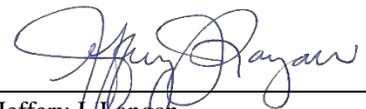


ENGINEER'S FEASIBILITY REPORT  
Shamineau Lake Outlet Investigation  
Morrison County  
Motley, Minnesota  
January 23, 2018

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.



---

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Minn. Lic. No. 22805

Date: 01/23/2018

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HEI Project R179276-001

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Shamineau Lake Outlet Investigation  
Motley, Minnesota  
January 23, 2018

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# I. INTRODUCTION

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## A. Project Description

The purpose of this project is to establish a maximum operating level of Shamineau Lake for economic and natural resource benefits. This can be accomplished by managing the high-water levels of Lake Shamineau at an elevation that protects riparian property interests and supports a healthy natural resource environment. The need for the project is to significantly reduce future property damages, shoreline and riparian damages, reduce property owner costs, and provide more efficient strategic planning abilities for the LID, County and State.

The proposed project concept involves the construction of a permanent outlet for Shamineau Lake. Shamineau lake is located in a closed watershed basin and during the current wet hydrologic cycle, has been subject to rising and historic high water levels. An increase in lake level has negatively affected properties and landscape around the lake with many property owners reporting shoreline and structural damages due to the high water levels. See **Exhibit A** for a breakdown of the damages. A project location map within Morrison County is shown in **Figure 1**.

The proposed project concept establishes a permanent outlet for Shamineau Lake and was initiated by the Shamineau Lake Improvement District (LID). Details for the improvement project including project costs, purpose and needs, practicability, and feasibility will be summarized and displayed in this report.

# I. INTRODUCTION

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**Figure 1 - Site Location Map (Morrison County)**

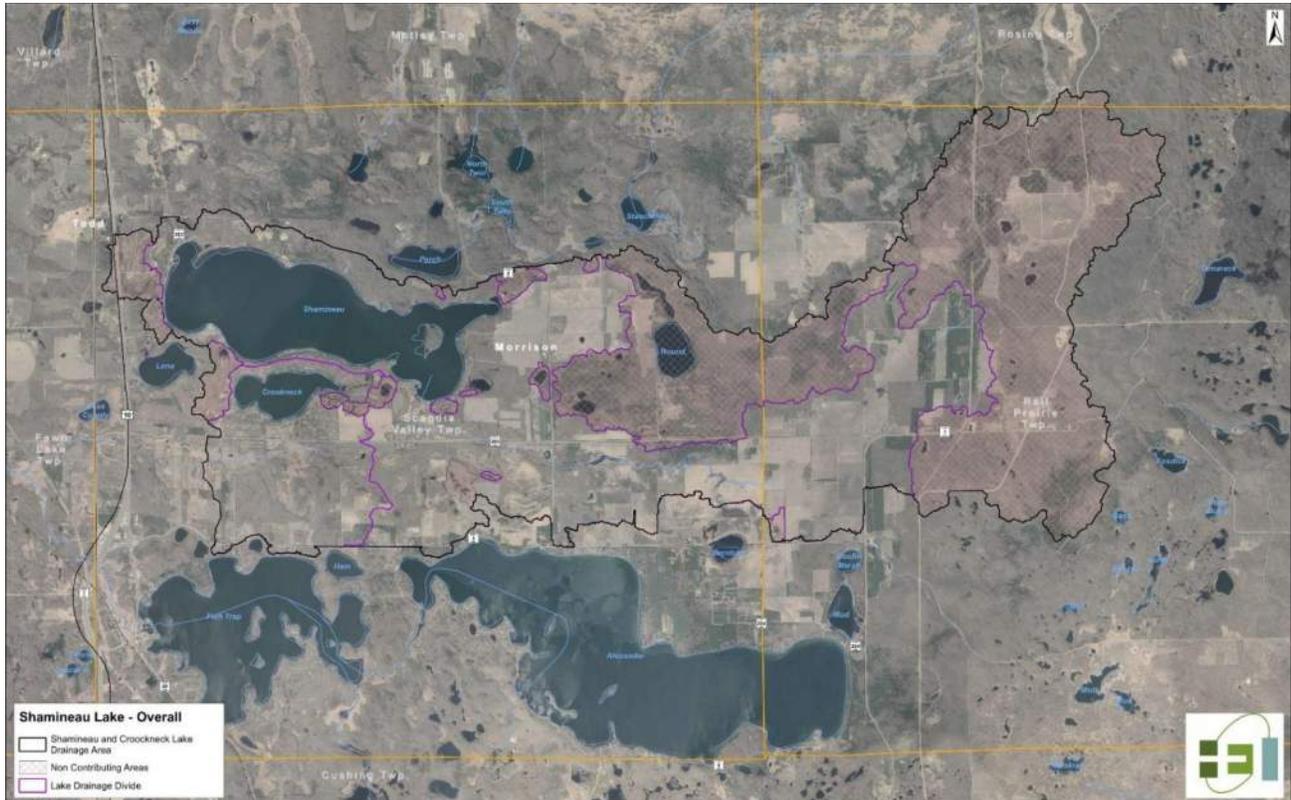
## 1. Benefits

The proposed drainage system improvements to Shamineau Lake will provide the following flood damage reduction benefits: 1) increase the capacity and efficiency of the outlet for Shamineau Lake (Alt 2 & 3), 2) increase the capacity of existing original drainage upstream and downstream of US 10 (Alt 3), 3) reduce lake bounce duration and magnitude (Alt 2 & 3), 4) significantly reduce the frequency of high lake stages exceeding the Ordinary High Water (OHW) elevation of Shamineau Lake causing physical damages to riparian land including wildlife habitat and residential/commercial/public properties (Alt 2 & 3), 5) improve effectiveness of lake shore land use management and planning (Alt 2 & 3), 6) reduce lake shore erosion (Alt 2 & 3), 7) increase the predictability of US 10 hydraulic operations (Alt 3), 8) improve the

# I. INTRODUCTION

general management efforts, operation and maintenance of the system (Alt 2 & 3).

The total contributing drainage area to Shamineau Lake is approximately 11.91 square miles. The concepts developed for the improvement project are included herein as **Exhibit B** of this report. **Figure 2** below displays the total drainage area boundary for Shamineau Lake.



**Figure 2 - Shamineau Lake Drainage Area**

## B. Hydrologic and Hydraulic Data

Shamineau Lake is located in a closed watershed basin, has a water surface area of 2.24 sq. mi., and has a contributing drainage area of 11.91 sq. mi.. A natural outlet does not exist for Shamineau Lake so the lake relies on groundwater movement, evaporation, and evapotranspiration to maintain or lower the Water Surface Elevation (WSE). During the more recent wet hydrologic cycle, inflows from runoff and

# I. INTRODUCTION

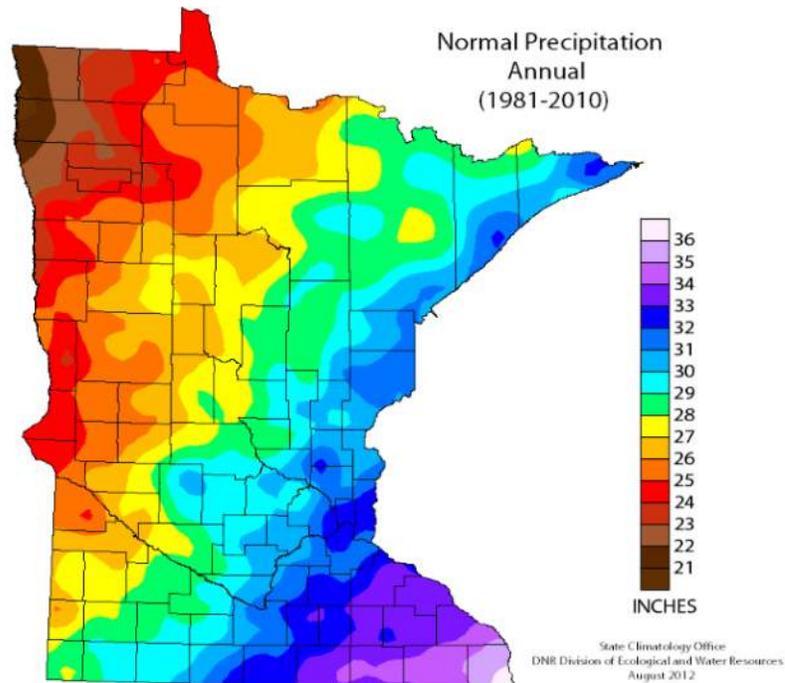
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groundwater have exceeded the outflows and have caused Shamineau Lake’s sustained WSE to rise.

## 1. Hydrologic Conditions

The normal precipitation annual (1981-2010) for the Shamineau Lake drainage area is 27.24” based on **Figure 3** provided by the DNR State Climatology Office. The measured average annual precipitation from the Brainerd Crow Wing County Airport for the same timeframe is 28.24”. Since the early 1990s, notably the last 5 to 19 years, higher than normal precipitation has occurred and based on measurements from the Brainerd Crow Wing County Airport, the average annual precipitation since 1991 has been just over 30”.

1991-2016	2007-2016	2011-2016	2012-2016
30.05	32.49	33.49	34.31



**Figure 3 - Normal Precipitation Annual (1981-2010)**

# I. INTRODUCTION

The drainage patterns south of CR 203 and east of Shamineau Lake have been taken into consideration for this report. **Figure 4** and **Figure 5** display the drainage patterns for those locations.

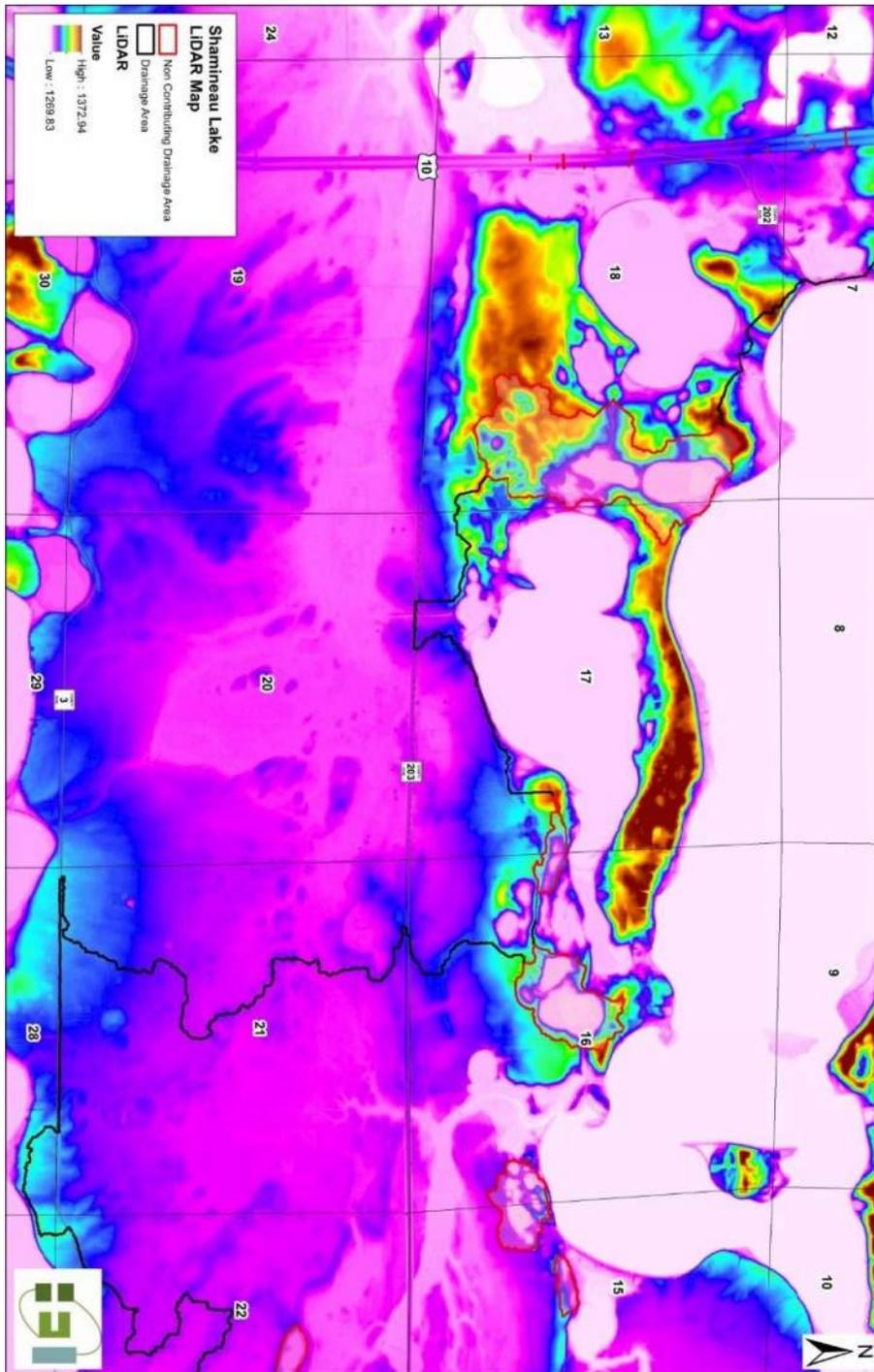


Figure 4 - LiDAR Map (Zoomed In)

