LAKE JACKSON ECOPASSAGE
FEASIBILITY STUDY

EXISTING CONDITONS TECHNICAL MEMORANDUM

1.0 PROJECT OVERVIEW

Lake Jackson is an approximately 4,000-acre sinkhole lake located in Northwestern Florida, seven (7) miles north of Tallahassee in the Ochlockonee River Basin. The lake is considered one of Leon County's most treasured natural resources, and is the only freshwater lake in the state to be designated as an Aquatic Preserve by the State of Florida.

Lake Jackson is a closed basin and the water depth in the lake fluctuates widely. Water level is controlled naturally by variations in rainfall and by two sinkholes in the lake bottom. During drought conditions, a lowering of the water table causes drainage into the sinkholes, and the lake dries up, exposing the lake bottom. This has occurred 9 times during the last 100 years with drying events occurring, on average, every 12 years (Hughes 1967, Wagner 1984). Following drydowns, major storm events and accumulation of seasonal rainfall restore the lake water levels. The drydowns and periodic refilling affect wildlife movements, as aquatic species attempt to seek habitat in times of drydown, and return to previously dry areas of the lake during refills.

A four-lane divided highway, U.S. Route 27 (North Monroe Street) was constructed directly across a ¾-mile portion of northwest Lake Jackson. This isolated an approximately 30 acre part of the lake to the west of the roadway (now known as Little Lake Jackson), as well as creating a barrier to wildlife movement. US 27 connects North Florida and South Georgia to Interstate 10, Tallahassee and points south. The approximately 4,000-foot stretch of roadway between Lake Jackson and Little Lake Jackson serves approximately 23,000 vehicles per day (FDOT 2003 Traffic Information CD).

During the drought of 1999-2000 in North Florida, Lake Jackson dried, causing a mass exodus of thousands of animals attempting to migrate across US 27 to Little Lake Jackson, which did not dry in the drought. Since February 2000, a total of 10,229 reptiles and amphibians of 44 species, and over 9,200 vertebrate animals have been found dead on the road or attempting to cross the ¾ mile section of US 27 at Lake Jackson (Aresco, 2004).

In order to prevent massive road mortality of migrating animals, a temporary fence (using silt barrier material) was constructed to prevent animals from crossing the road, instead redirecting them to a large (12 foot diameter), existing culvert that joins Lake Jackson to Little Lake Jackson under US 27. A 3,000-foot fence along US 27 North was completed in April 2000, and has been monitored 2-4 times per day since construction. A second, 2,000 foot fence was constructed along US 27 South to intercept animals attempting to migrate back across the road when Lake Jackson refilled in 2001. This fence also has been monitored 2-4 times per day since construction. During monitoring, animals found moving along fences were hand-collected, documented, and hand carried across the highway and released into the water. In 33 months, over 8,000 reptiles and amphibians trying to cross the highway were safely removed from potential impacts due to collisions with automobiles. But over 600 reptiles and amphibians were killed due to collisions with automobiles during this period.

Turtles and other wildlife play an important role in lake ecosystems by consuming invasive plant species such as *Hydrilla* and scavenging on dead material. These animals help maintain a properly functioning ecosystem in Lake Jackson and are important in the lake food web as both predators and prey. The loss of large numbers of these animals to road mortality could compromise the viability of populations and negatively impact the overall ecosystem.

Additionally, wildlife attempting to cross the highway can represent a threat to motorist safety. Many adult turtles weigh at least 5 to 10 pounds and are essentially “rocks” in the roadway, acting as potentially dangerous projectiles when hit, and causing serious damage to vehicles and injury to occupants. On US 27, near misses where vehicles have stopped to help animals, or have swerved sharply in attempt to veer around animals in the roadway, have been reported (Aresco, pers. com.). Peak migration days

can result in hundreds of animals trespassing on the highway, causing concern for motorist safety.

In order to address the issues of wildlife mortality, habitat fragmentation, and traffic safety concerns, The Florida Department of Transportation (FDOT) has provided the funding to prepare this Lake Jackson Ecopassage Feasibility Study ("Feasibility Study" or "Study"). Components of the Feasibility Study include:

- Statement of Goals and Objectives for the Study
- Public meetings to inform and solicit information from the community
- Coordination with FDOT ,
- Review of historical and existing conditions at the site (including review and compilation of Geographic Information System (GIS) data),
- Analysis of stresses, opportunities, and constraints,
- Identification of potential enhancement and protection alternatives,
- Recommendations for enhancement and protection,
- Conceptual plans (if a structural solution is the preferred alternative)

2.0 TASK DESCRIPTION - EXISTING CONDTIONS TECHNICAL MEMORANDUM

This Technical Memorandum is a summary of the results of the historical and existing conditions data collection activities conducted for the Lake Jackson Ecopassage Feasibility Study. The objective of this task was to develop a working understanding of how the historical environment shaped current conditions and how the hydrologic and physical conditions affect the existing natural resources.

The project team utilized available natural resource documentation, including historic aerial photographs, current and historic water level data, wildlife data, topographic data, and soil survey information to examine and document current and historic conditions in the project study area [*Figure 1*]. Data collection was supplemented with field reconnaissance to assess current soil and vegetative conditions, as well as to document wildlife habitat and utilization in the study area.

The study area is located in Northern Leon County adjacent to US 27 (North Monroe Street) in Section 5, Township 1 North, Range 1 West and Sections 32 and 33, Township 2 North, Range 1 West. The study area includes parcels currently owned by Leon County, the State of Florida, and some privately-owned areas within lakeside residential and commercial developments.

3.0 GENERAL AND HISTORICAL CONDITIONS AROUND LAKE JACKSON

3.1 Soils

The 1981 *Soil Survey of Leon County, Florida* (U.S. Department of Agriculture/Soil Conservation Service) shows several soil map units in the vicinity of the project study area [*Figure 2*]. The dominant soils within the project study area include Plummer fine sand, located along the majority of areas adjacent to the Lake Jackson shore, and Albany loamy sand (0 to 2 percent slopes), located along a portion of the area adjacent to the northeastern shore of Little Lake Jackson. Descriptions of these soil map units were excerpted from the Leon County Soil survey and are provided below:

> Plummer Fine Sand – is a poorly drained, moderately permeable, nearly level soil in low areas and poorly defined drainageways. It is described by the soil survey as being formed in marine or fluvial sediments, with slopes ranging from 0 to 2 percent, and a water table at the surface or within a depth of 15 inches from the surface for 3 to 6 months, in most years. Soils in the Plummer series are described as loamy, siliceous, thermic, grossarenic, paleaquults. Reaction ranges from very strongly acid to medium acid in the A horizons, and very strongly acid to strongly acid in the B horizon. Native vegetation associated with this map unit includes loblolly pine, slash pine, sweetgum, blackgum, and cypress canopy, with inkberry, waxmyrtle, ferns, and pineland threeawn understory.
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> Albany Loamy Sand (0 to 2 percent slopes) – is a nearly level, moderately permeable, somewhat poorly drained soil found in lower elevations of uplands. It is described by the soil survey as being formed in

unconsolidated deposits of marine sandy and loamy sediments. Slopes range from 0 to 2 percent, and the water table is generally 12 to 30 inches below the surface for 1 to 2 months in most years. Soils in the Albany series are described as loamy, siliceous, thermic grossarenic paleudults. Albany soils are better drained than Plummer soils that are in lower elevations. Soil reaction ranges from extremely acid to strongly acid in the A1 horizon, and strongly acid or very strongly acid in all other horizons. Native vegetation associated with this map unit includes longleaf pine, slash pine, and mixed hardwoods, such as white oak, live oak, laurel oak, sweetgum, hickory, dogwood, and persimmion.

Other soils identified within the project area include Wagram loamy fine sand (0 to 5 % slopes and 5% to 8% slopes), Lucy fine sand, 5 to 8 percent slopes, and Orangeburg fine sandy loam (2 to 5% slopes and 5 to 8% slopes). All of these soils are well drained, sloping soils found on upland hillsides around the lake.

