City of LAKELAND
Lakes & Stormwater

2009 Lakes Report

September 22, 2010

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Introduction

This document provides an overview of Lakeland's lakes and summarizes the Division of Lakes and Stormwater monitoring data for 2009. The report includes water quality and lake level information for the seventeen major lakes in the City which are currently monitored by Lakes and Stormwater. Water quality data from the past five years is also presented for comparison including averages, maximums, and minimums from 2005 to 2009. Both 2009 and historical lake level and rainfall data is also presented.

There are a total of 38 named lakes within City limits as well as numerous smaller lakes (Figure 1). Sizes among the 38 named lakes range from 1.5 acres (Lake Blanton) to 2,185 acres (Lake Parker). Water discharged from these lakes flows through creeks, ditches and pipes to tributaries of three major river systems - the Peace River, the Alafia River, and the Hillsborough River (Figure 2).

Our lakes are invaluable to the citizens of Lakeland as they provide opportunities for recreation, sanctuaries for wildlife, and natural beauty. The importance of our lakes has long been recognized by Lakeland's citizens and civic leaders and was the primary reason for the creation of The City of Lakeland's Lakes Program in 1987. All lakes have an economic value and contribute to a community's quality of life. Lake conditions which include water quality and water levels influence aquatic plant communities, fisheries, wildlife, recreational opportunities, and the aesthetic value of our lakes. These attributes impact the quality of life enhancement that our lakes provide the community.

The following sources are recommended for more information on lakes:

Florida Lakewatch Brochures:
http://lakewatch.ifas.ufl.edu/LWCIRC.HTML

USGS "Hydrology of Central Florida Lakes – A Primer":
http://fl.water.usgs.gov/PDF_files/c1137_schiffer.pdf

Polk County Water Atlas:
http://www.polk.wateratlas.usf.edu/

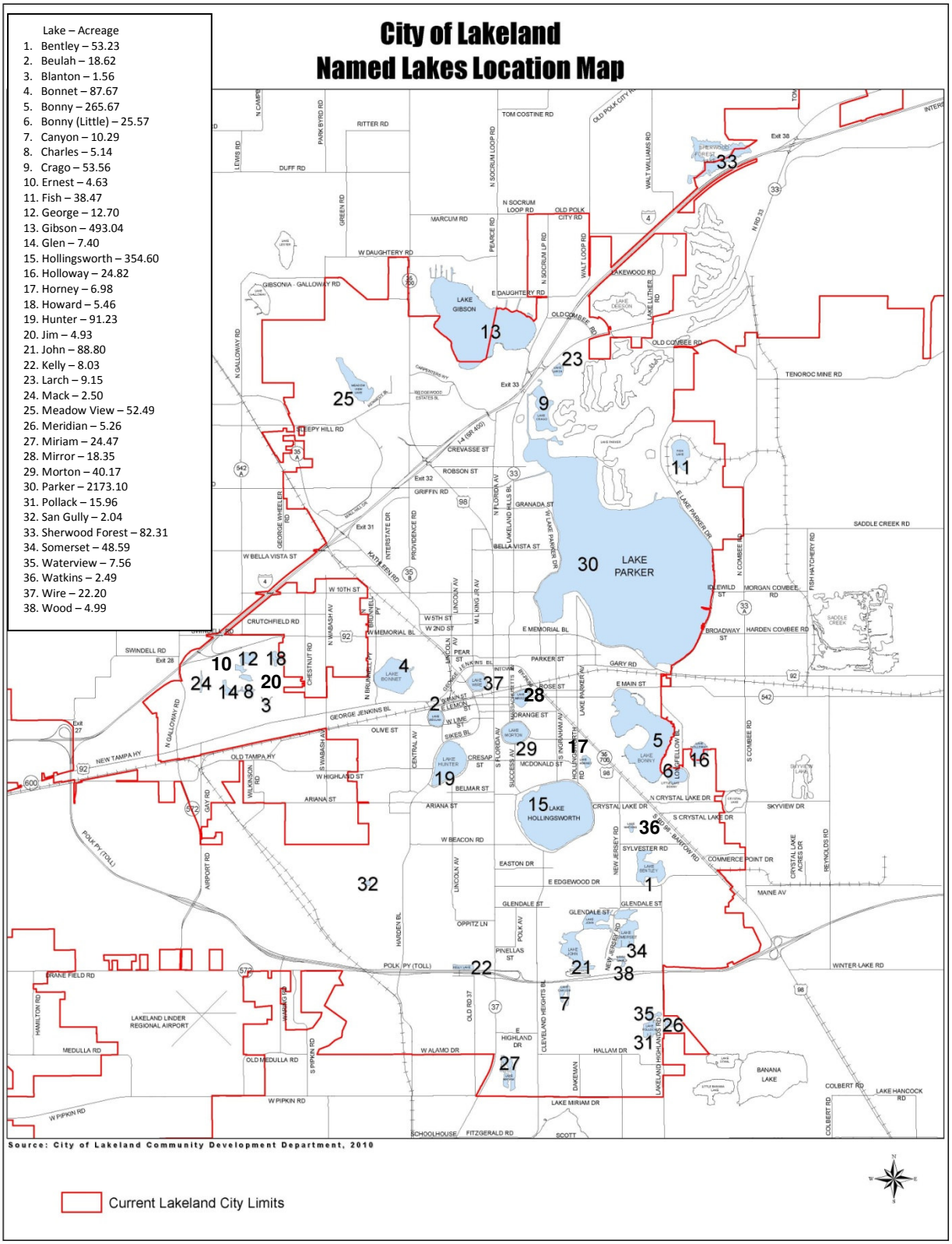

Figure 1. Map of City of Lakeland named lakes.

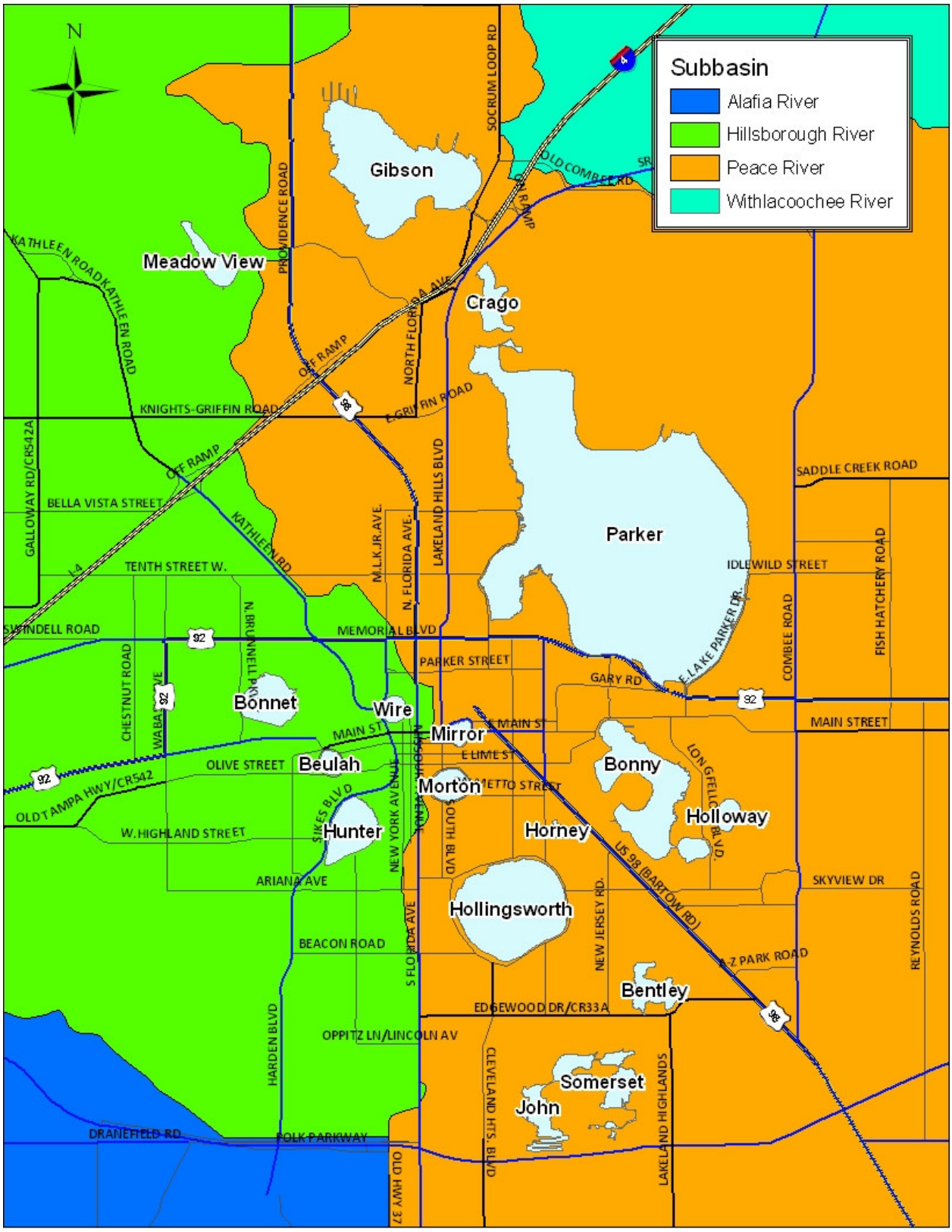

Figure 2. Location of lakes monitored by Lakes and Stormwater and their watersheds.

Lake Characteristics

Origin, Morphology, and Lake Life Cycle

Florida lakes are formed by many processes, both natural and man-made. Some common natural origins of Florida lakes are solution processes, depressions in the ancient sea floor, and riverine processes. Man-made lakes include stormwater treatment ponds, reservoirs, and reclaimed pits resulting from mining activities. Lakeland lakes include both natural and man-made lakes primarily formed by solution processes, or sinkholes, and phosphate mining.

Natural lakes and reclaimed phosphate pits vary in some important characteristics. Lakeland's natural lakes tend to be circular in shape, shallow, and have gradual sloping sides creating a littoral zone that supports a wide band of emergent vegetation. Phosphate pit lakes are irregularly shaped, have varying depths, and non-uniform bottom contours which often contain deep holes and shallow humps. These lakes typically have steeply sloped sides, which results in a narrower littoral zone. The steeply sloped banks of phosphate pit lakes may result in an unstable shoreline. The problem may be compounded by the lack of abundant vegetation that would help stabilize the bank and shoreline stabilization structures such as retaining walls and rip-rap may be necessary to prevent serious erosion issues.

Lakes undergo a life cycle that includes various stages from their formation to their eventual filling and return to terrestrial landscapes. In Florida, the vast majority of lakes are formed from sinkhole activity. Limestone, Florida's bedrock, is slowly dissolved by weakly acidic rainwater that percolates through the overlaying sand, clay and organic topsoil. In time, cavities in the limestone are formed and later collapse, resulting in depressions on the land surface. Water from rainfall, groundwater seepage and in some cases surface sources (creeks and rivers) fill the depressions.

In most cases, newly formed lakes are nutrient poor and have clear water. As lakes age, nutrients, sediments and pollutants from the surrounding watershed migrate to the basin. Lake productivity increases with increased nutrient loading resulting in a reduction in water clarity. Basins slowly fill with soil and the remains of plants and animals. The rate at which a lake basin fills typically increases with age. The process of lake aging through increasing productivity is termed eutrophication.

Geographical Setting and Soils

The City of Lakeland is located in west central Florida. The soils in this region are naturally rich in phosphorus, a major element needed for growth by plants. The rich phosphorus deposits in the soil have been mined since the early 1900s. It is important to note that soils in Lakeland differ significantly with those found in other parts of Polk County. Three ridges run through the County in a north-south direction. The Lakeland Ridge runs along the West side of the County, the Winter Haven Ridge through the center, and the Lake Wales Ridge along the East. The City of Lakeland is located on the top and eastern slope of the Lakeland Ridge.

In the eastern part of the County on the Lake Wales Ridge, the sandy, well-drained soils are typically nutrient poor. Lakes in this region generally have a low concentration of nutrients. These conditions support fewer plants and animals which results in clearer water. The rich, green-water lakes (as found in the Lakeland area) support a greater abundance of fish, and are therefore preferred by many

fishermen. Clear water lakes may be more aesthetically appealing, and are often the top choice of boaters, skiers and swimmers.

The combination of drainage basins that contain naturally rich soils, abundant rainfall (approximately 53 inches per year) that carries nutrients to the lakes, and a warm sub-tropical climate create the ideal environment for plant growth. Consequently, the lakes in Lakeland are naturally productive.

Pollutants

The alteration of land by development for residential, agricultural or other uses changes the way water flows through the watershed to a lake or river. The replacement of vegetation with concrete and asphalt reduces the capacity of the land to cleanse or remove pollutants from water as it travels through the watershed to a lake. Pollutants that are released into the environment are carried by stormwater runoff, groundwater and the atmosphere to our lakes. As a result, our lakes are reservoirs for a variety of naturally occurring and man-made contaminants including sediment, bacteria, nutrients, metals, and pesticides, among others.

The most common pollution problem in Lakeland and in many lakes throughout the world is over-enrichment. The discharge of nutrients from fertilizers, eroding soils, and other sources has resulted in nutrient concentrations in lakes high enough to cause imbalances in plant and animal communities. The construction of stormwater systems that transport this enriched water directly to our lakes and streams has hastened the rate that lakes age. Without the benefit of treatment that results from natural sheet flow of water over native soils and vegetation, the pollutants contained in runoff are discharged into our lakes. Stormwater runoff is now considered the greatest source of pollutant loading to Florida's lakes, rivers and estuaries.

Since the early 1980's, developments have been required to provide some degree of stormwater treatment prior to discharge offsite. Most of the City of Lakeland's stormwater system was constructed prior to any treatment requirements. These older systems will need to be outfitted with pollutant removal systems if long term water quality improvements are to be expected.

When nutrients are discharged into a lake at unnaturally high rates, lakes age faster. Nutrient concentrations in untreated urban runoff are typically ten to one hundred times higher than in runoff from similar undeveloped land. The rapid enrichment fuels algae blooms that cloud the water, cause changes in water chemistry, increase the rate at which the lake fills in, and disrupts fish and wildlife populations. Reversing over-enrichment is difficult and expensive. In lakes where eutrophication is advanced, such as Lake Hollingsworth, the sediments may be an important source of nutrient loading and must be removed before any improvements can be expected. Nutrients and their effects along with other pollutants are further discussed in the following section.

Water Quality

The Lakes and Stormwater Water Quality Monitoring Program was initiated in 1989 in order to define existing water quality conditions, analyze long term water quality trends, and to aid in developing lake management strategies and to monitor their effects. The program later sufficed to satisfy the monitoring and reporting requirements of the City's stormwater permit called the National Pollutant Discharge Elimination System Municipal Separate Storm Sewer System permit, or the NPDES MS4 permit. Since 1996, data has also been uploaded to the Florida Department of Environmental Protection (FDEP) storage and retrieval database, or STORET, for inclusion in the determination of impaired waters and for Total Maximum Daily Load (TMDL) development.

Lake water quality is monitored by the collection and analysis of water samples. The original monitoring program included one sampling location near the center of sixteen of Lakeland's lakes. The lakes included were Bentley, Beulah, Bonnet, Bonny, Crago, Gibson, Hollingsworth, Holloway, Horney, Hunter, John, Mirror, Morton, Parker, Somerset, and Wire. Meadow View Lake was added to the list of lakes monitored in 1999. The seventeen monitored lakes can be seen on the map in Figure 2. Monitoring was initially performed on a monthly basis, but reduced to quarterly in 1992. In 1997, Lake Hollingsworth monitoring increased preceding the planned dredging project. Sampling frequency was increased to a monthly basis at five stations throughout the lake. Bacteria monitoring strategies in Lake Hollingsworth have also changed overtime due to elevated results during the winter months, which typically result in posting water contact advisories.

Parameters

Water quality parameters are either measured in the field with portable equipment or water samples are preserved and taken to a laboratory for later analysis. The City of Lakeland monitors twenty-seven parameters for each of the seventeen lakes: station depth, Secchi depth, temperature, pH, dissolved oxygen, conductivity, turbidity, total dissolved solids, total suspended solids, color, alkalinity, ammonia, total Kjeldahl nitrogen, nitrate-nitrite, total nitrogen, total phosphorus, orthophosphorus, chlorophyll-a, calcium, magnesium, total hardness, zinc, lead, cadmium, copper, and total and fecal coliform.

Nutrients

Nutrients found in lakes, such as phosphorus and nitrogen, are critical for plant growth. Typically, nutrients are cycled in a lake through the process of plant production, decomposition of plant and animal matter through fungi and bacteria, and the ensuing release of nutrients. Some nutrients become part of the bottom sediments, some become available for plant growth, and others stay dissolved in the water column.

Nutrient enrichment can accelerate eutrophication. Nutrients entering a lake not only "fertilize" algae, increasing its production, they will also fertilize floating, submersed, and emergent aquatic plants. Often with extensive growth of rooted aquatic plants, the water becomes clearer, although nutrient input has increased. The plants grow and use the nutrients, binding them either in the sediments or in the plant itself. Nutrients can cause a lake to become shallower as increased algae and plant production, and ensuing decomposition, adds silt to lake bottoms. Layers of sediment accumulate over the years making the lake shallower, eventually turning the lake into a wetland. A nutrient rich lake will

fill in faster than a lake with low nutrient levels. The process of natural eutrophication, the infilling of a basin as a lake ages, occurs over many thousands of years. Cultural eutrophication is the acceleration of a lake's aging due to human activities and added nutrient inputs.

The City of Lakeland lies in a nutrient rich region known as the Bone Valley Formation. The soils in this area contain high amounts of phosphorus. Through dissolution by rain and groundwater, Lakeland's lakes have higher naturally occurring phosphorus values than most Florida lakes. Phosphorus and nitrogen are the two limiting nutrients in area lakes. These nutrients can enter the lake from many sources:

- rain and stormwater runoff
- agricultural nonpoint sources;
- atmospheric deposition;
- soils naturally containing phosphorus;
- fertilizers applied to crops and yards;
- treated waste from industrial processes, such as phosphate mining;
- effluent from sewage treatment plants;
- bird and animal waste;
- lawn and tree debris;
- detergents containing phosphates.

Often compounds found in rain contain the nutrients phosphorus and nitrogen, along with other compounds such as sulfides which contribute to lake acidification. Lakes receive nutrients from rain both directly and indirectly. When rain falls into lakes, the nutrients are received directly with the rainfall. Lakes also receive nutrients from rain that has fallen on land and has picked up added nutrients on the way. Surface runoff is rain that falls on the ground and flows overland. This runoff then picks up nutrients from yards, roadways and parking lots.

Nutrient laden water can also reach the lakes by traveling underground. Subsurface water flows through rocks or soils which can have high phosphorus concentrations; it can then seep into lakes or enter them as springs. Nutrients can also seep out of septic tanks and flow underground to lakes. Industrial effluent and treated sewage discharged to surface water from wastewater treatment plants may also add to nutrient concentrations.

Nutrient averages in 2009 varied greatly from lake to lake. Total phosphorus ranged from to 0.03 mg/L in Lake Wire to 0.27 mg/L in Lake John. Total nitrogen ranged from 1.09 mg/L in Lake Beulah to 7.50 mg/L in Lake Bonny. Nutrients are the primary pollutant of concern in Lakeland's lakes. By current water quality standards, all Lakeland lakes are likely impaired for nutrients.

Chlorophyll

Chlorophyll is the green pigment in plants that not only imparts color, but makes it possible for photosynthesis to occur. Chlorophyll is a frequently used estimator of algal biomass in lakes and streams. Algal production is controlled by water temperature, light availability, nutrient availability, hydraulic residence time (the time required for the lake volume to replace itself), and consumption by animals. When enough light is available for photosynthesis, the availability of nutrients is often the controlling factor. Usually phosphorus and nitrogen are the least available nutrients, so they become the limiting factors in algal production. The by-products of modern living are high in these sources of nutrients. Wastewater, fertilizers, agricultural drainage, detergents, and municipal sewage contain high

concentrations of phosphorus and nitrogen, and if they enter a lake, they will stimulate algal productivity. In 2009, chlorophyll a averages ranged from 3.5 µg/L in Lake Wire to 133.1 µg/L in Lake Bonnet.

Water Clarity

A Secchi Disk is a flat horizontal disk with alternating black and white quadrants that is lowered from a rope into the water until it disappears from view (Figure 3). The depth at which a Secchi Disk can no longer be seen is called the Secchi depth and is a measure of the water clarity or transparency. Water clarity is affected by the color of the water and by suspended particles of silt, clay, or algae and can be a measure of some types of pollution. Average Secchi depths in 2009 for Lakeland lakes ranged from 0.25 m (10 inches) to 4.96 m (16 feet). The lowest Secchi readings were in Lake Bonny; the highest readings were in Lake Wire. Lake Wire's extensive growths of submersed aquatic plants influence Secchi depth and water clarity. Average secchi depths can be seen in Figures 4 and 5.

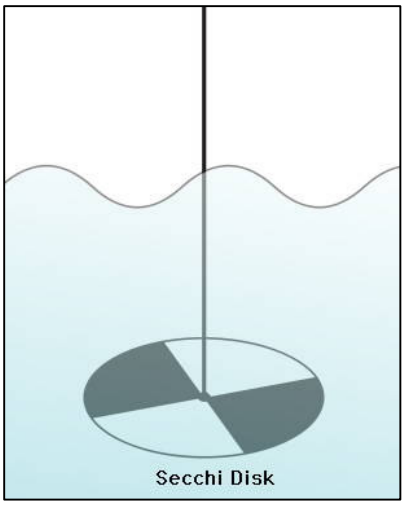

Figure 3. Secchi disk used to measure water clarity.

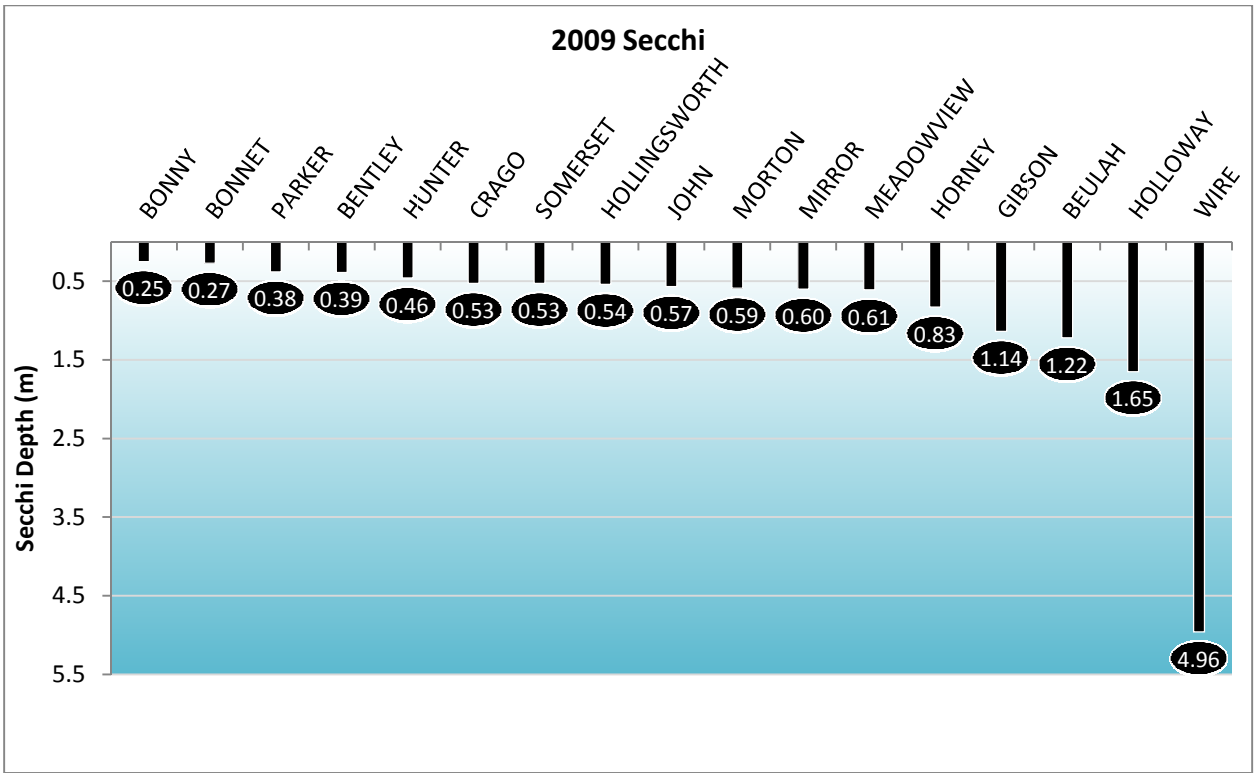

Figure 4. Average Secchi depths in Lakeland lakes in 2009.

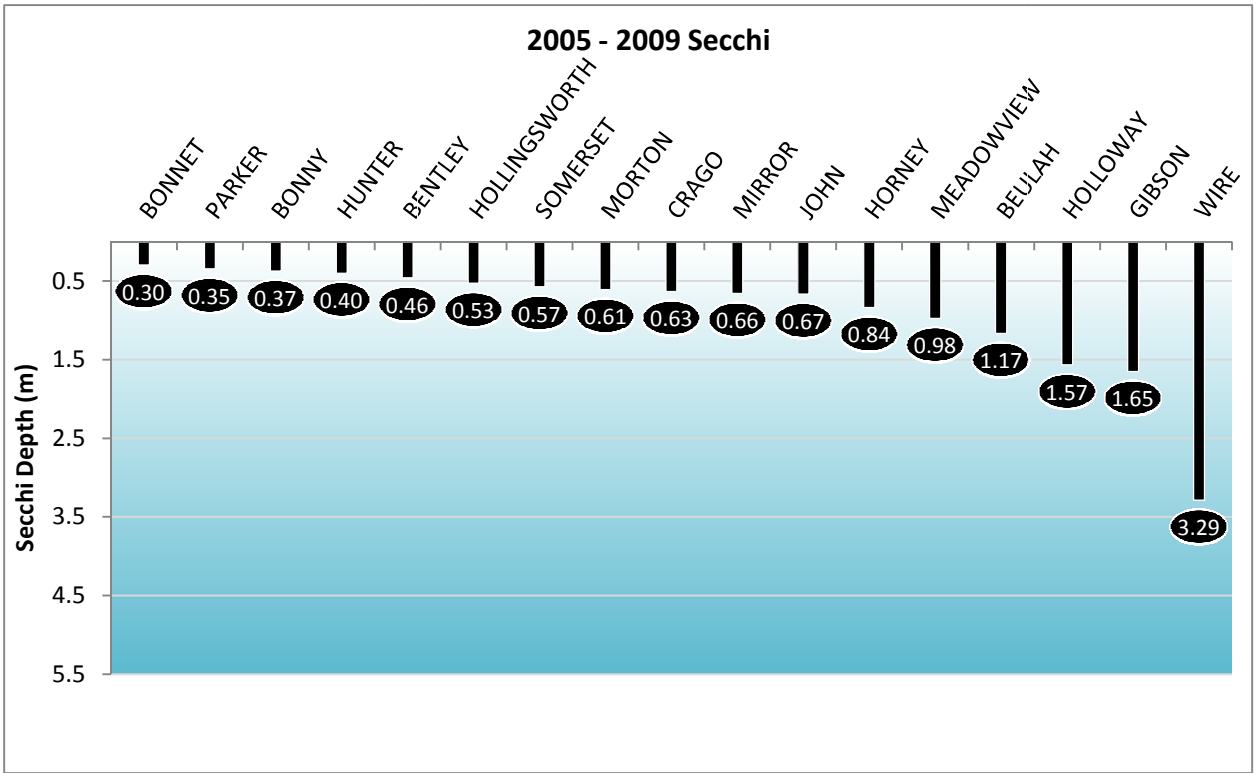

Figure 5. Average Secchi depth in Lakeland lakes from 2005 to 2009.

