Stormwater Management

Sub-Element

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II C. STORMWATER MANAGEMENT SUB-ELEMENT

1. INTRODUCTION

a. History

The City of Greenacres, which lies in the central flatlands of the County, originally consisted of mostly pines and palmetto flatwoods with numerous small ponds and lesser areas of broad, grassy sloughs. The soils, which are nearly level, wet and sandy, have a loamy subsoil or sandy layers that are weakly cemented with organic matter. In various areas the soils are underlain by limestone.

Early settlers to this County wanting to open it up to human occupation and activity, removed or controlled water by establishing drainage "districts". They constructed drainage canal networks, and thus put the reclaimed land into the production of agricultural goods. As more and more lands were drained, allowing flood protection for roads, buildings and adjacent lands from stormwater runoff, drainage programs no longer could concern themselves strictly with water removal. Today, quality of runoff water, the conservation of groundwater and surface waters, and the impact of drainage on the environment, all have to be considered.

This portion of the Plan inventories the natural conditions and drainage activities in the City of Greenacres. Although the City does not have operational authority and responsibility with respect to drainage facilities, this sub-element will evaluate the impacts of drainage activities, future actions and coordination needed concerning both drainage in general, and the overall management of surface waters.

b. Terms and Concepts

1) Drainage Systems

Water flowing overland during and immediately following a storm event is called stormwater runoff. Under the effect of gravity, the stormwater flows toward sea level through depressions and channels which comprise the drainage system of an area. The drainage system may consist of natural features, man made features, or a combination of both.

An abundance of surface water is the result of the imbalance between rainfall and its removal through ground absorption, evapotranspiration and runoff. The water that remains is surface water, some contained in lakes, shallow wetlands and in depressions. The relationships of these factors, and their effect on

the quantity of surface waters, are basic to an appreciation of the City's natural system.

a) Climate - Rainfall accounts for the majority of surface water in the City of Greenacres. An average of approximately 61 inches of rain falls annually on the City. "Precipitation occurs during all seasons, but, on the basis of mean monthly totals of precipitation, a rainy season of 5 months from June through October brings nearly 65 percent of the annual rainfall in this area."

b) Soil - Unique soil types absorb rainfall at different rates. According to the Soil Conservation Service, the predominant soil in our vicinity is the Myakka Immokakalee Basinger Association, which are "nearly level, poorly drained soils that are sandy throughout; some having a weakly cemented layer."

Level of saturation also affects the soil's ability to absorb rainfall. When the soil has reached its saturation level, which varies among soil types, all additional rainfall striking the area becomes surface runoff or standing surface water.

c) Natural Ground Cover - Through differences in the extent of root systems and in transpiration rates, differing types of vegetation can alter the speed at which infiltration occurs. Plants with large root systems create passage ways which may store additional water; those with high transpiration rates, particularly trees, literally pump water from the soil into the atmosphere. This explains why fallow land yields more runoff than forested land for a given soil type.

d) Topography - While climate, soils, and ground cover modify the volume of water retained or dissipated as runoff, topography generally effects or dictates the rate and direction of flow. Areas of greater slope will yield higher levels of runoff.

Natural drainage systems are defined by the topography of an area. The largest feature of a natural drainage system is the drainage basin, or watershed. The boundary of the basin is called the basin divide. This is a line where the natural land elevation directs runoff from the basin toward a common major drainage feature, such as a river, lake or bay. The major drainage feature is often called the receiving body and the smaller features are its tributaries.

2) Human Impact on the Natural System

Man-made stormwater facilities are designed to store or convey stormwater runoff. Swales, ditches, canals and storm sewers are typical conveyance structures, collecting stormwater runoff and directing it toward downstream receiving waters. Stormwater storage structures are generally classified as either detention or retention facilities. Detention facilities are designed to temporarily impound runoff and release it gradually to downstream portions of the drainage system through an outlet structure. Retention facilities are impoundments which release stormwater by evaporation and by percolation into the ground, with no direct discharge to surface waters.

Historically, the typical strategy adopted in response to stormwater flooding of developed areas was to modify the drainage system to convey runoff from developed sites more rapidly. Initially, this response may result in limited success in reducing nuisance effects and property damage. However, as urbanization of a drainage basin increases, storm events produce proportionately more and faster runoff, primarily due to the increase in impervious surfaces in the basin.

In addition to exacerbating flood problems, this strategy for coping with stormwater runoff has detrimental effects on water quality. Soil eroding from development sites and materials such as oil, grease, pesticides and fertilizers from urban land uses are washed off by runoff, increasing pollutant loading on receiving waters. The increased velocity of runoff also disrupts natural drainage features by destabilizing channels, leading to further sediment loading and debris accumulation.

