

Lower Penn Lake Management Plan

January 2010

City of Bloomington
Public Works Department
Engineering Division

Introduction

The goal of this management plan is to identify potential specific actions or improvements for Lower Penn Lake (DNR #27-0004-00) to address public input, agency direction, state statute, and to establish a future management direction for the lake. This plan attempts to balance the desires of the public with the City's Park Master Plan, Comprehensive Surface Water Management Plan, Storm Water Pollution Prevention Program, Nine Mile Creek Watershed District Water Management Plan and Rules, DNR Rules and guidance, and State Statute. Final implementation of components of this plan will be dependent on public input, adequacy of available funding, level of participation from other agencies and interested parties, and City Council direction.

Background

On Tuesday, April 17, 2007, Engineering staff hosted a public information meeting to discuss the management of Lower Penn Lake. The purpose of the meeting was to provide the public with background and a brief history of construction activities/management practices previously performed relating to Lower Penn Lake. A short survey/request for comments about the lake was sent prior to the meeting to approximately 130 area properties within 500 feet of the lake's shoreline – 44 responses were received. In addition, meeting notices and solicitation for comments were advertised in the Sun Current and posted on the City's web site.

A summary of the presentation (**Appendix A**) is attached. Comments from residents (also **Appendix A**) were addressed at the public information meeting and have been considered in the development of the draft plan.

The first draft plan (**Appendix B**) was presented to the public for comments on August 8, 2007. A number of comments revealed the need to collect more information and explore alternatives that benefit the lake water quality, fish habitat, and wildlife habitat without specifically excluding one or more of the main public uses. Many of the public comments and discussions leading to the development of the management plan have revolved around the use of a groundwater well at the north end of the lake to maintain consistent lake levels. State Statute 103G.271 Subd. 5a (**Appendix C**) significantly limits use of groundwater for the purposes of augmenting the lake.

After the August 8, 2007 public meeting, a small group of lakeside residents volunteered to work closely with City staff to help guide direction of future data collection efforts and development

of the management plan. City staff (and in some instances DNR and Watershed District staff) met with the resident group (this group later formed the Lower Penn Lake Association) on six occasions; November 27, 2007, December 18, 2007, April 15, 2008, February 3, 2009, June 2, 2009, and August 25, 2009. These meetings focused on determining the direction for a second draft of the management plan and sharing results of data collection efforts.

A public information meeting was held again on September 22, 2009 to present a second draft management plan reflecting comments from the previous draft and public meeting as well as the input provided from the resident group/Lower Penn Lake Association. DNR and Watershed District representatives were also present to take questions and provide information specific to the lake.

On October 13, 2009, City staff met with the Lower Penn Lake Association to review comments and to finalize this plan.

History

The following is a brief chronological history of construction and management activities on Lower Penn Lake.

- **1958** – Prior to 1958, Lower Penn Lake was a landlocked depressional wetland area possibly cultivated at times.
- **1958** – Trunk storm sewer system from I-494 to Upper Penn Lake was constructed including connection between Upper and Lower Penn Lakes and an outlet for Lower Penn Lake.
- **1971** – Trunk storm sewer system from 35W to Lower Penn Lake was constructed.
- **1974** – A report by Braun Intertec investigated the potential for dredging and lake-bottom sealing.
- **1974** – A DNR survey of the lake reported a maximum depth of 3 ½ feet.
- **1974** – Long dry periods lowered the lake elevation and exposed large mud flat areas.
- **1976** – Lower Penn Lake improvement project was constructed as a cooperative project involving the City, DNR, and other agencies. The project included:
 - Excavation at north end to provide deeper water;
 - Construction of a well and aeration system – DNR permit authorizing augmentation to improve the fishery;
 - Public access to lake with parking;
 - Public picnic area;
 - Fish stocking by the DNR (sunfish, bass, northern pike);
 - Construction of a fishing pier at the north end of the lake; and
 - Construction of sediment ponds at three storm sewer inlets.
- **1976** – The normal water level of Lower Penn Lake was established at 808.0.
- **1977** – Some homes along the south end of the lake flooded due to the August 30-31 rain event.
- **1981** – Pump motor on well replaced.
- **1982** – Well screen cleaned.
- **1984** – DNR groundwater augmentation permit amended from 60.5 MGY to 200 MGY.

