SURFACE WATER MANAGEMENT CALCULATIONS

UNIVERSITY STATION PARKING GARAGE

CITY OF HOLLYWOOD, BROWARD COUNTY, FLORIDA
HSQ PROJECT No.: 2107-63

PREPARED FOR:

HOUSING TRUST GROUP

3225 AVIATION AVENUE, 6TH FLOOR
COCONUT GROVE, FL 333133

Prepared By:

HSQ GROUP, INC.

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DATE: 08/20/2021

PROPOSED UNIVERSTIY STATION PARKING GARAGE

POST-CONDITION DRAINAGE CALCULATIONS

Water Table: 1.50 NAVD

Land Use Summary:

Lake/Water Areas (A_L):	0	sf	or	0.000	ac
Roof Areas (A_R):	27,575	sf	or	0.633	ac
Paved Areas (A_P):	216	sf	or	0.005	ac
Green Areas (A_G):	4,484	sf	or	0.103	ac
Total (A_T):	32,275	sf	or	0.741	ac

Compute Required Pretreatment Volume:

1. Provide at least 1/2 inch over the developed project:

V_{PRE} = 0.5 inch x A_T x 1 ft / 12 inches
= 0.5 x 2.013 / 12
= 0.03 ac-ft or 0.37 ac-in

Compute Water Quality Volume:

1. Provide at least 1 inch over the developed project:

V_{PRE} = 1 inch x A_T x 1 ft / 12 inches
= 1 x 2.013 / 12
= 0.06 ac-ft or 0.74 ac-in

2. Provide 2.5" over % impervious area:

a) Site Area for water quality pervious/impervious calculation:

A_S = A_T - (A_L + A_R)
= 2.013 - (+)
= 0.108 ac of site area for water quality pervious/impervious

b) Impervious area for water quality pervious/impervious calculation:

A_{IMP} = A_S - A_G
= 0.108 -
= 0.01 ac of impervious area for water quality pervious/impervious

c) Percent of impervious for water quality calculation:

= A_{IMP} / A_S x 100%
= 0.005 / 0.108 x 100%
= 4.6% impervious

d) For 2.5" times the percent impervious:

= 2.5" x % impervious area
= 2.5 x 0.046
= 0.12 inches to be treated

e) Compute volume required volume for quality detention

V_{PRE} = inches to be treated x (A_T - A_L)
= 0.12 x (-) x 1 foot / 12 inches)
= 0.01 ac-ft or 0.09 ac-in

3. Since the 0.74 ac-in is greater than the 0.09 ac-in computed for the 2.5 inches over % impervious area, the volume 0.74 ac-in controls

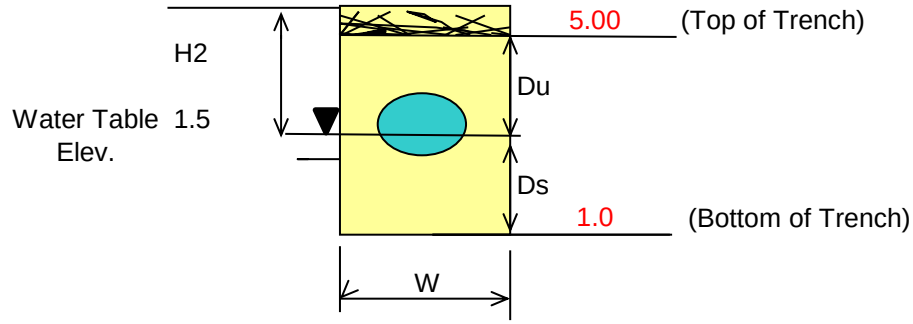
PROPOSED UNIVERSTIY STATION PARKING GARAGE

EXFILTRATION TRENCH CALCULATIONS

K-Value:

Test Hole #	(cfs/ft^2/ft hd)
P-1	2.00E-04
P-2	2.60E-04
K_{AVG}	2.30E-04

(Min. Pavement Elev.) 9.00
Wier Elevation 6.00



K = 2.30E-04 cfs/ft^2 - ft head
H_2 = 4.50 ft
W = 6.00 ft
D_u = 3.50 ft
D_s = 0.50 ft
H = Du + Ds = 4.00 ft

1) Trench Length for Water Quality Requirements:

V = 0.74 ac-in or 0.06 ac-ft

$$L = \frac{V\,(FS)}{K(H2W + 2H2Du - Du\text{^}2 + 2H2Ds) + (1.39 \times 10\text{^}-4)WDu}$$

L = 50.7 feet

2) Maximum Trench Length:

V = 3.28 inches X 0.74 acres = 2.43 ac-in or 0.20 ac-ft

L = 166.6 feet

3) Provided Trench Volume:

L = 150 LF Provided

V = (1/FS)L x (K(2H2Du - Du^2 + 2H2Ds) + (1.39 x 10^-4)Wdu)

V = 1.09 ac-in or 0.09 ac-ft *

* Since provided storage volume exceeds water quality requirement, 50% of excess strorage volume is credited. (SFWMD Page G-1)

Vexcess = 1.09 ac-in (150 LF) - 0.74 ac-in (water quality) = 0.35 ac-in

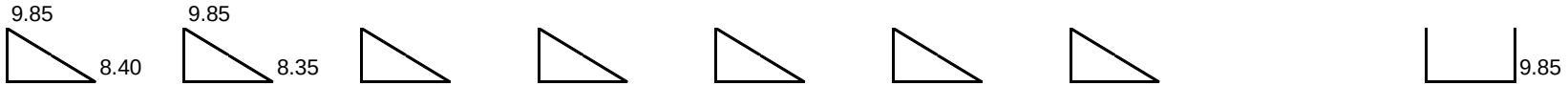
V= 0.74 ac-in + (0.35 ac-in X 50%) =

V= 0.92 ac-in or 0.08 ac-ft

PROPOSED UNIVERSTIY STATION PARKING GARAGE

STAGE\STORAGE AREA CALCULATION POST

Exist. Grades



Stage	Pavement Area Area 0.005 0.000 (ac.-ft.)	Landscape Area Area 0.103 0.000 (ac.-ft.)	0.000 0.000 (ac.-ft.)	Area 0.000 0.000 (ac.-ft.)	Area 0.000 0.000 (ac.-ft.)	Area 0.000 0.000 (ac.-ft.)	Area 0.000 0.000 (ac.-ft.)	Exfiltration Trench (See Previous Calculations) (ac.-ft.)	Buildng Area 0.633 0.000 (ac.-ft.)	Total Site 0.741
1.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01
2.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.03
3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.04
3.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05
4.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.06
4.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.08
5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.09
5.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.09
6.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.09
6.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.09
7.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.09
7.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.09
8.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.09
8.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.09
9.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.11
9.50	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.14
10.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.19

Soil Storage Post

Land Use Summary:

	Acres	Percent	
Lake Areas (A_L):	0.000	N/A	(Not Included)
Roof Areas (A_R):	0.633	85.4%	
Paved Areas (A_P):	0.005	0.7%	
Green Areas (A_G):	0.103	13.9%	
Total (A_T):	0.741	100.0%	

Compacted Soil Storage per SFWMD Vol. IV Page C-III-1

Depth to Water Table (feet)	Water Storage (inches)
1	0.45
2	1.88
3	4.05
4	6.75

Average Pervious Grade (Elev.): 6.00 ft
Depth to Water Table: 4.50 ft
Soil Storage at Average Depth (S_S): 6.75 inches

Weighted S value:
= S_S x % Pervious
= 6.75 x 0.139 =
= **0.94 inches**

Rainfalls (P)

From Figure C-5, 25-Year, 72-Hour Storm = 14.00 inches

From Figure C-9, 100-Year, 72-Hour Storm = 17.50 inches

SFMWD Storm Events

25-Yr 3-Day Storm Event

Stage for 25-Year 3-day Storm Event 7.58 ft. NAVD See attached ICPR Model

100-Yr 3-Day Storm Event

Stage for 100-Year 3-day Storm Event 7.76 ft. NAVD See attached ICPR Model

DRAINAGE WELL CALCULATIONS

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Storm Runoff Calculations

Note: Poriotn of waterway is included within the property area, but has been exlcuded from drainage area calculations as runoff in this area is not contained within site.

1. Weighted Runoff Coefficient C

Runoff Coefficient Impervious (C1) = 0.95
Runoff Coefficient Pervious (C2)= 0.2

A1 =	Impervious Area =	0.638	86.10%
A2 =	Pervious Area =	0.103	13.90%
A =	Total Area =	0.741	100.00%

C = {(A1 x C1) + (A2 x C2)} / A =
C = {(0.638 x 0.95)+(0.103 x 0.2)} /0.741 = 0.85

CA (Contributing Area) = C x A
CA = 0.85 x 0.741 = 0.63

2. Time Required to Generate One Inch of Runoff

Rainfall Intensity (I) = 308.5 / [48.6 x F^-0.11) + t*(0.5895 + F^-2/3)]
Frequency (F) = 10 Years

STORM RUNOFF CALCULATION TABLE

Time (t) (min.) {1}	Intensity (I) (in./hr) {2}	Contributing Area (C*A) {3}	Inflow Rate (cfs) (C*I*A) {4}	Inflow Volume (CF) (CIA*t) {5}	
8	6.99	0.630	4.40	2112.3	
10	6.74	0.630	4.25	2547.5	
13.162	6.38	0.630	4.02	3176.4	Time to Generate 1" of Runoff
15	6.19	0.630	3.90	3512.5	
20	5.73	0.630	3.61	4333.1	
23.162	5.47	0.630	3.45	4791.6	Total Time required to collect 1" of Runoff (10 min. t_C)
25	5.33	0.630	3.36	5039.5	
30	4.99	0.630	3.14	5654.1	
40	4.41	0.630	2.78	6670.9	
50	3.96	0.630	2.49	7477.8	
60	3.59	0.630	2.26	8133.7	
90	2.80	0.630	1.76	9526.3	
120	2.30	0.630	1.45	10418.2	

Q = CIA, V = Qt, $V_{(1")} = Qt_{(1")}$, $t_{(1")}$ = Time to generate 1" of runoff
$V_{(1")} = 1" \times A = CIAt_{(1")}$
V (1") = 0.062 Ac-ft or 2,690 cf

Time to generate one inch of run-off, $t_{(1")}$ = 10.715 minutes
Time to reach inlet, $t_{(C)}$ = 10 minutes
Total time required to collect 1" runoff= 20.715 minutes

3. Calculate Peak Runoff (Q)

Rainfall Intesity at T(20.715) = 5.721 in/hr
Peak Runoff (Q)= CA* I = 0.63 x 5.721 = **3.60** cfs

DRAINAGE WELL CALCULATIONS

Drainage Well Structures

Well No.	Rim / Grate Elev. (NAVD)	Lowest Inlet/ Weir Elev. (NAVD)	Design Ground Water Elevation (NAVD)	Well Structure			Structure Storage Volume (CF)
				Width (ft)	Length (ft)	H Req. (ft)	
1	9.50	6.00	1.50	6	10.00	6.00	360.00
						6.00	360

1. Drainage Well Structure Volume Calculations

Drainage well structure must be designed to detain runoff for a minum of 90 seconds prior to discharge

Required Runoff (Q) =	3.60	cfs
Min. Det. Volume = Runoff x 90 sec =	324	cf
Width of Well Structure (W) =	6	ft
Length of Well Structure (L) =	10.00	ft
Min. Height Required =	5.41	

Note: This is the total depth required from the top of well casing to the floor of the well box to achieve 90 second detention time

Proposed Number of Drainage Wells =	1	
Detention Volume Per Well Structure (cf) =	324	cf
Height Per Well (Top of Well to Bottom of Structure) =	5.41	ft
Top of Well Casing Elevation =	1.50	NAVD
Bottom of Structure Elevation =	-4.50	NAVD
Casing Height in Structure (H) =	6.00	ft

Det. Volume Per Well Structure (V)= H x W x L= 6 x 10 x 6 = 360 cf

2. Well Flotation Calculations

Calculate Upward Force:

Well Box Outside Length Dimension	11.33	ft.
Well Box Outside Width Dimension	7.33	ft.
Design Water Table	1.50	NAVD
Elevation at Bottom of Bottom Slab	-5.17	NAVD
Well Rim Elevation/Top of Slab	9.50	NAVD
Displacement Depth	14.67	ft.
Discplacement Volume	1,219	c.f.
Upward Force	76,063	lbs.

Calculate Downward Force:

Well Box Top Slab Thickness	8	inches
Well Box Wall Thickness	8	inches
Well Box Bottom Slab Thickness	8	inches
Top Slab Volume	55.41	c.f.
Wall Volume	338.96	c.f.
Bottom Slab Volume	55.41	c.f.
Total Volume	449.78	c.f.
Downward Force	67,467	lbs.

Total Force = Upward Force - Downward Force = -6,029 **OK**

DRAINAGE WELL DESIGN INPUTS

Per field data supplied by local drainage well company the general area is anticipated to produce a well with a capacity of 300 gpm/foot. This data will need to be confirmed at time of the well development and or reasonable assurance report.

1. Well Operating Table:

Design Discharge (Avg.) 300 gpm/foot
Number of Wells 1
Begin Discharge at Elevation 3.50 (Assume Top of Well Casing+ 2' to Overcome Column of Salt Water)

CFS/FT = (300 gal/min) * 1 ft/s / 448.83 gal/min = 0.67 cfs

Elev (ft)	Discharge (cfs) per well				Total Discharge
3.50	0.67 cfs x	0.00'	=	0.00 cfs	0.00 cfs
4.00	0.67 cfs x	0.50'	=	0.34 cfs	0.34 cfs
4.50	0.67 cfs x	1.00'	=	0.67 cfs	0.67 cfs
5.00	0.67 cfs x	1.50'	=	1.01 cfs	1.01 cfs
5.50	0.67 cfs x	2.00'	=	1.34 cfs	1.34 cfs
6.00	0.67 cfs x	2.50'	=	1.68 cfs	1.68 cfs
6.50	0.67 cfs x	3.00'	=	2.01 cfs	2.01 cfs
7.00	0.67 cfs x	3.50'	=	2.35 cfs	2.35 cfs
7.50	0.67 cfs x	4.00'	=	2.68 cfs	2.68 cfs
8.00	0.67 cfs x	4.50'	=	3.02 cfs	3.02 cfs
8.50	0.67 cfs x	5.00'	=	3.35 cfs	3.35 cfs
9.00	0.67 cfs x	5.50'	=	3.69 cfs	3.69 cfs
9.50	0.67 cfs x	6.00'	=	4.02 cfs	4.02 cfs
10.00	0.67 cfs x	6.50'	=	4.36 cfs	4.36 cfs
10.50	0.67 cfs x	7.00'	=	4.69 cfs	4.69 cfs
11.00	0.67 cfs x	7.50'	=	5.03 cfs	5.03 cfs
11.50	0.67 cfs x	8.00'	=	5.36 cfs	5.36 cfs
12.00	0.67 cfs x	8.50'	=	5.70 cfs	5.70 cfs
12.50	0.67 cfs x	9.00'	=	6.03 cfs	6.03 cfs

2. Weir Information

Top of Weir Elevation = 6.00 NAVD
Rim of Sturcture Elevation = 9.50 NAVD
Bottom of Structure Top Slab Elevation = 7.75 NAVD
Rim Thickness = 7.00 Inches
Total Brick Thickness = 6.00 Inches
Top Slab Thickness = 8.00 Inches
Height of Opening = 1.75 FT
Weir Length Per Structure = 6 LF
Total Weir Length = 6 LF

ICPR MODEL

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Node Max Conditions [Scenario1]

Node Name	Sim Name	Warning Stage [ft]	Max Stage [ft]	Min/Max Delta Stage [ft]	Max Total Inflow [cfs]	Max Total Outflow [cfs]	Max Surface Area [ft2]
Parking Garage (Node)	100Y-3D	13.00	7.76	0.0010	0.78	0.67	1307
Parking Garage (Node)	25Y-3D	13.00	7.58	0.0010	0.78	0.51	1307

Manual Basin: Parking Garage

Scenario: Scenario1
Node: Parking Garage (Node)
Hydrograph Method: NRCS Unit Hydrograph
Infiltration Method: Curve Number
Time of Concentration: 10.0000 min
Max Allowable Q: 9999.00 cfs
Time Shift: 0.0000 hr
Unit Hydrograph: UH323
Peaking Factor: 323.0
Area: 0.7410 ac

Area [ac]	Land Cover Zone	Soil Zone	Rainfall Name
0.6330	Building	A	
0.0050	Impervious	A	
0.1030	Pervious	A	

Comment:

Node: DWELL

Scenario: Scenario1
Type: Stage/Area
Base Flow: 1.50 cfs
Initial Stage: 0.00 ft
Warning Stage: 13.00 ft

Stage [ft]	Area [ac]	Area [ft2]
1.50	0.0000	0
13.00	0.0000	0

Comment:

Node: Groundwater

Scenario: Scenario1
Type: Time/Stage
Base Flow: 0.00 cfs
Initial Stage: 1.50 ft
Warning Stage: 13.00 ft
Boundary Stage:

Year	Month	Day	Hour	Stage [ft]
0	0	0	0.0000	1.50
0	0	0	72.0000	1.50
0	0	0	96.0000	1.50

Comment:

Rating Curve Link: DWELL

Scenario: Scenario1
From Node: DWELL
To Node: Groundwater
Link Count: 1
Flow Direction: Both

Table	Elev On [ft]	Elev On Node	Elev Off [ft]	Elev Off Node
DWELL	1.50	Parking Garage (Node)	1.49	Parking Garage (Node)

Comment:

Drop Structure Link: Weir

Scenario: Scenario1
From Node: Parking Garage (Node)
To Node: DWELL
Link Count: 1
Flow Direction: Both
Solution: Combine
Increments: 0
Pipe Count: 1
Damping: 0.0000 ft
Length: 200.00 ft
FHWA Code: 0
Entr Loss Coef: 0.00
Exit Loss Coef: 0.00
Bend Loss Coef: 0.00
Bend Location: 0.00 dec
Energy Switch: Energy

Upstream Pipe		Downstream Pipe	
Invert:	1.50 ft	Invert:	1.50 ft
Manning's N:	0.0130	Manning's N:	0.0130
Geometry: Circular		Geometry: Circular	
Max Depth:	2.00 ft	Max Depth:	2.00 ft
Bottom Clip			
Default:	0.00 ft	Default:	0.00 ft
Op Table:		Op Table:	
Ref Node:		Ref Node:	
Manning's N:	0.0000	Manning's N:	0.0000
Top Clip			
Default:	0.00 ft	Default:	0.00 ft
Op Table:		Op Table:	
Ref Node:		Ref Node:	
Manning's N:	0.0000	Manning's N:	0.0000