The term "stormwater management" refers to comprehensive strategies for dealing with stormwater quantity and quality issues. The central tenet of these strategies is to ensure that the volume, rate, timing and pollutant load of runoff after development is similar to that which occurred prior to development. To accomplish this, a combination of structural and non-structural techniques is utilized. Structural techniques emphasize preservation or simulation of natural drainage features to promote infiltration, filtering and slowing of runoff. The objective of stormwater management is to utilize the combination of techniques which provide adequate pollutant removal and flood protection in the most economical manner.

One of the key principles of current stormwater management

techniques is recognition of the need for basin wide planning. The stormwater management system must be designed beginning with the final outlet point to ensure adequate capacity to handle all discharges from the upstream portion of the basin under conditions present at the time of design. It is then necessary to ensure that subsequent development upstream utilizes stormwater management techniques and systems which maintain predevelopment runoff conditions so that the downstream system is not overloaded. By ensuring that all development within the basin is based on and supportive of a plan for the entire basin, the functions and useful life of both natural and man-made components of the system will be protected and extended.

There are two basic factors involved in establishing a successful stormwater management program around these principles:

1. establishing and applying uniform design standards and procedures; and

2. ensuring adequate maintenance of system components once they are constructed. The design standard which is of primary importance is the design storm event. This standard specifies the intensity (rate of rainfall) and duration of the rainfall event to be used in the design of facilities.

2. INVENTORY AND ANALYSIS

a. Drainage Features

1) Drainage Basins

With development covering much of the City of Greenacres area with buildings, roads, parking areas etc., thus altering the natural drainage patterns, man-made drainage structures were required in order to reduce the flooding potential of the land. These man-made drainage facilities are part of the regional water management system known as the Central and Southern Florida Flood Control Project (CSFFCP) operated by the South Florida Water Management District (SFWMD) and built by the United States Army Corps of Engineers (COE).

SFWMD is responsible for storm water control within the 16 counties of its defined region. The district owns and operates approximately 215 miles of major canals in Palm Beach County. Lake Okeechobee is the hub of the South Florida flood control and water conservation system. The lake level is maintained by levees and gate structures with

discharges into the major canal system. The major canal system is divided into several drainage basins within the County.

The portions of the CSFFCP project that serve the City of Greenacres are the C-51 and C-16 drainage basins identified on Map No. 1. Lake Worth Road (S.R. 802) divides the C-51 drainage basin to the north from the C-16 basin to the south. The C-51 and C-16 basins are generally drained by a system of east-west canals referred to as laterals and north-south canals referred to as equalizers. The outfall for the drainage basins is the C-51 canal operated by SFWMD.

