

Orange Lake Habitat Management Plan



Orange Lake Habitat Management Plan Final Draft

Prepared For

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Acronyms and Abbreviations

ACRWCCA	Alachua County Recreation and Water Conservation and Control Authority
BMAP	Basin Management Action Plan
ECT	Environmental Consulting and Technology
FDEP	Florida Department of Environmental Protection
FFS	Florida Forest Service
FWC	Florida Fish and Wildlife Conservation Commission
FWC OCBWG	FWC Orange Creek Basin Working Group
GIS	Geographic Information System
GPS	Global Positioning System
HMP	Habitat Management Plan
MKR	Marjorie Kinnan Rawlings
NAVD	North American Vertical Datum
NGO	Nongovernmental organization
NGVD	National Geodetic Vertical Datum
Plan	Habitat Management Plan
SAV	Submersed aquatic vegetation
SJRWMD	St. Johns River Water Management District
SR	State Road

Acknowledgements

Orange Lake Stakeholders

This Habitat Management Plan would not have been successful without the numerous stakeholders that participated in the process. The Florida Fish and Wildlife Conservation Commission appreciates the thoughtful input shared by people who have been involved with the lake for years and will continue to be involved in the years to come.

More than 200 stakeholders provided input on Orange Lake issues and values, goals and objectives, management techniques, and action strategies before each section was written and during each step of the process. They participated in interviews, interactive public meetings, and surveys. They also reviewed and provided feedback on the entire Plan in its final draft form.

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Executive Summary

Orange Lake presents an unusual challenge for fish and wildlife management. The 13,000- acre lake's underlying karst geology and history of large-scale hydrologic alterations by humans affect in-lake habitats from year to year and even from season to season. The lake's bottom topography includes extensive shallow areas that interact with dynamic water levels to create dynamic and diverse aquatic habitats. In addition, numerous stakeholder groups and concerned citizens have a variety of interests that at times compete with one another and with the differing management goals of various government agencies.

The Florida Fish and Wildlife Conservation Commission (FWC) incorporated a stakeholder engagement process in the preparation of this Habitat Management Plan (HMP, or Plan) with the goal of formulating future habitat management activities that would have broad support among the lake's many and diverse stakeholders. FWC's vision for Orange Lake is a dynamic aquatic resource characterized by a central open water area surrounded by freshwater marshes, which supports diverse and high quality fish and wildlife communities that are managed for their long-term well-being and the benefit of people. FWC's vision for this HMP is to allow implementation of the most effective future management of fish and wildlife habitats within Orange Lake that is broadly supported by stakeholders.

The stakeholder engagement process consisted of public meetings to gather input on issues of concern, attitudes toward management methods, and reaction to FWC's proposed habitat management action strategies. Specific stakeholder feedback was solicited as written and verbal comments at public meetings, participation in an online survey to assess stakeholder attitudes toward specific management tools, and comments on the draft final version of the Plan (dated April 2016). Feedback from the stakeholder engagement process is included in Appendices C and D of the HMP.

Orange Lake stakeholders raised concerns about access and navigation, focal wildlife and habitat, invasive species, tussocks, woody vegetation, Hydrilla, and accumulation of muck and sediment within the lake. Continued communication with stakeholders is also recognized by FWC as an essential part of this Plan. These issues were combined into four broad categories of concern:

- Communications
- Focal Wildlife Habitat
- Access and Navigation
- Invasive Species

For each category, management goals and objectives were established based on stakeholder input at the first three public meetings. Action strategies were then developed by FWC. In addition to addressing stakeholder concerns, the HMP action strategies address management needs for eight habitats and seven focal wildlife taxa that were identified by FWC at Orange Lake and are fully described in FWC's *Fish and Wildlife Habitat Management Guidelines for the Aquatic Resources of the Orange Creek Basin (Habitat Guidelines)*. The focal taxa represent suites of species that have a disproportionate effect on their habitats relative to their abundance, are sensitive to habitat manipulations, are rare or listed species in need of specific habitat protection, and have high economic and/or recreational value.

The action strategies presented in this HMP are compatible with maintaining the range of habitats that occur at Orange Lake under natural conditions, which include water levels that may change rapidly. Each action strategy is associated with a set of water levels to reflect the fact that water levels at Orange Lake are dynamic and affect the severity of issues, the type of management techniques and equipment that can be deployed, and the timing of actions that can be taken. For the purposes of this Plan, FWC identified water level thresholds based on access and habitat issues as well as habitat management techniques and equipment that can be deployed at each level:

- Normal water levels are above 52 feet NAVD—Public access and a variety of habitat management techniques are available.
- Low water levels are between 52 and 50 feet NAVD —Public access and habitat management options are severely limited.
- Extreme low water levels are below 50 feet NAVD —Public access is so limited that even airboats have difficulty gaining access to the lake, but several habitat management options can be applied proactively to minimize negative impacts of extreme low water to focal habitats and species.

Action strategies are presented in tables within each of the four categories of concern (see Section 4). Stakeholder feedback on proposed action strategies was solicited at the final public meeting, through an online input tool that was available for three weeks, and through email. Action strategies proposed in this HMP do not address two issues often mentioned by Orange Lake stakeholders: modification or removal of the fixed crest weir at Orange Lake’s surface water outlet into Orange Creek (the 301 weir) and modification of outflow through the sinkhole complex in the southwest corner of the lake. Determining the future of the weir is outside the direct statutory authority of FWC but is included in a list of potential opportunities for interagency collaboration (see Section 6). There is considerable uncertainty and risk regarding the effect that sinkhole modifications would have on the lake and therefore no action strategies or opportunities for interagency collaboration regarding sinkhole modifications are proposed.

The goals, objectives, and action strategies in this HMP are limited to those that are within FWC’s mission and statutory authority and so not all possible lake management issues at Orange Lake are included. Effective management of a dynamic, multiple use resource such as Orange Lake typically extends beyond the mission of any one agency, organization, or group of stakeholders. FWC recognizes the value of collaborative partnerships and supports the idea of exploring and developing opportunities with local, state, and federal agencies, private landowners, and nongovernmental organizations to maximize the benefits to fish and wildlife and the people who enjoy them. FWC also recognizes that effective partnerships can often lead to increased efficiencies in time and resources and direct cost savings that justify placing a high priority on projects or initiatives that involve a collaborative partnership approach.

The HMP establishes a stakeholder-informed framework for FWC’s management activities at Orange Lake over the next 5 years (2017 to 2021). FWC will use the HMP as a reference to prepare annual work plans and concisely inform current and future stakeholders about action strategies that are appropriate given the dynamic habitat conditions within Orange Lake. The HMP will be evaluated in 2021 to determine management success and to revise and update the Plan as needed.

1 Introduction, Overview, and Purpose

Orange Lake is one of north Florida's largest freshwater lakes, comprising approximately 13,000 acres (over 20 square miles). A portion of the lake's historical shoreline forms the boundary between Alachua and Marion counties—the lake area is within Alachua County, and the shoreline areas are in both counties (Figure 1–1).

The lake presents an unusual challenge for fish and wildlife management due to its many large shallow areas, variable water levels that can change rapidly, diverse aquatic habitats, underlying karst geology, and a history of large scale hydrologic alterations by humans. In addition, numerous stakeholders and concerned citizens have a variety of interests that at times compete with one another and with the differing management goals of various government agencies.

The purpose of this Habitat Management Plan (Plan or HMP) is to create a framework that reflects and incorporates stakeholder input and informs the Florida Fish and Wildlife Conservation Commission's (FWC's) management activities at Orange Lake over the next 5 years (2017–2021). FWC will use the HMP as a reference to prepare annual work plans. The HMP will be evaluated in 2021 to determine management success and to revise and update the Plan as needed.

The HMP is written for a target audience of FWC biologists and informed stakeholders. In keeping with creating a Plan for this audience, all measurements are in English units (e.g., feet not meters, acres not hectares). Water levels use the NAVD datum as opposed to the older NGVD datum that may be more familiar to readers. Elevations in NGVD can be obtained by adding 1.22 feet to the NAVD elevation.

The HMP addresses activities that are within the mission and statutory authority of FWC (see Section 3.2), thus not all of the possible lake management issues are included in the management recommendations. Two issues in particular, which are often mentioned by Orange Lake stakeholders, are not included: modification or removal of the fixed crest weir at Orange Lake's surface water outlet into Orange Creek and modification of outflow through the sinkhole complex in the southwest corner of the lake. Determining the future of the outlet weir is outside the direct statutory authority of FWC but is included in a list of potential opportunities for interagency collaboration (see Section 6). There is considerable uncertainty and risk regarding the effect that sinkhole modifications would have on the lake; therefore no related opportunities for interagency collaboration regarding sinkhole modifications have been included.

Effective management of a dynamic, multiple use resource such as Orange Lake typically extends beyond the mission of any one agency, organization, or group of stakeholders. FWC recognizes the value of collaborative partnerships and supports the idea of exploring and developing opportunities with local, state, and federal agencies, private landowners, and nongovernmental organizations to maximize the benefits to fish and wildlife and the people who enjoy them. FWC also recognizes that effective partnerships can often lead to increased efficiencies in time and resources and direct cost savings that justify placing a high priority on projects or initiatives that involve a collaborative partnership approach. FWC continues to cooperate with federal, state, and local regulatory agencies, particularly when these agencies have regulatory authority over a particular activity. These agencies include, but are not limited to, Florida Department of Environmental Protection, The Army Corp of Engineers, Alachua County Environmental Protection Division, Florida Division of Historical Resources, etc.



Figure 1–1. Orange Lake in Alachua and Marion counties.
 Yellow arrows denote direction of water flow.

2 Environmental Setting and Management Background

Much of the material in this section is condensed from two recent reports concerning Orange Lake: the *Orange Creek Basin Surface Water Improvement and Management Plan* prepared in 2011 by the St. Johns River Water Management District (SJRWMD; Lippincott 2011) and the *Fish and Wildlife Habitat Management Guidelines for the Aquatic Resources of the Orange Creek Basin (Habitat Guidelines; FWC OCBWG 2014)*.

2.1 Environmental Setting

2.1.1 Topography and Geology

Orange Lake is the largest lake in the Orange Creek Basin, comprising approximately 13,000 acres at a water surface elevation of 56.88 ft NAVD (ECT 1997). The lake is located in a topographical region of the state known as the Central Lowlands, and its watershed geology is dominated by the underlying Hawthorn formation. This unconsolidated geologic unit is relatively impermeable to surface water infiltration and typically creates a confining layer covering the Upper Floridan aquifer. However, the southern half of Orange Lake is directly underlain by the Ocala Limestone formation (Scott et al. 2001) and includes a group of sinkholes adjacent to Heagy Burry Park in Marion County. Other sinkholes have been identified in other sections of the lake (Kindiger et al. 1994).

2.1.2 Surface Water

Two surface streams flow into Orange Lake: Cross Creek from the east and River Styx from the northwest (see Figure 1–1). Cross Creek flows out of Lochloosa Lake (8,400 acres), while River Styx conveys water from its natural watershed and from Camps Canal, which diverts some of the flow from Prairie Creek away from Paynes Prairie and toward Orange Lake.

Water leaves Orange Lake through surface evaporation, outflow through sinkholes in several locations within the lake, and through Orange Creek, which flows east to the Ocklawaha River. Significant outflow to Orange Creek only occurs at water levels over 56.3 ft NAVD (Lippincott 2011). Below this elevation, the surface water outflow from Orange Lake to Orange Creek is blocked by a fixed crest concrete weir located at the southeast corner of the lake, east of State Road (SR) 301.

2.1.3 Groundwater

At low water levels, water can be observed flowing into the sinkhole complex in the southwest corner of the lake, especially a large sinkhole located next to the public boat ramp at Heagy Burry Park. Lake water has been observed flowing into other sinkholes in the lake bed as well during low water periods. A dye trace study conducted by SJRWMD in 2010 found that dye released into the Orange Lake sinkhole at Heagy Burry Park traveled through groundwater toward the south and southeast, moving about 8 miles in a little over 6 months (about 218 ft per day; McGurk et al. 2011). Water budgets determined by SJRWMD show little evidence for significant groundwater inflow to Orange Lake (Lippincott 2011).

2.1.4 Land Use

The communities of Evinston, Island Grove, and Cross Creek in Alachua County as well as McIntosh, Orange Lake, and Citra in Marion County lie in close proximity to the lakeshore.

Although these communities are neighbors to the lake, the predominant land use types in the watershed are rural. Based on aerial photography from 2003 to 2004, the largest land use class in the watershed that contributes directly to Orange Lake is forest (21,515 acres, or 23%) followed by pasture (17,875 acres, or 19%) (Lippincott 2011). No large scale changes in land uses in the watershed have taken place since the mid-2000s.

2.1.5 Water Quality

Orange Lake is classified by the Florida Department of Environmental Protection (FDEP) as a Class III waterbody, with designated uses of recreation and propagation and maintenance of healthy, well-balanced populations of fish and wildlife. For these uses, water quality in the lake is considered to be impaired due to high concentrations of phosphorus (FDEP 2014) entering the lake from sources in the watershed. A Basin Management Action Plan (BMAP) adopted by FDEP in 2014 includes watershed management strategies that when implemented would reduce levels of this nutrient. A target 45% reduction in these nutrient loadings from the watershed is called for in the BMAP (FDEP 2014). In addition, FDEP designated Orange Lake, Lochloosa Lake, Cross Creek, and River Styx as “special water” Outstanding Florida Waters in 1987.

2.1.6 Shoreline Habitats

The FWC’s internal Orange Creek Basin Working Group (FWC OCBWG) created a broad habitat classification system for the purpose of guiding management efforts at lakes within the Orange Creek Basin, which is presented in the *Habitat Guidelines* (FWC OCBWG 2014). The classification system defines eight habitat types that are indicated by capital letters in this HMP (e.g., Shallow Marsh). For descriptions of habitat types, see Section 3.4.1.

Orange Lake’s shoreline habitats are more diverse and dynamic than those at neighboring Lochloosa and Newnans lakes. An extensive perimeter marsh extends into the lake to a water depth of 8 ft on most shoreline areas of Orange Lake and an extensive interior Shallow Marsh occurs at water depths less than 5 ft (Bryan and Warr 1998). Both types of marsh vary temporally and spatially as water level changes and can range from stable wet prairie areas to dense patchworks of rooted emergent vegetation and Floating Marsh. The lake contains three permanent islands (Bird Island, Redbird Island, and McCormick Island).

2.1.7 Lake Volume and Surface Area

Orange Lake’s bottom configuration results in large water surface area changes when water levels recede (Figure 2–1), and these relatively rapid fluctuations affect the multiple habitat types within the lake. A bathymetric survey of the lake in 1997 found that a decline in water level elevation from 58.0 ft NAVD to 53.68 ft reduces the lake volume by 50% (ECT 1997). Similarly, the surface area of the lake at an elevation of 51.38 ft NAVD would be half the size of the surface area when compared to 58.0 ft NAVD.

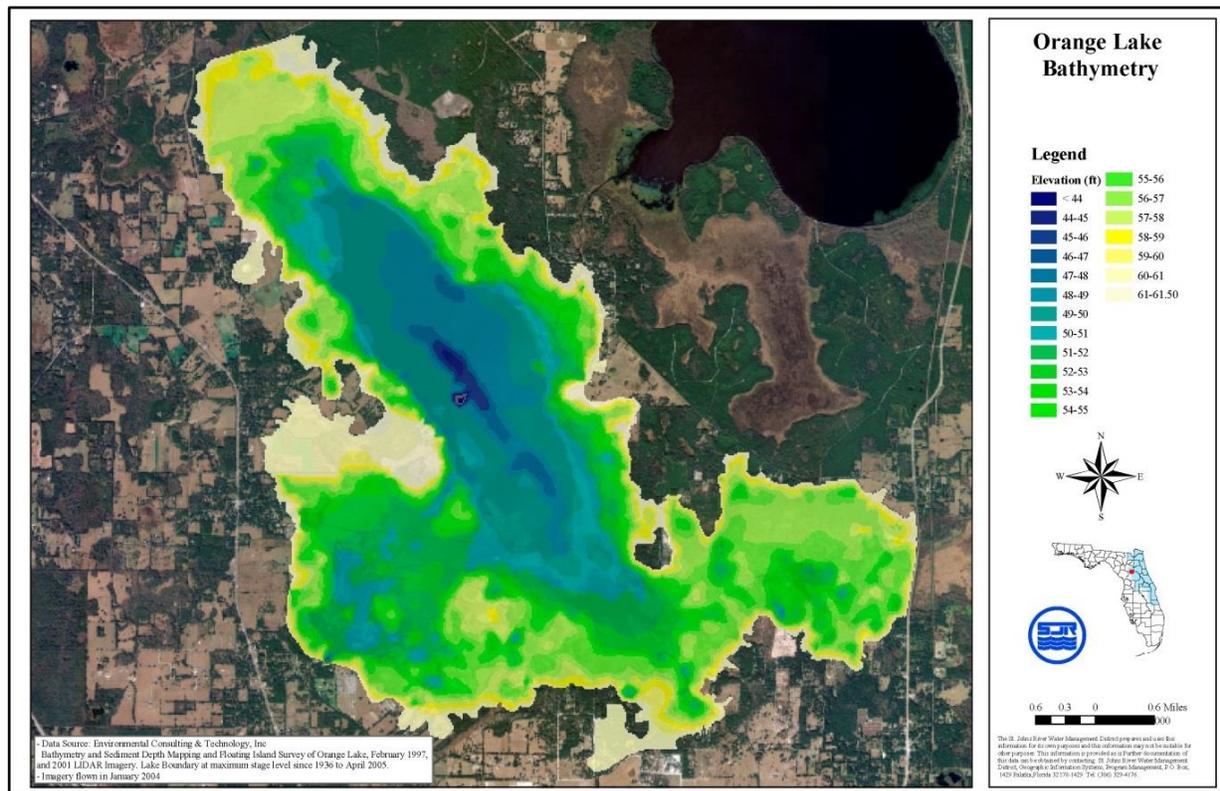


Figure 2–1. Orange Lake bathymetry in feet NGVD.

To convert to NAVD, subtract 1.22 feet.

2.1.8 Access

Lake level fluctuations can be frustrating for lakeshore residents and users. For example, between 2012 and 2014 the water level at Orange Lake rose from one of the lowest levels recorded since 1933 to near the record maximum. This included a lake level rise of over 5 ft during the 6-month period between August 2013 and February 2014. At the beginning of this period, lake users had been experiencing lake levels that resulted in the closure of boat ramps in 2012. These conditions changed with a rapid rise in water level that improved boat access but also created favorable conditions for the fragmentation of Floating Marsh, creating tussocks and Floating Islands (see Section 3.4.1). These can be several acres in size, move uncontrollably depending on wind speed and direction, and frequently block navigation.

2.1.9 Recreation

While the fluctuations in water level combined with the irregular geometry of the shoreline can be frustrating for lake users, they also make Orange Lake a highly diverse and biologically productive area, which is valued by the lake’s stakeholders. The lake is a popular destination for anglers, particularly for largemouth bass (*Micropterus salmoides*), panfish (*Lepomis* sp.), and black crappie (*Pomoxis nigromaculatus*; FWC OCBWG 2014). Because fishing at Orange Lake is productive, it is frequently included on the FWC’s list of top Florida fishing lakes. The lake is also popular for waterfowl hunters, especially the southern portion of the lake. Commonly hunted waterfowl in Orange Lake include Green-winged Teal (*Anas crecca*), Blue-winged Teal

(*Anas discors*), American Widgeon (*Anas americana*), Ring-necked Duck (*Aythya collaris*), Ruddy Duck (*Oxyura jamaicensis*), and Lesser Scaup (*Aythya affinis*). Other recreational uses at Orange Lake include alligator and frog hunting, wildlife/bird viewing, and recreational boating.

2.1.10 Wildlife

Wading birds, waterfowl, Bald Eagles (*Haliaeetus leucocephalus*), centrarchid fish, herpetofauna including alligators (*Alligator mississippiensis*), and round-tailed muskrat (*Neofiber alleni*) all use habitat at Orange Lake and are the focal wildlife taxa addressed in this Plan (see Section 3.4.2). This section provides an overview of the environmental setting for most of these focal wildlife taxa. For more detailed information, see the *Habitat Guidelines* (FWC OCBWG 2014).

Redbird Island and North Island are important rookeries for wading birds. The rookery at Bird Island, located in the southwest area of Orange Lake, is of historical significance as the first sanctuary purchased and defended from plume hunters by the Audubon Society, but it has not been active since the late 1990s.

Sandhill Cranes (*Grus canadensis*), including the Florida subspecies (*G. c. pratensis*), occur within Orange Lake habitats and are included in the FWC list of focal wildlife taxa. Orange Lake is a core nesting area for a population of Bald Eagles that has been stable for years, indicating high quality breeding and foraging habitats at the lake.

The round-tailed muskrat is sensitive to water level fluctuations and habitat changes at Orange Lake. Shallow Marsh dominated by maidencane (*Panicum hemitomon*) occurs in several Orange Lake locations and is considered critical habitat for round-tailed muskrat.

The lake has abundant populations of pig frogs (*Rana grylio*) and Florida softshell turtles (*Apalone ferox*), which are harvested commercially. Alligators and their eggs are also harvested at Orange Lake. The Orange Lake alligator population is one of the densest in Florida, in part due to the mixture of Open Water, emergent marsh, Floating Marsh, and Deep Marsh, which provide desirable habitat for all sizes of alligators for nesting and foraging. While no formal studies have been conducted on alligator habitat preference on Orange Lake, it is generally accepted that alligator populations flourish in aquatic habitats with a mosaic of vegetative communities interspersed with Deep Marsh or Open Water habitats such as those in Orange Lake.

2.1.11 Hydrologic Alteration

Although the HMP only addresses management activities to be undertaken by FWC within shoreline and Open Water areas of Orange Lake as opposed to its watershed, it is still important to understand how alterations within the contributing watershed of over 92,000 acres (143 square miles) influence the lake. A timeline of events affecting the lake is included as Appendix A.

Orange Lake's history includes large scale inflow modifications from the northern area of its contributing watershed, which affect the flow of water and nutrients from River Styx. These modifications followed changes in management goals for the large prairie wetland system in Paynes Prairie State Preserve. Although this approximately 22,000-acre area is now managed as a wetland, it was extensively modified in the early 1900s to make the prairie more suitable for

cattle grazing. This was achieved by installing pumps on the eastern rim of the prairie to remove stored water during wet periods and constructing a dike and drainage canal (Camps Canal) along the eastern rim so that the primary inflow stream (Prairie Creek) bypassed Paynes Prairie entirely and flowed into Orange Lake. The result was an increase in the inflow volume to Orange Lake from River Styx from the 1930s to the early 1970s (Robison et al. 1997).

After Paynes Prairie became a state preserve in 1971, the dike and Camps Canal were modified to allow some water from Prairie Creek to once again flow into Paynes Prairie. In 1994, the SJRWMD's Governing Board adopted a Reservation of Water rule that allows water to passively flow from Prairie Creek into Paynes Prairie through culverts that divert water from Camps Canal.

The recent range of lake water levels has changed compared to the earlier part of the period of record (1933 to current; Figure 2–2). A severe drought that affected most of the state of Florida between 1998 and 2002 brought Orange Lake down to the minimum level of the period of record, and another severe drought resulted in extended low water levels between 2010 and 2012. Extended periods of low water also occurred in the mid-1950s and the early 1970s. In contrast, the 1997–1998 El Niño created water levels that were nearly as high as the record maximum in 1941. Beginning in 2012, the lake level rose, and as of April 2016 water levels are nearly as high as they were in 2004–2005 when two hurricanes passed through the area.

Earthen berms and canals from former farms remain around parts of Orange Lake. The configuration of the lake prior to the 1930s included a large area to the east of SR 301 that was ditched and drained for farming and is isolated from the rest of the lake area by the concrete weir next to SR 301 as well as a railroad embankment/bridge and SR 301 itself. Much of this area now comprises the Orange Creek Restoration Area owned by SJRWMD.

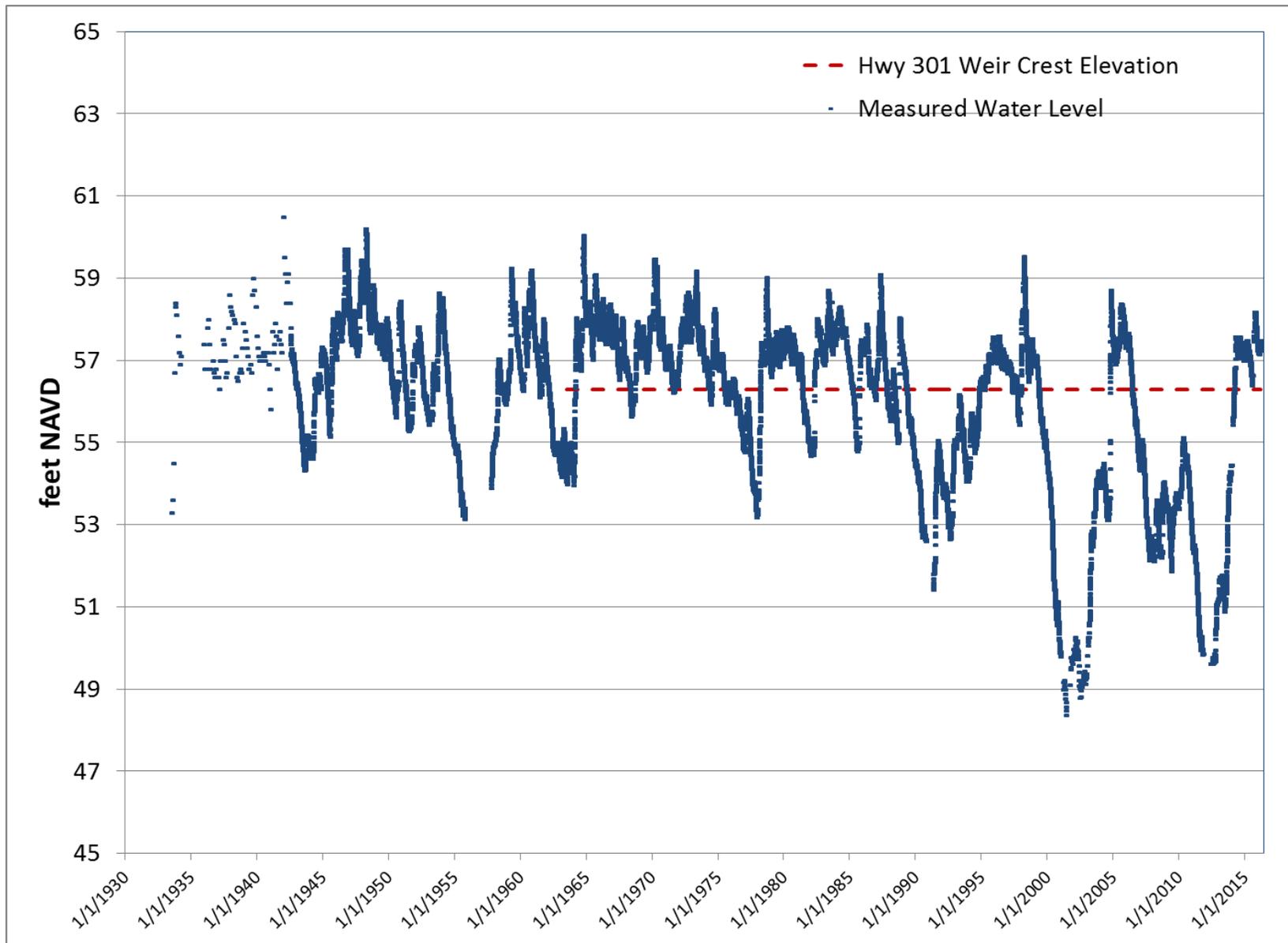


Figure 2–2. Water level at Orange Lake, June 1933 through March 2016 (SJRWMD 2016).

2.2 Management Background

Orange Lake was designated a Fish Management Area in 1963 under a cooperative agreement between FWC and Alachua County. Today it is widely known for its largemouth bass fishery. A statewide angler success survey in 2009 ranked Orange Lake in the middle third for black crappie and in the top third for sunfish and largemouth bass, with a catch rate of 1.23 fish per hour of effort. Economic studies have indicated high annual value for fisheries within the lake (FWC OCBWG 2014). Because of this, FWC's primary management goal at Orange Lake has historically been to optimize fisheries.

Currently, FWC generally manages fish and wildlife through habitat manipulation, harvest restrictions, and stock enhancements. Many of FWC's management strategies support the diverse habitat types in Orange Lake. During normal water levels, mechanical shredding of aquatic vegetation has been used to maintain navigation channels and break up Floating Marshes to maintain connectivity between Deep Marsh and Shallow Marsh habitats (see Section 3.4.1). Similarly, mechanical harvesting of aquatic vegetation and associated organic sediment has been used to accomplish this goal, with the added benefit of removing the harvested material from the lake to avoid additional organic deposition.

