Stormwater Management Study PBS&J 1989

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Prepared for

COUNTY OF SEMINOLE
BOARD OF COUNTY COMMISSIONERS

STORMWATER MANAGEMENT STUDY

JUNE 1989

Prepared by

POST, BUCKLEY, SCHUH & JERNIGAN, INC.
Water Resources Division
5300 West Cypress Street, Suite 300
Tampa, Florida 33607

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EXECUTIVE SUMMARY

In 1987, Seminole County contracted with Post, Buckley, Schuh & Jernigan, Inc. (PBS&J) to prepare a stormwater management study encompassing the unincorporated portions of Seminole County. The primary objective was to provide the necessary guidance to assist the County in satisfactorily managing growth.

Continuing development within the County, in both the unincorporated areas and the cities, combined with rapid development in northern Orange County have increased stormwater runoff and exacerbated existing stormwater management problems. In addition, the Florida Growth Management Act and its companion document, Chapter 9J-5 F.A.C., require local governments to make a comprehensive assessment of existing facilities and capacities, current and future needs, and methods to implement and finance the necessary programs and facilities required to effectively manage the County's stormwater challenges.

The intent of this study is to 1) provide a preliminary assessment of existing facility capacities, 2) establish an interim level of service in order to identify planning level needs, 3) provide recommendations regarding the need for new facilities (for growth and deficit correction), the means of financing these capital needs, and the annual Operation and Maintenance (O&M) costs for County stormwater facilities, 4) identify a program strategy to implement specific recommendations. These strategies should include: drainage basin master plans, expansion of the existing County stormwater program and staff, and the establishment of levels of service based upon detailed drainage basin studies which would quantify existing and future capital facility needs, and 5) prepare a Drainage

Element for the Comprehensive Plan which will establish directives for the County's stormwater management program.

The following summarizes this study's major findings and identifies specific recommendations based on these findings.

1. A compilation of available information established a preliminary inventory and atlas of 673 drainage structures. This included 312 major Structures (48 inch diameter or greater), 300 minor structures (30 to 42 inch diameter), and 61 secondary structures (less than 30 inch diameter). This inventory is estimated to represent 70% to 80% of the County's stormwater facilities.

2. Structure capacity analyses identified potential deficiencies based on the following levels of service using the 10-year design storm.

Service Level A:	Passes the 10-year storm. Flow is contained within drainage system.
Service Level B:	Capacity shortfall is within 10% of capacity for 10-year storm. Street flooding is typically experienced.
Service Level C:	Capacity shortfall is between 11% and 50% of capacity for 10-year storm. Street and yard flooding is usually experienced.
Service Level D:	Capacity shortfall is greater than 50% of capacity for 10-year storm. Street, yard and structure flooding is typically experienced.

The use of the 10-year design storm is recommended to evaluate levels of service on an interim basis in order to establish planning level needs. Upon completion of

detailed basin level studies, it is recommended that the levels of service be re-evaluated and adopted by individual basin while remaining consistent with standards established within the County's Land Development Code.

3. Preliminary capacity analyses of 263 of the major structures and other critical structures suspected of being deficient identified known deficiencies which will require an estimated $1,500,000 in capital projects to remediate. Currently, 198 of the evaluated structures are at Service Level A, while 65 structures are identified as needing remedial projects (service level C or D). Projected County growth is anticipated to result in a 7% decrease in the number of structures providing Service Level A. The number of structures providing Service Level C or D is expected to increase by 20% due to future growth. Identified deficiencies are primarily due to inadequate, non-existent or deteriorating structures and insufficient maintenance. As more comprehensive inventories and analyses are completed the number of identified deficiencies and resulting cost of correction could increase.

4. With the estimated current deficiencies, anticipated growth and legislative mandates, it is recommended that Seminole County expand its existing organizational and program structure to develop an ongoing and responsive stormwater management program. A 20-year program and associated expenditures for implementing the stormwater program are described and tabulated in the study. Major components requiring implementation are recommended as follows:

   - Conduct a system condition assessment through field reconnaissance to analyze structure capacities.

- o Implement prioritized drainage basin studies to identify and prioritize specific capital projects and management needs for each of the sixteen basins.
- o The existing maintenance program should be expanded to incorporate a systematic program of structure maintenance, channel maintenance and channel mowing. It is estimated that only 6% of identified maintenance needs can be met with current budget allocations.
- o Given that greater than 70% of the identified structures are thought to be over 30 years old, a detailed assessment is needed to program the systematic repair and replacement of structures.
- o A detailed analysis of stormwater management program staffing needs and objectives should evaluate the five following functional areas: administration, planning, design, operation and maintenance, and regulation and enforcement. It is recommended that the County contract with a consultant to assist in establishing the program and in system planning during the first year of the program.
- o The drainage complaint tracking system provided in this study should be incorporated into the County's existing system to facilitate the identification of capital improvement and O&M needs.

5. The goals, objectives and policies established in this study should be adopted within the County's Comprehensive Plan to establish directives for the County's stormwater program.

6. Historically, the County's involvement with stormwater management has been through the development review process with the intent of avoiding future problems

and identifying some maintenance activities and correction of nuisance problems. However, much of the County's stormwater needs is due to existing deficiencies. Current funding sources are not adequate to meet current and future needs while remaining equitable to the public. It is recommended that Seminole County continue pursuing the feasibility of establishing a stormwater utility system in combination with bonding of ad valorem taxes and implementation of system development charges. System development charges could be used for specific growth-related capital projects and provide the necessary revenues to meet identified needs. Bonding is generally used to fund major capital projects. Stormwater utility revenues are typically used for program development costs, repair and replacement projects and operation and maintenance program costs, although these revenues could also be used for construction of stormwater facilities.

Stormwater management will continue to receive increased emphasis throughout Florida as a major element in the State's plan to manage growth. With implementation of the plan presented, the County will be able to overcome its current deficiencies and develop and maintain a comprehensive stormwater program to meet future needs.

SEMINOLE COUNTY

STORMWATER MANAGEMENT STUDY

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Section 1

SECTION 1

SECTION 1

INTRODUCTION

1.1 BACKGROUND

Seminole County retained Post, Buckley, Schuh & Jernigan, Inc., (PBS&J) to prepare a stormwater management study. A similar study, prepared by PBS&J in 1976, addressed the County's stormwater management problems from the perspective of future growth. The objective was to assure that the County would satisfactorily manage its impending growth. At that time, four documents titled "Comprehensive Drainage Plan for Seminole County, Working Papers 1, 2, 3 and 4," were developed, which dealt with various aspects of stormwater management within the County. In addition, the County's first Comprehensive Plan, adopted in 1977, also address surface water management.

Continuing development within the County, both the unincorporated areas and the incorporated cities, combined with rapid development in northern Orange County have increased stormwater runoff and exacerbated existing management problems. These pressures were amplified by the legislature's efforts to control growth in the state and their development of stormwater management requirements in the Growth Management Act and its companion document, Chapter 9J-5 F.A.C.

1.2 PURPOSE AND SCOPE

The two main purposes of this study are to identify where the County is with regard to stormwater management and then to provide recommendations for appropriate directions in regulation of new development, construction of new facilities, and means of financing the capital needs for new facility construction and annual O&M costs for existing facilities.

The State's new growth management legislation requires local governments to make a comprehensive assessment of existing facilities and capacities, current and future needs and methods to implement and finance the necessary facilities and programs required to effectively manage the County's stormwater problems. This study will provide that necessary information, by addressing the requirements of Chapter 9J-5 F.A.C.

In addition to the requirements of Chapter 9J-5 F.A.C., the following specific needs of Seminole County are also met:

1) development of drainage atlas containing the inventoried structures in Seminole County;

2) development of a data base and information management system which locates and describes existing stormwater management facilities on a digitized mapping system;

3) development of a flooding complaint management system;

4) analysis of the capacity of the existing primary drainage system with regard to present and future flows;

5) assessment of existing and predictable future stormwater problems along with a priority evaluation;

6) development of planning level cost estimates;

7) preliminary development of a financing strategy to provide capital funds for construction and annual O&M;

8) preparation of a long-term phased program for implementing stormwater management recommendations; and

9) evaluation of long-term drainage demands with recommendations.

1.3 STUDY CONTENTS

Each section of their study provides a foundation for the reader to build on so that subsequent sections will be more clearly understood.

Section 2, Overview, provides a look at previous stormwater studies performed in Seminole County, a discussion of stormwater regulation and a detailed review of growth in Seminole County and how that growth relates to the drainage basins.

Section 3, Hydrologic and Hydraulic Assessment, discusses the general environmental setting, the basin soil types, the inventory of drainage structures, major conveyance outlet capacities, historical flooding problems and the preliminary identification of some critical structures.

Section 4, Methodology, deals with the methodology used in selecting the compatational procedures to be used in the hydraulic analyses in Seminole County. The selection was based on the ability of the procedure to use the data collected.

Section 5, Capacity and Demand Analyses, looks at the estimated capacity of the known, inventoried drainage structures, and the estimated flow going through the structure. This provides an estimate of the ability of the structure to handle the flow. This will provide the framework for analyzing the performance of the drainage systems on a basin by basin basis.

Section 6, Development of Solution, discusses the remedial action necessary to overcome the problem of a structure with inadequate capacity. We also cover facility sizing, solution costs, selection of solutions and the selected plan for correcting the existing problems.

Section 7, Stormwater Management Program, goes into the program which has been developed, as a result of this study, to give direction to Seminole County's stormwater management effort. Goals, objectives and policies are recommended

which give guidance to the program, institutional procedures and constraints are reviewed, and proposed projects are prioritized and scheduled. Finally, the program strategy is developed and a funding needs assessment is prepared.

Section 8, Funding and Financing Strategy, discusses funding and financing mechanisms as well as funding alternatives. This discussion provides the framework from which the recommended funding strategy has been developed.

The final section of their report is the appendices, which contains some of the supporting materials and documents, upon which this study was based.

Section 2

SECTION 2

SECTION 2

OVERVIEW

2.1 GENERAL

Available information and data was compiled to establish a baseline upon which to develop this study. In addition, interviews were conducted with key County staff members on a wide variety of topics ranging from flood prone areas to long-range growth forecasts. Appendix A documents these interviews.

2.2 PREVIOUS STUDIES

Two general groups of data were collected including stormwater/hydrologic information and growth/planning data. Appendix B documents the data collected and reviewed as part of this study.

The working papers developed during the 1976 Stormwater Management Study were used as a starting point for identifying drainage basin boundaries and flow patterns. Other sources for developing this study are listed in Appendix B and include FEMA, SJRWMD and SCS reports and additional reports by private consultants working for either government bodies or private developers. This information was updated through use of the USGS 7.5' quadrangle maps that were photo-revised in 1980, recent subdivision drainage plans, FDOT drainage plans and recent stormwater management studies prepared for the County. To aid in computational analyses, hydrologic, meteorological and soil data were obtained

from the United States Geological Survey (USGS), National Oceanic and Atmospheric Administration (NOAA) and Soil Conservation Service (SCS).

The Federal Emergency Management Agency (FEMA) has performed flood studies to determine flood elevations for the major conveyance systems in Seminole County. SCS is currently re-examining flooding elevations in 3 basins (Monroe, Lake Jessup and Gee/Soldiers Creek).

2.3 STORMWATER REGULATIONS

SJRWMD's regulations govern the entire County and their Applicant's Handbook (amended 10/84) outlines the requirements and application procedures. In most cases each city and the County have their own supplemental regulations that are usually more specific regarding the design and regulation of on-site stormwater collection, hydraulic attenuation and treatment.

Seminole County's stormwater regulations are outlined in the Land Development Code (LDC). The regulations basically require that pre-development peak discharge rates not be exceeded by post-development rates. Stormwater detention is encouraged in relatively impervious areas and retention likewise in previous areas. Amendments have been adopted recently (11/88) to bring the LDC more into conformance with SJRWMD requirements, specifically by the upgrading of the design storm from a 25-year, 6-hour storm to a 25-year, 24-hour storm. Seminole County currently has in place a generally complete and well-formulated set of stormwater management regulations and policies which

compliment those of the FDER and SJRWMD. The Land Development Code was developed with the intent of guiding engineers, architects, planners, and developers in the design of stormwater management systems while the Surface Water Management Standards further define standards of practice for stormwater systems in Seminole County. The county's regulations and policies go along way toward the goal of promoting controlled growth and future development.

2.4 GROWTH IN SEMINOLE COUNTY

Seminole County is located in east-central Florida within the Orlando metropolitan area. This location has made Seminole County one of the fastest growing areas in the state. The Orlando Metropolitan Statistical Area is comprised of Orange, Seminole and Osceola Counties. This is Florida's 4th most populous MSA, and, in the period of 1980-1984, it experienced the 14th fastest rate of population growth and the 3rd fastest rate of job growth among the nation's 316 MSAs. This high rate of growth was largely spurred in the early 1970's by the construction of Interstate 4 and Walt Disney World.

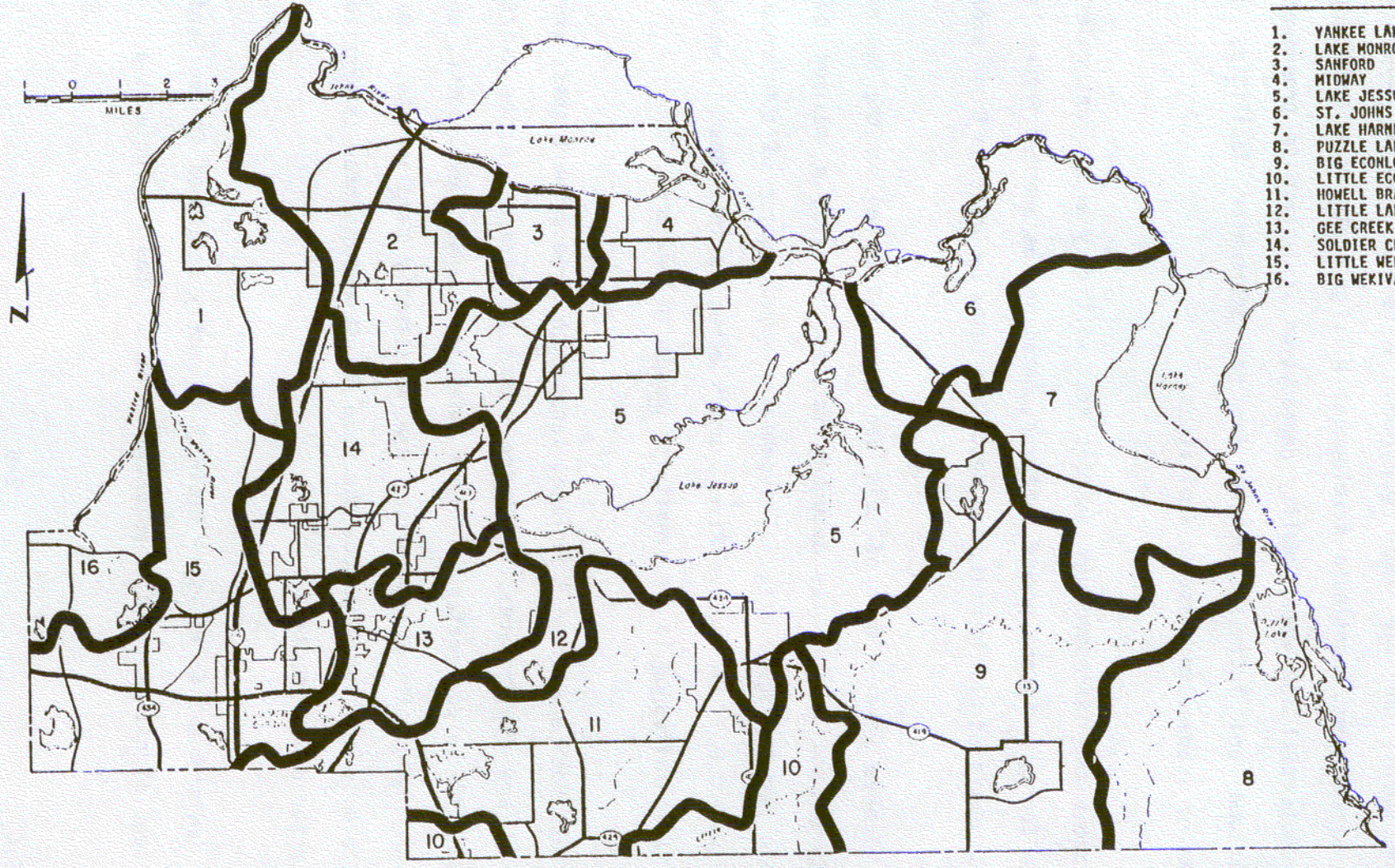
Between 1970 and 1987, the population of Seminole County more than tripled, increasing from 83,692 to 254,837. Relative to all Florida Counties, Seminole has climbed from 18th most populous in 1970 to 12th in 1987. Perhaps more dramatic than the County's fastest population growth has been its even faster rate of job growth. Jobs in Seminole County increased from 22,204 in 1970 to 86,733 in 1985. This trend is expected to continue as large, intense commercial development approved or planned in the County begin to buildout.

Seminole County's land area is 298 square miles; including lakes, the jurisdictional area is 344 square miles. Among Florida's 67 counties, Seminole's geographical area is the 4th smallest. This relatively small size, combined with historically large gains in population, have resulted in a high population density of 772 persons per square mile in 1986, the 5th highest county density in the state. To accommodate this large population increase, the County has urbanized at a relatively rapid rate. In 1975, urbanized land accounted for 18,125 acres; by 1986, this figure had increased to over 35,000 acres.

2.4.1 GROWTH TRENDS AND PATTERNS

Prior to 1970, Seminole County's population was concentrated within the Sanford, Casselberry, Longwood and Altamonte Springs Areas, especially within the U.S. 17-92, S.R. 436 and S.R. 434 corridors. During the 1970s, development extended into Southwest Seminole County, the Winter Springs/Red Bug Lake Road and Lake Mary areas. In the near-term future, strong growth will continue in South Central Seminole County (Basin 11), the South Oviedo area (Basin 10), Southwest Seminole County (Basin 15) and the Lake Mary/West Sanford area (Basin 2 and 14), see Figure 2-1.

Seminole County's Future Land Use map, adopted in 1987, allows a range of land uses from General Rural to Higher Intensity Planned Development. In addition to the County's continued residential growth, the designation of future areas for higher intensity mixed uses identified a need to address future potential impacts on adjacent drainage systems, particularly within high growth areas.



PBSJ Post, Buckley, Schuh & Jernigan, Inc.
CONSULTING ENGINEERS and PLANNERS

BASIN DELINEATION MAP
SEMINOLE COUNTY, FLORIDA

FIGURE 2-1

As Seminole County on the whole continues to grow, from a stormwater management perspective, continued development will generate more runoff and create new potential for water quality degradation, reduction in groundwater recharge volume and increased demand for new stormwater facilities and improvements of inadequate existing facilities.

The development and infrastructure factors that will play a dominant role in shaping the County's future growth patterns, based on the adopted Future Land Use map and committed development, are described below by Drainage Basin area.

BASIN 1: Yankee Lake - Most of this basin is designated on the Seminole County Future Land Use Map as Suburban Estates, allowing a maximum of 1 housing unit per buildable acre. The dominant growth factor of this area is the Heathrow P.U.D. The Wekiva River, which makes up this Basin's western boundary, is an influence to the density of growth in this area.

BASIN 2: Lake Monroe - Basin 2 includes lands with perhaps the highest growth potential of any County area. A large amount of acreage in the I-4/S.R. 46/C.R. 46A area is designated as Higher Intensity Planned Development, which allows industrial, office, commercial and multifamily developments. Major growth factors in this area include the Lake Forest and Heathrow International Business Center developments.

BASINS 3: Sanford AND 4: Midway - Basin 3 is mostly developed in the Sanford area, although significant infill potential remains. Basin 4 includes a

substantial amount of agricultural land that will likely experience residential development in the next twenty years.

BASIN 5: Lake Jessup - The US 17-92 and CR 427 corridors comprise the majority of development in this basin with General Sanford Estates being the major growth factor. This area also includes portions of south Sanford, the Sanford Regional Airport, Oviedo and the Lake Jessup basin. A significant amount of this acreage is currently vacant and is designated for low density residential uses.

BASINS 6: St. Johns, 7: Lake Harney, 8: Puzzle Lake, AND 9: Big Ecolockhatchee - These basins make up the eastern portion of the County, which has in the past remained predominantly rural due to the area's relative remoteness, the existence of large wetlands and floodprone areas and the limited availability of infrastructure. Most of this area is designated as Conservation or Suburban Estates (one housing unit per acre maximum) on the Future Land Use Map.

BASIN 10: Little Ecolockhatchee - This area is a fast growing sector of the Region with south Oviedo, large residential developments and Planned Unit Developments approved in Seminole County. Also present are large undeveloped tracts designated for Higher Intensity Planned Development and Medium Density Residential Use (10 housing units per acre maximum). This area is expected to develop rapidly as necessary roadway and infrastructure improvements are completed, such as the widening of McCulloch Road and S.R. 434, and the

University of Central Florida and Central Florida Research Park adjacent in Orange County continue to build out.

BASIN 11: Howell Branch - This basin contains a large amount of vacant/agricultural land with those developed areas being residential. Intensive commercial uses do exist to the east along S.R. 436 and at the Red Bug Lake Road/Tuskaville Road intersection. However, this basin is expected to experience a high rate of growth due to the construction of the Eastern Expressway. Higher Intensity Planned Developments and other non-residential uses are designated for the area between the proposed expressway and S.R. 426.

BASIN 12: Little Lake Howell, 13: Gee Creek, 15: Little Wekiva AND 16: Big Wekiva - These basins include the majority of Winter Springs, Casselberry and Altamonte Springs, respectively. A large portion of this area is already built out, but still has much infill development potential. Very little of this area's undeveloped acreage is agricultural land.

BASIN 14: Soldier Creek - This basin includes the fast growing Lake Mary area which has projects approved for office, retail and industrial including Primera, North Point, and Heathrow International Business Centre. Potential residential growth is also high and includes the Greenwood Lakes and Timacuan developments. However, the capacity of necessary infrastructure improvements may eventually constrain the rate at which this area develops.

2.4.2 THE IMPACT OF FUTURE GROWTH PATTERNS ON DEMAND WITHIN DRAINAGE BASINS

In light of the growth trends discussed in Section 2.4.1 above, it is evident that at least four drainage basins will be strongly impacted by future growth: Basins 2, 10, 11 and 14. Lake Monroe, Little Econlockhatchee, Howell Branch and Soldiers Creek respectively.

These basins will experience the greatest increase in drainage facility demand based on the high levels of growth projected. In particular, much of the projected growth in these areas is nonresidential development. As the matrix on page 5-6 indicates, land changes from undeveloped/agricultural to commercial/industrial result in the greatest net increase in surface water runoff of all land use change types.

These growth assumptions are supported by the capacity and demand analysis contained in Chapter 5.

Section 3

SECTION 3

SECTION 3

HYDROLOGIC AND HYDRAULIC ASSESSMENT

3.1 GENERAL

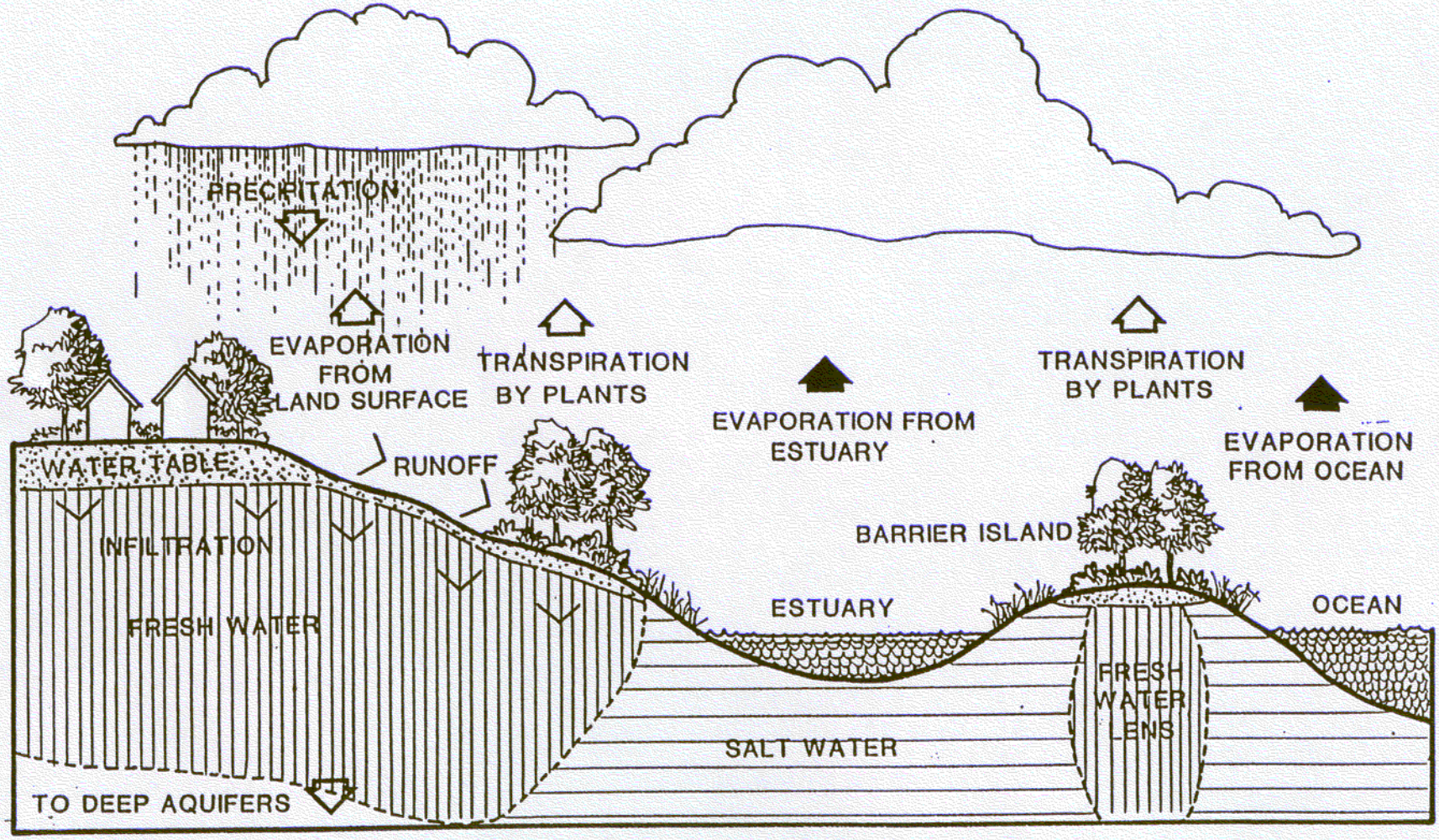
This section provides an overview of the general environmental setting as well as basin soil types and their general relationship to drainage. Additionally, the structure inventory is discussed along with major conveyance outlet capacities, data on historical flooding and the preliminary identification of critical structures.

In the discussion of the environmental setting, the climate, soils, surface water systems, and ground water systems are discussed in some detail. Figure 3-1, titled "Hydrologic Cycle" provides a pictorial representation of the different environmental elements at work in the hydrologic cycle.

3.2 CLIMATE

Seminole County's climate is semi-tropical and characterized by warm, long, mildly humid summers and by mild, dry winters. The average annual rainfall is approximately 53 inches and is seasonally distributed with nearly 60 percent of the annual average precipitation falling during the four month wet season of June through September. This phenomenon produces short but intense periods of rainfall which historically have caused flooding in the County as will be discussed in Section 3.8, Historical Flooding.

PBS



HYDROLOGIC CYCLE

FIGURE 3-1

3.2.1 Temperature

The Atlantic Ocean and Gulf of Mexico provide the warm air which largely accounts for the mild, moist climate of Seminole County. The Atlantic and Gulf, along with the many lakes of Seminole County, have a moderating effect on temperatures year round. Summer temperatures, in any year, vary only slightly from day to day. During June to August the average daily maximum is between 91°F and 92°F and the average daily minimum temperature is between 71° F and 72° F. The temperature normally reaches 90°F or higher 29 percent of the year, while it reaches 100°F or higher only one or two days a year. The humidity is somewhat higher during the summer in Seminole County because moist air masses that affect the area pass over many bodies of water.

Winter temperatures vary greatly from day to day due mainly to periodic cold dry air masses coming down from Canada. The average daily maximum temperature for December through February is 72° F with the highest temperatures on most winter days ranging between 65° F to 80° F. The average minimum for this same period is approximately 50° F with the daily minimum ranging between 40° F and 60° F. During an average winter, frost and freezing temperatures occur on only about eight days. Winter cold spells last approximately two or three days at a time and even on the coldest of days the temperature generally will rise to 40° F or higher at some point in the day.

The variation in normal monthly temperatures is summarized in Table 3-1 The minor variations between temperatures in Orlando and Sanford can probably be attributed to the proximity of the Sanford gage to the St. Johns River and Lake Harney with their moderating affects.

TABLE 3-1
MONTHLY TEMPERATURE AND PRECIPITATION VARIATIONS FOR GAGES AT
ORLANDO AND SANFORD, FLORIDA
MONTHLY TEMPERATURE VARIATIONS (° F)

MONTH	ORLANDO GAGE			SANFORD GAGE
	MINIMUM	AVERAGE	MAXIMUM	AVERAGE
January	49.1	60.3	71.4	53.5
February	50.5	61.8	73.2	61.4
March	55.3	66.7	78.1	66.9
April	60.5	72.0	83.4	69.5
May	66.3	77.3	88.2	75.4
June	71.3	81.1	90.9	81.1
July	72.9	82.4	91.8	81.1
August	73.4	82.5	91.5	81.7
September	72.2	80.8	89.4	78.7
October	65.5	74.8	84.0	77.9
November	56.6	67.1	77.5	71.8
December	51.1	62.0	72.8	57.7
Annual	62.1	72.4	82.7	71.4

AVERAGE MONTHLY PRECIPITATION (INCHES)

MONTH	ORLANDO GAGE	SANFORD GAGE	BOTH GAGES
January	2.10	0.51	1.31
February	2.91	0.47	1.69
March	3.22	1.14	2.18
April	2.53	2.70	2.62
May	3.56	2.10	2.83
June	7.19	7.65	7.42
July	8.04	6.02	7.03
August	6.61	10.40	8.51
September	6.89	9.53	8.21
October	3.33	3.52	3.43
November	1.66	2.31	1.98
December	1.94	2.40	2.17
Annual	49.99	48.75	49.38

Source: National Oceanic and Atmospheric Administration, Local Climatological Data Annual Summary, 1984.

3.2.2 Precipitation

During a normal year, more than half of the total annual precipitation falls during the rainy season of June through September though for any one month it can vary greatly from year to year. November, on average, is the driest month with November through February being considered the dry season. Only about 15 percent of the annual total precipitation generally falls during this period.

Summer rains come mostly as local showers or thundershowers of a short duration occurring mostly in the afternoon or early evening. An average of 85 thunderstorms occur each year with 75 percent of them occurring during the summer months. Summer showers are sometimes heavy with 2 or 3 inches of rain falling in a one- or two-hour period. Rains lasting all day are rare during the summer and when they occur are normally associated with a tropical disturbance.

Winter and early spring rains are generally associated with large-scale weather patterns and do not show any marked tendency toward occurring in afternoon or evening. On occasion these same rains may last 24 hours or longer, and although they are less intense than thundershowers, they may release a larger amount of rain but it is distributed over a large area.

Generally, rainfall is unevenly distributed over the year with periods of dry weather occurring almost every year. These dry periods can occur in any season but are generally found in winter and spring. Dry periods occur in April and May but generally do not last long. The variation in average

TABLE 3-5

STRUCTURE PROFILE

BASIN	Primary Structures			Secondary Structures	Unknown	Total Structures
	Major	Minor	Total			
1. Yankee Lake	4 44%	3 33%	7 78%	0 0%	2 22%	9
2. Lake Monroe	31 53%	25 43%	56 97%	2 3%	0 0%	58
3. Sanford	4 33%	8 67%	12 100%	0 0%	0 0%	12
4. Midway	19 40%	24 50%	43 90%	5 10%	0 0%	48
5. Lake Jessup	46 57%	22 27%	68 84%	3 4%	10 12%	81
6. St. Johns	4 57%	2 29%	6 86%	0 0%	1 14%	7
7. Lake Harney	6 86%	1 14%	7 100%	0 0%	0 0%	7
8. Puzzle Lake	0	0	0	0	0	0
9. Big Econlockhatchee	9 60%	3 20%	12 80%	0 0%	3 20%	15
10. Little Econlockhatchee	4 80%	1 20%	5 100%	0 0%	0 0%	5
11. Howell Branch	61 55%	39 35%	100 90%	4 4%	7 6%	111
12. Little Lake Howell	2 18%	6 55%	8 73%	2 18%	1 9%	11
13. Gee Creek	43 48%	38 42%	81 90%	3 3%	6 7%	90
14. Soldier Creek	28 39%	38 54%	66 93%	5 7%	0 0%	71
15. Little Wekiva	44 33%	84 63%	128 96%	3 2%	2 2%	133
16. Big Wekiva	7 47%	6 40%	13 87%	2 13%	0 0%	15
TOTALS	312 46%	300 45%	612 91%	29 4%	32 5%	673

- Blanton-Lakeland Association - Undulating, moderately well drained to somewhat excessively drained, sandy soils interspersed with lakes, ponds, and wet depression.

- Blanton-Leon-Plummer Association - Nearly level, moderately well drained, sandy soils interspersed with areas of slightly wet and wet soils, and dotted with lakes and ponds.

- Leon-Immokalee-Plummer Association - Nearly level, somewhat poorly drained, sandy soils underlain by a brown, stained pan, and very poorly drained soils in sloughs, swamps, and ponds.

- Leon-Delray-St. Johns Association - Nearly level, somewhat poorly drained to very poorly drained soils that are sandy to a depth of more than 30 inches.

- Pompano-Delray Association - Nearly level, poorly drained and very poorly drained soils that are sandy to a depth of more than 30 inches.

- Iberia-Manatee-Delray Association - Poorly drained and very poorly drained, dark-colored soils on flood plains; dominated by loamy or clayey surface layer.

- Delray-Manatee-Iberia Association - Poorly drained and very poorly drained soils on flood plains; dominated by dark-colored, sandy surface layer.

- Okeechobee-Terra Ceia Association - Nearly level, very poorly drained muck soils.

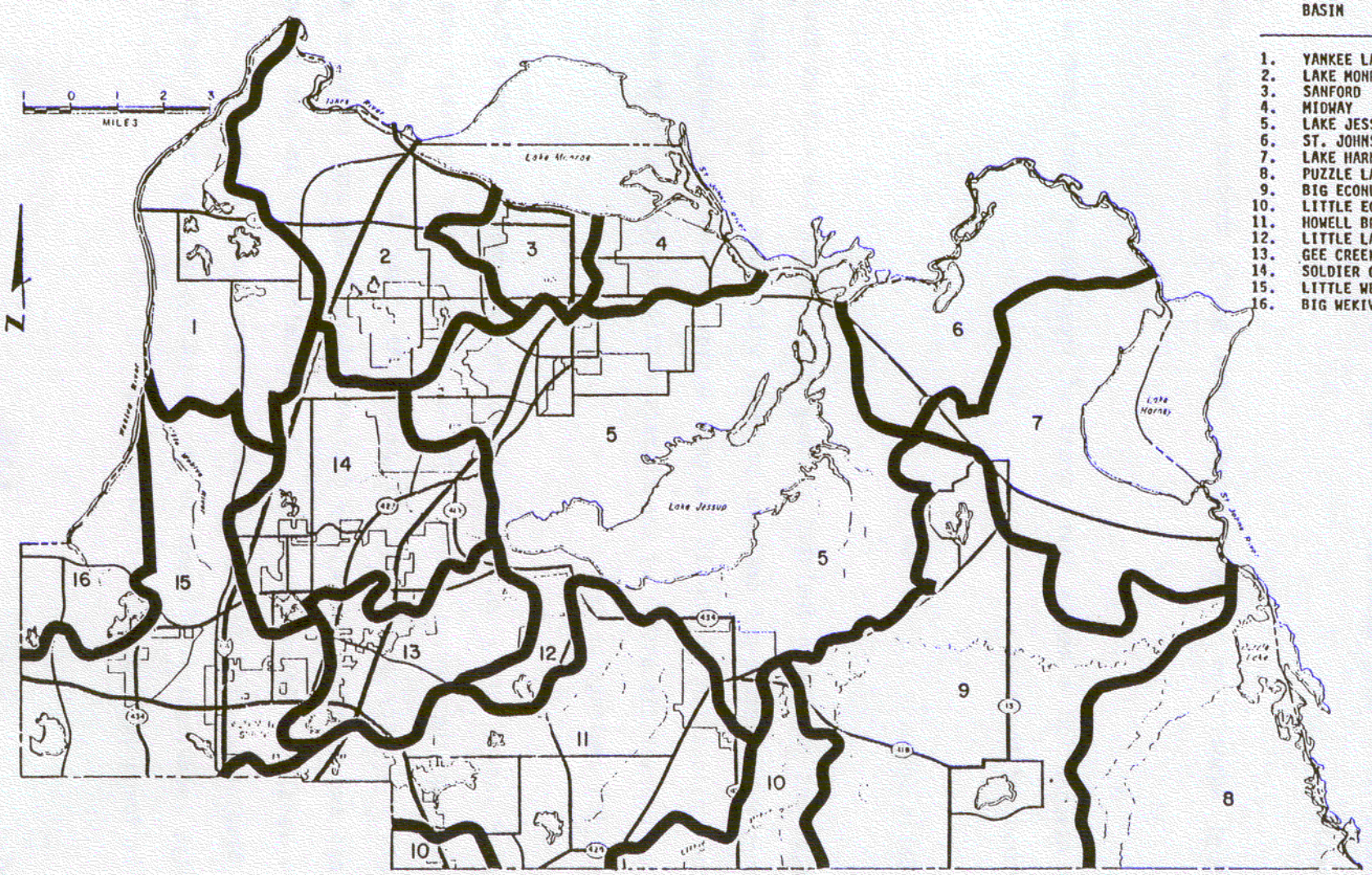
- Istokpoga Association - Nearly level, very poorly drained woody peat soils.

- Swamp Association - Nearly level areas of fresh water swamp covered by water most of the time.

3.3.2 Basin Soils

Soil associations have been analyzed as they occur within the various basins and subbasins which define the drainage patterns within the County. Figure 3-2 shows the delineation of the 16 drainage basins in Seminole County. The following is a brief discussion of the characteristics of the soils in each of the sixteen (16) drainage basins:

- Basin 1: Yankee Lake - Located in the northwest corner of Seminole County adjacent to the Wekiva River. The soils vary from somewhat poorly drained and very poorly drained along the river to moderately well drained and somewhat excessively drained inland. The area contains many small landlocked lakes and ponds. The predominant soil in this basin is the Blanton-Lakeland Association which covers about 20 percent of the County, Leon-Immokalee-Plummer is the secondary association in the basin and is found in 28 percent of the County.



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BASIN DELINEATION MAP
SEMINOLE COUNTY, FLORIDA

FIGURE 3-2

- Basin 2: Lake Monroe - Located in the northwest portion of Seminole County lying just west of the City of Sanford. It lies adjacent to the St. Johns River and Lake Monroe to the north and basically drains into them. The soils include somewhat poorly to very poorly drained in the north half and moderately well to excessively drained in the south half. The primary association in this basin is the Blanton-Lakeland Association with the Leon-Delray-St. Johns being a secondary association which covers 13 percent of the County. Leon-Immokalee-Plummer Association is also found in this basin.

- Basin 3: Sanford - Located on Lake Monroe and includes all of the developed City of Sanford except along the east edge of the city. The city is heavily developed. The soils vary from somewhat poorly drained in the north along Lake Monroe and to the west and south to moderately well drained in the southeast. This basin has a predominance of Leon-Immokalee-Plummer Association with a lesser amount of the Blanton-Leon-Plummer which is an association found in about 13 percent of the County.

- Basin 4: Midway - Located on Lake Monroe and the St. Johns River east of the City of Sanford. The soils vary from poorly drained to very poorly drained. This basin is predominated by the Leon-Delray-St. Johns Association with Leon-Immokalee-Plummer being the secondary association.

- Basin 5: Lake Jessup - Located in the center of Seminole County and nearly surrounds Lake Jessup. The soils within approximately 15 miles of Lake Jessup are very poorly drained. The remaining areas have well

drained soils. The predominant association in this basin is Leon-Delray-St. Johns. The Iberia-Manatee-Delray, Okeechobee-Terra Ceia, St. Lucie-Lakewood-Pomello and Delray-Manatee-Iberia are secondary soils and cover 6 percent, 1 percent, 4 percent and 2 percent of the County respectively.

- Basin 6: St. Johns - Located in the northeast portion of Seminole County adjacent to the St. Johns River. It contains predominantly poorly to very poorly drained soils. The Leon-Delray-St. Johns Association is primary in this basin with Leon-Immokalee-Plummer being the secondary association.

- Basin 7: Lake Harney - Located on the east side of Seminole County on Lake Harney and the St. Johns River. The soils are poorly drained except at Geneva where they are well drained. This basin is primarily covered by Leon-Immokalee-Plummer with Pompano-Delay and Iberia-Manatee-Delray being the secondary associations.

- Basin 8: Puzzle Lake - Located in the southeast corner of Seminole County adjacent to Puzzle Lake and the St. Johns River. The soils along the river are very poorly drained and improve inland to somewhat poorly drained. The primary association in this basin is the Leon-Immokalee-Plummer with the secondary associations being the Iberia-Manatee-Delray and the Pompano-Delray which covers 5 percent of the County.

- Basin 9: Big Econlockhatchee - Located in the southeastern portion of Seminole County. This basin includes the Econlockhatchee Creek from the

county line to its outfall into the St. Johns River. The soils along the creek are swamp covered by water and the remainder of the basin has moderately well drained soils. There are multiple soil associations in this basin with Blanton-Leon-Plummer being the most predominant. Other associations include Leon-Immokalee-Plummer, Blanton-Lakeland, Leon-Delray-St. Johns, St. Lucie-Lakewood-Pomello, Iberia-Manatee-Delray, Pompano-Delray and swamp which covers about 7 percent of the County.

- Basin 10: Little Econlockhatchee - Located in south Seminole County. The basin includes land along SR-436 which drains into the Crane Strand Canal. The canal flows south into Orange County, draining 49,600 acres in that county, and outfalls into the Little Econlockhatchee Creek which enters Seminole County west of SR-520. The basin follows the creek to its junction with the Big Econlockhatchee Creek. The soils along the creek are swamp and the remainder of the basin has moderately well drained soils. Blanton-Leon-Plummer is the primary association with Leon-Immokalee-Plummer and Swamp being secondary associations.

- Basin 11: Howell Branch - Located in south Seminole County and contains Howell Creek, the outfall from Lake Howell. Flow from Orange County, draining 19,200 acres, enters Lake Howell and Howell Creek. The soils are predominantly well drained. Blanton-Leon-Plummer is the primary association with Blanton-Lakeland, Leon-Immokalee-Plummer, Leon-Delray-St. Johns, Swamp and Istokpoga associations with Istokpoga being about 1 percent of the County.

- Basin 12: Little Lake Howell - Located in the center of Seminole County adjacent to and southwest of Lake Jessup. The soils range from poorly drained and Swamp near the lake to moderately well drained farther south. Blanton-Leon-Plummer and Swamp are the primary associations with Blanton-Lakeland and Leon-Delray-St. Johns Associations being secondary.

- Basin 13: Gee Creek - Located southwest of Lake Jessup. Its soils are moderately well drained except for a strip of swamp bordering Gee Creek from Lake Katherine to Lake Jessup. Many small lakes and ponds are scattered through the basin. Blanton-Leon-Plummer and Blanton-Lakeland are the primary associations with Swamp being a secondary association.

- Basin 14: Soldier's Creek - Located in west Seminole County. The soils are swamp and somewhat poorly drained near Lake Jessup and moderately well to excessively well drained to the west. This basin contains many small landlocked lakes and ponds. The basin's soils are the same as Basin 13 except for the addition of the Leon-Immokalee-Plummer Association.

- Basin 15: Little Wekiva - Located in the southwest corner of Seminole County adjacent to Orange County on the south and west. Soils range from somewhat poorly drained and swamp along the north reaches of the Little Wekiva to moderately well drained for the majority of the basin. Blanton-Lakeland Association is primary with both Swamp and Leon-Immokalee-Plummer Associations as secondary and Blanton-Leon-Plummer Association being tertiary.

- Basin 16: Big Wekiva - Located in west Seminole County adjacent to the Wekiva River and Orange County. Soils are swamp at the river and moderately well drained to excessively well drained to the south. Basin 16 soils associations are the same as Basin 15 except the Blanton-Leon-Plummer Association is absent.

3.4 SURFACE WATER SYSTEMS

The surface water system is divided into sixteen distinct basins as shown in Figure 3-2 on page 3-8, which are defined by topographic ridges and natural water courses. These basins contain wetland areas as well as landlocked and hydraulically connected lakes.

3.4.1 General Drainage Patterns

There are some notable drainage patterns which should be considered in view of the principal relationship of Seminole and Orange Counties and to a much lesser degree Lake County. The river and creek systems in Seminole County act as a drainage way for the surrounding area. The general pattern which can be seen is as follows:

1. The Econlockhatchee and Little Econlockhatchee Rivers provide a drainage conveyance for a large part of northeastern Orange County in the area of Union Park and Bithlo and a large portion of Southeastern Seminole County.

2. Howell Creek provides a drainage path for portions of east-central Orange County in the Maitland/Winter Park area, specifically in the area of Lake Maitland and south through a chain of several interconnected lakes and also south central Seminole County.

3. The Little Wekiva River is a drainage conveyance for part of west central Orange County around Lockhart and south to Lake Wekiva, Lawne Lake to Pine Hills as well as southwestern Seminole County.

4. The Wekiva River drains a portion of northwestern Orange County, southeastern Lake and west-central and northwestern Seminole Counties.

Clearly, a good portion of the stormwater moving in Seminole County to the St. Johns River system originates in Orange County. It can be seen that the river and creek systems in Seminole County play a very large part in the overall drainage system of both Seminole and Orange Counties. The St. Johns River, which forms a substantial part of Seminole County's boundary, is the watercourse which acts as the ultimate receiving body for most of these conveyances.

Tables 3-2 and 3-3 provides characteristic flow and gage height data for six surface water discharge and three lake stage gaging stations which are located in Seminole County and graphically shown on Figure 3-3. These stations are part of the system which the U.S. Geological Survey operates throughout the State of Florida. As can be seen from Tables 3-2 and 3-3 there can be extreme differences in rates of flow and water level heights in lakes and streams.

These extremes can be caused by weather, land use changes, alterations to the existing drainage system, road construction and many other factors. The flow data and staging data, over the period of a basin specific study provides the information to design for these extremes.

3.4.2 Basin Delineation

The purpose of basin delineation in Seminole County is: 1) to ascertain contributing areas to forecast flood flows and stages, 2) estimate the hydrologic impacts of development on a particular locale, and 3) to facilitate the effective management of watershed areas in the County.

To accomplish these goals of hydrologic definition and effective management, a means of watershed subdivision must be identified and utilized as a consistent and adaptable methodology applicable to present and future needs.

Seminole County's major subbasins were delineated in the 1976 study. This procedure involves successive stages of basin identification and refinement. As part of this study, new development was reviewed both through photo revised USGS quadrangle sheets (7.5 minute series) which indicate topography at 5' contours, and drainage area maps of large projects. County aerial photography (1986) was also used to provide a recent source of land use data to identify changes and visible drainage feature alterations.

TABLE 3-2

SURFACE WATER DISCHARGE DATA

STATION LOCATION	DRAINAGE AREA (SQ.MI.)	PERIOD OF RECORD	GAGE HEIGHT (FEET, NGVD) MAX.	MIN.	DATA FREQUENCY	AVERAGE ANNUAL FLOW IN WATER YEAR 1985 (cfs)	FLOW EXTREMES (cfs) MAX.	MIN.
Little Wekiva River near Altamonte Springs	90.7	13.3	27.34	23.14	Daily	34.1	592.0	1.9
Gee Creek near Longwood	12.8	12.5	14.69	5.56	Daily	17.0	310.0	1.2
Soldiers Creek near Longwood	21.2	14.0	NA	NA	Bimonthly	NA	429.0	0.15
Howell Creek near Slavia	29.2	14.0	36.71	32.24	Daily	33.5	412.0	0.91
Econlockhatchee River near Chuluota	241.0	50.5	18.69	0.08	Daily	14.88	11,000.0	6.70
Wekiva River near Sanford	189.4	54.5	6.09	1.75	Daily	287.0	2,060.0	105.0

Source: United States Geological Survey, Water Resources Data, - Florida, 1985

tm:SC:SWMS:E

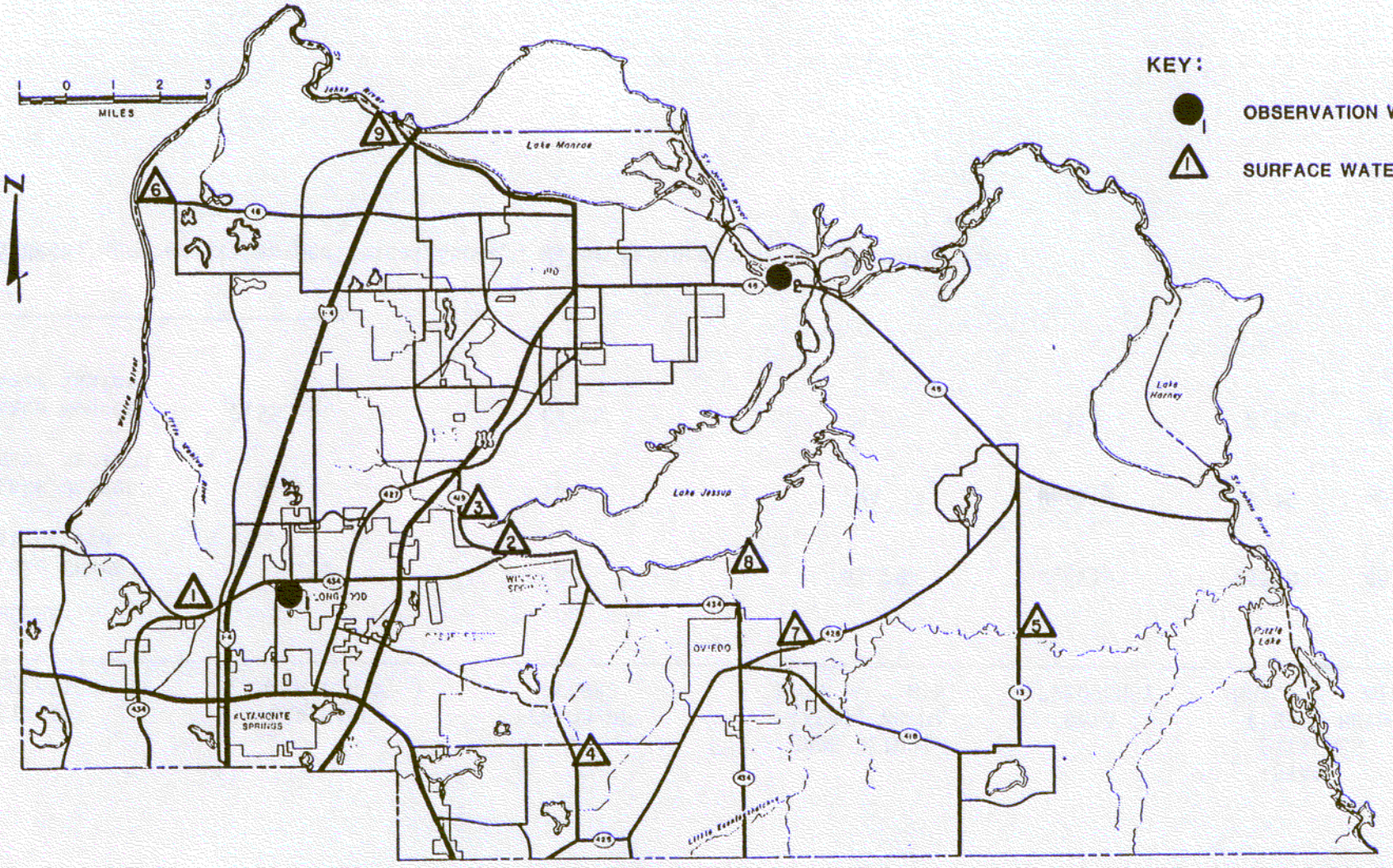
TABLE 3-3

LAKE STAGE FLUCTUATIONS DATA

STATION LOCATION	DRAINAGE AREA (SQ.MI.)	PERIOD OF RECORD	GAGE HEIGHT (FEET, NGVD) MAX.	GAGE HEIGHT (FEET, NGVD) MIN.	DATA FREQUENCY	STAGE EXTREMES (FEET, NGVD) MAX.	STAGE EXTREMES (FEET, NGVD) MIN.
LAKES							
Lake Charm at Oviedo	0.11	8.0	41.29		Weekly	46.50	40.24
Lake Jessup near Sanford	156.0	16.0	NA		Weekly	7.75	-0.63
Lake Monroe near Sanford	2,582.0	64.25	-0.09		Daily	8.50	-0.52

SOURCE: United States Geological Survey, Water Resources Data - Florida, 1985

tm:SC:SWMS:E



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LOCATION OF U.S. GEOLOGICAL SURVEY OBSERVATION WELLS AND SURFACE WATER GAGES FOR TABLES 3-2 AND 3-3
SEMINOLE COUNTY, FLORIDA

FIGURE 3-3

In most basins, boundaries changed very little from the 1976 study. However, a significant change was made in the boundary between drainage Basins 2 (Lake Monroe) and 14 (Soldier Creek). This was due in part to a previous misinterpretation of stream flow in the 1976 study.

It should also be noted for a point of clarity that Basin 8, previously called St. Johns River, has been renamed to Puzzle Lake in this study since the entire Seminole County basin is really within the St. Johns River Basin.

3.4.3 Lakes

Seminole County has approximately 18,451 acres of lakes which represent 9 percent of its total area. This figure does not include two large lakes, Lake Monroe and Harney, which are part of the St. Johns River system. Lake Monroe covers about 9,410 acres of which approximately 3800 acres are in Seminole County and Lake Harney covers about 6,060 acres of which approximately 3,000 acres are in Seminole County. It should be noted that a third large lake, Lake Jessup, is also connected to the St. Johns River System and acts as a detention area for the river but is not a part of the river flow system.

There are 162 named lakes in Seminole County and these may be divided into major and minor lakes. Major lakes are defined as having a surface area of 20 acres or larger and there are 84 lakes in this category. Minor lakes have less than 20 acres of surface area, and there are 78 in this category. Appendix D contains a complete list of these lakes including size, base elevation, Flood Emergency Management Agency (FEMA) flood category numbers,

10- and 100-year flood levels, and identifies the agencies that established flood elevations. Many of the 162 lakes are connected by natural drainage ways and some are connected by man-made canals. Some of the natural drainage ways are significant regional creeks such as Bear Gully Creek, Howell Creek, Gee Creek, and Mills Creek, as examples.

3.4.4 Watercourses

Seminole County has many small streams, creeks and man-made drainage ways as well as five rivers. Two of the rivers form a substantial portion of the county line. The Wekiva River forms a major part of Seminole County's western boundary from Wekiva Springs north to the St. Johns River. The St. Johns River forms Seminole County's north and eastern boundary. The basic direction of drainage in Seminole County is to the St. Johns River with highest elevations in Seminole County being in the south and western part of the county and the lower elevations being in the northeastern one-third. The three remaining rivers are the Little Wekiva River, which flows into the Wekiva River, the Econlockhatchee River, which flows to the St. Johns River directly and the Little Econlockhatchee River, which flows into the Econlockhatchee River.

3.5 GROUNDWATER SYSTEMS

Groundwater comes almost entirely from rainfall and occurs in Seminole County under both artesian or nonartesian conditions. When not confined, its upper surface, the water table, is free to rise and fall and is said to be under

nonartesian or water table conditions. When the water table is confined in a permeable bed that is beneath a less permeable material, where the upper surface is not free to rise and fall, artesian conditions are said to exist. Approximately 70 percent of the County's soils are affected by nonartesian ground water. The soils become saturated because the impervious material does not allow ground water drainage transfer to deeper levels. The depth of water table and/or saturated soil material will fluctuate according to the amount of seasonal rainfall.

Geologic stratification is common in Florida and accounts for the presence of high water tables in much of the County. The uppermost layer in most of the soils is porous, sandy, has rapid permeability and a thickness that ranges from 1 foot to more than 20 feet. The second layer consists of slowly permeable or impervious sandy clay or clay that is several feet thick. When free water accumulates in or on the soils as in depressions or lakes it is trapped by the slowly permeable or impervious clayey materials. Groundwater, or a perched water table, can occur at any elevation in areas where depressions and broad flats are underlain by impervious material. Under these conditions it will be difficult or impossible for absorbed rainwater to drain. Under such conditions it is possible for wet soils to exist at higher elevations than well drained soils at lower elevations.

Seminole County's main source of water is the Floridan aquifer. This aquifer is composed of a thick layer of cavernous limestone that underlies the entire County. This formation is called Ocala limestone and is as much as 150 feet below the surface. With the exception of a few areas, such as the springs

along the Wekiva and St. Johns Rivers and the bottoms of Lake Jesup and Crystal Lake, the overlying layers of relatively impermeable sand, clay and marl effectively cap or seal off the deep water-bearing limestone.

Groundwater is perched above this impervious layer in many places and it saturates all or at least the lower layers of many soils. Below this impervious layer large quantities of water fill the small pores and caverns in the limestone. This water is under pressure from recharge areas that may be at a higher elevation and even at great distance. This pressure will cause water to rise in a well to the level determined by the amount of pressure and is called the potentiometric surface.

Water from some artesian wells have a high chloride content which may come from salt water intrusion or from sea water trapped in old buried lakes. There is a wide range in the chloride content with lower readings in the southwestern part of the county and higher reading in the eastern and northeastern part of the county. This wide range in chloride content renders water from the deep aquifer unsuitable for any use in some parts of the county and excellent for general use in other parts.

Table 3-4 provides USGS observation well elevation data for two wells in Seminole County. Review of this data indicates that groundwater fluctuations of approximately 3-5 feet are typical with minimum levels occurring in the spring after the winter/spring dry season and the highest levels in the late fall/early winter at the conclusion of the annual wet season. Observation Well No. 1, it should be noted, is under artesian conditions.

TABLE 3-4

RECENT GROUNDWATER LEVEL FLUCTUATIONS

OBSERVATION WELL NO. 1

MAXIMUM ELEVATIONS, NGVD (FEET), WATER YEAR OCTOBER 1984 TO SEPTEMBER 1985

DAY	OCT	NOV.	DEC.	JAN.	FEB.	MAR.
5	43.43	42.64	42.41	42.00	40.98	39.71
10	43.20	42.28	42.27	41.48	41.18	39.13
15	42.78	40.85	41.96	41.81	41.07	---
20	42.25	41.63	41.85	41.61	40.78	---
25	42.16	41.90	41.28	41.17	40.12	---
EOM	42.40	42.67	41.42	41.14	39.98	38.58
MAX	43.78	42.90	42.62	42.00	41.49	---

DAY	APR.	MAY	JUNE	JULY	AUG.	SEP.
5	38.38	38.46	36.22	38.85	40.20	42.78
10	39.13	37.54	36.71	38.16	40.56	42.02
15	39.98	36.42	39.16	39.63	40.54	42.72
20	38.65	36.48	38.62	40.09	40.44	43.34
25	37.68	38.97	38.92	39.88	41.63	43.47
EOM	38.69	37.41	39.65	39.66	42.31	43.19
MAX	39.98	38.97	39.65	40.19	42.31	44.03

CAL YR 1984 MAX 44.75

OBSERVATION WELL NO. 2

ELEVATION, NGVD (FEET), WATER YEAR OCTOBER 1984 TO SEPTEMBER 1985

	TIME	ELEV. ABOVE NGVD (FEET)		TIME	ELEV. ABOVE NGVD (FEET)
OCT 16...	1438	22.01	MAY 17...	0915	18.55
NOV 21...	1211	21.57	JUN 11...	0910	18.41
DEC 10...	1535	22.13	AUG 06...	1055	20.96
FEB 04...	0950	20.59	SEP 09...	1115	22.16
APR 10...	0840	19.51			

Notes: NGVD: NATIONAL GEODETIC VERTICAL DATUM OF 1929
EOM: END OF MONTH
LOCATION: REFER TO FIGURE 3-3

3.6 STRUCTURE INVENTORY

In order to develop a County Drainage Atlas and assess the adequacy of the existing drainage system, an inventory of available drainage facility information was conducted. Available sources for this inventory included the 1976 Master Drainage Plan, DOT Drainage Atlases, SCS and SJRWMD studies and recorded development plans as listed in Appendix E. This inventory focused on large structures located in primary drainage ways. This inventory represents the initial development of a comprehensive, ongoing, structure tracking program which should be continued in the future.

3.6.1 Data Collection

The 1976 structure location map which was developed on the basis of aerial photo and map interpretation but was not field verified was used as an initial basis. Additional structure locations were identified by use of aerials, updated USGS Quad Maps, SCS and SJRWMD studies, FEMA (maps), FDOT roadway and Master Drainage Plans. Appendix F is a summary of stormwater management studies by SJRWMD either completed or currently underway in Seminole County. PBS&J field personnel visited 366 of the locations to document drainage features and complete a Structure Inspection Report Data Sheet shown in Figure 3-4.

Each structure inspection report details drainage parameters of not only the structure but of the upstream and downstream characteristics of the channel or conduit. Information obtained includes structure type, material, shape,

STRUCTURE INSPECTION REPORT

Basin _____

Subbasin _____

FDOT Number _____ 1976 ID Number _____

Range _____ Township _____ Section _____ Quarter Section _____

Location _____

STRUCTURE DATA

Type: ( ) Conduit ( ) Bridge ( ) Other _____

Material: ( ) Reinforced Concrete ( ) Corrugated Metal
( ) Wood ( ) Other _____

Shape: ( ) Elliptical ( ) Circular ( ) Rectangular ( ) Square
( ) Arched ( ) Pier Bridge ( ) Other _____

Dimension: Length _____ Width _____ Depth _____

Inverts: Upstream _____ Downstream _____ Datum _____

Source of data: _____

CHANNEL DATA

Upstream of Structure: Shape _____ Condition _____
Invert _____ Data Source _____

Downstream of Structure: Shape _____ Condition _____
Invert _____ Data Source _____

Cross-Section Area: Upstream _____ Downstream _____

Observed Structure Submergence ( ) Totally Under Water ( ) Dry
( ) Partially submerged at _____ above invert

COMMENTS

_____

_____

_____

PBSJ

FIGURE 3-4

dimensions and shape, condition, and cross-sectional areas of the conveyance. Degree of submergence during inspection was also noted. As further documentation, a sketch of each installation along with photographs were made to aid in processing and interpreting each report when reviewed by office personnel.

This information is used in the development of the County's Drainage Atlas and subsequently in the evaluation of structure capacities of the existing systems so that deficiencies can be identified and recommendations made for upgrading facilities.

The compilation of Structure Inspection Reports was prepared as two separate volumes. After the field documentation was complete, each report was reviewed for completeness and plotted on USGS 7.5' Quadrangle topographic mapping and on recent aerial photographs of Seminole County. The aerial mapping, scaled at 1" = 400', constitutes the Seminole County Drainage Atlas which also includes structure numbers as well as basin and subbasin delineations.

3.6.2 Inventory Overview

A total of 670 structures were inventoried and added to the Drainage Atlas. Table 3-5 provides a structure profile summary for all sixteen basins. Structures range in size from 18 inches in diameter to multispan FDOT bridges. Most structures in the inventory (91%) are equal to or larger than a 30 inch pipe.

TABLE 3-5

STRUCTURE PROFILE

BASIN	Primary Structures			Secondary Structures	Unknown	Total Structures
	Major	Minor	Total			
1. Yankee Lake	4 44%	3 33%	7 78%	0 0%	2 22%	9
2. Lake Monroe	31 53%	25 43%	56 97%	2 3%	0 0%	58
3. Sanford	4 33%	8 67%	12 100%	0 0%	0 0%	12
4. Midway	19 40%	24 50%	43 90%	5 10%	0 0%	48
5. Lake Jessup	46 57%	22 27%	68 84%	3 4%	10 12%	81
6. St. Johns	4 57%	2 29%	6 86%	0 0%	1 14%	7
7. Lake Harney	6 86%	1 14%	7 100%	0 0%	0 0%	7
8. Puzzle Lake	0	0	0	0	0	0
9. Big Econlockhatchee	9 60%	3 20%	12 80%	0 0%	3 20%	15
10. Little Econlockhatchee	4 80%	1 20%	5 100%	0 0%	0 0%	5
11. Howell Branch	61 55%	39 35%	100 90%	4 4%	7 6%	111
12. Little Lake Howell	2 18%	6 55%	8 73%	2 18%	1 9%	11
13. Gee Creek	43 48%	38 42%	81 90%	3 3%	6 7%	90
14. Soldier Creek	28 39%	38 54%	66 93%	5 7%	0 0%	71
15. Little Wekiva	44 33%	84 63%	128 96%	3 2%	2 2%	133
16. Big Wekiva	7 47%	6 40%	13 87%	2 13%	0 0%	15
TOTALS	312 46%	300 45%	612 91%	29 4%	32 5%	673

The distribution and size of structures inventoried in the sixteen basins were analyzed to determine a relative size criteria for "major" structures. Generally, the medium size of structures are equivalent to or slightly larger than a single 48" pipe. Consequently, the following definitions were developed for use in describing the drainage systems in Seminole County.

Primary Structures - Structures which have a clear opening equivalent to or larger than a single 30 inch diameter circular conduit (91% of inventoried structures)

- Major Primary Structures - Structures which have an equivalent opening equal to or larger than a single 48 inch diameter circular conduit (39% of inventoried structures).

- Minor Primary Structures - Structures which have equivalent clear openings equal to or larger than a single 30 inch circular conduit but no larger than a single 42 inch diameter circular conduit (52% of inventoried structures).

Secondary Structures - Structures which have a clear opening smaller than a 30 inch diameter circular conduit (4% of inventoried structures).

The focus of the field effort and plan review efforts was to find larger structures on the principal channels in the County. Consequently, very few smaller pipes were identified. Thirty-one structures, 5% of the inventoried structures, were noted as "unidentified" because they were identified through aerial and topographic mapping but were not inspected in the field. Many

"unidentified" structures were on private property and were not generally accessible. Inventoried structures are listed individually and then classified by basins in Appendix E.

The inventoried structures were further broken down by jurisdiction and the extent of capture of information was shown. The jurisdictional breakdown is shown below:

- o Florida Department of Transportation Structures
- o Seminole County Structures
- o Municipal Structures
- o Private Structures

The inventory contained in Appendix E is the most complete and accurate to date and will be very useful as the basis of future planning studies. Although capital improvement facility funding cannot be based on this inventory it should be used for capital improvement planning purposes. The data is significantly better, more complete and accurate, in certain catagories due to the availibility of construction plans and previous studies. The catagories where the data is considered better are FDOT-structures and Seminole County structures. The reader should find the tables to be self explanitory when used with the text in sub-section 3.6.2.

Table 3-6 to 3-9 summarizes this data.

TABLE 3-6

EXTENT OF CAPTURE

FDOT STRUCTURES

	PRIMARY		SECONDARY
	MAJOR (48"≥)	MINOR (30-42")	(<30")
EXTENT OF CAPTURE	90%	90%	80%
LEVEL OF INFORMATION			
Location of Structure	Very Good	Very Good	Very Good
Address of Structure	Good	Good	Good
Size of Conduits	Very Good	Very Good	Very Good
Conduit Material	Very Good	Very Good	Very Good
Direction of Flow	Marginal	Marginal	Marginal
Inverts	Good	Good	Fair
ACCURACY OF LEVEL DATA			
Planning	0%	0%	0%
Pre-Design	0%	0%	0%
Design	85%	85%	85%
Documentation/Record	15%	15%	15%

COMMENTS:

1. Direction of flow was not a characteristic that was monitored in this effort.

2. Most invert information is from design plans, not record drawings.

3. Assessment based on structure inventory completed May 1, 1988.

4. The percent (%) of capture was based on the objective judgement of the staff working on the project.

TABLE 3-7

EXTENT OF CAPTURE

SEMINOLE COUNTY STRUCTURES

	PRIMARY		SECONDARY
	MAJOR (48"≥)	MINOR (30"-42")	(<30)
EXTENT OF CAPTURE	80%	70%	20-25%
LEVEL OF INFORMATION			
Location of Structure	Very Good	Very Good	Very Good
Address of Structure	Good	Good	Good
Size of Conduits	Very Good	Very Good	Very Good
Conduit Material	Very Good	Very Good	Very Good
Direction of Flow	Marginal	Marginal	Marginal
Inverts	Fair	Fair	Good
ACCURACY OF LEVEL DATA			
Planning	0%	0%	0%
Pre-Design	0%	0%	0%
Design	90%	90%	90%
Documentation	10%	10%	10%

COMMENTS:

1. A number of the subdivision drainage plans were not recorded in County Plan files.

2. Direction of flow was not a characteristic that was monitored in this effort.

3. Assessment based on structure inventory completed through May 1, 1988.

4. The percent (%) of capture was based on the objective judgement of the staff working on the project.

TABLE 3-8

EXTENT OF CAPTURE

MUNICIPAL STRUCTURES

	PRIMARY		SECONDARY
	MAJOR (48"≥)	MINOR(30"-42")	(<30")
EXTENT OF CAPTURE	20% or less	15% or less	5% or less
LEVEL OF INFORMATION			
Location of Structure	Very Good	Very Good	Very Good
Address of Structure	Good	Good	Good
Size of Conduits	Very Good	Very Good	Very Good
Conduit Material	Very Good	Very Good	Very Good
Direction of Flow	Marginal	Marginal	Marginal
Inverts	Limited	Limited	Limited
ACCURACY OF DATA LEVEL			
Planning	0%	0%	0%
Pre-Design	0%	0%	0%
Design	95%	95%	95%
Documentation/Record	5%	5%	5%

COMMENTS:

1. Majority of information captured is in Sanford and Lake Mary.
2. Direction of flow was not a characteristic that was monitored in this effort.
3. Assessment based on structure inventory completed through May 1, 1988.
4. The percent (%) of capture was based on the objective judgement of the staff working on the project.

TABLE 3-9

EXTENT OF CAPTURE

PRIVATE STRUCTURES

	PRIMARY		SECONDARY
	MAJOR (48"≥)	MINOR (30"-42")	(<30")
EXTENT OF CAPTURE	5% or less	2% or less	2% or less
LEVEL OF INFORMATION			
Location of Structure	Very Good	Very Good	Very Good
Address of Structure	Fair	Fair	Fair
Size of Conduits	Limited	Limited	Limited
Conduit Material	Limited	Limited	Limited
Direction of Flow	Marginal	Marginal	Marginal
Inverts	None	None	None
ACCURACY OF LEVEL DATA			
Planning	N/A	N/A	N/A
Pre-Design	N/A	N/A	N/A
Design	N/A	N/A	N/A
Documentation/Record	N/A	N/A	N/A

COMMENTS:

1. Private structures were not readily accessible and were not inspected as part of this study.

2. Address of private structures is inherently limited by lack of reference streets and, in many cases, general location.

3. Direction of flow was not a characteristic that was monitored in this effort.

4. Assessment based on structure inventory completed through May 1, 1988.

5. The percent (%) of capture was based on the objective judgement of the staff working on the project.

A structured numbering system was devised to relate each structure to a basin and subbasin which is keyed to the Drainage Atlas and digitized on a computer data base map. Each structure number is a six digit number composed of 3 two-digit segments which identify the drainage basin, sub basin and relative structure location starting (typically) at the outlet and working upstream. Structure numbers were generally assigned on the basis of every third number in order to leave room to expand the listing at a later date..

XX - YY ZZ (Number Code)

Where:

XX = Basin Number

YY = Sub Basin (unnamed)

ZZ = Structure Number - Non Consecutive

A complete compilation of all inventoried structures is included as Appendix E. Structures are listed by basin and include the structure number, description of structure, location of structure and a cross-reference to which aerial photograph of the Drainage Atlas it is located within.

3.7 MAJOR CONVEYANCE OUTLET CAPACITIES

FEMA, in their 1980 Seminole County Flood Insurance Study, computed approximate peak discharges for 10-, 50-, and 100-year return storms for many major conveyances. They relied upon previous Army Corps of Engineers studies

for other drainageways.

Five of the FEMA studied conveyances, Howell, Soldier, Sweetwater, Six Mile and Gee Creeks flow into Lake Jessup and a sixth, Little Wekiva River, flow into the Wekiva River. Standard SCS methodology (Technical Release No. 55) was used to compute the outfall discharges summarized for these six conveyances in Table 3-10. Additional outlet capacities for those conveyances were computed as part of the capacity and demand analysis in Section 5.

The above cited conveyances were not typically field cross-sectioned with enough of a degree of comprehensiveness to be deemed accurate but none the less are good estimates. SCS currently is revisiting in a more comprehensive study Gee and Soldier Creeks specifically and the Monroe Basin generally which includes Sweetwater and Six mile Creeks. SCS is obtaining field cross-sections for the new flood routing analyses. SJRWMD previously completed a surface water management study of the Howell Branch basin which included the flood routing of Howell Creek.

These new studies will be of value to the County for future flood plain delineation and structure capacity analysis.

3.8 HISTORICAL FLOODING

As noted, County-wide drainage, on a whole, is satisfactory based on the fact that historically there has been no formal drainage programs. However this

TABLE 3-10

PRELIMINARY ESTIMATE OF BASIN OUTLET CAPACITIES FOR SELECTED OUTFALLS

BASIN NUMBER	CONVEYANCE NAME	OUTFALL LOCATION	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGES (CFS) FOR STORM RECURRANCE INTERVALS			
				10	25	50	100
5	Six Mile	Mouth	4.5	430	-	780	950
5	Sweetwater	Mouth	2.8	135	-	300	400
11	Howell Creek	SR-419	43.5	2,910	3,970	-	6,600
11	Howell Creek	SR-419	27.2	2,080	-	4,630	6,420
13	Gee Creek	Mouth	5.6	500	-	830	1,030
14	Soldier Creek	US 17-92	8.1	300	-	700	860
15	Little Wekiva	SR-434	33.8	920	-	1,500	1,800

Source: Seminole County Flood Insurance Study

tm:SC:SWMS:G

study identifies areas of localized and general flooding. This was done through interviews of County/City drainage personnel and review of established reports and other documentation.

It should be noted that this task involved a great deal more work than would be necessary if the County had an operational drainage complaint tracking (documentation) system. Such a system has been devised and is discussed in detail in Section 7 of their report. This system has been incorporated into the County Department of Engineering flooding complaint tracking system.

In general, the County's current known drainage problems are related to inadequate or non-existent drainage facilities coupled with aging, deteriorating conveyances and insufficient maintenance. In some cases systems are/were simply undersized. In other flooding and nuisances are caused by open drainage in what are now developed areas or systems are simply overtaxed by new development. These problems should be transferred from the interview sheets contained in Appendix A and incorporated into the drainage complaint tracking system and the digital data base.

A preliminary summary of specific known drainage problems appears as Appendix G. Specific concerns will be further addressed in Section 5 and 6 of this report.

Section 4

SECTION 4

Section 4

METHODOLOGY

4.1 GENERAL

PBS&J established the methodology to be used in the hydrologic and hydraulic analyses and specific computational procedures to be used in these analyses as part of Seminole County Stormwater Management Study. The methodology described in this section was selected on the basis of the ability to use the limited available data to prepare a planning level estimate of runoff rates and available conveyance capacities.

4.2 SELECTION OF COMPUTATIONAL PROCEDURES

It is necessary to determine peak flows for a range of frequencies at various sites in the drainage basin in order to plan and design urban storm drainage and flood control systems. The culverts, bridges, channels, and other structures in the drainage system are then evaluated according to their ability to convey this design peak discharge.

There are several approximate methods available for computing peak flows with limited horizontal and vertical control data. These include, but are not limited to regional regression equations, the rational formula, unit and synthetic hydrograph techniques, and methods developed by the U.S. Soil Conservation Service (SCS).

When adequate detailed hdyrologic and vertical control data are available for a basin, there are also numerous detailed and sophisticated hydrologic/hydraulic computer models that have been developed to generate site specific design hydrographs and flood stages. Due to the time, budgeting, and physical data limitations of this study, the more sophisticated and data intensive methods were ruled out from further consideration. However, recommendations will be made regarding appropriate methods to be utilized in future studies. Several of the options that were evaluated for a planning level evaluation are discussed in the following subsections.

