

Karth Lake Management Action Plan

Karth Lake (62-0072) is located in the City of Arden Hills, Ramsey County, Minnesota (Figure 1). The surface area of the lake is approximately 20 acres (Figure 2) and the lake has a maximum depth of 14 ft.¹ Based on its low maximum depth, it is considered a shallow lake according to MPCA's definition.

The watershed draining to Karth is approximately 118 acres and includes mixed commercial and residential areas, while the immediate lakeshore is primarily residential with a city park (Karth Lake Park) on the south and southwest sides. The primary use of the lake is by the residents or the public visiting the park. No motors are allowed on the lake. Public access for non-motorized boating is available from the park. Flooding has occurred in the past at Karth Lake so an outlet pump was installed in 2004 on the south side of the lake. This is the only current outlet from the lake and it flows to Valentine Lake.

Limited environmental and fish monitoring data are available, with a single DNR Lake Survey Summary available from 1980. This survey notes a problem with winter fish-kills, but no information is available on the fish community in the lake. DNR does not currently stock the lake with fish.



¹ The lake areas were determined by digitizing lake boundaries using 2006 1-foot resolution air photos; the maximum depth was taken from DNR files.

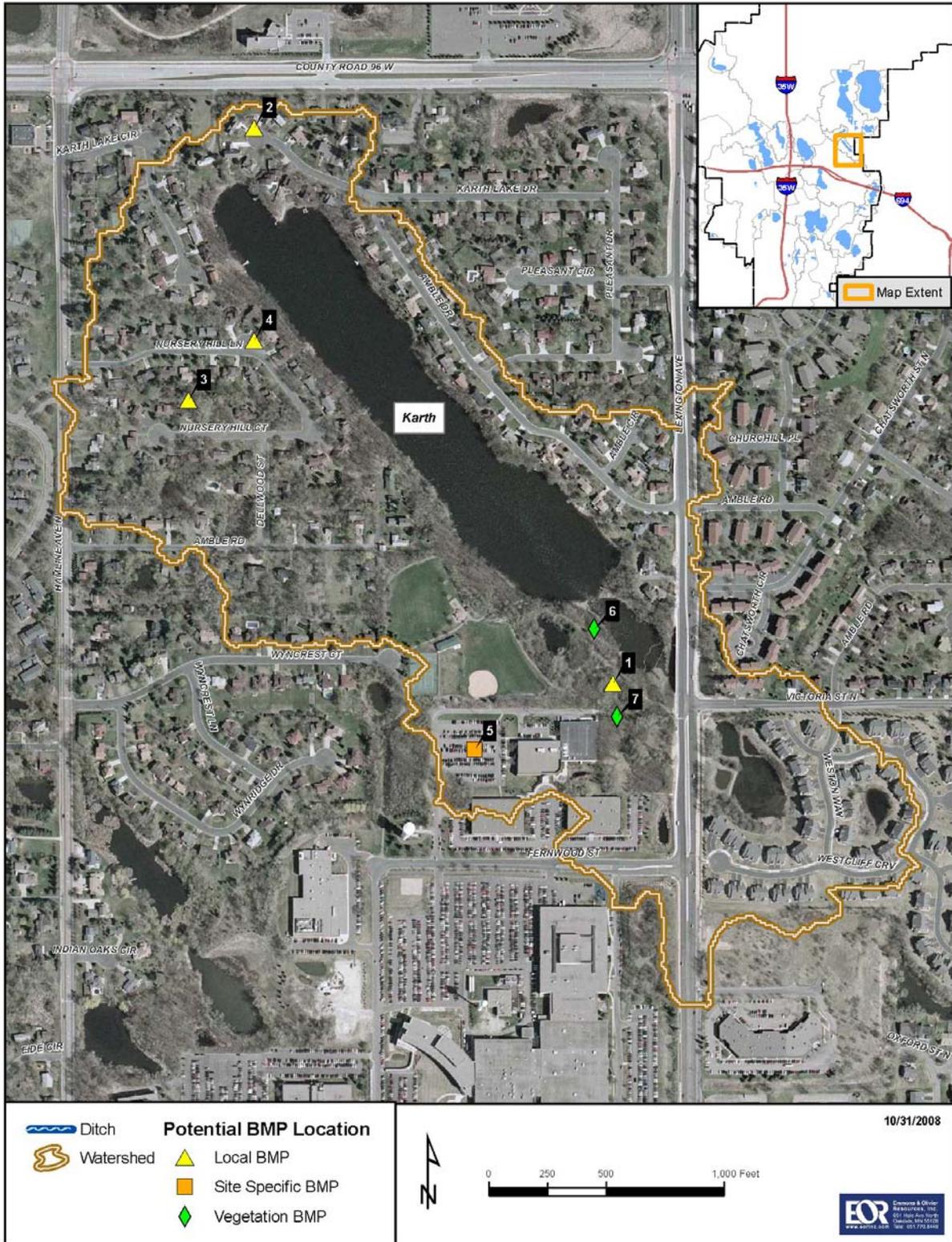


Figure 1. Karth Lake and Potential BMP Locations

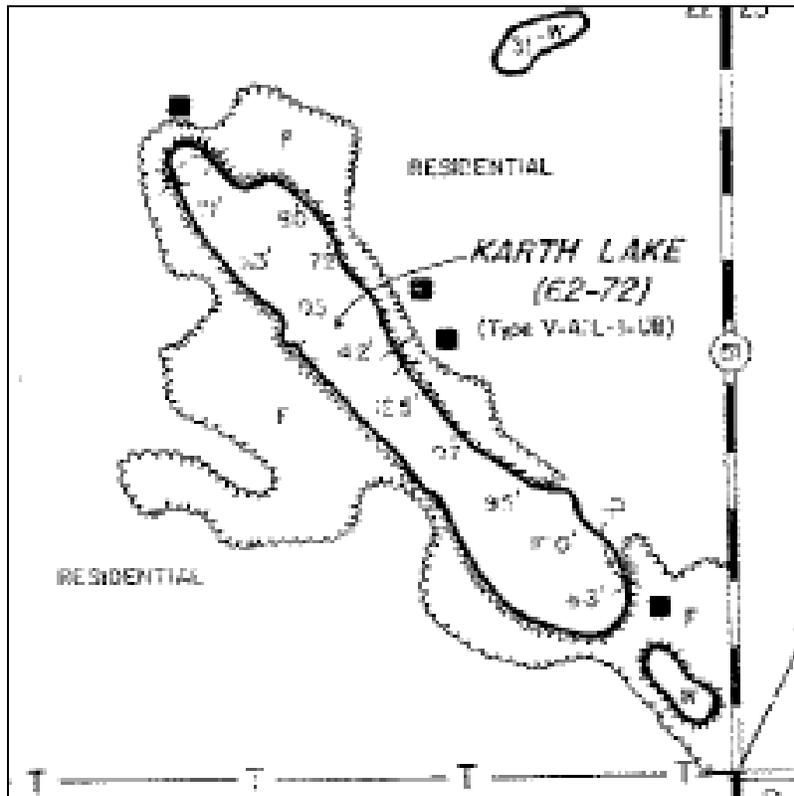


Figure 2. Karth Lake Bathymetry. Map from DNR files, unknown date.

Water Quality Summary

Limited historic data exist on the quality of Karth Lake. The Metropolitan Council's Citizen Assisted Monitoring Program (CAMP) has had the lake as part of its program since 2006. A summary of the CAMP data taken over the last two years (Table 1) shows that Karth Lake is meeting the water quality standards for shallow lakes.

Table 1. Average Water Quality Data (2006-2007) and Standards

Parameter	Karth Lake	Shallow Lakes Standard
TP ($\mu\text{g/L}$)	54	60
Chl ($\mu\text{g/L}$)	18	20
Secchi Depth (m)	1.0	1.0

Figures 2 through 4 show the total phosphorus (TP), chlorophyll-*a*, and Secchi depth (clarity) data from Karth Lake.

