

Entergy Fleet Fukushima Program
Flood Hazard Reevaluation Report for Indian Point Energy Center (IPEC) Units 2 and 3

Table 3.4-12: ADCIRC Simulated Storm Surge Stillwater Elevations

Rank	Storm ID (Vmax, Vf, Rmax, CPD, θ), Tide at IPEC	Peak Surge			
		The Battery	IPEC	The Battery	IPEC
		(feet, NAVD88)		(feet, NGVD29)	
1	14460 - (131kts Vmax, 20kts Vf, 20nm Rmax, 90mb, -20°), HT at IPEC	17.49	18.08	18.59	19.08
2	13915 - (134kts Vmax, 25kts Vf, 20nm Rmax, 90mb, -40°), HT at IPEC	23.26	17.22	24.36	18.22
3	11661 - (132kts Vmax, 35kts Vf, 28nm Rmax, 80mb, -30°), HT at IPEC	24.47	17.20	25.57	18.20
4	15385 - (134kts Vmax, 25kts Vf, 20nm Rmax, 90mb, 10°), HT at IPEC	15.32	17.16	16.42	18.16
5	14251 - (137kts Vmax, 30kts Vf, 20nm Rmax, 90mb, -30°), HT at IPEC	23.97	17.11	25.07	18.11
6	11367 - (124kts Vmax, 35kts Vf, 28nm Rmax, 80mb, -40°), HT at IPEC	24.46	16.84	25.56	17.84
7	11324 - (121kts Vmax, 30kts Vf, 28nm Rmax, 80mb, -40°), HT at IPEC	22.41	16.50	23.51	17.50
8	11611 - (125kts Vmax, 30kts Vf, 24nm Rmax, 80mb, -30°), HT at IPEC	21.39	16.44	22.49	17.44
9	11703 - (127kts Vmax, 40kts Vf, 28nm Rmax, 80mb, -30°), HT at IPEC	23.65	16.37	24.75	17.37
10	14790 - (138kts Vmax, 25kts Vf, 16nm Rmax, 90mb, -10°), HT at IPEC	17.91	16.28	19.01	17.28
11	11409 - (126kts Vmax, 40kts Vf, 28nm Rmax, 80mb, -40°), HT at IPEC	24.58	16.24	25.68	17.24
12	14881 - (140kts Vmax, 35kts Vf, 20nm Rmax, 90mb, -10°), HT at IPEC	20.96	16.11	22.06	17.11
13	11696 - (131kts Vmax, 40kts Vf, 24nm Rmax, 80mb, -30°), HT at IPEC	23.95	15.99	25.05	16.99
14	11996 - (126kts Vmax, 40kts Vf, 28nm Rmax, 80mb, -20°), HT at IPEC	22.47	15.88	23.57	16.88
15	14538 - (141kts Vmax, 30kts Vf, 16nm Rmax, 90mb, -20°), HT at IPEC	21.10	15.88	22.20	16.88
16	11451 - (129kts Vmax, 45kts Vf, 28nm Rmax, 80mb, -40°), HT at IPEC	24.61	15.85	25.71	16.85
17	14292 - (140kts Vmax, 35kts Vf, 20nm Rmax, 90mb, -30°), HT at IPEC	24.84	15.80	25.94	16.80
18	11745 - (129kts Vmax, 45kts Vf, 28nm Rmax, 80mb, -30°), HT at IPEC	23.62	15.78	24.72	16.78
19	14335 - (142kts Vmax, 40kts Vf, 20nm Rmax, 90mb, -30°), HT at IPEC	25.33	15.77	26.43	16.77
20	14586 - (140kts Vmax, 35kts Vf, 20nm Rmax, 90mb, -20°), HT at IPEC	23.56	15.74	24.66	16.74
21	11990 - (131kts Vmax, 40kts Vf, 24nm Rmax, 80mb, -20°), HT at IPEC	22.20	15.58	23.30	16.58
22	14832 - (141kts Vmax, 30kts Vf, 16nm Rmax, 90mb, -10°), HT at IPEC	19.68	15.52	20.78	16.52
23	11157 - (129kts Vmax, 45kts Vf, 28nm Rmax, 80mb, -50°), HT at IPEC	25.23	15.52	26.33	16.52
24	14041 - (143kts Vmax, 40kts Vf, 20nm Rmax, 90mb, -40°), HT at IPEC	25.76	15.52	26.86	16.52
25	14377 - (145kts Vmax, 45kts Vf, 20nm Rmax, 90mb, -30°), HT at IPEC	25.49	15.45	26.59	16.45

Entergy Fleet Fukushima Program
Flood Hazard Reevaluation Report for Indian Point Energy Center (IPEC) Units 2 and 3

Table 3.4-12: ADCIRC Simulated Storm Surge Stillwater Elevations (con't)

Rank	Storm ID (Vmax, Vf, Rmax, CPD, θ), Tide at IPEC	Peak Surge			
		The Battery	IPEC	The Battery	IPEC
		(feet, NAVD88)		(feet, NGVD29)	
26	14629 - (143kts Vmax, 40kts Vf, 20nm Rmax, 90mb, -20°), HT at IPEC	23.65	15.34	24.75	16.34
27	11408 - (126kts Vmax, 40kts Vf, 28nm Rmax, 80mb, -40°), HT at IPEC	23.85	15.32	24.95	16.32
28	12039 - (129kts Vmax, 45kts Vf, 28nm Rmax, 80mb, -20°), HT at IPEC	21.64	15.32	22.74	16.32
29	10863 - (129kts Vmax, 45kts Vf, 28nm Rmax, 80mb, -60°), HT at IPEC	25.10	15.29	26.20	16.29
30	14083 - (145kts Vmax, 45kts Vf, 20nm Rmax, 90mb, -40°), HT at IPEC	25.87	15.29	26.97	16.29
31	12032 - (134kts Vmax, 45kts Vf, 24nm Rmax, 80mb, -20°), HT at IPEC	22.69	15.26	23.79	16.26
32	11941 - (132kts Vmax, 35kts Vf, 20nm Rmax, 80mb, -20°), HT at IPEC	21.23	15.22	22.33	16.22
33	14923 - (143kts Vmax, 40kts Vf, 20nm Rmax, 90mb, -10°), HT at IPEC	21.65	15.19	22.75	16.19
34	14922 - (143kts Vmax, 40kts Vf, 20nm Rmax, 90mb, -10°), HT at IPEC	22.60	15.18	23.70	16.18
35	11744 - (129kts Vmax, 45kts Vf, 28nm Rmax, 80mb, -30°), HT at IPEC	23.47	15.12	24.57	16.12
36	9057 - (119kts Vmax, 40kts Vf, 28nm Rmax, 70mb, -30°), HT at IPEC	20.93	15.06	22.03	16.06
37	14671 - (146kts Vmax, 45kts Vf, 20nm Rmax, 90mb, -20°), HT at IPEC	23.79	15.02	24.89	16.02
38	11450 - (129kts Vmax, 45kts Vf, 28nm Rmax, 80mb, -40°), HT at IPEC	23.90	14.91	25.00	15.91
39	11737 - (134kts Vmax, 45kts Vf, 24nm Rmax, 80mb, -30°), HT at IPEC	23.86	14.72	24.96	15.72
40	13789 - (145kts Vmax, 45kts Vf, 20nm Rmax, 90mb, -50°), HT at IPEC	26.03	14.63	27.13	15.63
41	8182 - (115kts Vmax, 40kts Vf, 32nm Rmax, 70mb, -60°), HT at IPEC	22.01	14.47	23.11	15.47
42	14040 - (143kts Vmax, 40kts Vf, 20nm Rmax, 90mb, -40°), HT at IPEC	25.00	14.43	26.10	15.43
43	9070 - (111kts Vmax, 40kts Vf, 36nm Rmax, 70mb, -30°), HT at IPEC	19.44	14.41	20.54	15.41
44	9358 - (115kts Vmax, 40kts Vf, 32nm Rmax, 70mb, -20°), HT at IPEC	17.89	14.40	18.99	15.40
45	14670 - (145kts Vmax, 45kts Vf, 20nm Rmax, 90mb, -20°), HT at IPEC	24.02	14.38	25.12	15.38
46	8217 - (122kts Vmax, 45kts Vf, 28nm Rmax, 70mb, -60°), HT at IPEC	22.60	14.34	23.70	15.34
47	8776 - (111kts Vmax, 40kts Vf, 36nm Rmax, 70mb, -40°), HT at IPEC	19.72	14.21	20.82	15.21
48	9393 - (122kts Vmax, 45kts Vf, 28nm Rmax, 70mb, -20°), HT at IPEC	19.46	14.21	20.56	15.21
49	14082 - (145kts Vmax, 45kts Vf, 20nm Rmax, 90mb, -40°), HT at IPEC	25.01	14.14	26.11	15.14
50	8517 - (118kts Vmax, 45kts Vf, 32nm Rmax, 70mb, -50°), HT at IPEC	21.13	13.55	22.23	14.55

Note: Rank shown in Table 3.4-12 based on the ADCIRC calculated maximum water levels at IPEC.

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Flood Hazard Reevaluation Report for Indian Point Energy Center (IPEC) Units 2 and 3

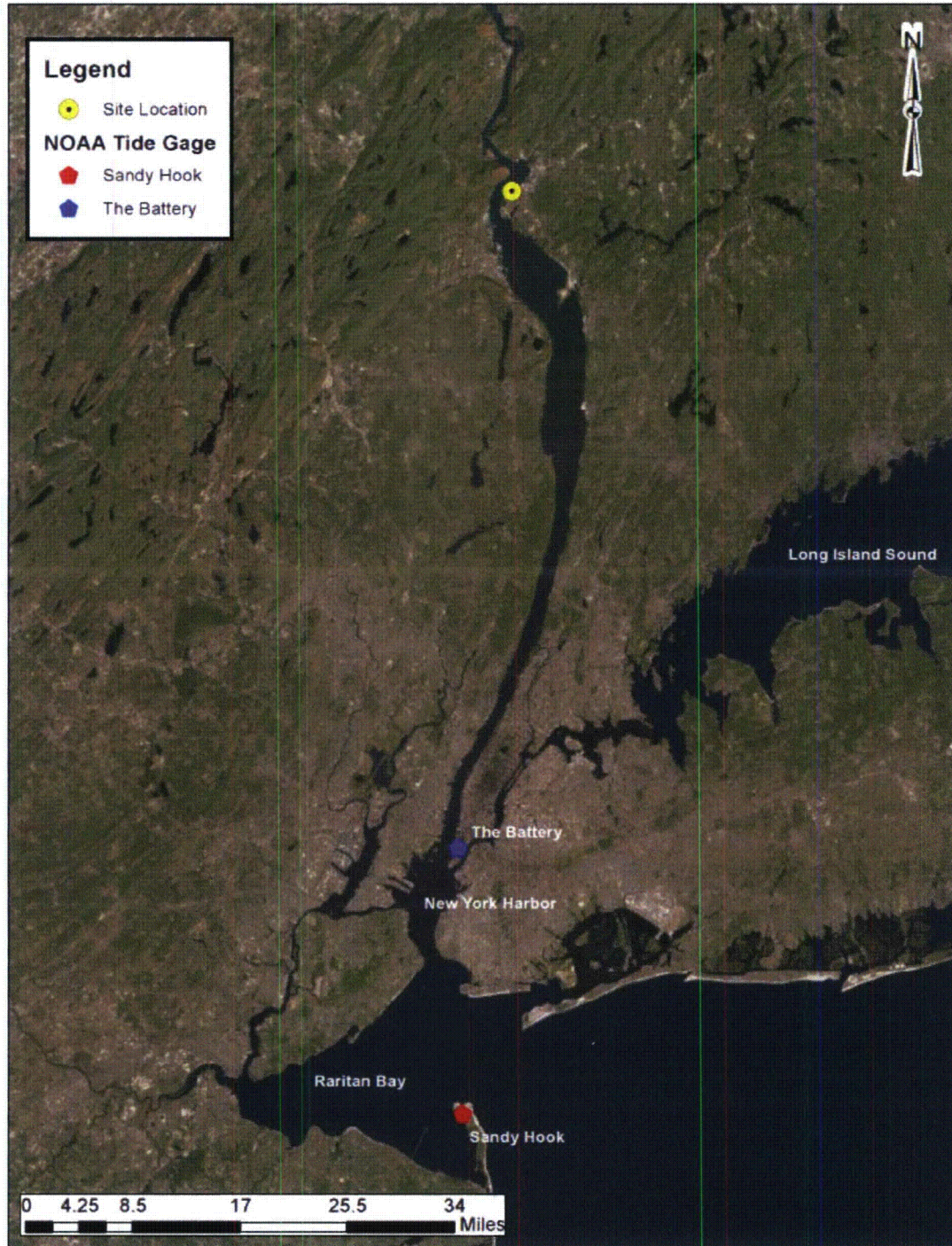


Figure 3.4-1: Location of NOAA Co-Op Stations in the Vicinity of IPEC

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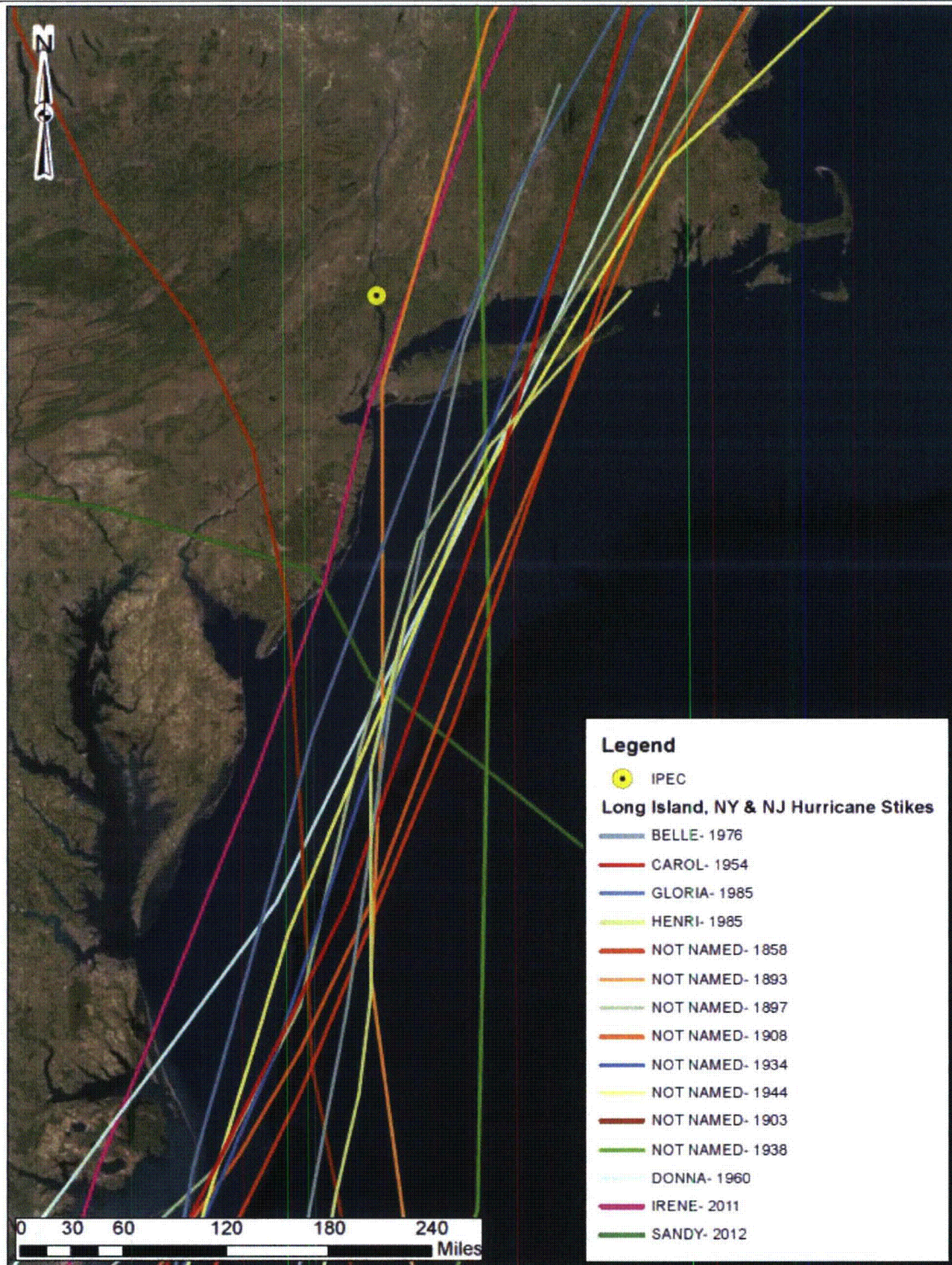