- **1987** – Some homes adjacent to Lower Penn Lake flooded due to July 20-23 rain events.
- **1989** – Storm sewer improvement construction to address July 1987 flooding included:
 - New outlet constructed re-establishing the lake's normal level at 807.0;
 - Construction of a storm sewer connection between Adelman Pond and Upper Penn Lake to equalize normal water levels providing better flood protection.
- **1989** – City-wide floodproofing project constructed at some homes on Lower Penn Lake (mainly on the south side of lake) providing protection from the one percent chance rain event.
- **1989** – Permit condition for replacement of the outlet and establishment of the 807.0 normal level included augmentation from May through September.
- **1990** – The DNR suspended the groundwater augmentation permit to protect groundwater supplies (April).
- **1990** – The groundwater augmentation permit was reinstated at the City's request to maintain game fish population (September).
- **1991** – The DNR authorized use of the well for winter aeration to prevent winter kill of fish.
- **1994** – State Statute 103G.271 Subd. 5a revoked all existing groundwater augmentation permits in excess of 10,000,000 gallons per year for the primary purpose of maintaining or increasing surface water levels in the seven-county metropolitan area.
- **2003** – The Nine Mile Creek Watershed District Completed the Penn Lake Use Attainability Analysis.
- **2005** – DNR evaluations of Lower Penn Lake concluded that augmenting the lake with groundwater is not effective for fisheries management under the current plan. Existing permit to remain in effect for up to three years to allow time for re-evaluation.
- **2006** – Public Works received a number of inquiries expressing concern over low water levels at Lower Penn Lake requesting use of the groundwater well. Water elevations that summer ranged from 807 in April, to 805.1 in July, to 807 in September. An information notice was mailed to residents explaining spring precipitation, use of the well, and development of the management plan.
- **2007** – First draft management plan created based on public input and comments received in April. Plan reviewed by City Council in July and presented to the public in August.
- **2007** – Small group of residents informally established to work more closely with City and Watershed District staff to address gaps, collect more data, and revise management plan to more clearly identify alternatives for implementing improvements. This group later formed the Lower Penn Lake Association.
- **2008** – The Nine Mile Creek Watershed District assisted with the collection of data and completed a water balance for the lake.
- **2009** – The Lower Penn Lake Association/resident group drafted a management plan for Lower Penn Lake.

- **2009** – Engineering staff completed the second draft of the Lower Penn Lake Management Plan incorporating goals from the resident drafted plan, input received from the public information meeting, results of the data collection efforts, and input from other agencies.
- **2009** – Public meeting to take comments on the second draft plan.
- **2010** – January 25, 2010 public hearing to consider approval of the final plan.

Characteristics of Lower Penn Lake

With a mean depth of approximately 4 feet and a maximum depth of 7 to 10 feet, Lower Penn Lake is considered a shallow lake. The lake is approximately 32 acres in size and receives runoff from over 1,200 acres of suburban/urban landscape, including two major interstates (I-35W and I-494). The lake has a fixed gravity outlet that establishes a normal level of 807.0. This elevation was established in 1989 to provide flood storage for the Penn Lake watershed and protection to nearby private properties. The lake was originally connected to the storm sewer system in 1958. A groundwater well, originally constructed in 1976 to augment the lake, has not been used for lake level augmentation since 2003. The well was still used for winter aeration for the prevention of fish kills until 2008, when the in-lake recirculation system, also originally constructed in 1976 began operation. Operation of the in-lake system has been successful to date in maintaining oxygen levels for the existing fish population. An added benefit of using the in-lake system has been a reduced area of open thereby not attracting the large over-wintering waterfowl population that was present in past years.

Lower Penn Lake was evaluated in 2001 by the Nine Mile Creek Watershed District as part of the Penn Lake Use Attainability Analysis (UAA) that was completed in 2003 (**Appendix D**). Water quality data collected for Lower Penn Lake showed it is considered to be hypereutrophic. Monitoring data obtained in 1979-1980 (after completion of the original project) also showed Lower Penn Lake to be hypereutrophic at that time even after the improvements. Hypereutrophic lakes are lakes with high levels of total phosphorus and chlorophyll-*a* (which is the photosynthetic pigment in algae or an indicator of the amount of algae present) and very low transparency levels. The water quality of these lakes can fluctuate daily and seasonally and experience anoxia (depletion of oxygen), fish kills, or even toxic conditions (blue-green algae blooms can sometimes become toxic and can cause rash or illness in animals and potentially people).

The lake has a relatively large fish population for its size (population estimate based on previous inventories and public accounts) of predominately carp, stunted crappies, bluegills, and bass (**Appendix J**). Large fish populations tend to degrade shallow lake water quality as the fish, with no significant natural predators, feast on the macroinvertebrates that in turn would normally consume algae. The high levels of nutrients, especially phosphorus, further contribute to algal blooms and the degradation of water quality.

Lower Penn Lake supports a wildlife population that has included ducks, geese, egrets, herons, hawks, raccoons, and reports of a fox and a bald eagle.

The shore area along Lower Penn is comprised of suburban lawn, a native vegetative buffer that was established on park property adjacent to the boat landing, and an existing buffer area along the north and northeast sides of the lake. Native vegetative buffers not only provide wildlife habitat, but can filter pollutants and uptake excess nutrients from surface runoff.

Current recreational uses of Lower Penn Lake and the park include: picnicking, fishing, canoeing/kayaking, scenic viewing, and other uses common in parks of this type.

