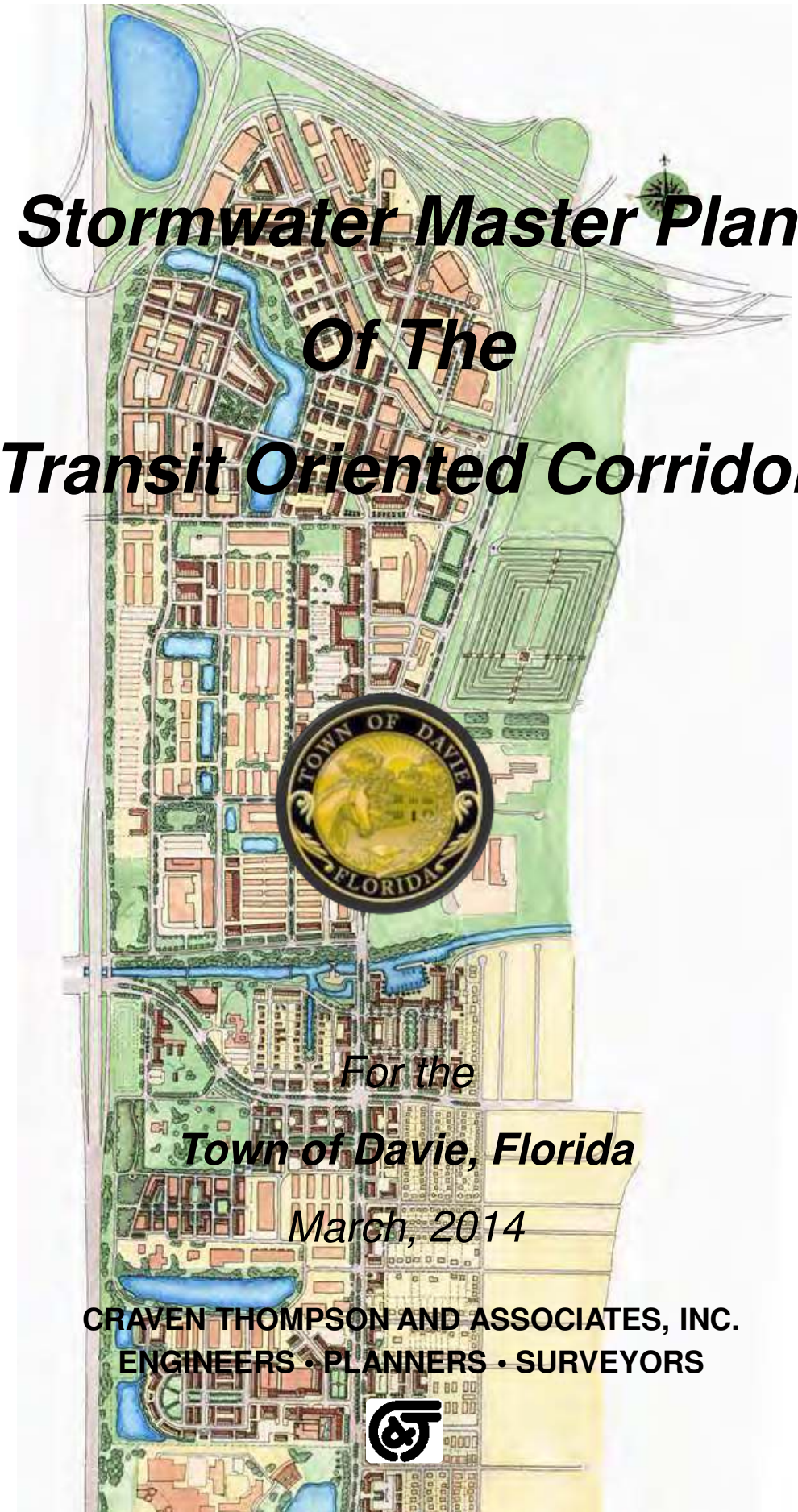

Stormwater Master Plan

Of The

Transit Oriented Corridor

For the

Town of Davie, Florida

March, 2014

CRAVEN THOMPSON AND ASSOCIATES, INC.
ENGINEERS • PLANNERS • SURVEYORS

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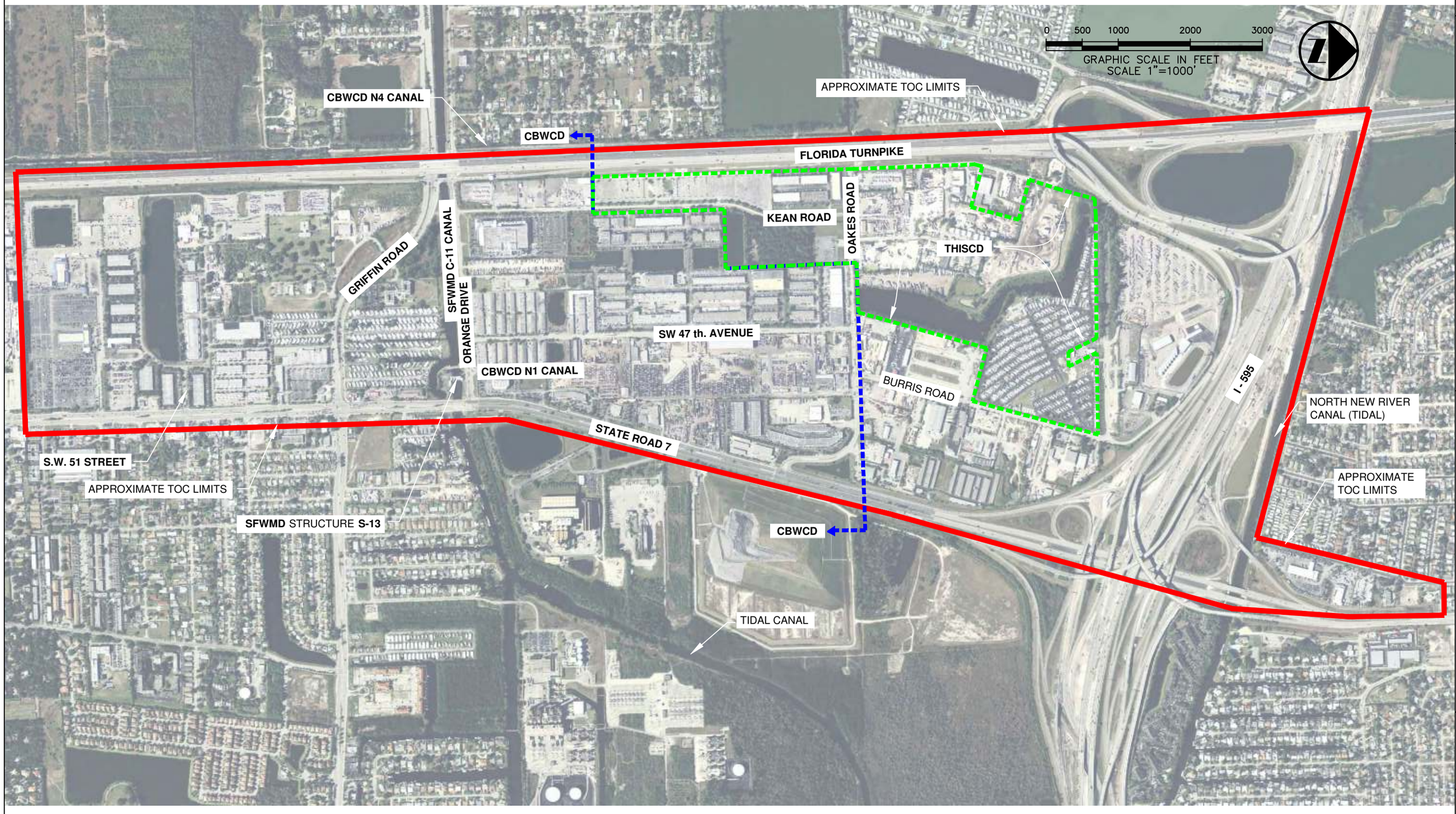
In January 2011, the Town of Davie entered into a contract with Craven Thompson & Associates, Inc. (CTA) for the preparation of a Stormwater Master Plan of the Transit Oriented Corridor (TOC) area. The scope of the Stormwater Master Plan is to provide a mechanism on how the Master Stormwater Management System can be designed, funded, constructed and operated to accommodate future development within the TOC.

The Town's boundaries of the TOC are roughly described as being within the following borders: South of I-595, west of S.R. 7, north of HardRock Café and east of the Turnpike, with the exception of a small area north of I-595 which is hydraulically independent from the rest of the TOC. An aerial map of the TOC limits is shown in ***Figure 1***.

While the goal of this study is to prepare a Stormwater Master Plan (SWMP) to accommodate future development within the TOC limits, the SWMP must also accommodate the existing properties that may remain and not be redeveloped. Therefore it is critical to ensure that the SWMP minimizes as much as possible adverse impacts caused by higher flood stages to existing properties. In order to evaluate and compare the Pre-Development versus Post-Development SWMP flood stages and attenuation, the existing conditions throughout the TOC must be determined and modeled.

Evaluation of the existing drainage infrastructure and topographic elevations together with the existing land barriers such as canals and roadways, the TOC is comprised of seven different drainage basins as illustrated in ***Figure 2*****.** Each basin has been evaluated and described within the main body of this report.



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TOWN OF DAVIE TOC STORMWATER MASTER PLAN

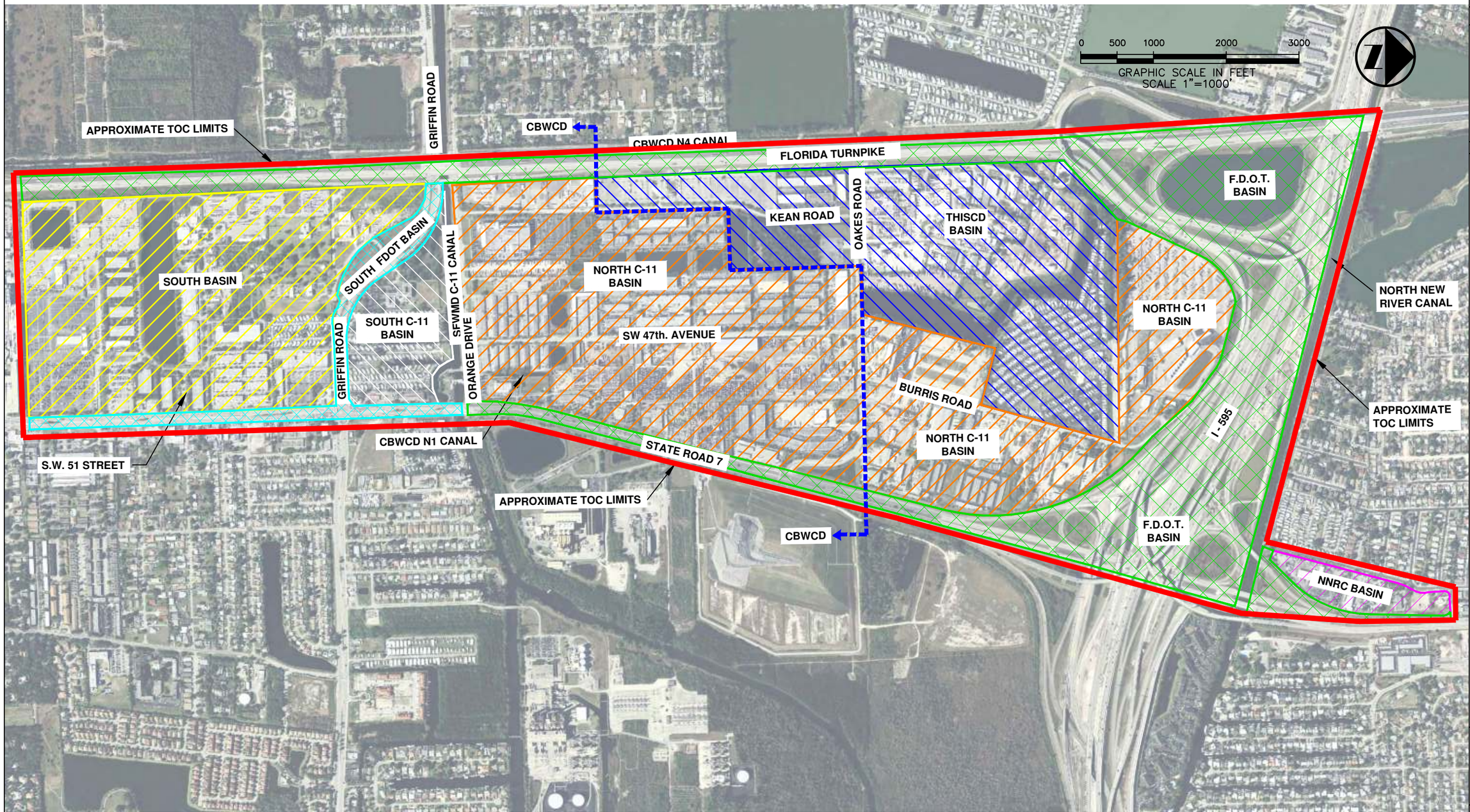
PREPARED FOR: TOWN OF DAVIE

AERIAL OF TOC LIMITS

PROJECT NO. 11-0009

FIGURE # 1

SHEET 1 OF 1



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TOWN OF DAVIE TOC
STORMWATER MASTER PLAN

PREPARED FOR:
TOWN OF DAVIE

EXISTING DRAINAGE BASINS

PROJECT NO.
11-0009

FIGURE # 2

SHEET 1 OF 1

EXISTING CONDITIONS

Most of the existing properties have independent drainage systems and the buildings and pavement areas have been built at different elevations than other properties. In order to create a stormwater model to emulate existing conditions, each basin or sub-basin must be dissected into multiple drainage areas to reflect each property or each individual drainage system. For each drainage area, the coverage areas and corresponding grading parameters were identified and the stage-storage, soil storage and time of concentration were calculated. The existing permit files, record drawings and Light Detection and Ranging (LIDAR) data were utilized to identify this information. The existing coverage areas, grading parameters and calculations for each basin area are provided in **Appendix 4.**

REDEVELOPMENT CRITERIA

The TOC lies within the regulatory jurisdictions of Central Broward Water Control District (CBWCD), Tindal Hammock Irrigation and Soil Conservation District (THISCD), Broward County Environmental Protection and Growth Management Department (BCEPGMD) & South Florida Water Management District (SFWMD) and consequently redevelopment is subject to the latest criteria of these agencies. The requirements for water quality are the same for all the agencies with one exception; CBWCD requires dry pretreatment for roadways. The requirements for water quantity storage and discharge differ between agencies and are explained in the main body of this report.

PREFERRED STORMWATER MANAGEMENT SYSTEM

Two different SWMP Alternatives where designed and presented to the Town Staff and Council. The first alternative consisted of a stormwater management system which would also function as public amenities; incorporating both dry and wet detention/retention areas into linear parks and open space with picnic tables, passive park facilities and pedestrian paths having connectivity through-out the TOC. The second alternative omitted public amenities and was designed to be as practical and economical as possible. Both alternatives were designed with a minimum of 120 acres of overall open space pursuant to Comprehensive Plan Policy 13.1-2. A copy of the two SWMP Alternatives are shown in **Exhibits 6** & **7**.

Two workshops were conducted at the Town of Davie, Town Hall Commission Chambers. The first workshop was held with the land owners and other stakeholders. The second workshop was held with the Town Staff and Commissioners. At each of the workshops, the existing drainage patterns within the TOC were explained and the proposed two alternatives were presented and described, as well as the potential modes of funding. At the conclusion of the second workshop, the Commissioners unanimously voted for the first alternative, which is the SWMP which can also function as public amenities.

FINAL STORMWATER MASTER PLAN

In order to develop the Preferred SWMP into the Final SWMP, the conceptual hydraulic model created for the Alternate No. 1 must was enhanced by separating out the proposed retention ponds, developments, roadways and drainage systems into basins, nodes and links. The Final SWMP reflecting all the basins/sub-basin south of I-595 is shown on **Exhibits 11 & 12**. The exhibits show the proposed developable areas with an orange hatch, the dry retention ponds with a green dot pattern and the wet retention ponds with a blue hatch. The solid green shade represents where park facilities could be created. The developable areas have been designed assuming an ultimate land use breakdown of 35% Building Area, 45% Pavement Area and 20% Green Area. Drainage calculations, assumptions and modeling input data and results are provided in the main body of this report and in **Appendix 5**.

COMPARISON & EVALUATION OF PRE VERSUS POST ICPR MODEL RESULTS

By comparing the Existing (Pre) versus Final (Post) ICPR Modeling Results, adverse affects due to higher flood stages can be identified and evaluated. The results shown in **Exhibit 14** indicate most of the proposed flood elevations are lower than the existing flood elevations, however, certain properties are anticipated to incur increased flood stages. The main cause for anticipated increased flood stages is because the post development discharge rates out of the TOC must be reduced to approximately 47 cubic feet per second (cfs) in accordance with SFWMD criteria; which is significantly reduced compared to the existing discharge rate of approximately 175 cfs. **Exhibit 15** is an aerial map identifying the properties which will experience higher flood stages due to the Final Stormwater Master Plan. The properties identified will be evaluated in the main body of the report, to verify if the increased flood stages will create adverse impacts.

CAPITAL IMPROVEMENT PLAN

The estimated costs to construct the SWMP are shown in **Figure 19**. Given the sizeable total cost, the best approach to construct the Final SWMP should be in phases. The primary and most crucial task to implement the SWMP is to acquire the lands necessary for the proposed retention ponds. The subsequent tasks are dependent on the acquisition of the land to provide necessary storage for the proposed redevelopment within the TOC.

The Final SWMP is made up of separate drainage basins which can be constructed independently or all together to implement the Final Stormwater Master Plan. This allows each basin to be constructed as a separate phase if the Town chooses to implement the SWMP in that manner. The order in which the basins are improved can be determined as best needed to meet proposed re-development demands, but the order of improvements within each sub-

basin however is not flexible and, for the most part, must be completed in a systematic order which is described in the main body of this report.

BASIN ID	LAND ACQUISITION	DEMOLITION & EARTHWORK	DRAINAGE	PAVING, AMENITIES & LANDSCAPING	ENGINEERING & CONTINGENCIES	TOTAL
NORTHEND & NORTHEAST	$9,847,469.00	$1,024,225.69	$1,586,550.00	$1,300,120.00	$2,158,015.61	$15,916,380.30
CBWCD N-1	$15,033,661.10	$1,877,260.07	$3,268,560.00	$4,016,026.67	$4,251,920.13	$28,447,427.96
THISCD	$12,725,736.02	$2,149,170.09	$2,114,420.00	$2,589,280.00	$3,328,434.63	$22,907,040.73
SOUTH CBWCD	$13,274,394.10	$2,400,259.04	$1,322,800.00	$735,600.00	$2,665,037.12	$20,398,090.27
TOTAL=	$50,881,260.22	$7,450,914.89	$8,292,330.00	$8,641,026.67	$12,403,407.49	$87,668,939.26
% OF TOTAL=	58.0%	8.5%	9.5%	9.9%	14.1%	100.0%

FIGURE 19: SUMMARY OF THE ENGINEER'S ESTIMATE OF PROBABLE COST

GOVERNANCE AND FUNDING ALTERNATIVES

The TOC Stormwater Management Program will consist of four stormwater management elements: i) program management (i.e., administration, planning, enforcement and permitting; ii) NPDES permit compliance; iii) operation and maintenance (i.e., cleaning, mowing and repairs associated with stormwater facilities); and iv) capital improvements (i.e., major design and construction). In order to address certain implementation issues associated with the TOC SWMP and the related Stormwater Management Program this task identifies and evaluates governance and funding alternatives for the Town's consideration.

The TOC SWMP has identified capital improvements for four separate basins within the TOC with a total cost of approximately $87 million. Administration of the TOC Stormwater Management Program will require the establishment of organizational activities related to governance and funding.

Governance Options

One of the first steps required to implement the TOC Stormwater Management Program is the establishment of a governing body with the power and authority to administer the affairs of the TOC Stormwater Management Program (the "Program"). The governing body would have the responsibility for oversight of the Program including: i) establishment of the necessary policies, rules and regulations, ii) management and staffing; iii) planning and budgeting; iv) establishment of a funding mechanism including financing of capital improvements and cost recovery associated with funding the operating and capital requirements.

There are four potential options for governing the TOC Stormwater Management Program including: i) form a Home Rule or Dependent Special District governed by the Town Council; ii)

forming a Stormwater Utility governed by the Town Council; iii) create an independent Special District as provided for in the Florida Statutes; and iv) establishing a Community Development District ("CDD"). Each option is explained in the body of this report.

Alternative Funding Sources

The various revenue sources available to the Town to fund the TOC Stormwater Management Program include constitutional and statutorily authorized tax revenue sources, home rule non-tax revenue sources, grants and developer extractions including impact fees. In developing the funding plan for the TOC Stormwater System, a combination of these various funding sources may be required. The available funding sources are explained in the body of this report.

Based on the review of the Town's governance options, the key issue is which options allow the Town to implement the TOC Stormwater Management Program in a manner consistent with the Town's redevelopment goals. Several of the options would require the Town to relinquish control of the Program management. Assuming that the Town's goal is to manage the implementation of the Program, the TOC redevelopment options are ranked as follows:

1) Municipal Service District
2) Stormwater Utility
3) Independent Special District
4) Community Development District

Both the Municipal Services District and the Stormwater Utility approaches would allow the Town to implement the Program consistent with the Town's redevelopment goals and maintain control of the Program.

Establishing an Independent Special District would not only require a voter referendum and approval of the Florida legislature, it would also relinquish control of the Program management to a board that would be independent of local government control. It would also create additional costs associated with the independent governance of the TOC program compared with a "home rule approach". The fourth option considered was establishment of a Community Development District. Implementation of this option would require that the governing board would only represent the interests of the current property owners with the votes weighted by the number of acres owned. This option would also involve additional costs related to governance.

When evaluating the two home rule options, it should be noted that Stormwater Utilities are typically established to provide services on a Town-wide basis and the cost recovery mechanism is based on the use of a monthly utility bill. The option of establishing a Municipal Services

District would allow the Town to recover the Program costs through a non-ad valorem assessment which would strengthen the revenue pledge associated with financing the Program and the district can be defined as a specific geographic area within the Town's boundaries. Thus, the Municipal Services District approach is the best option for implementing the TOC Stormwater Program.

Cost Recovery

The most commonly used cost recovery method associated with Stormwater Management Programs, used in over 90% of Florida communities, is based on each property's amount of impervious area with vacant or undeveloped residential and commercial properties charged based on total area and run-off coefficients to estimate such properties' contributions to the stormwater run-off problem. This approach will provide a solid legal foundation for the stormwater fee and assures that the fees are fairly determined and properly assigned based on sound stormwater engineering concepts. At this stage of the planning effort there is not enough information available to calculate a specific stormwater charge based on the impervious area method. A comprehensive annual rate analysis will likely be required based on the characteristics of the properties within the TOC and the changes to these properties that occur over time.

In order to provide information regarding the capital cost of the TOC Program to the property owners, a capital cost per developable acre and a cost per estimated drainage unit is the best indication of the Program's cost. Based on the costs identified in the Master Plan of approximately $87 million, the annual debt service is estimated to be approximately $5.8 million for a thirty year tax exempt bond based on a 5% interest rate and 3% issuance costs. At this time there are 466 developable acres identified within the TOC, therefore the estimated annual average capital cost per acre of developable property would be approximately $12,446. Information provided by the Town estimates that approximately 80% of the redeveloped properties' land area would be related to impervious surfaces (i.e., 35% buildings and 45% parking) based on the redevelopment plan. Based on this estimate there would be approximately 372.8 equivalent drainage unit/acres (EDU/acre), which yields an estimated annual charge of $15,558 per EDU/acre to recover debt service-related costs. This estimate assumes that all of the initial capital costs are funded through the issuance of debt and does not include any allowance for possible grant funding. Also the estimate does not include any allowance for the cost of annual operations and maintenance activities including maintenance of storm water structures, mowing of ditches and street sweeping, which are not known at this time.

CONCLUSION

The Final SWMP accomplishes the goal previously stated by accommodating stormwater requirements for future development within the Town of Davie TOC in accordance with the TOC Master Plan and the Town of Davie Land Development Regulations. In addition, the Final SWMP can serve as a public amenity with parks and pedestrian paths meandering and extending from the south to the north regions of the TOC.

The total estimated cost of approximately $87 million is a significant amount of money to be paid for stormwater management and therefore the benefits of the implementing the SWMD must be understood.

FIGURE 28

EXISTING CONDITIONS--OVERALL LAND USE COVERAGES BREAKDOWN

Basin ID	SITE AREAS (acres)					
	Total	Building	Pavement	Green	Dry Retention	Lake
THISCD	172.73	7.77	82.94	58.11	7.26	16.65
NORTH END	46.58	1.77	14.26	27.57	1.57	1.42
NORTHEAST	96.72	12.99	56.59	21.85	4.29	1.00
NORTH CB	187.28	33.39	112.58	28.23	2.90	10.18
SOUTH C-11	29.68	1.02	9.30	17.86	0.44	1.12
SOUTH	178.34	16.96	94.58	47.04	3.85	15.91
TOTAL	**711.33**	**73.90**	**370.25**	**200.66**	**20.31**	**46.28**

FINAL STORMWATER MASTER PLAN--LAND USE COVERAGES BREAKDOWN

Basin ID	SITE AREAS (acres)					
	Total	Building	Pavement	Green	Dry Retention	Lake
THISCD	173.44	34.55	54.09	53.12	15.14	16.53
NORTH END	46.08	12.35	17.84	7.51	4.14	4.24
NORTHEAST	74.32	18.34	27.10	13.57	6.70	8.62
NORTH CB	208.83	49.76	78.71	44.34	21.08	14.94
SOUTH C-11	29.99	8.73	11.22	6.45	2.18	1.42
SOUTH	178.57	40.88	54.90	46.75	11.86	24.18
TOTAL	**711.23**	**164.60**	**243.86**	**171.73**	**61.10**	**69.93**

The single most benefit to recognize, that meets the intent of the TOC Master Plan of promoting redevelopment, is that the Total Future Building Areas can increase from approximately 73.9 Acres existing to 164.60 Acres, thereby accommodating over 90 acres of buildings for future growth within the TOC as shown in **Figure 28**. A list of benefits as well as list of the detriments is provided in main body of this report.

In order to redevelop according to the Final TOC Land Use Breakdown shown in **Figure 28**, approximately the same amount of areas must be set aside for stormwater retention, whether on-site by individual property owners or off-site for public use. Since every property needs a certain amount of retention area to accommodate development and since creating separate retention ponds by each development is actually less efficient overall and would require more land area to create the same stormwater storage volume proposed in the Final Stormwater Master Plan, the aforementioned facts help to recognize that the Final SWMP would actually be more cost effective for each property owner within the TOC than not implementing the Final Stormwater Master Plan. Adopting the Final Stormwater Master Plan will not only meet the stormwater needs for existing and future developments within the TOC, but a framework of open areas usable for recreation and pedestrian connectivity will be made available for future generations to enjoy.

II. INTRODUCTION

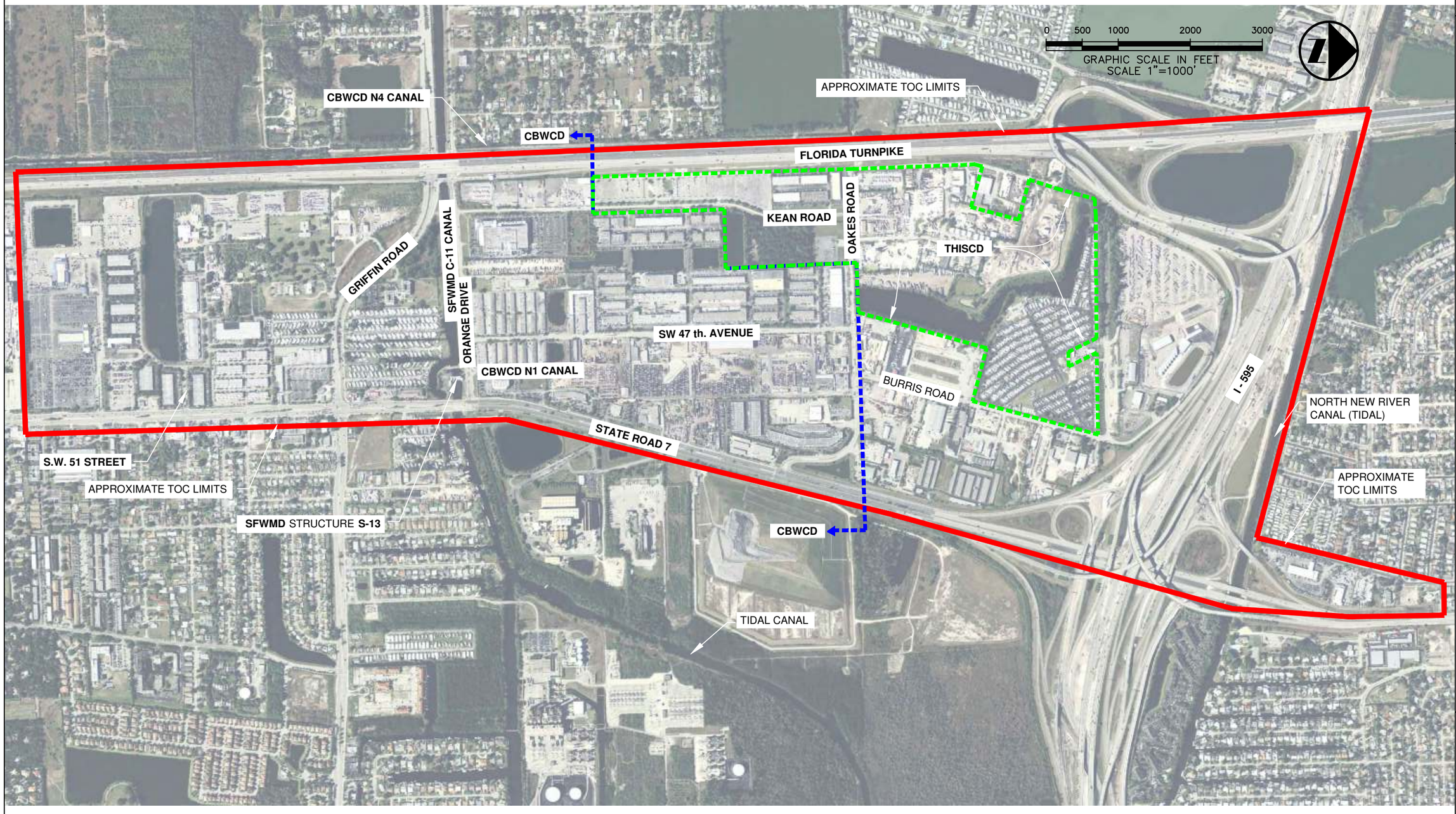
In 2004, the Davie/Hollywood/Seminole Nation Master Plan was created, representing the citizens' vision for the future of the State Road 7 corridor between I-595 and Stirling Road. Given the major roadway arteries of I-595, Florida Turnpike and State Road 7, this Master Plan has been identified as the Transit Oriented Corridor (TOC). The Master Plan was conceptually approved by the Town of Davie in 2005 and served as a guide for the creation of a TOC Future Land Use Amendment and corresponding land development regulations. In 2009, the TOC Future Land Use Category was adopted by the Town and incorporated into the Town's Land Development Regulations. The Davie Community Redevelopment Agency (CRA) convened a Technical Assistance Panel (TAP) in 2010 to determine if any adjustments were warranted to the TOC Master Plan, given the economic events since the creation of the TOC Master Plan. Among the TAP's recommendations, the TAP identified that a centralized drainage district should be evaluated to:

1) Understand what investments the CRA may implement, to enhance redevelopment opportunities so developers can utilize more of their land by utilizing a common stormwater management system, as opposed to developers being required to store stormwater on-site.
2) Identify how the CRA can recover the investment costs by developers purchasing or being charged for stormwater storage in the common stormwater system.