2) Drainage Canals

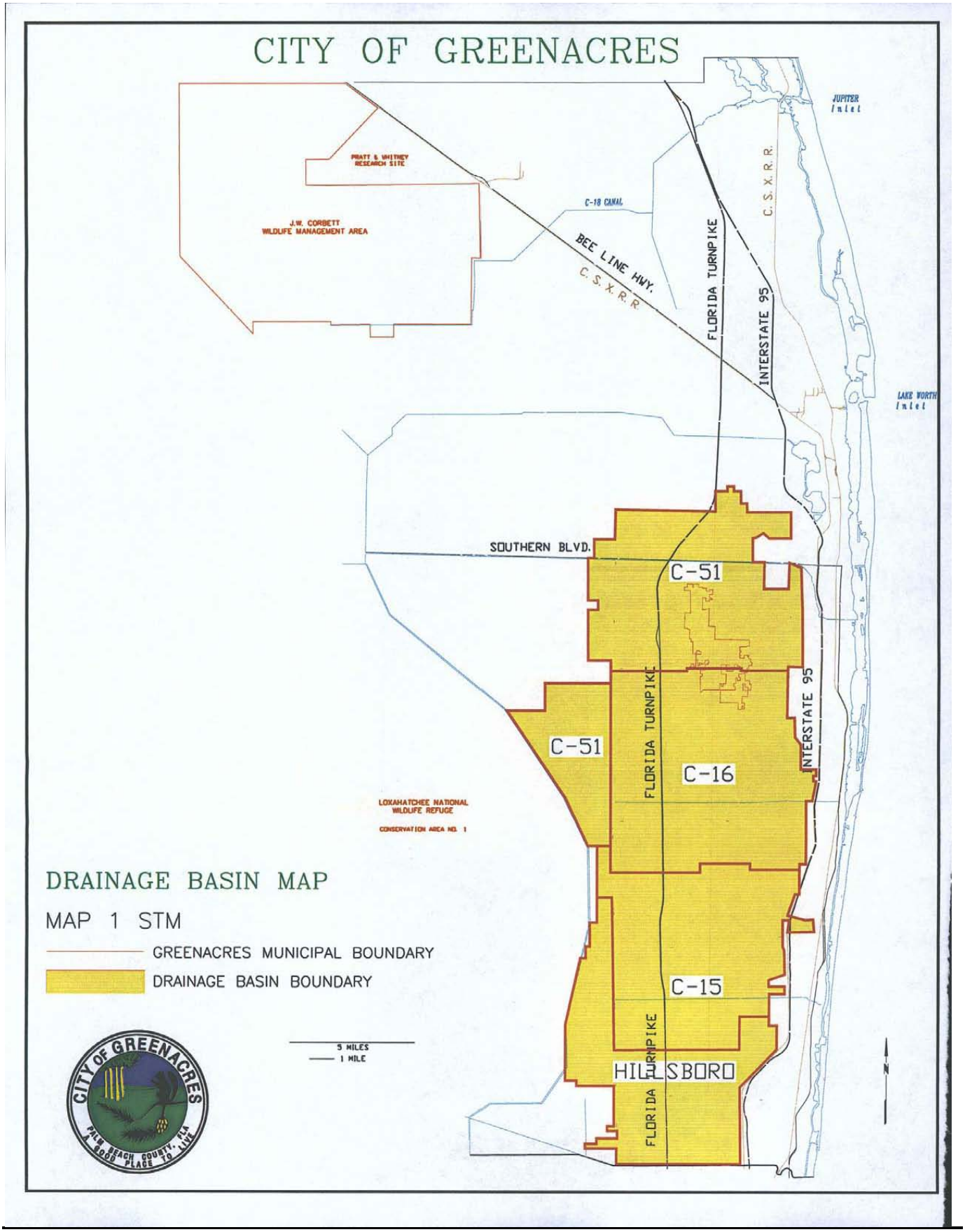
The surface water hydrology of the SFWMD is characterized by an extensive, heavily managed canal network, portions of which provide the primary drainage system to the City. There are a total of eleven (11) drainage canals bordering or within the corporate limits of the City whose locations are depicted on Map. No. 2 and include the following:

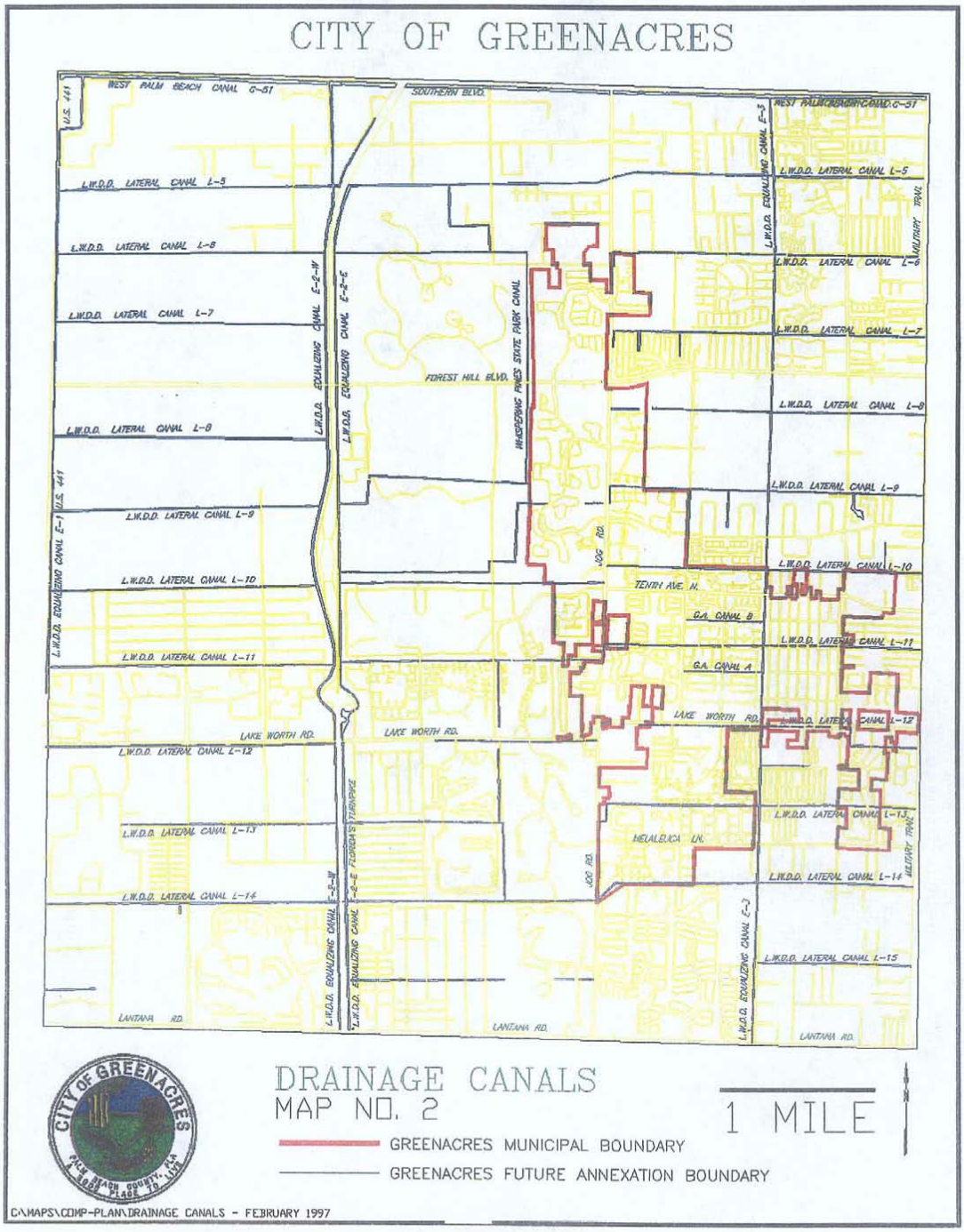
L-6	L-10	L-14
L-7	L-11	L-15
L-8	L-12	E-3
L-9	L-13	