FWC's Invasive Plant Management Section manages exotic and invasive aquatic plants, a program that was previously administered by FDEP until 2008. Herbicides have been used regularly to control exotic and invasive aquatic vegetation. FWC currently manages water lettuce (*Pistia stratiodes*) and water hyacinth (*Eichhornia crassipes*) at the lowest feasible level (i.e., maintenance control level; see Section 4.4.1) and manages Hydrilla (*Hydrilla verticillata*) on a lake-by-lake basis according to the agency's statewide position on Hydrilla management (FWC 2011; see Section 4.4.1).

Hydrilla has been present on Orange Lake since 1974 and is an important influence on habitat quality for fisheries and waterfowl. Its presence at low to moderate densities can be beneficial as a food source for many waterfowl species and as cover for fish. However, when it first became established its coverage at Orange Lake was estimated at 8,000 acres (more than 12 square miles), infesting most of the lake's water surface (Figure 2–3). Such high densities of Hydrilla can be detrimental to fish populations, causing slower growth rates and decreases in populations (FWC OCBWG 2014).

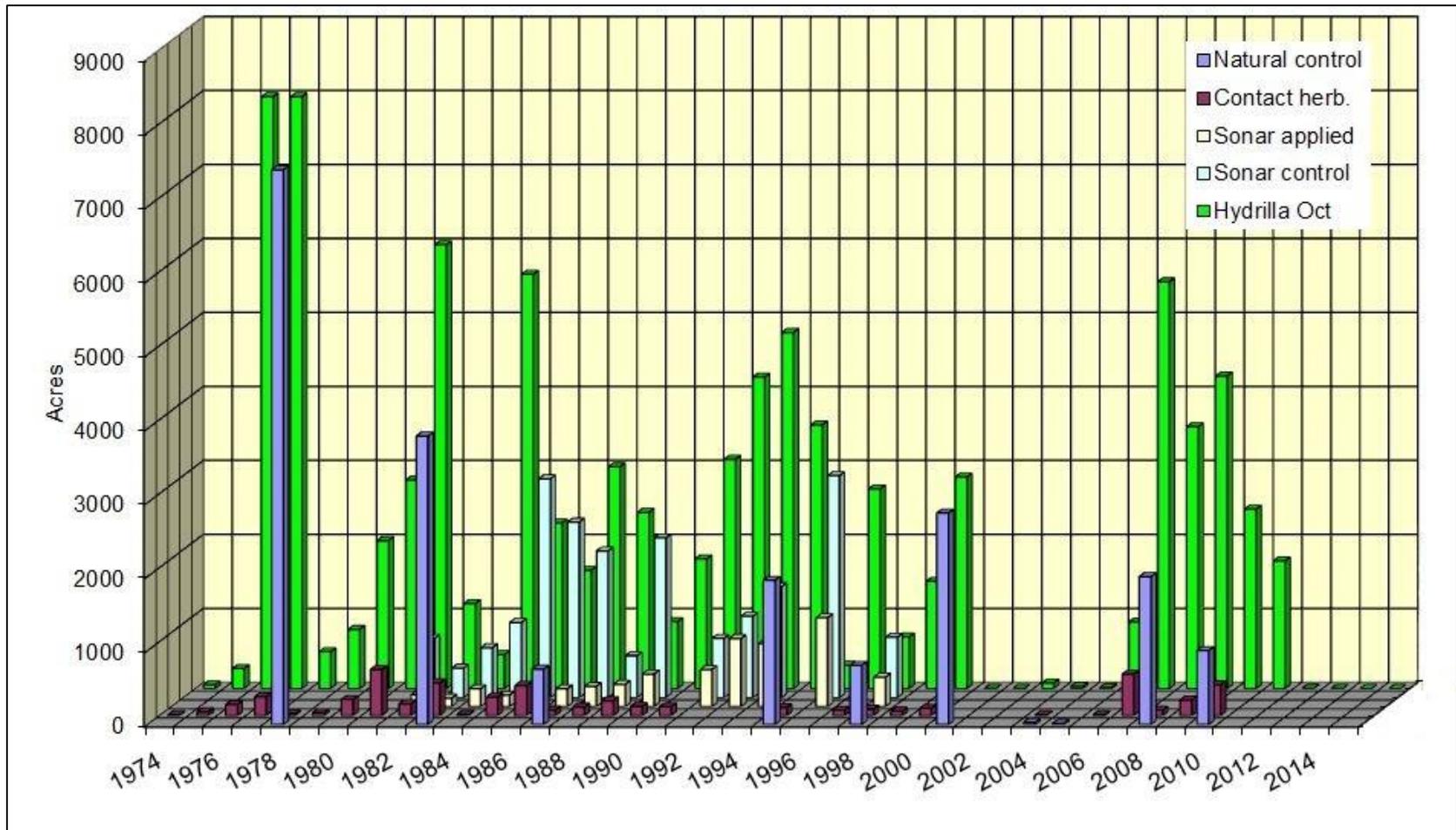


Figure 2-3. Hydrilla occurrence and treatment at Orange Lake, 1974–2015 (R. Hamm, FWC, pers. comm. 2015).

For Hydrilla at Orange Lake, herbicide control is currently considered the most efficient use of FWC's management resources to balance the need to minimize potential impacts to native plant communities and stakeholder uses. During the 1970s and 1980s numerous methods for Hydrilla control were tested at Orange Lake. Mechanical harvesting was also used in the 1970s to improve navigation in the lake but expense, high fish mortality rate, disposal of material, and slowness of control eliminated it as a viable alternative. Contact herbicides containing diquat and aquathol were subsequently used to provide navigation and openings for fishing. From 1982 to 1996, Fluridone (Sonar) was used extensively for Hydrilla control until the plant became resistant to this herbicide. Hydrilla coverage at Orange Lake is sometimes reduced without FWC intervention when lake conditions change. Rapid increases in water level provided natural Hydrilla control in 1978, 1983, and 1995. Consumption of Hydrilla by American Coots (*Fulica americana*) in 2008 reduced coverage by approximately 2,000 acres.

For water hyacinth and water lettuce, which are floating invasive plants, proactive management with herbicide is also considered by FWC to provide the best balance between potential impacts to native plant communities and stakeholder uses. From the 1950s to 2005, water hyacinth was a persistent exotic plant problem on Orange Lake. The peak coverage for water hyacinth was 4,100 acres during 1984, but since 1999 coverage of the lake by water hyacinth has been less than 100 acres each year due to consistent control effort by the invasive plant management program.

Although water lettuce can be invasive, its presence was not a management problem in Orange Lake until after the hurricanes of 2004. Between 1983 and 2003, a total of 15 acres of water lettuce was treated with herbicide. After 2004, water lettuce populations began to expand rapidly, prompting control efforts that resulted in a total of 1,514 acres of water lettuce treatment between 2004 and 2008. Water lettuce coverage during this treatment period was maintained at less than 10 acres.

FWC resource managers have recently focused on habitat management practices that attempt to mimic natural processes that have been disrupted. Prescribed burns mimic natural fire, but they must be implemented according to a written plan that addresses weather and safety conditions including smoke management (FFS 2010). Sediment cores from Orange Lake showed bands of charcoal varying in age from less than 200 years to over 1,000 years (Clark and Reddy 1998). The presence of charcoal in sediment cores indicates that fire played a role in the lake's history before European settlement of the area.

In the absence of natural fire or prescribed burns, other management methods can address accelerated lake succession to some degree. Mechanical sediment removal has been undertaken by FWC and other agencies during long periods of low water to delay or set back succession and provide firm substrate for vegetation root structure in some locations at Orange Lake. During Florida's 1998–2002 drought, sediment accumulation was addressed by natural processes as well as mechanical removal. A study of sediment consolidation carried out at Orange Lake in 2001–2002 during the record low lake level in May 2001 (ECT 2002) found a mean reduction in sediment of 15.5 inches at 31 sites in PG Run and 16.6 inches at 39 sites in River Styx due to sediment compaction and oxidation.

FWC used aerial surveys in 2007, 2010, and 2013 to track changes in habitats and assess how these changes are affecting focal wildlife species (FWC OCBWG 2014). GIS analysis was used to estimate the lake wide area of high quality and acceptable habitat for focal taxa based on the aerial surveys. Focal taxon experts within the FWC OCBWG established habitat objectives for focal taxa, and these were combined to derive an optimum habitat condition that would maximize habitat suitability for the broadest range of focal taxa.

Habitats based on the aerial surveys in all 3 years showed an excess of Shrub Swamp habitat and a shortage of Shallow Marsh habitat compared to the habitat matrix that focal taxon experts believe would be optimal. In all 3 years, the amount of total habitat (high quality plus acceptable) was greatest for herpetofauna and centrarchids. Focal taxa habitats with the lowest total area included alligator nesting and wading bird roosting in 2007 and 2010 and Ring-necked Duck and Wood Duck (*Aix sponsa*) in 2013. Between 2007 and 2010, the amount of high quality habitat increased for all focal taxa except round-tailed muskrat and black crappie. For those two focal taxa, only the amount of acceptable habitat increased. By 2013, changes in aquatic vegetation led to the lowest amount of high quality and acceptable habitat for alligator foraging, wading bird foraging, Wood Duck, Ring-necked Duck, black crappie, largemouth bass, and centrarchids.

3 Overall Management Vision and Guiding Principles

3.1 Vision

FWC's vision for Orange Lake is a dynamic aquatic resource characterized by a central Open Water area surrounded by freshwater marshes, which supports diverse and high quality fish and wildlife communities that are managed for their long-term well-being and the benefit of people.

FWC's vision for the Plan is to allow implementation of the most effective management of fish and wildlife habitats within Orange Lake and to include stakeholder input in the creation of the Plan that will guide this implementation. The goals, objectives, and action strategies in this Plan are limited to those that are within FWC's mission and statutory authority and are compatible with maintaining the range of habitats that occur at Orange Lake under natural conditions, which includes water levels that may rapidly change.

3.2 FWC Mission and Statutory Authority

The mission of FWC is to manage fish and wildlife resources for their long-term well-being and the benefit of people. The Commission administers six major divisions that include Habitat and Species Conservation, Freshwater Fisheries Management, Law Enforcement, Marine Fisheries Management, Hunting and Game Management, and Fish and Wildlife Research.

FWC is authorized to manage fish and wildlife in Orange Lake through regulation, augmenting stocks of sport fish, and manipulating habitats for fish and wildlife. FWC regulates and permits fishing, hunting of waterfowl and alligators, and commercial hunting of frogs in Orange Lake as well as the collection of alligator eggs and/or hatchlings above the elevation of sovereign submerged lands.

3.3 Public Participation

Stakeholder input for the HMP was solicited through four public meetings, two online surveys, and 10 one-on-one interviews with individuals who represent a diversity of stakeholder interest categories at the lake (Appendix B, C, and D). The public meetings were conducted collaboratively by the Normandeau facilitation team and FWC staff in 2015 and 2016. The online surveys were used in conjunction with the last two public meetings to solicit stakeholder input from those who could not attend meetings or preferred that form of involvement. The stakeholder interviews were conducted before the first public meeting.

Document drafts, meeting materials, and background literature were posted for review on the Orange Creek Basin Interagency Working Group website maintained by FWC (<https://orangecreekbasin.wordpress.com>).

3.3.1 *Promise to Stakeholders*

A promise to stakeholders is a way to let the participants in a public input process know exactly how their input will be integrated and what level of involvement they will have. It also clarifies the neutral role of the facilitator (Normandeau Associates, Inc.) in the stakeholder engagement process, with the focus being on writing the HMP while not advocating for any particular priorities or management strategies.

This promise to stakeholders for the Orange Lake HMP was presented at all public meetings held during development of the HMP:

The Normandeau project team promises to provide opportunities for stakeholders to provide input into development of the FWC Orange Lake HMP. We promise to consider all stakeholder input and recommendations for lake management goals, objectives, and action strategies. We promise to address and balance, where feasible, the needs of all stakeholder groups and FWC habitat management guidelines for the lake.

FWC is committed to an HMP that consists of stakeholder supported management strategies that are within FWC's statutory authority. FWC will make the final decisions on content of the Plan.

3.3.2 Stakeholder Values

In addition to reviewing comments documented by FWC at public meetings in September and December 2014, the Normandeau facilitation team carried out 10 one-on-one interviews with individuals who represent a diversity of stakeholder interest categories at the lake (see Appendix B). These interviews, along with comments documented at the 2014 meetings, revealed several common values across stakeholder groups:

- The value of healthy lake habitats is widely shared among stakeholders.
- Stakeholders are generally open-minded regarding the effectiveness of habitat management techniques, including spot treatment of vegetation with herbicide. However, there are concerns about large scale herbicide application and its effects on nontarget species and the aquifer, and whether decomposing plants killed by herbicide worsen sediment accumulation.
- Fire management is of interest to stakeholders as a potentially effective tool.
- Many stakeholders expressed conviction that the Highway 301 outlet weir contributes to problems within the lake.
- Many stakeholders expressed a high value for Orange Lake's rural setting, especially shoreline owners and residents.

3.4 Habitat Management in the Context of the HMP

The term habitat management as used within the Plan is defined as aquatic habitat management that optimizes fish and wildlife populations along with benefits for humans, including lake access. The current FWC management strategy for Orange Lake—the *Habitat Guidelines*—addresses eight habitat types and seven focal wildlife taxa. The management techniques used by FWC on the lake at any given time vary depending on the habitat and access issues as well as the water level.

3.4.1 Habitat Types

The eight habitat types addressed in the Plan are Tree Island, Shrub Swamp, Shallow Marsh, Floating Marsh, Deep Marsh, Floating Island, Open Water, and Hydrilla. Summaries of these are presented below, and they are fully described in the *Habitat Guidelines* (FWC OCBWG 2014).

FWC's schema of habitat types has its origins in a classification that was initially developed during studies for the SJRWMD (Bryan and Warr 1998), and it has been modified based on management experience.

Typical lake zonation is not often found at Orange Lake because of the unstable nature of much of the marsh. Floating Marsh now occupies many former Shallow Marsh and Deep Marsh zones, leading to a habitat transition gradient that progresses from uplands to Shrub Swamp, Floating Marsh, and finally Open Water. Under current conditions, Shallow Marsh and Deep Marsh are largely absent from this gradient and occur only sporadically where Floating Marsh has been affected by disturbance and/or management.

Tree Island

Tree Islands are typically small areas (<10 acres) dominated by mature trees and bald cypress that are anchored to the lake bottom but isolated from the shoreline of the lake by littoral vegetation or Open Water. The largest area of Tree Island habitat is at McCormick Island at the south end of McIntosh Bay.

Shrub Swamp

Shrub Swamp is dominated by small trees and shrubs intermixed with other wetland vegetation. This habitat type generally occurs in areas where surrounding Hardwood Swamps transition into Shallow Marsh habitats, or near the perimeter of Tree Islands. However much of the Shrub Swamp habitat now found at Orange Lake is a result of woody vegetation encroachment (primarily willow, elderberry, and primrose) into Shallow Marsh habitats during extended low water periods.

Shallow Marsh

Rooted emergent vegetation, often intermixed with submersed aquatic vegetation (SAV), dominates this habitat. Water level fluctuation is an important influence on this habitat type. Low water levels can cause the formation of Shallow Marsh when Floating Marsh habitat sinks and becomes attached to bottom sediments. Conversely, rapid changes in water levels can uproot Shallow Marsh and cause the formation of Floating Islands and Floating Marsh (see below). Shallow Marshes are highly variable in plant composition, and the habitat includes several subcategories depending on whether the habitat is dominated by one characteristic plant species or consists of multiple plant species.

Floating Marsh

A buoyant mat of plant roots and organic material supports native or exotic plants in this habitat. Floating Marshes are not entirely free-floating aquatic vegetation, rather they are attached to the shoreline but not anchored to the lake bottom. Floating Marsh may also have several inches of peat and/or organic sediment embedded in the vegetation. They typically occur near transition areas between Shallow and Deep Marshes. Floating Marsh communities can physically break into fragments that create free-floating tussocks or Floating Islands (see below). Floating Marsh fragments can drift to new locations and become part of the fringe of Floating Marsh in that new location, often covering up and smothering SAV and Deep Marsh. Floating Marsh occurs throughout Orange Lake at all water depths.

Deep Marsh

This habitat type typically occurs lakeward of Shallow Marsh–Floating Marsh complexes in water depths of 3 to 8 ft. Deep Marsh habitat is dynamic and often disrupted by the formation and movement of Floating Islands, especially when water levels rise rapidly after a period of extended low water. Because of this, lakewide coverage of Deep Marshes often depends on Floating Island coverage and lake stage, which facilitates the mobility of Floating Islands. There are several subcategories of this habitat type depending on which plant species are dominant.

Floating Island

Unlike Floating Marsh, Floating Island areas are not attached to the shoreline, nor are they anchored to the lake bottom like Tree Islands. The abundance and distribution of Floating Islands varies from year to year and can change rapidly following drought or flood events. The transient nature of Floating Islands and their tendency to impede public access and displace beneficial Deep Marsh habitat are significant challenges for lake management.

Open Water

The only plants that occur in this habitat are SAV species. Open water depths at Orange Lake typically range from 5 to 10 ft and occur in areas lower than the 52-ft contour NGVD (approximately 51.88 ft NAVD; see Figure 2–1). The amount of Open Water habitat varies considerably from year to year, depending on water level and length of time since a low water event has occurred as well as the coverage of Hydrilla. During periods when explosive Hydrilla growth covers large expanses of water, these areas are given their own classification of Hydrilla (see below).

Hydrilla

The FWC OCBWG created a distinct habitat category for Hydrilla at Orange Lake because of its importance to habitat management and because it creates conditions that differ considerably from those in the Open Water habitat type. In other lakes, mixed SAV is a distinct habitat, but at Orange Lake Hydrilla is typically the dominant SAV plant species. Hydrilla is found in all areas of Orange Lake and can have both positive and negative effects on fish and wildlife populations. Positive effects include serving as a food source for waterfowl, creating desirable substrate for invertebrates, and providing cover for forage fish. The negative effects of prolific Hydrilla can include fish kills created by low dissolved oxygen, loss of spawning substrate for some species due to excessive organic deposition, and obstructing navigation. Filamentous algae can add to infestation problems by combining with surface mats of Hydrilla, further reducing light penetration and oxygen concentration in the water column.

3.4.2 Focal Wildlife Taxa

The focal wildlife taxa addressed in the Plan are wading birds, waterfowl, Bald Eagles, centrarchid fish, herpetofauna, alligators, and round-tailed muskrat. These focal taxa exhibit one or more of the following attributes (FWC OCBWG 2014):

- High economic importance
- High recreational importance
- Sensitive to habitat manipulations

- Keystone species
- Rare or listed (FWC 2015)

Wading Birds

This group includes several listed species: Limpkin (*Aramus guarauna*), Wood Stork (*Mycteria americana*), Little Blue Heron (*Egretta caerulea*), Snowy Egret (*Egretta thula*), Tricolored Heron (*Egretta tricolor*), and Sandhill Crane. Wading birds are highly visible, dependent on aquatic habitats, and sensitive to changes in habitat quality. The group is broken into two subcategories (long legs and short legs) according to foraging and nesting/roosting habitats.

Waterfowl

This group includes duck species of interest to hunters and contributes to the lake's economic and recreational value. Wood Duck and Ring-Necked Duck are the FWC focal species within this group because they favor habitats used by many other species of dabbling and diving ducks.

Bald Eagles

A species of statewide conservation emphasis, Bald Eagles are strongly dependent on aquatic habitats for foraging. Large trees and snags on Tree Islands are favored as nesting sites for Bald Eagles. FWC uses a 660-ft disturbance buffer around Bald Eagle nests to guide management activities, especially between 1 October and 15 May when nests are most active. Nests occur in shoreline areas around the entire perimeter of Orange Lake, especially in the vicinity of Cross Creek.

Centrarchid Fish

This group includes species valued for recreational fishing, which adds to the lake's economic and recreational value. This group is also a good indicator of overall fish habitat quality and the presence of apex predators. Species of particular interest in this group include the following:

- Largemouth bass—an economically and recreationally valuable species, typically occupying vegetated areas of the lake
- Black crappie—an economically and recreationally valuable species, typically occupying the Open Water areas of the lake

Herpetofauna (Except Alligators)

Turtles, snakes, frogs, and salamanders are important species groups for the food web, and pig frogs are recreationally and economically important. This group represents a major component of biodiversity in lakes. There are no known rare, threatened, or endangered reptiles or amphibians in Orange Lake.

Alligators

Alligators are a keystone predator, an economically and recreationally valuable species, and an ecosystem engineer whose trails, holes, and nests affect and are used by other focal taxa.

Round-Tailed Muskrat

This species of conservation emphasis is sensitive to extreme water level fluctuations and habitat changes. Maidencane Shallow Marsh is a critical habitat for round-tailed muskrats, which are also found associated with Shallow Marsh, Floating Marsh, Floating Island, and Deep Marsh habitats. Round-tailed muskrats construct dome-shaped lodges from aquatic plants, attaching them to emergent vegetation.

3.4.3 Water Level Thresholds and Habitat Management Techniques

For the purposes of this Plan, water level thresholds are defined as follows based on access and habitat issues as well as habitat management techniques and equipment that can be deployed at each level (Figure 3–1; Table 3–1):

- **Normal** water levels are above 52 feet NAVD.
- **Low** water levels are between 52 and 50 feet NAVD.
- **Extreme low** water levels are below 50 feet NAVD.

At normal water levels, public access at boat ramps is available if it is not affected by other factors (e.g., blocked by vegetation), and a variety of habitat management techniques are available. Methods for managing tussocks and vegetation during normal water levels typically consist of mechanical harvesting or shredding, although these are somewhat limited at the lower end of the range, and herbicide application via airboat or aerial equipment.

At low water levels, public access and habitat management options are severely limited. Scraping and tilling cannot be used because nearshore zones are still saturated, and water levels are too low to deploy or stage equipment for mechanical harvesting or shredding. Thus the most viable option for managing habitat at low water levels is aerial herbicide application. Limited herbicide application via airboat is possible at the upper end of the range.

At extreme low water levels, public access is so limited that even airboats have difficulty gaining access to the lake, but several habitat management methods are available that can be applied to proactively minimize the negative impacts of extreme low water levels. Methods for managing vegetation and sediment at extreme low water levels include roller chopping, rotovating, mowing, scraping, tilling, and land-based or aerial herbicide application.

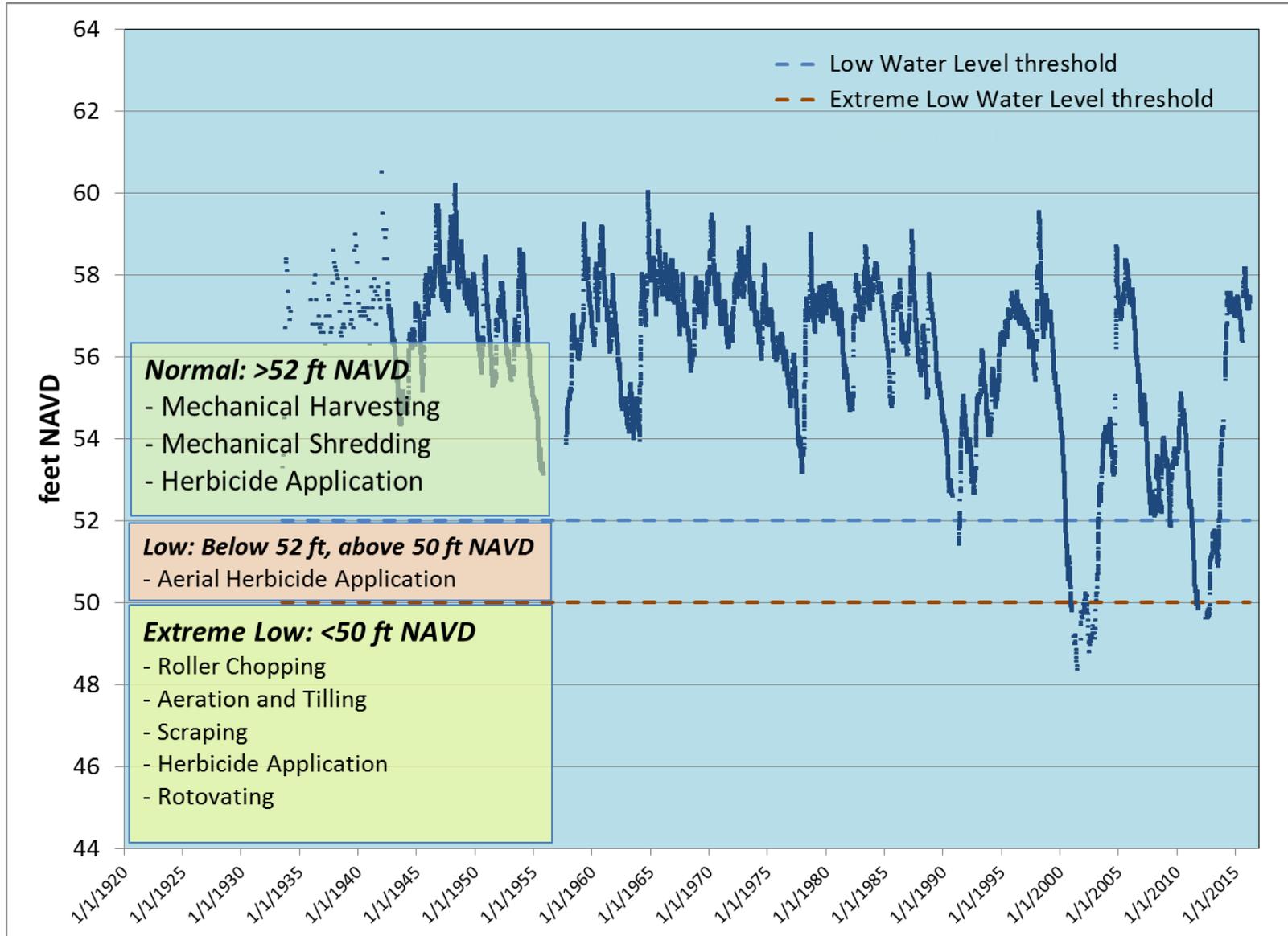


Figure 3–1. Measured water level compared with water level thresholds for habitat management techniques at Orange Lake.

Table 3–1. Habitat Management Techniques Available for Orange Lake

Technique	Purpose	Water Level	Estimated Cost	Habitat ^a
Mechanical shredding with in-lake disposal (cookie cutter)	<ul style="list-style-type: none"> Maintain access and Open Water using floating equipment at lower cost than mechanical harvesting Change vegetation composition 	Normal	\$875 to \$1,800 per acre depending on conditions	SM, DM, OW, SS, FM
Mechanical harvesting and removal with upland disposal	<ul style="list-style-type: none"> Remove vegetation and associated sediment completely using floating equipment 	Normal	\$4,000 to \$10,000 per acre	SM, DM, FM, OW, HY
Herbicide (aerial, boat-based, or land-based)	<ul style="list-style-type: none"> Control nuisance aquatic plants Clear access trails that lead to Open Water Slow down tussock formation Maintain previously scraped areas Enhance habitat for fish and wildlife that use openings in marsh 	Normal (aerial, boat) Low (aerial) Extreme Low (aerial, land)	\$130 per acre	SS, SM, FM, DM, FI, OW, HY, TI
Roller chopping, mowing, tilling, and rotovating	<ul style="list-style-type: none"> Disrupt plants and roots within upper layers of sediment Promote oxidation of organic sediments Discourage tussock formation when water rises 	Extreme Low	–	SM, SS
Scraping, muck removal, excavation	<ul style="list-style-type: none"> Remove sediment, muck, and vegetation 	Extreme Low	\$1.50 to \$3.00 per cubic yard depending on sediment characteristics	SM, DM, FM, SS
Transplanting native vegetation	<ul style="list-style-type: none"> Improve specific areas for specific habitats, especially on shorelines 	All	–	SM, DM
Small scale hydraulic (suction) dredging	<ul style="list-style-type: none"> Remove vegetation and sediment using floating equipment 	Normal	–	SM, DM, FM, OW, HY
Biological controls (insects, grass carp)	<ul style="list-style-type: none"> Using fauna to consume nuisance plants 	All	–	OW, HY, FM, FI, SM
Prescribed burning	<ul style="list-style-type: none"> Alter plant community species composition Set back vegetative succession 	Normal	–	SS, SM, FM, FI

^a TI = Tree Island, SS = Shrub Swamp, SM = Shallow Marsh, FM = Floating Marsh, DM = Deep Marsh, FI = Floating Island, OW = Open Water, HY = Hydrilla

3.5 Description of Geographic Units

Orange Lake's large size means that different areas of the lake have different characteristics. This can be a challenge for agencies with management responsibilities and for communicating about issues and events on and around the lake.

FWC staff recently developed a system of conceptual geographic units that help to communicate effectively about the lake (Figure 3–2). These units are approximate and conceptual, and their primary purpose in this Plan is to refer to the different geographic areas within Orange Lake concisely.

