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5.2 Acorn (Mud) Lake Watershed Management Plan

5.2.1 General Information

Acorn Lake (formerly known as Mud Lake) is a 44-acre lake in the City of Oakdale, between 45th and 50th Streets North and east of Granada Avenue North. As shown on Figure 5.2-1, the entire Acorn Lake watershed lies within the City of Oakdale.

Because of its size, location, and abundance of emergent aquatic vegetation (e.g., water lilies), recreational use of the lake is limited. Located north of Oakdale Park, the lake serves as an aesthetic amenity for preserve visitors. Paved and grass trails follow portions of the shoreline. The lake has east and west basins separated by a peninsula extending approximately three quarters of the way through the lake from north to south. A dock extends out into the lake from the east side of this peninsula. Tennis courts are located near the west side of the lake, and a nature center (Oakdale Nature Preserve) is located southeast of the lake. Castle Elementary School is located just north of the lake.

The lake is primarily surrounded by parkland, with low-density residential or institutional land use throughout the remainder of the watershed. Existing (2010) and future (2030) development land use conditions for Acorn Lake are shown on Figure 5.2-2.
The Acorn Lake watershed is approximately 296 acres, including the lake surface area and some local depressions that act as landlocked basins for smaller precipitation events. Runoff enters the lake from about three storm sewer outfalls and culverts at various points on the lakeshore. The outlet from Acorn Lake is a 12-inch diameter pipe at the northwestern point of the west basin of the lake. Outflow from Acorn Lake drains to the north and is tributary to Long Lake.

### 5.2.2 Water Quality Management Plan

Acorn Lake is classified as a shallow lake by the Minnesota Pollution Control Agency (MPCA) and has been identified by the MPCA (in 2011) as meeting the water quality standards for shallow lakes (see Table 5.2-1) and is not included among the list of impaired waters in Minnesota.

Acorn Lake is classified as a Medium Priority waterbody according to the VBWD’s waterbody classification system (see Section 4.1 – Water Quality), due to its classification as a shallow lake by the MPCA. The VBWD’s 2007 water quality assessment of Acorn Lake recommended that Acorn Lake be reclassified as a wetland by the MPCA, versus a shallow lake. Presently, Acorn Lake remains classified as a shallow lake. The VBWD may change its classification of Acorn Lake if the MPCA classification is changed.

Historically, the City of Oakdale classified Acorn Lake as a protected wetland in the 1989 Oakdale Surface Water Management Plan (1989 Oakdale plan). In 2009, the City of Oakdale updated its management classification for Acorn Lake to reflect the VBWD classification system applicable at the time (which classified Acorn Lake as a medium priority waterbody). Although the lake and all of its drainage area is within the jurisdiction of the City of Oakdale, the water quality of Acorn Lake can impact downstream water resources. Therefore, the VBWD has prepared the following water quality management goals and plan for Acorn Lake.

The water quality of Acorn Lake meets MPCA water quality standards for total phosphorus and chlorophyll a, although the Secchi disc depth is less than the standard applicable to shallow lakes (see Table 5.2-1). The VBWD has a non-degradation water quality policy which sets “action triggers” for all of its major waterbodies. Section 4.1 – Water Quality discusses the action triggers in more detail. Action triggers for VBWD lakes consider the following water quality parameters (summer average) relative to MPCA water quality standards and prior water quality data (i.e., trend analysis):

- Secchi disc depth
- Total phosphorus
- Chlorophyll a

Specific water quality implementation tasks for Acorn Lake include the following:

1. The VBWD will cooperate with other entities to monitor the water quality of Acorn Lake.
and perform the actions discussed in Section 4.1 – Water Quality for Medium Priority water bodies. The VBWD may conduct more intense monitoring on the lake as needed based on actions recommended in Table 4.1-6. VBWD will request that a copy of all water quality monitoring reports conducted by others for Acorn Lake be sent to VBWD.

The VBWD will evaluate the average summertime water quality (total phosphorus, chlorophyll \(a\), and Secchi disc transparency) and compare it to applicable water quality standards (Table 4.1-1) and applicable action triggers (described in Section 4.1.7.5).

2. The VBWD will cooperate with others to manage invasive macrophytes (aquatic plants) in Acorn Lake. The VBWD will provide technical support for the treatment of aquatic plants, possibly including point-intercept macrophyte surveys.

