

1.0 Introduction

1.1 GLWMO Water Quality Policies and Goals

The Grass Lake Watershed Management Organization (GLWMO) water quality goals as stated in the 2001 GLWMO *Watershed Management Plan* (WMP) are to:

- Manage the GLWMO's water resources on a regional basis to meet the goals established for each lake
- Maintain or restore the water quality of the GLWMO lakes to allow for the continuation or enhancement of existing recreation activities and habitat.

To accomplish its goals, the GLWMO established a water body classification system and determined the respective roles of the GLWMO and the cities in water quality management.

1.1.1 Policies for Lake Owasso Water Quality

1. All water bodies in the GLWMO will be classified according to either the GLWMO lake and pond classification system or the GLWMO wetland classification system. The GLWMO lake and pond classification system contains five categories that will be used by the GLWMO and member cities to classify lakes and ponds, defined as follows (see Table 5-1 of the *2001 WMP* for detailed descriptions of the categories and water quality parameters associated with each category):

Category I. Water bodies in this category are typically used for swimming and other direct contact recreational activities. These water bodies have the highest/best water quality and are usually the most popular water bodies with the public. Category I lakes are managed to provide water quality capable of supporting direct contact activities, such as swimming, scuba diving, snorkeling, and waterskiing. A reasonable water quality goal for Category I lakes is a minimum Secchi disc transparency of 1.0 meters, and a summer average transparency of at least 1.6 meters. Transparencies in this range are considered characteristic of moderately eutrophic (i.e., nutrient rich) lakes.

Category II. Water bodies in this category are typically used for incidental contact recreational activities such as boating and fishing that involve indirect contact with lake water. These water bodies have poorer water quality than Category I water bodies, but are still popular with the public.

Category III. Water bodies in this category serve important functions for wildlife habitat and aesthetic enjoyment, and may also provide opportunities for warm-water fishing, provided winter kill does not occur. These water bodies may have poorer water quality than Category I and II water bodies and typically are not viewed as swimmable.

Category IV—Nutrient Traps. Water bodies in this category are intended to reduce downstream loading of phosphorus and other nutrients that contribute to water pollution. These ponds are designed to have phosphorus removal efficiencies of at least 50 percent.

Category V—Sediment Traps. These water bodies are similar to Category IV water bodies, but are too small to effectively remove a significant fraction of nutrients. These basins will generally have phosphorus removal efficiencies of less than 50 percent.

2. Category I-III water bodies will be managed for non-degradation of water quality, with allowance for natural variability. This means that developments and city projects should be designed to preserve existing water quality so far as reasonably possible, even when existing water quality is better than the water body classification might otherwise infer. To conform to this policy, implementation of best management practices will be required during development and other types of construction.
3. Category I-III water bodies will also be managed to preserve and promote bio-diversity and improve aesthetics.
4. The GLWMO labeled water bodies as either WMO-managed, cooperatively managed, or city managed. “WMO-managed” means the WMO is responsible for all water quality management activities, including classification, setting numeric goals, monitoring, tracking data, etc. “Cooperatively managed” means the cities are responsible for all water quality management activities, except for classification, which is the WMO’s responsibility. “City managed” means the cities are responsible for all water quality management activities.

The GLWMO considers Lake Owasso, Lake Wabasso, Snail Lake, and grass Lake to be WMO-managed resources. Therefore the GLWMO established the following water quality policies for Lake Owasso:

1. Lake Owasso will be managed for non-degradation of water quality.
2. Lake Owasso will be managed to preserve and promote bio-diversity and improve aesthetics.

3. The GLWMO is responsible for all water quality management activities in and around Lake Owasso.
4. The action level for Lake Owasso is a minimum Secchi Disc transparency of 2.45 meters.
5. The GLWMO will monitor Lake Owasso using survey level water quality monitoring, and aesthetic and habitat monitoring, as a minimum. If the water quality action level is reached, Management Level and Intensive water quality monitoring will be performed.
6. Improve communications between the GLWMO and Ramsey County by coordinating with Ramsey County regarding proposed lake management actions and to seek information annually from Ramsey County regarding future lake management actions.
7. Manage Lake Owasso such that its water quality matches its intended use.

1.1.2 Lake Owasso Water Quality Goals

Based on its existing and desired use, the GLWMO classified Lake Owasso as a Category I water body.

1.1.2.1 Total Phosphorus

Phosphorus generally controls the growth of algae in lake systems and it is a useful measure to evaluate the lake's overall water quality. A summer-average total phosphorus goal of 45 µg/L was established by the GLWMO for Lake Owasso, based on the desired use of the lake and public perception. A total phosphorus goal of 45 µg/L is less stringent than the MPCA total phosphorus water quality criterion of 40 µg/L for deep lakes in the North Central Hardwood Forests ecoregion (Table 1-1).

The mean summer-average total phosphorus concentration for Lake Owasso is 54 µg/L for the period of record (1973 to 2008). This mean long term summer-average indicates that Lake Owasso currently does not meet the GLWMO's goal for in-lake phosphorus concentration. However the 2008 summer average does meet the GLWMO's goal for in-lake phosphorus concentration and the MPCA's total phosphorus concentration criterion for deep lakes (Table 1-1).

Table 1-1 Lake Owasso Summary of Historical Water Quality Data

Water Quality Parameter	Mean Summer-Average for Period of Record (1973-2008)	2008 Summer Average	GLWMO Existing Goal	GLWMO Action Level	MPCA's Deep Lake Standard
Total Phosphorus	54 µg/L	32 µg/L	45 µg/L	--	40 µg/L
Secchi Disc	6.2 ft (1.9 m)	6.9 ft (2.1 m)	5.2 ft (1.6 m)	8.0 ft (2.45 m)	4.6 ft (1.4 m)
Chlorophyll <i>a</i>	15.7 µg/L	13 µg/L	20 µg/L	--	14 µg/L

1.1.2.2 Water Clarity (Secchi Disc)

Transparency is measured by submerging a black and white patterned disc (a Secchi disc) into the lake. The depth at which the Secchi disc disappears determines the lake's transparency. A summer-average water clarity goal of 1.6 meters (5.2 feet) Secchi disc transparency was established by the GLWMO for Lake Owasso. The GLWMO's current water clarity goal is more stringent than the MPCA's water quality criterion for water clarity of 1.4 meters (4.6 feet) for deep lakes in the North Central Hardwood Forests ecoregion.