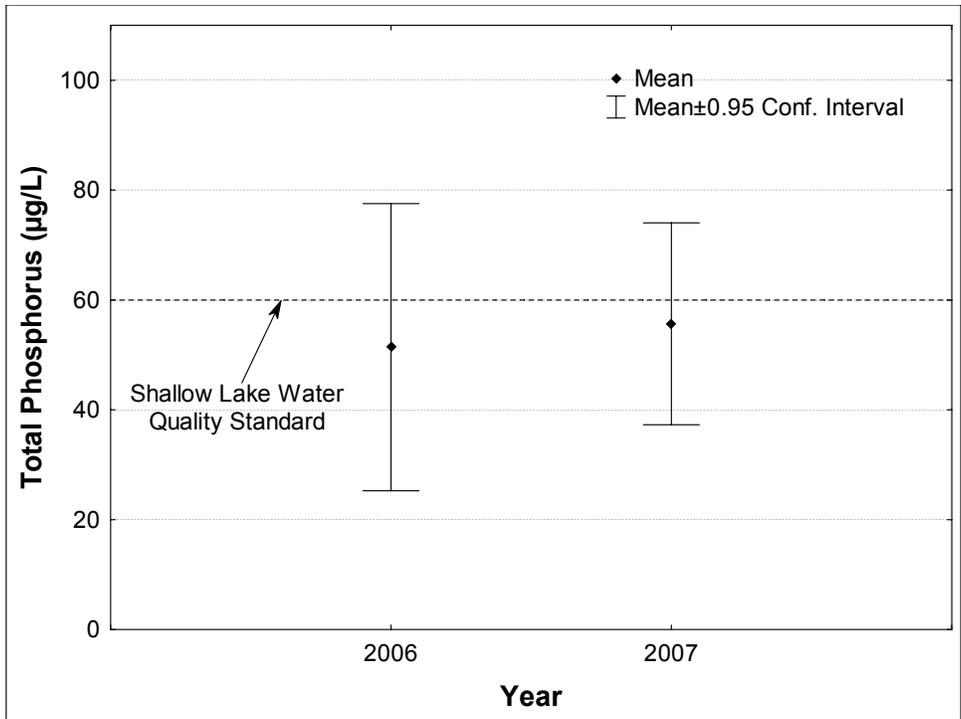


Figure 3. Karth Lake Total Phosphorus

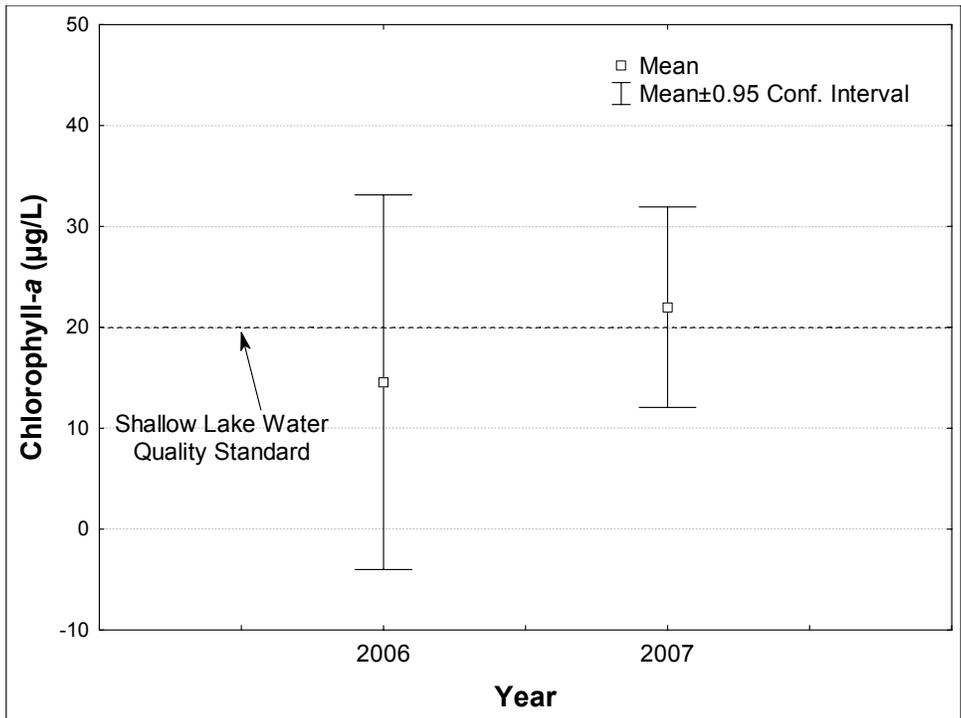


Figure 4. Karth Lake Chlorophyll-a

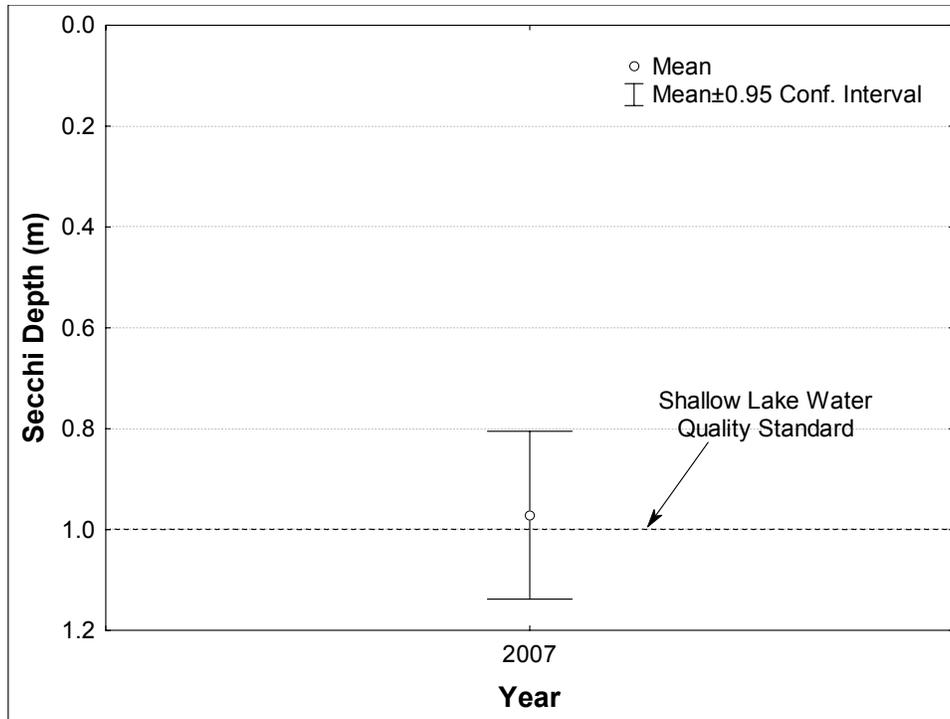


Figure 5. Karth Lake Secchi Depth

A watershed model (P8) was used to estimate the watershed phosphorus load to the lake, and an in-lake model (Bathtub) was used to predict the response of the lake to phosphorus loading. The lake model was calibrated to in-lake monitoring data. Water quality modeling indicates that the watershed inputs account for approximately 85% of the nutrient load, with internal loading accounting for the remaining 15% (Figure 6).

