2001 SUMMARY REPORT
of
WINDWARD LAKE

Lake County, Illinois

Prepared by the

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EXECUTIVE SUMMARY

Windward Lake is a 20.8 acre manmade lake located off Diamond lake Road in Ela Township in unincorporated Lake County. Access to Windward Lake is private. The lake's main use is fishing, swimming, and canoeing. Windward Lake was constructed in 1924 by damming Indian creek at two locations creating an oxbow lake. The lake is not online with Indian Creek but drains into the creek via two vertical out fall pipes. Past management activities have included: two fishery rehabilitations to control stunted and undesirable fish species, herbicide/algicide treatments to control nuisance growth of plants and algae, and fish stocking. Additionally, an aeration system was installed in the mid 1980s to improve the dissolved oxygen concentrations in the lake. In 1998, Windward Lake underwent a major rehabilitation to address deteriorating lake quality. This project included: dredging to remove sediment and to deepen the lake, recontouring, fish stocking, shoreline stabilization, and upgrading the aeration system.

As a result of the rehabilitation project, the water quality of Windward Lake is among the best in Lake County. The average Secchi disk depth was 14.3 feet, which is over triple the Lake County median depth of 4.2 feet. The Secchi depth in August was 17.3 feet and is the fifth deepest Secchi reading recorded by the Lakes Management Unit (LMU) out of 1,763 readings on 102 lakes (1988-2001). The extremely good water clarity is due to low concentrations of suspended particles in the water column. The average total suspended solids (TSS) concentration was 1.2 mg/L and is five times lower than the County median concentration of 5.7 mg/L. Furthermore, TSS concentrations in May, June, and August were below the laboratory detection limits of 1.0 mg/L. Additionally, other types of solids that can affect water clarity/quality were well below their respective County medians. Nutrient concentrations, which are the driving force behind nuisance algae blooms, were also very low. The average total phosphorus (TP) concentration in Windward Lake was 0.016mg/L and is below the Lake County median TP concentration of 0.047 mg/L. Nitrate nitrogen and ammonia nitrogen concentrations were below laboratory detection limits for the entire study.

Aquatic plant assessments found good plant densities and average plant diversity. The floristic quality index (FQI), a measurement of species richness, was 16.3 and was only slightly higher than the average FQI for Lake County (14.0). Nine species of aquatic plants were found including the macroalga *Chara*, which was the most abundant plant in the lake. The LMU found no Eurasian water milfoil (EWM), which is encouraging considering that EWM was present in the lake prior to the rehabilitation project. Special care should be taken to make sure that EWM does not become reestablished in Windward Lake.

The majority (68%) of Windward Lake's shoreline is undeveloped. Woodland is the most dominant type and made up 84% of the total shoreline. Other shoreline types included lawn (3%), seawall (3%), buffer areas (3%), shrub (3%) and beach (5%). The high occurrence of undeveloped shoreline provides good shoreline stabilization, which has kept the amount of erosion on Windward Lake to a minimum. LMU staff found only slight erosion on 5% of Windward Lake's shoreline.

LAKE IDENTIFICATION AND LOCATION

Windward Lake is located on the Windward Farms property off Diamond Lake Road in Ela Township and is completely within unincorporated Lake County (T45N, R10E, Section 28, NE ¼). Windward Lake is a 20.8 acre oxbow shaped manmade lake (Figure 1). The current maximum water depth is 18 feet with an average depth of 9 feet (Lake County Health Department – Lakes Management Unit[LMU] estimate). Lake volume is estimated to be approximately 187 acre feet (LMU calculation). Windward Lake is in the Indian Creek watershed, which is part of the Des Plaines River watershed. Windward Lake is not online with Indian Creek and only drains into the creek during periods of high water via two vertical outfall pipes.

BRIEF HISTORY OF WINDWARD LAKE

Windward Lake was created in 1924 on property owned by Holloway family by damming Indian Creek at two locations, creating an oxbow shaped lake. Indian Creek was then rerouted to the north side of the lake to its present flow. The lake remained under the ownership of the Holloway family until 1966, when the McHugh family purchased the farm. Access to Windward Lake is entirely private and the main uses of the lake are fishing, swimming, canoeing, and aesthetic enjoyment.