Pipe Comment:

Weir Component	
Weir:	1
Weir Count:	1
Weir Flow Direction:	Both
Damping:	0.0000 ft
Weir Type:	Horizontal
Geometry Type:	Rectangular
Invert:	6.00 ft
Control Elevation:	1.50 ft
Max Depth:	1.75 ft
Max Width:	6.00 ft
Fillet:	0.00 ft

Bottom Clip	
Default:	0.00 ft
Op Table:	
Ref Node:	

Top Clip	
Default:	0.00 ft
Op Table:	
Ref Node:	

Discharge Coefficients	
Weir Default:	3.200
Weir Table:	
Orifice Default:	0.600
Orifice Table:	

Weir Comment:

Drop Structure Comment:

Rating Curve: DWELL

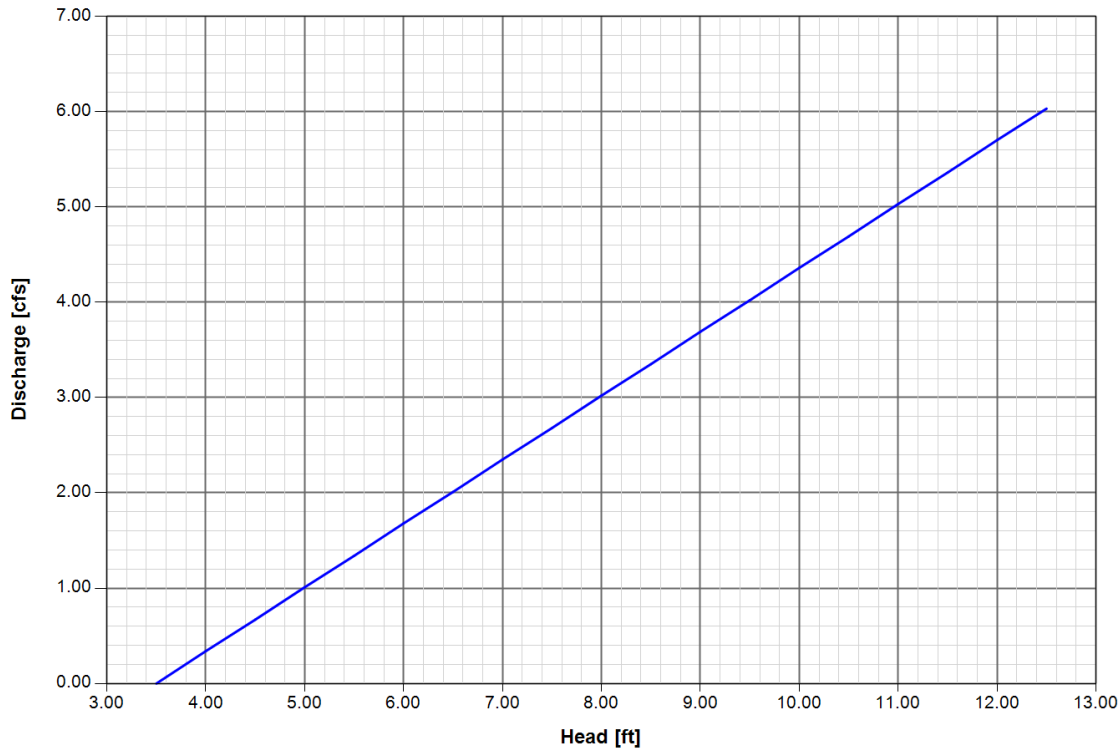
Scenario: Scenario1

Type: Head

Head [ft]	Discharge [cfs]
3.50	0.00
4.00	0.34
4.50	0.67
5.00	1.01
5.50	1.34
6.00	1.68
6.50	2.01
7.00	2.35
7.50	2.68
8.00	3.02
8.50	3.35
9.00	3.69
9.50	4.02
10.00	4.36
10.50	4.69
11.00	5.03
11.50	5.36
12.00	5.70
12.50	6.03

Comment:

Rating Curve: DWELL Scenario: Scenario1



Simulation: 100Y-3D

Scenario:	Scenario1
Run Date/Time:	8/20/2021 1:26:18 PM
Program Version:	ICPR4 4.07.08

General

Run Mode: Normal

	Year	Month	Day	Hour [hr]
Start Time:	0	0	0	0.0000
End Time:	0	0	0	72.0000

	Hydrology [sec]	Surface Hydraulics [sec]
Min Calculation Time:	60.0000	0.1000
Max Calculation Time:		30.0000

Output Time Increments

Hydrology

Year	Month	Day	Hour [hr]	Time Increment [min]
0	0	0	0.0000	15.0000
0	0	0	72.0000	15.0000

Surface Hydraulics

Year	Month	Day	Hour [hr]	Time Increment [min]
0	0	0	0.0000	15.0000
0	0	0	72.0000	15.0000

Restart File

Save Restart: False

Resources & Lookup Tables

Resources

Rainfall Folder:

Unit Hydrograph Folder:

Lookup Tables

Boundary Stage Set:
Extern Hydrograph Set:
Curve Number Set: Site
Green-Ampt Set:
Vertical Layers Set:
Impervious Set: Site

Tolerances & Options

Time Marching: SAOR
Max Iterations: 6
Over-Relax Weight Fact: 0.5 dec
dZ Tolerance: 0.0010 ft
Max dZ: 1.0000 ft
Link Optimizer Tol: 0.0001 ft
Edge Length Option: Automatic

IA Recovery Time: 24.0000 hr
Smp/Man Basin Rain Opt: Global
Rainfall Name: ~SFWMD-72
Rainfall Amount: 17.50 in
Storm Duration: 72.0000 hr
Dflt Damping (1D): 0.0050 ft
Min Node Srf Area (1D): 100 ft2
Energy Switch (1D): Energy

Comment:

Simulation: 25Y-3D

Scenario: Scenario1
Run Date/Time: 8/20/2021 1:29:49 PM
Program Version: ICPR4 4.07.08

General

Run Mode: Normal

	Year	Month	Day	Hour [hr]
Start Time:	0	0	0	0.0000
End Time:	0	0	0	72.0000

	Hydrology [sec]	Surface Hydraulics [sec]
Min Calculation Time:	60.0000	0.1000
Max Calculation Time:		30.0000

Output Time Increments

Hydrology

Year	Month	Day	Hour [hr]	Time Increment [min]
0	0	0	0.0000	15.0000
0	0	0	72.0000	15.0000

Surface Hydraulics

Year	Month	Day	Hour [hr]	Time Increment [min]
0	0	0	0.0000	15.0000
0	0	0	72.0000	15.0000

Restart File

Save Restart: False

Resources & Lookup Tables

Resources

Rainfall Folder:

Unit Hydrograph Folder:

Lookup Tables

Boundary Stage Set:
Extern Hydrograph Set:
Curve Number Set: Site
Green-Ampt Set:
Vertical Layers Set:
Impervious Set: Site

Tolerances & Options

Time Marching: SAOR
Max Iterations: 6
Over-Relax Weight Fact: 0.5 dec
IA Recovery Time: 24.0000 hr

dZ Tolerance:	0.0010 ft	Smp/Man Basin Rain Opt:	Global
Max dZ:	1.0000 ft		
Link Optimizer Tol:	0.0001 ft	Rainfall Name:	~SFWMD-72
		Rainfall Amount:	14.00 in
Edge Length Option:	Automatic	Storm Duration:	72.0000 hr
		Dflt Damping (1D):	0.0050 ft
		Min Node Srf Area (1D):	100 ft2
		Energy Switch (1D):	Energy

Comment:

REFERENCE MATERIAL

Prepared By:

HSQ GROUP, INC.

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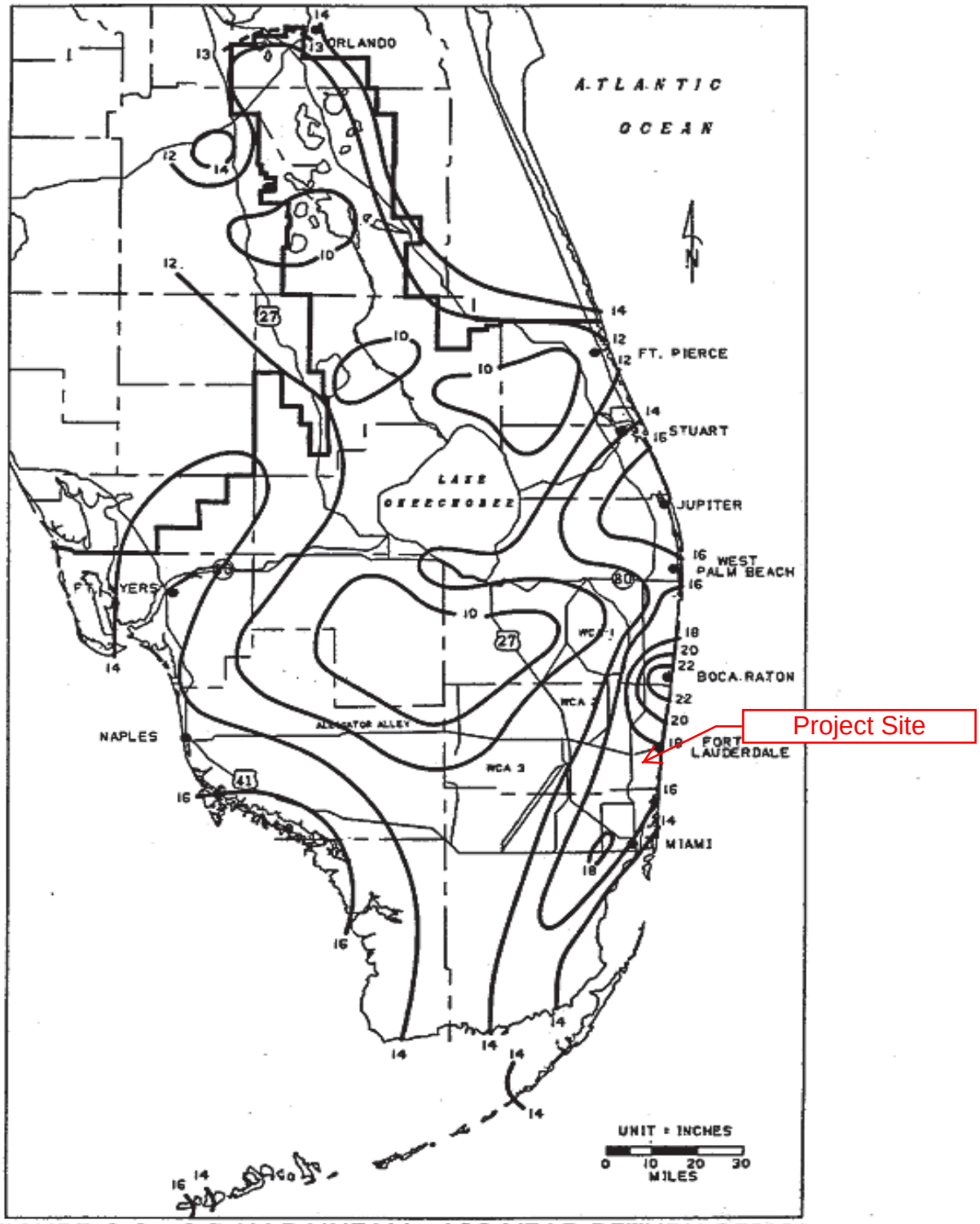


FIGURE C-9. 3-DAY RAINFALL: 100-YEAR RETURN PERIOD

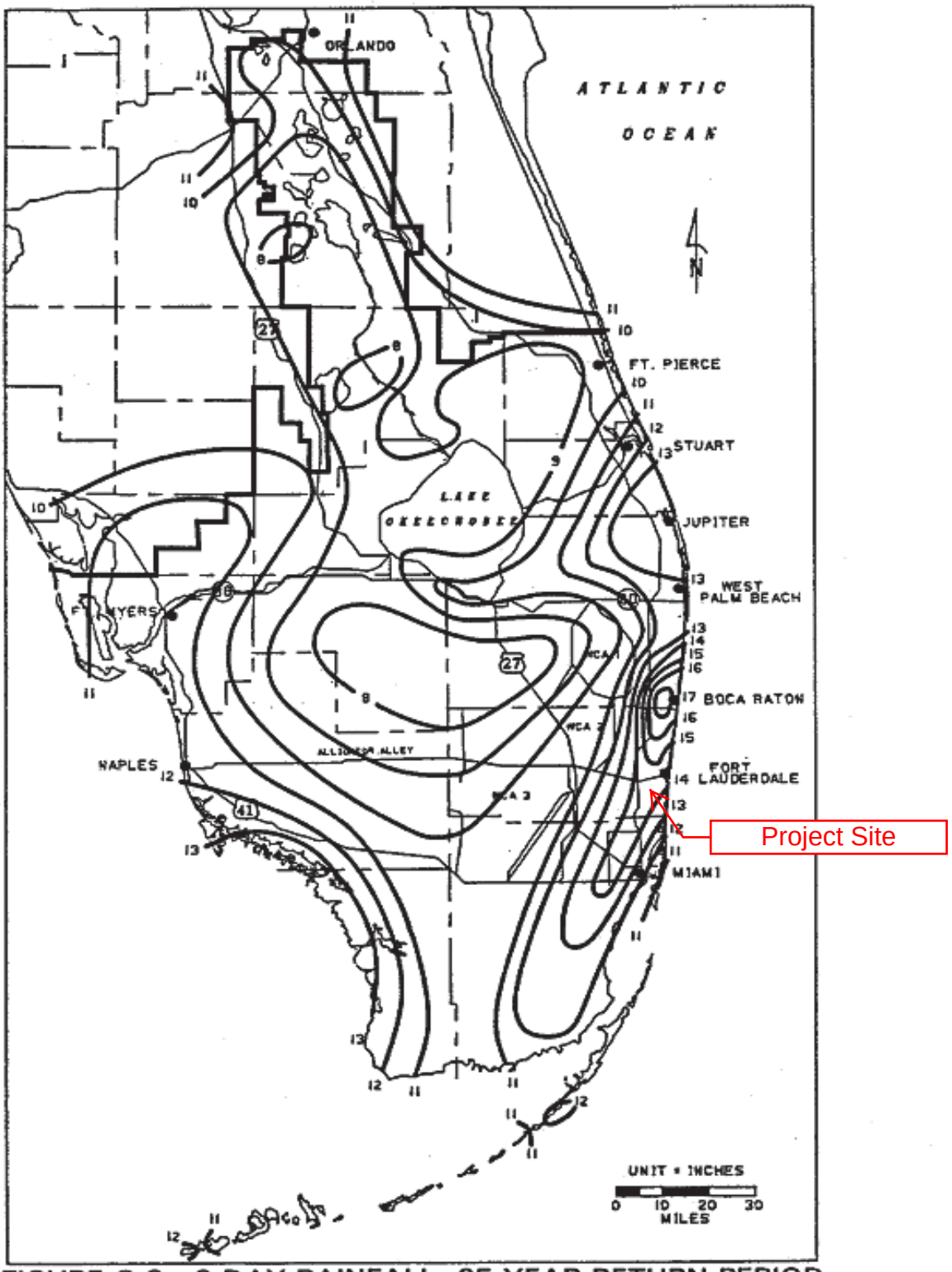
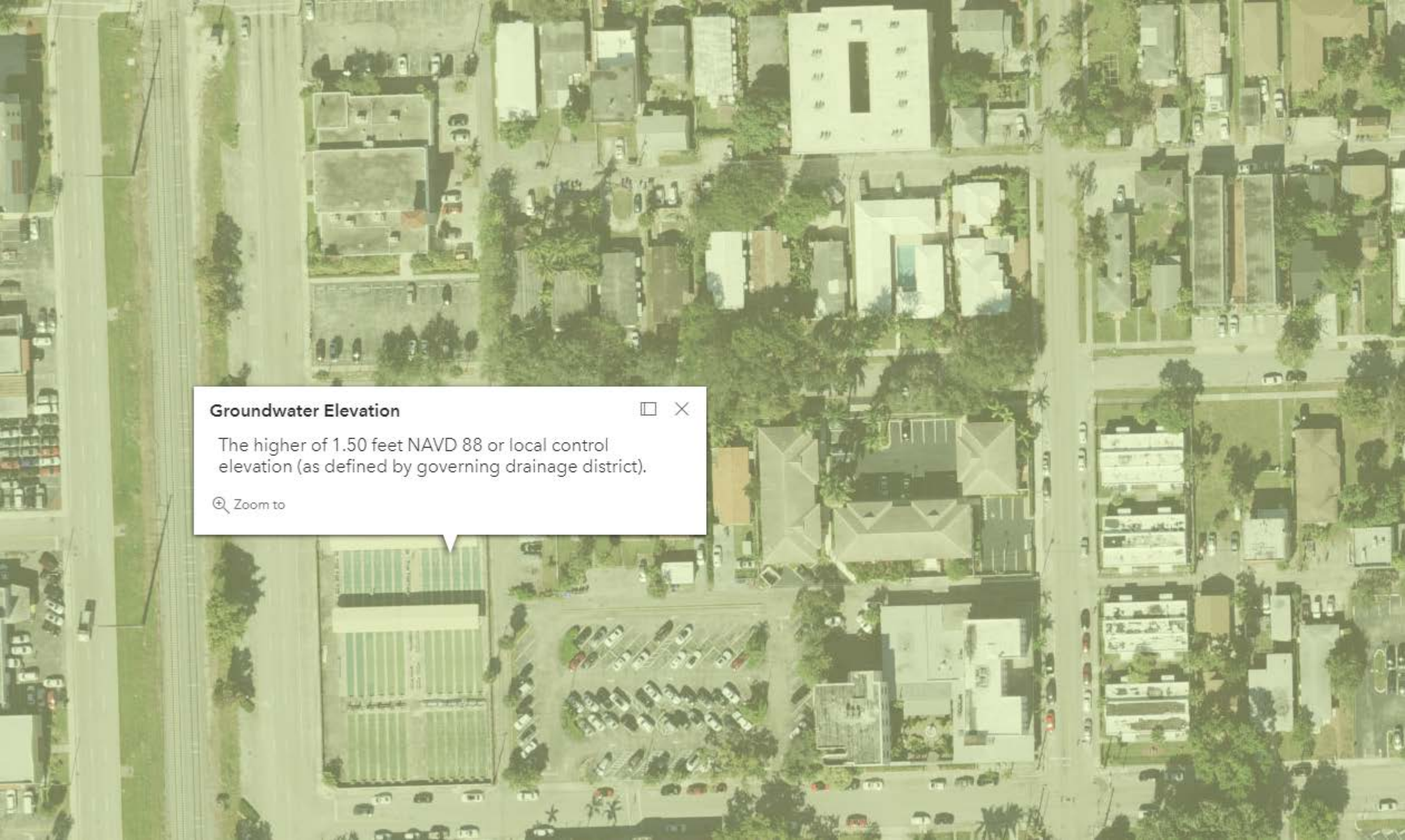
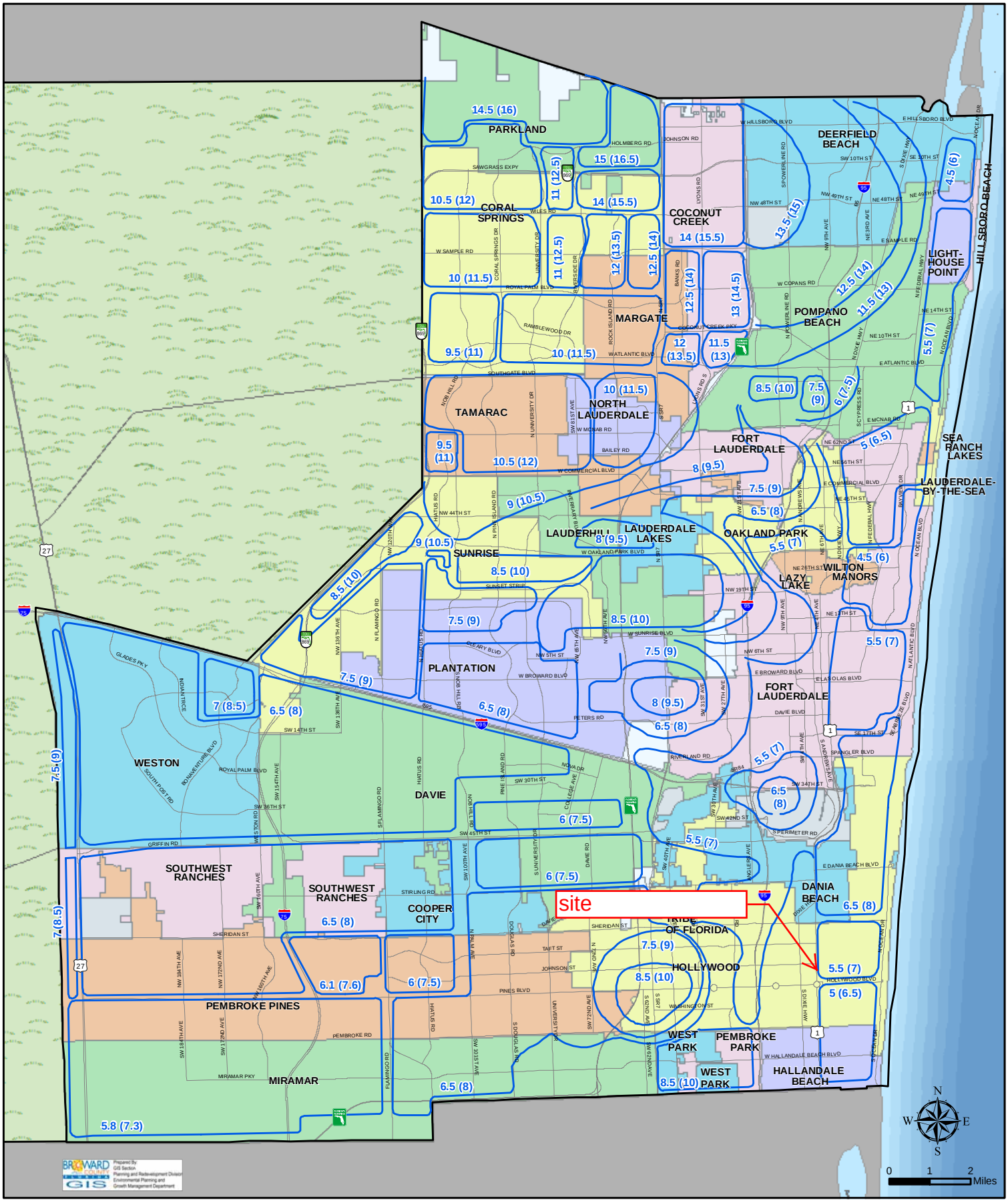


