Feasibility Report for the
Wirth Lake Outlet Modification Project

Prepared by the Bassett Creek Watershed Management Commission

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July 2011

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Golden Valley, Minnesota

Prepared by the
Bassett Creek Watershed Management Commission

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I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the Laws of the State of Minnesota.

Tim P. Brown
Reg. No. 24607, Date: July 7, 2011

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Feasibility Report for the Wirth Lake Outlet Modification Project

July 2011

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1.0 Summary

The *Wirth Lake TMDL Implementation Plan* (MPCA, 2010) includes modifying the outlet structure to prevent flow from Bassett Creek to Wirth Lake during flood periods. This modification is estimated to reduce phosphorus loading to the lake by an average of 55 pounds per year (*Wirth Lake Excess Nutrients Total Maximum Daily Load Report*, MPCA, 2010). Based on analysis of historic data, the modification of the Wirth Lake outlet will be required to achieve the annual load reductions prescribed in the TMDL allocations. The reductions in phosphorus that would be achieved are estimated to be sufficient to meet the water quality goals for the lake. In February 2011 the Bassett Creek Watershed Management Commission (BCWMC) approved adding modifications of the Wirth Lake outlet structure to include backflow protection to the 2012 CIP.

The proposed modifications to the existing outlet should be designed so as to not significantly raise flood levels in the creek and surrounding areas, and provide a low maintenance need with reliable operation. The resulting structure should be designed to maintain the normal water level of the lake and the outflow capacity of the existing outlet.

The following alteration alternatives were reviewed for this study:

- Stop logs
- Rubber Check Valve
- Steel Lift Gate
- Inflatable Barrier

The rubber check valve alternative is recommended based on the reliability, lower construction costs, and minimal maintenance needs. The opinion of cost for installing rubber check valves is $180,000. This is about $60,000 less than for installation of a steel lift gate. The rubber check valve alternative requires minimal maintenance and no ongoing electrical needs or additions to the City's Supervisory Control and Data Acquisition (SCADA) system.

The recommended alternative includes removing the existing timber outlet structure from Wirth Lake and placing a new bulkhead with openings for two rubber check valves. The proposed bulkhead would attach to the existing culvert. The exposed surface of the bulkhead could be colored, textured, or treated with a form liner to blend the wall into the surroundings.

The proposed modifications would include the installation of two rubber check valves inside the culvert using metal flange rings bolted in place. To accomplish this, an opening should be cut in the top of the culvert and finished with a flat metal, lockable cover at the upstream end of the culvert. The two proposed valves would slightly exceed the existing cross-sectional area for flow and would maintain the existing outflow capacity.

A slanted “self cleaning” inlet grate should be installed that is designed to maintain the normal water level of Wirth Lake at 818 feet (datum NAVD 88).

The rubber check valve option would maintain or increase the barrier to movement of fish and other aquatic animals upstream from Bassett Creek to Wirth Lake. The Minnesota Department of Natural Resources (MNDNR) has reviewed the impact of the fish barrier on Wirth Lake and found the potential for a minor impact to the fishery and was neutral on the project. The barrier may provide a benefit by preventing the migration of invasive species such as carp and zebra mussels to Wirth Lake.

2.0 Background and Objective

2.1 TMDL Implementation

The *Wirth Lake TMDL Implementation Plan* (MPCA, 2010), identifies modifications to the Wirth Lake outlet structure to prevent flow from Bassett Creek to the lake during flood periods to achieve the annual nutrient load reductions prescribed in the TMDL study allocations. This modification is estimated to reduce phosphorus loading to the lake by an average of 55 pounds per year (*Wirth Lake Excess Nutrients Total Maximum Daily Load Report*, MPCA, 2010). Based on analysis of historic data, the modification of the Wirth Lake outlet will be necessary and sufficient to meet the TMDL allocation. In February 2011 the BCWMC approved adding this project to its 2012 CIP.