Figure 3.4-2: Hurricane Strikes to New York and New Jersey

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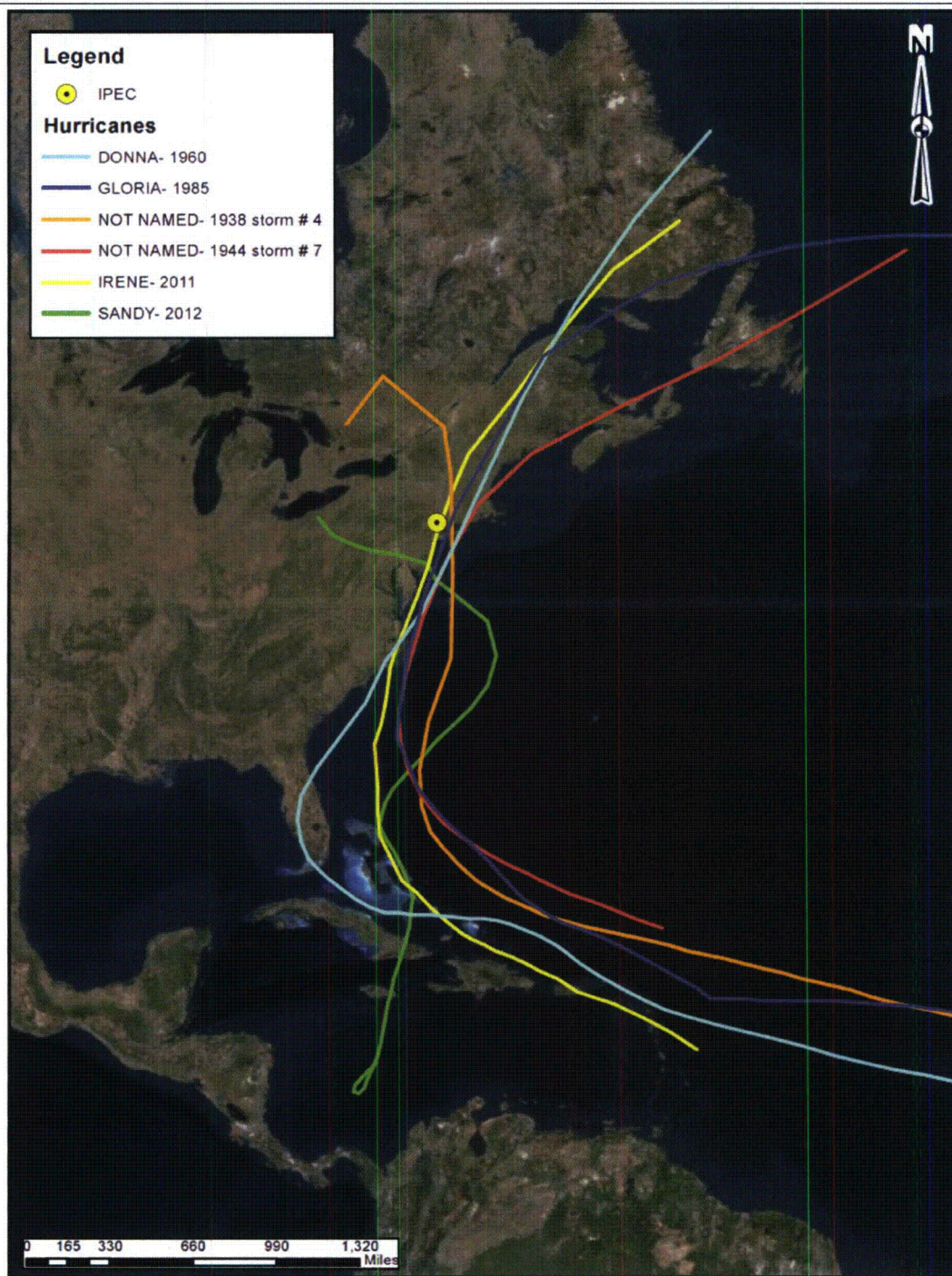


Figure 3.4-3: Hurricane Tracks of Recorded Extreme Water Levels at Sandy Hook, NJ and the Battery, NY

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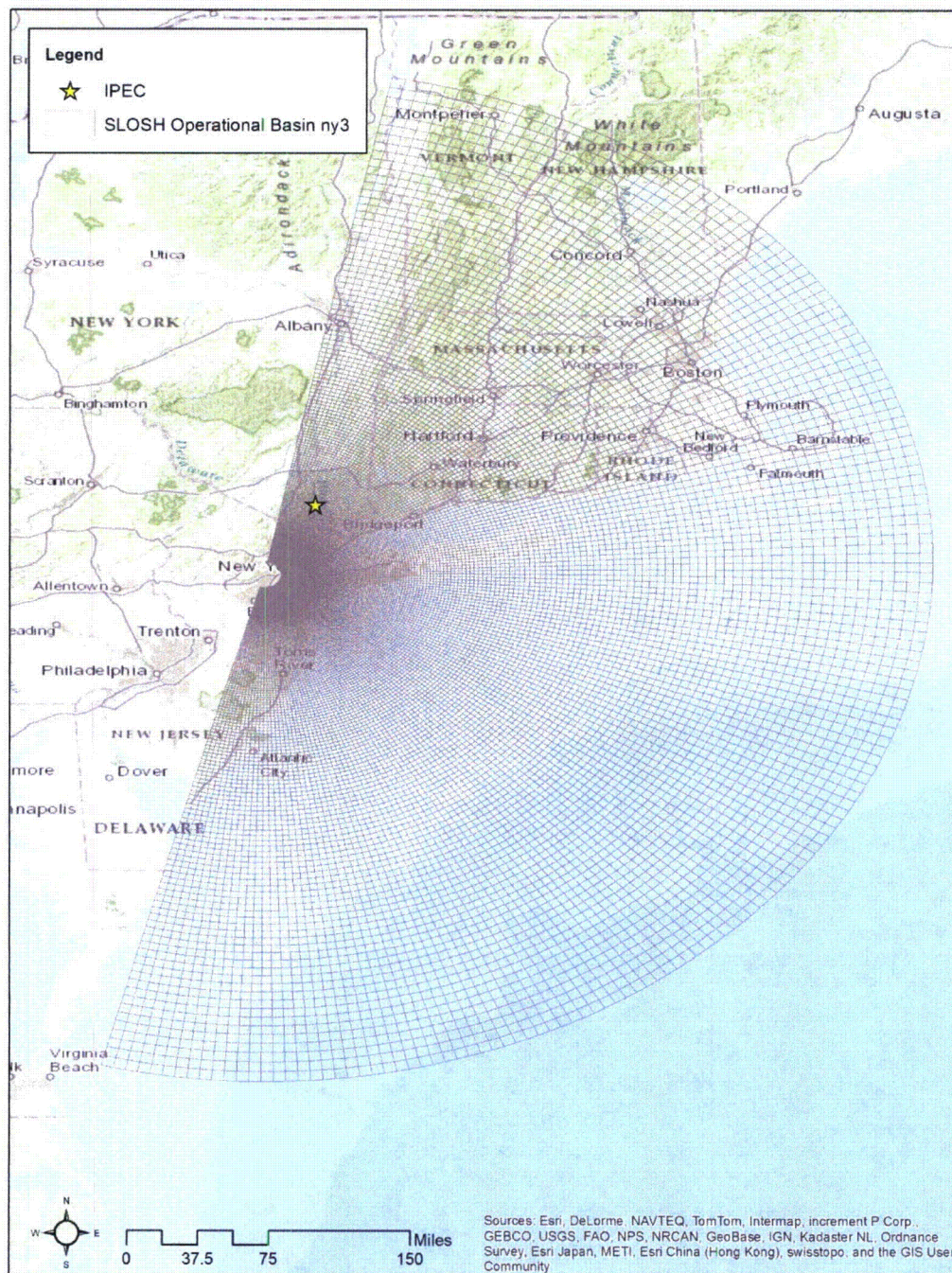


Figure 3.4-4: New York, Version 3 (ny3) SLOSH 3.97 Model Grid

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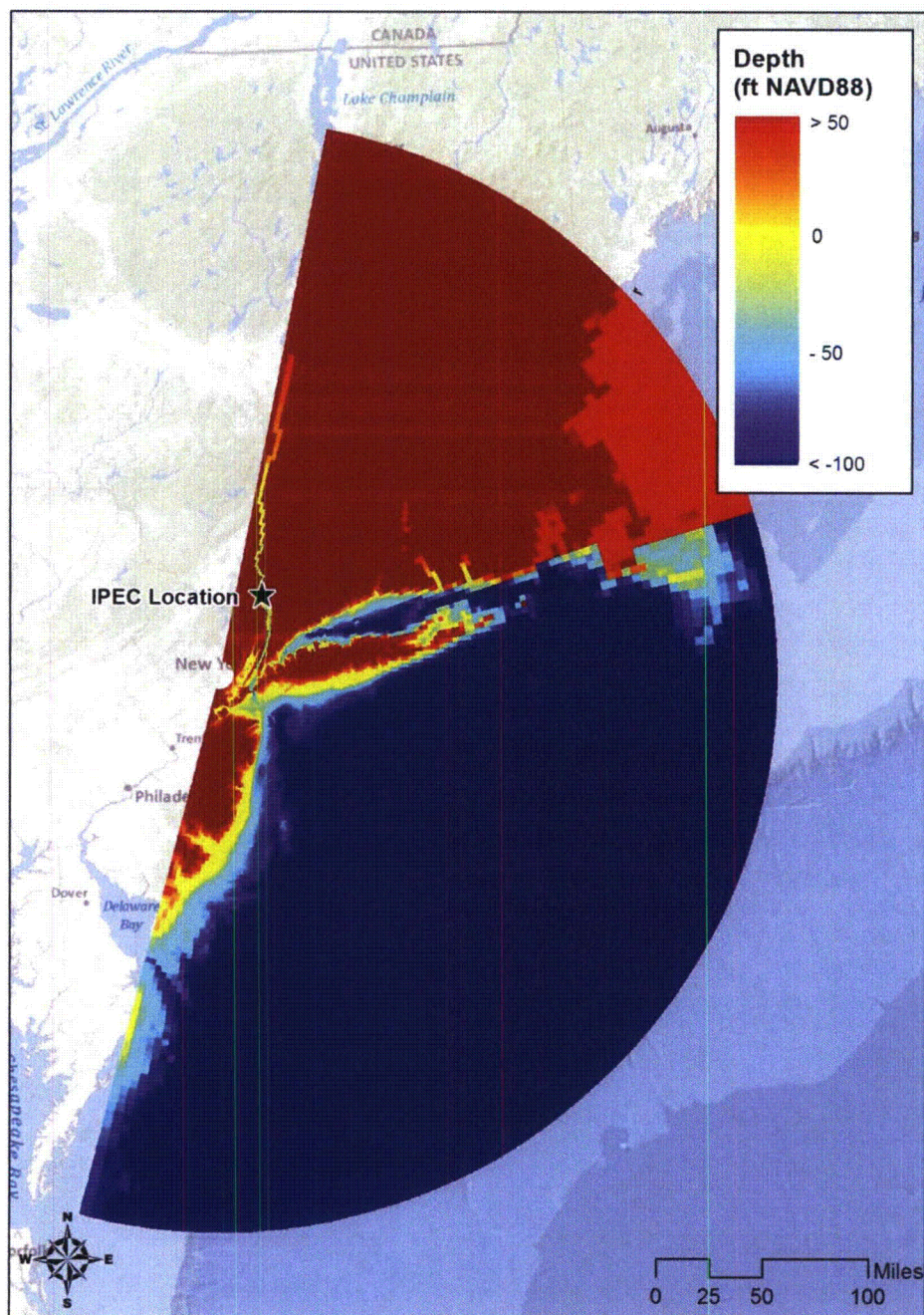


Figure 3.4-5: New York, Version 3 (ny3) Basin Digital Elevation Model (DEM) Defining Base of Model Domain

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Flood Hazard Reevaluation Report for Indian Point Energy Center (IPEC) Units 2 and 3

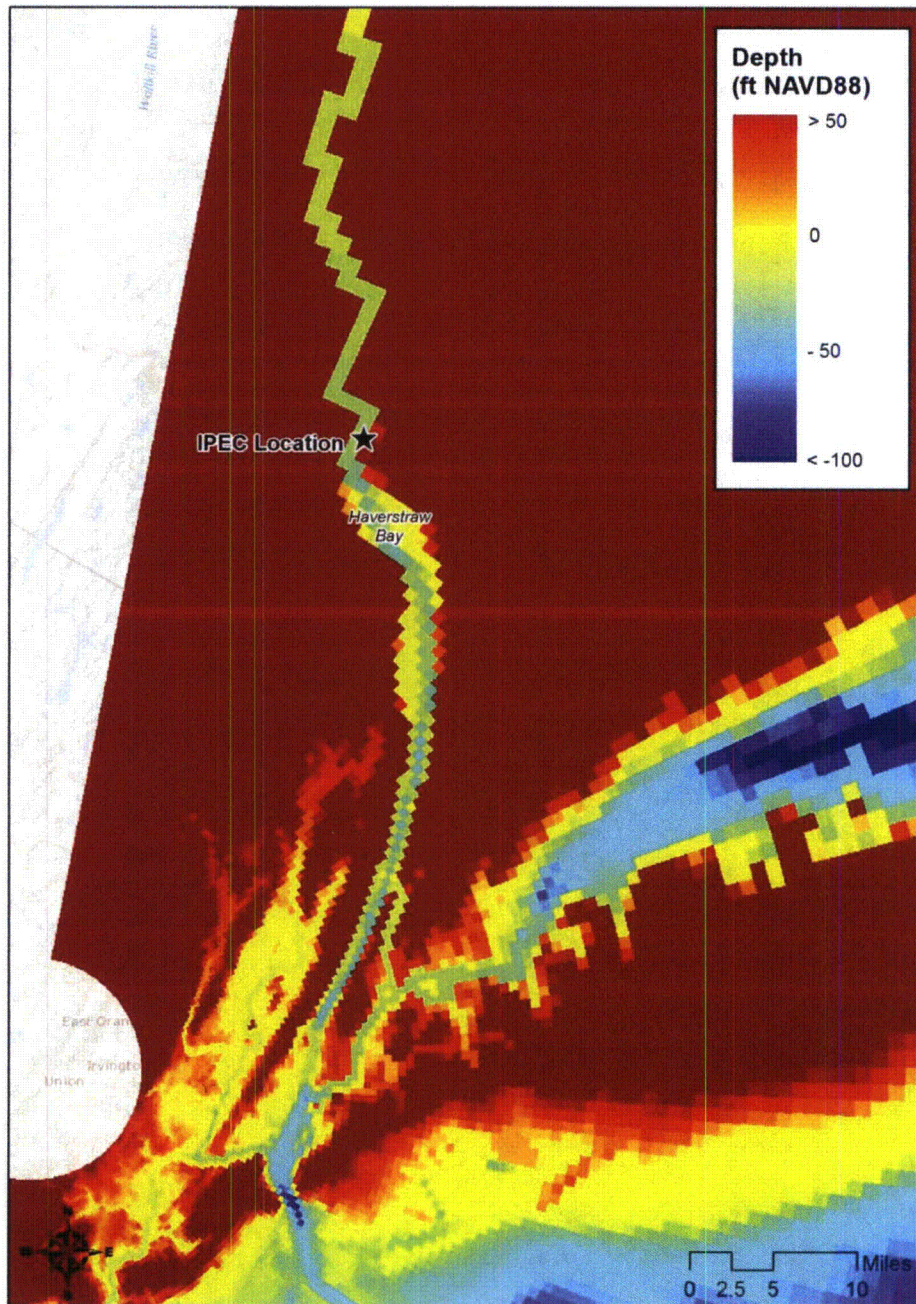


Figure 3.4-6: New York, Version 3 (ny3) Basin Digital Elevation Model (DEM) Defining Base of Model Domain in IPEC Vicinity (Upper Bay, New York and Hudson River)

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Flood Hazard Reevaluation Report for Indian Point Energy Center (IPEC) Units 2 and 3**