Development around the lakeshore has likely affected native soils and possibly soil profile in the areas around the lake. Soil samples were collected and analyzed at select habitat areas and potential nesting sites within the study area in order to develop a better understanding of the current conditions within the project area. The results of soil analysis are included in *Appendix A*.

3.2 Land Use and Vegetation

3.2.1 Historical Land Use

Historic land use within the project study area was assessed by reviewing a series of available aerial photographs, obtained from the Florida Department of Transportation (FDOT) Survey and Mapping Division. Black and white aerial photographs, dated 1949, 1957, 1962, 1966, 1968, 1973, 1980, 1982, 1987, 1995, and 2000 were provided by the FDOT in digital format (scanned from hardcopy). Photographs were assessed for general land use patterns. A summary of the Historical Aerial Review is provided in *Table 1*. From review of photographs, it appeared that land use in the study area was generally undeveloped and comprised primarily of agricultural land uses (e.g. farms and

pastureland) on the western side of US 27, and comprised of the lake on the eastern side of US 27. Most of the area on the western side of US 27 near the project area currently remains undeveloped pastureland and wetlands associated with Little Lake Jackson. Development along the project area generally began in the early 1980's with some small office buildings, with the Lakeside residential subdivision being constructed between the late 1980's to mid 1990's. The public access boat ramp within the project area appeared sometime in the late 1950's to early 1960's. With the exception of the residential subdivision and limited commercial and office uses, most of the land use within and adjacent to the project area has remained undeveloped wetlands associated with the lake, or pastureland associated with former agricultural use.

3.2.2 Historical Vegetative Communities

Historical aerial photographs obtained from FDOT were used to determine approximate boundaries of historical vegetative communities found within the project study area. The 1999 Florida Department of Transportation (FDOT) Florida Land Use, Cover and Forms Classification (FLUCFCS) Manual was used as the basis to describe and map the various historical ecological communities. FLUCFCS designations were mapped to Level II or Level III, where possible.

Three representative historical aerials, dated 1949, 1962, and 1982, were reviewed to show the various changes in land uses and site habitats. The 1949 aerial was selected because it was the earliest available image. The 1962 and 1982 aerials were selected because they show water levels comparable to the existing conditions (2001 aerial map), and because of the relative equal space in time between the 1949 and the 2001 aerials. Since documentation of the historical conditions of vegetation in the area was not available, it was difficult to determine the exact vegetative composition of each of the various historical land use categories.

The 1949 black and white aerial photograph was flown on 16 March 1949. This aerial shows several features including:

- Water levels much higher than the existing water levels, illustrating the extreme range of water levels this lake experiences.

- Water levels so high that the tops of large trees were inundated. This indicates that the flooding followed a much dryer period. The water edge borders US 27 along most of the study area.
- US 27 is a two-lane road, and it appears a small bridge functioned as the connection between Little Lake Jackson and Lake Jackson.
- The land surrounding the open water has already been converted to pasture and no native or well-developed forests are evident.
- A dairy and a small orchard or grove exist in the uplands.
- Forested areas appear to be open and maintained underneath.

The 1962 black and white aerial was flown on 26 June 1962. This aerial shows several features including:

- Lake levels that are comparable to the current (August 2004) lake levels.
- Lake levels appear to have recently receded.
- Expansive lake fringe areas are minimally vegetated.
- Two small boat launches are present. One of which is still in use today.
- US 27 is two lanes, however it appears that the bridge has been replaced with a culvert(s).

The 1982 black and white aerial was flown on 5 November 1982. This aerial illustrates features such as:

- US 27 is a four lane divided highway.
- Lake levels similar to existing conditions.
- Lake transitional zones are vegetated.
- Several small primitive roads are present.
- Only one small boat landing is present.
- Several of the upland forested areas are in old pasture areas and are densely forested and contain mature trees.

The following FLUCCS codes were assigned to mapped features on the historic aerials. The descriptions are our best interpretation of what likely occurred within the study area based on existing plant communities and the aerial signatures and characteristics of distinct plant communities. The historic plant communities are described below. Historical FLUCFCS maps are attached in *Appendix B*.

Urban (FLUCFCS 100) 1962 and 1982

These areas have been developed, however the type of development (e.g. residential, commercial, industrial) is not apparent. These areas are typically identified by cleared areas with buildings and associated infrastructure such as roads. Some areas may be completely devoid of vegetation, while others contain landscaped or domestic grass areas.

Residential (FLUCFCS 110) 1962 and 1982

This designation likely contains landscape vegetation and occasional tree species such as live oak, water oak, and pine. In the 1962 aerial this designation was composed of scattered single family structures; however, the 1982 aerial shows residential communities surrounding Little Lake Jackson.

Boat Launch (FLUCFCS 180) 1962 and 1982

Two-boat launch areas were identified in the 1962 aerial; however, by 1982, the western launch area does not appear to be in use. Vegetation within this area was likely bare ground with some vegetation from the adjacent land uses existing within the boat launch designation.

Improved Pastures (FLUCFCS 211) 1949, 1962 and 1982

These areas dominated the historical study area. These areas have been cleared and almost all of the native vegetation had been removed, with the exception of scattered tree species. These areas were likely used for cattle grazing and were planted with domestic grass species such as Bahia grass.

Woodland Pasture (FLUCFCS 213) 1962 and 1982

These areas consisted primarily of pastures with an overstory of mature trees. Often the trees are clustered together to form small hammocks. The ground cover typically consists of domestic grasses such as Bahia grass, and is likely utilized for cattle grazing or the dairy operations.

Woodland Pasture Submerged (FLUCFCS 213S) 1949

This designation contains similar species composition as the woodland pasture; however, the area was inundated at the time of the photograph. This inundation may have killed many of the trees, depending on the duration and their water tolerance.

Dairy (FLUCFCS 252) 1949 and 1962

A dairy area was identified in the southeastern portion of the site. This area corresponds to the location of the current dairy structures. The dairy appears to be operational in the 1949 and 1962 aerials; however, by 1982 it appears to have diminished in size.

Pine-Mesic Oak (FLUCFCS 414) 1949, 1962 and 1982

These are forested areas that contain a variety of pine and oak species. This community is probably very similar in composition to the existing pine-mesic oak community. The species within this area likely included slash pine (*Pinus elliottii*), water oak (*Quercus nigra*), and diamond oak (*Quercus hemisphaerica*). The ground cover within these areas appears to be open pasture and probably did not contain the weedy shrubs and herbs that currently dominate these areas.

Pine Mesic Oak-Submerged (FLUCFCS 414S) 1949

In the 1949 aerial the high water appeared to engulf several forested areas, and these areas were inundated at the time this photograph was taken. This area was probably similar to the pine-mesic-oak community of 1949. The inundation potentially killed many of the trees that typifiy the current dynamics of the shoreline along the lake.

Open Water (FLUCFCS 510) 1949, 1962 and 1982

In the 1949 aerial the open water areas comprise much of the study area. This designation was used for all open water areas regardless of floating or emergent vegetation. Due to the high-water levels in 1949, it does not appear that Lake Jackson contained any floating or emergent vegetation. However, in the 1962 and 1982 aerials vegetation is evident and there is less open water in the study area. It is assumed that the species composition during this time period was similar to the existing conditions.

Freshwater Marsh (FLUCFCS 641) 1949, 1962 and 1982

Freshwater marsh was identified surrounding the lakes in most areas in all historical aerials. These areas are vegetated wet areas that likely contain a variety of freshwater herbaceous species similar in composition to the existing freshwater marsh designation.

Orchard (FLUCCS 222) 1949

Two small areas were distinguished as orchards. These areas are located within, or immediately adjacent to, the dairy operation. The type of tree planted is unclear, but was likely pecans. This area was likely heavily disturbed and likely contained ground cover species similar to the improved pasture. The orchard does not appear in the 1962 aerial.