Open Water can occur in any of the geographic units depending on water level conditions. The largest Open Water area is located at the center of the lake, surrounded by the eight geographic units described below. While this central area of the lake remains predominately open except at extreme low water levels, it can become covered by Floating Marsh when water levels rise quickly.

3.5.1 North Marsh

This area is adjacent to the community of Evinston and includes the inlet from River Styx. The shoreline is predominantly forested. Willow and Hardwood Swamps are encroaching on the Shallow Marsh and Deep Marsh that were formerly the predominant aquatic habitats in this area.

3.5.2 Northeast Shore

The northeast shore includes a wide littoral zone and lies adjacent to a forested shoreline. A patchwork of habitats occurs in this area, although the predominant aquatic habitat is Shallow Marsh, including large areas of maidencane interspersed with Tree Islands.

3.5.3 MKR-Cross Creek

The community of Cross Creek is adjacent to this area, which includes the Marjorie Kinnan Rawlings (MKR) Historic State Park. A boat ramp located adjacent to the state park and maintained by Alachua County is a significant public access point for the lake. Inflow from Lake Lochloosa enters Orange Lake via Cross Creek within this geographic unit. The point of land known as Cow Hammock bounds the unit to the southeast. Habitat types in this unit made a recent transition from Open Water with SAV in 2007 to increased coverage by Floating Marsh in 2013.

3.5.4 Southeast Shore

Shoreline areas in this unit range from active pasture at Cow Hammock to forested areas farther south. The unit has its south boundary adjacent to Cane Hammock, a peninsula that extends south into the lake. A transition from Deep Marsh and Shallow Marsh to Floating Marsh occurred throughout this unit between 2007 and 2013.

3.5.5 PG Run

The community of Island Grove is adjacent to this unit as is the outlet channel of the lake that passes beneath SR 301, which forms the unit's eastern boundary. This unit is a large and

complex area that has changed dramatically in the past several decades as vegetation has accumulated and greatly reduced the coverage of Deep Marsh and Open Water.

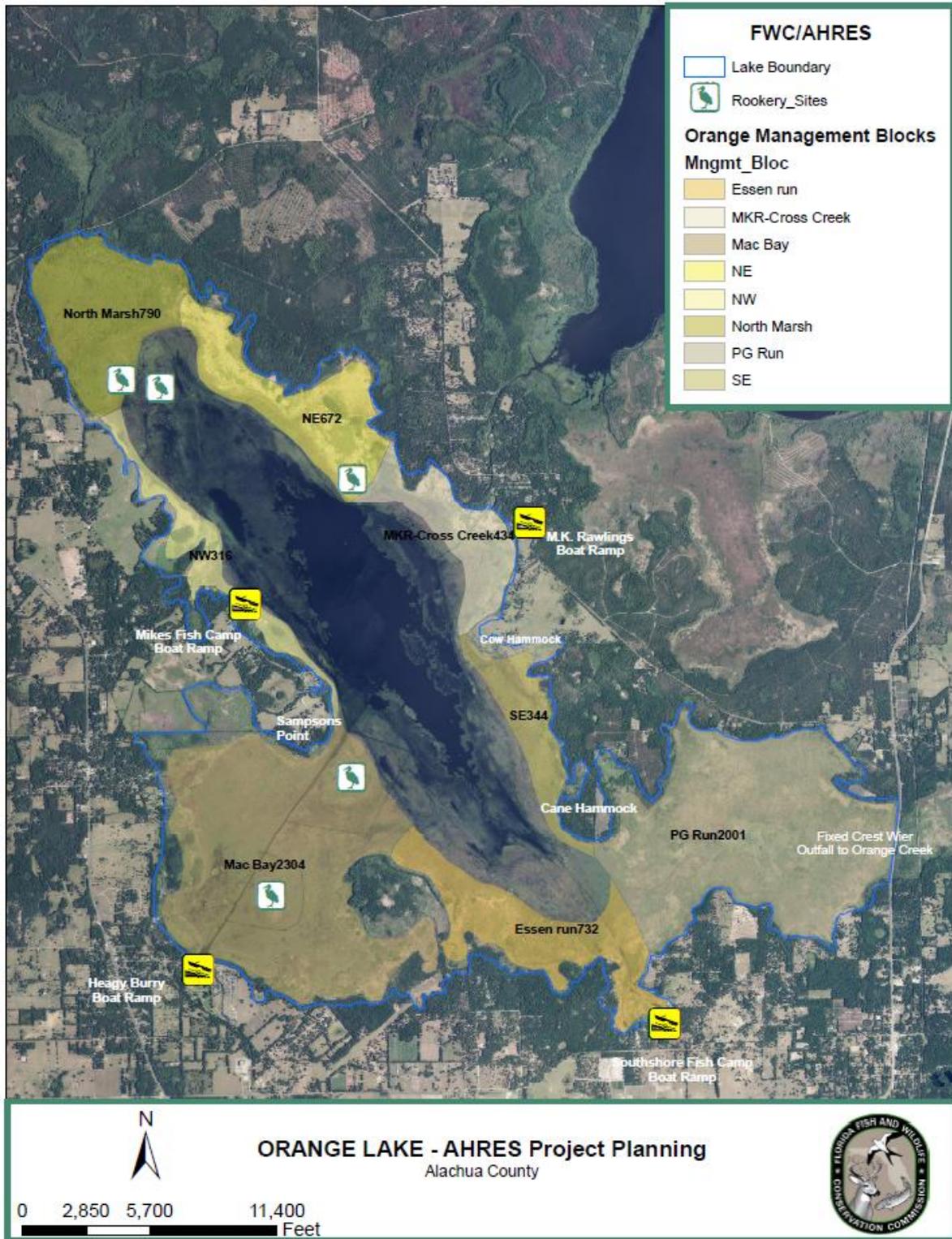


Figure 3–2. Geographic units for Orange Lake.

3.5.6 *Essen Run*

At the center of this unit is an area that traditionally provided access from the south shore out to Orange Lake. At times of low water this access dries up or becomes dominated by Floating Marsh, and since 2007 there has been a transition from Deep Marsh to Floating Marsh habitat types. A recent cooperative project between FWC, other agencies, and neighboring landowners affiliated with the Orange Lake Association used mechanical harvesting and replanting of shoreline species to remove excess Shrub Swamp and restore Deep Marsh habitat.

3.5.7 *McIntosh Bay*

The communities of McIntosh and Orange Lake are adjacent to the shoreline in this unit. It includes Heagy Burry Park, which provides the most reliable public boat access to Orange Lake and is maintained by Marion County. Several fish camps and the Grand Lake RV and Golf Resort are located along the shoreline. The predominant habitat types in 2007 were Deep Marsh and Hydrilla, while in 2013 Floating Marsh was most common. The unit includes McCormick Island, Bird Island, and Redbird Island, adding to the diversity of habitat types and littoral areas. At times, Floating Islands and Floating Marsh within McIntosh Bay create a landscape that can change within hours from being predominantly Open Water to resembling a permanent Freshwater Marsh.

3.5.8 *Northwest Shore*

This unit comprises a narrow area compared to other units, beginning at Sampson's Point and extending north toward River Styx. It includes a privately owned access point, Mike's Fish Camp, which is a reliable access point through a dredged channel into the lake even at low water levels. Much of the shoreline is hardwood swamp, and there are several Tree Islands surrounded by marsh areas. This unit is adjacent to the deepest part of the lake, resulting in a rapid transition from uplands to Open Water and Hydrilla/SAV habitats.

4 Management Recommendations

The recommendations in this section are based on stakeholders concerns raised at public meetings in 2014 and 2015 as well as specifications in FWC's *Habitat Guidelines*. Stakeholders raised concerns about access and navigation, focal wildlife and habitat, invasive species, tussocks, woody vegetation, Hydrilla, and accumulation of muck and sediment within the lake. The *Habitat Guidelines* also include concerns about focal wildlife and habitat. These concerns were used to develop the goals, objectives, and action strategies for the HMP during public meetings and internal meetings of FWC staff. In addition, FWC recognizes that continued communications with stakeholders is essential, and stakeholders expressed appreciation for the higher frequency of communications from FWC during the HMP process.

There are four broad categories that address FWC and stakeholder concerns:

- Communications
- Focal Wildlife Habitat
- Access and Navigation
- Invasive Species

For each category, FWC and Normandeau created a goal statement with a set of objectives that describe specific, achievable efforts that are needed to attain desired future conditions. A draft list of objectives based on input from Public Meeting 1 was presented to stakeholders at Public Meeting 2 for comment and to allow stakeholders to propose their own objectives within the categories of concern.

FWC and Normandeau used the public input to refine the list of objectives and formulate a draft list of action strategies based on management methods with a high likelihood of success in addressing the goals and objectives. These were presented at Public Meeting 3, and stakeholder support for various habitat management methods was evaluated through an online survey (Appendix C). FWC reviewed the public input and finalized the list of action strategies.

FWC's final goals, objectives, and action strategies are presented as tables in each of the following sections. Each action strategy has an associated water level because water levels at Orange Lake affect the severity of issues, the type of management techniques and equipment that can be deployed, and the likelihood of success. Projects based on action strategies will be included in annual work plans based on FWC's evaluation of habitat conditions and available funding each year. In any given year, even action strategies with a high likelihood of improving conditions may not be implemented due to funding constraints or prevailing habitat conditions.

4.1 Communications

4.1.1 Purpose and Need

A large number of stakeholders have a wide range of interests in Orange Lake and its associated resources (see Appendices C and D). More than 200 stakeholders participated in the process to develop this HMP. The higher level of interaction between stakeholders and FWC staff that occurred during the process of preparing the HMP has increased the two-way communications and understanding between the agency and the public. Stakeholders at the public meetings

voiced appreciation for the higher level of communication and interaction that formed the basis of the HMP.

FWC now has a better understanding of stakeholder concerns and how to balance the variety of stakeholder interests with one another and with habitat management goals. Many Orange Lake stakeholders no longer attend meetings only to voice concerns. Now they also attend to gain understanding of the resource and FWC's approach to managing aquatic vegetation and habitat. FWC wishes to enhance this success and further develop this working relationship through action strategies that address communications objectives.

4.1.2 Goal A, Objectives, and Action Strategies

Action Strategy Number	Goal A. Promote the growth and development of a mutual understanding between FWC and stakeholders regarding habitat management at Orange Lake.	Applicable Water Level*
<i>Objective A-1. Improve stakeholder engagement with FWC by increasing opportunities to exchange information through direct outreach.</i>		
A-1.1	Conduct two public forums annually to ensure that FWC and stakeholders communicate about the condition of the lake, annual work plans, results of recent management actions, and pertinent information relative to habitat management.	All
A-1.2	Provide public workshops on Orange Lake topics to ensure that stakeholders have the best available information regarding the resource.	All
A-1.3	Review HMP activities and progress at regular meetings of the Orange Creek Basin Interagency Working Group.	All
A-1.4	Identify areas where signage would improve communication, such as posting emergency contact information and procedures at boat ramps, and design and install signs in those locations.	All
A-1.5	Before wading bird nesting season each year, communicate with stakeholders regarding the metrics that FWC biologists will use to determine nesting success and locations within the lake that have high priority for rookery protection.	All
<i>Objective A-2. Improve communication between FWC and stakeholders by providing informative content on the FWC website.</i>		
A-2.1	Post annual work plans for the Aquatic Habitat Restoration/Enhancement Subsection and the Invasive Plant Management Section.	All
A-2.2	Provide a schedule of FWC management activities and opportunities for stakeholder involvement.	All
A-2.3	Provide maps that identify areas where habitat management has occurred and is proposed.	All
A-2.4	Develop a document library that consolidates pertinent current and historical information on Orange Lake including management plans and evaluations, scientific studies, physical and biological conditions, habitat enhancement, access/navigation maintenance, invasive plant management, surveys and monitoring, fish and wildlife rule changes, and fishing and hunting conditions.	All

Action Strategy Number	Goal A. Promote the growth and development of a mutual understanding between FWC and stakeholders regarding habitat management at Orange Lake.	Applicable Water Level*
A-2.5	Establish links to other relevant websites that facilitate recreation and other opportunities on Orange Lake, such as weather reports, fishing reports, current boating access conditions, and other pertinent lake information.	All
A-2.6	Establish a remote system for viewing and communicating current conditions at public access locations.	All
A-2.7	Provide contact information and procedures for emergency situations on Orange Lake.	All

*The habitat management techniques and equipment that can be deployed depend on the water level (see Section 3.4.3). For this HMP, water level thresholds are defined as follows: Normal = >52 feet NAVD, Low = between 52 and 50 feet NAVD, Extreme Low = <50 feet NAVD.

4.2 Focal Wildlife Habitat

4.2.1 Description of the Issues

Since at least the mid-2000s there has been evidence that conditions for fisheries and focal wildlife taxa at Orange Lake are declining (Figure 4–1). Detailed littoral vegetation mapping in 2007, 2010, and 2013 combined with assessments of habitat quality for the seven focal wildlife taxa described in Section 3.4 show that high quality habitat declined from 4,525 acres in 2007 to 1,871 acres in 2013. While some of the decline is associated with two extreme drought-flood cycles since the late 1990s, there is consensus within FWC and many stakeholders that some decline is due to other factors, and that active management of littoral habitats is needed to improve their quality for focal wildlife taxa.

Based on FWC aerial vegetation surveys, there has been an increase in Shrub Swamp and Floating Marsh compared to previous surveys, and a decrease in Open Water and Shallow Marsh (Figure 4–2).

4.2.2 Range of Conditions and Historic Conditions

When water level is normal (higher than 52 ft NAVD) for a prolonged period at Orange Lake there is a wide variety of water depths within Open Water and other habitat types, which increases the diversity of wildlife species that can use these areas as well as uplands adjacent to them. Littoral habitats can expand into the transitions between upland and lake and increase the number of acres of the habitat type.

Short-term and normal seasonal fluctuations in water level do not necessarily change habitat coverage or quality, but both of these attributes may change when water levels remain low over many months. When this occurs, the habitats themselves may change through the process of succession. During declines in water level that persist, Open Water habitat may make a transition into Shallow Marsh, leaving only a small vegetation-free area in the center of the lake.

Some focal taxa, notably wading birds, can adjust their habitat use to accommodate water level declines (e.g., no longer using nesting areas but still foraging for food there). Others such as dabbling duck species might leave to find more suitable habitat elsewhere. Wading bird rookeries may fail if water levels become too low during the peak of the breeding season (April–July) since they require enough water depth under nests to prevent predator access. Water level is a significant factor for habitat quality and coverage at Orange Lake, but the range of short-term fluctuation is also important, particularly rapid rises in water level. The most recent rise in water level occurred between 2012 and 2014, but similar rises have occurred since the water level record began (see Figure 2–2). When water level rises rapidly, Shallow Marsh and Floating Marsh habitats are disrupted. Floating Marsh becomes fragmented into Floating Island habitats, and nuisance tussocks proliferate. In Shallow Marsh habitats, vegetative mats that are rooted to lake sediment at low water levels become separated from the lake bottom and float. Desiccated peat, muck, and sediment submerged under the rising water become full of trapped gas during decomposition and rise to the surface, creating fresh organic material for seedlings to colonize.

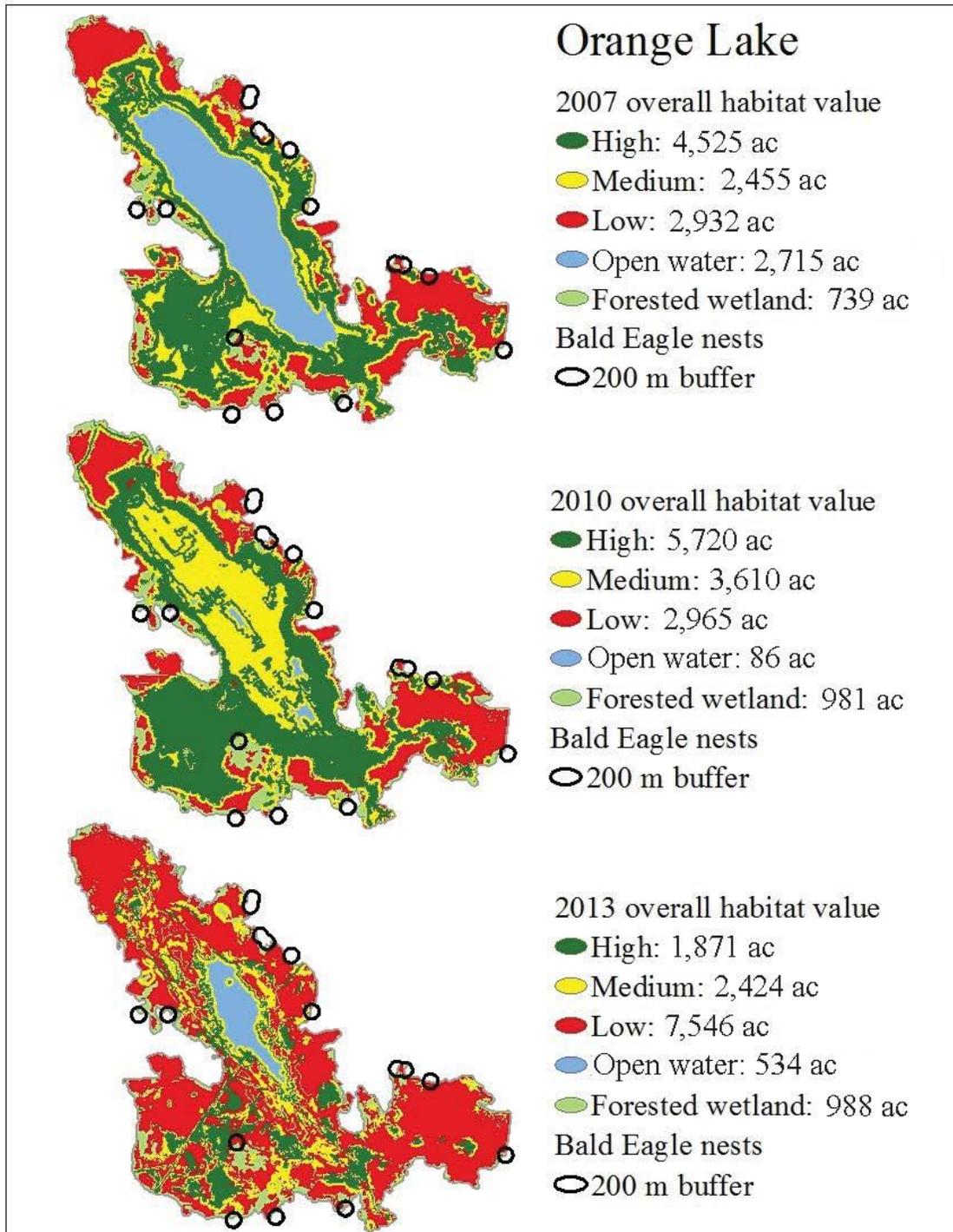


Figure 4–1. Overall habitat value on Orange Lake in 2007, 2010, and 2013 based on GIS analysis and littoral vegetation mapping (Modified from FWC OCBWG 2014).

High = high quality habitat for \geq four focal taxa and/or usable habitat for \geq seven focal taxa;

Low = high quality habitat for \leq two focal taxa and usable habitat for \leq four focal taxa (with areas of Open Water in the limnetic zone further specified); **Forested wetland** = Tree Island or hardwood swamp; **Medium** = all other areas.

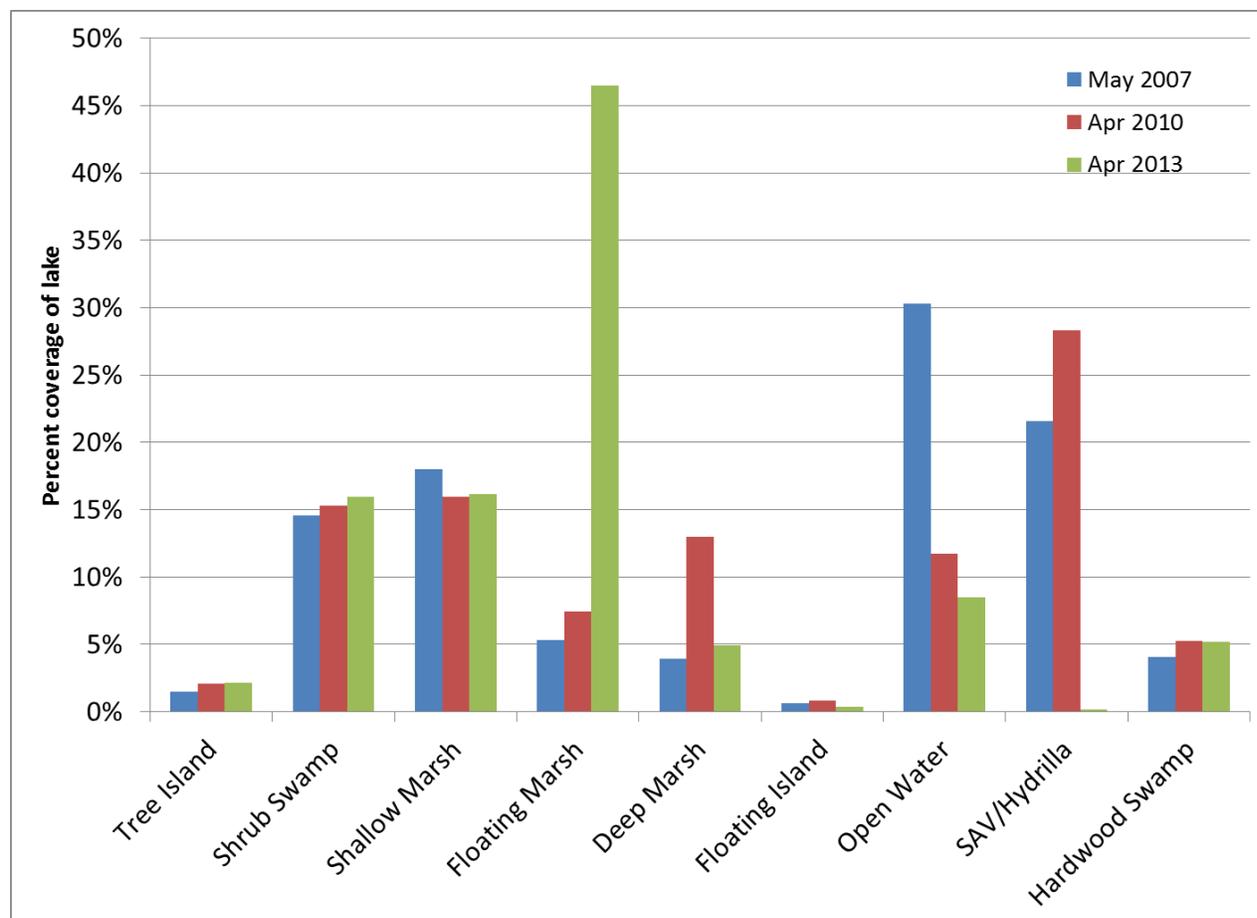


Figure 4–2. Coverage of habitat types at Orange Lake in 2007, 2010, and 2013 (FWC OCBWG 2014).

Water level changes also affect the encroachment of woody species into littoral habitats. A comparison of 2007 and 2013 littoral vegetation surveys shows that acreages of willow shrub swamp and hardwood swamp have recently increased, particularly in the North Marsh, McIntosh Bay, and PG Run geographic units. Shrub Swamp habitat coverage increases during extended low water periods when woody plant species (primarily willow, elderberry, and primrose) expand into Shallow Marsh zones.

Stakeholders have voiced concern for the well-being of Floating Islands that persist over a period of years, referred to in this Plan as legacy Floating Islands. FWC staff as well as stakeholders regard legacy Floating Islands as a valuable and unique habitat feature at Orange Lake, but little is actually known about their distribution, typical longevity, and other basic descriptors (Clarke and Reddy 1998).

FWC biologists have devised an approach to balance habitat quality and availability for numerous fish and wildlife species rather than managing only one or two species and assuming that this is sufficient to create good conditions for others. This schema for habitat management at Orange Lake is fully developed and documented in the *Habitat Guidelines* (FWC OCBWG

2014). FWC subject matter experts determined the range of habitat preferences for specific focal wildlife taxa (see Section 3.4.2) and combined these preferences into a set of recommended percent coverages, or a habitat matrix, for the eight habitat types (see Section 3.4.1) found on the lake.

The habitat matrix in the *Habitat Guidelines* describes target percent coverage ranges for each of the habitat types in the lake, excluding hardwood swamp (Table 4–1). Several objectives and action strategies for Goal B are based on this matrix. To account for changing water levels and other environmental factors, the ranges are sometimes broad; for example, Floating Marsh is assigned a desired range of 5% to 22.5% coverage. The *Habitat Guidelines* also note the degree of optimal interspersed, block size, vegetation coverage, density, and location of these habitats.

The objectives for Goal B include some that address access and navigation, tussocks, and woody vegetation encroachment. Access and navigation are included when an objective will primarily improve focal species habitat but also have potential to improve access and navigation. Tussock formation and control are included because tussocks originate as Floating Marsh, which is one of the eight habitat types addressed in the *Habitat Guidelines*. Woody vegetation encroachment is included when it can be addressed as part of habitat management activities.

Table 4–1. Observed Area, Coverage (Percentage of Lake), and Target Coverage for Habitat Types at Orange Lake

Habitat Type	May 2007		April 2010		April 2013		Target Coverage	
	Area (Acres)	Percent Coverage	Area (Acres)	Percent Coverage	Area (Acres)	Percent Coverage	Low (%)	High (%)
Tree Island	200	1.5	279	2.1	292	2.2	0.5	7.5
Shrub Swamp	1,950	14.6	2,046	15.3	2,138	16.0	2.5	7.5
Shallow Marsh	2,407	18.0	2,138	16.0	2,160	16.2	20.0	30.0
Floating Marsh	717	5.4	991	7.4	6,216	46.5	5.0	22.5
Deep Marsh	529	4.0	1,737	13.0	657	4.9	7.5	20.0
Floating Island	87	0.6	111	0.8	52	0.4	0.8	5.0
Open Water	4,056	30.3	1,569	11.7	1,137	8.5	30.0	50.0
SAV/Hydrilla	2,889	21.6	3,789	28.3	20	0.1	20.0	57.5
Hardwood Swamp	541	4.0	704	5.3	697	5.2	–	–

Source: Modified from FWC OCBWG 2014 to include percent coverage for hardwood swamp.

Note: SAV = submersed aquatic vegetation

4.2.3 Goal B, Objectives, and Action Strategies

Action Strategy Number	Goal B. Manage habitat for the focal taxa defined in the <i>Habitat Guidelines</i> .	Applicable Water Level*
<i>Objective B-1. Manage habitat types according to the Habitat Guidelines.</i>		
B-1.1	Conduct aerial mapping and GIS analysis of habitat composition every 3 years to assess compliance with the <i>Habitat Guidelines</i> .	All
B-1.2	Perform field assessments of changing conditions and produce an annual habitat status report that will communicate observed changes in habitat composition during interim mapping years.	All
B-1.3	When developing annual work plans, identify and develop projects to address habitat deficiencies based on results of aerial mapping/GIS analysis and observations from field assessments.	All
B-1.4	Periodically survey and document the location, size, and condition of legacy Floating Islands.	Normal, Low
B-1.5	Restore the use of prescribed burns as a viable tool for managing habitat to the extent feasible given weather and safety conditions, including smoke management, and as authorized by the Florida Forest Service.	All
B-1.6	Maintain conditions suitable for wading bird nesting at a minimum of four locations with the intent of achieving successful nesting at three sites each year.	Normal, Low
B-1.7	Identify species not included as focal taxa that may have unique conservation needs and develop habitat management action strategies to address those needs.	All
<i>Objective B-2. Establish and implement policies that minimize scope and scale of management related disturbance to fish and wildlife resources and the public.</i>		
B-2.1	Habitat maintenance and/or management actions that exceed a total of 750 acres (6% of total lake area) per year will not be conducted without stakeholder support. This excludes acreage required for routine maintenance described in goals C and D.	All
B-2.2	In the first 2 years following extreme low water levels, prioritize reclamation of Shallow Marsh/Deep Marsh/Open Water habitat types in the following manner: 1) areas in close proximity (within 1/2 mile) to public access points and 2) all other areas as necessary to achieve compliance with target coverage ranges recommended in the <i>Habitat Guidelines</i> .	Normal, Low

Action Strategy Number	Goal B. Manage habitat for the focal taxa defined in the <i>Habitat Guidelines</i> .	Applicable Water Level*
B-2.3	Use herbicide to proactively manage vegetation in response to extreme low water events to minimize the formation and the excessive expansion/encroachment of Floating Marsh (tussocks).	Extreme Low
B-2.4	Develop a comprehensive list of critical timing considerations for fish and wildlife and stakeholder concerns (see Appendix E).	All
B-2.5	Schedule management actions to minimize conflicts with wildlife critical life history events (e.g., nesting, spawning, molting) and public use opportunities (e.g., fishing, hunting) to the greatest extent feasible (see Appendix E).	All
Objective B-3. Streamline administrative and logistical processes to allow for timely implementation of adaptive management.		
B-3.1	Obtain necessary permits ² in advance of anticipated habitat management projects to expedite implementation when water levels change.	All
B-3.2	Improve internal FWC funding allocation process to expedite implementation of anticipated habitat management projects.	All
B-3.3	Identify potential vegetation and sediment disposal areas and maintain a list of feasible sites.	All
Objective B-4. Manage habitat in a manner that minimizes sediment accumulation by using methods appropriate to the habitat type and scale.		
B-4.1	Conduct management with ground based mechanical equipment during extreme low water events (<50 ft NAVD) to reduce organic sediment and inhibit excessive expansion/encroachment of Shrub Swamp beyond recommended target coverage ranges in the <i>Habitat Guidelines</i> .	Extreme Low
B-4.2	Use mechanical harvesting when removal of material is necessary to achieve the habitat objectives and when upland disposal is feasible.	Normal
B-4.3	Apply herbicides in a manner that is consistent with maintenance control ¹ methodology (UF/IFAS 2015) to minimize long-term accumulation of organic sediment.	All

*The habitat management techniques and equipment that can be deployed depend on the water level (see Section 3.4.3). For this HMP, water level thresholds are defined as follows: Normal = >52 feet NAVD, Low = between 52 and 50 feet NAVD, Extreme Low = <50 feet NAVD.