In January 2011, the Town of Davie entered into a contract with Craven Thompson & Associates, Inc. (CTA) for the preparation of a Stormwater Master Plan of the Transit Oriented Corridor (TOC) area. The scope of the Stormwater Master Plan is to provide a mechanism on how Master Stormwater Management System (MSWMS) can be designed, funded, constructed and operated to accommodate future development within the TOC, while adhering to the urban design principles set forth in the Davie/Hollywood/Seminole Nation Master Plan and the related comprehensive plan policies.

The Town's boundaries of the TOC are roughly described as being within the following borders: South of I-595, west of S.R. 7, north of HardRock Café and east of the Turnpike, with the exception of a small area north of I-595 which is hydraulically independent from the rest of the TOC. An aerial map of the TOC limits is shown in ***Figure 1***.

The TOC is situated within the drainage district jurisdictions of Central Broward Water Control District (CBWCD), Tindall Hammock Irrigation and Soil Conservation District (THISCD) and Broward County Environmental Protection and Growth Management Department (BCEPGMD). Each of these governing entities have similar but differing water management regulations and criteria, however they all operate under the authority of and in accordance with the regulations of the South Florida Water Management District (SFWMD). The TOC is also located within two separate SFWMD drainage basins. The small area north of I-595 is within the North New River Canal Basin



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TOWN OF DAVIE TOC STORMWATER MASTER PLAN

PREPARED FOR: TOWN OF DAVIE

AERIAL OF TOC LIMITS

PROJECT NO. 11-0009

FIGURE # 1

SHEET 1 OF 1

and the rest of the TOC lies within the C-11 East Basin. ***Exhibit 1*** shows the two SFWMD basins and the drainage district boundaries within the TOC.

While the goal of this study is to prepare a Stormwater Master Plan (SWMP) to accommodate future development within the TOC limits, the SWMP must also accommodate the existing properties that may remain and not be redeveloped. Therefore it is critical to ensure that the SWMP minimizes as much as possible, adverse impacts to existing properties. The adverse impacts which are of particular concern are higher flood stages and longer duration of flood stages than existing. In order to evaluate and compare the Pre-Development versus Post-Development SWMP flood stages and attenuation, the existing conditions throughout the TOC must be determined and modeled.

III. EXISTING CONDITIONS

The existing conditions that must be determined to develop a hydrologic and hydraulic Stormwater Model are the following:

1) Identify Drainage infrastructure and topographic contours to identify drainage patterns.
2) Identify Watershed Basins and Sub-Basins within the TOC.
3) Identify the coverage areas and the corresponding grading parameters to establish stage-storage relationships for the various properties within each watershed basin.
4) Soil characteristics.
5) Water table elevations.
6) Runoff Coefficients.
7) Time of Concentration.
8) Existing regulatory criteria governing stormwater management within the TOC.

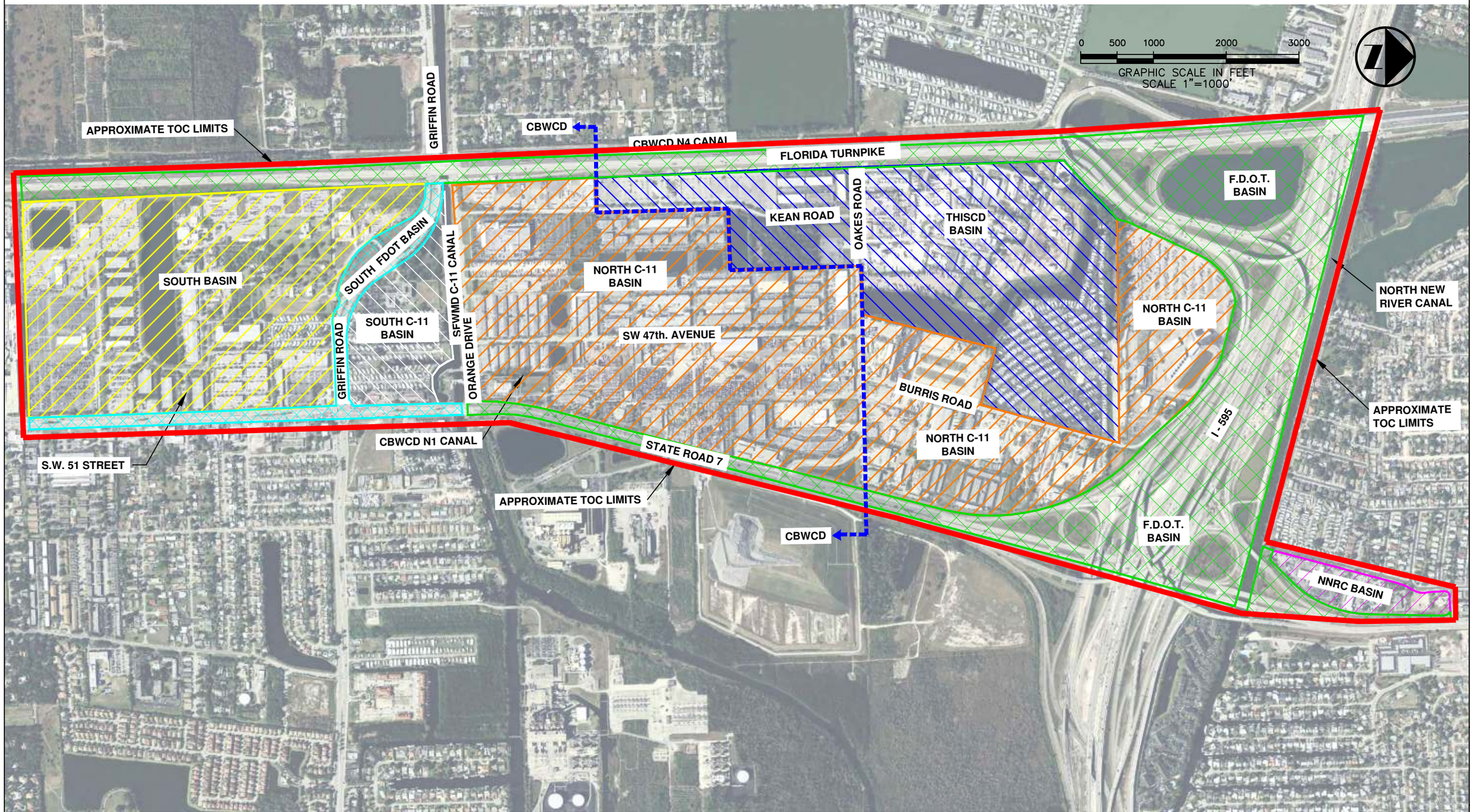
EXISTING DRAINAGE PATTERNS

In order to identify the existing drainage patterns, the existing drainage infrastructure and topographic elevations were sought through record drawings at the Town of Davie and permit files from SFWMD, CBWCD, THISCD and Broward County. Where discrepancies were found in the permit or record drawings of certain existing infrastructure and/or where field visits identified a discrepancy, additional field verification was performed by surveyors. ***Exhibit 2*** shows the 'Existing Drainage Infrastructure' on an aerial map of the TOC. A GIS database was also created reflecting the existing public stormwater infrastructure and is provided on a CD in ***Appendix 1.***

For properties which no permits or record drawings were found, Light Detection and Ranging (LIDAR) was utilized to determine the approximate topographic elevations. LIDAR is an optical remote sensing technology that can measure the distance to properties or targets. Airborne LIDAR sensors have been used over much of the USA's coastlines and the LIDAR data utilized for this study was obtained by Broward County. The raw LIDAR data was compared with known vertical reference points or benchmarks to calibrate and create a synthetic topographic surface throughout the TOC limits. A plan of the LIDAR topography south of I-595 within the TOC is shown on ***Exhibits 3A & 3B***.

EXISTING WATERSHED BASINS & SUB-BASINS

Evaluation of the existing drainage infrastructure and topographic elevations together with the existing land barriers such as canals and roadways, the TOC is comprised of seven different drainage basins as illustrated in ***Figure 2*****.** Each of the basins will be described below and select



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TOWN OF DAVIE TOC
STORMWATER MASTER PLAN

PREPARED FOR:
TOWN OF DAVIE

EXISTING DRAINAGE BASINS

PROJECT NO.
11-0009

FIGURE # 2

SHEET 1 OF 1

basins will be divided into sub-basins as necessary to identify runoff characteristics and infrastructure.

North New River Basin

The North New River Basin is approximately 13.8 acres and separated from the rest of the TOC by I-595 and the North New River Canal. No record drawings of these properties were found and it is assumed that these properties have no off-site discharge.

A Broward County Neighborhood Improvement Project was completed in 2007 consisting of drainage improvements within the local street Rights-of-Way including SW 41st Street, which is adjacent to the TOC limits. There are no known connections from the properties within the TOC limits to the drainage system within SW 41st Street.

FDOT Basin

The FDOT North Basin consists of the I-595, S.R. 7 north of the C-11 canal and the Turnpike Rights-of-Way, which are owned and operated by Florida Department of Transportation. These roadways are elevated above the TOC areas, acting as perimeter land barriers to the north, east and west of the TOC. The three Right-of-Way within this basin are not actually part of the same FDOT drainage basin, however because they are hydraulically separate from the rest of the TOC, they have been lumped together for simplicity.

Since this basin is limited to Public Rights-of-Way which have their own surface water management systems, no evaluations of this basin were performed, however some incoming flows from this basin are accounted for in the model. Approximately 13 acres of the I-595 and S.R. 7 Rights-of-Way discharge into the TOC at the southwest corner of the I-595 and S.R. 7 intersection. In addition, a portion of the Turnpike also shares the same outfall culvert from the Tindall Hammock Irrigation and Soil Conservation District Basin (THISCD).

North C-11 Basin

The North C-11 Basin is approximately 330 acres and consists of four separate sub-basins as shown on **Figure 3**. A portion of this Basin is within CBWCD and the remainder is located within Broward County Jurisdiction. The majority of this basin ultimately flows south to the C-11 via the N-1 canal. The remainder of this basin, the southwestern portion, flows into the C-11 canal via culverts within the Right-of-Way of Orange Drive.

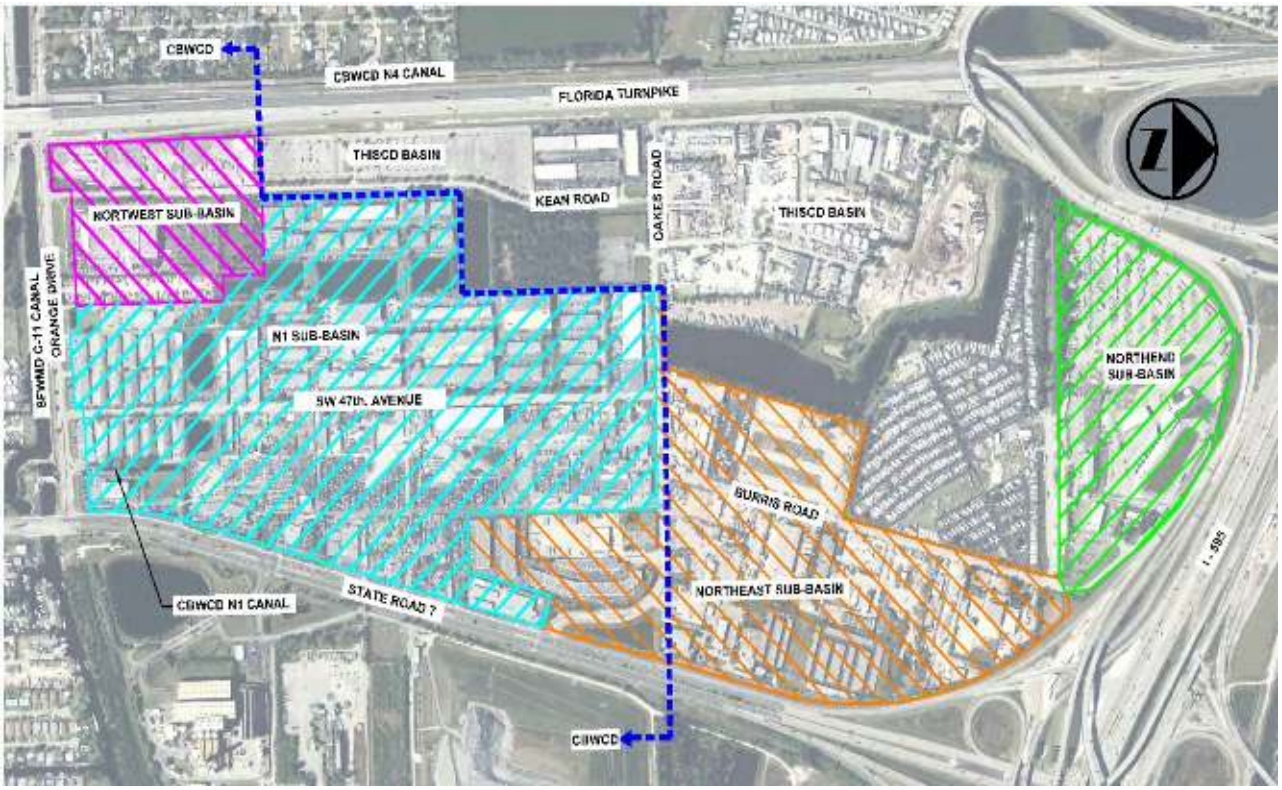


FIGURE 3: SUB-BASINS OF THE NORTH C-11 BASIN

In the 1950's a drainage ditch identified as Lateral Ditch No. 1 was constructed west of S.R. 7, from the C-11 canal north to the S.R. 84 Spur Road. This ditch was designed with an invert of (-)4.97 ft-NGVD at the south end and (-)1.33 ft-NGVD at the previous intersection of the S.R. 84 Spur Road, serving to drain the surrounding areas into the C-11 canal. Over the years, a majority of this ditch has been modified but still serves to drain the surrounding areas. The southernmost portion of the ditch has been widened and is currently known as the CBWCD N-1 canal. The ditch section between the N-1 canal and Oakes Road has been filled in and culverts have been installed ranging from 36-inch RCP at the northern limits to 84-inch RCP at the southern limits. The section north of Oakes Road still exists as a ditch, but is unmaintained and overgrown with vegetation. The northernmost reaches of the ditch have been disconnected, culverted and rerouted eastward to the S.R. 7 Right-of-Way.

The sub-basins within the North C-11 Basin will be described below to further recognize the existing conditions and drainage patterns.

NorthEnd Sub-Basin

The NorthEnd sub-basin is located just south of I-595 as shown in **Figure 4** and is approximately 46.5 acres. This sub-basin is comprised of light industrial and commercial properties, which have large open retention areas and pavement areas, both utilized for tractor trailer parking or for storage of materials. The properties within this sub-basin have independent drainage systems with no drainage outfalls. Future Development within this sub-basin is limited by having to store all runoff on-site, unless an outfall is created. This sub-basin is located within Broward County Jurisdiction, outside of CBWCD and THISCD. Even though this sub-basin has no apparent point of discharge, under an intense rainfall event, ultimately the surface water would rise up and overtop Burris Road and flow into the Northeast Sub-Basin or into the adjacent FDOT swale southwest of the I-595 and S.R. 7 intersection.

FIGURE 4: NORTH END SUB-BASIN

Northeast Sub-Basin

Northeast sub-basin is approximately 97 acres with the majority of the area within the Broward County Jurisdiction but a portion is located within the CBWCD boundaries. The areas north of Oakes Road are outside the CBWCD boundaries and the properties south are within the CBWCD. **Figure 5** shows the existing Northeast Sub-Basin limits including the CBWCD boundary line.

Majority of the land uses in this sub-basin are light industrial and commercial. Burris Road bisects this sub-basin and has a storm drainage system with a discharge into a dry retention pond at the north end of Burris Road. Street ponding within Burris Road occurs frequently with standing water hours after rainfall has ceased, even though the dry retention pond has little to no standing water.

The drainage system should be televised, cleaned and repaired as necessary to properly convey stormwater to the retention pond. The dry retention pond has a culvert located on the pond bank, allowing discharge into the adjacent FDOT swale that extends along the I-595 eastbound exit to southbound S.R. 7. This swale is graded to flow toward the southeast and eventually discharges into a 54-inch culvert that is connected to a drainage ditch. The drainage ditch was previously described within the North C-11 Basin description. The ditch extends about 1600-feet south to Oakes Road and serves this sub-basin for stormwater storage and conveyance.

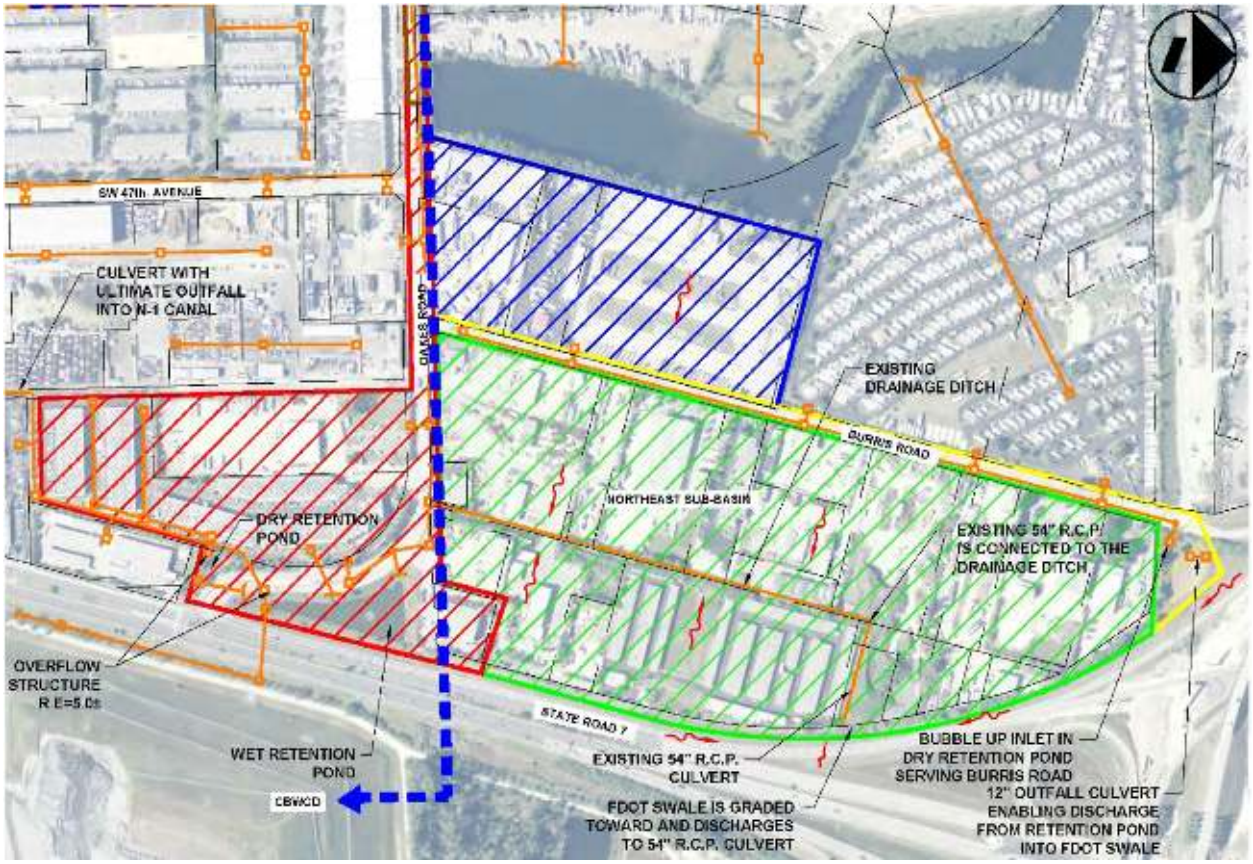


FIGURE 5: NORTHEAST SUB-BASIN

The properties west of Burris Road have no direct off-site discharge. However, off-site overland flow may occur after stormwater stages up and overtops the driveway connections to Burris Road. Most of the properties east of Burris Road have an outfall into the existing ditch or stage up and ultimately overflow into the ditch.

The Oakes Road drainage system is connected to the ditch and also connected to a wet retention pond located at Oakes Road and S.R. 7. The original design plans for Oakes Road & Burris Road show a proposed 24-inch culvert interconnecting the two roadway drainage systems. However the record drawings, as well as a recent survey investigation, reveal that the culvert interconnection was not constructed. The Oakes Road retention pond has an overflow structure

and culvert system that extend approximately 1,800 feet south through the N-1 sub-basin, with a discharge into the CBWCD N-1 Canal.

A commercial property just south of Oakes Road has a surface water management system that utilizes exfiltration trench and a dry retention pond for pre-treatment and water quality treatment prior to discharge into the Oakes Road wet retention pond.

N-1 Sub-Basin

The N-1 sub-basin is approximately 154 acres, located between Oakes Road and Orange Drive, extending from S.R. 7 west to Kean Road as shown on **Figure 6**. This sub-basin is comprised mainly of light industrial and commercial uses. A few large properties within this sub-basin contain open pavement areas with low elevations which provide considerable stormwater storage below the CBWCD flood elevation of 6.50 ft-NGVD. In addition, a few properties within this basin have water management systems that utilize existing lakes for stormwater storage.

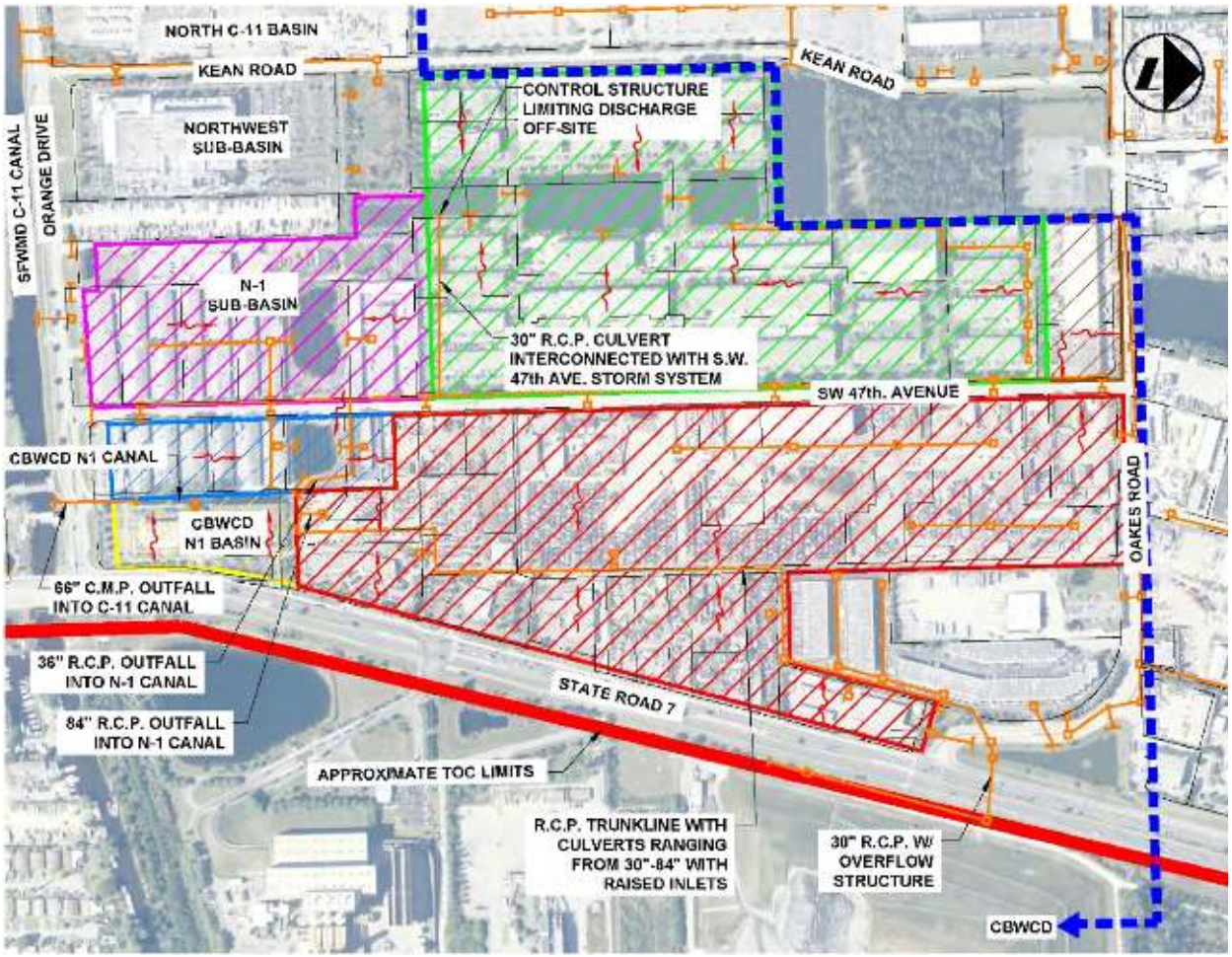


FIGURE 6: N-1 SUB-BASIN

S.W. 47th Avenue extends the length of this sub-basin and the record drawings do not reveal any means of dry pretreatment but shows a direct discharge into a private lake on the west of the road, beneath the existing FPL transmission lines and also a discharge directly into the N-1 canal. A commercial property west of S.W. 47 Avenue has a drainage system consisting of exfiltration trench and wet retentions ponds with a control structure and culvert connection serving as an outfall through the S.W. 47th Avenue system to the N-1 canal.

A portion of Orange Drive is included in this sub-basin because the commercial properties adjacent to Orange Drive and S.W. 47 Avenue sheet flow directly into the Right-of-Way of Orange Drive and little elevation change exists to indicate a hydraulic separation from these two roadways.

A significantly sized drainage trunk line with culverts up to 84-inch diameter extends up the east side of this sub-basin, conveying stormwater from the Northeast Sub-Basin, as well as collecting runoff from adjacent properties within this sub-basin via raised inlets and discharging into the N-1 canal which discharges to the C-11 canal via a 66-inch CMP culvert.

Northwest Sub-Basin

The Northwest Sub-Basin is shown in **Figure 7**, is approximately 33 acres and consists of commercial and light industrial properties. Kean Road bisects this sub-basin and an overflow structure at the northwest corner of Orange Drive and Kean Road conveys stormwater into the C-11 canal via a 24" RCP culvert. Watson Pharmaceuticals has a fairly new stormwater management system with exfiltration trench, a wet retention pond and a structure controlling discharge into the Kean Road drainage system. The property west of Kean Road is mostly beneath FPL electrical lines and consists of paved parking areas and low retention areas. Just east of Watson Pharmaceuticals a property is utilized for vehicle storage. No drainage system or retention pond is identified for this property.

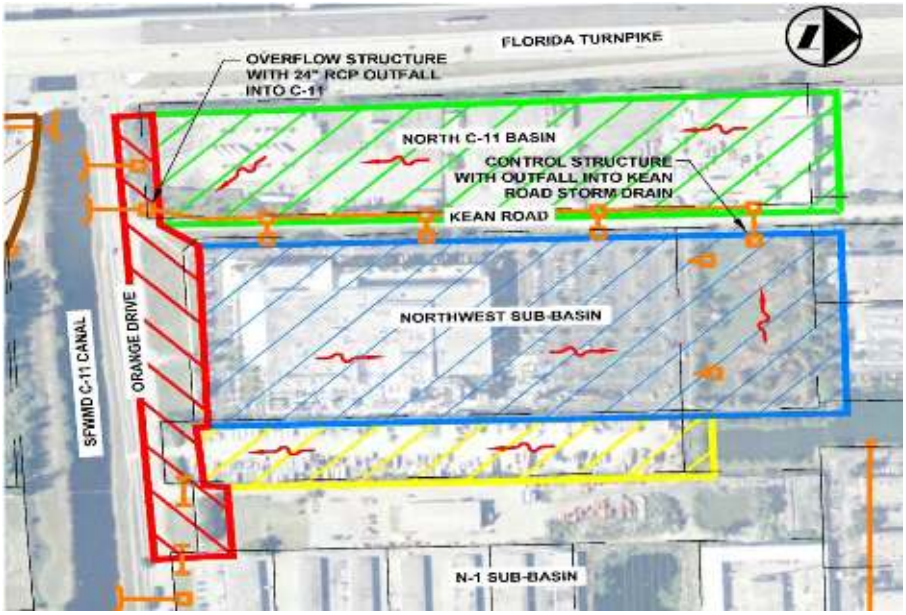


FIGURE 7: NORTHWEST SUB-BASIN

A portion of Orange Drive has been shown as part of this sub-basin because little to no hydraulic separation is identified along portions of the northern Right-of-Way line. However, Orange Drive was designed with its own surface water management system, utilizing dry retention swales for water quality and overflow structures to discharge into the C-11 canal.

THISCD Basin

The THISCD Basin is approximately 169 acres and is comprised of industrial, commercial and residential land uses. This basin lies primarily within Basin 'C' of the Tindal Hammock Irrigation & Soil Conservation District, but also includes of select properties that are not within the District boundaries as shown in **Figure 8**. Since these properties have no off-site discharge, they have been included in the same basin with THISCD.