Lake Level and Groundwater Well

The storm sewer outlet from Lower Penn Lake establishes a normal water level determined primarily to provide flood protection. While the outlet controls the “normal” water level, it is not capable of addressing water levels during abnormally wet or dry conditions. Lower Penn Lake receives surface water runoff from approximately 1200 acres of entirely developed suburban/urban landscape and two highways. It is this runoff from precipitation events (rainfall and snowmelt) that most directly impacts the lake level. In periods with normal precipitation, the lake has consistently been at or near the normal elevation of 807.0. However, in periods of below normal precipitation or drought, the lake level has dropped.

An independent water balance study (**Appendix H**) and an earlier investigation that included Lower Penn Lake have demonstrated that the well, at full capacity, is only able to add slightly more water to the lake than is lost through natural processes (evaporation and exfiltration). The well must run continuously in the absence of any precipitation, resulting in an annual groundwater use of 100-150 million gallons, in order to maintain a constant elevation. Since passage in 1993, State Statute 103G.271 Subd. 5 prohibits the use of groundwater for the primary purpose of maintaining or increasing surface water levels in excess of 10 million gallons per year. As can be seen from the numbers above, 10 million gallons per year represents less than 10% of the typical water volume historically utilized to maintain the water level of Lower Penn Lake during drier periods.

While a constant water level may be aesthetically desirable to some, small, shallow lakes like Lower Penn naturally have fluctuating water levels. The lake’s large suburban watershed area often contributes to a quick bounce in lake elevation after a precipitation/runoff event often above the normal elevation, while evaporation and exfiltration are visibly noticed between rain events due in part to the shallow topography of the lake-bottom. Fluctuating water levels are natural occurrences on most lakes and ponds and can have positive impacts on fish and wildlife habitat. Periods of low water can help consolidate exposed sediment and stimulate growth of aquatic vegetation. When normal or high water levels return, new habitat and food sources are available and accessible. When the water level is artificially sustained, it can reduce aquatic plant growth causing increased algal blooms and compromise the health of a shallow lake.

In reference to Statute 103G.271 Subd. 5 pertaining to the use of groundwater to augment surface waters in excess of 10 million gallons per year, the DNR Division of Waters, in a letter dated August 31, 2009 (**Appendix I**) in review of the draft management plan, clearly stated that there is absolutely no exception to this statute and no variances are possible under any circumstance. The DNR further advised that,

“The City appropriating up to the authorized 10 million gallons of groundwater per year is not a useful lake management strategy because it does not help in meeting any of the lake management goals. The water balance studies have demonstrated that groundwater augmentation has little or no effect on surface water levels and the City has installed a lake aeration system that recirculates lake water, which provides sufficient dissolved oxygen for fish survival during the winter.”

The use of groundwater resources for the primary purpose of maintaining surface water levels is not a sustainable practice in keeping with the City of Bloomington’s Strategic Vision to be an even more sustainable community. As such, the City will not support efforts to amend the current State Statute limitation to increase the amount of allowable groundwater appropriations for surface waters for Lower Penn Lake as it is not categorically different from other small, shallow lakes in Bloomington or the Metro Area. To allow such use for a broader grouping of such lakes could have a decided impact on the groundwater resources for which much of the Metro Area, including Bloomington, uses as its water supply.

Characteristics of Shallow Lakes

The following is provided to outline the traits of a shallow lake in two potential stable states. Shallow lakes will often fall into one of these two categories.

Characteristics of a *healthy shallow lake*, MDNR, 2005 and *Ducks Unlimited 2006 (Appendix E)* include:

- Water depth is often less than ten feet, although deeper depths are possible.
- Low fish numbers allowing aquatic plants to dominate resulting in clearer water.
- Significant buffer areas surrounding the lake to help filter out nutrients and sediment entering the lake.
- Temporary periods of low water stimulating plant growth.
- Minimized connectivity to impervious areas and storm water runoff.
- Shallow depths allow ample sunlight penetration for aquatic plant growth.

Characteristics of a *turbid shallow lake* include:

- Little or no aquatic plants (macrophytes)
- High concentration of nutrients (phosphorus)
- High population of bottom-feeding fish
- Frequent nuisance algal blooms

Based on observations and data collected to date, Lower Penn Lake can be classified as a shallow lake in a stable turbid water state that is characterized by largely absent submerged vegetation with fish populations that disturb and re-suspend lake-bottom sediments (see **Appendix E**). Large algal blooms are also common, limiting light penetration and consuming oxygen.

The intent of this plan is to identify strategies or alternatives that can be implemented with the goal of improving the quality of the lake moving it closer to a sustainable, healthier, stable shallow lake.

Lower Penn Lake Classifications and Goals

Lower Penn Lake has been evaluated or classified by a variety of agencies for various purposes over the years. The following is a brief summary of existing classifications and goals for the lake.