Trophic State Index

A trophic state index (TSI) is a tool used to evaluate measured in-lake variables to describe a lake's trophic state or degree of biological productivity. Trophic state indices provide a quantitative means of assessing lake changes by simplifying complex environmental measurements. It is the primary tool used by lake managers to detect changes in nutrient levels, for comparison across lakes, and to evaluate nutrient reduction efforts. The basis for using a trophic state index is that, in many lakes, the degree of eutrophication is related to increased nutrient concentrations in the lake. The assumption follows that an increase in lake phosphorus concentrations leads to an increase in algal biomass as measured by chlorophyll a, which would result in a decrease in water transparency as measured by Secchi disk.

The Carlson Trophic State Index is the most widely used and best known. Since its development in 1977, several additional trophic state indices have been developed that rely on Carlson's approach. However, while many of these indices have similar features, most of them were derived from data on temperate lakes. For this reason, Carlson's Index is not directly applicable to Florida Lakes. Studies on subtropical and warm-temperate Florida lakes argue that relationships among secchi depth, total phosphorus, and chlorophyll a are unique for Florida lakes. In addition, many Florida lakes are nitrogen limited, while the Carlson Index assumes that lakes are phosphorus limited.

A TSI specific to Florida was developed by the University of Florida and was later adopted by the Florida Department of Environmental Protection. The Florida trophic state index uses sub-indices for total phosphorus, total nitrogen, and chlorophyll a. The method to calculate overall TSI from the sub-indices depends on whether a lake is phosphorus limited, nitrogen limited, or relatively nutrient balanced. The Florida Department of Environmental Protection outlines the standard Florida TSI method in the 1996 305(b) report.

TSI is a range of numbers from 1 to greater than 70 that describes the productivity of a lake. A TSI of less than 60 is considered oligotrophic to mesotrophic, 60 to 70 is eutrophic, and greater than 70 is hypereutrophic (Figure 6). Oligotrophic lakes are the least biologically productive and are typically clear with no algae blooms, low in nutrient concentration, and lack an abundance of fish and aquatic plants. Mesotrophic lakes are moderately productive with moderate nutrient levels and fish and plant populations. Eutrophic and hypereutrophic lakes are highly productive and have a high concentration of nutrients. These lakes may have frequent algae blooms, low water clarity, a thick layer of organic sediment, and support an abundance of fish and vegetation. Due to the underlying phosphorus rich soils, most lakes in Lakeland are naturally eutrophic; however stormwater and other sources of nutrients have impaired some water bodies elevating them into the hypereutrophic range.

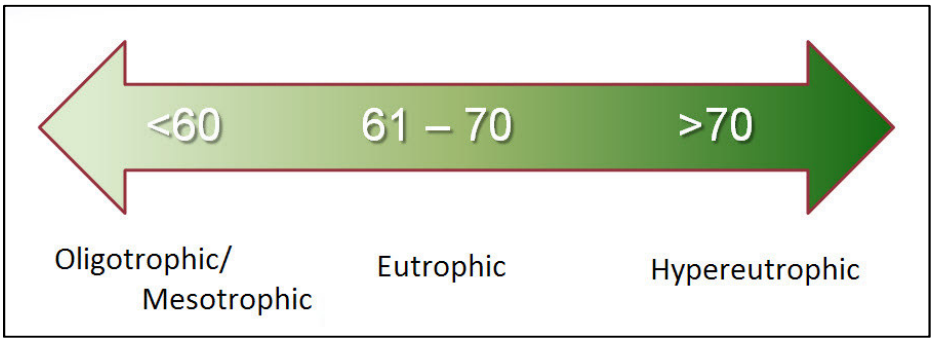

Figure 6. Trophic state index diagram.

TSI for Lakeland lakes ranged from an oligotrohpic 39 for Lake Wire to a hypereutrphic 87 for lakes Bonnet and Bonny in 2009. The 2009 annual average TSI and five year average TSI for Lakeland lakes can be seen in Figures 7 and 8.

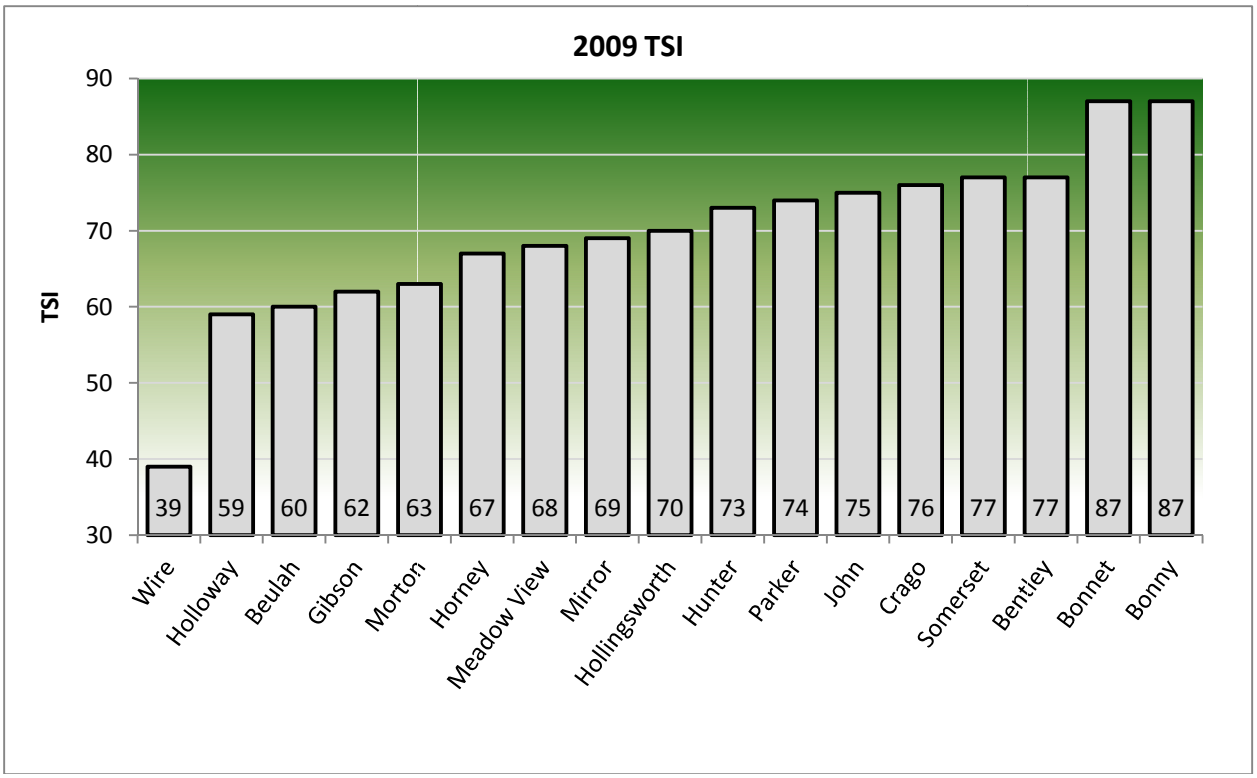

Figure 7. Average TSI for Lakeland lakes in 2009.

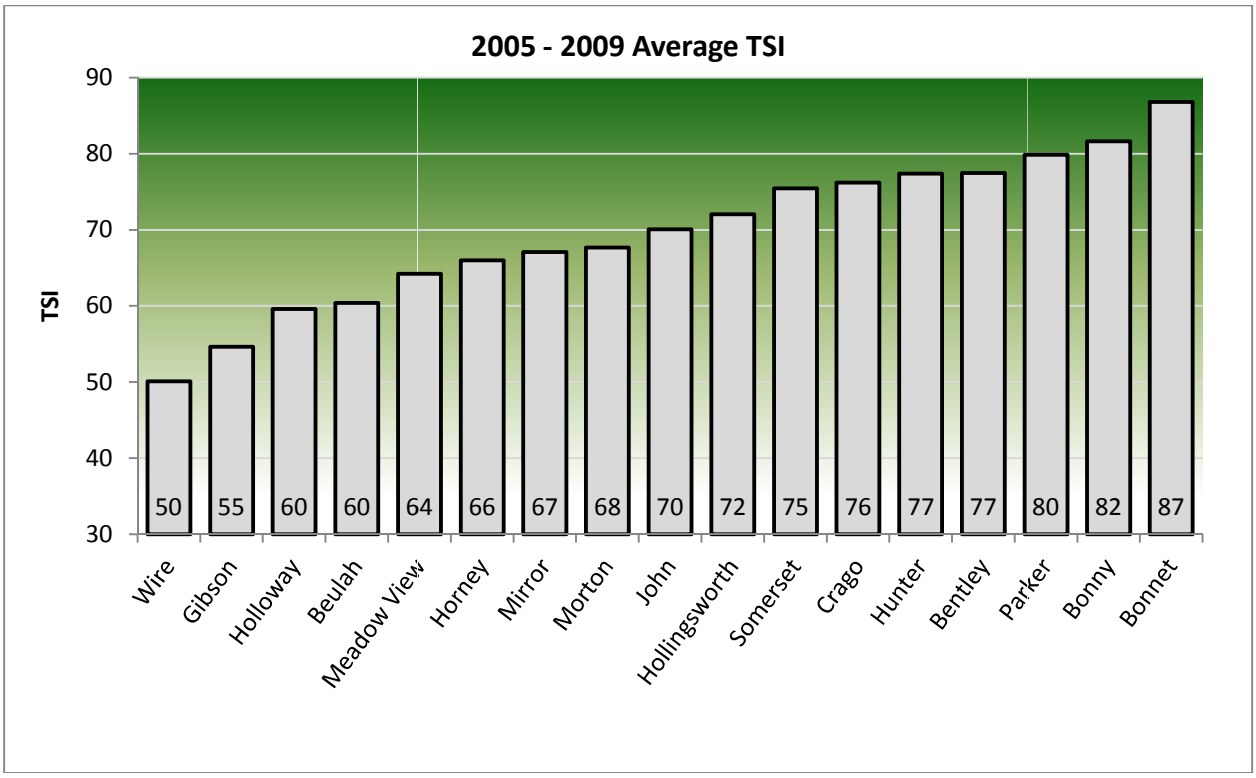

Figure 8. Average TSI for Lakeland lakes from 2005 to 2009.

Metals

The use of metals in many of the products we use in our society has resulted in the contamination of surface waters. Potential sources of metals are stormwater runoff, illicit dumping, and industrial discharge. Metal concentrations in stormwater can be significant and may be generated from sources such as wear from automobile parts or atmospheric deposition which are washed into the stormwater system. The pH of a lake can also influence the concentrations of metals found in the water column. In 2009, all monitored lakes were within water quality standards for metals except lead. Lead is very soluble, and as previously noted, pH can be a factor in high lead levels. As the pH increases, lead will fall out of solution and into sediments. Once pH decreases, the lead will dissolve out of the sediments and back into the water column. Four lakes exceeded the standard for lead during at least one sampling event for the year. Lake Bonnet and Lake Wire exceeded the standard during all four sampling events. Lake Bonnet had an average lead concentration of 2.7 µg/L, which is 0.94 µg/L above the standard and Lake Wire's average was 6.0 µg/L, which is 4.5 µg/L above the standard. In March, Bonny exceeded the standard by 1.76 µg/L with a lead result of 3.4 µg/L and Mirror was 0.47 µg/L over the standard at 3.7 µg/L.

Microbiology

Bacteria are a natural and necessary component of lake ecosystems. Bacteria carry out the important functions of decomposing dead plant and animal material and releasing nutrients back into the water column. Bacteria are also involved in some of the chemical processes that occur in aquatic systems such as nitrogen fixation and denitrification. However, some bacteria can be harmful and there are a small number of strains that can cause human illness. To determine whether or not human pathogens may be

present in a water body, a sample is tested for the presence of indicator organisms. Indicator organisms are not pathogenic themselves, but their presence is an indication that pathogenic bacteria may also be present. Samples are tested for indicator organisms rather than pathogens because they occur in much higher numbers and are detected more easily than pathogens. Fecal coliform is a commonly used indicator organism. The presence of fecal coliform indicates that harmful bacteria may also be present.

Fecal coliform counts remained well within safe levels during regular water quality monitoring events in 2009 except at Lake Morton. Lake Morton experienced a high count of 1,020 per 100 ml in December 2009, which is 220 over the state water quality standard. In addition, Lake Hollingsworth experienced some counts above the water quality standard during special sampling events that occur every winter for the lake. Lake Hollingsworth typically experiences elevated bacteria counts during the winter months and additional sampling is required to monitor during this time. Studies have been inconclusive in the identification of the source of bacteria in the lake. When counts rise above standards, an advisory against water contact activities is posted for the lake. Although the presence of fecal coliform does not always correspond to increased human health risks, they do indicate the potential presence of human pathogens, so contact with water is not recommended until bacteria counts return to acceptable levels. A lake advisory was posted on January 16, 2009 when counts at one station reached a year high of 1,200 per 100ml. The advisory remained in effect until March 13, 2009. However, only a small percentage of samples exceeded the standard during the time the advisory was posted.

Lake Levels

Lake level monitoring began in 1988 on lakes Beulah, Bonny, Bonnet, Gibson, Hollingsworth, Hunter, John, Mirror, Morton, Parker, and Wire. In 1993, monitoring was initiated at Bentley and Holloway and Lake Horney was added in 1996. The monitoring interval has varied over the years. Lake level data on the fifteen lakes is currently collected on a weekly basis. Lake levels are monitored by reading staff gauges which have been installed near the shoreline in each lake (Figure 9). All staff gauges were surveyed and installed by either the Southwest Florida Water Management District or the City's Public Works Department. The staff gauges measure the lake's elevation to the nearest hundredth of a foot above mean sea level.

Figure 9. Staff gauge at Lake Mirror.

A lake's water level fluctuates in response to rainfall, evaporation, surface water flows, and ground water flows. Fluctuation ranges vary by lake and in Lakeland may be as little as a foot to over 10 feet. As a result of man's activities, many lakes are not allowed to fluctuate naturally. Water level stabilization is considered one of the major causes of undesirable changes in lake and wetland ecosystems. Water level fluctuation is important to maintain healthy flora and fauna communities and in nutrient cycling.

The natural drainage of many lakes in Lakeland has been altered by man-made connections through pipes, ditches, and canals. The movement of water through the system can be controlled to a certain extent by the inclusion of water control structures within the system. The City owns and operates

adjustable water control structures on several of Lakeland's lakes that allow a limited amount of lake level control by releasing water to another lake or creek by way of pipes or ditches. Two types of adjustable structures are seen if Figure 10. Flow between lakes is typically unidirectional (except Lakes Bonny and Parker) and moved by gravity. In addition to City owned structures, the South West Florida Water Management District (SWFWMD) operates control structures on Lakes Gibson and Parker. The location of these structures and general routes of water movement through Lakeland's lakes is shown in Figures 11 to 13.

Figure 10. Adjustable water control structures. Lake Hunter, left, is a metal slide gate and Lake Wire, right, is a riser with boards. Both can be adjusted to release water through a culvert.

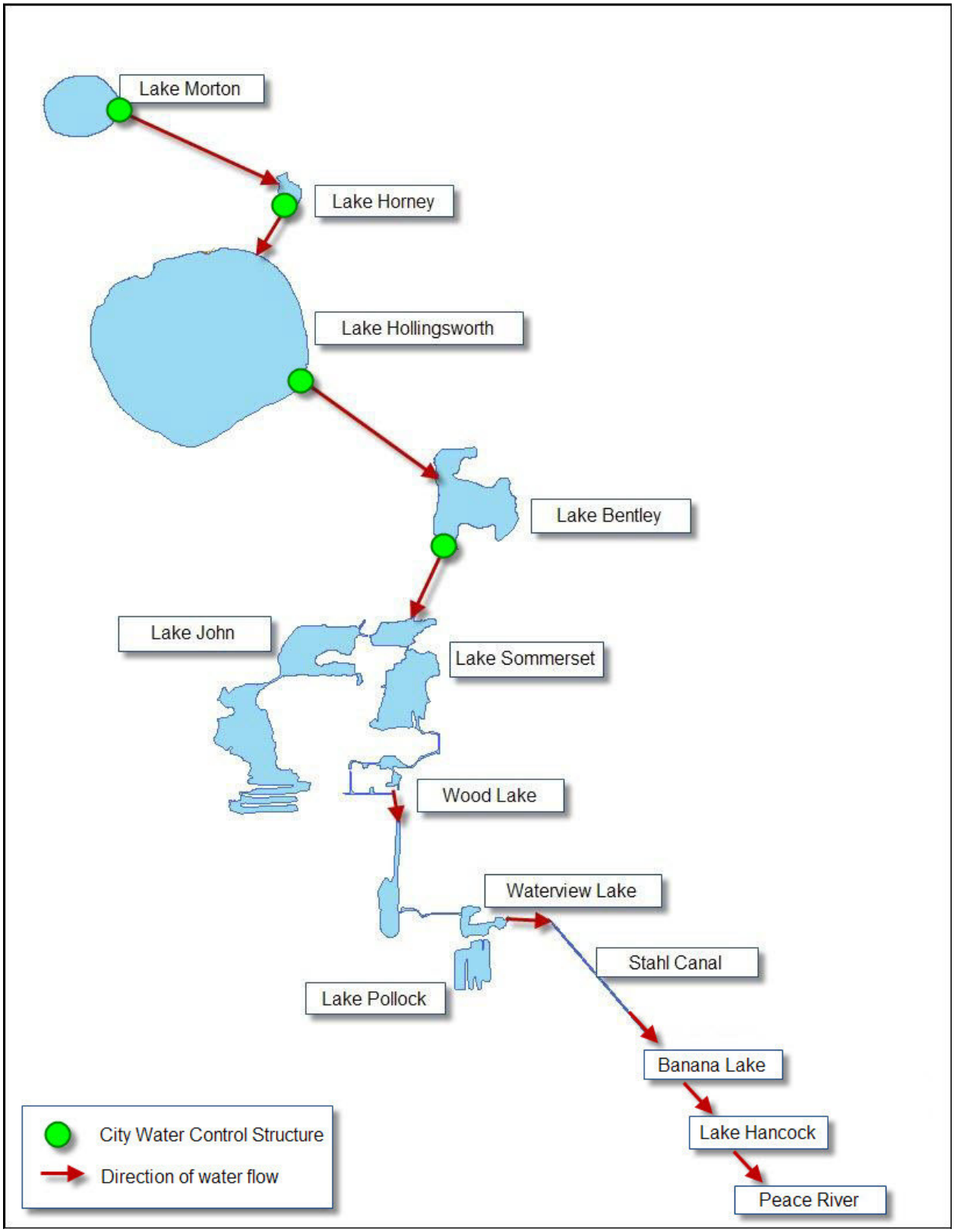

Figure 11. Adjustable water control structures and direction of water flow.

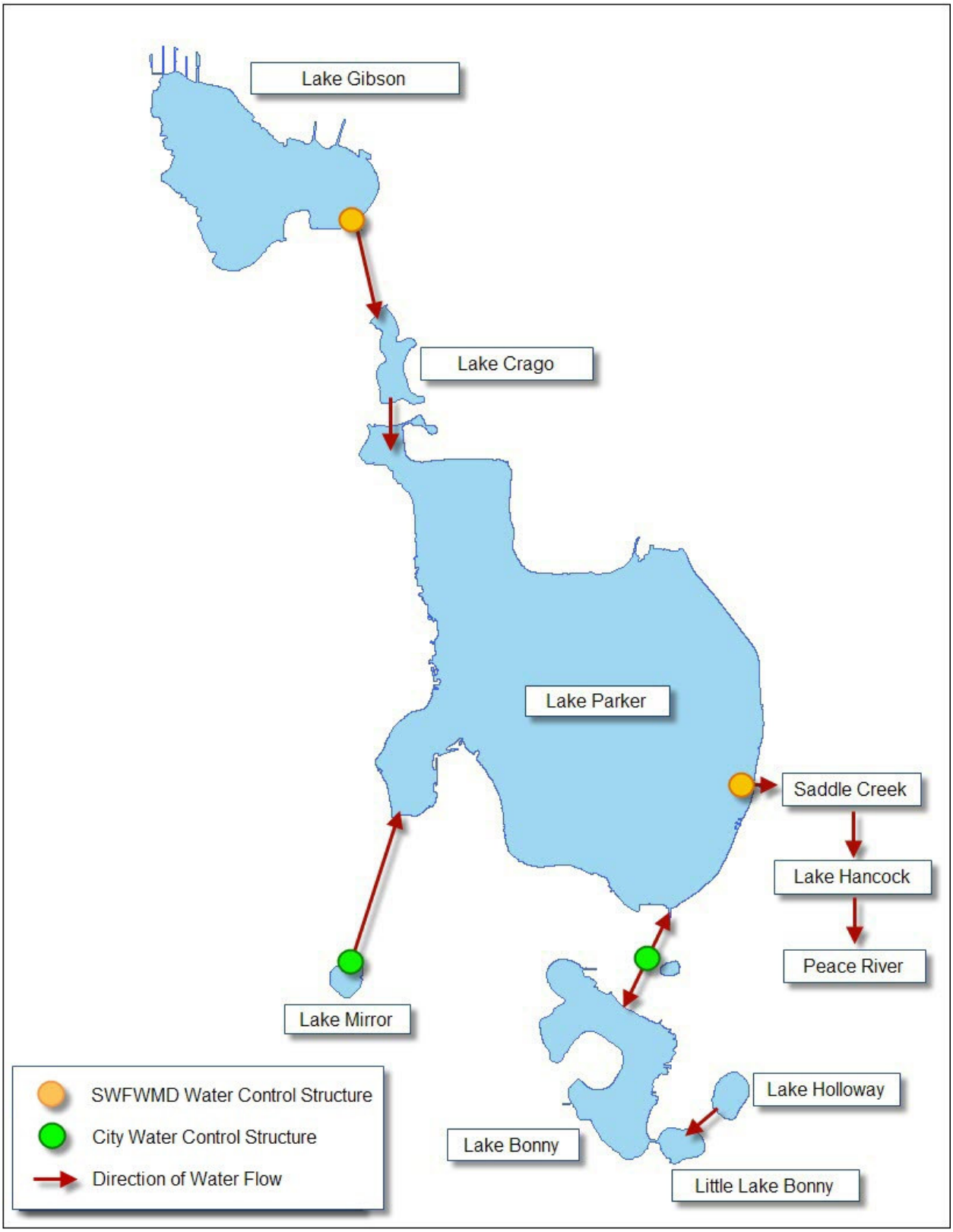

Figure 12. Adjustable water control structures and direction of water flow.

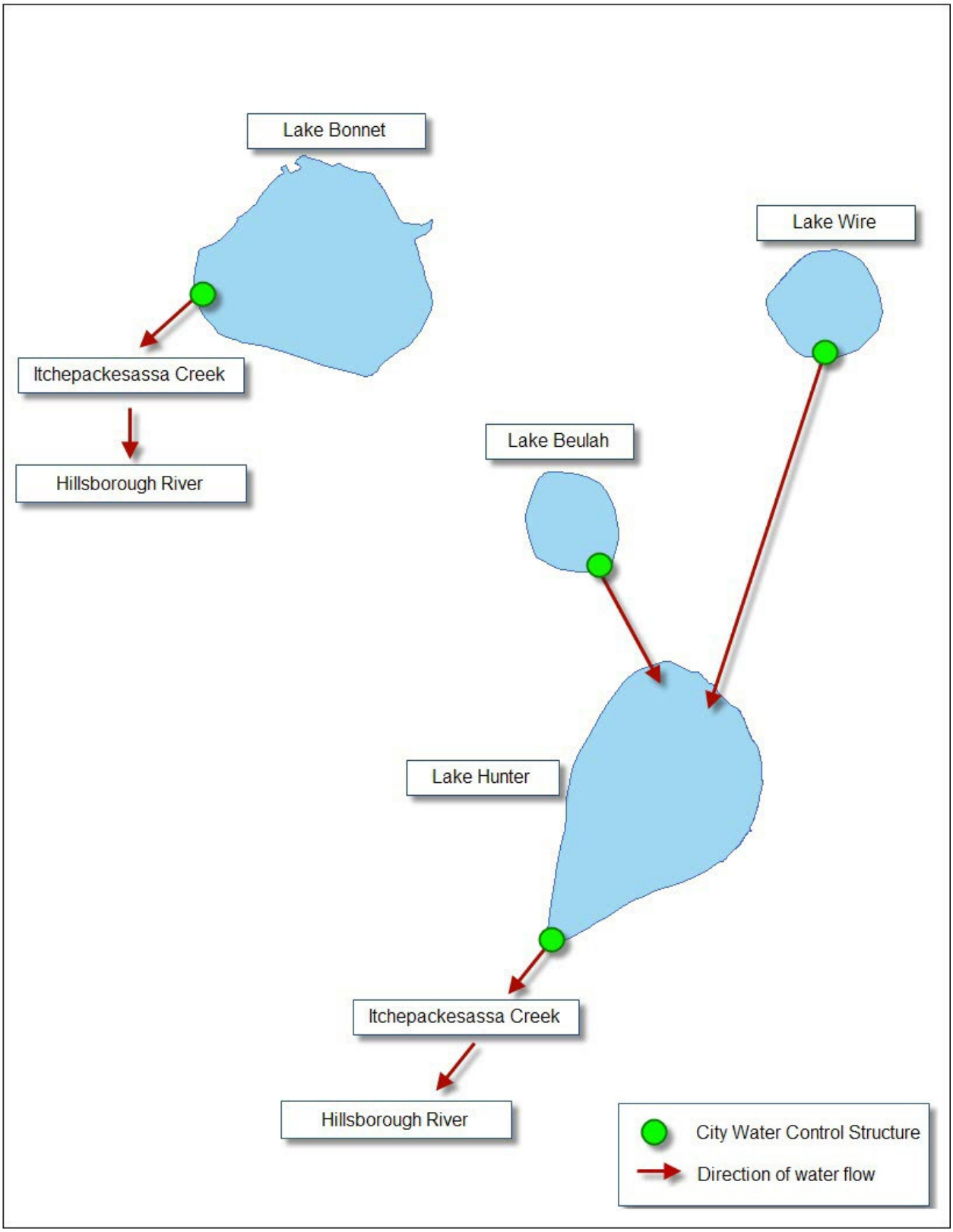

Figure 13. Adjustable water control structures and direction of water flow.

Many lakes in Lakeland experienced record lows in 2009 due to an extended period of drought. This was the fourth year of below normal rainfall. A summary of rainfall data for Lakeland can be found in the final section of this report. Lakes that experienced the lowest levels on record (excluding planned drawdowns) include Beulah, Bonny, Gibson, Horney, Morton, and Wire. Lake Bonny levels reached such an extreme low that much of the lake bottom became exposed and the lake was transformed into four small cells of water separated by dry lake bottom in between (Figures 14 and 15).

Figure 14. Exposed lake bottom in Lake Bonny following drought, April 2009.

Figure 15. Aerial photos of Lake Bonny. The left is at normal water level in 2005, the right is at low water level in 2009.

Lake Summaries

General lake information, water quality data and lake level data for monitored lakes in Lakeland are provided in this section. Water quality data provided includes 2009 averages, along with five-year averages, minimums and maximums. Beginning in 2009, Lakes and Stormwater began a new quality assurance program. Data prior to 2009 has not been verified by the same quality assurance standards and is presented for comparison purposes only. Data gaps may exist where normally scheduled monitoring events did not occur due to lack of staff or prohibitive environmental conditions.