# I. INTRODUCTION

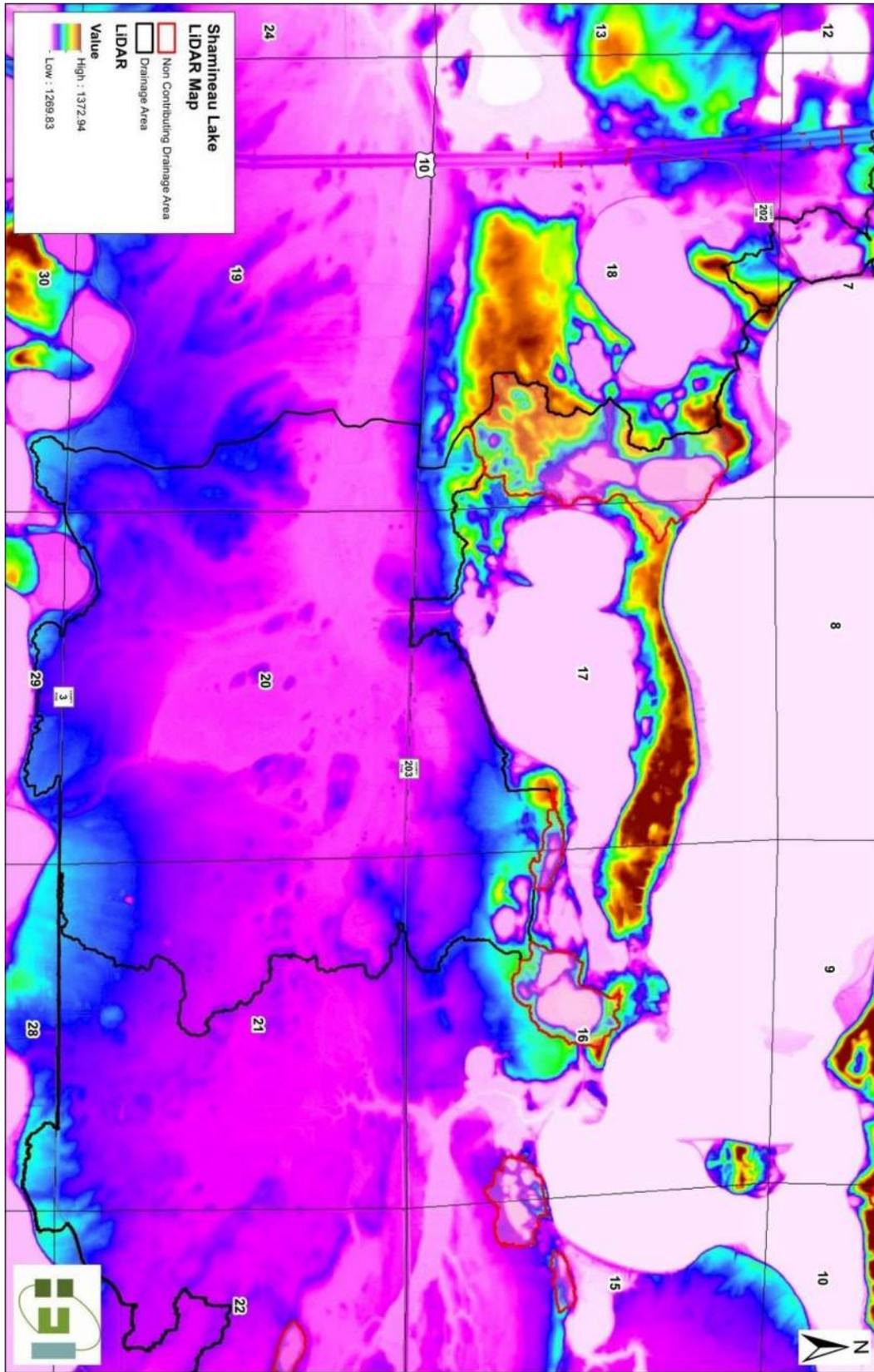
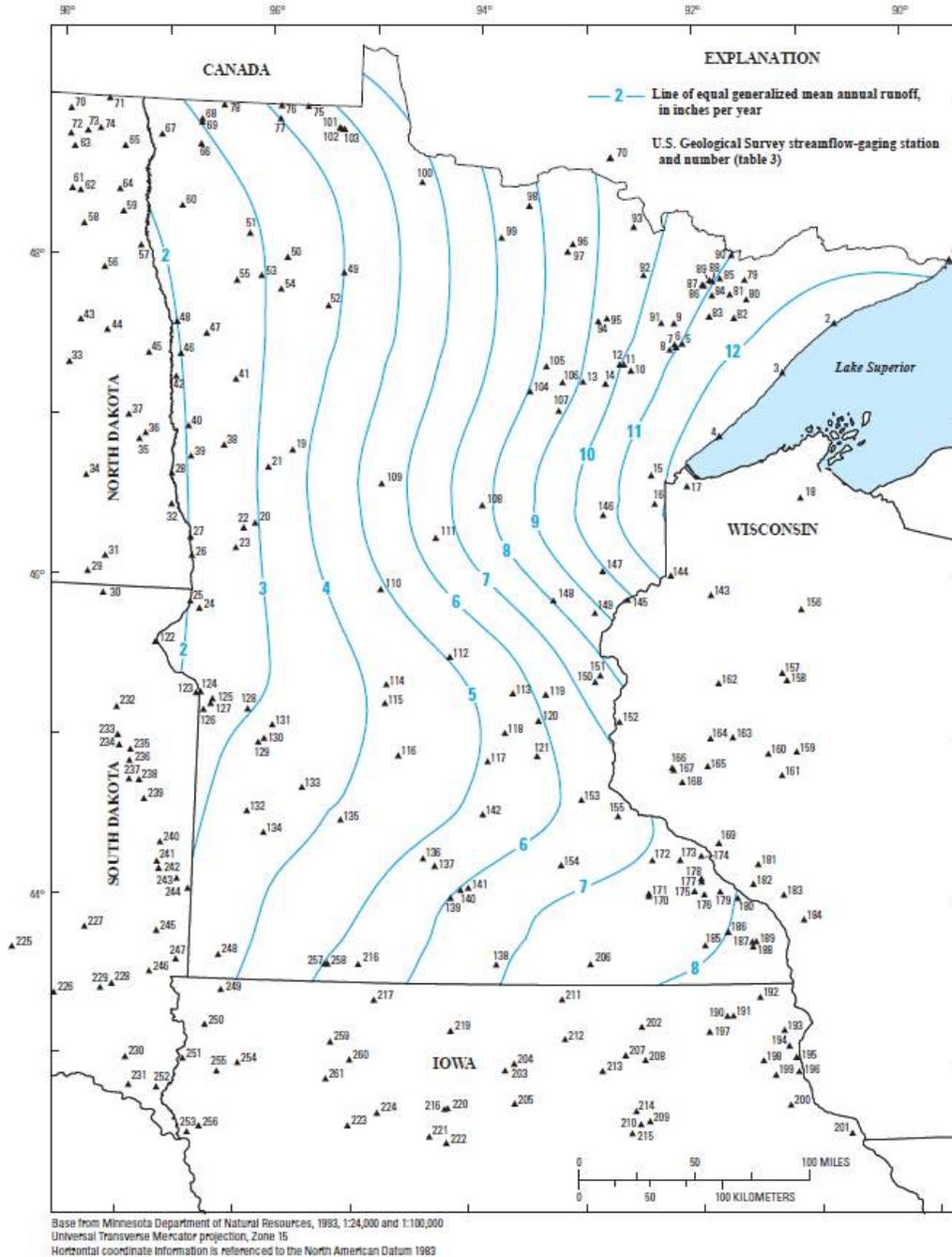


Figure 5 - LiDAR Map (Zoomed Out)

# I. INTRODUCTION

The generalized mean annual runoff for the Shamineau Lake drainage area is 6.01” based on **Figure 6** from the Techniques for Estimating the Magnitude and Frequency of Peak Flows on Small Streams in Minnesota Report.

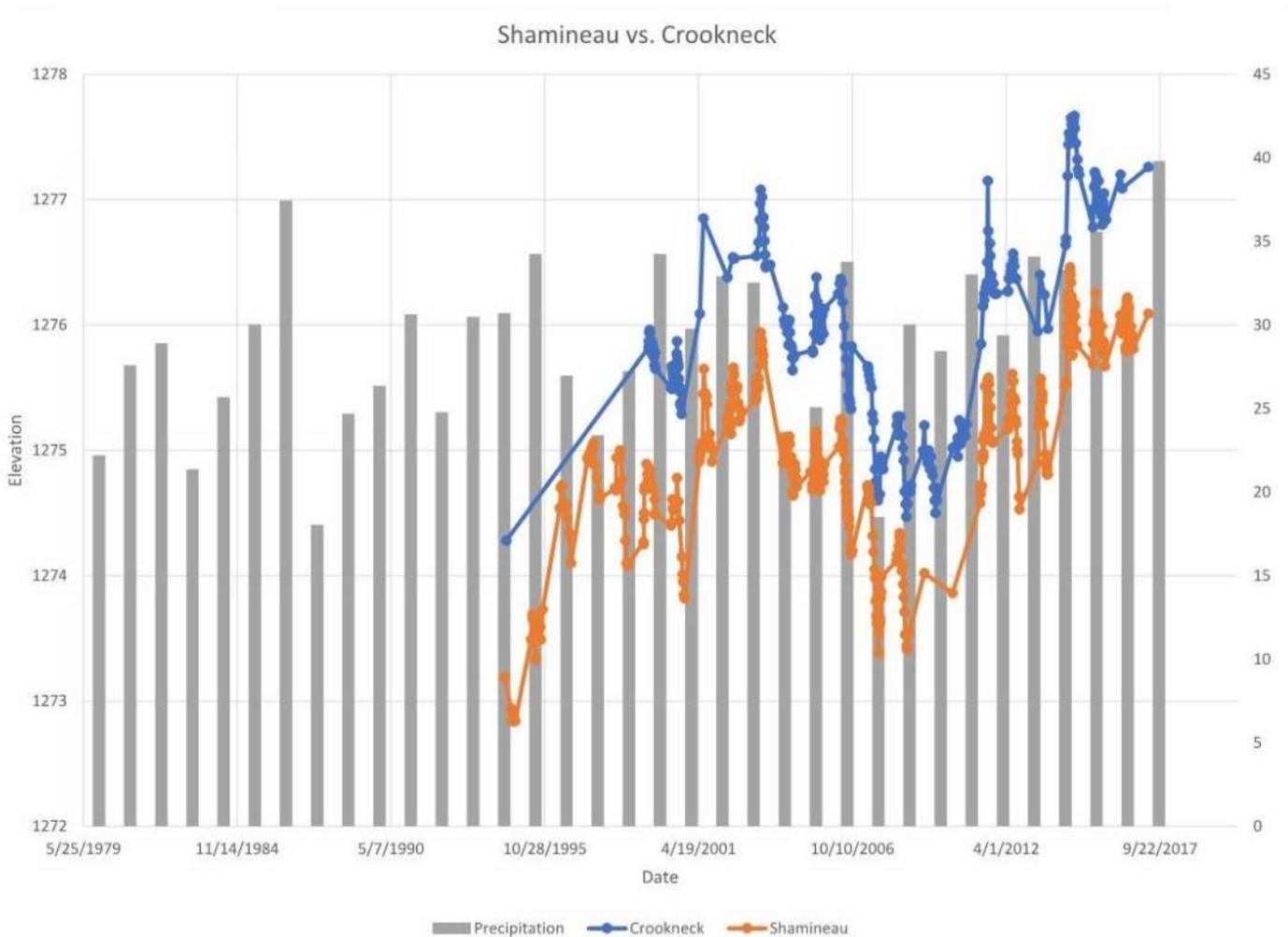
## 6 Techniques for Estimating the Magnitude and Frequency of Peak Flows on Small Streams in Minnesota



**Figure 6 - Generalized Mean Annual Runoff**

# I. INTRODUCTION

Crookneck Lake is located just to the south of Shamaineau Lake. A correlation between the WSE's of the two lakes has been observed through the comparison of lake elevation data. The data ranges from 1999 -2017 and shows that Crookneck Lake's WSE ranges from 0.81 ft to 1.60 ft above Shamaineau Lake's WSE with an average of 1.12 ft higher. As of August 1, 2017, the elevation difference is 1.13 ft. **Figure 7** below shows the correlation between the two lakes WSE's.



**Figure 7 - Lake Elevation Comparison (Shamaineau vs. Crookneck)**

Altered hydrologic patterns immediately south of Shamaineau and Crookneck

# **I. INTRODUCTION**

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Lakes were identified which appear to conflict with understood drainage area boundaries. The unnatural runoff contribution to these lakes inflows has an impact on lake levels and should be addressed. The altered hydrology appears to be ditching, road/trail grades without culverts, existing culverts set at high grades, and blocked drainage ways due to historic standing water with limited flows. It is understood that addressing these altered hydrology issues will reduce the total volume of water required to be discharged from Shamineau Lake; however, will likely have a minor impact on sustained high lake levels.

Interests regarding redirecting inflows to Shamineau Lake in the SE corner of the lake have been expressed to reduce inflows to the lake and reduce a contributing source of the high water levels on the lake. This issue will be addressed during the permitting process through state and federal wetland and waters interests, as well as Morrison County Planning. However, it is our experience that diverting the flow of natural watercourses is a difficult project type to process permitting. Therefore, the calculations used to estimate the outlet discharge includes the identified natural drainage area boundaries exhibited on current and available contour and planning maps.

## **2. Hydraulic Performance**

Several factors were looked at when determining the preliminary design outflow (20 cfs) to draw down and maintain Shamineau Lake's WSE to a preliminary target elevation of 1274.1 or 1.0 foot below the OHW of 1275.1. The need to draw down the lake to a target elevation of 1274.1 and the ability to maintain the WSE at desired levels were taken into consideration. For pumping operations, outflows would be allowed depending suitable downstream conditions. Discharge operations would be terminated

## **I. INTRODUCTION**

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during critical times of downstream highwater, or other identified impacts of concern. A cursory water balance study was developed using the generalized mean annual runoff for the contributing drainage area and the average annual precipitation for the surface area of Shamineau Lake. An outflow of up to 12 cfs is required to maintain the same WSE.

Using a conservative assumption that no other outflows such as groundwater or evaporation are considered, pumping at 20 cfs for 180 days would likely lower Shamineau Lake from the current WSE of 1276.09 to the target elevation of 1274.1. This operation would remove approximately 930 million gallons of water from Shamineau Lake.

## **II. RECOMMENDED SOLUTIONS TO ALLEVIATE EXISTING FLOODING AND DRAINAGE PROBLEMS**

A review of the historic and recent problems being experienced with Shamineau Lake indicate that a majority of the reported and documented problems appear due to the wet hydrologic cycle, the lake not having an operational outlet, and ultimately an uncontrolled increase in water surface elevation (WSE) of the lake. The problems appear related to an increase in WSE above those desired by the property owners around Shamineau Lake. A new outlet structure and pumping station is proposed to drawdown and maintain the lake at a lower maximum WSE. The proposed new outlet structure and drainage piping will provide for improved and adequate hydraulic capacity and improved economic and natural resource value to the lake.

Preliminary alternative alignments are included as **Exhibit B** to this report provide a graphical representation of the recommended solutions necessary to correct the drainage system deficiencies identified.