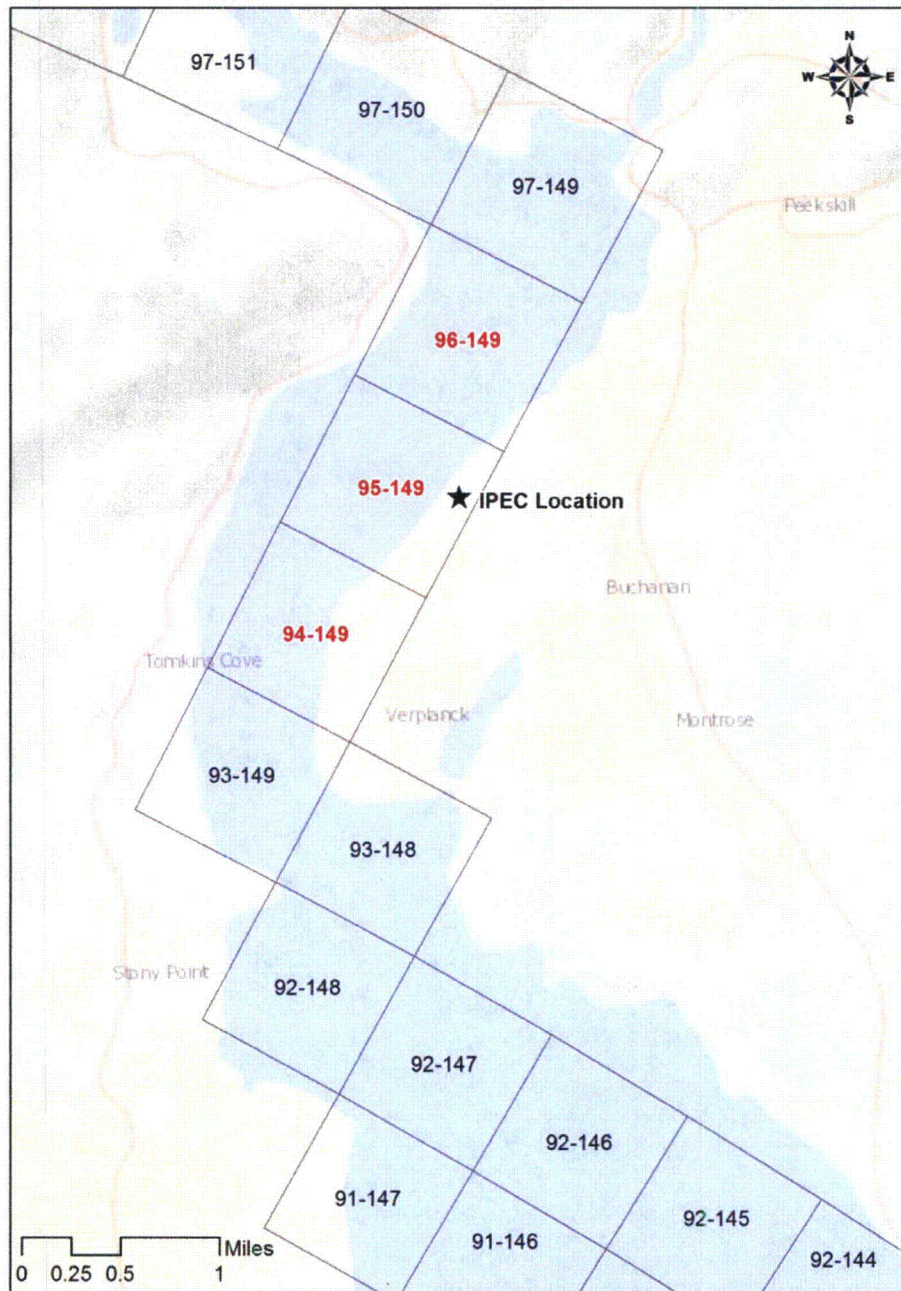


Figure 3.4-7: New York, Version 3 (ny3) Grid Cells Corresponding to the IPEC River Frontage

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Flood Hazard Reevaluation Report for Indian Point Energy Center (IPEC) Units 2 and 3**



Figure 3.4-8: Landfall Points for SLOSH 3.97 Storm Tracks

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Flood Hazard Reevaluation Report for Indian Point Energy Center (IPEC) Units 2 and 3

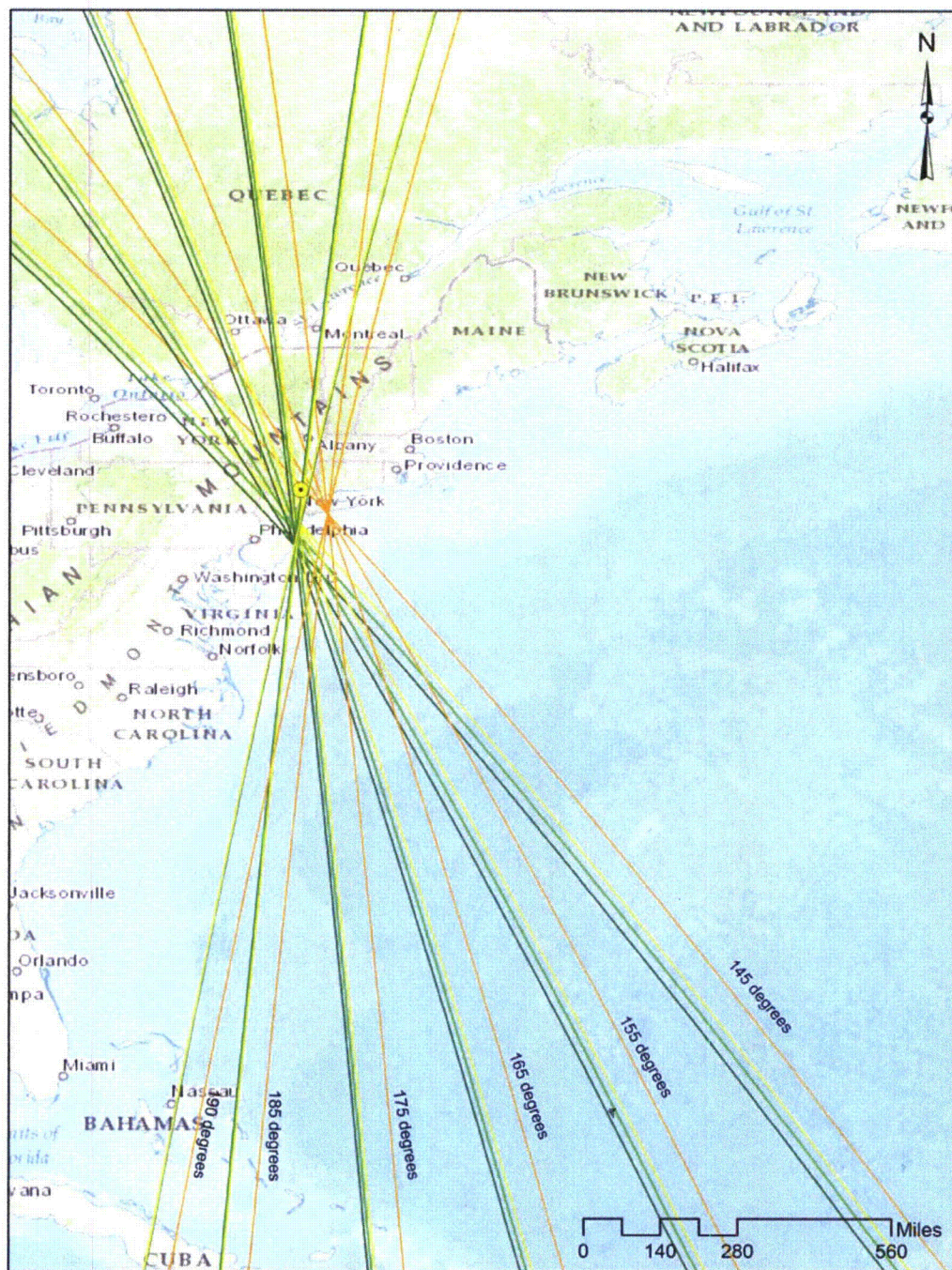


Figure 3.4-9: SLOSH 3.97 Bearing Range for Northerly Storm Tracks

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Flood Hazard Reevaluation Report for Indian Point Energy Center (IPEC) Units 2 and 3

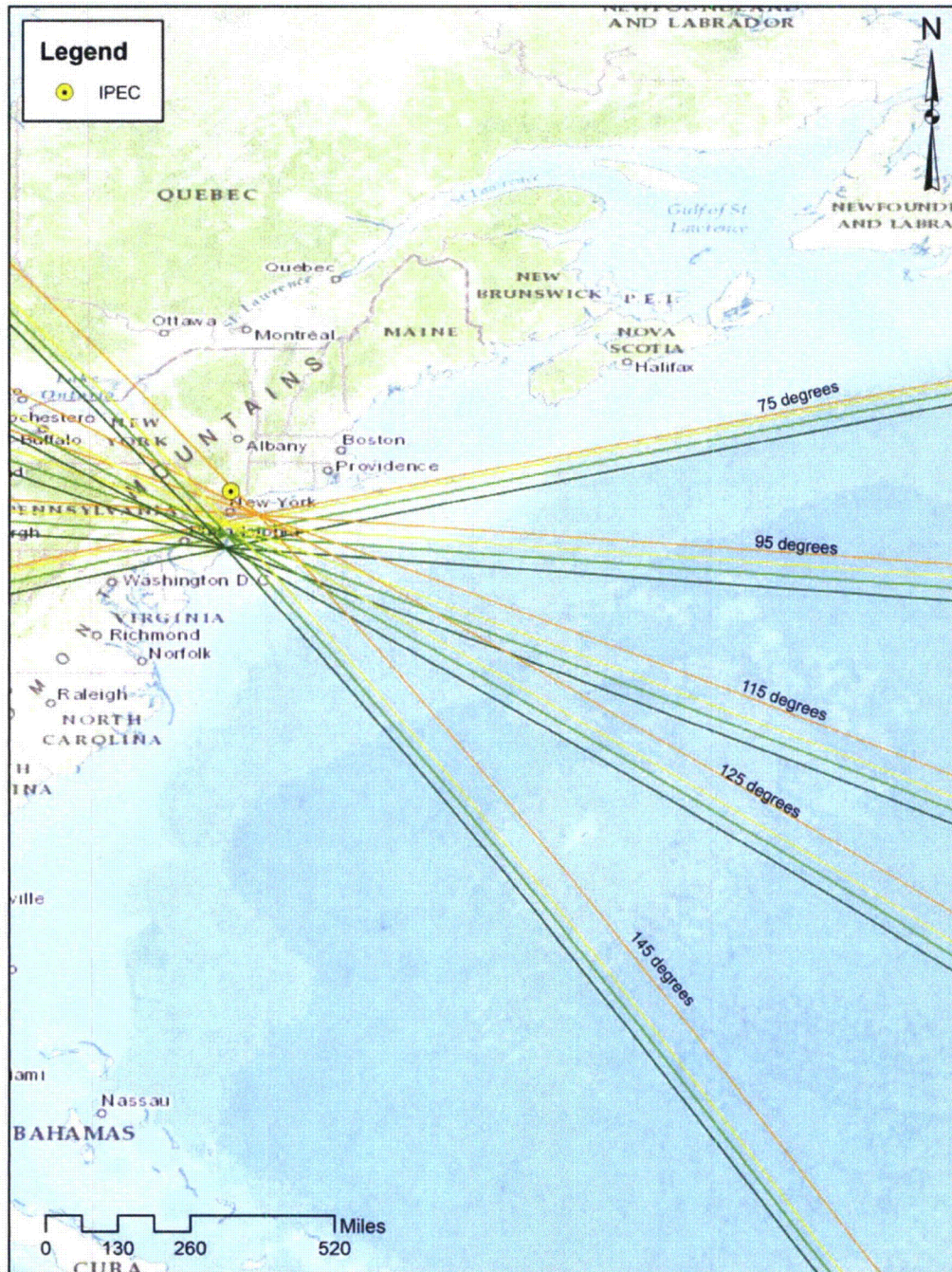


Figure 3.4-10: SLOSH 3.97 Bearing Range for Westerly Storm Tracks

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Flood Hazard Reevaluation Report for Indian Point Energy Center (IPEC) Units 2 and 3

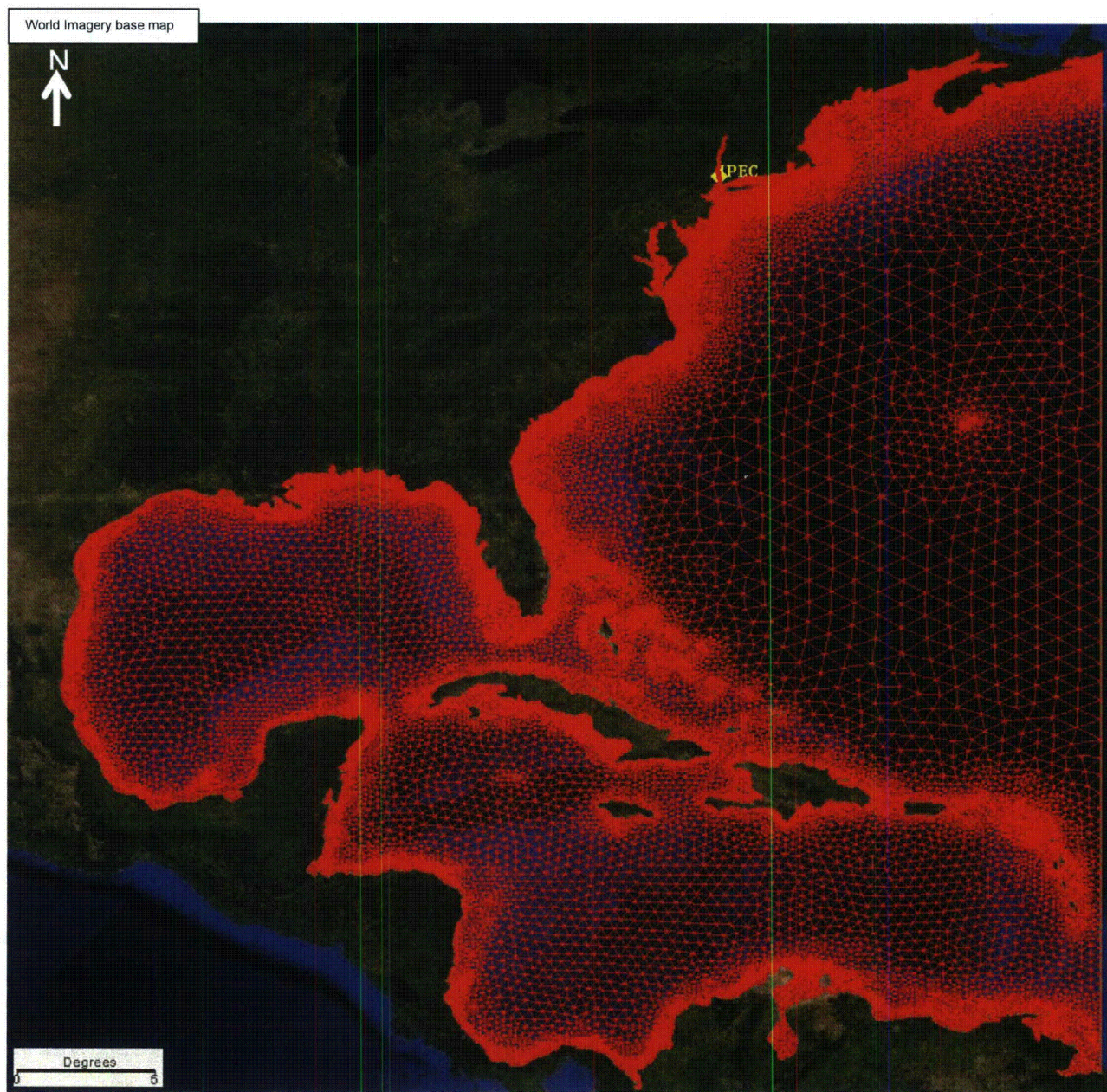


Figure 3.4-11: ADCIRC FEMA Region II Finite Element Mesh – Northern Atlantic

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Flood Hazard Reevaluation Report for Indian Point Energy Center (IPEC) Units 2 and 3

