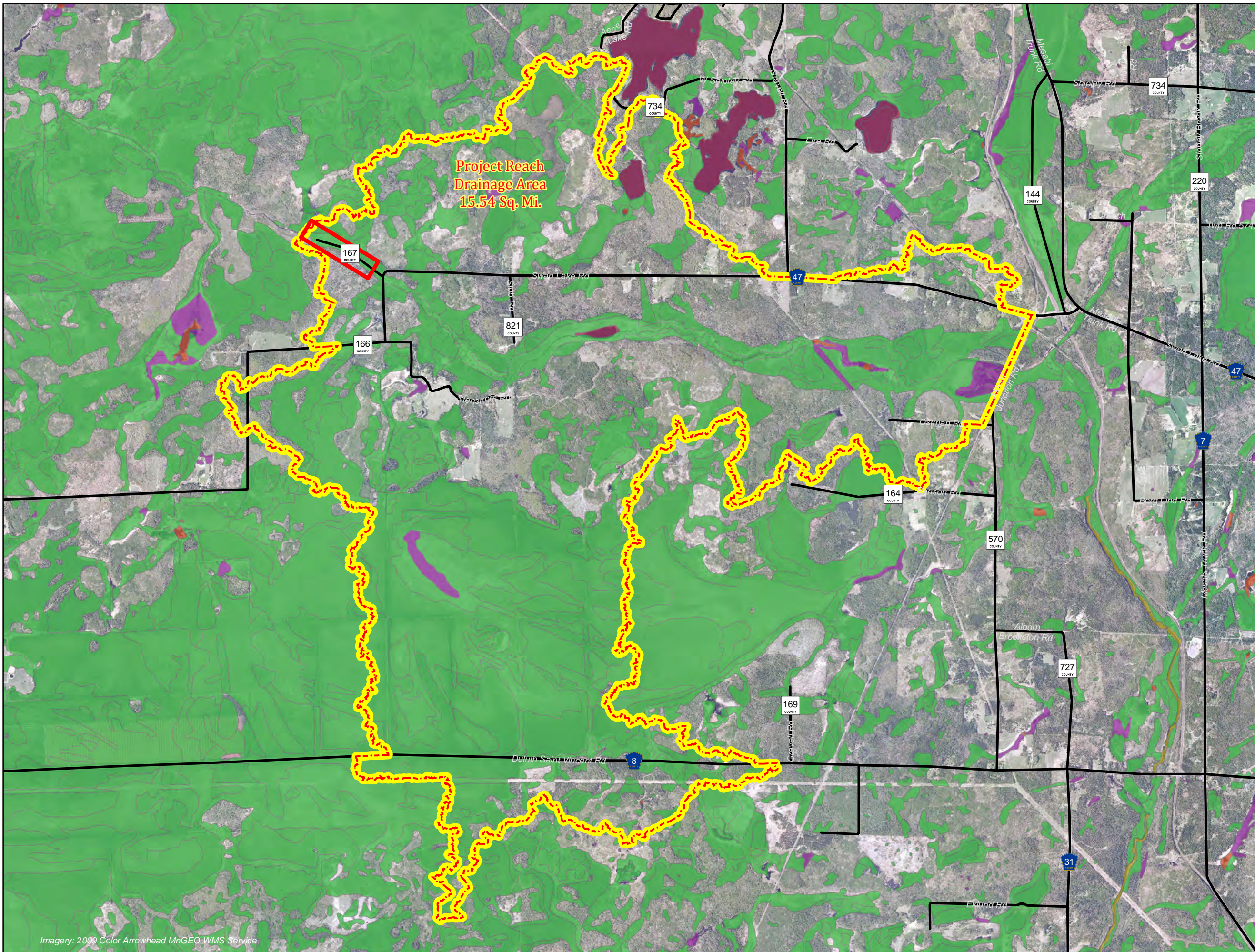
Figure 5  
 55+00 to 90+00

**REF #1 - SPIDER CREEK  
 EXISTING CONDITIONS**

Spider Creek Restoration  
 Minntac Mine Extension Stream Mitigation  
 U.S. Steel  
 St. Louis County



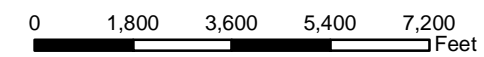




Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community  
 Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA,

- Project Reach
  - Project Reach Drainage
- WETLAND**
- Freshwater Emergent
  - Freshwater Forested/Shrub Wetland
  - Freshwater
  - Lake
  - Other
  - Riverine

\*Wetland Data from National Wetland Inventory



1 inch = 3,500 feet

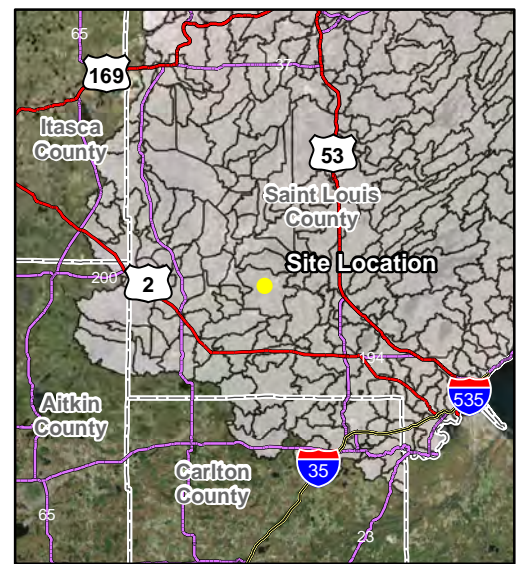
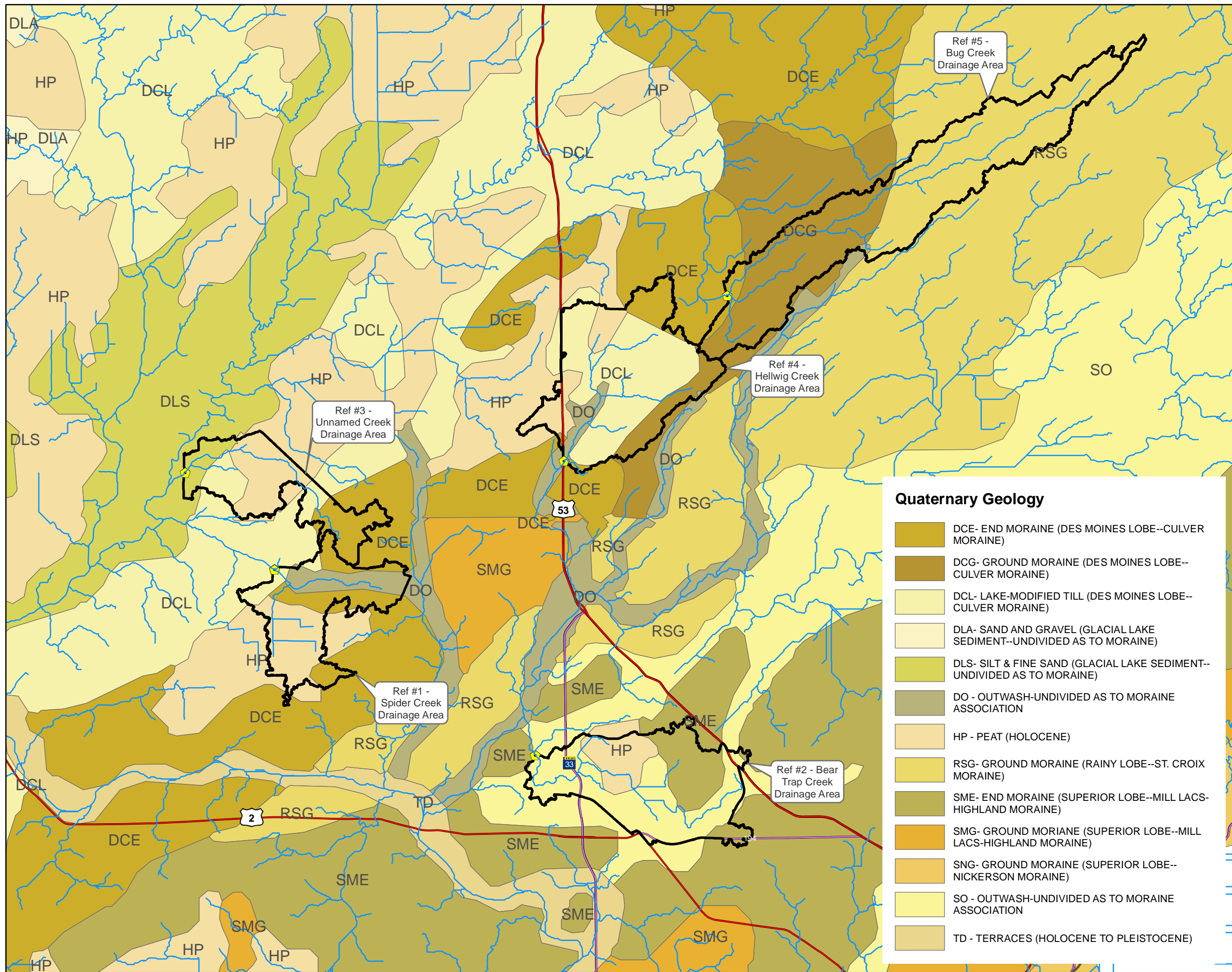
Figure 6

**NATIONAL WETLAND INVENTORY**

Spider Creek Restoration  
 Minntac Mine Extension Stream Mitigation  
 U.S. Steel  
 St. Louis County







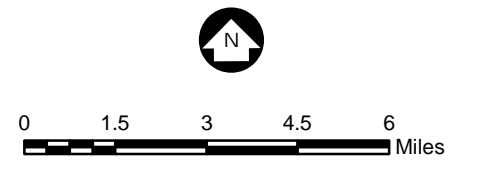
Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community  
 Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA,

- Reference Stream Drainage Area
- Reference Cross Sections
- Delineated Drainage Network

\*Drainage Network Delineated from 2012 MN DNR LiDAR

**Quaternary Geology**

	DCE- END MORaine (DES MOINES LOBE--CULVER MORaine)
	DCG- GROUND MORaine (DES MOINES LOBE--CULVER MORaine)
	DCL- LAKE-MODIFIED TILL (DES MOINES LOBE--CULVER MORaine)
	DLA- SAND AND GRAVEL (GLACIAL LAKE SEDIMENT--UNDIVIDED AS TO MORaine)
	DLS- SILT & FINE SAND (GLACIAL LAKE SEDIMENT--UNDIVIDED AS TO MORaine)
	DO - OUTWASH-UNDIVIDED AS TO MORaine ASSOCIATION
	HP - PEAT (HOLOCENE)
	RSG- GROUND MORaine (RAINY LOBE--ST. CROIX MORaine)
	SME- END MORaine (SUPERIOR LOBE--MILL LACS-HIGHLAND MORaine)
	SMG- GROUND MORaine (SUPERIOR LOBE--MILL LACS-HIGHLAND MORaine)
	SNG- GROUND MORaine (SUPERIOR LOBE--NICKERSON MORaine)
	SO - OUTWASH-UNDIVIDED AS TO MORaine ASSOCIATION
	TD - TERRACES (HOLOCENE TO PLEISTOCENE)



1 inch equals 3 miles

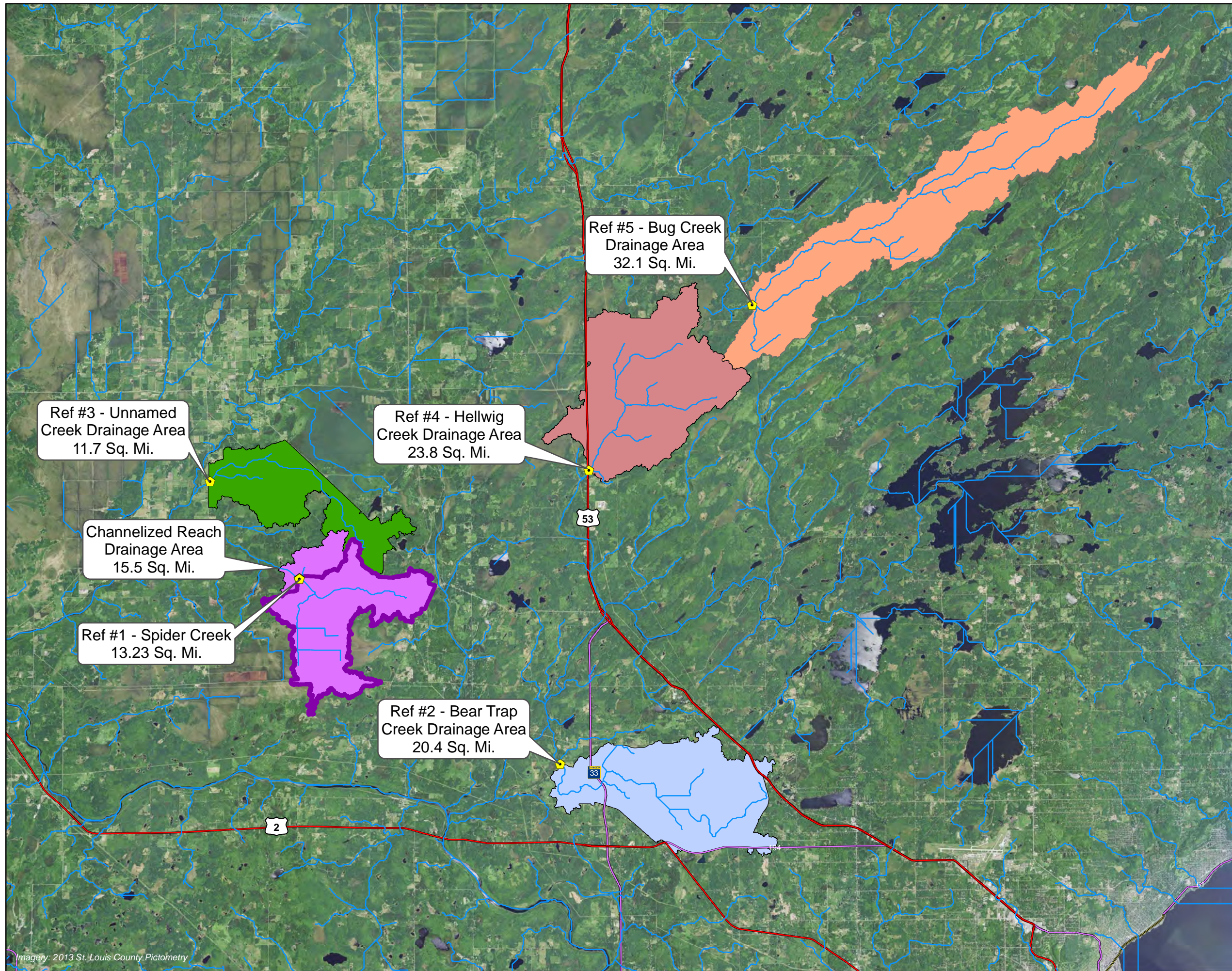
Figure 7

**REFERENCE STREAM SECTION QUATERNARY GEOLOGY**

Spider Creek Restoration  
 Minntac Mine Extension Stream Mitigation  
 U.S. Steel  
 St. Louis County







Ref #3 - Unnamed  
Creek Drainage Area  
11.7 Sq. Mi.

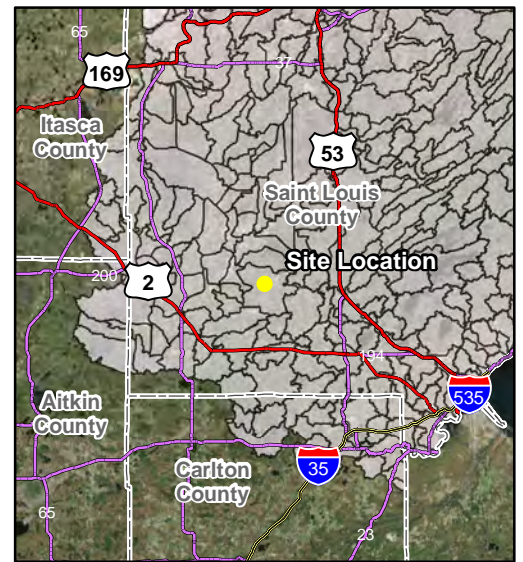
Channelized Reach  
Drainage Area  
15.5 Sq. Mi.

Ref #1 - Spider Creek  
13.23 Sq. Mi.

Ref #4 - Hellwig  
Creek Drainage Area  
23.8 Sq. Mi.

Ref #2 - Bear Trap  
Creek Drainage Area  
20.4 Sq. Mi.

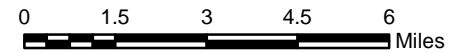
Ref #5 - Bug Creek  
Drainage Area  
32.1 Sq. Mi.



Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community  
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA,

- Channelized Reach - Spider Creek
- Ref #1 - Spider Creek
- Ref #2 - Bear Trap Creek
- Ref #3 - Unnamed Creek
- Ref #4 - Hellwig Creek
- Ref #5 - Bug Creek
- Reference Cross Sections
- Delineated Drainage Network

\*Drainage Network Delineated from 2012 MN DNR LiDAR



1 inch equals 3 miles

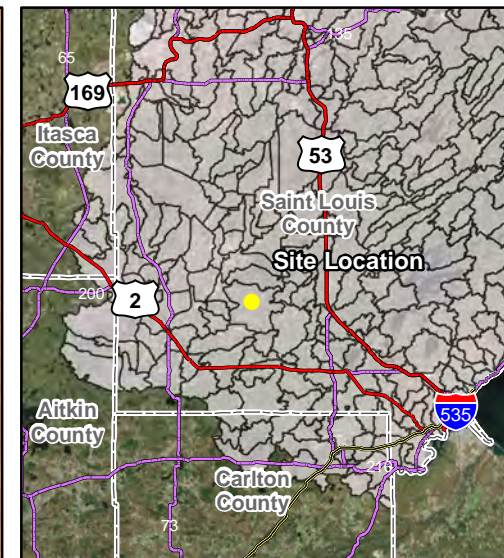
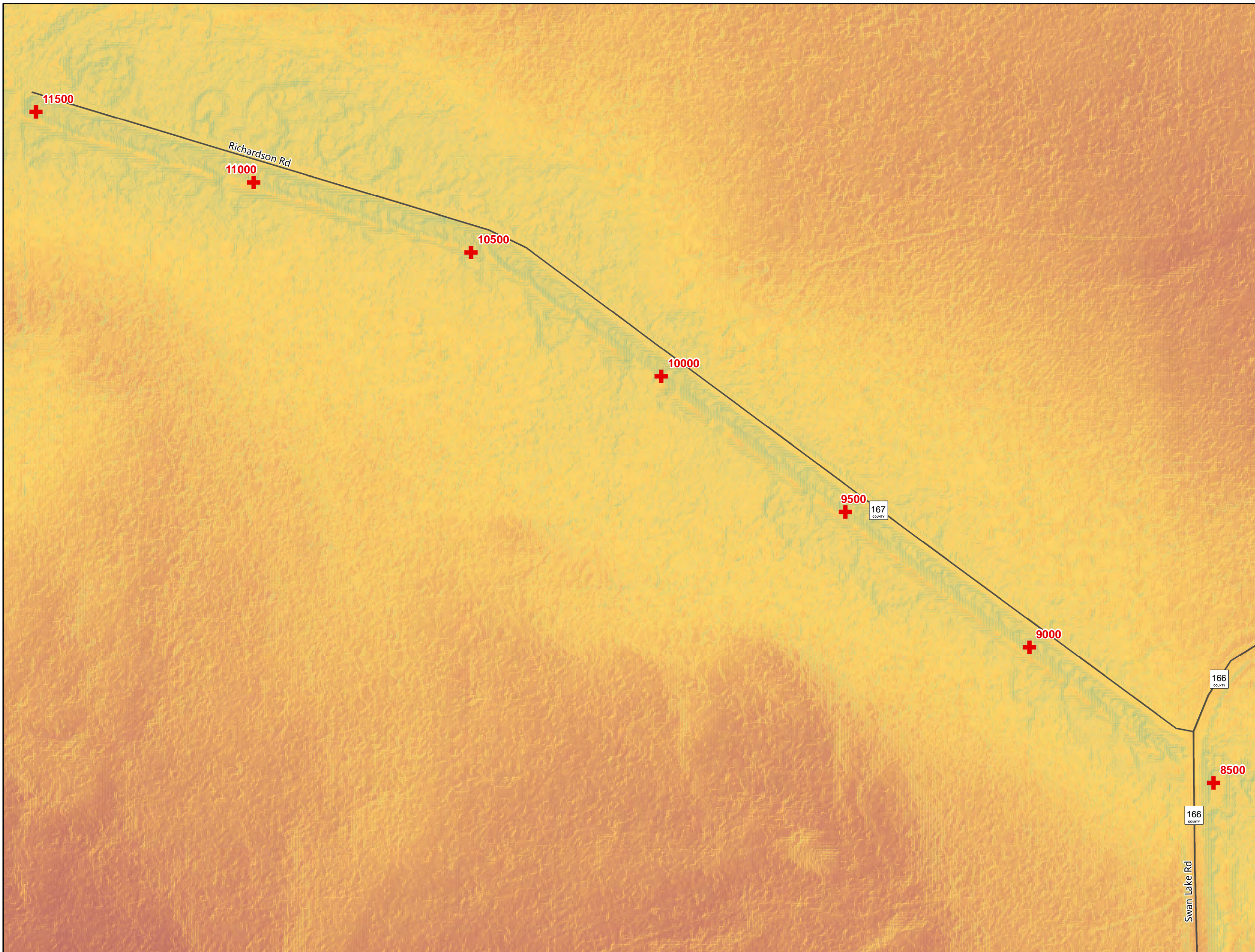
Figure 8

**REFERENCE STREAM SECTION LOCATION MAP**

Spider Creek Restoration  
Minntac Mine Extension Stream Mitigation  
U.S. Steel  
St. Louis County

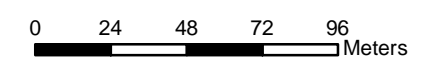
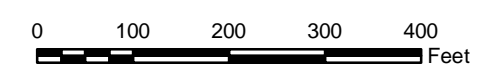
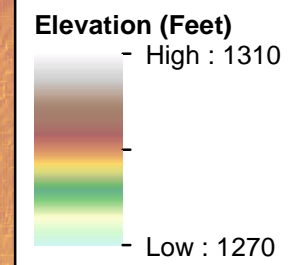






Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

**+** Station Points (500 ft Increments)



1 inch = 200 feet  
 1 centimeter = 24 meters

Figure 9

**MEANDER SCARS**

Spider Creek Restoration  
 Minntac Mine Extension Stream Mitigation  
 U.S. Steel  
 St. Louis County







## Appendices

## Appendix A

### Public Waters Work General Permit Issued to St. Louis County



MINNESOTA DEPARTMENT OF NATURAL RESOURCES

Amended  
**Public Waters Work General  
 Permit**

**General Permit Number  
 1996-2091**

**Expiration Date: 12/31/2017**

Pursuant to Minnesota Statutes, Chapter 103G, and on the basis of statements and information contained in the permit application, letters, maps, and plans submitted by the applicant and other supporting data, all of which are made part hereof by reference, **PERMISSION IS HEREBY GRANTED** to the applicant to perform actions as authorized below. This permit supersedes the original permit and all previous amendments.

<b>Project Name:</b> St. Louis County Bridges/Culverts	<b>County:</b> St. Louis	<b>Watershed:</b> Lake Superior - South, St. Louis River, Cloquet River, Nemadji River, Mississippi River - Grand Rapids, Rainy River - Headwaters, Vermillion River, Rainy River - Rainy Lake, Little Fork River	<b>Resource:</b> All Public Water Watercourses
<b>Purpose of Permit:</b> Construct and reconstruct bridges and culverts		<b>Authorized Action:</b> Construct/reconstruct bridges/culverts on watercourses that are public waters where all of the conditions specified herein are met.	
<b>Permittee:</b> ST LOUIS COUNTY PUBLIC WORKS DEPARTMENT CONTACT: INGA FOSTER 4787 MIDWAY ROAD DULUTH, MN 55811-9794 (218) 625-3862		<b>Authorized Agent:</b> N/A	
<b>Property Description (land owned or leased or where work will be conducted):</b> Lands located wholly within St. Louis County			
<b>Authorized Issuer:</b> Julie Ekman	<b>Title:</b> Conservation Assistance & Regulations Section Manager	<b>Issued Date:</b> 07/07/2013	<b>Effective Date:</b> 07/07/2013
		<b>Expiration Date:</b> 12/31/2017	

This permit is granted **subject to** the following **CONDITIONS**:

**APPLICABLE FEDERAL, STATE, OR LOCAL REGULATIONS:** The permittee is not released from any rules, regulations, requirements, or standards of any applicable federal, state, or local agencies; including, but not limited to, the U.S. Army Corps of Engineers, Board of Water and Soil Resources, MN Pollution Control Agency, watershed districts, water management organizations, county, city and township zoning.

**NOT ASSIGNABLE:** This permit is not assignable by the permittee except with the written consent of the Commissioner of Natural Resources.

**NO CHANGES:** The permittee shall make no changes, without written permission or amendment previously obtained from the Commissioner of Natural Resources, in the dimensions, capacity or location of any items of work authorized hereunder.

**SITE ACCESS:** The permittee shall grant access to the site at all reasonable times during and after construction to authorized representatives of the Commissioner of Natural Resources for inspection of the work authorized hereunder.

**TERMINATION:** This permit may be terminated by the Commissioner of Natural Resources at any time deemed

## **GENERAL PERMIT CONDITIONS** (Continued from previous page)

necessary for the conservation of water resources of the state, or in the interest of public health and welfare, or for violation of any of the conditions or applicable laws, unless otherwise provided in the permit.

**COMPLETION DATE:** Construction work authorized under this permit shall be completed on or before the date specified above. The permittee may request an extension of the time to complete the project, stating the reason thereof, upon written request to the Commissioner of Natural Resources.

**WRITTEN CONSENT:** In all cases where the permittee by performing the work authorized by this permit shall involve the taking, using, or damaging of any property rights or interests of any other person or persons, or of any publicly owned lands or improvements thereon or interests therein, the permittee, before proceeding, shall obtain the written consent of all persons, agencies, or authorities concerned, and shall acquire all property, rights, and interests needed for the work.

**BEST PRACTICES - MNDOT:** Please refer to the manual "Best Practices for Meeting DNR General Public Waters Work Permit GP 2004-0001" for guidance to meeting these and other conditions of this General Permit. A PDF version is available at: [http://www.dnr.state.mn.us/waters/watermgmt\\_section/pwpermits/gp\\_2004\\_0001\\_manual.html](http://www.dnr.state.mn.us/waters/watermgmt_section/pwpermits/gp_2004_0001_manual.html).

**PERMISSIVE ONLY / NO LIABILITY:** This permit is permissive only. No liability shall be imposed by the State of Minnesota or any of its officers, agents or employees, officially or personally, on account of the granting hereof or on account of any damage to any person or property resulting from any act or omission of the permittee or any of its agents, employees, or contractors. This permit shall not be construed as estopping or limiting any legal claims or right of action of any person other than the state against the permittee, its agents, employees, or contractors, for any damage or injury resulting from any such act or omission, or as estopping or limiting any legal claim or right of action of the state against the permittee, its agents, employees, or contractors for violation of or failure to comply with the permit or applicable conditions.

**EXTENSION OF PUBLIC WATERS:** Any extension of the surface of public waters from work authorized by this permit shall become public waters and left open and unobstructed for use by the public.

**WETLAND CONSERVATION ACT:** Where the work authorized by this permit involves the draining or filling of wetlands not subject to DNR regulations, the permittee shall not initiate any work under this permit until the permittee has obtained official approval from the responsible local government unit as required by the Minnesota Wetland Conservation Act.

**INVASIVE SPECIES - EQUIPMENT DECONTAMINATION:** All equipment intended for use at a project site must be free of prohibited invasive species and aquatic plants prior to being transported into or within the state and placed into state waters. All equipment used in designated infested waters, shall be inspected by the Permittee or their authorized agent and adequately decontaminated prior to being transported from the worksite. The DNR is available to train inspectors and/or assist in these inspections. For more information refer to the "Best Practices for Preventing the Spread of Aquatic Invasive Species" at [http://files.dnr.state.mn.us/publications/ewr/invasives/ais/best\\_practices\\_for\\_prevention\\_ais.pdf](http://files.dnr.state.mn.us/publications/ewr/invasives/ais/best_practices_for_prevention_ais.pdf). Contact your regional Invasive Species Specialist for assistance at [www.mndnr.gov/invasives/contacts.html](http://www.mndnr.gov/invasives/contacts.html). A list of designated infested waters is available at [http://files.dnr.state.mn.us/eco/invasives/infested\\_waters.pdf](http://files.dnr.state.mn.us/eco/invasives/infested_waters.pdf). A list of prohibited invasive species is available at [www.mndnr.gov/eco/invasives/laws.html#prohibited](http://www.mndnr.gov/eco/invasives/laws.html#prohibited).

**WATER LEVEL MAINTENANCE:** During construction, water levels shall be maintained at normal elevations relative to the time of year. Additionally, flow through the dam structure shall remain run of the river.

**EROSION AND SEDIMENT CONTROL:** In all cases, methods that have been determined to be the most effective and practical means of preventing or reducing sediment from leaving the worksite shall be installed in areas that slope to the water and on worksite areas that have the potential for direct discharge due to pumping or draining of areas from within the worksite (e.g., coffer dams, temporary ponds, stormwater inlets). These methods, such as mulches, erosion control blankets, temporary coverings, silt fence, silt curtains or barriers, vegetation preservation, redundant methods, isolation of flow, or other engineering practices, shall be installed concurrently or within 24 hours after the start of the project, and will be maintained for the duration of the project in order to prevent sediment from leaving the worksite. DNR requirements may be waived in writing by the authorized DNR staff based on site conditions, expected weather conditions, or project completion timelines.

**FISHERY PROTECTION - EXCLUSION DATES:** No work affecting the bed of any watercourse may be conducted during the following exclusion dates: Designated trout streams - September 15 through June 30 of the following year; all other streams - April 1 through June 30 of the same year. These exclusion dates may be waived only upon written approval from the Area Fisheries Supervisor.

**FISH PASSAGE AND MOVEMENT:** All projects shall provide for the passage of water, fish and sediment load through the

## **GENERAL PERMIT CONDITIONS** *(Continued from previous page)*

proposed structure(s). A hydrologic/hydraulic data report showing calculated flow velocities through the structure at 2-, 50-, and 100-year peak flows shall be provided for each project by the permittee. Two-year peak flow velocities shall not exceed the natural channel 2-year peak flow. In single culvert installations, the invert elevation shall be depressed below the stream channel at a depth that does not disrupt sediment load. Based on criteria developed by others, a minimum of 12 inches of 1/6th the bankfull width up to a maximum of 2-foot depth is recommended. In multiple culvert installations, only one culvert located nearest the deepest portion of the stream channel shall have the invert elevation depressed as described above, with the remaining culvert(s) set 12 inches above the elevation of the invert of the low flow culvert. All structures shall match the alignment and slope of the existing channel unless the crossing geometry needs to be realigned to restore the movement of water, fish and sediment load. Other specific recommendations shall be incorporated into the design. The permittee shall notify the Area Fisheries Manager at least five days prior to initiating work.

**ORIGINAL WIDTH AND GRADIENT:** Any project that alters the width or gradient of a watercourse shall re-establish the original width and gradient upon completion of the project.

**REVEGETATION:** If the portion of the site that contributes direct runoff to surface waters cannot be stabilized with vegetation before October 15 of any year, all exposed soil shall be adequately mulched at a rate of not less than 3500 lbs./acre, leaving no more than 20 percent visible soil surface and maintained until seeding/sodding can be achieved.

**CONSTRUCTION AIDS:** No construction of temporary channel diversions or placement of fill below OHW level for temporary work pads, bypass roads, or cofferdams to aid in construction of any authorized structure is allowed unless specifically approved in writing by the Division of Ecological and Water Resources. Clean non-erosive fill must be used and all such material shall be removed upon project completion.

**NAVIGATION MAINTAINED OR IMPROVED:** Permittee is responsible for maintaining existing navigation and access to navigation. Generally, three (3) feet of clearance above calculated 50-year recurrence interval flood stages will satisfy this requirement.

**FILL PLACEMENT:** All fill placement shall comply with applicable floodplain and wetland management standards and ordinances.

**ENVIRONMENTAL REVIEW:** If the bridge/culvert construction is part of a road project that requires mandatory environmental review pursuant to MN Environmental Quality Board rules, then the project shall not proceed until after this review is completed.

**REPORT / ANNUAL MEETING:** Prior to April 15 of each year, the permittee shall submit to the Division of Ecological and Water Resources a list of proposed projects to be constructed under this permit. If emergency or unforeseen projects arise that are not included in the annual report, or if a previously approved project causes unanticipated impacts to public waters once the project is underway, the permittee shall notify the Division of Ecological and Water Resources at the earliest opportunity to provide details and discuss project design and applicable performance standards. When the Division notifies the permittee that it wishes to inspect and/or comment on a specific project, then the project shall not proceed until after the receipt of the Division's recommendations.

**STATE AND FEDERAL LISTED SPECIES PROHIBITION:** If there are unresolved concerns regarding impacts to federally or state listed species (endangered, threatened, or special concern) this General Permit is not applicable and the project must be submitted as an individual separate permit application. Compliance with the DNR and federal guidelines established for a listed species (e.g. Topeka Shiner conditions) would constitute a resolved concern.

**APPLICABLE PROJECTS:** This permit applies only to bridge/culvert projects that are designed or approved by a registered professional engineer, except that any project reported pursuant to conditions in this permit that the Division of Ecological and Water Resources identifies as having the potential for significant resource impacts must be submitted as a separate individual permit application.

---

## Appendix B

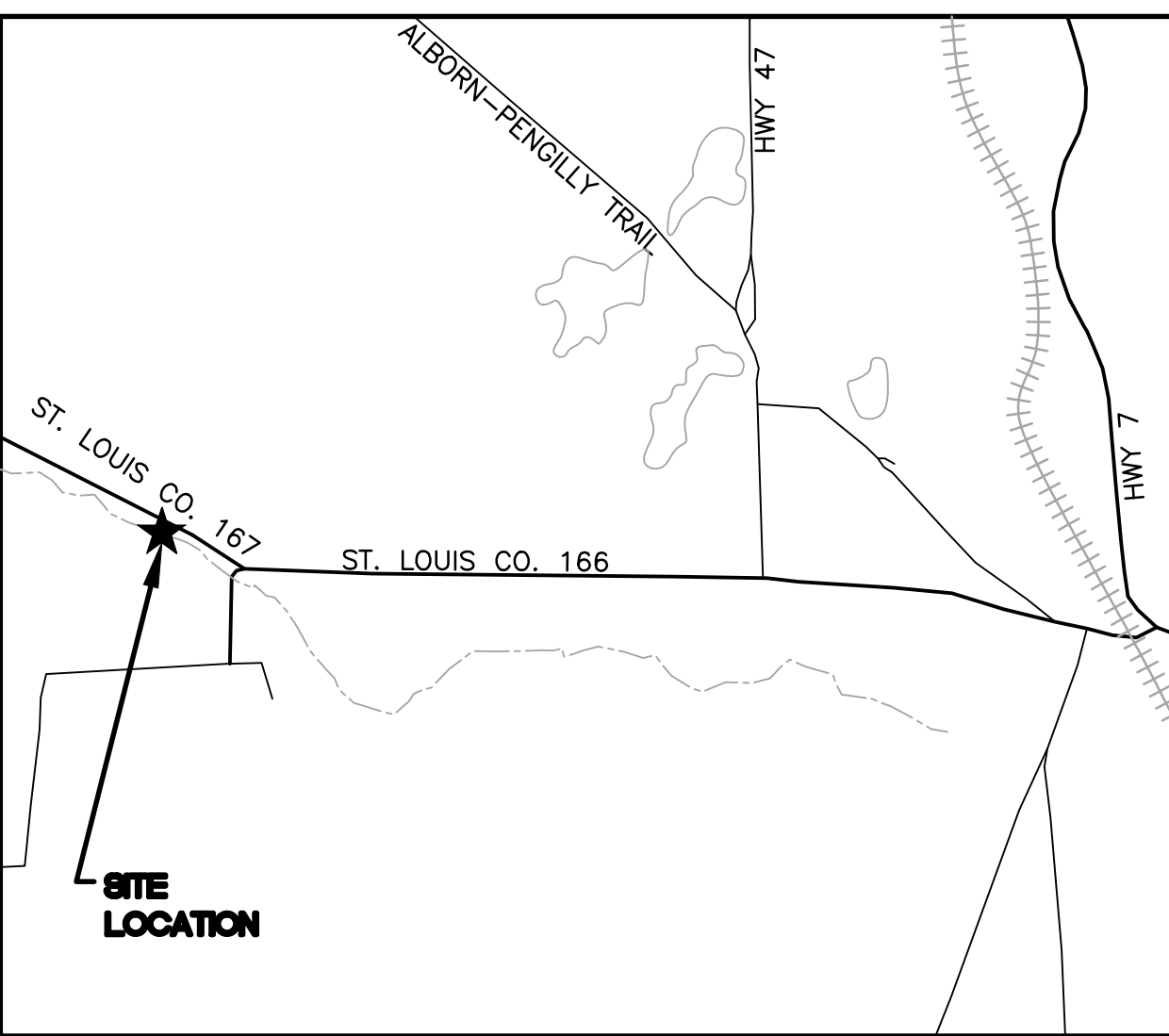
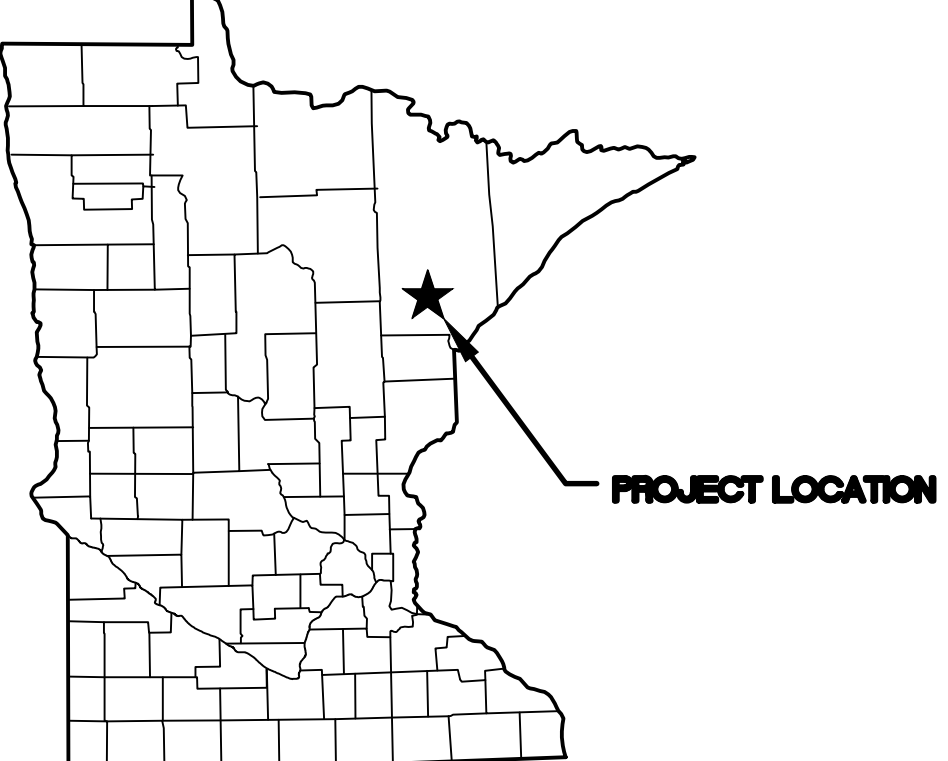
### Proposed Stream Restoration Plans



# SPIDER CREEK RESTORATION ALBORN, MINNESOTA

## SHEET INDEX

SHEET NO.	TITLE
G-01	LOCATION MAP, LEGEND AND SHEET INDEX
G-02	STRUCTURE TABLE AND QUANTITIES
C-01	PROPOSED PLAN - OVERVIEW
C-02	PROPOSED PLAN AND PROFILE STATIONS 0+00 TO 7+00
C-03	PROPOSED PLAN AND PROFILE STATIONS 7+00 TO 14+00
C-04	PROPOSED PLAN AND PROFILE STATIONS 14+00 TO 21+00
C-05	PROPOSED PLAN AND PROFILE STATIONS 21+00 TO 28+00
C-06	PROPOSED PLAN AND PROFILE STATIONS 28+00 TO 35+00
C-07	PROPOSED PLAN AND PROFILE STATIONS 35+00 TO 40+83
C-08	DESIGN CROSS SECTIONS
C-09	DESIGN CROSS SECTIONS
C-10	RESTORATION AND REVEGETATION PLAN
D-01	DETAIL SHEET 1 OF 3
D-02	DETAIL SHEET 2 OF 3
D-03	DETAIL SHEET 3 OF 3



SITE LOCATION



VICINITY MAP

**LEGEND**

PROPERTY BOUNDARY	---
EXISTING MAJOR CONTOURS	1000
EXISTING MINOR CONTOURS	1002
PROPOSED MAJOR CONTOURS	1000
PROPOSED MINOR CONTOURS	1002
PROPOSED STREAM	⊕
PROPOSED GRADE CONTROL RIFFLE	[Pattern]
PROPOSED TOE WOOD	[Pattern]
PROPOSED DITCH PLUG	[Pattern]
PROPOSED WETLANDS	[Pattern]

**NOTES:**  
 - ALL COORDINATES BASED ON UTM ZONE 15N, NAD83 US FOOT.  
 - ALL ELEVATIONS BASED ON NAVD83, 2012 VERTICAL DATUM.  
 - SEE SHEET C-01 FOR GENERAL CONSTRUCTION NOTES.

60% REVIEW  
NOT FOR CONSTRUCTION

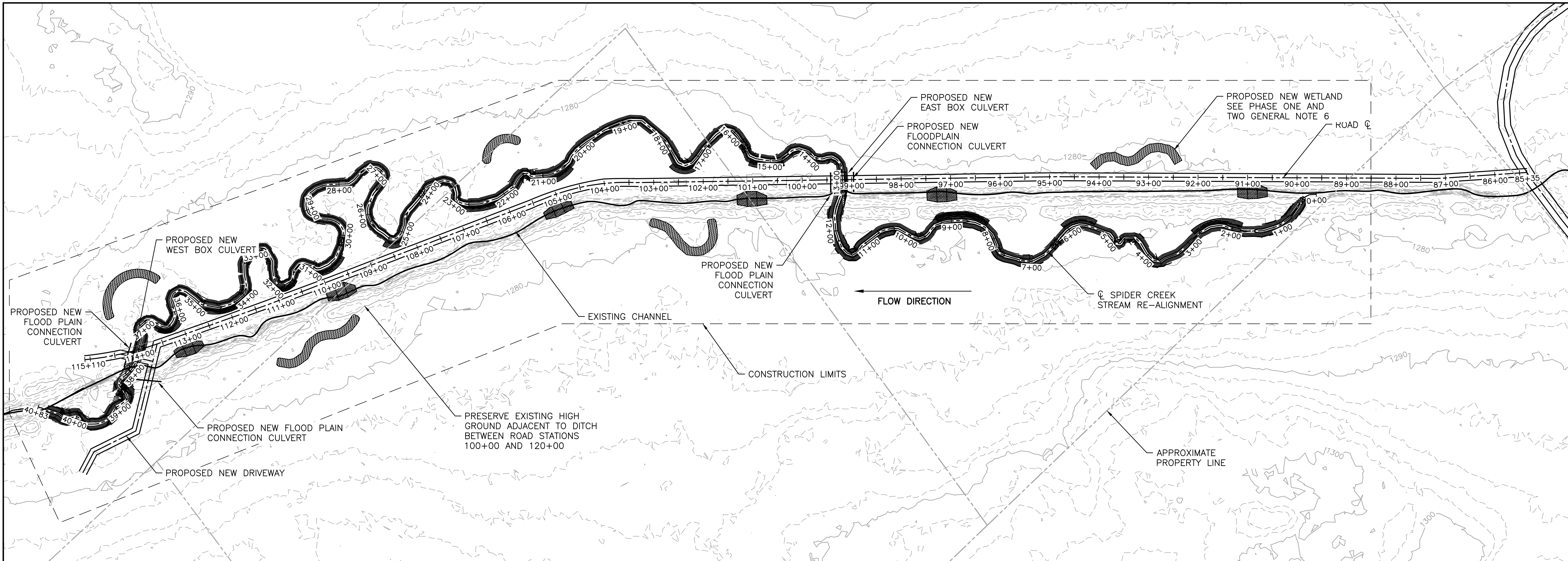
CADD USER: Randy R Roberts FILE: O:\DESIGN\23691303\303\_SPIDER CREEK\_G01\_TITLE SHEET.DWG PLOT SCALE: 1:1 PLOT DATE: 12/23/2015 3:52 PM  
 BARR MA\AutocAD 2011\AutocAD 2011 Support\enu\Template\Barr\_2011\_Template.dwt Plot at: 1 10/05/2010 14:03:50

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.		CLIENT: 12-23-15		<b>BARR</b>		Project Office: BARR ENGINEERING CO. 325 SOUTH LAKE AVENUE SUITE 700 DULUTH, MN. 55802		Scale: AS SHOWN Date: 5/26/15		UNITED STATES STEEL CORPORATION MINNESOTA ORE OPERATIONS - MINNTAC MOUNTAIN IRON, MINNESOTA		BARR PROJECT No. <b>23/69-1303</b>	
PRINTED NAME: JESSICA C. L. OLSON		PERMIT:		Corporate Headquarters: Minneapolis, Minnesota Ph: 1-800-632-2277		Ph: 1-800-786-5830 Fax: (218) 727-6450 www.barr.com		Drawn: EPF Checked: JCO Designed: JCO Approved:		CLIENT PROJECT No.		DWG. No.	
SIGNATURE:		RELEASED TO/FOR:		A B C 0 1 2 3		DATE RELEASED		MOUNTAIN IRON, MINNESOTA		SPIDER CREEK RESTORATION ALBORN, MINNESOTA		REV. No.	
DATE: 6/15/15 LICENSE # 43102		REVISION DESCRIPTION:		A B C 0 1 2 3		DATE RELEASED		MOUNTAIN IRON, MINNESOTA		LOCATION MAP, LEGEND AND SHEET INDEX		G-01 A	









1 PLAN: SPIDER CREEK STREAM RE-ALIGNMENT



LEGEND

- APPROX. PROPERTY BOUNDARY
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- GRADE CONTROL RIFFLE  
SEE DETAIL 1001
- TOE WOOD BANK PROTECTION  
SEE DETAIL 1002
- BERM  
SEE DETAIL 6003
- PROPOSED WETLANDS  
SEE PHASE ONE AND TWO GENERAL NOTES ON SHEET CG-001

GENERAL NOTES:

THESE DRAWINGS HAVE BEEN ISSUED FOR PURPOSES OF A 60% REVIEW. PROPOSED CONTOURS AS SHOWN ARE NOT FINAL, AND WILL BE EDITED PRIOR TO FINAL DRAWINGS BEING ISSUED.

PROJECT SHALL BE CONSTRUCTED IN TWO PHASES. THE FIRST PHASE WILL INCLUDE EXCAVATING THE NEW CHANNEL OFF-LINE OF THE EXISTING DITCHED CHANNEL. THE SECOND PHASE WILL TAKE PLACE AFTER AT LEAST ONE FULL GROWING SEASON. THE EXISTING DITCH WILL BE SHAPED AND FILLED TO ROUTE STREAM FLOW INTO THE NEW CHANNEL, NEW CULVERT WILL BE INSTALLED, AND A NEW DRIVEWAY WILL BE BUILT.

PHASE ONE AND TWO GENERAL NOTES

1. SALVAGE ALL TOPSOIL ON SITE.
2. CONTRACTOR TO OBTAIN CONSTRUCTION SITE NPDES PERMITS, AS NEEDED, FOR EACH PHASE OF CONSTRUCTION SEDIMENT AND EROSION CONTROL.
3. STOCKPILES SHALL BE TEMPORARILY SEEDED IF LEFT FOR MORE THAN 3 DAYS AND SURROUNDED WITH SILT FENCE.
4. ALL DISTURBED AREAS, HAUL ROADS, ECT. SHALL BE RESTORED, SEEDED AND MULCHED PRIOR TO LEAVING SITE.
5. WORK TO BE PHASED TO MINIMIZE AREA OF DISTURBED SOIL.
6. CONSTRUCTED WETLANDS WILL BE DESIGNED AND CONSTRUCTED USING GUIDANCE PROVIDED IN THE MINNESOTA BOARD OF WATER AND SOIL RESOURCES - MINNESOTA WETLAND RESTORATION GUIDE (SECOND EDITION): SECTION 4 - ENGINEERING DESIGN AND CONSTRUCTION, INCLUDING SECTION 4-6, SEDIMENT REMOVAL, SCRAPES AND OTHER EXCAVATIONS; SECTION 4 - APPENDIX 4B; AND STANDARD ENGINEERING DESIGN DRAWINGS FOR SCRAPE/SEDIMENT REMOVAL DETAILS - DRAWING# BWSR-104 (4/23/2014)

PHASE TWO GENERAL NOTES

1. DIRECT FLOW TO NEW CHANNEL BY FILLING OLD DITCHED CHANNEL. PHASE CONSTRUCTION TO PREVENT WORK IN FLOWING CHANNEL.
2. CONTRACTOR TO OBTAIN CONSTRUCTION SITE NPDES PERMITS, AS NEEDED, FOR EACH PHASE OF CONSTRUCTION SEDIMENT AND EROSION CONTROL.
3. STOCKPILES SHALL BE TEMPORARILY SEEDED IF LEFT FOR MORE THAN 3 DAYS AND SURROUNDED WITH SILT FENCE.
4. ALL DISTURBED AREAS, HAUL ROADS, ECT. SHALL BE RESTORED, SEEDED AND MULCHED PRIOR TO LEAVING SITE.
5. CONSTRUCTION ACTIVITIES WITHIN SPIDER CREEK, INCLUDING CONTROL OF WATER, SHALL BE PERFORMED WITHIN THE WORK IN WATER PERIOD OF XXXX TO XXXX.
6. CONTROL WATER AS NECESSARY TO MAINTAIN WORKING CONDITIONS IN CONSTRUCTION AREA.
7. CONTROL PUBLIC ACCESS TO CONSTRUCTION AND ACCESS AREAS AS NECESSARY WITH CONSTRUCTION FENCING OR SILT FENCING.
8. CONTRACTOR SHALL MONITOR THE SITE FOR PRESENCE OF BLANDING'S TURTLES AND SHALL RELOCATE ANY TURTLE OBSERVED IN THE WORK AREAS.

PROPOSED CHANNEL DETAILS

- CHANNEL TYPE: E  
RIFLE DIMENSIONS:
- WIDTH - 17 FT. +/- 1 FT.
  - MEAN DEPTH - 2.4 FT. +/- 0.2 FT.
  - MAX DEPTH - 3.7 FT. +/- 0.2 FT.
  - CROSS SECTIONAL AREA - 41 SQ. FT. +/- 2 SQ. FT.
  - W/D RATIO 7.2 +/- 0.2 FT.

POOL DIMENSIONS:

- WIDTH - 27 FT. +/- 4 FT.
- MAX DEPTH - 4.4 FT +/- 0.2 FT.
- CROSS SECTIONAL AREA - 65 SQ. FT. +/- 10 SQ. FT.

PROPOSED STREAM SLOPE - 0.0008 FT/FT

STREAM PLAN DETAILS:

- PROPOSED SINUOSITY - 1.6 +/- 0.1
- PROPOSED CHANNEL LENGTH, 4,000 FT., EXISTING LENGTH 2635 FT.
- MEAN MEANDER BELT WIDTH - 90 FT +/- 10 FT.
- MEAN MEANDER RADIUS OF CURVATURE - 28 FT.
- MEAN MEANDER LENGTH - 168 FT +/- 20 FT.
- MEAN LINEAR WAVELENGTH - 224 FT +/- 20 FT.

**HOLD FOR:**

- GRADING LIMITS
- PROPOSED CONTOUR UPDATES
- CHANNEL DETAILS
- QUANTITIES
- DITCH FILL PROFILE
- PROPOSED WETLANDS DETAIL
- CULVERT DETAILS
- LOG STEP STRUCTURAL DETAILS AND ELEVATIONS

60% REVIEW  
NOT FOR CONSTRUCTION

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

PRINTED NAME: JESSICA C. L. OLSON  
SIGNATURE: \_\_\_\_\_  
DATE: 6/15/15 LICENSE # 43102

CLIENT	12-23-15						
BID							
CONSTRUCTION PERMIT							
RECORD							
RELEASED TO/FOR	A	B	C	0	1	2	3
DATE RELEASED							

**BARR**  
Corporate Headquarters:  
Minneapolis, Minnesota  
Ph: 1-800-632-2277

Project Office:  
**BARR ENGINEERING CO.**  
325 SOUTH LAKE AVENUE  
SUITE 700  
DULUTH, MN. 55802  
Ph: 1-800-786-5830  
Fax: (218) 727-6450  
www.barr.com

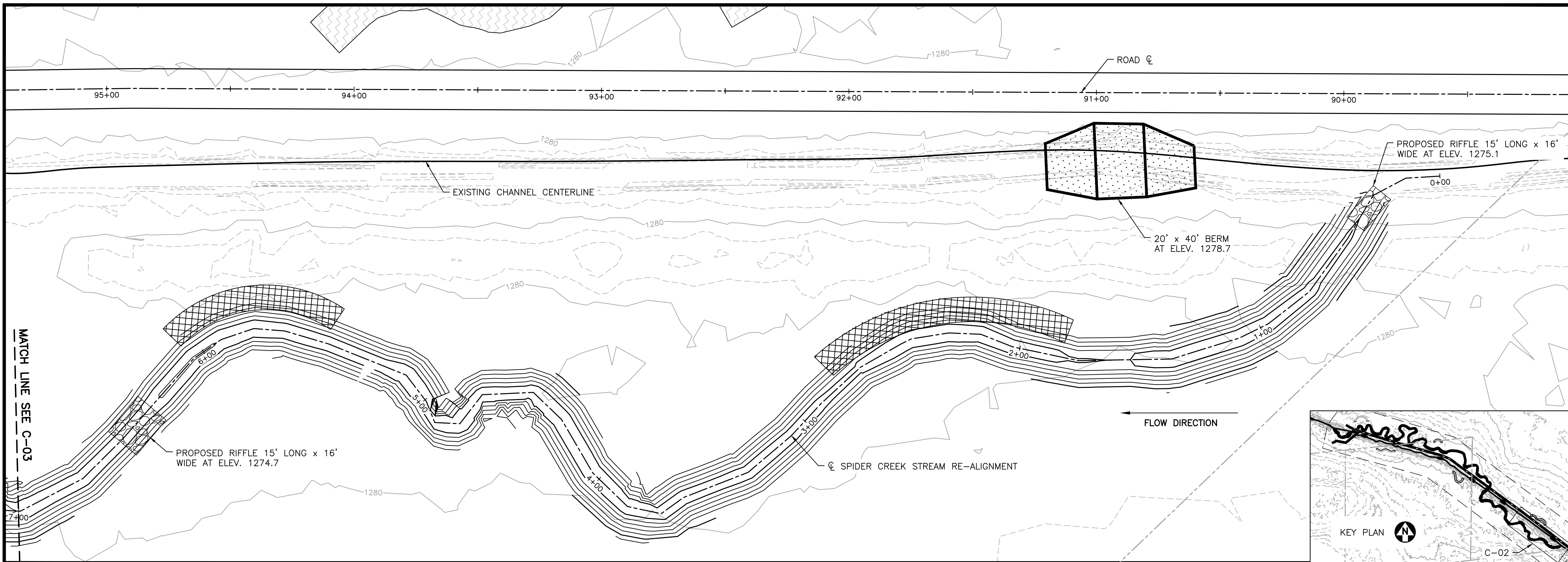
Scale	AS SHOWN
Date	12/04/15
Drawn	JDH2
Checked	JCO
Designed	JCO
Approved	

UNITED STATES STEEL CORPORATION  
MINNESOTA ORE OPERATIONS -  
MINNTAC  
MOUNTAIN IRON, MINNESOTA

SPIDER CREEK RESTORATION  
ALBORN, MINNESOTA  
PROPOSED PLAN - OVERVIEW

BARR PROJECT No.	23/69-1303
CLIENT PROJECT No.	
DWG. No.	C-01
REV. No.	A

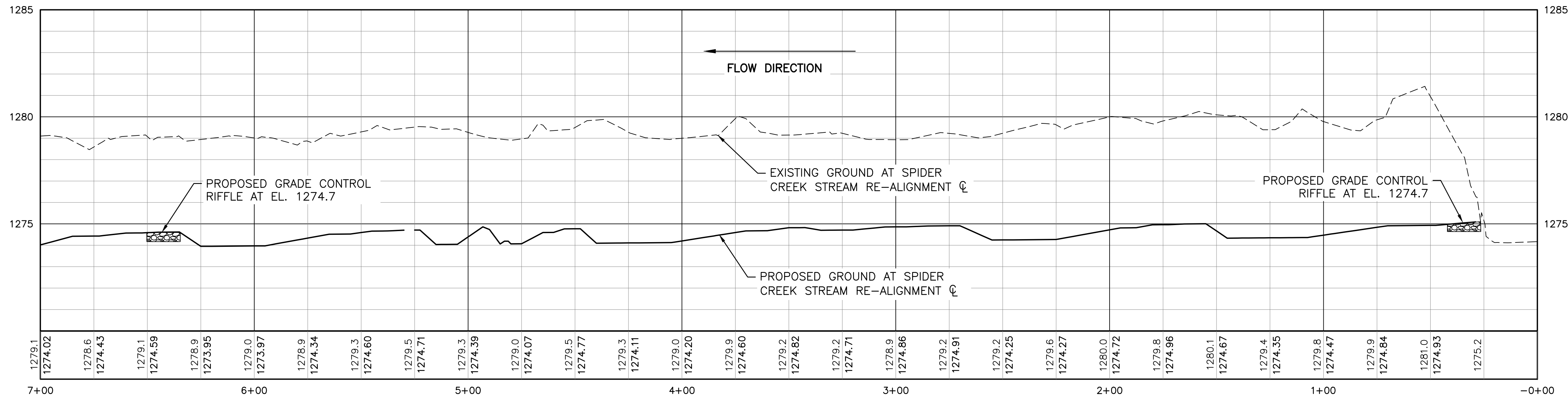




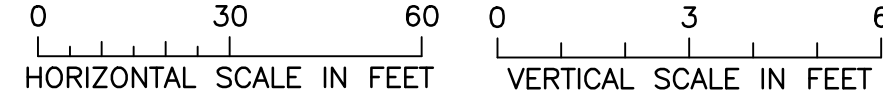
1 PLAN: SPIDER CREEK STREAM RE-ALIGNMENT



- NOTES:
- EXISTING CONTOURS REPRESENT 2012 LIDAR DATA ELEVATIONS MERGED WITH 2014 AND 2015 TOPOGRAPHIC SURVEY.
  - PROPOSED CHANNEL PROFILE ELEVATIONS AND CONTOURS REPRESENT AVERAGE FEATURE MAXIMUM DEPTHS.
  - FINAL CHANNEL DIMENSIONS, PATTERN AND PROFILE ELEVATIONS WILL VARY. SEE PROPOSED CHANNEL DETAILS ON SHEET C-01.