Oakes Road hydraulically divides this basin and the Oakes Road drainage system collects and conveys stormwater from the Right-of-Way and a commercial parcel on the south side of Oakes Road west to the Turnpike swale.

South of Oakes Road, a vacant parcel, a lake, approximately half of Kean Road and a large open parking lot are interconnected via culverts or overland flow. These properties discharge through a control structure into the FDOT swale.

On the north side of Oakes Road, majority of the industrial and commercial properties have little to no on-site drainage systems and are either graded to flow into the local street or stage up and eventually overflow into the street. NW 49th Way and NW 34th Place have drainage inlets and culverts that collect and convey runoff east to the existing 14 acre lake.

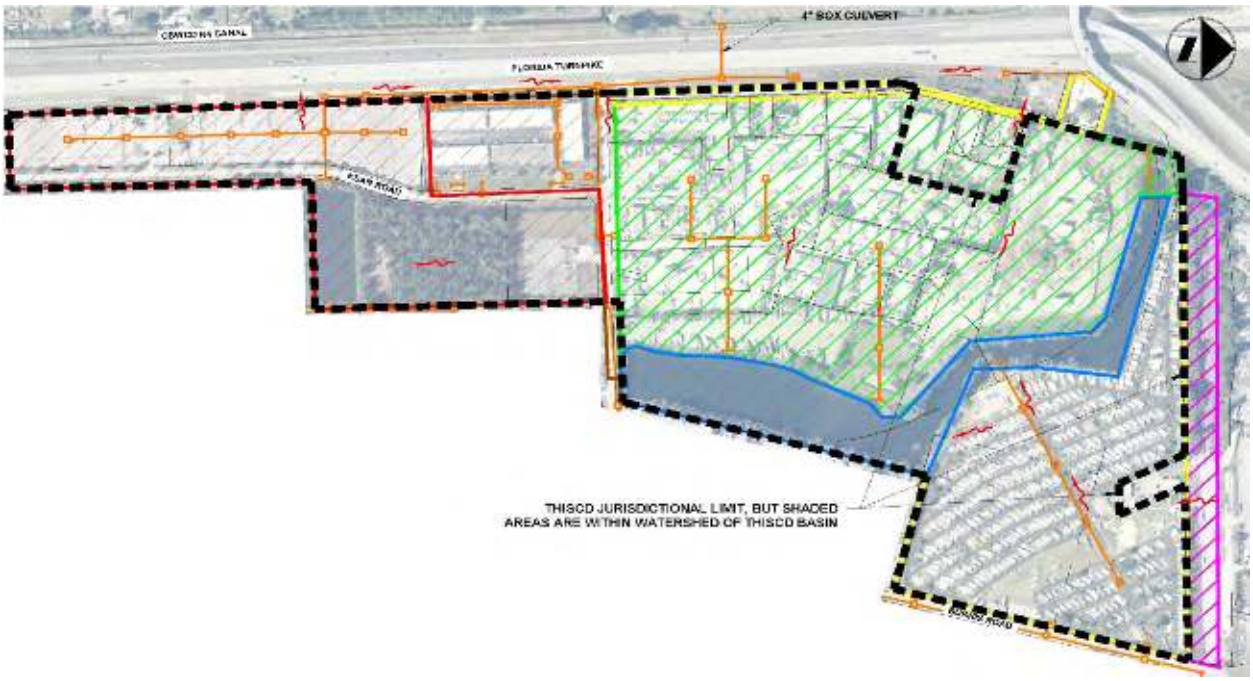


FIGURE 8: THISCD BASIN

On the opposite side of the lake, a 28 acre mobile home park is graded from northeast to the southwest, toward the lake. Limited information is known about the drainage system of this property, but it is believed this property discharges directly into the lake via culverts.

The old 84 spur road has a swale on the south side of the road which retains runoff within the Right-of-Way. This roadway was previously an exit from the Turnpike and has relatively high pavement elevations. No drainage system serving the swale could be found during site investigations. It is assumed that the swale retains runoff from the roadway but may ultimately overflow into the adjacent mobile home park.

Field Road, which is located adjacent to the Turnpike has limited or no drainage infrastructure and has a pavement cross-sloping to the east, away from the Turnpike. Ponding within the northern portion of the road was observed, flooding the entire road section until the water level overtopped the western edge of pavement, discharging via overland flow into the Turnpike swale.

The existing 14 acre lake has an outfall at the northwest, through a series of culverts, ditches and swales, ultimately flowing south along the Turnpike into a 48-inch box culvert that extends west beneath the Turnpike into a canal on the west side of the Turnpike. This canal discharges into the N-4 canal via a 36" culvert and hydraulic pumps which are manually operated as needed with a discharge rate of 5,000 gpm.

South C-11 Basin

The South C-11 basin is approximately 28.5 acres, located between the C-11 canal and Griffin Road, as shown in **Figure 9**. This basin is comprised of commercial, residential and one undeveloped property. The commercial properties are located adjacent to S.R. 7, have separate stormwater management systems and the northernmost property has a control structure and culvert outfall into the C-11 canal. The residential properties consist of a mobile home park and an apartment building. The mobile home park has two canals which are hydraulically connected to the C-11 canal, a limited drainage system which is directly connected to the canals and the site is mostly graded toward the inlets or graded to flow into the canal. The apartment building has a surface water management system consisting of culverts and dry retention ponds but no offsite discharge. The undeveloped property has low elevations and no apparent outfall; however stormwater runoff may ultimately flow into the C-11 canal.

FIGURE 9: SOUTH C-11 BASIN

South Basin

The South Basin is approximately 173 acres and located between the Turnpike and S.R. 7, from Griffin Road south to the Town Boundary, which is situated along the north property line of HardRock Café, as shown in **Figure 10**. This basin is comprised of agricultural, commercial, light industrial, residential, a church and a cemetery. The residential properties consist of three single family homes and a mobile home park. The mobile home park has relatively low pavement and green area grades with no storm drainage system. The other residential properties have no drainage systems, but are located adjacent to the agricultural areas. The agricultural areas have low elevations and contiguous, without berms, to the surrounding residential and commercial properties, consequently serving to collect and retain stormwater runoff.

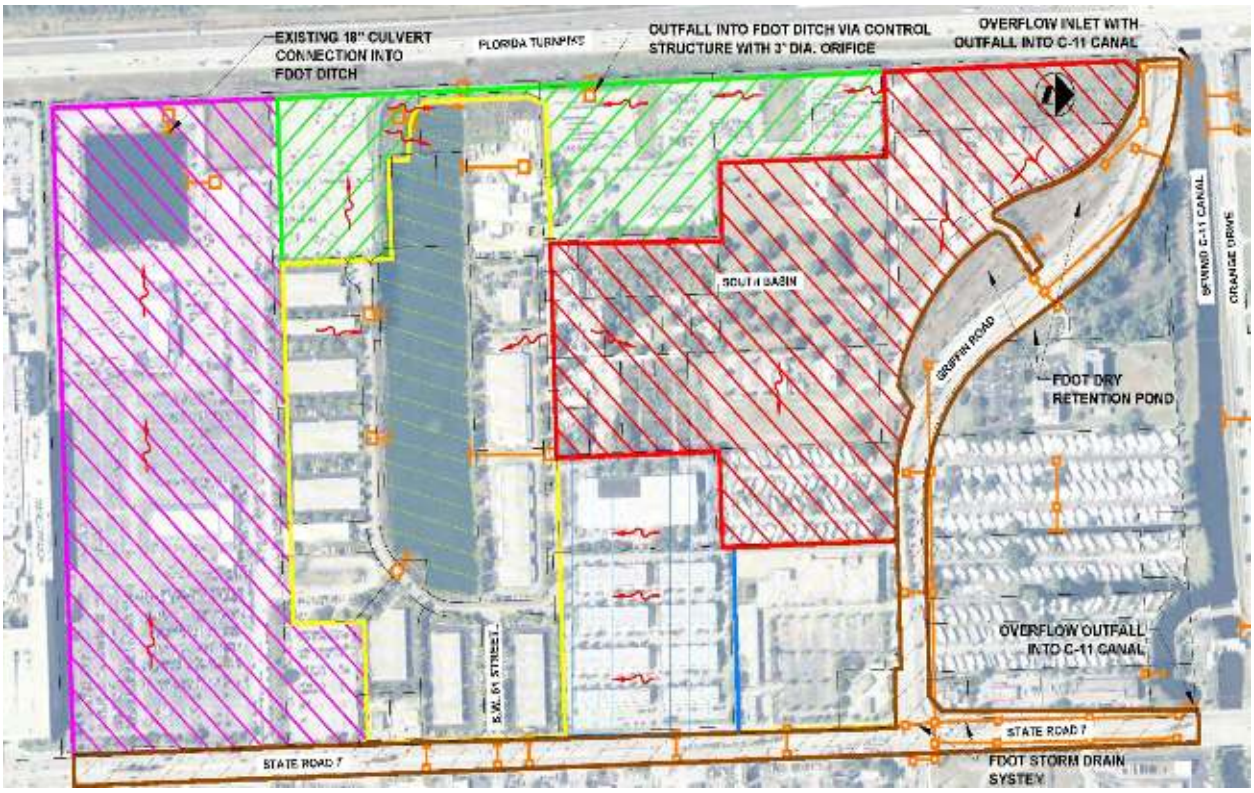


FIGURE 10: SOUTH BASIN + SOUTH F.D.O.T. BASIN

An approximate 52 acre commercial property known as Davie Commerce Center is centrally located within this basin and has an 8.75 acre lake which the stormwater management system discharges into for stormwater retention. This lake has no offsite connection.

Along the southern limits of this basin, a 44 acre commercial property consists of vast pavement areas, a few buildings and a 4.25 acre lake. This property has a stormwater management system utilizing exfiltration trench and dry retention prior to discharging into the on-site lake. According to the permit files, this property has no outfall however a survey obtained from FDOT identified an 18-inch culvert outfall. Further survey exploration confirmed an 18-inch CMP pipe extends from this property, adjacent to the on-site lake into the FDOT dry retention swale.

A 12.25 acre commercial property along the west of this basin consists of paved parking areas and dry retention ponds. This property has a stormwater drainage system with a permitted outfall into the FDOT turnpike canal.

A 7.7 acre commercial shopping center located on the southwest intersection of S.R. 7 and Griffin Road has a stormwater management system consisting of exfiltration trench, culverts with many inlets and an uncontrolled 15-inch culvert connection, discharging directly into the FDOT storm drain system within the Griffin Road Right-of-Way.

Most of the other commercial properties within this basin have separate surface water management systems with no outfall unless on-site flooding results in overland flow into the adjacent parcel or street.

FDOT South Basin

This basin consists of the FDOT Rights-of-Way of S.R. 7 from the C-11 canal south to SW 54 Street and Griffin Road from S.R. 7 west to the Turnpike. The storm drainage system within these roadways are interconnected and discharge into three separate dry retention ponds located on either side of Griffin Road, just east of the Turnpike, as shown in **Figure 10**. The westernmost retention pond has an overflow structure with a 36" culvert that extends to the C-11 canal for an outfall. In addition, a control structure with a raised weir is located within the S.R. 7 Right-of-Way, providing a secondary outfall for the FDOT drainage system if the stages rise above the weir, discharging into the C-11 canal with a 24-inch outfall.

WATER TABLE ELEVATIONS

The water table within the TOC fluctuates slightly throughout the year depending on rainfall and also varies slightly based on location. For design purposes, the design water level (DWL) is conservatively based on the wet season water table (WSWT). The WSWT within the TOC has been historically 2.0 ft-NGVD, however the maps have evolved over time as demonstrated by three different Broward County WSWT Maps dating back to 1980 shown as ***Exhibits 4A, 4B & 4C***. All of the maps except the most recent show the entire TOC limits to be within the 2.0 ft-NGVD contour. The most recent map shows the 2.0 ft-NGVD contour bisecting the TOC just north of the C-11 and with 3.0 ft-NGVD contour northwest of the TOC. This indicates the WSWT may vary between 2.0—3.0 ft-NGVD north of the C-11. Research and review of the plans and permits of the existing projects within the TOC reveals designs with DWL elevations varying between 2.0—3.0 ft-NGVD. CBWCD criteria stipulate a DWL of 3.0 ft-NGVD must be utilized whereas THISCD criteria stipulate a DWL of 2.0 ft-NGVD for the areas within the TOC under their respective jurisdiction. Broward County does not mandate a specific DWL but relies on maps and geotechnical borings to identify the WSWT. It is essential to establish a DWL that will suite the existing properties and also meet the regulatory standards. Therefore, the WSWT will be evaluated below for each Regulatory Agency and/or Basin Areas within the TOC and the DWL will be clearly defined.

CBWCD Jurisdiction

The best DWL to suite all the existing properties within these respective basins, whether previously designed at 2.0 or 3.0 ft-NGVD, is the lowest elevation. Since, a DWL of 2.0 ft-NGVD does not meet CBWCD criteria, a variance 'to utilize a DWL of 2.0 ft-NGVD' from CBWCD was requested and eventually obtained. The variance request process required numerous submittals and meetings to demonstrate and ensure a DWL below the CBWCD stipulated criteria makes

sound engineering sense and will not have adverse impacts. A copy of the Variance Request Submittals including cover letters, e-mail correspondence, various water table maps and graphs of the daily C-11 stages are provided in **Appendix 2**.

During the writing of this report, CBWCD updated their criteria with a new CBWCD basin east of the Turnpike, designated with a DWL= 2.0 ft-NGVD. On April 26, 2013, the new Engineering Standards Manual was adopted by CBWCD Board of Commissioners. Given this newly adopted criteria, future construction within the TOC will not require a Variance to utilize a DWL of 2.0 ft-NGVD.

THISCD Jurisdiction

The projects within THISCD basin were designed, permitted and constructed with a DWL of 2.0 ft-NGVD, consistent with the THISCD criteria and also matches the adjacent DWL to be utilized within CBWCD. Therefore, a DWL of 2.0 ft-NGVD will be utilized within the THISCD basin.

Broward County (Development and Environmental Regulation Division) Jurisdiction

The areas north of the CBWCD and outside of THISCD are reviewed by Broward County and the permit files reveal DWL elevations of 2.0 ft-NGVD, 2.50 ft-NGVD and 3.0 ft-NGVD were utilized for the construction of the existing properties. The DWL within the Broward County Jurisdiction will be evaluated below per Basin or Sub-Basin.

Northeast Sub-Basin

The permits within this sub-basin show the DWL varying between 2.0 to 3.0 ft-NGVD and there are many properties which no permits were found. As previously described, the ditch within this sub-basin was originally constructed with a direct connection to the C-11 canal, which has a DWL=2.0 ft-NGVD. The FDOT Rights-of-Way of I-595 and S.R. 7 have an outfall into this sub-basin, and the ICPR Model of the FDOT System indicates a DWL of 1.78 ft-NGVD. Further review of the FDOT ICPR Model reveals the tailwater conditions assumed an outfall into a node named 'Twin Lakes' which has a stage verse time description that matched the same conditions described in the model for the North New River Canal. This tailwater assumption is not accurate as the FDOT discharge is into the described ditch which has an ultimate outfall into the C-11 canal. In order to not adversely impact the FDOT historical flows, as well as any other properties within this sub-basin, the best DWL for this sub-basin is 2.0 ft-NGVD.

NorthEnd Sub-Basin

West of Burris Road and between the old Spur Road and I-595, the properties appear to be constructed with a DWL of 3.0 ft-NGVD. The most recent project in this area is the Truck Stop, and

the permit files identify a DWL of 3.0 ft-NGVD. Therefore, a DWL of 3.0 ft-NGVD will be utilized for this sub-basin.

NNRC Basin

The TOC area north of I-595 is adjacent to the Broadview Park Master Drainage system which was permitted with a DWL of 3.0 ft-NGVD. Therefore, a DWL of 3.0 ft-NGVD will be utilized in this basin.

Pursuant to the above descriptions, **Figure 11** shows the DWL elevations which will be utilized for the TOC Master Plan.

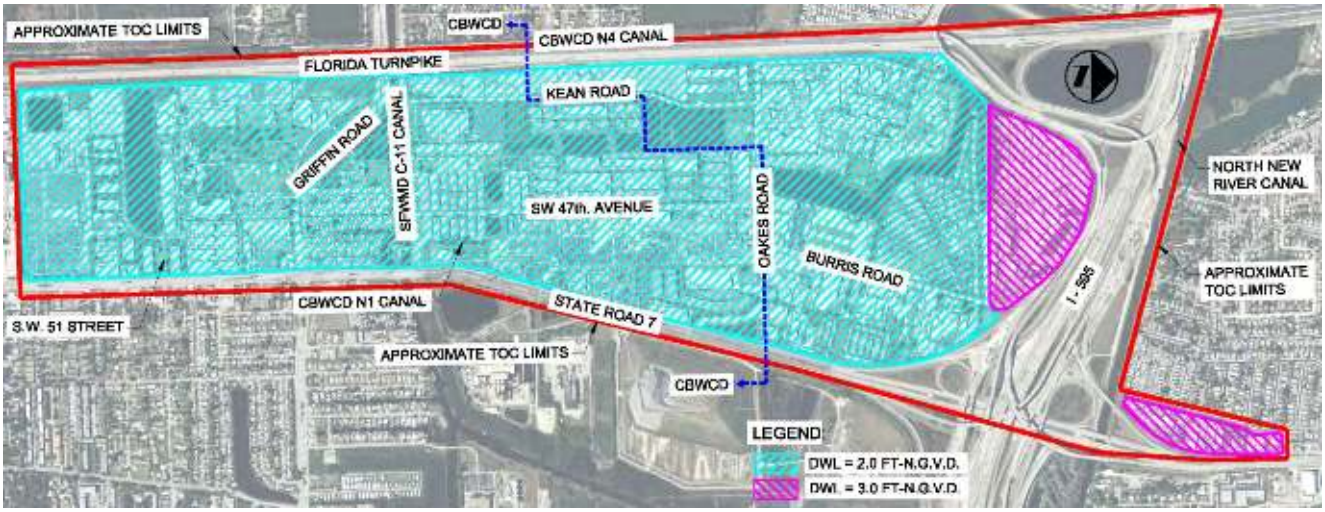


FIGURE 11: DWL WITHIN THE TOC LIMITS

SOIL CHARACTERISTICS

A Broward County Map showing the various soil types is provided as ***Exhibit 5***. The soil types identified within the TOC limits are listed below along with a description of each soil type.

Hallandale-Margate Association: Poorly drained, nearly level, sandy soils that are less than 60 inches deep to hard limestone.

Immokalee-Urban Land-Pompano Association: Poorly drained, nearly level, sandy soils that are more than 80 inches deep; most have a dark, organic coated subsoil; some areas have been modified for urban use.

Lauderhill-Dania Association: Very poorly drained, nearly level, organic soils that are less than 40 inches deep to hard limestone.

A Geotechnical Engineering Firm, Tierra South Florida, performed Borehole Permeability (BHP) tests to identify an average hydraulic conductivity rate within the TOC. Ten BHP Tests were

performed yielding an average hydraulic conductivity of 2.06 x 10^{-4} cfs/ft^2. This percolation rate is used to calculate the existing and proposed storage volume of exfiltration trenches. A copy of the Geotechnical Report is provided in **Appendix 3**.

RAINFALL

The rainfall amounts are assumed to be the same throughout the TOC but for design purposes, the rainfall amounts vary depending on the criteria of each regulatory drainage jurisdiction as shown in **Figure 12** below.

Storm Event	Rainfall (in)	Regulatory Agency(s)	Description of Storm Event Flood Criteria
5 yr-1day	7	TOD	Minimum Parking Lot Elevation
10yr-1day	8.5	BC, CBWCD, TOD	Minimum Crown of Road Elevation
10yr-3day	11	THISCD	Maximum Flood Elevation of 6.5 ft-NGVD
25yr-3day	14	BC, CBWCD & SFWMD	Maximum Off-Site Discharge of 40 csm in C-11 Basin and 70.8 csm in NNR Basin
50yr-3day	16.3	TOD	Required Pre vs. Post stage comparison per scope of Stormwater Master Plan
100yr-3day	17	BC, CBWMD, THISCD & TOD	Minimum Finished Floor Elevation, Flood elevation must not Exceed Broward County 100yr Flood Contour of 7.0 ft-NGVD

FIGURE 12: DESIGN RAINFALL AMOUNTS

TAILWATER CONDITIONS

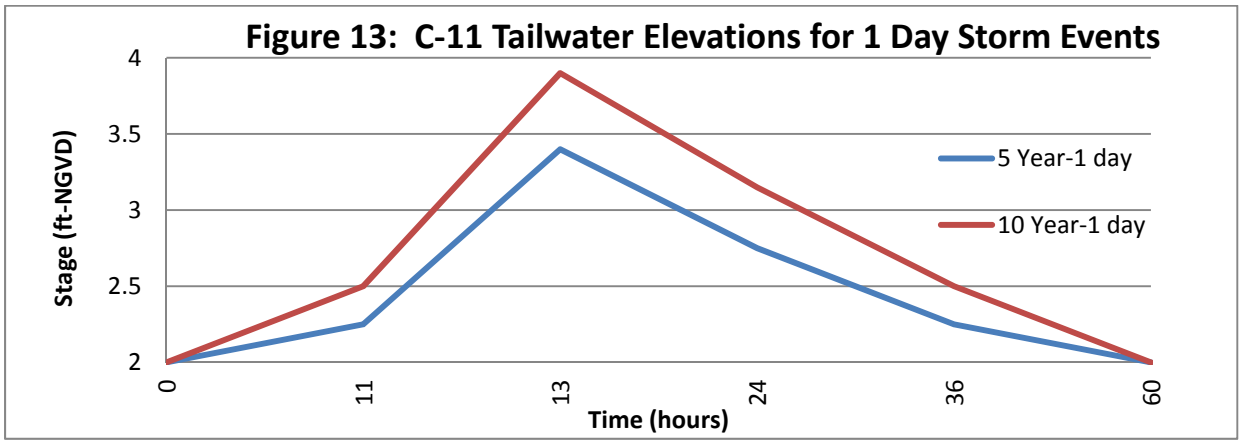
Tailwater refers to the elevation of the water surface at the point of discharge. Tailwater is different from the design water elevation because when a storm event occurs, the tailwater level in the canal or lake will rise up due to the volume of runoff it receives. After the storm is over and runoff has ceased, the tailwater recedes and ultimately returns to the design water level. The two SFWMD basins within the TOC are identified by the canals which receive the tributary runoff, the NNRC and the C-11. These two canals are the primary tailwater conditions to be considered.

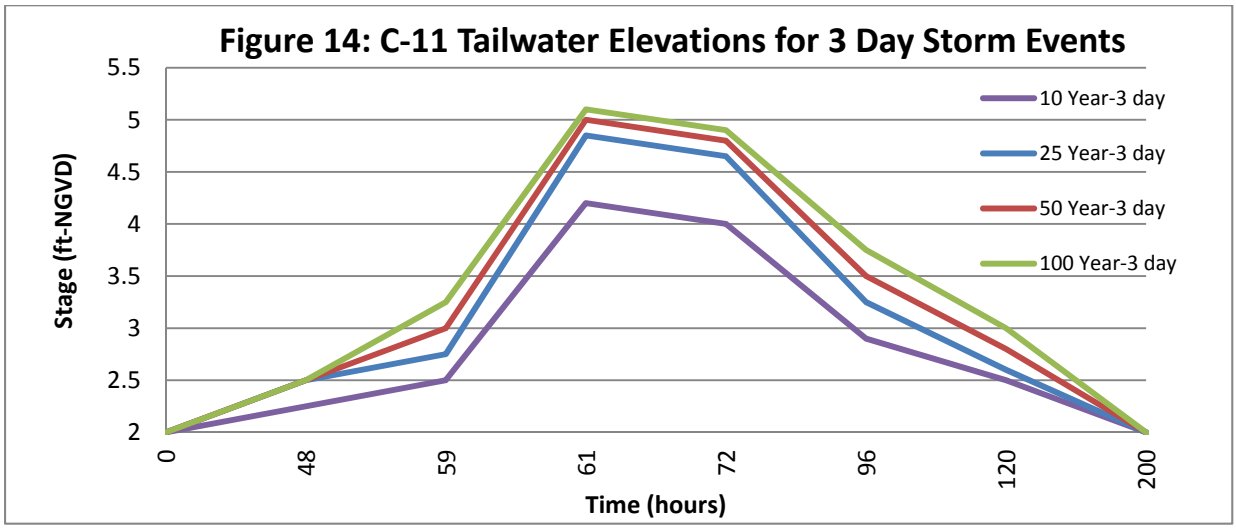
The NNRC Basin does not have an outfall, therefore the existing tailwater conditions are not relevant in order to model this basin. The North C-11 basin, South C-11 basin and FDOT South Basin discharge directly into the C-11 canal.

The THISCD Basin flows into a 4'x4' culvert which extends beneath the Florida Turnpike into a canal that eventually discharges into the CBWCD N-4 Canal. The CBWCD N-4 Canal is directly

connected to the C-11 canal. Since there are no control structures between THISCD and the C-11 canal, the tailwater will be assumed to be same as the C-11 canal.

The South Basin has three known outfalls. One outfall serves the shopping center located at the SW corner of S.R. 7 & Griffin Road, directly connected to the FDOT South drainage system. The other two outfalls discharge into the Turnpike Drainage Swales. One outfall serves a parking lot located beneath the FPL Transmission lines and the other outfall serves the Auto Auction at the southernmost end of the TOC. The FDOT South and the Florida Turnpike drainage systems are designed to collect and store the required water quality treatment volume and then outfall into the C-11 canal. For simplicity, the tailwater conditions will be assumed the same as the C-11.





The assumptions made above ignore frictional losses in each of the respective drainage systems leading to the C-11 canal. The purpose of modeling the existing conditions is to have a reference point to evaluate the proposed system improvements. Therefore, if the same assumptions or more conservative assumptions are made for the proposed tailwater modeling, the significance of any neglected frictional losses is eliminated.

Historical tailwater conditions in the C-11 canal were evaluated and compared with past storm events in a Facilities Update Report for CBWCD Eastern C-11 Basin by Earth Tech, August 2006. In this report, the stages for the C-11 were identified for the 10 year-1 day, 25 year-3 day and 100 year-3 day storm events. The scope of this report also requires the 5 year – 1 day, 10 year-3 day and 50 year-3 year storm events to be modeled. Since no historical water levels in the C-11 canal were found for these storm events, approximate values are assumed that resemble the shape of the curve for the 1 day and 3 day storm events, as shown in **Figures 13 & 14**.

MODEL OF THE EXISTING CONDITIONS

The existing drainage patterns previously explained are general summaries of the basins and sub-basins. Most of the existing properties that make up the basins have their own independent drainage systems and the buildings and pavement areas have been built at different elevations than other properties. In order to create a model of the existing conditions, each basin or sub-basin must be dissected into multiple drainage areas to reflect each property or each individual drainage system. For each drainage area, the coverage areas and corresponding grading parameters were identified and the stage-storage, soil storage and time of concentration were calculated. The existing permit files, record drawings and LIDAR were utilized to identify this information. The existing coverage areas, grading parameters and calculations for each basin area are provided in **Appendix 4.**

The next step to model the existing conditions is to recognize how each drainage area is hydraulically connected to the adjacent properties. The LIDAR topography and the existing drainage infrastructure were utilized to identify the drainage connections. **Figures 3 thru 10** demonstrate the existing drainage patterns for each of the Basins and Sub-Basins.

The ICPR model is developed by adding each property area (identified in ICPR as a basin), each property's stage-storage information (identified in ICPR as a node) and establishing the drainage connections between nodes (identified in ICPR as a link). The rainfall data shown in **Figure 12** and Tailwater Conditions shown in **Figures 13 & 14** are entered into the model, and the various storm events are routed. A copy of the ICPR Nodal Diagram, ICPR Input Data and Results (Maximum Node Stages and Maximum Link Flow Rates) of the Existing Conditions are also located in **Appendix 4**.

Modeling results of main interest are the peak stages of the various storm events and the discharge rates. The peak stage results will be utilized later for comparison against the model results of the proposed Stormwater Master Plan, to identify which properties may be impacted by higher post development flood stages. The maximum discharge rates of links out of the TOC are of high importance because any new developments or redevelopments, including improvements pursuant to the TOC Stormwater Master Plan, will be required to limit discharge to 40 cubic feet per second per square mile (CSM). The modeled discharge rates out of the TOC sum to

approximately 176 cubic feet per section (cfs) for the 25 year-3 day storm event as shown in **Figure 28**. The allowable discharge rate for the tributary area is only approximately 47 cfs. In order to reduce the discharge rates in the post development, storage must be created to offset the reduced discharge rates without flooding the existing properties.

IV. REGULATORY STANDARDS & CRITERIA APPLICABLE TO REDEVELOPEMENT

Redevelopment pursuant to the proposed TOC Stormwater Master Plan is subject to the latest standards of multiple agencies, since the TOC lies within the regulatory jurisdictions of CBWCD, THISCD, BCEPGMD & SFWMD. Each of these governing entities have similar but differing regulations and criteria. The requirements for water quality are the same for all the agencies with one exception; CBWCD requires dry pretreatment for roadways. The requirements for water quantity storage and discharge differ between agencies. The water quality criteria will be described below followed by the quantity storage and discharge criteria.

Water Quality

Chapter 17-302 of the Florida Administrative Code requires projects to be designed and operated so that off-site discharge will meet State water quality standards. SFWMD Basis of Review for Environmental Resource Permit Applications, Section 5.0, 'Water Quality Criteria' describes various design methods required for water quality. The fundamental design criteria applicable to the TOC Stormwater Master Plan are pre-treatment requirements, volumetric storage requirements, underground exfiltration systems, existing and proposed water bodies and best management practices. Additional water quality criteria may be required for specific sites depending on the type of use, such as solid waste facilities. However, since these uses are limited to individual sites, the master system will not be designed to accommodate any additional site specific water quality requirements, but must be provided within the site having such specific land use.

The proposed TOC Zoning allows for Commercial, Industrial and Residential land uses. The most restrictive land use with respect to water quality is commercial and industrial which requires at least ½" dry retention pretreatment to be provided over the entire site. For the purposes of master planning to accommodate all future land use types, each commercial or industrial property will be required to provide ½" dry pretreatment storage on-site and residential properties will be required to provide ½" of wet or dry detention on-site, prior to discharge into the proposed Master Stormwater Management System (MSWMS). The MSWMS will be designed to provide the remaining water quality treatment volume. Ideally, for best management practices, site discharge into the master system should be directed into dry retention ponds, as much as is practical and cost efficient.