The mean summer-average water transparency for Lake Owasso is 1.9 meters (6.2 feet) for the period of record (1973 to 2008) and 2.1 meters (6.9 feet) 2008. The mean summer-average for the period of record and specifically for 2008 indicates that Lake Owasso currently meets the GLWMO's water clarity goal as well as the MPCA clarity criterion (Table 1-1). However, the recent summer average clarity is less than the GLWMO's "action level" for Lake Owasso. Additionally, over the past 6 years (2003-2008), there has been a decrease in the water clarity in Lake Owasso, with an average summer transparency of 1.7 meters, just meeting the existing GLWMO goal and not meeting the "action level" established for Lake Owasso. Because the summer average transparency has fallen below the GLWMO "action level", the GLWMO is responsible for conducting management level and intensive water quality monitoring, as established in the 2001 *WMP*. These actions also include the completion of this study to evaluate the water quality in Lake Owasso and develop management options that will help improve the lake's water quality.

1.1.2.3 Chlorophyll *a*

Chlorophyll *a* is the main photosynthetic pigment in algae. Therefore, the amount of chlorophyll *a* in the water indicates the abundance of algae present in the lake. GLWMO's chlorophyll *a* goal of 20 µg/L for category I water bodies is less stringent than the MPCA chlorophyll *a* water quality criterion of 14 µg/L for deep lakes in the North Central Hardwood Forests ecoregion (Table 1-1).

The mean summer-average chlorophyll *a* concentration for Lake Owasso is 15.7 µg/L for the period of record (1973-2008) and 13 µg/L in 2008. As a result the 2008 summer average chlorophyll *a* concentration in Lake Owasso currently meets the goal established by the GLWMO and the MPCA's deep lake chlorophyll *a* criterion (Table 1-1).

1.2 Lake Owasso and the Impaired Waters List

The MPCA 303(d) Impaired Waters list results from the federal Clean Water Act, which requires states to define water quality standards, to identify waters that are impaired or are not meeting these standards, and to develop plans to improve the water quality in these impaired waters such that the standards are met. These standards vary depending on the designated use of the water body, such as for drinking water, fishing, swimming, irrigation, or industrial purposes. In Minnesota, the MPCA is responsible for the enforcement of the Clean Water Act in Minnesota. Every 2 years, the MPCA is required to publish an updated list of impaired waters that do not meet the state's water quality standards.

For all water bodies listed on the 303(d) Impaired Waters list, the MPCA requires that a strategy is developed to improve the quality of impaired waters by conducting a Total Daily Maximum Load (TMDL) study for each pollutant that causes a water body to fail to meet state water quality standards. TMDLs are often described as the maximum amount of a pollutant that can enter a surface and/or groundwater such that water quality standards are met. A TMDL study identifies point and nonpoint sources of each pollutant for which the water body fails to meet water quality standards. Water quality sampling and computer modeling are generally used to determine how much each pollutant source must reduce its contribution to assure the water quality standard is met.

Lake Owasso was listed on the MPCA's 2008 303(d) Impaired Waters List for mercury in fish tissues, impacting aquatic consumption. The lake was included as part of the statewide mercury TMDL which was approved by the EPA in 2008. Lake Owasso is not currently listed on the MPCA's 2008 303(d) Impaired Waters List for any other water quality impairments.

In the context of the 303(d) Impaired Waters list, Lake Owasso is considered a deep lake by the MPCA. The current phosphorus criterion is 40 µg/L for deep lakes in the Central Hardwood Forest ecoregion of Minnesota. The MPCA outlines the water quality criteria in the Minnesota Rules, Chapter 7050—Water Quality Standards for Protection of Waters of the State (amended in 2008).

Although Lake Owasso is not currently listed on the MPCA 303(d) Impaired Waters list, the average summer water quality in Lake Owasso for the past decade suggests that the lake could be listed on

the MPCA 303(d) Impaired Waters list in the future. The water quality monitoring, computer modeling, and remedial measures recommended as a part of this UAA would be useful in keeping Lake Owasso off the MPCA's 303(d) Impaired Waters list or during the completion of a future TMDL study for Lake Owasso, should this be required.

1.3 Overview of Lake Use

Lake Owasso is considered one of the GLWMO's most significant lakes. As a Category 1 lake, the lake is typically used for swimming and other direct contact activities as well as other recreational activities such as boating, fishing, wildlife habitat, and aesthetic viewing. Lake Owasso is a popular public resource, and there has been considerable public interest in the quality of Lake Owasso, as is evidenced by an active lake association.

There are currently two public access points on the lake, both located on the north side of the lake along North Owasso Boulevard. The first access point is the boat launch on the northeast corner of the lake. The second access point is the public swimming beach located just to the west of the boat launch.

Historically, extreme lake levels have been a concern in Lake Owasso. Ramsey County operated a series of groundwater pumping stations to augment low water levels until a state rule prohibited the use of groundwater to control lake levels. High water levels in the lake have been addressed with the construction of a controlled outlet.

1.4 Public Perception of Lake Water Quality

In March 2007, a survey was sent to 580 homeowners, deeded-access residents, and those living nearby (non-resident) to Lake Owasso. A total of 188 responses were received (141 responses were residents/deeded-access while 47 were non-resident responses). The purpose of the survey was to gauge how people living around Lake Owasso use the lake, what they value about it, and what they would like to improve in the lake.

This section summarizes some of the key conclusions of this survey as they pertain to the current and desired uses of Lake Owasso, and homeowners' perceptions of the current water quality of their lakes. The complete version of the surveys and homeowners' responses can be found in Appendix A of this report.

1.4.1 Pubic Use of Lake Owasso and Perception of Water Quality

Some of the most notable questions and answers from the Lake Owasso Homeowners' Survey are included below.