Lake Worth Drainage District has jurisdiction of canals L-6 thru L-14 and E-3. The majority of the drainage canals have an east-west orientation except for the E-3 canal which has a north-south orientation and is located west of Fleming Avenue. All these canals were constructed between 1913 and 1927. There are no low head pumping installations or surface water impoundment areas normally associated with the SFWMD system, within the City of Greenacres. However, the structures pertaining to the City are Control #6 and #4. The controls consist of 3 "a mile" gates, #6 on Southern Boulevard west of Haverhill Road and #4 west of the Turnpike, on Southern Boulevard. Control #6 has a capacity of 650 cu. ft. per second and control #4, 550 cu.ft. per second.

3) Supplemental Drainage

The City of Greenacres also relies on natural infiltration of runoff; namely swale areas. In some areas, spot drainage facilities, including french drains, catch basins, headwalls and retention ponds have been constructed. The primary purpose of these facilities is to direct surface runoff to natural outfalls where natural infiltration is inhibited to alleviate the temporary problem of standing water. In addition, various land developers have provided a few secondary drainage systems within their


CITY OF GREENACRES
PRATT & WHITNEY RESEARCH SITE
J.W. CORBETT WILDLIFE MANAGEMENT AREA
C-18 CANAL
BEE LINE HWY.
C.S.X.R.R.
FLORIDA TURNPIKE
INTERSTATE 95
C.S.X.R.R.
JUPITER Inlet
LAKE WORTH Inlet
SOUTHERN BLVD.
C-51
C-51
C-16
C-15
HILLSBORO
LOXAHATCHEE NATIONAL WILDLIFE REFUGE
CONSERVATION AREA NO. 1
DRAINAGE BASIN MAP
MAP 1 STM
GREENACRES MUNICIPAL BOUNDARY
DRAINAGE BASIN BOUNDARY
5 MILES
1 MILE
CITY OF GREENACRES
PALM BEACH COUNTY, FLA.
A GOOD PLACE TO LIVE


CITY OF GREENACRES
WEST PALM BEACH CANAL C-51
SOUTHERN BLVD.
U.S. 441
L.W.D.D. LATERAL CANAL L-5
L.W.D.D. LATERAL CANAL L-6
L.W.D.D. LATERAL CANAL L-7
L.W.D.D. LATERAL CANAL L-8
L.W.D.D. LATERAL CANAL L-9
L.W.D.D. LATERAL CANAL L-10
L.W.D.D. LATERAL CANAL L-11
L.W.D.D. LATERAL CANAL L-12
L.W.D.D. LATERAL CANAL L-13
L.W.D.D. LATERAL CANAL L-14
L.W.D.D. LATERAL CANAL L-15
L.W.D.D. EQUALIZING CANAL E-1
L.W.D.D. EQUALIZING CANAL E-2-W
L.W.D.D. EQUALIZING CANAL E-2-E
L.W.D.D. EQUALIZING CANAL E-3
L.W.D.D. EQUALIZING CANAL E-5
HAVERFORD PINES STATE PARK CANAL
FOREST HILL BLVD.
LAKE WORTH RD.
LANTANA RD.
10TH AVE. N.
G.A. CANAL B
G.A. CANAL A
MELALEUCA LN.
FLORIDA'S TURNPIKE
MILITARY TRAIL
100 RD.
DRAINAGE CANALS
MAP NO. 2
1 MILE
GREENACRES MUNICIPAL BOUNDARY
GREENACRES FUTURE ANNEXATION BOUNDARY
C:\MAPS\COMP-PLAN\DRAINAGE CANALS - FEBRUARY 1997

respective developments. These private systems are maintained by the development.

