2000 SUMMARY REPORT
of
Owens Lake

Lake County, Illinois

Prepared by the

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TABLE OF CONTENTS

LAKE IDENTIFICATION AND LOCATION

Lake Name: Owens

State: IL

County: Lake

Nearest Municipality: Wauconda

Township/Range: T44N, R10E, Section 29, SE ¼

Basin Name: Fox River Watershed

Subbasin Name: Long Lake

Major Tributaries: Small Unnamed Stream on Southeastern Shoreline

Receiving Water Bodies: Davis Lake

Surface Area: 5.0 acres

Shoreline Length: 0.4 miles

Maximum Depth: 9.0 feet

Mean Depth: 4.5 feet

Storage Capacity: 22.5 acre-feet

Lake Type: Impoundment (flooded wetland - 1941)

Watershed Area: Unknown

LIMNOLOGICAL DATA – WATER QUALITY

Samples were collected at the deep hole location from 3 feet below the surface and 2 feet above the bottom (5-6 feet) (Figure 1). Owens Lake was thermally stratified during the entire course of the study (except September when fall turn over had occurred). This means that the lake was divided into warm upper water (epilimnion) and cool lower water (hypolimnion). The strength of stratification dictates whether these layers mix. Thermal stratification is measured in relative thermal resistance to mixing (RTRM). At an RTRM of 20, layers generally do not mix. On Owens Lake, peak RTRM ranged from 28 in August to 53 in July. Normally, thermal stratification at a deep enough depth to prevent any of the high nitrogen and phosphorus concentration in the hypolimnion (released during biological and chemical processes) from mixing into the epilimnion. However, due to the shallow depth of the epilimnion in Owens Lake these nutrients were present in the surface waters. The proximity of these nutrients to the surface waters caused a variety of water quality problems. During turn over, these nutrients are mixed throughout the lake, which can cause late fall/winter/early spring algae blooms. The effects of fall turnover on Owens are unknown at this time and were out of the scope of this study.

The region in between the epilimnion and hypolimnion is called the metalimnion and is an area of changing water temperature and dissolved oxygen (D.O.) levels. Due to the process of stratification, oxygen is unable to mix into the hypolimnion. Therefore, as oxygen consuming biological processes and chemical (such as decomposition of plant material and biological respiration) increase, oxygen is stripped form the water and becomes more anoxic as the summer progresses. Within the metalimnion is the oxic voume, which is the point at which D.O. drops below 1.0 mg/L. At this level, no aquatic organisms (except non-photosynthetic bacteria) can live. The anoxic boundary becomes more shallow as summer progresses (the epilimnion becomes smaller; hypolimnion becomes larger). In Owens Lake the anoxic boundary in May was at 7.0 feet and was at its shallowest in July at 2.5 feet. As a result, the volume of the lake that can be inhabited by aquatic life was very small in comparison to the whole lake volume. Additionally, D.O. levels in the epilimnion were dangerously low (below 5.0 mg/L) in August and September. In August, D.O. levels were so low that even at the surface (where water is most oxygenated) concentrations were near hypoxia (2.18 mg/L). These low D.O. levels can cause fish stress. Continual stress can eventually lead to mortality. In August, this continual stress led to a large fish kill consisting of several hundred blue gill and a few large bass. These low oxygen levels are not problematic unless sport fishing is a management concern. Many non-game fish species are able to withstand these low oxygen conditions but these species are not of a high quality nature. Furthermore, due to shallow morphometry and high biological and chemical oxygen demands, Owens will continue to experience low D.O. conditions along with resulting fish kills.

Overall, Owens Lake has *poor* water quality. In general, Secchi disk readings are a good indicator of water quality. The average Secchi disk depth on Owens was 4.38 feet (Lake County avg. is 5.0 feet). The deepest Secchi readings occurred in May (6 feet). The shallowest Secchi disk depth was 3.15 feet (June). These below average Secchi depths were caused by debris in the water from die off and decomposition of aquatic

vegetation/filamentous algae. The lake wide filamentous algae and duckweed/watermeal blooms that followed often interfered with Secchi disk readings. At times these blooms were several inches thick (see *Limnological Data – Aquatic Plant Assessment*). Additionally, these thick blooms decreased light penetration. This resulted in aquatic plant die off, which lead to elevated levels of decomposing organic matter in the water column, which brought about increased nutrient concentrations via release from the dead pant material.