3. The VBWD will cooperate with the MPCA, as necessary, in any efforts to reclassify Acorn Lake as a wetland (as opposed to its current classification as a shallow lake) as related to water quality assessment.

4. The VBWD will continue to implement its Rules and Regulations (2013, as amended) in the Acorn Lake watershed. The VBWD Rules address water quality performance standards for development and redevelopment projects as well as required vegetated buffers around VBWD lakes, streams, and wetlands. The VBWD Rules and Regulations are included in this Plan as Appendix A-4.5.

Based on the observed data (see Section 5.2.2.1) and modeling results (see Appendix A-5.2), no additional management actions to improve water quality in Acorn Lake are currently recommended.

5.2.2.1 Water Chemistry Data

Water quality monitoring of Acorn Lake was conducted throughout the summers of 1995, 2000, 2003, 2007, and 2010. Limited water quality monitoring was performed in 2006, 2008, and 2009. Water quality samples are typically analyzed for total phosphorus and chlorophyll \(a\), and Secchi disc transparency (see Appendix A-4.1 – Water Quality Background Information).

Graphical depictions of Acorn Lake’s historical water chemistry from 1995 through 2014 are shown in Figure 5.2-3. Water quality in Acorn Lake was historically poor, but has generally improved in recent history. Over the most recent 10 year period, total phosphorus met the MPCA shallow lakes standard in all 5 years of sampling, while chlorophyll \(a\) met the MPCA shallow lakes standard in all sampled years except 2008. Conversely, Secchi disc transparency has been less than 1 meter (the shallow lakes standard) in all years but 2007. However, Secchi disc transparency depth in the summer months is often limited by the bottom of the water body or the plant bed, meaning that single and average measurements for water clarity are often shallower than what would be measured if the water body was deeper. Overall, the 10-year average water quality meets MPCA standards for shallow lakes (see Table 5.2-1).
Table 5.2-1  Summary of Acorn Lake summer average water quality (2005 – 2014)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>10-year Average (2004-2013)</th>
<th>Trend in Average</th>
<th>MPCA Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Phosphorus</td>
<td>ug/L</td>
<td>41</td>
<td>Improving</td>
<td>60</td>
</tr>
<tr>
<td>Chlorophyll a</td>
<td>ug/L</td>
<td>13</td>
<td>None</td>
<td>20</td>
</tr>
<tr>
<td>Secchi Disc Depth</td>
<td>m</td>
<td>0.82</td>
<td>Degrading</td>
<td>1.0</td>
</tr>
</tbody>
</table>

The VBWD completed a detailed water quality study of Acorn Lake in August 2000 (*Tri-Lakes (Lakes DeMontreville, Olson and Jane), Long, Echo, Mud (Acorn) and Silver Lakes, Watershed and Lake Management Plan, Volume I; Lake and Watershed Conditions, Water Quality Analysis, Improvement Options and Recommendations*). The study determined that Acorn Lake is a shallow wetland that receives a relatively small amount of runoff from the tributary watershed. Nearly all of the non-direct runoff from the watershed receives some form of wet detention or wetland treatment. Through the study, options were evaluated to determine if improving Acorn Lake’s water quality would benefit downstream water bodies. Because Acorn Lake is shallow, few options were considered feasible. In addition to general management practices, one potential improvement involved raising Acorn Lake’s water level by one foot through the construction of a new outlet to provide skimming. However, the in-lake water quality model did not predict a significant improvement in the lake water quality resulting from this improvement option, which was estimated to carry a capital cost of $11,200 (in 2000 dollars), not including annual operation and maintenance costs. Because no measurable water quality benefits were predicted with this option, this option was not pursued further.

The VBWD performed a detailed water quality study of Acorn Lake in 2007. The study included Lake monitoring in 2007, analysis of previous data, and modeling efforts conducted as to determine what steps could be taken to prevent Acorn Lake being listed by the MPCA as an impaired water body for nutrients. That study concluded that the year 2000 data were affected by periphyton due to the elevated amount of chlorophyll *a* during each sample collection. Normally attached to plants in the lake, periphyton can easily be knocked into the water column and sampled in shallow lakes or wetlands with high coverage of macrophytes, such as Acorn Lake.