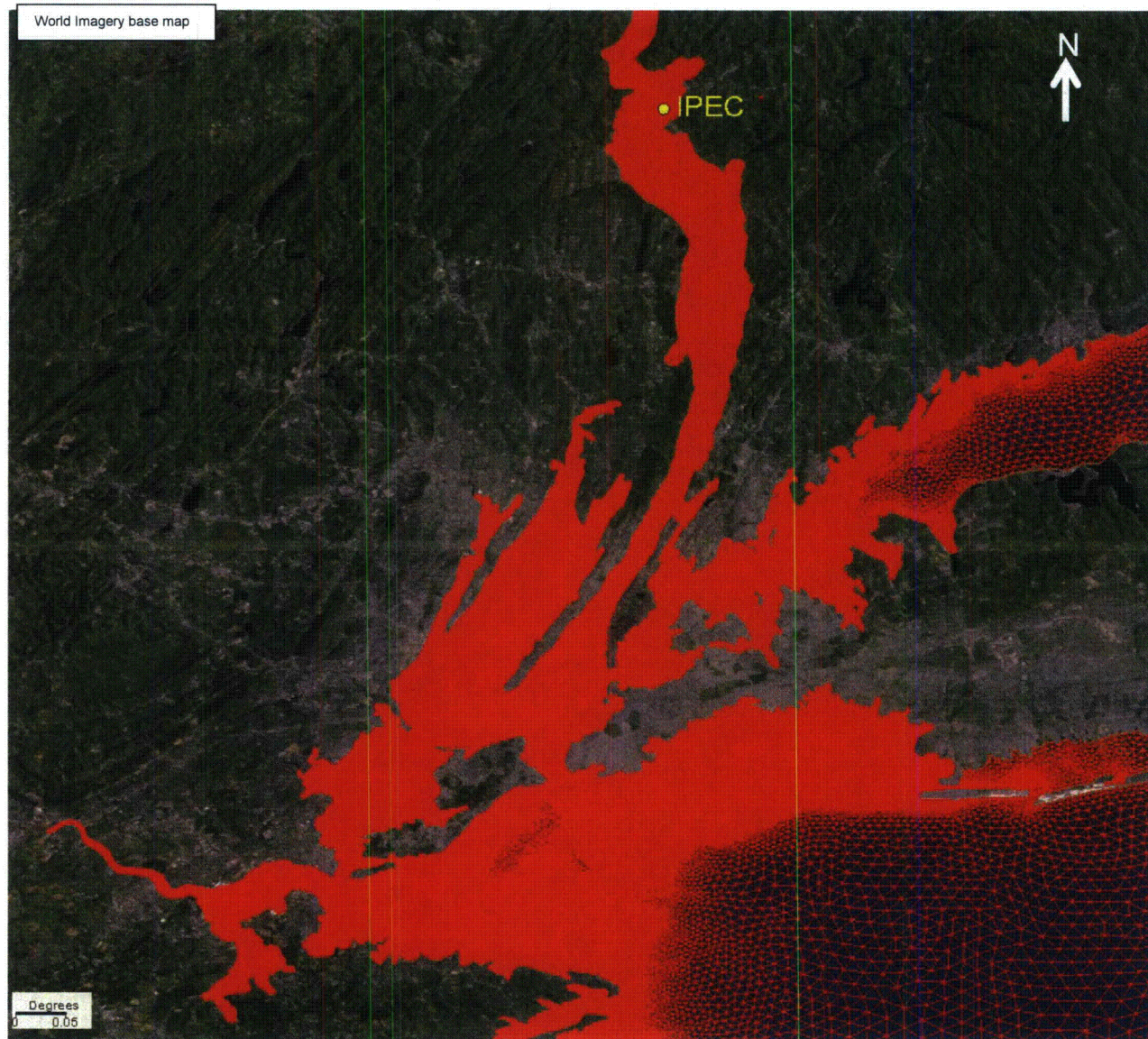


Figure 3.4-12: ADCIRC FEMA Region II Finite Element Mesh – New Jersey/New York

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Flood Hazard Reevaluation Report for Indian Point Energy Center (IPEC) Units 2 and 3

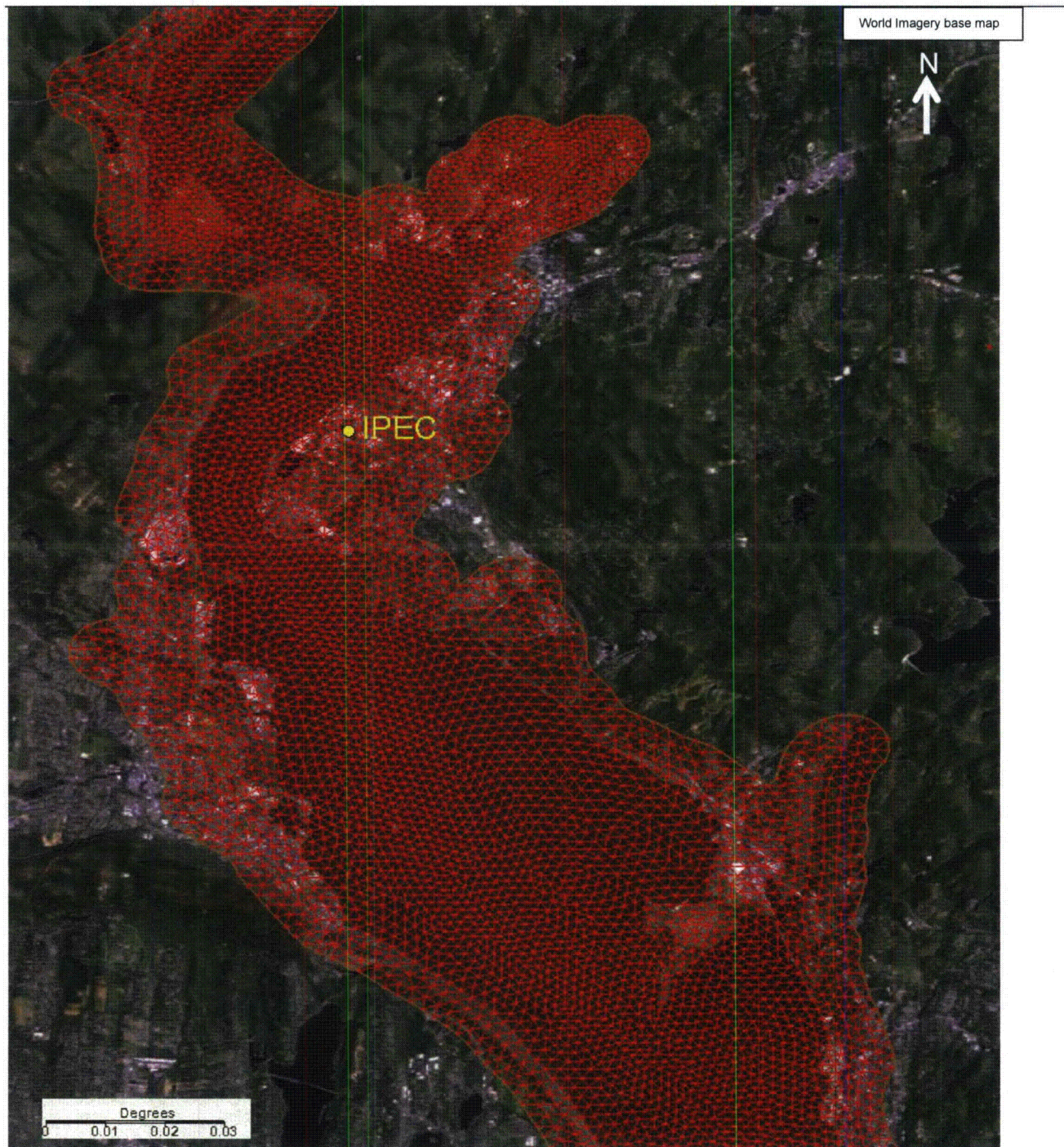


Figure 3.4-13: ADCIRC FEMA Region II Finite Element Mesh – IPEC Vicinity

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Flood Hazard Reevaluation Report for Indian Point Energy Center (IPEC) Units 2 and 3

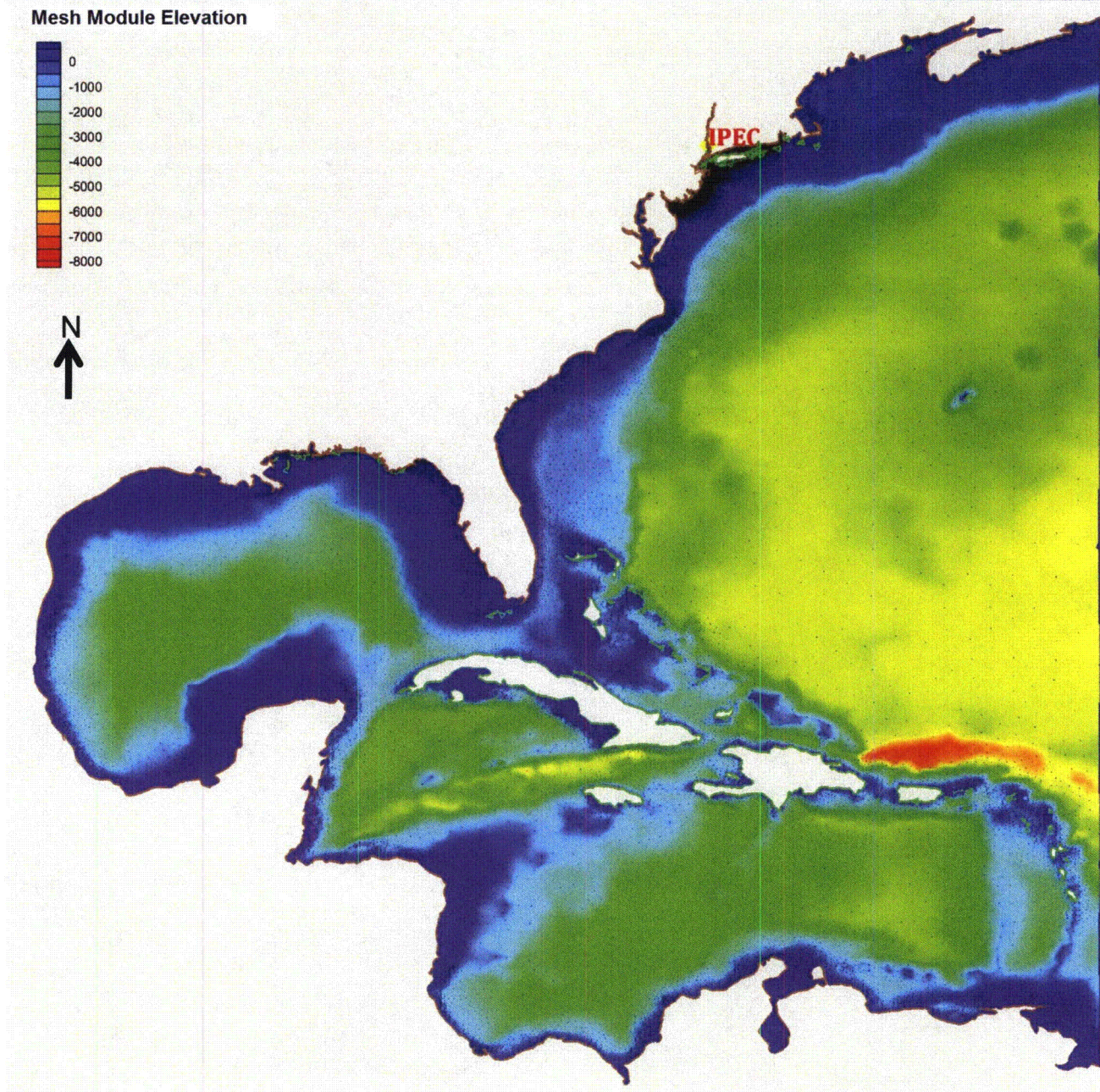


Figure 3.4-14: ADCIRC Module Mesh Elevation (m, NAVD88) – Northern Atlantic

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Flood Hazard Reevaluation Report for Indian Point Energy Center (IPEC) Units 2 and 3

World Imagery base map

Figure 3.4-15: ADCIRC Mesh Model Elevation (m, NAVD88) – New Jersey / New York

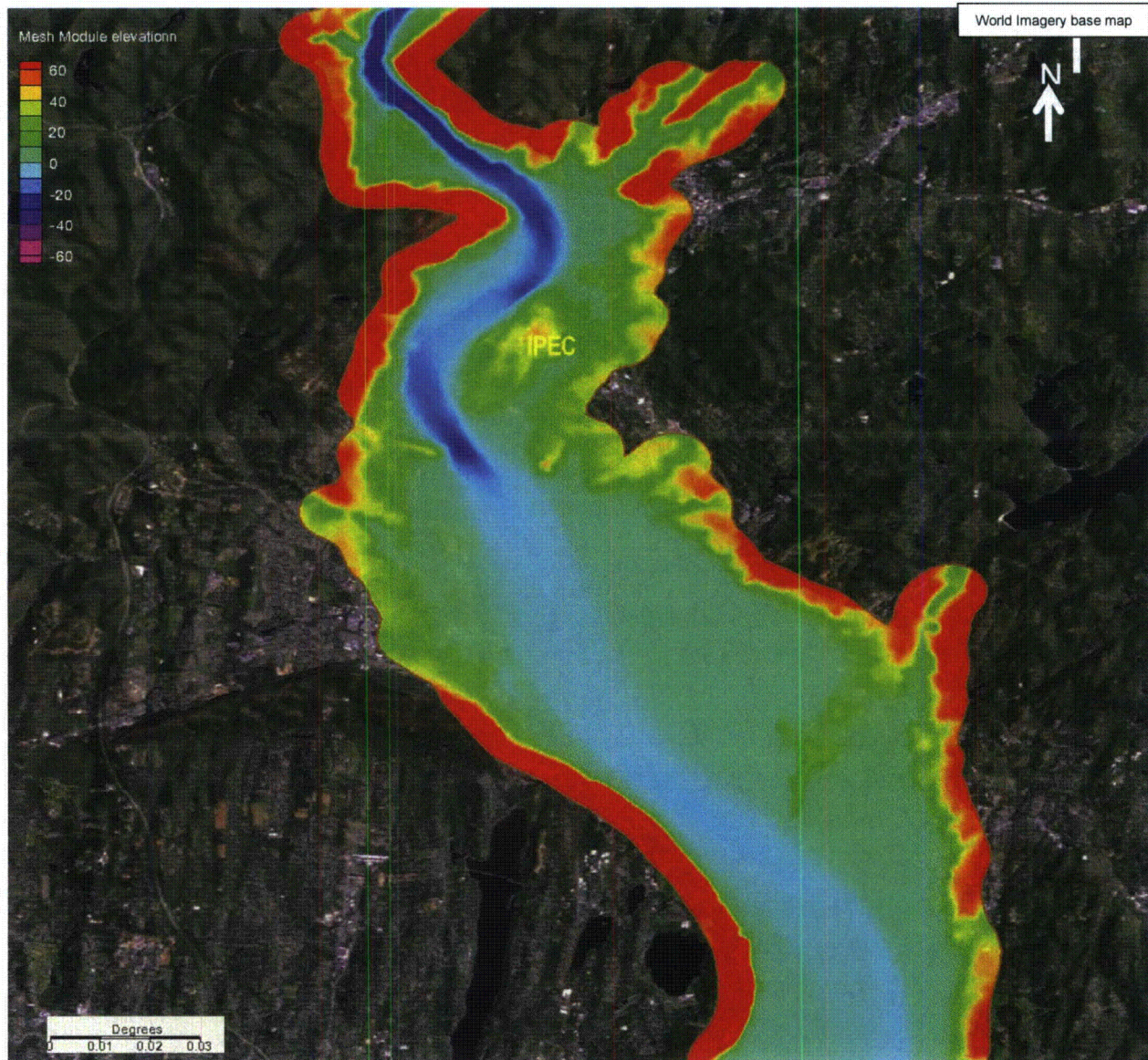


Figure 3.4-16: ADCIRC Mesh Model Elevation (m, NAVD88) – IPEC Vicinity

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Flood Hazard Reevaluation Report for Indian Point Energy Center (IPEC) Units 2 and 3

