2001 SUMMARY REPORT
of

LAKE CARINA

Lake County, Illinois

Prepared by the

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LAKE IDENTIFICATION AND LOCATION

Lake Name: Lake Carina (formally Cosmopolitan Pit)

County: Lake

Nearest Municipality: Gurnee

Location: T45N, R11E, Section 27, NW 1/4

Watershed: Des Plaines

Sub-Basin: Upper Des Plaines

Major Tributaries: None

Receiving Water Body: None

Surface Area: 23.2 acres

Shoreline Length: Approximately 0.9 miles

Maximum Depth: 24 feet (historically reported to be 30 feet)

Mean Depth: 12 feet (estimated)

Volume: 278.4 acre-feet (estimated)

Lake Type: Borrow Pit constructed in 1957

Elevation: Approximately 655 feet above mean sea level

EXECUTIVE SUMMARY

Lake Carina's water quality was similar to many lakes that were once old gravel pits in the county. Water clarity (as measured by Secchi disk transparency) for Lake Carina averaged 7.12 feet. This is better than the county median of 4.18 feet. The highest readings were found in July (8.37 feet) and August (8.30 feet), while the lowest reading was found in September (5.8 feet).

The 2001 values for total phosphorus (TP) in all samples were well below the county average. In May and August the hypolimnion sample had non-detectable levels (<0.01 mg/L) for TP. Although Lake Carina has low phosphorus levels, LCHD staff did note small algae bloom in the lake during the season.

Conductivity readings, and levels of total dissolved solids (TDS) and total solids (TS) were high. The epilimnion averages for all three parameters were near the highest levels recorded in lakes in the county since 1995. Due to the proximity of Lake Carina to Interstate 94 (less than 150 feet), the likely reason for these high readings is road salt which is applied to the roads in the winter.

The phosphorus trophic state index (TSI) for Lake Carina classified it as a mesotrophic lake (TSIp = 46.88). Old gravel pits are often mesotrophic or even oligotrophic since they are relatively new and have not had time to accumulate nutrients.

Six aquatic plant species, one macro-algae, and several emergent shoreline plants were found in Lake Carina. Due to the relatively steep slopes of the lake bottom, plants were only found primarily within 15-20 feet from the shore. The macro algae, Chara/Nitella, was the dominant macrophyte in Lake Carina. American pondweed, slender naiad, and sago pondweed were the next most abundant plants.

The shoreline of Lake Carina consists mostly of shrubby plant species. At the water's edge, several exotic species (buckthorn, Chinese elm, reed canary grass, and purple loosestrife) were found. None of these exotics were present in large numbers. Their expansion should be monitored. Upland from the lake, buckthorn is also becoming established. In addition, leafy spurge is common in the field west of the lake.

Approximately 276 feet (6%) of the shoreline is severely eroding; 174 feet (3.7 %) is moderately eroding. The severely eroding section is located at the southern end of the lake. This area was being worked on during the 2001 sampling season and was in the process of being reseeded.

LIMNOLOGICAL DATA – WATER QUALITY

Water samples were collected monthly from May - September at the deep-hole location near the lake's center (Figure 1). See Appendix B for water sampling methods.

Lake Carina's water quality was similar to many lakes that were once old gravel pits in the county (Table 1). Some interesting findings were noted.

Water clarity (as measured by Secchi disk transparency) for Lake Carina averaged 7.12 feet. This is better than the county median (where 50% of the lakes are above and below this value) of 4.18 feet. The highest readings were found in July (8.37 feet) and August (8.30 feet), while the lowest reading was found in September (5.8 feet). Higher rainfall amounts in September likely caused the decline in clarity. Overall the water clarity in Lake Carina is good.

Lake Carina stratified only in July and August. The thermocline was at approximately 16 feet in July and 18 feet in August. By September the lake had mixed completely. Dissolved oxygen readings in the epilimnion were good (> 5 mg/L) throughout the season. Anoxic conditions (< 1 mg/L) did occur below approximately 15 feet in July and August. Although no bathymetric map of Lake Carina is known to exist, the volume of the anoxic zone in these months is likely small and not significant to be a concern to aquatic life.

The 2001 values for total phosphorus (TP) in all samples were well below the county average. In May and August the hypolimnion sample had non-detectable levels (<0.01 mg/L) for TP. Most lakes in the county have high TP values (>0.03 mg/L) which lead to nuisance plant and algae growth. Although Lake Carina has low phosphorus levels, LCHD staff did note small algae bloom in the lake during the season.

Conductivity readings, and levels of total dissolved solids (TDS) and total solids (TS) were high. The epilimnion averages for all three parameters were near the highest levels recorded in lakes in the county since 1995. However, all three parameters are related. Conductivity readings are correlated with the levels of TDS in the water. TS is a parameter measuring several types of solids. In Lake Carina, most of the TS is in the form of TDS. Due to the proximity of Lake Carina to Interstate 94 (less than 150 feet), the likely reason for these high readings is road salt which is applied to the roads in the winter. In August and September, an additional parameter, chloride, was measured to determine if the source of the readings was road salt (which usually consists of sodium chloride) or from in-lake sources (i.e, calcium carbonate or bicarbonate). Chloride results were 300 mg/L in August and 400 mg/L in September. These results indicate that the source is likely road salt. The Illinois Environmental Protection Agency has a chloride standard of 500 mg/L.

