2019 Valley Branch Watershed District Infrastructure and Conveyance Systems Inspections

Prepared for
Valley Branch Watershed District Board of Managers

December 2019
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Appendix F 2019 Swede Hill Subwatershed Erosion Inventory Memorandum
Appendix G Long Lake Sediment Delta Assessment Memorandum
1.0 Executive Summary

The Valley Branch Watershed District (VBWD) owns, operates, and/or maintains a number of infrastructure and conveyance systems throughout the VBWD, including streams, storm sewer pipes, manholes, catch basins, water level control structures, infiltration basins, bank stabilizations, and dams. Natural and constructed, these systems convey, store, or treat surface water throughout the VBWD.

This report describes 25 VBWD systems (Figure 1-1) inspected by or to be inspected by Barr on a regular basis. Observations made by Barr staff during each inspection, including recommendations for maintenance and further inspection are provided. This report also documents maintenance activities performed by VBWD in 2019, including many activities recommended by Barr in the 2018 inspection report. Where maintenance or inspection are recommended in 2020, a cost estimate and priority level (Low, Medium, or High) are provided.

In 2019, VBWD experienced the wettest year on record, with large flood events resulting from snowmelt and rainfall in the spring, and persistently high water levels in landlocked and restricted-outlet basins throughout the watershed. All streams, infrastructure, and basins were stressed, resulting in only the 3rd emergency drawdown of the Project 1007 system in the past 30 years, and the first two emergency drawdowns of the Downs Lake Flood Duration Reduction project since the project was constructed.

In spite of the significant amount of flooding and conveyance throughout the watershed in 2019, the VBWD systems continue to perform well, with some exceptions as documented in the report. We recommend that the Managers authorize Barr to continue monitoring VBWD systems (natural and constructed) in 2020. Several of the systems can be inspected less than once a year (biennially, triennially, etc.); those systems would not be scheduled for re-inspection until 2021 or beyond. We also recommend that 21 of the 25 systems be inspected by Barr staff in 2020, for an estimated cost of $82,000.

Barr recommends 38 maintenance activities, classified as Low, Medium, or High priority. While completing all repairs would cost an estimated $442,500, we recommend that VBWD authorize the completion of all High-priority maintenance activities, for an estimated cost of $298,000, bringing the total for inspection and maintenance to $380,000 (assuming only High-priority items are addressed).
Figure 1-1

INFRASTRUCTURE AND CONVEYANCE SYSTEMS

2019 Infrastructure and Conveyance Systems Inspections Report
Valley Branch Watershed District

- Project 1007
- Echo Lake Outlet Project
- Weber Pond Outlet
- Silver Lake Outlet
- Silver Lake Bioretention Basin and Spent Lime Filter
- Olson Lake Estates Pond Outlet Project
- Downs Lake Flood Duration Reduction Project
- Oakgreen Avenue Infiltration Basin
- Blasko Dam Removal Location
- Ravine or Bank Stabilization Project

District Legal Boundary
Municipal Boundary
County Boundary

Valley Branch Watershed District

Map showing various infrastructure and conveyance systems in the district, including Projects 1007, Echo Lake Outlet, Weber Pond Outlet, Silver Lake Outlet, and other locations such as Silver Lake Bioretention Basin and Spent Lime Filter, Olson Lake Estates Pond Outlet Project, Downs Lake Flood Duration Reduction Project, Oakgreen Avenue Infiltration Basin, Blasko Dam Removal Location, and Ravine or Bank Stabilization Project.
2.0 Systems Inspections

This section summarizes Barr’s inspections of Valley Branch Watershed District (VBWD) infrastructure and natural conveyance systems and subsequent maintenance recommendations. VBWD systems are shown on Figure 1-1 and maintenance recommendations are shown on Figure 5-1. Systems discussed in this report are generally organized geographically from northwest to southeast.

2.1 Project 1007

2.1.1 Background

In 1987, the VBWD constructed Project 1007—a large flood-control project ($4.25 million). This project provides an outlet for many landlocked and flood-prone lakes in the northwest portion of the watershed, directing water to a Minnesota Department of Transportation (MNDOT) storm sewer along Interstate 94 and, ultimately, to the St. Croix River. The project included construction of new outlets for Long Lake, Lake Olson, Deer Pond, Hedges Pond, Hedges Bog, Lake Jane, Crombie Pond, Beutel Pond, Eagle Point Lake, Lake Elmo, Horseshoe Lake, the West Lakeland Storage Site (North, Middle, and South Ponds), and the MNDOT Rest Area Pond. VBWD has operated Project 1007 since construction. Project 1007 comprises approximately 5 miles of pipe, 60 manholes and water level control structures (including over 40 catch basins/manholes), two dams, and approximately 2 miles of open channels.

VBWD performs periodic maintenance on system components, as needed. In 2019, this included:

- Annual mowing of the Rest Area Pond and the side slopes of the channels between Horseshoe Lake and Interstate 94 and the West Lakeland Storage Site South Pond.
- Inspecting and removing vegetation from the Lake Olson outlet approximately monthly.
- Operating the system through a drawdown for the second time in Project 1007’s history, as described in Appendix A.

All 2019 operation and maintenance activities are listed in Section 4.0.

2.1.2 Observations

Barr staff members inspect Project 1007 open channels, water level control structures, and dams on an annual basis. The remaining manholes and catch basins are inspected every 3 years on a rotating basis, unless maintenance activities require more frequent inspection. On October 7 and 8, 2019, Patrick Brockamp, PE, and Josh Phillips conducted the regular (annual) inspection of Project 1007 components, as well as all 2019 maintenance activities performed by VBWD-hired contractors. Barr staff were unable to enter Structure 12 due to low oxygen levels at the time of the inspection; however, staff were able to visually observe flow from the surface and staff were able to enter and inspect Structure 12 in late November. On April 25, 2019, Pat Brockamp inspected the Eagle Point Lake Dam, and on October 30, 2019, Pat Brockamp and representatives from MNDOT inspected the Rest Area Pond Dam (both dams are part of the Project 1007 system). Appendices B and C contain separate inspection reports for Eagle Point Lake Dam and the Rest Area Pond Dam. While most open channels, manholes, catch basins, and
structures were accessible for inspection, some features were not fully accessible due to high water elevations.

Inspectors were unable to locate the outlet channel and pipe from Deer Pond during previous annual inspections. As recommended in the 2018 report, Barr inspected and was able to locate the Deer Pond outlet pipe. We found the 30-inch reinforced-concrete (RCP) outlet pipe to be in good condition, with no obstructions from sediment or vegetation (Photo 1).

Barr also met with The Royal Golf Club staff to investigate the channel downstream of Lake Elmo. Barr cleared vegetation and debris from the trash rack of the flared-end section channel outlet during the inspection (Photo 2).

Photo 1 (October 2019): Barr located the outlet pipe from Deer Pond.
Barr cleared vegetation and debris from the trash rack of the submerged flared-end section outlet for the channel downstream of Lake Elmo.

Barr staff noted a number of locations that require maintenance, as outlined in Section 2.1.3.

### 2.1.3 Recommendations

All of Project 1007’s components appeared to be performing adequately; however, we suggest that the Managers consider the maintenance items listed below. Relevant photos are provided following the recommendations list.

1. Continue annual mowing of the Rest Area Pond Dam and spillway.
2. Continue annual mowing of the side slopes of the channels between Horseshoe Lake and Interstate 94, including the West Lakeland Storage Site South Pond.
3. Remove accumulated dead trees and debris near the Rest Area Pond outlet and within the pipe to Structure 2 (Photo 3). The Managers authorized Buelow Excavating Inc. to perform this work in 2016; however, due to high water levels from 2016 through 2019, this work could not be completed. If water levels permit, this work will be performed in 2020.
4. Remove downed trees at Raleigh Creek (Photo 4, Photo 5, Photo 6).
5. Continue to implement animal management at the Rest Area Pond Dam at the burrows on the downstream side of the dam near the transmission tower (Photo 7) and continue to monitor and mitigate other animal activity.
6. Replace wooden stop logs with aluminum stop logs (Photo 8) at water level control structures, including structures 3, 4, 9, 10, and 12, in the order recommended in the April 19, 2019, memo to
the Managers. This Project 1007 Stop Log Replacement Prioritization memo is included in Appendix D.

7. Inspect the Project 1007 storm sewer via video. This storm sewer has not been inspected since construction in 1987; many municipalities conduct video inspections of their infrastructure every 5 to 10 years.

8. Inspect and remove vegetation from the Lake Olson outlet monthly from April to October.

9. Update the design and branding of, fabricate, and replace the faded Eagle Point Lake Dam sign.

Barr also recommends continuing the annual inspection of Project 1007 outlet control structures, channels, and associated dams and continuing the rotating triennial inspection of manholes and catch basins.

**Photo 3 (November 2015):** Barr recommends removing dead trees and debris from the Rest Area Pond outlet. (There is no 2019 photo because the outlet is under water.)
Photo 4 (October 2019): Barr recommends removing downed tree across Raleigh Creek.

Photo 5 (October 2019): Barr recommends removing downed tree across Raleigh Creek.
Photo 6 (October 2019): Barr recommends removing downed tree across Raleigh Creek.

Photo 7 (October 2019): Barr hired an animal management contractor to trap burrowing animals at the Rest Area Pond Dam. Barr recommends continuing to monitor and mitigate animal activity at the Rest Area Pond Dam in 2020 and as part of routine annual inspections.
2.2 Echo Lake Outlet

2.2.1 Background

In 1999, the City of Mahtomedi reconstructed the Echo Lake outlet to restrict outflows and protect downstream areas from flooding, as required by the VBWD. In 2002, the city installed a metal fence in front of the outlet to prevent debris from accumulating on the outlet structure.

2.2.2 Observations

Patrick Brockamp, PE, and Josh Phillips inspected the Echo Lake outlet on October 8, 2019, and found the structure in good condition. A dead tree noted in the 2018 inspection has since been removed from the path to the structure; it is not known who removed the tree. At the time of inspection, the inlet was submerged and the upstream water level was 0.14 feet below the elevation of the weir. The 4-inch-diameter low-flow orifice was functioning properly at the time of the inspection.

2.2.3 Recommendations

Barr recommends continuing the annual inspection of this project.
2.3 Weber Pond Outlet

2.3.1 Background
Weber Pond is a 7.5-acre wetland in the City of Mahtomedi that is split in two by an old streetcar embankment. In 2001, VBWD constructed a restricted outlet from the larger upstream portion of Weber Pond to the smaller downstream portion to replace the previous temporary outlet and limit the flood level of Long Lake.

2.3.2 Observations
Patrick Brockamp, PE, and Josh Phillips inspected the Weber Pond outlet on October 8, 2019, and found the structure in good condition. The inlet was submerged and the upstream water level was 0.52 feet below the elevation of the weir. The 9-inch-diameter low-flow orifice was functioning properly at the time of inspection.

2.3.3 Recommendations
Barr recommends continuing the annual inspection of this project.

2.4 Silver Lake Spent Lime Filter

2.4.1 Background
In 2015, the VBWD applied for and obtained a FY2016 State of Minnesota Clean Water Fund (CWF) grant to implement best management practices (BMPs) to reduce phosphorus loading from the watershed tributary to Silver Lake. The CWF grant included an "enhanced filtration" stormwater practice in the SLV-10 subwatershed, located north of Silver Lake in the City of Maplewood.

In 2017, Barr met with the City of Maplewood and the City of North St. Paul to discuss options for BMP design in the SLV-10 subwatershed. Barr designed a spent-lime filter that treats drainage from approximately 50% of the watershed tributary to Silver Lake.

In August 2018, the VBWD signed a joint powers agreement (JPA) defining roles and responsibilities related to the Silver Lake spent-lime filter. Among other items, the JPA indicates that the VBWD will annually inspect the site and perform routine maintenance of the filter. The VBWD will be responsible for removal and replacement of the spent-lime filter media when performance dictates (estimated at approximately 10 years). The VBWD contracted with Rachel Contracting, Inc., to construct the Silver Lake spent-lime filter in the fall of 2018. Rachel Contracting completed basin grading, filter media placement, and all structural elements from September 2018 through November 2018. The contractor completed planting and site restoration in the spring of 2019.

2.4.2 Observations
Following completion of the project, Barr observed that the inlet directing stormwater into the filter was allowing too much flow into the basin. Barr staff added a riser to the inlet to reduce inflow. As of fall 2019,
the basin is off-line while the appropriate inflow amount is determined. Once an acceptable inflow rate is determined, Barr staff will adjust the riser to allow inflow to the basin.

2.4.3 Recommendations

Barr will monitor the planting and site restoration completed in the spring of 2019 through the duration of the 1-year-guarantee period for plantings (expiring in the spring of 2020). The basin is currently off-line (see Section 2.4.211). Once the basin is online, Barr recommends periodic inspection during or following periods of precipitation to confirm that the amount of inflow to the filter is appropriate and that the filter is functioning as intended. At the request of the VBWD Managers, Barr will take samples of influent and effluent stormwater and test for total and dissolved phosphorus concentrations to assess BMP performance. The stormwater monitoring is not included in the budget values included in this report.

2.5 Silver Lake Bioretention Basin

2.5.1 Background

In 2000, the VBWD applied for and received a MetroEnvironment Partnership Grant to construct the Silver Lake Bioretention Basin. At the time, the stormwater management effectiveness of bioretention basins had not been studied to any great extent. The project was intended to treat stormwater runoff prior to discharging to Silver Lake and included designing, constructing, studying, and documenting the effectiveness of bioretention. The VBWD designed the project and the City of North St. Paul did the original construction and planting. After the original construction, the VBWD made enhancements to the basin to improve infiltration. The basin is approximately 0.4 acres and has a tributary area of about 7.4 acres.

In 2015, the VBWD applied for and obtained a FY2016 State of Minnesota Clean Water Fund (CWF) grant to implement BMPs to reduce phosphorus loading from the watershed tributary to Silver Lake. The CWF grant included improvements to the Silver Lake Bioretention Basin.

In January 2017, the VBWD and the City of North St. Paul signed a memorandum of understanding (MOU) regarding roles and responsibilities related to the Silver Lake Bioretention Basin. Among other items, the MOU indicates that the VBWD will annually inspect the site and provide a memorandum to the city with ordinary and necessary maintenance recommendations. The city will then contract with a qualified professional landscape maintenance company, facilitate, and pay for all maintenance at the site beginning the fifth year after construction. VBWD performed basin improvements in 2017 and 2018, with final revegetation completed in June 2018. VBWD’s contractor performed vegetation management under the original construction contract through June 2019. The VBWD will be responsible for vegetation management through June 2023, after which responsibility will be transferred to the city.

2.5.2 Observations

In fall 2018, the City of North St. Paul began street reconstruction work adjacent to the basin. Significant rainfall occurred on September 20, 2018. At that time, limited erosion control was in place upstream of the basin, and the basin’s primary outlet was blocked with sediment-control logs. As a result, significant
sedimentation occurred in the south end of the basin and water levels in the basin rose above the emergency overflow swale. Within 24 hours following the storm, water within the basin had completely infiltrated. Observation of the basin in 2019 suggests that infiltration performance was not affected, but increased weed growth was observed. The city’s road reconstruction and utility project is expected to continue into 2020.

Turf grass has successfully established around the perimeter of the basin. Some weed growth within the basin has occurred due to inadequate vegetation management within the 1-year maintenance period included in the original construction contract. Some of the plugs planted within the basin are failing. In fall 2019, Barr staff met with City of North St. Paul staff and a vegetation contractor (Prairie Restoration) to develop a vegetation management plan. The vegetation contractor mowed the basin in September 2019.