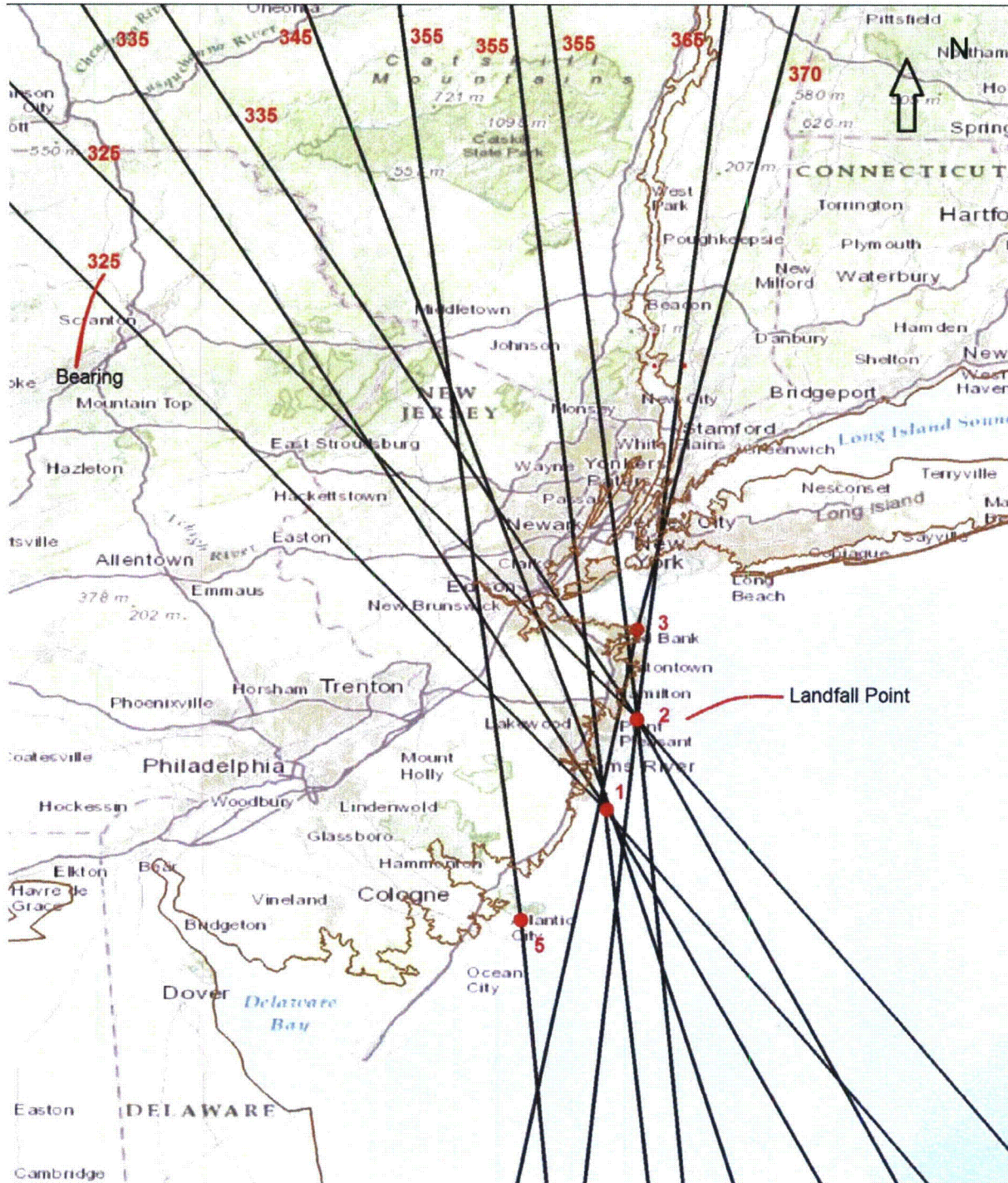


Figure 3.4-17: Track Directions and Landfall Locations for ADCIRC Simulations

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Flood Hazard Reevaluation Report for Indian Point Energy Center (IPEC) Units 2 and 3

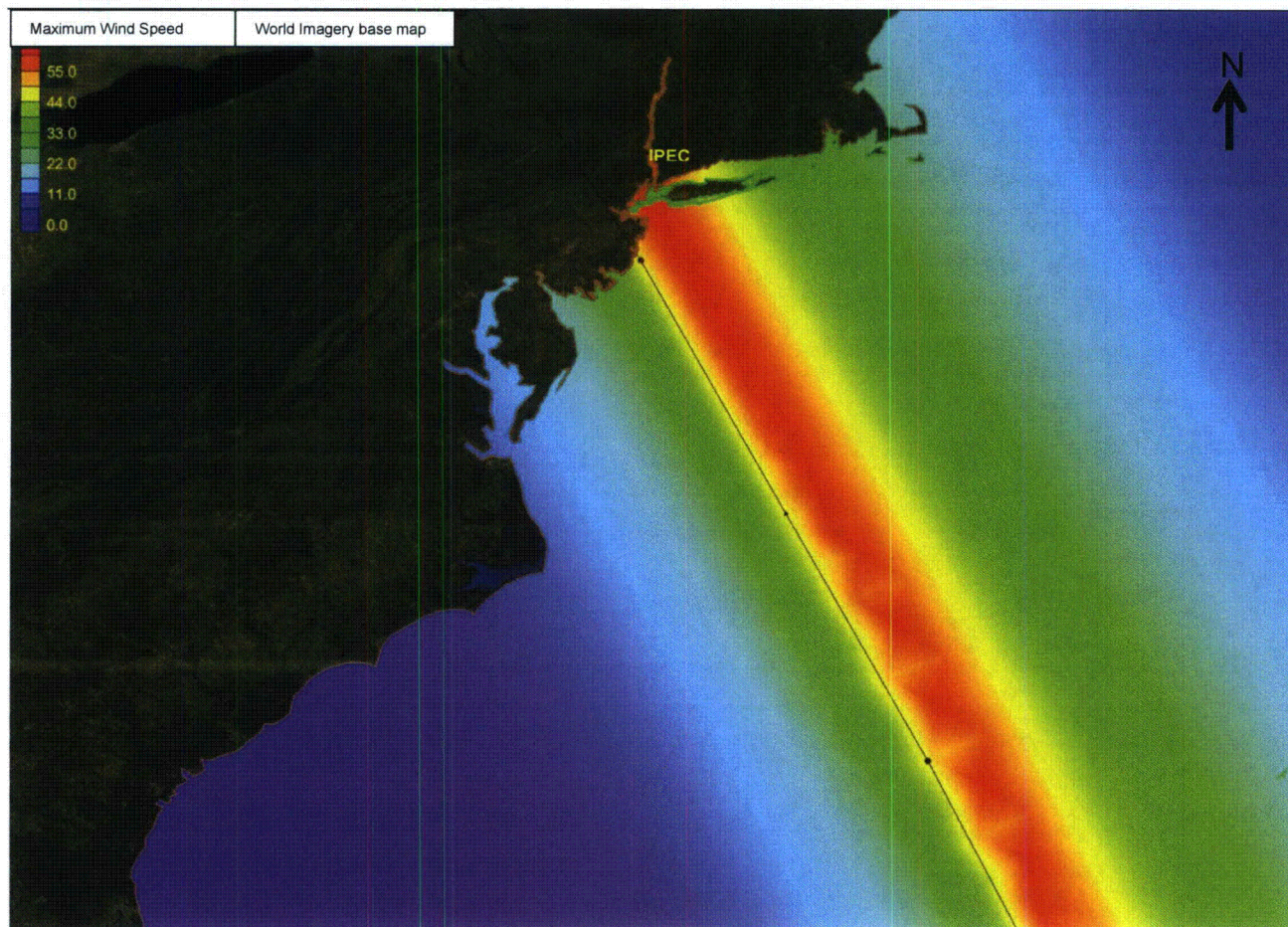


Figure 3.4-18: ADCIRC Envelope of Maximum Winds (m/s) of Storm No. 941

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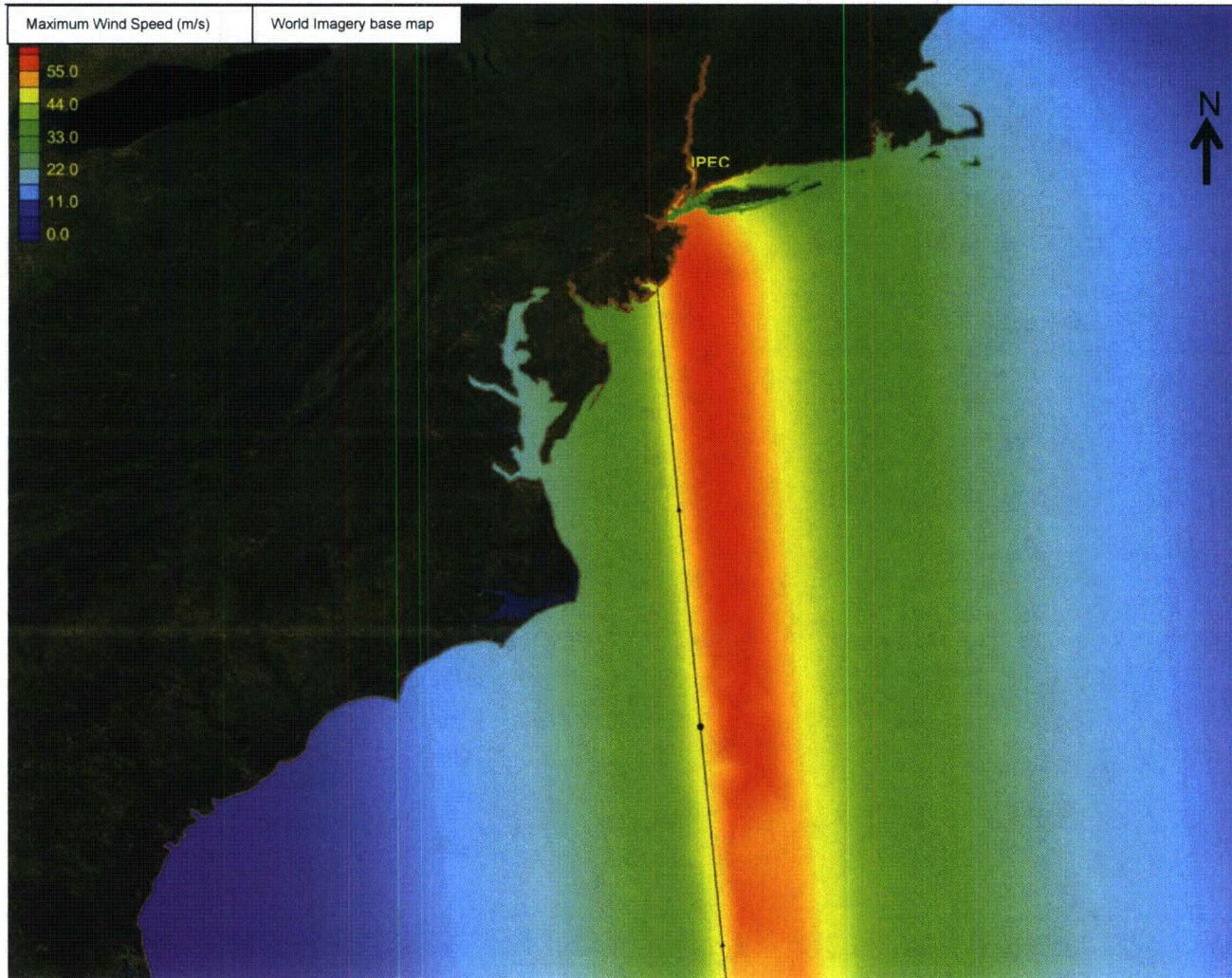


Figure 3.4-19: ADCIRC Envelope of Maximum Winds (m/s) of Storm No. 985*

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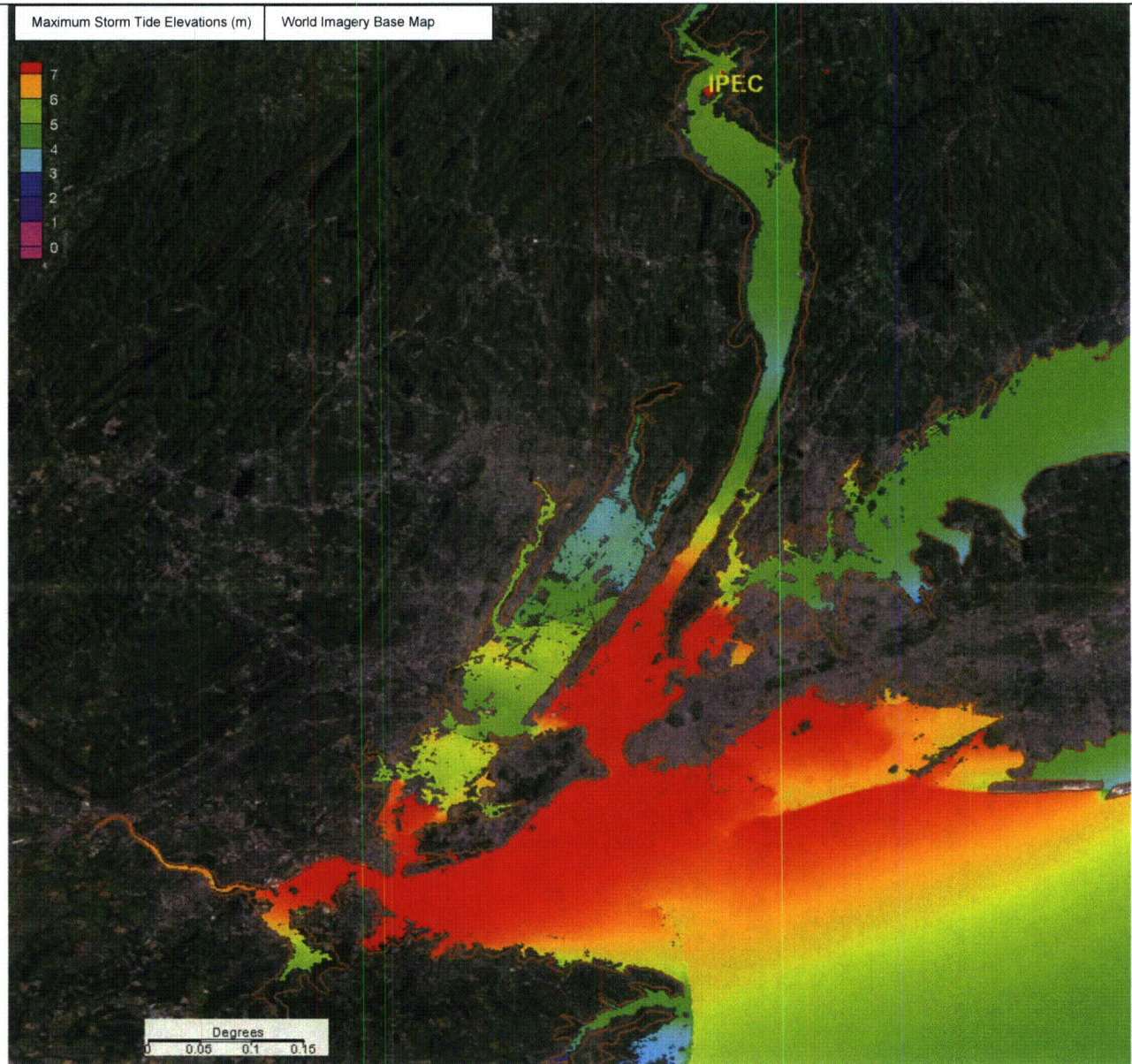


Figure 3.4-20: ADCIRC Maximum Storm Tide Stillwater Elevations (m, NAVD88) of Storm No. 941