4.2.1 Regional Regression Equations

Regional regression equations are the most commonly accepted method for estimating peak flows at ungaged sites or at sites with insufficient data. The Florida Department of Transportation (FDOT) typically uses this method for the design of highway culverts and bridges in Florida, and documents their usage in their most recent (1987) Drainage Manual. Regression equations are used to relate either the peak flow or some other flood characteristic at a specified return period to the physiographic, hydrologic, and meteorologic characteristics of the watershed.

The dependent variable is normally taken to be the peak flow for a given return period or some other property of the particular flood frequency, and the independent variables are selected to characterize the watershed and its hydrologic conditions.

In the United States Geological Survey (USGS) publication, Technique for Estimating Magnitude and Frequency of Floods on Natural-Flow Streams in Florida (Water Resources Investigations 82-4012), data from 182 gaging stations throughout the State were used in a multiple linear regression analysis. Flood magnitudes for recurrence intervals of 2, 5, 10, 25, 50, 100, 200, and 500 years (dependent variables) were regressed against the basin characteristics (independent variables). For each recurrence interval, the contributing drainage area (DA) was the most significant independent variable. Although the order of significance varied with recurrence interval, in most cases lake area (LK) was the next most important variable, followed by channel slope (SL). The regression model for the region of which Seminole County is a part has the form:

$$Q_T = C\ (DA)^a\ \ (SL)^b\ \ (LK+3.0)^c$$

where:

Q_T= the discharge for a recurrence interval of T-years, in cubic feet per second;

SL= the channel slope (minimum value set at 0.9), in feet per mile;

C= the regression constant;

DA= the drainage area, in square miles;

LK= lake area plus constant of 3, in percent; and

a, b, & c = exponents of the regression.

Using these equations, peak flow estimates may be derived at any location by simply measuring DA, SL, and LK for the contributing watershed. However, consideration must be given to the following limitations when applying the regional regression equations:

- The regression equations were developed using basin characteristics within certain ranges. The relationship of the regression equations outside these ranges is not known. The smallest watershed used in the regression analysis was 1.8 square mile and the largest was 9.640 square mile.

- In areas of karst topography, some basins may contain closed depressions and sinkholes which do not contribute to surface runoff. All basins in which the regression equations are used must be adjusted, as necessary, for contributing drainage area. Within Seminole County there are very few closed basins and any noncontributing drainage area can be readily identified from topographic mapping.

- The regional equations are not applicable where man-made changes have a significant attenuation affect on flood runoff. Flood runoff is affected by regulation from dams and reservoirs, levees, peak flow diversion canals, strip mines, and regional retention/detention basins that have signficant urban development. The equations are not suitable for analysis of individual storm sewer systems in the more intensely developed urban catchments in Seminole County. In addition, the equations are not able to quantify the impacts of land use changes and construction of stormwater attenuation and/or treatment facilities on small (10 acres or less) catchments. However the equations are generally appropriate for unincorporated areas of Seminole County.

For the reasons stated above, the regional regression equation methodology is appropriate and acceptable for this study as a planning level tool for determining peak flow estimates at major stormwater drainage stuructures.

4.2.2 Rational Method

For smaller drainage basins (usually taken to be less than 100 acres), the rational method continues to be the most widely used technique for determining design peak discharge. The rational method is generally expressed as the following equation:

$$Q=CiA$$

where: Q = the peak runoff in cubic feet per second for some recurrence interval storm;

C = the coefficient of runoff representing the ratio of surface runoff to rainfall;

i = the average rainfall intensity in inches per hour during a period of time equal to the critical time of concentration (t_c) for some recurrence interval storm;

A = the watershed area in acres contributing to the point of design; and

t_c = the rainfall intensity averaging time in minutes (or more commonly called the time of concentration). This is the time for water to flow from the hydraulically most distant point in the watershed to the point of design.

There are several well known assumptions and limitations associated with the rational equation. These include:

- The peak rate of runoff at the design point is a direct function of the tributary drainage area and the average rainfall intensity during the time of concentration to the design point.

- The rainfall intensity remains constant and spatially uniform during the time period equal to the time of concentration, t_c. Based on rainfall records, this assumption is accurate for short time periods such as a few minutes. As the time period increases, however, this assumption becomes less and less realistic.

- Runoff is linearly related to rainfall. That is, if rainfall is doubled, runoff is doubled. This assumption is not totally accurate as many variables interact such as antecedant precipitation and soil moisture conditions.

- The ratio of runoff to rainfall, C, remains constant during the storm duration.

- The method yields only a peak discharge, not a hydrograph.

The runoff coefficient, or C value, is the variable in the rational formula subject to the widest interpretation among users. Tables of C values from various agencies and texts are presently available for use by the engineer. It is unfortunate that values obtained may differ by a magnitude of two or

three, depending on which source is used. Hence, the experience and judgement of the engineer is critical in the selection of this extremely sensitive parameter.

Since the vast majority of the subbasins which have been delineated within Seminole County for this study are greater than 100 acres in size, and due to the foregoing limitations of the Rational Method, it is not reccmmended for use in the Seminole County study.

4.2.3 U.S. SOIL CONSERVATION SERVICE METHODS

A number of methods are available from the SCS for hydrologic analysis. The most commonly used method is known as Technical Release No. 55 Urban Hydrology for Small Urban Watersheds (TR-55). TR-55 analyzes the effects of urbanization in a watershed on hydraulic and hydrologic parameters and presents methods of estimating runoff volume and peak rates of discharge. General empirical relationships between the parameters that affect runoff and peak rates of discharge have been developed. Volume parameters include soil and cover type, whereas time parameters are the watershed slope, flow length, and surface roughness. A variety of charts, figures, and tables are used to relate these parameters to runoff volumes and peak rates of discharge.

TR-55 provides a simple rainfall-runoff method called the graphical method for determining the peak flow rate from a 24-hour net rain depth and a given time of concentration. The graphical method was developed for homogeneous watersheds where the land use and soil type may be represented by a single

parameter known as the runoff curve number, CN. If the watershed has uniform characteristics (e.g. cover, soils, land use, etc.) and can be represented by a single composite curve number, CN, the peak discharge can be estimated from a graph which gives the peak discharge in cfs/sq mi/in of rainfall.

The SCS peak discharge graphical method is limited to applications where only the peak flow rate is desired for 24-hour, Type II storm distributions (a Type II storm distribution is typical of the 24-hour thunderstorm experienced in all states except the Pacific Coast states) and the drainage areas should be limited to 20 square miles or less.

Another procedure for computing the peak discharge, which is called the chart method, is also described in TR-55. The chart method was designed for use in estimating the effect of development on the peak discharge rate. The input data include the hydraulic length (feet), drainage area (acres), the percentage of ponds and swampy area, the design return period (years), the CN, the watershed slope (%), the precipitation depth (inches) for the design return period, T, and the percentages of both the impervious area and the modified hydraulic length. All of the data are not necessary for all cases because some of the options are not mandatory. Application of the method is limited to watersheds from one acre to 2000 acres. The method is again based on a 24-hour storm volume and a Type II storm distribution.

Finally, the TR-55 tabular method was designed for use in the following circumstances:

- Developing composite flood hydrographs at any point within a watershed

- Measuring the effects of changes in land use of one or more subwatersheds

- Assessing the effects of structures or combinations of structures on peak flows

In general, the procedure was intended for measuring the effect on the composite flood hydrograph of changes within subwatersheds of a larger drainage area. The input requirements for the tabular method are minimal. The 24-hour rainfall depth (inches) for a selected exceedence probability (i.e., return period) is required. For each subwatershed, the drainage area, runoff curve number, and time of concentration must be determined. Additionally, the travel time for each channel reach is necessary.

It is the latter requirement that limits the utility of this method for the Seminole County Stormwater Management Study. With very little channel geometry and slope data, travel times can only be crudely approximated which tend to limit its viability for planning purposes. Recent modifications and updates to the TR-55 model have made it more applicable to Florida hydrology with its flatter slopes and large depressional storage areas. A new set of charts and tables have been developed for flatland watersheds with slopes of 0.005 ft/ft or less; this range is typical for Seminole County. However, the lack of channel specific data makes this method inappropriate for use in this study.

4.3 SELECTED METHOD

The Seminole County Stormwater Management Study, due to lack of structure and channel specific data as well as budgetary constraints, requires a method that can, with reasonable accuracy, produce peak flow rates at each of the stormwater facility locations throughout the County with a minimum amount of horizontal and vertical control data and minimal effort. The previous discussions have detailed the data requirements, theory limitations, validity and usefulness of the various hydrologic modeling methodologies which are available and, as a consequence, the USGS regression equations were selected for use in estimating peak runoff rates for the primary structures in Seminole County.

4.4 DEVELOPMENT OF DESIGN STORM

The usual analytical methodology adopted for the design of stormwater management facilities is to evaluate the flooding conditions that would be caused by selected critical rainstorms. The same critical rainstorms are used to evaluate land use changes due to development within a basin. Because it serves as one of the major yardsticks for quantifying runoff rates and volumes, the rainstorm database is one of the most important factors in a stormwater master planning program. Consequently, selection of the critical design storm(s) requires careful evaluation.

A synthetic design storm consists of a rainfall hyetograph (plot of rainfall intensity vs. time) which is based upon the characteristics of a number of

historical rainstorms. The key assumption of the design storm approach is that the frequency of occurrence of the design storm and the calculated runoff peak are identical. For example, it is assumed that a 25-year design storm will produce a 25-year peak runoff event. This assumption is critical because of the difficulty in ascribing a frequency of occurrence to a rainstorm synthesized from portions of several historical storms, the importance of antecedent soil moisture conditions and initial lake levels in determining watershed response to a given rainfall event, and the statistical non-homogeneity of rainfall and runoff data. However, the synthetic design storm concept is a theoretical method that continues to be the most widely used approach to stormwater management planning and drainage facility design.

The four facets which define a particular design storm are (1) the frequency of occurrence, (2) the storm duration, (3) the total volume of rainfall for the particular frequency and duration; and (4) the temporal distribution of that amount over the storm duration.

4.4.1 Rainfall Frequency

Stormwater planning studies have relied upon a range of design storm return periods (recurrence intervals), depending upon the area and the nature of the stormwater problem. For example, alternatives used within this region include design storms with 2-year, 5-year, 10-year, 25-year, 50-year, and 100-year return periods.

The 100-year flood event, which is the standard for FEMA's Federal Flood Insurance Program, is normally too stringent for a stormwater management master plan. Because it is such an infrequent and extreme event, the 100-year flood usually cannot be managed with traditional urban runoff controls. In Seminole County, it is likely that the majority of the streamflow peak and volume during the 100-year flood event are contributed by both urban and non-urban land uses during the frontal-type storms (i.e., long duration and moderate rainfall intensity) which produce most 100-year events. Consequently, it is recommended that the stormwater master planning study should not rely upon a 100-year design storm as a performance standard for structural stormwater management facilities.

Nonstructural stormwater management alternatives such as floodplain management and regulatory policies should be evaluated on the basis of 100-year flood flows and it is recommended that the runoff control facilities designed for less extreme rainstorms (storms of more frequent occurrence) should be tested with the 100-year design storm to ensure that the recommended runoff control plan does not aggravate the 100-year flood conditions. Floodplain development regulations should also require that loss of storage and conveyance capacity within the 100-year floodplain, as the result of development activities, be compensated for by providing off-setting storage within the floodplain. The 100-year high-water mark for small land-locked lakes may also be used as a sound standard for defining the floodplain in these basins.

Similarly, the 50-year flood is also a rather extreme event which is likely to require extremely expensive control measures. The only facilities which are typically designed for a 50-year event are the FDOT bridges and stream crossings.

The 25-year design storm tends to be the most commonly used "extreme" event for stormwater facility design in Florida. SJRWMD requires this storm frequency evaluation for its Surface Water Management Permit applications. The justification typically given for selecting the 25-year event for major stormwater facility design is that it is more conservative than the 10-year design storm typically used for local storm sewer design, but less conservative than the 50- and 100-year events which would require more expensive runoff control measures that would be used infrequently.

Additional justification for selecting the 25-year flood event is now available based upon a recent Army Corps of Engineers study of nationwide flood damage data compiled by the Federal Insurance Administration (FIA). Using generalized relationships between flood depth and damages for different types of property and generalized elevation-frequency relationships for different severities of flood hazard, the significance of different flood return periods was evaluated. This study concluded that the average annual flood damages within the 25-year floodplain are very high, typically up to ten times greater than the damages associated with the incremental area between the 25-year and 100-year floodplains. This conclusion suggests that a 25-year design event is both a reasonable and defensible upper limit for a stormwater management facility design.

The 5- and 10-year storm events are common design events for the design of closed storm sewer systems in urbanized drainage basins and subdivisions. Seminole County requires the use of the 10-year design storm for detailed evaluation and design of these type of urban stormwater management facilities. The 2-year flood event, generally described as the "mean annual flood", is typically equivalent to a bankfull open channel flow condition which will govern the cross-sectional area of the incised channel. If future development increases the 2-year flow, the stream channel will eventually be eroded until it reaches an equilibrium condition with a conveyance capacity equivalent to the 2-year flow. Thus, comparisons of pre-and post-development 2-year flows can be used to evaluate potential stream channel erosion impacts of future development.

4.4.2 Rainfall Duration

From various studies of past major rainfall events that have occurred in the southeastern portion of the United States, and in the northwest portion of Florida in particular, it is apparent that a large portion of the total rainfall of most major storms occurs within a 24-hour period. SJRWMD regulations stipulate the use of a 25-year/24-hour duration design storm event for the design of stormwater detention ponds for new development. This requirement is dictated by the need to address the total volume of runoff from a design storm event of given frequency in the design of such facilities. Seminole County's stormwater regulations should be consistent with SJRWMD regulations in this aspect and the revisions to the 6.D.C. reflect these requirements.

From the design perspective for stormwater conveyances such as ditches, inlets, storm sewers, and culverts, it is the peak rate of runoff that is the critical design factor, not the total volume of runoff. Hence a shorter duration storm event can be utilized in the evaluation and design of these facilities.

A 6-hour duration design rainfall is recommended for Seminole County. In accordance with the design criteria for hydrologic studies which mandates that the duration of the design rainfall should be approximately equal to or greater than the time of concentration of the basin, a 6-hour duration should be sufficient for any application within the County for determination of design peak flow rates.

4.4.3 Rainfall Volume

The Department of Commerce's Technical Paper No. 40 and the Soil Conservation Service's "Rainfall Frequency Atlas of Alabama, Florida, Georgia, South Carolina for Durations from 30 Minutes to 24 Hours and Return Periods from 1 to 100 Years" (USDA, SCS) sets forth a basis for the determination of design storm volumes in the Florida. FDOT's new Drainage Manual (1987) utilizes this reference in addition to the more recent NOAA Technical Memorandum NWS HYDRO-35 "Five to 60-Minute Precipitation Frequency for the Eastern and Central United States" publication to develop its set of rainfall intensity-duration-frequency (IDF) curves. IDF curves can be derived from these sources which are applicable for specific basin studies anywhere in Seminole County.

The following volumes have been calculated for Seminole County.

Storm Frequency	6-Hour	24-Hour
2	3.60	4.92
3	4.08	5.64
5	4.50	6.24
10	5.16	7.44
25	6.00	8.64
50	6.72	9.77
100	7.32	10.13

4.4.4 Rainfall Distribution

Peak runoff rates for a small (less than 100 acres in size and less than 30-minute time-of-concentration) urban drainage basin can be determined using the Rational Method. This method requires only a design rainfall intensity which corresponds to the time-of-concentration at the design point for the specified design return period. Since the Rational Method generates design peak flow rates, it is inappropriate to develop design storm hydrographs or determine runoff volumes. Hence, the Rational Method cannot be used for large basins or where runoff hydrographs and volumes are required for drainage facility design (e.g. detention pond designs).

Large basins (greater than 100 acres in size or longer than 30-minute time-of-concentration) require an alternate methodology which uses unit hydrograph theory. This method requires a design storm hyetograph which distributes a design storm rainfall volume over its duration at discrete time steps. Tables 4-1 and 4-2 present dimensionless design storm distributions for the design 24-hour and 6-hour duration storm events, respectively.

TABLE 4-1

DESIGN STORM RAINFALL DISTRIBUTION
24-HOUR DURATION STORM WITH 30-MINUTE TIME INCREMENT
(SCS TYPE II FLORIDA - MODIFIED DISTRIBUTION)

TIME, HRS.	ACCUMULATED FRACTION OF TOTAL 24-HOUR RAINFALL	INCREMENTAL FRACTION OF TOTAL 24-HOUR RAINFALL
0.0	0.000	0.000
0.5	0.006	0.006
1.0	0.012	0.006
1.5	0.019	0.007
2.0	0.026	0.007
2.5	0.034	0.008
3.0	0.042	0.008
3.5	0.050	0.008
4.0	0.059	0.008
4.5	0.068	0.009
5.0	0.078	0.010
5.5	0.088	0.010
6.0	0.099	0.011
6.5	0.110	0.011
7.0	0.122	0.012
7.5	0.135	0.013
8.0	0.149	0.014
8.5	0.164	0.015
9.0	0.180	0.016
9.5	0.200	0.020
10.0	0.224	0.024
10.5	0.253	0.029
11.0	0.289	0.036
11.5	0.343	0.054
12.0	0.593	0.250
12.5	0.689	0.096
13.0	0.731	0.042
13.5	0/763	0.032
14.0	0.789	0.026
14.5	0.811	0.022
15.0	0.829	0.018
15.5	0.844	0.015
16.0	0.858	0.014
16.5	0.871	0.013
17.0	0.883	0.012

TABLE 4-1
(Continued)

DESIGN STORM RAINFALL DISTRIBUTION
24-HOUR DURATION STORM WITH 30-MINUTE TIME INCREMENT
(SCS TYPE II FLORIDA - MODIFIED DISTRIBUTION)

TIME, HRS.	ACCUMULATED FRACTION OF TOTAL 24-HOUR RAINFALL	INCREMENTAL FRACTION OF TOTAL 24-HOUR RAINFALL
17.5	0.894	0.011
18.0	0.905	0.011
18.5	0.915	0.010
19.0	0.925	0.010
19.5	0.934	0.009
20.0	0.943	0.009
20.5	0.951	0.008
21.0	0.959	0.008
21.5	0.967	0.008
22.0	0.974	0.007
22.5	0.981	0.007
23.0	0.988	0.007
23.5	0.994	0.006
24.0	1.000	0.006
	TOTAL	1.000

TABLE 4-2

DESIGN STORM RAINFALL DISTRIBUTION
6-HOUR DURATION STORM WITH 10-MINUTE TIME INCREMENT

TIME, HRS.	ACCUMULATED FRACTION OF TOTAL 6-HOUR RAINFALL	INCREMENTAL FRACTION OF TOTAL 6-HOUR RAINFALL
0	0.000	0.000
0.17	0.010	0.010
0.33	0.020	0.010
0.50	0.030	0.010
0.67	0.041	0.011
0.83	0.053	0.012
1.00	0.065	0.012
1.17	0.078	0.013
1.33	0.092	0.014
1.50	0.107	0.015
1.67	0.123	0.016
1.83	0.140	0.017
2.00	0.159	0.019
2.17	0.181	0.022
2.33	0.209	0.028
2.50	0.244	0.035
2.67	0.290	0.046
2.83	0.370	0.080
3.00	0.559	0.189
3.17	0.672	0.113
3.33	0.732	0.060
3.50	0.772	0.040
3.67	0.803	0.031
3.83	0.828	0.025
4.00	0.848	0.020
4.17	0.866	0.018
4.33	0.882	0.016
4.50	0.897	0.015
4.67	0.911	0.014
4.83	0.924	0.013
5.00	0.937	0.013
5.17	0.949	0.012
5.33	0.960	0.011
5.50	0.971	0.011
5.67	0.981	0.010
5.83	0.991	0.010
6.00	1.000	0.009
	TOTAL	1.000

The 24-hour storm distribution, listed in 30-minute increments, is called the SCS Type II Florida - Modified Distribution and is required for the design of stormwater detention and retention ponds as per SJRWMD regulations. The 6-hour storm distribution is broken down into smaller, 10-minute time increments, and should be used to generate design peak flows and hydrographs for applications on which the smallest drainage subbasin being analyzed has a time-of-concentration less than 30 minutes.

The 6-hour duration design storm distribution was derived by the methodology originally employed by the SCS to derive the Type II Florida-Modified distribution. This procedure, as documented in "Interim Runoff Procedure for Florida", SCS Florida Bulletin Number 210-1-2, utilizes the rainfall volumes listed in NWS publications HYDRO-35 and TP-40 to obtain a set of design storm rainfall increments for a storm of given recurrence interval and duration. These discrete rainfall increments are arranged in the design storm by placing the largest increment in the middle of the storm event distribution. The second largest increment is placed after the first and the third largest is placed before the first. Alternating the remaining rainfall amounts continues in the same manner until the entire storm distribution is completed.

4.5 HYDRAULIC ANALYSIS

Stormwater conveyance facilities in Seminole County can be grouped into general categories of open channels, bridges and culverts, and storm sewers. Each must be treated in a separate manner to evaluate its ability to convey flood flows.

OPEN CHANNELS

Open channels are used extensively in the design of drainage systems as a means of collecting and conveying storm runoff. Open channels are used where it is considered impractical to provide a conduit system, either from a cost or capacity standpoint. Open channels may exist in a natural state, as carved by nature over a long period of time, or may be man-made. Natural channels are desirable and advantageous because they have stabilized over time.

The Manning equation is the method applied for determining flow rate in open channels. The equation is:

$$Q = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

where: Q = total discharge (cfs);

n = coefficient of roughness;

A = cross-sectional area (ft^2);

R = hydraulic radius = A/P (ft);

P = wetted perimeter (ft);

S = slope of the frictional gradient (ft/ft); and

= longitudinal slope of channel bottom for uniform flow (ft/ft).

The Manning equation provides an accurate estimate of discharge in a channel where uniform flow exists. The equation provides the most accurate results in those cases where the mean velocity, depth of flow, channel cross-section, and

roughness remain constant over a sufficient distance for uniform flow to be established. It is widely recognized, however, that uniform flow conditions seldom, if ever, occur because man-made structures such as bridges and culverts cause channel constrictions and channel sections change from point to point. In natural or man-made channels, bridges and culverts, changes in channel section, slope, or roughness cause the depths and average velocities of flow to vary from point to point along the channel. Thus, the slope of the water surface will not be parallel to the slope of the streambed and non-uniform flow exists. For practical purposes, however, it is acceptable to use the Manning equation to calculate discharge in generally uniform channels and this method is endorsed in the SJRWMD's Applicant's Handbook, Management and Storage of Surface Waters, August 31, 1988, and by the FDOT's Drainage Manual, March 1, 1987.

A limitation in the hydraulic analysis for the Seminole County Stormwater Management Study is the amount of information available for channel geometry. The only available channel cross-section and slope data are that contained in the FEMA flood insurance studies and some of the existing basin studies and drafts of some on-going studies. Hence, calculation of channel capacities throughout the County were approximated using the available information that has been collected from these sources and from the facilities inventory conducted under the data collection phase of this study.

BRIDGES AND CULVERTS

Bridges and a variety of culverts are used to pass a certain design flow across transportation rights-of-way. The desired result is to accomplish this flow without causing excessive backwater effects or excessive downstream velocities which may cause erosion problems. Culverts are generally distinguished from bridges in that they are usually covered with embankment material and are composed of structural material around the entire perimeter. Additionally, culverts typically have span lengths of less than 20 feet, whereas structures with longer spans are classified as bridges.

It is necessary to examine several design parameters which affect the desired objective of a bridge or culvert to convey flow from one side of the roadway to the other. In order to ensure that this objective will be met, the following design parameters should be considered:

- o design flood discharge
- o headwater elevation
- o tailwater elevation
- o outlet velocity

A bridge or culvert should be designed to pass a quantity of flow estimated on the basis of a preselected recurrence interval. While it is seldom economically feasible to design for the very rare flood, the structure should be designed to operate in a manner that is within acceptable limits of risk. In choosing a design recurrence interval, some consideration should be given

to the following elements:

- o highway classification
- o potential for loss of life
- o property damage
- o traffic interruption
- o economics

The draft "Seminole County Surface Water Management Guidelines" uses the highway classification approach to arrive at design recurrence intervals for drainage structures. The manual recommends a 100-year recurrence interval for bridges and major highway crossings and a 25-year recurrence interval for other canals, ditches, and culverts external to development. FDOT design criteria also conform to these figures.

Headwater refers to the depth of water in the stream, measured from the invert (bottom) of the bridge or culvert inlet. Bridges and culverts may serve as constrictions to the natural stream and cause a subsequent rise in the upstream water surface. In order to ensure that the rise is not excessive, an allowable headwater elevation should be generally specified and based on the following risk considerations:

- o damage to adjacent property
- o damage to the culvert and the roadway
- o traffic interruption
- o hazard to human life

- damage to stream and floodplain environment

According to the draft, "Seminole County Surface Water Management Guidelines," the allowable headwater of a culvert installation shall be 1.0 feet below edge of pavement for arterial and collector roadways, and 0.5 feet below edge of pavement for local and interior roadways. These criteria were used in the assessment of hydraulic capacities of all County drainage structures.

Tailwater is the total flow depth in the downstream channel measured from the invert at the bridge or culvert outlet. Varying tailwater conditions will affect the hydraulic capacity and performance of the structure. For example, a structure with a submerged outlet will flow full rather than partially full. Therefore, the downstream channel will be examined to determine if there are any obstructions which may influence the depth of the flow at the outlet. Tailwater elevations will be estimated using uniform flow depth calculations for the downstream channel.

The velocity of flow at the structure outlet will generally be greater than the mean velocity of the natural channel. The increased velocity may cause streambed scour and erosion near the outlet and for a limited distance downstream. Therefore, it is advisable to specify maximum allowable limits for exit velocities. For Seminole County, it is recommended that a maximum allowable exit velocity of 4.0 ft/sec be established.

In the analysis of drainage structure capacities, standard methods and nomographs documented in Hydraulic Design of Highway Culverts, 1985, by the

Federal Highway Administration were used employing the criteria specified in the previous discussion.

In ths section we established the methodology to be used in the hydrologic and hydraulic analyses and specific computational procedures to be used in these analyses. The methodology that was described was selected based on the ability of the method to be used with limited data on a planning level estimate of runoff rates and available conveyance capacities.

In the next section of this study the capacity demand calculations will be made using this methodology.

Section 5

SECTION 5

Section 5

CAPACITY AND DEMAND ANALYSIS

5.1 CAPACITY AND DEMAND CALCULATIONS

Assessment of the capability of the primary drainage structures within Seminole County to meet a defined service level requires an analysis of the facility capacity and an estimation of peak flow (demand). By a comparison of the two, it can be determined whether specific drainage facilities are of sufficient capacity to meet the designated service level or whether an upgrade is necessary to satisfy the expected demand. In addition, as a planning study, this type of comparison can provide specified direction for future study needs.

5.2. FACILITY CAPACITY ANALYSIS

Storm drainage facility capacity is a technical parameter that is difficult to accurately assess with limited data at a planning level. An accurate engineering determination requires a detailed hydraulic analysis of each element of the stormwater conveyance system including physical parameters of size, slope, elevation, roughness, and cross section area. Most of these parameters are unknown for the major drainage systems in Seminole County.

An analysis of the inventoried pipe sizes in the basins indicates that the median pipe size varies between basins but that the average of the median

cross-section areas was approximately 13 square feet which is slightly larger than the cross-sectional area of a 48-inch pipe. Consequently, the 48-inch pipe size was chosen as a dividing point between "major" and "minor" pipe size classifications. This criteria is generally consistent with size classifications in use throughout the state.

For the purpose of this analysis, major drainage facilities within Seminole County were identified as those structures with a cross-sectional area equal to or greater than a 48-inch diameter pipe or its equivalent, i.e., cross-sectional area in excess of 12.8 square feet.

The structure inventory for Seminole County was reviewed with this classification system and a total of 312 structures were identified as meeting the criteria of "major" structures (see Structure Profile, page 3-27). Capacities were calculated for all identified major structures and 76 minor structures know to be critical or located in the lower portion of the basin. The term "Major Structures" includes major structures, critical structures, and structures located in the lower portion of basins. These structures were reviewed because they could have the greatest overall impact on the system in which they are located and on other systems. They were as their name suggests: major or critical.

The capacity of a culvert in an open channel system was calculated assuming a headwater depth of 2 feet (or less depending on observed field conditions) and a full-flow condition. Nomographs published in FHWA's Hydraulic Design Series No. 5, Hydraulic Design of Highway Culverts, September 1985, were utilized to estimate the culvert capacity. The resulting capacity estimate for each

drainage facility is presented in Appendix H and summarized in terms of structure service level by basin in Table 5-1 for current conditions under the 10-year design storm. Appendix H contains the estimated demand and residual capacities for current conditions by basin major structures for the 10-, 25- and 100-year design storms. The estimates of adequacy are based on the following criteria:

PRELIMINARY SERVICE LEVEL ATTRIBUTION CRITERIA

Service Level A:	Passes the 10-year peak flow
Service Level B:	Capacity shortfall for the 10-year storm is within 10% of estimated capacity
Service Level C:	Capacity shortfall for the 10-year storm is between 11% and 50% of estimated capacity
Service Level D:	Capacity shortfall for the 10-year storm exceeds 50% of estimated capacity

5.3 FACILITY DEMAND AND RESIDUAL CAPACITY ANALYSIS

The residual facility capacity is simply calculated by subtracting the estimated demand (peak flow) from the estimated capacity for each facility. A positive residual value indicates that the facility has adequate capacity while a negative value indicates that the facility is unable to pass the peak demand flow.

The estimation of an existing design peak flow (demand) at a given storm

TABLE 5-1

Summary of Service Level Attainment

For Current Land Use Condition

10-Year Design Storm

	Basin	Service Level A	B	C	D	Total Number of Structures Evaluated *
1.	Yankee Lake	3 100%	0 0%	0 0%	0 0%	3
2.	Lake Monroe	25 69%	1 3%	3 8%	7 19%	36
3.	Sanford	2 100%	0 0%	0 0%	0 0%	2
4.	Midway	20 65%	2 6%	3 10%	6 19%	31
5.	Lake Jessup	36 78%	2 4%	1 2%	7 15%	46
6.	St. Johns	4 80%	0 0%	0 0%	1 20%	5
7.	Lake Harney	5 100%	0 0%	0 0%	0 0%	5
8.	Puzzle Lake	0	0	0	0	0
9.	Big Econlockhatchee	1 20%	2 40%	2 40%	0 0%	5
10.	Little Econlockhatchee	2 67%	1 33%	0 0%	0 0%	3
11.	Howell Branch	30 79%	1 3%	2 5%	5 13%	38
12.	Little Lake Howell	0 0%	0 0%	2 50%	2 50%	4
13.	Gee Creek	29 88%	0 0%	2 6%	2 6%	33
14.	Soldier Creek	20 80%	2 8%	2 8%	1 4%	25
15.	Little Wekiva	18 58%	0 0%	6 19%	7 23%	31
16.	Big Wekiva	3 43%	0 0%	1 14%	3 43%	7
	TOTALS	198 72%	11 4%	24 9%	41 15%	274

* - The 274 structures which were evaluated are composed of 198 of the 312 total major structures and 76 of the 300 total minor primary structures which were located at the lower portion of the basin and/or deemed critical. The remaining major structures were bridges, subdivision outfalls or part of a storm sewer system and therefore not evaluated.

drainage facility was calculated by use of the USGS regional regression equations as previously described in the methodology found in section 4. In order to estimate future demands this methodology was modified somewhat. Recognizing that, under "Pre-/Post" match regulation requirements (the same drainage discharge after development as before development) some increase in runoff will occur due to infill and gentrification, an adjustment was made according to the table on page 5-6 to account for this phenomena. What can occur with infill, especially in older subdivisions, is that larger homes may be constructed, through zoning variances, than were intended when the subdivision was designed. These larger homes produce a somewhat greater runoff, which was not envisioned during the original design of stormwater facilities. This cannot, realistically, be regulated. The same is true of gentrification, where a a neighborhood is slowly bought up by more affluent owners and the new owners construct improvements and additions to the homes. These additions add to the runoff from these homes and cannot, as a practical matter, be regulated. Neither the County nor SJRWMD have regulations for these phenomena. Overall, a maximum 10% increase in runoff is estimated to occur between current and future conditions for the same land use due to infilling and gentrification.

For future conditions, Seminole County's adopted future land use map and growth projections was used to assess the land use patterns anticipated to develop in the basin upstream of the structures.

The "Net Change Factor" is based on the Soil Conservation Service Technical Release No. 55 (June 1986) and uses runoff curve numbers which change based on land use changes. These curve numbers are related to the net change factors. As the degree of land use intensity changes, so does the relative net change for future conditions. The net change factors are presented in the following table:

Predominant Current Land Use	Projected Future Land Use	Resultant Net Change Factor
Undeveloped	General Rural (Undeveloped)	1.10
	General Rural (Agricultural)	1.14
	Residential	1.18
	High Intensity PUD	1.20
	Commercial	1.22
	Industrial	1.22
Agricultural	General Rural (Undeveloped)	1.00
	General Rural (Agricultural)	1.10
	Residential	1.16
	High Intensity PUD	1.17
	Commercial	1.18
	Industrial	1.18
Residential	Residential	1.10
	High Intensity PUD	1.13
	Commercial	1.14
	Industrial	1.14
Commercial	High Intensity PUD	1.10
	Commercial	1.10
	Industrial	1.10
Industrial	High Intensity PUD	1.10
	Commercial	1.10
	Industrial	1.10

The demands were estimated for major structures for future conditions for the 10-, 25-, and 100-year design storm. The 10-year design storm demand and previously calculated structure capacity were used to calculate residual capacities under both current and future conditons for major and critical structures. These values are presented in Appendix H. The next section will estimate approximate service levels for 198 of the 312 major structures based on the residual capacity under current and future conditions. The remaining major structures were not evaluated because they were bridges, subdivision outfalls or part of a drainage system. An additional 76 minor structures were identified as critical structures and therefore evaluated.

The existing drainage complaint data available in Seminole County was reviewed to compare actual flooding problems to areas identified by the capacity and demand analysis as having deficiencies. Unfortunately, the available drainage complaints document areawide problems within basins and are not tied to specific drainage structure locations. However, the basins experiencing historic complaints are generally consistent with the problem basins identified by this study. This finding tends to validate the overall results of the basin analyses.

The list of "Preliminarily Identified Drainage Problems" shown in Appendix G ranges from nuisance flooding to severe flooding. There were only two cases of severe flooding, one case considered to be moderate flooding and the remainder were listed as nuisance flooding. The flooding problems were concentrated in Basins 5 - Lake Jessup, 11 - Howell Branch and 15 - Little Wekiva.

TABLE 5-2

Summary of Anticipated Service Level Attainment

For Future Land Use Conditions

10-Year Design Storm

	Basin	Service Level A	B	C	D	Total Number of Structures Evaluated *
1.	Yankee Lake	3 100%	0 0%	0 0%	0 0%	3
2.	Lake Monroe	24 67%	1 3%	3 8%	8 22%	36
3.	Sanford	2 100%	0 0%	0 0%	0 0%	2
4.	Midway	18 58%	2 6%	5 16%	6 19%	31
5.	Lake Jessup	34 74%	2 4%	2 4%	8 17%	46
6.	St. Johns	2 40%	0 0%	2 40%	1 20%	5
7.	Lake Harney	4 80%	1 20%	0 0%	0 0%	5
8.	Puzzle Lake	0	0	0	0	0
9.	Big Econlockhatchee	1 20%	0 0%	3 60%	1 20%	5
10.	Little Econlockhatchee	2 67%	0 0%	1 33%	0 0%	3
11.	Howell Branch	29 76%	1 3%	1 3%	7 18%	38
12.	Little Lake Howell	0 0%	0 0%	1 25%	3 75%	4
13.	Gee Creek	28 85%	1 3%	1 3%	3 9%	33
14.	Soldier Creek	18 72%	2 8%	3 12%	2 8%	25
15.	Little Wekiva	16 52%	2 6%	4 13%	9 29%	31
16.	Big Wekiva	3 43%	0 0%	0 0%	4 57%	7
	TOTALS	184 67%	12 4%	26 9%	52 19%	274

* - The 274 structures which were evaluated are composed of 198 of the 312 total major structures and 76 of the 300 total minor primary structures which were located at the lower portion of the basin and/or deemed critical. The remaining major structures were bridges, subdivision outfalls or part of a storm sewer system and therefore not evaluated.

The problems were caused by a number of factors, with no one cause standing out. The causes included inadequate conveyances, inadequate design, no outfall, poor outfall, undersized outfall, undersized pipes, inadequate maintenance, open ditch flooding and two cases of unidentified flooding. The majority of the problems were associated with subdivisions. The Summary of Interviews contained in Appendix A detail these flooding problems.

5.4 SERVICE LEVEL DEFINITIONS

Only in the recent past has stormwater service been likened to highway capacities by defining levels of service with the performance of stormwater management systems being ranked on a relative continuum from adequate to inadequate for a given design storm. The City of Tampa and Hillsborough County use levels of service for stormwater and the Department of Community Affairs Circular 9J5 requires levels of service designations. The selection of appropriate performance criteria for a given service level is a policy issue which has significant budget consequences. If criteria are selected which are too conservative the cost of solutions for existing drainage problems become overly expensive. Conversely, if the selected criteria are too liberal, the resultant system does not meet the intended level of service. Clearly, the appropriate level of service is a policy issue which must be resolved.

Adequate or marginal performance for a system might be defined as minor, short-term street flooding while inadequate performance may be defined as structure flooding. It is fair to say that every portion of every service

area does not require the highest level of service at all times for all events. Primary arterials should be possible during design events to allow for police and fire emergency traffic as well as medical emergencies. However, many areas can tolerate a limited amount of street or yard flooding as long as it is short-lived and is not frequently experienced.

Seminole County experiences flooding from a variety of rainfall events. The degree of severity of flooding may be evaluated by its impacts on the environmental setting and citizens: roadway flooding, yard flooding or structure flooding. Four service levels were defined and later adopted by the City of Columbus, Georgia, based on a study performed in Columbus, Georgia during 1978. The service level system was developed by the Department of City Planning at the Georgia Institute of Technology and by the Department of Community Development of Columbus, Georgia. The system used in this study lists four service levels but can be expanded to include eight service levels if desired. The four service levels defined should not be confused with the four service levels established for structure performance. One set of service levels measures the performance of a structure or structures while the set discussed in this section measures the performance of a basin, subbasin, watershed, etc.. The four service levels as used here are defined as follows:

- Service Level A: Flow contained within Drainage Systems
- Service Level B: Street Flooding
- Service Level C: Street and Yard Flooding
- Service Level D: Street, Yard and Structure Flooding

While these definitions are rather simplistic, they represent a classification system that facilitates evaluation of overall system performance and the prioritization of funding for stormwater management system facilities construction, system O & M and regulation and enforcement of development activities.

Individual service levels are defined functionally in terms of the performance criteria for the stormwater management system. The development of service level criteria involves a compromise between an academic approach and the availability of accurate usable data for channel geometry, hydraulic profiles and reliable elevations for roadways, rights-of-way, yards and finish floors of structures.

Detailed performance criteria for each service level in Seminole County will require the completion of detailed basin studies, as outlined in Section 7.7 Program strategy, to establish water surface profiles for design storms and relatively accurate topographic and aerial photographic information to determine the extent and spread of the resultant flood plain. Unfortunately, this information is not presently available for use in Seminole County.

Functional criteria definitions, for use on a planning level, which should be considered by Seminole County in the absence of detailed criteria, are as follows:

- o Service Level A: Flow Contained Within Systems

  No flooding of major roadways, minor roadways, yards or structures. The hydraulic grade line (free water surface) is generally at or below inlet throats and/or top of bank in channels.

- o Service Level B: Water Contained Within Right-of-Way

  Flooding of major roadways is limited to the outer lane but does not prevent travel, i.e., limited duration flooding of minor streets, flooding of yards generally limited to the right-of-way but no flooding of structures. The hydraulic grade line is at or slightly above the inlet throat and/or encroaches on top of curb and/or breaches top of bank in channels.

- o Service Level C: Water Contained Within the Front Yard

  Flooding of major roadways precludes the use of outer lane and travel in inner lanes is possible but difficult, prolonged flooding of minor streets which precludes travel, flooding of front yards up to the front face of the structure but no flooding of the structure. The hydraulic grade line is significantly above the inlet, beyond road rights-of-way and beyond normal channel in the floodplain.

- o Service Level D: Structure Flooding

  Extensive flooding of streets, yards and structures for prolonged periods (24 hours or longer).

Clearly, the existence of Service Level D conditions represent an inadequate L.O.S. and should not be considered acceptable. However, virtually any system may suffer Service Level D performance if subjected to a severe enough rainfall event.

It is recommended that these definitions be reviewed by the County and then formally adopted as a basis for setting stormwater service levels, throughout the County.

5.5 CURRENT SERVICE LEVEL

Specific quantitative levels of service have not been recommended for drainage facilities in Seminole County at the present time due to lack of site specific data and the relative uncertainty of the hydraulic performance of the existing system. Consequently, it is not possible to evaluate the precise performance of individual facilities against specific quantitative design standards which require hydraulic studies to define specific water surface profiles throughout the County. However, until specific Service Level definitions are formally adopted, the definitions contained within Section 5.4 will be used for "interim" purposes in order to complete this study. These definitions are acceptable for a planning level study but may be modified as basin specific studies are completed.

An approximate Service Level was estimated for 198 of the 312 total major structures based on the residual capacity estimated in Section 5.3. The remaining major structures were identified as bridges, sub-division outfalls or part of a drainage system and therefore not evaluated. For both current and future conditions specific structure performance for the 198 major structures evaluated is summarized in Appendix H. Service levels were also estimated for 76 of the 300 minor primary structures. These 76 structures were evaluated due to known or suspected inadequacies.

Since specific water surface profiles and consistent reliable topographic information are not presently available for Seminole County, it was necessary to develop and test a set of service level attribution criteria. Service

levels were attributed to each structure based on its residual capacity. Any structure which can successfully pass the 10-year design storm is deemed to provide level of service A. All structures which can not pass the design storm are attributed to have B, C or D level service depending on their capacity shortfall (negative residual capacity).

Based on existing conditions in Seminole County, a preliminary set of service level attribution criteria (Criteria I) were developed and applied to two test basins, Midway and Lake Jessup. The resulting service levels were examined and deemed acceptable. A second set of criteria (Criteria II) were developed and applied. These additional criteria, which are less stringent, were used to test the sensitivity of the original attribution criteria. As can be seen from the summary of the attribution criteria and test basin results presented in Table 5-3, the results are not significatly different. Consequently, the most stringent service level attribution criteria were selected for use in this study. Criteria used in this assessment, and first discussed on pages 5-2 and 5-4, are briefly summarized as follows:

PRELIMINARY SERVICE LEVEL ATTRIBUTION CRITERIA

Service Level A:	Passes the 10-year peak flow
Service Level B:	Capacity shortfall for the 10-year storm is within 10% of estimated capacity
Service Level C:	Capacity shortfall for the 10-year storm is between 10% and 50% of estimated capacity
Service Level D:	Capacity shortfall for the 10-year storm exceeds 50% of estimated capacity

TABLE 5-3

Summary of Service Level Attribution Criteria Testing

10-Year Design Storm

Service Level Definition (Residual Capacity Estimate)	Service Level Attribution Criteria (% Below Estimated Structure Capacity) I	II
A	1% or More	1% or More
B	0% to -10%	0% to -25%
C	-11% to -50%	-26% to -100%
D	-51% or Less	-101% or Less

Current Service Level Attainment			
Basin 4 - Midway			
A	Structures	20	20
	% of Structures	65%	65%
B	Structures	2	5
	% of Structures	6%	16%
C	Structures	3	2
	% of Structures	10%	6%
D	Structures	6	4
	% of Structures	19%	13%
Basin 5 - Lake Jessup			
A	Structures	36	36
	% of Structures	78%	78%
B	Structures	2	2
	% of Structures	4%	4%
C	Structures	1	5
	% of Structures	2%	11%
D	Structures	7	3
	% of Structures	15%	7%

Criteria I & II are shown at the top of Table 5-3. The difference between the two sets of criteria is the percentage of the 10-year storm which the structure will pass. As can be seen, the more stringent guidelines were selected.

5.6 ANALYSIS OF BASIN PERFORMANCE

The evaluation of service levels for current conditions indicates that the County can expect to attain Service Level A during the 10-year design storm for 198 of the evaluated facilities, with 65 of the facilities, falling below Service Level B. Table 5-4 summarizes service level attainment for current conditions by basin.

Table 5-5 summarizes service level results by basin for future conditions during the 10-year design storm. The County should expect to obtain Service Level A in about 184 of its facilities which represents a 7.1% decrease from current conditions due to growth. Service will be below Service Level B for approximately 78 of its facilities which is 20% more facilities than under current conditions.

Comparison of Tables 5-4 and 5-5 indicates that about 13% of the facilities will experience service level degradation as growth continues in the County. It is estimated that about 7% of the structures attaining Service Level A under current conditions will experience degradation while 100% of today's Service Level B structures will fall to Service Level C or D. Of the structures currently experiencing Service Level C, about 46% will fall to Service Level D. The results of this service level degradation analysis are summarized in Table 5-6.

TABLE 5-4

Summary of Service Level Attainment
For Current Land Use Conditions

10-Year Design Storm

	Basin	Service Level A	B	C	D	Total Number of Structures Evaluated *
1.	Yankee Lake	3 100%	0 0%	0 0%	0 0%	3
2.	Lake Monroe	25 69%	1 3%	3 8%	7 19%	36
3.	Sanford	2 100%	0 0%	0 0%	0 0%	2
4.	Midway	20 65%	2 6%	3 10%	6 19%	31
5.	Lake Jessup	36 78%	2 4%	1 2%	7 15%	46
6.	St. Johns	4 80%	0 0%	0 0%	1 20%	5
7.	Lake Harney	5 100%	0 0%	0 0%	0 0%	5
8.	Puzzle Lake	0	0	0	0	0
9.	Big Econlockhatchee	1 20%	2 40%	2 40%	0 0%	5
10.	Little Econlockhatchee	2 67%	1 33%	0 0%	0 0%	3
11.	Howell Branch	30 79%	1 3%	2 5%	5 13%	38
12.	Little Lake Howell	0 0%	0 0%	2 50%	2 50%	4
13.	Gee Creek	29 88%	0 0%	2 6%	2 6%	33
14.	Soldier Creek	20 80%	2 8%	2 8%	1 4%	25
15.	Little Wekiva	18 58%	0 0%	6 19%	7 23%	31
16.	Big Wekiva	3 43%	0 0%	1 14%	3 43%	7
	TOTALS	198 72%	11 4%	24 9%	41 15%	274

* - The 274 structures which were evaluated are composed of 198 of the 312 total major structures and 76 of the 300 total minor primary structures which were located at the lower portion of the basin and/or deemed critical. The remaining major structures were bridges, subdivision outfalls or part of a storm sewer system and therefore not evaluated.

TABLE 5-5

Summary of Anticipated Service Level Attainment
For Future Land Use Conditions

10-Year Design Storm

	Basin	Service Level A	B	C	D	Total Number of Structures Evaluated *
1.	Yankee Lake	3 100%	0 0%	0 0%	0 0%	3
2.	Lake Monroe	24 67%	1 3%	3 8%	8 22%	36
3.	Sanford	2 100%	0 0%	0 0%	0 0%	2
4.	Midway	18 58%	2 6%	5 16%	6 19%	31
5.	Lake Jessup	34 74%	2 4%	2 4%	8 17%	46
6.	St. Johns	2 40%	0 0%	2 40%	1 20%	5
7.	Lake Harney	4 80%	1 20%	0 0%	0 0%	5
8.	Puzzle Lake	0	0	0	0	0
9.	Big Econlockhatchee	1 20%	0 0%	3 60%	1 20%	5
10.	Little Econlockhatchee	2 67%	0 0%	1 33%	0 0%	3
11.	Howell Branch	29 76%	1 3%	1 3%	7 18%	38
12.	Little Lake Howell	0 0%	0 0%	1 25%	3 75%	4
13.	Gee Creek	28 85%	1 3%	1 3%	3 9%	33
14.	Soldier Creek	18 72%	2 8%	3 12%	2 8%	25
15.	Little Wekiva	16 52%	2 6%	4 13%	9 29%	31
16.	Big Wekiva	3 43%	0 0%	0 0%	4 57%	7
	TOTALS	184 67%	12 4%	26 9%	52 19%	274

* - The 274 structures which were evaluated are composed of 198 of the 312 total major structures and 76 of the 300 total minor primary structures which were located at the lower portion of the basin and/or deemed critical. The remaining major structures were bridges, subdivision outfalls or part of a storm sewer system and therefore not evaluated.

TABLE 5-6

Facilities Experiencing Service Level Degradation Under Future Conditions

	Basin	Service Level Degradation						Total
		A to B	A to C	A to D	B to C	B to D	C to D	
1.	Yankee Lake	0	0	0	0	0	0	0
2.	Lake Monroe	1 33%	0 0%	0 0%	1 33%	0 0%	1 33%	3
3.	Sanford	0	0	0	0	0	0	0
4.	Midway	2 50%	0 0%	0 0%	2 50%	0 0%	0 0%	4
5.	Lake Jessup	2 40%	0 0%	0 0%	2 40%	0 0%	1 20%	5
6.	St. Johns	0 0%	2 100%	0 0%	0 0%	0 0%	0 0%	2
7.	Lake Harney	1 100%	0 0%	0 0%	0 0%	0 0%	0 0%	1
8.	Puzzle Lake	0	0	0	0	0	0	0
9.	Big Econlockhatchee	0 0%	0 0%	0 0%	2 67%	0 0%	1 33%	3
10.	Little Econlockhatchee	0 0%	0 0%	0 0%	1 100%	0 0%	0 0%	1
11.	Howell Branch	1 25%	0 0%	0 0%	1 25%	0 0%	2 50%	4
12.	Little Lake Howell	0 0%	0 0%	0 0%	0 0%	0 0%	1 100%	1
13.	Gee Creek	1 50%	0 0%	0 0%	0 0%	0 0%	1 50%	2
14.	Soldier Creek	2 40%	0 0%	0 0%	2 40%	0 0%	1 20%	5
15.	Little Wekiva	2 50%	0 0%	0 0%	0 0%	0 0%	2 50%	4
16.	Big Wekiva	0 0%	0 0%	0 0%	0 0%	0 0%	1 100%	1
	County Wide Degradation	12 33%	2 6%	0 0%	11 31%	0 0%	11 31%	36

* - The 274 structures which were evaluated are composed of 198 of the 312 total major structures and 76 of the 300 total minor primary structures which were located at the lower portion of the basin and/or deemed critical. The remaining major structures were bridges, subdivision outfalls or part of a storm sewer system and therefore not evaluated.

Section 6

SECTION 6

Section 6

DEVELOPMENT OF SOLUTIONS

6.1 GENERAL

This section addresses the solution of specific drainage problems identified in Section 5. Alternative solutions were developed for drainage structures with capacity problems (could not pass the 10-year storm), identified for current and future conditions using the 10-year design storm. Cost curves were developed to evaluate solutions proposed for drainage structures which were found to have capacity problems. Alternative solutions for each structure are evaluated and the best solution is chosen for each structure.

6.2 REMEDIAL SOLUTIONS

Potential solutions to the existing identified structural problems can take one of three forms: (1) decrease of existing flow rates and volumes by implementation of retroactive runoff controls on existing projects; (2) reduction of existing flow rates and runoff volumes by construction of flow attenuation devices; or, (3) provision of additional conveyance capacity to accommodate the existing runoff peak flow rates. The selection of an appropriate solution for Seminole County must consider available funding, the cost efficiency of individual solutions, the continuing operating and maintenance associated with the chosen solution and the organizational philosophy of the stormwater management agency.

Seminole County's adoption of discharge limitations to limit post development discharge to predevelopment levels is an effective measure for controlling stormwater discharges from new and future projects. However, the retroactive application of this regulation to existing developments in an effort to reduce current systemwide discharges is not feasible, practicable or legally defensible.

Existing projects, developed prior to the adoption of current discharge limitations, generally cannot be **retrofitted** due to lack of available land for flow attenuation facilities and the design of the installed stormwater conveyance facilities. Besides engineering limitations, the key issue of who would pay for the reconstruction of existing and construction of new attenuation facilities required to effectively retrofit a project creates institutional problems. In most cases, the developer of a project is long gone and the County would probably find themselves in protracted litigation with the endpoint user.

The second general type of solution is the construction of **large regional flow attenuation facilities** which are designed to reduce the existing peak flow rate by storing a portion of the stormwater runoff thereby reducing both the total system flow and peak runoff rates in the system. Land use patterns and the relatively undeveloped character of many portions of the County would tend to support the use of this approach in the less urbanized portions of Seminole County at first glance.

However, on closer inspection, there are several compelling reasons to avoid constructing municipally owned and operated flow attenuation facilities. First, due to the relatively flat topography which characterizes much of Seminole County, the maximum depth of these facilities is generally limited which, in turn, requires relatively large pond areas to be effective in attentuating flows in the primary channels that experience flooding. The final cost of acreage, not to mention its loss from the tax roles and the expenses associated with the land acquisition processes of appraisal to establish fair market value and subsequently purchase/condemnation must be carefully weighed when considering potential solutions.

Another major consideration of flow attenuation facilities is the municipal responsibility that attaches to them. Once the facility has been constructed it must be maintained and operated to assure proper performance. If the facility is located in a relatively undeveloped area, semi-annual cleaning may be adequate. However, if the facility is located in a residential or commercial area, as they typically are, the required maintenance to assure proper function and reduce neighborhood complaints is much more demanding and can vary from quarterly maintenance to monthly mowing and more frequent spraying to control rodents, snakes, and mosquitoes and maintain an acceptable asthetic condition.

The final argument against constructing flow attenuation facilities is the problem of access control and liability associated with a number of dispersed facilities. Civil courts in Florida have a long standing history of

classifying ponds as an "attractive nuisance" and attaching strict liability to municipalities in cases dealing with death and injury.

Most governments that own and operate ponds have required that access be strictly controlled by fencing the ponds, typically with 6-foot chain link fences with three strands of barbed wire on top and locked access gates. Fences of this kind are generally not aesthetically pleasing to the neighbors, are expensive to initially erect and annually maintain. Unfortunately, fencing is frequently not effective at access control and thereby preventing injuries and deaths and the resulting liability law suits.

The last category of solution is simply **improving the conveyance capacity** of the structures to accommodate the existing flows. Fortunately, most of the flooding problems identified in Seminole County are caused by inadequate structures capacity and are not a function of channel conveyance capacity. Therefore, it is a relatively simple matter of installing a parallel conduit to increase existing capacity to exceed projected peak flows or replacing the existing conduit with new conduits or a bridge with a design capacity in excess of anticipated peak flows for the design storm.

Recognizing the difficulty of retroactively imposing discharge controls on existing projects and the expense and liability of constructing a number of flow attenuation facilities, the third general type of solution-improving conveyance capacity--was selected for use in Seminole County.

6.3 SIZING OF FACILITIES

The general philosophy used in sizing remedial facilities was to parallel the existing conduit with one or, in a few cases, two new conduits to increase conveyance capacity to pass anticipated peak flows. Where the size and/or condition of existing conduits was a cause for concern based on field inspections, replacement of the existing conduit with one or more new conduits was considered in order to provide adequate capacity. The essence of this philosophy is to maximize the use of viable existing conduits in order to reduce the cost of remedial solutions.

A minimum of two solutions were developed for each of the 65 identified structures which have a current level of service of C or D. In many cases three alternate solutions were developed based on experience and engineering judgement and, in some case, four or five alternate solutions were developed for subsequent evaluation.

Sizing of parallel or replacement conduits was based on the same headwater conditions used in establishing existing structure capacity as previously discussed in Section 5. Analysis of remedial solution capacity is structure specific and is dependent on conduit length and headwater limitations. Conduit capacity was calculated using the Universal Energy Loss Equation which is generally accepted engineering practice for gravity conduit flow.

6.4 DEVELOPMENT OF COST CRITERIA

In order to evaluate the remedial alternatives for each identified structure replacement, construction cost curves were developed to estimate the probable cost of construction for the alternatives. Pre-design cost curves for replacement of existing inadequate drainage structures with the following structure types were formulated:

- single culvert (30-inch through 60-inch diameter)
- double culvert (30-inch through 60-inch diameter)
- triple culvert (30-inch through 60-inch diameter)
- reinforced concrete box culvert (3' x 3' through 2-5' x 10')
- bridge (concrete slab span or prestressed AASHTO girder, depending on bridge length and channel hydraulics)

These estimated cost curves, Figures 6-1 through 6-3, resulted from quantity estimates based on general assumptions regarding materials, construction methods, roadway widths and various other components which would be involved in the construction of such facilities. Appropriate unit costs were developed for each quantity item. Finally, a construction contingency of approximately ten percent (10%) was added to the extended item totals to account for uncertainties in the preliminary quantities and the assumed unit costs.

Figure 6-1

COST CURVES FOR CONVENTIONAL CULVERTS

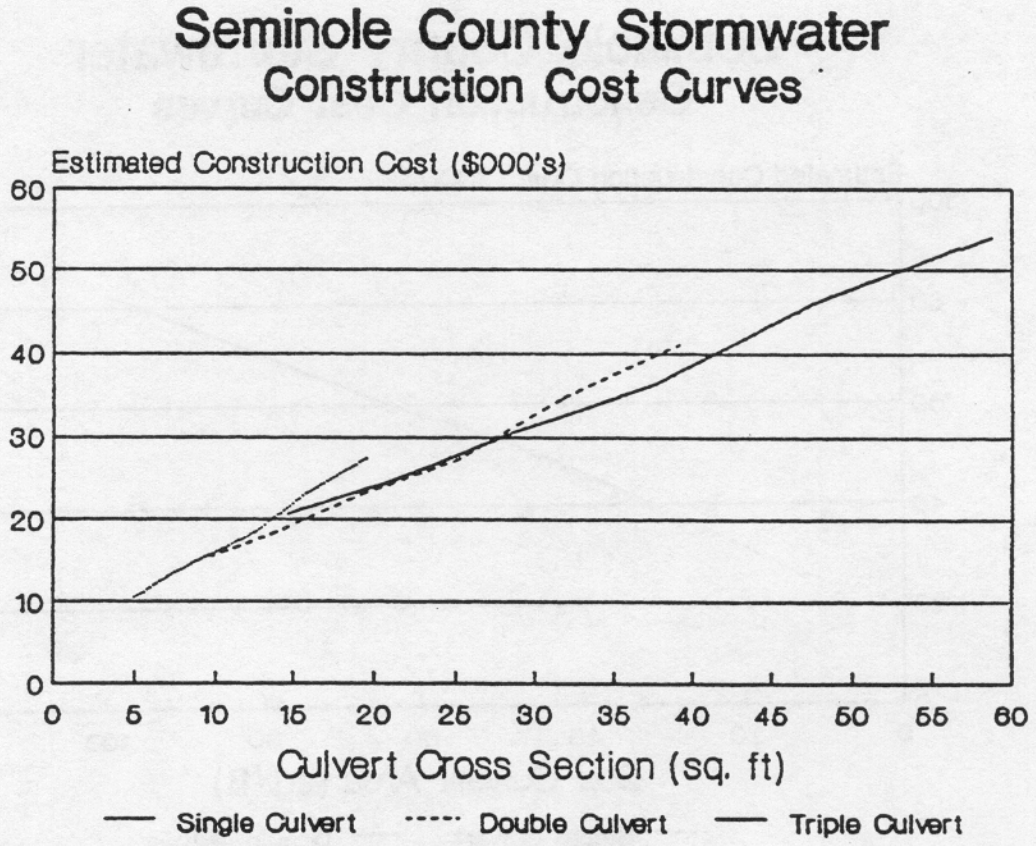


Figure 6-2

COST CURVES FOR BOX CULVERTS

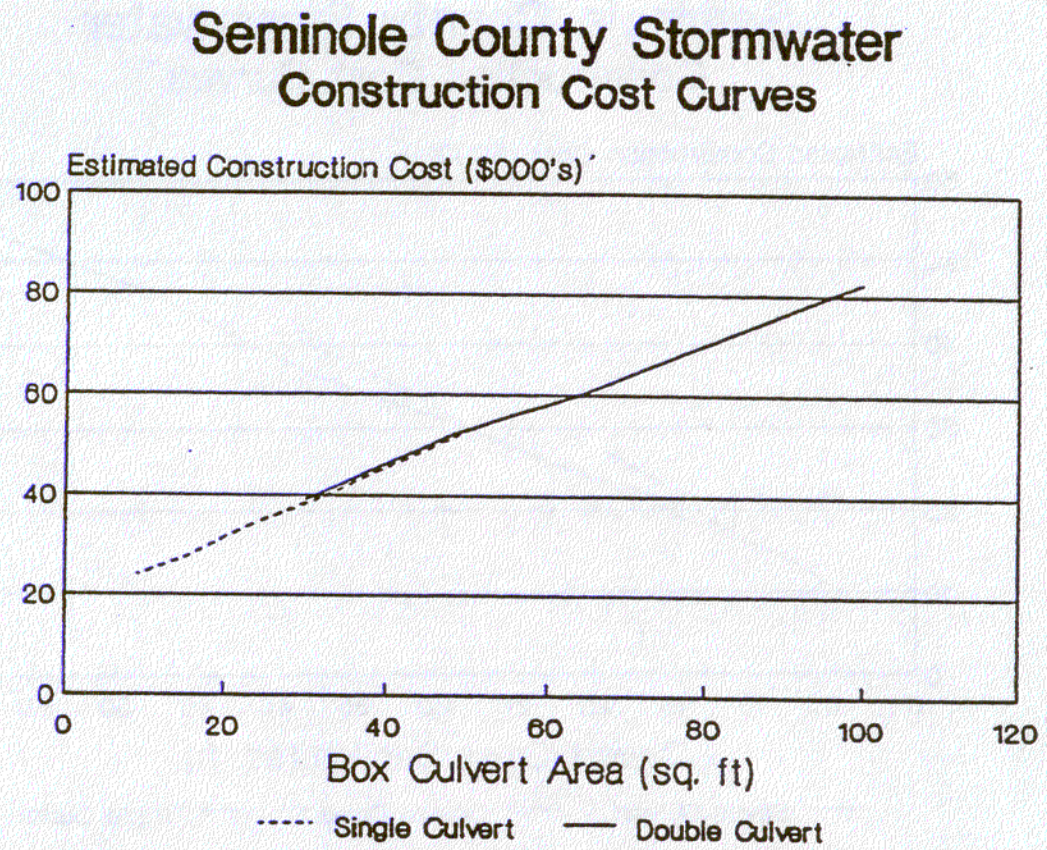
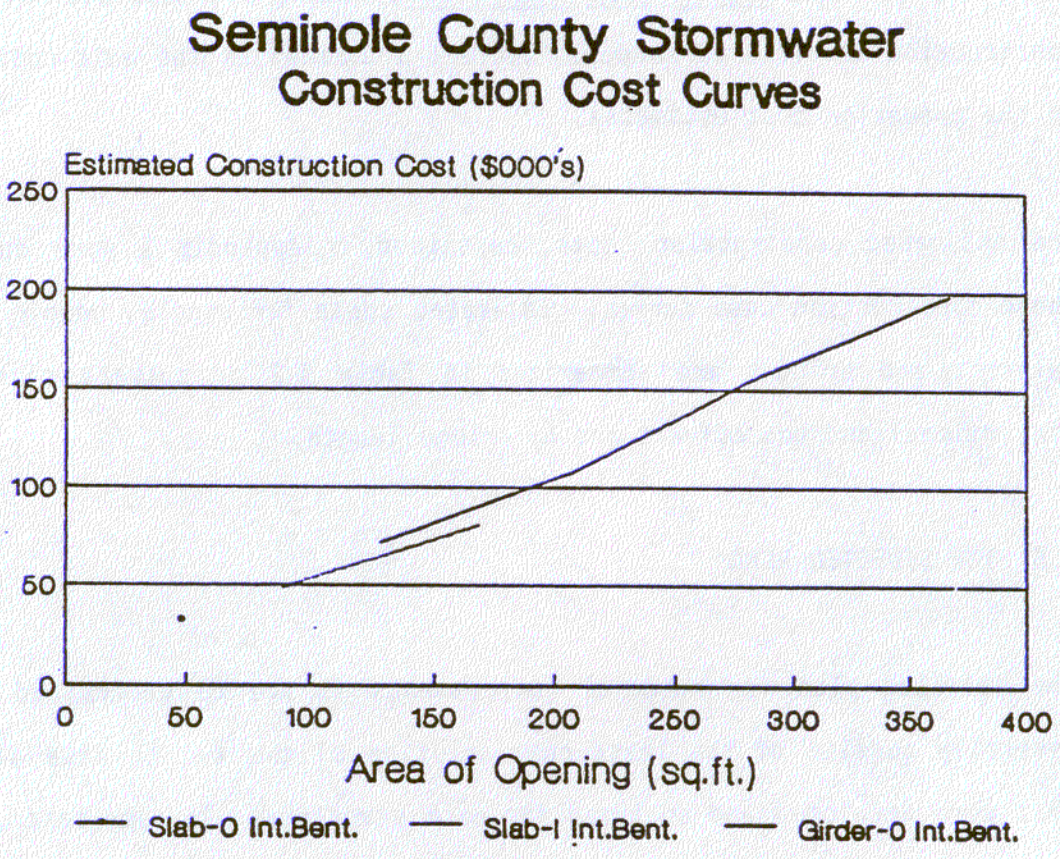


Figure 6-3

COST CURVES FOR BRIDGES



Unit costs for the proposed construction items were developed by consulting various sources and integrating the information into an appropriate unit cost for this project type, size and location. The sources reviewed include National Construction Estimator; Preliminary Estimates Section of the Florida Department of Transportation, Office of the State Estimates Engineer; PBS&J Master Price List; Engineering News-Record; recent bid tabulations; and PBS&J Construction Services personnel. Table 6-1 summarizes the unit costs utilized in the predesign cost estimates.

The estimated construction costs, contained in Appendix I were derived from these construction cost curves. Estimated costs for single, double and triple culverts and bridges are summarized in Table 6-2 by culvert size for both conventional and box culvert and by bridge length.

6.5 THE SELECTED PLAN

The selected plan for remedial improvements in the 65 undersized structures generally consist of the least cost solution of the two to five alternatives that were developed and analyzed for each structure. In some cases, the least cost solution was rejected because of the following reasons:

- The existing conduit was in poor structural condition
- The existing conduit was too small relative to the anticipated peak flow

TABLE 6-1

SUMMARY OF UNIT COSTS

Item		Unit	Unit Cost
Remove and Replace Asphalt Pavement		Sq.Yds.	$ 24
Remove Existing Drainage Structure(1)		Each	600 - 1,300(2)
Excavation		Cu.Yds.	7
Bedding and Backfill Material		Cu.Yds.	20
Culvert Pipe: 30"		L.F.	42
36"		L.F.	50
42"		L.F.	65
48"		L.F.	75
54"		L.F.	100
60"		L.F.	120
Reinforced Concrete:	Headwalls	Cu.Yds.	350
	Box Culverts	Cu.Yds.	400
Backfill		Cu.Yds.	13
Concrete Slab Span Bridge		Sq. Ft.	45
Prestressed AASHTO Girder Bridge:			
40' - 60' spans		Sq. Ft.	50
80' - 100' spans		Sq. Ft.	55

(1) Applies only to replacement with culvert pipe.

(2) Varies depending on size of replacement structure (assumes correlation to size of existing structure).

Table 6-2

SUMMARY OF REMEDIAL CULVERT SOLUTION COSTS

Conventional Culvert — Estimated Construction Cost

Size	Single	Double	Triple
30"	$10,800	$15,600	$20,700
36"	12,900	18,600	24,700
42"	15,700	23,000	30,700
48"	18,600	27,300	36,300
54"	23,200	34,700	46,000
60"	27,500	41,000	54,100

Box Culverts

Size			
3'x3'	$24,000	N/A	---
3'x5'	27,500	39,100	---
4'x6'	34,600	52,200	---
4'x8'	39,700	60,200	---
5'x10'	53,100	82,400	---

Bridges

Sizes		
20'	$32,400	Slab With No Intermediate Bent
30'	48,600	Slab With One Intermediate Bent
40'	64,800	Slab With One Intermediate Bent
50'	81,000	Slab With One Intermediate Bent
40'	72,000	Girder Bridge With No Intermediate Bent
50"	90,000	Girder Bridge With No Intermediate Bent
60'	108,000	Girder Bridge With No Intermediate Bent
80'	158,400	Girder Bridge With No Intermediate Bent
100'	198,000	Girder Bridge With No Intermediate Bent

- Operating conditions, relative cover, anticipated development activities or other considerations indicated that another alternative would provide the soundest long term solution for the problem.

The proposed solution for each of the 65 undersized structures is summarized in Table 6-3 by drainage basin. The cost of individual solutions range from a low of $9,800 for a simple parallel pipe to $79,400 for complete replacement of an existing structure with a twin box culvert. The total predesign construction cost of the proposed solutions is estimated at $1,504,800 The individual proposed solutions, representing the best solution for each structure, taken as a whole constitute "the selected plan".

6.6 PROJECT PRIORITIZATION

A simple numeric algorithm was developed for ranking priorities for replacement, rehabilitation or modification of existing structures. The algorithm considers the estimated current and future service levels as well as the growth, land use and relative basin location of each structure. The relative priority for each major structure providing service level C or D performance under future conditions was evaluated using the following algorithm:

Table 6-3

SUMMARY OF PROPOSED REMEDIAL SOLUTIONS

AND ESTIMATED COSTS

PRIORITY STRUCTURES

STRUCTURE NUMBER	PREFERRED SOLUTION	APPROXIMATE NEW CAPACITY (CFS)	PREDESIGN COST ESTIMATE ($)
Lake Monroe Basin:			
02-0118	Parallel w/ 36" RCP	157	12,900
02-0121	Parallel w/ 36" RCP	157	12,900
02-0221	Replace w/ triple 4' x 5' box culvert	534	56,500
02-0227	Replace w/ triple 36" RCP	180	24,700
02-0230	Replace w/ single 3' x 7' box culvert	187	34,600
02-0403	Replace w/ triple 36" x 58" CMPAC	330	37,500
02-0418	Parallel w/ 42" RCP	164	15,700
02-0421	Parallel w/ 31" x 50" CMPAC	90	16,000
02-0424	Parallel w/ 40" x 65" CMPAC	160	23,700
02-0439	Parallel w/ 24" RCP	76	9,800
Midway Basin:			
04-0103	Replace w/ twin 48" CMP	200	27,300
04-0104	Replace w/ twin 42" RCP	168	23,000
04-0112	Parallel w/ 54" RCP	175	23,200
04-0121	Replace w/ 36" x 58" CMPAC	108	19,000
04-0139	Replace w/ 43" x 68" ECP	110	23,700
04-0155	Replace w/ triple 36" RCP	150	24,700
04-0158	Replace w/ 43" x 68" ECP	141	23,700
04-0159	Replace w/ 36" x 58" ECP	110	19,000
04-0172	Replace w/ twin 3' x 6' box culvert	316	46,900
Lake Jessup Basin:			
05-0103	Replace w/ 25' bridge	548	40,500
05-0215	Parallel w/ 30" RCP	66	10,800
05-0218	Replace w/ 54" RCP	139	23,200
05-0315	Parallel w/ 42" RCP	138	15,700
05-0339	Parallel w/ 30" RCP	75	10,800
05-0533	Replace w/ 3' x 3' box culvert	79	24,000
05-0733	Replace w/ triple 36" RCP	150	24,700
05-0906	Replace w/ 3' x 8' box culvert	217	34,600

Table 6-3

SUMMARY OF PROPOSED REMEDIAL SOLUTIONS

AND ESTIMATED COSTS (continued)

STRUCTURE NUMBER	PREFERRED SOLUTION	APPROXIMATE NEW CAPACITY (CFS)	PREDESIGN COST ESTIMATE ($)
St. Johns Basin:			
06-0103	Parallel w/ 36" RCP	122	12,900
Big Econlockhatchee Basin:			
09-0206	Parallel w/ 36" RCP	236	12,900
09-0403	Parallel w/ 24" RCP	81	9,800
Howell Branch Basin:			
11-0103	Replace w/ twin 36" RCP	118	18,600
11-0805	Replace w/ 30' bridge	505	48,600
11-0816	Parallel w/ 31" x 50" CMPAC	123	16,000
11-0924	Parallel w/ 36" RCP	87	12,900
11-0930	Replace w/ 36" x 58" CMPAC	80	19,000
11-0931	Parallel w/ 48" RCP	170	18,600
11-1024	Parallel w/ twin 24" RCP	77	13,600
Little Lake Howell Basin:			
12-0103	Parallel w/ 36" RCP	120	12,900
12-0106	Parallel 42" RCP	150	15,700
12-0109	Replace w/ twin 36" RCP	122	18,600
12-0124	Parallel w/ 36" RCP	130	12,900
Gee Creek Basin:			
13-0309	Parallel w/ 24" x 38" ERCP	105	11,000
13-0403	Parallel w/ 36" x 60" CMAP	140	19,000
13-0609	Replace w/ twin 4' x 6' box culvert	426	69,200
13-1124	Replace w/ 3' x 3' box culvert	79	24,000

TABLE 6-3

SUMMARY OF PROPOSED REMEDIAL SOLUTIONS

AND ESTIMATED COSTS (continued)

STRUCTURE NUMBER	PREFERRED SOLUTION	APPROXIMATE NEW CAPACITY (CFS)	PREDESIGN COST ESTIMATE ($)
Soldier Creek Basin:			
14-0312	Replace w/ twin 48" RCP	212	27,300
14-0409	Construct detention pond		45,000
14-0421	Parallel 24" RCP	77	9,800
Little Wekiva Basin:			
15-0105	Parallel 36" RCP	120	12,900
15-0113	Replace w/ twin 4' x 8' box culvert	562	79,400
15-0162	Replace w/ 4' x 6' box culvert	426	34,600
15-0215	Replace w/ 3' x 8' box culvert	210	34,600
15-0226	Parallel 42" RCP	104	15,700
15-0229	Parallel 36" RCP	137	12,9[illegible]
15-0303	Replace w/ triple 36" CMP	180	24,7[illegible]
15-0309	Parallel w/ twin 36" RCP	165	18,600
15-0402	Parallel 30" RCP	106	10,800
15-0439	Parallel 30" RCP	86	10,800
15-0504	Parallel 2' x 4' box culvert	208	24,000
15-0512	Parallel 36" RCP	167	12,900
15-0513	Replace w/ twin 4' x 5' box culvert	330	32,000
Big Wekiva Basin:			
16-0109	Parallel 36" RCP	121	12,900
16-0112	Parallel 36" RCP	75	12,900
16-0115	Replace w/ twin 42" RCP	168	23,000
16-0403	Replace w/ triple 36" RCP	150	24,700
TOTAL ESTIMATED REMEDIAL COST:			$1,504,800

$$PP = (CSLP + FSLP) \times LUF \times IGF \times BPF$$

Where:

PP	=	Priority Points (1-5)
CSLP	=	Current Conditions Service Level Points (1-5)
FSLP	=	Future Condition Service Level Points (1.0 - 1.5)
LUF	=	Existing Condition Land Use Factor (1.0 - 1.6)
IGF	=	Incremental Growth Factor (1987-1995) (1.0 - 1.6)
BPF	=	Relative Basin Position Factor (1.0 - 1.5)

The priority points calculated for each major structure are used to assign relative construction priority rank such that the structure with the highest priority points would be constructed first and the structure with the lowest priority points would be constructed last. Algorithms similar to the algorithm developed for Seminole County are currently being used in the Cities of St. Petersburg, Florida and Lincoln, Nebraska. Other algorithms of similar construction are in use throughout the United States for project specific component prioritization.