### **III. EVALUATION OF ALTERNATIVE SOLUTIONS**

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Four alternatives were considered for this project. The below descriptions are intended to provide the information related to the alternatives considered. They are as follows:

- 1) Do Nothing
- 2) Northeast Bound Outlet
- 3) Southwest Bound Outlet
- 4) Property Buyout

A. Alternative No. 1: Do Nothing

This alternative involves the completion of no work or a No Build designation. The problems identified with high WSE's on Shamineau Lake and the damaging effects it has on the shoreline riparian features would remain. There would continue to be a lack of freeboard provided for significant rainfall or spring runoff events. This could cause significant damages to all riparian properties including, but not limited to, structural damages, septic system damages, water supply damages, loss of beaches and usable lakeshore, loss of mature growth trees, vegetation and landscape. The problems appear to be related to a lack of or inexistence of an adequate outlet causing excessive lake level bounce, excessive high lake levels and durations. The natural outlet to Shamineau Lake is to the southwest likely through Lena Lake. The natural outlet runout elevation would have likely been at 1280.0, but due to the construction of roads and other landscape alterations, now occurs around elevation 1285.0. Significant damages would be expected should Shamineau Lake reach the original natural runout elevation of 1280.0. This damage may not only be limited to structures, but high water levels and bounce would also be destructive to nesting habitats for riparian species. Private septic treatment systems (STS) and wells are currently being impacted and at a high risk of failing. Failure

### **III. EVALUATION OF ALTERNATIVE SOLUTIONS**

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would not be solely reflected in service, but potential contamination of the lake water and groundwater. Public roads, utilities, and other public infrastructure would be in a condition of likely imminent future flooding hazards affecting the safe and efficient operation by the public. If the water would continue to rise to the current outlet or runoff elevation, it could rise another 6 or 7 feet prior to discharging. However, due to the resulting obvious significant damage this highwater would impart on homes, roads, shoreline, and other natural resources prior to reaching these levels, it is anticipated that the water would be lowered under emergency discharge conditions to minimize these damages. Lake outlet projects can take up to three years or more to complete from the conceptual design phase to the operations phase. Therefore, it is difficult to conduct emergency discharge operations without a thoughtful and well-planned outlet project and operating plan. This presents the following planning scenario requiring a decision from the LID Board and community; be proactive and prevent imminent major future damages through a methodical planning process or delay decisions until apparent major damages are occurring and are widespread, and then proceed through an abbreviated and expedited project process under emergency conditions. A deliberate, methodical, and planned outlet project prior to apparent and imminent widespread major flooding damages provides for the most effective problem solving and planning. Most successful projects are not developed under emergency conditions. Proceeding with a project at this time on Lake Shamineau will provide benefits related to construction and operating costs, minimized environmental impacts, and efficiency in current and long-term operations.

The funding assistance scenario appears favorable in the State of Minnesota at the current time. FDR monies may be available in 2018 to supplement local costs. In

### **III. EVALUATION OF ALTERNATIVE SOLUTIONS**

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addition, interest rates and inflation will likely increase in future years, which will correlate into increased project costs. Considering all of these factors the Do Nothing or No Build Alternative is not considered a reasonable or practicable alternative.

B. Alternative No. 2: Northeast Bound Outlet

Alternative 2 proposes the construction of an outlet to the northeast of Shamineau Lake. The proposed project limits extend from a point near the shoreline of the NE part of Shamineau Lake and within the S 1/2 Section 10, T132N, R31W (Scandia Valley Township) and proceeds northeasterly into Stanchfield Lake. From there it flows north and then northeasterly before outletting into Lake Placid in the SW 1/4 Section 30, T133N, R30W (Rosing Township). The proposed project includes the installation of a new lake outlet structure and pumping station near Shamineau Lake immediately adjacent to the shoreline at the northeast part of the lake. From the pumping station, installation of drainage piping will take water to the northeast through a ridge to the location of a pipe outfall structure. A natural tributary to Stanchfield Lake will convey flows to Stanchfield Lake and ultimately to Lake Placid. The proposed project alignment and drainage area are shown in **Exhibit B**.

The DNR has expressed preliminary concerns regarding discharging flows from Shamineau Lake through Stanchfield Lake due to sensitivity issues through their fisheries program.

Alternative 2 requires a significant amount of pipe boring through the natural ridge that has a top elevation of 1356.0. It also proposes to convey flows through a corridor which has not historically existed. This alternative will provide freeboard for flooding rainfall events. Alternative 2 is currently considered to be the most expensive

### **III. EVALUATION OF ALTERNATIVE SOLUTIONS**

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construction alternative and further analysis will not be carried forward at this time.

Alternative 2 is not considered as the most practicable alternative, and therefore not recommended

C. Alternative No. 3: Southwest Bound Outlet

Alternative 3 proposes the construction of an outlet to the southwest of Shamineau Lake. The proposed project limits extend from a point near the shoreline of the SW part of Shamineau Lake and within the S 1/2 Section 7, T132N, R31W (Scandia Valley Township) and proceeds southwesterly along the north side of Aztec Road/ 340<sup>th</sup> Street towards Highway 10. The force main then crosses under 340<sup>th</sup> Street and heads south along the East side of Hwy 10 until the ground slopes south. An outfall structure will be placed near this point that will allow water to flow in a proposed constructed ditch heading south for about half a mile until it crosses under Hwy 10. From there it flows west through US 10 into the SE 1/4 Section 13, T132N, R32W (Fawn Lake Township) in Todd County and continues to flow to the southwest into Section 24, T132N, R32W (Fawn Lake Township) where it joins Fish Trap Creek and Todd CD 41, a tributary to the Long Prairie River. Fish Trap Creek is the outlet for Fish Trap Lake and has adequate flow capacity to accommodate design outflows from the proposed project. A preliminary plan and profile is shown in **Exhibit C**.

The proposed project includes the installation of a new lake outlet structure and pumping station near Shamineau Lake immediately adjacent to the shoreline at the southwest part of the lake. From the pumping station, installation of drainage piping will take water westerly along Aztec Road and then turn south along highway 10 to the location of a pipe outfall structure. A combination of existing ditch and a proposed ditch

### **III. EVALUATION OF ALTERNATIVE SOLUTIONS**

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segment will convey flows from the outfall structure to the pipe crossing under highway 10. This proposed project alignments for the southwest bound outlet and drainage area is shown in **Exhibit C**.

Alternative 3 currently has the least known opposition from the public and agencies affected by the outlet investigation. This alternative will also provide freeboard for future excessive flooding rainfall events. Considering the items presented, Alternative 3 provides the best known alternative serving the project purpose and needs identified.

Upon review of the known practical alternatives and consideration of the purpose and needs issues identified by the LID Board associated with the high water levels on Shamineau Lake it was determined by the Engineer that Alternative 3 best serves the overall interests identified by the Shamineau Lake LID and best serves the natural resource interests within the drainage area.

A potential project timeline reflecting Alternative 3 is as follows:

- Approval to proceed from governing bodies – June 2018
- Environmental review and permitting – July 2018 through July 2019
- Right of way proceedings – December 2018 through July 2019
- Engineering and Contract Documents – July 2018 through August 2019
- Construction operations – September 2019 through September 2020
- Operations – September 2020

#### **D. Alternative No. 4: Property Buyout**

Alternative 4 proposes the buyout of impacted riparian properties. The most likely properties to be purchased initially would be along the south and west shoreline of Lake Shamineau. Based on a cursory analysis, it appears there are approximately 80 residences

### **III. EVALUATION OF ALTERNATIVE SOLUTIONS**

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and commercial properties which would be inundated by flood water if the lake rises two additional feet from the November 2017 elevation; or from elevation 1276.0 to elevation 1278.1. Assuming these properties are valued at an average of \$200,000 each, the total buyout cost would be \$16 million. The costs associated with a property buyout alternative greatly exceeds the other alternatives considered. It is also noted that no property owners have approached the LID Board or Association requesting they pursue a buyout. This issue leads us to believe that this alternative would likely not be supported by the LID membership, causing divisive negotiations and conflicts during the buyout process. In addition, this option will not provide for any of the benefits listed on page I-2 or assist with the overall project goal, purpose or need.

This alternative would not address excessive lake level bounce, which would have a continued negative effect on remaining properties, riparian habitat (nesting), shoreline stabilization, erosion, water quality, and other riparian natural resource features. A property buyout does not address continued rising lake levels beyond these initial 80 properties. Therefore, this alternative is not considered a permanent solution, compared to an outlet project (i.e. Alternatives 2 and 3).

Property buyouts would reduce tax base in the county, township, and LID, placing higher tax burdens on remaining properties.

It has been noted at public meetings that buying out riparian properties along Lake Shamineau could provide additional floodplain storage capacity which could reduce lake levels in the future. This concept generally applies to watercourses and not closed basins of this size. Considering the hydrologic characteristics of the Lake Shamineau Watershed, buying out riparian properties will have negligible effects on lake levels

### **III. EVALUATION OF ALTERNATIVE SOLUTIONS**

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under any hydrologic conditions. Pre-settlement conditions which established the natural characteristics of the ecosystem of Lake Shamineau were disturbed when the original trails, roadway, utilities and other development occurred over the past century. Numerous issues have affected the ability for Lake Shamineau to maintain a highwater level consistent with presettlement conditions. Property buyouts will have negligible impact on restoring pre-settlement conditions related to highwater impacts.

This alternative is not being further pursued as a reasonable or practicable option due to the excessive cost and the lack of permanence of the solution. This alternative does not address the imminent future flood damages resulting from the continued increase of the high water levels.

## **IV. COMPATABILITY WITH EXISTING PLANS AND ENVIRONMENTAL INTERESTS**

---

### A. Agency Permits

#### 1. Local

Scandia Valley Township, Fawn Lake Township, Morrison County, and Todd County (including County Agencies) will be given an opportunity to review the plans of the proposed improvements. They may also require permits. During a conceptual planning meeting conducted with local agencies, no known significant impacts related to the proposed project concept were identified by the referenced counties (agencies) and townships.

No known significant impacts were identified at the planning meeting by attending county agencies.

No documented or known environmental or county utility interests appear to be significantly impacted by the proposed project.

Further investigation regarding county environmental and utility permitting will be required upon completion of the conceptual planning phase of this project.

Todd County Ditch 41 may require coordination related to introducing a controlled addition to the drainage area of CD 41. A redetermination of benefits may result.

#### 2. State

The Department of Natural Resources (waters, wildlife, fisheries, other), WCA Technical Evaluation Panel (TEP) representatives, MPCA, SHPO, MnDOT and other potential state agencies will likely influence a potential project in both operation and details. A MnDNR Waters Permit will be required. Local TEP

## **IV. COMPATABILITY WITH EXISTING PLANS AND ENVIRONMENTAL INTERESTS**

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involvement will likely be required regarding the MN WCA interests. A Stormwater Pollution Prevention Plan (SWPPP) will need to be developed and a permit will be required from the Minnesota Pollution Control Agency, since construction activities will disturb more than one acre of land. In addition, invasive species will likely need to be addressed through both MPCA and MnDNR.

No known significant impacts were identified at the planning meeting by attending state agencies.

No documented or known environmental or state utility interests appear to be significantly impacted by the proposed project.

Further investigation regarding state environmental and utility permitting will be required upon completion of the conceptual planning phase of this project.

### 3. Federal

The US Army Corps of Engineers (USACOE) Section 404 permit may be required for this Improvement Project. No fill will be placed in wetland areas. There are no known federally listed endangered or threatened species that will be impacted by the project. However, the USACE permit will likely identify any unknown endangered or threatened species requirements. No other federal permits are anticipated.

No known or documented archaeological or historical sites eligible for the national register exist within the project area. However, if necessary, further studies may be conducted to verify that there are no unreported sites that will be affected by the project. The formal permit process will be executed upon

#### **IV. COMPATABILITY WITH EXISTING PLANS AND ENVIRONMENTAL INTERESTS**

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completion and approval of the conceptual planning phase of the potential project.

##### **B. Conformance with Existing Water Management Plans**

The proposed project is consistent with the goals and objectives of the Morrison County Comprehensive Local Water Management Plan. The plan expresses concern with the spread of invasive species, flooding around Lake Shamineau, installation of buffers, and bank stabilization.

Todd County Comprehensive Local Water Management Plan has not been directly associated or reviewed relative to this project, but it is anticipated with requirements can be efficiently addressed through design methods and operating plan.

The proposed project is consistent with the goals and objectives of the Shamineau Lake Management Plan. The plan expresses concern with the spread of invasive species and restoration of shoreline.

## **V. EVALUATION OF SOCIAL, ECONOMIC AND ENVIRONMENTAL IMPACT OF THE PROJECT**

---

### A. Economic Analysis of Private and Public Benefits and Costs of the Project

#### 1. Shamaineau Lake

Lakeshore owners and recreational users will be provided improved shoreline management benefits. Improved planning efforts will be realized by establishing a consistent maximum operating lake level. This will reduce damages from flooding and shore erosion, stabilize and manage the shoreline of the lake for economic benefit, and stabilize the riparian area and shoreline for aquatic and wildlife habitat benefits. Private property, including residential and commercial benefits will experience direct benefits through an increase in the system's outlet capacity by reducing existing and future expenses related to flood damage. See **Exhibit D** for summary of private property owner repair, maintenance and mitigation expenses related to floodwater.

#### 2. Project and Operation Costs

The preliminary opinion of probable project cost for the improvement project described in this report is as follows:

<b>Proposed Improvements</b>	<b>Approximate Construction Cost</b>	<b>Other Costs</b>	<b>Total Cost</b>
Shamaineau Lake Outlet Improvement Project	\$2,310,000	\$440,000	\$2,750,000

Other costs include design and construction engineering, permitting, surveying, soils investigation, administration, legal, right of way acquisition proceedings, funding processing and other miscellaneous costs

### B. Cursory Environmental Review

## V. EVALUATION OF SOCIAL, ECONOMIC AND ENVIRONMENTAL IMPACT OF THE PROJECT

---

Various environmental concerns were taken into consideration while developing the proposed project. The main concern is the invasive species Eurasian Water-Milfoil that has invaded Shamineau Lake. To prevent the spread of invasive species, a screen or mechanical filter will be utilized in the pumping station to ensure no transfer of invasive species to downstream receiving waterbodies. **Exhibit E** contains maps showing the locations of various environmental interests along the project corridor.

A cursory water quality assessment was conducted for Alternative 3 on water bodies and water courses that could potentially be impacted by the project. The waters investigated include: Shamineau Lake, Lena Lake, Cass County Lake, Fish Trap Creek, Long Prairie River and Crow Wing River. The water quality assessment compares the lake water quality in Shamineau Lake to the downstream waterbodies and determines if the water quality will degrade due to water from the lake. If the water quality of the water in Shamineau Lake is better than the water quality in the downstream waterbodies and/or if the water quality is lower than numeric water quality standards, it will be determined that the water quality downstream will not degrade. For this analysis, total phosphorus, chlorophyll-a, dissolved oxygen, total suspended solids, and Secchi Disk were compared.

The overall findings from the water quality assessment is water from Shamineau Lake should not directly impact the water quality in the downstream reaches. The water quality in Shamineau Lake is either better than the water quality in downstream reaches or meets the water quality standards of the constituents analyzed.

### C. Effects of the Project on Water Quality

The occurrence of an extreme runoff condition during project construction should not cause an increased sediment load into downstream channels or Shamineau Lake.

## **V. EVALUATION OF SOCIAL, ECONOMIC AND ENVIRONMENTAL IMPACT OF THE PROJECT**

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Minimal changes to land use and cover type will result from the project. When the project is completed, the sediment load to receiving waterbodies from the project will not likely be increased from pre-project conditions. Erosion reduction techniques have also been incorporated into the project design, including riprap at the outfall structure and stabilize overflow structures at various waterbodies downstream. Erosion problems caused by high lake levels and overland flows will be reduced.

Shamineau Lake is on the 2017 Impaired Waters List for Hgf (mercury in the fish tissue) Impairments. There is a current Total Maximum Daily Load (TMDL) for Shamineau Lake related to this impairment. However, the construction and operation of the improvement project is not expected to have a positive or negative effect on the identified water quality impairment. In addition, there does not appear to be practical project feature that could be added as part of the project to address the mercury impairment.

