Table 2-1 – PSL Datum Conversions

Datum Output (Conversion To:)	Datum Input (Conversion From)[2]:									
	NAVD88		NGVD29		MSL[1] (epoch 1983-2001)		MLW[1] (epoch 1983-2001)		Plant Datum (MLW PSL Datum)	
	ft	m	ft	m	ft	m	ft	m	ft	m
NAVD88	0.000	0.000	-1.5	-0.457	-0.912	-0.278	-1.276	-0.39	-3.35	-1.021
NGVD29	1.5	0.457	0.000	0.000	0.588	0.179	0.224	0.068	-1.85	-0.564
MSL[1] (epoch 1983-2001)	0.912	0.278	-0.588	-0.179	0.000	0.000	-0.367	-0.112	-2.438	-0.743
MLW[1] (epoch 1983-2001)	1.276	0.39	-0.224	-0.068	0.367	0.112	0.000	0.000	-2.808	-0.856
Plant Datum (MLW PSL Datum)	3.35	1.021	1.85	0.564	2.438	0.743	2.808	0.856	0.000	0.000

[1] MSL and MLW datum adjustments based on Station 8722125, Vero Beach FL (27° 37.9' N, 80° 22.3' W)

[2] To use the table, start at the Datum Input columns at the top of the table to select the datum the data is presented in. Staying in the datum input column, move down the table rows to the desired Datum Output presented in the left side of the table. The value intersecting the Datum Input column and Datum Output row is the conversion between the datums.

Definitions:
MSL = Mean Sea Level
NGVD29 = National Geodetic Vertical Datum of 1929
NAVD88 = North American Vertical Datum of 1988
MLW = Mean Low Water
ft = feet
m = meters

Sample Conversions: 0 ft-NAVD88 = 3.35 ft-Plant Datum (0 ft + 3.35 ft = 3.35 ft)
2 ft-MSL = 1.088 ft-NAVD88 (2 ft – 0.912 ft = 1.088 ft)

References:
NEE, 2014b
NOAA, 2013w

Table 3-1 – CLB Probable Maximum Precipitation (PMP)

Duration (hours)	Amount (inches)
6	32.0
12	38.7
24	47.1
48	51.8
72	55.7

Reference:
NEE, 2013b
NEE, 2014c

Table 3-2 – CLB PMH Cases Analyzed

Number	Initial Stall Phase (Approximately 36 Hours)								Final Stall Phase (Approximately 12 Hours)								Surge Results			
	UFSAR Storm Case	P_o (in. Hg)		RMW (nautical miles)		T (knots)		PMH Parameter Changes	P_o (in. Hg)		RMW (nautical miles)		T (knots)		PMH Parameter Changes	Stall Distance From Shore	Duration of Surge Level Above +8 ft-PSL Datum	Pressure Setup	Wind Setup	Peak Surge Level
		Initial	Final	Initial	Final	Initial	Final		Initial	Final	Initial	Final	Initial	Final		(nautical miles)	(hours)	(ft)	(ft)	(ft-PSL Datum)
1	Not Given	26.28	26.28	5	5	4	4	None - Steady State	26.28	26.28	5	5	4	4	None - Steady State	N/A	Not Given	Not Given	Not Given	Not Given
2	Not Given	26.28	26.28	5	5	11	11	None - Steady State	26.28	26.28	5	5	11	11	None - Steady State	N/A	Not Given	Not Given	Not Given	Not Given
3	Not Given	26.28	26.28	5	5	18	18	None - Steady State	26.28	26.28	5	5	18	18	None - Steady State	N/A	Not Given	Not Given	Not Given	Not Given
4	Not Given	26.28	26.28	11	11	4	4	None - Steady State	26.28	26.28	11	11	4	4	None - Steady State	N/A	Not Given	Not Given	Not Given	Not Given
5	Not Given	26.28	26.28	11	11	11	11	None - Steady State	26.28	26.28	11	11	11	11	None - Steady State	N/A	Not Given	Not Given	Not Given	Not Given
6	Not Given	26.28	26.28	11	11	18	18	None - Steady State	26.28	26.28	11	11	18	18	None - Steady State	N/A	3	3.8	7.3	17.2[4]
7	Not Given	26.28	26.28	20	20	4	4	None - Steady State	26.28	26.28	20	20	4	4	None - Steady State	N/A	Not Given	Not Given	Not Given	Not Given
8	Not Given	26.28	26.28	20	20	11	11	None - Steady State	26.28	26.28	20	20	11	11	None - Steady State	N/A	Not Given	Not Given	Not Given	Not Given
9	Not Given	26.28	26.28	20	20	18	18	None - Steady State	26.28	26.28	20	20	18	18	None - Steady State	N/A	Not Given	Not Given	Not Given	Not Given
10a	High Tide	26.28	26.28	20	20	4	4	None - Steady State	26.28	26.28	20	20	4	4	None - Steady State	N/A	12	3.7	6.1	15.9
10b	Low Tide[1]	26.28	26.28	20	20	4	4	None - Steady State	26.28	26.28	20	20	4	4	None - Steady State	N/A	19	3.7	6.1	12.8
11	1[2][3]	26.28	26.28	5	5	2	2	None - Steady State	26.28	26.28	5	5	2	2	None - Steady State	N/A	9	3.6	5.4	15.1
12	2[2][3]	26.28	26.28	11	11	2	2	None - Steady State	26.28	26.28	11	11	2	2	None - Steady State	N/A	21	3.7	6.2	16.0
13	3[2][3]	26.28	26.28	20	20	2	2	None - Steady State	26.28	26.28	20	20	2	2	None - Steady State	N/A	36	3.7	6.3	16.1
14	4[3]	26.28	26.28	20	26.7	4	4	T=4, 3, 2 knots at 12 hours intervals ΔP_o & ΔRMW change linearly over last 24 hours due to upwelling	28.28	29.28	26.7	30	1	1	ΔP_o & ΔRMW change over the first 12 hours due to filling	18	8	1.5	2.5	10.1
15	5[3]	26.28	26.28	20	20	4	4	None - Steady State	26.28	27.28	20	20	1	1	ΔP_o change over first 5 hours (with 6 hours filling)	18	37	3.1	4.9	14.1
16	6[3]	26.28	26.28	20	20	4	4	None - Steady State	26.28	27.28	20	20	1	1	ΔP_o change over first 5 hours (without filling)	18	47	3.0	5.0	14.1
17	7[3]	26.28	26.28	20	20	4	4	None - Steady State	26.28	27.28	20	20	1	1	ΔP_o change over first 5 hours	27	55	3.0	5.0	14.1
18	8	28.24	28.24	30	30	10	0	T decreases as hurricane approaches coast	28.24	28.24	30	30	0	10	T increases as hurricane retreats from coast	18	7	3.1	5.0	14.2

[1] Tidal phase adjusted to maximize duration of surge above +8 ft-PSL Datum
[2] Case 1 through 3 are steady-state PMHs, but are listed for their exceptionally slow translation speed (T).
[3] P_n = 31.28 in. Hg for Case 1 through 7 and P_n = 30.42 in. Hg for Case 8 (Flora-type).
[4] Total Surge Height = Astronomical High Tide (4.6 ft-PSL Datum) + Initial Rise (1.5 ft) + Pressure Setup (3.8 ft) + Wind Setup (7.3 ft)

Definitions:
P_n = Peripheral Pressure
P_o = Central Pressure
RMW = Radius of Maximum Wind
Δ = "Change in"
PMH = Probable Maximum Hurricane
T = Forward Speed

References:
NEE, 2013b
NEE, 2014f
NEE, 2014c

Table 3-3 – CLB Erosion Reserve Distances to PSL

Transect [3]	Transect Origin	Steady State PMH at Low Tide with RMW = 20nm and T = 4 knots	PMH Case – Reserve Distance [1,2] (ft)			
			PMH Case 6, Method 1	PMH Case 6, Method 2	PMH Case 7	PMH Case 8
AA'	NW Corner Unit 1 Turbine Building	115	46	93	175	167
BB'	Unit 1 Reactor Building	184	105	156	245	235
CC'	Unit 1 Reactor Building	152	83	143	290	283
DD'	N Crest of Discharge Canal	120	0	151	310	304
EE'	NE Corner of Class I Fill	535	450	437	620	620
FF'	Unit 1 Diesel Oil Storage Tank	550	415	450	615	615
GG'	Unit 2 Diesel Oil Storage Tank	575	515	510	635	635
HH'	Crest of Storm Water Basin	565	430	465	695	695
II'[4]	Unit 2 Reactor Auxiliary Building	1265 70	1150 139	1160 136	1000 136	1315 34
MM'	North Diesel Oil Transfer Pump, Unit 1	673	N/A	537	457	Not calculated
NN'	Condensate Storage Tank	202	117	161	146	245

[1] Reserve distance due to frontal wave erosion and littoral drift loss plus bank recession due to channel scour
[2] PMH Cases are listed in Table 3-2
[3] Transects JJ' and KK' were for erosion estimates of Highway A1A and the PSL Discharge Canal respectively, no reserve distances were calculated. Refer to Figures 3-1 and 3-2 for the cross-section locations.
[4] Erosion and scour act at different locations, top line is the reserve distance from wave erosion and littoral drift loss, bottom line is reserve distance from bank recession due to channel scour

Definitions:
PMH = Probable Maximum Hurricane
RMW = Radius of Maximum Wind
T = Forward Speed

References:
NEE, 2013b
NEE, 2014c

Table 4-1 – LIP Scenario Characteristics

Scenario	Number of Units Operating	Water Level in Intake Canal (ft-NAVD88)	Flex Building	Model Input Rainfall Hyetographs[1]
A	2	-6.85	No	Q_1, Q_2, Q_3, Q_4
B	1	-2.35	No	Q_1, Q_2, Q_3, Q_4
C	0	-0.35	No	Q_1, Q_2, Q_3, Q_4
D	2	-6.85	Yes	Q_1, Q_2, Q_3, Q_4
E	1	-2.35	Yes	Q_1, Q_2, Q_3, Q_4
F	0	-0.35	Yes	Q_1, Q_2, Q_3, Q_4

[1] Model rainfall input hyetographs are shown in Figure 4-3. Q_1 = 1st Quartile, Q_2 = 2nd Quartile, Q_3 = 3rd Quartile, Q_4 = 4th Quartile

Definitions:
NAVD88 = North American Vertical Datum of 1988
No = No, not included in the FLO-2D Model
Yes = Yes, included in the FLO-2D Model

Reference:
NEE, 2014c

Table 4-2 – Maximum Water Depths [ft] for all the Scenarios at the Points of Interest

Points of Interest (POI)[1]	Scenario					
	A	**B**	**C**	**D**	**E**	**F**
1	1.15	1.01	1.00	**1.16**	1.01	1.03
2	**1.33**	1.20	1.19	1.33	1.20	1.21
3	**1.32**	1.19	1.19	1.31	1.20	1.20
4	1.47	1.43	1.41	**1.49**	1.47	1.45
5	2.40	2.39	2.37	2.43	2.40	**2.41**
6	**1.86**	1.86	1.84	1.82	**1.86**	1.84
7	0.93	2.04	2.02	0.92	2.02	**2.05**
8	**3.16**	2.50	2.49	3.13	2.49	2.50
9	**1.39**	0.72	0.72	1.38	0.73	0.77
10	**1.39**	0.72	0.72	1.38	0.73	0.77
11	**3.16**	2.48	2.47	3.13	2.48	2.49
12	1.20	**1.77**	**1.77**	1.20	1.76	1.76
13	1.87	1.87	1.85	1.84	1.87	**1.88**
14	**1.86**	1.83	1.84	1.82	1.84	1.82
15	**0.60**	0.60	0.60	0.60	0.60	**0.60**
16	**0.76**	0.69	0.68	0.74	0.69	0.69
17	0.56	0.56	0.56	0.56	0.56	**0.57**
18	1.21	1.21	**1.23**	1.21	1.21	1.22
19	0.59	0.59	0.59	**0.60**	0.59	0.58
20	**1.00**	**1.00**	**1.00**	0.99	**1.00**	**1.00**
21	1.64	1.63	1.64	1.62	**1.65**	1.24
22	**1.89**	1.87	1.86	1.86	1.88	1.88
23	2.04	2.03	2.04	2.03	2.02	**2.07**
24	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**
25	1.86	1.85	1.86	1.86	**1.88**	**1.88**
26	**2.01**	**2.01**	1.99	**2.01**	**2.01**	1.99
27	**1.48**	1.47	1.47	1.46	1.47	**1.48**
28	**1.00**	**1.00**	**1.00**	0.99	**1.00**	**1.00**
29	**0.69**	0.67	0.67	0.68	0.68	0.67
30	**0.30**	0.29	0.29	**0.30**	0.29	0.29
31	0.63	0.63	0.63	**0.64**	0.62	0.63
32	0.61	0.61	0.61	0.62	0.60	**0.62**
33	**0.12**	**0.12**	**0.12**	**0.12**	**0.12**	**0.12**
34	**1.28**	1.27	1.27	1.26	**1.28**	**1.28**
35	**0.20**	0.19	0.19	**0.20**	0.19	0.19
36	**0.12**	**0.12**	**0.12**	**0.12**	**0.12**	**0.12**

[1] Points of Interest are shown on Figure 4-6

Table 4-3 –Results for Exceedance High and Low Tides at Tide Stations

Station ID[1]	Station Name	Record Period Used (years)	Approximate Distance to St. Lucie[2] (miles)	10% Exceedance High Tide (m-NAVD88)	10% Exceedance High Tide (ft-NAVD88)	10% Exceedance Low Tide (m-NAVD88)	10% Exceedance Low Tide (ft-NAVD88)
8723214	Virginia Key	19	111.5	0.433	1.42	-0.823	-2.7
8722670	Lake Worth Pier	16[3]	52.2	0.53	1.74	-1.12	-3.67
8721604	Trident Pier	18	76.2	0.832	2.73	-1.26	-4.15

[1] Station locations are shown on Figure 4-9
[2] Distance is measured as a straight line
[3] 21 years of resynthesized tidal data was used to estimate the exceedance tides. 16 years of observed tidal data was used to estimate the effect of sea level anomaly.