The goal of this practice is so that for the most frequent and less intense storms which shed less than 1-inch of rainfall, commonly referred to as the first flush, stormwater runoff does not overfill the on-site facilities proposed for pre-treatment and/or water quality storage. If a minor storm event does overfill the proposed on-site facilities, the resulting discharge into the master system may consist of runoff having high concentrations of suspended pollutants since full water quality treatment has not been stored. If discharge is directed into a dry retention/detention pond, the

limited runoff volume will be subject to percolation and or evaporation, entrapping pollutants in the ground surface; consequently keeping stormwater pollutants out of the water bodies. By avoiding or minimizing discharge for water quality treatment purposes into wet retention ponds, the water bodies within the TOC will have a resulting better water quality. Furthermore, any discharge from the TOC into the SFWMD canal will also have better water quality. Conversely, if site discharge is directed into wet retention ponds, the higher pollutant concentrations associated with the first flush could get suspended in the water bodies, decreasing water quality within the TOC as well as the downstream water bodies.

Despite efforts to implement best management practices, particularly by discharging runoff to dry retention/detention ponds prior to wet retention ponds, this criterion is recommended but not mandated. Direct discharge into existing lakes currently exists within the TOC and it is cost prohibitive to reconstruct existing drainage systems to direct runoff to a dry retention pond prior to discharge into a lake. In addition, proposed developments may elect to construct on-site lakes as a means of providing on-site water quality treatment. Therefore, the stormwater master system will be designed to promote and encourage best management practices, but never-the-less assuming that water quality will be met within the wet detention ponds, dry detention ponds, exfiltration trench and swales.

According to SFWMD, wet detention volumetric requirements for water quality are the greater of the following: the first inch of runoff from the site area or 2.5 inches times the percentage of imperviousness. Since the TOC zoning criteria allows for a high percentage of imperviousness, the later criteria will most likely govern. If dry detention is utilized, the water quality volume can be reduced to 75% of the wet detention volume. If retention is proposed, the water quality volume is reduced to 50% of the wet detention volume.

Since it is impossible to foresee how each development will store their respective on-site pre-treatment or water quality treatment volume, the MSWMS will assume ½" of water quality treatment is met on-site; weather for commercial and industrial pre-treatment requirements or for partial water quality treatment in residential. This method verifies a select volume required for on-site storage by each property and ensures the MSWMS is properly designed to accommodate the additional water quality treatment requirements.

Discharge of detained water quality treatment volumes are restricted to ½" of the detention volume in 24 hours, pursuant to SFWMD Basis of Review, Section 7.2. If on-site detention is proposed, each site shall have a control structure with an orifice designed accordingly to limit the rate of discharge into the MSWMS. In addition, the control structures for the MSWMS must be designed to discharge the water quality treatment volume at a rate of ½" of the detention volume in 24 hours.

Water Quantity

The water quantity storage and allowable discharge requirements vary throughout the TOC, based on which agency has jurisdiction. The jurisdiction boundaries are depicted in **Exhibit 1** and the regulatory requirements of each agency are described below separated by the two SFWCD Canal basins.

SFWMD North New River Canal Basin

Broward County Environmental Protection and Growth Management Department (BCEPGMD)

1. The properties within this basin must operate independently, detaining or retaining both water quality and quantity runoff on-site. Offsite discharge of detained water quality shall not exceed ½" per day as previously described and discharge for storms up to the 25 yr-3day event is limited to 70.80 cubic feet per second per square mile (csm).

SFWMD C-11 Canal Basin

Broward County Environmental Protection and Growth Management Department (BCEPGMD)

1. Properties must detain on-site runoff up to the 25 year- 3 day storm with discharge offsite limited to 40 cubic feet per second per square mile (csm).

Central Broward Water Control District (CBWCD)

1. Properties must detain on-site runoff up to the 25 year- 3 day storm with discharge offsite limited to 40 csm.
2. Properties under 10 acres must provide 15% lake area and properties over 10 acres must provide 25% lake area. However, the minimum lake requirement can be avoided by providing Pre-Development verse Post-Development flood encroachment calculations to demonstrate post-development storage at the CBWCD 100 yr flood elevation meets or exceeds the pre-development storage. The CBWCD flood encroachment elevation within the TOC limits is 6.5 ft-NGVD.

Tindal Hammock Irrigation and Soil Conservation District (THISCD)

1. The post development 10 year-3 day flood elevation must be 6.0 ft-NGVD or lower.
2. The post development 100 year-3 day flood elevation must be 7.0 ft-NGVD or lower.

With the exception of the NNRC Basin, the MSWMS will be designed to accept uncontrolled water quantity discharge from developed sites. The control structures serving the master stormwater system will be designed pursuant to the criteria above, ensuring discharge rates into the SFWMD canals are adhered to.

Pursuant to previous meetings and discussions with CBWCD, the control structures serving areas within CBWCD are to be designed with operable gates. The intent of this feature is to provide CBWCD, under the direction or consent of SFWMD, the capabilities to lower the water level before a hurricane or storm which flooding is anticipated.

V. PROPOSED STORMWATER MASTER PLAN

The scope of this master plan entailed designing two different Stormwater Master Plan alternatives. The first Alternative is to consist of a stormwater management system which would also function as public amenities; incorporating both dry and wet detention/retention areas into linear parks and open space with picnic tables, passive park facilities and pedestrian paths having connectivity through-out the TOC. The second alternative omitted public amenities and was designed to be as practical and economical as possible. Both alternatives must demonstrate how the minimum of 120 acres of overall open space will be maintained within the TOC, pursuant to Comprehensive Plan Policy 13.1-2, and must be capable of meeting the requirements of the controlling water management district.

Since the proposed Stormwater Master Plan must reduce discharge off-site to 40 csm the most essential component necessary to create for either alternative is stormwater storage. Stormwater storage is achieved in two ways, surface storage and underground storage. Surface storage is the primary means to store the vast runoff from design storm events, where as underground storage is generally utilized for water quality treatment and for less intense storm events.

Surface Storage

Surface storage accounts for stormwater that is stored above the ground and water surface of lakes, starting at the control elevation. To generate new surface storage, properties must be purchased to create additional lakes and dry retention ponds. Selecting which properties to acquire and utilize for water management purposes is an uncertain task that must and will be subject to change as existing property owners may not be willing to sell whereas other properties not originally identified for retention may go out of business and become more readily acquired. The areas targeted for new retention areas were determined primarily due to site hardships, proximity to existing drainage infrastructure and pursuant to goals set forth in the Technical Assistance Panel Report (2010). Hardships include developed sites which have low elevations that are incompatible with the anticipated flood elevations determined from preliminary ICPR model. Other hardships include land with overhead power lines which limit building construction and/or development potential as well as limited vehicular access is a third type of hardship. One of the goals stated in Technical Assistance Panel Report (2010) is to increase accessibility within the TOC. Properties that have limited access and which increased accessibility appears infeasible or cost prohibitive were identified and are proposed as retention areas.

By utilizing existing water management areas and targeting sites which have hardships, for the additional required stormwater management areas, the two Stormwater Master Plan alternatives were formed. This methodology makes a way for other less encumbered properties to remain and increases their potential for future redevelopment in accordance with the more impervious land uses permitted by the TOC Zoning Designation. Another goal of the TOC is to create linear parks as

an amenity which promotes pedestrian connectivity throughout the TOC. Consequently, select properties which are not considered to be a hardship but which are located adjacent to proposed retention ponds are targeted for proposed retention/open area as a means to provide the desired TOC amenity of a linear park.

Preliminary modeling was performed in order to verify that both systems would meet the required stormwater requirements and also to compare the design storm flood elevations with the results of the existing conditions modeling results. By comparing the preliminary results with the existing results, sites which are anticipated to incur increased flood stages can be identified and evaluated for compatibility with the proposed flood elevations. Properties which were identified as incompatible with the proposed flood elevations were proposed to be converted into retention areas or identified as properties which must be redeveloped. Each of the properties to incur increased flood stages will be identified and described in detail in the section entitled "Comparison and Evaluation of the Pre Versus Post ICPR Model Results."

Underground Storage

For both alternatives, underground storage is proposed within most of the local roadways, existing and proposed, within the TOC. Some of the existing roads must be reconstructed to meet the proposed urban design section described in Technical Assistance Panel Report (2010). In addition, to increase accessibility within the TOC two new roads are proposed and Oakes Road is proposed to be realigned at the connection to S.R. 7. As part of the proposed roadway improvements, storm drainage consisting of exfiltration trench is proposed to provide stormwater storage and conveyance.

PREFERRED STORMWATER MANAGEMENT SYSTEM

In order to create and design both Stormwater Master Plans, the TOC was evaluated and broken up into new basins and/or sub-basins, hydraulically separating the various drainage districts and controlling discharge rates. The first alternative utilized the existing lakes and proposed dry retention as much as possible, particularly beneath the existing FPL transmission lines, to be utilized as linear parks with jogging trails, yet at low enough grades to suffice for dry detention. The first alternative also proposed parks at low elevations, sufficient for dry detention to be utilized for stormwater storage. The second alternative also utilized existing lakes and some proposed dry retention areas beneath the FPL transmission lines, however this alternative proposed mostly new lakes to be utilized for storage, minimizing the amount of land acquisition required for stormwater storage purposes. The reduced area required for second alternative is because lakes begin storing runoff at the water table elevation, whereas dry retention areas begin storing water at a minimum of one-foot above the water table. A copy of the two Stormwater Master Plan Alternatives are shown in **Exhibits 6** & **7**.

Two workshops were conducted at the Town of Davie, Town Hall Commission Chambers. The first workshop was held with the land owners and other stakeholders. The second workshop was held with the Town Staff and Commissioners. At each of the workshops, the existing drainage patterns within the TOC were explained and the proposed two alternatives were presented and described, as well as the potential modes of funding. At the conclusion of the second workshop, Town staff requested a decision by the Commissioners to determine which alternative to adopt as the 'Preferred Stormwater Management System.' The Commissioners unanimously voted for the first alternative, that incorporated public amenities into the Stormwater Master Plan. (See Exhibit 6)

VI. FINAL STORMWATER MASTER PLAN

In order to develop the Preferred Stormwater Master Plan into the Final Stormwater Master Plan, the conceptual hydraulic model created for the Alternate No. 1 must progress by separating out the proposed retention ponds, developments, roadways and drainage systems into basins, nodes and links. Similar to the evaluation and description of the existing conditions, the Final Stormwater Master Plan has been separated into different basins as shown in **Exhibit 8.** Each of the proposed drainage basins and the proposed improvements will be described below.

North New River Basin (NNRB)

The proposed NNRB is shown on **Figure 15**. Broward County recently upgraded the drainage and utilities within the public Right-of-Way on SW 41st Avenue, as well as other Rights-of-Way within this area, as part of the Broadview Park Neighborhood Improvement Project. The stormwater management system within the public Right-of-Way was designed to allow discharge from adjacent properties at a rate of 70.8 csm. According to the as-builts, the existing properties within the Town of Davie TOC limits do not have a drainage connection into the drainage system located within the Right-of-Way of SW 41st Avenue.

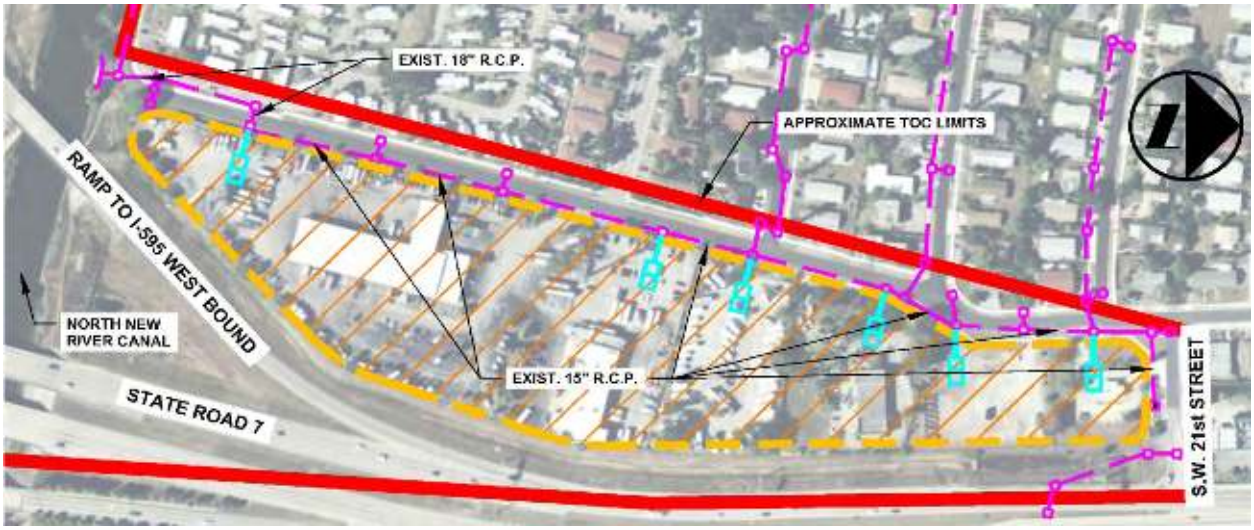


FIGURE 15: NORTH NEW RIVER BASIN

Since a public drainage system is now in operation adjacent to these properties, an off-site discharge could be permitted, increasing the development potential. The properties within this basin must provide on-site water quality and quantity storage up to a 25 year-3 day rainfall event, however discharge into the SW 41st Street storm drainage system could be permitted at a discharge rate of 70.8 CSM for the 25 year – 3 day storm. Broward County Department of Environmental Regulation may require Pre-vs. Post calculations to ensure there are no adverse impacts to the public storm drainage system. If necessary, the storm drainage system within SW

41st Street may require upsizing, from the proposed drainage connection downstream to the outfall into the NNR Canal to accommodate the additional runoff from the TOC properties.

Due to the fact that this basin is hydraulically separated from the rest of the TOC, little can be done to benefit these properties with respect to off-site stormwater storage. Consequently, since no off-site storage system is available to this basin, the Final Stormwater Master Plan hydraulic model does not include the NNRB.

North C-11 Basin

The proposed North C-11 Basin limits are similar to the existing limits, as outlined in **Figure 16A**, however a few of the sub-basins will be modified to hydraulically separate areas within CBWCD from areas not within their jurisdiction. Furthermore, control structures must be utilized to limit discharge into and out of CBWCD by the allowable discharge rate for the C-11 East Canal of 40 csm.

FIGURE 16A: SUB-BASINS OF THE NORTH C-11 BASIN

NorthEnd Sub-Basin

NorthEnd Sub-basin is comprised of individual properties in which no offsite discharge is available. The proposed improvements for this sub-basin consist of extending a swale with a drainage system along the south and western side of Burris Road as shown in **Figure 16B**. A proposed control structure with a culvert extending below Burris Road, will connect the western Burris Road swale to the retention pond on the east of Burris Road at SW 30th Street, providing a point of

discharge from this sub-basin into the Northeast Sub-basin. In addition, a 1,300 foot—30" culvert is proposed to connect this basin with the primary wet and dry retention ponds proposed within the Northeast sub-basin. Since the NorthEnd Sub-basin has a proposed DWL of 3.0 ft-NGVD, and

the downstream sub-basins have a DWL of 2.0 ft-NGVD, the control structure must be designed accordingly with an orifice invert at 3.0 ft-NGVD and also limit discharge to approximately 40 csm.

The properties within this sub-basin should be permitted to connect to the proposed Stormwater Master drainage system, however, each property must provide on-site water quality and quantity storage up to the 25 year-3 day storm event with discharge limited to 40 csm. The properties adjacent to Burris Road can discharge into the proposed drainage system to obtain an off-site outfall. The property located at 4601 SW 30 Street is isolated from the Burris Road Right-of-Way. SW 30th Street was formerly owned by FDOT and served as an access to the Turnpike. This roadway is now privately owned. To provide a drainage connection from the subject property to Burris Road, a drainage easement would be required and either a culvert or swale must be constructed approximately 300 feet east to the Burris Road Right-of-Way.

FIGURE 16B: NORTH END SUB-BASIN

The grading parameters for this sub-basin are slightly higher than the rest of the TOC, due to the fact of the higher DWL as well as the existing high elevations adjacent to the old 84 spur road. Since offsite discharge must be controlled by each property, the on-site grading parameters and land use breakdown are not limited by this report, as long as the 100 year flood elevation is met per B.C. flood map and the 25 year – 3 day flood elevation detained on-site. The land use breakdown, grading parameters and stage storage calculations are provided in **Appendix 5.**

Northeast Sub-Basin

Northeast Sub-basin has been reduced to approximately 73.2 acres, eliminating areas within the CBWCD jurisdiction and to consist of areas solely within the Broward County jurisdiction. Pursuant to CBWCD requirements, a control structure must be provided to restrict discharge into the CBWCD to a maximum of 40 csm. Since the NorthEnd Sub-Basin discharges into this sub-basin, the allowable discharge out of the control structure is based on the total upstream tributary area

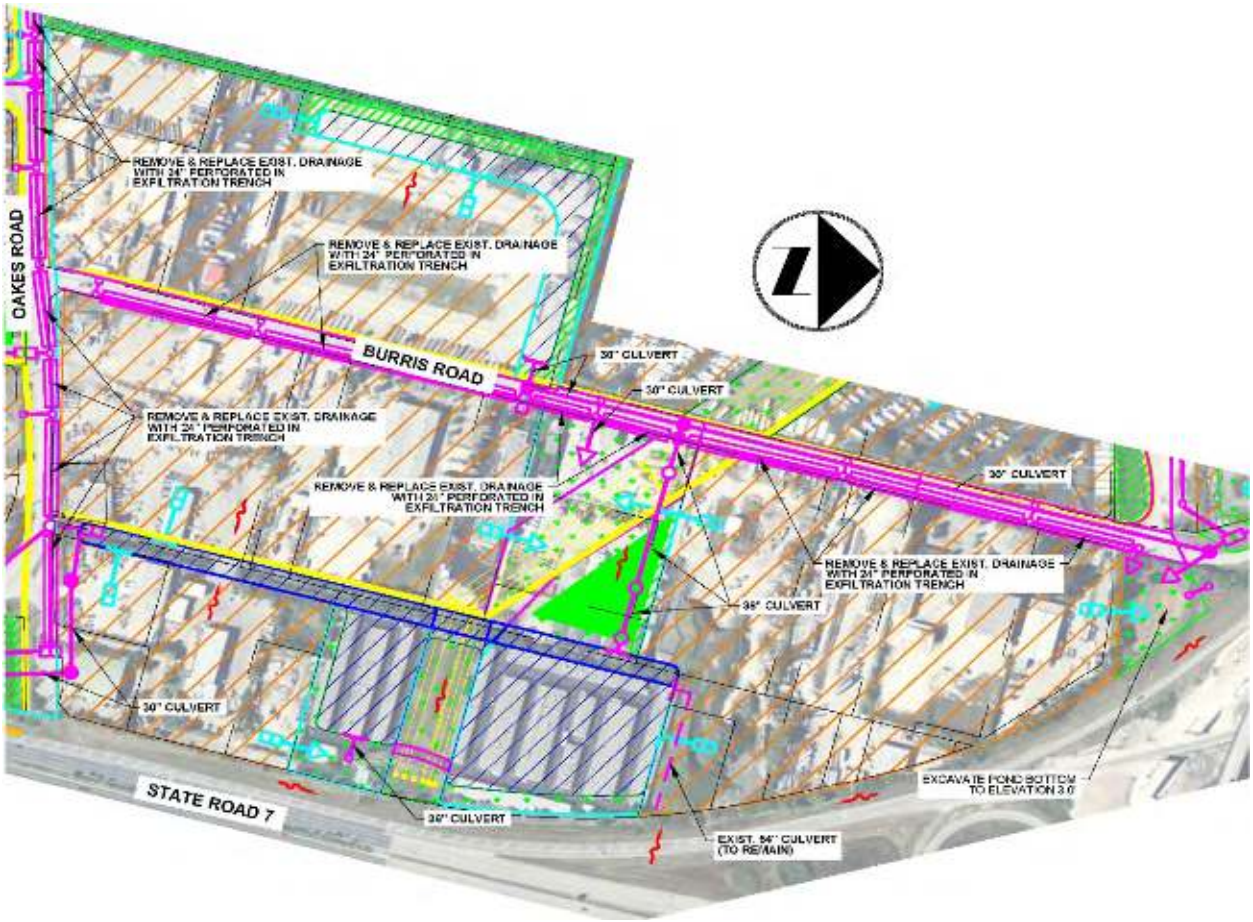


FIGURE 16C: NORTHEAST SUB-BASIN

which sums up to 119.3 acres, resulting in a discharge rate of 7.46 cfs. However, FDOT also discharges into this sub-basin at an approximate rate of 2.3 cfs. Therefore, the maximum discharge through the control structure is approximately 9.8 cfs as shown in **Exhibit 9**. The ICPR model of the existing stormwater management system depicts a discharge of 15.9 cfs, during a 25 yr-3 day storm event. The proposed reduced rate of discharge consequently results in stormwater runoff stored upstream of the control structure. To accommodate the proposed reduced rate of discharge, new dry and wet ponds are proposed to provide sufficient storage and yield manageable flood elevations that do not adversely impact existing properties.

Figure 16C depicts the proposed dry and wet retention ponds. The proposed stormwater retention areas are strategically placed adjacent to the existing ditch to minimize the need for new culvert and structure infrastructure and incorporates hardship areas beneath the FPL transmission lines. In addition, the areas east of the existing ditch have limited access and therefore are proposed as retention. A new wet retention pond is proposed west of Burris Road, to provide localized storage for the properties west of Burris Road.

A new exfiltration trench system is proposed within Burris Road with outfalls into the new and existing retention ponds. In addition, a culvert connection is proposed between the two wet retention ponds, serving to convey and equalize stormwater elevations within the Northeast sub-basin.

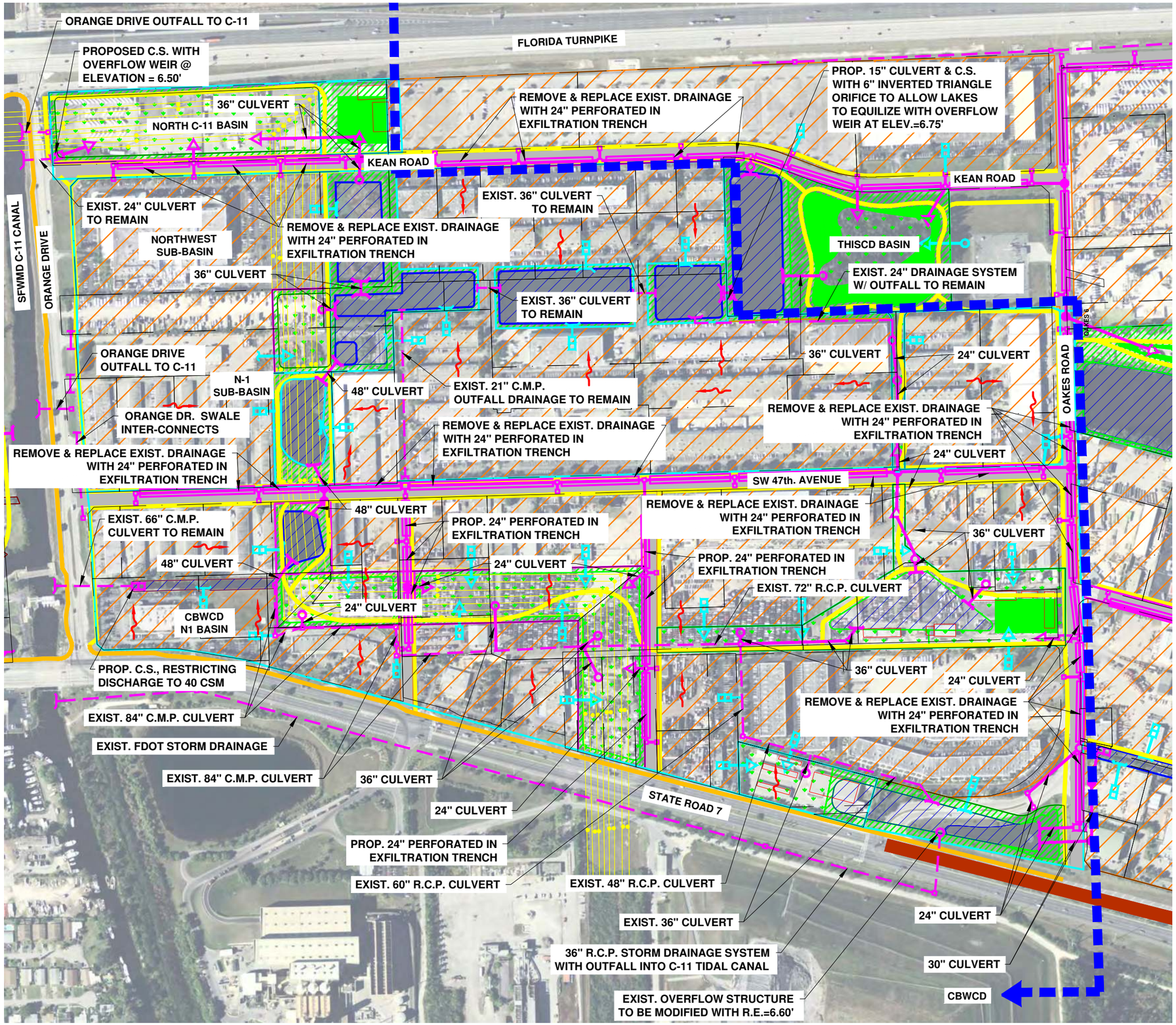
Properties within this sub-basin are proposed to provide ½-inch dry pretreatment on-site and then allowed an uncontrolled drainage connection into the nearest adjacent dry retention pond, wet retention or the storm drainage system within Burris Road. Site developments are to meet the grading parameters identified in **Exhibit 10**.

CBWCD N-1 Sub-Basin

The CBWCD N-1 sub-basin has been increased in size to approximately 209 acres, incorporating all of the areas within CBWCD north of Orange Drive, as shown on **Figure 16D**. A control structure is proposed to limit discharge into the C-11 canal to a rate of 40 csm, for storm events up to a 25 year-3 day frequency. However, since this basin collects runoff from other upstream areas the total allowable discharge rate is approximately 22.8 cfs as shown in **Exhibit 9**. The ICPR Model of the existing conditions depicts the discharge rate into the C-11 is approximately 93 cfs during a 25 year-3 day storm event. To compensate for the significantly reduced rate of discharge, properties must be acquired and converted into dry and wet retention ponds for stormwater storage in order to maintain reasonable flood elevations and minimize the impacts to existing developments.

To carve out the required retention areas, the same methodology has been utilized by selecting areas which are encumbered by FPL overhead transmission lines, properties with poor accessibility or properties which will be impacted due to their existing low elevations that are incompatible with the proposed flood elevations.

The 84 Lumber site, located at the southwest corner of S.R. 7 and Oakes Road has extremely low elevations, incompatible with the proposed design storm flood elevations. In addition, this site has poor accessibility with inadequate separation from Oakes Road for dedicated turn lanes. Given these two encumbrances and/or concerns, this property is shown to be converted into retention ponds.



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SCALE:	NTS
DESIGN BY:	C.L.
DRAWN BY:	E.H.M.
CHECKED BY:	C.L.
APPROVED BY:	

DESCRIPTION:	BY:	DATE:

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TOWN OF DAVIE TOC
STORMWATER MASTER PLAN

PREPARED FOR:
TOWN OF DAVIE

PROPOSED CBWCD N-1 SUB-BASIN

PROJECT NO.
11-0009

FIGURE 16D

SHEET 1 OF 1

An open/green space corridor is proposed consisting of retention ponds and a pedestrian path extending from Oakes Road south toward the N-1 Canal, approximately midway between S.R. 7 and S.W. 47 Avenue. In addition to this corridor which runs north and south, two new roads are proposed to extend west from S.R. 7 to S.W. 47th Avenue. These new roads are pursuant to goals outlined from the Technical Assistance Panel Report (2010) and are not required for stormwater management. A path and swale are proposed extending from the open corridor west to S.W. 47th Avenue which serve to increase stormwater equalization in the upper reaches of this sub-basin and increase pedestrian connectivity. The existing land uses, over which the above described improvements are proposed, consist of commercial buildings and pavement areas, of which, about half of the area is located beneath the FPL transmission lines. Acquiring these lands is vital to creating a linear park with interconnected pedestrian paths and having the dual use of stormwater storage. The proposed improvements in this area will require land acquisitions from many property owners; however the two primary businesses that are located within this area are 'U Pull It' and 'M & L Auto.' As previously stated, it is not the goal or intent of the TOC master plan to impair any of the existing developments as is practical to implement the Stormwater Master Plan. Therefore the Town should coordinate with these property owners to identify how the proposed areas could best be acquired without impairing how these businesses operate. The proposed retention pond layouts could be modified as best determined to minimize building demolition and impacts to business operations. Other properties or portions of properties could be acquired to reduce the land area required from each particular owner to create the corridor. For example, the commercial property identified by the Broward County Property Appraiser's website as 'McKenzie Tank Lines, Inc,' located off of Oakes Road just east of the proposed wet retention pond, may be more affordable and if acquired, this property could be utilized for the same purposes as establishing a linear path with retention ponds. Even though the 'McKenzie Tank Lines, Inc,' property does not extend the full distance, a narrower portion of land could be obtained from the 'U Pull It' and 'M & L Auto' properties to provide the desired result of a linear park amenity with stormwater storage.

The main objective with regards to stormwater requirements is the total land area as identified in the calculations for each basin or sub-basin must be acquired and converted into retention ponds for stormwater storage. If the ultimate location for the retention ponds is later determined as more desirable to be elsewhere within the same basin, the ICPR model must be re-evaluated and redesigned to hydraulically interconnect the storage ponds. The 'example' described above is not to infer that the 'McKenzie Tank Lines, Inc.' property should be more readily sacrificed than any other property, however, since the two properties 'U Pull It' and 'M & L Auto' are so large, bisecting their properties may not be possible without hindering their business, and properties of their size are not as easy to find. Whereas, smaller properties similar in size to 'McKenzie Tank Lines, Inc.' can be found within the Town and possibly within the TOC limits. In addition, when the Stormwater Master Plan is in place, a similar development like the 'McKenzie Tank Lines, Inc.'

would not need to set aside the same land area for stormwater management and therefore could relocate to smaller plot of land since stormwater management will be taken care of off-site. Likewise, if the areas required to accommodate the Stormwater Master Plan within the 'U Pull It' and 'M & L Auto' are coordinated and evaluated, since their future stormwater needs on-site will be reduced, each of these businesses maybe more accommodating even though site redevelopment may be necessary.