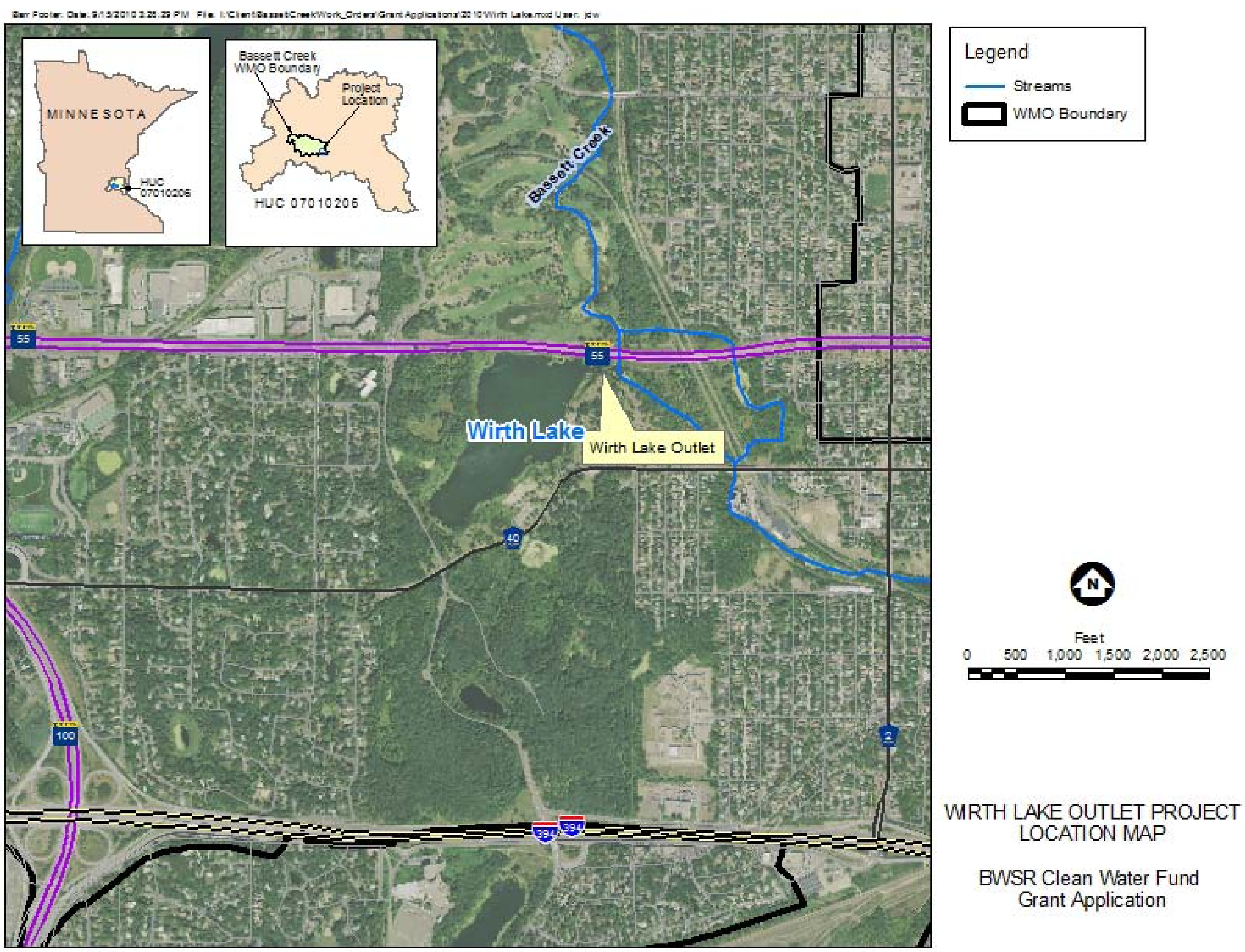

Figure 1. Project Location Map.

The initial planning estimate of cost for the Wirth Lake outlet modification for the BCWMC Capital Improvement Program was $250,000, which includes permitting and administration costs. The Board of Water and Soil Resources has awarded this project a $75,000 Clean Water Fund grant.

This feasibility study, including preliminary analysis and design, and opinion of construction cost, is required as part of the BCWMC implementation process. The feasibility study must be complete prior to the BCWMC holding a public hearing and ordering the project.

2.2 Goals and Objective

The objective of the project is to prevent Bassett Creek from back flowing into Wirth Lake during periods of high water in the creek, while maintaining the lake's ability to flow to the creek when water levels allow. The resulting modifications should be designed to result in no increased flood levels along the creek and surrounding areas. This project also provides an opportunity to replace the aging treated timber weir that currently maintains the normal lake level.

2.3 Wirth Lake Background

Wirth Lake (MNDNR ID 27-0037) and most of its watershed are located in the City of Golden Valley (**Figure 1**), within the Bassett Creek Main Stem Watershed. The remaining portion of the watershed, south of the lake, is in the City of Minneapolis. The entire shoreline around the lake is owned by the Minneapolis Park and Recreation Board (MPRB).

The lake has a surface area of 38 acres, a maximum depth of 26 feet, and an estimated mean depth of 14 feet. Wirth Lake is surrounded by significant wetland vegetation which provides excellent waterfowl habitat. The lake is bordered by parkland and open space areas to the south and east, by Hwy. 55 to the north, and by Theodore Wirth Parkway to the west. The Wirth Lake watershed has a total area of 346 acres, excluding landlocked areas.

Wirth Lake is currently listed on the Minnesota Pollution Control Agency's (MPCA) 2008 303(d) Impaired Waters List due to excessive nutrients (phosphorus) which requires a Total Maximum Daily Load (TMDL) study report. The lake was first listed on the MPCA's 303(d) list for aquatic recreation in 2002. The TMDL report for the lake had a target start date of 2007 and a target completion date of 2012. The TMDL study report and implementation plan was completed by the MPCA in 2010.