1 PROFILE: SPIDER CREEK STREAM RE-ALIGNMENT



LEGEND

- APPROX. PROPERTY BOUNDARY
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- GRADE CONTROL RIFFLE SEE DETAIL 1 (D01)
- TOE WOOD BANK PROTECTION SEE DETAIL 1 (D02)
- BERM SEE DETAIL 6 (D03)
- PROPOSED WETLANDS - SEE PHASE ONE AND TWO GENERAL NOTES ON SHEET C-01

60% REVIEW  
NOT FOR CONSTRUCTION

CADD USER: jessica\_olson FILE: \\EDU-CAD\CAD\DESIGN\23691303\C-02.DWG PLOT SCALE: 1:1 PLOT DATE: 12/23/2015 4:23 PM  
BARR - MA AutoCAD 2011 Support\enu\Template\Barr\_2011\_Template.dwt Plot at 1 10/05/2010 14:03:50

NO.	BY	CHK	APP.	DATE	REVISION DESCRIPTION
A	EPF	JCO		12/23/15	ISSUED FOR 60% REVIEW

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

PRINTED NAME: JESSICA C. L. OLSON  
SIGNATURE: \_\_\_\_\_  
DATE: 6/15/15 LICENSE # 43102

CLIENT	BID	CONSTRUCTION PERMIT	RECORD	RELEASED TO/FOR	DATE RELEASED
12-23-15				A B C 0 1 2 3	

**BARR**  
Corporate Headquarters: Minneapolis, Minnesota Ph: 1-800-632-2277

Project Office:  
**BARR ENGINEERING CO.**  
325 SOUTH LAKE AVENUE  
SUITE 700  
DULUTH, MN. 55802  
Ph: 1-800-786-5830  
Fax: (218) 727-6450  
www.barr.com

Scale	AS SHOWN
Date	12/04/15
Drawn	JDH2
Checked	JCO
Designed	JCO
Approved	

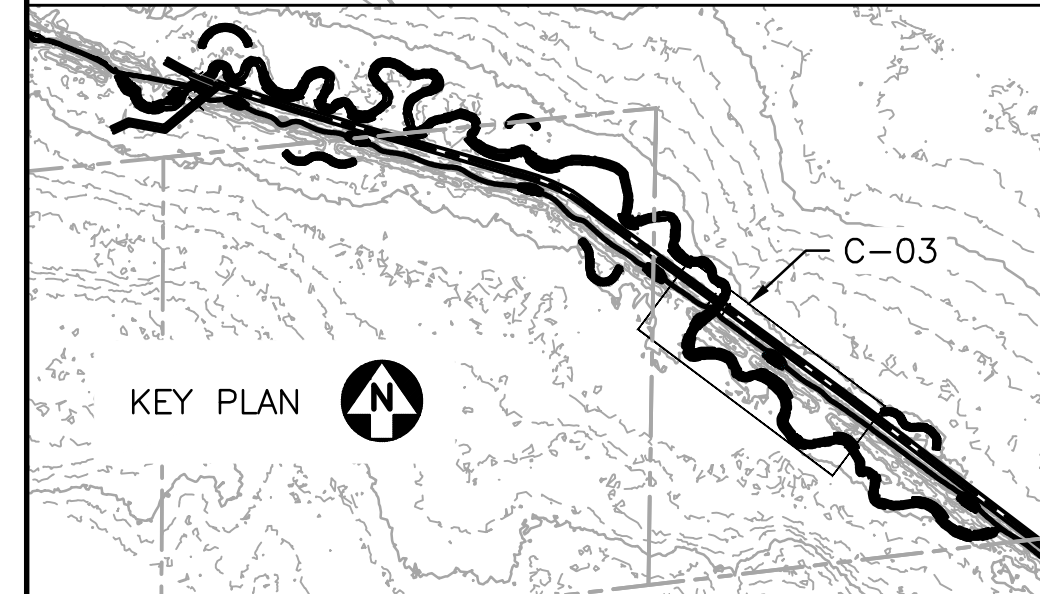
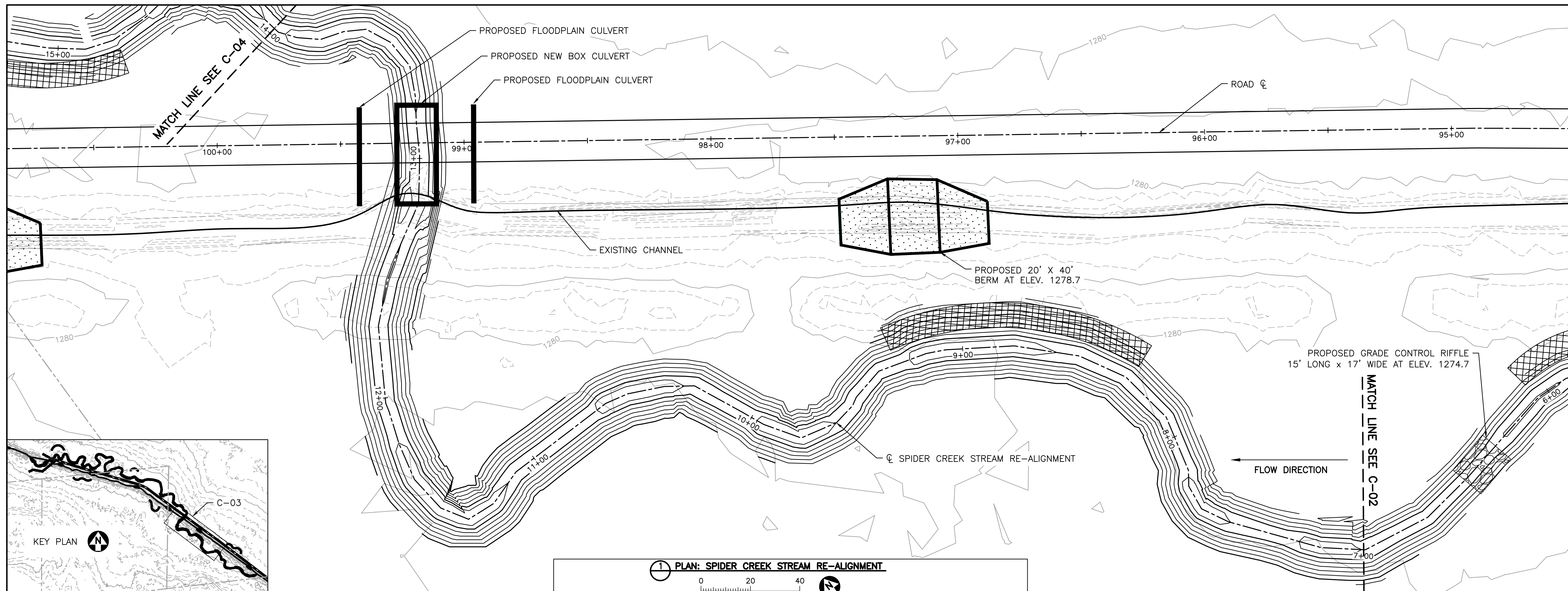
**UNITED STATES STEEL CORPORATION**  
**MINNESOTA ORE OPERATIONS -**  
**MINNTAC**  
**MOUNTAIN IRON, MINNESOTA**

**SPIDER CREEK RESTORATION**  
**ALBORN, MINNESOTA**  
**PLAN AND PROFILE STATIONS**  
**0+00 TO 7+00**

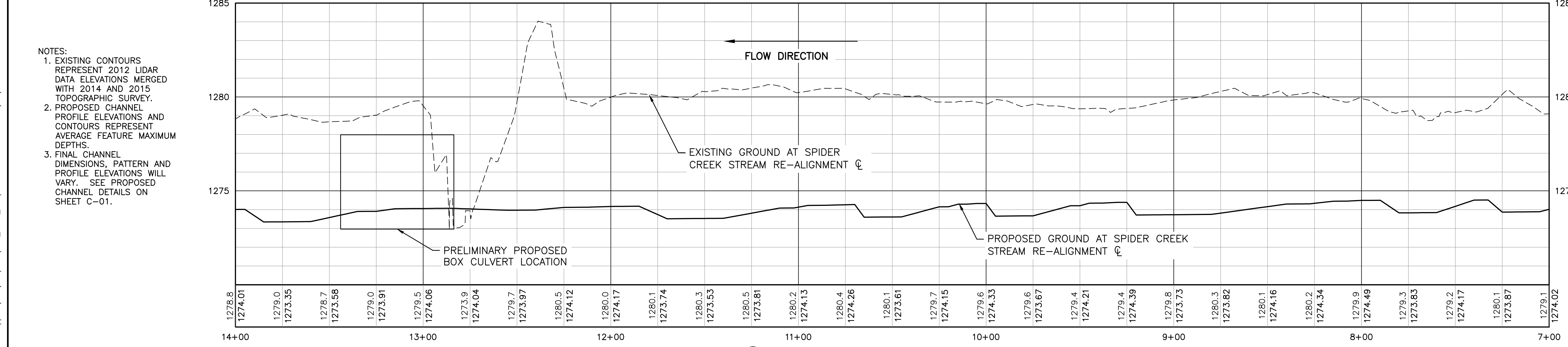
BARR PROJECT No.	23/69-1303
CLIENT PROJECT No.	
DWG. No.	C-02
REV. No.	A



CADD USER: Jessica Olson FILE: \\VEDI-CAD\CAD\DESIGN\23691303\C-03.DWG PLOT SCALE: 1:1 PLOT DATE: 12/23/2015 4:27 PM  
 BARR M:\AutoCAD 2011\AutoCAD 2011 Support\enu\Template\Barr\_2011\_Template.dwt Plot at 1 10/05/2010 14:03:50



1 PLAN: SPIDER CREEK STREAM RE-ALIGNMENT  
 0 20 40  
 SCALE IN FEET



1 PROFILE: SPIDER CREEK STREAM RE-ALIGNMENT  
 0 30 60 0 3 6  
 HORIZONTAL SCALE IN FEET VERTICAL SCALE IN FEET

NOTES:  
 1. EXISTING CONTOURS REPRESENT 2012 LIDAR DATA ELEVATIONS MERGED WITH 2014 AND 2015 TOPOGRAPHIC SURVEY.  
 2. PROPOSED CHANNEL PROFILE ELEVATIONS AND CONTOURS REPRESENT AVERAGE FEATURE MAXIMUM DEPTHS.  
 3. FINAL CHANNEL DIMENSIONS, PATTERN AND PROFILE ELEVATIONS WILL VARY. SEE PROPOSED CHANNEL DETAILS ON SHEET C-01.

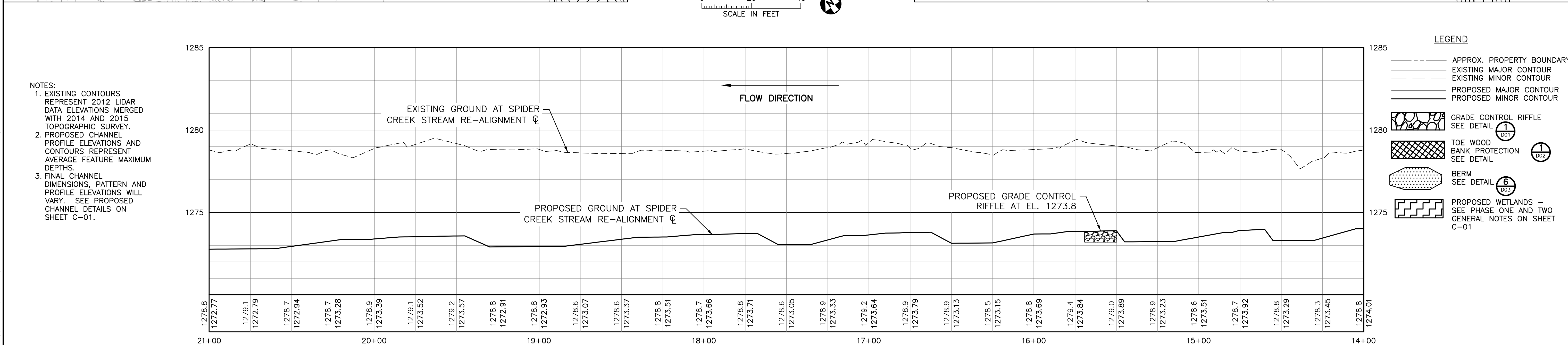
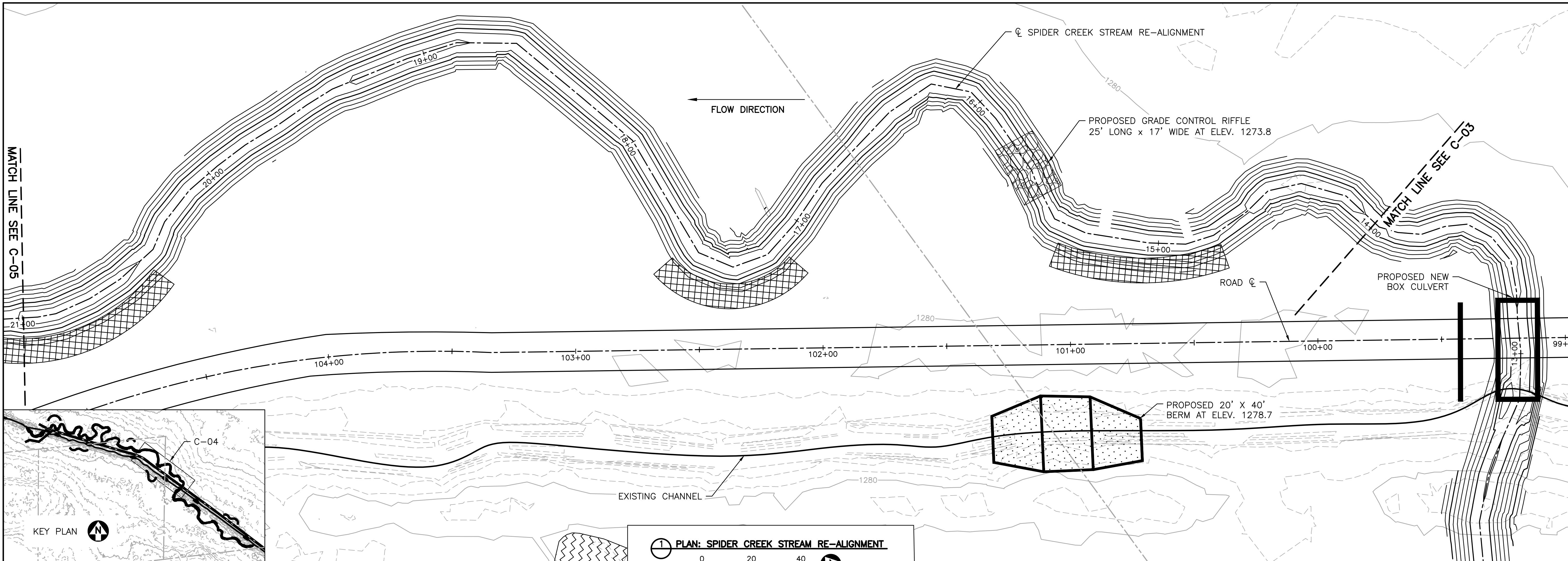
LEGEND

	APPROX. PROPERTY BOUNDARY
	EXISTING MAJOR CONTOUR
	EXISTING MINOR CONTOUR
	PROPOSED MAJOR CONTOUR
	PROPOSED MINOR CONTOUR
	GRADE CONTROL RIFFLE SEE DETAIL 1 (D01)
	TOE WOOD BANK PROTECTION SEE DETAIL 1 (D02)
	BERM SEE DETAIL 6 (D03)
	PROPOSED WETLANDS - SEE PHASE ONE AND TWO GENERAL NOTES ON SHEET C-01

60% REVIEW  
 NOT FOR CONSTRUCTION

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA. PRINTED NAME: JESSICA C. L. OLSON SIGNATURE: _____ DATE: 6/15/15 LICENSE # 43102		CLIENT: 2-23-15 CONSTRUCTION PERMIT RECORD RELEASED TO/FOR: A B C 0 1 2 3 DATE RELEASED:	Project Office: <b>BARR ENGINEERING CO.</b> 325 SOUTH LAKE AVENUE SUITE 700 DULUTH, MN. 55802 Corporate Headquarters: Minneapolis, Minnesota Ph: 1-800-786-5830 Fax: (218) 727-6450 www.barr.com	Scale: AS SHOWN Date: 12/04/15 Drawn: JDH2 Checked: JCO Designed: JCO Approved:	<b>UNITED STATES STEEL CORPORATION</b> <b>MINNESOTA ORE OPERATIONS -</b> <b>MINNTAC</b> <b>MOUNTAIN IRON, MINNESOTA</b>	<b>SPIDER CREEK RESTORATION</b> <b>ALBORN, MINNESOTA</b> <b>PLAN AND PROFILE STATIONS</b> <b>7+00 TO 14+00</b>	BARR PROJECT No. <b>23/69-1303</b> CLIENT PROJECT No. DWG. No. <b>C-03</b> REV. No. <b>A</b>
NO. BY CHK. APP. DATE REVISION DESCRIPTION							





60% REVIEW  
NOT FOR CONSTRUCTION

CADD USER: jessica\_olson FILE: \\EDU-CAD\CAD\DESIGN\23691303\00\23691303\_C-04.DWG PLOT SCALE: 1:1 PLOT DATE: 12/23/2015 4:30 PM  
BARR - MA AutoCAD 2011 Support\enu\Template\Barr\_2011\_Template.dwt Plot at 1 10/05/2010 14:03:50

NO.	BY	CHK	APP.	DATE	REVISION DESCRIPTION
A	EPF	JCO		12/23/15	ISSUED FOR 60% REVIEW

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

PRINTED NAME: JESSICA C. L. OLSON

SIGNATURE: \_\_\_\_\_

DATE: 6/15/15 LICENSE # 43102

CLIENT	12-23-15					
BID						
CONSTRUCTION PERMIT						
RECORD						
RELEASED TO/FOR	A	B	C	0	1	2
DATE RELEASED						

**BARR**

Corporate Headquarters:  
Minneapolis, Minnesota  
Ph: 1-800-632-2277

Project Office:  
**BARR ENGINEERING CO.**  
325 SOUTH LAKE AVENUE  
SUITE 700  
DULUTH, MN. 55802

Ph: 1-800-786-5830  
Fax: (218) 727-6450  
www.barr.com

Scale	AS SHOWN
Date	5/26/15
Drawn	JDH2
Checked	JCO
Designed	JCO
Approved	

**UNITED STATES STEEL CORPORATION**  
**MINNESOTA ORE OPERATIONS -**  
**MINNTAC**  
**MOUNTAIN IRON, MINNESOTA**

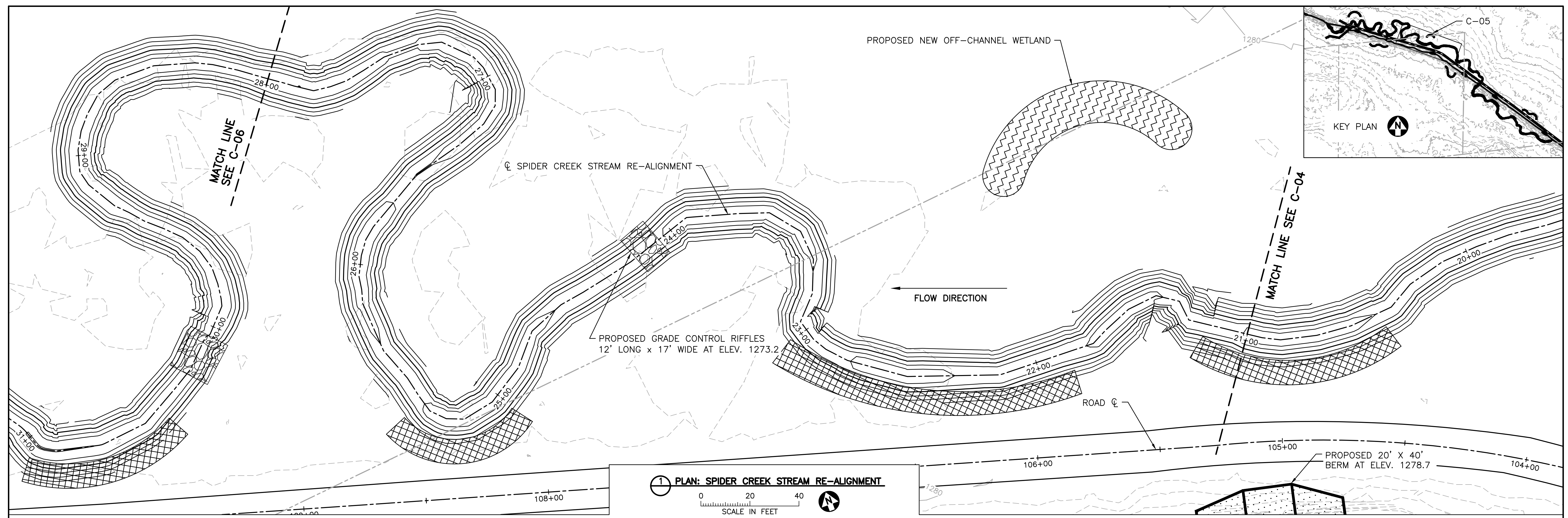
**SPIDER CREEK RESTORATION**  
**ALBORN, MINNESOTA**

**PLAN AND PROFILE STATIONS**  
**14+00 TO 21+00**

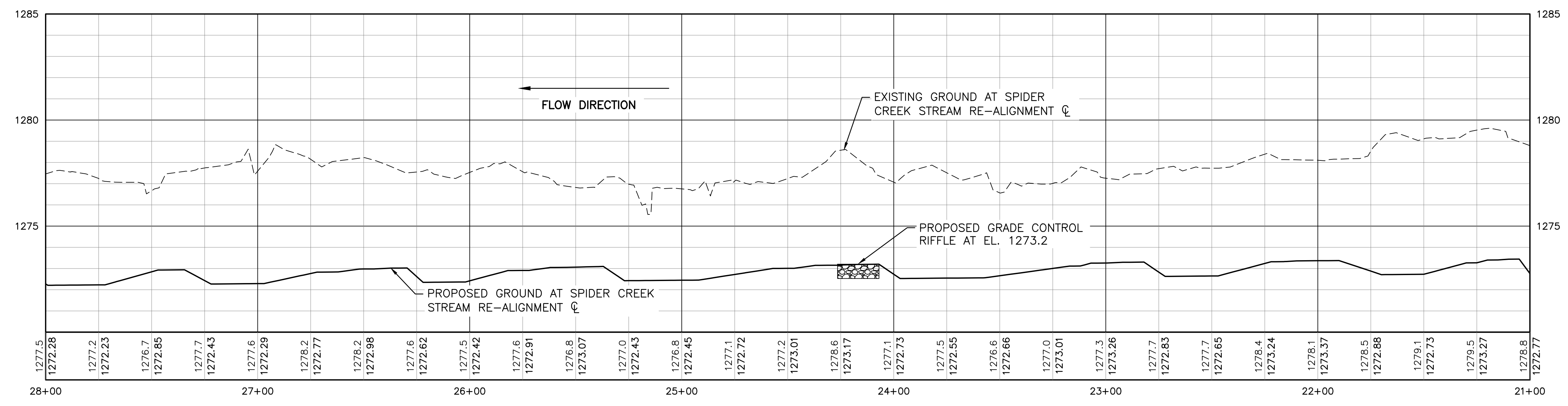
BARR PROJECT No.	23/69-1303
CLIENT PROJECT No.	
DWG. No.	C-04
REV. No.	A



CADD USER: jessica\_olson FILE: \\ED-CAD\CAD\DESIGN\23691303\C-05.DWG PLOT SCALE: 1:1 PLOT DATE: 12/23/2015 4:37 PM  
 BARR - MA AutoCAD 2011 Support\enu\Template\Barr\_2011\_Template.dwt Plot at 1 10/05/2010 14:03:50



- NOTES:**
- EXISTING CONTOURS REPRESENT 2012 LIDAR DATA ELEVATIONS MERGED WITH 2014 AND 2015 TOPOGRAPHIC SURVEY.
  - PROPOSED CHANNEL PROFILE ELEVATIONS AND CONTOURS REPRESENT AVERAGE FEATURE MAXIMUM DEPTHS.
  - FINAL CHANNEL DIMENSIONS, PATTERN AND PROFILE ELEVATIONS WILL VARY. SEE PROPOSED CHANNEL DETAILS ON SHEET C-01.

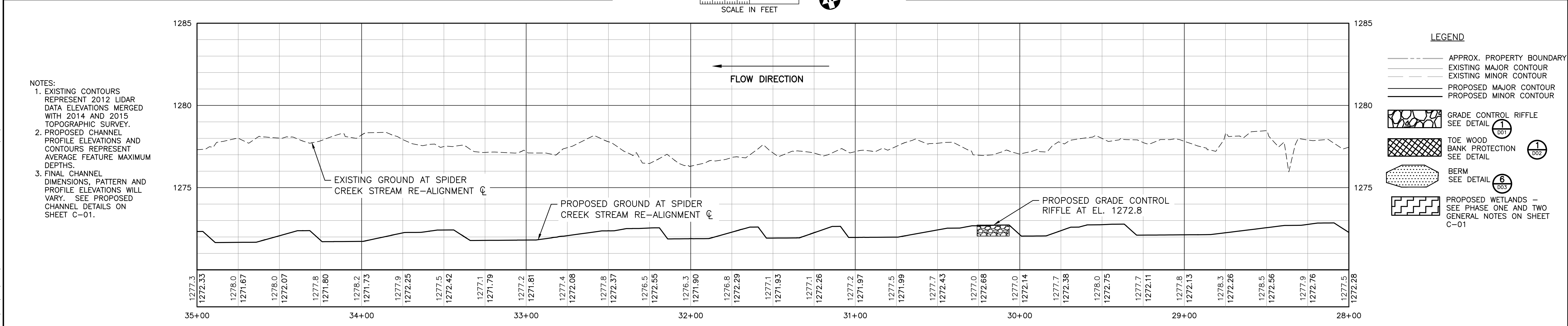
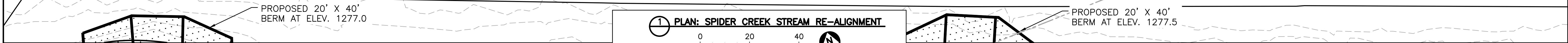
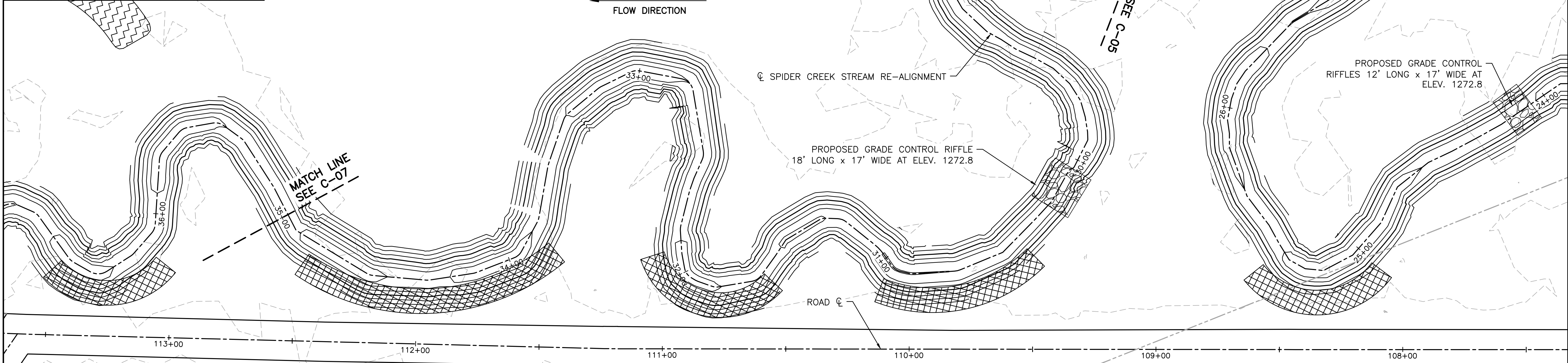
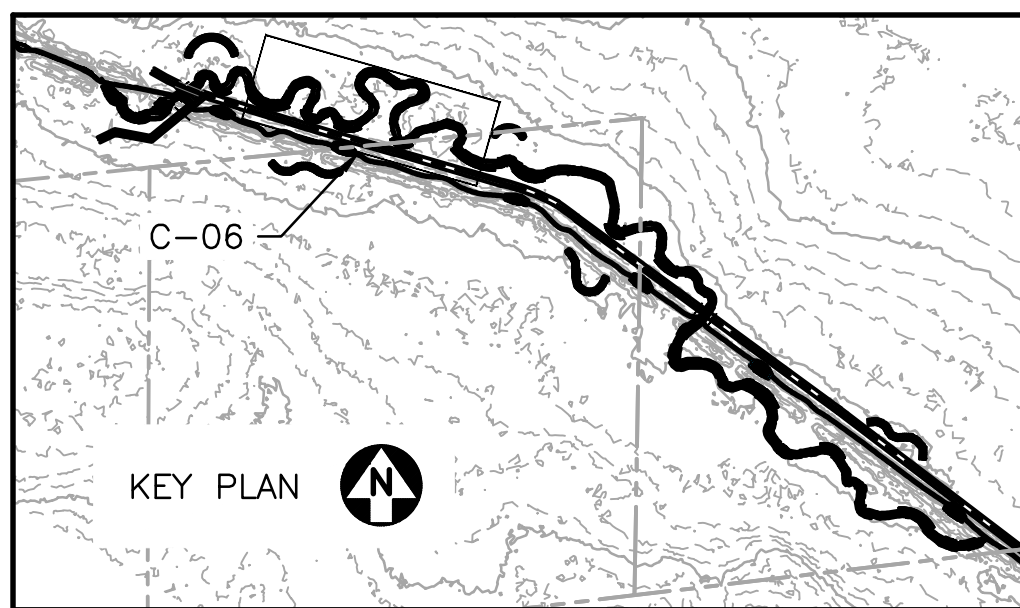


60% REVIEW  
NOT FOR CONSTRUCTION

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.		CLIENT 12-23-15	Project Office: BARR ENGINEERING CO. 325 SOUTH LAKE AVENUE SUITE 700 DULUTH, MN. 55802		Scale AS SHOWN	UNITED STATES STEEL CORPORATION MINNESOTA ORE OPERATIONS - MINNTAC MOUNTAIN IRON, MINNESOTA		SPIDER CREEK RESTORATION ALBORN, MINNESOTA		BARR PROJECT No. 23/69-1303		
PRINTED NAME: JESSICA C. L. OLSON		CONSTRUCTION PERMIT RECORD	Corporate Headquarters: Minneapolis, Minnesota Ph: 1-800-632-2277		Date 5/26/15	MINNESOTA ORE OPERATIONS - MINNTAC MOUNTAIN IRON, MINNESOTA		PLAN AND PROFILE STATIONS 21+00 TO 28+00		CLIENT PROJECT No.		
SIGNATURE		RELEASED TO/FOR	Ph: 1-800-786-5830 Fax: (218) 727-6450 www.barr.com		Drawn JDH2	MOUNTAIN IRON, MINNESOTA		REV. No. A		DWG. No. C-05		
DATE: 6/15/15 LICENSE # 43102		DATE RELEASED			Checked JCO							
NO.	BY	CHK.	APP.	DATE	REVISION DESCRIPTION							
A	EPF	--	JCO	12/23/15	ISSUED FOR 60% REVIEW							



CADD USER: jessica\_olson FILE: \\ED-CAD\CAD\DESIGN\23691303\00\23691303\_C-06.DWG PLOT SCALE: 1:1 PLOT DATE: 12/23/2015 4:45 PM  
 BARR - MA AutoCAD 2011 Support\enu\Template\Barr\_2011\_Template.dwt Plot at: 10/05/2010 14:03:50



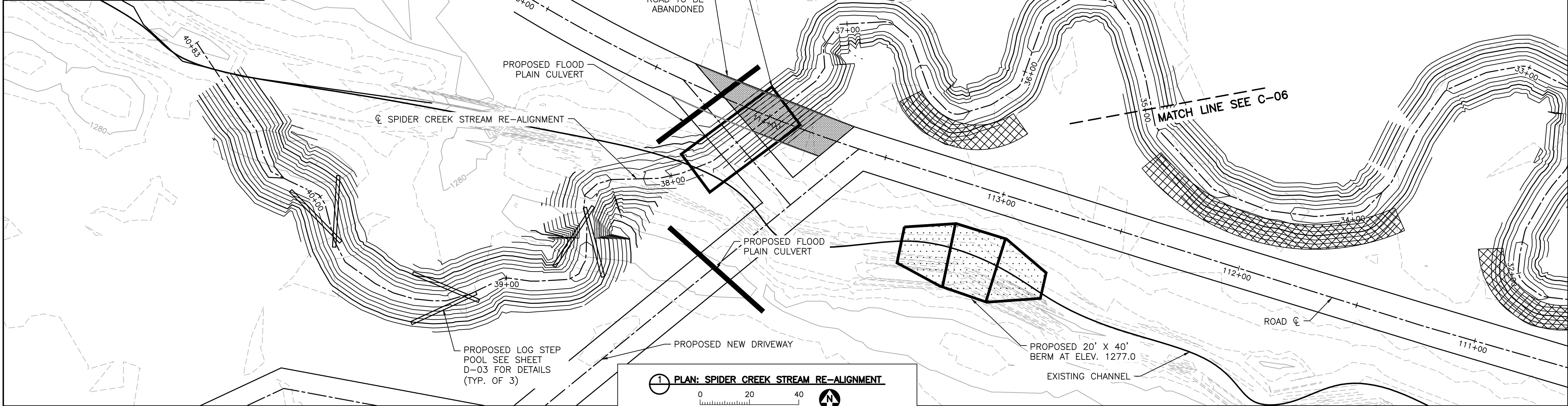
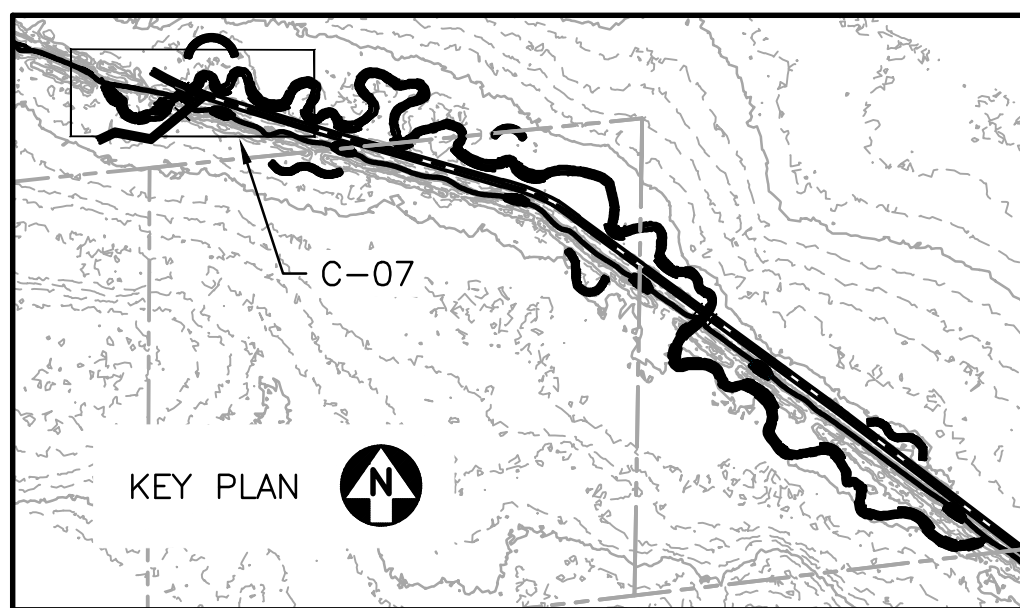
**NOTES:**  
 1. EXISTING CONTOURS REPRESENT 2012 LIDAR DATA ELEVATIONS MERGED WITH 2014 AND 2015 TOPOGRAPHIC SURVEY.  
 2. PROPOSED CHANNEL PROFILE ELEVATIONS AND CONTOURS REPRESENT AVERAGE FEATURE MAXIMUM DEPTHS.  
 3. FINAL CHANNEL DIMENSIONS, PATTERN AND PROFILE ELEVATIONS WILL VARY. SEE PROPOSED CHANNEL DETAILS ON SHEET C-01.

LEGEND	
	APPROX. PROPERTY BOUNDARY
	EXISTING MAJOR CONTOUR
	EXISTING MINOR CONTOUR
	PROPOSED MAJOR CONTOUR
	PROPOSED MINOR CONTOUR
	GRADE CONTROL RIFFLE SEE DETAIL 1 D01
	TOE WOOD BANK PROTECTION SEE DETAIL 1 D02
	BERM SEE DETAIL 6 D03
	PROPOSED WETLANDS - SEE PHASE ONE AND TWO GENERAL NOTES ON SHEET C-01

**60% REVIEW**  
**NOT FOR CONSTRUCTION**

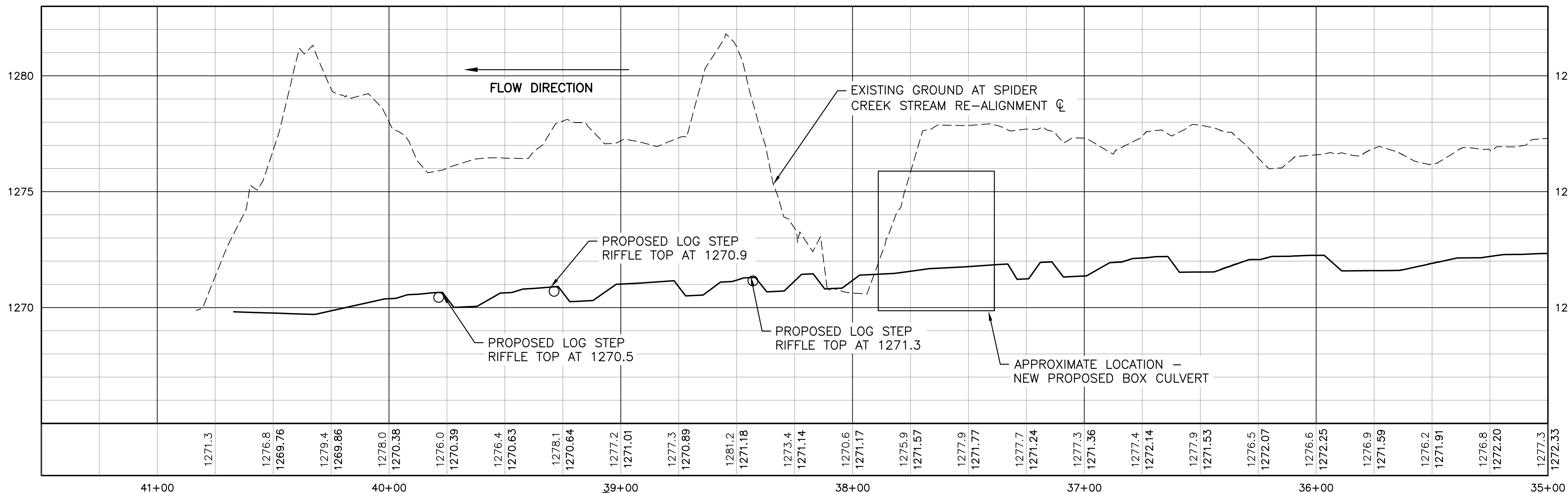
I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA. PRINTED NAME: JESSICA C. L. OLSON SIGNATURE: _____ DATE: 6/15/15 LICENSE # 43102		CLIENT: 12-21-15 BID: _____ CONSTRUCTION PERMIT: _____ RECORD: _____ RELEASED TO/FOR: _____ DATE RELEASED: _____		<b>BARR</b> Project Office: BARR ENGINEERING CO. 325 SOUTH LAKE AVENUE SUITE 700 DULUTH, MN. 55802 Corporate Headquarters: Minneapolis, Minnesota Ph: 1-800-632-2277		Scale: AS SHOWN Date: 5/26/15 Drawn: JDH2 Checked: JCO Designed: JCO Approved: _____		<b>UNITED STATES STEEL CORPORATION</b> <b>MINNESOTA ORE OPERATIONS -</b> <b>MINNTAC</b> <b>MOUNTAIN IRON, MINNESOTA</b>		<b>SPIDER CREEK RESTORATION</b> <b>ALBORN, MINNESOTA</b> <b>PLAN AND PROFILE STATIONS</b> <b>28+00 TO 35+00</b>		BARR PROJECT No. <b>23/69-1303</b> CLIENT PROJECT No. DWG. No. <b>C-06</b> REV. No. <b>A</b>	
---	--	---	--	--	--	---	--	--	--	--	--	---	--





1 PLAN: SPIDER CREEK STREAM RE-ALIGNMENT  
 0 20 40  
 SCALE IN FEET

- NOTES:
- EXISTING CONTOURS REPRESENT 2012 LIDAR DATA ELEVATIONS MERGED WITH 2014 AND 2015 TOPOGRAPHIC SURVEY.
  - PROPOSED CHANNEL PROFILE ELEVATIONS AND CONTOURS REPRESENT AVERAGE FEATURE MAXIMUM DEPTHS.
  - FINAL CHANNEL DIMENSIONS, PATTERN AND PROFILE ELEVATIONS WILL VARY. SEE PROPOSED CHANNEL DETAILS ON SHEET C-01.



1 PROFILE: SPIDER CREEK STREAM RE-ALIGNMENT  
 0 30 60 0 3 6  
 HORIZONTAL SCALE IN FEET VERTICAL SCALE IN FEET

LEGEND

- APPROX. PROPERTY BOUNDARY
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- GRADE CONTROL RIFFLE SEE DETAIL 1 D01
- TOE WOOD BANK PROTECTION SEE DETAIL 1 D02
- BERM SEE DETAIL 6 D03
- PROPOSED WETLANDS - SEE PHASE ONE AND TWO GENERAL NOTES ON SHEET C-01

60% REVIEW  
 NOT FOR CONSTRUCTION

CADD USER: jessica\_olson FILE: \\EDU-CAD\CAD\DESIGN\23691303\00\23691303\_C-07.DWG PLOT SCALE: 1:1 PLOT DATE: 12/23/2015 4:09 PM  
 BARR - MA AutoCAD 2011 Support\enu\Template\Barr\_2011\_Template.dwt Plot at 1 10/05/2010 14:03:50

NO.	BY	CHK.	APP.	DATE	REVISION DESCRIPTION
A	EPF	JCO		12/23/15	ISSUED FOR 60% REVIEW

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

PRINTED NAME: JESSICA C. L. OLSON  
 SIGNATURE: \_\_\_\_\_  
 DATE: 6/15/15 LICENSE # 43102

CLIENT	BID	CONSTRUCTION	PERMIT	RECORD
12-23-15				

RELEASED TO/FOR	A	B	C	0	1	2	3

**BARR**  
 Project Office:  
 BARR ENGINEERING CO.  
 325 SOUTH LAKE AVENUE  
 SUITE 700  
 DULUTH, MN. 55802  
 Corporate Headquarters:  
 Minneapolis, Minnesota  
 Ph: 1-800-632-2277

Scale	AS SHOWN
Date	5/26/15
Drawn	JDH2
Checked	JCO
Designed	JCO
Approved	

UNITED STATES STEEL CORPORATION  
 MINNESOTA ORE OPERATIONS -  
 MINNTAC  
 MOUNTAIN IRON, MINNESOTA

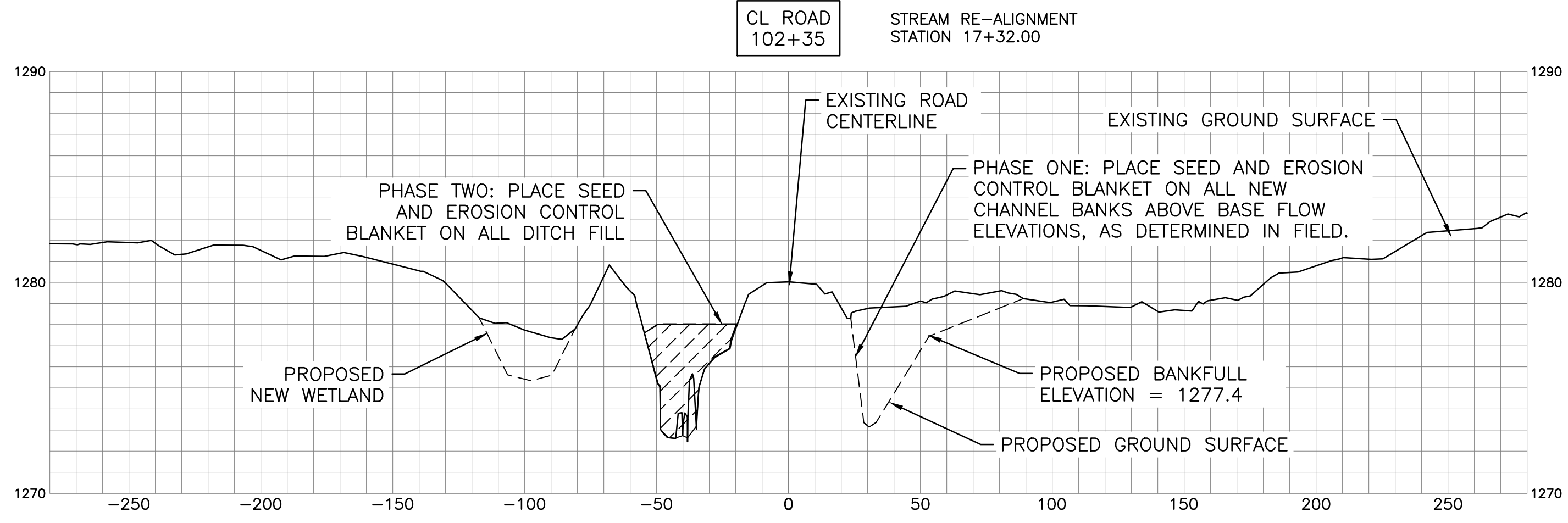
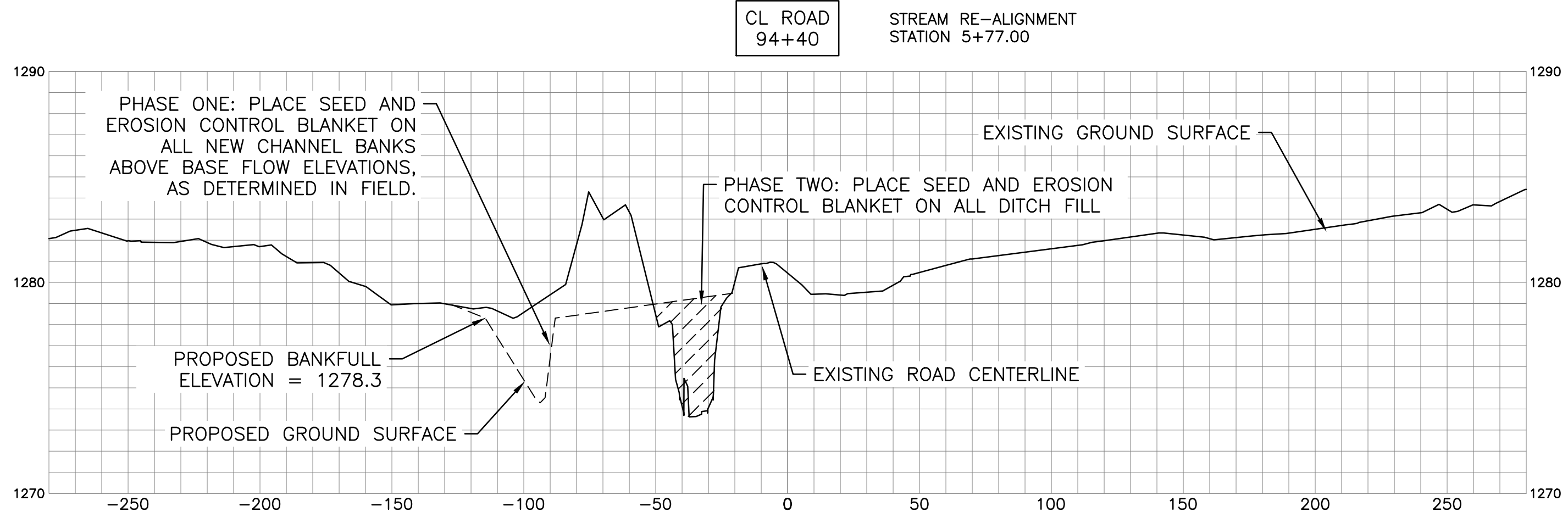
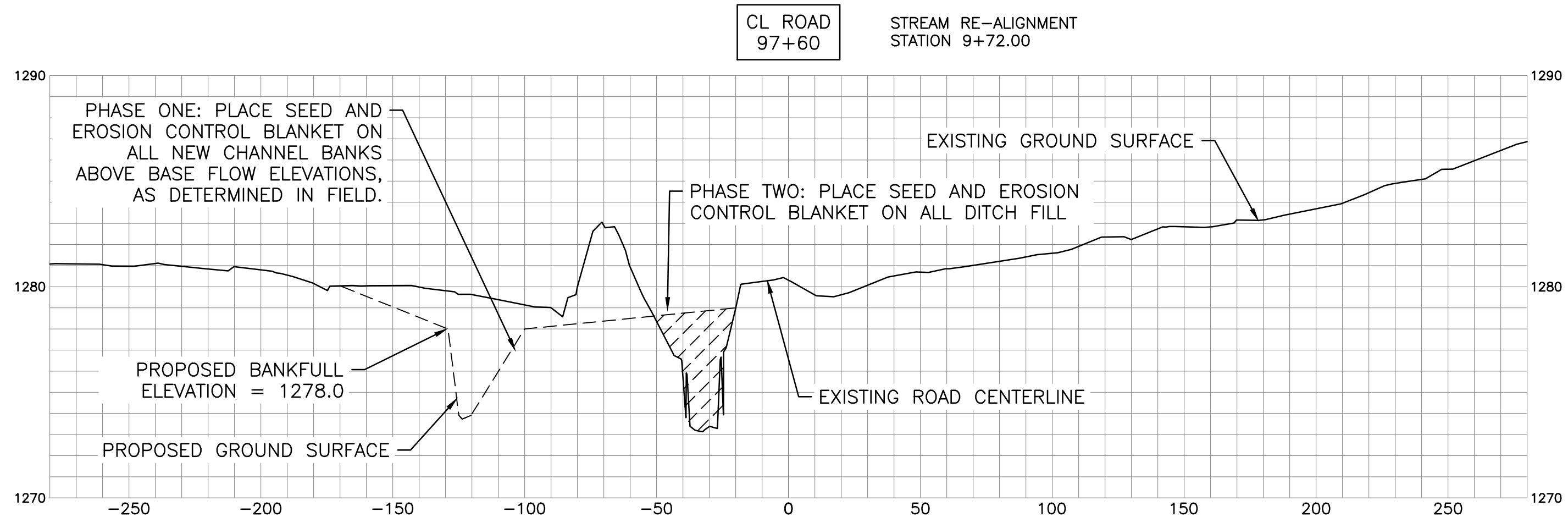
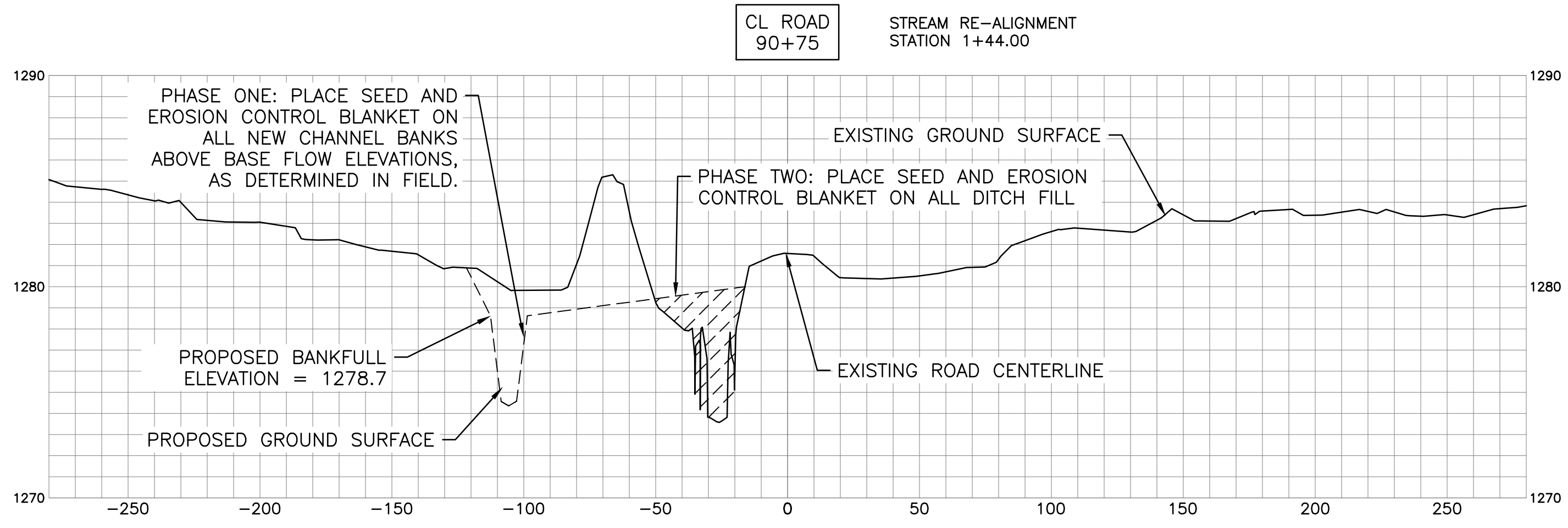
SPIDER CREEK RESTORATION  
 ALBORN, MINNESOTA  
 PLAN AND PROFILE STATIONS  
 35+00 TO 40+83

BARR PROJECT No.	23/69-1303
CLIENT PROJECT No.	
DWG. No.	C-07
REV. No.	A

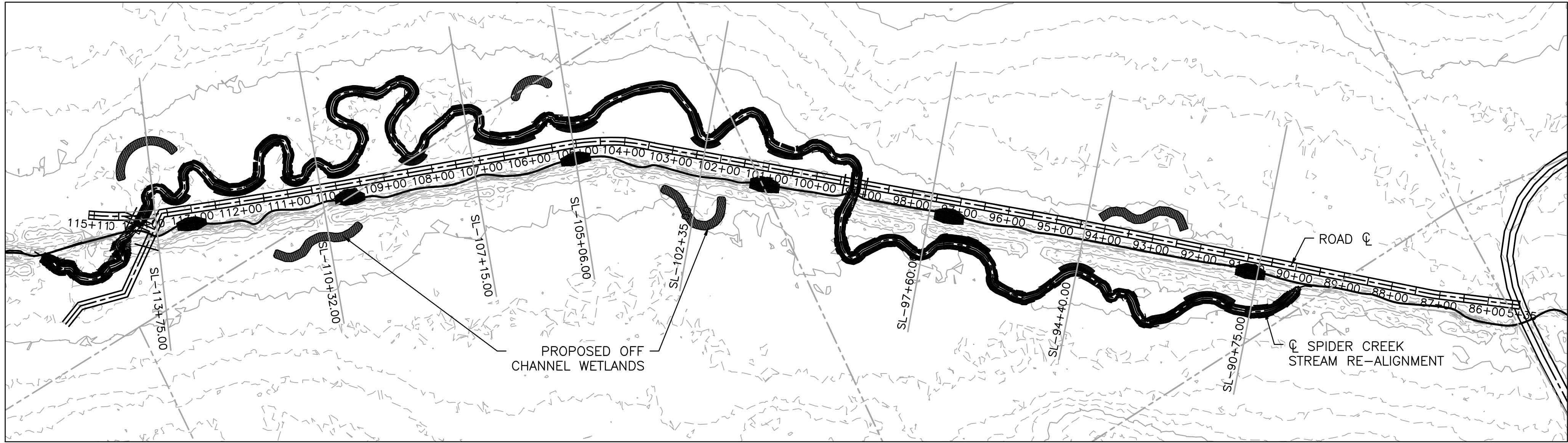
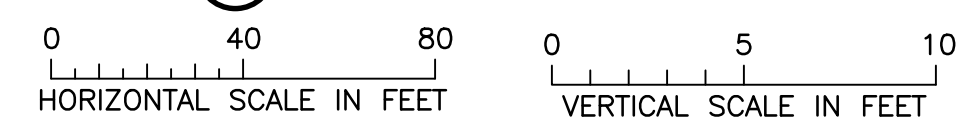


CADD USER: jessica\_olson FILE: \\EDI-CAD\CAD\DESIGN\23691303\00\23691303\_C-08.DWG PLOT SCALE: 1:1 PLOT DATE: 12/23/2015 4:59 PM  
 BARR - MA\AutocAD\_2011\AutoCAD\_2011\Support\enu\Template\Barr\_2011\_Template.dwt Plot at 1 10/05/2010 14:03:50

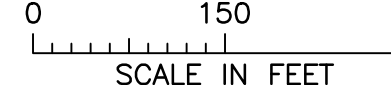
- NOTES:**
- EXISTING CONTOURS REPRESENT 2012 LIDAR DATA ELEVATIONS MERGED WITH 2014 AND 2015 TOPOGRAPHIC SURVEY.
  - PROPOSED SECTIONS REPRESENT AVERAGE FEATURE MAXIMUM DEPTHS AND DIMENSIONS.
  - FINAL CHANNEL DIMENSIONS, PATTERN AND PROFILE ELEVATIONS WILL VARY. SEE PROPOSED CHANNEL DETAILS ON SHEET C-01.



