FPL.

February 26, 2014
L-2014- 043

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555-0001

Re: Turkey Point Units 3 and 4
Docket Nos. 50-250 and 50-251
Response To Request For Additional Information (RAI) 6, 10, and 11 Regarding Supplemental Response to NRC Request for Information Pursuant to 10 CFR 50.54(f) Regarding the Flooding Aspects of Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident

References:

1. NRC Letter, Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3, of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, dated March 12, 2012, ML12073A348.

2. FPL Letter, M. Kiley to NRC, L-2013-087, Response to NRC Request for Information Pursuant to 10 CFR 50.54(f) Regarding the Flood Hazard Reevaluation of Recommendation 2.1, dated March 11, 2013, ADAMS Accession No. ML13095A196.

3. FPL Letter, M. Kiley to NRC, L-2013-256, Florida Power and Light Company's, Turkey Point Units 3 and 4, Supplemental Response to NRC Request for Information Pursuant to 10 CFR 50.54(f) Regarding the Flooding Aspects of Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, dated August 22, 2013 ADAMS Accession No. 13248A312.

4. NRC email from Audrey Klett to Bob Tomonto, Request for Additional Information - Turkey Point 3 & 4 - Flood Hazard Reevaluation Report (FHRR) - Recommendation 2.1-Flooding (TACs MF1114/15), dated January 15, 2014 ADAMS Accession No. ML14016A277.

5. FPL Letter, M. Kiley to NRC, L-2014-023, Florida Power and Light Company's, Turkey Point Units 3 and 4, Response To Request For Additional Information Regarding Supplemental Response to NRC Request for Information Pursuant to 10 CFR 50.54(f) Regarding the Flooding Aspects of Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, dated January 31, 2014.

6. NRC email From Audrey Klett NRC to Bob Tomonto FPL Subject: Request for Additional Information - Turkey Point 3 & 4 - Flood Hazard Reevaluation Report (FHRR) - Recommendation 2.1 - Flooding (TACs MF1114/15), Dated February 5, 2014 ML14036A274

A010
NRR

On March 12, 2012, the NRC issued Reference 1 to all power reactor licensees and holders of construction permits in active or deferred status. Enclosure 2 of Reference 1 requested that each licensee perform a reevaluation of external flooding sources and report the results in accordance with the NRC's prioritization plan. Florida Power & Light Company (FPL) submitted the Flood Hazard Reevaluation for Turkey Point Units 3 and 4 in Reference 2. FPL provided supplemental information regarding interim actions taken, associated supporting actions, and implementation dates for these supporting actions (Reference 3).

On January 15, 2014, the NRC requested FPL to respond to the request for additional information (RAI) for the Turkey Point Units 3 and 4 Flood Hazard Evaluation Report by January 31, 2014 for RAI questions 1-9 and by February 28, 2014 for questions 10 and 11 (Reference 4). On January 30, 2014, FPL discussed with Ms. Audrey Klett, NRC Project Manager for Turkey Point Units 3 and 4, the need to extend the due date for RAI-6 to a mutually agreed upon date. FPL submitted responses to RAIs 1-5, and 7-9 (Reference 5). Subsequently, the NRC revised RAI-6 and requested FPL to respond by February 28, 2014 (Reference 6).

The enclosure to this letter contains the response to RAI questions 6, 10, and 11.

This letter does not include any additional and or new regulatory commitments.
Should you have any questions concerning the content of this letter, please contact Mr. Robert J. Tomonto, Turkey Point Licensing Manager, at 305-246-7327.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on February 26, 2014.

Sincerely,

Michael Kiley

Vice President

Turkey Point Nuclear Plant

Enclosure

cc: USNRC Regional Administrator, Region II
USNRC Project Manager, Turkey Point Nuclear Plant
USNRC Senior Resident Inspector, Turkey Point Nuclear Plant

L-2014-043

Enclosure

Florida Power & Light Company's

Turkey Point Units 3 and 4

Response to

NRC Request for Additional Information (RAI)

Questions 6, 10, 11

NRC Request for Information Pursuant to 10 CFR 50.54(f)

Regarding the Flood Hazard Reevaluation Report (FHRR)

Recommendation 2.1 –Flooding

NRC RAI No. 6:

Section 3.2 Local Intense Precipitation and Associated Site Drainage

The NRC staff requests additional information to complete its review of the tabulated maximum predicted water elevations, depths, and flow velocities at 33 discrete points of interest, which the licensee identifies as potentially vulnerable areas. The NRC staff requests the licensee to provide a diagram or site plan that identifies/labels the facilities or buildings associated with the 33 locations for which flow depths and elevations are calculated for local intense precipitation Scenario A (see Table 4-2 of the FHRR). The NRC staff also requests the licensee to provide the maximum elevations and heights above local grade at the exterior of safety-related structures associated with these 33 locations. Please also confirm that evaluation of the resulting effects of water that has entered these structures will be evaluated and submitted as part of the integrated assessment.

FPL Response to RAI No. 6:

The 33 discrete points of interest (POI) that were selected are related to potentially vulnerable areas such as openings in the perimeter flood barriers water could build up and backflow into buildings. As requested, Figures 6.1 and 6.2 identify the facilities or buildings associated with the 33 POI locations. Figure 6.1 shows facilities or buildings associated with POIs 1 through 29 and Figure 6.2 shows facilities or buildings associated with POIs 30 through 33.

Information associated with each POI location is provided in Table 6-1, including the POI location, door entry number, door entry elevation, maximum water surface elevation (WSEL), depth above the door, ground surface elevation, and depth above ground surface (flow depth). The values provided in Table 6-1 have been updated based on the response to RAI 1. The plant floor is at Elevation +15.7 feet-NAVD88 in the power block area, which includes the Turbine Building, Auxiliary Building, and Control Building.

In development of the FLO-2D computational domain, multiple survey/topographic points were averaged to determine the elevation of each element. Thus, the elevation of selected critical POIs near the Auxiliary and Turbine Buildings were surveyed to ensure an accurate translation of the FLO-2D output water depths to critical WSELs (Table 6-1). The adjusted WSEL and water depths above the floor at these POIs are provided. Since FLO-2D output flow depths are insensitive to small topographic changes in the LIP analysis, these adjusted values are more appropriate for subsequent analyses as they more closely represent the actual levels above the floor elevations removing elevation interpolation performed during the FLO-2D evaluation (see Figure 6-3). In evaluating water levels at the selected critical POIs it is appropriate to use the adjusted water level values rather than the model output values.

After submittal of the responses to RAIs 1 through 5 and 7, FPL was informed by its vendor who prepared the FLO-2D model that a software error notice was received from their supplier of FLO-2D. The error was evaluated and determined not to have an impact on the Turkey Point (PTN) results. While evaluating the impact of the error, it was discovered that the model that was developed treated the building areas as being at the level of the adjacent ground, rather than above the ground. Therefore, depending on the hydraulic gradient away from the structure, flow from roofs could be inhibited, or possibly detained.