FIGURE C-8. 3-DAY RAINFALL: 25-YEAR RETURN PERIOD


Groundwater Elevation
The higher of 1.50 feet NAVD 88 or local control elevation (as defined by governing drainage district).
Zoom to

BROWARD COUNTY 100 YEAR FLOOD ELEVATIONS



100 Year Flood Contours NAVD (NGVD)
Example: 6.5 (8)

This map is for conceptual purposes only and should not be used for legal boundary determinations.

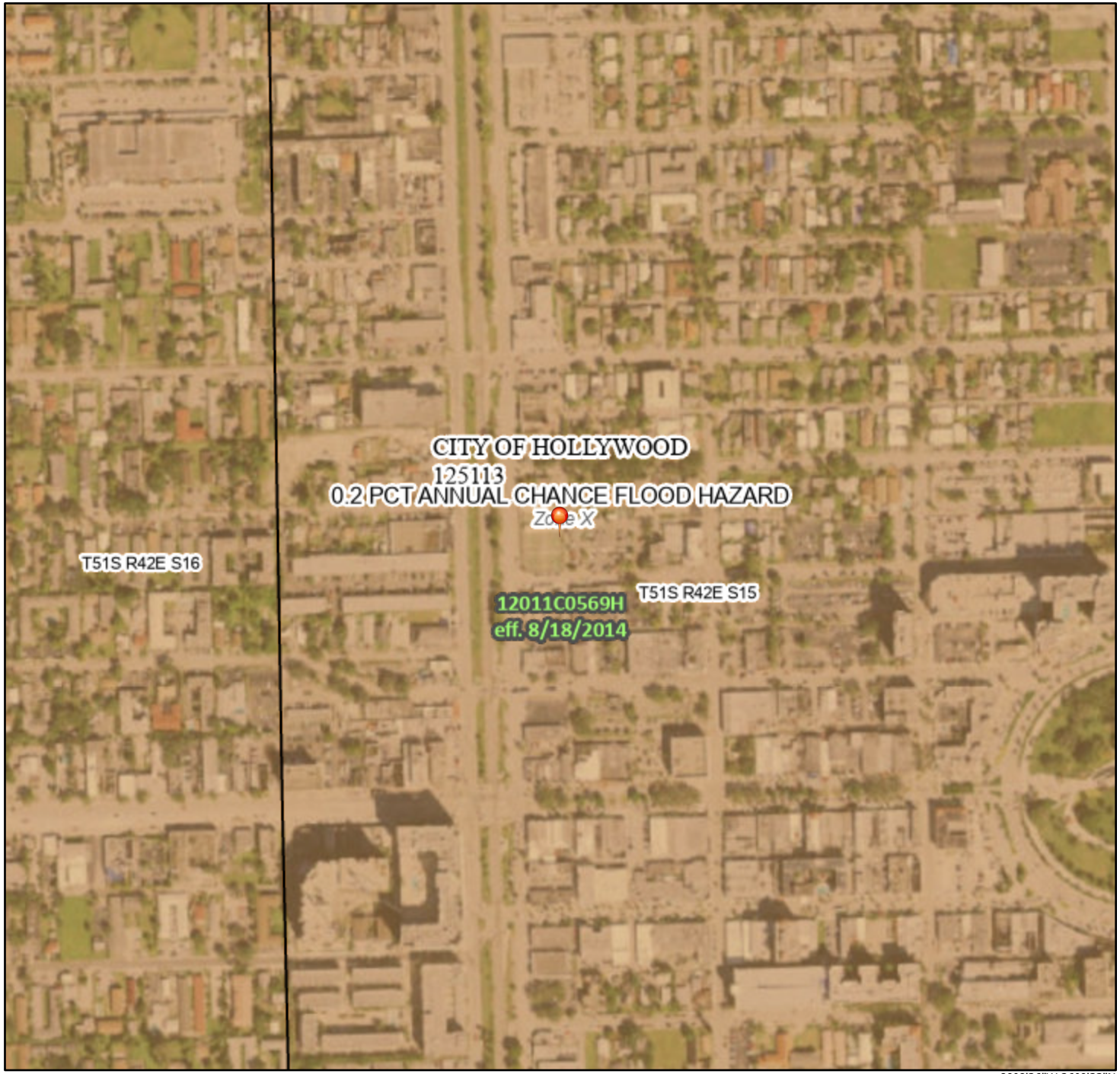
Elevations converted from NGVD to NAVD using the FEMA approved conversion factor for Broward County of (-)1.5, based on 1997 FEMA Flood Data

#12729 SNowicki 10/2014

National Flood Hazard Layer FIRMette

FEMA

80°9'13"W 26°1'5"N



80°8'36"W 26°0'33"N

Feet

0 250 500 1,000 1,500 2,000

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
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

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 8/18/2021 at 12:04 PM 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.

PERCOLATION TESTS

Prepared By:

HSQ GROUP, INC.

Engineers ● Planners ● Surveyors

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Percolation Test

Client	**Housing Trust Group**	Boring No.	**B-5**
Project	University Station, Hollywood, FL	Date Started	7/6/2021
Boring Location	See Boring Location Plan	Date Completed	7/6/2021
Elev. Ref.	N/A	PACIFICA Proj. No.	320-21024
Remarks			

Subsurface Profile	
Depth (ft)	**Soil Description**
0-0.1	ASPHALT
0.1-0.5	Base Material / LIMEROCK
0.5-8	Light to Dark Brown/Gray Fine SAND
8-10	Light Brown Fine SAND with Limestone

Percolation Results

Diameter		Depth of Hole (ft)	Depth of Groundwater Level Below Ground Surface (ft)		Hydraulic Head (ft)	Saturated Hole Depth (ft)	Average Flow Rate (gpm)	K, Hydraulic Conductivity cfs/ft^2-ft
Casing (in)	Perforated PVC (in)		Prior to Test	During Test				
6	4	10	8.5	0	8.5	1.5	4.8	2.0E-04

Note:

(1) The above hydraulic conductivity values are for a french drain installed to the same depth as the borehole tests. The values represent an ultimate value. The designer should apply the appropriate factor of safety.

(2) The hydraulic conductivity values were calculated based on the South Florida Water Management District's USUAL OPEN HOLE CONSTANT HEAD percolation test procedure as shown on the "Equations in SFWMD Permit Information Manual, Volume IV".

(3) A diameter of four inches was used in the computation of the Hydraulic Conductivity value presented in the above table.

Percolation Test

Client	**Housing Trust Group**	Boring No.	**B-10**
Project	University Station, Hollywood FL	Date Started	7/2/2021
Boring Location	See Boring Location Plan	Date Completed	7/2/2021
Elev. Ref.	N/A	PACIFICA Proj. No.	320-21024
Remarks			

Subsurface Profile	
Depth (ft)	**Soil Description**
0-0.1	ASPHALT
0.1-0.5	Base Material / LIMEROCK
0.5-8	Light to Dark Brown/Gray Fine SAND
8-10	Light Gray Sandy LIMESTONE

Percolation Results

Diameter		Depth of Hole (ft)	Depth of Groundwater Level Below Ground Surface (ft)		Hydraulic Head (ft)	Saturated Hole Depth (ft)	Average Flow Rate (gpm)	K, Hydraulic Conductivity cfs/ft^2-ft
Casing (in)	Perforated PVC (in)		Prior to Test	During Test				
6	4	10	7	0	7	3	5.7	2.6E-04

Note:

(1) The above hydraulic conductivity values are for a french drain installed to the same depth as the borehole tests. The values represent an ultimate value. The designer should apply the appropriate factor of safety.

(2) The hydraulic conductivity values were calculated based on the South Florida Water Management District's USUAL OPEN HOLE CONSTANT HEAD percolation test procedure as shown on the "Equations in SFWMD Permit Information Manual, Volume IV".

(3) A diameter of four inches was used in the computation of the Hydraulic Conductivity value presented in the above table.

SURFACE WATER MANAGEMENT CALCULATIONS

UNIVERSITY STATION PHASE 2 BUILDING

CITY OF HOLLYWOOD, BROWARD COUNTY, FLORIDA
HSQ PROJECT No.: 2107-63

PREPARED FOR:

HOUSING TRUST GROUP

3225 AVIATION AVENUE, 6TH FLOOR
COCONUT GROVE, FL 333133

Prepared By:

HSQ GROUP, INC.

Engineers ● Planners ● Surveyors
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Sunrise, FL 33351
(954) 440-6990 Phone

DATE: 08/20/2021

PROPOSED UNIVERSTIY STATION PHASE 2 BUILDING

POST-CONDITION DRAINAGE CALCULATIONS

Water Table: 1.50 NAVD

Land Use Summary:

Lake/Water Areas (A_L):	0	sf	or	0.000	ac
Roof Areas (A_R):	14,299	sf	or	0.328	ac
Paved Areas (A_P):	17,104	sf	or	0.393	ac
Green Areas (A_G):	7,431	sf	or	0.171	ac
Total (A_T):	38,834	sf	or	0.892	ac

Compute Required Pretreatment Volume:

1. Provide at least 1/2 inch over the developed project:

V_{PRE} = 0.5 inch x A_T x 1 ft / 12 inches
= 0.5 x 2.013 / 12
= 0.04 ac-ft or 0.45 ac-in

Compute Water Quality Volume:

1. Provide at least 1 inch over the developed project:

V_{PRE} = 1 inch x A_T x 1 ft / 12 inches
= 1 x 2.013 / 12
= 0.07 ac-ft or 0.89 ac-in

2. Provide 2.5" over % impervious area:

a) Site Area for water quality pervious/impervious calculation:

A_S = A_T - (A_L + A_R)
= 2.013 - (+)
= 0.563 ac of site area for water quality pervious/impervious

b) Impervious area for water quality pervious/impervious calculation:

A_{IMP} = A_S - A_G
= 0.563 -
= 0.39 ac of impervious area for water quality pervious/impervious

c) Percent of impervious for water quality calculation:

= A_{IMP} / A_S x 100%
= 0.392 / 0.563 x 100%
= 69.6% impervious

d) For 2.5" times the percent impervious:

= 2.5" x % impervious area
= 2.5 x 0.696
= 1.74 inches to be treated

e) Compute volume required volume for quality detention

V_{PRE} = inches to be treated x (A_T - A_L)
= 1.74 x (-) x 1 foot / 12 inches)
= 0.13 ac-ft or 1.55 ac-in

3. Since the 1.55 ac-in is greater than the 0.89 ac-in computed for the first inch of runoff, the volume 1.55 ac-in controls

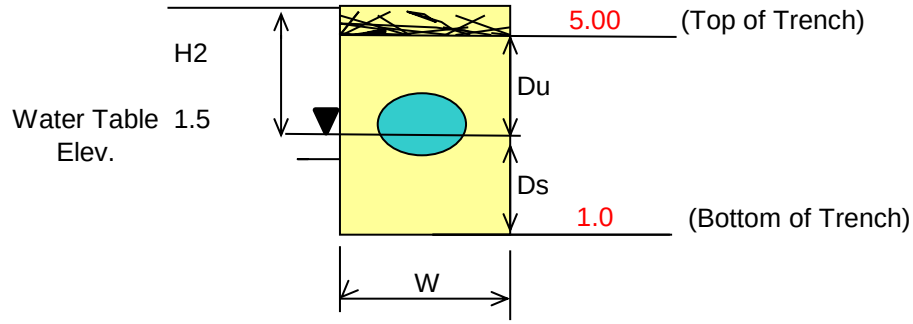
PROPOSED UNIVERSTIY STATION PHASE 2 BUILDING

EXFILTRATION TRENCH CALCULATIONS

K-Value:

Test Hole #	(cfs/ft^2/ft hd)
P-1	2.00E-04
P-2	2.60E-04
K_{AVG}	2.30E-04

(Min. Pavement Elev.) 9.00
Wier Elevation 6.00



K =		2.30E-04	cfs/ft^2 - ft head
H_2 =		4.50	ft
W =		6.00	ft
D_u =		3.50	ft
D_s =		0.50	ft
H = Du + Ds =		4.00	ft

1) Trench Length for Water Quality Requirements:

V = 1.55 ac-in or 0.13 ac-ft

$$L = \frac{V\,(FS)}{K(H2W + 2H2Du - Du\text{^}2 + 2H2Ds) + (1.39 \times 10\text{^}-4)WDu}$$

*FS= 2.0

L = 212.5 feet

2) Maximum Trench Length:

V = 3.28 inches X 0.89 acres = 2.92 ac-in or 0.24 ac-ft

L = 200.4 feet

3) Provided Trench Volume:

L = 215 LF Provided

V = (1/FS)L x (K(2H2Du - Du^2 + 2H2Ds) + (1.39 x 10^-4)Wdu)

V = 1.57 ac-in or 0.13 ac-ft *

* Since provided storage volume exceeds water quality requirement, 50% of excess strorage volume is credited. (SFWMD Page G-1)

Vexcess = 1.57 ac-in (215 LF) - 1.55 ac-in (water quality) = 0.02 ac-in

V= 1.55 ac-in + (0.02 ac-in X 50%) =

V= 1.56 ac-in or 0.13 ac-ft

PROPOSED UNIVERSTIY STATION PHASE 2 BUILDING

STAGE\STORAGE AREA CALCULATION POST

Exist. Grades

Stage	Pavement Area Area 0.393 0.000 (ac.-ft.)	Landscape Area Area 0.171 0.000 (ac.-ft.)	0.000 0.000 (ac.-ft.)	Area 0.000 0.000 (ac.-ft.)	Area 0.000 0.000 (ac.-ft.)	Area 0.000 0.000 (ac.-ft.)	Area 0.000 0.000 (ac.-ft.)	Exfiltration Trench (See Previous Calculations) (ac.-ft.)	Buildng Area 0.328 0.000 (ac.-ft.)	Total Site 0.892
1.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.02
2.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.04
3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.06
3.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.07
4.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.09
4.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.11
5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.13
5.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.13
6.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.13
6.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.13
7.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.13
7.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.13
8.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.13
8.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.13
9.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.13
9.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.13
10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.13
10.50	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.17
11.00	0.11	0.05	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.28
11.50	0.24	0.10	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.47
12.00	0.42	0.18	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.74

Soil Storage Post

Land Use Summary:

	Acres	Percent	
Lake Areas (A_L):	0.000	N/A	(Not Included)
Roof Areas (A_R):	0.328	36.8%	
Paved Areas (A_P):	0.393	44.0%	
Green Areas (A_G):	0.171	19.1%	
Total (A_T):	0.892	100.0%	

Compacted Soil Storage per SFWMD Vol. IV Page C-III-1

Depth to Water Table (feet)	Water Storage (inches)
1	0.45
2	1.88
3	4.05
4	6.75

Average Pervious Grade (Elev.): 6.00 ft
Depth to Water Table: 4.50 ft
Soil Storage at Average Depth (S_S): 6.75 inches

Weighted S value:
= S_S x % Pervious
= 6.75 x 0.191 =
= **1.29 inches**

Rainfalls (P)

From Figure C-5, 25-Year, 72-Hour Storm = 14.00 inches

From Figure C-9, 100-Year, 72-Hour Storm = 17.50 inches

SFMWD Storm Events

25-Yr 3-Day Storm Event

Stage for 25-Year 3-day Storm Event 8.05 ft. NAVD See attached ICPR Model

100-Yr 3-Day Storm Event

Stage for 100-Year 3-day Storm Event 8.44 ft. NAVD See attached ICPR Model

DRAINAGE WELL CALCULATIONS

Prepared By:

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Storm Runoff Calculations

Note: Poriotn of waterway is included within the property area, but has been exlcuded from drainage area calculations as runoff in this area is not contained within site.

