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Introduction

1.1 Background

The St. Johns River Water Management District (SJRWMD) in cooperation with Orange County, Seminole County, the City of Orlando and the City of Altamonte Springs (Participants) contracted with CDM in February 2002 to provide engineering services for Phase II of the Little Wekiva River Watershed Management Plan (WMP). The WMP for Phase II consists of three parts:

- Part I – Inventory update of existing stormwater management systems.
- Part II – Engineering analysis of the existing stormwater system and identification of problem areas.
- Part III – Engineering analysis to develop alternatives to alleviate flooding in problem areas and/or develop regional solutions.

The WMP builds upon Phase I of the Little Wekiva WMP which included detailed modeling, design and implementation of erosion control measures along the main stem of the Little Wekiva River. The stormwater model and analysis developed for Phase I was completed as part of the Recommended Erosion and Sedimentation Countermeasures, Little Wekiva River Watershed Management Plan (1998 Study) prepared by Singhofen & Associates, Inc. and Woodward-Clyde Consultants in 1998 The WMP also builds upon the stormwater master planning efforts completed as part of the Seminole County Little Wekiva River Basin Drainage Inventory Engineering Study (1995 Study) prepared by DRMP, Inc. in 1995. The intent of the WMP is to develop a regional solution for the entire Little Wekiva River watershed to alleviate both water quantity and water quality problems that have plagued the basin in the past.

This report presents the findings from Parts I, II and III of the WMP. Part III provides an alternatives analysis that addresses both flooding and water quality concerns. Additionally, there have been some modifications to the stormwater model based on feedback from the Participants during the development of Part III. The changes that occurred that are not reflected in the Part I and Part II reports are documented in this report. The Little Wekiva River Basin is also within the Wekiva Study Area (WSA) and therefore subject to the provisions of the Wekiva Parkway and Protection Act (WPPA). A master stormwater management plan (MSMP) required by the WPPA was developed independently from this effort.

1.2 Study Area Description

The Little Wekiva River Basin is located in the north central portion of Orange County and the western portion of Seminole County, Florida. The area directly tributary to the river itself consists of approximately 42 square miles (see **Figure 1-1**). The basin is generally bounded on the south by Colonial Drive (S.R. 50), on the east by I-4, on the north by the Alaqua Lakes Subdivision, and on the west by Pine Hills Road, Orange Blossom Trail (U.S. 441) and Lake Brantley. The Little Wekiva River Basin is comprised of approximately 15.5 square miles of unincorporated Seminole County, 13.2 square miles of unincorporated Orange County, 4.4 square miles of the City of Altamonte Springs, 0.11 square miles of the City of Longwood, 0.6 square miles of the Town of Eatonville, 0.9 square miles of the City of Maitland, and 6.3 square miles of the City of Orlando. There are also 3 subbasins that discharge to the Little Wekiva River via pump stations and are otherwise closed subbasins (i.e., no positive outfall except through the pump station). These are the Cranes Roost subbasin located in Seminole County and the Woodsmere and Long Lake subbasins in Orange County. The Cranes Roost subbasin is comprised of approximately of 4 square miles of the City of Altamonte Springs, 0.2 square miles of the City of Longwood and 3.4 square miles of unincorporated Seminole County. The Woodsmere subbasin is comprised of approximately 1.2 square miles of unincorporated Orange County (a very small fraction of the subbasin (less than 0.01 square miles is within the City of Orlando) while the Long Lake subbasin is comprised of approximately 4.2 square miles within unincorporated Orange County (approximately 0.01 square miles is within the City of Orlando). Accounting for the closed subbasins, the total area contributing to the Little Wekiva River is approximately 54.5 square miles.

The Little Wekiva River itself is approximately 15 miles long and is the predominant drainage feature in the basin. Its stream course consists of a combination of channelized ditches, lakes, incised channel reaches and meandering wetland flow until its confluence with the Wekiva River. Its main stem flows northward from Lake Lawne, just north of S.R. 50 in Orange County, through Lake Orlando (formerly Lake Wekiva), through Lake Lotus, Trout Lake and the eastern portion of the City of Altamonte Springs, and then eventually discharges through of the southern reaches of the Lower Wekiva River Preserve until it empties into the Wekiva River.

A segment of the Little Wekiva River is listed as a State of Florida Outstanding Florida Water (OFW). This OFW segment of the river includes the last four miles of the Little Wekiva River that flows through the Wekiva River Aquatic Preserve before its confluence with the Wekiva River.

Surface elevations in the area range from approximately 130 ft-NGVD in the southern portion of the basin to 15 ft-NGVD where the Little Wekiva River meets the Wekiva River in the northern portion of the basin. The terrain in the basin is characterized by broad flatlands interspersed with gently rolling hills and pocketed lakes.

gebhardtdm

11/15/02

Fig 1-1

Seminole County

Orange County

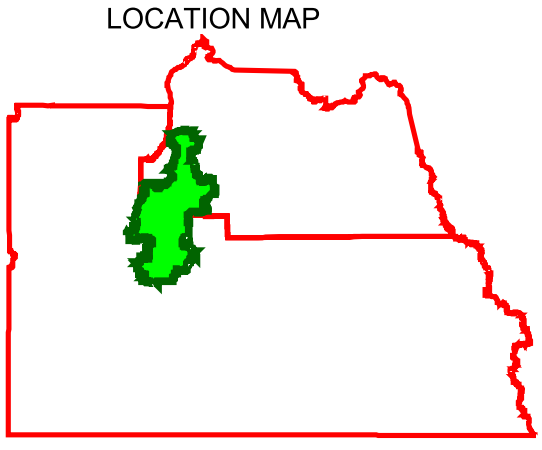
Woodsmere Subbasin

SOURCE: SJRWMD Digital Orthorectified Quarter Quadrangles, 2000

N
W E
S

6000 0 6000 12000 Feet

LOCATION MAP



LEGEND

- Basin Boundary
- County Line

Municipalities

- Altamonte Springs
- Eatonville
- Longwood
- Maitland
- Orlando

Little Wekiva River Watershed Management Plan

E:/Projects/9247/44143/gis/report figs.apr

CDM

Figure 1-1
Study Area Map

Land use data for the main basin (i.e., the basin that is directly tributary to the Little Wekiva River) indicates that almost half of the basin (approximately 20 square miles) has been developed as low, medium or high density residential. An additional 9.3 square miles consists of commercial, industrial, recreational, golf course, institutional or transportation land uses. The remainder of the basin consists of open or forested lands, wetlands and water bodies. Of this remainder, a very small percentage is considered developable lands (less than 10 percent). Land use in the Cranes Roost subbasin is primarily residential (43 percent), transportation and utilities (18 percent) and commercial (12 percent). Land use in the Woodsmere subbasin is dominated by residential (83 percent) while the Long Lake subbasin is comprised primarily of residential (41 percent), industrial (13 percent) and agriculture (12 percent).

1.3 Little Wekiva River Basin History

The Little Wekiva River has had a history of stormwater quantity and quality problems including:

- An increase in rate of volume, flow and velocities due to the basin's urbanization;
- Minimal upstream storage and treatment due to much of the current development occurring before current stormwater regulations (pre-1983);
- Erosion and flooding, which has caused public safety concerns; and
- Adverse environmental and water quality impacts from the movement and deposition of sediments.

Flow Sources

Two major sources contribute to stream flow in the Little Wekiva River: groundwater baseflow and urban stormwater runoff. Water levels in the river are extremely sensitive to stormwater runoff as one-inch of rainfall in the basin can result in a short term increase of the river's stage by 4 feet or more.

Problems

Drainage and surface water control problems in the Little Wekiva River Basin have been documented as early as 1960 (A.P. & R.K. Michaels et. al., 1960). At that time, problems were attributed mainly to flooded agricultural lands, inoperative septic tanks and roadway erosion. Rapid growth and land development was noted during these earlier periods as well. The original headwaters of the Little Wekiva River were near the Orange County/Seminole County line but were extended south by ditching to Lake Lawne. Lateral ditches were also created over time to serve the Lake Fairview/Lake Silver area as well as the Lake Lovely/Lake Shadow chain. A canal was excavated between Lake Lawne and Lake Orlando in the mid-1960s in response to several major storms that hit Orange County in 1959 and 1960.

Much of the early channelization of the river and its tributaries as well as the construction of several water discharge control structures was completed with the intent to expedite or control the flow in the river and to establish water levels in Lake Orlando and Lake Lawne. These include ditches that serve the Lake Fairview-Lake Silver chain and the Lake Lovely-Lake Shadow-Hungerford Lake chain. Early periodic flooding problems were experienced in the basin largely due to rapid development. Various pumping facilities, (i.e., the Dwarf Lake pumping station which discharges to Lake Orlando and the Long Lake/Lake Alpharetta pumping station which discharges to Lake Gandy) were then constructed to counteract these problems. The pumping facilities were constructed with the intent to remove excess surface water to other adjacent surface water basins on a periodic basis. In most cases, however, the facilities were used to transport water from otherwise closed basins to the Little Wekiva River. Drainage wells were constructed throughout the basin for water management purposes as well.

Stormwater runoff was identified back in 1980 (East Central Florida Regional Planning Council, 1980) as the major source of pollutants entering surface water bodies in the Little Wekiva River Basin. In 1977, approximately 40 percent of the total land area in the basin was developed as commercial and residential areas. The majority of the development in the basin was built prior to statewide stormwater regulations being enacted and therefore did not have effective stormwater management systems for both water quality and quantity. However, the report entitled *Biological Assessment of the Little Wekiva River Basin, including the Altamonte Springs Wastewater Treatment Plant (FDEP, 1997)* cited that much progress had been made toward improving water quality in the Little Wekiva River over the past two decades. Historically, seven wastewater treatment plants and a citrus processing plant discharged into the river system. Currently, the Altamonte Springs Wastewater Treatment Plant is the only point source discharge into the river and only discharges intermittently due to reuse efforts.

The basin has also experienced chronic occurrences of sedimentation, primarily along the Little Wekiva River. According to the American Society of Civil Engineers Manual 54 (ASCE, 1977), sedimentation embodies the processes of erosion, entrainment, transportation, deposition and the compaction of sediment. For the purposes of this report, this definition will be used and these processes will be referred to as sedimentation throughout this document. The problem of sedimentation along the river appears to be a direct result of urbanization of the river's watershed that has overtaxed the conveyance and sediment transport capacity of the river (DRMP, 1988). The river changes in elevation by approximately 58 feet from its headwaters in Orange County to S.R. 434 in Seminole County. Over time, the combined effect of the Lake Lawne/Lake Orlando Canal, urbanization, and the loss of the river's natural floodplain aggravated sedimentation problems along the Little Wekiva River, most notably in the Riverside Acres area. Orange County constructed a large structural plate pipe arch culvert through the Riverside Acres subdivision in the early 1970s in an attempt to correct these problems. Since that time, even more

urbanization has occurred in the basin and storm events have constituted the major cause of sedimentation as the river has been forced to handle larger discharges as a result of increased runoff volumes.

On February 15, 1998, a 50-foot section of the arch culvert pipe in the Riverside Acres subdivision collapsed followed by a 358-foot piece a week later. As an emergency effort to remediate the collapsed section of pipe, sheet pile was installed on either side of the banks for stabilization. Orange County bought a number of homes adjacent to the remaining arch pipe to provide a large enough right-of-way to return this segment of the river into an open channel. The design for this open channel section replaced the remaining section of the arch culvert pipe with a realigned open channel and included construction of a park on the County-purchased land along the river.

Wekiva River Protection Act

In 1988, the Florida Legislature passed the Wekiva River Protection Act, which requires the river's surrounding counties to amend their comprehensive plans and land development rules to deter wetlands losses and to promote protection of wildlife and their habitats. The act gives local governments the authority to create rules to treat stormwater runoff and basically provides long-term protection for the area. A small portion of the Little Wekiva River Basin is within this protection area, namely the area of the basin that is to the north of S.R. 434 and to the west of Markham Woods Road. A copy of the rule is provided in **Appendix A**. Additionally, chapters 40C-4, -40, -41 and -42 of the Florida Administrative Code (F.A.C.) establish additional surface water management standards and criteria for the Wekiva River Hydrologic Basin, which includes the Little Wekiva River Basin.

Little Wekiva River Working Group

In 1995, a technical working group was formed to seek funding and to make basin-wide decisions to solve sedimentation and flooding problems. The Little Wekiva River Working Group is comprised of representatives of the Florida Department of Environmental Protection (FDEP), the Florida Department of Transportation (FDOT), SJRWMD, Orange and Seminole Counties, the City of Altamonte Springs, the Florida Audubon Society, Friends of the Wekiva and local area residents. The group has secured funding which has been put towards such achievements as:

- Stabilization of the riverbank and riverbed using manmade and natural materials;
- Removal of invasive vegetation (funded by FDEP and U.S. Army Corps of Engineers); and,
- Formulation of a basin-wide management plan with respect to sedimentation control (funded by the SJRWMD).

Studies and Reports

The reports entitled *Reconnaissance Report Little Wekiva River Lake Regulation and Management Study* (SAI/Woodward Clyde Consultants, 1997) and *Recommended Erosion and Sedimentation Countermeasures, Little Wekiva River Watershed Management Plan* (SAI/Woodward Clyde Consultants, 1998), referred to herein as the 1998 Study, were the result of the basin wide management planning efforts. The 1998 Study presented appropriate countermeasures to address the sedimentation problems along the main stem of the Little Wekiva River. Erosion control projects were identified based on their ability to perform together in the system and help balance sediment transport in the river. The projects were not only selected for local stabilization, but also with the intent to flatten the slope of the river through the use of grade control structures.

In addition to the 1998 Study, other studies have also been conducted in the past to identify the primary causes of the sedimentation problems as well as identify possible solutions. These include *the Little Wekiva River Erosion & Sedimentation Study* (Orange County DRMP, 1988), *Reconnaissance Report , Little Wekiva River Lake Regulation and Management Study* (Woodward-Clyde Consultants, 1997) and the *Little Wekiva River Reconnaissance and Priority Re-Evaluation, Orange and Seminole Counties, Florida* (URS, 2001). Various sedimentation control projects have been constructed throughout the basin as a result of these studies as well as the work of the task force including:

- San Sebastian and Spring Oak Erosion Control Areas, City of Altamonte Springs
- Dredging of the river section within the Springs Subdivision, Seminole County
- Weathersfield Avenue Area Bridge and Grade Control Structures, Seminole County
- San Sebastian Area Grade Control Structures #6 and #8, City of Altamonte Springs
- Riverside Park Road Area and Lake Lovely Outfall Canal Grade Control Structure, Orange County
- Kelvington Drive, Orange County
- Wallington Drive, Orange County
- Orange County Sedimentation Basin, Orange County
- Edgewater Drive Vegetated Slope, Grade Control Structure #1, Orange County
- Northwestern Avenue Area Gabions and Control Structure, Seminole County
- Horselover's Lane Grade Control Structure #3, Seminole County
- Riverside Acres Subdivision Arch Pipe Rehabilitation, Orange County

Several projects are either pending or are currently under construction and include:

- Riverbend Apartments Area, City of Altamonte Springs
- Sherry Drive Rip Rap Channel #3, Orange County
- Gusty Lane Grade Control Structure, Orange County

Three optional erosion control projects that were also proposed in the 1998 Study include:

- Seminole County Sedimentation Basin, Seminole County
- Elba Way/Campo Way Dredge and Grade Section, Orange County
- Sedimentation Basin at Maitland Boulevard, Orange County

The locations of these projects are shown on **Figure 1-2**.

1.4 Wekiva Parkway & Protection Act

In 2002, Governor Jeb Bush created the Wekiva River Basin Task Force to evaluate and recommend the most appropriate location for the proposed Wekiva Parkway that would connect State Road (SR) 429 and Interstate 4 (I-4) in Seminole County. Due to the environmentally sensitive lands in the Wekiva River Basin that construction of the Wekiva Parkway may negatively impact, careful consideration had to be given to those alternatives that would cause the least disruption and provide the greatest protection to the Wekiva Basin ecosystem. Waters that constitute the upper reaches of the Wekiva River emanate from both the Floridan aquifer in the form of natural springs and from surface water runoff of approximately 130 square miles of watershed. The Little Wekiva River and Black Water Creek are two major tributaries of the Wekiva. Blackwater Creek drains an additional 126 square miles of watershed into the lower reaches of the Wekiva, just upstream of the St. Johns River.

Recommendations by the Task Force were submitted in a final report to the Governor in January 2003. Subsequently, Governor Bush created the Wekiva River Basin Coordinating Committee (the Committee) by Executive Order 2003-112 in July 2003. This Committee was created as a forum to identify land use planning strategies and development standards that are consistent with protected property rights and which improve and assure protection of surface and groundwater resources, including the recharge potential of the Wekiva River system. The Wekiva River Basin Coordinating Committee's Final Report was prepared in March, 2004, with the following recommendations:

- Build the Wekiva Parkway;
- Protect the Wekiva River Basin Environment;

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Fig 1-2

E:/Projects/9247/44143/gis/phi_rptfigs.apr

Lake Brantley

The Springs Subdivision - dredging and bank re-vegetation

Seminole County Sedimentation Basin

San Sebastian and Spring Oak Erosion Control Areas

San Sebastian Area Grade Control Structure #8

San Sebastian Area Grade Control Structure #6

SR 434 S

SR 436 W

I-4

Riverbend Apartments Area

Weathersfield Ave. Bridge Area

Northwestern Ave. Area - Gabions and Control Structure

Trout Lake

Bear Lake

Horselover's Lane Grade Control Structure #3

Spring La

Cub Lake

Lake Lotus

Little Bear Lake

SR 414

Lake Destiny

Lake Bosse

Lake Hill

Riverside Acres Arch Culvert Rehabilitation

NEEDLES

Elba/Campo Dredge and Grade Section/Sedimentation Basin at Maitland Blvd.

Orange Co. Sedimentation Basin

Riverside Park Road Area - Gabion Lined Channel & Bridge Replacement

Lake Lovely

Kelvington Drive Rip Rap Channel #2

Sherry Drive Rip Rap Channel #3

Gusty Lane - Rip Rap Channel #1

Lake Weston

Edgewater Drive Vegetated Slope, Grade Control Structure #1

Wallington Drive

LEE

EDGEWATER

Lake Orlando

ORANGE BLOSSOM

Lake Fairview

Bay Lake

MERCY

JOHN YOUNG

PRINCETON

Lake Lawne

COUNTRY CLUB

COLONIAL

N

W

E

S

6000 0 6000 12000 Feet

LOCATION MAP

LEGEND

Sedimentation and Erosion Control Projects

Basin Boundary

County Line

Street Centerlines

Water Bodies

Little Wekiva RIver (Main Stem)

Wetlands

Municipalities

Altamonte Springs

Eatonville

Longwood

Maitland

Orlando

Little Wekiva River Watershed Management Plan

CDM

Figure 1-2

Sedimentation and Erosion Control Projects

- Promote Innovative Planning & Development; and
- Implementation.

In addition to these recommendations, the Committee also delineated the WSA which includes the land area that contributes surface and groundwater to the Wekiva River and the various springs located in this area. The Little Wekiva River Basin is completely within the WSA as it is a major tributary to the Wekiva River. The WSA is comprised of approximately 304,666 acres or 473 square miles.

On June 29, 2004 Florida Governor Jeb Bush signed the WPPA into law. The WPPA, found in Part III of Chapter 369, Florida Statutes (F.S.), implements the findings and recommendations of the Wekiva River Basin Coordinating Committee's Final Report.

Under the initiative to "Protect the Wekiva River Basin Environment", the Committee stated the following concerns in its Final Report:

- In general, Florida springs are threatened by actual and potential flow reductions and declining water quality;
- Due to the increase in population, there has been a drastic increase in water use and well as extensive land use changes;
- In the past 30 years, Florida springs have exhibited increased nutrient loading and lowered water flow. Increased nutrient loadings are attributed to fertilizers, septic tanks and sewage treatment facilities that discharge treated wastewater to groundwater. Declining water levels are due to rainfall variation, decreases in aquifer storage due to increased withdrawals and reduced recharge; and
- The health and vitality of the springs is directly influenced by activities and land uses within the springshed.

The Committee's recommendations when taken as a whole are intended to achieve the objective of improving and assuring protection of surface water and groundwater resources. According to the Committee's final report, "to sustain surface water resources, the volume of water discharging to surface waters from new development should be managed to sustain a healthy, functioning ecosystem. Water from point and non-point sources must be adequately treated before discharging to surface waters." Additionally the report goes on to state that "to sustain groundwater resources, the volume of recharge that occurs after development must be no less than the volume before development. Recharge must be adequately treated consistent with the rules of the [Florida] Department of Environmental Protection and the SJRWMD. The quality of surface waters and groundwater recharge should be improved, where possible, by addressing existing problems."

Based on these objectives, Recommendation 7 in the Committee's final report which was subsequently adopted as Section 369.319, F.S. of the WPPA specifically requires that each local government within the Wekiva Study Area shall develop a MSMP. According to the WPPA, the MSMP shall contain the following components:

1) Assess existing problems and deficiencies in the community;

2) Identify projects to meet long-range needs;

3) Establish priorities to address existing deficiencies;

4) Establish measures to address redevelopment;

5) Establish a schedule to complete needed improvements;

6) Evaluate the feasibility of stormwater reuse; and,

7) Includes requirements for inspection and maintenance of facilities.

The legislation goes on to state that the MSMP shall identify a funding source, such as a stormwater utility fee, to fund implementation of the plan and maintenance program. In addition, the local government shall establish a water reuse and irrigation program that allows for reuse of stormwater on a site basis for development over a size threshold to be determined by the local government or on a jurisdiction-wide basis to minimize pumpage of groundwater for nonpotable usage.

During the development of the Little Wekiva River WMP, an independent effort was concurrently undertaken to develop a MSMP for the WSA in order to satisfy the requirements of the WPPA. In January 2005, CDM was retained by the SJRWMD, Lake County, the City of Eustis, the City of Mount Dora, Orange County, the City of Apopka, the Town of Eatonville, the Town of Oakland, the City of Ocoee, the City of Orlando, the City of Winter Garden, Seminole County, the City of Altamonte Springs, the City of Lake Mary and the City of Longwood (Stakeholders) to develop an MSMP for the WSA.

The WSA MSMP satisfies requirements 1 though 7 previously listed as well as identification of a funding source. Some of the recommendations made in the WSA MSMP are consistent with the recommendations made in this WMP.

Section 2
Data Collection and Evaluation

2.1 Introduction

This section summarizes the data collection efforts for the Little Wekiva River Watershed Management Plan. The data collected during this effort was used to update the existing stormwater model developed as part of the 1998 Study. Data collected from the SJRWMD and the Participants include reports and studies, construction drawings, Geographic Information System (GIS) coverages, topographic data, land use data, structure inventory data, and water quality data. Other data required as part of this study (i.e., National Wetlands Inventory (NWI) data, rainfall data, archaeological resource data, etc.) were collected from the appropriate governmental agencies. The following narrative describes the process involved in obtaining these data and provides a summary of the data collected.

2.2 Existing Studies and Reports

Due to the history of the Little Wekiva River Basin, an abundance of reports and studies have been prepared that focus on various issues surrounding the basin. CDM identified numerous documents that have focused either on the Little Wekiva River itself or other stormwater/surface water issues within the basin. The following is a brief summary of each of those reports/studies identified by CDM (listed chronologically starting with the most recent document).

North College Park Flood Study Draft Report (CDM, 2004) The existing stormwater management system in North College Park was evaluated to determine the 100-year base flood elevations and floodplain limits within existing regulated flood zones associated with Little Lake Fairview, Lake Silver, Lake Daniel and Lake Sarah.

Design Engineering Report, Little Wekiva River Basin Management Plan: Northwestern Avenue Bridge Area Erosion and Sediment Control Project, Final Report, Seminole County, Florida (SAI, 2002) This report summarized information gathered through field reconnaissance efforts, revisions to the Little Wekiva River model, design development, and evaluation and selection of alternatives in order to reduce erosion, protect channel banks and adjacent properties, and reduce maintenance. In addition, permitting and operation and maintenance information of the selected design were also presented.

Final Apopka Infrastructure Assessment, Orange County Florida, Volume I (Parsons, 2002) This report presented the results of an Infrastructure Assessment in the Apopka Maintenance District of Road and Drainage Division of Orange County (AMD). The objective of this program was to supplement the work previously identified in the 1996 Stormwater Needs Assessment Report focusing on specific "maintenance" related issues associated with the County's infrastructure system. It is the intent of the District-wide pilot study program to identify the problem areas and recommended improvements.

Letter of Map Revision (LOMR) Correspondence, City of Altamonte Springs (FEMA, 2002) The Flood Insurance Study (FIS) and Flood Insurance Rate Map (FIRM) for Seminole County and incorporated areas were revised to reflect more up-to-date hydrologic analyses and topographic mapping along Lake Maltbie, Lake Roy, Lake Ruby and Ponding Areas 1-6 as well as more detailed topographic information along Lake Adelaide, Cranes Roost, Lake Florida, North Lake, Lake Orienta, Pearl Lake, Pot Lake, Prairie Lake and Spring Lake.

Middle St. Johns River Basin Surface Water Improvement and Management (SWIM) Plan (SJRWMD, 2002) Under the SWIM Act of 1987, water management districts prioritized water bodies based on their need for protection and/or restoration. The purpose of the Middle St. Johns River Basin SWIM Plan was to set forth a course of action identifying projects and the effort needed to accomplish them, consistent with the levels and the trends of the SWIM funding. The FY2001 legislatively funded projects for the Little Wekiva River Basin identified in the SWIM plan included implementation of 3 sedimentation control projects identified in the 1998 Study. Other tasks included: secure $10-12 million in funding by FY 02/03 and facilitate implementation of 11 projects to reduce excessive sedimentation along seven miles of the Little Wekiva River; facilitate build-out of Phase I of the Little Wekiva River Watershed Management Plan (1998 Study); monitor biological and sediment transport changes as a result of project implementation; and by FY03/04, use monitoring findings to evaluate the effectiveness of the installed systems and determine their operation and maintenance requirements.

Orange County Stormwater Needs Assessment Update (Parsons Engineering Science, Inc. 2002) The objective of this study was to provide a comprehensive and updated assessment of county-wide stormwater needs within various divisions of Orange County government. This report was based on evaluation of documents, data, and interviews with staff. Ten (10) flood control, 4 erosion control and 1 water quality projects were identified for the Little Wekiva River Basin.

Final Drainage Investigation Report Londonderry Hills Subdivision, Orange County, Florida (Parsons Engineering Science, Inc. 2001) This report presented the results of a drainage investigation assessing three problem areas within the Londonderry Hills Subdivision, which is located in the Little Wekiva River Basin. Based on the analysis only two of the problem areas were determined to warrant corrective action. Both maintenance and structural improvements were recommended for these 2 problem areas.

Final Report, Little Wekiva River River Reconnaissance and Priority Re-Evaluation, Orange and Seminole Counties Florida (URS, 2001) The objectives of this priority re-evaluation were to present the results of conditions observed along the main stem of the Little Wekiva River and to develop a revised list of priority projects for implementation by the SJRWMD and/or local governments. River conditions were reviewed and those projects that should be implemented in subsequent years to 1) reduce sedimentation, 2) reduce risk of flooding, and 3) reduce risk to adjacent properties were also identified.

A Cultural Resource Assessment Survey, Little Wekiva River Watershed Management Plan, Orange and Seminole Counties, Florida (Archaeological Consultants, Inc., 2000) The purpose of this investigation was to locate and identify and cultural resources within 11 project sites along the Little Wekiva River and to assess their significance in terms for listing in the National Register of Historic Places. The report concluded that no cultural resources were found in the Little Wekiva River Watershed Management Plan project sites and that the proposed activities would have no effect on significant archaeological sites or historic properties.

Fish and Aquatic Invertebrate Communities of the Wekiva and Little Wekiva Rivers: A Baseline Evaluation in the Context of Florida's Minimum Flows and Levels Statutes, SJRWMD (Florida Fish and Wildlife Conservation Commission/University of Florida Department of Fisheries and Aquatic Sciences, 2000) In anticipation of spring discharge reductions to levels below the minima established by the SJRWMD due to projected water demand increases, the SJRWMD conducted a study with the following objectives: 1) determine the taxonomic compositions and structures of Wekiva River study area fish and aquatic invertebrate communities; 2)evaluate the current biological health of the Wekiva and Little Wekiva rivers using results compiled from objective 1; 3) predict the effects of projected 10-20 percent discharge reductions upon the target communities, using results from objectives 1 and 2; and 4) construct standard format databases designed to provide future investigators with a baseline reference useful for ecological comparisons of the compositions and structures of past and present fish and aquatic invertebrate communities. The taxonomic and functional compositions of the invertebrate fauna in most habitats sampled indicated high degree of habitat complexity, adequate and diverse food resources, abundant nutrients, good water quality, and a healthy but at least moderately eutrophic aquatic ecosystem. Results of the study indicated that the projected spring discharge reductions would cause large-scale shifts in the relative abundance of species within invertebrate communities associated with most of the habitats sampled.

