

CUBE SMART SELF STORAGE AND FIRE STATION

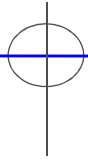
OAKLAND PARK, FLORIDA

PRELIMINARY STORM DRAINAGE CALCULATIONS

Prepared
For
Self Storage Associates, Inc.



March 4, 2020
BTE Project No. 20-0201



BOTEK THURLLOW ENGINEERING, INC.

Civil Engineers

BTE Storm Drainage Quick Checklist

Project Name Oakland Park Cube Smart/Fire Station
Project Number 20-0201
Date Updated 4-Mar-20

Drainage District(s) BCELBPD
Water Provider City of Oakland Park
Sewer Provider City of Oakland Park

Perc Rate 1.80E-04
Wellfield Zone No

FEMA Flood Zone Elevation AH8
Map Number 12011C0367H

Wet Season Water Table Elevation 1.5 NAVD
100 Year Elevation 6.5 NAVD
25 Year 1 Day Rainfall 11.0 in
100 Year 1 Day Rainfall 14.5 in

Section	22
Township	49
Range	42

	POST (Proposed)		PRE (existing)	
Site Area	1.000	ac	1.000	ac
Building Area	0.356	ac	0.000	ac
Pervious Area	0.210	ac	1.000	ac
Impervious Area	0.434	ac	0.000	ac

Soil Storage	PROPOSED
Average Site Grade	9 NAVD
Control Elevation	1.5 NAVD
Average depth to Water Table	7.5 ft
Soil Type	Flatwood
Soil Storage Under Pervious Area	6.75 in
Available Soil Storage (S)	1.42 in
SCS Curve Number, CN	87.58 SCS Curve Number

EXISTING
7.00 NAVD
1.5 NAVD
5.50 ft
Flatwood
6.75 in
6.75 in
59.70 SCS Curve Number

Cascade Stage Storage Table			
Stage	Trench	Site	Total Storage
			0.00
			0.00
			0.00
			0.00
			0.00
			0.00
			0.00

	Cumulative Water Storage (in)	Compacted Water Storage (in)	DWT
Coastal	0.6	0.45	1
	2.5	1.88	2
	6.6	4.95	3
	10.9	8.18	4
Flatwood	0.5	0.38	1
	2	1.50	2
	5.4	4.05	3
	9	6.75	4

Botek Thurlow Engineering

Civil Engineers

Exfiltration Trench Design

Project Name Oakland Park Cube Smart/Fire Station
Project Number 20-0201
Date Updated 25-Feb-20

1) Itemized Proposed Site Areas

Site = 1 Acre
Bldg = 0.356 Acre
Green = 0.21 Acre
Paved = 0.434 Acre

2) Proposed Trench Properties

Trench Width (W)= 7.00 ft
Trench Height= 4.00 ft
Bottom of Trench= 2.00 NAVD
Water Table= 1.50 NAVD
Top of Trench= 6.00 NAVD
Hydraulic Conductivity (K)= 1.80E-04 CFS/ft²-ft of head

3) Volume Treated

a) First one inch of runoff

Total Site Area = 1.00-Acre
V = 0.08-Ac-ft

b) 2.5 x Impervious

% Impervious = 67.4%
V = 2.5 x %Imp x Tot-Area= 0.14-Ac-ft

Design Volume= 0.14-Ac-ft via 2.5 x Impervious
or 1.68-Ac-inches

4) Input Values

H₂ = 4.00-ft
D_s = 0.00-ft
D_u = 4.00-ft
W = 7.00-ft
K = 1.80E-04*
V = 1.68-Ac-inches

5) Min. Length of Trench Required

L_(min) = 143 Feet

6) Max Trench Storage Credit

V (max credit)= 0.27-Ac-ft
or 3.20-Ac-inches

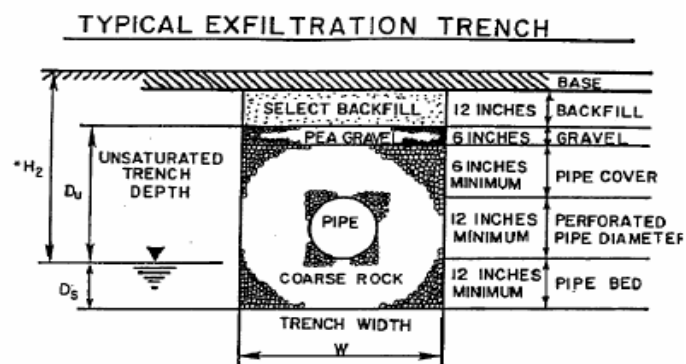
L_(max credit) = 271 Feet

7) Site Design Trench Provided

L_(Provided) = 150 Feet

CHECKS

Du > Ds : OK
Width < 2 x Height : OK



$$L = \frac{V}{K(H_2W + 2H_2D_u - D_u^2 + 2H_2D_s) + (0.39 \times 10^{-4})WD_u}$$

