

# City of Margate



## Centennial Park Project

**7800 NW 19 Court  
Margate, 33063**

**CMA Project No. 20-088.015**

## STORMWATER MANAGEMENT REPORT

**PREPARED BY:**

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EB0004593**



**June 2019**

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Patrick D. Kaimrajh, P.E.  
FL Reg. No. 78535

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## EXECUTIVE SUMMARY

Chen Moore and Associates (CMA) has prepared this report to supplement the design plans and calculations submitted to the City of Margate for the proposed Centennial Park Project located at 7800 NW 19 Court, Margate, FL 33063. The project consists of the redevelopment of the existing Margate park, with additions and upgrades for the city of Margate. The proposed project site consists of the redevelopment of the park with the addition of a playground, pavilion, restrooms, walkways, pickleball courts, a tennis court, a secondary parking lot, utilities, and with the replacement of the existing basketball court.

The proposed site stormwater management system considers the site as one (1) general basin with a total area of 4.07 acres. The project proposes a stormwater system consisting of graded retention areas to provide water quality treatment and retain the additional runoff generated by the redevelopment for up to a 100-year, 3-day rainfall event. CMA performed water quality calculations and flood routing analysis to evaluate the proposed stormwater management system.

## PROPOSED PROJECT DESCRIPTION

This project consists of the redevelopment of the park with the addition of a playground, pavilion, restrooms, walkways, pickleball courts, a tennis court, a secondary parking lot, and replacement of the existing basketball court within the boundary of the City of Margate owned parcel, Folio No.484126072660, in Broward County. The parcel currently includes a basketball court, playground area, and a parking lot which occupy approximately five percent of the total property area. The property has frontage on three rights-of-way: Royal Palm Boulevard to the north, Sunflower Drive to the west and NW 19<sup>th</sup> Court to the south. The total property and project area is approximately 4.07 acres.

**Table 1 – Site Area Summary**

Area Type	Existing Area (ac)	Proposed Area (ac)
Pervious	3.61	2.68
Site Impervious	0.46	1.37
Building	-	0.01
<b>TOTAL</b>	4.07	4.07

The project is included within FEMA Flood Zone X, an area of minimal flood hazard, as shown in Appendix A. The wet season water table elevation is approximately 5.00 ft-NAVD as shown in Appendix C. Information provided from the utility owners in the area indicate there are existing water, sewer, stormwater, telecommunication, and electrical utilities in and around the site.

The project site is currently included within South Florida Water Management District (SFMWD) Environmental Resource Permit (ERP) 06-00172-S which includes onsite retention prior to discharge to the “One Mile Canal” for the entire Sunflower subdivision. The existing drainage pattern of the project site is sheet flowing of runoff into adjacent Rights-of-Way with inlets and

pipings leading to the central lake within the Sunflower subdivision. The proposed stormwater management system uses graded retention areas to treat the calculated water quality volume for the project area and additional runoff generated by the redevelopment of the site for up to the 100-year, 3-day rainfall event as determined by a pre-vs-post glass wall analysis. A connection to the existing drainage in the Right-of-Way is proposed to formalize discharge into the local drainage system with a weir of sufficient elevation to retain the above-mentioned runoff volumes onsite prior to spillover. As the proposed development is not in a flood zone and continues to function within the limits of ERP 06-00172-S, the finished floor elevation (FFE) of the restroom building is set at above the peak stage of the 100-year, 3-day flood routed rainfall event with zero discharge and the minimum FFE noted in the ERP.

## **WATER QUALITY CALCULATIONS**

CMA prepared Water Quality and Quantity Calculations (Appendix E) for the project which determines the amount of water quality that will be treated onsite. These calculations check both the first inch of runoff for the whole site as well as the two and a half inches times the percentage imperviousness of the site area requirements. Given the project area and full site development, one-inch over the site is the controlling water quality volume criteria. The resulting water quality volume is 0.339 ac-ft.

Given the height of the groundwater table, lowest inlet grate and weir elevation, and poor soil percolation rates (average  $1.35 \times 10^{-5}$  cfs/ft<sup>2</sup>/ft-head), treatment of the water quality volume was deemed not to be feasible. The water quality volume is instead proposed to be managed via onsite retention in graded areas. The following section will describe the stage-storage relationship for the project.

## **WATER QUANTITY CALCULATIONS**

CMA proposed to manage additional runoff generated by the proposed development using graded retention areas. Grading and proposed weirs are designed such the water quality volume and additional runoff generated by the proposed development for up to the 100-year, 3-day rainfall event is maintained onsite prior to discharge into the adjacent drainage system in the Sunflower subdivision. A connection to the existing drainage system within NW 19th Court is proposed to formalize runoff patterns from the site via a junction structure with a weir at elevation 10.27 FT-NAVD. Overall, the FFE for the habitable spaces is set above the peak stage for the 100-year, 3-day rainfall event as determined by a glass wall analysis and zero discharge into the Sunflower subdivision system.

### **Design Rainfall**

The design rainfalls are based on the SFWMD Environmental Resource Permit (ERP) Applicant's Handbook Volume II (May 2016) "Appendix C: Isohyetal Maps" which are included in this report as Appendix D. Below is a summary of the design rainfalls for the Project:

**Table 2 - Design Rainfall**

Design Storm	Rainfall (in.)
25-year, 3-day	13.50
100-year, 3-day	18.00

### Ground Storage / Curve Number

The Ground Storage used in the flood routing calculations is derived from the soil storage table provided in Part III Section F of the SFWMD ERP Information Manual and evaluating the pervious areas within the project area. The average depth to water table is greater than 4 feet as supported by the Report of Geotechnical Exploration (Appendix B) and the Broward County Future Conditions Groundwater Elevation map (Appendix C). Given the geographical location of the project area, the soil is taken to be "Flatwoods" soil with an uncompacted soil storage of 9 inches. The Ground Storage value is determined by taking 75% of the value determined by multiplying the uncompacted soil storage by the percentage of pervious area (66%) to obtain the value of 4.44 inches. Similarly, the existing storage is estimated using the existing pervious area (89%) to obtain a value of 5.99 inches.

### Initial Stage

For the project, the initial stage is selected to be the same as the value given by the Broward County Future Conditions Groundwater Elevation map (Appendix C) which is 5.00 ft-NAVD.

### Stage Storage

The stage-storage for the proposed site flood routing calculations was performed using a linear storage approximation between low and high elevations of multiple sub-basins for the existing and proposed development as shown below in Tables 3 and 4.