Service level attainment must be considered as the key factor when evaluating priorities because the problems that are causing structure flooding must be corrected before the nuisance flooding problems elsewhere in the stormwater system are resolved. An arbitrary total point value of 5 was chosen for use in this ranking scale to characterize service level attainment. Relative factor values for both current and future conditions service level attainment were assigned as follows:

Service Level Attained	Point Value Assigned
A	0
B	1
C	3
D	5

Land use factors should assist the stormwater manager in ranking competing projects for construction priority. A case of flooding in an agricultural area due to an improperly sized culvert will impact fewer citizens than a minor flooding problem in a suburban or urban area. A higher population density in a problem area will result in a larger number of people being impacted by the resulting flooding. Consequently, the Land Use Factor (LUF) must be relatively linearly proportional with land use intensity. Relative factor values were assigned on the basis of existing land use intensity as follows:

General Land Use Intensity	Factor Value Assigned
Natural, Undeveloped	1.0
Agricultural	1.1
Agricultural/Residential	1.2
Suburban/LDR	1.3
Suburban/MDR	1.4
Urban/HDR	1.5
High Intensity PUD	1.5

The growth anticipated in an area in the near future (1987-1995) must also be considered when determining priorities. An area that is experiencing problems which is also projected to have rapid development and a large population increase is more likely to receive construction funds than a similar basin with exactly the same problems that is not expected to significantly change in the near future. Therefore, the Incremental Growth Factor(IGF) must be relatively linerarly proportional to projected growth in the immediate area of the structure. Estimates of incremental growth are based on the Traffic Analysis Zone (TAZ) level disaggregations of population and projections of total housing/hotel units developed in 1988 by Seminole County. TAZ growth rates were calculated using the following method:

$$CGR = 0.50 * (HGR + EGR)$$

Where:

CGR = Composite Growth Rate

HGR = Housing/Hotel Units Growth Rate

EGR = Employment Growth Rate

The calculated composite growth rates are converted to the Incremental Growth Factor (IGF) values based on the following relative basis:

Composite Growth Rate	Factor Value Assigned
0-25%	1.1
26%-50%	1.2

51%-100%	1.3
101%-200%	1.4
201%-300%	1.5
301%-500%	1.6

The location of a structure modification/replacement within a basin must also be evaluated when assigning priorities. When more than one structure on a channel must be replaced it is prudent practice to start with the downstream structures and work upstream. Otherwise, improvements made in upstream structures (prior to downstream improvements) tend to move the existing problem down the channel and cause flooding in the lower portion(s) of the basin. A relative Basin Position Factor (BPF) is utilized in the algorithm to reflect the potential impact of this phenomena. The following relative factor values were utilized:

Relative Basin Position	Factor Value Assigned
Upper Third	1.0
Middle Third	1.2
Lower Third	1.5

The algorithm was applied to the 65 structures previously identified for remedial improvements. The priority points for these structures ranged from a low of 7.2 to a high of 26.9 points. The resulting point values and relative construction priority of each considered structure is summarized in Table 6-4.

Table 6-4

PRIOITY RANKING OF PROPOSED CIP PROJECTS

RELATIVE PRIORITY POSITION	STRUCTURE NUMBER	PREFERRED SOLUTION	APPROXIMATE NEW CAPACITY (cfs)	PREDESIGN COST ESTIMATE	TOTAL PRIORITY POINTS
1	14-0312	Replace w/ twin 48" RCP	212	$27,300	26.9
2	15-0162	Replace w/ 4' x 6' box culvert	426	$34,600	25.2
3	15-0513	Replace w/ twin 4' x 5' box culvert	330	$32,000	25.2
4	11-0924	Parallel w/ 36" RCP	87	$12,900	21.0
5	11-0805	Replace w/ 30' bridge	505	$48,600	21.0
6	02-0424	Parallel w/ 40" x 65" CMPAC	160	$23,700	19.8
7	05-0103	Replace w/ 25' bridge	548	$40,500	19.5
8	11-0103	Replace w/ twin 36" RCP	118	$18,600	19.5
9	15-0113	Replace w/ twin 4' x 8' box culvert	562	$79,400	18.7
10	15-0215	Replace w/ 3' x 8' box culvert	210	$34,600	18.5
11	02-0230	Replace w/ single 3' x 7' box culvert	187	$34,600	18.5
12	11-1024	Parallel w/ twin 24" RCP	77	$13,600	18.2
13	11-0931	Parallel w/ 48" RCP	170	$18,600	18.2
14	16-0403	Replace w/ triple 36" RCP	150	$24,700	17.3
15	02-0221	Replace w/ triple 4' x 5' box culvert	534	$56,500	17.2
16	04-0104	Replace w/ twin 42" RCP	168	$23,000	17.2
17	02-0227	Replace w/ triple 36" RCP	180	$24,700	17.2
18	05-0339	Parallel w/ 30" RCP	75	$10,800	16.9
19	04-0155	Replace w/ triple 36" RCP	150	$24,700	16.5
20	04-0103	Replace w/ twin 48" CMP	200	$27,300	16.5
21	02-0403	Replace w/ triple 36" x 58" CMPAC	330	$37,500	16.5
22	13-1124	Replace w/ 3' x 3' box culvert	79	$24,000	16.1
23	05-0533	Replace w/ 3' x 3' box culvert	79	$24,000	15.6
24	05-0218	Replace w/ 54" RCP	139	$23,200	15.6
25	15-0303	Replace w/ triple 36" CMP	180	$24,700	15.4
26	13-0609	Replace w/ twin 4' x 6' box culvert	426	$69,200	15.4
27	16-0115	Replace w/ twin 42" RCP	168	$23,000	15.4
28	16-0109	Parallel 36" RCP	121	$12,900	15.0
29	16-0112	Parallel 36" RCP	75	$12,900	14.3
30	14-0409	Construct detention pond	N/A	$45,000	13.7
31	11-0816	Parallel w/ 31" x 50" CMPAC	123	$16,000	13.5
32	12-0124	Parallel w/ 36" RCP	130	$12,900	13.4
33	06-0103	Parallel w/ 36" RCP	122	$12,900	13.2
34	02-0121	Parallel w/ 36" RCP	157	$12,900	13.2
35	02-0118	Parallel w/ 36" RCP	157	$12,900	13.2

Table 6-4

PRIORITY RANKING OF PROPOSED CIP PROJECTS (Continued)

RELATIVE PRIORITY POSITION	STRUCTURE NUMBER	PREFERRED SOLUTION	APPROXIMATE NEW CAPACITY (cfs)	PREDESIGN COST ESTIMATE	TOTAL PRIORITY POINTS
36	02-0421	Parallel w/ 31" x 50" CMPAC	90	$16,000	13.2
37	15-0226	Parallel 42" RCP	104	$15,700	13.2
38	13-0309	Parallel w/ 24" x 38" ERCP	105	$11,000	13.0
39	05-0906	Replace w/ 3' x 8' box culvert	217	$34,600	13.0
40	05-0215	Parallel w/ 30" RCP	66	$10,800	12.0
41	12-0109	Replace w/ twin 36" RCP	122	$18,600	12.0
42	15-0309	Parallel w/ twin 36" RCP	165	$18,600	12.0
43	12-0106	Parallel 42" RCP	150	$15,700	12.0
44	05-0733	Replace w/ triple 36" RCP	150	$24,700	12.0
45	15-0229	Parallel 36" RCP	137	$12,900	11.9
46	15-0439	Parallel 30" RCP	86	$10,800	11.4
47	11-0930	Replace w/ 36" x 58" CMPAC	80	$19,000	11.2
48	04-0112	Parallel w/ 54" RCP	175	$23,200	11.0
49	04-0139	Replace w/ 43" x 68" ECP	110	$23,700	11.0
50	04-0172	Replace w/ twin 3' x 6' box culvert	316	$46,900	11.0
51	15-0105	Parallel 36" RCP	120	$12,900	10.6
52	09-0403	Parallel w/ 24" RCP	81	$9,800	10.4
53	14-0421	Parallel 24" RCP	77	$9,800	10.3
54	02-0418	Parallel w/ 42" RCP	164	$15,700	9.9
55	02-0439	Parallel w/ 24" RCP	76	$9,800	9.9
56	12-0103	Parallel w/ 36" RCP	120	$12,900	9.5
57	09-0206	Parallel w/ 36" RCP	236	$12,900	9.5
58	05-0315	Parallel w/ 42" RCP	138	$15,700	8.8
59	04-0158	Replace w/ 43" x 68" ECP	141	$23,700	8.6
60	04-0159	Replace w/ 36" x 58" ECP	110	$19,000	8.6
61	15-0504	Parallel 2' x 4' box culvert	208	$24,000	8.4
62	04-0121	Replace w/ 36" x 58" CMPAC	108	$19,000	7.9
63	15-0402	Parallel 30" RCP	106	$10,800	7.8
64	15-0512	Parallel 36" RCP	167	$12,900	7.2
65	13-0403	Parallel w/ 36" x 60" CMAP	140	$19,000	7.2

Section 7

SECTION 7

Section 7

STORMWATER MANAGEMENT PROGRAM

7.1 GENERAL

Stormwater Management Master Plans are a compilation of many elements brought together into one guiding plan document. This section brings together, for an overview, stormwater program goals, objectives, and policies, a flooding complaint management system, identifies institutional procedures and constraints, identifies and prioritizes projects, discusses capital and O&M needs, provides a program strategy and assess funding needs. These elements, when used as planning tools, provide the direction and guidance for Seminole County's Stormwater Management Program.

7.2 GOALS, OBJECTIVES AND POLICIES

Seminole County will have to develop methods to manage stormwater and direct growth with a minimum expenditure of funds. The goals, objectives, and policies formulated in this Section take this need into consideration along with the fact that even though state-of-the-art methods can be implemented in Seminole County in the same fashion that they are used in metropolitan population centers with vastly greater data bases and funding sources, the County cannot expect to replicate their stormwater management programs with their current levels of revenue allocation. The stormwater needs for Seminole County can be broken into three components stemming from the protection of the

health, safety and welfare of the public. The three areas are flooding control, pollution abatement and funding to prevent or address the first two.

The following are goals, objectives and policies recommended for adoption within the County's comprehensive plan. These goals, objectives and policies address the requirements of the State Growth Management Act and also set the direction for the development and management of the County Stormwater facilities.

Goal: Minimize the direct and indirect adverse impacts of uncontrolled flooding and stormwater runoff to the public health, safety and welfare and to the quantity and quality of natural resources in a cost effective manner.

Objective I

Develop and implement a program to identify, quantify and systematically eliminate existing and anticipated future facility deficiencies.

Policies

1a. Build upon the existing drainage studies to establish a comprehensive and quantifiable inventory and analysis of all drainage systems over a five-year period as follows:

- o complete a comprehensive survey and systems condition assessment of all drainage ways;
- o accept interim levels of service as a means to measure and prioritize identified planning level structure improvement and study needs;

- o conduct individual drainage basin master plans which assess and quantify service level capacities and identify existing and future system deficiencies;

- o prioritize basin master studies based on the 1989 Stormwater Planning Study, ongoing agency studies, identified deficiencies and anticipated growth;

- o adopt acceptable service level standards within the Capital Improvement Element based on completed basin master plans for use in regulating development and implementing a stormwater capital improvements program.

1b. Eliminate existing facility deficiencies through a systematic program to upgrade existing structures and/or construct areawide systems.

1c. Expand and develop the existing drainage complaint tracking system to facilitate the identification of nuisance problems; assist in locating and prioritizing capital projects and establish a database of historical drainage needs and corrective actions taken.

Objective II

Protect the public safety, welfare and property from hazards of flooding thru effective regulation, design and maintenance of stormwater facilities and systems. This includes the provision of existing and future development which is consistent with existing regualtions and programs while maximizing use of existing facilities.

Policies

IIa. Coordinate annual reviews and proposed changes to the Land Development Code and Surface Water Management Standards with the St. Johns River Water Management District rules and regulations.

IIb. Develop and implement an effective, on going maintenance and enforcement program that will assure open and unobstructed

drainage corridors and maximize use of existing system capacities.

IIc. Continue to administer FEMA regulatory program requirements and adopt FIRM flood plain and floodway delineation mapping in the absence of site specific mapping.

IId. Create through ordinance, proscriptive laws to regulate water degradation and implement an effective stormwater management enforcement program in conjunction with the SJRWMD and other jurisdictions.

IIe. Develop and implement maintenance levels of service as a means to schedule an on-going maintenance program.

IIf. Prohibit development in areas subject to flooding problems and in the development review process permit only minor modification, with compensating storage, of the 100 year flood elevation.

IIg. Continue to require conservation easements/dedication requirements as a means of protecting the functions of floodways.

IIh. Prohibit alteration of existing structures and natural drainage systems that would potentially endanger public safety and/or leave an adverse effect on property, water quality or other natural resources.

IIj. Continue to rely upon and periodically update the Land Development Code and Surface Water Management Standards to ensure that the design and operation of stormwater facilities is consistent with adopted engineering standards and encourages the use of best available management practices.

IIk. Require the use of temporary or permanent erosion and sediment control measures and drainage easements to protect adjacent property owners from potential adverse impacts and minimize water quality degradation.

IIl. Coordinate the implementation of stormwater projects with roadway or other facility improvements to maximize funds and to ensure that detailed drainage studies provide proper sizing of new and replacement structures, delineation of flood plain boundaries and upstream and downstream impacts.

IIm. The planning, Engineering and Development Review Departments should coordinate to assess the adequacy of drainage

facilities to meet the need of proposed developments or anticipated growth.

Objective III

Maintain or improve the quality and function of natural drainage systems, ground and surface waterways, recharge areas and associated natural resources through emphasis on non-structural approaches to floodplain management.

Policies

IIIa. Continue to rely on a non-structural approach to flood plain management in order to maximize flood holding capacity and minimize public expenditure for capital and maintenance costs.

IIIb. Establish a Countywide program to identify and assess potential sources/extent of water quality degradation related to stormwater runoff.

IIIc. Continue to work with the SJRWMD, Soil Conservation Service, FEMA and other agencies to update mapping of floodways, identify point sources of pollution, conduct basin specific studies and develop regulations for the protection of drainageways.

IIId. Continue to rely on the Land Development Code and encourage non-structural techniques to ensure stormwater runoff be treated to reduce the pollutant loads discharged into receiving waters.

IIIe. Prohibit development practices, such as the use of drainage canals, which create over-drainage of land and soil.

IIIf. Encourage on-site detention and/or retention facilities in upland areas to maximize groundwater recharge.

IIIg. Establish a surface water quality management plan to monitor and protect the quality and functioning of surface and groundwater resources and to implement the requirements of the National Pollution Discharge Elimination System (NPDES).

IIIh. Encourage the use of wetlands for stormwater treatment only when demonstrated that the use will maintain or enhance the long term natural viability of the wetland system.

Objective IV

Research and implement innovative and feasible regulations and financing mechanisms to eliminate existing deficiencies, maintain existing systems and plan future needs.

Policies

IVa. Develop incentives and set standards for joint developer/County projects to upgrade and maintain deficient drainage systems impacted by new developments.

IVb. Study and assess the feasibility and practicality of implementing area-wide or regional stormwater treatment facilities.

IVc. Study the feasibility of implementing a stormwater utility system to include the potential for a countywide system.

These integrated goals and objectives with supporting policies provide a philosophically and procedurally consistent basis for the planning design and construction of new facilities and systems and overall stormwater management in Seminole County.

7.3 FLOODING COMPLAINT MANAGEMENT SYSTEM

As Seminole County's population grows and land uses, by necessity, become more intensive, surface drainage problems will become more pronounced. In a similar manner the need for an adaptable system of organizing and responding

to drainage complaints becomes more important. The driving force behind the attention paid to increased levels and frequencies of flooding are the increased cost of damage to land and structures due to inadequate stormwater facilities. The need for an adequate stormwater complaint system is tied to the usage of land, the value of the structures and other improvements made to the land.

The complexity and magnitude of a complaint management system should not be keyed to the physical size or conditions in the area but rather to the value of the property it is designed to safeguard. The flood complaint management systems in national and regional use vary from nonexistent to being extremely complex. Likewise, the level of drainage service provided by governments varies within the same bounds.

Drainage problems are one of the critical areas of concern which Seminole County has to deal with today. A system of identifying drainage problems and establishing a priority ranking for remedial solutions in the unincorporated county would be very beneficial. As part of this study PBS&J has developed a "Flood Complaint Management System" which will provide several major benefits as follows:

- Identification of existing flooding and drainage problems in unincorporated Seminole County.

- o Ranking of identified problems according to their severity from major problems which need immediate attention to minor problems where corrective action can be delayed.

- o Documentation of the corrective action taken.

- o Information base for developing CIP projects and prioritization.

The following section (1) examines and identifies the goals, scope and products of the flood complaint management system, (2) addresses the needs, both present and future, of Seminole County and for a flood complaint management system, and (3) provides a system which can be utilized by the County for accurate and useful flood complaint receiving, tracking and storage.

Identifying flooding and drainage problems requires a method by which the problems can be ranked by relative importance from highest to lowest. Ranking of the priorities of problems for remedial action is necessary since the County does not have adequate funds or manpower to correct all problems at once. Table 7-1 describes the ranking system proposed for Seminole County. When a problem is identified and its location shown on the base map, the relationship of one problem to another will become evident. There are problems that are interrelated and best worked on at the same time. For example a minor problem, which has a low priority, may be part of a larger overall problem which has a high priority ranking.

TABLE 7-1

FLOODING PRIORITY RANKING SYSTEM

Priority	General Description of Flooding
1	Endangers human life and/or presents a public health hazard and/or exceeds first floor elevation which causes structural damage.
2	Water Exceeds first floor elevation but causes no structural damage and/or causes structural damage without exceeding first floor elevation.
3	Damages to public utilities or transportation facilities and/or causes major yard or lot flooding.
4	Prolonged inundation of major roadways which prohibits vehicular access under emergency response conditions.
5	Intermittent inundation of major roadways which inhibits traffic and/or prolonged inundation of residential streets which prohibits vehicular access for greater than eight hours.

7.3.1 Existing Drainage Complaint Tracking System

Through the course of this study, the Seminole County Department of Engineering implemented a formal system for recording and tracking of drainage complaints. The system tracks complaints on a computer and could interface with the system proposed in this study. The most common means by which flooding complaints would be received is by telephone or personal interview with County Drainage Engineering staff or Seminole County Commissioners. Drainage complaints to commissioners are generally directed to the County Pulbic Works staff with the pertinent name, date, and location data.

7.3.2 Database Needs

In order to define the attributes of a flood complaint tracking system, the purpose, goals and scope of the system must be identified. The purpose of a complaint tracking system is to (1) receive complaints and generate work requests, (2) track complaint status and to record remedial action and (3) provide a site-specific flooding complaint history. The tracking of stormwater problems will need to be identified on a base map so that current and future trends can be seen and managed in an effective manner. The base map will need to be continually updated so that the interrelationship of one problem area with another will be graphically depicted.

The data required for input includes, but is not be limited to, the following characteristics:

- o Location of problem
- o Date and time the complaint was received
- o Type of stormwater problem
- o Identification of the individual(s) reporting the problem's name and phone number
- o Who received the report on the County's behalf

Once all information has been taken, a mechanism to initiate and track the action taken on the problem must be activated. That system to track remedial action will require the following data:

- o Date problem was confirmed and inspected
- o Name of person performing inspection
- o Observed location of problem
- o Identified cause of the problem
- o Remedial action required to correct problem
- o Assigned priority ranking
- o Crew days required to complete maintenance (estimated and/or actual)

Additionally, the system should track the number of complaints turned in on each problem as a function of storm events. In this way, a chronic problem which has been worked on before will be detected and if the maintenance action

utilized has not been effective, a new form of corrective action can be taken. Areas of chronic flooding problem will show up in the system and causes should become more apparent.

The size and complexity of the flooding problem will directly affect the remedial action taken and will determine the manageability of a problem based on the available resources. There will be problems that are either individually so large or that are a part of a larger problem that requires a comprehensive regional evaluation. These major problems will require a longer response time and larger remedial action budget. The priority ranking list should serve as a guide to aid the County in choosing and scheduling drainage projects along with input from other sources.

7.3.3 Database Design

A variety of alternatives were reviewed to determine the most practical means of developing the database. The analysis included an evaluation of a variety of database management software packages i.e., Lotis 1-2-3, Symphony, etc., to be used for the system. The dBase III database management software, as developed by Ashton-Tate, was chosen as the software to be used for the County's complaint system because it provided the best system for saving and processing large amounts of data and was the most user friendly. dBase III is a database management system that is relatively easy to use, versatile for storage, management and retrieval of information from microcomputers. dBase III also allows the user to manipulate, sort, and file the data to produce a wide variety of customized reports.

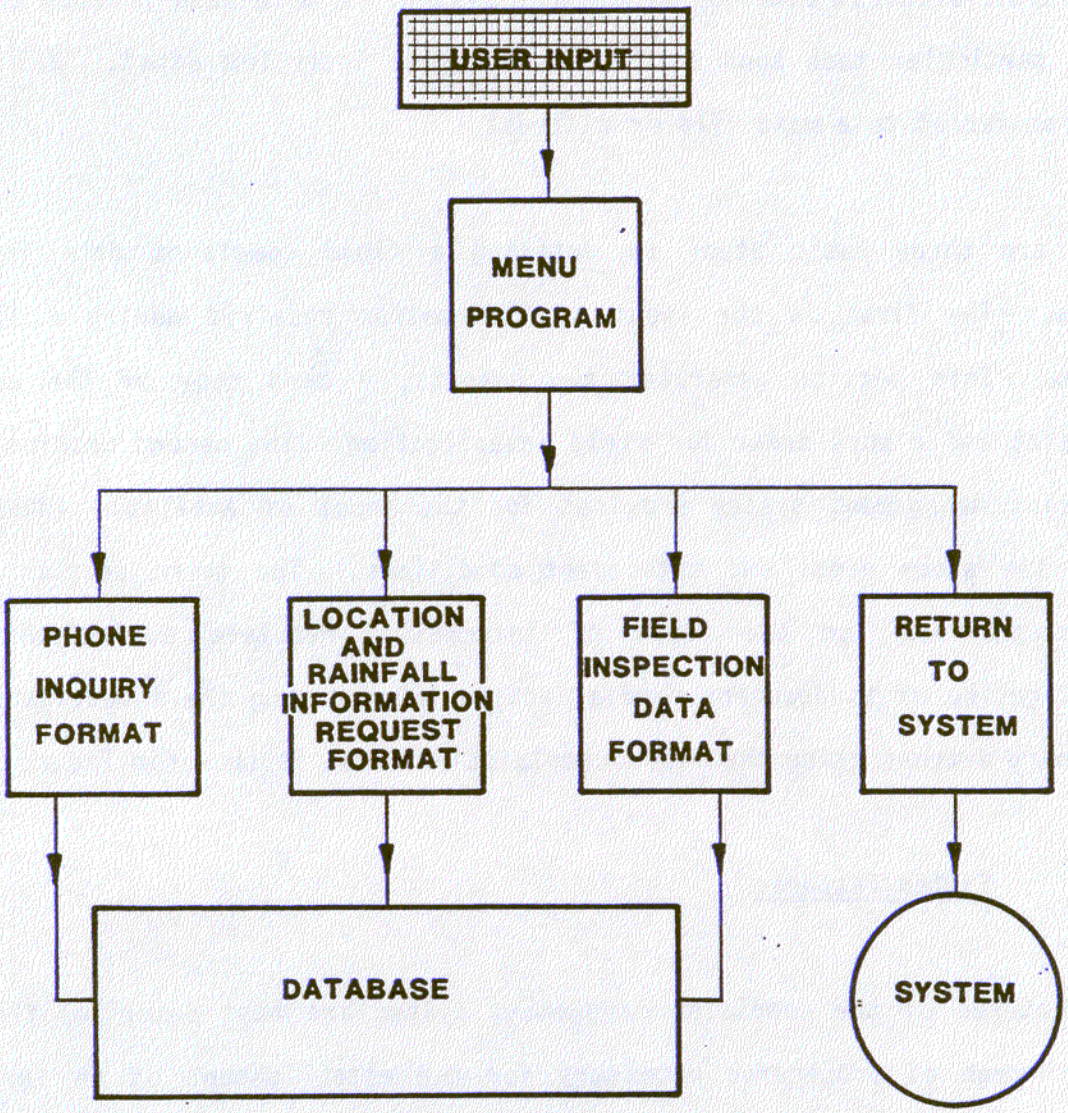
7.3.4 System Configuration

The system is organized into a variety of programs all interlinked to a main database. The database can basically be characterized as a network/hierarchical database management system. A main menu prompts the user for a particular task such as "enter telephone interview data". All inputs are transferred to a main file or database.

There are three basic steps to entering a flood complaint data into the system. The first is the input of information received during a flooding report. This section generates two outputs, a hard copy of the drainage complaint and a work order for field investigation. The second section of the complaint management system provides for the input of available information about the storm event and antecedent conditions. The third section of the system provides for the input of information received during the field investigation or to document remdial action taken during the investigation. A flowchart demonstrating the flood complaint database is shown in Figure 7-1.

7.3.5 System Features

The features of the complaint management system are best described through a walk-through of procedures necessary for the establishment of an individual complaint file. Figures 7-2 through 7-6 present a copy of the data entry "screens" used to enter a flood complaint into the database. Figure 7-2 is the initial program selection screen, also known as the menu, in which the



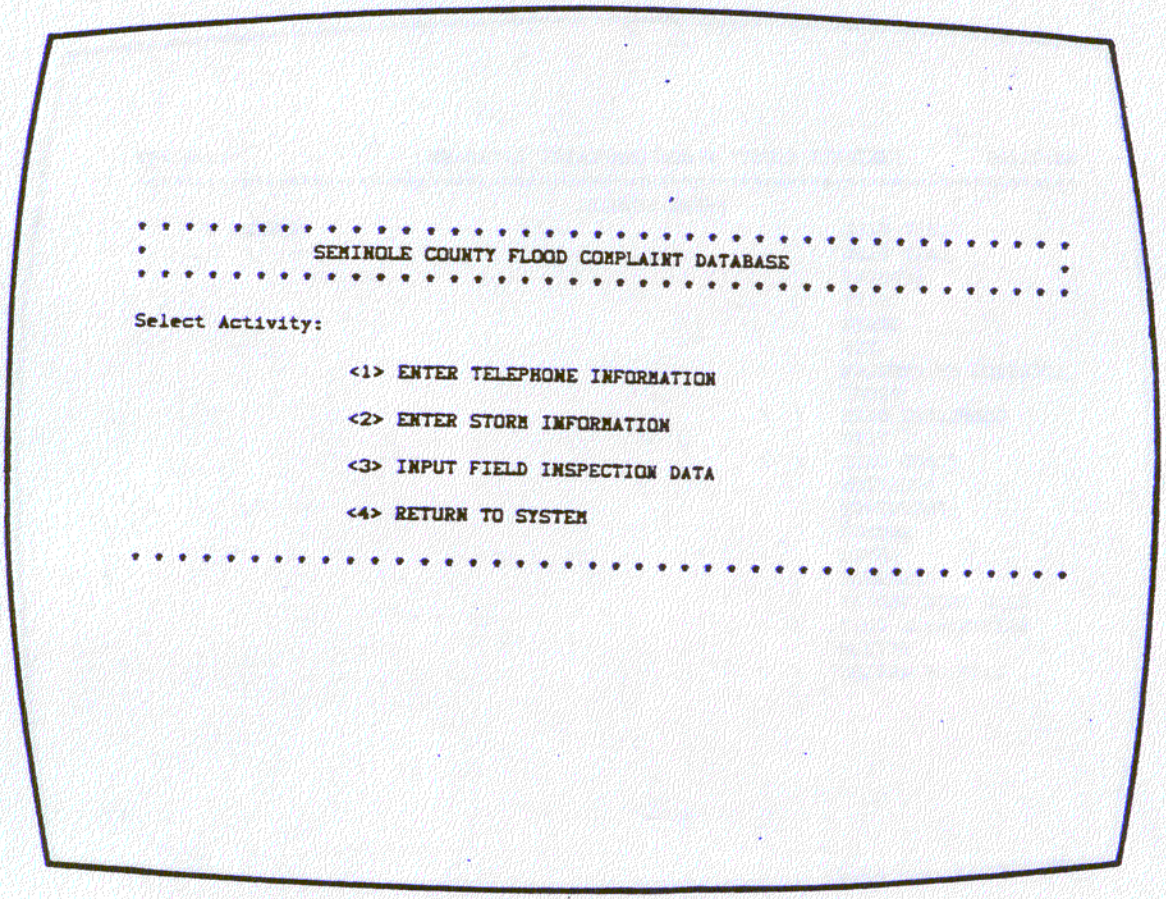
dBASE III STRUCTURE

PBSJ POST, BUCKLEY, SCHUH & JERNIGAN, INC.
SEMINOLE COUNTY
FLOOD COMPLAINT DATABASE FLOWCHART

FIGURE 7-1

74038

REPRO PRODUCTS INC.

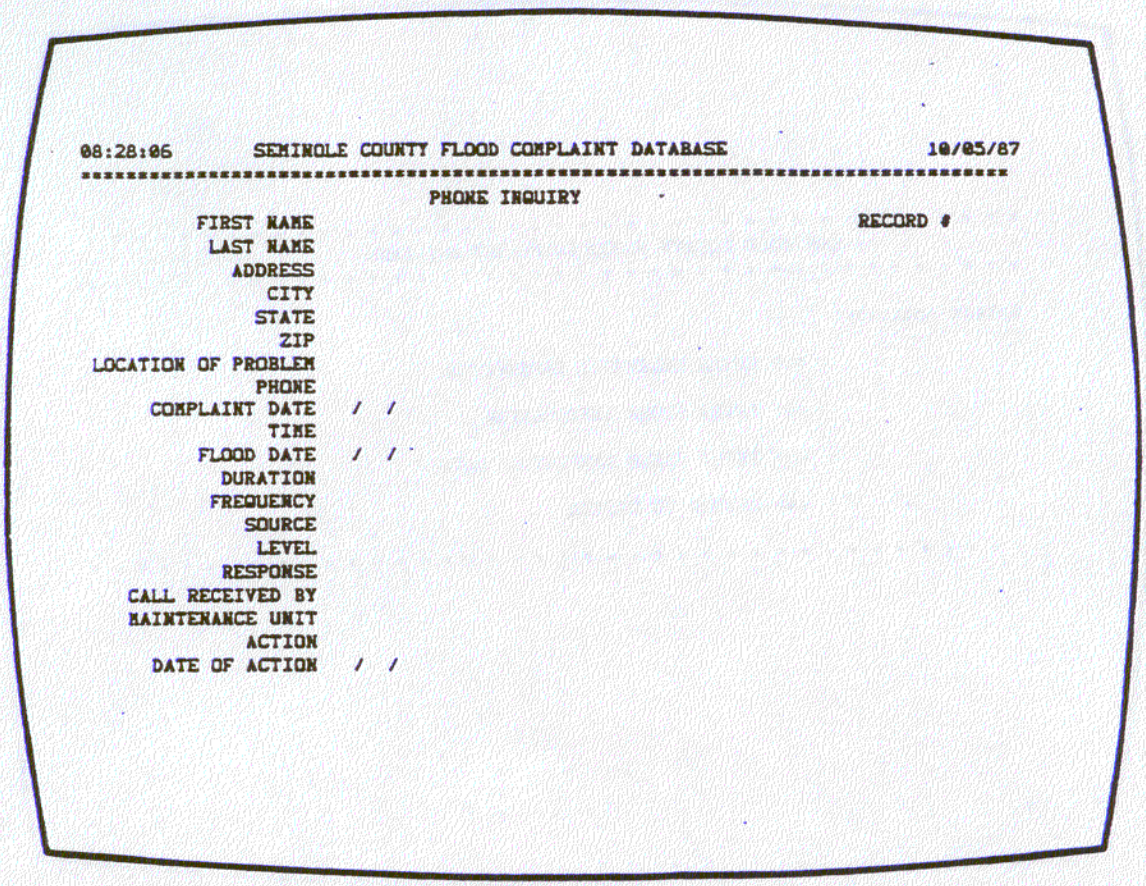


Initial Program Selection Screen

PBSJ POST, BUCKLEY, SCHUH & JERNIGAN, INC.
SEMINOLE COUNTY
STORMWATER MANAGEMENT MASTER PLAN

FIGURE 7-2

REPRO PRODUCTS INC.

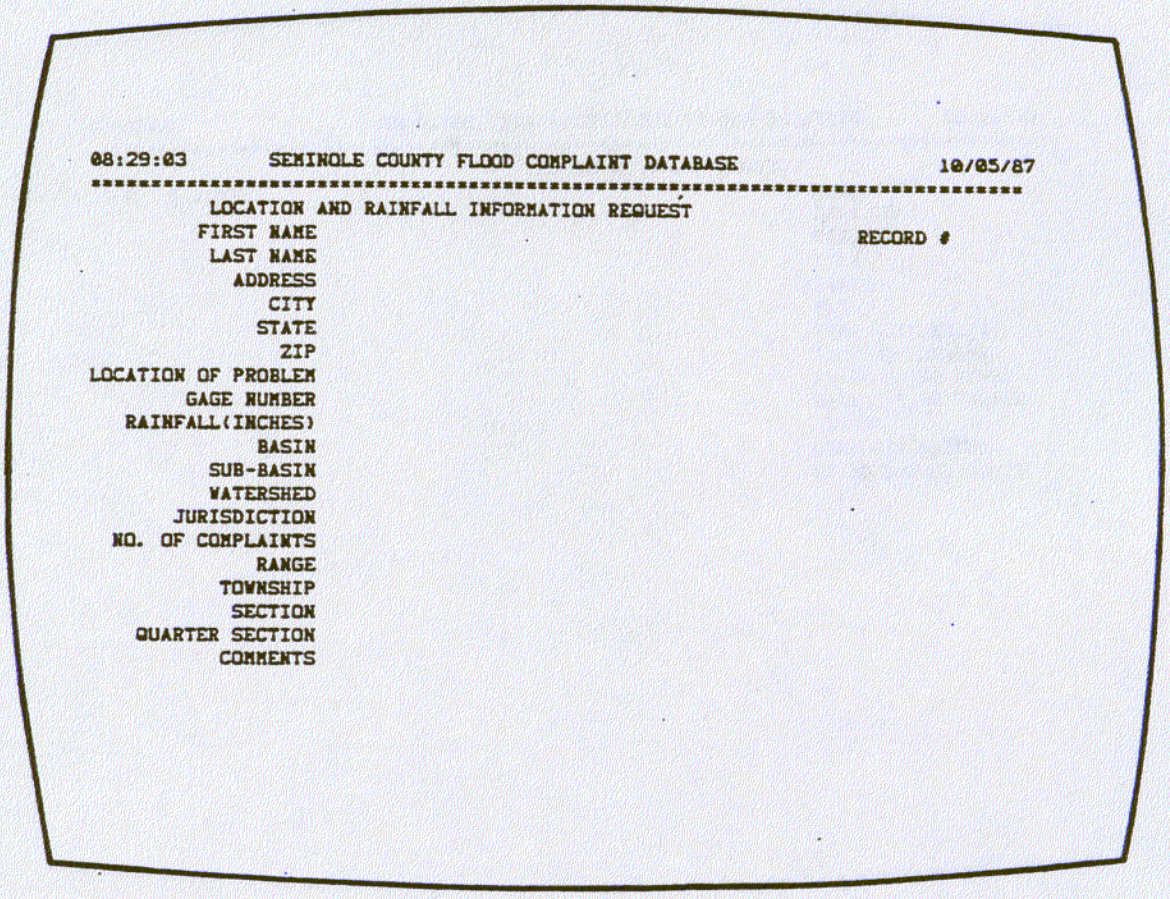


Flooding Data Entry Screen

PBSJ POST, BUCKLEY, SCHUH & JERNIGAN, INC.
SEMINOLE COUNTY
STORMWATER MANAGEMENT MASTER PLAN

FIGURE 7-3

REPRO PRODUCTS INC.

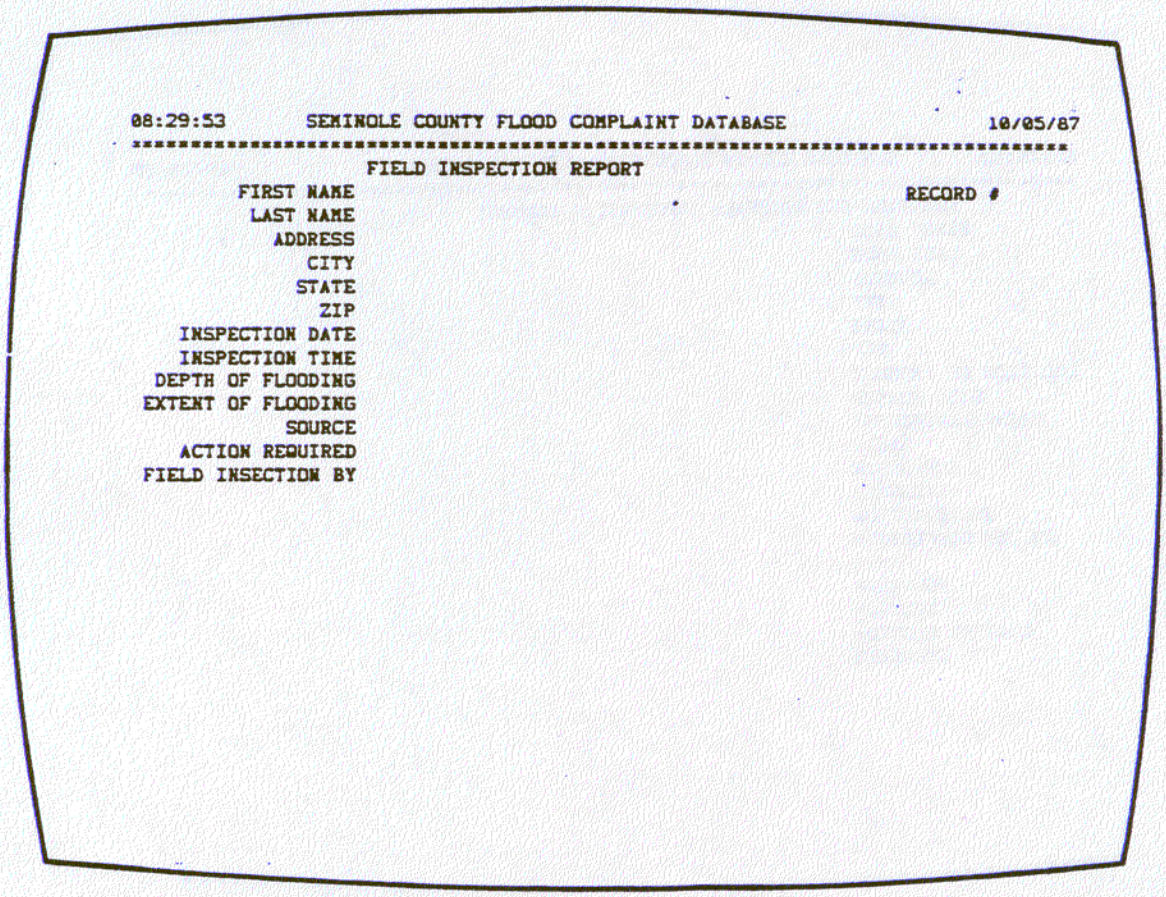


Supplemental Data Prompting Screen

PBSJ POST, BUCKLEY, SCHUH & JERNIGAN, INC.
SEMINOLE COUNTY
STORMWATER MANAGEMENT MASTER PLAN

FIGURE 7-4

REPRO PRODUCTS INC.



Field Inspection Report Screen

PBS&J POST, BUCKLEY, SCHUH & JERNIGAN, INC.

SEMINOLE COUNTY

STORMWATER MANAGEMENT MASTER PLAN

FIGURE 7-5

74038
REPRO PRODUCTS INC.

SEMINOLE COUNTY FLOOD COMPLAINT DATABASE

* * * * * * * * * * * * * * FIELD INSPECTION REPORT * * * * * * * * * * * * * *

DATE:_____

TIME:_____

DEPTH OF FLOODING:_____

AREA EXTENT OF FLOODING:_____

HIGH WATER MARKS: ( ) OBSERVED ( ) MARKED

CAUSE:_____

_____

_____

_____

_____

REMEDIAL ACTION TAKEN/REQUIRED: _____

_____

_____

FIELD INSPECTION BY:_____

Sample Drainage Complaint Maintenance Unit Report

operator selects the type of input function to be performed. There are four choices: entering telephone (or referral) information, entering storm data, entering field inspection data or exiting the complaint file.

Figure 7-3 presents the flooding data entry screen in which the operator enters pertinent complaint data. The information on flood source level and frequency is easily obtainable on a telephone interview but is less likely to be included on a complaint referral. Follow-up telephone contact with the citizen is a valuable public relations tool and can provide necessary additional information. Figure 7-4 presents the supplemental data prompting screen which solicits additional data on complaint location (range, township, section and quarter section). The specific location data provide the necessary input to determine the closest rainfall gage from which storm data would be available.

Figure 7-5 presents the field investigation data prompting screen, which solicits data on the results of the field inspection of a drainage complaint. The field inspection should be conducted either by County Stormwater Management Division staff or be investigated by Maintenance Unit personnel. Figure 7-6 is the drainage complaint field unit response which provides information on the remedial activities, if any, that were performed and the date of performance or on the recommended remedial activity which needs to be undertaken to prevent future problems.

7.3.6 Hardware and Software Requirements

The computer hardware utilized by PBS&J to create the data files for Complaint Management System consists of an IBM microcomputer in combination with Ashton-Tate's proprietary dBase III software. Both items are standard and are locally available. Table 7-2 presents a list of hardware items identified by manufacturer, model number and a brief statement of purpose or use in the system. The components summarized in Table 7-2 represent hardware configurations used by PBS&J for the creation of the Complaint Management System. Other compatible configurations may be added or substituted according to Seminole County's needs. Due to the complexity and sheer size of the data files expected for a long period of record, the use of a high density external storage devices is recommended in order to ensure adequate file storage capacity, facilitate data file manipulation and ensure the replicability of lost or damaged files. The use of diskettes to satisfy external storage needs is possible, however, the number of diskettes required for file back-ups and the time involved in loading and copying the material is considerable. In addition, any database sorting routines would require access to large volumes of the data. An alternate choice for this purpose would be a peripherial storage device suitable for small computer systems such as an external fixed disk system (Tallgrass System), an external exchangeable disk system (Bernoulli Box) or an external high density tape system (Maynstream tape back-up system). The benefits of these devices are ease and speed of operation and efficient use of magnetic media.

TABLE 7-2

RECOMMENDED COMPUTER SYSTEM HARDWARE

Device	Manufacturer and Model	Purpose
Computer	IBM-AT with: 1.2M Floppy Disk Drive* 360K Floppy Disk Drive 20M Hard Disk 512K RAM	Data Manipulation, Transfer and Storage
Computer Enhancements	AT Math Co-Processor*	Increase speed of math manipulations
	AST Advantage with 512K RAM	Increase memory and peripheral capability
	IBM Color Card	Control Card for Color Monitor
	Keyboard with Digital Key Pad	Computer Control and Digital Data Input
Printer	Okidata 193*	Digital Data Output
Monitor	Princeton RGB HX-12 High Resolution Color Monitor	Operations and Graphic Data Manipulation
Digitizer	Calcomp Model 9100*	Graphic Data Input
Plotter	Houston Instruments DMP 42*	Graphic Data Mapping
External Storage	Maynstream	20M Tape Backup System

*Optional Equipment

7.3.7 Implementation Program

There are several steps required to implement a complaint management system of this type. These steps comprise (1) the familiarization of County staff with the operations and usage of the system and the manipulation and storage of flooding complaint files, (2) the introduction of the new system to the Maintenance Staff, particularly the feedback functions, (3) obtaining and inputting rainfall gage data, (4) familiarization with basin designations and assignment scheme and (5) the usage of the compiled database for documentation of area conditions and identification of trends in the individual watersheds as both a planning tool and a calibration/verification method for hydrologic studies.

The familiarization of County staff with the operations and usage of the database can be accomplished through actual hands-on experience with system operation. It would be advantageous to log the telephone complaints in written form and allow a sufficient number to accumulate before devoting operator time to data entry. The most efficient use of operator time is to designate part of each week or day to data entry activities. Logging of complaints in written form would also permit the screening of non-flood related maintenance items which form a good percentage of telephone complaints.

The remaining implementation step involves the establishment of contacts with regulatory agencies in regards to receiving data publications from the USGS,

NOAA, SJRWMD and others who collect and report rainfall amounts recorded at the gages in and adjacent to Seminole County. The implementation of an orderly system for receiving and inputting rainfall data will assist in the management of the database. The data collected by this system will be a valuable asset when basin studies are performed.

7.4 INSTITUTIONAL PROCEDURES AND CONSTRAINTS

The objective of this section is to review adopted procedures which are currently used by Seminole County to regualte and review the design, construction and operation of stormwater management facilities and systems. Through this review certain constraints which could limit a county stormwater program were identified. The constraints would typically be the Comprehensive Plan, the Florida Growth Management Act, staffing level and budgeting. The Comprehensive Plan is, however, one of the driving forces behind the stormwater management study. The Florida Growth Management Act is seen as the guiding force for the stormwater management program through the adoption of the County's Comprehensive Plan and its goals, objectives and policies. Neither of these plans, therefore, is a constraining factor to the County's program.

The two constraints found, which strongly effect the County's program, are staffing and budget levels. The program staffing level is a direct function of the annual budget available. This section addresses current staffing levels and future staff needs and provides a funding needs assessment.

Inherent in this process is the analysis of existing objectives and organizational structure.

The County's objectives for stormwater management are focused in two distinct areas. The first is to keep roads passable, prevent flooding, and avoid erosion and pavement damage.

The second objective is the prevention of flooding in dwellings and commercial buildings. One of the motivations for this latter objective was the development of the Federal Flood Insurance Program and the formation of the FEMA. The purpose of this program was mapping of the 100-year flood plain, the 100-year floodway, and requiring that counties enact local ordinances to regulate the development of property to maintain buildings and structures out of the 100-year flood plain in order to be eligible for the Federal Insurance Program.

County staff should define and the Board should adopt one or more levels of service which should be used to establish design criteria, identify needed facilities, and define adequate annual maintenance and capital improvements program budgets. These service level definitions are based on the following:

- Street flooding
- Yard flooding
- Any flooding of the first habitable floor of private residences

- Flooding of commercial/industrial properties

- All bridge crossings

- The approach road to the bridges

7.4 Analysis of Organizational Structure

The operation of a stormwater management program consists of five distinct types of activities: administration, planning, design, regulation and enforcement, and maintenance. These five functions are generally supported by the countywide administration infrastructure which includes ancillary services, i.e., secretarial and clerical, personnel, accounting, budget/legal and management. Stormwater staffing is dependent on the stormwater management facility inventories, ongoing needs, and the standard established for the selected level of service in Seminole County. Duties and responsibilities in any comprehensive stormwater management program can be categorized in the following functions:

- Administration

  This function is responsible for the overall management and supervision of the program and the four functional areas: planning, design, regulation and enforcement, and maintenance. Work tasks include general administrative activities, preparation of the work

program, monitoring of budget expenditure and goal attainment, and coordination with other utilities.

o Planning

The first major responsibility of the planning function is master planning within the County, which includes development of policies, planning methodology, preparation of master plans, compliance review, planning and monitoring of captial facilities and inter-governmental coordination with the numerous cities within the County. The second major element of the planning function is to conduct a monitoring program that plans for and collects data to be utilized in planning studies, monitors existing stormwater management facilities for FDER's and SJRWMD's special permit requirements, and collects flood data during flooding events for subsequent planning and design studies.

o Design

The design function is responsible for providing general design services which include capacity analysis, channel and culvert design for rehabilitation and replacement projects, and special permit acquisitions. The second major responsibility of the design function is project management for ongoing capital improvement program projects. This includes construction coordination and administration, promulgation of design standards and standard specifications, and construction management.

- Regulation and Enforcement

  This function is responsible for general activities which include drainage code development, policy guidelines for the stormwater management group, and the handling of stormwater complaints. Permit administration is the second major area of activity. This includes review of residential and commercial development plans for consistency of ongoing projects in compliance with the development code as well as the review of dredge and fill projects to ensure that they do not adversely affect existing stormwater management facilities. The control of stormwater improvements through a permit system is critical to the success of the entire program.

- Operations and Maintenance

  This function is highly visible to the public and therefore very important. Routine O&M is the first major activity which includes street sweeping, inlet/pipe cleaning, ditch maintenance, and detention/retention pond maintenance. The second area is remedial maintenance which includes storm sewer reconstruction, limited amounts of storm sewer construction, retention/detention pond construction, and ditch reconstruction.

The current organization of County Stormwater sevices limits its functions primarily to the following activities: implementation of code requirements;

handling of complaints; limited maintenance and improvements associated with road construction projects. The responsibility for these activities lies within the Engieering, Public Works and Development Review Department. With the institution of the Florida Growth Management Act, the Planning Department is responsible for developing the Comprehensive Plan Drainage Element and has initiated this planning level study to assess long-range stormwater program needs and alternative funding mechanisms for a drainage Capital Improvements Program.

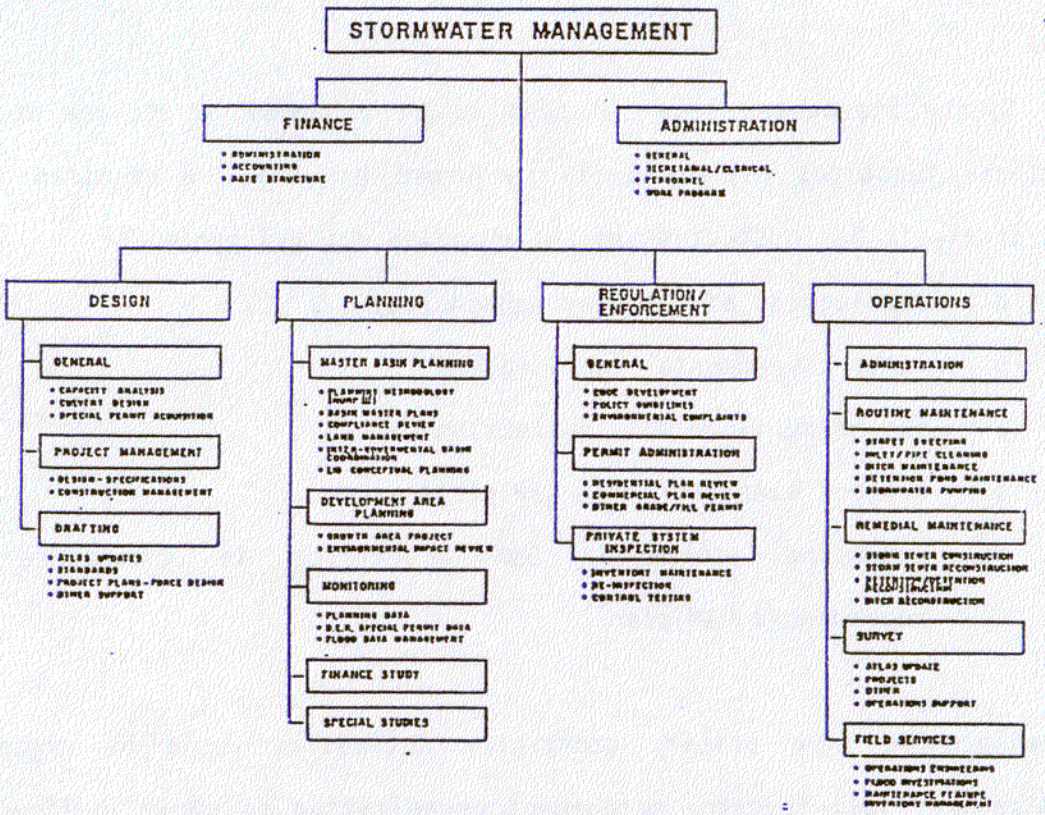
The County Stormwater services need to be expanded to include the following critical functions not currently performed but will be required to initiate the strategic basin studies and the proposed capital projects:

- o Development of planning methodology
- o Inter-governmental coordination
- o Expanding flood data collection
- o Project management for CIP projects
- o Expanding stormwater O&M activities in accordance with the recommended O&M plan

Ideally, the five primary stormwater activities would be organized as a centralized full-function management organization as shown in Figure 7-7. In this conceptual arrangement, four functional units report directly to the administrative group. Alternately, each of these functions can be

FIGURE 7-7

CENTRAL SERVICE UNIT ORGANIZATION MODEL FOR STORMWATER MANAGEMENT



accomplished in a matrix organization wherein each function is provided by a different group, i.e., the stormwater planning is accomplished by a comprehensive planning group, stormwater facility design is performed by a centralized Engineering Department, and so forth.

The County's current staffing and structure is limited. Many of the functions included in Figure 7-7 are not performed. However, the current sturcture, as shown in Figure 7-8, can serve as the foundation upon which the stormwater management program can be gradually built to meet the needs of the future.

7.4.2 Staffing Needs

The County stormwater management staffing needs, based on a analysis of current functions and county-wide projected future stormwater management needs, have been estimated by functional areas and are summarized in Table 7-3.

In the development of future staffing needs, the positions needed in 1990 to staff for administration, planning, design and enforcement/regulation functions were estimated to include an administrator, three engineers, one part-time technician, one part-time contracts administrator and two clericals. It was estimated that the O&M Section would require one part-time supervisor, one 3-person maintenance crew and one secretary. This proposed staff is nine (9) positions larger than the existing staff.

Figure 7-8

EXISTING DEPARTMENTAL RESPONSIBILITIES BY FUNCTION

FINANCE	OPERATE COUNTY WIDE		ADMINISTRATION
DESIGN*	PLANNING	REGULATION/ ENFORCEMENT	OPERATIONS
- GENERAL Engineering Dept.	- MASTER BASIN PLANNING Planning Dept. Engineering This study and support for S.C.S., FEMA, etc. are only activities	- GENERAL Planning/Land Management -Policy Guidelines &	- Administration
- PROJECT MANAGEMENT Engineering	- DEVELOPMENT AREA PLANNING Planning -Countywide studies not specific to drainage	- ENGINEERING -technical aspects of code are written	- ROUTING MAINTENANCE Road Division mowing contractor herbicide otherwise only as needed
- DRAFTING Engineering	- MONITORING Planning Engineering (rain gauge monitoring)	- PERMIT ADMIN. Development Review Dept.	- REMEDIAL MAINTENANCE Roads-in conjunction with roadway development
*activity limited to projects with the Roads Division and or on an as needed basis	- FINANCE STUDY Planning (Capital Imp. Funding Options)	- PRIVATE SYS. INSPECTION Engineering - only as complaints are received or Road Dept. notes	- SURVEY Engineering
	- SPECIAL STUDIES Planning		- FIELD SERVICES Engineering -minimal -regular rainfall guage

NOTE: MORE THAN ONE DEPARTMENT SHOWN INDICATES SHARED RESPONSIBILITY

TABLE 7-3

STORMWATER STAFFING NEEDS

	NUMBER OF FUNDED POSITIONS		
	Existing	1990 Needed	1995 Needed
Administration			
County Stormwater Engineer	0.05	1	1
Administrative Assistant	0.05	0	1
Secretary/Clerical	0.1	0.5	0.5
Planning Section			
Stormwater Engineer	0.25	1	1
Technician	0.2	0	0
Drafter	0	0	0
Secretary	0.1	0.5	0.5
Design Section			
Stormwater Engineer	0.2	0	0
Contract Administrator	0.2	0.5	1
Sr. Designer	0	0	0
Designer/Drafter	0.3	0	0
Secretary	0.1	0.5	0.5

TABLE 7-3

(Continued)

STORMWATER STAFFING NEEDS

	NUMBER OF FUNDED POSITIONS		
	Existing	1990 Needed	1995 Needed
Regulation and Enforcement Section			
Stormwater Engineer	0.25	2	2
Technician	0.5	0.5	1
Secretary	0.1	0.5	0.5
Operation and Maintenance Section			
Supervisor	1	0.5	1
3-person Maintenance Crew	2	1 (3 people)	9 (27 people)
Secretary	0.5	1	2
TOTAL POSITIONS	5.90	11.5	39

The staffing to provide these same functions will increase during the next five years so that in 1995 the staffing would include one administrator, an administrative assistant, three engineers, one technician, one contracts administrator, one O&M supervisor, nine (9) 3-person maintenance crews and four secretaries. The preliminary estimates presented here reflect the needs of a stormwater management program which is anticipated to grow at about 20 percent per year for the first ten years in order to serve growth needs in the County and solve current deficiencies which started years ago before the County provided comprehensive stormwater services.

A detailed organization and staffing analysis is needed as part of the County's stormwater management implementation program. This analysis should compare established service levels and performance criteria against existing system needs and anticipated growth in order to determine the staffing needs for each of the five functional areas.

7.4.3 REVIEW OF PRACTICE STANDARDS

Seminole County, in conjunction with FDER and SJRWMD, currently has in place a generally complete and well-formulated set of stormwater management regulations and policies to control growth and future development within the County. The new Land Development Code has been developed with the intent to guide engineers, architects, planners, and developers in the design of stormwater management systems in Seminole County. The draft Surface Water Management Standards further define standards of practice for stormwater

systems in Seminole County. Both documents were reviewed and specific comments and recommendations were offered in a Technical Mmemorandum, which is included as Appendix K.

7.5 CAPITAL NEEDS ASSESSMENT

The immediate result of the County's Stormwater Management Study has been the identification of: (1) potential Capital Improvements Program (CIP) projects, (2) defensible level of service criteria and analysis (page 5-13), and (3) the need to conduct basin specific studies to identify the cause of and solution for future problems indicated by the facilities analysis. These solutions were previously discussed in Section 6.

A total of 65 potential CIP projects were identified to solve existing problems with primary structures. These 65 projects will require capital expenditures of approximately $1,504,800 for new or upgraded facilities. As shown in Table 7-4, it was assumed that the number of unidentified structure modifications in each basin will be approximately three times the number of identfied structure modifications, or a minimum of three per basin. It is estimated that an additional 207 unidentified structure modifications will be needed, adding approximately $3,505,800 to the required capital expenditures for CIP projects. The total estimated construction cost for structure modifications is $5,010,600. These individual projects, previously listed in Table 6-4, will solve existing problems that will be further aggravated by future growth. These estimated cost figures are predesign cost estimates, meaning that an estimate has been made prior to any actual design, therefore

there is a relatively large margin for deviation. These cost estimates include construction costs only. Expenditures are summarized in Table 7-4 and are presented by basin. The largest expenditure, $1,052,675, is required in the Little Wekiva Basin while a number of basins require minimal immediate expenditures. Other project costs, estimated at 35 percent of the estimated construction costs, include engineering fees for facilities design, construction observation, rights-of-way and land cost, legal and administrative costs and project contingencies.

7.6 O&M ASSESSMENT

Adequate O&M effort scheduled at the appropriate time of the year is the key to keeping facilities in their peak operational condition. This subsection reviews the three most common maintenance activities and estimates the cost of adequate facilities maintenance.

STRUCTURE MAINTENANCE

Structure maintenance consists of: (1) removing snags and debris which increase hydraulic friction thereby reducing conveyance and (2) periodic bottom cleaning to remove silts and sands, deposited during periods of inactivity which act to reduce capacity. With limited historical maintenance activity records identifying the number of structures maintained, the frequency and timing of maintenance, or the cost of structure maintenance

TABLE 7-4

SUMMARY OF POTENTIAL CIP EXPENDITURES

NEEDED BY BASIN

BASIN	TOTAL NUMBER OF INVENTORIED STRUCTURES	NUMBER OF IDENTIFIED STRUCTURE MODIFICATIONS	PERCENT OF IDENTIFIED STRUCTURES MODIFIED	ESTIMATED NUMBER OF UNIDENTIFIED STRUCTURE MODIFICATIONS	TOTAL ESTIMATED NUMBER OF STRUCTURE MODIFICATIONS	IDENTIFIED STRUCTURE MODIFICATION COST ($)	ESTIMATED UNIDENTIFIED STRUCTURE MODIFICATION COST ($)	TOTAL ESTIMATED STRUCTURAL MODIFICATIONS COST ($)
1. YANKEE LAKE	9	0	0.0%	3	3	0	30,000	30,000
2. LAKE MONROE	58	10	17.2%	30	40	244,300	549,675	793,975
3. SANFORD	12	0	0.0%	3	3	0	30,000	30,000
4. MIDWAY	48	9	18.8%	27	36	230,500	518,625	749,125
5. LAKE JESSUP	81	8	9.9%	24	32	184,300	414,675	598,975
6. ST. JOHNS	7	1	14.3%	3	4	12,900	29,025	41,925
7. LAKE HARNEY	7	0	0.0%	3	3	0	30,000	30,000
9. BIG ECONLOCKHATCHEE	15	2	13.3%	6	8	22,700	51,075	73,775
10. LITTLE ECONLOCKHATCHEE	5	0	0.0%	3	3	0	30,000	30,000
11. HOWELL BRANCH	111	7	6.3%	21	28	147,300	331,425	478,725
12. LITTLE LAKE HOWELL	11	4	36.4%	12	16	60,100	135,225	195,325
13. GEE CREEK	90	4	4.4%	12	16	123,200	277,200	400,400
14. SOLDIER CREEK	71	3	4.2%	9	12	82,100	184,725	266,825
15. LITTLE WEKIVA	133	13	9.8%	39	52	323,900	728,775	1,052,675
16. BIG WEKIVA	15	4	26.7%	12	16	73,500	165,375	238,875
TOTALS	673	65	9.7%	207	272	$1,504,800	$3,505,800	$5,010,600

activities, it is difficult to accurately estimate the true cost of adequate structure maintenance. However, several enabling assumptions provide the basis for a preliminary estimate:

Number of Structures To Be Maintained

- o Major — 312 (from inventory)
- o Minor — 942 (assumed)

Estimated Cost of Structure Maintenance

- o Major — $375/each
- o Minor — $175/each

Recommended Maintenance Frequency

- o Major — Every 4 years
- o Minor — Every 6 years

The number of major structures are based on the current structure inventory and the number of minor structures were assumed to be triple the number of major structures. Maintenance costs are estimated from productivity standards developed from actual maintenance operations in Hillsborough County and the City of Sarasota as well as estimated crew labor costs. Frequencies were recommended by the Seminole County Road Superintendent.

Structure maintenance cost is estimated to be $56,725 annually for 942 structures. The largest estimated structure maintenance cost is associated with the Howell Branch Basin. No major structures are located in the Puzzle Lake Basin but a minimum annual expenditure of $175 was assumed to cover maintenance of six minor structures. Basin and countywide structure maintenance cost estimates are summarized in Table 7-5.

CHANNEL MAINTENANCE

Channel maintenance involves grading to remove deposited sediment and to maintain uniform design cross-section and grade in order to provide design hydraulic capacity. This maintenance activity, usually accomplished after the wet season, will help to provide reliable channel capacity to convey countywide flows to their ultimate receiving waters.

As with structure maintenance, channel maintenance activities are difficult to estimate. However, several enabling assumptions and review of channel system mapping provided the basis for a preliminary estimate:

Length of Channel To Be Maintained

o Major	97.32 miles
o Minor	194.64 miles

Estimated Cost of Channel Maintenance

o Major	$15,840/mile
o Minor	$10,000/mile

Recommended Maintenance Frequency

o Major	Annually
o Minor	Every 4 years

The length of major channels was measured on the basin maps, while the length of minor channels was assumed to be double the major channel length.

Maintenance costs are based on similar activities in Hillsborough County and the City of Sarasota. Frequencies are assumed to be once every year for major channel segments and once every four years for minor channel segments, based on recommendations from the Seminole County Road Superintendent.

TABLE 7-5

SUMMARY OF ANNUAL STRUCTURE MAINTENANCE COST BY BASIN

BASIN	NUMBER OF MAJOR STRUCTURES TO BE MAINTAINED	NUMBER OF MINOR STRUCTURES TO BE MAINTAINED	TOTAL STRUCTURES TO BE MAINTAINED	ESTIMATED STRUCTURE MAINTENANCE COST(YR)
1. YANKEE LAKE	4	12	16	$725
2. LAKE MONROE	31	93	124	$5,619
3. SANFORD	4	12	16	$725
4. MIDWAY	19	57	76	$3,444
5. LAKE JESSUP	46	138	184	$8,338
6. ST. JOHNS	4	12	16	$725
7. LAKE HARNEY	6	18	24	$1,088
8. PUZZLE LAKE	0	6	6	$175
9. BIG ECONLOCKHATCHEE	9	27	36	$1,631
10. LITTLE ECONLOCKHATCHE	4	12	16	$725
11. HOWELL BRANCH	61	183	244	$11,056
12. LITTLE LAKE HOWELL	2	6	8	$363
13. GEE CREEK	43	129	172	$7,794
14. SOLDIER CREEK	28	84	112	$5,075
15. LITTLE WEKIVA	44	132	176	$7,975
16. BIG WEKIVA	7	21	28	$1,269
COUNTY TOTAL	312	942	1254	$56,725

Annual channel maintenance cost is estimated to be $2,028,149 for about 146 miles of channel to be maintained each year. This sum consists of about $1,541,549 for 97.3 miles of major ditch segments and $486,600 for 48.7 miles of minor ditch segments.

The largest estimated annual expenditure is in the Lake Jessup Basin with no expenditure planned for the Puzzle Lake Basin. Basin and countywide channel maintenance cost estimates are summarized in Table 7-6.

CHANNEL MOWING

The last major maintenance activity, channel mowing, has seasonal value during the wet season when channels receive the majority of their flow. Mowing of ditches provides two benefits: (1) reduction of hydraulic friction thereby increasing conveyance of the channel section, and (2) prevention of tree growth which causes both hydraulic and major maintenance problems if not controlled.

As with structure and ditch maintenance, several assumptions provide the basis for a preliminary mowing needs estimate:

Length of Channel To Be Mowed

- o Major — 48.66 miles
- o Minor — 64.23 miles

TABLE 7-6

SUMMARY OF ANNUAL CHANNEL MAINTENANCE COST BY BASIN

BASIN	LENGTH OF MAJOR CHANNELS TO BE MAINTAINED (MILES)	LENGTH OF MINOR CHANNELS TO BE MAINTAINED (MILES)	ESTIMATED CHANNEL MAINTENANCE COST(YR)
1. YANKEE LAKE	0.41	0.82	$8,544
2. LAKE MONROE	11.66	23.32	$242,994
3. SANFORD	1.16	2.32	$24,174
4. MIDWAY	4.85	9.7	$101,074
5. LAKE JESSUP	22.89	45.78	$477,028
6. ST. JOHNS	1.74	3.48	$36,262
7. LAKE HARNEY	4.20	8.4	$87,528
8. PUZZLE LAKE	0.00	0	$0
9. BIG ECONLOCKHATCHEE	7.16	14.32	$149,214
10. LITTLE ECONLOCKHATCHE	1.49	2.98	$31,052
11. HOWELL BRANCH	14.20	28.4	$295,928
12. LITTLE LAKE HOWELL	0.83	1.66	$17,297
13. GEE CREEK	7.36	14.72	$153,382
14. SOLDIER CREEK	9.97	19.94	$207,775
15. LITTLE WEKIVA	8.06	16.12	$167,970
16. BIG WEKIVA	1.34	2.68	$27,926
COUNTY TOTAL	97.32	194.64	$2,028,149

Estimated Cost of Channel Mowing

o Major	$700/mile
o Minor	$700/mile

Recommended Maintenance Frequency

o Major	5 times per year
o Minor	5 times per year

The length of major channel to be mowed was assumed to be 50% of the major channel maintenance length and the length of minor channel to be mowed was assumed to be 33% of the minor channel maintenance length. Costs were estimated based on similar activities in the City of Sarasota and Hillsborough County. Frequencies were assumed based on the recommendation of the Seminole County Road Superintendent. Channel mowing costs for the recommended developed program are estimated to be about $395,119 annually for about 564 miles of channels. This maintenance cost consists of $170,312 for about 243 miles of major channel mowing and $224,807 for about 321 miles of minor ditch mowing. The largest basin expenditure is in the Lake Jessup Basin while no expenditure is planned in the Puzzle Lake Basin. Table 7-7 summarizes basin and countywide channel mowing cost estimates.

TABLE 7-7

SUMMARY OF ANNUAL CHANNEL MOWING COST BY BASIN

BASIN	LENGTH OF MAJOR CHANNELS TO BE MOWED (MILES)	LENGTH OF MINOR CHANNELS TO BE MOWED (MILES)	ESTIMATED CHANNEL MOWING COST(YR)
1. YANKEE LAKE	0.21	0.27	$1,665
2. LAKE MONROE	5.83	7.70	$47,340
3. SANFORD	0.58	0.77	$4,710
4. MIDWAY	2.43	3.20	$19,691
5. LAKE JESSUP	11.45	15.11	$92,933
6. ST. JOHNS	0.87	1.15	$7,064
7. LAKE HARNEY	2.10	2.77	$17,052
8. PUZZLE LAKE	0.00	0.00	$0
9. BIG ECONLOCKHATCHEE	3.58	4.73	$29,070
10. LITTLE ECONLOCKHATCHE	0.75	0.98	$6,049
11. HOWELL BRANCH	7.10	9.37	$57,652
12. LITTLE LAKE HOWELL	0.42	0.55	$3,370
13. GEE CREEK	3.68	4.86	$29,882
14. SOLDIER CREEK	4.99	6.58	$40,478
15. LITTLE WEKIVA	4.03	5.32	$32,724
16. BIG WEKIVA	0.67	0.88	$5,440
COUNTY TOTAL	48.66	64.23	$395,119

SUMMARY

A brief review of the existing condition of the County's major ditches and key structures in the sixteen basins suggests a need for programmed maintenance. Based on typical unit production rates and the County's actual manpower and equipment costs, it would require an O&M budget allocation of about $2,500,000 annually to adequately maintain these facilities. Individual basin costs vary from a high of $578,299 in the Lake Jessup Basin to a low of $175 in the Puzzle Lake Basin as summarized in Table 7-8. Maintenance costs vary by basin due to the growth experienced within each individual basin.

The County's current budget for stormwater-related O&M activities is approximately $151,100 annually or 6.1% of the identified need. This amount is used for the maintenance of roadside ditches as part of the roadway maintenance program. Therefore, it will be necessary for the County to provide substantially more funding to achieve the recommended stormwater maintenance program.

7.7 PROGRAM STRATEGY

The implementation program developed for the County consists of strategies for: development of the County's stormwater program (staff and review functions), capital and continuing repair and replacement (R&R) construction expenditures, annual O&M funding, strategic basin-wide studies, an integrated funding needs assessment and a 20-year plan to solve the County's stormwater problems. Figure 7-9 depicts the relationships of these elements. Strategies

TABLE 7-8

SUMMARY OF ESTIMATED ANNUAL BASIN O&M NEEDS

BASIN	ESTIMATED STRUCTURE MAINTENANCE COST(YR)	ESTIMATED CHANNEL MAINTENANCE COST(YR)	ESTIMATED CHANNEL MOWING COST(YR)	TOTAL ESTIMATED MAINTENANCE COST(YR)
1. YANKEE LAKE	$725	$8,544	$1,665	$10,934
2. LAKE MONROE	$5,619	$242,994	$47,340	$295,953
3. SANFORD	$725	$24,174	$4,710	$29,609
4. MIDWAY	$3,444	$101,074	$19,691	$124,209
5. LAKE JESSUP	$8,338	$477,028	$92,933	$578,299
6. ST. JOHNS	$725	$36,262	$7,064	$44,051
7. LAKE HARNEY	$1,088	$87,528	$17,052	$105,668
8. PUZZLE LAKE	$175	$0	$0	$175
9. BIG ECONLOCKHATCHEE	$1,631	$149,214	$29,070	$179,915
10. LITTLE ECONLOCKHATCHE	$725	$31,052	$6,049	$37,826
11. HOWELL BRANCH	$11,056	$295,928	$57,652	$364,636
12. LITTLE LAKE HOWELL	$363	$17,297	$3,370	$21,030
13. GEE CREEK	$7,794	$153,382	$29,882	$191,058
14. SOLDIER CREEK	$5,075	$207,775	$40,478	$253,328
15. LITTLE WEKIVA	$7,975	$167,970	$32,724	$208,669
16. BIG WEKIVA	$1,269	$27,926	$5,440	$34,635
COUNTY TOTAL	$56,725	$2,028,149	$395,119	$2,479,993

STORMWATER MANAGEMENT PROGRAM STRATEGY

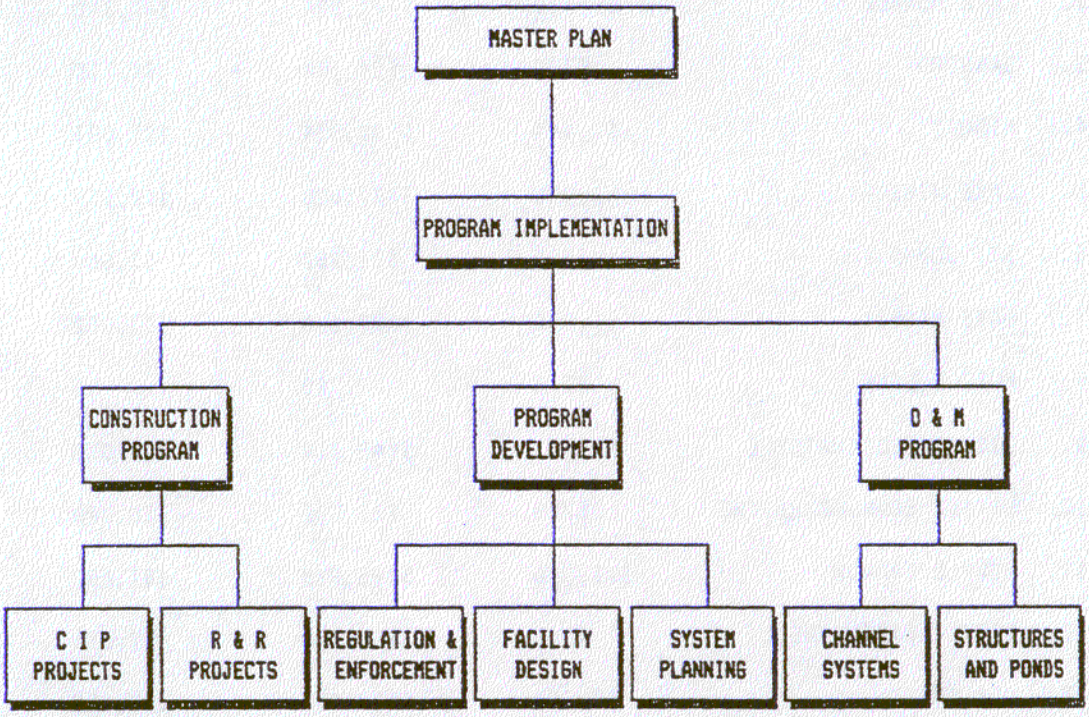


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FIGURE 7-9

for each of these aspects of stormwater management are discussed in the following text.

7.7.1 Stormwater Program Development

The development of the stormwater program, those aspects of stormwater management outside of capital construction and annual O&M activities, plays a key role in shaping the manner in which stormwater is managed in Seminole County. Consequently, special attention must be paid to each individual aspect of program development.

- System Condition Assessment

  The County should conduct a conditions assessment survey during the first three fiscal years of the program to ascertain the physical condition and remaining service life of its primary and secondary drainage facilities (structures and channels). Subsequent conditions surveys should be conducted at 10-year intervals. Based upon these surveys, the County should prioritize replacement and repair projects to prevent catastrophic failures. Funding at $150,000 should be allocated for the survey during the first 3-years of the program with $180,000 allocated for the second 3-year survey. Upon completion of surveys, appropriate funding should be allocated to maintain the integrity of the system.

- Horizontal and Vertical Survey Needs

Horizontal location of structures and channels is reasonably well established by the County's recent aerial photography. However, the vertical relationships between system facilities are not generally known throughout the County's stormwater system, thereby precluding detailed analyses of channel conveyance or adjustment of structure capacities due to identified backwater conditions.

A very preliminary survey costing approximately $150,000 will be needed in the next three years to establish a vertical control network and to document invert elevations of major structures and grades and cross-sections of major channels. This three-year effort will establish basic component elevations and channel characteristics. It should be noted that during fiscal year 1988-89 the County Engineering Department has funds allocated to accomphlish a more comprehensive structure inventory and should accomplish much of this identified need.

As detailed basin studies are undertaken, additional site specific survey information will be required for modeling and analysis. The scope of work for each of these studies should include a task that provides survey data and requires that all survey notebooks be the property of Seminole County. In this way, the basic network will be expanded and/or updated through the years. Similarly, the County should require certified record drawings of all new systems and facilities prior to County acceptance for maintenance and/or ownership.

A certain amount of annual survey will routinely be required for program operation. An allowance of $35,000 per year for the first five years of the program, decreasing to $5,000 per year for the next five years of program and escalating gradually thereafter, should be provided to meet this continuing survey need.

o Strategic Basin Studies

Evaluation of service level degradation due to the impact of growth on undersized and inadequate systems indicates that the number of major facilities below Service Level C standards will increase from 41 to 52 over the next 20 years. This fact indicates that the County should initiate a series of comprehensive basin studies to identify problems and select the best and most cost-effective solutions to solve existing problems and prevent the development of future problems.