In the past, Windward Lake has gone largely unmanaged except for occasional fish stocking and weed/algae treatment. In 1968, the lake underwent a fishery rehabilitation to reduce excessive numbers of carp and the lake was restocked with bass and bluegill. By 1975, the fish population was stunted and a selective removal of bluegills was conducted. An aeration system was added in the mid 1980s to address low dissolved oxygen concentrations. During the 1990s, the occurrence of blue green algae blooms was increasing and the condition of Windward Lake quickly deteriorating. As a result of the deteriorating quality of the lake, the McHugh family started a major rehabilitation project in 1998. Included in this project was dredging, recontouring, fish stocking, and improving the aeration system. During this project 72,000 cubic yards of sediment were removed from the lake and the maximum depth was increased from 12 feet to 18 feet. In 2000 and 2001, sport and forage fish were regularly stocked into the lake to supplement the fish population that was saved during the rehabilitation project. Additionally, emergent shoreline vegetation was planted at several locations around the lake in 2001.

LIMNOLOGICAL DATA – WATER QUALITY

Water samples collected from Windward Lake were analyzed for a variety of water quality parameters. Samples were collected at three feet below the surface and three feet off the bottom (13-15 foot deep) at the deep hole location in the lake (Figure 1). Since Windward Lake has an aeration system, which keeps the lake well mixed, thermal stratification does not occur. This means that the lake does not divide into a warm upper water layer (epilimnion) and a cool lower water layer (hypolimnion). This lack of

separation of the lake into layers is reflected in the water quality data. Below is a discussion of the highlights from the complete data set for Windward Lake (Table 1, *Appendix A*).

Secchi disk depth is a direct indicator of water clarity as well as overall water quality. In general, the greater the Secchi disk depth, the clearer the water and better the water quality. Based on average Secchi depth, Windward Lake has *exceptional* water quality. The 2001 average Secchi disk depth on Windward Lake was 14.3 feet, which is over triple the Lake County median Secchi disk depth of 4.2 feet. Monthly readings varied slightly from a low of 10.2 feet in June to a high of 17.3 feet in August. The August Secchi reading is the fifth deepest (best) Secchi depth recorded by the LMU out of 1763 readings on 102 lakes (1988 – 2001). These monthly variations were related to slight fluctuations in concentrations of suspended organic and inorganic particles in the water column. This extremely good Secchi depth is due to a variety of reasons including the lake's deeper morphology, good aquatic plant densities, recent dredging activities, and low nutrient concentrations. Historical Secchi data for Windward Lake from past IDNR surveys report Secchi depths as shallow as 24 inches.

Dissolved oxygen (D.O.) concentrations in Windward Lake were *good* during the entire study. Additionally, the epilimnetic and hypolimnetic D.O. concentrations were very similar for the five-month period. This is not surprising since an aeration system is operated year round in Windward Lake. Furthermore, the size and output of the aeration system is more than adequate to maintain good D.O. concentrations. There was enough D.O. to support aquatic life (>5.0 mg/L) throughout the whole lake for the entire study. The average epilimnetic and hypolimnetic D.O. concentrations were 8.55 mg/L and 8.25 mg/L, respectively.

Average total suspended solids (TSS), which is a measurement of suspended particles in the water column such as silt, clay, and organic matter (algae), was 1.2 mg/L, which is almost five times lower than the County median of 5.7 mg/L. Furthermore, during May, July and August, TSS concentrations were below laboratory detection limits (<1.0mg/L). Calculated nonvolatile suspended solids (NVSS), which is the part of TSS that is nonorganic particles (such as sediment), was also very low (0.80 mg/L) and is another reason Windward Lake has such good water clarity/quality. Additionally, NVSS accounted for a large majority (67%) of the TSS, which is reflected in the low occurrence of planktonic algal blooms on Windward Lake. This can be attributed to several factors including good aquatic plant densities and recent dredging activities. The average total dissolved solids (TDS), total solids (TS), and total volatile solids (TVS) were all below their respective County medians. Furthermore, other parameters such as conductivity, pH, and alkalinity were at normal levels and remained fairly stable throughout the study.