**Table 3 – Pre-Development Sub-Area Summary**

Sub-Areas	Low Elev. (ft-NAVD)	High Elev. (ft-NAVD)	Area (acres)
Basketball & Playground Area	12.5	13.0	0.29
Ex. Parking & PS Area	9.5	11.0	0.16
Eastern Swale	10.2	12.5	0.76
North Retention Area	11.0	12.4	0.62
Western and Southern Berm	10.0	13.8	0.59
Central Greenspace	12.5	13.1	1.65
		<b>TOTAL</b>	<b>4.07</b>

**Table 4 – Post-Development Sub-Area Summary**

Sub-Areas	Low Elev. (ft-NAVD)	High Elev. (ft-NAVD)	Area (acres)
Building	13.0	-	0.01
Basketball Court	11.9	12.4	0.18
Pickleball Court	12.1	12.5	0.11
Tennis Court	12.2	12.5	0.17
Sidewalks & Splashpad	11.3	13.0	0.40
Playground Area	12.5	13.3	0.21
Ex. Parking & PS Area	9.5	11.0	0.15
New Parking	10.0	12.5	0.16
Eastern Swale	10.2	12.5	0.60
Pickleball Swale	8.0	12.4	0.06
Central Retention	8.0	12.0	0.48
Pavilion Greenspace	11.0	13.0	0.22
Open Play Greenspace	11.0	12.9	0.30
Western & Southern Berm	10.0	13.6	0.85
Miscellaneous Greenspace	12.0	13.0	0.17
		<b>TOTAL</b>	<b>4.07</b>

Below is a table summarizing the stage-storage relationship per the sub-areas identified in Table 3 and 4:

**Table 5 – Stage-Storage Summary**

Stage (ft-NAVD)	Ex. Storage (ac-ft)	Prop. Storage (ac-ft)
8.00	0.00	0.00
8.50	0.00	0.02
9.00	0.00	0.07
9.50	0.00	0.15
10.00	0.01	0.28
*10.27	0.05	0.41
10.50	0.09	0.52
11.00	0.30	0.95
11.50	0.71	1.60
12.00	1.35	2.55
12.50	2.21	3.91
13.00	3.61	5.69

\*Water Quality Volume + Additional Runoff for the 100-Year Rainfall Event

## Model Results

The full Cascade models of both the existing and proposed conditions are included in Appendix F. A summary of the peak stages of the model results is included for quick reference in the table below.

**Table 6 – Peak Stage Summary**

Design Storm	Existing Peak Stage (FT-NAVD)	Proposed Peak Stage (FT-NAVD)
25-year, 3-day	12.71	12.22
100-year, 3-day	13.21	12.69

### Weir Elevation

As calculated in Appendix E, the water quality volume is 4.07 ac-in and the additional runoff generated by the proposed development for the 100-year, 3-day rainfall event is 0.79 ac-in. When summed and convert to acre-feet, the minimum retention volume is found to be approximately 0.41 ac-ft. From interpolation of the stage-storage relationship shown in Table 5 for the proposed condition, the minimum weir elevation is found to be 10.27 FT-NAVD.

## RESULTS

Summarizing the results above, the proposed stormwater management system is designed as an open system that utilizes onsite retention to treat the water quality volume (0.339 ac-ft) and retains the additional runoff for the proposed development for up to the 100-year, 3-day rainfall event as determined via a pre-vs-post analysis (0.066 ac-ft). Connection to the existing drainage system for the Sunflower subdivision permitted under SFWMD ERP 06-00172-S in NW 19th Court was made with a junction structure and weir at elevation 10.27 FT-NAVD which is sufficient in height to retain the aforementioned runoff volume prior to overflow. The flood routed peak stages of typical design rainfall events using a glass wall analysis were found to be lower in the post-development condition as compared to the pre-development condition. The peak stage of the flood routed 25-year, 3-day rainfall event with zero overflow into the Sunflower subdivision drainage system is 12.22 ft-NAVD for the proposed condition, which is lower than the pre-development condition. The peak stage of the flood routed 100-year, 3-day rainfall event with zero overflow into the Sunflower subdivision drainage system is 12.69 ft-NAVD for the proposed condition, which is lower than the pre-development condition. From review of the ERP, the minimum FFE of proposed buildings in the subdivision is 12.50-ft MSL; therefore, setting the FFE of the proposed restroom building at 13.00 ft-NAVD is sufficient to provide flood protection.

## APPENDIX A

### FEMA FLOOD ZONE MAP

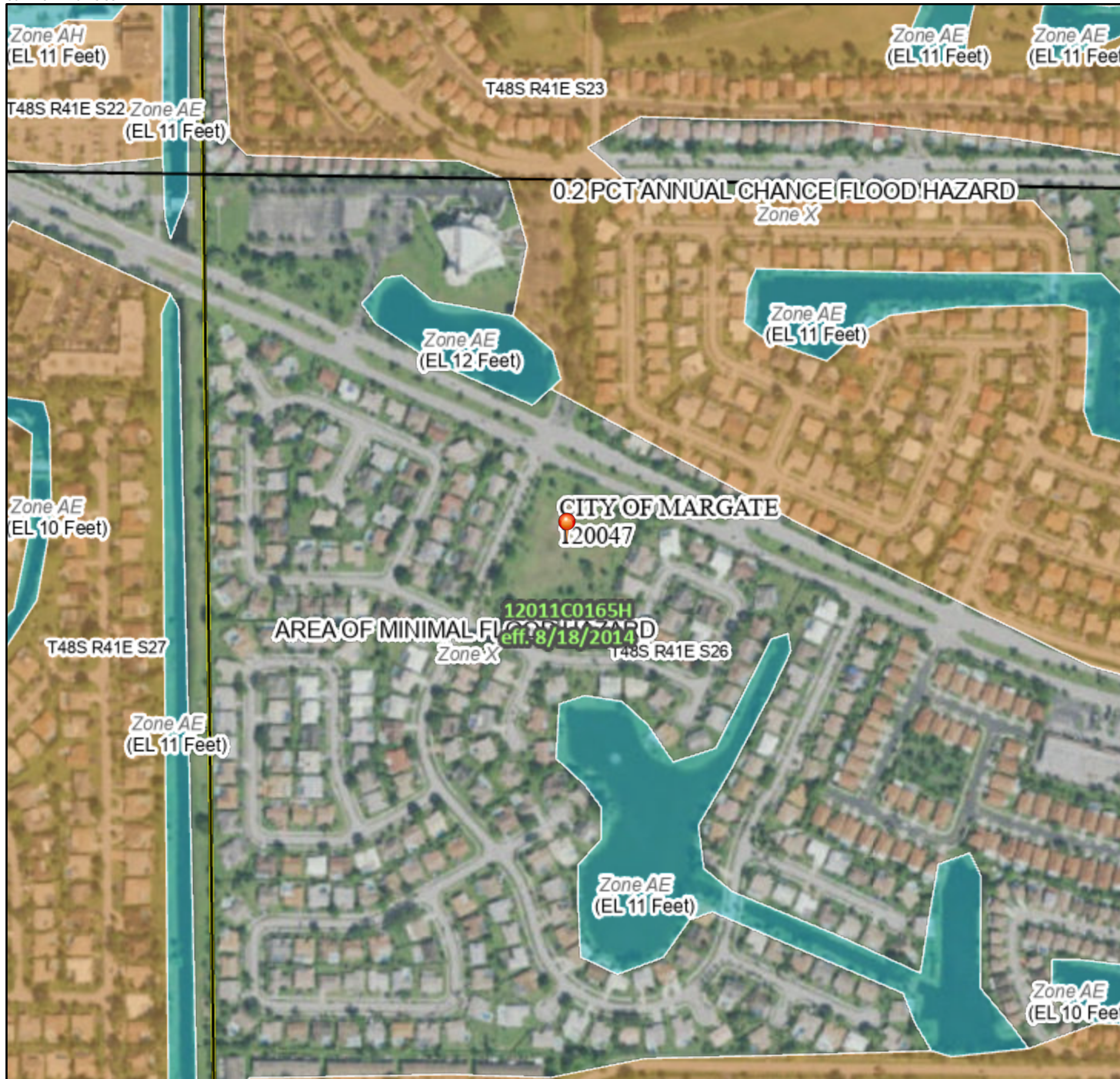
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# National Flood Hazard Layer FIRMette



80°14'8"W 26°15'33"N



0 250 500 1,000 1,500 2,000 Feet 1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

## Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) Zone A, V, A99
		With BFE or Depth Zone AE, AO, AH, VE, AR
		Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD		0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
		Future Conditions 1% Annual Chance Flood Hazard Zone X
		Area with Reduced Flood Risk due to Levee. See Notes. Zone X
		Area with Flood Risk due to Levee Zone D
OTHER AREAS		NO SCREEN Area of Minimal Flood Hazard Zone X
		Effective LOMRs
GENERAL STRUCTURES		Area of Undetermined Flood Hazard Zone D
		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall
OTHER FEATURES		20.2 Cross Sections with 1% Annual Chance Water Surface Elevation
		17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
		Coastal Transect
		Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary
		Coastal Transect Baseline
MAP PANELS		Profile Baseline
		Hydrographic Feature
		Digital Data Available
		No Digital Data Available
		Unmapped



The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 5/18/2021 at 10:50 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

## APPENDIX B

### REPORT OF GEOTECHNICAL EXPLORATION

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**REPORT OF  
GEOTECHNICAL EXPLORATION**

**PROPOSED CENTENNIAL PARK REDEVELOPMENT  
7800 ROYAL PALM BLVD.  
MARGATE, FL**

**FOR**

**CHEN MOORE AND ASSOCIATES  
500 S. AUSTRALIAN AVE. SUITE 850  
WEST PALM BEACH, FL 33401**

**PREPARED BY**

**PAN GEO CONSULTANTS  
8258 WEST STATE ROAD 84  
DAVIE, FL 33324**

**PROJECT NO. CMA02211**

**FEBRUARY 2021**

February 2, 2021

Mr. Cristobal Betancourt, RLA, Director – Planning/Landscape Architecture  
CHEN MOORE AND ASSOCIATES  
500 S. Australian Ave. Suite 850  
West Palm Beach, FL 33401  
Office: (561) 746-6900, x1078  
Email: [cbetancourt@chenmoore.com](mailto:cbetancourt@chenmoore.com)

Re: **Report of Geotechnical Exploration**  
Proposed Centennial Park Redevelopment  
7800 Royal Palm Blvd.  
Margate, FL

Dear Mr. Betancourt:

Pan Geo Consultants, LLC (PGC) has performed a limited geotechnical exploration for the above proposed project. The purpose of this exploration was to obtain information concerning the site and subsurface conditions at specific locations in order to provide site preparation recommendations for support of the proposed construction. This report presents our findings and recommendations.

### **PROJECT INFORMATION**

Based on our conversations with you and review of project documents, we understand that project plans call for the construction of new court sport facilities (basketball, tennis, pickleball, etc.), multi-purpose sports field, splash pad, playground, bathroom facilities, and sheltered pavilions. Sidewalks and other improvements are also proposed.

PGC should be notified in writing by the client of any changes in the proposed construction along with a request to amend our foundation analysis and/or recommendations within this report as appropriate.

### **GENERAL SUBSURFACE CONDITIONS**

#### **Subsurface Soil Exploration**

The exploration of subsurface conditions included site observation, two (2) standard penetration test borings (SPT) to fifteen feet below prevailing grade, and



one (1) exfiltration test to six feet in general accordance with South Florida Water Management District specifications. The approximate locations of the tests are shown on the attached Test Location plan, presented in the Appendix. The engineer may have adjusted the locations in the field due to site restrictions and/or utilities. As such, locations should be considered approximate.

### **Test Boring Results**

The test borings performed for this project generally revealed a surficial layer of loose to medium dense sand with limestone fragments and trace roots (topsoil) to depths of approximately two to four feet below grade. Below this layer, the borings encountered soft to medium hard limestone with varying proportions of sand to depths of approximately six to seven feet, followed by loose to medium dense sand and limestone with shell fragments to approximately thirteen feet. Loose sand with trace limestone and shell fragments was subsequently observed to fifteen feet, the maximum depth explored. Additional information is shown on the boring logs, presented in the Appendix of this report.

Representative samples collected from the SPT borings were visually reviewed in the laboratory by a geotechnical engineer to confirm the field classifications. A detailed description of the soil/rock profile is presented in the test boring records provided in the Appendix.

### **Groundwater Information**

The groundwater level was encountered at a depth of approximately seven to eight feet below the existing ground surface. The immediate depth to groundwater measurements presented in this report may not provide a reliable indication of stabilized or long-term depth to groundwater at this site. Water table elevations can vary dramatically with time through rainfall, droughts, storm events, flood control activities, nearby surface water bodies, tidal activity, pumping and many other factors. For these reasons, this immediate depth to water data **should not** be relied upon alone for project design considerations.

Further information regarding stabilized groundwater elevations at the site could be developed upon specific request. Additional evaluation might include monitoring of piezometers, survey of the project area for evidence of current groundwater elevation influences such as well fields, obvious construction dewatering, tidal activity, flood control canals and other surface water bodies.

### **Exfiltration Test Results**

One 'Usual Open-Hole' exfiltration test was performed in accordance with South Florida Water Management District (SFWMD) specifications to a depth of six feet below the existing ground surface. The test was performed to help determine the hydraulic conductivity of the in situ subsurface soils to evaluate drainage requirements for the project, by others.

The hydraulic conductivity value was determined to be approximately  $1.35 \times 10^{-5}$  cubic feet per second, per square foot, per foot of head. Detailed soil descriptions and flow rates are presented in the Appendix.

### **ANALYSIS AND RECOMMENDATIONS**

The test borings performed for this project generally revealed a soil profile of loose to medium dense sand at the project site. Pending proper site preparation, confirmed by inspections and testing, it is our opinion that the proposed construction may be supported on the existing soils utilizing shallow foundations sized for an allowable bearing pressure of ***2,000 pounds per square foot***.

We recommend a minimum width of 24 inches for continuous footings and 36 inches for individual footings, even though the soil bearing pressure may not be fully developed in all cases. We recommend that the bottom of footings be at least 12 inches below the lowest adjacent finished grade. The foundations should be constructed in accordance with the local building codes and good standard practice.

### **Site Preparation**

We recommend that the existing site to be cleared and stripped of vegetative topsoil to a lateral distance of at least 5 feet beyond the exterior of the new or repaired structure and pavement areas. Excavated topsoils containing grass, roots and vegetative materials should not be deposited within the construction site and should be transported away from the construction perimeter.

Upon completion of the stripping operations, the entire stripped area should then be proof-rolled and compacted with at least 20 overlapping passes of a vibratory compactor having a minimum dynamic force of 10 tons. The roller coverages should be equally divided into two perpendicular directions. The compactor should operate at the high frequency at a maximum speed of 2 feet per second (a slow walk pace). Rolling should continue until no further settlement is visually discernible at the subgrade surface.

Densities equivalent to at least 98 percent of the modified Proctor maximum dry density (ASTM-D1557) should also be achieved to a depth of at least 12 inches below the compacted surface. Frequent wetting of the subgrade may be necessary during the rolling operations to prevent drying and loosening of the upper 6 to 12 inches of soil.

Additional fill that is required may then be placed in maximum loose lifts of 12 inches and compacted until densities equivalent to at least 98 percent of the maximum dry density has been uniformly obtained. Density tests to confirm compaction should be performed in each fill lift before the next lift is placed. Any fill indicating less than above compaction requirements should be recompacted until the required density is obtained.

