

# 2018 PRIOR LAKE OUTLET SYSTEM ANNUAL OPERATIONS REPORT



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PRIOR LAKE – SPRING LAKE  
WATERSHED DISTRICT

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# INTRODUCTION

The Prior Lake Outlet Structure and Outlet Channel were constructed in 1983 under DNR permit 79-6016 to address high lake level issues on Prior Lake, which does not have a natural outlet. The Prior Lake Outlet Channel (PLOC) is utilized by the Prior Lake-Spring Lake Watershed District (District or PLSLWD) in managing lake levels on Prior Lake, as well as a trunk stormwater system for the Cities of Prior Lake and Shakopee, and the Shakopee Mdewakanton Sioux Community. The 7-mile long PLOC has been divided into 8 management Segments. Segment 1 is on the southern end beginning at the Prior Lake Outlet Structure, while Segment 8 is on the northern end and flows into the Minnesota River in Shakopee.

To address current needs and plan for future development in the watershed, in 2007 the District finalized a Memorandum of Agreement (MOA) with the Cities of Prior Lake and Shakopee, and the Shakopee Mdewakanton Sioux Community for the operation, maintenance and use of the Prior Lake Outlet Channel. The MOA is currently being updated and will be finalized in 2019. This group of cooperators oversees the operation of the PLOC, while the District administers the day to day operations. In the early 2000's, it was determined by these cooperators that while the channel and outlet had worked well since their inception, if modified in several places, they could operate more efficiently, reduce long term maintenance and enhance the environment. Acknowledging that the PLOC is used as a stormwater conveyance system and is not just a natural conveyance, the cooperator's focus is to manage the easements of the channel and the channel itself to maintain hydrologic capacity, reduce maintenance needs, provide long-term stability and improve water quality. Secondary benefits include increased aesthetics, providing improved habitat and providing consistency with city and county plans for parks and greenways.

## OUTLET STRUCTURE

### *HISTORY*

The Prior Lake Outlet Structure was originally constructed in 1982 and has been operated since 1983. The original design of the structure required manual operation to open and close gates to regulate the flow. This design posed safety concerns to staff while operating the structure during high water levels. Additionally, there were inefficiencies in the structure's design because the 36-inch pipe connected to the structure did not reach its maximum flow of 65 cfs until lake levels well-surpassed the outlet elevation. Over the years, the structure had also developed wear and required minor maintenance.

Given these conditions, a replacement structure was pursued by the District and installed in 2010 (Figure 1). The new design has increased the efficiency of discharging water by allowing the outlet pipe to reach capacity sooner. It has also proven to provide safer conditions for staff during inspections and maintenance, and is self-operating, which will reduce overall operations and maintenance costs. A schematic of the outlet structure is provided in Attachment A.



**FIGURE 1**

## *MAINTENANCE AND OPERATION*

Operation of the Prior Lake Outlet Structure is governed by the DNR-approved Prior Lake Outlet Control Structure Management Policy and Operating Procedures (Operating Procedures) dated October 2004, approved February 2005. This plan specifies a review procedure that is to be repeated every 3 years, which occurred in 2017. Changes mostly addressed guidance for opening the low-flow gate and removing old language that referred to the old outlet structure.

Additionally, an Operation, Inspection and Maintenance Manual was drafted and adopted in September 2011 for the Prior Lake Outlet Structure. The purpose of this secondary manual is to establish guidelines and practices to provide existing and future District Staff with the knowledge of how to properly operate, inspect and maintain the structural and operational components of the outlet to maximize the life and effectiveness of the structure. The manual includes a table of recommended inspection items along with the recommend frequency of inspection. These recommendations will be reviewed periodically by District Staff to determine if the frequency is appropriate based on findings in the field and the manual will be updated accordingly.