Shrubby Shoreline (FLUCCS 429) 1962

This designation was used to describe areas that contain small immature trees and shrubs. Likely vegetative components include water oak (*Quercus nigra*), live oak (*Quercus virginiana*), brambles (*Rubus* sp.), goldenrod (*Solidago* sp.), wax myrtle (*Myrica cerifera*) and salt bush (*Baccharis* sp.). This area succeeded in to a pine-mesic-oak community.

3.3 Hydrology

Lake Jackson is a shallow lake (<13 feet) surrounded by a closed basin with no natural outlets (NWFWMD, 2002). The water level in the lake is dependent on rainfall, and exhibits wide fluctuations as a result of storm and drought cycles. The presence of two

primary sinkholes (Porter Hole and Lime Sink) also plays a major role in lake water levels. Periodic fluctuations in lake levels, including periods of flooding and periods where the lake bottom is exposed, have been well-documented over the past 100 years. The Native American name for the lake, "Okeeheepkee" or "disappearing water" suggests that the periodic draining and refilling of the lake is a characteristic that has been occurring for centuries.

Drainage of the lake has been attributed to a combination of drought conditions and drainage of lake waters through open sinkhole systems (Kish, et.al, 2002). The rapid refilling of the lake can be attributed to major storm events and cumulative annual rainfall. Partial or total drying events at the lake were recorded eight (8) times over the past century (1907, 1909, 1932, 1935, 1936, 1957, 1982, and 1999) and once in this century (2002). Drying events occurred, on average, every 12.5 years. The normal annual water fluctuations and periodic natural drydown (and subsequent refilling) of the lake influence wildlife migrations, as aquatic species attempt to seek habitat in times of drydown, and return to previously dry areas of the lake during refills.

Historic lake hydrology was assessed through review of available hydrologic data from the Northwest Florida Water Management District (NWFWMD) as well as from review of historic aerial photographs [Section 3.2, *Table 1*].

According to NWFWMD data, the "typical" lake level range is between 82 and 88 feet ($NGVD_{29}$). Typical lake levels were recorded in 1953-1955, 1955-1961, 1963-1964, 1971-1982, 1984-1991, and 1992-1999. High/flood lake levels range between 88 and 98 feet, and were recorded in 1950 (earliest recorded data) to 1953, 1961-1963, 1964-1971, and 1995-1996. The highest lake levels to date were recorded around 1967, when the lake level was 96 feet NGVD. Low lake levels are 82 feet and below, with drydowns occurring when the lake level drops to approximately 78 feet. Low lake levels were recorded from 1955-1959 (with a drydown in 1957), 1982-1984 (drydown in 1982), 1991, and 1999-2002 (drydown in 1999/2000). The lowest lake level recorded was in 1957, when water level was recorded at 76 feet (no water level data available for 1958).

Lake water level data from NWFWMD and representative historic aerial photographs showing lake level fluctuations are provided in *Appendix C*.

3.4 Habitat and Wildlife

3.4.1 Habitat

The Lake Jackson ecosystem is a valuable biological, aesthetic and recreational resource of Leon County. This ecosystem was designated as the Lake Jackson Aquatic Preserve in 1974 for the primary purpose of preserving and maintaining the biological resources in their essentially natural condition. The expansive freshwater marshes and native submerged vegetation provide exceptional fish, reptile, amphibian, waterfowl and wading bird habitat. Lake Jackson is internationally known for sport fishing and its trophy largemouth bass, and locally for duck hunting.

Submerged vegetation is abundant throughout the lake because of its general shallowness and relatively good water clarity. Increased nutrients have also produced accelerated growth, as evidenced by the rapid expansion of the submerged exotic plant hydrilla (*Hydrilla verticillata*). Major native species occurring throughout the lake include blue hyssop (*Bacopa caroliniana*), coontail (*Ceratophyllum demersum*), green fanwort (*Cabomba caroliniana*), variable-leaf milfoil (*Myriophyllum heterophyllum*), and bladderworts (*Utricularia* spp.) The submerged vegetation provides a base for epiphytic algae and phytophilic invertebrates, and as habitat for small fish. This in turn provides forage for many species of game fish and wildlife.

Emergent vegetation covers the broad marsh regions of the lake. These areas range from being totally to periodically inundated, with some species able to tolerate merely damp conditions and others existing for lengthy periods totally submersed. Major species found in these areas include maidencane (*Panicum hemitomon*), pickerelweed (*Pontederia cordata*), American lotus (*Nelumbo lutea*), and slender spikerush (*Eleocharis baldwinii*). These species stabilize sediments and assimilate nutrients entering the lake from runoff and leachate (septic tanks). The vegetation also contributes detritus and is used as spawning and cover areas for fish, reptiles,

amphibians and some mammals. Birds utilize this habitat for nesting, loafing and foraging.

Numerous wetland tree and woody plant species also inhabit the drier portions of the transitional marsh in the study area. These include sweetgum (*Liquidambar styraciflua*), oak (*Quercus* spp.), wax myrtle (*Myrica cerifera*), dog fennel (*Eupatorium* spp.), elderberry (*Sambucus canadensis*), blackberry (*Rubus sp.*), smilax (*Smilax sp.*) and grapevine (*Vitis sp.*). These species provide wildlife habitat, filter storm water runoff, and cool near shore waters.

Algae grow in sediment, drift or float on the water column, or are attached to larger vegetation and structures such as docks. They can become noxious in a lake if they grow to enormous populations, often termed an algal "bloom". Blooms may discolor surface waters, form floating scum, and cause fish kills (Haynes, 1988). Two of the more prevalent macroalgae found in Lake Jackson are musk grass (*Chara* spp.) and stonewort (*Nitella* spp.). Musk grass is found in moderate to sparse growth, primarily in the middle portions of the lake. It is a favorable plant food for waterfowl, and provides good habitat for invertebrates and small fish. Stonewort is moderately established throughout the lake and is also propitious as habitat for invertebrates. A number of filamentous algae also occur in the preserve, including the potentially noxious blue-green species known as *Anabaena* spp. Due to the hypereutrophic conditions in the Meginniss and Fords Arm portions of the lake [*Figure 5*], numerous blooms have already taken place. These algae possess the ability to fix and store nitrogen for growth, and out- compete other vegetation. Therefore, extensive blooms threaten the viability of the resource as an optimal ecosystem. Other algae present include water-silk or *Spirogyra* spp., *Pithophora* spp., *Hydrodictyon* spp., and many more.

Various species of exotic vegetation have been introduced into the preserve within the last 10 to 20 years. Many of these have become quite abundant in the lake by out-competing native vegetation. This vegetation can be an impediment to boat traffic and contributes eutrophication through sedimentation and oxygen depletion. Some of these species grow so rapidly that herbicide and biological control methods have had to be

utilized to control them. The three most prevalent exotic plants in the lake are hydrilla (*Hydrilla verticillata*), water hyacinth (*Eichhornia crassipes*), and alligator weed (*Alternanthera philoxeroides)*.

The fluctuating water levels in Lake Jackson as a result of natural periodic lake drainage and refill have lead to "catastrophic" changes as the lake level drops. Depending on the how high the lake was before the drought conditions and the ultimate draining, as well as the time between the drying event and the refilling of the basin, vegetation from terrestrial plant communities may spread to the former shoreline. As time progresses, the density of vegetation found areas along the shoreline may increase. The dense vegetation may impair turtle nesting and animal movements from one lake to another.

3.4.2 Wildlife

Fish

Lake Jackson has a long-standing reputation as a world-class sport fishing resource. The natural fluctuations in lake water levels (drydowns and flooding) are considered beneficial for fisheries habitat and health. According to a study conducted by the Florida Fish and Wildlife Conservation Commission (FWC) (formerly the Florida Game and Freshwater Fish Commission), the number of fish species collected from 1985-1987 was more than double the number observed before the natural drydown in 1983 (Dobbins, et al., 1987). Prior to the major drydown in 1956, the lake was well known for bluegill fishing. After the refilling of the lake in 1958, the lake became known for trophy largemouth bass, a reputation it still holds.