Definitions:
NAVD88 = North American Vertical Datum of 1988

References:
NOAA, 2013p
NOAA, 2013r
NOAA, 2013s

Table 4-4 –Results for Sea Level Rise Trends at Tide Stations

Station ID[1]	Station Name	Record Period (years)	Approximate Distance to St. Lucie (miles)[2]	30-Year Linear Trend (ft)	30-Year Non-Linear 2nd Order Trend (ft)	100-Year Linear Trend (ft)	100-Year Non-Linear 2nd Order Trend (ft)
8723214	Virginia Key	19	111.5	0.34	1.08	1.15	7.09
8721604	Trident Pier	18	76.2	0.28	1.51	0.92	10.96
8722670	Lake Worth Pier	16	52.2	0.31	0.21	1.02	0.37
8720030	Fernandina Beach	89	240.6	0.20	0.25	0.66	0.91

[1] Station locations are shown on Figure 4-9
[2] Distance is measured as a straight line

References:
NOAA, 2013h
NOAA, 2013i
NOAA, 2013j
NOAA, 2013k

Table 4-5 – IHO Tide Station Constituents Used in Model Calibration

<table>
<tr><th>Number</th><th>Station Name[1]</th><th>Constituent</th><th>Amplitude (meters)</th><th>Phase (degrees)</th></tr>
<tr><td rowspan="11">1</td><td rowspan="11">Baracoa IHO</td><td>K1</td><td>0.082</td><td>213.9053</td></tr>
<tr><td>O1</td><td>0.062</td><td>217.0152</td></tr>
<tr><td>P1</td><td>0.027</td><td>213.8947</td></tr>
<tr><td>Q1</td><td>0.012</td><td>218.4933</td></tr>
<tr><td>M2</td><td>0.246</td><td>13.7205</td></tr>
<tr><td>S2</td><td>0.048</td><td>43.400002</td></tr>
<tr><td>N2</td><td>0.061</td><td>354.99869</td></tr>
<tr><td>K2</td><td>0.013</td><td>43.410702</td></tr>
<tr><td>NU2</td><td>0.012</td><td>357.46289</td></tr>
<tr><td>M4</td><td>0.002</td><td>343.741</td></tr>
<tr><td>M6</td><td>0.004</td><td>334.96161</td></tr>
<tr><td rowspan="15">2</td><td rowspan="15">Cat Cay IHO</td><td>K1</td><td>0.008</td><td>213.3054</td></tr>
<tr><td>O1</td><td>0.012</td><td>331.31519</td></tr>
<tr><td>S2</td><td>0.071</td><td>48.599999</td></tr>
<tr><td>M2</td><td>0.337</td><td>19.5205</td></tr>
<tr><td>Q1</td><td>0.005</td><td>322.2933</td></tr>
<tr><td>N2</td><td>0.078</td><td>355.5986</td></tr>
<tr><td>K2</td><td>0.017</td><td>52.610699</td></tr>
<tr><td>NU2</td><td>0.015</td><td>358.5629</td></tr>
<tr><td>MU2</td><td>0.01</td><td>0.541</td></tr>
<tr><td>S1</td><td>0.003</td><td>27.299999</td></tr>
<tr><td>M4</td><td>0.005</td><td>221.1411</td></tr>
<tr><td>L2</td><td>0.011</td><td>52.5424</td></tr>
<tr><td>2N2</td><td>0.01</td><td>331.57681</td></tr>
<tr><td>LABDA2</td><td>0.002</td><td>33.578098</td></tr>
<tr><td>S4</td><td>0.002</td><td>261.10001</td></tr>
<tr><td rowspan="10">3</td><td rowspan="10">Coat Zacoalcos IHO</td><td>K1</td><td>0.136</td><td>24.746401</td></tr>
<tr><td>O1</td><td>0.138</td><td>19.458201</td></tr>
<tr><td>P1</td><td>0.044</td><td>28.653601</td></tr>
<tr><td>M2</td><td>0.076</td><td>244.4046</td></tr>
<tr><td>Q1</td><td>0.027</td><td>16.691999</td></tr>
<tr><td>S2</td><td>0.021</td><td>246.2</td></tr>
<tr><td>N2</td><td>0.02</td><td>229.7384</td></tr>
<tr><td>MU2</td><td>0.002</td><td>242.40919</td></tr>
<tr><td>J1</td><td>0.011</td><td>27.3127</td></tr>
<tr><td>M4</td><td>0.002</td><td>142.5092</td></tr>
</table>

Table 4-5 – IHO Tide Station Constituents Used in Model Calibration (continued)

Number	Station Name[1]	Constituent	Amplitude (meters)	Phase (degrees)
4	Daytona Beach IHO	K1	0.098	196.4053
		O1	0.075	200.9152
		P1	0.032	190.7946
		M2	0.584	10.9205
		Q1	0.015	197.9933
		S2	0.104	32.4
		N2	0.144	349.6986
		K2	0.022	33.9107
		NU2	0.028	351.96289
		MU2	0.018	353.1411
		J1	0.006	194.2272
		L2	0.023	31.0424
		2N2	0.019	328.4768
		LABDA2	0.004	20.8781
		OO1	0.003	191.8955
		T2	0.006	32.394699
		SA	0.104	197.50529
		SSA	0.077	52.410702
5	Ireland Island IHO	K1	0.069	194.16431
		P1	0.054	194.77209
		S2	0.083	33
		O1	0.023	193.83569
		Q1	0.011	194.5946
		N2	0.086	345.75891
		M2	0.379	5.9363999
		K2	0.02	35.328602
		NU2	0.016	349.05029
		SA	0.101	238.16431
		T2	0.005	31.835699
		J1	0.004	193.3418
		M4	0.002	247.8728
		L2	0.008	21.113899
		SSA	0.034	11.3285
		MS4	0.002	317.9364
6	Miami Harbor Entrance IHO	K1	0.041	244.8054
		O1	0.033	268.71521
		P1	0.012	248.49471
		M2	0.365	20.4205
		Q1	0.006	280.59329
		S2	0.073	44.5
		N2	0.084	0.8987
		K2	0.019	56.410702
		NU2	0.016	3.4628999
		MU2	0.011	356.741
		T2	0.004	44.494701
		L2	0.01	23.242399
		SA	0.088	198.8053
		SSA	0.062	68.710701
		2N2	0.011	341.27679

Table 4-5 – IHO Tide Station Constituents Used in Model Calibration (continued)

Number	Station Name[1]	Constituent	Amplitude (meters)	Phase (degrees)
7	Myrtle Beach IHO	K1	0.102	188.9053
		O1	0.076	193.0152
		P1	0.038	187.3947
		Q1	0.018	163.4933
		M2	0.741	357.22049
		OO1	0.003	184.7955
		S2	0.134	20.700001
		N2	0.172	340.5986
		K2	0.034	1.6107
		NU2	0.038	333.1629
		MU2	0.025	339.841
		MSF	0.017	266.47949
		RO1	0.003	194.7576
		MK3	0.008	53.6259
		L2	0.019	334.34241
		T2	0.008	20.6947
		2N2	0.021	329.3768
		J1	0.006	186.9272
		M1	0.009	215.0835
		S1	0.018	157.60001
		MS4	0.012	235.4205
		MM	0.019	212.42191
		MF	0.022	57.9902
		2Q1	0.002	197.0714
		SA	0.109	174.6053
		SSA	0.063	60.8107
		LABDA2	0.011	24.0781
		R2	0.009	260.8053
		M3	0.016	76.7808
8	Nassau IHO	K1	0.087	197.3053
		O1	0.065	201.3152
		OO1	0.003	194.39549
		S2	0.064	31.700001
		P1	0.027	199.3947
		M2	0.379	7.7205
		Q1	0.012	195.3933
		RO1	0.002	203.35761
		N2	0.092	345.69861
		K2	0.02	40.710701
		NU2	0.021	343.6629
		MU2	0.009	357.741
		S1	0.003	249.3
		M6	0.002	383.06162
		SA	0.095	144.00529
		T2	0.004	31.6947
		J1	0.005	196.32719
		M1	0.004	179.3835
		LABDA2	0.003	19.678101
		2Q1	0.002	205.3714
		S6	0.001	208.10001
		M4	0.005	14.441
		L2	0.014	41.742401
		SSA	0.031	33.0107
		2N2	0.012	322.67679
		R2	0.001	31.705299
		S4	0.001	268.39999
		M3	0.002	26.080799

Table 4-5 – IHO Tide Station Constituents Used in Model Calibration (continued)

Number	Station Name[1]	Constituent	Amplitude (meters)	Phase (degrees)
9	San Juan IHO	K1	0.088	228.16431
		O1	0.073	227.0721
		P1	0.029	228.1357
		M2	0.146	19.236401
		Q1	0.014	226.0946
		S2	0.024	44.200001
		N2	0.039	353.25891
		K2	0.007	44.2285
		M6	0.002	353.70929
10	South Pass IHO	O1	0.144	13.7582
		K1	0.142	20.1464
		P1	0.047	20.1536
		Q1	0.028	10.492
		M2	0.017	110.7046
		J1	0.011	23.3127
		M1	0.01	16.9802
		S2	0.009	106.5
		N2	0.005	155.5384
		M4	0.004	263.5093
		M6	0.003	207.9139
11	Toco IHO	K1	0.1	244.16431
		O1	0.08	217.77209
		P1	0.03	243.83569
		M2	0.27	208.9364
		S2	0.09	242
		N2	0.03	176.7589
		K2	0.02	242.3286

[1] Station locations are shown on Figure 4-12

Reference:

Deltares, 2012

Table 4-6 – Results of Tide Calibration

Location	Latitude (Degrees)	Longitude (Degrees)	Approximate Distance to PSL[1] (miles)	RMSE (m)	NSE
Miami Harbor Entrance, Florida	-80.13	25.77	180	0.09	0.92
Daytona Beach, Florida	-81.00	29.23	230	0.06	0.99
Cat Cay, Bahamas	-79.28	25.55	320	0.05	0.96
Nassau, Bahamas	-77.35	25.08	380	0.04	0.99
Baracoa, Cuba	-74.50	20.35	530	0.03	0.98
Myrtle Beach, South Carolina	-78.90	33.67	710	0.10	0.97
South Pass, Louisiana	-89.13	28.98	900	0.04	0.88
Ireland Island, Bermuda	-64.83	32.32	1,590	0.42	-1.76
Coat Zacoalcos, Mexico	-94.42	18.15	1,750	0.09	0.59
San Juan, Puerto Rico	-66.12	18.47	1,750	0.03	0.94
Toco, Trinidad and Tobago	-60.93	10.83	2,690	0.05	0.94

[1] Distance is measured as a straight line

Definitions:
RMSE = Root Mean Square Error
NSE = Nash Sutcliffe Efficiency

Reference:
Deltares, 2012
Wilmott et al., 2012
Nash and Sutcliffe, 1970

Table 4-7 – Simulated versus Observed Maximum Water Surface Elevation for Hurricane Irene – Calibration Storm

Location[1]	Measured WSEL (m-MSL)	Delft3D WSEL (m-MSL)	Error (m)	Reference
	A	B	B - A	
Fernandina Beach, FL	1.647	1.421	-0.226	NOAA, 2011b
Fernandina Beach, FL	1.647	1.421	-0.226	NOAA, 2013m[2]
Lake Worth Pier, FL	0.883	0.522	-0.361	NOAA, 2011b
Lake Worth Pier, FL	0.859	0.522	-0.337	NOAA, 2011b
Mayport Bar Pilots Docks, FL	1.306	1.368	0.062	NOAA, 2013o[2]
San Juan, PR	0.316	0.313	-0.003	NOAA, 2011b
Trident Pier, FL	1.216	0.898	-0.318	NOAA, 2011b
Trident Pier, FL	1.230	0.898	-0.332	NOAA, 2013p[2]
Virginia Key, FL	0.708	0.538	-0.170	NOAA, 2011b
Virginia Key, FL	0.665	0.538	-0.127	NOAA, 2011b

[1] Some locations are presented twice since the duration of the surge event occurred over more than one high tide cycle and multiple data sources were available. Refer to Figure 4-9 for the locations of the observed water surface elevations.

[2] WSEL values referenced from time series available throughout the event.

Definitions:
WSEL = Water Surface Elevation
MSL = Mean Sea Level

Table 4-8 – Simulated versus Observed Maximum Water Surface Elevation for Hurricane Floyd – Validation Storm

Location[1]	Measured WSEL (m-MSL)	Delft3D WSEL (m-MSL)	Error (m)	Reference
	A	B	B - A	
Fernandina Beach, FL	1.039	1.424	0.4	NOAA, 2000
Fernandina Beach, FL	1.633	1.424	-0.2	NOAA, 2013m[2]
Key West, FL	0.516	0.392	-0.1	NOAA, 2013n[2]
Mayport, FL	1.295	1.447	0.2	NOAA, 2000
St Augustine Beach, FL	1.765	1.345	-0.4	NOAA, 2000
Trident Pier, FL	1.239	0.878	-0.4	NOAA, 2000
Trident Pier, FL	1.162	0.878	-0.3	NOAA, 2013p[2]
Virginia Key, FL	0.743	0.452	-0.3	NOAA, 2013r[2]

[1] Some locations are presented twice since the duration of the surge event occurred over more than one high tide cycle and multiple data sources were available. Refer to Figure 4-9 for the locations of the observed water surface elevations.

[2] WSEL values referenced from time series available throughout the event.

Definitions:
WSEL = Water Surface Elevation
MSL = Mean Sea Level

Table 4-9 – Simulated versus Observed Maximum Water Surface Elevation for Hurricane Frances – Validation Storm

Location[1]	Measured WSEL (m-MSL)	Delft3D WSEL (m-MSL)	Error (m)	Reference
	A	B	B - A	
Fernandina Beach, FL	1.351	1.247	-0.1	NOAA, 2013m[2]
Mayport Bar Pilots Dock, FL	1.078	1.320	0.2	NOAA, 2013o[2]
Trident Pier, FL	1.532	1.488	0.0	NOAA, 2013p[2]
Virginia Key, FL	0.576	0.475	-0.1	NOAA, 2013r[2]

[1] Refer to Figure 4-9 for the locations of the observed water surface elevations.

[2] WSEL values referenced from time series available throughout the event.