West College Park Drainage Evaluation, City of Orlando (ERD, 2000) The purpose of this study was to evaluate the characteristics of the existing drainage system, identify flooding problem areas and propose drainage system modifications to improve overall drainage characteristics within the vicinity of Rio Grande Ave. and West Smith St., and West Princeton Street. The highest priority was given to Subbasin H due to its historic flooding problems. Subbasin H encompasses the area east of the railroad, north of Stetson St., south of Vassar St. and west of Florida Ave. One option was the construction of a new storm sewer conveyance system along Rio Grande Ave. connecting to a small stormwater detention pond, currently under private ownership, which would provide the highest level of flood protection. A new outfall was proposed from the detention pond north to Lake Fairview. The second option was the construction of a larger dry detention pond on property currently under private ownership west of Rio Grande Ave. and south of the Green Street right-of-way, with an outfall connecting to the existing storm sewer system on Princeton St.

Drainage Basin Study for Woodsmere Stormwater Pumping Station, Orange County, Florida (PEC, 1999) This report summarized a comprehensive investigation of the drainage basin, which contributes stormwater runoff to the Woodsmere stormwater pumping station. Although the pump station is not located in the Little Wekiva River Basin, it does discharge to the Lake Lawne Outfall Canal in the Little Wekiva River Basin.

Individual Environmental Resource Permit Application and Erosion and Sediment Control Countermeasures in the Little Wekiva River Basin, SJRWMD (URS Greiner Woodward Clyde, 1999) An individual Environmental Resource Permit Application and supporting documentation was prepared to authorize the implementation of selected countermeasures for control of sedimentation within the portion of the Little Wekiva River that extends from U.S. Hwy 441 to S.R. 434, a distance of eight river miles. Countermeasures proposed to address the sedimentation problems include grade control structures, structural and non-structural protection measures, and dredging and grading, known as "dredge and grade". The proposed countermeasures would have primary and secondary impacts to the river and surrounding riparian habitat protection zone (RPHZ). Primary impacts to the wetlands and RPHZ would result from construction activities and in situ placement of structures and could be minimized using Best Management Practices (BMPs). Secondary impacts were expected to include a decrease in channel and stream bank sedimentation, which would result in improved aquatic biotic habitats and enhancement of existing biotic communities.

Responses to Request for Additional Information to the Individual Environmental Resource Permit Application and Erosion and Sediment Control Countermeasures in the Little Wekiva River Basin, SJRWMD (URS Greiner Woodward Clyde, 1999) This submittal provided responses and supporting documentation to each question outlined in the "Request for Additional Information" by the SJRWMD in response to the original permit application.

Feasibility Study for Replacement of 96-Inch Plate Arch Pipe, Little Wekiva River, Orange County, Florida (URS Greiner Woodward Clyde, 1999) In February 1998, the 96-inch plate arch pipe that conveys the Little Wekiva River through and below the Riverside Acres subdivision in Orange County experienced a progressive collapse. The purpose of this feasibility study was to consider alternative ways to restore the Little Wekiva River to open channel flow and elevate the riverbed.

Orange County Lake Index (Orange County Stormwater Management Department, 1999) This document contains basic information for all of the lakes in Orange County with respect to water quantity including FIRM zone, 100-year stage, FEMA Panel Number, minimum floor elevations in the area, normal high water elevation, maximum stage, control structure type and any additional remarks. Data for 36 lakes in the Little Wekiva River Basin within Orange County were included in the report.

Phase I and II Environmental Site Assessment Report, Goddard Avenue, City of Orlando, Florida (PBS&J, 1999) This report documented the results of a Phase I and Phase II Environmental Site Assessment of an approximately 6.7 acre undeveloped parcel located along Goddard Avenue and Lee Road in Orlando Florida.

Sawmill Pond/Horseshoe Lake/Crooked Lake Interconnection Study, Orange County, Florida (Singhofen & Associates, Inc., 1999) This investigation of the Horseshoe/Crooked Lake system was conducted to identify potential opportunities to increase recharge to the Floridan Aquifer and to investigate flooding problems associated with Sawmill Pond. This study was relevant to the Little Wekiva River Basin in that Lake Orlando intermittently discharges to the Horseshoe/Crooked Lake system through a gated outfall structure. The study recommended that the culvert connection between Horseshoe Lake and Crooked Lake be left as is and that the inlet and outlet ends of the pipe be routinely inspected and kept free on obstructions. A small pumping system to recover flood storage for Sawmill Pond was also recommended.

City of Orlando, Florida Little Lake Fairview Wet Detention Area Feasibility Study (CDM, 1998) The City of Orlando planned to improve the water quality discharging into Little Lake Fairview. The feasibility of retrofitting an existing disturbed natural wetland system into a stormwater treatment facility adjacent to Little Lake Fairview basin was investigated. The study found that the proposed wet detention area facility is a feasible project and is capable of meeting the SJRWMD water quality treatment criteria.

Drainage Calculations Lake Hill Drainage Study, Orange County, Florida (GTC Engineering Corporation, 1998) A detailed study of Lake Hill was performed to establish an accurate 100-year flood stage since the existing 100-year stage published by Orange County is not based on an actual study.

Recommended Erosion and Sedimentation Countermeasures, Little Wekiva River Watershed Management Plan, SJRWMD (Singhofen & Associates Inc., Woodward-Clyde Consultants, 1998) This report presented the results of a study to determine the countermeasures appropriate to address the sedimentation problems within the Little Wekiva River Basin. A basin-wide assessment was made of the causes of the erosion problems and the countermeasures recommended along the main stem of the river to correct the identified problems. Conclusions from this study included: rapid urbanization has decreased stormwater runoff time of concentration, increased imperviousness and increased river flows; increased river flows have caused erosion problems in Orange County, sedimentation in Lake Lotus, erosion in the upper reaches of Seminole County and sedimentation from SR 434 northward; informal or "ad hoc" river bed protection below bridges at Riverside Park road, Elba, Egret, and Campo Ways, Northwestern Avenue and Weathersfield Avenue were acting as grade control; Orange County's sedimentation basin appeared to be effective with sediment removal estimated on the order of 50%; and flooding of property appeared to be limited to the Riverside Acres Subdivision and the aggrading reaches north of SR 434. More extensive flooding occurred during tropical storm Gordon upstream of S.R. 434.

Riverside Acres Culvert Collapse Construction Alternatives and Emergency Sheet Pile Analysis, Orange County, Florida (PBS&J, 1998) Potential alternatives for stabilizing the 50-ft section of collapsed arch pipe culvert in the Riverside Acres subdivision were studied to determine the most economical, permanent solution to this emergency situation. It was recommended that the entire culvert be removed and replaced by an open channel with sheet pile.

Stormwater Master Plan for the Beggs Road/Overland Road Area, Orange County, Florida (PEC, 1998) The primary purpose of this study was to investigate and address existing flooding problems in the immediate vicinity and surrounding areas of Beggs and Overland Roads.

Application for Standard General Environmental Resource Permit, Dubsdread/Northwest College Park Drainage Improvements, City of Orlando, Orange County Florida (DRMP, Inc., 1997) Work to provide flood relief to stormwater problems in the vicinity of the Northwest College Park Area and the Dubsdread Golf Course in the project area was proposed and submitted for review in an Environmental Resource Permit application along with supporting documentation. The proposed improvements included installing a storm sewer system, reconstruction of a drainwell, and providing water quality treatment for runoff from the Edgewater Drive system.

Biological Assessment of Little Wekiva River Basin, including the Altamonte Springs Wastewater Treatment Plant, Orange and Seminole Counties, NPDES #FL0033251 (FDEP, 1997) Biological, physical, chemical and habitat information was collected from seven stations in the Little Wekiva River and two stations in the Wekiva River to assess the effects of human activities in the watershed (i.e., the Altamonte Springs Wastewater Treatment Plant and numerous stormwater inputs). Results for stations in the Little Wekiva River were as follows: habitat quality ranged from sub-optimal to optimal; all stations but one complied with the 5.0 mg/L Class III dissolved oxygen standard; total coliform bacteria complied with the Class III water quality standard at all sites; substantial nitrate-nitrite enrichment was observed at 3 stations; biota inhabiting the river immediately downstream of the Altamonte Springs WWTP were not negatively affected by intermittent discharge; all stations received a good or excellent rating based on the Stream Condition Index (SCI); low Florida Index and/or Ephemeroptera/Plecoptera/Trichoptera (EPT) Index values at some of the upstream sites demonstrated that humans have influenced portions of the river; and phytoplankton communities at some portions of the Little Wekiva River were typical of those inhabiting culturally eutrophic systems.

Drainage Inventory Engineering Study, Little Wekiva River Basin, SJRWMD Conceptual Permit History, Permit Application Number 4-117-0416AGC, Seminole County, Florida (DRMP, 1997) This report documented the conceptual permit history for a stormwater program strategy for the Little Wekiva River Basin that identifies drainage deficiencies and their magnitude. The report contains pertinent correspondence regarding the history of this project.

Little Wekiva River Basin Tributary C Flooding Investigation, Seminole County, Florida (DRMP, Inc., 1997) This report documented the historical flooding conditions of the area defined as Tributary C as well as an analysis of existing conditions and proposed alternatives that considered the construction of a pump and force main permitted by the SJRWMD as part of an emergency relief effort.

Little Wekiva River Pilot Dredging Project, Contract No. 97W169A Reimbursement Requirements (Seminole County, 1997) This report consists of the required documentation needed for reimbursement for the pilot dredging of 450 cubic yards of spoil material from the Little Wekiva River performed by the Seminole County Public Works Department in 1996. The project was a success on a pilot basis showing that physical construction methods could be used to excavate material in the flowing section of the river and turbidity levels could meet permit conditions.

Draft Seminole Wekiva Trail Master Plan, Seminole County, Florida (Glatting Jackson Kercher Anglin Lopez Rinehart, Inc., 1997) This report consists of a site evaluation, a conceptual master plan, and a management and maintenance plan for the Seminole Wekiva Trail. The site evaluation documented collected information that may affect development of the trail. The conceptual master plan described the design concept and elements of the trail. Finally, the management and maintenance plan provided recommendations for trail operation and management.

Reconnaissance Report, Little Wekiva River Lake Regulation and Management Study, Final Report, SJRWMD (Woodward-Clyde Consultants, 1997) Reports and data related to the pervasive sedimentation problems in the Little Wekiva River basin were reviewed and a one-day reconnaissance of the Little Wekiva River was conducted in order to identify the causes of sedimentation problems. The report describes how the consultant planned to proceed with the next phase of the project which included the need for hydrologic and hydraulic (H&H) modeling and sediment and geomorphic (S&G) modeling.

Emergency Sediment Removal and Restoration, The Springs, Seminole County, Florida (Seminole County, 1996) The intent of this document was to request an emergency authorization from the SJRWMD by Seminole County for partial restoration of a segment of the Little Wekiva River system in the vicinity of the foot bridges within the Springs subdivision. The report provided a summary of the existing and proposed conditions and an environmental analysis for the emergency work. In order to provide temporary relief, 160 linear feet of dredging within the Springs Subdivision was proposed at two locations.

Little Lake Fairview Water Quality Study, Orange County, Florida (Miller-Sellen Associates, Inc., 1996) The objective of this study was to identify all the stormwater inflows entering into Little Lake Fairview, determine its water quality, calculate the pollutant loading to the lake, and identify potential retrofit projects to reduce the pollutant loadings and help eliminate drainage problems in the area. Historical water quality

trends within Little Lake Fairview indicated a steady increase in biochemical oxygen demand (BOD), suspended solids, and zinc (Zn). These trends also include steady decreases of total phosphorus (TP), total nitrogen (TN), lead (Pb), and copper (Cu). Trophic state index (TSI) showed the water quality as generally being good. Recommendations for reducing the pollutant load included: installing stormwater treatment facilities on several of the outfalls; begin a program to educate homeowners on proper pesticide/fertilizer uses; and enforce connection to available centralized sewer systems.

Orange County Stormwater Needs Assessment Final Report (Miller-Sellen Associates, Inc., Orange County Stormwater Management Department, 1996) The purpose of this document was to identify the extent of the stormwater management capital improvement needs in Orange County on a County-wide basis. The study identified 11 various types of projects including sedimentation mitigation, stormwater master plans, and stormwater retrofits for the Little Wekiva River Basin.

SJRWMD Individual Environmental Resource Permit, Little Wekiva River, Sediment Removal and Restoration, Seminole County, Florida (Seminole County, 1996) This report is the Environmental Resources Permit Package for the restoration of the Little Wekiva River from Woodbridge Road to 4,000 feet north in Seminole County. The County proposed to dredge 3,250 linear feet of the Little Wekiva River within the Springs Subdivision as well as remove sediment from the Spring Run to Sanlando Springs. The report summarized existing and proposed conditions, impacts of sediment removal, environmental analyses, modeling results, construction methods, erosion controls and restoration and maintenance. The report concluded that dredging the channel bottom for this project would provide a temporary solution to low storm events. Long-term solutions would include constructing sedimentation basins.

SJRWMD Individual Modification Environmental Resource Permit, Guernsey Basin Outfall to Lake Adair, City of Orlando, Florida (DRMP, Inc., 1996) The City continued to receive flooding complaints in the area of the Guernsey Basin even after improvements were made in 1988. This analysis found that the only option to provide flood control benefits to the Guernsey Basin area was connection to Lake Adair as originally proposed in the 1960s.

SJRWMD Individual Modification Environmental Resource Permit, Guernsey Basin Outfall to Lake Adair Response to Comments, City of Orlando, Florida (DRMP, Inc., 1996) Responses to a Request for Additional Information are provided in this document along with supporting documentation.

Stormwater Management Master Plan, Altamonte Springs Florida, Task Assignments 1.4, 1.5 & 1.7, Identification and Investigation of Stormwater Problem Areas (PEC, 1996) This report identified and prioritized areas prone to localized inundation during certain key storm events within the City, and identified possible causes and potential solutions for each problem area.

Draft Little Wekiva River Channel Stabilization Study, Little Wekiva River Basin, Orange and Seminole Counties (SJRWMD, 1995) This study was undertaken at the request of Seminole County and residents of the Springs community due to chronic flooding. It provided: a comparison of the Little Wekiva River flood profiles between the 1979 FEMA City of Altamonte Springs FIS, District Technical Publication SJ89-3, current river conditions downstream of S.R. 434; identification and recommendations for a short-term solution with comparisons to current river conditions, and recommended plans to develop long-term solutions.

Flood Insurance Study, Seminole County Florida and Incorporated Areas (FEMA, 1995) This FIS investigated the existence and severity of flood hazards in, or revises previous FIS/ FIRMs for the geographic area of Seminole County Florida. The report contains flood profiles for the Little Wekiva River for the 10-, 50-, 100- and 500-year storm event.

Little Wekiva River Basin Drainage Inventory Engineering Study, Seminole County Florida (DRMP, Inc., 1995) This document identified unincorporated areas of the Little Wekiva River Basin in Seminole County which may have potential drainage problems related to structural or channel deficiencies. Phase I of this study involved data collection to develop a drainage structure inventory. Phase II of this project provided an analysis of those structures which are maintained by Seminole County or affect the drainage in Seminole County and assigned an appropriate Level of Service (LOS). Twenty (20) structures with significant problems were identified. The alternatives recommended in this study included: low flow restrictors, culvert improvements, channel armoring, off-line retention, bridge reconstruction at higher elevations, and channel restoration.

Little Wekiva River Drainage Basin Drainage Inventory Engineering Study, Tributary "C" Retrofit, Seminole County, Florida (DRMP, Inc., 1995) This report proposed a solution for flooding in the Tributary "C" area where flooding had been a chronic problem. Recommendations for retrofit in the Tributary "C" basin included creation of a 100-year floodplain storage area on Forest Lake Academy property and culvert replacements.

Exhibits – Historical Information on Little Wekiva River, Starbuck Springs and vicinity property, Seminole County, Florida (Thomas B. Israel, 1994) This document included exhibits and data from researched files for two river front properties on the Little Wekiva River contiguous to and north of Springs Landing.

Little Wekiva River Analysis, City of Altamonte Springs, Florida, Discharge Contribution to the Little Wekiva River (PEC, Inc., 1994) This study quantified the City of Altamonte Springs point source discharge contribution to the Little Wekiva River. Sources identified include the pumped discharge from the City of Altamonte Springs Cranes Roost Stormwater Pumping Facility and the wastewater effluent disposal from the City of Altamonte Springs Swofford Regional Water Reclamation Facility. The results

of this study showed that both facilities could potentially impact the Little Wekiva River by contributing: additional flow which could result in increased river water surface elevations, additional erosion of the stream bed and channel banks due to increased velocities; and additional sedimentation which could result in an increased river water surface elevation.

Little Wekiva River Restoration Project: Erosion and Sedimentation Mitigation, Orange County, Florida (Orange County Stormwater Management Department, 1994) This document was a proposal to the Florida Pollution Recovery Trust fund for funding to help achieve the goals of environmental restoration, enhancement and protection of the Little Wekiva River.

Subsurface Soil Exploration, Proposed Summit Apartment Complex, Summit Centre Way and Maitland Summit Boulevard, Seminole County, Florida (Ardaman & Associates, Inc. 1994) This report summarized the results of a shallow subsurface soil exploration performed at the subject property in order to evaluate the general subsurface conditions within the building and parking/drive areas and to provide recommendations for site preparation, foundation support and pavement design.

Bear Lake Drainage Basin Hydrology Study, Seminole County, Florida (T.E. Knowles & Associates, 1993) A hydrologic study of the Bear Lake Drainage Basin was performed to: investigate physical and chemical parameters of soils surrounding Bear Lake and obtain topography, floodplain and geological maps; determine past, present and future improvements to the drainage basin and discuss the desired pollutant removal efficiency of any systems that may be installed in the future; and to recommend optimum locations and sizes of berms and swales within the basin to most effectively retain stormwater runoff. The study found that the overall water quality in Bear Lake was excellent. It was estimated that pollution abatement retention areas were treating 75 percent of the total drainage basin. This study recommended treating the remaining 25 percent of the basin with constructed swales.

Diagnostic Feasibility Study for the Restoration of Lake Lawne (FDEP, 1993) The historical water quality for Lake Lawne indicate it is in need of restoration. The three major components of this study included sediment, surface water and stormwater characterization. The study indicated that nutrients and suspended solids are the critical contaminants to reduce in Lake Lawne sediments and in the surrounding watershed. A reduction in external contaminant loadings to Lake Lawne could be best achieved by constructing stormwater detention ponds to treat stormwater runoff. It was also recommended that dredging be performed to remove part of the deep muck in the lake, as sediment internal loadings were found to be a significant source of phosphorus.

Pleasant Oaks Drainage Basin, Orange County, Florida (BJM Associates, 1993) This study focused on flooding problems occurring in the Pleasant Oaks Subdivision, located in northwest Orange County at the headwaters of the Little Wekiva River. Hydraulic

conditions were evaluated and used as a basis for the selection of flood control alternatives. Alternatives to improve conditions consisted of maintenance of existing systems, providing additional stormwater storage capacity both on-site and off-site, and the re-directing of stormwater to its historical destinations.

Reestablish Streambank Vegetation, Streambank Stabilization, and Limited Dredging of the Little Wekiva River, Phase II, FDEP (University of Central Florida, 1993) Objectives of this report included: 1) restoring a portion of the Little Wekiva River by improving stream flow and planting native, flood tolerant tree species in place of exotic species; 2) collecting quantitative data on selected physical and biological attributes of the area to be restored; 3) documenting the success of the restoration in terms of growth and survival of planted trees; 4) determining what habitat conditions predispose in the Wekiva Basin in general and the Little Wekiva River in particular to an invasion of exotic plant species; 5) describe litter production and the seed rain over an annual cycle; and 6) draw summary conclusions as to the causes and consequences of the degradation of the Little Wekiva River and the role of restoration in a non-equilibrium ecological system. The study found that exotic plant species were not a significant problem along the stream channels and the riparian zones of the Wekiva River Basin, with the exception of the Little Wekiva River. Urbanization upstream of this reach of the Little Wekiva River has produced high levels of disturbance and provided a source of exotic plant propogules. The high levels of sediment in the Little Wekiva River accelerate this process as it clogs open channels causing water levels to rise. This, in turn, causes high tree mortality in the former hydric hammocks bordering the river and produces more areas, which can subsequently be colonized by exotic species.

Analysis of Drainwells in Orange County (Orange County Stormwater Management Department, 1992) This report provided a summary and analysis of the drainwell inventory within Orange County's jurisdiction. According to this report there are 27 drainwells in the Little Wekiva River Basin within Orange County.

Oak Avenue and Lake Mobile Drive Winwood Target Area, Project Number 91-02, Stormwater Calculations, Seminole County, Florida (The Civil Design Group, 1991) This report documented a proposed stormwater management system for Oak Avenue and Lake Mobile Drive vicinity in the Lake Mobile Shores subdivision area. The report included the design criteria, methodology, calculations and modeling results for the proposed system. A dry-bottom detention pond located northwest of the Oak Avenue-CR 427 intersection was proposed for the project basins.

A Proposed Flood Management Plan for the Little Wekiva River Basin, Orange and Seminole Counties, Florida (SJRWMD, 1991) The SJRWMD conducted a two-phase study to evaluate the flooding problems of the Little Wekiva River Basin and formulated a comprehensive management plan to reduce flood and erosion damages. Phase I entitled the *Little Wekiva River Floodplain Study* (SJRWMD, 1989) determined flood elevation and flood prone areas in the basin. Phase II of the study identified major

problem areas in the basin and presented several flood protection alternatives for each problem area. Phase I indicated that more than 500 buildings are located in the 100-year floodplain of the Little Wekiva River and 25 bridges and culverts might be overtopped during a 100-year storm event. Phase II found that of the 500 buildings in the 100-year floodplain, only 140 may suffer actual flood damages. Other residents would experience street or yard flooding but no structural damages.

Pump Station Analysis: Woodsmere Pump Station, Little Wekiva Drainage Basin, Orange County, Florida (Orange County Stormwater Management Department, 1991) The purposes of this pump station study were to inventory information and to determine the amount of flooding that would occur during Orange County's 24-hour 10-, 25- and 100-year storm events with the pumps operating at design outflow expectations.

Manchester Oaks, Technical Information Supporting LOMA Request made to FEMA, Seminole County, Florida (CPH, 1990) The intent of this study was to show that the existing FEMA FIRM map (#120289 0110 B, Seminole County, FL) was inaccurate and to determine a new 100-year floodplain elevation. This report provided supporting documentation to amend the floodplain elevation in the area of the Manchester Oaks Subdivision.

Hunt Club Boulevard Area Drainage Study, Seminole County, Florida (Miller-Sellen Associates, 1989) This drainage study was initiated by Seminole County in response to several drainage problems in the Hunt Club Boulevard area. The purpose of this study was to provide improvements to the existing drainage problems within the study area. The first phase involved identification of existing drainage patterns and the delineation of the 100-year flood elevations. The second phase consisted of the design of improvements to alleviate existing drainage problems. This report recommended the construction of a bleed-down system for the lake west of Hunt Club Boulevard and for a piped conveyance system through the Palm Park Subdivision. It also recommended that any future encroachment into the 100-year floodplain be accompanied by compensating storage and conveyance considerations.

Little Wekiva River Floodplain Study (SJRWMD, 1989) The objective of this study was to complete a floodplain study, which consists of detailed hydraulic and hydrologic analyses to determine flood elevations and flood prone areas throughout the basin. The report also included flood discharges and velocities for critical locations in the basin and identified areas of major flood hazards. The study found that over 400 structures, primarily single-family residences, have been found to lie in the 100-year floodplain. The study also indicated that 6 river structures (bridges and culverts) might be overtopped during a 10-year storm event, 18 during a 25-year storm event and 25 during a 100-year storm event.

Management and Storage of Surface Waters Application and Engineering Report for the Seminole County Softball Complex, Seminole County, Florida (PBS&J, 1989) This report provided the pertinent information for a stormwater treatment system design

necessary to comply with local and state regulations for construction of the Seminole County Softball Complex. The facility was to be constructed on a site that was previously being used as a solid waste transfer facility. The report concluded that the post development peak rate of discharge would not exceed the pre-development rate for the 25-year/24-hour storm event. The proposed stormwater management system would improve the quality of stormwater entering the groundwater by installing an impervious layer over existing solid waste and re-directing stormwater to an off-site retention area containing no sub-surface trash.

Water Quality Assessment of the Floridan Aquifer in the Wekiva River Basin of Orange, Lake, and Seminole Counties (SJRWMD, 1989) The purpose of this study was to determine the present condition of water quality in the Floridan aquifer in the Wekiva River basin. The study area encompassed the Little Wekiva River Basin. The study demonstrated that water levels fluctuate seasonally in the Wekiva River Basin, but there had been no long-term water level decline and water quality had not changed significantly in the last decade.

Drainage Calculations, Royal Estates, Seminole County, Florida (Bowyer-Singleton & Associates, 1988) This report summarized the pre-development and post-development conditions in terms of discharge to Bear Lake from the proposed development of Royal Estates. The site runoff from the proposed development would be collected by storm sewers and then conveyed to a retention pond for treatment. Overflow from the system would be directed via an outfall control structure to the storm sewer system on Bear Lake Road.

The Nutrient Assimilation Capacity of the Little Wekiva River, City of Altamonte Springs, Florida (Institute of Food and Agricultural Services, University of Florida, 1988) A three-year research project was conducted to determine the nutrient assimilation capacity of the Little Wekiva River and was designed to assess the effects of discharges from the Altamonte springs Regional Wastewater Treatment Plant, the Weathersfield Sewage Treatment Plant and the Hi-Acres Citrus processing plant on stream hydrology, water quality and biology. The primary objective of the study was to determine a relationship, if any, between stream nutrient concentrations and the abundance of aquatic macrophytes. This study found that anthropogenic discharges, especially those from the Altamonte Springs Regional Wastewater Treatment Plant, were responsible for a significant enrichment of the Little Wekiva River as well as changes to general stream chemistry. There was no evidence found that the distribution and abundance of aquatic plants in the Little Wekiva River are related to nutrient enrichment.

Phase I Project Summary Report Little Wekiva River, Erosion and Sedimentation Study, Orange County, Florida (DRMP, Inc., 1988) An engineering study of the Little Wekiva River between Edgewater Drive and the Seminole County line was performed to evaluate the erosion conditions along this reach of the river; to determine its causes; to assess its impact on existing bridges, dwellings and other structures; and to

recommend solutions to the problems. Three feasible strategies were recommended including: a non-structural/natural state approach that allows the river to follow its natural course; lowering peak flows upstream of the study area by lowering lake levels to provide additional stormwater storage and incorporating sedimentation control measures; and incorporating sedimentation control measures only.

Guernsey Basin Drainage Improvements, Application for Permit for the SJRWMD, City of Orlando, Florida (DRMP, Inc., 1987) The purpose of this report was to present information to the SJRWMD in order to receive an Individual Permit for the Guernsey Basin Drainage Improvements. The City of Orlando has experienced problems with the drainage well draining this area and anticipated its eventual failure. The City proposed to modify the existing storm sewer system, regrade and expand the basin in Guernsey Park and close the drainage well in the park.

Preliminary Design Manual for the Riverside Acres Sedimentation Basin, Orange County, Florida (CPH, 1986) This report was prepared to document the recommended sedimentation basin plan for removing suspended sand particles in the flow from the Little Wekiva River near the Riverside Acres Subdivision. Two alternative sedimentation basins were evaluated and the preliminary engineering, construction and implementation aspects of the selected plan were also presented.

Comprehensive Soil and Groundwater Investigation and Evaluation for Individual On-Site Septic Tank Systems, Springs Landing Phase II, Seminole County, Florida (Jammal & Associates, Inc., 1983) The purpose of this report was to obtain detailed lot-by-lot soil and groundwater data for the planned subdivision in order to provide the basis for a final evaluation regarding the use of individual septic tank systems. The report provided supporting documentation that septic systems could be incorporated on a project-wide basis.

Kensington P.U.D., Seminole County, Florida for Florida Residential Communities (Canin Associates, 1982) This document was intended to act as an application submitted to the Seminole County Land Management Division for review and approval of the Kensington P.U.D. The report consists of the design concept, land use and zoning information, and potential impacts to the project area. Drainage improvements for the overall development would utilize existing depressions to provide storage for the additional runoff volume generated by post development conditions.