Besides decreasing Secchi disk depth, lake wide algal blooms and resulting organic debris negatively impacted other water quality parameters. The average total suspended solids (TSS) over the course of the study was 11.0 mg/L. TSS increased over the duration of the study as algal blooms increased from 2 mg/L in May to a high of 31.0 mg/L in August, which is over 3.5 times the Lake County average (8.6 mg/L: 1995-2000 samples). Measurements of other types of solids, unaffected by algae growth, were below or near the County average. This further reinforces that the elevated TSS and decreased Secchi disk readings were due to algal blooms and organic debris in the water . Other water quality parameters were at or near the Lake County average (Table 1).

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 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. Most lakes in Lake County are phosphorus limited. Owens Lake had a TN:TP ratio of 18:1, which means that the lake is slightly phosphorus limited. However, phosphorus concentrations in Owens Lake were high and this low ratio was due to high concentrations of nitrogen. Consequently, as phosphorus concentrations in Owens Lake increased so did the degree of algae growth. With the exception of May and June, the phosphorus concentration were near double the County average (0.066 mg/L) or greater. Furthermore, soluble reactive phosphorus (SRP), which is the form of P most available to algae, was in problematic concentrations in the epilimnion (Table 1). Typically SRP is undetectable in the epilimnion. However, since the volume of the epilimnion was so shallow, SRP from the hypolimnion could easily mix into surface waters. In general, the phosphorus concentration started to drastically increase in June. This coincides with the die off of massive stands of curly leaf pondweed and the decreasing depth of the epilimnion. Phosphorus concentrations were highest in August with 0.229 mg/L, which is 3.8 times the County average. This coincides with the greatest extent of algal blooms. Additionally, other water quality parameters, which are closely linked to phosphorus concentrations and algae growth, such as Secchi depth and TSS, were also problematic in during these months.

The source of phosphorus in a lake can be either external or internal. Internal sources are a common source in manmade lakes, which by their nature contain rich organic sediments. Additionally, biological and chemical processes (such as decomposition, sediment resuspension, etc) release phosphorus from the sediment and organic debris.

Since stratification occurs at an abnormally shallow depth at Owens Lake, released phosphorous can be utilized by algae in the surface waters. The other main input of phosphorus is from sources outside of the lake (external). These external inputs consist of a variety of sources. They can include fertilizer runoff, failing septic systems and erosion. However, with regard to Owens Lake, these external sources are minor in comparison to internal sources. Rain data shows that during periods of elevated rainfall (spring) phosphorus concentrations were actually lower than when there was lower rainfall (summer). The opposite would occur (increasing rainfall would bring increased phosphorus concentrations) if nutrients were coming from external source.

Another way to look at phosphorus levels and how they affect productivity of the lake is the use of a Trophic State Index (TSI) based on phosphorus. TSI is based on phosphorus, chlorophyll *a*, and Secchi disk depth to classify and compare lake productivity levels (trophic state). The phosphorus TSI is setup so the higher the phosphorus concentration the greater amount of algal biomass and as a result, a higher trophic state. Based on a TSI phosphorus value of 73.7, Owens Lake is classified as hypereutropic (>70 TSI). This means that the lake is a highly productive system that has above average nutrient levels and high algal biomass (growth). Field observations reinforce that Owens Lake is hypereutrophic and is choked with excessive vegetation and algae growth, which are a sign of an unhealthy, over-productive system. Most manmade lakes in the county fall into eutrophic (TSI values >50 <70). Out of all the lakes in Lake County studied by the LMU since 1988, Owens Lake ranks 78th out of 86 lakes based on average TSI (Table 2). Based on lakes studied in 2000, Owens Lake ranked 26th out of 32.

TSI values along with other water quality parameters can be used to make other analysis of Owens Lake based on water quality standards and use impairment indexes established by the Illinois Environmental Protection Agency (IEPA). Using the TSI and IEPA standards, Owens Lake has water quality standard impairments based on high phosphorus concentrations and low D.O. levels. Furthermore, impairment due to noxious aquatic plant growth was listed as *High*. Based on indices such as swimming use guidelines, Owens Lake is categorized as providing only *Partial* support. This is due to poor Secchi disk readings and high phosphorus concentrations. Additionally, due to massive surface mats of algae and duckweed/watermeal, swimming use would be near impossible and this impairment should be listed as *Nonsupport*. Under recreational use impairment, Owens Lake was categorized as *Nonsupport*. This is due to a high TSI value and high concentration of suspended sediments, both of which result in poor visibility and contribute to an overall reduction in use of the lake. In the case of aquatic life use, Owens Lake was categorized as providing *Full* support. However, field observations of excessive amounts of vegetation and resulting fish kills do not support this categorization. Based on the above indices, Overall Use support on Owens Lake is categorized as *Partial* support.