The following factors were used to establish relative priorities for the strategic basin studies: (1) the number of structures in the basin identified for remediation, (2) the total number of priority points assigned for structures in the basin, and (3) the average number of priority points per structure in the basin. The three values were computed for each of the 16 basins in Seminole County. Each of these values was normalized to a maximum scale of 33.33 (33.33 times the basin's points as a percentage of the highest basin's points) and summed to determine the basin priority points for each basin. The maximum point value achievable was, therefore, 100. A simple ranking was used, so the

basin with the highest number of points would be studied first, the basin with the second highest point value would be the second and so forth. The basins with no points were ranked by evaluating the number of primary structures, their estimated service levels and future service level degradation. The results of this analysis are summarized in Table 7-9. These studies should begin in the second year of the program and should be undertaken in the following basin order:

Priority	Basin
1	Little Wekiva
2	Lake Monroe
3	Howell Branch
4	Lake Jessup
5	Midway
6	Big Wekiva
7	Soldier Creek
8	Gee Creek
9	Little Lake Howell
10	St. Johns
11	Big Econlockhatchee
12	Little Econlockhatchee
13	Lake Harney
14	Yankee Lake
15	Sanford
16	Puzzle Lake

However, additional information which the County staff should incorporate into the decision on prioritization of basin studies are the ongoing studies being performed by various agencies (see Appendix F), identified nuisance problems and changing growth patterns.

Table 7-9 indicates the estimated current cost to evaluate each basin using hydraulic simulation procedures and to provide recommendations for capital and remedial projects and O&M requirements. The preliminary

TABLE 7-9

SUMMARY OF BASIN RANKING FOR STRATEGIC BASIN STUDIES

RELATIVE BASIN PRIORITY	BASIN NAME	TOTAL NORMALIZED POINTS	BASIN SIZE (Sq.Mi.)	PRELIMINARY ESTIMATED BASIN STUDY COST
1	LITTLE WEKIVA	93.8	8.27	$45,505
2	LAKE MONROE	80.6	25.01	137539
3	HOWELL BRANCH	73.3	30.03	195,176
4	LAKE JESSUP	67.9	8.55	64,145
5	MIDWAY	65.4	8.27	62,053
6	BIG WEKIVA	50.9	21.10	105,513
7	SOLDIER CREEK	49.2	30.31	151,530
8	GEE CREEK	44.2	57.17	285,862
9	LITTLE LAKE HOWELL	41.0	30.86	154,319
10	ST. JOHN'S	30.1	4.79	31,110
11	BIG ECONLOCKHATCHEE	27.7	14.50	94,265
12	LITTLE ECONLOCKHATCHEE	0.0	4.83	36,256
13	LAKE HARNEY	0.0	27.42	205,681
14	YANKEE LAKE	0.0	10.88	81,575
15	SANFORD	0.0	1.80	13,472
16	PUZZLE LAKE	0.0	37.84	283,770
	TOTALS		282.00	$1,650,530

estimated basin study cost was determined by assuming a cost of $5,000 per per square mile times a land use factor between 1.0 and 1.5. Some studies, based on the size and complexity of the basins, will be very expensive and complicated and may take two or three years to complete. The County should monitor each basin during the year preceding the basin's study in order to have appropriate rainfall and runoff data to conduct the hydrologic and hydraulic simulations.

The total estimated fees for the basin studies are approximately $1,650,000. It is assumed that approximately $150,000 will be allocated annually for 11 years.

o Annual System Planning

Continuing planning services will be required to "catch up" and then to stay ahead of stormwater management problems in Seminole County. Given the size of the County and the wide range of detailed, engineering-oriented planning activities which need to be undertaken, a minimum of one full-time staff position should be allocated for the next 20 years. Initially, this should be an entry level engineering position, with the job responsibilities to grow with the job-holder's experience.

Engineering-oriented planning activities which should be handled by the System Planning engineer include:

- o Supervision and coordination of strategic basin studies
- o Monitoring and analysis of system hydraulic and water quality performance
- o Monitoring and analysis of intergovernmental stormwater flows
- o Review of data collected, studies and reports by County Engineering staff, outside agencies and consultants
- o Maintenance and updating of the County Stormwater Atlas and structure inventory
- o Development of a programmed maintenance management system for County Stormwater systems

To assist this employee with these tasks and to deal with the backlog of engineering-related planning activities, the County should consider a one-time allocation to hire a consultant during the first year of the program. The funding, $150,000 - $200,000, would be used to define staff functions, assist in the development of a suitable monitoring program, develop detailed scopes of work for the first two strategic basin studies, develop files and information retrieval systems to facilitate use of the drainage complaint tracking system and system conditions assessment, and provide a variety of other services and technical assistance as may be required during start-up.

System planning should also include the immediate funding of approximately $150,000 to evaluate, develop and implement the funding mechanisms for the stormwater management program.

o Regulation and Enforcement (R&E)

The last major element of the program development is Regulation and Enforcement. Development-regulating activity will vary throughout the year with weather, variations in economic conditions and a variety of other factors. Current staffing requires two full-time engineers. As population grows in the County, staffing needs will increase. For the purpose of strategy, a minimum of two full-time positions should be allocated and maintained for R&E activities. Staffing needs should be analyzed annually to assure that sufficient staff is available to meet development review needs.

Enforcement covers both the inspection and certification of new facilities for compliance with County design criteria, standards and materials specifications, as well as the periodic reinspection of permitted facilities to assure their integrity and function. Specific manpower allocations for enforcement will be developed on an annual basis depending on the County's prevailing regulatory philosophy, budgetary constraints and staff conditions.

7.7.2 Construction Program

The construction program established for capital projects focuses on prioritized projects and seeks to complete all of the current identified as well as unidentified projects within a 10-year period. Allowing 35% of the construction cost for rights-of-way and land costs, design services,

construction administration, legal services, administration and project contingencies, the estimated annual expenditure required to achieve this program is approximately $676,400 over a 10-year period.

In addition to these CIP projects, the County will in all probability need to construct additional capital projects as a result of the recommendations of the strategic basin studies. In order to accommodate this future need, beginning in year 12 an annual construction allowance of about $150,000 is provided, which is approximately 30% of the CIP annual budget for the previous ten years. Including 35% for other project costs, the total annual cost is estimated to be $202,500 for these future CIP projects.

The third major capital expenditure consideration is the repair and/or replacement (R&R) of existing facilities as they reach the end of their service life and approach failure. Recognizing that a number of the facilities in Seminole County have been in service since the 1940s and 1950s, the County must be prepared to begin replacing and repairing these facilities.

Prior to a detailed structural conditions assessment and a complete inventory of all county structures, it is difficult to accurately predict future R&R expenditures. However, a number of enabling assumptions, combined with the partial structure inventory, have provided a basis for a preliminary estimate of potential future R&R need in Seminole County. The current structure inventory's completeness, previously discussed in Section 3, can be summarized as follows:

	Number Inventoried	Extent of Capture	Projected Number	Aggregate Value
Major	312	90%	350	$5,500,000
Minor/Secondary/ Unknown	361	15%-20%	1800-2400	2,500,000
Total	673		2150-2750	$8,000,000

Allowing a 25% contingency for estimated structure value suggests a total current investment of about $10,000,000. If this investment is bracketed evenly and presumed to age 20 years, the following investment age profiles can be estimated:

Age (Years)	Distribution of Investment 1988	2008
0-10	$3,000,000	$2,000,000
11-20	3,000,000	6,750,000
21-30	2,000,000	3,000,000
31-40	1,000,000	3,000,000
41-50	1,000,000	2,000,000
51-60	0	1,000,000
61-70	0	1,000,000
Total	$10,000,000	$18,750,000

This profile assumes that none of the existing structures are over 50 years old and that only 70% of the total investment is over 30 years old. The difference between total invested values for 1988 and 2008 reflects the anticipated new capital construction in Seminole County of approximately $8,750,000 over the next 20 years.

The average service life of concrete and corrugated metal culverts has been estimated at 30-50 years depending upon their method of manufacture, protective coatings, installation procedures and service environment. Using an average service life of 40 years, in the absence of a conditions assessment, provides an estimated R&R need of about $4,000,000 in the next 20 years.

7.8.3 Annual Operating and Maintenance Program

Based on the maintenance program outlined in Section 7.6, the County's annual O&M expenditure would be approximately $2,500,000 which is about 17 times the current annual expenditure of $151,000. In order to achieve an adequate O&M funding program, the strategy recommended is to gradually raise the annual O&M funding level from its current level of $151,000 to the needed level of about $2,500,000 over the next 10 years. Thereafter, the O&M funding level would be increased at about 2% per year to reflect the increasing inventory of structures and channels that will require maintenance for proper operation.

In addition to the identified maintenance activities, the County must be prepared to effectively address additional maintenance activities that will be required to keep the stormwater management systems functional. An example of these additional activities is the maintenance of County retention ponds. To accomplish these activities, an allowance of 10% of the identified maintenance budget should be provided.

7.8 FUNDING NEEDS ASSESSMENT

Stormwater management will continue to receive increased emphasis throughout Florida as a major element in the State's plan to manage growth. The 1985 Florida Growth Management Act requires Seminole County to establish a stormwater program that addresses new growth by establishing goals and identifying needs. The success of the program will depend on the ability of the County to fund the stormwater management program.

In order to implement the stormwater management strategy discussed in this section, the following funding needs have been identified for the 20-year program:

	20-Year Totals	
	Assuming 0% Inflation	Assuming 5% Inflation
Total Estimated Program Development Costs	$ 5,859,000	$ 9,221,200
Total Estimated Construction Program Costs	10,746,800	16,591,300
Total Estimated O&M Program Costs	43,060,400	79,567,400
Total Estimated Stormwater Program Revenue Needs	$59,666,200	$105,380,000

The detailed breakdown of estimated costs by year and by program element is summarized in Tables 7-10 and 7-11 for the 0% and 5% inflation scenarios, respectively.

Tables 7-12 and 7-13 provide the estimated costs by the following catagories: Existing Deficiencies; Growth-related Deficiencies; Recurring Capital Costs and Recurring Operating Costs. These costs have also been shown for 0% and 5% inflation scenarios respectively. These costs are summarized as follows:

	20-Year Total	
	Assuming 0% Inflation	Assuming 5% Inflation
Existing Deficiencies	$ 9,024,800	$ 12,032,700
Growth-Related Deficiencies	1,822,500	3,819,000
Recurring Capital Costs	2,160,000	3,838,900
Recurring Operating Costs	46,658,900	85,689,400
TOTALS	$59,666,200	$105,380,000

In general, traditional financing methods have not generated sufficient revenue to fund comprehensive stormwater programs that address flooding, water quality enhancements, replacing decaying infrastructure, meeting the demands of new developments and performing the required maintenance and operating activities. Seminole County must develop and adopt a funding strategy that generates the required funds while being equitable and acceptable to the citizens of the County. Financing methods, as outlined in Section 8.2, must be evaluated by these criteria and a strategy, which may include a mix of various methods, must be customized to meet Seminole County's particular needs.

TABLE 7-10

SUMMARY OF 20-YEAR REVENUE NEEDS ASSUMING NO INFLATION

(All Costs In $1000s)

Program Year	Calendar Year	System Condition Assessment	Estimated Survey Needs	Strategic Basin Studies	Annual System Planning	Regulation and Enforcement	TOTAL PROGRAM DEVELOPMENT COST	CIP Projects - Construction	CIP Projects - Other Costs	Future CIP Projects - Construction	Future CIP Projects - Other Costs	Repair and Replacement Costs - Construction	Repair and Replacement Costs - Other Costs	TOTAL CONSTRUCTION PROGRAM COSTS	Identified O & M Components	Unidentified O & M Components	TOTAL OPERATIONS & MAINTENANCE PROGRAM COSTS	TOTAL ESTIMATED STORMWATER PROGRAM REVENUE NEEDS
1	1990	$50.0	$35.0	$0.0	$328.0	$75.0	$488.0	$0.0	$0.0	$0.0	$0.0	$50.0	$17.5	$67.5	$151.0	$15.1	$166.1	$721.6
2	1991	$50.0	$35.0	$150.0	$30.0	$75.0	$340.0	$501.1	$175.4	$0.0	$0.0	$50.0	$17.5	$743.9	$383.9	$38.4	$422.3	$1,506.2
3	1992	$50.0	$35.0	$150.0	$32.0	$80.0	$347.0	$501.1	$175.4	$0.0	$0.0	$50.0	$17.5	$743.9	$616.8	$61.7	$678.5	$1,769.4
4	1993	$0.0	$35.0	$150.0	$34.0	$85.0	$304.0	$501.1	$175.4	$0.0	$0.0	$50.0	$17.5	$743.9	$849.7	$85.0	$934.7	$1,982.6
5	1994	$0.0	$35.0	$150.0	$36.0	$90.0	$311.0	$501.1	$175.4	$0.0	$0.0	$50.0	$17.5	$743.9	$1,082.6	$108.3	$1,190.9	$2,245.8
6	1995	$0.0	$5.0	$150.0	$38.0	$95.0	$288.0	$501.1	$175.4	$0.0	$0.0	$70.0	$24.5	$770.9	$1,315.5	$131.6	$1,447.1	$2,506.0
7	1996	$0.0	$5.0	$150.0	$40.0	$100.0	$295.0	$501.1	$175.4	$0.0	$0.0	$70.0	$24.5	$770.9	$1,548.4	$154.8	$1,703.2	$2,769.2
8	1997	$0.0	$5.0	$150.0	$42.0	$105.0	$302.0	$501.1	$175.4	$0.0	$0.0	$70.0	$24.5	$770.9	$1,781.3	$178.1	$1,959.4	$3,032.4
9	1998	$0.0	$5.0	$150.0	$44.0	$110.0	$309.0	$501.1	$175.4	$0.0	$0.0	$70.0	$24.5	$770.9	$2,014.2	$201.4	$2,215.6	$3,295.6
10	1999	$0.0	$5.0	$150.0	$46.0	$115.0	$316.0	$501.1	$175.4	$0.0	$0.0	$70.0	$24.5	$770.9	$2,247.1	$224.7	$2,471.8	$3,558.7
11	2000	$60.0	$7.0	$150.0	$48.0	$120.0	$385.0	$501.1	$175.4	$0.0	$0.0	$90.0	$31.5	$797.9	$2,480.0	$248.0	$2,728.0	$3,910.9
12	2001	$60.0	$7.0	$150.5	$50.0	$125.0	$392.5	$0.0	$0.0	$150.0	$52.5	$90.0	$31.5	$324.0	$2,529.6	$253.0	$2,782.6	$3,499.1
13	2002	$60.0	$7.0	$0.0	$52.0	$130.0	$249.0	$0.0	$0.0	$150.0	$52.5	$90.0	$31.5	$324.0	$2,580.2	$258.0	$2,838.2	$3,411.2
14	2003	$0.0	$7.0	$0.0	$54.0	$135.0	$196.0	$0.0	$0.0	$150.0	$52.5	$90.0	$31.5	$324.0	$2,631.8	$263.2	$2,895.0	$3,415.0
15	2004	$0.0	$7.0	$0.0	$56.0	$140.0	$203.0	$0.0	$0.0	$150.0	$52.5	$90.0	$31.5	$324.0	$2,684.4	$268.4	$2,952.9	$3,479.9
16	2005	$0.0	$9.0	$0.0	$58.0	$145.0	$212.0	$0.0	$0.0	$150.0	$52.5	$110.0	$38.5	$351.0	$2,738.1	$273.8	$3,011.9	$3,574.9
17	2006	$0.0	$9.0	$0.0	$60.0	$150.0	$219.0	$0.0	$0.0	$150.0	$52.5	$110.0	$38.5	$351.0	$2,792.9	$279.3	$3,072.2	$3,642.2
18	2007	$0.0	$9.0	$0.0	$63.0	$157.5	$229.5	$0.0	$0.0	$150.0	$52.5	$110.0	$38.5	$351.0	$2,848.7	$284.9	$3,133.6	$3,714.1
19	2008	$0.0	$9.0	$0.0	$64.0	$160.0	$233.0	$0.0	$0.0	$150.0	$52.5	$110.0	$38.5	$351.0	$2,905.7	$290.6	$3,196.3	$3,780.3
20	2009	$0.0	$9.0	$0.0	$66.0	$165.0	$240.0	$0.0	$0.0	$150.0	$52.5	$110.0	$38.5	$351.0	$2,963.8	$296.4	$3,260.2	$3,851.2
Total Funds Required (In 1000's)		$330.0	$280.0	$1,650.5	$1,241.0	$2,357.5	$5,859.0	$5,010.6	$1,753.7	$1,350.0	$472.5	$1,600.0	$560.0	$10,746.8	$39,145.8	$3,914.6	$43,060.4	$59,666.2
Percent of Total Need		0.55%	0.47%	2.77%	2.08%	3.95%	9.82%	8.40%	2.94%	2.26%	0.79%	2.68%	0.94%	18.01%	65.61%	6.56%	72.17%	100.00%

* - Other project costs include engineering fees for facilities design, construction observation, rights-of-way and land costs, legal and administrative costs and project contingencies.

TABLE 7-11

SUMMARY OF 20-YEAR REVENUE NEEDS ASSUMING 5% INFLATION

(All Costs In $1000s)

Program Year	Calendar Year	System Condition Assessment	Estimated Survey Needs	Strategic Basin Studies	Annual System Planning	Regulation and Enforcement	TOTAL PROGRAM DEVELOPMENT COST	CIP Projects - Construction	CIP Projects - Other Costs	Future CIP Projects - Construction	Future CIP Projects - Other Costs	Repair and Replacement Costs - Construction	Repair and Replacement Costs - Other Costs	TOTAL CONSTRUCTION PROGRAM COSTS	Identified O & M Components	Unidentified O & M Components	TOTAL OPERATIONS & MAINTENANCE PROGRAM COSTS	TOTAL ESTIMATED STORMWATER PROGRAM REVENUE NEEDS
1	1990	$50.0	$35.0	$0.0	$328.0	$75.0	$488.0	$0.0	$0.0	$0.0	$0.0	$50.0	$17.5	$67.5	$151.0	$15.1	$166.1	$721.6
2	1991	$52.5	$36.8	$157.5	$31.5	$78.8	$357.0	$526.1	$184.1	$0.0	$0.0	$52.5	$18.4	$781.1	$403.1	$40.3	$443.4	$1,581.5
3	1992	$55.1	$38.6	$165.4	$35.3	$88.2	$382.6	$552.4	$193.3	$0.0	$0.0	$55.1	$19.3	$820.2	$680.0	$68.0	$748.0	$1,950.8
4	1993	$0.0	$40.5	$173.6	$39.4	$98.4	$351.9	$580.0	$203.0	$0.0	$0.0	$57.9	$20.3	$861.2	$983.6	$98.4	$1,082.0	$2,295.1
5	1994	$0.0	$42.5	$182.3	$43.8	$109.4	$378.0	$609.0	$213.2	$0.0	$0.0	$60.8	$21.3	$904.3	$1,315.9	$131.6	$1,447.5	$2,729.8
6	1995	$0.0	$6.4	$191.4	$48.5	$121.2	$367.6	$639.5	$223.8	$0.0	$0.0	$89.3	$31.3	$983.9	$1,678.9	$167.9	$1,846.8	$3,198.3
7	1996	$0.0	$6.7	$201.0	$53.6	$134.0	$395.3	$671.5	$235.0	$0.0	$0.0	$93.8	$32.8	$1,033.1	$2,075.0	$207.5	$2,282.5	$3,711.0
8	1997	$0.0	$7.0	$211.1	$59.1	$147.7	$424.9	$705.0	$246.8	$0.0	$0.0	$98.5	$34.5	$1,084.8	$2,506.5	$250.6	$2,757.1	$4,266.8
9	1998	$0.0	$7.4	$221.6	$65.0	$162.5	$456.5	$740.3	$259.1	$0.0	$0.0	$103.4	$36.2	$1,139.0	$2,975.9	$297.6	$3,273.5	$4,869.0
10	1999	$0.0	$7.8	$232.7	$71.4	$178.4	$490.2	$777.3	$272.1	$0.0	$0.0	$108.6	$38.0	$1,196.0	$3,486.0	$348.6	$3,834.6	$5,520.8
11	2000	$97.7	$11.4	$244.3	$78.2	$195.5	$627.1	$816.2	$285.7	$0.0	$0.0	$146.6	$51.3	$1,299.7	$4,039.7	$404.0	$4,443.6	$6,370.5
12	2001	$102.6	$12.0	$257.4	$85.5	$213.8	$671.3	$0.0	$0.0	$256.6	$89.8	$153.9	$53.9	$554.1	$4,326.5	$432.6	$4,759.1	$5,984.6
13	2002	$107.8	$12.6	$0.0	$93.4	$233.5	$447.2	$0.0	$0.0	$269.4	$94.3	$161.6	$56.6	$581.9	$4,633.7	$463.4	$5,097.0	$6,126.0
14	2003	$0.0	$13.2	$0.0	$101.8	$254.6	$369.6	$0.0	$0.0	$282.8	$99.0	$169.7	$59.4	$611.0	$4,962.6	$496.3	$5,458.9	$6,439.4
15	2004	$0.0	$13.9	$0.0	$110.9	$277.2	$401.9	$0.0	$0.0	$297.0	$103.9	$178.2	$62.4	$641.5	$5,315.0	$531.5	$5,846.5	$6,889.9
16	2005	$0.0	$18.7	$0.0	$120.6	$301.4	$440.7	$0.0	$0.0	$311.8	$109.1	$228.7	$80.0	$729.7	$5,692.4	$569.2	$6,261.6	$7,432.0
17	2006	$0.0	$19.6	$0.0	$131.0	$327.4	$478.0	$0.0	$0.0	$327.4	$114.6	$240.1	$84.0	$766.2	$6,096.5	$609.7	$6,706.2	$7,950.4
18	2007	$0.0	$20.6	$0.0	$144.4	$361.0	$526.0	$0.0	$0.0	$343.8	$120.3	$252.1	$88.2	$804.5	$6,529.4	$652.9	$7,182.3	$8,512.8
19	2008	$0.0	$21.7	$0.0	$154.0	$385.1	$560.7	$0.0	$0.0	$361.0	$126.3	$264.7	$92.7	$844.7	$6,993.0	$699.3	$7,692.2	$9,097.7
20	2009	$0.0	$22.7	$0.0	$166.8	$416.9	$606.5	$0.0	$0.0	$379.0	$132.7	$278.0	$97.3	$887.0	$7,489.4	$748.9	$8,238.4	$9,731.8
Total Funds Required (in $1000s)		$465.7	$395.0	$2,238.4	$1,962.0	$4,160.0	$9,221.2	$6,617.4	$2,316.1	$2,828.9	$990.1	$2,843.6	$995.3	$16,591.3	$72,334.0	$7,233.4	$79,567.4	$105,380.0
Percent of Total Need		0.44%	0.37%	2.12%	1.86%	3.95%	8.75%	6.28%	2.20%	2.68%	0.94%	2.70%	0.94%	15.74%	68.64%	6.86%	75.51%	100.00%

* - Other project costs include engineering fees for facilities design, construction observation, rights-of-way and land costs, legal and administrative costs and project contingencies.

TABLE 7-12

SUMMARY OF 20-YEAR REVENUE NEEDS ASSUMING NO INFLATION

SORTED BY CURRENT AND FUTURE NEEDS

(All Costs In $1000s)

Program Year	Calendar Year	System Condition Assessment	Estimated Survey Needs	Strategic Basin Studies	CIP Projects - Construction	CIP Projects - Other Costs	TOTAL COSTS DUE TO EXISTING DEFICIENCIES	Future CIP Projects - Construction	Future CIP Projects - Other Costs	TOTAL COSTS RELATED TO FUTURE GROWTH	Repair and Replacement Costs - Construction	Repair and Replacement Costs - Other Costs	TOTAL RECURRING CAPITAL COSTS	Annual System Planning	Regulation and Enforcement	Identified O & M Components	Unidentified O & M Components	TOTAL RECURRING OPERATING COSTS	TOTAL ESTIMATED STORMWATER PROGRAM REVENUE NEEDS
1	1990	$50.0	$35.0	$0.0	$0.0	$0.0	$85.0	$0.0	$0.0	$0.0	$50.0	$17.5	$67.5	$328.0	$75.0	$151.0	$15.1	$569.1	$721.6
2	1991	$50.0	$35.0	$150.0	$501.1	$175.4	$911.4	$0.0	$0.0	$0.0	$50.0	$17.5	$67.5	$30.0	$75.0	$383.9	$38.4	$527.3	$1,506.2
3	1992	$50.0	$35.0	$150.0	$501.1	$175.4	$911.4	$0.0	$0.0	$0.0	$50.0	$17.5	$67.5	$32.0	$80.0	$616.8	$61.7	$790.5	$1,769.4
4	1993	$0.0	$35.0	$150.0	$501.1	$175.4	$861.4	$0.0	$0.0	$0.0	$50.0	$17.5	$67.5	$34.0	$85.0	$849.7	$85.0	$1,053.7	$1,982.6
5	1994	$0.0	$35.0	$150.0	$501.1	$175.4	$861.4	$0.0	$0.0	$0.0	$50.0	$17.5	$67.5	$36.0	$90.0	$1,082.6	$108.3	$1,316.9	$2,245.8
6	1995	$0.0	$5.0	$150.0	$501.1	$175.4	$831.4	$0.0	$0.0	$0.0	$70.0	$24.5	$94.5	$38.0	$95.0	$1,315.5	$131.6	$1,580.1	$2,506.0
7	1996	$0.0	$5.0	$150.0	$501.1	$175.4	$831.4	$0.0	$0.0	$0.0	$70.0	$24.5	$94.5	$40.0	$100.0	$1,548.4	$154.8	$1,843.2	$2,769.2
8	1997	$0.0	$5.0	$150.0	$501.1	$175.4	$831.4	$0.0	$0.0	$0.0	$70.0	$24.5	$94.5	$42.0	$105.0	$1,781.3	$178.1	$2,106.4	$3,032.4
9	1998	$0.0	$5.0	$150.0	$501.1	$175.4	$831.4	$0.0	$0.0	$0.0	$70.0	$24.5	$94.5	$44.0	$110.0	$2,014.2	$201.4	$2,369.6	$3,295.6
10	1999	$0.0	$5.0	$150.0	$501.1	$175.4	$831.4	$0.0	$0.0	$0.0	$70.0	$24.5	$94.5	$46.0	$115.0	$2,247.1	$224.7	$2,632.8	$3,558.7
11	2000	$60.0	$7.0	$150.0	$501.1	$175.4	$893.4	$0.0	$0.0	$0.0	$90.0	$31.5	$121.5	$48.0	$120.0	$2,480.0	$248.0	$2,896.0	$3,910.9
12	2001	$60.0	$7.0	$150.5	$0.0	$0.0	$217.5	$150.0	$52.5	$202.5	$90.0	$31.5	$121.5	$50.0	$125.0	$2,529.6	$253.0	$2,957.6	$3,499.1
13	2002	$60.0	$7.0	$0.0	$0.0	$0.0	$67.0	$150.0	$52.5	$202.5	$90.0	$31.5	$121.5	$52.0	$130.0	$2,580.2	$258.0	$3,020.2	$3,411.2
14	2003	$0.0	$7.0	$0.0	$0.0	$0.0	$7.0	$150.0	$52.5	$202.5	$90.0	$31.5	$121.5	$54.0	$135.0	$2,631.8	$263.2	$3,084.0	$3,415.0
15	2004	$0.0	$7.0	$0.0	$0.0	$0.0	$7.0	$150.0	$52.5	$202.5	$90.0	$31.5	$121.5	$56.0	$140.0	$2,684.4	$268.4	$3,148.9	$3,479.9
16	2005	$0.0	$9.0	$0.0	$0.0	$0.0	$9.0	$150.0	$52.5	$202.5	$110.0	$38.5	$148.5	$58.0	$145.0	$2,738.1	$273.8	$3,214.9	$3,574.9
17	2006	$0.0	$9.0	$0.0	$0.0	$0.0	$9.0	$150.0	$52.5	$202.5	$110.0	$38.5	$148.5	$60.0	$150.0	$2,792.9	$279.3	$3,282.2	$3,642.2
18	2007	$0.0	$9.0	$0.0	$0.0	$0.0	$9.0	$150.0	$52.5	$202.5	$110.0	$38.5	$148.5	$63.0	$157.5	$2,848.7	$284.9	$3,354.1	$3,714.1
19	2008	$0.0	$9.0	$0.0	$0.0	$0.0	$9.0	$150.0	$52.5	$202.5	$110.0	$38.5	$148.5	$64.0	$160.0	$2,905.7	$290.6	$3,420.3	$3,780.3
20	2009	$0.0	$9.0	$0.0	$0.0	$0.0	$9.0	$150.0	$52.5	$202.5	$110.0	$38.5	$148.5	$66.0	$165.0	$2,963.8	$296.4	$3,491.2	$3,851.2
Total Funds Required (In 1000's)		$330.0	$280.0	$1,650.5	$5,010.6	$1,753.7	$9,024.8	$1,350.0	$472.5	$1,822.5	$1,600.0	$560.0	$2,160.0	$1,241.0	$2,357.5	$39,145.8	$3,914.6	$46,658.9	$59,666.2
Percent of Total Need		0.55%	0.47%	2.77%	8.40%	2.94%	15.13%	2.26%	0.79%	3.05%	2.68%	0.94%	3.62%	2.08%	3.95%	65.61%	6.56%	78.20%	100.00%

* - Other project costs include engineering fees for facilities design, construction observation, rights-of-way and land costs, legal and administrative costs and project contingencies.

TABLE 7-13

SUMMARY OF 20-YEAR REVENUE NEEDS ASSUMING 5% INFLATION

SORTED BY CURRENT AND FUTURE NEEDS

Program Year	Calendar Year	System Condition Assessment	Estimated Survey Needs	Strategic Basin Studies	CIP Projects - Construction	CIP Projects - Other Costs	TOTAL COSTS DUE TO EXISTING DEFICIENCIES	Future CIP Projects - Construction	Future CIP Projects - Other Costs	TOTAL COSTS RELATED TO FUTURE GROWTH	Repair and Replacement Costs - Construction	Repair and Replacement Costs - Other Costs	TOTAL RECURRING CAPITAL COSTS	Annual System Planning	Regulation and Enforcement	Identified O & M Components	Unidentified O & M Components	TOTAL REOURRING OPERATING COSTS	TOTAL ESTIMATED STORMWATER PROGRAM REVENUE NEEDS
					(All Costs In $1000s)														
1	1990	$50.0	$35.0	$0.0	$0.0	$0.0	$85.0	$0.0	$0.0	$0.0	$50.0	$17.5	$67.5	$328.0	$75.0	$151.0	$15.1	$569.1	$721.6
2	1991	$52.5	$36.8	$157.5	$526.1	$184.1	$957.0	$0.0	$0.0	$0.0	$52.5	$18.4	$70.9	$31.5	$78.8	$403.1	$40.3	$553.7	$1,581.5
3	1992	$55.1	$38.6	$165.4	$552.4	$193.3	$1,004.9	$0.0	$0.0	$0.0	$55.1	$19.3	$74.4	$35.3	$88.2	$680.0	$68.0	$871.5	$1,950.8
4	1993	$0.0	$40.5	$173.6	$580.0	$203.0	$997.2	$0.0	$0.0	$0.0	$57.9	$20.3	$78.1	$39.4	$98.4	$983.6	$98.4	$1,219.8	$2,295.1
5	1994	$0.0	$42.5	$182.3	$609.0	$213.2	$1,047.1	$0.0	$0.0	$0.0	$60.8	$21.3	$82.0	$43.8	$109.4	$1,315.9	$131.6	$1,600.7	$2,729.8
6	1995	$0.0	$6.4	$191.4	$639.5	$223.8	$1,061.1	$0.0	$0.0	$0.0	$89.3	$31.3	$120.6	$48.5	$121.2	$1,678.9	$167.9	$2,016.6	$3,198.3
7	1996	$0.0	$6.7	$201.0	$671.5	$235.0	$1,114.2	$0.0	$0.0	$0.0	$93.8	$32.8	$126.6	$53.6	$134.0	$2,075.0	$207.5	$2,470.1	$3,711.0
8	1997	$0.0	$7.0	$211.1	$705.0	$246.8	$1,169.9	$0.0	$0.0	$0.0	$98.5	$34.5	$133.0	$59.1	$147.7	$2,506.5	$250.6	$2,964.0	$4,266.8
9	1998	$0.0	$7.4	$221.6	$740.3	$259.1	$1,228.4	$0.0	$0.0	$0.0	$103.4	$36.2	$139.6	$65.0	$162.5	$2,975.9	$297.6	$3,501.0	$4,869.0
10	1999	$0.0	$7.8	$232.7	$777.3	$272.1	$1,289.8	$0.0	$0.0	$0.0	$108.6	$38.0	$146.6	$71.4	$178.4	$3,486.0	$348.6	$4,084.4	$5,520.8
11	2000	$97.7	$11.4	$244.3	$816.2	$285.7	$1,455.3	$0.0	$0.0	$0.0	$146.6	$51.3	$197.9	$78.2	$195.5	$4,039.7	$404.0	$4,717.3	$6,370.5
12	2001	$102.6	$12.0	$257.4	$0.0	$0.0	$372.0	$256.6	$89.8	$346.3	$153.9	$53.9	$207.8	$85.5	$213.8	$4,326.5	$432.6	$5,058.4	$5,984.6
13	2002	$107.8	$12.6	$0.0	$0.0	$0.0	$120.3	$269.4	$94.3	$363.7	$161.6	$56.6	$218.2	$93.4	$233.5	$4,633.7	$463.4	$5,423.9	$6,126.0
14	2003	$0.0	$13.2	$0.0	$0.0	$0.0	$13.2	$282.8	$99.0	$381.8	$169.7	$59.4	$229.1	$101.8	$254.6	$4,962.6	$496.3	$5,815.3	$6,439.4
15	2004	$0.0	$13.9	$0.0	$0.0	$0.0	$13.9	$297.0	$103.9	$400.9	$178.2	$62.4	$240.6	$110.9	$277.2	$5,315.0	$531.5	$6,234.6	$6,889.9
16	2005	$0.0	$18.7	$0.0	$0.0	$0.0	$18.7	$311.8	$109.1	$421.0	$228.7	$80.0	$308.7	$120.6	$301.4	$5,692.4	$569.2	$6,683.6	$7,432.0
17	2006	$0.0	$19.6	$0.0	$0.0	$0.0	$19.6	$327.4	$114.6	$442.0	$240.1	$84.0	$324.2	$131.0	$327.4	$6,096.5	$609.7	$7,164.6	$7,950.4
18	2007	$0.0	$20.6	$0.0	$0.0	$0.0	$20.6	$343.8	$120.3	$464.1	$252.1	$88.2	$340.4	$144.4	$361.0	$6,529.4	$652.9	$7,687.7	$8,512.8
19	2008	$0.0	$21.7	$0.0	$0.0	$0.0	$21.7	$361.0	$126.3	$487.3	$264.7	$92.7	$357.4	$154.0	$385.1	$6,993.0	$699.3	$8,231.3	$9,097.7
20	2009	$0.0	$22.7	$0.0	$0.0	$0.0	$22.7	$379.0	$132.7	$511.7	$278.0	$97.3	$375.3	$166.8	$416.9	$7,489.4	$748.9	$8,822.1	$9,731.8
Total Funds Required (in $1000s)		$465.7	$395.0	$2,238.4	$6,617.4	$2,316.1	$12,032.7	$2,828.9	$990.1	$3,819.0	$2,843.6	$995.3	$3,838.9	$1,962.0	$4,160.0	$72,334.0	$7,233.4	$85,689.4	$105,380.0
Percent of Total Need		0.44%	0.37%	2.12%	6.28%	2.20%	11.42%	2.68%	0.94%	3.62%	2.70%	0.94%	3.64%	1.86%	3.95%	68.64%	6.86%	81.31%	100.00%

* - Other project costs include engineering fees for facilities design, construction observation, rights-of-way and land costs, legal and administrative costs and project contingencies.

Section 8

SECTION 8

Section 8

FUNDING NEEDS AND IMPLEMENTATION PROGRAM

8.1 GENERAL

This section evaluates the County's past and current funding of drainage projects, overall funding needs, develops a plan to implement the program over the next 20 years, and evaluates funding mechanisms needed to provide the funds for the program.

8.2 DRAINAGE PROGRAM FUNDING HISTORY

Historically, Seminole County has not had a comprehensive stormwater management program to solve drainage problems. The County's primary involvement has been through the development review process in an effort to avoid future problems. While this approach is appropriate and desirable, additional program elements are necessary.

Funding for drainage projects has, in the past, come from the County-wide Transportation Fund: 101 and projects funded have been primarily incidental to road improvement work. Table 8-1 provides an expenditure history for Fiscal Year 81/82 through 86/87. During this period there was a steady increase in funding. The funds were used during this period for maintenance ($44,825) and right-of-way purchase ($491,742). During FY 88-89, $1,054,340 has been

TABLE 8-1

SEMINOLE COUNTY

DRAINAGE EXPENDITURE HISTORY

	FY 81/82	FY 83/84	FY 84/85	FY 85/86	FY 86/87	FY 87/88
Materials & Supplies (1)	$ 0	$ 0	$ 6,125	$ 38,700	$ 0	$ 0
Land (2)	$ 0	75,696	143,781	189,989	8,686	73,590
Subtotal:	0	$75,696	$149,906	$228,689	$ 8,686	$ 73,590
Roads Division	N/A	N/A	N/A	N/A	151,095	151,095
				Total:	$159,781	$224,685

(1) Maintenance of drainage facilities and/or systems.

(2) R/W purchase for drainage facilities and/or systems.

Historically funds for drainage improvements have been derived from "Countywide Transportation Fund:101" (from a combination of property and gas tax revenues) and from the Seminole County Roads Division operating budget (for roadside ditch maintenance).

budgeted from General Fund:001 for five specific projects, culvert construction on Wekiva Springs Road, reconstruction of the Lynwood storm sewer system, improvements at the Longwood Hills bridge, the Wekiva Hunt Club Outfall and the Interlachen Canal. These funds (State shared revenues) are for design and construction, with no funds indicated for facilities or systems maintenance. Additionally, the County Road Department budgets approximately $151,000 annually for road-side ditch cleaning and mowing from a separate roads division operating budget. These dollars are over and above the other funds expended from the Transportation Fund:101. The Roads Divison operating budget is funded by a combination of Transportation Funds:101 and 109. The primary revenue sources for Unincorporated Transportation Fund:109 are (1) Unincorporated Ad Valorum Taxes at 0.65 mils and (2) the balance of the County 1 cent gas tax (7th cent).

Currently, a conservative estimate of future funds available from Transportation Fund:001 for the drainage budget is $500,000 per year through Fiscal Years 1992-93. This budgeted amount should be for drainage basin studies, preliminary engineering, project design, construction and operation and maintenance. Based on the revenue needs estimated for the overall stormwater management program, the $500,000 allocation will provide approximately 25 percent of the total need over the next five years. It should be noted that the $500,000 should be allocated in accordance with the needs summary as detailed in Table 7-12.

8.3 FUNDING AND FINANCING MECHANISMS

Financing of stormwater management varies from community to community. This is especially true in the case of storm drainage utilities, which typically have rate structures tailored to local circumstances, needs, and attitudes. This is a technical rather than legal analysis of funding options. It is intended to identify and evaluate the options which are available, establish criteria for selecting a preferred funding strategy, and examine the procedural considerations which may affect the timing of implementation of the program. The County may wish to have a legal opinion prepared on one or more of the funding methods.

Based on experience gained in working with cities and counties throughout the United States, a range of stormwater management financing options have been identified, including the following:

- Stormwater Utility Service Charges

  This is usually the primary funding method used by stormwater utilities. Charges reflect property characteristics which affect stormwater runoff and the cost of services and facilities, such as gross area, impervious coverage, impervious percentage, and floodplain location.

- System Development Charges

  System development charges (SDC's) are a subset within a stormwater utility rate structure which ensures that properties developed after the completion of drainage improvements participate in the cost of the facilities. This rate structure concept improves the equity of the stormwater utility approach in a rapidly developing community, where improvements must often be built in anticipation of growth. It may be applicable with other funding methods as well. Present residents and businesses would not have to pay the entire cost of improvements for future residents if a system development charge is adopted. The revenue from SDC's is used for capital improvements only.

- Revenue and General Obligation Bonding

  Major capital improvements to the stormwater systems are often too expensive to fund from revenues available in a single year. Bonding allows construction of costly projects by borrowing the money and repaying it from future revenues. Two methods of bonding stormwater improvements are common. Revenue bonding can be used with one or more funding methods that generate revenue to service the debt. General obligation bonding can be used with or without a separate source of drainage funding because this type of debt is secured by the full credit of the County and involves property tax support and a referendum.

o In-lieu of Construction Fees for Stormwater Detention

On-site detention has been a commonly used drainage control requirement on new development for several years. On-site systems are not without problems, however. Sometimes they are poorly sited, and maintenance of numerous small facilities is a constant and costly burden on the County regardless of what maintenance commitments may have been originally required (homeowners' associations, etc.). In-lieu of construction fees offer an alternative to a proliferation of on-site detention systems. Rather than requiring that each developer build a separate on-site system, a fee is charged to the developer and is used to help finance regional detention that is usually more effective and less expensive to maintain. As the County develops specific basin master plans, this option could be considered more extensively. Such regional facilities would be planned in conjunction with the SJRWMD. Current trends point to more regional detention facilities instead of a proliferation of small on-site ponds. A move is currently underway to apply the National Point Discharge Elimination System (NPDES) permitting requirements to stormwater discharges. This action will promote regional facilities in an effort to limit the number of stormwater discharge points.

o Special Improvement Assessment Districts

Special Improvement Assessment Districts are special-purpose funding mechanisms usually used to pay for small capital projects serving a

limited area. The district boundaries are defined as a method of distributing costs formulated to generate an assessment roll. This funding mechanism may be used as an adjunct to other funding methods, leveraging revenue with locally-generated funding to build minor projects that otherwise would not rate highly on a County-wide basis.

- Plan Review, Development Inspection, and Special Inspection Fees

  Plan review and inspection fees are used by most Counties to recapture the expense of development plan review and inspection. Other types of inspection fees, such as annual charges to inspect private on-site detention systems on commercial sites should also be considered to recapture the expense of the inspections. Review and inspection fees should not be considered as a revenue source for capital projects.

- Impact Fees

  New development impacts many aspects of the County such as water, sewer, transportation, recreation, and drainage systems. Impact fees are generally popular with present residents because they transfer costs which are otherwise borne by the County (and its taxpayers and utility ratepayers) to the developers. Limited use of this type of charge within the context of other storm drainage funding methods should be considered.

- Developer Extension/Latecomer Fees

  Development in a rapidly growing County rarely happens in the most orderly fashion. Properties not yet served by water, sewer, or drainage systems may develop before those closer to existing systems. In these cases, the developers must extend the facilities to serve their projects. Developer extension/latecomer fees provide a mechanism for compensating developers for the additional expense of extensions and/or oversizing to accommodate other users. The fees are paid by those developing in the future, and a major portion of the fee is turned over to the original developer to repay his financing of the original improvement. The County's comprehensive Plan should limit the applicability of these fees to urban service areas.

- Expanded Sanitary Sewer Utility Charges

  There are many similarities between sanitary sewage operations and stormwater management. One financing option the County could consider is expanding the scope of responsibility of the sanitary sewage program to include storm drainage with funding from sewer service charges. There are disadvantages to this approach, particularly when a single sewer utility does not provide jurisdiction-wide services.

- Federal and State Funding

  Federal and State funding for stormwater management is very limited, but these sources should be examined as part of the ongoing financing program of Seminole County.

Special attention should be paid to defining a mix of financing methods that fit the functional requirements of the stormwater management program in Seminole County. The experience in other communities is that no single funding method is suitable for all aspects of a local stormwater management program. Moreover, a well-designed combination of financing options improves both the equity of the funding and the total revenue available for drainage purposes, as well as segregates funds to be used for capital improvement programs, operation and maintenance, and program development.

8.4 RECOMMENDED FUNDING STRATEGY

The County's stormwater management program must develop a stable and reliable financing program if it is to be successful and solve Seminole County's current and future stormwater problems. There are several alternatives that were discussed which can be used to fund Seminole County's stormwater management program; however, only the stormwater utility and bonding programs are capable of providing adequate funding to completely meet the County's long-term needs for stormwater facilities.

8.4.1 The Stormwater Utility

The stormwater utility concept is still fairly new, with most stormwater utilities having been established within the past 10 years. One of the purposes of utility user charges and rate structures is to equitably distribute the costs of the utility program. It has been recognized that charging in relationship to each property's role in contributing stormwater runoff is at least as equitable as charging for service or benefit. By instituting user fees, individuals pay according to the service/benefit that is used/received. Parcels of properties are frequently charged according to their runoff characteristics. Charges are most often based on the percent of impervious area and on the parcel size. Adjustments can be built into the system for those properties who use appropriate stormwater management control practices that may change the runoff characteristics of the property (detention/retention practices) and reduce downstream impacts.

User charges can provide a true alternative to general fund financing for drainage rather than just a supplement to it. Revenues derived from service charges can be used to pay for administration, planning, design, operations and maintenance, revenue bonds for new construction and replacement of old systems, support services, regulatory functions and virtually any other element required in the comprehensive stormwater management program. Rate structures are flexible mechanisms which enable a local government to tailor the cost distribution to fit the local program and be consistent with other

local policies. Finally, drainage utility revenues remain in the utility fund if not spent rather than reverting for redistribution in the next year's general budget, an important factor in long-term program stability.

Considering the establishment of a stormwater utility for Seminole County requires a thoughtful evaluation of the program steps and structure. Typical steps which should be considered in setting up a utility are as follows:

- Identify Functional Requirements
- Understand Legal Framework
- Determine Organizational Structure
- Prepare O&M/CIP Program (short and long range)
- Review Finance Options
- Establish Utility Rate Policy/Model
- Implement Billing System
- Conduct Public Awareness Program

The length of time required to develop and implement a stormwater utility varies based on the public awareness program undertaken, the availability of a current billing system and other factors. The program development work itself is not the principal determinant of the time required to set up a stormwater utility. Rather, appropriate involvement of elected officials and the general public dictates the pace. The work itself can be done much more quickly than the community can be informed and consensus developed that a long-term program is needed. A schedule which expedites the work as much as possible

but also allows proper public involvement typically requires 16 to 24 months for program development and an additional 6 to 10 months for implementation of a master account file and billing system. However, in Tulsa, Oklahoma the first billing was sent out in just under 24 months, so the schedule can be expedited somewhat in extreme situations. It is also desirable to begin actual billing in the first month of a fiscal year.

As applied to Seminole County, the land use mix of the County must be considered as well as runoff generation characteristics. For purposes of illustration, a very preliminary analysis of land uses suggests that the 1988 level of development within the unincorporated county generated a runoff volume equal to the runoff generated by about 94,462 average residential parcels. The Equivalent Residential Unit (ERU) is a common unit of measurement used in assessing land use mixes, the effect of various percentages of impervious surface, and the stormwater runoff potential within a county. The calculation of an ERU for Seminole County is based on typical single family lot size (0.9 acres) and a typical level of impervious surface on the single family lot (20%) which results in a ERU value of about 0.18 acres of impervious surface. Similar calculations for other land uses within the County are summarized in Table 8-2, based on 1988 data which is included in Appendix C. It was assumed that the number of ERU's would increase from the 1988 estimate at 4 percent annually to the maximum estimated potential of 208,349 ERU's at build-out.

TABLE 8-2

SUMMARY OF ERU'S BY LAND USE (1988 DATA)

	Estimated Gross Area (Acres)	Estimated Impervious Area (AC)	Number of Potential ERU Equivalents	Estimated Occupancy Rate (%)	1988 Number of ERU's
Single Family Residential	40,900	8,180	45,444	90	40,689
Mobile Home	500	325	1,806	54	971
Multi-Family	5,000	4,000	22,222	24	5,356
Group Quarters	10	8	44	100	44
Commercial	10,500	8,925	49,583	8	3,768
Industrial	10,500	8,925	49,583	8	3,967
General Rural	30,500	3,050	16,944	100	16,944
Public	5,000	3,250	18,056	100	18,056
Miscellaneous	2,100	840	4,667	100	4,667
TOTAL	105,010	37,503	208,349		94,462

Based on the estimated annual revenue needs previously presented in Table 7-11, assuming 5% inflation, an estimated monthly charge per ERU was calculated. As indicated in Section 7, these needs are based on a 10-year construction program to solve current deficiencies. It was assumed that utility charges would be revised only every five years, and that two series of bonds would be issued to fund the capital improvements projects. An interest rate of 9.00% was assumed, with a bond life of 30 years. The average monthly residential stormwater utility charge per ERU, as summarized in Table 8-3, varies from about $1.21 in 1990-94 to $25.67 in the years 2035-2039. This charge per ERU would probably be closer to $1.50 per month in 1990-94, in order to cover billing and other administrative costs and would likely rise to $27.00 over the 50-year program period. Surplus revenues can be used for other stormwater program efforts or the rate could be reduced if general funds from ad valorem taxes will continue to be used. These average monthly rates are very reasonable when compared to current rates and projected rates across the country.

In order to demonstrate the effect of the time frame of the initial capital improvement program, Table 8-4 details revenue needs and sources based on a 20-year construction program to solve current deficiencies. The average monthly residential stormwater utility charge varies from about $1.08 to $25.69 over the 50-year period. Table 8-5 summarizes the estimated monthly stormwater utility charges per ERU for the 10-year and 20-year construction programs. The difference between the charges under the 10- and 20-year programs is so minimal that the 10-year program is recommended.

TABLE 8-3

SUMMARY OF POTENTIAL CHARGES AND REVENUES

FOR 10-YEAR CONSTRUCTION PROGRAM

10-year Capital Construction Program (2 bond issues @ 5 years each)

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
ESTIMATED CIP PROGRAM COSTS													
Phase I $3,924,400	$0	$710,200	$745,700	$783,000	$822,200	$863,300	$906,500	$951,800	$999,400	$1,049,400	$1,101,900		
Phase II $5,009,000													
Total Estimated CIP Costs $8,933,400	$0	$710,200	$745,700	$783,000	$822,200	$863,300	$906,500	$951,800	$999,400	$1,049,400	$1,101,900		
DEBT SERVICE BY BOND ISSUE													
Terms: Interest rate 9.00%													
Life of bonds (years) 30													
Reserve & Bond Issuance Costs 12.50%													
Issue 1 (1989-1995)		$429,735	$429,735	$429,735	$429,735	$429,735	$429,735	$429,735	$429,735	$429,735	$429,735	$429,735	$429,735
Issue 2 (1996-2000)							$548,503	$548,503	$548,503	$548,503	$548,503	$548,503	$548,503
ANNUAL PROGRAM COSTS													
Total Estimated Debt Service	$0	$429,735	$429,735	$429,735	$429,735	$429,735	$978,238	$978,238	$978,238	$978,238	$978,238	$978,238	$978,238
Estimated O & M Program Costs	$166,100	$443,400	$748,000	$1,082,000	$1,447,500	$1,846,800	$2,282,500	$2,757,100	$3,273,500	$3,834,600	$4,443,600	$4,759,100	$5,097,000
Estimated Continuing Repair & Replacement and Future CIP Program Costs	$67,500	$70,900	$74,400	$78,200	$82,100	$120,600	$126,600	$133,000	$139,600	$146,600	$197,900	$554,100	$581,900
Estimated Program Development Costs	$488,000	$357,000	$382,570	$351,920	$378,020	$367,570	$395,330	$424,940	$456,530	$490,220	$627,120	$413,900	$447,170
Total Estimated Annual Program Costs	$721,600	$1,301,035	$1,634,705	$1,941,855	$2,337,355	$2,764,705	$3,782,668	$4,293,278	$4,847,868	$5,449,658	$6,246,858	$6,705,338	$7,104,308
ESTIMATED STORMWATER REVENUE ANALYSIS													
Stormwater Utility Charges													
Estimated ERU's	102,170	106,257	110,507	114,927	119,525	124,306	129,278	134,449	139,827	145,420	151,237	157,286	163,578
Required Annual Charge per ERU	$7.06	$12.24	$14.79	$16.90	$19.56	$22.24	$29.26	$31.93	$34.67	$37.48	$41.31	$42.63	$43.43
Proposed Annual Charge per ERU	$14.50	$14.50	$14.50	$14.50	$14.50	$31.50	$31.50	$31.50	$31.50	$31.50	$43.00	$43.00	$43.00
Resultant Revenue	$1,481,466	$1,540,725	$1,602,354	$1,666,448	$1,733,106	$3,915,625	$4,072,250	$4,235,140	$4,404,545	$4,580,727	$6,503,178	$6,763,305	$7,033,838
Annual Surplus/Shortage	$1,481,466	$239,690	($32,351)	($275,407)	($604,249)	$1,150,920	$289,582	($58,138)	($443,322)	($868,930)	$256,321	$57,968	($70,470)
Cumulative Surplus/Shortage	$759,866	$999,556	$967,205	$691,799	$87,550	$1,238,469	$1,528,051	$1,469,913	$1,026,591	$157,661	$413,981	$471,949	$401,479

TABLE 8-3
(CONTINUED)

	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
ESTIMATED CIP PROGRAM COSTS													
Phase I $3,924,400													
Phase II $5,009,000													
Total Estimated CIP Costs $8,933,400													
DEBT SERVICE BY BOND ISSUE													
Terms: Interest rate 9.00%													
Life of bonds (years) 30													
Reserve & Bond Issuance Costs 12.50%													
Issue 1 (1989-1995)	$429,735	$429,735	$429,735	$429,735	$429,735	$429,735	$429,735	$429,735	$429,735	$429,735	$429,735	$429,735	$429,735
Issue 2 (1996-2000)	$548,503	$548,503	$548,503	$548,503	$548,503	$548,503	$548,503	$548,503	$548,503	$548,503	$548,503	$548,503	$548,503
ANNUAL PROGRAM COSTS													
Total Estimated Debt Service	$978,238	$978,238	$978,238	$978,238	$978,238	$978,238	$978,238	$978,238	$978,238	$978,238	$978,238	$978,238	$978,238
Estimated O & M Program Costs	$5,458,900	$5,846,500	$6,261,600	$6,706,200	$7,182,300	$7,692,200	$8,238,400	$8,823,400	$9,449,861	$10,120,802	$10,839,378	$11,608,974	$12,433,212
Estimated Continuing Repair & Replacement and Future CIP Program Costs	$611,000	$641,500	$729,700	$766,200	$804,500	$844,700	$887,000	$931,350	$977,918	$1,026,813	$1,078,154	$1,132,062	$1,188,665
Estimated Program Development Costs	$369,590	$401,930	$440,730	$478,050	$526,020	$560,740	$606,470	$649,529	$695,646	$745,037	$797,934	$854,588	$915,264
Total Estimated Annual Program Costs	$7,417,728	$7,868,168	$8,410,268	$8,928,688	$9,491,058	$10,075,878	$10,710,108	$11,382,517	$12,101,662	$12,870,889	$13,693,705	$14,573,861	$15,515,377
ESTIMATED STORMWATER REVENUE ANALYSIS													
Stormwater Utility Charges													
Estimated ERU's	170,121	176,926	184,003	191,363	199,017	206,978	215,257	223,867	208,349	208,349	208,349	208,349	208,349
Required Annual Charge per ERU	$43.60	$44.47	$45.71	$46.66	$47.69	$48.68	$49.75	$50.84	$58.08	$61.78	$65.72	$69.95	$74.47
Proposed Annual Charge per ERU	$43.00	$43.00	$47.75	$47.75	$47.75	$47.75	$47.75	$61.25	$61.25	$61.25	$61.25	$61.25	$84.75
Resultant Revenue	$7,315,191	$7,607,799	$8,786,123	$9,137,568	$9,503,071	$9,883,193	$10,278,521	$13,711,870	$12,761,376	$12,761,376	$12,761,376	$12,761,376	$17,657,578
Annual Surplus/Shortage	($102,536)	($260,369)	$375,855	$208,880	$12,013	($192,684)	($431,586)	$2,329,353	$659,714	($109,513)	($932,328)	($1,812,485)	$2,142,200
Cumulative Surplus/Shortage	$298,943	$38,574	$414,429	$623,310	$635,323	$442,639	$11,052	$2,340,405	$3,000,119	$2,890,606	$1,958,278	$145,793	$2,287,993

TABLE 8-3
(CONTINUED)

	Year 27	Year 28	Year 29	Year 30	Year 31	Year 32	Year 33	Year 34	Year 35	Year 36	Year 37	Year 38	Year 39
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
ESTIMATED CIP PROGRAM COSTS													
Phase I $3,924,400													
Phase II $5,009,000													
Total Estimated CIP Costs $8,933,400													
DEBT SERVICE BY BOND ISSUE													
Terms: Interest rate 9.00%													
Life of bonds (years) 30													
Reserve & Bond Issuance Costs 12.50%													
Issue 1 (1989-1995)	$429,735	$429,735	$429,735	$429,735	$429,735								
Issue 2 (1996-2000)	$548,503	$548,503	$548,503	$548,503	$548,503	$548,503	$548,503	$548,503	$548,503	$548,503			
ANNUAL PROGRAM COSTS													
Total Estimated Debt Service	$978,238	$978,238	$978,238	$978,238	$978,238	$548,503	$548,503	$548,503	$548,503	$548,503	$0	$0	$0
Estimated O & M Program Costs	$13,315,970	$14,261,403	$15,273,963	$16,358,414	$17,519,862	$18,763,772	$20,096,000	$21,522,816	$23,050,936	$24,687,552	$26,440,368	$28,317,635	$30,328,187
Estimated Continuing Repair & Replacement and Future CIP Program Costs	$1,248,098	$1,310,503	$1,376,028	$1,444,830	$1,517,071	$1,592,925	$1,672,571	$1,756,199	$1,844,009	$1,936,210	$2,033,020	$2,134,671	$2,241,405
Estimated Program Development Costs	$980,247	$1,049,845	$1,124,384	$1,204,215	$1,289,714	$1,381,284	$1,479,355	$1,584,389	$1,696,881	$1,817,360	$1,946,392	$2,084,586	$2,232,592
Total Estimated Annual Program Costs	$16,522,552	$17,599,989	$18,752,613	$19,985,697	$21,304,885	$22,286,483	$23,796,428	$25,411,907	$27,140,329	$28,989,624	$30,419,781	$32,536,892	$34,802,183
ESTIMATED STORMWATER REVENUE ANALYSIS													
Stormwater Utility Charges													
Estimated ERU's	208,349	208,349	208,349	208,349	208,349	208,349	208,349	208,349	208,349	208,349	208,349	208,349	208,349
Required Annual Charge per ERU	$79.30	$84.47	$90.01	$95.92	$102.26	$106.97	$114.21	$121.97	$130.26	$139.14	$146.00	$156.17	$167.04
Proposed Annual Charge per ERU	$84.75	$84.75	$84.75	$84.75	$115.25	$115.25	$115.25	$115.25	$115.25	$157.25	$157.25	$157.25	$157.25
Resultant Revenue	$17,657,578	$17,657,578	$17,657,578	$17,657,578	$24,012,222	$24,012,222	$24,012,222	$24,012,222	$24,012,222	$32,762,880	$32,762,880	$32,762,880	$32,762,880
Annual Surplus/Shortage	$1,135,025	$57,589	($1,095,035)	($2,328,119)	$2,707,338	$1,725,739	$215,794	($1,399,685)	($3,128,106)	$3,773,256	$2,343,100	$225,989	($2,039,303)
Cumulative Surplus/Shortage	$3,423,018	$3,480,607	$2,385,572	$57,453	$2,764,791	$4,490,530	$4,706,324	$3,306,639	$178,533	$3,951,790	$6,294,889	$6,520,878	$4,481,575

TABLE 8-3
(CONTINUED)

	Year 40	Year 41	Year 42	Year 43	Year 44	Year 45	Year 46	Year 47	Year 48	Year 49	Year 50
	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
ESTIMATED CIP PROGRAM COSTS											
Phase I $3,924,400											
Phase II $5,009,000											
Total Estimated CIP Costs $8,933,400											
DEBT SERVICE BY BOND ISSUE											
Terms: Interest rate 9.00%											
Life of bonds (years) 30											
Reserve & Bond Issuance Costs 12.50%											
Issue I (1989-1995)											
Issue 2 (1996-2000)											
ANNUAL PROGRAM COSTS											
Total Estimated Debt Service	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Estimated O & M Program Costs	$32,481,488	$34,787,673	$37,257,598	$39,902,888	$42,735,993	$45,770,248	$49,019,936	$52,500,351	$56,227,876	$60,220,055	$64,495,679
Estimated Continuing Repair & Replacement and Future CIP Program Costs	$2,353,475	$2,471,149	$2,594,706	$2,724,442	$2,860,664	$3,003,697	$3,153,882	$3,311,576	$3,477,155	$3,651,012	$3,833,563
Estimated Program Development Costs	$2,391,106	$2,560,874	$2,742,696	$2,937,427	$3,145,985	$3,369,350	$3,608,574	$3,864,782	$4,139,182	$4,433,064	$4,747,811
Total Estimated Annual Program Costs	$37,226,068	$39,819,696	$42,595,001	$45,564,757	$48,742,641	$52,143,295	$55,782,391	$59,676,709	$63,844,213	$68,304,132	$73,077,054
ESTIMATED STORMWATER REVENUE ANALYSIS											
Stormwater Utility Charges											
Estimated ERU's	208,349	208,349	208,349	208,349	208,349	208,349	208,349	208,349	208,349	208,349	208,349
Required Annual Charge per ERU	$178.67	$191.12	$204.44	$218.69	$233.95	$250.27	$267.74	$286.43	$306.43	$327.84	$350.74
Proposed Annual Charge per ERU	$157.25	$219.75	$219.75	$219.75	$219.75	$219.75	$308.00	$308.00	$308.00	$308.00	$308.00
Resultant Revenue	$32,762,880	$45,784,693	$45,784,693	$45,784,693	$45,784,693	$45,784,693	$64,171,492	$64,171,492	$64,171,492	$64,171,492	$64,171,492
Annual Surplus/Shortage	($4,463,188)	$5,964,996	$3,189,692	$219,936	($2,957,948)	($6,358,602)	$8,389,101	$4,494,783	$327,279	($4,132,640)	($8,905,562)
Cumulative Surplus/Shortage	$18,387	$5,983,383	$9,173,076	$9,393,012	$6,435,063	$76,461	$8,465,562	$12,960,345	$13,287,624	$9,154,984	$249,423

TABLE 8-4

SUMMARY OF POTENTIAL CHARGES AND REVENUES

FOR 20-YEAR CONSTRUCTION PROGRAM

FILE NAME: MODELC

20-year Capital Construction Program (4 bond issues @ 5-year intervals)

		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
ESTIMATED CIP PROGRAM COSTS														
Phase I	$1,962,300	$0	$355,200	$372,900	$391,500	$411,100	$431,600	$453,200	$475,900	$499,700	$524,700	$550,900	$578,500	$607,400
Phase II	$2,504,400													
Phase III	$3,196,300													
Phase IV	$4,079,500													
Total Estimated CIP Costs	$10,413,500	$0	$355,200	$372,900	$391,500	$411,100	$0	$453,200	$475,900	$499,700	$524,700	$550,900	$578,500	$607,400
DEBT SERVICE BY BOND ISSUE														
Terms: Interest rate	9.00%													
Life of bonds (years)	30													
Reserve & Bond Issuance Costs	12.50%													
Issue 1 (1989-1995)			$214,879	$214,879	$214,879	$214,879	$214,879	$214,879	$214,879	$214,879	$214,879	$214,879	$214,879	$214,879
Issue 2 (1996-2000)								$274,240	$274,240	$274,240	$274,240	$274,240	$274,240	$274,240
Issue 3 (2000-2005)													$350,006	$350,006
Issue 4 (2006-2010)														
ANNUAL PROGRAM COSTS														
Total Estimated Debt Service		$0	$214,879	$214,879	$214,879	$214,879	$214,879	$489,119	$489,119	$489,119	$489,119	$489,119	$839,125	$839,125
Estimated O & M Program Costs		$166,100	$443,400	$748,000	$1,082,000	$1,447,500	$1,846,800	$2,282,500	$2,757,100	$3,273,500	$3,834,600	$4,443,600	$4,759,100	$5,097,000
Estimated Continuing Repair & Replacement and Future CIP Program Costs		$67,500	$70,900	$74,400	$78,200	$82,100	$120,600	$126,600	$133,000	$139,600	$146,600	$197,900	$554,100	$581,900
Estimated Program Development Costs		$488,000	$357,000	$382,570	$351,920	$378,020	$367,570	$395,330	$424,940	$456,530	$490,220	$627,120	$413,900	$447,170
Total Estimated Annual Program Costs		$721,600	$1,086,179	$1,419,849	$1,726,999	$2,122,499	$2,549,849	$3,293,549	$3,804,159	$4,358,749	$4,960,539	$5,757,739	$6,566,225	$6,965,195
ESTIMATED STORMWATER REVENUE ANALYSIS														
Stormwater Utility Charges														
Estimated ERU's		102,170	106,257	110,507	114,927	119,525	124,306	129,278	134,449	139,827	145,420	151,237	157,286	163,578
Required Annual Charge per ERU		$7.06	$10.22	$12.85	$15.03	$17.76	$20.51	$25.48	$28.29	$31.17	$34.11	$38.07	$41.75	$42.58
Proposed Annual Charge per ERU		$13.00	$13.00	$13.00	$13.00	$13.00	$28.00	$28.00	$28.00	$28.00	$28.00	$42.00	$42.00	$42.00
Resultant Revenue		$1,328,211	$1,381,340	$1,436,593	$1,494,057	$1,553,819	$3,480,555	$3,619,778	$3,764,569	$3,915,151	$4,071,757	$6,351,942	$6,606,019	$6,870,260
Annual Surplus/Shortage		$606,611	$295,161	$16,745	($232,941)	($568,679)	$930,707	$326,229	($39,590)	($443,597)	($888,781)	$594,203	$39,795	($94,934)
Cumulative Surplus/Shortage		$606,611	$901,773	$918,517	$685,576	$116,897	$1,047,604	$1,373,832	$1,334,242	$890,645	$1,863	$596,066	$635,861	$540,926

TABLE 8-4
(CONTINUED)

	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
ESTIMATED CIP PROGRAM COSTS													
Phase I $1,962,300													
Phase II $2,504,400													
Phase III $3,196,300	$637,700	$669,600	$703,100										
Phase IV $4,079,500				$738,300	$775,200	$813,900	$854,700	$897,400					
Total Estimated CIP Costs $10,413,500	$637,700	$669,600	$703,100	$738,300	$775,200	$813,900	$854,700						
DEBT SERVICE BY BOND ISSUE													
Terms: Interest rate 9.00%													
Life of bonds (years) 30													
Reserve & Bond Issuance Costs 12.50%													
Issue 1 (1989-1995)	$214,879	$214,879	$214,879	$214,879	$214,879	$214,879	$214,879	$214,879	$214,879	$214,879	$214,879	$214,879	$214,879
Issue 2 (1996-2000)	$274,240	$274,240	$274,240	$274,240	$274,240	$274,240	$274,240	$274,240	$274,240	$274,240	$274,240	$274,240	$274,240
Issue 3 (2000-2005)	$350,006	$350,006	$350,006	$350,006	$350,006	$350,006	$350,006	$350,006	$350,006	$350,006	$350,006	$350,006	$350,006
Issue 4 (2006-2010)				$446,719	$446,719	$446,719	$446,719	$446,719	$446,719	$446,719	$446,719	$446,719	$446,719
ANNUAL PROGRAM COSTS													
Total Estimated Debt Service	$839,125	$839,125	$839,125	$1,285,844	$1,285,844	$1,285,844	$1,285,844	$1,285,844	$1,285,844	$1,285,844	$1,285,844	$1,285,844	$1,285,844
Estimated O & M Program Costs	$5,458,900	$5,846,500	$6,261,600	$6,706,200	$7,182,300	$7,692,200	$8,238,400	$8,823,400	$9,449,861	$10,120,802	$10,839,378	$11,608,974	$12,433,212
Estimated Continuing Repair & Replacement and Future CIP Program Costs	$611,000	$641,500	$729,700	$766,200	$804,500	$844,700	$887,000	$931,350	$977,918	$1,026,813	$1,078,154	$1,132,062	$1,188,665
Estimated Program Development Costs	$369,590	$401,930	$440,730	$478,050	$526,020	$560,740	$606,470	$649,529	$695,646	$745,037	$797,934	$854,588	$915,264
Total Estimated Annual Program Costs	$7,278,615	$7,729,055	$8,271,155	$9,236,294	$9,798,664	$10,383,484	$11,017,714	$11,690,123	$12,409,268	$13,178,495	$14,001,311	$14,881,467	$15,822,983

ESTIMATED STORMWATER REVENUE ANALYSIS

Stormwater Utility Charges													
Estimated ERU's	170,121	176,926	184,003	191,363	199,017	206,978	208,349	208,349	208,349	208,349	208,349	208,349	208,349
Required Annual Charge per ERU	$42.78	$43.69	$44.95	$48.27	$49.24	$50.17	$52.88	$56.11	$59.56	$63.25	$67.20	$71.43	$75.94
Proposed Annual Charge per ERU	$42.00	$42.00	$49.25	$49.25	$49.25	$49.25	$49.25	$63.50	$63.50	$63.50	$63.50	$63.50	$86.25
Resultant Revenue	$7,145,070	$7,430,873	$9,062,127	$9,424,612	$9,801,596	$10,193,660	$10,261,188	$13,230,162	$13,230,162	$13,230,162	$13,230,162	$13,230,162	$17,970,101
A[illegible] Surplus/Shortage	($133,544)	($298,181)	$790,972	$188,318	$2,933	($189,823)	($756,525)	$1,540,039	$820,893	$51,666	($771,149)	($1,651,3[illegible]	$2,147,118
[illegible]ative Surplus/Shortage	$407,382	$109,201	$900,174	$1,088,49[illegible]	191,425	$901,601	$145,076	$1,685,115	$2,506,008	$2,557,674	$1,786,525	$135[illegible]	2,282,336

TABLE 8-4
(CONTINUED)

	Year 27	Year 28	Year 29	Year 30	Year 31	Year 32	Year 33	Year 34	Year 35	Year 36	Year 37	Year 38	Year 39
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
ESTIMATED CIP PROGRAM COSTS													
Phase I $1,962,300													
Phase II $2,504,400													
Phase III $3,196,300													
Phase IV $4,079,500													
Total Estimated CIP Costs $10,413,500													
DEBT SERVICE BY BOND ISSUE													
Terms: Interest rate 9.00%													
Life of bonds (years) 30													
Reserve & Bond Issuance Costs 12.50%													
Issue 1 (1989-1995)	$214,879	$214,879	$214,879	$214,879	$214,879								
Issue 2 (1996-2000)	$274,240	$274,240	$274,240	$274,240	$274,240	$274,240	$274,240	$274,240	$274,240	$274,240			
Issue 3 (2000-2005)	$350,006	$350,006	$350,006	$350,006	$350,006	$350,006	$350,006	$350,006	$350,006	$350,006	$350,006	$350,006	$350,006
Issue 4 (2006-2010)	$446,719	$446,719	$446,719	$446,719	$446,719	$446,719	$446,719	$446,719	$446,719	$446,719	$446,719	$446,719	$446,719
ANNUAL PROGRAM COSTS													
Total Estimated Debt Service	$1,285,844	$1,285,844	$1,285,844	$1,285,844	$1,285,844	$1,070,965	$1,070,965	$1,070,965	$1,070,965	$1,070,965	$796,725	$796,725	$796,725
Estimated O & M Program Costs	$13,315,970	$14,261,403	$15,273,963	$16,358,414	$17,519,862	$18,763,772	$20,096,000	$21,522,816	$23,050,936	$24,687,552	$26,440,368	$28,317,635	$30,328,187
Estimated Continuing Repair & Replacement and Future CIP Program Costs	$1,248,098	$1,310,503	$1,376,028	$1,444,830	$1,517,071	$1,592,925	$1,672,571	$1,756,199	$1,844,009	$1,936,210	$2,033,020	$2,134,671	$2,241,405
Estimated Program Development Costs	$980,247	$1,049,845	$1,124,384	$1,204,215	$1,289,714	$1,381,284	$1,479,355	$1,584,389	$1,696,881	$1,817,360	$1,946,392	$2,084,586	$2,232,592
Total Estimated Annual Program Costs	$16,830,158	$17,907,595	$19,060,219	$20,293,303	$21,612,491	$22,808,946	$24,318,891	$25,934,370	$27,662,791	$29,512,087	$31,216,505	$33,333,616	$35,598,908
ESTIMATED STORMWATER REVENUE ANALYSIS													
Stormwater Utility Charges													
Estimated ERU's	208,349	208,349	208,349	208,349	208,349	208,349	208,349	208,349	208,349	208,349	208,349	208,349	208,349
Required Annual Charge per ERU	$80.78	$85.95	$91.48	$97.40	$103.73	$109.47	$116.72	$124.48	$132.77	$141.65	$149.83	$159.99	$170.86
Proposed Annual Charge per ERU	$86.25	$86.25	$86.25	$86.25	$117.50	$117.50	$117.50	$117.50	$117.50	$161.00	$161.00	$161.00	$161.00
Resultant Revenue	$17,970,101	$17,970,101	$17,970,101	$17,970,101	$24,481,008	$24,481,008	$24,481,008	$24,481,008	$24,481,008	$33,544,189	$33,544,189	$33,544,189	$33,544,189
Annual Surplus/Shortage	$1,139,943	$62,507	($1,090,117)	($2,323,201)	$2,868,517	$1,672,062	$162,117	($1,453,362)	($3,181,784)	$4,032,102	$2,327,684	$210,573	($2,054,719)
Cumulative Surplus/Shortage	$3,422,279	$3,484,786	$2,394,669	$71,467	$2,939,984	$4,612,046	$4,774,163	$3,320,800	$139,017	$4,171,119	$6,498,803	$6,709,375	$4,654,657

TABLE 8-4
(CONTINUED)

	Year 40	Year 41	Year 42	Year 43	Year 44	Year 45	Year 46	Year 47	Year 48	Year 49	Year 50
	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
ESTIMATED CIP PROGRAM COSTS											
Phase I $1,962,300											
Phase II $2,504,400											
Phase III $3,196,300											
Phase IV $4,079,500											
Total Estimated CIP Costs $10,413,500											
DEBT SERVICE BY BOND ISSUE											
Terms: Interest rate 9.00%											
Life of bonds (years) 30											
Reserve & Bond Issuance Costs 12.50%											
Issue 1 (1989-1995)	$350,006	$350,006									
Issue 2 (1996-2000)	$446,719	$446,719	$446,719	$446,719	$446,719	$446,719	$446,719				
Issue 3 (2000-2005)											
Issue 4 (2006-2010)											
ANNUAL PROGRAM COSTS											
Total Estimated Debt Service	$796,725	$796,725	$446,719	$446,719	$446,719	$446,719	$446,719	$0	$0	$0	$0
Estimated O & M Program Costs	$32,481,488	$34,787,673	$37,257,598	$39,902,888	$42,735,993	$45,770,248	$49,019,936	$52,500,351	$56,227,876	$60,220,055	$64,495,679
Estimated Continuing Repair & Replacement and Future CIP Program Costs	$2,353,475	$2,471,149	$2,594,706	$2,724,442	$2,860,664	$3,003,697	$3,153,882	$3,311,576	$3,477,155	$3,651,012	$3,833,563
Estimated Program Development Costs	$2,391,106	$2,560,874	$2,742,696	$2,937,427	$3,145,985	$3,369,350	$3,608,574	$3,864,782	$4,139,182	$4,433,064	$4,747,811
Total Estimated Annual Program Costs	$38,022,793	$40,616,421	$43,041,720	$46,011,476	$49,189,360	$52,590,014	$56,229,110	$59,676,709	$63,844,213	$68,304,132	$73,077,054
ESTIMATED STORMWATER REVENUE ANALYSIS											
Stormwater Utility Charges											
Estimated ERU's	208,349	208,349	208,349	208,349	208,349	208,349	208,349	208,349	208,349	208,349	208,349
Required Annual Charge per ERU	$182.50	$194.94	$206.58	$220.84	$236.09	$252.41	$269.88	$286.43	$306.43	$327.84	$350.74
Proposed Annual Charge per ERU	$161.00	$222.25	$222.25	$222.25	$222.25	$222.25	$308.25	$308.25	$308.25	$308.25	$308.25
Resultant Revenue	$33,544,189	$46,305,565	$46,305,565	$46,305,565	$46,305,565	$46,305,565	$64,223,579	$64,223,579	$64,223,579	$64,223,579	$64,223,579
Annual Surplus/Shortage	($4,478,604)	$5,689,144	$3,263,846	$294,089	($2,883,795)	($6,284,449)	$7,994,469	$4,546,870	$379,367	($4,080,552)	($8,853,474)
Cumulative Surplus/Shortage	$176,052	$5,865,197	$9,129,042	$9,423,132	$6,539,337	$254,888	$8,249,357	$12,796,227	$13,175,593	$9,095,041	$241,567

TABLE 8-5

SUMMARY OF ESTIMATED MONTHLY STORMWATER UTILITY CHARGES PER ERU *

Duration of Construction Program	1990-94	1995-99	2000-04	2005-09	2010-14	2015-19	2020-24	2025-29	2030-34	2035-39
10-year	$1.21	$2.63	$3.58	$3.98	$5.10	$7.06	$9.60	$13.10	$18.31	$25.67
20-year	$1.08	$2.33	$3.50	$4.10	$5.29	$7.19	$9.79	$13.42	$18.52	$25.69

* - Assuming no other revenue source.