Water quality modeling for Acorn Lake is described in Appendix A-5.2 and revealed that water quality in Acorn Lake is highly affected by:

- Stormwater inputs
- Changes in waterbody size and volume
- Sediment drying
• Internal phosphorus loading from sediment (relatively minor)

Internal loading in Acorn Lake is low, estimated as 0.26 mg/m²/day based on sediment cores taken in spring 2007. During summer 2007, substantial portions of the sediment were exposed and dried, causing a short term phosphorus uptake once sediment is flooded again.

5.2.2.2 Biological Data

The Minnesota Department of Natural Resources (MDNR) currently has no fish stocking program on Acorn Lake. No fisheries surveys have been conducted to date.

The VBWD conducted macrophyte (aquatic plant) surveys in June 1995, June 2003, August 2003, May 2007, August 2007, June 2009, June 2011, and August 2011 at Acorn Lake. The VBWD collected this macrophyte data to identify the conditions of plant growth throughout the lake. Macrophytes are the primary producers in the aquatic food chain, converting the basic chemical nutrients in water and soil into plant matter through photosynthesis, which becomes food for all other aquatic life. While macrophytes can impact the recreational use of a water body, they are critical to the ecosystem as fish and wildlife habitat.

Appendix B-5.2 includes the 1995, 2003, 2007, 2009, and 2011 macrophyte survey information. Because of its shallow depth (i.e., maximum depth of 4 feet), aquatic plants are found throughout the entire lake basin. Macrophytes were found throughout the entire water body in later surveys. The lake’s macrophyte community is diverse, comprised of floating, submersent, and emergent plants in varying densities and compositions. Nine individual taxa were identified during the 1995 survey, with the heaviest densities comprised of coontail and Robbins’ pondweed. Among later surveys, the macrophyte community consisted of 13 to 18 individual species during May and June and 14 to 19 individual species during August. These species are common to Minnesota lakes and, with the exception of purple loosestrife, provide good habitat for the lake’s fish and aquatic animals. Although not observed during the 1995 survey, growth of purple loosestrife (Lythrum salicaria), an undesirable exotic (non-native) species, was observed along more than half of the lake’s shore in 2003, 2007, 2009, and 2011. This is of concern because this plant is replacing cattails (Typha spp.), a native species considered better for the lake than purple loosestrife. Once a water body becomes infested with purple loosestrife, the plant typically replaces native vegetation and rapidly becomes the sole emergent species.

Purple loosestrife can be effectively managed through the use of leaf-eating beetles, which reduce plant growth and seed production by feeding on the leaves and new shoots. At the request of the VBWD, the MDNR released 1,000 beetles (Galerucella pusilla) at a location on the southwest shore of Acorn Lake in the spring of 2009. In October of 2009, a MDNR follow-up survey identified less than 30 insects within a 15 foot radius of the release point. The MDNR observed very little damage to the purple loosestrife plants during the follow-up survey, and subsequent macrophyte surveys indicate no residual effectiveness from the original beetle release. The MDNR has not released additional beetles at Acorn Lake since the 2009 release.
The VBWD will cooperate with others entities in their efforts to manage aquatic invasive species, including the MDNR if the MDNR recommends additional release of leaf-eating beetles. The VBWD will continue to provide technical assistance to entities seeking to manage aquatic invasive species. This may include development of lake vegetation management plans and surveys conducted in the years following treatments to track purple loosestrife extent.

Phytoplankton (non-rooted floating plants—algae) and zooplankton (microscopic aquatic animals) were monitored on Acorn Lake in 2007. Phytoplankton are the base of the aquatic food chain and Acorn Lake has a diverse population, including several types of algae, diatoms, and other microorganisms. Appendix C-5.2 presents the distribution of phytoplankton in Acorn Lake throughout the year.

The most common type of zooplankton is rotifera, a family of microscopic animals who consume detritus and contribute to nutrient cycling. They also serve as a food source for the population of copepods, a family of small freshwater crustaceans also found in Acorn Lake. Appendix D-5.2 presents the distribution of zooplankton in Acorn Lake throughout the year.