The new structure needs minimal maintenance to operate. Once Prior Lake reaches 902.45', water starts spilling over the accordion shaped weir located inside the trash rack. Maintenance includes visual inspections, greasing gates, and removing debris from the trash rack. Removing vegetation and other debris from the trash rack is the most time-consuming and labor-intensive task (Figure 2). When the structure is operating (Prior Lake is greater than 902.45'), the structure will be inspected no less than once a week, and as much as twice per day, depending on the lake level and amount of vegetation getting stuck on the trash rack. Inspections and debris removal are typically conducted by PLSLWD staff. During times when water is high and lots of vegetation is getting stuck on the track rack, the City of Prior Lake staff helped remove vegetation to ensure the Outlet Structure was not blocked. In 2018, a private contractor was hired to help remove vegetation as the City of Prior Lake staff was unable to assist in all occasions (evenings and/or weekends).



**FIGURE 2**

Excluding 2009, the Prior Lake Outlet Structure had flow, at least partially, every year since 1999. The year 2011 held the greatest volume of water flowing through the system since the structure's establishment in 1983. This was partially due to the more efficient design of the new Outlet Structure; however, the primary factor was the duration of continuous discharge being significantly greater than in previous years.

During 2018 operations, the Prior Lake Outlet Structure performed well throughout the duration that water discharged from the lake. Prior Lake overtopped the outlet weir most of the year with a few exceptions: January 1-23, March 22-30, and August 14-September 20. In other words, the Outlet Structure operated all but 69 days.



At certain lake levels, the Low Flow gate allows more water through the outlet structure, resulting in the lake level lowering more quickly and creating more storage (see Attachment C). To reduce the risk of flooding, the District opened the Low Flow gate from on March 9 due to anticipated high lake levels. However, due to ice in the channel, there were some blockages in culverts from ice chunks causing flooding. The main gate of the outlet structure was closed on March 12 to stop all flow to the channel. On March 19, after the risk of flooding was removed, the main gate was opened slightly to allow the water to melt some of the ice in the culverts. The PLSLWD staff opened the main gate a little more on March 21 and all the way on March 26. However, it was later realized that the main gate was only approximately 75% open and was actually opened all the way on May 8. It was noticed after a flow measurement was taken at the end of the outlet pipe and the result was lower than expected (37cfs instead of ~55 cfs). The main gate is very hard to turn and sometimes seems like it is done turning because it gets extremely hard to turn, but it actually is not. The low-flow gate remained open since March 9 and was closed on May 24 for the rest of the year (See Figure 3).



**FIGURE 3 – OPENING THE LOW-FLOW GATE**

In its 296 days of discharge during 2018, an estimated 5.98 feet of vertical volume was eliminated from the lake through the Prior Lake Outlet Structure (see Attachment D). Prior Lake *theoretically* could have reached approximately 909.30' without operating the outlet structure. Attachment D is provided for comparison between years on the overall usage of the Prior Lake Outlet Structure. The numbers shown are calculated based on the most accurate information available. They are not exact and are intended for yearly comparisons only. Attachments E and F show daily Prior Lake elevations throughout 2018.

## OUTLET PIPE

The Outlet Pipe leads from the Outlet Structure to the beginning, or “daylight,” of the outlet channel. It is buried underground for approximately 2075 feet, with 5 manholes and 7 access points (Figure 4).

### MAINTENANCE

Visu-Sewer televises the entire length of the pipe every two years to look for potential damage, areas in need of repair, blockages, accumulated debris, and to assess whether the pipe is reaching full hydraulic capacity.



**FIGURE 4 – MAP OF OUTLET PIPE**

Chemical grouting was scheduled to be completed in 2017 to address leaking joints discovered by Visu-Sewer when they televised the outlet pipe in 2014. However, due to staff injuries, the company was unable to complete this task in 2017. The work was completed March 9, 2018. 120 leaks were sealed, but it was originally estimated to only have 50. As the original leaks were sealed, that forced other leaks to start due to more pressure. Visu-sewer documented all the seals with video.

In 2018, Visu-Sewer televised the pipe after grouting the leaking joints. They televised the pipe each time after grouting joints to look for additional leaks. Many times, after grouting some joints, more leaks would be discovered as the pressure became greater after sealing. VisuSewer continued to televise until no more leaks were found. No red flags were found in the 2018 televising. In general, the lake outfall pipe is in good to fair condition and the pipe will be televised again in 2020.