Construction of Interstate 10 and other development in the southern watershed increased pollutant and nutrients entering the lake from stormwater runoff resulting in degraded fisheries in the southern portion of the lake (Meginniss and Fords Arms). A lake restoration plan was undertaken by NWFWMD during the drydown in 1999/2000 to remove sediments and exotic plants caused by stormwater runoff. The restoration was undertaken in part to help restore fisheries habitat in the lake.

Major Fish Species Found in Lake Jackson from The Lake Jackson Aquatic Preserve Management Plan, Florida Department of Natural Resources (Florida Department of Environmental Protection), 1991

Bowfin, *Amia calva*
Black Crappie, *Poxis nigromaculatus*
Brown Bullhead *Ictalurus rebulosis*
Bluespotted Sunfish, *Enneacanthus gloriosus*
Florida Gar, *Lepisosteus platyrhincus*
Golden Topminnow, *Fundulus chrysotus*
Golden Shiner, *Notemigonus crysoleucas*
Lake Chubsucker, *Erimyzon sucetta*
Least Killfish, *Heterandria formosa*
Mosquito Fish, *Gambusia affinis*
Swamp Darter, *Etheostoma fusiforme*
Spotted Bullhead, *Ictalurus serracanthus*
Yellow Bullhead, *Ictalurus natalis*
Warmouth, *Lepomis gulosus*
Largemouth Bass, *Micropterus salmoides*
Bluegill, *Lepomis macrochirus*
Redear Sunfish, *Lepomis microlophus*

Birds

The Lake Jackson area was designated as an aquatic preserve in part due to the excellent diversity of habitats that produced a high biodiversity. Numerous species of songbirds, wading birds, waterfowl, and shorebirds use the Lake Jackson area as part of either breeding, summer, or winter ranges. The area has been known for years as a stopping point during migrations for Scaup and other ducks that were favored by local duck hunters. The forested hills surrounding the area combined with open water and marshlands provide a diverse stopping point for other migrants that boost the number of known species of birds to nearly 170 species.

Mammals

There may be 40 species of mammals occurring in the Lake Jackson area. Up to ten of these may be bats which feed in the area, while tree dwelling species may be residents. Approximately 8 species of small rodents occur in the area. The lake also provides habitat for otter, raccoon and the round-tailed muskrat, among other species.

Mammals Occurring in the Lake Jackson Area from The Lake Jackson Aquatic Preserve Management Plan, Florida Department of Natural Resources (Florida Department of Environmental Protection), 1991

Virginia Opossum, *Didelphis virginiana*
Least Shrew, *Cryptotis parva*
Shorttail Shrew, *Blarina brevicauda*
Eastern Mole, *Scalopus aquaticus*
Raccoon, *Procyon lotor*
Long-Tailed Weasel, *Mustela frenata*
River Otter, *Lutra Canadensis*
Spotted Skunk, *Spilogale putorius*
Striped Skunk, *Mephitis mephitis*
Red Fox, *Vulpes vulpes*
Gray Fox, *Urocyon cinereoargenteus*
Bobcat, *Felis rufus*
Eastern Gray Squirrel, *Sciurus carolinensis*
Eastern Fox Squirrel, *Sciurus niger*
Southern Flying Squirrel, *Glaucomys volans*
Round-Tailed Muskrat, *Neofiber alleni*
Beaver, *Castor Canadensis*
Eastern Cottontail, *Sylvilagus floridanus*
Marsh Rabbit, *Sylvilagus palustrus*
Coyote, *Canis latrans*
White-tailed Deer, *Odocoileus virginianus*
Nine-banded Armadillo, *Dasypus novemcinctus*

Reptiles and Amphibians

There may be as many as 30 species of frogs, toads and salamanders, 10 species of turtles, 27 species of snakes, 9 lizards, and the alligator within the Lake Jackson area (Aresco, 2004).

Reptile and Amphibian Species Reported by Aresco (2004) at drift fences or on the road, or species known to occur in Leon County and appropriate habitat occurs within the Lake Jackson area(*)

Salamanders

Central Newt, *Notophthalmus viridescens**
Dwarf salamander, *Eurycea quadridigitata**
Dwarf Siren, *Pseudobranchus striatus**
Lesser Siren, *Siren intermedia**
Marbled salamander, *Ambystoma opacum**
Mole salamander, *Ambystoma talpoideum**
Slimy salamander, *Plethadon glutinosis**
Southern dusky salamander, *Desmognatus auricularis**
Southern two-lined salamander, *Eurycea bislneata**
Tiger salamander, *Ambystoma tigrinum**
Two-toed amphiuma, *Amphiuma means*

Anurans

Barking tree frog, *Hyla gratiosa**
Bird-voiced tree frog, *Hyla avivoca**
Bronze frog, *Rana clamitans**
Bullfrog, *Rana catesbeiana*
Cricket frog, *Acris gryllus*
Eastern spadefoot toad, *Scaphiopus holbrookii*
Gray tree frog, *Hyla chrysoscelis**
Greenhouse frog, *Eleutherodactylus planirostris**
Green tree frog, *Hyla cinerea*