Wirth Lake is an important recreational resource to residents of north Minneapolis and surrounding inner-ring suburbs and it is used extensively for swimming, fishing, non-motorized boating and aesthetic viewing. As noted in the Bassett Creek Watershed Management Commission Watershed Management Plan (BCWMC WMP, 2004) the City of Golden Valley, the City of Minneapolis, the MPRB and the BCWMC have collaborated to improve the water quality of Wirth Lake for many years.

2.4 Site Conditions

The existing Wirth Lake outlet is located in the northeast corner of the lake in Theodore Wirth Regional Park. The outlet consists of an 80 foot long, 8 foot wide by 4 foot high concrete box culvert. The normal water level of Wirth Lake is maintained by a treated timber plank weir on the upstream end of the box culvert. The weir includes three, 3-inch thick by 12-inch high treated wood planks. Wirth Lake directly discharges to the main stem of Bassett Creek.

The timber planks maintain the normal water level (NWL) of Wirth Lake at approximately 818.0 feet (NAVD 88). The Ordinary High Water Level (OHWL) for Wirth Lake has been set by the MNDNR at 818.9 (NAVD 88).

The existing stone-faced concrete culvert once served as a roadway crossing of the flow out of the lake. The roadway was removed but the culvert was left in place. The existing timber weir was built onto this concrete culvert in the 1970's to hold three submerged perforated outlet pipes that extend into the lake and are covered with a gravel bed. Originally this was designed to prevent rough fish from entering the lake. These perforated pipes are not visible and are no longer functioning. Three shafts that controlled valves in these perforated pipes still exist and can be seen in **Figure 2**. These valves no longer function.

Over time the perforated pipes clogged and could not maintain the flow needed to keep the lake level stable. Therefore, one of the planks was cut out from the wooden bulkhead to form a 64-inch by 13-inch opening at the NWL. This opening currently serves as the outlet for the lake and maintains the lake level and outlet capacity. The NWL and flow capacity must be maintained with a new structure.

The water surface elevation of Bassett Creek under typical flow conditions is approximately one to two feet lower than the Wirth Lake outlet elevation. The 10- and 100-year Bassett Creek flood elevations are 820.4 and 821.5 feet, respectively, in the vicinity of the Wirth Lake outlet. Under existing conditions, bank full flows (approximately 2-year frequency) in Bassett Creek would result in backflow from Bassett Creek into Wirth Lake. The low point of the natural overflow between Wirth Lake and Bassett Creek occurs along the old road bed on top of the outlet culvert at a ground elevation of 824.2 feet.

Construction access to perform the outlet modification is expected to be relatively easy due to the existing recreation trail system adjacent to the lake.

Figure 2. Existing Wirth Lake Outlet Structure.

Condition of the Existing Culvert

The existing culvert is made of concrete and was faced with Platteville limestone. It was inspected for condition on April 7, 2011. The culvert was found to be in very good condition and suitable for the installation of a new upstream bulkhead. A summary of the inspection observations is included in the Appendix of this study.

2.5 Hydrologic Modeling

This section describes the results of the 2009 floodplain analysis completed for Wirth Lake and adjacent portions of Bassett Creek from Plymouth Avenue in Golden Valley to Penn Avenue in Minneapolis as part of the TMDL study. The purpose of this floodplain analysis was to determine how Wirth Lake's flood storage affects the floodplain elevations along Bassett Creek. The following is a summary of the modeling methodology, assumptions for completing the floodplain modeling, and results of the analysis.

XP-SWMM Model

The US EPA's Storm Water Management Model (SWMM), with a computerized graphical interface provided by XP Software (XP-SWMM), was chosen as the computer modeling package for this study. The XP-SWMM model is able to use rainfall and watershed information to generate runoff hydrographs or utilize user input hydrographs that are routed simultaneously through complicated pipe and natural channel flow networks. The model can account for detention in ponding areas, backwater conditions, weirs, orifices, and backflow through culverts, all of which do occur in this study area. Version 10.6 of the XP-SWMM model was used to model Wirth Lake and Bassett Creek from the flood storage area between Plymouth Ave and Highway 55 (Golf Course Pond) to Penn Avenue.

Bassett Creek was previously modeled using the U.S. Army Corps of Engineers HEC-1 (hydrologic model) and HEC-2 (hydraulic model) models for the effective FEMA Flood Insurance Rate Maps dated September 2004. The XP-SWMM model was selected for the TMDL study due to its robust modeling capabilities, especially with regards to unsteady flow, flood storage areas, and complicated outlet structures.