Definitions:
WSEL = Water Surface Elevation
MSL = Mean Sea Level

Table 4-10 – Simulated versus Observed Maximum Water Surface Elevation for Hurricane Jeanne – Validation Storm

Location[1]	Measured WSEL (m-MSL)	Delft3D WSEL (m-MSL)	Error (m)	Reference
	A	B	B - A	
Fernandina Beach, FL	1.898	1.650	-0.25	NOAA, 2004d
Fernandina Beach, FL	1.841	1.650	-0.19	NOAA, 2013m[2]
Mayport Bar Pilots Dock, FL	1.553	1.562	0.01	NOAA, 2004d
Mayport Bar Pilots Dock, FL	1.547	1.562	0.02	NOAA, 2004d
Trident Pier, FL	1.843	1.713	-0.13	NOAA, 2013p[2]
Virginia Key, FL	0.515	0.665	0.15	NOAA, 2004d
Virginia Key, FL	0.737	0.665	-0.07	NOAA, 2013r[2]

[1] Some locations are presented twice since the duration of the surge event occurred over more than one high tide cycle and multiple data sources were available. Refer to Figure 4-9 for the locations of the observed water surface elevations.

[2] WSEL values referenced from time series available throughout the event.

Definitions:

WSEL = Water Surface Elevation

MSL = Mean Sea Level

Table 4-11 – Summary of Final PMSS Parameters for Delft3D–FLOW Model

Grid Parmeters	Final Parameters (4 FLOW Grids)			
Grid Type	Rectangular			
Grid Cell Size	Grid 1: 10.5 km	Grid 2: 525 m	Grid 3: 75 m	Grid 4: 18.75 m
Grid Cells M Direction	Grid 1: 467	Grid 2: 561	Grid 3: 512	Grid 4: 293
Grid Cells N Direction	Grid 1: 293	Grid 2: 461	Grid 3: 638	Grid 4: 249
Reference Datum	Mean Sea Level (MSL)			
Coordinate System	Speherical - Projected WGS 1984			
Number of Layers	One Layer for Depth Averaged Computations			
Thin Dams	None Specified			
Dry Points	None Specified			
Time Step	0.02 Minutes (1.2 seconds)			
Physical Processes Modelled	Wind, Tidal Forces, Boundry Forces, Online with WAVE			
Initial Condition Water Level	Uniform at 0 meters			
Open Boundary Conditions	Water Levels (Grid 1 only)			
Boundary Conditions Type	Grid 1: Astronomic Forcing using Tidal Constituents	Grid 2: Domain Decomposition	Grid 3: Domain Decomposition	Grid 4: Domain Decomposition
Number of Boundary Conditions	27 Divisions on the North Boundary (Grid 1 only) 29 Divisions on the East Boundary (Grid 1 only)			
Open Boundary Conditions Pressure	Average Pressure of 1020 mbar			
Open Boundary Condition Reflection Coefficient	1000 s^2 (Grid 1 only)			
Gravitational Acceleration	9.81 m/s^2			
Water Density	1025 kg/m^3			
Air Density	1.229 kg/m^3			
Wind Drag Coefficient Breakpoints	A (0.00063 at 0 m/s), B (0.0025 at 25 m/s), C (0.0025 at 100 m/s)			
Bottom Roughness	Spatially varied Mannings (Uniform at 0.02)			
Stress formulation due to wave forces	Fredsøe			
Wall Roughness Slip Condition	Free Slip			
Eddy Viscosity	Uniform at 50 m^2/s	Uniform at 5 m^2/s	Uniform at 5 m^2/s	Uniform at 5 m^2/s
Wind	Time, and Space Varying Wind and Pressure			
Drying and Flooding Check at	Grid Cell Centers and Faces			
Depth Specified at	Grid Cell Corners			
Depth at Grid Cell Centers	Maximum			
Depth at Grid Cell Faces	Mean			
Advection Scheme for Momentum	Grid 1: Cyclic	Grid 2: Cyclic	Grid 3: Cyclic	Grid 4: Flooding
Threshold Depth	0.005 meters			
Marginal Depth	None			
Smoothing Time	7200 minutes (results not sensitive to smoothing time)			
Threshold Depth for Critical Flow Limiter	N/A			

Table 4-12 – Summary of Parameters for Delft3D–WAVE Model

Grid Parmeters	Final Parameters (5 WAVE Grids)				
Grid Type	Rectangular				
Grid Cell Size	Grid 1: 10.5 km	Grid 2: 525 m	Grid 3: 75 m	Grid 4: 18.75 m	Grid 5: 18.75 m
Grid Cells M Direction	Grid 1: 467	Grid 2: 561	Grid 3: 512	Grid 4: 293	Grid 5: 293
Grid Cells N Direction	Grid 1: 293	Grid 2: 461	Grid 3: 638	Grid 4: 249	Grid 5: 249
Reference Datum	Mean Sea Level (MSL)				
Coordinate System	Speherical - Projected WGS 1984				
Spectral Resolution N Directions	36				
Lowest Frequency	0.05 Hz				
Highest Frequency	1 Hz				
N bins	24				
Boundary – significant wave height	1 m				
Boundary – Peak period	10 s				
Boundary (nautical)	90				
Boundary - Directional Spreading	4				
Gravity	9.81 m/s^2				
Water density	1025 kg/m^3				
North with respect to x-axis	90 (deg)				
Minimum depth	0.05 (m)				
Generation Mode	3rd generation				
Depth induced breaking alpha	1				
Depth induced breaking gamma	0.4				
Non-linear triad interactions alpha	0.1				
Non-linear triad interactions beta	2.2				
Bottom friction type	JONSWAP				
JONSWAP Coefficient	0.067 m^2 / s^3				
Wind Growth	Activated				
Whitecapping	Komen et al.				
Wave Propagation – Refraction	Activated				
Wave Propagation – Frequency Shift	Activated				
Directional space scheme	1.0				
Frequency space scheme	1.0				
Relative Change Hs-Tm01	0.01				
Percentage wet criteria	98%				
Relative Change Hs	0.01				
Relative Change TM01	0.01				
N Iterations	20				

Table 4-13 – Recorded Major (H3 and Above) Hurricanes within 120 Nautical Miles of PSL Since 1842

Hurricane	Dates	Maximum Category[1]	Make Landfall within ± 120 nautical miles?[2]	General Trajectory
Wilma	October 15, 2005 to October 26, 2005	H3	No	SW to NE
Jeanne	September 13, 2004 to September 29, 2004	H3	Yes	E to W
Charley	August 9, 2004 to August 15, 2004	H4	No	SW to NE
Floyd	September 7, 1999 to September 19, 1999	H4	No	SE to NW
Isbell	October 8, 1964 to October 16, 1964	H3	No	SW to NE
Donna	August 29, 1960 to September 13, 1960	H4	No	S to N
Not Named 1949	August 23, 1949 to August 31, 1949	H4	Yes	SE to NW
Not Named 1948	October 3, 1948 to October 15, 1948	H3	No	SW to NE
Not Named 1948	September 18, 1948 to September 25, 1948	H3	No	SW to NE
Not Named 1947	September 4, 1947 to September 21, 1947	H5	Yes	E to W
Not Named 1945	September 21, 1945 to September 20, 1945	H4	Yes	S to N

Table 4-13 – Recorded Major (H3 and Above) Hurricanes within 120 Nautical Miles of PSL Since 1842 (continued)

Hurricane	Dates	Maximum Category[1]	Make Landfall within ± 120 nautical miles?[2]	General Trajectory
Not Named 1935	September 23, 1935 to October 2, 1935	H4	No	SW to NE
Not Named 1933	August 31, 1929 to September 7, 1929	H4	Yes	SE to NW
Not Named 1928	September 6, 1928 to September 20, 1928	H4	Yes	SE to NW
Not Named 1926	September 11, 1926 to September 22, 1926	H4	Yes	SE to NW
Not Named 1926	October 14, 1926 to October 28, 1926	H3	No	SW to NE
Not Named 1910	October 9, 1910 to October 23, 1910	H3	No	S to N
Not Named 1906	October 8, 1906 to October 23, 1906	H3	No	SW to NE
Not Named 1899	August 3, 1899 to September 4, 1899	H3	No	S to N
Not Named 1893	September 25, 1893 to October 15, 1893	H3	No	SE to NW
Not Named 1893	August 15, 1893 to August 24, 1893	H3	No	SE to NW
Not Named 1888	August 14, 1888 to August 24, 1888	H3	Yes	E to W

Table 4-13 – Recorded Major (H3 and Above) Hurricanes within 120 Nautical Miles of PSL Since 1842 (continued)

Hurricane	Dates	Maximum Category[1]	Make Landfall within ± 120 nautical miles?[2]	General Trajectory
Not Named 1873	September 26, 1873 to October 10, 1873	H3	No	SW to NE
Not Named 1871	August 14, 1871 to August 23, 1871	H3	Yes	E to W
Not Named 1854	September 7, 1854 to September 12, 1871	H3	No	SE to NW

[1] Based on maximum wind speed recorded when the storm was within 120 nm of PSL. The storm's strength may have been greater outside this radius.

[2] Hurricanes were only marked as "yes" if the hurricane made landfall on the eastern side of Florida

Reference:
NOAA, 2013v

Table 4-14 – Hurricanes Since 1940 within ~120 Nautical Miles of PSL and Central Pressures Under 990 mbar

Hurricane Name	Year	Lowest Central Pressure (mbar)[1]	ΔP (mbar)[2]
No Name	1941	-----	-----
No Name	1945	951	69
No Name	1947	947	73
No Name	1948	964	56
No Name	1948	979	41
No Name	1949	954	66
Easy	1950	958	62
King	1950	-----	-----
Able	1951	-----	-----
Donna	1960	950	70
Cleo	1964	968	52
Isbell	1964	968	52
David	1979	970	50
Andrew[3]	1992	922	98
Erin	1995	982	38
Floyd	1999	935	85
Irene	1999	982	38
Frances	2004	958	62
Jeanne	2004	950	70

Table 4-14 – Hurricanes Since 1940 within ~120 Nautical Miles of PSL and Central Pressures Under 990 mbar (continued)

Hurricane Name	Year	Lowest Central Pressure (mbar)[1]	ΔP (mbar)[2]
Charley	2004	941	79
Ophelia	2005	988	32
Katrina	2005	983	37
Wilma	2005	950	70

[1] Lowest recorded pressure when storm was within 120 nm radius of PSL. Central pressure may have been lower outside this radius. If storm only had pressure recorded near (within ~15 nm) the 120 nm radius, then that pressure was used to expand the data set. Otherwise, central pressure was not considered.

[2] Δp = 1020 mbar – lowest central pressure (NWS, 1979).

[3] Hurricane Andrew is just outside of the 120 nautical mile range, but is presented due the strength of the hurricane

References:

NWS, 1979

NOAA, 2013v

Table 4-15 – Scenarios Evaluated to Determine Probable Maximum Storm Surge

Run ID	N FLOW Grids	10% Exceedance High Tide	SLR	Finest Grid Cell Size	Delft3D WAVE Coupled	Peripheral Pressure (in. Hg)	Central Pressure (in. Hg)	RMW (nautical miles)	Distance (RMW)	Forward Speed (knots)	Track Direction (degrees)[1]	Description
1	1	N	N	10.5 km	N	30.12	26.15	20	1	4	70	Track direction sensitivity 1
2	1	N	N	10.5 km	N	30.12	26.15	20	1	4	80	Track direction sensitivity 2
3	1	N	N	10.5 km	N	30.12	26.15	20	1	4	90	Track direction sensitivity 3
4	1	N	N	10.5 km	N	30.12	26.15	20	1	4	100	Track direction sensitivity 4
5	1	N	N	10.5 km	N	30.12	26.15	20	1	4	110	Track direction sensitivity 5
6	1	N	N	10.5 km	N	30.12	26.15	20	1	4	120	Track direction sensitivity 6
7	1	N	N	10.5 km	N	30.12	26.15	20	1	4	130	Track direction sensitivity 7
8	1	N	N	10.5 km	N	30.12	26.15	20	1	4	140	Track direction sensitivity 8
9	1	N	N	10.5 km	N	30.12	26.15	20	1	4	150	Track direction sensitivity 9
10	1	N	N	10.5 km	N	30.12	26.15	20	1	4	160	Track direction sensitivity 10
11	1	N	N	10.5 km	N	30.12	26.15	4	1	4	70	RMW sensitivity 1
12	1	N	N	10.5 km	N	30.12	26.15	13	1	4	70	RMW sensitivity 2
13	1	N	N	10.5 km	N	30.12	26.15	15	1	4	70	RMW sensitivity 3
14	1	N	N	10.5 km	N	30.12	26.15	17	1	4	70	RMW sensitivity 4
15	1	N	N	10.5 km	N	30.12	26.15	19	1	4	70	RMW sensitivity 5
16	1	N	N	10.5 km	N	30.12	26.15	20	1	4	70	RMW sensitivity 6
17	1	N	N	10.5 km	N	30.12	26.15	21	1	4	70	RMW sensitivity 7
18	1	N	N	10.5 km	N	30.12	26.15	17	1	4	70	Forward speed sensitivity 1
19	1	N	N	10.5 km	N	30.12	26.15	17	1	6	70	Forward speed sensitivity 2
20	1	N	N	10.5 km	N	30.12	26.15	17	1	8	70	Forward speed sensitivity 3
21	1	N	N	10.5 km	N	30.12	26.15	17	1	12	70	Forward speed sensitivity 4
22	1	N	N	10.5 km	N	30.12	26.15	17	1	16	70	Forward speed sensitivity 5
23	1	N	N	10.5 km	N	30.12	26.15	17	1	20	70	Forward speed sensitivity 6
24	1	N	N	10.5 km	N	30.12	26.15	19	1	20	70	Landfall location sensitivity 1
25	1	N	N	10.5 km	N	30.12	26.15	19	0.875	20	70	Landfall location sensitivity 2

Table 4-15 – Scenarios Evaluated to Determine Probable Maximum Storm Surge (continued)

Run ID	N FLOW Grids	10% Exceedance High Tide	SLR	Finest Grid Cell Size	Delft3D WAVE Coupled	Peripheral Pressure (in. Hg)	Central Pressure (in. Hg)	RMW (nautical miles)	Distance (RMW)	Forward Speed (knots)	Track Direction (degrees)[1]	Description
26	1	N	N	10.5 km	N	30.12	26.15	19	1.25	20	70	Landfall location sensitivity 3
27	1	N	N	10.5 km	N	30.12	26.15	19	1.50	20	70	Landfall location sensitivity 4
28	1	N	N	10.5 km	N	30.12	26.15	19	1.75	20	70	Landfall location sensitivity 5
29	1	N	N	10.5 km	N	30.12	26.15	19	2.00	20	70	Landfall location sensitivity 6
30	1	N	N	10.5 km	N	30.12	26.15	19	0.75	20	70	Landfall location sensitivity 7
31	1	N	N	10.5 km	N	30.12	26.15	19	0.50	20	70	Landfall location sensitivity 8
32	1	N	N	10.5 km	N	30.12	26.15	19	0.25	20	70	Landfall location sensitivity 9
33	1	N	N	10.5 km	N	30.12	26.15	19	0.00	20	70	Landfall location sensitivity 10
36	4	Y2	Y2	37 m	Y – 5 WAVE Grids	30.12	26.15	19	0.875	20	70	PMSS with dunes
37	4	Y2	Y2	37 m	Y – 5 WAVE Grids	30.12	26.15	19	0.875	20	70	PMSS without dunes

[1] Track direction is in accordance with the nautical convention (0° = North, 90° = East [degrees clockwise from North])

[2] Added to the end result

Definitions:
N FLOW Grids = Number of FLOW Grids Run in the Model
RMW = Radius of Maximum Wind
N = No, not included in the model run
Y = Yes, included in the model run
SLR = Sea Level Rise
Distance (RMW) = Landfall location of 0 indicates the hurricane passes 1 RMW south of PSL. This convention was chosen as landfall at 1 RMW south of the site maximizes the wind speed at PSL. A landfall location of +1 RMW indicates that the hurricane eye passes over PSL. A landfall location of -1 indicates the hurricane eye passes 2 RMW south of PSL.