8.4.2 Ad Valorem Taxation

A bonding program secured by pledged revenue sources is the other principal method of providing financing for the proposed long-term stormwater management program. Whether a general obligation or revenue bond, the County would have to utilize ad valorem taxes or utility revenues to repay the debt service.

8.4.3 System Development Charges

System development charges (SDC's) have been used by municipal utilities, especially water purveyors, for a number of years as a method of financing system improvements. They have been known by several titles other than "system development charges", such as utility expansion charges and extension/improvement charges. Recently, SDC's have been used for other purposes, including sewer interceptors and drainage systems. SDC's differ from other similar charges in that they are associated with specific improvements. They are usually charged to new developments after public improvements are built as a means of balancing financial participation, or used to accumulate a reserve fund to finance future construction or specific improvement. The revenue form SDC's, therefore, is to be used strictly for capital improvements.

System development charges enable a community to improve facilities in advance of growth, yet place an equitable portion of the cost on all properties, including those which later develop and make use of extra capacity previously

built into the system. Usually, SDC's are most appropriate for facilities which improve service only to a portion of a total service area. Regional detention/retention facilities would be an appropriate drainage project for SDC funding. When revenue bonds are used to finance major drainage improvements, SDC's can ensure that all properties equitably participate in the financing of the improvement. SDC's to developing properties should be consistent with the amount paid by properties which were already developed when capital improvements were built. Such charges levied when a property develops should approximate the total that the property would have paid into the improvement bond fund had it been developed at the time the bonds were sold, less the diminished value of the improvement (depreciation) during the time when the subject property was undeveloped and not fully utilizing the facilities. An SDC of this type allows owners of undeveloped land to defer paying for capital improvements to a drainage system until development occurs, but ensures that all properties which use improvements help pay for them.

One example of a community which has implemented an SDC is Aurora, Colorado, a rapidly developing suburb east of Denver. In addition to its monthly service fee, the City charges a "storm sewer development fee" at the time of development. The development fee is a one-time charge of $500.00 per acre, which is levied when the development permit is issued.

An order-of-magnitude estimate of an SDC for Seminole County is $500.00 to $1,000.00 per acre, based on the cost of stormwater facilities construction in the area. A more detailed estimate will be developed when a rate study is

performed. It should be noted that a careful analysis should be made of the legal steps required to properly implement a systems development charge related to specific capital improvements.

8.4.4 A Combined Approach Program

Many communities (Boulder, Colorado for example) have found that a combination of stormwater utility charges and ad valorem taxation provides a balanced stormwater funding program. During the first years of a stormwater management program, the differences between utility charges per ERU and ad valorem taxation is often relatively insignificant. Beyond a certain point in time, however, the stormwater utility charges begin to exceed those from ad valorem taxation because the taxable value of a jurisdiction typically increases at a greater rate than the ERU base used for determining the stormwater utility charges. Therefore, a combined funding approach could be implemented to minimize future increases in stormwater utility charges. However, it should be noted that a rate structure developed in one community is rarely suitable in another city or county.

In using a combined approach, it is advisable to determine which program elements will be funded by each source. Frequently, the stormwater utility fund is used for program development costs, repair and replacement projects and O&M program costs. Ad valorem taxation and system development charges would then be used to fund the construction of stormwater facilities.

8.4.5 Summary

Stormwater management will continue to receive increased emphasis throughout Florida as a major element in the State's plan to manage growth. The requirements of the 1985 Florida Growth Management Act have required that each county establish a stormwater program that addresses new growth by establishing goals and identifying needs. The success of the County's program will depend on its ability to fund the stormwater management program. In general, traditional financing methods have not generated sufficient revenue to fund comprehensive stormwater programs that address flooding, water quality enhancements, replacement of decaying infrastructure, the demands of new development and the necessary maintenance and operating activities. The most promising revenue source for many communities is the creation of an enterprise-funded stormwater utility, including system development charges, with ad valorem taxation as a complementary funding mechanism. With the implementation plan presented, the County will be able to overcome its current deficiencies with a 10-year construction program, and to develop and maintain a comprehensive stormwater program to meet future needs.

Appendix A

APPENDIX A

APPENDIX A

SUMMARY OF INTERVIEW

Date of Interview: February 4, 1987

Agency Name: Seminole County Drainage Department

Address: c/o Seminole County, 1101 East First Street, Seminole, Florida 32771

Contact Person: O. G. Bryant

Telephone No.: (305) 323-2500 Ext. 257

PERMITTING CONSIDERATIONS

- Applicable Regulations: N/A

- Permit(s) Required: N/A

CONCERNS:

Seminole County Flooding Problem Areas

1. County Road 426 from Oviedo city limit to Snow Hill Road (SR 13). Water cannot be conveyed away from road quickly enough. Apparently laterial drainage (N & S) is insufficient and roadway floods.

2. Midway section east of Sanford Corporate limits and north of SR 46. Lateral drainage is insufficient to prevent localized flooding throughout this area. A study for block grant purposes may have been prepared for this area.

3. Sunland Estates is an old, 35 years, subdivision which has undersized piping. County drainage is available through the Lockhart Smith Canal which runs close by.

4. Very localized problem whereby Lilian Drive area can't get into Prairie Lake. No outfall has been provided.

5. Springs Landing Subdivision. Cause of problem within subdvision not known.

6. Hattaway Drive outfall into Lake Orienta seems undersized.

tm:SC:EE

7. Forest Brook Subdivision undersized. Poor design and construction may be part of a future restoration project (Lake Howell).

8. 1.5 mi. north of CR 426 on Tuskawilla-Gabrillo Road. Three large pipes in poor conditino. Continual problem area. Flows and source unknown.

9. Lynwood Subdivision concerned about 2nd and 3rd phases since 1st has been causing problems.

10. Lake harriet Estates open (deep) ditch. (S. of Virginia Drive off Lake Brantley Road).

11. Brooks Lane S. of Red Bug Lake Road need easement to get drainage through Roann Estates to outfall.

12. CR 427 has low area that flows near Longwood Hills Road - Drainage needs to be directed to Lake Alma.

13. Chuluota has problems in general.

14. Hunt Club Road drains through Highland Memorial Cemetary. A drainage easement is necessary and a conveyance constructed.

15. Drainage on SE corner of 17-92 and Airport Boulevard. Pipes are inadequately sized.

COMMENTS: NONE

Interview Conducted By: William Shallcross, Jr., P.E.

tm:SC:EE

SUMMARY OF INTERVIEW

Date of Interview: February 19, 1987

Agency Name: Former County Employee

Address: N/A

Contact Person: Paul Magnant

Telephone No.:

PERMITTING CONSIDERATIONS

- Applicable Regulations: N/A

- Permit(s) Required: N/A

CONCERNS:

1. The City of Sanford is upgrading the airport facility with attendant drainage improvements. Assurance should be made that this will cause no adverse impacts.

2. A number of rezones are taking place in the Econlockhatchee Basin which may affect floodplains.

3. Development in that basin in Orange County needs to be reviewed for its impact.

4. East of Hunt Club Boulevard in Wekiva Basin - Problem of overland flow through cemetary. Need easement.

5. N.W. section Lake Jessup Basin - Airport Boulevard & 17-92 (SE corner) pipes are undersized).

6. General concern of lack of direction/concern by County toward drainage.

COMMENTS:

See Items 14 and 15 from the O.G. bryant interview of February 4, 1987.

Interview Conducted By: William Shallcross, Jr., P.E.

tm:SC:EE

SUMMARY OF INTERVIEW

Date of Interview: February 20, 1987

Agency Name: Seminole County Engineering Department

Address: c/o Seminole County, 1101 East First Street, Seminole County, Florida 32771

Contact Person: George Merak, Assistant County Engineer

Telephone No.:

PERMITTING CONSIDERATIONS

- Applicable Regulations: N/A

- Permit(s) Required: N/A

CONCERNS:

The current drainage information the County uses and he feels the Auto-CAD system will help.

COMMENTS:

Mr. Merak basically reiterated what Mr. Magnant had discussed.

Interview Conducted By: William Shallcross, Jr., P.E.

tm:SC:EE

Appendix B

APPENDIX B

APPENDIX B

LIST OF COLLECTED DATA

WATER RESOURCE DATA

1. Water Resources Data, Florida - United States Geological Survey

   Volume 1A Northeast Florida Surface Water
   Water Years 1981-1985

   Volume 1B Northeast Florida Groundwater
   Water Years 1981-1985

2. Total Precipitation and Departures By Month - National Oceanic and Atmospheric Administration.

   1966-1982, 1983, 1984, and 1985

3. Climatological Data - National Oceanic and Atmospheric Administration

   1985 - Orlando, Florida

REPORTS

1. Seminole County Stormwater Management Plan Working Papers (PBSJ, et.al 1976)

   Uniform Drainage Evaluation
   Data Base (Part 1) Basins; Characteristics (Part II)
   Land Use Alternative Evaluation
   Untitled (Supplemental Appendices)

2. Urban Stormwater Management Plan - Howell Branch-208 (ECFRPC) (1980)

3. Urban Stormwater Management Plan - Wekiva River-208 (ECFRPC) (1980)

4. Midway:Preliminary Engineering Design Study (1980)

5. Windwood Park:Preliminary Engineering Design Study (1979)

6. Rolling Hills:Preliminary Engineering Design Study (1980)

7. Stormwater Management Plan (1979)

8. City of Longwood Master Drainage Plan (1979)

9. Seminole County Flood Insurance Study (1980)

10. Oviedo Master Drainage Study (PBS&J) (1984)

11. Howell Branch Basin Surface Water Management Study (SJRWMD) (1984)

12. Floodplain Study of the Econlockhatchee Rivers (GSA) (1985)

13. FEMA Technical Data for Flood Studies in Seminole County

PLANNING DOCUMENTS

1. Seminole County Comprehensive Plan Elements:

    1. Development Framework
    2. Short Range Development Plan

2. Seminole County Land Development Code 5th Draft (2/12/87) (Ordinance)

3. Perspective on Regional Growth 1985-1989 (ECFRPC) (1986)

4. Seminole County Capital Improvement Program Plan History (1981-1987)

REGULATIONS

1. SJRWMD Regulations: Chapters 40C-4, 40C-40, 40C-41, 40C-42 (Applicants' Handbook)

2. City of Casselberry, Subdivision Regulations

NOTE: Oviedo uses Seminole County Regulations
Longwood uses SJRWMD Regulations

MAPS/AERIALS

1. USGS 7.5' Quadrangle Mapping (Generally QUAD Photo-revised 1980)
2. Structure and Basin Delineation Map 1976 (PBSJ)
3. 1986 Seminole County Aerial Mapping (1"=400')
4. FEMA Flood Insurance Rate Maps for Seminole County

MASTER DRAINAGE PLANS

1. Deer Run
2. Sabal Point
3. Heathrow
4. North Point
5. The Crossings
6. The Plantation
7. Kings Cove
8. Kingwood
9. Riverwood
10. County Creek
11. Timacuan

12. Alfaya Woods
13. Altamonte Springs
14. Florida Department of Transportation Drainage Atlas

FIELD DOCUMENTATION

1. Stucture inventory (structure inspection reports)
2. Photographs of selected structures and adjacent channels

MISCELLANEOUS

1. SCS Soils Handbook for Seminole County (1966)
2. SCS Soils Handbook for Seminole County - Supplement (1975)

Appendix C

APPENDIX C

APPENDIX C

PROPERTY ASSESSMENT DATA, MILLAGE HISTORY AND LAND USE DATA

BSJ POST, BUCKLEY, SCHUH & JERNIGAN, INC.

COMP. BY: KBD
CHK. BY: WLB
DATE: 5-15-89
SHEET NO.: 1 of 4
JOB NO.: 10-953.30

PROJECT: Seminole County SWMS Financial Model

Determination of ERU's in unincorporated Seminole County

Total potential ERU estimate:

From Future Land Use Map, a rough percentage of land uses is as follows:

residential	43%
commercial	10%
industrial	10%
gen'l rural	30%
public	5%
miscellaneous	2%
	100%

Summary of Potential ERU's By Land Use

	Estimated Gross Area (Acres)	Intensity of Development Factor	Estimated Impervious Area (Acres)	Estimated (1) Potential ERU's
Single Family Residential	40,900	0.20	8,180	45,444
Mobile Home	500	0.65	325	1,806
Multi-Family	5,000	0.80	4,000	22,222
Group Quarters	10	0.75	8	44
Commercial/Service	10,500	0.85	8,925	49,583
Industrial	10,500	0.85	8,925	49,583
General Rural	30,500	0.10	3,050	16,944
Public	5,000	0.65	3,250	18,056
Miscellaneous	2,100	0.40	840	4,667
TOTAL	105,010	0.357	37,503	208,349

(1) - Based on 0.18 impervious acres per ERU.

PBSJ POST, BUCKLEY, SCHUH & JERNIGAN, INC.

COMP. BY: KBD
CHK. BY: WLB
DATE: 5-15-89
SHEET NO.: 2 of
JOB NO.: 10-953.3

SUBJECT: Seminole County SWMS
Financial Model

Current ERU estimate (1988 data):

From Table 1, 1988 housing estimates for unincorporated County are as follows:

single family	41,230 *	(adjusted to 40,689)
mobile home	1,078 *	(adjusted to 1,619)
multi-family	13,389	
	55,697	

*- Mobile homes pre-1980 were included in single family.

To adjust for pre-1980 mobile homes, assume 2% of pre-1980 single family is mobile home. Adjusted estimates are shown above

Based on vacancy rates from real property ~~assessment~~ rolls, use the following occupancy rates:

group quarters	100%
general rural	100%
public	100%
miscellaneous	100%

From Table 2, estimates of existing developed acres are as follows:

industrial	835 acres	
service	301	} 796 acres
commercial	495	

Calculate occupancy rates:

industrial 835/10,500 acres = 8.0%

commercial/service 796/10,500 acres = 7.6%

POST, BUCKLEY, SCHUH & JERNIGAN, INC.

COMP. BY: KBD
CHK. BY: WLB
DATE: 5-15-89
SHEET NO.: 3 of 4
JOB NO.: 10-953.30

PROJECT: Seminole County SWIMS Financial Model

Summary of Current ERU's By Land Use (1988 Data)

		Estimated Current ERU's
Single Family Residential		40,689
Mobile Home	(1,619)(.60)(1)	971
Multi-Family	(13,389)(.40)(2)	5,356
Group Quarters	(44)(1.00)	44
Commercial/Service	(49,583)(.076)	3,768
Industrial	(49,583)(.080)	3,967
General Rural	(16,944)(1.00)	16,944
Public	(18,056)(1.00)	18,056
Miscellaneous	(4,667)(1.00)	4,667
TOTAL		94,462

(1) Assumed ERU ratio for mobile homes is .60.

(2) Assumed ERU ratio for multi-family is .40.

Use 94,462 ERU's in 1988 and increase 4% annually to the maximum potential of 208,349

Post, Buckley, Schuh & Jernigan, Inc.
CONSULTING ENGINEERS and PLANNERS

COMP. BY: KBD
CHK. BY: WLB
DATE: 11-7-88
SHEET NO.: 4 of 4
JOB NO.: 10-953.3

SUBJECT: Seminole County SWMP
Financial Model

	1984	1985	1986	1987	1988
Total Gross Taxable Value (County Road Improvement)	$2.24^B	$2.49^B	$2.90^B	$3.29^B	$3.64^B
% change	—	11.2%	16.5%	13.4%	10.6%
# parcels	N.A.	N.A.	N.A.	N.A.	61,19[illegible]

Projections: 1988 — 3.64^B
annual growth - assume 8% (conservative)

Table 1

UNINCORPORATED COUNTY HOUSING UNITS
OCTOBER 1988 ESTIMATES

	SINGLE FAMILY	MOBILE HOME	MULTI-FAMILY	TOTAL
1980 EXISTING (1)	27,038	(3)	7,120	34,158
1980-87 UNITS PERMITTED (2) (INCLUSIVE)	14,192	1,078	6,269	21,539
	41,230	1,078	13,389	55,697

(1) From U.S. Census (Orlando MSA by Census Tracts) Required estimation due to Census omission of Oviedo and Lake Mary.

(2) ECFRPC building permit reports

(3) 1980 mobile homes are included in Single Family category.

Source: Seminole County Planning Office

Table 2

ESTIMATION OF 1988 NONRESIDENTIAL ACRES BY SECTOR
FOR UNINCORPORATED SEMINOLE COUNTY

	INDUS Att.	INDUS Emp.	Service Att.	Service Emp.	(4) Commercial Att.	(4) Commercial Emp.	Total
(1) ECFRPC Uninc. CO Attendant Employment (1985):		5,924		6,402		5,614	17,940
Percent of Total:		33.0%		35.7%		31.3%	
(2) Planning Office Uninc. County Att. Employment: (1988 Interpolation)		11,136		12,035		10,554	33,725
(3) Estimated Existing Acres:		835		301		495	1,631

(1) Based on Planning Office City/County splits

(2) Calculated by applying ECFRPC sector shares (line 1) to estimate of total uninc. County Att. Emp. from 1988 Road Impact Fee Update (1988 Interpolation = 33,725)

(3) Based on Emp. densities shown below, plus 20% allowance for roads, retention areas, etc. Consistent with densities assumed in 1988 Road Impact Fee Program.

Employees Per Acre

Indus Att.	Indus Emp.	Service Att.	Service Emp.	Commercial Att.	Commercial Emp.
16.0		48.0		25.6	

(4) Commercial consists of retail and wholesale

Source: Seminole County Planning Office

PROPERTY VALUE HISTORY-SEMINOLE COUNTY

	A	B	C	D	E	F	G	H	I	J	
1										~~TENTATIVE~~	Certified 1988
2		1984		1985		1986		1987		1988	
3	COUNTYWIDE:										
4											
5	Prior Year Gross Taxable										
6	Value	$3,631,192,511		$4,265,987,922		$4,890,061,505		$5,656,816,533		$6,496,367,522	✓
7	∘Reappraisals	388,044,962		266,087,169		402,763,108		507,023,358		~~349,716,352~~	419,192,249
8	∘ New Construction	235,742,954		358,854,996		350,817,893		334,566,867		~~326,942,155~~	369,814,006
9	∘ Total Gross Taxable Value	4,254,980,427		4,890,930,087		5,643,642,506		6,498,406,758		~~7,173,026,029~~	7,285,373,777
10	∘ Variance	11,007,495		-868,582		13,174,027		-2,039,236		unknown at this	
11	Recapitulation	$4,265,645,941		$4,890,061,505		$5,656,816,533		$6,496,129,379		time.	
12											
13	UNINCORPORATED AREA:										
14	**Fire Suppression/Rescue**										
15	Prior Year Gross Taxable										
16	Value	$1,844,566,006		$2,174,483,772		$2,477,097,569		$2,846,154,394		~~$3,250,996,372~~	3,251,145,666
17	∘ Reappraisals	145,066,572		93,063,415		208,971,844		217,345,394		~~185341,726~~	188,534,607
18	∘ New Construction	117,273,093		201,270,057		186,356,945		201,744,278		~~176875401~~	223,704,821
19	∘ Total Gross Taxable Value	2,106,905,671		2,468,817,244		2,872,426,358		3,265,244,066		~~$3,613,213,499~~	3,663,384,494
20	∘ Variance	67,578,101		8,511,049		26,118,468		14,247,632		unknown at this	
21	Recapitulation	$2,174,240,965		$2,477,328,293		$2,846,154,394		$3,250,996,372		time	
22											
23	**County Road Improvement**										
24	Prior Year Gross Taxable										
25	Value	$1,877,280,981		$2,204,112,488		$2,505,842,340		$2,876,386,504		~~$3,280,928,021~~	3,281,042,646
26	∘ Reappraisals	145,769,277		87,564,455		207,780,070		212,323,969		~~191,710,923~~	185,469,907
27	∘ New Construction	118,612,803		202,046,577		188,457,512		202,356,448		~~171,410,649~~	229,248,913
28	∘ Total Gross Taxable Value	241,663,061		2,493,723,520		2,902,089,922		3,291,066,921		$3,644,049,593	3,695,830,866
29	∘ Variance	62,449,427		12,367,628		25,703,410		10,138,900		unknown at this	
30	Recapitulation	$2,203,854,191		$2,506,091,148		$2,876,386,504		$3,280,928,021		time	
31											
32	Figures obtained from Certification of Taxable Value DR 420 form except for appraisals which were figured from the difference between prior										
33	year gross taxable value and new construction less the new year's proposed taxable value. Also used for comparison was the Recap Sheet.										

DR-489 PC
R 5/85

THE VALUE AND NUMBER OF PARCELS ON THE REAL PROPERTY ASSESSMENT ROLL BY CATEGORY

Total Parcels: 112,994
CITY: 51,799
COUNTY: 61,195 (54.2%)

Seminole County, Florida, 19 88

	Code 00 Vacant Residential	Code 01 Single Family Residential	Code 02 Mobile Homes	Code 08 Multi-Family Less Than 10 Units	Code 03 Multi-Family 10 Units or More	Code 04 Condominiums
1. Just Value	$ 428,983,950	4,957,311,350	54,454,330	86,179,950	460,205,170	345,955,640
2. Taxable Value for Operating Purposes	$ 421,630,280	3,557,187,687	27,144,730	78,107,257	457,245,100	344,625,921
3. Number of Parcels	# 19,237 ✓	71,766 ✓	1,371 ✓	1,209 ✓	125 ✓	7,418 ✓

	Code 05 Cooperatives	Codes 06 and 07 Ret. Homes and Misc. Res.	Code 10 Vacant Commercial	Codes 11-39 Improved Commercial	Code 40 Vacant Industrial	Codes 41-49 Improved Industrial
4. Just Value	$ 0	14,790,800	168,856,540	1,079,508,190	84,001,440	252,490,200
5. Taxable Value for Operating Purposes	$ 0	12,472,910	164,953,700	1,073,170,880	83,529,910	250,414,340
6. Number of Parcels	# 0	7 ✓	1,231 ✓	2,584 ✓	586 ✓	751 ✓

	Codes 50-69 Agricultural	Codes 70-79 Institutional	Codes 80-89 Government	Code 90 Leasehold Interests	Codes 91-97 Miscellaneous	Code 98 Centrally Assessed
7. Just Value	$ 212,621,640	157,919,370	184,654,480	3,542,360	18,751,490	135,760
8. Taxable Value for Operating Purposes	$ 38,253,220	52,789,679	1,058,900	3,496,660	13,584,900	5,170
9. Number of Parcels	# 1,221 ✓	369 ✓	756 ✓	11	522	65

	Code 99 Non-Agricultural (Rural) Acreage	Code H. Header	Code N. Notes	Code S. Spaces
10. Just Value	$ 107,751,940	NONE	2,640	NONE
11. Taxable Value for Operating Purposes	$ 105,015,670	NONE	2,630	NONE
12. Number of Parcels	# 1,834	NONE	1,811	NONE

NO ENTRIES SHALL BE MADE WITHOUT WRITTEN PERMISSION FROM THE DEPARTMENT OF REVENUE

Codes	Codes

13. Total Real Property: Just Value 8,614,007,230 (Sum lines 1, 4, 7, and 10); Taxable Value for Operating Purposes 6,606,711,606 (Sum lines 2, 5, 8, and 11); Parcels 112,994 (Sum lines 3, 6, 9, and 12)

THE VALUE AND NUMBER OF PARCELS ON THE REAL PROPERTY ASSESSMENT ROLL BY CATEGORY

SEMINOLE County, Florida, 19 87

	Code 00 Vacant Residential	Code 01 Single Family Residential	Code 02 Mobile Homes	Code 08 Multi-Family Less Than 10 Units	Code 03 Multi-Family 10 Units or More	Code 04 Condominia
1. Just Value	$ 369,540,920	4,413,383,380	53,717,530	73,193,150	413,983,770	327,739,640
2. Taxable Value for Operating Purposes	$ 359,732,386	3,104,399,394	27,211,937	67,229,517	410,906,960	254,261,679
3. Number of Parcels	# 20,450	67,698	2,020	1,060	117	7,048

	Code 05 Cooperatives	Codes 06 and 07 Ret. Homes and Misc. Res.	Code 10 Vacant Commercial	Codes 11-39 Improved Commercial	Code 40 Vacant Industrial	Codes 41-49 Improved Industrial
4. Just Value	$ NONE	14,689,570	172,407,680	971,377,050	75,523,280	224,922,700
5. Taxable Value for Operating Purposes	$ NONE	12,376,680	169,778,150	965,585,240	75,246,840	223,054,010
6. Number of Parcels	# NONE	5	1,383	2,543	598	712

	Codes 50-69 Agricultural	Codes 70-79 Institutional	Codes 80-89 Government	Code 90 Leasehold Interests	Codes 91-97 Miscellaneous	Code 98 Centrally Assessed
7. Just Value	$ 207,781,850	149,691,550	156,391,960	3,723,940	21,346,890	90,190
8. Taxable Value for Operating Purposes	$ 32,623,590	50,597,612	1,729,400	3,678,240	12,735,990	120
9. Number of Parcels	# 1,321	370	618	10	507	58

	Code 99 Non-Agricultural Acreage	Code H. Header	Code N. Notes	Code S. Spaces
10. Just Value	$ 112,045,300	NONE	11,500*	NONE
11. Taxable Value for Operating Purposes	$ 102,312,920	NONE	11,500*	NONE
12. Number of Parcels	# 2,009	NONE	1,710	NONE

NO ENTRIES SHALL BE MADE WITHOUT WRITTEN PERMISSION FROM THE DEPARTMENT OF REVENUE

Codes	Codes

13. Total Real Property: Just Value 7,761,561,850 (Sum lines 1, 4, 7, and 10): Taxable Value for Operating Purposes 5,873,492,165 (Sum lines 2, 5, 8, and 11): Parcels 110,237 (Sum lines 3, 6, 9, and 12)

*TO BE CORRECTED VIA MANUAL E & I

DR-403 PC
R. 5-85

THE VALUE AND NUMBER OF PARCELS ON THE REAL PROPERTY ASSESSMENT ROLL BY CATEGORY

SEMINOLE County, Florida, 19 86

	Code 00 Vacant Residential	Code 01 Single Family Residential	Code 02 Mobile Homes	Code 08 Multi-Family Less Than 10 Units	Code 03 Multi-Family 10 Units or More	Code 04 Condominia
1. Just Value	$ 315,272,500	4,003,819,890	43,488,320	66,083,670	340,520,170	324,073,220
2. Taxable Value for Operating Purposes	$ 308,133,766	2,784,560,895	19,849,195	59,974,319	336,091,160	245,986,306
3. Number of Parcels	# 19,799	63,526	1,941	985	108	6,967

	Code 05 Cooperatives	Codes 06 and 07 Ret. Homes and Misc. Res.	Code 10 Vacant Commercial	Codes 11-39 Improved Commercial	Code 40 Vacant Industrial	Codes 41-49 Improved Industrial
4. Just Value	$ NONE	1,036,200	110,214,520	806,524,950	64,276,590	203,441,870
5. Taxable Value for Operating Purposes	$ NONE	118,910	105,965,740	800,478,060	62,337,410	201,593,380
6. Number of Parcels	# NONE	4	1,721	2,361	625	698

	Codes 50-69 Agricultural	Codes 70-79 Institutional	Codes 80-89 Government	Code 90 Leasehold Interests	Codes 91-97 Miscellaneous	Code 98 Centrally Assessed
7. Just Value	$ 179,825,080	136,444,740	135,592,800	3,714,090	16,991,320	NONE
8. Taxable Value for Operating Purposes	$ 30,542,630	43,205,097	833,250	3,668,390	9,195,100	NONE
9. Number of Parcels	# 1,384	362	471	10	501	64

	Code 99 Non-Agricultural Acreage	Code H. Header	Code N. Notes	Code S. Spaces
10. Just Value	$ 97,123,670	NONE	NONE	NONE
11. Taxable Value for Operating Purposes	$ 89,882,320	NONE	NONE	NONE
12. Number of Parcels	# 2,275	NONE	1,529	NONE

NO ENTRIES SHALL BE MADE WITHOUT WRITTEN PERMISSION FROM THE DEPARTMENT OF REVENUE

Codes _____ Codes _____

13. Total Real Property: Just Value 6,848,443,600 (Sum lines 1, 4, 7, and 10); Taxable Value for Operating Purposes 5,102,415,928 (Sum lines 2, 5, 8, and 11); Parcels 105,331 (Sum lines 3, 6, 9, and 12)

DR-403 PC
N 3/84

THE VALUE AND NUMBER OF PARCELS ON THE REAL PROPERTY ASSESSMENT ROLL BY CATEGORY

SEMINOLE County, Florida, 19 85

	Code 00 Vacant Residential	Code 01 Single Family Residential	Code 02 Mobile Homes	Code 08 Multi-Family Less Than 10 Units	Code 03 Multi-Family 10 Units or More	Code 04 Condominia
1. Just Value	$ 263,620,060	3,597,837,350	38,188,710	54,314,970	277,383,140	327,355,440
2. Taxable Value for Operating Purposes	$ 256,263,611	2,457,862,246	15,882,416	48,304,218	273,426,020	247,595,173
3. Number of Parcels	# 19,062	59,248	1,857	852	104	6,914

	Code 05 Cooperatives	Codes 06 and 07 Ret. Homes and Misc. Res.	Code 10 Vacant Commercial	Codes 11-39 Improved Commercial	Code 40 Vacant Industrial	Codes 41-49 Improved Industrial
4. Just Value	$ NONE	1,036,200	92,758,400	626,729,450	26,734,500	163,593,050
5. Taxable Value for Operating Purposes	$ NONE	118,910	89,802,500	621,365,800	25,964,010	162,067,990
6. Number of Parcels	# NONE	4	1,746	2,290	489	650

	Codes 50-69 Agricultural	Codes 70-79 Institutional	Codes 80-89 Government	Code 90 Leasehold Interests	Codes 91-97 Miscellaneous	Code 99 Non-Agricultural Acreage
7. Just Value	$ 157,451,330	133,456,540	129,769,490	2,510,310	15,182,320	114,665,620
8. Taxable Value for Operating Purposes	$ 32,158,395	41,868,851	900,820	2,464,610	8,335,800	111,474,790
9. Number of Parcels	# 1,475	357	476	8	496	3,509

NO ENTRIES SHALL BE MADE WITHOUT WRITTEN PERMISSION FROM THE DEPARTMENT OF REVENUE

	Codes	Codes	Codes	Codes	Codes	Codes
10. Just Value	$					
11. Taxable Value for Operating Purposes	$					
12. Number of Parcels	#					

13. Total Real Property: Just Value 6,022,586,880 (Sum lines 1, 4, 7, and 10); Taxable Value for Operating Purposes 4,395,856,160 (Sum lines 2, 5, 8, and 11); Parcels 99,537 (Sum lines 3, 6, 9, and 12)

DR-403 PC
R. 3/84

THE VALUE AND NUMBER OF PARCELS ON THE REAL PROPERTY ASSESSMENT ROLL BY CATEGORY

SEMINOLE County, Florida, 19 84

	Code 00 Vacant Residential	Code 01 Single Family Residential	Code 02 Mobile Homes	Code 08 Multi-Family Less Than 10 Units	Code 03 Multi-Family 10 Units or More	Code 04 Condominia
1. Just Value	$ 236,108,180	3,222,889,090	34,910,390	48,076,720	218,052,890	289,520,810
2. Taxable Value for Operating Purposes	$ 228,573,731	2,135,239,303	13,977,777	41,836,355	214,511,160	215,691,474
3. Number of Parcels	# 18,907	55,188	1,768	775	96	6,261

	Code 05 Cooperatives	Codes 06 and 07 Ret. Homes and Misc. Res.	Code 10 Vacant Commercial	Codes 11-39 Improved Commercial	Code 40 Vacant Industrial	Codes 41-49 Improved Industrial
4. Just Value	$ NONE	1,029,000	85,489,310	553,367,850	29,110,130	140,120,280
5. Taxable Value for Operating Purposes	$ NONE	111,710	81,935,790	544,459,780	23,074,040	137,811,770
6. Number of Parcels	# NONE	4	1,313	2,172	415	614

	Codes 50-69 Agricultural	Codes 70-79 Institutional	Codes 80-89 Government	Code 90 Leasehold Interests	Codes 91-97 Miscellaneous	Code 99 Non-Agricultural Acreage
7. Just Value	$ 156,624,980	120,579,530	100,996,530	2,040,400	11,542,370	125,745,230
8. Taxable Value for Operating Purposes	$ 32,551,505	30,407,700	388,530	2,037,130	8,427,490	119,901,170
Number of Parcels	# 1,612	352	288	6	498	5,076

NO ENTRIES SHALL BE MADE WITHOUT WRITTEN PERMISSION FROM THE DEPARTMENT OF REVENUE

	Codes	Codes	Codes	Codes	Codes	Codes
9. Just Value	$					
10. Taxable Value for Operating Purposes	$					
12. Number of Parcels	#					

13. Total Real Property: Just Value 5,376,203,690 (Sum lines 1, 4, 7, and 10); Taxable Value for Operating Purposes 3,830,956,415 (Sum lines 2, 5, 8, and 11); Parcels 95,345 (Sum lines 3, 6, 9, and 12)

DR-403-5C-R 3-02

SHEET NO. 1 OF 1

THE VALUE AND NUMBER OF PARCELS ON THE REAL PROPERTY ASSESSMENT ROLL BY CATEGORY

SEMINOLE COUNTY, FLORIDA, 19 83 REVISED TAX ROLL

	Code 00 Vacant Residential	Code 01 Single Family Residential	Code 02 Mobile Homes	Code 08 Multi-Family Less Than 10 Units	Code 03 Multi-Family 10 Units or More	Code 04 Condominia
1. Just Value	$ 209,046,430	2,718,562,880	55,681,160	31,237,790	209,500,760	255,201,770
2. Taxable Value for Operating Purposes	$ 202,588,091	1,698,947,744	16,283,703	27,360,893	206,106,750	192,103,430
3. Number of Parcels	# 18,377	52,106	1,751	582	91	5,814

	Code 05 Cooperatives	Codes 06 and 07 Ret. Homes and Misc. Res.	Code 10 Vacant Commercial	Codes 11-39 Improved Commercial	Code 40 Vacant Industrial	Codes 41-49 Improved Industrial
4. Just Value	$ None	941,580	85,279,630	491,289,080	24,148,600	123,608,550
5. Taxable Value for Operating Purposes	$ None	7,440	81,483,770	484,412,170	18,006,810	121,313,760
6. Number of Parcels	# None	2	1,262	1,792	397	578

	Codes 50-69 Agricultural	Codes 70-79 Institutional	Codes 80-89 Government	Code 90 Leasehold Interests	Codes 91-97 Miscellaneous	Code 99 Non-Agricultural Acreage
7. Just Value	$ 145,901,510	117,245,060	99,784,320	2,166,970	10,810,760	133,066,210
8. Taxable Value for Operating Purposes	$ 35,094,550	31,211,040	2,286,080	524,880	8,070,160	125,413,780
9. Number of Parcels	# 1,486	340	269	8	486	3,341

10. Total Real Property (Codes 00 through 97 plus 99): Just Value 4,693,475,060 (Sum lines 1, 4 and 7); Taxable Value for Operating Purposes 3,251,215,051 (Sum lines 2, 5 and 8); Parcels 88,662 (Sum lines 3, 6 and 9)

THIS AREA FOR D.O.R. USE ONLY

KEY:

% Value	% Parcels
% Value	% Parcels

00	01	02	08	03	04
05	06	10	11-39	40	41-49
00-07-99	50-69	70-79	80-89	90	91-97	99

MILLAGE HISTORY

FUND	FY 77/78 TAX ROLL 1977 ACTUAL	% OVER OR UNDER PRIOR YR	FY 78/79 TAX ROLL 1978 ACTUAL	% OVER OR UNDER PRIOR YR	FY 79/80 TAX ROLL 1979 ACTUAL	% OVER OR UNDER PRIOR YR	FY 80/81 TAX ROLL 1980 ACTUAL	% OVER OR UNDER PRIOR YR	FY 81/82 TAX ROLL 1981 ACTUAL	% OVER OR UNDER PRIOR YR
COUNTYWIDE:										
• General Fund	6.2300	4.7300	6.0000		6.2900		5.0310		5.0370	
• Transportation	0.1200	0.1200	0.1200		0.1200		0.0450		0.0490	
SUBTOTAL	6.3500	30.93%	6.1200	-3.62%	6.4100	4.74%	5.0760	-20.81%	5.0860	0.20%
• DEBT SERVICES										
- Courthouse/Jail	0.1700	0.1600	0.1300		0.1000		0.0890		0.0780	
- General Obligations	0.1200	0.1100	0.1100		0.0900		0.0720		0.0730	
- Libraries	0.0000	0.0000	0.0000		0.0000		0.0000		0.0000	
SUBTOTAL	0.2900	7.41%	0.2400	-17.24%	0.1900	-20.83%	0.1610	-15.26%	0.1510	-6.21%
TOTAL COUNTYWIDE:	**6.6400**	**29.69%**	**6.3600**	**-4.22%**	**6.6000**	**3.77%**	**5.2370**	**-20.65%**	**5.2370**	**0.00%**
UNINCORPORATED:										
• Fire Suppression/Rescue	1.9000	1.4800	1.9000		2.7200		2.2100		2.2100	
• County Road Improvement	0.0000	0.0000	0.0000		0.0000		0.0710		0.7010	
SUBTOTAL	1.9000	28.38%	1.9000	0.00%	2.7200	43.16%	2.2810	-16.14%	2.9110	27.62%
INDEPENDENT AGENCIES:										
• Oakland Hills SLD	1.1200	15.46%	1.2800	14.29%	1.3200	3.13%	1.2800	-3.03%	0.0000	
• Memorial Hospital	0.1600	-36.00%	0.2400	50.00%	0.0000		0.0000		0.0000	
• Port Authority	0.0500	66.67%	0.0300	-40.00%	0.0300	0.00%	0.0170	-43.33%	0.0060	-64.71%

MILLAGE HISTORY

FUND	FY 82/83 TAX ROLL 1982 ACTUAL	% OVER OR UNDER PRIOR YR	FY 83/84 TAX ROLL 1983 ACTUAL	% OVER OR UNDER PRIOR YR	FY 84/85 TAX ROLL 1984 ACTUAL	% OVER OR UNDER PRIOR YR	FY 85/86 TAX ROLL 1985 ACTUAL	% OVER OR UNDER PRIOR YR	FY 86/87 TAX ROLL 1986 ACTUAL	% OVER OR UNDER PRIOR YR
COUNTYWIDE:										
• General Fund	4.2901		4.2678		3.9049		3.7854		4.2337	
• Transportation	0.0560		0.0544		0.0000		0.1776		0.1776	
SUBTOTAL	4.3461	-14.55%	4.3222	-0.55%	3.9049	-9.65%	3.9630	1.49%	4.4113	11.31%
• DEBT SERVICES										
- Courthouse/Jail	0.0499		0.0563		0.0392		0.0386		0.0000	
- General Obligations	0.0499		0.0483		0.0440		0.0000		0.0299	
- Libraries	0.0000		0.0000		0.1895		0.1760		0.1588	
SUBTOTAL	0.0998	-33.91%	0.1046	N/A	0.2727	160.71%	0.2146	-21.31%	0.1887	-12.07%
TOTAL COUNTYWIDE:	**4.4459**	**-15.11%**	**4.4268**	**-0.43%**	**4.1776**	**-5.63%**	**4.1776**	**0.00%**	**4.6000**	**10.11%**
UNINCORPORATED:										
• Fire Suppression/Rescue	1.6719		1.8087		1.8087		2.0000		2.0000	
• County Road Improvement	0.5379		0.5363		0.4977		0.4787		0.4787	
SUBTOTAL	2.2098	-24.09%	2.3450	6.12%	2.3064	-1.65%	2.4787	7.47%	2.4787	0.00%
INDEPENDENT AGENCIES										
• Oakland Hills SLD	0.0000		0.0000		0.0000		0.0000		0.0000	
• Memorial Hospital	0.0000		0.0000		0.0000		0.0000		0.0000	
• Port Authority	0.0000		0.0000		0.0000		0.0000		0.0000	

MILLAGE HISTORY

FUND	FY 87/88 TAX ROLL 1987 ACTUAL	% OVER OR UNDER PRIOR YR	FY 88/89 TAX ROLL 1987 PROPOSED	% OVER OR UNDER PRIOR YR
COUNTYWIDE:				
• General Fund	3.8133		3.8373	
• Transportation	0.5980		0.5740	
SUBTOTAL	4.4113	0.00%	4.4113	0.00%
• DEBT SERVICES				
- Courthouse/Jail	0.0000		0.0000	
- General Obligations	0.0318		0.0279	
- Libraries	0.1333		0.1190	
SUBTOTAL	0.1651	-12.51%	0.1469	-11.02%
TOTAL COUNTYWIDE:	**4.5764**	**-0.51%**	**4.5582**	**-0.40%**
UNINCORPORATED:				
• Fire Suppression/Rescue	2.0000		2.1000	
• County Road Improvement	0.4787		0.6500	
SUBTOTAL	2.4787	0.00%	2.7500	10.95%
INDEPENDENT AGENCIES:				
• Oakland Hills SLD	0.0000		0.0000	
• Memorial Hospital	0.0000		0.0000	
• Port Authority	0.0000		0.0000	

Appendix D

APPENDIX D

APPENDIX D

IDENTIFIED AND NAMED LAKES IN SEMINOLE COUNTY

Table 1:

Reprinted from Seminole County's Draft Surface Water Management Guidelines (Appendix B)

Draft Copy Dated 4-28-86

LAKES IN SEMINOLE COUNTY

Section-Township-Range	Name of Lake	Surface Area (AC)	Base Elev.	10 Yr. Flood Level	100 Yr. Flood Level	Estab. By	Year Estab.	Flood Category
11-20-30	Ada, Lake	39	42	43.6	44.4	COE	1978	A2
13-21-29	Adelaide, Lake	23	56	58.2	61.3	COE	1978	A6
30-20-30	Alma, Lake	20	53	57.9	58.6	COE	1979	A1
3-20-30	Amory Lake	7	42	43.7	45.3	COE	1978	
27-21-30	Ann, Lake	14	60	62.0	62.8	COE	1978	A2
38-21-30	Annette, Lake	1	54	55.3	56.3	COE	1978	A2
1-20-29	Banana Lake	18	47		50.0	SCE	1984	
22-21-32	Bess Lake	5	40	44	46	SCE		
22-21-31	Bath Lake	14	66	67	68	SCE		
36-21-30	Bear Gully Lake	128	49	52.2	53.6	SJRWMD	1984	A4
19 21-29	Bear Lake	310	104	105.6	106.9	COE	1979	A3
3-20-30	Belair Lake	34	40	43.7	45.3	COE	1977	A3
22-20-30	Bingham, Lake	17	40	42.7	43.7	COE	1977	A2
33-20-30	Boat Lake	10	50	53	55	SCE		
7-21-29	Border Lake	19	74	80	83			
4-21-29	Brantley, Lake	269	48	47.3	48.5	COE	1979	A4
28-20-32	Buck Lake	158	27	30	32	SCE		
36-21-30	Burkette, Lake	74	53	55.2	57.2	SJRWMD	1984	A3
21-21-32	Catherine, Lake	14	53	56	57	SCE		
36-21-30	Cecile, Lake	6	54	55.3	56.3	COE	1978	A2
10-21-31	Charm, Lake	19	45	46.6	47.6	COE	1978	A2
36-21-30	Clear Lake	7	60	63	65	SCE		
20-20-32	Cochran, Lake		25	28	30	SCE		
5-20-30	Como, Lake	56	41	44.4	46.1	COE	1977	A3
8-21-30	Concord, Lake	20	59	59.3	59.9	COE	1978	A1
11-21-29	Crane's Roost			58.2	61.3	COE	1978	A6
33-21-30	Crystal Bowl Lake	7	62	63.3	64.9	COE	1978	A3
9-20-30	Crystal Lake	351	40	44.4	46.1	COE	1977	A3
20-21-29	Cub Lake	14	102	104.2	104.6	COE	1979	A1
8-20-30	Darwin Lake	23	40	44.4	46.1	COE	1977	A3
26-21-30	Deeks, Lake	5	61	64.0	65.5	SCE		
31-21-31	Deep Lake	43	56	57.2	57.8	SJRWMD	1984	
8-20-30	Deforest Lake	10	40	43.7	45.3	COE	1977	A3
25-21-29	Destiny, Lake	25	89	89.4	91.0	COE	1978	A3
15-21-30	Dew Drop Pool	8	67	68.9	70.3	COE	1979	A3
27-21-29	Don, Lake	2	43	45	47	SCE		
37-21-30	Duck Pond	1	54	56.0	57.0	COE	1978	A4
30-20-30	[illegible]	7	59	64.4	66.5	COE	1978	A4
9-21-30	Ellen, Lake	6	65	67.4	68.6	COE	1978	A4
30-21-30	Emily, Lake	5	54	55.3	56.3	COE	1978	A2
7-20-30	Emma, Lake	49	42	45.4	46.6	COE	1977	A2
26-21-32	Eva, Lake	22	41	43	45	SCE		
5-21-30	Evergreen, Lake	2	59	61.2	61.5	COE	1978	A1
5-21-30	Fairy Lake	50	55	56.6	57.5	COE	1979	A2
24-21-29	Faith, Lake	34	68	71.3	72.4	COE	1979	A4
4-21-30	Fern Lake	3	60		64.7	SCE	1984	
29-21-30	Florence, Lake	28	63		66.2	SCE	1984	
12-21-29	Florida, Lake	24	56	58.2	61.3	COE	1978	A6
17-21-29	Forest Lake	5	65	66	67	SCE		
25-21-30	Garden Lake	22	53	56.2	57.4	SJRWMD	1984	A1
27-19-29	Gary, Lake	4	43	45	47	SCE		
22-21-31	Gem, Lake	9	48	53	55	SCE		
15-20-32	Geneva, Lake	29	27	29	31	SCE		
20-20-30	Geoffrey, Lake	3	46	47	48	SCE		
6-20-31	Golden Lake	45	38	39.4	40.2	COE	1979	A2
22-21-32	Gore, Lake	30	41	43	44	SCE		
25-20-29	Grace Lake	32	59	64.6	66.0	COE	1979	A3
17-21-30	Grassy Lake	8	84	84.8	85.7	COE	1979	A2
8-21-30	Griffin, Lake	10	73	73.7	75.5	COE	1978	A4

(The indicated flood elevations are based upon the best available information and are subject to change as better data becomes available)

LAKES IN SEMINOLE COUNTY

Section-Township-Range	Name of Lake	Surface Area (AC)	Base Elev.	10 Yr. Flood Level	100 Yr. Flood Level	Estab. By	Year Estab.	Flood Category
16-21-29	Harriet, Lake	6	53	55	56	SCE		
	Harney, Lake	6058	2	9.7	12.0	COE	1977	A4
15-20-32	Harts Lake	15	32	34	35	SCE		
27-21-31	Hayes, Lake	12	44	46	47	SCE		
39-20-30	Hidden Lake	10	35	37.5	38.8	COE	1979	A3
4-21-30	Hodge, Lake	16	54		58.5	SCE	1984	
24-21-29	Hope, Lake	36	67	71.5	74.3	COE	1979	A6
29-21-32	Horseshoe Lake	95	38	40	42	SCE		
27-19-29	Howard, Lake	3	43	45	47	SCE		
27-21-30	Howell, Lake	406	53	56.6	58.6	SJRWMD	1984	A3
37-21-30	Irene, Lake	14	55		60.4	SCE	1984	
36-19-29	Irish, Lake	71	44		45.9	CPH	1984	A2
1-20-29	Island Lake (H)	53	44		47.8	SCE	1984	A1
1-21-29	Island Lake (L)			84.2	85.2	COE	1979	A2
29-20-32	Island Pond	72	28	32	35	SCE		
5-21-30	Jane, Lake	1	62	67	70	SCE		
39-20-30	Jennie, Lake	22	36	37.1	38.3	COE	1979	A2
28-20-31	Jesup, Lake	10011	3	8.1	9.8	COE	1979	A3
37-21-30	Kathryn, Lake	76	52	53.5	55.1	COE	1979	A3
19-21-30	Lake-of-the-Woods	51	76	78.0	79.7	SJRWMD	1984	
28-19-32	Le Fils Slough	75	4	8.7	10.8	COE	1979	A4
14-20-29	Linden Lake	15	42	44	45	SCE		
19-21-29	Little Bear Lake	28	103	105.6	108.9	COE		
3-20-30	Little Crystal Lake		40	43.7	45.3	COE	1979	A3
31-21-31	Little Lake Georgia	12	59	61.1	61.9	OCE		
14-21-30	Little Lake Howell (Lake Tuskawilla)	99	54		57	SCE		
5-21-30	Little Wildmere Lake		60		64.7	SCE	1984	
29-20-30	Loch Low Lake	23	41	44.0	44.9	COE	1979	A2
13-21-31	Long Lake	69	44	46.7	47.2	COE	1978	A1
36-21-30	Lost Lake	11	52	55.5	55.1	COE	1978	A3
8-21-30	Lotus, Lake (C)	3	79	78.4	81.7	COE	1979	A7
21-21-29	Lotus, Lake (A)	115	61	62.2	64.1	COE	[illegible]78	A4
22-20-30	Lucerne, Lake	3	55	58	59	SCE		
18-21-30	Maitole, Lake	3	84	85	88	SCE		
32-21-30	Mack, Lake	3	54	55.2	55.8	COE	1979	A2
3-21-29	Mallette, Lake	77	44		45.1	CPH		A1
19-21-29	Marion, Lake	10	55	58	60	SCE		
24-21-30	Markham, Lake	79	42	45	47	SCE		
28-20-30	Mary, Lake	150	40	43.5	44.6	COE	1977	A2
27-21-32	Mills, Lake	282	42	43	45	SCE		
14-20-30	Minnie, Little Lake	2	39	40	42	SCE		
14-20-30	Minnie, Lake	39	35	35.7	38.2	COE	1979	A3
22-19-29	Miranda, Lake	4	38	42	43	SCE		
17-21-29	Mirror, Lake	34	61	62	64	SCE	1985	
7-21-30	Mobile, Lake	23	78	80.2	81.0	COE	1979	A2
	Monroe, Lake	9405	2	7.3	9.6	COE	1978	A5
36-20-29	Mud Lake			84.3	85.3	COE	1978	A2
33-19-32	Mullet, Lake	631	3	8.5	10.6	COE	1979	
28-20-29	Myrtle Lake	65	48	53.1	54.2	COE	1979	A2
14-21-29	North Lake			58.8	61.9	COE	1978	A6
17-21-32	Nixon, Lake	16	42	43	45	SCE		
7-20-31	Omaro, Lake	7	43	44	45	SCE		
32-20-30	Orange, Lake	1	68	70	74	SCE		
24-21-29	Orienta, Lake	129	61	65.0	67.2	COE	1979	A4
19-21-29	Pearl, Lake (FC)	29	59	60.4	61.1	COE	1979	A1
18-21-30	Pearl, Lake (A-C)	14	86	87.2	87.8	COE	1979	A1

(The indicated flood elevations are based upon the best available information and are subject to change as better data becomes available)

LAKES IN SEMINOLE COUNTY

Section-Township-Range	Name of Lake	Surface Area (AC)	Base Elev.	10 Yr. Flood Level	100 Yr. Flood Level	Estab. By	Year Estab.	Flood Category
35-19-29	Pearl, Lake	4	46	52	55	SCE		
34-21-32	Pickett, Lake	742	56	58.0	59.6	COE		
32-19-30	Pine Lake	2	47		55	SCE		
8-21-30	Plaza Pool	3	70	72	73			
18-21-30	Pot Lake			87.2	87.8	COE	1978	A1
36-20-29	Prairie Lake (L)			84.3	85.3	COE	1978	A2
18-21-30	Prairie Lake	124	86	87.2	87.8	COE	1979	A1
22-20-32	Proctor, Lake	74	29	29.5	30.0	SCE	1985	A1
9-21-33	Puzzle Lake	1300	3	10.3	12.5	COE	1979	A7
8-21-30	Quail Pond	3	62	63.5	64.9	COE	1978	A3
16-21-30	Queens Mirror Lake	12	53	54.3	56.2	COE	1978	A4
25-21-30	Red Bug Lake	28	66	67.1	68.2	COE	1979	A2
29-20-30	Reservoir Lake	18	43	44.8	45.6	COE	1979	A2
14-20-30	Rice Lake	45	43	44	45	SCE		
35-20-29	Rock Lake	19	79	80.3	81.5	COE	1979	A2
22-21-31	Rogers, Lake	4	68	70	71	SCE		
27-19-29	Ross Lake	21	39	45	47	SCE		
11-21-31	Round Lake	12	45	47.2	48.0	COE	1979	A2
29-20-30	Ruth, Lake	10	58	62.3	63.9	COE	1979	A3
1-20-29	Sawyer Lake	17	44		48.3	CPH	1984	
31-20-30	Searcy, Lake	11	58	65.2	67.4	COE	1978	A4
30-21-30	Secret Lake	5	53	53.5	55.1	COE	1978	A3
19-21-30	Seminary, Lake	55	82	85.0	85.9	COE		
6-21-30	Seminole, Lake	1	78	79	80	SCE		
7-20-31	Silver Lake	33	41	43	45	SCE		
22-21-29	Spring Lake	87	66	65.4	67.2	COE	1979	A3
23-21-29	Springwood Lake		89	89.4	91.0	COE	1978	A3
31-19-30	Star, Lake	9	66	68	70	SCE		
26-19-29	Sylvan, Lake	186	40	42.0	44.0	CPH	1978	A4
28-20-30	Talma, Lake	4	53	57	60	SCE		
10-21-29	Tillie, Lake			50.2	52.0	COE	1975	A6
27-21-30	Tony, Lake	22	58	61	63	SCE		
20-21-30	Triplett, Lake	196	52	53.5	55.1	COE	1978	A3
31-21-29	Trout Lake (A)	17	58	61.7	63.5	COE	1978	A3
8-21-30	Trout Lake (C)	15	77	81.0	81.5	COE	1979	A1
31-19-30	Trout Lake	2	68	73	75	SCE		
31-19-30	Trout Lake	2	66	69	72	SCE		
20-20-29	Twin Lakes (Forest)	5	79	84.3	86.0	COE	1978	A3
4-21-32	Twin Lake	25	28	33	35	SCE		
35-19-30	Twin Lakes	52	45	48	55	SCE		
30-20-30	Wayman Lake	2	68	72	74	SCE		
7-21-29	Weldon, Lake (Sand)	42			116	SCE		
8-20-30	West Crystal Lake	27	42	44.4	46.1	COE	1978	A3
31-20-30	West Lake	25	62	63.9	65.9	COE	1978	A4
5-21-30	Wildmere, Lake	23	59	61.2	61.6	COE	1978	A1
20-19-29	Yankee Lake	49	33	40	43	SCE		
30-21-30	Yvonne, Lake	6	54	55.3	56.3	COE	1978	A2

SOURCE CODES:

COE:	U.S. Army Corps of Engineers
CPH:	Conklin, Porter & Holmes Engineering, Inc.
SCE:	Seminole County Engineer
SJRWMD:	St. Johns River Water Management District
OCE:	Orange County Engineering
(A):	Altamonte Springs
(C):	Casselberry
(FC):	Forest City
(H):	Heathrow
(L):	Longwood

(The indicated flood elevations are based upon the best available information and are subject to change as better data becomes available)

Appendix E

APPENDIX E

APPENDIX E

STRUCTURE INVENTORY LISTING

BASIN 1: YANKEE LAKE

STRUCTURE NUMBER	DESCRIPTION	LOCATION	AERIAL PHOTOGRAPH NUMBER
01-0103	Single 30" CMP	Wekiva Park Drive	4
01-0104	Single 36" CP	SR-46,north of Sylvan Lake	13
01-0106	9' x 2' Box Culvert	SR-46 & Markam Road	13
01-0107	Dual 42" CP	SR-46 & Markam Road	13
01-0203	10'6" x 200' Bridge	SR-46 & Wekiva River	5
01-0501	Culvert, Size Unknown	Markam Woods Rd., north of Lake Mary Blvd.	14
01-0502	Culvert, Size Unknown	Heathrow Blvd., north of Lake Mary Blvd.	14
01-0503	30" CP	I-4,1/4 mile north of Lake Mary Blvd.	22
01-0504	48" RCP	I-4 & Lake Mary Vlvd.	15

BASIN 2: LAKE MONROE

STRUCTURE NUMBER	DESCRIPTION	LOCATION	AERIAL PHOTOGRAPH NUMBER
02-0103	Twin 42" RCP	End of Delaware St. north of Orange Blvd.	20
02-0106	Single 60" RCP	Delaware St. 1/2 mile north of Orange Blvd.	20
02-0109	Single 72" CMP	Ohio Ave. and Delaware St.	20
02-0112	5' x 9' Box Culvert	Delaware St. at Orange Blvd.	20
02-0115	Single 42" CMP	Ohio Ave. 1/4 mile west of Indiana St.	20
02-0118	Twin 36" CP	SR-46, west of I-4	21
02-0121	Twin 36" CP	SR-46, west of I-4	21
02-0206	12' x 48' RC Bridge	Orange Blvd. west of I-4, past Missouri St.	20
02-0209	10' x 8' Conc. Box Culvert	I-4,north of Sanford and Mt. Dora exit	20
02-0212	Twin 108" CMP	Hickman Dr. north of SR-46	28
02-0213	Twin 30" CP	I-4 at SR-46	21
02-0214	36" CP	I-4 at SR-46	21
02-0215	Twin 7' x 8' Box Culvert	1/2 mile south of I-4 on SR-46	28
02-0216	Single 30" RCP	I-4, north of Paola Rd	21
02-0218	7' x 25' RC Bridge	Intersection of Upsala and 5th St.	28
02-0221	Single 36" CMP	North of Str. 02-0227 1/2 mile along canal	28
02-0224	Twin 48" RCP	North of Str. 02-0227 1/4 mile along canal	28
02-0227	Single 36" x 58" CMAP	On Vihlen Rd. east of Kennel Rd.	28
02-0230	Twin 30" X 19" RCP	On W. 25th St., east of Larkwood Dr.	28
02-0236	4' x 5' Box Culvert	On Country Club Rd., east of Central Ave.	28
02-0239	Single 64" x 43" CMP	On W. 25th St., 200 yards west of Airport Blvd.	37
02-0242	Single 49" x 32" CMP	On Airport Blvd., 200 yards north of Old Lake Mary Rd.	37
02-0245	Single 24" RCP	Old Lake Mary Rd., 1/4 mile north of Airport Blvd.	37
02-0303	Single 42" RCP	At Lake Blvd. and Sunset Dr.	29
02-0306	Single 42" RCP	200 yards south of Lake Blvd. on North Shore Lake Dr.	29
02-0309	8'6" x 16' CMA	Country Club Rd., 300 yards north of Ridgewood	22
02-0312	Single 42"	Rhinehart Rd., south of Paola Rd.	29
02-0315	Single 42" Pipe	Golf course, I-4 and Paola Rd.	22
02-0318	48" RCP Pipe System	Golf course, I-4 and Paola Rd.	22
02-0321	30" Pipe System	Golf course, I-4 and Paola Rd.	22
02-0323	30" Lake Outfall	Golf course, south of Paola Rd.	22
02-0325	30" RCP Lake Equalizer	Golf course, south of Paola Rd.	22
02-0327	30" RCP Lake Equalizer	Golf course, south of Paola Rd.	22
02-0403	18" x 24" Box Culvert	I-4, 1 mile north of SR-46	27
02-0406	49" x 78' Bridge (Est. Dimensions)	North end of Upsala Rd. 100 yards east of RR track	27

BASIN 2: LAKE MONROE - Concluded

STRUCTURE NUMBER	DESCRIPTION	LOCATION	AERIAL PHOTOGRAF NUMBER
02-0409	Twin 44" x 72" RCAP	Monroe School St. east of Upsala Rd.	27
02-0411	Twin 24" CP	SR-45 & Old Monroe Rd.	28
02-0412	Twin 42" x 6'6" CMAP	Church St., 50 yards from Upsala Rd.	27
02-0413	Twin 24" CP	SR-46, 1/4 mile west of Old Monroe Rd.	28
02-0414	Single 42" RCP	Sr-46, 1/3 mile west of Old Monroe Rd.	28
02-0415	5'10" x 16' Box Culvert	1 mile north of RR tracks on Upsala Rd.	28
02-0416	6' x 3' Conc. Box Culvert	SR-46, 1/3 mile west of Old Monroe Rd.	28
02-0417	Single 30" RCP	SR-46, 1/2 mile west of Old Monroe Rd.	28
02-0418	Single 42" RCP	1/4 mile south of Elder Rd. and Narcissus Ave.	27
02-0419	Dual 30" RCP	SR-46, 3/4 mile west of Old Monroe Rd.	28
02-0420	Single 30" RCP	SR-46, 3/4 mile west of Old Monroe Rd.	28
02-0421	1'10" x 3' Box Culvert	Intersection of Old Monroe Rd. and Narcissus Rd.	27
02-0424	2' x 3' Box Culvert	Kennel Rd. and Church St.	27
02-0425	10' x 4' Conc. Box Culvert	SR-46, 1/4 mile west of New Upsala Rd.	28
02-0427	6' x 6' Box Culvert	1/4 mile southeast of I-4 on Seminole Blvd.	
02-0428	Single 48" RCP	SR-46, 1/4 mile west fo New Upsala Rd.	28
02-0429	2' x 10' Box Culvert	S.C.L. Railroad southeast of Kennel Rd.	27
02-0430	4' x 8' Box Culvert	1 mile west of Ranyard Rd. on Narcissus Rd.	27
02-0433	6' x 6' Box Culvert	1 mile southeast of I-4 on Seminole Blvd.	27
02-0436	Single 60" RCP	Iowa St. at S.C.L. Railroad	27
02-0439	Single 36" RCP	Rand Rd. and Narcissus Ave.	27
02-0442	15' x 36' RC bridge	U.S. 17-92: L. Monroe next to Policeman's Benevolent Assoc	27
02-0445	6 x 6' Box Culvert	U.S. 17-92	35

BASIN 3: CITY OF SANFORD

STRUCTURE NUMBER	DESCRIPTION	LOCATION	AERIAL PHOTOGRAPH NUMBER
03-0313	7' x 7' Box Culvert	SR-436 and Polar Avenue	36
03-0315	Triple 7' x 8' Box Culvert	SR-436 and Oleander	36
03-0318	30" RCP Pipe System	SR-436 between Old Monroe Rd. and Poplar Rd.	36
03-0321	36" Pipe System	SR-436 between Old Monroe Rd. and Poplar Rd.	36
03-0323	42" Lake Outfall	SR-436 between Old Monroe Rd. and Poplar Rd.	36
03-0333	Twin 24" RCP	West of CR 427 at Second St.	37
03-0336	Single 34" x 53" RCEP	Lake Mary Blvd. at Pathway Ct.	37
03-0339	Twin 19" x 30" RCEP	Lake Mary Blvd. at Cherokee Ct.	37
03-0342	48" System	SR-46 & CR-425	37
03-0343	54" System	SR-46 & CR-425	37
03-0345	42" System	CR-46 & Magnolia	36
03-0348	30" System	CR-46 & Magnolia	36

BASIN 4: MIDWAY

STRUCTURE NUMBER	DESCRIPTION	LOCATION	AERIAL PHOTOGRAPH NUMBER
04-0103	Twin 18" RCP	Celery Ave. 1/4 mile east of Scott Ave.	44
04-0104	Single 30" CMP	On North St. at Rosenberry Ln.	44
04-0106	Single 48" RCP	SR-46 1/2 mile west of Brisson Ave	44
04-0107	Single 30"	SR-46, 3/4 mile west of Brisson Ave.	44
04-0109	Single 65" x 40" CMAP	Celery Ave. south of Beck field	44
04-0112	Single 54" RCP	Scott Ave. 80 ft. south of 8th St.	44
04-0114	Single 30" RCP	On railroad 1 mile east of Rosenberry Ln.	44
04-0115	Triple 48" CMP	Celery Ave. 1/2 mile east of Scott Ave.	44
04-0118	Twin 36" RCP	Corner of Celery Ave and Brisson Ave	44
04-0119	Single 24" RCP	On Brisson at Celery Ave.	44
04-0120	Single 30" CMP	On Brisson 600' south of Celery Ave.	44
04-0121	Twin 24" VCP	Celery Ave. 1/4 mile east of Brisson Ave.	44
04-0122	Single 24" CMP	On Celery 1 mile east of Brisson	44
04-0123	Single 36" RCP	On Granby at railroad	
04-0124	Twin 30" RCP	20th St. 100 ft. east of Ruff Rd.	
04-0127	Single 24" RCP	20th St. at Henri Ave.	44
04-0133	Single 4' x 8' Box Culvert	SR-415 1/2 mile north of SR-46	52
04-0134	Single 84" CMP	Hughey St. east of Cameron St.	52
04-0136	6' x 5' Box Culvert	Cameron Ave. 1/2 mile south of SR-415	52
04-0139	Single 42" RCP	Hughey Ave. at RR crossing	52
04-0142	3' x 5' Box Culvert	Corner of Hughey St. at Beardall Ave.	52
04-0143	Single 36" RCP	Hughey St. west of Beardall Ave.	52
04-0145	Single 42" CMP	Hughey St. at Deepwater Ave.	52
04-0146	Twin 36" CMP	Hughey St.	52
04-0147	Single 42" CMP	Hughey St.	52
04-0148	30" RCP	Sipes Ave. at Hughey St.	44
04-0151	3' x 10' Box Culvert	SR-415 1/4 mile north of SR-46	52
04-0152	Single 84" CMP	Wash St. between Cameron Ave. and SR-415	52
04-0153	Single 72" CMP	Cameron Ave and Wash St.	52
04-0154	6' x 5' Box Culvert	Cameron Ave and Wash St.	52
04-0155	Twin 24"CMP	Beardall Ave. and Wash St.	52
04-0156	Twin 24" x 36" CMEP	One block north of SR-46 on Beardall Ave.	52
04-0157	Twin 36" CMP	Frog Alley south of Washington St.	52

BASIN 4: MIDWAY - Concluded

STRUCTURE NUMBER	DESCRIPTION	LOCATION	AERIAL PHOTOGRAPH NUMBER
04-0158	Single 42" RCP	On Sipes at Northward Ave.	44
04-0159	Single 36" RCP	On Central at Northward Ave.	44
04-0160	Single 36" RCP	On Church at Northward Ave.	44
04-0161	Single 36" RCP	On Granby at Northward Ave.	44
04-0162	20" CMP	Crawford Dr. and Grady St.	44
04-0163	24" CMP w/Drop Inlet	Byrd Ave. at Brisson Ave	44
04-0172	Single 36" RCP	Celery Ave. south of Tecumsen Rd.	52
04-0175	Single 36" CMP	Celery Ave west of Blackhawk Rd.	52
04-0178	Single 42" RCP	North of Celery Rd.	52
04-0181	8' x 3' Box Culvert	Celery Ave. east of Beardall Rd.	52
04-0184	Single 36" CMP	North of Beardall Ave	52
04-0187	Single 36" RCP	North of Beardall Ave	52
[illegible]190	Twin 36" RCP	North of Beardall Ave	52
[illegible]193	6' x 3' Box Culvert	North of Beardall Ave	52
04-0194	Dual 24" RCP	SR-415, 1/4 mile north of SR-46	52

BASIN 5: LAKE JESSUP

STRUCTURE NUMBER	DESCRIPTION	LOCATION	AERIAL PHOTO NUMBER
05-0103	6'6" x 7'4" Box Culvert	Miller Rd. at Sanford Ave.	38
05-0106	8'5" x 22' Box Culvert	Myrtle St. west of Sanford Ave.	38
05-0109	6'6" x 10' Box Culvert	Magnolia Ave., 200 yds. north of Myrtle	38
05-0112	8' x 40' 4-Span Wooden Bridge	RR track 1/4 mile east of Hester Ave.	38
05-0115	10' x 4' Box Culvert	CR-427 north Hester Ave.	38
05-0203	Twin 36" RCP	Collins St., 200 yds. east of U.S. 17-92	38
05-0206	12' x 11' Box Culvert	U.S. 17-92, 20 yds. south of Fairmont Dr.	38
05-0209	Culvert, No Access	1/4 mile south of Lake Mary Blvd. on Hospital Rd.	30
05-0215	Single 36" RCP	U.S. 17-92 200 yds. north of Country Home Rd.	38
05-0218	28" x 15" CMAP	Lake Mary Blvd. 1/4 mile west u.s. 17-92	37
05-0219	Pipe (Unknown Size)	Lake Mary Blvd. & Hospital Rd.	30
05-0220	2 - 19" x 30" RCEP System	Lake Mary Blvd. & U.S. 17-92	37
05-0221	2 - 24" x 38" RCEP System	Lake Mary Blvd. & U.S. 17-92	37
05-0222	2 - 24" x 38" RCEP System	Lake Mary Blvd. & U.S. 17-92	37
05-0223	30" System	U.S. 17-92 at SR 427	38
05-0224	42" RCP System	U.S. 17-92 at SR 427	38
05-0225	36" System	U.S. 17-92 at SR 427	38
05-0226	48" System	U.S. 17-92 at SR 427	38
05-0227	48" System	U.S. 17-92 at SR 427	38
05-0228	60" System	U.S. 17-92 at SR 427	38
05-0229	30" System	U.S. 17-92 at SR 427	38
05-0230	36" System	U.S. 17-92 at SR 427	38
05-0303	Culvert, No Access	S.C.L. Railroad 200 yds. west of Oak Ave.	38
05-0306	Twin 6' x 7' Box Culverts	CR-425 and Laurel Ave.	38
05-0309	Twin 48" RCP	Airport Blvd. 200 yds. west of W. Wood Ct.	37
05-0315	Single 48" RCP	Airport Blvd west of 30th St.	37
05-0321	Single 48" RCP	Intersection CR-425 and Airport Blvd.	37
05-0324	Single 36" RCP	CR-425 north of Airport Blvd.	37
05-0325	Single 30" Pipe	CR-425 north of 29th St.	37
05-0327	30" RCP w/Drop Inlet	On French south of Pinecrest	37
05-0330	Single 36" RCP	South of French Ave. on 27th St.	37
05-0331	Single 30" RCP	U.S. 17-92 north of Airport Rd.	37
05-0333	Twin 24" RCP	West of CR-425 south of Airport Blvd.	37
05-0336	Single 34" x 53" ERCP	East of U.S. 17/92 south of Airport Blvd.	37
05-0339	Twin 19" x 30"	East of U.S. 17/92 south of Airport Blvd.	37
05-0403	46" x 27' Wooden Bridge	Silver Lake Dr. and RR crossing	45
05-0406	Triple 48" RCP	Silver Lake Dr. and RR track	45
05-0409	Triple 36" RCP	Cornwall Rd. 1 mile from Sanford Ave.	45
05-0503	Triple 36" RCP	Richmond Ave. and SR-46	53
05-0505	Twin 24" RCP	SR-415 & SR-47	2

BASIN 5: LAKE JESSUP - Concluded

STRUCTURE NUMBER	DESCRIPTION	LOCATION	AERIAL PHOTOGRAPH NUMBER
05-0506	Triple 30" RCP	One block west of SR-415 and SR-46 and Cameron Ave.	53
05-0507	Triple 30" RCP	Cameron Avenue at SR-46	52
05-0508	Single 36" RCP	Beardall Avenue at SR-46	52
05-0509	5' x 8' Box Culvert	Richmond Ave. 1/4 mile south of SR-46	53
05-0512	Twin 24" CMP	Cameron Ave. and south of SR-46, 1/4 mile	53
05-0515	18" and 24" RCP	Beardall Ave. 1/4 mile south of Geneva Ave.	53
05-0518	Culvert, No Access	Sanford Airport Property, no access	53
05-0521	6'x 8' Box Culvert	Adjacent to 2695 Richmond Ave.	53
05-0524	4' x 8' Box Culvert	Adjacent to 2690 Cameron Ave.	53
05-0527	3'x 5' Box Culvert	Beardall Ave. 1/2 mile north of Moores Station Rd.	53
05-0530	6' x 6' Box Culvert	Adjacent to 2790 Richmond Ave.	53
05-0533	Twin 24" x 36" CMEP	Cameron Ave. south of Str. 05-0524	53
05-0536	3' x 8' Box Culvert	Cameron Ave. north of Str. 05-0545	53
05-0539	58" x 36" CMAP	Moores Station Rd. at Beardall Ave.	53
05-0542	Culvert, No Access	Sanford Airport Property	53
05-0545	3' x 5' Box Culvert	Cameron Ave. 1/4 mile north of Str. 05-0548	53
05-0548	5' x 6' Box Culvert	Marquette Ave. at Cameron Ave.	53
05-0551	5' x 9' Box Culvert	Kentucky St. and Beardall Ave.	53
05-0554	Culvert, No Access	Sanford Airport Property	53
05-0557	Single 96" Struct. Plate Arch-Alum.	Marquette Ave.	53
05-0560	Culvert, No Access		53
05-0563	Culvert, No Access		53
05-0567	Culvert, No Access		53
05-0703	Single 72" CMP	Deleon 1/4 mile north of Florida Ave.	56
05-0706	Single 72" CMP	Deleon 1/4 mile north of Florida Ave.	56
05-0709	Single 72" CMP	Deleon 1/4 mile north of Florida Ave.	56
05-0712	6' x 14' Box Culvert	Deleon St. 0.1 mile south of Florida Ave.	56
05-0715	Single 72" CMP	Magnolia St. 1/4 mile east of Central Ave.	56
05-0718	6' x 12' Box Culvert	CR-426 north of Broadway St.	56
05-0721	Twin 60" RCP	North of Broadway St. and east of CR-426	56
05-0724	4' x 11' Box Culvert	Broadway St. and Station St.	56
05-0727	Culvert, No Access	Private Property south of CR-426, Oviedo. No access	56
05-0730	Single 24" RCP	Dellwood Dr. east of Palm Springs Dr.	56
05-0733	Twin 30" RCP	Broadway St.	56
05-0803	9'6" x 42' Wooden Bridge	Bridge D.O.T. #774027 at Howard Ave.	62
05-0806	8' x 25' Wooden Bridge	Canal St. and Howard Ave.	62
05-0807	Twin 72" CMAP	Howard Ave., 1/4 mile east of Canal St.	62
05-0808	Bridge	Howard Ave., 1/2 mile east of Canal St.	62
05-0809	6'2" x 10' Wooden Bridge	Kansas St. and Florida Ave.	63
05-0903	Single 72" x 44" CMAP	Stone St. approx. 1 1/2 mile from Florida Ave.	62
05-0906	Twin 36" CMP	Independence Dr. 1 mile ? of Stone St.	62

BASIN 6: ST. JOHNS

STRUCTURE NUMBER	DESCRIPTION	LOCATION	AERIAL PHOTOGRAPH NUMBER
06-0103	Single 36" RCP	Mullet Lake Park Rd.	67
06-0106	Twin 72" x 44" CMAP	Mullet Lake Park Rd. at Oseola Rd.	67
06-0107	CMP (Unknown Size)	Mullet Lake Park Rd.	66
06-0108	Twin 8' x 2' Box Culverts	SR-46 & Mullet Lake Park Rd.	67
06-0109	Twin 24" CP's	SR-46, 1.5 miles south of Lake Park Rd.	68
06-0203	Twin 48" RCP	St Johns Ave. 1/2 mile north of Osceola Rd.	82
06-0303	96"CMP, S/D Equilizer	St. Johns Ave. & St. Johns River	81