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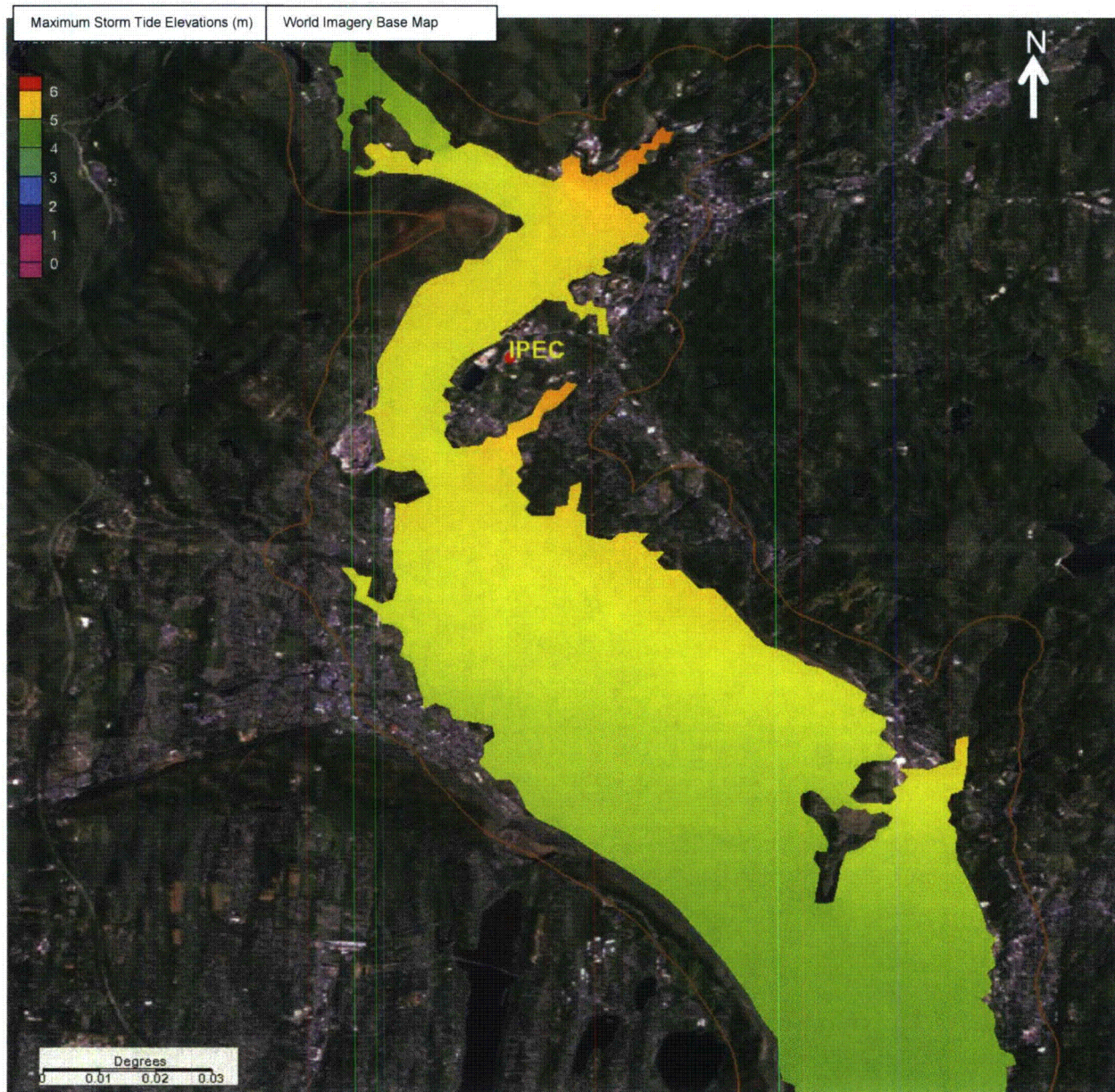


Figure 3.4-21: ADCIRC Maximum Storm Tide Stillwater Elevations (m, NAVD88) of Storm No. 941 – IPEC Vicinity

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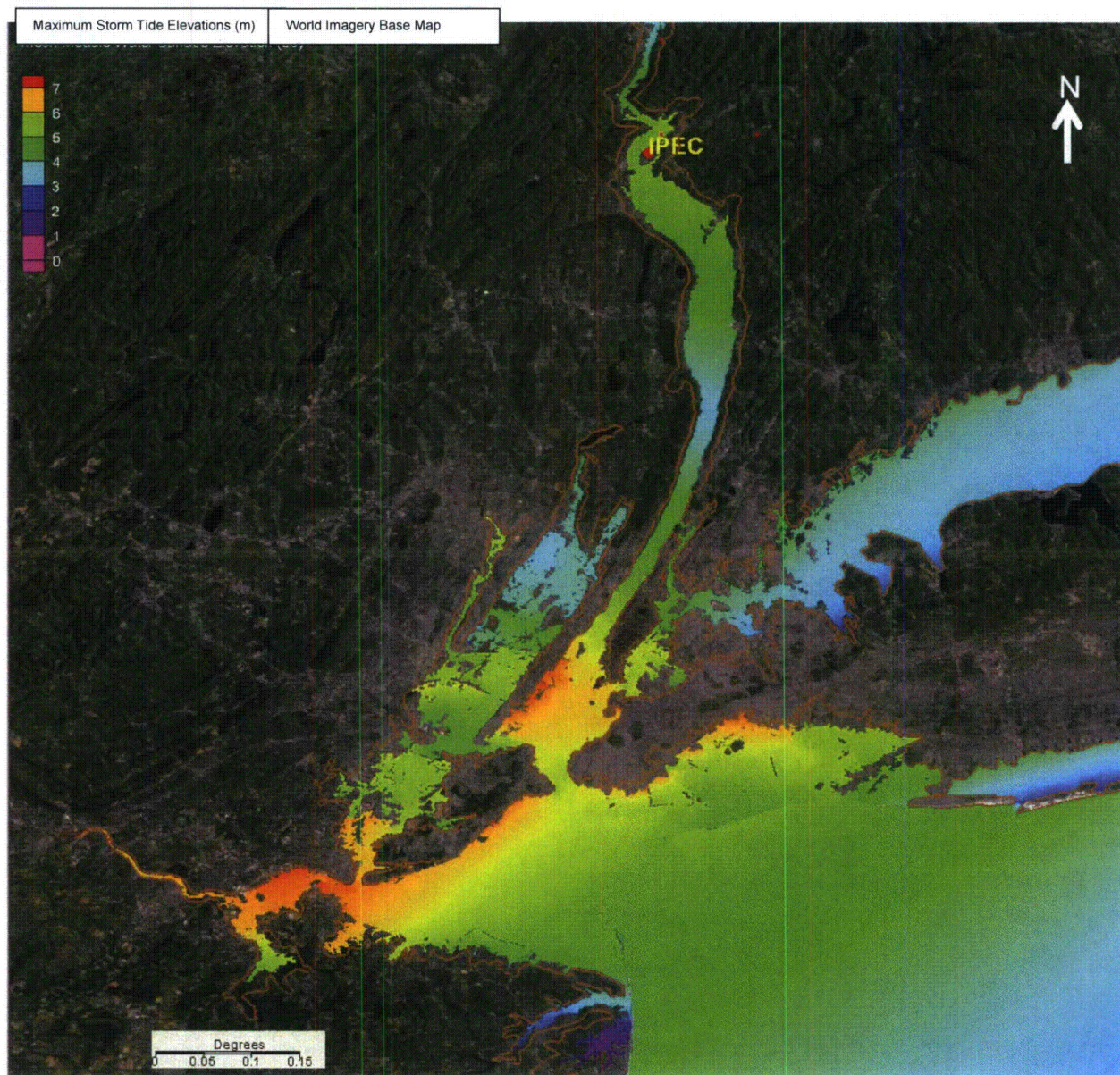


Figure 3.4-22: ADCIRC Maximum Storm Tide Stillwater Elevations (m, NAVD88) of Storm No. 985*

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Flood Hazard Reevaluation Report for Indian Point Energy Center (IPEC) Units 2 and 3

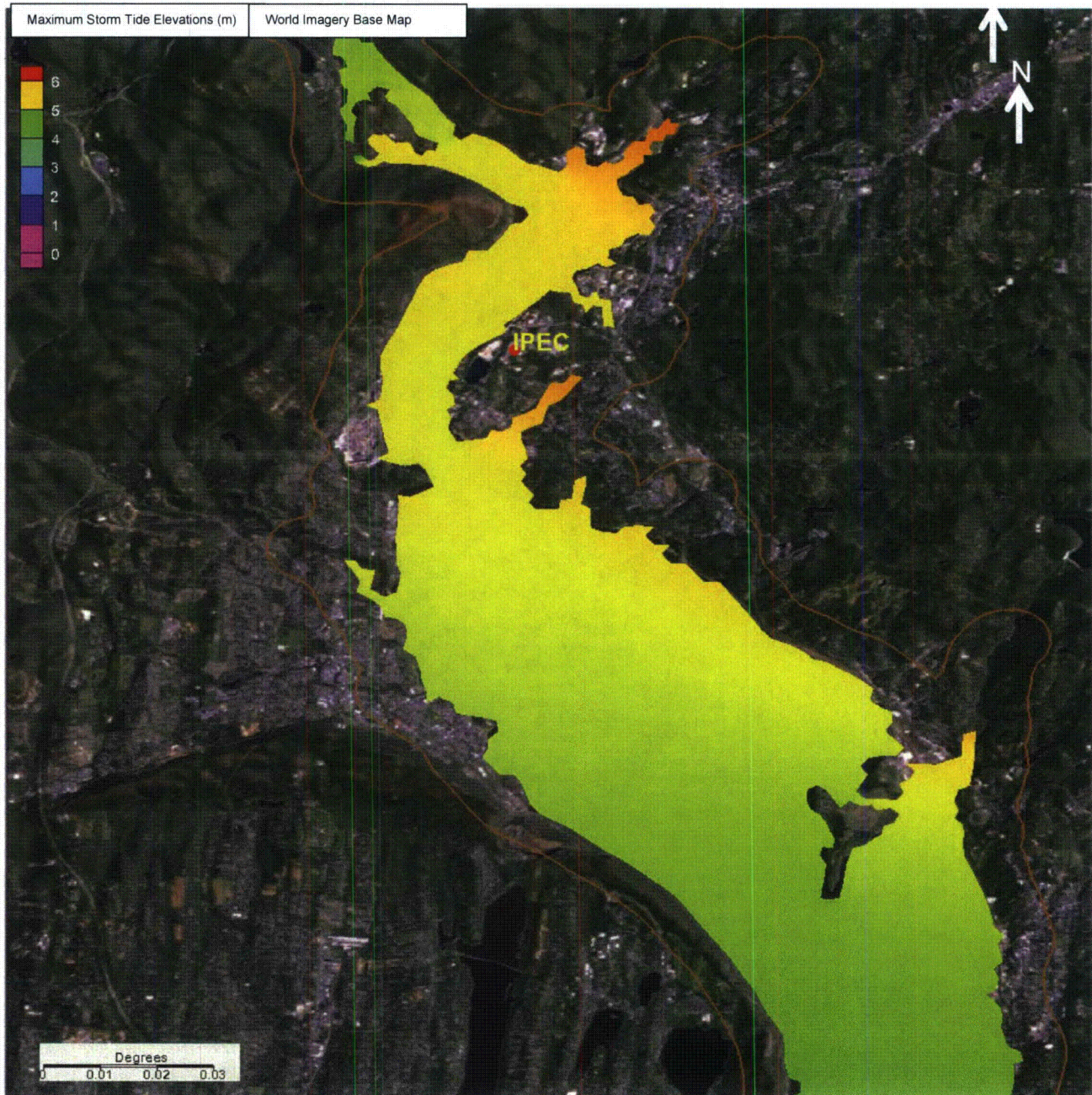


Figure 3.4-23: Maximum Storm Tide Stillwater Elevations (m, NAVD88) of Storm No. 985* - IPEC Vicinity

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Flood Hazard Reevaluation Report for Indian Point Energy Center (IPEC) Units 2 and 3

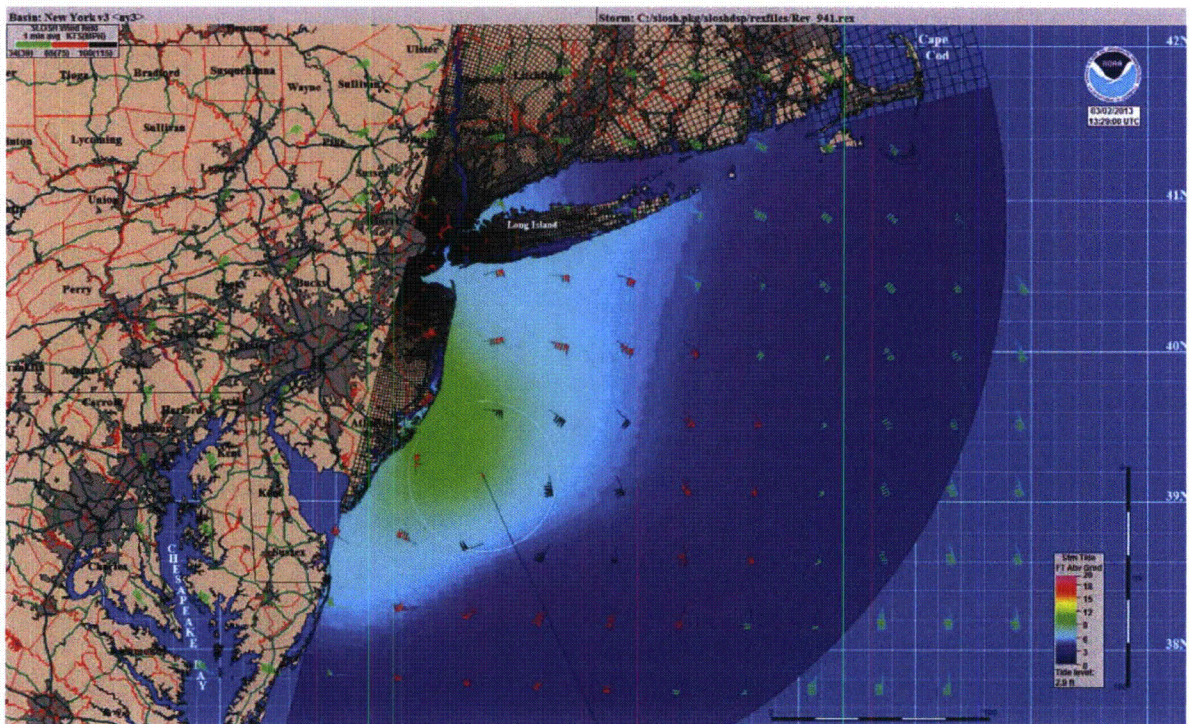
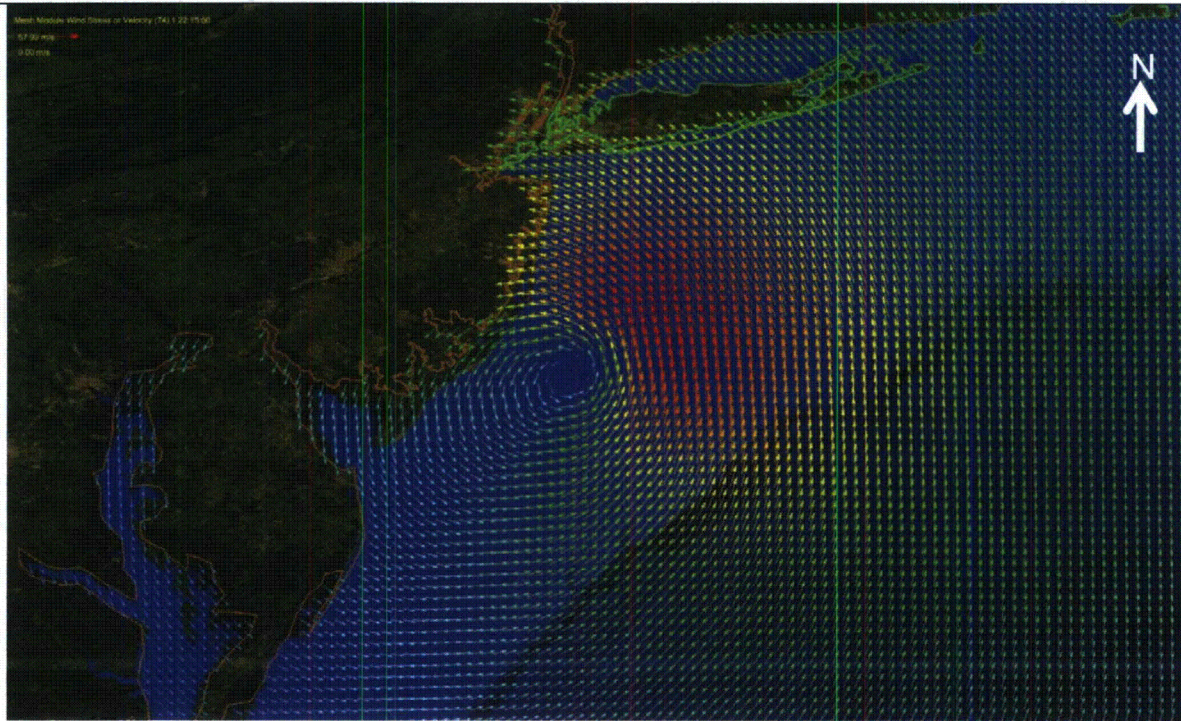


Figure 3.4-24: Comparison of Wind Field of ADCIRC and SLOSH Models – Storm No. 941

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Flood Hazard Reevaluation Report for Indian Point Energy Center (IPEC) Units 2 and 3