1. Maintenance control is the lowest level feasible that funding and technology will permit and that promotes native plant communities. This management approach reduces herbicide use, the amount of organic material deposited, impacts to nontarget species, and cost. See Section 4.4.1.

4.3 Access and Navigation

4.3.1 Description of the Issues

In this Plan the term access means the ability of a lake user to launch a vessel from an established boat ramp and make their way out of the ramp area. Navigation refers to the ability to move around from one part of the lake to another. These issues are affected by the extent of Open Water, Hydrilla, Floating Marsh, and Shrub Swamp that are present at a given time.

Stakeholder descriptions of access and navigation problems are similar to one another despite the differences between user groups. When water levels are normal there is a reasonable expectation of uncomplicated access and navigation by lake users, especially those who travel from other parts of the state. There is frustration across all stakeholder groups when access and navigation are difficult.

When conditions on Orange Lake are favorable for tussock formation, free-floating vegetation mats can interfere with access and navigation. Short-term remedies such as vegetation shredding in ramp areas may only temporarily improve conditions. Planning, financing, and obtaining permits for long-term actions that have the potential to resolve access and navigation challenges require large amounts of agency effort and time, thus they cannot be quickly implemented.

Woody vegetation encroachment affects lake navigation when Shallow Marsh makes a transition into Shrub Swamp habitat because it is more difficult to travel by boat through Shrub Swamp areas than Shallow Marsh.

4.3.2 Range of Conditions and Historic Conditions

At normal water levels, Orange Lake offers a wide variety of water depths and habitats for a wide variety of stakeholder activities. When the water level is normal, initial access to the lake may be uncomplicated. However once a boater has moved out from the access point, navigation may be blocked by tussocks that make returning to the access point very difficult especially if vegetation moves into navigation channels.

Many lake users cannot make their way from public access points to the lake at all when the water level is low, and when the water is at extreme low levels, even air boaters are unable to access and navigate around the lake. During extended periods of extreme low water levels there are no areas of Open Water adjacent to ramps and former areas of shallow water have become mudflats (Figure 4–3). In the course of Florida’s 1998–2002 drought, the water level remained below 52 feet NAVD for nearly 3 years. One positive result of the prolonged drought was that there was considerable sediment compaction during this period with some long-term benefits for both access and navigation (ECT 2002).



Figure 4–3. Heagy Burry public boat ramp looking northeast in April 2001 (left) and February 2012 (right; Source: FWC).

Goal C includes the concept of reasonable lake access and navigation. The intention is to allow reliable use by diverse users at customary places, such as public boat ramps, and at customary times and seasons. However, the highly dynamic nature of water level changes at Orange Lake and the response of native biota to these changes combine to create a lake system in which it is not possible to guarantee lake access and navigation 100% of the time.

In addition to addressing lake access and navigation, the objectives and action strategies for Goal C include some that address tussock formation and control, since tussocks consistently interfere with access and navigation for most user groups for the lake. Objectives in this section also address woody vegetation encroachment. This has resulted in recent rapid succession of many areas of Shallow Marsh to Shrub Swamp, a habitat type through which it is more difficult to navigate.

4.3.3 Goal C, Objectives, and Action Strategies

Action Strategy Number	Goal C. Improve and maintain reasonable lake access and navigation in a way that balances the needs of diverse user groups under varying water level conditions.	Applicable Water Level*
<i>Objective C-1. Manage vegetation to provide access to Open Water in the vicinity of boat ramps appropriate to varying water level conditions.</i>		
C-1.1	Treat mobile floating tussocks within 100 yards of publicly owned access points during normal water levels using the most efficient method based on vegetation composition, which is generally mechanical harvesting and/or shredding for mud tussocks and herbicides for vegetative tussocks (see Appendix E).	Normal
C-1.2	Investigate the feasibility of installing permanent barriers near public access points to minimize adverse impacts caused by mobile tussocks.	All
C-1.3	Investigate the feasibility of anchoring legacy Tree Islands to minimize adverse impacts to public access.	All
<i>Objective C-2. Adopt a standard network of boat trails and manage the vegetation within those trails to enhance navigation.</i>		
C-2.1	Propose a standard network of boat trails that does not adversely impact sensitive wildlife habitat, discuss with stakeholders, and make the final version widely available.	All
C-2.2	Proactively treat SAV in the adopted network of trails before it limits access as a way to prevent it from limiting access in the future.	Normal
C-2.3	During extreme low water levels use mowing and tilling in the adopted network of trails where feasible.	Extreme Low
C-2.4	Evaluate sediment/vegetation accumulation status in PG Run to determine the feasibility and cost for maintaining navigation.	All
C-2.5	Explore opportunities to cooperate with partners to create paddle trails through marsh habitats.	All
<i>Objective C-3. Collaborate with other agencies and partners to maintain and/or upgrade public access facilities.</i>		
C-3.1	Explore opportunities to cooperate with partners to create new public access points.	All
C-3.2	Explore opportunities to cooperate with partners to manage/deepen channels the next time the water is at extreme low levels.	All

Action Strategy Number	Goal C. Improve and maintain reasonable lake access and navigation in a way that balances the needs of diverse user groups under varying water level conditions.	Applicable Water Level*
C-3.3	Cooperate with partners to enhance wildlife viewing opportunities at public facilities.	All
C-3.4	Explore opportunities to cooperate with partners to expand parking at public access points.	All

*The habitat management techniques and equipment that can be deployed depend on the water level (see Section 3.4.3). For this HMP, water level thresholds are defined as follows: Normal = >52 feet NAVD, Low = between 52 and 50 feet NAVD, Extreme Low = <50 feet NAVD.

4.4 Invasive Species

4.4.1 Description of the Issues

The predominant stakeholder and agency concerns regarding invasive species were directed at water lettuce, water hyacinth, Hydrilla, willow and woody vegetation, and tussocks. These are grouped together because some of the management techniques are similar, notably the use of herbicide. Invasive plant coverage also affects access to and navigation in Orange Lake (see Section 4.3). While stakeholder comments included the observation that Island Apple Snail (*Pomacea insularum*) and Brown Hoplo (*Hoplosternum littorale*; an invasive fish) occur in the vicinity of Orange Lake, the Island Apple Snail has not been found in Orange Lake and FWC did not have sufficient information about the population and biology of Brown Hoplo for Orange Lake to consider possible management actions at the time this Plan was created. FWC is currently researching these two species at a statewide level.

Water lettuce and water hyacinth float on the surface of the water and grow rapidly. The vegetation communities in tussocks can include water lettuce and water hyacinth as well as native plants. FWC currently manages water lettuce and water hyacinth at a maintenance control level, which is the lowest level feasible that funding and technology will permit and that promotes native plant communities (UF/IFAS 2015). This management approach reduces herbicide use, the amount of organic material deposited, impacts to nontarget species, and cost.

In contrast, Hydrilla is a submerged invasive exotic plant that grows rapidly but has been found to have some benefits to fisheries and is a food source for waterfowl. For example Ring-necked Ducks are a popular species among waterfowl hunters, and aerial surveys of this species in Florida show that their distribution is associated with the presence and abundance of dense Hydrilla beds. While native SAV typically occurs in water depths of less than 6.56 ft, Hydrilla is not limited by water depth in Orange Lake and can potentially grow in all areas of the lake.

Because the primary uses and functions differ widely between lakes, FWC has developed a statewide management position regarding Hydrilla, which specifies a waterbody-by-waterbody risk-based approach to determine the level of management (FWC 2011). The agency position consists of a set of implementation guidelines that include annual coverage surveys, determination of the primary public uses and functions of the waterbody, obtaining stakeholder input, and consultation among FWC staff. At Orange Lake, the level of management for Hydrilla is included in a target coverage range of 20% to 57.5% for all SAV (FWC OCBWG 2014). This range balances the fact that this species is a source of food and cover for some focal wildlife but also has potential to impair access and the health of fish populations during periods of excessive growth.

Willow is a natural component of Shrub Swamp, but for several focal wildlife taxa in Orange Lake it is desirable to maintain medium-stage successional plant communities within this habitat type (see Section 3.4). Wildfire is a significant natural control that can maintain medium-stage successional plant communities in the absence of human intervention. In the absence of wildfire or prescribed fire, herbicide is often used by habitat managers to eliminate willow and other

hardwoods that have become larger than is optimal for use by focal species, or where these species encroach on Shrub Swamp.

4.4.2 Range of Conditions and Historic Conditions

At normal water levels, all of the plant species described in this section can occur in most parts of the lake. When the lake level is normal, areas of Open Water can become extensive but often become covered by floating mats of native and nonnative vegetation (tussocks) and Floating Islands. Areas of prolific vegetation growth that can fragment into tussocks and Floating Islands can occur anywhere in the lake. Boaters are highly motivated to get out on the lake when the water level is normal but may find themselves blocked by tussocks and Floating Islands that interfere with the return to their original boat launch area.

The rate of water level rise affects conditions for invasive plants and the proliferation of tussocks through fragmentation of Floating Marsh. Orange Lake's surface area increases markedly when the water level rises, and this creates more habitat for floating plants especially those that propagate rapidly. When Floating Marsh is fragmented by rapid rises in water level combined with wind, tussocks and Floating Islands are created that can be many acres in size and move freely around Open Water areas of the lake according to wind direction.

At water levels above 52 feet NAVD, invasive plant conditions are variable due to water level fluctuations as well as management activities. For example, water lettuce did not occur in excessive amounts on Orange Lake between 1983 and 2003, but it proliferated in 2005. Abundant rainfall during hurricanes Francis and Jeanne in the fall of 2004 after a long period of drought caused a sharp rise in water levels which created ideal conditions for the expansion of water lettuce. A significant expansion of water hyacinth occurred in 1984, with over 4,000 acres treated with herbicide, but since 2004 water hyacinth acreages have been much smaller, with control operations applied to less than 100 acres per year.

At water levels at or below 52 feet NAVD, conditions for invasive plants and tussock formation from Floating Marsh are constrained by the reduction in lake surface area and shallower water depths (see Figure 2-1). Declining water levels can strand Floating Islands, especially when windy conditions are present. During Florida's 1998-2002 drought, when the coverage of the Open Water habitat type was considerably lower than at full pool, low acreages of Hydrilla, water hyacinth, and water lettuce were observed in the October survey.

The aerial extent of Hydrilla on Orange Lake has ranged from covering most of the lake's surface soon after it first became established in the mid-1970s, to much lower coverages (see Figure 2-3). Recent Hydrilla coverage has remained relatively low despite the rapid rise in water level in 2013 and 2014; unlike water lettuce and water hyacinth, Hydrilla coverage can be reduced when the plants are shaded by water level rises. Consumption of Hydrilla by waterfowl, especially American Coot, can be considerable and was observed to have reduced Hydrilla coverage by approximately 2,000 acres in 2008 (FWC OCBWG 2014).

4.4.3 Goal D, Objectives, and Action Strategies

Action Strategy Number	Goal D. Manage invasive species to minimize their adverse impact while maintaining habitat objectives outlined in the <i>Habitat Guidelines</i> .	Applicable Water Level*
<i>Objective D-1. Plan vegetation management to minimize adverse impacts to fish and wildlife and their habitats.</i>		
D-1.1	Minimize noncritical management actions ¹ during the full and new moons of the fish spawning season (1 February to 15 May).	All
D-1.2	Minimize Hydrilla and other SAV herbicide applications during warmer months, when dissolved oxygen levels are naturally low, to minimize negative impacts to fish and wildlife.	All
D-1.3	Avoid noncritical invasive plant management actions ¹ 2 weeks before opening and during various waterfowl hunting seasons.	All
D-1.4	Control water lettuce and water hyacinth with herbicide at the lowest feasible level. Avoid herbicide applications within 300 feet of an active wading bird rookery during the nesting season (March–July).	All
D-1.5	When treating invasive plants during the spring months (mid-February through June) comply with Sandhill Crane best management practices (see Appendix E) to minimize disturbance to nesting Sandhill Cranes.	All
D-1.6	Continue to coordinate with the University of Florida’s Institute of Food and Agricultural Sciences to produce and disseminate written, peer-reviewed best management practices for methods of herbicide application likely to be used at Orange Lake.	All
<i>Objective D-2. Maintain lakewide Hydrilla coverages to fit within ranges in the Habitat Guidelines.</i>		
D-2.1	Conduct aerial mapping and GIS analysis of habitat composition every 3 years to assess compliance with the <i>Habitat Guidelines</i> .	All
D-2.2	Conduct annual Hydrilla surveys using sonar and GPS equipment.	Normal
D-2.3	Perform field assessments of changing conditions and produce an annual habitat status report that will communicate observed changes in habitat composition during interim mapping years.	All

Action Strategy Number	Goal D. Manage invasive species to minimize their adverse impact while maintaining habitat objectives outlined in the <i>Habitat Guidelines</i> .	Applicable Water Level*
D-2.4	Proactively manage Hydrilla with herbicide ² to maintain coverage within the target coverage range specified by the <i>Habitat Guidelines</i> (20% to 57.5%).	All

*The habitat management techniques and equipment that can be deployed depend on the water level (see Section 3.4.3). For this HMP, water level thresholds are defined as follows: Normal = >52 feet NAVD, Low = between 52 and 50 feet NAVD, Extreme Low = <50 feet NAVD.

1. Critical management actions are those that must be implemented to maintain reasonable access and navigation and/or prevent wildlife habitat damage or loss. Noncritical management actions are those that can be delayed to minimize impacts to fish and wildlife, their habitats, and public use of the resource without severely impacting access, navigation, and wildlife habitat.
2. Herbicide application is considered by FWC to provide the best balance between potential impacts to native plant communities and stakeholder uses (see Section 2.2).

5 Metrics and Monitoring

The following metrics and monitoring efforts are relevant to habitat management at Orange Lake. They include some that are handled by agencies other than FWC.

- Percent coverage of focal habitats using high resolution aerial mapping of vegetation
- Status of Hydrilla abundance based on submersed vegetation surveys (sonar, GPS)
- Fish population surveys
- Creel surveys and reward tags
- Documentation of fish kills
- Measurements of water quality, particularly dissolved oxygen and nutrients
- Documenting cost of habitat management activities
- Population counts of focal species
- Wading bird rookery nest and fledgling counts
- Alligator population surveys and trend modeling
- Alligator egg counts

The primary metric currently in use by FWC is percent coverage of focal habitats (acres) compared to the targets stated in the *Habitat Guidelines* (see Table 4–1). FWC is currently committed to conducting aerial mapping and GIS analysis of habitat composition every 3 years to determine the effects of management activities over the lake as a whole and to monitor changes in focal habitat coverage and quality.

Because conditions at Orange Lake are more dynamic than at other north Florida lakes, some form of habitat coverage and quality monitoring is needed during the years between detailed aerial surveys. To address this need, FWC proposes to conduct field assessments of habitat coverage and quality and produce an annual status report that will communicate observed changes in habitat composition during interim mapping years.

6 Potential Opportunities Identified by Stakeholders for Interagency Collaboration

6.1 Introduction and Background

Some of the issues and concerns raised by stakeholders are not fully within the mission and statutory authority of FWC, thus they are included here as potential opportunities for interagency collaboration. As stated in the Introduction to this HMP, effective management of a dynamic, multiple use resource such as Orange Lake typically extends beyond the mission of any one agency, organization, or group of stakeholders. FWC recognizes the value of collaborative partnerships and supports the idea of exploring and developing opportunities with local, state, and federal agencies, private landowners, and nongovernmental organizations to maximize the benefits to fish and wildlife and the people who enjoy them. FWC also recognizes that effective partnerships can often lead to increased efficiencies in time and resources and direct cost savings that justify placing a high priority on projects or initiatives that involve a collaborative partnership approach.

Regarding the Heagy Burry sinkhole complex, no potential opportunity is included in this section addressing interventions and/or modification, because there is considerable uncertainty and risk regarding the effect that sinkhole modifications would have on the lake. The range of water level fluctuation due to outflow into sinkholes at low water levels contributes to the unique habitats and wildlife at Orange Lake. It is widely accepted among staff at various agencies, including the Florida Geological Survey, that alterations to the sinkhole complex have potential to create further instability (Kindinger et al. 1994; Means 2015) and that other less obvious sinkholes in the lake would continue to be active at low water levels.

6.2 Potential Opportunities

For each of the potential opportunities, a brief description and justification is provided along with agencies and other partners that would be involved.

Action 1. Determine whether there are shoreline areas where land could be purchased for new public access points, particularly those that are close to deep water.

- **Justification:** FWC is generally not involved in land acquisition for the purpose of boating access but instead relies on partnerships between agencies to explore possible new public land acquisitions and management. There may be opportunities for public access points at shoreline areas of Orange Lake that are closer to deep water than current boat ramps. New public access points have potential to increase the length of time that public access is possible to Open Water areas of the lake when water levels are low.
- **Agencies Potentially Involved:** Florida Park Service, SJRWMD, Marion County, Alachua County, Town of McIntosh.
- **Other Partners:** Private landowners.

Action 2. Collaborate on infrastructure improvement at public boat ramps and other public access points.

- **Justification:** FWC by itself does not typically provide manpower or funding to improve infrastructure but instead relies on partnerships between agencies to provide these services and amenities.
- **Agencies Potentially Involved:** Florida Park Service, SJRWMD, Marion County, Alachua County.

Action 3. Consider the future of the Highway 301 weir.

- **Justification:** This stakeholder concern is expressed repeatedly in commentary and at public meetings. FWC has no authority on its own to explore options for modifying and/or removing the structure. There are numerous affected parties, and a process to address this action would begin by considering the feasibility and outcomes for numerous engineering scenarios.
- **Agencies Potentially Involved:** Florida Department of Transportation, SJRWMD, US Army Corp of Engineers, Department of Environmental Protection, Marion County, and Alachua County.
- **Other Partners:** Private landowners.

Action 4. Continue water quality and hydrologic monitoring programs.

- **Justification:** Water quality and water level data collection is a long-term activity for agencies other than FWC. Data are important for monitoring lake conditions and evaluating potential effectiveness of management methods that are under consideration at a given time.
- **Agencies Potentially Involved:** FDEP, SJRWMD.
- **Other Partners:** University of Florida LakeWatch.

Action 5. Explore opportunities to cooperate with partners to manage channels the next time water levels are low.

- **Justification:** Many channel and boat trail areas are adjacent to private property. Landowner cooperation and permission may be needed to carry out sediment management in these areas once water level conditions are acceptable.
- **Agencies Potentially Involved:** Army Corps of Engineers, SJRWMD, Alachua County, Marion County.
- **Other Partners:** Private landowners.

Action 6. Cooperate with partners to enhance wildlife viewing opportunities at existing public facilities.

- **Justification:** There may be opportunities to expand these opportunities through cooperative funding. FWC generally does not by itself provide manpower or funding to expand recreational opportunities on land it does not control, but instead relies on partnerships between agencies to expand these services and amenities.
- **Agencies Potentially Involved:** Florida Park Service, SJRWMD, Marion County, Alachua County.

Action 7. Explore opportunities to cooperate with partners to expand parking at access points.

- **Justification:** The issue of parking availability that is occasionally exceeded at publicly owned access points (Heagy Burry and MKR county parks) has been mentioned by stakeholders.
- **Agencies Potentially Involved:** Alachua County, Marion County.
- **Other Partners:** Private landowners.

Action 8. Explore opportunities to cooperate with partners to create paddle trails through marsh habitats.

- **Justification:** There may be opportunities to expand paddle trails through cooperative funding and collaboration with local government and private entities.
- **Agencies Potentially Involved:** Florida Park Service, SJRWMD, Marion County, Alachua County.
- **Other Partners:** Private landowners.

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8 Glossary

Access (n.)

A means of entering or approaching a place; the opportunity or right to experience or make use of something. (Encarta Dictionary)

Bathymetry

The measurement of the depth of large bodies of water (oceans, seas, ponds, and lakes). The measurement of water depth at various places in a body of water. The information derived from such measurements. (USF Water Institute)

Block Size

A discrete spatial area per habitat type that represents the minimum size area required for a focal taxa breeding population. (*Habitat Guidelines*)

Burn

The controlled application of fire to naturally occurring vegetative fuels, under specified environmental conditions, and following appropriate protocols. (*Habitat Guidelines*)

Cookie Cutter

A weed cutting machine that chops and shreds floating aquatic vegetation, tussocks and associated sediment to open the water column in wetland areas. The material is usually disposed of in the lake. See also mechanical shredding.

Critical Management Action

Actions that must be implemented to maintain reasonable access and navigation and/or prevent wildlife habitat damage or loss. See also Noncritical Management Actions.

Focal Taxa

Species whose requirements for persistence define the attributes that must be present if that landscape is to meet those requirements (Lambeck 1997). (*Habitat Guidelines*)

Historic (adj.)

Something that is important or influential in history.

Historical (adj.)

Anything from the past, important or not.

Keystone Species

A species that has a disproportionately large effect on its environment relative to its abundance (Paine 1995). Such species are described as playing a critical role in maintaining the structure of an ecological community, affecting many other organisms in an ecosystem and helping to determine the types and numbers of various other species in the community.

Manage

Undertake activities to improve and maintain habitat quality for focal taxa given the funding and ecological constraints.

Mechanical Harvesting

Removal of aquatic plants, tussocks, and/or sediments with equipment that removes the material for disposal. The vegetation and/or sediments are usually disposed on an upland site.

Mechanical Shredding

Chopping and shredding floating aquatic vegetation, tussocks, and associated sediment with aquatic equipment called shredders or cookie cutters. The vegetation and sediments are usually disposed of in the lake or waterbody. See also cookie cutter.

Metric

A system of related measures that facilitates the quantification of some particular characteristic. (*Habitat Guidelines*)

National Geodetic Vertical Datum (NGVD)

A measure of land elevation established in 1929 that compares land surface elevation with Mean Sea Level, based on 26 tide stations throughout North America.

Navigation

The process of planning and following a route. The passage of vessels.

Noncritical Management Action

Actions that can be delayed to minimize impacts to fish and wildlife, their habitats, and public use of the resource without severely impacting access, navigation, and wildlife habitat.

North American Vertical Datum (NAVD)

A measure of land elevation established in 1988 throughout North America that incorporates more precise survey technologies compared with earlier measures of land surface elevation above sea level.

Reasonable

As much as is appropriate or fair. Having sound judgment; fair and sensible.

Roller Chopping

Using a large drum with blades that is pulled by a tractor to cut down brush and open up cuts in soil.

Rotovating

Using a rotovator, which is similar to a rototiller and has blades that turn 7 to 9 inches below the surface of the sediment to turn over and oxidize the sediments.

Stakeholder

Any person who is significantly affected by or significantly affects wildlife or wildlife management decisions or actions

Taxon (plural. taxa)

A group of (one or more) organisms, which a taxonomist adjudges to be a unit (Wikipedia 2010). A taxonomic unit, whether named or not: i.e., a population, or group of populations of organisms which are usually inferred to be phylogenetically related and which have characters in common which differentiate (q.v.) the unit (e.g. a geographic population, a genus, a family, an order) from other such units. A taxon encompasses all included taxa of lower rank (q.v.) and individual organisms. (Glossary of the International Code of Zoological Nomenclature 1999)

Tussock

A community of floating vegetation that occurs in two habitat types—Floating Island (not attached to the shoreline) and Floating Marsh (attached to shoreline vegetation) and forms in two different ways. A Vegetative Tussock is formed by mat-forming vegetation such as frogs bit (*Limnobium spongia*), water hyacinth, water lettuce, and other species; it has very little to no associated sediment but can form a substrate for heavier vegetation. A Mud Tussock is formed when deep organic sediments (up to 3 feet or more) have dried out when the water level is low and then float when the water level increases; it can be composed of pickerelweed, cattail, smartweed, other native species, and small shrubs.

9 Appendices

Appendix A. Chronology of Events Affecting Orange Lake

Significant events for Orange Lake have been compiled from several sources. Events prior to 1996 are from the 1996 Surface Water Improvement and Management Plan (Lasi and Shuman 1996) and a historic retrospective on vegetation management by staff at SJRWMD (Warr et al. 1999). Events between 1997 and 2011 are based on a chronology presented in the 2011 Surface Water Improvement and Management Plan (Lippincott 2011). Notes regarding water level conditions throughout the chronology are based on the record maintained by SJRWMD at station 02611465.

Pre-1871

- Paynes Prairie consists of a Shallow Marsh/lake, with Prairie Creek flowing into Alachua Sink from Newnans Lake

1871

- Alachua Sink is full due to high water levels, making Paynes Prairie a lake

1881

- Railroad bridge constructed across Orange Lake outlet to Orange Creek

1891

- Lower water levels cause Paynes Prairie to revert to a Shallow Marsh/lake

1926

- U.S. Highway 301 constructed across outlet to Orange Creek

1927

- Camp family (private owners of Paynes Prairie) diverts Prairie Creek to Camps Canal and Orange Lake in order to drain water from Paynes Prairie to create Camps Ranch

1930s

- Agricultural landowners construct Shands Dike and Canal downstream from Orange Lake to provide farming access and drain muckland

1955

- Orange Lake Watershed Association organizes to address low water levels in Orange Lake

1956

- Report that “mucklands” in Orange Lake burned in March (Warr et al. 1999)

1957

- Report that over 2,000 acres of “muckland” burned in February (Warr et al. 1999)

- Alachua and Marion Counties build a berm in southwest corner of Orange Lake in an unsuccessful attempt to isolate sinkholes and raise lake water levels
- Alachua County Recreation and Water Conservation and Control Authority (ACRWCCA) is established to study and implement lake level stabilization; replaces Orange Lake Watershed Association
- Water level in the lake rises for the first time in 2 years.

1958

- Local individuals build an earth and concrete rubble dam across Orange Lake outlet to raise water levels

1959

- Outlet dam is removed during reconstruction of SR 301.

1960s

- U.S. Highway 301 four-laned across Orange Lake outlet
- U.S. Highway 441 four-laned across Paynes Prairie
- ACRWCCA proposes to construct a new outlet dam for Orange Lake, but the idea is controversial between citrus owners and fish camps

1961

- Paynes Prairie is purchased by the State of Florida and established as wildlife sanctuary

1963

- ACRWCCA builds Orange Lake outlet weir to raise lake water level
- Lakes Newnans, Lochloosa, and Orange are designated as Fish Management Areas in 1963 in a cooperative agreement between the Florida Game and Freshwater Fish Commission (now FWC) and Alachua County (FWC OCGWG 2014)

1964

- Unsuccessful attempts are made to raise water level in Orange Lake by filling the sinkhole in the southwest corner of Orange Lake with debris
- The highest lake water levels since 1948 occur in September (Hurricane Dora)

Early 1970s

- Florida Department of Natural Resources (now FDEP) buys Camps Ranch to restore Paynes Prairie

1973

- Hydrilla introduced into Orange Lake, most likely from a boat. Its first occurrence was noted in the MKR area, spreading throughout the lake by 1975 (see Figure 2–3).

1975

- Florida Department of Natural Resources (now FDEP) breaches Camps Canal levee to partially restore Prairie Creek flow to Paynes Prairie

1977

- Studies conducted on Orange Lake in 1977 (Colle et al. 1987 cited in FWC OCBWG 2014) estimate the annual economic value of the largemouth bass fishery as one million dollars (FWC OCBWG 2014).

1979

- FDEP installs flashboard riser culverts in breach in Camps Canal levee.