Further land acquisitions are proposed beneath the FPL transmissions lines, extending the contiguous open space amenity west from the CBWCD N-1 canal across S.W. 47 Avenue, past Kean Road, then south to Orange Drive. Most of the existing areas between the N-1 Canal west to Kean Road, which are to be acquired, are already being utilized for dry or wet retention purposes. A few existing lakes north of this corridor are proposed for land acquisition and are proposed to remain as lakes. West of Kean Road, the proposed open space corridor requires land acquisitions that consist of existing buildings and pavement areas that are being utilized for vehicle parking and storage, mostly below the FPL transmission lines.

An existing swale is also proposed to be acquired and utilized as dry retention west of S.W. 47th Avenue and north of New Town Commerce Center. This swale has an existing culvert outfall into the northernmost lake within the New Town Commerce Center. New culverts are proposed within this swale to increase stormwater conveyance in the northwestern reaches of this sub-basin by interconnecting the storm drainage system of S.W. 47th Avenue with the lakes toward the west.

The existing and proposed retention areas must be interconnected to ensure this sub-basin operates and equalizes effectively. The existing drainage trunk line, which extends from Oakes Road to the N-1 canal, is a major feature that is proposed to remain as it serves to interconnect and equalize the separate retention ponds along its extents. The existing control structure within the Oakes Road wet retention pond must be removed to provide a direct connection with the N-1 canal through the existing drainage trunk line. The trunk line drainage structures that fall within the proposed dry retention ponds should be modified to have a grate elevation of 3.25 ft-NGVD, which is elevated 3-inches above the bottom of the pond, providing dry retention for a portion of the water quality treatment volume and ensuring the dry ponds which are to also function as amenities, are not more than 3-inches deep prior to discharge into the lakes.

New culverts are proposed at select locations to interconnect and equalize the wet and dry retention ponds. Pursuant to CBWCD criteria, a minimum of 48-inch diameter lake interconnects are proposed below S.W. 47 Avenue and at the lake interconnections proposed west of S.W. 47th Avenue.

The existing control structures for Watson Pharmaceuticals and New Town Commerce Center are to be removed and interconnections from the wet retention ponds to adjacent properties are proposed. The existing 24-inch drainage outfall into the C-11 canal from the Kean Road Right-of-

Way is to be modified into an overflow structure above the proposed 25 year-3 day storm elevation. This outfall modification eliminates discharge from this location unless a storm event greater than a 25 year-3 day is incurred. The 'Sloan' property located north of Orange Drive, between the Turnpike and Kean Road, is mostly beneath the FPL Transmission lines and therefore proposed as dry detention. Discharge from this area is proposed through interconnections with the wet retention ponds east of Kean Road.

Kean Road within this sub-basin consists of an inverted crown road with exfiltration trench beneath the center of road. The existing crown of road is below the 10 year-1 day flood elevation. Pursuant to CBWCD criteria, the minimum road crown must be above the 10 year-1 day storm event. Therefore Kean Road should be reconstructed with the road crown above the 10 year-1 day flood elevation and the entire road Right-of-Way should also be elevated prior to the driveway connection to Orange Drive, in order to contain the 25 year-3day flood within the sub-basin. Depending on the condition of the existing exfiltration trench, it may be possible to reutilize the existing exfiltration trench and discharge into the dry retention pond proposed west of Kean Road. If the existing exfiltration trench cannot be reutilized, new exfiltration trench should be constructed along the extents of Kean Road to provide a minimum ½" dry pretreatment storage and any additional water quantity storage within the Right-of-Way.

SW 47th Avenue consists of existing pavement grades between 4.5 and 5.5 ft-NGVD, which are below the 10 year-1 day storm event. This roadway must be reconstructed with a road crown above the 10 yr-1 day flood elevation and raised up at the connection to the Orange Drive Right-of-Way to contain the runoff of a 25 year-3 day storm. The proposed drainage system for SW 47th Avenue should be redesigned with exfiltration trench along its extents, to provide a minimum ½" dry pretreatment storage and any additional water quantity storage within the Right-of-Way. Drainage connections should be made to any adjacent retention ponds along the Right-of-Way limits to help convey and equalize stormwater within this sub-basin. By having multiple drainage connections to the proposed retention ponds adjacent to the Right-of-Way serves to provide relatively close outfalls, which keeps pipe sizes smaller. In addition, the storm drainage system should be designed to permit select adjacent sites in which no offsite drainage connection is available, to connect and discharge after their respective on-site pretreatment requirements have been met. The existing drainage culverts within SW 47 Avenue could possibly be utilized for stormwater conveyance but must be further evaluated when this project proceeds for design.

Oakes Road is proposed to be reconstructed with a straight alignment at the connection to S.R. 7. The realignment is not required for the implementation of the Stormwater Master Plan, however if Oakes Road is reconstructed, the storm drainage system should be improved with exfiltration trench along its extents to provide a minimum ½" dry pretreatment storage and any additional water quantity storage within the Right-of-Way. The storm drainage system should be designed to permit select adjacent sites in which no offsite drainage connection is available, to connect and

discharge after their respective on-site pretreatment requirements have been met. Furthermore, the Oakes Road drainage system should be interconnected to S.W. 47th Avenue storm drainage system and any adjacent retention ponds within this sub-basin, to help convey and equalize stormwater within this sub-basin. In order to keep CBWCD runoff hydraulically separated from Broward County, the Oakes Road drainage system must be modified to remove the outfall into the drainage ditch to the north.

The two new roads proposed to extend between S.R. 7 and S.W. 47th Avenue are not a requirement of this Stormwater Master Plan, however if these roads are to be constructed pursuant to the goals of TOC, exfiltration trench should be installed along the extents of these roads to provide a minimum ½" dry pretreatment and any additional water quantity storage within the Rights-of-Way. The drainage systems should also be interconnected with S.W. 47th Avenue and having outfalls into the adjacent proposed dry retention ponds. Furthermore, the storm drainage system should be designed to permit select adjacent sites in which no offsite drainage connection is available, to connect and discharge after their respective on-site pretreatment requirements have been met.

THISCD Basin

The proposed THISCD basin limits remain the almost the same size as the existing THISCD basin, keeping all of the properties within the jurisdictional limits of Tindall Hammock Irrigation and Soil Conservation District and adding select areas that have no existing outfall but hydraulically will overflow into the nearest roadway given enough rainfall, and ultimately discharge into the THISCD limits. The proposed improvements to this basin are shown on **Figure 17**. To provide adequate stormwater storage to this basin, both existing lakes are to remain and additional areas must be acquired and converted into dry retention ponds. Located south of Oakes Road and on the east side of Kean Road, a vacant lot is to be acquired and converted into a park with low green areas and dry retention areas. North of Oakes Road, adjacent to and west of the existing lake, multiple commercial/industrial parcels and/or portions of parcels are to be acquired and converted into dry retention ponds and low green areas. Portions of the Mobile Home Park, located southwest of Burris Road and the old 84 Spur Road, are to be acquired and converted into dry retention ponds and low green areas for park facilities.

Kean Road, Oakes Road and Field Road are to be reconstructed with exfiltration trench along their extents to provide a minimum ½" dry pretreatment storage and any additional water quantity storage within the Right-of-Way. The roadway drainage systems are to be interconnected with each other and into any adjacent retention ponds, to help convey and equalize stormwater within this basin. In addition, select adjacent sites in which no offsite drainage connection is available, shall be permitted to connect and discharge after their respective on-site pretreatment requirements have been met. The dry retention ponds are to be interconnected with inlets

elevated 3-inches above the bottom of the pond, providing dry retention for a portion of the water quality treatment volume and ensuring the dry ponds which are to also function as amenities, are not more than 3-inches deep prior to discharge into the lakes.

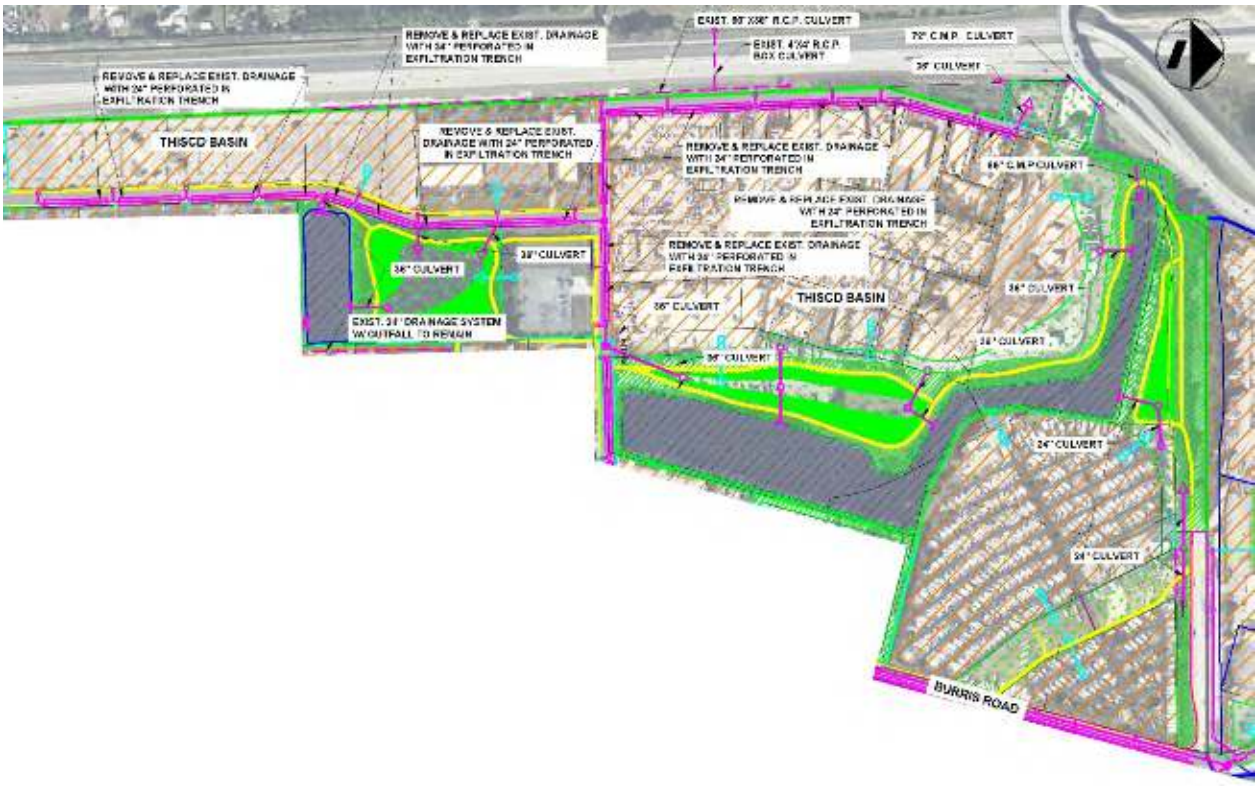


FIGURE 17: THISCD BASIN

A new control structure is not required to limit discharge from this Basin but is permitted by THISCD to freely discharge into the existing drainage system that extends west beneath the Turnpike into an existing THISCD canal. The THISCD canal has a permitted and controlled rate of discharge into the CBWCD N-4 canal that serves to limit discharge from this subject basin. However, in the modeling of this Basin, a fictitious control structure was placed in the ICPR model to confirm flood stages within this Basin were acceptable with the existing and proposed conditions, given a discharge of 40 csm.

One outfall from the northernmost lake is proposed to remain in place and is adequately sized to convey runoff from the THISCD basin into the downstream Tindall Hammock Irrigation & Soil Conservation District canal. Two existing points of discharge into the FDOT drainage swale are to be modified and raised up above the 25 year-3day flood elevation to ensure the retention ponds are adequately utilized for water quality and quantity storage prior to discharge from the TOC

limits. The proposed interconnected roadway drainage system will serve to equalize and convey stormwater toward the remaining point of discharge for this basin.

Since water quality pretreatment is to be met within the prior to discharge into the lakes, the two lakes will not be hydraulically connected below the weir elevation. The weir will limit the southern lake from returning to the control elevation after a storm event. A three-inch bleeder connection is proposed from the southern lake in THISCD basin to the northwestern lake in CBWCD N-1 basin. This proposed feature will provide a means for the subject lake to recover after a storm without violating dry pretreatment requirements.

Park Amenities including pedestrian paths are proposed throughout this Basin within the green areas extending from the Northeast Sub-basin along Burris Road, west toward the Turnpike and then back southeast along the existing lake to Oakes Road. Additional pedestrian paths are proposed along and south of Oakes Road to the proposed park facilities east of Kean Road. The proposed pedestrian paths extend into the CBWCD N-1 Sub-basin via Oakes Road and Kean Road.

South C-11 Basin

The South CBWCD Basin has been increased in size to consist of approximately 209 acres by combining the South C-11 basin and the South Basin into one basin, by a proposed 48-inch diameter culvert interconnection beneath Griffin Road as shown in **Figure 18**. A control structure located north of Griffin Road is proposed into the C-11 canal providing a positive outfall to this Basin.

In order to carve out the required retention areas to serve this Basin, multiple areas must be acquired. A principal area to be acquired lies beneath the FPL transmission lines, along the western limits of this Basin, currently utilized as open parking facilities for an Auto Auction business and a vacant parcel. An open area along the southern border of this basin is proposed for dry retention ponds and low green areas which is owned and utilized by the Auto Auction business for vehicle parking/storage. The existing lakes are to be acquired and expanded until the two existing lakes are connected which will require further land acquisition from the Auto Auction including demolition of a building. A new lake is proposed south of the Cemetery and an existing church, extending north to Griffin Road, displacing some agricultural areas, a single family home and a mobile home park. Existing dry retention ponds are to be purchased from FDOT, along the south side of Griffin Road, pursuant to the goals outlined by the Technical Assistance Panel Report (December 2010), so that buildings can be constructed closer to the Roadway with parking in the rear. In order to hydraulically dispose the FDOT dry retention ponds, a new separate retention pond, toward the west must be purchased and given to FDOT to provide the same volume of storage and new storm drains must be installed to convey runoff to the new FDOT retention pond. North of Griffin Road, a wet retention pond and dry retention ponds are proposed to store and covey runoff toward the proposed control structure, requiring land acquisitions from a mobile

home park and an open area already utilized for dry retention by a multifamily residential housing development.

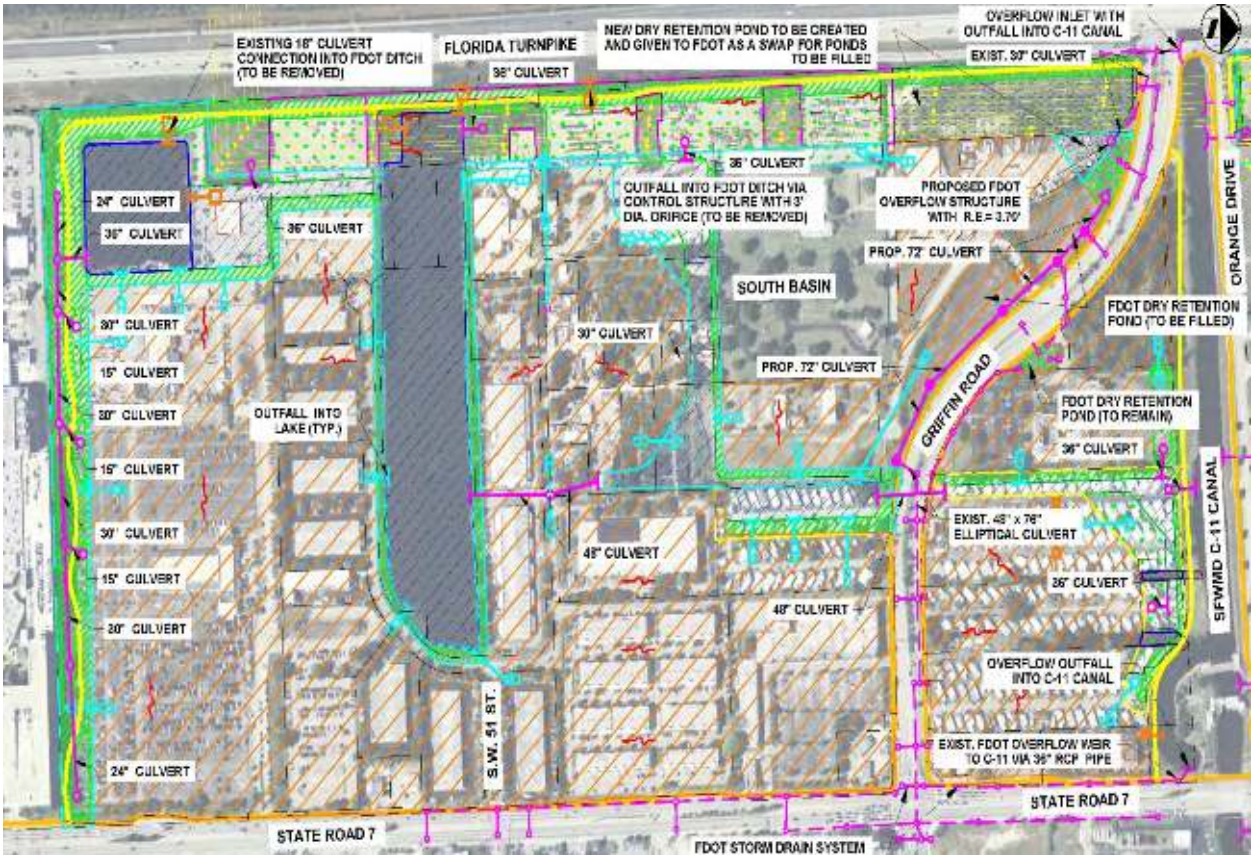


FIGURE 18: SOUTH C-11 BASIN + SOUTH BASIN + SOUTH F.D.O.T. BASIN

The existing and proposed dry and wet retention ponds are located throughout this Basin to provide the required stormwater conveyance and storage needs. The dry retention ponds are proposed to be connected to the lakes with inlets elevated 3-inches above the bottom of the pond, providing dry retention for a portion of the water quality treatment volume and ensuring the dry ponds, which are also to function as amenities, are not more than 3-inches deep prior to discharge into the lakes.

Once the retention ponds are constructed and the proposed control structure is in operation, the existing outfalls can be removed, as long as the site having the outfall is reconstructed to direct runoff into the nearest facility of the Stormwater Master Plan. The existing outfalls to be removed are the following:

- Two existing outfalls into the Turnpike swale
- The outfall into the FDOT (Griffin Road) Right-of-Way from the shopping located at the southwest corner of S.R. 7 and Griffin Road

- A control structure discharging into the C-11 from strip of commercial properties north of Griffin Road, along the west side of S.R. 7
- The mobile home park located north of Griffin Road has a few drainage connections into the existing finger canals. The existing canals are to be filling in and hydraulically separated from the C-11 canal.

MODEL OF THE FINAL STORMWATER MASTER PLAN

The Final Stormwater Master Plan reflecting all the basins/sub-basin south of I-595 is shown on **Exhibits 11 & 12**, reflecting the areas north and south of the C-11 canal respectively. **Exhibit 13** is an overall Final Stormwater Master Plan of the TOC on a 24"x36" plan sheet. These exhibits show the proposed developable areas with an orange hatch, the dry retention ponds with a green dot pattern and the wet retention ponds with a blue hatch. The solid green shade represents where park facilities can be placed. The existing and proposed drainage culverts, exfiltration trenches, inlets and control structures are also identified on **Exhibits 11, 12 & 13**.

In order to create a model of the Final Stormwater Master Plan, each sub-basin was broken down to reflect the various proposed developable areas, Right-of-Ways, stormwater retention ponds and the existing and proposed drainage infrastructure. The developable areas have been designed assuming an ultimate land use breakdown of 35% Building Area, 45% Pavement Area and 20% Green Area. **Exhibit 9** shows the Final Land Use Breakdown and Maximum Discharge Calculations for the Final Stormwater Master Plan per basin. **Exhibit 10** shows the proposed grading assumptions for future development. Utilizing the land use and grading parameters, stage-storage and soil storage calculations were created for each basin and node throughout the TOC. The calculations and input data for the Final ICPR model are provided in **Appendix 5**.

The existing and proposed drainage culverts shown in **Figures 15-18** and as described for each drainage sub-basin were input as links to interconnect the nodes in the Final ICPR Model. In addition, control structures were utilized in the Final Model to limit discharge to 40 CSM from the Northeast Basin into the CBWCD N-1 basin and from CBWCD N-1, THISCD Basin and South C-11 basins into the C-11 Canal. The proposed links from the private development sites are included in the model in order to interconnect the nodes; however the design and construction of these links shall be performed by the developer in order to connect to the Master Stormwater Master System. The same Rainfall Data and Tailwater Conditions as utilized in the Existing Model and as shown **Figures 12, 13 & 14,** were also utilized for the Final Model. A copy of the ICPR Nodal Diagram, ICPR Input Data and Results (Maximum Node Stages and Maximum Link Flow Rates) of the Final Stormwater Master Plan are located in **Appendix 5**.

VII. COMPARISON & EVALUATION OF EXISTING VERSUS FINAL ICPR MODEL RESULTS

By comparing the Existing (Pre) versus Final (Post) ICPR Modeling Results, adverse affects due to higher flood stages can be identified and evaluated. **Exhibit 14** is a chart that compares the ICPR Model Peak Stage Results of the Existing Conditions (Pre) and the Final (Post) Stormwater Master Plan. Red font is provided on the spreadsheet where existing flood stages are exceeded by more than 0.1 feet by the post development flood stages. Most of the proposed flood elevations will be lower than the existing flood elevations, however, certain properties which are anticipated to incur increased flood stages must be evaluated to identify if the increased flood elevations will create adverse impacts. The main cause for anticipated increased flood stages is because the post development discharge rates out of the TOC must be reduced to approximately 47 cubic feet per second (cfs) in accordance with SFWMD criteria; which is significantly reduced compared to the existing discharge rate of approximately 175 cfs.

It is important to understand that the model of the Final Stormwater Master Plan assumes all of the areas shown with an orange hatch in **Exhibits 11-13** as being redeveloped per the land use and grading parameters identified in **Exhibit 10**, and that each proposed development has been modeled with an overflow structure ensuring dry pretreatment is met on-site prior to discharge into the nearest retention pond. These proposed features may indicate higher stages on-site for the post development model. However, if an existing site is not redeveloped, the best comparison for Pre versus Post Stages is the nearest retention pond or public right-of-way. If the nearest retention pond or right-of-way has lower stages then the existing subject node, the existing site, if not redeveloped, will continue to drain same as the existing conditions.

Exhibit 15 is an aerial map of the TOC identifying the properties which will experience higher flood stages due to the Final Stormwater Master Plan. The properties identified with a blue shade pattern on **Exhibit 15** will be evaluated below to verify if the increased flood stages will create adverse impacts and separated into three different categories. The first category is for properties that are not adversely impacted by the increased flood stages. The second category describes properties that will be adversely impacted. The third category describes properties that may or may not be adversely impacted, and must be further evaluated to verify.

Category 1: Properties Not Adversely impacted by Post-Development flood elevations

M1—This site only experiences higher stages during the 5 year-1 day storm event which should have minimal affect to this site. All other design storm flood levels are lower.

M6—This site only experiences increased flood elevations during the 100 year-3 day storm. A survey for this site revealed the finished floor elevation of 7.47 ft-NGVD, which is higher than the modeled flood stage of 6.85 ft-NGVD. Therefore this site will not be adversely impacted.

M32—This site is an industrial site with an existing drainage system consisting of numerous underground drainfields and having no positive outfall. The post development flood stages increase by less than 2.5" for the 50 & 100 year storm events. Record drawings indicate the finished floor elevations are above the post development 100 year flood elevation. No adverse impacts are anticipated to this site.

M41, M41A & M41 Lake—These existing properties are directly connected to the wet retention pond identified as Node "M41 Lake." The model results indicate only the 5 year-1day flood elevation will increase for the existing lake. Since nodes M41 & M41A are directly connected to this lake, if these sites are not redeveloped, the existing grades and finished floors will function fine with the modeled results of the Final Stormwater Master Plan and no adverse impacts are anticipated to these sites.

M42 & M42 Lake—These existing properties are directly connected together through an existing 30" culvert. The model results indicate increased flood elevations for every storm event modeled. However, review of the as-built plans indicate the lowest pavement elevation is above the 10 year-1 day flood elevation and the buildings are constructed above the 100 year-3 day flood elevation. Therefore, Node M42 will not be adversely impacted. Node M42 Lake is located beneath the FPL Power Lines and is proposed to be acquired and incorporated into the Final Stormwater Master Plan. The increased flood elevations will not adversely impact this site as it has no existing buildings or pavement areas.

N15A—This site only experiences higher stages during the 5 year-1 day storm event which should have minimal affect to this site. All other design storm flood levels are lower in the post development model.

N46—This site only experiences higher stages during the 5 year-1 day storm event which should have minimal affect to this site. All other design storm flood levels are lower in the post development model.

North Oakes Ret & N Retention—Since these sites are existing retention ponds which are proposed to be incorporated into the Final Stormwater Master Plan, increased stages to these properties are acceptable.

SC7—This is a developed site with asphalt parking and apartment buildings. Review of the As-built Paving and Grading Plans for this development indicate finished floors of 7.5 ft-NGVD and crown of road 6.1 ft-NGVD which are above the modeled post development flood stages for the 100 year and 10 year events respectively. Therefore no adverse affects are anticipated for this site.

SC8—This site is an undeveloped vacant parcel. Development of this site will not be adversely impacted by the anticipated stages of Final Stormwater Master Plan.

SS6—This site experiences higher stages during the 5 year-1 day and 10 year-1 day storm events which should have minimal affect to this site but slightly higher elevations within the lake for the two specified design storm events. All other design storm flood levels are lower in the post development model.

SS10—This site experiences higher stages during the 5 year-1 day storm event which should have minimal affect to this site but slightly higher elevations within the lake. All other design storm flood levels are similar or lower in the post development model.

SS11—This site is an existing Church and the only anticipated increased flood stage is for the 5 year-1day event. The existing drainage inlets within the inverted crown parking lot are approximately 5.5 ft-NGVD which is slightly lower than the model flood stages of 5.62 ft-NGVD. The adjacent retention area has a 5year-1day flood stage of only 4.59 ft-NGVD, which indicates the on-site flood stages could be reduced if the modeled hydraulic connections were increased. Since the drainage connections from the private developments to the Final Stormwater Master System are to be performed by each development, the modeled flood stages to this site are acceptable and will not adversely impact this site.

SS12—This site is an existing Cemetery and no improvements are proposed within this property. The increased flood stages are for the 5 year-1 day and 10 year-1 day storm event. The adjacent proposed retention areas have flood elevations over 1 foot below the on-site flood stages. Since no improvements to this site are proposed and since the adjacent flood stages are lower than this site, no adverse impacts are anticipated to this site.

SS14—This site consists of commercial and residential properties along the north side of SW 51st Street. The model results indicate increased flood stages for the 5 year-1 day and 10 year-1 day events. Evaluation of the proposed adjacent retention areas indicate the flood elevations are over one foot below the proposed on-site flood elevations for the same storm events. This indicates the existing sites will not be adversely impacted if they are not redeveloped.

THISCD Lake—Since this is an existing lake which is proposed to remain a lake and be incorporated into the Final Stormwater Master Plan, increased stages to this property are acceptable. Furthermore, this lake only experiences higher stages during the 5 year-1 day and 10 year-1 day storm events which are not storm events regulated by Tindall Hammock Irrigation & Soil Conservation District.

THISCD Oakes2—This portion of road right-of-way has increased flood stages for the 5 year-1 day and 10 year-1 day, however the post developed flood elevations are lower than the existing edge of pavement. Therefore no adverse impacts are expected for this road. Exfiltration trench should be installed to meet water quality treatment prior to discharge into the retention ponds and increase overall stormwater storage within this basin.

W8 PH2—This site only experiences increased flood stages during the 10 year-1 day flood event. A permit found for this site indicates the pavement was designed with a minimum elevation of 6.0 ft-NGVD which is the same elevation of the post development flood stage. Therefore no adverse impacts should be expected for this site.

Category 2: Properties that will be adversely impacted by higher Post-Development flood elevations

Burris Road—Comparison of the Pre versus Post Modeled Results indicate that the flood stages in two of the roadway nodes will increase by approximately 3.0-inches or less for every design event modeled. The design plans indicate the profile grade line is lower than both the pre and the post development 10 year-1 day flood elevation in select locations. Portions of this road are known to experience water ponding over the pavement for numerous hours even after the storm is over. This road should be reconstructed in select locations to ensure the crown of road is above the 10 year-1 day flood elevation. In addition, exfiltration trench should be installed to meet dry pretreatment prior to discharge into wet retention ponds and to increase hydraulic capacity to the retention ponds.

M43—Little survey information of this site is known but from aerial maps, this property is being utilized for vehicle storage. The proposed retention ponds adjacent to this site have flood elevations higher than existing. Since every storm event indicates increase flood stages by over six inches, this site will be adversely impacted unless it is redeveloped with grades similar to the grading parameters identified in **Exhibit 10**.

M42A—No as-built survey of this site was found however the original design plans for this property indicate proposed finished floor elevations of 6.25 ft-NGVD. The site is directly connected to the wet retention pond identified as Node "M42 Lake" and the post development flood stages will adversely impact this site by flooding the buildings during the 50 year-3 day and 100 year-3 day storm events.

M47th Avenue—SW 47th Avenue as-builts reveal this roadway was constructed below the 10 year-1 day flood elevation. Comparison of the Pre versus Post Modeled Results indicate that the flood stages will increase for every design event modeled. Since this road is below the 10 year- 1 day flood elevation, this road must be reconstructed with the crown of road above elevation 6.0 ft-NGVD per CBWCD Criteria. In addition, exfiltration trench should be installed to meet dry pretreatment prior to discharge into wet retention ponds.

Oakes Road—Comparison of the Pre versus Post Modeled Results indicate that the flood stages will increase by approximately 2.5-inches or less for every design event modeled. The design plans indicate the profile grade line is lower than the post development 10 year-1 day flood elevation in select locations. This road should be reconstructed in select locations to ensure the crown of road

is above the 10 year-1 day flood elevation. In addition, exfiltration trench should be installed to meet dry pretreatment prior to discharge into wet retention ponds.

SC4, SC5 & SC6—These properties consist of a mobile home park which has a limited drainage system or grading that promotes direct discharge into canals which are hydraulically connected to the C-11 canal. The existing elevations are very low with no storage since all runoff discharges directly to the C-11 Canal. Comparison of the Pre versus Post Modeled Results indicate that the flood stages will increase by approximately 9-inches for the 5 year and 10 year storm events, 14-inches for the 25 year storm event and 18-inches for the 50 year and 100 year storm events. These existing developments will be adversely impacted by the increased flood stages.