1. In the past 12, months, how have you used Lake Owasso?

Most of the survey respondents indicated that the most common uses of Lake Owasso are observation of nature (both scenery and wildlife) and activities such as swimming, fishing, boating, and water skiing. Lakeshore and deeded-access residents more commonly used the lake for the various water sports where as those residents living near the lake, but who do not have direct access to the lake, predominantly enjoy the scenery and wildlife viewing the lake provides. In addition, many residents use the lake in the winter when it is ice-covered.

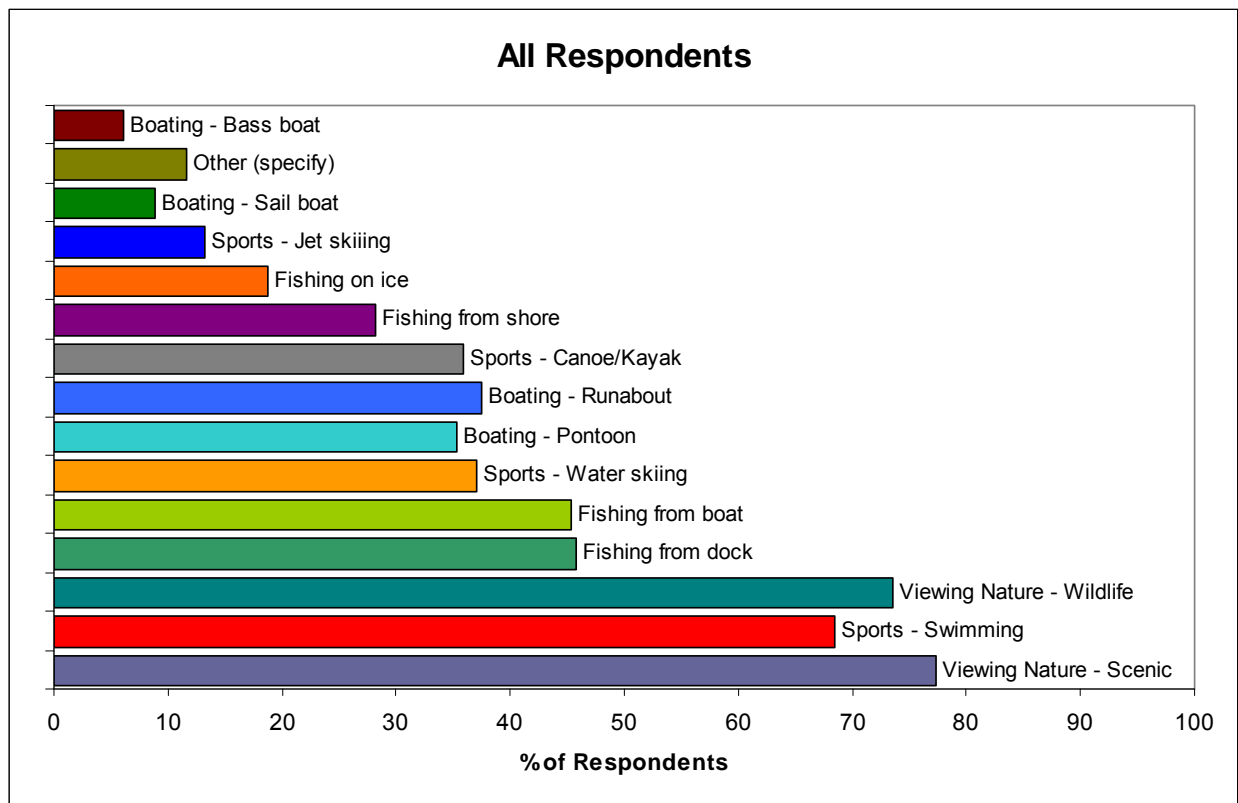


Figure 1-1 Recreational Uses of Lake Owasso

2. How often in the past 12 months have you used Lake Owasso for recreation?

Most survey respondents indicate that they have used Lake Owasso for recreation in the past year, although there were some respondents who do not use the lake at all. Typically, lakeshore and deeded-access residents used the lake more frequently than those who do not have direct access to the lake.