Lake Bentley

General Information

Section-Township-Range: 29-28-24
Lat/Long: 28°00'51"N / 81°55'35"W
Drainage Basin: Peace River
Origin: Phosphate Pit
Public Boat Ramp: No
Surface Area: 21 ha (52 ac)
Avg. Depth: 2.2 m (7.2 ft)
Max Depth: 3.7 m (12.1 ft)
Volume: 469,527 m^3 (124,035,911 gal)
Shoreline Length: 2,818 m (9,245 ft)
Watershed Area: 939 ha (2,319 ac)

Lake Levels

Adjustable Control Structure: Yes
Operator: City of Lakeland
Operating Range: 114.00 – 114.90
Contributing Water body: Lake Hollingsworth
Discharges to: Lake Somerset
10 Yr. Flood: no data
100 Yr. Flood: 120.00
Historic High: 115.92 (1/1/03)
Historic Low: 112.36 (6/11/08)
2009 Avg: 114.23
2009 High: 114.96
2009 Low: 113.54

Water Quality

FDEP Verified Impairments: none
COL Potential Impairments: nutrients
Limiting Nutrient: nitrogen

Parameter (unit)	2009 Avg	5 yr Avg	5 yr Min	5 yr Max
Temperature (°C)	21.91	24.01	15.78	30.59
pH (std unit)	9.02	9.21	7.87	10.21
Conductivity (uS)	194	193	155	229
Dissolved Oxygen (mg/L)	13.03	10.33	6.18	14.65
Turbidity (NTU)	16.1	15.1	2.2	30.3
Secchi Disk (m)	0.39	0.45	0.32	0.63
TSI	77	76	62	86
Total Alkalinity (mg/L)	44	50	20	68
Total Ammonia (mg/L)	<0.010	0.042	<0.010	0.229
Total Kjeldahl Nitrogen (mg/L)	2.25	2.10	1.15	4.23
Nitrate-Nitrite (mg/L)	<0.010	0.013	<0.010	0.038
Total Nitrogen (mg/L)	2.25	2.11	1.15	4.23
Total Phosphorus (mg/L)	0.195	0.233	0.154	0.337
Ortho Phosphorus (mg/L)	0.006	0.012	0.001	0.040
Chlorophyll a, uncorrected (ug/L)	99.6	79.7	49.6	151.0
Color (Pt-Co)	19	41	15	100
Total Dissolved Solids (mg/L)	137	125	92	216
Total Suspended Solids (mg/L)	24	24	12	44
Calcium (mg/L)	22.1	18.6	13.6	25.2
Magnesium (mg/L)	4.0	4.0	3.3	4.8
Total Hardness (mg/L)	71.5	62.8	52.5	80.6
Cadmium (ug/L)	<0.02	0.67	<0.02	5.90
Copper (ug/L)	<2	5	<2	12
Lead (ug/L)	2.1	1.8	1.4	2.4
Zinc (ug/L)	7	12	3	32
Fecal Coliform (#/100 ml)	<10	18	<10	60
Total Coliform (#/100 ml)	175	288	<100	2000

Table 1. Lake Bentley water quality data summary.

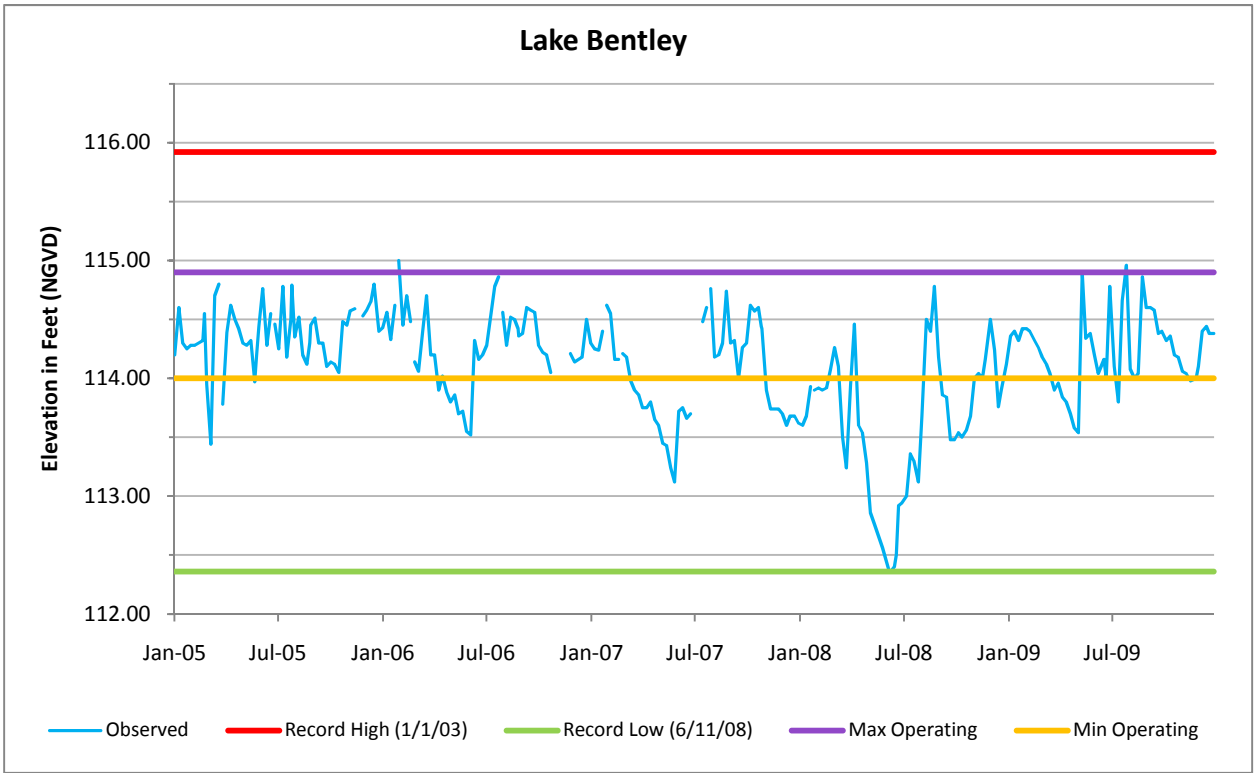

Figure 16. Lake Bentley elevation from 2005 to 2009.

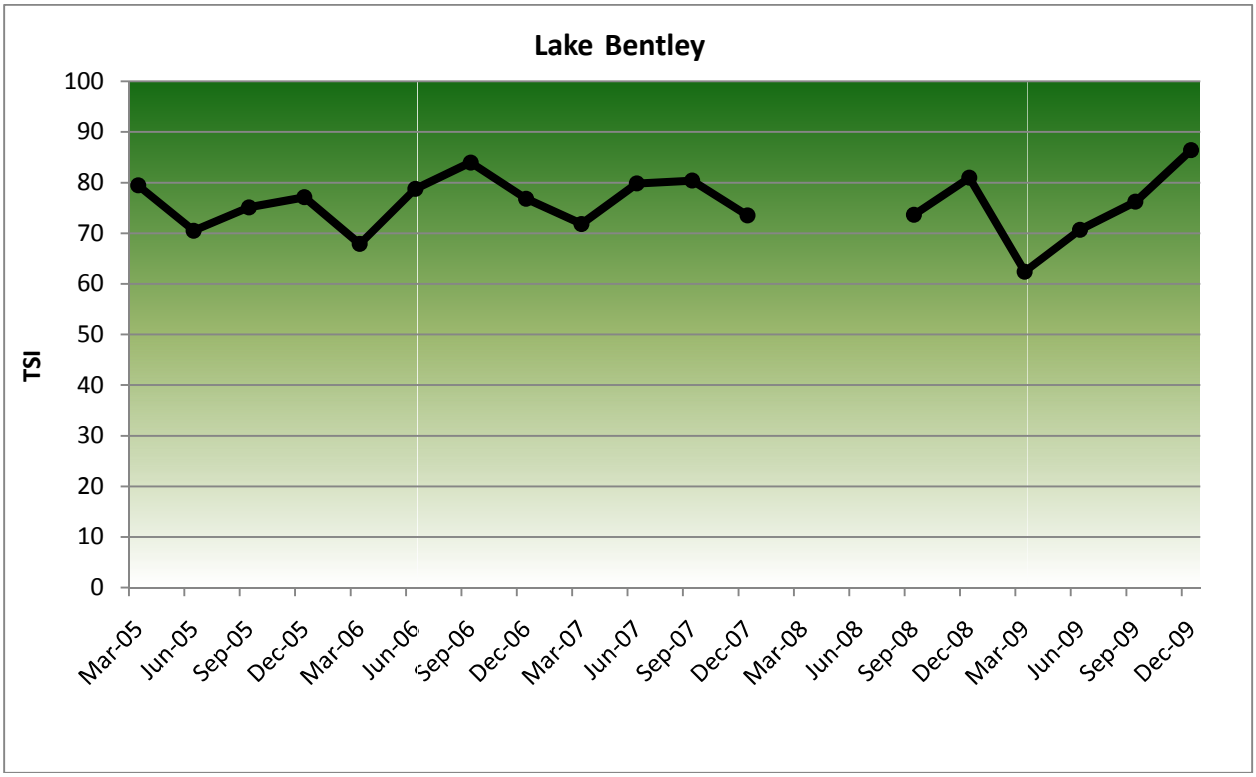

Figure 17. Lake Bentley TSI from 2005 to 2009.

Lake Beulah

General Information

Section-Township-Range: 24-28-23
Lat/Long: 28°02'26"N/81°58'06"W
Drainage Basin: Hillsborough River
Origin: Natural
Public Boat Ramp: No
Surface Area: 7 ha (17 ac)

Avg. Depth: 5.0 m (16.4 ft)
Max Depth: 8.5 m (27.9ft)
Volume: 354,230 m^3 (93,577,666 gal)
Shoreline Length: 1,002 m (3,287 ft)
Watershed Area: 128 ha (316 ac)

Lake Levels

Adjustable Control Structure: Yes
Operator: City of Lakeland
Operating Range: 179.50-180.50
Contributing Water body: none
Discharges to: Hunter
10 Yr. Flood: no data

100 Yr. Flood: no data
Historic High: 181.69 (9/8/88)
Historic Low: 172.94 (5/8/09)
2009 Avg: 175.41
2009 High: 176.98
2009 Low: 172.94

Water Quality

FDEP Verified Impairments: none
COL Potential Impairments: nutrients
Limiting Nutrient: balanced

Parameter (unit)	2009 Avg	5 yr Avg	5 yr Min	5 yr Max
Temperature (°C)	23.43	23.95	16.63	31.01
pH (std unit)	8.26	8.61	7.52	9.61
Conductivity (uS)	110	130	89	152
Dissolved Oxygen (mg/L)	10.31	9.72	3.27	13.01
Turbidity (NTU)	4.86	4.58	1.10	9.97
Secchi Disk (m)	1.22	1.23	0.63	2.45
TSI	60	59	43	68
Total Alkalinity (mg/L)	42	52	32	64
Total Ammonia (mg/L)	<0.010	0.142	<0.010	0.885
Total Kjeldahl Nitrogen (mg/L)	1.09	1.18	0.39	2.18
Nitrate-Nitrite (mg/L)	0.011	0.023	<0.010	0.090
Total Nitrogen (mg/L)	1.09	1.20	0.39	2.25
Total Phosphorus (mg/L)	0.043	0.058	0.034	0.086
Ortho Phosphorus (mg/L)	0.006	0.009	0.005	0.040
Chlorophyll a, uncorrected (ug/L)	29.0	29.0	17.1	37.0
Color (Pt-Co)	20	33	2	87
Total Dissolved Solids (mg/L)	70	76	50	93
Total Suspended Solids (mg/L)	5	6	1	17
Calcium (mg/L)	17.6	17.3	11.0	23.5
Magnesium (mg/L)	1.2	1.3	1.1	1.6
Total Hardness (mg/L)	49.0	48.7	32.0	63.7
Cadmium (ug/L)	<0.02	0.48	<0.02	2.80
Copper (ug/L)2	<2	6	<2	17
Lead (ug/L)	1.30	1.28	0.75	1.79
Zinc (ug/L)	65	65	46	82
Fecal Coliform (#/100 ml)	15	32	3	180
Total Coliform (#/100 ml)	175	294	<10	1100

Table 2. Lake Beulah water quality data summary.

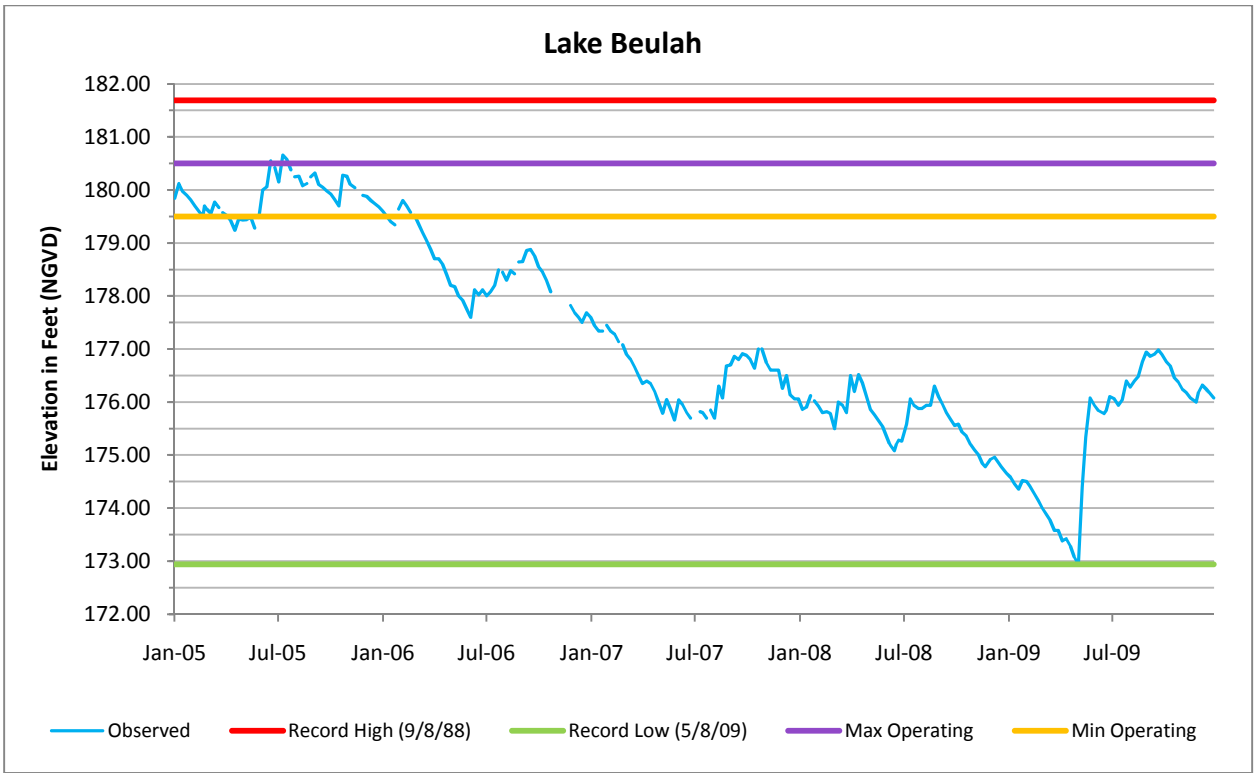

Figure 18. Lake Beulah elevation from 2005 to 2009.

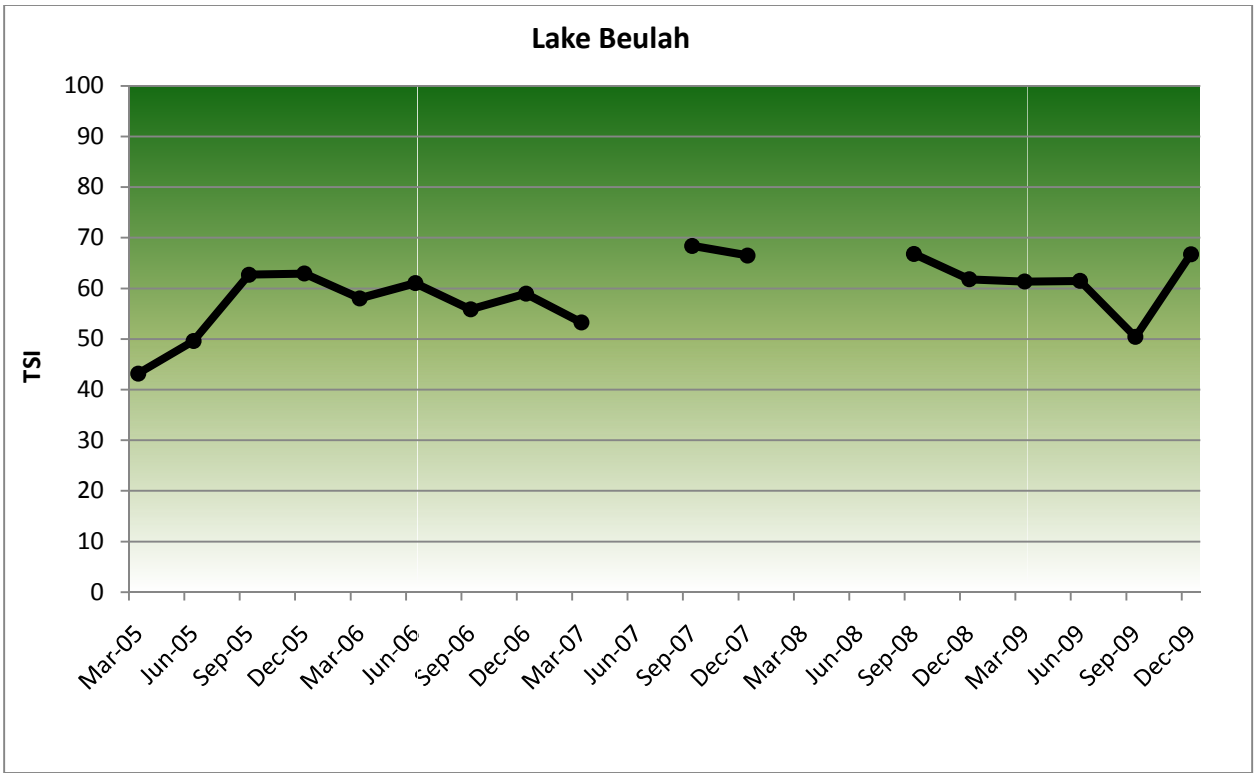

Figure 19. Lake Beulah TSI from 2005 to 2009.

Lake Bonnet

General Information

Section-Township-Range: 14-28-23
Lat/Long: 28°02'53" N/81°58'36" W
Drainage Basin: Hillsborough River
Origin: Natural
Public Boat Ramp: No
Surface Area: 32 ha (79 ac)
Avg. Depth: 1.2 m (4.0 ft)
Max Depth: 4.0 m (13.1 ft)
Volume: 377,569 m^3 (99,725,980 gal)
Shoreline Length: 3,488m (11,442 ft)
Watershed Area: 275 ha (679 ac)

Lake Levels

Adjustable Control Structure: Yes
Operator: City of Lakeland
Operating Range: 143.50-145.00
Contributing Water body: none
Discharges to: Lake Blanton, Itchepackesassa Creek
10 Yr. Flood: 145.9
100 Yr. Flood: 147.00
Historic High: 146.62 (11/11/88)
Historic Low: 142.08 (5/30/97)
2009 Avg: 144.57
2009 High: 145.50
2009 Low: 143.84

Water Quality

FDEP Verified Impairments: none
COL Potential Impairments: nutrients, lead
Limiting Nutrient: balanced

Parameter (unit)	2009 Avg	5 yr Avg	5 yr Min	5 yr Max
Temperature (°C)	21.49	23.06	14.55	29.25
pH (std unit)	8.97	9.28	8.26	10.80
Conductivity (uS)	169	176	129	211
Dissolved Oxygen (mg/L)	9.60	9.80	3.92	15.04
Turbidity (NTU)	28.6	26.5	10.1	54.1
Secchi Disk (m)	0.27	0.30	0.15	0.47
TSI	87	84	66	102
Total Alkalinity (mg/L)	53	53	37	66
Total Ammonia (mg/L)	0.014	0.103	0.010	0.490
Total Kjeldahl Nitrogen (mg/L)	3.847	4.081	1.091	9.710
Nitrate-Nitrite (mg/L)	0.010	0.021	0.010	0.127
Total Nitrogen (mg/L)	3.847	4.096	1.091	9.735
Total Phosphorus (mg/L)	0.267	0.311	0.137	0.727
Ortho Phosphorus (mg/L)	0.005	0.011	0.005	0.040
Chlorophyll a, uncorrected (ug/L)	133.1	139.0	44.0	383.0
Color (Pt-Co)	39	45	13	87
Total Dissolved Solids (mg/L)	136	133	78	272
Total Suspended Solids (mg/L)	58	62	15	152
Calcium (mg/L)	20.9	16.9	12.6	24.5
Magnesium (mg/L)	2.7	2.9	2.2	3.9
Total Hardness (mg/L)	63.4	54.1	41.3	75.6
Cadmium (ug/L)	0.02	0.83	0.02	6.80
Copper (ug/L)	2	7	2	20
Lead (ug/L)	2.7	3.3	1.0	5.4
Zinc (ug/L)	16	24	7	97
Fecal Coliform (#/100 ml)	130	56	10	430
Total Coliform (#/100 ml)	325	276	100	1100

Table 3. Water quality data summary for Lake Bonnet.

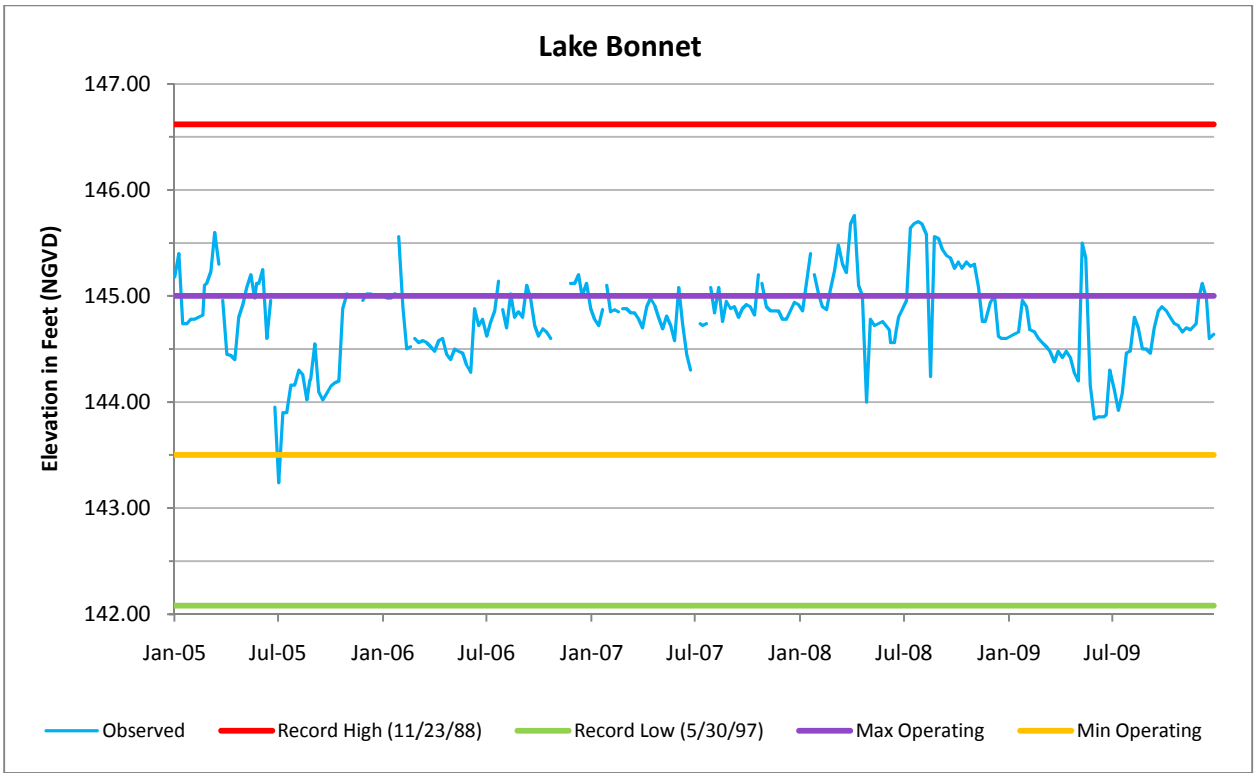

Figure 20. Lake Bonnet elevation from 2005 to 2009.

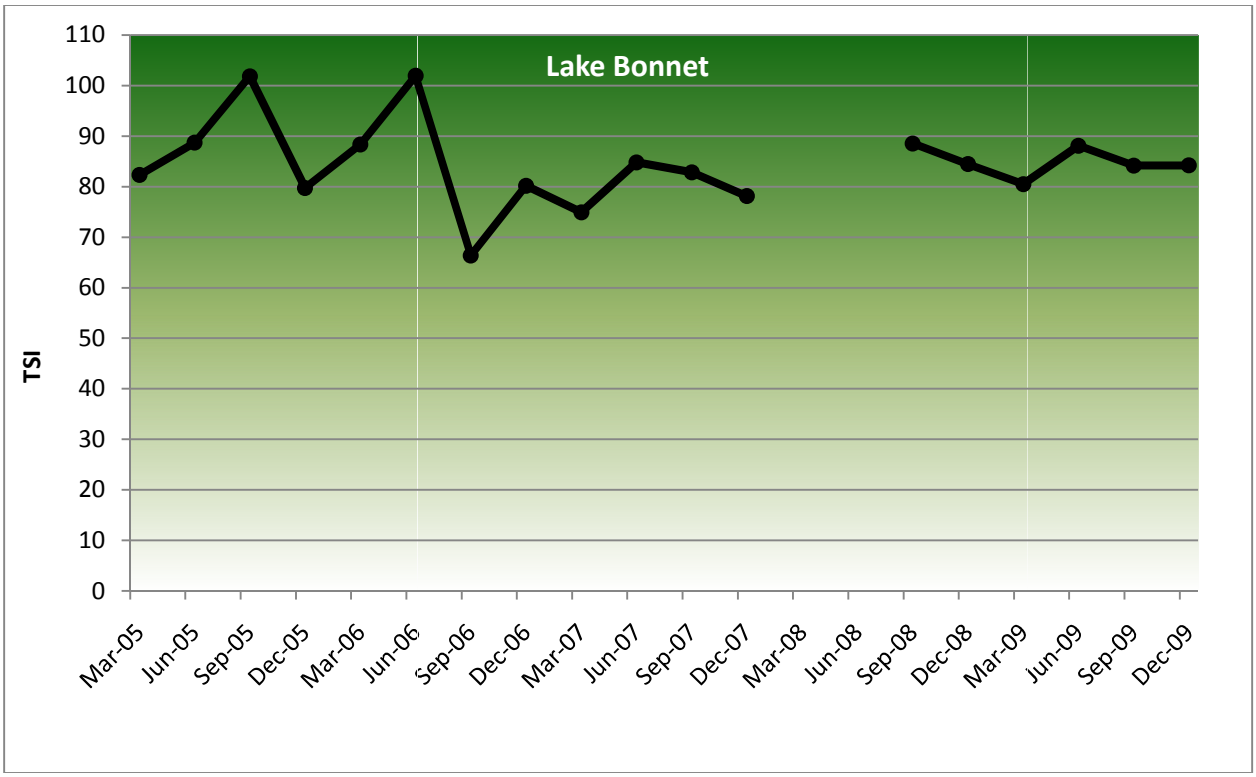

Figure 21. Lake Bonnet TSI from 2005 to 2009.