1986

- Studies conducted on Orange Lake in 1986 (Milon 1986, cited in FWC OCBWG 2014) estimate the annual economic value of the largemouth bass fishery as \$5 million (FWC OCBWG 2014), with a total impact of over \$10 million to the local economy.

1987

- FDEP designates Lochloosa Lake, Orange Lake, Cross Creek and River Styx as “Special Water” Outstanding Florida Waters (FWC OCBWG 2014).

1988

- FDEP replaces flashboard riser culverts in Camps Canal levee with gated culverts.

1989

- Orange Lake Dam Task Force forms to address lake levels in Orange Lake

1990

- Low-flow notch in Orange Lake weir illegally obstructed

1994

- SJRWMD Governing Board establishes Orange Creek Basin Advisory Council
- SJRWMD Governing Board passes Rule 40C-2.302, FAC, Reservation of Water From Use for Paynes Prairie State Preserve. This allowed a percentage of the flow from Prairie Creek to be re-diverted into Paynes Prairie instead of into Orange Lake

1995

- Orange Lake Advisory Council approves the Orange Creek Basin Surface Water Management Plan
- SJRWMD Governing Board approves Orange Creek Basin Surface Water Management Plan

1997

- Hydrilla covers 2,700 acres of Orange Lake (see Figure 2–3)

1998

- Near-record high lake levels in Newnans and Orange Lakes
- Flashboards are installed at Camps Canal culverts into Paynes Prairie to stop flow into Paynes Prairie due to high water threatening closure of Highway 441
- FWC scrapes 15 acres of sediment and vegetation near MKR boat ramp

2000

- Hydrilla covers 2,860 acres of Orange Lake (see Figure 2–3); water level drops over 4.5 ft during the year

2001

- Record low water level reduces the normally 12,355-acre Orange Lake to roughly 2,471 acres, exposing large areas of organic sediments
- (Fiscal Year 2000–2001) A total of 50,000 yd³ of aquatic plant material and associated organic sediments (muck) is removed from 15 acres of the bottom of Orange Lake

2002

- FWC removes organic material from 160 acres of shoreline in four areas of Orange Lake and creates seven 1-acre in-lake disposal islands in Orange Lake. Upland disposal sites are utilized for some of the scraped organics. The remainder is placed in previously created disposal islands near the shoreline adjacent to Sportsman’s Cove Fish Camp in McIntosh Bay and immediately south of the MKR public ramp
- Water level begins to rise from the extended low levels since 2000
- During the lake refill approximately 5,000 acres of tussocks settle in Deep and Shallow Marsh habitats

2003

- SJRWMD denies permit request by Marion County to plug sinkhole at Heagy Burry Park

2004

- As of January 2004, there was an estimated 2,500 acres of Open Water in Orange Lake
- FDEP convenes the Orange Creek Basin Interagency Working Group to develop a BMAP
- Lake water level continues to rise, reaching the highest level since 1998 in October 2004 after Hurricanes Frances and Jeanne
- High winds during hurricanes of 2004 stranded or sunk 1,500 acres of tussocks, reclaiming some areas of traditional Deep and Shallow Marsh habitats

2005

- Florida Land and Water Adjudicatory Commission upholds denial of permit by SJRWMD to Marion County to plug Heagy Burry sinkhole
- Lake water level remains high, similar to 2004
- High flow in Prairie Creek is temporarily diverted away from Paynes Prairie and toward Orange Lake due to high water in Paynes Prairie that threatens closure of Highway 441
- FDEP and FWC continue work begun in 2004 to remove a combined 2,451 acres of floating vegetation in Orange Lake using herbicide, mechanical harvesting, and mechanical shredding
- FWC forms internal Orange Creek Basin Working Group (OCBWG) composed of FWC biologists with goal of developing lake-specific habitat management plans for Orange, Lochloosa, and Newnans lakes

2007

- Hydrilla covers 5,500 acres of Orange Lake (see Figure 2–3)
- Water lettuce covers 513 acres of Orange Lake, the most ever recorded
- Water levels fall through the year, reaching the lowest level since Florida’s 1998–2002 drought

2008

- FDEP Secretary orders adoption of Orange Creek BMAP
- Hydrilla covers 3,540 acres of Orange Lake, but heavy feeding on Hydrilla by American Coot reduces coverage by approximately 2,000 acres (see Figure 2–3)

2009

- Hydrilla covers 4,225 acres of Orange Lake (see Figure 2–3)
- FWC and Alachua County plant 3.5 acres of wetland trees within the Essen Run area to provide long-term fish and wildlife habitat benefits

2010

- Cold weather and waterfowl control approximately 70% of Hydrilla in Orange Lake by February 2010 (see Figure 2–3)
- Hydrilla covers 2,426 acres of Orange Lake
- Water levels decline 5 ft between March and July and continue falling through the end of the year

2011-2012

- Cold weather, reduced area of Open Water, and waterfowl combine to reduce Hydrilla coverage (see Figure 2–3)
- Water levels reach the lowest point since 2002, then rapidly rise with rain from tropical storms in May and June 2012

2013

- Aerial survey of vegetation by FWC shows very low coverage of high quality and acceptable habitat compared to surveys in 2007 and 2010 for alligator and wading bird foraging, Wood Duck, Ring-necked Duck, black crappie, largemouth bass, and other centrarchids

2014–2015

- Water levels remain high, with Floating Marsh fragmenting into large Floating Islands that affect access and navigation
- FWC management actions include:
 - Mechanical shredding and spot herbicide application to maintain access at the MKR public boat ramp and Mike’s Fish Camp
 - Vegetation shredding around rookery island sites to maintain disturbance buffers and moat zones and restore Deep Marsh
 - Vegetation shredding and herbicide application to maintain four Shallow and Deep Marsh areas created in previous years from Shrub Swamp and Floating Marsh

Appendix B. Public Participation

Orange Lake Stakeholder Engagement

Orange Lake is challenging to manage due to its wide shallow bottom contours, dramatically changing water levels due to a direct link to the Floridan aquifer, rich organic sediment, drifting islands of vegetation, human-induced changes to hydrology, and long history of recreational and financial importance to local communities. A large number of stakeholders have a wide range of interests in Orange Lake and its associated resources.

The conflicting needs of different user groups that must be considered as possible future management actions are developed by the Florida Fish and Wildlife Conservation Commission (FWC) through a Habitat Management Plan (HMP). The HMP development process is designed to provide stakeholders with the opportunity to provide input to the HMP, while ensuring that the HMP provides a clear, achievable roadmap for future management activities at Orange Lake.

Guiding Principles

Stakeholder engagement will be guided by these principles: honesty, fairness, transparency, and facilitator neutrality.

FWC is committed to engaging stakeholders in the HMP development process. This will be accomplished through activities that will include public meetings, stakeholder interviews and communications, an online survey, and a stakeholder comment compilation as an appendix in the final HMP.

Promise to Stakeholders

The Normandeau project team promises to provide opportunities for stakeholders to offer input into development of the FWC Orange Lake HMP. We promise to consider all stakeholder input and recommendations for lake management goals, objectives, and action strategies. We promise to address and balance, where feasible, the needs of stakeholder groups along with FWC habitat management guidelines for the lake.

FWC is committed to an HMP that consists of stakeholder supported management actions that are within FWC's statutory authority. FWC will make the final decisions on content of the Plan.

Stakeholder Level of Participation

The Normandeau project team will be asking stakeholders to voice their thoughts and concerns about Orange Lake habitat management. The team will work to get input from stakeholders that represent a wide diversity of interests at Orange Lake.

Decision making on content of the HMP will ultimately be FWC's responsibility. The Normandeau project team will incorporate stakeholder input into several drafts of the Plan. FWC will review, provide comment on, and approve each draft of the Plan after considering 1) the feasibility of recommended actions, 2) FWC's ability to implement recommended actions, 3) whether recommended actions are within FWC statutory authority, and 4) whether actions are consistent with the FWC Orange Lake Habitat Management Guidelines.

Orange Lake Stakeholders

Stakeholder Groups

A listing of stakeholder individuals and organizations was compiled from an Orange Creek Basin Interagency Working Group contact list provided by FWC in February 2015, along with additional information from Normandeau technical lead staff. This yielded a list of 92 individuals and organizations to be included in the HMP stakeholder engagement process, based on previous attendance at meetings and potential interest or statutory authority at Orange Lake.

Using this list, each stakeholder was assigned to one of 15 primary categories (Table A–1). This listing was then used to determine the relative numbers of individuals and organizations in each primary category.

Table A-1. Stakeholder Categories at Orange Lake

Primary Category	Details/Interests	Number of Individuals on Contact List
Recreation-consumptive	Fishing, duck hunting, other recreational hunting	18
State Government	Dictated by agency mission	14
NGO-Environmental	Bird rookeries, regional water resources, aquifer protection, land conservation	11
Shoreline Property Owners	Public access, noise; varies with location and nature of property	11
Fish Camp	Visitor destination, quality of bass fishing, quality of other fishing	9
Local Government	Regional issues in the two counties and six communities that neighbor Orange Lake	5
Scientific	Aquatic plants, geology, hydrology, fisheries, aquatic biology, other	5
Fishing equipment sales	Sale/repair of boats, fishing equipment, other supplies	4
Concerned Citizen	Regional and local hydrology, noise, water quality	3
Federal Government	Dictated by agency mission	3
Resource Extraction	People who sell what they catch—alligator, alligator eggs, frogs	3
Archeological/Historical	Known and undiscovered archeological and historic sites in and around Orange Lake	2
Nearby Business	Other than fishing equipment sales: restaurants, etc.	2
Hunting/guide business	Primarily fishing	1
Recreation-nonconsumptive	Canoeing, kayaking, wildlife watching	1

Note: NGO = Nongovernmental organization

When stakeholders affiliated with government institutions (24 people) are excluded from the tabulation of stakeholders, the five most numerous categories are recreation-consumptive, NGO-environmental, shoreline property owners, fish camps, and fishing equipment sales; 53 out of 92 stakeholders (58%) were in one of these categories.

One-on-One Interviews

Ideally, every stakeholder with an interest in the HMP could be interviewed to clarify their values and concerns regarding the HMP. Obviously this is not practical in a situation with this large a number of stakeholders. Therefore one-on-one stakeholder interviews of about 1 hour in length were carried out to gain familiarity with multiple stakeholder viewpoints. For the Orange Lake HMP process, the one-on-one interviews had the following goals:

- Improve Normandeau's familiarity with local people and issues relevant to the final Plan
- Enhance Normandeau's ability to focus public meeting time on issues and values as opposed to individuals/organizations
- Determine the relative importance of various habitat management issues to various individual/organizational stakeholders
- Determine whether there are stakeholder group values that overlap or conflict

The stakeholder list, created using the FWC contact list combined with information from Normandeau Associates technical lead staff, was reviewed to identify a shorter list of individuals who could give insight into a wide diversity of stakeholder values and outlooks. These individuals were asked to participate in 1-hour long interviews with Normandeau staff regarding their interests and values relevant to future habitat management activities on Orange Lake. Three stakeholder groups that represent government agencies (local, state and federal) were excluded from the potential interview list since their input is generally assured as part of their professional responsibilities during review processes.

Initial review of the full list of 92 stakeholders by FWC and Normandeau yielded a potential interview pool of approximately 30 individuals in six categories: concerned citizen, fish camp, nearby business, NGO-environmental, consumptive recreation (fishing, hunting), and shoreline property owner. This list of 30 was narrowed to a final list of 10 individuals as follows:

1. Within a stakeholder category, individuals who were identified by both FWC and Normandeau Associates as having long-term knowledge and engagement as well as ability to elucidate stakeholder values and issues were given high priority.
2. The final list of individuals to be interviewed endeavored to create a relatively even distribution of people among stakeholder categories so that a wide range of viewpoints could be reflected.
3. Where there was a choice between two individuals representing similar stakeholder interests, local versus nonlocal individuals were chosen. This resulted in several interviewees identifying themselves as primarily shoreline residents, but they had differing secondary interests.

Interviews took place between April and June 2015. Four of the interviews took place at the MKR county park boat ramp, three were held over the telephone, two were at the interviewee's workplace/home, and one was held at the Normandeau Associates Gainesville office.

Summary of Concerns and Values

A summary of concerns and values expressed during the interviews is presented in Table A-2. Several generally shared values were revealed by the one-on-one interviews that have also been expressed by individuals at Orange Lake public meetings in September and December 2014:

1. The concept of "healthy lake/habitats" was mentioned in nearly all interviews. This value was expressed as an attribute of the lake that exists now that is desirable to keep (i.e., much of the lake is not currently unhealthy).
2. Interviewees were generally open-minded regarding the effectiveness of habitat management techniques, including spot treatment of vegetation with herbicide. Suspicion of large scale herbicide treatment was expressed in many interviews, including reservations about the effects on nontarget species, the aquifer, and questions about whether decomposing plants killed by herbicide exacerbate sediment accumulation.
3. Fire was mentioned as an important potential management tool in 6 out of 10 interviews.
4. Conviction that the 301 weir contributes to problems within the lake was expressed in 5 out of 10 interviews.
5. A high value was expressed for Orange Lake's rural setting by all interviewees who identified themselves as shoreline owners/residents. The word "unique" was often used to describe Orange Lake during interviews.

Table A-2. Summary of Concerns and Values Expressed by Individual Stakeholders, April–June 2015.

Interview Number	Primary Interest Category (Secondary)	Concerns	Values	What Does Success Look Like?
1	Environmental organization (Wildlife observer)	<ul style="list-style-type: none"> • Past habitat management actions by agencies prioritized Open Water to detriment of other habitat types • Regional aquifer decline is affecting water level regime and habitat quality • Collapse of Bird Island rookery 	<ul style="list-style-type: none"> • Should work with natural processes not against them • Consider all HM techniques 	Healthy habitats of many kinds
2	Sportsman/duck hunter (Concerned citizen)	<ul style="list-style-type: none"> • Hydrilla is interfering with access and use of lake • Regional aquifer decline is affecting water levels 	<ul style="list-style-type: none"> • Healthy habitats for fish, all wildlife species using any appropriate method • Invasives are here to stay and must be managed • Reliable access to the lake for multiple uses 	<ul style="list-style-type: none"> • Minimal treatment of invasives to maintain access and healthy lake • Plan/permit process that allows quick response to vegetation management problems
3	Fish camp owner (Sportsman)	<ul style="list-style-type: none"> • Regional aquifer decline is affecting water levels • There is too much muck in the lake and it is impacting access and lake health 	Promote a healthy environment—take care of the lake	Natural lake shoreline to shoreline—native plants, clean, healthy environment
4	Shoreline resident (Wildlife observer)	<ul style="list-style-type: none"> • Invasive exotic plants on spoil islands • Need to preserve existing habitat quality and diversity, especially Floating Islands • Runoff from cattle areas 	<ul style="list-style-type: none"> • The lake is a unique, large, mostly healthy aquatic ecosystem • Rural (i.e., not populated) setting is part of the value of the lake 	<ul style="list-style-type: none"> • High species richness and diversity (which exists now in some areas) • Good water quality without cattle manure inflows
5	Sportsman (Concerned citizen)	<ul style="list-style-type: none"> • Access to Open Water is impaired by tussocks and muck • Lake marshes are being taken over by willow 	<ul style="list-style-type: none"> • Ability to get out to Open Water and marshes in boats/airboats • Variety of habitats in different areas of the lake 	Access to Open Water at all times for all user groups from public access points

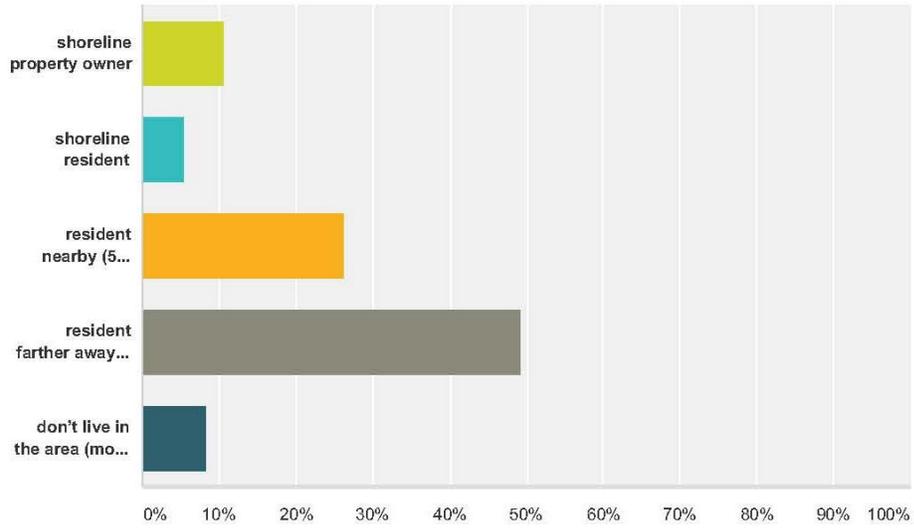
Interview Number	Primary Interest Category (Secondary)	Concerns	Values	What Does Success Look Like?
6	Shoreline owner (Environmental organization)	<ul style="list-style-type: none"> • There is disruption of natural water flow through lake • Invasive plants 	<ul style="list-style-type: none"> • Quality and diversity of bird habitats in lake • Uniqueness of lake habitats especially Floating Islands 	<ul style="list-style-type: none"> • Natural flows restored • Fish and bird habitats restored • No invasives
7	Sportsman (Fishing equipment business)	<ul style="list-style-type: none"> • Need high quality habitat for all fisheries • Need reliable access to Open Water 	<ul style="list-style-type: none"> • The lake is a unique and beautiful place • Need to keep management simple, it is not possible to satisfy everyone's interests 	<ul style="list-style-type: none"> • Open waterways that are free of vegetation • Minimal vegetation management
8	Shoreline owner (Sportsman)	<ul style="list-style-type: none"> • Disruption of water levels from 301 weir • Muck buildup because of fire exclusion 	<ul style="list-style-type: none"> • Rural shoreline • Connection with the past 	<ul style="list-style-type: none"> • Restore "natural" water level regime • Restore marshes being encroached on by woody vegetation
9	Shoreline owner (Wildlife observer)	<ul style="list-style-type: none"> • Encroachment of woody vegetation into marsh areas • Future population pressures on inflows and shoreline development 	<ul style="list-style-type: none"> • Wildlife; peace and quiet • "You are close to natural Florida here" 	<ul style="list-style-type: none"> • Restored hydrology and no exclusion of fire • Access for any type of boat
10	Shoreline owner (Sportsman)	Accumulation of vegetation and sediment in south part of lake	Serenity; rural/undeveloped shoreline; wildlife	<ul style="list-style-type: none"> • Access to Open Water during normal and high water • Large tussocks eliminated • Optimal conditions for bass, eagles, migratory waterfowl

Appendix C. Stakeholder Survey Results

FWC Orange Lake Habitat Management Plan - Stakeholder Survey

Q1 How would you describe your location with respect to Orange Lake?

Answered: 217 Skipped: 0

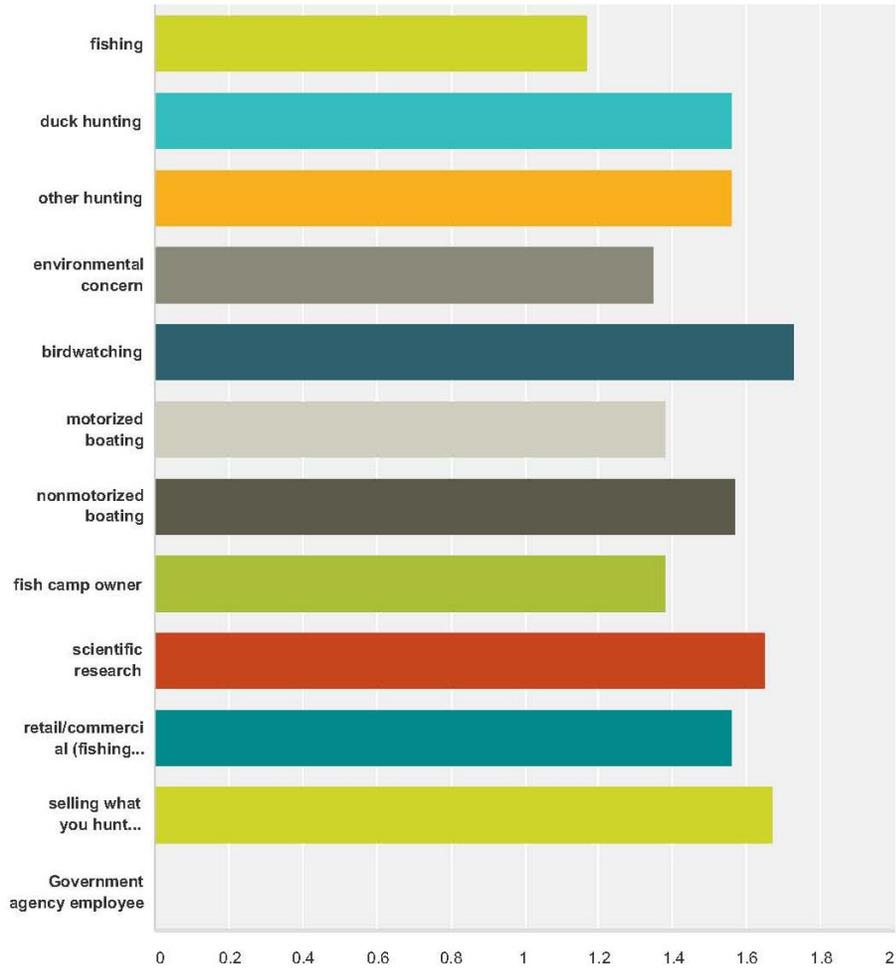


Answer Choices	Responses	Count
shoreline property owner	10.60%	23
shoreline resident	5.53%	12
resident nearby (5 miles)	26.27%	57
resident farther away (6-50 miles)	49.31%	107
don't live in the area (more than 50 miles)	8.29%	18
Total		217

FWC Orange Lake Habitat Management Plan - Stakeholder Survey

Q2 Please rank your top two interests:

Answered: 216 Skipped: 1



	1st Priority	2nd Priority	Total	Weighted Average
fishing	82.97% 151	17.03% 31	182	1.17
duck hunting	44.07% 26	55.93% 33	59	1.56
other hunting	44.44% 16	55.56% 20	36	1.56
environmental concern	65.28% 47	34.72% 25	72	1.35
birdwatching	27.27% 9	72.73% 24	33	1.73

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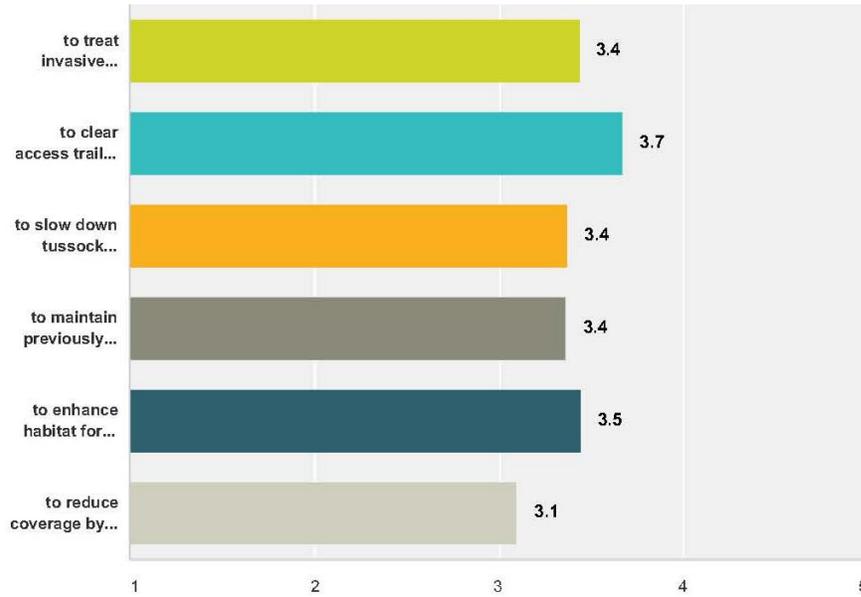
motorized boating	61.54% 56	38.46% 35	91	1.38
nonmotorized boating	43.48% 10	56.52% 13	23	1.57
fish camp owner	62.50% 10	37.50% 6	16	1.38
scientific research	35.29% 6	64.71% 11	17	1.65
retail/commercial (fishing equipment/boat sales)	44.44% 8	55.56% 10	18	1.56
selling what you hunt (frogs, alligator, alligator eggs)	33.33% 5	66.67% 10	15	1.67
Government agency employee	0.00% 0	0.00% 0	0	0.00

#	Other (please specify)	Date
1	Night time frog gigging. Used to go twice a week before they stopped us.	2/10/2016 9:52 AM
2	Frog gigging at night on airboat	2/10/2016 8:22 AM
3	Kayaking/ canoeing	2/9/2016 9:11 PM
4	Deer	2/9/2016 7:35 PM
5	remove some of the tussocks/muck, way too many	2/8/2016 9:47 AM
6	sport fishing	2/8/2016 9:16 AM
7	Just riding and seeing the scenery in my boat	2/7/2016 8:57 AM
8	airboating	2/6/2016 5:38 PM
9	Personal family recreation. Gardening	2/5/2016 12:26 PM
10	gator hunting and frogging	2/5/2016 12:06 PM
11	Airboating	2/4/2016 11:24 PM
12	Removal of invasive vegetation that blocks the ramp and waterways	2/4/2016 10:04 AM
13	Environmental concern #1 for water; Environmental concern #2 for animal life health	1/27/2016 8:11 AM
14	Remove some of the tussocks/much. Way too many	1/27/2016 7:45 AM
15	access to the lake, tussocks are a hazard and blocking navigation	1/26/2016 11:15 PM
16	i hunt and fish this lake, but am more concerned about keeping chemicals out of the food chain	1/23/2016 3:19 PM
17	Ala.Co. to enforce air boat law	1/23/2016 9:27 AM
18	Frog hunting	1/22/2016 5:19 PM
19	undesirable proliferations of venomous cottonmouth snakes	1/22/2016 4:03 PM
20	Heagy Bury Access	1/22/2016 2:35 PM
21	I enjoy viewing the diversity of all life in this system while fishing.	1/22/2016 2:34 PM
22	Business owner nearby	1/22/2016 9:41 AM
23	observing, enjoying the naturalness of the lake environment	1/22/2016 8:15 AM
24	clean up our towns get trash and drugs out and fishermen back I am 60 years old and remember the old days 11 fish camp motels all where busy come look around the town never look this bad i live on 441 south of fire dep. across the street cops over day and night thanks	1/22/2016 7:42 AM
25	area retail shop	1/21/2016 10:48 PM

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Q3 How acceptable to you is the use of herbicide application in the following circumstances?