**1 SECTIONS: EXISTING GROUND**



**1 SECTION MAP: SPIDER CREEK STREAM RE-ALIGNMENT**



**LEGEND**

- APPROX. PROPERTY BOUNDARY
- - - EXISTING MAJOR CONTOUR
- - - EXISTING MINOR CONTOUR
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- [Pattern] GRADE CONTROL RIFFLE SEE DETAIL 1 D01
- [Pattern] TOE WOOD BANK PROTECTION SEE DETAIL 1 D02
- [Pattern] BERM SEE DETAIL 6 D03
- [Pattern] PROPOSED WETLANDS - SEE PHASE ONE AND TWO GENERAL NOTES ON SHEET C-01

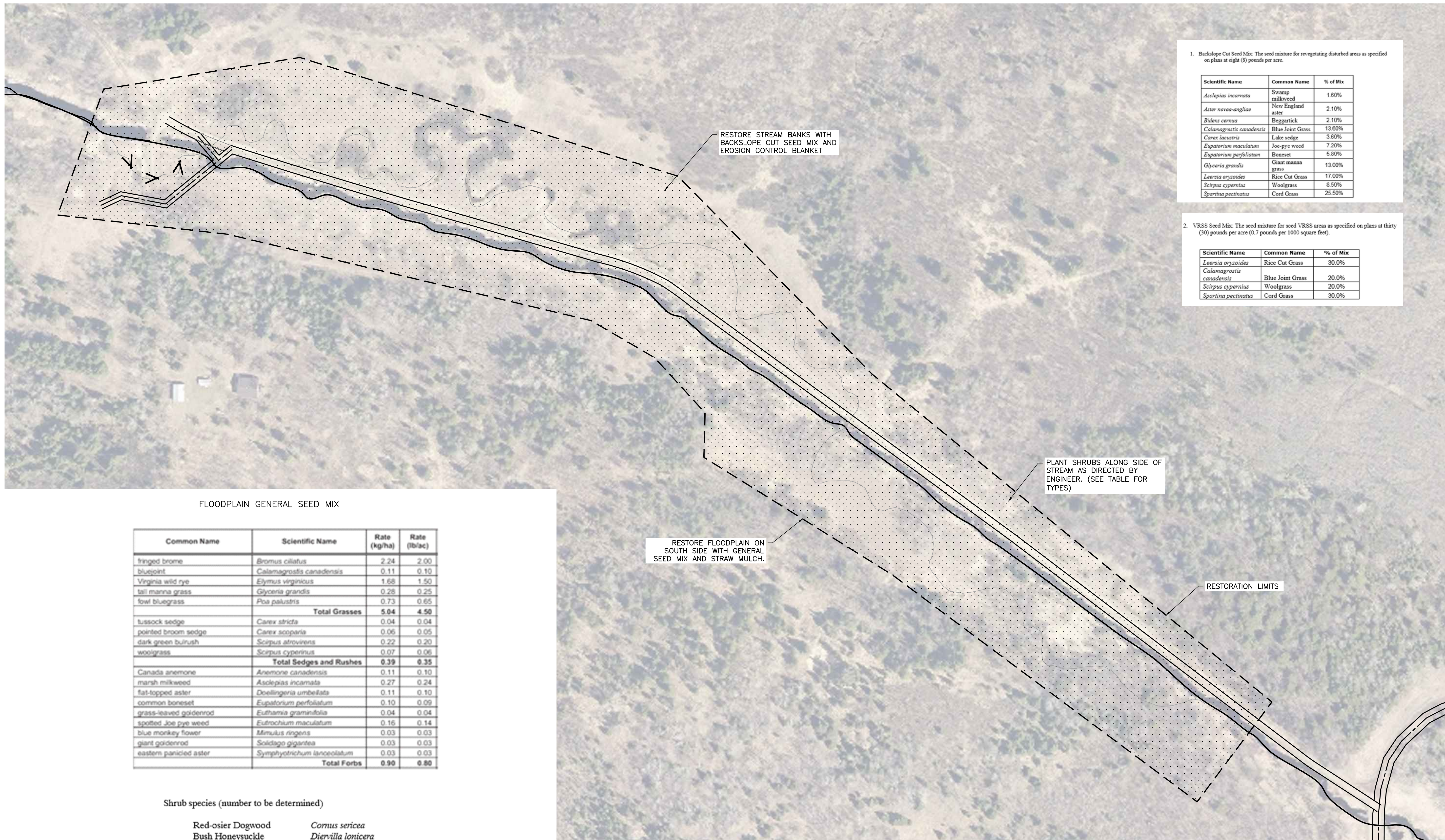
**60% REVIEW  
NOT FOR CONSTRUCTION**

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA. PRINTED NAME: JESSICA C. L. OLSON SIGNATURE: _____ DATE: 6/15/15 LICENSE # 43102		CLIENT: 12-23-15 BID: _____ CONSTRUCTION PERMIT: _____ RECORD: _____ RELEASED TO/FOR: _____ DATE RELEASED: _____	<b>BARR</b> Corporate Headquarters: Minneapolis, Minnesota Ph: 1-800-632-2277	Project Office: <b>BARR ENGINEERING CO.</b> 325 SOUTH LAKE AVENUE SUITE 700 DULUTH, MN. 55802 Ph: 1-800-786-5830 Fax: (218) 727-6450 www.barr.com	Scale: AS SHOWN Date: 5/26/15 Drawn: JDH2 Checked: JCO Designed: JCO Approved: _____	<b>UNITED STATES STEEL CORPORATION</b> <b>MINNESOTA ORE OPERATIONS -</b> <b>MINNTAC</b> <b>MOUNTAIN IRON, MINNESOTA</b>	<b>SPIDER CREEK RESTORATION</b> <b>ALBORN, MINNESOTA</b> <b>DESIGN CROSS SECTIONS</b>	BARR PROJECT No. <b>23/69-1303</b> CLIENT PROJECT No. DWG. No. <b>C-08</b> REV. No. <b>A</b>
---	--	---	--	--	---	--	---	---









1. Backslope Cut Seed Mix: The seed mixture for revegetating disturbed areas as specified on plans at eight (8) pounds per acre.

Scientific Name	Common Name	% of Mix
<i>Asclepias incarnata</i>	Swamp milkweed	1.60%
<i>Aster nove-angliae</i>	New England aster	2.10%
<i>Bidens cernua</i>	Beggartick	2.10%
<i>Calamagrostis canadensis</i>	Blue Joint Grass	13.60%
<i>Carex lacustris</i>	Lake sedge	3.60%
<i>Eupatorium maculatum</i>	Joe-pye weed	7.20%
<i>Eupatorium perfoliatum</i>	Boneset	5.80%
<i>Glyceria grandis</i>	Giant manna grass	13.00%
<i>Leersia oryzoides</i>	Rice Cut Grass	17.00%
<i>Scirpus cyperinus</i>	Woolgrass	8.50%
<i>Spartina pectinatus</i>	Cord Grass	25.50%

2. VRSS Seed Mix: The seed mixture for seed VRSS areas as specified on plans at thirty (30) pounds per acre (0.7 pounds per 1000 square feet).

Scientific Name	Common Name	% of Mix
<i>Leersia oryzoides</i>	Rice Cut Grass	30.0%
<i>Calamagrostis canadensis</i>	Blue Joint Grass	20.0%
<i>Scirpus cyperinus</i>	Woolgrass	20.0%
<i>Spartina pectinatus</i>	Cord Grass	30.0%

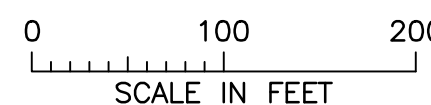
FLOODPLAIN GENERAL SEED MIX

Common Name	Scientific Name	Rate (kg/ha)	Rate (lb/ac)
fringed brome	<i>Bromus ciliatus</i>	2.24	2.00
bluejoint	<i>Calamagrostis canadensis</i>	0.11	0.10
Virginia wild rye	<i>Elymus virginicus</i>	1.68	1.50
tall manna grass	<i>Glyceria grandis</i>	0.26	0.25
low bluegrass	<i>Poa palustris</i>	0.73	0.65
<b>Total Grasses</b>		<b>5.04</b>	<b>4.50</b>
tussock sedge	<i>Carex stricta</i>	0.04	0.04
pointed broom sedge	<i>Carex scoparia</i>	0.06	0.05
dark green bulrush	<i>Scirpus atrovirens</i>	0.22	0.20
woolgrass	<i>Scirpus cyperinus</i>	0.07	0.06
<b>Total Sedges and Rushes</b>		<b>0.39</b>	<b>0.35</b>
Canada anemone	<i>Anemone canadensis</i>	0.11	0.10
marsh milkweed	<i>Asclepias incarnata</i>	0.27	0.24
flat-topped aster	<i>Doellingeria umbellata</i>	0.11	0.10
common boneset	<i>Eupatorium perfoliatum</i>	0.10	0.09
grass-leaved goldenrod	<i>Euthamia graminifolia</i>	0.04	0.04
spotted Joe pye weed	<i>Eutrochium maculatum</i>	0.16	0.14
blue monkey flower	<i>Mimulus ringens</i>	0.03	0.03
giant goldenrod	<i>Solidago gigantea</i>	0.03	0.03
eastern panicled aster	<i>Symphoricarum lanceolatum</i>	0.03	0.03
<b>Total Forbs</b>		<b>0.90</b>	<b>0.80</b>

Shrub species (number to be determined)

Red-osier Dogwood	<i>Cornus sericea</i>
Bush Honeysuckle	<i>Diervilla lonicera</i>
Pussy Willow	<i>Salix bonplandiana (discolor)</i>
Meadowsweet	<i>Spiraea alba</i>

1 PLAN: SPIDER CREEK BANK STABILIZATION  
1"=100'-0"



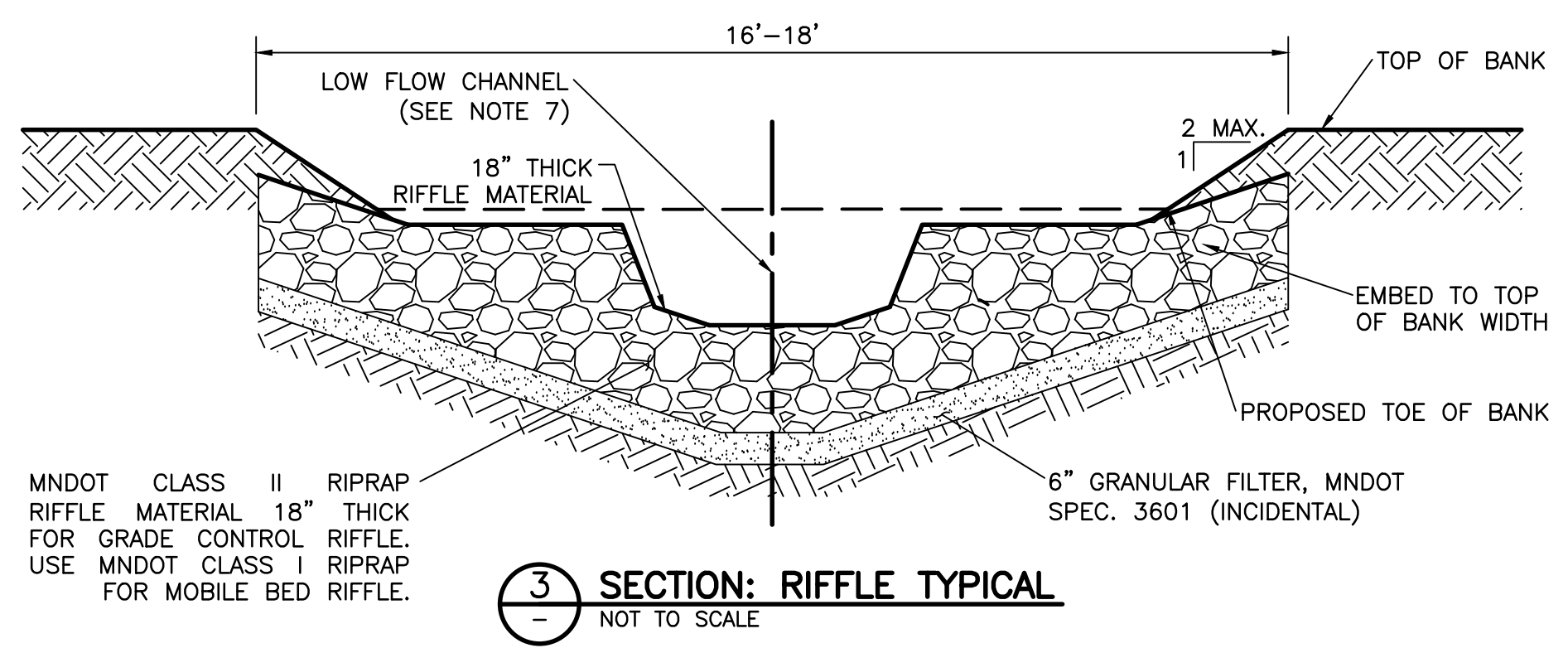
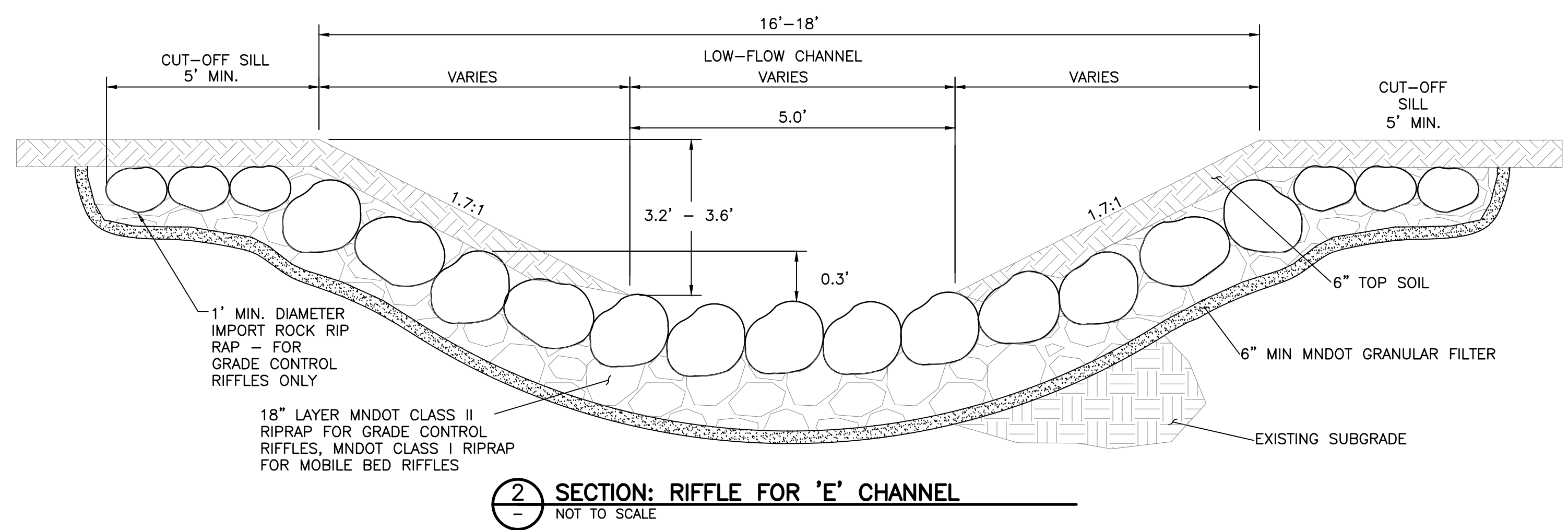
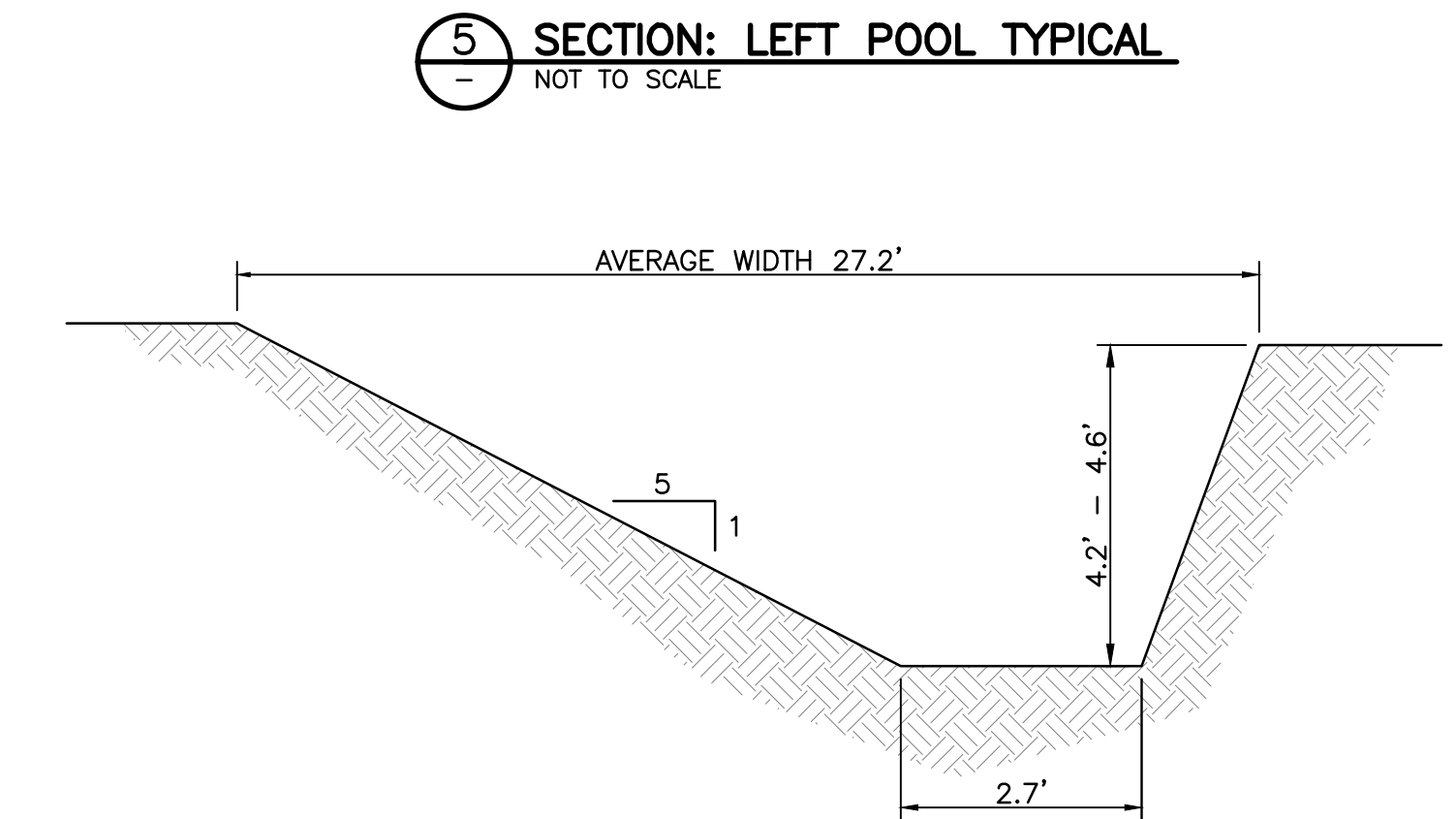
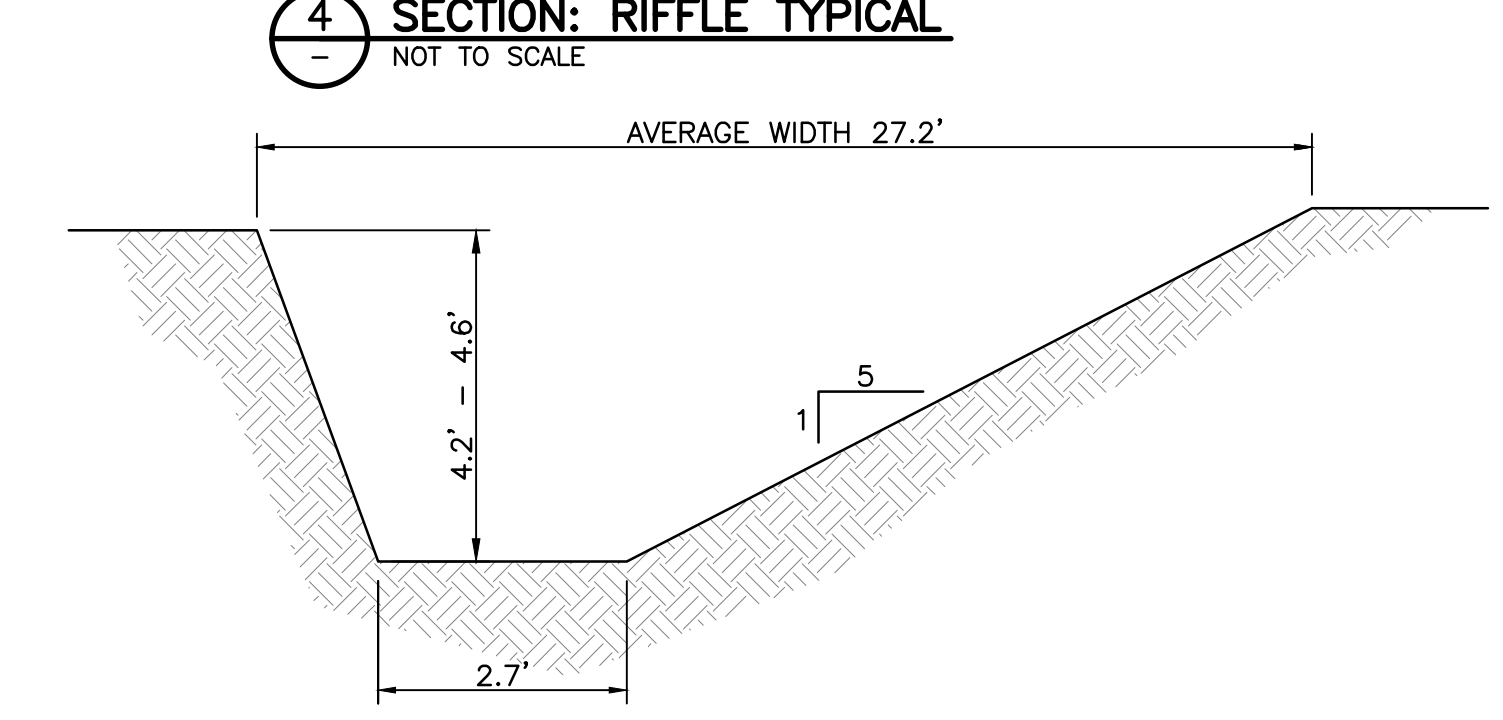
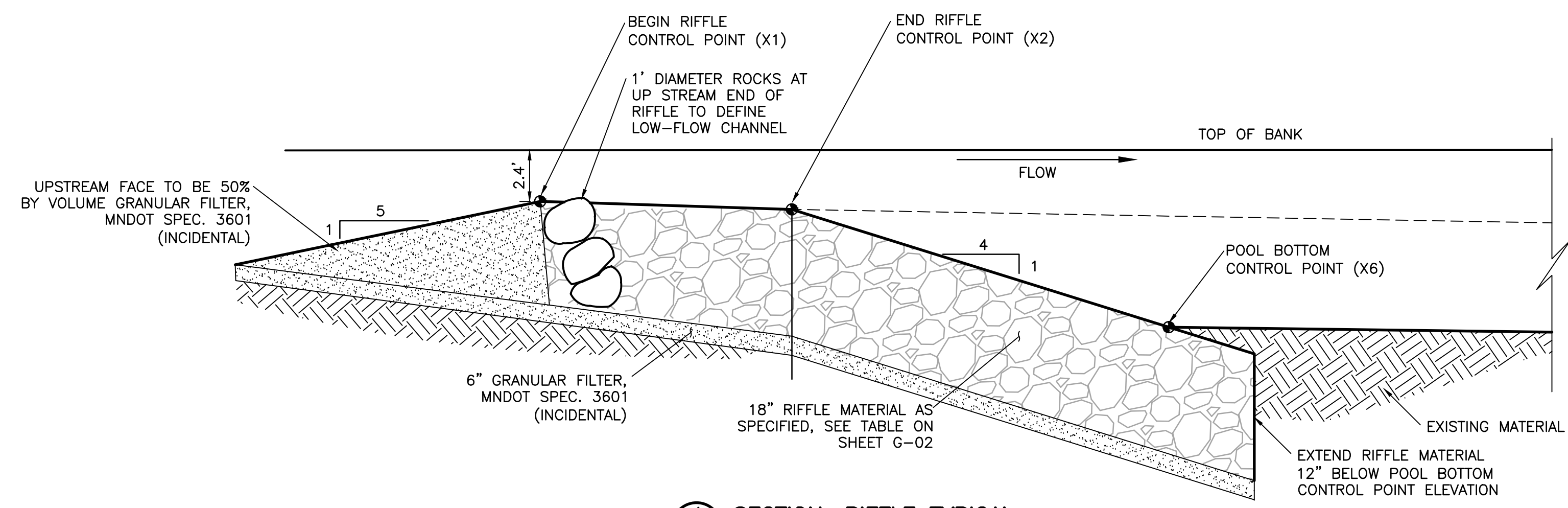
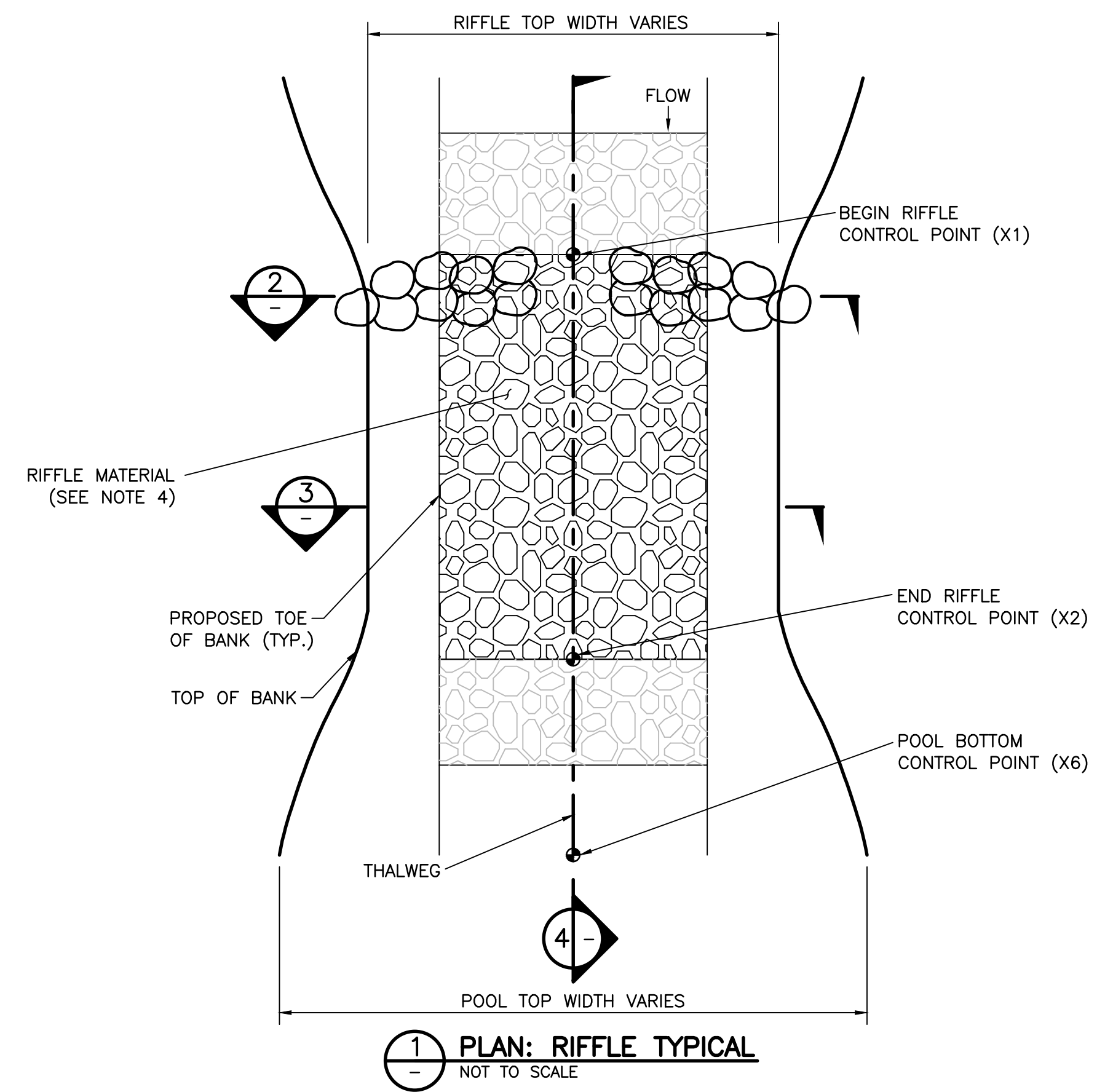
60% REVIEW  
NOT FOR CONSTRUCTION

CADD USER: jessica\_olson FILE: \\ED-CAD\CAD\DESIGN\23691303\_C-10.DWG PLOT SCALE: 1:1 PLOT DATE: 12/23/2015 2:12 PM  
BARR MA AutoCAD 2011 Support\enu\Template\Barr\_2011\_Template.dwt Plot at 1 10/05/2010 14:03:50

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.		CLIENT BID CONSTRUCTION	12-23-15	Project Office: BARR ENGINEERING CO. 325 SOUTH LAKE AVENUE SUITE 700 DULUTH, MN 55802		Scale AS SHOWN	UNITED STATES STEEL CORPORATION MINNESOTA ORE OPERATIONS – MINNTAC MOUNTAIN IRON, MINNESOTA	SPIDER CREEK RESTORATION ALBORN, MINNESOTA RESTORATION AND REVEGETATION PLAN	BARR PROJECT No. 23/69-1303	
PRINTED NAME JESSICA C. L. OLSON	SIGNATURE	RELEASED TO/FOR	A B C 0 1 2 3	Corporate Headquarters: Minneapolis, Minnesota Ph: 1-800-786-5830 Fax: (218) 529-8202 www.barr.com	Date 12/23/15	Drawn RRR2			Checked JCO	Designed JCO
NO.	BY	CHK.	APP.	DATE	REVISION DESCRIPTION	DATE RELEASED		DWG. No. C-10	REV. No. A	



CADD USER: jessica\_olson FILE: \\EDU-CAD\CAD\DESIGN\23691303\00\23691303\_D01.DWG PLOT SCALE: 1:1 PLOT DATE: 12/23/2015 1:43 PM  
 BARR MA AutoCAD 2011 Support\enu\Template\Barr\_2011\_Template.dwt Plot at: 10/05/2010 14:03:50



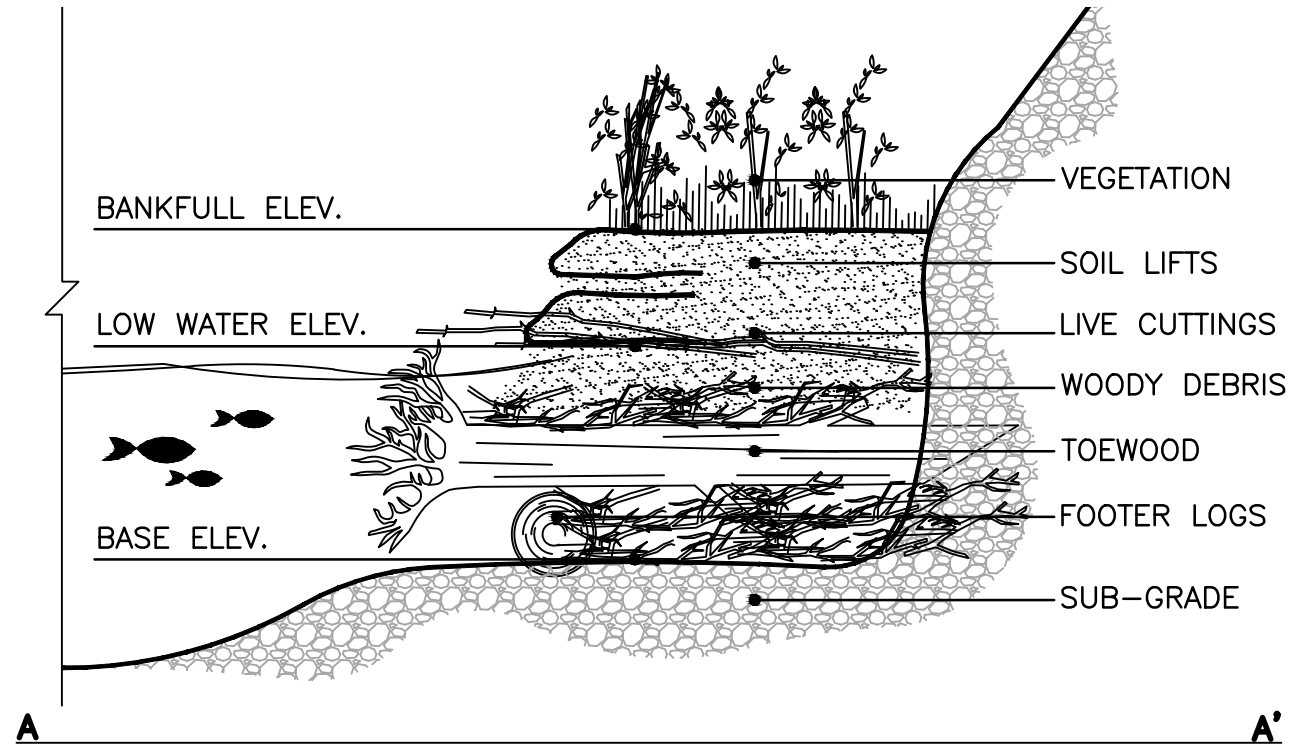
- NOTES:**
- CONSTRUCTION RIFFLES SHALL BE INSTALLED IN NEWLY GRADED CHANNEL SECTION.
  - ELEVATION CONTROL POINTS SHALL BE DESIGNATED AT THE BEGINNING AND END OF RIFFLE POINTS TO ESTABLISH PART OF THE PROFILE OF THE CHANNEL. SURVEY OF CONTROL POINTS SHALL BE REQUIRED TO ESTABLISH ACCURATE RIFFLE INSTALLATION.
  - RIFFLE MATERIAL SHALL BE OF A TYPE, SIZE, AND GRADATION AS SPECIFIED.
  - THE FACE OF THE RIFFLE UPSTREAM OF THE BEGIN RIFFLE CONTROL POINT SHALL BE 50% BY VOLUME GRANULAR FILTER AGGREGATE (MNDOT SPEC 3601) TO REDUCE VOID SPACES. FILTER AGGREGATE SHALL BE INCIDENTAL TO THE RIFFLE MATERIAL.
  - THE PLACEMENT OF BACKFILL AND/OR RIFFLE MATERIAL SHALL BE DONE IN A MANNER TO CREATE A SMOOTH PROFILE, WITH NO ABRUPT 'JUMP' (TRANSITION) BETWEEN THE UPSTREAM POOL-GLIDE AND THE RIFFLE, AND LIKEWISE NO ABRUPT 'DROP' (TRANSITION) BETWEEN THE RIFFLE AND THE DOWNSTREAM RUN-POOL. ALSO A THALWEG SHALL BE FASHIONED WITHIN THE RIFFLE WIDTH SO THAT THE FINISHED CROSS SECTION OF THE RIFFLE MATERIAL MATCHES THE SHAPE AND DIMENSIONS SHOWN ON THE RIFFLE TYPICAL SECTION.
  - SEE THE STREAM RESTORATION STRUCTURES TABLE ON SHEET G-02 FOR STATIONING AND ELEVATIONS.
  - SEE RIFFLE SECTIONS OR BANKFULL AND LOW-FLOW CHANNEL DIMENSIONS.
  - FEATURE WIDTHS AND DEPTHS WILL VARY THROUGHOUT THE RESTORATION REACH. SEE PROPOSED CHANNEL DETAILS ON SHEET C-01 FOR DESIGN RANGES.
  - ALL EXPOSED SLOPES ABOVE FIELD-DETERMINED BASE-FLOW ELEVATION WILL BE STABILIZED WITH SEED AND EROSION CONTROL BLANKET UPON CONSTRUCTION COMPLETION.

**60% REVIEW**  
**NOT FOR CONSTRUCTION**

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.				CLIENT: 12-23-15 BID: _____ CONSTRUCTION: _____ PERMIT: _____ RECORD: _____				Project Office: <b>BARR ENGINEERING CO.</b> 325 SOUTH LAKE AVENUE SUITE 700 DULUTH, MN. 55802 Corporate Headquarters: Minneapolis, Minnesota Ph: 1-800-786-5830 Fax: (218) 727-6450 www.barr.com				Scale: AS SHOWN Date: 5/26/15 Drawn: EPF Checked: JCO Designed: JCO Approved: _____				<b>UNITED STATES STEEL CORPORATION</b> <b>MINNESOTA ORE OPERATIONS -</b> <b>MINNTAC</b> <b>MOUNTAIN IRON, MINNESOTA</b>				<b>SPIDER CREEK RESTORATION</b> <b>ALBORN, MINNESOTA</b> <b>DETAILS</b> <b>SHEET 1 OF 3</b>				BARR PROJECT No. <b>23/69-1303</b> CLIENT PROJECT No. DWG. No. <b>D-01</b> REV. No. <b>A</b>			
NO.	BY	CHK.	APP.	DATE	REVISION DESCRIPTION	DATE	6/15/15	LICENSE #	43102	RELEASED TO/FOR	A	B	C	O	1	2	3	DATE RELEASED									
				PRINTED NAME: JESSICA C. L. OLSON SIGNATURE: _____ DATE: 6/15/15    LICENSE # 43102																							

**1**  
D-02  
**INSTALLATION SUMMARY**

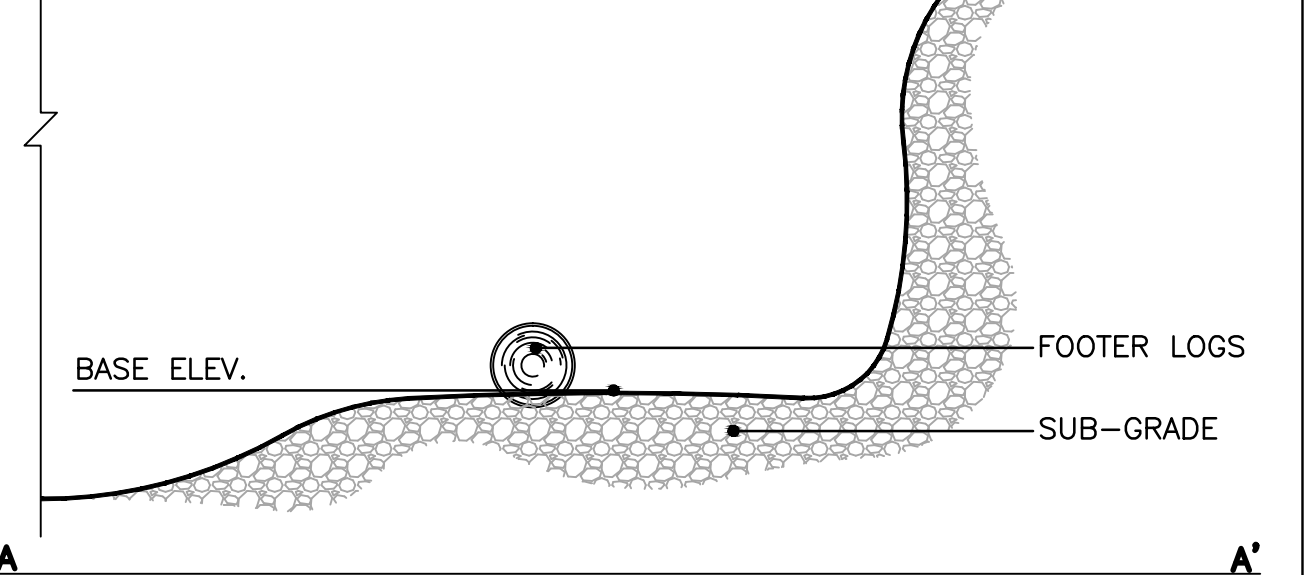
-TOEWOOD BENCH CONSTRUCTION WILL BE DONE IN DRY WEATHER CONDITIONS AFTER SITE HAS BEEN DE-WATERED.  
 -ENGINEER MUST BE PRESENT FOR INSTALLATION OF TOEWOOD BENCH.  
 -THE DRAWINGS ON THIS PAGE ARE NOT TO SCALE.  
 -SEE TABLE ON SHEET C-03 FOR TOEWOOD ELEVATIONS AND STATIONING.  
 -ALL TOEWOOD MATERIALS INCLUDED IN THIS DETAIL ARE INCIDENTAL TO THE TOEWOOD INSTALLATION. THIS INCLUDES, BUT IS NOT LIMITED TO THE FOLLOWING: SUBGRADE AND FOOTER LOGS, ROOT WADS & LARGE WOODY DEBRIS, WOODY DEBRIS AND GRANULAR FILL, LIVE CUTTINGS, SOIL LIFTS, VEGETATION, AND SILL LOGS.



**2**  
D-02  
**SUBGRADE AND FOOTER LOGS**

**SPECIFICATION:**  
 -8" TO 1' DIAMETER  
 -LIMBS REMOVED  
 -APPROX 10' LENGTH

**PLACEMENT:**  
 -EXCAVATE TO BASE ELEVATION - CONTRACTOR SHALL MAKE EFFORT TO SEPARATE GRANULAR AND FINE FILL NATIVE MATERIAL FOR USE IN STEPS 4 AND 6.  
 -PLACE FOOTER LOGS 30 DEGREES FROM PARALLEL TO STREAM FLOW WITH ENDS STACKED CREATING A ZIG ZAG PATTERN (PLAN VIEW BELOW)  
 -MAINTAIN AVERAGE ELEV. OF 1' ABOVE BASE ELEV.  
 -MATERIAL EXCAVATION AND OFF-SITE DISPOSAL IS INCIDENTAL TO INSTALLATION

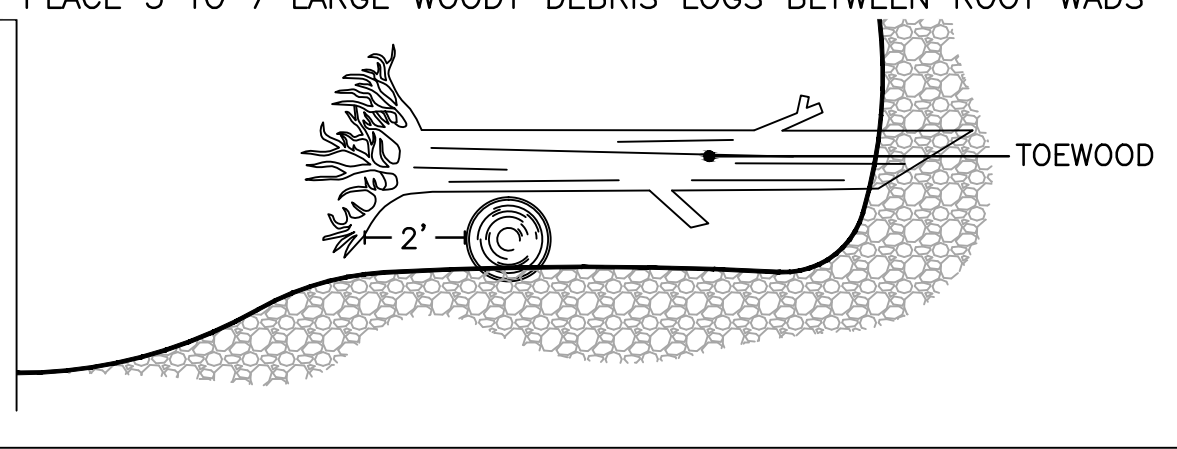


**3**  
D-02  
**ROOT WADS & LRG WOODY DEBRIS**

**ROOT WAD SPECIFICATION:**  
 -10" MIN DIAMETER  
 -LENGTH INDICATED IN DESIGN CROSS SECTION OR 10' MIN.  
 -LIMBS REMOVED  
 -ROOT WADS LEFT INTACT  
 -ENDS SHARPENED TO A POINT

**LARGE WOODY DEBRIS SPECIFICATION:**  
 -8" MIN DIAMETER  
 -LIMB INTACT

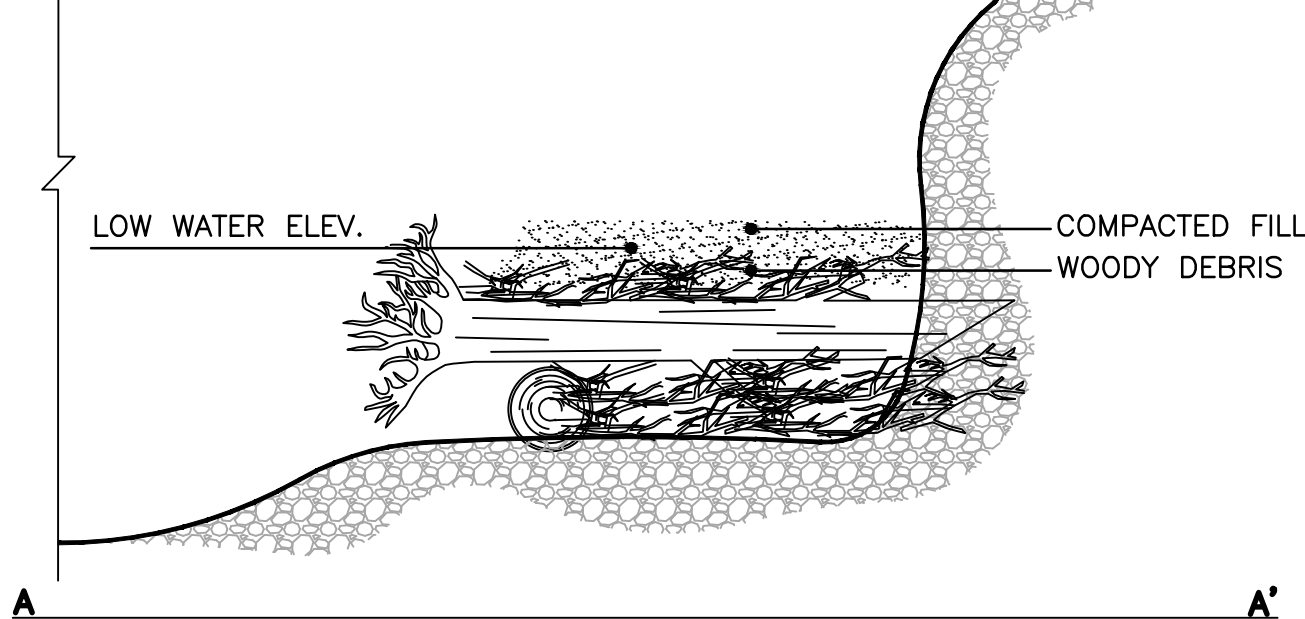
**PLACEMENT:**  
 -PLACE ROOT WADS HORIZONTALLY ON TOP OF FOOTER LOGS, OVERHANG ROOT WAD LOGS 2'  
 -ANGLE ROOTWADS UPSTREAM  
 -DRIVE SHARPENED TRUNKS MIN. 3' INTO BANK OR DIG IN  
 -PLACE 1 ROOT WAD PER FOOTER LOG  
 -PLACE 5 TO 7 LARGE WOODY DEBRIS LOGS BETWEEN ROOT WADS



**4**  
D-02  
**WOODY DEBRIS & GRANULAR FILL**

**SPECIFICATION:**  
 -WOODY MATERIAL (COMPOSED OF SMALL LIMBS AND BRANCHES, APPROX. 4" MAX DIAMETER AND SMALLER)  
 -DO NOT USE ROTTEN WOODY MATERIAL  
 -NATIVE GRANULAR FILL

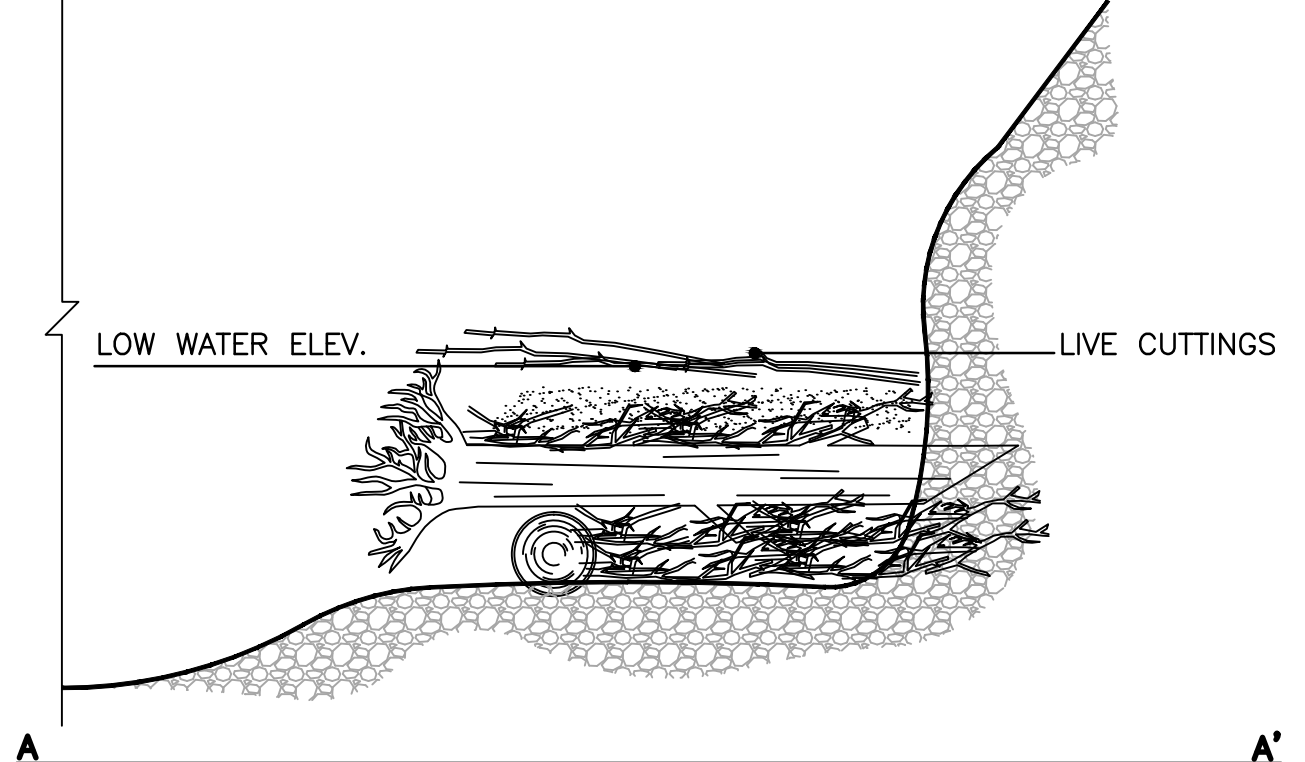
**PLACEMENT:**  
 -FILL BETWEEN FOOTER LOGS AND ROOT WAD WITH WOODY DEBRIS  
 -STACK WOODY DEBRIS TO LOW WATER ELEVATION  
 -LAYER NATIVE GRANULAR FILL ON TOP OF WOODY DEBRIS  
 -COMPACT SO THAT SETTLING OF FILL IS MINIMIZED BUT DEBRIS IS NOT DISPLACED  
 -COMPACTED FILL WILL MEET 2"-5" ABOVE LOW WATER ELEVATION



**5**  
D-02  
**LIVE CUTTINGS**

**SPECIFICATION:**  
 -SEE LIVE STAKE AND LIVE CUTTING DETAIL ON SHEET D-03.

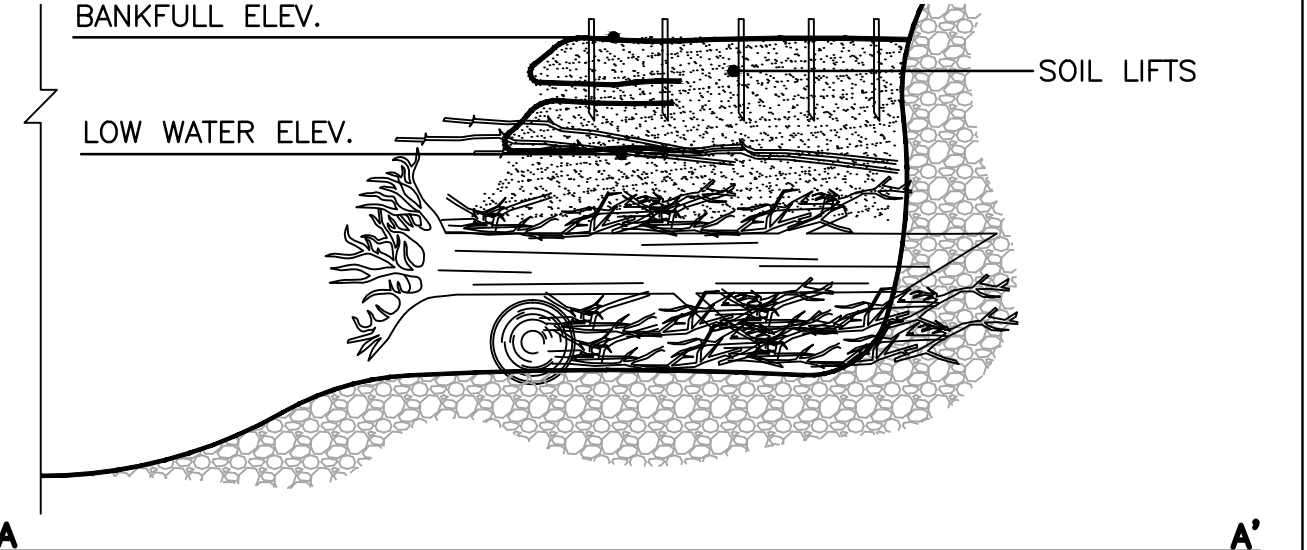
**PLACEMENT:**  
 -LAY CUTTINGS WITH A DENSITY OF 10 CUTTINGS PER LINEAL FOOT  
 -TOPS OF CUTTING WILL POINT TOWARD CHANNEL SEE SECTION BELOW  
 -TRIM EXPOSED ENDS OF CUTTINGS, LEAVE NO MORE THAN 6" EXPOSED  
 -DEPOSIT NATIVE FILL OVER CUTTINGS AND WATER LIBERALLY, COMPRESS FILL TO 2"- 4"



**6**  
D-02  
**SOIL LIFTS**

**SPECIFICATION:**  
 -NATIVE FILL (FINE)  
 -1' FORMS  
 -MIN 6.5' WIDE ROLANKA BIOD-MAT 70, GEOCOIR 700, OR EQUAL LINED WITH MNDOT CAT II EROSION CONTROL BLANKET WITH NATURAL NETTING  
 -18" WOODEN STAKES (2X4 CUT AT ANGLE), PLACED AT 3' SPACING

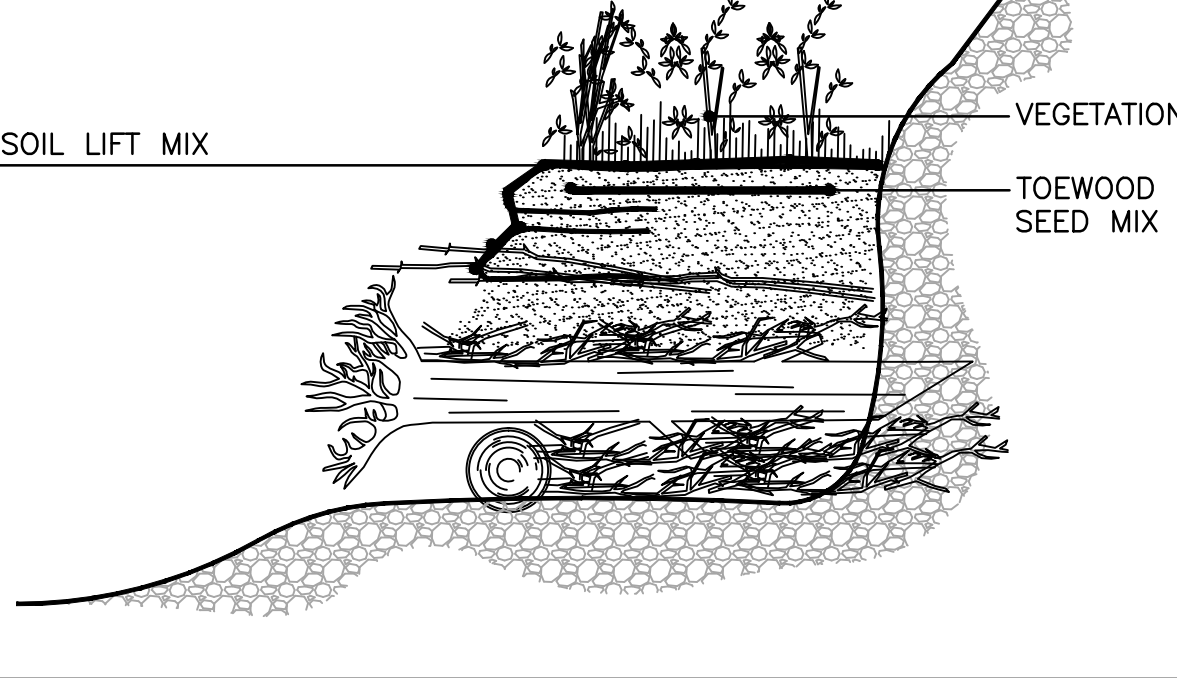
**PLACEMENT:**  
 -PLACE FORM  
 -LAY MIN 2.5' OF FABRIC (COCONUT BLANKET AND LINER) ALONG BENCH  
 -PLACE 1' OF FILL ON TOP OF MAT AND COMPACT  
 -WRAP FILL WITH REMAINING BLANKET AND SECURE WITH STAKES  
 -REPEAT UNTIL BANKFUL ELEVATION IS MET, STEP EACH LIFT BACK 1'  
 -FOR TOP SOIL LIFT, EXTEND BLANKET TO EXISTING GRADE/BANK



**7**  
D-02  
**VEGETATION**

**SPECIFICATION:**  
 -LIVE STAKES  
 -TOEWOOD SEED MIX  
 -SOIL LIFT SEED MIX

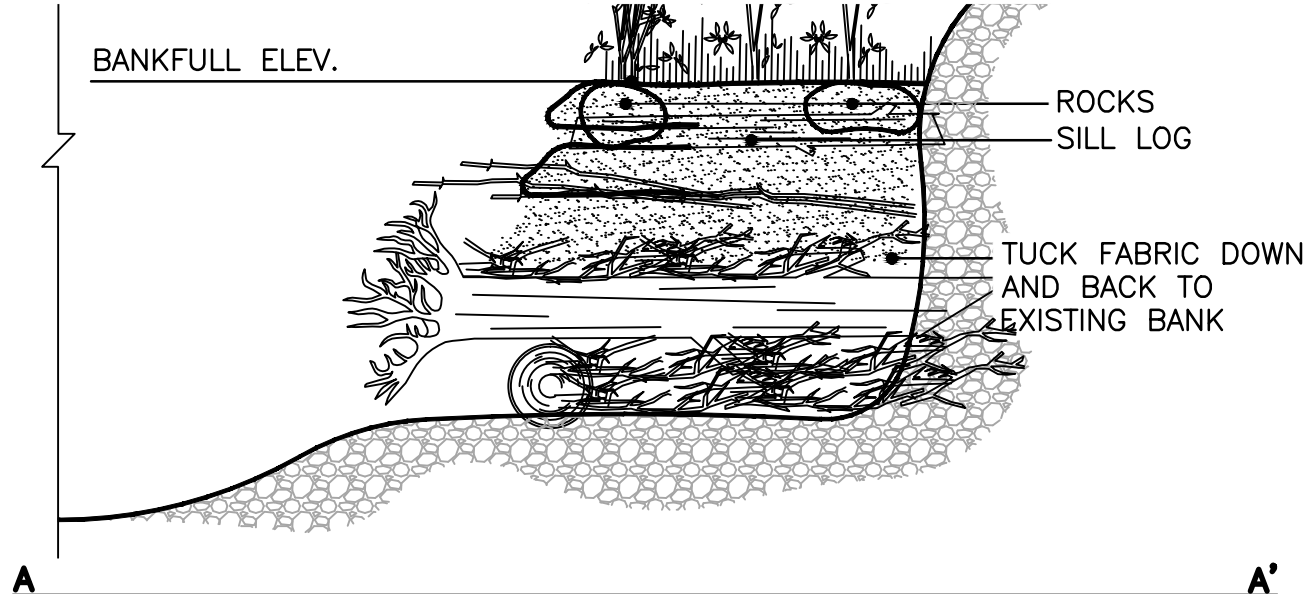
**PLACEMENT:**  
 -PLANT LIVE STAKES IN TOP SOIL LIFT IN BETWEEN 18" WOODEN STAKES.  
 -PLANT SEED (TOEWOOD MIX) INSIDE OF SOIL LIFT PRIOR TO COVERING WITH FABRIC.  
 -PLANT SEED ON THE FACE OF EACH SOIL LIFT AS WELL AS ACROSS THE TOP SOIL LIFT (SOIL LIFT MIX).