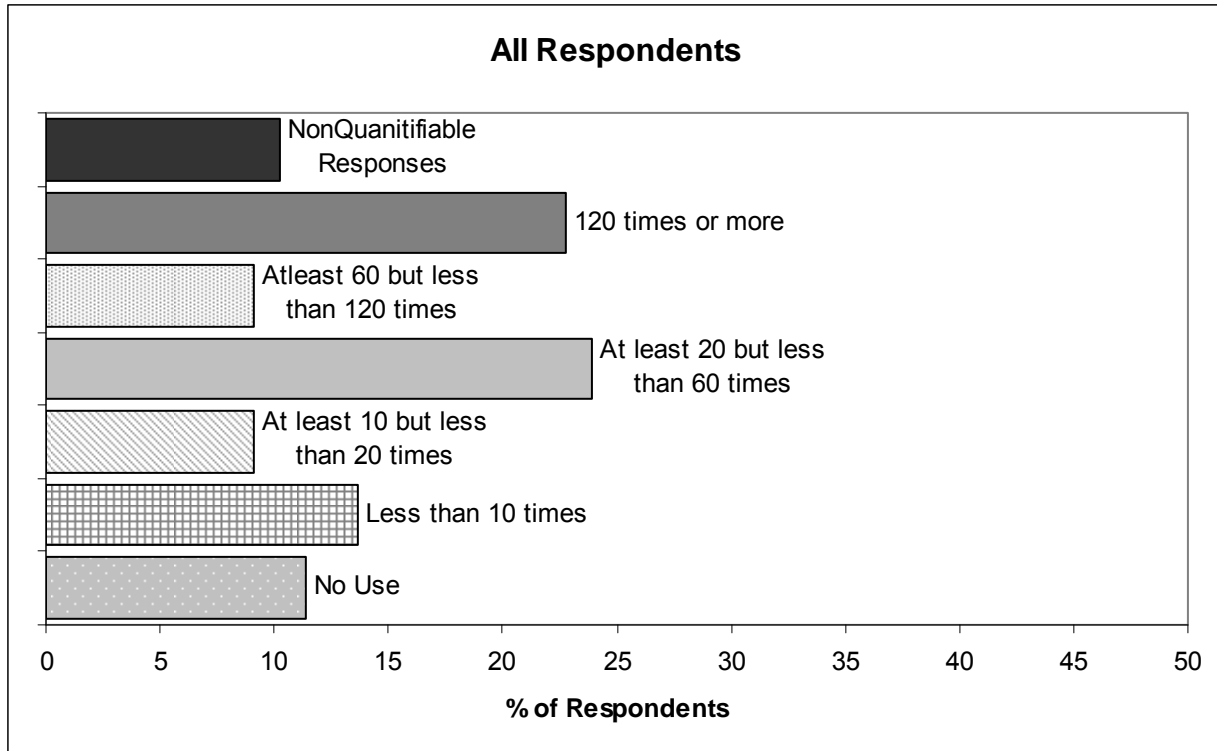


Figure 1-2 Frequency of Recreational Uses of Lake Owasso

3. Do aquatic plants interfere with your enjoyment of Lake Owasso?

More than half of the survey respondents indicated that aquatic plants do interfere with their enjoyment of Lake Owasso (those responding “Yes” and “Sometimes”). This percentage is greater for lakeshore and deeded-access residents, than those who do not have direct access to the lake.

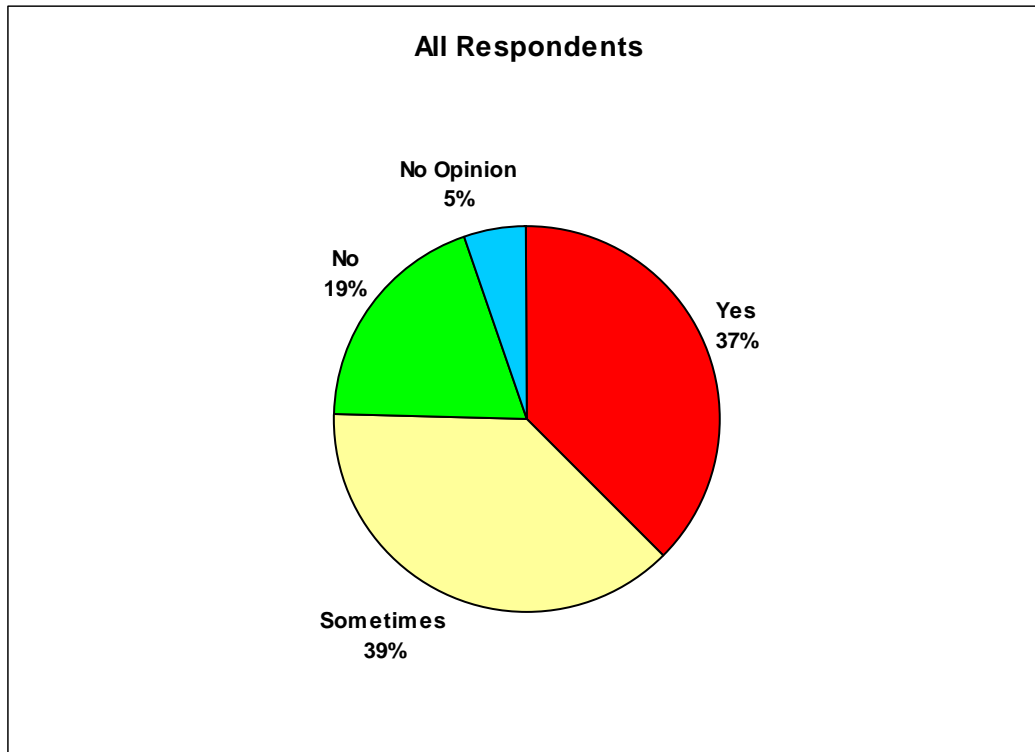


Figure 1-3 Interference of Aquatic Plants on Recreational Uses of Lake Owasso

4. How has aquatic plant interference changed over the past years?

The majority of survey respondents indicated that the interference by aquatic plants has gotten worse over the past few years.

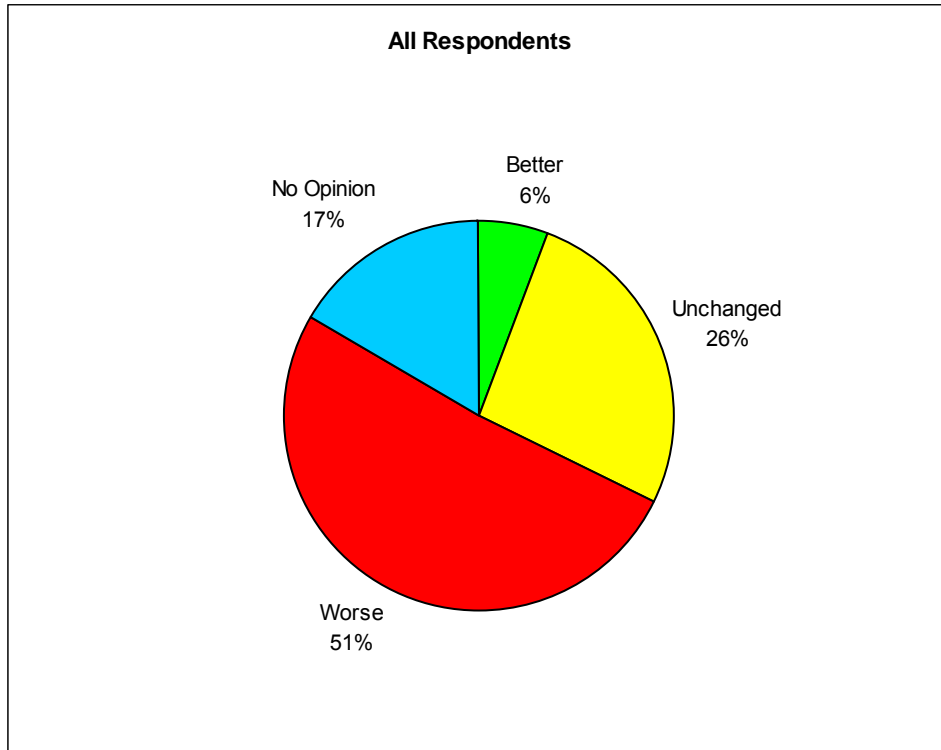


Figure 1-4 Change in Interference of Aquatic Plants on Recreational Uses of Lake Owasso

5. Which plants are the most problematic to your personal use of Lake Owasso?

The most problematic plants in Lake Owasso, as identified by the survey respondents, included filamentous green algae, Eurasian watermilfoil, northern watermilfoil, and Curlyleaf pondweed.