SS3—No existing plans or permit files were found for this site. This property is an existing mobile home park. The existing coverage areas and grades for this site were found using aerial maps and Lidar. The post development flood stages increase by approximately 6-inches for the 5 year storm and 3-inches for the 10 year storm event. The existing road elevations are incompatible with the proposed flood elevations due to flooding over the crown of road.

Category 3: Properties that may or may not be adversely impacted by Post-Development flood stages and must be further evaluated to verify impacts.

M Sloan—This site is located almost entirely beneath overhead power lines and proposed to be converted into dry retention pursuant to the Final Stormwater Master Plan. If the existing site remains as is, increased flood stages for the 25 year, 50 year and 100 year events are anticipated. The increased flood stages may be acceptable but further survey of this site is required to verify the increased flood stages will incur adversely impacts.

M Keane— No existing plans or permit files were found for this site. The elevation of this road must be further evaluated to verify if compatible with the anticipated flood stages. Even though all of the storm events reflect an increased flood stage, the only relevant evaluation is if the crown of road is above the modeled 10 year-1 day flood.

M12C—No existing plans or permit files were found for this site. This node is an industrial site made up of mostly open pavement areas. The existing coverage areas and grades for this site were found using aerial maps and Lidar. The post development flood stages increase by just over 0.1 feet for the 10 year storm event and by more than 6-inches for the 25, 50 & 100 year storm events. More topographic survey should be obtained to verify if this site will be adversely impacted by the increased flood stages.

M45—This site consists of pavement elevations below elevation 5.0 ft-NGVD which means the pavement areas or portions of the pavement areas will be flooded during the 5 year and 10 year storm events for both the Pre and the Post ICPR Models. The post development flood stages

increase by more than 6-inches for the 25, 50 & 100 year storm events. No survey elevations of this site are available other than a few existing inlets along the west property line. More topographic survey should be gathered to verify if this site will be adversely impacted by the increased flood stages.

M31—No existing plans or permit files were found for this site. This node is an industrial site made up of mostly open pavement areas. The existing coverage areas and grades for this site were found using aerial maps and Lidar. The post development flood stages increase by more than 6-inches for the 25, 50 & 100 year storm events. More topographic survey should be obtained to verify if this site will be adversely impacted by the increased flood stages.

N30—No existing plans or permit files were found for this site. This node is an industrial site made up of mostly open pavement areas. The existing coverage areas and grades for this site were found using aerial maps and Lidar. The post development flood stages increase by approximately 2.5-inches for the 25, 50 & 100 year storm events. More topographic survey should be obtained to verify if this site will be adversely impacted by the increased flood stages.

N20, N21, N22, N23, N25, N26, N27 & N47—Limited to no existing plans or permit files were found for these sites. These properties consist of industrial sites made up of mostly open pavement areas. The existing coverage areas and grades for these sites were found using aerial maps and Lidar. The post development flood stages increase by approximately 2.75-inches or less for the 25, 50 & 100 year storm events. More topographic survey should be obtained to verify if these sites will be adversely impacted by the increased flood stages.

VII. CAPITAL IMPROVEMENT PLAN

The estimated costs to construct the Stormwater Master Plan are shown in **Figure 19**. Given the sizeable total cost, the best approach to construct the Final Stormwater Master Plan should be in phases. The primary and most crucial task to implement the Stormwater Master Plan is to acquire the lands necessary for the proposed retention ponds. The subsequent tasks are dependent on the acquisition of the land to provide necessary storage for the proposed redevelopment within the TOC.

In the case that the required lands cannot be obtained, the Stormwater Master Plan must be re-evaluated with the areas that have been or can be acquired, and redesigned accordingly. The redesigned plan would require developments to store more stormwater on-site, limiting their developable area, similar to the current conditions.

BASIN ID	LAND ACQUISITION	DEMOLITION & EARTHWORK	DRAINAGE	PAVING, AMENITIES & LANDSCAPING	ENGINEERING & CONTINGENCIES	TOTAL
NORTHEND & NORTHEAST	$9,847,469.00	$1,024,225.69	$1,586,550.00	$1,300,120.00	$2,158,015.61	$15,916,380.30
CBWCD N-1	$15,033,661.10	$1,877,260.07	$3,268,560.00	$4,016,026.67	$4,251,920.13	$28,447,427.96
THISCD	$12,725,736.02	$2,149,170.09	$2,114,420.00	$2,589,280.00	$3,328,434.63	$22,907,040.73
SOUTH CBWCD	$13,274,394.10	$2,400,259.04	$1,322,800.00	$735,600.00	$2,665,037.12	$20,398,090.27
TOTAL=	$50,881,260.22	$7,450,914.89	$8,292,330.00	$8,641,026.67	$12,403,407.49	$87,668,939.26
% OF TOTAL=	58.0%	8.5%	9.5%	9.9%	14.1%	100.0%

FIGURE 19: SUMMARY OF THE ENGINEER'S ESTIMATE OF PROBABLE COST

The Final Stormwater Master Plan is made up of separate drainage basins which can be constructed independently or all together to implement the Final Stormwater Master Plan. This allows each basin to be constructed as a separate phase if the Town chooses to implement the SWMP in that manner. Since the land acquisition phase costs approximately 58% of the total estimated cost and must be performed first, the proposed land acquisitions should be targeted in one basin at a time. The order in which the basins are improved can be determined as best needed to meet proposed re-development demands, but the order of improvements within each sub-basin, however, is not flexible and, for the most part, must be completed in a systematic order. Each of the steps for the CIP will be described below:

Phase 1—Land Acquisitions

The land costs were taken from the appraisal values shown on the Broward County Property Appraisers (BCPA) website in 2013, which are likely to change over time. The

values of lands to be acquired vary depending on the existing use. The land acquisition cost estimates are broken down into seven different categories which are listed and described below.

Normal Lands: Normal lands describe property which is unencumbered by overhead FPL transmission lines or lakes. The BCPA website indentifies properties matching this description with a value that varies slightly but is approximately $8 per square foot.

Buildings: The value of buildings varies greatly from site to site. The BCPA website provides a footprint sketch and breakdown of each properties buildings, however the separate unit values per building are not identified for properties having multiple buildings. The approximate cost for each building per property is based on the BCPA assessed building value divided by the total building area and multiplied by the building area to be acquired. Since this value changes from property to property, the unit price shown on the cost estimates for building area is different for each basin. However the methods described above were followed for each building and each basin. The building areas to be acquired are depicted on the aerial map figures for each sub-basin.

Mobile Home: The land value for mobile home parks is listed by BCPA as approximately $4 per square foot.

Lakes: The land value for lakes is listed by BCPA as approximately $0.10 per square foot.

Dry Retention: The land value for dry retention is listed by BCPA as approximately $1.00 per square foot.

Useable below FPL Lines: The useable lands area below the FPL Transmission lines are listed by the BCPA as approximately $7 per square foot.

Dry Retention below FPL Lines: The dry retention pond areas below the FPL Transmission lines are listed by the BCPA as approximately $0.51 per square foot.

FDOT Dry

Retention Areas: The FDOT dry retention ponds to be acquired are located within the South CBWCD Basin, south of Griffin Road just east of the Turnpike. The goal of purchasing these areas is to allow commercial developments adjacent to Griffin Road, with parking in the rear, pursuant to the Technical Assistance Panel Report (December 2010). The costs for these areas are not identified by the BCPA, however the same price for Dry Retention below FPL lines was assumed.

Construction Phases

1. *Excavate Dry and Wet Retention Ponds*

The proposed retention ponds are necessary to provide stormwater storage to accommodate new redevelopment consistent with the TOC Zoning Criteria. Ideally, retention areas will be developed to serve all parcels within a basin, rather than a single parcel.

Particular site redevelopment within the TOC may help direct the order in which the ponds are constructed. For instance, if a particular site is to be redeveloped adjacent to a proposed retention pond, it is possible that for the short term, only that particular retention pond or a portion thereof be required to accommodate the stormwater needs, pending engineering analysis and permitting.

Ultimately, all of the retention ponds are to be constructed to match the Final Stormwater Master Plan. Individual retention pond locations and sizes can vary from the Final Stormwater Master Plan as long as the sum total retention pond areas are equal to the Final Stormwater Master Plan. The drainage infrastructure and drainage model may require reevaluation depending on the changes in pond location and size.

Depending on market conditions, the excavated fill could potentially be a sold at a profit, serving to pay for excavation costs and provide revenue, which could help pay for further implementation of the Stormwater Master Plan. Since this condition may not be the case when construction commences, no income for fill sales are accounted for in the cost estimates.

2. *Construct Storm Drainage System interconnecting retention ponds.*

   The proposed storm drainage system must be constructed to interconnect retention ponds, collect stormwater discharge from roads and developments and provide the sub-basin a positive outfall.

3. *Reconstruct Existing Roads with proposed storm drainage systems within the Right-of-Way*

   Each existing road must be evaluated to ensure the crown of road is above the 10 year-1 day flood elevation. The proposed drainage within the existing Right-of-Ways shall consist of exfiltration trench systems to provide water quality and quantity storage. In addition, the drainage system must be hydraulically designed to accommodate discharge from select properties which are isolated from the proposed retention ponds and provide additional interconnects between retention ponds, serving to convey and equalize stormwater within each respective sub-basin.

   The proposed sidewalks within the right-of-way serve to accommodate a stated goal by the Town, to provide pedestrian connectivity within the TOC.

4. *Install a Control Structure*

   This improvement is to be constructed after all the above items are complete, because the control structure will serve as a dam, restricting discharge out of the respective sub-basin. This restriction will cause stormwater to stage up and store runoff within the retention ponds and discharge at controlled rate downstream. The restriction is required to meet SFWMD & CBWCD criteria.

   If the control structure is installed prior completion of Items 1-4, the flood stages will be higher than depicted in the Stormwater Master Plan and must be re-evaluated by an Engineer.

5. *Construct Pedestrian Paths, Park Facilities and Landscaping*

   The pedestrian paths, park facilities and landscaping can be installed anytime as best determined by the Town of Davie to accomplish the goals of creating pedestrian connectivity and amenities within the TOC. These improvements are not required for the Stormwater Management System to function.

6. *Construct New Roads with storm drainage systems*

   New roads are proposed to increase vehicular accessibility within the TOC. This item is also not required for the Stormwater Management System to function. However, if new roads are constructed, a storm drainage system should be constructed consisting of exfiltration trench to provide water quality and quantity storage. The drainage system should also be interconnected to other adjacent drainage facilities within the same sub-basin and provide an outfall to any adjacent properties along new the roadway limits which are otherwise isolated from the master stormwater drainage facilities.

The Capital Improvement Plan for each sub-basin will be provided below including a description, aerial map exhibit and cost estimate. As previously stated, each sub-basin can be constructed independently from the other sub-basins and the order in which the sub-basins are constructed is flexible. Therefore, the order in which the sub-basins are listed below is from North to South and not in an order of recommended priority.

TOWN OF DAVIE STORMWATER MASTER PLAN FOR THE TOC

CAPITAL IMPROVEMENT PLAN

Northend & Northeast Sub-Basin Phase

Location Map **Project Location**

The Northend & Northeast Sub-Basins are located north of Oakes Road, west of S.R. 7, south of I-595 and east of THISCD. This area is located within the jurisdictional limits of Broward County Surface Water Licensing Division pursuant to the delegation agreement with SFWMD.

Project Summary: The reason these sub-basins are combined into one CIP project phase is due to the need for a trunk line drainage system in Burris Road to serve as a positive outfall for the Northend Sub-basin. Burris Road is located within the Northeast Sub-basin and the existing drainage system is proposed to be reconstructed with exfiltration trench and drainage connections into the proposed retention ponds. The primary land acquisitions are located beneath and around the existing FPL transmission lines within the Northeast sub-basin. A portion of the FDOT Right-of-Ways of I-595 & S.R. 7 also discharge into the Northeast sub-basin and must be maintained and not hydraulically compromised. The control structure proposed for this project phase will provide a hydraulic separation from the Broward County jurisdictional limits and the CBWCD limits. Careful evaluation must be made prior to installation of the control structure to ensure no adverse impacts to existing properties, FDOT or Oakes Road.

Descriptions and Order of Steps to Implement the Stormwater Master Plan

1. *Land Acquisitions & Acquire Drainage Easement*
   The primary land acquisitions are located beneath and around the existing FPL transmission lines between S.R. 7 and Burris Road. Additional land acquisition is proposed west of Burris Road to provide storage for the properties located west of Burris Road within the Northeast sub-basin.

No land acquisitions are proposed within the Northend Sub-basin, however a drainage easement may be required to provide a positive outfall the property located off of the 84 Spur Road. The drainage easement should extend east from the subject property to the Burris Road swale.

2. *Excavate Dry and Wet Retention Ponds & Burris Road Swale*

Northeast Sub-Basin: The dry retention ponds and swale will serve to provide storage to these sub-basins. The existing drainage ditch shall be regraded to consist of cross slopes and easements meeting Broward County criteria. The ditch is to be connected to the proposed wet retention pond. Dry retentions ponds are to be graded to contain dry pre-treatment prior to overflowing into the wet retention ponds. The properties within the Northeast sub-basin can connect into the proposed drainage system after dry pretreatment is stored on-site. Discharge from private developments into the nearest dry retention pond is recommended but the properties can also discharge into the wet retention ponds/ditch as well.

Northend Sub-basin: The Burris Road swale within the Northend Sub-basin is proposed to accommodate controlled discharge from the adjacent properties. Unlike other sub-basins, the three properties within this sub-basin must collect, store, and control discharge into the master system at controlled rate of 40 csm. The reason for this is because this sub-basin has a higher wet season water table and consequently has higher proposed grading parameters than the downstream sub-basins. By controlling the discharge off-site will detain storage within this sub-basin and avoid flooding the downstream sub-basin which have lower elevations. Furthermore, since these sites previously had no outfall, providing a positive outfall at a rate 40 csm is an improvement.

3. *Construct Storm Drainage System including Reconstruction of Burris Road*

Burris Road drainage system is to be reconstructed with exfiltration trench along the entire length of the road with outfall connections into the adjacent dry retention ponds. In addition, a parallel trunk line culvert is proposed within Burris Road from the Northend sub-basin to the wet retention ponds located within the Northeast sub-basin.

Culverts with raised inlets are to be extended from the dry retention ponds to the wet retention ponds, serving to collect and convey pretreated runoff to the lake system.

The proposed drainage system with pond interconnections will provide a positive outfall for the Northend sub-basin through the Northeast sub-basin toward the C-11 canal via an existing drainage connection into Oakes Road. This outfall connection is to be maintained

until all the retention ponds are constructed. The discharge from ditch into the Oakes Road system will be reduced by the additional stormwater storage created by step 2 above.

4. *Construct Control structure and outfall connection to Oakes Road Retention Pond*
   The proposed control structure will hydraulically separate the Broward County jurisdictional limits from CBWCD, limiting discharge through proposed orifices and an overflow weir at the maximum rate of 40 csm. An independent culvert outfall is proposed from the control structure to the Oakes Road retention pond. An overflow weir is also proposed into the Oakes Road system, increasing drainage interconnections above the 25 year-3 day flood elevation and serving as additional flood protection to Oakes Road if the storm drainage system within Oakes Road rises above the weir elevation.

   This step must include hydraulic evaluation of the Oakes Road drainage system to ensure that removal of the outfall into the ditch does not adversely impact Oakes Road. It may be necessary to continue accepting runoff from Oakes Road into the ditch until the Oakes Road drainage system is reconstructed, which will be explained in the North CBWCD Sub-Basin.

5. *Construct Pedestrian Paths, Park Amenities and Landscaping*
   The pedestrian paths, park Amenities and Landscaping shall be constructed to meet the desired goals of the TOC to provide pedestrian connectivity and desirable park amenities. The pedestrian path along the wet retention pond and existing ditch may require careful evaluation to ensure safe cross-slopes are provided. In addition, the proposed path intersections at Burris Road and Oakes Road should be carefully evaluated to consider the best location for a pedestrian cross-walk and consider the timing of the pedestrian paths proposed within the adjacent sub-basins on the opposite side of the Burris Road and Oakes Road.

ENGINEER'S ESTIMATE OF PROBABLE COST

NORTHEND & NORTHEAST SUB-BASINS

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL
LAND ACQUISITION					
100	LAND ACQUISITION (Normal Lands)	12.29	AC	$348,480.00	$4,282,819.20
101	LAND ACQUISITION (Buildings)[1]	176,114	SF	$27.72	$4,882,421.80
102	LAND ACQUISITION (Mobile Home Park)	0.00	AC	$174,240.00	$0.00
103	LAND ACQUISITION (Existing Lakes)	1.69	AC	$4,356.00	$7,361.64
104	LAND ACQUISITION (Existing Retention)	0.00	AC	$1.00	$0.00
105	LAND ACQUISITION (Useable Below FPL Lines)	2.12	AC	$304,920.00	$646,430.40
106	LAND ACQUISITION (Retention Below FPL Lines)	1.28	AC	$22,215.60	$28,435.97
107	LAND ACQUISITION (FDOT Retention Ponds)	0.00	AC	$1.00	$0.00
				SUB-TOTAL=	**$9,847,469.00**
DEMOLITION & EARTHWORK					
200	BUILDING DEMOLITION	19,568	SY	$10.00	$195,682.22
201	DEMOLITION OF MOBILE HOMES	0	EA	$3,500.00	$0.00
202	SITE DEMOLITION, CLEARING & GRUBBING	94,235	SY	$2.00	$188,469.60
203	GRADE GREEN AREAS	11,326	SY	$1.50	$16,988.40
204	EXCAVATE NEW WET RETENTION PONDS[2]	139,069	CY	$2.00	$278,138.67
205	EXCAVATE DRY RETENTION PONDS[3]	41,188	CY	$2.00	$82,376.80
208	SOD DRY PONDS, GREEN AND FILLED AREAS	52,514	SY	$5.00	$262,570.00
				SUB-TOTAL=	**$1,024,225.69**
DRAINAGE					
300	15" CULVERT	240	LF	$75.00	$18,000.00
301	24" CULVERT	1,804	LF	$100.00	$180,360.00
302	30" CULVERT	2,828	LF	$125.00	$353,550.00
303	36" CULVERT	586	LF	$150.00	$87,840.00
304	4' x 4' EXFIL. TRENCH W/ 24" PERF. CULVERT	2,892	LF	$200.00	$578,400.00
305	CATCH BASINS & MANHOLES	35	EA	$8,000.00	$278,400.00
306	HEADWALLS	4	EA	$15,000.00	$60,000.00
307	CONTROL STRUCTURES	3	EA	$10,000.00	$30,000.00
				SUB-TOTAL=	**$1,586,550.00**
PAVING, AMENITIES & LANDSCAPING					
400	ROADWAY RECONSTRUCTION (Burris Road)[4]	22,000	SY	$40.00	$880,000.00
401	PAVED PEDESTRIAN PATH	2,337	SY	$30.00	$70,120.00
402	CONCRETE SIDEWALK	0	SY	$35.00	$0.00
403	PARK AMENTIES	1	LS	$50,000.00	$50,000.00
404	LANDSCAPING	1	LS	$300,000.00	$300,000.00
				SUB-TOTAL=	**$1,300,120.00**
ENGINEERING DESIGN, PERMITTING & CONSTRUCTION OBSERVATION					**$782,179.14**
CONTINGENCIES					**$1,375,836.47**
				GRAND TOTAL THIS BASIN=	**$15,916,380.30**

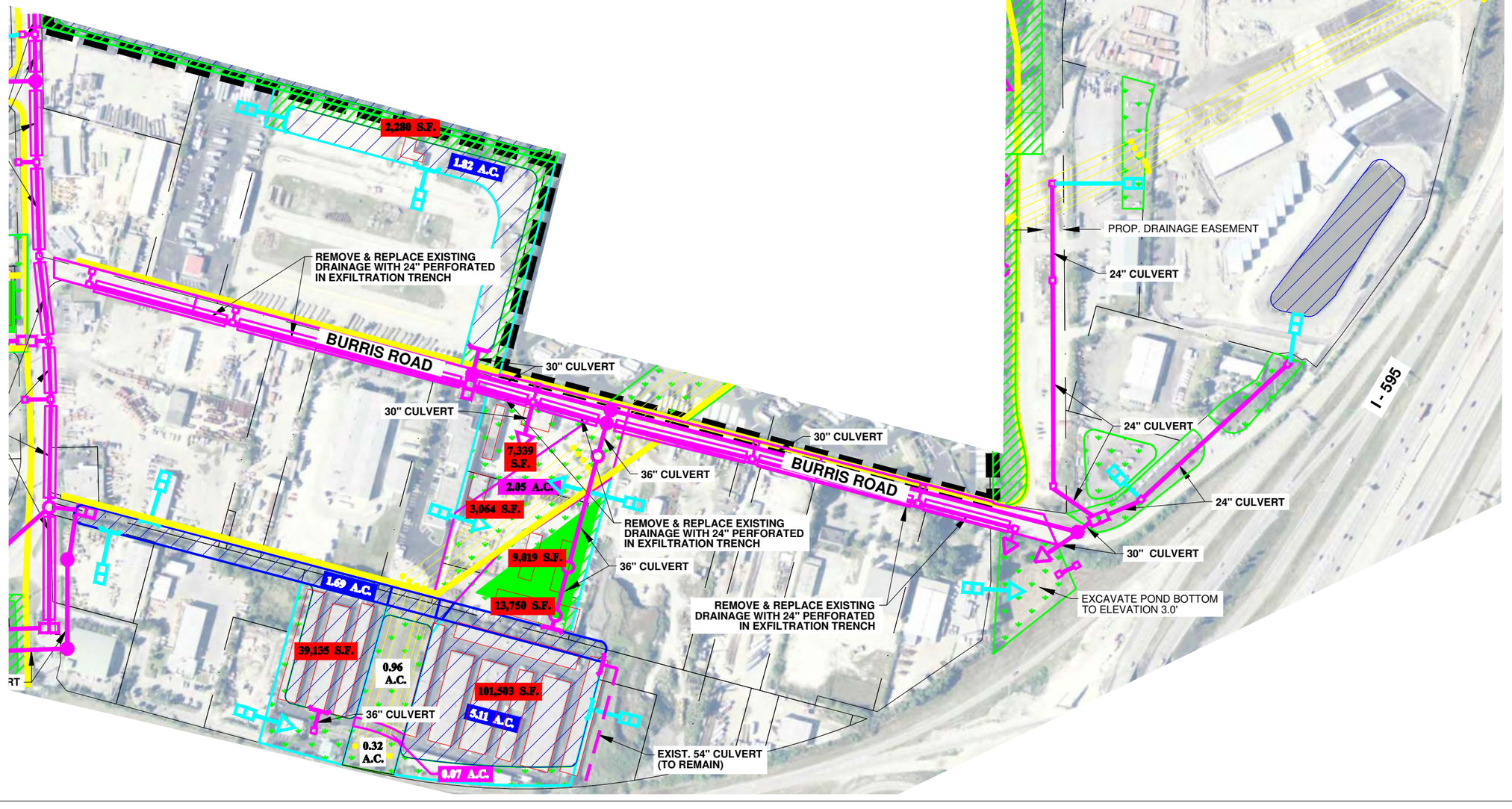
1 Building Unit Cost varies per indivudual BCPA appraisal value
2 Assumes average cut or fill of 10.0'.
3 Assumes average cut or fill of 3.0'.
4 Price Includes sidewalk construction within R.O.W.

0 150 300 600 900

GRAPHIC SCALE IN FEET

LAND ACQUISITION LEGEND

X.XX S.F.	BUILDING AREA	X.XX A.C.	USEABLE AREA BELOW FPL
X.XX A.C.	MOBILE HOME AREA	X.XX A.C.	RETENTION AREA BELOW FPL
X.XX A.C.	EXISTING LAKE AREA		
X.XX A.C.	EXISTING DRY RETENTION AREA		



DATE: 11/29/12
SCALE: NTS
DESIGN BY: C.L.
DRAWN BY: E.H.M.
CHECKED BY: C.L.
APPROVED BY:

DESCRIPTION: BY: DATE:

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FINAL STORMWATER MASTER PLAN
CAPITAL IMPROVEMENT PLAN

PREPARED FOR:
TOWN OF DAVIE

NORTHEND AND NORTHEAST SUB-BASIN PHASE

PROJECT NO.
11-0009

FIGURE
21

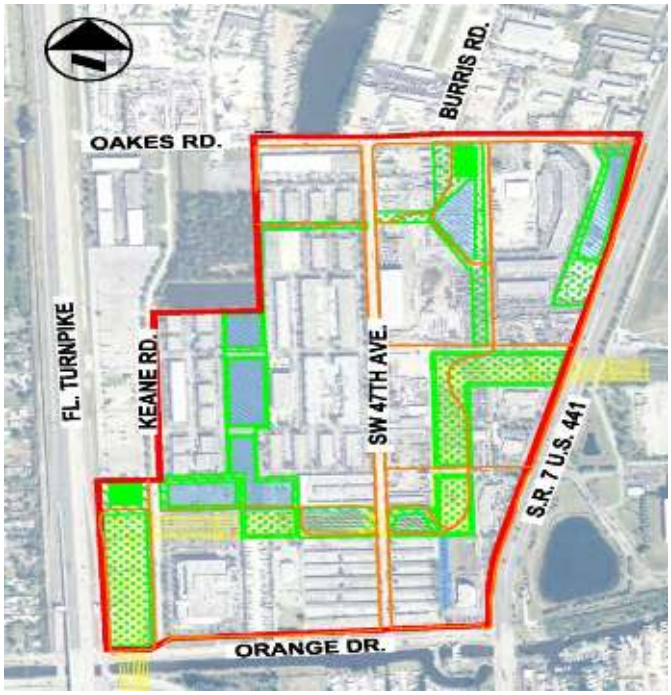
N:\dwgs\eng\PROJECTS\2011\11-0009-001-01 TOC\Current Report Figures & Exhibits\Engineers Estimate Exhibit.dwg [NORTHEND & NORTHEAST] Mar 17, 2014 1:57pm EMARTIN

TOWN OF DAVIE STORMWATER MASTER PLAN FOR THE TOC

CAPITAL IMPROVEMENT PLAN

North CBWCD Sub-Basin Phase

Location Map **Project Location**



The North CBWCD Sub-Basin is located south of Oakes Road, west of S.R. 7, north of Orange Drive, east of the Turnpike and south & east of THISCD. This area is located within the jurisdictional limits of Central Broward Water Control District.

Project Summary: This project phase consists of extensive land acquisitions, mainly but not limited to, the lands beneath the FPL Transmission lines. The existing lakes and wet retention ponds are proposed to be acquired and interconnected with drainage culverts. An existing drainage trunk line extends from the Oakes Road retention pond south to the CBWCD N-1 canal. Drainage interconnections from the proposed retention ponds to this trunk line are essential to ensure adequate conveyance and equalization of flood stages throughout this sub-basin.

SW 47 Avenue is proposed to be reconstructed with the crown of road above the 10 year-1 day flood elevation with exfiltration trench and overflow connections into the proposed retention ponds.

Oakes Road is to be reconstructed with a straight realignment at S.R. 7. The proposed realignment is based on previous goals for the TOC Master Plan and is not required for stormwater benefits. The proposed realignment may require modifications to the I-595/S.R. 7 connections, which are outside the scope of the Stormwater Master Plan. The Oakes Road reconstruction is to include exfiltration trench and overflow connections into proposed retention ponds and including modifications to the existing wet retention pond.

The existing Oakes Road outfall into the existing drainage ditch within the Northeast sub-basin is to be modified to an overflow structure above the 25 year-3 day flood elevations of either sub-basin, pending completion of the 'Northend & Northeast Sub-basin Phase.' Historical drainage connections must be evaluated and maintained until all stormwater improvements are in place.

Kean Road should be reconstructed with exfiltration trench and with overflow connections into the adjacent wet and dry retention ponds. The existing overflow structure providing discharge into the C-11 canal, located at the northwest corner of Kean Road and Orange Drive is to be raised to eliminate discharge below the 25 year-3 day. Drainage interconnections beneath Kean Road will allow the retention ponds on both sides to equalize and convey stormwater east toward the proposed control structure.

The proposed control structure is to be located at the south end of the CBWCD N-1 canal. This structure is ultimately to be designed to restrict discharge into the C-11 canal by a rate of 40 csm. If the improvements within the Northeast and Northend sub-basins are not complete, the control structure must accommodate all historical flow rates until all the upstream retention ponds and storm drainage systems have been completed to ensure no adverse impacts.

Descriptions and Order of Steps to Implement the Stormwater Master Plan

1. *Land Acquisitions*

   The primary land acquisitions are located beneath and around the existing FPL transmission lines which extend from S.R. 7 west to Kean Road and then south of Orange Drive. Additional land acquisitions are proposed which will require building demolition which will likely impact and even require some businesses to be relocated.

   A new corridor is proposed from Oakes Road south to the FPL Transmission lines, approximately midway between S.R 7 and SW 47th Avenue, in effort to construct retention ponds which will also serve to provide a linear pedestrian path having connectivity throughout the TOC.

   The existing '84 Lumber' property located at the southwest of S.R. 7 and Oakes Road is proposed to be acquired and converted into wet and dry retention ponds.

   Between SW 47th Avenue and Kean Road, the existing lakes are proposed to be acquired and shall continue to serve as retention as well as some existing swales and open areas.

   West of Kean Road, buildings and parking areas are to be acquired and converted into a park facility and a dry retention pond beneath the FPL power lines.

2. *Excavate Dry and Wet Retention Ponds*

   The dry and wet retention ponds will serve to provide storage to this sub-basin. Caution should be used in the design and excavation of the dry retention ponds directly over the existing drainage trunk line between the Oakes Road wet retention pond and the N-1 canal to not over excavate and expose or provide less than 12" cover over the culverts. The dry retention ponds are to be graded to contain dry pre-treatment prior to overflowing into the wet retention ponds. The existing wet retention pond banks should be evaluated and improved as necessary to provide safe cross-slopes and or buffered by the introduction of a flat shelf with littoral plantings to discourage pedestrian access to the unsafe slope.

   The properties within this sub-basin can connect into the proposed drainage system after dry pretreatment is stored on-site. Discharge from private developments into the nearest dry retention pond is recommended but not required if no other outfall is available.