**8**  
D-02  
**SILL LOGS & TERMINATION**

**SPECIFICATION:**  
 -10" MIN DIAMETER LOGS  
 -LIMBS REMOVED  
 -LENGTH DETERMINED BY WIDTH OF TOEWOOD BENCH  
 -ROCKS

**PLACEMENT:**  
 -PLACE ONE SILL LOG AT THE START AND END OF THE TOEWOOD BENCH PERPENDICULAR TO THE DIRECTION OF FLOW.  
 -PLACE LARGE ROCKS ON TOP OF SILL LOG, TOP OF ROCK WILL MEET BANKFULL ELEVATION  
 -TUCK SOIL LIFT BLANKET DOWN AND BACK TOWARDS EXISTING BANK  
 -TRANSITION BANKFULL ELEVATION TO EXISTING GRADE AT DETERMINED LOCATION AT START AND END OF BENCH



CADD USER: jessica\_olson FILE: \\EDI-CAD\CAD\DESIGN\23691303\00\23691303\_D02.DWG PLOT SCALE: 1:1 PLOT DATE: 12/23/2015 1:37 PM  
 X-REFS: BARR  
 BASE: MA:AutoCAD 2011 Support\enu\Template\Barr\_2011\_Template.dwt Plot at: 10/05/2010 14:03:50

NO.	BY	CHK	APP.	DATE	REVISION DESCRIPTION
A	JCO	JCO	JCO	12/23/15	ISSUED FOR 60% REVIEW

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

PRINTED NAME: JESSICA C. L. OLSON  
 SIGNATURE: \_\_\_\_\_  
 DATE: 6/15/15 LICENSE # 43102

CLIENT	12-23-15						
BID							
CONSTRUCTION PERMIT							
RECORD							
RELEASED TO/FOR	A	B	C	0	1	2	3
DATE RELEASED							

**BARR**  
 Corporate Headquarters:  
 Minneapolis, Minnesota  
 Ph: 1-800-632-2277

Project Office:  
**BARR ENGINEERING CO.**  
 325 SOUTH LAKE AVENUE  
 SUITE 700  
 DULUTH, MN. 55802  
 Ph: 1-800-786-5830  
 Fax: (218) 727-6450  
 www.barr.com

Scale	AS SHOWN
Date	5/26/15
Drawn	EPF
Checked	JCO
Designed	JCO
Approved	

**UNITED STATES STEEL CORPORATION**  
**MINNESOTA ORE OPERATIONS - MINNTAC**  
**MOUNTAIN IRON, MINNESOTA**

**SPIDER CREEK RESTORATION**  
**ALBORN, MINNESOTA**

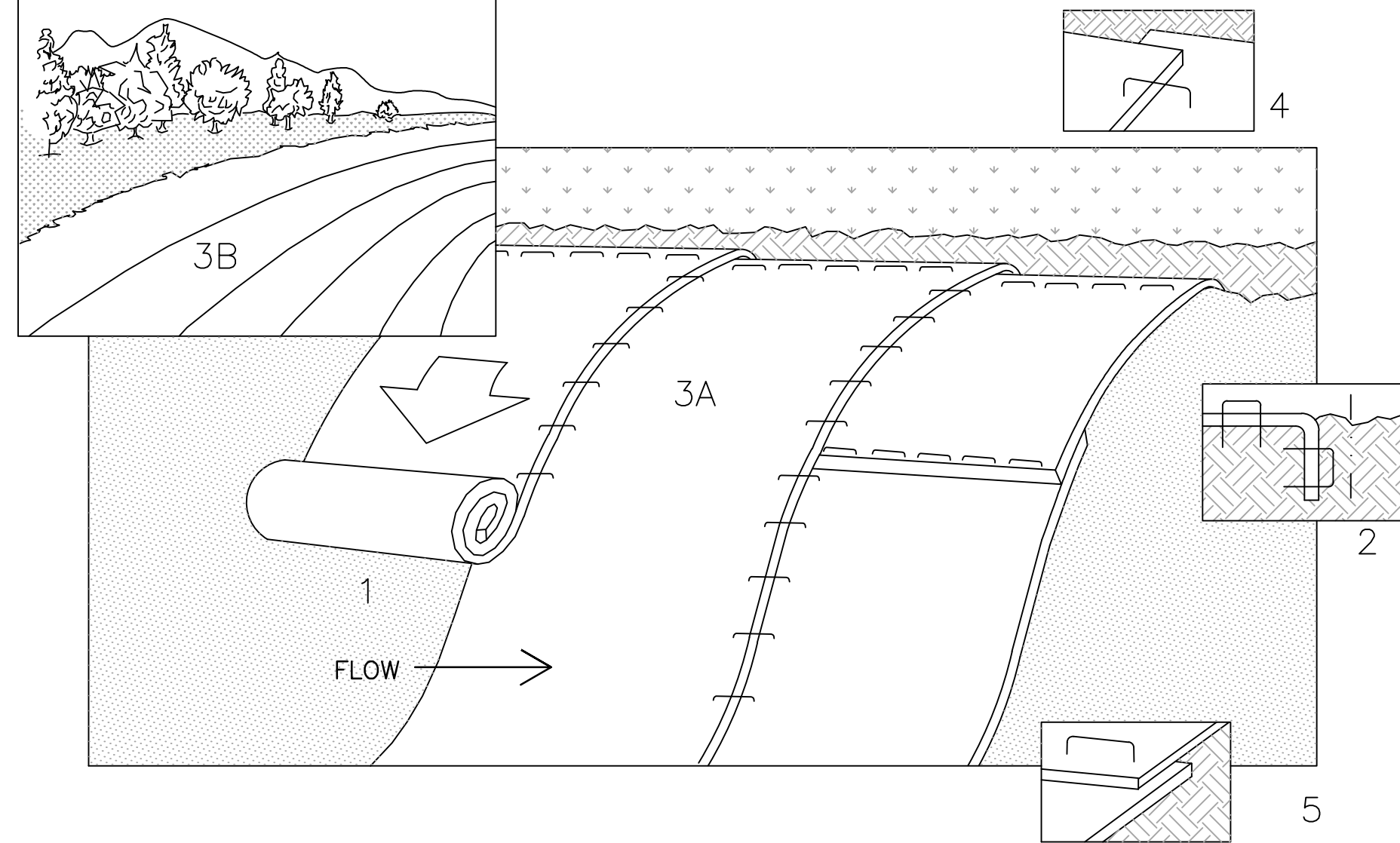
**DETAILS**  
**SHEET 2 OF 3**

BARR PROJECT No.	23/69-1303
CLIENT PROJECT No.	
DWG. No.	D-02
REV. No.	A

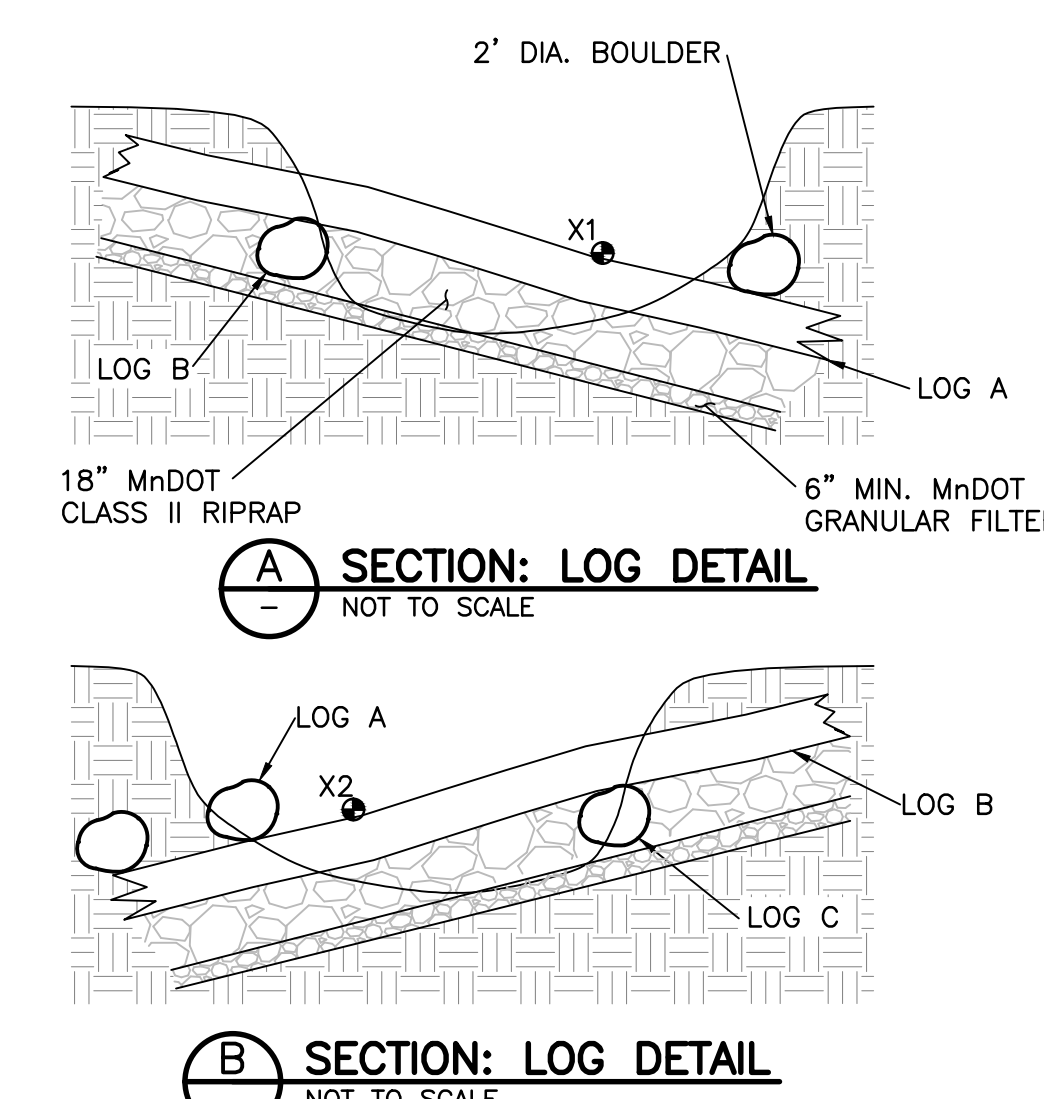
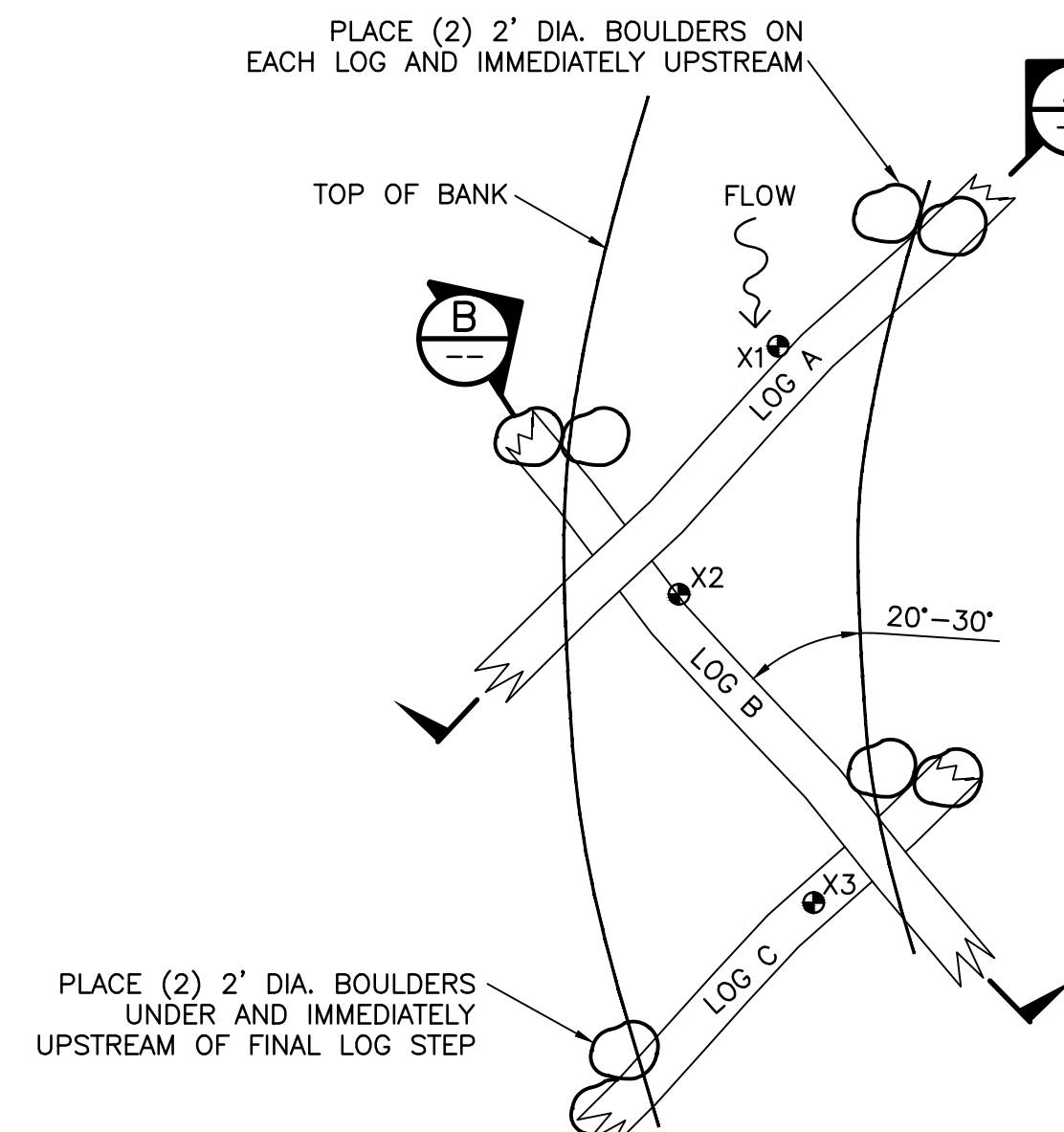
*60% REVIEW  
 NOT FOR CONSTRUCTION*



**SLOPE INSTALLATION**



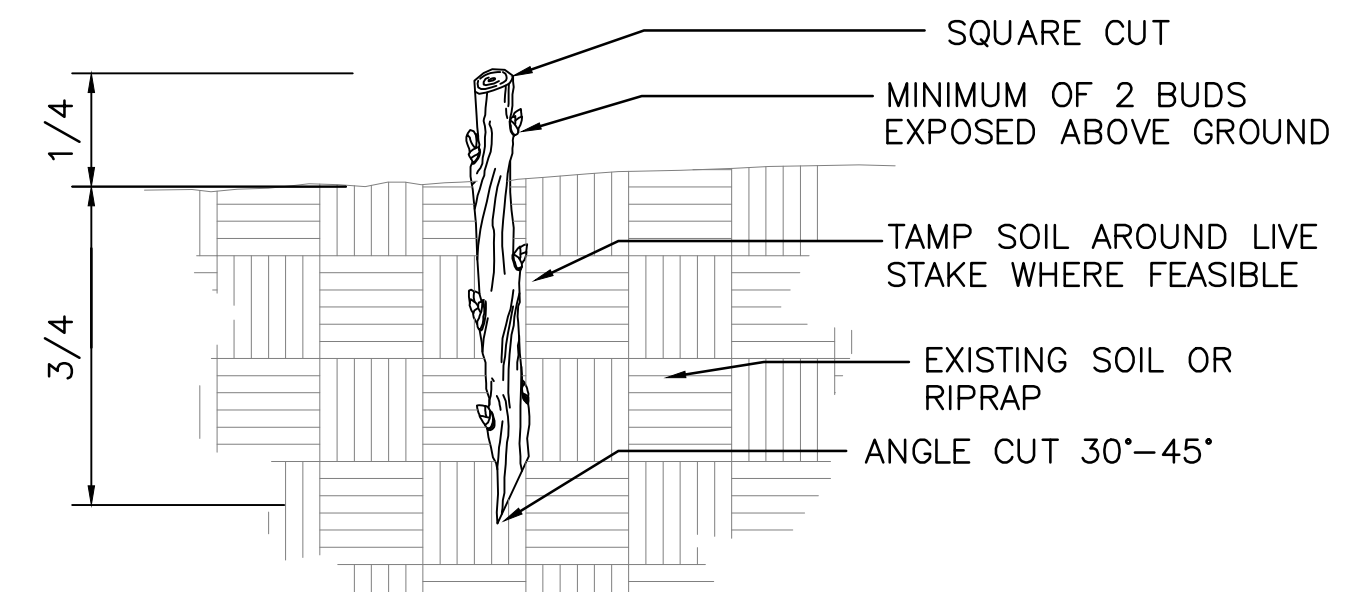
- REFER TO GENERAL STAPLE PATTERN GUIDE FOR CORRECT STAPLE PATTERN RECOMMENDATIONS FOR SLOPE INSTALLATIONS.
- PREPARE SOIL BEFORE INSTALLING BLANKETS, INCLUDING APPLICATION OF LIME, FERTILIZER, AND SLOPE SEED MIX (WOODLAND EDGE). NOTE: WHEN USING CELL-O-SEED DO NOT SEED PREPARED AREA. CELL-O-SEED MUST BE INSTALLED WITH PAPER SIDE DOWN.
- BEGIN AT THE TOP OF THE SLOPE BY ANCHORING THE BLANKET IN 6" DEEP X 6" WIDE TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING.
- ROLL THE BLANKETS (A) DOWN OR (B) HORIZONTALLY ACROSS THE SLOPE.
- THE EDGES OF PARALLEL BLANKETS MUST BE STAPLED WITH APPROXIMATELY 6" OVERLAP, WITH THE UPHILL BLANKET ON TOP.
- WHEN BLANKETS MUST BE SPICED DOWN THE SLOPE, PLACE BLANKETS END OVER END (SHINGLE STYLE) WITH APPROXIMATELY 6" OVERLAP. STAPLE THROUGH OVERLAPPED AREA, APPROXIMATELY 12" APART.



- LOG STEP NOTES:**
- SEE TYPICAL SECTION (B TYPE RIFFLE) FOR BANKFULL AND LOW-FLOW CHANNEL DIMENSIONS.
  - LOGS SHALL BE 12"-18" DIAMETER.
  - RIPRAP BEDDING SHALL EXTEND TO LOG TOP SURFACE ON UPSTREAM FACE.
  - MANUALLY PLACE GRANULAR FILTER AGGREGATE ON UPSTREAM FACE OF RIPRAP BEDDING TO FILL GAPS BETWEEN STONES.

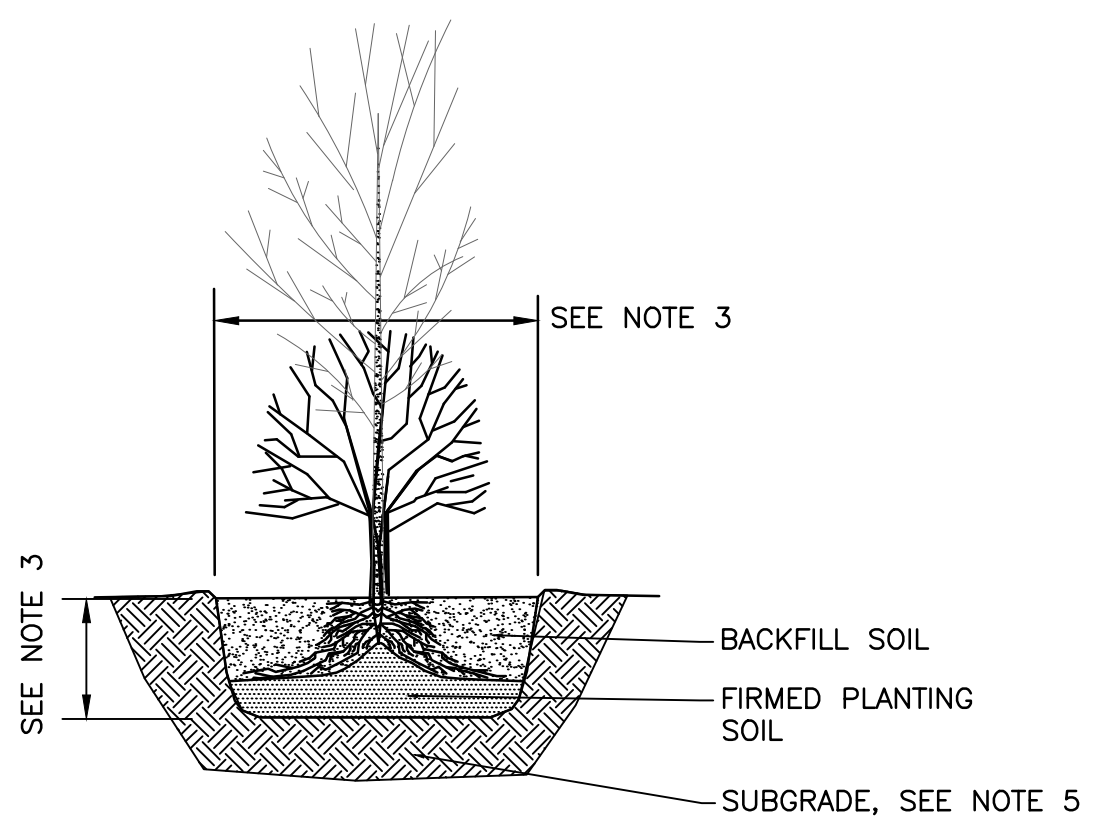
**3 PLAN: LOG STEP POOL**  
D-03 NOT TO SCALE

**1 DETAIL: TEMPORARY EROSION CONTROL BLANKET**  
D-03 NOT TO SCALE



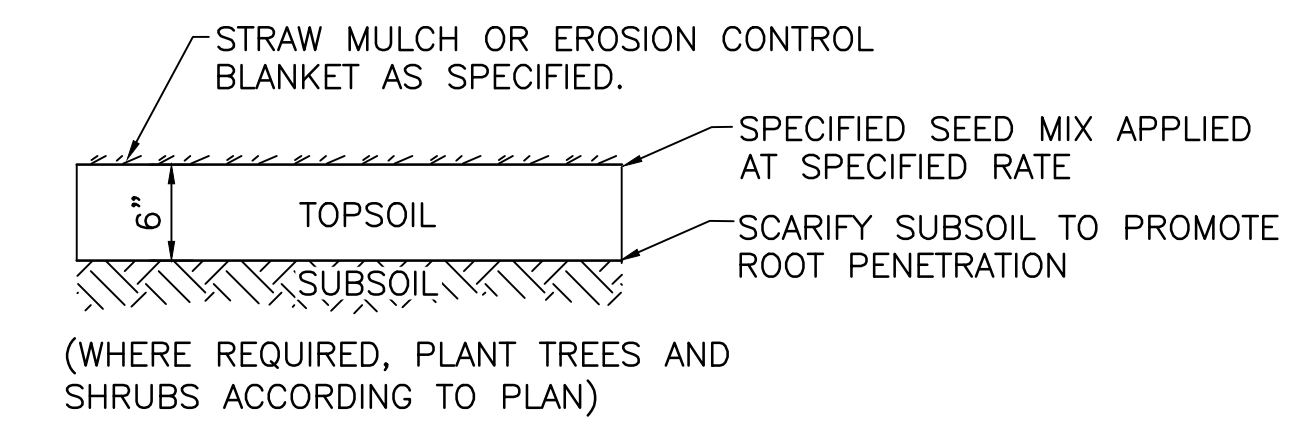
- LIVE STAKE AND CUTTING NOTES:**
- LIVE STAKE PLANTED PERPENDICULAR TO GROUND SURFACE.
  - LIVE CUTTINGS PLANTED AS SHOWN ON DETAIL SHEET D-02.
  - LIVE STAKES AND CUTTINGS TO BE WILLOW, (SALIX SP.), DOGWOOD, OR APPROVED EQUIVALENT.
  - LIVE STAKES - 1" DIAMETER MINIMUM. LIVE CUTTINGS - 1/2" DIAMETER MINIMUM.
  - PLANT LIVE STAKES 2' APART, STARTING AT EDGE OF BANKFULL BENCH.
  - STAKES AND CUTTINGS SHALL BE HARVESTED WHEN DORMANT (SPRING OR FALL) AND KEPT COOL AND MOIST UNTIL INSTALLATION, WHICH SHALL BE WITHIN TWO WEEKS OF HARVESTING.

**2 DETAIL: LIVE STAKES AND LIVE CUTTINGS**  
D-03 NOT TO SCALE

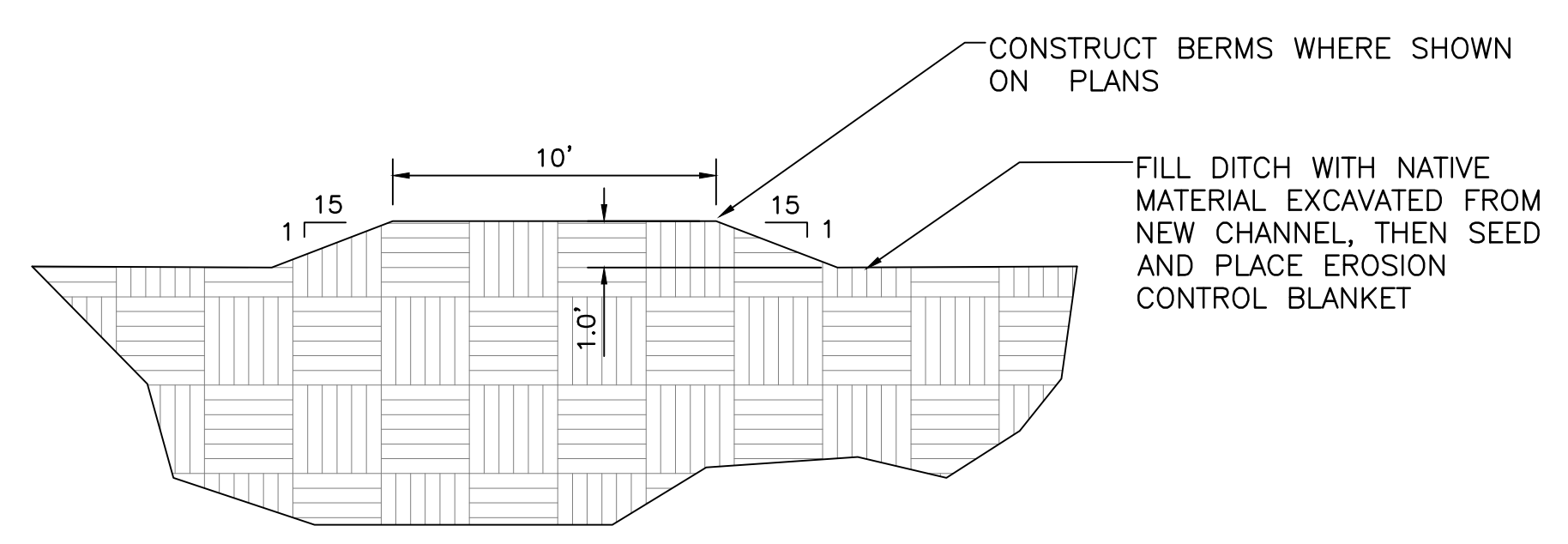


- BARE ROOT PLANTING NOTES:**
- PROVIDE AND INSTALL PLANT MATERIAL THAT MEET SPECIFICATIONS.
  - SOAK ROOTS IN WATER MINIMUM OF ONE HOUR PRIOR TO PLANTING.
  - PLANTING HOLE DIMENSIONS:
  - 18" TALL SHRUB: MIN 30" WIDE, MIN. 8" DEEP
  - SCARIFY SIDES AND BOTTOM OF PLANTING HOLE PRIOR TO PLANTING.
  - TRANSFER PLANT DIRECTLY FROM WATER TO HOLE, SET PLANT AT SAME DEPTH AS IT WAS GROWN IN NURSERY.
  - SET PLUMB AND IMMEDIATELY BACKFILL WITH PLANTING SOIL. DO NOT LEAVE PLANT IN PLANTING HOLE UNCOVERED. LIGHTLY FIRM SOIL TO MAINTAIN PLUMB POSITION.
  - APPLY WATER TO SETTLE PLANTS AND FILL VOIDS THEN CONSTRUCT 3" DEPTH WATERING BASIN.
  - WATER THOROUGHLY WITHIN 2 HOURS (1ST WATERING).

**4 DETAIL: BARE ROOT SHRUB STOCK PLANTING**  
D-03 NOT TO SCALE



**5 DETAIL: TOPSOIL AND SEEDING**  
D-03 NOT TO SCALE



**6 DETAIL: BERM (DITCH FILL)**  
D-03 NOT TO SCALE

**60% REVIEW  
NOT FOR CONSTRUCTION**

CADD USER: jessica\_olson FILE: \\EDI-CAD\CAD\DESIGN\23691303\00\23691303\_D03.DWG PLOT SCALE: 1:1 PLOT DATE: 12/23/2015 1:29 PM  
BARR - MA AutoCAD 2011\AutoCAD 2011 Support\enu\Template\Barr\_2011\_Template.dwt Plot at: 1 10/05/2010 14:03:50

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.		CLIENT BID CONSTRUCTION	12-23-15	Project Office: BARR ENGINEERING CO. 325 SOUTH LAKE AVENUE SUITE 700 DULUTH, MN 55802		Scale AS SHOWN	UNITED STATES STEEL CORPORATION MINNESOTA ORE OPERATIONS - MINNTAC MOUNTAIN IRON, MINNESOTA	SPIDER CREEK RESTORATION	BARR PROJECT No. 23/69-1303	
PRINTED NAME JESSICA C. L. OLSON		RELEASED TO/FOR	A B C 0 1 2 3	Corporate Headquarters: Minneapolis, Minnesota Ph: 1-800-786-5830 Fax: (218) 529-8202 www.barr.com	Date 12/21/15	Drawn RRR2			Checked JCO	Designed JCO
NO.	BY	CHK.	APP.	DATE	REVISION DESCRIPTION	DWG. No. D-03		REV. No. A		





## Appendix C

### Natural Channel Design Dimensions

Existing Reach Stream & Location:		Spider Creek, Minnesota		
Reference Reach Stream & Location:		Spider Creek, Minnesota		
Entry Number & Variable		Existing Reach	Proposed Design Reach	Reference Reach
	1 Valley Type (I–XII)	X	X	X
	2 Valley Width ( $W_{val}$ )	50	700	300-700
	3 Stream Type	B 5c	E4	E4
	4 Drainage Area, mi <sup>2</sup> (DA)	15.6	15.6	13.2
	5 Bankfull Discharge, cfs ( $Q_{bkt}$ )	130	130	82
Riffle Dimensions	6 Riffle Width, ft ( $W_{bkt}$ )	Mean: 18.1 Min: 15.7 Max: 20.3	Mean: 17.1 Min: 16.8 Max: 17.4	Mean: 16.7 Min: 16.5 Max: 17.0
	7 Riffle Mean Depth, ft ( $d_{bkt}$ )	Mean: 2.08 Min: 1.79 Max: 2.51	Mean: 2.38 Min: 2.34 Max: 2.43	Mean: 2.33 Min: 2.28 Max: 2.38
	8 Riffle Width/Depth Ratio ( $W_{bkt}/d_{bkt}$ )	Mean: 9.0 Min: 6.3 Max: 10.5	Mean: 7.2 Min: 6.9 Max: 7.4	Mean: 7.2 Min: 6.9 Max: 7.4
	9 Riffle Cross-Sectional Area, ft <sup>2</sup> ( $A_{bkt}$ )	Mean: 37.2 Min: 32.7 Max: 39.5	Mean: 40.7	Mean: 39.0 Min: 38.7 Max: 39.2
	10 Riffle Maximum Depth ( $d_{max}$ )	Mean: 2.67 Min: 2.32 Max: 3.00	Mean: 3.70 Min: 3.43 Max: 3.97	Mean: 3.62 Min: 3.43 Max: 3.80
	11 Riffle Maximum Depth to Riffle Mean Depth ( $d_{max}/d_{bkt}$ )	Mean: 1.293 Min: 1.195 Max: 1.387	Mean: 1.554 Min: 1.441 Max: 1.667	Mean: 1.554 Min: 1.441 Max: 1.667
	12 Width of Flood-Prone Area at Elevation of $2 * d_{max}$ , ft ( $W_{fpa}$ )	Mean: 33.6 Min: 29.1 Max: 37.3	Mean: 446.7 Min: 370.0 Max: 490.0	Mean: 511.7 Min: 314.4 Max: 709.0
	13 Entrenchment Ratio ( $W_{fpa}/W_{bkt}$ )	Mean: 1.9 Min: 1.6 Max: 2.4	Mean: 26.1 Min: 21.6 Max: 28.7	Mean: 30.5 Min: 19.1 Max: 41.8
Riffle Inner Berm Dimensions	14 Riffle Inner Berm Width, ft ( $W_{ib}$ )	Mean: 11.6 Min: 10.6 Max: 12.4	Mean: 8.8 Min: 7.7 Max: 10.3	Mean: 8.8 Min: 6.9 Max: 10.4
	15 Riffle Inner Berm Width to Riffle Width ( $W_{ib}/W_{bkt}$ )	Mean: 0.649 Min: 0.578 Max: 0.791	Mean: 0.514 Min: 0.448 Max: 0.601	Mean: 0.514 Min: 0.448 Max: 0.601
	16 Riffle Inner Berm Mean Depth, ft ( $d_{ib}$ )	Mean: 0.24 Min: 0.16 Max: 0.35	Mean: 0.18 Min: 0.10 Max: 0.24	Mean: 0.18 Min: 0.10 Max: 0.25
	17 Riffle Inner Berm Mean Depth to Riffle Mean Depth ( $d_{ib}/d_{bkt}$ )	Mean: 0.121 Min: 0.063 Max: 0.179	Mean: 0.077 Min: 0.041 Max: 0.101	Mean: 0.077 Min: 0.041 Max: 0.101
	18 Riffle Inner Berm Width/Depth Ratio ( $W_{ib}/d_{ib}$ )	Mean: 53.6 Min: 33.9 Max: 78.6	Mean: 51.7 Min: 41.5 Max: 69.1	Mean: 51.7 Min: 41.5 Max: 69.1
	19 Riffle Inner Berm Cross-Sectional Area ( $A_{ib}$ )	Mean: 2.8 Min: 2.0 Max: 4.1	Mean: 1.6 Min: 0.8 Max: 2.5	Mean: 1.7 Min: 0.7 Max: 2.6
	20 Riffle Inner Berm Cross-Sectional Area to Riffle Cross-Sectional Area ( $A_{ib}/A_{bkt}$ )	Mean: 0.075 Min: 0.050 Max: 0.103	Mean: 0.040 Min: 0.020 Max: 0.061	Mean: 0.040 Min: 0.020 Max: 0.061

Entry Number & Variable		Existing Reach	Proposed Design Reach	Reference Reach
Pool Dimensions	21 Pool Width, ft ( $W_{bkfp}$ )	Mean: 22.0 Min: 22.0 Max: 22.0	Mean: 27.2 Min: 20.4 Max: 31.7	Mean: 26.6 Min: 19.9 Max: 31.0
	22 Pool Width to Riffle Width ( $W_{bkfp}/W_{bkt}$ )	Mean: 1.216 Min: 1.216 Max: 1.216	Mean: 1.590 Min: 1.191 Max: 1.856	Mean: 1.590 Min: 1.191 Max: 1.856
	23 Pool Mean Depth, ft ( $d_{bkfp}$ )	Mean: 3.32 Min: 3.32 Max: 3.32	Mean: 2.42 Min: 2.18 Max: 2.72	Mean: 2.37 Min: 2.13 Max: 2.66
	24 Pool Mean Depth to Riffle Mean Depth ( $d_{bkfp}/d_{bkt}$ )	Mean: 1.596 Min: 1.596 Max: 1.596	Mean: 1.017 Min: 0.914 Max: 1.142	Mean: 1.017 Min: 0.914 Max: 1.142
	25 Pool Width/Depth Ratio ( $W_{bkfp}/d_{bkfp}$ )	Mean: 6.6 Min: 6.6 Max: 6.6	Mean: 11.2 Min: 7.5 Max: 14.6	Mean: 11.2 Min: 7.5 Max: 14.6
	26 Pool Cross-Sectional Area, ft <sup>2</sup> ( $A_{bkfp}$ )	Mean: 73.0 Min: 73.0 Max: 73.0	Mean: 65.3 Min: 55.4 Max: 80.8	Mean: 62.5 Min: 53.0 Max: 77.4
	27 Pool Area to Riffle Area ( $A_{bkfp}/A_{bkt}$ )	Mean: 1.961 Min: 1.961 Max: 1.961	Mean: 1.605 Min: 1.361 Max: 1.986	Mean: 1.605 Min: 1.361 Max: 1.986
	28 Pool Maximum Depth ( $d_{maxp}$ )	Mean: 4.78 Min: 4.78 Max: 4.78	Mean: 4.35 Min: 4.17 Max: 4.70	Mean: 4.26 Min: 4.08 Max: 4.60
	29 Pool Maximum Depth to Riffle Mean Depth ( $d_{maxp}/d_{bkt}$ )	Mean: 2.298 Min: 2.298 Max: 2.298	Mean: 1.828 Min: 1.751 Max: 1.974	Mean: 1.828 Min: 1.751 Max: 1.974
	30 Point Bar Slope ( $S_{pb}$ )	Mean: 0.000 Min: 0.000 Max: 0.000	Mean: 0.014 Min: 0.012 Max: 0.012	Mean: 0.014 Min: 0.012 Max: 0.012
Pool Inner Berm Dimensions	31 Pool Inner Berm Width, ft ( $W_{ibp}$ )	Mean: 7.0 Min: 7.0 Max: 7.0	Mean: 4.7 Min: 0.0 Max: 11.0	Mean: 7.4 Min: 0.0 Max: 19.5
	32 Pool Inner Berm Width to Pool Width ( $W_{ibp}/W_{bkfp}$ )	Mean: 0.320 Min: 0.320 Max: 0.320	Mean: 0.171 Min: 0.000 Max: 0.403	Mean: 0.272 Min: 0.000 Max: 0.641
	33 Pool Inner Berm Mean Depth, ft ( $d_{ibp}$ )	Mean: 0.39 Min: 0.39 Max: 0.39	Mean: 0.28 Min: 0.00 Max: 0.67	Mean: 0.29 Min: 0.00 Max: 0.70
	34 Pool Inner Berm Mean Depth to Pool Mean Depth ( $d_{ibp}/d_{bkfp}$ )	Mean: 0.118 Min: 0.118 Max: 0.118	Mean: 0.117 Min: 0.000 Max: 0.275	Mean: 0.117 Min: 0.000 Max: 0.275
	35 Pool Inner Berm Width/Depth Ratio ( $W_{ibp}/d_{ibp}$ )	Mean: 18.0 Min: 18.0 Max: 18.0	Mean: 19.1 Min: 0.0 Max: 28.6	Mean: 19.1 Min: 0.0 Max: 28.6
	36 Pool Inner Berm Cross-Sectional Area ( $A_{ibp}$ )	Mean: 2.8 Min: 2.8 Max: 2.8	Mean: 3.6 Min: 0.0 Max: 11.5	Mean: 4.0 Min: 0.0 Max: 13.6
	37 Pool Inner Berm Cross-Sectional Area to Pool Cross-Sectional Area ( $A_{ibp}/A_{bkfp}$ )	Mean: 0.038 Min: 0.038 Max: 0.038	Mean: 0.055 Min: 0.000 Max: 0.176	Mean: 0.055 Min: 0.000 Max: 0.176

Entry Number & Variable		Existing Reach	Proposed Design Reach	Reference Reach
Run Dimensions	38 Run Width, ft ( $W_{bkfr}$ )	Mean: Min: Max:	Mean: 20.0 Min: 16.1 Max: 24.8	Mean: 19.6 Min: 15.8 Max: 24.3
	39 Run Width to Riffle Width ( $W_{bkfr}/W_{bkt}$ )	Mean: Min: Max:	Mean: 1.173 Min: 0.943 Max: 1.451	Mean: 1.173 Min: 0.943 Max: 1.451
	40 Run Mean Depth, ft ( $d_{bkfr}$ )	Mean: Min: Max:	Mean: 2.50 Min: 2.08 Max: 2.80	Mean: 2.45 Min: 2.04 Max: 2.74
	41 Run Mean Depth to Riffle Mean Depth ( $d_{bkfr}/d_{bkt}$ )	Mean: Min: Max:	Mean: 1.052 Min: 0.876 Max: 1.176	Mean: 1.052 Min: 0.876 Max: 1.176
	42 Run Width/Depth Ratio ( $W_{bkfr}/d_{bkfr}$ )	Mean: Min: Max:	Mean: 8.2 Min: 39.0 Max: 38.7	Mean: 8.2 Min: 6.3 Max: 11.9
	43 Run Cross-Sectional Area, ft <sup>2</sup> ( $A_{bkfr}$ )	Mean: Min: Max:	Mean: 49.7 Min: 41.1 Max: 57.1	Mean: 47.6 Min: 39.3 Max: 54.7
	44 Run Area to Riffle Area ( $A_{bkfr}/A_{bkt}$ )	Mean: Min: Max:	Mean: 1.222 Min: 1.009 Max: 1.402	Mean: 1.222 Min: 1.009 Max: 1.402
	45 Run Maximum Depth ( $d_{maxr}$ )	Mean: Min: Max:	Mean: 3.83 Min: 3.35 Max: 4.54	Mean: 3.75 Min: 3.28 Max: 4.44
	46 Run Maximum Depth to Riffle Mean Depth ( $d_{maxr}/d_{bkt}$ )	Mean: Min: Max:	Mean: 1.609 Min: 1.408 Max: 1.906	Mean: 1.609 Min: 1.408 Max: 1.906
Glide Dimensions	47 Glide Width, ft ( $W_{bkfg}$ )	Mean: Min: Max:	Mean: 29.5 Min: 18.3 Max: 50.2	Mean: 28.9 Min: 17.9 Max: 49.1
	48 Glide Width to Riffle Width ( $W_{bkfg}/W_{bkt}$ )	Mean: Min: Max:	Mean: 1.727 Min: 1.071 Max: 2.937	Mean: 1.727 Min: 1.071 Max: 2.937
	49 Glide Mean Depth, ft ( $d_{bkfg}$ )	Mean: Min: Max:	Mean: 2.28 Min: 1.77 Max: 2.66	Mean: 2.23 Min: 1.73 Max: 2.60
	50 Glide Mean Depth to Riffle Mean Depth ( $d_{bkfg}/d_{bkt}$ )	Mean: Min: Max:	Mean: 0.957 Min: 0.742 Max: 1.116	Mean: 0.957 Min: 0.742 Max: 1.116
	51 Glide Width/Depth Ratio ( $W_{bkfg}/d_{bkfg}$ )	Mean: Min: Max:	Mean: 14.0 Min: 8.0 Max: 28.4	Mean: 14.0 Min: 8.0 Max: 28.4
	52 Glide Cross-Sectional Area, ft <sup>2</sup> ( $A_{bkfg}$ )	Mean: Min: Max:	Mean: 64.1 Min: 39.6 Max: 88.7	Mean: 61.3 Min: 37.9 Max: 84.9
	53 Glide Area to Riffle Area ( $A_{bkfg}/A_{bkt}$ )	Mean: Min: Max:	Mean: 1.574 Min: 0.972 Max: 2.179	Mean: 1.574 Min: 0.972 Max: 2.179
	54 Glide Maximum Depth ( $d_{maxg}$ )	Mean: Min: Max:	Mean: 3.67 Min: 3.27 Max: 4.13	Mean: 3.59 Min: 3.20 Max: 4.04
	55 Glide Maximum Depth to Riffle Mean Depth ( $d_{maxg}/d_{bkt}$ )	Mean: Min: Max:	Mean: 1.541 Min: 1.373 Max: 1.734	Mean: 1.541 Min: 1.373 Max: 1.734

Entry Number & Variable		Existing Reach	Proposed Design Reach	Reference Reach
Glide Inner Berm Dimensions	56 Glide Inner Berm Width, ft ( $W_{ibg}$ )	Mean: Min: Max:	Mean: <b>10.1</b> Min: <b>4.8</b> Max: <b>18.9</b>	Mean: <b>9.2</b> Min: <b>2.9</b> Max: <b>13.4</b>
	57 Glide Inner Berm Width to Glide Width ( $W_{ibg}/W_{bkfg}$ )	Mean: Min: Max:	Mean: <b>0.343</b> Min: <b>0.163</b> Max: <b>0.642</b>	Mean: <b>0.343</b> Min: <b>0.163</b> Max: <b>0.642</b>
	58 Glide Inner Berm Mean Depth, ft ( $d_{ibg}$ )	Mean: Min: Max:	Mean: <b>0.23</b> Min: <b>0.10</b> Max: <b>0.38</b>	Mean: <b>0.22</b> Min: <b>0.10</b> Max: <b>0.29</b>
	59 Glide Inner Berm Mean Depth to Glide Mean Depth ( $d_{ibg}/d_{bkfg}$ )	Mean: Min: Max:	Mean: <b>0.102</b> Min: <b>0.046</b> Max: <b>0.167</b>	Mean: <b>0.102</b> Min: <b>0.046</b> Max: <b>0.167</b>
	60 Glide Inner Berm Width/Depth Ratio ( $W_{ibg}/d_{ibg}$ )	Mean: Min: Max:	Mean: <b>41.3</b> Min: <b>30.0</b> Max: <b>64.5</b>	Mean: <b>41.3</b> Min: <b>30.0</b> Max: <b>64.5</b>
	61 Glide Inner Berm Cross-Sectional Area ( $A_{ibg}$ )	Mean: Min: Max:	Mean: <b>2.2</b> Min: <b>0.5</b> Max: <b>3.3</b>	Mean: <b>2.2</b> Min: <b>0.3</b> Max: <b>3.1</b>
	62 Glide Inner Berm Area to Glide Area ( $A_{ibg}/A_{bkfg}$ )	Mean: Min: Max:	Mean: <b>0.034</b> Min: <b>0.008</b> Max: <b>0.051</b>	Mean: <b>0.034</b> Min: <b>0.008</b> Max: <b>0.051</b>
Step Dimensions	63 Step Width, ft ( $W_{bkfs}$ )	Mean: Min: Max:	Mean: <b>#VALUE!</b> Min: Max:	Mean: Min: Max:
	64 Step Width to Riffle Width ( $W_{bkfs}/W_{bkt}$ )	Mean: Min: Max:	Mean: <b>#VALUE!</b> Min: Max:	Mean: Min: Max:
	65 Step Mean Depth, ft ( $d_{bkfs}$ )	Mean: Min: Max:	Mean: <b>#VALUE!</b> Min: Max:	Mean: Min: Max:
	66 Step Mean Depth to Riffle Mean Depth ( $d_{bkfs}/d_{bkt}$ )	Mean: Min: Max:	Mean: <b>#VALUE!</b> Min: Max:	Mean: Min: Max:
	67 Step Width/Depth Ratio ( $W_{bkfs}/d_{bkfs}$ )	Mean: Min: Max:	Mean: Min: Max:	Mean: Min: Max:
	68 Step Cross-Sectional Area, ft <sup>2</sup> ( $A_{bkfs}$ )	Mean: Min: Max:	Mean: <b>#VALUE!</b> Min: Max:	Mean: Min: Max:
	69 Step Area to Riffle Area ( $A_{bkfs}/A_{bkt}$ )	Mean: Min: Max:	Mean: <b>#VALUE!</b> Min: Max:	Mean: Min: Max:
	70 Step Maximum Depth ( $d_{maxs}$ )	Mean: Min: Max:	Mean: <b>#VALUE!</b> Min: Max:	Mean: Min: Max:
	71 Step Maximum Depth to Riffle Mean Depth ( $d_{maxs}/d_{bkt}$ )	Mean: Min: Max:	Mean: <b>#VALUE!</b> Min: Max:	Mean: Min: Max:

Entry Number & Variable	Existing Reach	Proposed Design Reach	Reference Reach
72 Linear Wavelength, ft ( $\lambda$ )	Mean: Min: Max:	Mean: 223.9 Min: 61.3 Max: 391.6	Mean: 219.0 Min: 60.0 Max: 383.0
73 Linear Wavelength to Riffle Width ( $\lambda/W_{bkt}$ )	Mean: Min: Max:	Mean: 13.098 Min: 3.589 Max: 22.907	Mean: 13.098 Min: 3.589 Max: 22.907
74 Stream Meander Length, ft ( $L_m$ )	Mean: Min: Max:	Mean: 167.7 Min: 52.1 Max: 515.3	Mean: 164.0 Min: 51.0 Max: 504.0
75 Stream Meander Length Ratio ( $L_m/W_{bkt}$ )	Mean: Min: Max:	Mean: 9.809 Min: 3.050 Max: 30.144	Mean: 9.809 Min: 3.050 Max: 30.144
76 Belt Width, ft ( $W_{bit}$ )	Mean: Min: Max:	Mean: 90.0 Min: 17.4 Max: 199.4	Mean: 88.0 Min: 17.0 Max: 195.0
77 Meander Width Ratio ( $W_{bit}/W_{bkt}$ )	Mean: Min: Max:	Mean: 5.263 Min: 1.017 Max: 11.663	Mean: 5.263 Min: 1.017 Max: 11.663
78 Radius of Curvature, ft ( $R_c$ )	Mean: Min: Max:	Mean: 67.5 Min: 16.4 Max: 292.4	Mean: 66.0 Min: 16.0 Max: 286.0
79 Radius of Curvature to Riffle Width ( $R_c/W_{bkt}$ )	Mean: Min: Max:	Mean: 3.947 Min: 0.957 Max: 17.105	Mean: 3.947 Min: 0.957 Max: 17.105
80 Arc Length, ft ( $L_a$ )	Mean: Min: Max:	Mean: 61.3 Min: 27.6 Max: 132.9	Mean: 60.0 Min: 27.0 Max: 130.0
81 Arc Length to Riffle Width ( $L_a/W_{bkt}$ )	Mean: Min: Max:	Mean: 3.589 Min: 1.615 Max: 7.775	Mean: 3.589 Min: 1.615 Max: 7.775
82 Riffle Length ( $L_r$ ), ft	Mean: Min: Max:	Mean: 17.4 Min: 8.2 Max: 25.6	Mean: 17.0 Min: 8.0 Max: 25.0
83 Riffle Length to Riffle Width ( $L_r/W_{bkt}$ )	Mean: Min: Max:	Mean: 1.017 Min: 0.478 Max: 1.495	Mean: 1.017 Min: 0.478 Max: 1.495
84 Individual Pool Length, ft ( $L_p$ )	Mean: Min: Max:	Mean: 74.4 Min: 25.6 Max: 156.4	Mean: 72.8 Min: 25.0 Max: 153.0
85 Pool Length to Riffle Width ( $L_p/W_{bkt}$ )	Mean: Min: Max:	Mean: 4.354 Min: 1.495 Max: 9.151	Mean: 4.354 Min: 1.495 Max: 9.151
86 Pool-to-Pool Spacing, ft ( $P_s$ )	Mean: Min: Max:	Mean: 127.8 Min: 66.5 Max: 157.5	Mean: 125.0 Min: 65.0 Max: 154.0
87 Pool-to-Pool Spacing to Riffle Width ( $P_s/W_{bkt}$ )	Mean: Min: Max:	Mean: 7.476 Min: 3.888 Max: 9.211	Mean: 7.476 Min: 3.888 Max: 9.211

