Plymouth Creek Phase 1
Feasibility Report for Construction of the West Medicine Lake Park Pond

City Project #3105

May 2006

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1.0 Summary and Conclusions

The city of Plymouth is reviewing alternatives for reducing the Plymouth Creek Watershed phosphorus load to Medicine Lake from the Plymouth Creek Watershed. The water quality goal associated with improvements in the vicinity of West Medicine Lake Park, as stated in the *Phase II Medicine Lake Implementation and Management Plan* (Medicine Lake Watershed Sub-committee, August 2004), is a reduction in phosphorus loading into Medicine Lake by 336 pounds.

1.1 West Medicine Lake Park Pond

Construction of a wet detention pond would reduce the amount of phosphorus and suspended sediments entering the lake. A review of the removal efficiency of various pond sizes was conducted to determine the feasibility of meeting the nutrient removal goals at the West Medicine Lake Pond site. The P8 Model predicted that a 5.5-acre pond, approximately 6.5 feet deep, that provided 24 acre-feet of dead storage would reduce phosphorus loading into Medicine lake by approximately 350 pounds per year, on average.

Therefore, based on the P8 Model results, the West Medicine Lake Pond will meet the phosphorus reduction goal for Plymouth Creek established in the Plymouth Medicine Lake Implementation and Management Plan.

If feasible, a skimming device should be incorporated to reduce floating debris and litter from entering the lake.

The total estimated cost for the West Medicine Lake Park Pond is $900,000, excluding park improvements.

1.2 Phase 2 Study

A Phase 2 study may be necessary to address the following issues:

- Stream bank erosion and restoration located upstream (west) of West Medicine Lake Drive.
- Reroute and stabilize Plymouth Creek.
- Reroute 18th Avenue Drainage.

The City may consider a Phase 2 feasibility study to further address stream bank erosion and channel Following are several recommended tasks and budgeting cost estimates that could be included in the study.

- Perform wetland delineation of proposed pond and proposed study areas identified in Figure 2 and prepare delineation report. Delineating the entire wetland complex shown on Figure 4 would require much greater effort. Delineation should be expanded if City is considering restoration of the historic Plymouth Creek channel. Estimate does not include survey.—(Budgeting Cost Estimate: $5,000 to $10,000)
- Identify project goals and objectives.—(City of Plymouth)
- Review potential recreation assets.—(City of Plymouth)
- Perform additional review of the Plymouth Creek historic channel including review of aerial photographs, quads, etc. if the City pursues restoring the entire Plymouth Creek channel.—(Budgeting Cost Estimate: $1,000 to $2,000)
- Contact regulatory agencies (DNR, Corps, BCWMC) to discuss the proposed restoration project, wetland delineation and impacts, conveyance and flooding issues.—(City of Plymouth)
- Detailed wetland replacement and mitigation plan assuming on site mitigation, if necessary.—(Budgeting Cost Estimate: $10,000 to $20,000)
- Revise and update September 7, 2004 creek inventory of the erosion and sedimentation sites along Plymouth Creek from Medicine Lake to 26th Avenue and cost estimates for repairing the creek channel.—(City of Plymouth)
- Prepare Phase 2 feasibility study to compile recommended tasks, identify problem erosion, encroachment and flooding areas; evaluate alternatives, review hydraulics and flooding impacts (assuming use of existing hydraulic and hydrologic models), design a stable channel, address 18th Avenue drainage issues and provide a construction cost estimate. Detailed review of alternatives and new channel could significantly increase costs.

  Budgeting Cost Estimate:
  Restore Existing Channel: $16,000 to $21,000
  Channel Relocation (Restore Historic Channel) Project: $13,000 to 18,000

- Final design and preparation of plans and specifications (not including bid administration and construction administration). Actual cost also depends on the level of detail of the feasibility study.