The improvement project outlet point on Lena or Cass County Lake is not identified or listed on the 2017 Impaired Waters.

### **D. Effects on Fish and Wildlife Resources**

The lake outlet project will stabilize maximum lake levels and reduce the frequency and magnitude of the lake level bounce. The reduction in bounce will have a significant effect on habitat diversity and stability within the riparian area of the lake. Loons are a highly valued species of wildlife within the state but primarily understood as a treasured species by residents of Lake Shamineau. It is believed that the Loon population has been reduced in the past years, and it is understood locally to be a result of the highwater conditions. It is understood that stable water levels during the nesting

## **V. EVALUATION OF SOCIAL, ECONOMIC AND ENVIRONMENTAL IMPACT OF THE PROJECT**

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season is a critical element to the successful reproduction rates of eggs/birds who nest within riparian areas. Therefore, the lake outlet project will provide a significant improvement to the successful nest season of the Loons and support their sustainability and population on Lake Shamineau.

Relative to the fishery, the lake outlet project proposes to incorporate screens and mechanical filter at the pumping station to prevent invasive species and fish passage from traveling downstream. It is assumed that fish passage prevention will benefit the fishery interests of Shamineau Lake as well as Fish Trap Lake.

### **E. Overall Environmental Impact**

It appears, based on a cursory environmental review of existing data, that this project will likely impart no long-term adverse effects on the environment. In fact, it is believed the project will have a net positive affect on Lake Shamineau. While construction operations have an inherent adverse effect on the environment, these effects are temporary in comparison to the long-term net benefits anticipated from the project operation.

## VI. DETAILED DESCRIPTION OF THE PROJECT

### A. Project Elements

Shamineau Lake currently has no existing lake outlet structure. **Figure 8** and **Figure 9** display a general schematic of the existing and proposed systems.



**Figure 8 - Schematic of Existing Conditions (No Outlet)**

# VI. DETAILED DESCRIPTION OF THE PROJECT

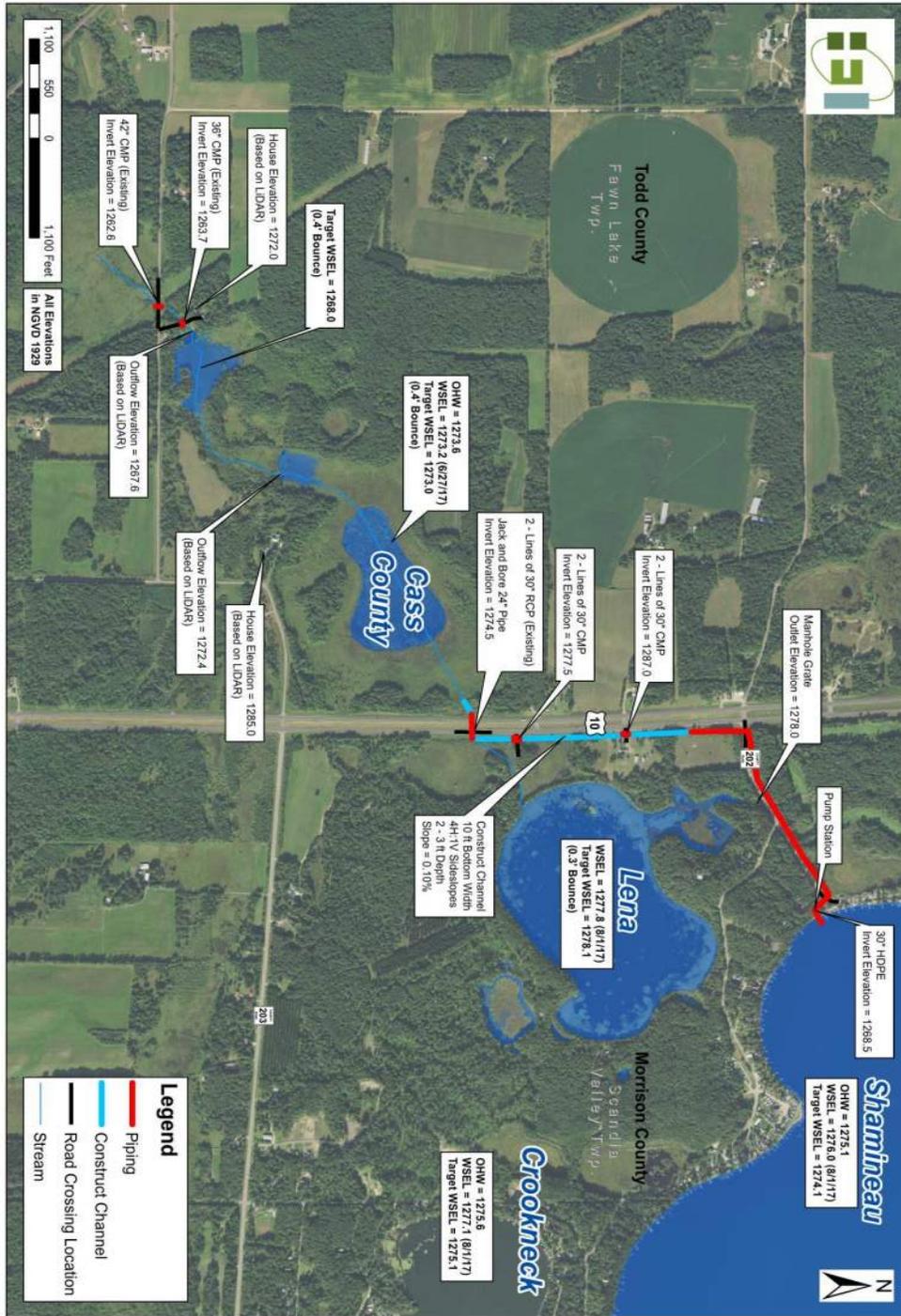


Figure 9 - Schematic of Proposed SW Bound Outlet (Alternative 3)

## **VI. DETAILED DESCRIPTION OF THE PROJECT**

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### **B. Project Operation and Maintenance (O&M) Plan**

An O&M plan will be developed during the preliminary design and permitting phase to establish operating lake levels, pump run time restrictions and opportunities, seasonal restrictions, and other identified discharge operating criteria to most efficiently establish optimal times to activate the lake outlet. Primary intention of the operating plan is to minimize hydraulic impacts to adjacent and downstream property owners, and to minimize stress on channel, water bodies, and natural resource interests. Trigger elevations on Shamineau Lake and downstream receiving waterbodies will be established to direct pump operation times. As a result of the conceptual planning phase, it is proposed to maintain Shamineau Lake's maximum WSE between 1274.1 and 1275.1. However, a section in the operating plan will be included to describe a process to modify the operating plan if the system is not functioning as anticipated. The intention is to allow for adjusting the lower limits of the drawdown elevation on Shamineau, to review operating times during the year, or change downstream trigger elevations for operation of the pumping system.

### **C. Analysis Outlet Conditions and Adequacy**

The proposed Alternative 3 will follow Aztec Road towards highway 10 where it will have an outlet structure and ditch constructed. The flow will then head south to a point where it crosses under US 10 and outletting into Cass County Lake. From Cass County Lake, a natural stream continues southwesterly and connects to Fish Trap Creek which shortly downstream becomes Todd County Ditch 41 (CD 41). Fish Trap Creek (including CD 41 reach) is the outlet channel to Fish Trap Lake and has adequate flow capacity to accommodate outflows from the proposed project. **Figure 9** shows the

## **VI. DETAILED DESCRIPTION OF THE PROJECT**

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expected bounce across each of the receiving waterbodies for the southwest bound outlet alternative (Alternative 3).

### **D. Hydraulic Design of Proposed Drainage Improvements**

The proposed Shamineau Lake Outlet improvement project will increase the hydraulic capacity of the culverts through US 10. The existing two lines of 30” drainage pipes will be cleaned out and a 24” pipe will be jack and bored through US 10 at a lower elevation to convey low flows resulting from the pumping operations on Shamineau Lake. The proposed project design provides Shamineau Lake drawdown rates from stage elev. 1276.1’ to 1274.1’ in approximately 180 days from the start of the pumping operations. Once the initial drawdown is completed, the conceptual operating plan could generally require pumps to operate on 3-month pump operating intervals to maintain these levels. To draw down Shamineau Lake from elevation 1275.1 to elevation 1274.1 could take approximately 90 days of operating pumps, assuming average hydrologic conditions during operation.

### **E. Right-of-Way**

Damages or payments may be required for all right-of-way of flowage easements obtained for the interests of the project.

Right-of-way is classified as a permanent or temporary easement. Permanent right-of-way includes that land necessary for the drainage system improvements, and future access for system maintenance. Temporary right-of-way will be utilized for general construction operations throughout the duration of the project; generally, for a 2-year period.

## **VII. PROJECT ECONOMIC ANALYSIS AND FINANCING**

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The proposed project is necessary if the LID Membership intends to reduce the risk of the following current and future flood damage to the riparian area of Shamineau Lake:

- 1) Flooding of structures, septic systems, well water systems, public infrastructure and other physical property interests adjacent to Shamineau Lake
- 2) Shoreline damages due to significant variance of high water levels and ice jacking. These damages include soil loss, lack of established vegetation, wildlife habitat destruction, and tree loss. The highwater creates negative impacts to nesting and riparian habitat sustainability. Stable water levels are critical to the success and sustainability of waterfowl habitat and nesting.
- 3) Lakeshore management difficulties, repair costs, and maintenance efforts including future dwelling construction/planning, management of public and private boat landings and private docks, ice jacking effects, and recreational beach limits
- 4) Maintain consistent property values for economic interests of all lakeshore properties

Approximately 400 parcels and over 10 miles of riparian shoreline will benefit from the proposed lake outlet project. Last year it was approximated that lakeshore owners reported an estimated amount exceeding \$1.23 million in expenses to mitigate damages resulting from the high lake level conditions.

The preliminary opinion of probable cost (OPC) for design and construction of the Lake Shamineau Outlet Project is \$2,750,000. This cost is distributed as follows:

## VII. PROJECT ECONOMIC ANALYSIS AND FINANCING

Construction Items	\$2,020,000
Project Contingency (approx. 15%)	\$290,000
Engineering (environ., survey, design, construction, geotech)	\$285,000
Administration (Legal, RW, and Financing Processing)	\$75,000
Easement Acquisition	\$60,000
Utility Accommodation and Services	\$20,000
<b>Total OPC for the Project</b>	<b>\$2,750,000</b>

This OPC represents a proposed project which follows the general alignment and includes the project features presented in this report. It is important to consider that as the preliminary and detail design of the project proceeds, more efficient alignments, water conveyance methods, filtering process, and other efficiencies may allow for reduced Construction Items costs.

The total OPC may be financed over a period recommended by the LID Board. A possible cost breakdown reflecting a 10 year period at 4% APR and a 15 year period at 5% APR are provided for illustration as follows:

Total OPC	10 Year Period	15 Year Period
Total Project OPC	\$2,750,000	\$2,750,000
Total Interest Payment (4% APR)	\$650,000	
Total Interest Payment (5% APR)		\$1,250,000
<b>Total Assessment Payment</b>	<b>\$3,400,000</b>	<b>\$4,000,000</b>

## **VII. PROJECT ECONOMIC ANALYSIS AND FINANCING**

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Interest Rates will be determined at the time of the financing or bonding process.

Legal Bond Counsel will advise regarding locking in an interest rate.

An application for Flood Damage Reduction (FDR) Grant Funds through the MnDNR has been submitted on behalf of the project for a total of \$2,000,000. If successful in 2018, the grant funds should be available after July 1 of 2018. Assuming a lesser amount of \$1,500,000 is awarded (to be conservative) to this project the Total Assessment Payments could be reduced as follows:

Total OPC with Grant Included	10 Year Period	15 Year Period
Total Project OPC	\$1,250,000	\$1,250,000
Total Interest Payment (4% APR)	\$300,000	
Total Interest Payment (5% APR)		\$550,000
<b>Total Assessment Payment</b>	<b>\$1,550,000</b>	<b>\$1,800,000</b>

Successful procurement of the FDR funds will have a significant effect on the Total Assessment Payment.

An assessment distribution formula was established to the benefitting properties which includes four tiers of property classifications; residential, commercial, public, and association. Residential is assigned a full assessment share and public property up to a full assessment share per riparian parcel. Association property is assigned 20% of the full assessment share. Commercial properties are assigned a full assessment share for each riparian parcel and each affiliated non-riparian parcel as well as an additional 35% assessment fee based upon the number of rental units.

## VII. PROJECT ECONOMIC ANALYSIS AND FINANCING

As an example, the following table displays an assessment distribution of estimated project costs by the different tier classifications based on the above 10 year financing scenario with no grant assistance:

Parcel Class	# Parcels	Total Assessment by Class	Lump Sum Payment/Parcel
Riparian Parcels - residential, commercial & public	368	\$3,024,960	\$8,220
Associated Non-Riparian Commercial Parcels			\$8,220
Augers Resort	1	\$8,220	
Shamineau Acres Resort	1	\$8,220	
Camp Shamineau	2	\$16,440	
Public Lands	*3	*TBD	
<b>Total Parcel Income</b>	<b>372</b>	<b>\$3,057,840</b>	
<b>Additional Commercial (Rental Unit) Fee - 35% of rate</b>			
	# Units	\$2,877	\$2,877
Augers Resort	60	\$172,620	
Shamineau Acres Resort	24	\$69,048	
Camp Shamineau	30	\$86,310	
<b>Total Unit Fee</b>	<b>114</b>	<b>\$327,978</b>	
<b>Shamineau View Association = 20% of rate</b>			
	# Parcels	\$1,644	\$1,644
Shamineau View Association - parcels	14	\$23,016	
<b>Total Shamineau View Association</b>	<b>14</b>	<b>\$23,016</b>	
<b>Total Project Assessment</b>		<b>\$3,408,834</b>	

Based on the above assessment distribution and the potential financing and funding scenarios, the following table displays a breakdown of potential assessments by parcel class for total, annual and monthly assessment shares per unit:

(See Next Page)

## VII. PROJECT ECONOMIC ANALYSIS AND FINANCING

Funding Scenario	Parcel Class	Full Assessment Share/Unit	Annual Equivalent Assessment Share/Unit	Monthly Equivalent Assessment Share/Unit
10 Year Finance @ 4% APR – No Grant	Residential, Commercial, Public	\$8220	\$822	\$69
	Commercial Fee (Rental Unit)	\$2877	\$288	\$24
	Association	\$1644	\$164	\$14
10 Year Finance @ 4% APR – Grant Included	Residential, Commercial, Public	\$3730	\$373	\$31
	Commercial Fee (Rental Unit)	\$1306	\$131	\$11
	Association	\$746	\$75	\$6
15 Year Finance @ 5% APR – No Grant	Residential, Commercial, Public	\$9670	\$645	\$54
	Commercial Fee (Rental Unit)	\$3385	\$226	\$19
	Association	\$1934	\$129	\$11
15 Year Finance @ 5% APR – Grant Included	Residential, Commercial, Public	\$4400	\$293	\$24
	Commercial Fee (Rental Unit)	\$1540	\$103	\$9
	Association	\$880	\$59	\$5

The original Engineer’s Conceptual Summary Report, which focused on practical concepts of the project, provided a conceptual opinion of probable project cost for the Lake Shamineau Outlet Project at \$1,500,000. This total is significantly less than the costs included in the current preliminary opinion of probable cost for the project of \$2,750,000 plus interest charges. The primary differences in these cost estimates are as follows:

- 1) Higher unit bid prices for piping and pumps were used in this report to reflect economic effects of 2017 hurricane season in the southern US. These increased costs were reflected in a recent 2017 bid opening for a similar project in Perham. Therefore, for conservative interests, these increased unit prices were applied to the Lake Shamineau Outlet project.
- 2) The Pump Station estimated costs used for the conceptual report were too low. The recent prices presented in the Perham area lake outlet project indicated that costs have increased, and our estimated costs for dewatering operations

## **VII. PROJECT ECONOMIC ANALYSIS AND FINANCING**

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and the mechanical screen/filtering system for preventing AIS migration were significantly lower than anticipated. Therefore, we increased the preliminary OPC to reflect the more recent bid prices.