Lake Bonny

General Information

Section-Township-Rain: 20-28-24
Lat/Long: 28°02'21" N/ 81°55'38" W
Drainage Basin: Peace River
Origin: Natural
Public Boat Ramp: Yes
Surface Area: 101 ha (249 ac)
Avg. Depth: 0.9m (3.0 ft)
Max Depth: 3.4 m (11.2 ft)
Volume: 1,475,940 m^3 (389,902,099gal)
Shoreline Length: 7,599 m (24,930 ft)
Watershed Area: 612 ha (1,512 ac)

Lake Levels

Adjustable Control Structure: Yes
Operator: City of Lakeland
Operating Range: 129.50-130.90
Contributing Water body: Lake Holloway, Lake Parker
Discharges to: Lake Parker
10 Yr. Flood: 130.90
100 Yr. Flood: 132.00
Historic High: 133.10 (9/27/04)
Historic Low: 122.34 (5/8/09)
2009 Avg: 124.08
2009 High: 124.92
2009 Low: 122.34

Water Quality

FDEP Verified Impairments: nutrients
COL Potential Impairments: nutrients, lead
Limiting Nutrient: balanced

Parameter (unit)	2009 Avg	5 yr Avg	5 yr Min	5 yr Max
Temperature (°C)	21.62	23.55	12.35	29.57
pH (std unit)	8.76	8.35	7.06	9.61
Conductivity (uS)	173	169	138	204
Dissolved Oxygen (mg/L)	8.48	7.66	3.07	10.89
Turbidity (NTU)	33.7	22.3	7.5	65.5
Secchi Disk (m)	0.25	0.39	0.15	0.85
TSI	87	80	60	99
Total Alkalinity (mg/L)	34	44	29	70
Total Ammonia (mg/L)	0.022	0.094	0.010	0.651
Total Kjeldahl Nitrogen (mg/L)	7.500	4.434	0.822	11.860
Nitrate-Nitrite (mg/L)	0.013	0.015	0.010	0.031
Total Nitrogen (mg/L)	7.505	4.443	0.822	11.882
Total Phosphorus (mg/L)	0.286	0.209	0.084	0.669
Ortho Phosphorus (mg/L)	0.005	0.009	0.005	0.04
Chlorophyll a, uncorrected (ug/L)	106.9	96.0	26.3	197.0
Color (Pt-Co)	29	48	24	85
Total Dissolved Solids (mg/L)	206	160	40	480
Total Suspended Solids (mg/L)	145	79	10	325
Calcium (mg/L)	27.7	19.3	10.5	37.0
Magnesium (mg/L)	2.4	2.5	1.8	3.4
Total Hardness (mg/L)	79.2	58.4	34.9	106.4
Cadmium (ug/L)	0.03	0.37	0.02	2.00
Copper (ug/L)	2	6	2	20
Lead (ug/L)	1.9	1.7	0.2	5.2
Zinc (ug/L)	9	16	4	56
Fecal Coliform (#/100 ml)	18	34	10	360
Total Coliform (#/100 ml)	175	367	100	2300

Table 4. Water Quality data summary for Lake Bonny.

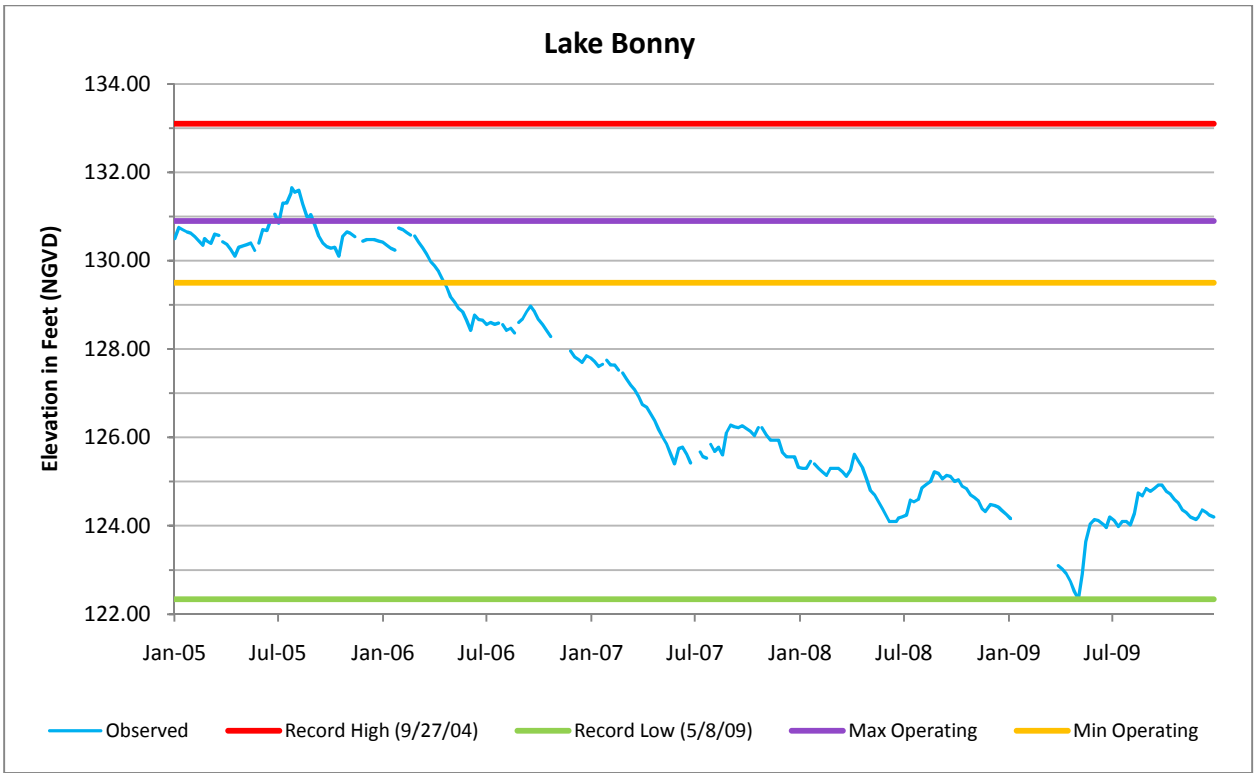

Figure 22. Lake Bonny elevation from 2005 to 2009.

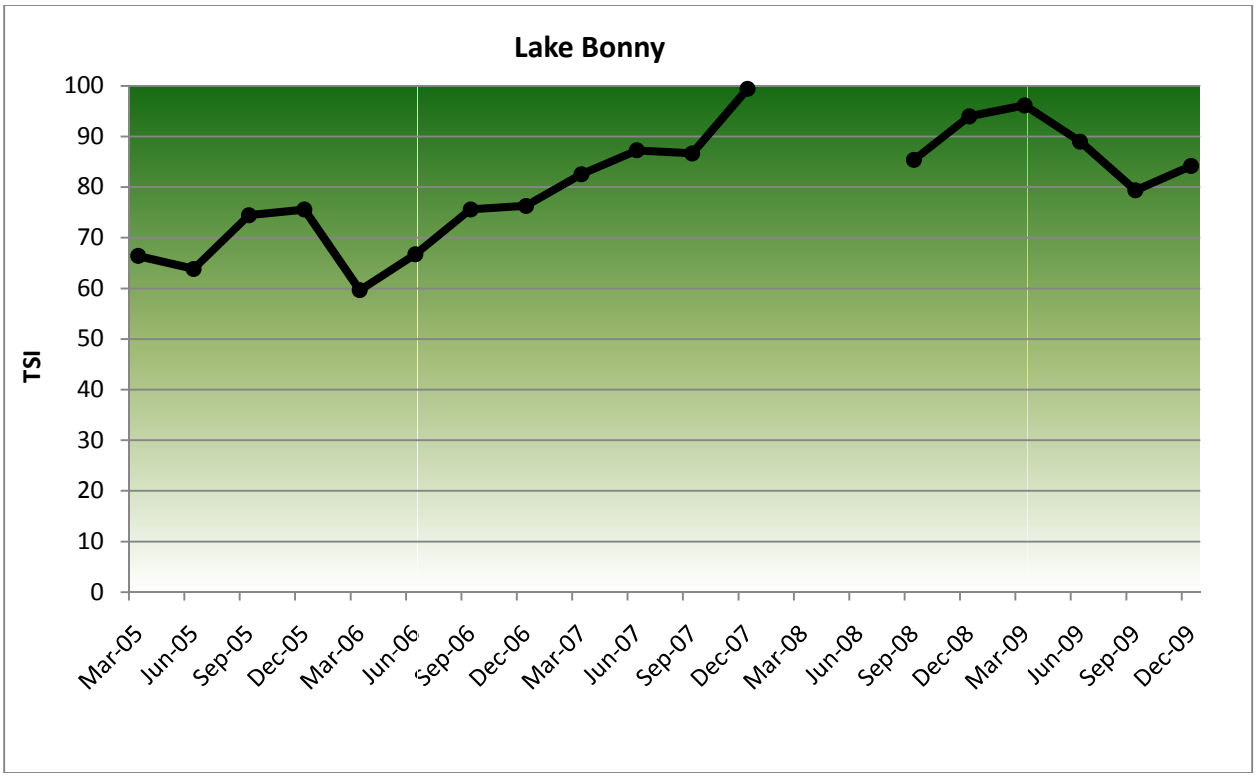

Figure 23. Lake Bonny TSI from 2005 to 2009.

Lake Crago

General Information

Section-Township-Range: 31-27-24
Lat/Long: 28°05'34" N/ 81°56'52" W
Drainage Basin: Peace River
Origin: Phosphate Pit
Public Boat Ramp: no, canal access from Parker
Surface Area: 21 ha (52 ac)
Avg. Depth: 4.0 m (13.1 ft)
Max Depth: 10.7 m (35.1 ft)
Volume: 842,053 m^3 (222,446,869 gal)
Shoreline Length: 2,576 m (8,951 ft)
Watershed Area: 1,168 ha (2,885 ac)

Lake Levels

Adjustable Control Structure: No
Operator: N/A
Operating Range: N/A
Contributing Water body: Lake Gibson
Discharges to: Lake Parker
10 Yr. Flood: no data
100 Yr. Flood: 134.00
Historic High: no data
Historic Low: no data
2009 Avg: no data
2009 High: no data
2009 Low: no data

Water Quality

FDEP Verified Impairments: none
COL Potential Impairments: nutrients
Limiting Nutrient: balanced

Parameter (unit)	2009 Avg	5 yr Avg	5 yr Min	5 yr Max
Temperature (°C)	22.85	23.99	16.67	29.68
pH (std unit)	8.74	9.00	7.46	10.16
Conductivity (uS)	215	198	156	233
Dissolved Oxygen (mg/L)	10.44	10.03	2.79	16.46
Turbidity (NTU)	15.7	12.1	2.5	32.1
Secchi Disk (m)	0.53	0.66	0.30	0.98
TSI	76	74	66	86
Total Alkalinity (mg/L)	60	56	41	71
Total Ammonia (mg/L)	0.339	0.261	0.010	1.260
Total Kjeldahl Nitrogen (mg/L)	2.729	2.136	1.093	4.440
Nitrate-Nitrite (mg/L)	0.014	0.081	0.010	0.547
Total Nitrogen (mg/L)	2.735	2.212	1.093	4.467
Total Phosphorus (mg/L)	0.129	0.144	0.065	0.232
Ortho Phosphorus (mg/L)	0.006	0.024	0.005	0.086
Chlorophyll a, uncorrected (ug/L)	70.6	67.2	22.0	144.9
Color (Pt-Co)	30	42	15	77
Total Dissolved Solids (mg/L)	140	117	50	164
Total Suspended Solids (mg/L)	16	12	6	24
Calcium (mg/L)	24.2	18.4	10.9	26.1
Magnesium (mg/L)	4.2	4.0	3.1	5.0
Total Hardness (mg/L)	77.9	62.2	40.8	84.4
Cadmium (ug/L)	0.02	0.29	0.02	1.20
Copper (ug/L)	2	6	2	21
Lead (ug/L)	0.4	0.5	0.2	1.1
Zinc (ug/L)	6	13	3	36
Fecal Coliform (#/100 ml)	10	9	1	10
Total Coliform (#/100 ml)	125	395	10	4800

Table 5. Water quality data summary for Lake Crago.

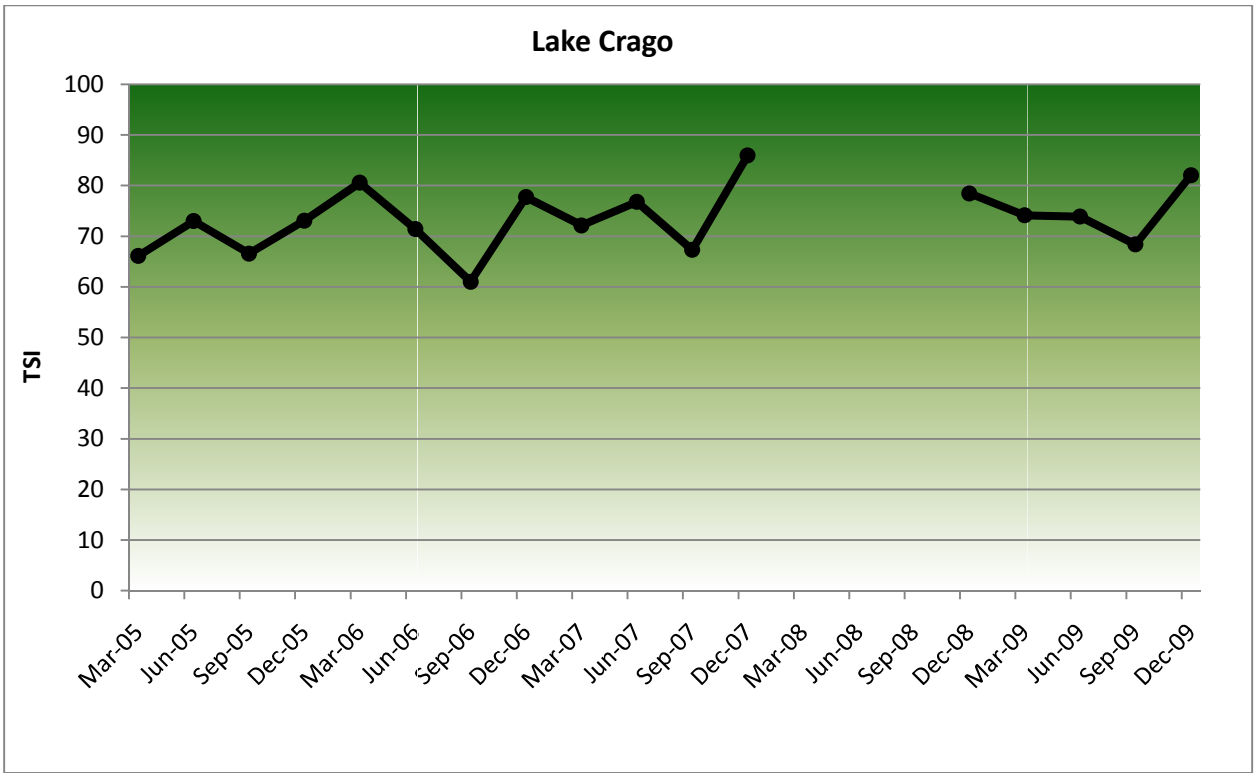

Figure 24. Lake Crago TSI from 2005 to 2009.

Lake Gibson

General Information

Section-Township-Range: 25-27-23
Lat/Long: 28°06'31" N/ 81°57'33" W
Drainage Basin: Peace River
Origin: Natural
Public Boat Ramp: Yes
Surface Area: 198 ha (490 ac)
Avg. Depth: 2.0 m (6.6 ft)
Max Depth: 6.1 m (20.0 ft)
Volume: 3,888,927 m^3 (1,027,345,827 gal)
Shoreline Length: 10,467 m (34,340 ft)
Watershed Area: 1,013 ha (2,502 ac)

Lake Levels

Adjustable Control Structure: Yes
Operator: SWFWMD
Operating Range: no data
Contributing Water body: none
Discharges to: Lake Crago
10 Yr. Flood: 144.20
100 Yr. Flood: 146.00
Historic High: 145.15 (9/9/88)
Historic Low: 140.36 (5/8/09)
2009 Avg: 142.15
2009 High: 142.98
2009 Low: 140.36

Water Quality

FDEP Verified Impairments: none
COL Potential Impairments: nutrients
Limiting Nutrient: nitrogen

Parameter (unit)	2009 Avg	5 yr Avg	5 yr Min	5 yr Max
Temperature (°C)	22.45	23.81	16.75	30.09
pH (std unit)	8.15	8.04	7.54	9.81
Conductivity (uS)	216	186	136	222
Dissolved Oxygen (mg/L)	6.91	7.71	3.56	10.89
Turbidity (NTU)	4.1	2.4	0.1	5.8
Secchi Disk (m)	1.14	1.62	0.76	2.65
TSI	62	52	39	71
Total Alkalinity (mg/L)	38	31	15	61
Total Ammonia (mg/L)	0.014	0.115	0.010	0.526
Total Kjeldahl Nitrogen (mg/L)	1.163	0.880	0.441	2.140
Nitrate-Nitrite (mg/L)	0.010	0.019	0.010	0.089
Total Nitrogen (mg/L)	1.163	0.893	0.453	2.140
Total Phosphorus (mg/L)	0.091	0.119	0.061	0.168
Ortho Phosphorus (mg/L)	0.035	0.072	0.005	0.108
Chlorophyll a, uncorrected (ug/L)	24.5	13.9	2.1	49.0
Color (Pt-Co)	26	44	17	85
Total Dissolved Solids (mg/L)	132	112	54	196
Total Suspended Solids (mg/L)	6	4	1	9
Calcium (mg/L)	18.6	13.0	9.2	21.4
Magnesium (mg/L)	4.4	3.9	2.9	5.0
Total Hardness (mg/L)	64.6	48.4	36.9	72.0
Cadmium (ug/L)	0.02	0.61	0.02	7.70
Copper (ug/L)	2	5	2	19
Lead (ug/L)	0.4	0.6	0.2	1.6
Zinc (ug/L)	6	13	3	37
Fecal Coliform (#/100 ml)	10	10	1	10
Total Coliform (#/100 ml)	275	179	10	1000

Table 6. Water quality data summary for Lake Gibson.

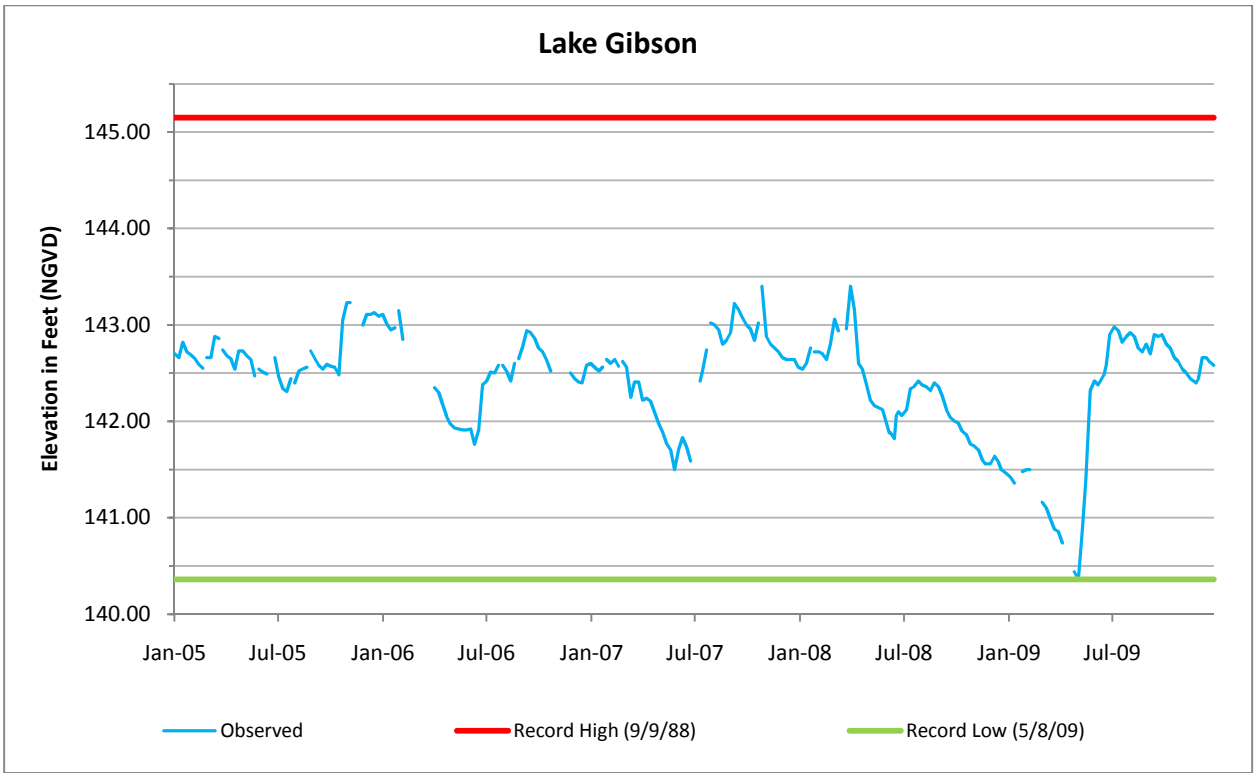

Figure 25. Lake Gibson elevation from 2005 to 2009.

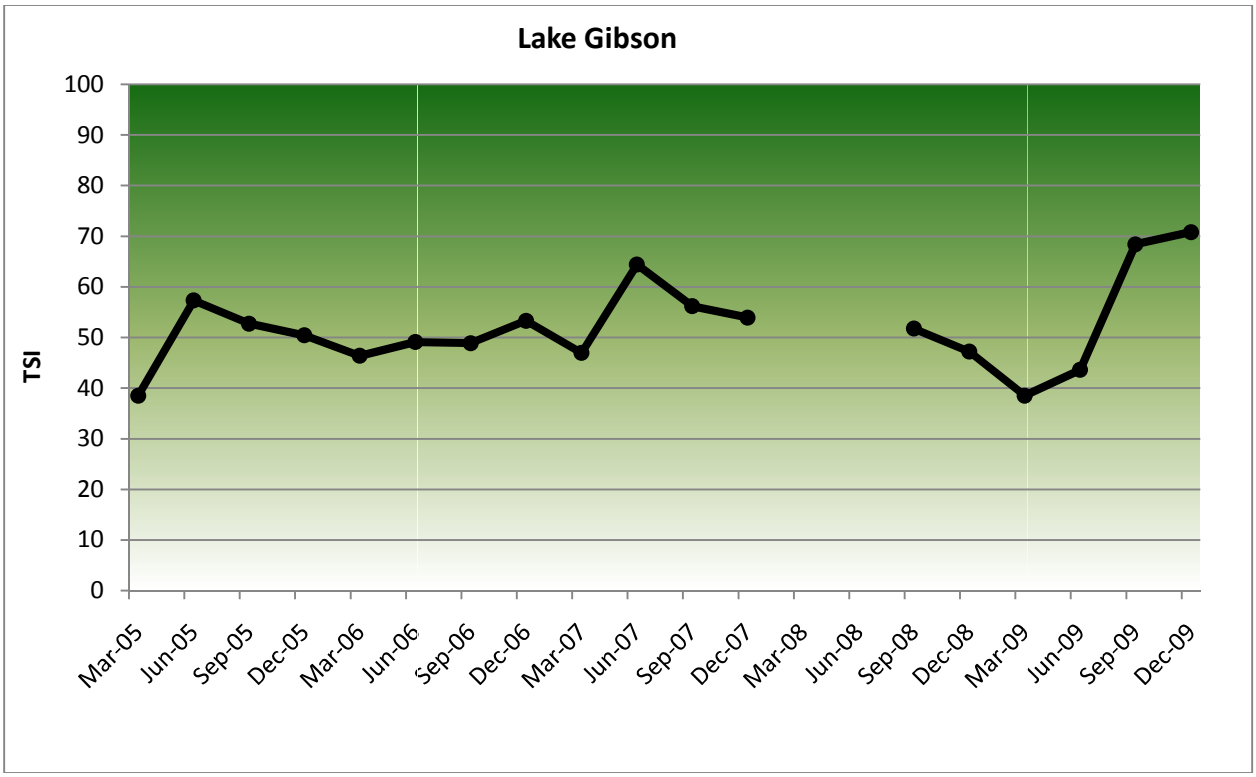

Figure 26. Lake Gibson TSI from 2005 to 2009.

Lake Hollingsworth

General Information

Section-Township-Range: 30-28-24
Lat/Long: 28°01'30" N/81°56'44" W
Drainage Basin: Peace River
Origin: Natural
Public Boat Ramp: Yes
Surface Area: 144 ha (356 ac)
Avg. Depth: 1.2 m (3.9 ft)
Max Depth: 4.3 m (14.2 ft)
Volume: 3,001,061 m^3 (792,833,452 gal)
Shoreline Length: 4,529 m (14,857 ft)
Watershed Area: 667 ha (1,647 ac)

Lake Levels

Adjustable Control Structure: Yes
Operator: City of Lakeland
Operating Range: 130.50-131.50
Contributing Water body: Lake Morton, Lake Horney
Discharges to: Lake Bentley
10 Yr. Flood: 134.20
100 Yr. Flood: 135.00
Historic High: 133.21 (7/14/91)
Historic Low: 129.72 (5/20/94)
2009 Avg: 131.11
2009 High: 131.60
2009 Low: 130.44

Water Quality

FDEP Verified Impairments: none
COL Potential Impairments: nutrients
Limiting Nutrient: balanced

Parameter (unit)	2009 Avg	5 yr Avg	5 yr Min	5 yr Max
Temperature (°C)	22.31	23.04	11.75	32.09
pH (std unit)	8.44	8.58	7.08	10.49
Conductivity (uS)	176	177	141	212
Dissolved Oxygen (mg/L)	9.69	9.48	4.89	14.38
Turbidity (NTU)	12.2	11.9	0.7	28.2
Secchi Disk (m)	0.54	0.53	0.05	0.82
TSI	71	71	50	86
Total Alkalinity (mg/L)	37	42	22	100
Total Ammonia (mg/L)	0.011	0.058	0.001	1.128
Total Kjeldahl Nitrogen (mg/L)	1.744	2.025	0.768	9.607
Nitrate-Nitrite (mg/L)	0.013	0.074	0.010	6.681
Total Nitrogen (mg/L)	1.749	2.089	0.768	9.620
Total Phosphorus (mg/L)	0.087	0.101	0.017	1.030
Ortho Phosphorus (mg/L)	0.005	0.008	0.003	0.081
Chlorophyll a, uncorrected (ug/L)	53.5	56.8	12.1	123.5
Color (Pt-Co)	20	41	6	118
Total Dissolved Solids (mg/L)	110	107	42	176
Total Suspended Solids (mg/L)	21	19	8	40
Calcium (mg/L)	16.6	15.7	3.2	20.0
Magnesium (mg/L)	3.8	3.6	2.6	14.9
Total Hardness (mg/L)	57.2	54.1	21.1	98.6
Cadmium (ug/L)	0.02	0.31	0.02	7.50
Copper (ug/L)	2	5	2	19
Lead (ug/L)	0.58	1.27	0.04	5.50
Zinc (ug/L)	9	15	2	93
Fecal Coliform (#/100 ml)	92	143	10	960
Total Coliform (#/100 ml)	265	410	10	2400

Table 7. Water quality data summary for Lake Hollingsworth.

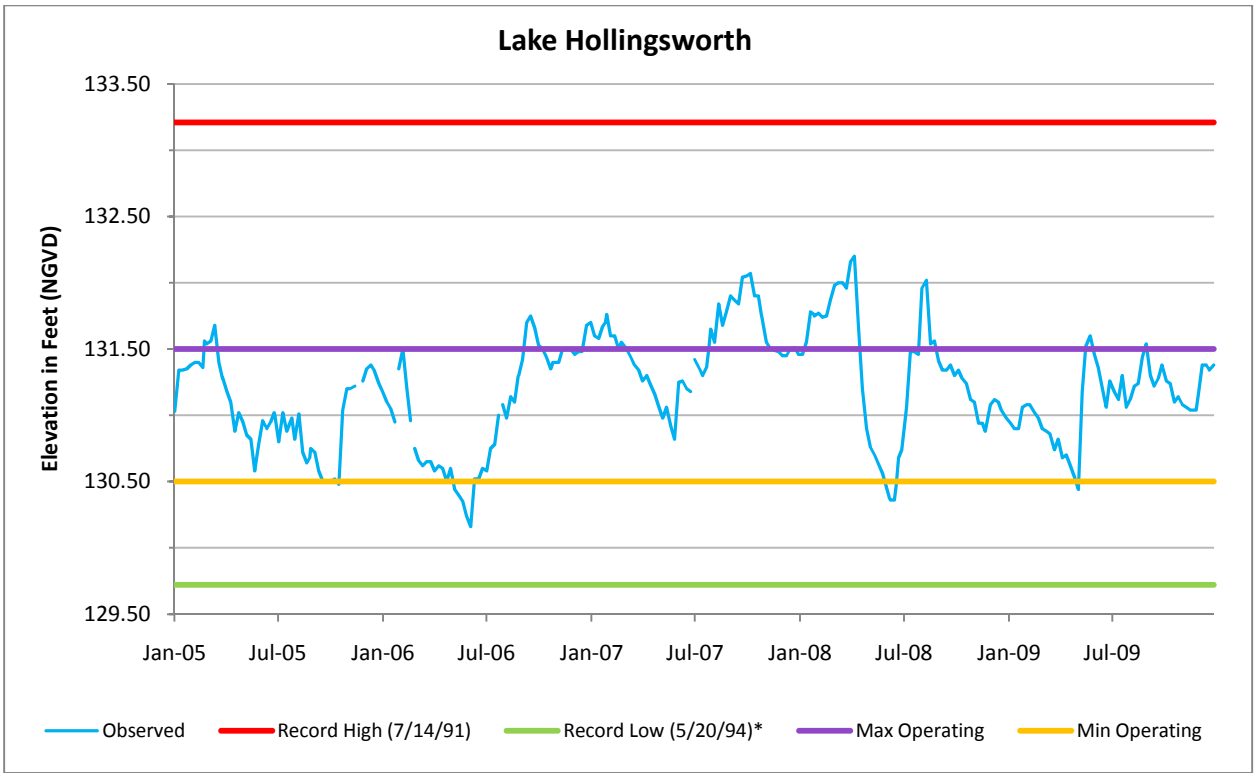

Figure 27. Lake Hollingsworth elevation from 2005 to 2009. *Data from dredging period omitted.