As part of the Integrated Assessment, the FLO-2D model will be refined by providing roof elevation above grade and include the Condenser Pits, CCW pits, flood walls, roof drainage features, interior building structures. These details will redirect runoff flow in some areas which could result in changes to presently-calculated maximum water depths adjacent to exterior of buildings. It is anticipated that the inclusion of the Condenser Pits will increase flow gradients and reduce water levels in and around the Turbine Building area (POIs 1-12 and 27-29). Changes to water levels near the east side of the Auxiliary Building (POIs 15-20), however, are not readily apparent before the analysis is complete but are not anticipated to be significant.

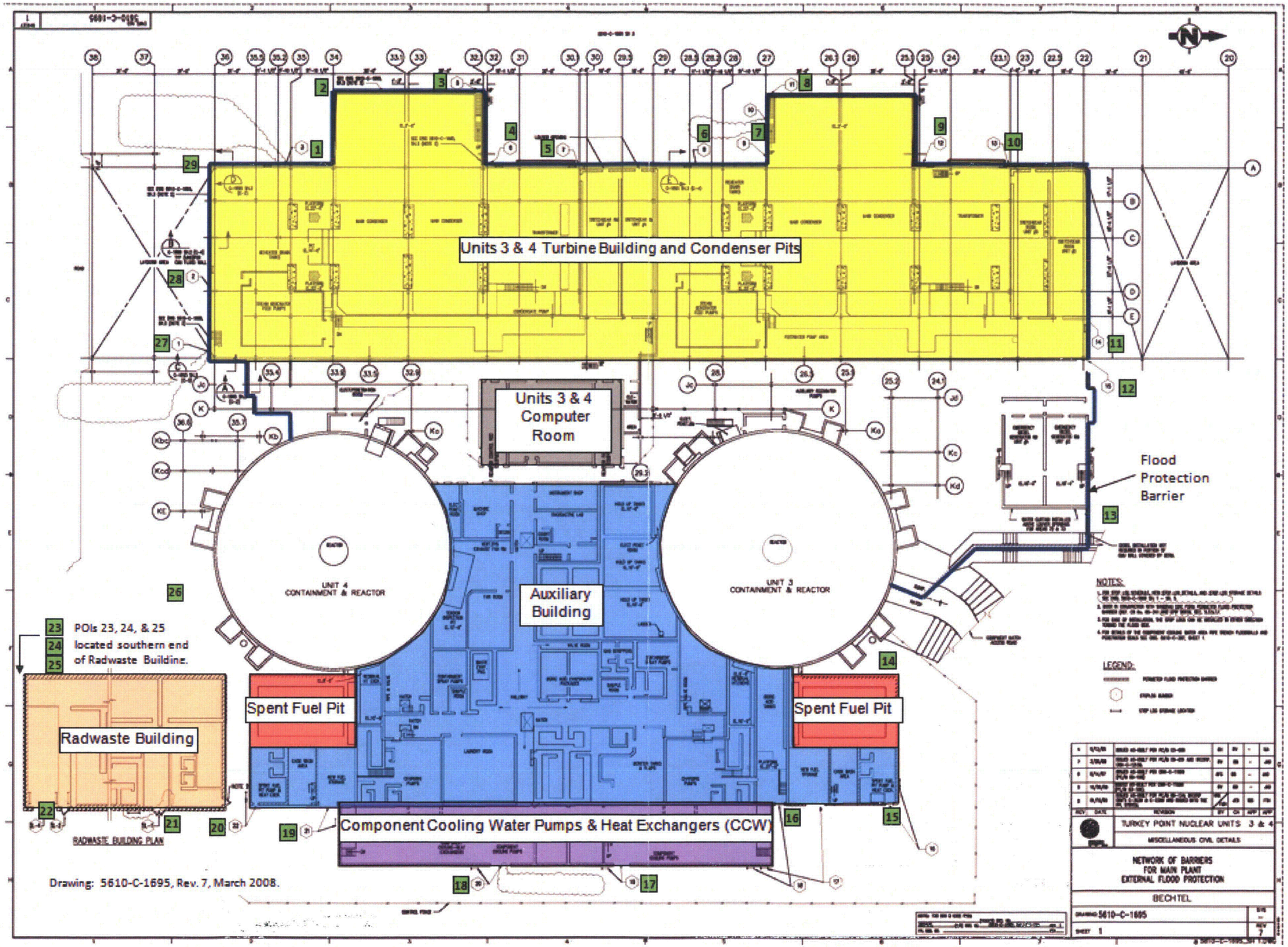

Figure 6-1 – Points of Interest Overlaid with Site Drawing

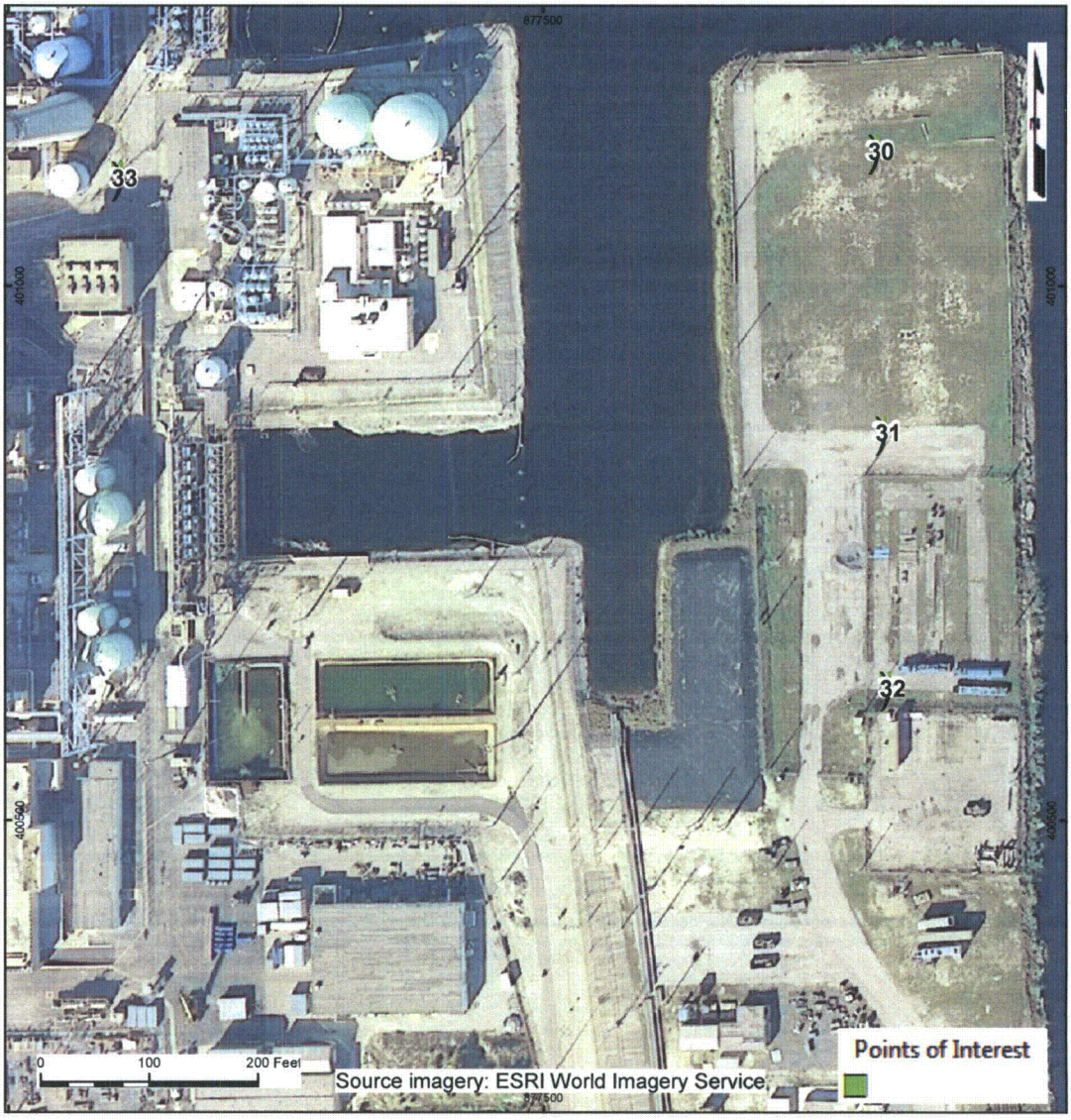

Figure 6-2 - Points of Interest Located Near Intake Canal and ISFSI Pad

Table 6-1 - Flow Depths, Peak Water Surface Elevations at Each Point of Interest Location

Point of Interest	Location	Door Entry No.[1]	Floor Elevation (ft-NAVD88) (a)	Maximum Resulting WSEL (ft-NAVD 88)[2] (b)	Resulting Depth Above Floor (ft) (c)	Modeled Ground Surface Elevation (ft-NAVD88) (d)	Resulting Depth Above Ground Surface (ft)[2] (e)	Measured Ground Surface Elevation (ft-NAVD88)[5] (f)	Corrected WSEL (ft-NAVD88)[6] (g)	Corrected Depth Above Floor (ft)[6] (h)
1	Unit 4 Instrument Air Equipment Area	3	15.70	15.97	0.27	15.05	0.92	15.70	16.62	0.92
2	Unit 4 Lube Oil Reservoir Area	N/A	N/A	15.97	N/A	14.65	1.32	15.20	16.52	N/A
3	Unit 4 Main Condenser Area	5	15.70	15.93	0.23	14.95	0.98	15.30	16.28	0.58
4	Unit 4 Auxiliary Area	6	15.70	15.98	0.28	15.30	0.68	15.53	16.21	0.51
5	Unit 4 Auxiliary Area	7	15.70	15.98	0.28	15.30	0.68	15.62	16.30	0.60
6	Unit 3 Instrument Air equipment Area	8	15.70	16.27	0.57	15.67	0.60	15.70	16.30	0.60