- 3) The ability to discharge into Lake Lena may not be achievable due to lakeshore property owners concerns along Lake Lena. Therefore, a more conservative route was used to establish the preliminary opinion of cost, which primarily includes, but is not solely limited to, additional forcemain piping length, pavement repairs, and pump HP requirements.
- 4) A 15% construction cost contingency is included to provide for dynamic bidding environment due unique nature of the project.
- 5) Due to potential of reduced pumping rate allowance longer duration pumping operations may be advantageous. Therefore, winter pumping features are included in the construction cost estimate to allow for cold weather pumping operations. This includes a bypass channel feature near the Zetah property to preserve private land use interests on their property and a fully insulated pump station building.
- 6) Financing or interest on debt was not included in the opinion of cost estimate in the concept summary report. This item will vary depending on the term or period of the financing.

The possible project cost assessment summary above consists of project costs and do not include monthly operation and maintenance costs of the pump station operating/discharge fees and infrastructure.

## **VII. PROJECT ECONOMIC ANALYSIS AND FINANCING**

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Based on an estimate from Crow Wing Power, the operating cost of the pump station is approximately \$5,800/month of operation. For cold weather operation, the pump station will likely require climate control which is estimated at \$200 per month; contingent on elements housed within the station. Lastly, an escrowed maintenance account is recommended which could be set at \$15,000 minimum balance to cover maintenance and repairs of the outlet system. This escrow account could be funded over a 5 year assessment period and reflect the annual assessment formula currently in place. Operation and maintenance costs will likely be funded solely with local assessments.

Availability of potential funding sources are as follows.

- 1) Hazard Mitigation Grant Program through the Minnesota Department of Natural Resources (MnDNR). This grant is a flood damage reduction grant and could provide 50% of the project funding with a 50% local match required. This grant has the highest potential for funding and possible funding available after July of 2018.
- 2) Clean Water Fund Grant Program through the Minnesota Board of Water and Soil Resources (BWSR). This grant could be used for erosion control, shoreline erosion control and protection. 75% of the project could be funded through this grant with a required 25% of the funding being local. This is a very competitive grant.
- 3) Local Bonding (Loan Process) – MS 429 process. To be executed upon determination of LID to proceed from the conceptual report. The MS 429 process provides for a legal proceeding to define the project details, project benefits, the estimated cost, and other details necessary to determine the value of the project. Public notice for formal project input will be provided to the LID membership who are proposed to be assessed for the project prior to proceeding with the project work under MS 429.

## **VII. PROJECT ECONOMIC ANALYSIS AND FINANCING**

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State funding sources generally fall within budget years for the various agencies, and currently would appear most state funding sources would be eligible for expenditures after July of 2018. Therefore, if we receive any funds from state sources, we could coordinate various project cost elements to be eligible for these grant funds. It would be difficult to coordinate, but is possible.

With that said, the LID will need to prioritize outside funding sources with schedule for completion of work.

Considering current and imminent future flood damages and lakeshore management complications to approximately 400 parcels and 10 miles of shoreline, negative impacts to sustainability riparian and aquatic habitat along the Shamineau shoreline, reduced water quality due to increased turbidity from wave erosion and ice jacking, damages to and limitations of beaches and shoreline recreational interests, and lack of consistent future market values of shoreline properties all contribute to the necessity of the proposed lake outlet project. Considering the current and imminent flood related damages to Lake Shamineau and its riparian area, the proposed project provides for a cost effective, practicable, and reasonable solution to mitigate the identified damages and address the project purpose and need identified by the Lake Shamineau LID.

## VIII. EXHIBITS

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### A. **Exhibit A** – Breakdown of Damages

This breakdown shows the different repairs that property owners have made. It also shows how many property owners have made repairs within the cost range.

### B. **Exhibit B** – Project Alignment and Drainage Area

Exhibit B shows the two preliminary potential outlet routes. This alignment shown are general alignments for both the NE and the SW outlet options.

### C. **Exhibit C** – Preliminary Plan and Profile

The Preliminary Plan and Profile shown is a basic representation of the preliminary alignment, slopes, and culverts for construction.

### D. **Exhibit D** – Cost Breakdown of Property Owners

Exhibit D shows how the different land owners have been affected by the high water levels of Lake Shamineau. It also expresses how serious the effects on the property are according to the property owners. The next page shows the total number of landowners that have spent certain ranges of money repairing damages due to high water.

### E. **Exhibit E** – Environmental Review

The environmental review shows preliminary potential outlet routes along with different environmental aspects in the area. The different environmental factors were used in design and taken into consideration.

**EXHIBIT A**

**BREAKDOWN OF DAMAGES**

### Shamaineau Lake Damages Breakdown

How much would you estimate that you have spent on any of the following expenses due to high water level?

(Number of responses out of 107 submitted surveys)

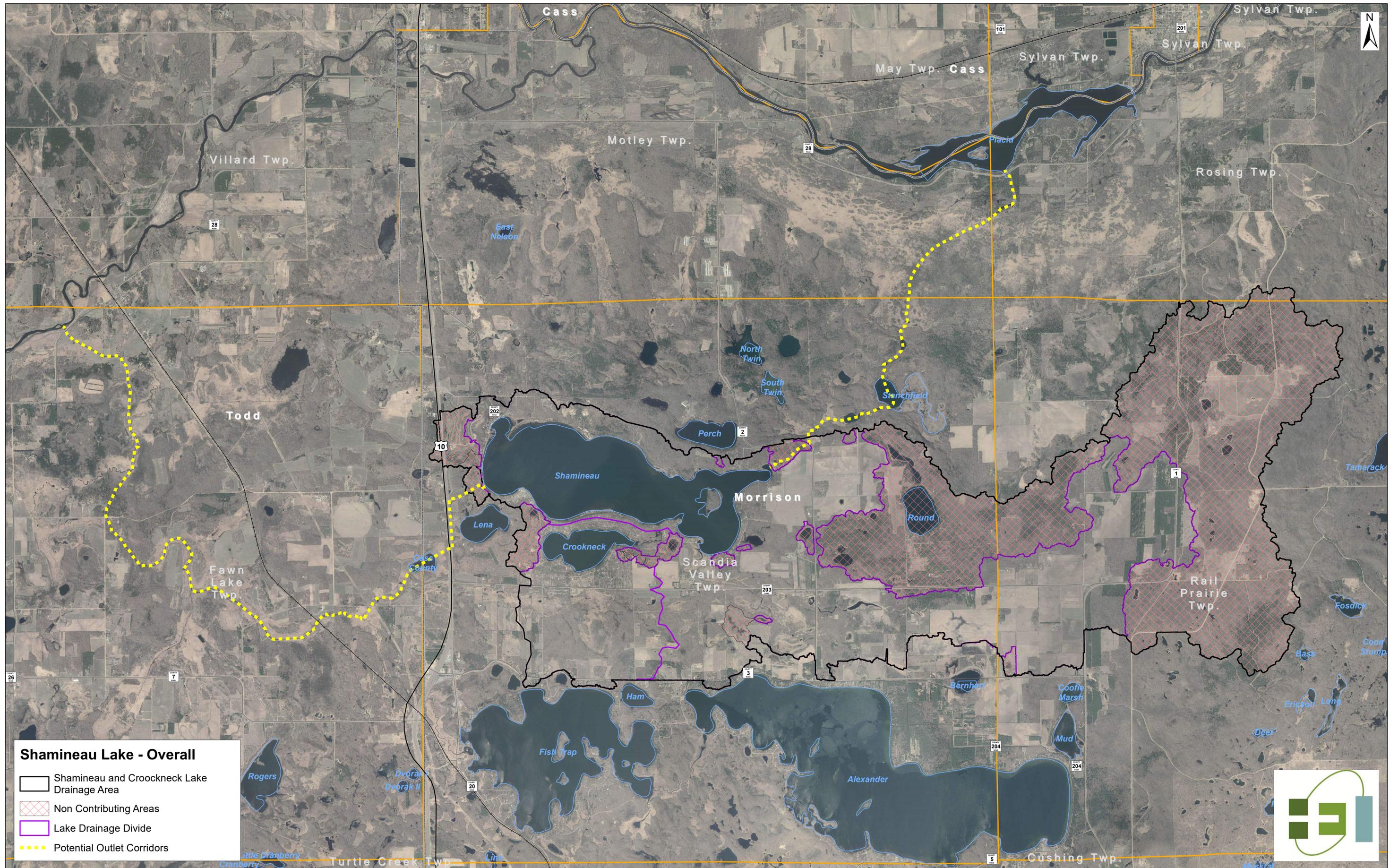
		Shoreline repair	Landscaping	Aeration	Dock repair	House or Cabin repair	Septic repair	Well repair
\$0-\$99		6	8	8	10	11	18	17
\$100-\$499		7	26	3	17	2	2	3
\$500-\$1,999		34	18	18	9	17	1	2
\$2,000-\$4,999		17	7	8	3	4	1	2
\$5,000-\$9,999		50	0	1	3	3	3	0
\$10,000-\$14,999		0	1	0	0	1	0	0
\$15,000+		1	1	0	1	6	1	1
\$100,000+		0	0	0	0	3	0	0
		115	61	38	43	47	26	25

	Average Cost	Shoreline repair	Landscaping	Aeration	Dock repair	House or Cabin repair	Septic repair	Well repair	Total
\$0-\$99	\$ 50	\$ 300	\$ 400	\$ 400	\$ 500	\$ 550	\$ 900	\$ 850	\$ 3,900
\$100-\$499	\$ 250	\$ 1,750	\$ 6,500	\$ 750	\$ 4,250	\$ 500	\$ 500	\$ 750	\$ 15,000
\$500-\$1,999	\$ 1,250	\$ 42,500	\$ 22,500	\$ 22,500	\$ 11,250	\$ 21,250	\$ 1,250	\$ 2,500	\$ 123,750
\$2,000-\$4,999	\$ 3,500	\$ 59,500	\$ 24,500	\$ 28,000	\$ 10,500	\$ 14,000	\$ 3,500	\$ 7,000	\$ 147,000
\$5,000-\$9,999	\$ 7,500	\$ 375,000	\$ -	\$ 7,500	\$ 22,500	\$ 22,500	\$ 22,500	\$ -	\$ 450,000
\$10,000-\$14,999	\$ 12,500	\$ -	\$ 12,500	\$ -	\$ -	\$ 12,500	\$ -	\$ -	\$ 25,000
\$15,000+	\$ 15,000	\$ 15,000	\$ 15,000	\$ -	\$ 15,000	\$ 90,000	\$ 15,000	\$ 15,000	\$ 165,000
\$100,000+	\$ 100,000	\$ -	\$ -	\$ -	\$ -	\$ 300,000	\$ -	\$ -	\$ 300,000