Table 4-16 – Wave Parameters Coinciding with Peak Surge Elevation

Observation Point	Point ID[1]	Water Surface Elevation (m-MSL)[2]	Significant Wave Height (m)	Peak Wave Period (s)	Wave Length (m)
Atlantic	2	4.53	3.1	6.0	25.2
Big Mud Creek	1	5.31	2.6	3.5	18.8
Intake Canal	5	4.90	1.0	1.8	4.9
Discharge Canal	3	4.87	0.6	1.3	2.8
Observation Point 4	4	4.58	-	-	-
Observation Point 6	6	4.60	0.79	2.13	7.01

[1] Locations of the points are shown on Figure 4-31.

[2] Water surface elevations do not include the 10% exceedance high tides or sea level rise.

Table 4-17 – Indian River Lagoon Eigen Periods Computed with Merian's Formula

n	m	0 m-MSL		10% High Tide		10 % High tide + Sea Level Rise	
		T_{nm} (s)	T_{nm} (hr)	T_{nm} (s)	T_{nm} (hr)	T_{nm} (s)	T_{nm} (hr)
0	1	17,157.4	4.77	12,128.5	3.37	12,026.0	3.34
1	0	1,668.3	0.46	1,179.3	0.33	1,169.3	0.32
1	1	1,660.5	0.46	1,173.8	0.33	1,163.9	0.32
0	2	8,578.7	2.38	6,064.3	1.68	6,013.0	1.67
2	0	834.2	0.23	589.7	0.16	584.7	0.16
2	2	830.2	0.23	586.9	0.16	581.9	0.16
0	3	5,719.1	1.59	4,042.8	1.12	4,008.7	1.11
3	0	556.1	0.15	393.1	0.11	389.8	0.11
3	3	553.5	0.15	391.3	0.11	388.0	0.11

Definitions:

T_{nm} = Eigen period
n = number of nodes in the standing wave in *x* direction
m = number of nodes in the standing wave in *y* direction

Table 4-18 – Tsunami Sources Considered for Probable Maximum Tsunami (PMT) Evaluation

Input Sources Considered	Source Type	Near Field or Far Field[1]	Reference(s)	Potential PMT Source
Marques de Pombal Fault	Earthquake	Far Field	USGS, 2008; Barkan et al., 2009	Yes
Puerto Rico Trench	Earthquake	Far Field	USGS, 2008; Geist and Parsons, 2009	Yes
Hispaniola Trench	Earthquake	Far Field	USGS, 2008	Yes
Cape Fear	Landslide	Near Field	USGS, 2008; Hornbach, 2007	Yes
Cape Lookout	Landslide	Near Field	USGS, 2008, Hasegawa and Kanamori, 1987	Yes
1929 Grand Banks, Newfoundland	Landslide	Far Field	Fine et al., 2005; Natural Resources Canada, 2013; NOAA, 2014c; Hasegawa and Kanamori, 1987	No
1886 Charleston, SC	Historical Earthquake	Near Field	Fine et al., 2005; Johnson, 1996; USGS, 2008	No
2004 Sumatra, Indonesia	Historical Earthquake	Far Field	NOAA, 2014c	No
1946 Samana, Dominican Republic	Historical Earthquake	Far Field	NOAA, 2014c	No
1755 Lisbon, West of Gibraltar	Historical Earthquake	Far Field	USGS, 2008; NOAA, 2014c; Mader, 2001a;	Yes, as part of the Marques de Pombal Fault
1992 Florida Coast	Historical Meteorological Event	Near Field	NOAA, 2014c; Churchill et al., 1995	No
Blake Escarpment, FL	Landslide	Near Field	USGS, 2008; Twichell et al., 2009	No
Puerto Rico & Lesser Antilles	Volcanos	Far Field	Knight, 2006; Geist and Parsons, 2009	No
Cumbre Vieja, Cantry Islands	Volcano	Far Field	Ward and Day, 2001; USGS, 2008; Mader, 2001b; Gisler et al., 2006	No
Storegga, North Sea	Landslide	Far Field	Haflidason et al., 2004; USGS, 2008	No
South Sandwich Islands near Argentina	Earthquake	Far Field	NOAA, 2011c; NOAA, 2011d	No
Caribbean Sea, Gulf of Mexico, Southern Atlantic	Any	Near Field and Far Field	Knight, 2006; Geist and Parsons, 2009	No

[1] Near-field sources are located within 621 miles (1,000 km) from the site of interest (IOC, 2006). Far-field sources are located more than 621 miles (1,000 km) from the site of interest (IOC, 2006).

Table 4-19 – Earthquake Tsunami Source Parameters

Tsunami Source	Slip (m)	μ (Pa)	Length (km)	Width (km)	S (km^2)	M_0 (Nm)	M_w	P	Reference(s)
1755 Lisbon	30	$3e^{+10}$	600	600	282,743	$2.5e^{+23}$	9.6	$< 10^{-6}$	Mader, 2001a
1755 Lisbon: Source 3	13.1	$3e^{+10}$	200	80	16,000	$6.3e^{+21}$	8.53	$9e^{-6}$	Barken et al., 2009; Bird and Kagan, 2004
Lisbon M_w=8.61	15	$3e^{+10}$	200	90	18,000	$8.1e^{+21}$	8.61	10^{-6}	N/A
Puerto Rico Trench	10	$3e^{+10}$	675	102	68,850	$2.1e^{+22}$	8.85	$2e^{-4}$	Bird and Kagan, 2004; USGS, 2008
Hispaniola Trench	10	$3e^{+10}$	700	87.75	61,425	$1.8e^{+22}$	8.81	$3e^{-4}$	Bird and Kagan, 2004; USGS, 2008

Definitions:

μ = shear modulus
S = size
M_o = scalar seismic moment
M_w = moment magnitude
P = annual exceedance probability

Table 4-20 – Landslide Tsunami Source Parameters

Landslide	Length (km)	Width (km)	Thickness (km)	Volume (km^3)	Source Parameter P	P ($M_w > 7$)	Event P	Reference(s)
Cape Fear Slide	200	25	0.04	200[1]	0.009[1]	0.002	$1.89e^{-05}$	Tappin, 2010; ICAO, 2005; Rodriguez and Paul, 2000
Currituck Slide	180	55	0.02	165	0.057	0.002	$9.43e^{-05}$	Locat et al., 2009

[1] The probability of a 200 km^3 landslide is conservatively estimated by following the linear portion of the slide distribution from Chaytor et al. (2009) out to 200 km^3 and applying the P = 1/106 where 106 is the total number of slides observed (USGS, 2008).

Definitions:

Source Parameter P	= probability of a landslide volume exceeding the value given based on a log-normal distribution
P (Mw > 7)	= probability that an earthquake moment magnitude of greater than 7 occurs in a given year
Event P	= probability of a landslide volume exceeding the value given times the probability that an earthquake moment magnitude of greater than 7 occurs in a given year

Table 4-21 – Probable Maximum Tsunami Water Surface Elevation at PSL

Source	Tsunami Surge (m)	10% Exceedance High Tide (m-MSL)	Sea Level Rise (m)	Peak WSEL (m-MSL)	Peak WSEL (m-NAVD88)	Peak WSEL (ft-NAVD88)	Peak WSEL (ft-PSL Datum)
Hispaniola Trench	+ 0.65	0.808	0.0609	1.52	3.99	13.09	7.42
Cape Fear Landslide	+ 3.76	0.808	0.0609	4.63	4.35	14.27	17.62

Definitions:
WSEL = Water Surface Elevation
MSL = Mean Sea Level

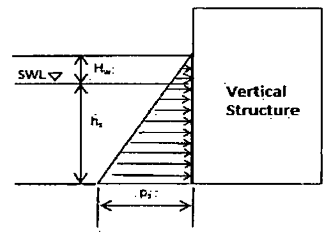
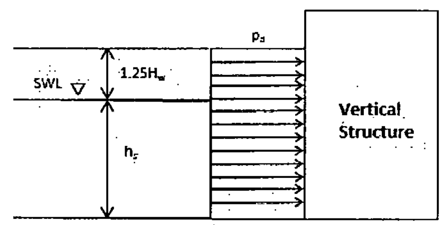
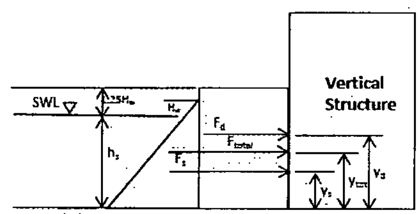
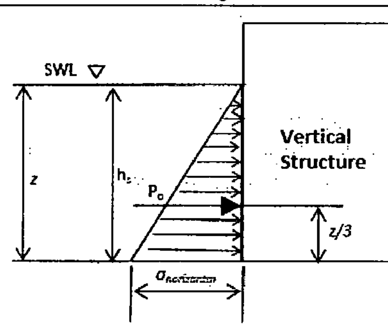
Table 4-22 – Bounding Hydrodynamic Forces on Vertical Walls at POIs

Point of Interest (POI) ID[1]	Plant Door ID	Security Door ID	Flow Depth (ft)	Velocity Magnitude (ft/s)	Total Head (ft)	Force (lb/ft)
1	RA-22	N/A	1.2	1.6	2.2	78.7
2	RA-18	143	1.3	1.4	2.4	98.1
3	RA-11	140 & 141	1.3	1.2	2.3	96.9
4	RA-35	N/A	1.5	0.7	2.5	115.7
5	RA-32	N/A	2.4	1.3	3.4	259.9
6	RA-37	148	1.9	1.3	2.9	166.1
7	RA-38	147	2.1	2.6	3.1	195.8
8	RA-39	146	3.2	0.9	4.2	409.5
9	M002	145	1.4	1.8	2.4	103.6
10	FH-003	172	1.4	1.8	2.4	103.6
11	FH-002	169	3.2	0.8	4.2	409.7
12	FH-001	163	1.8	1.4	2.8	153.6
13	DG-004	175	1.9	2.0	2.9	169.9
14	DG-005	176	1.9	1.9	2.9	166.0
15	DG-003	177	0.6	0.7	1.6	30.4
16	N/A	121	0.8	1.1	1.8	41.7
17	RA-037	243	0.6	1.7	1.6	28.2
18	RA-030	240 & 241	1.2	1.5	2.3	86.1
19	RA-041	249	0.6	1.0	1.6	30.0
20	RA-073	248	1.0	1.8	2.0	63.8
21	RA-084	247	1.6	2.4	2.7	138.3
22	RA-083	246	1.9	1.2	2.9	170.4
23	RA-082	245	2.1	0.9	3.1	198.3
24	FH-003	272	0.5	2.0	1.5	23.9
25	FH-002	269	1.9	1.2	2.9	170.4
26	FH-001 & FH-001A	263	2.0	2.7	3.1	192.2
27	DG-006	275	1.5	4.1	2.6	117.9
28	DG-005	276	1.0	1.7	2.0	63.8
29	DG-003	281	0.7	2.0	1.7	36.9
30	DG-004	282	0.3	0.9	1.3	12.2
31	CD-001	221	0.6	1.2	1.7	33.0
32	CD-002	222	0.6	1.6	1.6	31.8
33	DG-001	279	0.1	0.3	1.1	4.1
34	DG-002	280	1.3	3.7	2.3	93.6
35	DG-001	180	0.2	0.8	1.2	7.6
36	DG-002	179	0.1	0.7	1.1	4.2

[1] POI's shown on Figure 4-6

Reference:
NEE, 2014d

Table 4-23a – Probable Maximum Storm Surge Summary of Maximum Loads

Type of Force	Applicability	Force (lbs)	Elevation at which Force is Applied (feet NAVD88)	Pressure (psf)	Pressure Distribution (Section 6)
Hydrostatic	Buildings/Structures in the Area South of Power Block	1975	12.22	503	
Hydrostatic	FESB	1	15.70	10	
Hydrostatic	ISFSI Pad	34	14.64	66	
Hydrodynamic	Buildings/Structures in the Area South of Power Block	474	12.74	75	
Hydrodynamic	FESB	3	15.75	15	
Hydrodynamic	ISFSI Pad	47	14.87	41	
Hydrostatic plus Hydrodynamic	Buildings/Structures in the Area South of Power Block	2,449	14.18	578	
Hydrostatic plus Hydrodynamic	FESB	4	15.74	25	
Hydrostatic plus Hydrodynamic	ISFSI Pad	81	14.77	107	
Debris Impact	Buildings/Structures in the Area South of Power Block	16,857	15.89	13,705	No Diagram
Debris Impact	ISFSI Pad	16,857	15.44	13,705	No Diagram
Sediment	Buildings/Structures in the Area South of Power Block	482	11.37	Vertical 350 Horizontal 182	
Sediment	ISFSI Pad	6	14.50	Vertical 40 Horizontal 21	

Definitions:

FESB	= FLEX Equipment Storage Building		
SWL	= Still Water Level	p_s	= Hydrostatic Pressure
NAVD88	= North American Vertical Datum of 1988	h_s	= Still Water Depth
ISFSI	= Independent Spent Fuel Storage Facility	p_d	= Hydrodynamic Pressure
P_o	= Resultant Force per Unit Area	z	= Depth of Soil/Sediment
$\sigma_{horizontal}$	= Lateral Pressure of the Soil/Sediment	F_s	= Resultant Hydrostatic Force
F_d	= Resultant Hydrodynamic Force	F_{total}	= Resultant Total Force
y_s	= Height at which Hydrostatic Force Acts	y_d	= Height at which Hydrodynamic Force Acts
y_{tot}	= Height at which Total Force Acts	H_w	= Incident Wave Height

Table 4-23b – PMSS Hydrostatic Loading Parameters

Parameter	Area South of Power Block	FESB	ISFSI Pad
p_s = hydrostatic pressure (psf)	503	10	66
γ_w = unit weight sea water (pcf)	64	64	64
h_s = water depth at wall (ft)	5.3	0	0.6
H_w = wave height at the wall (ft)	2.6	0.2	0.4
h_b = water depth at wave breaking (ft)	1.01	1.01	1.01
H_b = breaking wave height (ft)	0.79	0.79	0.79
F_s = hydrostatic force (lb/ft)	1975	1	34
y_s = resultant force elevation (feet NAVD88)	12.22	15.70	14.64

Table 4-23c – PMSS Hydrodynamic Loading Parameters (FESB and ISFI)

Parameter	FESB	ISFSI Pad
p_d = hydrodynamic pressure (psf)	15	41
γ_w = unit weight sea water (pcf)	64	64
h_s = water depth at wall (ft)	0	0.6
H_w = wave height at the wall (ft)	0.2	0.4
h_b = water depth at wave breaking (ft)	1.01	1.01
H_b = breaking wave height (ft)	0.79	0.79
F_d = hydrodynamic force (lb/ft)	3.0	46.9
y_d = resultant dynamic force elevation (feet NAVD88)	15.75	14.87

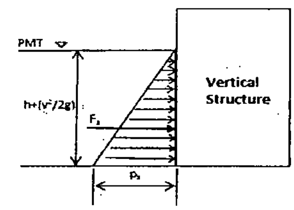
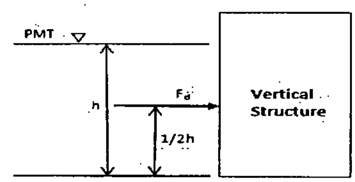
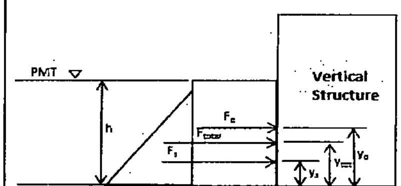
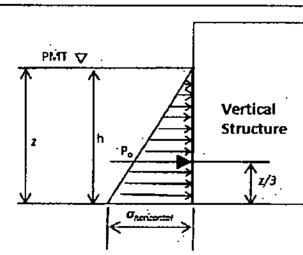
Table 4-23d – PMSS Hydrodynamic Loading Parameters (Area South of Power Block)

Parameter	Area South of Power Block
γ_w = unit weight sea water (pcf)	64.0
h_s = still water depth at vertical wall (ft)	5.3
l = wave length (ft)	2.7
H_w = wave height at the vertical wall (ft)	0.8
Sainflou P_1	75.5
Sainflou P_2	0.0
Sainflou δ_0	0.7
F_d = Hydrodynamic force (lb/ft)	474.4
y_d = resultant dynamic force elevation (feet NAVD88)	12.74

Table 4-23e – PMSS Sediment Loading Parameters

Location	Soil/Sand Wet Unit Weight (pcf) γ_{soil}	Seawater Unit Weight (pcf) γ_w	Buoyant Weight (pcf) $\gamma_{bouyant}$	Potential Sediment Height (ft)	Coefficient of At-Rest Earth Pressure K_o	Angle of Internal Friction (degrees)	Vertical Soil Pressure (psf) σ_v	Horizontal Soil Pressure (psf) σ_h	Resultant Force Per Unit Length P_o	Elevation of Resultant Force (ft-NAVD88)
FESB	130	64	66	0	0.52	29	0.506	0	0	0
Area South of Power Block	130	64	66	5.3	0.52	29	0.506	350	182	482
ISFSI	130	64	66	0.6	0.52	29	0.506	40	21	6

Table 4-24a – Probable Maximum Tsunami Summary of Maximum Loads

Type of Force	Applicability	Force (lbs)	Elevation at which Force is Applied (feet NAVD88)	Pressure (psf)	Pressure Distribution (Section 6)
Hydrostatic	Buildings/Structures in the Area South of Power Block	1,144	11.6	382	
Hydrodynamic	Buildings/Structures in the Area South of Power Block	490	11.9	Not applicable	
Hydrostatic plus Hydrodynamic	Buildings/Structures in the Area South of Power Block	1,635	11.7	Not applicable	
Debris Impact	Buildings/Structures in the Area South of Power Block	816 pounds on wood wall. 1,143 pounds on steel pile. 2,857 pounds on reinforced concrete wall. 1,904 pounds on concrete masonry wall.	14.3	664 lb/ft^2 on wood wall. 929 lb/ft^2 on steel pile. 2,322 lb/ft^2 on reinforced concrete wall. 1,548 lb/ft^2 on concrete masonry wall.	No Diagram
Sediment	Buildings/Structures in the Area South of Power Block	374	11.2	160	

Definitions:

FESB	= FLEX Equipment Storage Building		
PMT	= Probable Maximum Tsunami Water Level	p_s	= Hydrostatic Pressure
NAVD88	= North American Vertical Datum of 1988	h	= Still Water Depth
p_d	= Hydrodynamic Pressure	y_{tot}	= Height at which Total Force Acts
P_o	= Resultant Force per Unit Area	z	= Depth of Soil/Sediment
$\sigma_{horizontal}$	= Lateral Pressure of the Soil/Sediment	F_s	= Resultant Hydrostatic Force
F_d	= Resultant Hydrodynamic Force	F_{total}	= Resultant Total Force
y_s	= Height at which Hydrostatic Force Acts	y_d	= Height at which Hydrodynamic Force Acts

Table 4-24b – PMT Hydrostatic Loading Parameters

Parameter	Value
ρ = density of water (slugs/ft^3)	1.985
g = acceleration due to gravity (ft/s^2)	32.2
v = velocity (ft/s)	9.2
h = height of water (ft)	4.7
F_s = Hydrostatic Force (lb/ft)	1,144
h_r = Resultant height (ft)	2.0
Resultant elevation (ft-NAVD88)	11.6
p_s = Hydrostatic pressure (lb/ft^2)	382

Table 4-24c – PMT Hydrodynamic Loading Parameters

Parameter	Value
ρ = density of water (slugs/ft^3)	1.985
g = acceleration due to gravity (ft/sec^2)	32.2
C_d = Drag coefficient (dimensionless)	1.25
L = Length (ft)	1.0
A = Area (ft^2) = L*h	4.7
v = velocity (ft/sec)	9.2
h = height of water (ft)	4.7
F_d = Hydrodynamic Force (lb)	490
h_r = Resultant height (ft)	2.3
Resultant elevation (ft-NAVD88)	11.9

Table 4-25 – Probable Maximum Tsunami Low Water Surface Elevation at PSL

Tsunami Source & PSL Location of Low Water Result	Tsunami Low WSEL (m)	10% Exceedance Low Tide (m-MSL)	Min WSEL (m-MSL)	Min WSEL (m-NAVD88)	Min WSEL (ft-NAVD88)	Min WSEL (ft-PSL Datum)
Hispaniola Trench – Atlantic	- 0.56	-0.84	-1.40	-1.68	-5.51	-2.20
Hispaniola Trench – UHS Barrier	-0.074	-0.84	-0.91	-1.19	-3.90	-1.71
Cape Fear Landslide – Atlantic	- 2.19	-0.84	-3.03	-3.31	-10.86	-7.50
Cape Fear Landslide – UHS Barrier	0	-0.84	-0.84	-1.12	-3.67	-1.64

Definitions:

WSEL = Water Surface Elevation
NAVD88 = North American Vertical Datum of 1988
MSL = Mean Sea Level
UHS = Ultimate Heat Sink

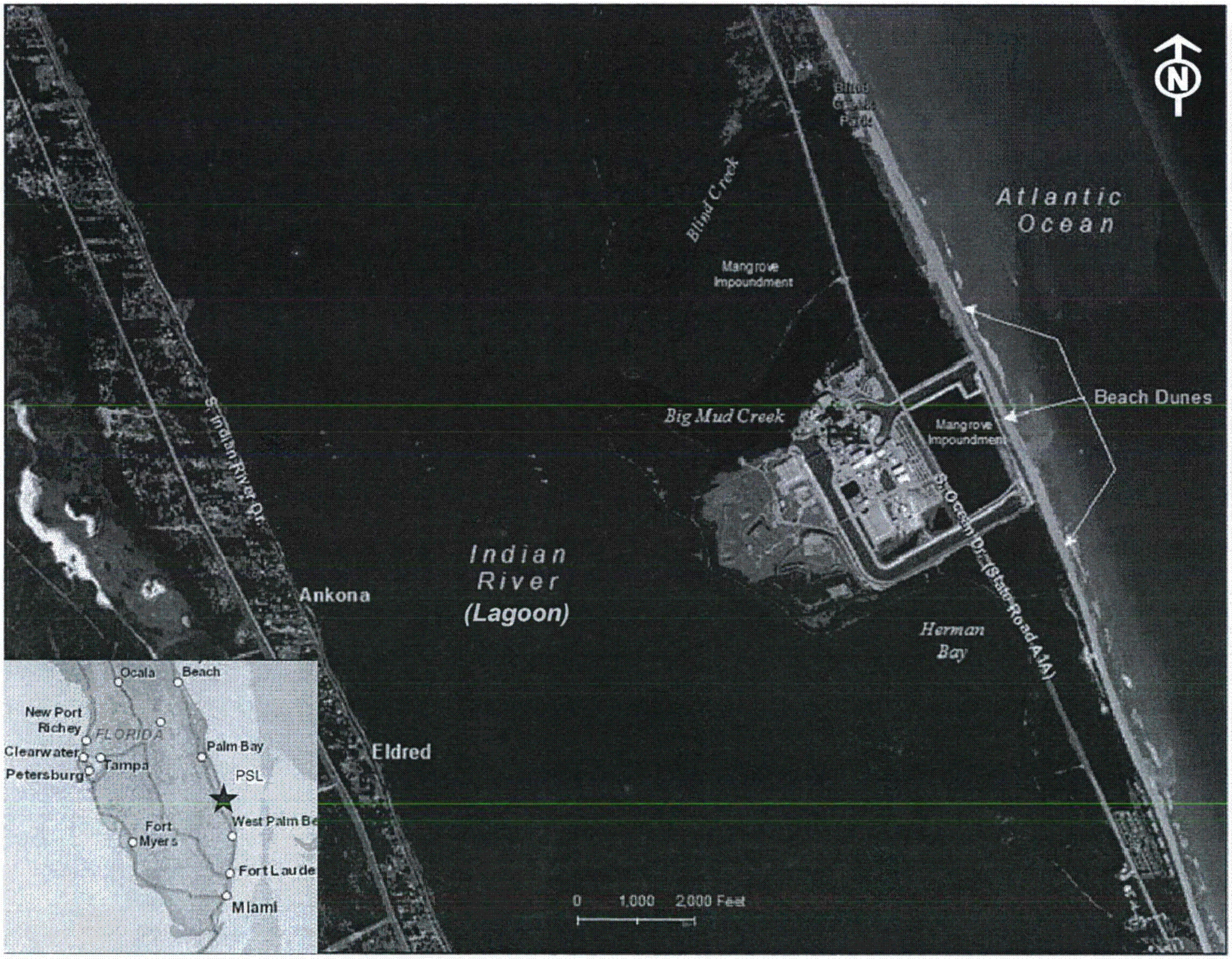


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Figure 2-1
Features Near PSL

References: ESRI, 2014a; ESRI, 2014b

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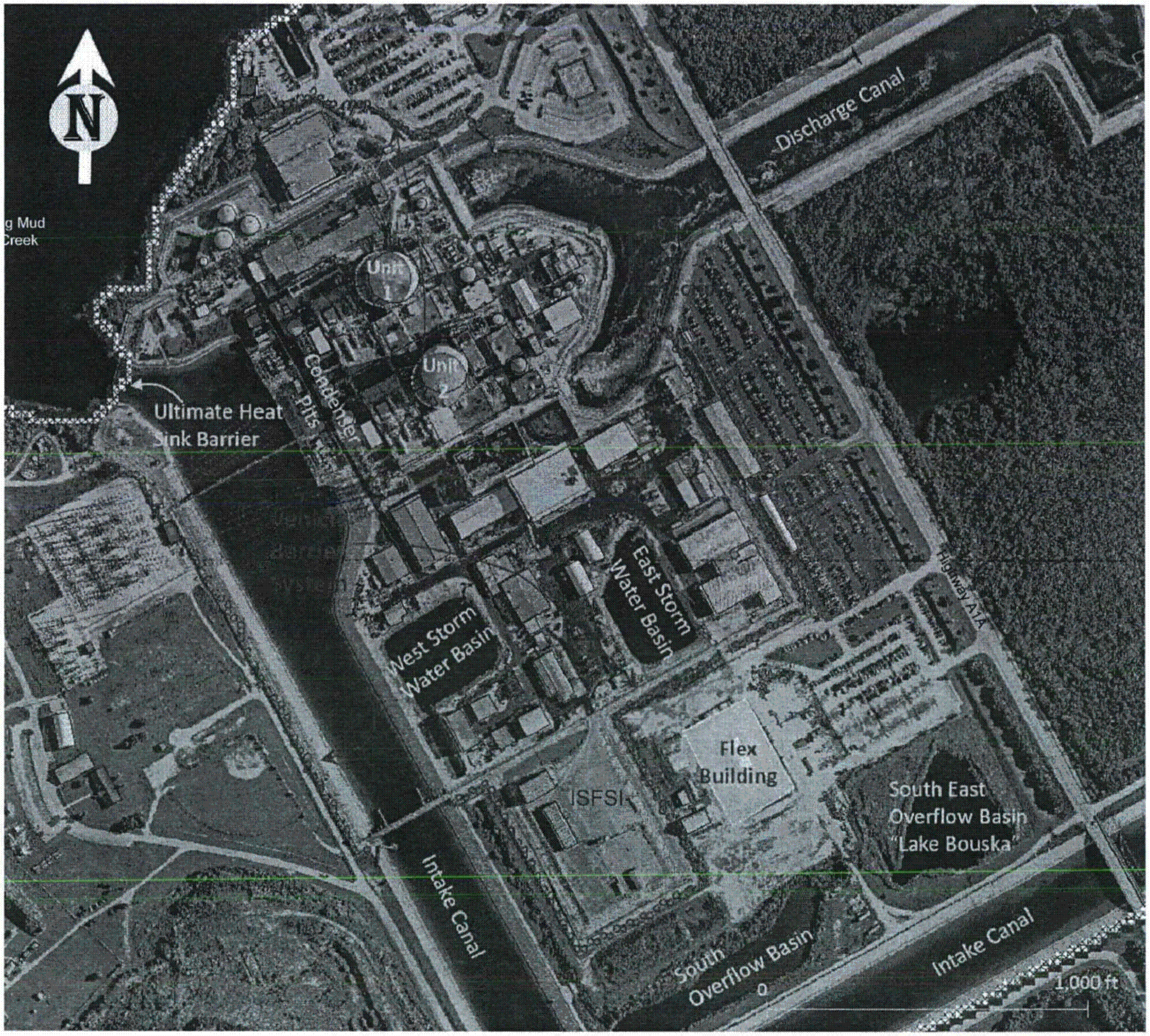