Another very important measurement of water quality is nutrient concentrations. High nutrient concentrations are indicative of water quality problems. Algae need light and nutrients, most importantly carbon, nitrogen (N) and phosphorus (P), to grow. Light and carbon are not normally in short supply (limiting). This means that nutrients (N&P) are usually the limiting factors in algal growth. To compare the availability of these

nutrients, a ratio of total nitrogen to total phosphorus is used (TN: TP). Ratios < 10:1 indicate nitrogen is limiting. Ratios of >15:1 indicate phosphorus is limiting. Ratios >10:1, <15:1 indicate that there is enough of both nutrients for excessive algal growth. Windward Lake has a TN:TP ratio of 36:1, which means that the lake is highly phosphorus limited. *Due to the highly phosphorus limited nature of Windward Lake, external inputs of phosphorus should be carefully monitored as even small increases could trigger algae blooms.*

The 2001 average total phosphorus (TP) concentration in Windward Lake was 0.016 mg/L., which is three times lower than the Lake County median phosphorus concentration of 0.047 mg/L. The TP concentrations in Windward Lake were fairly stable over the five-month study. Additionally, hypolimnetic TP concentrations were slightly lower than epilimnetic concentrations. This is more than likely due to higher concentrations of suspended organic matter (algae) in the epilimnion, which can contribute to elevated TP concentrations. Overall, low TP concentrations prevented nuisance algae blooms, which in turn helps maintain good water clarity. As with phosphorus, nitrogen concentrations in Windward Lake are extremely low. Nitrate nitrogen (NO_3-N) and ammonia nitrogen (NH_3-N) concentrations were below detectable concentrations in the epilimnion and hypolimnion for the entire study due to uptake by both filamentous and macroalgae. The average total Kjeldahl nitrogen (TKN) concentration was 0.57 mg/L, which is two times lower than the County median concentration of 1.120 mg/L. The below average TKN concentrations may be due to the low occurrence of planktonic algae blooms, which are a source of TKN.

In lakes, phosphorus originates from two sources. One source is from within the lake (internal). This is a common source of phosphorus in lakes, which contain nutrient rich sediment. Furthermore, biological and chemical processes release phosphorus from the anoxic (D.O. = 0 mg/L) sediment. Additionally, sediment bound phosphorus can also be mixed into the water column by wind/wave action where there is a lack of aquatic plants (which stabilize sediment). However, these internal sources may not be contributing to the TP load in Windward Lake. Since the lake was recently dredged, there are very little/no nutrient rich sediment left in the lake to contribute to internal phosphorus loading. LMU staff observed hard clay bottom at several locations throughout the lake. Additionally, Windward Lake has an aeration system and anoxic conditions do not form and there is no apparent biological release from the sediment. Sediment resuspension may not be a major source of TP due to the lake's deep morphology, dredging activities, and extensive aquatic plant coverage. The other main input of phosphorus is from sources outside of the lake (external). These external inputs consist of a variety of sources and they can include fertilizer runoff, failing septic systems and erosion. Since agricultural/pasture land borders Windward Lake on its south side, this may be one possible source.

Another way to look at phosphorus concentrations and how they affect the productivity of the lake is to use a Trophic State Index (TSI) based on phosphorus. TSI values are commonly used to classify and compare lake productivity (trophic state). The higher the phosphorus concentration, the greater amount of algal biomass, which then results in a

higher TSI and corresponding trophic state. Based on a TSI phosphorus value of 44.0, Windward Lake is classified as mesotrophic (≥40, <50 TSI). A mesotrophic lake is defined as a moderately productive system that has below average nutrient concentrations and low algal biomass (growth). Based on a TSI Secchi value of 38.8, Windward Lake is classified as oligotrophic (<40 TSI). However, visual observations support that Windward Lake is *mesotrophic*. Out of the 102 lakes that the LMU has phosphorus data, only 17 lakes are classified as *mesotrophic*. TSI can also be used to compare lakes within the County. Based on the average phosphorus TSI, Windward Lake ranks 3 out of 102 lakes studied by the LMU between 1988-2001 (Table 2, Appendix A).

TSI values along with other water quality parameters can be used to make other analyses of Windward Lake based on water quality standards and use impairment indexes established by the Illinois Environmental Protection Agency (IEPA). For Windward Lake, all water quality standard violations (TP, NO_3-N, NH_3-N, pH, D.O., TDS, NVSS, exotic species) were listed as *None*. For the IEPA Aquatic Life Use, Swimming Use, and Recreational Use indices, Windward Lake was ranked as providing *Full Support*. Additionally, the Overall Use impairment assessment is listed as *Full Support*.