**\$ 494,050   \$ 81,400   \$ 59,150   \$ 64,000   \$ 461,300   \$ 43,650   \$ 26,100   \$ 1,229,650**

**EXHIBIT B**

**PROJECT ALIGNMENT AND DRAINAGE  
AREA**

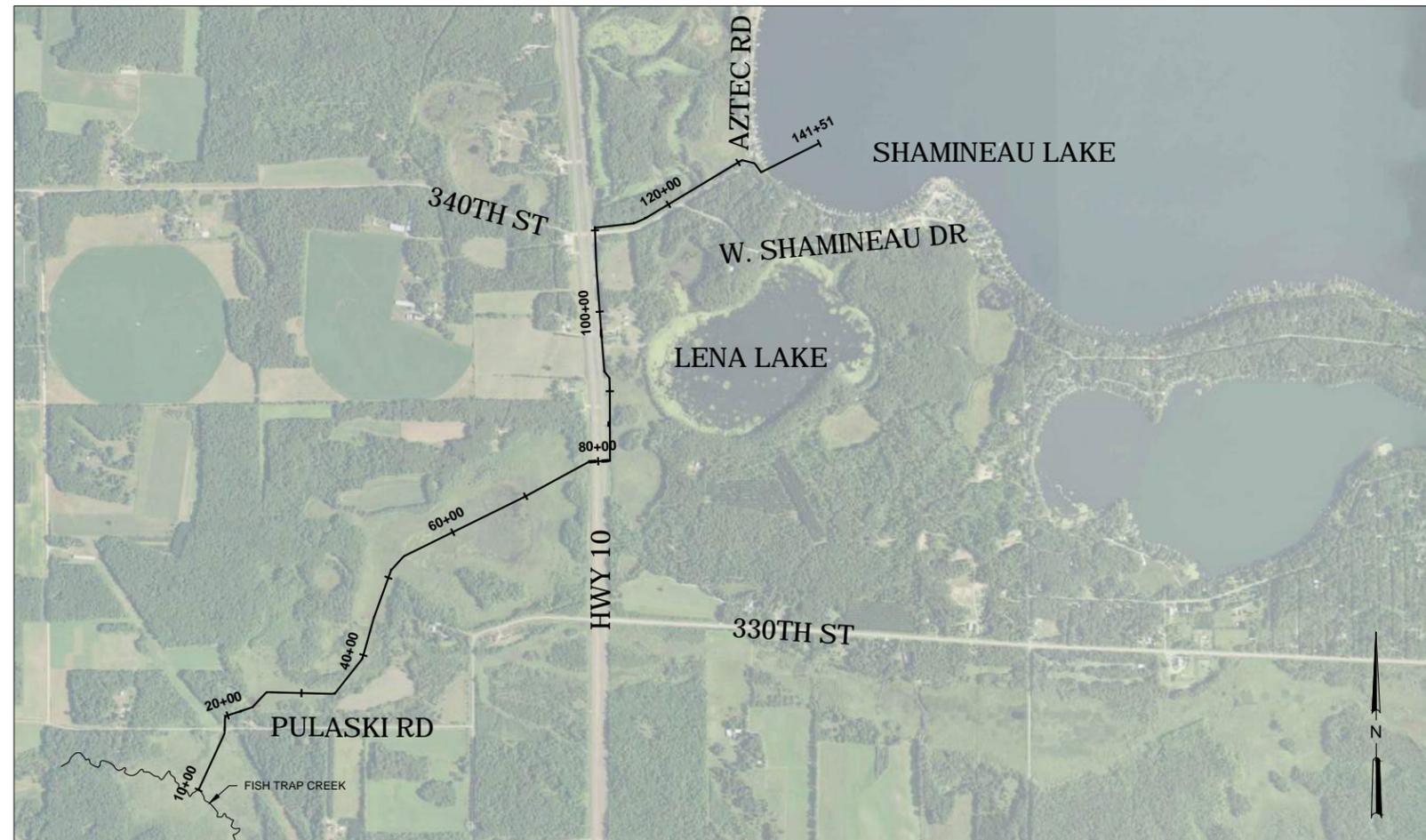


## **EXHIBIT C**

### **PRELIMINARY PLAN AND PROFILE**

# PRELIMINARY CONSTRUCTION PLANS FOR LAKE SHAMINEAU HIGHWATER REDUCTION

## MORRISON COUNTY MINNESOTA



### SHEET INDEX

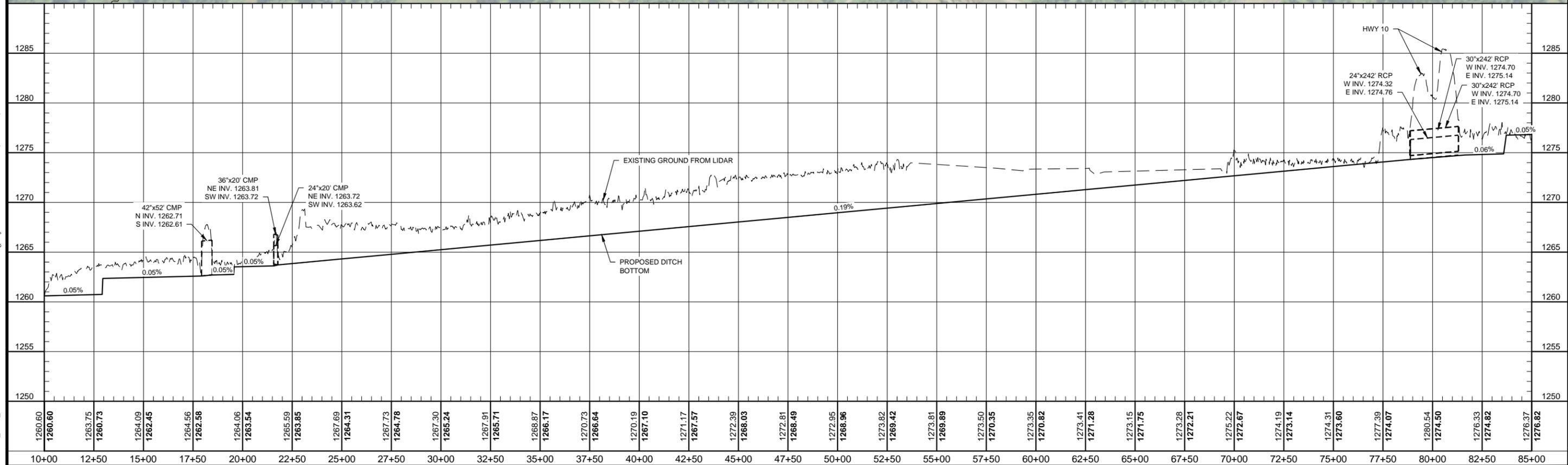
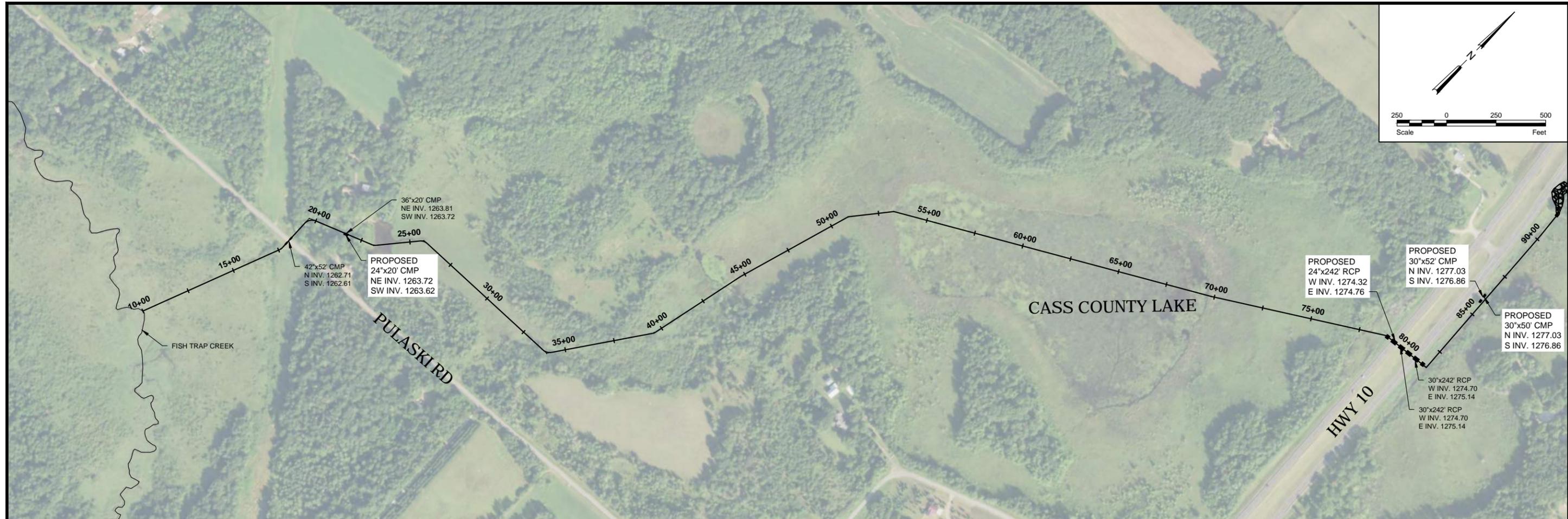
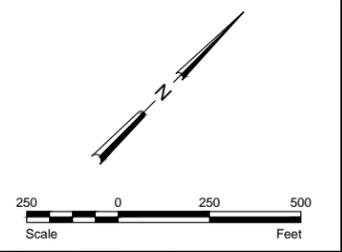
1	COVER
2-3	PLAN AND PROFILE

**PRELIMINARY**  
Not for Construction

PREPARED BY:



FARGO, NORTH DAKOTA



H:\Fargo\JBN\9276\17\_9276\_001 Lake Shamineau\CAD\Plans\Plan and Profile.dwg; Layout: 1/8/2018 10:22 AM - (mildredtb)

1260.60	1260.60	1263.75	1260.73	1264.09	1262.45	1264.56	1262.58	1264.06	1263.54	1265.59	1263.85	1267.69	1264.31	1267.73	1264.78	1267.30	1265.24	1267.91	1265.71	1268.87	1266.17	1270.73	1266.64	1270.19	1267.10	1271.17	1267.57	1272.39	1268.03	1272.81	1268.49	1272.95	1268.96	1273.82	1269.42	1273.81	1269.89	1273.50	1270.35	1273.35	1270.82	1273.41	1271.28	1273.15	1271.75	1273.28	1272.21	1275.22	1272.67	1274.19	1273.14	1274.31	1273.60	1277.39	1274.07	1280.54	1274.50	1276.33	1274.82	1276.37	1276.82
10+00	12+50	15+00	17+50	20+00	22+50	25+00	27+50	30+00	32+50	35+00	37+50	40+00	42+50	45+00	47+50	50+00	52+50	55+00	57+50	60+00	62+50	65+00	67+50	70+00	72+50	75+00	77+50	80+00	82+50	85+00																															

**PRELIMINARY**  
Not for Construction



Fargo  
 Drawn by: AJK  
 Date: 1-8-18  
 Checked by: MJH  
 Scale: AS SHOWN

LAKE SHAMINEAU HIGHWATER REDUCTION  
 LAKE SHAMINEAU LAKE IMPROVEMENT DISTRICT  
 MOTLEY, MINNESOTA

PLAN & PROFILE  
 PROJECT NO. 9276-001

SHEET  
 2 of 3

No.	Revision	Date	By



**EXHIBIT D**

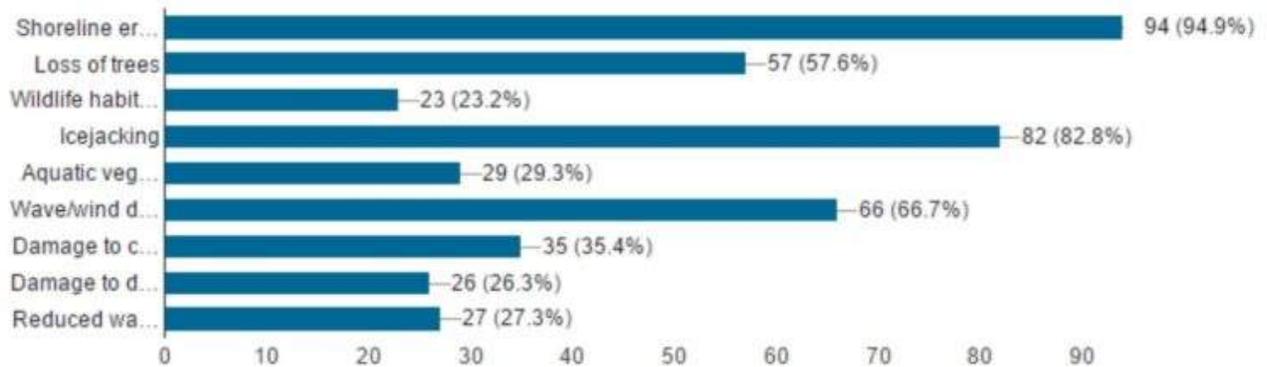
**COST BREAKDOWN OF PROPERTY  
OWNERS**



# Summary Charts

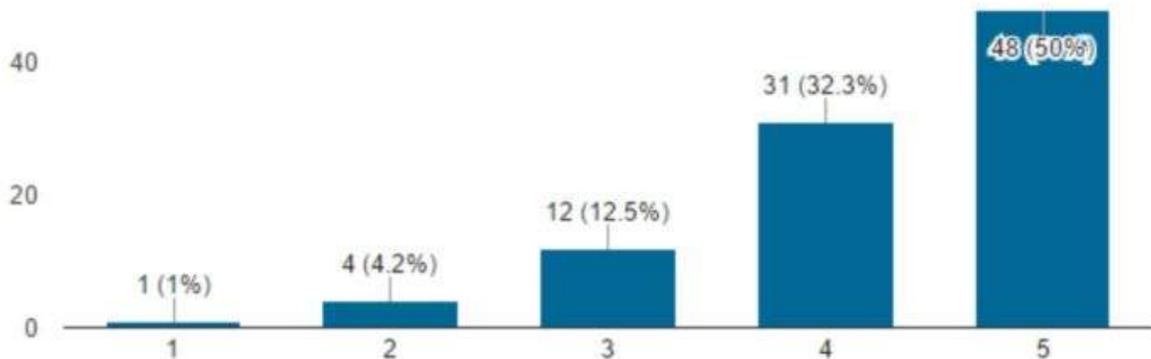
How has your property been affected by the high water levels of Lake Shamineau? Check all that apply.

99 responses

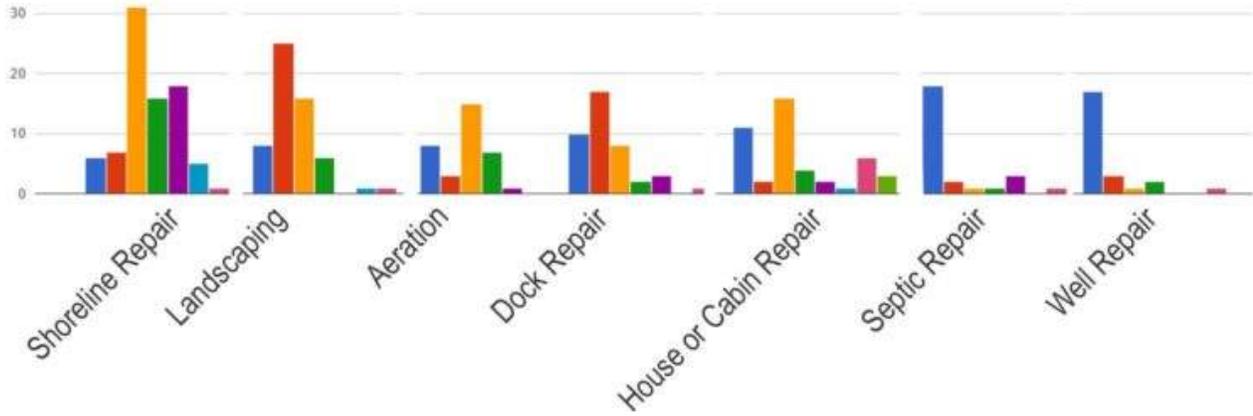


How serious would you rate the effects?