L = LENGTH OF TRENCH REQUIRED (FEET)
V = VOLUME TREATED (ACRE-INCHES)
W = TRENCH WIDTH (FEET)
K = HYDRAULIC CONDUCTIVITY (CFS/FT.²-FT.HEAD)
*H₂ = DEPTH TO WATER TABLE (FEET)
D_u = NON-SATURATED TRENCH DEPTH (FEET)
D_s = SATURATED TRENCH DEPTH (FEET)

* The value of H₂ to be used in the equation is the effective head on the saturated surface. A weir must be installed at the downstream end of the trench, to create true retention and to establish H₂. To achieve the design retention and exfiltration, the crest of the weir must be no lower than the top of the trench pipe.

Figure F-4

Project Name: OP CubeSmart/FS PRE

Reviewer: sfb

Project Number: 20-0201

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

Time Step: 0.2 hr, Iterations: 10

Elevations shown in this report are NAVD 88

Basin 1: Site

Method: Santa Barbara Unit Hydrograph

Rainfall Distribution: SFWMD - 3day

Design Frequency: 25 year

1 Day Rainfall: 11 inches

Area: 1 acres

Ground Storage: 0.1 inches

Time of Concentration: 0.25 hours

Initial Stage: 1.5 ft ~~NAVD~~

Stage (ft NAVD)	Storage (acre-ft)
1.50	0.00
2.00	0.00
3.00	0.00
4.00	0.00
5.00	0.00
6.00	0.00
7.00	0.02
8.00	0.45
9.00	1.38
10.00	2.38
11.00	3.38
12.00	4.38

STRUCTURE MAXIMUM AND MINIMUM DISCHARGES

Struc	Max (cfs)	Time (hr)	Min (cfs)	Time (hr)
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BASIN MAXIMUM AND MINIMUM STAGES

Basin	Max (ft)	Time (hr)	Min (ft)	Time (hr)
Site	8.85	72.00	1.50	0.00

BASIN WATER BUDGETS (all units in acre-ft)

Basin	Total Runoff	Structure Inflow	Structure Outflow	Initial Storage	Final Storage	Residual
Site	1.23	0.00	0.00	0.00	1.23	0.00

Project Name: OP CubeSmart/FS POST

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Basin 1: Site

Method: Santa Barbara Unit Hydrograph

Rainfall Distribution: SFWMD - 3day

Design Frequency: 25 year

1 Day Rainfall: 11 inches

Area: 1 acres

Ground Storage: 1.42 inches

Time of Concentration: 0.5 hours

Initial Stage: 1.5 ft NGVD

Stage (ft NGVD)	Storage (acre-ft)
1.50	0.00
2.00	0.00
3.00	0.00
4.00	0.00
5.00	0.00
6.00	0.14
7.00	0.14
8.00	0.14
9.00	0.43
10.00	1.16
11.00	1.93
12.00	2.70