Entry Number & Variable		Existing Reach	Proposed Design Reach	Reference Reach
Sinuosity and Slope	88 Stream Length (SL)	2579.0	4060.0	3443.0
	89 Valley Length (VL)	2449.0	2635.0	2237.0
	90 Valley Slope ( $S_{val}$ )	0.0012	0.0012	0.0013
	91 Sinuosity (k)	SL/VL: 1.05 VS/S: 1.09	SL/VL: 1.54	1.54 VS/S: 1.21
	92 Average Water Surface Slope (S)	0.0011	$S = S_{val}/k$ 0.0008	0.0011
Floodplain	93 Floodplain Width, ft ( $W_f$ )	Mean: Min: Max:	Mean: Min: Max:	Mean: 305.0 Min: 210.0 Max: 400.0
	94 Floodplain Surface Depth Limit, ft ( $d_f$ )	Mean: Min: Max:	Mean: Min: Max:	Mean: 2.00 Min: 1.80 Max: 2.20
Low Terrace	95 Low Terrace Width, ft ( $W_{lt}$ )	Mean: Min: Max:	Mean: Min: Max:	Mean: 450.0 Min: 290.0 Max: 620.0
	96 Low Terrace Surface Depth Limit, ft ( $d_{lt}$ )	Mean: Min: Max:	Mean: Min: Max:	Mean: 5.60 Min: 5.30 Max: 6.00
Flood-Prone Area	97 Flood-Prone Area Width, ft ( $W_{fpa}$ )	Mean: Min: Max:	Mean: Min: Max:	Mean: 450.0 Min: 290.0 Max: 610.0
	98 Flood-Prone Area Surface Depth Limit, ft ( $d_{fpa}$ )	Mean: Min: Max:	Mean: Min: Max:	Mean: 5.60 Min: 5.30 Max: 6.00
Degree of Incision	99 Low Bank Height (LBH)	Mean: Min: Max:	Mean: Min: Max:	Mean: Min: Max:
	100 Maximum Bankfull Depth ( $d_{max}$ ) at Same Location as Low Bank Height (LBH) Measurement	Mean: Min: Max:	Mean: Min: Max:	Mean: Min: Max:
	101 Bank-Height Ratio (LBH/ $d_{max}$ )	Mean: Min: Max:	Mean: Min: Max:	Mean: Min: Max:

Entry Number & Variable		Existing Reach	Proposed Design Reach	Reference Reach
Bed Feature Max Depth Measurements and Dimensionless Ratios from Profile	102 Riffle Maximum Depth, ft ( $d_{max}$ )	Mean: Min: Max:	Mean: 3.45 Min: 3.25 Max: 3.71	Mean: 3.38 Min: 3.18 Max: 3.63
	103 Riffle Maximum Depth to Riffle Mean Depth ( $d_{max}/d_{bkt}$ )	Mean: Min: Max:	Mean: 1.451 Min: 1.365 Max: 1.558	Mean: 1.451 Min: 1.365 Max: 1.558
	104 Pool Maximum Depth, ft ( $d_{maxp}$ )	Mean: Min: Max:	Mean: 4.26 Min: 4.01 Max: 4.55	Mean: 4.17 Min: 3.92 Max: 4.45
	105 Pool Maximum Depth to Riffle Mean Depth ( $d_{maxp}/d_{bkt}$ )	Mean: Min: Max:	Mean: 1.790 Min: 1.682 Max: 1.910	Mean: 1.790 Min: 1.682 Max: 1.910
	106 Run Maximum Depth, ft ( $d_{maxr}$ )	Mean: Min: Max:	Mean: 3.87 Min: 3.62 Max: 4.07	Mean: 3.79 Min: 3.54 Max: 3.98
	107 Run Maximum Depth to Riffle Mean Depth ( $d_{maxr}/d_{bkt}$ )	Mean: Min: Max:	Mean: 1.627 Min: 1.519 Max: 1.708	Mean: 1.627 Min: 1.519 Max: 1.708
	108 Glide Maximum Depth, ft ( $d_{maxg}$ )	Mean: Min: Max:	Mean: 3.24 Min: 3.20 Max: 3.33	Mean: 3.17 Min: 3.13 Max: 3.26
	109 Glide Maximum Depth to Riffle Mean Depth ( $d_{maxg}/d_{bkt}$ )	Mean: Min: Max:	Mean: 1.361 Min: 1.343 Max: 1.399	Mean: 1.361 Min: 1.343 Max: 1.399
	110 Step Maximum Depth, ft ( $d_{maxs}$ )	Mean: Min: Max:	Mean: 0.00 Min: 0.00 Max: 0.00	Mean: 0.00 Min: 0.00 Max: 0.00
	111 Step Maximum Depth to Riffle Mean Depth ( $d_{maxs}/d_{bkt}$ )	Mean: Min: Max:	Mean: 0.000 Min: 0.000 Max: 0.000	Mean: 0.000 Min: 0.000 Max: 0.000
	Bed Feature Water Surface Facet Slopes and Dimensionless Ratios from Profile	112 Riffle Slope (water surface facet slope) ( $S_{rif}$ )	Mean: Min: Max:	Mean: 0.0011 Min: 0.0006 Max: 0.0018
113 Riffle Slope to Average Water Surface Slope ( $S_{rif}/S$ )		Mean: Min: Max:	Mean: 1.3969 Min: 0.7634 Max: 2.2748	Mean: 1.3969 Min: 0.7634 Max: 2.2748
114 Pool Slope (water surface facet slope) ( $S_p$ )		Mean: Min: Max:	Mean: 0.0001 Min: 0.0001 Max: 0.0008	Mean: 0.0007 Min: 0.0003 Max: 0.0014
115 Pool Slope to Average Water Surface Slope ( $S_p/S$ )		Mean: Min: Max:	Mean: 0.1500 Min: 0.1000 Max: 1.0382	Mean: 0.1500 Min: 0.1000 Max: 1.0382
116 Run Slope (water surface facet slope) ( $S_{run}$ )		Mean: Min: Max:	Mean: 0.0010 Min: 0.0003 Max: 0.0017	Mean: 0.0017 Min: 0.0005 Max: 0.0029
117 Run Slope to Average Water Surface Slope ( $S_{run}/S$ )		Mean: Min: Max:	Mean: 1.2748 Min: 0.3588 Max: 2.1756	Mean: 1.2748 Min: 0.3588 Max: 2.1756
118 Glide Slope (water surface facet slope) ( $S_g$ )		Mean: Min: Max:	Mean: 0.0003 Min: 0.0002 Max: 0.0005	Mean: 0.0006 Min: 0.0003 Max: 0.0008
119 Glide Slope to Average Water Surface Slope ( $S_g/S$ )		Mean: Min: Max:	Mean: 0.4351 Min: 0.2519 Max: 0.5878	Mean: 0.4351 Min: 0.2519 Max: 0.5878
120 Step Slope (water surface facet slope) ( $S_s$ )		Mean: Min: Max:	Mean: 0.0000 Min: 0.0000 Max: 0.0000	Mean: 0.0000 Min: 0.0000 Max: 0.0000
121 Step Slope to Average Water Surface Slope ( $S_s/S$ )		Mean: Min: Max:	Mean: 0.0000 Min: 0.0000 Max: 0.0000	Mean: 0.0000 Min: 0.0000 Max: 0.0000



Entry Number & Variable	Existing Reach	Proposed Design Reach	Reference Reach
<b>122 Particle Size Distribution of Reach-wide Channel Materials</b>			
D <sub>16</sub> (mm)			0.1
D <sub>35</sub> (mm)			1.8
D <sub>50</sub> (mm)			4.2
D <sub>84</sub> (mm)			15.3
D <sub>95</sub> (mm)			30.4
D <sub>100</sub> (mm)			180.0
<b>123 Particle Size Distribution of Active Bed or Pavement Channel Materials</b>			
D <sub>16</sub> (mm)			0.0
D <sub>35</sub> (mm)			0.0
D <sub>50</sub> (mm)			0.1
D <sub>84</sub> (mm)			3.5
D <sub>95</sub> (mm)			5.5
D <sub>100</sub> (mm)			22.6
<b>124 Particle Size Distribution of Bar Material or Sub-pavement</b>			
D <sub>16</sub> (mm)			2.0
D <sub>35</sub> (mm)			51.0
D <sub>50</sub> (mm)			49.0
D <sub>84</sub> (mm)			0.0
D <sub>95</sub> (mm)			0.0
D <sub>max</sub> (mm)			0.0
<b>Hydraulics &amp; Flood Capacity</b>			
<b>125</b> Estimated Bankfull Mean Velocity, ft/sec ( $\bar{U}_{bkt}$ )	5.14		2.1
<b>126</b> Estimated Bankfull Discharge, cfs ( $Q_{bkt}$ ); Compare with Regional Curve	165.0	130.0	82.4
<b>127</b> Floodplain Capacity: Discharge ( $Q_{fp}$ )			1220.0
<b>128</b> Floodplain Capacity: Cross-Sectional Area ( $A_{fp}$ )			610.0
<b>129</b> Low Terrace Capacity: Discharge ( $Q_{lt}$ )			4060.0
<b>130</b> Low Terrace Capacity: Cross-Sectional Area ( $A_{lt}$ )			812.0
<b>131</b> Flood-Prone Area Capacity: Discharge ( $Q_{fpa}$ )			5280.0
<b>132</b> Flood-Prone Area Capacity: Cross-Sectional Area ( $A_{fpa}$ )			1422.0

Entry Number & Variable		Existing Reach	Proposed Design Reach	Reference Reach
<b>Sediment Competence</b>	<b>133</b> Calculated bankfull shear stress value, lbs/ft <sup>2</sup> ( $\tau$ )		<b>0.116</b>	
	<b>134</b> Predicted largest moveable particle size (mm) at bankfull shear stress, ( $\tau$ )	Shields:	Shields: <b>8</b>	Shields:
		Colo.:	Colo.: <b>31</b>	Colo.:
	<b>135</b> Largest particle size to be moved ( $D_{max}$ ) (mm) (see #124: Particle Size Distribution of Bar Material)			
	<b>136</b> Predicted shear stress required to initiate movement of $D_{max}$ (mm)	Shields:	Shields:	Shields:
		Colo.:	Colo.:	Colo.:
	<b>137</b> Predicted mean depth required to initiate movement of $D_{max}$ (mm), $d = \tau/\gamma S$ ( $\tau$ = predicted shear stress, $\gamma = 62.4$ , $S$ = existing or design slope)	Shields:	Shields:	Shields:
		Colo.:	Colo.:	Colo.:
	<b>138</b> Predicted slope required to initiate movement of $D_{max}$ (mm) $S = \tau/\gamma d$ ( $\tau$ = predicted shear stress, $\gamma = 62.4$ , $d$ = existing or design depth)	Shields:	Shields:	Shields:
		Colo.:	Colo.:	Colo.:
<b>139</b> Bankfull dimensionless shear stress ( $\tau^*$ )				
<b>140</b> Required bankfull mean depth $d_{bkf}$ (ft) using dimensionless shear stress equation: $d_{bkf} = \tau^*(\gamma_s - 1)D_{max}/S$ (Note: $D_{max}$ in ft)				
<b>141</b> Required bankfull water surface slope $S$ (ft) using dimensionless shear stress equation: $S = \tau^*(\gamma_s - 1)D_{max}/d_{bkf}$ (Note: $D_{max}$ in ft)				
<b>Sediment Yield</b>	<b>Sediment Yield (FLOWSED)</b>	<b>Existing Reach</b>	<b>Proposed Design Reach</b>	<b>Difference in Sediment Yield</b>
	<b>142</b> Bedload Sediment Yield (tons/yr)			
	<b>143</b> Suspended Sediment Yield (tons/yr)			
	<b>144</b> Suspended Sand Sediment Yield (tons/yr)			
	<b>145</b> Total Annual Sediment Yield (tons/yr)			
<b>Sediment Transport</b>	<b>Sediment Yield (POWERSED)</b>	<b>Existing Reach</b>	<b>Proposed Design Reach</b>	<b>Difference in Sed. Transport</b>
	<b>146</b> Bedload Sediment Transport (tons/yr)			
	<b>147</b> Suspended Sediment Transport (tons/yr)			
	<b>148</b> Suspended Sand Sediment Transport (tons/yr)			
	<b>149</b> Total Annual Sediment Transport (tons/yr)			

Entry Number & Variable		Existing Reach	Proposed Design Reach	Reference Reach
<b>Streambank Erosion</b>	<b>Streambank Erosion</b>	<b>Existing Reach</b>	<b>Proposed Design Reach</b>	<b>Reference Reach</b>
	<b>150</b> Stream Length Assessed (ft)		<b>4,060</b>	<b>5,250</b>
	<b>151</b> Graph/Curve Used (e.g., Yellowstone or Colorado)			<b>Colorado</b>
	<b>152</b> Streambank Erosion (tons/yr)		<b>31.71</b>	<b>41.00</b>
	<b>153</b> Streambank Erosion Rate (tons/yr/ft)			<b>0.0078</b>

## Appendix D

### Spider Creek Conservation Easement

STATE OF MINNESOTA  
DEPARTMENT OF TAXATION

\* Indicates  
Recorded in ESM  
Abstract

CONVEYANCE OF FORFEITED LANDS  
(Issued Pursuant to Minnesota Statutes, Section 282.37)

THIS INDENTURE, made this 7th day of April, 1972, between the State of Minnesota, as party of the first part, and the STATE DEPARTMENT OF NATURAL RESOURCES, as party of the second part, WITNESSETH:

WHEREAS, the land hereinafter described was duly forfeited to the State of Minnesota for the nonpayment of taxes, and,

WHEREAS, pursuant to Minnesota Statutes, Section 282.37, the party of the second part has applied to the Commissioner of Taxation for the conveyance of lands hereinafter described granting permanent easements for public access and improvement of trout habitat and,

WHEREAS, the Board of County Commissioners of the County of ST. LOUIS, State of Minnesota, has recommended to the Commissioner of Taxation by resolution adopted on the 27th day of March, 1972, that such conveyance be made,

NOW, THEREFORE, the State of Minnesota, pursuant to said laws and in consideration of the premises, does hereby grant, bargain, sell and convey unto the party of the second part, forever, an easement of all the parcels or tracts of land lying and being in the County of ST. LOUIS, State of Minnesota, described as follows, to-wit:

Antiv Creek where it crosses the following described lands:  
NE $\frac{1}{4}$  of NW $\frac{1}{4}$  of NE $\frac{1}{4}$  of NW $\frac{1}{4}$  Sec. 25, Twp. 51N., R 14W *Unit No. F-526*

Artichoke Creek where it crosses the following described lands:  
SE $\frac{1}{4}$  of NW $\frac{1}{4}$  Sec. 18, Twp. 52N., R 17W *Unit No. F-527*

Bear Trap Creek where it crosses the following described lands:  
NE $\frac{1}{4}$  of SW $\frac{1}{4}$  Sec. 25, Twp. 51N., R 17W *Unit No. F-528*  
SW $\frac{1}{4}$  of NW $\frac{1}{4}$  Sec. 26, Twp. 51N., R 17W

Berry Creek where it crosses the following described lands:  
SW $\frac{1}{4}$  of NE $\frac{1}{4}$  Sec. 2, Twp. 56N., R 12W *Unit No. F-529*

Blackduck River where it crosses the following described lands:  
Govt. Lot 5 Sec. 6, Twp. 66N., R 19W *Unit No. F-530*  
NW $\frac{1}{4}$  of SW $\frac{1}{4}$  Sec. 8, Twp. 66N., R 19W

Coolidge Creek where it crosses the following described lands:  
Govt. Lot 2 Sec. 30, Twp. 55N., R 14W *Unit No. F-531*

Daan Creek where it crosses the following described lands:  
SW $\frac{1}{4}$  of NE $\frac{1}{4}$  Sec. 23, Twp. 61N., R 21W *Unit No. F-532*  
W $\frac{1}{2}$  of SE $\frac{1}{4}$  Sec. 23, Twp. 61N., R 21W  
SW $\frac{1}{4}$  of SE $\frac{1}{4}$  Sec. 27, Twp. 61N., R 21W  
S $\frac{1}{2}$  of SW $\frac{1}{4}$  Sec. 27, Twp. 61N., R 21W

East Two Rivers where it crosses the following described lands:  
SW $\frac{1}{4}$  of NE $\frac{1}{4}$  Sec. 31, Twp. 62N., R 14W *Unit No. F-533*  
SE $\frac{1}{4}$  of NW $\frac{1}{4}$  Sec. 32, Twp. 62N., R 14W  
NW $\frac{1}{4}$  of SW $\frac{1}{4}$  Sec. 32, Twp. 62N., R 14W

Lester River where it crosses the following described lands:  
NE $\frac{1}{4}$  of NW $\frac{1}{4}$  NW of NE Sec. 2, Twp. 51N., R 14W *Unit No. F-215*  
SW $\frac{1}{4}$  of NW $\frac{1}{4}$  Sec. 35, Twp. 52N., R 14W  
N $\frac{1}{2}$  of NW $\frac{1}{4}$  of SW $\frac{1}{4}$  Sec. 35, Twp. 52N., R 14W

Little Swan Creek where it crosses the following described lands:  
NE $\frac{1}{4}$  of SW $\frac{1}{4}$  Sec. 10, Twp. 56N., R 20W *Unit No. F-534*  
NW $\frac{1}{4}$  of SE $\frac{1}{4}$  Sec. 10, Twp. 56N., R 20W

ACQUISITION RECORD

DIVN.	G & F
NO.	ESM
MAP	E-37
ABST.	5/8/72
CARDS	-
F-44	-
I.B.M.	-

PROJECT F-2-L-F *SEE ABOVE*  
TRACT NO. 1 UNIT NO. ---  
NAME OF UNIT LOSI  
COUNTY ST. LOUIS

Little Sand Creek where it crosses the following described lands: *Unit No. F-53*  
 Govt. Lot 3 *does not cross these* Sec. 6, Twp. 62N., R 12W ✓  
 Govt. Lot 5 *pwc's* Sec. 6, Twp. 62N., R 12W ✓

Lost River where it crosses the following described lands: *Unit No. F-53*  
 NE $\frac{1}{4}$  of SE $\frac{1}{4}$  Sec. 35, Twp. 66N., R 20W ✓  
 S $\frac{1}{2}$  of NE $\frac{1}{4}$  Sec. 35, Twp. 66N., R 20W ✓

Mud Creek where it crosses the following described lands: *Unit No. F-53*  
 SW $\frac{1}{4}$  of SE $\frac{1}{4}$  Sec. 20, Twp. 54N., R 12W ✓  
 SE $\frac{1}{4}$  of SE $\frac{1}{4}$  Sec. 30, Twp. 54N., R 12W ✓

Pine River where it crosses the following described lands: *Unit No. F-53*  
 W $\frac{1}{2}$  of SE $\frac{1}{4}$  of NE $\frac{1}{4}$  Sec. 4, Twp. 50N., R 16W ✓

Purvis Creek where it crosses the following described lands: *Unit No. F-53*  
 SW $\frac{1}{4}$  of NW $\frac{1}{4}$  Sec. 22, Twp. 62N., R 13W ✓  
 NW $\frac{1}{4}$  of SE $\frac{1}{4}$  Sec. 22, Twp. 62N., R 13W ✓  
 W $\frac{1}{2}$  of NE $\frac{1}{4}$  Sec. 27, Twp. 62N., R 13W ✓  
 SE $\frac{1}{4}$  of NW $\frac{1}{4}$  Sec. 27, Twp. 62N., R 13W ✓  
 N $\frac{1}{2}$  of NE $\frac{1}{4}$  Sec. 33, Twp. 62N., R 13W ✓  
 SW $\frac{1}{4}$  of NE $\frac{1}{4}$  Sec. 33, Twp. 62N., R 13W ✓

Sand Creek where it crosses the following described lands: *Unit No. F-540*  
 SW $\frac{1}{4}$  of NE $\frac{1}{4}$  Sec. 3, Twp. 60N., R 21W ✓  
 NE $\frac{1}{4}$  of SE $\frac{1}{4}$  Sec. 3, Twp. 60N., R 21W ✓

Spider Creek where it crosses the following described lands: *Unit No. F-54*  
 Govt. Lot 3 Sec. 17, Twp. 52N., R 18W ✓  
 NE $\frac{1}{4}$  of SW $\frac{1}{4}$  Sec. 19, Twp. 52N., R 18W ✓  
 SE $\frac{1}{4}$  of SE $\frac{1}{4}$  Sec. 20, Twp. 52N., R 18W ✓  
 SW $\frac{1}{4}$  of SW $\frac{1}{4}$  Sec. 21, Twp. 52N., R 18W ✓  
 SE $\frac{1}{4}$  of SW $\frac{1}{4}$  Sec. 21, Twp. 52N., R 18W ✓  
 SW $\frac{1}{4}$  of SE $\frac{1}{4}$  Sec. 21, Twp. 52N., R 18W ✓  
 S $\frac{1}{2}$  of SW $\frac{1}{4}$  Sec. 22, Twp. 52N., R 18W ✓  
 NE $\frac{1}{4}$  of NE $\frac{1}{4}$  Sec. 27, Twp. 52N., R 18W ✓  
 N $\frac{1}{2}$  of NE $\frac{1}{4}$  Sec. 28, Twp. 52N., R 18W ✓  
 N $\frac{1}{2}$  of NE $\frac{1}{4}$  Sec. 29, Twp. 52N., R 18W ✓  
 NE $\frac{1}{4}$  of NE $\frac{1}{4}$  Sec. 30, Twp. 52N., R 18W ✓  
 SW $\frac{1}{4}$  of SW $\frac{1}{4}$  Sec. 13, Twp. 52N., R 19W ✓  
 SW $\frac{1}{4}$  of NW $\frac{1}{4}$  Sec. 14, Twp. 52N., R 19W ✓  
 N $\frac{1}{2}$  of SW $\frac{1}{4}$  Sec. 14, Twp. 52N., R 19W ✓  
 W $\frac{1}{2}$  of SE $\frac{1}{4}$  Sec. 14, Twp. 52N., R 19W ✓  
 SE $\frac{1}{4}$  of SE $\frac{1}{4}$  Sec. 14, Twp. 52N., R 19W ✓  
 NE $\frac{1}{4}$  of NW $\frac{1}{4}$  Sec. 15, Twp. 52N., R 19W ✓  
 W $\frac{1}{2}$  of NE $\frac{1}{4}$  Sec. 15, Twp. 52N., R 19W ✓  
 SE $\frac{1}{4}$  of NE $\frac{1}{4}$  Sec. 15, Twp. 52N., R 19W ✓  
 N $\frac{1}{2}$  of NW $\frac{1}{4}$  Sec. 24, Twp. 52N., R 19W ✓  
 NW $\frac{1}{4}$  of NE $\frac{1}{4}$  Sec. 24, Twp. 52N., R 19W ✓  
 SE $\frac{1}{4}$  of NE $\frac{1}{4}$  Sec. 24, Twp. 52N., R 19W ✓  
 N $\frac{1}{2}$  of NE $\frac{1}{4}$  Sec. 27, Twp. 52N., R 19W ✓

Spring Creek where it crosses the following described lands: *Unit No. F-540*  
 S $\frac{1}{2}$  of NW $\frac{1}{4}$  Sec. 1, Twp. 54N., R 12W ✓

Stoney Brook where it crosses the following described lands: *Unit No. F-54*  
 E $\frac{1}{2}$  of NW $\frac{1}{4}$  Sec. 7, Twp. 61N., R 21W ✓  
 NE $\frac{1}{4}$  of SW $\frac{1}{4}$  Sec. 7, Twp. 61N., R 21W ✓  
 Govt. Lot 3 Sec. 7, Twp. 61N., R 21W ✓

West Knife River where it crosses the following described lands: *Unit No. F-540*  
 NE $\frac{1}{4}$  of SE $\frac{1}{4}$  Sec. 22, Twp. 53N., R 12W ✓  
 NE $\frac{1}{4}$  of SE $\frac{1}{4}$  Sec. 35, Twp. 53N., R 12W ✓

West Two River where it crosses the following described lands: *Unit No. F-540*  
 That part of NE $\frac{1}{4}$  of SW $\frac{1}{4}$  lying  
 North of West Two River Sec. 8, Twp. 61N., R 15W ✓

PROVIDED, that the grantee's easement shall include the bed of the stream and a strip of land no wider than will be enclosed between the top edge of the stream bank and a line parallel thereto and sixty (60) feet distance therefrom on either side; and

Except that employees of the State shall be permitted to approach the stream at any point over the property described below, compatible with current use, established routes to be used whenever feasible;

TO HAVE AND TO HOLD THE SAME, together with all the hereditaments and appurtenances thereto belonging, or in anywise appertaining, to the said party of the second part,

IN TESTIMONY WHEREOF, the State of Minnesota, party of the first part, has caused this deed to be executed in its name in the City of St. Paul, County of Ramsey, and State of Minnesota, the day and year first above written.

In Presence of:

*Patricia Zentzis*

KATHERINE J. ZIMMERMAN

STATE OF MINNESOTA  
ARTHUR C. ROEMER  
Commissioner of Taxation

*Arthur C. Roemer*

STATE OF MINNESOTA )  
                                  )ss.  
County of Ramsey )

On this 7th day of April, 1972, before me personally appeared ARTHUR C. ROEMER, Commissioner of Taxation of the State of Minnesota, to me known to be the person who executed the foregoing conveyance in behalf of the State of Minnesota and acknowledged that he executed the same as the free act and deed of said state pursuant to the statutes in such case made and provided.

THIS INSTRUMENT WAS DRAFTED BY  
ARTHUR C. ROEMER  
COMMISSIONER OF TAXATION  
ST. PAUL, MINNESOTA 55101

PATRICIA ZENTZIS  
Notary Public, Ramsey County, Minn.  
My Commission Expires May 9, 1975

E-37

Public Access  
Imp. of Tour Habitat

E-37

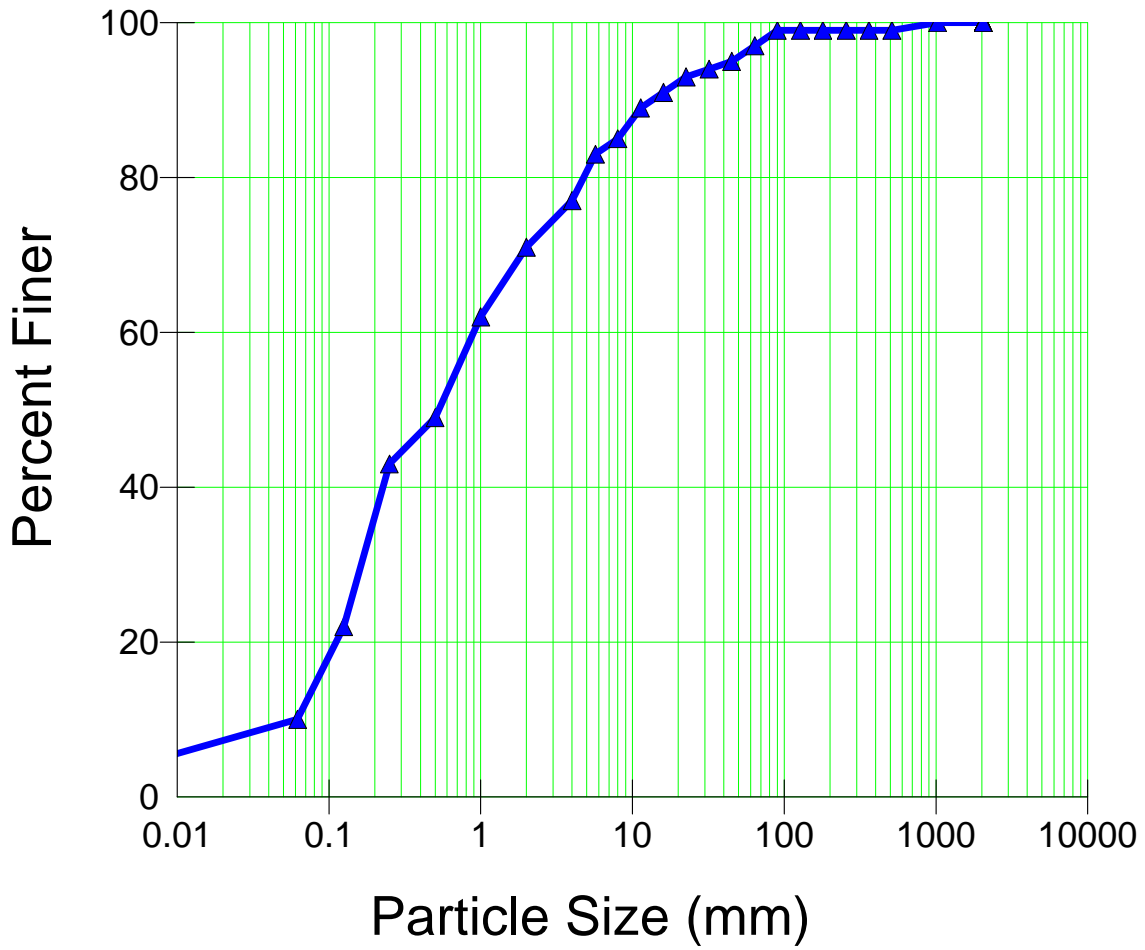
St. Louis County



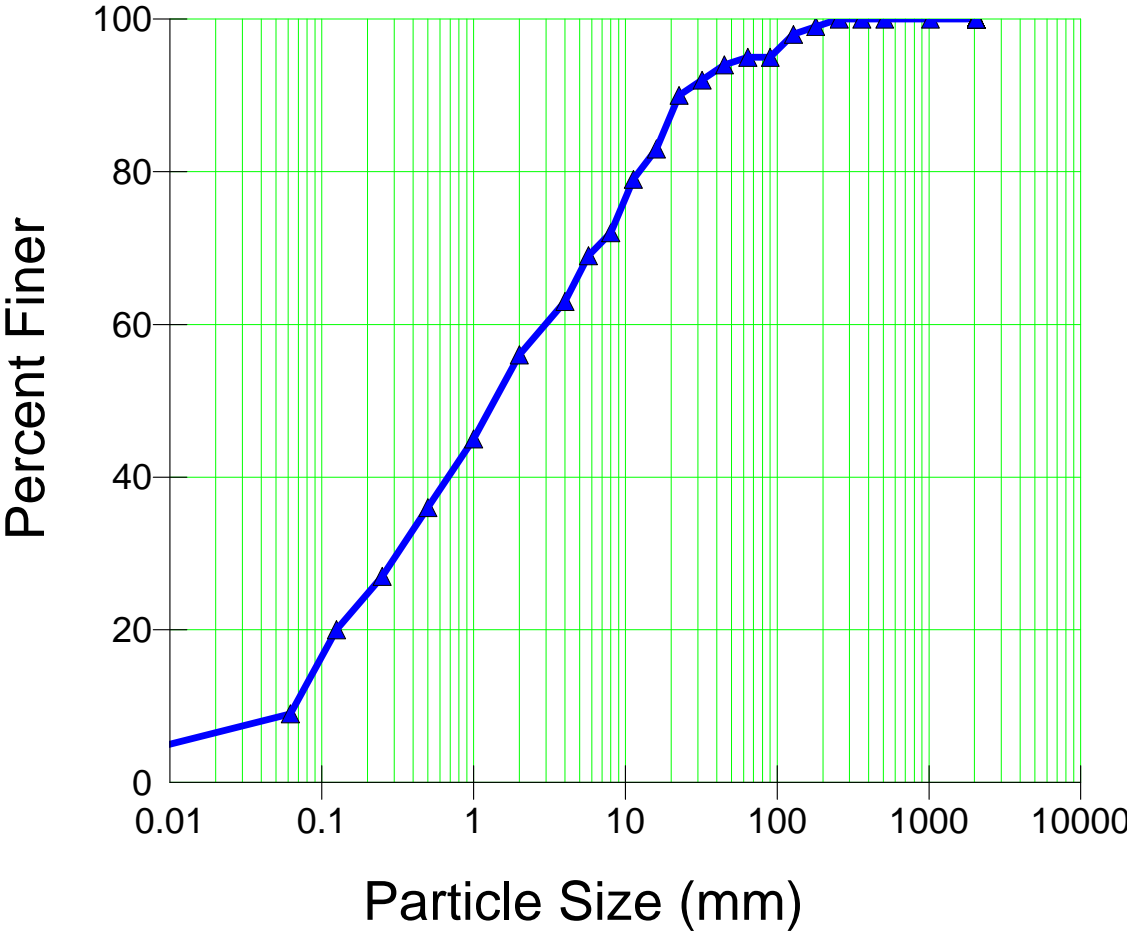
## Appendix E

### Particle Distributions

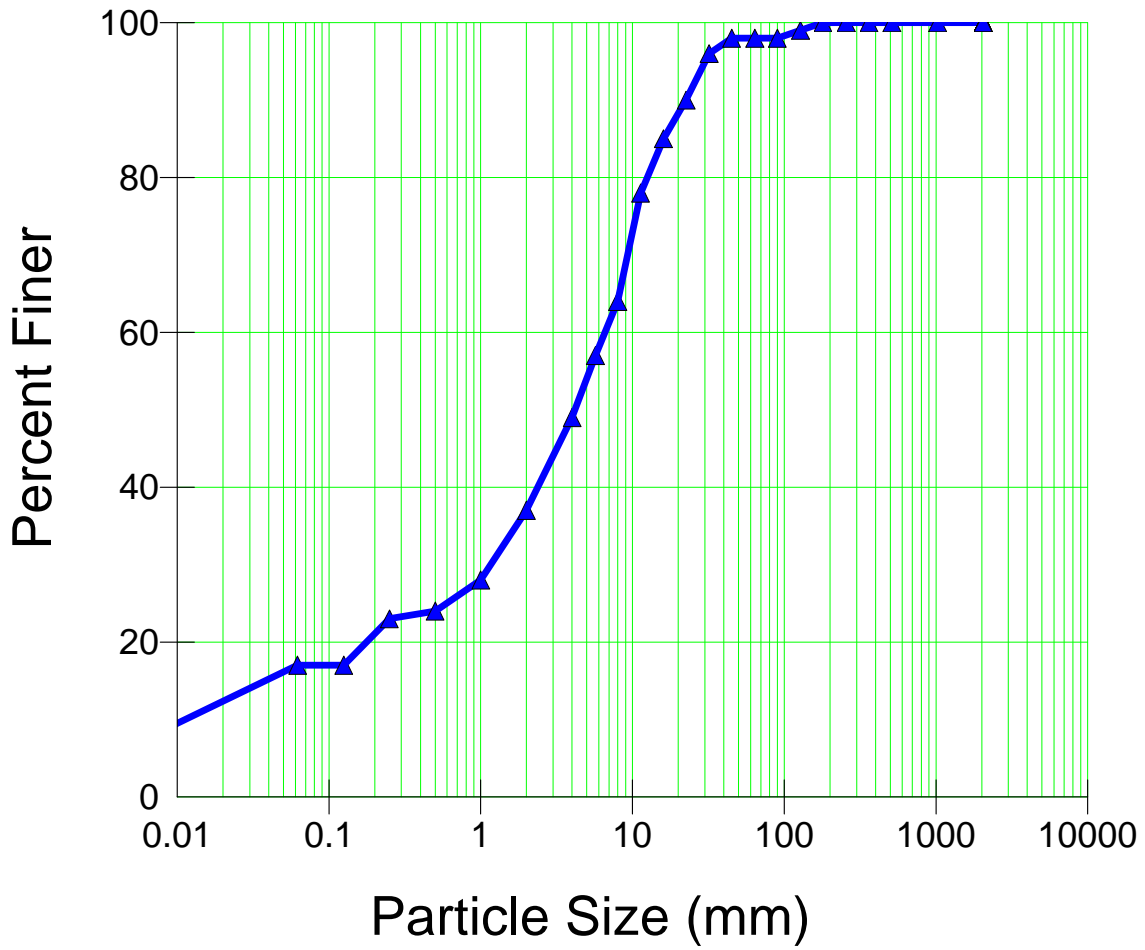
# Channelized Reach Representative Particle Distribution



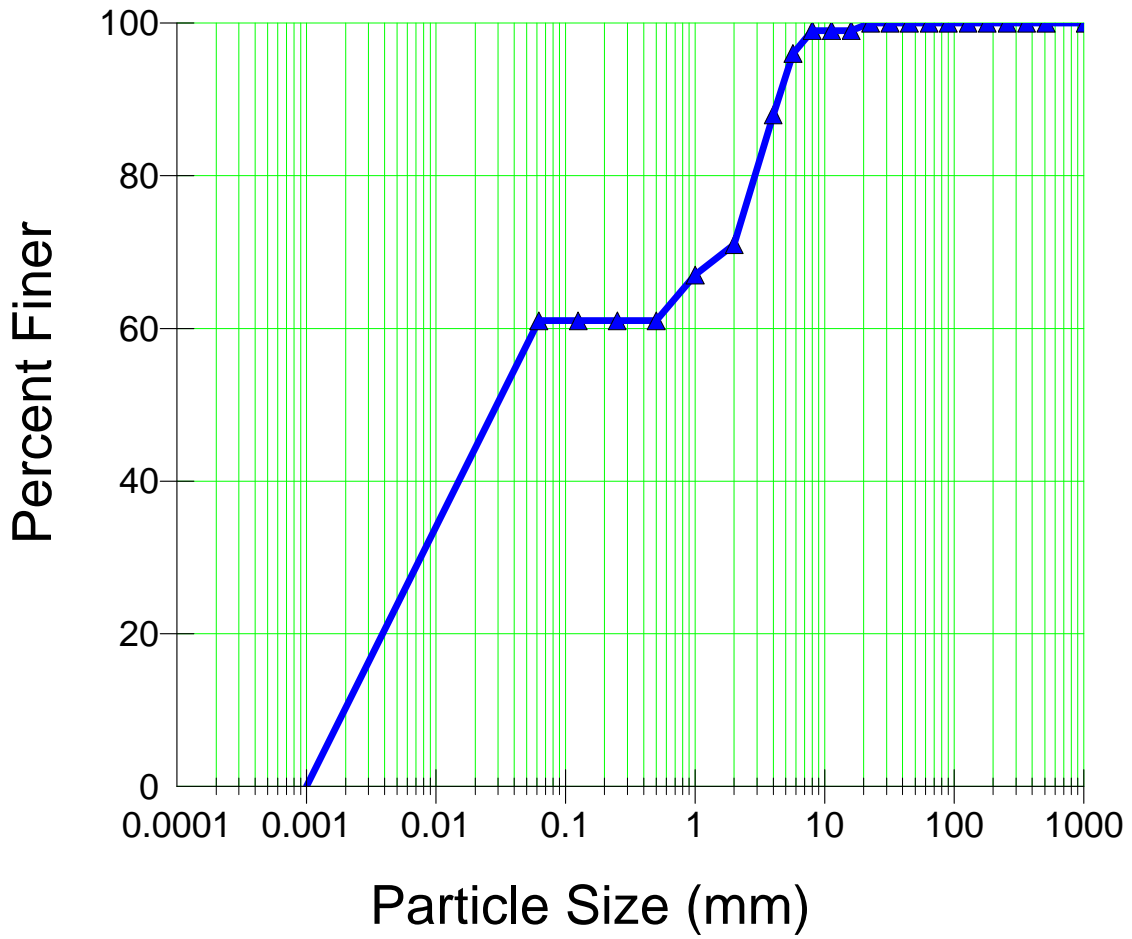
# Channelized Reach Active Bed Riffle Particle Distribution



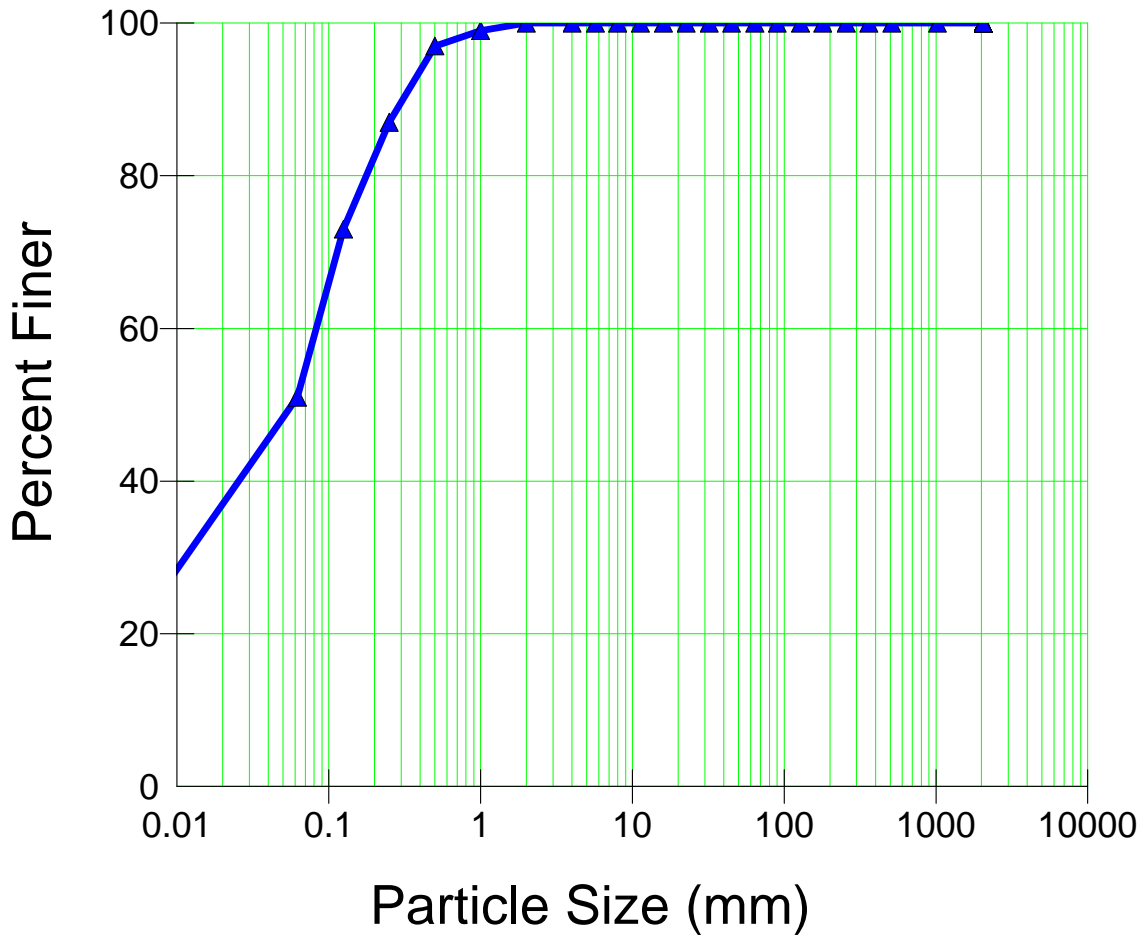
# Reference Reach #1 Representative Particle Distribution



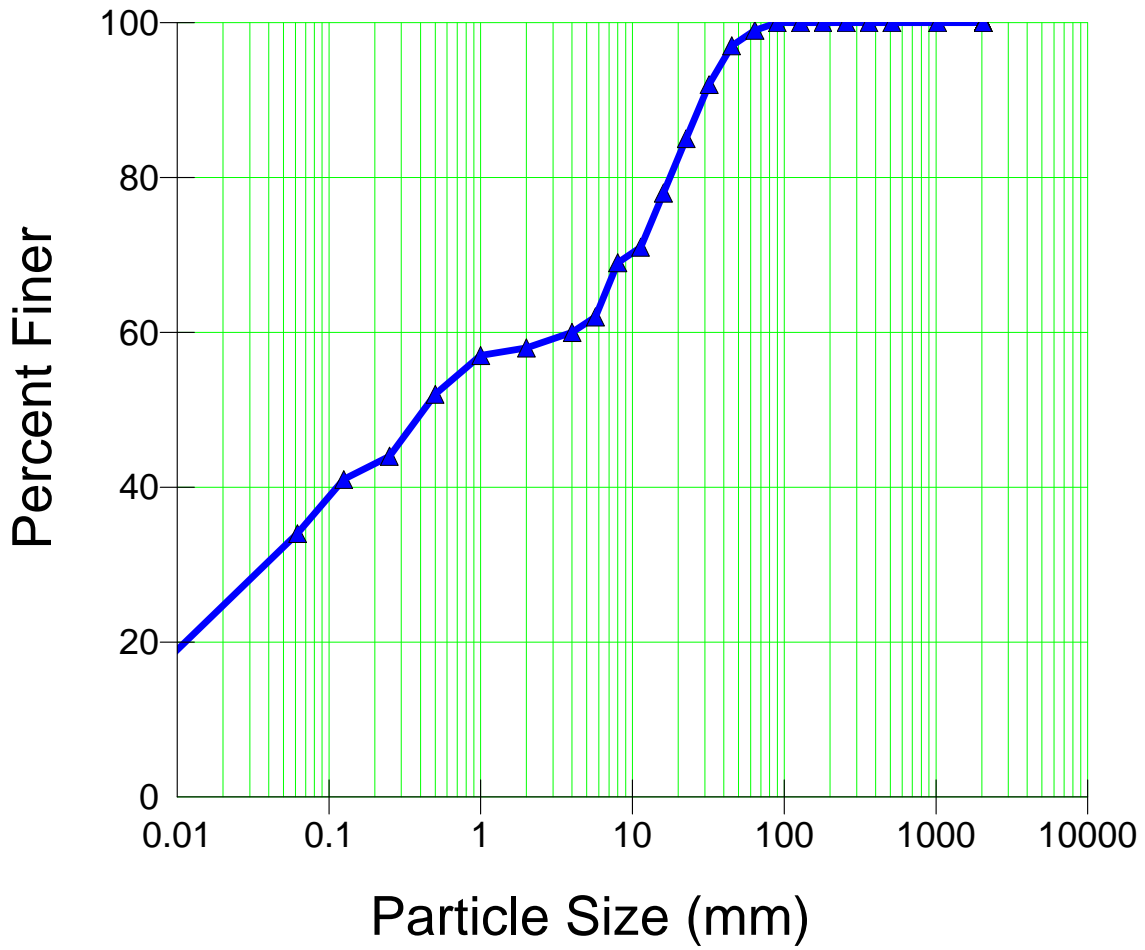
# Reference Reach #1 Active Bed Riffle Particle Distribution



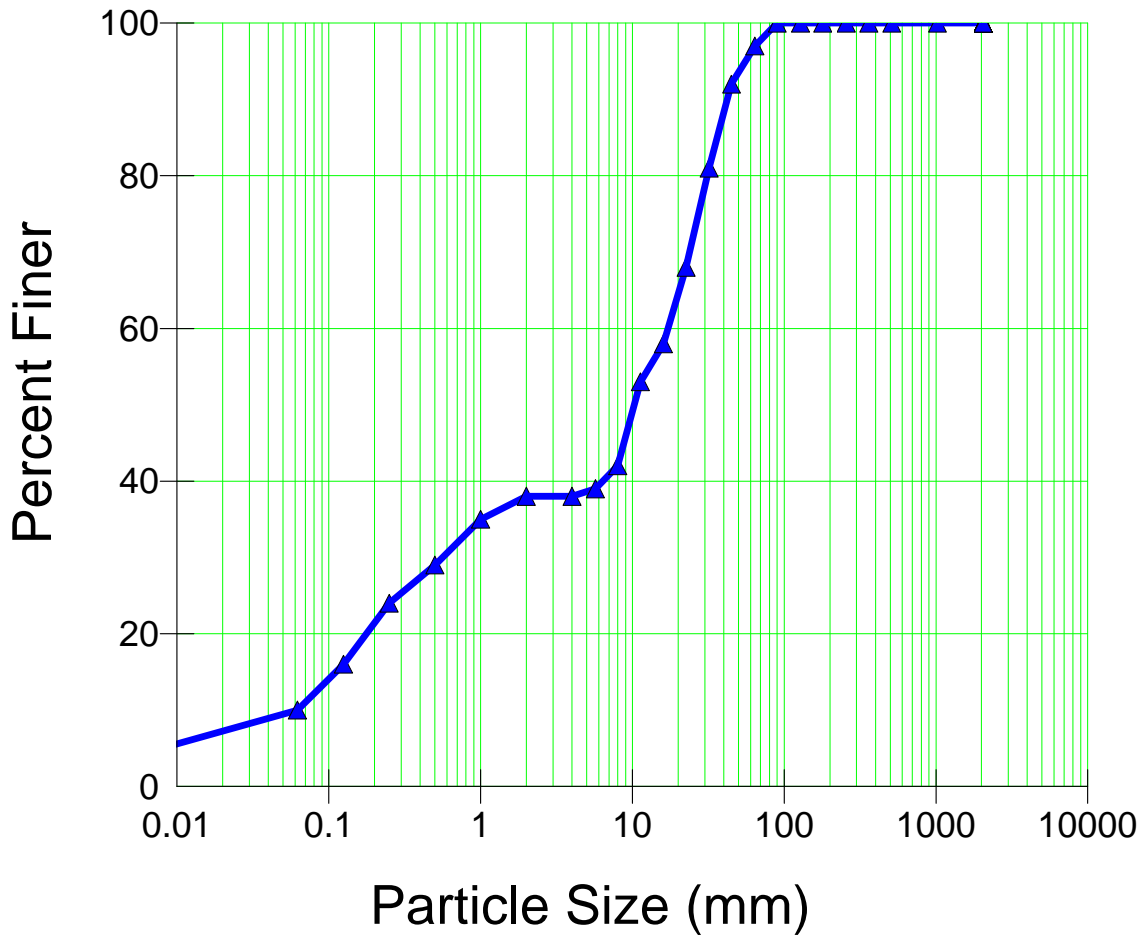
# Reference Reach #1 Point Bar Particle Distribution



# Reference Reach #2 Representative Particle Distribution



# Reference Reach #2 Active Bed Riffle Particle Distribution







# Saint Louis County

Land and Minerals Dept. • [www.stlouiscountymn.gov](http://www.stlouiscountymn.gov) • [landdept@stlouiscountymn.gov](mailto:landdept@stlouiscountymn.gov)

**Mark Weber**  
Land Commissioner

July 29, 2016

Mr. Will Seuffert, Executive Director  
Minnesota Environmental Quality Board  
520 Lafayette Road North  
St. Paul, MN 55155

RECEIVED  
AUG 01 2016

BY:.....

Dear Mr. Seuffert:

St. Louis County requests that the Minnesota Environmental Quality Board (EQB) designate the Department of Natural Resources (DNR) as the responsible Government Unit (RGU) for the upcoming Environmental Assessment Worksheet (EAW) for the stream mitigation project proposed by United States Steel Corporation.

The proposal is to restore the historic pattern, profile and dimension to approximately 3,697 feet of Spider Creek. The restoration will improve hydrologic connectivity between the stream and the floodplain and provide increased floodplain storage. The project falls under MN Rule Chapter 4410.4300, Subpart 26, Stream Diversion. DNR review for impacts upon affected watersheds will be performed using the following expertise:

- Hydrology effect to public water
- Ecological function of aquatic habitat
- Ecological effects to the flora and fauna
- Experience with preparation of joint state/federal Environmental Review Documents with the U.S. Army Corps of Engineers

St. Louis County believes the interest of the public will be better served with the DNR conducting the review of this project. The project will require a DNR Public Water Work Permit and will not require permitting by St. Louis County.

Please contact me at 218-726-2606 or e-mail: [weberm@stlouiscountymn.gov](mailto:weberm@stlouiscountymn.gov) with any questions you may have.

Sincerely,

Mark Weber  
Land Commissioner

Land Commissioner's Office  
320 West 2<sup>nd</sup> Street, GSC 302  
Duluth, MN 55802  
(218) 726-2606  
Fax: (218) 726-2600

Pike Lake Area Office  
5713 Old Miller Trunk Hwy  
Duluth, MN 55811  
(218) 625-3700  
Fax: (218) 625-3733

Virginia Area Office  
7820 Highway 135  
Virginia, MN 55792  
(218) 742-9898  
Fax: (218) 742-9870

cc. Thomas A. Moe, Environmental Control Engineer, U.S. Steel Minntac  
Kate J. Frantz, Planning Director, MN DNR Environmental Review Unit  
Jason Meyer, Deputy Land Commissioner  
Mark Pannkuk, Area Manager



August 17, 2016

Will Seuffert  
Executive Director  
Environmental Quality Board  
520 Lafayette Road North,  
Saint Paul, MN 55155

**RE: United States Steel Corporation Spider Creek Restoration Project**

Dear Mr. Seuffert:

Pursuant to *Minnesota Rules*, part 4410.0500, subpart 1, each of the mandatory categories in *Minnesota Rules*, part 4410.4300, specify the responsible governmental unit (RGU) for completing an Environmental Assessment Worksheet (EAW). *Minnesota Rules*, part 4410.4300, subpart 26, dealing with the diversion, realignment or channelization of any trout stream, or affecting greater than 500 feet of natural watercourse with a total drainage area of 10 or more square miles, the local governmental unit is designated as RGU. Saint Louis County is the RGU for preparation and review of state environmental documents for the restoration of Spider Creek, a project proposed by United States Steel Corporation (U.S. Steel).

According to Saint Louis County's July 29, 2016 letter, the project proposal is to restore the historic pattern, profile, and dimension to approximately 3,697 feet of Spider Creek. The restoration would improve the hydrologic connectivity between the stream and the floodplain, and provide increased floodplain storage. In Saint Louis County's letter, the RGU states that, "[t]he project falls under *Minnesota Rules* Chapter 4410.4300, Subpart 26, Stream Diversion," inferring that an EAW is required.

Saint Louis County has requested that its RGU status be reassigned to the Minnesota Department of Natural Resources (MNDNR). The MNDNR has been in communication with Saint Louis County and U.S. Steel on the proposed RGU reassignment. Saint Louis County has stated that MNDNR's expertise in work in public waters and ecological function and effects of aquatic ecosystems would assist in assessment of the project. The MNDNR is willing to serve as RGU for the U.S. Steel proposed Spider Creek Restoration Project. Please feel free to contact me with any further questions or comments.

Sincerely,

Kate Fairman  
Environmental Review Planning Director

CC (via email): Mark Weber, Land Commissioner, Saint Louis County  
Tomas A. Moe, Environmental Control Engineer, U.S. Steel Minntac  
Jason Meyer, Deputy Land Commissioner, Saint Louis County





# STATE OF MINNESOTA

## EXECUTIVE DEPARTMENT



**MARK DAYTON**  
**GOVERNOR**

**Executive Order 16-07**

### **Directing Steps to Reverse Pollinator Decline and Restore Pollinator Health in Minnesota**

**I, Mark Dayton, Governor of the State of Minnesota**, by virtue of the authority vested in me by the Constitution and applicable statutes, do hereby issue this Executive Order:

**Whereas**, Minnesota farmers provide food, feed, fuel, and fiber for the nation and the world, and agriculture is a cornerstone of Minnesota's economy;

**Whereas**, Minnesota's agricultural economy provides over 340,000 jobs and \$90 billion in economic activity;

**Whereas**, pollinators are essential to the reproduction of many native plants and cultivated food crops;

**Whereas**, pollinators sustain habitat that support wildlife and provide aesthetic and ecological benefits such as carbon storage and improved water quality;

**Whereas**, more than 200,000 pollinator species including insects, birds, bats, and other animals exist worldwide; including insect pollinators such as bees, wasps, flies, butterflies, moths, and beetles that are critical to our food production system;

**Whereas**, bees are considered to be the most efficient and important pollinators for our food crops; the estimated annual value of honey bee pollination alone for food production is \$17 billion dollars while that of native pollinators is estimated at \$6 billion;

**Whereas**, over the past decade there has been a significant loss of pollinators including honey bees, native bees, butterflies, moths, birds and bats;



**Whereas**, bees and other pollinator populations have been in decline in Minnesota and across the country due to a variety of pressures including habitat loss, pesticides, diseases, and parasites;

**Whereas**, the Special Registration Review conducted by the Minnesota Department of Agriculture found sufficient scientific evidence that neonicotinoid pesticides present toxicity concerns for honey bees, native bees, as well as other pollinating insects; and

**Whereas**, pollinator decline is serious and requires immediate attention to ensure the sustainability of our food production systems, avoid economic impact on our farmers and rural communities, and to protect the health of the environment in Minnesota.