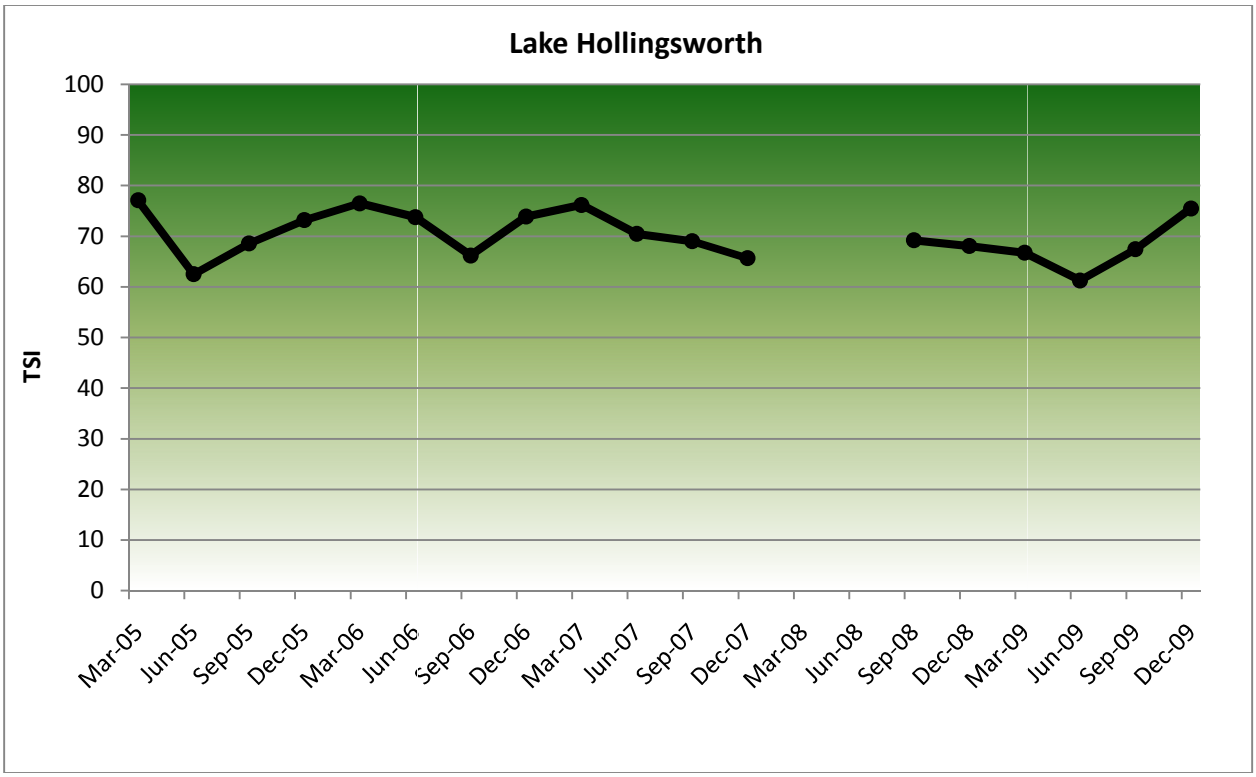

Figure 28. Lake Hollingsworth TSI from 2005 to 2009.

Lake Holloway

General Information

Section-Township-Range: 21-28-24
Lat/Long: 28°02'04" N/ 81°55'01" W
Drainage Basin: Peace River
Origin: Natural
Public Boat Ramp: No
Surface Area: 10 ha (24 ac)
Avg. Depth: 2.0 m (6.6 ft)
Max Depth: 3.7 m (12.1 ft)
Volume: 206,465 m^3 (54,542,283 gal)
Shoreline Length: 1,223 m (4,105 ft)
Watershed Area: 121 ha (299 ac)

Lake Levels

Adjustable Control Structure: No
Operator: N/A
Operating Range: 138.00-139.00
Contributing Water body: none
Discharges to: Little Lake Bonny
10 Yr. Flood: no data
100 Yr. Flood: 141.00
Historic High: 140.32 (7/24/98)
Historic Low: 135.53 (6/22/01)
2009 Avg: 137.82
2009 High: 138.70
2009 Low: 136.10

Water Quality

FDEP Verified Impairments: none
COL Potential Impairments: nutrients
Limiting Nutrient: balanced

Parameter (unit)	2009 Avg	5 yr Avg	5 yr Min	5 yr Max
Temperature (°C)	23.56	24.81	17.33	31.65
pH (std unit)	8.08	8.29	7.04	9.31
Conductivity (uS)	180	192	167	214
Dissolved Oxygen (mg/L)	9.56	9.07	4.47	11.91
Turbidity (NTU)	5.8	5.8	0.1	35.9
Secchi Disk (m)	1.65	1.57	0.45	2.95
TSI	59	57	49	68
Total Alkalinity (mg/L)	38	44	33	57
Total Ammonia (mg/L)	0.010	0.054	0.010	0.192
Total Kjeldahl Nitrogen (mg/L)	1.242	1.304	0.560	2.983
Nitrate-Nitrite (mg/L)	0.011	0.017	0.010	0.036
Total Nitrogen (mg/L)	1.246	1.317	0.560	3.010
Total Phosphorus (mg/L)	0.042	0.055	0.032	0.099
Ortho Phosphorus (mg/L)	0.005	0.010	0.005	0.040
Chlorophyll a, uncorrected (ug/L)	24.3	20.5	2.7	59.0
Color (Pt-Co)	26	35	3	62
Total Dissolved Solids (mg/L)	109	115	72	148
Total Suspended Solids (mg/L)	6	7	4	16
Calcium (mg/L)	20.4	18.5	15.2	23.2
Magnesium (mg/L)	2.4	2.4	2.0	2.8
Total Hardness (mg/L)	60.7	56.3	47.0	69.5
Cadmium (ug/L)	0.02	1.88	0.02	25.90
Copper (ug/L)	2	6	2	14
Lead (ug/L)	0.4	0.7	0.2	1.6
Zinc (ug/L)	10	18	3	53
Fecal Coliform (#/100 ml)	15	12	5	30
Total Coliform (#/100 ml)	200	114	20	400

Table 8. Water quality data summary for Lake Holloway.

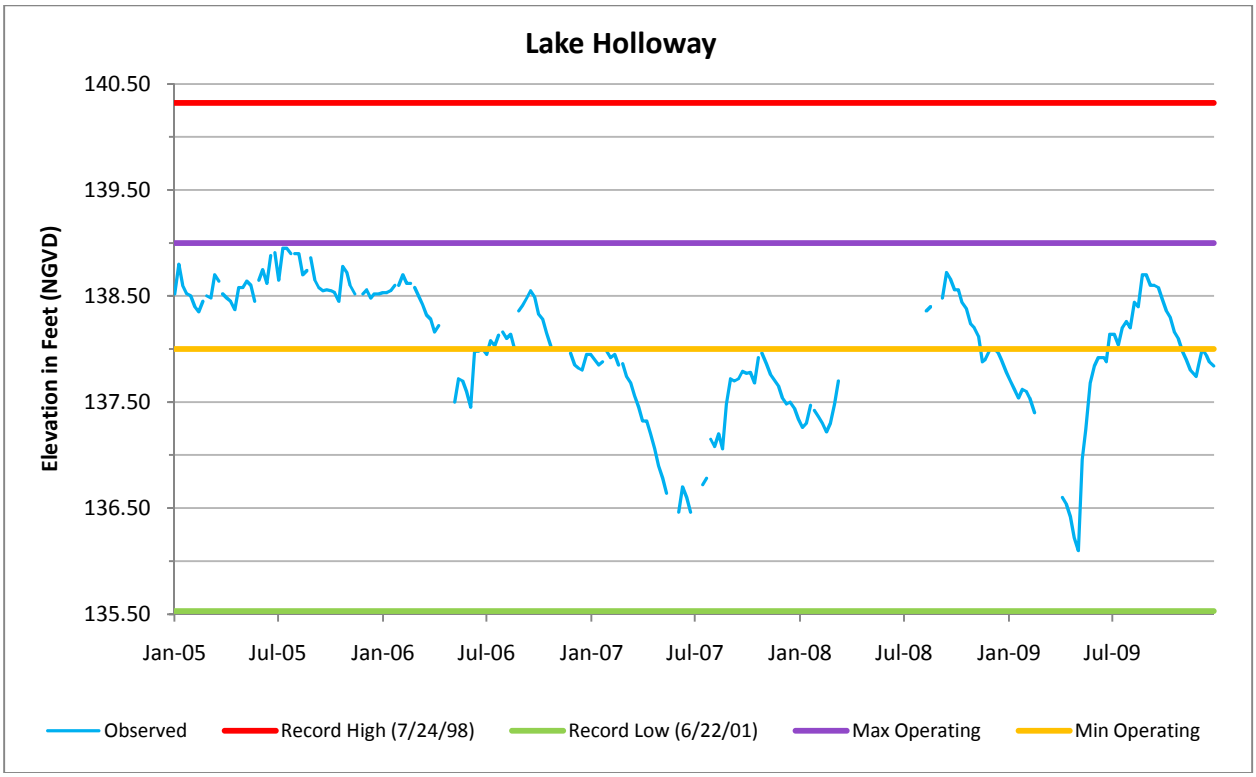

Figure 29. Lake Holloway elevation from 2005 to 2009.

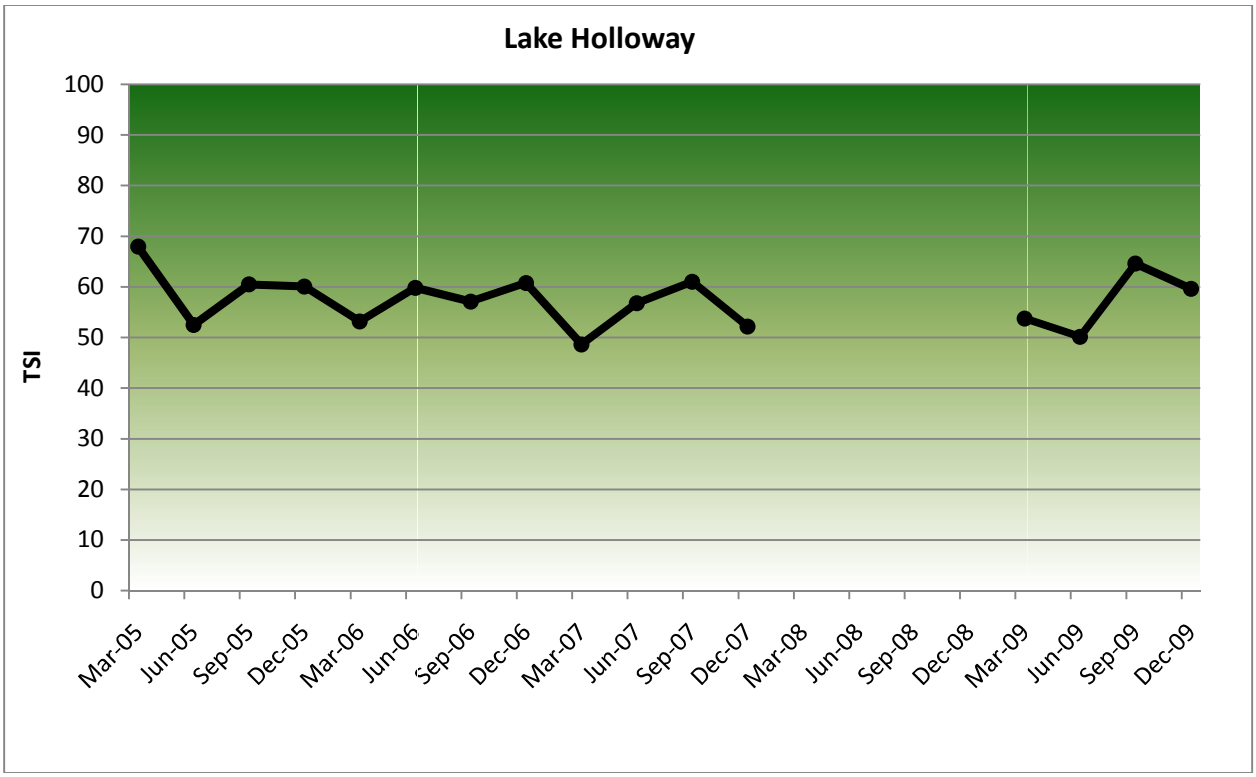

Figure 30. Lake Holloway TSI from 2005 to 2009.

Lake Horney

General Information

Section-Township-Range: 20-28-24
Lat/Long: 28°01'59" N/81°56'20" W
Drainage Basin: Peace River
Origin: dredged natural willow wetland
Public Boat Ramp: No
Surface Area: 3 ha (7 ac)

Avg. Depth: 1.2 m (3.9 ft)
Max Depth: 3.0 m (9.8 ft)
Volume: 32,429 m3 (8,566,835 gal)
Shoreline Length: 677 m (2,221 ft)
Watershed Area: 108 ha (267 ac)

Lake Levels

Adjustable Control Structure: Yes
Operator: City of Lakeland
Operating Range: up to 137.10
Contributing Water body: Morton
Discharges to: Lake Hollingsworth
10 Yr. Flood: no data

100 Yr. Flood: no data
Historic High: 138.30 (6/24/02)
Historic Low: 134.16 (5/8/09)
2009 Avg: 136.37
2009 High: 137.46
2009 Low: 134.16

Water Quality

FDEP Verified Impairments: none
COL Potential Impairments: nutrients
Limiting Nutrient: balanced

Parameter (unit)	2009 Avg	5 yr Avg	5 yr Min	5 yr Max
Temperature (°C)	21.21	23.80	14.04	31.40
pH (std unit)	7.90	7.87	7.06	9.68
Conductivity (uS)	184	169	138	218
Dissolved Oxygen (mg/L)	7.32	7.48	3.81	10.65
Turbidity (NTU)	4.4	7.5	0.7	20.5
Secchi Disk (m)	0.83	0.83	0.48	1.30
TSI	67	64	46	78
Total Alkalinity (mg/L)	67	58	36	92
Total Ammonia (mg/L)	0.012	0.029	0.010	0.116
Total Kjeldahl Nitrogen (mg/L)	1.585	1.417	0.675	3.395
Nitrate-Nitrite (mg/L)	0.010	0.016	0.010	0.044
Total Nitrogen (mg/L)	1.585	1.425	0.675	3.395
Total Phosphorus (mg/L)	0.089	0.143	0.067	0.503
Ortho Phosphorus (mg/L)	0.008	0.012	0.004	0.040
Chlorophyll a, uncorrected (ug/L)	40.5	32.5	2.3	144.0
Color (Pt-Co)	44	38	4	58
Total Dissolved Solids (mg/L)	116	99	32	172
Total Suspended Solids (mg/L)	10	11	3	36
Calcium (mg/L)	29.0	21.4	14.3	33.2
Magnesium (mg/L)	3.0	3.0	1.9	4.5
Total Hardness (mg/L)	84.8	65.5	46.8	96.5
Cadmium (ug/L)	0.03	0.75	0.02	5.90
Copper (ug/L)	2	6	2	15
Lead (ug/L)	0.6	1.9	0.2	4.4
Zinc (ug/L)	11	23	3	77
Fecal Coliform (#/100 ml)	18	36	10	220
Total Coliform (#/100 ml)	250	363	100	1800

Table 9. Water quality data summary for Lake Horney.

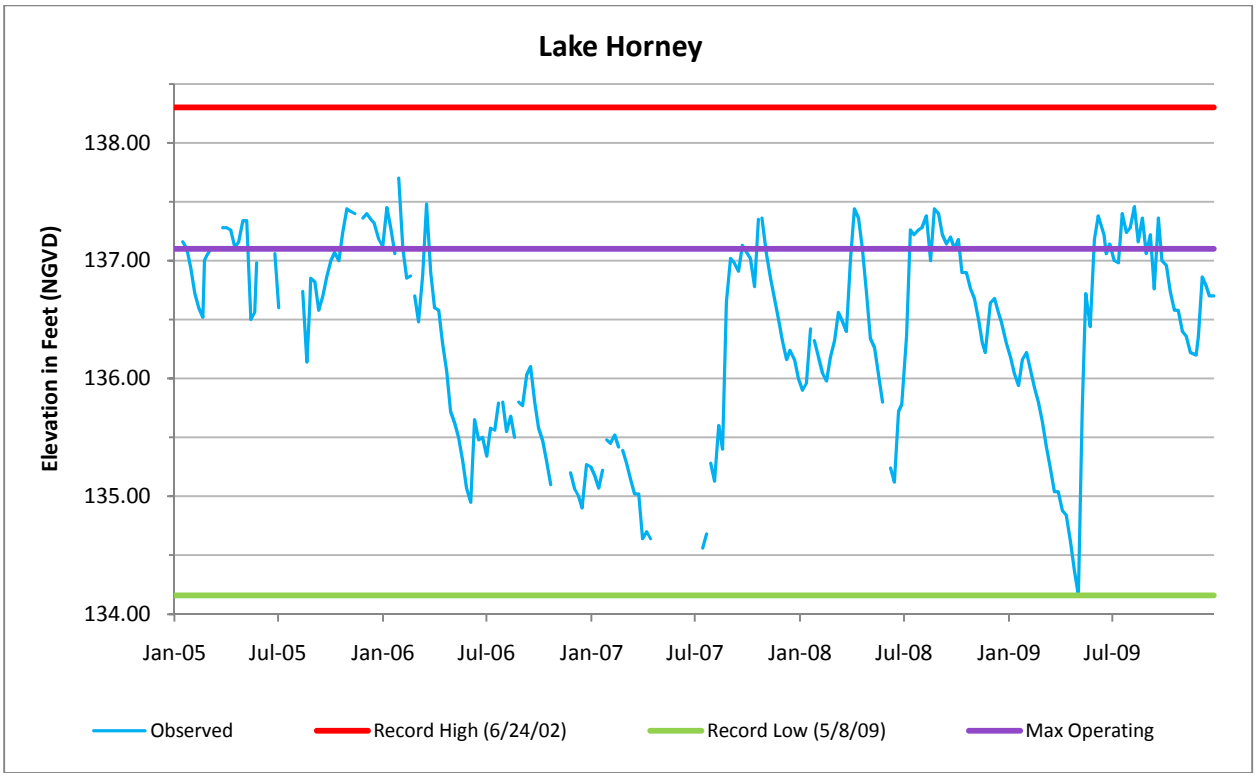

Figure 31. Lake Horney elevation from 2005 to 2009.

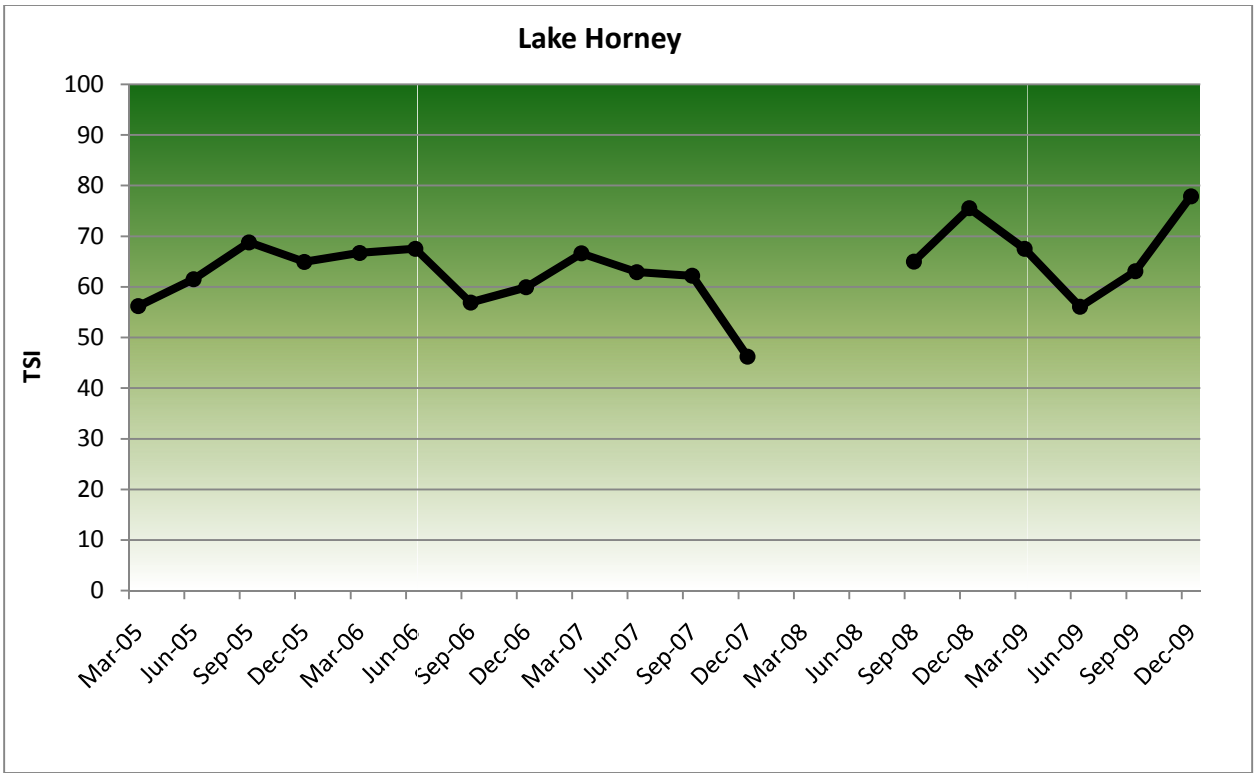

Figure 32. Lake Horney TSI from 2005 to 2009.

Lake Hunter

General Information

Section-Township-Range: 20-28-23
Lat/Long: 28°01'58" N/ 81°57'57"
Drainage Basin: Hillsborough River
Origin: Natural
Public Boat Ramp: Yes
Surface Area: 38 ha (93 ac)
Avg. Depth: 1.7m (5.6 ft)
Max Depth: 2.7 m (8.9 ft)
Volume: 676,151 m3 (178,620,197 gal)
Shoreline Length: 2,571 m (8,435 ft)
Watershed Area: 296 ha (731 ac)

Lake Levels

Adjustable Control Structure: Yes
Operator: City of Lakeland
Operating Range: 161.00 – 162.30
Contributing Water body: Lake Beulah, Lake Wire
Discharges to: Itchepackesassa Creek
10 Yr. Flood: 162.30
100 Yr. Flood: 163.00
Historic High: 163.25 (12/13/02)
Historic Low: 159.59 (2/23/96)
2009 Avg: 161.95
2009 High: 162.76
2009 Low: 161.56

Water Quality

FDEP Verified Impairments: nutrients
COL Potential Impairments: nutrients
Limiting Nutrient: balanced

Parameter (unit)	2009 Avg	5 yr Avg	5 yr Min	5 yr Max
Temperature (°C)	22.87	24.17	16.61	30.27
pH (std unit)	9.03	9.21	8.60	10.24
Conductivity (uS)	162	167	141	191
Dissolved Oxygen (mg/L)	11.88	10.36	5.15	17.29
Turbidity (NTU)	16.1	21.3	7.6	45.7
Secchi Disk (m)	0.46	0.38	0.27	0.65
TSI	73	77	60	84
Total Alkalinity (mg/L)	61	60	50	70
Total Ammonia (mg/L)	0.129	0.187	0.010	1.908
Total Kjeldahl Nitrogen (mg/L)	2.132	2.554	1.423	4.471
Nitrate-Nitrite (mg/L)	0.011	0.011	0.010	0.020
Total Nitrogen (mg/L)	2.135	2.555	1.437	4.471
Total Phosphorus (mg/L)	0.115	0.164	0.058	0.245
Ortho Phosphorus (mg/L)	0.005	0.009	0.005	0.040
Chlorophyll a, uncorrected (ug/L)	67.2	82.0	19.5	139.6
Color (Pt-Co)	22	43	7	85
Total Dissolved Solids (mg/L)	111	108	42	196
Total Suspended Solids (mg/L)	28	42	11	70
Calcium (mg/L)	24.2	19.4	12.7	27.5
Magnesium (mg/L)	2.1	2.2	1.7	2.7
Total Hardness (mg/L)	69.0	57.4	40.8	79.0
Cadmium (ug/L)	0.02	0.36	0.02	1.87
Copper (ug/L)	2	6	2	20
Lead (ug/L)	0.6	1.4	0.2	2.9
Zinc (ug/L)	6	17	3	62
Fecal Coliform (#/100 ml)	85	50	10	310
Total Coliform (#/100 ml)	550	483	100	3700

Table 10. Water quality data summary for Lake Hunter.

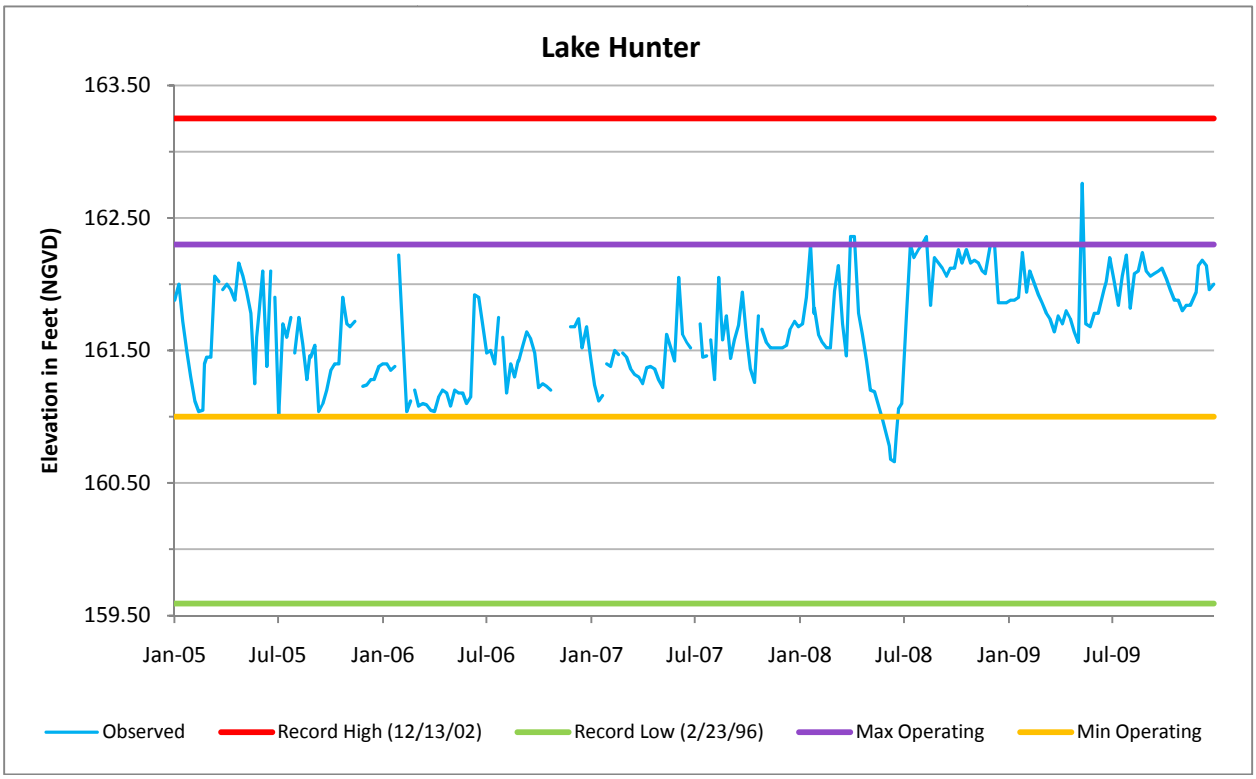

Figure 33. Lake Hunter elevation from 2005 to 2009.