City of Bloomington Wetland Protection and Management Plan

The City's 1997 Wetland Protection and Management Plan (WPMP) inventoried Lower Penn Lake as a Circular 39 Type 5 wetland defined as shallow open water typically bordered by emergent vegetation providing floodwater detention, wildlife and fish habitat, and recreation uses. The use classification specified in the WPMP (**Appendix F**) for Lower Penn Lake is for indirect recreational use including boating and fishing. The water quality of the lake was classified as being highly impacted with only slight sensitivity to storm water impacts. The highest inventoried functional value is that of providing flood protection and storm water storage.

The WPMP further evaluated Lower Penn Lake in the context of the Minnesota Rule 7050 and classified it as Class 2C. According to 7050.0222 Subp. 5, the quality of Class 2C surface waters shall be such as to permit the propagation and maintenance of a healthy community of indigenous fish and associated aquatic life, and their habitats. These waters shall be suitable for boating and other forms of recreation for which the waters may be usable.

Finally, the management designation in the WPMP is to apply best management practices (BMPs). BMPs have been and will continue to be utilized in an effort to maintain inventoried functions and values and can include items such as public education, invasive or exotic vegetative species control, buffer establishment, or other structural storm water components.

Nine Mile Creek Watershed District Use Attainability Analysis

The Nine Mile Creek Watershed District goals for Lower Penn Lake address water quality, aquatic communities, water quantity, wildlife, and recreation, as described below:

- Water Quantity – to provide sufficient storage of surface runoff during a regional flood for the critical one percent chance frequency event.
- Water Quality – to support runoff management. The water quality of Lower Penn Lake is not expected to support significant recreational use values (The average TSI_{SD} for Lower Penn Lake is estimated to range from 74 to 81 in the summer).

Nine Mile Creek Lake Management Category Criteria

Lake Category	District Water Quality Goal (TSI _{SD})
I. Whole body-contact recreational	<50
II. Partial body-contact recreational	51-60
III. Fishing and aesthetic viewing	61-70
IV. Runoff Management	>71

- Aquatic Communities – to achieve water quality that fully supports the DNR's lake's fishery use classification (see **Appendix D** for additional information).
- Recreation Goal – to maintain a DNR ecological Class 40 rating with a balanced fishery (see **Appendix D** for additional information).
- Wildlife Goal – to protect existing, beneficial wildlife uses.

Minnesota Department of Natural Resources

The State of Minnesota classifies Penn Lake as a public water (DNR#27-0004-00). Public waters are designated as such to indicate which lakes, wetlands, and watercourses the DNR has regulatory jurisdiction over. The statutory definition of public waters includes public waters and public waters wetlands. Public waters are all waterbasins and watercourses that meet the criteria set forth in Minnesota Statutes, Section 103G.005, subd. 15 that are identified on Public Water Inventory maps authorized by Minnesota Statutes, Section 103G.201. The DNR is the state agency responsible for the Public Waters Inventory and for administration of the Public Waters Work Permit Program. This program, started in 1937, regulates development activities below the ordinary high water level (OHWL) in public waters and public waters wetlands. Examples of development activities addressed by this program include filling, excavation, shore protection, bridges and culverts, structures, docks, marinas, water level controls, dredging, and dams.

The DNR Division of Wildlife encourages shoreline restoration and native vegetative buffers around lakes to filter runoff and provide better wildlife habitat. Little change in wildlife use of the lake is expected due to fluctuating water levels or use or non-use of the well.

DNR Fisheries has stated that the lake's poor water quality, depth, and the ease of rough fish movement into the lake are impediments to actively managing the lake as a fishery different from what exists today. There is no apparent need for active fisheries management by the DNR as the existing fish population seems to be self-sustaining.

Minnesota Pollution Control Agency

The MPCA is in the process of assessing all waters of the state to evaluate whether or not those waters are meeting their designated uses. Some waters along with their designated uses are specifically listed in Minnesota Rule Chapter 7050. Non-listed waters that are not wetlands are automatically classified as 2B, 3B, 4A, 4B, 5, and 6 waters where all of the water quality standards and their designated uses for each class apply. The most restrictive of the standards for each class apply when parameters between classes differ.

In the case of Lower Penn Lake, which has not been assessed by the State, Class 2B is the most restrictive class. The quality of Class 2B waters are to generally support fish and associated aquatic life and habitat, as well as being suitable for aquatic recreation. Lower Penn Lake could be classified as a Class 2D wetland where it would be expected to generally support the propagation and maintenance of a healthy community of aquatic and terrestrial species indigenous to wetlands and their habitats. Other classifications or even multiple classifications for Lower Penn Lake along with subsequent assessments or evaluations could drive significant modifications or changes to this plan.

Future Objectives and Goals for Lower Penn Lake

A public process was utilized to help identify objectives and goals for the lake. A survey and public open house in 2007 along with working directly with the Lower Penn Lake Association group has provided the City with valuable input. A letter dated 2-13-2009 (**Appendix G**) was given to the City of Bloomington Engineering Division and Nine Mile Creek Watershed District by the Lower Penn Lake Association Steering Committee outlining the main objectives of the

association. The objectives represent what the Association expects to accomplish for Lower Penn Lake as a result of recent study and meeting efforts.