**Now, Therefore**, I hereby order that:

1. The Minnesota Department of Agriculture (MDA) shall take immediate action to implement the recommendations in the Department's Special Registration Review of Neonicotinoid Pesticides, including:
  - a. Requiring a "verification of need" prior to the use of neonicotinoid pesticides, where appropriate;
  - b. Review pesticide product labels and implement restrictions, as appropriate, to minimize impact on pollinator communities;
  - c. Increase inspections and enforcement of label requirements for pesticides that are acutely toxic to pollinators;
  - d. Develop pollinator stewardship materials for pesticides to minimize non-target exposures; and
  - e. Continue to develop and promote best management practices designed to protect and enhance pollinator health in Minnesota.
2. The Environmental Quality Board (EQB) shall convene agency leadership and Minnesotans to implement this Executive Order; including the following steps:
  - a. The EQB shall establish an Interagency Pollinator Protection Team to provide operational support, ensure interagency coordination, develop cross agency policies and programs, and report regularly on progress;
  - b. The Interagency Pollinator Protection Team shall consist of designees of the Departments of Administration, Agriculture, Corrections, Education, Health, Natural Resources, Transportation, Board of Water and Soil Resources, the Minnesota Pollution Control Agency, and the Minnesota Zoo;

- c. The Interagency Pollinator Protection Team shall develop statewide pollinator goals and metrics and report on the progress toward those goals in a report to the EQB by December 1 of each year. The report shall include recommendations for pollinator policy, research needs, and budget recommendations; and
    - d. Member agencies of the EQB will contribute available staff resources as requested by the EQB Chair for purposes of carrying out the work directed by this Executive Order.
- 3. The Governor's Committee on Pollinator Protection is created to advise the Governor, the Environmental Quality Board, the Interagency Pollinator Protection team, and participating agencies on pollinator policy and programs.
  - a. The committee shall consist of up to 15 members appointed by the Governor with relevant experience in agriculture, conservation, education, academia, or local government.
  - b. The committee will do the following:
    - i. Promote statewide collaboration on pollinator protection efforts;
    - ii. Raise public awareness of pollinator issues;
    - iii. Review and comment on agency pollinator programs, reports, and recommendations; and
    - iv. Identify and support opportunities for local and public-private partnerships.
- 4. The Commissioner of the Department of Natural Resources (DNR) shall develop an integrated pest management strategy to minimize pesticide use on public lands administered by the Department of Natural Resources; and shall develop a strategy to maximize restoration, creation, and management of habitat for pollinators on DNR administered land consistent with the DNR's ecological, economic, and recreational mission and mandates.
- 5. The Board of Water and Soil Resources (BWSR) shall direct work to restore and improve high quality pollinator habitat by:
  - a. Incorporating pollinator habitat into BWSR programs, including wetland protection and restoration, conservation easements, agricultural conservation practices, and urban water quality projects;
  - b. Creating and updating program policies and technical resources to enhance opportunities for pollinator habitat restoration;
  - c. Coordinate with other agencies, conservation partners, and researchers to use best available science; and
  - d. Guiding program and project improvements by measuring outcomes, evaluating restoration projects, and documenting successful restoration strategies.

6. The Commissioner of the Department of Transportation (MnDOT) shall manage state-owned transportation properties and rights of way to create, protect, and enhance pollinator habitat.
7. The Commissioner of the Minnesota Pollution Control Agency (MPCA) shall manage closed landfills under its supervision to create, protect, and enhance pollinator habitat.
8. The Commissioner of Administration shall take immediate measures to support pollinator health on the State Capitol Complex, other state buildings, and where applicable on leased property, including:
  - a. The purchase of neonicotinoid plants and pesticide products are prohibited for use on the Capitol Complex, unless no other suitable product is available;
  - b. Pollinator friendly plants shall be included in the Capitol Landscaping Design Plan, as part of the Capitol Preservation, where practical;
  - c. The State's Design Guidelines and the Minnesota Sustainable Building Guidelines shall be modified to incorporate that products must be neonicotinoid free on all state funded projects, where practical;
  - d. The Department of Administration will work with leased properties where the State is the sole (or majority) lessee to incorporate nonuse of neonicotinoid applied plants and neonicotinoid pesticide products at leased buildings; and
  - e. To the extent available and verifiable, state contracts must accommodate the purchasing of neonicotinoid free plants and pesticides.

This Executive Order is effective fifteen days after publication in the State Register and filing with the Secretary of State, and shall remain in effect until rescinded by proper authority or until it expires in accordance with Minnesota Statute, section 4.035, subdivision 3.

In Testimony Whereof, I have set my hand on this 25<sup>th</sup> day of August, 2016.



**Mark Dayton**  
Governor

Filed According to Law:



**Steve Simon**  
Secretary of State





# Review of Neonicotinoid Use, Registration, and Insect Pollinator Impacts in Minnesota

---

August 2016





# Review of Neonicotinoid Use, Registration, and Insect Pollinator Impacts in Minnesota

August 2016

Minnesota Department of Agriculture  
Pesticide and Fertilizer Management Division  
625 Robert Street North  
Saint Paul, Minnesota 55155-2538

Dave Frederickson, Commissioner  
Matthew Wohlman, Assistant commissioner

## **Report collaborators:**

Dan Stoddard, Minnesota Department of Agriculture  
Gregg Regimbal, Minnesota Department of Agriculture  
Jamison Scholer, Minnesota Department of Agriculture  
Joseph Zachmann, Minnesota Department of Agriculture  
Loretta Ortiz-Ribbing, Minnesota Department of Agriculture  
Rajinder Mann, Minnesota Department of Agriculture

## **Acknowledgments:**

Carmen Converse, Minnesota Department of Natural Resources  
Carmelita Nelson, Minnesota Department of Natural Resources  
Robert Dana, Minnesota Department of Natural Resources  
Dan Shaw, Minnesota Board of Water and Soil Resources  
Phil Monson, Minnesota Pollution Control Agency  
Judy Wu, University of Minnesota  
Robert Koch, University of Minnesota  
Gurinderbir Chahal, Minnesota Department of Agriculture

## **Please direct inquiries on this report to:**

Raj Mann, Research Scientist  
Minnesota Department of Agriculture  
651.201.6208  
[rajinder.mann@state.mn.us](mailto:rajinder.mann@state.mn.us)

Additional information available at:

<https://www.mda.state.mn.us/chemicals/pesticides/regs/pestprodreg.aspx>  
<http://www.mda.state.mn.us/en/protecting/bmps/pollinators.aspx>



## Executive summary

Neonicotinoid insecticides are currently one of the most widely used insecticides in the world because of their properties including potent broad-spectrum toxicity possessing contact, oral, and systemic activity. They are effective at very low concentrations, are less toxic to mammals, and are not cross-resistant to other classes of insecticides including carbamates, organophosphates, and synthetic pyrethroids. However, recent research has suggested potential toxicity concerns for neonicotinoids to various life stages of honey bees, native bees, as well as other pollinating insects. Pollinators are essential in the reproduction of 90% of the world's flowering plants and 30% of the food humans consume. Many plants such as alfalfa, apple, blueberry, sunflower and canola, cannot reproduce without the help from insect pollinators. The pollination services offered by insect pollinators also play a crucial role in the maintenance of biodiversity and ecological balances in natural ecosystems by providing important food and habitat for other wildlife species. Managed honey bees (*Apis mellifera*) alone pollinate more than \$17 billion worth of crops in the U.S. each year and are regarded as the most important managed pollinator. Over the last 50 years, honey bees have been faced with a number of stressors that impact their health and survivorship including a number of pests and diseases, fewer flowering plants available to meet their nutritional needs, and a wide variety of pesticides that can be toxic.

Pesticides have long been suspected as a potential cause of contemporary honey bee declines. Honey bees are exposed to pesticides and other chemicals commonly used in agriculture and landscapes via numerous pathways including direct exposure, exposure through the pollen and nectar of plants treated with contact or systemic pesticides and pesticides used by beekeepers themselves. Although many insecticides have been shown to affect honey bees, the attention has focused on neonicotinoid insecticides in recent years. The concern over the use of neonicotinoid insecticides in relation to insect pollinators led the Minnesota State Legislature to request that the Minnesota Department of Agriculture (MDA) report on the process and criteria to be used in a review of neonicotinoid use in Minnesota currently and in the future. Consequently, the Commissioner of Agriculture directed MDA staff, on November 5, 2013, to initiate a special review of neonicotinoid insecticides.

The MDA is the lead state agency for pesticide and fertilizer environmental and regulatory functions in Minnesota under the Pesticide Control Law (Minn. Stat. Chapter 18B). In addition to functions related to pesticide registration and monitoring, the MDA carries out in-depth reviews of pesticides to better understand Minnesota-specific issues related to pesticides. The scope of these special registration reviews varies depending on the potential education, outreach, and enforcement needs identified by the Department. As such, these reviews are not intended to be redundant of analyses and decisions reached by the United States Environmental Protection Agency (USEPA). Rather, these reviews result in a greater understanding of federal registration concerns and provide a variety of Minnesota specific opportunities for action.

In order to conduct the current review, the MDA followed a pre-established process to develop the criteria MDA would use to conduct a variety of in-depth pesticide reviews. The MDA has also previously reviewed several neonicotinoids of concern as part of its emerald ash borer insecticide review (including



concerns about pollinator exposure). Following the pre-established process, the MDA developed a scoping document after soliciting input from the public and a number of interested stakeholders, including beekeepers, academics, citizens, farmers and their suppliers, and pesticide registrants. In addition, the MDA collaborated with the Minnesota Board of Water and Soil Resources (BWSR), the Minnesota Department of Natural Resources (DNR), the Minnesota Pollution Control Agency (MPCA), and the University of Minnesota (U of M). Based on the scoping document, the review was categorized into six broad criteria including:

- Neonicotinoid background, chemistry, and mode of action;
- Federal, state, and other neonicotinoid registration policies and initiatives;
- Neonicotinoid use and sales;
- Neonicotinoid applications and movement in the environment;
- Risks of neonicotinoid use; and
- Benefits of neonicotinoid use.

Each criterion was explored in relation to Minnesota-specific concerns and opportunities for action.

#### **Neonicotinoid background, chemistry, and mode of action:**

Neonicotinoids are used on nearly 140 agricultural crops and in many other uses including garden, turf, residential, and animal use. In the United States, six neonicotinoid insecticides: acetamiprid, clothianidin, dinotefuran, imidacloprid, thiacloprid, and thiamethoxam with potential pollinator impacts were registered for controlling agricultural and urban insect pests. Thiacloprid registration has been cancelled voluntarily by the registrants and will no longer be available after 2016. Neonicotinoids are systemic insecticides with a structure and mode of action similar to nicotine, a naturally occurring plant alkaloid compound toxic to humans. Contact and oral exposures of neonicotinoids target the acetylcholine receptors (nAChR) on the insect nerve cells within an insect nervous system. However, neonicotinoids vary from nicotine in their affinity to different nAChR subtypes, with nicotine showing selective toxicity to vertebrates whereas neonicotinoids are highly selective to insect nAChRs. Their action causes excitation of the insect nerves that lead to trembling, shaking and eventual paralysis, which can lead to death depending on the dose and exposure duration. Neonicotinoids bind at a receptor site specific to insect nerve cells, therefore, they are less toxic to mammals. All neonicotinoid insecticides show similar broad spectrum insecticidal activity but vary in their biological and physicochemical properties such as photolytic stability, soil degradation, metabolism in plants and insects, and toxicity to different animals.

#### **Federal, state, and other neonicotinoid registration policies and initiatives**

Both federal and state laws govern the registration and use of neonicotinoid insecticides in Minnesota. The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) of 1972, amended by the Food Quality Protection Act of 1996, and the Pesticide Registration Improvement Act of 2003, requires all pesticides sold or distributed in the United States (including imported pesticides) to be registered by USEPA. The USEPA registers a pesticide after determining that the pesticide meets the statutory standard and there



are no outstanding data requirements. The law requires USEPA to review each pesticide registration at least once every 15 years. Registration reviews for the six neonicotinoid insecticides were initiated between 2008 and 2012 and are expected to be completed between 2016 and 2019. The USEPA released the preliminary imidacloprid, pollinator specific review for agricultural and horticultural crops in January 2016. Work plans for neonicotinoids identified numerous ecological information gaps on toxicity and exposure to honey bee life stages and/or full colonies on acute or chronic exposure basis.

Historically, the USEPA's testing paradigm for pollinators relied on qualitative evaluations rather than precise quantitative measurements. The process relied primarily on developing an understanding of the types of effects that might be caused by the pesticide (hazard characterization), based on toxicity studies using honey bees as surrogate species. In 2012, the USEPA in collaboration with Health Canada's Pest Management Regulatory Agency (PMRA) and the California Department of Pesticide Regulation (CalDPR) developed a new risk assessment framework for bees. The new framework takes into account multiple lines of evidence including registrant-submitted data, open literature, and ecological incident data. The USEPA has acknowledged some uncertainties with initial registration of neonicotinoid insecticides regarding their potential environmental fate and effects, particularly as they relate to pollinators. Considering these uncertainties, the USEPA amended label language to clarify the risk some of the neonicotinoid products may have to non-target insect pollinators. One of the major changes USEPA made to neonicotinoid insecticide products approved for outdoor foliar uses, is the addition of a "Protection of Pollinators" box. This box visually alerts the user of application restrictions when bees are present by displaying a bee icon, near important information, and accenting key phrases in red "Application Restrictions" and "This product can kill bees and other insect pollinators." The "Protection of Pollinators" box further describes how foliar applications of these insecticides can result in pollinator exposure, and provides steps an applicator can take to reduce non-target impacts. However, there remains criticism of the ability of these label amendments to reduce impacts on pollinators. In addition, some states and communities around the United States have decided to minimize any potential impacts of neonicotinoids on insect pollinators through ordinances or commitments to minimize their use on city, township, or university/school district property. In Minnesota, 16 cities, townships, or school districts including Minneapolis and Saint Paul currently have some ordinance limiting the use of neonicotinoid insecticides on the land they own.

Canada's province of Ontario implemented new laws beginning July 1, 2015 that aim to reduce prophylactic use of neonicotinoid treated corn and soybean seed, through requiring farmers to demonstrate that a pest problem exists before allowing the sale of treated seed. The goal is to reduce the number of acres planted with neonicotinoid treated corn and soybean seed by 80% by 2017. The plan requires farmers to ensure that neonicotinoid-treated corn and soybean seeds are used only when there is a demonstrated pest problem. In addition, Canada added a new seed packaging label with updated advisories and is requiring farmers to use Bayer's new seed lubricant call Fluency Agent that may reduce the amount of active ingredient abraded from seeds. Claims of abrasion reductions has been variable in the US and Canada ranging from 0, 55, and 65%. The European Union member countries have been restricting neonicotinoid use on certain crops since 1999. More recently, the EU as a whole, enacted a moratorium (December 1, 2013 – December 1, 2015) applying to imidacloprid,



clothianidin, and thiamethoxam seed, soil and foliar treatments to bee-attractive crops and cereal grains. Updated risk evaluations are proposed to be completed by January 2017. At present, and despite high use of neonicotinoids on the Australian continent, honey bee populations are generally not considered to be in decline and insecticide impacts to pollinators are not considered a highly significant issue.

#### **Neonicotinoid use and sales:**

In the global insecticide market, neonicotinoids accounted for 24% of total insecticide use in 2008. The seed treatment market, initially dominated by insecticides from the carbamate family, was 80% comprised of neonicotinoid insecticides by 2008. Neonicotinoid insecticides, used primarily as seed treatments, accounted for more than 98% of the annual average 133 million acres of corn, soybean, wheat, cotton, and sorghum acres farmers treated in North America.

In Minnesota, there were 510 registered neonicotinoid products in 2015 to control soil (wireworms, seedcorn maggot, corn rootworm, white grubs, etc.) and foliar insect pests (corn earworm, flea beetles, aphids, armyworms, plant bugs, leaf hoppers, grasshoppers, etc.). With the introduction of soybean aphid in 2004, use of neonicotinoids has increased significantly in soybean in Minnesota through seed treatments or foliar applications. In addition to crop protection, applications of neonicotinoid insecticides in non-agricultural fields such as urban household, lawn and garden and animal health have also expanded in recent years. Total sale of neonicotinoid products in Minnesota from 2010 to 2013 was 381.30 thousand pounds. The bulk (>99%) of neonicotinoid products sold from 2010 to 2013 in Minnesota comprised of clothianidin, thiamethoxam, and imidacloprid. In comparison to all pesticides (pounds sold of all chemistries including nonagricultural pesticide products), neonicotinoids accounted for 0.05, 0.12, 0.06, and 0.09% of all pesticide products sold in Minnesota in 2010, 2011, 2012, and 2013, respectively. Because, the State does not have the authority to regulate the sale and use of pesticide treated seeds, almost all corn seed and about 20% of soybean seed treated outside of Minnesota's borders and shipped into the state for planting is not tracked by the MDA. Gross sales and revenues from neonicotinoids and all pesticides in Minnesota showed wide variation from 2010 to 2013 and may not be related to pounds sold each year because price of the same pesticide can vary from year to year and also from seller to seller (manufacturers/retailer). The MDA collected \$332,480 from registration of neonicotinoid products (pesticide fee+ AACRA fee + registration fee), which was 3.7% of total revenue for all pesticide registration in 2013.

#### **Neonicotinoid applications and movement in the environment:**

Neonicotinoid insecticides are widely used for seed treatment on various crops. Studies of the uptake for each neonicotinoid seed dressing chemistry into a target crop suggest that between 1.6 and 20% of the active ingredient is absorbed by the plant, depending on the chemistry, while the remainder enters the soil. As with any other pesticide, the behavior of neonicotinoids in soils, and hence their bioavailability and transfer to other environmental compartments (i.e. atmosphere, water bodies, etc.), is governed by a variety of complex dynamic physical, chemical, and biological processes, including adsorption-desorption, volatilization, chemical, photo and biological degradation, uptake by plants, run-off, and leaching. The rate and magnitude of transport of pesticides to environmental compartments is also influenced by factors like properties of the pesticide (water solubility, adsorption, chemical



structure, acid dissociation constant, etc.) and soil (bulk density, organic matter, texture, pH, etc.), the soil hydrologic cycle, how the pesticide was applied, proximity to sensitive aquatic resources (streams, rivers, etc.), and environmental conditions surrounding the application. These processes directly control the transport of pesticides within the soil and their transfer from the soil to water, air or food. The relative importance of these processes varies with the pesticide compound and the properties of the soil. The high water solubility and low K<sub>oc</sub> for neonicotinoids indicate low tendency for adsorption to soil particles. Laboratory and field studies have produced a wide range of values for soil dissipation half-lives (7 to 6,931 days) of neonicotinoid compounds. In general, half-lives have been reported to be longer for N-nitroguanidines (imidacloprid, thiamethoxam, clothianidin, and dinotefuran) than N-cyanoamidines (acetamiprid and thiacloprid). However, the highest and lowest values may not represent typical half-life values under Minnesota-specific conditions. Neonicotinoid half-life in soils will vary with soil type, climate, soil pH, moisture, temperature, light intensity, use of organic fertilizers, presence or absence of ground cover, etc. For example, the half-life for imidacloprid is estimated to be longer in temperate regions than in the mid and higher latitudes, because of fewer sun hours, lower sun light intensity, and lower average seasonal temperatures.

Chemicals applied to the soil or plant surfaces may be transported to groundwater or surface water through leaching, runoff, and drift. Presence of pesticides in water poses a concern for humans relying on groundwater as a source of drinking water, and for aquatic communities of invertebrates, fish, and plant life. Owing to high water solubility, some neonicotinoid insecticide compounds may be more prone to leaching into groundwater or running off into surface water. Both thiamethoxam and imidacloprid have been shown to be highly mobile in soils with a high potential to leach downward through the soil profile or laterally through soil flow paths to contaminate surface and groundwater. The persistence of neonicotinoids in aqueous environments depends upon its exposure to sunlight, the soil or water's pH and temperature, the composition of microorganisms and other biotic communities, the concentration of the pesticide in a given water resource, and the pesticide's product formulation. For example, imidacloprid and thiamethoxam have been shown to degrade more rapidly in alkaline media than in acidic or neutral conditions.

MDA regularly monitors groundwater and surface water for presence of neonicotinoids in Minnesota. When a pesticide is detected frequently and benchmarks are reached, it triggers regulatory agencies to take additional actions to mitigate future exposure to the pesticide of concern. To date, the detected neonicotinoid insecticide concentrations in groundwater samples have been below the Minnesota Department of Health (MDH) drinking water guidance values of concern. Clothianidin, imidacloprid, and thiamethoxam detected in 4.3% (71 out of total 1,644 samples) of groundwater samples collected in Minnesota in 2014. The highest concentration for clothianidin, imidacloprid, and thiamethoxam in groundwater was 391, 59, and 14.8 times below the drinking water level of concern concentrations, respectively. There were no detections in urban areas and private drinking water wells.

In surface water, neonicotinoids insecticides were detected in up to 4.5% of surface water samples (58 out of total 1,284 samples) in 2014. No neonicotinoids have been found in any lake samples; however, they are being detected in rural and some urban river and stream sites, and in wetland water and



sediment samples. The maximum values for clothianidin and imidacloprid was 22.23% and 44.5% of EPA's chronic aquatic life benchmarks for aquatic invertebrates, respectively.

#### **Risk of neonicotinoid use:**

For an insecticide to become lethal to an organism, the organism must be exposed to a sufficient amount of active ingredient for a sufficient period of time. Bees and other insect pollinators can be exposed to insecticides primarily through contaminated plant parts (pollen and nectar) and through unintended, exposure pathways like insecticide drift and abraded seed dust generated during planting. Pollinators may also be exposed to pesticides via plant guttation droplets, contaminated surface water, or soil. However, the extent to which bees may be exposed via direct contact with guttation, surface water, or soil is considered uncertain. Exposure from contaminated plant parts depends upon factors such as attraction or frequency of visitation to the pollen or nectar source, concentration of residue in plant parts collected and daily amount of pollen and nectar consumed by a pollinator. Insecticide residues can vary greatly in their concentration at an exposure point and are a function of the type and amount of active ingredient applied, application methods used, and ability of the plant to uptake the active ingredient. In addition, there are factors that influence an active ingredient's rate of degradation and movement in the soil thus impacting the amount of residues available to the plant for uptake at a given time. The complexity of these interacting factors makes it difficult to anticipate the environmental exposure to pollinators over a period of time.

Wide variation has been reported in neonicotinoid residue concentrations in various exposure points. Review of several studies revealed that, foliar or soil treatments closer to blooming resulted in higher concentrations of active ingredients in pollen and nectar of plants as compared to the seed treatments. For example, in one study, it was shown that residue concentrations in pollen from seed treated with  $\leq 1$  mg imidacloprid resulted in an average of 2.1 ppb imidacloprid in corn pollen (5.4% of a honey bees oral  $LD_{50}$ ). While, foliar treatments of pumpkin at 96 g thiamethoxam/ha resulted in up to 127 ppb thiamethoxam in the pollen (2.5 times a honey bees oral  $LD_{50}$ ).

Abraded dust when released into the air during planting, can contain insecticide concentrations toxic to bees. Bees could be directly 'powdered' by insecticides if their flight path went through airborne planter dust or bees may be exposed to the vegetation on which planting dust has settled during planting. In addition to amount and type of active ingredient applied on seed, concentration of residues in treated seed planting dust may depend upon the type of planter and seed lubricant used, application distance from bee hives/nesting sites and abiotic factors such as temperature, relative humidity, and wind. In one study where honey bees presumably flew through dust abraded from the seed during planting, individuals were exposed to an average of 5,700 ppb and up to 12,400 ppb clothianidin. These levels far exceed clothianidin's honey bee acute contact  $LD_{50}$  value.

It is important to note that many pesticides, not just neonicotinoids, can make their way into honey bee colonies and possibly result in adverse effects on honey bee colony health and behavior. Field experiments studying pesticide residue accumulation in wax, pollen, water, and individual honey bees, showed colonies located near high intensity agricultural areas accumulated many pesticides in a single sample. For example, residues of up to 39 different pesticides were detected from one sample of the



wax of brood comb, while analysis of bees revealed residues of up to 25 different pesticides on or within their bodies.

Based on acute LD<sub>50</sub> values, four of the six neonicotinoids (clothianidin, dinotefuran, imidacloprid, thiamethoxam) are highly toxic to insect pollinators. Typically, lethal effects to insect pollinators are considered on an acute (single) exposure basis, however, chronic (multiple or duration-based) exposures to an insecticide at levels below an organism's acute LD<sub>50</sub> can also cause mortality in insect pollinators. There are several ways in which sublethal concentrations of neonicotinoid residues might adversely affect honey bees or other pollinators such as by impacting their orientation, learning, memory, feeding, movement, foraging, reproduction, or colony health. However, there have been relatively few field studies that confirm or invalidate the findings associated with these adverse sublethal effects found in laboratory studies. Further research is needed to identify sublethal exposure thresholds according to standardized protocols that can be reproducible across all pesticide chemistries.

Although this review was scoped to evaluate the impacts of neonicotinoids on insect pollinators, neonicotinoid concentrations can persist, and possibly accumulate under certain soil, water, and sediment conditions and may pose a risk to other taxa (mammals, birds, fish, arthropods, etc.) living in these environments. In general, neonicotinoids pose low to moderate risks (acute or chronic) to mammals and birds. Relative toxicity of neonicotinoids to fish and amphibians varies from practically nontoxic to moderately toxic. However, chronic exposure to neonicotinoids at sublethal concentrations could be a concern to various taxa.

#### **Benefits of neonicotinoid use:**

Neonicotinoid insecticides have some distinct advantages over other classes of insecticides such as organophosphates, carbamates, pyrethroids, and chlorinated hydrocarbons. They provide very effective control of piercing and sucking insect pests and some difficult-to-control foliage- and root-feeding insects, such as Colorado potato beetles, termites and white grubs, which have developed resistance to other classes of insecticides. Neonicotinoids show distinct advantages in pest control including efficacy against boring insects and root-feeding insects, both of which cannot easily be controlled using foliar sprays of non-systemic compounds. Neonicotinoids are also known to suppress the secondary spread of insect-transmitted plant pathogens in various crops such as barley yellow dwarf virus in cereal crops. Seed treatment provides efficient and prolonged control of insect pests at low dosages when plants are small and most vulnerable to pests. Seed treatment applications also, generally limit non-target organism direct exposure, or field runoff from foliar, or soil-applied liquid and granular products. Neonicotinoids were registered by USEPA as "reduced risk" pesticides due to their low mammalian toxicity, thus protecting applicators and farm workers from adverse impacts. Several of the alternatives (older chemistries) are considered to be more toxic to bees, mammals, birds, and aquatic organisms than neonicotinoids. In addition, pest management programs that rely on fewer chemical choices and foliar applications may result in the evolution of resistance in insect populations.

Based on the review, the MDA identified several opportunities for action to minimize the impact of neonicotinoids on pollinators.



### **Proposed action steps regarding use of neonicotinoids**

1. Pursue the creation of a Treated Seed program (requires legislative action):  
A Treated Seed program would provide the State with the authority to regulate seeds treated with pesticides, fund research to develop need based recommendations for the use of seed treatments, and may require that untreated seeds and seeds treated at lower pesticide application rates are available in the market.
2. Pursue the creation of a dedicated pollinator protection account (requires legislative action):  
The dedicated pollinator protection account would support activities related to pollinators including evaluating and supporting research on economic thresholds, development of an educational campaign on the use of pesticides and development of stewardship materials.
3. Require formal verification of need prior to use of neonicotinoid pesticides, where appropriate:  
The MDA will work with the U of M and other stakeholders to develop pest thresholds and acceptable IPM criteria. Once pest thresholds and IPM criteria are established, the MDA will ensure that pesticide applicators understand the verification process and requirements. The MDA will ensure that applications of neonicotinoids are made only when a qualified individual verifies that there is a demonstrated pest problem and there is a need for neonicotinoid pesticide use. The MDA will develop a formal process for verification of need by a trained and approved individual prior to the use of neonicotinoid pesticides on crops.
4. Develop an educational campaign for homeowners and residential users of insecticides:  
An educational campaign, with an emphasis on neonicotinoids, will educate homeowners and other residential users of the appropriate and safe use of insecticides and emphasize practices related to the creation of pollinator habitat.
5. Review product labels for appropriate use of neonicotinoids for homeowners and residential users:  
On an ongoing basis, the MDA will review product labels for appropriate urban and suburban uses and restrictions of neonicotinoids to minimize the impact to pollinators.
6. Develop Minnesota specific pollinator stewardship materials:  
The MDA will work with pesticide registrants to develop a Minnesota-specific stewardship program to promote practices targeted at minimizing non-target exposure to pollinators in Minnesota.
7. Increase use inspections for insecticides that are highly toxic to pollinators:  
The MDA will increase use inspections for insecticides that are classified as highly toxic to pollinators on acute exposure basis.
8. Review label requirements for individual neonicotinoid products:  
The MDA will review product labels for enforceable language and appropriate requirements. After reviewing and identifying the language, steps may be taken to clarify and revise the label language.





# Minnesota Department of Agriculture Pollinators Summit

## Summit Outcomes Report

**IN THIS REPORT:**

<b>Pollinators Summit Overview and Purpose .....</b>	<b>2</b>
<b>Agricultural Lands: Discussion Themes.....</b>	<b>3</b>
<b>Agricultural Lands: Detailed Comments .....</b>	<b>3</b>
Top Broadly Supported Action Items .....	3
What Is Working .....	5
Barriers .....	6
Solutions.....	9
<b>Public Lands: Discussion Themes .....</b>	<b>15</b>
<b>Public Lands: Detailed Comments.....</b>	<b>15</b>
Top Broadly Supported Action Items .....	15
What Is Working .....	17
Barriers .....	19
Solutions.....	22
<b>Roadsides and Rights-of-Way: Discussion Themes.....</b>	<b>28</b>
<b>Roadsides and Rights-of-Way: Detailed Comments.....</b>	<b>29</b>
Top Broadly Supported Action Items .....	29
What Is Working .....	30
Barriers.....	30
Solutions.....	33
<b>Commercial Landscapes: Discussion Themes.....</b>	<b>39</b>
<b>Commercial Landscapes: Detailed Comments .....</b>	<b>39</b>
Top Broadly Supported Action Items .....	39
What Is Working .....	40
Barriers.....	40
Solutions.....	41
<b>Residential Landscapes: Discussion Themes.....</b>	<b>44</b>
<b>Residential Landscapes: Detailed Comments .....</b>	<b>44</b>
Top Broadly Supported Action Items .....	44
What Is Working .....	45
Barriers.....	47
Solutions.....	49
<b>Pollinators Summit Agenda .....</b>	<b>53</b>
<b>Pollinators Summit Participants .....</b>	<b>55</b>

Presentations from the Summit can be accessed at <http://www.environmental-initiative.org/our-work/environmental-policy/pollinators-summit>.



## Pollinators Summit Overview and Purpose

Pollinators are an irreplaceable public resource. Insect pollinators, such as bees, butterflies, wasps, flies, and beetles, are critical for the pollination and production of crops and the health of native flora and landscapes. Some are especially valued for their beauty and place in our culture, like the monarch butterfly and the honeybee.

On February 12, 2016 Environmental Initiative, on behalf of the Minnesota Department of Agriculture (MDA), convened the full spectrum of Minnesota's insect pollinator experts and interested stakeholders—from beekeepers to landscapers to farmers—for a day of collaboration to identify solutions that will protect and support Minnesota's insect pollinators. The goal of this summit was to identify challenges and propose broadly supported solutions, particularly strategies that could be implemented by state agencies in the near term. Participants came prepared to discuss current efforts and offer specific policy and program ideas to protect and support Minnesota's insect pollinators.

Following a series of expert presentations, participants provided input to the MDA via a set of small group discussions designed to generate constructive ideas and solutions to address the needs of pollinators in Minnesota. Input was gathered during two 60-minute breakout sessions. Participants were able to choose from five breakout topics during each session. Topics included management of agricultural landscapes, management of public lands, management of roadsides and rights-of-way, management of residential landscapes, and management of commercial landscapes. During each session, multiple small group conversations were facilitated on each topic. Groups varied in size from eight to 17 people, were multi-sector and designed to include a diverse range of perspectives.

Each discussion was facilitated by a state employee with some expertise in land management and included a dedicated note taker. Groups were asked to select up to three broadly supported strategies/solutions from each conversation to share with all attendees. Broadly supported ideas from each group were posted for all participants to read, and participants were given the opportunity to show support for three strategies by placing dot stickers on the strategies of their choice, regardless of the topic.

This document, which contains the input gathered from the Pollinators Summit, is organized by the five breakout session topics: agricultural lands, public lands, roadsides and rights-of-way, commercial landscapes, and residential landscapes. Each section of this report begins with discussion themes, which are a synthesis of the small group discussion notes. Each section also includes a full list of the broadly supported strategies from each discussion group, ranked by the number of dot stickers participants placed on each strategy. Finally, detailed comments from each breakout session have been organized into broad themes. Many groups touched separately on similar ideas, and these comments have been grouped together to identify topics of particular interest and to show how different groups approached and discussed similar issues. Environmental Initiative lightly edited some comments for the sake of clarity.



## **Agricultural Lands: Discussion Themes**

### Farmer Education and Outreach

Though participants consistently noted that public awareness, including farmers, is at all time high, participants spent much of their time discussing the importance of continued—and more effective—education for landowners and operators. Comments about farmer education and outreach related to:

- helping farmers to access available federal and state programs,
- the importance of finding the right messenger (many participants suggested crop advisors and other influential leaders in the farming community),
- as well as the need to replace educational capacity lost as funding for University of Minnesota Extension programs has decreased.

Participants also noted the importance of meeting farmers on their own terms—in their communities and using positive messaging that invites constructive participation.

Small groups also spent significant time discussing the specific practices that education and outreach to farmers should focus on, including integrated pest management, use of cover crops / diversification of crop systems, reduced tillage, and reducing treated seed dust. Several groups also noted the need for greater incentives to promote the use of these practices.

### Policies/Regulations on Use of Pesticides

The other topic the agricultural lands discussion groups focused on was pesticide use. Notably, about half of “top” strategies proposed to the full group in the agricultural lands category (and about half that participants marked as favorites) related specifically to pesticide use. Participants focused on the issue of seed treatment and called on the Minnesota Department of Agriculture to support reduction in the use of treated seeds (participants offered a number of specific suggestions). Numerous participants also expressed support for Province of Ontario policy as a model for reducing neonicotinoid use. Comments also addressed ending the prophylactic use of neonicotinoids, setbacks and pesticide drift prevention, and funding for additional research on the effects of (and alternatives to) pesticide application, particularly spraying for soybean aphids.

### Coordination Across Public Agencies and Programs

The final broad topic that garnered significant discussion and many comments was the need for greater coordination across public agencies. In particular, people expressed an interest in drawing connections between the Department of Natural Resources Prairie Plan, efforts to improve water quality such as the 2015 buffer bill, and other conservation delivery programs in order to leverage existing resources for the benefit of pollinators.

## **Agricultural Lands: Detailed Comments**

### TOP BROADLY SUPPORTED ACTION ITEMS

- Implement Rep. Rick Hansen’s 5 step plan, though among other things implement the DNR prairie plan (31 dots)

- Improve education of farmers and agronomists on pollinator issue and resources available (CRP practices, etc.) (14 dots)
- Provide information and incentives to farmers about when and how to use Integrated Pest Management (IPM) and limit prophylactic pesticide use (14 dots)
- Government programs: (7 dots)
  - Raise CRP crop acreage base (CAB)
  - Remove barriers from conservation programs for pollinator habitat (existing and new)
  - Promotion, flexibility
- Statewide campaign (commercials, billboards, radio ads) focused on improving awareness about pollinator crisis, issues, and positive changes everyone can consider (5 dots)
- Chemical decisions and applications need to be based on what is needed for crop health (5 dots)
  - Recommendations need to be impartial and based on science.
  - More education is needed for certified crop advisors on pollinator issues.
  - More focus on precision agriculture practices to help farmers meet their needs and enhance pollinator habitat
- Reduce unnecessary pesticide applications through IPM (4 dots)
  - Regulation like Ontario? [sic]
  - Education/outreach? [sic]
- Incentives for long term monitoring and reinforcement as part of initial process (cost-share should include more robust incentives) (2 dots)
- Modernize conservation delivery system by addressing/acknowledging the modern farm community. Minnesota Department of Agriculture (MDA) and Soil and Water Conservation Districts actions should address: (1 dot)
  - Who is “go to”
  - One stop shop
  - Accessibility
  - Using modern technology
- Expand DriftWatch to include protected lands, wildlife management areas, state parks (helps applicators with setbacks, etc.) (1 dot)
- Encourage greater availability of non-treated seeds (1 dot)
- Drop the part of the law requiring beekeepers to be registered with DriftWatch and invest in an extension program for beekeepers, run by beekeepers.
- Pair pollinator education with practices that offer additional positive economic impacts
- Existing government programs (Conservation Reserve Enhancement Program, Conservation Reserve Program, Reinvest in Minnesota, etc.)
  - Flexibility (long term too)
  - Make changes easier
  - Allow/promote pollination mixes
- Increase supply of seed mixes:
  - Support seed production and collection in Scientific and Natural Areas (SNAs)
  - Support supply by increasing demand through public programs



- Foster communication and unified approach between conservation initiatives
- Monetary incentives (\$ or tax rebates) for growers and residential property owners to set aside land for pollinators
- Reduce seed treatment:
  - Research
  - Promotion/education
  - Funding/incentives
  - Offer options
- Farmer choice
  - Seed treatment
  - Labeling education (product and proper use)
- Research the effects of the environmental impacts of the insecticides used for aphids, and require reporting of aphid pesticide applications.
- Set pesticide reduction targets and meet them. Back targets up with funding and research. Approach should be comprehensive and integrated: reduce use of chemicals, need creative/innovative incentives to plant pollinator species, education is needed.

## WHAT IS WORKING

### ***Public Education and Awareness***

- Educational programs with youth have been successful at teaching about planting seeds/plants for pollinator habitat.
- Growers, when approached about adding planted buffers for pollinators, are in most cases receptive. This is also true pertaining to modifying spray programs in areas adjacent to organic production or sensitive areas.
- Ag industry awareness
- The level of knowledge and collaboration is high
- New professionals appear to be having an impact by interacting with the established clientele and having them reevaluate their positions. Relationship building is key.
- Initiatives are working where we can identify growers who are interested.
- The local media is engaged and helping to build momentum.
- Public awareness about pollinators
- There are a lot more entities promoting habitat than before. Overall public awareness seems good.
- The public is aware and putting pressure on businesses to change. For example Home Depot has even made sustainability changes.
- There is a lot going on to raise awareness. For example, the Farm Bureau gave out pollinator seeds, which drove a lot of conversation. Farmers asked, “Why are you giving away milkweed seed?” so it elevated the conversation.

### ***Public Sector Investment/Leadership***

- Minnesota is spending much more money than other states on this issue and is a good model for getting practices on the ground.
  - Money in Minnesota for research has stimulated the conversation.
- The Bee Lab at the University of Minnesota
- The fact that we are having a pollinator summit today and that there is receptive leadership at the MDA is hugely positive
  - This issue has an unprecedented level of support within the administration (three commissioners and the Lt. Governor here today).
- [On monarchs,] strong level of interagency coordination between all levels of government, in addition to the international agreement with Canada and Mexico
- Cost share programs for seeding are effective with growers.
- Federal Farm Bill programs (Conservation Reserve Program, Conservation Stewardship Program, Environmental Quality Incentives Program, etc.)
- Land into going into CRP and other programs for water quality, grazing, etc. has the unintentional impact of helping pollinators.
  - Recent focus/efforts related to water quality have also helped pollinators

### ***Voluntary Actions and BMPs***

- On their own (without state money or support) R.D. Offutt has taken land out of agricultural production (parcels ranging in size from five to 40 acres, for a total of 600 acres). They are also working with cover crops in the potato rotation. RDO uses signage to identify pollinator habitat.
- Organic farming movement
- That people are interested in cover crops and putting cover back on the land
- Better use of chemicals – less used now than in the past
- Pollinator-friendly seed mixes that are available
- We should recognize the long history of community beekeepers partnering with landowners and locating hives. A volunteer approach as been the backbone since beekeeping began. There are successful working relationships.

### ***Pesticide Regulations and Reduction Programs***

- Bee kill compensation program
- Training of pesticide applicators
- Research on efficacy of neonicotinoids and seed coatings

### **BARRIERS**

#### ***Information/Research Needs***

- When it comes to pollinators we don't know what is out there—we are still developing baselines.



### ***Access to Existing Programs and Incentives***

- A lot of federal money is potentially available for habitat, but it's hard to find land to fit the criteria for it to be used.
  - It's difficult to have land qualify for federal programs. Programs need to be flexible enough to allow land in.
  - Barriers to use of federal funding—need more flexibility so programs can work in Minnesota
- Lots of resources are available, but there needs to be more information/education on how to access the resources and who qualifies.
- Lack of funding for programs is a major barrier to implementation and follow-up.
- It's not to the farmer's [economic] advantage to conserve land. Some want to do the right thing, but the dollars aren't there, so loss of habitat and marginal land being farmed is the result.
- Federal programs are inflexible, with mandatory agreements.
- Reductions in payments from programs might force farmers to leave programs in order to pay bills.
- CRP mid-contract management.
- We've lost a lot of CRP.

### ***Establishing and Maintaining Habitat***

- Finding the right locations for habitat that won't be contaminated by neonicotinoids
- It takes years to establish native prairie (5+ years), so even if the land is there, establishing habitat is harder than most people think.
  - There is a learning curve that people need to be patient with, because it doesn't look good for a while.
  - Getting these plantings/communities to grow is difficult. Doesn't happen naturally, especially if there's a lot of reed canary grass.
  - Shifting to a diverse habitat takes time.
  - Weed pressure is a problem in getting prairie started.
- Need better availability of quality seed
- There is no cookie cutter approach for farmers and landowners to implement and manage habitat.
- There's a lot of handholding required because farmers don't have a lot of time for this type of management. We need to know if the placement of a planting is in a good spot.

### ***Farmer Education and Outreach***

- Some landowners are not responsive to the messengers/messages that are out there.
- Psychological and social barriers...relationships are the key to overcoming these.
  - Cultural shift is needed.
  - Scariest than the government is what will the neighbors think. Milkweeds in roadsides – oh no.
- Need more partnerships and grassroots support

- Lack of interest on the part of conventional growers to adopt more diverse crop production practices (and maybe knowledge about why or how)
  - There's too much corn-on-corn.
- Lack of expertise is also a problem. Need one-on-one interactions with local programs.
- University of Minnesota Extension ran out of money 25 years ago, so farmers get their information from piecemeal sources – crop consultants, dealers etc.
- Historically, conservation has been driven through the Natural Resources Conservation Service (NRCS) – not sure every district conservationist has this as a priority and can advise appropriately.
  - I do think NRCS does have the education. Hurdle is getting people educated because it seems that only the people who are already on board are the ones who attend the trainings/meetings. It's hard to get to the broader audience.
- Need to work at messaging. Agriculture gets blamed for everything these days – every crisis there ever was. There are no meetings to celebrate success, only disaster. Figure out proactive messaging.

### ***Use of Pesticides***

- Lack of options for pest control other than neonicotinoids—not enough incentive for developing new chemicals.
- Concerned with the prophylactic use of insecticides.
  - Most farmers don't apply until they are over the economic threshold.
  - Thresholds are followed, it's all about input prices.
  - Minimal benefit for prophylactic use.
  - Prophylactic use is 7,000-10,000 times more toxic to bees than DDT.
- Pesticide drift is a major issue. More flowers should be planted in agricultural settings. If farmers could visibly see flowers on the landscape there would be more awareness in regards to drift.
  - Rampant poisoning is going on—we need clean flowers and to reduce the poison.
  - If we continue to have pesticide drift concerns, than the prairie plan is not doing its job.
  - There are technologies to reduce drift but not everyone is willing to spend the money.
- We need an honest conversation. Alternatives to the way we farm need to be at the forefront of that conversation.
- Barrier is not being able to consider all factors in the equation [pesticides, requirements of farmers].
- State needs to better regulate neonicotinoids – seed treatment is not treated as a pesticide application.
- Lack of access to non treated seeds.
  - Lack of choices for producers.
  - Farmers are not really asking for untreated corn seed.
  - Seeds only planted three inches deep—pheasants dig them up and die.



- We are seeing success in program adoption, especially NRCS/Environmental Quality Incentives Program (EQIP), yet honeybees are declining and monarchs are down 90%. Not sure the habitat strategy is working.
- Decision makers are not willing to move forward [to address pesticides] when needed. They keep putting money in habitat and are not willing to make hard decisions.
- The current situation is unrealistic – voluntary does not work. There needs to be mandated reductions.
- Keeping bees in California until after seeding is done in Minnesota is not profitable.
- Longevity of neonicotinoids in soil and movement in plants is a factor.

### ***Other***

- Landowners aren't the ones who farm the land.
  - 83,000 landowners in MN, 63,000 of them don't live on the farm.
- Milkweed is still considered a noxious weed in some counties and townships.
- One honey bee hive takes about two acres of lush alfalfa to support the colony through the season, so we have a huge lack of flowers (takes about two million flowers to make about one pound of honey).

## SOLUTIONS

### ***Farmer Education and Outreach***

- Crop advisors (including public agencies like conservation districts) are the key way to get to growers having impacts on watersheds. They are the key connections to growers.
  - Need to team with crop advisors to get better engagement.
  - Consultants are the key.
  - Psychological and social barriers...relationships are the key to overcoming these.
  - Need to make sure that farmers are using what [pesticide] is needed for crops and not just using general recommendations—those giving recommendations need to be impartial, and science-based information is the key. Use only what is needed at that point in time for crop health.
  - Crop advisors need to be more aware of pollinator issues. It should be private certified crop advisors and not always the co-op.
  - Farmers want a private organization to help them set up conservation plans (farmers go to the agricultural chemical suppliers for recommendations).
- Find influential people.
  - Target the grower who's a leader in the community, and set up a demo.
  - Use local Farm Bureau, retailers, NRCS, SWCDs, etc. to identify local leaders.
  - Maybe approach the national women's chapters.
  - Work with local leaders on smaller-scale networking.
- Extension funding has been reduced, so we need another way to promote IPM
  - Without University of Minnesota Extension there is a need for a new type of clearinghouse of information for farmers.

- Redirect funding of Extension to SWCDs.
- The Minnesota Department of Agriculture needs to come up with specific recommendations for reducing pesticide use and exposure.
  - The Minnesota Department of Agriculture should offer more advice and experience to farmers. Minnesota farmers love MDA and hate the NRCS.
- People need info beyond just how to sign up land. They need to know what to plant, how to grow it, how to manage it so that it comes back, etc. Train people on how to manage a site.
- Use the media to emphasize success stories.
  - Maybe need TV commercials
- Make sure these types of meetings take place in farm communities.
  - Maybe go to the meetings the farmers are already attending. A trusted partner – get on their program.
- Use proactive and positive messaging (rather than pointing fingers).
  - Provide recognition to landowners that it's their private property—you'll get greater buy-in if it is voluntary rather than mandatory.
  - A lot of our farmers don't understand they are a part of the problem. There needs to be an acknowledgement that they are part of the solution. Education without pointing fingers.
- Farmers need a tool for obtaining more information on what impact their farm is having on the environment.
- Have farmers teach farmers—demos. Gabe Brown with soil health message.
- Need reinforcement of successes—follow-up is the key. Growers need to take ownership of decisions and see positive impacts.
- Find ways to focus habitat development on farmstead property.
- Focus efforts on the conventional growers and their programs.
- Growers need to know options—education at all levels
- Need more education about existing agricultural pesticide application laws
- Educate farmers and agronomists on pollinator issue and resources available such as federal programs.
- We need to inform people about how beneficial pollinators are and how much we need these pollinator acres.

### ***Support for Beekeepers***

- Invest in an extension program for beekeepers, run by beekeepers.

### ***Federal Programs***

- Get marginal lands into the Conservation Reserve Program as pollinator habitat.
- Recruit more farmers to participate in federal conservation programs (e.g., Environmental Quality Incentives Program).
- Make federal programs easier to access and qualify for.
- More use of IPM approaches is needed (information for growers).

- Allow grazing on existing CRP land.
  - Allow grazing on CRP in more situations.
  - If livestock numbers increase, then more pollinator-friendly plants would be grown.
- Revamping Federal conservation programs to fit today's needs, e.g., Farm Bill could lift the cap on conservation acreage.

### ***Practices***

- Focus on practices that can also have positive economic impacts.
- Challenge farmers who are creating pollinator habitat (including buffers) to consider best management practices (BMPs) for using neonicotinoids and preventing pollinator deaths.
- IPM and its guidelines need to be revisited and followed.
- We need to diversify crops, use cover crops, decrease pesticide dependence, improve soil health.
  - Plant cover crops.
  - Plant diverse “whole” crop systems in agriculture.
  - Support diversification of agriculture.
  - Task the land grant universities with figuring out how to make the economics work [for cover crops/perennials].
  - Plant other things (like alfalfa).
- Include pollinator goals in all conservation practices.
- Beneficial insect strip idea – need to use different spraying times of the day and use different chemicals. We need to encourage farmers to put the buffers in and this will be a paradigm shift.
- More reduced tillage
- Need a standard for the pollinator seed mixes—maybe different levels of mixes
- Let's talk about reducing exposure.
  - Technology, IPM and setbacks can be used together to minimize exposure.
- Reduce seed dust.
  - When these products were first registered, the planters would plant so that the dust would go into the furrow with the seed and get covered up. Now the vacuum planters cause more dust.
- There is a lot of idle land that has not been optimized [as habitat] yet.

### ***Incentives***

- Create a value for pollinator habitat, “Put nature back in farmer's lives”.
- Farmers need incentives for planting of pollinators and so is reduced agricultural chemical usage.
- Include comprehensive and integrated incentives and focus on neonicotinoids as a start, but they are not the only concern
- Would like to see crop insurance money go towards pollinators – subsidize farmers and landowners directly for pollinators.



- Precision agriculture: How can we use this for pollinators and to improve profitability? How can we focus on marginal lands and put in pollinator habitat? More incentives are needed for this.
- Incentives (\$) for growers to set aside marginal land for pollinators.
- Tax rebates for residential and agricultural lands.

### ***Policies/Regulations on Use of Pesticides***

- Put a moratorium on the use of neonicotinoids
- Restrict prophylactic use of neonicotinoids, or require that people justify use á la Ontario
- Minnesota should be proactive and consider the approach taken in Ontario. However, we need more money for this. We need restrictions that make sense and reduce chemical use.
  - Our neighbors in Ontario are on track based on science—they have a plan in place to reduce neonicotinoids by 80%.
  - We should be starting real conversation on what Ontario is doing (good and bad).
  - Ontario and Europe have set restrictions and bans on neonicotinoids, and first year in Europe without neonicotinoids they had a bumper crop.
  - Canada model of regulating.
  - Follow Ontario’s example of reducing neonic uses and their goals, process, rules and regulations in regards to seed coating.
- Is it possible and wise to deal with the neonicotinoid issue? MDA has authority to do it. This past year was first year Europe had their ban on neonicotinoids—higher results without seed coatings in Europe.
- Department of Agriculture needs to use its authority to add protective measures (e.g., setbacks).
  - A lot of money is already spent to ensure that pesticides go where they need to go.
  - Need more consistent investment in technologies to reduce drift
  - Should have setbacks around water, where there is runoff
  - There is no right for someone to kill pollinators on other peoples’ lands.
- Protected and sensitive areas should be listed on Driftwatch.
- Drop the part of the compensation law that beekeepers need to be registered on Driftwatch.
- Labeling on seed bags would be beneficial, with information/education on seed application risks.
- Need choices regarding seed treatment
  - Recommend that Minnesota regulates treated seeds the same as pesticides.
  - State ban on seed treatment.
  - Neonicotinoids is the gorilla in the room. The state of Minnesota needs to reduce the excessive exposure to these seeds.
  - Regulating treated seeds as pesticides would greatly increase costs.
  - Corn and soybean growers need to have a choice of treated and untreated seed.
  - Soybean farmers have the option now and have reduced treated seed use by 40%.
  - Provide information on use of neonicotinoids as seed treatment.

- Communication and research: Provide a grant program to get at the use of seed treatment.
- More choices for farmers on untreated seed.
- Offer/use seed coatings without neonicotinoids.
- Have more non-treated seed available.
- Improve access to non-treated seeds.
- Purdue and Brookings have done studies and have shown no difference in yields between treated and untreated seeds.
- Grants from the MDA for seed production
- Precision agriculture solutions could be important especially in seed treatments – both at the plant and then in the field.
- Because predatory pests are being killed by the early treatment, more chemicals are being used later in the season—it’s creating a cycle.
- Put restrictions on the timing of insecticide applications and types of plants that can be sprayed/treated.
- If wind is greater than a specific speed, they could prohibit spraying.
- Department of Agriculture may need more lab space and employees to handle more samples to adequately test for drift/contamination.
  - Should have multiple labs to send samples to
- Restrict neonicotinoids
  - Reduction of Neonicotinoids on the landscape
- There needs to be responsible pesticide management. We know what needs to happen and how—now we need to scale it up into action.
- Agriculture should be regulated and required to do things like other industries (not always paid to do things through incentives).

### ***Coordination Across Public Agencies and Programs***

- Learn lessons from public lands and how they are managed for pollinators.
- Approach needs to be integrated and in parallel plan that all the agencies can use and work together. Farmers need to be profitable and any approaches needs to be comprehensive.
- Use existing programs to provide incentives to stack the benefits, including the Minnesota Agricultural Water Quality Certification Program: One practice is grass waterway, strips, minimal till...a number of things that can benefit pollinators. Focus is on water quality, but there are secondary benefits.
  - Couple with water quality programs, because that’s all the rage now.
- We need to manage diverse habitat in strategic locations. We have 123 different plans—let’s stack them all up (and implement them) so that we can establish enough habitat on the landscape so we have larger areas managed in a consistent way to support diverse habitat.
  - Implement the DNR Prairie plan (secure needed investment for implementation).
- Make after hours help/information available at SWCDs.

- Set targets for pesticide reduction and meet them. Back targets up with funding and research. Do this all in a coordinated manner—use an integrated approach:
  - Reduce use of chemicals
  - Incentives to plant pollinator species
  - Education

### ***Consumer-driven Change***

- Businesses should set standards – we shouldn't buy products unless the businesses support pollinators.
- Consumers should put pressure on companies to do this.

### ***Research Needs***

- Technology development to reduce use of pesticides.
- Research the effects of the environmental impacts of the insecticides used for aphids, and require reporting of aphid pesticide applications.
  - Soybean drift of aphid spray—we need a better understanding of that pesticide and how it affects bees and butterflies.
  - Spraying aphids aerially: Specific recommendation to legislature is to allocate money to study the effects of this
  - Needs to be a law in place to report when or where they are spraying so that we know where to do the research
  - Invest in the research for bio-control of aphids
- Research on soybean treated seed efficacy
- We need more info on native bees.
  - We need to focus on all pollinators, not just honey bees.

### ***Representative Rick Hansen's List (as [published in the Star Tribune](#) on February 11, 2016)***

- No neonicotinoids on state land, untreated seed available, pollinator safe zones, new chemistry effects and impact of land/air, and habitat corridors.
- Implement Rick Hansen's five-step plan



## **Public Lands: Discussion Themes**

### Regulation and Use of Pesticides

A major focus of discussion regarding public lands was the use of pesticides on public lands as well as on neighboring lands. Some participants suggested the state eliminate all use of pesticides on state lands, which would also include not purchasing plants or seeds treated with systemic pesticides. Most other comments related to controlling pesticide drift, through setbacks or buffers, as well as more fully utilizing reporting programs (for example, including all public lands in DriftWatch).

### Public Funding and Programs to Support Habitat Creation/Maintenance

The other major area of discussion was public programs and funding. Areas of particular interest included the need to fund maintenance costs alongside habitat establishment; leveraging existing resources for maximum impact (e.g., prioritizing projects on existing public land over acquisition, focusing on restoration projects that already include major changes/plantings, etc.); and use of public lands for native seed production. Participants also proposed several innovative options for use of public and quasi-public land to establish habitat.

### State/Federal Government Coordination and Leadership

Many of the small groups discussed the opportunities and benefits of enhanced coordination across state and federal agencies on the issue of pollinators. Several people also brought up the need for public funding for research related to pollinator populations and habitat on public lands. In a couple of instances the options of requiring native plants/pollinator habitat to be included in public plantings and/or management plans were raised.

### Education and Awareness

A number of comments related to the need to raise awareness and expand education for both the general public, and specifically land managers (including contractors). Multiple people suggested the creation of a clearinghouse or other centralized source of information for public (particularly local) land managers so that high-quality and current information is easy to find, including information on native landscape/habitat maintenance.

### Stakeholder Engagement

Some groups discussed the importance of engaging and partnering with stakeholders outside of state government, including private landowners and industry. Participants noted this as a timely opportunity to capitalize on current interest and cement partnerships and commitments while the issue is in the public spotlight.

## **Public Lands: Detailed Comments**

### TOP BROADLY SUPPORTED ACTION ITEMS

- All state lands [should] be pesticide free (managed without pesticides) (13 dots)
- Manage public lands for habitat: (8 dots)

1. Shift from turf to habitat.
  2. Lots of public and quasi-public land (campuses, medical centers, etc.)
  3. Money is needed for maintenance (easy to get money to establish habitat, no money for maintaining).
- Science: We need to improve scientific understanding of pollinator issues. It's complex. We have a lot of excitement and enthusiasm but let's not get ahead of science and what it's telling us or not telling us. (8 dots)
  - Stricter regulations (ban neonicotinoids) on public lands, transparency, and pesticide drift enforcement (7 dots)
  - Increase capacity for managing habitat: (4 dots)
    - Citizen participation
    - Funding
  - Encourage education of local leaders on need to manage public land for pollinators (2 dots)
  - Funding: (2 dots)
    - Acquisition (targeted)
    - Management - especially in the long-term
    - Public relations
    - Education: staff and public
    - Research
  - Burn management: smaller burns; 20% ideal (2 dots)
  - Diversification of plantings including legumes and natives (2 dots)
  - Legislative support: more funding for research, outreach and education (1 dot)
  - Increase awareness of stewardship actions strategically
  - Mandates for all public lands to include native pollinator plants.
  - One stop shop for all available pollinator resources.
    - One entity needs to be the manager of a website, etc.
    - Needs to be easy to use and informative.
  - Communication about all resources that are available for all sectors and that educates people/stakeholders about the one stop shop idea. (People need to know what's available where it's at, etc.)
  - Funding and economics: Limited financial resources exist despite the various local, state and federal funding sources. Need to prioritize funding and think about new ways to fund pollinator incentives.
  - Formalize the cooperation that currently exists:
    1. Develop MOU.
    2. Executive order for state plan.
    3. Strong support now - solidify it.
  - Ecosystem approach: soil health, invasive species, biodiversity, adjacent lands, carbon sequestration, community involvement, public lands can't do it all.
  - Place priority on restoring degraded public natural areas with native plants (also, increase supply of systemic pesticide free plant material).
  - Critically evaluate the use of pesticides on public lands, especially insecticides.