BASIN 7: LAKE HARNEY

STRUCTURE NUMBER	DESCRIPTION	LOCATION	AERIAL PHOTOGRAPH NUMBER
07-0102	6'x 6' Box Culvert	SR-46, 2 miles east of SR-13	85
07-0103	4'8" x 31' Wooden Bridge	Old Mills Rd. 1/2 mile east of Jungle Rd.	85
07-0106	Twin 36" RCP	Old Mills Rd. and Jungle Rd.	85
07-0303	Twin 24" CP	SR-46, 2 1/8 miles east of SR-13	85
07-0503	Single 48" RCP	Osceola Rd. southeast of the Str. 07-0506	83
07-0506	Twin 36" RCP	Adjacent to 1275 (east) Osceola Rd.	83
07-0509	Single 48" RCP	Osceola Rd. northeast of Str. 07-0506	83

BASIN 9: BIG ECONLOCKHATCHEE

STRUCTURE NUMBER	DESCRIPTION	LOCATION	AERIAL PHOTOGRAPH NUMBER
09-0103	Pipe (Unknown Size)	Old Mines Rd., 1/4 mile east of Snow Hill Rd.	77
09-0203	22' x 200' 10-Span RC Bridge	SR-13 and Econlockhatchee River	78
09-0206	Twin 36" RCP	CR-426 at Seminole Woods Blvd.	77
09-0209	20' x 520' 16-Span RC Bridge	Willingham Rd. at CR-419	64
09-0212	1'6" x 5' Box Culvert	On SR-13 1/2 mile south of Snow Queen Dr.	79
09-0215	9'4" x 75' 3-Span RC Bridge	Golf View Ave. north of Overlook Dr.	79
09-0403	Twin 24" RCP	Brumley Rd. 1 1/2 mile northeast of Lake Mills Rd.	87
09-0406	5' x 21' Wooden Bridge	Brumley Rd. 1 mile northeast of Lake Mills Rd.	87
09-0409	6'6" x 16' RC Bridge	Lake Mills Rd. east of Mills Lake on Mills Creek	80
09-0412	Culvert, No Access	Private property. First Ave at Lake Mills Rd.	80
09-0415	Twin 36" RCP	Lake Mills Rd. at 3rd Ave.	80
09-0418	Twin 24" CMP	Lake Mills Rd. at Silcox Branch Creek	88
09-0421	6'9" x 48' 4-Span Wooden Bridge	Lake Mills Rd. at Silcox Branch Creek, 1 mile southeast of Str. 09-0418	88
09-0503	Twin 24" CP	SR-46, 1/3 mile east of SR-426	7
09-0506	Twin Pipes (Unknown Sizes)	SR-46 & Lake Proctor	77

BASIN 10: LITTLE ECONLOCKHATCHEE

STRUCTURE NUMBER	DESCRIPTION	LOCATION	AERIAL PHOTOGRAPH NUMBER
10-0103	13'3" x 85' 7-Span Bridge	Lockwood Rd. Bridge D.O.T. #774026	64
10-0203	25' x 200' RC Bridge	SR-434 at Little Econlockhatchee River	58
10-0303	Single 36" RCP	Broadway St. and Reed Ave.	64
10-0403	12' x 10' Box Culvert	SR-436 at Orange Co. Line	34
10-0406	Twin 54" CMP	Eastbrook Blvd. at Australian Cir.	34

Basin 11: HOWELL BRANCH

STRUCTURE NUMBER	DESCRIPTION	LOCATION	AERIAL PHOTOGRAPH NUMBER
11-0103	Single 18" CMP	SR-434, 1/4 mile west of Gardenia Ave.	48
11-0106	5' x 9'6" Box Culvert	SR-434, 1/2 mile east of Gardenia Ave.	48
11-0203	8' x 44' 3-Span Bridge RC	SR-434, 1 mile east of Gardenia Ave.	48
11-0206	Culvert, No Access	CSX Railroad north of Laurel Dr.	48
11-0207	Single 42" CMP	CSX Railroad north of Laurel Dr.	48
11-0209	13' x 27'6" Bridge	D.O.T. Bridge #77579, Northern Way west of Brown Bear Ct.	48
11-0210	Single 36" CMP S/D Outfall	Tuskawilla Country Club Golf Course	49
11-0211	Single 36" RCP	Northern Way & Howell Creek	49
11-0212	13'4" x 130' RC Bridge	D.O.T. Bridge #775711, Winter Sprins Blvd.	48
11-0213	42" RCP S/D Outfall	Howell Creek, south of Northern Way	49
11-0214	30" CMP S/D Outfall	Howell Creek, south of Northern Way	48
11-0215	9' x 30' Wooden Bridge	Tuskawilla Country Club Golf Course	49
11-0218	11'10" x 51' RC Bridge	D.O.T. Bridge #77503, Northern Way and Howell Creek	49
11-0224	10'8" x 45' RC Bridge	D.O.T. Bridge #775702, Dyson Dr.	41
11-0227	Single 30" RCP	Adjacent to 1209 Wolverine Tr.	41
11-0228	Single 36" Al. Pipe S/D Outfall	Mapim. Ct., East of Tuskawilla Rd.	41
11-0229	Single 30" RCP S/D Outfall	Mapim. Ct., East of Tuskawilla Rd.	41
11-0232	29" x 42" CAPA S/D Outfall	West of Tuskawilla Rd., north of ????????CAN'T READ	41
11-0233	Twin 60" x 48" RCEP	Tuskawilla Rd. and Tuskawilla Pt. Ln.	41
11-0236	Twin 9' x 8' Box Culverts	1/4 mile Red Bug Lake east of Tuskawilla Rd.	41
11-0303	14'4" x 68' RC Bridge	Tuskawilla Rd. at Howell Creek	41
11-0306	Culvert, No Access	Private property, 600' west of Tuskawilla Rd.	41
11-0309	Twin 18' x 19.2' RC Bridge	Dodd Rd. and Aldergate Dr.	41
11-0402	Culvert (unknown)	Lake Howell Lane	34
11-0403	Culvert (unknown)	Lake Ann Lane	34
11-0406	Twin 12' x 125' RC Bridge	SR-436 and Lake Howell Square	34
11-0409	8' x 50' RC Bridge	Lake Howell Ln. and Lake Howell Rd.	34
11-0412	9' x 21' Bridge	Lake Howell Rd. at Sierra Ln.	34
11-0415	Single 60" RCP	Red Bug Lake Rd. at Eagle Cir.	33
11-0418	2-68" x 43" and 1-38" x 24" Pipe	Eagle Cir. at Red Bug Lake Rd.	33
11-0419	Single 36" CMP	Eagle Cir. at Red Bug Lake Rd.	33
11-0421	Two 60" CMP	Eagle Cir. at Fairway Oaks Dr.	33
11-0424	Twin 24" RCP	100' e. of Red Bug Lk Rd. and Winding Rdge-across from F.D	33
11-0427	Single 48" RCP	Winter Park Dr. 0.1 mile north of Red Bug Lake Rd.	33
11-0428	Twin 24" CP	SR-436 & Red Bug Lake Rd.	33

Basin 11: HOWELL BRANCH - Continued

STRUCTURE NUMBER	DESCRIPTION	LOCATION	AERIAL PHOTOGRAPH NUMBER
11-0429	Single 36" CMP	SR-436 & Red Bug Lake Rd.	33
11-0430	Single 30" CMP	SR-436 & Red Bug Lake Rd.	33
11-0431	Single 36" CMP	SR-436 & Red Bug Lake Rd.	33
11-0432	Single 30" System	Red Bug Lake Rd.	33
11-0433	Single 36" System	Red Bug Lake Rd.	33
11-0434	Single 42" System	Red Bug Lake Rd.	33
11-0435	Single 54" System	Red Bug Lake Rd.	33
11-0436	Single 36" System	Red Bug Lake Rd.	33
11-0437	Single 60" System	Red Bug Lake Rd.	33
11-0438	Single 66" System	Red Bug Lake Rd.	33
11-0439	Single 66" System	Red Bug Lake Rd.	33
11-0440	Single 42" System	Red Bug Lake Rd.	33
11-0441	Single 48" x 76" System	Red Bug Lake Rd.	33
11-0442	Twin 72" System	Red Bug Lake Rd.	33
11-0443	Single 66" System	Red Bug Lake Rd.	33
11-0444	Twin 53" x 34" RCP System	Red Bug Lake Rd.	33
11-0445	Single 35" x 24" CMP System	Red Bug Lake Rd.	33
11-0503	6' x 10' Box Culvert	SR-436 north of Lake Howell Rd.	33
11-0506	Four 96" CMP	Under Cassel Creek Blvd. 1 block west of SR-436	33
11-0512	Single 30" RCP	Southwest of Wyndotte Tr.	26
11-0515	8' x 43' RC Bridge	Kewanee Tr. north of Falmouth Rd.	26
11-0518	Three 48" CMP	Talbor Rd. west of Sepler	26
11-0521	Three 66" x 40" CMAP	Graham Rd. east of Doverwood Rd.	26
11-0524	Three 50" x 31" CMAP	Waverly Dr. at Maid of the Mist Dr.	26
11-0527	Twin 48" CMP	Fernwood Blvd. & Oxford Ave.	26
11-0530	Twin 48" CMP	Oxford Ave. at Fernpark Blvd.	26
11-0533	Single 48" CMP	Oxford Ave. at Fern Rd.	26
11-0535	Single 30" Pipe System	Fernwood Blvd. between Oxford Rd. & US-17/92	26
11-0538	Single 36" Pipe System	Fernwood Blvd. between Oxford Rd. & US-17/92	26
11-0540	Single 42" Pipe System	Fernwood Blvd. between Oxford Rd. & US-17/92	26
11-0542	Single 60" Pipe System	Fernwood Blvd. between Oxford Rd. & US-17/92	26
11-0603	Twin 20" x 48" Box Culverts	Derbyshire Rd. east of Birchwood Dr.	26
11-0606	Single 36" RCP	Derbyshire Rd. 50' north of Str. 11-0603	26
11-0609	Single 36" CMP System	Spartan Dr. at east end on the lake	26
11-0611	Single 36" CMP System	US-17/92 & Lake of the Woods	26

Basin 11: HOWELL BRANCH - Continued

STRUCTURE NUMBER	DESCRIPTION	LOCATION	AERIAL PHOTOGRAPH NUMBER
11-0613	Single 30" RCP System	US-17/92, north of Lake of the Woods	26
11-0614	Single 48" RCP System	US-17/92, north of Lake of the Woods	26
11-0803	13' x 87' RC Bridge	Northern Way north of Grizzly Ct. on Bear Galley Creek	48
11-0804	30" RCP	Florida Power Lines east of Northern Way	48
11-0805	Single 54" RCP	Florida Power Lines east of Northern Way	48
11-0806	RC bridge, No Access	Canal at west end of Canal St.	49
11-0807	Culvert (unknown size)	Winter Springs Rd. & Northern Way	49
11-0809	Twin 8' x 9' Box Culverts	Bear Gulley Canal and Red Bug Lake Rd.	49
11-0812	Twin 66" CMP	Milker Rd. approx. 1 1/2 mile south of Red Bug Lake Rd.	49
11-0815	Single 72" CMP	Doubler Ln. approx. 1 mile east of Brooks Ln.	50
11-0816	Double 36"	Brooks Ln., north of Gabriella Dr.	50
11-0818	5'8" x 17' RC Bridge	Bruce Ln. approx 1/2 mile east of Brooks Ln.	50
11-0821	Three 48" CMP	Michael Dr. east of Milanda Ln.	50
11-0824	Four 36" RCP	Tuskawilla Rd. south of Parker Ct.	49
11-0827	6' x 3' Box Culvert	Oviedo Rd. and railroad west of Church St.	
11-0903	6'2" x 74' Wooden Bridge	Canal St. at Old CR-426	57
11-0906	8' x 13'6" CMAP	Old CR- 4267 1/4 mile north of new CR 426	57
11-0909	Twin 6' x7' Box Culverts	CR-426 1 mile north of Red Bug Lake Rd.	57
11-0912	Culvert, No Access	CR-426 1/4 mile north of Red Bug Lake Rd.	57
11-0915	Single 96" CMP	Chapman Rd. ,200' ft. east of Story Book Ln.	57
11-0918	Triple 24" CMP	Chapman Woods Pl.	57
11-0921	Single 48" RCP	West of SR-426 on SC railroad	57
11-0924	Single 30" RCP	On SR-434 south of Mitchell Hammock	57
11-0927	Single 24" RCP	On SR-434 south of Str. 11-0924	57
11-0929	Single 30" Pipe	SR-44 & Lake Hays	58
11-0930	Single 36" RCP	On SR-434 north of Chapman	57
11-0931	Single 42" Pipe	West of SR-434 between Michell Hammock Rd. & Chapman Rd.	57
11-0932	Single 48" RCP w/Control Structure	Lightwood Knox Canal, West of Lake Hayes	58
11-0933	Single 36" Alum. Pipe	Lightwood Knox Canal, West of Lake Hayes	58
11-0934	Single 36" Alum. Pipe	Lightwood Knox Canal, West of Lake Hayes	58
11-1003	Twin 24" RCP	Dodd Rd. 3/4 mile north of Howell Branch Rd.	42
11-1006	Single 24" RCP	R30E, T21S S26 east of Str. 11-1003	42
11-1012	Single 43" x 68" CMAP	R30E, T21S,S26, east of Str.11-1006	42
11-1015	Single RCP	Grand Rd., north of 436A	42
11-1018	Single 34" x 53" RCEP	Grand Rd. and Garden Lake Blvd.	42

Basin 11: HOWELL BRANCH - Concluded

STRUCTURE NUMBER	DESCRIPTION	LOCATION	AERIAL PHOTOGRAPH NUMBER
11-1021	Single 18" RCP	Howell Branch Rd., south of Garden Lake	42
11-1023	Single 30" Pipe	Oviedo Rd. & Howell Branch Rd.	42
11-1024	Single 24" x 42" CMAP	East of Goldenrod Dr. on Bear Gulley Lk.	42
11-1027	Single 42" RCP	Bear Gulley Rd. at Goldenrod Dr.	42
11-1030	Single 48" RCP	S.C.L. Railroad 0.2 mile south of Trinity Way	42
11-1033	Twin 36" RCP	Aloma Ave. 0.2 mile southwest of Bear Gulley Rd.	42

BASIN 12: LITTLE LAKE HOWELL

STRUCTURE NUMBER	DESCRIPTION	LOCATION	AERIAL PHOTOGRAPH NUMBER
12-0103	Twin 36" RCP	Winter Springs Blvd. and Beachwood Dr.	40
12-0106	Single 42" CMP	Sequoia Dr. and Forest Cir.	40
12-0109	Single 36" CMP	Sequoia Ct. and Chokeberry Dr.	40
12-0112	Single 30" RCP	Chockcherry Dr. and Sapling Dr.	40
12-0115	Single 30" CMP	Lake Dr. south of Center Dr.	41
12-0116	Single 35" x 24" CAPA w/Control Struc	Between Eagle Circle & Lake Drive	41
12-0118	Single 30" CMP	Lake Dr. south of Lake Tony	40
12-0124	65" x 40" CMAP	Eagle Cir. at Twelve League Cir.	41
12-0127	Culvert S/D Outfall	Tuskawilla Rd. north of Winter Springs Blvd.	40
12-0129	Single 24" Pipe	Oak Forest S/D at Winter Springs Rd.	40
12-0130	Single 24" RCP	Tuskawilla Rd. south of Winter Springs Blvd.	40

BASIN 13: GEE CREEK

STRUCTURE NUMBER	DESCRIPTION	LOCATION	AERIAL PHOTOGRAPH NUMBER
13-0106	Wooden RR Bridge, No Access	North of SR-419 on Gee Creek	39
13-0109	4'6" x 6' RCEP	SR-149 0.1 mile west of SR-434	39
13-0112	Culvert	Wade St. south of George St.	31
13-0113	Culvert	Sherry Ave. south of George St.	31
13-0115	Culvert	Moss Rd. at Aspen Ct.	31
13-0203	Triple 10'x 11' Box Culvert	D.O.T. #770014 Gee Creek and SR-434	39
13-0206	Triple 60" RCP	Alton Rd. at Holiday Ln.	39
13-0209	Triple 60" RCP	Shore Rd. at Sailfish Rd.	40
13-0212	6' x 27' RC Bridge	Hayes Rd. at Alton Rd.	40
13-0215	10' x 27' RC Bridge	Casa Grande Ct.	32
13-0218	Single 42" Pipe System	SR-434 between Mopss Rd. & Sanford Road	39
13-0221	Single 36" Pipe System	SR-434 between Mopss Rd. & Sanford Road	39
13-0224	Single 30" Pipe System	SR-434 between Mopss Rd. & Sanford Road	31
13-0303	Twin 48" CMP	Mocking Bird Ln. 100 yards east under power lines	39
13-0306	Single 36" CMP	Shore Rd. at Sailfish Rd.	40
13-0309	Twin 24" x 30" CMAP	Stoner Rd. east of Hayes Rd.	40
13-0312	Single 30" CMP	Hayes Rd. south of Sailfish Rd.	40
13-0403	Single 36" x 60" CMAP	Moss Wood Circle and Moss Rd.	32
13-0406	Single 48" RCP	Flamingo Ave. and Burgos Rd.	32
13-0503	Triple 30" x 12' Box Culvert	Moss Rd. north of Elderwood St.	32
13-0506	Triple 4' x 12' Box Culvert	Edgemont Ave. north of Elderwood St.	32
13-0509	Triple 4' x 13' Box Culverts	Murphy Rd. north of Elderwood St.	32
13-0603	7' x 28' RC Bridge	Gee Creek Ln. and Winter Park Dr.	32
13-0606	4'6" X 30' RC Bridge	Laura St. east of Mahogany Dr.	32
13-0609	Single 34" x 7' CMAP	Sewer Plant and Cross St. west of Winter Park Dr.	32
13-0703	Twin 39" x 6' Box Culvert	U.S. 17-92 at Lake Katherine	25
13-0706	Single 24" RCP	Wildmere Rd. at Oxford St.	25
13-0707	4' X 3' Conc. Box Culvert	SR-427, south of Salando Springs Blvd.	25
13-0708	Single 36" Pipe System	SR-427, south of Salando Springs Blvd.	25
13-0709	Single 30" Pipe System	Salando Springs Blvd., west of R.R.	25
13-0711	Single 36" Pipe System	Salando Springs Blvd., west of R.R.	25
13-0713	Single 42" Pipe System	Salando Springs Blvd., west of R.R.	25
13-0715	Special 42" Under R.R.	Salando Springs Blvd., west of R.R.	25
13-0718	38" X 60" Outfall Pipe	Salando Springs Blvd., west of R.R.	25
13-0721	Single 30" Pipe System	Salando Springs Blvd. & Grant	25

Basin 13: GEE CREEK - Continued

STRUCTURE NUMBER	DESCRIPTION	LOCATION	AERIAL PHOTOGRAPH NUMBER
13-0723	Single 36" Pipe System	Salando Springs Blvd. & Grant	25
13-0725	Single 42" Pipe System	Salando Springs Blvd. & Grant	25
13-0728	Dual 36" Pipes	Salando Springs Blvd. & Grant	25
13-0731	Single 30" Pipe System	Salando Springs Blvd. & Grant	25
13-0732	Single 42" Pipe System	SR-427, south of Salando Springs Blvd.	25
13-0733	Single 48" Pipe System	SR-427, south of Salando Springs Blvd.	25
13-0734	Single 48" Pipe System	SR-427, south of Salando Springs Blvd.	25
13-0803	Twin 36" RCP	U.S. 17-92 and Seminole Blvd.	25
13-0806	Single 48" RCP w/ drop	U.S. 17-92 and Seminole Blvd.	25
13-0809	3' x 4' Box Culvert	U.S. 17-92 and Golden Days	25
13-0811	Dual 24" Pipe	SR-427 & Seminole Blvd.	25
13-0812	Single 30" Pipe System	SR-427, south of Seminole Blvd.	25
13-0813	Single 42" RCP System	SR-427, south of Seminole Blvd.	25
13-0814	Single 42" RCP System	SR-427, south of Seminole Blvd.	
13-0903	Twin 5'x 6' Box Culvert and Single 55" X 84" RCEP	Seminole Blvd. and Lake Katherine Cir.	25
13-0906	Culvert	West of Ivy Rd. north of Frances Ave.	25
13-0912	Single 36" x 58" CMAP	Secret Way Dr. and Secret Lake Cir.	25
13-0914	Single 53" x 34" RCEP	Clombo Dr.	25
13-0915	Single 36" RCP	Sunset Dr. north of Oakwood Dr.	25
13-0918	Single 42" RCP S/D Outfall	Melody Ln. and Quail Pond Rd.	25
13-0921	7' x 30' RC Bridge	N. 3rd St. and Sheoah Blvd.	32
13-0927	Road Crosses Ditch	Lost Lake Ln. south of N. Lake Triplet Dr.	32
13-0930	Triple 27" x 43" CMAP	Winter Park Dr. 100 yards north of Quintuplet Dr.	32
13-0933	Triple 36" RCP	Lake Triplet Dr. south of Thomas Dr.	26
13-0936	Twin 36" RCP	Sunset Blvd. north of Overbrook Dr.	26
13-0939	Twin 24" RCP	Overbrook Dr. west of Sunset Blvd.	26
13-0942	Twin 36" RCP	West on Southcot Rd. south of Overbrook Dr.	26
13-0945	Single 20" x 30" RCEP	West of Str. 13-0948	26
13-0948	Trapezoidal RC Weir, 42" X 84"	West on Southcot Rd. south of Overbrook Dr.	26
13-0951	74" x 72' Wooden Arch Bridge	Between Triplet Lake and S. Triplet Lake golf course	33
13-0954	6' x 30' RC Bridge	Queen's Mirror Cir.	33
13-0957	Single 30" RCP	Lake Triplet Dr. south of Oakwood Dr., next to Triplet Lk.	25
13-0960	Single 30" RCP	Lake Triplet Dr. south of Oakwood Dr.	25
13-1003	Single 36" RCP	Lake Howell Rd. at Amanda St.	
13-1006	Single 30" CMP	Lake Howell Rd at North St.	

Basin 13: GEE CREEK - Concluded

STRUCTURE NUMBER	DESCRIPTION	LOCATION	AERIAL PHOTOGRAPH NUMBER
13-1103	Three 48" x 76" RCEP	Winter Park Dr. 100 yards from Queen's Mirror Rd.	33
13-1106	Three 48" x 76" RCEP	Winter Park Dr. and Queen's Mirror Rd.	33
13-1112	Culvert	South of Shady Hollow at Ivy Farm Ln.	26
13-1115	48" x 72" CMAP and 30" x 28" CMAP	Oxford Rd. and Shady Hollow	26
13-1118	Twin 31" x 50" CMAP	200 feet from Oxford Rd.	26
13-1121	Single 30" RCP	400 feet from Oxford Rd.	26
13-1124	Single 40" x 65" CMAP	154 feet upstream from Str. 13-1121	26
13-1127	2' X 3' Drop Inlet	162 feet from Str. 13-1121	26
13-1128	Single 30" RCP System	SR-17/92 & Lake Prairie	26
13-1129	Single 36" CP System	SR-17/92 & Lake Prairie	26
13-1130	Single 43" x 68" RCEP	264 feet upstream of Str. 13-1127	26
13-1133	Single 48" RCP	U.S. 17-92 0.2 mile north of SR-436	26
13-1203	Single 36" RCP System	SR-436 at Grassy Lake .	26
13-1204	Single 30" RCP System	SR-436 at Grassy Lake	26
13-1206	Single 96" CMP, Lake Outfall	Gladwin Ave. Bridge west of Meredith St.	26
13-1208	Single 30" RCP System	Semoran Blvd. west of Jackson St.	26
13-1209	Single 24" RCP System	Semoran Blvd. west of Jackson St.	26
13-1210	Single 36" RCP System	South of Str. 13-1209 on Semoran Blvd.	26
13-1213	Single 30" RCP System	U.S. 17-92 & Lake Prairie	26
13-1214	Single 36" RCP System	U.S. 17-92 & Lake Prairie	26

BASIN 14: SOLDIER CREEK

STRUCTURE NUMBER	DESCRIPTION	LOCATION	AERIAL PHOTOGRAPH NUMBER
14-0103	60" x 92" RCAP	On RR tracks 300 yards east of Benchmark Ln.	30
14-0106	36" x 64" Box Culvert	Corner of CR-427 and Bryant Ave.	30
14-0109	42" RCP	U.S. 17-92 200 yards south of Country Home Rd.	30
14-0203	8' x 75' RC Bridge	CR-419, D.O.T. #770036	31
14-0206	50" x 72" CMAP S/D Outfall	75 feet south of Shepard Rd. and Marni Dr. bridge	31
14-0209	4'9" x 53' RC Bridge	Shepard Rd. north of Marni Dr.	31
14-0212	Single 24" RCP Detention Outfall	100 feet west of Sheoah Blvd. on Shane Cir.	31
14-0215	7'7" x 38' RC Bridge	Sheoah and 3rd St. on the lake	31
14-0218	Single 60" RCP Lk. Level Con. Struc.	West of Nighthawk Cir. on the Lake	31
14-0221	Single 36" RCP Detention Outfall	Across from Str. 14-0224	31
14-0224	Single 36" RCP	Sheoah and 3rd St. on the lake	31
14-0225	Single 30" Pipe System	SR-434, east of SR-17/92	31
14-0226	Single 36" Pipe System	SR-434, east of SR-17/92	31
14-0228	Single 30" Pipe System	SR-434, east of SR-17/92	31
14-0229	Single 36" Pipe System	SR-434, east of SR-17/92	31
14-0230	Single 36" RCP	Sheoah Cir.	[illegible]
14-0233	Triple 8'x 8' Box Culvert	U.S. 17-92 100 feet north of General Hutchison Rd.	[illegible]
14-0236	5'4" x 8' Box Culvert	General Hutchison Rd. and U.S. 17-92	31
14-0303	Triple 57" x 76" CMAP	150 yards south of Country Club Rd. on SR-427	30
14-0309	59" x 96" RCAP	300 yards from 2163 Longwood-Lake Mary Dr.	30
14-0312	31" x 50" CMAP	Longwood-Lake Mary Dr., 200 yards south Greenway Blvd.	23
14-0318	Single 54" RCP	Lake Emma and Technology Park Rd.	23
14-0321	Single 60" RCP	North of Str. 14-0318	23
14-0323	Single 42" RCP	North of Str. 14-0321 on Lake Emma Rd.	
14-0324	Single 30" CMP	150' east of CR-427 on Georgia Ave.	24
14-0325	Single 36" Pipe	Seaboard Coastline R.R. south of Georgia Ave.	24
14-0327	Single 84" RCP	400 yards northwest of Calico Rd. and Country Club Rd.	30
14-0328	Dual 30"	Longwood Drive at Georgia Ave.	30
14-0330	Triple 36" RCP	Longwood-Lake Mary Dr., 1/4 mile south of Washington Ave.	23
14-0331	Single 30" Pipe	Longwood Drive, 400 ft. south of Palmetto	24
14-0333	Single 30" RCP	Lake Way 200 yards west of Gold Stone Pl.	23
14-0336	Triple 33" and Single 30" RCP	Lake Way 100 feet west of Westward Cir.	23
14-0339	Twin 30" RCP	Lake Emma Rd. 100 yards south of Greenwood Blvd.	23
14-0340	Single 30" Pipe	Rinehart Rd. 1/4 mile north of Lake Mary Blvd.	22
14-0342	Single 48" RCP	I-4 & Lake Mary Blvd.	15
14-0343	3-48" RCP's in Series	South of I-4 - Lake Mary Blvd. Interchange	15
14-0345	Single 30" RCP	South of I-4 - Lake Mary Blvd. Interchange	15
14-0346	Single 30" RCP System	Lake Mary Blvd., east of I-4	[illegible]
14-0347	Single 35" RCP System	Lake Mary Blvd., east of I-4	[illegible]

Basin 14: SOLDIERS CREEK - Concluded

STRUCTURE NUMBER	DESCRIPTION	LOCATION	AERIAL PHOTOGRAPH NUMBER
14-0348	Single 30" RCP System	Lake Mary Blvd., east of Greenwood Blvd.	23
14-0349	Single 48" RCP System	Lake Mary Blvd., east of Greenwood Blvd.	23
14-0350	Single 42" RCP System	Lake Mary Blvd., east of Greenwood Blvd.	23
14-0351	Single 48" RCP System	Lake Mary Blvd., east of Greenwood Blvd.	23
14-0352	Single 38" X 60" RCP System	Lake Mary Blvd., east of Greenwood Blvd.	23
14-0353	Single 34" X 53" RCP System	Lake Mary Blvd., east of Greenwood Blvd.	23
14-0354	Single 29" X 45" RCP System	Lake Mary Blvd., east of Greenwood Blvd.	23
14-0355	Single 30" RCP System	Lake Mary Blvd.; east of Greenwood Blvd.	23
14-0405	Single 36" RCP	I-4 north of Williamson Rd.	16
14-0409	Single 36" RCP	I-4 rest area 2 miles north of SR-434	16
14-0410	Single 54" RCP	I-4, south of north-bound rest area at Longwood	16
14-0412	Single 36" RCP	Dixon Rd. east of Sunshine Tree Blvd.	16
14-0415	32" x 49" RCEP	I-4 at Grace Lake south of rest area	16
14-0418	Single 24" RCP	E.E. Williamson Rd. east of I-4	16
14-0421	Single 42" RCP	Penelope Rd. north of Hickory Tree Rd.	16
14-0424	Single 57" x 88" CMAP	Hickory Tree Rd. at Penelope Rd.	16
14-0427	Twin 36" RCP w/ Drop Inlet	South of Str. 14-0424 at the pond	16
14-0430	Single 42" RCP	On Fox Ridge Run north of Western Fork Rd.	16
14-0433	Single 30" RCP	On Western Fork Rd. west of Tollgate Tr.	16
14-0436	Single 30" RCP	On Tollgate Tr. north of Post & Rail Rd.	16
14-0439	Single 30" RCP	Sheridan Ave. north of Sheridan Way	16
14-0441	Single 18" RCP	Adjacent to 116 Dellwood	16
14-0444	Single 18" RCP	Adjacent to 117 Glendale	16
14-0447	Single 22" x 36" RCAP	SR-434 east of Palm Springs Dr.	16
14-0450	Single 22" x 36" RCAP	SR-434 east of Str. 14-0447	16
14-0453	Single 22" x 36" RCAP	SR-434 east of Str. 14-0450	16
14-0455	Single 36" Pipe System	Sanlando Springs Blvd. & Island Lake	17
14-0457	Single 42" Pipe System	Sanlando Springs Blvd. & Island Lake	17
14-0459	Single 36" Pipe System	Sanlando Springs Blvd. & Island Lake	17
14-0460	Single 30" Pipe System	Sanlando Springs Blvd. & Island Lake	17
14-0462	Single 48" Pipe System	Sanlando Springs Blvd. & Island Lake	17
14-0464	28" X 18" CMP	Sanlando Springs Blvd. & Island Lake	17

BASIN 15: LITTLE WEKIVA

STRUCTURE NUMBER	DESCRIPTION	LOCATION	AERIAL PHOTOGRAPH NUMBER
15-0101	Single 36" RCP System	I-4 rest area south of Williamson Rd.	16
15-0102	Single 36" RCP	I-4 rest area south of Williamson Rd.	16
15-0103	10' X 300' 7-Span RC bridge	Landing Blvd. off Markam Woods Rd.	8
15-0104	Single 30" Pipe	West of I-4 at Longwood	16
15-0105	Single 36" RCP	Markham Rd. south of Williamson Rd.	16
15-0107	2-30" RCP's In Series	I-4 west of Longwood	16
15-0109	Wooden Bridge	Little Wekiva River at Wood Bridge Rd.	9
15-0112	RC Bridge	Little Wekiva River south of Str. 15-0109	9
15-0113	Single 30" Pipe	SR-434 & Little Wekiva River	9
15-0115	Single 30" RCP	Along Marshall Dr.	17
15-0118	Single 30" RCP	East of Victor Ave.	17
15-0121	Single 30" RCP	Along Kelson St. north of Str. 15-0124	17
15-0124	Single 30" RCP	On Kelson St. north of North St.	17
15-0127	Single 36" CMP	Along North St. west of Palm Springs Dr.	17
15-0130	Single 36" CMP	Along Palm Springs Dr. at Alpine St.	17
15-0133	Single 36" CMP	Along Pineview St. east of Palm Springs Dr.	17
15-0136	Single 36" CMP	North of Pineview St. next to Center	17
15-0140	42" RCP S/D Lake Outfall	Little Wekiva River, north of Markham Rd.	7
15-0142	24" X 38" RCPA S/D Lake Outfall	Little Wekiva River, north of Markham Rd.	7
15-0144	Twin 42" RCP S/D Lake Outfall	Little Wekiva River, north of Markham Rd.	7
15-0146	Unknown Lake Outfall	Little Wekiva River, north of Markham Rd.	7
15-0148	Twin 42" RCP S/D Lake Outfall	Little Wekiva River, north of Markham Rd.	7
15-0150	Dual 42" RCP S/D Lake Outfall	Little Wekiva River, north of Markham Rd.	7
15-0152	Dual 42" RCP S/D Lake Outfall	Little Wekiva River, north of Markham Rd.	7
15-0154	Dual 36" RCP S/D Lake Outfall	Little Wekiva River, north of Markham Rd.	7
15-0156	Single 30" Pipe System	SR-434 & I-4	17
15-0158	Single 36" Pipe System	SR-434 & I-4	17
15-0160	Single 42" Pipe System	SR-434 & I-4	17
15-0162	Single 36" RCP	SR-434 & I-4	17
15-0164	Single 30" CP System	SR-434 & I-4	17
15-0166	Single 30" RCP	SR-434 & I-4	17
15-0167	38" X 24" ERCP System	Estates Park, west of Markham Woods Rd.	16
15-0168	Single 30" RCP	Estates Park, west of Markham Woods Rd.	16
15-0169	29" X 45" ERCP System	Estates Park, west of Markham Woods Rd.	16
15-0170	Single 42" RCP	Springs Landing Blvd.	16

Basin 15: LITTLE WEKIVA - Continued

STRUCTURE NUMBER	DESCRIPTION	LOCATION	AERIAL PHOTOGRAPH NUMBER
15-0171	Single 72" RCP	Springs Landing Blvd.	16
15-0172	Single 48" Pipe System	South of Sabal Palm Dr., Sabal Palm Country Club	9
15-0173	Single 30" RCP System	Lake Mary Blvd., west of I-4	15
15-0174	Single 30" RCP	Wingfield Subdivision Outfall	16
15-0175	Single 30" RCP	Wingfield Subdivision Outfall	16
15-0202	Single 30"	SR-434 at Little Wekiva River	9
15-0203	RC Bridge	SR-434 at Little Wekiva River	9
15-0204	Single 30"	SR-434 west of Montgomery Rd.	9
15-0205	Single 36" Pipe System	SR-434 west of Montgomery Rd.	9
15-0206	15' x 37' RC Bridge	Montgomery Rd. at Wekiva River	9
15-0207	Dual 30" Pipe	SR-434 east of Lake Brantley Rd.	9
15-0208	Single 30" Pipe	SR-434 at Lake Brantley Rd.	9
15-0209	Single 84" x 30" RCEP	Jamestown Blvd.	9
15-0210	Single 30"	SR-434 at Lake Brantley Rd.	9
15-0211	Single 36"	SR-434 at Lake Brantley Rd.	9
15-0212	Triple 3' x 9' Box Culvert	SR-434 and Alamano Dr.	9
15-0213	Single 42" Pipe	SR-434 at Lake Brantley Rd.	9
15-0214	Single 30" Pipe	SR-434 south of Lake Brantley Rd.	9
15-0215	Single 48" CMP	Alder Ave. and Sage St.	9
15-0216	Single 36" Pipe	SR-434 south of Lake Brantley Rd.	9
15-0217	Single 30" Pipe	SR-434 south of Lake Brantley Rd.	9
15-0218	Single 18" CMP	Alder Ave. and Alhambra Ave.	9
15-0219	Single 36" Pipe	SR-434 south of Lake Brantley Rd.	9
15-0220	Single 54" Pipe	SR-434 south of Lake Brantley Rd.	9
15-0221	Single 60" RCP w/Drop Structure	Dalia Ct. and Alhambra Ave.	9
15-0222	Single 30" Pipe	SR-434 at Calabria Dr.	9
15-0223	Single 36" Pipe	SR-434 at Calabria Dr.	10
15-0224	7-Span Wooden Bridge	Off SR-436 and Little Wekiva River	10
15-0225	Single 36" RCP	SR-436 at R.R.	10
15-0226	Single 42" RCP	SR-436 at R.R.	10
15-0227	Twin 10' x 12' Box Culvert	SR-436 and Little Wekiva River	10
15-0228	Single 42" RCP	SR-434 at Calabria Dr.	10
15-0229	Single 48" CMP	SR-434 at Calabria Dr.	10
15-0230	Twin 48" RCP	SR-436 and Hersfield Ave.	10
15-0231	Dual 54" CMP		10

Basin 15: LITTLE WEKIVA - Continued

STRUCTURE NUMBER	DESCRIPTION	LOCATION	AERIAL PHOTOGRAPH NUMBER
15-0232	Single 36" CP	SR-434 south of Semoran Blvd.	10
15-0233	Single 24" RCP w/Drop	Middle of I-4 n. of Altamonte exit, between Alt. Commerce	17
15-0301	Dual 30" RCP	SR-434 at Lake Pearl	10
15-0302	Dual 24" RCP	SR-434 at SR-436	10
15-0303	Single 43" x 29" CMAP	Willow Dr. and Birch St.	2
15-0304	Single 30" RCP System	SR-436 at Bear Lake Rd.	2
15-0305	Single 36" RCP System	SR-436 at Bear Lake Rd.	2
15-0306	Single 60" CMP	Virginia Dr.	2
15-0307	Single 42" RCP System	SR-436 at Bear Lake Rd.	2
15-0308	Single 54" RCP System	SR-436 at Bear Lake Rd.	2
15-0309	Single 31" x 50" RCEP	W. Lake Brantley between SR-436 and Virginia Dr.	2
15-0310	Single 60" RCP System	SR-436 at Bear Lake Rd.	2
15-0311	Single 42" RCP System	SR-436 at Bear Lake Rd.	2
15-0315	Single 30" RCP	Hunt Club Rd. across from "The Village of Foxwood"	
15-0402	3' X 3' Conc. Box Culvert	I-4 south of SR-436	18
15-0403	10' x 25' Concrete Arch Bridge	Corner of Orange Ave. and SR-436	10
15-0406	84' x 12' RC Bridge	West of Weathersfield Ave.	10
15-0407	Single 30" CP System	SR-436 east of I-4	18
15-0408	Single 36" CP System	SR-436 east of I-4	18
15-0409	23' x 12'6" RC Bridge	Weathersfield Ave. at Clemson Dr.	10
15-0410	Single 30" CP System	SR-436 east of I-4	18
15-0411	Single 48" Pipe System	SR-436 east of I-4	18
15-0412	30' x 10' Wooden Bridge	South of Str. 15-0409 on Little Wekiva River	10
15-0413	Single 60 " Pipe System	SR-436 east of I-4	18
15-0415	25' x 13' Bridge	N. Western Ave. at Mahogany Ln.	10
15-0418	118' x 10' RC bridge	SR-434 west of Trout Lake	10
15-0420	16' x 5' CMAP	S.C.L. Railroad south of Bunnel Rd.	3
15-0421	Single 30" RCP	CSX RR South of Bunnel Rd.	3
15-0424	Unknown	East of Lake Lotus, north of CSX Railroad	10
15-0429	Twin 14'6" x 7'6" CMA	Country Creek Parkway	3
15-0430	Twin 35" RCP	Eden Park Rd. south of CSX Railroad	3
15-0433	Twin 36" RCP	CSX Railroad west of Eden Park Rd.	3
15-0439	Twin 24" x 30" RCEP	Bear Lake Rd. at N. Neil Beach Dr.	3
15-0444	Twin 54" x 42" RCEP	Spring Valley Rd. south of Long Leaf Ln.	
15-0501	Single 30" RCP System	SR-436 & I-4	

Basin 15: LITTLE WEKIVA - Concluded

STRUCTURE NUMBER	DESCRIPTION	LOCATION	AERIAL PHOTOGRAPH NUMBER
15-0502	Single 36" RCP System	SR-436 & I-4	18
15-0503	Single 102" CMP	Crane's Roost Blvd. behind Altamonte Mall	17
15-0504	4' X 4' Conc. Box Culvert	I-4 at Cranes Roost	18
15-0506	Three 36" RCP	Palm Springs Dr. at Crane's Roost Blvd.	17
15-0509	Twin U-shaped 2' x 4' Weirs	East of Str. 15-0506	17
15-0512	Twin 43" x 27" RCEP	Tropic Hill west of Hermits Tr.	17
15-0513	Single 30" RCP	Base of Lake Florida on Florida Blvd.	17
15-0515	Single 36" RCP	On Magnolia St. at Plymoth Ave	25
15-0518	Single 24" x 36" RCEP	On Plymoth Ave. south of Str. 15-0515	25
15-0521	Single 36" RCP System	On Jackson St. north of Plum Lane	25
15-0522	Single 36" RCP System	On Jackson St. south of Str. 15-0521	25
15-0524	30" RCP w/Drop Inlet	Along Jackson St. at Peach Treelane	25
15-0527	Single 36" CMP	On Sanford Rd. north of Third St.	25
15-0528	Dual 24" CP	SR-437 & Lake Mabile	25
15-0529	Dual 24" CP	SR-437 & Lake Mabile	25
15-0530	Single 36" CMP	On Sanford Rd. west of Str. 15-0527	26
15-0533	Single 42" CMP	On Brentwood Ave. north of Magnolia St.	25
15-0601	Single 30" RCP System	SR-436 & Palm Springs Dr.	18
15-0602	Single 36" RCP System	SR-436 & Palm Springs Dr.	18
15-0603	Single 42" RCP System	SR-436 & Palm Springs Dr.	18
15-0604	Single 30" RCP System	SR-436 & Palm Springs Dr.	18
15-0605	Single 60" RCP System	SR-436 & Palm Springs Dr.	18
15-0606	Single 30" RCP System	SR-436 & Lake Adelaide	18
15-0607	Single 36" RCP System	SR-436 & Lake Adelaide	18
15-0608	Single 42" RCP System	SR-436 & Lake Adelaide	18
15-0609	Single 30" RCP System	SR-436 & Lake Adelaide	18
15-0610	Single 36" RCP System	SR-436 & Lake Adelaide	18
15-0611	Single 42" RCP System	SR-436 & Lake Adelaide	18

BASIN 16: BIG WEKIVA

STRUCTURE NUMBER	DESCRIPTION	LOCATION	AERIAL PHOTOGRAPH NUMBER
16-0103	Single 30" RCP	Sweetwater Cir. at Sweetwater Park	1
16-0109	Twin 36" CMP	Wekiva Springs Rd. east of Sweetwater Cover Blvd.	1
16-0112	Single 36" CMP and Single 24" RCP	Camellia Dr. and Azelia Dr.	2
16-0115	Single 36" CMP and Single 24" RCP	Azelia Dr. 30 feet from Str. 16-0112	2
16-0118	Single 24" CIP	Clay Ct. and Westwood Dr.	2
16-0120	Single 30" RCP	Sweetwater Blvd., Sweetwater Lakes	8
16-0203	Single 24" CMP	Westwood Dr. east of Clay Ct.	2
16-0206	12' x 8' Box Culvert	West Lake Brantley Rd. south of Cove Ct.	2
16-0208	Bridge	West Lake Brantley Rd.	9
16-0209	Bridge	Island Dr., west of Lake Brantley	9
16-0212	Single 30" RCP	Countryside Dr., Sweetwater Oaks	9
16-0215	Single 30" RCP	Blue Lake Ct., Sweetwater Oaks	8
16-0303	Triple 60" CMP	Riverbend Blvd. at Sweetwater Bay Ct.	1
16-0403	Single 58" x 36" CMAP	Wekiva Spring Rd. west of Miami Springs Dr.	
16-0404	Single 48" RCP	West of Hunt Club Rd., Sage Ridge Ct.	2

Appendix F

APPENDIX F

APPENDIX F

INTERAGENCY WATER MANAGEMENT PROJECT STATUS REPORT

MIDDLE ST. JOHNS RIVER BASIN

QUARTER ENDING: JUNE 30, 1988

SUBBASIN	PROJECT TITLE	AGENCY RESPONSIBLE	ACTIVITIES COMPLETED INCLUDING THIS QTR	ACTIVITIES SCHEDULED FOR NEXT QUARTER
Lake Monroe	Lake Monroe Basin Floodplain Management Study	SCS	Photogrammetric aerials recieved. Field reconnassance completed. Field survey work completed. Developing hydraulic and hydrologic data for basin simulation.	Simulate existing basin conditions. Evaluate existing water management problems.

QUARTER ENDING: SEPTEMBER 30, 1988

Little Wekiva River	Little Wekiva River Basin Floodplain Study	SJRWMD	Review Draft completed.	In-house review of draft report.
Little Wekiva River	Little Wekiva River Basin Surface Water Management Study	SJRWMD	Identification of areas with potential flooding problems - 80% complete.	Complete potential flooding area identification. Perform damage assessment analysis.
Little Wekiva River	Little Wekiva River Study-Erosion Control	Orange Co.	Public meeting held Phase I study completed	Await SJRWMD Little Wekiva River WMS report
Wekiva River	Wekiva River Basin Level II Floodplain Study	USACOE	Coordination with COE	Continued coordination between SJRWMD and USACOE
Black Water Creek	(Same as above)	SJRWMD	Reviewed Black Water Creek SCS study, identified survey needs	Advertise for survey contractor bids. Receive and review qualifications and proposals

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APPENDIX F
(Continued)

QUARTER ENDING: SEPTEMBER 30, 1988

SUBBASIN	PROJECT TITLE	AGENCY RESPONSIBLE	ACTIVITIES COMPLETED INCLUDING THIS QTR	ACTIVITIES SCHEDULED FOR NEXT QUARTER
Gee & Solider Creeks	Gee & Solider Creeks Floodplain Management Study	SCS with SJRWMD	Draft report completed	Model calibration and verification. Perform hydrologic and hydraulic data analysis
Lake Jessup	Lake Jessup Floodplain Management Study	SCS with SJRWMD	No activity	No activity planned due to non-delivery of photogrammetric aerials from contractor
Econlockhatchee River	Econ River Basin Floodplain Study	USACOE	Fifty % of hydraulics/ hydrology completed	Continue work on hydraulic/hydrology
Howell Branck (Creek)	Howell Branch Basin Surface Water Mgmt Study	SJRWMD	Review hydrologic model input data. Commenced simulation for existing basin conditions	Complete simulation for existing basin conditions Develop water management alternatives.

tm:ML27:r

Appendix G

APPENDIX G

APPENDIX G

PRELIMINARILY IDENTIFIED DRAINAGE PROBLEMS

The following summarizes drainage problems identified though interviews with County staff. Additional problem areas are acknowledged in the Short Range Development Plan.

BASIN NO.	DESCRIPTION	PROBLEM	DEGREE
5/8	SR-426: Oviedo to CR-13	Inadequate conveyances	Nuisance
4	Midway	Inadequate conveyances	Severe
5	Sunland Estates Subdivision	Inadequate design	Nuisance
11	Lilian Dr. into Prarie Lake	No outfall	Nuisance
15	Springs Landing Subdivision	Unidentified (flooding)	Nuisance
15	Hattaway Dr.	Outfall undersized	Nuisance
11	Forest Brook Subdivision	Inadequate design	Nuisance
11	1.5 Mi. N. of CR-426 on Tuskawilla	Poor Maintenance	Nuisance
15	Lynwood Subdivision	Unidentified (flooding)	Nuisance
15	Lake Harriet Estates	Open ditch flooding	Severe (Local)
11	Brooks Ln. South of Red Bug Lake Rd.	No outfall	Nuisance
14	CR-427 at Longwood Hills Rd.	Poor outfall	Nuisance
8	Chuluota	General	Nuisance
15	Hunt Club Rd.	Poor outfall	Moderate
5	S.E. Corner 17-92 and Airport Blvd.	Undersized pipes	Moderate

SC/12

Appendix H

APPENDIX H

REFER TO SECTIONS 4 AND 5 FOR ASSUMPTIONS AND METHODOLOGY USED IN THE CALCULATION OF CAPACITY AND DEMAND FOR STRUCTURES.

BASIN 1: YANKEE LAKE

STRUCTURE NUMBER	CURRENT CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	CURRENT CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
01-0103	0	0	0	0	0	0	0
01-0104	0	0	0	0	0	0	0
01-0106	91	149	233	144	53	-5	-89
01-0107	91	149	233	140	49	-9	-93
01-0203	0	0	0	0	0	0	0
01-0501	0	0	0	0	0	0	0
01-0502	0	0	0	0	0	0	0
01-0503	0	0	0	0	0	0	0
01-0504	46	74	116	80	34	6	-36

BASIN 2: LAKE MONROE

STRUCTURE NUMBER	CURRENT CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	CURRENT CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
02-0103	110	183	286	120	10	-63	-166
02-0106	110	183	286	150	40	-33	-136
02-0109	110	183	286	186	76	3	-100
02-0112	110	183	286	371	261	188	85
02-0115	0	0	0	0	0	0	0
02-0118	143	231	357	95	-48	-136	-262
02-0121	143	231	357	95	-48	-136	-262
02-0206	0	0	0	0	0	0	0
02-0209	526	851	1302	520	-6	-331	-782
02-0212	503	813	1244	690	187	-123	-554
02-0213	0	0	0	0	0	0	0
02-0214	0	0	0	0	0	0	0
02-0215	499	808	1236	950	451	142	-286
02-0216	0	0	0	0	0	0	0
02-0218	0	0	0	0	0	0	0
02-0221	376	608	934	47	-329	-561	-887
02-0224	183	301	472	240	57	-61	-232
02-0227	171	281	442	83	-88	-198	-359
02-0230	154	253	398	51	-103	-202	-347
02-0236	54	89	143	179	125	90	36
02-0239	50	82	132	64	14	-18	-68
02-0242	38	63	101	50	12	-13	-51
02-0245	0	0	0	0	0	0	0
02-0303	0	0	0	0	0	0	0
02-0306	0	0	0	0	0	0	0
02-0309	52	88	141	375	323	287	234
02-0312	27	43	69	60	33	17	-9
02-0315	0	0	0	0	0	0	0
02-0318	0	0	0	0	0	0	0
02-0321	0	0	0	0	0	0	0
02-0323	0	0	0	0	0	0	0
02-0325	0	0	0	0	0	0	0
02-0327	0	0	0	0	0	0	0
02-0403	195	315	483	30	-165	-285	-453
02-0406	0	0	0	0	0	0	0
02-0409	121	196	304	286	165	90	-18
02-0411	0	0	0	0	0	0	0
02-0412	62	100	156	279	217	179	123
02-0413	0	0	0	0	0	0	0
02-0414	31	49	77	82	51	33	5

STRUCTURE NUMBER	CURRENT CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	CURRENT CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
02-0415	82	130	202	689	607	559	487
02-0416	31	49	77	100	69	51	23
02-0417	0	0	0	0	0	0	0
02-0418	93	148	228	82	-11	-66	-146
02-0419	0	0	0	0	0	0	0
02-0420	0	0	0	0	0	0	0
02-0421	64	101	157	44	-20	-57	-113
02-0424	95	151	232	50	-45	-101	-182
02-0425	42	66	104	270	228	204	166
02-0427	80	129	201	311	231	182	110
02-0428	42	66	104	120	78	54	16
02-0429	45	74	116	89	44	15	-27
02-0430	24	40	64	206	182	166	142
02-0433	121	192	296	309	188	117	13
02-0436	75	119	185	89	14	-30	-96
02-0439	62	98	154	50	-12	-48	-104
02-0442	0	0	0	0	0	0	0
02-0445	95	153	236	309	214	156	73

BASIN 3: CITY OF SANFORD

STRUCTURE NUMBER	CURRENT CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	CURRENT CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
03-0313	261	416	635	300	39	-116	-335
03-0315	342	545	827	930	588	385	103
03-0318	0	0	0	0	0	0	0
03-0321	0	0	0	0	0	0	0
03-0323	0	0	0	0	0	0	0
03-0333	0	0	0	0	0	0	0
03-0336	0	0	0	0	0	0	0
03-0339	0	0	0	0	0	0	0
03-0342	0	0	0	0	0	0	0
03-0343	0	0	0	0	0	0	0
03-0345	0	0	0	0	0	0	0
03-0348	0	0	0	0	0	0	0

BASIN 4: MIDWAY

STRUCTURE NUMBER	CURRENT CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	CURRENT CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
04-0103	181	289	441	28	-153	-261	-413
04-0104	147	234	359	34	-113	-200	-325
04-0106	105	167	257	108	3	-59	-149
04-0107	0	0	0	0	0	0	0
04-0109	103	164	252	100	-3	-64	-152
04-0112	135	216	331	75	-60	-141	-256
04-0114	28	45	72	38	10	-7	-34
04-0115	43	70	111	234	191	164	123
04-0118	51	81	126	95	44	14	-31
04-0119	0	0	0	0	0	0	0
04-0120	0	0	0	0	0	0	0
04-0121	62	99	154	50	-12	-49	-104
04-0122	0	0	0	0	0	0	0
04-0123	0	0	0	0	0	0	0
04-0124	23	37	58	83	60	46	25
04-0127	0	0	0	0	0	0	0
04-0133	165	263	402	346	181	83	-56
04-0134	162	257	394	304	142	47	-90
04-0136	95	151	233	250	155	99	17
04-0139	90	144	223	46	-44	-98	-177
04-0142	83	133	206	112	29	-21	-94
04-0143	0	0	0	0	0	0	0
04-0145	0	0	0	0	0	0	0
04-0146	76	121	188	95	19	-26	-93
04-0147	0	0	0	0	0	0	0
04-0148	0	0	0	0	0	0	0
04-0151	168	268	410	254	86	-14	-156
04-0152	157	251	384	304	147	53	-80
04-0153	151	241	368	222	71	-19	-146
04-0154	151	241	368	254	103	13	-114
04-0155	124	198	305	26	-98	-172	-279
04-0156	0	0	0	0	0	0	0
04-0157	101	161	249	102	1	-59	-147
04-0158	81	129	201	69	-12	-60	-132
04-0159	66	105	163	59	-7	-46	-104
04-0160	0	0	0	0	0	0	0
04-0161	0	0	0	0	0	0	0
04-0162	0	0	0	0	0	0	0
04-0163	0	0	0	0	0	0	0
04-0172	282	449	684	59	-223	-390	-625

STRUCTURE NUMBER	CURRENT CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	CURRENT CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
04-0175	0	0	0	0	0	0	0
04-0178	81	129	201	75	-6	-54	-126
04-0181	77	123	191	140	63	17	-51
04-0184	39	62	98	51	12	-11	-47
04-0187	39	62	98	59	20	-3	-39
04-0190	39	62	98	79	40	17	-19
04-0193	39	62	98	104	65	42	6
04-0194	0	0	0	0	0	0	0

BASIN 5: LAKE JESSUP

STRUCTURE NUMBER	CURRENT CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	CURRENT CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
05-0103	581	937	1419	251	-330	-686	-1168
05-0106	578	932	1411	1367	789	435	-44
05-0109	257	419	646	551	294	132	-95
05-0112	0	0	0	0	0	0	0
05-0115	179	294	459	279	100	-15	-180
05-0203	128	212	333	131	3	-81	-202
05-0206	128	211	332	1171	1043	960	839
05-0209	0	0	0	0	0	0	0
05-0215	61	97	151	33	-28	-64	-118
05-0218	98	160	251	12	-86	-148	-239
05-0219	0	0	0	0	0	0	0
05-0220	0	0	0	0	0	0	0
05-0221	0	0	0	0	0	0	0
05-0222	0	0	0	0	0	0	0
05-0223	0	0	0	0	0	0	0
05-0224	0	0	0	0	0	0	0
05-0225	0	0	0	0	0	0	0
05-0226	0	0	0	0	0	0	0
05-0227	0	0	0	0	0	0	0
05-0228	0	0	0	0	0	0	0
05-0229	0	0	0	0	0	0	0
05-0230	0	0	0	0	0	0	0
05-0303	0	0	0		0	0	0
05-0306	127	209	327	730	603	521	403
05-0309	91	149	234	242	151	93	8
05-0315	115	184	283	79	-36	-105	-204
05-0321	51	81	127	108	57	27	-19
05-0324	48	77	121	46	-2	-31	-75
05-0325	0	0	0	0	0	0	0
05-0327	0	0	0	0	0	0	0
05-0330	0	0	0	0	0	0	0
05-0331	30	49	78	29	-1	-20	-49
05-0333	37	59	93	38	1	-21	-55
05-0336	23	38	60	60	37	22	-0
05-0339	58	92	143	26	-32	-66	-117
05-0403	0	0	0	0	0	0	0
05-0406	53	84	133	251	198	167	118
05-0409	38	61	97	174	136	113	77
05-0503	84	134	208	175	91	41	-33
05-0505	0	0	0	0	0	0	0

STRUCTURE NUMBER	CURRENT CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	CURRENT CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
05-0506	50	80	125	94	44	14	-31
05-0507	43	69	109	120	77	51	11
05-0508	0	0	0	0	0	0	0
05-0509	202	322	491	304	102	-18	-187
05-0512	0	0	0	0	0	0	0
05-0515	0	0	0	0	0	0	0
05-0518	0	0	0	0	0	0	0
05-0521	79	125	195	383	304	258	188
05-0524	53	84	131	205	152	121	74
05-0527	8	13	22	115	107	102	93
05-0530	83	133	206	240	157	107	34
05-0533	57	91	141	32	-25	-59	-109
05-0536	68	109	171	156	88	47	-15
05-0539	33	52	83	77	44	25	-6
05-0542	0	0	0	0	0	0	0
05-0545	45	72	112	112	67	40	-0
05-0548	45	72	112	180	135	108	6
05-0551	72	115	182	367	295	252	18
05-0554	0	0	0	0	0	0	0
05-0557	85	139	216	426	341	287	210
05-0560	0	0	0	0	0	0	0
05-0563	0	0	0	0	0	0	0
05-0567	0	0	0	0	0	0	0
05-0703	158	259	401	246	88	-13	-155
05-0706	158	258	400	246	88	-12	-154
05-0709	152	248	386	246	94	-2	-140
05-0712	150	246	251	476	326	230	225
05-0715	138	225	151	359	221	134	208
05-0718	141	229	353	651	510	422	298
05-0721	126	203	314	286	160	83	-28
05-0724	141	227	349	392	251	165	43
05-0727	0	0	0	0	0	0	0
05-0730	0	0	0	0	0	0	0
05-0733	117	186	284	76	-41	-110	-208
05-0803	0	0	0	0	0	0	0
05-0806	0	0	0	0	0	0	0
05-0807	174	278	423	300	126	22	-123
05-0808	0	0	0	0	0	0	0
05-0809	0	0	0	0	0	0	0
05-0903	72	114	180	110	38	-4	-70
05-0906	199	317	489	114	-85	-203	-

BASIN 6: ST. JOHNS

STRUCTURE NUMBER	CURRENT CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	CURRENT CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
06-0103	101	166	262	61	-40	-105	-201
06-0106	86	141	224	248	162	107	24
06-0107	0	0	0	0	0	0	0
06-0108	110	86	138	110	0	24	-28
06-0109	38	39	64	38	0	-1	-26
06-0203	21	36	60	206	185	170	146
06-0303	0	0	0	0	0	0	0

BASIN 7: LAKE HARNEY

STRUCTURE NUMBER	CURRENT CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	CURRENT CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
07-0102	27	44	70	240	213	196	170
07-0103	0	0	0	0	0	0	0
07-0106	114	182	280	122	8	-60	-158
07-0303	0	0	0	0	0	0	0
07-0503	66	110	175	113	47	3	-62
07-0506	81	129	200	95	14	-34	-105
07-0509	81	129	200	113	32	-16	-87

BASIN 9: BIG ECONLOCKHATCHEE

STRUCTURE NUMBER	CURRENT CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	CURRENT CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
09-0103	0	0	0	0	0	0	0
09-0203	0	0	0	0	0	0	0
09-0206	153	252	395	123	-30	-129	-272
09-0209	0	0	0	0	0	0	0
09-0212	68	112	177	64	-4	-48	-113
09-0215	0	0	0	0	0	0	0
09-0403	74	119	182	56	-18	-63	-126
09-0406	0	0	0	0	0	0	0
09-0409	0	0	0	0	0	0	0
09-0412	0	0	0	0	0	0	0
09-0415	61	103	164	95	34	-8	-69
09-0418	45	75	120	42	-3	-33	-78
09-0421	0	0	0	0	0	0	0
09-0603	0	0	0	0	0	0	0
09-0606	0	0	0	0	0	0	0

BASIN 10: LITTLE ECONLOCKHATCHEE

STRUCTURE NUMBER	CURRENT CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	CURRENT CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
10-0103	0	0	0	0	0	0	0
10-0203	0	0	0	0	0	0	0
10-0303	50	82	128	55	5	-27	-73
10-0403	214	342	531	700	486	358	169
10-0406	246	392	607	234	-12	-158	-373

BASIN 11: HOWELL BRANCH

STRUCTURE NUMBER	CURRENT CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	CURRENT CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
11-0103	78	125	193	9	-69	-116	-184
11-0106	74	118	179	445	371	327	266
11-0203	0	0	0	0	0	0	0
11-0206	0	0	0	0	0	0	0
11-0207	0	0	0	0	0	0	0
11-0209	0	0	0	0	0	0	0
11-0210	0	0	0	0	0	0	0
11-0211	0	0	0	0	0	0	0
11-0212	0	0	0	0	0	0	0
11-0213	0	0	0	0	0	0	0
11-0214	0	0	0	0	0	0	0
11-0215	0	0	0	0	0	0	0
11-0218	0	0	0	0	0	0	0
11-0224	0	0	0	0	0	0	0
11-0227	0	0	0	0	0	0	0
11-0228	0	0	0	0	0	0	0
11-0229	0	0	0	0	0	0	0
11-0232	0	0	0	0	0	0	0
11-0233	33	54	85	198	165	144	113
11-0236	2030		6240	2600	570	2600	-3640
11-0303	0	0	0	0	0	0	0
11-0306	0	0	0	0	0	0	0
11-0309	0	0	0	0	0	0	0
11-0402	0	0	0	0	0	0	0
11-0403	0	0	0	0	0	0	0
11-0406	0	0	0	0	0	0	0
11-0409	0	0	0	0	0	0	0
11-0412	0	0	0	0	0	0	0
11-0415	72	117	184	160	88	43	-24
11-0418	101	163	255	132	31	-31	-123
11-0419	0	0	0	0	0	0	0
11-0421	185	296	456	264	79	-32	-192
11-0424	0	0	0	0	0	0	0
11-0427	26	41	65	103	77	62	38
11-0428	0	0	0	0	0	0	0
11-0429	0	0	0	0	0	0	0
11-0430	0	0	0	0	0	0	0
11-0431	0	0	0	0	0	0	0
11-0432	0	0	0	0	0	0	0
11-0433	0	0	0	0	0	0	0
11-0434	0	0	0	0	0	0	0
11-0435	0	0	0	0	0	0	0
11-0436	0	0	0	0	0	0	0
11-0437	0	0	0	0	0	0	0
11-0438	0	0	0	0	0	0	0

STRUCTURE NUMBER	CURRENT CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	CURRENT CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
11-0439	0	0	0	0	0	0	0
11-0440	0	0	0	0	0	0	0
11-0441	0	0	0	0	0	0	0
11-0442	0	0	0	0	0	0	0
11-0443	0	0	0	0	0	0	0
11-0444	0	0	0	0	0	0	0
11-0445	0	0	0	0	0	0	0
11-0503	231	369	564	499	268	130	-65
11-0506	231	369	564	1048	817	679	484
11-0512	0	0	0	0	0	0	0
11-0515	0	0	0	0	0	0	0
11-0518	106	169	263	280	174	111	17
11-0521	61	98	152	319	258	221	167
11-0524	55	98	152	182	127	84	30
11-0527	51	98	152	186	135	88	34
11-0530	11	98	152	173	162	75	21
11-0533	24	98	152	90	66	-8	-62
11-0535	0	0	0	0	0	0	0
11-0538	0	0	0	0	0	0	0
11-0540	0	0	0	0	0	0	0
11-0542	0	0	0	0	0	0	0
11-0603	74	121	190	111	37	-10	-79
11-0606	0	0	0	0	0	0	0
11-0609	0	0	0	0	0	0	0
11-0611	0	0	0	0	0	0	0
11-0613	0	0	0	0	0	0	0
11-0614	0	0	0	0	0	0	0
11-0803	0	0	0	0	0	0	0
11-0804	0	0	0	0	0	0	0
11-0805	435	716	1107	180	-255	-536	-927
11-0806	0	0	0	0	0	0	0
11-0807	0	0	0	0	0	0	0
11-0809	188	331	521	1298	1110	967	777
11-0812	138	230	365	371	233	141	6
11-0815	228	230	365	245	17	15	-120
11-0816	93	148	229	65	-28	-83	-164
11-0818	0	0	0	0	0	0	0
11-0821	135	224	355	233	98	9	-122
11-0824	118	197	313	222	104	25	-91
11-0827	22	37	60	160	138	123	100
11-0903	0	0	0	0	0	0	0
11-0906	377	609	924	630	253	21	-294
11-0909	377	609	924	734	357	125	-190
11-0912	0	0	0	0	0	0	0
11-0915	167	267	409	429	262	162	20

STRUCTURE NUMBER	CURRENT CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	CURRENT CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
11-0918	0	0	0	0	0	0	0
11-0921	92	146	224	103	11	-43	-121
11-0924	72	115	177	37	-35	-78	-140
11-0927	0	0	0	0	0	0	0
11-0929	0	0	0	0	0	0	0
11-0930	71	115	179	53	-18	-62	-126
11-0931	110	175	269	60	-50	-115	-209
11-0932	0	0	0	0	0	0	0
11-0933	0	0	0	0	0	0	0
11-0934	0	0	0	0	0	0	0
11-1003	0	0	0	0	0	0	0
11-1006	0	0	0	0	0	0	0
11-1012	97	159	249	137	40	-22	-112
11-1015	0	0	0	0	0	0	0
11-1018	35	56	89	50	15	-6	-39
11-1021	0	0	0	0	0	0	0
11-1023	0	0	0	0	0	0	0
11-1024	69	115	184	27	-42	-88	-157
11-1027	69	115	184	66	-3	-49	-118
11-1030	57	95	153	70	13	-25	-83
11-1033	57	95	153	96	39	1	-57

BASIN 12: LITTLE LAKE HOWELL

STRUCTURE NUMBER	CURRENT CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	CURRENT CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
12-0103	90	149	234	80	-10	-69	-154
12-0106	90	149	234	45	-45	-104	-189
12-0109	90	149	234	36	-54	-113	-198
12-0112	0	0	0	0	0	0	0
12-0115	0	0	0	0	0	0	0
12-0116	0	0	0	0	0	0	0
12-0118	0	0	0	0	0	0	0
12-0124	112	186	290	80	-32	-106	-210
12-0127	0	0	0	0	0	0	0
12-0129	0	0	0	0	0	0	0
12-0130	0	0	0	0	0	0	0

BASIN 13: GEE CREEK

STRUCTURE NUMBER	CURRENT CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	CURRENT CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
13-0106	0	0	0	0	0	0	0
13-0109	151	240	368	175	24	-65	-193
13-0112	0	0	0	0	0	0	0
13-0113	0	0	0	0	0	0	0
13-0115	0	0	0	0	0	0	0
13-0203	379	613	938	2259	1880	1646	1321
13-0206	375	607	927	549	174	-58	-378
13-0209	368	595	909	549	181	-46	-360
13-0212	0	0	0	0	0	0	0
13-0215	0	0	0	0	0	0	0
13-0218	0	0	0	0	0	0	0
13-0221	0	0	0	0	0	0	0
13-0224	0	0	0	0	0	0	0
13-0303	17	28	46	184	167	156	138
13-0306	21	36	57	46	25	10	-11
13-0309	58	96	151	31	-27	-65	-120
13-0312	0	0	0	0	0	0	0
13-0403	88	140	216	70	-18	-70	-146
13-0406	88	140	216	104	16	-36	-112
13-0503	193	317	494	643	450	326	149
13-0506	486	783	1181	1350	864	567	169
13-0509	486	783	1181	1400	914	617	219
13-0603	0	0	0	0	0	0	0
13-0606	0	0	0	0	0	0	0
13-0609	380	612	929	140	-240	-472	-789
13-0703	105	172	268	314	209	142	46
13-0706	0	0	0	0	0	0	0
13-0707	46	74	118	90	44	16	-28
13-0708	0	0	0	0	0	0	0
13-0709	0	0	0	0	0	0	0
13-0711	0	0	0	0	0	0	0
13-0713	0	0	0	0	0	0	0
13-0715	0	0	0	0	0	0	0
13-0718	0	0	0	0	0	0	0
13-0721	0	0	0	0	0	0	0
13-0723	0	0	0	0	0	0	0
13-0725	0	0	0	0	0	0	0
13-0728	49	79	124	80	31	1	-44
13-0731	0	0	0	0	0	0	0
13-0732	0	0	0	0	0	0	0

STRUCTURE NUMBER	CURRENT CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	CURRENT CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
13-0733	0	0	0	0	0	0	0
13-0734	0	0	0	0	0	0	0
13-0803	69	112	175	106	37	-6	-69
13-0806	0	0	0	0	0	0	0
13-0809	43	70	111	91	48	21	-20
13-0811	0	0	0	0	0	0	0
13-0812	0	0	0	0	0	0	0
13-0813	0	0	0	0	0	0	0
13-0814	0	0	0	0	0	0	0
13-0903	122	202	317	700	578	498	383
					0	0	0
13-0906	0	0	0	0	0	0	0
13-0912	35	58	92	52	17	-6	-40
13-0914	34	56	88	74	40	18	-14
13-0915	25	42	66	50	25	8	-16
13-0918	0	0	0	0	0	0	0
13-0921	0	0	0	0	0	0	0
13-0927	0	0	0	0	0	0	0
13-0930	32	53	84	133	101	80	49
13-0933	133	214	329	172	39	-42	-157
13-0936	84	136	212	131	47	-5	-81
13-0939	0	0	0	0	0	0	0
13-0942	84	136	212	131	47	-5	-81
13-0945	0	0	0	0	0	0	0
13-0948	0	0	0	0	0	0	0
13-0951	0	0	0	0	0	0	0
13-0954	0	0	0	0	0	0	0
13-0957	0	0	0	0	0	0	0
13-0960	0	0	0	0	0	0	0
13-1003	0	0	0	0	0	0	0
13-1006	0	0	0	0	0	0	0
13-1103	94	154	242	542	448	388	300
13-1106	88	145	228	597	509	452	369
13-1112	0	0	0	0	0	0	0
13-1115	55	91	146	58	3	-33	-88
13-1118	52	86	137	130	78	44	-7
13-1121	0	0	0	0	0	0	0
13-1124	51	84	135	36	-15	-48	-99
13-1127	0	0	0	0	0	0	0
13-1128	0	0	0	0	0	0	0
13-1129	0	0	0	0	0	0	0

STRUCTURE NUMBER	CURRENT CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	CURRENT CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
13-1130	50	83	132	100	50	17	-32
13-1133	49	82	131	80	31	-2	-51
13-1203	0	0	0	0	0	0	0
13-1204	0	0	0	0	0	0	0
13-1206	0	0	0	0	0	0	0
13-1208	0	0	0	0	0	0	0
13-1209	0	0	0	0	0	0	0
13-1210	0	0	0	0	0	0	0
13-1213	0	0	0	0	0	0	0
13-1214	0	0	0	0	0	0	0

BASIN 14: SOLDIER CREEK

STRUCTURE NUMBER	CURRENT CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	CURRENT CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
14-0103	130	208	321	272	142	64	-49
14-0106	78	125	195	136	58	11	-59
14-0109	45	71	112	79	34	8	-33
14-0203	0	0	0	0	0	0	0
14-0206	0	0	0	0	0	0	0
14-0209	0	0	0	0	0	0	0
14-0212	0	0	0	0	0	0	0
14-0215	0	0	0	0	0	0	0
14-0218	0	0	0	0	0	0	0
14-0221	0	0	0	0	0	0	0
14-0224	0	0	0	0	0	0	0
14-0225	0	0	0		0	0	0
14-0226	0	0	0		0	0	0
14-0228	0	0	0		0	0	0
14-0229	0	0	0		0	0	0
14-0230	0	0	0	0	0	0	0
14-0233	711	1146	1734	1728	1017	582	-6
14-0236	231	371	563	345	114	-26	-218
14-0303	332	545	842	501	169	-44	-341
14-0309	189	311	486	265	76	-46	-221
14-0312	177	292	455	80	-97	-212	-375
14-0318	75	122	189	100	25	-22	-89
14-0321	75	122	189	180	105	58	-9
14-0323	0	0	0	0	0	0	0
14-0324	0	0	0	0	0	0	0
14-0325	0	0	0		0	0	0
14-0327	198	325	504	379	181	54	-125
14-0328	0	0	0		0	0	0
14-0330	164	269	419	154	-10	-115	-265
14-0331	0	0	0		0	0	0
14-0333	0	0	0	0	0	0	0
14-0336	85	139	218	200	115	61	-18
14-0339	56	92	145	80	24	-12	-65
14-0340	0	0	0		0	0	0
14-0342	8	14	24	103	95	89	79
14-0343	8	14	24	103	95	89	79
14-0345	0	0	0		0	0	0
14-0346	0	0	0		0	0	0
14-0347	0	0	0		0	0	0

STRUCTURE NUMBER	CURRENT CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	CURRENT CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
14-0348	0	0	0		0	0	0
14-0349	0	0	0		0	0	0
14-0350	0	0	0		0	0	0
14-0351	0	0	0		0	0	0
14-0352	0	0	0		0	0	0
14-0353	0	0	0		0	0	0
14-0354	0	0	0		0	0	0
14-0355	0	0	0		0	0	0
14-0405	0	0	0		0	0	0
14-0409	67	106	164	46	-21	-60	-118
14-0410	108	171	264	180	72	9	-84
14-0412	0	0	0	0	0	0	0
14-0415	63	101	157	86	23	-15	-71
14-0418	0	0	0	0	0	0	0
14-0421	58	97	155	52	-6	-45	-103
14-0424	52	87	140	132	80	45	-8
14-0427	0	0	0	0	0	0	0
14-0430	47	78	126	85	38	7	-41
14-0433	46	77	124	42	-4	-35	-82
14-0436	42	69	112	42	0	-27	-70
14-0439	42	69	112	42	0	-27	-70
14-0441	0	0	0	0	0	0	0
14-0444	0	0	0	0	0	0	0
14-0447	0	0	0	0	0	0	0
14-0450	0	0	0	0	0	0	0
14-0453	0	0	0	0	0	0	0
14-0455	0	0	0		0	0	0
14-0457	0	0	0		0	0	0
14-0459	0	0	0		0	0	0
14-0460	0	0	0		0	0	0
14-0462	0	0	0		0	0	0
14-0464	0	0	0		0	0	0

BASIN 15: LITTLE WEKIVA

STRUCTURE NUMBER	CURRENT CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	CURRENT CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
15-0101	0	0	0		0	0	0
15-0102	0	0	0		0	0	0
15-0103	0	0	0	0	0	0	0
15-0104	0	0	0		0	0	0
15-0105	90	145	226	60	-30	-85	-166
15-0107	0	0	0		0	0	0
15-0109	0	0	0	0	0	0	0
15-0112	0	0	0	0	0	0	0
15-0113	491	783	1183	39	-452	-744	-1144
15-0115	0	0	0	0	0	0	0
15-0118	0	0	0	0	0	0	0
15-0121	0	0	0	0	0	0	0
15-0124	0	0	0	0	0	0	0
15-0127	0	0	0	0	0	0	0
15-0130	0	0	0	0	0	0	0
15-0133	0	0	0	0	0	0	0
15-0136	0	0	0	0	0	0	0
15-0140	0	0	0		0	0	0
15-0142	0	0	0		0	0	0
15-0144	0	0	0		0	0	0
15-0146	0	0	0		0	0	0
15-0148	0	0	0		0	0	0
15-0150	0	0	0		0	0	0
15-0152	0	0	0		0	0	0
15-0154	0	0	0		0	0	0
15-0156	0	0	0		0	0	0
15-0158	0	0	0		0	0	0
15-0160	0	0	0		0	0	0
15-0162	359	575	864	58	-301	-517	-805
15-0164	0	0	0		0	0	0
15-0166	0	0	0		0	0	0
15-0167	0	0	0		0	0	0
15-0168	0	0	0		0	0	0
15-0169	0	0	0		0	0	0
15-0170	62	100	157	85	23	-15	-72
15-0171	69	113	178	220	151	107	42
15-0172	0	0	0		0	0	0
15-0173	0	0	0		0	0	0
15-0174	0	0	0		0	0	0
15-0175	0	0	0		0	0	0