Barr will continue to monitor infiltration performance and vegetation in the basin through 2020. In spring 2020, the vegetation contractor will perform spot weed removal and replace plugs in select areas where weed management has removed native vegetation. Following initial vegetation management activities planned for spring 2020, Barr will assist the VBWD in hiring a contractor to perform an additional 3 years of basin vegetation management prior to transferring maintenance responsibility to the city, as described in the MOU.

2.5.3 Recommendations

Barr recommends continued inspection of erosion- and sediment-control practices adjacent to the basin to ensure the basin is protected. Barr also recommends continued inspection of the basin after significant rainfall events to determine if the sedimentation resulting from the September 20, 2018, storm has permanently impacted basin infiltration performance. Following the conclusion of the road reconstruction and utility work, Barr recommends that the VBWD request that the city hire a contractor to remove the deposited sediment from the south end of the basin and replace vegetation that is damaged during sediment removal (Photo 9). Barr also recommends that VBWD update the design and branding of, fabricate, and replace the missing Silver Lake Bioretention Basin sign.
Photo 9 (Fall 2019): Following completion of the City of North St. Paul’s road reconstruction project, Barr recommends coordinating with the city to remove deposited sediment from the Silver Lake Bioretention Basin.

2.6 Silver Lake Outlet

2.6.1 Background

The outlet from Silver Lake is a V-notch weir located on the west side of Century Avenue (T.H. 120) on the east side of the lake. The outlet is located in the City of Oakdale and Washington County, but Ramsey County has historically inspected and maintained the outlet. Since Silver Lake is tributary to Project 1007, VBWD’s flood-control project, it is important that the VBWD not allow modifications to the Silver Lake outlet that would negatively affect the proper functioning of Project 1007. Responding to a September 27, 2018, Ramsey County request, the VBWD has agreed to take over inspection and maintenance responsibilities from the county for the Silver Lake outlet effective January 1, 2020. MNDOT will continue to own and operate the culvert downstream of the outlet.

2.6.2 Observations

Patrick Brockamp, PE, and Josh Phillips inspected the Silver Lake outlet on October 8, 2019, and found the structure in good condition. The lake level was approximately 4 inches above the V-notch weir. There was some minor debris and vegetation buildup at the weir, but flow was not being obstructed (Photo 10). Barr cleared the weir during the inspection.
2.6.3 Recommendations

Barr recommends inspecting and cleaning the outlet (as needed) on a weekly basis from ice-out until October. This inspection and maintenance frequency corresponds to what Ramsey County performed.

2.7 Long Lake Ravine Stabilization Project

2.7.1 Background

The Long Lake Ravine Stabilization Project was constructed by the VBWD in 2009. The project included channel grading, riprap, and natural vegetation to stabilize the head of a ravine entering Long Lake from the west. A portion of the stream entering the ravine is contained within a culvert and manhole to give neighboring landowners access to their property.

2.7.2 Observations

Barr mostly recently inspected this project in 2018 and found the project area in good condition with well-established vegetation and no signs of erosion. The rock vanes toward the downstream end of the project appeared to be intact and functioning as intended.

2.7.3 Recommendations

Barr recommends continuing the biennial inspection of this project, with the next inspection scheduled for 2020.
2.8 DeMontreville Ravine Stabilization Project

2.8.1 Background

VBWD constructed the DeMontreville Ravine Stabilization Project in 2009. The ravine runs through the City of Lake Elmo’s DeMontreville Wildlife Park, connecting the ponds downstream of Long Lake with Lake DeMontreville. This VBWD project included installation of boulder cross vanes, straight vanes, and natural vegetation to repair and stabilize the stream banks throughout the ravine. To reduce the amount of sediment entering Lake DeMontreville, VBWD also installed a sedimentation basin. In 2015, VBWD installed a baffle box and a flat, slotted grate at Catch Basin 47 to reduce plugging caused by leaf and tree debris and promote more efficient flow through the outlet.

2.8.2 Observations

On October 8, 2019, Patrick Brockamp, PE, and Josh Phillips inspected the project. The vegetation along the entire ravine is well-established, including the tree and shrub plantings. The boulder straight vanes appear to have partially washed away and are not easily identifiable in the channel. The boulder cross vanes appeared to be in good condition, but contained minor built-up debris and vegetation that partially obstructed flow. The debris and vegetation at Cross Vane No. 2 has caused minor erosion on both channel banks (Photo 11). Barr staff removed the built-up debris and vegetation at all boulder cross vanes during the inspection to restore unobstructed flow through the ravine (Photo 12).

The improvements at Catch Basin 47 appear to be functioning well, but vegetation and debris was blocking portions of the baffle box at the time of the inspection. Barr cleared the vegetation around the catch basin and baffle box to restore full flow through the outlet.

Barr observed accumulated sediment in the DeMontreville Ravine sedimentation basin and near the outlet to Lake DeMontreville (Photo 13). Barr also observed some vegetation growing in the sedimentation basin. In the fall of 2019, Barr developed plans to dredge the sedimentation basin and the area around the outlet into Lake DeMontreville. On November 14, 2019, the VBWD Board of Managers awarded the work to Rachel Contracting, Inc. This dredging work is scheduled to be completed in December 2019.
Photo 11 (October 2018): Barr observed minor bank erosion on both sides of the channel at Cross Vane #2.

Photo 12 (October 2019): Barr staff removed debris from DeMontreville Ravine during inspection.
2.8.3 Recommendations
Barr recommends continuing the annual inspection of this project.

2.9 Olson Lake Estates Pond Outlet Project
2.9.1 Background
VBWD constructed the Olson Lake Estates outlet in 1996 to connect the overflow from the Olson Lake Estates Pond (located west of Lake Olson in an Oakdale housing development) to Project 1007. This allows the stormwater runoff from the housing development to bypass Lake Olson and discharge to Project 1007 downstream of Crombie Pond—protecting the water quality of Lake Olson. The project included the construction of 19 manholes. These are inspected every 3 years on a rotating basis, unless maintenance activities necessitate more frequent inspection.

2.9.2 Observations
On October 8, 2019, Patrick Brockamp, PE, and Josh Phillips inspected six manholes and found them all to be generally in good condition. Barr observed a casting that is slightly offset relative to the adjusting rings at MH 13. In 2018, Barr observed partially cracked casting rings at MH 6.


**2.9.3 Recommendations**

The Olson Lake Estates Pond Outlet Project components appeared to be performing adequately; however, we suggest that the Managers consider video inspection of the portion of storm sewer not inspected by Washington County in 2017. Many municipalities conduct a video inspection of their infrastructure every 5 to 10 years. Barr also recommends that we continue to coordinate with the City of Lake Elmo to remove the 7-inch-diameter maple tree adjacent to MH 9 to ensure that the tree does not damage the structure or casting).

Barr also recommends continuing the rotating triennial inspection of this project, with the exception of MH 6, which should be inspected on an annual basis to monitor deterioration.

**2.10 Raleigh Creek**

**2.10.1 Background**

Raleigh Creek is a stream that drains water from portions of Oakdale and Lake Elmo, ultimately discharging to Eagle Point Lake. Downstream of Stillwater Boulevard, Raleigh Creek is used as a conveyance for, and inspected as part of, Project 1007 (Section 2.1). The Raleigh Creek Bank Stabilization Project (Section 2.10) is at two locations between the Union Pacific Railroad and Stillwater Boulevard (CSAH 6).

**2.10.2 Observations**

On October 31, 2019, Alec Bateman and Sean Campbell inspected approximately 8,500 feet of Raleigh Creek, from the Lake Elmo Park Reserve Red Trail (south of Tablyn Park), to the railroad culvert near 32nd Street North. Photo 14 shows the general cross section of Raleigh Creek. Barr observed some locations with minor-to-moderate erosion along the creek banks (Photo 15 and Photo 16) and some locations where erosion is undercutting stream bank vegetation, causing roots and smaller trees to begin to lean over the creek (Photo 17).
Photo 14 (October 2019): This photo shows the Raleigh Creek typical section downstream of Stillwater Boulevard.

Photo 15 (October 2019): Barr observed minor bank erosion, downstream of Tablyn Park.
Photo 16 (August 2019): Barr observed moderate bank erosion downstream of Tablyn Park.

Photo 17 (August 2019): Barr observed moderate bank erosion undercutting vegetation on the bank, downstream of Tablyn Park.
2.10.3 Recommendations
Barr recommends assessing potential access routes that could make it possible to stabilize the eroding areas while minimizing tree removals. Barr also recommends inspecting the observed erosion sites in conjunction with the Raleigh Creek Bank Stabilization Project (Section 2.11) in 2020 to better determine how rapidly the erosion is occurring. Barr recommends continuing the triennial inspection of the entire creek, with the next inspection in 2022.

2.11 Raleigh Creek Bank Stabilization Project

2.11.1 Background
The VBWD Raleigh Creek Bank Stabilization Project, constructed in 2009, includes two reaches. The first reach is in Oakdale's Anna's Grove development, located between the railroad tracks and 31st Street North, primarily on City of Oakdale property. A small section of the creek meanders onto private property, currently owned by Tony Ulrich (7650 31st Street North). The second reach is approximately 350 feet upstream of Tablyn Park in Lake Elmo on private properties currently owned by David Moore, Jr. (8680 Stillwater Boulevard) and Michael Reid (8740 Stillwater Boulevard). Stabilization work included installation of cross vanes for grade control, two new outlets for stormwater ponds, root wads, live stakes, and plantings.

2.11.2 Observations
Sean Campbell and Alec Bateman inspected this project on October 31, 2019, while completing an inspection of the entire creek. Most areas remained in stable condition. Minor erosion previously documented upstream of a rock vane installed on the Moore property has not worsened.

2.11.3 Recommendations
Barr recommends continued biennial monitoring of the minor erosion on the Moore property and the stream upstream of the property to determine if additional action is necessary. The next inspection should be in 2020.

2.12 Farney Creek Stabilization Project

2.12.1 Background
VBWD constructed the Farney Creek Stabilization Project in 2005 on the property currently owned by Aaron and Trista Goldstrohm (8171 21st Street North) within the Torre Pines subdivision of Lake Elmo. In March 2013, VBWD installed riprap to repair bank erosion caused by a July 2011 storm. In May 2013, the contractor returned to make final adjustments and repair minor damage to the lawn and sprinkler caused during riprap installation. In the spring of 2014, the homeowners noted new erosion downstream of the repaired area and adjacent to a private walking bridge.

In 2015, the former owners of the home at 8219 21st Street North (Joe and Tammy Dunckel), downstream of the Goldstrohms, also contacted the VBWD Engineer regarding eroding banks on their property. David
and Beverly Liebenow currently own the property. Barr assessed the erosion in 2015 and 2017 and recommended stabilizing the creek in this area by stabilizing a head cut and grading eroding banks.

Jeff Weiss, PE, and Briana Drake completed a design to stabilize the project reach and Minnesota Native Landscapes, Inc., (MNL) completed the work in November 2018. MNL regraded steep, eroded banks through the power line corridor and Liebenow property, installed four rock vanes for grade control, and installed cedar revetments on the upstream end of the Goldstrohm property. MNL seeded disturbed areas with a riparian mix of natural grasses and flowers and covered exposed banks with erosion-control blanket.

### 2.12.2 Observations

Samantha Beck inspected this project on September 9, 2019. Though much of the site has vegetation, and the rock vanes and cedar revetments are stable, there are three areas of the bank that show signs of erosion due to a lack of established vegetation (Photo 15).

![Photo 18 (September 2019): This photo shows the eroded bank on the Liebenow property, looking downstream.](image)

### 2.12.3 Recommendations

Barr recommends completing minor grading on the erosion sites and re-establishing a vegetative cover to protect the banks. Barr also recommends continued annual inspection of the project until repairs are considered stable.
2.13 Goetschel Pond Ravine Stabilization Project

2.13.1 Background
VBWD completed construction of the Goetschel Pond Ravine Stabilization Project in 2009 in the City of Lake Elmo. The ravine drains to Goetschel Pond and affects land on property currently owned by:

- Julie and Michael Nelson (4768 Larkspur Lane North).
- Kevin and Maureen Tholen (4854 Linden Trail North).
- Anthony and Sara Yocum (4886 Linden Trail North).
- The Fields of St. Croix Homeowners Association (some parcels).
- The Robert Engstrom Companies (out lots).

Prior to the project, residents reported erosion and accumulation of sediment at the downstream end of the ravine. Stabilization required:

- Importing fill to rebuild the base.
- Installing an armored channel to prevent future erosion of the base.
- Installing vegetated reinforced soil slope (VRSS) to stabilize a steep slope adjacent to a private residence.
- Repairing an upstream detention pond to prevent stormwater seepage near the outlet pipe.

2.13.2 Observations
Barr most recently inspected this project in 2018 and observed that sites stabilized during the original project were in good condition.

2.13.3 Recommendations
Barr recommends continuing the biennial inspection of this project, with the next inspection in 2020.

2.14 Sunfish Lake Ravines

2.14.1 Background
Sunfish Lake is a landlocked, nutrient-impaired water in Lake Elmo. Along the north shore there are a number of ravines that drain into the lake, several of which have erosion areas. The ravines are city-owned and private (residential) property. The Friends of Lake Elmo’s Sunfish Lake Park and Sally Manzera Interpretive Nature Center are located on the northwest shore of the lake, and there may be opportunities for VBWD to collaborate with the Nature Center on natural resources improvement and education efforts.
2.14.2 Observations
Josh Phillips and Kallie Doeden inspected the Sunfish Lake ravines on May 6, 2019. Barr observed 12 locations with minor erosion and no moderate, significant, or severe erosion sites. Barr staff documented erosion sites in a memorandum, included in Appendix E.

2.14.3 Recommendations
Barr recommends inspecting the erosion sites triennially, with the next inspection scheduled for 2022.

2.15 Goose Lake Ravine Stabilization Project

2.15.1 Background
VBWD completed construction of the Goose Lake Ravine Stabilization Project in 2009 at 9200 10th Street North (former Zimmerhakl residence) and 9140 10th Street North (Dennis and Karen Geffre residence) to stabilize significant erosion at the head of the ravine. Mr. Zimmerhakl had made several attempts to stabilize the channel on his property with mixed results. The initial project included installation of rock vanes, plantings, and an armored channel through the steepest and most actively eroding portion of the channel. High flows in the following years undermined the armoring and caused additional erosion in the armored channel. VBWD installed two large rock vanes in the ravine in December 2012 to act as grade control and stop erosion. After additional erosion was observed in subsequent years, VBWD hired Wetland Habitat Restorations (WHR) to install stabilization measures in October 2017. WHR installed two additional cross vanes, repaired a previously installed cross vane, and installed armoring in select places.

2.15.2 Observations
Samantha Beck inspected the project site on September 9, 2019, and observed that the stabilization measures installed by WHR in 2017 are in good condition (Photo 19).
2.15.3 Recommendations
Barr recommends continuing annual inspection of this project.

2.16 Downs Lake Flood Duration Reduction Project

2.16.1 Background
VBWD constructed the Downs Lake Flood Duration Reduction (FDR) Project in 2002 to provide an emergency flood outlet from Downs Lake and a complex of wetlands and lowlands adjacent to it. The project created a lower overflow from Downs Lake to Horseshoe Lake, which is part of the Project 1007 system. Efforts included the installation of pipes, a check valve (which acts as a flap gate), and four gates which require manual operation. The operating plan for the gates allows the water level on Downs Lake to be lowered under certain conditions. In 2019, the system was operated for the first time, with VBWD performing two separate drawdowns.