7	Unit 3 Main Condenser Area	9 and 10	15.70	18.03	2.33	17.42	0.61	15.37	15.98	0.28
8	Unit 3 Main Condenser Area	11	15.70	15.89	0.19	15.20	0.69	15.37	16.06	0.36
9	Unit 3 Auxiliary Area	12	15.70	18.03	2.33	17.42	0.61	15.62	16.23	0.53
10	Unit 3 Auxiliary Area	13	15.70	15.78	0.08	15.05	0.73	15.53	16.26	0.56
11	Units 3 and 4 Auxiliary Feedwater Pump Area	14	15.70	16.14	0.44	15.49	0.65	15.45	16.10	0.40
12	Unit 3 Switchgear/D.G. Building Vestibule	15	15.70	16.18	0.48	15.49	0.69	15.45	16.14	0.44
13	Outside building near Emergency Diesel Generator Rooms	N/A	N/A	18.97	3.27	17.80	1.17	15.37	16.54	N/A
14	Outside Unit 3 Containment Building	N/A	N/A	20.43	4.73	19.83	0.60	(7)	(7)	(7)
15	Unit 3 Spent Fuel Pit Heat Exchanger Room	16	15.70	17.11	1.41	15.67	1.44	(7)	(7)	(7)
16	Units 3 and 4 Boric Acid Tanks and Pump Room Unit 3 New Fuel Storage Room	17 and 18	15.70	17.04	1.34	15.77	1.27	(7)	(7)	(7)
17	Unit 3 Component Cooling Pump and Heat Exchanger Area	19	15.70	16.76	1.06	15.52	1.24	(7)	(7)	(7)
18	Unit 4 Component Cooling Pump and Heat Exchanger Area	20	15.70	16.59	0.89	15.37	1.22	(7)	(7)	(7)
19	Unit 4 New Fuel Storage Room	21	15.70	16.41	0.71	15.79	0.62	(7)	(7)	(7)
20	Unit 4 Spent Fuel and Heat Exchanger Area	22	15.70	16.30	0.60	15.47	0.83	(7)	(7)	(7)
21	Radwaste Building	SL-1[4]	15.70	16.28	0.58	15.60	0.68	(7)	(7)	(7)
22	Radwaste Building	SL-2 and SL-4[4]	15.70	16.34	0.64	15.50	0.84	(7)	(7)	(7)
23	Radwaste Building	N/A	N/A	16.25	0.55	15.65	0.60	(7)	(7)	(7)
24	Radwaste Building	N/A	N/A	16.11	N/A	15.50	0.61	(7)	(7)	(7)
25	Radwaste Building	N/A	N/A	19.23	N/A	18.61	0.62	(7)	(7)	(7)
26	Outside Unit 4 Containment Building	N/A	N/A	28.61	N/A	28.01	0.60	(7)	(7)	(7)
27	Unit 4 Steam Generator Feed Pump Area	1	15.70	16.01	N/A	15.29	0.72	(7)	(7)	(7)
28	Unit 4 Instrument Air Equipment Area	2	15.70	16.01	0.31	15.30	0.71	15.20	15.92	0.22
29	Unit 4 Compressors and Condensate Storage	N/A	N/A	15.95	0.25	15.29	0.66	15.20	15.91	0.21