STRUCTURE NUMBER	CURRENT CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	CURRENT CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
15-0202	0	0	0		0	0	0
15-0203	0	0	0	0	0	0	0
15-0204	0	0	0		0	0	0
15-0205	0	0	0		0	0	0
15-0206	0	0	0	0	0	0	0
15-0207	0	0	0		0	0	0
15-0208	0	0	0		0	0	0
15-0209	44	72	115	132	88	60	17
15-0210	0	0	0		0	0	0
15-0211	0	0	0		0	0	0
15-0212	198	325	502	662	464	337	160
15-0213	0	0	0		0	0	0
15-0214	0	0	0		0	0	0
15-0215	177	290	448	87	-90	-203	-361
15-0216	0	0	0		0	0	0
15-0217	0	0	0		0	0	0
15-0218	0	0	0		0	0	0
15-0219	0	0	0		0	0	0
15-0220	79	125	194	120	41	-5	-74
15-0221	0	0	0	0	0	0	0
15-0222	0	0	0		0	0	0
15-0223	0	0	0		0	0	0
15-0224	0	0	0	0	0	0	0
15-0225	0	0	0	0	0	0	0
15-0226	82	131	202	52	-30	-79	-150
15-0227	362	577	872	480	118	-97	-392
15-0228	0	0	0		0	0	0
15-0229	116	185	286	87	-29	-98	-199
15-0230	44	70	111	213	169	143	102
15-0231	116	185	286	230	114	45	-56
15-0232	0	0	0		0	0	0
15-0233	0	0	0	0	0	0	0
15-0301	55	90	141	60	5	-30	-81
15-0302	0	0	0		0	0	0
15-0303	157	258	398	42	-115	-216	-356
15-0304	0	0	0		0	0	0
15-0305	0	0	0		0	0	0
15-0306	103	171	268	180	77	9	-88
15-0307	0	0	0		0	0	0
15-0308	0	0	0		0	0	0

STRUCTURE NUMBER	CURRENT CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	CURRENT CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
15-0309	139	228	355	65	-74	-163	-290
15-0310	0	0	0	0	0	0	0
15-0311	0	0	0		0	0	0
15-0315	0	0	0	0	0	0	0
15-0402	84	135	211	65	-19	-70	-146
15-0403	0	0	0	0	0	0	0
15-0406	0	0	0	0	0	0	0
15-0407	0	0	0		0	0	0
15-0408	0	0	0		0	0	0
15-0409	0	0	0	0	0	0	0
15-0410	0	0	0		0	0	0
15-0411	0	0	0		0	0	0
15-0412	0	0	0	0	0	0	0
15-0413	0	0	0		0	0	0
15-0415	0	0	0	0	0	0	0
15-0418	0	0	0	0	0	0	0
15-0420	101	161	247	220	119	59	-27
15-0421	0	0	0	0	0	0	0
15-0424	0	0	0		0	0	0
15-0429	112	186	290	578	466	392	288
15-0430	109	181	282	122	13	-59	-160
15-0433	95	158	249	121	26	-37	-128
15-0439	74	122	193	50	-24	-72	-143
15-0444	168	277	430	183	15	-94	-247
15-0501	0	0	0		0	0	0
15-0502	0	0	0		0	0	0
15-0503	106	174	274	406	300	232	132
15-0504	164	270	417	140	-24	-130	-277
15-0506	90	148	233	150	60	2	-83
15-0509	0	0	0	0	0	0	0
15-0512	142	232	358	117	-25	-115	-241
15-0513	297	473	715	26	-271	-447	-689
15-0515	0	0	0	0	0	0	0
15-0518	0	0	0	0	0	0	0
15-0521	0	0	0	0	0	0	0
15-0522	0	0	0	0	0	0	0
15-0524	0	0	0	0	0	0	0
15-0527	0	0	0	0	0	0	0
15-0528	0	0	0		0	0	0
15-0529	0	0	0		0	0	0

STRUCTURE NUMBER	CURRENT CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	CURRENT CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
15-0530	0	0	0	0	0	0	0
15-0533	54	86	135	77	23	-9	-58
15-0601	0	0	0		0	0	0
15-0602	0	0	0		0	0	0
15-0603	0	0	0		0	0	0
15-0604	0	0	0		0	0	0
15-0605	0	0	0		0	0	0
15-0606	0	0	0		0	0	0
15-0607	0	0	0		0	0	0
15-0608	0	0	0		0	0	0
15-0609	0	0	0		0	0	0
15-0610	0	0	0		0	0	0
15-0611	0	0	0		0	0	0

BASIN 16: BIG WEKIVA

STRUCTURE NUMBER	CURRENT CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	CURRENT CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
16-0103	0	0	0	0	0	0	0
16-0109	112	188	295	81	-31	-107	-214
16-0112	68	110	172	32	-36	-78	-140
16-0115	114	181	280	32	-82	-149	-248
16-0118	0	0	0	0	0	0	0
16-0120	0	0	0		0	0	0
16-0203	0	0	0	0	0	0	0
16-0206	71	119	188	539	468	420	351
16-0208	0	0	0		0	0	0
16-0209	0	0	0		0	0	0
16-0212	0	0	0		0	0	0
16-0215	0	0	0		0	0	0
16-0303	10	17	28	450	440	433	422
16-0403	139	225	342	58	-81	-167	-284
16-0404	47	75	118	103	56	28	-15

BASIN 1: YANKEE LAKE

STRUCTURE NUMBER	FUTURE CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	FUTURE CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
01-0103	0	0	0	0	0	0	0
01-0104	0	0	0	0	0	0	0
01-0106	100	163	256	144	44	-19	-112
01-0107	100	163	256	140	40	-23	-116
01-0203	0	0	0	0	0	0	0
01-0501	0	0	0	0	0	0	0
01-0502	0	0	0	0	0	0	0
01-0503	0	0	0	0	0	0	0
01-0504	51	81	128	80	29	-1	-48

BASIN 2: LAKE MONROE

STRUCTURE NUMBER	FUTURE CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	FUTURE CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
02-0103	130	216	337	120	-10	-96	-21
02-0106	130	216	337	150	20	-66	-18
02-0109	130	216	337	186	56	-30	-15
02-0112	130	216	337	371	241	155	3
02-0115	0	0	0	0	0	0	
02-0118	157	254	393	95	-62	-159	-29
02-0121	157	254	393	95	-62	-159	-29
02-0206	0	0	0	0	0	0	
02-0209	610	988	1510	520	-90	-468	-99
02-0212	583	943	1443	690	107	-253	-75
02-0213				0	0	0	
02-0214				0	0	0	
02-0215	579	937	1434	950	371	13	-48
02-0216				0	0	0	
02-0218	0	0	0	0	0	0	
02-0221	413	669	1028	47	-366	-622	-
02-0224	202	331	519	240	38	-91	
02-0227	188	310	486	83	-105	-227	-40
02-0230	169	278	438	51	-118	-227	-38
02-0236	60	98	157	179	119	81	22
02-0239	55	91	145	64	9	-27	-8
02-0242	42	69	111	50	8	-19	-6
02-0245	0	0	0	0	0	0	
02-0303	0	0	0	0	0	0	
02-0306	0	0	0	0	0	0	
02-0309	57	96	155	375	318	279	22
02-0312	29	48	76	60	31	12	-1
02-0315				0	0	0	
02-0318				0	0	0	
02-0321				0	0	0	
02-0323				0	0	0	
02-0325				0	0	0	
02-0327				0	0	0	
02-0403	230	371	570	30	-200	-341	-54
02-0406	0	0	0	0	0	0	
02-0409	143	231	359	286	143	55	-7
02-0411	0	0	0	0	0	0	
02-0412	73	118	184	286	213	168	10
02-0413	0	0	0	0	0	0	
02-0414	37	58	91	286	249	228	19

STRUCTURE NUMBER	FUTURE CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	FUTURE CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
02-0415	97	154	238	689	592	535	451
02-0416	37	58	91	100	63	42	9
02-0417				0	0	0	0
02-0418	110	175	269	82	-28	-93	-187
02-0419				0	0	0	0
02-0420				0	0	0	0
02-0421	75	120	186	44	-31	-76	-142
02-0424	112	178	274	50	-62	-128	-224
02-0425	48	77	120	270	222	193	150
02-0427	92	150	233	311	219	161	78
02-0428	49	78	122	120	71	42	-2
02-0429	53	87	137	89	36	2	-48
02-0430	29	47	76	206	177	159	130
02-0433	140	223	343	309	169	86	-34
02-0436	88	140	218	89	1	-51	-129
02-0439	72	114	178	50	-22	-64	-128
02-0442	0	0	0	0	0	0	0
02-0445	105	168	259	309	204	141	50

BASIN 3: CITY OF SANFORD

STRUCTURE NUMBER	FUTURE CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	FUTURE CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
03-0313	287	458	699	300	13	-158	-399
03-0315	376	600	909	930	554	330	21
03-0318	0	0	0	0	0	0	0
03-0321	0	0	0	0	0	0	0
03-0323	0	0	0	0	0	0	0
03-0333	0	0	0	0	0	0	0
03-0336	0	0	0	0	0	0	0
03-0339	0	0	0	0	0	0	0
03-0342	0	0	0	0	0	0	0
03-0343	0	0	0	0	0	0	0
03-0345	0	0	0	0	0	0	0
03-0348	0	0	0	0	0	0	0

BASIN 4: MIDWAY

STRUCTURE NUMBER	FUTURE CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	FUTURE CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
04-0103	200	318	485	28	-172	-290	-457
04-0104	162	258	395	34	-128	-224	-361
04-0106	116	184	283	108	-8	-76	-175
04-0107	0	0	0	0	0	0	0
04-0109	113	180	278	100	-13	-80	-178
04-0112	149	237	364	75	-74	-162	-289
04-0114	32	53	84	38	6	-15	-46
04-0115	48	78	122	234	186	156	112
04-0118	56	89	139	95	39	6	-44
04-0119	0	0	0	0	0	0	0
04-0120	0	0	0	0	0	0	0
04-0121	69	109	170	50	-19	-59	-120
04-0122	0	0	0	0	0	0	0
04-0123	0	0	0	0	0	0	0
04-0124	25	40	63	83	58	43	20
04-0127	0	0	0	0	0	0	0
04-0133	181	289	442	346	165	57	-96
04-0134	178	283	434	304	126	21	-130
04-0136	104	166	256	250	146	84	-6
04-0139	100	159	245	46	-54	-113	-199
04-0142	92	146	226	112	20	-34	-114
04-0143	0	0	0	0	0	0	0
04-0145	0	0	0	0	0	0	0
04-0146	84	133	206	95	11	-38	-111
04-0147	0	0	0	0	0	0	0
04-0148	0	0	0	0	0	0	0
04-0151	185	295	451	254	69	-41	-197
04-0152	173	276	422	304	131	28	-118
04-0153	166	265	405	222	56	-43	-183
04-0154	166	265	405	254	88	-11	-151
04-0155	137	218	336	26	-111	-192	-310
04-0156	0	0	0	0	0	0	0
04-0157	111	177	274	102	-9	-75	-172
04-0158	89	142	221	69	-20	-73	-152
04-0159	72	115	180	59	-13	-56	-121
04-0160	0	0	0	0	0	0	0
04-0161	0	0	0	0	0	0	0
04-0162	0	0	0	0	0	0	0
04-0163	0	0	0	0	0	0	0
04-0172	310	494	753	59	-251	-435	-694

STRUCTURE NUMBER	FUTURE CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	FUTURE CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
04-0175	0	0	0	0	0	0	0
04-0178	89	142	221	75	-14	-67	-146
04-0181	85	135	210	140	55	5	-70
04-0184	46	74	116	51	5	-23	-65
04-0187	46	74	116	59	13	-15	-57
04-0190	46	74	116	79	33	5	-37
04-0193	46	74	116	104	58	30	-12
04-0194				0			

BASIN 5: LAKE JESSUP

STRUCTURE NUMBER	FUTURE CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	FUTURE CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
05-0103	640	1031	1560	251	-389	-780	-1309
05-0106	636	1025	1552	1367	731	342	-185
05-0109	282	460	711	551	269	91	-160
05-0112	0	0	0	0	0	0	0
05-0115	197	324	504	279	82	-45	-225
05-0203	141	233	366	131	-10	-102	-235
05-0206	140	232	365	1171	1031	939	806
05-0209	0	0	0	0	0	0	0
05-0215	67	107	166	33	-34	-74	-133
05-0218	107	176	276	12	-95	-164	-264
05-0219	0	0	0	0	0	0	0
05-0220	0	0	0	0	0	0	0
05-0221	0	0	0	0	0	0	0
05-0222	0	0	0	0	0	0	0
05-0223	0	0	0	0	0	0	0
05-0224	0	0	0	0	0	0	0
05-0225	0	0	0	0	0	0	0
05-0226	0	0	0	0	0	0	0
05-0227	0	0	0	0	0	0	0
05-0228	0	0	0	0	0	0	0
05-0229	0	0	0	0	0	0	0
05-0230	0	0	0	0	0	0	0
05-0303	0	0	0		0	0	0
05-0306	140	230	359	730	590	500	371
05-0309	100	164	257	242	142	78	-15
05-0315	127	202	311	79	-48	-123	-232
05-0321	56	89	139	108	52	19	-31
05-0324	53	85	133	46	-7	-39	-87
05-0325	0	0	0	0	0	0	0
05-0327	0	0	0	0	0	0	0
05-0330	0	0	0	0	0	0	0
05-0331	33	54	86	29	-4	-25	-57
05-0333	41	65	102	38	-3	-27	-64
05-0336	25	41	66	60	35	19	-6
05-0339	63	101	157	26	-37	-75	-131
05-0403	0	0	0	0	0	0	0
05-0406	58	93	146	251	193	158	105
05-0409	42	67	107	174	132	107	67
05-0503	99	158	245	175	76	17	-70
05-0505				0			

STRUCTURE NUMBER	FUTURE CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	FUTURE CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
05-0506	59	95	148	94	35	-1	-5
05-0507	51	82	128	120	69	38	-
05-0508	0	0	0	0	0	0	
05-0509	222	355	541	304	82	-51	-23
05-0512	0	0	0	0	0	0	
05-0515	0	0	0	0	0	0	
05-0518	0	0	0	0	0	0	
05-0521	86	138	215	383	297	245	16
05-0524	58	92	144	205	147	113	6
05-0527	9	15	24	115	106	100	9
05-0530	92	146	226	240	148	94	1
05-0533	63	100	155	32	-31	-68	-12
05-0536	75	120	188	156	81	36	-3
05-0539	36	57	91	77	41	20	-1
05-0542	0	0	0	0	0	0	
05-0545	50	79	123	112	62	33	-1
05-0548	50	79	123	180	130	101	
05-0551	79	127	200	367	288	240	1
05-0554	0	0	0	0	0	0	
05-0557	93	153	238	426	333	273	18
05-0560	0	0	0	0	0	0	
05-0563	0	0	0	0	0	0	
05-0567	0	0	0	0	0	0	
05-0703	174	285	442	246	72	-39	-19
05-0706	173	284	441	246	73	-38	-19
05-0709	167	273	424	246	79	-27	-17
05-0712	165	270	276	476	311	206	20
05-0715	152	247	166	359	207	112	19
05-0718	156	252	389	651	495	399	26
05-0721	138	223	346	286	148	63	-6
05-0724	155	249	384	392	237	143	
05-0727	0	0	0	0	0	0	
05-0730	0	0	0	0	0	0	
05-0733	128	204	313	76	-52	-128	-2
05-0803	0	0	0	0	0	0	
05-0806	0	0	0	0	0	0	
05-0807	192	306	465	300	108	-6	-16
05-0808	0	0	0	0	0	0	
05-0809	0	0	0	0	0	0	
05-0903	79	126	198	110	31	-16	-4
05-0906	219	349	538	114	-105	-235	

BASIN 6: ST. JOHNS

STRUCTURE NUMBER	FUTURE CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	FUTURE CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
06-0103	117	193	304	61	-56	-132	-243
06-0106	100	164	259	248	148	84	-11
06-0107	0	0	0	0	0	0	0
06-0108	128	100	160	110	-18	10	-50
06-0109	44	46	74	38	-6	-8	-36
06-0203	25	41	69	206	181	165	137
06-0303	0	0	0	0	0	0	0

BASIN 7: LAKE HARNEY

STRUCTURE NUMBER	FUTURE CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	FUTURE CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
07-0102	32	51	81	240	208	189	159
07-0103	0	0	0	0	0	0	0
07-0106	133	211	324	122	-11	-89	-202
07-0303	0	0	0	0	0	0	0
07-0503	76	128	203	113	37	-15	-90
07-0506	89	142	220	95	6	-47	-125
07-0509	89	142	220	113	24	-29	-107

BASIN 9: BIG ECONLOCKHATCHEE

STRUCTURE NUMBER	FUTURE CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	FUTURE CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
09-0103	0	0	0	0	0	0	0
09-0203	0	0	0	0	0	0	0
09-0206	174	287	450	123	-51	-164	-327
09-0209	0	0	0	0	0	0	0
09-0212	78	128	201	64	-14	-64	-137
09-0215	0	0	0	0	0	0	0
09-0403	85	135	208	56	-29	-79	-152
09-0406	0	0	0	0	0	0	0
09-0409	0	0	0	0	0	0	0
09-0412	0	0	0	0	0	0	0
09-0415	70	117	187	95	25	-22	-92
09-0418	52	85	137	42	-10	-43	-95
09-0421	0	0	0	0	0	0	0
09-0603	0	0	0	0	0	0	0
09-0606	0	0	0	0	0	0	0

BASIN 10: LITTLE ECONLOCKHATCHEE

STRUCTURE NUMBER	FUTURE CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	FUTURE CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
10-0103	0	0	0	0	0	0	0
10-0203	0	0	0	0	0	0	0
10-0303	55	90	140	55	-0	-35	-85
10-0403	236	376	584	700	464	324	116
10-0406	270	431	668	234	-36	-197	-434

BASIN 11: HOWELL BRANCH

STRUCTURE NUMBER	FUTURE CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	FUTURE CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
11-0103	92	148	227	9	-83	-139	-218
11-0106	81	130	197	445	364	315	248
11-0203	0	0	0	0	0	0	0
11-0206	0	0	0	0	0	0	C
11-0207	0	0	0	0	0	0	0
11-0209	0	0	0	0	0	0	0
11-0210	0	0	0	0	0	0	0
11-0211	0	0	0	0	0	0	0
11-0212	0	0	0	0	0	0	0
11-0213	0	0	0	0	0	0	0
11-0214	0	0	0	0	0	0	0
11-0215	0	0	0	0	0	0	0
11-0218	0	0	0	0	0	0	0
11-0224	0	0	0	0	0	0	0
11-0227	0	0	0	0	0	0	0
11-0228	0	0	0	0	0	0	0
11-0229	0	0	0	0	0	0	0
11-0232	0	0	0	0	0	0	0
11-0233	36	59	94	198	162	139	104
11-0236	2233	0	6864	2600	367	2600	-4264
11-0303	0	0	0	0	0	0	0
11-0306	0	0	0	0	0	0	0
11-0309	0	0	0	0	0	0	0
11-0402	0	0	0	0	0	0	0
11-0403	0	0	0	0	0	0	0
11-0406	0	0	0	0	0	0	0
11-0409	0	0	0	0	0	0	0
11-0412	0	0	0	0	0	0	0
11-0415	79	129	202	160	81	31	-42
11-0418	111	180	280	132	21	-48	-148
11-0419	0	0	0	0	0	0	0
11-0421	203	326	502	264	61	-62	-238
11-0424	0	0	0	0	0	0	0
11-0427	28	45	71	103	75	58	32
11-0428	0	0	0	0	0	0	0
11-0429	0	0	0	0	0	0	0
11-0430	0	0	0	0	0	0	0
11-0431	0	0	0	0	0	0	0
11-0432	0	0	0	0	0	0	0
11-0433	0	0	0	0	0	0	0
11-0434	0	0	0	0	0	0	0
11-0435	0	0	0	0	0	0	0
11-0436	0	0	0	0	0	0	0
11-0437	0	0	0	0	0	0	0
11-0438	0	0	0	0	0	0	0

STRUCTURE NUMBER	FUTURE CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	FUTURE CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
11-0439	0	0	0	0	0	0	
11-0440	0	0	0	0	0	0	
11-0441	0	0	0	0	0	0	
11-0442	0	0	0	0	0	0	
11-0443	0	0	0	0	0	0	
11-0444	0	0	0	0	0	0	
11-0445	0	0	0	0	0	0	
11-0503	255	406	620	499	244	93	-12
11-0506	255	406	620	1048	793	642	42
11-0512	0	0	0	0	0	0	
11-0515	0	0	0	0	0	0	
11-0518	116	186	289	280	164	94	-
11-0521	70	111	174	319	249	208	14
11-0524	62	112	173	182	120	70	
11-0527	56	108	167	186	130	78	1
11-0530	12	108	167	173	161	65	
11-0533	26	108	167	90	64	-18	-7
11-0535	0	0	0	0	0	0	
11-0538	0	0	0	0	0	0	
11-0540	0	0	0	0	0	0	
11-0542	0	0	0	0	0	0	
11-0603	84	138	217	111	27	-27	-10
11-0606	0	0	0	0	0	0	
11-0609	0	0	0	0	0	0	
11-0611	0	0	0	0	0	0	
11-0613	0	0	0	0	0	0	
11-0614	0	0	0	0	0	0	
11-0803	0	0	0	0	0	0	
11-0804	0	0	0	0	0	0	
11-0805	505	830	1284	180	-325	-650	-11
11-0806	0	0	0	0	0	0	
11-0807	0	0	0	0	0	0	
11-0809	218	384	604	1298	1080	914	6
11-0812	160	267	424	371	211	104	-
11-0815	264	267	423	245	-19	-22	-1
11-0816	108	172	265	65	-43	-107	-2
11-0818	0	0	0	0	0	0	
11-0821	156	260	412	233	77	-27	-1
11-0824	137	228	364	222	85	-6	-1
11-0827	26	43	69	160	134	117	
11-0903	0	0	0	0	0	0	
11-0906	437	707	1072	630	193	-77	-4
11-0909	437	707	1072	734	297	27	-
11-0912	0	0	0	0	0	0	
11-0915	194	309	474	429	235	120	

STRUCTURE NUMBER	FUTURE CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	FUTURE CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
11-0918	0	0	0	0	0	0	0
11-0921	101	161	246	103	2	-58	-143
11-0924	83	133	205	37	-46	-96	-168
11-0927	0	0	0	0	0	0	0
11-0929	0	0	0	0	0	0	0
11-0930	82	133	208	53	-29	-80	-155
11-0931	128	203	312	60	-68	-143	-252
11-0932	0	0	0	0	0	0	0
11-0933	0	0	0	0	0	0	0
11-0934	0	0	0	0	0	0	0
11-1003	0	0	0	0	0	0	0
11-1006	0	0	0	0	0	0	0
11-1012	107	175	273	137	30	-38	-136
11-1015	0	0	0	0	0	0	0
11-1018	38	62	98	50	12	-12	-48
11-1021	0	0	0	0	0	0	0
11-1023	0	0	0	0	0	0	0
11-1024	76	127	202	27	-49	-100	-175
11-1027	76	127	202	66	-10	-61	-136
11-1030	63	105	168	70	7	-35	-98
11-1033	63	105	168	96	33	-9	-72

BASIN 12: LITTLE LAKE HOWELL

STRUCTURE NUMBER	FUTURE CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	FUTURE CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
12-0103	99	164	257	80	-19	-84	-177
12-0106	99	164	257	45	-54	-119	-212
12-0109	99	164	257	36	-63	-128	-221
12-0112	0	0	0	0	0	0	0
12-0115	0	0	0	0	0	0	0
12-0116	0	0	0	0	0	0	0
12-0118	0	0	0	0	0	0	0
12-0124	124	205	319	80	-44	-125	-239
12-0127	0	0	0	0	0	0	0
12-0129	0	0	0	0	0	0	0
12-0130	0	0	0	0	0	0	0

BASIN 13: GEE CREEK

STRUCTURE NUMBER	FUTURE CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	FUTURE CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
13-0106	0	0	0	0	0	0	0
13-0109	166	264	405	175	9	-89	-230
13-0112	0	0	0	0	0	0	0
13-0113	0	0	0	0	0	0	0
13-0115	0	0	0	0	0	0	0
13-0203	417	675	1032	2259	1842	1584	1227
13-0206	412	667	1020	549	137	-118	-471
13-0209	404	654	1000	549	145	-105	-451
13-0212	0	0	0	0	0	0	0
13-0215	0	0	0	0	0	0	0
13-0218	0	0	0	0	0	0	0
13-0221	0	0	0	0	0	0	0
13-0224	0	0	0	0	0	0	0
13-0303	19	31	50	184	165	153	134
13-0306	24	39	63	46	22	7	-17
13-0309	64	106	166	31	-33	-75	-135
13-0312	0	0	0	0	0	0	0
13-0403	97	154	237	70	-27	-84	-167
13-0406	97	154	238	104	7	-50	-134
13-0503	212	348	543	643	431	295	100
13-0506	534	851	1299	1350	816	489	51
13-0509	534	861	1299	1400	866	539	101
13-0603	0	0	0	0	0	0	0
13-0606	0	0	0	0	0	0	0
13-0609	418	673	1022	140	-278	-533	-882
13-0703	116	189	295	314	198	125	19
13-0706	0	0	0	0	0	0	0
13-0707	50	82	130	90	40	8	-40
13-0708	0	0	0	0	0	0	0
13-0709	0	0	0	0	0	0	0
13-0711	0	0	0	0	0	0	0
13-0713	0	0	0	0	0	0	0
13-0715	0	0	0	0	0	0	0
13-0718	0	0	0	0	0	0	0
13-0721	0	0	0	0	0	0	0
13-0723	0	0	0	0	0	0	0
13-0725	0	0	0	0	0	0	0
13-0728	54	87	136	80	26	-7	-56
13-0731	0	0	0	0	0	0	0
13-0732	0	0	0	0	0	0	0

STRUCTURE NUMBER	FUTURE CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	FUTURE CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
13-0733	0	0	0	0	0	0	0
13-0734	0	0	0	0	0	0	0
13-0803	75	123	193	106	31	-17	-87
13-0806	0	0	0	0	0	0	0
13-0809	47	77	122	91	44	14	-31
13-0811	0	0	0	0	0	0	0
13-0812	0	0	0	0	0	0	0
13-0813	0	0	0	0	0	0	0
13-0814	0	0	0	0	0	0	0
13-0903	135	222	349	700	565	478	351
				0	0	0	0
13-0906	0	0	0	0	0	0	0
13-0912	39	64	101	52	13	-12	-49
13-0914	37	61	96	74	37	13	-22
13-0915	28	46	73	50	22	4	-23
13-0918	0	0	0	0	0	0	0
13-0921	0	0	0	0	0	0	
13-0927	0	0	0	0	0	0	
13-0930	35	58	92	133	98	75	41
13-0933	146	235	362	172	26	-63	-190
13-0936	92	150	233	131	39	-19	-102
13-0939	0	0	0	0	0	0	0
13-0942	92	150	233	131	39	-19	-102
13-0945	0	0	0	0	0	0	0
13-0948	0	0	0	0	0	0	0
13-0951	0	0	0	0	0	0	0
13-0954	0	0	0	0	0	0	0
13-0957	0	0	0	0	0	0	0
13-0960	0	0	0	0	0	0	0
13-1003	0	0	0	0	0	0	0
13-1006	0	0	0	0	0	0	0
13-1103	103	169	267	542	439	373	275
13-1106	97	159	251	597	500	438	346
13-1112	0	0	0	0	0	0	0
13-1115	61	100	160	58	-3	-42	-102
13-1118	57	95	151	130	73	35	-21
13-1121	0	0	0	0	0	0	0
13-1124	56	93	148	36	-20	-57	-112
13-1127	0	0	0	0	0	0	0
13-1128	0	0	0	0	0	0	0
13-1129	0	0	0	0	0	0	

STRUCTURE NUMBER	FUTURE CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	FUTURE CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
13-1214	0	0	0	0	0	0	0
13-1130	55	91	146	100	45	9	-46
13-1133	54	90	144	80	26	-10	-64
13-1203	0	0	0	0	0	0	0
13-1204	0	0	0	0	0	0	0
13-1206	0	0	0	0	0	0	0
13-1208	0	0	0	0	0	0	0
13-1209	0	0	0	0	0	0	0
13-1210	0	0	0	0	0	0	0
13-1213	0	0	0	0	0	0	0

BASIN 14: SOLDIER CREEK

STRUCTURE NUMBER	FUTURE CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	FUTURE CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
14-0103	143	229	353	272	129	43	-81
14-0106	86	138	214	136	50	-2	-78
14-0109	49	78	123	79	30	1	-44
14-0203	0	0	0	0	0	0	0
14-0206	0	0	0	0	0	0	0
14-0209	0	0	0	0	0	0	0
14-0212	0	0	0	0	0	0	0
14-0215	0	0	0	0	0	0	0
14-0218	0	0	0	0	0	0	0
14-0221	0	0	0	0	0	0	0
14-0224	0	0	0	0	0	0	0
14-0225	0	0	0		0	0	0
14-0226	0	0	0		0	0	0
14-0228	0	0	0		0	0	0
14-0229	0	0	0		0	0	0
14-0230	0	0	0	0	0	0	
14-0233	782	1260	1907	1728	946	468	
14-0236	255	408	620	345	90	-63	-27
14-0303	365	600	926	501	136	-99	-425
14-0309	208	343	534	265	57	-78	-269
14-0312	195	321	501	80	-115	-241	-421
14-0318	83	134	208	100	17	-34	-108
14-0321	83	134	208	180	97	46	-28
14-0323	0	0	0	0	0	0	0
14-0324	0	0	0	0	0	0	0
14-0325	0	0	0		0	0	0
14-0327	217	357	554	379	162	22	-175
14-0328	0	0	0		0	0	0
14-0330	190	313	486	154	-36	-159	-332
14-0331	0	0	0		0	0	0
14-0333	0	0	0	0	0	0	0
14-0336	93	153	240	200	107	47	-40
14-0339	65	107	168	80	15	-27	-88
14-0340	0	0	0		0	0	0
14-0342	9	16	26	103	94	87	77
14-0343	9	16	26	103	94	87	77
14-0345	0	0	0		0	0	0
14-0346	0	0	0		0	0	0
14-0347	0	0	0		0	0	0
14-0348	0	0	0		0	0	

STRUCTURE NUMBER	FUTURE CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	FUTURE CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
14-0349	0	0	0		0	0	0
14-0350	0	0	0		0	0	0
14-0351	0	0	0		0	0	0
14-0352	0	0	0		0	0	0
14-0353	0	0	0		0	0	0
14-0354	0	0	0		0	0	0
14-0355	0	0	0		0	0	0
14-0405	0	0	0		0	0	0
14-0409	73	117	181	46	-27	-71	-135
14-0410	118	189	290	180	62	-9	-110
14-0412	0	0	0	0	0	0	0
14-0415	70	111	173	86	16	-25	-87
14-0418	0	0	0	0	0	0	0
14-0421	64	106	170	52	-12	-54	-118
14-0424	58	96	154	132	74	36	-22
14-0427	0	0	0	0	0	0	0
14-0430	52	86	139	85	33	-1	-54
14-0433	51	85	136	42	-9	-43	-94
14-0436	46	76	123	42	-4	-34	-81
14-0439	46	76	123	42	-4	-34	-81
14-0441	0	0	0	0	0	0	0
14-0444	0	0	0	0	0	0	0
14-0447	0	0	0	0	0	0	0
14-0450	0	0	0	0	0	0	0
14-0453	0	0	0	0	0	0	0
14-0455	0	0	0		0	0	0
14-0457	0	0	0		0	0	0
14-0459	0	0	0		0	0	0
14-0460	0	0	0		0	0	0
14-0462	0	0	0		0	0	0
14-0464	0	0	0		0	0	0

BASIN 15: LITTLE WEKIVA

STRUCTURE NUMBER	FUTURE CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	FUTURE CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
15-0101	0	0	0		0	0	0
15-0102	0	0	0		0	0	0
15-0103	0	0	0	0	0	0	0
15-0104	0	0	0		0	0	0
15-0105	100	160	248	60	-40	-100	-188
15-0107	0	0	0		0	0	0
15-0109	0	0	0	0	0	0	0
15-0112	0	0	0	0	0	0	0
15-0113	541	862	1301	39	-502	-823	-1262
15-0115	0	0	0	0	0	0	0
15-0118	0	0	0	0	0	0	0
15-0121	0	0	0	0	0	0	0
15-0124	0	0	0	0	0	0	0
15-0127	0	0	0	0	0	0	0
15-0130	0	0	0	0	0	0	0
15-0133	0	0	0	0	0	0	0
15-0136	0	0	0	0	0	0	
15-0140	0	0	0		0	0	
15-0142	0	0	0		0	0	0
15-0144	0	0	0		0	0	0
15-0146	0	0	0		0	0	0
15-0148	0	0	0		0	0	0
15-0150	0	0	0		0	0	0
15-0152	0	0	0		0	0	0
15-0154	0	0	0		0	0	0
15-0156	0	0	0		0	0	0
15-0158	0	0	0		0	0	0
15-0160	0	0	0		0	0	0
15-0162	395	633	951	58	-337	-575	-893
15-0164	0	0	0		0	0	0
15-0166	0	0	0		0	0	0
15-0167	0	0	0		0	0	0
15-0168	0	0	0		0	0	0
15-0169	0	0	0		0	0	0
15-0170	69	110	172	85	16	-25	-8
15-0171	76	125	196	220	144	95	2
15-0172	0	0	0		0	0	0
15-0173	0	0	0		0	0	0
15-0174	0	0	0		0	0	0
15-0175	0	0	0		0	0	0

STRUCTURE NUMBER	FUTURE CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	FUTURE CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
15-0202	0	0	0		0	0	0
15-0203	0	0	0	0	0	0	0
15-0204	0	0	0		0	0	0
15-0205	0	0	0		0	0	0
15-0206	0	0	0	0	0	0	0
15-0207	0	0	0		0	0	0
15-0208	0	0	0		0	0	0
15-0209	48	79	127	132	84	53	5
15-0210	0	0	0		0	0	0
15-0211	0	0	0		0	0	0
15-0212	218	358	552	662	444	304	110
15-0213	0	0	0		0	0	0
15-0214	0	0	0		0	0	0
15-0215	195	320	493	87	-108	-233	-406
15-0216	0	0	0		0	0	0
15-0217	0	0	0		0	0	0
15-0218	0	0	0		0	0	0
15-0219	0	0	0		0	0	0
15-0220	86	138	213	120	34	-18	-93
15-0221	0	0	0	0	0	0	0
15-0222	0	0	0		0	0	0
15-0223	0	0	0		0	0	0
15-0224	0	0	0	0	0	0	0
15-0225	0	0	0		0	0	0
15-0226	90	144	222	52	-38	-92	-170
15-0227	398	634	959	480	82	-154	-479
15-0228	0	0	0		0	0	0
15-0229	128	204	315	87	-41	-117	-228
15-0230	49	78	122	213	164	135	91
15-0231	128	204	315	230	102	26	-85
15-0232	0	0	0		0	0	0
15-0233	0	0	0		0	0	0
15-0301	61	99	156	60	-1	-39	-96
15-0302	0	0	0		0	0	0
15-0303	172	283	438	42	-130	-241	-396
15-0304	0	0	0		0	0	0
15-0305	0	0	0		0	0	0
15-0306	113	186	294	180	67	-8	-114
15-0307	0	0	0		0	0	0
15-0308	0	0	0		0	0	0

STRUCTURE NUMBER	FUTURE CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	FUTURE CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
15-0309	153	251	391	65	-88	-186	-326
15-0310	0	0	0	0	0	0	0
15-0311	0	0	0		0	0	0
15-0315	0	0	0	0	0	0	0
15-0402	92	149	232	65	-27	-84	-167
15-0403	0	0	0	0	0	0	0
15-0406	0	0	0	0	0	0	0
15-0407	0	0	0		0	0	0
15-0408	0	0	0		0	0	0
15-0409	0	0	0	0	0	0	0
15-0410	0	0	0		0	0	0
15-0411	0	0	0		0	0	0
15-0412	0	0	0	0	0	0	0
15-0413	0	0	0		0	0	0
15-0415	0	0	0	0	0	0	0
15-0418	0	0	0	0	0	0	
15-0420	111	177	272	220	109	43	
15-0421	0	0	0	0	0	0	0
15-0424	0	0	0		0	0	0
15-0429	123	204	319	578	455	374	259
15-0430	120	199	311	122	2	-77	-189
15-0433	105	174	274	121	16	-53	-153
15-0439	81	135	213	50	-31	-85	-163
15-0444	185	304	473	183	-2	-121	-290
15-0501	0	0	0		0	0	0
15-0502	0	0	0		0	0	0
15-0503	116	192	301	406	290	214	105
15-0504	181	297	459	140	-41	-157	-319
15-0506	99	163	257	150	51	-13	-107
15-0509	0	0	0	0	0	0	0
15-0512	157	255	394	117	-40	-138	-277
15-0513	327	521	787	26	-301	-495	-761
15-0515	0	0	0	0	0	0	0
15-0518	0	0	0	0	0	0	0
15-0521	0	0	0	0	0	0	0
15-0522	0	0	0	0	0	0	0
15-0524	0	0	0	0	0	0	0
15-0527	0	0	0	0	0	0	0
15-0528	0	0	0		0	0	0
15-0529	0	0	0		0	0	0

STRUCTURE NUMBER	FUTURE CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	FUTURE CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
15-0530	0	0	0	0	0	0	0
15-0533	59	95	148	77	18	-18	-71
15-0601	0	0	0		0	0	0
15-0602	0	0	0		0	0	0
15-0603	0	0	0		0	0	0
15-0604	0	0	0		0	0	0
15-0605	0	0	0		0	0	0
15-0606	0	0	0		0	0	0
15-0607	0	0	0		0	0	0
15-0608	0	0	0		0	0	0
15-0609	0	0	0		0	0	0
15-0610	0	0	0		0	0	0
15-0611	0	0	0		0	0	0

BASIN 16: BIG WEKIVA

STRUCTURE NUMBER	FUTURE CONDITIONS FACILITY DEMAND (CFS)			ESTIMATED CAPACITY	FUTURE CONDITIONS RESIDUAL CAPACITY (CFS)		
	10 YEAR	25 YEAR	100 YEAR		10 YEAR	25 YEAR	100 YEAR
16-0103	0	0	0		0	0	0
16-0109	124	207	324	81	-43	-126	-243
16-0112	75	121	189	32	-43	-89	-157
16-0115	125	199	308	32	-93	-167	-276
16-0118	0	0	0	0	0	0	0
16-0120	0	0	0		0	0	0
16-0203	0	0	0	0	0	0	0
16-0206	78	131	206	539	461	408	333
16-0208	0	0	0		0	0	0
16-0209	0	0	0		0	0	0
16-0212	0	0	0		0	0	0
16-0215	0	0	0		0	0	0
16-0303	11	19	31	450	439	431	419
16-0403	153	247	376	58	-95	-189	-318
16-0404	51	82	130	103	52	21	-27

Appendix I

APPENDIX I

APPENDIX I

Seminole County Stormwater

Construction Cost Curves

PBSJ POST, BUCKLEY, SCHUH & JERNIGAN, INC.

COMP. BY: KBD
CHK. BY:
DATE: 1-19-99
SHEET NO.: 1
JOB NO.:

SUBJECT: Seminole County Stormwater - Construction Cost Curves

Purpose: To develop construction cost curves for replacement of existing inadequate drainage structures with the following structure types:

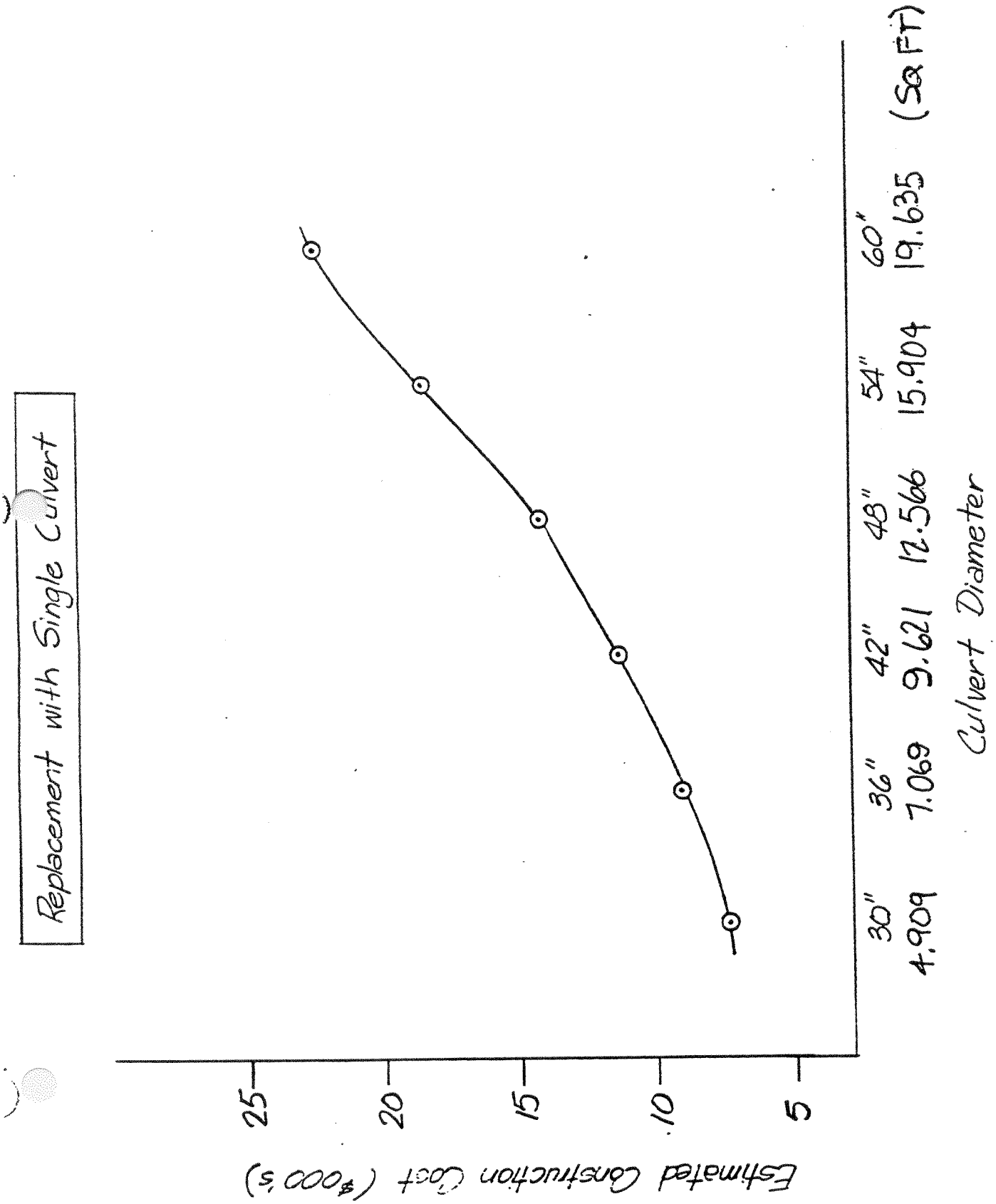
- single culvert (30" through 60")
- double culvert (30" through 60")
- triple culvert (30" through 60")
- box culvert (3'x3' through 2-5'x10')
- bridge (slab span or AASHTO girder, depending on bridge length and channel hydraulics)

All construction cost curves are based on preliminary estimated construction costs and assumptions stated herein.

POST, BUCKLEY, SCHUH & JERNIGAN, INC.

COMP. BY: KED
CHK. BY:
DATE: 1-19-88
SHEET NO.: 2
JOB NO.:

PROJECT: Seminole County Stormwater - Construction Cost Curves



POST, BUCKLEY, SCHUH & JERNIGAN, INC.

COMP. BY: KBD
CHK. BY:
DATE: 1-19-88
SHEET NO.: 3
JOB NO.:

SUBJECT: Seminole County Stormwater - Construction Cost Curves

Estimated Construction Cost

1-30" culvert

Remove and replace asphaltic pavement:
(50' × 5.5')/9 = 30.6 sq. yds. @ $24.00/sq.yd. = $734.40

Remove existing drainage structure = 600.00

Additional excavation:
(50' × 4' × 3.5')/27 = 25.9 cyds @ $7.00/cyd. = 181.30

30" culvert pipe:
50 lf @ $42.00/lf = 2,100.00

Bedding and backfill material:
(50' × 4' × 4.5')/27 = 33.3 cyds @ $20.00/cyd = 666.00

Reinforced concrete headwalls:
~~2×[(' × ') (sq.ft)]× 1/27~~ = 6.68 cyds
@ $350.00/cyd = 2,338.00

Subtotal $6,619.70
Constr. Contingency 680.30
Total Est. Constr. Cost $7,300.00

POST, BUCKLEY, SCHUH & JERNIGAN, INC.

COMP. BY: KBD
CHK. BY:
DATE: 1-19-88
SHEET NO.: 4
JOB NO.:

: Seminole County Stormwater-
Construction Cost Curves

Estimated Construction Cost

1-36" culvert

Remove and replace asphaltic pavement:
(50' x 6')/9 = 33.3 sq. yds. @ $24.00/sq.yd. = $ 799.20

Remove existing drainage structure = 650.00

Additional excavation:
(50' x 4' ~~x 3.5'~~ 4')/27 = 29.6 cyds @ $ 7.00/cyd. = 207.20

36" culvert pipe:
50 lf @ $ 50.00/lf = 2,500.00

Bedding and backfill material:
(50' x 4' ~~x 4.5'~~ 5')/27 = 37.0 cyds @ $20.00/cyd = 740.00

Reinforced concrete headwalls:
~~2 x [(' x ') (sq ft)] x 1/27~~ = 9.28 cyds
@ $350.00/cyd = 3,248.00

Subtotal $8,144.40

Constr. Contingency 855.60

Total Est. Constr. Cost $9,000.00

POST, BUCKLEY, SCHUH & JERNIGAN, INC.

COMP. BY: KBD
CHK. BY:
DATE: 1-19-88
SHEET NO.: 5
JOB NO.:

SUBJECT: Seminole County Stormwater-
Construction Cost Curves

Estimated Construction Cost

1-42" culvert

Remove and replace asphaltic pavement:
(50' x 6.5')/9 = 36.1 sq. yds. @ $24.00/sq.yd. = 866.40

Remove existing drainage structure = 700.00

Additional excavation:
(50' x 4' x ~~3.5~~ 4.5')/27 = 33.3 cyds @ $ 7.00/cyd. = 233.10

42" culvert pipe:
50 lf @ $ 65.00/lf = 3,250.00

Bedding and backfill material:
(50' x 4' x ~~4.5~~ 5.5')/27 = 40.7 cyds @ $20.00/cyd = 814.00

Reinforced concrete headwalls:
~~2 x [(' x ') x (sq. ft.)] x 1/27~~ = 12.98 cyds
@ $350.00/cyd = 4,543.00

Subtotal $10,406.50

Constr. Contingency 993.50

Total Est. Constr. Cost $11,400.00

POST, BUCKLEY, SCHUH & JERNIGAN, INC.

COMP. BY: KBD
CHK. BY:
DATE: 1-19-88
SHEET NO.: 6
JOB NO.:

Seminole County Stormwater-
Construction Cost Curves

Estimated Construction Cost

1-48" culvert

Remove and replace asphaltic pavement:
(50' x 8')/9 = 44.4 sq. yds. @ $24.00/sq.yd. = $ 1,065.60

Remove existing drainage structure = 700.00

Additional excavation:
(50' x 6.5' x 3.5')/27 = 60.2 cyds @ $ 7.00/cyd. = 421.40
5

48" culvert pipe:
50 lf @ $ 75.00/lf = 3,750.00

Bedding and backfill material:
(50' x 5' x 4.5')/27 = 55.6 cyds @ $20.00/cyd = 1,112.00
6'

Reinforced concrete headwalls:
~~2 x [(' x ') x (sq.ft.)] x 1/27~~ = 16.76 cyds
@ $ 350.00/cyd = 5,866.00

Subtotal $ 12,915.00

Constr. Contingency 1,285.00

Total Est. Constr. Cost $ 14,200.00

POST, BUCKLEY, SCHUH & JERNIGAN, INC.

COMP. BY: KBD
CHK. BY:
DATE: 1-19-88
SHEET NO.: 7
JOB NO.:

PROJECT: Seminole County Stormwater - Construction Cost Curves

Estimated Construction Cost

1-54" culvert

Remove and replace asphaltic pavement:
(50' × 8.5')/9 = 47.2 sq. yds. @ $24.00/sq.yd. = $1,132.80

Remove existing drainage structure = 700.00

Additional excavation:
(50' × 7.0' × ~~3.5~~ 5.5)/27 = 71.3 cyds @ $ 7.00/cyd. = 499.10

54" culvert pipe:
50 lf @ $100.00/lf = 5,000.00

Bedding and backfill material:
(50' × 5' × ~~4.5~~ 6.5')/27 = 60.2 cyds @ $20.00/cyd = 1,204.00

Reinforced concrete headwalls:
~~2×[(' × ') - (sq. ft.)] × 1/27~~ = 23.54 cyds
@ $350.00/cyd = 8,239.00

Subtotal $16,774.90

Constr. Contingency 1,725.10

Total Est. Constr. Cost $18,500.00

POST, BUCKLEY, SCHUH & JERNIGAN, INC.

COMP. BY: KBD
CHK. BY:
DATE: 1-19-88
SHEET NO.: 8
JOB NO.:

PROJECT: Seminole County Stormwater-
Construction Cost Curves

Estimated Construction Cost

1-60" culvert

Remove and replace asphaltic pavement:
(50' × 9')/9 = 50.0 sq. yds. @ $24.00/sq.yd. = $1,200.00

Remove existing drainage structure = 700.00

Additional excavation:
(50' × 7.5' × ~~3.5'~~ 6')/27 = 83.3 cyds @ $ 7.00/cyd. = 583.10

60" culvert pipe:
50 lf @ $120.00/lf = 6,000.00

Bedding and backfill material:
(50' × 5' × ~~4.5'~~ 7')/27 = 64.8 cyds @ $20.00/cyd = 1,296.00

Reinforced concrete headwalls:
~~2 × [(' × ') - (sq ft)] × 1/27~~ = 30.40 cyds
@ $350.00/cyd = 10,640.00

Subtotal $ 20,419.10

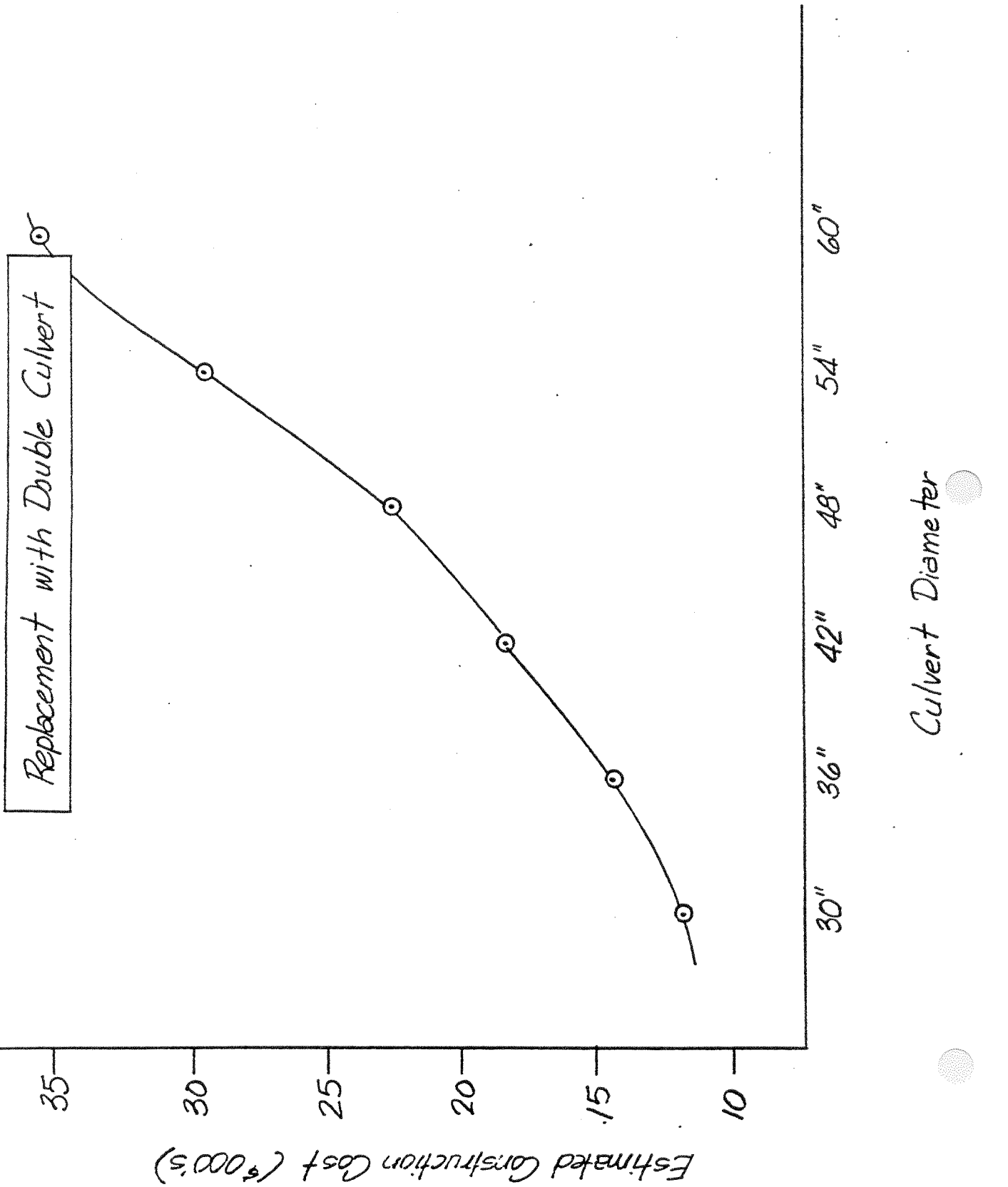
Constr. Contingency 2,080.90

Total Est. Constr. Cost $ 22,500.00

PBSJ POST, BUCKLEY, SCHUH & JERNIGAN, INC.

COMP. BY: KBD
CHK. BY:
DATE: 1-19-93
SHEET NO.: 9
JOB NO.:

SUBJECT: Seminole County Stormwater - Construction Cost Curves



POST, BUCKLEY, SCHUH & JERNIGAN, INC.

COMP. BY: KBD
CHK. BY:
DATE: 1-19-88
SHEET NO.: 10
JOB NO.:

: Seminole County Stormwater-
Construction Cost Curves

Estimated Construction Cost

2 - 30" culverts

Remove and replace asphaltic pavement:
(50' × 10')/9 = 55.6 sq. yds. @ $24.00/sq.yd. = $1,334.40

Remove existing drainage structure = 700.00

Additional excavation:
(50' × 8' × 3.5')/27 = 51.9 cyds @ $7.00/cyd. = 363.30

30" culvert pipe:
2 × 50 lf @ $42.00/lf = 4,200.00

Bedding and backfill material:
(50' × 7' × 4.5')/27 = 58.3 cyds @ $20.00/cyd = 1,166.00

Reinforced concrete headwalls:
~~2×[(' × ') (sq.ft.)]× 1/27~~ = 8.56 cyds
@ $350.00/cyd = 2,996.00

Subtotal $10,759.70

Construction Contingency 1,040.30

Total Est. Constr. Cost $11,800.00

PBSJ POST, BUCKLEY, SCHUH & JERNIGAN, INC.

COMP. BY: KBD
CHK. BY:
DATE: 1-19-88
SHEET NO.: 11
JOB NO.:

SUBJECT: Seminole County Stormwater - Construction Cost Curves

Estimated Construction Cost

2- 36" culverts

Remove and replace asphaltic pavement:

(50' x 11')/9 = 61.1 sq. yds. @ $24.00/sq.yd. = $1,466.40

Remove existing drainage structure = 750.00

Additional excavation:

(50' x 8.5' x ~~3.5'~~ 4')/27 = 63.0 cyds @ $ 7.00/cyd. = 441.00

36" culvert pipe:

2 x 50 lf @ $ 50.00/lf = 5,000.00

Bedding and backfill material:

(50' x 7' x ~~4.5'~~ 5')/27 = 64.8 cyds @ $20.00/cyd = 1,296.00

Reinforced concrete headwalls:

~~2 x [(' x ') (sq. ft.)] x 1/27~~ = 11.90 cyds

@ $350.00/cyd = 4,165.00

Subtotal $13,118.40

Construction Contingency 1,281.60

Total Est. Constr. Cost $14,400.00

POST, BUCKLEY, SCHUH & JERNIGAN, INC.

COMP. BY: KBD
CHK. BY:
DATE: 1-19-88
SHEET NO.: 12
JOB NO.:

Seminole County Stormwater-
Construction Cost Curves

Estimated Construction Cost

2-42" culverts

Remove and replace asphaltic pavement:
(50' x 12')/9 = 66.7 sq. yds. @ $24.00/sq.yd. = 1,600.80

Remove existing drainage structure = 800.00

Additional excavation:
(50' x 9' x ~~3.5~~ 4.5')/27 = 75.0 cyds @ $ 7.00/cyd. = 525.00

42" culvert pipe:
2 x 50 lf @ $ 65.00/lf = 6,500.00

Bedding and backfill material:
(50' x 7' x ~~4.5~~ 5.5')/27 = 71.3 cyds @ $20.00/cyd = 1,426.00

Reinforced concrete headwalls:
~~2x[(' x ') - (sq. ft)] x 1/27~~ = 16.86 cyds
@ $350.00/cyd = 5,901.00

Subtotal $16,752.80

Construction Contingency 1,647.20

Total Est. Constr. Cost $18,400.00

PBSJ POST, BUCKLEY, SCHUH & JERNIGAN, INC.

COMP. BY: KBD
CHK. BY:
DATE: 1-19-88
SHEET NO.: 13
JOB NO.:

SUBJECT: Seminole County Stormwater - Construction Cost Curves

Estimated Construction Cost

2-48" culverts

Remove and replace asphaltic pavement:
(50' × 15')/9 = 83.3 sq. yds. @ $24.00/sq.yd. = $1,999.20

Remove existing drainage structure = 850.00

Additional excavation:
(50' × 9.5' ~~3.5'~~ 5')/27 = 88.0 cyds @ $ 7.00/cyd. = 616.00

48" culvert pipe:
2 × 50 lf @ $ 75.00 /lf = 7,500.00

Bedding and backfill material:
(50' × 9' × ~~4.5'~~ 6')/27 = 100.0 cyds @ $20.00/cyd = 2,000.00

Reinforced concrete headwalls:
~~2×[(' × ') (sq.ft)] × 1/27~~ = 21.70 cyds
@ $350.00/cyd = 7,595.00

Subtotal $20,560.20

Construction Contingency 2,039.80

Total Est. Constr. Cost $22,600.00

POST, BUCKLEY, SCHUH & JERNIGAN, INC.

COMP. BY: KBD
CHK. BY:
DATE: 1-19-88
SHEET NO.: 14
JOB NO.:

Seminole County Stormwater-
Construction Cost Curves

Estimated Construction Cost

2-54" culverts

Remove and replace asphaltic pavement:
(50' x 16')/9 = 88.9 sq. yds. @ $24.00/sq.yd. = $2,133.60

Remove existing drainage structure = 900.00

Additional excavation:
(50' x 10' x ~~3.5'~~ 5.5')/27 = 101.9 cyds @ $ 7.00/cyd. = 713.30

54" culvert pipe:
2 x 50 lf @ $100.00/lf = 10,000.00

Bedding and backfill material:
(50' x 9' x ~~4.5'~~ 6.5')/27 = 108.3 cyds @ $20.00/cyd = 2,166.00

Reinforced concrete headwalls:
~~2 x [(' x ') - (sq. ft.)] x 1/27~~ = 31.46 cyds
@ $350.00/cyd = 11,011.00

Subtotal $26,923.90

Construction Contingency 2,676.10

Total Est. Constr. Cost $29,600.00

PBSJ POST, BUCKLEY, SCHUH & JERNIGAN, INC.

COMP. BY: KBD
CHK. BY:
DATE: 1-19-88
SHEET NO.: 15
JOB NO.:

SUBJECT: Seminole County Stormwater-
Construction Cost Curves

Estimated Construction Cost

2-60" culverts

Remove and replace asphaltic pavement:
(50' × 17')/9 = 94.4 sq. yds. @ $24.00/sq.yd. = $2,265.60

Remove existing drainage structure = 1,000.00

Additional excavation:
(50' × 11' × ~~3.5'~~ 6')/27 = 122.2 cyds @ $ 7.00/cyd. = 855.40

60" culvert pipe:
2 × 50 lf @ $ 120.00/lf = 12,000.00

Bedding and backfill material:
(50' × 9' × ~~4.5'~~ 7')/27 = 116.7 cyds @ $20.00/cyd = 2,334.00

Reinforced concrete headwalls:
~~2 × [(' × ') - (sq. ft.)] × 1/27~~ = 39.50 cyds
@ $350.00/cyd = 13,825.00

Subtotal $32,280.00

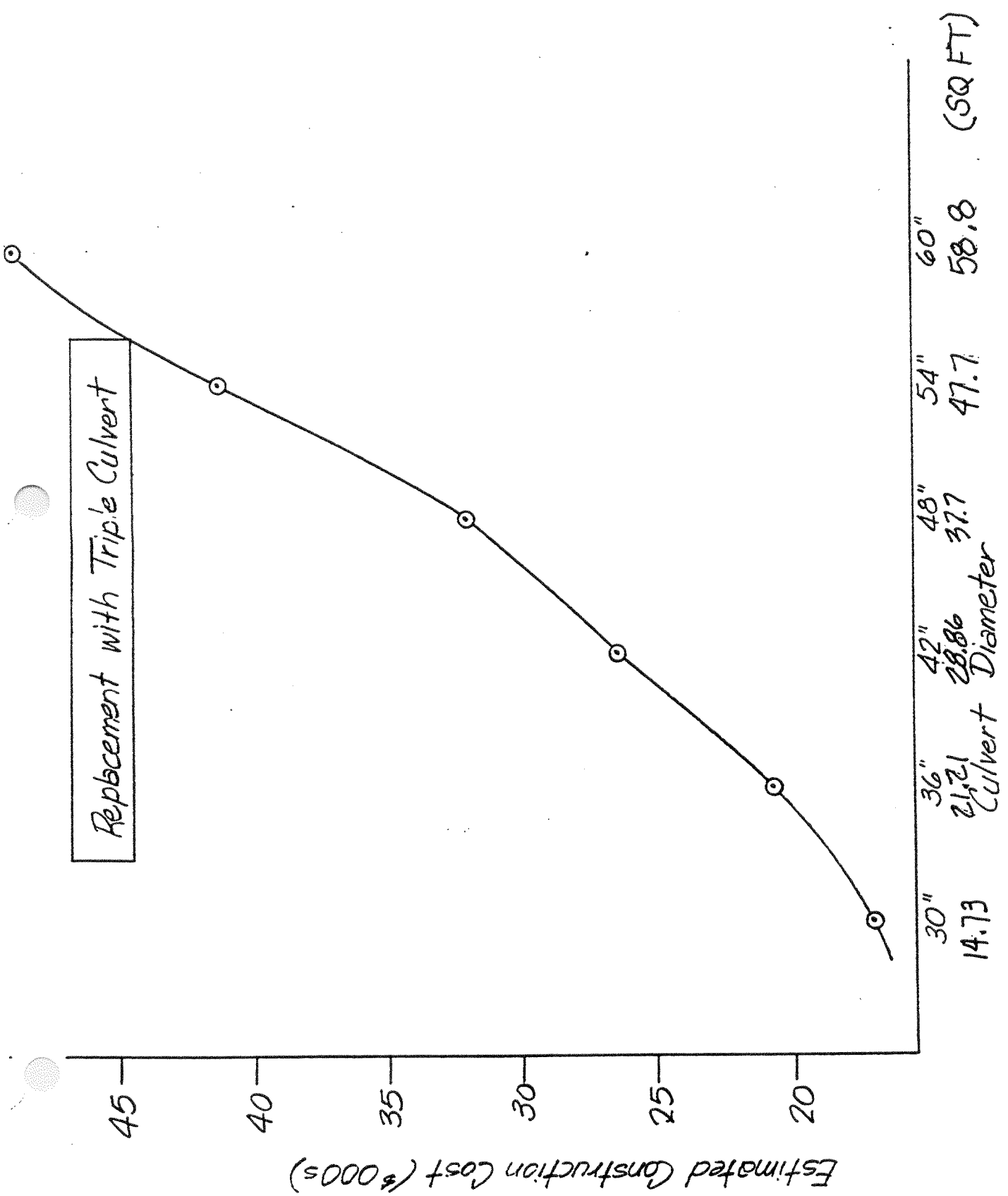
Construction Contingency 3,220.00

Total Est. Constr. Cost $35,500.00

BSJ POST, BUCKLEY, SCHUH & JERNIGAN, INC.

COMP. BY: KRD
CHK. BY:
DATE: 1-19-88
SHEET NO.: 16
JOB NO.:

SUBJECT: Seminole County Stormwater - Construction Cost Curves



PBSJ POST, BUCKLEY, SCHUH & JERNIGAN, INC.

COMP. BY: KBD
CHK. BY:
DATE: 1-19-88
SHEET NO.: 17
JOB NO.:

SUBJECT: Seminole County Stormwater - Construction Cost Curves

Estimated Construction Cost

3-30" culverts

Remove and replace asphaltic pavement:
(50' x 16.5')/9 = 91.7 sq. yds. @ $24.00/sq.yd. = $2,200.80

Remove existing drainage structure = 800.00

Additional excavation:
(50' x 14' x 3.5')/27 = 90.7 cyds @ $ 7.00/cyd. = 634.90

30" culvert pipe:
3 x 50 lf @ $ 42.00/lf = 6,300.00

Bedding and backfill material:
(50' x 12' x 4.5')/27 = 100.0 cyds @ $20.00/cyd = 2,000.00

Reinforced concrete headwalls:
~~2 x [(x) = (sq. ft.)] x 1/27~~ 10.40 cyds
@ $350.00/cyd = 3,640.00

Subtotal $15,575.70

Construction Contingency 1,524.30

Total Est. Constr. Cost $17,100.00

POST, BUCKLEY, SCHUH & JERNIGAN, INC.

COMP. BY: KBD
CHK. BY:
DATE: 1-19-88
SHEET NO.: 18
JOB NO.:

: Seminole County Stormwater-
Construction Cost Curves

Estimated Construction Cost

3-36" culverts

Remove and replace asphaltic pavement:
(50' x 18')/9 = 100.0 sq. yds. @ $24.00/sq.yd. = $2,400.00

Remove existing drainage structure = 900.00

Additional excavation:
(50' x 15' x ~~3.5~~ 4')/27 = 111.1 cyds @ $ 7.00/cyd. = 777.70

36" culvert pipe:
3 x 50 lf @ $ 50.00/lf = 7,500.00

Bedding and backfill material:
(50' x 12' x ~~4.5~~ 5')/27 = 111.1 cyds @ $20.00/cyd = 2,222.00

Reinforced concrete headwalls:
~~2x[(' x ') (sq. ft.)] x 1/27~~ = 14.50 cyds
@ $350.00/cyd = 5,075.00

Subtotal $18,874.70

Constr. Contingency 1,925.30

Total Est. Constr. Cost $20,800.00

POST, BUCKLEY, SCHUH & JERNIGAN, INC.

COMP. BY: KBD
CHK. BY:
DATE: 1-19-88
SHEET NO.: 19
JOB NO.:

SUBJECT: Seminole County Stormwater - Construction Cost Curves

Estimated Construction Cost

3-42" culverts

Remove and replace asphaltic pavement:
(50' x 19.5')/9 = 108.3 sq. yds. @ $24.00/sq.yd. = $2,599.20

Remove existing drainage structure = 1,000.00

Additional excavation:
(50' x 16' x ~~3.5'~~ 4.5')/27 = 133.3 cyds @ $ 7.00/cyd. = 933.10

42" culvert pipe:
3 x 50 lf @ $ 65.00/lf = 9,750.00

Bedding and backfill material:
(50' x 12' x ~~4.5'~~ 5.5')/27 = 122.2 cyds @ $20.00/cyd = 2,444.00

Reinforced concrete headwalls:
~~2 x [(' x ') (sq.ft.)] x 1/27~~ = 20.76 cyds
@ $350.00/cyd = 7,266.00

Subtotal $ 23,992.30

Constr. Contingency 2,407.70

Total Est. Constr. Cost $ 26,400.00

POST, BUCKLEY, SCHUH & JERNIGAN, INC.

COMP. BY: KBD
CHK. BY:
DATE: 1-19-88
SHEET NO.: 20
JOB NO.:

Seminole County Stormwater-
Construction Cost Curves

Estimated Construction Cost

3-48" culverts

Remove and replace asphaltic pavement:
(50' x 23')/9 = 127.8 sq. yds. @ $24.00/sq.yd. = $3,067.20

Remove existing drainage structure = 1,100.00

Additional excavation:
(50' x 19' x ~~3.5'~~ 5')/27 = 175.9 cyds @ $7.00/cyd. = 1,231.30

48" culvert pipe:
3x50 lf @ $75.00/lf = 11,250.00

Bedding and backfill material:
(50' x 14' x ~~4.5'~~ 6')/27 = 155.6 cyds @ $20.00/cyd = 3,112.00

Reinforced concrete headwalls:
~~2x[(' x ') (sq.ft.)] x 1/27~~ = 26.68 cyds
@ $350.00/cyd = 9,338.00

Subtotal $29,098.50
Constr. Contingency 2,901.50
Total Est. Constr. Cost $32,000.00

POST, BUCKLEY, SCHUH & JERNIGAN, INC.

COMP. BY: KBD
CHK. BY:
DATE: 1-19-88
SHEET NO.: 21
JOB NO.:

SUBJECT: Seminole County Stormwater - Construction Cost Curves

Estimated Construction Cost

3-54" culverts

Remove and replace asphaltic pavement:
(50' × 24.5')/9 = 136.1 sq. yds. @ $24.00/sq.yd. = $3,266.40

Remove existing drainage structure = 1,200.00

Additional excavation:
(50' × 20' × ~~3.5'~~ 5.5')/27 = 203.7 cyds @ $7.00/cyd. = 1,425.90

54" culvert pipe:
3×50 lf @ $100.00/lf = 15,000.00

Bedding and backfill material:
(50' × 14' × ~~4.5'~~ 6.5')/27 = 168.5 cyds @ $20.00/cyd = 3,370.00

Reinforced concrete headwalls:
~~2×[(' × ') + (sq.ft.)] × 1/27~~ = 37.90 cyds
@ $350.00/cyd = 13,265.00

Subtotal	$ 37,527.30
Constr. Contingency	3,772.70
Total Est. Constr. Cost	$ 41,300.00

POST, BUCKLEY, SCHUH & JERNIGAN, INC.

COMP. BY: KBD
CHK. BY:
DATE: 1-19-88
SHEET NO.: 22
JOB NO.:

Seminole County Stormwater-
Construction Cost Curves

Estimated Construction Cost

3-60" culverts

Remove and replace asphaltic pavement:
(50' x 26')/9 = 144.4 sq. yds. @ $24.00/sq.yd. = $3,465.60

Remove existing drainage structure = 1,300.00

Additional excavation:
(50' x 21' x ~~3.5'~~ 6')/27 = 233.3 cyds @ $ 7.00/cyd. = 1,633.10

60" culvert pipe:
3 x 50 lf @ $120.00/lf = 18,000.00

Bedding and backfill material:
(50' x 14' x ~~4.5'~~ 7')/27 = 181.5 cyds @ $20.00/cyd = 3,630.00

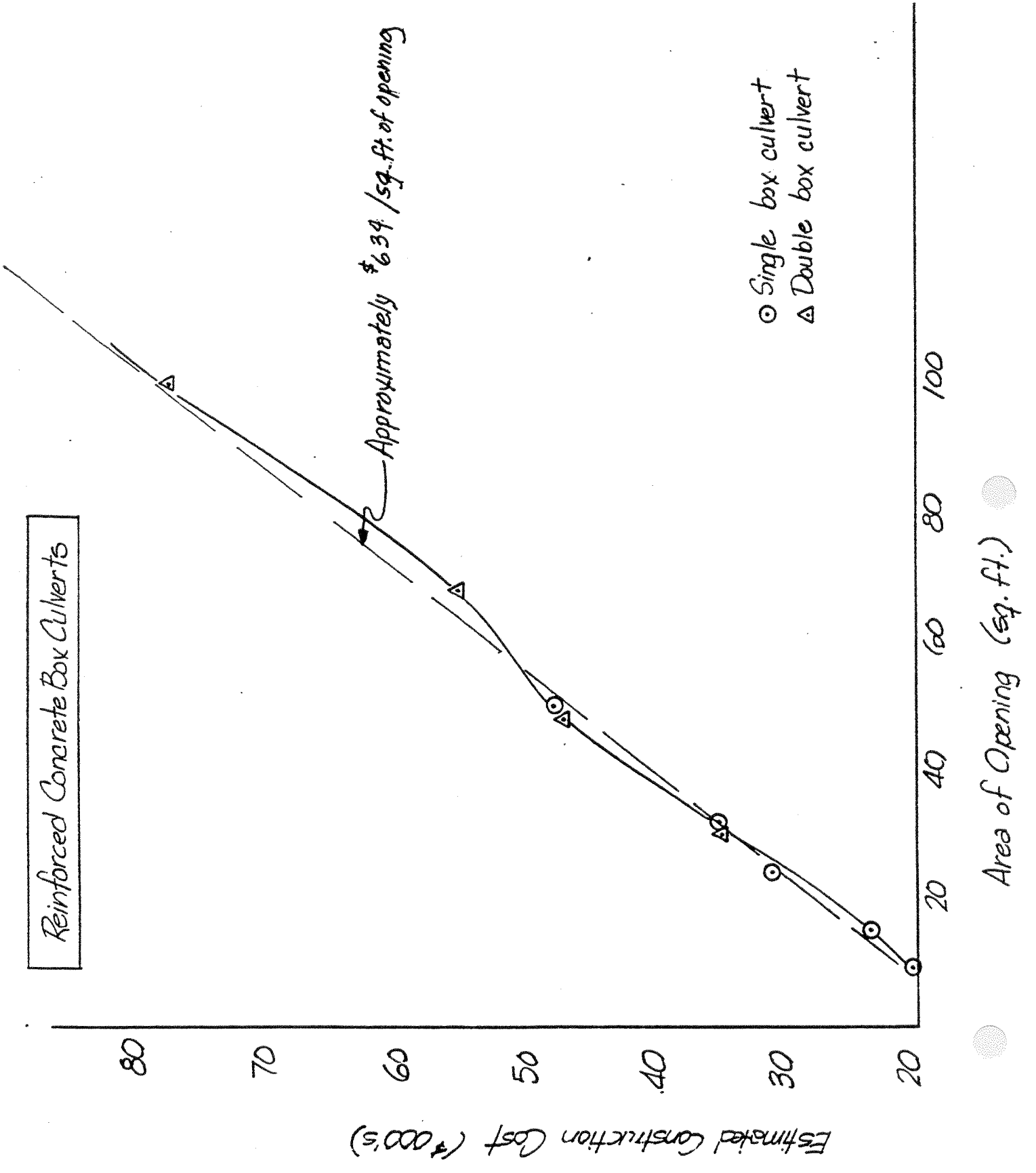
Reinforced concrete headwalls:
~~2 x [(' x ') (sq. ft.)] x 1/27~~ = 47.00 cyds
@ $350.00/cyd = 16,450.00

Subtotal	$44,478.70
Constr. Contingency	4,421.30
Total Est. Constr. Cost	$48,900.00

PBSJ POST, BUCKLEY, SCHUH & JERNIGAN, INC.