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Figure 2-2
Key Site Features

References: NEE, 2014d; Southern Resource Mapping, 2013; NEE, 2014b

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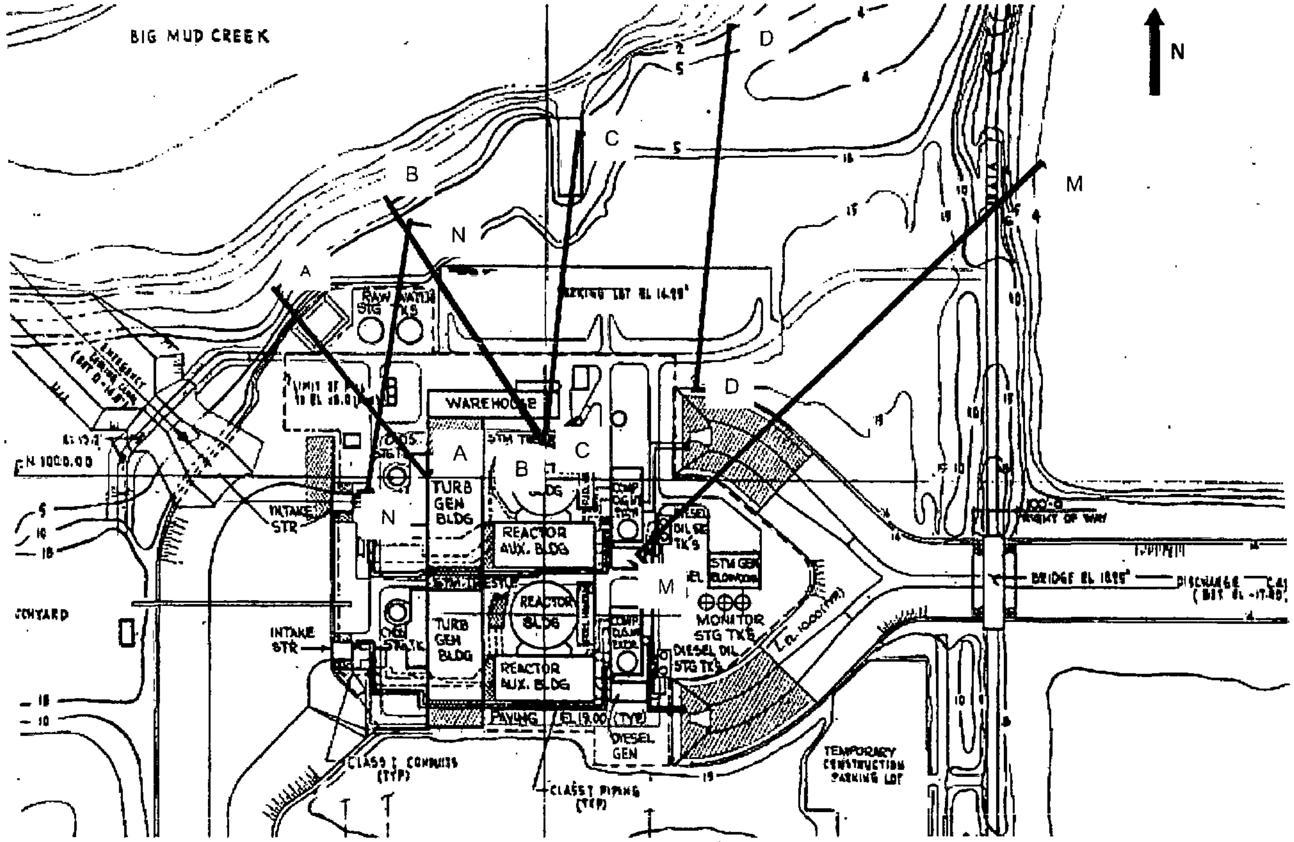

Not to Scale

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Figure 3-1
Transects for Erosion Profiles, 1 of 2

References: NEE, 2014c; NEE, 2013b

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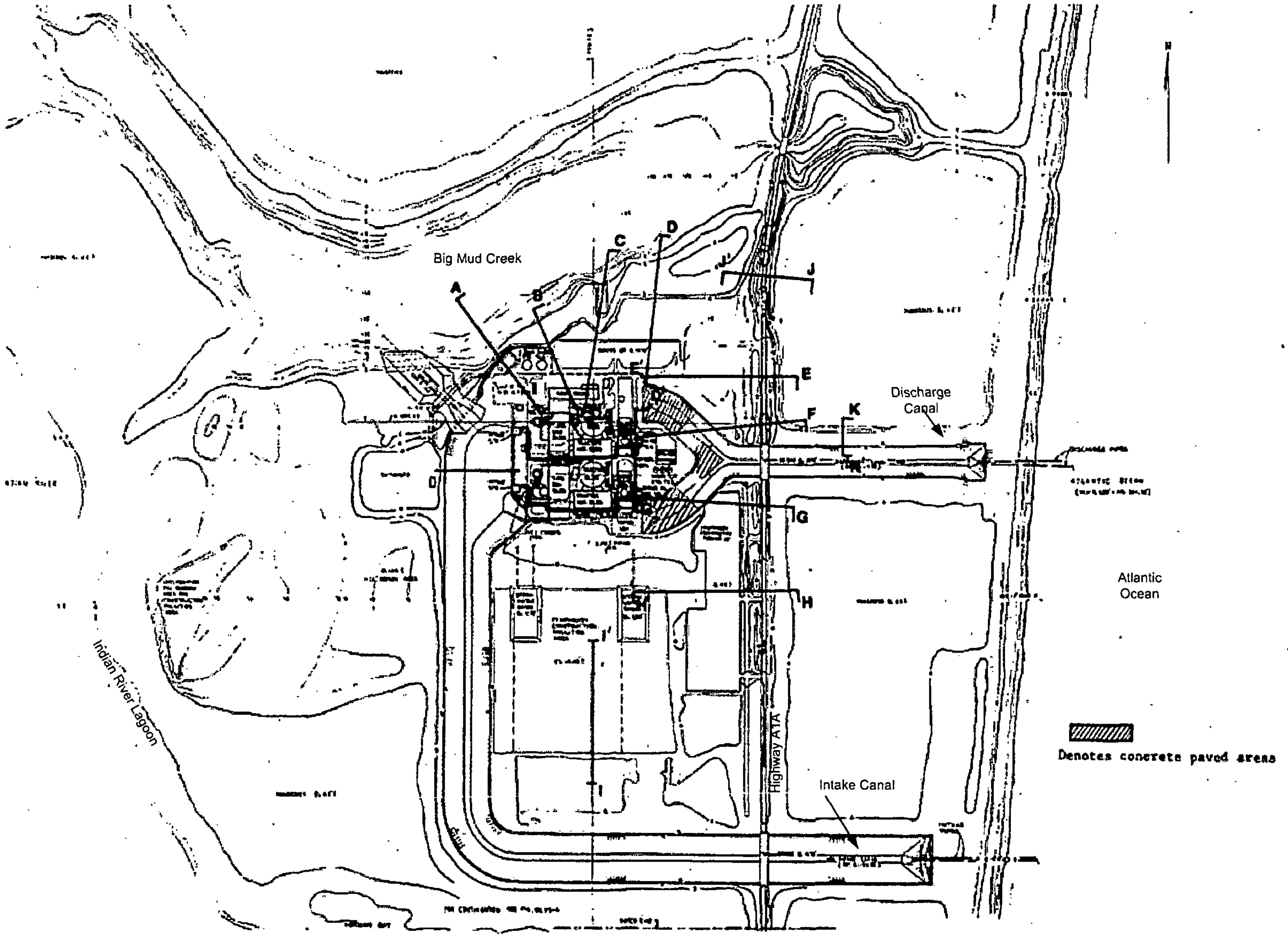

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Figure 3-2
Transects for Erosion Profiles, 2 of 2

References: NEE, 2014c; NEE, 2013b

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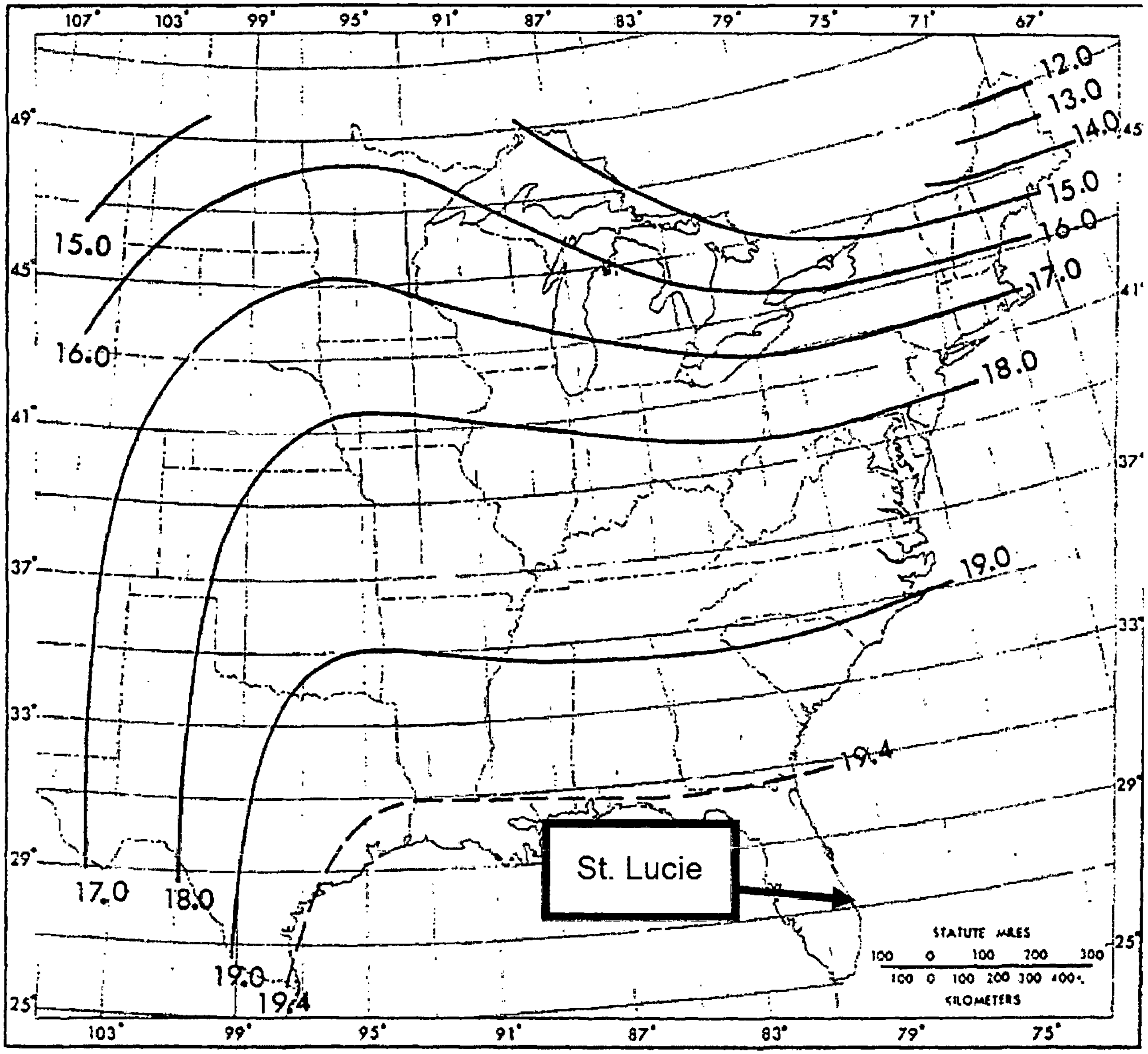