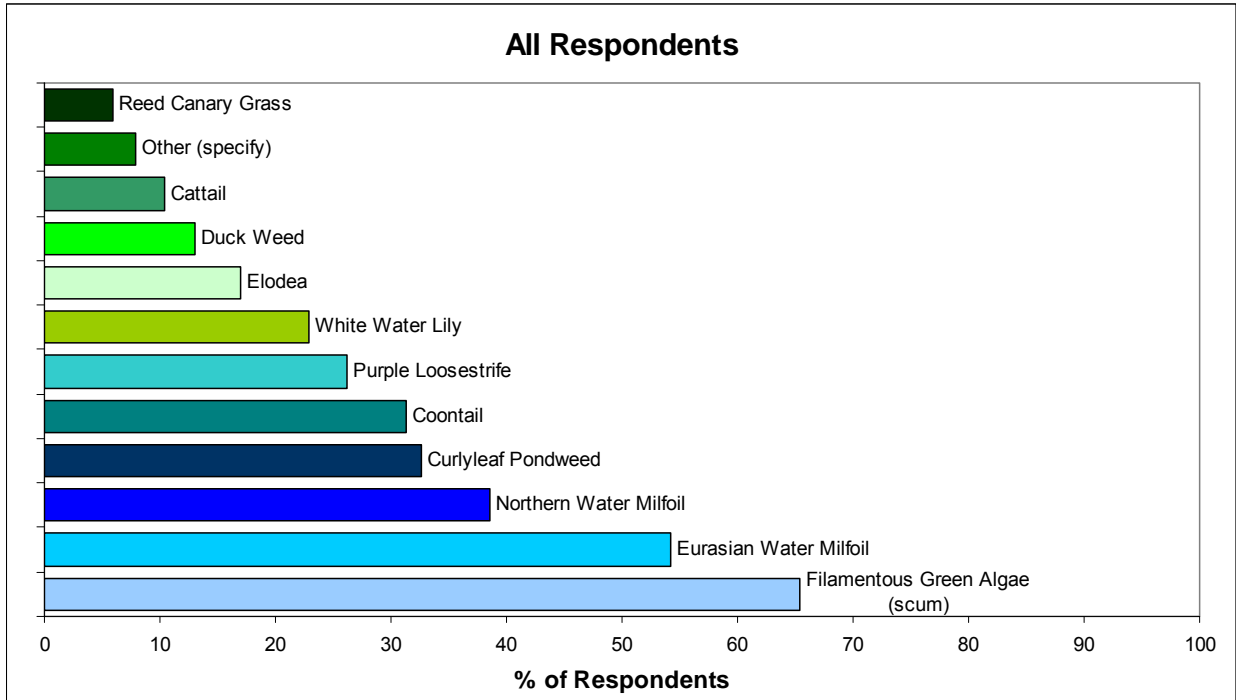


Figure 1-5 Problematic Aquatic Plants in Lake Owasso

6. How would you describe the clarity of Lake Owasso over the past 2 years?

Half of all survey respondents indicated that the water clarity has gotten worse in the past two years. A third of all respondents thought that water clarity was about the same in the past two years.

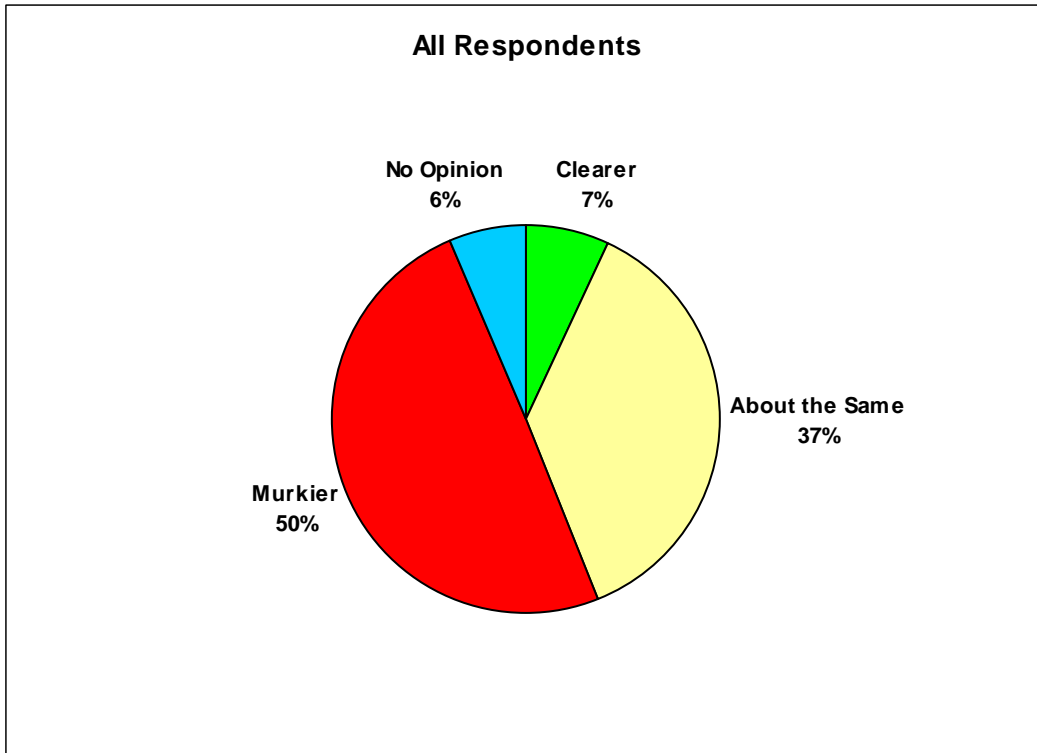


Figure 1-6 Change in Clarity in Lake Owasso

7. Which month does Lake Owasso have the worst water clarity?

August was identified as the month during the growing season with the worst water clarity.