The objectives outlined in that letter are consistent with the goals outlined in the Use Attainability Analysis prepared by the Watershed District, and are compatible with the City's Comprehensive Surface Water Management Plan. For the purposes of this plan, those objectives have been combined with agency input and other public input, including the management plan prepared by the Lower Penn Lake Association (available by request from the Lower Penn Lake Association) as well as public input taken in 2007 to identify the goals for this plan.

The goals of this plan are (not listed in order of priority):

1. *Enhance the current fishery*
2. *Improve water quality*
3. *Provide flood protection*
4. *Improve wildlife habitat*

Implementation Strategies

It is the intent of this plan to identify potential implementation strategies, improvements, or best management practices that could address the issues and goals for the lake consistent with regulatory requirements. The implementation strategies should be effective as stand-alone measures or compliment a wider array of actions for lake improvement while considering other factors such as long-term sustainability, impacts to natural resources, cost, and other considerations. Successful implementation of any component of this plan will require collaboration with the public and other agencies. Funding sources and partners will need to be identified for projects that are outside the City's standard management practices for the lake.

The implementation strategies have been developed based on public comment, state and local agency input, and applicable state and federal laws. The implementation strategies in this plan represent a group of potential alternatives that could be considered by one or more organizations. The intent of this plan is to allow the City, Watershed District, Lake Association, or others to move forward with one or more of the strategies. Some alternatives will be better suited for a specific entity, so on-going collaboration will be necessary for success.

The implementation strategies listed here do not represent an absolute subset of alternatives, but rather a starting point for working toward achieving the identified goals and objectives for the lake. Final details, feasibility analyses, and necessary approvals are also required as this plan is finalized and implemented.

Implementation Strategies

The following list represents potential implementation strategies to be considered for achieving the goals outlined in this plan. The actual implementation and/or associated schedules are greatly dependent on adequate funding from both the City and other sources. Funding and the expenditure of the City's public resources must be considered on a City-wide scale as to not disproportionately direct efforts solely to Lower Penn Lake at the expense of other locations.

Additionally, efforts that provide limited benefit to the larger public will require appropriate contribution from the actual beneficiaries or interested parties.

Beyond the implementation strategies approved by the City Council to be undertaken by the City utilizing City funding, it will be necessary for other stakeholders to provide assistance for feasibility analyses and implementation. This list and its details should be considered preliminary subject to modification as this plan is finalized and executed.

Recommended Implementation Strategies

A. Public education

Goals: 2 & 4

Purpose: Provide the public information and resources on general stormwater runoff and water resource issues as well as information specific to Lower Penn Lake.

- A better informed public should learn techniques that can be practiced on their own property and in their day-to-day activities to improve surface water quality.
- The availability of information specific to Lower Penn Lake would benefit residents and lake users.
- Program includes various target audiences including residential property owners, commercial property owners, lake users, property maintenance personnel, and the general public.

Implementation Schedule: On-going

Estimated Cost: \$15,000/annually (includes costs associated with city-wide public education program)

Potential Funding Sources or In-Kind Participation: City, Watershed District

B. Remove accumulated sediment from the storm sewer inlets

Goals: 2 & 3

Purpose: Remove sediment from the lake that has been deposited directly from the storm sewer system.

- Removal of accumulated sediment to improve water quality.
- Whole-lake bathymetric survey of the lake is needed to determine if removal is warranted along with determining actual locations and volumes.
- Removal of accumulated sediment would help ensure continued proper operation of the storm sewer system.
- Locations limited to immediate storm sewer inlets.
- Core samples should be taken to help determine extent and depth of sediment removal. Core samples should provide additional information on the characteristics of sediment in the lake and potentially provide more information on historical trends within the lake.
- This may occur as routine maintenance on a 20-yr schedule depending on inspection results.

Implementation Schedule: 2010

Cost: \$100,000

Potential Funding Sources or In-Kind Participation: City, Watershed District

C. Increase visibility of the waterfowl feeding ban information

Goals: 2 & 4

Purpose: Reduce the nuisance goose population and discourage over-population by other waterfowl.

- Observations have shown that the current waterfowl feeding ban is not always followed by visitors to Lower Penn Lake Park.
- Attracting excess waterfowl can have negative effects on water quality. Additionally, consumption of bread and other human-foods may be detrimental to the waterfowl.
- High goose populations can negatively impact the habitat for other wildlife.
- Include improved signage and possible policy or ordinance work.
- Pursue goose population control methods with DNR and US Fish and Wildlife Service.