### 5.2.3 Water Quantity Management Plan

The 1989 Oakdale Plan discussed stormwater management issues in the Acorn Lake watershed and proposed modification to the Acorn Lake outlet as a top priority in that plan (scheduled for 1991). The outlet modification was not performed. In its 2005 Plan, the VBWD requested that the City of Oakdale either: 1) install the restriction as called for in the Oakdale Plan, or 2) provide information to VBWD that shows the restriction is not needed.

As part of its 2009 Plan, the City of Oakdale performed hydrologic and hydraulic modeling of the Acorn Lake watershed. The study estimated the peak water elevation of Acorn Lake resulting from the 100-year storm event (based on TP-40 precipitation data) as 994.7 feet, and the peak water level from a 12 inch rainfall event as 996.9 feet; both elevations are below the emergency overflow of the basin (998 feet) as well as the low opening of adjacent homes. The City of Oakdale provided a memorandum summarizing the modeling results to the VBWD in 2010, thus demonstrating that an outlet modification was not necessary.

Any future water quantity project pursued by the City of Oakdale will need to comply with VBWD requirements and be approved by the VBWD.

In 2013, the National Oceanographic and Atmospheric Administration (NOAA) published Atlas 14, Volume 8 (see Section 4.7.6). Atlas 14 contains updated precipitation data for Minnesota and supersedes TP-40 and TP-49 (the precipitation sources used in the 2005 VBWD Plan). Comparison of precipitation depths between TP-40 and Atlas 14 indicates increased precipitation depths for more extreme events. Within the VBWD, the 100-year, 24-hour event within the VBWD increased from 6.0 inches to 7.3 inches.

The 100-year water level established for Acorn Lake predates Atlas 14 and does not reflect the
most current precipitation data. The VBWD plans to update the 100-year flood level for lakes, including Atlas Lake, to reflect Atlas 14 precipitation data and other current data sources. These updates may result in an increased flood level, which may place additional structures within the floodplain. The VBWD estimated 100-year flood elevation of 995.6 feet assumes that a more restrictive outlet would be placed on Acorn Lake. The City of Oakdale’s modeling estimated the 100-year flood elevation of Acorn Lake at 994.7 feet based on TP-40 precipitation data. As the TP-40 precipitation data has now been superseded by Atlas 14 (see Section 4.7), the VBWD will continue to use the higher elevation (995.6 feet) until more detailed modeling of Acorn Lake is performed using the most recent precipitation data.

5.2.4 References


Figure 5.2-2
ACORN LAKE WATERSHED
CURRENT (2010) AND FUTURE (2030) LANDUSE
2016-2020 Watershed Management Plan
Valley Branch Watershed District

Source: Metropolitan Council 2010
1 inch = 1,000 feet
Appendix A-5.2 Additional Water Quality Information
Appendix A-5.2 Additional Water Quality Information

Water Quality Modeling

Water quality modeling was conducted with both 2003 and 2007 monitoring data using a mass balance model (demonstration of model calibration is given in Appendix B). Stormwater inflow data was not available for either year. Runoff and nutrient loading was estimated using the P8 stormwater modeling program (calibrated using Long Lake runoff data). Lake level data was only available for 2007 and, thus, the 2003 model used the assumption that inflow was equal to outflow. Climatologically speaking, 2003 was considered an average year, while 2007 was mainly a dry year (winter, spring and through mid-summer) with wet late summer and fall conditions.

External phosphorus inputs (i.e., stormwater runoff) were the largest phosphorus source to Acorn Lake, ranging from 68 to 71%. Internal phosphorus loading was small, ranging from 6 to 12%. This mass balance indicates that in order to change the phosphorus levels in Acron Lake, external phosphorus loads will need to be reduced.

Internal Load

The sediments in Acorn Lake are very high in water content, unconsolidated, and low in mobile phosphorus, meaning internal loading is low in the lake. The model runs for 2003 and 2007 confirm this with only 2 pounds of phosphorus being released from the sediment in 2003 and 7 pounds in 2007. In addition, it appears that the drying of Acorn Lake sediment during July and early August caused sorption of phosphorus from the water once heavy storms raised the level of the water. If this phosphorus uptake by sediment is taken away from the internal loading seen in the earlier part of the season, there was a net phosphorus loss to the sediment over the season.