Fill should consist of fine sand with less than 10% passing the No. 200 sieve, free of rubble, organics, clay, debris and other unsuitable material. Prior to initiating compaction operations, we recommend that representative samples of the structural fill material to be used and acceptable in-place soils be collected and tested to determine their compaction and classification characteristics. Fill should be tested and approved by PGC prior to acquisition and placement. The maximum dry density, optimum moisture content, gradation and plasticity characteristics should be determined. These tests are needed for compaction quality control of the structural fill and existing soils, and to determine if the fill material is acceptable.

Foundation areas should be excavated to at least 12 inches below the surrounding grade. The surface should then be compacted to at least 98 percent of the maximum dry density as determined by the Modified Proctor ASTM D-1557.

Slabs on grade may be supported on the existing soils utilizing a modulus of subgrade reaction of 200 pci. The bearing surface should be compacted in accordance with the specification above.

### **Pavement Section**

A stabilized subgrade having a minimum LBR of 40 shall be placed to a depth of at least twelve inches below the base course. The onsite material may meet this requirement however laboratory testing of representative samples would be required to confirm this. The base course should be at least twelve inches thick in the areas where/if heavy truck traffic is anticipated. The base course will range from six to eight inches within drive areas in areas where only passenger vehicles are expected. The base course should have a minimum LBR of 100. The stabilized subgrade and base material should be compacted to an equivalent density of 98

percent of the modified Proctor maximum dry density (ASTM D-1557). The pavement material and thickness should be based on design requirements.

### **Light Standards Caisson Foundations**

We understand that light standards are typically supported on a caisson. We note that other methods of construction are available for construction. The decision as to which type of foundation will be best for this project will depend on the structural loading conditions and costs. We recommend that discussions be held with us, the structural engineer, owner, specialty contractor, and other interested parties to provide input concerning the best alternative for this project.

We note that within the limestone formation some very hard limestone pockets may be encountered, which may not be indicated within test borings. The foundation contractor should be fully advised of this potential condition and coordinate respectively the foundation installation.

In order to provide design parameters for the proposed light foundations, the values in the accompanying table may be used for design. The table is based on visual classification, empirical relationships and our experience with similar soil conditions.

**TABLE OF SOIL PARAMETERS**

SOIL DESCRIPTION	SOIL UNIT WEIGHT (PCF)		ANGLE OF INTERNAL FRICTION (DEGREES)	EARTH PRESSURE COEFFICIENT	
	SATURATED	SUB-MERGED		ACTIVE (K <sub>a</sub> )	PASSIVE (K <sub>p</sub> )
Loose to Medium Dense Sand	110	48	30	0.30	3.33
Soft to Medium Hard Limestone	125	62	40	0.22	4.60

We note that the values in the table are based on visual classification and if more exact values are needed, specific laboratory testing should be performed. The depths of the soils were not included since the depths of each strata varies.



Appropriate factors of safety should be applied by the design engineer depending on the application. We are available to assist in the design process if needed.

### **GENERAL INFORMATION**

Our client for this geotechnical evaluation was:

Chen Moore and Associates  
500 S. Australian Ave. Suite 850  
West Palm Beach, FL 33401

The contents of this report are for the exclusive use of the client, the client's design & construction team and governmental authorities for this specific project exclusively. Information conveyed in this report shall not be used or relied upon by other parties or for other projects without the expressed written consent of PGC. This report discusses geotechnical considerations for this site based upon observed conditions and our understanding of proposed construction for foundation support. Environmental issues including (but not limited to), soil and/or groundwater contamination are beyond our scope of service for this project. As such, this report shall not be used or relied upon for evaluation of environmental issues.

Prior to initiating compaction operations, we recommend that representative samples of the structural fill material to be used and acceptable in-place soils be collected and tested to determine their compaction and classification characteristics. The maximum dry density, optimum moisture content, gradation and plasticity characteristics should be determined. These tests are needed for compaction quality control of the structural fill and existing soils, and to determine if the fill material is acceptable.

If conditions are encountered which are not consistent with the findings presented in this report, or if proposed construction is moved from the location investigated, this office shall be notified in writing immediately so that the condition or change can be evaluated and appropriate action taken.

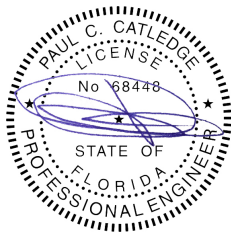
PGC shall bear no liability for the implementation of recommended inspection and testing services as described in this report if implemented by others. PGC has no ability to verify the completeness, accuracy or proper technique of such procedures if performed by others.

Excavations of five feet or more in depth should be sloped or shored in accordance with OSHA and State of Florida requirements.

The Geotechnical Engineer warrants that the findings, recommendations, specifications, or professional advice contained herein, have been presented after being prepared in accordance with general accepted professional practice in the field of foundation engineering, soil mechanics and engineering geology. No other warranties are implied or expressed.

We appreciate the opportunity to provide these services for you and look forward to completing this and other projects with you. If we can be of any further assistance with the design or construction services, or if you need additional information, please feel free to contact us at your convenience.

Sincerely,  
PAN GEO CONSULTANTS, LLC



Paul C.  
Catledge, P.E.  
2021.02.02  
10:45:31-05'00'

Paul C. Catledge, P.E. #68448  
Principal

Attachments:      Test Location Plan  
                            Test Boring Logs (B-1 & B-2)  
                            Exfiltration Test Results (EX-1)





# BORING NUMBER B-1

PAGE 1 OF 1



Pan Geo Consultants  
8258 W SR 84  
Davie, FL 33324  
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CLIENT CHEN MOORE AND ASSOCIATES

PROJECT NAME CENTENNIAL PARK REDEVELOPMENT

PROJECT NUMBER CMA02211

PROJECT LOCATION 7800 ROYAL PALM BLVD., MARGATE, FL 33063

DATE STARTED 1/27/21 COMPLETED 1/27/21

GROUND ELEVATION \_\_\_\_\_ HOLE SIZE 3 inches

DRILLING CONTRACTOR DANCOR

GROUND WATER LEVELS:

DRILLING METHOD MUD ROTARY DRILLING

▽ AT TIME OF DRILLING 7.00 ft

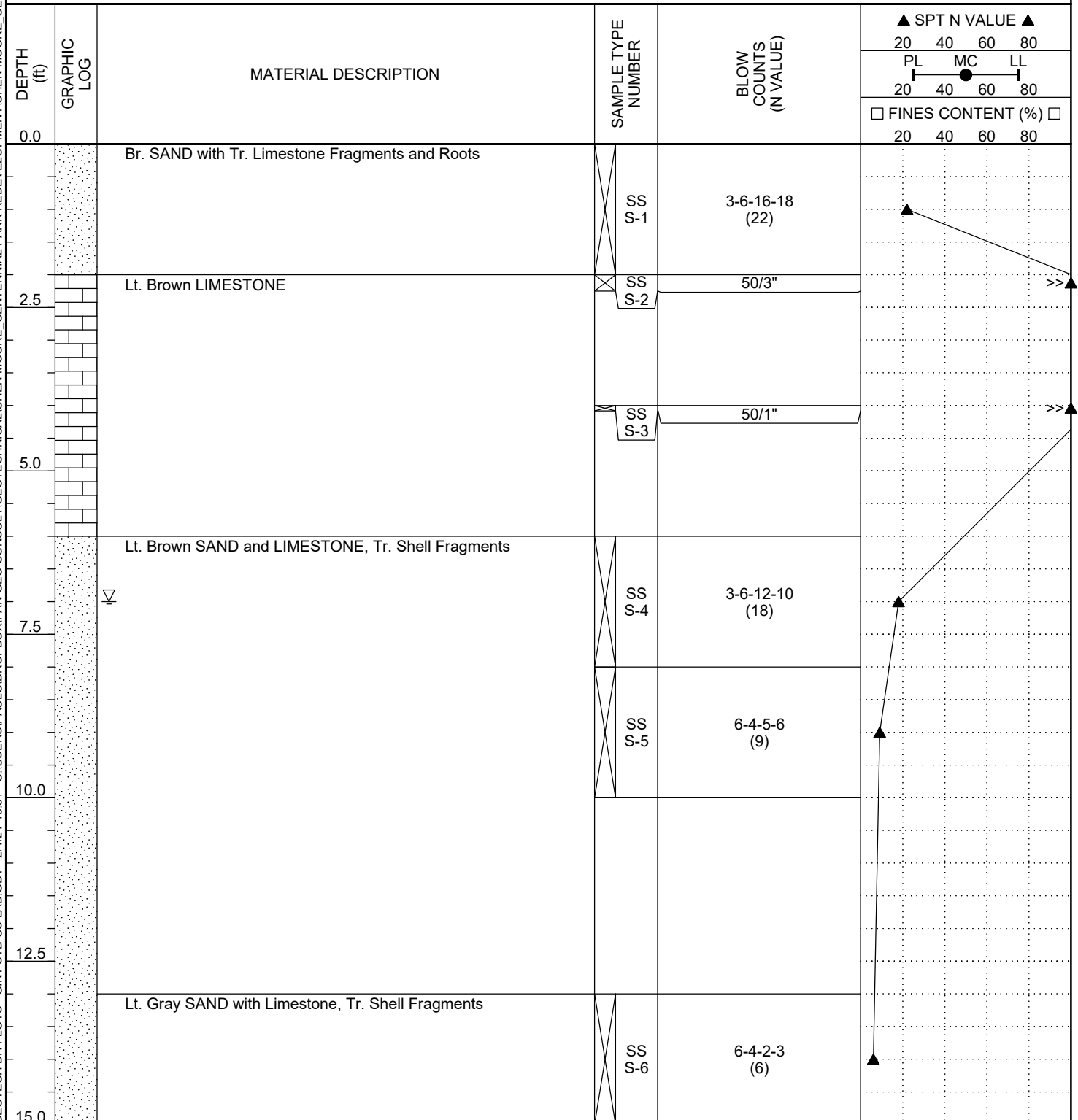
LOGGED BY PE CHECKED BY PCC

AT END OF DRILLING ---

NOTES AS LOCATED ON SITE PLAN

AFTER DRILLING ---

GEOTECH BH PLOTS - GINT STD US LAB.GDT - 2/1/21 16:31 - C:\USERS\PAUL\DROPBOX\IPAN GEO CONSULTING\TECHNICAL\CHEN MOORE - CENTENNIAL PARK REDEVELOPMENT\CHEN MOORE - CENTENNIAL PARK REDEVELOPMENT.GPJ





# BORING NUMBER B-2

PAGE 1 OF 1



Pan Geo Consultants  
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Davie, FL 33324  
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CLIENT CHEN MOORE AND ASSOCIATES

PROJECT NAME CENTENNIAL PARK REDEVELOPMENT

PROJECT NUMBER CMA02211

PROJECT LOCATION 7800 ROYAL PALM BLVD., MARGATE, FL 33063

DATE STARTED 1/4/21 COMPLETED 1/4/21

GROUND ELEVATION \_\_\_\_\_ HOLE SIZE 3 inches

DRILLING CONTRACTOR DANCOR

GROUND WATER LEVELS:

DRILLING METHOD MUD ROTARY DRILLING

▽ AT TIME OF DRILLING 8.00 ft

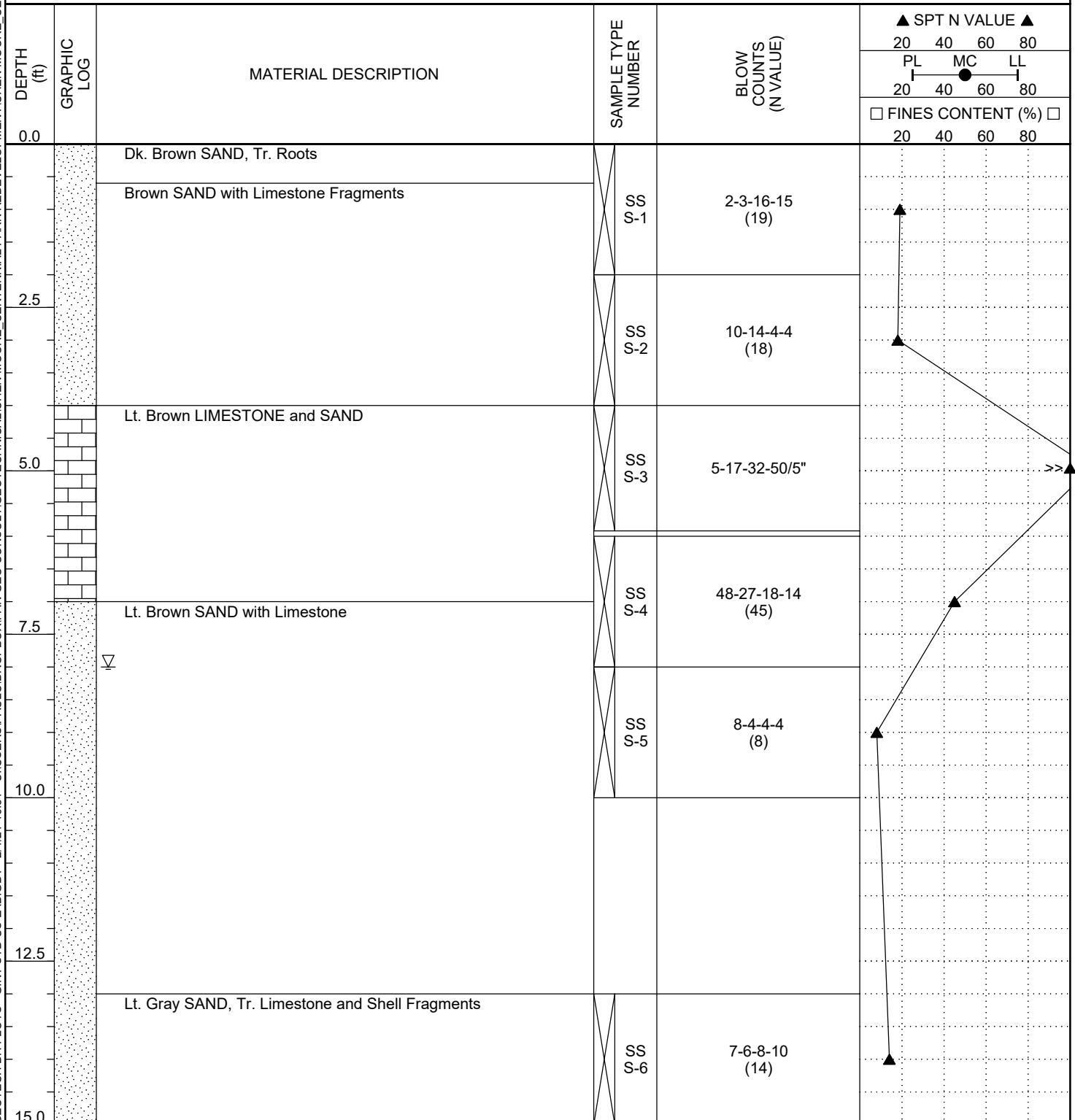
LOGGED BY PE CHECKED BY PCC

AT END OF DRILLING ---

NOTES AS LOCATED ON SITE PLAN

AFTER DRILLING ---

GEOTECH BH PLOTS - GINT STD US LAB.GDT - 2/1/21 16:31 - C:\USERS\PAUL\CDROPBOX\IPAN GEO CONSULTING\TECHNICAL\CHEN MOORE - CENTENNIAL PARK REDEVELOPMENT\CHEN MOORE - CENTENNIAL PARK REDEVELOPMENT.GPJ



Bottom of borehole at 15.0 feet.