LIMNOLOGICAL DATA – AQUATIC PLANT ASSESSMENT

Aquatic plant surveys were conducted every month for duration of the study (*Appendix A* for methodology). The extent to which these plants grow is largely dictated by light availability. Plants need at least 1% of surface light levels in order to survive. Based on the depth of 1% light level, depth at which plant growth could occur in Owens Lake varied on a monthly basis. Light measurements show that aquatic plants could have grown from a depth of 4.2 feet (July) to a depth greater than 8 feet (May). Due to thick algae mats these light penetration measurements are not representative of the overall conditions on Owens Lake. However, due to the shallow nature of Owens Lake plants grew throughout the lake regardless of depth as enough light penetration occurred in May.

From the shore to depths of 6 feet there was low species diversity of aquatic vegetation (Table 3). Furthermore, all vegetation sampled after July was in poor condition and was in various stages of decay. This was due to lack of light penetration caused by the massive algae and duckweed/watermeal mats. Coontail was the only plant found deeper than 6.5 feet. This phenomenon, with coontail occurring at all depths, occurred in all months of the study. Coontail plants deeper than 6.5 feet were reduced in structure and had a noticeable dark appearance to them due to poor light availability. In general this is typical of coontail found at deeper depths.

The aquatic plant population of Owens Lake is drastically unbalanced (Table 4). Coontail was the most abundant aquatic plant and was found at 92% of all sites sampled. Other species that occurred in high numbers included common duckweed (61%) and watermeal (80%). These free-floating species are able to inhabit all parts of the lake and were unaffected by coontail growth because they grow on the surface of the water. These two species, along with filamentous algae, significantly reduced light penetration, which led to several water quality problems including a major fish kill. As a result of the aggressive nature of coontail and poor light penetration, other species such as American elodea and white water crowsfoot occurred in low densities. On a positive note, there was no Eurasian water milfoil (northern water milfoil was found but poses no real threat). This is more than likely due to the secluded nature of Owens Lake. Once access to Owens (and Davis) is made easier with the installation of the access road/trail, signage should be posted educating the public about Eurasian water milfoil, identification, ecological impacts, and the steps that should be taken to prevent its spread. Owens Lake has enough problems without Eurasian water milfoil.

Table 3. Aquatic Plants Found in Owens Lake (May – September 2000).

Coontail	*Ceratophyllum demersum*
American Elodea	*Elodea canadensis*
Common Duckweed	*Lemna minor*
Northern Water Milfoil	*Myriophyllum sibiricum*
White Water Lily	*Nymphaea fuberosa*
Curly Leaf Pondweed	*Potamogeton crispus*
Leafy Pondweed	*Potamogeton foliosus*
Flatstem Pondweed	*Potamogeton zosterifomis*
Sago Pondweed	*Stuckenia pectinatus*
White Water Crowsfoot	*Ranunculus longirostris*
Watermeal	*Wolffia columbiana*

LIMNOLOGICAL DATA – SHORELINE ASSESSMENT

Overall, the shoreline is in a "natural" state. Some of the plants located around the shore are invasive species (i.e., buckthorn, garlic mustard, multiflora rose) and should be dealt with accordingly. However, overall there was good diversity of plants in the areas surrounding the lake. Unfortunately, due to recent land management practices (construction of a forest preserve roads) some of this habitat has been destroyed. Impacts to the shoreline and the surrounding flora should be kept to minimum during construction of these roads (silt fences, etc.).

LIMNOLOGICAL DATA – WILDLIFE ASSESSMENT

Wildlife observations were made on a monthly basis during water quality and plant sampling actives. All observations were visual. Several types of waterfowl were observed during the course of the study (Table 5). Included in these were the pied-billed grebe and the black-crowned night heron, which are Illinois threatened and endangered species, respectively. Additionally, immature black crowned night herons were also observed on Owens, indicating that there is likely a nesting pair near by. Overall, Owens Lake provides excellent habitat for birds and waterfowl. As with adjacent Davis and Schreiber Lakes, wildlife refuge/habitat is Owens best use. There are several shrub areas that provide habitat for smaller bird and mammal species. Additionally, the lake is surrounded by stands of mature hardwood trees that also provide habitat for a variety of

wildlife species. As stated previously, several invasive plants/shrubs have been noted in several areas around the lake. These plants are seldom used by wildlife for food or shelter and should be eliminated before they spread and displace other native and more desirable plant species.

As stated above, due to the low D.O. levels in the lake, the presence of quality game fish is limited. Additionally, fish were consistently observed to be near the surface the water. This is indicative of Low D.O. conditions and poor fishery health. Historically, Owens has experienced several fish kills. During the course of the study a major fish kill was observed and consisted of a few large bass and hundreds of panfish. With dangerously low D.O. levels occurring for several months throughout the summer this will continue to be a common occurrence on Owens Lake. These summer kills, likely winterkills have probably resulted in poor species composition and overall fishery health. A fishery study would need to be conducted in order to determine the exact health of the fishery.