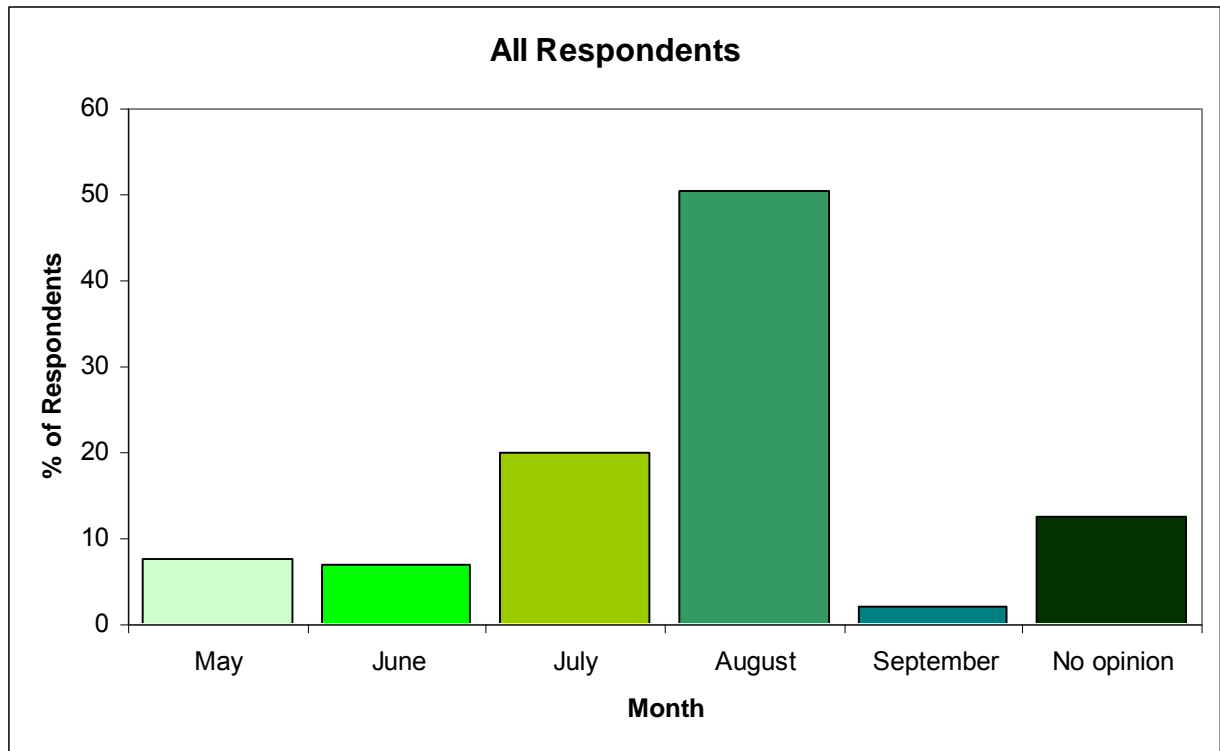


Figure 1-7 Month of Worst Water Clarity in Lake Owasso

8. What are the most important criteria for the quality of the lake?

Survey respondents indicated that the top 3 criteria impacting the quality of Lake Owasso were water clarity, having no invasive/non-native aquatic plants, and stable water levels. Stable water levels were identified as being much more important to lakeshore and deeded-access residents than to those living near the lake with no direct access.