# OUTLET CHANNEL

The MOA cooperator goals of the outlet channel include: maintain hydrologic capacity, reduce maintenance needs, provide long-term stability, improve water quality, increase aesthetics, provide improved habitat and provide consistency with city and county plans for parks and greenways. Several of these goals have been met, but the channel will always require maintenance.

## *MAINTENANCE*

While the Outlet Structure is in full operation and discharging water, the District is required to perform regular inspections (at least once per week) of the Outlet Structure and the Outlet Channel in accordance with the Operating Procedures looking for debris or any other issue along the channel or at the structure. Debris, downed trees, or other material are removed when they pose a risk, such as flooding or erosion. When debris is too difficult for PLSLWD staff to remove, the party in charge of that culvert, or land, will be contacted to inform them of the work needing to be done and they will need to address the issue.

A detailed report of this year's outlet channel inspections can be found in Appendix B. Below is a summary of maintenance projects that have been completed each year:

- 2006
  - Work completed on Segment 1 in 2006 consisted of bank stabilizations, increased native plantings and a creation of a spillway between Upper and Lower Jeffers Ponds.
- 2007
  - A basin was excavated and sinuosity was added to the channel in Segment 5c prior to entering Dean Lake during the early portion of 2007.
- 2009
  - Replacement of an undersized culvert on the northern end of Segment 8.
- 2010
  - Finalization of work in several Segments including: banks being reshaped, in addition to toe stabilization and weir reinforcements put in place on Segment 7a
  - Toe stabilization, bank protections and flow realignment in Segment 3
  - Work to build up the channel bed and reconnect it to the floodplain in Segment 2.
- 2012
  - Site checks were made throughout 2012 to ensure stability against erosion and vegetation survival within the areas of previous work in Segments 2, 3, and 7a.
- 2013
  - Three failing culverts were replaced between Segments 3 and 4B (Pike Lake Road, Jackson Trail, and Gonyea field crossing).
  - Vegetation along the channel was managed for herbaceous invasives by EOR and woody invasives by Applied Ecological Services. Garlic mustard was hand cut in Segments 3-8. Small populations of Common burdock were cut in Segments 4A, 4B, and 8. Black locust, common buckthorn, and Tatarian honeysuckle suckers and seedlings were treated in segments 1, 3, 4A, 5C, 6, and 7A.

- 2014
  - Garlic mustard was hand cut with a weed cutter in segments 3-7 by EOR.
  - Wild Parsnip was hand cut with a weed cutter in segment 1 by EOR (only location wild parsnip was found).
  - A foliar spray was applied for woody invasives (black locust, common buckthorn, and honeysuckle) in segments 1, 3, 4a, 5c, 6, and 7a (by AES).
- 2015
  - Garlic Mustard was hand cut by EOR on May 15 in segments 3 through 8.
  - EOR released flea beetles on June 26 in Segment 7 to treat the leafy spurge in that segment.
  - Downed trees were removed from the channel by WHR.
  - Segment 4A was realigned by Sunram to protect field road from eroding (EOR design). Trees replaced by Scott Soil and Water Conservation District (SWCD).
  - The Shakopee Mdewakanton Sioux Community replaced the KiciYapi culvert in Segment 3 (Bolton and Menk design).
  - USFWS removed the field road crossing near the parking lot north of Highway 101. This crossing experienced damage many times and restored the area to a native flood plain instead of replacing the crossing again.
- 2016
  - EOR hand-cut Garlic Mustard in segments 3-7.
  - A site visit with EOR and Minnesota Department of Agriculture determined beetle establishment in Segment 7 was successful, but too low to capture and redistribute beetles to more sites. Another assessment will be completed in 2017.
  - In Segment 1, AES spot-treated wild parsnip, locust and thistle and removed Locust and Silver Poplar.
  - AES treated a large patch of Garlic Mustard on the north and south side of County Road 16 (Segments 4 and 5).
  - A large purple loosestrife plant was removed from Segment 4A by AES.
  - All manhole benches in the outlet pipe were reconstructed (smoothed) by IBA manhole.
  - Kes Field Crossing culvert (Figure 5), Gonyea culvert, and Pike Lake Park stream crossing repaired by Nadeau Companies
  - The remaining downed trees and woody debris were removed by WHR