XPSWMM Modeling Assumptions and Methodologies

The contributing watershed area to Wirth Lake, not including the surface area of Wirth Lake, is 308 acres. Watershed input parameters for the Wirth Lake watershed were calculated using geographic information systems (GIS) along with typical published values for infiltration parameters. As noted, the Bassett Creek watershed area was previously modeled using the HEC-1 hydrologic model. Therefore, the inflow hydrographs for Bassett Creek at Plymouth Avenue for the 100-year (6 inches), 50-year (5.3-inches), and 10-year (4.2-inches) 24-hour design storms were taken from the HEC-1 model and entered into XP-SWMM.

In the XP-SWMM model, water can be stored in constructed basins or natural ponding areas until it reaches a certain elevation corresponding to an outlet, such as overflow via a weir, orifice and/or overland flow. Elevation-storage curves were obtained for Wirth Lake and for the Theodore Wirth Golf Course flood storage area north of Highway 55 on Bassett Creek using a digital elevation model (DEM) developed from 2007 Light Detection and Ranging (LIDAR) data acquired by Science Applications International Corporation (SAIC) for the US Army Corps of Engineers St. Paul District.

The NWL of the Theodore Wirth Golf Course flood storage area was assumed to be the same as the control structure (modified weir) elevation of 815.5. The NWL of Wirth Lake was surveyed as 818.0. The Wirth Lake outlet structure was modeled as an orifice that flows into an 8-ft wide by 3.5-ft high (considering 0.5 foot sediment depth) box culvert which discharges water to Bassett Creek.

According to the Hennepin County FEMA Flood Insurance Rate Map (September 2004), the 100-year, 50-year, and 10-year flood elevations at Penn Avenue are approximately 815 feet, 814 feet, and 813 feet, respectively. These elevations were used as the starting water surface elevations (i.e. backwater elevations) at the downstream end of the model (Penn Avenue). Backwater can be defined as a rise in water surface elevation caused by some obstruction such as a narrow bridge or culvert opening that limits the area through which water can flow.

Floodplain cross sections for Bassett Creek were obtained from the HEC-2 model, a survey completed by Barr Engineering on May 5, 2009 and/or the DEM from the LiDAR data. More specifically, cross sections for the two railroad bridges located upstream of Penn Avenue, the box culvert connecting Wirth Lake and Bassett Creek, the dual box culverts under Highway 55, and the culvert under the Old Penn Avenue bridge crossing were also surveyed on May 5, 2009. All other cross sections were obtained from the HEC-2 model, with some supplemental data obtained from the DEM.

Modeling Results

Two floodplain scenarios for three design storms (10-yr, 50-yr, and 100-yr) were modeled in the XPSWMM model:

1. Existing Conditions: allows Wirth Lake to overflow into Bassett Creek and allows Bassett Creek to backflow into Wirth Lake.

2. Proposed Condition: allows Wirth Lake to overflow into Bassett Creek and prevents Bassett Creek from back flowing into Wirth Lake.

Tables 1a and 1b present the comparison of the peak flood elevations for the three design storms at locations along the study area between Highway 55 and Penn Avenue for the two floodplain scenarios.

Conclusion

The change in Bassett Creek water elevations for the three event scenarios under existing and proposed conditions (the Wirth Lake outlet preventing flow from the creek to the lake) are shown in **Tables 1a and 1b**. The maximum increase for all events and locations along Bassett Creek of 0.1 feet is predicted near and downstream of the Wirth Lake outlet. This change was deemed to be insignificant in terms of impacts from flooding along the creek and is expected to produce no increases in flood damage.

The model predicted the maximum increase in elevation for Wirth Lake for all modeled events would be 0.4 feet during a 10-year storm event. This short term condition would not impact buildings or other structures and would have negligible impact on the lake shoreline.

Table 1a: Comparison of peak flood elevations for the three design storms at different locations for the existing and proposed condition scenarios.

Location	Peak Flood Elevation (feet above sea level – NAVD88)					
	100-Year, 24-Hour Existing Conditions	100-Year, 24-Hour Proposed Conditions	50-Year, 24-Hour Existing Conditions	50-Year, 24-Hour Proposed Conditions	10-Year, 24-Hour Existing Conditions	10-Year, 24-Hour Proposed Conditions
Theodore Wirth Golf Course Flood Storage Area[1]	824.8	824.8	824.2	824.2	822.9	822.9
Wirth Lake	820.9	821.0	820.4	820.6	819.7	820.1
Bassett Creek where Wirth Lake inflows	820.9	821.0	820.4	820.4	819.4	819.4
Bassett Creek at Glenwood Avenue	819.9	820.0	819.4	819.5	818.6	818.5
Bassett Creek at U/S face Fruen Mill Dam	817.5	817.6	817.0	817.1	816.5	816.5
Bassett Creek at M.N. & S. Railroad Bridge	816.6	816.6	815.7	815.7	814.4	814.4
Bassett Creek at B.N. Railroad Bridge	815.5	815.5	814.4	814.4	813.3	813.3
Bassett Creek at Penn Avenue	815.0	815.0	814.0	814.0	813.0	813.0

[1] Directly upstream of the Highway 55 control structure.