  Budgeting Cost Estimate:
  Restore Existing Channel: $35,000 to $40,000
  Channel Relocation (Restore Historic Channel): $30,000 to $35,000

2.0 Background and Objective

2.1 Background

Medicine Lake Watershed Implementation and Management Plan

In 2003, the city of Plymouth and its Medicine Lake Watershed Sub-committee prepared the Medicine *Lake Watershed Implementation and Management Plan* (June 2001). That plan sets forth water quality goals for the lake and specifies watershed best management practices (BMPs) and management activities to be undertaken to improve the quality of stormwater inflow in order to meet those goals. Medicine Lake is classified as a Level I water body by the Bassett Creek Watershed Management Commission and city of Plymouth. Specific water quality goals for Medicine Lake are:

- A summer average concentration for total phosphorus of 38 µg/L.
- A minimum Secchi disc transparency depth of 1.5 – 1.75 meters (about 5 - 7 feet).

Phase II: Medicine Lake Watershed Implementation and Management Plan.

In 2004, the City and its Medicine Lake Watershed Subcommittee prepared the *Phase II: Medicine Lake Watershed Implementation and Management Plan* (August 2004). This objective of this plan was to reduce Medicine Lake external watershed phosphorus loading by 1,000 ponds per year and to reduce its internal loading by controlling curly leaf pondweed. The plan recommended a goal of removing 336 pounds of phosphorus from the Plymouth Creek outfall by realigning the creek and excavating a 4-acre pond in the vicinity of West Medicine Lake Park. The plan was adopted by the City Council on September 28, 2004.

August 30, 2005 Technical Meeting

City of Plymouth staff scheduled a meeting on August 30, 2005 with technical staff from the City, Bassett Creek Watershed Management Commission (BCWMC) and Three Rivers Park District to discuss implementation of the Plymouth Creek portion of its plan for removal of 336 pounds of Phosphorus. Several preliminary tasks were identified during the meeting that needed to be completed to prior to preparation of construction documents. Some of these tasks included:

- Prepare detailed topographic and boundary survey of project area.
- Take soil borings and classify soils in project area.

- Revise the P8 Water Quality Model of the Plymouth Creek Watershed with recent monitoring and watershed data to assess water quality issues.
- Revise or prepare hydraulic model to assess water quantity and flooding issues.
- Prepare Feasibility study.

The City performed the detailed topographic survey and obtained soil borings during the winter when frozen ground condition allowed access to the wetland areas. The City also revised the P8 Model as discussed during the meeting.

March 24, 2006 Technical Meeting

On March 24, 2006 a meeting regarding the Plymouth Creek BMP project was held at the Plymouth City Hall. Representatives from the Bassett Creek Watershed Management Commission, Three Rivers Park District, Blue Water Science and the city of Plymouth engineering and parks staff attended the meeting. Several issues regarding drainage, nutrient loading, localized street flooding, stream bank erosion and aesthetics were discussed. In addition, the revised information including topographical survey, soil borings, revised P8 modeling and recent monitoring results were discussed. A number of project components were considered and identified as essential to the success of the Plymouth Creek BMP project. The group also developed a preliminary list of potential best management practices (BMPs) that could be considered for Plymouth Creek. Preliminary potential BMPs included ponding, aeration, stream restoration and alum treatment. The City selected West Medicine Lake Park, located along the east side of West Medicine Lake Drive, as its desired location for implementation of a water quality pond. to meet the goal of removing 336 pound of phosphorus annually from Plymouth Creek. This location offered the easiest access for construction and maintenance and provided opportunity for park and recreation use. The group/City decided to further pursue a water quality pond at this location and indicated the initial step would be to perform modeling and complete a feasibility study prior to design and preparation of engineering plans.

2.2 Objective

The objective of this study is to review the feasibility of constructing a water quality pond at West Medicine Lake Park located along Plymouth Creek, east of West Medicine Lake Drive; develop a conceptual plan for a large pond; model the concept pond using the City's recently revised P8 Model to predict the removal efficiency of the pond; and determine if the concept pond can remove 336 pounds of phosphorus annually from Plymouth Creek.

3.0 Proposed Improvements

3.1 Plymouth Creek Watershed

The 6,380-acre Plymouth Creek watershed is located west of Medicine Lake and represents more than half of the Medicine Lake watershed. Plymouth Creek drains a large portion of south and central Plymouth and passes through West Medicine Lake Park before discharging into the southwest bay of Medicine Lake. Approximately 30 percent of this watershed, including the Parkers Lake subwatershed, enters Plymouth Creek downstream of where West Medicine Lake Drive crosses Plymouth Creek. The City has referred to this area as the 18th Avenue Drainage. Most of the remaining Plymouth Creek watershed area drains through four large, channelized wetlands downstream of Turtle Lake. Existing land use includes approximately 28 percent commercial/industrial; 40 percent single-family residential; 4 percent multi-family residential; 7 percent highway; 7 percent parks and undeveloped land; and water surface area over the remaining land area.