Point of Interest	Location	Door Entry No.[1]	Floor Elevation (ft-NAVD88) (a)	Maximum Resulting WSEL (ft-NAVD 88)[2] (b)	Resulting Depth Above Floor (ft) (c)	Modeled Ground Surface Elevation (ft-NAVD88) (d)	Resulting Depth Above Ground Surface (ft)[2] (e)	Measured Ground Surface Elevation (ft-NAVD88)[5] (f)	Corrected WSEL (ft-NAVD88)[6] (g)	Corrected Depth Above Floor (ft)[6] (h)
	Area									
30	ISFSI Pad	N/A	N/A	4.48	N/A	3.88	0.60	15.20	15.86	N/A
31	ISFSI Pad	N/A	N/A	3.02	N/A	2.13	0.89	(7)	(7)	(7)
32	South of ISFSI Pad	N/A	N/A	3.20	N/A	2.45	0.75	(7)	(7)	(7)
33	East Heavy Haul Route – inside nuclear parameter fence near Water Treatment Area	N/A	N/A	15.01	N/A	14.41	0.60	(7)	(7)	(7)

1. Stop Log locations and numbers obtained from Drawing number 5610-C-1695, Revision 7, March 2008.
2. Maximum WSEL and depth above ground surface are based on values in response to RAI 1.
3. Area of high ground surface elevation.
4. 'SL' designates Stop Log location.
5. Measured elevations of POIs (FPL, 2014).
6. Corrected WSEL and water depths at doors were determined by using the measured ground elevations with the modeled water depths.
7. Measure elevations are not available at building wall

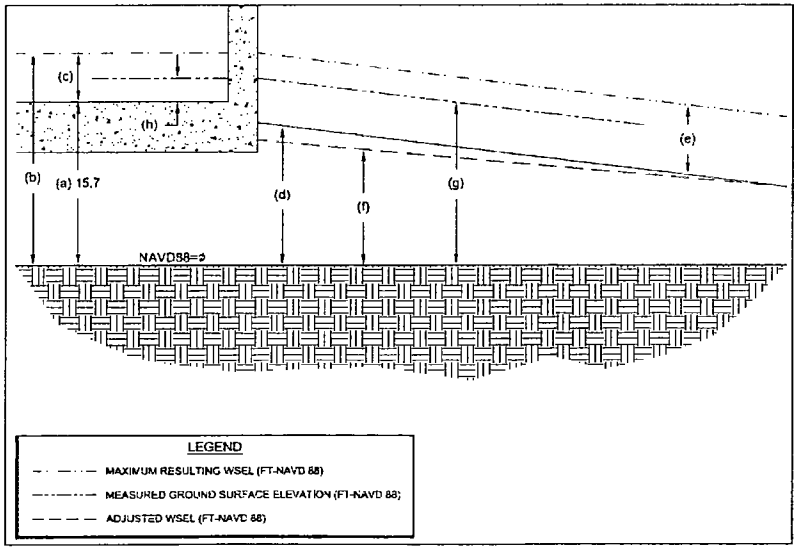

Figure 6-3 – Adjusted Ground Elevation

NRC RAI No. 10:

Section 4.0 Integrated Assessment

The March 12, 2012, 50.54(f) letter, Enclosure 2, requests the licensee to perform an integrated assessment of the plant's response to the reevaluated hazard if the reevaluated flood hazard is not bounded by the current design basis. The NRC staff requests the licensee to provide the applicable flood event duration parameters (see definition and Figure 6 of the Guidance for Performing an Integrated Assessment, JLD-ISG-2012-05) associated with mechanisms that trigger an Integrated Assessment. This includes (as applicable) the warning time the site will have to prepare for the event, the period of time the site is inundated, and the period of time necessary for water to recede off the site for the mechanisms that are not bounded by the current design basis. The NRC staff also requests the licensee to provide a basis for the flood event duration parameters. The basis for warning time may include information from relevant forecasting methods (e.g., products from local, regional, or national weather forecasting centers).

FPL Response to RAI No. 10:

The Guidance for Performing an Integrated Assessment for External Flooding, JLD-ISG-2012-05 (NRC, 2012), defines the flood event duration parameters, shown in Figure 10.1:

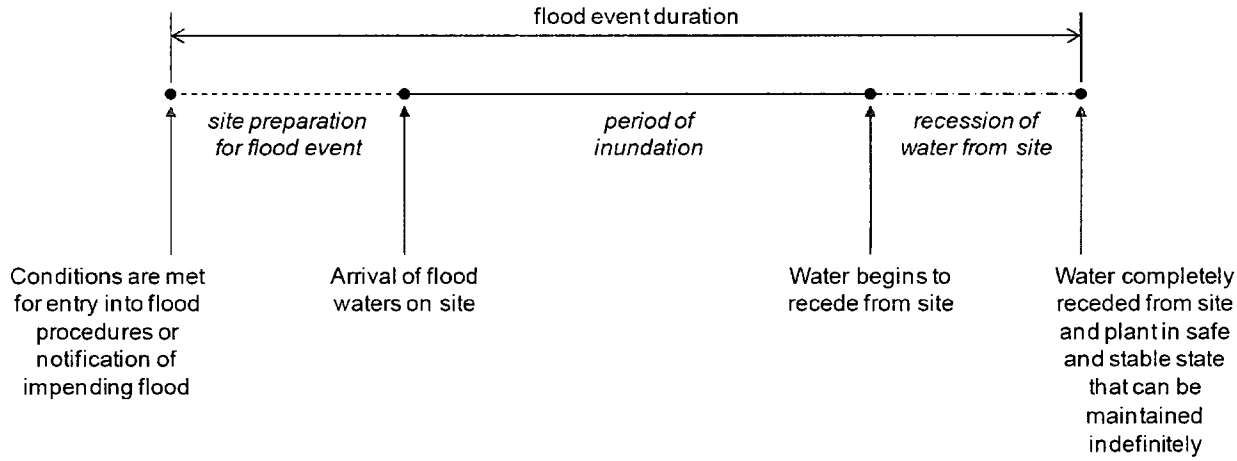

Figure 10.1 – Illustration of Flood Event Duration (Figure 6 from NRC, 2012)

The flood event duration is defined as the time from when conditions are met for entry into flood procedures or notification of impending flood to when water has completely receded from the site with the plant in an indefinite safe and stable state. The flood event duration can be divided into shorter durations of interest: 1) site preparation, 2) period of inundation and 3) recession from site. Site preparation may include warning time from when a meteorological forecast predicts inclement weather, as in the case of precipitation and hurricane events. Site preparation may be limited to when the flooding mechanism is initiated, such as a tsunamigenic earthquake or landslide. The period of inundation exists from when the flood arrives on site to the peak of the flooding event. The recession of water occurs between the peak of the flooding event and when flood waters have completely evacuated the site.