Urban Stormwater Management Plan, Little Wekiva River Sub-Basin, Part One: Background Information (East Central Florida Regional Planning Council, 1980) This report provided background information on the Little Wekiva River including an overview of the subbasin, characteristics of the subbasin, assessment of the drainage systems, water pollution sources in the Little Wekiva River subbasin and an assessment of the water quality management needs. Water pollution sources in the Little Wekiva River subbasin consisted of domestic wastewater treatment plant discharges, industrial wastewater treatment plant discharges, septic tank and drain field discharges,

stormwater runoff, and drainage wells. Water quality management needs included: coordination of water quality sampling activities; storm sewer system information; BMP design criteria for existing storm sewer systems; financial assistance for urban storm sewer BMP design and construction; and impacts of stormwater on groundwater quality.

Urban Stormwater Management Plan, Little Wekiva River Sub-Basin, Part Two: Urban Stormwater Management Strategies (East Central Florida Regional Planning Council, 1980) This plan identified activities and procedures to achieve and maintain water quality conditions suitable for recreational uses in the Little Wekiva River subbasin. The report included summaries of the existing water quality sampling system, existing stormwater management practices in the subbasin, alternative urban stormwater management measures and a review of the existing water quality monitoring network in the Little Wekiva River subbasin. Alternative urban stormwater management measures discussed in the report included streambank management, lake management, urban stormwater runoff management and public awareness. A combination of these strategies was recommended for various management areas identified throughout the subbasin.

Little Wekiva River Nutrient Study Wasteload Allocation Documentation, City of Altamonte Springs (FDER, 1979) This report is the third of a series of documents relating the consideration of water quality based effluent limits for dischargers into the Little Wekiva River including the Altamonte Springs STP, the Weathersfield S/D STP and the Hi-Acres Concentrate Plant. This report documented the final results of a study conducted by the Florida Department of Environmental Regulation (FDER) of nutrients in the river.

Floodplain Information, Little Wekiva River, Seminole County, Florida (U.S. Army Corps of Engineers, 1970) This report was prepared at the request of the Board of County Commissioners to aid in the solution of local flood problems and in planning the best utilization of land subject to flooding. This study summarized a record of the past largest known flood events on the river and showed the extent of flooding experienced in the past as well as those that could occur in the future.

An Engineering Report on a Drainage and Water Control Program for the Little Wekiwa Basin, Orange County, Florida (AP&RK Michaels/AE O'Neall & Associates/David B. Smith, 1960) This report presented the results of a comprehensive engineering study on a water control program for the Little Wekiwa River drainage basin in Orange County. A proposed water control system for the basin that is adequate to control flood flows resulting from the design rainstorm and to minimize the damage of floods caused by greater rainfalls was presented in this report.

Preliminary Engineering Report, Little Wekiva River Management, Seminole County, Orange County Florida (AP&RK Michaels-AE O'Neall & Associates, 1960) The purpose of this study was to suggest corrective measures for immediate temporary relief from

flooding and high water conditions in the Little Wekiva River basin in Seminole and Orange Counties. The proposed water control system, which is adequate to control flows resulting from the design storm, consisted of 2 pumping stations and force mains and nine lake-level control structures.

Design Study for S.R. 438 'Silver Star Road' from S.R. 435 (Hiawassee Road) to S.R. 500 (Orange Blossom Trail), Orange County, Florida (FDOT, Date Unknown) The purpose of this design study was to document the various factors and analyses considered in defining a specific design and location alignment for section of S.R. 438 from S.R. 435 to S.R. 500.

Infrastructure Inspection and Assessment Program Goldenrod Maintenance District, Orange County, Florida (PEC, Date Unknown) The primary objective of this program was to evaluate the condition of the existing drainage infrastructure within the Goldenrod Maintenance District with respect to maintenance and chronic roadway and drainage related problems and bring it to acceptable standards. Recommended improvements for problem areas were identified and approximate construction costs were provided. Of the problems identified, approximately 45 were flooding related, of which several were categorized as construction in progress (CIP) infrastructure improvements.

Wekiva Reserve (Stockbridge North) Drainage Calculations (Bowyer-Singleton & Associates, Inc., Date Unknown) This report contains the drainage calculations for the design and sizing of retention facilities for Stockbridge North, part of the Stockbridge Master Development Project.

2.3 Construction Drawings

Plans and drawings for several projects in the Little Wekiva River Basin were obtained as part of the data collection effort. CDM contacted each of the Participants to collect copies of plans for roadway projects, subdivisions, drainage improvements, water quality improvement projects, survey drawings and sedimentation control projects. Due to the number of subdivisions in the Little Wekiva River Basin (there are close to 900), only subdivision drawings where problem areas were reported were collected.

Roadway/Right-of-Way:

- Construction Plans for Kennedy Blvd. From Forest City Road to Wymore Road (International Engineering Consultants, Inc., 2005)
- Sand Lake Road (Hunt Club Blvd. to S.R. 434), PEC, 2003 (estimated date of completion).
- Orange County S.R. No. 423 (John Young Parkway) Shader Road to Forest City Road (S.R. 424) Phase II Submittal, Parsons Brinckerhoff Quade and Douglas, Inc., 2002.
- Markham/Douglas (S.R. 434 Intersection), FDOT, 2001.

- Markham Woods Road Widening to 3 Lanes, Seminole County Public Works Department, June 2000.
- State of Florida Department of Transportation, Plans of Proposed State Highway, State Project No. 77080-3561, Seminole County, State Road No. 436, URS Greiner, 1998.
- Markham Woods Road Stormwater Retrofit Project Construction Plans, REPS, 1998.
- State of Florida Department of Transportation, Plans of Proposed State Highway, State Project No. 77080-3560, Seminole County, State Road No. 436, HNTB, 1998.
- Wymore Road (Orange County line to S.R. 436), Glace and Radcliffe, 1997.
- Montgomery Road (S.R. 436 to S.R. 434), Seminole County Public Works Department, 1997.
- Pennington Drive Survey, Orange County Engineering Survey Section, 1993.
- 4th Street and Winston Avenue Drainage Improvements, Orange County Engineering Department, 1988.
- Little Wekiva River Study for Orange County Florida, DRMP, 1988.
- Cameo Way/Needle Drive Drainage Improvements, Orange County Engineering Department, 1987.
- F.A. Project No. M-8832-(2), Orange County, State Road 438, 1977.
- Construction Plans for Albemarle Road, date unknown.
- Markham Woods Road Crossdrain Extension, Seminole County Public Works Department, date unknown.

Waterway:

- General Site Plan, River Run South, Pond 23 Improvements, 2002.
- As-Built Drawing of Grade Control Structure #8, Little Wekiva River, Snyder Surveying, Inc., 2001.
- Little Wekiva River Basin Management Plan, Northwestern Avenue Erosion and Sediment Plan, Singhofen & Associates, Inc., 2001.
- Riverside Park Road Bridge Replacement, FDOT, 2001.
- Construction Plans for Long Lake Stormwater Pump Station Improvements, WBQ Design & Engineering, Inc., 2000.

- Lake Lovely Erosion and Sedimentation Controls (Record Drawings) (URS Greiner Woodward Clyde, 2000)
- Little Lake Fairview Outfall Canal Improvements for Orange County, Florida, PEC, 2000.
- As-Built Survey Riverside Acres Drainage, PBS&J, Inc., 1999.
- Construction Plans for Little Wekiva River – Altamonte Springs Grade Control Structures 7 & 8, URS Greiner Woodward Clyde, 1999.
- Water Quality Improvement Project Construction Plans for Sedimentation Baffle Boxes – Little Wekiva River, PEC, 1999.
- Little Wekiva River, Erosion Management, DRMP, 1997.
- Lake Lotus Park, Parking Facility, AR Miller Engineering, Inc., 1996.
- Construction Plans for Hunt Club Blvd. Area Drainage Improvements, Seminole County, Florida, Miller Sellen Associates, Inc., 1991.
- Composite Drawing, Little Wekiva River Study for Orange County, Florida, DRMP 1989.
- Construction Plans for Lake Lawne Outfall Weir, Orange County Engineering Department, 1989.
- 1962 and 1987 River Location Comparison, Little Wekiva River Project, DRMP, 1988.
- Little Wekiwa at Riverside Park, CPH, date unknown.

Subdivision:

- Construction Plans for Pleasant Oaks Drainage Retrofit, BJM Associates, 1997.
- Construction Plans for Hazelhurst Drainage Improvements, Gee & Jenson, date unknown.

Other:

- Construction Plans for Guernsey Basin Drainage Improvements, DRMP, 1996.
- Construction Plans for Guernsey Basin Drainage Improvements, DRMP, 1988.
- Cranes Roost Outfall Storm Water Force Main, HNTB, 1983.
- Rio Grande Pond, Project #2356, Engineering Bureau, City of Orlando, date unknown.

2.4 Hydrologic Data

Historical rainfall, stage and stream flow data were collected for the Little Wekiva River Basin. Data were collected from National Oceanic and Atmospheric Administration (NOAA), the United States Geologic Survey (USGS) and both Orange and Seminole Counties. The following subsections provide a summary of the data collected.

2.4.1 Rainfall Data

The rainfall station with the most complete period of record and located closest to the study area was the Sanford Experiment Station in Seminole County. Monthly rainfall totals were available from 1957 through 2001. The location of this station is shown in **Figure 2-1**. The historical monthly rainfall data for this station were graphed and are shown in **Figure 2-2**. Additionally, rainfall data for the gage at Orlando International Airport (also located as shown in Figure 2-1) were obtained. This station has a slightly longer period of record than the Sanford Experiment Station (1948 through 2002). The historical data for this station were also graphed and is shown on Figure 2-2. Within the last year, the USGS has also installed rain gage USGS 284051081234300 in the City of Altamonte Springs within the basin boundaries. The location of this station is shown in Figure 2-1. This is a real-time station and historical data were not available.

Orange County also collects rainfall data at many stations throughout the county. The County monitors rainfall data at two stations within the Little Wekiva River Basin including Lake Orlando and Riverside Acres. These data were obtained from the County and reviewed. The available periods of record for Lake Orlando and Riverside Acres are relatively short (1986 through 2002 and 1989 through 2002, respectively).

The SJRWMD also receives Next Generation Radar (NEXRAD) from Weather Services International (WSI) on a monthly basis and uses it in conjunction with rainfall data collected at rainfall gauge stations located throughout the SJRWMD's jurisdiction. The two closest stations to the Little Wekiva River Basin are located at Charlotte Street in Longwood and at Rock Springs and are also shown on Figure 2-1. The data collected from both radar and rainfall gauges are adjusted to determine actual rainfall amounts spatially throughout the SJRWMD's jurisdiction. NEXRAD data has only been available since 1995 and the SJRWMD is currently conducting an effort to adjust all of its rainfall data collected at gauge stations with the radar data.

NEXRAD can measure both precipitation and wind. NEXRAD is classified as a Doppler radar and it emits a short pulse of energy. If the pulse strikes an object (e.g., rain, snow, etc,), the radar waves are scattered in all directions and a small portion of the scattered energy is directed back toward the radar. The reflected signal is received by the radar. The strength of the returned waves is analyzed to determine the time it took to travel to the object and back and frequency shift of the pulse.

LAKE MONROE

Sanford Experiment Station

Orlando Sanford Airport

I-4

CENTRAL FLORIDA GREENEWAY

LAKE JESUP

USGS 02234998

USGS 02234990

USGS 284051081234300

COLONIAL

Orlando Executive Airport

EAST WEST EXPRESSWAY

BEELINE EXPRESSW

Orlando International Airport

N

W E

S

12000 0 12000 Feet

LOCATION MAP

LEGEND

- Hydrologic Stations
- SJRWMD Rainfall Gage Station
- Basin Boundary
- County Line
- Street Centerlines

Water Bodies

Little Wekiva RIver (Main Stem)

Wetlands

Municipalities

- Altamonte Springs
- Eatonville
- Longwood
- Maitland
- Orlando

Little Wekiva River Watershed Management Plan

CDM

Figure 2-1
Hydrologic Station Locations

Figure 2-1

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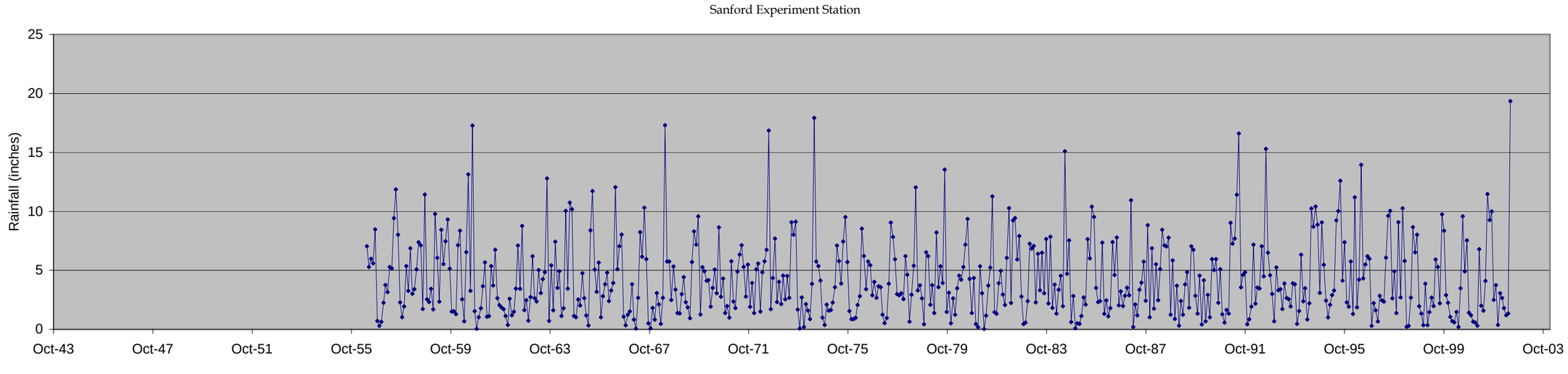
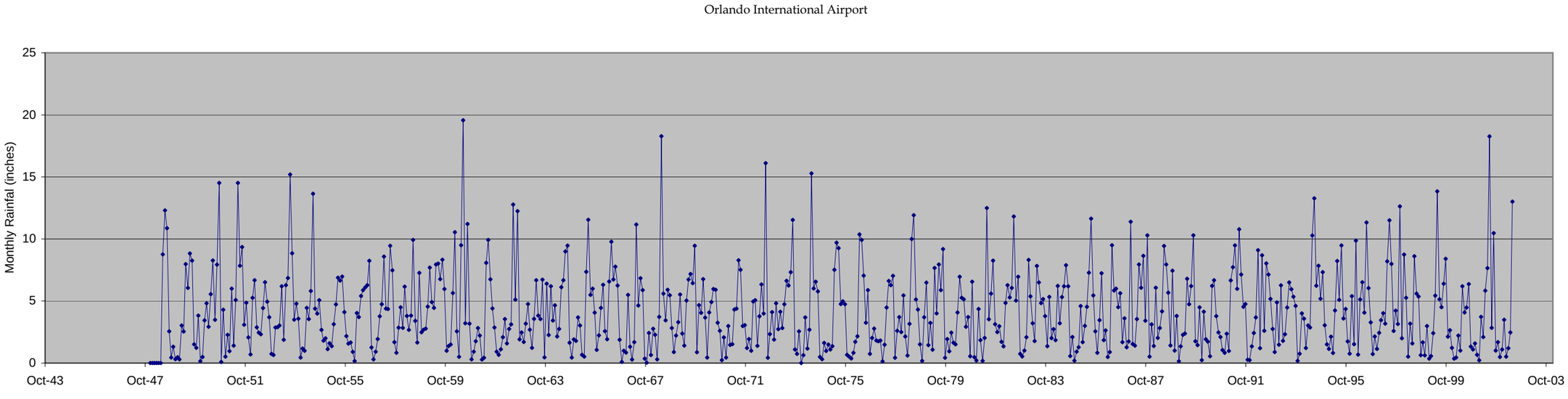
Figure 2-2
Little Wekiva River Watershed Management Plan
Historical Rainfall
Monthly Totals





Information on the movement of objects either toward or away from the radar can be used to estimate the speed of wind. The National Weather Service's Doppler radars can detect most precipitation within approximately 90 miles of the radar and intense snow or rain within 155 miles.

2.4.2 Stage Data

Historical stage data were available for the two USGS stations 02234990 and 02234998 and are shown in **Figure 2-3**. USGS station 02234990 is located near the river's crossing with SR 434 and USGS station 02234998 is located at the river's crossing with Springs Landing Blvd. The stage data were plotted with historical monthly rainfall totals recorded at the Sanford Experiment Station in Seminole County. The locations of these stations are also shown in Figure 2-1. Additionally, stage data were available for several water bodies in Seminole County including Bear Lake, Cub Lake, Lake Destiny, Lake Lotus, Mirror Lake, Pearl Lake and Spring Lake. These historical data have been plotted and are shown in figures included in **Appendix B**. Historical stage data for water bodies in Orange County were obtained from the Survey Section of the Orange County Public Works Department. Data were available for Lake Bosse, Lake Fairview, Little Lake Fairview, Lake Gandy, Lake Lawne, Lake Lovely, Lake Lucien, Lake Orlando, Lake Shadow and Lake Silver. These data were plotted and are also included in Appendix B.

2.4.3 Stream Flow Data

Historical stream flow data were also available for USGS Stations 02234990 and 02234998. The available period of record was from 1972 through 2002 and from 1995 through 2001 for USGS stations 02234990 and 02234998, respectively. These data were plotted and shown on **Figures 2-4** and **2-5**. These data were plotted with historical monthly rainfall totals recorded at the Sanford Experiment Station in Seminole County.

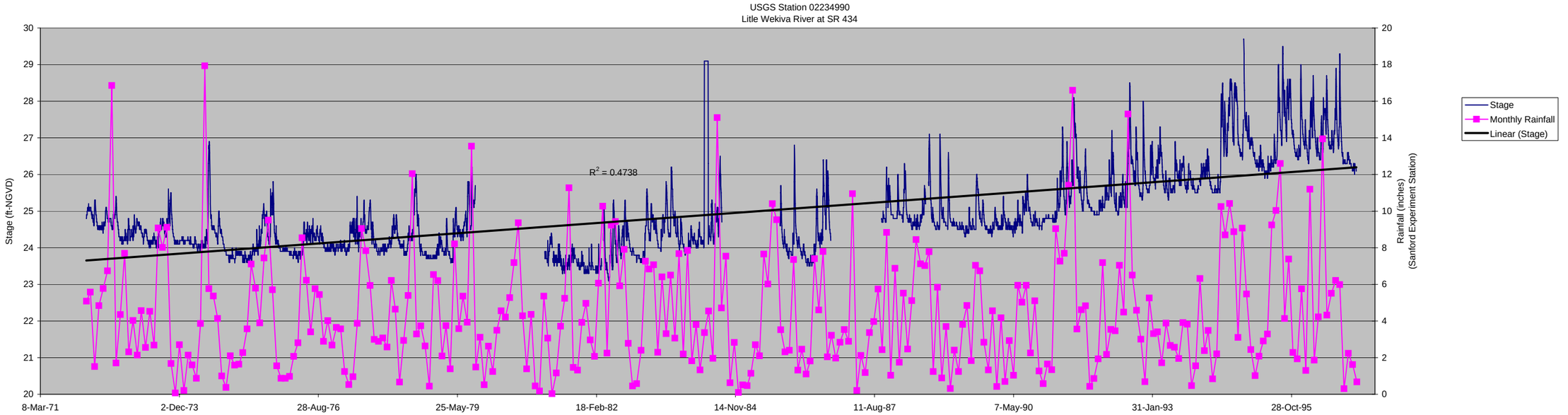
2.5 Mapping and Structure Inventory

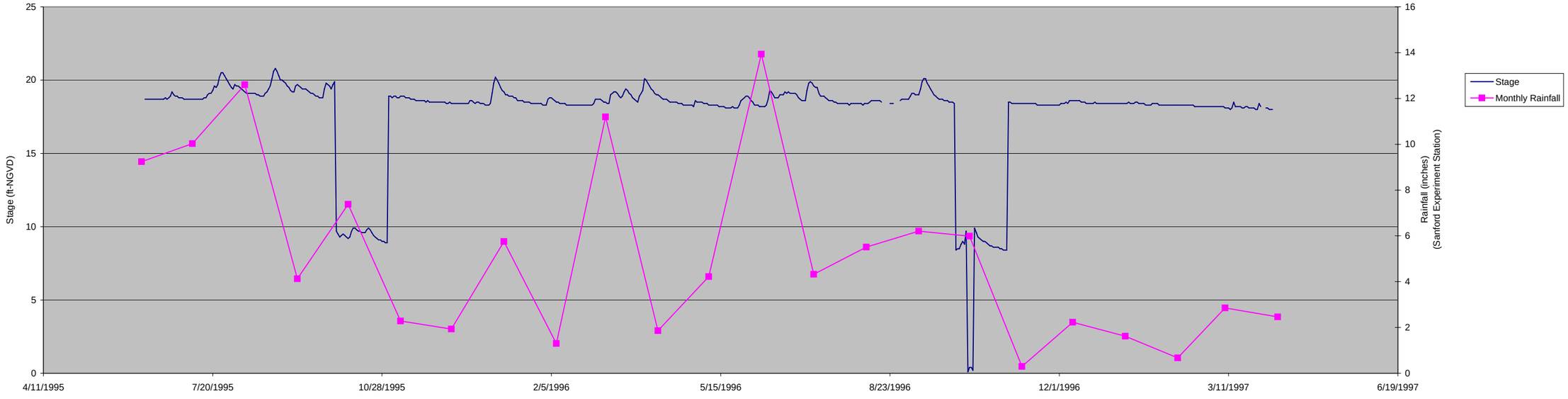
This section summarizes data related to updating the existing hydrologic and hydraulic models (i.e., land use, soils, topographic data, etc.) for Part 2 of this study as well as the inventory of the primary structures in the Little Wekiva River Basin.

2.5.1 Base Mapping

All mapping for the Little Wekiva River WMP was completed using the GIS software package Arcview©. GIS coverages for the mapping effort for this project were obtained from the SJRWMD, Orange and Seminole Counties and the City of Orlando. The base map for the Little Wekiva River Basin developed includes the basin boundary, parcels, streets, municipalities, section/township/range and water and wetland features. A base map of the Little Wekiva River Basin is provided in **Figure 2-6**.

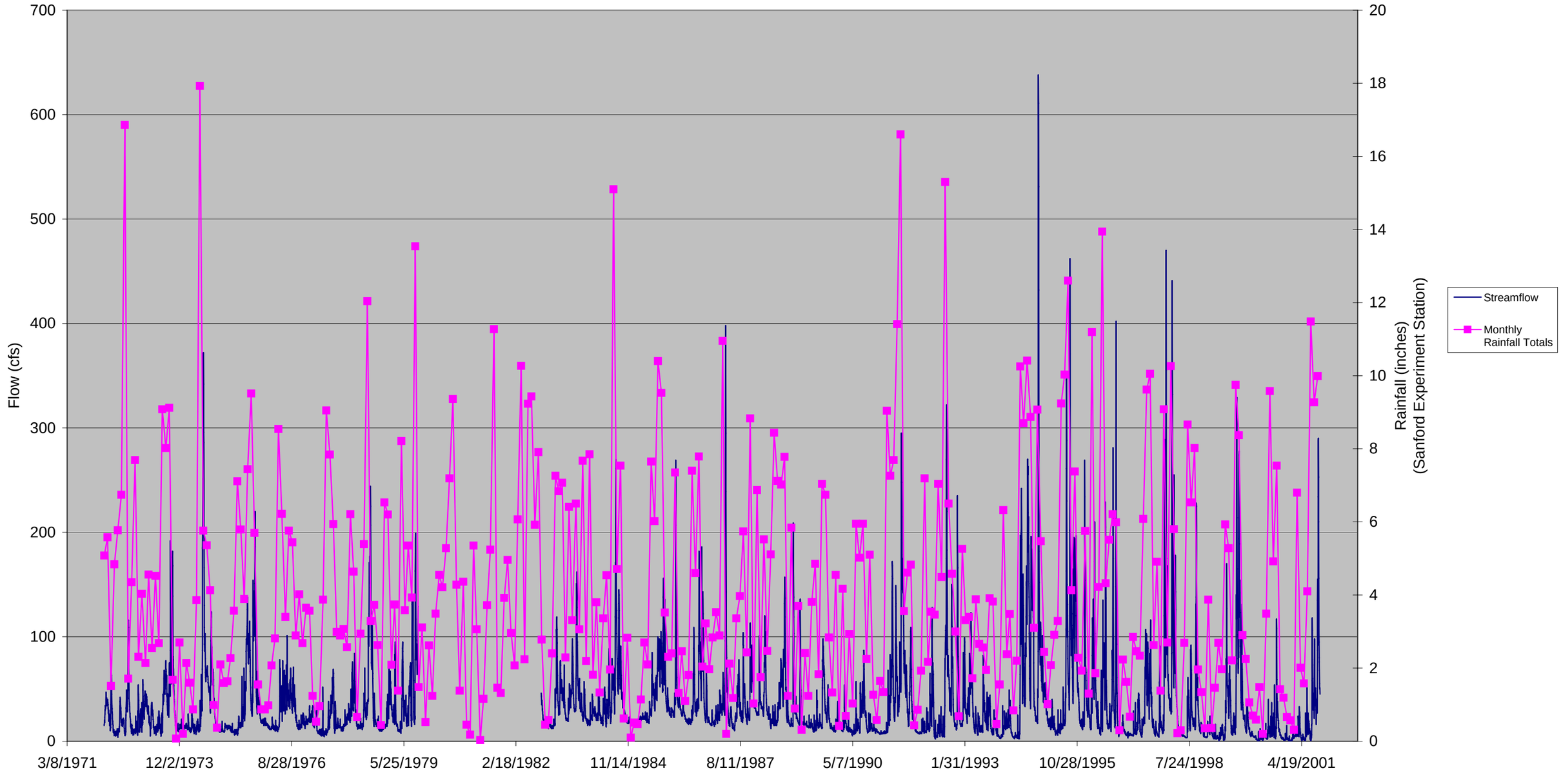
Figure 2-3
Little Wekiva River Watershed Management Plan
Historical Stage Data





CDM

Figure 2-4
Little Wekiva River Watershed Management Plan
Historical Streamflow Data
USGS Station 02234990
Little Wekiva River at SR 434



CDM

Figure 2-5
Little Wekiva River Watershed Management Plan
Historical Streamflow Data
USGS Station 02234998
Little Wekiva River at Springs Landing Blvd.