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Figure 4-1

1-hour 1-square mile Probable Maximum Precipitation

Reference: NOAA, 1978

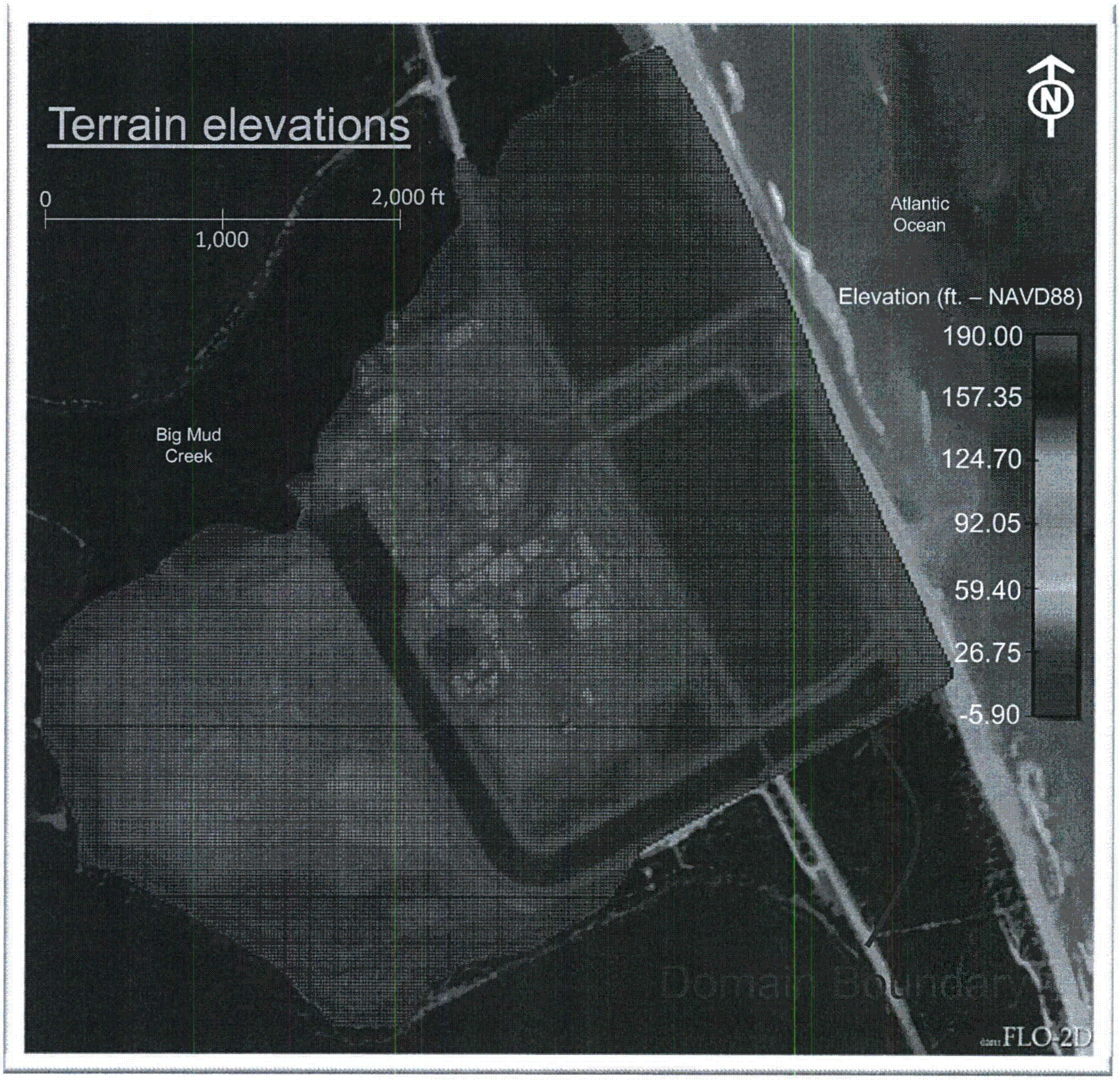

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Figure 4-2
Elevations Rendered over PSL FLO-2D Grid

Reference: FLO-2D, 2013; Southern Resources Mapping, 2013; NEE, 2014b

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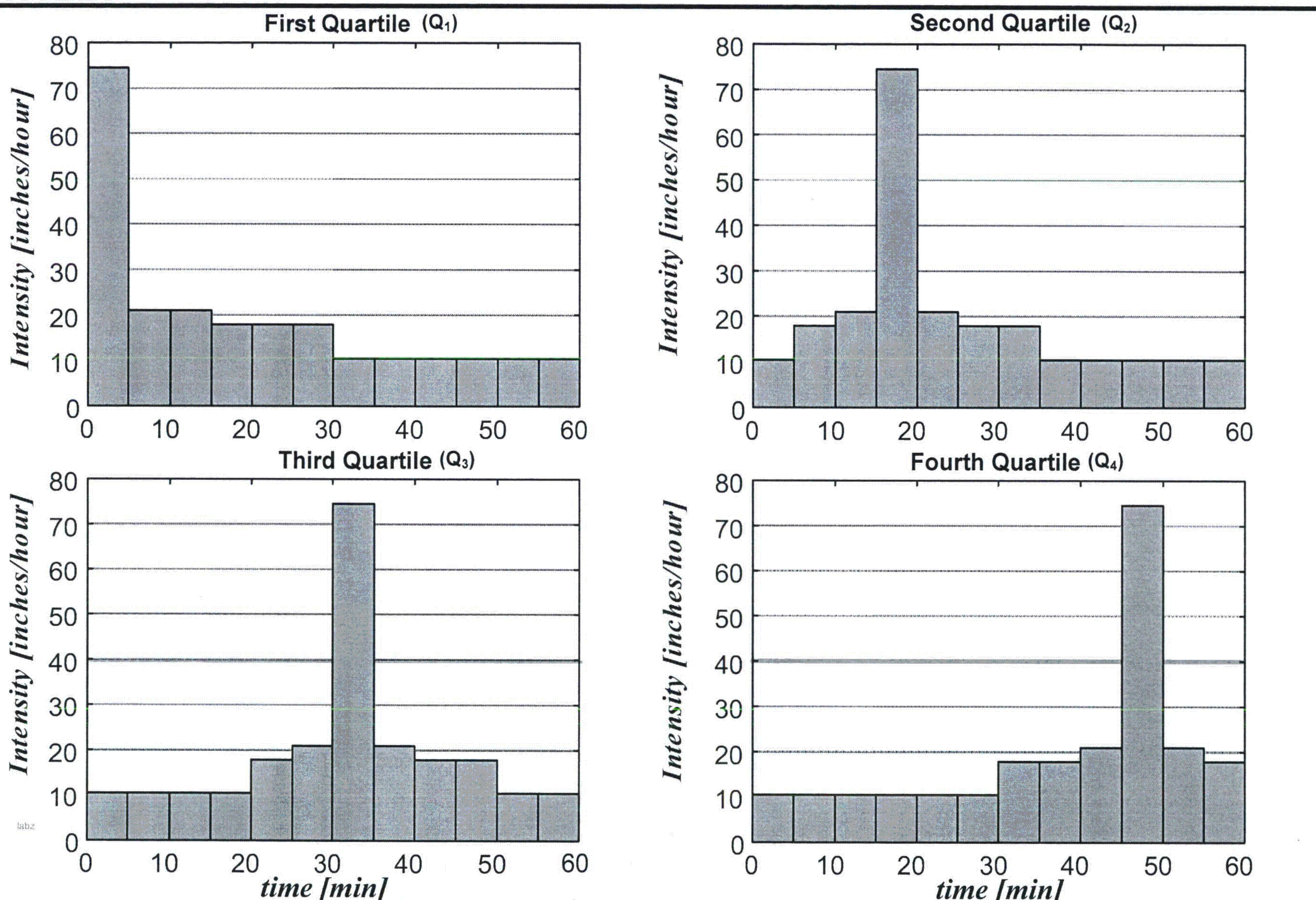

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Figure 4-3
Temporal Distributions of Precipitation for 19.4 in, 1-hour, 1-square mile at PSL

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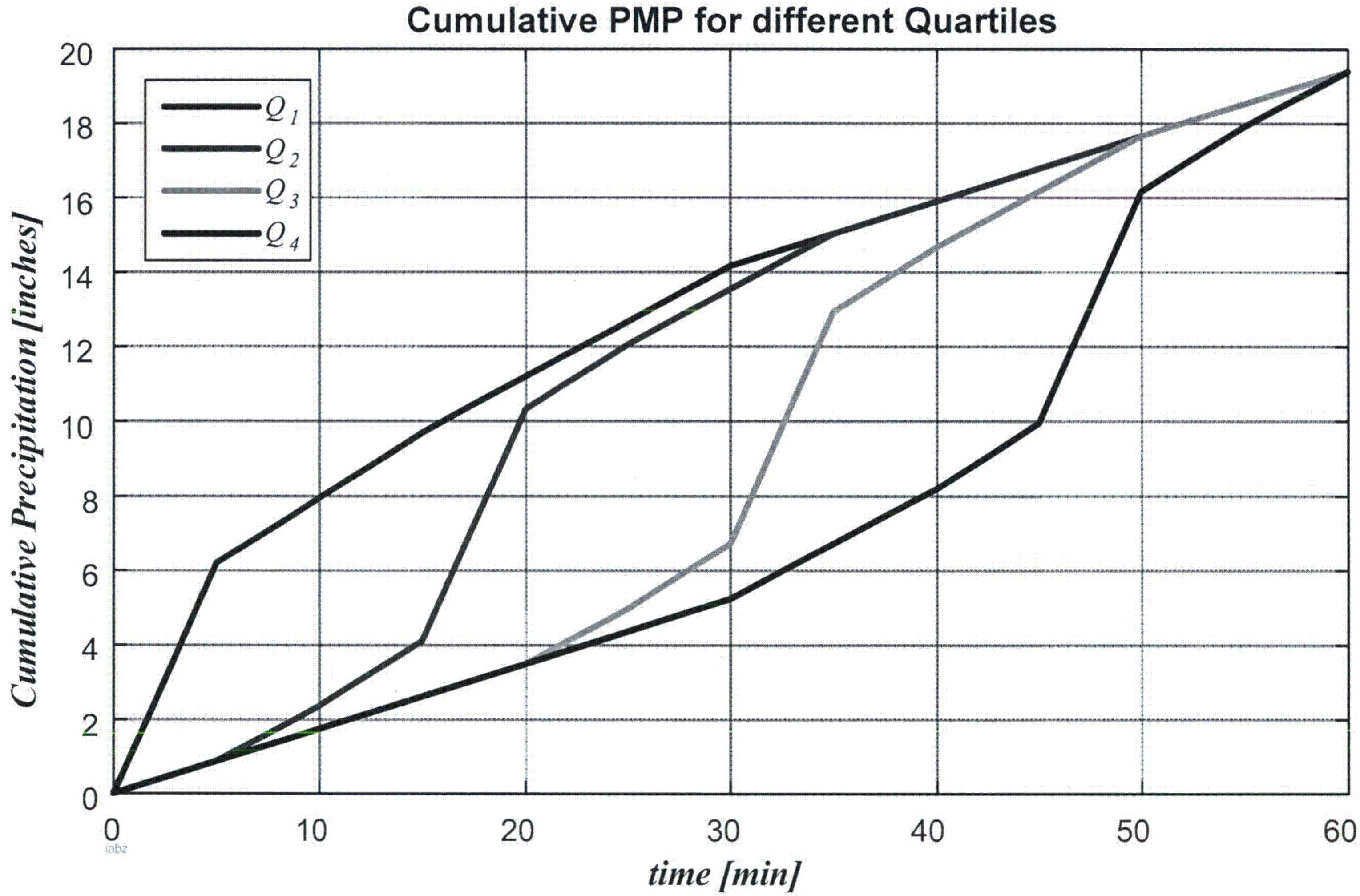

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Figure 4-4
Probable Maximum Precipitation Cumulative Distributions for 19.4 in, 1-hour, 1-square mile at PSL

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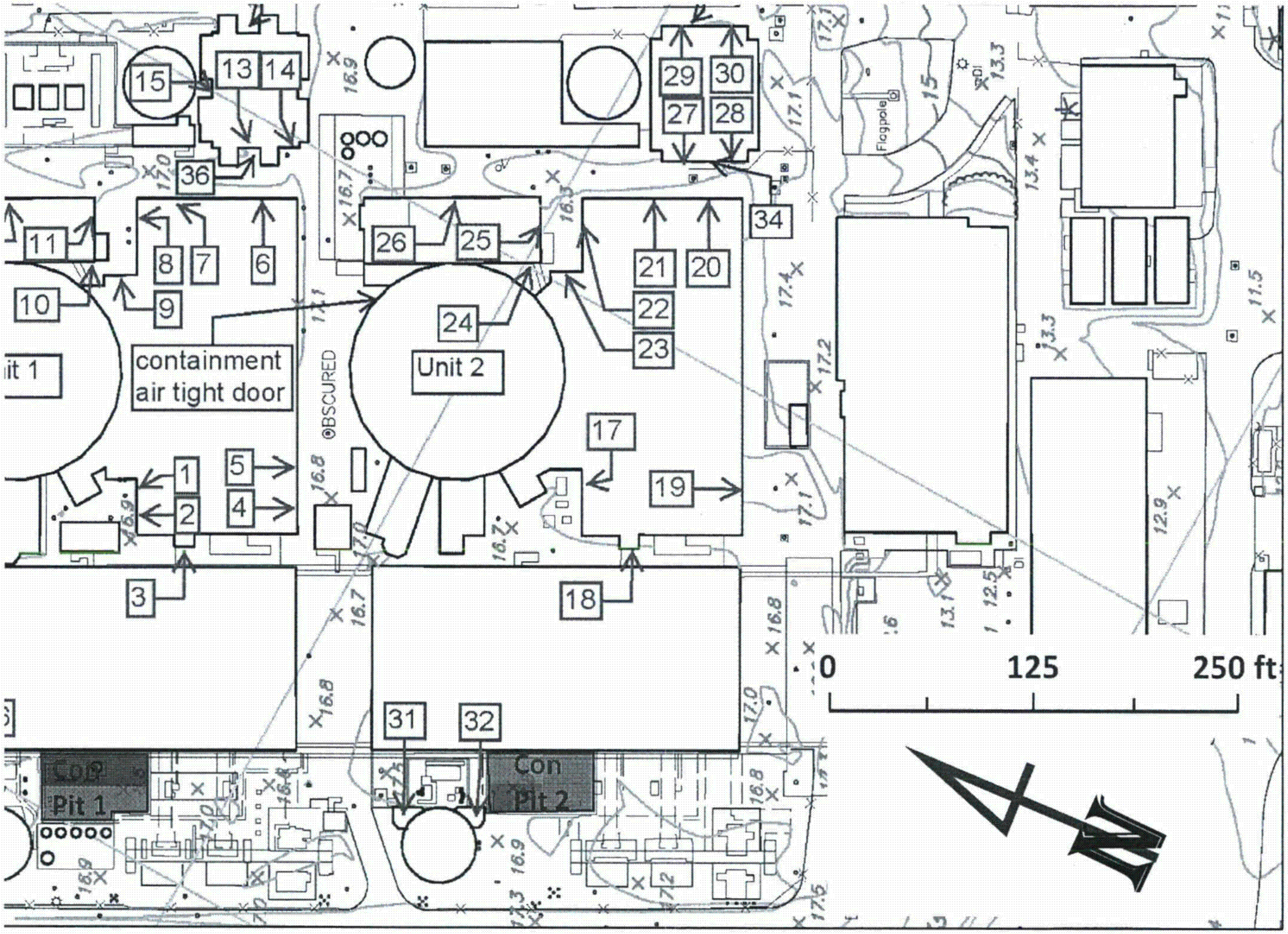
Reference: FLO-2D, 2013	FPL-072-PR-002 REV. 0



ferenced to NGVD29.