The present surface water management system, consisting of a series of canals, drainage ditches, swale systems, retention ponds and the natural percolation characteristic of area soils, will continue to provide adequate service if designed and maintained properly. However, due to the increased amounts of surface runoff generated by developed areas, initial design considerations and proper maintenance techniques are essential for the maintenance of a proper functioning system.

b. Facility Capacity

Project control structures (under the operational jurisdiction of the SFWMD) that serve the City of Greenacres regulate the flow of water in the canals. In general, they are used to discharge excess water from the basins during wet weather and to maintain minimum water levels in the canals during drought periods. Some structures are normally in the closed position to prevent water from passing from one basin to another, but can be opened to supply water from one basin or canal to another as necessary.

One of the purposes of the LWDD is to provide for water control and water supply through the construction and maintenance of canals, ditches, water control structures and pumping stations.

An extensive intermediate network of secondary canals under the jurisdiction of the Lake Worth Drainage District (See Map No. 2) discharges to primary basin canals. These LWDD canals located within the City, serve a variety of functions:

1. Flood protection
2. Land drainage for urban development
3. Regulation of groundwater elevations
4. Recharge of wellfields

The current primary drainage basins (See Map No. 1) of Palm Beach County were first delineated in the 1950's by the U.S. Army Corps of Engineers (COE) in their General Design Memorandum for the Central and Southern Florida Flood Control Project. Based on the hydrology of the basins, the COE designed and constructed a system of canals, levees, and control structures to provide flood protection for Southern and Central Florida. Most of the works constructed under the Project are now under the operational jurisdiction of the South Florida Water Management District (SFWMD). Those basins which directly impact Greenacres City are outlined below.

1) C-51 Basin

"The C-51 basin has an area of approximately 164.3 square miles. The basin is comprised of two sub basins (C-51 west and C-51 east). Stages within the C-51 canal are regulated by SFWMD. To improve the hydraulic capacity of the C-51 canal, SFWMD has recently completed channel improvements between Kirk Road and Florida's Turnpike. These improvements have resulted in the lowering of stages with the C-51 canal, thereby reducing tailwater conditions for LWDD canals. As a result of the improvements made to C-51 canal along with the exchange of discharge between LWDD C-51 and C-16 basins, it was determined that the capacity of the C-51 basin is equivalent to a 10-year, 24-hour storm event.

2) C-16 Basin

The C-16 Basin has an area of approximately 65 square miles and is designed for a 10 year, 24-hour storm event. Inflows to C-16 are by various Lake Worth Drainage District (LWDD) canals, because some of the north-south flowing LWDD canals do not have divide structures between the C-16 and the C-15 basins, between the C-16 and C-51 basins, and between the C-15 and Hillsboro basins. Therefore, some interbasin transfer of water may occur.

The LWDD canal system was designed for 25-year flood protection. Although the system has not yet been constructed to design specifications, LWDD requires that developers planning to drain to the LWDD improve the canals to design specifications.

Lake Worth Drainage District (LWDD) maintains 511 square miles of canals making it the largest independent district in the eastern county. LWDD is located in and discharges to four basins: C-51, Hillsboro, C-15, and C-16. LWDD conducted a study of its system, capacities and problem areas. This study gave the district a better indication of how the system should be operated and maintained.

Regardless of design criteria, the LWDD has fixed capacities in that it is only able to provide a set level of service and must make all flow and discharge fit into the system. Problems do arise, as with every system, with extreme storms. As growth continues in the service area, LWDD will be able to operate more efficiently. Regulations are in place which require new development to include on-site retention and regulates the outfall into SFWMD. These regulations require review and permitting by SFWMD. Occasional minor problems, such as growth of grasses and creation of sandbars which hinder flow are remedied with maintenance.

c. General Performance - Level of Service

1) Drainage District Operating Policies

Lake Worth Drainage District's plan for improvements consists of:

1. regular maintenance of canals, and
2. upgrading of control structures.

The following discharge criteria is currently held by the Lake Worth Drainage District. (Allowable discharge limits apply to all developments and/or street or road improvements).