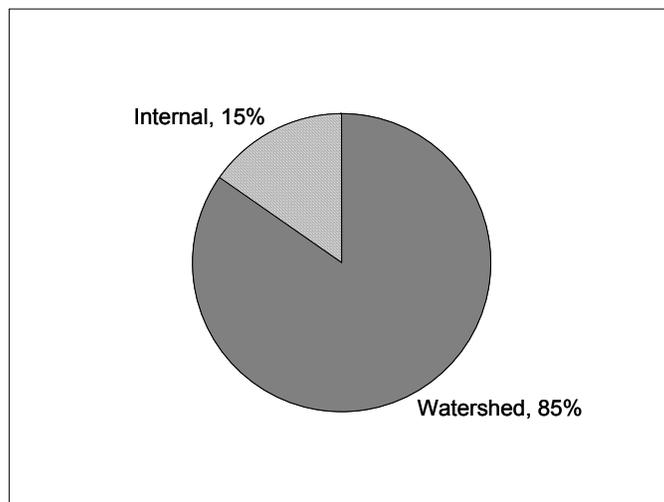


Figure 6. Karth Lake Phosphorus Load Distribution

Public Input

At the public input meeting held on May 29, 2008, lake residents offered local insight on Karth Lake. Residents are very interested in keeping the lake at its current quality or even in reducing the TP level further. A homeowners group, the Karth Lake Improvement District, has attempted to establish technical assistance from RCWD in framing issues and defining problems and solutions.