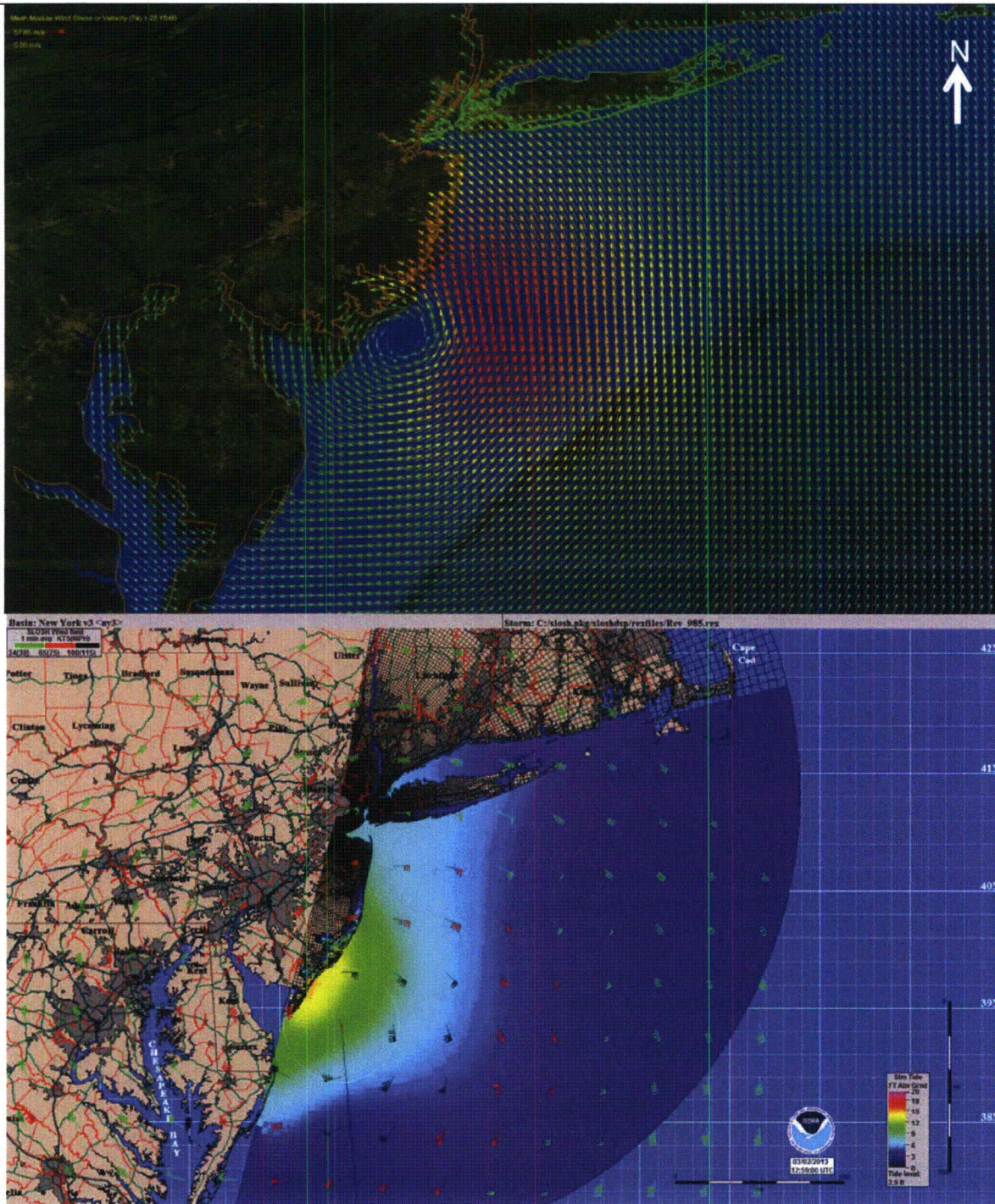


Figure 3.4-25: Comparison of Wind Field of ADCIRC and SLOSH Models – Storm No. 985*

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Flood Hazard Reevaluation Report for Indian Point Energy Center (IPEC) Units 2 and 3

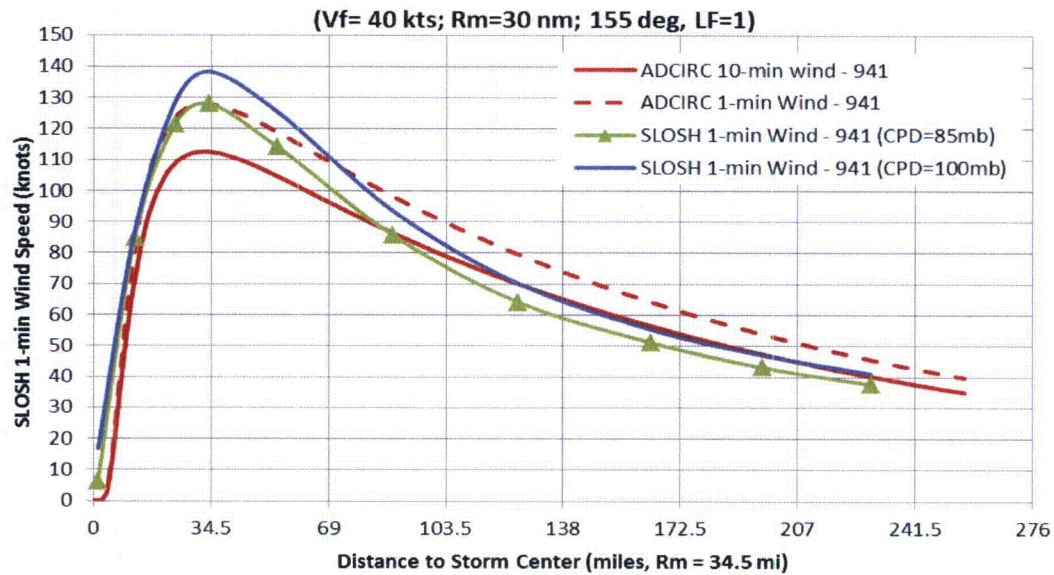


Figure 3.4-26: Comparison of Wind Profiles of ADCIRC and SLOSH Models – Storm No. 941

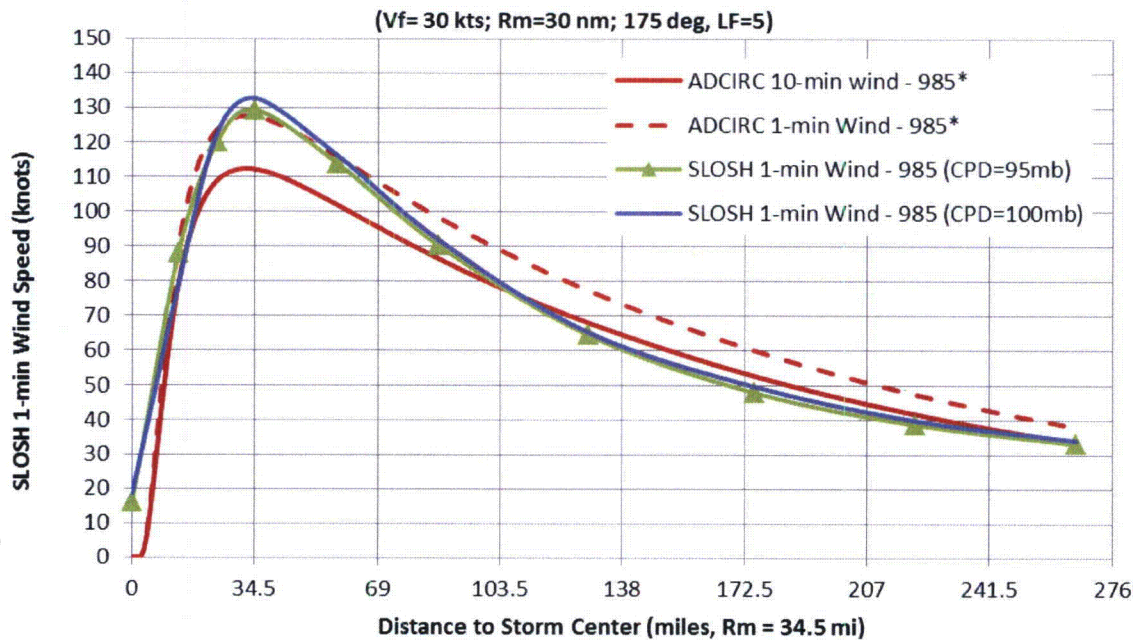


Figure 3.4-27: Comparison of Wind Profiles of ADCIRC and SLOSH Models – Storm No. 985*

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Flood Hazard Reevaluation Report for Indian Point Energy Center (IPEC) Units 2 and 3

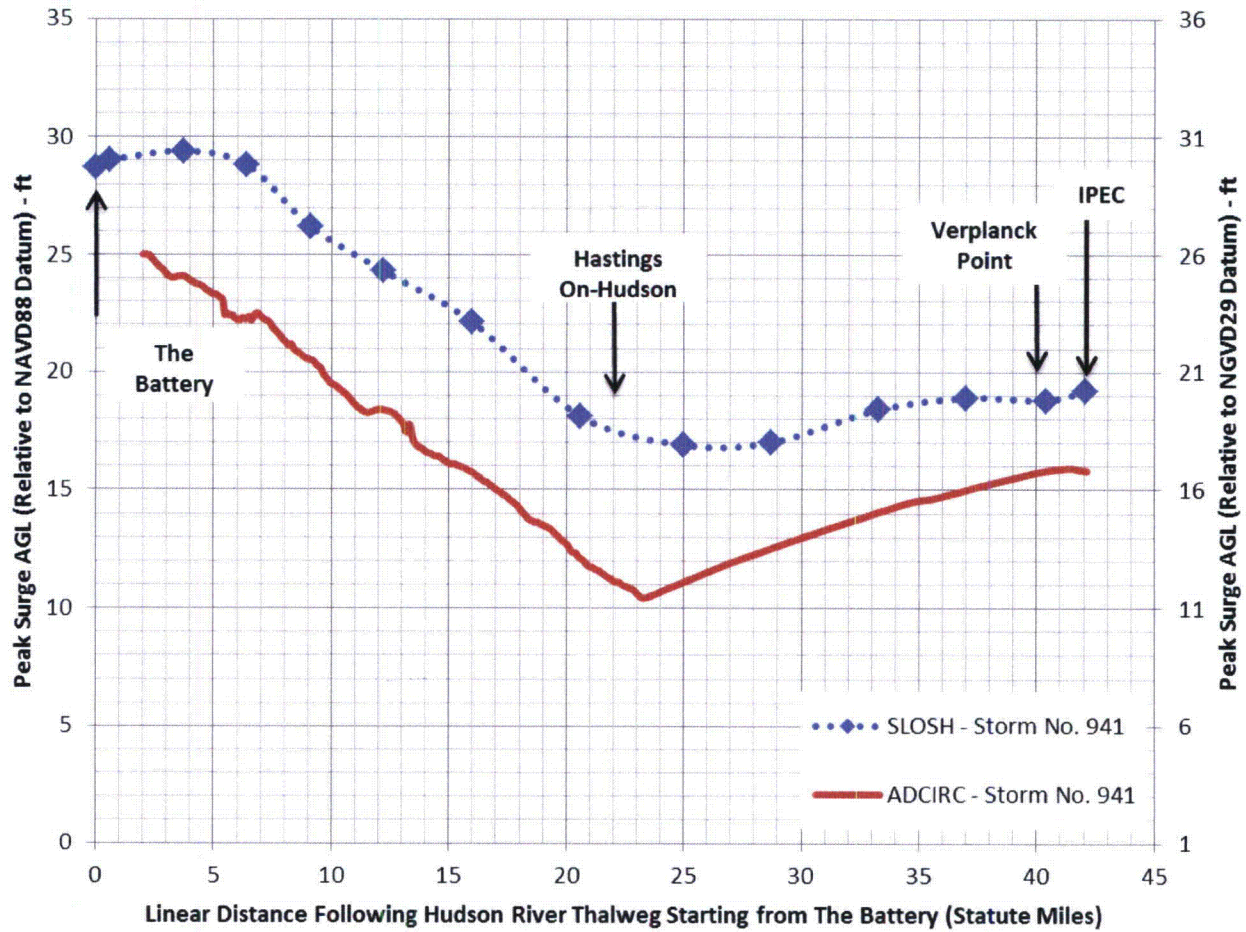


Figure 3.4-28: Comparison of Water Levels on Hudson River of ADCIRC and SLOSH Models – Storm 941

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Flood Hazard Reevaluation Report for Indian Point Energy Center (IPEC) Units 2 and 3

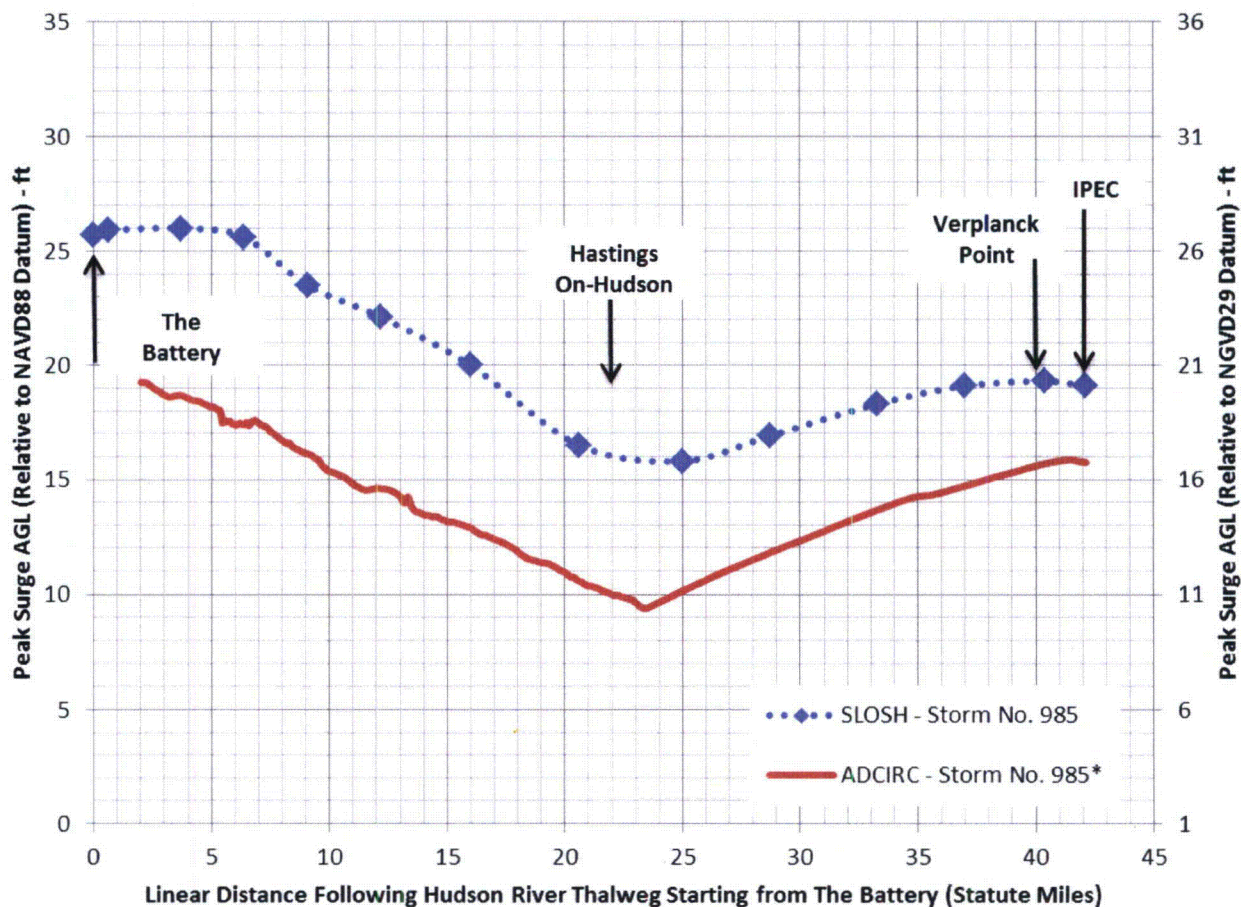


Figure 3.4-29: Comparison of Water Levels on Hudson River of ADCIRC and SLOSH Models – Storm 985*