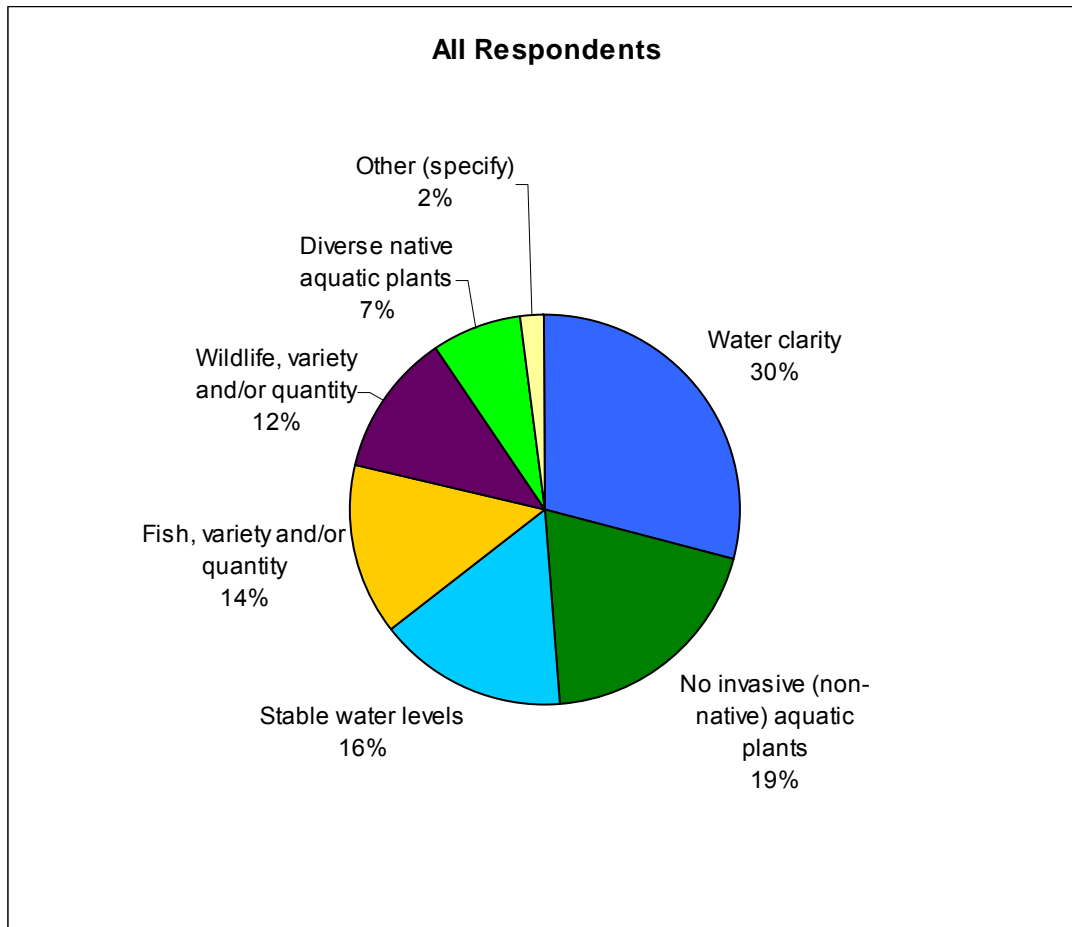


Figure 1-8 Important Criteria for the Quality of Lake Owasso

9. Have you noticed any of the following relative to the fish population in Lake Owasso?

Those survey respondents that fish on Lake Owasso indicated the following about the fish populations within the lake. However, many respondents indicated that they did not fish in Lake Owasso and could not answer questions about the fish population.

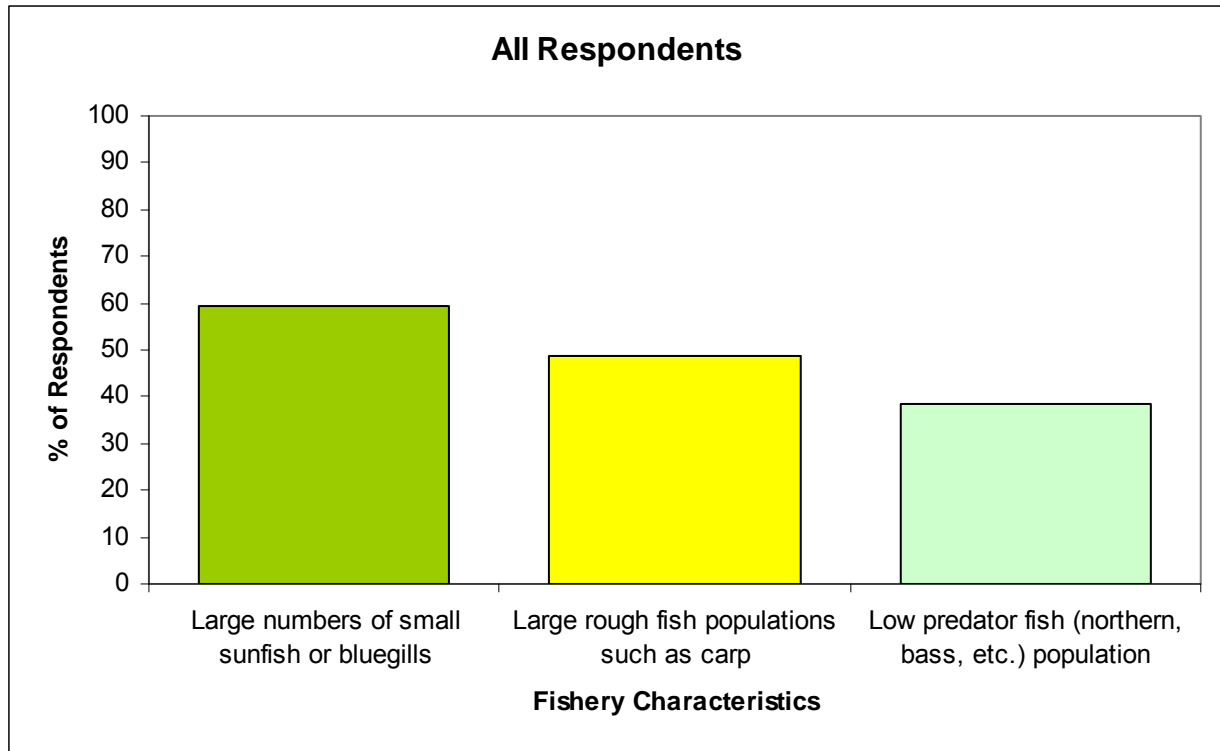


Figure 1-9 Characteristics of Fish Populations in Lake Owasso

10. What aquatic plant control method do you support for Lake Owasso?

Only those respondents who are lakeshore or deeded-access residents were asked which methods of aquatic plant control they supported. More than half of all respondents supported chemical treatments or mechanical harvesting. Some survey respondents supported both methods of aquatic plant management.