Leopard frog, *Rana sphenocephala*

Little grass frog, *Pseudacris ocularis**

Narrowmouthed toad, *Gastrophryne carolinensis*

Oak toad, *Bufo quercicus**

Ornate chorus frog, *Pseudacris ornate**

Pig frog, *Rana grylio*

Pinewoods treefrog, *Hyla femoralis**

Southern chorus frog, *Pseudacris nigrita**

Southern toad, *Bufo terrestris*

Squirrel tree frog, *Hyla squirella*

Spring peeper, *Pseudacris crucifer**

Turtles

Box turtle, *Terrapene carolina*

Chicken turtle, *Deirochelys reticularia*

Common musk turtle, *Sternotherus odoratus*

Common snapping turtle, *Chelydra serpentina*

Eastern mud turtle, *Kinosternon subrubrum*

Florida cooter, *Pseudemys floridana*

Florida softshell, *Apalone ferox*

Gopher tortoise, *Gopherus polyphemus*

Suwannee cooter, *Pseudemys concinna*

Yellow-bellied slider, *Trachemys scripta*

Snakes

Banded water snake, *Nerodia fasciata*

Black racer, *Coluber constrictor*

Black swamp snake, *Seminatrix pygaea*

Brown snake, *Storeria decayi**

Coral Snake, *Micrurus fulvius**

Corn snake, *Elaphe guttata*

Cottonmouth, *Agkistrodon piscivorus*

Eastern Coachwhip Snake, *Masticophis flagellum**

Eastern diamondback rattlesnake, *Crotalus adamanteus**

Eastern Hognose Snake, *Heterodon platyrhinos**

Eastern Indigo Snake, *Drymarchon corias couperi**

Eastern kingsnake*, Lampropeltis getulus getulus*

Florida green water snake*, Nerodia floridana*

Florida pine snake, *Pituophus melanoleucus mugitus**

Garter snake*, Thamnophis sirtalis*

Glossy crayfish snake, *Regina ridgida**

Gray rat snake*, Elaphe obsoleta spiloides*

Mud snake*, Farancia abacura*

Pigmy rattlesnake, *Sistrurus miliarious**

Pinewoods snake, *Rhadineaea flavilata**

Rainbow snake, *Farancia erytrogramma**

Red-bellied snake*, Storeria occipitomaculata*

Ribbon snake*, Thamnophis sauritus*

Ringneck snake*, Diadophis punctatus*

Rough green snake*, Opheodrys aestivus*

Scarlet kingsnake, *Lampropeltis triangulum**

Scarlet snake*, Cemophora coccinea**

Smooth earth snake*, Virginia valeriae**

Striped crayfish snake*, Regina alleni**

Lizards

Broadhead skink*, Eumeces laticeps*

Eastern slender glass lizard, *Ophisaurus attenuatus**

Eastern glass lizard*, Ophisaurus ventralis*

Five-lined skink*, Eumeces fasciatus*

Green anole*, Anolis carolinensis*

Ground skink*, Scincella lateralis*

Six-lined racerunner, *Cnemidophorus sexlineatus*

Southern fence lizard, *Sceloporus undulates**

Souteastern five-lined skink,*Eumeces inexpectatus**

Crocodilians

Alligator*, Alligator mississippiensis*

3.4.2.1 Common Species

Many species of migratory waterfowl have been declining for a number of years. This has been due in part by habitat loss and degradation in breeding areas and along the migratory routes. This has severely impeded the traditional duck hunting in the lake. The movement of large flocks in the past surely had impacts on the Lake Jackson system. Other common species of animals are also in decline. For example, many of the salamanders once common are now extremely rare or have disappeared from many areas in Florida and throughout their range. The southern dusky salamander is a good example of a common species that is now considered extremely rare. Also, as the upland forests have changed and small ephemeral ponds have been filled or drained, the tiger salamander and others have declined sharply. As overall water levels have declined, some species like the gopher tortoise dig burrows into the sandy gentle slopes that were in the past frequently inundated as the lakes rise. The old field coverage of weeds and grasses provide the highly diverse forage this herbivore needs.

3.4.2.2 Listed Species

Various species of bats were not included on this list because surveys or data showing what species are using or living in the area were not available. The other species listed in Table 3-1 still occur in the lake basin, and there are no indications of current decline. Suwannee cooters (a state listed species of special concern) were recorded as being killed in the last drydown as they crossed US 27. Eastern indigo snakes (a state and federally listed threatened species) and Florida pine snakes (a state listed species of special concern) are likely in the faunal basin and are vulnerable to being killed on roads in their habitat. In addition, alligators (a state listed species of special concern, and a federally listed threatened species) have been found dead on the road at US 27 and Lake Jackson. Juvenile alligators are especially vulnerable, likely as a result of trying to cross the road as they disperse from nests noted around Little Lake Jackson. Gopher tortoises (a state listed species of special concern) have also been identified in the area and have been found dead on the road. *Appendix D* includes maps showing locations where gopher tortoises and alligators have been found near the temporary fence or dead on the road along the project study area.

Table 3-1: Federal and state listed species that are known or likely to occur from the Lake Jackson area (FWC, 1997).

Reptiles		State (FWC)	Federal (USFWS)
American alligator*	*Alligator mississipiensis*	SSC	T (s/a)[1]
Gopher Tortoise*	*Gopherus polyphemus*	SSC	Proposed T
Suwannee cooter*	*Pseudemys concinna suwanniensis*	SSC	N
Eastern indigo snake	*Drymarchon corais couperi*	T	T
Florida pine snake	*Pituophis melanoleucus mugitus*	SSC	N
Birds			
Little blue heron	*Egretta caerulea*	SSC	N
Snowy egret	*Egretta thula*	SSC	N
White Ibis	*Eudocimus albus*	SSC	N
Tricolored Heron	*Egretta tricolor*	SSC	N
Bald eagle	*Haliaeetus leucocephalus*	T	T
Wood stork	*Mycteria americana*	E	E
Least tern	*Sterna antillarum*	E	N
Mammals			
round-tailed muskrat	*Neofiber alleni*	n/a	UR

N – Not listed SSC – Species of special concern T – Threatened E- Endangered UR – Former candidate for listing

[1]s/a – listed due to similarity of appearance to the American Crocodile

*Listed species that have been killed on US 27 at Lake Jackson

4.0 EXISTING CONDITIONS WITHIN STUDY AREA

4.1 Soils

Within the study area, there have been considerable disruptions of the soils around Lake Jackson. These disruptions have been due to agriculture, construction of residential and commercial development, and the construction of infrastructure, especially construction of US 27. It is difficult to quantify the impacts of these changes, but it is likely that the changes in elevation and the incorporation of rock and fill have altered vegetative habitat and hydrological conditions in the area.

Within the basins, the soils have been altered due to upland silt flow, some agricultural activities within the basin, and the likely deposition of chemicals from storm water runoff from commercial, residential, roadway and other impervious surfaces surrounding the basin. These changes have likely affected nesting areas for some reptiles and altered vegetative communities around the lake.

During the 1999/2000 drydown, Leon County and the NWFWMD undertook a restoration project at the lake. The restoration project consisted of de-mucking select areas in the lake, including Meginniss and Fords Arms at the southeastern end of the lake, Church Cove, the US 27 landing, and other areas. The de-mucking was completed in response to degrading water quality and habitat as a result of increased pollutants entering the lake from stormwater runoff. The stormwater runoff carries nutrients such as phosphorus and nitrogen, which compromises water quality in the lake as well as encourages rapid growth of exotic nuisance vegetation such as blue green algae, hydrilla, and water hyacinth. This in turn increases the amount of decaying vegetative matter and organic muck. The muck and sediment, which not only may contain low-levels of pollutants, also adversely affects water quality and fish habitat, which can affect the overall ecosystem of the lake. The project, conducted during the natural dewatering that occurred during the drydown, included removal of exotic vegetation, accumulated muck, and debris from select areas of the lake, including the area near the US 27 boat ramp, and an area to the north of the ramp, adjacent to the project study area. The removed sediment was

deposited at borrow pits and nearby upland sites (most on the east side of the lake). No sediment material was deposited within the project study area.

4.2 Land Use and Vegetation

4.2.1 Land Use

Current land use was assessed from recent aerial photographs as well as from data available though the Leon County GIS Department. *Figure 3* shows general land use and ownership (i.e. public or privately owned) along the study area. Most of the study area is comprised of undeveloped lands owned by the State of Florida (submerged lands associated with Lake Jackson Aquatic Preserve) or Leon County (US 27 Boat Ramp, proposed Jackson View Park Site). There is an approximately 33-acre area adjacent to Little Lake Jackson, between the lake and the Lakeside residential subdivision (including the small pond referred to as "Lakeside stormwater pond") that was placed under conservation easement as part of the Lakeside development. Undeveloped, privately-owned parcels within the project study area include three small (< 0.5 ac) parcels along the lake edge just south of the County boat ramp property, two parcels (0.6 ac. and 1.2 ac.) on either side of Cool View Drive, and a property known as the Sellers parcel, a large tract of land located on the western side of US 27 (south of the Lakeside Subdivision). The Sellers parcel is currently under review by Leon County for development as a Planned Unit Development (PUD) which will include high-density residential development and associated infrastructure. The Sellers parcel is an approximately 107-acre parcel; ±25 acres immediately adjacent to the Lakeside Subdivision were included in the study area due to the identification of wetlands and potential turtle nesting habitat. Another small undeveloped parcel (0.5 ac.) near the northern limits of the property, on the western side of US 27 was also identified. This parcel has steep, uneven topography and is covered in kudzu vine.

4.2.1.1 Public Access

Public access to Lake Jackson along the project study area is available at the US 27 boat ramp, which is located near the center of the Project Study area. It will also be available from the proposed Jackson View Park, which will have an access from US 27

between the two existing office buildings near the southern limits of the project study area. Additionally, Leon County is proposing to purchase an approximately 14-acre parcel just north of the project study area known as the "Red and Sam's property". Another public access point to the lake, the County-owned Sunset Landing, is located just north of the Red and Sam's property, approximately 1,800 feet northeast of the project study area.

Public access to Little Lake Jackson is more restricted, as there are no official public access points or public lands located around the lake. The area is surrounded by a conservation easement along the south-southeastern shore, and most of the properties located along the northern and western shores are private lots. An unimproved road created through the conservation easement as a construction access for the Lakeside Subdivision was unofficially used by some individuals as access to Little Lake Jackson. However, this access was closed due to the fact that it was a non-permitted, temporary construction access and it was not consistent with the conservation easement. There is potential for access to Little Lake Jackson from US 27, however, there are safety concerns regarding the lack of parking and the steep terrain between the roadway and the lake.