SFWMD 'USUAL OPEN HOLE' EXFILTRATION TEST RESULTS

DATE	1/4/2021
CLIENT:	CHEN MOORE AND ASSOCIATES
PROJECT:	CENTENNIAL PK. REDEVELOP.
ADDRESS:	7800 ROYAL PALM BLVD. MARGATE, FL

TEST NO.: EX-1  
TEST LOCATION: AS LOCATED ON SITE PLAN

TEST DEPTH: 6 ft  
HOLE DIAMETER: 0.5 ft  
APPROX. WATER TABLE DEPTH: 7.083 ft

SUBSURFACE CONDITIONS:

DEPTH SOIL DESCRIPTION

0-1' Dk. Brown SAND w/Trace Roots  
1-3' Brown SAND and LIMESTONE  
3-6' Lt. Brown LIMESTONE

MINUTE	FLOW RATE (GAL/MIN)
1	0.25
2	0.25
3	0.25
4	0.125
5	0.25
6	0.125
7	0.125
8	0.125
9	0.125
10	0.125

K VALUE = 1.357E-05 CFS/FT<sup>2</sup> - FT. HEAD

## APPENDIX C

### BROWARD COUNTY FUTURE GROUNDWATER MAP

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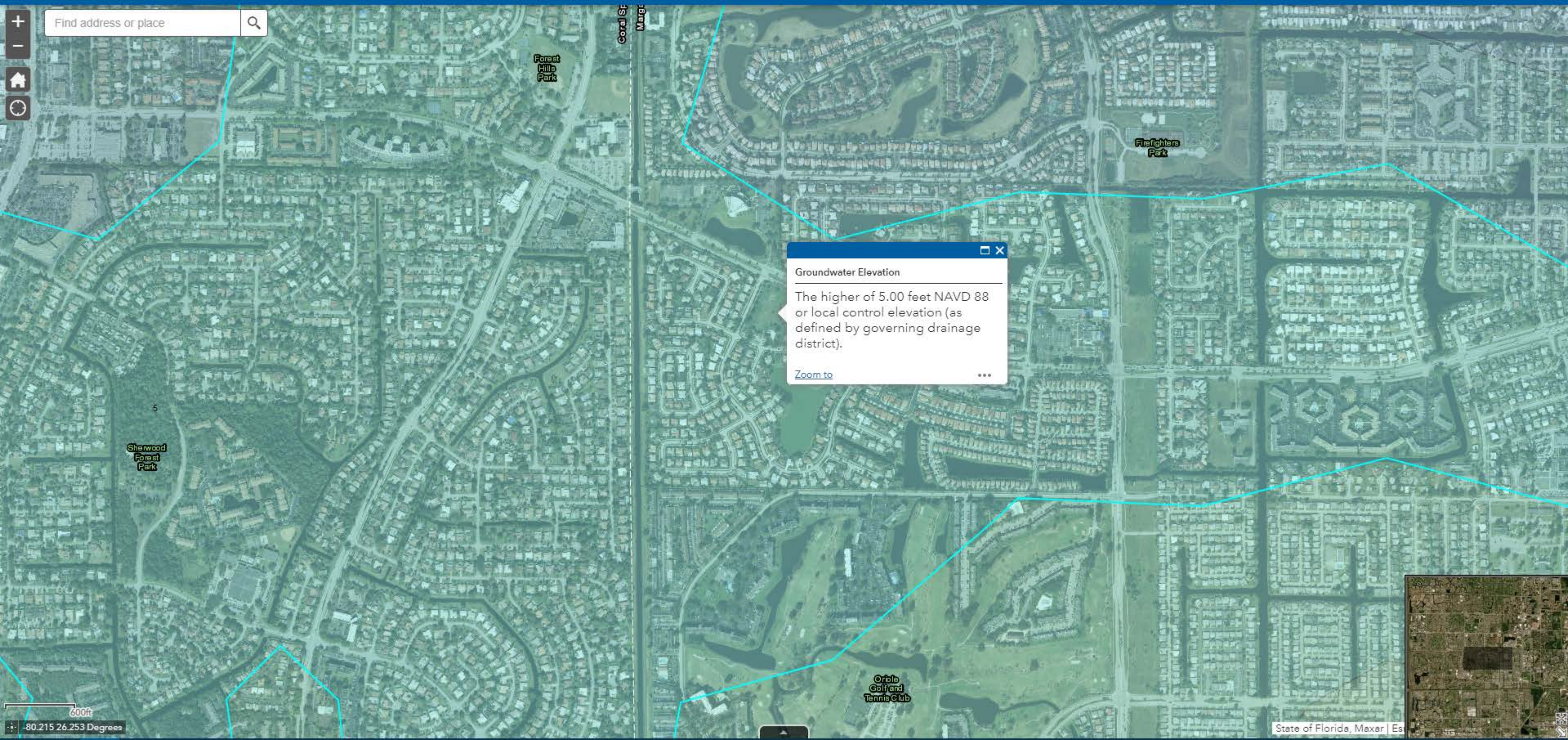
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Find address or place

🔍



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Groundwater Elevation

The higher of 5.00 feet NAVD 88 or local control elevation (as defined by governing drainage district).