Medicine Lake receives more than 30 percent of its total annual phosphorus load (including internal loading) and more than 60 percent of its external phosphorus load (excluding internal loading) from Plymouth Creek. Stormwater runoff from this watershed passes through a channelized wetland area upstream of West Medicine Lake Road before discharging to Medicine Lake.

3.2 Site Description

The City identified the West Medicine Lake Park site as its preferred location for a water quality pond. This location offered uncomplicated access for construction and maintenance. The site is also located on city property and provides opportunity for park and recreation activities. Plymouth Creek passes under a bridge at West Medicine Lake Drive and flows along open channel approximately 1,400 feet downstream to Medicine Lake. West Medicine Lake Drive in the vicinity of Plymouth Creek was relocated during 1996. Park facilities include a pedestrian bridge and boardwalk across Plymouth Creek and the adjacent wetland; fishing piers and sand beach at Medicine Lake; basketball courts, sand play area, children's play structure and parking facilities. A second pedestrian bridge across Plymouth Creek is located near its convergence with Medicine Lake.

3.3 West Medicine Lake Park Pond

Construction of a wet detention pond will reduce the amount of phosphorus and suspended sediments entering Medicine Lake. Two concept ponds were developed for analysis by the P8 Model. The

limits of the pond were maximized based on the location of existing permanent structures including West Medicine Lake Drive and the existing parking facilities. The concept ponds were developed using 4:1 side slopes above its normal water surface, 10:1 side slopes along its 10-foot. bench, and 3:1 side slopes below the first foot of depth. Figure 1 shows the general location and layout of the pond. The first concept pond was assumed to have a maximum depth of 6.5 feet. This depth was selected to minimize potential wetland impacts. The second concept pond was assumed to have a depth 10 feet, generally the maximum accepted depth for water quality ponds. Deeper ponds tend to stratify which can release nutrients to the water column. Table 1 summarizes the predicted area and dead storage volume of each concept pond.

If feasible a skimming device should be incorporated to reduce floating debris and litter from entering the lake. Design of the pond should also include detailed review of site utilities and features.

3.4 P8 Water Quality Modeling

The previously calibrated P8 water quality model of the Plymouth Creek watershed was used to determine how well the conceptual pond at the West Medicine Lake Park would be expected to meet the phosphorus reduction goal for the watershed. A review of the removal efficiency of two different pond sizes was conducted to determine the feasibility of meeting the phosphorus reduction goal based on the maximum area available at the West Medicine Lake Park site. The surface area of the proposed pond at the normal water level, in both cases, is 5.5 acres. The following table shows the water quality modeling results for the 2003 and 2004 water years, both of which experienced near-average precipitation amounts for the Twin City Metropolitan Area.

Pond Depth/Permanent Pool Storage Scenarios	Water Year Load Reductions, lbs.		
	2003 (Precipitation=25.60")	2004 (Precipitation=28.83")	Average
6.5-feet deep/29 ac-ft storage	301	399	350
10-feet deep/42 ac-ft storage	310	408	359

The P8 modeling results predict that a 5.5-acre pond approximately 6.5 feet deep that provides 29 acre-feet of permanent pool storage would reduce the phosphorus loading into Medicine Lake by approximately 350 pounds per year, on average. The P8 Model predicts that the larger, 10-foot deep pond at this location would only result in a further reduction of 9 pounds per year. The larger pond

would also be more likely to experience sediment phosphorus release under occasional anoxic conditions. Based on the results predicted by the P8 Model, constructing a 6.5-foot deep pond at the West Medicine Lake Park site will meet the phosphorus reduction goal for Plymouth Creek established in the Plymouth Medicine Lake Implementation and Management Plan.