1. Weighted Runoff Coefficient C

Runoff Coefficient Impervious (C1) = 0.95
Runoff Coefficient Pervious (C2)= 0.2

A1 =	Impervious Area =	0.721	80.83%
A2 =	Pervious Area =	0.171	19.17%
A =	Total Area =	0.892	100.00%

C = {(A1 x C1) + (A2 x C2)} / A =
C = {(0.721 x 0.95)+(0.171 x 0.2)} /0.892 = 0.81

CA (Contributing Area) = C x A
CA = 0.81 x 0.892 = 0.723

2. Time Required to Generate One Inch of Runoff

Rainfall Intensity (I) = 308.5 / [48.6 x F^-0.11) + t*(0.5895 + F^-2/3)]
Frequency (F) = 10 Years

STORM RUNOFF CALCULATION TABLE

Time (t) (min.) {1}	Intensity (I) (in./hr) {2}	Contributing Area (C*A) {3}	Inflow Rate (cfs) (C*I*A) {4}	Inflow Volume (CF) (CIA*t) {5}	
8	6.99	0.723	5.05	2424.1	
10	6.74	0.723	4.87	2923.6	
13.162	6.38	0.723	4.62	3645.3	Time to Generate 1" of Runoff
15	6.19	0.723	4.48	4031.0	
20	5.73	0.723	4.14	4972.7	
23.162	5.47	0.723	3.96	5498.9	Total Time required to collect 1" of Runoff (10 min. t_C)
25	5.33	0.723	3.86	5783.5	
30	4.99	0.723	3.60	6488.7	
40	4.41	0.723	3.19	7655.7	
50	3.96	0.723	2.86	8581.7	
60	3.59	0.723	2.59	9334.4	
90	2.80	0.723	2.02	10932.6	
120	2.30	0.723	1.66	11956.1	

Q = CIA, V = Qt, $V_{(1")} = Qt_{(1")}$, $t_{(1")}$ = Time to generate 1" of runoff
$V_{(1")} = 1" \times A = CIAt_{(1")}$
V (1") = 0.074 Ac-ft or 3,238 cf

Time to generate one inch of run-off, $t_{(1")}$ = 11.377 minutes
Time to reach inlet, $t_{(C)}$ = 10 minutes
Total time required to collect 1" runoff= 21.377 minutes

3. Calculate Peak Runoff (Q)

Rainfall Intesity at T(21.377) = 5.711 in/hr
Peak Runoff (Q)= CA* I = 0.723 x 5.711 = **4.13** cfs

DRAINAGE WELL CALCULATIONS

Drainage Well Structures

Well No.	Rim / Grate Elev. (NAVD)	Lowest Inlet/ Weir Elev. (NAVD)	Design Ground Water Elevation (NAVD)	Well Structure			Structure Storage Volume (CF)
				Width (ft)	Length (ft)	H Req. (ft)	
1	9.50	6.00	1.50	6	11.00	6.00	396.00
						6.00	396

1. Drainage Well Structure Volume Calculations

Drainage well structure must be designed to detain runoff for a minum of 90 seconds prior to discharge

Required Runoff (Q) =	4.13	cfs
Min. Det. Volume = Runoff x 90 sec =	372	cf
Width of Well Structure (W) =	6	ft
Length of Well Structure (L) =	11.00	ft
Min. Height Required =	5.63	

Note: This is the total depth required from the top of well casing to the floor of the well box to achieve 90 second detention time

Proposed Number of Drainage Wells =	1	
Detention Volume Per Well Structure (cf) =	372	cf
Height Per Well (Top of Well to Bottom of Structure) =	5.63	ft
Top of Well Casing Elevation =	1.50	NAVD
Bottom of Structure Elevation =	-4.50	NAVD
Casing Height in Structure (H) =	6.00	ft

Det. Volume Per Well Structure (V)= H x W x L= 6 x 11 x 6 396 cf

2. Well Flotation Calculations

Calculate Upward Force:

Well Box Outside Length Dimension	12.33	ft.
Well Box Outside Width Dimension	7.33	ft.
Design Water Table	1.50	NAVD
Elevation at Bottom of Bottom Slab	-5.17	NAVD
Well Rim Elevation/Top of Slab	9.50	NAVD
Displacement Depth	14.67	ft.
Discplacement Volume	1,327	c.f.
Upward Force	82,775	lbs.

Calculate Downward Force:

Well Box Top Slab Thickness	8	inches
Well Box Wall Thickness	8	inches
Well Box Bottom Slab Thickness	8	inches
Top Slab Volume	60.30	c.f.
Wall Volume	358.52	c.f.
Bottom Slab Volume	60.30	c.f.
Total Volume	479.11	c.f.
Downward Force	71,867	lbs.

Total Force = Upward Force - Downward Force = -6,029 **OK**

DRAINAGE WELL DESIGN INPUTS

Per field data supplied by local drainage well company the general area is anticipated to produce a well with a capacity of 300 gpm/foot. This data will need to be confirmed at time of the well development and or reasonable assurance report.

1. Well Operating Table:

Design Discharge (Avg.) 300 gpm/foot
Number of Wells 1
Begin Discharge at Elevation 3.50 (Assume Top of Well Casing+ 2' to Overcome Column of Salt Water)

CFS/FT = (300 gal/min) * 1 ft/s / 448.83 gal/min = 0.67 cfs

Elev (ft)	Discharge (cfs) per well				Total Discharge
3.50	0.67 cfs x	0.00'	=	0.00 cfs	0.00 cfs
4.00	0.67 cfs x	0.50'	=	0.34 cfs	0.34 cfs
4.50	0.67 cfs x	1.00'	=	0.67 cfs	0.67 cfs
5.00	0.67 cfs x	1.50'	=	1.01 cfs	1.01 cfs
5.50	0.67 cfs x	2.00'	=	1.34 cfs	1.34 cfs
6.00	0.67 cfs x	2.50'	=	1.68 cfs	1.68 cfs
6.50	0.67 cfs x	3.00'	=	2.01 cfs	2.01 cfs
7.00	0.67 cfs x	3.50'	=	2.35 cfs	2.35 cfs
7.50	0.67 cfs x	4.00'	=	2.68 cfs	2.68 cfs
8.00	0.67 cfs x	4.50'	=	3.02 cfs	3.02 cfs
8.50	0.67 cfs x	5.00'	=	3.35 cfs	3.35 cfs
9.00	0.67 cfs x	5.50'	=	3.69 cfs	3.69 cfs
9.50	0.67 cfs x	6.00'	=	4.02 cfs	4.02 cfs
10.00	0.67 cfs x	6.50'	=	4.36 cfs	4.36 cfs
10.50	0.67 cfs x	7.00'	=	4.69 cfs	4.69 cfs
11.00	0.67 cfs x	7.50'	=	5.03 cfs	5.03 cfs
11.50	0.67 cfs x	8.00'	=	5.36 cfs	5.36 cfs
12.00	0.67 cfs x	8.50'	=	5.70 cfs	5.70 cfs
12.50	0.67 cfs x	9.00'	=	6.03 cfs	6.03 cfs

2. Weir Information

Top of Weir Elevation = 6.00 NAVD
Rim of Sturcture Elevation = 9.50 NAVD
Bottom of Structure Top Slab Elevation = 7.75 NAVD
Rim Thickness = 7.00 Inches
Total Brick Thickness = 6.00 Inches
Top Slab Thickness = 8.00 Inches
Height of Opening = 1.75 FT
Weir Length Per Structure = 6 LF
Total Weir Length = 6 LF

ICPR MODEL

Prepared By:

HSQ GROUP, INC.

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Node Max Conditions [Scenario1]

Node Name	Sim Name	Warning Stage [ft]	Max Stage [ft]	Min/Max Delta Stage [ft]	Max Total Inflow [cfs]	Max Total Outflow [cfs]	Max Surface Area [ft2]
Phase2 Building (Node)	100Y-3D	13.00	8.44	0.0010	0.84	1.17	1742
Phase2 Building (Node)	25Y-3D	13.00	8.05	0.0010	0.78	1.00	1742

Manual Basin: Phase2 Building

Scenario: Scenario1
Node: Phase2 Building (Node)
Hydrograph Method: NRCS Unit Hydrograph
Infiltration Method: Curve Number
Time of Concentration: 10.0000 min
Max Allowable Q: 9999.00 cfs
Time Shift: 0.0000 hr
Unit Hydrograph: UH323
Peaking Factor: 323.0
Area: 0.8920 ac

Area [ac]	Land Cover Zone	Soil Zone	Rainfall Name
0.3280	Building	A	
0.3930	Impervious	A	
0.1710	Pervious	A	

Comment:

Node: DWELL

Scenario: Scenario1
Type: Stage/Area
Base Flow: 1.50 cfs
Initial Stage: 0.00 ft
Warning Stage: 13.00 ft

Stage [ft]	Area [ac]	Area [ft2]
1.50	0.0000	0
13.00	0.0000	0

Comment:

Node: Groundwater

Scenario: Scenario1
Type: Time/Stage
Base Flow: 0.00 cfs
Initial Stage: 1.50 ft
Warning Stage: 13.00 ft
Boundary Stage:

Year	Month	Day	Hour	Stage [ft]
0	0	0	0.0000	1.50
0	0	0	72.0000	1.50
0	0	0	96.0000	1.50

Comment:

Node: Phase2 Building (Node)

Scenario: Scenario1
Type: Stage/Volume
Base Flow: 0.00 cfs
Initial Stage: 1.50 ft
Warning Stage: 13.00 ft

Stage [ft]	Volume [ac-ft]	Volume [ft3]
1.50	0.00	0
2.00	0.02	871
2.50	0.04	1742
3.00	0.06	2614
3.50	0.07	3049
4.00	0.09	3920
4.50	0.11	4792
5.00	0.13	5663
5.50	0.13	5663
6.00	0.13	5663
6.50	0.13	5663
7.00	0.13	5663
7.50	0.13	5663
8.00	0.13	5663
8.50	0.13	5663
9.00	0.13	5663
9.50	0.13	5663
10.00	0.13	5663
10.50	0.17	7405
11.00	0.28	12197
11.50	0.47	20473
12.00	0.74	32234

Comment:

Rating Curve Link: DWELL

Scenario: Scenario1
From Node: DWELL
To Node: Groundwater
Link Count: 1
Flow Direction: Both

Table	Elev On [ft]	Elev On Node	Elev Off [ft]	Elev Off Node
DWELL	1.50	Phase2 Building (Node)	1.49	Phase2 Building (Node)

Comment:

Drop Structure Link: Weir

Scenario: Scenario1
From Node: Phase2 Building (Node)
To Node: DWELL
Link Count: 1
Flow Direction: Both
Solution: Combine
Increments: 0
Pipe Count: 1
Damping: 0.0000 ft
Length: 200.00 ft
FHWA Code: 0
Entr Loss Coef: 0.00
Exit Loss Coef: 0.00
Bend Loss Coef: 0.00
Bend Location: 0.00 dec
Energy Switch: Energy

Upstream Pipe

Invert: 1.50 ft
Manning's N: 0.0130

Geometry: Circular

Max Depth: 2.00 ft

Bottom Clip

Default: 0.00 ft
Op Table:
Ref Node:
Manning's N: 0.0000

Top Clip

Default: 0.00 ft
Op Table:
Ref Node:
Manning's N: 0.0000

Downstream Pipe

Invert: 1.50 ft
Manning's N: 0.0130

Geometry: Circular

Max Depth: 2.00 ft

Bottom Clip

Default: 0.00 ft
Op Table:
Ref Node:
Manning's N: 0.0000

Top Clip

Default: 0.00 ft
Op Table:
Ref Node:
Manning's N: 0.0000

Pipe Comment:

Weir Component

Weir: 1
Weir Count: 1
Weir Flow Direction: Both
Damping: 0.0000 ft
Weir Type: Horizontal
Geometry Type: Rectangular
Invert: 6.00 ft
Control Elevation: 1.50 ft
Max Depth: 1.75 ft
Max Width: 6.00 ft
Fillet: 0.00 ft

Bottom Clip

Default: 0.00 ft
Op Table:
Ref Node:

Top Clip

Default: 0.00 ft
Op Table:
Ref Node:

Discharge Coefficients

Weir Default: 3.200
Weir Table:
Orifice Default: 0.600
Orifice Table:

Weir Comment:

Drop Structure Comment:

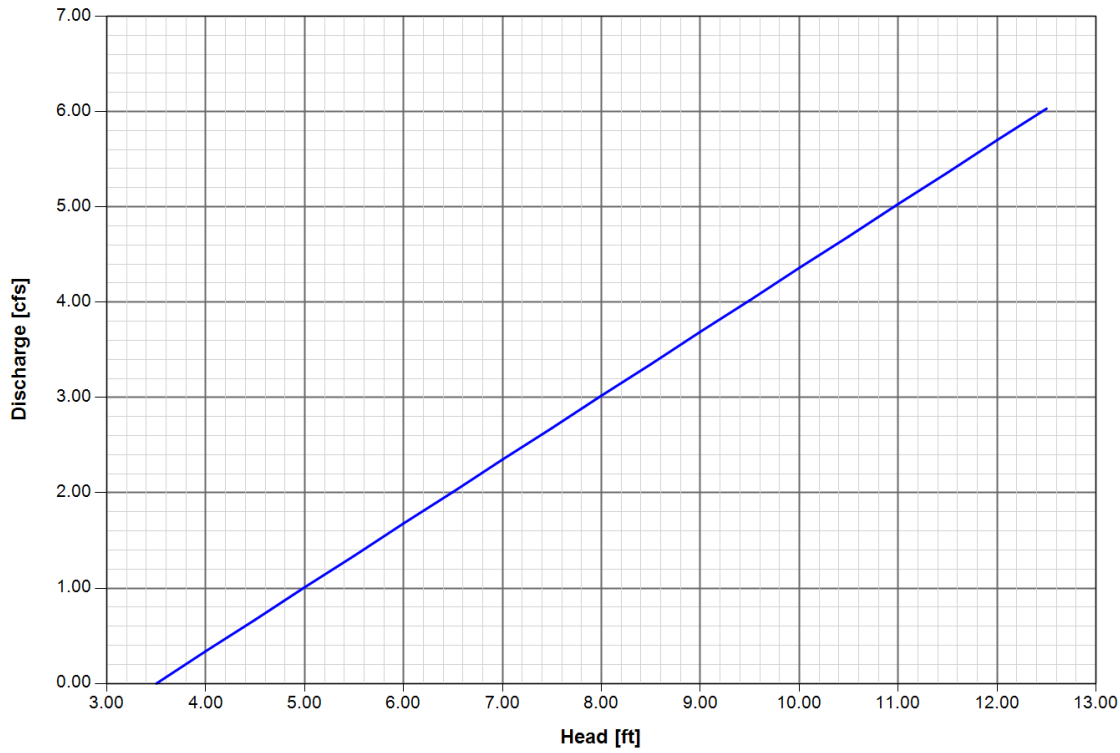
Rating Curve: DWELL

Scenario: Scenario1
Type: Head

Head [ft]	Discharge [cfs]
3.50	0.00
4.00	0.34
4.50	0.67
5.00	1.01
5.50	1.34
6.00	1.68
6.50	2.01
7.00	2.35
7.50	2.68
8.00	3.02
8.50	3.35
9.00	3.69
9.50	4.02
10.00	4.36
10.50	4.69
11.00	5.03
11.50	5.36
12.00	5.70
12.50	6.03

Comment:

Rating Curve: DWELL Scenario: Scenario1



Simulation: 100Y-3D

Scenario:	Scenario1
Run Date/Time:	8/20/2021 3:03:07 PM
Program Version:	ICPR4 4.07.08

General

Run Mode: Normal

	Year	Month	Day	Hour [hr]
Start Time:	0	0	0	0.0000
End Time:	0	0	0	72.0000

	Hydrology [sec]	Surface Hydraulics [sec]
Min Calculation Time:	60.0000	0.1000
Max Calculation Time:		30.0000

Output Time Increments

Hydrology

Year	Month	Day	Hour [hr]	Time Increment [min]
0	0	0	0.0000	15.0000
0	0	0	72.0000	15.0000

Surface Hydraulics

Year	Month	Day	Hour [hr]	Time Increment [min]
0	0	0	0.0000	15.0000
0	0	0	72.0000	15.0000

Restart File

Save Restart: False

Resources & Lookup Tables

Resources

Rainfall Folder:

Unit Hydrograph Folder:

Lookup Tables

Boundary Stage Set:
Extern Hydrograph Set:
Curve Number Set: Site
Green-Ampt Set:
Vertical Layers Set:
Impervious Set: Site

Tolerances & Options

Time Marching: SAOR
Max Iterations: 6
Over-Relax Weight Fact: 0.5 dec
dZ Tolerance: 0.0010 ft
Max dZ: 1.0000 ft
Link Optimizer Tol: 0.0001 ft
Edge Length Option: Automatic

IA Recovery Time: 24.0000 hr
Smp/Man Basin Rain Opt: Global
Rainfall Name: ~SFWMD-72
Rainfall Amount: 17.50 in
Storm Duration: 72.0000 hr
Dflt Damping (1D): 0.0050 ft
Min Node Srf Area (1D): 100 ft2
Energy Switch (1D): Energy

Comment:

Simulation: 25Y-3D

Scenario: Scenario1
Run Date/Time: 8/20/2021 3:06:05 PM
Program Version: ICPR4 4.07.08

General

Run Mode: Normal

	Year	Month	Day	Hour [hr]
Start Time:	0	0	0	0.0000
End Time:	0	0	0	72.0000

	Hydrology [sec]	Surface Hydraulics [sec]
Min Calculation Time:	60.0000	0.1000
Max Calculation Time:		30.0000

Output Time Increments

Hydrology

Year	Month	Day	Hour [hr]	Time Increment [min]
0	0	0	0.0000	15.0000
0	0	0	72.0000	15.0000

Surface Hydraulics

Year	Month	Day	Hour [hr]	Time Increment [min]
0	0	0	0.0000	15.0000
0	0	0	72.0000	15.0000

Restart File

Save Restart: False

Resources & Lookup Tables

Resources

Rainfall Folder:
Unit Hydrograph Folder:

Lookup Tables

Boundary Stage Set:
Extern Hydrograph Set:
Curve Number Set: Site
Green-Ampt Set:
Vertical Layers Set:
Impervious Set: Site

Tolerances & Options

Time Marching: SAOR
Max Iterations: 6
Over-Relax Weight Fact: 0.5 dec
IA Recovery Time: 24.0000 hr

dZ Tolerance:	0.0010 ft	Smp/Man Basin Rain Opt:	Global
Max dZ:	1.0000 ft		
Link Optimizer Tol:	0.0001 ft	Rainfall Name:	~SFWMD-72
		Rainfall Amount:	14.00 in
Edge Length Option:	Automatic	Storm Duration:	72.0000 hr
		Dflt Damping (1D):	0.0050 ft
		Min Node Srf Area (1D):	100 ft2
		Energy Switch (1D):	Energy

Comment:

REFERENCE MATERIAL

Prepared By:

HSQ GROUP, INC.