96 responses

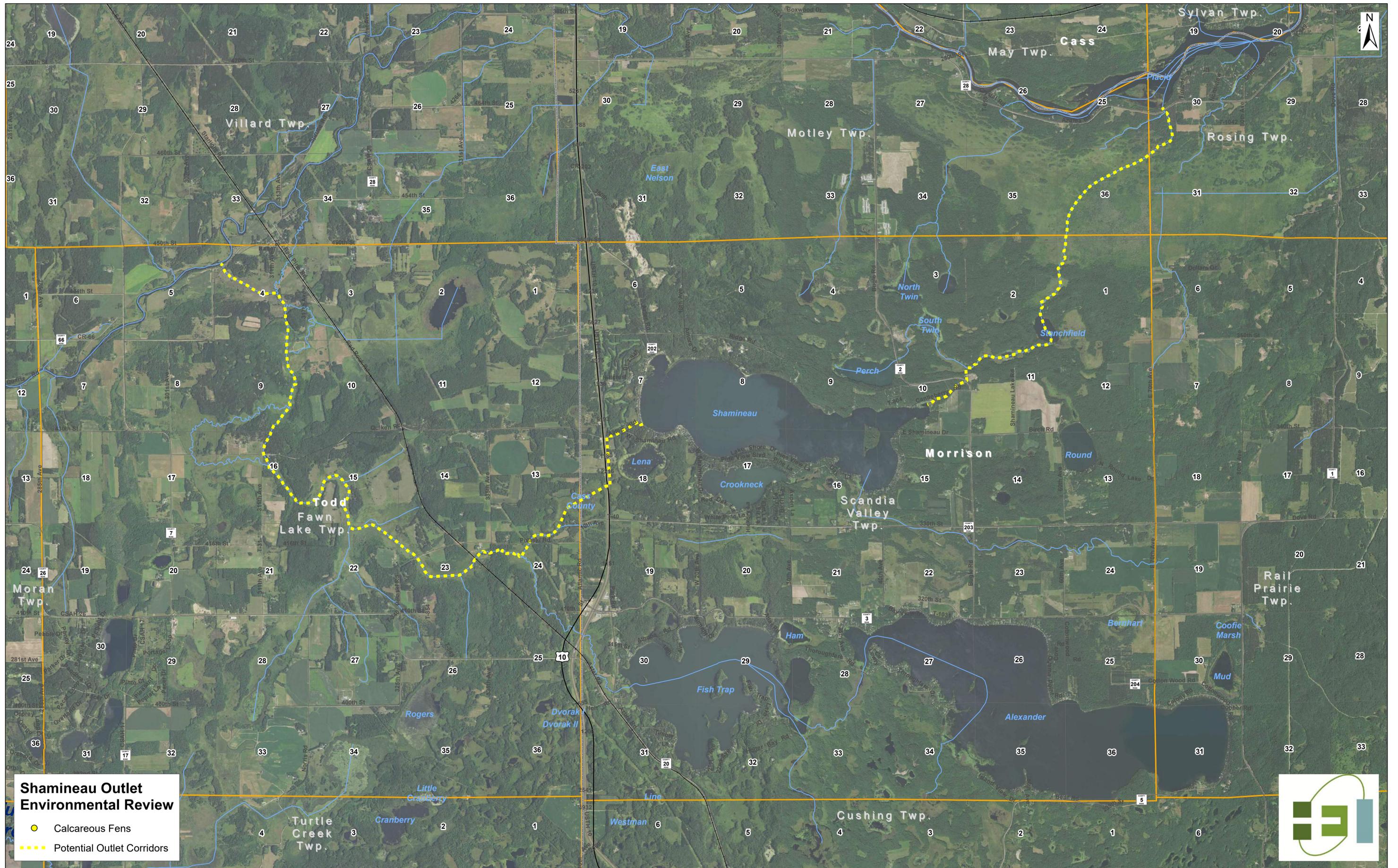


# How much would you estimate that you have spent on any of the following expenses due to high water level?



**EXHIBIT E**

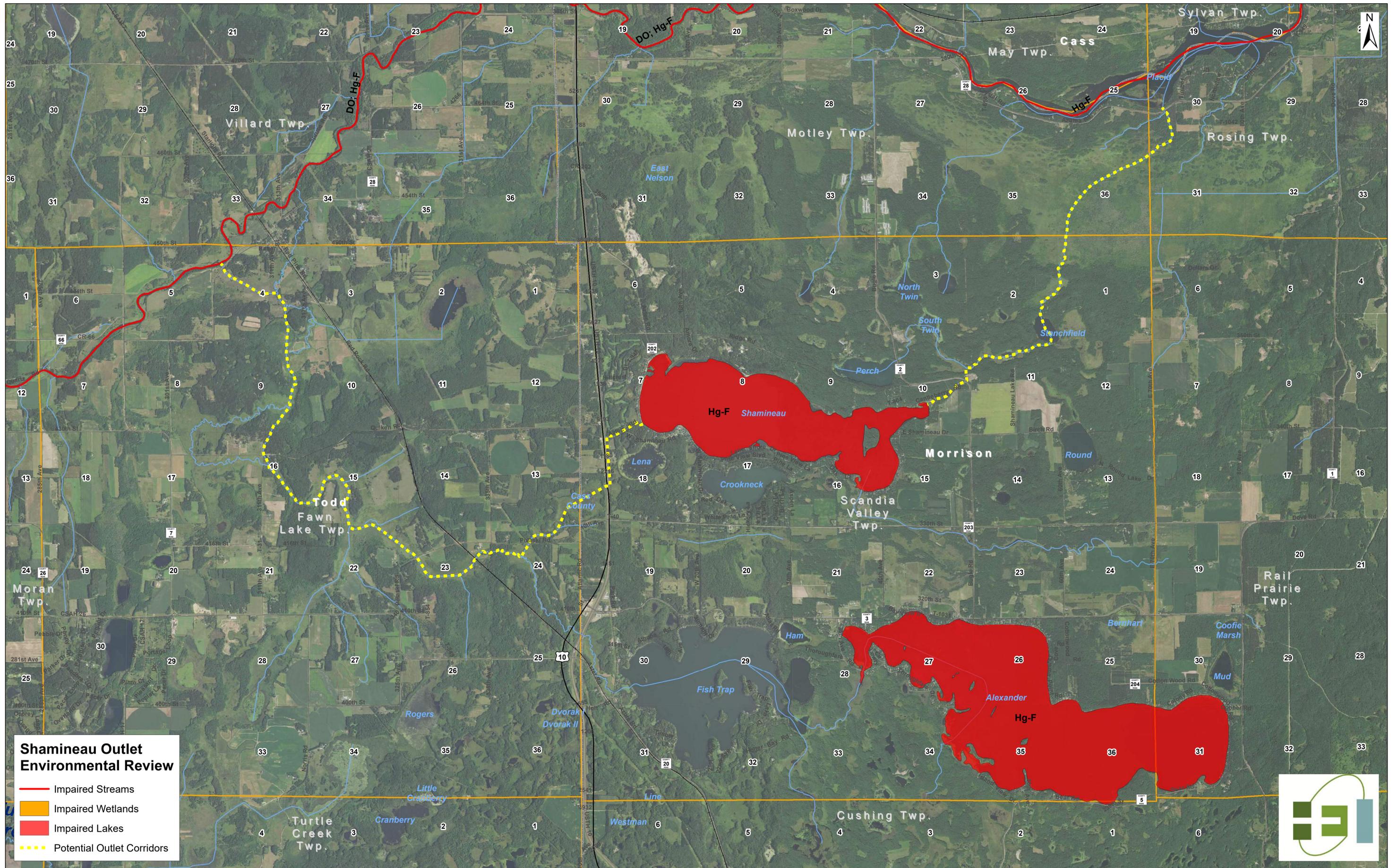
**ENVIRONMENTAL REVIEW**

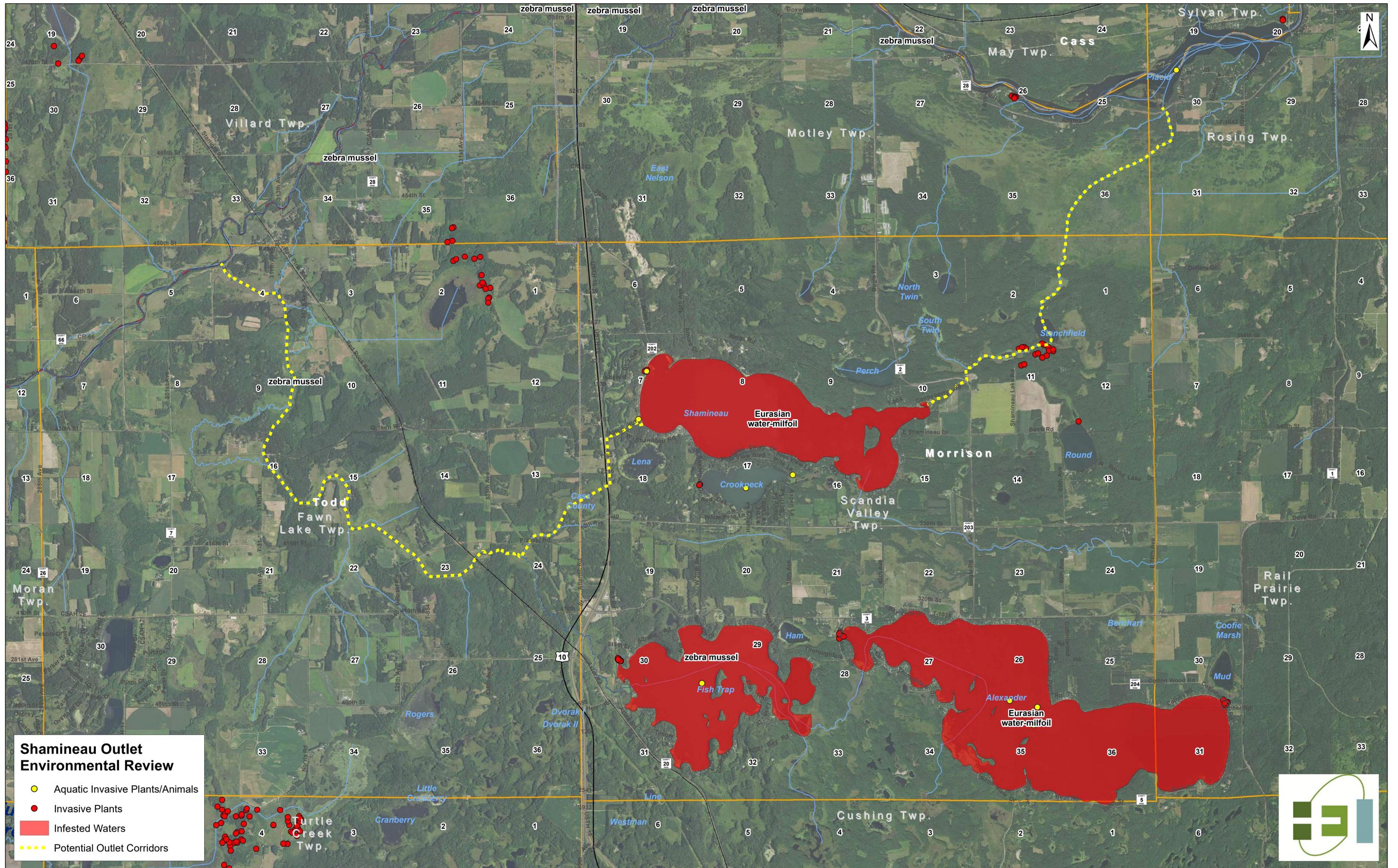


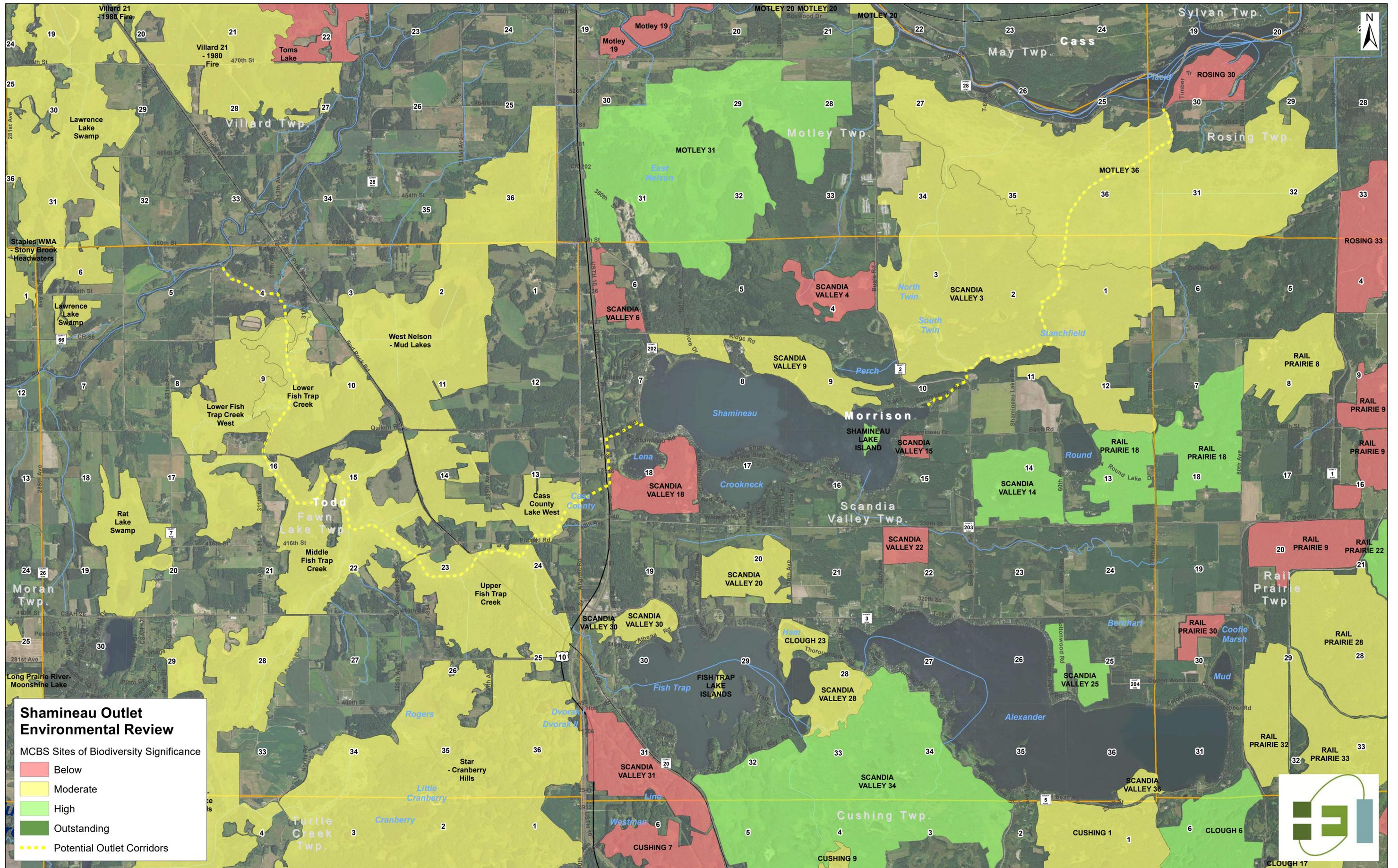
**Shamineau Outlet  
Environmental Review**