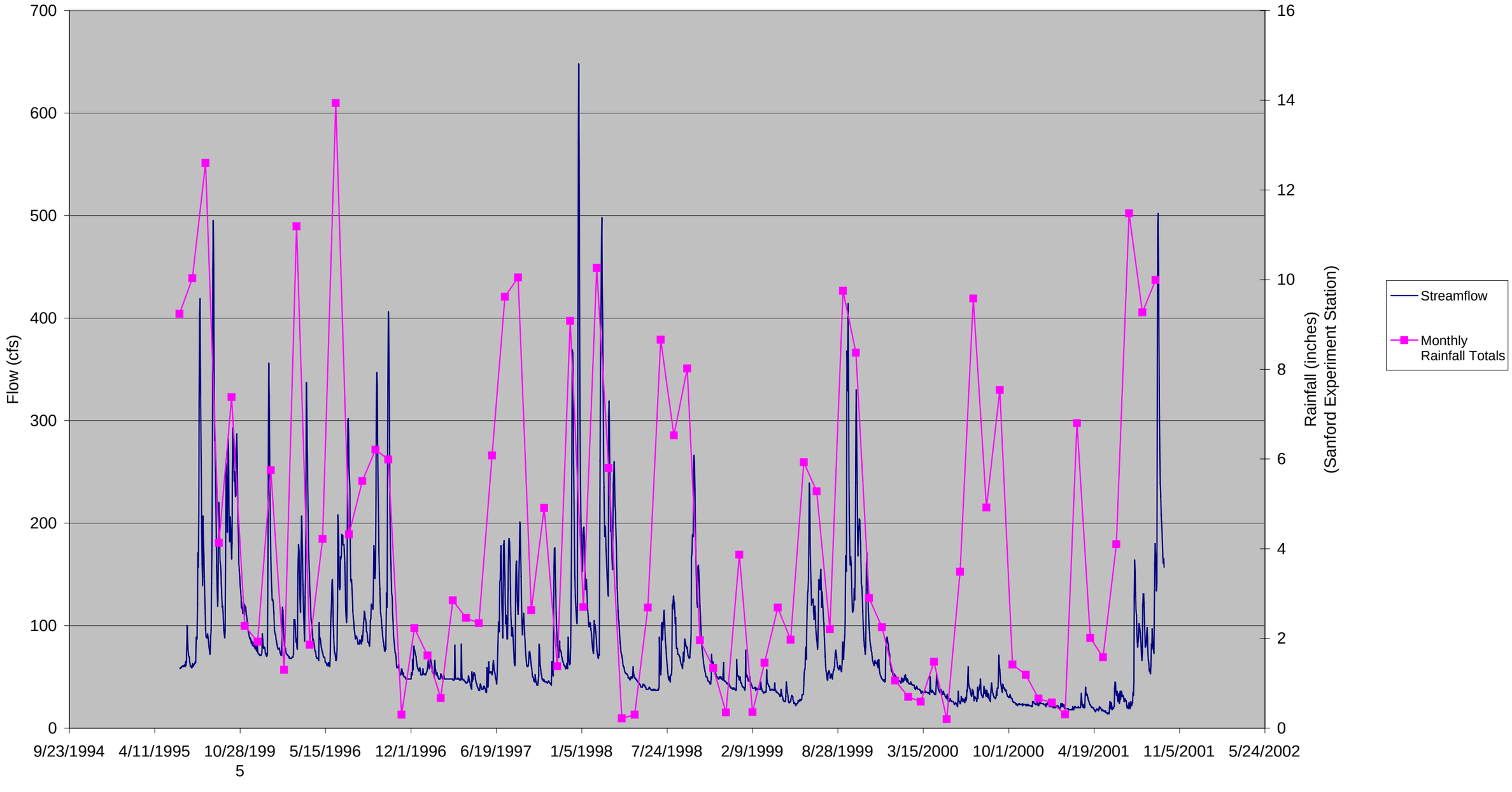


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Fig 2-6

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15,-20,28 | 14,-20,28 | 13,-20,28 | 18,-20,29 | 17,-20,29 | 16,-20,29 | 15,-20,29 | 14,-20,29 | 13,-20,29 | 18,-20,30 | 17,-20,30

22,-20,28 | 23,-20,28 | 24,-20,28 | 19,-20,29 | 20,-20,29 | 21,-20,29 | 22,-20,29 | 23,-20,29 | 24,-20,29 | 19,-20,30 | 20,-20,30

27,-20,28 | 26,-20,28 | 25,-20,28 | 30,-20,29 | 29,-20,29 | 28,-20,29 | 27,-20,29 | 26,-20,29 | 25,-20,29 | 30,-20,30 | 29,-20,30

34,-20,28 | 35,-20,28 | 36,-20,28 | 31,-20,29 | 32,-20,29 | 33,-20,29 | 34,-20,29 | 35,-20,29 | 36,-20,29 | 31,-20,30 | 32,-20,30

3,-21,28 | 2,-21,28 | 1,-21,28 | 6,-21,29 | 5,-21,29 | 4,-21,29 | 3,-21,29 | 2,-21,29 | 1,-21,29 | 6,-21,30 | 5,-21,30

10,-21,28 | 11,-21,28 | 12,-21,28 | 7,-21,29 | 8,-21,29 | 9,-21,29 | 10,-21,29 | 11,-21,29 | 12,-21,29 | 7,-21,30 | 8,-21,30

15,-21,28 | 14,-21,28 | 13,-21,28 | 18,-21,29 | 17,-21,29 | 16,-21,29 | 15,-21,29 | 14,-21,29 | 13,-21,29 | 18,-21,30 | 17,-21,30

22,-21,28 | 23,-21,28 | 24,-21,28 | 19,-21,29 | 20,-21,29 | 21,-21,29 | 22,-21,29 | 23,-21,29 | 24,-21,29 | 19,-21,30 | 20,-21,30

27,-21,28 | 26,-21,28 | 25,-21,28 | 30,-21,29 | 29,-21,29 | 28,-21,29 | 27,-21,29 | 26,-21,29 | 25,-21,29 | 30,-21,30 | 29,-21,30

34,-21,28 | 35,-21,28 | 36,-21,28 | 31,-21,29 | 32,-21,29 | 33,-21,29 | 34,-21,29 | 35,-21,29 | 36,-21,29 | 31,-21,30 | 32,-21,30

3,-22,28 | 2,-22,28 | 1,-22,28 | 6,-22,29 | 5,-22,29 | 4,-22,29 | 3,-22,29 | 2,-22,29 | 1,-22,29 | 6,-22,30 | 5,-22,30

10,-22,28 | 11,-22,28 | 12,-22,28 | 7,-22,29 | 8,-22,29 | 9,-22,29 | 10,-22,29 | 11,-22,29 | 12,-22,29 | 7,-22,30 | 8,-22,30

15,-22,28 | 14,-22,28 | 13,-22,28 | 18,-22,29 | 17,-22,29 | 16,-22,29 | 15,-22,29 | 14,-22,29 | 13,-22,29 | 18,-22,30 | 17,-22,30

22,-22,28 | 23,-22,28 | 24,-22,28 | 19,-22,29 | 20,-22,29 | 21,-22,29 | 22,-22,29 | 23,-22,29 | 24,-22,29 | 19,-22,30 | 20,-22,30

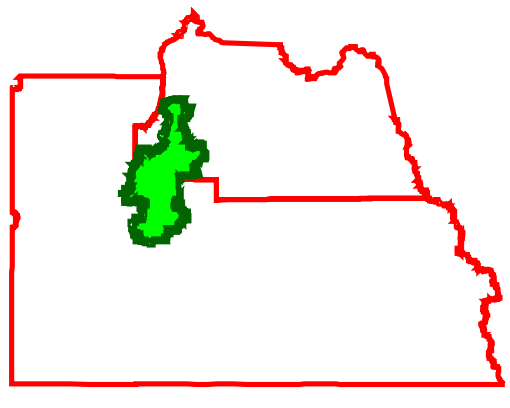
27,-22,28 | 26,-22,28 | 25,-22,28 | 30,-22,29 | 29,-22,29 | 28,-22,29 | 27,-22,29 | 26,-22,29 | 25,-22,29 | 30,-22,30 | 29,-22,30

Lake Brantley
Cranes Roost
Bear Lake
Trout Lake
LAKE ORIENTA
Spring Lake
Lake Lotus
Cub Lake
Little Bear Lake
Lake Bosse
Lake Hill
Lake Destiny
Lake Lovely
Lake Weston
Lake Orlando
Lake Fairview
Bay Lake
Lake Lawne

N
W E
S

6000 0 6000 12000 Feet

LOCATION MAP



LEGEND

- Basin Boundary
- County Line
- Section,Township,Range
- Street Centerlines

Water Bodies

- Little Wekiva RIver (Main Stem)
- Wetlands
- Parcels

Municipalities

- Altamonte Springs
- Eatonville
- Longwood
- Maitland
- Orlando

Little Wekiva River Watershed Management Plan

CDM

Figure 2-6
Base Map

2.5.2 System Structure Inventory

As part of the data collection effort, an inventory of the existing primary stormwater management system (PSMS) was developed. Primary structures are defined as structures with an equivalent diameter of 36 inches or greater. In addition to primary structures, a number of structures were identified in problem areas that were not previously included as part of the stormwater model developed as part of the 1998 Study (for a detailed discussion of problem areas please refer to Section 2.6). The majority of these structures are considered secondary systems but were included in the structure inventory as well. A number of sources were used to develop the structure inventory for the basin, including:

- Little Wekiva River Basin Stormwater Inventory, Seminole County (Preliminary Data), 2002.
- City of Altamonte Springs Stormwater Inventory Geodatabase, 2003.
- Hydraulic input data from the Advanced Interconnected Pond Routing (adICPR) stormwater model developed as part of the 1998 Study.
- Stormwater Management Master Plan, Structure Inventory, Altamonte Springs Florida, (PEC, 1996).
- Little Wekiva River Basin Drainage Inventory Engineering Study, Seminole County Florida (DRMP, Inc., 1995).
- Orlando Urban Stormwater Management Manual, Phase I Inventory, (DRMP, Inc., 1984).
- O. C. Roads and Drainage Division.
- Field reconnaissance performed by CDM.

Most of these data were provided in digital format and were imported into Arcview 3.2a©. Data not provided in digital format were digitized using Arcview 3.2a©. Once in digital format, the structure inventory data for a total of 402 structures were merged into a single GIS coverage. These include both primary structures previously modeled along the main stem of the river as well as those primary structures not previously included in the 1998 stormwater model and/or associated with problem areas. For the purposes of this WMP, only bridges, culverts, control structures, storm sewers and force mains were accounted for in the inventory. Additional facilities such as end structures, manholes and inlets were not included. The completed stormwater GIS inventories for Seminole County and the City of Altamonte Springs were provided during Phase II of the WMP. As both of these inventories consisted of entire storm sewer systems, only the structures that were equivalent to 36 inches in diameter were included in this WMP. This brought the grand total of inventoried stormwater structures to 996. The locations of these structures are provided in **Figure 2-7**, located at the end of this section. Existing structural data for each facility were compiled and are provided in **Appendix C**.

A standard naming convention was used to assign all structures unique identification numbers. The identification number consists of the major basin identifier (i.e., LW for the Little Wekiva River Basin), a unique identification number (e.g., 0001, 0002, 0003, etc.) and a symbol denoting the type of structure. The following symbols were used for each type of structure:

"B" – Bridge "S" – Storm Sewer

"C" – Culvert "SFM" – Stormwater Force Main

"D" – Drop Structure

"W" – Weir

An example of the resulting structure identification would be "LW0002C".

Once the preliminary structure inventory was compiled, a field reconnaissance of a subset of the structures was conducted by CDM. Since the main stem and tributaries of the Little Wekiva River system have been previously documented and studied extensively, a subset of structures was selected for inspection during the field reconnaissance. The selection of these structures was based on the following criteria:

- Conflicting structural information was documented from different sources.
- A structure was included in only one of the above-mentioned references.
- A structure was located within a problem area.
- The potential location of an unidentified/unknown structure was identified based on inspection of the 2000 DOQs and the existing primary system.

Based on these criteria, approximately 75 structures were identified to be included as part of the field reconnaissance. Of these 75 structures, 56 structures were part of closed storm sewer systems and were not accessible during the field inspection. Construction drawings for these areas were requested and the inventory was updated with structural data extracted from these drawings. For each structure inspected, geometric measurements (i.e., span, rise, shape), construction material and general condition of the structure were confirmed by observation. Field photographs of each structure inspected were also taken. This information was then used to update the existing structure inventory data.

2.5.3 Drainwells

In addition to collecting information for the structure inventory for the PSMS, data on existing drainwells were obtained. A drainwell is a pipe that conveys surface water to the groundwater. Drainwells are somewhat controversial as they are directly connected to the aquifer and may potentially affect the groundwater quality if the

surface water discharging through the drainwell is polluted. However, in many areas, specifically in Orange County, drainwells are the sole source of drainage (Orange County Stormwater Management Department, 1992). If drainwells are closed in these areas, there is a greater potential for flooding during the wet season.

The Central Florida Drainage Well Inventory prepared by Hartman & Associates, Inc. (2003) was referenced to identify those drainage wells within the Little Wekiva River Basin as shown on **Figure 2-8**. According to the inventory there are 47 drainage wells within the Little Wekiva River Basin. Of these 21 drainage wells are each located within the City of Orlando and Orange County, 3 are within the City of Altamonte Springs, and 2 are within Seminole County.

Additionally, Orange County has inventoried each drainwell in its jurisdiction and has prepared a report, which describes the water quantity and flooding elevations at the drainwell. The report entitled *Analysis of Drainwells in Orange County* (Orange County Stormwater Management Department, 1992) summarizes the inventory of drainwells and their analyses. Based on this report, drainwells 18, 30, 40, and 42 have all been classified as critical drainwells by the County. A critical drainwell indicates that it is the only source of drainage for its basin and that it controls the initial water level of a lake, pond, swale, etc. If these critical drainwells are plugged, water levels in these areas will rise during the wet season, increasing the likelihood of flooding. Hydraulic analyses performed by Orange County indicate that these drainwells cannot be plugged unless some alternate means of drainage is developed for the areas they serve. A project addressing flooding in the area of drainwell #42 is currently under design by the Orange County Roads and Drainage Division. The remaining drainwells (19, 31, 32, 39 and 46) have been classified as non-critical drainwells and are believed not to have a significant effect on surface drainage in surrounding areas.

2.5.4 Stormwater Transfer Facilities

As mentioned in Section 1 of this report, there are several pump stations and one gated outfall station located both inside and outside of the Little Wekiva River Basin that allow for the transfer of stormwater either into or out of the basin. A brief description of each facility is provided in the following paragraphs.

2.5.4.1 Woodsmere Stormwater Pumping Station (Orange County)

The Woodsmere Stormwater Pumping Station, located immediately south of Silver Star Road (SR 438), in between Golf Club Parkway and Pine Hills Road, was constructed in 1965 for the primary purpose of alleviating flooding problems that occurred in the 1960s. The location of the pump station is shown in **Figure 2-9**. As described in the *Drainage Basin Study for Woodsmere Stormwater Pumping Station (PEC, 1999)*, the pump station discharges stormwater by means of a combined force main and gravity outfall system, eastward down Silver Star Road to the Lake Lawne Outfall Canal (i.e., the Little Wekiva River). Stages versus discharge rating curves were developed by PEC, Inc. to simulate the pumping capacity of the pump station and are summarized below in **Table 2-1.**

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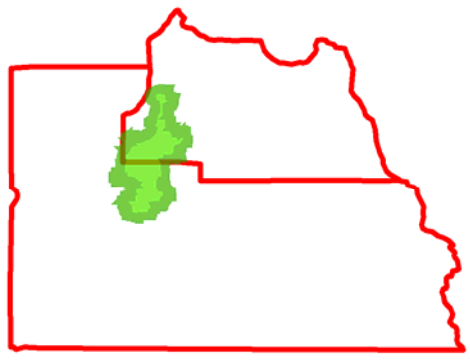
LOCATION MAP



LEGEND

- Basin Boundary
- County Boundary
- Roads
- Little Wekiva River
- Water Bodies

Drainage Wells

- abandoned
- active
- capped
- clogged
- inaccessible
- inactive
- lost
- needs work
- pump in well
- pump installed

City Boundaries

- Altamonte Springs
- Eatonville
- Longwood
- Maitland
- Orlando

N

0 3,000 6,000 12,000 Feet

Little Wekiva River Watershed Management Plan

CDM

Figure 2-8
Drainage Wells

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1/29/03

Hunt Club Boulevard Pump System

Cranes Roost Stormwater Pumping Facility

Long Lake Stormwater Pump Station

Horseshoe/Crooked Lake System

Lake Sparling Pump Station

Kelly Lake Pump Station

Dwarf Lake Pump Station

Woodsmere Stormwater Pumping Station

Lake Brantley
Bear Lake
Trout Lake
Lake Lotus
Spring Lake
Cub Lake
Little Bear Lake
Lake Destiny
Lake Bosse
Lake Hill
Lake Gandy
Lake Lovely
Lake Lockhart
Lake Weston
Lake Orlando
Horseshoe Lake
Crooked Lake
Lake Fairview
Bay Lake
Lake Lawne

N
W
E
S
6500 0 6500 Feet

LOCATION MAP

LEGEND

- Stormwater Transfer Facilities
- Basin Boundary
- County Line
- Street Centerlines

Water Bodies

- Shadehyd_region.shp

Little Wekiva RIver (Main Stem)

Wetlands

Municipalities

- Altamonte Springs
- Eatonville
- Longwood
- Maitland
- Orlando

Little Wekiva River Watershed Management Plan

CDM

Figure 2-9
Stormwater Transfer Facility Locations

Fig 2-9

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Table 2-1
Little Wekiva River Watershed Management Plan
Woodsmere Stormwater Pumping Station Pump Characteristics

Pump	Stage (ft-NGVD)	Discharge (gpm/cfs)	Notes
Pump #1 (Diesel)	74.00	19,000/42.3	Pump on Elev. 74.00 Pump Off Elev. 70.50
Pump #2 (Diesel)	74.00	20,000/44.6	Pump on Elev. 74.00 Pump Off Elev. 70.50
Pump #3 (Electric Motor Driven)	74.34	8,500/18.9	Last Pump on Elev. 74.34 Pump Off Elev. 70.50

2.5.4.2 Horseshoe/Crooked Lake System (Orange County)

There is a gated outfall structure located on the west side of Lake Orlando that allows for intermittent discharges to Horseshoe Lake, located outside of the basin (also shown in Figure 2-9). Singhofen & Associates, Inc. prepared a study in 1999 entitled *Sawmill Pond/Horseshoe Lake/Crooked Lake Interconnection Study* that describes this system in detail. The gated outfall structure in Lake Orlando consists of a concrete weir approximately 5 feet wide at elevation 83.8 ft-NGVD. A 30-inch circular pipe is located downstream of the concrete weir which conveys surface water to Horseshoe Lake, the invert of which is at 81.0 ft-NGVD. There is a gate on this pipe that is typically partially closed and restricts flow through the pipe. According to Singhofen's 1999 study, operating records for the gate do not exist and the gate is reportedly opened 8 inches from the bottom of the pipe. There are 2 additional pump stations, one each located in Lake Sparling and Dwarf Lake that discharge to the 30-inch circular pipe mentioned above. Two pumps are used to control levels in Lake Sparling and turn on at elevation 63 ft-NGVD and discharge at a rate of 8.9 cfs. There are three separate pumps to control levels in Dwarf Lake, a manually operated gas pump and 2 electric pumps. One of the electric pumps turns on at elevation 63.5 ft-NGVD while the other is set to turn on at elevation 67 ft-NGVD. Both pumps discharge at a rate of 8.9 cfs.

2.5.4.3 Long Lake Pump Station (Orange County)

There is a pump station located to the west of the Little Wekiva River Basin in Orange County in the Wekiva Basin and serves an area of approximately 3,367 acres. The pump station conveys surface water from Long Lake to Lake Gandy in the Little Wekiva River Basin. According to the Orange County *Pump Stations Summary Report* (CEG, 2000), the Long Lake pump station has two diesel pumps that turn on when the elevation in Long Lake reaches 70 ft-NGVD and each discharge at a rate of 20,000 gpm (44.6 cfs) to Lake Gandy through a 48-inch force main.

2.5.4.4 City of Altamonte Springs Cranes Roost Stormwater Pumping Facility

In 1994, PEC, Inc. prepared a study entitled *City of Altamonte Springs Discharge Contribution to the Little Wekiva River*. The Cranes Roost water body has historically experienced a wide range of surface water elevations due to the lack of a natural outfall, its function as a regional aquifer recharge area and the urbanized nature of the watershed. According to this report, the City of Altamonte Springs constructed a pump station and force main system in 1977 for the Cranes Roost water body that discharges to the Little Wekiva River during periods of high levels that exceed elevation 53.75 ft-NGVD (see Figure 2-9). The City recently upgraded its system to two (2) 16-inch pumps and one (1) 10-inch pump which then lead to a 20-inch stormwater force main which discharges water directly to the Little Wekiva River. Pumping within Cranes Roost cannot continue when its level is below 51.72 or when the stage in the Little Wekiva River is above 53.00 ft-NGVD. The combined pumping capacity of the two pumps is 7,855 gpm (11.3 cfs).

2.5.4.5 Hunt Club Boulevard Area Pump System (Seminole County)

The Hunt Club pump system is located in Seminole County on the west side of Hunt Club Boulevard approximately 0.5 miles north of SR 436 (see Figure 2-9). This system consists of an outfall structure with a control weir and bleed down pump system to pump water from an existing retention pond through a 4-inch diameter pipe to the headwaters of a tributary, commonly referred to as Tributary C, to the Little Wekiva River. The bleed-down pump system consists of a 15-inch intake pipe, weir structure, 10 horsepower pump and a 4-inch force main discharge pipe. When the surface water elevation in the retention pond exceeds 69.0 ft-NGVD, water discharges to the pump system manhole. When the water elevation in the manhole reaches 66.0 ft-NGVD, the pump will turn on. The pump system automatically turns off when the elevation in the manhole is 63.5 ft-NGVD.

2.5.4.6 Lake Kelly Pump Station (City of Orlando)

Lake Kelly, Lake Kristie, and Lake Kasey are all interconnected and there is a pump station at Lake Kelly. The pump has a capacity of 5,000 gpm and is set to automatically turn on at elevation 72 ft-NGVD and turn off at 71 ft-NGVD. The force main runs south to and then easterly along North Lane. It discharges to a gravity system that flows to Lake Orlando.

2.5.5 Survey Plan

A survey plan was developed based on review of the structure inventory and the results of the field reconnaissance. Stormwater facilities (i.e., culverts and open channels) to be included in the survey plan are those structures within the defined PSMS or a problem area where geometric and/or cross-sectional data were not available or conflicting information for the structure was noted during the field observations. Additionally, several tributaries were modeled on a very coarse scale in the 1998 study (namely Tributary C and Tributary D shown on **Figure 2-10**). Previous studies were reviewed and field visits were made to these areas to verify the extent to

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2/4/03

Fig 2-10

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Lake Brantley
Tributary "A"
Tributary "B"
Tributary "C"
Tributary "D"
Tributary "E"
Tributary "F"
Tributary "G"
Tributary "H"
Tributary "I"
Lake Florida
Lake Adelaide
Prairie Lake
Trout Lake
Spring Lake
Lake Lotus
Bear Lake
Cub Lake
Little Bear Lake
Lake Bosse
Lake Hill
Lake Destiny
Lake Lovely
Lake Weston
Lake Orlando
Lake Fairview
Bay Lake
Lake Lawne

LW0103C
LW0096C
LW0097C
LW0413X
LW0099C
LW0100cC
LW0100bC
LW0100aC
LW0101aC
LW0101C
LW0101bC
LW0404C
LW0095C
LW0409X
LW0408X
LW0094C
LW0412X
LW0093D
LW0407bC
LW0407aC
LW0410X
LW0423C
LW0422C
LW0411X
LW0098C
LW0091C
LW0090C
LW0080C
LW0414X
LW0415X
LW0081C
LW0079bD
LW0077C
LW0079aD
LW0416X
LW0362C
LW0075C
LW0061C
LW0044C
LW0516X
LW0517X
LW0520X
LW0519X
LW0518X
LW0076C

N
W
E
S

6000 0 6000 Feet

LOCATION MAP

LEGEND

Surveyed Open Channels
Surveyed Drop Structures
Surveyed Culverts
Surveyed Ground Street Cross-Sections
Basin Boundary
County Line
Street Centerlines
Water Bodies
Little Wekiva River (Main Stem)
Wetlands
Wetlands
Municipalities
Altamonte Springs
Eatonville
Longwood
Maitland
Orlando

Little Wekiva River Watershed Management Plan

CDM

Figure 2-10
Survey Plan

which these systems were modeled. Based on these reviews, several of the structures and or channel cross-sections in these areas were included in the survey plan so that these systems may be more accurately represented in the updated stormwater model. The locations of the structures and open channel cross-sections that required survey are provided on Figure 2-10. All elevations were relative to the National Geodetic Vertical Datum of 1929 (NGVD 29). The following data were provided in the completed survey:

- Channel cross sections were surveyed perpendicular to the channel, in sufficient detail to describe the geometric shape of the incised channel, and extend a minimum of 150 feet beyond the right and left top of channel bank (floodplain). The water surface elevation was also obtained. Visual inspection as well as digital photographs of the cross-section were used to determine a reasonable Manning's "n".

- Culvert crossing surveys included a description of the geometric shape of the structure, upstream and downstream invert elevations, structure material (i.e., concrete, corrugated metal pipe, etc.), and a description of the conditions of the structure including the extent of silting (if any). The water surface elevation was also obtained. A detailed sketch of the structure was provided in the field notes. Additionally, a profile of the road centerline perpendicular to the pipe or bridge structure was obtained. The profile included 5 to 10 spot elevations that identified the "low spot" in the road where water can first overtop the structure during a flood event.

- For bridges, the surveys included data describing geometric shape of the opening, length of the bridge perpendicular to flow line, channel cross-sections perpendicular to the flow line, bridge material, top of bank elevations, number of piers, width of piers, height of pier caps, low chord elevation at each pier, channel bottom elevations at each pier, and minimum top of road elevation at each pier. The water surface elevation will also be obtained. A detailed sketch of the structure was provided in the field notes.

- Deliverables included two (2) copies of the survey field books showing the raw survey data and a sketch of the structure; two (2) sets of field maps showing the approximate location of each structure or channel cross-section surveyed (horizontal control is not required, however, a rough location by GPS is required); two photographs of each structure or cross-section location; digital backup for any data obtained by GPS must be provided; and final deliverables will be accompanied by a certified Professional Surveying and Mapping (PSM) report. Survey data was submitted to the SJRWMD under separate cover.

- All survey work was performed in accordance with the Minimum Technical Standards set forth by the Florida Board of Professional Surveyors and Mappers in Chapter 61G17-6, Florida Administrative Code pursuant to Section 472.027 Florida Statutes.

2.5.6 Right-of-Way/Easements

To assist with identifying possible alternatives to be developed as part of the Engineering Analysis in Part III, CDM collected existing right-of-way/easement data for the basin. The data may be useful when identifying potential project sites and determining whether these sites are accessible or not. Both Seminole County and the City of Orlando have developed digital right-of-way/easement coverages in GIS format. These are shown on **Figure 2-11**. Additionally, CDM reviewed the Orange County digital GIS parcel coverage. The parcels that were identified in the coverage as Board of County Commissioners (BCC) owned land were extracted and are also illustrated in Figure 2-11.

2.6 Problem Identification

Problem areas within the Little Wekiva River Basin were identified through a combination of meetings and review of existing reports. In June 2002, CDM met with the Seminole County Roads Operations and Stormwater Team Leaders to discuss and identify both flooding and water quality problems in the basin. CDM also contacted the City of Orlando to inquire about existing problem areas. Additionally, CDM reviewed several reports to compile a list of problem areas in the basin including:

- Final Apopka Infrastructure Assessment, Orange County Florida, Volume I (Parsons, 2002).
- Orange County Stormwater Needs Assessment Update (Parsons, 2002).
- Little Wekiva River Basin Tributary C Flooding Investigation, Seminole County, Florida (DRMP, Inc., 1997)
- Orange County Stormwater Needs Assessment Final Report (Miller-Sellen Associates, Inc., Orange County Stormwater Management Department, 1996).
- Stormwater Management Master Plan, Altamonte Springs Florida, Task Assignments 1.4, 1.5 & 1.7, Identification and Investigation of Stormwater Problem Areas (PEC, 1996).
- Drainage Inventory Engineering Study, Little Wekiva River Basin (DRMP, 1995)
- Infrastructure Inspection and Assessment Program Goldenrod Maintenance District (PEC, date unknown).

Based on these meetings and review of the above listed documents, CDM developed a list of problem areas and a corresponding problem area location map. This list was reviewed by each of the Participants and feedback was provided as to the accuracy of the problem areas. As there are a variety of the types of problems that occur in the basin, problem areas were assigned to one of four general problem categories, which include:

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Lake Brantley
Bear Lake
Cub Lake
Little Bear Lake
Trout Lake
Lake Lotus
Spring Lake
Lake Bosse
Lake Hill
Lake Destiny
Lake Lovely
Lake Weston
Lake Orlando
Lake Fairview
Bay Lake
Lake Lawne
SR 434 S
SR 436 W
I-4
SR 414
EDGEWATER
ORANGE BLOSSOM
SILVER STAR
PRINCETON

N
W
E
S

6000 0 6000 12000 Feet

LOCATION MAP

LEGEND

- County Line
- Basin Boundary
- City of Orlando ROW Acquisition Boundaries
- City of Orlando ROW Boundaries
- City of Orlando Easements
- Seminole County Easements
- Seminole County ROW
- Orange County BCC Owned Parcels
- Street Centerlines
- Parcels

Water Bodies

- Little Wekiva RIver (Main Stem)
- Wetlands

Little Wekiva River Watershed
Management Plan

Figure 2-11

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CDM

Figure 2-11
Right-of-Way/Easement Locations

- Flooding
- Drainwell
- Sedimentation
- Water Quality

Based on the compiled list, approximately 56 problem areas were initially identified in the basin. After review and comment by the Participants, 23 of these problem areas are currently being addressed either by maintenance, are under design or are being studied. Locations of the problem areas are shown in **Figure 2-12**, which is located at the end of this section. A listing of each problem area and description is provided in **Table 2-2**. Most of these problems identified are related to secondary system operation and maintenance. Those problems that were previously identified through earlier modeling efforts of the basin (e.g., Drainage Inventory Engineering Study, Little Wekiva River Basin (DRMP, 1995) and the 1998 Study) are not included in Table 2-2. The problems listed in Table 2-2 are documented problem areas based on local knowledge and maintenance reports, whereas the watershed plans predict problems based on the modeling results. This current effort is an update of earlier work done by others and provides more detail in certain tributaries of the PSMS. Therefore it was felt that it was more appropriate to discuss problems predicted by earlier modeling efforts that correspond to problem areas identified from this modeling effort in *Section 5 – Engineering Analysis*.