2.16.2 Observations
Patrick Brockamp, PE, Josh Phillips, and Jeff Brower inspected the project components on October 7, 2019, and found them to generally be in good condition. Barr observed pumping and drawdown efforts (second 2019 drawdown) for Downs Lake during the inspection, including pumping from The Royal Golf Club pond to Downs Lake, conveyance of flows through Structure 1 and Structure 2, pumping from Eden Park Pond to Downs Lake (bypassing MH-4 and Structure 3), and a muni-ball placed in the pipe upstream of MH-4 to restrict backflow from Downs Lake to Eden Park Pond. VBWD hired a contractor to install the
muni-ball because the backflow preventer (Red Valve) in Structure 3 and the manhole riser section were leaking, contributing to a rise in the elevation of the Eden Park Pond.

During the second drawdown, erosion developed around the culvert under 20th Street North, and VBWD hired a contractor to repair the erosion and install riprap around the upstream end of the culvert (Photo 20).

Further discussion of the operation of the Downs Lake FDR Project can be found in Section 4.0.

Photo 20 (October 2019): VBWD hired a contractor to install riprap at the inlet pipe to Downs Lake Structure 1 on the upstream side of 20th Street North.
Photo 21 (October 2019): This photo shows the pump at Eden Park Pond, pumping to Downs Lake.

Photo 22 (October 2019): This photo shows the pump discharge from Eden Park Pond to Downs Lake.
2.16.3 Recommendations

Barr recommends that the Managers consider the following maintenance items:

1. Replace the failed backflow preventer in Structure 3.
2. Consider video inspection of the project components not inspected by The Royal Golf Club in 2018. These portions of the 16-year-old storm sewer have never been video inspected. Many municipalities conduct a video inspection of their infrastructure every 5 to 10 years.
3. Re-evaluate the operation of the system and recommend improvements, including new infrastructure, to make operation of the system more efficient.

Barr also recommends continuing annual inspection of this project.

2.17 Valley Creek

2.17.1 Background

Valley Creek comprises three major reaches: the North Fork, the South Fork, and the Main Stem. The North Fork flows 1.6 miles from Lake Edith to its confluence with the South Fork. Below the confluence of the North and South Forks, the Main Stem of Valley Creek flows 1.8 miles to the mouth of the creek at the St. Croix River. The perennially flowing reaches of Valley Creek make up a trout stream.

The South Fork of Valley Creek has areas of both perennial and intermittent flow. From a point approximately 0.75 miles east of Neal Avenue (CSAH 71) to its junction with the Main Stem (a 2.5-mile stretch) the South Fork flows year-round. Upstream of this location, the creek is dry most of the time, flowing only during rain or snowmelt. The most upstream and western end of intermittent flow is about a half mile west of Manning Avenue (Highway 95) and north of Valley Creek Road in Woodbury. A southern leg of the South Fork includes a privately owned dam and splits into three reaches that each extend to near 40th Street South.

The Oakgreen Avenue Infiltration Basin (Section 2.18) and the stabilization projects on the Landucci and Moynagh properties (Section 2.19) are within the watershed of the South Fork of Valley Creek. The Blasko Dam Removal Project (Section 2.20) and the Valley Creek Upstream Stabilization Project (Section 2.21) are on the South Fork of Valley Creek. The Valley Creek Downstream Stabilization Project (Section 2.22) is on the Main Stem of the creek.

2.17.2 Observations

At its December 2017 meeting, the Managers authorized Barr to perform additional investigation of one site on the North Fork of Valley Creek and three sites on Valley Creek tributary ravines, as listed in Table 2-1. During 2017 inspections, Barr had identified the sites as having significant erosion that warranted additional investigation to determine whether corrective action was needed. The Board authorized Barr to visit each of the sites and assess the feasibility of construction site access as well as gauge landowner willingness to complete a project and, in some cases, incorporate a vegetated buffer.
### Table 2-1  Prioritized Significant Erosion Locations for Valley Creek

<table>
<thead>
<tr>
<th>Site</th>
<th>Property</th>
</tr>
</thead>
<tbody>
<tr>
<td>57</td>
<td>2167 Oakgreen Avenue South</td>
</tr>
<tr>
<td>72</td>
<td>14640 32nd Street South</td>
</tr>
<tr>
<td>223</td>
<td>14300 15th Street Circle South</td>
</tr>
<tr>
<td>221</td>
<td>1520 Stagecoach Trail South</td>
</tr>
</tbody>
</table>

Barr described the site inspections and evaluations in a memo provided to the Managers dated August 3, 2018. Continued triannual inspection of Valley Creek was recommended, with the next inspections to occur in 2020.

#### 2.17.2.1 Ravine 2 East

Following a 2008 inspection, Barr classified Ravine 2 East as medium priority; however, it was not included in Table 2-1, as the landowners at that time were not conducive to incorporating stabilization and/or infiltration measures. In 2016, during the construction of the Moynagh ravine stabilization project, the landowner of the main portion of the ravine approached Barr about installing stabilization features in Ravine 2 East. Barr re-inspected the ravine in 2017 and again identified some erosion concerns.

During their August 9, 2018, meeting, the Managers directed Barr to consider submitting a Clean Water Fund (CWF) grant for a project on Valley Creek. Briana Drake, Jen Koehler, PE, and Jeff Brower inspected Ravine 2 East on August 22, 2018.

The ravine is mostly on property owned by Don and Mary Lacho; however, at the time of the 2018 inspection, the field area immediately above the ravine was owned by Landucci Homes. In the spring of 2019, the Landucci property was sold to Tim and Mary Leba.

The 2018 inspection found that moderate, ongoing erosion is evident within the ravine (site 32) and significant headcutting is occurring at the head of the ravine on property now owned by the Lebas. Barr recommended the installation of a vegetated infiltration basin on the Leba property to reduce the rate of erosion, along with stabilization at the erosion and headcut sites within the ravine. In August 2018, Barr discussed partnering with Mr. Lacho and Mr. Landucci on a ravine stabilization project and the property owners were interested. Barr developed the CWF grant application, the VBWD submitted the application in August 2018, and was notified that they received the grant in late 2018. As of March 2019, all grant agreements were in place. Barr has since been in the process of collecting field data, including soil borings and topographic and tree survey data. Barr will proceed with project design and permitting over the winter and spring of 2019 and 2020, with construction anticipated in the fall of 2020.

#### 2.17.3 Recommendations

At Ravine 2 East, Barr will continue with the design and permitting for a vegetated infiltration basin for rate control at the head of the ravine and stabilizing the erosion and headcut sites within the ravine to
reduce the rate of erosion. Following completion, Barr recommends annual inspection of the project until vegetation is established.

At Valley Creek Site 72, we recommend discussing with the City of Afton the feasibility of installing a surface infiltration feature adjacent to the 32nd Street South cul-de-sac to reduce runoff to the top of the ravine, and annual inspection of the ravine (Qualters, Holzmer, and Du properties).

We also recommend continued triennial inspection of Valley Creek, with the next inspection scheduled for 2020.

2.18 Oakgreen Avenue Infiltration Basin

2.18.1 Background

VBWD completed the Oakgreen Avenue Infiltration Basin Project in 2008. The project involved the construction of a 0.4-acre infiltration basin at the top of an eroding ravine to reduce runoff volume and sediment loading to Valley Creek.

VBWD and an Environmental Protection Agency 319 grant paid for the project.

2.18.2 Observations

Andrea Wedul inspected this project on June 19, 2019, and found it in generally good condition; however, some undesirable vegetation (woody plants, vines, and invasive species) was present in and around the basin. The overall vegetative diversity in the basin appeared relatively low for forbs, but the grass presence and diversity was relatively good overall. The riprap at the outlet was clean and free of debris and sediment.

2.18.3 Recommendations

The Oakgreen Avenue Infiltration Basin appeared to be performing adequately; however, we suggest hiring a vegetative management contractor to remove invasive woody and vine species within the basin and provide a higher diversity of forbs through seeding and selective maintenance.

Barr also recommends continuing the biennial inspection of this project, with the next inspection in 2021.

2.19 Valley Creek Ravine Stabilization Projects—Landucci and Moynagh Ravines

2.19.1 Background

The Valley Creek Ravine Stabilization Projects—Landucci and Moynagh Ravine (also known as the Clean Water Fund Ravine 2 West Project) stabilized approximately 2,100 feet of eroding ravine in the Valley Creek subwatershed of Afton with 29 check dams and a riprapped drop structure. A grant from the Clean Water Fund, matched with VBWD dollars, paid for construction of the projects. The Landucci Ravine Stabilization Project was completed in December 2015 and the Moynagh Ravine Stabilization Project was completed in October 2016. The Moynagh Ravine property was sold to Jim and Marjorie Wade in 2016.
2.19.2 Observations
Josh Phillips inspected the Landucci Ravine Stabilization Project and the Moynagh Ravine Stabilization Project in October 2019 and found them in good condition. Rock vanes appear intact and are not being bypassed or significantly eroded. Vegetation has generally established throughout the ravine with denser establishment in areas where sunlight reaches the floor of the ravine and thinner establishment in shadier areas. The property owner has mowed a portion of the ravine to establish a walking path.

In 2018, Barr observed evidence of bank erosion where additional sediment had deposited at the upstream side of the Valley Creek Trail culvert crossing. It appeared that the source of the sediment was Ravine 2 East (Section 2.17.2.1), which is adjacent to the Landucci/Moynagh Ravine and drains to the same culvert crossing of Valley Creek Trail. In 2019, Barr did not observe any new sediment deposition and noted the bank erosion appeared to be stable. The previously deposited sediment has been stabilized with vegetation.

2.19.3 Recommendations
Barr recommends continuing annual inspection of these projects to monitor vegetation growth and possible sediment movement in the ravine.

2.20 Blasko Dam Removal Project
2.20.1 Background
VBWD completed the Blasko Dam Removal Project in 2010 at the request of landowners Scott and Audrey Blasko (14020 Valley Creek Trail South). VBWD removed the existing dam and replaced it with a series of boulder weirs that maintain upstream water levels, allow upstream fish passage, and prevent channel downcutting at the upstream bridge on Valley Creek Trail. The boulder weirs also result in less upstream pool area and associated reductions in solar input benefit the trout population.

2.20.2 Observations
Tom MacDonald, PE, inspected the project on June 27, 2019, and found the project site was in excellent overall condition, with no observed erosion despite elevated springtime flows (Photo 23). The landowner has constructed a point bar upstream of the boulder riffle, but it is functioning well and not impeding flows (Photo 24).
Photo 23 (June 2019): Looking upstream at boulder riffle

Photo 24 (June 2019): The landowner created a point-bar upstream of the boulder riffle.
2.20.3 **Recommendations**

Barr recommends continuing the biennial inspection of this project, with the next inspection in 2021.

### 2.21 Valley Creek Upstream Stabilization Project

#### 2.21.1 Background

The Valley Creek Upstream Stabilization Project addressed bank erosion exacerbated by a severe flood in the spring of 2007. The work was done on properties owned by Charles and Natalie Cremens (formerly Jeff and Angela Polacek, 14100 Valley Creek Trail South) and Kenneth and Heidi Brooks (formerly Joseph Meissner, 14186 Valley Creek Drive South). Work on the Cremens property consisted of stabilizing a short portion of streambank using a root wad, grading, biolog, and revegetation. More extensive remediation was required on the Brooks property, located several hundred feet downstream of the Cremens. This included repair of two significantly eroded banks using a combination of grading, root wads, boulder vanes, and riprap, as well as replacement of an illegal weir/culvert with a boulder riffle more amenable to fish passage. VBWD also stabilized a nearby culvert inlet to the creek on the downstream end of the Doyle property (14378 Valley Creek Trail) using rock and native vegetation. The work was completed in 2008 and paid for by the VBWD and an Environmental Protection Agency 319 grant. In 2009, VBWD repaired erosion of a contributing ravine where it joins the creek on the Brooks property (caused by early spring snowmelt). These repairs were paid for by VBWD.

#### 2.21.2 Observations

Tom MacDonald, PE, inspected the project on June 27, 2019, and found it in overall excellent condition. Minor streambank erosion was evident at the Cremens property, but additional repairs are not recommended. The project that was completed on the Brooks property is in excellent condition, with no observed erosion ([Photo 25](#)). The culvert stabilization on the Doyle property was also in excellent condition ([Photo 26](#)).

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**Photo 25 (June 2019):** A constructed riffle on the Brooks property is functioning well.
2.21.3 Recommendations

Barr recommends continuing the biennial inspection of this project, with the next inspection in 2021.

2.22 Valley Creek Downstream Stabilization Project

2.22.1 Background

In 2009, VBWD completed the Valley Creek Downstream Stabilization Project at 15901 Putnam Boulevard South (property formerly owned by Tom Johnson and now owned by Tim and Diane Rivas) and 2398 St. Croix Trail South (property owned by Susan Stanton). The VBWD and an Environmental Protection Agency 319 grant paid for the project. The purpose of the project was to stabilize the badly eroded and incised channel reach. To accomplish this, VBWD installed a series of eight boulder riffles to achieve channel grade control, created floodplain terraces to provide connectivity to the floodplain, and restored the streambanks with native vegetation. The VBWD stabilized channel banks susceptible to
erosion using bioengineering methods (primarily root wads) and established a native vegetation buffer along the project corridor to provide additional protection and habitat.

The project has largely been successful, and the associated reach of Valley Creek is considered stable; however, at the upstream reach of the project, Tim and Diane Rivas have not maintained the full extent of the native buffer. This has increased the potential for future erosion. In addition, the channel had been eroding the east streambank at the upstream-most riffle.

In 2015, Barr recommended repairs consisting of repositioning the boulders on the left side of the riffle (looking downstream) and adding additional boulders to further reinforce the riffle. Barr also recommended repairing the bank immediately downstream of Riffle 8 by installing root wads, provided that Mr. Rivas would agree to stop mowing the overbank adjacent to the erosion area. Mr. Rivas agreed to stop mowing in certain vulnerable areas, but not to maintain the extent of the original buffer. The Managers obtained bids for the work in late June 2016, and they selected Nadeau Companies to perform the work. Construction was completed in the fall of 2016.

2.22.2 Observations

Tom MacDonald, PE, inspected the project on June 27, 2019, and found it in overall good condition, with a few areas of minor-to-moderate bank erosion. The repaired riffle was in very good condition and has improved over recent years as vegetation has become more established (Photo 27). Barr noted two areas of minor erosion downstream of the repaired riffle, but the erosion does not pose a threat to the riffle structure and should be self-mitigating. Several other areas of moderate erosion were noted downstream of this, some of which are the result of inadequate buffer width. They do not pose an immediate concern, and would likely recover if the buffer width is enhanced (Photo 28).

On the Stanton property, mowing has occurred adjacent to the stream in an area that has not been previously mowed, and minimal buffer exists for a portion of the left (north) overbank (Photo 29). No related stream erosion is evident, but it increases the vulnerability of the channel to future erosion.
Photo 27 (June 2019): The riffle repaired in 2016 is holding up well, with minor erosion on the downstream left bank.

Photo 28 (June 2019): Moderate bank erosion could be self-mitigated with a wider buffer.
2.22.3 Recommendations
Barr staff will discuss the vegetative buffer concerns with the two landowners to encourage them to increase the buffer width. Barr recommends continuing annual inspection of this project, with the next inspection in 2020.

2.23 30th and Trading Post Ravine Stabilization Project

2.23.1 Background
VBWD stabilized approximately 325 feet of an eroding ravine with a concrete drop structure and 130 feet of 60-inch-diameter pipe. The project site is near the intersection of 30th Street South and Trading Post Trail South in the Valley Creek subwatershed of Afton. Construction of the project was completed in December 2015 and funded by a grant from the Clean Water Fund with matching VBWD dollars.