**FIGURE 5 KES FIELD CROSSING REPAIR IN 2016**



- 2017
  - Segment 1 – Locust foliar, Parsnip rosette, and thistle spot treatment
  - Segment 2 – Buckthorn foliar treatment, larger than ½” diameter cut/treat
  - Segment 4a – Buckthorn scouting/treating (foliar treat small individuals, cut/treated larger as needed); Pulled loosestrife
  - Segment 4b - Buckthorn scouting/treating (foliar treat small individuals, cut/treat larger as needed); Spot treat thistle northern half – especially pasture
  - CR 16 – Garlic mustard treatment; Pulled loosestrife
- 2018
  - Outlet Pipe – Chemical grouting to seal 120 leaks
  - Segment 1 – Wild Parsnip treatment
  - Segment 3 – Scouted for garlic mustard, but no plants were found.
  - Segment 4 – Five purple loosestrife and 11 wild parsnip plants were treated
  - Segment 5 – Six purple loosestrife plants treated
  - Segment 7 – Released purple loosestrife and leafy spurge beetles and weevils
  - Ice dam on Gonyea culvert steam jetted by City of Shakopee staff due to flooding

## MONITORING

Monitoring along the outlet channel in 2018 consisted of water quantity (flow), water quality (chemistry), vegetation surveys, and erosion monitoring. Some of this monitoring is funded by the MOA cooperators, and some is done for other programs or entities.

### *WATER QUANTITY*

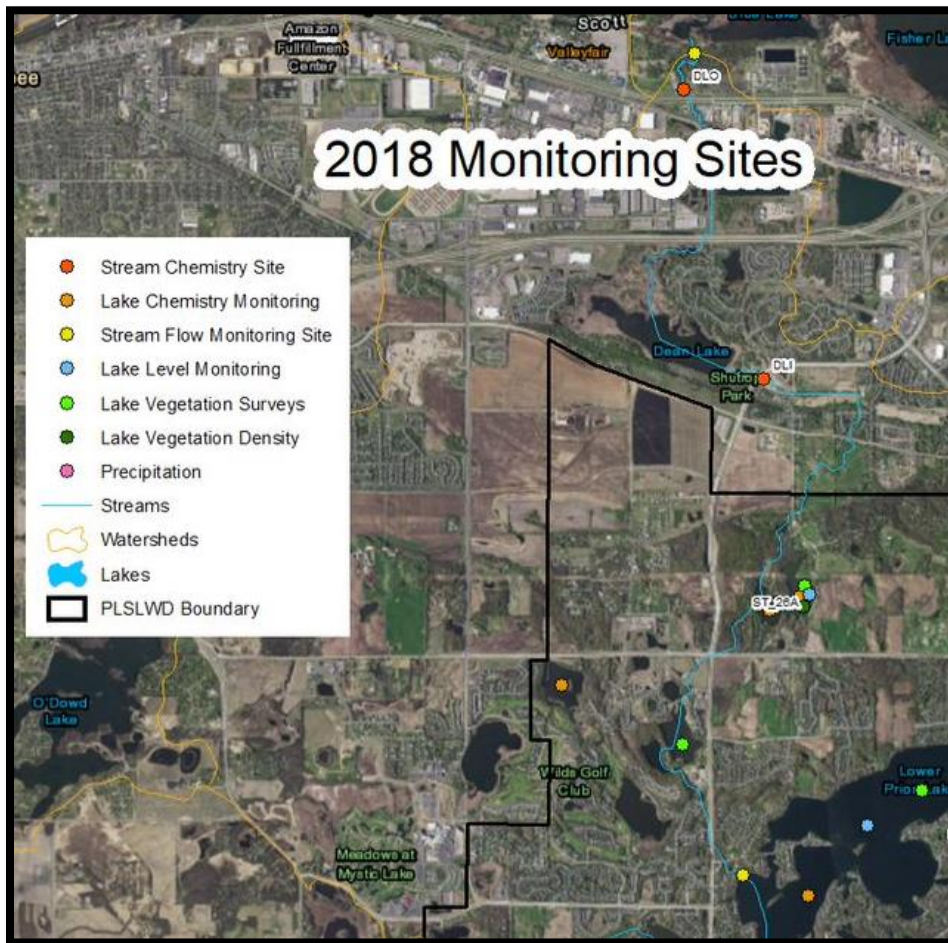
Water quantity monitoring consisted of obtaining continuous stage and flow measurements. PLSLWD and Scott SWCD staff measured flow and stage at the beginning of the Outlet Channel (ST\_OTs), in the middle at Pike Lake Park (ST\_26A – Figure 6), and the end of the Outlet Channel (ST\_32A). Site ST\_OTs was actually located at the Outlet Structure and records the level of Prior Lake using an Ott Level Logger and updated hourly on the PLSLWD website. Scott SWCD also had a site (DLI) under Highway 21, right before Dean Lake, which measures flow (and water quality). Each site recorded stage in 15-minute increments on a level logger recorded. Flow measurements were taken at various stages to create a stage-discharge relationship (rating curve). Flow data can be used to help estimate pollutant loads, calibrate the XP-SWMM model, and determine the level and volume of water flowing through the system.