2.7 Basin Water Quality

With the new emphasis of Total Maximum Daily Loads (TMDLs), water quality continues to be an increasingly important issue in the State of Florida. A TMDL is a calculation of the maximum amount of a pollutant that a water body can receive and still meet water quality standards, and an allocation of that amount to the pollutant's sources. Section 303(d) of the Clean Water Act (CWA) requires states to submit lists of surface waters that do not meet applicable water quality standards (impaired waters) after implementation of technology-based effluent limitations, and to complete TMDLs for these waters on a prioritized schedule. The FDEP's Impaired Waters Rule (IWR, Chapter 62-303, F.A.C.) became effective in June 2002 and defines impaired lakes, streams, and estuaries that are in need of restoration. The IWR chapter establishes a methodology to identify surface waters of the state that will be included on the state's planning list of waters and also establishes a methodology to identify impaired waters that will be included on the state's verified list of impaired waters, for which the FDEP will calculate TMDLs.

Each year the FDEP will propose new verified lists as the groups of basins are rotated through 5 groups. The Little Wekiva River Basin is located in the Middle St. Johns River Basin, which is in Group 2. FDEP adopted the verified list of impaired water bodies for the Group 2 basin in May 2004 through a secretarial order. There are

Table 2-2
Little Wekiva River Watershed Management Plan
Problem Areas

Problem ID	Problem Category	Problem Description	Reference	Subdivision	Participant Response
Problem No.1	M	Maintenance problem with ditch system serving residences on Canovia, Carew, and Naples--limited access to ditch; flooding; 320 - 324 Lake Fair Ln--possible need for pipe lining	Orange County Stormwater Needs Assessment Final Report 1996; Infrastructure Inspection and Assessment Program, Goldenrod Maintenance District	N/A	Under study by Orange County Roads & Drainage
Problem No.2	F/DW	Flooding along Knollwood Circle and Crestwood Dr--Critical drainwell W-42 proposed for closure due to potential contaminants/hi turbidity in runoff; County's Current CIP	Orange County Stormwater Needs Assessment Update 2002; Infrastructure Inspection and Assessment Program, Goldenrod Maintenance District	Fairvilla Park	Drainwell receives direct runoff from roadside drainage systems with no pre-treatment andprovides the only source of relief to the stormwater management system. The drainwell should be abandoned and replaced with a new well and inlet.
Problem No.3	F	Maintenance and flooding problems with drainage system for Rio Grande and Princeton---minimal easement width	Orange County Stormwater Needs Assessment Final Report 1996	N/A	During the development of this WMP, this project has been completed by the City. They will next be focusing on Taft Avenue north of this area..
Problem No.4	F	Residential area east of Little Lake Fairview--drainage problems and possible water quality impacts on Lake; County's Current CIP	Orange County Stormwater Needs Assessment Update 2002; Infrastructure Inspection and Assessment Program, Goldenrod Maintenance District	Golfview/Nikkis Run/Pinewood/Roclair/ Stansbury Estates/The Pines/Villa Farm	This area was recently annexed by the City of Orlando. A drainage investigation is currently underway for the Dubsdread Circle area by PEC.
Problem No.5	F	Runoff bypasses inlets and drains to dead end on Meadow Glen Dr resulting in ponding; Intersection of Meadow Glen and Riverside Park--possible need for pipe lining	Orange County Stormwater Needs Assessment Update 2002	Twin Lakes Estates	Additional stormwater storage is needed to alleviate flooding problems. This area was annexed by the City of Orlando. A drainage investigation is currently underway for the Dubsdread Circle area by PEC.
Problem No.6	F	Ponding occurs at dead ends of Lovely Ln and Duo Lake Dr	Orange County Stormwater Needs Assessment Update 2002	Twin Lakes Estates	Retrofitting the subdivision with stormwater management facilities, provision of adequate secondary drainage systems to alleviate flooding as well as to direct flows to the stormwater pond for treatment and eliminate the maintenance intensive ditch system.
Problem No.7	F	Localized flooding in areas of Londonderry Hills Subdivision; Danny Boy Cir has flooding	Orange County Stormwater Needs Assessment Update 2002; Final Apopka Infrastructure Assessment, Orange County, Vol.1, 2002	Londonderry	The existing ditch requires a positive outfall with the nearest discharge point being the FDOT secondary drainage system for Pine Hills Road. The ditch serving Danny Bor Cir. should be redesigned to recover via an underdrain system based on the high water table conditions. Under construction by Orange County Roads & Drainage
Problem No.11	DW	Critical drainwell W-18 proposed for closure due to potential contaminants/hi turbidity in runoff	Orange County Stormwater Needs Assessment Final Report 1996	Tabory Pult	No action
Problem No.12	DW	Critical drainwell W-30 proposed for closure due to potential contaminants/hi turbidity in runoff	Orange County Stormwater Needs Assessment Final Report 1996	Beatrice Village	No action

F - Flooding
DW - Drainage Well
E/S - Erosion/Sedimentation
M - Maintenance
WQ - Water Quality

Table 2-2
Little Wekiva River Watershed Management Plan
Problem Areas

Problem ID	Problem Category	Problem Description	Reference	Subdivision	Participant Response
Problem No.13	DW	Critical drainwell W-31 proposed for closure due to potential contaminants/hi turbidity in runoff	Orange County Stormwater Needs Assessment Final Report 1996	Fairview Terrace	No action
Problem No.14	DW	Critical drainwell W-40 proposed for closure due to potential contaminants/hi turbidity in runoff	Orange County Stormwater Needs Assessment Final Report 1996	Crestwood Estates	No action
Problem No.15	DW	Critical drainwell W-41 proposed for closure due to potential contaminants/hi turbidity in runoff	Orange County Stormwater Needs Assessment Final Report 1996	N/A	Annexed by City of Orlando
Problem No.16	DW	Critical drainwell W-43 proposed for closure due to potential contaminants/hi turbidity in runoff	Orange County Stormwater Needs Assessment Final Report 1996	N/A	Annexed by City of Orlando
Problem No.17	M	Sunniland Dr 912--ditch does not drain, sides eroding	John Young Maintenance Facility	N/A	Under maintenance by Orange County Roads & Drainage
Problem No.18	F	Subdivisions along Little Wekiva River north of All-American Blvd--secondary drainage problems	Orange County Stormwater Needs Assessment Update 2002	Riverside Park Estates/Rosemont Crossings/Wallington Heights	Under maintenance by Orange County Roads & Drainage
Problem No.19	F	Kingswood Manor subdivision north of Lee Rd---secondary drainage problems; County's Current CIP, on-going construction	Orange County Stormwater Needs Assessment Update 2002; Infrastructure Inspection and Assessment Program, Goldenrod Maintenance District	Kingswood Manor	Increase the capacity of the pipe networks, and realizing aquifer recharge by using the drainage wells. Under maintenance by Orange County Roads & Drainage
Problem No.20	F	Residential community east and south of Big Lake Fairview---secondary drainage problems; County's Current CIP	Orange County Stormwater Needs Assessment Update 2002; Infrastructure Inspection and Assessment Program, Goldenrod Maintenance District	Interlaken/Lakeview Park/Palomar/ University Heights	Under maintenance by Orange County Roads & Drainage
Problem No.21	F/DW	Barry St-- flooding since the closing of drainwell	Orange County Stormwater Needs Assessment Update 2002	Pine Villa	Final design of retrofit project includes replacement of the closed drainwell and the purchase of property for a drainage easement need to construct stormwater management pond. Study has been completed by Orange County Stormwater Management Department.
Problem No.22	E/S	Outfall canal from Lake Gandy, located north of Rundle Rd---severe erosion problems affecting properties next to canal	Orange County Stormwater Needs Assessment Update 2002	N/A	Install grade control structures; under design by Orange County Stormwater Management Department.
Problem No.23	E/S	River water flowing from Orange County to Lake Lotus in Seminole County creates sediments deposit in lake; natural erosion along river	Orange County Stormwater Needs Assessment Update 2002	N/A	Under study by Orange County Stormwater Management
Problem No.24	F	Clemson Road--- lot flooding during heavy rain events	Final Apopka Infrastructure Assessment, Orange County, Vol.1, 2002	N/A	No action

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WQ - Water Quality

Table 2-2
Little Wekiva River Watershed Management Plan
Problem Areas

Problem ID	Problem Category	Problem Description	Reference	Subdivision	Participant Response
Problem No.25	F	Alton Ave--Storm sewer system is undersized and clogged with debris/sediments; 905 Alton Ave---yard flooding, lowest house at the intersection	Infrastructure Inspection and Assessment Program, Goldenrod Maintenance District	Sunshine Gardens	Under maintenance by Orange County Roads & Drainage
Problem No.26	F	4605, 4609-4617 Andrus Ave---yard flooding, homes are lower than roadway; Courtland St (SE corner of Lee Rd)-- Lack of drainage inlets within subdivision; 5013 Davisson Ave-- driveway and yard flooding	Infrastructure Inspection and Assessment Program, Goldenrod Maintenance District	Fairview Shores	Fairview Shores area recently annexed by City of Orlando and drainage investigation is currently underway by PEC.
Problem No.27	F	Conrad Ct--Flooding within Cul-de-Sac, lacking drainage inlets	Infrastructure Inspection and Assessment Program, Goldenrod Maintenance District	Shells Terrace	Under maintenance by Orange County Roads & Drainage
Problem No.29	F	Lantry Ct-- Homes are lower than roadway	Infrastructure Inspection and Assessment Program, Goldenrod Maintenance District	Fairview Court	Under maintenance by Orange County Roads & Drainage
Problem No.30	F	Neuse Ave--roadway flooding, yards leach due to high ground water conditions, very poor percolation, headwall failure and erosion	Infrastructure Inspection and Assessment Program, Goldenrod Maintenance District	Sunshine Gardens	Under study by Orange County Roads & Drainage
Problem No.32	F	3438 - 3440 Fairway Lane-- roadway and yard flooding, structural flooding (1999)	Infrastructure Inspection and Assessment Program, Goldenrod Maintenance District	Golfview	Under maintenance by Orange County Roads & Drainage
Problem No.33	F	Ponding in low areas at intersection of Edgewater Dr and Magnolia Homes Rd; no stormwater infrastructure	Final Apopka Infrastructure Assessment, Orange County, 2002	Ramir/Magnolia Terrace	Under maintenance by Orange County Roads & Drainage
Problem No.34	F	Water ponding at intersection of Ava Lake Dr and Joyann St.-- Recommend inlet or pavement regrading	Final Apopka Infrastructure Assessment, Orange County, 2002	Monroe Manor	Under maintenance by Orange County Roads & Drainage
Problem No.35	M	Peaceful Pl-- Water ponding, recommend inlet or pavement regrading	Final Apopka Infrastructure Assessment, Orange County, 2002	Shady Grove	Under maintenance by Orange County Roads & Drainage
Problem No. 36	F	The Springs Subdivision - located within natural floodplain of the LWR.	Altamonte Springs Stormwater Management Master Plan, PEC 1996; Little Wekiva River Basin Drainage Inventory Engineering Study, Seminole County, Florida, DRMP 1995	Spring Run Patio Homes	
Problem No. 37	F	Franklin and Central Parkway dry pond - possible problem with pond storage design - overflowed during Tropical Storm Gordon.	Altamonte Springs Stormwater Management Master Plan, PEC 1996	N/A	City has not reported any problems since Tropical Storm Gordon

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E/S - Erosion/Sedimentation
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WQ - Water Quality

Table 2-2
Little Wekiva River Watershed Management Plan
Problem Areas

Problem ID	Problem Category	Problem Description	Reference	Subdivision	Participant Response
Problem No. 38	F	Altamonte Landings Subdivision - stormwater management system not designed according to "land-locked" basin criteria.	Altamonte Springs Stormwater Management Master Plan, PEC 1996	Altamonte Landings	Stormwater pump constructed in 2001 and pumps stormwater to Altamonte Springs Reclaimed Water Reclamation Facility
Problem No.39	F	Lake in golf course stages up; upward leakage in golf course area; water comes up over sidewalks and flows into storm sewer	Seminole County Team Leader Meeting, 6/02	Sabal Point	
Problem No.40	F	Spring Lake/LWR convergence; Co. currently replacing 3-72" at bridge on Horselovers La.; tailwater condition; Tributary D - There are 4 homes predicted to flood during the 100-year, 24-hour storm event.	Seminole County Team Leader Meeting, 6/02; Little Wekiva River Basin Drainage Inventory Engineering Study, Seminole County Florida (DRMP 1995).	Spring Valley Farms	
Problem No.41	F	Upward leakage during heavy rainfall events in the Hillview Drive area; lack of an outfall from SR434 and east along Hillview Drive.	Seminole County Team Leader Meeting, 6/02	N/A	
Problem No.41a	F	Outfall from Altamonte Springs Wastewater Treatment Plant goes through Spring Valley Chase Subdivision and has limited capacity, New development in the area will also be discharging to this outfall as well.	Seminole County Public Works	Spring Valley Chase Subdivision	
Problem No.42	F	McNeil Woods Pl. - upward leakage; water comes up underneath several homes just east of middle school.	Seminole County Team Leader Meeting, 6/02	McNeil Woods	
Problem No.43	F	Bonnie/Anna Dr. - flooding/upward leakage/homes reported flooding	Seminole County Team Leader Meeting, 6/02	Bear Lake Hills	
Problem No.44	F	Mirror Lake Dr.-Steep grade change between subdivisions, overland flow through mid-subdivisions towards lake	Seminole County Team Leader Meeting, 6/02	Beverly Terrace Dedicated	
Problem No.45	F	Bear Lake Terrace - pipe serves Linneal Beach/deteriorated/no easement for Co. to get into and repair/replace; All Lineal Beach area drains into Bear Lake without treatment.	Seminole County Team Leader Meeting, 6/02	Bear Lake Heights	
Problem No.46	F	Markham Woods Rd. - project under design; curb and gutter system to be installed.	Seminole County Team Leader Meeting, 6/02	N/A	Completed Feb, 2003
Problem No.47	F	Linneal Beach Drive-failed pipe/capacity problem; old CMP.	Seminole County Team Leader Meeting, 6/02	Bear Lake Forest	

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E/S - Erosion/Sedimentation
M - Maintenance
WQ - Water Quality

Table 2-2
Little Wekiva River Watershed Management Plan
Problem Areas

Problem ID	Problem Category	Problem Description	Reference	Subdivision	Participant Response
Problem No.48	F/WQ	Mobile Manor-low depressional area; finger canals can stage up and flood homes; water quality problem in canal	Seminole County Team Leader Meeting, 6/02	Mobile Manor	
Problem No.49	WQ	Lake Lawne; TSIs of 61,71,75; hi bacterial counts, exceeded standard for chlorophyll a, hi exposure to industrial pollution	Orange County Stormwater Needs Assessment Update 2002	N/A	For chlorophyll a, habitat restoration through invasive plant removal and replacement by more environmentally friendly plants.
Problem No.50	WQ	Little Lake Fairview; TSI of 55; sedimentation problem, septic tanks in area, receives runoff from I-4 and Edgewater Dr w/ little or no treatment	Orange County Stormwater Needs Assessment Update 2002	N/A	Little Lake Fairview, Minnesota ditch and Edgewater ditch are the subject of a restoration/retrofit project with the City of Orlando, Orange County and the SJRWMD; clean up of groundwater petroleum plume entering the storm system is planned by state funding source.
Problem No.51	WQ	Lake Fairview; TSI of 53; severe problems w/ bacterial coliforms, exceeded standard for total coliforms and chlorophyll a, receives discharge from Coke Company	Orange County Stormwater Needs Assessment Update 2002	N/A	Bird scaring project to reduce bacterial coliforms was performed and fecal coliform counts have returned to normal. Orange County continues to monitor these levels. Habitat restoration through invasive plant removal and replacement by more environmentally friendly plants (chlorophyll a)
Problem No.52	WQ	Lake Weston; TSI of 65; exceeded standards for DO and chlorophyll a, shows downward trend in water quality	Orange County Stormwater Needs Assessment Update 2002	N/A	Nothing planned at this time.
Problem No.53	WQ	Lake Gandy; TSI of 54; went from TSI of 31 to 54 within one year	Orange County Stormwater Needs Assessment Update 2002	N/A	Nothing planned at this time.
Problem No.54	WQ	Little Wekiva River; erosion and sedimentation problems, exceeded standards for DO, chlorophyll a, and total coliforms; need to prevent entry of bacteria and nutrients	Orange County Stormwater Needs Assessment Update 2002	N/A	
Problem No.55	WQ	Lake Hill; TSI of 56; TSI was 57 in 1993, shows slight upward trend in water quality	Orange County Stormwater Needs Assessment Update 2002	N/A	Nothing planned at this time.
Problem No.56	WQ	Spring Oaks Subdivision - Direct discharge to LWR without treatment	Altamonte Springs Stormwater Management Plan, PEC 1996	Spring Oaks	The City of Altamonte Springs will be installing sediment control structures at this location as resources become available.
Problem No.57	WQ	Weathersfield Ave. Area; direct discharge to river without treatment	Seminole County Public Works		
Problem No.58	WQ	Northwestern Avenue; direct discharge to river without treatment	Seminole County Public Works		
Problem No.59	WQ	Spring Lake; direct discharge to river without treatment	Seminole County Public Works		
Problem No.60	WQ	Mirror Lake; direct discharge to river without treatment	Seminole County Public Works		

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M - Maintenance
WQ - Water Quality

Table 2-2
Little Wekiva River Watershed Management Plan
Problem Areas

Problem ID	Problem Category	Problem Description	Reference	Subdivision	Participant Response
Problem No.61	E/S	Severe erosion through Country Creek Subdivision (outfall from Bunnell Road)	Seminole County Public Works	Country Creek	
Problem No.62	F	Poor conveyance/limited access between Lake Marion and Lake Florida.	Seminole County Public Works	Sanlando, The Altamonte Section	
Problem No. 63	F/WQ	10 homes long Cocoa Lane have chronic septic tank and reported flooding problems.	City of Orlando	Dubsdread Heights	
Problem No. 64	F	Par Street has been the subject of drainage complaints over time. Complaints of standing water in the area have been received by the City	City of Orlando	Anderson Park, Bay Run Gardens, Bonita Park, Briarwood, Bryn Mawr, Edgewater Park, Golfview, Greens Phase 2 and 3, Neva Cout, Palomar Townhouses, Phelps Replat, Pinewood Plat 1, Villa Farms	
Problem No. 65	F	Rear yard drainage complaints for several home in the College Park area.	City of Orlando	Anderson Park, Bay Run Gardens, Bonita Park, Briarwood, Bryn Mawr, Edgewater Park, Golfview, Greens Phase 2 and 3, Neva Court, Palomar Townhouses, Phelps Replat, Pinewood Plat 1, Villa Farms	City is currently investigating this; survey has been completed.

F - Flooding
DW - Drainage Well
E/S - Erosion/Sedimentation
M - Maintenance
WQ - Water Quality

currently 10 water bodies on FDEP's verified list of impaired water bodies that are within the Little Wekiva River basin. These include the Little Wekiva River, Little Wekiva Canal, Spring Lake, Lake Florida, Lake Orienta, Lake Adelaide, Lake Lawne, Lake Lucien, Silver Lake and Bay Lake. The locations of these water bodies are shown on **Figure 2-13**. The impaired water bodies on the verified list are listed primarily for nutrients and coliform. FDEP's verified list of the impaired water bodies within the Little Wekiva River basin is shown in **Table 2-3**.

CDM collected and reviewed available water quality data for the Little Wekiva River Basin. A detailed summary including an analysis of sampling data is included in the following sections.

2.7.1 Sampling Data

Water quality data for the Little Wekiva River Basin have been collected by various agencies over the past several decades including the SJRWMD, the FDEP, the United States Geological Survey (USGS), Orange County Environmental Protection Department (OCEPD), Seminole County, the City of Orlando and the City of Altamonte Springs. The available period of record for sites throughout the Little Wekiva River Basin for chemical (i.e., oxygen demand, nutrients, solids and metals) and physical parameters ranges from the 1960s to the present. In more recent years, several of the aforementioned agencies have established biological sampling programs to assist in determining the long-term health of water bodies throughout the basin.

2.7.1.1 Chemical Data

As mentioned previously, an abundance of chemical and physical data for water bodies within the Little Wekiva Basin have been collected over the last few decades. Sources of data include the USEPA's Storage and Retrieval database (STORET), the USGS, the Seminole County Watershed Atlas, OCEPD, and the City of Orlando. STORET is the database used for the storage of biological, chemical, and physical data for groundwater and surface water and includes data collected by the City of Orlando, Florida Fish and Wildlife, FDEP, OCEPD, Seminole County and Florida LAKEWATCH. The Seminole County Watershed Atlas is a cooperative project between the Seminole County Public Works Department Stormwater Division, the SJRWMD, the City of Altamonte Springs, the City of Lake Mary, the City of Casselberry, the City of Longwood, the City of Oviedo, the City of Winter Springs, and the University of South Florida. The Atlas was designed to provide users with comprehensive and current water quality, hydrologic, and ecological data, as well as a library of scientific and educational resources on ecology and management. This tool proved valuable for the water quality data review as it provides a warehouse for water quality data in Seminole County that have been collected by federal, state, county, city and volunteer agencies.

CDM obtained the available data from all the aforementioned sources and compiled them using a Microsoft Access 97© database. For this effort, CDM summarized

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11/05/02

Linden Lake
Rock Springs Run
Wekiva River
LITTLE WEKIVA RIVER
Greenwood Lake
POND
Lake Myrtle
Lake Ruth
West Lake
LAKE SEARCY
East Lake
ROCK LAKE
LAKE WINSOR
RIVER
ISLAND LAKE
Lake Wildmere
Lake Brantley
Lake Alma
LAKE JEANETTE
LAKE SEMINOLE
Wekiva (Sand) Lake
LAKE MARION
Lake Griffin
Trout Lake
Lake Cortez
Hunt club Liftstation
LAKE LOTUS
Lake Ellen
Lake Concord
LAKE FLORIDA
LAKE MOBILE
Border Lake
QUAIL POND
SR 436 W
LAKE ADELAIDE
Mirror Lake
Cranes Roost
I-4
Lake McDade
Lake Piedmont
FOREST LAKE
PEAR LAKE
PEARL LAKE
GRASSY LAKE
Lake Page
Blue Lake
LAKE MALTBIE
Prairie Lake
Lake Pleasant
LAKE ORIENTA
TROUT LAKE
Lake Hamer
Lake Pike
Lake Lotus
Spring Lake
Cub Lake
Lake of the Woods
SPRING WOOD LAKE
LAKE DESTINY
Lake Seminary
Lake Faith
Lake Vivian
Lake Betty
Lake Bosse
Lake Ava
Lake Destiny
Lake Hope
Lake Grace
Lake Hill
Loch Lomond
Lake Charlotte
Lake Julia
Lake Charity
Lake Lenore
Lake Gandy
Lake Sybelia
Lee
Lake Starlite
Lake Lucien
Lake Lovely
Lake Harvest
Lake Jackson
Lake Lockhart
Lake Meadow
Lake Lily
Lake Hungerford
Lake Tuscany
Lake Sandra
Lake Alpharetta
Lake Eulalia
Lake Bream
Long Lake
Lake Preston
Lake Osceola
Park Lake
Lake King
Lake Arlie
Lake Gem
Lake Bell
Lake Knowles
Lake Bessye
Palomino Lake
Lake Asbury
Lake Sumerset
EDGEWATER
Lake Sparling
Lake Fair
Lake Killarney
Kasey Lake
Misty Lake
Lake Sylvan
Horeshoe Lake
Lake Orlando
Lake Fairview
Emerald Springs Basin
Crooked Lake
Lake Mizell
Dwarf Lake
White Heron Lake
Little Lake Fairview
Lake Genie
Lake Tiny
Lake Virginia
JOHN YOUNG
Lake Barlow
Lake Sarah
Lake Fairhope
Lake Stanley
Lake Daniel
Lake Silver
Lake Winyah
Lake Sue
Lake Chelton
Lake Lucy
Lake Estelle
Lake Forest
PRINCETON
Lake Rowena
Lake Florence
Lake Divot
Lake Formosa
Lake Gleneagle
Lake Shannon
Lake Robin
Lake Lorine
Lake Lawne
Lake Cay Dee
Lake Ivanhoe
Lake Druid
Lake Theresa
ORANGE BLOSSOM
Lake Adair
Lake Highland
Lake Marilyn
Lake Jane
Lake Concord
Lake Dot
Lake Sherwood
Lake Notasulga
Lake Herrick
Lake Helen
Rock Lake

N
W
E
S

5800 0 5800 11600 Feet

LOCATION MAP

LEGEND

Basin Boundary
County Line
OCEPD Sampling Sites

Orange County STORET Sampling Locations
CITY OF ORLANDO
FL FISH AND WILDLIFE
FLORIDA DEPT ENV
ORANGE COUNTY ENV

Seminole County Sampling Stations
FDEP
LAKEWATCH
Seminole County Environmental Services
SJRWMD
Seminole County Public Works
USGS
WAV

TMDL Rivers/Streams/Canals
Little Wekiva Canal
Little Wekiva River
TMDL Lakes
Street Centerlines
Water Bodies

Little Wekiva RIver (Main Stem)
Little Wekiva RIver (Main Stem)

Wetlands
Wetlands

Municipalities
Altamonte Springs
Eatonville
Longwood
Maitland
Orlando

Fig 2-13

D:/Projects/9247/LWR/gis/report figs.apr

Little Wekiva River Watershed Management Plan

CDM

Figure 2-13
Water Quality Sampling Stations

Table 2-3
Little Wekiva River Watershed Management Plan
FDEP Verified List of Impaired Water Bodies
Middle St. Johns River Basin - Group 2

OGC Case Number	Basin Group Name	WBID	Waterbody Segment Name	Waterbody Type	Waterbody Class	Parameters Assessed Using the IWR	Concentrations Causing Impairment[1]	Priority for TMDL Development[2]	Projected Year for TMDL Development[2]	Comments[3] (# Exceedances/ # Samples) PP= Planning Period VP= Verified Period
03 2594	Middle St. Johns	2987	Little Wekiva River*	Stream	3F	Fecal Coliform Bacteria	> 400 per 100 ml	Low	2008	PP - 23/49 values exceed criterion. VP - 20/44 values exceed criterion. Coliform median 420 colonies/100ml, range 1.0 - 5800 colonies/100ml. No more than 5 values per month.
03 2595	Middle St. Johns	2987	Little Wekiva River*	Stream	3F	Total Coliform Bacteria	> 2400 per 100 ml	Low	2008	PP - 9/33 values exceed criterion. VP - 5/24 values exceed criterion. Coliform median 2000 colonies/100ml, range 120 - 24,000 colonies/100ml. No more than 5 values per month.
03 2596	Middle St. Johns	2987A	Spring Lake	Lake	3F	Nutrients (TSI)	TP = 0.04 mg/L	Medium	2008	Phosphorus limited based on a TN/TP median of 37 (228 values) in the PP and a median of 37 (230 values) in the VP. PP - 6 TSI annual means exceeded 60 (1995-2000). VP - 7 TSI annual means exceeded 60 (1996-2002). 261 TN values, median 1.53 mg/L, mean 1.55 mg/L. 275 TP values, median 0.041 mg/L, mean 0.04 mg/L.
03 2613	Middle St. Johns	2998A	Lake Florida	Lake	3F	Nutrients (TSI)	TN = 0.83 mg/L TP = 0.04 mg/L	Medium	2008	Colimitation by nitrogen and phosphorus based on a TN/TP median of 21 (186 values) during the PP and a median of 22 (242 values) during the VP. PP - 0 TSI annual means exceeded 60. VP - 1 TSI annual mean exceeded 60 (2002). 257 TN values, median 0.83 mg/L. 258 TP values, median 0.04 mg/L.
03 2614	Middle St. Johns	2998C	Lake Orienta	Lake	3F	Nutrients (TSI)	TN = 1.26 mg/L TP = 0.04 mg/L	Medium	2008	Colimitation of nitrogen and phosphorus based on a TN/TP median of 31 (31 values) during the PP and a median of 30 (696 values) during the VP. PP - 3 TSI annual means exceeded 60 (1996, 1999, 2000). VP - 5 TSI annual means exceeded 60 (1996, 1999-2002). 725 TN values, median 1.26 mg/L, mean 1.33 mg/L. 726 TP values, median 0.04 mg/L, mean 0.04 mg/L.
03 2615	Middle St. Johns	2998E	Lake Adelaide	Lake	3F	Nutrients (TSI)	TN = 1.02 mg/L TP = 0.05 mg/L	Medium	2008	Colimitation by nitrogen and phosphorus based on a TN/TP median of 23 (147 values) during the PP and a median of 22 (159 values) during the VP. PP - 1 TSI annual mean exceeded 60 (1993). VP - 1 TSI annual mean exceeded 60 (2001). 216 TN values, median 1.02 mg/L. 216 TP values, median 0.05 mg/L.
03 2621	Middle St. Johns	3004	Little Wekiva Canal*	Stream	3F	Dissolved Oxygen and BOD	< 5.0 mg/L	Low	2008	PP - 32/103 values below DO criterion. VP - 23/65 values below DO criterion. DO met verification threshold of IWR and BOD is causative pollutant. (BOD median = 2.1 mg/L). 103 DO values, median 6.2 mg/L, mean 5.9 mg/L, range 0.5 - 12.09 mg/L.
03 2622	Middle St. Johns	3004	Little Wekiva Canal*	Stream	3F	Fecal Coliform Bacteria	> 400 per 100 ml	Low	2008	PP - 29/95 values exceed criterion. VP - 21/61 values exceed criterion. Coliform median 170 colonies/100ml, range 2 - 4,320 colonies/100ml. No more than 4 values per month.