- Attendees noted that they have seen an orange discharge entering the lake occasionally from the Cummins stormsewer outlet on the southeast side of the lake. The nature of this discharge is unknown. The RCWD was urged to collect a sample if this colored discharge is seen again by residents. It was mentioned that it could be simply an iron coloring from groundwater seepage into the pipe.
- The residents felt that additional BMPs should be identified and retrofit opportunities sought. Several general approaches were recognized within the immediate watershed for retrofits whenever redevelopment or road projects are undertaken.
- The residents were also interested in undertaking a fish stocking program to attain a better ecological balance. They would like to either invite DNR to stock the lake or do some stocking themselves if an affordable supplier could be found and permission granted from DNR. The residents were interested in conducting a fish survey to see what fish are present and then determining a proper mix that would restore ecological balance among the planktivores (plankton eaters) and piscivores (fish eaters).
- The presence of curly-leaf pondweed (a nuisance macrophyte) was noted by attendees at the meeting. RCWD staff confirmed the presence of curly-leaf, but also noted that some native macrophytes (like coontail) were also present in the lake. A plant management program could target curly-leaf pondweed eradication and fostering of natives. Residents would like to pursue curly-leaf pondweed control either through chemical addition or control of sediment pH. The residents are interested in how such a program could be initiated, perhaps in cooperation with the RCWD. Various methods of chemical control were discussed at the meeting.
- Residents are currently controlling buckthorn along the shore of the lake to improve overall habitat and bank stability.

Water Quality Issues

- Curly-leaf pondweed, a nuisance macrophyte, is present in the lake. Curly-leaf may contribute to internal loading of phosphorus.
- Soil erosion has been observed at the site of the outlet pump on the south side of the lake.
- There is an access/parking street between the commercial/industrial area and the lake that slopes steeply to the east and discharges water at a high velocity into a channel draining to the lake.

Recommended Management Approach

Watershed Management Recommendations

Because the Karth Lake watershed is fully developed, opportunities for retrofitting BMPs into the watershed as it re-develops or as routine maintenance occurs should be sought. To that end, a preliminary field reconnaissance was conducted to identify likely regional, local and site-

specific retrofit opportunities. Potential BMP locations identified during this field investigation are identified on Figure 1 and detailed in the *field reconnaissance supplement* at the end of this report. In summary, four BMP retrofit opportunities were identified in this preliminary field reconnaissance. The following are specific actions that could be pursued to reduce external loading.

- Consideration of local partnerships for further assessment of the 4 potential local BMP locations identified in the *field reconnaissance supplement*.
- Notice/letter to FairIssac (business area south of the lake) educating them of potential grant funding through the District's Urban Stormwater Remediation Cost-Share Program. All of this area (BMP #5) discharges directly to the lake untreated. There would be opportunity for easy (surface) retrofits in this area during pavement maintenance activities.
- Erosion control measures could be put in place to address soil erosion at the site of the outlet pump (BMP #6) on the south side of the lake.
- Erosion at the bottom of the slope that discharges water at a high velocity into a channel (BMP #7) draining to the lake should be stabilized.