The Turkey Point Nuclear Generating Station Units 3 & 4 (PTN) plant grade elevation is +15.7 feet North American Vertical Datum 1988 (NAVD88) at the power block, which includes the Turbine Building, Auxiliary Building, and Control Building. This area is significantly higher than the surrounding topography. The plant grade elevation was used to define the maximum period of inundation and recession for each flooding or operability mechanism. A summary of the flood duration parameters for each flooding mechanism is listed in Table 10.1. Details on how each duration was determined are provided in the following sections.

Table 10.1 – Flood Duration Parameters at PTN

	Elevated Winds	Probable Maximum Storm Surge (PMSS) Water Levels	Local Intense Precipitation (LIP)[3]	Probable Maximum Tsunami (PMT)
Site preparation	72 hours	48 hours	48 hours	2 hours
Period of inundation	73 hours	2 hours[1]	30 minutes	N/A
Recession from site		3 hours[2]	45 minutes	N/A
Event duration	145 hours	53 hours	49.25 hours	2 hours

1. Still water value shown. Add 1 additional hour to include wave run-up
2. Still water values shown. Add 2 additional hours to include wave run-up
3. LIP coincident with PMSS

Duration of Elevated Winds

Tropical-storm-force winds (39 miles per hour [mph] or greater) may affect plant operability. Preparation for a hurricane or tropical storm event is incorporated within the PTN Administrative Procedure 0-ADM-116 for Hurricane Season Readiness. Severe weather preparations are initiated 72 hours prior to the projection of tropical storm force winds (PTN, 2012). Tropical storm watches are issued 48 hours in advance of the anticipated tropical-storm-force winds by the National Hurricane Center (NHC); warnings are issued 36 hours in advance (NOAA, 2014a). Since the PTN severe weather preparations are procedurally directed to start prior to the 48-hour tropical storm watch forecast from NHC, 72 hours is the proper preparation/warning time for tropical-storm-force winds.

The duration of elevated winds associated with the PMH at PTN is 73 hours. Thus, the total duration of the event is 145 hours.

Probable Maximum Storm Surge

Storm surge probabilities, based on NHC official advisory, are available approximately 48 hours in advance of tropical-storm-force winds. The NHC produces a set of updated storm surge probability graphics for every active hurricane watch or warning along any portion of the Gulf of Mexico or Atlantic coasts of the continental United States. These graphics are updated on the NHC website approximately 30 minutes following the issuance of the NHC

tropical cyclone advisories at 4:00 a.m. eastern standard time (EST), 10:00 a.m. EST, 4:00 p.m. EST, and 10:00 p.m. EST (NOAA, 2014b). Since the surge levels are likely not to be above plant grade at the onset of tropical-storm-force winds, 48 hours provides the lower bound of possible preparation time. Turkey Point administrative procedure 0-ADM-116 also directs storm surge preparation activities to start at 48 hours prior to arrival of tropical storm winds.

For the probable maximum storm surge (PMSS) produced by the PMH, the period of inundation of the storm surge water levels above plant grade is 2 hours for surge levels to reach a maximum of +17.3 feet NAVD88. For the following 3 hours, flood waters would recede until the storm surge level is below plant grade. Thus, the duration of the storm surge event would be 53 hours, or 2.2 days. Additionally, wave runup may reach plant grade 1 hour prior to the arrival of storm surge to plant grade and remain for an additional 2 hours following the storm surge recession from plant grade.

Local Intense Precipitation

The Local Intense Precipitation (LIP) event may be associated with a tropical cyclone event or be a stand-alone intense rain storm. A LIP resulting from tropical cyclone will have approximately the same warning/preparation time as the tropical-storm-force winds (72 hours). For non-tropical events, the Weather Prediction Center (WPC) of the National Weather Service (NWS) provides Quantitative Precipitation Forecasts (QPF) with lead times of 6 hours to 7 days, three times daily (NOAA, 2014d). The QPF provides an estimate of the precipitation that may occur in the near future. The WPC also offers Probabilistic Precipitation Guidance for Days 1-3 and for every 6-hours and 24-hours periods with different levels of probability of exceedance, including probability of precipitation of at least a specific amount and precipitation amount by percentile probability on their website (NOAA, 2014d). These forecasts are most useful to determine the level of responses to a possible extreme precipitation event such as the LIP.

The Storm Prediction Center (SPC) of the NWS issue thunderstorm outlooks with a lead time of approximately 4 hours, but the forecast does not include quantitative precipitation estimates. When conditions become favorable for organized severe thunderstorms and tornadoes to develop, the SPC issues a severe thunderstorm or tornado watch. The watch is usually issued at least 1 hour prior the onset of severe weather (NOAA, 2014c).

Based on the varying warning time provided by the WPC, a mid-range site preparation period of 48 hours has been chosen. The inundation duration for the 1-hour LIP event begins nearly instantaneously to the rainfall and is approximately 30 minutes (time to peak levels vary by minutes depending on the specific location of interest). The recession from the peak level lasts the remainder of the LIP event and for an additional 15 minutes afterwards, for a total recession of 45 minutes. The total flooding event duration when combined with a tropical cyclone is 49.25 hours, or 2.1 days.

Probable Maximum Tsunami

The Flood Hazard Re-evaluation Report (FHRR) indicated that the probable maximum tsunami (PMT) and coincident wind wave runup would reach a height of a maximum water level of +14.8 feet NAVD88. Since the site grade of PTN is +15.7 feet NAVD88, the inundation and recession durations are zero for the PMT (i.e., no flood water enters the site). Still, other associated

effects from the PMT, such debris loading, sediment deposition and erosion, or waterborne projectiles, may require additional analysis which would require warning/preparation time.

No reliable method exists for predicting the occurrence of tsunamigenic events, such as earthquakes or submarine landslides. The minimum travel time of a tsunami wave to PTN would be slightly greater than 2 hours for an earthquake event along the Hispaniola or Puerto Rican Trench and greater for other sources (NOAA, 2011). NOAA's National Tsunami Warning Center (NTWC) provides notifications for all U.S. coastal states alerting of tsunamigenic events in the Atlantic Ocean or Caribbean Sea (NOAA, 2014b). If the alert from the NTWC closely coincides with the event itself, the full tsunami travel time becomes the warning and preparation duration for the PMT. Any associated effects would be nearly instantaneous to the tsunami runup arrival; accordingly, the total flood event duration is also at least 2 hours.