Engineers ● Planners ● Surveyors

4577 North Nob Hill Road, Suite 210

Sunrise, FL 33351

(954) 440-6990 Phone

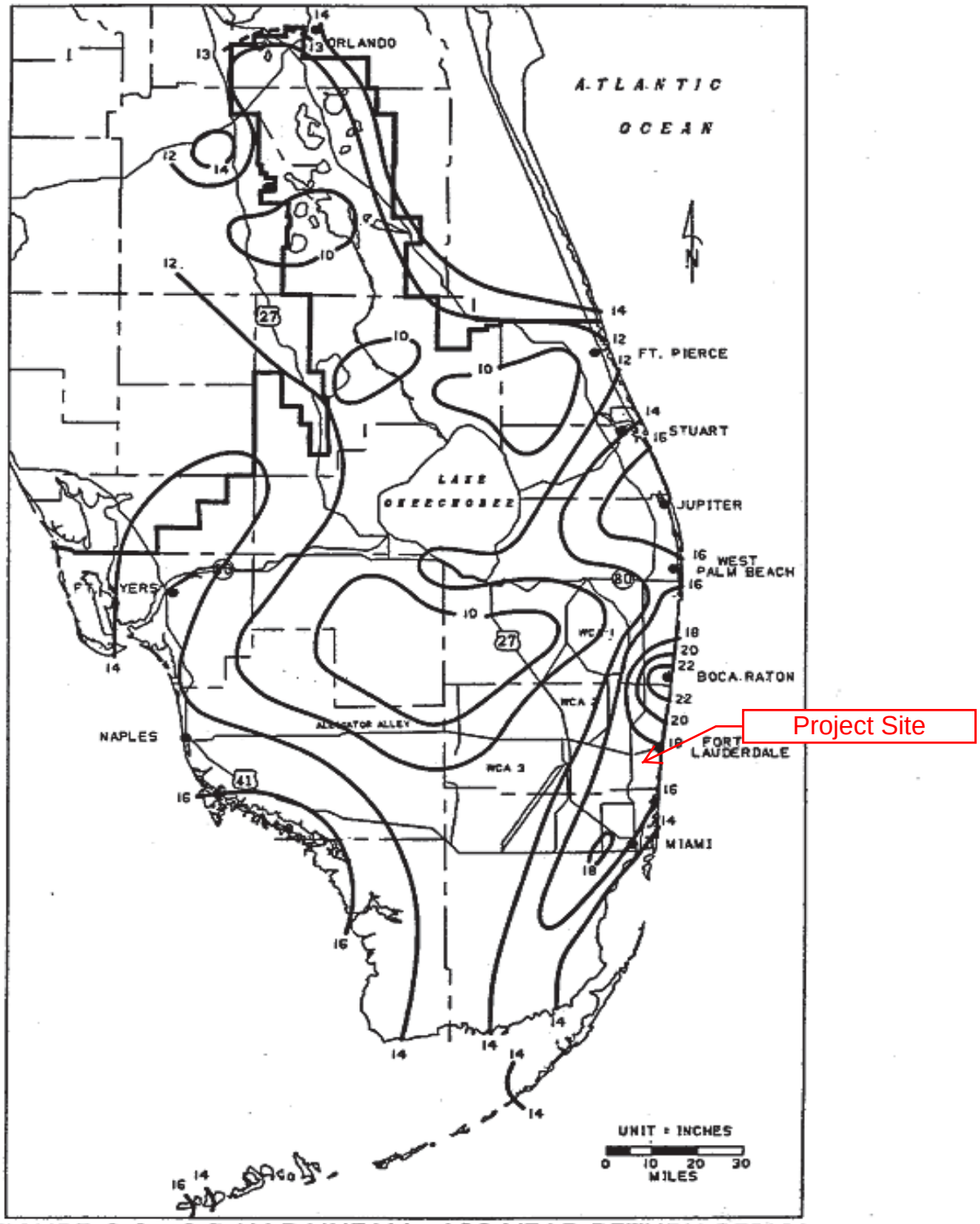


FIGURE C-9. 3-DAY RAINFALL: 100-YEAR RETURN PERIOD

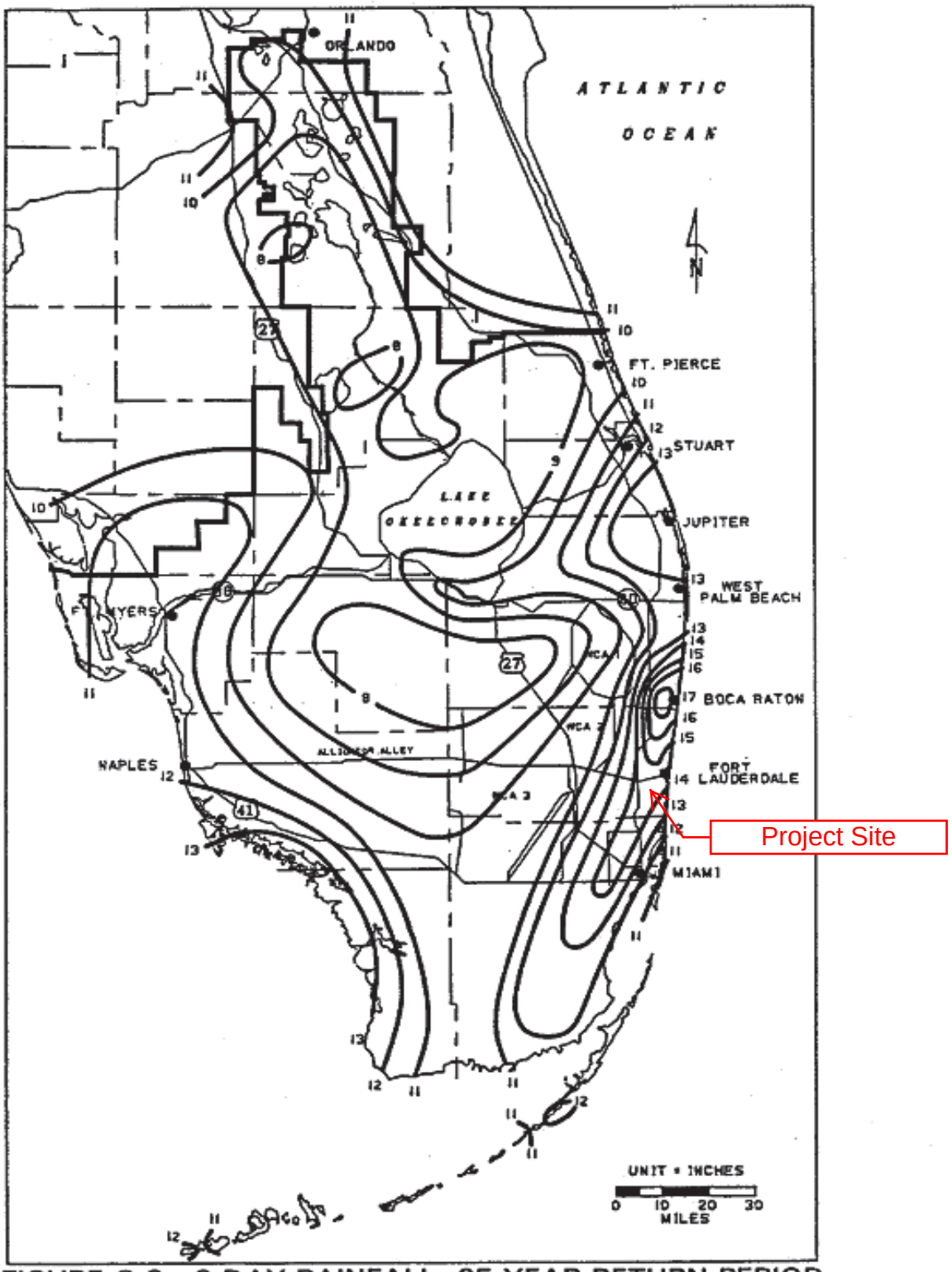
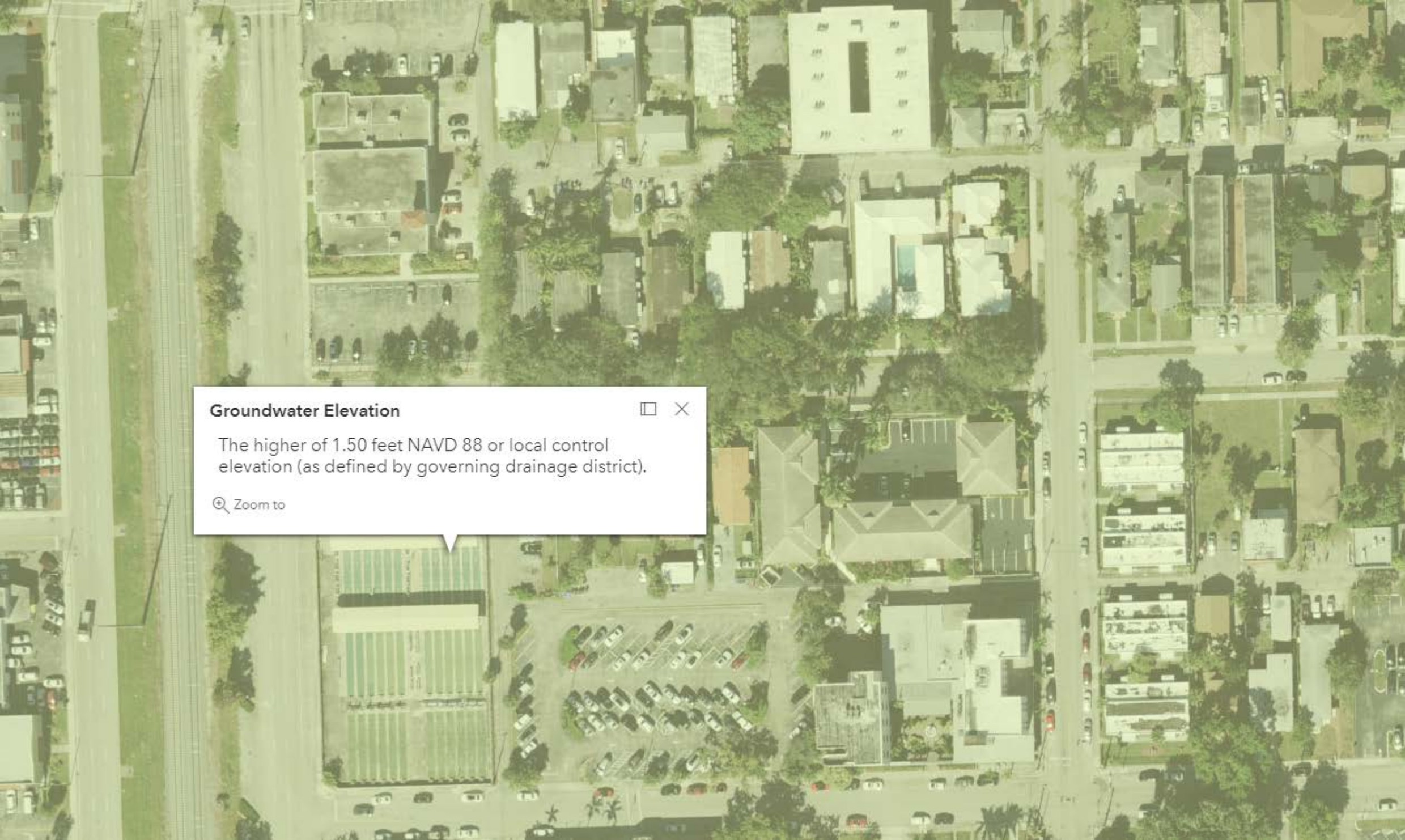
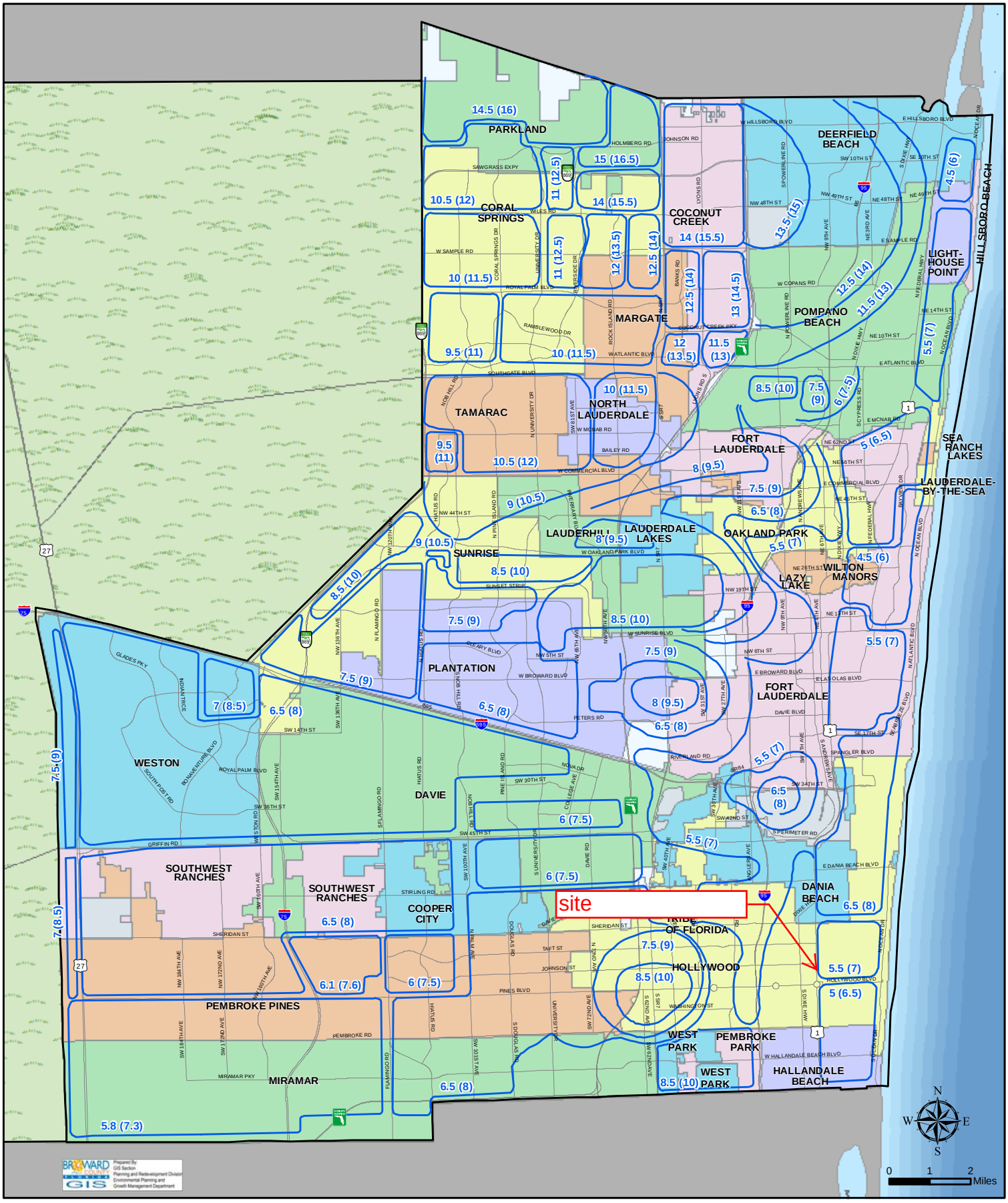


FIGURE C-8. 3-DAY RAINFALL: 25-YEAR RETURN PERIOD


Groundwater Elevation
The higher of 1.50 feet NAVD 88 or local control elevation (as defined by governing drainage district).
Zoom to

BROWARD COUNTY 100 YEAR FLOOD ELEVATIONS



100 Year Flood Contours NAVD (NGVD)
Example: 6.5 (8)

This map is for conceptual purposes only and should not be used for legal boundary determinations.