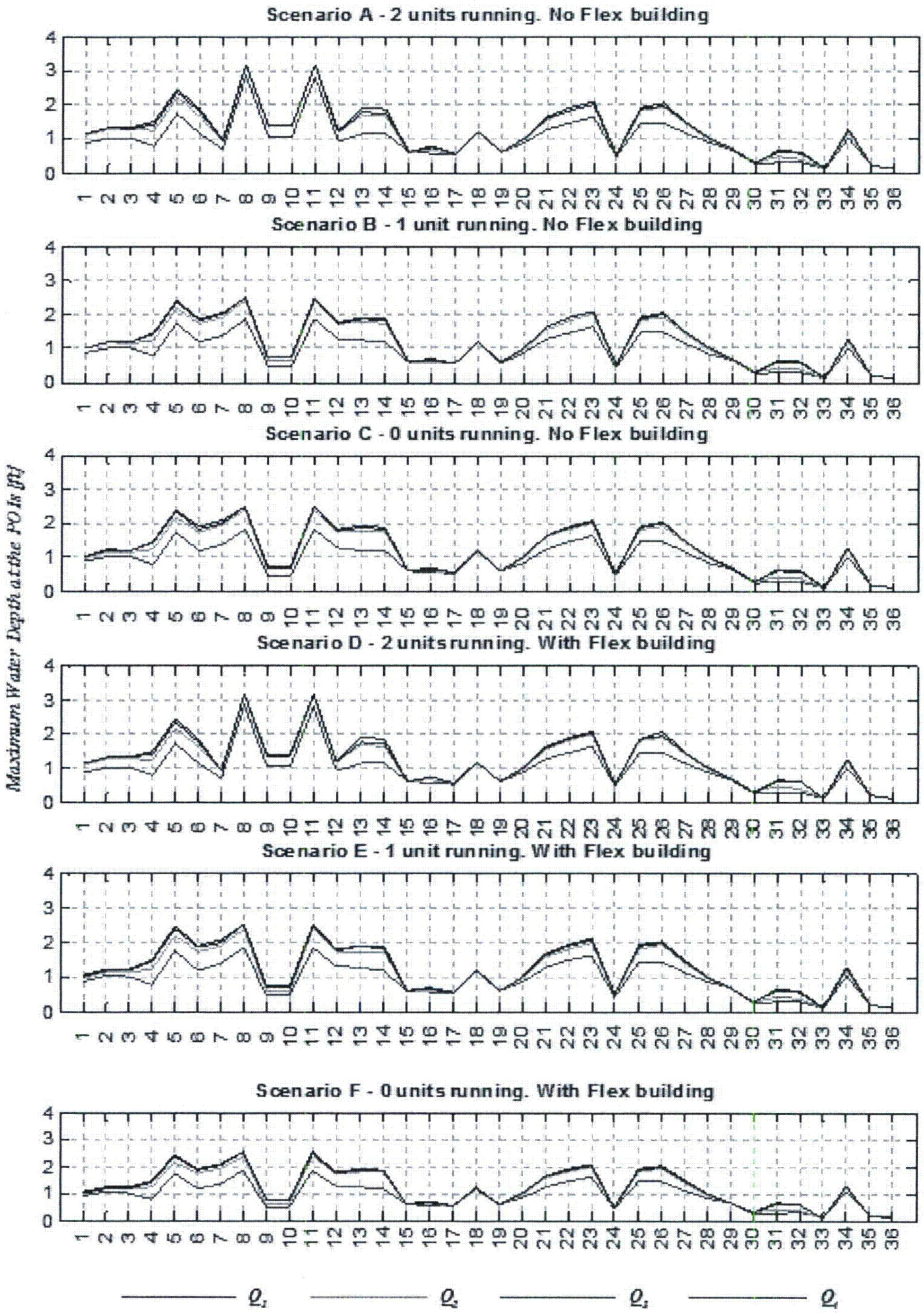
2	143	RA-18	19.5	RAB
3	140 & 141	RA-11	19.5	RAB
4	N/A	RA-35	19.5	RAB
5	N/A	RA-32	19.5	RAB
6	148	RA-37	19.5	RAB
7	147	RA-38	19.5	RAB
8	146	RA-39	19.5	RAB
9	145	M002	19.5	RAB
10	172	FH-003	19.5	FHB
11	169	FH-002	19.5	FHB
12	163	FH-001	19.5	FHB
13	175	DG-004	19.5**	DGB
14	176	DG-005	19.5**	DGB
15	177	DG-003	22.6	DGB
16	121	N/A	20	CST
				Unit 2
17	243	RA-037	19.5	RAB
18	240 & 241	RA-030	19.5	RAB
19	249	RA-041	19.5	RAB
20	248	RA-073	19.5	RAB
21	247	RA-084	19.5	RAB
22	246	RA-083	19.5	RAB
23	245	RA-082	19.5	RAB
24	272	FH-003	19.5	FHB
25	269	FH-002	19.5	FHB
26	263	FH-001 & FH-001A	19.5	FHB
27	275	DG-006	22.9	DGB
28	276	DG-005	22.9	DGB
29	281	DG-003	19.5**	DGB
30	282	DG-004	19.5**	DGB
31	221	CD-001	19.5***	CST
32	222	CD-002	19.5***	CST
33	279	DG-001	22.6	DGB
34	280	DG-002	22.6	DGB
35	180	DG-001	22.6	DGB
36	179	DG-002	22.6	DGB

*** Plant door number should be used to identify doors**

**** Exterior elevation of the doorway is at EL. 19.5' ; however, interior flood elevati**

***** Exterior doorway is at EL. 19.5' ; however, the doorway is located on the interi**

Note: All elevations listed in table are in ft – PSL Datum



Note 1: Locations of the points of interest are shown on Figure 4-6

Note 2: Q_1, Q_2, Q_3 and Q_4 cumulative rainfall intensity and cumulative rainfall are shown on Figures 4-3 and 4-4 respectively

NextEra Energy (NEE) **St. Lucie Nuclear Power Plant Units 1 & 2** **Flooding Hazards Reevaluation Report**	ENERCON **Figure 4-7** **Maximum Water Depth at POIs for all Simulations**
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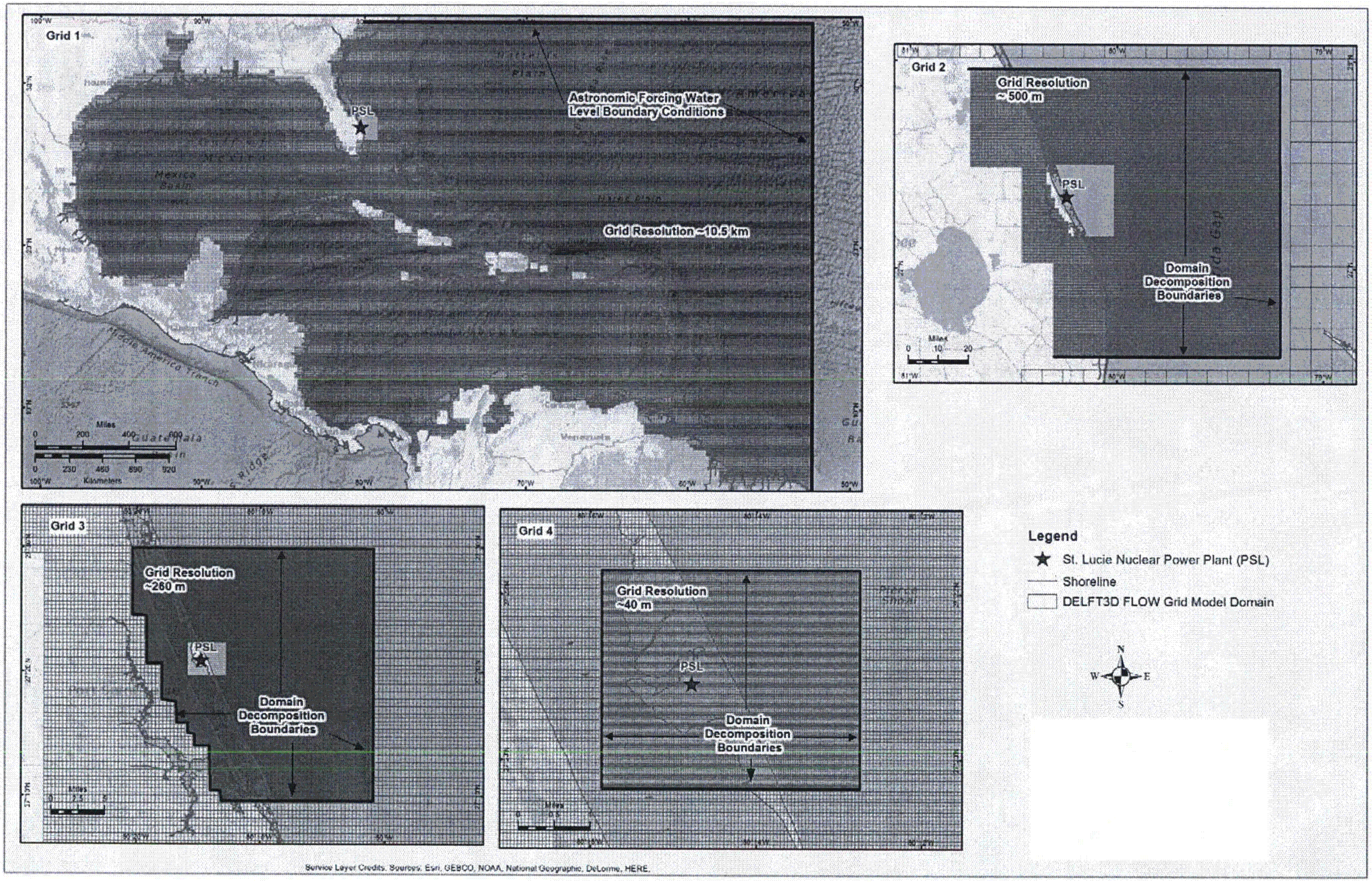

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Figure 4-8
Delft3D Model Domain

Reference: ESRI, 2014a

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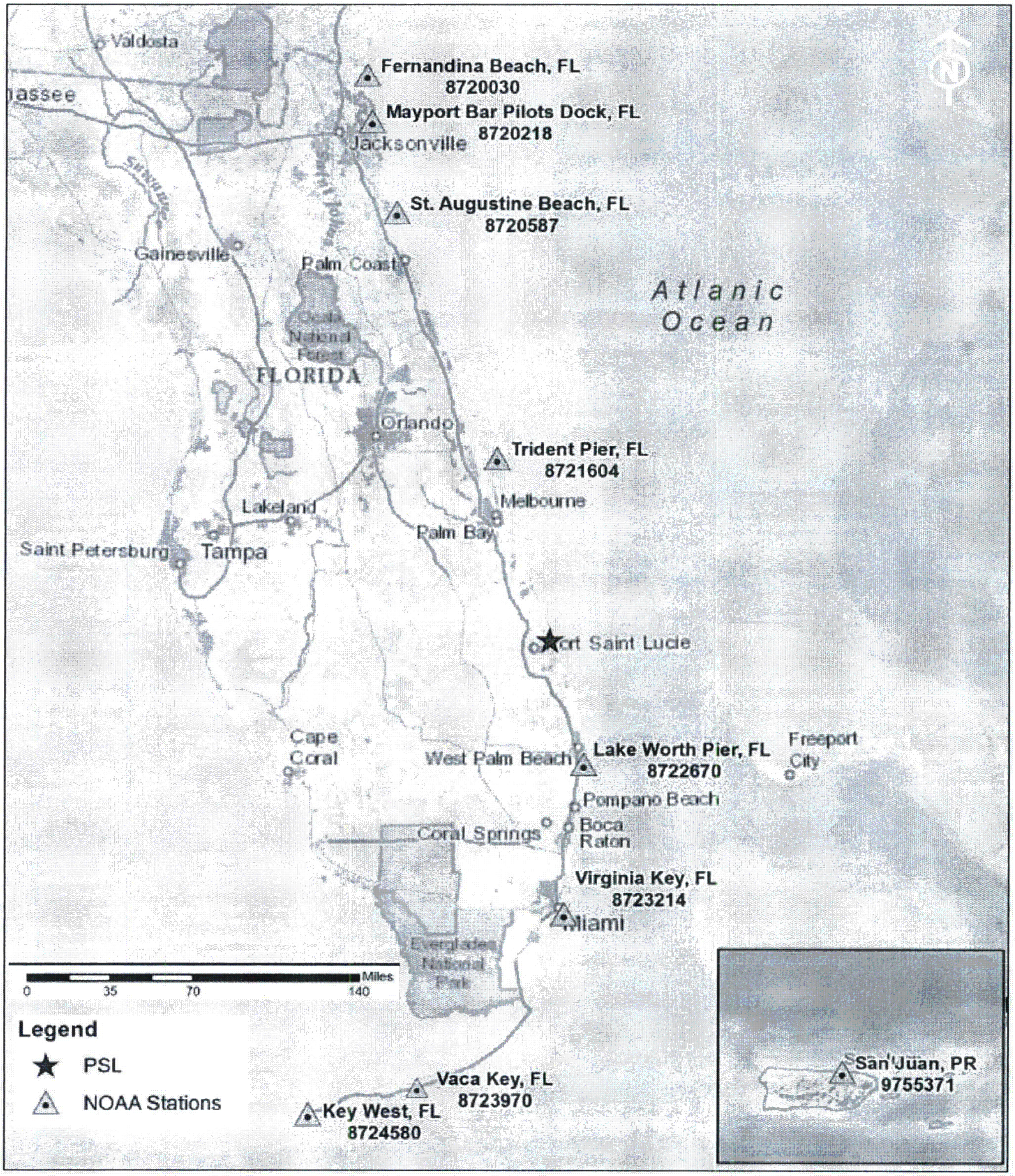

NextEra Energy (NEE)
St. Lucie Nuclear Power Plant Units 1 & 2
Flooding Hazards Reevaluation Report

References: ESRI, 2014c, NOAA, 2013m; NOAA, 2013n; NOAA, 2013o; NOAA, 2013p; NOAA, 2013q; NOAA, 2013r; NOAA, 2013s; NOAA, 2013t; NOAA, 2013ae

ENERCON

Figure 4-9

Locations Evaluated for Sea Level Rise, 10% and 90% Exceedance Tides and Storm Surge Calibration & Verification

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