[Zoom to](#) ⋮



## APPENDIX D

### SFWMD RAINFALL MAPS

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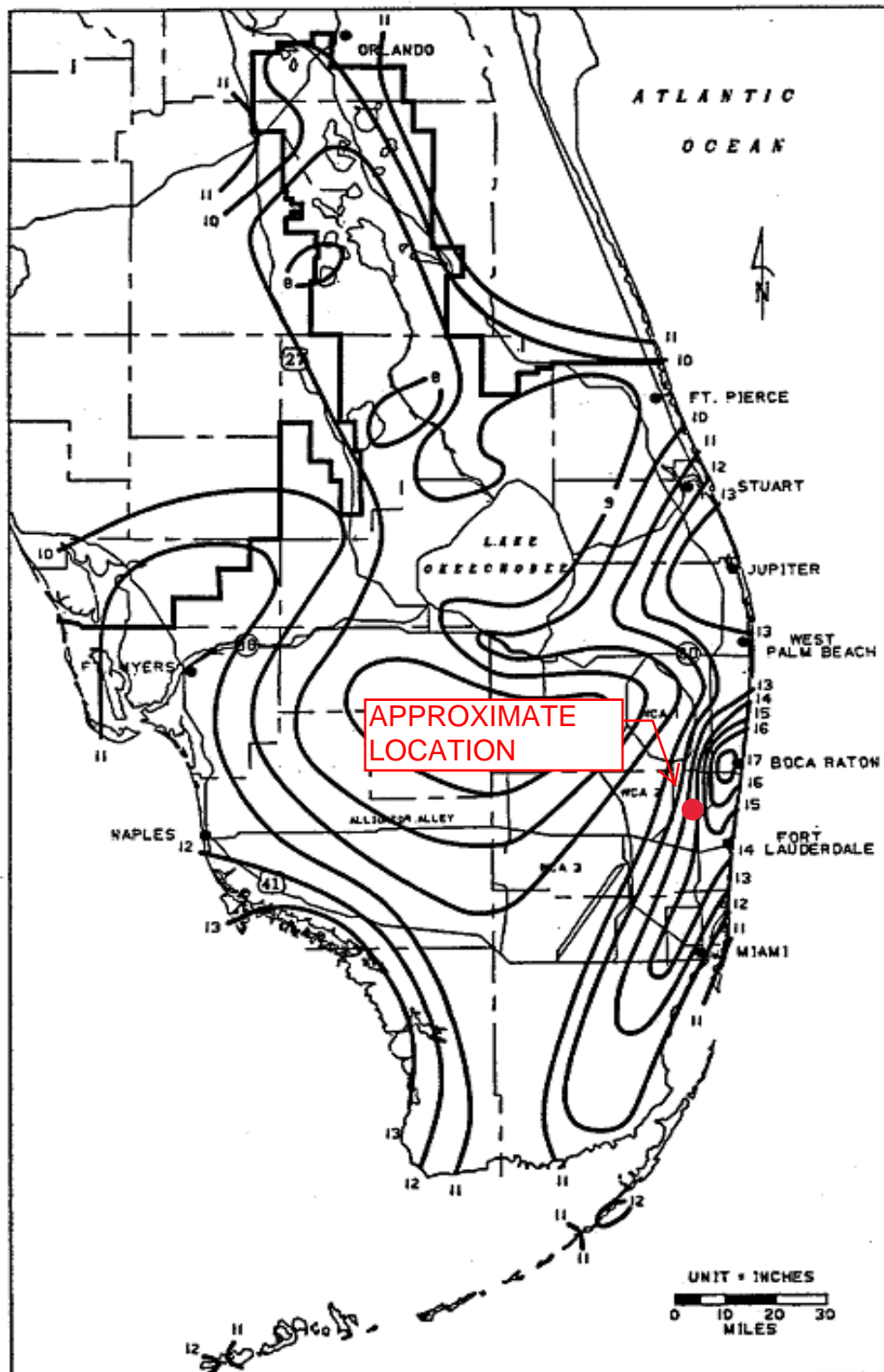


FIGURE C-8. 3-DAY RAINFALL: 25-YEAR RETURN PERIOD

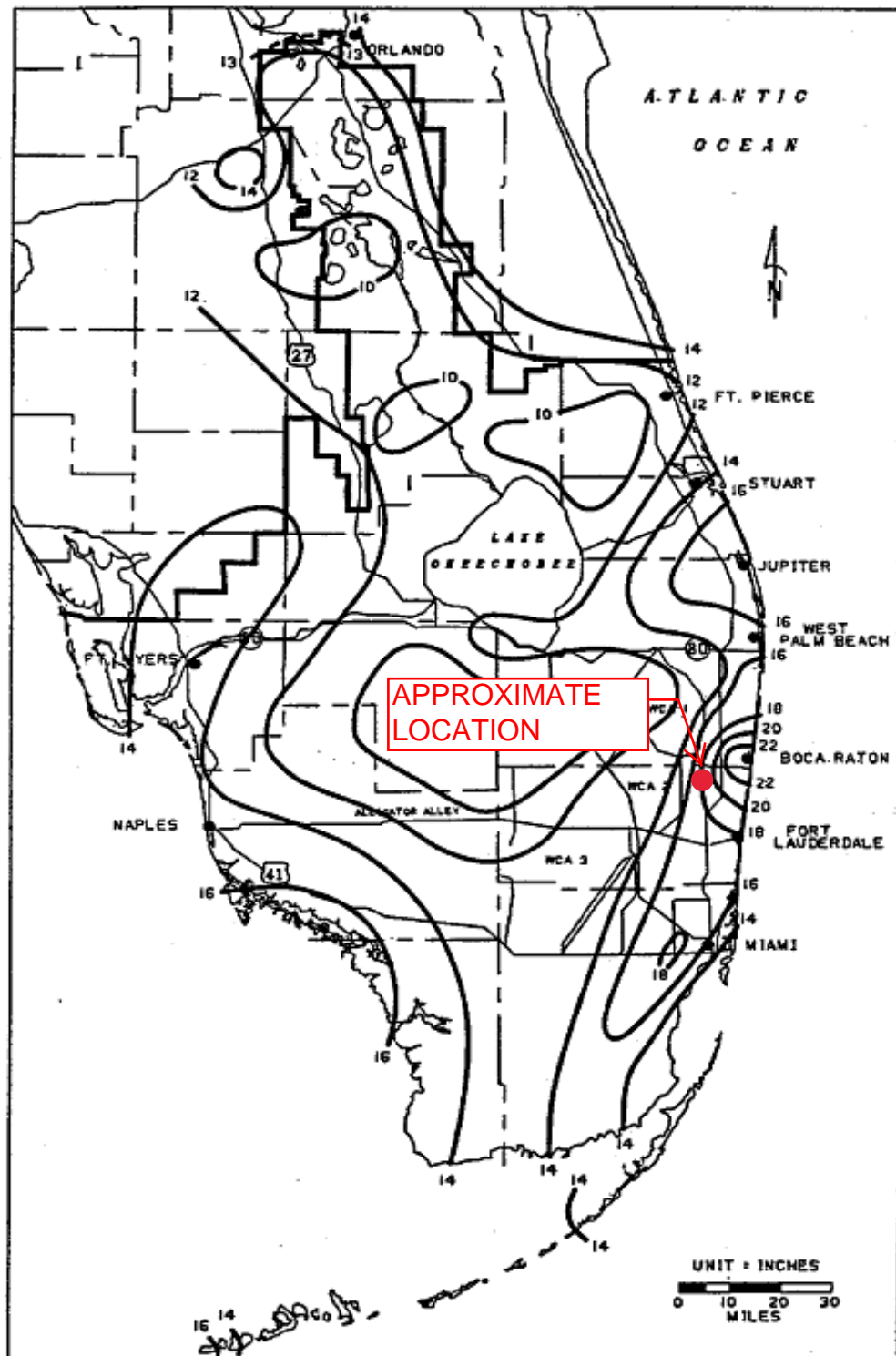


FIGURE C-9. 3-DAY RAINFALL: 100-YEAR RETURN PERIOD

## APPENDIX E

### WATER QUALITY AND QUANTITY CALCULATIONS

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## EXISTING

### Project Area Information

Total Project Area	4.07	ac
Total Exist. Impervious Area	0.46	ac
Exist. Water Surface Area	0.00	ac
Exist. Roof Area	0.00	ac
Total Exist. Pervious Area	3.61	ac
Exist. Percent Impervious	11%	

### Determination of Curve Number and Soil Storage

Soil Type	Flatwoods		
Avg. Depth to Water Table	4+	ft	$S_{design} = 0.75 \times S$
Uncomp. Storage	S=	9.0	in
Design Storage	$S_{design}$ =	5.99	in
Curve Number	CN=	62.55	
			$CN = \frac{1000}{S_{design} + 10}$