**FIGURE 6 - PIKE LAKE PARK MONITORING SITE**

## WATER QUALITY

Three Rivers Park District monitored water quality at two locations on Pike Lake (the east and west bay). Samples are collected bimonthly and analyzed at Three River Park District's laboratory. Parameters that are sampled include temperature, dissolved oxygen, pH, conductivity, secchi, Chlorophyll-a, total phosphorus, soluble reactive phosphorus, total nitrogen, and chlorides. Results for these sites can be found on the PLSLWD website.



**FIGURE 7 2018 MONITORING SITES ALONG OUTLET CHANNEL**

PLSLWD took water quality samples at the Pike Lake Park monitoring site (ST\_26A) in addition to water quantity. Samples are taken biweekly for temperature, dissolved oxygen, pH, conductivity, turbidity, secchi tube, total phosphorus, orthophosphorus, nitrite + nitrate, total kjeldahl nitrogen, total suspended solids, total volatile suspended solids, e. coli, and chlorides. Scott SWCD took water quality samples at site DLI (Dean Lake Inlet) and DLO (Dean Lake Outlet). DLI sampling efforts are paid for by Lower Minnesota River Watershed District and DLO sampling efforts are paid for by PLSLWD (not the PLOC cooperators). Water quality samples were also taken in Prior Lake by a Citizen-Assisted Monitoring Program volunteer, which can serve as the water quality at the very beginning of the channel. As mentioned above, there are 2 sample sites within the PLOC and one at the very end to

determine how water quality changes along the channel. Data can be accessed by contacting PLSLWD staff.

Other monitoring along the PLOC in 2018 includes lake level on Prior and Pike Lake, vegetation surveys on Prior and Jeffers Pond, and BioBase (vegetation density mapping) on Prior and Pike Lake. (See Figure 7)

## PRECIPITATION

Precipitation can highly affect water quality and water levels. It is recorded at the PLSLWD office using a manual rain gauge provided by the State Climatologist. 2018 was an above average by 3.57" of rainfall, which helps explain why so much water left the lake through the outlet structure (see Attachment D). Luckily, the lake level never reached flood stage. The precipitation data is summarized in Appendix G.