2.23.2 Observations
Patrick Brockamp, PE, inspected the project on October 7, 2019, and found most of the site in good condition. In 2018, a new home construction site and plugged driveway culvert on the north side of 30th Avenue contributed to additional flow and sedimentation in the roadway which caused nuisance conditions and erosion at the driveway of Mr. Du, resident at 2997 Trading Post Trail South. Jeff Brower visited the site on November 4, 2019, and confirmed that the City of Afton had unplugged the driveway culvert and that the new home construction was complete and stabilized. Jeff noted that no new riprap
was installed downstream of the culvert and that he thought some should be added. In the southeast corner of the intersection along Trading Post Trail, there is a steep slope (< 0.5H:1V) that has minor erosion under previously installed erosion-control blanket (Photo 30). In the northwest corner of the intersection, there is a damaged flared-end section that has been noted in previous inspections (Photo 30).

Photo 30 (October 2019): This photo shows a damaged flared-end section in the northwest corner of the intersection.

Photo 31 (October 2019): There is a steep slope from the road to the existing culvert and some erosion is evident below the vegetation.
2.23.3 **Recommendations**

Barr recommends:

- Coordinating with the City of Afton to replace the damaged flared-end section.
- Extending the 30” CMP to the south along the ditch, reattaching the flared-end section, placing new riprap, and backfilling over the pipe to achieve flatter and more stable ditch slopes.
- Continuing annual inspection of the 30th and Trading Post site to monitor erosion of the steep roadside ditch slope.

2.24 **Kelle’s Creek**

2.24.1 **Background**

Kelle’s Creek, formerly part of the Lower St. Croix Watershed Management Organization (LSCWMO), was added to the VBWD in 2009. Kelle’s Creek has areas of both perennial and intermittent flow. The perennially flowing portion of the creek starts about 0.45 miles northeast of the intersection of Trading Post Trail and Afton Boulevard (CSAH 18) in a steep-walled valley that extends approximately 2.8 miles to the mouth of the St. Croix River. Upstream, the creek is intermittent—dry most of the time but flowing during runoff events. VBWD has funded several projects implemented by the Washington Conservation District (WCD) in the Kelle’s Creek subwatershed to stabilize eroding ravines.

2.24.2 **Observations**

Barr most recently inspected Kelle’s Creek and its tributary ravines in 2017 and 2018. Barr observed 70 sites with minor erosion, 29 sites with moderate erosion, and six sites with significant erosion and one site with severe erosion. In 2018, Barr also observed a flared-end section (FES) that was separated from the storm sewer along the ravine (Photo 32).
2.24.3 Recommendations

Barr recommends:

- Continuing to investigate the feasibility of a ravine stabilization project for erosion site No. 9 along the St. Croix Trail South ravine by initiating discussions with the WCD to collaborate on a stabilization project,
- Continuing to coordinate with the City of Afton to repair the separated FES and storm sewer along the ravine,
- Continuing discussions with the WCD about erosion sites identified in the Kelle’s Creek erosion inventory and continued collaboration with the WCD to work toward implementation of the funded stabilization project, and
- Continued triennial inspection of the entire creek and major ravines to complete an erosion inventory, with the next inspection scheduled for 2020. Future inspections should include prioritization of erosion sites.

2.25 Swede Hill Creek Subwatershed

2.25.1 Background

The Swede Hill Creek subwatershed has a drainage area of 836 acres, or approximately 1.3 square miles, and contains several steep-sided ravines and bluffs that drain directly to the St. Croix River. Most of the subwatershed is undeveloped and heavily forested; there are no perennial streams, Minnesota
Department of Natural Resources (MNDNR) public waters, or other significant waterbodies. The channels in this subwatershed consist of ravines and ephemeral streams that only transport water during and immediately after storm events.

### 2.25.2 Observations

On May 1, 2019, Josh Phillips and Kallie Doeden inspected all of the Swede Hill Creek subwatershed ravines that were not included in the 2017 inspection due to budget constraints. Between the 2017 and 2019 inspections, Barr observed 124 locations with minor erosion, 24 locations with moderate erosion, two locations with significant erosion, and zero locations with severe erosion. Barr staff documented erosion sites in a memorandum, included in Appendix F.

### 2.25.3 Recommendations

Barr recommends inspecting the significant erosion locations in 2020. Barr also recommends completing an inspection and erosion inventory of the entire creek and major ravines every 5 years, with the next full inspection and erosion inventory scheduled for 2022.

### 2.26 Cost-Share Projects with More Than $5,000 in VBWD Contribution

#### 2.26.1 Background

VBWD provides cost-share assistance (administered by the WCD) for projects that improve water quality and natural resources. In 2019, the VBWD asked the WCD to provide inspection reports for projects that received more than $5,000 in VBWD funding. A full list of these projects is shown in Table 2-2.

#### 2.26.2 Recommendations

Barr recommends that for all projects receiving $5,000 or more of VBWD funding, the District continue to request that the WCD and Ramsey County (formerly Ramsey Conservation District, RCD) annually inspect and provide reports on the project for the first 5 years following installation—or direct Barr staff to inspect and report during that period. After 5 years, Barr recommends that VBWD request inspections from WCD, Ramsey County, and/or Barr staff for each project at least triennially, which would include any project constructed in 2011 or earlier.

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Grant Year</th>
<th>Grant Type</th>
<th>VBWD Contribution</th>
<th>Inspected in 2019?</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wiessner</td>
<td>2018</td>
<td>Individual</td>
<td>$5,000</td>
<td>Yes</td>
<td>Project completed in September 2019.</td>
</tr>
<tr>
<td>Washington County Roadways, Lake Elmo Avenue</td>
<td>2018</td>
<td>Community</td>
<td>$10,000</td>
<td>Yes</td>
<td>Project completed in October 2019.</td>
</tr>
<tr>
<td>City of Oakdale Nature Preserve</td>
<td>2017</td>
<td>Community</td>
<td>$5,408.50</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Project Name</td>
<td>Grant Year</td>
<td>Grant Type</td>
<td>VBWD Contribution</td>
<td>Inspected in 2019?</td>
<td>Comment</td>
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<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Kopotzkie Property</td>
<td>2017</td>
<td>Individual</td>
<td>$5,250.00</td>
<td>Yes</td>
<td>Project is partially functioning and appears typical for first year restoration. Native grasses and forbs are present under heavy annual weeds.</td>
</tr>
<tr>
<td>White Property</td>
<td>2016</td>
<td>Individual</td>
<td>$6,988.60</td>
<td>Yes</td>
<td>Project generally looks great and is fully functional. No maintenance needed.</td>
</tr>
<tr>
<td>Kramer/Kirkwold Property</td>
<td>2015</td>
<td>Individual</td>
<td>$5,000.00</td>
<td>Yes</td>
<td>Project is in third year of establishment of native species. There are lots of active species present but weed encroachment is heavy in places resulting in degraded aesthetics. Owner should consider hiring contractor to perform additional weed control.</td>
</tr>
<tr>
<td>Landucci Property</td>
<td>2015</td>
<td>Buckthorn</td>
<td>$10,110.00</td>
<td>Yes</td>
<td>Project is partially functioning. Buckthorn re-sprouts are heavy and owner should consider cutting and applying herbicide to stems. Owner should also consider replanting to avoid complete control by garlic mustard.</td>
</tr>
<tr>
<td>Wiessner/Hill Property</td>
<td>2015</td>
<td>CWF/Match</td>
<td>$22,419.00</td>
<td>Yes</td>
<td>No maintenance needed.</td>
</tr>
<tr>
<td>Homestead Development</td>
<td>2015</td>
<td>Community</td>
<td>$13,250.00</td>
<td>Yes</td>
<td>Project has some degraded aesthetics. Owner should consider controlling the spread of kentucky bluegrass, reed canary grass, and other non-natives to support native plant species diversity. Owner should also consider adding wet species to pond edge.</td>
</tr>
<tr>
<td>Mutter Property</td>
<td>2015</td>
<td>Individual</td>
<td>$7,900.00</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>McComb/Kotz Property</td>
<td>2013</td>
<td>Special Incentive</td>
<td>$10,700.00</td>
<td>No</td>
<td>Inspected triennially after 5 years</td>
</tr>
<tr>
<td>Gurney Property</td>
<td>2012</td>
<td>Individual</td>
<td>$5,550.00</td>
<td>No</td>
<td>Inspected triennially after 5 years</td>
</tr>
<tr>
<td>Lake Elmo Streets</td>
<td>2012</td>
<td>Special Incentive</td>
<td>$27,822.00</td>
<td>No</td>
<td>Inspected triennially after 5 years</td>
</tr>
<tr>
<td>DeMontreville Boat Launch</td>
<td>2011</td>
<td>Community</td>
<td>$9,000.00</td>
<td>No</td>
<td>Inspected triennially after 5 years</td>
</tr>
<tr>
<td>Project Name</td>
<td>Grant Year</td>
<td>Grant Type</td>
<td>VBWD Contribution</td>
<td>Inspected in 2019?</td>
<td>Comment</td>
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<td>----------------------------------------------</td>
</tr>
<tr>
<td>Lake Elmo Roadways</td>
<td>2011</td>
<td>Community</td>
<td>$17,000.00</td>
<td>No</td>
<td>Inspected triennially after 5 years</td>
</tr>
<tr>
<td>Lake Elmo Roadways</td>
<td>2009</td>
<td>Community</td>
<td>$28,750.00</td>
<td>No</td>
<td>Inspected triennially after 5 years</td>
</tr>
<tr>
<td>Joy Park Shoreline, Maplewood</td>
<td>2009</td>
<td>Community</td>
<td>$18,789.10</td>
<td>No</td>
<td>Inspected triennially after 5 years</td>
</tr>
<tr>
<td>Century College</td>
<td>2009</td>
<td>Community</td>
<td>$50,000.00</td>
<td>No</td>
<td>Inspected triennially after 5 years</td>
</tr>
<tr>
<td>Mahtomedi Public Works</td>
<td>2008</td>
<td>Community</td>
<td>$22,500.00</td>
<td>No</td>
<td>Inspected triennially after 5 years</td>
</tr>
</tbody>
</table>
3.0 Non-System Specific Activities

3.1 Web Mapping

3.1.1 Background
Barr maintains an online map to assist with inspection and maintenance activities and information requests. In 2019, Barr performed minor updates to the web map, including adding easements from Washington County.

3.1.2 Recommendations
Barr recommends that the VBWD web map be updated with additional infrastructure and conveyance systems data, as needed.

3.2 Web-Based Permit Inspection Reporting

3.2.1 Background
Barr developed and maintains a GIS-based mapping and data collection system to assist the VBWD inspector in performing permit inspections and developing reporting and file organization on the VBWD web map. As part of the development of the system, Barr designed a database for collecting and reporting permit inspection information. Barr also purchased and setup an iPad for Inspector Brower to use for completing the inspections. A map of the permit locations was developed using ArcGIS desktop and published using ArcGIS Server. The system uses ArcGIS Online (AGOL) and the Esri Collector App to view the published map. The Collector App allows the inspector to navigate to permit locations and collect inspection information including photos. A Python script was written by Barr to processes the field-collected inspection information into a PDF report. The reports are uploaded to a Barr-hosted project website. Inspector Brower is currently testing the draft version of the application and some edits and/or updates may be needed.

3.2.2 Recommendations
Barr recommends that a follow-up meeting with the inspector be scheduled to identify needed updates to the application and reporting interface.

3.3 Beaver-Removal Cost-Share Program

3.3.1 Background
Over the last 10 years, beaver activity—particularly the construction of dams—has damaged several Valley Creek locations and impacted the conveyance of flows through the Project 1007 system in the West Lakeland Storage Site.

To reduce costs related to beaver activity, the Managers established a beaver-removal cost-share program at their November 10, 2016, meeting. Homeowners must request access to the cost-share program before initiating beaver removal, and if the Managers approve, the homeowners are then required to hire a beaver trapper and can submit their receipts to VBWD for full reimbursement.
3.3.2 Recommendations
Barr recommends that the beaver-removal cost-share program be included in the 2020 VBWD operations and maintenance budget.

3.4 General Maintenance
3.4.1 Background
As outlined in this report, VBWD maintains a number of structures and systems throughout the watershed to protect the District’s water resources and property. Emergency maintenance issues occasionally come up during the course of the year and cannot wait for VBWD’s normal annual budgeting process to be addressed. Most of these issues involve removal of trees and debris from streams and channels to protect the stream from erosion and adjacent properties from flooding. In 2019, the Managers acted on over $2,000 of unanticipated maintenance expenses. In addition to contractor costs, Barr staff members spend time preparing related memos for the Board packet; this adds to the total cost of these relatively inexpensive maintenance projects. Additionally, waiting 2 to 4 weeks for Manager authorization can sometimes increase the risk of damage to the water resource or property.

At their January 10, 2019, meeting, the Managers authorized Barr to hire contractors for maintenance activities less than $3,000.

3.4.2 Recommendations
Barr suggests that the Managers continue giving Barr authorization to hire contractors for maintenance activities less than $3,000 for a total estimated annual budget of $10,000.

3.5 Locating Services
3.5.1 Background
VBWD owns several underground facilities (e.g., storm sewer pipes), including major portions of Project 1007, the Olson Lake Estates Pond Outlet Project, and the Downs Lake Flood Duration Reduction Project. Currently, these underground facilities are not registered in Minnesota’s Gopher State One Call (GSOC) system. This is the standard method of communicating the location of underground facilities and must be used by anyone planning excavation or soil boring activities. Currently, an entity such as MNDOT, Washington County, or the City of Lake Elmo would not know about the presence of VBWD’s underground facilities through the use of GSOC.

At their April 26, 2018, meeting, the Managers authorized Barr to register all VBWD underground infrastructure in the GSOC system and perform locating services beginning January 1, 2019.

Barr registered all VBWD infrastructure in the GSOC system and has performed locating services since January 1, 2019.

3.5.2 Recommendations
Barr recommends that the Managers continue giving Barr authorization to perform locating services.
3.6 Major Repair Funding Approaches

3.6.1 Background

Over the past 30 years, VBWD has installed millions of dollars in infrastructure and performs annual inspections and routine maintenance on these systems described in this report. All infrastructure comes to the end of its useful life. For example, concrete structures are typically expected to last between 50 and 100 years. Since much of the Project 1007 system is made of concrete, major portions of that system may need to be replaced in as few as 20 years. In 2019, Barr explored approaches to fund future major repairs by investigating how other watershed management organizations and municipalities fund those repairs. Barr is preparing a memorandum for the Managers.

3.6.2 Recommendations

Barr recommends that the Managers consider acting on the recommendations of the memorandum.

3.7 Long Lake Sediment Delta Assessment

3.7.1 Background

At the southwest corner of the north basin of Long Lake, a sediment delta has formed at the inlet northeast of the Highways 36 and 694 interchange. The inlet conveys flow from the upstream Silver Lake subwatershed. The presence of the sediment delta was also noted by the MNDNR in their 1989 fisheries survey. According to lake residents, the sediment delta has been forming for nearly 30 years, possibly as a result of highway runoff. The VBWD investigated and identified possible conveyors of the sediment, including culvert under Highway 36. In 2011, MNDOT implemented improvements to reduce the sediment loading. The Friends of Long Lake have requested that the VBWD remove the delta.

Barr staff performed a survey of the Long Lake sediment delta on August 13, 2019 in order to document the current conditions of the sediment delta. We measured sediment surface elevations using survey grade Real-Time Kinematic Global Positioning Survey (RTK GPS) equipment with a vertical accuracy of 0.10 feet. We collected elevation measurements across the sediment delta, as well as areas within the lake adjacent to the sediment accumulation, and created a bathymetric surface for the sediment delta. We also used hand tools to probe material from the sediment delta for visual inspection, and found that the sediment delta consisted primarily of sand, along with sticks and other dead vegetation. We documented the results of the 2019 survey in a memo included in Appendix G.