### Determination of Runoff Volumes

25-year, 3-day	$P_{25}$ =	13.5	in	
Runoff	$Q_{25pre}$ =	8.28	in	$Q = \frac{(P - 0.2S_{design})^2}{P + 0.8S_{design}}$
Runoff Volume	$V_{25pre}$ =	2.807	ac-ft	
		33.68	ac-in	
100-year, 3-day	$P_{100}$ =	18.0	in	$V = Q \times \text{Area} \times (1\text{ft} / 12\text{in})$
Runoff	$Q_{100pre}$ =	12.39	in	
Runoff Volume	$V_{100pre}$ =	4.202	ac-ft	
		50.42	ac-in	

## RUNOFF CALCULATIONS (PROPOSED CONDITION)

### Project Area Information

Total Project Area	4.07	ac
Total Prop. Impervious Area	1.39	ac
Prop. Water Surface Area	0.00	ac
Prop. Roof Area	0.01	ac
Total Prop. Pervious Area	2.68	ac
Prop. Percent Impervious	34%	
Site Area for Water Quality*	4.06	ac
*Total Project - (water surface + roof) per SFWMD ERP Applicant Handbook Volume II 4.2.2 (c)		
Impervious for Water Quality	1.38	ac
% Imp. for Water Quality	34%	

### Determination of Water Quality Volume

Greater of first inch or 2.5 x % imperviousness x area

1" x area =>	0.339	ac-ft
2.5 x %Imp. X area =>	0.288	ac-ft

#### First Inch Controls

Water Quality	0.339	ac-ft
Volume	V <sub>wq</sub> = 4.07	ac-in

### Determination of Curve Number and Soil Storage

Soil Type	Flatwoods
Avg. Depth to Water Table	4+ ft
Uncomp. Storage	S = 9.0 in
Design Storage	S <sub>design</sub> = 4.44 in
Curve Number	CN = 69.23

$$V_{add} = V - V_{wq}$$

### Determination of Runoff Volumes

25-year, 3-day	P <sub>25</sub> = 13.5	in
Runoff	Q <sub>25post</sub> = 9.32	in
Runoff Volume	V <sub>25post</sub> = 3.163	ac-ft
	37.95	ac-in
100-year, 3-day	P <sub>100</sub> = 18.0	in
Runoff	Q <sub>100post</sub> = 13.58	in
Runoff Volume	V <sub>100post</sub> = 4.607	ac-ft
	55.28	ac-in

### Pre vs. Post Condition Runoff Volumes

25-year, 3-day

$V_{25pre}$

$V_{25post}$

$V_{25\Delta}$

33.68

37.95

4.27

ac-in

ac-in

ac-in

100-year, 3-day

$V_{100pre}$

$V_{100post}$

$V_{100\Delta}$

50.42

55.28

4.86

ac-in

ac-in

ac-in

## APPENDIX F

### FLOOD ROUTING CALCULATIONS

---

Project Name: Centennial Park Redevelopment

Reviewer: SB

Project Number: 088.015

Period Begin: Jan 01, 2000;0000 hr End: Jan 04, 2000;0000 hr Duration: 72 hr

Time Step: 0.2 hr, Iterations: 10

## Basin 1: Pre-Development

Method: Santa Barbara Unit Hydrograph

Rainfall Distribution: SFWMD - 3day

Design Frequency: 25 year

3 Day Rainfall: 13.5 inches

Area: 4.07 acres

Ground Storage: 5.99 inches

Time of Concentration: 0.17 hours

Initial Stage: 5 ft NAVD

Stage (ft NAVD)	Storage (acre-ft)
8.50	0.00
9.00	0.00
9.50	0.00
10.00	0.01
10.50	0.09
11.00	0.30
11.50	0.71
12.00	1.35
12.50	2.21
13.00	3.61

## Basin 2: Post-Development

Method: Santa Barbara Unit Hydrograph

Rainfall Distribution: SFWMD - 3day

Design Frequency: 25 year

3 Day Rainfall: 13.5 inches

Area: 4.07 acres

Ground Storage: 4.44 inches

Time of Concentration: 0.17 hours

Initial Stage: 5 ft NAVD

Stage (ft NAVD)	Storage (acre-ft)
8.00	0.00
8.50	0.02
9.00	0.07
9.50	0.15
10.00	0.28
10.50	0.52
11.00	0.95
11.50	1.60
12.00	2.55
12.50	3.91
13.00	5.69

## STRUCTURE MAXIMUM AND MINIMUM DISCHARGES

```
=====
Struc  Max (cfs)  Time (hr)  Min (cfs)  Time (hr)
=====
```

## BASIN MAXIMUM AND MINIMUM STAGES

```
=====
Basin  Max (ft)  Time (hr)  Min (ft)  Time (hr)
=====
Pre-Developmen  12.71    72.00     5.00     0.00
Post-Developme  12.22    72.00     5.00     0.00
=====
```



## BASIN WATER BUDGETS (all units in acre-ft)

Basin	Total Runoff	Structure Inflow	Structure Outflow	Initial Storage	Final Storage	Residual
Pre-Developmen	2.80	0.00	0.00	0.00	2.80	0.00
Post-Developme	3.16	0.00	0.00	0.00	3.16	0.00

Project Name: Centennial Park Redevelopment

Reviewer: SB

Project Number: 088.015

Period Begin: Jan 01, 2000;0000 hr End: Jan 04, 2000;0000 hr Duration: 72 hr

Time Step: 0.2 hr, Iterations: 10

## Basin 1: Pre-Development

Method: Santa Barbara Unit Hydrograph

Rainfall Distribution: SFWMD - 3day

Design Frequency: 100 year

3 Day Rainfall: 18 inches

Area: 4.07 acres

Ground Storage: 5.99 inches

Time of Concentration: 0.17 hours

Initial Stage: 5 ft NAVD

Stage (ft NAVD)	Storage (acre-ft)
8.50	0.00
9.00	0.00
9.50	0.00
10.00	0.01
10.50	0.09
11.00	0.30
11.50	0.71
12.00	1.35
12.50	2.21
13.00	3.61

## Basin 2: Post-Development

Method: Santa Barbara Unit Hydrograph

Rainfall Distribution: SFWMD - 3day

Design Frequency: 100 year

3 Day Rainfall: 18 inches

Area: 4.07 acres

Ground Storage: 4.44 inches

Time of Concentration: 0.17 hours

Initial Stage: 5 ft NAVD

Stage (ft NAVD)	Storage (acre-ft)
8.00	0.00
8.50	0.02
9.00	0.07
9.50	0.15
10.00	0.28
10.50	0.52
11.00	0.95
11.50	1.60
12.00	2.55
12.50	3.91
13.00	5.69

## STRUCTURE MAXIMUM AND MINIMUM DISCHARGES

```
=====
Struc  Max (cfs)  Time (hr)  Min (cfs)  Time (hr)
=====
```

## BASIN MAXIMUM AND MINIMUM STAGES

```
=====
Basin  Max (ft)  Time (hr)  Min (ft)  Time (hr)
=====
Pre-Developmen  13.21    72.00     5.00     0.00
Post-Developme  12.69    72.00     5.00     0.00
=====
```

## BASIN WATER BUDGETS (all units in acre-ft)

```
=====
      Basin      Total  Structure  Structure  Initial  Final
      Runoff     Inflow  Outflow   Storage  Storage  Residual
=====
Pre-Developmen    4.19      0.00      0.00      0.00      4.19      0.00
Post-Developme    4.60      0.00      0.00      0.00      4.60      0.00
```