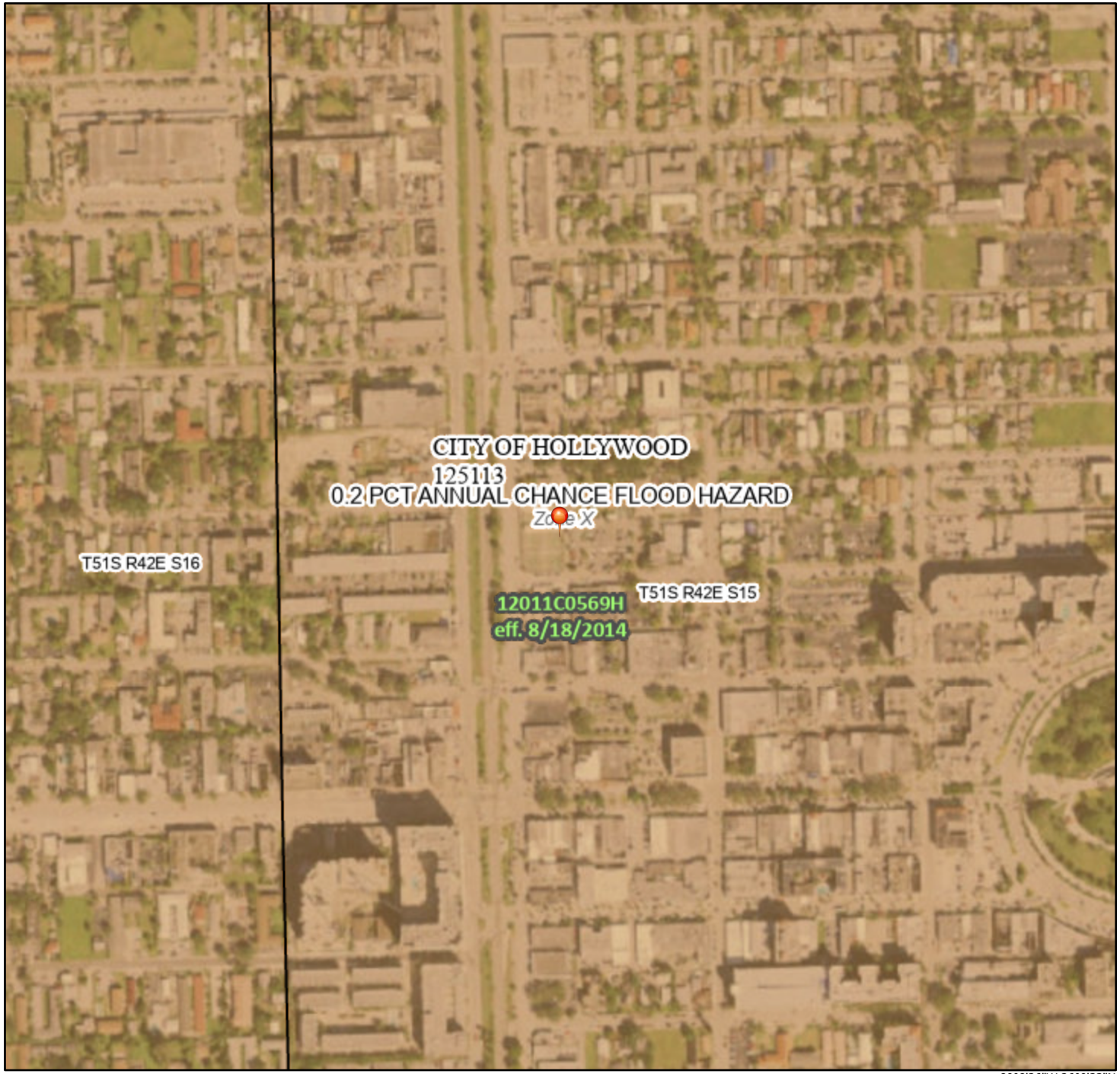
Elevations converted from NGVD to NAVD using the FEMA approved conversion factor for Broward County of (-)1.5, based on 1997 FEMA Flood Data

#12729 SNowicki 10/2014

National Flood Hazard Layer FIRMette

FEMA

80°9'13"W 26°1'5"N



80°8'36"W 26°0'33"N

Feet

0 250 500 1,000 1,500 2,000

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
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

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 8/18/2021 at 12:04 PM 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.

PERCOLATION TESTS

Prepared By:

HSQ GROUP, INC.

Engineers ● Planners ● Surveyors

4577 North Nob Hill Road, Suite 210

Sunrise, FL 33351

(954) 440-6990 Phone

Percolation Test

Client	**Housing Trust Group**	Boring No.	**B-5**
Project	University Station, Hollywood, FL	Date Started	7/6/2021
Boring Location	See Boring Location Plan	Date Completed	7/6/2021
Elev. Ref.	N/A	PACIFICA Proj. No.	320-21024
Remarks			

Subsurface Profile	
Depth (ft)	**Soil Description**
0-0.1	ASPHALT
0.1-0.5	Base Material / LIMEROCK
0.5-8	Light to Dark Brown/Gray Fine SAND
8-10	Light Brown Fine SAND with Limestone

Percolation Results

Diameter		Depth of Hole (ft)	Depth of Groundwater Level Below Ground Surface (ft)		Hydraulic Head (ft)	Saturated Hole Depth (ft)	Average Flow Rate (gpm)	K, Hydraulic Conductivity cfs/ft^2-ft
Casing (in)	Perforated PVC (in)		Prior to Test	During Test				
6	4	10	8.5	0	8.5	1.5	4.8	2.0E-04

Note:

(1) The above hydraulic conductivity values are for a french drain installed to the same depth as the borehole tests. The values represent an ultimate value. The designer should apply the appropriate factor of safety.

(2) The hydraulic conductivity values were calculated based on the South Florida Water Management District's USUAL OPEN HOLE CONSTANT HEAD percolation test procedure as shown on the "Equations in SFWMD Permit Information Manual, Volume IV".

(3) A diameter of four inches was used in the computation of the Hydraulic Conductivity value presented in the above table.

Percolation Test

Client	**Housing Trust Group**	Boring No.	**B-10**
Project	University Station, Hollywood FL	Date Started	7/2/2021
Boring Location	See Boring Location Plan	Date Completed	7/2/2021
Elev. Ref.	N/A	PACIFICA Proj. No.	320-21024
Remarks			

Subsurface Profile	
Depth (ft)	**Soil Description**
0-0.1	ASPHALT
0.1-0.5	Base Material / LIMEROCK
0.5-8	Light to Dark Brown/Gray Fine SAND
8-10	Light Gray Sandy LIMESTONE

Percolation Results

Diameter		Depth of Hole (ft)	Depth of Groundwater Level Below Ground Surface (ft)		Hydraulic Head (ft)	Saturated Hole Depth (ft)	Average Flow Rate (gpm)	K, Hydraulic Conductivity cfs/ft^2-ft
Casing (in)	Perforated PVC (in)		Prior to Test	During Test				
6	4	10	7	0	7	3	5.7	2.6E-04

Note:

(1) The above hydraulic conductivity values are for a french drain installed to the same depth as the borehole tests. The values represent an ultimate value. The designer should apply the appropriate factor of safety.

(2) The hydraulic conductivity values were calculated based on the South Florida Water Management District's USUAL OPEN HOLE CONSTANT HEAD percolation test procedure as shown on the "Equations in SFWMD Permit Information Manual, Volume IV".

(3) A diameter of four inches was used in the computation of the Hydraulic Conductivity value presented in the above table.

SURFACE WATER MANAGEMENT CALCULATIONS

UNIVERSITY STATION PHASE 1 BUILDING

CITY OF HOLLYWOOD, BROWARD COUNTY, FLORIDA
HSQ PROJECT No.: 2107-63

PREPARED FOR:

HOUSING TRUST GROUP

3225 AVIATION AVENUE, 6TH FLOOR
COCONUT GROVE, FL 333133

Prepared By:

HSQ GROUP, INC.

Engineers ● Planners ● Surveyors
4577 North Nob Hill Road, Suite 210
Sunrise, FL 33351
(954) 440-6990 Phone

DATE: 08/20/2021

PROPOSED UNIVERSTIY STATION PHASE 1 BUILDING

POST-CONDITION DRAINAGE CALCULATIONS

Water Table: 1.50 NAVD

Land Use Summary:

Lake/Water Areas (A_L):	0	sf	or	0.000	ac
Roof Areas (A_R):	14,996	sf	or	0.344	ac
Paved Areas (A_P):	15,231	sf	or	0.350	ac
Green Areas (A_G):	7,972	sf	or	0.183	ac
Total (A_T):	38,199	sf	or	0.877	ac

Compute Required Pretreatment Volume:

1. Provide at least 1/2 inch over the developed project:

V_{PRE} = 0.5 inch x A_T x 1 ft / 12 inches
= 0.5 x 2.013 / 12
= 0.04 ac-ft or 0.44 ac-in

Compute Water Quality Volume:

1. Provide at least 1 inch over the developed project:

V_{PRE} = 1 inch x A_T x 1 ft / 12 inches
= 1 x 2.013 / 12
= 0.07 ac-ft or 0.88 ac-in

2. Provide 2.5" over % impervious area:

a) Site Area for water quality pervious/impervious calculation:

A_S = A_T - (A_L + A_R)
= 2.013 - (+)
= 0.533 ac of site area for water quality pervious/impervious

b) Impervious area for water quality pervious/impervious calculation:

A_{IMP} = A_S - A_G
= 0.533 -
= 0.35 ac of impervious area for water quality pervious/impervious

c) Percent of impervious for water quality calculation:

= A_{IMP} / A_S x 100%
= 0.35 / 0.533 x 100%
= 65.7% impervious

d) For 2.5" times the percent impervious:

= 2.5" x % impervious area
= 2.5 x 0.657
= 1.64 inches to be treated

e) Compute volume required volume for quality detention

V_{PRE} = inches to be treated x (A_T - A_L)
= 1.64 x (-) x 1 foot / 12 inches)
= 0.12 ac-ft or 1.44 ac-in

3. Since the 1.44 ac-in is greater than the 0.88 ac-in computed for the first inch of runoff, the volume 1.44 ac-in controls

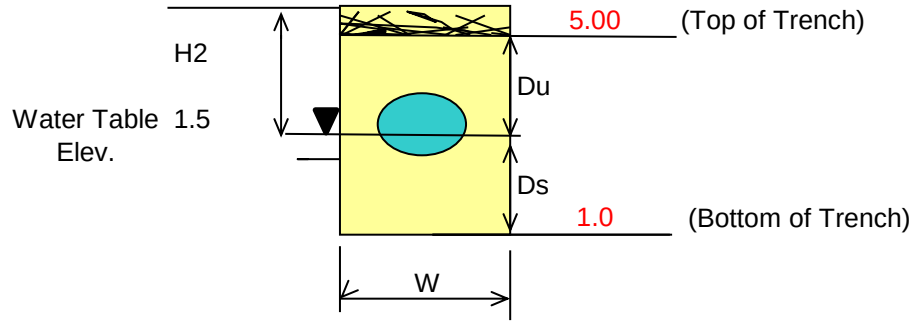
PROPOSED UNIVERSTIY STATION PHASE 1 BUILDING

EXFILTRATION TRENCH CALCULATIONS

K-Value:

Test Hole #	(cfs/ft^2/ft hd)
P-1	2.00E-04
P-2	2.60E-04
K_{AVG}	2.30E-04

(Min. Pavement Elev.) 9.00
Wier Elevation 6.00



K = 2.30E-04 cfs/ft^2 - ft head
H_2 = 4.50 ft
W = 6.00 ft
D_u = 3.50 ft
D_s = 0.50 ft
H = Du + Ds = 4.00 ft

1) Trench Length for Water Quality Requirements:

V = 1.44 ac-in or 0.12 ac-ft

$$L = \frac{V\,(FS)}{K(H2W + 2H2Du - Du\text{^}2 + 2H2Ds) + (1.39 \times 10\text{^}-4)WDu}$$

*FS= 2.0

L = 197.4 feet

2) Maximum Trench Length:

V = 3.28 inches X 0.88 acres = 2.88 ac-in or 0.24 ac-ft

L = 197.1 feet

3) Provided Trench Volume:

L = 215 LF Provided

V = (1/FS)L x (K(2H2Du - Du^2 + 2H2Ds) + (1.39 x 10^-4)Wdu)

V = 1.57 ac-in or 0.13 ac-ft *

* Since provided storage volume exceeds water quality requirement, 50% of excess strorage volume is credited. (SFWMD Page G-1)

Vexcess = 1.57 ac-in (215 LF) - 1.44 ac-in (water quality) = 0.13 ac-in

V= 1.44 ac-in + (0.13 ac-in X 50%) =

V= 1.51 ac-in or 0.13 ac-ft

PROPOSED UNIVERSTIY STATION PHASE 1 BUILDING

STAGE\STORAGE AREA CALCULATION POST

Exist. Grades

Stage	Pavement Area Area 0.350 0.000 (ac.-ft.)	Landscape Area Area 0.183 0.000 (ac.-ft.)	0.000 0.000 (ac.-ft.)	Area 0.000 0.000 (ac.-ft.)	Area 0.000 0.000 (ac.-ft.)	Area 0.000 0.000 (ac.-ft.)	Area 0.000 0.000 (ac.-ft.)	Exfiltration Trench (See Previous Calculations) (ac.-ft.)	Buildng Area 0.344 0.000 (ac.-ft.)	Total Site 0.877
1.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.02
2.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.04
3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.06
3.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.07
4.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.09
4.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.11
5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.13
5.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.13
6.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.13
6.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.13
7.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.13
7.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.13
8.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.13
8.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.13
9.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.13
9.50	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.15
10.00	0.06	0.03	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.22
10.50	0.14	0.07	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.34
11.00	0.25	0.13	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.50
11.50	0.38	0.20	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.71
12.00	0.55	0.29	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.97

Soil Storage Post

Land Use Summary:

	Acres	Percent	
Lake Areas (A_L):	0.000	N/A	(Not Included)
Roof Areas (A_R):	0.344	39.3%	
Paved Areas (A_P):	0.350	39.9%	
Green Areas (A_G):	0.183	20.9%	
Total (A_T):	0.877	100.0%	

Compacted Soil Storage per SFWMD Vol. IV Page C-III-1

Depth to Water Table (feet)	Water Storage (inches)
1	0.45
2	1.88
3	4.05
4	6.75

Average Pervious Grade (Elev.): 6.00 ft
Depth to Water Table: 4.50 ft
Soil Storage at Average Depth (S_S): 6.75 inches

Weighted S value:
= S_S x % Pervious
= 6.75 x 0.209 =
= **1.41 inches**

Rainfalls (P)

From Figure C-5, 25-Year, 72-Hour Storm = 14.00 inches

From Figure C-9, 100-Year, 72-Hour Storm = 17.50 inches

SFMWD Storm Events

25-Yr 3-Day Storm Event

Stage for 25-Year 3-day Storm Event 8.11 ft. NAVD See attached ICPR Model

100-Yr 3-Day Storm Event

Stage for 100-Year 3-day Storm Event 8.53 ft. NAVD See attached ICPR Model

DRAINAGE WELL CALCULATIONS

Prepared By:

HSQ GROUP, INC.

Engineers ● Planners ● Surveyors

4577 North Nob Hill Road, Suite 210

Sunrise, FL 33351

(954) 440-6990 Phone

Storm Runoff Calculations

Note: Poriotn of waterway is included within the property area, but has been exlcuded from drainage area calculations as runoff in this area is not contained within site.

1. Weighted Runoff Coefficient C

Runoff Coefficient Impervious (C1) = 0.95
Runoff Coefficient Pervious (C2)= 0.2

A1 =	Impervious Area =	0.694	79.13%
A2 =	Pervious Area =	0.183	20.87%
A =	Total Area =	0.877	100.00%

C = {(A1 x C1) + (A2 x C2)} / A =
C = {(0.694 x 0.95)+(0.183 x 0.2)} /0.877 = 0.79

CA (Contributing Area) = C x A
CA = 0.79 x 0.877 = 0.693

2. Time Required to Generate One Inch of Runoff

Rainfall Intensity (I) = 308.5 / [48.6 x F^-0.11) + t*(0.5895 + F^-2/3)]
Frequency (F) = 10 Years

STORM RUNOFF CALCULATION TABLE

Time (t) (min.) {1}	Intensity (I) (in./hr) {2}	Contributing Area (C*A) {3}	Inflow Rate (cfs) (C*I*A) {4}	Inflow Volume (CF) (CIA*t) {5}	
8	6.99	0.693	4.84	2323.5	
10	6.74	0.693	4.67	2802.3	
13.162	6.38	0.693	4.42	3494.1	Time to Generate 1" of Runoff
15	6.19	0.693	4.29	3863.7	
20	5.73	0.693	3.97	4766.4	
23.162	5.47	0.693	3.79	5270.7	Total Time required to collect 1" of Runoff (10 min. t_C)
25	5.33	0.693	3.70	5543.5	
30	4.99	0.693	3.46	6219.5	
40	4.41	0.693	3.06	7338.0	
50	3.96	0.693	2.74	8225.6	
60	3.59	0.693	2.49	8947.1	
90	2.80	0.693	1.94	10478.9	
120	2.30	0.693	1.59	11460.0	

Q = CIA, V = Qt, $V_{(1")} = Qt_{(1")}$, $t_{(1")}$ = Time to generate 1" of runoff
$V_{(1")} = 1" \times A = CIAt_{(1")}$
V (1") = 0.073 Ac-ft or 3,184 cf

Time to generate one inch of run-off, $t_{(1")}$ = 11.743 minutes
Time to reach inlet, $t_{(C)}$ = 10 minutes
Total time required to collect 1" runoff= 21.743 minutes

3. Calculate Peak Runoff (Q)

Rainfall Intesity at T(21.743) = 5.706 in/hr
Peak Runoff (Q)= CA* I = 0.693 x 5.706 = **3.95** cfs

DRAINAGE WELL CALCULATIONS

Drainage Well Structures

Well No.	Rim / Grate Elev. (NAVD)	Lowest Inlet/ Weir Elev. (NAVD)	Design Ground Water Elevation (NAVD)	Well Structure			Structure Storage Volume (CF)
				Width (ft)	Length (ft)	H Req. (ft)	
1	9.50	6.00	1.50	6	10.00	6.00	360.00
						6.00	360

1. Drainage Well Structure Volume Calculations

Drainage well structure must be designed to detain runoff for a minum of 90 seconds prior to discharge

Required Runoff (Q) =	3.95	cfs
Min. Det. Volume = Runoff x 90 sec =	356	cf
Width of Well Structure (W) =	6	ft
Length of Well Structure (L) =	10.00	ft
Min. Height Required =	5.93	

Note: This is the total depth required from the top of well casing to the floor of the well box to achieve 90 second detention time

Proposed Number of Drainage Wells =	1	
Detention Volume Per Well Structure (cf) =	356	cf
Height Per Well (Top of Well to Bottom of Structure) =	5.93	ft
Top of Well Casing Elevation =	1.50	NAVD
Bottom of Structure Elevation =	-4.50	NAVD
Casing Height in Structure (H) =	6.00	ft

Det. Volume Per Well Structure (V)= H x W x L= 6 x 10 x 6 = 360 cf

2. Well Flotation Calculations

Calculate Upward Force:

Well Box Outside Length Dimension	11.33	ft.
Well Box Outside Width Dimension	7.33	ft.
Design Water Table	1.50	NAVD
Elevation at Bottom of Bottom Slab	-5.17	NAVD
Well Rim Elevation/Top of Slab	9.50	NAVD
Displacement Depth	14.67	ft.
Discplacement Volume	1,219	c.f.
Upward Force	76,063	lbs.

Calculate Downward Force:

Well Box Top Slab Thickness	8	inches
Well Box Wall Thickness	8	inches
Well Box Bottom Slab Thickness	8	inches
Top Slab Volume	55.41	c.f.
Wall Volume	338.96	c.f.
Bottom Slab Volume	55.41	c.f.
Total Volume	449.78	c.f.
Downward Force	67,467	lbs.