3. *Construct Storm Drainage System interconnecting retention ponds*

   The existing trunk line drainage system consists of culverts with raised inlets with approximately 75' spacing to ensure the water within the culverts do not become anaerobic. These structures should remain as inlets but may need to be modified to provide flood relief for the proposed dry retention ponds. The inlets should be elevated as necessary to ensure dry pretreatment and maximize water quality treatment within the dry retention ponds, prior to overtopping the grates and discharging into the wet retention ponds.

   The proposed lake interconnections beneath and west of SW 47th Avenue must be 48-inch diameter per CBWCD criteria.

   Culverts are to be extended from the dry retention ponds and swales to the wet retention ponds, serving to collect and convey pretreated runoff to the lake systems.

4. *Road and Storm Drainage Reconstruction within SW 47th Avenue, Kean Road and Oakes Road*

   Each of these named roadways should be reconstructed with exfiltration trench along the limits of the roadway to maximize stormwater storage for both water quality and quantity. The road crown should be designed above the 10 year-1 day flood elevations and discharge structures should be provided into all retention ponds adjacent to each road. These outfalls will also serve as interconnections when the water levels rise above the overflow weir. The overflow weirs are to be set to provide dry pretreatment within the exfiltration trench. The drainage system should also be designed to accommodate discharge from any developments that have no access to other drainage facilities proposed in the stormwater

master plan. SW 47 Avenue and the Oakes Road drainage systems should also be interconnected.

5. *Install Control Structure from CBWCD N-1 Canal into C-11 Canal*

   The lake interconnects will provide adequate conveyance from all upstream tributary areas to the proposed control structure which is to be located at the south end of the N-1 Canal. The control structure is to limit discharge at 40 csm for tributary area into the C-11 canal. Depending on how much of the retention ponds are complete in the Northend and Northeast sub-basins, extreme caution should be used by installing the control structure prematurely.

   If the control structure installation is required by the regulatory agencies prior to construction of all upstream retention ponds and the interconnecting drainage system, the orifice may need to designed a bit larger to accommodate historical flows and then modified per the ultimate design flow when all Stormwater Master Plan upstream is complete.

   The control structure shall also include an operable gate to lower or better manager water levels prior to or after a major storm, pursuant to the request of the District Manager of CBWCD.

6. *Construct Pedestrian Paths, Park Facilities and Landscaping*

   The pedestrian paths, park amenities and landscaping shall be constructed to meet the desired goals of the TOC. The proposed path intersections at Oakes Road, SW 47 Avenue and Kean Road should be carefully evaluated to consider the best location for a pedestrian cross-walk.

7. *Construct New Roads including proposed storm drainage systems*

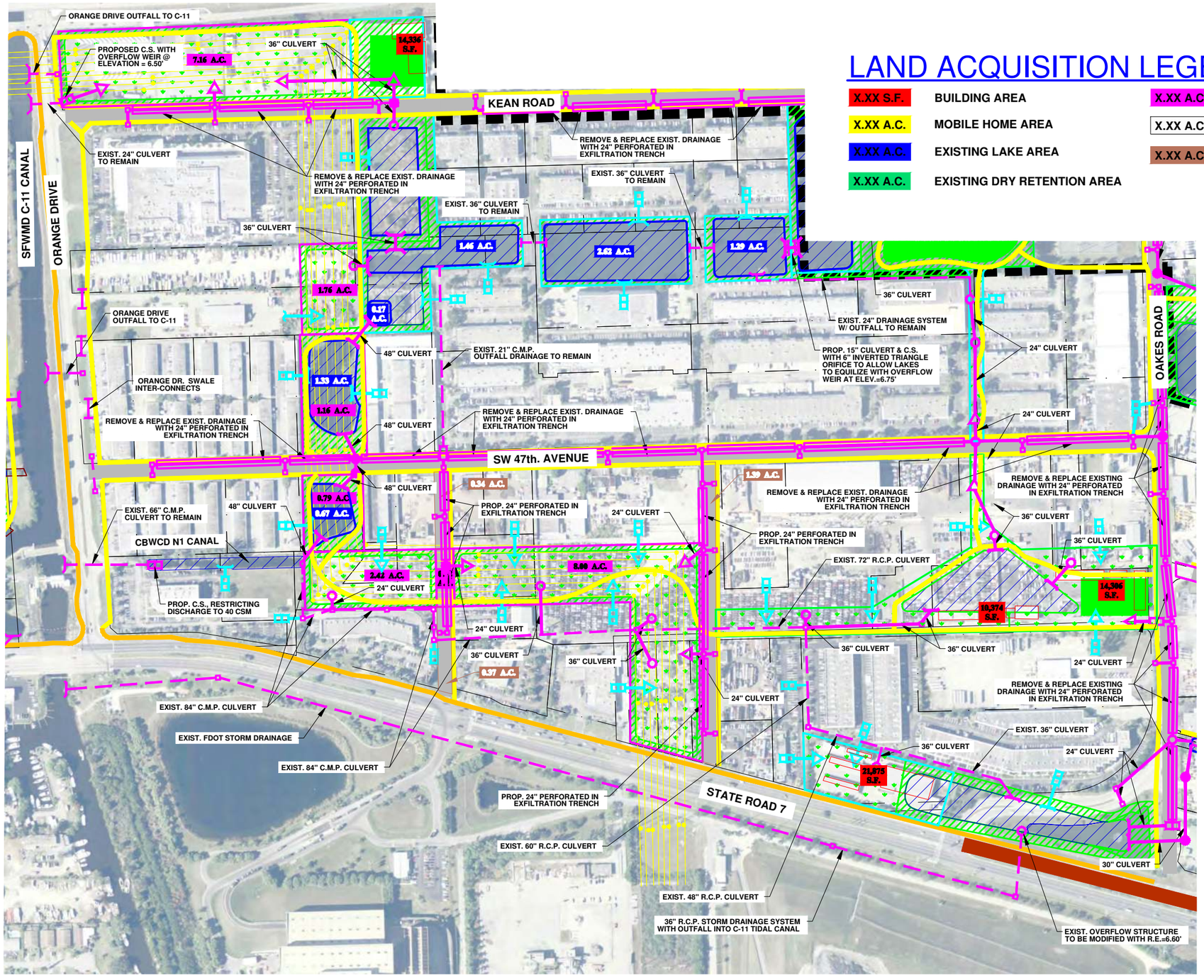
   Two new roadways are proposed as shown in Figure 6-4 to meet a goal of the TOC to "increase vehicular accessibility." These roads are not required as part of the stormwater master plan, however if new roads are constructed, a storm drainage system should be constructed consisting of exfiltration trench to provide water quality and quantity storage. The drainage system should also be interconnected to the SW 47 Avenue drainage system and with outfalls to the adjacent dry retention ponds after the dry pretreatment storage is provided. In addition, the drainage system shall provide an outfall to any adjacent properties along new the roadway limits which are otherwise isolated from the master stormwater drainage facilities.

ENGINEER'S ESTIMATE OF PROBABLE COST

CBWCD N-1 SUB-BASIN

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL
LAND ACQUISITION					
100	LAND ACQUISITION (Normal Lands)	17.65	AC	$348,480.00	$6,150,672.00
101	LAND ACQUISITION (Buildings)[1]	60,891	SF	$24.89	$1,515,642.74
102	LAND ACQUISITION (Mobile Home Park)	0.0	AC	$174,240.00	$0.00
103	LAND ACQUISITION (Existing Lakes)	9.21	AC	$4,356.00	$40,118.76
104	LAND ACQUISITION (Existing Retention)	0	AC	$1.00	$0.00
105	LAND ACQUISITION (Useable Below FPL Lines)	21.6	AC	$304,920.00	$6,595,419.60
106	LAND ACQUISITION (Retention Below FPL Lines)	0.0	AC	$22,215.60	$0.00
107	LAND ACQUISITION (Normal Lands for New Roads)	2.1	AC	$348,480.00	$731,808.00
				SUB-TOTAL=	**$15,033,661.10**
DEMOLITION & EARTHWORK					
200	BUILDING DEMOLITION	6,766	SY	$10.00	$67,656.67
201	DEMOLITION OF MOBILE HOMES	0	EA	$3,500.00	$0.00
202	SITE DEMOLITION, CLEARING & GRUBBING	203,958	SY	$2.00	$407,915.20
203	GRADE GREEN AREAS	63,162	SY	$1.50	$94,743.00
204	EXCAVATE NEW WET RETENTION PONDS[2]	73,407	CY	$2.00	$146,813.33
205	EXCAVATE DRY RETENTION PONDS[3]	118,774	CY	$2.00	$237,547.20
207	FILL EXISTING WET RETENTION PONDS[1]	6,453	CY	$2.00	$12,906.67
208	SOD DRY PONDS, GREEN AND FILLED AREAS	181,936	SY	$5.00	$909,678.00
				SUB-TOTAL=	**$1,877,260.07**
DRAINAGE					
300	15" CULVERT	506	LF	$75.00	$37,980.00
301	24" CULVERT	2,236	LF	$100.00	$223,560.00
302	36" CULVERT	1,691	LF	$150.00	$253,620.00
303	48" CULVERT	468	LF	$200.00	$93,600.00
304	4' x 4' EXFIL. TRENCH W/ 24" PERF. CULVERT	9,048	LF	$200.00	$1,809,600.00
305	CATCH BASINS & MANHOLES	74	EA	$8,000.00	$595,200.00
306	HEADWALLS	13	EA	$15,000.00	$195,000.00
307	CONTROL STRUCTURES	6	EA	$10,000.00	$60,000.00
				SUB-TOTAL=	**$3,268,560.00**
PAVING, AMENITIES & LANDSCAPING					
400	ROADWAY RECONSTRUCTION (Oakes Road)[3]	23,003	SY	$40.00	$920,106.67
401	ROADWAY RECONSTRUCTION (SW 47th Avenue)[3]	31,752	SY	$40.00	$1,270,080.00
402	ROADWAY RECONSTRUCTION (Kean Road)[3]	11,184	SY	$40.00	$447,360.00
403	NEW ROAD CONSTRUCTION (SW 42th Street)[3]	8,976	SY	$40.00	$359,040.00
404	NEW ROAD CONSTRUCTION (SW 40th Street)[3]	6,776	SY	$40.00	$271,040.00
403	PAVED PEDESTRIAN PATH	8,627	SY	$30.00	$258,800.00
404	CONCRETE SIDEWALK	2,560	SY	$35.00	$89,600.00
405	PARK AMENITIES	1	LS	$100,000.00	$100,000.00
406	LANDSCAPING	1	LS	$300,000.00	$300,000.00
				SUB-TOTAL=	**$4,016,026.67**
ENGINEERING DESIGN, PERMITTING & CONSTRUCTION OBSERVATION					**$1,832,369.35**
CONTINGENCIES					**$2,419,550.78**
				GRAND TOTAL THIS BASIN=	**$28,447,427.96**

1 Building Unit Cost varies per indivudual BCPA appraisal value
2 Assumes average cut or fill of 10.0'.
3 Assumes average cut or fill of 3.0'.
4 Price Includes sidewalk construction within R.O.W.



LAND ACQUISITION LEGEND

X.XX S.F.	BUILDING AREA	X.XX A.C.	USEABLE AREA BELOW FPL
X.XX A.C.	MOBILE HOME AREA	X.XX A.C.	RETENTION AREA BELOW FPL
X.XX A.C.	EXISTING LAKE AREA	X.XX A.C.	NEW ROAD AREA
X.XX A.C.	EXISTING DRY RETENTION AREA		

0 200 400 800 1200

GRAPHIC SCALE IN FEET

DATE: 11/29/12
SCALE: NTS
DESIGN BY: C.L.
DRAWN BY: E.H.M.
CHECKED BY: C.L.
APPROVED BY:

BY:	DATE:	DESCRIPTION:

CRAVEN • THOMPSON AND ASSOCIATES, INC.
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FLORIDA LICENSED ENGINEERING, SURVEYING & MAPPING BUSINESS No. 271
FLORIDA LICENSED LANDSCAPE ARCHITECTURE BUSINESS No. 000014

FINAL STORMWATER MASTER PLAN
CAPITAL IMPROVEMENT PLAN

PREPARED FOR:
TOWN OF DAVIE

NORTH CBWCD SUB-BASIN PHASE

PROJECT NO.
11-0009

FIGURE
23

TOWN OF DAVIE STORMWATER MASTER PLAN FOR THE TOC

CAPITAL IMPROVEMENT PLAN

THISCD Basin Phase

Location Map **Project Location**

The THISCD Basin is located south of I-595, west of Burris Road, north of Orange Drive and east of the Turnpike. This area is located within the jurisdictional limits of Tindall Hammack Irrigation & Soil Conservation District.

Project Summary: This project phase consists of land acquisitions to be utilized for retention ponds as well as for amenities consisting of pedestrian paths and parks. Raised inlets within the dry retention ponds will provide dry pretreatment prior to discharge into the lakes. The drainage systems in Kean Road, Oakes Road and Field Road are proposed to be reconstructed with exfiltration trench and proposed to be interconnected together having outfalls into the adjacent existing and proposed retention ponds. Any properties which are not adjacent to a retention pond could discharge into the roadway drainage system after the dry pretreatment volume is stored on-site.

Land Acquisitions

1. *Land Acquisitions*
   The land acquisitions are spread throughout this basin consisting of the two existing wet retention ponds, and open area beneath FPL transmission lines, a few commercial properties, portions of a mobile home park and a vacant field.

2. *Excavate Retention Ponds*
   The proposed retention ponds will serve to provide storage to this basin and also serve as park amenities. To ensure adequate storage and drainage is provided in the dual use retention/recreation area, the grading parameter should be followed and park areas graded toward the low areas.

No new lake areas are proposed in this basin however the existing lake banks should be surveyed, evaluated and improved as necessary to ensure proper and safe lake banks per THISCD criteria.

3. *Construct Storm Drainage System interconnecting retention ponds*

The proposed drainage system is to consist of raised inlets within the dry retention ponds with culverts providing discharge into the lakes.

All existing discharge structures from this Basin into the Turnpike drainage system are to be modified to eliminate discharge below the 25 year-3 day storm elevation except for the drainage structures downstream of the northern lake in this basin.

The existing outfall for the northern lake consists of an earthen dam originally designed to retain water quality than stormwater overtops the dam to discharge into a series of culverts, ditches and swales. The existing earthen dam is to be removed but the downstream drainage system is to remain. No new control structure is proposed for this basin because an existing control structure west of the Turnpike is already in place regulating the flow out of this basin.

A 15-inch culvert with 6-inch bleeder is proposed from the south lake into an adjacent lake located within North CBWCD sub-basin. The proposed orifice will allow the two lake systems to equalize before or after a storm event and return to the control elevation. The orifice is small enough that flows during a storm event will have a negligible effect on flood stages or allowable discharge rates for either basin. If this bleeder is not permitted by either THISCD or CBWCD, the south lake within THISCD will not be able to bleed down below the weirs proposed within the roadway drainage systems because equalization with the northern lake is through the road systems, which are proposed with raised weirs to meet dry pretreatment.

4. *Road and Storm Drainage Reconstruction within Kean Road and Oakes Road*

The two roadways should be reconstructed with exfitration trench along the limits of the roadways to maximize stormwater storage for both water quality and quantity. The road crown should be designed above the 10 year-1 day flood elevation and discharge structures should be provided into all retention ponds adjacent to each road. These outfalls will also serve as interconnections when the water levels rise above the overflow weir. The overflow weirs are to be set to provide dry pretreatment for the Rights-of-Ways within the exfiltration trench. The drainage systems of each road should be interconnected

and should also be designed to accommodate discharge from any developments that have no access to other drainage facilities proposed in the stormwater master plan.

5. *Road and Storm Drainage Reconstruction within Field Road (or other Public Roads)*
   A future bridge is conceptually proposed over the Turnpike which may require or spur a different roadway layout north of Oakes Road. Regardless of weather the future layout matches the existing Field Road or if a new road layout is built, the road should be reconstructed with exfitration trench along the limits of the roadways to maximize stormwater storage for both water quality and quantity. The road crown should be designed above the 10 year-1 day flood elevation and discharge structures should be provided into all adjacent retention ponds. These outfalls will also serve as interconnections when the water levels rise above the overflow weir. The overflow weirs are to be set to provide dry pretreatment for the Rights-of-Ways within the exfiltration trench. The drainage system should also be interconnected to the Oakes Road drainage system and should also be designed to accommodate discharge from any developments that have no access to other drainage facilities proposed in the stormwater master plan.

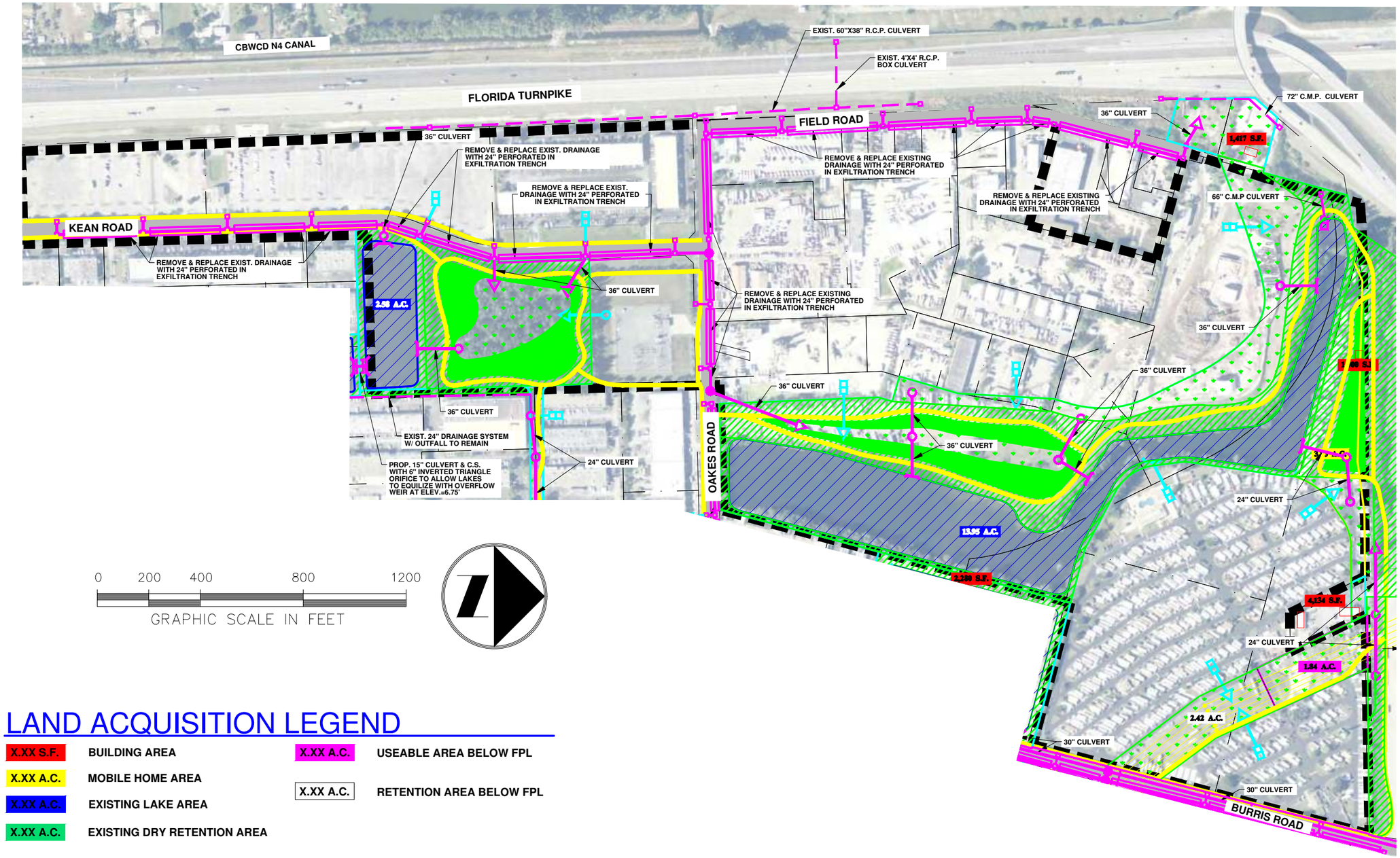
6. *Construct Pedestrian Paths, Park Facilities and Landscaping*
   The pedestrian paths, park amenities and landscaping shall be constructed to meet the desired goals of the TOC. The proposed improvements in this item should match the grading parameters for the subject area. The proposed path intersections at Burris Road, Oakes Road and Kean Road should be carefully evaluated to consider the best location for pedestrian cross-walks.

ENGINEER'S ESTIMATE OF PROBABLE COST

THISCD BASIN

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL
LAND ACQUISITION					
100	LAND ACQUISITION (Normal Lands)	31.00	AC	$348,480.00	$10,802,880.00
101	LAND ACQUISITION (Buildings)[1]	6,542	SF	$81.72	$534,616.24
102	LAND ACQUISITION (Mobile Home Park)	3.75	AC	$174,240.00	$653,400.00
103	LAND ACQUISITION (Existing Lakes)	16.53	AC	$4,356.00	$72,004.68
104	LAND ACQUISITION (Existing Retention)	0.00	AC	$1.00	$0.00
105	LAND ACQUISITION (Useable Below FPL Lines)	1.98	AC	$304,920.00	$603,741.60
106	LAND ACQUISITION (Retention Below FPL Lines)	2.66	AC	$22,215.60	$59,093.50
107	LAND ACQUISITION (FDOT Retention Ponds)	0.00	AC	$1.00	$0.00
				SUB-TOTAL=	**$12,725,736.02**
DEMOLITION & EARTHWORK					
200	BUILDING DEMOLITION	727	SY	$10.00	$7,268.89
201	DEMOLITION OF MOBILE HOMES	61	EA	$3,500.00	$213,500.00
202	SITE DEMOLITION, CLEARING & GRUBBING	221,866	SY	$2.00	$443,731.20
203	GRADE GREEN AREAS	136,778	SY	$1.50	$205,167.60
204	EXCAVATE NEW WET RETENTION PONDS[2]	0	CY	$2.00	$0.00
205	EXCAVATE DRY RETENTION PONDS[3]	85,087	CY	$2.00	$170,174.40
208	SOD DRY PONDS, GREEN AND FILLED AREAS	221,866	SY	$5.00	$1,109,328.00
				SUB-TOTAL=	**$2,149,170.09**
DRAINAGE					
300	15" CULVERT	634	LF	$75.00	$47,520.00
301	24" CULVERT	1,090	LF	$100.00	$108,960.00
302	30" CULVERT	0	LF	$125.00	$0.00
303	36" CULVERT	1,134	LF	$150.00	$170,100.00
304	4' x 4' EXFIL. TRENCH W/ 24" PERF. CULVERT	5,845	LF	$200.00	$1,169,040.00
305	CATCH BASINS & MANHOLES	64	EA	$8,000.00	$508,800.00
306	HEADWALLS	6	EA	$15,000.00	$90,000.00
307	CONTROL STRUCTURES	2	EA	$10,000.00	$20,000.00
				SUB-TOTAL=	**$2,114,420.00**
PAVING, AMENITIES & LANDSCAPING					
400	ROADWAY RECONSTRUCTION (Kean Road)[4]	21,208	SY	$40.00	$848,320.00
401	ROADWAY RECONSTRUCTION (Oakes Road)[4]	8,096	SY	$40.00	$323,840.00
402	ROADWAY RECONSTRUCTION (Field Road)[4]	15,056	SY	$40.00	$602,240.00
403	PAVED PEDESTRIAN PATH	11,169	SY	$30.00	$335,080.00
404	CONCRETE SIDEWALK	2,280	SY	$35.00	$79,800.00
405	PARK AMENITIES	1	LS	$100,000.00	$100,000.00
406	LANDSCAPING	1	LS	$300,000.00	$300,000.00
				SUB-TOTAL=	**$2,589,280.00**
ENGINEERING DESIGN, PERMITTING & CONSTRUCTION OBSERVATION					**$1,370,574.02**
CONTINGENCIES					**$1,957,860.61**
				GRAND TOTAL THIS BASIN=	**$22,907,040.73**

1 Building Unit Cost varies per indivudual BCPA appraisal value
2 Assumes average cut or fill of 10.0'.
3 Assumes average cut or fill of 3.0'.
4 Price Includes sidewalk construction within R.O.W.



LAND ACQUISITION LEGEND

X.XX S.F.	BUILDING AREA	X.XX A.C.	USEABLE AREA BELOW FPL
X.XX A.C.	MOBILE HOME AREA	X.XX A.C.	RETENTION AREA BELOW FPL
X.XX A.C.	EXISTING LAKE AREA		
X.XX A.C.	EXISTING DRY RETENTION AREA		

DATE: 11/29/12
SCALE: NTS
DESIGN BY: C.L.
DRAWN BY: E.H.M.
CHECKED BY: C.L.
APPROVED BY:

DESCRIPTION: BY: DATE:

CRAVEN • THOMPSON AND ASSOCIATES, INC.
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FLORIDA LICENSED ENGINEERING, SURVEYING & MAPPING BUSINESS No. 271
FLORIDA LICENSED LANDSCAPE ARCHITECTURE BUSINESS No. 000014

FINAL STORMWATER MASTER PLAN
CAPITAL IMPROVEMENT PLAN

PREPARED FOR:
TOWN OF DAVIE

THISCD BASIN PHASE

PROJECT NO.
11-0009

FIGURE
25

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TOWN OF DAVIE STORMWATER MASTER PLAN FOR THE TOC

CAPITAL IMPROVEMENT PLAN

South Basin Phase

Location Map **Project Location**

The South CBWCD Basin is located south of the C-11 canal, west of S.R. 7, north of HardRock Cafe and east of the Turnpike. This area is located within the jurisdictional limits of Central Broward Water Control District.

Project Summary: This project phase consists of extensive land acquisitions, mainly but not limited to, the lands beneath the FPL Transmission lines. Other land areas to be acquired consist of agricultural, residential, mobile home, commercial, FDOT Rights-of-Ways and existing lake areas. This project phase consists of land acquisitions to be utilized for retention ponds as well as for amenities consisting of pedestrian paths and parks. Raised inlets within the dry retention ponds will provide dry pretreatment prior to discharge into the lakes.

The proposed drainage system will consist of culverts which will serve to interconnect the proposed retention ponds and convey stormwater north below Griffin Road and provide this Basin a positive outfall via a control structure with outfall into the C-11 canal.

The drainage systems in SW 51st Street, SW 52nd Street and SW 46th Way currently collect and discharge runoff into the adjacent lake without providing dry pretreatment. If these roadways require improvements, they should be reconstructed with exfiltration trench to provide dry pretreatment prior to discharge into the lake. In addition, the proposed drainage system should extend to collect discharge from any properties which are not adjacent to a retention pond. The private properties should provide on-site dry pretreatment and then discharge into the nearest retention pond or the adjacent roadway drainage system which is part of this Stormwater Master Plan. .

Land Acquisitions

1. *Land Acquisitions*

   The primary land acquisitions are located beneath and around the existing FPL transmission lines which extend south from Griffin Road. Additional land acquisitions are proposed which will require displacing both single family and mobile home residential units as well as impact select commercial businesses. Two existing lakes are also to be acquired and proposed to continue serving as retention ponds for the Stormwater Master Plan.

   The portion of land area beneath the FPL transmission lines located just east of the Turnpike, south of Griffin Road and north of the existing Cemetery is to be acquired with the goal of swapping this land area for the FDOT retentions ponds located south of Griffin Road. If FDOT is agreeable to the swap, the existing FDOT retention ponds could be filled and developed as commercial properties with buildings closer to the road and parking in the rear as proposed in the Technical Assistance Panel Report (December 2010). If FDOT is not agreeable to the land swap, the approximately 4.9 acre area beneath the FPL Transmission lines could still be utilized for storage to benefit the TOC Stormwater Master Plan and therefore less dry retention areas would be required in other more desirable areas within this basin.

2. *Excavate Retention Ponds*

   The new retention ponds together with existing retention ponds proposed to remain will serve to provide storage to this basin.

   The existing lake banks should be surveyed, evaluated and improved as necessary to ensure proper and safe lake banks per CBWCD criteria.

3. *Construct Storm Drainage System interconnecting retention ponds*

   The proposed drainage system is to consist of raised inlets within the dry retention ponds with culverts providing discharge into the lakes.

   48-inch drainage culverts are proposed to interconnect the wet retention ponds, providing adequate conveyance to equalize stages throughout the basin and convey discharge to the proposed control structure.

   Developments are required to store dry pretreatment on-site and then discharge into the nearest dry retention, wet retention pond or Master Storm Drainage System.

4. *Road and Storm Drainage Reconstruction*

   The drainage systems in SW 51st Street, SW 52nd Street and SW 46th Way currently collect and discharge runoff into the adjacent lake without providing dry pretreatment. This condition does not meet CBWCD standards but is allowed to remain unless these roadways are reconstructed. If these roads require other utility or paving improvements, they should be reconstructed with exfiltration trench to provide dry pretreatment prior to discharge into the lake and the road crown should be designed above the 10 year-1 day flood elevation. The drainage systems of each road should be interconnected and should also be designed to accommodate discharge from any developments that have no access to other drainage facilities proposed in the stormwater master plan.

5. *Extend FDOT Storm drainage outfall to new FDOT retention pond location*

   If the proposed land swap with FDOT is accepted, the outfall into the existing FDOT dry retention pond is to be removed and extended with drainage structures and culverts to provide an outfall into the new dry retention pond as shown in Exhibit 7-4. Upon design and permitting for this improvement, a hydraulic analysis must be performed to verify the proposed 72-inch diameter culverts have sufficient capacity to convey the runoff from the FDOT Rights-of-Ways to the new outfall location. The existing retention ponds were designed with a bottom elevation of 3.2 ft-NGVD. The proposed pond is larger than the existing ponds and could be designed with a bottom of pond elevation of 3.0 ft-NGVD, which will hydraulically reduce the tailwater condition at the proposed outfall.

6. *Install Control Structure into C-11 Canal*

   The proposed control structure is proposed to discharge into the C-11 canal at a rate of 40 csm. The lake interconnects will provide adequate conveyance from all upstream tributary areas to the proposed control structure which is to be located at the north end of this basin, near the C-11 Canal.

   The control structure shall also include an operable gate to lower or better manager water levels prior to or after a major storm, pursuant to the request of the District Manager of CBWCD.

   Once the proposed control structure has been installed existing discharge structures from this Basin into the Turnpike drainage system are to be eliminated.

7. *Construct Pedestrian Paths, Park Facilities and Landscaping*

   The pedestrian paths, park amenities and landscaping shall be constructed to meet the desired goals of the TOC. The park facilities whether open fields, playgrounds or picnic facilities should match the grading parameters for the subject area. The proposed path intersections at Griffin Road should be carefully evaluated to consider the best location for the pedestrian cross-walk.