Food plots on Wildlife Management Areas (WMAs).

- No neonicotinoids
- Polycultures
- Prevent pesticide drift on public land (also, do not use plant material with systemic pesticides on public land).
- City and county government adopt resolutions to restrict pesticide use on public lands.
- Funds used for chemical management on public lands [should] be redirected to chemical-free options.

## WHAT IS WORKING

### ***Public Education and Awareness***

- Recognition of the importance of habitat, and also the efforts to make people aware of problems facing pollinators
- People are making more connections about the importance of pollinators, their habitat and related issues.
- Tons of interest and an overwhelming amount of information and activities
- There are many resources available from local, state and federal agencies as well as the private sector for private citizens and landowners.
  - All the educational materials available online
- The public has caught on to, and taken ownership of, this issue. People come out of the woodwork to help on restoration projects – in 30 years of experience I have not seen such support: it’s crazy!
  - This is an issue that transcends; it brings everyone to the table.
- Minnesota has the luxury of having many nonprofits that are willing to help pull with the agencies. This issue cuts across a wide area; we need to pull the available energy from many groups together.
- We are seeing collaboration across all types of organizations: public, private citizens, non-profit organizations, city councils, utility companies, etc.
  - Impressed by extent of partnering that is already happening
- Many good pollinator-related questions are being raised, beyond awareness. For example, creating the right habitat for specific geographical locations, maintenance of habitats after establishment, and potential funding for agencies or organizations to address pollinator issues.
- Rain gardens are providing habitat.

### ***Local Policies and Initiatives***

- The adoption of pollinator-friendly resolutions by municipalities and other governmental units. Some local units of government, primarily in the Twin Cities Metro Area, have passed resolutions regarding pollinator habitat and related initiatives. This is a good model for other cities and local units of government to utilize in their pollinator work.



- It is good that it is recognized that there IS habitat in urban areas and that funding is coming into urban areas for restoration projects.
  - Urban areas are becoming the habitat refuges for small animals and plants that will not do well in large managed landscapes.
- Cities, schools, and counties are limiting the use of plants treated with neonicotinoid pesticides on their public land. If local and state government support the protection of habitat on public land businesses and agriculture will follow the example.
- Pollinator-supportive resolutions by various governmental units
- It's easier to leverage federal dollars in urban areas because of the concentration of people and businesses that are willing to support projects through in-kind and cash donations.
- There are great examples of local government initiatives/projects:
  - Anoka County Parks is active in natural area restoration. Rum River Central Regional Park plantings are an amazing example of what can be done.
  - Duluth is removing invasive species and replacing them with pollinator-friendly native plants. There are plans for doing a demonstration garden with educational signage.

### ***State/Federal Government Coordination and Leadership***

- Agency collaboration and the fact that the state owns land where pollinator habitat can be enhanced or further developed. Just the fact that this summit was organized illustrates that the State of Minnesota is willing to listen.
  - Lots of organization/agency discussion
  - Public and decision-maker attention
- The Legacy Fund puts Minnesota in a better position than other states. Legislators in other states cannot fathom the restoration resources Minnesota has available.
  - Compared to other states, there are a lot of resources targeted to the pollinator issue – we are ahead of the game.
- There is national awareness regarding this issue, especially given that the US, Canada and Mexico have signed an agreement. This has been a fairly quick response.
- Good cooperation of state agencies and integration with federal agencies on this issue
- Habitat protection and management (e.g., Scientific and Natural Areas program) in western Minnesota is doing a good job of supporting pollinators.

### ***Limits on Pesticide Use***

- Limited agricultural chemicals are used in natural settings.
- People are paying attention to pesticide labels. There are lots of tree pesticides being used in urban areas such as for Emerald Ash Bore and Dutch Elm Disease control and it is good applicators are aware of the need to practice care.
- Technology is getting better on sprayers.

## BARRIERS

### ***Public Education and Awareness***

- Education and communication needs to be more tailored to the appropriate audiences.
- Cultural beliefs—cultural preferences for landscaping that are pollinator-unfriendly
  - There is a perception barrier of what is pretty and what is not. Often native plantings are not seen as pretty.
  - There are cases where native planting has generated public pushback.
- Better communication to the public about what they can and cannot do (example: collecting and dispersing seeds on state/federal lands)
- How to channel public interest/energy toward conservation efforts
- Education and outreach has room to grow.
- Complicated message – how to tell story that motivates without overwhelming
- People in rural areas don't use as much social media—need for outreach
- LOT's of information about monarch's and pollinators, but maybe not enough focus for public to know what is important.
- We need to educate people better on pollinators, monarchs and honey bees.

### ***Land Manager Education and Awareness***

- Need to get information resources about pollinator-related topics to the entities that can use them
- Getting information to public lands staff for management and education
- Pollinator habitats need to be managed to maintain a rich diversity of flowering forbs and grasses to sustain insect pollinators. Education is needed in “how to manage a pollinator habitat.”
- Dissemination of research is an issue—awareness of what research exists and ease of access to it
- Not a lot of experts that can identify the insects in the area

### ***Complexity of Issue/Solutions***

- More information is needed about alternative practices.
  - Difficulty in finding less-harmful alternative methods of achieving the results the harmful chemicals are used for
  - Alternative practices are not easily found and could potentially be more harmful than the original practice.
  - Unintended consequences of certain practices
- Lack of knowledge about the entire system—to implement, manage and sustain native prairie for pollinators is complex, and so are the life systems of pollinator species
  - The complexity of natural systems and solutions—no single route to solve all the problems
  - The focus on single actions and individual species, rather than ecosystems/habitats/interconnectivity—should use flagship species to educate about ecosystem relationships

- Other factors relating to pollinator habitat are not being fully addressed, such as control of invasive species and their effects on habitat and wildlife, soil conservation as it relates to pollinator plants, water quality effects with increased pollinator habitat, etc.

### ***Regulation and Use of Pesticides***

- Unless neonicotinoids are eliminated, focusing on creation/protection of pollinator habitat is pointless.
- State laws are not properly regulating agricultural chemicals.
- The Minnesota Department of Agriculture does not have the authority to stop pesticide drift on neighboring property.
- Pre-emption laws—statutory prohibitions on lower-level units of government for creation of more stringent regulations [on pesticides] than those imposed by higher-level units
  - Cities cannot regulate pesticide use; regulation of pesticides is preempted by the state. A local unit of government can pass a pollinator friendly resolution, but they currently cannot regulate pesticide use within their jurisdiction.
- Use of pesticides in crops planted on public lands in transition out of agriculture
- Pesticide drift can move 0.5 to 1.0 miles and impact pollinators on land adjacent to where pesticides are being used. We need to figure out the pesticide issue.
- There is a lack of action and funding. Where is the law? We know that we need habitat and to remove some pesticide use.
- Mortality and how public lands are sprayed

### ***Public Funding and Programs to Support Habitat Creation/Maintenance***

- There was a misunderstanding that Legacy Fund land purchases need to be open for hunting and fishing, which would limit its use in urban areas. That is not the case. This is good because it will allow for planting of flowering basswood and willow as urban ash trees are cut.
- Money is still a barrier. We are getting lots of money for pollinator work, but compared to the need, money is still short. The need is huge.
  - Funding is a key issue as well as how to access funds for pollinator initiatives.
  - Long-term funding is needed for improving pollinator habitat on public lands.
  - Lack of resources (time/staff/money for all the work to do)
  - Funding
  - Inadequate funding
  - Many smaller communities do not have the staff or budget to undertake habitat establishment projects.
- Buying land is flashy – it provides opportunities for photos and erecting signs honoring individuals. Establishing and maintaining habitat on existing public land does not give that level of recognition, but is a more effective way of getting the job done.
- There is plenty of money to establish habitat but money for maintenance is short.
  - Short of money and staff to maintain the natural habitats being established in the City of Saint Paul.
  - Natural areas are easy to buy, hard to maintain



- Maintenance activities often take a backseat. It is a challenge to be able to maintain existing natural areas in a way that will benefit pollinators.
- Lack of resources (for management and monitoring) to take on additional lands when they are available
- Managing public lands requires long-term management, strategy, and resources—this comes with a cost.
- Habitat maintenance challenges
- Overlapping jurisdictions! City, Met Council, Park Board, DNR; all need to coordinate and sometimes they do not. They can also be at cross-purposes (Loring Lake example).
  - Confusion about public lands—who does what, rules, info, etc.
  - The number of agencies working on the same goal is a barrier. It is hard to know how to engage all these agencies for the best results.
  - Public doesn't recognize the difference between different land management agencies/properties
- Pollinator information flow within organizations is not streamlined. Staff is unsure of whom to contact with questions/issues on pollinators.
- Appropriate management for pollinator habitat has to be tied to the functionality of the public land (parks, golf courses, city parks, recreational fields, etc.).
  - Public lands that are primarily set aside for recreation, how to manage the resources with competing goals (agency) and interests (interest groups)
  - In Duluth, more public land is being dedicated to recreational activities (soccer, mountain bike), which leaves less for natural habitat (not much interest in natural habitat use).
  - User demands are an issue
- State wildlife management areas have traditionally been managed for game species.
- There is a lack of research on habitat restoration: defining the problem and finding solutions
- Honeybees need legumes—bees don't only need prairie. Have not had legumes in CRP since the 90's. It's all brown grass, no milkweeds. Native wildflowers generate less honey than basswood trees or legumes.
- There are local ordinances that inhibit establishment of perennial vegetation.
- Not enough protected habitat
  - Much less prairie land

### ***Habitat Fragmentation***

- Pollinator habitat is too disjointed and not connected. The gaps need to be reduced to allow for insect pollinators to move more freely and efficiently between habitats (some pollinators are localized and not strong fliers).
- Public lands are too diffuse and fragmented.
- We are looking at how much we burn. Large blocks give you more bang for your buck, but we're looking to reduce the size of burn since insects can't travel far.

### ***Relationship to (Programs Targeting) Private Lands***

- Public lands adjacent to private lands need to be studied as to what is conceivable between the landowners so as to achieve a plan that is beneficial to the pollinators and agreeable to the landowners.
- Public lands are tiny compared to the total area of Minnesota. Roadsides account for 0.8% of the total state area. We need a bigger vision of pollinator protection that also includes private land.
- If you take all of the government land and convert it to prairie it would not amount to much.
- Farmers are at the mercy of the market and have the incentive to plant every inch of their land.

### ***Availability of and Access to Trained Contractors/Landscapers***

- Often public works contractors are not experienced in creating roadside habitat. It might be put into job specifications, but contractors can struggle to implement correctly. There are not enough specialized native restoration firms to cover the work.

### ***Additional Work/Effort Needed***

- Native plantings can take more work to establish and maintain. Turf grass is easy to do. Also, if those mowing are not informed, native plantings can be damaged.
- Cost/availability of seed is an issue.

### ***Competition with Invasive Species***

- With climate change and warming temperatures, southern species are moving north and competing with native Minnesota species. Researchers may call this evolution and a natural process, but it makes maintaining endangered species all the more difficult.
- ATV, hiking and bikes disperse invasive species.
- Reliance on burning public lands for control of noxious/invasive weeds and not working with grazing animal farmers to use conservation grazing to manage invasive weeds
- Even though everyone says invasive species need to be controlled, there is not enough money for the job.

### ***Value Placed on Native Species***

- Native species not seen as having an economic value

## **SOLUTIONS**

### ***Regulation and Use of Pesticides***

- The state of Minnesota should follow the lead of cities, schools, and counties and limit the use of plants treated with neonicotinoid pesticides on public land.
  - The state should not purchase plants or seeds treated with systemic pesticides. This will provide protection of pollinators, set precedence, and provide an opportunity for education.

- Do not use plant materials treated with neonicotinoid pesticides for new [public] plantings.
- No pesticide use on public lands
  - No pesticides on public land
  - Proscribe the use of pesticides on all public lands.
  - Changes in public programs' (Minnesota Department of Transportation, City Public Works, Park and Rec, etc.) IPM strategies to reduce or eliminate pesticide usage; increased IPM training for individuals responsible for creating plans at those agencies
- Tighten up regulations on drift
  - Public land can be included in DriftWatch to monitor for pesticide drift.
  - DriftWatch collectors could be installed on state land and have enforcement if drift is detected.
  - Include drift monitoring and reporting as part of habitat restoration contracts on state land.
  - Pesticide application setbacks are needed – we don't have the right to kill pollinators on our neighbor's land (due to pesticide drift). The Commissioner of Agriculture could require setbacks in the registration of pesticides.
  - Public land should be a sanctuary for endangered species and pesticide drift on these lands should be prevented.
  - Creation of buffers around important habitat: There should be buffer zones around pollinator habitat areas that are free from agricultural chemicals and pesticide drift.
  - Greater interagency reporting on potential pesticide drift issues
  - State protected lands need more protection when up against agricultural lands— make them high priorities
- End prophylactic spraying on soybean aphids.
- Redirect funds devoted to management with pesticides to pesticide-free alternative techniques.
- Public lands have to implement a strategy of restricting the use of pesticides (insecticides/herbicides/fungicides/other) in a manner that is not detrimental to pollinators.
- Increase the available supply of systemic pesticide-free seed and plant material.
- The agricultural chemical companies need to synthesize new pollinator friendly chemicals.
- Stricter regulation on pesticides, ban on neonicotinoids, stricter regulations on systemic pesticides

***Public Funding and Programs to Support Habitat Creation/Maintenance***

- Incentives to install pollinator-friendly plots
- Money provided for easements should include dedicated funding for on-going maintenance and monitoring of long-term performance.



- Local governments/land managers need resources both to establish habitat, but then also to maintain it. (For example, City of Stillwater decided against a water quality project not because of its construction cost, but on-going maintenance costs.)
  - Clearer access/pathways to information, resources and staff
- We can do more working with existing public land than buying more. Land acquisition should be reserved for when it's needed to create habitat connectivity and corridors, but otherwise resources should be focused on establishing and maintaining habitat on existing land.
- Using local ecotypes is so important. Priority should be to find locations of local ecotypes and then expand their range locally around those locations.
- Rather than focus on converting turf to natural habitat, suggest focusing on introducing pollinator-friendly species (basswood and willow) as part of natural area restoration projects (e.g. invasive species removal). Put a priority on restoring natural areas rather than converting lawns to native plants.
  - Place a priority on restoring degraded natural areas with pollinator-friendly plants (as opposed to converting turf grass areas to natural areas).
  - Renovate past restoration projects that were mostly grass-based and lack flowering plants.
- Use public lands for native seed production.
  - Work with seed growers for adequate supplies of high-value pollinator plants such as thistle.
  - Let commercial seed producers have access to public land to collect seed stock (wild harvest).
  - Open up state lands for growing additional pollinator seed production. The state needs to support the seed industry.
- We often don't know why these butterflies have disappeared. We have lost populations due to controlled burns. We don't know how much of an issue controlled burns are. Lots of interacting factors including weather, chemicals and management practices. I want to recommend smaller burns.
  - Reduce burn frequency and extent
- Conservation grazing on public lands can control invasive species and enhance pollinator habitat.
- Pollinator planting and apiaries on prison lands
- Use of prison crews to help with removing invasive species and restorations
- More seasonal employees
- Habitat areas on public lands need to be focused on as how to manage native plant communities. Minnesota has prairie, wetlands, forests, prairie-forest interface areas that have diverse and different plant communities from each other. Some public land may not have the right attributes to effectively manage a [pollinator-friendly] plant community.
  - Use appropriate plants for the site
- Use of non-native plants on public lands can offer benefits to wild and managed bees.
  - Diversification of planting—add legumes

- Honeybee management and their pests have to be integrated with management of other pests on public lands so they are compatible.
- Managing public lands abutting private agricultural production land will require cooperation with farmers to reduce pesticide drift on to public lands, managing invasive species, or in some cases a diffuse buffer area (mixed and dispersed vegetation adjacent to private lands, with vegetation becoming more intense further from the buffer area). The diffused vegetation border area allows for more light and lower statured vegetation to grow which will enhance a more favorable site for pollinator habitat vegetation and insect pollinators.

### ***State/Federal Government Coordination and Leadership***

- We should formalize this current level of cooperation in some way, such as creating an interagency memorandum of understanding.
  - Progress happens when there are established broad partnerships and integrated incentives and funding sources.
  - Hopefully Environmental Quality Board (EQB) will be able to provide the needed central coordination role for state agencies.
  - State coordination is needed to tap public interest in this issue and leverage the resources available.
  - Better coordination of public land efforts
  - Interagency work for plantings on other public lands
  - We need sustainable and integrated management techniques and tools.
- A comprehensive effort is needed. A coordinated state plan is needed otherwise this effort can get into trouble. If the state legislature directs agencies to create a plan, it will be done.
- There are multiple efforts—monarch butterfly efforts, bee efforts; it would be easier for those who aren't experts if species-specific efforts could be presented as a united effort so projects could be designed to have multiple benefits. People will follow guidance if provided.
- Legislative solution: more funding for research, outreach and education
  - Funding—incentives for landowners and habitat funds are needed
  - Turfgrass is cheap and easy to maintain. Money will be needed to transition public land to perennial vegetation.
- Legislative action to mandate state owned lands are managed for optimum habitat
- Garner political support for government resources and programs that benefit pollinators (one way to do this might be to publicize bipartisan benefits of pollinators)
- Executive orders are one option, but they can go away with change of administrations. However if an executive order is in place and it works, then there is a good chance it will continue or be later placed into law.
- EQB or Metropolitan Council could create a map of all types of public land so it can be visualized.
- We need to plant a flag and say we are going to hold this ground as far as species loss. Climate change is making it more difficult by allowing southern species to move north and compete with our natives, but we have to make a stand to save what we have.

### ***Local Policies and Initiatives***

- Have a requirement for public buildings to incorporate native plants into current plantings and proposed planning/development (at all levels, especially city and county)
- Allow local units of government to regulate pesticide use in their jurisdictions.
- There are large urban parks in the Twin Cities Metro Area that can provide pollinator habitat.
- The state can help local government establish habitat on land they manage.
- Cities and counties could include in specifications for new land management projects that a given portion of land needs to be in native flowering plants. They should have a goal for land area to be restored to natural landscape.
- Integration of pollinator habitats in large urban areas is needed due to the increase of beekeepers in Metro area.

### ***Relationship to (Programs Targeting) Private Lands***

- Discussions have to be held to address ways to connect public and private lands for the enhancement, sustainability of pollinators and endangered species that have specific localized, geographical habitats.
- We need to think of all public land available, including quasi-public land like University of Minnesota and MSCU campuses.
- The public cannot rely on public lands to provide enough pollinator habitat for the state.

### ***Research Needs***

- We need to determine what the baseline is for pollinator habitat.
- More research dollars
- Research: More research and continued support
- Increase funding for fundamental research.
- Public lands need more flowering forbs and more research is needed as to the proper mix for a location.

### ***Public Education and Awareness***

- Signage is important to explain “wild” look of native planting and get past that possible barrier of public non-acceptance due to appearance.
  - Universal signage (symbols) for sensitive areas
- Minneapolis Park Board (and I think Hennepin County Parks as well) is doing [things] for pollinators and they need to get the message out to the public about why they are doing certain things, such as not spraying dandelions. Need to make sure the public understands the relationship between these measures and pollinators.
- If we can get people to understand the monarch butterfly issue it can serve as an entrée to understanding other issues, including the impact of climate change. If they understand the issue, they will get behind and advocate for it, including advocating to their legislators.
- The monarch butterfly is a great flagship species to raise awareness and build support around. However, we need to expand that awareness and support to lesser-known species that need attention too.



- More education has to be offered to the public on pesticide movement on the landscape (above/below ground) and keeping it out of soil and surface water on public lands.
- Could there be a clearer path to information about what to do and what not to do, for example, through QR codes?
- Improve the information about how to create pollinator habitat, especially for the urban environment.
- Capitalize on the great interest in urban agriculture.
- Let the public know what success looks like.
- Bees are a food issue—it should be framed as a food issue for the support that would give.

### ***Land Manager Education and Awareness***

- Develop a clearinghouse for information or a habitat database.
- Dissemination of information—there is lots of information, but knowing how to access it is a problem, especially maintenance information.
- Those outside of state agencies need better information on what is available for funding.
- Provide local governments with the greatest and best information.
- Educate local government leaders to make it a priority to manage a portion of their public lands for pollinators.
- Make sure that city staff are properly trained on how to manage rain gardens or other infrastructure that they now have to deal with.

### ***Stakeholder Engagement***

- Land protection entities such as The Nature Conservancy, Pheasants Forever, etc., need to be more involved.
- All stakeholders need to be part of this. Local soil and water conservation districts can play a big part in outreach and the implementation of pollinator habitat.
- Tap into data industry has generated in the process of testing their products
- High-level collaboration is needed—this is a case in which it would be useful to coordinate actions of agencies and NGOs. A memorandum of understanding would be an umbrella over the top giving legitimacy at the highest levels, just as President Obama’s pollinator program support has done. We have public attention now but we can lose it . . . we need to solidify the current level of collaboration.
  - We need to coordinate the tremendous amount of interest and support we have now.
- Fundraising for pollinator projects and programs on public lands
- Everyone needs to be a part to have an effective solution.

## **Roadsides and Rights-of-Way: Discussion Themes**

### Public Funding and Programs to Support Habitat Creation/Maintenance

The roadsides and rights-of-way groups focused most of their conversation on public programs and policies that can help enhance pollinator habitat. Comments particularly addressed:

- Specific ideas for sources of dedicated funding
- Enforcement of existing (and reexamination of) mowing laws for ditches and roadsides
- The need to prioritize projects and areas of biggest impact
- Program examples from other states
- Other opportunities for habitat on roadsides, such as stormwater ponds, rain gardens, rest areas, and medians

The issue of how to prioritize actions so that they have the greatest possible impact generated the largest number of comments, and ranged from suggestions to select roadways with lower speed limits and wider corridors (to minimize vehicle strikes) to focusing on connecting existing habitat patches with roadside corridors. Participants made suggestions both for and against investing in habitat adjacent to agricultural lands, noting the risk of pesticide drift, but also cost savings associated with eliminating the need to mow in those areas.

### Regulation and Use of Pesticides

While comments related to the use of pesticides were limited from the roadsides and rights-of-way groups compared to those on other breakout topics, several suggestions were made related to targeted or spot spraying to limit pesticide use for weed control.

### Research

Multiple groups discussed and put forward ideas related to using roadsides and rights-of-way for pilot projects and research, including research on:

- Population-level impacts of roadside habitat on rare species
- Pesticide drift effects
- Effectiveness of different seed mixes on different landscapes and topographies
- Maintenance options/techniques

### Role of the Private Sector

Several groups discussed power line and gas line rights-of-way as significant opportunities, but also discussed the challenges that come with more complex ownership and management models, given that most of that land is privately owned and under easement.

### Education and Awareness

Like in many of the public lands discussions, the importance of educating the general public, as well as land managers, was addressed by several groups. Specifically, the idea was raised of establishing a volunteer/partnership program using the Adopt-a-Highway program model.

## **Roadsides and Rights-of-Way: Detailed Comments**

### TOP BROADLY SUPPORTED ACTION ITEMS

- Dedicated funding source for roadside pollinator habitat (e.g. tax-return check-off, lottery funds, license plate funds) (18 dots)
- Re-examine Minnesota's roadside mowing law (5 dots)
- Consider context (roadside habitat may not make sense in all cases, could be a population sink) (5 dots)
  - Prioritize connecting existing habitat w/ roadside corridors
  - Prioritize wide swaths where possible
- Pilot projects on roadsides and rights of way (ROW) (4 dots)
  - Test different seed mixes to determine most effective habitat/wildflowers for pollinators
  - Tie replanting to road construction projects (opportune timing)
- Habitat pilot projects on roadsides and ROWs: (3 dots)
  - Pair w/ funding for research to better understand population-level effects on rare species
  - Pair w/ pesticide research to better understand drift
- Better enforcement of existing mowing laws (consider setting a maximum deck height of 8-12") (3 dots)
- Regulate timing of roadside/ditch mowing: (2 dots)
  - Prohibit mowing in peak summer
  - Pair enforcement with education/outreach
  - Exempt top cut for safety
- Connect prairie conservation plan corridors (2 dots)
- Establish showcase pollinator plantings where highly visible (1 dot)
- Updated public education on aesthetic and environmental benefits of natural habitats (1 dot)
- Develop targeted education on mowing and spraying for counties and townships, including updating Extension materials and outreach (1 dot)
- Utilize areas to provide maximum benefit such as wide corridors (1 dot)
- Enforce existing mowing law (1 dot)
- Facilitate better interagency and state/local coordination (including funding and technical assistance to LGUs) (1 dot)
- More public engagement and consistent symbolgy (e.g., interpretive signage, roadway signage)
- Establish a trust fund to provide for roadside pollinator seeding and continued management
- Examine Iowa Living Roadside Trust Fund
- Don't farm right of ways



## WHAT IS WORKING

### ***Public Funding and Programs to Support Habitat Creation/Maintenance***

- Programs such as “Living Snow Fences” have had an impact—also Wildflower Route.
- Can see impacts on roadside projects here in Minnesota vs. other states—commitment of Minnesota to programs is evident.
- Iowa integrated roadside vegetation management program
- BWSR seed mixes
- Some counties are finally leaving milkweed instead of spraying it.

### ***State/Federal Government Coordination and Leadership***

- This meeting is good.
- Meeting people doing this work, such as the presenters this morning. Educating people about all the different pollinators, not just bees and butterflies. This meeting is great.
- DOT, MDA, and DNR have some strong programs and education.
- From top – down, federal to state to local, everyone wants to do something (but not sure what).

### ***Regulation and Use of Pesticides***

- Momentum from bill in Oregon
- DriftWatch program

### ***Public Education and Awareness***

- Conversation (about pollinators) in Minnesota is ahead of other states. More awareness is needed, but need a simple approach. “What can I do as a landowner?”
- Minnesota is a very activist state. Next week is a statewide conference—campaign called Pledge to Plant for Pollinators and Clean Water. Moving forward, need a cultural movement and change. Millennials want “back-to-nature” rather than “golf course” lawns. The public is demanding the natural landscape aesthetic.
- Signage has been useful to point out habitat projects...public awareness
- The education effort has appeared to have an impact on the local level. Awareness of pollinator programs and seeding mixtures to use [has grown].
- Rain gardens/native plant establishments have been successful—increased awareness.
- More and more hobby beekeepers

## BARRIERS

### ***Public Funding and Programs to Support Habitat Creation/Maintenance***

- Funding: Lack of long term consistent funds
  - DNR Program (Roadsides for Wildlife) is on hold due to underfunding and lack of staff

- Budget restraints are always an issue to success of projects—must be well-funded
- Short-term cost
- Needed maintenance/management after seeding
  - DOT didn't come out to inspect a ditch
  - Native planting push along Hiawatha LRT was successful, but no follow-up maintenance was done and the garden has suffered (miscommunication between MnDOT and City of Minneapolis or Met Council?)
- Roadside authorities are not willing to compromise or make changes in their vegetation management of ditches (roadside authorities: MnDOT, county highway departments, and townships).
- Potential lack of incentives to local jurisdictions to get on board with programs
- All roads are salted and graveled so the bottom of ditches will silt in eventually, which is a threat to natives.
- Road salt
- In Minnesota, only able to mow after August first
- Different species have different needs—some don't fly far

#### ***Local/State/Federal Government Coordination and Leadership***

- Communication between agencies/governments
- Why is each agency developing their own material? Why don't we all combine?
- Interagency coordination is a problem.
- Jurisdictional divides create complexity regarding ownership.
- Not enough coordination between state, county, city roads to manage mowing schedules, etc.
  - There is no uniformity across the state in how roadside mowing is enforced.
  - Variation across counties—some blanket spray and others do not (inconsistency)
  - Townships or counties have jurisdiction over ditch maintenance (local weed inspectors).
  - MnDOT practices vs. county highway practices
  - Mowing laws are not easy to enforce (you're not supposed to mow before August first but lots of people do). Who is responsible for enforcement?
- BMP Committee discussed haying—state can hay if it owns the ROW; some owned by landowner, haying is allowed; other parts of the state, you're not allowed to hay

#### ***Regulation and Use of Pesticides***

- Pesticide drift when adjacent to agricultural lands
- Drift from seed coatings
- Stores that no longer want to carry neonicotinides are phasing out product and selling it at a discount. Not everyone has the buying power of Bachmanns (who can return product).
- Drift as an issue on the back slope, unless farmers set back their spray pattern to avoid the ditch—weeds take over in those steep areas that are hard to manage

#### ***Competition with Invasive Species***

- Invasive species
- Invasive species (yellow sumac and thistles) are problematic. They are spreading into fields if the ditches aren't well managed.
- Corridor of trees in Dakota County cut for power lines has now filled in with burdock and it is spreading (clear cutting can lead to invasive species taking over).
- Limited weed control options—mowing destroys habitat, and herbicides have issues too.
- Law requires invasive species management, so that will trump pollinator habitat practices.

### ***Public Education and Awareness***

- Minnesota needs a massive information campaign. I'm asking people about monarchs and butterflies and nobody knows anything, and I'm from a very ag-intense rural area.
- Lack of education
- Realistic expectations
- There is a rural culture of roadsides being mowed for appearance or to harvest vegetation.
- Social media—how do we get info shared with farmers? We need to update Extension materials. The boots-on-the-ground are the master gardeners—they need updated material.

### ***Land Manager Education and Awareness***

- Timing of mowing is critical—or understanding the need to mow or not mow. Getting people to understand at the township level... Use MDA's BMPs and IPM classes and re-educate on management broadly—need education.
  - Roadside management—mowing frequency
- Installment/seeding of mixes can tend to be an afterthought—less than desirable seed bed prep when including specific species in mixes, compacted ground, etc. Need awareness of how best to plant/maintain these specific mixtures. Also, usually it's their last operation—time constraints to complete it.
  - Contractors may not have expertise in establishment or post seeding maintenance [for native plantings]. Need education with these pollinator-friendly species mixtures.
  - Tendency to take lowest bid on projects may affect the success rate of effective establishments.

### ***Private Land Management***

- Utilities have an easement on the ROW but they do not own the land; farmers can farm it if they own it and they choose to.
  - Property under power lines is not owned or controlled—need permission of landowners
- There are companies with good pollinator initiatives, but we don't know who is doing what so that we can tap into those resources.
- Railroads—spraying of weeds



- Timing of mowing of ditches is questionable. Not sure we have given people the info they need to do what they can.
- Education needs to include how low to mow. Maybe a change in how to mow in addition to when.
- Everyone is busy—needs to be simple—where to get seeds, how to plant, how to manage it.
- If monoculture plants exist in roadsides and are cut before frost, the habitat and food source is lost to insect pollinators for the season from the roadside.

### ***Risk of Vehicle Strikes***

- Car strikes can have population-level impacts on certain populations of rare species—need to balance the need for improving roadside habitat without imperiling native species.
  - Different considerations for I-35 vs. county roads, which are much less frequently traveled.
  - Population-level biology needs to be considered—herp habitat in particular is not recommended along roadways.
  - Car strikes and trauma of the wind/air pressure change can be lethal to butterflies or bees.
- Not enough knowledge on population-level effects on pollinators of roadside habitat planting
  - Don't ignore the negative consequences of roadside prioritization for habitat—potentially needs more study before we push statewide policy/practices
  - Open question on how much potential roadsides present for pollinator habitat
- Prairie skippers feed on grasses, so its especially important to consider for them.
- Monarchs are fairly unique, and highway corridors can work well for them.
- Considerations for different roadways, such as speed limits
  - County roadways present a better opportunity, perhaps, than major highways.
  - Trade-offs with visible education opportunity with high traffic roads
  - Ground-nesting bees of the *nomia* genus in the Northwest have designated beds and “slow” signs to alert drivers.
- Plant habitat away from the road where possible.

### ***Conflicts with Public Safety Issues***

- High-speed highways with high traffic—8 foot buffer gets mowed for safety and therefore detracts pollinators
- Light pollution and its effects on moths and pollinating beetles—different light fixtures and types can minimize light pollution

## SOLUTIONS

### ***Public Funding and Programs to Support Habitat Creation/Maintenance Funding Sources***

- Establish a trust fund to provide for both establishment of pollinator-friendly species in roadsides/ROW areas and for continued maintenance.
- Possible funding sources include percentage of lottery fund or some sort of pollinator habitat “check off” type program/funds designation on state taxes.
- Wilflower vanity license plate as a funding source
- Pool of money for DNR (e.g., Roadsides for Wildlife)—this has been effective for grassland birds
- CRP agreements set requirements on maintenance and management and provide funding.

#### *Enforcement of Existing Mowing Laws*

- There should be more regulatory control over how ditches are managed and enforced.
- Uniform enforcement of the roadsides mowing law (MS 160.232 Mowing Ditches Outside Cities)
- Better enforcement of existing mowing laws (with 8-12” max deck height)
- Regulation to control timing of roadside mowing (stop mowing before August 15 with top cuts exempted for safety reasons). Couple it with education, outreach and awareness-building.
- Based on local needs, the timing of mowing needs to be re-examined or enforced. Full-bloom plants are being cut.
- Determine the best time to mow—not before July—and enforce it, but top-cut only near shoulders to allow sightlines around corners
- One thing we can do is not farm highway ROWs. You can see farmers “scalping” (plowing and planting) into ROW, or baling and selling hay cut from ROWs. There will be some squealing, but not farming ROWs is something we can do.
- Monitor and limit hay harvesting.
- Maybe signage would be effective.

#### *Need to Prioritize Projects and Areas of Biggest Impact*

- Many township roads are too steep or too narrow—county- and state-run highways should be the focus.
- Utilize areas that provide maximum benefit: Wide corridors and open spaces.
- Widest possible habitat plantings can prevent road mortality—focus on wide swaths on one side of the ditch vs. narrow patches on both sides.
- Prioritize habitat corridors for roadside planting (look at land acquisition opportunities and map current assets and overlay existing easements to find areas to expand).
- Prioritize certain roadways and focus efforts based on GIS data (MnDOT-managed especially).
- Connect existing habitat patches with roadside corridors.
  - Roadsides present connectivity opportunities – prioritize there
- Direct limited resources to larger swaths of land, not focusing as much on roadways.
  - Buffer strips on waterways and utility ROWs could be a better opportunity than roads

- Prioritize planting wildflowers in residential ditches and leave agricultural ditches alone since there is the added challenge of weed maintenance and pesticide drift.
  - Roadsides that do not border cropland are a great opportunity.
- Back slope opportunities: Any opportunity to avoid having to manage while ensuring invasive species and weeds don't take over would save counties a lot of money (they have to go in with heavy equipment in areas that are difficult to maintain, which is tricky due to adjacent crop line).
- An area that could be restored is the I-35 corridor. It is dominated by weeds, including noxious weeds that are supposed to be controlled. We can start with highway ROW for restoration sites.
  - Could focus efforts on specific sites on I-35 corridor for monarch habitat improvement (i.e., integrate plantings of milkweed in designated areas).
  - Monarchs are not necessarily as susceptible to pesticide drift.
- Strategic and selective prioritization of certain roadways
- Roadsides provide a lot of acreage but require maintenance so there are definite tradeoffs of planting habitat in roadsides vs. other conserved lands.
- Consider context—roadside habitat may not make sense in all cases (speed limits, traffic patterns, etc.).
- Urban areas present a lot of opportunities, so roadsides may not need to be the focus, but in rural areas roadside opportunities may be more prevalent.

#### *Program Examples from Other States*

- Coordinate re-plantings with road construction projects – opportunistic chance to build new and to educate (Texas program is an example – every new road construction project since 1938 has included wildflower planting)
  - Statewide wildflower program (similar to Texas) to get out of the mowing and bagging cycle (each June)
- Revisit the Iowa Living Roadway Trust Fund to see if there are possibilities for something like this to be established in Minnesota.
  - Iowa has a robust roadsides program through state grants to counties plus state agency technical assistance—counties need funding and assistance
- West Virginia or Indiana programs – Chamber of Commerce or Adopt-a-Highway programs could provide matching funds to keep flowers on the roadsides

#### *Other Opportunities for Habitat on Roadsides*

- Storm water ponds could be used to expand native/pollinator habitats.
  - Storm water storage ponds are currently mowed but it's not clear why; native grasses could be preferable (if we can get over the aesthetic barrier)
- When roads are being built, rain gardens should replace old landscapes.
- Establish showcase “pollinator areas” in heavily used areas such as rest stops.
  - Rest stop education opportunities and/or habitat opportunities at rest stops (larger footprint)



- Introduce pollinator friendly plants to roadsides that have lower plant height and would not be required to mow regularly, but have flowers to provide food resource to insect pollinators.
  - Want to see a diversity of flowering forbs in roadsides that bloom from spring to fall, thereby providing pollen and nectar all season long.
  - In new roadside construction, plant less brome grass and more native grass species.
  - Allow middle section of roadsides to grow longer into season or establish taller plant species in middle to catch snow.
  - Provide plant seed diversity with plants that bloom from spring to fall when seeding roadsides.
  - The goal has to be to get flowers on the landscape
- Need well-designed site prep and long-term management plans for pollinator habitat/plantings.
- Need well-designed wildlife/native plant/pollinator planting corridors/transitions
- Utilize species that are reasonable and competitive—seed mixes should be tailored and site-specific
  - More strategic seed mixes to provide a barrier to protect pollinators from drift (there are trade-offs but it is possible – drift can go up to half a mile so a buffer strip would not be sufficient)
  - Forage production as a seed mix vs. local natives
- Controlled burning as a strategy to allow flowers to recover (burning in mid- to late-summer is most effective)
  - Burn smaller parcels to allow faster re-colonization for species that can't travel long distances (can take years)
  - Burn maintenance can be easier in the median
- Energy is around monarchs and bees. Make sure whatever is designed for those two, works for all the other pollinators.
  - Long, narrow strips of habitat sometimes are too much distance for certain species (skippers)
- Use light fixtures and types that minimize light pollution
- Need to incentivize programs
- Start at the state level and figure out what works on a pilot scale and then be patient with scaling up and expansion, figure out sustainable funding
  - Get easy things going, then build momentum.
- Ramp up the creation of pollinator habitat (native habitat) along transportation corridors.
- Germany has used roadsides for solar and wind development

#### ***Local/State/Federal Government Coordination and Leadership***

- Laws to require establishing pollinators
- Better coordination between agencies and between state and local government
- Interagency coordination and state/local coordination

### ***Regulation and Use of Pesticides***

- Roadside authorities should move away from using some pesticides
- Weed management – “spot” spraying herbicides needs to be considered
  - Targeted/spot spraying
- Integrated pest management
- More selective herbicides could be used for invasives management, but there’s a trade-off because it limits your diversity in the seed mix

### ***Research Needs***

- Research on roadside habitat effects on rare species
- Research on native insect species and habitat needs
- Small pilot projects through MnDOT
  - Pair with funding for population-level research to better understand roadside effects on rare species
  - Also pair with pesticide research to better understand drift effects
  - Pilot project for roadsides to see what works well – updated to today’s research and technology – try different seed mixes on different landscapes and typographies
  - Pilot/demonstration projects to test different seed mixes, determine what is most effective (and connect native and flower planting with road construction projects), and research pesticide effects on pollinators
- Ongoing monitoring of roadside plantings

### ***Private Sector Action***

- Power lines and gas lines ROWs as an opportunity—alfalfa could be planted in June so it can bloom through the summer
  - Opportunities under power lines
  - Power line corridors as an opportunity
  - Great River Energy has tried to partner with public land managers to establish natural habitat under power line right-of-ways (they will cover the cost of establishment and three to five years of maintenance), but public land managers have not been receptive. They don’t like the “weedy” look or maintenance requirements.
- Getting buy-in from ALL adjacent landowners is key. There is a great example of a success story in Inver Grove Heights
- Railroad beds could be used much more intensively to cultivate pollinator habitat
- Pheasants Forever can be a source of private funds to supplement planting projects
- Controlled, rotational haying

### ***Land Manager Education and Awareness***

- What about educating the roadside mowers?
- Target counties and townships for education on mowing. Update Extension education materials.

- Create BMPs for ROWs that include species considerations
- Monarch Joint Venture has recommended 8 – 12” deck height on mowers (recommended but not regulated)

***Public Education and Awareness***

- Change expectations for appearance
- Target public for education—teach that it is good to have roadside habitat and a good property aesthetic.
- Right of way signage—interpretive signs
- Need to engage citizen groups, like “adopt a highway,” that can take ownership of an area
  - Adopt-a-Highway program – any potential to modify the model? Turn it into Citizen science plots where we can monitor for rare and endangered species
- Milkweed education—opportunities to encourage common milkweed planting by finding other uses for it



## **Commercial Landscapes: Discussion Themes**

### Education and Outreach to Landscaping and Lawn Care Companies

Participants noted the need for more trained landscaping professionals who can install and maintain native and other pollinator-friendly plantings. According to many participants, trained landscaping professionals are critical, not only to meeting growing demand for this type of landscaping, but also to ensuring that companies help to build demand by encouraging, rather than dissuading, land owners to shift to native landscapes. A professional certification program was one option suggested for encouraging landscaping professionals to seek training in this area and to help make ongoing training profitable.

### Education and Outreach to Commercial Property Owners

Although public awareness has already been growing, education was noted as essential to overcoming some companies' aesthetic concerns and entrenched cultural preferences, as well as, in some cases, fear of liability associated with bee stings. Participants suggested providing a toolbox resource for companies to make it easy for them to choose plants, assess costs, and carry out maintenance. A certification program (or the addition of pollinator-friendly landscaping standards to existing programs) could also be targeted at properties or property owners.

### Financial and Technical Assistance

Several people suggested that financial incentives—which could include a cost share program and/or free or easily accessible technical assistance and marketing support—would increase business engagement. Recognition programs could help businesses see a financial benefit from investing in pollinator-friendly practices.

### Local Policy Change

A couple of comments related to how local government policies can help drive the installation of pollinator habitat on commercial properties, either by eliminating restrictions on landscaping or by requiring the inclusion of pollinator habitat in site plans through municipal development codes.

### Business-Led Solutions

Participant comments included a number of suggestions for things businesses can do on their own, including establishing volunteer pollinator teams, trying out native plantings in raised beds, educating shoppers on pollinator-friendly practices, and incorporating habitat into existing green infrastructure such as stormwater ponds.

## **Commercial Landscapes: Detailed Comments**

### TOP BROADLY SUPPORTED ACTION ITEMS

- Incentives/financial assistance for clients to install pollinator-friendly habitat  
Financial/technical assistance for landscapes to maintain plantings (14 dots)
- Expansion of education to create a formal communication structure for: (10 dots)

- Toolbox for commercial landscaping
- Public info campaign re: urgency and solutions
- Bee certification like LEED
- etc.
- Develop a certification program and marketing mechanisms to increase recognition for businesses. (4 dots)
- Educate decision-makers, designers, and property owners on the business case and environmental benefits of pollinator plantings. (2 dots)
- Combine [integrate] pollinators into multiple existing programs to result in synergy of costs and benefits. (1 dot)
- Leverage existing assets (for example space) with minimal disruption and costs

### WHAT IS WORKING

- Increased residential awareness is spilling over into the commercial sector (consumers are becoming more aware, and companies are realizing this).
- There are currently some good examples (city halls, corporate campuses).
- The University is doing educational outreach (e.g., workshops focused on IPM).
- There is some funding available for projects (e.g., Mississippi Watershed Management Organization provides grants).
- National Wildlife Federation has a wildlife habitat certification (<http://www.nwf.org/How-to-Help/Garden-for-Wildlife/Certify-Your-Wildlife-Garden.aspx>).
- Increased availability of native plants/seed
- Companies are signing on to pledges and advertising their connections to this issue.
  - There is safety in numbers—if other companies are sticking their necks out, it is easier to join in.
  - Companies see this as a way to attract Millennials.

### BARRIERS

#### *Aesthetics/Perceptions*

- The pollinator-friendly plants/landscapes need to be attractive.
  - Unkempt look may not be what people want to see.
  - Industry follows what the consumer wants.
- General public needs to be educated about benefits of native landscapes
  - We need ways to reach new receptive audiences (not preach to the choir).
- There is a need for education as to the variety of native plants.
- Big name chains have planned landscaping set-ups. They do not want native landscaping because they feel it looks messy.

- Customers may be bothered by bees when walking into a business (may also have legal impacts if a customer is stung).
  - Fear of bugs and snakes
- Purism: For example, native plant proponents being upset that some nonnatives were used in a planting. There should be some recognition that even if something is not 100% native there are still at least some benefits seen.
  - Another option is transitional landscapes, for example flowers/pollinator attractants being planted further away from a daycare center, as an alternative to not having any pollinator attractants on the daycare site.

### ***Lack of Space/Resources***

- The cost of restoration to “pollinator-friendly” landscapes
- Resources may not be available for ongoing maintenance.
- Loss of parking spaces in commercial areas
- Pollinator-friendly planting may require more uniform planting areas/beds.
- Lack of space where businesses could install habitat in urban/compact environments

### ***Need to educate landscaping companies/property managers***

- Expertise: Some landscapers are not educated on native plants.
- Having enough crews that can work on pollinator-friendly areas
- People need to be clearer on the difference between prairie restorations and pollinator plantings.
- Native landscapes are not maintenance-free, and the maintenance required is different than what people are used to.
- Need to address the nesting aspect of pollinator needs—they need uncut native plants to overwinter in.
- Landscaping companies may not be proponents of this as it may be outside of their expertise/experience and perceived as reducing the need for their services.

### ***Neighboring property use of pesticides/herbicides***

## **SOLUTIONS**

### ***Education/outreach to landscaping and lawn care companies***

- Educate landscaping companies on how to maintain pollinator habitat, as well as how to maximize income from maintaining pollinator habitat.
- MDA certification is needed for pesticide applicators.

### ***Education/outreach to commercial property owners***

- Provide a toolbox resource for commercial companies to help them choose plants, assess costs, and carry out maintenance.



- Include the rules and regulations for permits and regulatory processes a commercial business may need.
- Include information on how to make a pollinator-friendly landscape compatible with other uses
- Certification for pollinator-friendly landscapes
  - Tiered program with greater levels of recognition for more effective/significant efforts
  - Can be used as a vehicle to inspire others and publicize a company's efforts
- Add pollinator-friendly standards as a layer to existing programs.
  - Expand connections with in the infrastructure that is already in place.
  - Storm water: A lot of people understand the process and money for storm water permitting, why not find ways to incorporate pollinator-friendly methods into business storm water programs?
  - Incorporate into green sanctuary program (program aimed at churches)

### ***Financial Assistance***

- Provide technical and financial assistance for landscaping with native plants.
  - Offer cost sharing for projects that are already implemented.
  - Provide a sliding scale of incentives [Example: Stop spraying herbicide and seed low-growing nonnatives and let them bloom to earn a lesser incentive. Plant an all-native prairie restoration to earn a greater incentive.]
  - Incentivize the additional efforts businesses are making, especially if there is a public benefit.
- Support the development of more examples of well-designed native landscapes. This will help with education and managing expectations.
- Give companies the opportunity to improve their corporate image by using natural landscaping.

### ***Local Policy Change***

- Eliminate municipal (or other government) restrictions on pollinator habitat (e.g., lawn height, setbacks). Do this by educating council members so they can vouch for pollinator-friendly development.
- Change municipal codes to require that a certain percentage of property be managed as pollinator-friendly.

### ***Business-led Solutions***

- Commercial pollinator teams that can educate and provide maintenance
  - Could be a summer intern program
  - Volunteer program for current employees/retirees to maintain
- Bring in a raised bed—removable planters are a lower commitment, less intimidating, and can be borrowed or rented.
- Large businesses with corporate campuses could incorporate distinct landscapes with different purposes within their property/footprint (an area for picnicking, garden plots, pollinator plantings).



*Powerful Partnerships, Effective Solutions*

- Specific trees and shrubs are beneficial for pollinators and should be included in the plans for commercial areas (e.g., basswoods, dogwoods, etc.).
- Educate shoppers. They will then “vote with their wallet” by choosing plants that are best for pollinators.
- Install floating pallets into storm water ponds and drainage areas that have native pollinator-friendly plants on them.

## **Residential Landscapes: Discussion Themes**

### Public/Homeowner Outreach and Education

Among the residential landscapes discussion groups, more than twice as many comments were made related to public education than any other category. These included calls for demonstration sites, youth education and incorporation into the K-12 curriculum, community/neighborhood-level leadership programs, and paid advertising, among other ideas.

### Education of Planning/Development Professionals

Participants also stressed the importance of getting information about the benefits of pollinators and how to establish pollinator habitat (for example, on species selection and plant sources) to planners, developers, and engineers. New housing developments were noted as a particular opportunity, and developers could be encouraged or required to include pollinator-friendly landscapes in development designs.

### Certification and Recognition Programs

Residential landscapes discussion groups proposed the development (or support) of certification/recognition programs for:

- Nurseries
- Gardeners/Naturalists
- Residences/Individuals' Yards
- Neighborhoods
- Other Stores

### Local Policies and Ordinances

Much like in the commercial landscapes groups, either removing current restrictions that limit or prohibit the development of pollinator habitat on private property, and/or requiring that public buildings/property include pollinator habitat were suggested.

### Regulation of Pesticides

Several groups discussed options for reducing pesticide exposure from residential gardens, including whether changing [the plant labeling law](#) back to its original wording would help with the accessibility of pollinator-friendly plants.

## **Residential Landscapes: Detailed Comments**

### TOP BROADLY SUPPORTED ACTION ITEMS

- Policy-level incentives: (13 dots)
  - Certifications for yards (pollinator-friendly certification)
  - Signage/recognition
  - Tax breaks for increased habitat
- Homeowner education: (8 dots)
  - Simple main message



- Unified statewide education program (centralized website, educational materials, multimedia programs, games, toolkits for empowering stakeholders)
- Make it easier for homeowners to participate--no risk of failure
- Expand seed and native plant availability (plant exchanges [only with proper] quality control) (5 dots)
- University of Minnesota Extension possible pollinator friendly certification (gardens and landscapes) (3 dots)
- Local government demo sites: (2 dots)
  - Public buildings and spaces
  - Neighborhood leaders
- Ban neonicotinoids on ornamental and retail plants (2 dots)
- A source or directory to find knowledgeable and/or certified landscape professionals for pollinator friendly designs (1 dots)
- Education (1 dot)
  - City inspectors
  - Residents
- Financial incentives: (1 dot)
  - Tax incentives
  - Cost share
- [When] prioritizing specific areas for native/pollinator plantings, focus on connectivity (including collaboration with other state agencies) (1 dot)
- K-12 curriculum and demo gardens, kits to take home
- Native master garden training program
- Education: more demonstration projects, state government leads by example (Governor's residence, etc.)
- Education sources, neighbors teaching neighbors
- Central hub for info:
  - One-stop website
  - Link to website from cities/counties
  - Educate people to ask questions
  - Natural nurseries support/sponsor info hub
- Reduce/eliminate restrictive ordinances that prohibit pollinator habitat

## WHAT IS WORKING

### ***Education and Public Awareness***

- Local technical support for landscape transformation, including county extension offices and other local government (city, county), to help people convert underutilized properties, make native planting central to local planning and development, spearhead public engagement, and provide advice on IPM/chemical treatment strategies for property owners

- Use of imagery to support education—imagery of “good” vs. “bad” insects and when to use insecticides (University of Minnesota Extension and PollinatorRevival.org are sources of that information)
- Connections to storm water management in cities—increased promotion of rain gardens, which can provide a good mix of plants for pollinator species
  - Metro Blooms has done a good job promoting rain gardens.
- The MDA-developed BMPs are popular.
- More programs are being organized (like the [Minneapolis Monarch Festival](#)).
- The Minnesota Landscapes Arboretum has done a lot to help people understand the value of native landscapes.
- The University of Minnesota Morris has been very vocal about pollinator habitat, education and prairie restoration.
- The Watershed Friendly yard program in Minneapolis is working.
  - Yard signs to recognize native plantings have helped shape positive changes in community policy related to native plantings.
- Corporate leaders using their properties to showcase the balance of design and responsible planting of native species
  - Businesses adopting native planting on their property have driven a cultural shift.
- Awareness that not all plants are “weeds” has empowered people to make small changes and consider larger projects.
- Grassroots ownership of neighborhood revitalization has led to more community gardens, educational opportunities in the community, and local celebrations/recognition events to show accomplishments.
  - Engagement by hobby groups and gardening associations
- Many more people now know about the plight of monarch butterflies (Wild Ones has helped to disseminate this information).
  - There has been a rush of good information published, especially on bees and monarchs.
- Media is disseminating the information.
- More information is available on neonicotinoids than it used to be previously.
- People in urban areas seem more accepting of a patchwork of pollinator gardens across the community (as opposed to large single restoration plots).
- We have reached a critical mass of interest in this topic. We are at a point in which we can have these conversations.

### ***Changes in Landscaping Industry and Plant Nurseries***

- Stores are keeping neonicotinoid-free plants.
- A local newspaper has published a list of stores where neonicotinoid-free plants are available.
- Small nurseries are seeing business benefits from this awareness, although big stores are behind on the issue.

### ***State Incentives***

- Incentives to plant buffer strips with native plantings

### ***Local Policies and Ordinances***

- More cities are allowing people to keep bees.
  - Some cities are warming to the idea of apiaries within city limits. There are quite a few that are “not on the grid” because some cities have been slower to accept, but acceptance is certainly becoming more widespread.

### **BARRIERS**

#### ***Public/Client Preferences and Expectations***

- Timeline for establishment of native plantings is felt to be too long.
- Concerns about the amount of labor involved with installation and upkeep
  - People are too busy.
- Scale of project (larger may be prohibitive)
- Most homeowners only know what is available at the nursery (typically cultivars and non-native species).
- Cultural mindset of what a yard is supposed to look like
  - Stigma of anything other than a mowed, pristine lawn
  - Perceptions of what lawns should look like
  - There are differing values moving from core metro to outer suburbs, with the core more likely to support native plants.
  - The City of Minneapolis gets calls to report messy looking yards that are not up to code.
  - Peer pressure is a barrier.
- Awareness that plant diversity is very important—some people like how just a few species look which limits pollinator use.
- Concerns about getting stung by bees
- People do not play in public/common places, because of which younger people are not involved in the issue.
- Not enough public spaces/buildings/properties as examples
- Advertisements shown in media emphasize flower-free lawns as the best maintained lawns. This leaves the impression on people that well mowed lawn is the best maintenance.

#### ***General Lack of Knowledge***

- Figuring out which types of plants to purchase and how to manage those plants
- Garden plot owners are not educated on safe use of pesticides.
- People don’t know what to do or how to start.
- Residents are not experts or do not have access to one.
  - Homeowners are not experts.



### ***Differentiating Good Information***

- There is lot of information available, however, people are not sure which information is reliable and what strategies are going to work.
- Some people get lost trying to figure out where to go for reliable information.
- Stopping the spread of misinformation—the emotion vs. science issues
- Poor government website synchronization: It is difficult to find unified information/messages from various government agencies, websites are poorly structured, and they don't link to info on other agency pages.

### ***Lack of Availability/Accessibility of Pollinator-Friendly Plants and Seeds***

- Most people go to bigger stores to buy plants. However, bigger stores are still behind on pollinator issues as compared to the local nurseries.
- It is still hard to find pollinator-friendly (pesticide free) plants/seed from the stores that are in easy reach of people.
- Poor availability of native plants for sale in metro (it is better in rural areas)
  - Lack of native species selections within central metro
- Nurseries have not caught up to this movement. Selection of pollinator-friendly plants is limited.
- There's not a respectable retailer for native plants.

### ***Local Policy/Ordinances***

- Many cities still haven't updated city codes to help pollinators.
- Public management programs that conflict with pollinator support such as:
  - Turf management in public spaces
  - Mosquito Control District application as possible endangerment to pollinators
- City policies can be a barrier, for example rules and regulations related to weeds, plants next to sidewalks, etc.

### ***Regulation of Pesticides***

- State pollinator laws are not really “pollinator friendly.” Why was the law on neonicotinoid concentrations changed to “no observable effect” level and why will pesticide concentrations from flowers be analyzed? The current law takes into consideration the acute concentrations only and not the chronic or sub-lethal concentrations.
- Labeling is not clear on containers.
- Pesticides like glyphosate and neonicotinoids, which can harm pollinators, should be restricted or banned.
- There are not enough pesticides that are identified as restricted use for only licensed individuals.

### ***Program Accessibility***

- Property wasn't eligible for native planting CRP application because the property owner hadn't owned it long enough (it would have qualified if eligibility had started from signing of purchase agreement).
- Application for rain garden grant via a watershed group was too confusing for client to complete.

### ***Fragmentation of Habitat***

- Sustaining populations won't happen with little rain garden patches sporadically placed around a neighborhood or town. You need a network so that pollinators can move.

### ***Residential Site Limitations***

- Some residential lots are large, which takes some thought about where a pollinator habitat should be placed, other residential lots are very small and might not be conducive to creating habitat.