3.5 Wetland Issues

Wetlands are protected by state and federal jurisdiction:

- The Wetland Conservation Act (WCA) regulates filling and draining wetlands and excavating with 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. Plymouth is the LGU for the proposed project site. The Minnesota Board of Water and Soil Resources (BWSR) oversees administration of the WCA statewide.

- The Minnesota Department of Natural Resources (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.

- The Army Corps of Engineers (Corps) regulates the placement of fill into wetlands, if the wetlands are hydraulically linked to a water of the United States, under Section 404 of the Clean Water Act. In addition, the Corps may regulate all proposed wetland alteration if any wetland fill is proposed.

Creation of the proposed storm water pond may involve filling and excavation within wetlands. If wetland fill is proposed, the WCA and Corps may regulate all proposed wetland impacts.

Both the WCA and Section 404 require that anyone proposing wetland impacts conduct a "sequencing analysis" which consists of three general steps:

1. Avoid disturbing wetlands.
2. Minimize impacts to wetlands.
3. Replace any lost wetland functions and values.

When planning for wetland replacement, attempts must be made to replace wetlands on-site before considering other options. Certain wetland activities are exempt from the WCA, allowing projects with minimal impact or projects located on land where certain pre-established land uses are present to proceed without regulation.

Figure 4 show the National Wetland Inventory (NWI) coverage in the project area. As shown, some of this area has been developed. The City should perform a wetland delineation of the project site to determine the actual wetland limits and potential wetland impacts associated with the project. These wetland issues must be evaluated as part of the proposed project. The City should also contact the regulatory agencies to review the delineation and outline the need for the water quality improvement project and creek restoration project.

3.6 Cost Estimate

A conceptual cost estimate for implementation of the West Medicine Lake Drive Pond is $900,000. This cost assumes wetland mitigation is not necessary and some assistance is provided by the City to identify soils disposal areas. Cost does not include any park improvements. A preliminary cost estimate for the project is included in Table 1.

3.7 Funding Sources

Discussion with Plymouth staff indicates that limited funds are currently available for the water quality pond and the proposed Plymouth Creek improvement projects. It is our understanding the City is investigating potential funding sources. Based on available funds, the City may consider phasing the water quality pond and creek improvement projects as funds become available.

The city of Plymouth could also approach the Bassett Creek Watershed Management Commission (BCWMC) to participate in funding of the water quality pond. The City would need to formally request the BCWMC to add the project in its Capital Improvement Program (CIP). The BCWMC would then need to review the request. If approved, the BCWMC would submit the proposed modification to its Bassett Creek Watershed Management Plan as a "minor plan amendment" to the BWSR for its review and approval. The review process requires a public hearing for the proposed project. If approved, the BCWMC could fund up to 100% of the portions of the project related to water quality improvements. BCWMC would obtain funds by an Ad-Valorem tax of properties located in the Bassett Creek Watershed. The BCWMC could next review a request to modify its CIP during May 2007. If approved, funds could potentially be available by 2008 for construction of the

project. However, if the City elects to utilize this funding source, the City could proceed with the project once a feasibility study has been completed, a hearing has been held by the Commission, and the project has been approved by the BCWMC and BWSR. Reimbursement would be provided after funds are available. The BCWMC will not fund projects that have been completed prior to its review and approval.

PRELIMINARY CONSTRUCTION COST ESTIMATE
West Medicine Lake Park Pond

Item	Description	Units	Qty.	Unit Cost	Extension
1	Mobilization/Demobilization (10%)	LS	1	$60,000	$60,000
2	Site Preparation/Clearing/Grubbing	AC	5	$2,000	$10,000
3	Pond Excavation & Disposal	CY	52,000	$10	520,000
4	Restoration & Plantings	LS	1	$50,000	50,000
5	Park Features??	LS	0	0	0
6	Wetland Mitigation??	LS	0	0	0
				Project Total	$640,000
	Contingency		20%		$130,000
	Legal/Eng/Permitting/Admin		20%		$130,000
				Total	$900,000

Note: Estimated cost assumes some assistance by Plymouth to identify soil disposal site

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Legend

- Proposed Pond
- Pond Bottom - 6.5 Foot Depth

N

Feet
200 0 200

Figure 1

WEST MEDICINE LAKE PARK POND
City Project #3105
Plymouth, Minnesota