Implementation Schedule: 2010

Estimated Cost: minimal

Potential Funding Sources or In-Kind Participation: City

D. Winter aeration

Goal: 1

Purpose: To maintain adequate oxygen levels for the fish population during winter ice-cover

- Utilize existing infrastructure to provide in-lake recirculation in order to improve winter oxygen levels for fish.
- In 2009-2010, operate the well not to exceed 10 million gallons per year for aeration if the lake elevation is below 803.0 at time of freeze up.
- Investigate other alternative aeration systems such as a portable, floating in-lake recirculation system or subsurface bubbler system if conditions change.
- In some instances, a winter kill may be unavoidable and potentially beneficial.
- Pursue Alternative F to identify an adequate fish re-stocking plan in the event of a winter kill.
- Based on a fish survey, bathymetric survey, or other data, work with DNR Fisheries to determine the potential need for aeration at other times.

Implementation Schedule: On-going

Cost: \$5,000/annually (Cost only includes power consumption and routine upkeep)

Potential Funding Sources or In-Kind Participation: City, Lake Association

E. Water quality monitoring program

Goals: 1, 2, & 4

Purpose: Obtain water quality data to help guide decisions necessary to achieve improvements to water quality, fish habitat, and wildlife habitat.

- Reliable, accurate data is necessary for making decisions on the management of the lake.
- Citizen participation would allow residents an opportunity to learn more about the lake as well as help to minimize the costs of a monitoring program.
- Program should include an aquatic vegetation component to identify non-native invasive species. Diverse, native aquatic vegetation will improve fish and wildlife habitat.
- Nine Mile Creek Watershed District is currently sponsoring the Citizen Assisted Lake Monitoring Program at Lower Penn Lake.

Implementation Schedule: On-going started in 2009

Estimated Cost: \$15,000/annually

Potential Funding Sources or In-Kind Participation: City, Watershed District, Lake Association

F. Fish inventory

Goals: 1 & 2

Purpose: Obtain an accurate inventory of the fish population to aid in assessment of potential future actions as well as appropriateness of recommended alternatives.

- Work with DNR Division of Fisheries to undertake a fish population inventory.
- Inventory will provide necessary information for determining ultimate effectiveness of a number of the alternatives.
- Will be needed to determine details for a fish re-stocking plan.

Implementation Schedule: 2010

Estimated Cost: \$10,000

Potential Funding Sources or In-Kind Participation: City, DNR, Lake Association

Potential Implementation Strategies

I. Rough fish removal

Goals: 1, 2, & 4

Purpose: Remove undesirable fish species to improve water quality and fish habitat.

- An over abundance of bottom feeding fish can significantly degrade water quality by over-consuming aquatic vegetation and continually stirring up the lake sediment, re-suspending pollutants – especially phosphorus.
- Should be completed after construction of fish barriers but before an alum treatment or barley straw application.

Potential Implementation Schedule: 2012

Cost: \$15,000

Potential Funding Sources or In-Kind Participation: City, Watershed District, Lake Association

G. Construct fish barriers

Goals: 1, 2, & 4

Purpose: Prevent movement of rough fish into the lake from the storm sewer system.

- Keeping rough fish out of the lake to minimize the negative impacts of large populations.
- Smaller rough fish populations should lead to an improvement in the existing fishery for Lower Penn Lake and in time, improve water quality.

Potential Implementation Schedule: 2011

Cost: \$150,000

Potential Funding Sources or In-Kind Participation: City, Watershed District, Lake Association

H. Alum treatment

Goals: 1, 2, & 4

Purpose: Bind lake bottom sediment to minimize internal nutrient loading.

- A successful alum treatment could bind lake bottom sediment preventing resuspension of sediment and phosphorus into the water column ultimately reducing the available phosphorus for algae and improving lake clarity.
- An increase to water clarity could help to stimulate aquatic plant growth leading to further improvements in water quality and fish habitat.
- An alum treatment would only be effective after removal of rough fish and placement of barriers to prevent re-introduction.

Potential Implementation Schedule: 2012

Cost: \$50,000

Potential Funding Sources or In-Kind Participation: City, Watershed District

J. Barley Straw Application

Goals: 1, 2 & 4

Purpose: To improve water clarity

- Barley straw projects have been shown to improve water clarity by providing a carbon source for microbes which out compete algae for nutrients (microbes out compete the phytoplankton and floating macrophytes for biologically available nutrients).
- A reduction in algae would improve water clarity and improve the potential for establishment of aquatic vegetation.
- May be used subsequent to or in conjunction with alum treatment.
- Data on successful projects is limited on waterbodies over 20 acres.

Potential Implementation Schedule: 2012

Cost: \$50,000

Potential Funding Sources or In-Kind Participation: Lake Association

K. Improve the existing sediment ponds

Goal: 2

Purpose: Improvements such as enlarging pond volume or modifying the outlet structures would increase pollutant removal efficiency for small rain events.

- Increased removal efficiency of the sediment ponds would reduce pollutant loading directly to the lake leading to an improvement in water quality.