### ***Availability of Qualified Contractors***

- Finding contractors or landscapers or vendors who know what they're doing

### ***Cultivation/Breeding of Native Species***

- The breeding of native plants for landscape purposes creates cultivars that cross with native plants that could compromise the genes of the entire population (e.g., purple cone flower).

## **SOLUTIONS**

### ***Public/Homeowner Outreach and Education***

- More demonstration sites for education and outreach
  - High-visibility, well-designed demonstration projects (golf courses, municipal buildings, libraries, etc.)
  - Promote demonstration sites
    - § Local government (public properties)
    - § Neighborhood leaders (private properties)
- Make it easier for newcomers to do something (e.g., distributing seed packets of pollinator-friendly seed mixes).
- Produce some public service announcements (PSAs) on what people can do to support pollinators.
- Roadside advertisements that list available resources
- Incorporate importance of native plantings into statewide K-12 curriculum.
  - Offer grant program
  - Engagement of Department of Education
  - Kits could be created to take projects from classrooms to backyards
- Improved youth education

- Youth garden programs with summer support (STEM opportunity)
- Youth programs for unified native plants and agricultural education
- Develop a centralized (managed) resource/dashboard to make finding resources easier.
- Use simplified and consistent messages/branding to get the word out.
- Develop statewide educational materials and toolkits similar to [Http://rootsinminnesota.com/](http://rootsinminnesota.com/).
- Get strong Minnesota Nursery and Landscaping Association (landscaping industry) buy-in and support.
- Create multimedia games, videos, and tools to create no-risk interest and training for current and potential users.
  - How-to videos, Plant ID tools, life cycle ID tools, etc.
  - Provide rich training and support to make it easy for stakeholders/public to participate.
- Create a community of native plant gardeners to support education/outreach.
  - Encourage block club leaders to have (and advertise) pollinator-friendly yards—create a ripple effect through the block.
  - Create a registry of pollinator-friendly gardens around the area.
  - Rain garden grading (Better Homes and Gardens-type of thing)
- Outreach documents should show before and after photos of regular lawns with native landscaping and explain the benefits, barriers, and aesthetic biases of each.
- Produce educational documents to explain where different types of native plants should be planted in your yard and what mixes will provide blooms all growing season.
- Cities should link to MDA pollinators website—it doesn't make sense for each city to recreate its own pollinator outreach materials.
- State agencies and universities should disseminate more information and encourage people to buy pollinator-friendly plants.
- Providing resources “in hand” (how-tos, info packets, seed packets) puts tools in the hands of the people who want to do something.
- Help get people to the following (.org) resources:
  - Wild Ones
  - The Prairie Enthusiasts
  - Minnesota Native Plant Society
- Better education to support responsible (appropriate) planting to ensure success of establishment
- Education for people who have large lots and want to mow it all—changing perceptions
- Encourage people to grow plants producing nectar.
- Fact sheets distilled to basic concepts—simplify to a level that average landowners can understand

### ***Education of Planning/Development Professionals***

- Get strong Minnesota Nursery and Landscaping Association (landscaping industry) buy-in and support



- Get the right information to planners, developers, and engineers on species selection and plant sources.
  - Place priorities on multi-user landscapes (humans and insects).
- New housing developments should include pollinator friendly landscapes in the design.
  - There is an opportunity to create different, native habitats in new developments.
  - Create similar habitat to the surroundings of a development to create a more seamless residential landscape.
  - In shared backyards continuous plantings should be created—especially in developments.

### ***Certification and Recognition Programs***

- Nurseries that sell pollinator-friendly plants should be certified by the state and a list of certified nurseries/stores selling pollinator-friendly plants be advertised.
- Master Native Gardener program similar to Master Gardener and Master Naturalist programs
- Designations (official or unofficial) of pollinator-friendly residences or neighborhoods
- People, nurseries, and stores promoting pollinators should be awarded at the State Fair or other venues.
- Signage that shows your yard is pollinator-friendly—would need a partner like Metro Blooms or some other third-party verifier
- Development of a pollinator maintenance certification program

### ***Provide Incentives***

- Create a refund program for buying native plants.
  - Rebate program for native plants
- Small-scale “CRP-like” program
- Layering program support (financial) for pollinators and storm water management
  - Property tax credits—grant one for rain gardens and storm water mitigation.
  - An all-encompassing initiative that incorporates different efforts to restore natural hydrology and ecology: rain gardens, pollinators, etc.
- Scalable incentives for projects of all sizes

### ***Availability/Accessibility of Pollinator-Friendly Plants and Seeds***

- Make pesticide-free (untreated) seed available to growers.
- Duluth Public Library seed program
- Appropriate seeds in retail stores
- Encourage seed exchange programs.
  - Risk of spreading invasive plants and pathogens places limits on these types of programs.

### ***Local Policies and Ordinances***

- Cities should pass ordinances that a certain proportion of land must be designated for pollinators.

- City governments should be doing something at a scale that can make a difference (they can).
- Cities and developments should follow different protocols and plant different landscapes.
- Have a requirement for public buildings to incorporate native plants into current plantings and proposed planning/development (at all levels, especially city and county).
- Enable more pollinator-friendly lawns by changing zoning laws and protocols for citations and by educating city staff who issue citations.
- Eliminate prohibitive ordinances or housing association covenants that hinder the development of habitat.

### ***Regulation of Pesticides***

- Change the pesticide law back to original where a plant cannot be labeled as pollinator-friendly if any concentration of pesticide is detected in the plant.
  - This could lead to having less pollinator-friendly plants available, as pesticide can get into the plant from soil, water or other sources that the nursery owner does not know about. Fear of penalties could lead nursery owners not to offer these plants at all.
- Ban neonicotinoids on ornamentals and pollinator-attractive plants.



# Minnesota Department of Agriculture Pollinators Summit

## Pollinators Summit Agenda

Friday, February 12, 2016  
8:30 a.m. – 4:30 p.m.  
The Wellstone Center  
179 Robie Street East  
Saint Paul, MN 55107

- 8:00** Registration and Continental Breakfast
- 8:30** Welcome  
*Dave Frederickson, Commissioner, Minnesota Department of Agriculture and Lt. Governor Tina Smith*
- 8:40** Introductions and Housekeeping  
*Mike Harley, Executive Director, Environmental Initiative*
- 8:45** Current Research Updates Related to Stressors Facing Minnesota Pollinators
- *Dr. Marla Spivak, MacArthur Fellow and Distinguished McKnight Professor in Entomology, University of Minnesota Bee Lab*
  - *Dr. Dan Cariveau, Assistant Professor, University of Minnesota Bee Lab*
  - *Wendy Caldwell, Community Program Specialist, Monarch Joint Venture, University of Minnesota Monarch Lab*
  - *Dr. Erik Runquist, Butterfly Conservation Biologist, Minnesota Zoo*
- 10:00** Break
- 10:15** State Pollinator Programs and Initiatives
- *Jamison Scholer, Research Scientist, Minnesota Department of Agriculture*
  - *Dan Shaw, Native Vegetation Specialist, Board of Water and Soil Resources*
  - *Crystal Boyd, Entomologist/Bee Specialist, Minnesota Department of Natural Resources*
  - *Tina Markeson, Roadside Vegetation Management Unit Supervisor, Minnesota Department of Transportation*
- 11:30** Federal Pollinator Programs and Initiatives
- *Charlie Zelle, Commissioner, Minnesota Department of Transportation*
  - *Ryan Galbreath, State Resource Conservationist, Natural Resources Conservation Service, United States Department of Agriculture*
  - *AnnMarie Krmpotich, Monarch Coordinator, Midwest Region, U.S. Fish and Wildlife Service, United States Department of the Interior*



- 12:00** Identifying Opportunities for Action  
*Mike Harley, Executive Director, Environmental Initiative*
- 12:15** Lunch
- 1:15** Breakout Group Discussions – Session I
- Agricultural Landscapes
  - Residential Landscapes
  - Commercial Landscapes
  - Roadsides and Rights-of-Way
  - Public Lands
- 2:15** Break (move between groups)
- 2:25** Breakout Group Discussions – Session II
- Agricultural Landscapes
  - Residential Landscapes
  - Commercial Landscapes
  - Roadsides and Rights-of-Way
  - Public Lands
- 3:25** Break
- 3:45** Report Back from Breakouts and Identify Priorities
- 4:15** Wrap-up Comments on Action Steps  
*Dave Frederickson, Commissioner, Minnesota Department of Agriculture*
- 4:30** Adjourn



## Pollinators Summit Participants

### Participating Stakeholders

Sabin Adams, Pheasants Forever  
Kristy Allen, The Beez Kneez, LLC  
Brett Arne, Minnesota Board of Water and Soil Resources  
Rich Baker, Minnesota Department of Natural Resources  
Duane Bakke, Fillmore County Commissioner  
Sherie Bartsh  
Cory Bennett, Bennett Government Consulting  
Chris Berglund, Xcel Energy  
Adam Birr, Minnesota Corn Growers Association  
David Bly, Minnesota House of Representatives  
Bill Bond, Minnesota Crop Production Retailers  
Vicki Bonk, Minneapolis Monarch Festival  
Autumn Boos, Midwest Floating Island  
Ron Bowen, Prairie Restorations, Inc.  
Crystal Boyd, Minnesota Department of Natural Resources  
Charlene Brooks, Conservation Marketplace Midwest  
Doug Busselman, Minnesota Farm Bureau  
Wendy Caldwell, Monarch Joint Venture  
Erin Campbell, Minnesota Department of Administration  
Dan Cariveau, University of Minnesota  
Douglas Carnival, McGrann Shea Carnival Straughn & Lamb chartered  
Sebastiana Cervantes, City of Minneapolis  
Lynn Clarkowski, Minnesota Department of Transportation  
Anna Claussen, Institute for Agriculture and Trade Policy  
Nancy Conley, Minnesota House of Representatives  
Jennifer Conrad, Minnesota Department of Natural Resources  
Chris Cowen, Pesticide Action Network North America  
Robert Dana, Minnesota Department of Natural Resources  
Pat Davies, Loring Greenway Association and Friends of Loring Park  
Rob Davis, Fresh Energy  
Julie Drennen, Conservation Minnesota  
Jim Eckberg, Xerces Society for Invertebrate Conservation  
Dennis Egan, Egan Public Affairs  
Rose Eggert, Minnesota State Horticultural Society  
Steve Ellis, Old Mill Honey Company  
Robert Engstrom, Robert Engstrom Companies  
Paul Erdmann, Izaak Walton League of America Minnesota Division  
Elaine Evans, University of Minnesota  
David Flakne, Syngenta  
Sarah Foltz Jordan, Xerces Society for Invertebrate Conservation  
Karl Foord, University of Minnesota



*Powerful Partnerships, Effective Solutions*

Marcie Forsberg, Pollinator Friendly Alliance  
Matt Frank, Dovetail Partners  
Ryan Galbreath, Natural Resources Conservation Service, U.S. Department of Agriculture  
Jason Garms, Minnesota Department of Natural Resources  
Chris Gevara, West St. Paul Environmental Committee  
Gail Gilliland, Izaak Walton League of America Minnesota Division  
Jenny Guardia, Great River Energy  
Jeff Hahn, University of Minnesota  
Patrick Hanlon, City of Minneapolis  
Rick Hansen, Minnesota House of Representatives  
Bonnie Harper-Lore  
Tara Harris, Minnesota Zoo  
Rich Harrison, Metro Blooms  
Melissa Haselhorst, LandSculpt, Inc.  
Erik Hatlestad, MPIRG  
Vern Heise, Tri-County Beekeepers Association  
Angie Hettinger, EnergyScapes, Inc.  
Kent Honl, Rainbow Treecare  
Rachel Hopwood  
Lex Horan, Pesticide Action Network North America  
Gina Hugo, Sherburne Soil and Water Conservation District  
Chad Ingeman, R.D. Offutt Company  
Jake Janski, Minnesota Native Landscapes, Inc.  
John Jaschke, Minnesota Board of Water and Soil Resources  
Clark Johnson, Minnesota House of Representatives  
Mark Johnson, Lessard Sams Outdoor Heritage Council  
Phyllis Kahn, Minnesota House of Representatives  
Lisa Kane, The Lone Grazer  
Rick Klevorn, Minnesota Department of Natural Resources  
Cy Kosel, City of Saint Paul  
AnnMarie Krmpotich, U.S. Fish and Wildlife Service  
Charley Kubler, CHS Inc.  
Matt Kumka, Barr Engineering Company  
Ian Lane, University of Minnesota  
Bryan Lueth, Minnesota Department of Natural Resources  
Mary Maier, Loring Greenway Association  
Stephen Manweiler, Metropolitan Mosquito Control District  
Josephine Marcotty, Star Tribune  
Tina Markeson, Minnesota Department of Transportation  
Howard Markus, Izaak Walton League of America (Jaques Chapter)  
Lynne Markus, Wild Ones  
Brian Martinson, Minnesota Senate  
Daryn McBeth, Gray Plant Mooty  
Mike McLean, Metropolitan Mosquito Control District





*Powerful Partnerships, Effective Solutions*

Paul Meints, Minnesota Corn Growers Association  
Douglas Mensing, Applied Ecological Services  
Jamshed Merchant, Consulate General of Canada  
Jen Merth, Wetland Habitat Restorations  
Craig Mischo, Bayer  
Margot Monson  
Robin Moore, Land Stewardship Project  
John Moriarty, Three Rivers Park District  
Carrie Nelson, U.S. Forest Service  
Andy Novak, Metro Blooms  
Jon Olson, Metro Blooms  
Wayne Ostlie, Minnesota Land Trust  
Nels Paulsen, Conservation Minnesota  
Joe Pavelko, Lessard Sams Outdoor Heritage Council  
Annie Perkins, Andersen Corporation  
John Persell, Minnesota House of Representatives  
Thom Petersen, Minnesota Farmers Union  
Doug Peterson, Minnesota Farmers Union  
Todd Peterson, Winfield/Land O' Lakes  
Ann Pierce, Minnesota Department of Natural Resources  
Leslie Pilgrim  
Stephanie Pinkalla, Faegre Baker Daniels  
Craig Poorker, Great River Energy  
Tim Power, Minnesota Nursery and Landscape Association  
MaryLynn Pulscher, Minneapolis Park and Recreation Board  
Mike Purtell  
Edward Quinn, Minnesota Department of Natural Resources  
Tom Rabaey, General Mills, Inc.  
Gene Ranieri, City of Minneapolis  
Victoria Ranua, Shakopee Mdewakanton Sioux Community  
Dave Rapaport, Aveda  
Gary Reuter, University of Minnesota  
Becky Rice, Metro Blooms  
Dave Rickert, Minnesota Board of Water and Soil Resources  
Adam Robbins, City of Saint Paul  
Amanda Rudolph  
Erik Runquist, Minnesota Zoo  
Erin Rupp, Pollinate Minnesota  
Deb Ryun, St. Croix River Association  
Laurie Schneider, Pollinator Friendly Alliance  
Chris Schoenherr, Southern Minnesota Municipal Power Agency  
Dave Schroeder, Minnesota Honey Producers  
Greg Senst, Hennepin County Environment and Energy  
Will Seuffert, Environmental Quality Board



*Powerful Partnerships, Effective Solutions*

Tim Sexton, Minnesota Department of Transportation  
Dan Shaw, Minnesota Board of Water and Soil Resources  
Dan Shimek, Wetland Habitat Restorations  
Brian Shipley, Consulate General of Canada  
Katherine Sill  
Regina Small, Minnesota Pollution Control Agency  
Neil Smarjesse, National Park Service  
Joe Smentek, Minnesota Soybean Growers Association  
Chris Smith, Minnesota Department of Natural Resources  
Sally Sorensen, Bluestem Prairie  
Marla Spivak, University of Minnesota  
Mike Stevenson, Nicollet Conservation Club  
Terry Stieren, Minnesota Agricultural Aircraft Association  
John Linc Stine, Minnesota Pollution Control Agency  
Jessica Strange, IPM Consultant  
Peter Strohmeier, Minnesota House of Representatives  
Susan Thornton, LCCMR  
John Thorson  
Dave Tierney, Monsanto  
Paul Torkelson, Minnesota House of Representatives  
Nancy Uhlenkamp, Todd County Ag Inspector  
Julia Vanatta, Pollinator Revival  
Jean Wagenius, Minnesota House of Representatives  
Joe Walton, Dakota County Parks  
JoAnn Ward, Minnesota House of Representatives  
Jason Weinerman, Minnesota Board of Water and Soil Resources  
Julie Weisenhorn, University of Minnesota Extension  
Elizabeth Welty, Honey Bee Club of Stillwater  
Dan Whitney, Dan's Honey Company  
Nora Wildgen, Bee Swell.org  
Barb Yarusso, Minnesota House of Representatives  
Leslie Yetka, Minnesota Landscape Arboretum  
Monica Zachay, St. Croix River Association  
Joseph Zachmann  
Jeffrey Zajac, Minnesota Department of Natural Resources  
Charlie Zelle, Minnesota Department of Transportation



*Powerful Partnerships, Effective Solutions*

Small Group Facilitators and Note Takers

Brett Arne, Minnesota Board of Water and Soil Resources  
Rich Baker, Minnesota Department of Natural Resources  
Jeff Berg, Minnesota Department of Agriculture  
Kevin Cavanaugh, Minnesota Department of Agriculture  
Jennifer Conrad, Minnesota Department of Natural Resources  
Robert Dana, Minnesota Department of Natural Resources  
Annie Felix-Gerth, Minnesota Department of Agriculture  
Bill Fitzgerald, Minnesota Department of Agriculture  
Jennifer Gallus, Minnesota Department of Agriculture  
Ellen Gibson, Environmental Initiative  
Paul Haiker, Minnesota Department of Agriculture  
Matt Jorgenson, Minnesota Department of Agriculture  
Bryan Lueth, Minnesota Department of Natural Resources  
Rajinder Mann, Minnesota Department of Agriculture  
Tina Markeson, Minnesota Department of Transportation  
Bob Patton, Minnesota Department of Agriculture  
Heidi Peterson, Minnesota Department of Agriculture  
Whitney Place, Minnesota Department of Agriculture  
Gregg Regimbal, Minnesota Department of Agriculture  
Dave Rickert, Minnesota Board of Water and Soil Resources  
Jamison Scholer, Minnesota Department of Agriculture  
Tim Sexton, Minnesota Department of Transportation  
Rob Sip, Minnesota Department of Agriculture  
Regina Small, Minnesota Pollution Control Agency  
Dan Stoddard, Minnesota Department of Agriculture  
Ron Struss, Minnesota Department of Agriculture  
Margaret Wagner, Minnesota Department of Agriculture  
Jason Weinerman, Minnesota Board of Water and Soil Resources  
Jeffrey Zajac, Minnesota Department of Natural Resources  
Joe Zawierucha, Minnesota Department of Agriculture

Other Participating Staff and Leadership

David Frederickson, Minnesota Department of Agriculture  
Geir Friisoe, Minnesota Department of Agriculture  
Tina Smith, Office of Governor Mark Dayton & Lt. Governor Tina Smith  
Allen Sommerfeld, Minnesota Department of Agriculture  
Andrea Vaubel, Minnesota Department of Agriculture  
Matthew Wohlman, Minnesota Department of Agriculture





## Clean Power Plan Community Listening Session – Common Themes

The MPCA has been engaging stakeholders on the Clean Power Plan since it was originally proposed in 2014, through a number of approaches, including public meetings and increased web and social media presence. In February and March 2016, the MPCA conducted public listening sessions around the state to seek input on the development of a state Clean Power Plan.

Meeting dates and locations:

- **February 9:** St. Cloud
- **February 16:** Bemidji
- **February 23:** Duluth
- **February 24:** Marshall
- **March 2:** St. Paul
- **March 8:** Minneapolis
- **March 9:** Rochester
- **March 10:** Youth session - Minneapolis

Meeting attendees shared a number of varied concerns ranging from climate and health protections to compliance costs. Attendees were also asked to share input on the MPCA's "dotmocracy" poster at each meeting, which outlined a number of potential plan priorities; people were provided three dot stickers and asked to use their stickers to identify their preferred options. Input from the listening session portion of the public meetings are provided below.

"Dotmocracy" results are available online: <https://www.pca.state.mn.us/air/clean-power-plan-dotmocracy-results>

Generally, though many Minnesotans are very concerned with potential increased costs – primarily in the form of higher electricity bills – associated with reducing greenhouse gas emissions, there is considerable support for a plan that maximizes emissions reductions and develops economic opportunities in an ongoing transition to cleaner energy. Many stakeholders also made clear the need to address environmental justice and ensure that vulnerable communities are provided an active voice in a fair and just plan development process. Finally, most participants supported the need for broad coordination across states in developing a sensible and effective Clean Power Plan.

Because public input on the Clean Power Plan goes well beyond the "traditional" environmental concerns managed by the MPCA (and perhaps, well beyond the confines of the Clean Power Plan), it is important to share meeting results broadly, both within and beyond state government. Progress in addressing public concerns will require coordination and regular communication between agencies, and commitment to continued engagement with stakeholders around the state. Listening session follow up requires us to address the question:

- *How will the state of Minnesota respond to stakeholder input on clean energy planning, public health, energy sector jobs, ratepayer impacts, climate justice, etc., given the multiple agencies working on such issues?*

## Environmental/Health Protections

### **Maximize greenhouse gas emissions reductions and move as quickly as possible to minimize climate impacts**

- I'm not getting enough of a sense of urgency. I'm feeling it is not enough, not fast enough...we are going to be too late. Glaciers are melting too fast. (Rochester)
- The costs of inaction are four times the cost of action. Minnesota led the way on acid rain – do the same now. Don't delay. (Bemidji)
- We need to act. We are suffering the consequences of climate change. I worry about my children's future. (Bemidji)

### **Ensure that health impacts from co-pollutants and also from climate change are adequately factored into any plan**

- We're seeing health impacts from climate change and fossil fuel emissions – increased number of ticks, respiratory problems from increased ozone, mercury levels in children. (St. Paul)
- Mitigating public health impacts should be on our list of Clean Power Plan objectives. Asthma, COPD, cardiopulmonary impacts – these disproportionately impact the poor, the young, the old (Minneapolis)
- The ALA strongly supports the Clean Power Plan. Climate change threatens our health and the CPP promises prevention of many deaths, and 90,000 asthma attacks nationally. (Rochester)

## **Factor in externality costs – the costs of climate-change-caused natural disasters, related health effects, etc. - when determining acceptable versus unacceptable costs**

- Weather patterns are already changing. This is the #1 issue in the world...The 2012 flooding in Duluth demonstrated the harms of extreme weather, and added costs that monthly energy bills don't account for. (Duluth)
- Add in the outside costs – breathing polluted air, hospitalizations, sick days (St. Cloud)
- Make clear the costs of healthcare and cobenefits of action. (Bemidji)

## **Renewable Energy/Energy Efficiency/Innovation**

### **Ensure that Minnesota's early actions in clean energy are recognized by EPA**

- Rural co-ops don't have a lot of members to spread new costs among. Minnesota has a great deal of wind, and we want credit for that in whatever plan comes out. (Marshall)
- Consider how to capture the full benefit of the early initiatives we have taken; make sure we aren't worse off for having started early. (Duluth)

### **Energy efficiency is the cheapest and quickest way to reduce CO2 emissions**

- Energy efficiency should be done first and fastest. UMD has doubled its footprint without increasing energy use. Consider mechanisms to incentivize energy efficiency. "I am addicted to energy efficiency." (Duluth)
- There are huge opportunities for industrial energy conservation. They are huge users of power. (Minneapolis)

### **Push for more community solar programs**

- Solar is getting cheaper. Distributing energy generation means we need less of a grid. (St. Paul)
- We have a solar garden array on Broadway Ave (Shiloh Temple). It saves energy, and invests in our community. We need you to partner with the groups that are doing the work already. Invest in communities and you'll see the residuals (Minneapolis)
- We need legislative action to make it easier for people to install solar panels. (Rochester)

### **We are at a "Manhattan project" moment and need to innovate our way out of climate change disaster**

- One way to encourage moving faster is through innovation – encouraging 3<sup>rd</sup> party innovation. Things like combined heat and power. We have the talent and innovation to do this, and do it faster and cheaper. (Duluth)
- We have to move towards renewable energy, we have to look towards the future. Innovation is key. (Bemidji)

## **Costs of Compliance (Rates, Reliability, Jobs)**

### **Consider the impacts on reliability and electric bills before rapidly changing the state's energy portfolio**

- Don't oversimplify [how difficult it is to plan/change the energy system] – consider when and how electricity is used. Peaking [generation] is harder with renewables. (Bemidji)
- To date, outages come from transmission problems, not generation, but the Clean Power Plan will affect that. When adding more intermittent resources (100% renewables), the system becomes less reliable. I don't believe that EPA can know this plan will be reliable. (St. Cloud)
- We all want clean air, but we need to consider if a drastic energy transition will allow us to make enough power for industry. (Duluth)

### **Don't underestimate the effect of job losses from the current energy sector for families or communities**

- Shutting down coal, having our brothers (IBEW) lose their jobs, and then raising their electricity costs as consumers will cripple the economy (Marshall)
- The Clean Power Plan will create winners and losers. Becker will be a loser – 15% of our taxes come from Sherco. We will lose jobs. We need to think about preserving current energy sector jobs (St. Cloud)

### **Renewable energy is cheap and provides significant opportunities for job growth and economic growth in Minnesota**

- There weren't many job opportunities here...Wind power came along, and now people are staying in the area. Wind is providing good jobs and keeping our small towns alive. (Marshall)
- Keep in mind that jobs created in renewable energy/wind are local jobs. Every state should be looking at this (Minneapolis)



## Environmental Justice

### **Trading could pose problems, especially for vulnerable communities, if the dirtiest plants are allowed to continue polluting at high levels**

- I worry about accountability in a trading system. How will you make sure you have actually achieved the reductions? (Bemidji)
- The flexibility of trading means that potentially the dirtiest coal plants could continue to operate, and could continue to disproportionately affect vulnerable communities that bear the burden of that pollution (St. Paul)

### **Make sure any Clean Power Plan legitimately considers environmental justice – both in terms of the cumulative effects of pollution and in terms of the potential benefits the plan can produce**

- I want to advocate for consideration of vulnerable communities, to ensure they are targeted for benefit from these new policies and make sure they're at the table every stop along the way. (Rochester)
- Communities of color have been marginalized by the federal and state process. An equity analysis is critical. I urge that you engage with organizations and experts to inform the process. (St. Paul)
- What are you planning to do about a just transition? To ensure benefits are going to communities traditionally deprived of them? Folks are concerned about cumulative impacts. (Minneapolis)

### **Don't allow garbage/biomass incineration to count for credit in the plan**

- Folks are concerned about cumulative impacts – especially with the HERC incinerator running. We do not want any garbage incinerators in our neighborhood, creating credits that Xcel can use to run Sherco. (Minneapolis)
- Too much of PCA's focus has been on helping utilities not have to do anything rather than reducing climate-changing causing emissions. We need to move away from the combustion problem in Minnesota where garbage and biomass burning have a lot of clout. (Rochester)

## Government/Regulatory Structure

### **Work with other states in your planning to avoid over-regulation and reduce costs**

- Many people here are co-op members. Don't make people who get power from North Dakota comply twice. (Bemidji)
- The electric grid follows the load, not state boundaries. (Marshall)
- I support the idea of working with other states, and an open process. (St. Cloud)

### **Think outside the framework of the plan – consider a carbon tax/fee to reduce emissions**

- With a carbon fee and dividend structure, we determine how much it will cost to emit; business like the predictability, and unlike a tax, the profits don't go back to the government, but directly back to households like a tax return to help offset the cost of fuel going up. (Rochester)
- The Clean Power Plan only targets 40% of the CO2 from power plants in Minnesota. Would a carbon tax work with the Clean Power Plan? (Minneapolis)

### **Trading will make the plan more flexible and cost effective**

- The proper role of the government is allowing the marketplace to work and ensuring incentives are in the right place (St. Cloud)
- We're concerned about North Dakota versus Minnesota regulations, and we're concerned about cost. Trading is key. We want everyone to be able to trade. (Bemidji)

### **Ensure that any new energy source is properly regulated to protect public health and the environment (including renewable energy resources)**

- The MN model [MN's RES of 25% by 2025] didn't have a scientific basis – no models, studies. Wind is a disaster and we should have no more siting of it. (Rochester)
- There are issues about wind and solar siting that we need to address – statutory changes and PCA noise rules (Rochester)





# INCORPORATING CLIMATE CHANGE INTO MINNESOTA'S ENVIRONMENTAL REVIEW PROGRAM

*ENVIRONMENTAL  
QUALITY BOARD  
September 2016*



## Table of Contents

About the EQB .....	2
About this Document.....	2
The National Environmental Policy Act .....	3
Guidance from the CEQ.....	3
Considering GHG Emissions or Climate Change in Environmental Review .....	4
Project Specific Impacts .....	4
Applying NEPA at the State Level .....	5
California .....	5
District of Columbia.....	5
Hawai'i.....	6
Massachusetts.....	7
Washington .....	7
SEPA Programs across the United States.....	8
Minnesota Environmental Policy Act & the Environmental Quality Board .....	8
Examples of Greenhouse Gas Analysis in Minnesota Environmental Review Documents.....	9
Department of Natural Resources .....	9
Department of Transportation.....	10
Department of Commerce .....	10
Pollution Control Agency.....	10
Appendix A: SEPA Programs across the United States .....	11
Appendix B: Minnesota State Agency Publications .....	15
Interagency Publications .....	15
Department of Health: Climate and Health .....	15
Department of Natural Resources .....	15
Department of Commerce .....	15
Department of Agriculture.....	15
Pollution Control Agency.....	15
Environmental Quality Board.....	16
Department of Transportation.....	16
Board of Water and Soil Resources.....	16
Metropolitan Council .....	16
Appendix C: Endnotes.....	17

## About the EQB

The Environmental Quality Board (EQB) draws together the Governor's Office, five citizens, and the heads of nine state agencies in order to develop policy, create long-range plans and review proposed projects that would significantly influence Minnesota's environment. The EQB is responsible for overseeing the environmental review program for the state of Minnesota.

## About this Document

In 2016, University of Minnesota undergraduate student Samantha Radermacher and EQB Environmental Review Program staff Courtney Ahlers-Nelson and Mark Riegel prepared this document.

This document is not intended to be comprehensive nor does it represent the policy of the Environmental Quality Board. Additional information about the environmental review program is available at the EQB website identified below.

## Contact the Minnesota Environmental Quality Board at:

Environmental Review Program  
520 Lafayette Road North  
Saint Paul, MN 55155  
Phone: (651) 757-2873  
Website: <https://www.eqb.state.mn.us/>  
E-mail: [Env.Review@state.mn.us](mailto:Env.Review@state.mn.us)

## Introduction

As our climate changes, it is crucial to put our best foot forward in preserving our natural resources. The Minnesota Environmental Quality Board is responsible for overseeing the environmental review program and identifying opportunities to improve its effectiveness. It may be beneficial to our environment to assess climate change impacts through the environmental review process. The Federal Council on Environmental Quality has provided guidance and recommendations to include climate change and greenhouse gas considerations into environmental review documents in an effort to modernize the environmental review process.

This document was created in collaboration with the University of Minnesota, which offers undergraduate coursework modeling the environmental review process. This document aims to accomplish three things:

- (1) Provide examples of modernized environmental review processes and documents at the state and federal level;
- (2) highlight efforts made within Minnesota to analyze climate change through environmental review; and
- (3) outline opportunities for the EQB to incorporate climate change into the environmental review process.

## The National Environmental Policy Act

In 1969, the National Environmental Policy Act ([NEPA or Act](#)) was enacted. The Act originated in the United States Congress as a response to public concern regarding environmental quality.<sup>1</sup> The intent of NEPA, as defined in [42 U.S.C.S. §§ 4321](#), is “to declare a national policy which will encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of ecological systems and natural resources important to the Nation; and to establish the Council on Environmental Quality (CEQ).” The CEQ is responsible for overseeing environmental review at the Federal level, and works in conjunction with several White House offices to accomplish its defined goals under NEPA.<sup>2</sup>

### Guidance from the CEQ

The goal of the CEQ is to “continue developing tools to improve and modernize NEPA.”<sup>3</sup> Modernizing NEPA will allow the Act to remain effective in addressing current environmental concerns, including climate change. In 2010, the CEQ released a [guidance document](#) of their recommendations for considering climate change and greenhouse gas (GHG) emissions within the NEPA process. The idea of modernizing the environmental review process was not believed by the CEQ to be a “new” component of NEPA analysis, but rather something to be considered within the existing framework.<sup>4</sup> The document was later revised in 2014. The most notable change was the application of the guidance to all federal actions, including land and resource



management.<sup>5</sup> The guidance provided in the [revised draft document](#) will be analyzed for the remainder of this document.

Federal agencies fulfill the requirements of NEPA by completing a Categorical Exclusion (CE), Environmental Assessment (EA) or Environmental Impact Statement (EIS) document. In the 2014 draft guidance document, the CEQ recommends that proportionate to the proposed action, federal agencies will consider the following:

- (1) The potential effects of a proposed action on climate change as indicated by its GHG emissions, and
- (2) the impacts of climate change on the environmental effects of a proposed action.<sup>6</sup>

In short, the CEQ is asking federal agencies to consider both mitigation and adaptation within the environmental review documents. The CEQ has expressed their hopes to continue to modernize the environmental review process moving forward.

### **Considering GHG Emissions or Climate Change in Environmental Review**

Federal agencies are encouraged to continue to implement the environmental review process as they do currently, while also taking into consideration GHG emissions or climate change and incorporating that information into future environmental review documents.

Federal agencies are expected to continually update their knowledge on current scientific knowledge concerning climate change. The CEQ strongly encourages each agency to take the guidance documents and build upon them using their individual resources and strengths.<sup>7</sup>

When an agency is determining if quantitative or qualitative analysis in the environmental review document is more appropriate, the following should be considered:

- (1) Look to the current tools and information available to analyze the impacts of a proposed action;
- (2) consider the project size and availability of data when choosing modeling tools; and
- (3) consider mitigation actions to reduce the volume of GHG emissions.<sup>8</sup>

The CEQ has identified a threshold of significance for GHG emissions and emissions exceeding the threshold qualify for a more in-depth analysis to be included in the environmental review document. The threshold has been defined as 25,000 metric tons of CO<sub>2-e</sub> per year. Any emissions below this level need not be quantified, but instead should be analyzed qualitatively.<sup>7</sup>

### **Project Specific Impacts**

In attempts to determine the significance of GHG emissions, the CEQ looked to California as an example. In 2006, California established state-wide emissions goals under [Assembly Bill 32](#). The bill required state agencies in California to look at each project relative to the state's emission reduction goals.<sup>9</sup> This approach is helpful when examining emissions at the project level, because emissions appear insignificant until they are examined in context of the state's goals. California, much like the CEQ, encouraged agencies to develop and publish thresholds of significance that the agency will then use in future cases.<sup>10</sup>

## Applying NEPA at the State Level

Since the enactment of NEPA, twenty-eight states have adopted “NEPA-like impact statement procedures” and sixteen states have “fully developed policy acts.”<sup>1</sup> These sixteen states and the District of Columbia will be examined later in greater detail. The adoption of NEPA at the state level occurred as early as 1970 and as recently as 1991.<sup>11</sup> These laws are often referred to in a broad sense as State Environmental Policy Acts (SEPA).

The following five SEPA summaries are intended to aid the reader in familiarizing themselves with the application of SEPA. The examples were chosen due to either their success in modernizing their respective environmental review procedure, their emission reductions in recent years, and to illustrate the variety of approaches used to achieve their goals.

### California

By enacting the California Environmental Quality Act ([CEQA](#)) in 1970, California was the first state to follow the Federal example set by NEPA. CEQA applies to projects which may have a significant impact on the environment at both the state and local level.<sup>12</sup> In 2006, California enacted Assembly Bill 32 ([Global Warming Solutions Act](#)). Although A.B. 32 did not amend CEQA, it did acknowledge the need to reduce GHG emissions across the state.<sup>13</sup> In 2007, [Senate Bill 97](#) was passed, expressing the need to analyze greenhouse gas emissions in accordance with CEQA. The Governor’s Office of Planning and Research (OPR) was charged with developing guidelines and thresholds of significance for this new requirement. The [Environmental Checklist Form](#) has specific language guiding the lead agency in analyzing greenhouse gas emissions. In 2008, the OPR created a series of [Technical Advisories](#), providing guidance on addressing climate change within the environmental review process in three major steps:

- (1) Greenhouse gas emissions must be identified and quantified;
- (2) the significance of the emissions should be determined; and
- (3) if the impact of emissions is determined to be significant, mitigation tactics must be outlined.

### *Analysis of California*

- California’s progressive thinking and quick reaction to NEPA has made them a national leader in modernizing the environmental review process.
- Minnesota could benefit from analyzing the updated language used in California’s Environmental Checklist Form.

### District of Columbia

In 1989, The District of Columbia Environmental Policy Act ([DCEPA](#)) was adopted. This Act requires the District of Columbia to prepare an Environmental Impact Statement (EIS) for projects which cost in excess of 1 million dollars or have the potential to substantially affect the quality of the environment or public standard of life.<sup>14</sup> In 2013, Washington D.C. implemented

their [Sustainable DC](#) plan. The plan was created to make D.C. the most livable and sustainable city in America.<sup>15</sup> This document lays out goals to reduce greenhouse gas emissions and climate change adaptation strategies. Although the *Sustainable D.C. Plan* does not specifically mention the environmental review process or DCEPA, one goal included in the “*Climate and Environment*” section would require “all new building and major infrastructure projects to undergo climate change impact assessment as part of the regulatory planning process”.<sup>16</sup> As part of the DCEPA process, the [Environmental Intake Form](#) and the [Environmental Impact Screening Form](#) are meant to act as an environmental assessment (EA) or environmental impact statement (EIS) might work at the federal level.<sup>17</sup> Although neither reflect the goals outlined in *Sustainable D.C.*, Washington D.C. has achieved a sixteen percent decrease in greenhouse gas emissions between 2013 and 2015 despite the lack of incorporation into the environmental review documents.<sup>18</sup>

### *Analysis of the District of Columbia*

- Washington D.C. has made impressive progress in reducing their greenhouse gas emission little change of their environmental review documents.
- Washington D.C. identified specific project types which should require climate change consideration or analysis of GHG emissions.

### **Hawai'i**

In 1974, the Hawai'i Environmental Policy Act ([HEPA](#)) was enacted. Hawai'i is unique in that each county has created its own comprehensive plan, which strongly shapes the projects which are subject to environmental review. If a project is in accordance with the county plan, it is automatically exempt from completing an Environmental Assessment Worksheet (EAW). The only exception to this streamlined process is when a project is located within an environmentally sensitive area. Although Hawai'i was slow to develop their environmental review framework, they have set such a strong example of climate change preparedness they have been recognized by the federal government. In 2013, President Obama asked former governor of Hawai'i, Neil Abercrombie to join the President's Task Force on Climate Preparedness and Resilience. In 2012, climate change was added to the list of the state's major concerns.<sup>19</sup> Moving forward, Hawai'i plans to increase public outreach and education. Unique to Hawai'i, traditional knowledge will be taken into account when considering adaptation strategies. However, Hawai'i does not currently show an updated EAW or EIS form that reflects the state's goals to reduce emissions or address climate change.

### *Analysis of Hawai'i*

- The use of comprehensive plans to guide the environmental review process in Hawai'i is similar to the Alternative Urban Area Review (AUAR) process in Minnesota.
- The EQB could look for opportunities to collaborate with local and regional planning organizations to incorporate environmental review into comprehensive plans.



## Massachusetts

In 1972, Massachusetts adopted the Massachusetts Environmental Protection Act ([MEPA](#)); this act enforces environmental review at the state level only. Massachusetts has established clear thresholds to aid agencies in determining what is “significant” when preparing environmental review documents. A project is “significant” if it “may damage the environment” and “Damage to the Environment” is defined<sup>20</sup> as “any destruction or impairment...to any of the natural resources of the Commonwealth including...GHG emissions...” In 2008, the Global Warming Solutions Act (GWSA) amended MEPA to consider “foreseeable climate change impacts, including additional greenhouse gas emissions.”<sup>21</sup> The intent of this Act is to assist the Massachusetts Department of Environmental Protection (MassDEP) in attaining the GHG goals of the state by assessing new projects. There is no specific modeling program or method recommended to the lead agency, however it is asked that when quantifying emissions and alternatives, the same method should be used throughout the document. The Executive Office of Environmental Affairs has provided guidance for projects which require the quantification of greenhouse gas emissions. Massachusetts has applied GWSA to MEPA by creating the [Environmental Notification Form](#) (ENF), which shows the incorporation of climate change and greenhouse gas analysis into the environmental review process. Expanded ENFs require the preparer to quantify greenhouse gas emissions and provide mitigation measures to further reduce the impact of the project on the environment.

### *Analysis of Massachusetts*

- Massachusetts requires specific project types that trigger an expanded ENF to quantify GHG emissions.
- Massachusetts has qualitatively defined “damage” to the environment and in doing so, included GHG.

## Washington

In 1971, the state of Washington enacted the State Environmental Policy Act ([SEPA](#)), which operates at both the state and local level. Originally, the Act closely mirrored NEPA but was amended in 1996 to incorporate the Growth Management Act ([GMA](#)) into the SEPA process. The GMA set goals for the state to improve the quality of the environment and by extension, the health of Washington’s residents. Environmental review documents, such as an EIS form, may accompany the GMA document or the two forms may be integrated. However, the Department of Ecology has developed an [Environmental Checklist](#) which currently does not have any language to support climate change analysis or mitigation into the environmental review process.

### *Analysis of Washington*

- The state of Washington has molded the environmental review process after the example set by the Federal Council on Environmental Quality.

## SEPA Programs across the United States

The five states that were just examined in depth in regards to their efforts to modernize the environmental review process. There are sixteen states, plus the District of Columbia, which have implemented NEPA at the state level. These programs are often referred to as SEPAs, or state environmental policy acts. Included in Appendix A is a table which provides information on each of the states which follow NEPA. This table will briefly provide, historical context of the SEPA as well as legislative and executive actions made to modernize the environmental review program.

## Minnesota Environmental Policy Act & the Environmental Quality Board

In 1973, the Minnesota Environmental Policy Act (MEPA) was enacted, creating the Environmental Quality Board (EQB). The EQB, much like the CEQ, is responsible for overseeing the environmental review process in Minnesota. According to [Minnesota Rules 4410.0400](#), “the EQB shall monitor the effectiveness of parts [4410.0200](#) to [4410.6500](#) and shall take appropriate measures to modify and improve their effectiveness. The EQB shall assist governmental units and interested persons in understanding and implementing the rules.” There are three main forms of environmental review within MEPA. The Environmental Assessment Worksheet (EAW), the Environmental Impact Statement (EIS), and the Alternative Urban Areawide Review (AUAR).

### *Minnesota Rule 4410*

Minnesota Rule 4410 covers the Environmental Review program. The following analysis of this rule is to provide the reader understanding of the environmental review program and the powers held by the Environmental Quality Board regarding this program.

It is stated, in 4410.0400 subpart 1; “the EQB shall monitor the effectiveness of parts 4410.0200 to 4410.6500 and shall take appropriate measures to modify and improve their effectiveness. The EQB shall assist governmental units and interested persons in understanding and implementing the rules.” This allows for the Environmental Quality Board to make changes as needed to improve the effectiveness of environmental review, including updates to the EAW, EIS, and AUAR processes.

### Environmental Assessment Worksheet

As described by the EQB, the EAW form is “a brief document designed to lay out the basic facts of a project necessary to determine if an EIS is required for the proposed project.” The form contains twenty questions which will determine if the proposed action will have a significant impact on the environment. The EAW form is developed and “may be altered” by the EQB

chair, thereby offering an opportunity to address current environmental issues including climate change.<sup>22</sup> EAWs are completed by a Responsible Governmental Unit (RGU), as designated in [Minnesota Rules 4410](#). A project requires an EAW when it meets or exceeds predetermined thresholds, as outlined in [Minnesota Rules 4410.4300](#). Projects may be considered exempt from requiring an EAW based on the nature of the project, outlined in [Minnesota Rules 4410.4600](#).

### *Environmental Impact Statement*

An Environmental Impact Statement is prepared when the RGU determines that a project has the potential for significant environmental effects, or when a project exceeds thresholds defined in [Minnesota Rules 4410.2000](#) thereby automatically requiring the preparation of an EIS. This form is “prepared using an interdisciplinary approach that includes the natural, environmental, and social sciences.” The EIS document includes a scoping process during which a scoping EAW is prepared. The scoping EAW is based on the form approved by the EQB Chair.

### *Alternative Urban Areawide Review*

Responsible Governmental Units (RGU) can use an AUAR as a planning tool to understand how different development scenarios will affect the environment of their community before the development occurs. The AUAR is a review process intended to allow the RGU to review several projects within the same geographic location. The questions used on an AUAR form are adopted from the EAW. Again, the EQB Chair can update the EAW form as needed. Further guidance for the AUAR process and content is outlined in [Minnesota Rules 4410.3610](#).

## **Examples of Greenhouse Gas Analysis in Minnesota Environmental Review Documents**

Even though climate change is not currently required to be analyzed through environmental review, there have been environmental review processes completed in Minnesota that incorporated climate change and/or analysis of GHG emissions into the review process. Due to the size and complexity of the environmental review documents, they are provided below to be reviewed at the reader’s discretion.

### **Department of Natural Resources**

[NorthMet Mining Project and Land Exchange – Environmental Impact Statement](#)

[Keetac Mine Expansion Project – Environmental Impact Statement](#)

[Fargo-Moorhead Flood Risk Management Project – Environmental Impact Statement](#)



**Department of Transportation**  
[US Highway 53 – Environmental Impact Statement](#)

**Department of Commerce**  
[Mankato Energy Center Expansion – Environmental Assessment](#)

[Black Dog Unit Six Project – Environmental Assessment](#)

**Pollution Control Agency**  
[Flint Hills Resources Combined Heat and Power \(CHP\) Cogeneration Project – Environmental Assessment Worksheets](#)

[Valero Welcome Plant Production Increase Project – Environmental Assessment Worksheet](#)

[Discussing Greenhouse Gas Emissions in Environmental Review Guidance Document](#)

DRAFT

## Appendix A: SEPA Programs across the United States

STATE & STATE AGENCY <sup>5</sup>	SEPA ENACTED <sup>5</sup>	LEGISLATIVE & EXECUTIVE ACTIONS TO INCORPORATE CLIMATE CHANGE INTO ENVIRONMENTAL REVIEW	HIGHLIGHTS
<b>CALIFORNIA</b> <a href="#">Office of Planning &amp; Research</a>	<b>1970</b> California Environmental Quality Act	<b>2008</b> CEQA & Climate Change <b>2009</b> Environmental Checklist Form (Section VII. GHG Emissions) <b>2010</b> Senate Bill 97 Chapter 185	
<b>CONNECTICUT</b> <a href="#">Office of Policy &amp; Management</a>	<b>1971</b> Connecticut Environmental Policy Act	<b>2004</b> Public Act 04-252 (An Act Concerning Climate Change) <b>2014</b> Taking Action on Climate Change: Progress Report Environmental Review Team Application	
<b>DISTRICT OF COLUMBIA</b> <a href="#">Department of Consumer &amp; Regulatory Affairs</a>	<b>1981</b> District of Columbia Environmental Policy Act	<b>1997</b> Preparation of the Environmental Impact Statement Guidance Document <b>2012</b> Sustainable D.C. Plan	-The guidance document for the EIS form does not require greenhouse gas emissions or climate change analysis. <i>Sustainable D.C.</i> was based on a strong community engagement. -The goals for the city have not been carried over to DCEPA.
<b>GEORGIA</b> <a href="#">Department of Natural Resources</a>	<b>1991</b> Georgia Environmental Policy Act		

<p><b>HAWAII</b>  <a href="#">Office of Environmental Quality Control</a></p>	<p><b>1974</b>  Hawai'i Environmental Policy Act</p>	<p><b>2014</b>  Hawai'i Environmental Policy Act Citizen's Guide  <b>2016</b>  Final Environmental Assessment Report: Proposed Verizon Wireless HI3 Kona Airport Telecommunications Facility</p>	<p>- "...sea level rise and other climate change impacts should also be considered when drafting an EA." (Page 16)  - "...sea level rise and other climate change effects into plans for future development, these impacts should also be considered when drafting an EIS." (Page 18)  - Example EA document shows there is some consideration of climate change and/or greenhouse gas emissions</p>
<p><b>INDIANA</b>  <a href="#">Department of Environmental Management</a></p>	<p><b>1972</b>  Indiana Environmental Policy Act</p>	<p><b>1987</b>  The Indiana Environmental Protection Act; An Environmental Weapon in Need of Repair  <b>2008</b>  Procedure Manual for Preparing Environmental Documents  <b>2008</b>  State Environmental Assessment Form</p>	<p>-Greenhouse Gases and Climate Change: "The EPA has not established [emission standards for CO<sub>2</sub>]. When those standards are established, greenhouse gases will be addressed in more detail..." (Page 91)</p>
<p><b>MARYLAND</b>  <a href="#">State Clearinghouse Review</a></p>	<p><b>1973</b>  Maryland Environmental Policy Act</p>	<p>MEPA Environmental Assessment Form</p>	
<p><b>MASSACHUSETTS</b>  <a href="#">Executive Office of Environmental Affairs</a></p>	<p><b>1972</b>  Massachusetts Environmental Policy Act</p>	<p><b>2010</b>  Revised MEPA Greenhouse Gas Emissions Policy &amp; Protocol  <b>2011</b>  Environmental Notification Form</p>	



<b>MINNESOTA</b> <a href="#">Environmental Quality Board</a>	<b>1973</b> Minnesota Environmental Policy Act	<b>2013</b> Environmental Assessment Worksheet <b>2009</b> Environmental Impact Statement Content Requirements	
<b>MONTANA</b> <a href="#">Environmental Quality Council</a>	<b>1971</b> Montana Environmental Policy Act		
<b>NEW JERSERY</b> <a href="#">Office of Permit Coordination &amp; Environmental Review</a>	<b>1989</b> Executive Order 215		
<b>NEW YORK</b> <a href="#">Department of Environmental Conservation</a>  <b>NEW YORK CITY</b> <a href="#">Mayor's Office of Sustainability</a>	<b>1976</b> State Environmental Quality Review Act  <b>1973</b> Emergency Executive Order 87	<b>SEQRA</b> Full Environmental Assessment Form Part II SEQRA Handbook  <b>CEQR</b> <b>2016</b> Short Environmental Assessment Form Full Environmental Assessment Form CEQR Technical Manual	-The state has developed very clear thresholds of significance which will be uniformly applied to all projects undergoing review. -Both SEQRA and CEQR documents ask targeted questions about greenhouse gas emissions, and provide guidance.
<b>NORTH CAROLINA</b> <a href="#">State Environmental Review Clearinghouse</a>	<b>1971</b> State Environmental Policy Act	<b>1999</b> Environmental Assessment  <b>2015</b> House Bill 795	-No documents recommend or requirements for climate change or greenhouse gas emissions analysis
<b>SOUTH DAKOTA</b> <a href="#">Division of Environmental Services</a>	<b>1974</b> South Dakota Environmental Policy Act		

<b>VIRGINIA</b> <a href="#">Office of Environmental Quality</a>	<b>1973</b> Virginia Environmental Impact Report Procedure	<b>2013</b> Procedure Manual	-The <i>Procedure Manual</i> does not require the environmental impact statement to include any climate change or greenhouse gas emissions analysis
<b>WASHINGTON</b> <a href="#">Department of Ecology</a>	<b>1971</b> State Environmental Policy Act	<b>1994</b> Model Toxic Cleanup Act (MTCA) <b>2008</b> Growth Management Act (GMA)	-MTCA created a threshold to be applied in the environmental review process. -GMA and MTCA both have amended the SEPA process.
<b>WISCONSIN</b> <a href="#">Department of Natural Resources</a>	<b>1971</b> Wisconsin Environmental Policy Act	N/A	

DRAFT

## **Appendix B: Minnesota State Agency Publications**

### **Interagency Publications**

[Adapting to Climate Change in Minnesota](#)

### **Department of Health: Climate and Health**

[Minnesota Climate and Health Profile Report 2015: An Assessment of Climate Change Impacts on the Health & Well-Being of Minnesotans](#)

[Incorporating Health and Climate Change into the Minnesota Environmental Assessment Worksheet](#)

[Minnesota Climate Change Vulnerability Assessment](#)

### **Department of Natural Resources**

[Climate Change and Renewable Energy: Management Foundations](#)

### **Department of Commerce**

*n/a*

### **Department of Agriculture**

*n/a*

### **Pollution Control Agency**

[Minnesota Climate Change Action Plan: A Framework for Climate Change Action](#)

[Greenhouse Gas Emissions in Minnesota, Biennial Legislative Reports](#)

[Discussing GHG Emissions in Environmental Review](#)

[Minnesota Climate Change Advisory Group Final Report](#)

[Final Minnesota Greenhouse Gas Inventory and Reference Case Projections 1990-2025](#)

[Greenhouse Gas Emissions in Minnesota, Technical Support Document](#)

### **Permits**

[General Guidance for Carbon Footprint Development in Environmental Review](#)

[Annual Air Monitoring Network Plan for Minnesota](#)



## **Environmental Quality Board**

[Minnesota and Climate Change: Our Tomorrow Starts Today](#)

[Minnesota Environmental and Energy Report Card](#)

## **Department of Transportation**

[MnDOT Flash Flood Vulnerability and Adaptation Assessment Pilot Project](#)

## **Board of Water and Soil Resources**

[Carbon Sequestration in Wetlands](#)

[Climate Change Trends and Action Report](#)

[Native Vegetation Establishment and Enhancement](#)

[Managing Private Land for Climate Change](#)

## **Metropolitan Council**

[Land Use and Planning Resources Report](#)

[Regional Benchmarks: Measuring Our Progress](#)

[Metropolitan Agricultural Preserves Program Status Report](#)

[Climate Change Mitigation, Adaptation & Resilience: Proposed Policy Direction](#)

[Thrive MSP 2040 Policy Discussion Outline Climate Change](#)

[Community Development Committee 2015 Work Plan for Climate Change Initiative](#)

## Appendix C: Endnotes

---

- <sup>1</sup> Caldwell, Lynton K. "Beyond NEPA: Future Significance of the National Environmental Policy Act." *The Harvard Environmental Law Review* 22 (1998): n. page. LexisNexis Academic. 1998 President and Fellows of Harvard College, 1998. Web.
- <sup>2</sup> "The Council on Environmental Quality-About." Council on Environmental Quality. The White House, n.d. Web.
- <sup>3</sup> Rezmuel, G. "CEQ Published NEPA-EMS Guide." Council on Environmental Quality, February 2010. Web.
- <sup>4</sup> USA. Council on Environmental Quality. *DRAFT NEPA GUIDANCE ON CONSIDERATION OF THE EFFECTS OF CLIMATE CHANGE AND GREENHOUSE GAS EMISSIONS*. N.p.: n.p., n.d. 11. Web.
- <sup>5</sup> "CEQ Releases Final Guidance on Greenhouse Gases and Climate Change." *The White House*. The White House, n.d. Web. 05 Sept. 2016.
- <sup>6</sup> The Council on Environmental Quality. "DRAFT Published for Public Review and Comment Dec 2014." The White House, Dec. 2014. Web.
- <sup>7</sup> 2012 CEQ doc page 4
- <sup>8</sup> 2012 CEQ doc page 15
- <sup>9</sup> 2012 CEQ doc page 14
- <sup>10</sup> Sive, David, and Mark A. Chertok. "'Little NEPAs' and Their Environmental Impact Assessment Procedures." Sive, Paget & Riesel, P.C., June 2005. Web.
- <sup>11</sup> "State NEPA Contacts." Council of Environmental Quality, 2013. Web.
- <sup>12</sup> Montana State Senate. "Improving the Montana Environmental Policy Act (MEPA) Process." Montana 64th Session. Senate Joint Resolution No. 18: Chapter 5. State of Montana, 2008. Web.
- <sup>13</sup> Governor's Office of Planning and Research. "Technical Advisory: CEQA AND CLIMATE CHANGE: Addressing Climate Change through California Environmental Quality Act (CEQA) Review." Office of Planning and Research, 2008. Web.
- <sup>14</sup> "Introducing Federal National Environmental Policy Act Practitioners to The District of Columbia Environmental Policy Act Process." DOE.gov. Department of Energy & Environment, 2015. Web. page 1
- <sup>15</sup> See *Sustainable D.C. Plan*
- <sup>16</sup> USA. Washington D.C. *Sustainability DC*. N.p.: n.p., 2013. 10. Print.
- <sup>17</sup> Council on Environment. "Introducing Federal National Environmental Policy Act Practitioners to The District of Columbia Environmental Policy Act Process." Web.
- <sup>18</sup> See *Sustainable D.C. Progress Report*
- <sup>19</sup> USA. Executive Chambers Honolulu. *Act 286*. Honolulu: n.p., 2012. Print.
- <sup>20</sup> See <http://www.mass.gov/eea/agencies/mepa/about-mepa/statute-and-regulations/11-02-definitions.html>
- <sup>21</sup> See <https://malegislature.gov/Laws/GeneralLaws/PartI/TitleIII/Chapter30/Section61>
- <sup>22</sup> See <https://www.revisor.mn.gov/rules/?id=4410.1300>