4.2.2 Vegetation

A vegetative assessment was conducted in order to evaluate the current vegetative conditions within the project study area. The assessment was conducted using a combination of review of readily available natural resource documentation as well as field surveys, including observations along random pedestrian transects and quadrat sampling along representative transects within the project study area. A portion of the study area was not accessible. Vegetation in these areas were mapped by others as part of a Natural Features Inventory (NFI) and obtained from Leon County.

Field ecologists reviewed available existing documentation including NRCS soil surveys and aerial photography prior to conducting site-specific surveys. Once the various plant communities were identified on the aerials, surveys consisting of meandering pedestrian transects were conducted through each distinct plant community. Plant species were

recorded and lists of existing vegetation were compiled for each designation, along with the frequency they were observed. Surveys were conducted during July 2004.

Additionally, vegetative monitoring transects were established by placing 1 meter 3/4" PVC pipes in the ground at three locations (top of slope, mid-slope and adjacent to the lake edge) along four transects. A 1-meter square quadrat was used to record and estimate the species percent cover within each monitoring plot. A total of twelve plots were established. The monitoring transects were co-located in the same locality as soils transects for comparative analysis [Figure 4, Appendix A].

The 1999 FDOT FLUCFCS Manual was used as the basis to describe and map the ecological communities on recent 1:300-scale aerial photography. A general species list for all plants found within the vicinity of the monitoring transects was also recorded. The results of vegetative monitoring and FLUCFCS mapping are provided below. The FLUCFCS Map of the project study area is attached as *Figure 4*.

4.2.2.1 Results of Vegetative Survey

Fourteen (14) distinguishable vegetative communities were documented within the project area. A description of each of the existing vegetative communities is provided below. The results of the quantitative monitoring transects follows the community descriptions.

Commercial (FLUCFCS 141, 0.5 Acres)

One commercial area was identified within the study area. This establishment (Colonial Liquors and Lounge) is located north of U.S 27 on the western portion of the project. There is no vegetation associated with this designation, as it is entirely paved.

Pond (FLUCFCS 166, 3.3 Acres)

Several small stormwater ponds are present in various locations throughout the study area. These ponds are typically excavated from upland soils and retain runoff from surrounding developments. The pond

areas vary greatly in vegetative composition. One area adjacent to U.S 27 is dominated by pickerelweed (*Pontederia cordata*) with subdominants of jointweed (*Polygonum hydropiperoides*), sawgrass (*Cladium jamaicensis*), Carolina willow (*Salix caroliniana*), and American cupscale (*Sacciolepis striata*). A second area contains low growing herbaceous vegetation such as jointweed, American cupscale, danglepod (*Sesbania herbacea*), fringe rush (*Fimbristylis* sp.), dog fennel (*Eupatorium capillifolium*), switchgrass (*Dicanthelium* sp.), wispy panicum (*Panicum virgatum*) and black senna (*Senna* sp.).

Park (FLUCFCS 185, 1.8 Acres)

A small community park and boat launch facility is located on the northeastern side of US 27. This park contains a dirt/gravel parking area for approximately 20-30 parking spaces and a boat ramp. Vegetation within this area includes water oak, along with bahia grass (*Paspalum notatum*), centipede grass (*Cynodon dactylon*), crape myrtle (*Lagerstroemia indica*), wax myrtle, pecan (*Carya illinoinensis*), Carolina willow, and mixed weedy herbaceous species.

Domestic Grasses-Improved Pasture (FLUCFCS 211, 33.9 Acres)

Two large areas located on well drained soils contained a predominance of domestic grass. These areas are significantly disturbed and the historical ground cover and canopy have been removed. These areas were most likely historically utilized for either agriculture or cattle grazing. The domestic grass areas are open and are interspersed with young tree species such as live oak, diamond oak, water oak, black cherry (*Prunus serotina*), and loblolly pine (*Pinus taeda*). The ground cover is dominated by bahia grass and contains subdominant species such as ragweed (*Ambrosia artemisiifolia*), fleabane (*Erigeron quercifolius*), white mulberry (*Morus alba*), danglepod, Canada lettuce, dog fennel, Canada goldenrod (*Solidago canadensis*), and pokeweed (*Phytolacca americana*).

Pine- Mesic- Oak (FLUCFCS 414, 25.0 Acres)

Several areas containing a mature canopy of oaks and pines were identified along US 27. Additionally, several small areas of this cover were also located adjacent to the limits of the study area and offsite residential lots. A closed canopy composed of loblolly pine and oak species (*Quercus* spp.) and an open understory characterize this community. Review of historical aerials shows the majority of these areas as clear open land in 1949. These areas have since regenerated and are either secondary or tertiary growth forest. The ground cover contains vines and other weedy herbaceous vegetation. Typical vegetative composition includes water oak, diamond oak, live oak, black cherry, persimmon, elderberry (*Sambucus canadensis*), Chinese privet (*Ligustrum senescence*), winged sumac (*Rhus copallina*), wax myrtle, poison ivy (*Toxicodendron radicans*), Virginia creeper (*Parthenocissus quinquefolia*), muscadine (*Vitis rotundifolia*), and spleenwort (*Asplenium* sp.).

Kudzu (FLUCFCS 422, 0.5 Acres)

One area is dominated by an exotic vine, kudzu (*Pueraria montana*). In this small area kudzu has smothered the trees and groundcover. Little to no native vegetation exists within this designation.

Wax Myrtle-Brambles-Goldenrod (FLUCCS 429, 24.2 Acres)

This is one of the most dominant upland communities found within the study area. These areas are usually dry however they are subjected to a wide range of water level fluctuations and periodically experience-prolonged inundation during high water conditions. These areas contain a mixture of open areas that are comprised solely of groundcover species and areas that are dominated by immature trees and shrubs but still maintain groundcover. The vegetation within these areas includes brambles (*Rubus cuneifolius*), Canada goldenrod, dog fennel, wax myrtle, black cherry, loblolly pine, water oak, sassafras (*Sassafras albidum*), and passionflower (*Passiflora incarnata*).

Swale (FLUCFCS 511, 0.2 Acres)

One small swale was identified that connects a residential apartment complex to a pond. This swale is vegetated with domestic grasses and contains species similar to FLUCFCS 211.

Willow (FLUCFCS 618, 3.6 Acres)

Two wetland areas are dominated by Carolina willow. These areas are disturbed sites located adjacent to U.S 27 at the base of the road and along the slopes. One area is located adjacent to a small pond that appears to be utilized for stormwater retention. The pond is covered with duckweed (*Lemna minor*). Subdominant species include water oak, Chinese privet, wax leaf privet, popcorn tree (*Sapium sempervirens*), wax myrtle, Japanese climbing fern (*Lygodium japonicum*), false nettle, red maple (*Acer rubrum*), and pepper vine (*Ampelopsis arborea*).

Freshwater Marsh (FLUCFCS 641, 17.6 Acres)

This designation identifies those areas that are currently at or near waters edge and contain a variety of herbaceous vegetative species. These areas are typically diverse and relatively undisturbed. Vegetation within these areas includes false nettle, saltbush, coinwort (*Centella asiatica*), buttonbush (*Cephalanthus occidentalis*), flatsedge (*Cyperus* spp.), rein orchid (*Habenaria repens*), marsh pennywort (*Hydrocotyle umbellata*), rushes (*Juncus* spp.), anglestem, primrose willow (*Ludwigia leptocarpa*), American lotus (*Nelumbo lutea*), water lily (*Nymphaea odorata*), hairy smart weed (*Polygonum hirsutum*), American cupscale, arrowhead (*Sagittaria latifolia*), and humped bladderwort (*Utricularia gibba*).