Table 1b: XP-SWMM modeled flow rates from Wirth Lake to Bassett Creek under existing conditions.

	100-Year, 24-Hour Existing Conditions	50-Year, 24-Hour Existing Conditions	10-Year, 24-Hour Existing Conditions
Peak flow rate in cubic feet per second (cfs) from Wirth Lake to Bassett Creek	54.8 cfs	50.9 cfs	42.8 cfs

3.0 Alternatives

The following alternatives were evaluated for backflow prevention between Bassett Creek and Wirth Lake through the existing lake outlet culvert. The following alteration alternatives were reviewed for this study:

- Stop logs
- Rubber Check Valve
- Steel Lift Gate
- Inflatable Barrier

Table 2 compares the alternatives evaluated to accomplish the goals in this study. The opinion of cost includes design, construction administration, construction, and a 25% contingency.

Table 2. Comparison of alternatives considered.

Alternative	Advantages	Disadvantages	Opinion of Cost
Steel Lift Gate	• reliable, familiar	• relatively high cost • needs electrical service • needs regular maintenance • high visibility	$240,000
Rubber Check Valves	• relatively lower cost • reliable • minimal maintenance • least visible	• may need access hatch through top of culvert for install or replacement	$180,000
Stop Logs	• relatively low cost	• depends on manual operation, reliability uncertain	Low
Inflatable Barrier	• flexible operation	• high cost • complex • reliability issues • needs most space	High

3.1 Automated Steel Lift Gate

The first alternative investigated includes replacing the existing timber weir with a new concrete bulkhead and adding a fabricated steel lift gate. The lift gate would be fabricated from plate steel with steel ribs, and slide on a channel track with a Teflon sliding surface. The lifting mechanism would use a threaded stem gear to raise and lower the gate. The gate would be powered by an electric motor and outfitted for automated operation. Electrical service would need to be installed to the site. This alternative would be similar to the lift gate installed by the City of Golden Valley at Wisconsin Avenue North in 2001.

Automated operation of the control structure would allow the gate to close as the water elevation in Bassett Creek rises, preventing backflow from the creek to Wirth Lake. The system could also include controls for automated operation based on upstream and downstream creek elevations and be operated by the City of Golden Valley SCADA system. In case of electrical system problems, the gate could be manually operated with a hand wheel.

The control structure system would include the following components:

- concrete bulkhead including a flat crested weir opening
- concrete surface treatment to soften the structures appearance
- steel slide gate and rails
- electric motor and hoist system
- control panel and ultrasonic level transducer
- master SCADA radio, control panel and PC

The primary advantage of this system is demonstrated reliability due to common usage. It would provide the flexibility of automated or manual function, further increasing reliability.

This system would require at least annual inspection and test operation. Lubrication and occasional replacement of electrical and mechanical components should be expected.

This installation would be in a public park area with high traffic making vandalism a possibility. That potential could be minimized by installing electrical and other vulnerable components within locked boxes or a control shed.

Table 3. Opinion of cost for the automated steel lift gate alternative.

COMPONENTS	OPINION OF COST ($)
Mobilize and demobilization	10,000
Diversion and dewatering	25,000
Demolition	10,000
Reinforced concrete bulkhead w/ form liner	10,000
Steelwork (platform, gate, fencing)	18,000
Hoist system w/electric motor	15,000
Electric service, controls and SCADA system	40,000
Engineering, permits, construction admin	72,000
Subtotal	200,000
Contingency (20%)	40,000
TOTAL	**240,000**

Figure 3. Example of an automated steel lift gate at Wisconsin Avenue in the City of Golden Valley.

3.2 Rubber Check Valve

The second alternative includes replacing the existing timber weir with a new weir structure that incorporates two-24 inch rubber check valves. The proposed valves would be placed inside the existing culvert so as to be out of site of park users. Installation of locking hatch gates on the top of the culvert should be installed make the structure accessible for inspection and maintenance.

The rubber check valves operate by opening in response to elevated hydraulic head (or water level) at the upstream (lake side) opening, and closing in response to neutral or elevated hydraulic head at the downstream end (creek side). In its resting position it resembles a vertical duck's bill, with the downstream end of the heavy duty rubber cylinder curled shut as shown in **Figure 4**. Rubber check valves are in common use to prevent back flow in tidal zones and have become increasingly used for flood protection.

The primary advantage to rubber check valves is that they generally require minimal routine maintenance or repair due to their all-rubber construction. They are passive valves, operating solely on water pressure differences, and require no outside energy source for operation. These valves are not known to warp or freeze. They typically handle large obstructions without jamming, and tend to clean themselves out under flow. Occasional maintenance to remove accumulated debris may be necessary. The manufacturer estimates these valves to have a 30 year operational life span.