Total Force = Upward Force - Downward Force = -6,029 **OK**

DRAINAGE WELL DESIGN INPUTS

Per field data supplied by local drainage well company the general area is anticipated to produce a well with a capacity of 300 gpm/foot. This data will need to be confirmed at time of the well development and or reasonable assurance report.

1. Well Operating Table:

Design Discharge (Avg.) 300 gpm/foot
Number of Wells 1
Begin Discharge at Elevation 3.50 (Assume Top of Well Casing+ 2' to Overcome Column of Salt Water)

CFS/FT = (300 gal/min) * 1 ft/s / 448.83 gal/min = 0.67 cfs

Elev (ft)	Discharge (cfs) per well				Total Discharge
3.50	0.67 cfs x	0.00'	=	0.00 cfs	0.00 cfs
4.00	0.67 cfs x	0.50'	=	0.34 cfs	0.34 cfs
4.50	0.67 cfs x	1.00'	=	0.67 cfs	0.67 cfs
5.00	0.67 cfs x	1.50'	=	1.01 cfs	1.01 cfs
5.50	0.67 cfs x	2.00'	=	1.34 cfs	1.34 cfs
6.00	0.67 cfs x	2.50'	=	1.68 cfs	1.68 cfs
6.50	0.67 cfs x	3.00'	=	2.01 cfs	2.01 cfs
7.00	0.67 cfs x	3.50'	=	2.35 cfs	2.35 cfs
7.50	0.67 cfs x	4.00'	=	2.68 cfs	2.68 cfs
8.00	0.67 cfs x	4.50'	=	3.02 cfs	3.02 cfs
8.50	0.67 cfs x	5.00'	=	3.35 cfs	3.35 cfs
9.00	0.67 cfs x	5.50'	=	3.69 cfs	3.69 cfs
9.50	0.67 cfs x	6.00'	=	4.02 cfs	4.02 cfs
10.00	0.67 cfs x	6.50'	=	4.36 cfs	4.36 cfs
10.50	0.67 cfs x	7.00'	=	4.69 cfs	4.69 cfs
11.00	0.67 cfs x	7.50'	=	5.03 cfs	5.03 cfs
11.50	0.67 cfs x	8.00'	=	5.36 cfs	5.36 cfs
12.00	0.67 cfs x	8.50'	=	5.70 cfs	5.70 cfs
12.50	0.67 cfs x	9.00'	=	6.03 cfs	6.03 cfs

2. Weir Information

Top of Weir Elevation = 6.00 NAVD
Rim of Sturcture Elevation = 9.50 NAVD
Bottom of Structure Top Slab Elevation = 7.75 NAVD
Rim Thickness = 7.00 Inches
Total Brick Thickness = 6.00 Inches
Top Slab Thickness = 8.00 Inches
Height of Opening = 1.75 FT
Weir Length Per Structure = 6 LF
Total Weir Length = 6 LF

ICPR MODEL

Prepared By:

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Node Max Conditions [Scenario1]

Node Name	Sim Name	Warning Stage [ft]	Max Stage [ft]	Min/Max Delta Stage [ft]	Max Total Inflow [cfs]	Max Total Outflow [cfs]	Max Surface Area [ft2]
Phase1 Building (Node)	100Y-3D	13.00	8.53	0.0010	0.90	1.21	1742
Phase1 Building (Node)	25Y-3D	13.00	8.11	0.0010	0.78	1.04	1742

Manual Basin: Phase1 Building

Scenario: Scenario1
Node: Phase1 Building (Node)
Hydrograph Method: NRCS Unit Hydrograph
Infiltration Method: Curve Number
Time of Concentration: 10.0000 min
Max Allowable Q: 9999.00 cfs
Time Shift: 0.0000 hr
Unit Hydrograph: UH323
Peaking Factor: 323.0
Area: 0.8770 ac

Area [ac]	Land Cover Zone	Soil Zone	Rainfall Name
0.3440	Building	A	
0.3500	Impervious	A	
0.1830	Pervious	A	

Comment:

Node: DWELL

Scenario: Scenario1
Type: Stage/Area
Base Flow: 1.50 cfs
Initial Stage: 0.00 ft
Warning Stage: 13.00 ft

Stage [ft]	Area [ac]	Area [ft2]
1.50	0.0000	0
13.00	0.0000	0

Comment:

Node: Groundwater

Scenario: Scenario1
Type: Time/Stage
Base Flow: 0.00 cfs
Initial Stage: 1.50 ft
Warning Stage: 13.00 ft
Boundary Stage:

Year	Month	Day	Hour	Stage [ft]
0	0	0	0.0000	1.50
0	0	0	72.0000	1.50
0	0	0	96.0000	1.50

Comment:

Node: Phase1 Building (Node)

Scenario: Scenario1
Type: Stage/Volume
Base Flow: 0.00 cfs
Initial Stage: 1.50 ft
Warning Stage: 13.00 ft

Stage [ft]	Volume [ac-ft]	Volume [ft3]
1.50	0.00	0
2.00	0.02	871
2.50	0.04	1742
3.00	0.06	2614
3.50	0.07	3049
4.00	0.09	3920
4.50	0.11	4792
5.00	0.13	5663
5.50	0.13	5663
6.00	0.13	5663
6.50	0.13	5663
7.00	0.13	5663
7.50	0.13	5663
8.00	0.13	5663
8.50	0.13	5663
9.00	0.13	5663
9.50	0.15	6534
10.00	0.22	9583
10.50	0.34	14810
11.00	0.50	21780
11.50	0.71	30928
12.00	0.97	42253

Comment:

Rating Curve Link: DWELL

Scenario: Scenario1
From Node: DWELL
To Node: Groundwater
Link Count: 1
Flow Direction: Both

Table	Elev On [ft]	Elev On Node	Elev Off [ft]	Elev Off Node
DWELL	1.50	Phase1 Building (Node)	1.49	Phase1 Building (Node)

Comment:

Drop Structure Link: Weir

Scenario: Scenario1
From Node: Phase1 Building (Node)
To Node: DWELL
Link Count: 1
Flow Direction: Both
Solution: Combine
Increments: 0
Pipe Count: 1
Damping: 0.0000 ft
Length: 200.00 ft
FHWA Code: 0
Entr Loss Coef: 0.00
Exit Loss Coef: 0.00
Bend Loss Coef: 0.00
Bend Location: 0.00 dec
Energy Switch: Energy

Upstream Pipe

Invert: 1.50 ft
Manning's N: 0.0130

Geometry: Circular

Max Depth: 2.00 ft

Bottom Clip

Default: 0.00 ft
Op Table:
Ref Node:

Manning's N: 0.0000

Top Clip

Default: 0.00 ft
Op Table:
Ref Node:

Manning's N: 0.0000

Downstream Pipe

Invert: 1.50 ft
Manning's N: 0.0130

Geometry: Circular

Max Depth: 2.00 ft

Bottom Clip

Default: 0.00 ft
Op Table:
Ref Node:

Manning's N: 0.0000

Top Clip

Default: 0.00 ft
Op Table:
Ref Node:

Manning's N: 0.0000

Pipe Comment:

Weir Component

Weir: 1
Weir Count: 1
Weir Flow Direction: Both
Damping: 0.0000 ft
Weir Type: Horizontal
Geometry Type: Rectangular
Invert: 6.00 ft
Control Elevation: 1.50 ft
Max Depth: 1.75 ft
Max Width: 6.00 ft
Fillet: 0.00 ft

Bottom Clip

Default: 0.00 ft
Op Table:
Ref Node:

Top Clip

Default: 0.00 ft
Op Table:
Ref Node:

Discharge Coefficients

Weir Default: 3.200
Weir Table:
Orifice Default: 0.600
Orifice Table:

Weir Comment:

Drop Structure Comment:

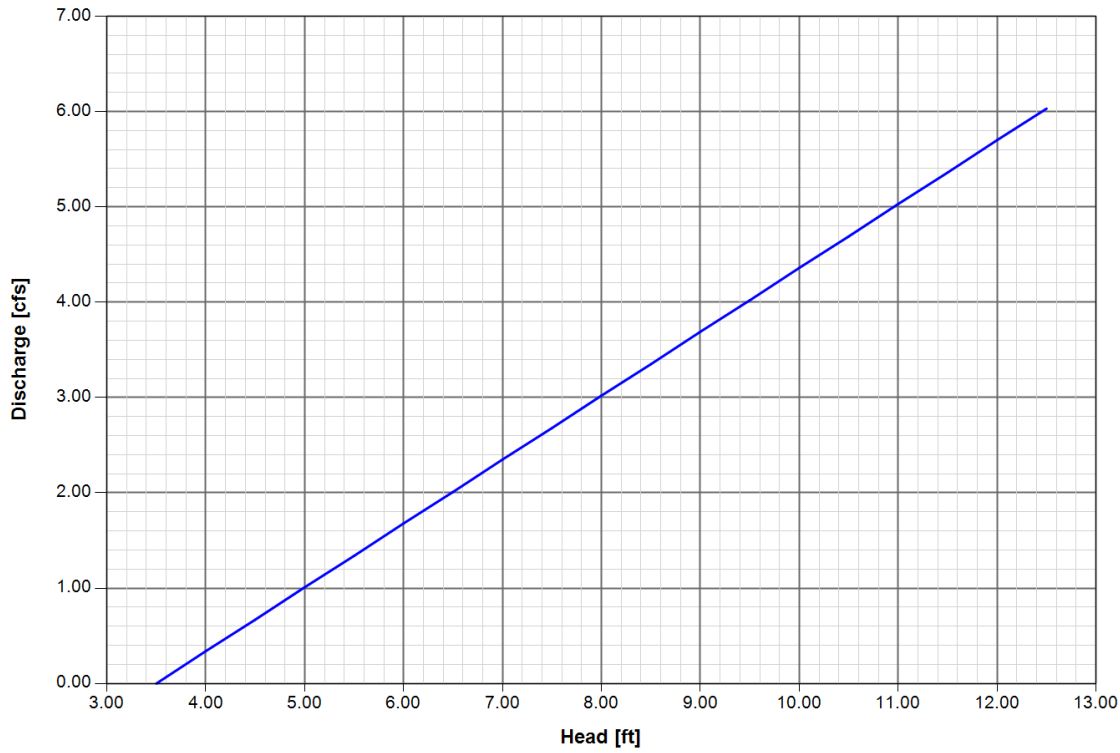
Rating Curve: DWELL

Scenario: Scenario1
Type: Head

Head [ft]	Discharge [cfs]
3.50	0.00
4.00	0.34
4.50	0.67
5.00	1.01
5.50	1.34
6.00	1.68
6.50	2.01
7.00	2.35
7.50	2.68
8.00	3.02
8.50	3.35
9.00	3.69
9.50	4.02
10.00	4.36
10.50	4.69
11.00	5.03
11.50	5.36
12.00	5.70
12.50	6.03

Comment:

Rating Curve: DWELL Scenario: Scenario1



Simulation: 100Y-3D

Scenario:	Scenario1
Run Date/Time:	8/20/2021 2:20:07 PM
Program Version:	ICPR4 4.07.08

General

Run Mode: Normal

	Year	Month	Day	Hour [hr]
Start Time:	0	0	0	0.0000
End Time:	0	0	0	72.0000

	Hydrology [sec]	Surface Hydraulics [sec]
Min Calculation Time:	60.0000	0.1000
Max Calculation Time:		30.0000

Output Time Increments

Hydrology

Year	Month	Day	Hour [hr]	Time Increment [min]
0	0	0	0.0000	15.0000
0	0	0	72.0000	15.0000

Surface Hydraulics

Year	Month	Day	Hour [hr]	Time Increment [min]
0	0	0	0.0000	15.0000
0	0	0	72.0000	15.0000

Restart File

Save Restart: False

Resources & Lookup Tables

Resources

Rainfall Folder:

Unit Hydrograph Folder:

Lookup Tables

Boundary Stage Set:
Extern Hydrograph Set:
Curve Number Set: Site
Green-Ampt Set:
Vertical Layers Set:
Impervious Set: Site

Tolerances & Options

Time Marching: SAOR
Max Iterations: 6
Over-Relax Weight Fact: 0.5 dec
dZ Tolerance: 0.0010 ft
Max dZ: 1.0000 ft
Link Optimizer Tol: 0.0001 ft
Edge Length Option: Automatic

IA Recovery Time: 24.0000 hr
Smp/Man Basin Rain Opt: Global
Rainfall Name: ~SFWMD-72
Rainfall Amount: 17.50 in
Storm Duration: 72.0000 hr
Dflt Damping (1D): 0.0050 ft
Min Node Srf Area (1D): 100 ft2
Energy Switch (1D): Energy

Comment:

Simulation: 25Y-3D

Scenario: Scenario1
Run Date/Time: 8/20/2021 2:23:34 PM
Program Version: ICPR4 4.07.08

General

Run Mode: Normal

	Year	Month	Day	Hour [hr]
Start Time:	0	0	0	0.0000
End Time:	0	0	0	72.0000

	Hydrology [sec]	Surface Hydraulics [sec]
Min Calculation Time:	60.0000	0.1000
Max Calculation Time:		30.0000

Output Time Increments

Hydrology

Year	Month	Day	Hour [hr]	Time Increment [min]
0	0	0	0.0000	15.0000
0	0	0	72.0000	15.0000

Surface Hydraulics

Year	Month	Day	Hour [hr]	Time Increment [min]
0	0	0	0.0000	15.0000
0	0	0	72.0000	15.0000

Restart File

Save Restart: False

Resources & Lookup Tables

Resources

Rainfall Folder:
Unit Hydrograph Folder:

Lookup Tables

Boundary Stage Set:
Extern Hydrograph Set:
Curve Number Set: Site
Green-Ampt Set:
Vertical Layers Set:
Impervious Set: Site

Tolerances & Options

Time Marching: SAOR
Max Iterations: 6
Over-Relax Weight Fact: 0.5 dec
IA Recovery Time: 24.0000 hr

dZ Tolerance:	0.0010 ft	Smp/Man Basin Rain Opt:	Global
Max dZ:	1.0000 ft		
Link Optimizer Tol:	0.0001 ft	Rainfall Name:	~SFWMD-72
		Rainfall Amount:	14.00 in
Edge Length Option:	Automatic	Storm Duration:	72.0000 hr
		Dflt Damping (1D):	0.0050 ft
		Min Node Srf Area (1D):	100 ft2
		Energy Switch (1D):	Energy

Comment:

REFERENCE MATERIAL

Prepared By:

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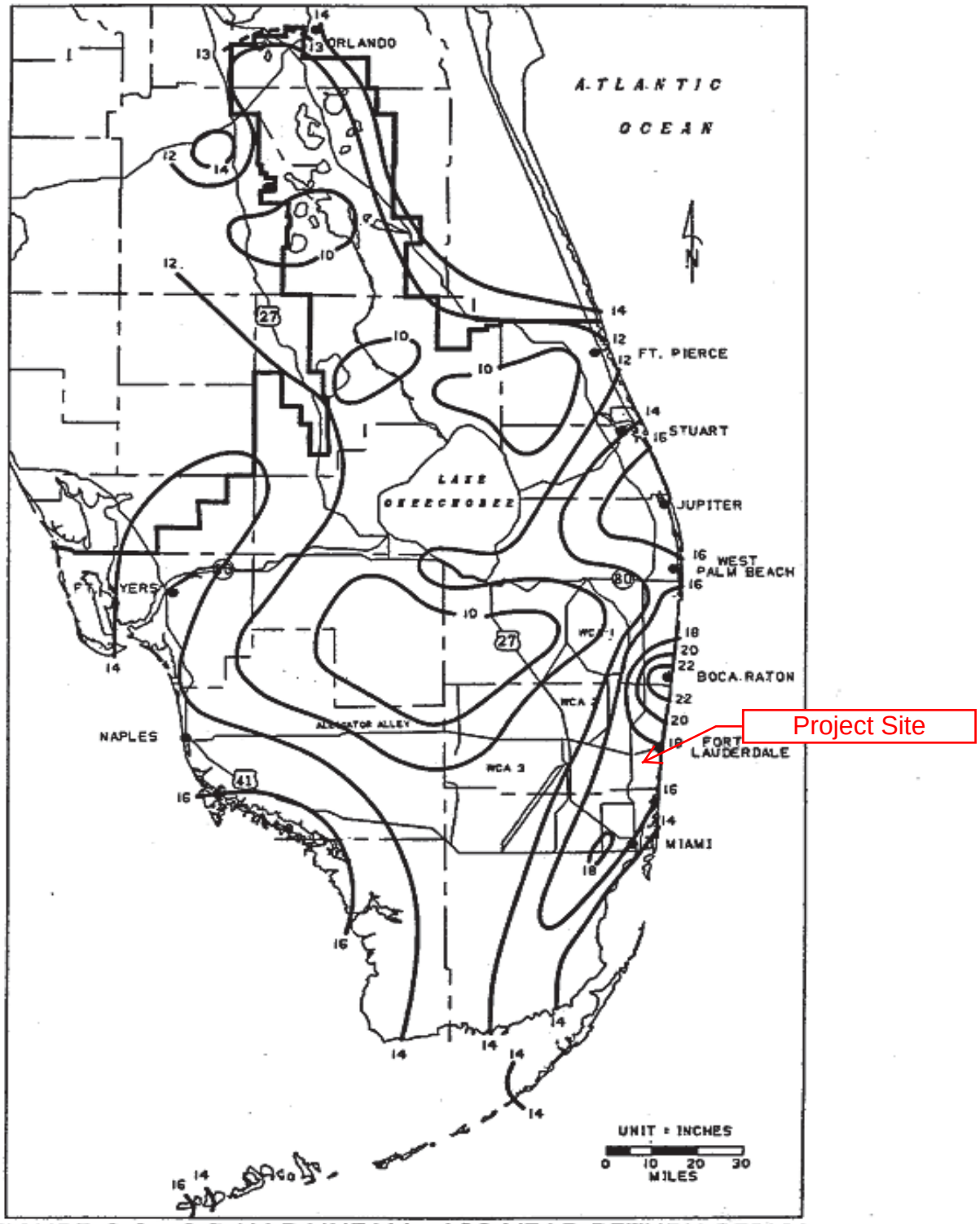