TABLE No. 1
BASIN DISCHARGE CRITERIA

Basin	Rate	Frequency (Yrs)
C-51	35 CSM (East of Turnpike)	25
	27 CSM (West of Turnpike)	
C-16	62.6CSM	25
C-15	70 CSM	
Hillsboro	35 CSM	

SOURCE: LWDD Operating Policies-1986

Minimum discharge culverts shall be fifteen (15) inches in diameter. Minimum road and parking tract elevations shall in no case be any lower than the elevation of the Lake Worth Drainage District design profiles. The backwater effects due to distance from the receiving canal must be considered. These profiles approximate the protection required by Palm Beach County road criteria. The maximum allowable discharge from any newly constructed road or street, or from any road or street improvements, must be limited to two and one-half cubic feet per second (2.5 cfs) per half 1/2 mile section for the twenty five (25) year storm frequency.

2) Future Drainage System

All future major residential developments are required by the Land Development Regulations to provide comprehensive stormwater facilities.

These facilities must comply with the requirements of SFWMD. All runoff must be directed to percolation and detention areas for on site retention of stormwater. Therefore, the majority of the requirements for future stormwater drainage systems will be provided by developers.

3) Level of Service (LOS)

The City of Greenacres will adopt those Level of Protection LOS criteria established in the 1989 Palm Beach County Comprehensive Plan to provide the residents of the City flooding and inundation protection. Those levels of service for drainage protection, as adopted in this Sub-element, represent degrees of protection provided for various development features expressed in terms of storm events to be accommodated by the applicable stormwater facility.

a) Primary Drainage System

The "primary system" consists of classified surfacewaters of the state including canals and/or natural water courses providing final conveyance of overall drainage basin flows to the ocean or major inland water bodies. This is the outlet system for the basin. Capacity is essentially fixed by original design as well as natural, economic and environmental constraints which preclude significant upgrading or expansion. In Palm Beach County permitting and operational jurisdiction over this portion of the system is held by the South Florida Water Management District and Lake Worth Drainage District (LWDD) which is the Chapter 298, F.S., drainage district serving the City of Greenacres.

b) Secondary Systems

The "secondary system" consists of a broad range of facilities for treatment and/or control of runoff generated by defined areas of specific land uses. Outflows from such systems are normally subject to positive structural control requirements and permit limitations on their discharge to the primary system.

These facilities are generally designed to control area surface and groundwater elevations and maintain the quantity and quality of developed area runoff at pre-development levels or as otherwise required to mitigate adverse impacts on classified receiving waters. The secondary system includes "on-site" storage facilities, providing stormwater treatment and control prior to discharge from individual development projects, as well as "off-site" facilities operated by the Lake Worth Drainage District (LWDD) to provide

comparable treatment of combined runoff from multiple project sites.

c) Tertiary Drainage Systems

Storm sewers, swales, gutters and site grading comprise the "tertiary system" for immediate drainage of streets and developed areas. The major design consideration is rapid removal of stormwater from structures and areas of land uses subject to damage or disruption by inundation. These facilities must be capable of continuous, reliable performance with minimal interruption for maintenance. Although they normally provide little or no capacity for runoff control and treatment, maximizing the use of overland flow across previous areas, grassed swales and other non-structural techniques may significantly reduce the capacity requirements of the secondary system.

Since the possible combinations of rainfall rate and duration are essentially limitless, rainfall records for a given geographic area are grouped according to the statistical probability that a given average rate of rainfall (intensity) will be equaled or exceeded for a given period of time (duration). As a convention, probability is expressed in terms of the number of years (return period) expected between recurring storms of a specific intensity and duration or, more properly, that the probability of such a storm occurring in any single year is one divided by the return period. For example, if a 2-hour rainfall at an average rate of at least 3 inches/hour is expected to occur once in 5 years (or has a 1/5 chance of occurring in any given year), such a storm would be expressed as a "5-year, 2-hour storm of 3 inches/hour." The capability of a drainage system to dispose of runoff is commonly expressed in terms of the maximum storm event from which runoff can be conveyed or stored by the component facilities in a desirable manner. (See Table No. 2)

Specifying the return period and duration of rainfall to be handled by a drainage facility establishes the degree of protection that the facility can be expected to provide. That is, the chance of overloading a facility designed to accommodate runoff from a 5 year, 2-hour "design storm" is 1 in 5, while the chance of satisfactory performance is 4 in 5, in any given year for a storm lasting 2 hours.

The City lies in an area identified by the Florida Department of Transportation as Zone Ten for rainfall intensity and duration.