This option would also eliminate the need for electrical service and controls at the site, thereby significantly reducing the construction and maintenance costs of the project. The valves are custom built and require about 10 weeks from the order to delivery.

The proposed concrete bulkhead required for this alternative includes two 24 inch diameter holes to fit the flanges for two 24 inch rubber check valves. The bulkhead would attach to the existing culvert. It is recommended that the exposed surface of the bulkhead be colored, textured, or a form liner applied, to mimic the existing stone facing and blend into the surroundings.

Two 24-inch Tideflex Series 35-1 (or similar) rubber check valves should be installed using metal flange rings bolted in place. The two proposed valves would slightly exceed the existing cross-sectional area for flow and would maintain the existing outflow capacity. An opening should be cut in the top of the culvert and finished with a metal, lockable cover. A slanted "self cleaning" inlet grate should be installed that would maintain the normal water level of the lake at 818 feet (datum NAVD 88).

Table 4. Opinion of cost for constructing a bulkhead and rubber check valves.

COMPONENTS	OPINION OF COST ($)
Mobilization and demobilization	10,000
Diversion and dewatering	25,000
Demolition	10,000
Reinforced concrete structure w/ form liner	12,000
2 rubber check valves w/flanges, delivered	21,000
Inlet box and grate	5,000
Install manhole opening and cover	6,000
Engineering, permits, construction admin	61,000
Subtotal	150,000
Contingency (20%)	30,000
TOTAL	**180,000**

Figure 4. Photos of the Rubber Check Valve.

3.3 Other Alternatives Considered

Stop Logs: The alternative of replacing the existing bulkhead with manually placed stop-logs was considered but not evaluated for cost. The main drawback of a stop-log installation is that the open/close operation cannot be automated. Maintenance workers would need to manually place the stop-logs to prevent backflow, and then remove them after high flow events. The workers would use a special hooked pole to lift stop-logs out one-by-one. The stop-logs would be permanently stored at the site. This method has the greatest risk of not being implemented during a backflow event and was deemed to be unreliable, especially during periods of high flow late at night, or other times when maintenance staff may not be available. This alternative was not investigated further.

Inflatable Barrier: The alternative of adding an inflatable dam, or weir, to the existing structure was also reviewed. The inflatable barrier would consist of a steel wall that is raised by forcing compressed air into a bladder beneath it when high water conditions exist. To house the heavy structure a large concrete apron would be required along with an electrical control system, air compressor and a control building.

This method was deemed to be fairly complex and cost more than either the steel lift gate or rubber check valve alternatives. Due to the complexity of the device, maintenance cost is also anticipated to be higher than other alternatives. The inflatable device requires much more space than is available at the Wirth Lake site and presents vulnerabilities to vandalism due to its exposure and construction. This alternative was not investigated further.

Figure 5. Inflatable barrier at Minnehaha Creek and Lake Nokomis.

3.4 Impact of Alternatives on Fish Movement

Currently, the movement of fish from Bassett Creek to Wirth Lake is largely limited to periods when the level of the creek is near to that of the lake which occurs during flood conditions. Under normal conditions, the two - three foot drop at the timber weir would prevent all but the most aggressive fish species, such as carp, from entering the lake.

The alternatives considered for this study and described above include mechanical backflow prevention combined with a trash rack, or grate, for safety and to minimize maintenance. These features would create a somewhat larger barrier to the movement of fish and other aquatic animals upstream from Bassett Creek to Wirth Lake than exists today. While both the proposed and existing structures provide a substantial barrier under typical flow conditions, the considered modification alternatives would block movement during flood conditions as well. This flood condition is expected to occur on average about every two years and may occur in any season.

Because the change is limited in scope, the impact on the current ecology of Wirth Lake is expected to be minimal. It may result in diminishing the ability of some species from Bassett Creek to spawn in Wirth Lake. It is expected that the benefits of the modifications will include preventing the influx of nutrients during the flood events, and increased prevention of the migration of invasive species such as carp and zebra mussels into Wirth Lake.

The MNDNR reviewed the impact of this study's proposed modifications on fish passage at the Wirth Lake outlet. The MNDNR found that a potential for minor impact to the fishery exists and declared a neutral position on the project implementation.

The MNDNR has been stocking Wirth Lake with game fish for at least 10 years. The MNDNR fish stocking history for Wirth Lake is summarized below:

1998: 290 adult black crappie 258 adult bluegill sunfish.
1999: 1,900 fingerling channel catfish.
2000: 1,900 fingerling channel catfish.
2001: 2,304 yearling channel catfish.
2003: 600 adult walleye.
2007: 23,000 fry walleye.
2008: 40 adult walleye and 57 fingerling walleye.