Answered: 215 Skipped: 2



	Strongly Oppose	Somewhat Oppose	Neutral	Somewhat Accept	Strongly Accept	Don't Know	Total	Weighted Average
to treat invasive floating exotic species (ex. Water Hyacinth)	22.01% 46	10.05% 21	8.13% 17	19.62% 41	39.71% 83	0.48% 1	209	3.44
to clear access trails to open water	17.70% 37	6.70% 14	10.53% 22	18.18% 38	46.41% 97	0.48% 1	209	3.67
to slow down tussock formation	22.22% 46	7.73% 16	13.04% 27	22.71% 47	33.82% 70	0.48% 1	207	3.37
to maintain previously scraped areas	19.12% 39	9.31% 19	13.73% 28	19.61% 40	35.78% 73	2.45% 5	204	3.36
to enhance habitat for fish and wildlife species that use openings in marsh	20.98% 43	7.80% 16	11.71% 24	21.95% 45	37.07% 76	0.49% 1	205	3.45
to reduce coverage by Hydrilla	28.10% 59	12.38% 26	10.00% 21	20.95% 44	28.57% 60	0.00% 0	210	3.10

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Q4 If you oppose herbicide application in any of the above circumstances,

Answered: 89 Skipped: 128

Answer Choices	Responses
Please explain the reason for your concern.	95.51% 85
Are there any circumstances that would make this acceptable?	69.66% 62

#	Please explain the reason for your concern.	Date
1	Because it is applied too often and it turns the lakes you treat into dead pools du to the lack of flow in the lake. Instead of spraying why not try and use a harvester like what was used in Rodman and Toho over the years.	2/14/2016 8:02 AM
2	The fact that the herbicide is being sprayed shows that the fwr does not care about the lakes wildlife it's more for boaters to ski or run jet skis it's not for the environment at all! It's been proven on multiple occasions that spraying a lake ruins the fishing and hurts the surrounding wildlife!	2/13/2016 7:45 PM
3	Love to get rid of hydrilla but don't want to affect wildlife	2/11/2016 6:59 PM
4	I want our lake back	2/10/2016 8:33 AM
5	I love to frog Gig and frogs love cover	2/10/2016 8:22 AM
6	The people hired act as though any vegetation is an affront to them and all of it must die.	2/9/2016 10:37 PM
7	Ruins Fishing.. reduces oxygen in the water	2/9/2016 9:11 PM
8	It's not organic would you drink it????the fish don't want to either	2/9/2016 9:05 PM
9	Because you really know nothing about fish habitat,just ruining the lakes	2/9/2016 8:35 PM
10	Should use harvesters as opposed to herbicide	2/9/2016 7:51 PM
11	Needs hydrilla for better duck hunting	2/9/2016 7:35 PM
12	Hydrilla grows giant fish (bass) and they love to getuncer water hyaciniths	2/9/2016 3:10 PM
13	because the idiots who decide what and when to spray dont have a clue.	2/8/2016 10:58 AM
14	if it doesn't harm wildlife	2/8/2016 9:43 AM
15	hydrilla is good to a degree	2/8/2016 9:34 AM
16	already to much organics on the bottom	2/8/2016 9:26 AM
17	development of resistance	2/8/2016 9:16 AM
18	contracted herbicide appliers	2/8/2016 8:23 AM
19	the negative impact	2/8/2016 8:04 AM
20	herbicides are not good for the fishing, I don't care what some paid biologist says.	2/7/2016 8:54 PM
21	The deletion of plants and plant growth whether native or non-native will reduce the habitat for prey fish and bait fish to grow.	2/7/2016 2:32 PM
22	It affects the fishing, I don't care what some pointy head biologist says !	2/7/2016 12:19 PM
23	it's been proven that hydrilla lakes grow more and bigger bass period. not only bass, but all species of game fish.	2/7/2016 10:45 AM
24	It dies and goes to the bottom creating more muck. Orange and Lochloosa lakes are already filled with muck from all the herbicide spraying that has been done over the years. Both lakes need the tussocks to be removed with a havesters and later a dridge system installed to clean out all the muck and sediment. These are two of the best lakes in Florida for all types of fishing. It would be a shame to loose either one of them to, in my opinion has been gross mismanagement.	2/7/2016 9:35 AM
25	Too much spraying	2/7/2016 9:34 AM

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26	Herbicides make the fish sick whether y'all admit it or not. They people you get to spray it only care about emptying tanks unordered to get paid better. They always over spray the lakes. Maybe have more regulated procedures for use and only allow certified people to spray herbicides.	2/7/2016 8:57 AM
27	long term habitual overspraying by uncaring apathetic application technicians . zero accountability for their actions. this includes not only the applicators, but also the management who condones, or doesnt care about the waters they are destroying.	2/6/2016 10:37 PM
28	The hydrilla does not need to be sprayed. It is the best cover for bass and other fish to hunt and hide in. It also provides waterfowl with crucial food. There is no need to kill it, spraying does more damage than good.	2/6/2016 5:38 PM
29	My concern is that when they use the herbicide, they kill EVERYTHING not just what they are supposed to i.e. Water hyacinth.	2/6/2016 5:19 PM
30	Seems that spraying herbicides are not applied properly to areas of need. Erratic spraying to every living plant is not acceptable	2/6/2016 2:31 PM
31	native wetland plant damage and native wildlife species harm.....not good for the natural ecosystem which includes Tussock formations	2/6/2016 9:36 AM
32	Fish need it.	2/6/2016 8:30 AM
33	Because it destroys the fishing. The herbicide applicators go way above what is required. That destroys the fishing.	2/6/2016 7:40 AM
34	Hydrilla is good for fish and ducks.	2/5/2016 10:53 PM
35	because you can use a harvester	2/5/2016 10:06 PM
36	lockloossa is a good example, the lake was finally turning around and starting to fish good and then the fwc nuked all the hydrilla. Navigation was not an issue now after the spraying there are people that have not caught a bass in 5 plus trips since	2/5/2016 9:45 PM
37	Use for Fishing	2/5/2016 6:46 PM
38	Would rather it be mechanically removed	2/5/2016 12:32 PM
39	Investigate the core analysis for the marsh areas. The lake goes dry every 100 years.	2/5/2016 12:26 PM
40	not a fan of spraying a chemical that kills things into the water where fish,frogs,alligators,ducks,deer and all other type of animals live and drink.	2/5/2016 12:06 PM
41	There is not enough management of the spray boats and they tend to go "hog wild" spraying everything and ruining the habitat.	2/5/2016 9:06 AM
42	Because there is too much over spraying..takes a long time for the lake to recover	2/5/2016 8:44 AM
43	No hydrilla no fish	2/5/2016 7:46 AM
44	Orange Lake is directly connected to our drinking water source. Herbicides are not entirely safe to drink. We need to use as little as we possible while still effectively managing the lake. Also, this is expensive. We should be cost effective.	2/5/2016 6:58 AM
45	I think the herbicides used should be disclosed and what the possible side effects may be...	2/5/2016 1:39 AM
46	I believe that natural vegetation growth is necessary for proper environment for forage fish growth and for gamefish fry to have a sanctuary.	2/4/2016 11:37 PM
47	It kills the food chain that eat the grass shrimp	2/4/2016 11:19 PM
48	Just makes more mud on the bottom.	2/4/2016 11:03 PM

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49	I have personally witnessed the use of herbicide completely ruin a fishery such as Lake Rousseau. The over-use of herbicide chemicals has killed the majority of floating species of vegetation that keep the hydrilla under check naturally. Since the use of heavy herbicides Lake Rousseau in the summer time is completely choked out with hydrilla to the point the stump fields are unfishable. Back 15 years ago this severe of a hydrilla problem was not an issue. Why is that you ask? Because the use of herbicides were minimal compared to the amounts used this day and time. The hydrilla was controlled naturally by floating hyacinth mats/islands that shaded out a lot of the hydrilla and kept it under control enough so the stump fields were still fishable even in the heat of the summer. This is my fear for Orange lake. This lake in its prime 10yrs ago stood toe to toe with the best lakes in the country. I have personally witnessed a five fish limit weighing 40lbs brought to the scales. My point in this argument is these herbicide companies contract these sprayer in who have no clue what a lilly pad is from water lettuce and could care less honesty. They are there for one purpose and that is to blast everything in sight thats green. I have personally witnessed this on numerous occasions. They sit back in there airboat seats with a firehose of herbicides blasting away. I think herbicides should be used MINIMALLY to keep water access routes open and residential access's open and thats IT! You see hydrilla needs photosynthesis to grow. Photosynthesis is a process used by plants and other organisms to convert light energy, normally from the Sun, into chemical energy that can be later released to fuel the organisms' activities. This means once ALL the floating hyacinth mats are killed and lilly pads are killed their is no more shade being cast onto the growing hydrilla and what do you know, it completely takes over. This is the exact same thing that has happened at Lake Rousseau. You see without an adequate amount of light Hydrilla cannot grow to its fullest potential and there for its self regulating. Yes I agree with minimal herbicide use but these days its all about money and how much you guys can get away with.	2/4/2016 10:41 PM
50	certain types of hydrilla are duck feed	2/4/2016 10:23 PM
51	hydrilla is a natural filter and fish habitat as well as frogs. the marsh is for airboats	2/4/2016 10:02 PM
52	Hydrilla is natural shelter to baitfish which produces bigger fish, but if its over produced it can have negative consequences so a little herbicide is okay in that it is used sparsely. More natural or less harmful options should be of top priority for the initial treatment	2/4/2016 9:43 PM
53	Ducks and fish love hydrilla and it's great for the lake	2/4/2016 9:39 PM
54	hydrilla is a necessity for fish cover and a food for ducks	2/4/2016 9:12 PM
55	kills fish.	2/4/2016 8:54 PM
56	Fish kills and the fact tge dead vegetation makes more muck	2/4/2016 6:15 PM
57	When we mess with chemicals in the ecosystem, we disrupt and damage our water and wildlife. We are trying too hard to please the human factor- as to fishing and boating, etc as opposed to what is right for the lake. It needs to flow, and it really wants to be a wetlandd	2/4/2016 5:13 PM
58	I am a tournament fisherman throughout the state and in every single instance eht is being sprayed is were the fish are ...hydrilla in okachobee. ...cane in the Harris chain ...or hyacinths in orange and loch....you guys need to talk to the fishermen a lot more....and never spray or shock during the spawn....	2/4/2016 5:00 PM
59	Oppose herbicide treatment for activities other than for invasive exotic control. I would rather see FWC focus of the cause of why there is an increase in vegetation then to continue to try to treat the problem on the backend.	2/4/2016 2:11 PM
60	Plants such as hydrilla provide a great home for bass.	2/4/2016 1:33 PM
61	I do not agree on chemical treating water on any regular basis.	2/4/2016 1:19 PM
62	The Marsh is natural is does not need human disruption.	2/4/2016 11:04 AM
63	Our well is 30 foot from the lake	2/4/2016 10:57 AM
64	Harvest the problem and get the material out of the lake or onto an in lake disposal island	1/28/2016 8:44 AM
65	Herbicide is a poison. It either kills or makes animals like us sick. Who in the right mind would want to spread poisons around? To save money? To lower labor intensity? For profit?	1/27/2016 8:11 AM
66	The number 1 reason is because it is not sustainable. You are always fighting the natural processes of the lake. Additionally, herbicide application kills desirable wetland plants that provide important wildlife habitat for nongame species, it has the possibility of over-spray, and there is no monitoring performed so FWC does not know what unintended effects occurred. If there was an oxygen sag or even a population drop in declining species such as Purple Gallinule or American Bittern, you would not know because of lack of monitoring.	1/26/2016 9:17 AM
67	Herbicides contain 2-4-D. Should not be sprayed in our water regardless of cost/benefit	1/25/2016 7:54 PM
68	Juvenile Fish use the marsh for protection from larger Fish and Predators. Marsh is natural, leave it alone nature takes care of it self in the Marsh.	1/25/2016 9:19 AM
69	I believe this is a band-aid fix to a bigger underlying problem that is causing the floating tussocks	1/25/2016 8:50 AM

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70	Adding herbicides to a natural system to "control" native plants adds pollutants into the food chain, nutrients that feed floating algae, and is a waste of tax payer dollars.	1/24/2016 10:06 AM
71	my major concern is keeping herbicides and constituents out of the food chain and aquifer	1/23/2016 3:19 PM
72	The herbicides that were presented in our talks were only for use for plants growing in the lake when it had water.	1/23/2016 11:54 AM
73	Is 2,4-D likely to contribute to the development of cancer Scientists have not found a clear link between 2,4-D and cancer in people. Because 2,4-D is often mixed with other herbicides, it is difficult to tell if 2,4-D or one of the other herbicides might be linked to cancer. Some studies have suggested that there may be links between non-Hodgkin's lymphoma and exposure to 2,4-D by itself,	1/22/2016 7:16 PM
74	The lake will naturally take care of itself if left alone	1/22/2016 5:19 PM
75	Exchange of toxicity from herbicide of waters into the aquifer.	1/22/2016 4:03 PM
76	need to harvest floating vegetation, not kill and sink to bottom	1/22/2016 10:30 AM
77	I don't like the over use of chemicals like I have seen on Orange and Loclossa in the past.	1/22/2016 9:58 AM
78	This doesn't get the debris out of the lake	1/22/2016 9:41 AM
79	Floating invasives are unhealthy for the lake, but both fish and wildlife benefit from good hydrilla coverage	1/22/2016 9:35 AM
80	If the underlying cause of the problem is nutrient availability for these plants (I did not attend the meeting so I do not know), maybe herbiciding will just re-release the nutrients.	1/22/2016 8:29 AM
81	It creates additional muck on the lake bottom which never gets removed. You are opposed to burning during the dry years. You say that mechanical excavation is too expensive. There is never any effort to reduce the muck, only activities that continue to create more.	1/22/2016 8:07 AM
82	The regularity, intensity, and nature of the applied herbicide cocktail were originally unclear. Particularly, if the lake is in succession to a prairie, better to manage the water table as a primary control method, supported by herbicide application. A lake in succession will take a lot of herbicide over time to be kept clear. The items in #3 can only be rated in the context of a plan.	1/22/2016 8:07 AM
83	we have wells here	1/22/2016 7:42 AM
84	only if damage to fish	1/22/2016 7:12 AM
85	Killing it does not REMOVE it and increases muck and sediment accumulation	1/21/2016 10:48 PM
#	Are there any circumstances that would make this acceptable?	Date
1	NONE!!!	2/14/2016 8:02 AM
2	No	2/13/2016 7:46 PM
3	None leave it alone.	2/11/2016 7:59 PM
4	Everybody that's has a airboat misses frog gigging orange lake	2/10/2016 8:22 AM
5	If some how we could have conservation minded people who understand the needs of the users i.e. (The fishermen) doing the spraying then I think there would be less damage done and fewer conflicts.	2/9/2016 10:37 PM
6	No	2/9/2016 9:11 PM
7	Only if it was your yard and drinking water	2/9/2016 8:35 PM
8	No	2/9/2016 7:51 PM
9	see above comment	2/9/2016 3:10 PM
10	probably not	2/8/2016 10:58 AM
11	after the muck is removed	2/8/2016 9:26 AM
12	preventive maintainence, low pop levels	2/8/2016 9:16 AM
13	choose applier based on reputation, not low bid	2/8/2016 8:23 AM
14	Manual removal is the only acceptable method imo, and even then should be done very sparingly.	2/7/2016 8:54 PM
15	Not acceptable unless the entire body of water is covered with plant growth to the surface.	2/7/2016 2:32 PM
16	i under stand that you can't let the whole place get covered with hydrilla, but letting some grow here and there won't hurt.	2/7/2016 10:45 AM

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17	very little	2/7/2016 9:35 AM
18	Carefully regulated spraying. Like a 1/4 of the lake per year instead of whole perimeters	2/7/2016 8:57 AM
19	only after public forums have been called to discuss the need for herbicide applications. having a local biologist treatment without any checks and balances is / has been a disaster for the waters of florida. theres not enough accountability for their actions.	2/6/2016 10:37 PM
20	The only acceptable case is if it is too thick in trails leading out to the main lake where boats cannot run their motors through it.	2/6/2016 5:38 PM
21	Acceptable with minimal use.	2/6/2016 5:19 PM
22	Supervised applications by certified biologist	2/6/2016 2:31 PM
23	the very short term benefit does not outweigh the harm	2/6/2016 9:36 AM
24	Cut the grass	2/6/2016 8:30 AM
25	If it was really controlled, unlike how it is now. They overspray by 10 fold.	2/6/2016 7:40 AM
26	Yes but the contractors can't be trusted and the fwc lies to us all claiming to aid navigation	2/5/2016 9:45 PM
27	no	2/5/2016 6:46 PM
28	Show a detailed success story where your agency was involved	2/5/2016 12:26 PM
29	Only if there are stronger regulations and bigger penalties for spraying more than is necessary.	2/5/2016 9:06 AM
30	Just enough to make waters navigable..as was intended.	2/5/2016 8:44 AM
31	Yes. If it is very limited in extent, then it is fine.	2/5/2016 6:58 AM
32	I would like to have various opinions, not just one, about the herbicides themselves and the good and bad to make them acceptable or not.	2/5/2016 1:39 AM
33	Means to access the water for navigation.	2/4/2016 11:37 PM
34	No I disagree with any spraying.Harvesters are the way to manage the growth	2/4/2016 11:03 PM
35	The ONLY acceptable conditions for using herbicide chemicals is for the maintenance of public access waterways and residential access routes.	2/4/2016 10:41 PM
36	no	2/4/2016 10:02 PM
37	If all other options fail and o2 level in water is at risk of severely decreasing and whole ecosystem to die	2/4/2016 9:43 PM
38	boat ramps and canal entrances for boats	2/4/2016 9:12 PM
39	Only if it can be scientifically proven to not damages anything- flora or fauna, than what it was intended for- and I don't believe that can happen	2/4/2016 5:13 PM
40	Only to keep open waterways	2/4/2016 5:00 PM
41	Infrequent and small/limited area treatment may be ok since it will have little effect on the overall natural system and water quality balance on the lake.	2/4/2016 2:11 PM
42	boat access.	2/4/2016 1:19 PM
43	No	2/4/2016 11:04 AM
44	no	2/4/2016 10:57 AM
45	Do NOT let the plants get out of hand once the initial spraying has been accomplished. O2 deprivation may be more prevalent once decay sets in & you know the results.	1/30/2016 8:52 AM
46	no	1/28/2016 8:44 AM
47	NO. You only aim a gun at what you intent to kill. Not trying to be flippant, but this appears to help lower human overpopulation without leaving much trace.	1/27/2016 8:11 AM
48	Yes, limit herbicide application to keep access trails open and at the previously scraped areas. But don't invest so much money and effort in nonsustainable lake management practices that come with environmental risks.	1/26/2016 9:17 AM
49	NO	1/25/2016 7:54 PM
50	USE BETTER TIMING! NOT DURING SPAWNING, MAR.-SEPT.@ gTimingt	1/25/2016 9:31 AM

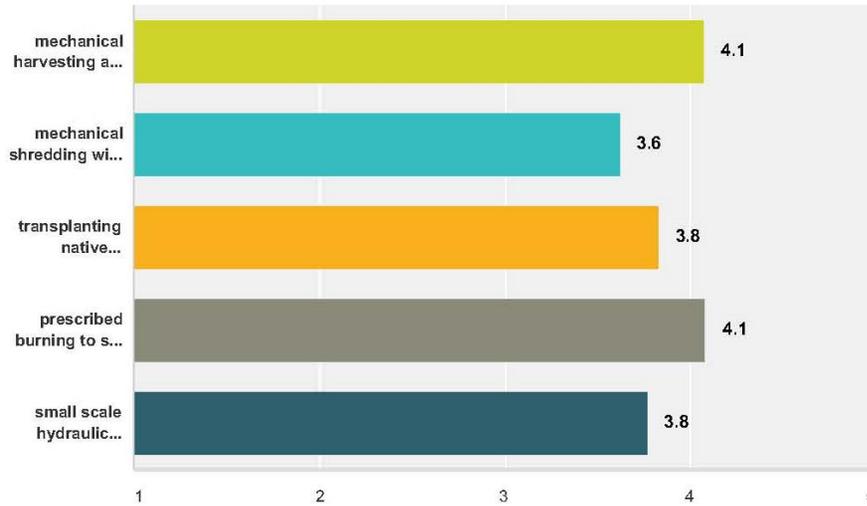
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51	None.	1/25/2016 9:19 AM
52	It some instances it may be useful to apply herbicide to invasive exotic plant infestations when no other options are available.	1/24/2016 10:06 AM
53	Only if the herbicides were proven to have no detrimental effects, i.e. long term, to wild life, fish, soil, or aquifer (the sink hole is a direct conduit to the Floridan aquifer),etc.Round up was marketed as safe.	1/23/2016 11:54 AM
54	no	1/22/2016 7:16 PM
55	No	1/22/2016 5:19 PM
56	I don't know of any technology filters/pumps to purify herbicides from water.	1/22/2016 4:03 PM
57	To keep lake ramps and access open.	1/22/2016 9:58 AM
58	Remove the dead debris	1/22/2016 9:41 AM
59	I endorse creating openings in places dominated by weedy or exotic species, I decline doing so in diverse native marsh.	1/22/2016 8:45 AM
60	Yes, there are many circumstances in which these management goals are acceptable.	1/22/2016 8:07 AM
61	to keep lake open	1/22/2016 7:12 AM
62	Only if it can be REMOVED after it dies.	1/21/2016 10:48 PM

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Q5 How acceptable to you are the following management practices commonly used at normal water levels?

Answered: 214 Skipped: 3



	Strongly Oppose	Somewhat Oppose	Neutral	Somewhat Accept	Strongly Accept	Don't Know	Total	Weighted Average
mechanical harvesting and excavating of vegetation and sediment	6.54% 14	4.67% 10	10.28% 22	21.03% 45	55.14% 118	2.34% 5	214	4.07
mechanical shredding with in-lake disposal (cookie cutter)	10.48% 22	10.95% 23	17.14% 36	16.67% 35	42.38% 89	2.38% 5	210	3.62
transplanting native vegetation (esp. shorelines) to improve specific habitats	6.22% 13	3.83% 8	17.22% 36	19.62% 41	47.85% 100	5.26% 11	209	3.83
prescribed burning to slow succession	4.72% 10	6.13% 13	13.68% 29	20.28% 43	53.77% 114	1.42% 3	212	4.08
small scale hydraulic dredging	5.24% 11	6.67% 14	19.52% 41	21.90% 46	42.38% 89	4.29% 9	210	3.77

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Q6 If you oppose any of the above management practices,

Answered: 53 Skipped: 164

Answer Choices	Responses
Please explain the reason for your concern.	98.11% 52
Are there any circumstances that would make this acceptable?	64.15% 34

#	Please explain the reason for your concern.	Date
1	Possible water life harm due to machines	2/10/2016 10:33 AM
2	I feel like disposing the shredding in the lake would creat too much of a mess and more problems.	2/10/2016 9:52 AM
3	-	2/10/2016 8:22 AM
4	clear the muck and allow hydrilla to take root	2/9/2016 3:10 PM
5	unclear on necessity	2/8/2016 9:50 AM
6	puts muck back on the bottom	2/8/2016 9:26 AM
7	chopping the debris and leaving it in the lake does nothing except make more muck bottom and decay. remove it from the lake at time of harvest	2/7/2016 10:45 AM
8	Cookie cutting does not remove the tussocks. I see no long term value in cookie cutting. Waste of money in my opinion.	2/7/2016 9:35 AM
9	In lake disposal of any plant material leads to the build up of "muck" and accelerates tussock formation.	2/6/2016 10:34 AM
10	the cookie cutter makes a muddy bottom Lake	2/5/2016 10:06 PM
11	Those machines will kill fish	2/5/2016 6:01 PM
12	Without total restoration, I-75, 441, 301, railroad bed, dam, Rodman dam; efforts are pointless. The lake and marshes served to polish the water and vegetative matter in a natural state. Nutrient, organic vegetative matter has always formed the marshes. The cycle of dry periods always provided an abundance of plant material to be repetitively consumed by high water periods.	2/5/2016 12:26 PM
13	Mechanical Shredding seems to just create a ton of floating sediments and a huge mess!	2/5/2016 9:19 AM
14	Hydraulic dredging and mechanical harvesting are too expensive -- herbicides are safe and cheap	2/5/2016 7:56 AM
15	I just believe less is more when it comes to our natural habitat. Balance is key, obviously we cannot remove our footprint, but we can certainly make it smaller.	2/5/2016 1:39 AM
16	We have enough growth on shorelines	2/4/2016 11:03 PM
17	In lake disposals do nothing but create oxygen sucking sediment that build up on the lake floor and create major oxygen issues in the future. I have personally seen lakes like Panasoftkee go to waste for year because of dredging projects. it is just not getting back to producing somewhat quality fish again.	2/4/2016 10:41 PM
18	I believe there is no shortage of native vegetation	2/4/2016 10:02 PM
19	I don't think hydrilla should be killed off expecially right before duck season	2/4/2016 9:39 PM
20	The shredding creates more muck and floating debris and breaks the tussocks lose so they float around with the wind stopping up access to the lake	2/4/2016 6:15 PM
21	Too much habitat and wildlife harmed and nesting disrupted- changeds the ecosystem	2/4/2016 5:13 PM
22	Cutting is a much better practice than spraying	2/4/2016 5:00 PM
23	Dredging and mechanical harvesting should only be used to improve access or safety. Otherwise these activities have significant negative impacts when done on a large scale. Not sure what is implied by the term "transplanting"? Does it include removing significant amounts of native vegetation from the shoreline or just planting new vegetation?	2/4/2016 2:11 PM
24	Allowing vegetation to settle on the lake bottom will create a long term sediment issue	2/4/2016 2:05 PM

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25	We do not need to add plants they grow on their own.	2/4/2016 1:19 PM
26	water quality impacts and loss of habitat	2/4/2016 1:15 PM
27	this makes the lake look like pea soup.We have done this in our canal and it never rots or goes away.	2/4/2016 11:15 AM
28	makes problem worse by growing fragmentation or decaying on the bottom	2/4/2016 10:57 AM
29	I don't think that hydraulic dredging is the answer to what ails Orange Lake	2/2/2016 8:32 PM
30	Get the lake substrate in better condition first. NO SHREDDING! puts the mud back on the bottom.	1/28/2016 8:44 AM
31	They are still brutal ways to "manage" Nature for our convenience and pleasure	1/27/2016 8:11 AM
32	Again, these are not sustainable practices in a shallow eutrophic lake and practices kill desirable wetland plants that provide important wildlife habitat for nongame species like Purple Gallinule, American Bittern, and Sandhill Crane, and the extensive prey items that they feed on. Perhaps if you presented the SJRWMD data on wildlife mortality from mechanical harvesting, others would understand the widespread impacts this unsustainable practice has. And again, there is no monitoring performed so FWC does not know what unintended effects occur.	1/26/2016 9:17 AM
33	Exporting nutrients for disposal on land.	1/25/2016 11:51 AM
34	Timing!	1/25/2016 9:31 AM
35	Fighting natural lake succession with herbicides and mechanical treatments is not a wise use of tax payer money and increases the chances of negatively affecting the lake ecology.	1/24/2016 10:06 AM
36	Worried about the lake bed being disturbed too much	1/23/2016 8:18 PM
37	Many elderly or chronically ill have breathing problems, also drifting smoke can cause traffic accidents. The bottom of the lake has caught fire before and burned/smoldered for months.	1/23/2016 11:54 AM
38	use as last resort and not continued use over same area... if lake levels recede cross creek will look like a mud bog...	1/22/2016 7:16 PM
39	These methods are not good for the longevity of the lake and do not take into use more naturally pccuring means of clearing the water	1/22/2016 5:21 PM
40	This creates silt and muck	1/22/2016 5:19 PM
41	Practices would not substantiate cost productiveness, and Environmental conditions ought be reflected from natural changes in the lake which serves essentially for habitat preservation and scientific study.	1/22/2016 4:03 PM
42	I have no concerns.I first fished O.L. in the early 60's. Hydrilla was only visibly present in one area, at the mouth of cross Creek. There were many deeper areas all over the lake due to dredging for peat in the 50's. The fishing, duck hunting, & boating was magnificent.	1/22/2016 2:34 PM
43	Wildfire danger	1/22/2016 12:07 PM
44	Burning and in-lake disposal does not remove the debris	1/22/2016 9:41 AM
45	Disposing sediment in the lake leads to muck build up	1/22/2016 9:35 AM
46	Decline hydraulic and mechanical excavation of sediments to protect cultural resources. There are only 5 or 6 cypress transplants remaining alive in McIntosh Bay. The others were killed by ORVs and the combination of strong competition from marsh plants plus sudden high water levels.	1/22/2016 8:45 AM
47	build up on bottom creates low ph	1/22/2016 8:38 AM
48	My concern is that mechanical shredding with in-lake disposal is a never-ending battle.	1/22/2016 8:29 AM
49	What are normal water levels? Is normal in a state of flux around a steady mean and range, or is normal in a 10-year decline at a steady rate?	1/22/2016 8:07 AM
50	Shredding back into the lake builds the potential for the decay to let off methane gas.	1/22/2016 7:59 AM
51	smoke	1/22/2016 7:42 AM
52	In-lake disposal increases muck and sediment accumulation	1/21/2016 10:48 PM
#	Are there any circumstances that would make this acceptable?	Date
1	-	2/10/2016 8:22 AM
2	to grow giant bass and create better water clarity	2/9/2016 3:10 PM
3	no	2/8/2016 9:26 AM
4	No	2/7/2016 9:35 AM

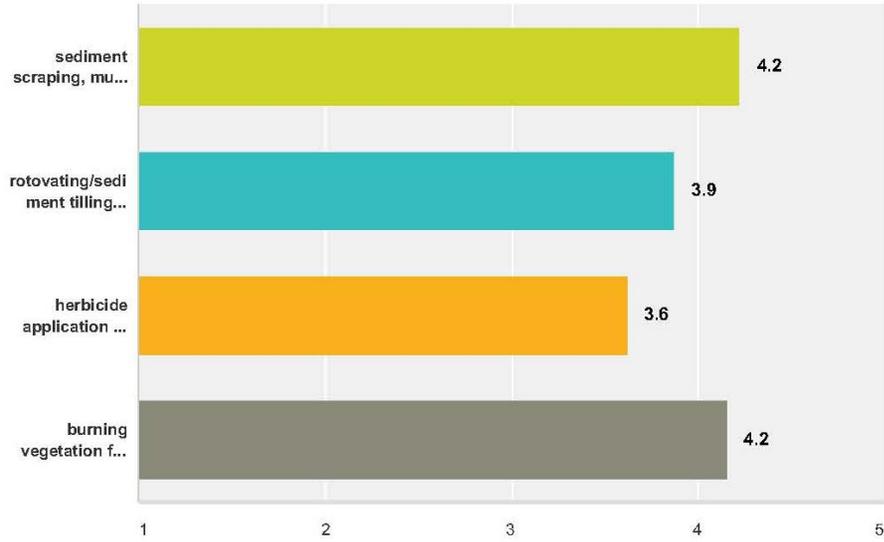
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5	I have seen Tsala Apopka Lake cleaned up with the machines, and think that if the FWC could use them and make island it helps fishing and the habits of the fish.	2/5/2016 9:25 PM
6	Complete and total restoration. Aquatic weed control is effective for the weed of the period with the chemical of the period. Once coontail moss was prevalent in the lake along with eel grass. Restoring is an expensive process. The lake is full now and consuming organic vegetative matter from significant dog fennel growth. That will never cease due to the drastic natural water level changes in the lakes. Four generations of active users of this lake system bear this out to be factual. The earliest history from my family regarding lake levels was provided by Native Americans to one of my family members.	2/5/2016 12:26 PM
7	If they are cost effective for accomplishing tasks	2/5/2016 7:56 AM
8	Again, different scientific data from multiple sources.	2/5/2016 1:39 AM
9	No	2/4/2016 11:03 PM
10	if there was a shortage	2/4/2016 10:02 PM
11	Again, when we mess with the natural order of things, we tend to do more harm than good- after living here 35 years, and watching all the changes the lake has gone through- some natural, some due to us- nothing we do has made a positive difference	2/4/2016 5:13 PM
12	Ok, for very small scale projects and for access needs	2/4/2016 2:11 PM
13	No.	2/4/2016 1:19 PM
14	not really	2/4/2016 11:15 AM
15	no	2/4/2016 10:57 AM
16	NO	1/28/2016 8:44 AM
17	Can't think of any.off hand. Don't know enough... but also realize that sometimes knowledge does not seem to matter much in these matters. Money does.	1/27/2016 8:11 AM
18	Maintenance of access routes.	1/26/2016 9:17 AM
19	Ensure disposal of excavated material prohibits nutrients from leaching into and polluting other areas.	1/25/2016 11:51 AM
20	Not during SPAWNING!	1/25/2016 9:31 AM
21	Maybe acceptable for dredging boat slips	1/23/2016 8:18 PM
22	No	1/23/2016 11:54 AM
23	as last resort to clear trail for navigation	1/22/2016 7:16 PM
24	limit areas where used	1/22/2016 5:21 PM
25	No	1/22/2016 5:19 PM
26	If costs restricted to minor impact with maintenance to existing shoreline/boat lanes for limited human-friendly use, and precluding toxins.	1/22/2016 4:03 PM
27	No	1/22/2016 12:07 PM
28	Remove the debris	1/22/2016 9:41 AM
29	Getting rid of the tussocks is the priority now	1/22/2016 9:35 AM
30	Accept hydraulic and mechanical dredging in existing boat-ways. Accept dredging following archaeological mitigation.	1/22/2016 8:45 AM
31	It might be necessary for limited areas.	1/22/2016 8:29 AM
32	Within the context of a sensible long-range plan.	1/22/2016 8:07 AM
33	NO	1/22/2016 7:59 AM
34	Out-lake disposal removes it where it can be used for compost or top soil	1/21/2016 10:48 PM

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Q7 How acceptable to you are the following management practices commonly used during low water levels?