3.7.2 Recommendations

Barr does not recommend any further action at this time. If concerns are brought to VBWD in the future about an increase in the size of the sediment delta, then the 2019 inspection and survey can be used as a baseline to evaluate any changes to the delta.
3.8 2020 Flood Mitigation and Coordination Efforts

3.8.1 Background
Due to high water levels in the fall of 2019, Barr anticipates flooding mitigation and coordination efforts will be needed in 2020, similar to the efforts performed in 2019.

3.8.2 Recommendations
Barr recommends that the Managers consider budgeting for snowpack monitoring and flooding mitigation and coordination efforts in 2020.
4.0 Maintenance and Operation Work Performed in 2019

The Managers took the following actions in 2019:

1. Hired Buelow Excavating Inc. (Buelow) to:
   a. Mow the Rest Area Pond Dam crest and spillway. This work was completed in September 2019 for $500.
   b. Mow the side slopes of the channels between Horseshoe Lake and Interstate 94, including the West Lakeland South Storage sites. The Managers approved $1,800 for mowing; however, due to high water levels, only a portion of the channels could be mowed. This work was completed in September 2019 for $1,300.
   c. Remove accumulated dead trees and debris near the outlet of the Rest Area Pond. The Managers originally approved $1,411 for removals in 2016; however, due to high water levels in 2016 through 2019, the work could not be completed. Buelow plans to complete the remaining work once the water levels recede.
   d. Perform the Project 1007 Emergency Drawdown (Photo 33 and Photo 34). The Managers authorized this work in March 2019. This work was completed in April 2019 for $20,000.
   e. Install a muni-ball upstream of Structure 3 of the Downs Lake Flood Duration Reduction Project because the backflow preventer (Red Valve) in Structure 3 was leaking, contributing to a rise in the elevation of the Eden Park Pond (Photo 35). After consulting with President Lucas and Attorney Torseth, Barr issued a notice to proceed to Buelow on June 4, 2019, and Buelow installed the muni-ball on June 5, 2019. The muni-ball is still installed. As of December 5, 2019, the cost for this work is $8,302. A charge of $350 per month will continue to accrue thereafter until water levels recede or another plan to address the leak is implemented.
   f. Repair erosion and install riprap around the upstream end of the culvert under 20th Street North, upstream of Structure 1 of the Downs Lake Flood Duration Reduction Project (Photo 20). This work was completed in June 2019 for $877.
   g. Assist with the second Downs Lake Drawdown through pumping from the Royal Golf Course pond and Eden Park Pond (Photo 21 and Photo 22). The Managers authorized this work in August 2019. This work was completed in October 2019 for $45,530.

2. Hired Rachel Contracting LLC (Rachel) to remove accumulated sediment from the DeMontreville ravine basin and Lake DeMontreville. The Managers approved $29,900 for this work, which is scheduled to be completed in December 2019.
3. Hired Plunkett’s Varment Guard to perform animal management at the Rest Area Pond (Photo 7). The Managers authorized this work in September 2019. This work was completed in November 2019 for $427.43.

4. Hired Tri County Services Inc. to remove a warming house from a pond south of Downs Lake that was damaged during the Downs Lake Drawdown and debris from it impeded flow. This work was completed in October 2019 for $3,500.

5. Barr completed the following activities in 2019:
   a. Performed Gopher State One Call utility locate services.
   b. Performed snowpack monitoring (Photo 37) and implemented and oversaw the Project 1007 Emergency Drawdown. A Project 1007 2019 Emergency Drawdown Summary memorandum was provided to the Managers on April 19, 2019, and is included in Appendix A.
   c. Performed and administered pumping associated with the two Downs Lake drawdowns (Photo 38).
   d. Administered the application for a MNDNR water appropriations permit to pump water from the Royal Golf Course Pond into Horseshoe Lake, including coordination with the golf course and VBWD staff.
   e. Performed monthly inspections and cleanings (as necessary) of the Olson Lake outlet, including removal of the Olson Lake outlet grate in October 2019 (Photo 39, Photo 40).
   f. Requested that the WCD submit annual inspection reports to VBWD on all projects that VBWD supported with contributions of more than $5,000.
   g. Lake DeMontreville and DeMontreville Ravine Sedimentation Basin:
      i. Collected sediment samples and surveyed the accumulated sediment.
      ii. Subcontracted with Pace Analytical Services LLC to analyze sediment samples for contaminants.
      iii. Prepared a sediment characterization memo.
      iv. Prepared plans and specifications for the Lake DeMontreville and Ravine Sediment Removal Project and solicited quotes from contractors.
      v. Administered the work performed by Rachel, to be completed in December 2019.
   i. Administered the work performed by contractors for the VBWD.

The total cost of the completed operations and maintenance activities (including the sediment removal at DeMontreville Ravine and Lake DeMontreville scheduled for December 2019) was $110,336.43, excluding Barr fees and fees directly paid to Gopher State One Call.”
Photo 33 (March 2019): Buelow Excavating, Inc. installed eye bolts to remove stop logs at Project 1007 - Structure 3.

Photo 34 (March 2019): Buelow Excavating, Inc. removing the stop logs at Project 1007 - Structure 3.
Photo 35 (October 2019): Buelow Excavating, Inc. installed a muni-ball between Downs Lake FDR MH-04 and Structure 3. This photo shows the rope and pressure gauge attached to the muni-ball.

Photo 36 (October 2019): Tri-County Services, Inc. removed a warming house from a pond south of Downs Lake.
Photo 37 (February 2019): Barr performed snowpack monitoring at Tablyn Park.

Photo 38 (August 2019): Barr operated gate valves in Structure 1 for Downs Lake Flood Duration Reduction project.
Photo 39 (May 2019): Barr removed vegetation from the Lake Olson outlet grate.

Photo 40 (October 2019): Barr removed the Lake Olson outlet grate from the outlet pipe.
5.0 Recommendations

We recommend that the Managers consider the inspection, operation, and maintenance items summarized in Table 5-1 and Table 5-2. If the Managers agree to the recommended actions, we will obtain bids from contractors to perform the work and present those bids to the Managers for consideration. Several recommended projects could be grouped and performed by a single contractor to reduce costs. Maintenance locations are shown on Figure 5-1.

5.1 Inspections

Table 5-1 summarizes the recommended inspection frequency and inspection/reporting cost for each VBWD system described in Section 2.0.

Table 5-1 2020 Recommended Inspection Activities

<table>
<thead>
<tr>
<th>System</th>
<th>Inspection Frequency</th>
<th>Last Inspected</th>
<th>Next Recommended Inspection</th>
<th>Estimated 2020 Inspection/Reporting Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project 1007</td>
<td>Annual</td>
<td>2019</td>
<td>2020</td>
<td>$24,000</td>
</tr>
<tr>
<td>Echo Lake Outlet</td>
<td>Annual</td>
<td>2019</td>
<td>2020</td>
<td>$1,000</td>
</tr>
<tr>
<td>Weber Pond Outlet</td>
<td>Annual</td>
<td>2019</td>
<td>2020</td>
<td>$1,000</td>
</tr>
<tr>
<td>Silver Lake Spent Lime Filter</td>
<td>Annual</td>
<td>2019</td>
<td>2020</td>
<td>$1,500 1</td>
</tr>
<tr>
<td>Silver Lake Bioretention Basin</td>
<td>Annual</td>
<td>2019</td>
<td>2020</td>
<td>$1,000</td>
</tr>
<tr>
<td>Silver Lake Outlet</td>
<td>Annual</td>
<td>2019</td>
<td>2020</td>
<td>$1,000</td>
</tr>
<tr>
<td>Long Lake Ravine Stabilization Project</td>
<td>Biennial</td>
<td>2018</td>
<td>2020</td>
<td>$1,000</td>
</tr>
<tr>
<td>DeMontreville Ravine Stabilization Project</td>
<td>Annual</td>
<td>2019</td>
<td>2020</td>
<td>$1,000</td>
</tr>
<tr>
<td>Olson Lake Estates Pond Outlet Project</td>
<td>Annual</td>
<td>2019</td>
<td>2020</td>
<td>$3,000</td>
</tr>
<tr>
<td>Raleigh Creek</td>
<td>Part-Annual</td>
<td>2019</td>
<td>2020 2022</td>
<td>$1,500 1 NA</td>
</tr>
<tr>
<td>Raleigh Creek Bank Stabilization Project</td>
<td>Biennial</td>
<td>2018</td>
<td>2020</td>
<td>$1,000</td>
</tr>
<tr>
<td>Farney Creek Stabilization Project</td>
<td>Annual</td>
<td>2019</td>
<td>2020</td>
<td>$1,000</td>
</tr>
<tr>
<td>Goetschel Pond Ravine Stabilization Project</td>
<td>Biennial</td>
<td>2018</td>
<td>2020</td>
<td>$1,000</td>
</tr>
<tr>
<td>Sunfish Lake Ravines</td>
<td>Triennial</td>
<td>2019</td>
<td>2022</td>
<td>NA</td>
</tr>
<tr>
<td>Goose Lake Ravines</td>
<td>Annual</td>
<td>2019</td>
<td>2020</td>
<td>$1,000</td>
</tr>
<tr>
<td>Downs Lake Flood Duration Reduction Project</td>
<td>Annual</td>
<td>2019</td>
<td>2020</td>
<td>$2,000</td>
</tr>
<tr>
<td>Valley Creek</td>
<td>Part-Annual</td>
<td>2019 2017</td>
<td>2020</td>
<td>$22,000</td>
</tr>
<tr>
<td>Oakgreen Avenue Infiltration Basin</td>
<td>Biennial</td>
<td>2019</td>
<td>2021</td>
<td>NA</td>
</tr>
<tr>
<td>Valley Creek Ravine Stabilization Projects—Landucci and Moynagh Ravine</td>
<td>Annual</td>
<td>2019</td>
<td>2020</td>
<td>$1,000</td>
</tr>
<tr>
<td>Blasko Dam Removal Project</td>
<td>Biennial</td>
<td>2019</td>
<td>2021</td>
<td>NA</td>
</tr>
<tr>
<td>Valley Creek Upstream Stabilization Project</td>
<td>Biennial</td>
<td>2019</td>
<td>2021</td>
<td>NA</td>
</tr>
<tr>
<td>System</td>
<td>Inspection Frequency</td>
<td>Last Inspected</td>
<td>Next Recommended Inspection</td>
<td>Estimated 2020 Inspection/Reporting Cost</td>
</tr>
<tr>
<td>--------------------------------------------------</td>
<td>----------------------</td>
<td>----------------</td>
<td>----------------------------</td>
<td>----------------------------------------</td>
</tr>
<tr>
<td>Valley Creek Downstream Stabilization Project</td>
<td>Annual</td>
<td>2019</td>
<td>2020</td>
<td>$1,500</td>
</tr>
<tr>
<td>30th and Trading Post Ravine Stabilization Project</td>
<td>Annual</td>
<td>2019</td>
<td>2020</td>
<td>$1,000</td>
</tr>
<tr>
<td>Kelle's Creek</td>
<td>Triennial</td>
<td>2017</td>
<td>2020</td>
<td>$12,000</td>
</tr>
<tr>
<td>Swede Hill Creek subwatershed</td>
<td>Part-Annual, Full every 5 years</td>
<td>2019 2017</td>
<td>2020 2022</td>
<td>$2,500 NA</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>$82,000</strong></td>
</tr>
</tbody>
</table>

1 The stormwater monitoring is not included in the budget values included in this report.

### 5.2 Operations and Maintenance Items

Table 5-2 summarizes responsible parties, planning-level cost estimates, and estimated priority \((High, Medium, or Low)\) for recommended maintenance activities. Estimates are for total project costs including contractor time, Barr time, and expenses.

**Table 5-2** Recommended Operations and Maintenance Activities Based on 2019 Inspections

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Responsible Party</th>
<th>Planning-Level Cost Estimate</th>
<th>Estimated Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Annually mow the Rest Area Pond Dam and spillway</td>
<td>VBWD</td>
<td>$500</td>
<td>High</td>
</tr>
<tr>
<td>2</td>
<td>Annually mow channel side slopes between Horseshoe Lake and Interstate 94, including the West Lakeland Storage Site South Pond</td>
<td>VBWD</td>
<td>$2,000</td>
<td>High</td>
</tr>
<tr>
<td>3</td>
<td>Remove accumulated dead trees and debris near the Rest Area Pond outlet and within the pipe to Structure 2 (Photo 3)</td>
<td>VBWD</td>
<td>$1,500 (Authorized)</td>
<td>High</td>
</tr>
<tr>
<td>4</td>
<td>Remove downed trees at Raleigh Creek</td>
<td>VBWD</td>
<td>$3,000</td>
<td>High</td>
</tr>
<tr>
<td>5</td>
<td>Continue to implement animal management at the Rest Area Pond Dam at the burrows located on the downstream side of the dam near the transmission tower (Photo 7)</td>
<td>VBWD</td>
<td>$3,000</td>
<td>High</td>
</tr>
<tr>
<td>6</td>
<td>Replace wooden stop logs with aluminum stop logs at Structures 3, 4, 9, 10 and 12 (Photo 8)</td>
<td>VBWD</td>
<td>$177,000</td>
<td>High</td>
</tr>
<tr>
<td>7</td>
<td>Inspect the Project 1007 storm sewer not previously inspected via video</td>
<td>VBWD</td>
<td>$85,000</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Action</td>
<td>Responsible Party</td>
<td>Cost</td>
<td>Priority</td>
</tr>
<tr>
<td>---</td>
<td>------------------------------------------------------------------------</td>
<td>-------------------</td>
<td>-------</td>
<td>----------</td>
</tr>
<tr>
<td>8</td>
<td>Inspect and remove vegetation from the Lake Olson outlet monthly from April to October</td>
<td>VBWD</td>
<td>$2,500</td>
<td>High</td>
</tr>
<tr>
<td>9</td>
<td>Update design, fabricate, and install a new sign to replace the existing faded sign at Eagle Point Lake Dam</td>
<td>VBWD</td>
<td>$3,000</td>
<td>High</td>
</tr>
</tbody>
</table>

**Silver Lake Spent Lime Filter**

<table>
<thead>
<tr>
<th></th>
<th>Action</th>
<th>Responsible Party</th>
<th>Cost</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Monitor vegetation growth and perform warranty inspection for plantings and site restoration at the end of the 1-year guarantee period.</td>
<td>VBWD</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>11</td>
<td>Inspect the basin during or following periods of precipitation to confirm that the amount of inflow to the filter is appropriate and the filter is functioning as intended</td>
<td>VBWD</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>12</td>
<td>Take samples of influent and effluent stormwater and test for total and dissolved phosphorus concentrations to assess BMP performance</td>
<td>VBWD</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

**Silver Lake Bioretention Basin**

<table>
<thead>
<tr>
<th></th>
<th>Action</th>
<th>Responsible Party</th>
<th>Cost</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>Monitor infiltration performance and vegetation in the basin through 2020 and provide oversight for the vegetation contractor, who will perform spot weed removal and replace plugs in select areas where weed management has removed native vegetation</td>
<td>VBWD</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>14</td>
<td>Hire a contractor to perform an additional 3 years of basin vegetation management prior to transferring maintenance responsibility to the city</td>
<td>VBWD</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>15</td>
<td>Following the conclusion of the City of North St. Paul road reconstruction work in 2020, request that the city hire a contractor to remove the deposited sediment from the south end of the basin and replace vegetation that has died as a result of excess sedimentation (Photo 9)</td>
<td>VBWD/City of North St. Paul</td>
<td>$0</td>
<td>High</td>
</tr>
<tr>
<td>16</td>
<td>Update design, fabricate, and install a new sign to replace a missing sign</td>
<td>VBWD</td>
<td>$3,000</td>
<td>High</td>
</tr>
</tbody>
</table>