NRC RAI No. 11:

4.1 Integrated Assessment

The March 12, 2012, 50.54(f) letter, Enclosure 2, requests the licensee to perform an integrated assessment of the plant's response to the reevaluated hazard if the reevaluated flood hazard is not bounded by the current design basis. The NRC staff requests the licensee to provide the flood height and associated effects (as defined in Section 9 of JLD-ISG-2012-05) that are not described in the flood hazard reevaluation report for mechanisms that trigger an Integrated Assessment. This includes the following quantified information for each mechanism (as applicable):

- *Hydrodynamic loading, including debris,*
- *Effects caused by sediment deposition and erosion (e.g., flow velocities, scour),*
- *Concurrent site conditions, including adverse weather,*
- *Groundwater ingress, and*
- *Other pertinent factors (e.g., waterborne projectiles).*

FPL Response to RAI No. 11:

Table 11.1 summarizes the relevant inputs for each factor requested for each flooding mechanism. The following sections provide details regarding each factor.

Table 11.2 - Integrated Assessment Associated Effect Inputs

Factor	PMP/LIP		PMSS	PMT
	Scenario A	Scenario B		
Hydrodynamic loading at plant grade	Minimal, not bounding (FHRR, Sect. 4.1)	Minimal, not bounding (FHRR, Sect. 4.1)	up to 240 lbs/ft^2 (FHRR, Fig. 4-48)	None
Debris loading at plant grade	None	None	up to 20,000 lbs (110 lbs/in^2)	up to 65,300 lbs (370 lb/in^2) [1]
Sediment loading at plant grade	None	None	Horizontal: up to 64 lbs/ft^2 Vertical: up to 110 lbs/ft^2	None
Sediment deposition and erosion	None	None	Scour up to 2 feet; Deposition bounded by PMSS elevation	Deposition bounded by PMT runup elevation

Concurrent conditions, including adverse weather	None	High winds (RAI 10 response); PMSS	High winds (RAI 10 response)	None
Groundwater ingress	None	None	None	None
Other pertinent factors (e.g., waterborne projectiles)	None	None	up to 556,000 lbs (FHRR, Sect. 4.11)	None

[1] PMT debris loading acts at maximum water level elevation, 12.1 feet NAVD88, not plant grade

Local Intense Precipitation (LIP)

Neither LIP event scenario generates unique debris, sedimentation, groundwater ingress, or waterborne projectiles since the precipitation and resulting runoff is limited to the nearly impervious surrounding the powerblock and runoff velocities that were bounded by the PMSS, as reported in the FHRR. Therefore, hydrodynamic and debris loading, sedimentation effects, groundwater ingress, or other pertinent factors, such as waterborne projectiles, for the LIP scenarios are not required to be analyzed separately during the Integrated Assessment since they are bounded by the PMSS analysis.

No concurrent conditions or adverse weather were considered during the warning/preparation time prior to the Scenario A LIP rainfall. The Scenario B LIP event would occur coincident with a hurricane event surge and the durations of tropical-storm-force winds defined in the RAI 10 response, as well as the PMSS, would be potential concurrent conditions. The high wind duration and PMSS water level will be considered in the Integrated Assessment.

Probable Maximum Storm Surge (PMSS)

Hydrodynamic, Debris, and Sediment Loading

The hydrostatic and hydrodynamic loading associated with the PMSS water level and wave activity at plant grade was calculated to be 275 pounds per square foot (see FHRR Figure 4-48 and discussed in FHRR Sections 4.10 and 5.10). If entrained sediment were deposited up to the stillwater depth (i.e., up to an elevation of 17.3 feet NAVD88), a horizontal pressure of 64 pounds per square foot and vertical pressure of 110 pounds per square foot are possible at plant grade (Table 11.2). Areas lower than plant grade would see a horizontal and vertical loads as shown in Table 11.2. The largest debris considered, a 2,000-pound, 15-inch log, has an impact force up to 20,000 pounds, with an impact pressure of 110 pounds per square inch. Debris loads applied to SSCs may be less than the maximum depending on the presence of local intervening structures. As an interim action, concrete barriers will be installed as part of storm preparation actions in front of the east side stop log that may be subject to debris. These actions provide reasonable assurance that the stop logs are protected from the debris loading including sedimentations.

Table 11.2 – Soil/Sediment Horizontal and Vertical Pressure

Base Elevation of SSC (ft NAVD88)	Depth of Sediment (ft)	Horizontal Loading (lbs/ft^2)	Vertical Loading (lbs/ft^2)
17.5	0.0	0	0
17.0	0.5	18	31
16.5	1.0	36	61
16.0	1.5	54	92
15.7 [1]	1.8	64	110
15.5	2.0	71	122
15.0	2.5	89	153
14.5	3.0	107	183
14.0	3.5	125	214
13.5 [2]	4.0	142	244

[1] Plant grade elevation
[2] Reference ground elevation

Effects of Sediment Deposition and Erosion

Note that PTN currently has a sedimentation monitoring and maintenance plan for the cooling water and intake canal systems; thus, the canal systems are well maintained. For the sedimentation study, flow velocities and bed shear stresses were evaluated to determine areas vulnerable to accumulated erosion and deposition during the PMSS. The peak bed shear stresses during the PMSS (Figure 11.1) are capable of mobilizing noncohesive sediment typical near PTN. Potential erosional and depositional areas were determined from comparison of the relative magnitudes and directions of sediment transport (Figure 11.1). In general, the peak bed shear stresses move in a northeast-to-southwest direction, indicating erosion from Biscayne Bay east of the plant and eventual deposition to the west of PTN. However, localized effects can drive sediment in other directions and produce smaller zones of erosion and deposition, such as those east of PTN (Figure 11.1). Maximum erosive scour depth of up to 2 feet is possible along vertical structures (e.g., observation points TP5, TP6, and TP8 on Figure 11.1) at plant grade. Further, during the PMSS recession, deposition is possible over the inundated area (Figure 11.2). The depth of potential sediment accumulation is bounded by the peak local water depth during the PMSS. It is noted that operational challenges due to sedimentation have not be experienced at PTN in past hurricanes including Hurricane Andrew.

Concurrent Conditions, including Adverse Weather

The duration of tropical-storm-force winds would be associated with the PMSS, as defined in the RAI 10 response. The period of high winds may effect actions in preparation of the PMSS and will be considered in the Integrated Assessment.

Groundwater Ingress

Elevated PMSS levels would induce a hydraulic groundwater gradient, but the relatively short duration (6 hours) of sustained storm surge levels above site grade would not be sufficient for inducing significant flow through the asphalt surface layer that covers a majority of the areas surrounding the power block structures and underlying compacted fill. During the life of the plant, the plant has not experienced any significant groundwater effects during tidal fluctuations or post storm surge events. PTN hurricane operating procedures require the closing of storm drains prior to PMSS arrival. Therefore, neither ingress nor backflow is a factor during the PMSS.