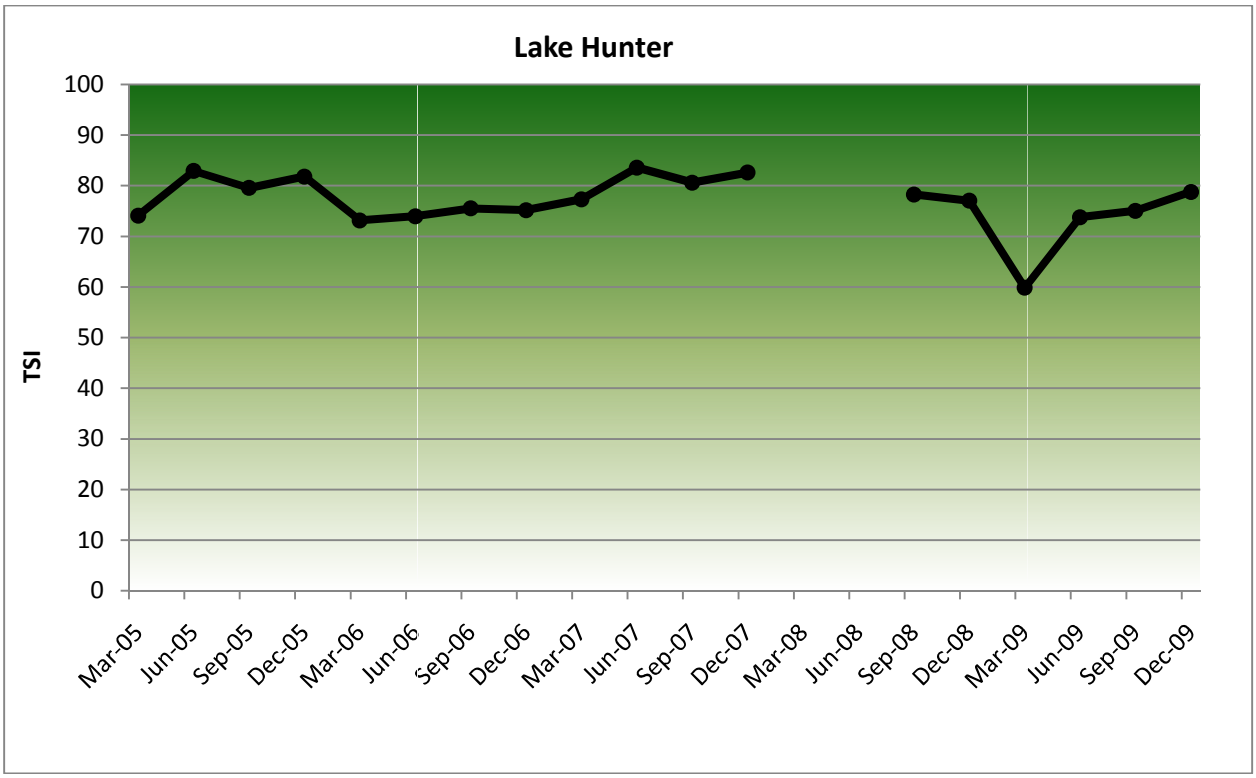

Figure 34. Lake Hunter TSI from 2005 to 2009.

Lake John

General Information

Section-Township-Range: 32-28-24
Lat/Long: 28°00'15'' N/ 81°56'17" W
Drainage Basin: Peace River
Origin: Phosphate Pit
Public Boat Ramp: Yes
Surface Area: 39 ha (97 ac)
Avg. Depth: 2.8 m (9.2 ft)
Max Depth: 6.1 m (20.0 ft)
Volume: 1,116,123 m^3 (294,848,504 gal)
Shoreline Length: 7,864 m (25,800 ft)
Watershed Area: 556 ha (1,373 ac)

Lake Levels

Adjustable Control Structure: No
Operator: N/A
Operating Range: N/A
Contributing Water body: Lake Somerset
Discharges to: Lake Somerset/Lake Wood/Lake Waterview
10 Yr. Flood: no data
100 Yr. Flood: 113.00
Historic High: 111.00 (7/14/91)
Historic Low: 107.28 (4/16/99)
2009 Avg: 108.13
2009 High: 108.64
2009 Low: 107.48

Water Quality

FDEP Verified Impairments: none
COL Potential Impairments: nutrients
Limiting Nutrient: nitrogen

Parameter (unit)	2009 Avg	5 yr Avg	5 yr Min	5 yr Max
Temperature (°C)	21.52	24.00	15.61	31.29
pH (std unit)	8.56	8.67	7.67	10.09
Conductivity (uS)	199.75	213	181	259
Dissolved Oxygen (mg/L)	11.79	9.62	4.02	15.97
Turbidity (NTU)	12.6	7.8	2.5	24.9
Secchi Disk (m)	0.57	0.67	0.45	0.85
TSI	75	69	49	78
Total Alkalinity (mg/L)	66	69	44	88
Total Ammonia (mg/L)	0.012	0.061	0.002	0.541
Total Kjeldahl Nitrogen (mg/L)	1.824	1.482	0.310	2.707
Nitrate-Nitrite (mg/L)	0.015	0.015	0.010	0.042
Total Nitrogen (mg/L)	1.831	1.489	0.310	2.707
Total Phosphorus (mg/L)	0.270	0.255	0.159	0.343
Ortho Phosphorus (mg/L)	0.086	0.085	0.008	0.162
Chlorophyll a, uncorrected (ug/L)	72.9	51.1	13.6	86.0
Color (Pt-Co)	33	42	20	66
Total Dissolved Solids (mg/L)	120	126	68	204
Total Suspended Solids (mg/L)	17	13	8	27
Calcium (mg/L)	27.2	22.6	14.6	30.9
Magnesium (mg/L)	3.1	3.3	2.2	4.9
Total Hardness (mg/L)	80.4	70.1	45.5	91.2
Cadmium (ug/L)	0.02	0.46	0.02	3.80
Copper (ug/L)	2	6	2	16
Lead (ug/L)	0.4	0.6	0.2	1.5
Zinc (ug/L)	7	17	3	65
Fecal Coliform (#/100 ml)	15	31	2	300
Total Coliform (#/100 ml)	575	506	10	3200

Table 11. Water quality summary for Lake John.

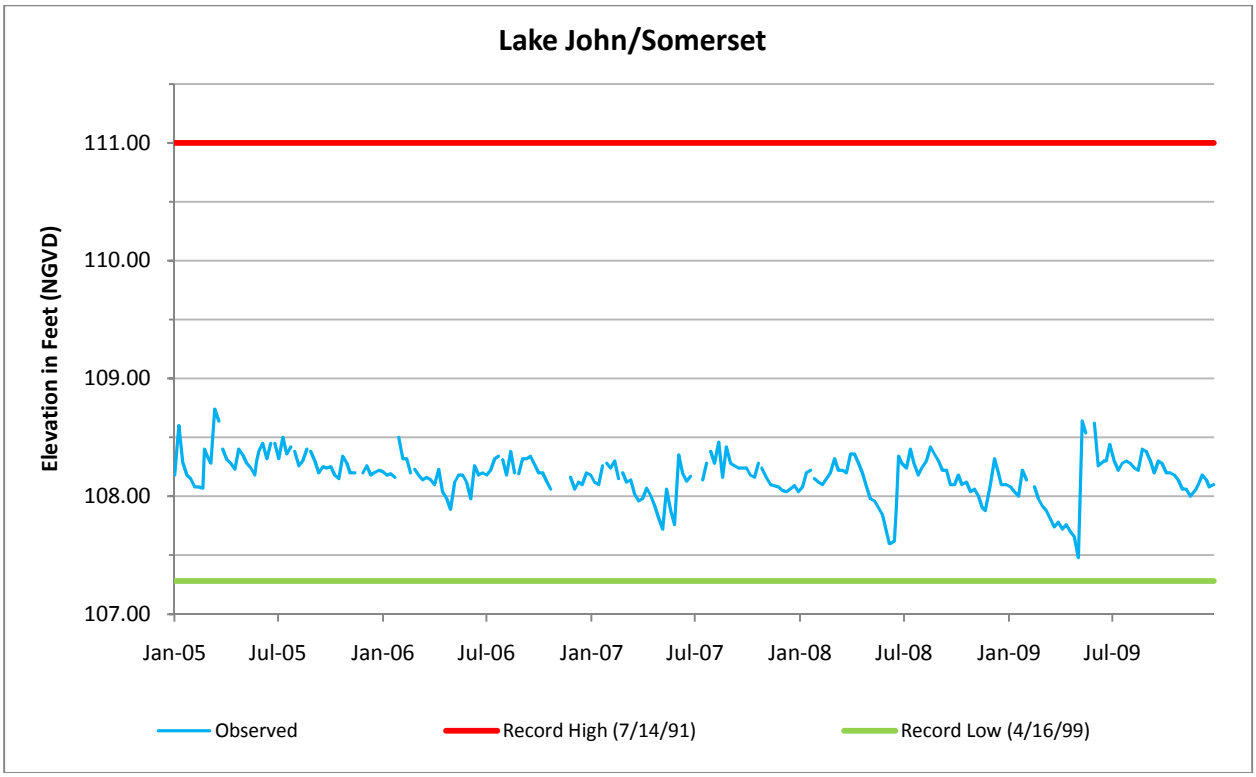

Figure 35. Lake John and Lake Somerset elevation from 2005 to 2009.

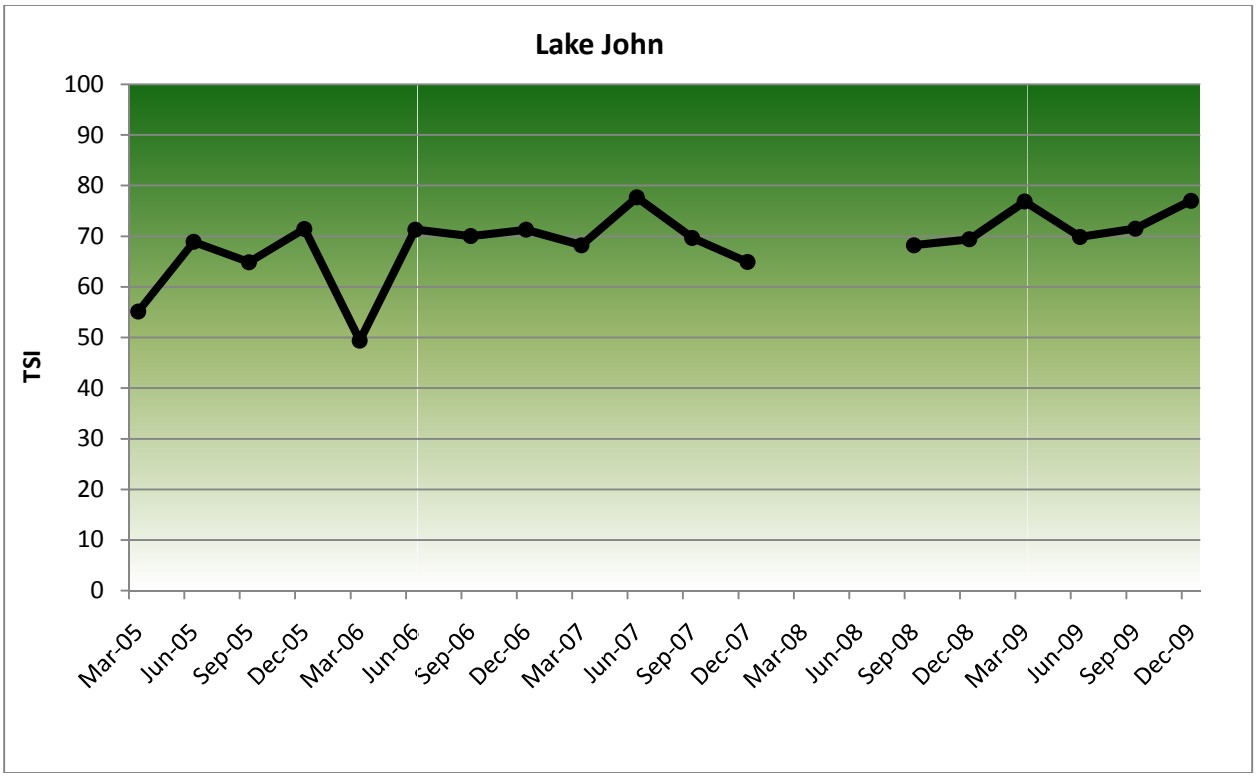

Figure 36. Lake John TSI from 2005 to 2009.

Meadow View Lake

General Information

Section-Township-Range: 35-27-23
Lat/Long: 28° 05' 55" N/ 81° 59' 03" W
Drainage Basin: Hillsborough River
Origin: Natural
Public Boat Ramp: No
Surface Area: 21 ha (51 ac)

Avg. Depth: no data
Max Depth: no data
Volume: no data
Shoreline Length: 2,560 m (8,399 ft)
Watershed Area: no data

Lake Levels

Adjustable Control Structure: No
Operator: N/A
Operating Range: N/A
Contributing Water body: none
Discharges to: Itchepackesassa
10 Yr. Flood: no data

100 Yr. Flood: no data
Historic High: no data
Historic Low: no data
2009 Avg: no data
2009 High: no data
2009 Low: no data

Water Quality

FDEP Verified Impairments: none
COL Potential Impairments: nutrients
Limiting Nutrient: balanced

Parameter (unit)	2009 Avg	5 yr Avg	5 yr Min	5 yr Max
Temperature (°C)	20.36	22.86	14.74	28.85
pH (std unit)	8.67	8.04	7.11	9.57
Conductivity (uS)	157	185	148	230
Dissolved Oxygen (mg/L)	10.32	8.30	3.01	11.81
Turbidity (NTU)	9.7	8.5	2.3	41.8
Secchi Disk (m)	0.61	0.99	0.55	1.78
TSI	68	62	73	43
Total Alkalinity (mg/L)	51	60	49	76
Total Ammonia (mg/L)	0.017	0.079	0.010	0.288
Total Kjeldahl Nitrogen (mg/L)	1.372	1.239	0.774	2.201
Nitrate-Nitrite (mg/L)	0.010	0.083	0.010	0.747
Total Nitrogen (mg/L)	1.372	1.315	0.774	2.201
Total Phosphorus (mg/L)	0.095	0.113	0.045	0.368
Ortho Phosphorus (mg/L)	0.005	0.010	0.005	0.057
Chlorophyll a, uncorrected (ug/L)	52.1	31.9	5.2	72.5
Color (Pt-Co)	17	38	8	84
Total Dissolved Solids (mg/L)	119	109	72	144
Total Suspended Solids (mg/L)	16	10	2	25
Calcium (mg/L)	17.1	16.3	10.7	19.3
Magnesium (mg/L)	5.1	6.2	4.1	10.9
Total Hardness (mg/L)	63.7	66.2	48.9	92.9
Cadmium (ug/L)	0.02	1.24	0.02	11.20
Copper (ug/L)	2	5	2	13
Lead (ug/L)	0.4	0.6	0.2	1.5
Zinc (ug/L)	6	17	3	50
Fecal Coliform (#/100 ml)	25	33	6	120
Total Coliform (#/100 ml)	250	166	30	600

Table 12. Water quality data summary for Meadow View Lake.

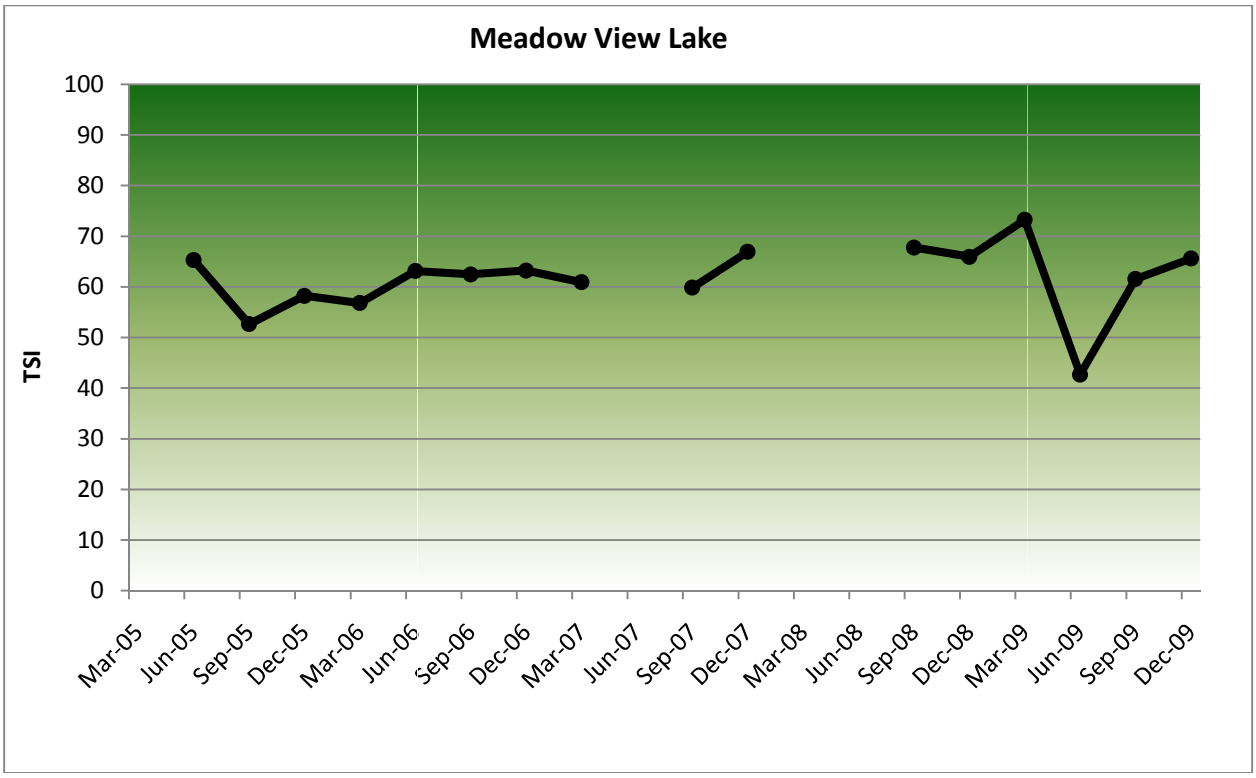

Figure 37. Meadow View Lake TSI from 2005 to 2009.

Lake Mirror

General Information

Section-Township-Range: 18-28-24
Lat/Long: 28°02'38" N / 81°57'06" W
Drainage Basin: Peace River
Origin: Natural
Public Boat Ramp: No
Surface Area: 7 ha (18 ac)
Avg. Depth: 2.7 m (8.9 ft)
Max Depth: 5.2 m (17.1 ft)
Volume: 197,428 m^3 (52,154,960 gal)
Shoreline Length: 1,052 m (3,453 ft)
Watershed Area: 36 ha (89 ac)

Lake Levels

Adjustable Control Structure: Yes
Operator: City of Lakeland
Operating Range: 177.50-179.00
Contributing Water body: none
Discharges to: Lake Parker
10 Yr. Flood: no data
100 Yr. Flood: no data
Historic High: 180.01 (11/23/88)
Historic Low: 177.10 (5/11/01)
2009 Avg: 178.52
2009 High: 178.92
2009 Low: 178.04

Water Quality

FDEP Verified Impairments: none
COL Potential Impairments: nutrients
Limiting Nutrient: balanced

Parameter (unit)	2009 Avg	5 yr Avg	5 yr Min	5 yr Max
Temperature (°C)	21.73	23.09	15.38	30.52
pH (std unit)	7.98	8.40	7.43	9.63
Conductivity (uS)	193	209	171	248
Dissolved Oxygen (mg/L)	8.66	9.06	3.89	14.17
Turbidity (NTU)	9.4	8.1	3.4	13.7
Secchi Disk (m)	0.60	0.66	0.51	0.82
TSI	69	66	56	73
Total Alkalinity (mg/L)	82	81	68	98
Total Ammonia (mg/L)	0.018	0.051	0.010	0.263
Total Kjeldahl Nitrogen (mg/L)	1.384	1.265	0.587	2.200
Nitrate-Nitrite (mg/L)	0.010	0.018	0.010	0.087
Total Nitrogen (mg/L)	1.384	1.275	0.587	2.200
Total Phosphorus (mg/L)	0.101	0.099	0.075	0.149
Ortho Phosphorus (mg/L)	0.005	0.011	0.005	0.046
Chlorophyll a, uncorrected (ug/L)	53.8	42.8	16.0	75.2
Color (Pt-Co)	15	27	7	71
Total Dissolved Solids (mg/L)	118	116	93	148
Total Suspended Solids (mg/L)	15	12	6	22
Calcium (mg/L)	32.1	26.7	18.7	36.0
Magnesium (mg/L)	2.7	2.9	2.1	3.7
Total Hardness (mg/L)	91.4	78.5	60.5	102.3
Cadmium (ug/L)	0.02	0.42	0.02	1.70
Copper (ug/L)	2	6	2	21
Lead (ug/L)	1.9	2.5	0.2	9.5
Zinc (ug/L)	10	14	5	23
Fecal Coliform (#/100 ml)	198	135	10	470
Total Coliform (#/100 ml)	1000	953	100	2300

Table 13. Water quality data summary for Lake Mirror.

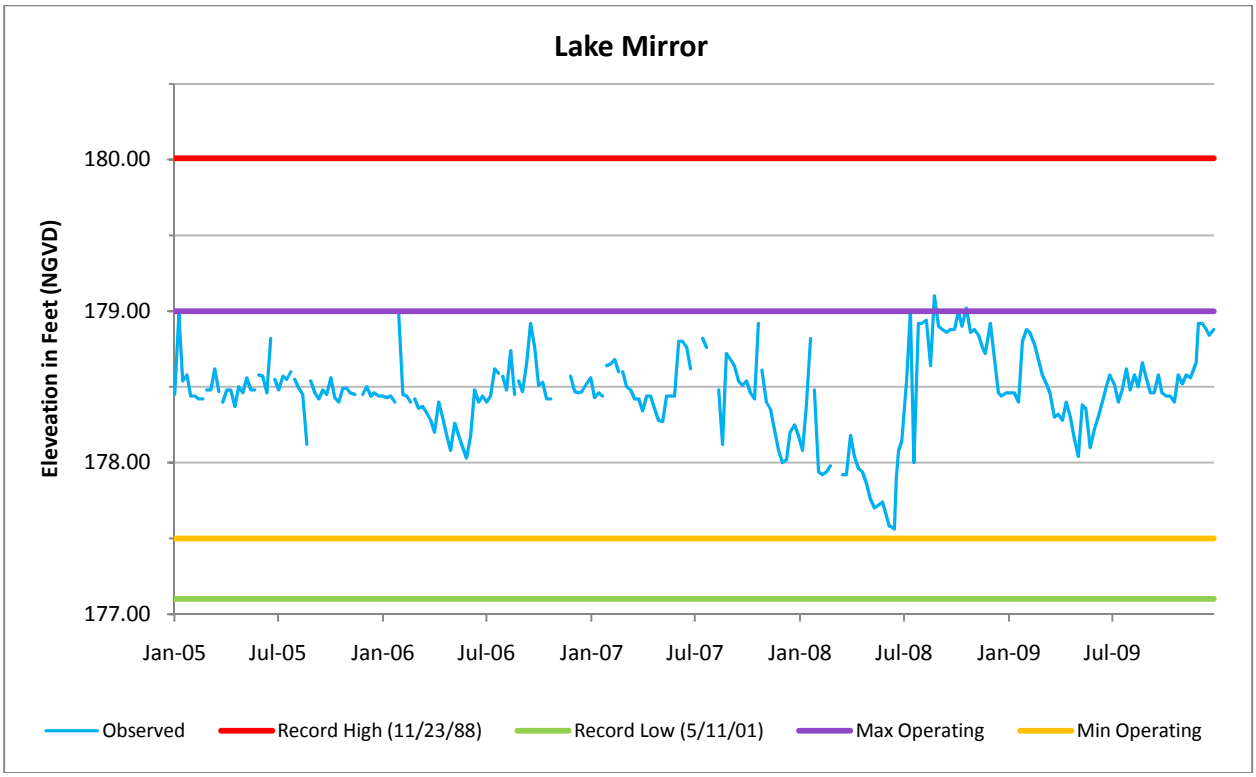

Figure 38. Lake Mirror elevations from 2005 to 2009.

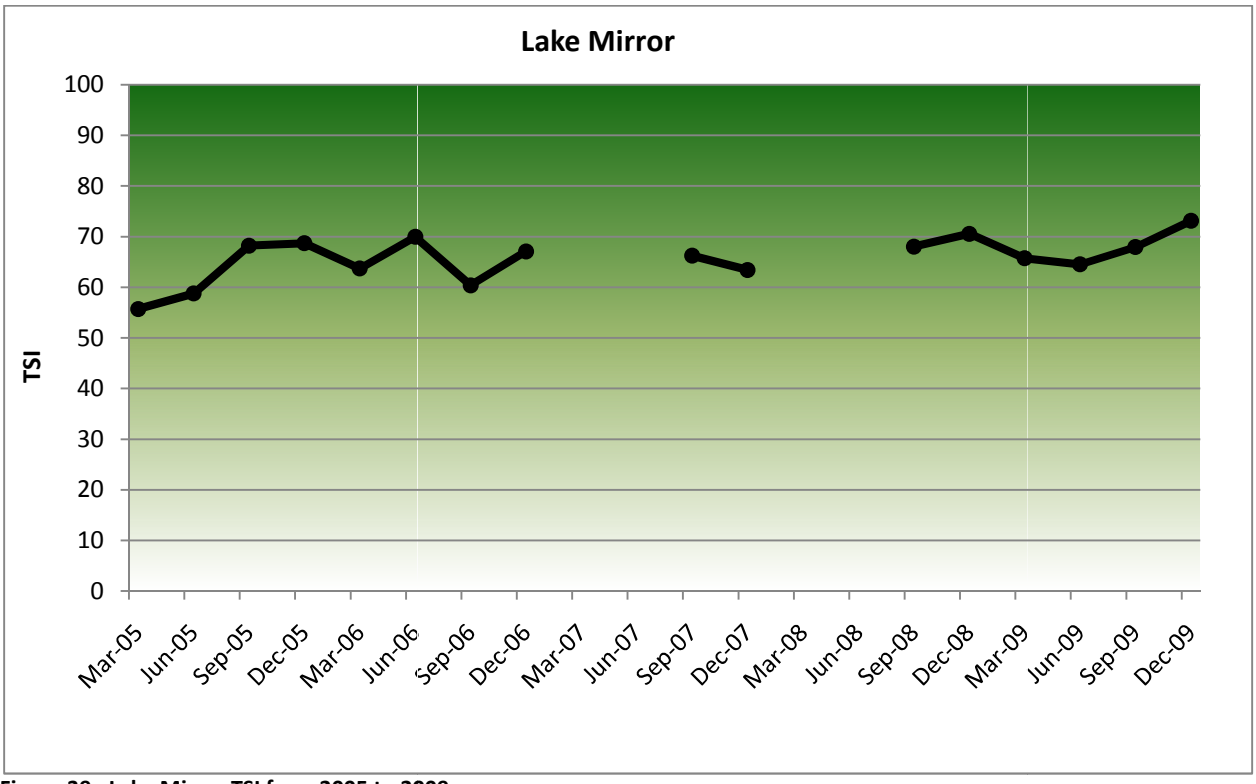

Figure 39. Lake Mirror TSI from 2005 to 2009.