**Silver Lake Outlet**

<table>
<thead>
<tr>
<th></th>
<th>Action</th>
<th>Responsible Party</th>
<th>Cost</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>Inspect and remove vegetation from the outlet weekly from April to October (assumed by Inspector Brower)</td>
<td>VBWD</td>
<td>$3,000</td>
<td>High</td>
</tr>
</tbody>
</table>

**Olson Lake Estates Pond Outlet Project**

<table>
<thead>
<tr>
<th></th>
<th>Action</th>
<th>Responsible Party</th>
<th>Cost</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>Continue to coordinate with the City of Lake Elmo to remove the 7-inch-diameter maple tree adjacent to MH 9 to ensure that the tree does not damage the structure or casting or grow over the casting cover and seal the structure</td>
<td>VBWD/City of Lake Elmo</td>
<td>$0</td>
<td>High</td>
</tr>
<tr>
<td>19</td>
<td>Inspect the Olson Lake Estates Pond Outlet Project storm sewer not previously inspected via video</td>
<td>VBWD</td>
<td>$20,000</td>
<td>Low</td>
</tr>
<tr>
<td>Project Description</td>
<td>VBWD/Partner</td>
<td>Cost</td>
<td>Priority</td>
<td></td>
</tr>
<tr>
<td>-----------------------------------------------------------------------------------</td>
<td>---------------------------------------</td>
<td>-------</td>
<td>----------</td>
<td></td>
</tr>
<tr>
<td>Raleigh Creek</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 Assess potential access routes that could make it possible to stabilize the</td>
<td>VBWD</td>
<td>$2,000</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>eroding areas while minimizing tree removals</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farney Creek Stabilization Project</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21 Perform minor grading at the erosion sites and re-establish a vegetative</td>
<td>VBWD</td>
<td>$7,500</td>
<td>Medium</td>
<td></td>
</tr>
<tr>
<td>cover to protect the banks.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Downs Lake Flood Duration Reduction Project</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22 Replace the backflow preventer at Structure 3</td>
<td>VBWD</td>
<td>$5,000</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>23 Inspect the Downs Lake Flood Duration Reduction Project storm sewer not</td>
<td>VBWD</td>
<td>$5,000</td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>previously inspected by video</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24 Re-evaluate the operation of the entire system</td>
<td>VBWD</td>
<td>NA</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>Valley Creek</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25 Request that the City of Afton consider installing an infiltration feature</td>
<td>VBWD/City of Afton</td>
<td>$0</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>near 32nd Street South cul-de-sac</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oakgreen Avenue Infiltration Basin</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 Hire a vegetative management contractor to remove invasive woody and vine</td>
<td>VBWD</td>
<td>$15,000</td>
<td>Medium</td>
<td></td>
</tr>
<tr>
<td>species within the Oakgreen Avenue Infiltration Basin and provide a higher</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>diversity of forbs through seeding and selective maintenance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Valley Creek Downstream Stabilization Project</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27 Discuss the vegetative buffer concerns at the Valley Creek Downstream</td>
<td>VBWD</td>
<td>$500</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>Stabilization Project with the two adjacent landowners to encourage them to</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>increase the buffer width</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30th and Trading Post Ravine Stabilization Project</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28 Coordinate with the City of Afton to replace the damaged flared-end section at</td>
<td>VBWD/City of Afton</td>
<td>$500</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>30th and Trading Post</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29 Extend the 30” CMP at 30th and Trading Post to the south along the ditch.</td>
<td>VBWD</td>
<td>$12,000</td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>Reattach the flared-end section, place new riprap, and backfill over the pipe to</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>achieve flatter and more stable ditch slopes.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kelle’s Creek</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30 Continue to investigate the feasibility of a ravine stabilization project for</td>
<td>VBWD/WCD</td>
<td>$2,000</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>erosion site No. 9 along the St. Croix Trail South ravine or initiate discussions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>with the Washington Conservation District to collaborate on a stabilization</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>project</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31 Continue to coordinate with the City of Afton to repair separated flared-end</td>
<td>VBWD/City of Afton</td>
<td>$500</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>section and storm sewer in the ravine along St. Croix Trail South</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32 Continue to collaborate with the Washington Conservation District to work</td>
<td>VBWD/WCD</td>
<td>$1,000</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>towards implementation of a stabilization project along Kelle’s Creek</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5.3 Maintenance Costs

Table 5-3 summarizes the estimated project costs by priority.

<table>
<thead>
<tr>
<th>Priority Rank</th>
<th>Planning-Level Cost Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Priority</td>
<td>$298,000</td>
</tr>
<tr>
<td>Medium Priority</td>
<td>$22,500</td>
</tr>
<tr>
<td>Low Priority</td>
<td>$122,000</td>
</tr>
<tr>
<td>TOTAL</td>
<td>$442,500</td>
</tr>
</tbody>
</table>

1 This project’s budget is not part of the Inspections, Operations, and Maintenance budget as it is separately accounted for in other portions of the VBWD budget.
Appendix A

Project 1007 2019 Emergency Drawdown Summary Memorandum
Memorandum

To: Valley Branch Watershed District Board of Managers  
From: Nathan Campeau, PE, Water Resources Engineer, and Josh Phillips, Water Resources Engineer  
Subject: Project 1007 2019 Emergency Drawdown Summary  
Date: April 19, 2019  
Project: 23820045.01 2019 010  
c: Melissa Imse, Susannah Torseth, Jeff Brower, John Hanson

Background
The Twin Cities experienced heavy snows in the late winter of 2019, with 39 inches of snowfall measured in February at the Minneapolis-St. Paul Airport (MSP), besting the previous record of 26.5 inches. With the historically high snowfall and cold temperatures helping to maintain that snowpack, Barr Engineering Co. (Barr) initiated regular monitoring of the National Oceanic and Atmospheric Administration’s (NOAA) Interactive Snow Information mapping website in February to estimate the water equivalent in the snowpack. This monitoring is critical to determine if and when the Valley Branch Watershed District (VBWD) should implement the emergency drawdown procedures for the Project 1007 flood control project.

VBWD constructed Project 1007 in 1986–87 to provide an outlet for many landlocked and flood-prone lakes in the northwest portion of the watershed, directing water to a Minnesota Department of Transportation (MNDOT) storm sewer along Interstate 94 and, ultimately, to the St. Croix River. As part of the project, several of the constructed outlets to the lakes and other water bodies included adjustable weirs so that the VBWD could lower the lake levels under certain conditions. The adjustable weirs typically consist of 6-inch-high wooden or aluminum stop logs stacked on top of one another.

The Minnesota Department of Natural Resources (MNDNR) permitted Project 1007, set an outlet elevation for each water body, and approved operating plans that detail how to lower the water bodies when snowpack conditions warrant. If VBWD measures greater than 4 inches of water equivalent in the snowpack between February 15 and April 15, the VBWD initiates a drawdown of the water bodies to certain target elevations as detailed in the operating plan for each water body. Since construction of the project, VBWD implemented drawdowns in 1997, 2001, and now 2019.

2019 Snowpack Monitoring
While monitoring snowpack on NOAA’s website in February 2019, Barr determined that initiation of an emergency drawdown was probable. On February 26, 2019, Barr contacted a local contractor familiar with the VBWD outlets to prepare for the drawdown. The contractor was on site by the end of the day, and the drawdown was completed within the next couple of days.
with VBWD’s infrastructure, Buelow Excavating (Buelow), to determine if they would be available to assist VBWD in a drawdown, if necessary.

On February 28 and March 10, Barr staff measured the water equivalent of the snowpack at four locations in the watershed, as shown in Table 1, and found the field measurements were close to the NOAA website estimates. The March 10 measurements indicated an average of 4.0 inches of water equivalent in the snowpack, thus triggering the emergency drawdown procedures.

<table>
<thead>
<tr>
<th>Table 1  Snowpack Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site #</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

2019 Emergency Drawdown Preparation

Barr communicated the water equivalent results to the Board on March 10, and President Lucas directed Barr to proceed with hiring a contractor to adjust the stop log weirs. On March 11, Barr requested a formal bid from Buelow to implement the emergency drawdown plans for the six outlets with a MNDNR-approved drawdown plan. On March 11 and 12, Buelow provided a quote for the work and at the March 14 VBWD meeting, the Managers formally authorized the contract.

On March 12, Barr provided official notice to the MNDNR area hydrologist that VBWD would be implementing the emergency drawdown plan and requested permission from the MNDNR Trails division to access the Gateway Trail to lower the level of Long Lake by accessing Structure 12. Barr also informed The Royal Golf Club and Washington County Parks of the emergency drawdown so that they would be prepared for increased flows and potential flooding of their property.

On March 12 and 13, Barr issued press releases to multiple news outlets, including the Star Tribune, Pioneer Press, Lillie News, and the Stillwater Gazette to inform the public about the drawdown. Barr also updated the VBWD website with the press release.

2019 Emergency Drawdown Implementation

On March 13, VBWD initiated the drawdown by authorizing Buelow to lower the Horseshoe Lake outlet (Structure 3). Over the next 12 days, Buelow removed stop logs, monitored water body elevations, and then replaced stop logs at all six outlets and associated water bodies. The final stop logs were replaced at
Structures 9 and 11 on March 25. Barr provided general construction oversight and also monitored the water equivalent of the snowpack daily to guide decisions about when to replace the stop logs.

**Conclusion**
During the 12-day emergency drawdown, VBWD created an additional storage volume of nearly 600 acre-feet in the water bodies through the lowering of the outlets. This provided capacity for the system to store and convey snowmelt and rain runoff with a reduced flood risk to adjacent property owners. While many areas in the Twin Cities experienced flooding that affected infrastructure and homes, no significant flooding occurred around the Project 1007 system and VBWD received no reports of damage to homes protected by the Project 1007 system.
Appendix B

2019 Eagle Point Lake Dam Inspection Report
May 1, 2019

Mr. Jason Boyle
Dam Safety Unit, Division of Waters
Minnesota Department of Natural Resources
500 Lafayette Road
St. Paul, MN 55155

Re: 2019 Annual Inspection of Eagle Point Lake Dam, Valley Branch Watershed District

Dear Mr. Boyle:

On April 25, 2019, I performed an inspection of the Eagle Point Lake Dam and its control structures. This was done in accordance with Special Provision 8 of the Minnesota Department of Natural Resources permit for the dam, issued to the Valley Branch Watershed District (VBWD). The inspection report form and photographs of the dam and control structures are enclosed. The results of the inspection are summarized below.

- The inspections revealed the dam to be in generally good condition.
- In 2018, we observed trees growing on both faces of the dam and requested that Washington County Parks remove the trees. This was not completed before the 2019 inspection. We will request that Washington County Parks remove the trees and treat the stumps.
- In 2018 and 2019, we noted an animal path crossing the dam near the secondary outflow structure on the upstream face and near the secondary outlet pipe on the downstream face. While we do not recommend maintenance at this time, we will continue to monitor these locations in future inspections to assess if action is required.
- We observed soil disturbance on the crest of the emergency overflow that may have been caused by snow plowing activities. We will request that Washington County Parks replace the displaced topsoil and re-seed.
- We noted concrete spalling on the northwest corner of the secondary outlet structure. We do not consider this a structural deficiency and we will continue to monitor this location for deterioration and, if needed, recommend repairs.

If you have any questions or need additional information, please contact me at 952-842-3593 or pbrockamp@barr.com.

Sincerely,

Patrick Brockamp, PE

Enclosures

c: VBWD Managers
   Dan MacSwain – Washington County Public Works Department
# Inspection Report

**Eagle Point Lake Dam**  
Valley Branch Watershed District  
Inspected by Patrick Brockamp, PE  
April 25, 2019

<table>
<thead>
<tr>
<th>Feature</th>
<th>Deficiency Observed</th>
<th>Remarks</th>
<th>Photo #</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>I. Outlet Structures</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. Accumulation of debris</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. Cracking or spalling of concrete</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. Deterioration of concrete</td>
<td>X</td>
<td></td>
<td>Spalling concrete on NW corner of secondary outlet structure</td>
</tr>
<tr>
<td>D. Abnormal leakage</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E. Unusual or inadequate operational behavior</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>II. Upstream Embankment Slope</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. Wave erosion</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. Cracks</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. Slides or sloughs</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D. Subsidence</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E. Damage to slope protection</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F. Other erosion</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G. Vegetation failure</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H. Tree growth</td>
<td>X</td>
<td></td>
<td>Willow trees observed on upstream face</td>
</tr>
<tr>
<td>I. Animal burrows</td>
<td>X</td>
<td></td>
<td>Animal path crossing dam, no damage</td>
</tr>
<tr>
<td>III. Downstream Embankment Slope</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. Wave erosion</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. Cracks</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. Slides or sloughs</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D. Subsidence</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E. Other erosion</td>
<td>X</td>
<td></td>
<td>Disturbed soil on crest of emergency overflow (possible snow plowing damage)</td>
</tr>
<tr>
<td>F. Excessive seepage or boils</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G. Vegetation failure</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H. Tree growth</td>
<td>X</td>
<td></td>
<td>Small trees observed on downstream face</td>
</tr>
<tr>
<td>I. Animal burrows</td>
<td>X</td>
<td></td>
<td>Animal path crossing dam, no damage</td>
</tr>
</tbody>
</table>

1 Animal paths still present on both faces but they are difficult to see in 2019 photos—2018 photo included
EAGLE POINT LAKE DAM
Valley Branch Watershed District

PHOTOGRAPHS (taken April 25, 2019)

Photo 1: Upstream face, looking toward left abutment (north)

Photo 2: Downstream face, looking toward left abutment (north)
Photo 5: Aluminum stop log weir in primary outlet (water too high to inspect stop logs)

Photo 6: Inlet to secondary structure
Photo 7: Inside of secondary structure

Photo 8: Outfall pipe from secondary structure
Photo 9: Willow trees on upstream face of dam should be removed

Photo 10: Multiple small trees on downstream face of dam should be removed
Photo 11: Disturbed soil on crest of emergency overflow (possible snow-plowing damage) should be reseeded

Photo 12: Spalling concrete on secondary outlet structure should be monitored
INSPECTION REPORT (continued)

EAGLE POINT LAKE DAM
Valley Branch Watershed District

PHOTOGRAPHS (taken May 25, 2018)

Photo 13: Animal path crossing dam—upstream face looking upstream (2018 inspection)

Photo 14: Animal path crossing dam—upstream face looking downstream (2018 inspection)
Appendix C

2019 Rest Area Pond Dam Inspection Report
October 31, 2019

Mr. Bryce Fossand, P.E.
MNDOT Water Resources Engineering
1500 West County Road B2
Roseville, MN 55113

Re: 2019 Annual Inspection of Interstate 94 Rest Area Pond Dam

Dear Mr. Fossand:

On October 30, 2019, you and Christina Caouette of MNDOT, and myself, representing the Valley Branch Watershed District, inspected the Interstate 94 Rest Area Pond Dam (Permit 86-6270). Barr staff (Josh Phillips and myself) also performed an inspection of the dam on October 7, 2019. Two copies of related documents are enclosed:

- Chart of historic water levels
- Completed Rest Area Pond Dam inspection form
- Comment sheet
- Photographs from the inspection

We found the dam and outlet structure to be in good condition. On October 7, 2019, Barr staff estimated the water level of the pond at Elevation 839.6 feet, approximately 5.6 feet above the invert elevation of the low-flow orifice outlet and 2.9 feet below the elevation of the secondary outlet weir.

Since the 2018 inspection, VBWD performed minor maintenance on the Rest Area Pond Dam, mowing the entire dam and spillway in September 2019 prior to the recent inspections. VBWD also hired an animal management contractor (Plunkett’s Varment Guard) to set traps and remove burrowing animals. The first traps were set on October 14, 2019 and thus far one animal has been captured and removed.