LIMNOLOGICAL DATA – AQUATIC PLANT ASSESSMENT

A healthy aquatic plant population is critical to good lake health. Aquatic vegetation provides important food sources and wildlife habitat. Additionally, aquatic plants provided many water quality benefits such as sediment stabilization and competition with algae for available resources. Aquatic plant diversity on Windward Lake is *average* (Table 3). Floristic quality index (FQI) (Swink and Wilhelm 1994) is a rapid assessment metric designed to evaluate the closeness that the flora of an area is to that of undisturbed conditions. It can be used to: 1) identify natural areas, 2) compare the quality of different sites or different locations within a single site, 3) monitor long-term floristic trends, and 4) monitor habitat restoration efforts. Each submersed and floating aquatic plant species (emergent shoreline species were not counted) in the lake is assigned a number between 1 and 10 (10 indicating the plant species most sensitive to disturbance). Nonnative species were also counted in the FQI calculations for Lake County lakes. We then averaged these numbers and multiplied by the square root of the number of species present to calculate an FQI. A high FQI number indicates that there are a large number of sensitive, high quality plant species present in the lake. In 2001, Windward Lake has a FQI of 16.3. The average FQI of lakes studied by the LMU in 2000-2001 was 14.0. This FQI supports that Windward Lake has *average* aquatic plant diversity compared to other lakes in Lake County.

During the 2001 study of Windward Lake, only eight species of aquatic plants were found (including the macroalga *Chara* sp.). The month with the highest plant diversity was September, in which five species were sampled. The most frequent species during

Table 3. Aquatic and shoreline plants on Windward Lake, May-September 2001.

Aquatic Plants	
Coontail	*Ceratophyllum demersum*
Chara (macrophytic algae)	*Chara* sp.
Slender Naiad	*Najas flexilis*
Curlyleaf Pondweed	*Potamogeton crispus*
Leafy Pondweed	*Potamogeton foliosus*
Small Pondweed	*Potamogeton pusillus*
Flatstem Pondweed	*Potamogeton zosteriformis*
Sago Pondweed	*Stuckenia pectinatus*
Horned Pondweed	*Zannichellia palustris*
Shoreline Plants	
Purple Loosestrife	*Lythrum salicaria*

the study was *Chara*, which occurred at 91% of all sample sites (May-September) and is the most dominant plant species in the lake (Table 4, *Appendix A*). Other plants that were present included sago pondweed (5% of sites), curly leaf pondweed (7 % of sites), and horned pondweed (5% of sites). Although a desirable species, *Chara* does not provide the quality habitat that higher vascular aquatic macrophytes can provide. However, it is very surprising that Windward Lake has the diversity that it does given the recent rehabilitation of the lake and the fact that none of the nine species were introduced. *Chara* appeared in Windward Lake the summer after the rehabilitation. This is not surprising since *Chara* is an alga, and not a true vascular plant, and it becomes established more quickly than vascular plants since it does not have to establish a root system. There are several possible routes of reintroduction of the vegetation into Windward Lake. Small fragments of *Chara* and the seeds and root structures of other plants may have survived the dredging project. Additionally, since waterfowl frequent the lake, this could be a route of introduction. Often plants become tangled in the feathers and legs of waterfowl as they move from one water body to another. Additionally, reproductive structures such as seeds commonly survive the digestion process so plants eaten at one location are transplanted to another. However, these water fowl introductions might be an area for concern. Eurasian water milfoil (EWM), a highly aggressive aquatic weed, was not found at any of the sample sites in 2001. This is encouraging since EWM was present in the lake before the project (IDNR reports) and can quickly dominate newly disturbed sites. Care should be taken to ensure that this nuisance aquatic weed does make its way back into Windward Lake. Furthermore, coontail can be very problematic and should be monitored to ensure that it does not reach nuisance levels.

Aquatic plant surveys were conducted every month for the duration of the study (*Appendix B* for methodology). Shoreline plants of interest were also observed (Table 3). However, no surveys were made of these shoreline species and all data is purely observational. Several areas around the lake have been planted with emergent, shoreline vegetation. However, due to wildlife herbivory, these plantings have been largely unsuccessful. Efforts to establish emergent vegetation should continue despite recent setbacks. Future plantings should be protected from wildlife until the plants are well established.