Lake Morton

General Information

Section-Township-Range: 19-28-24
Lat/Long: 28°02'17" N/81°57'11" W
Drainage Basin: Peace River
Origin: Natural
Public Boat Ramp: No
Surface Area: 16 ha (40 ac)
Avg. Depth: 3.6 m (11.8 ft)
Max Depth: 6.7 m (22.0 ft)
Volume: 576,331 m^3 (152,250,543 gal)
Shoreline Length: 1,463 m (4,800 ft)
Watershed Area: 58 ha (143 ac)

Lake Levels

Adjustable Control Structure: Yes
Operator: City of Lakeland
Operating Range: 177.50-178.70
Contributing Water body: none
Discharges to: Lake Hollingsworth
10 Yr. Flood: no data
100 Yr. Flood: no data
Historic High: 181.00 (7/13/91)
Historic Low: 175.82 (5/15/06)
2009 Avg: 177.44
2009 High: 178.56
2009 Low: 175.80

Water Quality

FDEP Verified Impairments: none
COL Potential Impairments: nutrients
Limiting Nutrient: balanced

Parameter (unit)	2009 Avg	5 yr Avg	5 yr Min	5 yr Max
Temperature (°C)	23.11	23.81	17.09	31.03
pH (std unit)	8.60	8.82	7.57	9.52
Conductivity (uS)	158	178	130	227
Dissolved Oxygen (mg/L)	10.28	9.05	3.88	14.30
Turbidity (NTU)	14.9	12.0	3.8	28.4
Secchi Disk (m)	0.59	0.62	0.43	0.90
TSI	69	70	60	78
Total Alkalinity (mg/L)	66	79	50	97
Total Ammonia (mg/L)	0.013	0.104	0.010	0.595
Total Kjeldahl Nitrogen (mg/L)	1.751	1.669	0.998	3.390
Nitrate-Nitrite (mg/L)	0.010	0.016	0.010	0.045
Total Nitrogen (mg/L)	1.751	1.679	0.998	3.390
Total Phosphorus (mg/L)	0.086	0.119	0.053	0.291
Ortho Phosphorus (mg/L)	0.006	0.011	0.005	0.040
Chlorophyll a, uncorrected (ug/L)	55.3	58.9	13.4	105.0
Color (Pt-Co)	17	30	1	85
Total Dissolved Solids (mg/L)	95	97	76	132
Total Suspended Solids (mg/L)	16	13	6	28
Calcium (mg/L)	23.9	22.8	17.3	29.1
Magnesium (mg/L)	3.8	4.0	3.2	4.8
Total Hardness (mg/L)	75.2	73.4	60.5	88.7
Cadmium (ug/L)	0.02	0.55	0.02	6.20
Copper (ug/L)	2	5	2	11
Lead (ug/L)	0.4	1.4	0.2	6.4
Zinc (ug/L)	10	15	4	39
Fecal Coliform (#/100 ml)	295	309	10	1460
Total Coliform (#/100 ml)	1025	1134	100	4400

Table 14. Water quality data summary for Lake Morton.

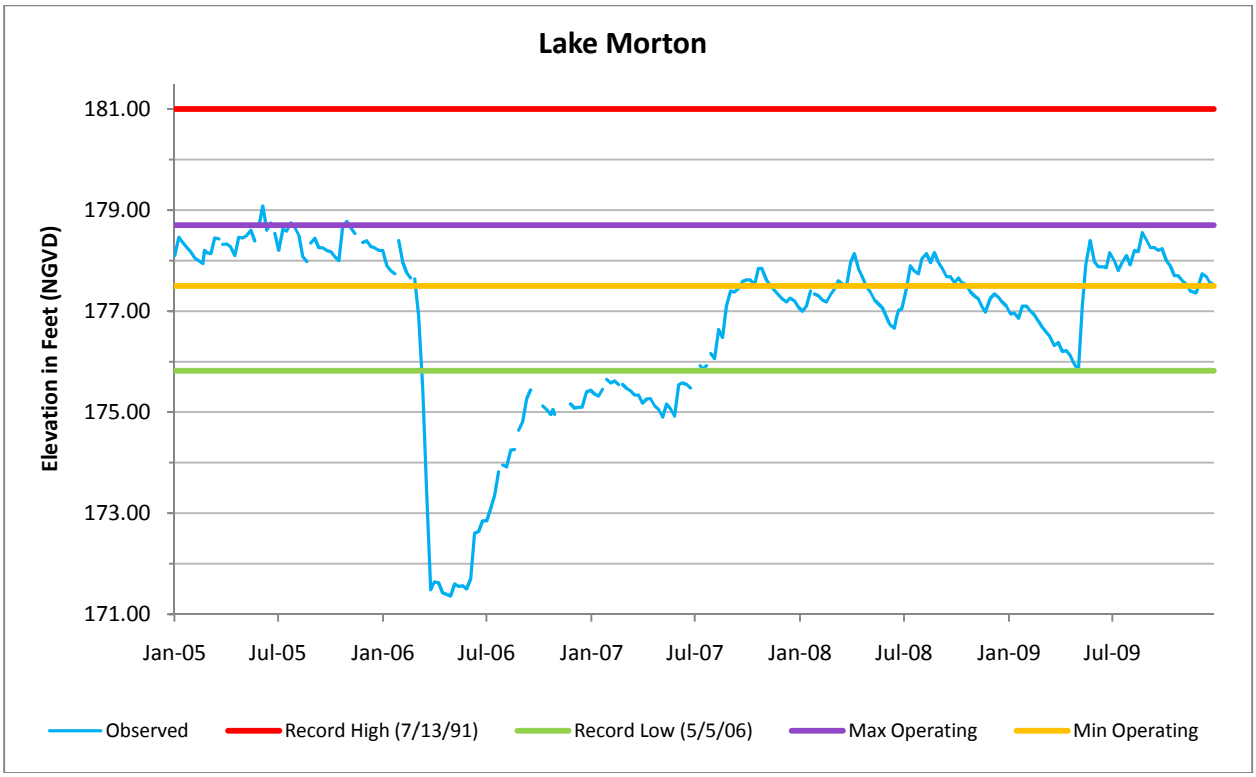

Figure 40. Lake Morton elevation from 2005 to 2009. *Data from planned drawdown omitted.

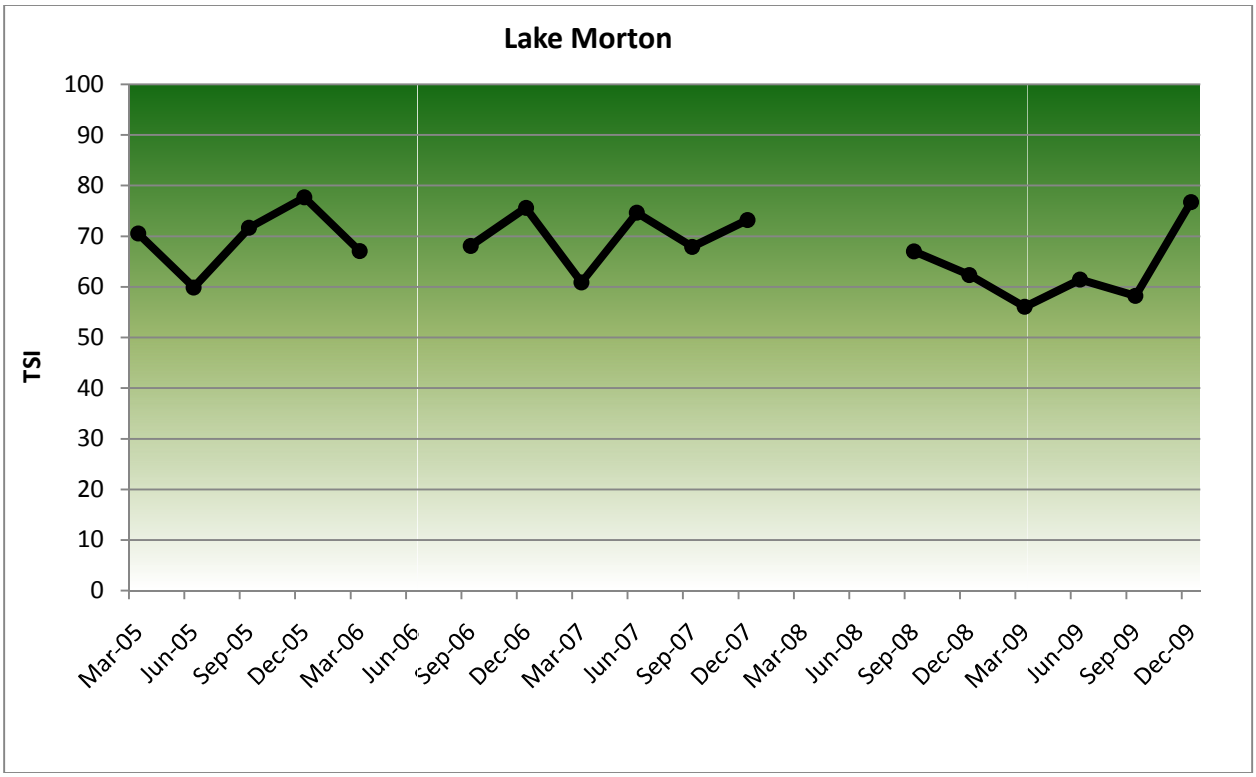

Figure 41. Lake Morton TSI from 2005 to 2009.

Lake Parker

General Information

Section-Township-Range: 08-28-24
Lat/Long: 28°04'04" N/ 81°55'53"W
Drainage Basin: Peace River
Origin: Natural
Public Boat Ramp: Yes
Surface Area: 884 ha (2,185 ac)
Avg. Depth: 1.6 m (5.2 ft)
Max Depth: 7.5 m (24.6 ft)
Volume: 20,311,746 m^3 (5,365,756,287 gal)
Shoreline Length: 19,823 m (65,035 ft)
Watershed Area: 5,534 ha (13,674 ac)

Lake Levels

Adjustable Control Structure: Yes
Operator: SWFWMD
Operating Range: 129.00-130.60
Contributing Water body: Crago
Discharges to: Saddle Creek
10 Yr. Flood: 131.60
100 Yr. Flood: 134.00
Historic High: 132.36 (10/1/04)
Historic Low: 126.78 (6/22/01)
2009 Avg: 128.21
2009 High: 127.16
2009 Low: 129.06

Water Quality

FDEP Verified Impairments: nutrients
COL Potential Impairments: nutrients
Limiting Nutrient: balanced

Parameter (unit)	2009 Avg	5 yr Avg	5 yr Min	5 yr Max
Temperature (°C)	22.07	23.73	15.88	30.05
pH (std unit)	8.88	8.78	7.70	10.15
Conductivity (uS)	235	218	163	259
Dissolved Oxygen (mg/L)	10.92	8.96	3.39	15.56
Turbidity (NTU)	16.4	20.5	6.9	30.5
Secchi Disk (m)	0.38	0.36	0.23	0.50
TSI	74	79	66	92
Total Alkalinity (mg/L)	66	58	22	76
Total Ammonia (mg/L)	0.013	0.139	0.010	0.805
Total Kjeldahl Nitrogen (mg/L)	3.024	3.375	1.559	7.403
Nitrate-Nitrite (mg/L)	0.018	0.015	0.010	0.051
Total Nitrogen (mg/L)	3.037	3.383	1.559	7.403
Total Phosphorus (mg/L)	0.058	0.156	0.037	0.248
Ortho Phosphorus (mg/L)	0.005	0.010	0.005	0.062
Chlorophyll a, uncorrected (ug/L)	63.9	85.2	43.1	178.0
Color (Pt-Co)	28	47	11	85
Total Dissolved Solids (mg/L)	178	153	60	276
Total Suspended Solids (mg/L)	29	47	19	100
Calcium (mg/L)	30.2	22.8	12.8	35.6
Magnesium (mg/L)	4.2	3.6	2.6	5.1
Total Hardness (mg/L)	92.9	71.6	43.5	105.8
Cadmium (ug/L)	0.02	0.55	0.02	3.41
Copper (ug/L)	2	9	2	25
Lead (ug/L)	0.6	4.0	0.3	7.5
Zinc (ug/L)	7	19	3	58
Fecal Coliform (#/100 ml)	13	28	10	300
Total Coliform (#/100 ml)	175	211	100	1700

Table 15. Water quality data summary for Lake Parker.

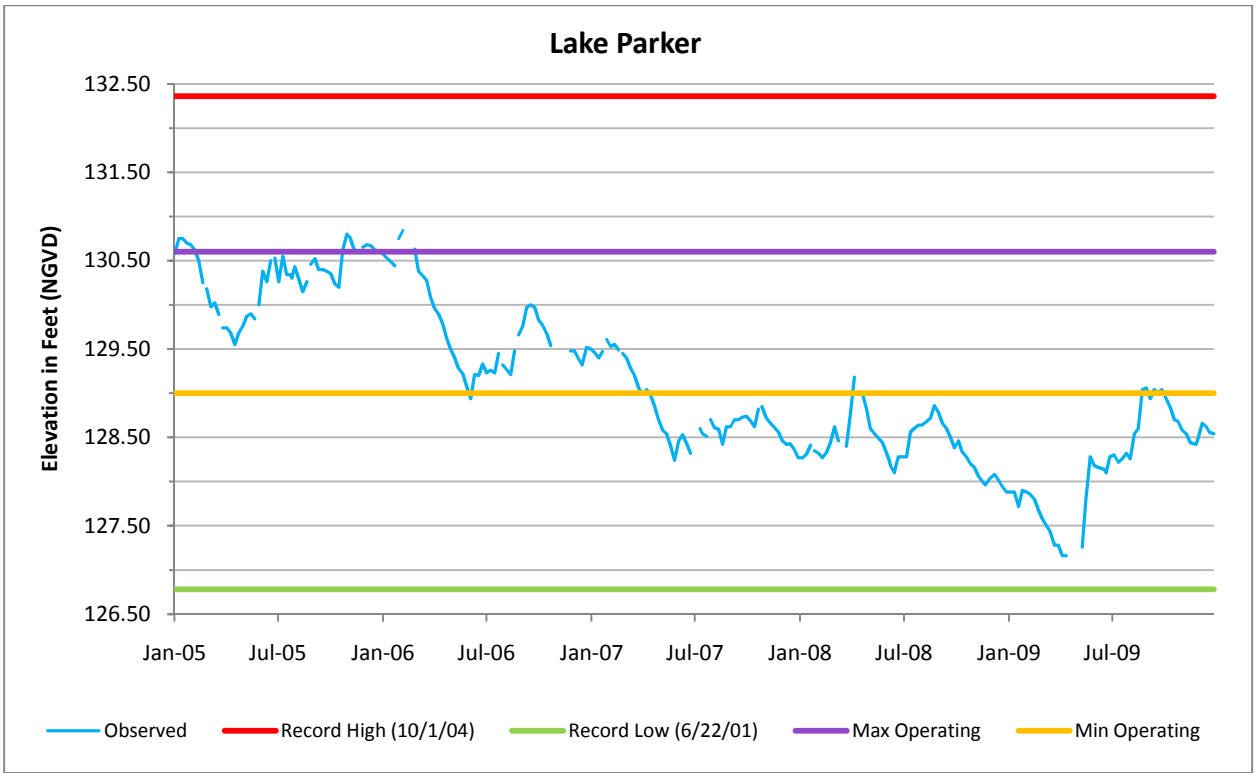

Figure 42. Lake Parker elevation from 2005 to 2009.

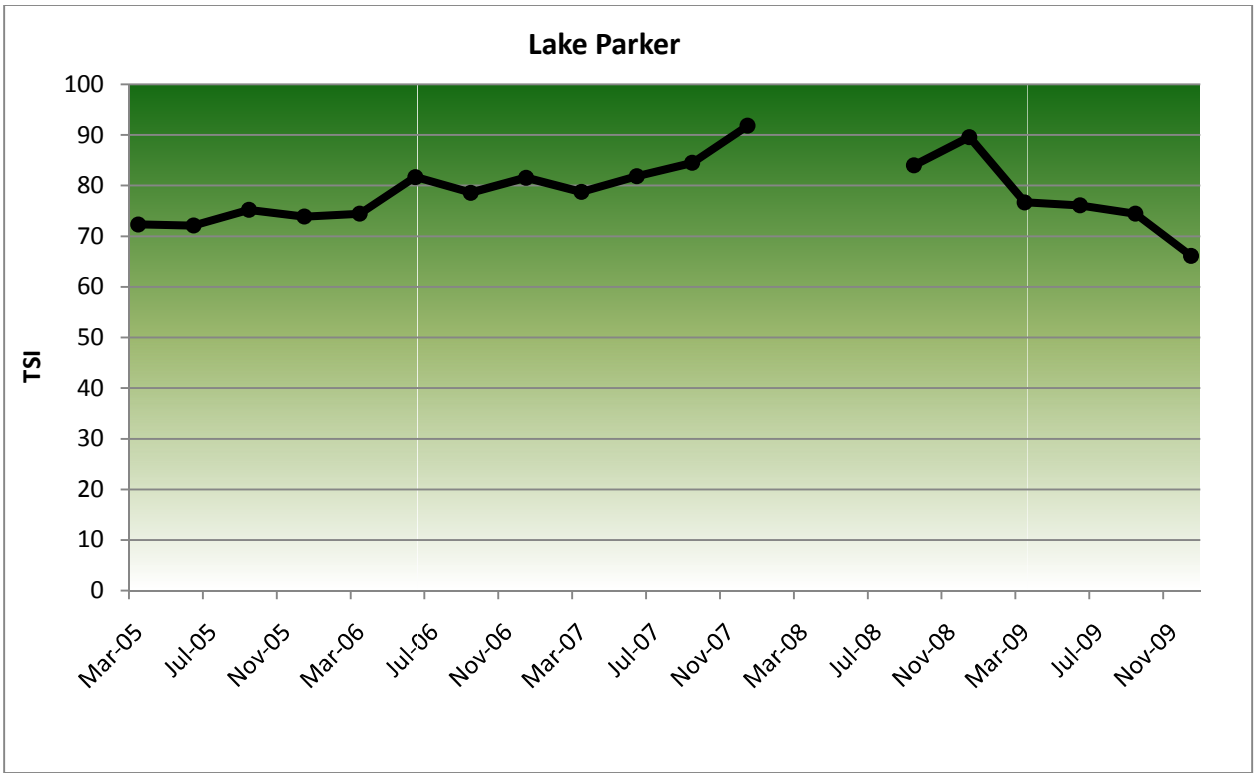

Figure 43. Lake Parker TSI from 2005 to 2009.

Lake Somerset

General Information

Section-Township-Range: 32-28-24
Lat/Long: 28°00'14" N/81°55'52" W
Drainage Basin: Peace River
Origin: Phosphate Pit
Public Boat Ramp: Yes
Surface Area: 19 ha (48 ac)
Avg. Depth: 2.4 m (7.9 ft)
Max Depth: 7.6 m (24.9 ft)
Volume: 468,811 m^3 (123,846,764 gal)
Shoreline Length: 5,717 m (18,757 ft)
Watershed Area: 1,102 ha (2,722 ac)

Lake Levels

Adjustable Control Structure: No
Operator: N/A
Operating Range: N/A
Contributing Water body: Lake John, Lake Bentley
Discharges to: Lake Wood/Lake Waterview
10 Yr. Flood: no data
100 Yr. Flood: 113.00
Historic High: 111.00 (7/14/91)
Historic Low: 107.28 (4/4/99)
2009 Avg: 108.13
2009 High: 108.64
2009 Low: 107.48

Water Quality

FDEP Verified Impairments: none
COL Potential Impairments: nutrients
Limiting Nutrient: nitrogen

Parameter (unit)	2009 Avg	5 yr Avg	5 yr Min	5 yr Max
Temperature (°C)	23.69	24.51	17.79	29.73
pH (std unit)	8.89	8.96	7.30	10.27
Conductivity (uS)	194	204	177	249
Dissolved Oxygen (mg/L)	12.03	10.51	4.91	16.25
Turbidity (NTU)	16.0	11.3	3.8	21.9
Secchi Disk (m)	0.53	0.57	0.45	0.72
TSI	77	74	68	82
Total Alkalinity (mg/L)	59	64	52	86
Total Ammonia (mg/L)	0.014	0.078	0.010	0.557
Total Kjeldahl Nitrogen (mg/L)	1.825	1.835	1.185	2.457
Nitrate-Nitrite (mg/L)	0.010	0.013	0.010	0.034
Total Nitrogen (mg/L)	1.825	1.840	1.185	2.457
Total Phosphorus (mg/L)	0.202	0.240	0.173	0.340
Ortho Phosphorus (mg/L)	0.012	0.029	0.005	0.084
Chlorophyll a, uncorrected (ug/L)	97.2	73.9	20.6	132.0
Color (Pt-Co)	27	38	7	66
Total Dissolved Solids (mg/L)	133	112	30	160
Total Suspended Solids (mg/L)	18	15	4	20
Calcium (mg/L)	23.6	20.3	14.2	29.6
Magnesium (mg/L)	3.7	3.8	3.1	5.0
Total Hardness (mg/L)	73.8	66.1	50.3	89.2
Cadmium (ug/L)	0.02	0.47	0.02	3.30
Copper (ug/L)	2	6	2	17
Lead (ug/L)	0.4	0.8	0.2	4.2
Zinc (ug/L)	9	15	5	49
Fecal Coliform (#/100 ml)	18	29	7	120
Total Coliform (#/100 ml)	150	309	60	1200

Table 16. Water quality data summary for Lake Somerset.

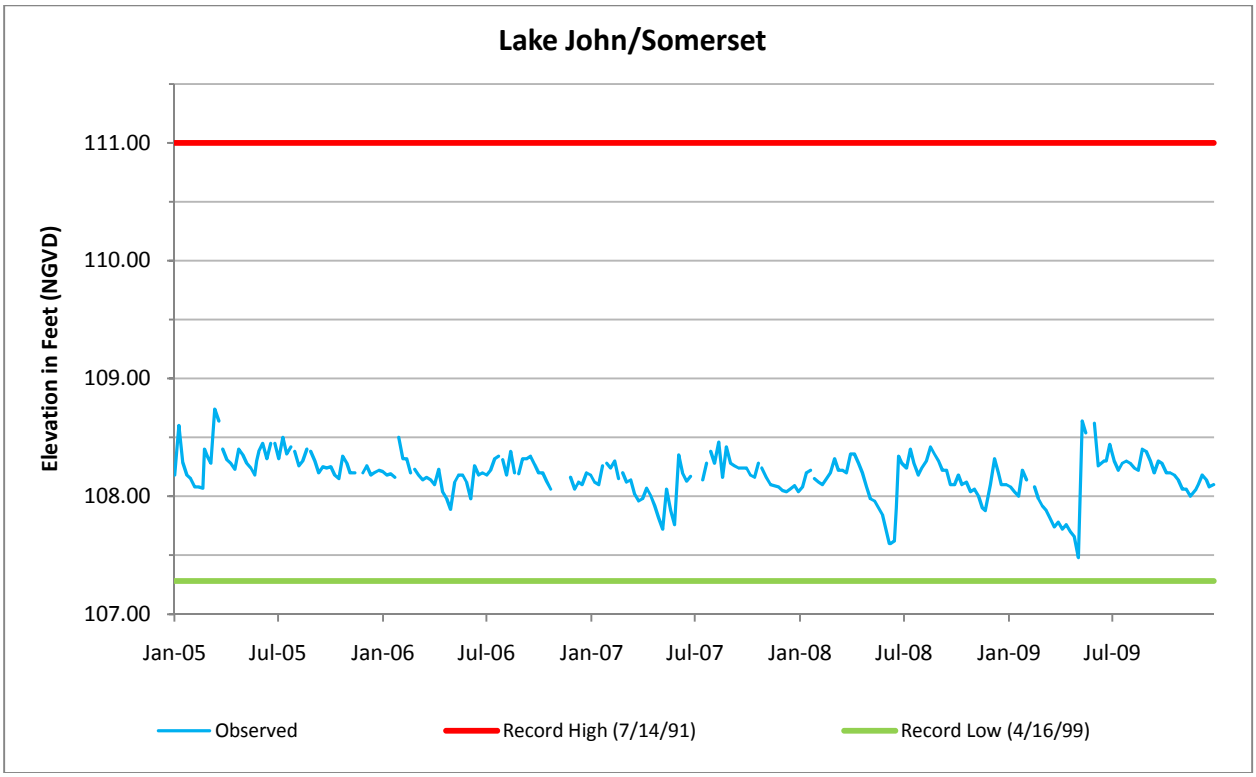

Figure 44. Lake John and Lake Somerset elevation from 2005 to 2009.

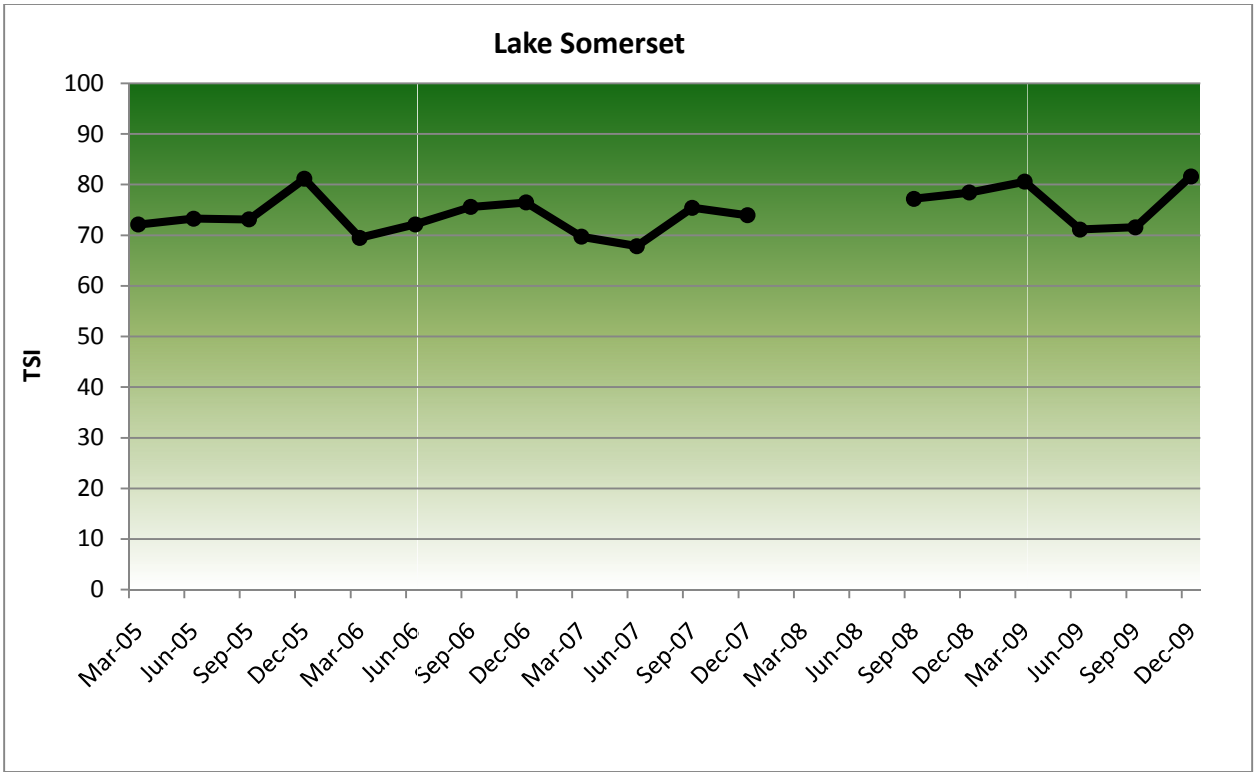

Figure 45. Lake Somerset TSI from 2005 to 2009.