VBWD plans the following maintenance activities before the next inspection in fall 2020:

- Mowing the entire dam and spillway
- Continued trapping and removal of burrowing animals until November 11, 2019; burrows are located on the back-side of the dam near the transmission tower, above and below the elevation of the emergency spillway
- Removing tree debris near the pond outlet; this work was authorized in 2016, but has not been performed due to high water
Please contact me with any corrections to the inspection form. If we do not hear from you, we will assume that you have forwarded this information to Jason Boyle at the Department of Natural Resources Dam Safety Unit, 500 Lafayette Road, St. Paul, MN, 55155. If you have any questions or need additional information, please contact me at (952) 842-3593.

Sincerely,

Patrick Brockamp, P.E.

Enclosures

c: VBWD Managers
District Maintenance Engineer
DNR Dam Safety Unit
State Foundations Engineer
District Hydraulics Engineer

<table>
<thead>
<tr>
<th>Dam No.</th>
<th>T.H. No.</th>
<th>Mile Post</th>
<th>Location</th>
<th>Maintenance Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-94 Rest Area Pond</td>
<td>94</td>
<td>S.P. 8282-37</td>
<td>West Lakeland Township</td>
<td>Metro-Oakdale</td>
</tr>
</tbody>
</table>

**Type**
Pond

**Location**
1.0 Mile East of Rest Area
West Lakeland Township
Washington County

<table>
<thead>
<tr>
<th>Item</th>
<th>Rating</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Vegetation Cover</td>
<td>See note</td>
<td>See Remarks 1 and 3</td>
</tr>
<tr>
<td>2. Rip Rap</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>3. Spillway</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>4. Seepage Rate</td>
<td>None Observed</td>
<td>None Observed</td>
</tr>
<tr>
<td>5. Pond Elevation</td>
<td>Approx. 835.5</td>
<td>Approx. 834.7</td>
</tr>
<tr>
<td>6. Changes in Stream Area</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>7. Photographs</td>
<td>Taken 10-17-16</td>
<td>Taken 10-04-17</td>
</tr>
<tr>
<td>8. Structure #2</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>9. 60&quot; RCP</td>
<td>See Remark 2</td>
<td>See Remark 2</td>
</tr>
<tr>
<td>10. RCP</td>
<td>Good</td>
<td>Good</td>
</tr>
</tbody>
</table>

**Year 2019 Remarks**
1. Dam and spillway were mowed September 2019, including the dam crest and embankments before inspections were performed.
2. Water level was too high to inspect the flared-end section inlet and RCP pipe.
3. Animal burrows observed in one location on the back side of the embankment, near the transmission tower.

**Year 2018 Remarks**
1. Dam and spillway were mowed October 2018, including the dam crest and embankments before inspections were performed.
2. Water level was too high to inspect the flared-end section inlet and RCP pipe.
3. Animal burrows observed in one location on the back side of the embankment, near the transmission tower. Traps set to capture animals.

---

**Inspected By:**
**Date:** Oct. 17 & 25, 2016
Nathan Campeau and Patrick Brockamp

**Inspected By:**
**Date:** Oct. 4, 2017
Patrick Brockamp and Josh Phillips

**Inspected By:**
**Date:** Oct. 23, 2018
Patrick Brockamp and Josh Phillips

**Inspected By:**
**Date:** Oct. 7, 2019
Patrick Brockamp and Josh Phillips

Bridge Inspections Engineer
**Date:** Oct 31, 2019
1 - Condition of vegetation cover (brush and trees cleared)
2 - Condition of Rip Rap
3 - Condition of Spillway
4 - Check drainage pipe on downstream side
5 - Top pond water elevation
6 - Look for changes of downstream area (new building, excavation, etc.)
7 - Take representative photos

Rating
G - Good – No repairs needed
F - Fair – Minor repairs
P - Poor – Repairs needed
U - Unsatisfactory – Repairs needed immediately
Comments
2019 I-94 Rest Area Pond Dam Inspection
Valley Branch Watershed District

Other Comments and Observations

- Valley Branch Watershed District (VBWD) and Minnesota Department of Transportation staff inspected the dam on October 7 and October 30, 2019.

- In general, dam and appurtenant structures are in good condition.

- The water level of the pond is above the low-flow control elevation and water is discharging from the pond.

- VBWD’s contractor mowed the dam and spillway in September 2019, before the inspections.

- Inspectors observed woody debris at the pond outlet (flared end inlet to Structure 2) during the 2015 inspections, and VBWD has hired a contractor to remove the debris. High water levels from 2016 through 2019 prevented removal of the woody debris prior to the 2019 inspections. The pond outlet was submerged and could not be inspected. Inspectors observed water discharging from the outlet structure.

- Inspectors observed animal burrows at one location on the back side of the dam near the power line tower. VBWD hired an animal management contractor who placed traps on October 14, 2019 and will continue to monitor the traps for a period of 4 weeks. The Contractor will remove captured burrowing animals from the site.
2019 I-94 Rest Area Pond Dam Inspection Photographs (October 7, 2019)

Photo 1: Crest, looking toward left abutment (northeast)

Photo 2: Spillway and downstream face, looking northeast

Photo 3: Upstream face, looking toward right abutment (south)

Photo 4: Downstream face, looking toward spillway (south)
2019 I-94 Rest Area Pond Dam Inspection Photographs (continued)

Photo 5: Animal traps, downstream side near tower

Photo 6: 60-inch-diameter reinforced-concrete pipe outlet (submerged)

Photo 7: Outlet structure, upstream side of weir

Photo 8: Outlet structure, downstream side of weir
Appendix D

Project 1007 Stop Log Replacement Prioritization Memorandum
Memorandum

To: Valley Branch Watershed District Board of Managers
From: Nathan Campeau, PE, Water Resources Engineer
Subject: Project 1007 Stop Log Replacement Prioritization
Date: April 19, 2019
Project: 23820045.01 2019 010
cc: Melissa Imse, Susannah Torseth, Jeff Brower, John Hanson

Introduction
During the emergency drawdown of the Project 1007 system in March 2019, Barr staff noted that many of the wooden stop logs were in poor condition. Some of the logs had fully rotten out and could not be reused, while others had deteriorated, likely contributing to leakage. Barr reported this observation to the Managers, who then directed us to prepare this memo to prioritize the replacement of the wooden stop logs.

Background
VBWD constructed Project 1007 in 1986–87 to provide an outlet for many landlocked and flood-prone lakes in the northwest portion of the watershed, directing water to a Minnesota Department of Transportation (MNDOT) storm sewer along Interstate 94 and, ultimately, to the St. Croix River. As part of the project, seven of the constructed outlets to the lakes and other water bodies included adjustable weirs with wooden stop logs. The purpose of the stop logs is to allow VBWD to adjust lake levels under certain conditions.

In 2017 and 2018, due to the deteriorating conditions of stop logs at two structures (Structure 6/Eagle Point Lake Dam and Structure 11/Lake Olson), VBWD hired a contractor to replace the stop log weirs and reset the outlet elevation at Lake Olson to the Minnesota Department of Natural Resources (MNDNR) permitted elevation. In both cases, Minger Construction Co. performed the work for a construction price of $27,500 and $20,000, respectively.

Benefits of Stop Log Replacement
There are a number of reasons to replace the wooden stop logs, including (1) replacing deteriorated stop logs, (2) better maintaining lake elevations by reducing leakage, (3) limiting negative consequences for lake recreation, (4) limiting negative consequences downstream from a sudden failure, and (5) improving operation of the stop logs during a drawdown. Table 1 summarizes the first four benefits by structure as well as providing a high-level cost estimate for replacing the stop logs.

Requested Manager Action
Discuss memo findings and provide direction to Barr.
To: Valley Branch Watershed District Board of Managers  
From: Nathan Campeau, PE, Water Resources Engineer  
Subject: Project 1007 Stop Log Replacement Prioritization  
Date: April 19, 2019  

Table 1  Project 1007 Stop Log Replacement Prioritization

<table>
<thead>
<tr>
<th>Proposed Priority</th>
<th>Outlet Structure Number and Water/Pond Name</th>
<th>Deteriorated Stop Logs (yes/no)</th>
<th>History of Leaking (maintaining permitted lake elevations)</th>
<th>Consequences</th>
<th>Estimated Cost to Replace¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>NA</td>
<td>6: Eagle Point Lake</td>
<td>Replaced in 2017</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NA</td>
<td>11: Lake Olson</td>
<td>Replaced in 2018</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>4: Lake Elmo</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>2</td>
<td>10: Hedges Pond/Lake Jane</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>3</td>
<td>3: Horseshoe Lake</td>
<td>Yes (temporary replacements to 4 logs)</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>4</td>
<td>9: Crombie Pond</td>
<td>Unknown²</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>5</td>
<td>12: Long Lake</td>
<td>Unknown²</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

¹Includes engineering and construction costs  
²No deterioration observed in top stop log that VBWD removed in March 2019. The condition of the other stop logs is unknown.

Replace Deteriorated Stop Logs

As noted, in March 2019 during the emergency drawdown, Barr staff observed that many of the wooden stop logs were in poor condition. The Horseshoe Lake stop logs were so deteriorated that they could not be placed back in the outlet structure; VBWD’s contractor placed four new temporary wooden stop logs in the outlet structure and then sealed the stop logs with plastic to reduce leakage. Barr did not fully inspect all of the wooden stop logs at all structures since VBWD did not need to remove every stop log during the drawdown; therefore, we cannot comment on the condition of all stop logs.

Better Maintain Permitted Outlet Elevations

The elevations of the lakes in VBWD are very important to the users of those lakes. The wooden stop logs have developed leaks which can lower lake levels noticeably over time. VBWD has repaired leaks several times over the years at a cost of thousands of dollars. The wooden stop logs can also swell and then raise the elevation of a lake. Stop logs made of more durable material would mitigate both of these concerns.

Reduce Consequences to Lake Recreation and Downstream

If the stop logs leak or fail, that can have consequences for the water bodies as well as downstream infrastructure and property that would receive the water released by the stop logs.

Several of the stop log structures maintain water elevations at lakes that are used for recreation; a drop in elevation, as noted in the previous section, would have adverse consequences for the users of those lakes.
A couple water bodies (i.e., Horseshoe Lake and Crombie Pond) are not used as much for recreation, and a drop in water elevation there would not disrupt recreation to as great a degree as, for example, Lake Elmo.

A sudden release of water from a failure of the stop logs could impact downstream infrastructure and property. While Barr has not performed an analysis of the specific consequences from a sudden failure, a failure of a taller stop log weir likely would have more negative consequences downstream than the failure of a shorter stop log weir. So, for example, a failure of the Horseshoe Lake stop log weir (5 feet in height) could cause greater downstream damage than a failure of the Lake Elmo stop log weir (0.5 feet in height).

**Improve Operation**

Additionally, during the drawdown, we noted how long it took for VBWD’s contractor to remove the wooden stop logs as compared to removing the aluminum stop log in Structure 11 (Lake Olson Outlet). The wooden stop logs become water-logged and quite heavy, and as the wood expands it becomes even more challenging and labor-intensive to remove and replace them.

If the wooden logs were replaced with logs made out of a lighter material, such as aluminum, the cost to implement emergency drawdown procedures would be reduced. For example, we estimate that VBWD’s contractor spent about 10 hours at each structure removing and replacing the wooden stop logs and only 2 hours removing and replacing the aluminum stop log at Structure 11. Comparing the actual cost at Structure 11 with the likely cost of replacing wooden stop logs at that location, we estimate that the cost savings was approximately $3,500.

**Recommendation**

We recommend that the District use Table 1 to prioritize stop log replacement.

Stop log replacement is not currently in the 2019 VBWD budget. If the Managers would like to replace any stop logs in 2019, we can provide opinions on which activities to delay to cover the costs.
Appendix E

2019 Sunfish Lake Erosion Inventory Memorandum
Memorandum

To: File
From: Jeff Weiss, PE, Senior Water Resources Engineer
Subject: 2019 Sunfish Lake Erosion Inventory
Date: August 9, 2019
Project: 23-82-0045.01 2019 509
c: Melissa Imse, Susannah Torseth, Jeff Brower, John Hanson

Introduction

At its January 24, 2019, meeting, the Valley Branch Watershed District (VBWD) Board of Managers authorized Barr Engineering Co. (Barr) to perform an erosion inventory along the ravines adjacent to the north shore of Sunfish Lake. The purpose was to determine whether ravine stabilization projects to improve water quality are warranted.

Barr staff performed the Sunfish Lake erosion inventory on May 6, 2019, by walking identified ravines surrounding the northern portion of Sunfish Lake. Barr selected the ravines for inspection based on concerns from the area’s residents, a preliminary field visit by Barr staff, and a GIS review of the terrain. During the erosion inventory, Barr made observations and collected geo-referenced photographs at sites of interest, including areas of erosion. Barr then categorized the erosion sites based on the severity of the erosion. This memorandum summarizes the results of our erosion inventory and provides recommendations for the Managers’ consideration.

Background

Figure 1 shows the ravines that Barr staff inspected. All of the ravines are to the north of Sunfish Lake, which is located in Sunfish Lake Park in the center of the City of Lake Elmo. VBWD included this subwatershed area as part of its erosion inventory because local residents have reported erosion concerns. The total tributary watershed to the ravines has a drainage area of approximately 45 acres, or 0.07 square miles. These ravines convey intermittent flows during snowmelt and storm events.

Land use, as documented in the City of Lake Elmo’s 2009 Comprehensive Plan, includes public park land immediately surrounding the northern portion of Sunfish Lake and adjacent to rural area development (primarily single-family residential lots). Areas immediately adjacent to the ravines and channels are forested, with upstream portions beginning in or near the backyards of single-family homes.

This is the first ravine inspection that VBWD has conducted for the Sunfish Lake area. The purpose of the inspection was to:

Requested Manager Actions

Monitor erosion sites on a regular 3-year inspection schedule, with the next inspection scheduled for 2022.
1. Establish a baseline understanding of the existing erosion in the ravines for comparison with future inspections.

2. Identify potential sites for ravine stabilization.

3. Determine whether VBWD should consider any stabilization projects for the ravines.

**Erosion Inventory and Inspection**

Barr selected the ravines based on a GIS review of the terrain to determine all of the significant ravines that could be inspected, as shown in Figure 1. Barr inspected approximately 4,300 feet, or 0.8 miles, of ravines in the Sunfish Lake subwatershed. Barr did not inspect any slopes without defined ravines. Overall, the ravines within this area were in stable condition and typically well-vegetated. Some of the ravines had natural riffles of rocks and logs to help stabilize potential head-cutting. Photos 1 through 3 show typical Sunfish Lake ravines.

*Photo 1: Typical reach, Sunfish Lake ravines (May 6, 2019)*
Photo 2: Typical reach, Sunfish Lake ravines (May 6, 2019)

Photo 3: Typical reach, Sunfish Lake ravines (May 6, 2019)
While the ravines adjacent to the north shore of Sunfish Lake were generally in good condition, Barr documented and categorized 12 erosion sites (Figure 1). These categories are defined as follows:

**Minor erosion** – A site that appears to be slightly eroding and/or is a minor sediment source. Minor erosion sites would not justify a project on their own merits, but would likely be included in a project if other work is performed nearby and access to the site is easy. These sites may be left alone if access is difficult or would cause more harm than good.

**Moderate erosion** – A site that appears to have more sediment loading than minor sites, but not enough to justify a project on its own merits. Moderate erosion sites would usually be included in a nearby project unless access is difficult.