The extent to which aquatic plants grow is largely dictated by light availability. Aquatic plants need at least 1% of surface light levels in order to survive. Based on light penetration, the extent of aquatic growth in Windward Lake could have been as high as 100% of the surface area (bottom coverage). However, we found that plants did not completely grow in all of these areas or to this depth. Aquatic vegetation in Windward Lake occupied approximately 45-75% of the bottom area, which is a bit excessive (30-40% is ideal). However, these high densities help maintain good water quality and *Chara*, which make up a large majority of the coverage, is low growing and does inhibit the use of surface waters.

There are several ways to reduce *Chara* densities to allow the other plant populations to expand. The first is the use of algicides. However, the amount of algicides needed to appreciably reduce *Chara* densities is impractical. Continuous treatment of these areas would be needed in order to prevent the surrounding *Chara* from reinhabiting the site before other plants could become established. Another technique would be the use of mechanical harvesting in selected areas. Although, *Chara* reencroachment and regrowth would be a concern thus increasing the frequency/costs of harvesting. Additionally, harvester activities may be limited because of the size of Windward Lake. The most practical method for expansion of aquatic vegetation in Windward Lake is by planting native aquatic vegetation. Hopefully over time, the other plant species in Windward Lake will continue to naturally expand into *Chara* dominated areas. Even though this method is slow, this the most ecologically sound approach for Windward Lake. Furthermore, other native species, such as large leaf pondweed, American pondweed, and eel grass could be introduced and planted in Windward lake. These species would not only improve the species diversity of the lake but would also provide excellent fish habitat.

Aquatic herbicides have been used in a limited capacity during the past two years. In 2000, fluridone (Sonar™) was used as a whole lake treatment to control curly leaf pondweed. The concentration was approximately 2 parts per billion (based on LMU lake volume), which is a very low rate of fluridone. In 2001, endothall (Aquathol K®) was used to spot treat small patches of curly leaf pondweed. Additionally, a chelated copper algicide (Cutrine®) has been used both years to control minor filamentous algae blooms.

LIMNOLOGICAL DATA – SHORELINE ASSESSMENT

A shoreline assessment was conducted at Windward Lake on July 18, 2001. The shoreline of Windward Lake was assessed for a variety of criteria (*Appendix B* for methodology). Based on this assessment several important generalizations can be made. A majority (68%) of Windward Lake's shoreline is undeveloped. The most dominant shoreline type was woodland, which made up 84% of the total shoreline and 91% of the undeveloped shoreline (Figure 2). The high percentage of woodlands and overall undeveloped nature of the shoreline around Windward Lake is encouraging, because these woodlands contain plants with deep root systems and are less prone to erosion and provide good wildlife habitat. Also noted during the assessment were other shoreline types such as lawn (3%), seawalls (2%), buffer strips (3%), shrub (3%), and beach (5%). While shoreline types such as lawn and seawall can be considered undesirable, their limited presence at Windward Lake makes them of lower concern.

The shoreline that surrounds Windward Lake is flat to gently sloping and helps to protect against erosion due to wind and wave action as well as water fluctuations. The water level of Windward Lake fluctuated very little over the five-month study. The biggest change was from May to June, when the lake level dropped 2.25 inches. The rest of the study, the level of Windward Lake fluctuated only +/- 1.0 inches. Due to the flat shoreline and low water level fluctuations, the occurrence of erosion on Windward Lake is very *low*. Only 5% (370 feet) of the total shoreline was assessed as having *slight* erosion (Figure 3). These slightly eroded areas are made up of only two shoreline types: shrub and manicured lawns. The shrub areas that have experienced erosion were found on the islands where the substrate was very loose and rocky. Manicured lawns are prone to erosion due to the lack of quality root structure. These slightly eroded areas could be easily addressed by establishing well-maintained buffer strips consisting of deep-rooted prairie grasses and wildflowers. Additionally, it would be beneficial to extend these buffers into the lake by planting native emergent vegetation. There are several areas around the lake that are being planted with emergent vegetation. These areas should be expanded to include the slightly eroded areas.