COMP. BY: KBD
CHK. BY:
DATE: 1-20-88
SHEET NO.: 23
JOB NO.:

SUBJECT: Seminole County Stormwater-
Construction Cost Curves



POST, BUCKLEY, SCHUH & JERNIGAN, INC.

COMP. BY: KBD
CHK. BY:
DATE: 1-20-88
SHEET NO.: 24
JOB NO.:

PROJECT: Seminole County Stormwater - Construction Cost Curves

Estimated Construction Costs

3' x 3' Box Culvert

Excavation (includes removal of existing pipe culvert):

50' x 14' x 7'/27 = 181 cyds @ $ 7.00/cyd = $ 1,267.00

Remove and replace asphaltic pavement:

50' x 19'/9 = 106 sq. yds. @ $24.00/cyd = 2,544.00

Backfill:

50' x 11' x 7'/27 = 143 cyds @ $13.00/cyd = 1,859.00

Reinforced Concrete:

29.7 cyds. @ $ 400.00/cyd = 11,880.00

Subtotal	$ 17,550.00
Construction Contingency	1,750.00
Total Estimated Construction Cost	$ 19,300.00

PBSJ POST, BUCKLEY, SCHUH & JERNIGAN, INC.

COMP. BY: KBD
CHK. BY:
DATE: 1-20-88
SHEET NO.: 25
JOB NO.:

PROJECT: Seminole County Stormwater - Construction Cost Curves

Estimated Construction Costs

3' x 5' Box Culvert

Excavation (includes removal of existing pipe culvert):

50' x 16' x 7'/27 = 207 cyds @ $ 7.00/cyd = $ 1,449.00

Remove and replace asphaltic pavement:

50' x 21'/9 = 117 sq. yds. @ $24.00/cyd = 2,808.00

Backfill:

50' x 11' x 7'/27 = 143 cyds @ $13.00/cyd = 1,859.00

Reinforced Concrete:

36.5 cyds. @ $ 400.00/cyd = 14,600.00

Subtotal	$ 20,716.00
Construction Contingency	2,084.00
Total Estimated Construction Cost	$ 22,800.00

BSJ POST, BUCKLEY, SCHUH & JERNIGAN, INC.

COMP. BY: KBD
CHK. BY:
DATE: 1-20-88
SHEET NO.: 26
JOB NO.:

PROJECT: Seminole County Stormwater - Construction Cost Curves

Estimated Construction Costs

4' x 6' Box Culvert

Excavation (includes removal of existing pipe culvert):

50' x 18' x 8'/27 = 267 cyds @ $ 7.00/cyd = $ 1,869.00

Remove and replace asphaltic pavement:

50' x 24'/9 = 133 sq. yds. @ $24.00/cyd = 3,192.00

Backfill:

50' x 12' x 8'/27 = 178 cyds @ $13.00/cyd = 2,314.00

Reinforced Concrete:

50.7 cyds. @ $ 400.00/cyd = 20,280.00

Subtotal $27,655.00

Construction Contingency 2,745.00

Total Estimated Construction Cost $30,400.00

PBSJ POST, BUCKLEY, SCHUH & JERNIGAN, INC.

COMP. BY: KBD
CHK. BY:
DATE: 1-20-98
SHEET NO.: 27
JOB NO.:

PROJECT: Seminole County Stormwater - Construction Cost Curves

Estimated Construction Costs

4' x 8' Box Culvert

Excavation (includes removal of existing pipe culvert):

50' x 20' x 8'/27 = 296 cyds @ $ 7.00/cyd = $ 2,072.00

Remove and replace asphaltic pavement:

50' x 26'/9 = 144 sq. yds. @ $24.00/cyd = 3,456.00

Backfill:

50' x 12' x 8'/27 = 178 cyds @ $13.00/cyd = 2,314.00

Reinforced Concrete:

58.7 cyds. @ $400.00/cyd = 23,480.00

Subtotal	$ 31,322.00
Construction Contingency	3,178.00
Total Estimated Construction Cost	$ 34,500.00

BSJ POST, BUCKLEY, SCHUH & JERNIGAN, INC.

COMP. BY: KBD
CHK. BY:
DATE: 1-20-88
SHEET NO.: 28
JOB NO.:

PROJECT: Seminole County Stormwater - Construction Cost Curves

Estimated Construction Costs

5' x 10' Box Culvert

Excavation (includes removal of existing pipe culvert):

50' x 24' x 9'/27 = 400 cyds @ $ 7.00/cyd = $ 2,800.00

Remove and replace asphaltic pavement:

50' x 32'/9 = 178 sq. yds. @ $24.00/cyd = 4,272.00

Backfill:

50' x 14' x 9'/27 = 233 cyds @ $13.00/cyd = 3,029.00

Reinforced Concrete:

83.2 cyds. @ $400.00/cyd = 33,280.00

Subtotal $43,381.00

Construction Contingency 4,319.00

Total Estimated Construction Cost $47,700.00

PBS POST, BUCKLEY, SCHUH & JERNIGAN, INC.

COMP. BY: KBD
CHK. BY:
DATE: 1-20-88
SHEET NO.: 29
JOB NO.:

PROJECT: Seminole County Stormwater - Construction Cost Curves

Estimated Construction Costs

2- 3' x 5' Box Culvert

Excavation (includes removal of existing pipe culvert):

50' x 22' x 7'/27 = 285 cyds @ $ 7.00/cyd = $ 1,995.00

Remove and replace asphaltic pavement:

50' x 27'/9 = 150 sq. yds. @ $24.00/cyd = 3,600.00

Backfill:

50' x 11' x 7'/27 = 143 cyds @ $13.00/cyd = 1,859.00

Reinforced Concrete:

59.6 cyds. @ $400.00/cyd = 23,840.00

Subtotal	$ 31,294.00
Construction Contingency	3,106.00
Total Estimated Construction Cost	$ 34,400.00

POST, BUCKLEY, SCHUH & JERNIGAN, INC.

COMP. BY: KBD
CHK. BY:
DATE: 1-20-88
SHEET NO.: 30
JOB NO.:

PROJECT: Seminole County Stormwater - Construction Cost Curves

Estimated Construction Costs

2- 4' x 6' Box Culvert

Excavation (includes removal of existing pipe culvert):

50' x 25' x 8'/27 = 370 cyds @ $ 7.00/cyd = $ 2,590.00

Remove and replace asphaltic pavement:

50' x 31'/9 = 172 sq. yds. @ $24.00/cyd = 4,128.00

Backfill:

50' x 12' x 8'/27 = 178 cyds @ $13.00/cyd = 2,314.00

Reinforced Concrete:

84.0 cyds. @ $400.00/cyd = 33,600.00

Subtotal	$ 42,632.00
Construction Contingency	4,268.00
Total Estimated Construction Cost	$ 46,900.00

PBSJ POST, BUCKLEY, SCHUH & JERNIGAN, INC.

COMP. BY: KBD
CHK. BY:
DATE: 1-20-88
SHEET NO.: 31
JOB NO.:

SUBJECT: Seminole County Stormwater - Construction Cost Curves

Estimated Construction Costs

2-4' x 8' Box Culvert

Excavation (includes removal of existing pipe culvert):

50' x 29' x 8'/27 = 430 cyds @ $ 7.00/cyd = $ 3,010.00

Remove and replace asphaltic pavement:

50' x 35'/9 = 194 sq. yds. @ $24.00/cyd = 4,656.00

Backfill:

50' x 12' x 8'/27 = 178 cyds @ $13.00/cyd = 2,314.00

Reinforced Concrete:

100.0 cyds. @ $400.00/cyd = 40,000.00

Subtotal	$ 49,980.00
Construction Contingency	5,020.00
Total Estimated Construction Cost	$ 55,000.00

BSJ POST, BUCKLEY, SCHUH & JERNIGAN, INC.

COMP. BY: KBD
CHK. BY:
DATE: 1-20-88
SHEET NO.: 32
JOB NO.:

PROJECT: Seminole County Stormwater - Construction Cost Curves

Estimated Construction Costs

2-5' x 10' Box Culvert

Excavation (includes removal of existing pipe culvert):
50' x 35' x 9'/27 = 583 cyds @ $ 7.00/cyd = $ 4,081.00

Remove and replace asphaltic pavement:
50' x 43'/9 = 239 sq. yds. @ $24.00/cyd = 5,736.00

Backfill:
50' x 14' x 9'/27 = 233 cyds @ $13.00/cyd = 3,029.00

Reinforced Concrete:
143.0 cyds. @ $400.00/cyd = 57,200.00

Subtotal $ 70,046.00

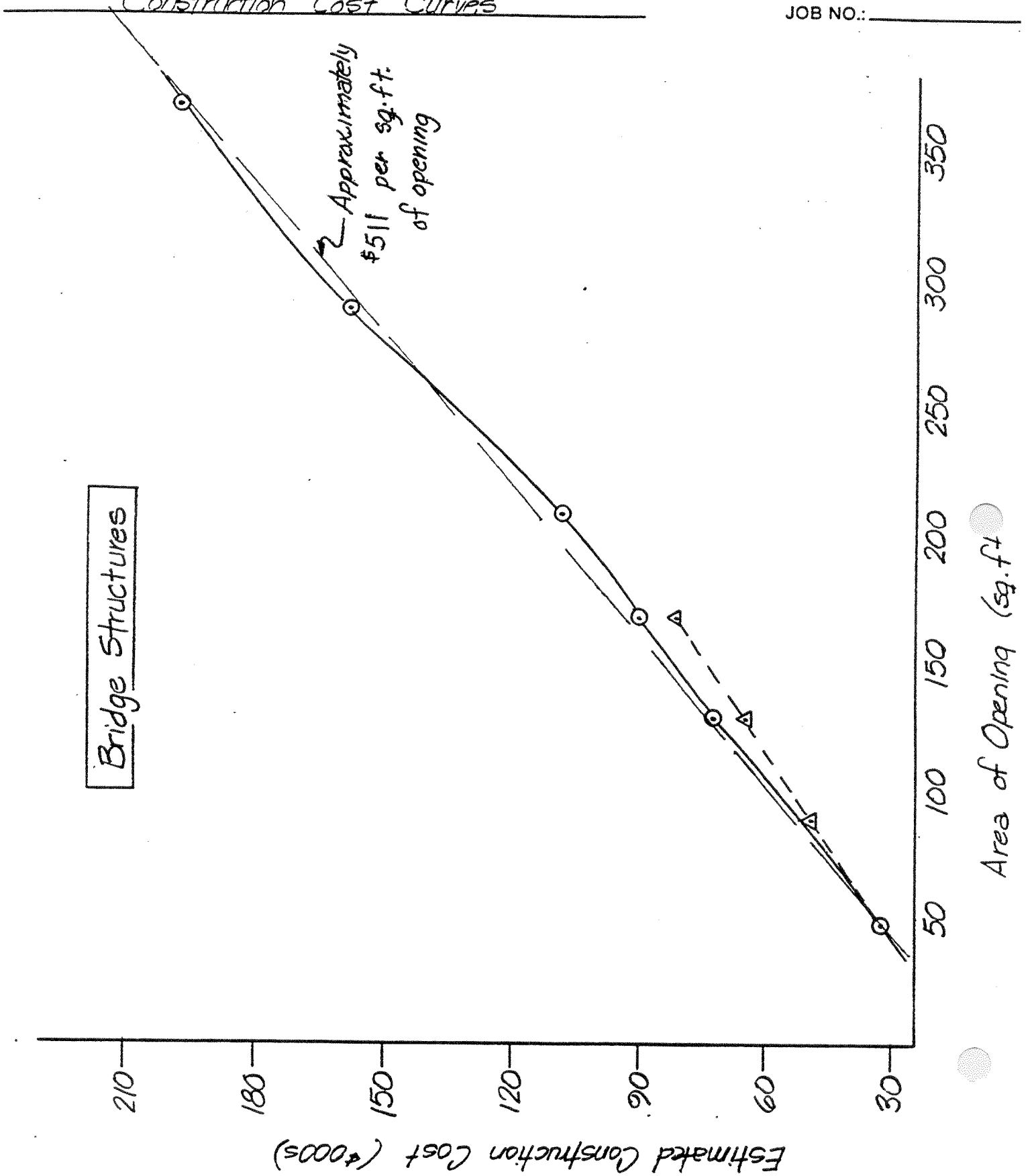
Construction Contingency 6,954.00

Total Estimated Construction Cost $ 77,000.00

PBSJ POST, BUCKLEY, SCHUH & JERNIGAN, INC.

COMP. BY: KBD
CHK. BY:
DATE: 1-21-98
SHEET NO.: 33
JOB NO.:

SUBJECT: Seminole County Stormwater-
Construction Cost Curves



POST, BUCKLEY, SCHUH & JERNIGAN, INC.

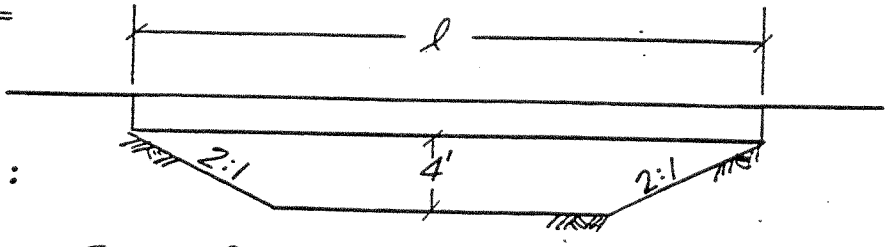
COMP. BY: KBD
CHK. BY:
DATE: 1-21-88
SHEET NO.: 34
JOB NO.:

PROJECT: Seminole County Stormwater - Construction Cost Curves

Estimated Construction Costs

Bridges

Assume the shown section:



l	Area of Opening (sq.ft.)	Sq. Ft. of Bridge (1)	Price per Sq. Ft.	Total Est. Constr. Cost
20' (2)	48	720	$45	$32,400
30' (3)	88	1,080	45	48,600
40' (3)	128	1,440	45	64,800
50' (3)	168	1,800	45	81,000
40' (4)	128	1,440	50	72,000
50' (4)	168	1,800	50	90,000
60' (4)	208	2,160	50	108,000
80' (4)	288	2,880	55	158,400
100' (4)	368	3,600	55	198,000

(1) Assume bridge width of 36'.
(2) Assumes slab span bridge with no intermediate bent.
(3) Assumes slab span bridge with one intermediate bent.
(4) Assumes AASHTO girder bridge with no intermediate bent.

Appendix J

APPENDIX J

REFER TO SECTION 6 FOR ASSUMPTIONS AND METHODOLOGY USED FOR DETERMINING THE REMEDIAL SOLUTIONS FOR DRAINAGE PROBLEMS

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 02-0221 C=D

Q10 = 413 F=D

Capacity = 47

Deficit = -366

Cost

Solution A: Replace existing 36" CMP with twin 4X8 box culverts. Capacity will be 574 cfs ~~with~~ 2 ft minimum cover. 55,000

Cost

Solution B: Replace existing 36" CMP with ~~triple~~ quadruple 34" ~~42~~" CMPs 54,700
Capacity is 564 cfs. 4½' cover
Roadway would have to be mounded over pipes.
~~Excessive fill over~~ to provide minimum 2 ft cover

Sdc: Replace existing 36" CMP with triple ~~4'x5' Box culverts~~ ~~42" CMP culverts~~ 50,200
~~Capacity = 534 cfs~~. ~~Roadway overtop~~ 27,500
If only 1 ft of cover is maintained over culverts capacity is only 378 cfs.
If roadway is mounded over culverts to provide 2 feet of head capacity is 534 cfs.

Comments:

Recommended Solution Cost:

JT

4x8 BC

Energy loss Eqtn

$$Q = A\sqrt{\frac{2gH}{1 + ke + \frac{29n^2L}{R^{1.33}}}}$$

$g = 32.2$

$H = 2$

$ke = .5$

$n = 0.012$

$L = 40$ ft

$R = \frac{32}{22} = 1.45$

$A = 32$ ft^2

$$Q = 32\sqrt{\frac{128.8}{1 + 0.5 + \frac{29(0.004176)40}{(1.45)^{1.33}}}}$$

$Q = 287$ cfs

287×2

$= 574$ cfs twin 4x8 BC

54"

$$15.9\sqrt{\frac{128.8}{1.5 + \frac{(.004176)(40)}{\left(\frac{4.5}{4}\right)^2}}}$$

$141 \times 4 = 564$

4x5 BC (H=1ft

$$20\sqrt{\frac{64.4}{1.5 + \frac{(.004176)(40)}{\left(\frac{20}{16}\right)^{1.33}}}}$$

178×3

534

126 cfs $\times 3$

378 cfs

Existing: Twin 36" CP

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 02-0121

Q10 = 143 cfs

Capacity = 95 cfs

Deficit = -48 cfs (current)
-62 cfs (future)

new cap. 157 cfs

Cost

Solution A: Add single 36" CP @ 48 to 62 cfs 12,900

Cost

Solution B: 348' BC @ 210 cfs

no! Same as before!
not cost effective

Comments:

Recommended Solution Cost:

Existing: Twin 36" CP

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 02-0118

Q10 = 143 cfs

Capacity = 95 cfs

Deficit = -48 cfs (current)
-62 cfs (future)

new cap. = 157 cfs

Solution A: Add 1 single 36" CP @ 48 to 62 cfs — Cost 12,900

Solution B: 3 + 8' BC @ 210 cfs — Cost

No! Not cost effective!

Comments:

Recommended Solution Cost:

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 02-0403

Q10 = 230

Capacity = 30

Deficit = -200

C = D

F = D

Cost

Solution A: Replace existing 18" X24" BC with a 4' x 8' Box culvert. Capacity will be 287 cfs — 34,500

* Assumed that there would be adequate cover for 4x8 box culvert

Cost

Solution B: Replace with triple 36"x58" CMPACs Capacity is 330 cfs. — 8000

* assuming that there will be adequate cover.

Comments:

Recommended Solution Cost:

SD

$$Q = 32 \sqrt{\frac{128.8}{1.5 + \frac{(.004176)(40)}{(1.45)^{1.33}}}}$$

$$Q = 287$$

36" x 58"

36" x 60"

110 cfs

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 02-0227

Q10 = 188

Capacity = 83

Deficit = -105

C = D

F = D

Cost

Solution A: Replace 56 x 36 ECP with triple 36" RCP. Capacity will be 180 cfs and 2 ft minimum cover will be maintained 20,800

Solution B: Replace with triple 48" CMPs, Capacity is 201 cfs reducing cover to 1 ft. 32,000

Cost

Solution C: 3x8 Box culvert, Capacity is 210 cfs and 2 ft minimum cover will be maintained. 30,400

Comments:

Recommended Solution Cost:

JD

Energy loss eqtn triple 36" RCP

$$Q = 7.069 \sqrt{\frac{128.8}{1 + 0.5 + \frac{(.004176)(48)}{(.75)^{1.33}}}}$$

$Q = 60 \times 3$

180 cfs

---

3 x 8 BC

$$Q = 24 \sqrt{\frac{128.8}{1 + 0.5 + \frac{(.004176)(48)}{\left(\frac{24}{22}\right)^{1.33}}}}$$

$= 210$

48" $(n = .024)(H = 1.47)(ke = 0.5)$

$$12.57 \sqrt{\frac{64.4}{1.5 + \frac{(.0167)(48)}{}}}$$

109 cfs x 2 218

67 cfs x 3

$= 201$

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 02-0230

Q10 = 169

Capacity = 51

Deficit = -118

C = D

F = D

Cost

Solution A: Remove existing twin 24 x 31" CMP and replace with 1 - 3'x8' box culvert 30,400
Capacity will be 222 cfs and 3 ft cover will be maintained.

Cost

Solution B: Replace with 1-3x7' box culvert 28,000
Capacity is 187 cfs, 2 foot of cover maintained

Comments:

Recommended Solution Cost:

GD

3x8

$$Q = 21 \sqrt{\frac{128.8}{1 + 0.5 + \frac{(.004176 \times 30)}{(1.09)^{1.33}}}}$$

$$= 222 \text{ cfs}$$

3x7

$$21 \sqrt{\frac{128.8}{1.5 + \frac{(.004176 \times 30)}{\left(\frac{21}{20}\right)^{1.33}}}}$$

187

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 02-0424

$Q10_F$ = 112 Future = D

Capacity = 50 Current = D

$Deficit_F$ = -62

Cost

Solution A: Replace existing 2x3 Box culvert with 3'x 6' box culvert. Capacity is 111 cfs. * Minimum cover can not be maintained. With 3x6' BC cover will be only 1 Ft. 25,000

Solution B: Parallel with one 3'x5' Box Culvert Capacity is 93 cfs (parallel 3x5 or replace)

Cost

Solution C: Parallel with two 30" CMPs Capacity is 104 cfs. 8 cfs below capacity. 11,800

Solution D: Parallel with one 36"x56" CMPAC (38x60 from nomograph Q=110 cfs), Capacity is 160 cfs 40x65 3500

Comments:

Recommended Solution Cost:

n = 0.024

30" CMP (ke = 0.5)(H = 1.5')

$$4.91\sqrt{\frac{96.6}{1.9+\frac{(.0167)(40)}{\left(\frac{2.5}{4.0}\right)^{1.33}}}}$$

= 38 cfs

27 x 2

= 54

3x5 BC

$$15\sqrt{\frac{64.4}{1.5+\frac{(.004176)(40)}{\left(\frac{15}{16}\right)^{1.33}}}}$$

93 cfs

3x6 (H = 1ft | ke = .5, L = 40)

$$18\sqrt{\frac{64.4}{1.5+\frac{(.004176)(40)}{\left(\frac{15}{16}\right)^{1.33}}}}$$

111

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 02-0418

Q10 = 110

Capacity = 82

Deficit = -28

C = C
I = C

Cost

Solution A: Install parallel 42" RCP ~~with~~ 11,400
which will double existing capacity to 164 cfs
1½ foot cover H = 1½

Cost

Solution B: Replace with one 4'x5' Box Culvert 27,500
Capacity is ~~179~~ ~~cfs~~ 125 cfs
(Head = 1 ft)

Solution C: Replace with 3x5 box culvert 22,800
Capacity is 131 cfs.
(head = 2 ft)

Comments:

Recommended Solution Cost:

JD

4 x 5 BC

$$20\sqrt{\frac{128.8\ \ 64.4}{1.5+\frac{(.004176)(40)}{\left(\frac{20}{18}\right)^{1.33}}}}$$

~~177 cfs~~ 175 cfs

42"

ke = 0.2 1.5

$$9.62\sqrt{\frac{96.6}{1.2+\frac{(.004176)25}{\left(\frac{3.5}{4}\right)^{1.33}}}}$$

82

3 x 5

$$15\sqrt{\frac{128.8}{1.5+\frac{(.004176)(40)}{\left(\frac{15}{16}\right)^{1.33}}}}$$

131 cfs

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 02-0421

Q10 = 75

Capacity = 44

Deficit = -31

C = C
F = D

Cost

Solution A: Replace existing 1'x3' box culvert with a 3'x3' box culvert. Capacity will be 79 cfs and 2 ft minimum cover will be maintained — 19,300

Solution B: Replace with one 36"x58" CMPAC Capacity is 110 cfs — 2600

Cost

Solution C: Replace with twin 36" CMPs Capacity is 122 cfs — 14,400

Solution D: Parallel with one 31"x50" CMPAC Capacity is 90 cfs — 2300

Comments:

Recommended Solution Cost:

JD

$$Q = 9\sqrt{\frac{128.8}{1 + 0.5 + \frac{(.004176)(37)}{1^{1.33}}}}$$

$= \cancel{69}$ 79.4 cfs 3x3 BC

36 x58

38 x60

110 cfs

36"

$$7.07\sqrt{\frac{128.8}{1.5 + \frac{(.004176)(37)}{\left(\frac{3}{4}\right)^{1.33}}}}$$

61 x 2 = 122

31 x 50

34 x 53

90 cfs

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 02-0439

Q10 = 68

Capacity = 50

Deficit = -18

C = B

F = C

Cost

Solution A: Replace existing 36" RCP with 3x3 BC. Capacity is 79 cfs 19,300
2 ft minimum cover will be maintained

Solution B: Parallel with one 24" CMP, Capacity is 76 cfs 5800

Cost

Solution C: 3x4 BC, Capacity is 104 cfs 21,500

Solution D: Replace with twin 30" CMPs 11,800
Capacity is 68 cfs

Comments:

Recommended Solution Cost:

(JD)

3x3 BC

assume 40' length

$$Q = 9 \sqrt{\frac{128.8}{1.5 + \frac{(.004176)\,40}{1}}}$$

79

24"

$$3.14 \sqrt{\frac{128.8}{1.5 + \frac{(.004176)(40)}{\left(\frac{2}{1}\right)^{1.33}}}}$$

25.7 cfs

3x5

$$15 \sqrt{\frac{128.8}{1.5 + \frac{(.004176)\,40}{\left(\frac{15}{16}\right)^{1.33}}}}$$

131 cfs

30" CMP ($k = 0.5$, $n = .024$)

$$4.91 \sqrt{\frac{128.8}{1.5 + \frac{(.0167)(40)}{\left(\frac{2.5}{4.0}\right)^{1.33}}}}$$

$= 37.5$

$34 \times 2 = 68$

3x4

$$12 \sqrt{\frac{128.8}{1.5 + \frac{(.004176)\,40}{\left(\frac{12}{14}\right)^{1.33}}}}$$

104 cfs

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 04-0159 C=C

Q10 = 72 F=C

Capacity = 59

Deficit = -13

Cost

Solution A: Replace existing 36" RCP with
38" x 60" ECP Capacity is 110 cfs 2600
36"+38"
E Existing cover is maintained

Cost

Solution B: Parallel with new 24" RCP 5800
Capacity is 85 cfs.

Comments:

Recommended Solution Cost:

(B)

34" X 60"

Eq. Round = 48"

$$Q = 12.57 \sqrt{\frac{128.8}{1.5 + \frac{(.004176)40}{1}}}$$

Assume 40' length

110 cfs

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 04-0139

Q10 = 100

Capacity = 46

Deficit = -54

C = D

I = D

Cost

Solution A: Replae existing 42" CMP with 43" X 68" ECP. Capacity is ~~44~~ 110 cfs 4500

* 1 ft of existing cover will be maintained

Cost

Solution B: Replae with 3'x5' box culvert 22,800
Capacity is 118 ~~135~~ cfs. (Head = 1½')

* cover will be increased from 1 Ft to 1½ ft

Comments:

Recommended Solution Cost:

SD

43"x68" Equiv to 54" Round

$$15.9\sqrt{\frac{128.8}{1.5+\frac{(.004176)(18)}{(1.125)^{1.33}}}}$$

$= 141.4$ cfs

from nomingraph H = 1 ft
Q = 110 cfs

3x5' BC

$$15\sqrt{\frac{\cancel{128.8}\ 96.6}{1.5+\frac{(.004176)(18)}{\left(\frac{15}{16}\right)^{1.33}}}}$$

~~135. cfs~~ 118

42" $k_e = 0.9$ $H = 0.8$

$$9.62\sqrt{\frac{51.52}{1.7+\frac{(.004176)(25)}{\left(\frac{3.5}{4}\right)^{1.33}}}}$$

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 04-0103 C = D

Q10 = 200 F = D

Capacity = 28

Deficit = -172

Cost

Solution A: Replace existing twin 20" RCP with twin 3'x6 Box culverts Capacity is 226 cfs ft = 1ft ke = 0.5 25,000

* Minimum cover of 2 ft can not be maintained. There will be only 1 ft cover with 3'x5' box culverts.

Cost

Solution B: Replace with twin 48" CMPs 22,600
Road would have to be mounded over CMPs, Assuming 2 ft of cover over pipes Capacity is 200 cfs

Solution C: Replace with 4x6 Box Culvert.
Road would have to be mounded over box culvert. Assuming 1 ft cover
Capacity is 153 cfs

Comments:

Recommended Solution Cost:

3x5 BC

2' head

$$15\sqrt{\frac{128.8}{1.5+\frac{(.004176)33}{\left(\frac{15}{16}\right)^{1.33}}}}$$

2 - 3x5 BC

132 x 2 = 264

3x5

1 ft head

$$132\Big/15\sqrt{\frac{64.4}{1.5+\frac{(.004176)(33)}{\left(\frac{15}{16}\right)^{1.33}}}}$$

94 x 2 = 188

3x4

$$12\sqrt{\frac{64.4}{1.5+\frac{(.004176)(33)}{\left(\frac{12}{14}\right)^{1.33}}}}$$

75 cfs = 150 cfs

3x6 1ft head

$$18\sqrt{\frac{64.4}{1.5+\frac{(.004176)(33)}{\left(\frac{18}{18}\right)^{1}}}}$$

113 x 2 = 226 cfs

48" CMP (n=0.024, ke=0.5, H=2ft)

$$12.57\sqrt{\frac{128.8}{1.5+\frac{(.0167)33}{1}}}$$

n = .024

100 cfs

4x6 BC. (1ft=H, 0.5=ke)

$$24\sqrt{\frac{64.4}{1.5+\frac{(.004176)(33)}{\left(\frac{24}{18}\right)^{1.33}}}}$$

153 cfs

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 04-0104

Q10 = 162

Capacity = 34

Deficit = -128

C = D

F = D

Cost

Solution A: Replace existing 30" CMP with a 3x8 box culvert. Capacity will be 214 cfs. 30,400

* No photo or inspection report for this structure assume minimum cover will be maintained.

Cost

Solution B: Replace with 4x6 Box Culvert 30,400
assume 2 ft head capacity is 214 cfs

Solution C. Replace with twin 42" RCPs 18,400
assume 2 ft head. Capacity is 168

Comments:

Recommended Solution Cost:

JD

3x8 BC

24 $\sqrt{\dfrac{128}{1.5+(.004176)(40)}}$ $\dfrac{24}{18}$

$= 214$ cfs

4x6 ($k_e = 0.5$, $L = 40$, $H = 2$)

24 $\sqrt{\dfrac{128.8}{1.5 + \dfrac{(.004176)(40)}{\left(\frac{24}{18}\right)^{1.33}}}}$

$= 214$ cfs

42" ($H = 2$, $k_e = 0.5$, $L = 40$)

9.62 $\sqrt{\dfrac{128.8}{1.5 + \dfrac{(.004176)\,40}{\left(\frac{3.5}{4.0}\right)^{1.33}}}}$

84 cfs x 2 = 168

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 04-0112 C = D

Q10 = 149 I = D

Capacity = 75

Deficit = -74

Solution A: Replace existing 54" RCP with 3'X6' box culvert. Capacity is 137 ~~158~~ cfs. 12 cfs below capacity (Head = 1.5 ft) Cost 25,000

* Cover over pipe will be increased from 2" to 18"

Solution B: Replace with triple 36" RCP Capacity is 156 cfs (Head = 1.5 ft) Cost 20,800

Solution C: ~~Replace~~ Parallel with ~~double~~ new 54" RCP Assuming 1' ft head. 175 cfs capacity 18,500

Comments:

Recommended Solution Cost:

JP

3×6 (H = 1.5 A

$$Q = 18 \sqrt{\frac{96.6}{1.5 + \frac{(.004176)(43)}{\left(\frac{18}{18}\right)^{1.33}}}}$$

~~158 cfs~~

137

36" RCP H = 1.5 ke = 0.5

$$7.07 \sqrt{\frac{96.6}{1.5 + \frac{(.004176)(43)}{\left(\frac{3}{4}\right)^{1.33}}}}$$

52 cfs × 3 = 156

54" (H = 1 A, ke = 0.5

$$15.9 \sqrt{\frac{64.9}{1.5 + \frac{(.004176)(43)}{\left(\frac{4.5}{4}\right)^{1.33}}}}$$

= 99

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 04-0155 C=D

Q10 = 137 F=D

Capacity = 26

Deficit = -111

Solution A: Replace twin ~~[illegible]~~ 24" CMP with 3'x 6' box culvert. Capacity is 142 cfs — Cost 25,000

~~[illegible]~~

* No photo or inspection report available to determine minimum cover. Assume 2 ft head.

Solution B: Replace with twin ~~[illegible]~~ 48" RCPs (assume H = 2ft, L = 40ft) Capacity = 198 cfs — Cost 22,600

Solution C: Replace with triple 36" RCPs (assume H = 2ft, L = 40ft) 150 cfs Capacity — 20,800

Comments:

Recommended Solution Cost:

(D)

3 x 6 BC

$$Q = 18\sqrt{\frac{128.8}{1.5 + \frac{(.004176)(135)}{1}}} \qquad 14'$$

$$= 142 \text{ cfs}$$

54" RCP

$$15.9\sqrt{\frac{128.8}{1.5 + \frac{(.004176)(135)}{\left(\frac{4.5}{4}\right)^{1.33}}}}$$

128 cfs

---

48 99 cfs

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 04-0158 C=C

Q10 = 89 F=C

Capacity = 69

Deficit = -20

Cost

Solution A: Replace existing 42" RCP with 43" x 68" ECP. Capacity is 141 cfs 4500

* No photo or inspection report. Minimum cover is assumed acceptable because replacement pipe is the same height as existing pipe.

Cost

Solution B: Parallel with new 24" RCP 5800
Capacity is 95 cfs

Solution C: Replace with twin 36" RCPs 14,400
Capacity is 100 cfs.
(assuming 2 ft head)

Comments:

Recommended Solution Cost:

SP

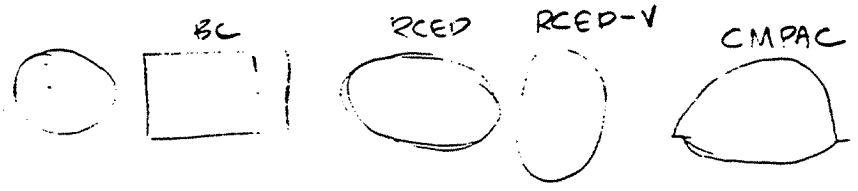
43" X 68" ECP

equiv to 54" round

assume length of 40'

$$15.9 \sqrt{\frac{128.8}{1.5 + \frac{(.004176)(40)}{(1.125)^{1.33}}}}$$

141 cfs



SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 04-0172

Q10 = 310

Capacity = 59

Deficit = -251

Cost

olution A: Replace single 36" RCP with triple 3x5 box culvert, capacity = 393 cfs — 46,000

Cost

Solution B: Replace single 36" RCP with twin 3'x6' box culvert, Capacity = 316 cfs — 36,000

Comments:

Recommended Solution Cost:

3x5 BC

2' head

$$15\sqrt{\frac{128.8}{1.5+\frac{(.004176)33}{\left(\frac{15}{16}\right)^{1.33}}}}$$

2 - 3x5 BC

132 x 2 = 264

3x5

1 ft head

$$132\Big/15\sqrt{\frac{64.4}{1.5+\frac{(.004176)(33)}{\left(\frac{15}{16}\right)^{1.33}}}}$$

94 x 2 = 188

3x4

$$12\sqrt{\frac{64.4}{1.5+\frac{(.004176)(33)}{\left(\frac{12}{14}\right)^{1.33}}}}$$

75 cfs = 150 cfs

3x6 1ft head

$$18\sqrt{\frac{64.4}{1.5+\frac{(.004176)(33)}{\left(\frac{18}{18}\right)^{1}}}}$$

113 x 2 = 226 cfs

48" CMP (n=0.024, ke=0.5, H=2ft)

$$12.57\sqrt{\frac{128.8}{1.5+\frac{(.0167)33}{1}}}$$

n = .024

100 cfs

4x6 BC. (1ft=H, 0.5=ke)

$$24\sqrt{\frac{64.4}{1.5+\frac{(.004176)(33)}{\left(\frac{24}{18}\right)^{1.33}}}}$$

153 cfs

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 04-0121 C=C

Q10 = 69 F=C

Capacity = 50

Deficit = -19

Cost

Solution A: Add another 24" pipe to existing twin 24" VCP to increase capacity to 75 cfs. 5800

Solution B: Replace with new 36"x~~58~~50" CMPAC (H=1.5) 2600
Capacity is 108 cfs (from nomograph)

Cost

Solution ~~B~~C: Replace twin 24" ~~pipe~~pipes with a box culvert 19,300

3x3 capacity = 79 cfs
~~3x4 capacity = 104 cfs~~
~~3x5 capacity = 131 cfs~~

Solution ~~C~~D: Replace with twin 30" RCPs (H=2.0ft) 11,800
Capacity is 84 cfs

Comments:

Recommended Solution Cost:

50

3x3 Box Culvert

assume 40' length

3x3 = 79
3x4 = 104
3x5 = 131

see back of structure sheet 02-0439 for calculations

30"

$$4.91 \sqrt{\frac{128.8}{1.5 + \frac{(.064176)(40)}{\left(\frac{2.5}{4}\right)^{1.33}}}}$$

42 c_{As} x 2 = 84

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

C = D

I = D

Structure No: 05-0906

Q10 = 219

Capacity = 114

Deficit = -105

Solution A: Replace existing twin 36" CMP with 3'x8' box culvert. Capacity is 217 cfs. 1½ foot cover is maintained

Cost 30,400

Solution B: Replace pipes with small (20' (16' SPAN)) concrete slab bridge

Cost 32,400

Solution C: Replace with triple 54" RCPs Road would have to be mounded over pipes. Assuming 2 foot cover over pipes Capacity is 258 cfs.

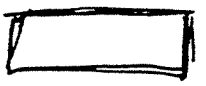
41,300

Comments:

Recommended Solution Cost:

JD

3' x 8' BC



24

$$\sqrt{\frac{128.8}{1.5 + \frac{(.004176)(20)}{\left(\frac{24}{22}\right)^{1.33}}}}$$

217 cfs

54"

15.9

$$\sqrt{\frac{128.8}{1.5 + \frac{(.004176)(20)}{\left(\frac{4.5}{4}\right)^{1.33}}}}$$

144

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 05-0733

Q10 = 126

Capacity = 76

Deficit = -50

C = C

F = D

Cost

Solution A: Replace twin 30" RCP with a 3'x6' box culvert. Capacity is 158 cfs — 25,000

* No photo or inspection report

Cost

Solution B: Replace with 3x5 Box Culvert Capacity 130 cfs — 22,800

Solution C: Replace with triple 36" RCPs Capacity = 150 — 9,000

Solution D: Replace with twin 54" RCPs Capacity = 139 cfs — 29,600

Comments:

* - All solutions assume head = 2 feet

Recommended Solution Cost:

(JP)

3x6 BC

$$Q = 18 \sqrt{\frac{128.8}{1.5 + \frac{(.004176)(40)}{1}}}$$

assume 40 ft length

$$= 158 \text{ cfs}$$

Existing: Twin 24"x36" CMEP

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 05-0533

Q10 = 57 cfs

Capacity = 32 cfs

Deficit = -25 cfs (current)
-31 cfs (future)

new cap. = 79 cfs

Cost

Solution A: 3'x3' BC @ 79 cfs (Replacement) 24,000

Cost

Solution B:

Comments:

Recommended Solution Cost:

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 05-0339

Q10 = 63

Capacity = 32

Deficit = -37

C=D

F=D

Cost

Solution A: ~~Install parallel~~

19,000

Replace twin 19"x30" ECP with 2'x4' box culverts. Capacity is 68 cfs

* No photo or inspection report

Cost

Solution B: Parallel with 30" RCP Capacity 75 cfs

7,300

Comments:

Recommended Solution Cost:

JB

$$8\sqrt{\frac{128.8}{1.5 + \frac{(.004176)(40)}{\left(\frac{8}{12}\right)^{1.33}}}}$$

$$= 68$$

30"

43 cfs

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 05-0315

Q10 = 127

Capacity = 79

Deficit = -48

C=D

F=D

Cost

Solution A: Replace existing 48" RCP with a 3'x6' box culvert. Capacity is 158 cfs. 25,000

Cover over pipe will be increased from 14" to 2 ft.

Cost

Solution B: Parallel with new 42" RCP Capacity is 138 cfs 11,400

Solution C: Replace with twin 48" RCPs Capacity is 158 cfs. 22,600

Comments:

Recommended Solution Cost:

(SD)

3x6 BC

$$Q = 18\sqrt{\frac{128.8}{1 + 0.5 + \frac{(.004176)(40)}{\left(\frac{18}{18}\right)^{1.33}}}}$$

assume length 40'

158. cfs

$$\frac{42}{9.62\sqrt{\frac{64.4}{1.5 + \frac{(.004176)(40)}{\left(\frac{3.5}{4}\right)^{1.33}}}}}$$

59 cfs + 79

138

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 05-0218 C=D F=D

Q10 = 107

Capacity = 12

Deficit = -95

Cost

Solution A: Replace existing 15"X 28" CMAP with 54" RCP. Capacity is 139 cfs. 2½' of cover is maintained 18,500

Cost

Solution B: Replace with a 3x4 Box Capacity is 102 cfs. 21,500

Comments:

Recommended Solution Cost:

(50)

H6

54"

$$15.9 \sqrt{\frac{128.8}{1.5 + \frac{(.004176)(52)}{(1.125)^{1.33}}}}$$

139 cfs

3 x 4

$$12 \sqrt{\frac{128.8}{1.5 \quad \frac{(.004176)(52)}{\left(\frac{12}{14}\right)^{1.33}(\text{illegible})}}}$$

102 cfs

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 05-0103

Q10 = 482

Capacity = 251

Deficit = -231

C = D

F = D

Cost

Solution A:

Replace Bridge with 25' Bridge. 40,500

bridge opening would have to be 22 ft wide in order to handle 10 yr flow (assuming 3.5 ft/sec)

Cost

Solution B:

Comments:

Recommended Solution Cost:

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 12-0109

Q10 = 99

Capacity = 36

Deficit = -63

C = D

F = D.

Cost

tion A: Replace single 36" [redacted] CMP. with twin 36" RCP. Capacity is 122 cfs. — 9,000

No photo or inspection report

Cost

tion B: Replace with 3x4 Box Culvert Capacity = 104 cfs — [redacted] 21,500

ments:

mmended Solution Cost:

JD

36 RCP

$$7.07 \sqrt{\frac{128.8}{1.5 + \frac{(.004176)(40)}{\left(\frac{3}{4}\right)^{1.33}}}}$$

assume 40' Length

$$60.7 = 61 \text{ cfs}$$

$$2 - 36" = 122 \text{ cfs}$$

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 12-0106

Q10 = 99

Capacity = 45

Deficit = -54

C = D

F = D

Cost

tion A: I have calculated a single 42" [redacted] CMP to have a [redacted] capacity of 75[redacted] cfs. In this case install a parallel 42" [redacted] CMP to bring capacity to 150 [redacted] cfs. 11,400

* No photo or inspection report

Cost

tion B:

nents:

ommended Solution Cost:

SD

42" RCP

$$9.62\sqrt{\frac{128.8}{1.9+\frac{(.004176)(40}{\left(\frac{35}{4}\right)1.53}}}$$

assume 40' length

0.9 Ke

= ~~80.8~~ 75 cfs

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 15-0402 C=C

Q10 = 92 F=C

Capacity = [redacted]65

Deficit = -27

Cost

tion A: Install parallel ~~$13 box culvert~~ 30" RCP

to increase capacity to [redacted] 106 cfs [redacted]

7,300

* No photo or inspection report

Cost

tion B:

nents:

ommended Solution Cost:

36"

$$4.91\sqrt{\frac{178.8}{1.5+\frac{(.009116)(40)}{\left(\frac{2.5}{4}\right)^{1.33}}}}$$

assume 40' lengths

41 cfs

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 15-0309

Q10 = 153

Capacity = 65

Deficit = -88

C=D

F=D

	Cost
tion A: Replace 31" x 50" RCEP with 3' x 6' box culvert. Capacity is 154 cfs minimum cover is maintained.	25,000
ıtion B: Parallel with twin 36" RCPs Capacity = 165 cfs	14,400
solution C: Replace with twin 42" RCPs Capacity = 168 cfs	18,400

ments:

(JD)

commended Solution Cost:

3 x 6

$$18\sqrt{\frac{128.8}{1.5 + \frac{(.004176)(60)}{18}}}$$

154 cfs

Existing: Single 43"x29" CMAP

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 15-0303

Q10 = 157 cfs

Capacity = 42 cfs

Deficit = -115 cfs (current)
-130 cfs (future)

new cap. = 180 cfs

Cost

Solution A: Replace w/ triple 36" CMP @ 180 cfs 24,700

Cost

Solution B:

Comments:

Recommended Solution Cost:

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

C=C
F=C

Structure No: 15-0229

Q10 = 128

Capacity = 87

Deficit = -41

Cost

tion A: Install parallel 36" ~~48~~ CMP increasing capacity to 137 cfs — 9,000

* No photo or inspection report

Cost

ıtion B: ~~Replace~~ Replace with 3x5 Box Capacity is 131 cfs — 22,800

ments:

ommended Solution Cost:

(12)

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 15-0226 C=D F=D

Q10 = 90

Capacity = 52

Deficit = -38

Cost

tion A: Install a parallel 42" RCP which will increase capacity to 104 cfs — 11,400

No photo or inspection report

Cost

ıtion B: Replace with 3x4 Box Capacity is 104 cfs — ~~20,000~~ 21,500

ments:

ommended Solution Cost:

Existing: Single 48" CMP

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 15-0215

Q10 = 177 cfs

Capacity = 87 cfs new cap. = 210 cfs

Deficit = -90 cfs (current)

-108 cfs (future)

Cost

Solution A: Replace w/ 3'x8' BC @ 210 cfs 34,600

Cost

Solution B:

Comments:

Recommended Solution Cost:

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 13-0309

Q10 = 64

Capacity = 31

Deficit = -33

C = D

F = D

Cost

tion A: I estimated capacity for 24" X30" to be 30 cfs. There are two pipes located at this structures which increases capacity to 60 cfs. Another pipe can be added (24" X38" RCP) to increase capacity to 105 cfs

2600

Cost

ition B:

ments:

ommended Solution Cost:

(30)

24" x 38" RCP

30 Equiv Rd.

from nomograph 45 cfs

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 12-0124 C=C

Q10 = 124 I=D

Capacity = 80

Deficit = -44

Cost

ıtion A: Replace 40" x 65" CMAP with a 3' x5' box culvert. Capacity is 131 cfs. And cover over pipe is maintained. 22,800

* No photo or inspection report

Cost

ution B: Paralled with 36" RCP 9,000
Capacity = 130 cfs

Solution C: Replace with ~~1~~ single 54" RCPs
Capacity is 141 cfs. ~~Bottom will~~ ~~have to be~~ Cover over pipe is assumed to be 2 ft (Head = 2ft) 18,500

ments:

ommended Solution Cost: JD

3 x 5 box culvert

$$15 \sqrt{\frac{128.8}{1.5 \frac{(.004176)(40)}{\left(\frac{15}{16}\right)^{1.33}}}}$$

assume 40' length

131 cfs

54'

$$15.9 \sqrt{\frac{128.8}{1.5 + \frac{(.004176)(40)}{\left(\frac{4.5}{4}\right)^{1.33}}}}$$

141 cfs

Existing: Single 30" pipe

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 15-0113

Q10 = 491 cfs

Capacity = 39 cfs

Deficit = -452 cfs (current)
-502 cfs (future)

new cap. = 562 cfs

Cost

Solution A: Replace w/ twin 4'x8' BC @ 562 cfs 79,400

Cost

Solution B:

Comments:

Recommended Solution Cost:

3x5 box culvert

$$15\sqrt{\frac{108.8}{1.5+\frac{(0.004176)(80)}{\left(\frac{15}{16}\right)^{1.33}}}}$$

125 cfs

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 16-0115

Q10 = 125

Capacity = 32

Deficit = -93

C = D

F = D

Cost

Solution A: Replace 36" CMP and 24" RCP with a single 3' x 5' box culvert. Capacity is 131 cfs. 22,800

Cost

Solution B: Replace with twin 42" RCPs 18,400

Comments:

Recommended Solution Cost:

(D) ?

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 16-0112 C = D

Q10 = 75 F = D

Capacity = 32

Deficit = -43

Cost

Solution A: Replace both 36" CMP and 24" RCP with a 48" RCP. Capacity = 110 cfs — 14,200

Cost

Solution B: Parallel with 36" RCP — 9,000

Solution C: Replace with 3x3 Box Culvert — 19,300

Comments:

Recommended Solution Cost:

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 16-0109 C=C

Q10 = 124 F=D

Capacity = 81

Deficit = -43

Cost

Solution A: ~~Eliminate~~ Install a third parallel 36" CMP increasing capacity to 120 (~~a~~ slightly below Q10) 9,000

Cost

Solution B: Replace twin 36" RCP with 3'x5' box culvert. Capacity is 128 cfs minimum cover is maintained 22,800

Comments:

Recommended Solution Cost:

D

69

4x6 box culvert

$$24\sqrt{\frac{128.8}{1.5 + \frac{(.004176)(40)}{\left(\frac{24}{20}\right)^{1.33}}}}$$

assume 40' Length

$$= 213 \text{ cfs}$$

40'

$$9.68\sqrt{\frac{128.8}{1.5 + \frac{(.004176)(40)}{\left(\frac{2.5}{4}\right)^{1.33}}}}$$

84

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 16-0403 C = D F = D

Q10 = 153

Capacity = 58

Deficit = -95

Cost

Solution A: Replace 36" x 58" CMAP with 4' x 5' box culvert Capacity is 165 cfs. ~~28,000~~ 27,500

Solution B: Replace with triple 36" RCP Capacity 150 cfs. 20,800

Cost

Solution C: ~~Parallel~~ Replace with dual 3x3 Box Culverts Capacity = 140 cfs. 13 cfs below Q_{10} 25,700

Comments:

Recommended Solution Cost:

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 15-0504

Q10 = 181

Capacity = 140

Deficit = -41

C = C

I = C

Cost

Solution A: ~~Install parallel 4x4 box culvert increasing capacity to 280 cfs~~

Install a parallel 2'x4' box culvert assuming Head = 2 feet, Capacity = 208 cfs

~~[illegible]~~ 19,000

Cost

Solution B:

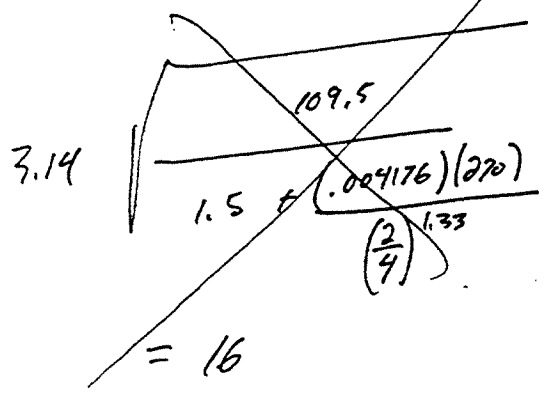
Comments:

Recommended Solution Cost:

72

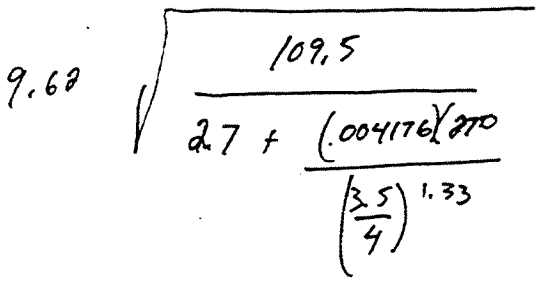
24"

$H = 1.7$ ~~ft~~



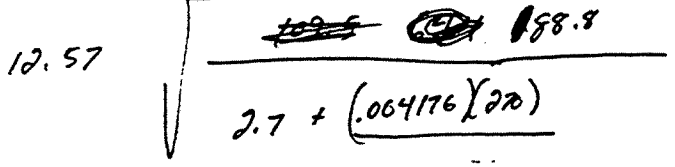
$= 16$

42



50 cfs

48 ($Ke = 1.7$, $H =$ 2, $L = 270$ ft)



~~67~~ cfs

88

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 15-0512 C=C

Q10 = 157 F=C

Capacity = 117

Deficit = -40

Cost

Solution A: Install a parallel 27"x42" RCEP to existing lines increasing capacity to 175 cfs. 11,200

Cost

Solution B: Parallel with 36" RCP Capacity = 167. Assuming road would be mounded over pipe creating 2 foot head. Road surface would have to be raised 2 feet. 9,000

Comments:

Recommended Solution Cost:

JP

Existing: Single 30" RCP

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 15-0513

Q10 = 297 cfs

Capacity = 39 cfs

Deficit = ~~-258~~ -271 cfs (current)
-301 cfs (future)

new cap. = 330 cfs

Cost

Solution A: Replace w/ twin 4'x5' BC @ 330 cfs 32,000

Cost

Solution B:

Comments:

Recommended Solution Cost:

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

C = C
F = D

Structure No: 15-0105

Q10 = 100

Capacity = 60

Deficit = -40

Cost

tion A: Install parallel 36" RCP along existing + increase capacity to 120 cfs. 9,000

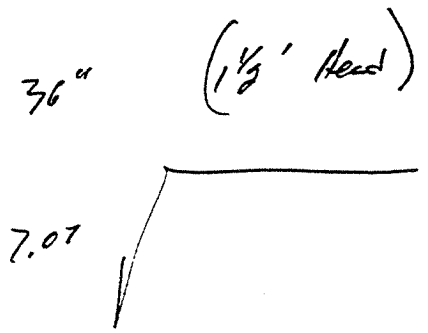
Cost

tion B: (Replace with dual 42" RCP)

nents:

ommended Solution Cost:

JD


36"
(1½' Head)
7.07

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 14-0421

Q10 = 64

Capacity = 52

Deficit = -12

C = B

F = C.

Cost

tion A: Install parallel 24" RCP to increase capacity to [redacted] cfs. 77 cfs 5800

Cost

ition B: Replace with 48" RCP. [redacted] cfs. Assuming Road will be mounded over pipe creating 2 foot head. 14,200

ments:

ommended Solution Cost:

(D)

2x4'

$$8\sqrt{\frac{178.8}{1.5+\frac{(.004176)(40)}{\left(\frac{8}{12}\right)^{1.33}}}}$$

68 cfs

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

VERY EXPENSIVE

Structure No: 14-0409 C=C

Q10 = 73 F=D

Capacity = 46

Deficit = -27

7

tion A: Do nothing — Cost

J&B 42" Pipe in Casing under Roadway 150,000+

Pipe goes under I-4 (DOT) BASED ON 200'R/W

Cost

tion B: Provide for 2 Hours of peak flow

excess detention in pond (194,400 cuft = 4.46 Ac-ft) 45,000

Need 2.25 Ac pond site

ments:

ommended Solution Cost:

3 x 3 BC

$$9\sqrt{\frac{128.8}{1.5 + \frac{(.004176)(105)}{\left(\frac{9}{17}\right)^{1.33}}}}$$

70 cfs

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: ~~136-R34~~ 14-0312 C=D

Q10 = ~~86~~ 195 F=D

* Capacity = ~~216~~ 80

Deficit = ~~130~~ -115

		Cost
tion A:	Replace the 31" x 50" CMAP with a 4' x 6' box culvert. Capacity is 213 cfs. Maintaining 3ft cover	30,400
dution B:	Replace with triple 42" RCPs Capacity is 252 cfs	26,400
ition C:	Replace with ~~two 36" RCPs~~ two 36" RCPs and one 42" RCP Capacity is 182 cfs, 13 cfs below Q_{10}	14,400 11,400 25,800
Solution D:	Replace with ~~two~~ 48" RCPs Capacity = 212 cfs	22,600

ments:

ommended Solution Cost:

(20)

3'x5' box culvert

$$15 \sqrt{\frac{128.8}{1.5 + \frac{(.004176)(60)}{\left(\frac{15}{16}\right)^{1.33}}}}$$

128

Existing: Single 40"x65" CMAP

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 13-1124

Q10 = 51 cfs

Capacity = 36 cfs

Deficit = -15 cfs (current)
-20 cfs (future)

New cap. = 79 cfs

Cost

Solution A: Replace w/ 3'x3' RC @ 79 cfs 24,000

Cost

Solution B:

Comments:

Recommended Solution Cost:

48" RCP

$$12.57 \sqrt{\frac{128.8}{1.5 + \frac{(.004176)(40)}{1}}}$$

$= 110$ cfs

Existing: Single 34"x 7' CMAP

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 13-0609

Q10 = 380 cfs

Capacity = 140 cfs

Deficit = -240 cfs (current)
-278 cfs (future)

new cap. = 426 cfs

Cost

Solution A: Replace w/ twin 4'x6' bc @ 426 cfs 69,200

Cost

Solution B:

Comments:

Recommended Solution Cost:

3' x 5' box culverts

$$15\sqrt{\frac{128.8}{1.5 + \frac{(.004176)(40)}{\left(\frac{15}{16}\right)^{1.33}}}}$$

assume 40' length

131 cfs

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

C = C

F = C

Structure No: 13-0403

Q10 = 97

Capacity = 70

Deficit = -27

		Cost
tion A:	Install a parallel 36" x 60" CMAP to increase capacity to 140 cfs	2600
Solution B:	Parallel with 30" RCP Capacity = 104 cfs	7,300
ution C/B:	Replace 36" x 60" CMAP with 104 a 3' x 4' box culvert. Capacity is [redacted] cfs 2 feet minimum cover will be maintained.	Cost [redacted] 21,500
Solution D:	Replace with twin 36" RCPs Capacity = 100 cfs	14,400

mments:

commended Solution Cost:

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

C = D
F = D

Structure No: 13-0309

Q10 = 64

Capacity = 31

Deficit = -33

Cost

tion A: I estimated capacity for 24" X30" to be 30 cfs. There are two pipes located at this structures which increases capacity to 60 cfs. Another pipe can be added (24"X38" RCP) to increase capacity to 105 cfs 2600

Cost

tion B:

ments:

ommended Solution Cost:

50

Existing: Twin 36" RCP

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 12-0103

Q10 = 90 cfs

Capacity = 80 cfs

Deficit = -10 cfs (CURRENT)
-19 cfs (future)

New cap. = 120 cfs

Solution A: Add single 36" RCP @ 40 cfs — Cost 12,900

Solution B: — Cost

Comments:

Recommended Solution Cost:

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 11-0805

Q10 = 505

Capacity = 180

Deficit = -325

C = D

I = D

Cost

Solution A: Replace Single 54" RCP with 5' x 12' box culvert. Capacity is 542 cfs. 53,000

* No photos or inspection sheet

Cost

Solution B: Construct Bridge with 30' opening 48,600

Solution C: Replace with twin 5x6 Box Culverts 55,000
Capacity = 536 cfs

Comments:

Recommended Solution Cost:

5x12 box culvert

assume 40 ft length

$$60\sqrt{\frac{128.8}{1.5+\frac{(.004176)(40)}{\left(\frac{60}{34}\right)^{1.33}}}}$$

$= 542$ cfs

5x6

$$30\sqrt{\frac{128.8}{1.5+\frac{(.004176)(40)}{\left(\frac{30}{20}\right)^{1.33}}}}$$

$268 \text{ cfs} \times 2 = 536$

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 11-0816

Q10 = 108

Capacity = 65

Deficit = -43

C = C

F = D

Cost

Solution A: Replace existing twin 36" pipes with a ~~[illegible]~~ box culvert ~~[illegible]~~ cfs 131

22,800

* No photo or inspection report

Cost

Solution B: Parallel with 31"x50" CMPAC
Capacity = 123 cfs

2300

Comments:

Recommended Solution Cost:

3x4 RC

Assume 40 ft length

$$12\sqrt{\frac{128.8}{1.5 + \frac{(.004176)(40)}{\left(\frac{12}{14}\right)^{1.33}}}}$$

104 cfs

3x5 RC

$$15\sqrt{\frac{128.8}{1.5 + \frac{(.004176)(40)}{\left(\frac{15}{16}\right)^{1.33}}}} = 131 \text{ cfs}$$

31 x 50

58[illegible] cfs Area non-grav

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 11-0931 C=D

Q10 = 128 F=D

Capacity = 60

Deficit = -68

Cost

Solution A: Replace single 42" pipe with a 3x5 BC. Capacity is 131 cfs. 22,800
amount of cover is increased by 6 inches

* No photo or inspection report

Cost

Solution B: Replace single 42" pipe with 54" RCP. Capacity is 118 cfs. 18,500
(does not meet Q10)
Minimum cover unknown.

Solution C: Parallel with 48" RCP 14,200
Capacity = 170 cfs.

Comments:

Recommended Solution Cost:

3X5 BC

Assume 40' length

$$15\sqrt{\frac{128.8}{1.5+\frac{(.004176)(40)}{\left(\frac{15}{16}\right)^{1.33}}}}$$

= 131 cfs

48

$$12.57\sqrt{\frac{128.8}{1.5+(.004176)(40)}}$$

110 cfs

54" RCP

$$15.9\sqrt{\frac{128.8}{1.5+\frac{(.004176)\,40}{\left(\frac{4.5}{4}\right)^{1.33}}}}$$

118 cfs

60"

$$19.63\sqrt{\frac{128.8}{1.5+\frac{(.004176)(40)}{\left(\frac{5}{4}\right)^{1.33}}}}$$

174.8

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 11-0924

Q10 = 83

Capacity = 37

Deficit = -46

C = D

F = D

Cost

Solution A: Replace single 30" RCP with 48" RCP. Capacity is 110 cfs. minimum cover unknown — 14,200

* No photo or inspection report

Cost

Solution B: Parallel with 36" RCP Capacity = 87 cfs — 9,000

Comments:

Recommended Solution Cost:

SP

48" RCP

$$12.57\sqrt{\frac{128.8}{1.5 + \frac{(.004176)(40)}{(1)^{1.33}}}}$$

Assume 40' length

110 cfs

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 11-0930

Q10 = 82

Capacity = 53

Deficit = -29

C = C

I = D

Solution A: Install a parallel 30" RCP Ø and increase capacity to [redacted] 87 cfs

Cost 7,300

* No photo or inspection report

Solution B: Replace with 36" x 58" CMPAC
Capacity = 80 cfs

Cost 2600

Solution C: Replace with 3x4 Box
Capacity = 104 cfs.

[redacted] 21,500

Comments:

Recommended Solution Cost:

SD

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 11-1024 C=D

Q10 = 76 I=D

Capacity = 27

Deficit = -49

Cost

Solution A: Replace 24" x 48" CMAP with twin 24" x 38" ERCP. Capacity is 84 cfs 2 feet minimum cover is maintained 4800

Solution B: Replace with 54" RCP 18,500
Road will have to be mounded over pipe, road surface will have to be raised 3 ft. to provide minimum cover of 2 ft. Capacity is 144 cfs.

Cost

Solution C: Replace with 2'x4' Box Culvert 19,000
Capacity = 69 cfs @ 7cfs below q_{10}

Solution D: Parallel with 2 - 24" RCPs 11,000
Capacity = 77 cfs

Comments:

Recommended Solution Cost:

(12)

24" x 38" ERCP

30" equiv. round

$$4.91\sqrt{\frac{128.8}{1.5+\frac{(.004176)(32)}{\left(\frac{2.5}{4}\right)^{1.33}}}}$$

42 x 2

84 cfs

$$\frac{24}{8\sqrt{\frac{128.8}{1.5+\frac{(.004176)(32)}{\left(\frac{8}{12}\right)^{1.33}}}}}$$

69 cfs

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 11-0103 C = D

Q10 = 92 F = D

Capacity = 9

Deficit = -83

Cost

Solution A: replace existing single 18" CMP with twin 36" RCP. Capacity is 118 cfs 14,400

Cost

Solution B: Replace existing 18" CMP with a 3x4 box culvert 102 cfs 21,500

Comments:

Recommended Solution Cost:

(50) dock pipe placement (concrete)

36" RCP

$$7.07 \sqrt{\frac{128.8}{1.5 + \frac{(.004176)(57)}{\left(\frac{3}{4}\right)^{1.33}}}}$$

$57 \times 2 =$ 118 cfs

3 x 4 BC

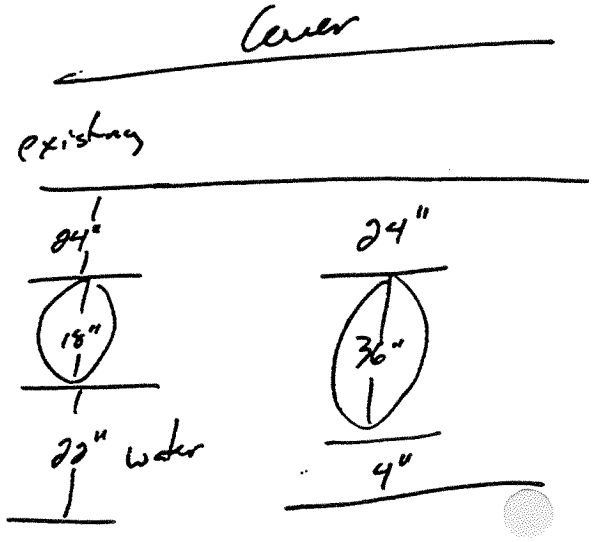
$$12 \sqrt{\frac{128.8}{1.5 + \frac{(.004176)(57)}{\left(\frac{12}{14}\right)^{1.33}}}}$$

$101.7 =$ 102 cfs

3 x 5 BC

$$15 \sqrt{\frac{128.8}{1.5 + \frac{(.004176)(57)}{\left(\frac{15}{16}\right)^{1.33}}}}$$

128 cfs



SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 09-0206

Q10 = 174

Capacity = 123

Deficit = -51

C=C

F=C

Cost

Solution A: Install a third parallel 36" RCP to bring capacity to 236 cfs — 9,000

Cost

Solution B: Replace existing twin 36" RCP with ~~3x8' box culvert, Capacity 243 cfs~~ → 3x7 box culvert, capacity 186 cfs — 28,000

Comments:

Recommended Solution Cost:

JD

3x8 BC

$$24\sqrt{\frac{178.8}{1.5\left(\frac{.004176\,(35)}{\left(\frac{24}{22}\right)^{1.33}}\right)}} = 213\ cA_s$$

3'x7' (assume 2' hard)

$$21\sqrt{\frac{178.8}{1.5 + \left(\frac{.004176\,(35)}{\left(\frac{21}{20}\right)^{1.33}}\right)}}$$

186 A_s

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 09-0403 C=C

Q10 = 85 F=D

Capacity = 56

Deficit = -29

Cost

Solution A: Replace twin 24" RCP with twin 36" RCP. Capacity is 120 cfs. 2 ft of cover is maintained — 14,400

Soluhm B: Add Parallel 24" RCP, Capacity = 81 cfs — 5800

Cost

Solution C: Replace twin 24" RCP with a 3x4 BC, Capacity 104 cfs — 21,500

Comments:

Recommended Solution Cost:

50

24" = 75 cfs

36" RCP

$$7.07\sqrt{\frac{128.8}{1.5+\frac{(.004176)(40)}{\left(\frac{3}{4}\right)^{1.33}}}}$$

60

twin 36
= 120 cfs

3 x 4 BC

$$12\sqrt{\frac{128.8}{1.5+\frac{(.004176)(40)}{\left(\frac{12}{14}\right)^{1.33}}}}$$

104 cfs

3 x 5 BC

$$15\sqrt{\frac{128.8}{1.5+\frac{.004176(40)}{\left(\frac{15}{16}\right)^{1.33}}}}$$

131 cfs

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 06-0103

Q10 = 117

Capacity = 61

Deficit = -56

C = D

F = D

Cost

Solution A: Install parallel 36" RCP 9,000
Capacity will be 122 cfs 4 ft of
cover will be maintained.

Cost

Solution B: ~~[illegible]~~" Replace existing
36" with 54" RCP. 18,500
Capacity is 141 cfs. 2½ ft of cover
will be maintained.

Solution C: Replace with 3x5 Box 22,800
131 cfs = Capacity

Comments:

Recommended Solution Cost:

54" RCP

$$15.9 \sqrt{\frac{128}{1.5 \cdot \frac{(.004176)36}{(1.125)^{1.33}}}}$$

141 cfs

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 05-0815

Q10 = 67

Capacity = 33

Deficit = -34

C=D

F=D

Cost

Solution A: Replace ~~existing~~ 30" RCP with a 3'x3' ~~box~~ culvert, Capacity is 45 ~~cfs~~ $22,800

OR

3'x5' box culvert, capacity is 80 cfs (Head = 1ft)

* Minimum coverage problems with this solution - cover would be less than 1 foot

Cost

Solution B: Install a parallel 30" RCP increasing capacity to 66 cfs $7,300

* existing cover of 10" would remain

Comments:

Recommended Solution Cost:

(JD)

3 x 3 BC

$$9\sqrt{\frac{64.4}{1.5 + \frac{(.004176)(168)}{\left(\frac{9}{12}\right)^{1.33}}}}$$

64.2 45 cfs

3 x 4

$$12\sqrt{\frac{128.8}{1.5 + \frac{.004176(168)}{\left(\frac{12}{14}\right)^{1.33}}}}$$

88

3 x 5

$$15\sqrt{\frac{64.4}{1.5 + \frac{.004176(168)}{\left(\frac{15}{16}\right)^{1.33}}}}$$

80 cfs

SEMINOLE COUNTY SWMMP
REMEDIAL SOLUTIONS

Structure No: 15-0439

Q10 = 81

Capacity = 50

Deficit = -31

C=C

F=D

Cost

tion A: ~~[illegible]~~

Replace existing 24" x 30" RCEP (twin) with a 3'X4' box culvert. Capacity is 104 cfs. minimum cover of 2 feet is maintained

21,500

Cost

tion B: Parallel w/ 30" RCP
Capacity = 86 cfs

7,300

ments:

ommended Solution Cost:

3 x 4

$$12\sqrt{\frac{128.8}{1.5 + \frac{(.004176)(40)}{\left(\frac{12}{14}\right)^{1.33}}}} = 104\ cfs$$

30" $H = 1.5'$

$$4.91\sqrt{\frac{96.6}{1.5 + \frac{(.004176)(40)}{\left(\frac{2.5}{4}\right)^{1.33}}}} =$$

36 cfs

Appendix K

APPENDIX K

APPENDIX K

LAND DEVELOPMENT CODE AND SURFACE WATER MANAGEMENT STANDARDS

A TECHNICAL MEMORANDUM

Seminole County, in conjunction with FDER and SJRWMD, currently has in place a generally complete and well-formulated set of stormwater management regulations and policies to control growth and future development within the County. The new Land Development Code has been developed with the intent to guide engineers, architects, planners, and developers in the design of stormwater management systems in Seminole County. The draft Surface Water Management Standards further define standards of practice for stormwater systems in Seminole County. Both documents were reviewed and specific comments and recommendations are offered in this technical memorandum.

Land Development Code

- Section 6.4.5.2

  This section is inconsistent within itself. Drainage ditches, specifically swales, should be allowed within the boundaries of a subdivision provided an adequate drainage easement is provided.

- Section 6.4.6.2(a)9

  Performance criteria need to be specified here. Drainage facilities should be designed based on a 10-year storm frequency with hydraulic grade line elevations below gutter or edge of pavement. Detention and

retention basins should be designed based on a 25-year storm frequency with two feet of freeboard provided to top of bank.

o Section 6.4.6.2(a)11

The maximum inlet spacing limitations are excessive. We recommend adoption of FDOT criterion of 400' maximum inlet spacing.

o Section 6.4.6.2(a)13

A 15-foot wide maintenance road should be provided around the perimeter of all detention and retention basins.

o Section 6.4.6.2(b) 1 and 2

To be consistent with the St. John's River Water Management District (SJRWMD), the 25-year frequency, 24-hour duration design rainfall event (SCS Type II Florida-Modified Distribution) should be utilized as the basis for comparison of pre-development and post-development runoff peaks. In addition, the 10% allowance should be eliminated.

o Section 6.4.6.2(b)3

The intent of this regulation is to control post-development runoff peaks from a site to whatever excess capacity above a 100-year frequency storm

event is available downstream. This section requirement places undue hardship on the developer to analyze the downstream conveyance and provide flood relief, even if he is matching the pre-development runoff conditions for his site. In addition, it is not stipulated how far downstream this restriction is to be applied. Since no drainage facilities in Seminole County are designed for a 100-year event, this is a severe requirement. We recommend this section be revoked.

o Section 6.4.6.2(b) 5 and 6

Type C and D soils are not considered "impervious". They are simply less permeable than A and B soils. Again, the basis of design for detention and retention basins should be the 25-year, 24-hour storm event, as per SJRWMD guidelines. There needs to be inclusion of definitions of detention and retention ponds in Chapter 2 - Definitions.

o Section 6.5.6.1

The FDOT has accepted the use of corrugated polyethylene pipe as an alternate pipe material. It is recommended that this be included. The minimum cover requirements of this section are extremely excessive. FDOT requires 12 inches of cover (between outside crown of pipe and bottom of road base) as a minimum, with 15 to 18 inches recommended, regardless of the pipe diameter. Requiring one pipe diameter of cover would far surpass this criterion for any large diameter pipes. We recommend

adoption of the FDOT criterion. A minimum clearance of 0.5 feet between shell of pipe and shell of any utility crossing should be specified.

- Section 6.5.6.2

  It is recommended that all inlets be required to have manhole lids for maintenance access. Drainage calculations for storm sewers should include storm sewer tabulation forms.

- Section 7.4.3.2(a)9

  Same as Section 6.4.6.2(a)9

- Section 7.4.3.2(a)11

  Same as Section 6.4.6.2(a)11

- Section 7.4.3.2(a)13

  Same as Section 6.4.6.2(a)13

- Section 7.4.3.2(b) 1 and 2

  Same as Section 6.4.6.2(b) 1 and 2

o Section 7.4.3.2(b)3

Same as Section 6.4.6.2(b)3

o Section 7.4.3.2(b) 5 and 6

Same as Section 6.4.6.2(b) 5 and 6

o Appendix B

Remove the 10-year, 3-hour and 25-year, 6-hour design rainfall tables from this appendix. They should be replaced with the design rainfall intensity-duration-frequency tables as developed in the Seminole County Stormwater Management Plan.

Surface Water Management Standards

The Seminole County Surface Water Management Standards (Draft) were reviewed with regard to applicability, consistency, and conformity to the Seminole County Stormwater Management Plan and the Seminole County Land Development Code. Specific recommendations for change are listed as follows:

o Section 1.1

Grass-lined ditches, i.e., swales, are open ditches that provide water

quality and environmental benefits. Open ditches should be permitted within subdivision boundaries.

o Section 2

There is an inconsistency within this section. At one point it is stated that: "Flood plains shall be maintained in their natural state, declared as a preservation area and protected with a Conservation Easement." The rest of the section deals with permissible activities within flood prone areas. This seems contradictory.

o Section 3.2

Whenever open drainage systems have sideslopes shallower than 4:1, there will be inadequate maintenance access (see Section 4.3.2) and additional easement width will be required. If criteria were changed to "15' + TOP WIDTH", confusion could be avoided.

o Section 4.1

The 10-year, 3-hour design storm reference for closed drainage systems (internal to development) and roadside swales should be changed to just a 10-year design storm. The 10-year, 3-hour design storm should be removed from Appendices. A separate listing for various classes of road culverts (outside of development) should be included, distinguishing them from

bridges, and requiring a 25-year design storm criterion.

o Section 4.2.1B

It must be demonstrated that the required retention volume will be available in the retention pond for the developed condition. Pond must percolate at a required rate and seasonal highwater table should be a minimum of 1 foot below pond bottom.

o Section 4.2.4A

The drawdown period for retention/detention ponds must also be stipulated. There is only a reference to detention with filtration ponds.

o Section 4.3.2

The "Ditch" or "Canal Width" reference should be the bottom width.

o Section 4.3.6

Pond side slopes need only be sodded to the normal pool elevation for wet bottom ponds and the bottom should not require any planting.

o Section 4.3.7

A definition of "canals" is needed to distinguish from swales and ditches. Fencing for shallow swales and ditches should not be required.

o Section 4.4.1B.4b

The intent of this criterion is the bottom of the base course shall not be placed more than 24 inches below the seasonal high water table elevation prior to underdraining.

o Section 4.4.1D

FDOT criterion for maximum inlet spacing in curb and gutter drainage systems is 400 feet. We recommend conformance to this criterion.

o Section 4.4.1F

Storm sewer tabulation forms should be required submittals with all drainage plans.

o Section 4.4.1G

Stipulate that stormwater spread criteria are for 10-year design storm frequency.

o Section 4.4.3E

A freeboard requirement of 1' to the edge-of-pavement should be added to the allowable headwater criteria.

o Section 4.5.3A

Storm sewers are designed for a 10-year frequency storm. Storm sewer tabulations for 25-year and 100-year events should not be required. Only pond design calculations should be provided for the 25-year and 100-year storms.

o Section 6

This entire section needs to be re-formatted and written as a specific set of erosion control criteria, standards, and requirements. Nothing is rigidly specified. This makes it untenable as a set of regulatory guidelines.