Freshwater Marsh, Shrubs, Brush and Vines (FLUCFCS 6417, 43.0 Acres)

These areas experience significant variation in inundation, and undergo several years of inundation followed by several years of drought. The water levels in the lake are currently rising; however, the lake remains lower than “normal”. Due to the prolonged absence of hydrology this

plant community contains a mixture of wetland, upland and transitional vegetative species. The ground cover is the most dominant strata within these areas and is composed of herbs, vines, young shrubs and small trees. Dominant plant species includes brambles, Canada goldenrod, pinebarren goldenrod (*S. fistulosa*), American cupscale, hairy smartweed, dog fennel, elderberry, wax myrtle, red maple, saltbush, black cherry, and black gum (*Nyssa biflora*).

Water Hyacinth-Open Water (FLUCCS 6443, 19.3 Acres)

This land cover classification is associated with the existing emergent aquatic vegetation and open water areas of Little Lake Jackson. This area is dominated by floating water hyacinth (*Eichhornia crassipes*) and also contains open water. Rein orchid (*Habenaria repens*) is also common growing within the water hyacinth mats.

Duck Weed (FLUCFCS 6444, 1.4 Acres)

A small pond located between a residential subdivision and US 27 is entirely dominated by duck weed (*Leman minor*) and hydrilla (*Hydrilla verticillata*). This pond is symmetrically round and contains steep side slopes.

Water Lily (FLUCFCS 6445, 3.2 Acres)

This designation is associated with a small ponded area in southeastern portion of the project area. This area experiences a wide range of water elevations and contains a variety of emergent and floating vegetative species. This area contains species such as mild water pepper, cattails (*Typha latifolia*), pickerel weed and three species of water lily including American lotus (*Nelumbo lutea*), pond lily (*Nuphar advena*) and fragrant water lily (*Nymphaea odorata*).

Tables showing the results of the baseline vegetation survey along the four monitoring transects are attached in *Appendix E*.

4.3 Hydrology

The last recorded drydown was in 1999-2000. The lake level started to drop in the fall of 1998 and drought conditions resulted in lowering lake levels though 1999. As the water level declined, the lake separated into pools divided by ridges or "saddles" of higher elevation on the lake bottom. The three major saddles include North Saddle, Little River Saddle, and Brill Point Saddle [*Figure 5*]. In early September 1999, Brill Point Saddle became exposed, leaving a shallow pool of water in the portion of the lake by Porter Hole Sink. The water in that pool began to rapidly drain into the Sink, leaving it virtually dry on September 16, 1999. The drought continued through summer 2000 and most of the pools on the lake bottom dried. A large pool in the northwestern portion of the lake was connected to Lime Sink, and slowly drained during spring 2000, becoming completely drained in May 2000. A few small areas did hold water during the drydown, including the area adjacent to Miller Landing in the northwestern portion of the lake. These small pools, as well as Little Lake Jackson on the western side of US 27, became refuges for aquatic species able to migrate to these areas during the drydown.

A tropical storm in September 2000 helped to raise water levels back up over the saddles, however, water drained out again through Porter Hole sink, leaving only shallow pools in some areas of the lake by October 2000. Increased rainfall in 2001 allowed lake levels to rise to 80 to 81 feet above sea level, still lower than 'typical' levels of 84-86 feet (NWFWMD, 2002). The pool around Porter Sink drained again in December 2002 and February 2003, although the lake levels were not as low as those recorded in 1999/2000. Lake levels have been maintained at 'typical' or slightly lower than typical levels as a result of rainfall since that time.

4.3.1 Topography

Topographic information was obtained from the Tallahassee-Leon County GIS Department, 2002 Light Detection and Ranging (LIDAR) topographic contour data. A topographic map of the site is attached as *Figure 6.*

Topography in the project study area ranges from approximately 80 to 100 feet ($NGVD_{29}$), sloping downwards towards the lake. The highest elevations (100-feet +) are found on the Sellers parcel and adjacent to the Lakeside subdivision. Elevations along the road are generally around 94-feet, dropping steeply from the road for 4 or 5 feet before sloping more gently towards the lake. Elevations from the roadway between Lake Jackson and Little Lake Jackson are rather steep, with elevations dropping sharply 8 to 10 feet from the roadway to the lake elevation, which is around 80-feet. Elevations along the roadway have been influenced by fill material placed for construction of the roadway.

4.3.2 Floodplains

Information of Floodplains was obtained from the Federal Emergency Management Agency (FEMA) and from Leon County GIS. A map of the 100-year floodplain along the project study area is attached as *Figure 7*. Areas of the 100-year floodplain are located along the entire study area to the east of US 27. Along the western side of US 27, areas of the 100-year floodplain are limited to the northern $\pm$1,700 feet of the project study area and the area around the Lakeside stormwater pond.

4.3.3 Physiography and Drainage

The Lake Jackson area is located within the northern portion of Leon County, in the Tallahassee Hills physiographic province. The topography is described as erosional remnant hills that are approximately 120 feet high (USDA/SCS, 1981). Elevations in the area are generally between 100 and 200 feet above sea level. The area contains four enclosed lake basins, which lack external outlets or major tributaries: Lake Lafayette, Lake Iamonia, Lake Miccosukee, and Lake Jackson. The lake basins are confined by the Miccosukee formation or the underlying, poorly consolidated Miocene Torreya formation, comprised of sands, clays, and carbonate rock (Kish, et. al. 2002). The Miocene St. Marks formation and the Oligocene Suwanee Limestone, which are major karst-forming units, underlay the Torreya Formation (Kish, et. al., 2002). These units make up the Floridan Aquifer System, the major aquifer in the region. Sinkholes are present within all of the major lake basins, where the karst-forming units are close to the

ground surface. Two major sinks are located within Lake Jackson; Lime Sink, in the southwestern portion of the lake, and Porter Hole, in the east-central portion of the lake.

The project study area is primarily located within the Lake Jackson basin, which is surrounded to the Tallahassee Red Hills physiographic region. The Ochlockonee River Valley lowlands are located to the north and west of the Lake Jackson basin. Because of the steep hills in the region, numerous sub-basins are formed within the complete drainage area of Lake Jackson. The three major basins within the lake are the southern watersheds draining into Megginniss Arm and Fords Arm, and an area draining into the northeastern segment of the lake via Ox Bottom Creek. These and other sub-basins comprise a Lake Jackson drainage area of approximately 43 square miles. During drought conditions, the southern basins of the lake are isolated from the northern basin by Cattle Gap, a divide with an elevation of approximately 84 feet ($NGVD_{29}$).

4.3.4 Wetlands and Water Bodies

Littoral wetland areas exist around the edges of Lake Jackson and Little Lake Jackson. General characteristics of these areas are described in sections 3.4.1 and 4.2.2. Wetlands and water bodies located within the project area (in addition to Lake Jackson and Little Lake Jackson) include a small, ±1.5 acre stormwater pond located along US 27 (Lakeside stormwater pond) and its associated littoral wetlands, wetlands located in the conservation area within the Lakeside Subdivision, a wetland on the Sellers Property, and a small stormwater pond behind the office building on the eastern side of US 27 at the southern limits of the site. Wetland and Surface Water areas in the project study area are depicted on *Figure 8.*

The Lakeside stormwater pond is a closed basin stormwater pond for the Lakeside Subdivision. There are no hydrological connections to Lake Jackson or Little Lake Jackson. The wetlands within the Lakeside Subdivision conservation easement (not associated with Little Lake Jackson or Lakeside stormwater pond) appear to be isolated. The wetland located on the Sellers property is currently isolated; however, evidence (i.e. aerial photography and Leon county GIS data) suggests that it was once connected to Little Lake Jackson via a ditch. The stormwater pond behind the office building also appears isolated, however, it would likely become hydrologically connected to Lake

Jackson during periods of high water in the lake. Lake Jackson and Little Lake Jackson are connected via a large (±12 foot diameter) culvert under US 27. In most years, the elevation of the culvert is above the water elevation, so the two water bodies are only truly hydrologically connected during times of very high water.