LIMNOLOGICAL DATA – WILDLIFE ASSESSMENT

Wildlife observations were made on a monthly basis during water quality and plant sampling activities. All observations were visual. Several types of waterfowl were observed during the course of the study including great blue herons and belted king fishers (Table 5). There are healthy populations of mature trees that provide good habitat for a variety of bird species. There are also a few large dead trees that provide excellent habitat for Double Crested Cormorants. Additionally, there are several shrub and woodland areas that provide habitat for smaller bird and mammal species. The majority of Windward's shoreline (68%) is undeveloped and provides excellent wildlife habitat. There was very little invasive species growth found along Windward Lake's shoreline. The only invasive species found was purple loosestrife, which can have negative impacts on the habitat around the lake and should be controlled/eliminated. This plant is seldom

used by wildlife for food or shelter. Purple loosestrife was mostly noted in the woodland areas along the west side of the lake. While the LMU only noted a few isolated patches these areas should be eliminated before they spread and displace other native and more desirable plant species. Additionally, shoreline habitat should be further improved upon and should include buffer strips of deep rooted native plants and emergent vegetation such as arrowhead (*Sagittarria* spp.), blue flag iris (*Iris hexagona*), and pickerelweed (*Pontederia cordata*).

In 1998, during the rehabilitation project, Windward Lake experienced a severe fish kill due to low D.O. conditions. As a result the lake was drained and 198 bass that survived the fish kill were transplanted to a nearby pond and put back into Windward Lake once the rehabilitation project was completed. Additionally, since the completion of the rehabilitation project, sport and forage fish have been stocked on several occasions over the last two years. The sport fish that have been stocked include bluegills, hybrid bluegills, largemouth bass, and trout (rainbow and brown). In addition to stocking, fish structures have also been sunk and include large trees, boulders, piers, and even a car hood.

Table 5. Wildlife species observed on Windward Lake, May-September 2001.

<u>*Birds*</u>	
Double Breasted Cormorant	*Phalacrocorax auritus*
Canada Goose	*Branta canadensis*
Mallard	*Anas platyrhnchos*
Great Blue Heron	*Ardea herodias*
Red-tailed Hawk	*Buteo jamaicensis*
Belted King Fisher	*Megaceryle alcyon*
Barn Swallow	*Hirundo rustica*
American Crow	*Corvus brachyrhynchos*
Blue Jay	*Cyanocitta cristata*
American Robin	*Turdus migratorius*
Northern Cardinal	*Cardinalis cardinalis*
<u>*Reptiles*</u>	
Painted Turtle	*Chrysemys picta*

EXISTING LAKE QUALITY PROBLEMS

Windward Lake is a high quality lake and is among the best in Lake County based on several water quality parameters such as water clarity and nutrient concentrations. The McHugh family should be commended on their successful rehabilitation efforts of Windward Lake. As a result of the rehabilitation project, Windward Lake has extremely good water clarity as well as overall water quality. Aquatic plant diversity is average, but densities are good. The occurrence of erosion is very low and shoreline development has been kept to a minimum. However, there are a few areas in which Windward Lake could be further improved.

- *Aquatic Plant Density/Diversity*

  While the aquatic plant diversity on Windward Lake was *average* when compared to other lakes in the County, it is not reflective of the overall quality of the rest of the lake. Besides the macroalga *Chara*, the density of the other plants found in Windward Lake was minimal. While *Chara* does provide habitat for various aquatic organisms and rarely becomes a nuisance; it does not provide the quality habitat that higher aquatic plants can provide. Submersed plants such as largeleaf pondweed (*Potamogeton amplifolius*), American pondweed (*Potamogeton nodosus*), floatingleaf pondweed (*Potamogeton natans*) provide excellent habitat and food sources. Due to their growth habit, these plants rarely become nuisances. Additionally, these aquatic plants are commonly available from aquatic nurseries and are hearty and easy to establish species. By planting aquatic vegetation throughout Windward Lake, species diversity as well as density will be improved upon. Table 6 (Appendix A) lists several species of aquatic plants that could be used to increase the aquatic plant diversity in Windward Lake.

- *Lack of Emergent Vegetation*

  The only shortcomings that LMU staff found at Windward Lake was the lack of emergent shoreline vegetation. These beneficial plants not only provide excellent wildlife habitat; they also help deter erosion due to their deep root systems. Furthermore, by establishing buffers and emergent vegetation around the lake, the number of geese utilizing the lake could decrease. Currently, there are efforts to establish emergent vegetation along the shores of Windward Lake at select locations. However, waterfowl herbivory and other variables have kept this vegetation from becoming established. In the future, these areas should be better protected from the waterfowl herbivory. Furthermore, these emergent shoreline plantings could be expanded inland and incorporated into a buffer area along developed shorelines such as the manicured lawn area on the east shore. This would also help to improve the slight erosion that is occurring along this area of the lake. Table 6 (Appendix A) lists several types of native plant species for use in both emergent and upland applications.