## VEGETATION AND EROSION MONITORING

The outlet channel was assessed on foot from Segment 1 to Segment 7 on May 16, July 3, and September 19, 2018. Segment 8, which is under management by the United States Fish & Wildlife Service, was not assessed. For the spring and fall assessments, a series of photographs were taken in each segment to characterize the condition of the outlet channel, assess new areas of bank erosion, and document any obstructions to flow such as down trees, debris piles, or culvert blockages. All images were collected working upstream to downstream in each segment to aid in channel reference. The July survey was for targeted vegetation management. These reports can be found on the PLSLWD website with a summary of recommendations for continued channel and vegetation management in 2019. During these inspections, a species of concern, Fourpoint Evening Primrose, was first discovered in Segment 7 (see Figure 8).



**FIGURE 8 FOURPOINT EVENING PRIMROSE**

In 2018, Blue Water Science conducted an aquatic plant point-intercept survey on Jeffers Pond. The results of this survey can be found on the District's website.

## PERMITS

In 2018, the District had two open permits along the PLOC:

- Permit #10.02 *Jeffers Waterfront*: The District will complete the final inspection and close the permit in 2019.
- Permit #11.03 *Jeffers Pointe*: The District and the City of Prior Lake are coordinating to ensure proper establishment of the raingarden, at which time this permit will be closed.

## EASEMENTS

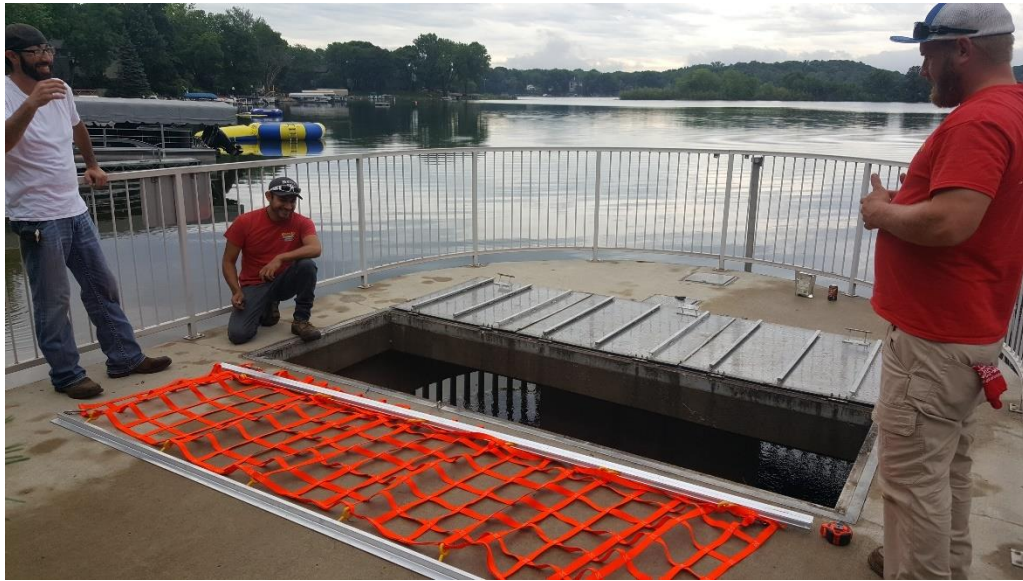
The District holds drainage easements along most of the Outlet Channel. An easement allows the District to access and maintain the channel and the land within the easement area. Because of damage in the channel by the 2014 flood, bank repair is needed along much of the channel. During the preparatory review process for this work, it had come to light that some of the easements are inaccurate and need to be amended. This could be because the channel has shifted over time, or due to errors in the legal description when it was originally established. Although the existing easements may be erroneous, the District retains prescriptive rights along the channel.

In 2018, the District closed on an easement amendment in Segment 4b that better aligns with the location of the Outlet Channel. The District also amended an easement in Segment 2 for the same purpose in anticipation of upcoming development. The District continues to negotiate and complete amendments to the Outlet Channel easements as opportunities arise.