Waterborne Projectiles

The FHRR presented the maximum force generated by a waterborne projectile (a 60-foot-long watercraft) during the PMSS: 556,000 pounds (FHRR, Section 4.11). Loads applied to SSCs may be less than the maximum PMSS load depending on the presents of local intervening structures. The CLB does not address waterborne projectile loading and therefore their loadings will be evaluated in the Integrated Assessment.

Probable Maximum Tsunami (PMT)

Hydrodynamic, Debris, and Sediment Loading and Waterborne Projectiles

The maximum runup associated with the PMT does not reach site grade. Thus, no hydrodynamic, debris, or waterborne projectile loadings are expected on site-grade, powerblock structures. At the maximum tsunami water level, 12.1 feet NAVD88, a debris loading of 65,300 pounds, or 370 pounds per square inch is possible. Tsunami loads are bounded by the hurricane loads. The effect of this loading on the intake and cooling canals will be documented during the Integrated Assessment.

Effects of Sediment Deposition and Erosion

Noncohesive sediment in adjacent Biscyane Bay will mobilized by the PMT wave. Deposition of mobilize sediment will occur in shallow water near the maximum tsunami water level (i.e., elevation 12.1 feet NAVD88). The potential deposition area associated with the PMT is shown on Figure 11.3. Deposition is bounded by the maximum runup elevation and will not impact any structure above that level. The intake canal at the northeast portion of the PTN site is potentially vulnerable to deposition feature and will be evaluated in the Integrated Assessment.

Concurrent Conditions, including Adverse Weather

No concurrent conditions or adverse weather is expected during the PMT occurring during normal operating operations; no adverse weather needs to be considered in the Integrated Assessment.

Groundwater Ingress

Groundwater ingress is not expected during the PMT because the maximum tsunami water level (12.1 feet NAVD88) is well below site grade (15.7 feet NAVD88). Further, the very short duration of the PMT inundation would not induce significant groundwater flow.