Figure 1.

The average ratio between nitrogen and phosphorus for Lake Carina was 31:1, indicating a strongly phosphorus-limited system. Nitrogen, as well as carbon, naturally occur in high concentrations and come from a variety of sources (soil, air, etc.) which are more difficult to control than sources of phosphorus. Lakes that are phosphorus-limited may be easier to manage, since controlling phosphorus is more feasible than controlling nitrogen or carbon.

Rain events probably contributed additional sediment or nutrients (like phosphorus) to the lake, which may have influenced the water sample results. Rain occurred within 48 hours prior to water sampling in June (0.48 inches) and September (0.17 inches) as recorded at the Lake County Stormwater Management Commission rain gage in Vernon Hills.

Based on data collected in 2001, standard classification indices compiled by the Illinois Environmental Protection Agency (IEPA) were used to determine the current condition of Lake Carina. A general overall index that is commonly used is called a trophic state index or TSI. The TSI index classifies the lake into one of four categories: oligotrophic (nutrient-poor, biologically unproductive), mesotrophic (intermediate nutrient availability and biological productivity), eutrophic (nutrient-rich, highly productive), or hypereutrophic (extremely nutrient-rich productive). This index is calculated using total phosphorus values obtained at or near the surface. The phosphorus TSI for Lake Carina classified it as a mesotrophic lake (TSIp = 46.88). Eutrophic lakes are the most common types of lakes throughout the lower Midwest, and they are particularly common among man-made lakes. Old gravel pits are often mesotrophic or even oligotrophic since they are relatively new and have not had time to accumulate nutrients. See Table 2 in Appendix A for a ranking of average TSI values for Lake County lakes (Lake Carina is currently #10). This ranking is only a relative assessment of the lakes in the county. The current rank of a lake is dependent upon many factors including lake origin, water source, nutrient loads, and morphometric features (volume, depth, substrate, etc.). Thus a small shallow manmade lake with high nutrient loads could not expect to achieve a high ranking even with intensive management.

In Lake Carina, the IEPA aquatic life impairment index was low, indicating a full degree of support for all aquatic organisms in the lake. In addition, the swimming and recreation use indices showed a full support of these activities. The Health Department did not test for bacteria or other harmful pathogens on Lake Carina in 2001.

LIMNOLOGICAL DATA – AQUATIC PLANT ASSESSMENT

Aquatic plant species presence and distribution in Lake Carina were assessed monthly from May through September 2001 (see Appendix B for methods). Overall, Lake Carina does not have a large aquatic plant population. Six aquatic plant species, one macro-algae, and several emergent shoreline plants were found (see Table 3, below). The average plant sample depth was 5.2 feet. Plants were found primarily within 15-20 feet from the shore with the exception of a small section near the north end of the lake where

a healthy stand of American pondweed, with scattered plants of sago pondweed, was found growing in approximately six to eight feet of water. Plants were found at a maximum lake depth of 11.7 feet. Most aquatic vegetation did not reach the water surface, with the exception of some of the American pondweed. Areal plant coverage in the lake was estimated to be 25%.

The macro algae, Chara/Nitella, was the dominant macrophyte in Lake Carina (Table 4 in Appendix A). American pondweed, slender naiad, and sago pondweed were the next most abundant plants. Early in the season (May and June) curlyleaf pondweed was found as well. Slender naiad was not found until later (July-September). Sufficient light penetration for plant photosynthesis (i.e., the 1% light level) was found to the lake bottom (as measured at the deep point in the lake) in all months, except July when the 1 % light level was at approximately 16 feet. Since light levels appear to be sufficient for plant growth, the likely reason that Lake Carina does not have more aquatic plants is its rocky substrate. This may change over time as the lake accumulates organic matter.

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

Aquatic Plants	
Chara/Nitella	*Chara* sp./*Nitella* sp.
Slender Naiad	*Najas flexilis*
Spiny Naiad	*Najas marina*
American Pondweed	*Potamogeton nodosus*
Curlyleaf Pondweed	*Potamogeton crispus*
Small Pondweed	*Potamogeton pusillus*
Sago Pondweed	*Stuckenia pectinatus*
Shoreline Plants	
Silver maple	*Acer saccharinum*
Prairie Dogbane	*Apocynum cannabinum*
Marsh Milkweed	*Asclepaias incarnuta*
Spikerush	*Eleocharis* sp.
Flowering Spurge	*Euphorbia corollata*
Leafy Spurge	*Euphorbia esula*
Purple Loosestrife	*Lythrum salicaria*
Reed Canary Grass	*Phalaris arundinacea*
Swamp Smartweed	*Polygonum coccineum*
Pickeral Weed	*Pontederia cordata*
Buckthorn	*Rhamnus cathartica*
Willow	*Salix sp.*
Softstem Bulrush	*Scirpus validus*
Cattail	*Typha* sp.