OGC Case Number	Basin Group Name	WBID	Waterbody Segment Name	Waterbody Type	Waterbody Class	Parameters Assessed Using the IWR	Concentrations Causing Impairment[1]	Priority for TMDL Development[2]	Projected Year for TMDL Development[2]	Comments[3] (# Exceedances/ # Samples) PP= Planning Period VP= Verified Period
03 2623	Middle St. Johns	3004	Little Wekiva Canal*	Stream	3F	Nutrients (Chla)	TN = 1.16 mg/L TP = 0.08 mg/L	Low	2008	Colimitation by nitrogen and phosphorus based on a TN/TP median of 14 (156 values) during the PP and a median of 17 (84 values) during the VP. 84 TN values, median 1.16 mg/L . 84 TP values, median 0.08 mg/L. PP - 6 chla annual means exceeded 20 ug/l (1991, 1992, 1994, 1996, 1998, 1999). VP - 3 chla annual means exceeded 20 ug/l (1996, 1998, 1999). The annual chla concentrations were: 1991 - 20.5 ug/l, 1992 - 20.7 ug/l, 1993 - 13.6 ug/l, 1994 - 23.2 ug/l, 1996 - 25.1 ug/l, 1997 - 13.0 ug/l, 1998 - 20.0 ug/l, 1999 - 26.6 ug/l, and 2000 - 10.0 ug/l.
03 2625	Middle St. Johns	3004C	Lake Lawne	Lake	3F	Nutrients (TSI)	TN = 1.48 mg/L TP = 0.13 mg/L	Medium	2008	Colimitation by nitrogen and phosphorus based on a TN/TP median of 13 (320 values) during the PP and a median of 17 (98 values) during the VP. PP - 6 TSI annual means exceeded 60 (1991-1994, 1996, 1997). VP - 2 TSI annual means exceeded 60 (1996, 1997). 27 TN values, median 1.48 mg/L, mean 1.57 mg/L. 404 TP values, median 0.128 mg/L, mean 0.203 mg/L.
03 2626	Middle St. Johns	3004D	Silver Lake	Lake	3F	Nutrients (TSI)	TN = 0.64 mg/L TP = 0.03 mg/L	Medium	2008	Colimitation by nitrogen and phosphorus based on a TN/TP median of 25 (237 values) during the PP and a median of 27 (118 values) during the VP. PP - 0 TSI annual means exceed threshold of 60. VP - 1 TSI annual means exceed threshold of 60 (1998). 173 TN values, median 0.64 mg/L, mean 0.76 mg/L. 224 TP values, median 0.027 mg/L, mean 0.04 mg/L.
03 2627	Middle St. Johns	3004G	Bay Lake	Lake	3F	Nutrients (TSI)	TN = 1.21 mg/L TP =0.04 mg/L	Medium	2008	Colimitation by nitrogen and phosphorus based on a TN/TP median of 29 (406 values) during the PP and a median of 31 (286 values) during the VP. PP - 8 TSI annual means exceeded 60 (1993-2000). VP - 7 TSI annual means exceeded 60 (1996-2002). 442 TN values, median 1.21 mg/L, mean 1.27 mg/L. 443 TP values, median 0.04 mg/L, mean 0.042 mg/L.
03 2629	Middle St. Johns	3011C	Lake Lucien	Lake	3F	Mercury (in fish tissue)	> 0.5 ppm	Medium	2011	Mercury (in fish tissue) met verification threshold of IWR. Fish tissue levels in 20 samples averaged 0.5075 ppm in 2000.

[1] "ln H" means the natural logarithm of total hardness expressed as mg/L of CaCO3. For metals criteria involving equations with hardness, the hardness shall be set as 25 mg/L if actual hardness is < 25mg/L and set at 400 mg/L if actual hardness is > 400 mg/L. The concentration causing impairment for nutrient listings is the median.

[2] Where a parameter was 1998 303(d) listed, the priority shown for it in the 1998 303(d) list was retained (high or low). Where a parameter was only identified as impaired under the IWR, priorities of high, medium or low were used.

[3] **PP** - Planning Period (January, 1991 through December, 2000); **VP** - Verified Period (January, 1996 through June 30, 2003)

The Middle St. Johns Verified List is based on IWR2002 Run 14.2.

* The Little Wekiva River is that portion of the river flows generally from Lake Lotus downstream to its confluence with the Wekiva River. The Little Wekiva Canal is generally that portion of the river that has been channelized and flows through Orange County.

historical chemical sampling data for the larger water bodies within the Little Wekiva River Basin including Bear Lake, Lake Fairview, Little Lake Fairview, Lake Lawne, Lake Orlando, Lake Shadow, Lake Silver, the Little Wekiva River at various locations, Mirror Lake, and Spring Lake. The sampling locations within the Little Wekiva River Basin are shown on Figure 2-13. Due to large data gaps and different reporting techniques, the water quality data summaries are not necessarily consistent for all the water bodies mentioned (i.e., period of record and parameters reported).

Statistical Analysis

Due to the large fluctuation of data over time for the majority of the water bodies, statistical methods were used to determine if trends existed for any of the water bodies. Correlation coefficients are used to measure the strength of association between two continuous variables (e.g., concentration, flow, and/or stage vs. time). The correlation coefficient is used to determine if one variable generally increases as the second increases, if it decreases as the second increases, or whether the patterns of the variation have no relationship. A Spearman's rho correlation was used to determine what type of relationship, if any, exists between concentration and time for each of the water bodies analyzed. The Spearman's rho correlation is based on rank and measures relationships where the "y" variable generally increases or decreases as the "x" variable increases. These correlations may be linear or nonlinear. This method of correlation is also resistant to the effects of outliers in the data.

Once it is determined if a relationship exists using the Spearman's rho correlation, it is then necessary to determine if this relationship is statistically significant or not (i.e., there is a high confidence level that a trend exists). To accomplish this objective, a null hypothesis was formed (i.e., *there is no trend with respect to time*) and an acceptable error rate was established (i.e., $\alpha = 0.05$ error rate or 0.95 confidence rate)). This is the probability of rejecting the null hypothesis (i.e., *there is a trend with respect to time*). The test is then run and the probability (p) is computed. If $p \leq \alpha$, then the probability of this occurrence is too low to accept the null hypothesis, it is rejected, and the data set is found to be statistically significant. The following sub-sections describe the results of this exercise for each water body and identify those parameters that were found to have relationships that were statistically significant. A summary of the statistical relationships is provided in **Table 2-4**.

2.7.1.1.1 Bear Lake

The most complete available period of record for Bear Lake was from 1998 through mid-2002 for dissolved oxygen (DO), total suspended solids (TSS), 5-day biochemical oxygen demand (BOD_5), total nitrogen (TN), and total phosphorus (TP). The data were graphed and included in **Appendix D**. For Bear Lake, the relationships for TSS, DO, BOD_5, TN and TP were all found to be statistically significant at the 0.05 level. Based on the correlation coefficients, the relationships for BOD5, TN and TP increased with time whereas the relationships for TSS and DO decreased over time. There were little to no data available for Bear Lake for metals.

Table 2-4
Little Wekiva River Watershed Management Plan
Water Quality Data Statistical Trends

Water Body/Parameter	DO	TSS	TDS	BOD5	TN	TKN	TP	Cd	Cu	Fe	Pb	Zn
Bear Lake	-	-	NS	+	+	ND	+	ND	ND	ND	ND	ND
Lake Fairview	NS	+	NS	+	+	+	NS	-	-	NS	NS	NS
Little Lake Fairview	+	NS	NS	NS	NS	+	-	NS	NS	NS	NS	NS
Lake Lawne	NS	NS	-	NS	NS	NS	-	-	NS	-	+	NS
Lake Orlando	+	NS	+	NS	+	+	+	NS	NS	-	NS	NS
Lake Shadow	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	ND
Lake Silver	+	-	NS	-	-	-	-	-	-	-	NS	+
Little Wekiva River:												
Silver Star Road	+	+		-	-	NS	-	-	-	-	NS	NS
US 441	NS	NS	NS	-	ND	NS	NS	NS	-	-	NS	ND
upstream confluence with Spring Lake	NS	ND	ND	NS	ND	ND	-	ND	ND	ND	ND	ND
0.38 miles downstream of confluence with Spring Lake	NS	ND	ND	-	ND	ND	-	ND	ND	ND	ND	ND
2.6 miles downstream of confluence with Spring Lake	+	ND	ND	-	ND	ND	-	ND	ND	ND	ND	ND
3.4 miles downstream of confluence with Spring Lake	+	ND	ND	-	ND	ND	-	ND	ND	ND	ND	ND
Mirror Lake	NS	NS	ND	NS	NS	ND	NS	ND	ND	ND	ND	ND
Spring Lake	+	NS	ND	NS	NS	ND	-	ND	ND	ND	ND	ND

+ relationship between concentration and time increases
- relationship between concentration and time decreases
NS not statisitically significant
ND no data

2.7.1.1.2 Lake Fairview

For Lake Fairview, the most complete period of record was available for BOD_5, total Kjeldahl nitrogen (TKN), TN, DO, TP, TSS, total dissolved solids (TDS), cadmium (Cd), copper (Cu), iron (Fe), lead (Pb) and zinc (Zn) from 1972 through 2001. The relationships for BOD5, TKN, TN, and TSS were found to be statistically significant and the correlation coefficients for these parameters were positive indicating that the concentrations increased over time. Of the metals, only Cd and Cu were found to have statistically significant relationships that decreased with time. The plotted data are included in Appendix D.

2.7.1.1.3 Little Lake Fairview

The most complete period of record available for Little Lake Fairview was from 1981 through 1999 for BOD_5, TKN, TN, DO, TP, TSS, TDS, Cd, Cu, Pb, Fe and Zn. TKN, DO, and TP were all found to have statistically significant relationships. Of these, TKN and DO had positive correlation coefficients indicating the relationship increased over time whereas the relationship for TP decreased over time. Of the metals, the data for Cd and Cu were found to be statistically significant with negative correlation coefficients indicating the concentrations decreased with time. The plotted data are included in Appendix D.

2.7.1.1.4 Lake Lawne

For Lake Lawne, the most complete available period of record was from 1980 through 2001 for BOD_5, TKN, TN, DO, TP, TSS, TDS, Cd, Cu, Pb, Fe and Zn. The relationships for TDS and TP were found to be statistically significant both with downward trends. The relationships for Cd, Fe and Pb were found to be statistically significant with the trends for Cd and Fe decreasing over time and the trend for Pb increasing over time. The plotted data are included in Appendix D.

2.7.1.1.5 Lake Orlando

The most complete period of record available for Lake Orlando was from 1972 through 2001 for BOD_5, TKN, TN, DO, TP, TSS, TDS, Cd, Cu, Pb, Fe and Zn. The relationships for TKN, TN, DO, TP and TDS were found to be statistically significant. Of these, TKN, TN, TP and TDS had negative correlation coefficients indicating the relationship decreased over time whereas the relationships for DO increased with time. Of the metals, only the relationship for Fe was found to be statistically significant with a negative correlation coefficient indicating the concentration decreased over time. The plotted data are included in Appendix D.

2.7.1.1.6 Lake Shadow

Data for only a two-year period of record (1997-1999) were available for Lake Shadow. There were no statistically significant relationships found for any of the parameters analyzed for Lake Shadow. The plotted data are included in Appendix D.

2.7.1.1.7 Lake Silver

The available period of record for Lake Silver was from 1980 through 2001. Over this time, the relationships for BOD_5, DO, TN, TKN, TP and were found to be statistically

significant. The correlation coefficients for BOD_5, TN, TKN, TP and TSS were negative indicating the trend for the data decreased over time, while the trend for DO increased with time. Relationships for Cd, Cu, Fe and Zn were found to be statistically significant. The relationships for all of these with the exception of Zn decreased with time. The plotted data are included in Appendix D.

2.7.1.1.8 Little Wekiva River

Little Wekiva River at the intersection of Silver Star Road

The period of record available for this site was from 1980 through 2000. The relationships for BOD_5, TN, DO, TP and TSS were found to have statistically significant relationships. Of these, the correlation coefficients for BOD_5, TN, and TP were negative indicating the concentrations decreased over time. DO and TSS concentrations increased over time based on the correlation coefficients. Of the metals, Cd, Cu, and Fe had significant relationships that decreased with time. The plotted data are included in Appendix D.

Little Wekiva River at the intersection of U.S. 441

Sampling data for a 6-year period of record (1994 through 2000) were also available further downstream at the point at which the river meets U.S. 441. Only the data for BOD_5 was found to be statistically significant with the concentration decreasing with time. The relationships for Cu and Fe were found to be statistically significant at this location. The correlation coefficients for both of these parameters were negative indicating the concentrations decreased with time. The plotted data are included in Appendix D.

Little Wekiva River upstream of the confluence with Spring Lake

The stations sampled were all located upstream of the river's confluence with Spring Lake but downstream of Trout Lake. The most complete period of record available for this area was from 1971 through 1997 for BOD_5, DO and TP. Of these parameters, only the relationship for TP was found to be statistically significant. The correlation coefficient was negative indicating concentrations decreased over time. Metals data were not available for this location. The plotted data are included in Appendix D.

Little Wekiva River downstream of the confluence with Spring Lake

Water quality data were examined at 3 different locations downstream of the river's confluence with Spring Lake. The first location is approximately 2,000 ft downstream of the confluence, south of S.R. 436. A period of record was available from 1970 through early 2002 for BOD_5, DO and TP. Of these parameters, BOD_5 and TP had statistically significant relationships both with negative correlation coefficients indicating the concentrations decreased over time.

The second location is located approximately 2.6 miles downstream of the Spring Lake confluence near the river's intersection with Montgomery Rd. The most complete period of record was from 1973 through early 1987 for BOD_5, DO and TP. All three parameters were found to have statistically significant relationships. BOD_5 and TP both had negative correlation coefficients indicating the concentrations decreased over time. A positive correlation coefficient for DO indicated that concentrations increased with time.

The last location along the Little Wekiva River is just north of the river's intersection with S.R. 434 (approximately 3.4 miles downstream of the confluence with Spring Lake). The most complete period of record available for this location was from 1971 through mid-2002 for BOD_5, DO and TP. Similar to the previous site, the relationships for both BOD_5 and TP were found to be statistically significant with negative correlation coefficients. The relationship for DO was also found to be statistically significant with a positive correlation coefficient indicating that the concentrations for this parameter increased over time. The plotted data for all of these locations are included in Appendix D.

2.7.1.1.9 Mirror Lake

The most complete period of record for Mirror Lake was from 1994 through mid-2002 for BOD_5, DO, TN, TP and TSS. None of the relationships for any of these parameters were found to be statistically significant. The plotted data are included in Appendix D.

2.7.1.1.10 Spring Lake

The most complete period of record available for Spring Lake was from 1998 through 2002. Both DO and TP were found to have statistically significant relationships. The relationship for DO increased over time while the relationship for TP decreased over time. The plotted data are included in Appendix D.

2.7.1.2 Trophic State Index

FDEP recommends the use of the Florida Trophic State Index (TSI) to characterize water quality conditions in lakes and estuaries based on nutrient and chlorophyll concentrations (Hand et al. 1990, 1996). The trophic state index or TSI was measured by their respective jurisdictions for several lakes within the Little Wekiva River Basin including Lake Lawne, Lake Fairview, Lake Orlando, Lake Silver, Mirror Lake, Bear Lake and Spring Lake. Trophic state is defined as the total weight of biomass (living biological material) in a water body at a specific location and time and is generally applied to lakes. The trophic state is the biological response to factors such as chlorophyll a, Secchi depth, and total phosphorus and total nitrogen levels. Trophic states are typically referred to as oligotrophic, mesotrophic, eutrophic and hypereutrophic. Very low phytoplankton levels, suitable for water-based recreation, characterize oligotrophic water bodies which are considered to have excellent water quality. Mesotrophic waters are those that are moderately clear, some depletion of oxygen and algal turbidity but otherwise still suitable for water-based recreation. Lake with high levels of nutrients and planktonic algae are considered eutrophic.

These lakes are highly productive and have the potential for water quality problems resulting from algae blooms and oxygen depletion. Hypereutrophic are those water bodies that have dense algae and macrophytes and the high levels of phytoplankton growth diminish other uses. The TSI for Florida lakes is as follows:

TSI	Trophic State
0-49	Oligotrophic
50-60	Mesotrophic
61-70	Eutrophic
71-100	Hypereutrophic

The TSI calculations provided below are based on FDEP's Water-Quality Assessment for the State of Florida. Section 305(b) Main Report. In recent years FDEP has encountered problems interpreting Secchi depth data in many "blackwater" (tannic) Florida water bodies, where water column transparency can be reduced by naturally-elevated concentrations of dissolved organic matter. As a result, Secchi depth has been dropped as an indicator in FDEP's recent TSI calculations (Hand et al., 1996). The TSI for Florida lakes can be calculated as follows:

Phosphorus-Limited Lakes (TN/TP >30):

TSI (AVG) = 1/2 [TSI (chlorophyll a) + TSI (TP)]

Where: TSI (chlorophyll a) = 16.8 + 14.4 ln chlorophyll a
TSI (TP) = 10 (2.36 In (1000TP) – 2.38)

Nitrogen-Limited Lakes (TN/TP<10):

TSI (AVG) = 1/2 [TSI (chlorophyll a) + TSI (TN)]

Where: TSI (chlorophyll a) = 16.8 + 14.4 In chlorophyll a
TSI (TN) = 10(5.96 + 2.15 ln (TN + 0.001))

Nutrient-Balanced Lakes (10 <TN/TP <30):

TSI (AVG) = 1/2 [TSI (chlorophyll a) + 0.5 (TSI (TP) + TSI (TN))]

Where: TSI (chlorophyll a) = 16.8 + 14.4 ln chl a
TSI (TN) = 56 + 19.8 ln TN
TSI (TP) = 18.6 In TP - 18.4

TSIs were calculated for the referenced lakes using data collected between 1978 and 2002. TSI data for Lake Fairview and Bear Lake are statistically significant and fall within the oligotrophic range with trends showing increases towards the mesotrophic level. The TSI values for Lake Orlando are also statistically significant and are in the mesotrophic range with a trend approaching the eutrophic range. TSI data for Spring Lake were also found to be statistically significant and experienced a change in trophic state over time from hypereutrophic to eutrophic levels. TSI data were available for Lake Lawne, Mirror Lake, Silver Lake and the Little Wekiva River, however the trend of data for these water bodies were not found to be statistically significant. The plotted TSI data for all water bodies are included in **Appendix E**.

2.7.1.3 Biological Sampling

CDM obtained available biological sampling data for the Little Wekiva River Basin. Data sources included FDEP, OCEPD and Seminole County. Some macroinvertebrate sampling data were available for a few of the water bodies in the Little Wekiva River Basin. More recently, biological monitoring has been performed by several agencies using the Stream Condition Index and the Bioreconnaissance sampling methods, which are discussed later in this section.

2.7.1.3.1 Macroinvertebrate Sampling

Macroinvertebtrate data were collected for three sites in the Little Wekiva River Basin from 1992 through 2000. The sites include Lake Fairview, Lake Lawne and the Little Wekiva River upstream of Lake Lotus. Data compiled from these sampling events included: total number of individuals collected, total number of species present, the total number of individuals, diversity, biotic index, evenness or equitability index, feeding guild composition, dominant taxa and physical parameters of the water body itself.

The Shannon-Weaver Diversity Index (SWDI) is used to assess or characterize a macro-invertebrate community (i.e., the number of species present). Wilhm and Dorris (1968) cite that SWDI values less than 1.0 indicate heavy pollution, values between 1.0 and 3.0 are indicative of moderate pollution, and values greater than 3.0 typify clean waters. The Biotic Index (BI) is also another indicator of the biological integrity of a macro-invertebrate community. The BI considers the pollution tolerance of the species collected whereas the SWDI does not. Hadley (1989) indicates that in Florida, a BI of 0.0 to 3.0 indicates gross organic material, a range of 3.0 to 6.0 indicates moderate organic material, and a BI greater than 10.0 is typical of good water quality.

The SDWI calculated for composite samples taken from the natural substrate in Lake Lawne ranged from 3.01 to 3.15 indicating clean waters. BI values were not available for this site. The SWDI for individual samples taken from the natural substrate in Lake Fairview ranged from 2.08 to 2.84 with the exception of one sample where the SWDI was 0.68 indicating this value may be an outlier. The values, excluding the suspected outlier, indicate moderate pollution. BI values for this site were not available.

Samples in the Little Wekiva River were taken from an artificial substrate and the SWDI ranged from 1.79 to 4.32 between March 1991 and March 2000. Since the Little Wekiva River is a flowing river, an artificial substrate was used for these sampling efforts as opposed to a natural substrate in a lake where grab samples can be taken from. The plotted data shows the SWDI increasing indicating that the water quality of the river has been improving over time. The plotted data are included in **Appendix F**. BI values for individual samples ranged from 6 to 25 between September 1995 and March 2000. Large fluctuations were observed in the plotted data ranging from a BI value of 6 to 25.

2.7.1.3.2 Stream Condition Index and Bioreconnaissance

In more recent years, biological sampling has been performed in accordance with the FDEP's bioassessment program for streams. Work done under this program resulted in the Stream Condition Index (SCI) and the Bioreconnaissance (BioRecon) sampling methods. The SCI is a composite macroinvertebrate index for use in flowing streams. Sampling consists of 20 dipnet sweeps of habitats in a 100-meter stretch of the stream. Organisms collected during this process are processed in the laboratory in accordance with the FDEP MacroInvertebrate Sample Processing Standard Operating Procedure (SOP). The results of this processing are used to calculate seven biological metrics including:

- Number of total taxa;
- Florida index – this is based on the relative pollution tolerances of the organisms present in the sample;
- Number of Ephemeroptera (mayflies), Plecoptera (stoneflies) and Tricoptera (caddisflies) taxa also known as the EPT Index;
- Number of Chironomid taxa;
- Percent dominant taxa;
- Percent diptera (flies); and,
- Percent filterers.

Once these are calculated, points are assigned for each metric based on the regionally calibrated criteria. The criteria differ by bioregions, or areas of general homogeneity in the freshwater macrobenthic community assemblage of wadeable streams. These bioregions include the Panhandle, the Peninsula (excludes the Everglades Ecoregion) and a small portion of Northeast Florida. The Little Wekiva River Basin is located in the Peninsula bioregion (see **Figure 2-14**). The points from these from each of the seven biological metrics are summed to rate a site as "excellent", "good", "fair" or "poor".

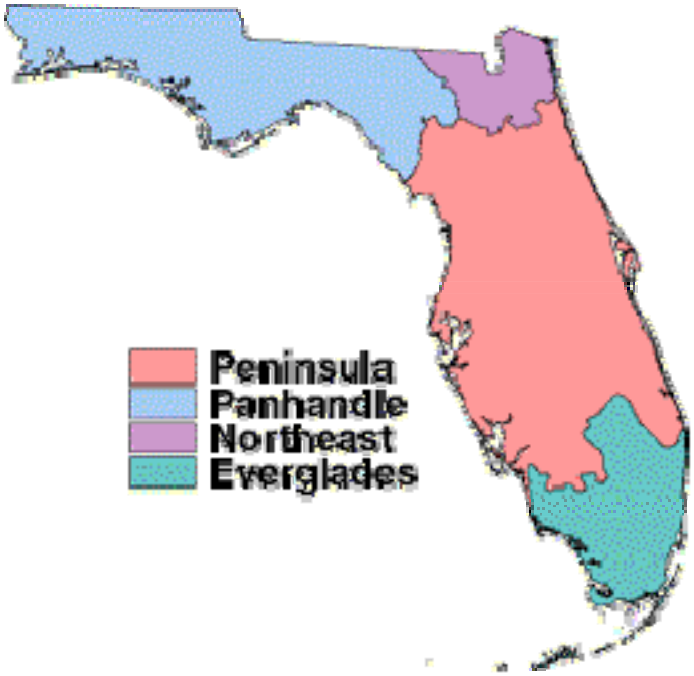

Figure 2-14 – FDEP Stream BioRegions

The BioRecon is a screening tool version of the SCI as it is designed to rapidly assess a site to prioritize it for more intensive sampling. It is different from the SCI method in that only four dipnet sweeps of the habitat are performed. Another difference is that the organisms are sorted and identified in the field rather in the laboratory. The relative abundance of species is then recorded on a BioRecon field sheet. Samples of each taxa are eventually verified in the laboratory. A subset of the seven metrics used for the SCI method is incorporated into the BioRecon Assessment and includes:

- Number of total taxa;
- Florida index – this is based on the relative pollution tolerances of the organisms present in the sample; and,
- Number of Ephemeroptera (mayflies), Plecoptera (stoneflies) and Tricoptera (caddisflies) taxa also known as the EPT Index.

After determining the region in which the sampling site is located, the sampling data are then compared to the established regional thresholds to determine whether or not they have been exceeded. If the values meet or exceed the regional thresholds for two out of the three metrics calculated, the site is classified as "healthy". If the site fails to pass two out of the three metrics, it is then recommended for further study. A classification of "suspect" or "impaired" may then be assigned.

The SJRWMD performs BioRecons at six sites along the river twice per year in order to assess the impacts of the erosion control projects that have been implemented. A description of the results is provided in the following paragraphs.

2.7.1.3.3 Stream Condition Index/Bioreconnaissance Results

Both SCI and BioRecon sampling results were available for several sites along the Little Wekiva River with various periods of record. The following is a brief discussion of the biological sampling results and changes throughout the course of the river. The locations of the biological sampling sites are included on **Figure 2-15**.

The most upstream point in the Little Wekiva River at which sampling data were available was Edgewater Drive. BioRecon results obtained by the SJRWMD as of 2001 indicate this section of the river is "suspect". Earlier sampling done between 1999 and 2001 has indicated that the conditions have fluctuated between "suspect" and "impaired". BioRecons have been ongoing through 2005 at this site. Results have been variable and no trend has been indicated to date. Notes in the biological monitoring reports have indicated that habitat could be expected to improve with increased vegetarian riparian buffer, increasing shading of the stream and overall habitat quality. The sedimentation control measures proposed in the 1998 study were completed in early 2003.

The next station downstream of Edgewater Drive at which biological sampling results were available was the Kelvington/Wallington Drive area. BioRecon sampling performed in 2001 also indicates the conditions at this location are "suspect". Similar to the Edgewater Drive, sampling done between 1999 and 2001 at this location indicated that the conditions have fluctuated between "suspect" and "impaired". BioRecons have been ongoing through 2005 at this site. Results have been variable and no trend has been indicated to date. Notes in the biological monitoring reports have indicated that habitat could be expected to improve with increased vegetarian riparian buffer, increasing shading of the stream and overall habitat quality. Sedimentation controls were put in place at this location in 1998.

The next station downstream is located in the Lake Lovely Canal which is tributary to the Little Wekiva River. BioRecon sampling performed in 2001 also indicates that this section of the canal is "suspect".

Further downstream Elba Way and Campo Way, the most recent 2001 BioRecon results indicate this section of the river is "healthy". BioRecon sampling at this location has also been performed between 1998 and 2001 and results have fluctuated between "healthy" and "impaired". BioRecons have been ongoing through 2005 at this site. Results have been variable and no trend has been indicated to date. Notes in the biological monitoring reports have indicated that habitat could be expected to improve with increased vegetarian riparian buffer, increasing shading of the stream and overall habitat quality. The sedimentation control measures proposed at this location in the 1998 Study are still pending at this time.

BioRecon sampling performed in 2001 in Tributary "D", which is a channelized portion upstream of Lake Lotus that discharges from the Bear Lake system, classified this section as "suspect". Further downstream in the river itself, before it flows into Lake Lotus, 2001 SCI results indicate the conditions in the river at this location are "excellent".