External Load

The tributary watershed to Acorn Lake is small (296 acres including the lake and landlocked areas) and nearly all runoff comes from natural areas or is treated by wet detention ponds. No monitoring of stormwater inputs to Acorn Lake was conducted in 2007. A P8 model was developed to estimate phosphorus loading to Acorn Lake from stormwater inputs.

BMP Scenario Modeling Results

Modeling scenarios were run under different Best Management Practices (BMP) applications including the reduction of internal loading or the lowering of external phosphorus inputs to the lake. Models were run for years 2003 and 2007. Both years currently meet the MPCA threshold for nutrients and chlorophyll a for shallow lakes, but 2003 does not meet the criteria for Secchi disc transparency depth.
However, because Secchi disc transparency depths were physically limited by the lake bottom or the submerged macrophyte bed during nearly all sampling periods, both years are likely to have had higher water clarity. A decrease in total phosphorus is seen in both years when internal phosphorus loading is controlled in the lake. The decrease is greater in 2007 (20%), a drier year, because internal phosphorus loading will generally constitute a larger portion of the total phosphorus load to the lake under dry conditions. Again, internal phosphorus loading in the lake is considered low, and further reduction is not deemed necessary.

Reducing the external flow of phosphorus to the lake by 60% also causes a decrease in water column phosphorus in Acorn Lake. The reduction is greatest in 2003, an average year, because a greater proportion of the phosphorus load comes from outside the lake when compared to a mainly dry year like 2007. Because wet detention treats nearly all stormwater coming from non-natural areas, drastic measures would need to be taken to reduce phosphorus further (i.e. an inflow treatment plant). Because Acorn Lake currently meets the MPCA shallow lake criteria, it is not recommended to attempt further reduction in nutrient levels in Acorn Lake.
Appendix B-5.2 Additional Macrophyte Information
The Entire Lake Basin is Impacted With Aquatic Vegetation.

Macrophyte Densities Estimated As Follows: 1 = light; 2 = moderate; 3 = heavy

Submerged Aquatic Plants:
- Blatterwort
- Coontail
- Flanstem pondweed
- Largeleaf pondweed
- Robbins' pondweed

Floating Leaf:
- White waterlily
- Yellow waterlily

Emergent:
- Cattail
- Pickerelweed

No Aquatic Vegetation Found:

Common Name
- Nymphaea tuberosa
- Nuphar variegatum

Scientific Name
- Utricularia spp.
- Ceratophyllum demersum
- Potamogeton zosteriformis
- Potamogeton amplifolius
- Potamogeton robbinsii
- Typha spp.
- Pontederia cordata
The Entire Lake Basin is Impacted With Aquatic Vegetation.

Macrophyte Densities Estimated As Follows: 1 = light; 2 = moderate; 3 = heavy

### Submerged Aquatic Plants:
- Blatterwort
- Coontail
- Flatstem pondweed
- Largeleaf pondweed
- Robbins' pondweed

### Floating Leaf:
- White waterlily
- Yellow waterlily

### Emergent:
- Cattail
- Pickerelweed

### Common Name

<table>
<thead>
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<th>Scientific Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utricularia spp.</td>
</tr>
<tr>
<td>Ceratophyllum demersum</td>
</tr>
<tr>
<td>Potamogeton amplifolius</td>
</tr>
<tr>
<td>Potamogeton robbinsii</td>
</tr>
<tr>
<td>Typha spp.</td>
</tr>
<tr>
<td>Pontederia cordata</td>
</tr>
<tr>
<td>Nymphaea tuberosa</td>
</tr>
<tr>
<td>Nuphar variegatum</td>
</tr>
</tbody>
</table>