TABLE No. 2
TERTIARY DRAINAGE - LOS

	LEVEL OF SERVICE DEVELOPMENT FEATURE	LEGAL POSITIVE OUTFALL LEVEL OF PROTECTION
1.	Lowest habitable space of residential and commercial buildings	Inundation elevation resulting from 100-year, 3-day rainfall, assuming zero discharge; or 100-year flood elevation per F.E.M.A. Flood Insurance Rate Maps; or 100-year flood elevation as established by SFWMD Rule, whichever is more restrictive.
2.	Residential subdivision lots with gross area l/4 acre or less	3-year, 24-hour rainfall
3..	Residential subdivision lots with gross area greater than 1/4 acre a) within 20 ft. of habitable building b) remainder of lot except areas management purposes	 a) 3-year, 24-hour rainfall b) duration of inundation not to exceed 8 hours subsequent to 3-year, 24-hour rainfall
4.	Local Streets	3-year, 24-hour rainfall
5.	Collector streets not included in Thoroughfare Plan	5-year, 24-hour rainfall
6.	Thoroughfare Plan Streets	In accordance with applicable requirements per FDOT DRAINAGE MANUAL
7.	Residential parking lots	3-year, 24-hour rainfall (5-year,24-hour rainfall when exfiltration trench system used)
8.	Commercial parking lots	3-year, 1-hour rainfall (5-year, 1-hour rainfall when exfiltration trench system used)
9.	Recreation and open space areas not specifically designated for stormwater management purposes	Duration of inundation not to exceed 8 hours following 3-year, 24-hour rainfall

d) Impact on Natural Resources

1) Wildlife Habitats

The City of Greenacres is committed to the support of various species of endangered or threatened wildlife and their habitats. These habitats can be altered through drainage programs, sometimes drastically. When drained, wetland areas no longer will support the native vegetation and corresponding wildlife. At present, no threatened or endangered wildlife have been identified within the City.

2) Aquifer Systems and Recharge

Two aquifer systems underlie the City of Greenacres. They are, in descending order, the Surficial Aquifer System and the Floridan Aquifer System. Since this portion of the element deals only with aquifer recharge, additional details of the aquifer systems and the City's location within identified areas of "high aquifer recharge" can be found in the Conservation Element of this plan.

a) Surficial Aquifer System.

This system is divisible into three interconnected zones on the basis of relative permeabilities; Zone 1, which includes Greenacres City, is generally the most permeable part of the aquifer system and is located in the eastern part of the County.

County wellfields are generally located in Zone 1 which is a discontinuous zone of high secondary permeability (See Potable Water Sub Element for wellfields.) This zone, also referred to as the Turnpike Aquifer or cavity riddled zone, is the northern extension of the Biscayne Aquifer. Formed by varying dissolution of aquifer limestone materials, this has up to double the productivity of nonsolutioned parts of the system. Transmissivities of greater than 1,000,000 gallons per day per foot have been reported in this zone, according to South Florida Water Management District (SFWMD).

No single entity has "jurisdiction" over the aquifer, although the SFWMD does permit wells and water

withdrawal activities. SFWMD has been designated by the Florida Department of Environmental Protection to undertake a groundwater assessment study and identify prime areas of aquifer recharge. This study, although underway, has not been completed. The aquifer serves Palm Beach County's population regardless of jurisdictions in the County to coordinate and cooperate with each other to protect the natural system and its processes.

Water levels in the Surficial Aquifer System are largely controlled by the canal network. Recharge to the system is through infiltration from rainfall, canals, the conservation areas and Lake Okeechobee. Lake Okeechobee is particularly important during dry periods when water is moved from the lake to canals and then into the aquifer through infiltration. The role of canals in the recharge process is especially important during the "dry season" and periods of drought.

Rainfall in the City, as well as in Palm Beach County, is seasonal with about 65% of the yearly rainfall being deposited in the months of June through October. In prolonged periods of rain, soils become saturated at varying rates depending on their individual texture and the depth to a less impervious layer, with the resulting runoff following topographic features in its movement.

In addition to the monitoring, compiling and archiving of climatologic and hydrologic data, the SFWMD has analyzed these data to determine frequency, duration, and estimated recurrence of extreme hydrologic events, such as excessive rainfall and droughts. The District also publishes an annual summary of hydrologic conditions. Two recent tropical storms (Dennis, during August 16-18, 1981 and Bob, during July 22-24, 1985) and a severe drought (during 1980-82) affected portions of Palm Beach County and were the subjects of special reports by the SFWMD. The Surficial Aquifer System will probably continue to be the primary source of water for Palm Beach County

and, with proper management, should meet future needs.

b) Floridan Aquifer System

The second aquifer system in Palm Beach County is the Floridan Aquifer System. It is an artesian aquifer underlying the Surficial Aquifer System. The two systems are essentially separated by largely confining beds. Although the Floridan Aquifer is a prime source of freshwater in central Florida, water from the aquifer is non-potable in Palm Beach County due to high chloride levels and dissolved solids. The Floridan does have potential for use either as a source of brackish water for reverse osmosis or as a reservoir for storage and recovery of freshwater.