Lake Wire

General Information

Section-Township-Range: 13-28-23
Lat/Long: 28°02'48" N/ 81°57'38" W
Drainage Basin: Hillsborough River
Origin: Natural
Public Boat Ramp: No
Surface Area: 9 ha (22 ac)

Avg. Depth: 3.3 m (10.8 ft)
Max Depth: 6.7 m (22.0 ft)
Volume: 303,289 m^3 (80,120,478 gal)
Shoreline Length: 1,151 m (3,776 ft)
Watershed Area: 43 ha (106 ac)

Lake Levels

Adjustable Control Structure: Yes
Operator: City of Lakeland
Operating Range: 194.00-196.00
Contributing Water body: none
Discharges to: Lake Hunter
10 Yr. Flood: no data

100 Yr. Flood: no data
Historic High: 197.37 (9/7/88)
Historic Low: 190.94 (5/8/09)
2009 Avg: 194.05
2009 High: 195.70
2009 Low: 190.94

Water Quality

FDEP Verified Impairments: nutrients, lead
COL Potential Impairments: nutrients, lead
Limiting Nutrient: balanced

Parameter (unit)	2009 Avg	5 yr Avg	5 yr Min	5 yr Max
Temperature (°C)	21.97	22.91	15.89	29.75
pH (std unit)	8.20	8.49	7.26	9.61
Conductivity (uS)	115	126	100	184
Dissolved Oxygen (mg/L)	7.12	7.84	3.38	13.36
Turbidity (NTU)	0.9	1.0	0.0	3.1
Secchi Disk (m)	4.22	3.35	1.35	5.95
TSI	39	48	33	63
Total Alkalinity (mg/L)	47	51	38	82
Total Ammonia (mg/L)	0.029	0.072	0.010	0.351
Total Kjeldahl Nitrogen (mg/L)	0.540	0.821	0.320	2.069
Nitrate-Nitrite (mg/L)	0.013	0.053	0.010	0.643
Total Nitrogen (mg/L)	0.545	0.869	0.320	2.097
Total Phosphorus (mg/L)	0.031	0.048	0.020	0.075
Ortho Phosphorus (mg/L)	0.008	0.483	0.005	8.000
Chlorophyll a, uncorrected (ug/L)	3.5	8.6	2.2	28.8
Color (Pt-Co)	17	31	3	72
Total Dissolved Solids (mg/L)	74	79	44	128
Total Suspended Solids (mg/L)	2	2	1	9
Calcium (mg/L)	20.9	18.0	13.1	25.7
Magnesium (mg/L)	0.9	1.2	0.8	1.6
Total Hardness (mg/L)	56.2	49.8	36.6	70.8
Cadmium (ug/L)	0.02	0.43	0.02	2.30
Copper (ug/L)	2	6	2	15
Lead (ug/L)	6.0	7.7	0.8	18.7
Zinc (ug/L)	15	19	3	67
Fecal Coliform (#/100 ml)	38	36	10	250
Total Coliform (#/100 ml)	275	188	100	700

Table 17. Water quality data summary for Lake Wire.

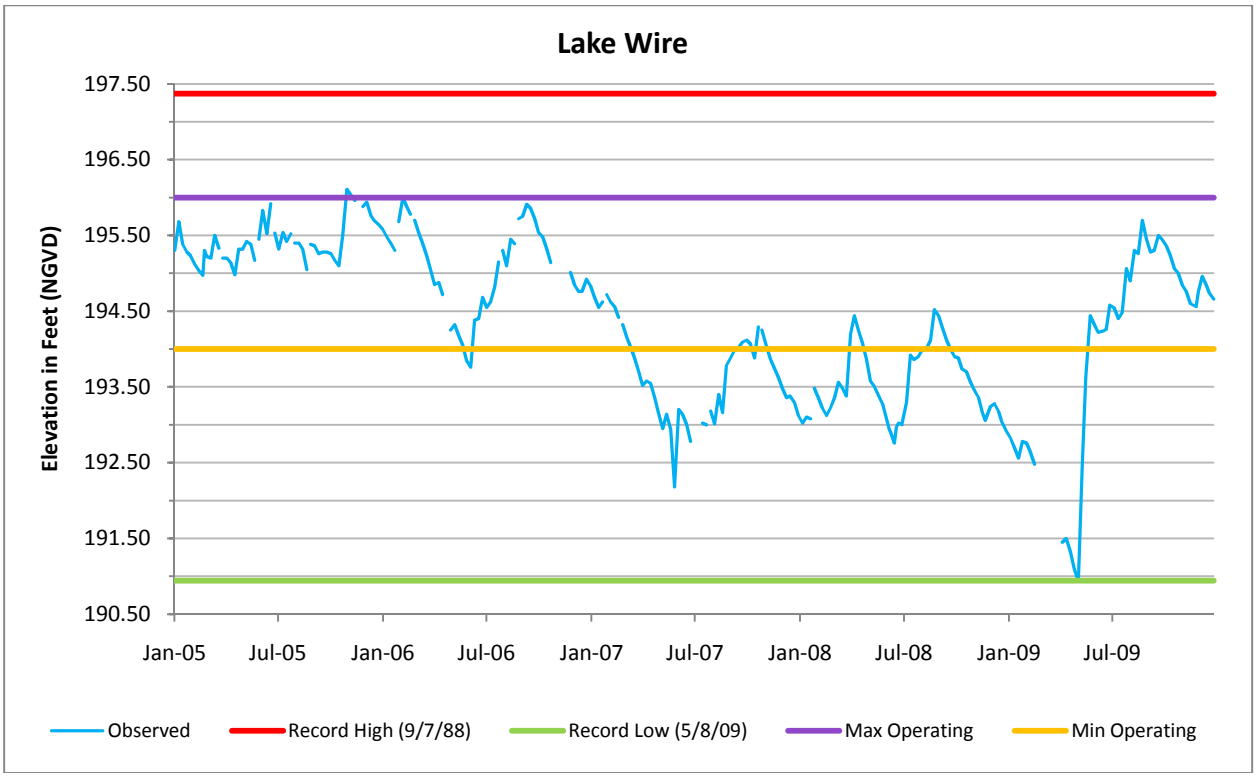

Figure 46. Lake Wire elevation from 2005 to 2009.

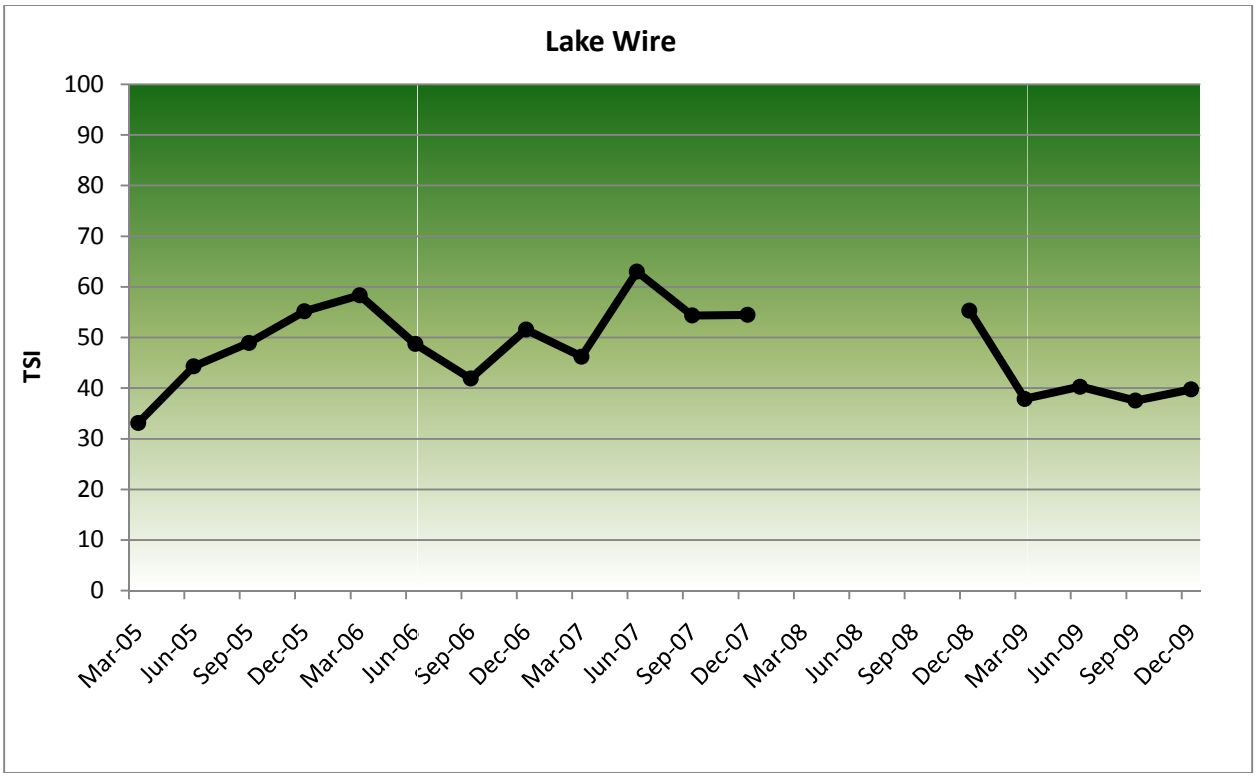

Figure 47. Lake Wire TSI from 2005 to 2009.

Rainfall Summary

Rainfall is monitored at several locations by different departments within the City (Figure 48). Lakes and Stormwater monitors one rain gauge located at Lake Hollingsworth. Local storm events are common and rainfall totals can be highly variable between locations. Rainfall affects lake levels and water quality both directly and through the influence of stormwater runoff. Data for 2009 from each station is shown in Table 18 and Figure 49, with a closer look at Lake Hollingsworth rainfall in Figure 50. Long term data from the Lake Hollingsworth station is shown in Figures 51 and 52.

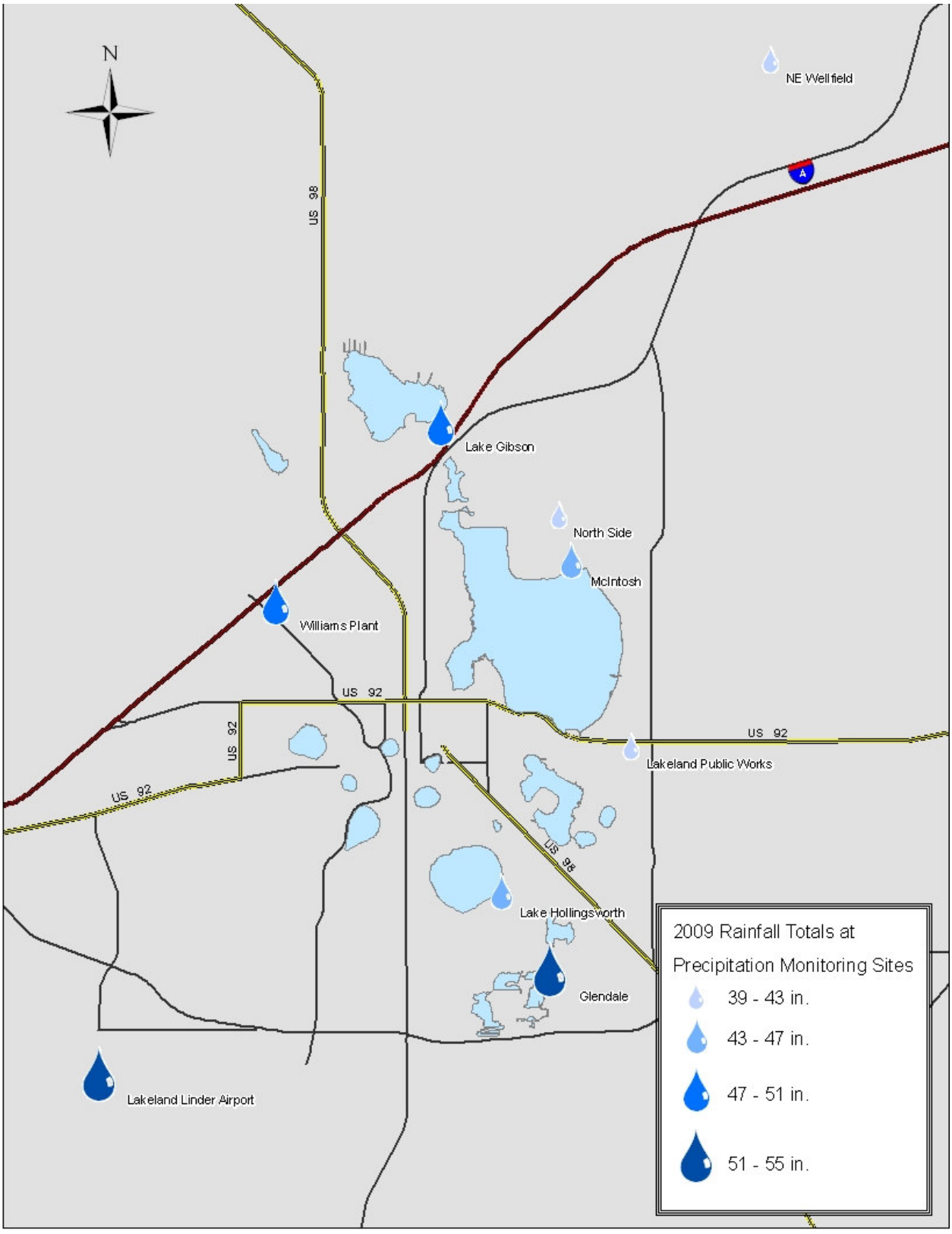

Figure 48. Precipitation monitoring sites.

Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
McIntosh	2.05	0.25	0.50	1.75	11.80	4.65	5.00	8.30	3.97	0.40	1.30	3.48	43.45
Glendale	1.88	0.60	0.11	1.21	14.82	6.12	5.54	5.58	5.90	3.96	1.06	6.43	53.21
North Side	2.24	0.84	0.84	1.31	10.71	4.05	4.33	8.76	3.27	0.70	0.62	3.48	41.15
NE Wellfield	2.83	0.62	0.68	1.51	9.70	8.99	4.76	4.98	2.45	0.37	1.52	0.30	38.71
Combee Plant	no data	no data	no data	no data	8.96	6.01	no data	no data	3.01	0.94	1.59	0.25	no data
Williams Plant	2.19	0.67	0.86	1.29	14.94	5.90	5.62	6.32	5.79	0.23	1.09	2.53	47.43
Lakeland Linder Airport	2.24	0.78	0.57	1.34	14.95	8.59	6.52	6.79	7.73	0.48	1.12	3.6	54.71
Lake Gibson	2.25	0.67	1.01	0.94	15.49	7.66	4.69	8.26	2.29	0.12	1.20	2.86	47.44
Lakeland Public Works	1.91	0.71	0.24	1.22	11.55	5.88	3.87	6.67	1.94	0.79	0.98	3.10	38.86
Lake Hollingsworth	1.64	0.79	0.45	1.32	13.90	6.98	4.14	6.84	5.15	1.35	0.52	3.34	46.42
Polk County Average[1]	2.34	2.73	3.28	2.64	4.18	7.88	7.99	7.48	6.74	2.91	1.78	2.15	52.10

Table 18. Monthly rainfall totals for 2009. [1] According to SWFWMD.

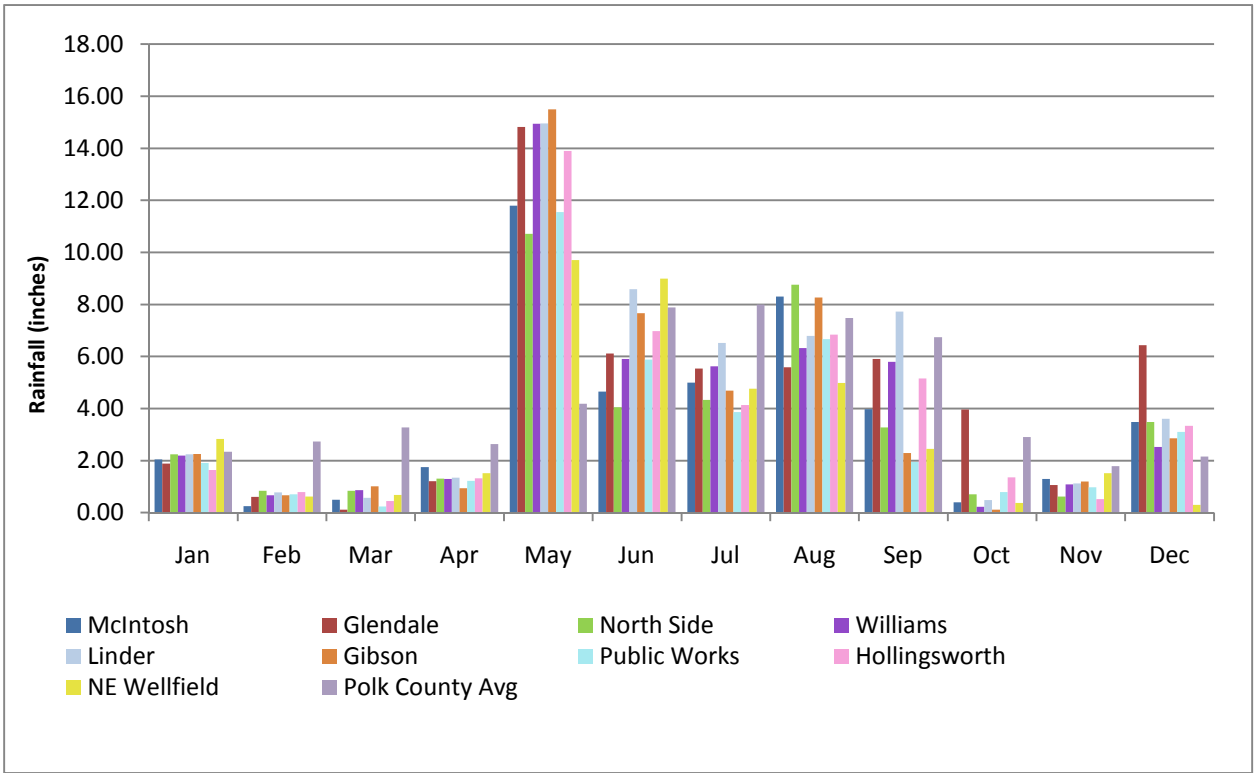

Figure 49. Monthly rainfall totals for 2009.

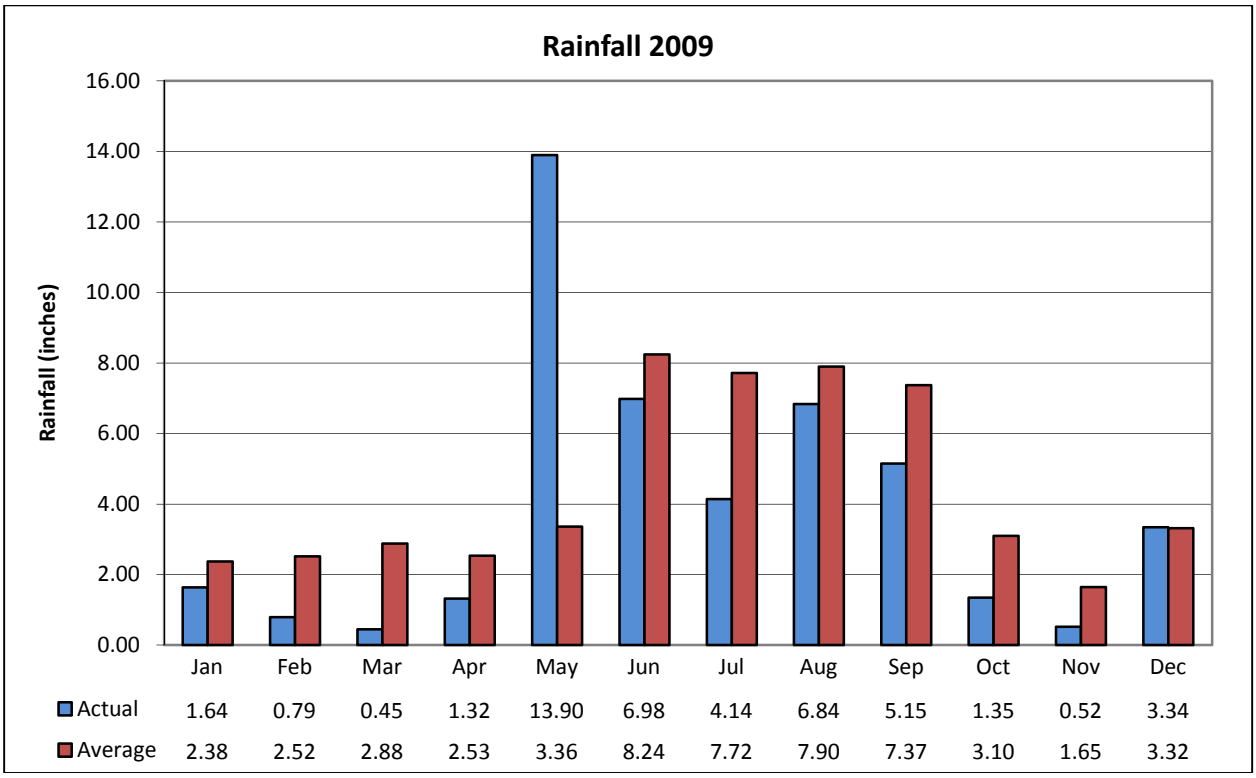

Figure 50. Monthly total rainfall for 2009 compared to monthly average at Lake Hollingsworth. Monthly averages based on data collected at Lake Hollingsworth from 1991 – 2009.

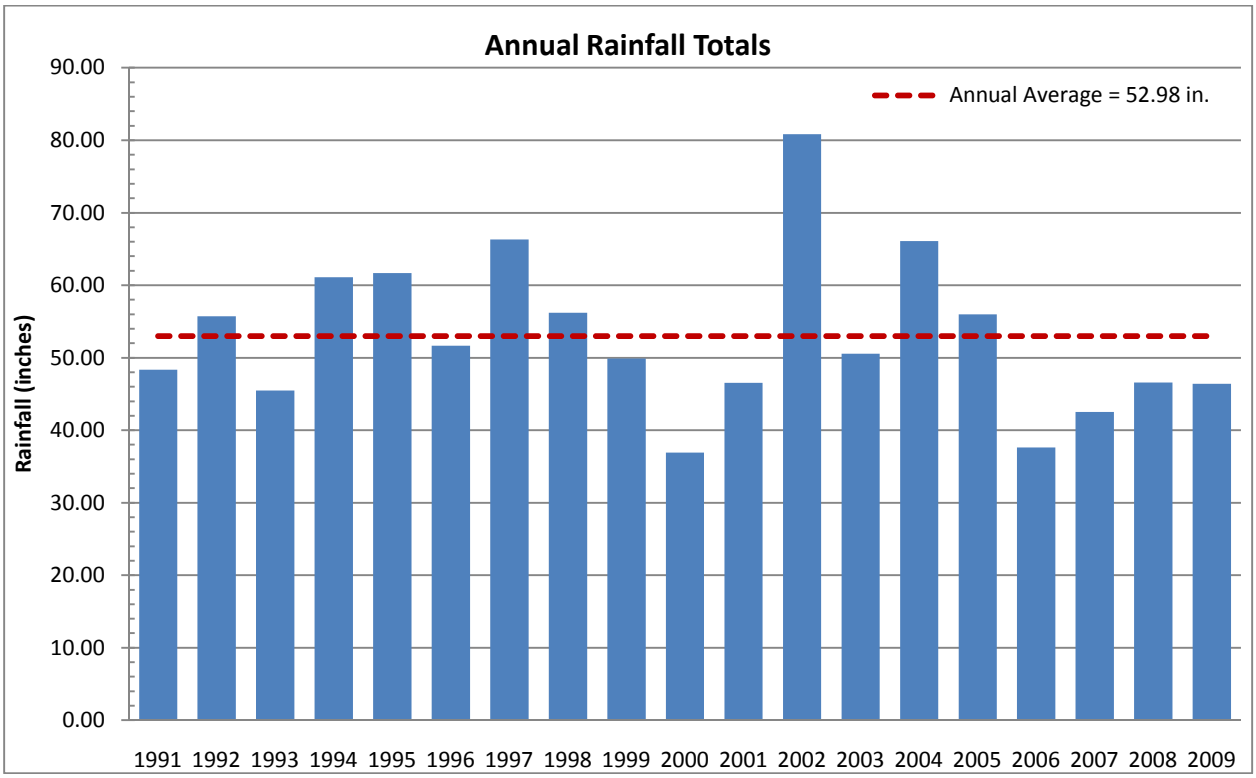

Figure 51. Annual rainfall at Lake Hollingsworth from 1991 to 2009.

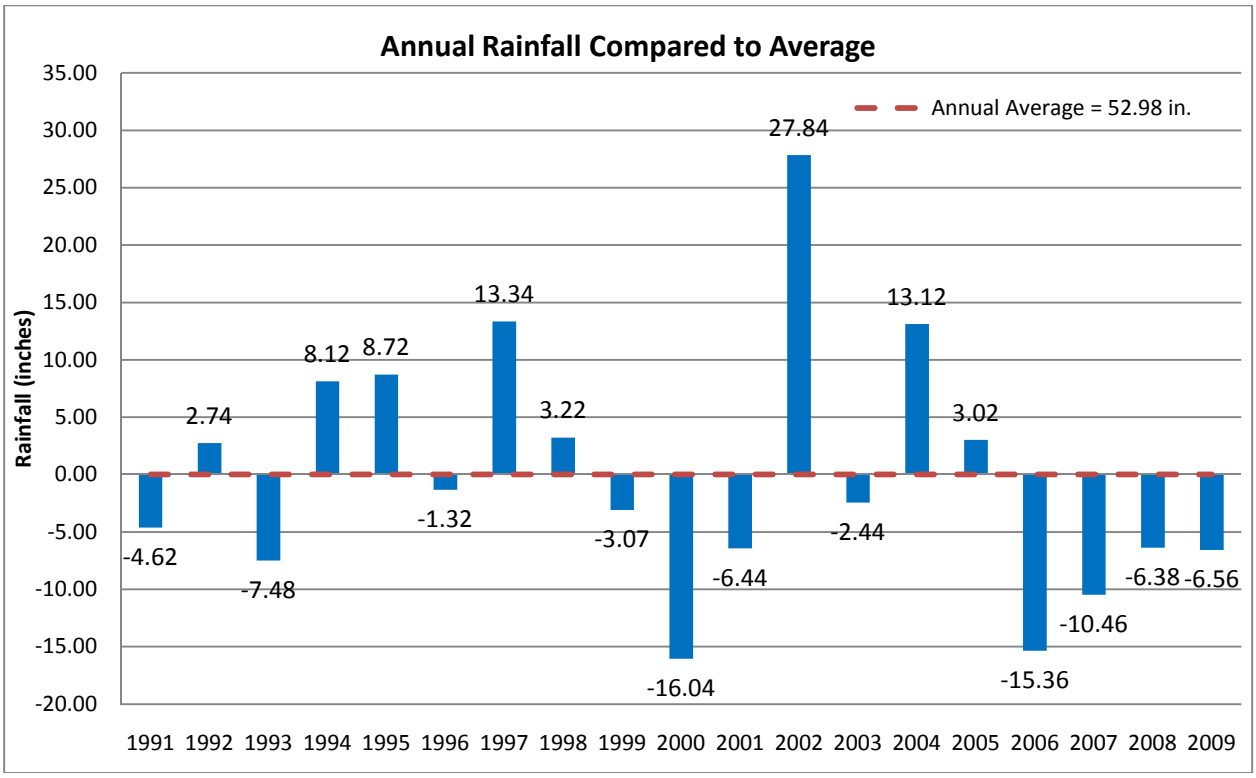

Figure 52. Annual rainfall compared to average at Lake Hollingsworth form 1991 to 2009.