4.4 Wildlife

4.4.1 Migrations

Migrations of animals in the Lake Jackson basin from season to season are undertaken by a species because they are nesting, possibly looking for a mate, moving because of forage changes, moving from one part of their home range to another, or simply moving to another location to establish a new home range. Based on available data, 783 turtles were found "dead on the road" (DOR) or "alive at fences" (AAF) during the non-drought years, 2002-2004 (Aresco, 2004). These turtles included nesting females, migrating males and juveniles, and hatchlings leaving nests (Aresco, 2004). The high rate of terrestrial recaptures (33%) of turtles in this study demonstrates that aquatic turtles move overland frequently at Lake Jackson. These data suggest that even if a turtle successfully crosses the highway one time, it is likely that they will migrate back across the highway, increasing the probability of being killed by vehicles. *Appendix F* includes maps showing the locations of possible nesting areas around the project study area, as well as a map showing the numbers of turtles found crossing, attempting to cross, or dead on the road at different locations (zones) along the corridor.

Aresco (in press) describes the massive migration of turtles and other animals during the most recent drydown (1999-2000). "A large migration of turtles occurred during this study in response to the natural drydown of Lake Jackson in 2000 (February-July) and the subsequent refilling of the lake in 2001 (March-September)." As Lake Jackson dried, turtles and other herpetofauna migrated to the west towards Little Lake Jackson that held water throughout the drought. Heavy rain associated with two tropical storms (Alison and Barry) caused Lake Jackson to refill in 2001 and turtles migrated back from Little Lake Jackson. In 2002 and 2003, both Lake Jackson and Little Lake Jackson held water and seasonal movements of turtles associated with normal activities occurred in

both directions. Table 4-1 provides a listing of the species and the numbers that were found either dead on the road or along the drift fences that were being monitored.

Table 4-1. 44 species of reptiles and amphibians found either behind the fences or on U.S. 27 (dead or alive) at Lake Jackson, Leon County, Florida from 22 February 2000 - November 2003. "Alive" includes number alive at fences (AAF) or alive on the road (AOR) and "Dead" is number found dead on road (DOR) or number in parentheses is dead at or near fences (DAF). An asterisk indicates a State of Florida Species of Special Concern.

Species	Alive	Dead	Total
Salamanders (*n* = 2)			
Central Newt, *Notophthalmus viridescens*	1	0	1
Two-toed Amphiuma, *Amphiuma means*	0	0 (1)	1
Anurans (*n* = 838)			
American Bullfrog, *Rana catesbeiana*	1	35	36
Eastern Spadefoot, *Scaphiopus holbrookii*	1	4	5
Greenhouse Frog, *Eleutherodactylus planirostris*	0	1	1
Green Treefrog, *Hyla cinerea*	2	37	39
Narrow-mouthed Toad, *Gastrophryne carolinensis*	5	0	5
Pig Frog, *Rana grylio*	7	57	64
Southern Cricket Frog, *Acris gryllus*	309	3	312
Southern Leopard Frog, *Rana sphenocephala*	69	202	271
Southern Toad, *Bufo terrestris*	84	18	102
Squirrel Treefrog, *Hyla squirella*	2	1	3
Turtles (*n* = 8842)			
Chicken Turtle, *Deirochelys reticularia*	2	0	2
Eastern Box Turtle, *Terrapene carolina*	18	3	21
Eastern Mud Turtle, *Kinosternon subrubrum*	75	20	95
Florida Cooter, *Pseudemys floridana*	3353	276 (68)	3697

Florida Softshell, *Apalone ferox*	224	26 (1)	251
Gopher Tortoise, *Gopherus polyphemus**	2	3	5
Stinkpot, *Sternotherus odoratus*	710	61(4)	775
Snapping Turtle, *Chelydra serpentina*	11	5 (1)	17
Suwannee Cooter, *Pseudemys concinna**	3	0	3
Yellow-bellied Slider, *Trachemys scripta*	3737	218 (21)	3976
Snakes (*n* = 363)			
Banded Watersnake, *Nerodia fasciata*	19	44	63
Cornsnake, *Elaphe guttata*	10	4	14
Cottonmouth, *Agkistrodon piscivorus*	33	8	41
Eastern Gartersnake, *Thamnophis sirtalis*	13	5	18
Eastern Kingsnake, *Lampropeltis getulus*	7	1	8
Eastern Mudsnake, *Farancia abacura*	0	3	3
Eastern Ribbonsnake, *Thamnophis sauritus*	3	1	4
Florida Green Watersnake, *Nerodia floridana*	13	63	76
Gray Ratsnake, *Elaphe obsolete*	11	4	15
Northern Florida Swampsnake, *Seminatrix pygaea*	1	6	7
Red-bellied Snake, *Storeria occipitomaculata*	1	0	1
Southern Ring-necked Snake, *Diadophis punctatus*	1	0	1
Rough Greensnake, *Opheodrys aestivus*	3	0(2)	5
Scarletsnake, *Cemophora coccinea*	0	1	1
Southern Black Racer, *Coluber constrictor*	103	3	106
Lizards (*n* = 152)			
Broad-headed Skink, *Eumeces laticeps*	4	0	4
Common Five-lined Skink, *Eumeces fasciatus*	126	0	126
Eastern Glass Lizard, *Ophisaurus ventralis*	14	0	14
Green Anole, *Anolis carolinensis*	NA	NA	NA
Little Brown Skink, *Scincella lateralis*	7	0	7
Six-lined Racerunner, *Cnemidophorus sexlineatus*	0	1	1
Crocodilians (*n* = 32)			
American Alligator, *Alligator mississippiensis* *	25	7	32

Total	9010	1219	10229

From: Aresco, M. J. (2004 in press) Mitigation Measures to Reduce Excessive Highway Mortality of Turtles and Other Herpetofauna at a North Florida lake. Journal of Wildlife Management.

It is likely that the natural drydowns of Lake Jackson have occurred long before written history, as suggested by the Native American name for the lake, “Okeeheepkee”, meaning “disappearing water”. As the water drains from the lake into the sinkholes, and portions of the lake bottom begin to become exposed, many species move to available bodies of water within the Lake Jackson basin. These water bodies include Little Lake Jackson, which does not dry up during drydowns. Historically, these migrations did not have anthropogenic obstacles, such as the four-lane US 27, which crosses one of the main migration routes. There is no indication that the composition of migrating species has changed, nor are there sufficient records to indicate how many animals traversed over uplands in lieu of following the drying lake bed.

The entire basin has drastically changed from its historical forests. Uplands currently are a mixture of hardwood forests and remnants of planted pine. The habitat since the early 1970’s has become more urbanized and dissected by various hard surfaced roads. This has led to a continual reduction of large areas of habitat around the lake, thus reducing the chances for large mammals such as the black bear to continue to exist. Large species of snakes that have large home ranges such as the Eastern indigo and the Florida pine snake are extremely vulnerable to being killed on rural highways. As human developments have grown around the lake, the lowering of predator species such as bobcats and large alligators have allowed raccoon and armadillo populations to explode. This in turn has likely caused a greater loss of turtle nests to these specialized egg predators. The long term impact of this on turtles and other species is not known. However, combining this loss with the take of adults as they migrate over roads is likely to cause a serious decline in some species.

As pointed out in 4.1, the impacts of change in Lake Jackson caused by run off from storm water, septic tanks and other sources is causing the lake to become more eutrophic and causing impacts to habitat and water quality. The positive impact of the periodic drydowns has been a “flushing” of the main lake, decreasing the proliferation of exotic and nuisance vegetation and increasing fisheries habitat. However, as development continues to increase, the time between drydowns may be too long to keep the lake from becoming unhealthy for both wildlife and humans. Additionally, due to the fragmentation of habitat, when drydowns do occur, the migration of aquatic animals to available bodies of water may present challenges, such as concerns for human safety due wildlife on roadways and animals such as alligators entering residential areas, as well as the ecological concerns from wildlife being killed on roadways.