Answered: 213 Skipped: 4



	Strongly Oppose	Somewhat Oppose	Neutral	Somewhat Accept	Strongly Accept	Don't Know	Total	Weighted Average
sediment scraping, muck removal during extended periods of low water	6.16% 13	3.32% 7	8.06% 17	18.01% 38	62.56% 132	1.90% 4	211	4.22
rotovating/sediment tilling during extended periods of low water	5.71% 12	4.76% 10	16.67% 35	19.05% 40	49.05% 103	4.76% 10	210	3.87
herbicide application to proactively prevent tussock formation during lake refill after a drought	17.14% 36	6.19% 13	12.86% 27	22.86% 48	40.48% 85	0.48% 1	210	3.62
burning vegetation for habitat improvement	6.13% 13	1.42% 3	15.57% 33	17.45% 37	58.02% 123	1.42% 3	212	4.16

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Q8 If you oppose any of the above management practices,

Answered: 47 Skipped: 170

Answer Choices	Responses
Please explain the reason for your concern.	97.87% 46
Are there any circumstances that would make this acceptable?	55.32% 26

#	Please explain the reason for your concern.	Date
1	The use of a herbicide is not necessary there are other means to help with the over growth of lakes vegetation	2/13/2016 7:45 PM
2	That lake was all natural and a few years ago that was the best bass fishing lake around so my mess with its natural habitat	2/10/2016 8:22 AM
3	Don't like herbicide application	2/9/2016 7:51 PM
4	agree but NONE of this was done during the last cydle of low water at Orange... why ask???	2/9/2016 3:10 PM
5	no long term effects	2/8/2016 9:26 AM
6	Herbicide is poison.	2/7/2016 8:54 PM
7	No spraying ever !	2/7/2016 12:19 PM
8	Mechanical harvesting and dredging is in my opinion the long term solution to saving Orange and Lochloosa lakes.	2/7/2016 9:35 AM
9	Not opposing, please burn. It will rejuveniate the habitat and benefit wildlife.	2/6/2016 5:38 PM
10	Herbicides not only kill plants , but also the ecosystem	2/6/2016 2:31 PM
11	Havent seen any case where herbicide has been used and it benifit fisherman. They spray everything green and ruin the fishing.	2/6/2016 7:40 AM
12	spraying herbicide is never good for our waters	2/5/2016 10:06 PM
13	Need to define "low water levels"	2/5/2016 9:45 PM
14	See above	2/5/2016 12:26 PM
15	1. seems to me that if you till the ground that any amount of watershed will wash sediment into the deeper areas causing the lake to slowly fill up with sediment. 2. refer to question 4	2/5/2016 12:06 PM
16	When a lake is refilling it needs a rest period for the fish populations to come back. A large amount of tussock vegetation prevents it from being over fished before it has had time to recuperate.	2/5/2016 9:06 AM
17	Herbicides are not entirely safe to drink, so applying them in massive amounts to a lake that is directly connected to our drinking water supply is problematic.	2/5/2016 6:58 AM
18	I think to ask opinions of such strong questions without explanation is ridiculous.	2/5/2016 1:39 AM
19	Herbicides are an unnatural means to manage aquatic habitat	2/4/2016 11:37 PM
20	Why was little down over the last 3 years of low water conditions before water came back?	2/4/2016 11:19 PM
21	use excavators	2/4/2016 10:41 PM
22	To much machinery on the lake can't be good for it. Having worked with heavy equipment and tractors I have seen the amount of fuel/hydraulic leaks that occur.	2/4/2016 9:40 PM
23	Again anything other than havesting the vegaitaion and removing it from the lake is damaging the lake causing more muck	2/4/2016 6:15 PM
24	see above	2/4/2016 5:13 PM
25	No chemicals period	2/4/2016 5:00 PM
26	Prefer burning, mowing and rotovating over dredging and spraying on chemical. Go with the more natural approaches, allowing nature to assist in the process to reduce much and control vegetation.	2/4/2016 2:11 PM

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27	For same reasons above.	2/4/2016 2:05 PM
28	Herbicide can kill more than what it is intended to kill.	2/4/2016 1:33 PM
29	Herbicide-Our well is 30 foot from the lake.	2/4/2016 10:57 AM
30	Again, sediment tilling, scraping & removal are not the answer to Orange Lake current problem	2/2/2016 8:32 PM
31	Rotovating and tilling only mix the muck into the hard substrate. Grows right back, sometimes worse.	1/28/2016 8:44 AM
32	At some point we may need to let Nature do what it does best... shows us how to adapt rather than fight it year after year, season after season	1/27/2016 8:11 AM
33	For the reasons listed above.	1/26/2016 9:17 AM
34	same as 4 above	1/25/2016 7:54 PM
35	Muck islands are not natural features of the landscape. Removal could move pollution (nutrients) to other areas. Expensive.	1/25/2016 11:51 AM
36	Fighting natural lake succession with herbicides and mechanical treatments is not a wise use of tax payer money and increases the chances of negatively affecting the lake ecology.	1/24/2016 10:06 AM
37	See answer to question #3 above	1/23/2016 11:54 AM
38	muck removal had no results but ugly piles of muck and very expensive.	1/23/2016 9:27 AM
39	This could end up being a large area to treat with herbicide.	1/22/2016 10:13 PM
40	strongly against herbicide use ... I will manually remove and move upland any nuisance vegetation around my shoreline after c proper permits...	1/22/2016 7:16 PM
41	The amounts of TOXIC herbicide exchanged with waters of our aquifer and beneficial species.	1/22/2016 4:03 PM
42	I have no concerns.I first fished O.L. in the early 60's. Hydrilla was only visibly present in one area, at the mouth of cross Creek. There were many deeper areas all over the lake due to dredging for peat in the 50's. The fishing, duck hunting, & boating was magnificent.	1/22/2016 2:34 PM
43	Wildfire Danger	1/22/2016 12:07 PM
44	Archeological resources re tilling and muck removal.	1/22/2016 8:45 AM
45	What are low water levels? Is low in a state of flux around a steady mean and range, or is low in a 10-year decline at a steady rate? For how long will the levels be low?	1/22/2016 8:07 AM
46	smoke	1/22/2016 7:42 AM
#	Are there any circumstances that would make this acceptable?	Date
1	Nope	2/10/2016 8:22 AM
2	no	2/8/2016 9:26 AM
3	no.	2/7/2016 8:54 PM
4	No	2/7/2016 9:35 AM
5	Leave it alone	2/6/2016 2:31 PM
6	no.	2/6/2016 7:40 AM
7	Yes if defined and low level is low enough that the boat ramps not useable	2/5/2016 9:45 PM
8	Do it for others. Don't manage mine.	2/5/2016 12:26 PM
9	I can't see any.	2/5/2016 9:06 AM
10	Again, it is a matter of scale. A few acres might be okay. Hundreds of acres would not be okay.	2/5/2016 6:58 AM
11	No	2/4/2016 11:37 PM
12	Herbicide if invasive exotics become a problem and you cannot access to mow or burn	2/4/2016 2:11 PM
13	no	2/4/2016 10:57 AM
14	The fish kill 4-5 years ago during high temps & low water was devastating. Be smart about when to apply anything. You've seen what the affects. Lets learn from this mistake.	1/30/2016 8:52 AM
15	NO	1/28/2016 8:44 AM

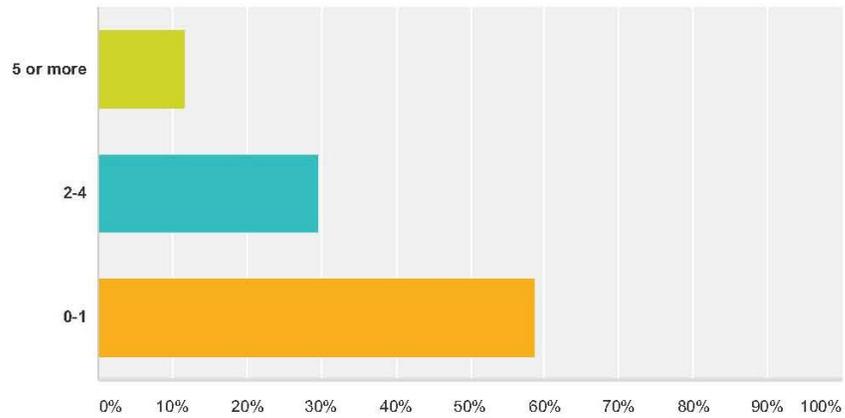
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16	None that I can think of.	1/27/2016 8:11 AM
17	Maintenance of access routes.	1/26/2016 9:17 AM
18	no	1/25/2016 7:54 PM
19	No	1/23/2016 11:54 AM
20	yes,--- Get rid of Gov.Scott	1/23/2016 9:27 AM
21	Can control be achieved by treating smaller areas a few at a time instead of all at once?	1/22/2016 10:13 PM
22	no...please do not use herbicide	1/22/2016 7:16 PM
23	Keeping COSTS low for rotovating, etc. during extended low water levels	1/22/2016 4:03 PM
24	No	1/22/2016 12:07 PM
25	Archaeological mitigation.	1/22/2016 8:45 AM
26	I cannot comment on non-herbicide-related treatments because I am not suitably trained or educated in their implementation. Again, if the vegetation levels are driven by long-term water level recession, herbicide treatments will predictably intensify over time, without foreseeable end. This is a good reason for having a long-term plan in place.	1/22/2016 8:07 AM

FWC Orange Lake Habitat Management Plan - Stakeholder Survey

Q9 How many public meetings hosted by FWC and the Orange Creek Basin Working Group have you attended since January 2014?

Answered: 213 Skipped: 4

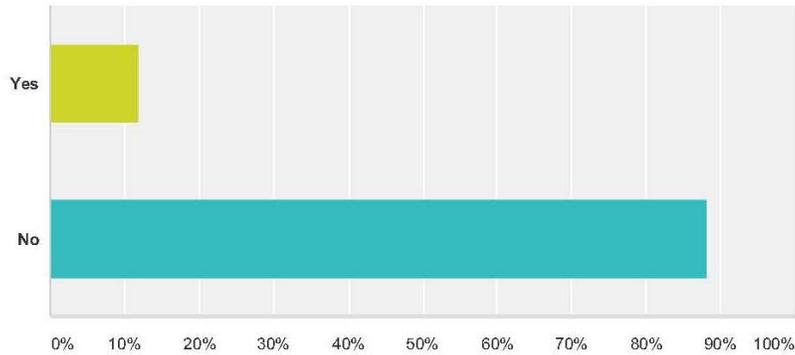


Answer Choices	Responses	
5 or more	11.74%	25
2-4	29.58%	63
0-1	58.69%	125
Total		213

FWC Orange Lake Habitat Management Plan - Stakeholder Survey

Q10 Are your responses intended to represent input from a stakeholder organization?

Answered: 210 Skipped: 7



Answer Choices	Responses	
Yes	11.90%	25
No	88.10%	185
Total		210

#	If yes, please indicate the name of the organization.	Date
1	I	2/13/2016 9:54 AM
2	bass/tx fishermen	2/9/2016 3:10 PM
3	OLA	2/8/2016 9:24 AM
4	Gary's Tackle Box	2/8/2016 8:23 AM
5	OLA	2/5/2016 12:32 PM
6	Alachua Audubon Society	2/5/2016 6:58 AM
7	North Florida Christian Bass Club	2/4/2016 2:05 PM
8	B.A.S.S. Nation	2/4/2016 10:35 AM
9	The Villages Freshwater Fishing Club	1/30/2016 8:52 AM
10	I did not know about the meetings otherwise I would have attended more.	1/27/2016 8:11 AM
11	Orange Lake Association	1/27/2016 7:45 AM
12	Suwannee/St.Johns sierra Club Group & Silver Springs Alliance	1/25/2016 7:54 PM
13	Marion County	1/25/2016 2:08 PM
14	Audubon Florida	1/25/2016 11:51 AM
15	Is a resident considered part of a stakeholder group/organization?	1/23/2016 11:54 AM
16	East side garden club	1/22/2016 7:19 PM
17	residents, neighbors and fisherman at Water's edge oaks rv park	1/22/2016 7:16 PM
18	Newnans Lake resident	1/22/2016 5:21 PM

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19	Orange Lake Stakeholders	1/22/2016 2:35 PM
20	Bassmasters of Gator Country	1/22/2016 9:58 AM

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Q11 Additional Comments.

Answered: 80 Skipped: 137

#	Responses	Date
1	I know money controls all you do, just stop killing the money maker for the area...in case you don't know that's bass habitat!	2/14/2016 9:54 PM
2	If the FWR is trying to help the environment STOP HERBACIDES!!!	2/13/2016 7:45 PM
3	I havnt been on the lake since they made the new laws. I would love to be back on it	2/10/2016 9:52 AM
4	I haven't been able to fish in orange lake since I was in the 8th grade that was over 5 years ago I would really like to see be something done about all the excess vegetation	2/10/2016 8:43 AM
5	I am currently 18 years old when I was in middle and in high school this was me and my buddies escape after school load the boat and go bass fishing haven't been on orange since 8th grade year and I have currently graduated please bring the lake back Im ready to pull in some hogs	2/10/2016 8:33 AM
6	There needs to be a wall built around the sink hole at the boat ramp cause it will open up again and that's the biggest reason orange lake dried up. And get rid of the airboat cure few riding the airboat at night is my most favorite thing to do I grew up doing it and now y'all took away the most fun thing in my life..	2/10/2016 8:22 AM
7	Forever and always orange lake has been a fishing and hunting paradise, very reminiscent of old Florida please use as little poison as possible. Thanks for taking my survey??	2/9/2016 10:37 PM
8	Fished lake for 45 years	2/9/2016 9:11 PM
9	How can you make lakes like woodruff and Dexter look like they do and consider yourself helping the habitat?	2/9/2016 8:35 PM
10	there needs to be a grass roots stakeholder panel that is consulted before any spraying is done and they decide when and where to spray.	2/8/2016 10:58 AM
11	14. when clearing a new area creates a new "trail" allow an old trail to overgrow, especially if it is with beneficial flora.	2/8/2016 9:50 AM
12	13. Maintain already completed habitat projects for 10 years since some of them have 10 year contracts with USFWS	2/8/2016 9:47 AM
13	12. would like to see any action to improve habitat and navigation as long as it is safe for environment	2/8/2016 9:43 AM
14	11. no comments	2/8/2016 9:41 AM
15	10. we heard nothing in the summary presentations the other night about place a weir around the largest of the Orange Lake sink holes to prevent those extremely low water levels during some years. We understand this would be expensive but in the long run it would certainly reduce significantly the need for much or perhaps most of the other applications and management practices being used and considered. Thus saving money maintaining a healthy and accessible lake. We would love to hear a response to this solution. E-mail fireplug1@bellsouth.net	2/8/2016 9:40 AM
16	9. this lake was world class until drought. Let's get it back asap.	2/8/2016 9:34 AM
17	8. no comments	2/8/2016 9:31 AM
18	7. remove the muck	2/8/2016 9:26 AM
19	6. Thanks!	2/8/2016 9:24 AM
20	5. Thank you for asking for our input. Follow up meeting X2 per year is a very good idea	2/8/2016 9:22 AM
21	4.no comments	2/8/2016 9:19 AM
22	3.thank you for allowing input	2/8/2016 9:16 AM
23	2. very good presentation, great job by speakers	2/8/2016 9:14 AM
24	1. keep best efforts to keep ramps clear and promote usage and help local economy	2/8/2016 9:12 AM
25	Thank you for all your efforts	2/8/2016 8:23 AM
26	Stop the needless spraying of our beautiful lakes!	2/7/2016 8:54 PM
27	Mechanical, herbicides or other means to reduce to delete plant growth should only be used in cases where the waterways such as channels and boat ramps are completely blocked off. The waterways are normally navigational without this extrenuous activity.	2/7/2016 2:32 PM

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28	I love bass fishing and catching giant bass. if treated properly Orange lake will again be what it once was. Please do the right thing with it. Thanks	2/7/2016 10:45 AM
29	I live in Arizona. But I can't wait to move back to Florida this summer! Orang lake has been one of my favorite places on earth to fish! Please do what you can to bring it back! When I get home I'll help!!!	2/7/2016 10:00 AM
30	We need a long term solution to saving Orange and Lochloosa lakes .	2/7/2016 9:35 AM
31	With good lake management Orange Lake can be one of the best fish and wildlife habitats in the US.	2/7/2016 9:34 AM
32	mandate desalinization plants for coastal communities in order to reduce the strain on the floridian aquifer, thereby helping to prevent the formation of sinkholes which can drain the lake. these plants , once phased in, would also eliminate the need to draw water from the st johns river, which is nothing short of a ticking environmental time bomb.	2/6/2016 10:37 PM
33	I think that whomever makes the decisions to apply chemicals to body's of water have no interest in the said body of water	2/6/2016 2:31 PM
34	Unable to attend public meetings due to work. Please get orange lake back in shape .	2/6/2016 2:14 PM
35	Save our fishing	2/6/2016 8:30 AM
36	All you have to do to make the bass anglers happy is be honest and if the lake navigation is impeded then do what needs to be done but don't use that part of the plan as a cop out.	2/5/2016 9:45 PM
37	I fished at Orange Lake back in November and there were no water lillies (pads) I have fished Orange my entire 31 years and never seen this lake without water Lillies.	2/5/2016 9:25 PM
38	I've never received an invitation to attend.	2/5/2016 12:26 PM
39	Overall, I like the current management effort. Keeping the lake open to lake users is very important. Attempting to restore sites for a bird rookery is important. Maintaining some open water and open boat channels is good. Trying to change the character of the lake by eliminating the floating islands that are a part of the natural ecology of the lake is not a good idea. We need to find a better way of dealing with this.	2/5/2016 6:58 AM
40	Please help save our lake it is one of best lakes in the United States thank you for your help and concern for our Orange Lake	2/4/2016 11:03 PM
41	orange lake used to be an incredible lake to both hunt and fish. lately the numbers on both of these have been way lower than six or seven years ago before the lake dried up. ducks have been almost non existent on orange lake.	2/4/2016 10:23 PM
42	The weir at 301 bridge in pg run needs to be removed and the lake restored back to its natural state before we end up with another paynes praire	2/4/2016 6:15 PM
43	We are very active in many organizations that are working for our water and springs protection- everything is connected	2/4/2016 5:13 PM
44	I appreciate the opportunity to provide feedback	2/4/2016 2:11 PM
45	The club is thankful to the FWC for inviting members to the meeting, unfortunately the meeting times did not allow for members to attend. Thank you for allowing us to voice our opinions through the survey	2/4/2016 2:05 PM
46	We need to stop the meetings and actually clean up the lake it is turning into a political pile and not helping anything to actually happen.	2/4/2016 1:19 PM
47	I've fished the lake for 55 years my dad was born and raise on it he commercial fished it for years as well as ran several of the fish camps before I was born. There's no other lake I would rather fish. Thanks for all y'all efforts.	2/4/2016 12:10 PM
48	Thank you for providing this avenue of communication for long distance fishermen.	2/4/2016 11:04 AM
49	no herbicides	2/4/2016 10:57 AM
50	My hope is that the lake recovery will proceed soon!	2/4/2016 10:45 AM
51	I strongly believe in the science associated with the use of chemicals and believe that the best management plan would and could be formulated by the scientists employed by the FWC. I believe that the fwc is doing a great job with what they have been given in this situation.	2/4/2016 10:35 AM
52	I understand that it's not the states responsibility but it would be very helpful for recreation on the lake if some access to the lake was cut for the residence on the south side of the lake.	2/4/2016 10:26 AM
53	Bring back this great fishery!	2/4/2016 10:04 AM

FWC Orange Lake Habitat Management Plan - Stakeholder Survey

54	I've been on Orange 3 times in December & January fishing for crappies since bass aren't yet abundant. We have caught a few good sized specks, but we released all of them, including about a dozen last Sat. (30 Jan. 2016) from yearlings to 3-4 year-old fish. I was also pleasantly surprised to see renewed growth of Nuphar (Yellow lily pads, also known as spatterdock and Tuckahoe in the Chesapeake Bay region where I lived for nearly 63 yrs before retiring to Gainesville Sept. 2009. In my opinion, what is desperately needed to improve bass population levels is massive restocking of fingerlings as well as 1 and 2 year old bass. There are now plenty of smaller fish species in Orange that can serve as prey for yearling and older bass. I also suggest restocking of fingerling & year-old chain pickerel which were totally wiped out during the recent drought.	2/2/2016 8:32 PM
55	I haven't fished Orange since it's refilled due to the possibility of getting trapped by floating tussocks.	1/30/2016 8:52 AM
56	I live in Virginia. Own mobile home and boats that stay in FL. I would love to see more progress in lake vegetation cleanup. Have been visiting since 1984. Have pictures on Orange Lake that are breath taking. Was there 3 months in 2015 and had to fish mostly at other lakes due to lack of lake access from vegetation. Very sad to look at lake now compared to how beautiful i have seen it in past years.	1/29/2016 12:18 PM
57	Move faster on tussock removal.	1/28/2016 8:44 AM
58	1. "Environmental concern" does not clearly convey the degree of complexity to be considered. The environment weights much more than all the other items listed. 2. Knowledge at the service of agencies and research is at best incomplete. Animals and plants are trying hard to adapt to us. It's time for us to learn from them and their survival strategies; but it is not possible to learn if we keep killing them. Something like this might inform further discussions, perhaps http://www.amazon.com/The-New-Wild-Invasive-Salvation/dp/0807033685 . Glad I don't have kids or grandkids to worry about. Whew! Thank you for your attention and your efforts.	1/27/2016 8:11 AM
59	Maintain already completed habitat projects for 10 years since some of them have 10 yr contracts with USFWS	1/27/2016 7:45 AM
60	Just want access to the lake to fish knowing that I can get back to launched ramp.	1/26/2016 5:31 PM
61	Very good facilitators. Good Job!	1/25/2016 7:54 PM
62	My interest in the lake is for fishing with a motorized bass boat from my dock on my lakeside property.	1/25/2016 3:00 PM
63	I live far away from Orange Lake and can not drive to Stakeholder meetings. Thank you very much for providing a way for me to participate and have a say in the progression of Orange Lake. I fish the lake on Weekends and Stay at the Cross Creek Lodge Palmeters and eat at the Yearling Restaurant across the street. We put a lot of money in the Local Economy of Cross Creek, Florida.	1/25/2016 9:19 AM
64	thank you for accepting input from locals	1/23/2016 3:19 PM
65	Thank you for letting us express our concerns and hopes for solutions for problems with Orange Lake. I have been impressed that you continually brought in experts, encouraged honest communication, expressed your limitations and have now given us a viable on going plan that extends into the future.	1/23/2016 11:54 AM
66	Question: Who initiated this project (name & dept.) and a VERY transparent budget & expenses on line.	1/23/2016 9:27 AM
67	Thank you for all of the hard work you have done.	1/22/2016 7:45 PM
68	Thanks for your ongoing efforts...contingency funding prior to dry or flood cycles.	1/22/2016 7:19 PM
69	over 40 of us have attended the meetings and our number 1 concern is the safety in the ability to eat the fish, frogs, birds , alligators etc from the basin...	1/22/2016 7:16 PM
70	we don't rely on fishing from Orange Lake, but mostly discouraged by proliferations of cottonmouth and mosquitos.	1/22/2016 4:03 PM
71	Do whatever necessary to guarantee access for motorboats from Heagy Burry. It will lift housing prices, and enhance local economy. This is necessary for all northern Ocala-Marion County .citizens.Gas stations, restaurants, jiffy stores, antique stores, rental business will all thrive once again like when we purchased property here.	1/22/2016 2:35 PM
72	I respect & support environmental concerns. However sometimes drastic measures are needed to combat exotic species and suppression of natural burn/drying cycles.	1/22/2016 2:34 PM
73	I'm okay with you "taking the gloves off" so to speak, and doing what you need to do (within your budgetary/feasibility constraints and jurisdiction) to manage for access and quality habitat.	1/22/2016 11:16 AM
74	would appreciate a more aggressive plan to keep Heagy-Burry access open to the lake when floating vegetation is minimal	1/22/2016 10:30 AM
75	We have 1100 ft. canal which the Army Corp of Eng. kept it clean but now no one cleans we have been left by the side line.	1/22/2016 8:59 AM
76	Thank you for promoting this public review process.	1/22/2016 8:45 AM
77	help keep the lake open for all to use and enjoy	1/22/2016 8:18 AM

FWC Orange Lake Habitat Management Plan - Stakeholder Survey

78	I strongly support using prescribed burns to control the woody vegetation, which over the last 20 years has taken over the north end of the lake. Any efforts to maintain trails on the lake and surrounding marsh should not just be for the use of airboaters, but for all users and types of watercraft. In addition, signage should be placed on the trails (and possibly at boat ramps) informing airboaters that other users may be on the trail and to use caution.	1/22/2016 8:15 AM
79	I wish you all success and appreciate that you're investing resources of time and knowledge in this circumstance. I will review the HMP linked to below with particular interest in the hydrology of orange lake and how similar lakes respond to similar management plans over time. Additionally, while i am responding as a concerned citizen who occasionally fishes at Lochloosa, i disclose my bias as an invasive plant, arboriculture, and ecological services contractor in Alachua and surrounding counties. Best wishes for success!	1/22/2016 8:07 AM
80	Trails will need to be maintained and marked. Scraping helps remove rhizomes. Bi-annual 'results' meetings needed.	1/21/2016 10:48 PM

Appendix D. Stakeholder Comments on the Final Draft Orange Lake HMP

Verbal Comments Received at Public Meeting 4

Chris Farrell, Audubon

The HMP has two important parts, the outcome and how you will get there. We spent most of our time discussing the methods. The final goal is basically the habitat guidelines, so we need to define what the habitat will look like. If we can revisit that, the rest has been useful.

Jim Stevens, Cross Creek, Orange Lake Shoreline Owner

The word is fish. Most people outside this group and inside this group are concerned about fish. Will we ever see bass fishing on Orange Lake like it was in the 1970s?