## OTHER ACTIVITIES

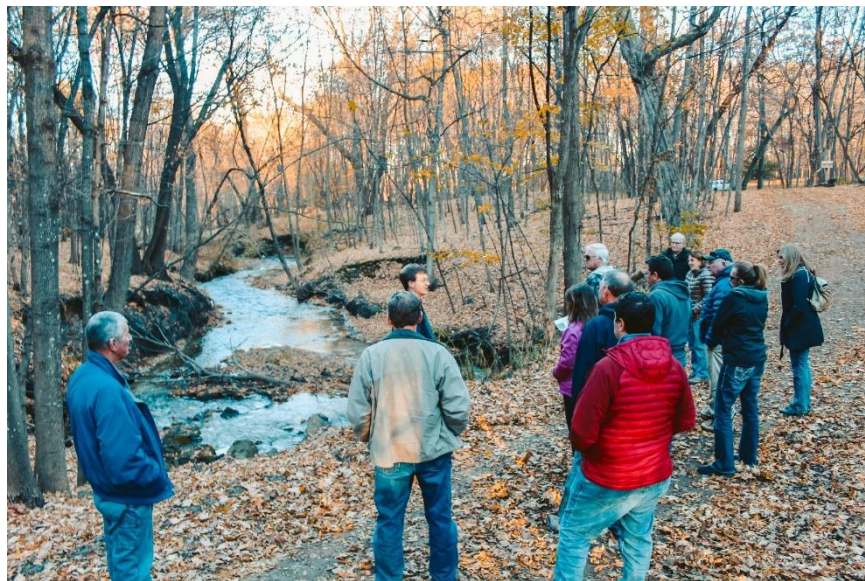
### *SAFETY NET AT OUTLET STRUCTURE*



**FIGURE 9 NEW SAFETY NET AT OUTLET STRUCTURE**

In 2018, a safety net was installed under the large trap doors at the outlet structure (see Figure 9). This was a huge safety concern. Without the safety net, it was possible to fall into the outlet structure which is connected to the outlet pipe, which travels underground until reaching the west side of Highway 21 (approximately 1/3 mile long).

### *TOUR OF OUTLET CHANNEL BANK EROSION*



**FIGURE 10 OUTLET TOUR**

A tour of the Outlet Channel was given on October 23, 2018 (see Figure 10). The tour was intended to inform PLSLWD Board Managers and partners of the bank erosion repair projects that will be completed in 2019 due to the 2014 floods. These repair projects will be funded by FEMA.





**FIGURE 11 SEDIMENT DELTA**

The Prior Lake Outlet Channel incurred substantial damage during the 2014 flood, including downed trees, accumulated woody debris, sediment accumulation, culvert damage and over 2.8 miles of bank erosion. In 2015, most of the tree and woody debris removal work was completed and one of the culverts (KiciYapi) was repaired by the Shakopee Mdewakanton Sioux Community. Removal of the remaining trees and woody debris, culvert repairs (Gonyea and Kes Field Crossing), and Pike Lake Park stream crossing repair work was completed in 2016. The sediment delta was excavated in spring of 2018. Due to permit and engineering design delays, the Bank Erosion project is expected to begin in the Summer of 2019. The Federal Emergency Management Administration (FEMA) has approved federal funding to cover 75% of the costs of the 2014 flood damage to the PLOC. The State of Minnesota will pay the remaining 25%.

After the washout of County Road 16, a lot of sediment accumulated along the channel in segment 5, including a sediment delta formed in the channel just downstream of Pike Lake Road after the flood in 2014 (see Figure 11). The delta was excavated in the end of 2017 and sediment within the channel was removed in early 2018 by BKJ Land Company. The costs of this project will be reimbursed by FEMA, however, the City of Shakopee did pay BKJ extra to remove some additional sediment that had accumulated before the flood.

### **MASTER PLAN**

A Master Plan was adopted by the Cooperators on 8/21/2018. The purpose of a master plan is to assess the current conditions of the Prior Lake Outlet Channel (PLOC) from a channel capacity, bank stability, easement alignment with physical conditions, and invasive species management standpoint. The Cooperators requested this master plan as a means to guide PLOC MOA activities over the next five years as a bridge to consideration of alternate means to manage the channel.