Table 5. Observed Wildlife Species on Owens Lake (May - September 2000).

Birds/Waterfowl	
Pied-billed Grebe+	*Podilymbus podiceps*
Double Crested Cormorant	*Phalacrocorax auritus*
Mute Swan	*Cygnus olor*
Mallard	*Anas platyrhnchos*
Great Blue Heron	*Ardea herodias*
Green Heron	*Butorides striatus*
Black-crowned Night Heron*	*Nycticorax nycticorax*
Belted King Fisher	*Megaceryle alcyon*
Red-winged Blackbird	*Agelaius phoeniceus*
Mammals	
Beaver	*Castor canadensis*

+ Threatened in Illinois
* Endangered in Illinois

EXISTING LAKE QUALITY PROBLEMS

Owens Lake is best used as a wildlife area and is well suited for anything else. Little should be done from a management standpoint except to maintain current quality and limit impacts from external sources. However, there are a few management concerns with regard to Owens.

- Low Dissolved Oxygen

  Due to the shallow morphometry and massive biological and chemical oxygen demand during mid-summer months, Owens Lake experiences low dissolved oxygen levels. D.O. levels were dangerously low July, August, and September. Low D.O. levels can cause fish stress and if continual, stress can eventually lead to fish mortality. Furthermore, the volume of the epilimnion (oxic waters) at Owens Lake is very small during several months and most of the lake volume is contained in the hypolimnion (anoxic waters). This does not leave an appreciable volume of the lake for habitation by aquatic life. Historically, Owens Lake has experienced fish kills. Owens Lake still experiences fish kills and it's almost certain that Owens will continue to experience fish kills. This has probably led to a very poor quality sport fishery. If fishing were to become a priority at Owens Lake, besides a stocking program, the low D.O. problems would have to be remedied. This could be accomplished via an aerator. However, this will probably cause wide spread, noxious planktonic algae blooms, on top of the extensive filamentous mat blooms which already occur on Owens. Based on the low (if not nonexistent) usage of Owens, and the inevitable side effects, an aeration system is not justified.

- Excessive Aquatic Vegetation

  From a plant/algae management standpoint, it is advisable that Owens be left alone. This is largely due to the usage of the site versus the cost of management. Owens Lake is a shallow lake and consequently has several problems, in particular excessive plant/algae growth. More than likely, these problems have plagued Owens Lake for a long time. Furthermore, without very intensive management, these problems will continue. Even with intensive management, it is possible that the reduction of the plant problem could bring about a more severe algae problem (and visa-versa). Below are management suggestions on how the excessive plant/algae problem might be addressed.

  A key to a healthy lake is a well-balanced aquatic plant population. Owens Lake ahs a very unbalanced aquatic plant population and therefore several

water quality parameters suffer. Two species, coontail and watermeal, dominate Owens Lake. At times, coverage by coontail and watermeal is almost 100% of the surface area of the lake. These two species, especially coontail, are the cause of problems such as low D.O., unhealthy fishery, and nutrient enrichment. In order to improve Owens Lake, coontail densities could be reduced. This can best be accomplished by the use of aquatic herbicides. All of the lake would not need to be treated, only enough to bring densities down to 30-40% surface area coverage. This could be accomplished using 2,4-D. This could be applied in either liquid form or slow release pellet form. To reduce coontail densities to 30% surface coverage (treat 3 acres), treatment would cost approximately $1050-1275. To reduce plant densities to 40% surface coverage (treat 3.5 acres), treatment cost would be approximately $1,225-$1,140. Treatment should not be done all at once. This can cause severe D.O. depletions. Instead, treatment should be divided up into two parts with the treatments about two weeks apart. Application of herbicides will not totally eliminate the coontail problem. Treatment will have to be made each year, possibly multiple time in a year, depending on re-growth.

Options for control of watermeal (and duckweed) infestation are limited. Some herbicides claim to be effective on these two problematic species, but field applications area rarely successful. Typically, once a lake has a duckweed/watermeal problem as severe as Owens Lake, that problem does not go away, it can only be temporarily alleviated.

Treatment of the filamentous algae could prove to be problematic. Filamentous algae can be very difficult to treat depending on the species and thickness of the mat. The use of algaecides (copper sulfate or chelated copper) could be used to reduce the mats. As with the herbicides, treatment should not be done all at once. Additionally, these algaecides could be applied at the same time as the herbicides to save on labor costs. Cost for algaecide application would differ based on product but would cost approximately $170-$228 per application. This is based on a treatment volume of 6 acre-feet. Multiple applications might be necessary over the course of a season due to re-growth.