Potential Implementation Schedule: 2011

Cost: \$100,000

Potential Funding Sources or In-Kind Participation: City, Watershed District

L. Retro-fit water quality treatment devices to the existing storm sewer system

Goal: 2

Purpose: Improve water quality from the storm sewer system prior to discharge to lake.

- Additional water quality treatment devices on the storm sewer system could serve to remove additional pollutants and reduce loading to the lake.
- Feasibility analyses would be required due to the developed nature of the watershed.

Potential Implementation Schedule: Future

Cost: \$120,000/each site

Potential Funding Sources or In-Kind Participation: City, Watershed District

M. Develop a vegetation management plan

Goals: 2 & 4

Purpose: Re-establish aquatic and terrestrial vegetation to improve fish and wildlife habitat.

- Diverse, native vegetation will provide habitat for fish, birds, and other wildlife.
- Shore area buffers help to minimize erosion from runoff and wave action by stabilizing shore area soils.
- Existing grants and cost share opportunities from the Watershed District and possible other sources for private projects.

Potential Implementation Schedule: 2012

Cost: \$50,000

Potential Funding Sources or In-Kind Participation: City, Watershed District, Lake Association

O. Additional street sweeping

Goal: 2

Purpose: Collect sediment and debris before it can enter the storm sewer system.

- Increased street sweeping can help to remove sediment and other pollutants before entering the storm sewer system and surface water resources.
- The current street sweeping program includes two complete sweeps per year.

Potential Implementation Schedule: Possibly on-going beginning in 2010

Cost: \$30,000 per sweeping event

Potential Funding Sources or In-Kind Participation: City, Lake Association

N. Increase the frequency of sweeping/cleaning the park parking lot

Goal: 2

Purpose: Collect sediment and debris before it can enter the storm sewer system.

- Prevent parking lot sediment and park debris from entering Lower Penn Lake.
- Adopt-a-park program could be utilized by residents to help collect garbage or debris around the park area.

Potential Implementation Schedule: 2009

Cost: \$500/event

Potential Funding Sources or In-Kind Participation: City, Lake Association

Implementation Strategies Not Recommended

P. Maintain, replace, or improve groundwater well

Goal: 1

Purpose: To provide aeration for winter fish habitat.

- Other methods of aeration exist without the use of groundwater resources.
- Existing State Statute prohibits the use of groundwater in excess of 10 million gallons per year for surface water augmentation.
- Use of groundwater for surface water augmentation for Lower Penn is shown to be unnecessary to maintain existing recreational uses and support the goals of this plan.

Implementation Schedule: None

Cost: \$50,000-\$100,000

Potential Funding Sources: Lake Association

Q. Whole lake dredging to create deeper water

Goal: 1

Purpose: Provide additional deep water habitat for fish.

- Significant alteration of existing habitat.
- Permit difficult to obtain.
- Very high project cost.
- Not necessary to maintain habitat for fish.
- Potential to remove a portion of in-lake phosphorus source.
- May increase surface water – ground water interaction.

Implementation Schedule: None

Cost: \$1,500,000

Potential Funding Sources: City, Lake Association

R. Remove/seal groundwater well

Goal: n/a

Purpose: To eliminate unnecessary infrastructure and a potential groundwater contamination source.

- All wells must be in use, protected under a maintenance permit, or sealed as specified under Minnesota Statute 103I.301
- The well is not needed to support the goals of this plan.
- The use of groundwater for surface water augmentation is not a sustainable practice that is in keeping with the City's Strategic Vision to be an even more sustainable community.
- Work to be completed outside the scope of this plan.

Implementation Schedule: None as associated with this plan.

Cost: \$25,000

Potential Funding Sources: City

The preceding implementation strategies are intended to address the goals identified resulting in improvements to help maintain recreational uses and other existing functions and values. Table 1 on the following page separates the implementation strategies or alternatives into three sections:

1. Alternatives that are recommended to be implemented as part of this plan consistent with the City's current stormwater management program to meet plan goals (green).
2. Alternatives that have been identified as having the potential to further help meet the goals of this plan (yellow). **These alternatives are not currently funded and require additional feasibility and stakeholder participation prior to consideration of implementation.** They may also be useful in development of future water quality improvement efforts for Lower Penn Lake.
3. Alternatives that are **not** recommended because they do not directly meet the goals of this plan or due to cost or conflict with existing permits, statutes, or rules (orange). These alternatives are listed for information only because they have identified or even undertaken in the past.

The goals of this plan can all be met through these implementation strategies without a continual reliance on groundwater resources. Climatic events and other occurrences, natural and unnatural, are not controllable and could impact the effectiveness of one or more of the items listed above. The aim of this plan is to recognize the environmental conditions and implement appropriate strategies to meet the goals.

Summary of Alternatives and Cost Estimate

Preliminary estimates for each implementation strategy or alternative are included in Table 1 to help guide a future direction. Accurate cost estimates for each implementation strategy will be needed prior to moving forward. An additional preliminary cost estimate and long-term projection of costs associated with the implementation strategies is provided in **Appendix J**.