There are several options known to successfully reduce nutrient runoff that can be suggested even before data are available that will allow more targeted management. These general practices include:

- Stormwater management retrofits for better nutrient, volume, rate, and erosion control
- Nutrient and stormwater volume absorbing raingardens
- Increased frequency of street-sweeping and targeted prioritization to direct runoff areas
- Buffer zones of native vegetation along the lake-shore (good for both runoff problems and fish survival)
- Public education programs to encourage voluntary land-owner changes in landscaping, lawn fertilization, and runoff management
- Active inspection programs for and routine maintenance of previously installed stormwater BMPs

Internal Lake Management Recommendations

With very little in-lake biological data for Karth Lake, specific in-lake management recommendations can not be made at this time. However, a number of shallow lake management principles will likely apply to Karth Lake:

- If curly-leaf pondweed is present in high densities, it likely contributes to internal loading, and curly-leaf pondweed removal activities should be considered. Curly-leaf pondweed releases a pulse of phosphorus into the water column in June when the plants senesce.
- Submerged and emergent aquatic macrophytes in the lake normally stabilize the sediments and provide refugia for zooplankton. If the macrophyte communities are determined to be sparse, shoreline and littoral zone restoration practices should be undertaken.

- The balance of benthivores, planktivores, and piscivores in the lake can influence the lake's water quality. Benthivores disturb the bottom sediments and release phosphorus into the water column, and high densities of planktivores can overgraze zooplankton, which normally graze on phytoplankton and keep chlorophyll concentrations in balance. If there is an overabundance of benthivorous fish (such as carp or bullhead) or an overabundance of planktivores, a fisheries management plan should be developed that will aim to restore the balance of these types of fish in the lake. If cooperation is possible, work with DNR to promote a fisheries management strategy that places importance on water quality, while maintaining a viable fishery.

Recommended Data Collection

The following in-lake data collection will help tailor the management recommendations for Karth Lake. Since there are only two years of in-lake data on Karth Lake and the lake is close to the water quality standards, additional in-lake data collection on the lake should be considered high priority.

- Updated bathymetric data collection
- TP, chlorophyll, and Secchi depth data: Collect data for one to two additional years, with at least five sampling dates per year. Continued support of data collection through the CAMP program will provide sufficient information.
- Macrophyte surveys: Complete one macrophyte survey during June to evaluate the presence/absence of curly-leaf pondweed and other invasive aquatic vegetation. Complete another survey during August to evaluate the quality of the macrophytes after senescence of curly-leaf pondweed, when native macrophytes may dominate.
- Fish survey: Complete a fish survey to evaluate the fish species composition of the lake.
- Plankton survey: Collect zooplankton and phytoplankton data for one full season. This will supplement the information from the fish survey regarding the food web, which influences nutrient cycling within the lake. Management recommendations can then be targeted towards manipulating the food web dynamics to improve water quality.

Karth Lake Field Reconnaissance Supplement

Local Management BMPs



Karth #1

Location: South end of Karth Lake

Description: Low wooded area that could be used to treat the large manufacturing business south of lake. There is room to incorporate a good sized feature, which would be needed for that large amount of impervious draining to this location.

Potential Improvements: Incorporate ponding, infiltration, or wetland treatment depending on soils and water table.



Karth #2

Location: Cul-de-sac at the end of Karth Lake Drive

Description: Catch basins drain directly to lake

Potential Improvements: Incorporate island with treatment in cul-de-sac to treat adjacent impervious.



Karth #3

Location: North of Nursery Hill Court and west of Dellwood Street

Description: Low wooded wetland area

Potential Improvements: Incorporate treatment for adjacent roads (would need to assess current quality and function of the wetland)



Karth #4

Location: Cul-de-sac on Nursery Hill Lane

Description: A lot of unnecessary impervious, typical of several neighborhood streets around Karth Lake.

Potential Improvements: Incorporate islands with treatment in cul-de-sacs and reduce street widths. Reclaimed green space could also be used for raingardens.

Site Specific Management BMPs



Karth #5

Location: Parking lot serving manufacturing business south of Karth Lake

Description: The flume for storm water runoff from the large parking area currently discharges offsite untreated.

Potential Improvements: Incorporate stormwater treatment retrofits onsite during pavement maintenance.

Vegetation Management BMPs



Karth #6

Location: South end of Karth Lake

Description: Outlet pump and associated erosion.

Potential Improvements: Incorporate erosion control measures to prevent sediments from entering the lake.

No Photo

Karth #7

Location: East end of private drive on FairIssac site

Description: Erosion at the bottom of the slope that discharges water at a high velocity into a channel.

Potential Improvements: Stabilize outfall to prevent further erosion.