### Scientific Name

<table>
<thead>
<tr>
<th>Common Name</th>
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</thead>
<tbody>
<tr>
<td>Blatterwort</td>
</tr>
<tr>
<td>Coontail</td>
</tr>
<tr>
<td>Flatstem pondweed</td>
</tr>
<tr>
<td>Largeleaf pondweed</td>
</tr>
<tr>
<td>Robbins' pondweed</td>
</tr>
<tr>
<td>White waterlily</td>
</tr>
<tr>
<td>Yellow waterlily</td>
</tr>
<tr>
<td>Cattail</td>
</tr>
<tr>
<td>Pickerelweed</td>
</tr>
<tr>
<td>Potamogeton zosteriformis</td>
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<tr>
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<td>Typha spp.</td>
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<td>Ceratophyllum demersum</td>
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<td>Potamogeton zosteriformis</td>
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<tr>
<td>Potamogeton robbinsii</td>
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<td>Typha spp.</td>
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<td>Ceratophyllum demersum</td>
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<tr>
<td>Nuphar variegatum</td>
</tr>
<tr>
<td>Potamogeton zosteriformis</td>
</tr>
<tr>
<td>Potamogeton robbinsii</td>
</tr>
<tr>
<td>Typha spp.</td>
</tr>
</tbody>
</table>
Macrophytes Found Throughout Entire Water Body (except where noted on map)
- Macrophyte Densities Estimated as Follows: 1 = Light; 2 = Moderate; 3 = Heavy

Submerged Aquatic Plants:
- Narrowleaf pondweed
- Robbin's pondweed
- Flatstem pondweed
- Coontail
- Elodea
- Bladderwort
- Potamogeton spp. (narrowleaf)
- Potamogeton robustus
- Potamogeton zosteriformis
- Ceratophyllum demersum
- Elodea canadensis
- Utricularia spp.

Floating Leaf:
- White water lily
- Yellow water lily
- Nymphaea tuberosa
- Nuphar variegata

Emergent:
- Cattail
- Purple Loosestrife
- Blue flag iris
- Pickereweed
- Typha spp.
- Lythrum salicaria
- Iris versicolor
- Pontederia cordata

NOTE:
- Nymphaea tuberosa and Nuphar variegata located throughout entire lake. Densities greatest in areas with Iris versicolor sporadic growth along entire lake edge.

ACORN (MUD) LAKE
MACROPHYTE SURVEY
JUNE 13, 2003
Macrophytes Found Throughout Entire Water Body
Macrophyte Densities Estimated as Follows: 1 = Light; 2 = Moderate; 3 = Heavy
Lythrum salicaria (purple loosestrife) is Located Sporadically Along Shoreline
Heavy Growth of Nymphaea tuberosa (white water lily), Nuphar variegata (yellow water lily)
Throughout Entire Lake

Submerged Aquatic Plants:
- Narrowleaf pondweed
- Robbin's pondweed
- Flatstem pondweed
- Coontail
- Elodea
- Bladderwort
- Bushy pondweed and naiad
- Large-leaf pondweed
- Potamogeton spp. (narrowleaf)
- Potamogeton robbinsii
- Potamogeton zosteriformis
- Ceratophyllum demersum
- Elodea canadensis
- Utricularia spp.
- Najas spp.
- Ceratophyllum demersum 3
- Potamogeton spp. (narrowleaf) 1
- Potamogeton robbinsii 2-3
- Nuphar variegata 1
- Najas spp. 1
- Potamogeton amplifolius 1
- Elodea canadensis 1
- Utricularia spp. 1-2
- Nymphaea tuberosa
- Nuphar variegata
- Potamogeton robbinsii 2

Floating Leaf:
- White water lily
- Yellow water lily
- Nymphaea tuberosa
- Nuphar variegata

Emergent:
- Cattail
- Purple Loosestrife
- Blue flag iris
- Pickeral weed
- Typha spp.
- Lythrum salicaria
- Iris versicolor
- Pontederia cordata

No Aquatic Vegetation Found:

NOTE: Nymphaea tuberosa and Nuphar variegata located throughout entire lake. Densities greatest in areas with Iris versicolor sporadic growth along entire lake edge.
FIELD NOTES:
- Macrophyte densities estimated as follows:
  1=light; 2=moderate; 3=heavy
- Densities generally not noted for emergent and floating leaf plants
- Macrophytes found throughout entire water body
- Nymphaea tuberosa and Nuphar variegata located throughout entire lake.
- Iris versicolor sporadic growth along entire lake edge
FIELD NOTES:
- Macrophyte densities estimated as follows:
  1 = light; 2 = moderate; 3 = heavy
- Densities generally not noted for emergent and floating leaf plants
- Macrophytes found throughout entire water body
- Low water level, unable to survey west basin
- Nymphaea tuberosa and Nuphar variegata located throughout entire lake.
- Iris versicolor, Carex sp. and Scirpus sp. sporadic growth along entire lake edge