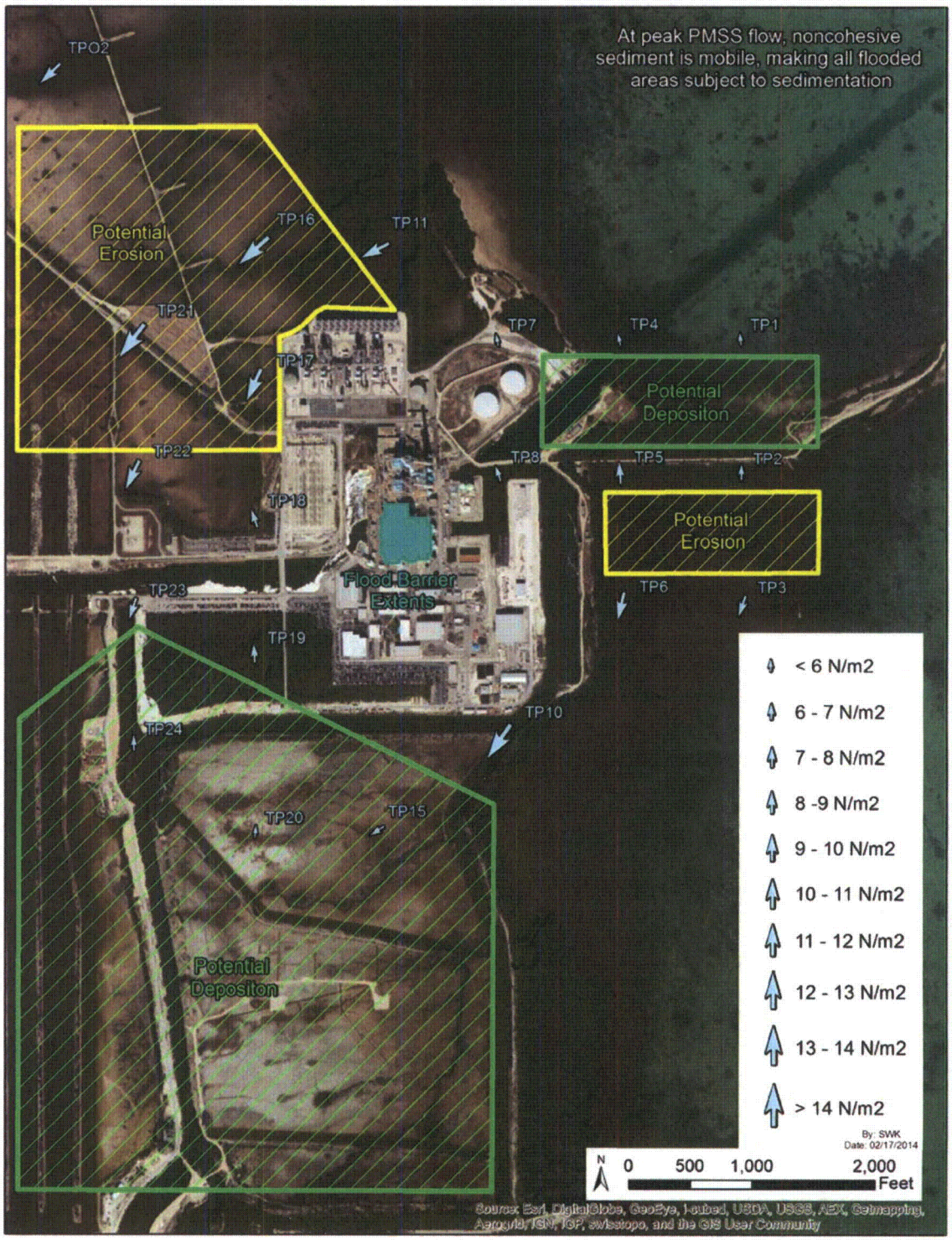

Figure 11.1 – PMSS Peak Flow Potential Erosion and Deposition Zones

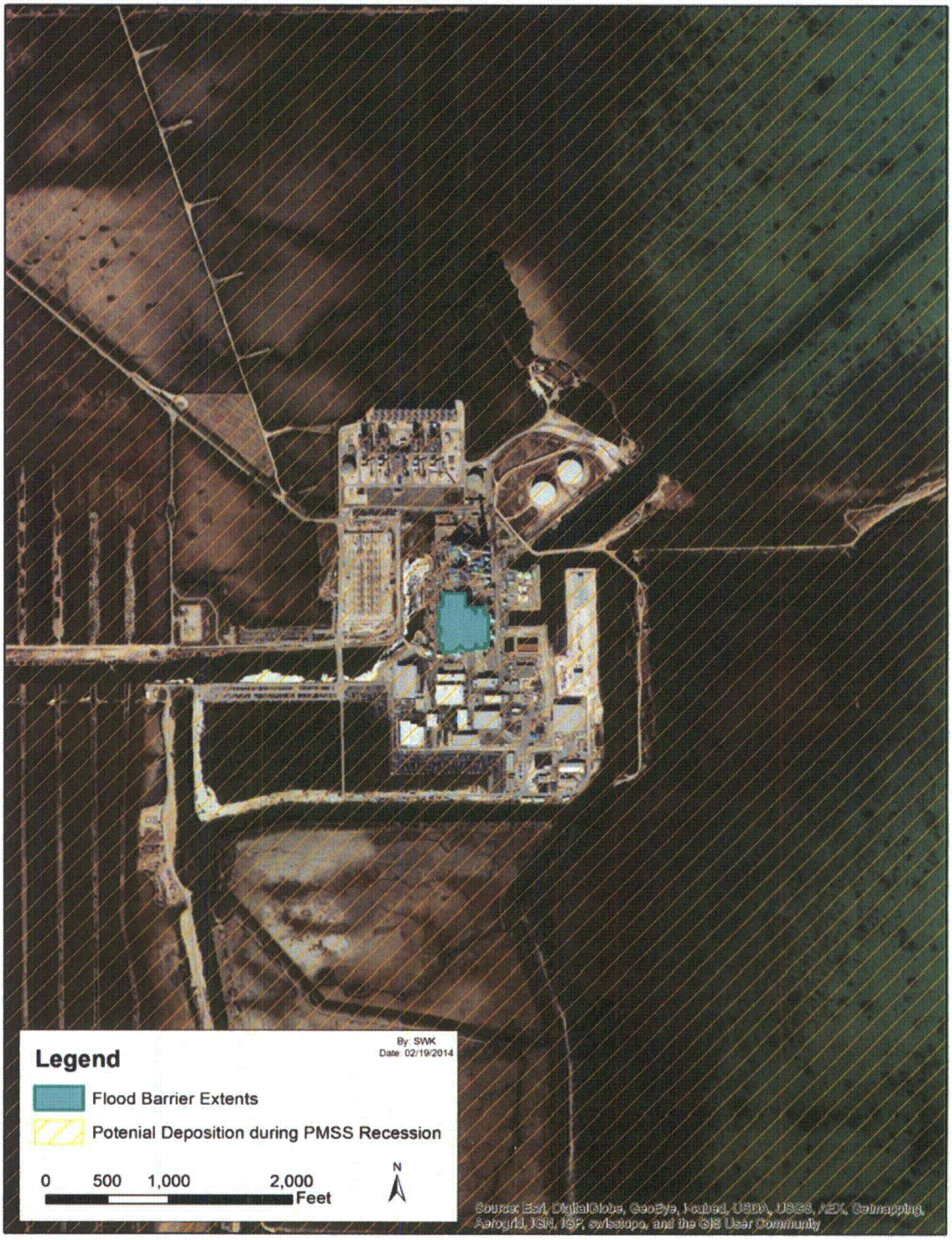

Figure 11.2 – Potential Deposition during PMSS Recession

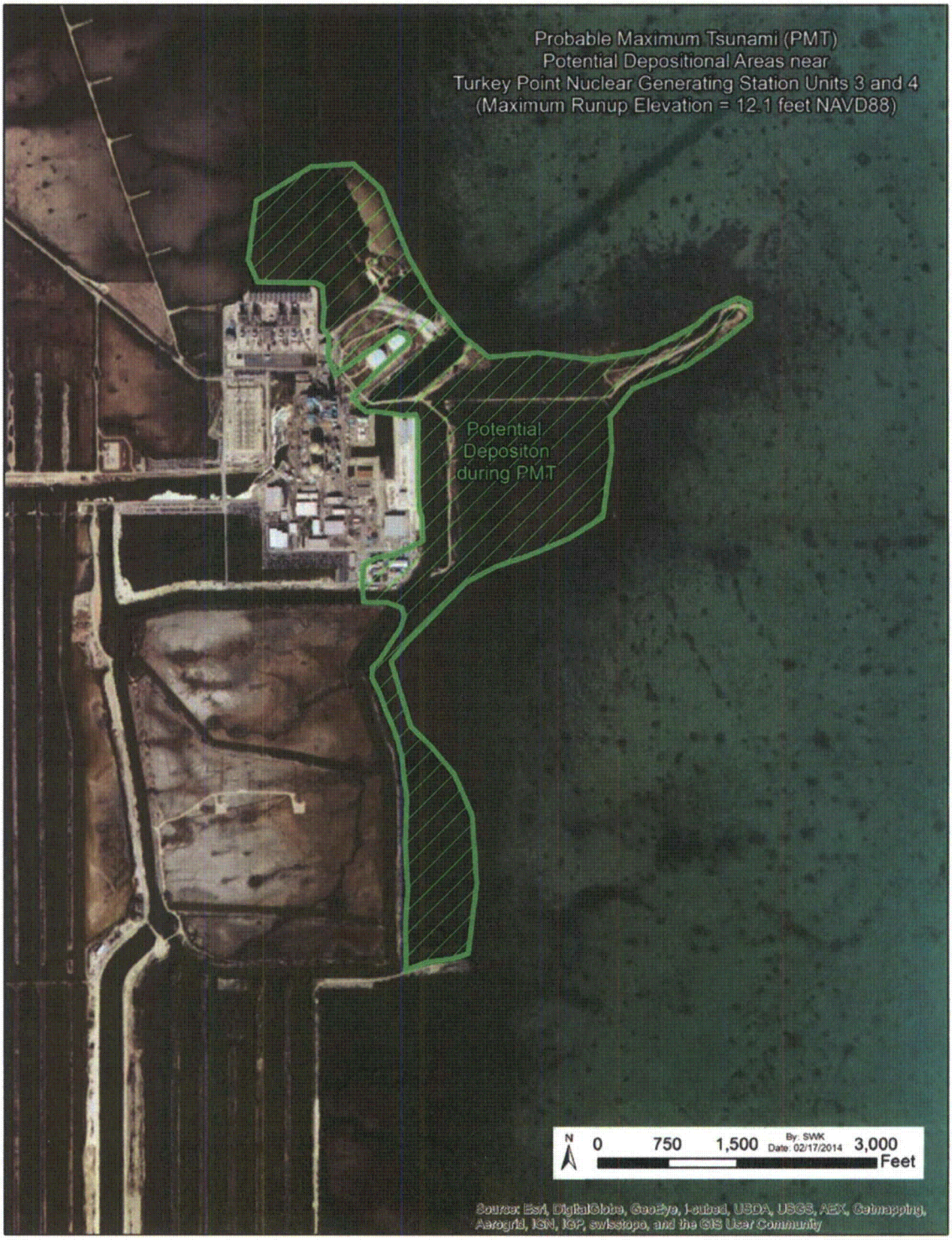

Figure 11.3 – PMT Potential Deposition Zones