FWC answer: It depends on the habitat for the fish, which is recovering from the dry period. The habitat is coming back and fish have been stocked in the lake. We look for it to be back strong in the next couple years.

Whitey Markle, Sierra Club

When you have an annual plan and annual goals, you are limited to that. They have satellite images every 3 years, those last 2 years you do not get to see your progress, so I suggest drones. As in the BMAP process where they set a 5-year plan and they set goals with milestones, you reduce the vegetation by a certain percentage and you measure to see if you did that, and if not, you have to improve methods. You have to get the legislature to fund it. The solution to this lake is to raise the highway at 301, let the water flow out, and let the lake clean itself. The interagency group defers the responsibility to others, but at some point, someone needs to take responsibility and initiate this.

Comments Received via the Online Survey Input Tool

Page	Comment	Last Name
General	A well-presented and beneficial series of meetings. Would be easier to rally support from the fishing group if it could be done in one or two fewer meetings.	Simpson
General	We have expert and concerned staff on our local FWS staff..but meager resources to implement any plan.. A flexible funding scheme would allow . burn or scrape exposed muck in DRY WEATHER..or . pump vegetation or dredge muck in HIGH WATER ..(for instance) There are proven methods..cost is the limiting factor..We all need to take a mandate to appeal to ALL sources of fundi g to assist..i Thanks for an excellent series of workshops , and for your love of this wonderful resource !	Williamson
General	Overall I believe that it's a good plan. If the established strategies are used and flexible enough, these goals can be reached w/I the set time frame. These need to be long term goals strategies.	Roddy
General	The HMP is very informative and objective, job well done. I've lived in Cross Creek 19 years and the scariest thing to me is wildfire, so I'm strongly opposed to any control burns. I strongly oppose shoreline trails cut for canoes/kayaks. I would like to see more study on the entomology of the	Lawyer

Page	Comment	Last Name
	Orange Creek Basin and any effects HMP may have on insect populations. Waterfowl hunting should be a minimum of 1000 ft off private shoreline.	
1	I cannot download on my smartphone??	Williamson
26	New Action Strategy - Research ways to notify nearby residents prior to prescribed burns, such as email, text, twitter, radio/TV announcement, FWC website,	Halback
29	The maps are hard for me to understand and do you have the most up to date bald eagle info.	Lawyer
36	C-2.3.....Not along private shoreline C-2.5.....Not along private shoreline, this idea in an invitation to disaster.	Lawyer
44	Potential Action #3: The I-75 Relief Project, expected to be finished this fall, will include improving and enhancing the 301 corridor as part of FDOT's long range goal to improve connectivity from Tampa Bay to Jax. for both highway and railroad. FWC should monitor this process for opportunities to provide input addressing how the current problems associated with the 301 bridge and weir, and the railroad bridge and dike affecting water flow out of Orange Lake could be re-engineered when these old structures are replaced or modified as part of the corridor improvements.	Halback
45	Potential Action 8 Other Partners: Include private paddle guide businesses and tour operators	Halback
45	Action 9: Plum Creek Envision Alachua Plan proposed for parts of the Orange Creek Basin watershed is currently in limbo. Its long term effects upon Orange Lake due to increased aquifer pumping, run off, and possible sewage overflows under certain conditions, were cited as potential problems, but were not adequately addressed in its proposal. It is understood that this project is out of the realm of FWC jurisdiction. If it should be approved and projected water quality/quantity issues appear to be detrimental to Orange Lake and it's habitat, would FWC make comments or recommendations regarding these adverse effects?	Halback

Comments Received via Email

Dziergowski

From: Dziergowski, Annie [mailto:annie_dziergowski@fws.gov]

Sent: Tuesday, May 03, 2016 1:35 PM

To: Hamm, Ryan <Ryan.Hamm@MyFWC.com>

Subject: Re: Orange Lake Habitat Management Plan Comment Reminder

Ryan,

Hope all is going well.

I got your message regarding grants for wildlife viewing areas. I take it that this could include elevated walkways and viewing towers. The only instance that I have seen is with a friends group that was able to get funding for scenic overlooks through some kind of grant. Most grants I

work with are for habitat restoration, this might be related to more recreation based grants. Sorry I couldn't be more helpful.

Good work on the plan. You all have really done a good job incorporating all aspects of the management. I wish I could have been more involved, but have gotten pulled into other duties in my office.

Thanks,
Annie

Annie Dziergowski, Fish and Wildlife Biologist
U.S. Fish and Wildlife Service
Email: annie_dziergowski@fws.gov
7915 Baymeadows Way, Suite 200
Jacksonville, FL 32256-7517
904.731.3089 (direct)
904.731.3336 (main)
904.731.3045 or 3048 (fax)
<http://www.fws.gov/northflorida>

Etzler

From: Judy Etzler [<mailto:ejl788@aol.com>]
Sent: Saturday, April 23, 2016 9:25 AM
To: Hamm, Ryan <Ryan.Hamm@MyFWC.com>
Subject: Thank you

Ryan,

I just posted this on facebook and wanted you to know

Pictures and a link to the Orange Lake Habitat Management Plan meeting that I attended last evening along with others who have championed a plan. Congratulations to Ryan Hamm and the rest of the Florida Fish and Wildlife employees who kept in communication with us as we learned. We were treated like intelligent adults who all had something valuable to bring to the table. Check out this blog for info. and at different meetings I saw other agency staff showing up to listen and learn - SJRWMD, FDEP, etc.

Judy Etzler

Hofstetter

From: Stephen Hofstetter [<mailto:SHofstetter@alachuacounty.us>]
Sent: Thursday, May 05, 2016 1:58 PM
To: Hamm, Ryan <Ryan.Hamm@MyFWC.com>
Subject: RE: Orange Lake Habitat Management Plan Comment Reminder

Ryan,

We really appreciate the opportunity to review and provide input on the draft management document and participate in the stakeholder process. Here are our comments:

Include an appendix that includes copies of all existing relevant permits.

Recommend adding the follow language to either the introduction or in the Interagency collaboration section: All work is conducted (in the public interest by a government entity) in compliance with Chapters 373 and 403 Florida Statutes (for the purpose of access, restoration or enhancement) and includes any permitting or approvals required by the Florida Department of Environmental Protection, St Johns River Water Management District, United States Army Corps of Engineers, Alachua and Marion Counties.

We recommend that FWC come to the Alachua County Board of County Commissioners (BoCC) and present the proposed Habitat Management Plan to the BoCC as either an informational item for discussion and public comment or to request that the BoCC review and approve, or adopt the plan pursuant to the Section 406.06(c) of the Alachua County Unified Land Development Code. Based on this code policy, activities consistent with a management plan adopted by Alachua County BoCC would be exempt from additional permitting requirements and could help streamline the review process with the county. For the plan to be approved the Board, there needs to be very clear parameters and limitations on the management activities in the plan so that it is clear what would be approved and not approved by the County. Activities outside these parameters, for example dredging and filling activities, would require additional county review and approval. County staff would be glad to discuss this option further with FWC staff.

We look forward to continued collaboration and cooperation on Orange Lake management activities and related issues. Let me know if you have any questions or concerns about our comments.

Thank you,
Steve

Stephen Hofstetter
Natural Resource Program Manager
Alachua County Environmental Protection Department
408 W. University Ave., Suite 106
Gainesville, FL 32601
shofstetter@alachuacounty.us
(352) 264-6811
(352) 264-6852 (fax)

Markle

Orange Lake Habitat Management Plan Comments

Whitey Markle

Ryan:

Thank you for conducting the long process of developing the Orange Lake HMP. Considering the diversity of stakeholders, I am impressed with the “final” product. Although parts of the plan still are vague, I think you have covered all the issues.

Let me stress several points that we consider to be most important in my comments.

1. In reading the Plan, we are having trouble reading the print on the PDF’s. Why such small print? The stakeholders’ replies were unreadable much of the time. Can you change the format to larger font?
2. It is obvious from reading the input that herbicide usage is disliked by many stakeholders and should be carefully administered by certified applicators. (We still prefer no herbicide usage). Birding was listed as one of the biggest interests on the lake and we would like to see more emphasis on bird habitat and safety from pollutants, specifically herbicides. In your presentation at the final meeting you repeatedly said that “herbicide spraying would be used AS NEEDED.” This is quite vague. It seems to me that you all should be far more specific in describing your criteria for all of the techniques proposed to be used in the plan, but especially this technique as there was so much opposition.
4. I attempted to press you all in the final meeting for a figure on your budget and in reading the criteria for application of actions it stated that one criterion would be “feasibility”. Are we to interpret that to mean money? Are we to assume that all of these solutions are at the mercy of the legislature? It is quite difficult for the stakeholders and the public to understand what paths to follow in participating in the process when such vague criterion are in place. We learned during the BMAP process for the Orange Creek Basin that the Basin (including Orange Lake) doesn’t have as much political strength compared to other Basins in Florida, so why should we expect projects that would be more effective but more expensive to be implemented?
5. We noticed that the first HMP meeting got the most attendance in the series and that at the final meeting there were very few stakeholders attending compared to the first meetings. Could it be that the participants are disappointed with the process? We wonder how many stakeholders were really part of the process.
6. The removal of the US 301 Weir, berm (under the existing highway), box culvert, railroad trestle and the construction of a causeway-style bridge was downplayed if not totally ignored. Bigger projects are being constructed daily across the state so this is a realistic proposal. Again there seems to be a lack of will in this issue. I would personally like to see some documentation as to your deliberations with the “Working Group” you all kept referring this issue to.

7. We consider burning to be the safest method of vegetation control regarding the water quality. We suggest using burning as often as possible.

8. The Sierra Club, of course, endorses the development of paddling trails all around the lake. However, we are concerned about the access to the lake by paddlers and we endorse the establishment of paddlers' access points, excluding motorized watercraft, especially on the South shore and on the East end,

9. Motorized boating trails should be located with noise abatement in mind, especially airboat nuisance. Average airboats emit 65dB an $\frac{3}{4}$ mile. Alachua County daytime acceptable noise level= 65dB and Marion County= 55dB. Thus no motorized trail in marshlands should come within $\frac{3}{4}$ mile from the shoreline. Non-motorized trails could be closer to the shoreline and could enhance control burning.

Thank you, your staff, and Normandeau Assts. For the work you have done in this process.

Whitey Markle, Conservation Chair, Suwannee/St. Johns Sierra Club Group.

Paulic

Orange Lake Habitat Management Plan Comments

Mary Paulic – FDEP

General Comment. Were any evaluations made between aquatic plant growth (as acres occupied) and water quality parameters?

General Comment. The plan acknowledges Hydrilla, though an invasive plant, as having value. But recommends that water hyacinth and water lettuce be managed at the lowest possible level. Both these species do remove nutrient from the water column and at least in the case of water hyacinth have strong luxury uptake of nutrients compared to native plants. Why the difference in treatment between these plants?

Page 5, Section 2.1.8 and 2.1.9. Tone of first sentence is starting to sound like opinion rather than statement of fact. Suggest reworking to fit word choices into document.

Page 20, Table 3-1. Not all the techniques listed have estimated costs. Is it possible to make an estimate of cost, even if the basis for that cost is another lake?

Page 31, Table 4-1. Is the target coverage identified for one habitat type considered when setting the target coverage for another habitat type? The percent target coverages listed under low and high do not add up to 100 percent. Or can there be more than 100 percent coverage? Could more detail be added on how the ranges of percent coverage of habitat type are determined?

Page 44, Actions. McIntosh was not included as a partner under any action. The city fronts Orange Lake.

Page 44, Actions. Was any consideration given to partnering with other agencies for sediment removal during low water conditions?

Page 53, Appendix A. Noted earlier in time sequence that Florida Department of Natural Resources is now Florida Department of Environmental Protection. In keeping with that style, under 1987, FDEP would be Florida Department of Environmental Regulation.

Page 54, Appendix A. Under 2004, it is just the Orange Creek Basin Working Group.

Page 55, Appendix A. Under 2008, FDEP adopts Orange Creek BMAP by Secretarial Order. Phase 2 of the BMAP adopted in 2014.

Pruitt

April 26, 2016
PO Box 274
McIntosh, FL 32664-0274

Ms. Fay Baird
Normandeau Associates, Inc.
4581 NW 6th Street, Suite A
Gainesville, FL 32609

Re: Orange Lake Habitat Management Plan Final Draft dated April 16, 2016

Fay:

This letter summarizes my comments about the Orange Lake Habitat Management Plan Final Draft, dated April 16, 2016. First, I want to thank the Florida Fish and Wildlife Conservation Commission (FWC) and Normandeau Associates, Inc., for going through the process to develop and promulgate the referenced management plan. I am sure that incorporating input from outside an agency can be difficult, especially in efforts to include citizens like me, so I want to express my sincere appreciation to FWC for its leadership and Normandeau for its front-line initiatives in this excellent example of agency-citizen coordination. Personally, I have been given numerous opportunities to participate in it, and know that FWC and Normandeau staff have occasionally bent over backwards to explain things to me or hear me out. Kudos!

The timeline contained in Appendix A is a welcome source of information. I had prepared my own version, but FWC's is much more thorough and extends much further back in time. It is harder to ignore the lessons of history when they are in front of us, and a whole lot easier for me to keep the facts straight!

I endorse FWC's use of prescribed burns as a viable and cost-effective tool for managing the lake. The benefits of fire to thusly adapted ecosystems in general, and to fish and wildlife in specific, are well-documented and, in the case of Orange Lake, might be particularly useful for removing organic sediments. The challenges of managing peat fires and fire smoke around Orange Lake homes means that it is not feasible to use this tool at all times and places, but there should be some when it is.

The grass carp is mentioned as an example of a biological control agent to consume nuisance plants. I am strongly opposed to the introduction of nonnative fish species into Orange Lake or any other water body in Florida. The artificial introduction of insects that exclusively target individual species of exotic plants may be a better long-term management practice.

The report of 15.5 inches of sediment reduction in PG Run and 16.6 inches in River Styx due to sediment compaction and oxidation are eye-opening measures of one benefit of natural water level fluctuations. In the absence of any alternative with results as deep or as wide, or as inexpensive, these numbers support the contention that efforts to artificially elevate the lake's level at the Orange Creek outlet and the southwest sinkhole are misguided. It is good to see that these historic errors have fallen into the plan's official disfavor, and I appreciate that FWC considers the removal or disablement of the US 301 fixed crest weir US 301 among a "list of potential opportunities for interagency collaboration." Removing the structure should have a high benefit-cost ratio, but simply disabling it could have an even higher ratio due to the presence of the US 301 and railroad causeways. Therefore, I urge the responsible state and federal agencies to cooperate in disabling the US 301 water control structure.

Similarly, modifications to the southwest sinkhole in the past have failed, proven contentious, and perhaps are no longer permissible. For example, the channel leading from the Heagy Burry boat ramp to the deep part of the lake provides boat access to the lake but at the cost of hastening the drainage of lake waters into the sinkhole during drought. Too, periodically exposing benthic substrates to the air facilitates the removal of organic materials but may also increase the carbon footprint. I say leave the sinkhole unmodified and refrain from any more dredging in the lake other than to maintain existing access channels and remove artificial fills (e.g., spoil islands and levees).

Ms. Fay Baird
April 26, 2016
Page 2

FWC maintains a desire to dispose of additional dredged material on existing spoil piles within Orange Lake wetland jurisdictional boundaries, which I am firmly opposed to. I understand that state and federal wetland permitting agencies did not favor the 2000-2001 sediment spoiling actions, but permitted them anyway with prejudice. After mentioning numerous times to FWC staff my objections to further dredge and fill activities, I am gratified to see in the plan that FWC no longer proposes to spoil dredged material at new sites within the lake and instead intends to look to upland disposal. I would be even happier if FWC committed to place no new spoil on the existing in-lake spoil islands. It has been difficult for FWC to find suitable upland disposal sites in the past, and I suspect that this will prevail in the future even if FWC abandons trying to lease sites and instead embraces acquisition by fee simple; however, eminent domain might have to be invoked. This is one more reason to stop dredging in the lake as a management tool.

Mechanical sediment removal is identified as an alternative method to set back succession and provide firm substrates for vegetation root structure in Orange Lake. I could not disagree more, for three sets of reasons: cultural resources, benefit-cost ratio, and in-lake spoil piles.

Cultural Resources: Orange Lake was foraged extensively by Native Americans for thousands of years. Personal communications with locals inform us that large numbers of artifacts (e.g., "arrowheads") were picked up every day "after work" by pothunters walking over the dredged sediment spoil piles in McIntosh Cove. No cultural resources investigations were done prior to the excavations, so the magnitude of the impact to this site is completely unknown (I have little personal knowledge of the spoil sites on the east side of the lake, but suspect that similar cultural resources were damaged or destroyed in adjacent scrapings). In addition, FWC staff discovered a vandalized Native American burial at the edge

of the lake in deep peaty sediments. Heavy equipment operators do not necessarily see the cultural resources they expose nor are they qualified to rapidly assess them while doing the excavation work. Nowhere in this management plan or other FWC documents that I have reviewed is there mention of conducting cultural resources investigations prior to mechanical sediment removal. I am surprised that the Florida Division of Historical Resources does not object to mechanical sediment removal projects within areas known and documented to contain cultural resources sites.

Benefit-Cost Ratio: The 2000-2001 mechanical sediment removal project cost \$500,000 and resulted in scraping down 175 acres, or \$2,857 per acre. In McIntosh Cove, much of the scraped area is re-occupied by bands of rooted and floating herbaceous plants, whereas floating tussocks are blown back and forth across the area's open waters. I live only a stone's throw from that scrape-down area and 500 ft from its four spoil islands, and can attest that the number of anglers using that area during November 2007 to March 2016 was small. People who put in at the boat ramps in McIntosh Cove typically pass quickly over the scraped area on their way to points distant (I can hear their boat engines from my living room as they set out). I do not know how much of the \$10 million annually claimed for the overall Orange Lake fishery is reflected in angling and duck hunting at the McIntosh Cove scrape-down area, but my observations suggest it is small.

In-Lake Spoil Piles: The dredged material spoil piles had several adverse impacts at construction and currently have on-going adverse impacts that are likely to continue to adversely impact the lake's ecology sans mitigation. Construction removed preexisting wetland vegetation and smothered more, and in the case of McIntosh Cove, the spoil piles replaced high quality emergent herbaceous marsh habitat and subsequently provided a colonization site for non-native invasive plants. The involvement of an external volunteer organization was used to try to clear the eastern spoil piles of exotics, but I have no knowledge of how successful that effort was. On the other hand, I do know that (1) nuisance plants on the McIntosh Cove spoil piles have received only cursory attention from FWC, (2) the plant communities on the McIntosh spoil piles are going through a successional transition from a community dominated by native invasives to associations controlled by three exotic invasives: Chinese tallow, Chinaberry, and paper mulberry, (3) these nuisance species are of less value to native fish and wildlife than native plants, (4) as they mature into large trees, these three will inhibit further deposition of spoil, and (5) the spoil piles are used by nuisance exotics as stepping-stones to colonize other lake habitats.

Ms. Fay Baird

April 26, 2016

Page 3

Section 4.4 on invasive species is entirely devoted to aquatic vegetation and contains nothing about upland invasive plants on FWC spoil islands. This should be addressed in the plan. If FWC will not remove the in-lake spoil piles altogether, then the existing invasive plants should be eliminated and the islands should be planted with a variety of native species having high value to native fish and wildlife. Furthermore, this replacement vegetation should be nursed into dominance because these early successional spoil pile habitats favor invasive species. Volunteers like me from organizations such as the Florida Native Plant Society might be willing to assist in mitigation field work.

Cultural resources reconnaissance level surveys should be conducted prior to any new dredge and fill footprints being considered within Orange Lake. The lake experienced water levels low enough to allow reconnaissance surveys only once (2010+) in the 15 years since the 2000-2001 scrape-down excavations. Therefore, future cultural resource surveys and habitat modification excavations could be shoehorned

together with too-tight timetables or untimely financial non-support. On the other hand, if FWC has a pretty good idea of where it wants to establish new scrape-down areas but does not want to dig them any time soon, then conducting cultural resource surveys during the next low water event should be considered.

The high dollar costs of mechanical sediment removal projects and their potential impacts to cultural resources in Orange Lake warrant pre-impact cultural resources surveys and independent benefit-cost assessments before any more of them are conceived. Indeed, I was disappointed to see that Goal B (manage habitat for focal taxa) does not include an objective for quantifying the habitat quality of existing scrape-down areas and spoil islands. After all, there is no better way to assess the success or failure of these artificial habitats than to compare their before-and-after sampling data against original project goals. In the absence of FWC complying with this request for future dredge and fill habitat management projects in Orange Lake, I plan to voluntarily conduct benefit-cost assessments of them myself.

Figure 4.2 on page 30 shows that only open water, floating marsh, deep marsh, and SAV/Hydrilla habitats vary significantly from low (2010) to high (2007) water conditions.

Table 4-1 indicates that the maximum target coverage for shrub swamp is 7.5%, or 1002 acres, but the plan contains no proposal for accomplishing that target (I certainly hope that it would not be done via scrape-downs, as that could cost \$2.86 million in 2001 dollars). The targeted decrease is based on a semi-quantitative methodology based on expert knowledge of target species' natural histories and subjective evaluations of a given habitat's ability to support one or more of the target species' biological requirements. I have used similar methodologies in the past and found them to be cost-effective; however, they employ "gut feel" protocols that often produce widely disparate results when done for differing agendas by opposing parties. Therefore, I consider the *Habitat Guidelines'* methodology acceptable for relatively small, inexpensive projects and for rapid responses but unsuitable for half-million-dollar projects having undemonstrated quanta of benefits to fish and wildlife while causing demonstrably adverse impacts to cultural resources and providing inoculation points for nuisance exotic vegetation within the natural marsh.

The draft plan mentions two potential technologies for minimizing the blockages of public access points by floating vegetation: (1) erecting permanent barriers near public access points against mobile tussocks and (2) anchoring tree islands. I have not seen these two mentioned in prior Orange Lake management plan, although I may have simply missed them. However, I have mentioned them to FWC in the past and am gratified to see them added to the list of potential management tools.

I am very glad to see that the plan recognizes the value that stakeholders place in long-term floating islands. My literature review of floating islands reveals that Orange Lake's floating islands are probably among the most substantial and longest-lived in the world. I believe that they should be officially recognized for their uniqueness for all to appreciate and conserve. I suspect that they qualify for National Natural Landmark status, and I intend to follow up on this possibility. I hope to enlist FWC or another state conservation agency in this effort.

Ms. Fay Baird
April 26, 2016
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Objective C-2 (boat trail network) is laudable, especially the concept of paddle trails. I would volunteer to assist in establishing and maintaining paddle trails that exclude motorized craft and allow paddlers to explore the lake's marshes. Creating trails in cooperation with outdoor recreation organizations such as hikers and mountain bikers works well in many instances, and I applaud FWC's interest in pursuing this. The effort could be considered in tandem with additional public access points, as the latter are currently too few and far between for paddlers to experience more than a fraction of what motor-boaters enjoy. Obviously, paddler's access points can be relatively small as they do not have to contain boat ramps.

Again, thank you very much for the opportunity to comment on this important resource management document. I look forward to seeing the final plan.

Sincerely,



Buford Pruitt, Jr., CEP Emeritus

Appendix E. Draft Orange Lake Best Management Practices

Public Access Point Blockages

This appendix is to clarify the thought process of the FWC in regards to maintaining public access points. The nature of Orange Lake floating vegetation after refill from extended low water conditions makes this management actions challenging and expensive. As experienced after the refill of 2012, floating vegetative tussocks were the primary factor blocking access and restricting navigation. Conceptually, with a Habitat Management Plan in place, the abundance of floating tussocks will be reduced when future refill events occur. Furthermore, stakeholder acceptance of management techniques described by Habitat Management Plan will allow the FWC to more effectively manage tussock blockages in the future.

In general, when a small to moderate size blockage occurs (generally less than 10 acres), action will be taken as soon as wind conditions are favorable. If the blockage can be moved away from the access point prior to shredding, this will be done to minimize accumulation of organic matter in the immediate vicinity of access corridors. In the case of large scale blockages that occur under extreme conditions (e.g. 10s or 100s of acres following severe drought/recovery periods) shredding in the immediate vicinity of access points will be avoided until the majority of drifting material has dispersed. Under extreme conditions such as this, FWC will attempt to take advantage of favorable wind conditions that results in localized aggregation of drifting tussocks and target them for control when they occur in remote areas where public access/private property are less likely to be impacted. This strategy will typically be employed under extreme conditions when drifting tussocks are causing persistent access and public safety concerns.

These considerations attempt to illustrate the FWC rational when addressing and remediating public access point blockages. The FWC retains the right and responsibility to address each blockage on a case by case basis.

Consideration for Public Access Blockage Response

- Scope and scale of blockage
- Wind forecast
- Timeframe for response decision
- Available budget

Best Management Practices (BMPs)

1. Use herbicides to maintain floating vegetation and tussocks within immediate vicinity of designated public access facilities.
2. Attempt to relocate blockage material prior to shredding when feasible.
3. Plan shredding around favorable winds to the greatest extent feasible.
4. Large scale blockages that involve several acres of heavy compacted tussocks will be evaluated on a case by case basis. Primary factors considered in development of individual management strategies for extreme situations will include scope, scale and consistency of material causing blockage, wind forecast (speed and direction), length of time blockage has been present, type of access (public facility or private fee open to public).

Sandhill Crane

Sandhill Cranes: Interim guidelines for operators on Orange Lake

Created: February 6, 2015

Revised: March 31, 2016

Prepared by: Amy Schwarzer

The Florida Sandhill Crane is a State-designated Threatened species protected under rule 68A-27 F.A.C., which prohibits take of the birds, nests, eggs, or young without a permit. Florida Sandhill Cranes, active nests, eggs, and young also are protected under the Federal Migratory Bird Treaty Act, state rule 68A-16.001 F.A.C., and state rule 68A-4.001 F.A.C.

These interim guidelines are meant for operators conducting aquatic habitat management on Orange Lake. Sandhill Cranes on Orange Lake generally nest on thick mats of vegetation and tussocks. Nesting season is generally from mid-February to June, though March through May tend to be the most active time of the breeding season. During nesting, Sandhill Cranes are a cryptic species that lay eggs on a low nest mound made of marsh vegetation and debris, relying on camouflage to protect the nest from predators. Under some circumstances, the incubating adult may stay on the nest until approached at a very close distance (less than 10 feet). However, some cranes will flush if approached within 250 feet of a nest site, and disturbances within 400 feet can interrupt nesting activity and even cause abandonment of the area, even if the birds do not flush. Chicks are mobile at a very early age and tend to stay very close to the parents, though the chicks may hide in vegetation, especially when young. Therefore you may see adults, but not the accompanying chicks. Adults with chicks will often time act agitated and give alarm calls if you approach the chicks too closely.

When possible, conduct work outside of the breeding season. If work on Orange Lake must be conducted during the breeding season, follow these guidelines to avoid destruction of nests and/or chicks.

- Scan work area for signs of Sandhill Cranes prior to undertaking work. Pay particular attention for pairs, single birds (which may indicate that the mate is nearby), or a sitting Sandhill Crane. Any of these may indicate the presence of a nest.
- If you see a Sandhill Crane pair, a single adult, a sitting Sandhill Crane, or adults with chicks give the birds a 400 foot berth if possible.
- While operating, be alert! Sandhill Cranes may not pop up from nests until you are very nearby. Be on constant look out for movement near area of operation. If/when you see a Sandhill Crane raise its head or pop out of the vegetation, cease operations and back off quickly to a distance of at least 400 feet.
- Remain vigilant for unusual behaviors that may signal the presence of a nest or chicks, including cranes feigning an injury by dragging a wing, facing an intruder with spread wings, or showing reluctance to leave an area.
- If you observe cranes in any of the above scenarios (pairs, single birds, sitting or flushed birds), cease operations, contact the Project Manager, and maintain a 400 foot setback

from the observed birds until FWC can verify the presence/absence of an active nest or chicks.

- All nests should be given a 400 foot buffer until either young have permanently left the nest or the nest fails due to natural causes. The buffer is extremely important to avoid stress to the adults, abandonment or predation of the nest, or heat/cold stress to the eggs.
- When removing vegetation outside of the 400 foot buffer around a nest, leave enough vegetation to enable flightless young to reach upland foraging areas (e.g., avoid creating a complete, extensive moat around the nest).

Orange Lake Management Timing Annual Schedule

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Stakeholder Considerations ○ Fishermen ▪ Largemouth Bass ▪ Panfish ▪ Crappie ○ Hunting ▪ Waterfowl ▪ Alligators ▪ Frogs												
Critical Wildlife Considerations ○ Avian Nesting ▪ Wading Birds ▪ Bald Eagles ▪ Sandhill Cranes ○ Alligator Nesting												
Management Considerations ○ Herbicide efficacy ▪ Hydrilla ▪ Floating Plants ○ Water quality-DO caution ○ Burn conditions optimal												

Key: Be cautious and considerate
 Optimum timing for activity