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Lake Brantley
LAKE MARION
LAKE FLORIDA
LAKE MOBILE
Cranes Roost
SR 436 W
I-4
LAKE ORIENTA
Trout Lake
Bear Lake
Spring Lake
Cub Lake
Lake Lotus
Little Bear Lake
Lake Destiny
Lake Bosse
Lake Hill
Lake Lovely
Lake Weston
EDGEWATER
Lake Orlando
Lake Fairview
Bay Lake
JOHN YOUNG
PRINCETON
Lake Lawne

N
W
E
S

5800 0 5800 11600 Feet

LOCATION MAP

LEGEND
Basin Boundary
County Line
BioRecon/SCI Sites
Street Centerlines
Water Bodies
Little Wekiva RIver (Main Stem)
Wetlands
Municipalities
Altamonte Springs
Eatonville
Longwood
Maitland
Orlando

Little Wekiva River Watershed Management Plan

Fig 2-15

D:/Projects/9247/LWR/gis/report figs.apr

CDM

Figure 2-15
BioRecon/SCI Sampling Sites

Further downstream in the river at Northwestern Avenue, 2001 BioRecon results classify this section of the river as "suspect". Past sampling results from 1998 through 2001 have indicated that the condition of the river was "impaired". It appears the water quality has somewhat improved in this area based on the most recent sampling data. BioRecons have been ongoing through 2005 at this site. Results have been variable and no trend has been indicated to date. Notes in the biological monitoring reports have indicated that habitat could be expected to improve with increased vegetarian riparian buffer, increasing shading of the stream and overall habitat quality. The erosion control measures proposed at this location in the 1998 Study were completed in 2004.

A BioRecon performed in May 2002 at the intersection of the Little Wekiva River and S.R. 436 indicates "healthy" conditions.

Further downstream in the river at Merrill Park, sampling performed between 1999 and 2001 have indicated that conditions have fluctuated between "healthy" and "impaired". However, both sampling results in 2001 indicated "healthy" conditions. BioRecons have been ongoing through 2005 at this site. Results have been variable and no trend has been indicated to date. Notes in the biological monitoring reports have indicated that habitat could be expected to improve with increased vegetarian riparian buffer, increasing shading of the stream and overall habitat quality. The sedimentation control measures proposed in the 1998 study at this site were completed in 2000 which may explain some of the variability in conditions from 1999 through 2000.

Seminole County performed a BioRecon at the Little Wekiva River at the intersection with S.R. 434 in December 2001. Results of this analysis indicate that the water body is "healthy" at this location. Sampling was also performed by the SJRWMD at the same station in May 2002 and the BioRecon results indicate "healthy" conditions.

2.8 Archaeological Resources

The Florida Department of State Division of Historical Resources was contacted to obtain a listing of those archaeological sites within the Little Wekiva River Basin. According to the Master Site File, there are 7 archaeological sites, 1 resource group, and 517 historic structures within the basin. Pertinent information provided in the data includes a site identification code, a township/range/section, site name, location and any additional useful information associated with the site. The Department of State requests that the locations of these sites be limited in distribution as vandalism is common at Florida sites.

The Department of State claims that areas, which have not been subjected to a complete survey, may contain unrecorded archaeological sites and/or historical buildings. Additionally, both state and federal law require formal environmental review for some projects and the receipt of the Master Site File search results does not constitute such a review. As a disclaimer, it was also mentioned that inclusion within the state's database does not necessarily imply that the structure or site is significant.

Additionally in 2000, Archaeological Consultants, Inc. performed a cultural resource assessment survey within the Little Wekiva River Basin in Orange and Seminole Counties for SJRWMD. The purpose of this investigation was to identify any cultural resources within the 11 project sites along the Little Wekiva River and assess their significance in terms of eligibility for listing in the National Register of Historic Places (NRHP). Background research and review of the Florida Master Site File indicated that no archaeological sites were recorded within the 11 project areas or in the immediate project vicinity. Research also revealed that no prehistoric or historic sites in the project areas were listed or considered eligible for listing in the NRHP. Historical background research indicated that no historic properties (50 years of age or older) were previously recorded in the project areas.

2.9 Riverine Habitat Restoration

Areas of extensive urban development have occurred in the Little Wekiva River Watershed. The impacts have reduced the natural drainage patterns and flow-ways creating water quality problems as well as reducing the habitat quality in the basin. Several sections of the river have been channelized and numerous ditches, canals, and storm drains now discharge directly to the river. More specifically, urbanization in the Little Wekiva watershed has led to 1) loss of riparian habitat, and 2) an increase in sediments (and nutrients) reaching the river which results in constriction of flow, loss of aquatic habitat, and establishment of nuisance and exotic vegetation. As previously indicated, a multi-jurisdictional master plan was developed by Singhofen & Associates Inc. [SAI] (1998) to address the excessive erosion and sediment transport that occurs in the river and thereby improve flow conveyance and improve aquatic habitat. Implementation of the plan by the SJRWMD began in 1999 and a majority of the planned sedimentation and erosion control projects have been constructed to date. A recent summary of bio-monitoring data for the Little Wekiva River provided by CDM (2003) to the SJRWMD indicates that implementation of sedimentation and erosion control projects are having a positive effect on restoration of aquatic habitat in the river.

2.9.1 Riverine Habitat Restoration Projects within the Little Wekiva River Watershed

In addition to the erosion control projects described above, larger scale riverine habitat restoration projects in the Little Wekiva Basin have been proposed (but not yet funded) for implementation under the USACE Ecosystem Restoration Program as follows.

Little Lake Fairview Restoration Project

Although not funded for implementation under the USACE Ecosystem Restoration Program, this project is currently being funded by the SJRWMD, City of Orlando and Orange County. Little Lake Fairview is located in the City of Orlando in Orange County within the Little Wekiva River Basin. Little Lake Fairview discharges west to

Lake Fairview, which discharges north to the lower reaches of the Little Wekiva River, through drainage canals. Urbanization around the Little Lake Fairview has altered the timing, distribution, quantity, and quality of water that enters the adjacent wetland and the lake. In addition, the southern shoreline of the lake and the wetland are dominated by nuisance vegetation such as primrose willow, torpedo grass, Japanese climbing fern, China berry, air potato, Japanese honeysuckle, camphor tree, Chinese tallow, and Caesar's weed.

The wetland and the lake are in need of hydrologic and ecologic restoration and implementation of a stormwater management system which will improve the water quality in the lake and provide for wetland and shoreline habitat restoration. This project will include ditch improvements, construction of wet detention ponds, and restoration of the adjacent wetland and the shoreline of the lake. Nuisance vegetation will be removed where it exists in the wetland and trees such as cypress, black gum, red maple, sweet bay, and red bay will be planted in these wetland areas and around the wet ponds. Establishment of the appropriate hydroperiod and vegetation communities in the wetland will also improve the habitat for wetland dependent species. Shoreline restoration will consist of the removal of sediments and nuisance vegetation, and planting of robust emergent vegetation such as bulrush and soft rush, and broad-leaved emergent vegetation such as arrowhead, and arrow arum to establish a littoral zone along the southern shoreline of the lake.

Wetland restoration will provide important habitat and green space that is limited in this urban setting. The establishment of open water habitat, and wetland and shoreline habitat restoration will provide recreational and educational opportunities for the local community. The wet detention ponds will provide flow attenuation and treatment of stormwater whereas the restored wetland will provide additional flow attenuation and additional water quality improvement of flows that discharge to the lake. These habitats will provide an ecosystem with increased natural integrity, productivity, stability, and biological diversity. The restored areas will also provide valuable nesting and foraging habitat.

Lake Lotus Restoration Project

Lake Lotus is located in the City of Altamonte Springs in Seminole County within the Little Wekiva River Watershed. The lake discharges northeast to Trout Lake, which discharges to the Little Wekiva River. Inputs to the lake include the Little Wekiva River from the south, an unnamed tributary via a large floodplain wetland from the southwest (Tributary "E"), and an unnamed tributary from the west (Tributary "D").

Urbanization in the lower reaches of the Little Wekiva River began in the 1950s and greatly accelerated in the 1970s. Urbanization is particularly intense in the Altamonte Springs area of Seminole County. Singhofen & Associates Inc. [SAI] (1998) summarized the following modifications in the basin. Many of the subtropical forest have been removed and many of the lakes and swamps have been filled. In Seminole

County, the floodplain has been filled-in along some reaches in order to allow for the construction of residential areas immediately adjacent to the river. The result is a dramatic change in hydrology and a river that functions in a radically different way from a natural river in the same setting. In particular, it is likely that peak flood discharges have greatly increased in response to urbanization. In addition base flow is decreased as a result of urbanization. Increased peak flows tend to increase the sediment transport capacity of the river. The result is a river that is degraded and eroding its banks.

Chronic deposition of sediment has occurred just upstream of Lake Lotus along the Little Wekiva River and in the southern portion of the lake where the river enters the lake. Stream habitat degradation, which has occurred in this portion of the Little Wekiva River, is often exemplified by loss of pool and riffle structure, embedding of stream bed sediments, shallow depths of flow, eroding and unstable banks, and frequent streambed turnover. Nuisance vegetation such as willow, primrose willow, and cattail has colonized the areas where sediments have been deposited. In 2000 the Florida Department of Transportation (FDOT) dredged some of the deposited sediment from the confluence of the river and the lake. Some nuisance vegetation was also removed and trees were planted to stabilize the new shoreline. Unfortunately, sediment deposition continued to reduce the quality of the habitat adjacent to, and in the southern portion of the lake including wetlands and the shoreline habitat that provides spawning areas for fish.

The purpose of the Lake Lotus Restoration project is to provide stream and riparian habitat restoration along the Little Wekiva River just upstream of Lake Lotus, and floodplain and shoreline habitat restoration in the southern portion of the lake where the river enters the lake. Nuisance vegetation will be removed from the stream, the riparian habitat along the stream, and the southern portion of the lake where the river enters the lake. Riparian habitat restoration will include improvement in flow conveyance in this portion of the river, stabilization of stream banks to prevent erosion for the range of stream flows than occur in this portion of the river, and planting of riparian trees in these areas. A broader floodplain wetland area exists adjacent to where the river enters the lake and appropriate floodplain trees will be planted in this area for wetland habitat restoration. Shoreline habitat restoration will include emergent vegetation planting to establish a littoral zone in the southern portion of the lake.

Removal of sediment and nuisance vegetation will also help restore aquatic, riparian, floodplain, and shoreline habitat in the area where the river enters the lake. Sediment removal and stabilization of the stream banks will restore the physical characteristics necessary for the reestablishment of diverse aquatic communities in the stream. Planting of vegetation in the riparian zone, the broader floodplain wetland area, and along the southern shoreline of Lake Lotus will provide improved habitat for wetland dependent species. Shoreline habitat restoration in the southern portion of the lake, i.e. the establishment of a littoral zone, will improve the water quality in the lake and

provide habitat for fish. These restoration activities will improve the water quality of the river and the lake and improve open water habitat for waterfowl, and the conditions for organisms that will utilize the river, wetlands, and the lake for food, nesting, and shelter. The restoration activities will also provide hydrologic and ecologic restoration to this integrated river, wetland, and lake system. Stream, riparian, floodplain, and shoreline habitat restoration will additionally provide recreational opportunities for the public that visits the park.

2.9.2 Vegetation Sub-Committee

As mentioned in Section 1, the Little Wekiva River Technical Working Group was formed in 1995 to seek funding and to make basin-wide decisions to solve erosion and flooding problems. Part of the funding that the group has secured from the Florida Legislature as well as local governments has been put towards removal of invasive vegetation in the river system. Recently, the vegetation sub-committee, which was established as part of this effort, in cooperation with the FDEP, U.S. Army Corps of Engineers, and volunteers completed clearing the section of the Little Wekiva River from the Springs subdivision to the confluence with the Wekiva River of invasive vegetation. The vegetation sub-committee focused on areas along this stretch of the river where "choking" of vegetation was deemed critical. One incentive for this effort was to promote recreational use of the Little Wekiva River to provide for a continuous vegetation control that results from canoe and small boat traffic.

As part of the development of this Little Wekiva River Watershed Management Plan, Mobile Boundary Hydraulics, PLLC also performed an evaluation of the river which is summarized in a report entitled *Little Wekiva River Sediment and Geomorphic Re-Evaluation* (2004). Conclusions made from this study include that, in addition to the flood control element that is realized by ensuring that the vegetation does not block the downstream reaches of the Little Wekiva River, sedimentation quantities downstream of S.R. 434 would also be minimized with an unblocked channel where the velocities are not forced to become reduced due to vegetation blockages. Observations made during this study also pertain to streambank vegetation along the Little Wekiva River and that maintaining the vegetative cover along the bank and down the river side slopes, particularly north of S.R. 436 and downstream through Seminole County, would help to reduce erosion and sediment transport. Finally, the biological monitoring data for several stations along the river indicate that the biological integrity may be improved in areas that currently do not have canopy, with the planting of vegetation to increase the vegetated riparian buffer area. This is particularly true for segments of the river within Orange County.

2.10 Wetland and Listed Species Inventory

2.10.1 Introduction

Wetlands have been documented as supporting and serving a variety of functions. These include groundwater recharge and discharge, wildlife habitat, maintaining aquatic species diversity, recreation, removal of sediments and nutrients from runoff, and flood flow alteration (Adamus, 1987; Myers and Ewel, 1990; Miller and Gunsalus, 1997). The effectiveness of a wetland to perform these functions is based on its physical, chemical, and biological characteristics. Wetlands that have been historically altered, drained or disturbed have reduced functions. For this study, the wetland functions of greatest interest are habitat, flood attenuation and water quality improvement.

The value and function of altered or disturbed wetlands can be enhanced by increasing their hydroperiod (depth and duration of inundation). This can be accomplished by introducing water that has been diverted away due to human impacts. The hydroperiod and functions of some altered wetlands can be enhanced if they are incorporated into a stormwater management system as a BMP. By controlling flows, filtration, nutrient removal and settling of sediments the historically altered wetlands can be used in the attenuation and treatment of stormwater runoff (FDER, 1988; CDM, 1994). The use of a wetland to provide flood attenuation and stormwater treatment or management can increase its function, value, and economic and social significance (Ewel and Odum, 1986).

The focus of the Little Wekiva River WMP wetland evaluation was to identify wetlands that currently have reduced functions and value. Wetlands that can be functionally enhanced or restored are potential candidates to be incorporated into a stormwater management system or for use as mitigation sites.

Listed species that could occur within wetlands and uplands in the study area are also documented in this section. If listed species are found within a proposed project area, any proposed work to modify the area must be performed in accordance with necessary and appropriate permits. Enhancement of wetland systems may provide additional habitats for listed species, due to restoration of feeding, nesting, or roosting areas.

2.10.2 Wetland Study Area

The Little Wekiva River WMP study area extends approximately 14 miles from the north basin boundary in Seminole County at Alaqua Lakes Blvd. south into Orange County at Highway 50 (Colonial Drive) in the City of Orlando. The study area includes a portion of the eastern riparian habitat of the Wekiva River, and the Little Wekiva River and its riparian habitat. These areas are significant and protected wetland and environmental features in the study area and management of other resources in the Little Wekiva River basin can affect these features. The eastern study

area boundary meanders and extends along I-4. The western study area boundary is within the Wekiva River riparian habitat, west of the Little Wekiva River, and turns west and south of Bear Lake to the Orange/Seminole County line. The study area boundary extends south along the county boundaries to SR 441, east to Pine Hills Road, south to SR 50, and east to Interstate-4.

The Little Wekiva River WMP study area includes lands within portions of the municipalities of Altamonte Springs, Eatonville, Maitland, and Orlando, as well as areas within unincorporated Orange and Seminole Counties. The majority of the lands within the municipalities are developed areas with urban land uses such as commercial, residential, and industrial. There are also scattered areas of former upland forest that are undeveloped, located primarily in the northern half of the study area.

Interstate-4 extends from north to south from Seminole County to Orlando within the Little Wekiva River WMP area. The north quarter of the study area lies within the Wekiva River Protection Area (WPA) (the WPA extends south to the Springs Subdivision and its eastern boundary is along Markham Woods Road). The WPA is conservation land that includes the riparian habitat of the Little Wekiva River. These conservation lands have planned unit developments (PUD) or rural character development proposed for the future, and additional stormwater treatment is required within the WPA.

A separate designation from the WPA is the Riparian Habitat Protection Zone (RHPZ). The RHPZ is also mandated by Florida Administrative Code (40C-41 F.A.C.) and is a buffer that includes wetland and upland areas along the Wekiva and Little Wekiva Rivers. It is 50 feet wide along some parts of the rivers whereas the more natural parts have RHPZ as wide as 550 feet (i.e., each side for a total in excess of 1,100 feet). The upstream most RHPZ is at the Maitland Blvd. (S.R. 414) crossing of the Little Wekiva River.

In the analysis of the wetlands and surface waters, the focus was placed on lands within the boundaries of Orange and Seminole Counties. Land within municipalities was included in the review. The areas that are designated as conservation lands are currently under the management of the St. Johns River Water Management District or some other regulatory entity as lands used for conservation in the Wekiva River basin.

2.10.3 Preliminary Wetland Screening

The approximate limits of wetlands in the Little Wekiva River WMP that were identified in this study were evaluated in terms of their federal, state, and county designation. The guidelines and regulations that are used by the regulatory agencies to define the jurisdictional boundaries of wetlands include the US Army Corps of Engineers Wetlands Delineation Manual, Technical Report Y-87-1 (Federal) and

Chapter 62-340, F.A.C., Delineation of the Landward Extent of Wetlands and Surface Waters (State). Other documents pertaining to wetland designations include Article X of Chapter 15, Wekiva Protection Act (Orange County and Seminole County), a map of Orange County Conservation Areas (County), and Chapter 30, Parts 52 and 53, Wetlands Overlay Zoning Classification (Seminole County).

A variety of maps were used as aides in determining the extent of wetlands and surface waters. These maps included:

1. Color infrared photographs, Scale 1 inch = 1,200 feet to 1 inch = 2,000 feet, 1995, obtained from Seminole County GIS Department, Orange County Planning Department, St. Johns River Water Management District, and the United States Geological Survey;

2. National Wetland Inventory (NWI) Wetland Delineation Map, scale 1 inch = 4,000 feet, 1995, obtained from Seminole County GIS Department, St. Johns River Water Management District, and the United States Geological Survey;

3. Florida Atlas and Gazetteer, Fourth Edition, scale 1 inch = 2.3 miles, 1997, Delorme Publishers, maps #79;

4. Florida Natural Areas Inventory Map, 2001 data base for Seminole County and Orange County;

5. United States Department of Agriculture Soil Conservation Service Soil Survey of Seminole County and Orange County, scale 1 inch = 1,666 feet, 1960 and 1989 editions; and,

6. United States Geological Survey (USGS) Quadrangle Maps, scale 1 inch = 2000 feet (Forest City (1980) and Orlando West (1980)).

The wetland and surface water limits from existing NWI maps were compared to actual field conditions in accessible areas wherever possible. Areas with differences were noted and the changes were digitized onto a revised NWI map layer. **Figure 2-16** is the revised NWI map for the study area that incorporates the location of field verified wetlands.

The wetland limits mapped from the NWI overlay, and the subsequent changes from field review and aerial photo interpretation, have not been reviewed by regulatory agency staff personnel. The wetland limits depicted on the maps included within this study document are intended for planning purposes only, and are not to be used for regulatory agency permitting applications or to be construed as an indication of approval as a Class I, II, or III Conservation Area in Orange County.

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A - Alaqua Subdivision

B - Marsh Wren Circle

C - The Springs Subdivision

D - Jamestown Blvd.

E - Merrill Park

F - Forest Lake Academy

G - Lake Lotus

H - McNorton Road

I - Lake Gandy

J - Lake Lovely

K - Lake Lucien

L - Lake Fairview

M - Courtland Swamp

N - Shader Industrial Park

O - Shader Road (eliminated)

P - Little Lake Fairview

Q - Commerce Oak Road

Lake Brantley

Bear Lake

Cub Lake

Little Bear Lake

Trout Lake

Spring Lake

Lake Lotus

Lake Bosse

Lake Hill

Lake Destiny

Lake Lovely

Lake Weston

Lake Orando

Lake Fairview

Bay Lake

Lake Lawne

WEKIVA SPRINGS RD

I-4(THRU LANES)

SR 434

SR 436

MAITLAND

KENNEDY

EDGEWATER

ORANGE BLOSSOM

LEE

SILVER STAR

COLONIAL

LAKE MARION

LAKE FLORIDA

LAKE MOBILE

Cranes Roost

LAKE ORIENTA

Fig 2-16

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N

W E

S

5800 0 5800 11600 Feet

LOCATION MAP

LEGEND

Basin Boundary

County Line

Verified Wetland

Water Bodies

Water Bodies

Little Wekiva RIver (Main Stem)

Little Wekiva RIver (Main Stem)

Orange County Conservation Areas

National Wetlands Inventory

Aquatic Bed

Emergent Wetland

Forested

Scrub-Shrub

Roads

Municipalities

Altamonte Springs

Eatonville

Longwood

Maitland

Orlando

Little Wekiva River Watershed Management Plan

CDM

Figure 2-16
Field Verified Wetlands

The existing land uses within the Little Wekiva River WMP study area are designated using the FLUCCS (FDOT, 1985) codes (land uses are discussed in Section 3). The major upland land use types include: urban and built-up (FLUCCS 100), agricultural (FLUCCS 200), shrub and brushland (FLUCCS 320), forest (FLUCCS 400), and a list of the typical dominant plant species found in these natural upland land uses types, is provided in **Table 2-5**.

Both herbaceous and forested wetlands occur within the Little Wekiva River WMP area. These include numerous hydrologically isolated wetlands, wetlands connected with Little Wekiva River and lakes within the Little Wekiva River WMP area, and the larger riparian wetlands associated with the Wekiva River and the Little Wekiva River. The major wetland and surface water land use types include: streams and waterways (FLUCCS 510), lakes (FLUCCS 520), reservoirs/man made ponds (FLU 530), bay swamps (FLUCCS 611), stream and lake swamps (FLUCCS 615), cypress (FLUCCS 621), wetland forested mixed (FLUCCS 630), and freshwater marsh (FLUCCS 641). A list of the typical dominant plant species found in these natural wetland and surface water land use types, is provided in **Table 2-6**.

Certain wetlands in Orange County are designated as Conservation Areas based upon the size and hydrologic connection of the system to other wetlands, as follows:

1. Class I Conservation Areas include lake littoral zones, large isolated wetlands greater than 40 acres, and those wetlands with a hydrologic connection to natural surface waters, or any that provide critical habitat for listed species;

2. Class II Conservation Areas include isolated or formerly isolated wetlands that may be connected to surface waters by man-made systems, are greater than 5.0 acres, and do not qualify as a Class I Conservation Area; and,

3. Class III Conservation Areas include isolated wetlands less than 5.0 acres that do not otherwise qualify as Class I or II Conservation Areas.

The Orange County Conservation Area determinations are not related to the type of plant community. Rather, these are based on value of the aquatic and wetland systems. The Class I Conservation Areas are expected to be the highest quality systems providing more functions due to their larger size and hydrologic connections. The Class III Conservation Areas are presumed to be lower quality systems that provide lower functional value due to their small size and altered hydrology. Seminole County does not have a classification system for conservation areas.

Table 2-5
Little Wekiva River Basin Watershed Management Plan
Dominant Plants Found in Natural Upland Land Use Types

Plant Species		FLUCCS Code		
Comon Name	**Scientific Name**	**200**	**320**	**400**
Trees				
Red maple	*Acer rubrum*			X
Sweet gum	*Liquidambar styraciflua*			X
Sand pine	*Pinus clausa*			X
Sand live oak	*Quercus geminata*		X	X
Slash Pine	*Pinus elliotti*			X
Laurel Oak	*Quercus laurifolia*		X	X
Cabbage palm	*Sabal palmetto*	X		X
Shrub				
Florida groundsel bush	*Baccharis halimifolia*	X	X	X
Florida rosemary	*Ceratiola ericoides*		X	
Gallberry	*Ilex glabra*		X	X
Saw palmetto	*Sereno repens*		X	X
Wax myrtle	*Myrica cerifera*		X	X
Brazilian pepper	*Shinus terebinthifolius*		X	X
Herbaceous				
Bromsedge	*Andropogon sp.*			X
American beautyberry	*Callicarpa ameriacna*		X	X
Dog fennel	*Eupatorium capillifolium*	X	X	
Bahia grass	*Paspalum notatum*	X		
Vasey grass	*Paspalum urvillei*			
Goldenrod	*Solidago sp.*			X
High bush bluebery	*Vaccinium corybosum*			
Vines				
Trumpet creeper	*Campsis radicans*			
Japanese honeysuckle	*Lonicera japonica*			X
Green briar	*Smilax sp.*		X	X
Poison ivy	*Toxicodendron radicans*			X
Muscadine vine	*Vitis sp.*		X	X

Sources: FDOT (1985)(FLUCCS code)
FDOA (1998)
Wunderlin, R.P. (1998)

Table 2-6
Little Wekiva River Basin Watershed Management Plan
Dominant Plants Found in Major Wetland and Surface Water Land Use Types

Scientific Name	Common Name	FLUCCS Code							
		510	520	530	611	615	621	630	641
Trees									
Acer rubrum	Red maple	X	X	X		X		X	
Celtis laevigata	Hackberry	X				X		X	
Diospyros virginiana	Persimmon	X							
Liquidambar styraciflua	Sweet gum	X				X			
Nyssa aquatica	Black gum	X				X			
Magnolia virginiana	Sweet bay	X			X	X		X	
Persea palustris	Swamp bay	X	X	X		X			
Pinus elliottii	Slash pine					X		X	
Quercus laurifolia	Laurel oak	X				X		X	
Quercus virginiana	Live oak			X				X	
Sabal palmetto	Cabbage palmetto	X						X	
Salix caroliniana	Carolina willow	X						X	
Taxodium distichum	Cypress	X	X	X		X	X	X	
Shrubs									
Baccharis halimifolia	Groundsel bush	X				X	X	X	
Cephalanthus occidentalis	Buttonbush	X				X	X		X
Ilex cassine	Dahoon holy	X					X		
Myrica cerifera	Wax myrtle	X	X	X	X	X			X
Herbaceous									
Bacopa caroliniana	Carolina water hyssops				X		X	X	X
Bidens alba	Spanish needles		X	X					
Bohemeria cylindrica	False nettle	X					X		X
Callicarpa americana	American beauty-berry							X	
Carex sp.	Sedge	X	X	X		X	X		
Eupatorium capillfolium	Dog fennel	X	X	X	X	X			X
Fimbristylis sp.	Fringe-rushes								X
Hydrocotyle umbellata	Pennywort	X	X	X	X	X			X
Juncus effusus	Soft rush	X	X			X			X
Ludwigia puruviana	Primrose willow	X			X	X			X
Mimosa strigillosa	Sensitive plant		X						
Osmunda cinnamonea	Cinnamon fern	X	X		X	X	X		
Panicum notatum	Bahia grass		X	X					
Paspalum conjugatum	Sour paspalum		X	X		X			
Paspalum setaceum	Thin paspalum		X	X					

Table 2-6 (continued)
Little Wekiva River Basin Watershed Management Plan
Dominant Plants Found in Major Wetland and Surface Water Land Use Types

Scientific Name	Common Name	FLUCCS Code							
		510	520	530	611	615	621	630	641
Herbaceous									
Phyla nodiflora	Frog-fruit	X	X	X		X	X		X
Plantago major	Broadleaf plantain		X	X					
Ponderia cordata	Pickerelweed	X	X		X	X	X		X
Rhynchospora sp.	Beakrush		X	X		X			
Ruellia brittonia	Brittton's wild petuna		X	X				X	
Scoparia dulcis	Goat-weed		X	X				X	X
Serenoa repens	Saw palmetto	X						X	
Setaria geniculata	Fox tail	X	X	X					
Solidago sp.	Goldenrod		X	X					X
Spartina bakerii	Sand cord grass					X			X
Sporobulsu indicus	Smutgrass		X	X					
Typha sp.	Cattail	X	X	X	X		X		X
Xanthium strumarium	Rough cockle-bur								X
Vines									
Campsis radicans	Trumphet creeper	X				X			
Mykania scandens	Hempvine	X			X	X			X
Paederia foetida	Skunkvine								
Toxicodendron radicans	Poison ivy	X				X	X		
Smilax auricula	Greenbriar	X			X	X	X		
Smilax laurifolia	Grenbriar	X			X	X	X		
Vitis rotundifolia	Muscadine vine	X				X			

2.10.4 Wetland Functional Assessment

The potential uses for wetlands in the study area include habitat, alleviation of flooding by attenuating flows, and for stormwater treatment. The purpose of this portion of the study is to identify wetlands which, when enhanced or restored, have the potential to provide beneficial uses. This information will be used in Phase III to develop alternatives for implementation.