- Calcareous Fens
- Potential Outlet Corridors







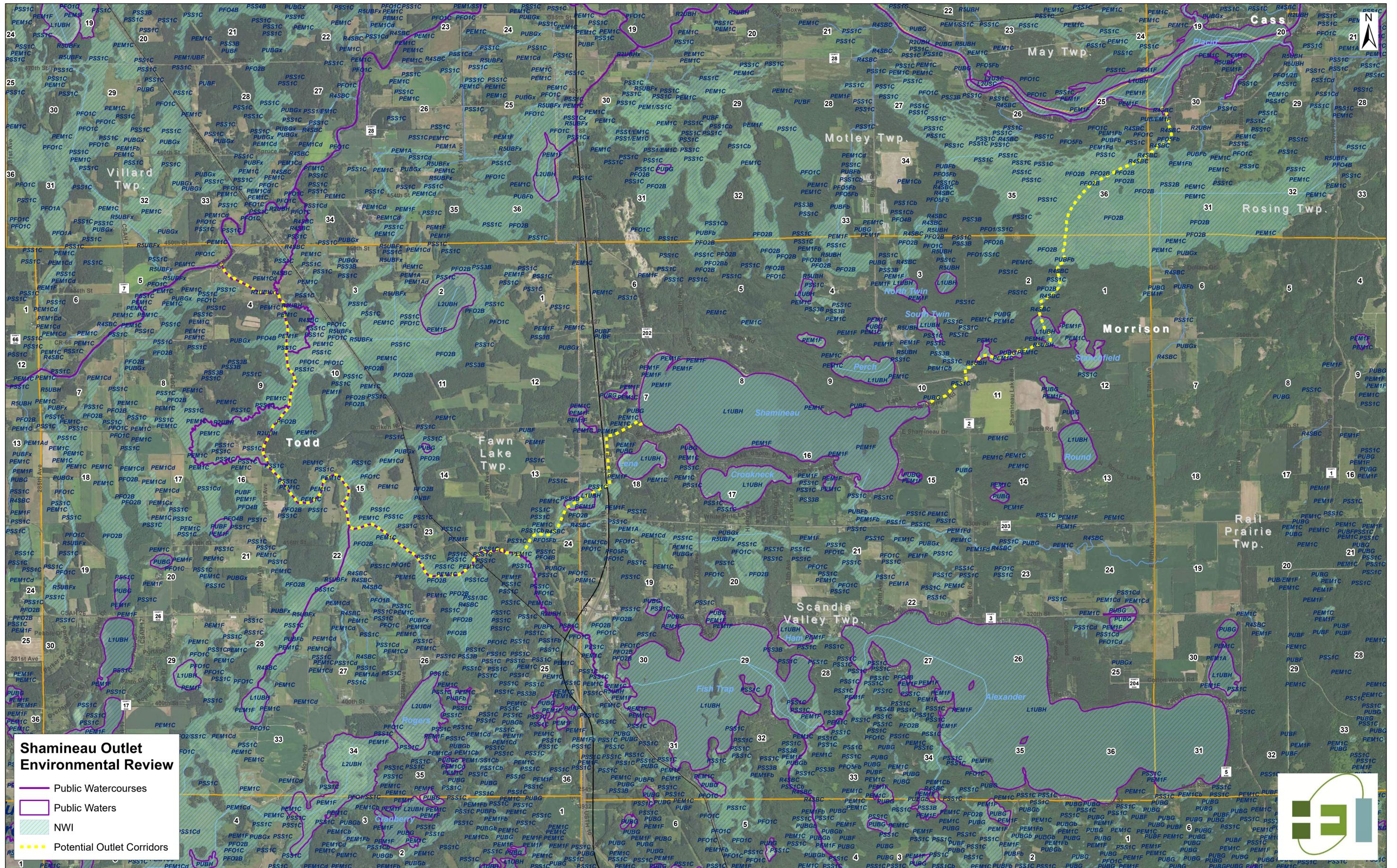


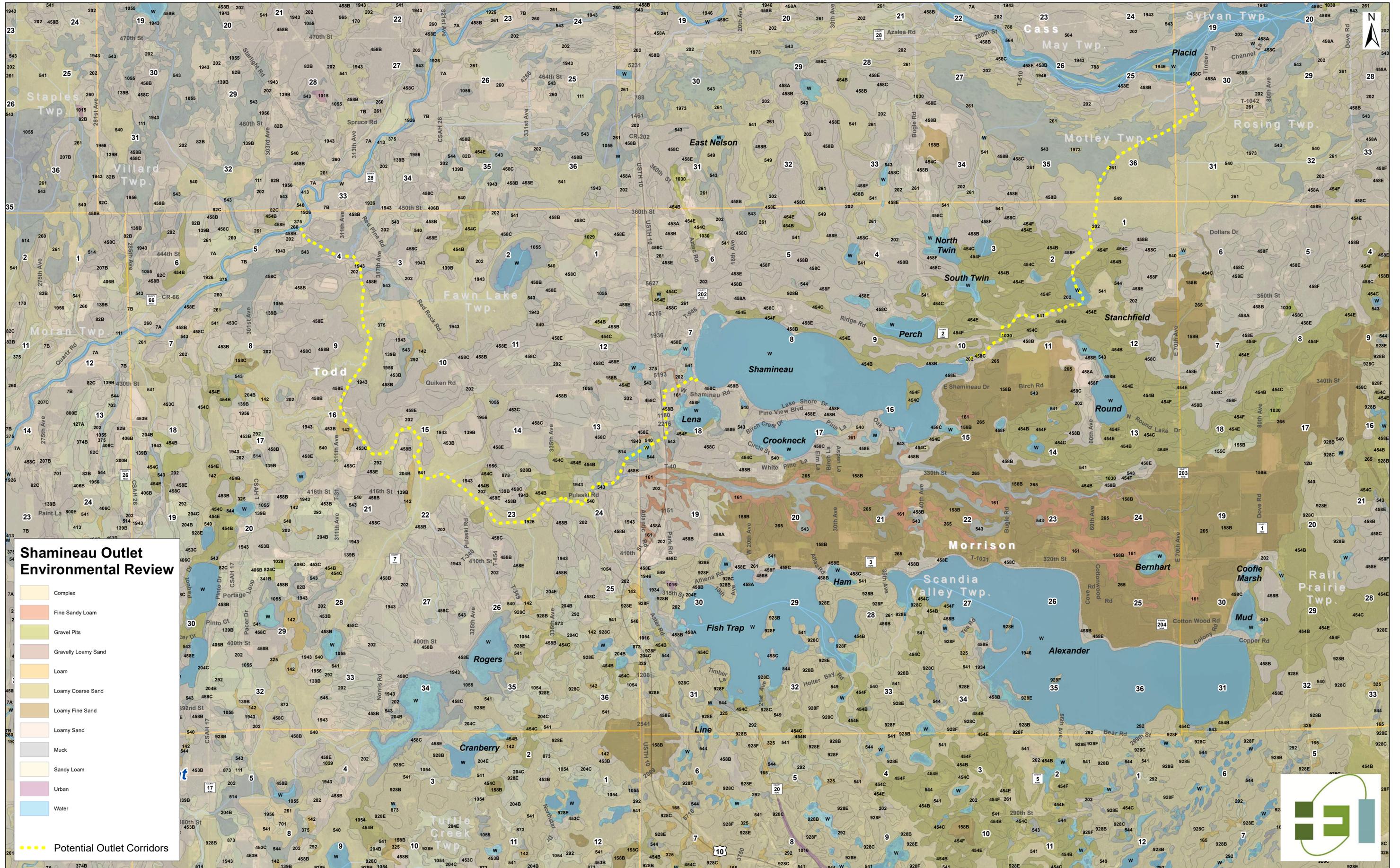
**Shamineau Outlet Environmental Review**

MCBS Sites of Biodiversity Significance

- Below
- Moderate
- High
- Outstanding
- Potential Outlet Corridors



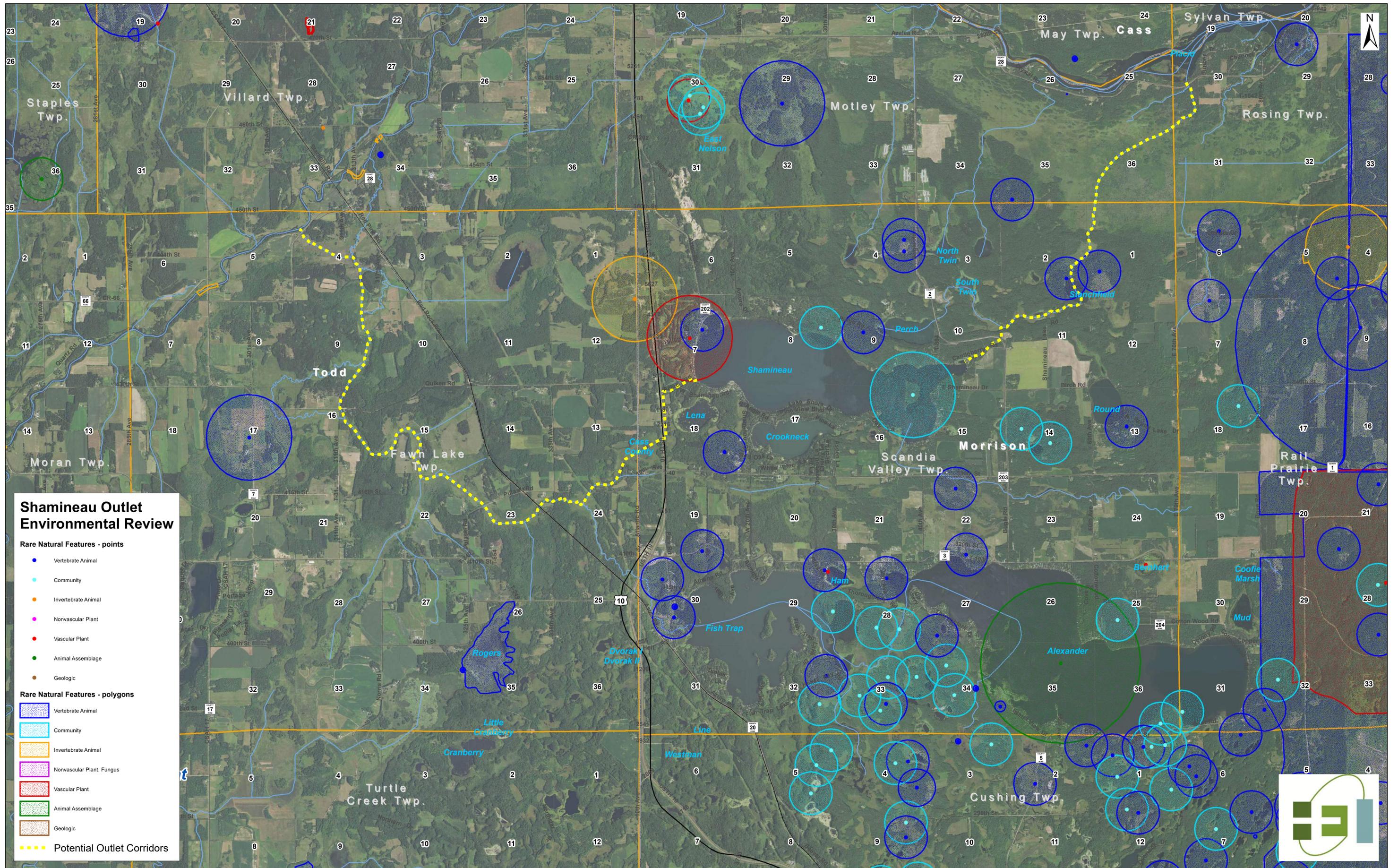


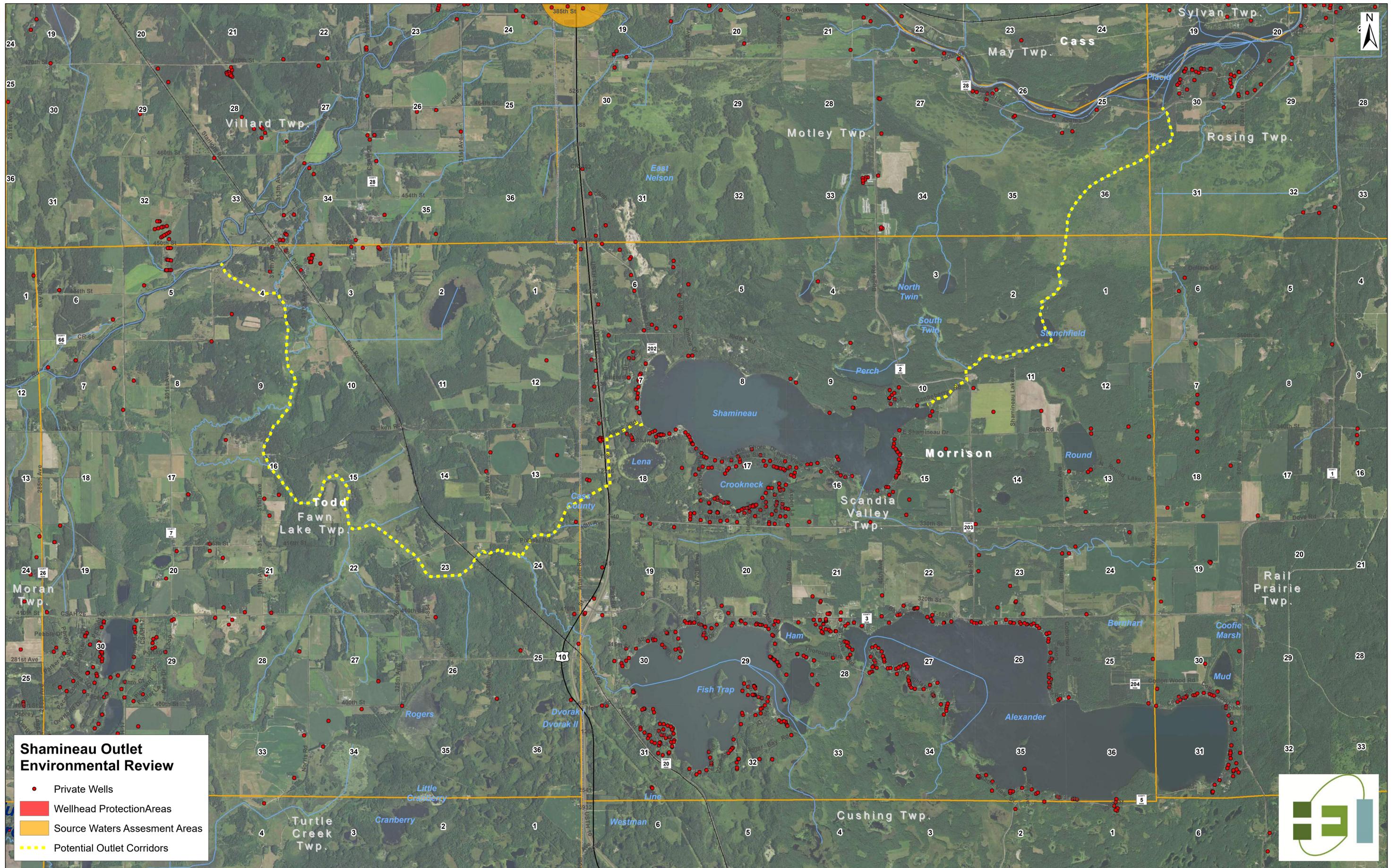


### Shamineau Outlet Environmental Review

-  Complex
-  Fine Sandy Loam
-  Gravel Pits
-  Gravelly Loamy Sand
-  Loam
-  Loamy Coarse Sand
-  Loamy Fine Sand
-  Loamy Sand
-  Muck
-  Sandy Loam
-  Urban
-  Water
-  Potential Outlet Corridors







**Shamineau Outlet Environmental Review**

- Private Wells
- Wellhead Protection Areas
- Source Waters Assesment Areas
- Potential Outlet Corridors