Table 1
Preliminary Cost Estimate

<i>Alternative</i>		<i>Cost</i>	<i>Potential Funding Source</i>	<i>Comments</i>
A	Public Education	\$15,000 annually	City	Program already in-place city wide
B	Excavate Accumulated Sediment	\$100,000	City	Excavation at storm sewer outfalls only
C	Waterfowl Feeding Ban Sign/Ordinance	Minimal	City	Relocate sign or add another. Ord. update
D	Winter Aeration	\$5,000 annually	City	Already in place and currently funded
E	Water Quality Monitoring Program	\$15,000 annually	WD, Lake Association	Could utilize volunteers
F	Fish Inventory	\$10,000	City, DNR, Lake Association	Help determine scope of other alternatives
G	Rough Fish Removal	\$15,000	City, WD, DNR, Lake Association	Likely not effective if stand-alone project
H	Fish Barrier Construction	\$150,000	City, WD, DNR, Lake Association	To prevent passage of rough fish
I	Alum Treatment	\$50,000	City, WD, Lake Association	May only be effective for 2-5 yrs
J	Barley Straw Application	\$50,000	Lake Association	May only be effective for 2-5 yrs
K	Sediment Pond Reconstruction	\$100,000	City, WD	Improve capacity of sediment basins
L	Storm Sewer Retro-fits	\$150,000 ea	City, WD	Site dependent costs could vary widely
M	Vegetation Management Plan	\$50,000 \$10,000 annually for maintenance	City, WD, DNR, Lake Association	Existing grants available for private projects
N	Increase Street Sweeping Frequency for Penn Lake watershed	\$30,000/sweep	City	Estimate to sweep entire Penn Lake watershed 1 time.
O	Additional Park/Parking Lot Cleanup	\$500/time	City, Lake Association	Could utilize volunteers
P	Maintain, Replace, or Improve Groundwater Well for additional Augmentation	\$50,000-\$100,000	Lake Association	Conflicts with existing statute. Need not supported.
Q	Whole Lake Dredging to Create Deeper Water	\$1,500,000	City, Lake Association	Dramatically alters existing lake characteristics.
R	Remove/seal groundwater well	\$25,000	City	Unused wells must be sealed as a potential threat to groundwater

- Estimates are preliminary for scoping purposes only and not based on actual quantities.
- Some projects may be eligible for grant funding.
- Actual funding sources may differ from those listed above.
- Since many of the City funded alternatives are to be included in the annual Stormwater Utility Budget, budget restraints and Council approval will be required in conjunction with each alternative.
- Potential funding from the Nine Mile Creek Watershed District will require an approved project petition from the City.
- A more detailed cost estimate table is provided in Appendix K.
- This list as well as the list in Appendix K should be considered preliminary and subject to change based on City Council approval.

Conclusion

This plan attempts to balance the interests of the public, scientific data, state laws and regulations, agency direction, and limited budgets to develop a strategy for meeting the goals and objectives outlined. Other potential alternatives to meet the goals and objects exist and others will likely be identified in the future. This plan can be modified to adapt to environmental changes or alter course based on regulatory direction, monitoring results, data collection efforts, or public input.

The feasibility of alternatives or implementation strategies will need to be reviewed prior to implementation. The City Council direction is ultimately required for the implementation of this plan.

It is proposed that this plan and progress updates be maintained on the City's website.

References

Nine Mile Creek Watershed District/Bloomington Use Attainability Analysis (UAA), Prepared for Nine Mile Creek Watershed District and the City of Bloomington, Barr Engineering, September 2001

Penn Lake Use Attainability Analysis (UAA), Prepared for the Nine Mile Creek Watershed District, Barr Engineering, December 2003

Bottom Seal Investigation at Adelman Pond and Upper Penn Lake, Blue Water Science, December 3, 1990

Shoreland Management Guide, Minnesota Department of Natural Resources. 2007. The Minnesota Department of Natural Resources Web Site (online). Accessed 2007-7-20 at <http://www.dnr.state.mn.us/sitertools/copyright.html>

Lake Water Quality Summary Information, MPCA, September 2004 Minnesota Pollution Control Agency Web Site (online)
<http://www.pca.state.mn.us/water/clmp/ikwqReadFull.cfm?lakeid=27-0004>

What Makes for a Healthy Shallow Lake, Ducks Unlimited, 2006

Nature of Shallow Lakes, Minnesota Department of Natural Resources, 2005

Minnesota Rules, Chapter 7050
<https://www.revisor.leg.state.mn.us/rules/?id=7050>

Minnesota DNR Public Waters Work Permit Program
http://www.dnr.state.mn.us/waters/watermgmt_section/pwpermits/index.html

Minnesota DNR definition of public waters
http://www.dnr.state.mn.us/waters/watermgmt_section/pwpermits/pw_definition.html