The determination of the ability of a wetland to be enhanced or restored includes factors such as size, amount of disturbance, adjacency to other systems (hydrologic connections), and accessibility. Restored or enhanced wetlands may also serve as potential mitigation areas as the function and value of these wetland systems can be improved. Additionally, using natural systems to aid in stormwater management systems, if done properly, can be more cost effective as less construction and earthwork are involved. Less maintenance may also be required for these natural systems.

The preliminary wetland screening and the characteristics presented above were used to identify the major wetlands in the Little Wekiva River WMP study area and to identify wetlands that may be managed to provide direct benefits in the Little Wekiva River Basin. The location of these wetlands, identified as A through L, are depicted on Figure 2-16 and described below. Wetland Qualitative Evaluation Study forms for each wetland are presented in **Appendix G**. The functional rating (1, 2, or 3) for each wetland was based on the potential for enhancement, restoration, preservation, and incorporation into a stormwater management system as well as the size, amount of disturbance, hydrologic connectedness, and location in the landscape. A prioritized ranking for acquisition was also developed for the identified wetlands. The prioritized ranking (low or high) for these wetlands is based on the opportunity to provide benefits in the Little Wekiva River Basin, the susceptibility to further impact, and the degree to which they are currently protected. A summary of the information regarding wetlands evaluated in this study is presented in **Table 2-7**.

Table 2-7
Little Wekiva River Basin Watershed Management Plan
Summary of Wetlands Evaluated in the Little Wekiva River Basin Study Area

ID	Name	Approximate Area (Acres)	FLU NWI Codes [1]	Conservation Class [2]	Use Code[3]	Functional Rating [4]	Acquisition Ranking [5]
A	Alaqua Subdivision	77	630 FO	NA	p, e, s	2	Low (13)
B	Marsh Wren Circle	26	630 FO	NA	p	2	Low (12)
C	The Springs Subdivision	17	630 FO	NA	e	1	Low (15)
D	Jamestown Boulevard	13	641+630 EM+FO	NA	p	2	Low (6)
E	Merrill Park	14	630 FO	NA	e,p	2	High (5)
F	Forest Lake Academy	9	630 SS	NA	p,s	2	Low (16)
G	Lake Lotus	232	630 FO	NA	p, r, e	2	High (3)
H	McNorton Road	15	630 FO	NA	p, e, s	2	Low (11)
I	Lake Gandy	1	641 EM	I	e	3	Low (14)
J	Lake Lovely	38	630 FO	I	e	2	Low (8)
K	Lake Lucien	19	630+641 FO+EM	I	e	2	Low (7)
L	Lake Fairview	6	630 FO+SS	II	e	2	Low (9)
M	Courtland Swamp	3	630 FO	II	e	2	Low (10)
N	Shader Industrial Park	39	630 FO	NA	e	2	High (4)
O	Shader Road (eliminated)	0	630+641 SS+EM	NA	NA	NA	NA
P	Little Lake Fairview	26	630 FO	I	e, s	2	High (2)
Q	Commerce Oak Road	17	630 FO	NA	e	2	High (1)

[1] FLU Code – Land use per Florida Land Use Cover and Classification System, FDOT, 1989.
NWI Code – FO = Forested, SS = Shrub-scrub, EM = Emergent, and AQ = Aquatic bed.
[2] Conservation Class– conservation areas per Orange County Conservation Area definition. NA not applicable (in Seminole County)
[3] Use Code – enhancement = e, r = restoration, p = preservation, s=incorporation into a stormwater management system
[4] Functional Assessment Rating – Scale of 1 to 3, with 1 having the highest functional rating and 3 having the lowest functional rating
[5] Acquisition ranking – low, high, or NA (=not applicable), and 1-16 [high to low]

Wetland A

Alaqua Subdivision (Section 14, Township 21 South, Range 29 East)

Wetland A: Alaqua Subdivision Forested Wetland

This forested wetland is located at the entrance to the Alaqua subdivision on Markham Road. This wetland may be connected to the Little Wekiva River via an intermittent stream but it appears as though it is isolated from the river the majority of the time, although it is within the Wekiva River Protection Area (WPA). The wetland is dominated by sweet bay, red maple, and bald cypress with nuisance vegetation along the western boundary. It has an intermediate (2) functional rating. This wetland serves as a buffer for the subdivision and should retain this preservation status. Nuisance species could be removed to improve wetland habitat. There may be opportunities for incorporation into a stormwater management system. The acquisition ranking is low because there is little opportunity for further impact and it is located within the Wekiva Protection Area.

In 1988, the Florida Legislature passed the Wekiva River Protection Act establishing the Wekiva River Protection Area (WPA). The WPA has special Environmental Resource Permitting (ERP) criteria for wetlands and stormwater treatment as regulated by the St Johns River Water Management District (SJRWMD). The WPA also authorized local governments to create rules to protect habitat and treat runoff.

Wetland B

Marsh Wren Circle (Section 23, Township 20 South, Range 29 East)

Wetland B: Marsh Wren Circle Wetland

This forested wetland is located east of Marsh Wren Circle, west of Longwood Markham Road, and north of Archers Point. The wetland is isolated and dominated by slash pine, red maple and sweet bay. Nuisance species occur throughout the wetland. It has an intermediate (2) functional rating. The wetland serves as a buffer for the subdivision and should retain this preservation status. Nuisance species could be removed to improve wetland habitat. The acquisition ranking is low because there is little opportunity for further impact and this wetland is protected as part of the WPA.

Wetland C

The Springs Subdivision (Sections 34 and 35, Township 29 South, Range 29 East)

Wetland C: Just Downstream of the Springs Subdivision at Delk Road

This forested wetland is representative of forested riparian wetlands along the Little Wekiva River that flows north from the Sanlando Springs. There are extensive riparian hardwood wetlands along the Little Wekiva River. Much of the east bank of the river has been developed while the west bank of the river remains predominantly undeveloped. This wetland is located within the Springs subdivision that includes a golf course. This wetland receives flow from Sanlando Springs and is hydrologically connected to the Little Wekiva River. This wetland is within the Wekiva River Protection Area (WPA). The wetland is dominated by hardwood species, and nuisance species could be removed to improve wetland habitat. It has a high (1) functional rating. The acquisition ranking is low because there is little opportunity for further impact and this wetland is protected as part of the WPA.

Wetland D

Jamestown Boulevard (Section 9, Township 21 South, Range 29 East)

Wetland D: Jamestown Blvd. Wetland

This herbaceous marsh with a perimeter of forested wetlands is located north of Jamestown Boulevard, west of Sanlando Road and west of Mohawk Lane. Marsh plants include goldenrod, St. Johns wort, plume grass, arrowhead, and hatpins. The forested wetland is dominated by slash pine, red maple, Carolina willow, and wax myrtle. Nuisance herbaceous plants and vines occur along the perimeter of the forested wetland. It has an intermediate (2) functional rating. The wetland serves as a buffer for the subdivision and should retain this preservation status. Nuisance species could be removed to improve wetland habitat. The acquisition ranking was low because there is little opportunity for further impact.

Wetland E

Merrill Park (Section 9, Township 21 South, Range 29 East)

Wetland E: Merrill Park Wetland

This forested wetland is located south of Jamestown Blvd., north of Little Wekiva Road, east of State Road 434, and adjacent to Merrill Park, a county recreational facility. The wetland is dominated by slash pine, red maple, sweet bay, laurel oak and sweet gum. Nuisance herbaceous plants and vines occur along a tributary that drains south through the wetland and connects to the Little Wekiva River. It has an intermediate (2) functional rating. The wetland serves as a buffer for the park and adjacent subdivision, and should retain this preservation status. Nuisance species could be removed to improve wetland habitat. The acquisition ranking is high because there is opportunity for enhancement and preservation.

Wetland F

Forest Lake Academy (Section 17, Township 21 South, Range 29 East)

Wetland F: Forest Lake Academy Wetland

This is a shrub-scrub wetland located on the northwest corner of State Road 436 and Lake Brantley Road. The wetland is hydrologically isolated from any other wetland, but is south of a drainage way that connects to the Little Wekiva River. The wetland is dominated by Carolina willow, red maple, and primrose willow. Nuisance species surround the wetland and the wetland has an intermediate (2) functional rating. Nuisance species could be removed to improve wetland habitat. The acquisition ranking is low because this wetland will be used for stormwater treatment for a proposed development.

Wetland G

Lake Lotus (Sections 20 and 21, Township 21 South, Range 29 East)

Wetland G: Lake Lotus Wetland

This forested riparian wetland is located along the southwest edge of Lake Lotus where the Little Wekiva River enters the lake. Nuisance vegetation occurs along the lake. Sediment transported in the river upstream of the lake is deposited where the river enters the lake. Therefore the wetland has an intermediate (2) functional rating. Nuisance species and sediment could be removed to restore wetland habitat and this wetland should be preserved. The acquisition ranking was high because the wetlands are directly connected to the lake and the river.

Wetland H

McNorton Road (Section 22, Township 22 South, Range 29 East)

Wetland H: McNorton Road Wetland

This wetland is located just south of McNorton road adjacent to a wastewater treatment facility. The wetland consists of several bay dominated depressions and there is nuisance vegetation along the wetland edges. It has an intermediate (2) functional rating. Nuisance species could be removed to improve wetland habitat. The wetland is located within existing subdivisions and there may be opportunities for incorporation into a stormwater management system or preservation. The acquisition ranking was low because there is little opportunity for further impact.

Wetland I

Lake Gandy (Sections 29 and 32, Township 21 South, Range 29 East)

Wetland I: Lake Gandy Wetland

This herbaceous wetland is located on the southern edge of Lake Gandy and is a Class I Conservation Area. The lake is hydrologically connected to the Little Wekiva River. Nuisance vegetation occurs along the shore of the lake. The hydroperiod of the wetland has been altered therefore it has a low (3) functional rating. Nuisance species could be removed to improve wetland habitat. The acquisition ranking was low because this wetland has been incorporated into a development mitigation plan.

Wetland J

Lake Lovely (Section 34, Township 21 South, Range 29 East)

Wetland J: Lake Lovely Wetland

This forested wetland is located between Keller Road and Forest City Road. This bay dominated wetland borders Lake Lovely, Lake Shadow and Lake Weston, there are lake-fringing cypress, and is a Class I Conservation Area. Nuisance vegetation occurs along the southwestern boundary therefore it has an intermediate (2) functional rating. Nuisance species could be removed to improve wetland habitat. The acquisition ranking was low because there is little opportunity for further impact and the wetland is in a Conservation Area.

Wetland K

Lake Lucien (Section 26, Township 21 South, Range 29 East)

Wetland K: Lake Lucien Wetland

This forested wetland is located on the western edge of Lake Lucien and east of Keller Road. This fringing cypress dominated wetland is a Class II Conservation Area. Herbaceous emergent wetland vegetation occurs along the western edge of this wetland and nuisance vegetation occurs along the northern boundary. A portion of the wetland has been drained therefore it has an intermediate (2) functional rating. Nuisance species could be removed to improve wetland habitat. The acquisition ranking was low because there is little opportunity for further impact and the wetland is in a Conservation Area.

Wetland L

Lake Fairview (Section 3, Township 22 South, Range 29 East)

Wetland L: Lake Fairview Wetland

This wetland is an isolated shrub and forested wetland located north of Lake Fairview and under a power line. The wetland is isolated and surrounded by development. It is dominated by willow and is a Class II Conservation Area. Nuisance vegetation occurs along the southern boundary and it has an intermediate (2) functional rating. Nuisance species could be removed to improve wetland habitat. The acquisition ranking was low because there is little opportunity for further impact.

Wetland M

Courtland Swamp (Section 2, Township 22 South, Range 29 East)

Wetland M: Courtland Swamp

This forested wetland is located south of Lee Road and west of I-4 and is surrounded by development. This bay wetland is hydrologically isolated and is a Class II Conservation Area. Nuisance vegetation occurs along the southern boundary therefore it has an intermediate (2) functional rating. Nuisance species could be removed to improve wetland habitat. The acquisition ranking was low because this wetland has been incorporated into a development mitigation plan.

Wetland N

Shader Industrial Park (Section 8, Township 22 South, Range 29 East)

Wetland N: Shader Industrial Park

This is an isolated forested wetland located west of the Little Wekiva River and within Shader Industrial Park. This is a bay dominated wetland that is surrounded by development. Minimal nuisance vegetation occurs along the western boundary and the wetland has an intermediate (2) functional rating. Nuisance species could be removed to improve wetland habitat. The acquisition ranking was high because this wetland supports listed species. There is an active bald eagle's nest at the west end of Shader Road.

Wetland O

Shader Road [eliminated] (Section 8, Township 22 South, Range 29 East)

Wetland O: Shader Road [eliminated]

The wetland at Shader Road has been eliminated. The National Wetlands Inventory Map indicates the site included scrub-shrub and forested wetlands. The site was converted to an industrial park that includes buildings, an open field, a parking lot and paved roads.

Wetland P

Little Lake Fairview (Section 11, Township 22 South, Range 29 East)

Wetland P: Little Lake Fairview Wetland

This wetland is a forested wetland located south of Little Lake Fairview and adjacent to Dubsdread Golf Course. The wetland is hydrologically connected to the lake and surrounded by development and the golf course. The wetland is dominated by bay and willow and part of the wetland is a Class I Conservation Area. Nuisance vegetation occurs along the western boundary and the wetland has an intermediate (2) functional rating. Nuisance species could be removed to improve wetland habitat and there may be opportunities for incorporation into a stormwater management system. The acquisition ranking was high because this wetland is not currently protected and there are opportunities to provide benefits in the Little Wekiva River Basin.

Wetland Q

Commerce Oak Avenue (Section 16, 17, 20 and 21, Township 22 South, Range 29 East)

Wetland Q: Commerce Oak Avenue Wetland

This is a forested wetland located south of Princeton Street and west of John Young parkway on Commerce Oak Avenue. The wetland is hydrologically connected to Lake Lawne that is part of the Little Wekiva River and is surrounded by development. The wetland is dominated by bay and cypress. Nuisance vegetation occurs along the northern boundary and the wetland has an intermediate (2) functional rating. Nuisance species could be removed to improve wetland habitat. The acquisition ranking was high because this is a large wetland that is connected to the Little Wekiva River.

2.10.5 Listed Species Documentation

Upon request the Florida Natural Areas Inventory (FNAI) will provide information on listed species and their habitats. More specifically, for a defined project area the FNAI provides information and a map indicating element occurrences (sittings of rare species and natural communities), managed areas, potential natural areas, and potential habitat for rare species. The FNAI also provided a list of rare species and natural communities for counties where the defined project area is located. This list indicates the status of these rare species and natural communities (threatened, endangered, species of special concern). CDM made a request to the FNAI for information and a map indicating element occurrences, managed areas, potential natural areas, and potential habitat for rare species which is presented in **Appendix H.** The list of rare species and natural communities for Orange County and Seminole County are also provided in Appendix H.

There are element occurrences in the study area for limpkin, Florida scrub jay, least tern, bald eagle, osprey, and for a bald eagle's nest, as well as habitat for bald eagle, wood stork, eastern indigo snake, Florida black bear, and the Sanlando spring siltsnail. There are numerous element occurrences in the Wekiva River and the Little Wekiva River and their associated habitats that are outside of the study area but many of these organisms may utilize habitats in the study area.

The database maintained by the FNAI is the single most comprehensive source of information available on the locations of rare species and other significant ecological resources. However, the data are not always based on comprehensive or site-specific field surveys. Therefore, this information should not be regarded as a final statement on the biological resources of the site under consideration.

The SJRWMD identifies regionally significant habitats and these are indicated for the study area on **Figure 2-17**. CDM conducted limited field surveys in selected areas to verify habitat types and identify the presence of listed species. These areas included both wetland and upland habitats. None of the species listed by the FNAI were observed during the limited field surveys.

Seminole County regulations (Chapter 35, Part 45) require compliance with State and Federal species protection rules and site evaluations for listed species to be performed and review by Seminole County staff prior for development activities.

2.10.6 Summary

Wetlands provide many functions including habitat, flood sources, flood attenuation and water quality improvement. Wetlands in the Little Wekiva River WMP study area were evaluated to determine if there is opportunity to improve these functions through implementation of the stormwater master plan. Listed species that could occur in the study area were also identified.

gebhardtdm

11/19/02

Fig 2-17

D:/Projects/9247/LWR/gis/report figs.apr

Lake Brantley
WEKIVA SPRINGS RD
SR 434
I-4(THRU LANES)
LAKE MARION
LAKE FLORIDA
LAKE MOBILE
Cranes Roost
SR 436
LAKE ORIENTA
Bear Lake
Trout Lake
Spring Lake
Cub Lake
Lake Lotus
Little Bear Lake
SR 434
Lake Bosse
Lake Hill
Lake Destiny
MAITLAND
Lake Lovely
KENNEDY
Lake Weston
EDGEWATER
ORANGE BLOSSO
LEE
Lake Orlando
Lake Fairview
Bay Lake
SILVER STAR
Lake Lawne
COLONIAL

N
W
E
S

6000 0 6000 12000 Feet

LOCATION MAP

LEGEND

- Basin Boundary
- County Line
- Water Bodies
- Orange County Conservation Areas

Regionally Significant Habitats
- Five or Six Rare Species*
- Seven or More Rare Species*
- Strategic Habitat Conservation Area**

National Wetlands Inventory
- Aquatic Bed
- Emergent Wetland
- Forested
- Scrub-Shrub
- Roads

Municipalities
- Altamonte Springs
- Eatonville
- Longwood
- Maitland
- Orlando

*Represents biodiversity hotspots which are regional areas of high biological diversity.
**Strategic Habitat Conservation Area - that area that is essential for the long term viability of selected species and natural communities not protected by the current system of conservation lands.

Little Wekiva River Watershed Management Plan

CDM

Figure 2-17
Regionally Significant Habitats
(as defined by SJRWMD)

Both herbaceous and forested wetlands occur within the Little Wekiva River WMP area. These include numerous hydrologically isolated wetlands, wetlands connected with Little Wekiva River and lakes within the Little Wekiva River WMP area, and the larger riparian wetlands associated with the Wekiva River and the Little Wekiva River. Urbanization has encroached on wetland resources in the Little Wekiva River WMP area.

The functional rating for each wetland was based on the potential for enhancement, restoration, preservation, and incorporation into a stormwater management system as well as the size, amount of disturbance, hydrologic connectedness, and location in the landscape. A prioritized ranking for acquisition was also developed, for the identified wetlands that is based on the opportunity to provide benefits in the Little Wekiva River Basin, the susceptibility to further impact, and the degree to which they are currently protected.

The majority of the wetlands evaluated had an intermediate functional rating as there is some opportunity for enhancement, preservation or incorporation into stormwater management systems. Most of the wetlands could be enhanced with elimination of nuisance vegetation. Four wetlands could be incorporated into stormwater management systems and one of these wetlands as well as three other wetlands had a high acquisition ranking. Several listed species occur in Orange and Seminole County and many are associated with the Wekiva River and Little Wekiva River and their associated riparian habitat. The urbanization that has encroached on wetland resources in the Little Wekiva River WMP study area has reduced habitat for listed species. This along with limited field survey contributed to the fact that none of the species listed were observed during the field investigation.

2.10.7 Literature Cited

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Fig 2-7

C:/Projects/9247/39740/gis/phi_rprtfigs.apr

Lake Brantley

Bear Lake

Lake Lotus

Trout Lake

Cub Lake

Little Bear Lake

Spring Lake

LAKE FLORIDA

LAKE ORIENTA

Lake Destiny

Lake Bosse

Lake Hill

MATCHLINE A

N

W E

S

1400 0 1400 2800 4200 5600 7000 8400 Feet

LOCATION MAP

LEGEND

Basin Boundary

Structure Inventory
- Bridge
- Culvert
- Drop Structure
- Force Main
- Weir
- storm sewer
- County Line
- Street Centerlines

Water Bodies
- Water Bodies

Little Wekiva RIver (Main Stem)
- Little Wekiva RIver (Main Stem)

Wetlands
- Wetlands

Municipalities
- Altamonte Springs
- Eatonville
- Longwood
- Maitland
- Orlando

Little Wekiva River Watershed Management Plan

CDM

Figure 2-7
Structure Inventory (1 of 2)

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Fig 2-7

E:/Projects/9247/44143/gis/report figs.apr

MATCHLINE A

Bear Lake
Lake Lotus
Spring Lake
Cub Lake
Little Bear Lake
Lake Destiny
Lake Bosse
Lake Hill
Lake Starlite
Lake Gandy
Lake Lucien
Lake Lovely
Lake Shadow
Lake Hungerford
Long Lake
Lake Weston
Lake Orlando
Lake Fairview
Bay Lake
Little Lake Fairview
Lake Sarah
Lake Daniel
Lake Silver
Lake Lawne

LW0085C LW0809S LW0756S LW0562S LW0595S LW0720S LW0684C LW0892S LW0894S LW0895S LW0689C LW1032S LW0827S LW1006S LW1005S LW1068S LW1069S LW1070S LW1067S LW0544S
LW0079bD LW0078C LW0537C LW0077C LW0079aD LW0607S LW0608S LW0609S LW0610S LW0611S LW0612S LW0613S
LW1073S LW0908S LW0080C LW0081C LW0934S LW0933S LW0082C LW0808S LW0897S LW0781S LW0815S LW0935S LW0874S LW0875S LW0876S LW0930S LW0918S LW0919S LW0920S LW0714S LW0832S LW0939S LW0030B LW0027B LW0362C LW0029B LW0028B LW0026D
LW0741S LW1112S LW0811S LW0812S LW0813S LW0932S LW0810S LW0702S LW0701S LW0795S LW0931S LW0928S LW0929S LW0917S LW0877S LW0921S LW1103S LW1110S LW1109S LW0677S LW0675S LW0659S LW1107S LW1100S LW1101S LW0924S LW1092S LW1106S LW1091S LW1080S LW1079S LW0898S LW0915S LW0899S LW0844S LW0914S LW0927S LW0916S LW0780S LW0778S LW0779S LW0911S LW0909S LW0913S
LW0076C LW0075C LW0073C LW0483SFM LW0025W LW0024W LW0074C LW0072C LW0023B
LW0022B LW0021B LW0020B LW0071W LW0070D LW0069C
LW0019C LW0017C LW0016B LW0013C LW0014W LW0015W LW0361S LW0360S LW0359S LW0358S LW0358S LW0357S LW0356S LW0355S LW0322S LW0323S LW0324S LW0325S LW0346S LW0347S LW0348S LW0349S LW0334C LW0352C LW0353C LW0354C
LW0068C LW0067C LW0064C LW0011C LW0066C LW0012C LW0063C LW0062C LW0061C LW0010W LW0009W LW0008B LW0282C LW0281C LW0280C LW0279D LW0283C LW0060C LW0057C LW0050C LW0058C LW0059C LW0055C LW0054C LW0052C LW0051C LW0053C LW0273C LW0274C LW0272C LW0275C LW0276C LW0277C LW0278C LW0266C LW0265C LW0268C LW0007C LW0269C LW0263C LW0005C LW0006C LW0271C LW0264C LW0262C LW0267C LW0270C LW0260C LW0261C LW0252C LW0251C LW0004C LW0259C LW0249C LW0250C LW0234S LW0235S LW0248C LW0233S LW0246C LW0232S LW0236S LW0237S LW0247C LW0238S LW0239S LW0253C LW0255C LW0254C LW0257C LW0240S LW0241S LW0242S LW0243S LW0258C LW0256C LW0245S LW0230S LW0406W LW0229SFM LW0403aS LW0403bS LW0403cS LW0403dS LW0403eS LW0403fS LW0003C LW0002C LW0403hS LW0403gS LW0224C LW0226C LW0227C LW0225C LW0228C LW0001W
LW0049D LW0048D LW0222C LW0221C LW0220C LW0219C LW0223C LW0218C LW0217C LW0216C LW0174S LW0173S LW0172S LW0167S LW0166S LW0165S LW0163S LW0164S LW0154C LW0151S LW0150S LW0149S LW0148S LW0145S LW0146S LW0147S LW0144S LW0143S LW0142S LW0141S LW0140S LW0139S LW0138S LW0137S LW0153S LW0152S LW0136S LW0132S LW0133S LW0134S LW0135S LW0129C LW0128C LW0130C LW0131C LW0157C LW0155C LW0156C LW0044C LW0045C LW0158C LW0160C LW0127C LW0125C LW0126C LW0124C LW0123S LW0116S LW0117S LW0118S LW0119S LW0120S LW0121S LW0122S LW0162C LW0161C
LW0191S LW0190S LW0189S LW0188S LW0187S LW0185S LW0184S LW0183S LW0182S LW0181S LW0180S LW0178S LW0170S LW0171S LW0179S LW0177S LW0176S LW0175S LW0169S LW0168S LW0186S LW0199S LW0198S LW0202S LW0201S LW0200S LW0197S LW0196S LW0195S LW0194S LW0193S LW0192S LW0207S LW0206S LW0204S LW0205S LW0203S LW0214S LW0213S LW0208S LW0209S LW0210S LW0211S LW0212S LW0215S LW0293S LW0294S LW0288S LW0046C LW0284C LW0047C LW0299S LW0297S LW0288S LW0295S LW0296S LW0292S LW0291S LW0289S LW0287S LW0285S LW0286S LW0290S LW0351C LW0350C LW0318S LW0315S LW0312S LW0310S LW0308S LW0307S LW0305S LW0306S LW0301S LW0302S LW0300S LW0303S LW0304S LW0309S LW0311S LW0314S LW0313S LW0321S LW0319S LW0320S LW0333S LW0332S LW0330S LW0329S LW0328S LW0327S LW0317S LW0341S LW0344S LW0343S LW0340S LW0338S LW0337S LW0336S LW0335S

N W E S

1200 0 1200 2400 3600 4800 6000 7200 8400 Feet

LOCATION MAP

LEGEND

Basin Boundary

Structure Inventory
- Bridge
- Culvert
- Drop Structure
- Force Main
- Weir
- storm sewer
- County Line
- Street Centerlines

Water Bodies
- Water Bodies

Little Wekiva RIver (Main Stem)
- Little Wekiva RIver (Main Stem)

Wetlands
- Wetlands

Municipalities
- Altamonte Springs
- Eatonville
- Longwood
- Maitland
- Orlando

Little Wekiva River Watershed Management Plan

CDM

Figure 2-7
Structure Inventory (2 of 2)

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11/14/02

Problem No.39
Problem No.46
Problem No.48
Problem No. 36
Problem No. 56
Problem No. 37
Problem No. 60
Problem No.44
Problem No.43
Problem No. 38
Problem No. 57
Problem No.42
Problem No. 58
Problem No.40
Problem No. 59
Problem No. 61
Problem No.41
Problem No. 41a
Problem No.47
Problem No.45
Problem No.23
Problem No.34
Problem No.55
Problem No.22
Problem No.35
Problem No.53
Problem No.5
Problem No.6
Problem No.18
Problem No.33
Problem No.11
Problem No.52
Problem No.54
Problem No.19
Problem No.12
Problem No.26
Problem No.30
Problem No.13
Problem No.1
Problem No.29
Problem No.25
Problem No.27
Problem No.51
Problem No.50
Problem No. 63
Problem No.7
Problem No.20
Problem No.4
Problem No.32
Problem No. 64
Problem No.14
Problem No.24
Problem No.15
Problem No.16
Problem No.2
Problem No. 65
Problem No. 3
Problem No.49
Problem No.17
Problem No.21

Lake Brantley
Lake Bosse
Lake Hill
Lake Lovely
Lake Weston
Lake Orlando
Bay Lake
Lake Fairview
Lake Lawne
Bear Lake
Cub Lake
Little Bear Lake
Trout Lake
Lake Lotus
Spring Lake
Lake Destiny
LAKE MARION
LAKE FLORIDA
LAKE MOBILE
LAKE ORIENTA
Cranes Roost

SR 434 S
SR 436 W
SR 414
DOUGLAS AV
I-4
OVERLAND
EDGEWATER
ORANGE BLOSSOM
MERCY
PRINCETON
JOHN YOUNG
COUNTRY CLUB

N
W
E
S

3000 0 3000 6000 9000 12000 Feet

LOCATION MAP

LEGEND

- Basin Boundary
- County Line
- Water Quality Problems
- Street Centerlines

Problem Areas
- Drain Well
- Erosion/Sedimentation
- Flooding
- Flooding/Drain Well

Water Bodies
- Little Wekiva RIver (Main Stem)
- Wetlands

Municipalities
- Altamonte Springs
- Eatonville
- Longwood
- Maitland
- Orlando

Little Wekiva River Watershed Management Plan

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Fig 2-12

CDM

Figure 2-12
Problem Area Location Map