Dense, low permeable limestones and dolomites occur throughout the Floridan Aquifer System. These materials of low permeability divide the Floridan into two semi-confined aquifers. The lower portion of the Floridan known as the Boulder Zone, is cavernous, and contains water similar to seawater. The Boulder Zone is significant because it is used for waste disposal via deep-well injections.

e) Regulatory Framework

Section 208 of the Federal Water Pollution Control Act (PL92-500, 1972) is the directing federal law with respect to water pollution abatement. In implementing the Act, the Environmental Protection Agency (EPA) identified pollutants carried in stormwater runoff as a major source of water contamination. To achieve the pollution abatement goals of the Act, EPA provided assistance to state and local governments to develop Areawide Water Quality Management Plans, or "208 Plans" as they are commonly known. These 208 Plans studied a broad range of potential water pollution sources, including stormwater, and focused on identifying pollutant sources and abatement needs as well as development of regulatory programs to ensure implementation. At present, there are no federal regulations for stormwater management concerning the quantity of stormwater runoff.

The Florida Department of Environmental Protection (DEP) has adopted a Stormwater Rule (Ch. 17-25, FAC) to fulfill part of the State's responsibilities under Section 208 of the Federal Water Pollution Control Act. The Rule's basic objective is to achieve 80-95 percent removal of stormwater pollutants before discharge to receiving waters. This rule requires treatment of the first inch of runoff for sites less than 100 acres in size and the first one-half inch of runoff for sites 100 acres or greater in size.

Treatment is generally accomplished through retention or through detention with filtration. Retention requires the diversion of the required volume of runoff to an impoundment area with no subsequent direct discharge to surface waters. Pollutant removal by settling and by percolation of the stormwater through the soil is almost total. Detention facilities are typically within the line of flow of the drainage system. Stormwater from a site passes through the detention facility and is filtered prior to discharge to remove pollutants.

Implementation of the stormwater rule is achieved through a permitting process. DEP has delegated permitting responsibility to the regional water management district with jurisdiction over the Palm Beach County area.

The Central and Southern Florida Flood Control District was created by Chapter 270 Laws of Florida (1949) as a multi-county district for purposes of flood control and water conservation. Chapter 373, Florida Statutes (F.S.), the Florida Water Resources Act of 1972 (Act), greatly expanded the District's responsibilities from flood control to the full range of water management activities. In addition, the Act changed the name of the agency to the South Florida Water Management District (SFWMD).

The Act is intended to govern the regulation of all waters of the State, unless exempted by law, where waters of the State are defined to include all water on or beneath the surface of the ground or in the atmosphere. Generally, the purposes for which the Act was adopted are to provide for management of water and related land resources; to promote the conservation, development and proper utilization of surface and groundwater; to provide water storage for beneficial purposes, to prevent damage from floods, soil erosion and excessive drainage; to preserve natural resources, fish and wildlife; and to promote recreational development.

Pursuant to the Administrative Procedures Act (Chapter 120 F.S.), the District has implemented all of the permitting programs that

were authorized by the Act, by adopting rules which are published as Chapter 40E of the Florida Administrative Code (FAC).

There are two types of water resource permits issued by the District: permits for the consumptive use of water and permits for drainage or surface water management. The basic criteria for both types of permits are the same. The proposal must be reasonable and beneficial, must be in the public interest, and must not harm any other existing legal user of water. How these criteria are applied~~,~~ differs by the type of permit.

Permit review is handled by a staff of professionals experienced in water resource engineering, hydrology and the other disciplines. District staff provides assistance to meet the applicant's needs and to protect the resources and public safety of the people of South Florida.

1) Surface Water Quality Programs

The SFWMD conducts two primary types of surface water quality studies. The first is a series of research programs that are designed to address specific water quality problems. The second is a District-wide surface water quality monitoring program that is conducted by the SFWMD in cooperation with the United States Geological Survey and other agencies. Additional comments on the aforementioned agencies can be found in the Intergovernmental Element of this Plan.

f) Stormwater Runoff Quality

1) Pollution Sources

Currently, few specific water pollution problems originate in Greenacres, partly as a result of natural factors and partly as a result of development regulations. Sediment pollution caused by soil erosion is minimal. However, pollutants from lawns and roadways, such as motor oil, gas, pesticides and fertilizers, do taint stormwater runoff. Such adverse impacts result from the predominance of residential and commercial land uses coupled with the lack of a stormwater system in the City. Very frequently, therefore, strategies to manage the quantity of stormwater runoff will inherently improve the quality of stormwater runoff.