LEGEND

Emergent Plants
Floating Leaf Plants
Submerged Aquatic Plants
No Aquatic Vegetation

Common Name | Scientific Name
-------------|------------------
Robbins' pondweed | Potamogeton robbinsii
bladderwort | Utricularia sp.
coontail | Ceratophyllum demersum
flatstem pondweed | Potamogeton zosteriformis
largeleaf pondweed | Potamogeton amplifolius
pondweed | Potamogeton sp.
Canada waterweed | Elodea canadensis

Common Name | Scientific Name
-------------|------------------
spatterdock | Nuphar variegata
white waterlily | Nymphaea tuberosa

cattail | Typha sp.
green bulrush | Scirpus atrovirens
pickerelweed | Pontederia cordata
purple loosestrife | Lythrum salicaria
sedge | Carex sp.

Imagery Source: 2006 AE

ACORN LAKE MACROPHYTE SURVEY RESULTS
August 16, 2007
Valley Branch Watershed District
FIELD NOTES:
- Macrophyte densities estimated as follows:
  1 = light; 2 = moderate; 3 = heavy
- Densities generally not noted for emergent and floating leaf plants
- Macrophytes found throughout entire water body
- Nymphaea tuberosa and Nuphar variegata located throughout entire lake.
- Iris versicolor sporadic growth along entire lake edge
- Potamogeton robbinsii is less dense than 2007
- Low water level
**FIELD NOTES:**
- Macrophyte densities estimated as follows:
  1 = light; 2 = moderate; 3 = heavy
- Densities generally not noted for emergent and floating leaf plants
- Macrophytes found throughout entire water body
- Ponded area, Nymphaea odorata and Nuphar lutea located throughout entire lake
- Iris versicolor sporadic growth along entire lake edge
- Sparganium sp. observed along lake perimeter

**Legend**
- **Emergent Plants**
- **Floating Leaf Plants**
- **Submerged Aquatic Plants**
- **No Aquatic Vegetation**

**Macrophyte Densities**
- **Robbins' pondweed**
- **Muskgrass**
- **Bladderwort**
- **Coontail**
- **Flatstem pondweed**
- **Largeleaf pondweed**
- **Pondweed**
- **Canada waterweed**
- **Wild celery**
- **Water stargrass**

**Scientific Name**
- Potamogeton robbinsii
- Utricularia sp.
- Ceratophyllum demersum
- Potamogeton zosteriformis
- Potamogeton amplifolius
- Potamogeton sp.
- Elodea canadensis
- Vallisneria americana
- Zostera dubia

**Scientific Name**
- Chara sp.
- Lythrum salicaria
- Typha sp.
- Utricularia sp.
- Sparganium sp.
- Elodea canadensis
- Carex sp.
- Nymphaea tuberosa
- Nuphar lutea
- Potamogeton sp.
- Elodea canadensis
- Potamogeton robbinsii
- Potamogeton amplifolius
- Potamogeton zosteriformis
- Potamogeton sp.
- Elodea canadensis
- Carex sp.
- Lythrum salicaria
- Sparganium sp.
- Nymphaea tuberosa
- Nuphar lutea
- Potamogeton sp.
- Elodea canadensis
- Carex sp.
- Lythrum salicaria
- Sparganium sp.

**Common Name**
- Spatterdock
- White waterlily
- Cattail
- River bulrush
- Pickerelweed
- Burr-reed
- Sedge

**Scientific Name**
- Nuphar lutea
- Nymphaea odorata
- Typha sp.
- Scirpus fluviatilis
- Pontederia cordata
- Lythrum salicaria
- Sparganium sp.
- Carex sp.
Appendix C-5.2 Additional Phytoplankton Information
2007 Acorn Lake
Phytoplankton Data Summary

No. Per Milliliter

Date


Phytoplankton Data Summary

Pyrrhophyta
Euglenophyta
Cryptophyta
Bacillariophyta
Cyanophyta
Chrysophyta
Chlorophyta
Appendix D-5.2  Additional Zooplankton Information
2007 Acorn Lake Zooplankton Data Summary

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No. Per Square Meter