**Significant erosion** – A site that is a notable source of sediment and, at a minimum, should be monitored at least every other year. A significant erosion site may justify a project on its own merits if access is relatively easy and/or the project provides additional benefits related to infrastructure protection and/or habitat improvement. If a project is not justified, additional investigation to properly assess the cause and severity of the issue may be warranted.

**Severe erosion** – A site that is a significant source of sediment and would usually justify a project on its own merits unless access is difficult. If a project is not completed, the site would be monitored annually.

Barr categorized all of the erosion sites as minor and did not observe any sites with moderate, significant, or severe erosion. Table 1 summarizes the severity and number of erosion sites observed during the inventory. Figure 1 shows the location of each erosion site.

**Table 1  Erosion Summary**

<table>
<thead>
<tr>
<th>Erosion Severity</th>
<th>Ravine Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minor</td>
<td>12</td>
</tr>
<tr>
<td>Moderate</td>
<td>0</td>
</tr>
<tr>
<td>Significant</td>
<td>0</td>
</tr>
<tr>
<td>Severe</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
</tr>
</tbody>
</table>

**Minor Erosion Site Details**

Barr observed 12 minor erosion sites during inspections. A few of the typical minor erosion sites are shown below and identified on Figure 1.

**Site 237 – Headcut and Bank Erosion**

Photos 4 and 5 show minor bank erosion that is approximately 12 feet wide and 5 feet high on the unvegetated bank, with some recent headcutting upstream. The site is located on the left bank of the seventh ravine from the west, shown on Figure 1. There are residential homes at the north end of the

To: File
From: Jeff Weiss, PE, Senior Water Resources Engineer
Subject: 2019 Sunfish Lake Erosion Inventory
Date: August 9, 2019
Page: 5

ravine, which then drains overland to Sunfish Lake. Erosion in this area appears to have occurred fairly recently due to the exposed ground (no leaf cover) near the top of the bank and in the upstream section of the ravine.

Photos 4 and 5: Typical minor erosion reach, Sunfish Lake ravines (May 6, 2019)

**Site 240 - Bank Erosion**

Photo 6 shows relatively recent minor bank erosion that is approximately 25 feet wide and 3 to 6 feet high on a previously vegetated bank—as is evident by the two trees that have fallen and the recent sediment deposits downstream in the ravine channel. The site is located on the left bank, about a quarter of the way up the ravine from Sunfish Lake, as shown on Figure 1. There are residential homes upstream of and along either side of the ravine, which then drains overland to Sunfish Lake.

Photos 6 and 7: Typical reach with minor erosion, Sunfish Lake ravines (May 6, 2019)
Recommendations

The sites noted as having minor erosion do not require additional action besides monitoring. The erosion at such sites may be due to a temporary disturbance (e.g., a fallen tree or new residential development) and may self-stabilize, or it may be more permanent due to site conditions (e.g., steep topography, lack of ground vegetation), but not, necessarily, growing worse. Barr recommends monitoring the ravines adjacent to the north shore of Sunfish Lake on a regular 3-year inspection schedule, with the next inspection scheduled for 2022. At this time, Barr does not advise a full feasibility study since only minor erosion sites were observed.
FIGURE 1

EROSION LOCATIONS
2019 Sunfish Lake
Erosion Inventory
Valley Branch Watershed District

Intermittent Stream/Ravine Inspection
2-Foot Elevation Contour
(DNR, 2011)

Level of Erosion
- Green: Minor
- Yellow: Moderate (none)
- Orange: Significant (none)
- Red: Severe (none)

Imagery Source:
NearMap, April 2019
Appendix F

2019 Swede Hill Subwatershed Erosion Inventory Memorandum
Memorandum

To: File
From: Jeff Weiss, PE, Senior Water Resources Engineer
Subject: 2017 and 2019 Swede Hill Creek Subwatershed Erosion Inventories
Date: August 9, 2019
Project: 23820045.01 2019 210
cc: Susannah Torseth, Jeff Brower, Melissa Imse, John Hanson

Introduction

At its January 12, 2017, meeting, the Valley Branch Watershed District (VBWD) Board of Managers authorized Barr Engineering Co. (Barr) to perform an erosion inventory of the ravines in the Swede Hill Creek subwatershed. Due to budget constraints, some ravines were not inspected in 2017. At its January 24, 2019, meeting, the Board authorized Barr to complete the erosion inventory.

This memorandum summarizes the inventory performed by Barr to assess the current condition of the Swede Hill Creek subwatershed ravines. During the erosion inventory, Barr made observations and collected geo-referenced photographs at sites of interest, including areas of erosion.

Background

The Swede Hill Creek subwatershed is located on the south end of the City of Afton and has a drainage area of 836 acres, or approximately 1.3 square miles. VBWD incorporated this subwatershed into its jurisdictional boundaries in 2009 when the Lower St. Croix Watershed Management Organization dissolved. The Swede Hill Creek subwatershed includes areas draining to the St. Croix River between St. Croix Trail South, River Road South, and Afton State Park. The channels in this subwatershed consist of ravines and ephemeral streams that only transport water during and immediately after storm events.

Land use, as documented in 2010, includes scattered single-family residential lots, agricultural land in the western portion of the subwatershed, and Afton State Park in the southern portion of the subwatershed. Areas immediately adjacent to the ravines and channels are forested.

The 2017 inspection was the first that VBWD has conducted in this subwatershed. The purpose of the inspection was to:

Requested Manager Actions

A. Consider budgeting $2,500 to monitor significant erosion areas in 2020
B. Monitor other erosion sites on the regular 5-year inspection schedule in 2022
1. Identify areas of special concern with regard to karst geology.
2. Identify potential locations for ravine and gully stabilization.
3. Establish a baseline understanding of the ravines for comparison with future inspections.
4. Determine whether VBWD should consider any stabilization projects for the ravines.

**Erosion Inventory and Inspection**

Barr staff performed the majority of the Swede Hill Creek subwatershed erosion inventory on May 9, 2017, and completed remaining ravine inspections on May 1, 2019. Barr selected the ravines based on a GIS review of the terrain to determine the most significant ravines that could be inspected for the allocated budget. Figure 1 shows ravines that Barr staff inspected in 2017 and 2019—approximately 13,800 feet (2.6 miles) in 2017 and 16,100 feet (3.0 miles) in 2019. Barr did not inspect any steep slopes without defined ravines. Overall, the channels within the subwatershed were in stable condition. Ravine slopes were typically well-vegetated, with natural riffles of rocks and logs to help stabilize potential head-cutting of the ephemeral streambed. Photos 1–7 show typical Swede Hill Creek subwatershed ravines from both the 2017 and 2019 ravine inspections.

![Photo 1: Sandstone wall in the middle of a ravine in the Swede Hill Creek subwatershed (May 9, 2017)](image-url)
Photo 2: Typical Swede Hill Creek subwatershed ravine section (May 9, 2017)

Photo 3: Typical Swede Hill Creek subwatershed ravine section (May 9, 2017)
Photo 4: Typical Swede Hill Creek subwatershed ravine section (May 1, 2019)

Photo 5: Typical Swede Hill Creek subwatershed ravine section (May 9, 2017)
To: File  
From: Jeff Weiss, PE, Senior Water Resources Engineer  
Subject: 2017 and 2019 Swede Hill Creek Subwatershed Erosion Inventories  
Date: August 9, 2019  
Page: 5

Photo 6: Typical Swede Hill Creek subwatershed ravine section (May 9, 2017)

Photo 7: Typical Swede Hill Creek subwatershed ravine section (May 9, 2017)
Barr noted a total of 150 erosion sites—101 sites in 2017 and 49 sites in 2019. Many of these sites were minor headcuts that should be monitored during future inspections. Following the inventory, Barr staff reviewed field observation data and photos and categorized these sites as having minor, moderate, significant, or severe erosion. These categories are defined as follows:

**Minor erosion** – a site that appears to be slightly eroding and/or is a minor sediment source. Minor erosion sites would not justify a project on their own merits, but would likely be included in a project if other work is performed nearby and access to the site is easy. These sites may be left alone if access is difficult or would cause more harm than good.

**Moderate erosion** – a site that appears to have more sediment loading than minor sites, but not enough to justify a project on its own merits. Moderate erosion sites would usually be included in a nearby project unless access is difficult.

**Significant erosion** – a site that is a notable source of sediment and, at minimum, should be monitored at least every other year. A significant erosion site may justify a project on its own merits if access is relatively easy and/or the project provides additional benefits related to infrastructure protection and/or habitat improvement. If a project is not justified, additional investigation to properly assess the cause and severity of the issue may be warranted.

**Severe erosion** – a site that is a significant source of sediment and would usually justify a project on its own merits unless access is difficult. If a project is not completed, the site would be monitored annually.

Barr categorized most of the observed erosion sites as minor or moderate; however, during the 2017 inventory, some areas of erosion were determined to be significant due to size, recent activity, or risk of continued erosion. No additional significant erosion sites were identified in 2019, and no locations were categorized as severe.

Table 1 summarizes the severity and number of erosion sites observed during the 2017 and 2019 inventories. Figure 2 shows the location and year inspected of each observed erosion site. Erosion observed as significant or severe is summarized in the following subsection.

**Table 1  Erosion Inventory Summary**

<table>
<thead>
<tr>
<th>Erosion Severity</th>
<th>2017 Sites</th>
<th>2019 Sites</th>
<th>Total Sites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minor</td>
<td>80</td>
<td>44</td>
<td>124</td>
</tr>
<tr>
<td>Moderate</td>
<td>19</td>
<td>5</td>
<td>24</td>
</tr>
<tr>
<td>Significant</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Severe</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>101</strong></td>
<td><strong>49</strong></td>
<td><strong>150</strong></td>
</tr>
</tbody>
</table>
Significant Erosion Site Details

This section contains descriptions of the erosion sites that Barr staff categorized as significant during the 2017 inspection, along with a qualitative assessment of the possible downstream sediment loading generated by each site. These sites are shown on Figure 3.

Site 21—Significant Ravine Bank Erosion

Bank erosion at Site 21 is 30 feet long, 3 feet deep, and 20 feet high on a steep, unvegetated bank (Photos 8 and 9). The site is located near the far downstream end of the southernmost ravine near the St. Croix River. The lot is owned by River Road South LLC at 4767 River Road South. There is no perennial stream in this area, so sediment loading from the erosion occurs only during storm events.

Photo 8: Bank erosion near 4767 River Road South (May 9, 2017)
Site 43 - Bank Erosion

Bank erosion at Site 43 is approximately 40 feet wide and 15 feet high on a steep, unvegetated bank (Photos 10 and 11). The site is on the right bank, just downstream of a 30-foot sandstone wall and upstream of River Road South, on the Heffron property at 4350 River Road South. The ravine drains under the road and into the St. Croix River. There is a home just north of the ravine and on the bank opposite the erosion.

Erosion in this area looks fairly recent due to the lack of vegetation and the exposed ground (no leaf cover) near the top of the bank. The close proximity of the bank erosion to the St. Croix River makes it unlikely that sediment would settle before discharging to the river, particularly because the ravine carries swift-moving stormwater through its channel.
Photo 10: Bank erosion near 4350 River Road South (May 9, 2017)

Photo 11: Bank erosion near 4350 River Road South (May 9, 2017)
Recommendations

In general, minor and moderate erosion sites do not require additional action besides monitoring.

For sites categorized as significant, Barr recommends one of the following:

1. Continued monitoring every 2 years (more frequent than the 5-year inspection program for Swede Hill Creek subwatershed) to assess how quickly the site is changing

2. Further investigation to better identify the root causes of the erosion issues and develop concept-level plans and cost estimates for mitigation projects

3. Repair for sites that justify immediate attention

Table 2 summarizes the significant erosion locations and provides a recommendation for next steps. In addition, Figure 3 shows the erosion locations that should be prioritized for the Swede Hill Creek subwatershed.

<table>
<thead>
<tr>
<th>Site</th>
<th>Property</th>
<th>Year Inspected</th>
<th>Severity</th>
<th>Observation</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>4767 River Road South</td>
<td>2017</td>
<td>Significant</td>
<td>Bank Erosion</td>
<td>Monitor in 2020</td>
</tr>
<tr>
<td>43</td>
<td>4350 River Road South</td>
<td>2017</td>
<td>Significant</td>
<td>Bank Erosion</td>
<td>Monitor in 2020</td>
</tr>
</tbody>
</table>

Barr recommends additional monitoring in 2020 at each of the erosion sites classified as “Significant” to assess how rapidly the system is changing and if additional investigation or repairs may be justified. The total estimated cost for completing the recommended monitoring in 2020 is approximately $2,500. Barr recommends that the remainder of the major ravines in the Swede Hill Creek subwatershed be evaluated on a 5-year schedule, with the next inspection occurring in 2022. While some sites would be inspected after only 3 years, this schedule would allow all ravines to be inspected and analyzed on a consistent timeline.
Erosion Locations*

Level of Erosion
- Minor
- Moderate
- Significant
- Severe (none)

Intermittent Stream/Ravine

2017 Inspection
2019 Inspection

*Note: Numbering refers to Erosion Location ID

Imagery Source:
USDA NAIP 2017

EROSION LOCATIONS
2017 & 2019 Swede Hill Creek Subwatershed Erosion Inventories
Valley Branch Watershed District

FIGURE 2
SIGNIFICANT EROSION SITES
2017 & 2019 Swede Hill Creek Subwatershed Erosion Inventories
Valley Branch Watershed District

FIGURE 3
Appendix G

Long Lake Sediment Delta Assessment Memorandum
Memorandum

To: File
From: Kevin Menken, Senior Environmental Engineer
Subject: Long Lake Sediment Delta Assessment
Date: December 3, 2019
Project: 23820045.01 2019 508
c: Melissa Imse, Susannah Torseth, Jeff Brower, John Hanson

Background

A sediment delta has formed at the southwest corner of the main basin of Long Lake, at the inlet northeast of the Highway 36 and 694 interchange. The inlet conveys flow from the upstream Silver Lake subwatershed. The Minnesota Department of Natural Resources (MNDNR) noted the presence of the sediment delta in their 1989 fisheries survey. According to lake residents, the sediment delta has been expanding for nearly 30 years, possibly as a result of highway runoff.

In 2011, the Minnesota Department of Transportation implemented stormwater management practices within the highway interchange that should have reduced the sediment loading to the lake. Barr staff conducted a survey in August 2019 to assess the current conditions of the Long Lake sediment delta. The 2019 survey can now be used as a baseline condition to determine if the sediment delta is increasing.

2019 Survey

On August 13, 2019, Barr staff collected sediment surface elevation data using survey-grade Real-Time Kinematic Global Positioning Survey (RTK GPS) equipment with a vertical accuracy of 0.10 feet. Barr collected elevation measurements across the sediment delta and in lake areas adjacent to the sediment accumulation. Barr staff used hand tools to probe material from the sediment delta for visual inspection and found that the sediment delta consisted primarily of sand, along with sticks and other dead vegetation (Photograph #1).
The results of the August 2019 bathymetric survey are mapped in Figure 1. Barr compared the August 2019 bathymetric survey to a historic bathymetric surface from the MNDNR created in 1964 (Attachment A). The MNDNR’s map, which covers the entire lake, is at a lower resolution than the 2019 survey; therefore, accurate comparisons for determining changes in sediment volume of the delta cannot be made.

The 2019 bathymetric survey of the sediment delta provides an accurate record of the current conditions of the sediment delta at the south end of Long Lake. If there are continued concerns about sediment loading from the highway interchange ditch, bathymetric surveys can be repeated and compared to the 2019 survey to determine the volume of sediment that has accumulated.
Long Lake Sediment Delta Survey Area

Note: Bathymetry depths are relative to the OHWL of 939.4 ft NGVD29.

Imagery Source: NearMap, April 2019