Offsite Receiving Body: Offsitel

Time (hr)	Stage (ft NGVD)
0.00	1.50
96.00	1.50

Structure: 1

From Basin: Site

To Basin: Offsitel

Structure Type: Gravity

Weir: Broad Crested, Crest Elev = 6 ft NGVD, Length = 0.5 ft, Weir Coef = 3.13

Bleeder: None

Pipe: Diameter = 2 ft, Manning's n = 0.012, Length = 50 ft

US Invert Elev = 1.5 ft NGVD, DS Invert Elev = 1.5 ft NGVD, no flap gate

Time (hr)	Cumulative Rainfall (in)	Instant Runoff (cfs)	Current Discharge (cfs)	Cumulative Discharge (acre-ft)	Head Water Stage (ft NGVD)	Tail Water Stage (ft NGVD)
0.00	0.00	0.00	0.00	0.00	1.50	1.50
4.00	0.27	0.00	0.00	0.00	1.50	1.50
8.00	0.54	0.02	0.00	0.00	5.02	1.50
12.00	0.80	0.03	0.00	0.00	5.07	1.50
16.00	1.07	0.04	0.00	0.00	5.16	1.50
20.00	1.34	0.04	0.00	0.00	5.25	1.50
24.00	1.61	0.05	0.00	0.00	5.36	1.50
28.00	2.00	0.08	0.00	0.00	5.53	1.50
32.00	2.39	0.08	0.00	0.00	5.72	1.50
36.00	2.78	0.09	0.00	0.00	5.92	1.50
40.00	3.17	0.09	0.00	0.00	8.06	1.50
44.00	3.56	0.09	0.00	0.07	5.80	1.50
48.00	3.95	0.09	0.00	0.07	8.01	1.50
52.00	4.44	0.14	0.00	0.07	8.13	1.50
56.00	5.46	0.30	0.00	0.15	8.13	1.50

Time (hr)	Cumulative Rainfall (in)	Instant Runoff (cfs)	Current Discharge (cfs)	Cumulative Discharge (acre-ft)	Head Water Stage (ft NGVD)	Tail Water Stage (ft NGVD)
60.00	11.16	4.93	4.85	0.46	8.13	1.50
64.00	13.63	0.34	0.00	0.84	8.04	1.50
68.00	14.42	0.20	0.00	0.91	8.03	1.50
72.00	14.95	0.13	0.00	0.99	5.86	1.50

STRUCTURE MAXIMUM AND MINIMUM DISCHARGES

Struc	Max (cfs)	Time (hr)	Min (cfs)	Time (hr)
1	4.96	59.80	0.00	0.00

BASIN MAXIMUM AND MINIMUM STAGES

Basin	Max (ft)	Time (hr)	Min (ft)	Time (hr)
Site	8.16	59.80	1.50	0.00

BASIN WATER BUDGETS (all units in acre-ft)

Basin	Total Runoff	Structure Inflow	Structure Outflow	Initial Storage	Final Storage	Residual
Site	1.11	0.00	0.99	0.00	0.12	0.00

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Basin 1: Site

Method: Santa Barbara Unit Hydrograph

Rainfall Distribution: SFWMD - 3day

Design Frequency: 100 year

1 Day Rainfall: 14.5 inches

Area: 1 acres

Ground Storage: 0.1 inches

Time of Concentration: 0.25 hours

Initial Stage: 1.5 ft ~~NCVD~~

Stage (ft NCVD)	Storage (acre-ft)
1.50	0.00
2.00	0.00
3.00	0.00
4.00	0.00
5.00	0.00
6.00	0.00
7.00	0.02
8.00	0.45
9.00	1.38
10.00	2.38
11.00	3.38
12.00	4.38

STRUCTURE MAXIMUM AND MINIMUM DISCHARGES

Struc	Max (cfs)	Time (hr)	Min (cfs)	Time (hr)
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BASIN MAXIMUM AND MINIMUM STAGES

Basin	Max (ft)	Time (hr)	Min (ft)	Time (hr)
Site	9.25	72.00	1.50	0.00

BASIN WATER BUDGETS (all units in acre-ft)

Basin	Total Runoff	Structure Inflow	Structure Outflow	Initial Storage	Final Storage	Residual
Site	1.63	0.00	0.00	0.00	1.63	0.00

Project Name: OP CubeSmart/FS POST

Reviewer: sfb

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1 Day Rainfall: 14.5 inches

Area: 1 acres

Ground Storage: 1.42 inches

Time of Concentration: 0.5 hours

Initial Stage: 1.5 ft NGVD

Stage (ft NGVD)	Storage (acre-ft)
1.50	0.00
2.00	0.00
3.00	0.00
4.00	0.00
5.50	0.10
6.00	0.14
7.00	0.14
8.00	0.18
9.00	0.59
10.00	1.32
11.00	2.09

Offsite Receiving Body: Offsitel

Time (hr)	Stage (ft NGVD)
0.00	1.50
96.00	1.50

STRUCTURE MAXIMUM AND MINIMUM DISCHARGES

Struc	Max (cfs)	Time (hr)	Min (cfs)	Time (hr)
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BASIN MAXIMUM AND MINIMUM STAGES

Basin	Max (ft)	Time (hr)	Min (ft)	Time (hr)
Site	10.23	72.00	1.50	0.00

BASIN WATER BUDGETS (all units in acre-ft)

Basin	Total Runoff	Structure Inflow	Structure Outflow	Initial Storage	Final Storage	Residual
Site	1.50	0.00	0.00	0.00	1.50	0.00