Figure 2

Figure 3

LIMNOLOGICAL DATA – SHORELINE ASSESSMENT

A shoreline assessment was conducted in May 2000 to determine the condition of the lake shoreline (see Appendix B). Of particular interest was the condition of the shoreline at the water/land interface.

The shoreline of Lake Carina consists mostly of shrubby plant species (78%; see Figure 2). At the water's edge, several exotic species (buckthorn, Chinese elm, reed canary grass, and purple loosestrife) were found. None of these exotics were present in large numbers. Their expansion should be monitored. Removal of buckthorn and purple loosestrife is recommended before stands become too large. Upland from the lake, buckthorn is also becoming established. In addition, leafy spurge is common in the field west of the lake. Other shoreline types include sandy/beach areas (9%) and rip-rap (7%). The southern shoreline (6% of total) was bare soil at the time of the shoreline assessement, but has since been planted with grasses on top of an erosion blanket.

Approximately 276 feet (6%) of the shoreline is severely eroding; 174 feet (3.7 %) is moderately eroding (see Figure 3). The severely eroding section is located at the southern end of the lake. This area was being regraded and seeded during the 2001 sampling season. Bare soil was exposed until approximately August, when straw erosion blankets were installed. However, rill erosion continued along this shoreline in August and September. The moderately eroding section is located along the northeastern section of the lake (see map).

LIMNOLOGICAL DATA – WILDLIFE ASSESSMENT

Good wildlife populations, primarily birds, were found on and around Lake Carina (see Table 5, below). See Appendix B for methods. Good wildlife habitats exist around Lake Carina. Many of the birds noted were observed using the prairie and shrub habitats around the lake.

No fish surveys were completed by the Lake County Health Department during 2001.

Table 5. Wildlife species observed on Lake Carina, May – September, 2001.

Birds	
Canada Goose	*Branta canadensis*
Mallard	*Anas platyrhnchos*
Ring-billed Gull	*Larus delawarensis*
Tern	*Sterna sp.*
Belted Kingfisher	*Megaceryle alcyon*
Common Flicker	*Colaptes auratus*
Red-bellied Woodpecker	*Melanerpes carolinus*
Downy Woodpecker	*Picoides pubescens*

Table 5. Wildlife species observed on Lake Carina, May – September, 2001 (cont'd).

Eastern Kingbird	*Tyrannus tyrannus*
Barn Swallow	*Hirundo rustica*
American Crow	*Corvus brachyrhynchos*
Blue Jay	*Cyanocitta cristata*
Black-capped Chickadee	*Poecile atricapillus*
Catbird	*Dumetella carolinensis*
American Robin	*Turdus migratorius*
Red-eyed Vireo	*Vireo olivaceus*
Warbling Vireo	*Vireo gilvus*
Yellow Warbler	*Dendroica petechia*
Common Yellowthroat	*Geothlypis trichas*
Red-winged Blackbird	*Agelaius phoeniceus*
Common Grackle	*Quiscalus quiscula*
Northern Oriole	*Icterus galbula*
Northern Cardinal	*Cardinalis cardinalis*
American Goldfinch	*Carduelis tristis*
Field Sparrow	*Spizella pusilla*
Song Sparrow	*Melospiza melodia*
Mammals	
Muskrat	*Ondatra zibethicu*s
Amphibians	
American Toad	*Bufo americanus*
Reptiles	
None noted.	
Insects	
Cicadas	
Dragonfly	
Damselfly	

EXISTING LAKE QUALITY PROBLEMS AND MANAGEMENT SUGGESTIONS

Lake Carina has good water quality compared to many of the other lakes in the county. The lake and surrounding area have good potential for native plant restoration, public recreation, or a combination of these opportunities.

- *Lack of a Quality Bathymetric Map*

  A bathymetric (depth contour) map is an essential tool for effective lake management since it provides critical information on the morphometric features of the lake (i.e., acreage, depth, volume, etc.). This information is particularly important when intensive management techniques (i.e., chemical treatments for plant or algae control, dredging, fish stocking, etc.) are part of the lake's overall management plan. Currently, no such map exists for Lake Carina.

- *High Conductivity Readings and Concentrations of Chlorides and Total Dissolved Solids*

  Water quality samples showed high conductivity readings and high levels of chlorides and total dissolved solids. These readings are likely the result of stormwater runoff from adjacent Interstate 94. The long-term impacts of these parameters on the lake's ecosystem are unknown.

- *Invasive Shoreline Plant Species*

  At the water's edge several exotic species (buckthorn, Chinese elm, reed canary grass, and purple loosestrife) were found. None of these exotics were present in large numbers. Their expansion should be monitored. Removal of buckthorn and purple loosestrife is recommended before stands become too large. Upland from the lake buckthorn is also becoming established. In addition, leafy spurge is common in the field west of the lake.