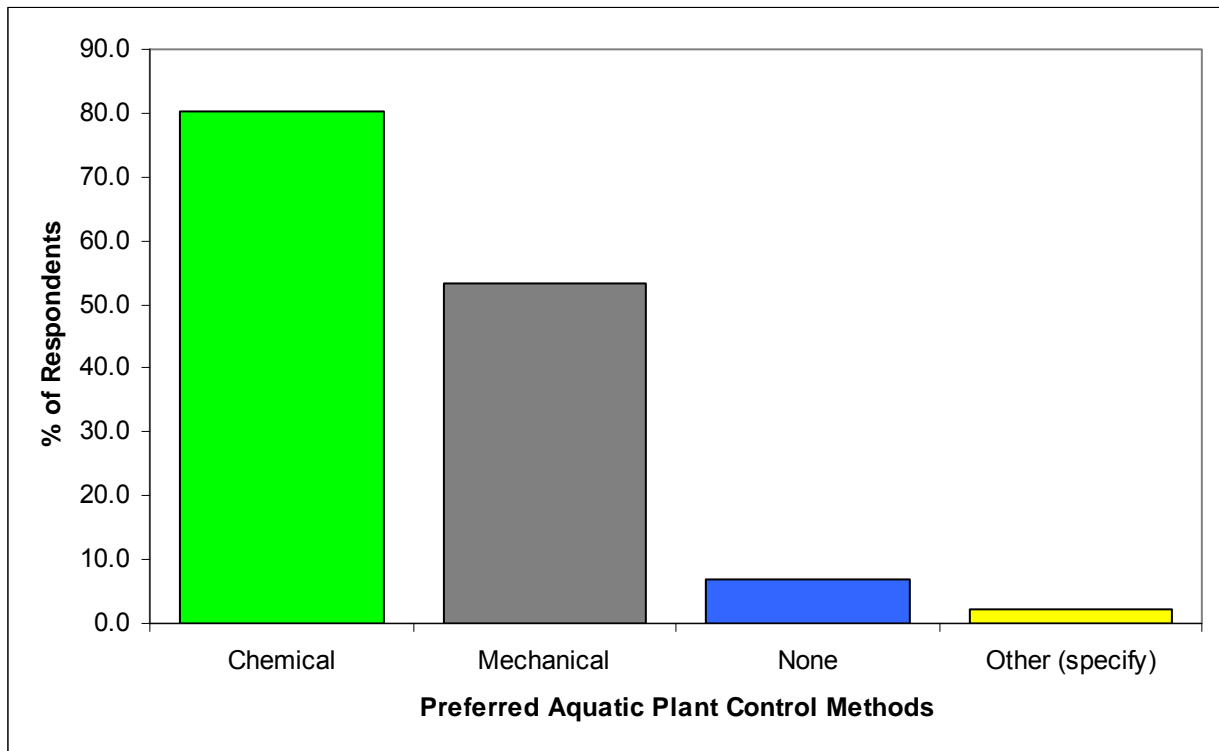


Figure 1-10 Supported Aquatic Plant Management Methods in Lake Owasso

11. What do you do to help decrease phosphorus and sediments to the lakes?

Most survey respondents indicated that they kept lawn and grass clipping off the streets, driveways, and sidewalks, they used phosphorus-free or no fertilizer, and they also directed downspouts onto their lawns and gardens.

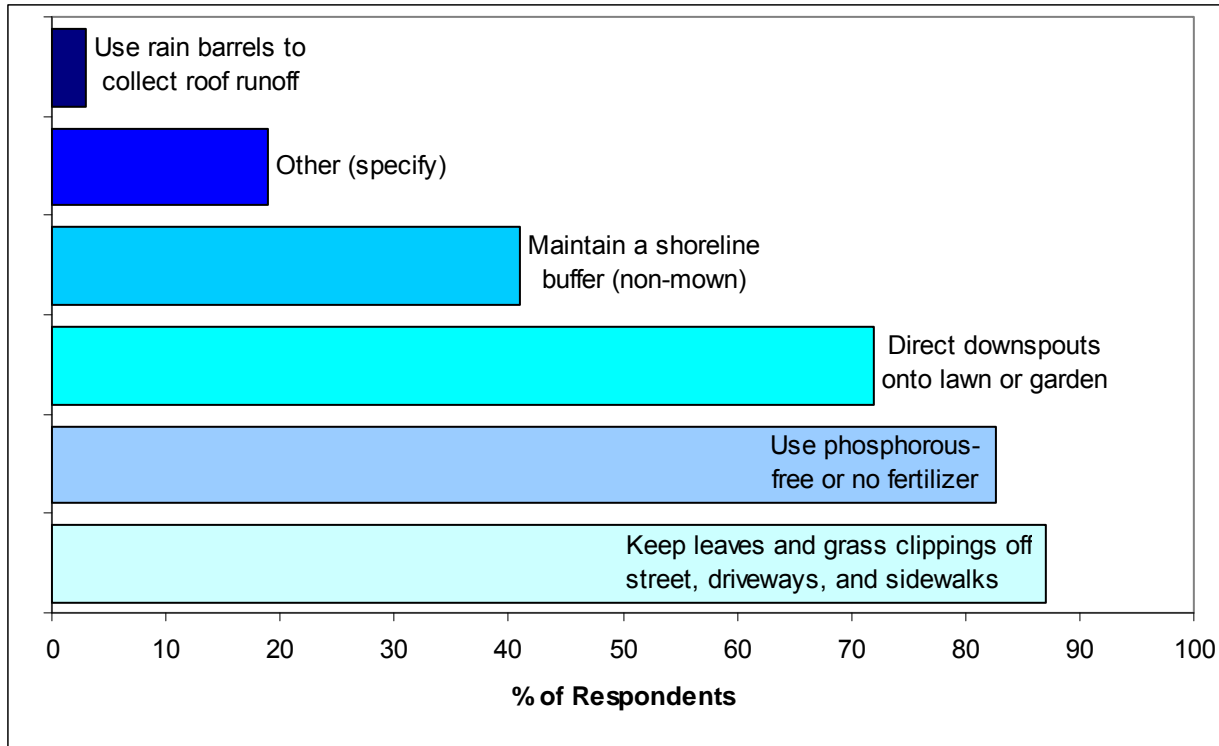


Figure 1-11 Actions by Residents to Decrease Phosphorus and Sediment Loads to Lake Owasso

1.5 Past Studies

There have been several studies of Lake Owasso in the past. These studies include:

- *Water Quality Management Alternatives: A Report on the Diagnostic Feasibility Study of Lake Owasso, Lake Wabasso, and Snail Lake, 1991*
- *Lake Owasso Management Plan, 2000*

1.6 Report Coverage

This report on Lake Owasso's water quality will answer the following four questions that apply to properly managing lakes:

1. What is the general condition of the lake?
2. Are there problems or trends evident in the lake's water quality?
3. What is a reasonably achievable goal for water transparency and phosphorus?
4. If there are water quality problems, what would be the most effective solutions?

To answer the first question, this report begins with description of the lake, the watershed, methods of data collection, and analysis. The results of water quality monitoring are then summarized in tables, figures, and accompanying descriptions.

To answer the second question, water quality data are analyzed for trends and compared to established water quality standards for the lake.

To answer the third and final questions, a water quality model, developed specifically for the lake's watershed, is described. The model incorporates the water quality data, land use characteristics, and Best Management Practices (BMPs). The model is then used to evaluate the impact of changing land use patterns and BMPs on the water quality of Lake Owasso. This includes the relative contributions of runoff and pollutants from each subwatershed. Based on these analyses, the cost and effectiveness of alternative management solutions are discussed. The final step is a set of recommendations for improving and protecting the water quality of Lake Owasso.

Background information sections are also included in the report. Section 2.0 covers general concepts in lake water quality, and the first part of the discussion section (Section 6.0) gives an overview of BMPs for controlling the quality of urban watershed runoff.