FIGURE C-9. 3-DAY RAINFALL: 100-YEAR RETURN PERIOD

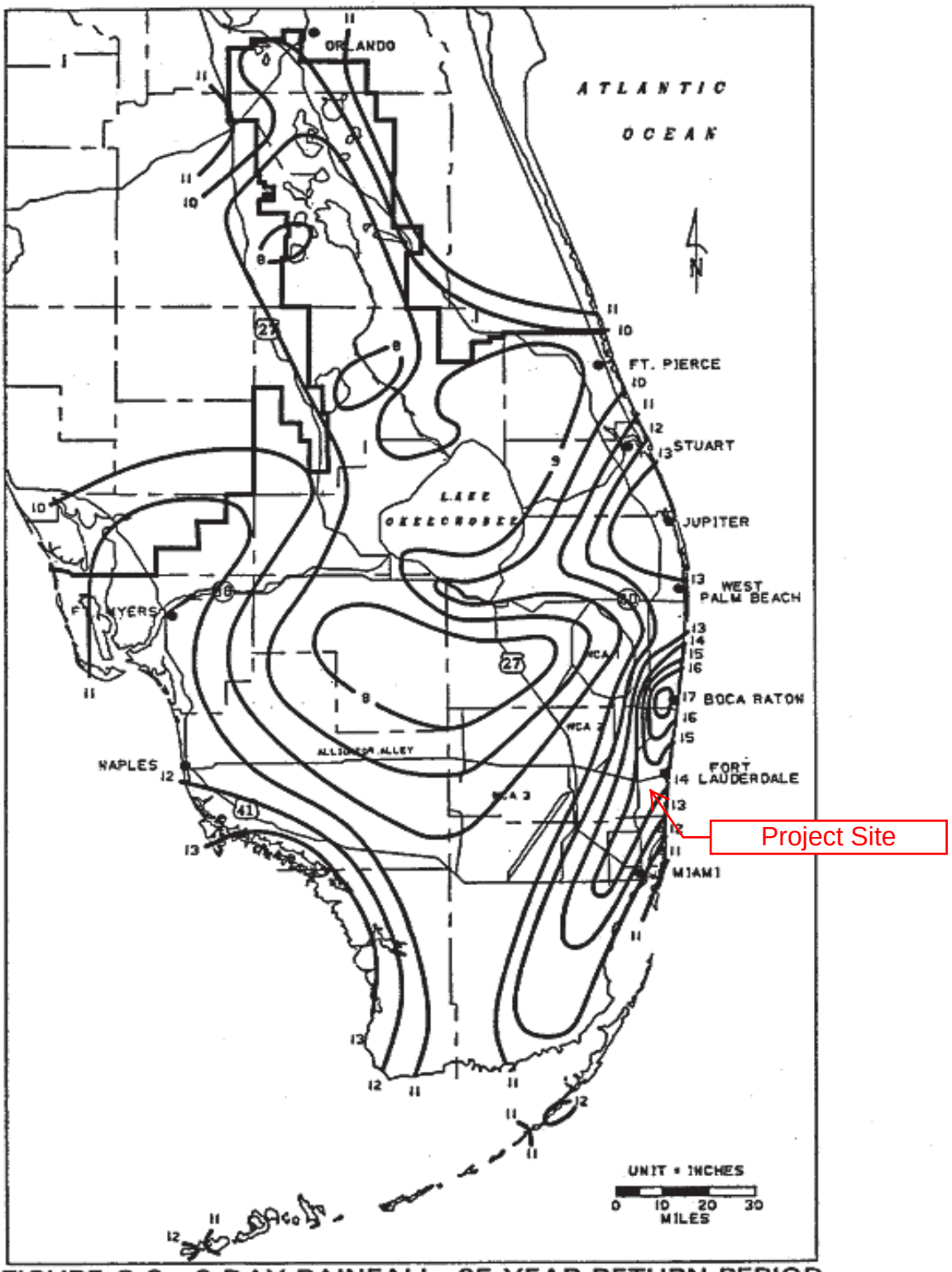
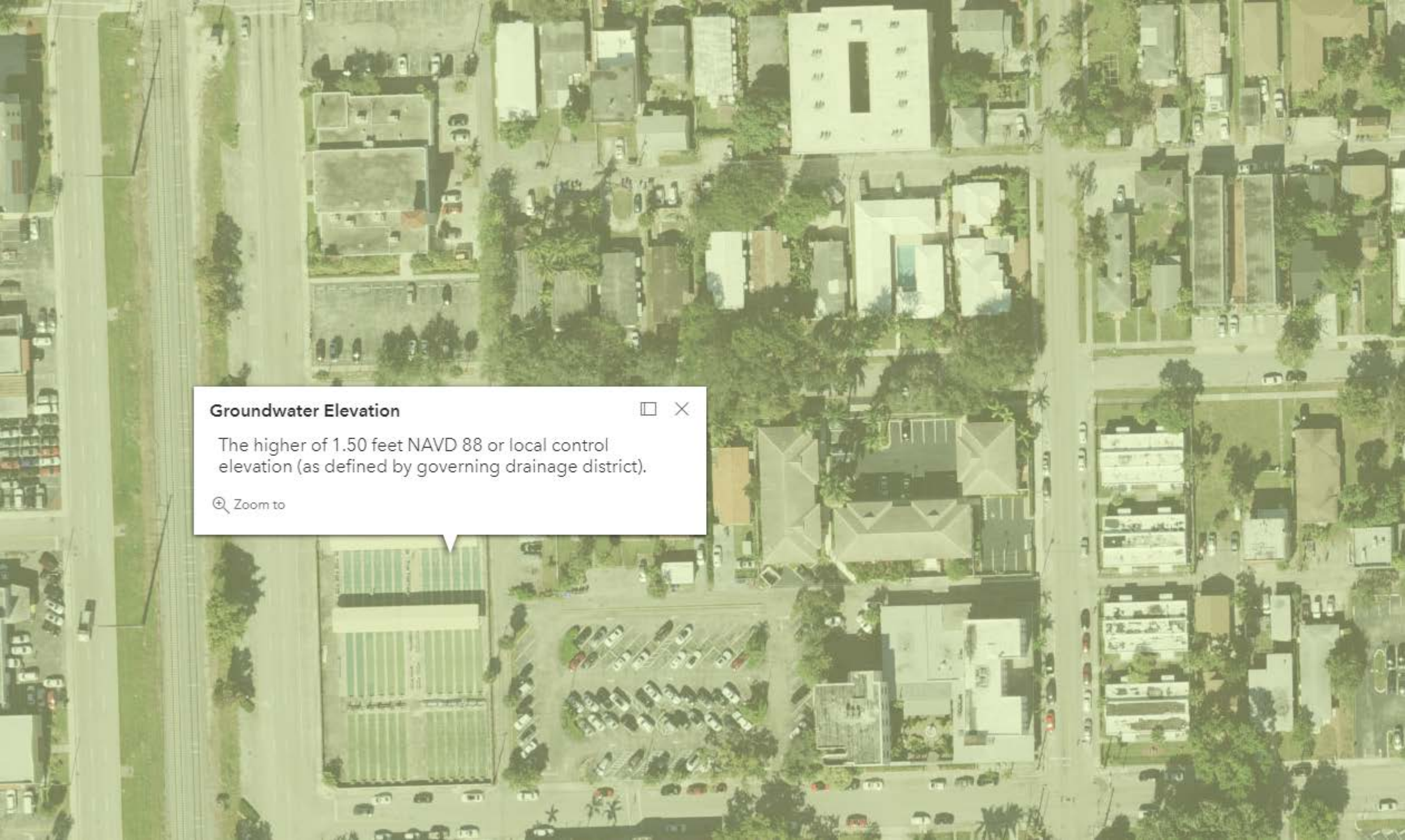
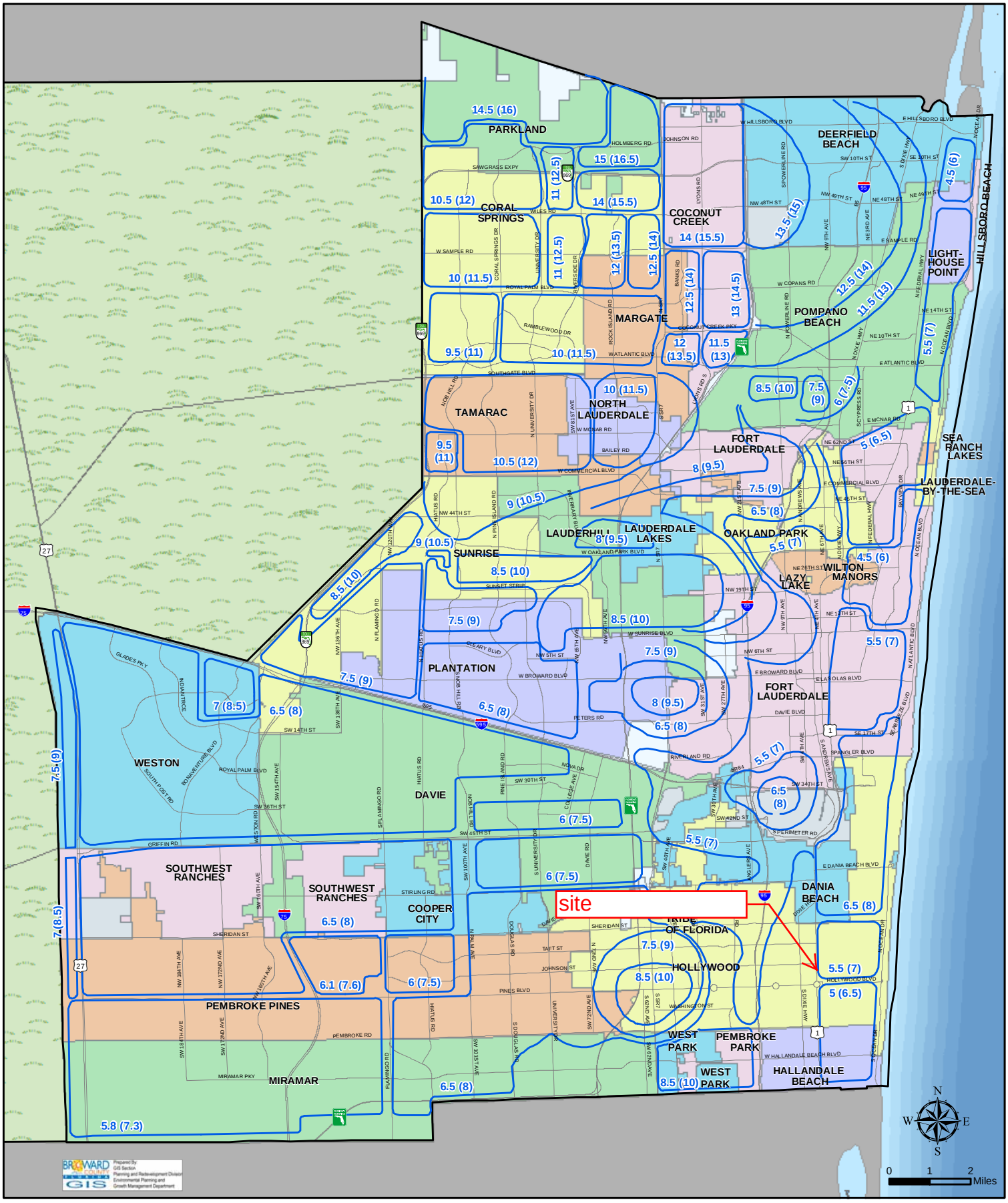


FIGURE C-8. 3-DAY RAINFALL: 25-YEAR RETURN PERIOD


Groundwater Elevation
The higher of 1.50 feet NAVD 88 or local control elevation (as defined by governing drainage district).
Zoom to

BROWARD COUNTY 100 YEAR FLOOD ELEVATIONS



100 Year Flood Contours NAVD (NGVD)
Example: 6.5 (8)

This map is for conceptual purposes only and should not be used for legal boundary determinations.

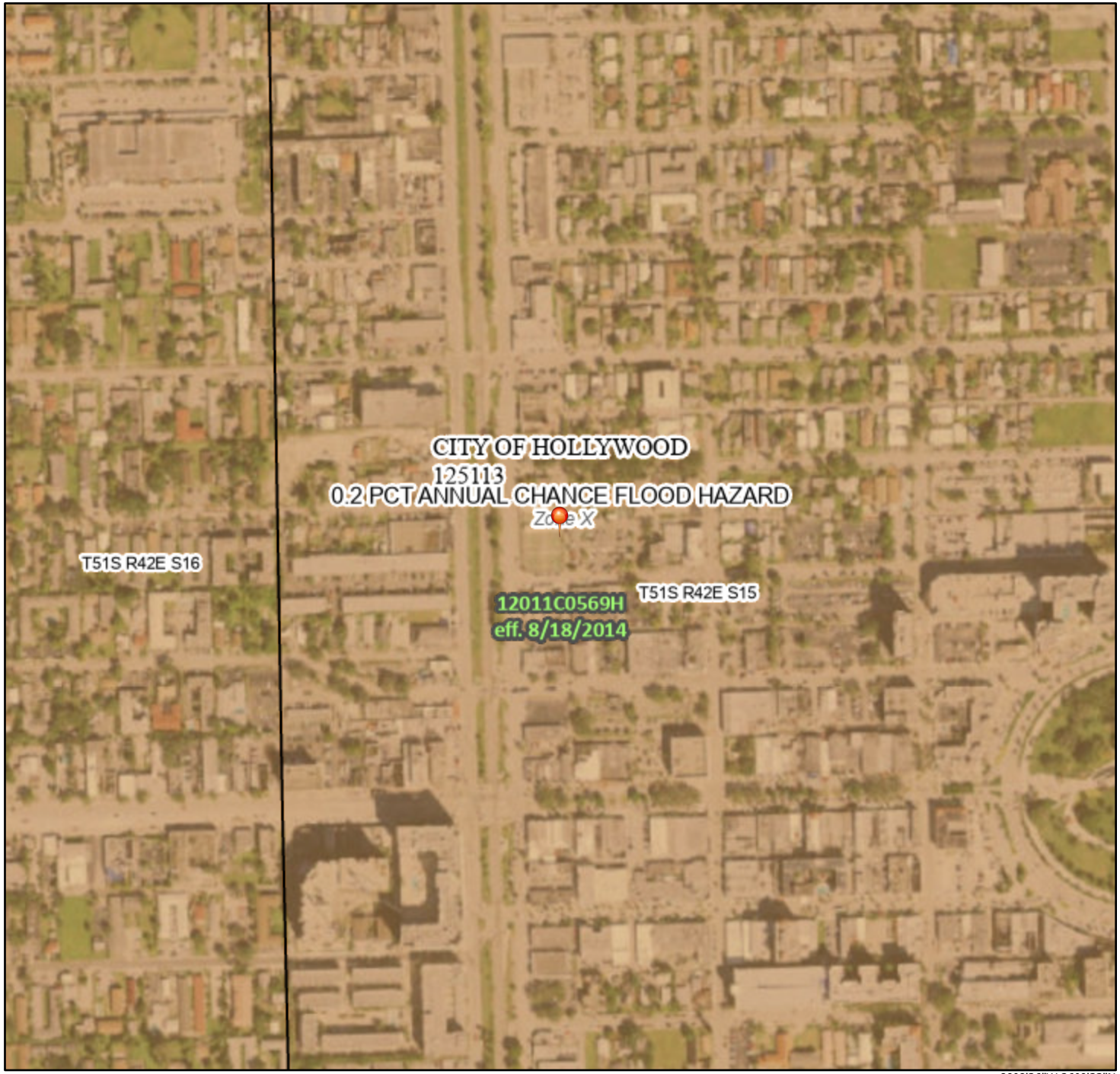
Elevations converted from NGVD to NAVD using the FEMA approved conversion factor for Broward County of (-)1.5, based on 1997 FEMA Flood Data

#12729 SNowicki 10/2014

National Flood Hazard Layer FIRMette

FEMA

80°9'13"W 26°1'5"N



80°8'36"W 26°0'33"N

Feet

0 250 500 1,000 1,500 2,000

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
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

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 8/18/2021 at 12:04 PM 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.

PERCOLATION TESTS

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Percolation Test

Client	**Housing Trust Group**	Boring No.	**B-5**
Project	University Station, Hollywood, FL	Date Started	7/6/2021
Boring Location	See Boring Location Plan	Date Completed	7/6/2021
Elev. Ref.	N/A	PACIFICA Proj. No.	320-21024
Remarks			

Subsurface Profile	
Depth (ft)	**Soil Description**
0-0.1	ASPHALT
0.1-0.5	Base Material / LIMEROCK
0.5-8	Light to Dark Brown/Gray Fine SAND
8-10	Light Brown Fine SAND with Limestone

Percolation Results

Diameter		Depth of Hole (ft)	Depth of Groundwater Level Below Ground Surface (ft)		Hydraulic Head (ft)	Saturated Hole Depth (ft)	Average Flow Rate (gpm)	K, Hydraulic Conductivity cfs/ft^2-ft
Casing (in)	Perforated PVC (in)		Prior to Test	During Test				
6	4	10	8.5	0	8.5	1.5	4.8	2.0E-04

Note:

(1) The above hydraulic conductivity values are for a french drain installed to the same depth as the borehole tests. The values represent an ultimate value. The designer should apply the appropriate factor of safety.

(2) The hydraulic conductivity values were calculated based on the South Florida Water Management District's USUAL OPEN HOLE CONSTANT HEAD percolation test procedure as shown on the "Equations in SFWMD Permit Information Manual, Volume IV".

(3) A diameter of four inches was used in the computation of the Hydraulic Conductivity value presented in the above table.

Percolation Test

Client	**Housing Trust Group**	Boring No.	**B-10**
Project	University Station, Hollywood FL	Date Started	7/2/2021
Boring Location	See Boring Location Plan	Date Completed	7/2/2021
Elev. Ref.	N/A	PACIFICA Proj. No.	320-21024
Remarks			

Subsurface Profile	
Depth (ft)	**Soil Description**
0-0.1	ASPHALT
0.1-0.5	Base Material / LIMEROCK
0.5-8	Light to Dark Brown/Gray Fine SAND
8-10	Light Gray Sandy LIMESTONE

Percolation Results

Diameter		Depth of Hole (ft)	Depth of Groundwater Level Below Ground Surface (ft)		Hydraulic Head (ft)	Saturated Hole Depth (ft)	Average Flow Rate (gpm)	K, Hydraulic Conductivity cfs/ft^2-ft
Casing (in)	Perforated PVC (in)		Prior to Test	During Test				
6	4	10	7	0	7	3	5.7	2.6E-04

Note:

(1) The above hydraulic conductivity values are for a french drain installed to the same depth as the borehole tests. The values represent an ultimate value. The designer should apply the appropriate factor of safety.

(2) The hydraulic conductivity values were calculated based on the South Florida Water Management District's USUAL OPEN HOLE CONSTANT HEAD percolation test procedure as shown on the "Equations in SFWMD Permit Information Manual, Volume IV".

(3) A diameter of four inches was used in the computation of the Hydraulic Conductivity value presented in the above table.