4.0 Permits and Schedule

4.1 Constructability of Recommended Improvements

To begin the work, the area near the outlet would need to be dewatered and flow out of the lake diverted around the work area. This could be done using a temporary dike system and a water bypass duct with a pump. Appropriate erosion control would be installed. The contractor would then remove the existing timber weir, the buried metal perforated pipes and valve rod controllers, and the gravel covering on top of the pipes. Some of the existing stone façade on the concrete culvert would also need to be removed.

A new bulkhead would be placed or installed that includes two 24 inch diameter holes to fit the flanges for two 24 inch rubber check valves. These out flow ports should be as low on the wall as feasible and still allow attachment of the check valves. The bulkhead will attach to the existing culvert. The exposed surface of the bulkhead should be colored, textured, or a form liner applied, to blend the wall into the surroundings. Two rubber check valves would be installed inside the culvert using metal flange rings bolted in place. As noted an opening should be cut in the top of the culvert and finished with a metal, lockable cover. Construction disturbance to the park grounds would be cleaned up and restored.

This project will not overlap in time or space with the Bassett Creek Main Stem restoration project scheduled for this area in 2012, and there should be no conflict between this work and the Main Stem project.

It is anticipated that the City of Golden Valley will manage the construction of the structure. The implementation of this project will occur exclusively on land owned by the Minneapolis Park & Recreation Board (MPRB) and will not require formal easements. Along with an MPRB construction permit, the project will require an agreement between the City of Golden Valley and the MPRB allowing the City to manage the project and establishing maintenance responsibilities. These issues will also be addressed in the cooperative agreement between the City of Golden Valley and the BCWMC.

4.2 Permits

The proposed project will require a Public Waters Work Permit from the Minnesota Department of Natural Resources (MNDNR). The project will also need a construction permit from the MPRB to cover impacts to property from the construction and access to the site. The project will also require an agreement between the City of Golden Valley and the MPRB allowing the City to manage the construction project and provide agreement for long term maintenance. The contact for this agreement should be the MPRB Planning Department (612-230-6400).

Public Waters Work Permit

The MNDNR regulates projects constructed below the ordinary high water level of public waters or public waters wetlands, which alter the course, current, or cross section of the water body. Public waters regulated by the MNDNR are identified on published public waters inventory (PWI) maps. Wirth Lake is classified as a Minnesota public water, therefore the proposed work will require a MNDNR public waters work permit. This permit process is subject to a 45-60 day approval cycle. The MNDNR will want to be provided evidence that demonstrates the hydrologic impacts from the outlet modifications will not present flooding problems or raise the normal water level of Wirth Lake.

Section 404 Permit

The COE regulates the placement of fill into wetlands under Section 404 of the Clean Water Act (CWA) if the wetlands are hydraulically linked to a water of the United States. In addition, the COE may regulate all proposed wetland alterations. No wetland impacts are proposed as part of this project. It is expected that the proposed project will involve little, if any, grading or excavation within wetlands. When final design plans are complete, this impact should be assessed and contact made with the COE.

Minnesota Wetland Conservation Act

The Minnesota Wetland Conservation Act (WCA) regulates filling and draining wetlands and excavating within Type 3, 4, and 5 wetlands. In addition, WCA may regulate all types of wetland alteration if any wetland fill is proposed. The WCA is administered by local government units (LGU), which include: cities, counties, watershed management organizations, soil and water conservation districts, and townships. The City of Golden Valley is the LGU for the proposed project site. The Minnesota Board of Water and Soil Resources (BWSR) oversees administration of the WCA statewide. It is expected that the proposed project will involve little, if any, grading or excavation within wetlands. When final design plans are complete this impact should be assessed and contact made with the LGU.

MPCA Guidance for Managing Dredged Materials

The MPCA considers material excavated below the MNDNR's ordinary high water level to be dredged material. Because dredged material is defined as a waste and is regulated by MPCA, the MPCA has developed a guidance document for managing dredged material (document available on the MPCA website: http://www.pca.state.mn.us/water/dredgedmaterials.html).

Dredging is not expected to be required to complete the project. If sediments are to be excavated as part of the project, joint application may need to be made to the U.S. Army Corps of Engineers (COE) for a Clean Water Act Section 404 permit. In this case, the project would also need to comply with the Minnesota Wetland Conservation Act and follow the Minnesota Pollution Control Agency's (MPCA) guidance and permitting for handling dredged material. When final design plans are complete this impact should be assessed and contact made with the COE.

MPRB Permit

The project is expected tp occur exclusively on land owned by the Minneapolis Park & Recreation Board (MPRB). The MPRB requires a construction permit for construction activity occurring on its land. The permit application can be found at:
http://www.minneapolisparks.org/documents/permits/ConstPermitPacket.pdf

The project will also require an agreement between the City of Golden Valley and the MPRB allowing the City to manage the construction project and provide agreement for long term maintenance. The contact for this agreement should be the MPRB Planning Department (612-230-6400).