ENGINEER'S ESTIMATE OF PROBABLE COST

SOUTH CBWCD BASIN

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL
LAND ACQUISITION					
100	LAND ACQUISITION (Normal Lands)	23.42	AC	$348,480.00	$8,161,401.60
101	LAND ACQUISITION (Buildings)[1]	12,016	SF	$74.28	$892,534.00
102	LAND ACQUISITION (Mobile Home Park)	6.67	AC	$174,240.00	$1,162,180.80
103	LAND ACQUISITION (Existing Lakes)	16.04	AC	$4,356.00	$69,870.24
104	LAND ACQUISITION (Existing Retention)	0.65	AC	$1.00	$0.65
105	LAND ACQUISITION (Useable Below FPL Lines)	9.15	AC	$304,920.00	$2,790,018.00
106	LAND ACQUISITION (Retention Below FPL Lines)	8.93	AC	$22,215.60	$198,385.31
107	LAND ACQUISITION (FDOT Retention Ponds)	3.50	AC	$1.00	$3.50
				SUB-TOTAL=	**$13,274,394.10**
DEMOLITION & EARTHWORK					
200	BUILDING DEMOLITION	1,335	SY	$10.00	$13,351.11
201	DEMOLITION OF MOBILE HOMES	46	EA	$3,500.00	$161,000.00
202	SITE DEMOLITION, CLEARING & GRUBBING	252,116	SY	$2.00	$504,231.20
203	GRADE GREEN AREAS	88,524	SY	$1.50	$132,785.40
204	EXCAVATE NEW WET RETENTION PONDS[2]	158,107	CY	$2.00	$316,213.33
205	EXCAVATE DRY RETENTION PONDS[3]	99,220	CY	$2.00	$198,440.00
206	FILL EXISTING FDOT DRY RETENTION PONDS[2]	16,940	CY	$2.00	$33,880.00
207	FILL EXISTING CANALS[1]	4,840	CY	$2.00	$9,680.00
208	SOD DRY PONDS, GREEN AND FILLED AREAS	206,136	SY	$5.00	$1,030,678.00
				SUB-TOTAL=	**$2,400,259.04**
DRAINAGE					
300	15" CULVERT	218	LF	$75.00	$16,380.00
301	24" CULVERT	670	LF	$100.00	$66,960.00
302	30" CULVERT	1,397	LF	$125.00	$174,600.00
303	36" CULVERT	530	LF	$150.00	$79,560.00
304	48" CULVERT	870	LF	$200.00	$174,000.00
305	72" CULVERT	1,230	LF	$350.00	$430,500.00
306	CATCH BASINS & MANHOLES	28	EA	$8,000.00	$220,800.00
307	HEADWALLS	10	EA	$15,000.00	$150,000.00
308	CONTROL STRUCTURES	1	EA	$10,000.00	$10,000.00
				SUB-TOTAL=	**$1,322,800.00**
PAVING, AMENITIES & LANDSCAPING					
400	PAVED PEDESTRIAN PATH	11,187	SY	$30.00	$335,600.00
401	PARK AMENITIES	1	LS	$100,000.00	$100,000.00
402	LANDSCAPING	1	LS	$300,000.00	$300,000.00
				SUB-TOTAL=	**$735,600.00**
ENGINEERING DESIGN, PERMITTING & CONSTRUCTION OBSERVATION					**$891,731.81**
CONTINGENCIES					**$1,773,305.31**
				GRAND TOTAL THIS BASIN=	**$20,398,090.27**

1 Building Unit Cost varies per indivudual BCPA appraisal value
2 Assumes average cut or fill of 10.0'.
3 Assumes average cut or fill of 3.0'.
4 Price Includes sidewalk construction within R.O.W.

LAND ACQUISITION LEGEND

X.XX S.F.	BUILDING AREA
X.XX A.C.	MOBILE HOME AREA
X.XX A.C.	EXISTING LAKE AREA
X.XX A.C.	EXISTING DRY RETENTION AREA
X.XX A.C.	USEABLE AREA BELOW FPL
X.XX A.C.	RETENTION AREA BELOW FPL

0 150 300 600 900

GRAPHIC SCALE IN FEET

FLORIDA TURNPIKE

EXIST. 30" CULVERT

36" CULVERT

1.25 A.C.

2.02 A.C.

1.74 A.C.

0.22 A.C.

6.91 A.C.

0.38 A.C.

36" CULVERT

0.64 A.C.

4.92 A.C.

PROPOSED FDOT OVERFLOW STRUCTURE WITH R.E.= 3.70'

3.74 A.C.

24" CULVERT

36" CULVERT

9,606 S.F.

PROP. 72" CULVERT

1.30 A.C.

2.20 A.C.

GRIFFIN ROAD

30" CULVERT

15" CULVERT

30" CULVERT

2,410 S.F.

PROP. 72" CULVERT

12.86 A.C.

OUTFALL INTO LAKE (TYP.)

15" CULVERT

6.11 A.C.

48" CULVERT

0.65 A.C.

36" CULVERT

30" CULVERT

48" CULVERT

48" CULVERT

2.50 A.C.

1.42 A.C.

EXIST. 48" x 76" ELLIPTICAL CULVERT

15" CULVERT

S.W. 51 St.

4.16 A.C.

36" CULVERT

0.10 A.C.

30" CULVERT

0.10 A.C.

S.W. 51 STREET

EXIST. FDOT OVERFLOW WEIR TO C-11 VIA 36" RCP PIPE

24" CULVERT

STATE ROAD 7

SFWMD C-11 CANAL

DATE: 11/29/12
SCALE: NTS
DESIGN BY: C.L.
DRAWN BY: E.H.M.
CHECKED BY: C.L.
APPROVED BY:

DESCRIPTION: BY: DATE:

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FLORIDA LICENSED LANDSCAPE ARCHITECTURE BUSINESS No. 000014

FINAL STORMWATER MASTER PLAN
CAPITAL IMPROVEMENT PLAN

PREPARED FOR:
TOWN OF DAVIE

SOUTH CBWCD BASIN PHASE

PROJECT NO.
11-0009

FIGURE
27

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IX GOVERNANCE AND FUNDING ALTERNATIVES

The Town of Davie (the "Town") has developed a Stormwater Master Plan for the proposed redevelopment within the Transit Oriented Corridor ("TOC"). The TOC Stormwater Management Program will consist of four stormwater management elements: i) program management (i.e., administration, planning, enforcement and permitting; ii) NPDES permit compliance; iii) operation and maintenance (i.e., cleaning, mowing and repairs associated with stormwater facilities); and iv) capital improvements (i.e., major design and construction). In order to address certain implementation issues associated with the TOC Stormwater Master Plan and the related Stormwater Management Program this task identifies and evaluates governance and funding alternatives for the Town's consideration.

The TOC Stormwater Master Plan has identified capital improvements for four separate basins within the TOC with a total cost of approximately $87 million. Administration of the TOC Stormwater Management Program will require the establishment of organizational activities related to governance and funding.

Governance Options

One of the first steps required to implement the TOC Stormwater Management Program is the establishment of a governing body with the power and authority to administer the affairs of the TOC Stormwater Management Program (the "Program"). The governing body would have the responsibility for oversight of the Program including: i) establishment of the necessary policies, rules and regulations, ii) management and staffing; iii) planning and budgeting; iv) establishment of a funding mechanism including financing of capital improvements and cost recovery associated with funding the operating and capital requirements.

There are four potential options for governing the TOC Stormwater Management Program including: i) form a Home Rule or Dependent Special District governed by the Town Council; ii) forming a Stormwater Utility governed by the Town Council; iii) create an independent Special District as provided for in the Florida Statutes; and iv) establishing a Community Development District ("CDD").

Home Rule District

Under the Home Rule or Dependent District approach the Town Council would typically function as the governing body or legislative branch or, alternatively, appoint a governing board that serves at the pleasure of Town Council. The Home Rule or Dependent District would be created by local ordinance and could establish a Municipal Services Benefit Unit ("MSBU") to utilize home rule non-tax revenue sources such as special assessments and fees such as developer impact fees to fund the Stormwater Management Program and related capital costs. The enabling ordinance would, among other things, set forth the purpose and duties of the district, the geographic boundaries of the district and the methods to be used for financing the

district. This approach would require Town Council approval of budgets, financing and funding methods.

A special assessment is a charge assessed by a government unit against a parcel of real property because it receives a special benefit from a public project. In order to adopt a special assessment, Florida case law also requires that the assessment be based on a fair and reasonable apportionment of the costs of the benefit among the affected properties. With respect to these fair share rules, there are established methods to calculate and apply valid assessment charges. These methods are typically based on defining an appropriate level of service that serves as the underlying basis for the assessment methodology.

In this governance option the Home Rule or Dependent District would not have any taxing power; however, that does not preclude the Town using other constitutional and statutorily authorized tax revenue sources collected by the Town to supplement the revenues collected through special assessments and developer extractions such as Impact Fees to help fund the Stormwater Management Program. Typically when relying on the Home Rule or Dependent District approach to governance the City staff would be responsible for Program management and operations, which generally allows for economies associated with sharing administrative and operational costs with other Town functions and departments such as engineering, public works, finance and human resources.

Stormwater Utility

Establishment of a stormwater utility or enterprise fund is a method used by many Florida governments to manage, finance and fund stormwater management programs. A stormwater utility would be governed by the Town Council and would function very similar to a Home Rule or Dependent Special District. Typically stormwater utilities serve throughout the entire community while a Home Rule District is focused on a limited geographic area within the municipal boundaries. Many stormwater utilities established by local governments provide for stormwater costs to be recovered through providing customers with a stormwater utility bill although approximately 20% of Florida's stormwater utilities apply the utility charges as a non-ad valorem special assessment on the properties annual property tax bill.

Independent Special District

Florida Statues, Chapter 189, provides for the legal authority to create an Independent Special District for the purpose of managing and financing capital infrastructure and provide related services. Typically this type of entity is created to provide services on a regional basis in multiple local government jurisdictions. The process of establishing a Independent Special District includes defining procedures to elect or create a governing board. Once established the board's decisions regarding selection of capital projects, financing, management, and adopting budgets is independent of local government control. An Independent Special District has taxing powers similar to local governments in addition to the ability to adopt assessment and fee

based funding mechanisms. A voter referendum and approval of the Florida legislature is required to create an Independent Special District.

Community Development District

A Community Development District (CDD) is a local special purpose government framework authorized by Chapter 190 of the Florida Statues as an alternative to municipal incorporation. The purpose of a CDD is to manage and support new development and typically CDD's are developer driven entities. CDD's of less than 1000 acres in size are established pursuant to an ordinance adopted by the county commission having jurisdiction over the majority of the land within the CDD. While a CDD is subject the local government's comprehensive plan requirements, the CDD Board of Supervisors are elected by the landowners within the CDD and is independent of the local government.

Alternative Funding Sources

The various revenue sources available to the Town to fund the TOC Stormwater Management Program include constitutional and statutorily authorized tax revenue sources, home rule non-tax revenue sources, grants and developer extractions including impact fees. In developing the funding plan for the TOC Stormwater System, a combination of these various funding sources may be required. The available funding sources are as follows:

Constitutional and Statutorily Authorized Revenue Sources

- Ad Valorem Property Taxes
- Motor Fuel Taxes
  - Constitutional Fuel Tax
  - County Fuel Tax
  - Local Option Motor Fuel Taxes
- Local Government Infrastructure Surtax
- Communications Services Tax
- Public Service Tax
- Intergovernmental Revenues

Home Rule non-Tax Revenue Sources

- Utility Rates / Fees
- Special Assessments

Grants

Additional Funding Sources

- Developer Exactions / Impact Fees

Four primary funding sources utilized by local governments to fund stormwater management programs include special assessments, stormwater utility fees, local government infrastructure sales taxes and public service taxes.

Special Assessments or Non-ad Valorem Assessments

As discussed previously, a special or non-ad valorem assessment is a method to charge property owners for services provided by the Town. The two major criteria to judge the validity of a special assessment are the property must receive special benefit from the service and the assessment must be reasonably apportioned according to the benefit. The assessment is billed through the County Tax Collector's Office on the annual tax bill; however, to properly collect the assessment, a rigorous protocol must be followed as defined in Florida Statues, Chapter 197 which includes:

- Adoption of a resolution during the year prior stating that the non-ad valorem assessment may be billed in the following year;
- An agreement with the Property Appraiser and Tax Collector to implement the non-ad valorem assessment;
- Development of a non-ad valorem assessment roll, consistent with the Property Appraiser's data for the Tax Collector, and provided to the Tax Collector in September
- During the first year of the assessment, a first-class mailing to property owners announcing the assessment; and
- A public hearing in which the non-ad valorem assessment roll is adopted prior to September 15 of the year in which the assessment is billed.

The schedule is stringent, the data requirements are specific, and implementation starts during the year prior to billing.

It is important to note that the non-ad valorem assessment is not a tax and is sent to taxed and non-taxed property alike. That is, tax-exempt property, such as homesteaded residential properties valued less than $50,000 governmental (local, state and federal, including schools) and institutional (churches and non-profit agencies) properties, must pay the assessment.

The advantages of a special assessment include:

- A billing mechanism is already in place with the Tax Collector;
- Revenues can pay for all components of the stormwater management program;
- Property owners are given an assessment which is equitably apportioned to then in relation to the benefits they receive;
- Tax-exempt properties pay for the assessment in recognition that they receive special benefits from the stormwater services provided;

- Non-payment is minimal due to the ability to place a tax lien;
- Many property owners will pay the fee from an escrow account from which they normally pay property taxes; and,
- The method has been adjudicated up to the Florida Supreme Court where it was upheld.

The disadvantages of a special assessment include:

- Because it is on the tax bill, it is perceived by the public as a tax;
- The cost of starting the assessment is moderate considering the one year advanced notice and stringent guidelines of Florida Statutes, Chapter 197.

Stormwater Utility Fee

Governments can charge customers for services it provides for the following reasons: fees in exchange for a service or privilege (e.g., admission fees); fees to fund a regulatory responsibility (e.g., building fees and inspection fees); and fees for a service for which the customer's own actions or property creates the need for the revenue (e.g., utility fees, impact fees, etc.). For the last two categories, there must be a reasonable connection (nexus) between cost of the service or regulatory activity and the fee charged. Fees such as these are usually charged on a utility bill which may include other fees (e.g., water and sewer).

The use of stormwater utility fees started in Florida in October of 1986 with the $1.00 per month per single family until equivalent for the City of Tallahassee. In this case and in many others in Florida, the user charge is assigned to the fee payer relative to the contribution to the stormwater problem or burden. For the majority of stormwater utilities, the contribution is related to stormwater runoff which, in turn, is related to impervious area (or a combination of pervious and impervious areas). Therefore, for most utilities, the fee is based upon the relative amount of impervious area for developed properties and estimates of stormwater runoff for vacant or undeveloped residential and commercial properties. Properties zoned as agriculture use are exempt from stormwater fees. Since residential impervious area varies much less than does non-residential impervious area, almost all stormwater utility fees in Florida are based on an average residential equivalent: that is, residential fees are generally uniform equal to or a fraction of the single family unit rate, and non-residential fees depend on the relative amount of impervious area compared to either single family dwelling units or an average of all dwelling unit types. For vacant or undeveloped properties, a run-off coefficient is typically applied to develop an equivalency factor for such properties. In this manner, the fees charged are related to the service being provided.

The fee structure for a stormwater utility fee and a stormwater special assessment can be developed in the same manner. The biggest difference between the two is the billing method: a stormwater utility fee can be billed monthly with other utility services and the non-ad valorem assessment would be billed on the annual tax bill.

The advantages of a stormwater utility fee include:

- revenues can pay for all components of the stormwater management program;
- customers pay a fee which is equitably related to the benefits they receive;
- tax-exempt properties pay the fee just as they pay for water and sewer services;
- a dedicated and stable funding source;
- located on a utility bill, the stormwater fee is not perceived as a tax;
- stormwater utility fees are consistent with and can be associated with other municipal utility fees such as water or sewer.

Disadvantages of the utility fee include:

- the cost of starting the assessment is moderate considering the data analysis necessary to assign each fee payer a correct fee; and,
- if it is not associated with other utilities, total collection of the stormwater utility fee for certain properties can be difficult.

Local Government Infrastructure Sales Tax

The local government infrastructure sales tax allows for the collection of up to 1 percent on sales within the Town. The revenues can be used for capital improvements for infrastructure, land acquisition, and landfill closures. This sales tax must be approved by voters in a referendum and has the ability to generate significant revenues. A local government infrastructure sales tax could be used for funding stormwater capital improvements.

An advantage of this method is that it will generate a significant amount of funding for a stormwater capital improvement program. Generally, the sales tax is used for all of the local government's capital improvements (government buildings, sports arenas, entertainment halls, etc.) so that the stormwater program is only a part of the overall funding program. Another advantage is that because it is a sales tax applied to everyone who purchases products in the Town, both citizens and visitors alike pay for the capital improvements. That is, not just citizens pay for the improvements. A disadvantage of the sales tax include that a citizen vote is required: generally, voters are reluctant to vote for an additional tax. Also, the revenues can only be used for capital improvements which the overall stormwater program includes operational expenses as well.

Public Service Tax

Another funding alternative would be a public service tax, which can be up to 10 percent of the purchases of electric, gas, water, garbage, telecommunications (only up to 7 percent) and fuel oil (up to 4 cents per gallon). It would be the Town's choice as to which utility would be taxed. No referendum would be required to adopt a public service tax and the revenues could be used for any county service.

Other Funding Sources

Additional sources are available to local governments to pay for a portion of the stormwater management financial needs. These alternatives generally do not generate sufficient funds for the entire stormwater program and in many cases are ear-marked to fund specific programs. These alternatives include impact fees and grants.

Impact Fees

Stormwater management programs may use impact fees as well as utility fees or assessments to provide funding support for the programs. Impact fees are imposed on new construction because the development causes an impact on the utility service (e.g., increased capacity). The concept is that a one-time fee is charged to the new development to pay for the construction of new facilities which services the fee payer. Once the development has been connected to the utility service, normal monthly fees are imposed to pay for the actual service received.

There are four major restrictions on the use of impact fees:

- Impact fees must be used for construction of facilities related to the stormwater utility;
- Impact fees must be defined based upon a clear connection between the fee and the construction required;
- Impact fees must be used for facilities, or incremental increases in facilities, required for new growth; and,
- Impact fees must be used in the area of the growth.

Impact fees can be used only for the design and construction of major capital projects related to new growth. None of the other stormwater management functions can be funded by impact fees. For this reason, impact fees should be considered as a supplemental funding source.

Grants/Cost Sharing. Another method to provide funding for capital portions of the stormwater management program is through grants (external funding without significant cost to the Town) and cost sharing (partial external funding). In neither of these cases is the cost to the Town zero. Furthermore, grants can only be used for capital construction projects and not for the maintenance of the facility constructed. For grants, there are costs related obtaining the grant (applications, environmental assessment, etc.). Sources of grants and cost sharing funds include the following:

Water Management District (WMD). There are two sources of WMD funding, both of which require cost sharing: cooperative funds and Surface Water Improvement and Management Act (SWIM) funds. Cooperative funds generally provide up to 50 percent funding for projects that are deemed mutually beneficial to the municipality and WMD. Cooperative funding can also provide the revenue for capital construction, generally for water quality and ecosystem enhancement projects as well as water supply improvements. SWIM funds were developed to

improve the quality of priority water bodies in Florida. Recently SWIM funding has been very limited.

State of Florida. There are a number of ways to fund projects with the state of Florida (usually through the Florida Department of Environmental Protection FDEP). First, periodically, the legislature provides FDEP with grant funding to stormwater purposes. The grants are generally small and currently there are no such grants available. The FDEP's State Revolving Loan Funds (SRF) has low interest loan funds available for stormwater management projects. These loans have very competitive interest rates.

Comparison of Alternatives

Based upon the previous discussion, the various funding alternatives can be compared and assessed for use in the TOC Stormwater Management Program. The following table lists the alternatives along with the stormwater management functions that can be addressed by the alternative. The General Fund and Stormwater Utility alternatives address all aspects of stormwater management. For this reason, these options are capable of being the foundation of the funding the TOC Stormwater Management Program.

A tabular representation of the results of the review is provided in following Table.

Town of Davie TOC Stormwater Governance Study
Summary of Funding Options

Funding Option	*Management Services*	*Operation & Maintenance*	*Capital Improvements*	*Growth*
Ad Valorem	✓	✓	✓	✓
Municipal Service Districts	✓	✓	✓	✓
Special Assessments			✓	✓
Local Government Sales Tax			✓	✓
Public Service Tax	✓	✓	✓	✓
Stormwater Utility Fee	✓	✓	✓	✓
Impact Fees				✓
Grants			✓	✓

Based on the review of the Town's governance options, the key issue is which options allow the Town to implement the TOC Stormwater Management Program in a manner consistent with the Town's redevelopment goals. Several of the options would require the Town to relinquish control of the Program management. Assuming that the Town's goal is to manage the implementation of the Program, the TOC redevelopment options are ranked as follows:

1) Municipal Service District
2) Stormwater Utility
3) Independent Special District
4) Community Development District

Both the Municipal Services District and the Stormwater Utility approaches would allow the Town to implement the Program consistent with the Town's redevelopment goals and maintain control of the Program.

Establishing an Independent Special District would not only require a voter referendum and approval of the Florida legislature, it would also relinquish control of the Program management to a board that would be independent of local government control. It would also create additional costs associated with the independent governance of the TOC program compared with a "home rule approach". The fourth option considered was establishment of a Community Development District. Implementation of this option would require that the governing board would only represent the interests of the current property owners with the votes weighted by the number of acres owned. This option would also involve additional costs related to governance.

When evaluating the two home rule options, it should be noted that Stormwater Utilities are typically established to provide services on a Town-wide basis and the cost recovery mechanism is based on the use of a monthly utility bill. The option of establishing a Municipal Services District would allow the Town to recover the Program costs through a non-ad valorem assessment which would strengthen the revenue pledge associated with financing the Program and the district can be defined as a specific geographic area within the Town's boundaries. Thus, the Municipal Services District approach is the best option for implementing the TOC Stormwater Program.

Cost Recovery

The most commonly used cost recovery method associated with Stormwater Management Programs, used in over 90% of Florida communities, is based on each property's amount of impervious area with vacant or undeveloped residential and commercial properties charged based on total area and run-off coefficients to estimate such properties' contributions to the stormwater run-off problem. This approach will provide a solid legal foundation for the stormwater fee and assures that the fees are fairly determined and properly assigned based on sound stormwater engineering concepts. At this stage of the planning effort there is not enough information available to calculate a specific stormwater charge based on the impervious area method. Also, it should be noted that the relevant characteristics of properties located within the TOC may change significantly as the redevelopment process occurs. This will complicate cost recovery. A comprehensive annual rate analysis will likely be required based on the characteristics of the properties within the TOC and the changes to these properties that occur over time.

At this stage of planning, in order to provide information regarding the capital cost of the TOC Program to the property owners, a capital cost per developable acre and a cost per estimated drainage unit is the best indication of the Program's cost. Based on the costs identified in the Master Plan of approximately $87 million, the annual debt service is estimated to be approximately $5.8 million for a thirty year tax exempt bond based on a 5% interest rate and 3% issuance costs. At this time there are 466 developable acres identified within the TOC, therefore the estimated annual average capital cost per acre of developable property would be approximately $12,446. Information provided by the Town estimates that approximately 80% of the redeveloped properties' land area would be related to impervious surfaces (i.e., 35% buildings and 45% parking) based on the redevelopment plan. Based on this estimate there would be approximately 372.8 equivalent drainage unit/acres (EDU/acre), which yields an estimated annual charge of $15,558 per EDU/acre to recover debt service-related costs. This estimate assumes that all of the initial capital costs are funded through the issuance of debt and does not include any allowance for possible grant funding. Also the estimate does not include any allowance for the cost of annual operations and maintenance activities including maintenance of storm water structures, mowing of ditches and street sweeping, which are not known at this time.

X. CONCLUSION

The Final Stormwater Master Plan accommodates the stormwater requirements for future development within the Town of Davie TOC in accordance with the TOC Master Plan and the Town of Davie Land Development Regulations. In addition, the Final Stormwater Master Plan can serve as a public amenity with parks and pedestrian paths meandering and extending from the south to the north regions of the TOC. The total estimated costs of approximately $79 million is a significant amount of money to be paid for stormwater management, however the alternatives could be more costly to the vitality of the TOC Master Plan if the Final Stormwater Master Plan is not implemented.

The following list identifies the benefits to the TOC if the Final Stormwater Master Plan is implemented followed by a list of the detriments to the TOC if the Final Stormwater Master Plan is not implemented.

List of Benefits to the TOC if the Final Stormwater Master Plan is implemented

1) The Total Future Building Areas can increase from approximately 73.9 Acres existing to 164.60 Acres, thereby accommodating over 90 acres of buildings for future growth within the TOC.
2) Approximately 58% of the total estimated costs of the Final Stormwater Master Plan are for Land Acquisitions.
    A. If the required lands are not acquired at the current prices, future land acquisition costs may be higher.
    B. If the required lands are acquired at today's prices, if land prices increase in the future as expected, the value of properties within the TOC will increase and the potential for redevelopment will increase since on-site retention areas will not be required.
    C. If the required lands are acquired at today's prices, and if land prices increase in the future as expected, if redevelopment within the TOC does not occur and if the TOC Master Plan is deemed unnecessary in the future, the acquired lands could be resold at the same or higher prices than purchased. Therefore the initial investment costs will not be lost but could be redeemed.
3) The Final Stormwater Master Plan consists of utilizing many land areas within the TOC that are encumbered by overhead power lines or poor accessibility for retention areas. This concept allows unencumbered properties to reach a greater potential for future development without being limited due to on-site stormwater retention requirements.
4) The Final Stormwater Master Plan also can function as public amenities consisting of linear parks, pedestrian paths, open space and the opportunity to create various park facilities.

List of Detriments to the TOC if the Final Stormwater Master Plan is not implemented

1) If the Final Stormwater Master Plan is not implemented, all future developments will be required to construct on-site retention ponds to accommodate their own respective stormwater management needs.

2) If the Final Stormwater Master Plan is not implemented, many properties will continue to not have an off-site outfall, which necessitates additional on-site retention areas to meet their respective stormwater management requirements. Consequently, it will be much more difficult for the TOC to sustain redevelopment at the same aggressive land use breakdown as proposed in the Final Stormwater Master Plan, if a public stormwater master system is not provided. This fact will continue to hinder the development potential within the TOC until a Stormwater Master System is constructed.

3) If the Final Stormwater Master Plan is not implemented, in order to meet individual development requirements, private on-site stormwater retention ponds maybe located in places within the TOC that have good access, visibility and adjacent to utilities, which are desirable features for proposed developments. This requirement decreases the value of select properties. In contrast, the Final Stormwater Master Plan consists of utilizing as much as possible, lands that are encumbered by overhead power lines or that have limited accessibility for stormwater retention ponds.

4) If the Final Stormwater Master Plan is not implemented, separate retention ponds spread out throughout the TOC for each individual property or development will persist which is a less efficient means for stormwater management with respect to volumetric storage and a less effective use of land for the following reasons:

   A. To design and construct a retention pond within a property, the pond bank must slope down to the pond bottom typically at a 4:1 maximum slope. If the pond bottom is three foot below grade, this requires about a 12-feet wide bank slope around the perimeter. If multiple adjacent properties were to construct adjacent but separate retention ponds within their respective site limits, each retention pond would be separated from each other by approximately 24-feet, neglecting regulatory requirements to provide landscape buffers between properties or perimeter berms to retain on-site stormwater. The areas that make up each pond bank are not useable for building, parking, recreation or landscaping as most of the regulatory agencies do not allow plantings other than sod within the pond banks. The volume of soil within each pond bank is wasted storage area that would be better utilized if one continuous retention pond were created across all the properties, with the pond bank limited to one outer perimeter.

   B. Multiple separate retention ponds within each site, without the benefit of an overall master plan, cannot be capable of also functioning as a public amenity with linear parks and pedestrian paths. Instead, the isolated retention ponds will function solely as retention ponds, with limited use other than for stormwater management.

In order to redevelop according to the Final TOC Land Use Breakdown shown in **Figure 28**, approximately the same amount of areas must be set aside for stormwater retention, whether on-site by individual property owners or off-site for public use. Since every property needs a certain amount of retention area to accommodate development and since creating separate retention ponds by each development is actually less efficient overall and would require more land area to create the same stormwater storage volume proposed in the Final Stormwater Master Plan, the aforementioned facts help to recognize that the Final Stormwater Master Plan would actually be more cost effective for each property owner within the TOC than not implementing the Final Stormwater Master Plan. Adopting the Final Stormwater Master Plan, not only will the stormwater needs be met for existing and future developments within the TOC, but a framework of open areas usable for recreation and pedestrian connectivity will be made available for future generations to enjoy.

FIGURE 28

EXISTING CONDITIONS--OVERALL LAND USE COVERAGES BREAKDOWN

Basin ID	SITE AREAS (acres)					
	Total	Building	Pavement	Green	Dry Retention	Lake
THISCD	172.73	7.77	82.94	58.11	7.26	16.65
NORTH END	46.58	1.77	14.26	27.57	1.57	1.42
NORTHEAST	96.72	12.99	56.59	21.85	4.29	1.00
NORTH CB	187.28	33.39	112.58	28.23	2.90	10.18
SOUTH C-11	29.68	1.02	9.30	17.86	0.44	1.12
SOUTH	178.34	16.96	94.58	47.04	3.85	15.91
TOTAL	**711.33**	**73.90**	**370.25**	**200.66**	**20.31**	**46.28**

FINAL STORMWATER MASTER PLAN--LAND USE COVERAGES BREAKDOWN

Basin ID	SITE AREAS (acres)					
	Total	Building	Pavement	Green	Dry Retention	Lake
THISCD	173.44	34.55	54.09	53.12	15.14	16.53
NORTH END	46.08	12.35	17.84	7.51	4.14	4.24
NORTHEAST	74.32	18.34	27.10	13.57	6.70	8.62
NORTH CB	208.83	49.76	78.71	44.34	21.08	14.94
SOUTH C-11	29.99	8.73	11.22	6.45	2.18	1.42
SOUTH	178.57	40.88	54.90	46.75	11.86	24.18
TOTAL	**711.23**	**164.60**	**243.86**	**171.73**	**61.10**	**69.93**