4.4 Project Schedule

The construction of the Wirth Lake outlet modifications are slated to be completed in the winter of 2011-12.

Appendix: Wirth Lake Outlet Culvert Inspection Report

Memorandum

To: Tim Brown, P.E.
From: Richard Ver Strate, P.E.
Subject: Inspection of Wirth Lake Box Culvert Outlet
Date: April 7, 2011
Project: 23270051.32
c: File

The purpose of this memorandum is to provide documentation of the visual inspection completed on the Wirth Lake Box Culvert Outlet structure. The inspection was conducted to evaluate the condition of the structure for design and installation of a back-flow preventer based on the Wirth Lake Outlet Feasibility Study. The inspection was completed on April 7, 2011 by Tim Brown and Richard Ver Strate of Barr Engineering. The following are observations made.

Background

1. The box culvert is a 4'x8' cast-in-place reinforced concrete structure. The structure provides an overflow outlet for Wirth Lake to Bassett Creek. Wirth Lake surface water elevation is controlled by a weir at the upstream end of the culvert. The age of the structure is unknown.

2. The inlet and outlet (including wing walls) of the structure have been faced with a limestone façade (assumed placed during original construction).

3. The Wirth Lake inlet control (weir) consists of timber planks that are anchored to the structure. The timber planking has a smaller rectangular opening cut into it to allow water to pass from Wirth Lake to Bassett Creek. The original design of the inlet control included three pipes (material unknown, possibly PVC) that were extended upstream into the lake along the lake bottom. Flow through the pipes was controlled by separate valves at the inlet structure. This system did not operate as expected and thus a rectangular opening was later cut into the timber planking to provide an overflow weir. The valves are currently inoperable. The structure has been operating with the opening in the timber planking for the past 20 years (approximately).

Inlet

1. The left (looking downstream) wing wall concrete is badly deteriorated. The right wing wall is in good condition.

2. The limestone façade is mostly in place. Some blocks (left wing wall) are dislodged.

3. The timber planking is in good condition. The three vertical pipes (steel) that are used to operate the control valves are badly deteriorated.

4. The concrete apron is buried or non-existent (between the wing walls).

Upstream Box Culvert (Downstream of Timber Planking)

1. The left and right box culvert walls are badly deteriorated where the timber bulkhead is attached for a distance approximately 8-10 inches downstream of the timber planking. The rest of the box culvert concrete is sound and in good condition downstream from this point. As a note, before the addition of a new bulkhead to the inlet, this upstream 8-10 inches of deterioration should be saw cut and removed.

2. A 6-inch wide steel plate (possibly lower flange of I-Beam) was placed along the top slab of the box culvert at the upstream end. The steel plate was set flush with the bottom of the top slab. This plate or I-beam is likely used as a support for the limestone façade. The steel plate is deteriorated and is delimitating (assumed 25% section loss).

3. The culvert bottom slab is clean (no debris). Box height confirmed at 4 feet. Water depth measured at 1'-8" at the time of inspection.

Box Culvert

1. The box culvert concrete is in good condition. There were no signs of deterioration, spalls, cracks, or exposed reinforcement. One small spot (approximately 2 to 3-inch diameter), located approximately 20 to 30 feet upstream from the outlet on the top slab, was only visible flaw consisting of exposed reinforcement steel with some deterioration.

2. Two eighteen-inch diameter RCP storm sewer pipe connectors exist along the right (looking downstream) wall of the structure. The furthest upstream sewer pipe is in good condition, clean (no debris), and leads to manhole structure approximately 50 feet from box culvert wall. The downstream sewer pipe is in good condition and had some (2 to 3-inch) gravel debris. No flow was observed in either sewer pipes.

3. Some sediment and debris exists (sand, gravel, sticks) along the culvert bottom. The sediment depth varies and tends to increase toward the downstream end.

Downstream Box Culvert (Upstream of Outlet)

1. The box culvert concrete is in good condition. There were no signs of deterioration, spalls, cracks, or exposed reinforcement.

4. A 6-inch wide steel plate (possibly lower flange of I-Beam) was placed along the top slab of the box culvert at the downstream end, similar to the upstream construction. The steel plate was set flush with the bottom of the top slab. This plate or I-beam is likely used as a support for the limestone façade. The steel plate is deteriorated and is delimitating (assumed 20% or less section loss).

2. Some sediment and debris (soil, gravel, sticks) along the culvert bottom. Box height measured 3’-7” from top of debris. Assume depth of debris is about 5”. Water depth measured at 1’-3” at the time of inspection to the top of debris.

Outlet

1. The left and right (looking downstream) wing wall concrete is in good condition. No signs of deterioration, spalls, cracks or exposed reinforcement.

2. The limestone façade is mostly in place. Some blocks on the right wing wall are missing.

3. The concrete apron between the wing walls condition is unknown.