**Entergy Fleet Fukushima Program
Flood Hazard Reevaluation Report for Indian Point Energy Center (IPEC) Units 2 and 3**

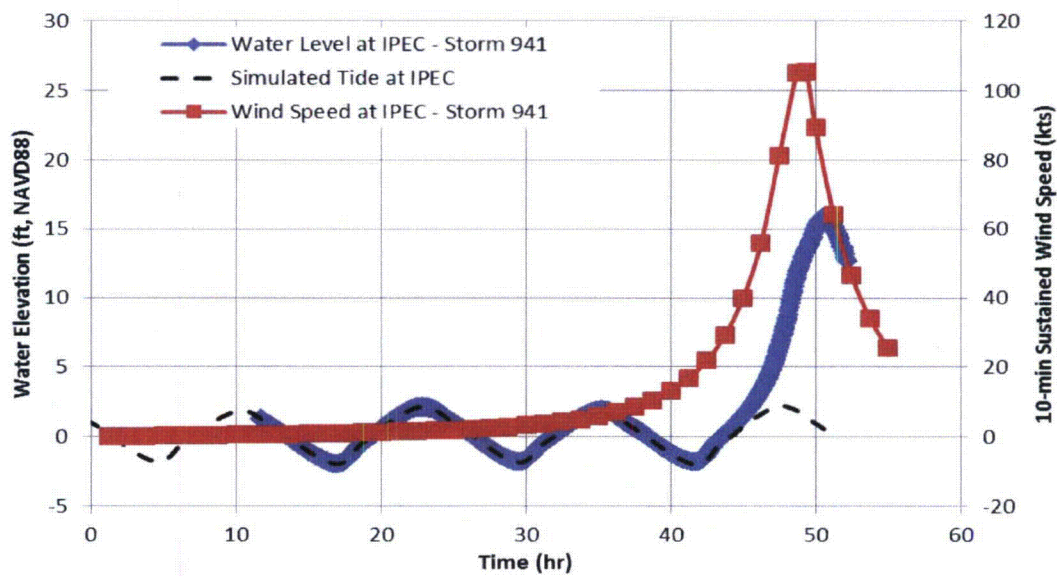
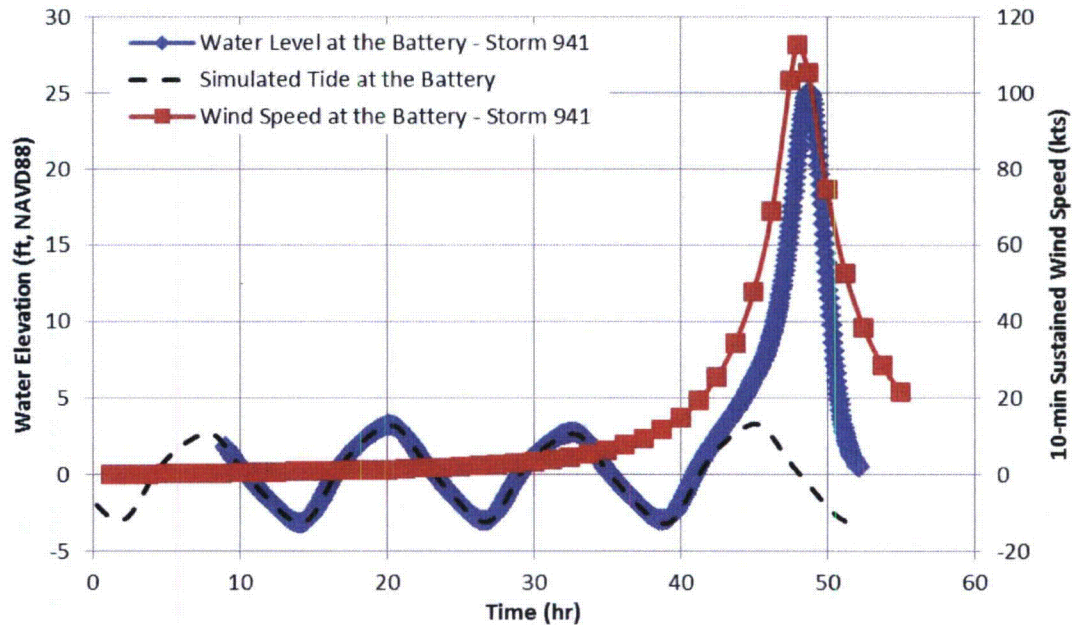
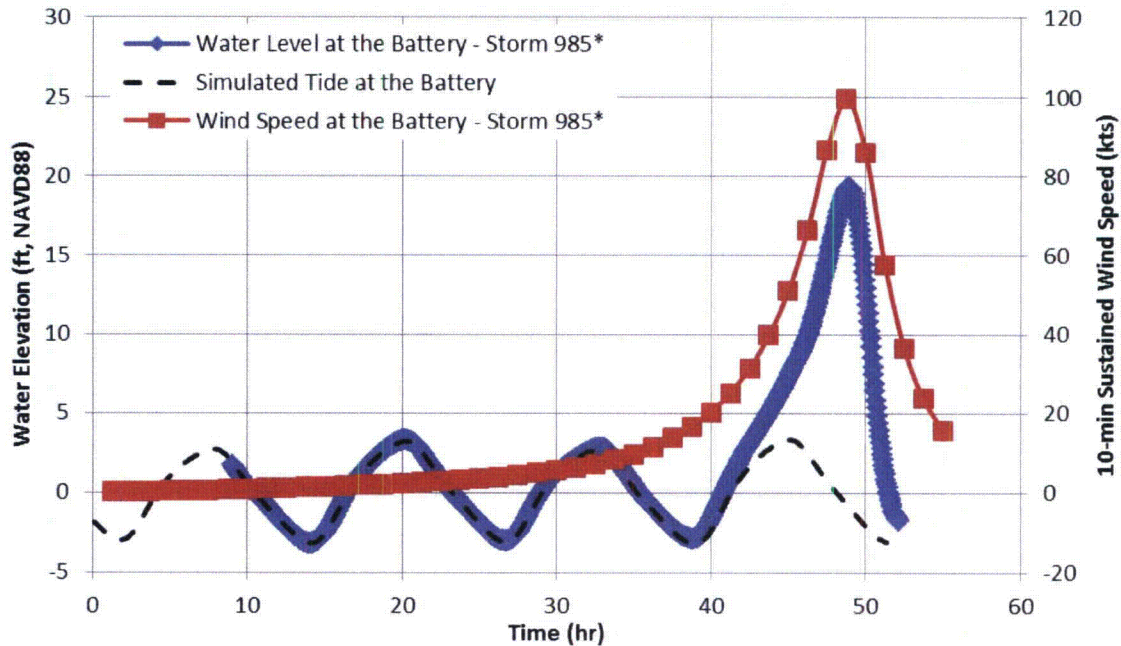


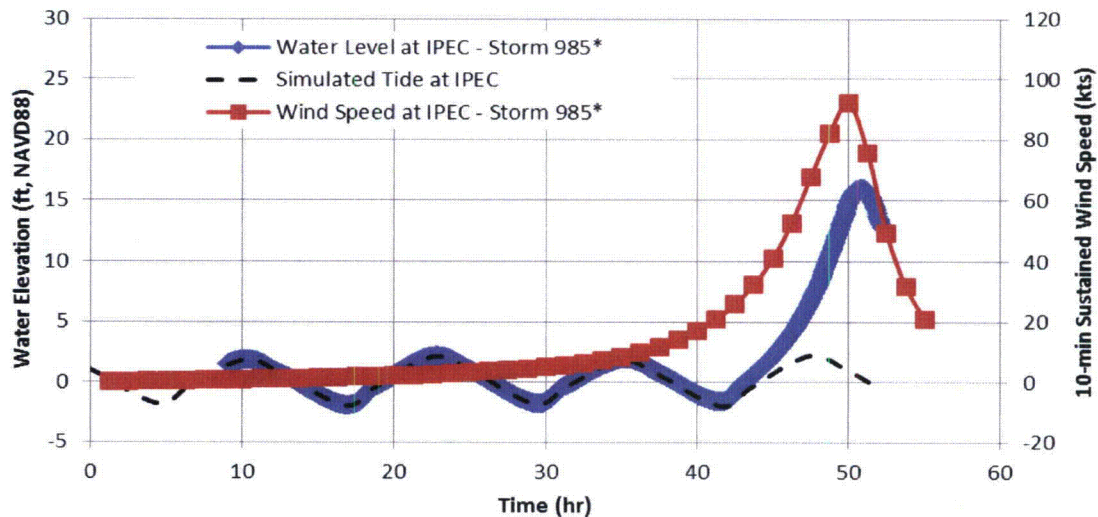
Figure 3.4-30: Time Series of Wind and Storm Tide Stillwater Elevation – Storm No. 941

Note: Hurricane (wind) decay after landfall not applied for Storm No. 941.

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Flood Hazard Reevaluation Report for Indian Point Energy Center (IPEC) Units 2 and 3**



(a) The Battery



(b) IPEC

Figure 3.4-31: Time Series of Wind and Storm Tide Stillwater Elevation – Storm No. 985*

Note: Hurricane (wind) decay after landfall applied for Storm No. 985*.

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Flood Hazard Reevaluation Report for Indian Point Energy Center (IPEC) Units 2 and 3**

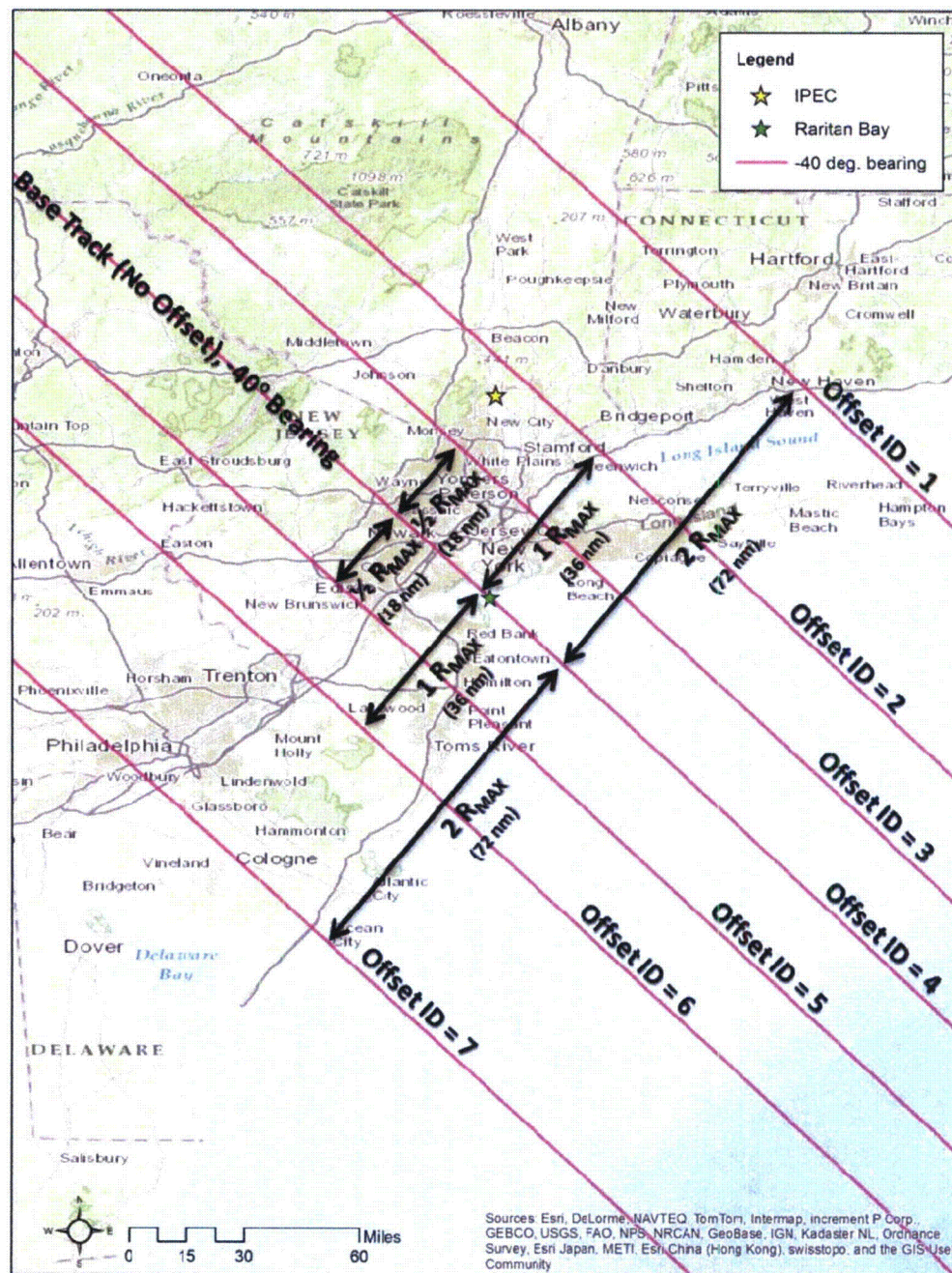


Figure 3.4-32: Example Storm Tracks ($\theta = -40$ degree bearing) with Offset Calculation (Offset IDs Indicated) from Base Track

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Flood Hazard Reevaluation Report for Indian Point Energy Center (IPEC) Units 2 and 3

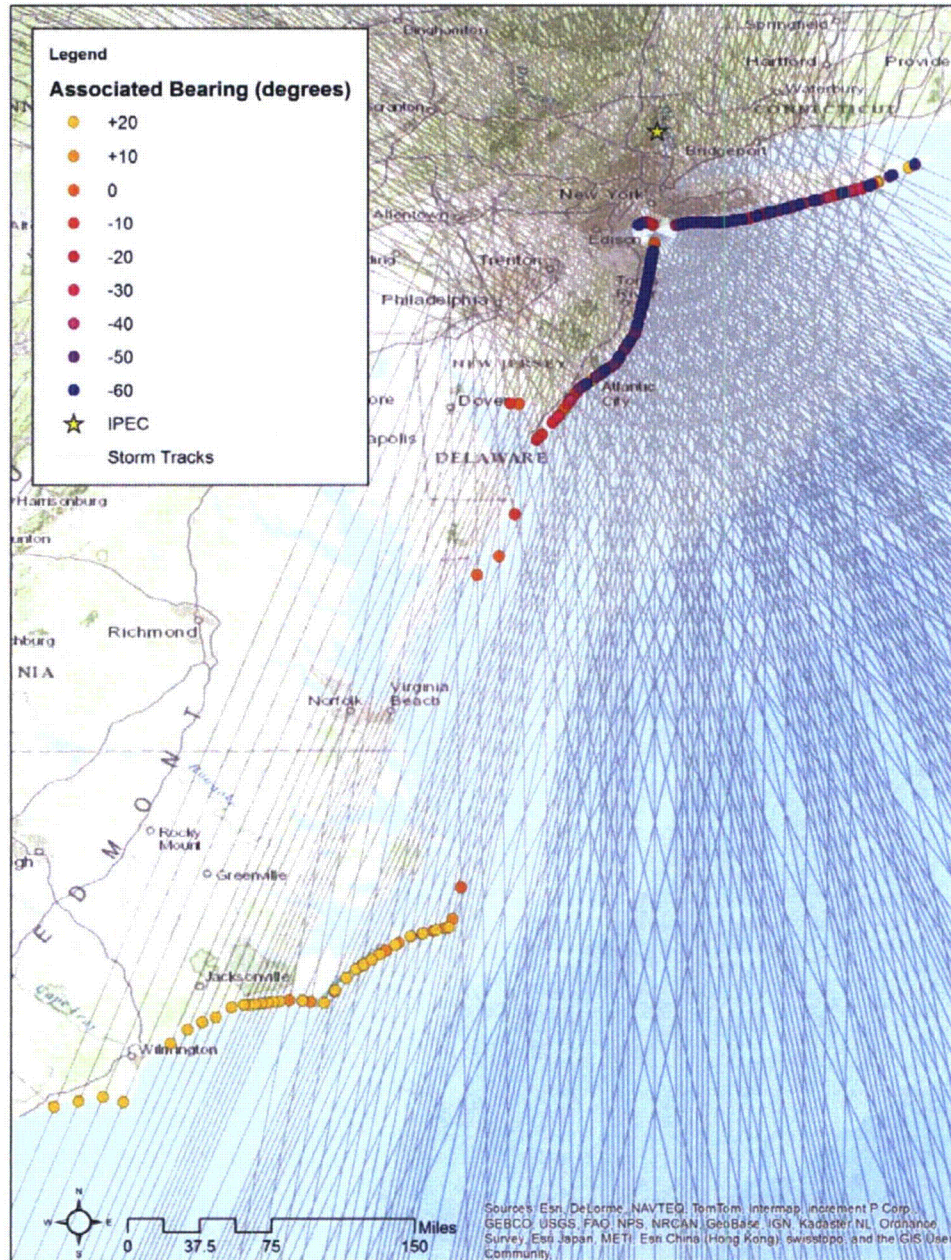


Figure 3.4-33: Landfall Points for the JPM Synthetic Storms Shown by Associated Storm Track Bearing (θ) in Degrees

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Flood Hazard Reevaluation Report for Indian Point Energy Center (IPEC) Units 2 and 3**

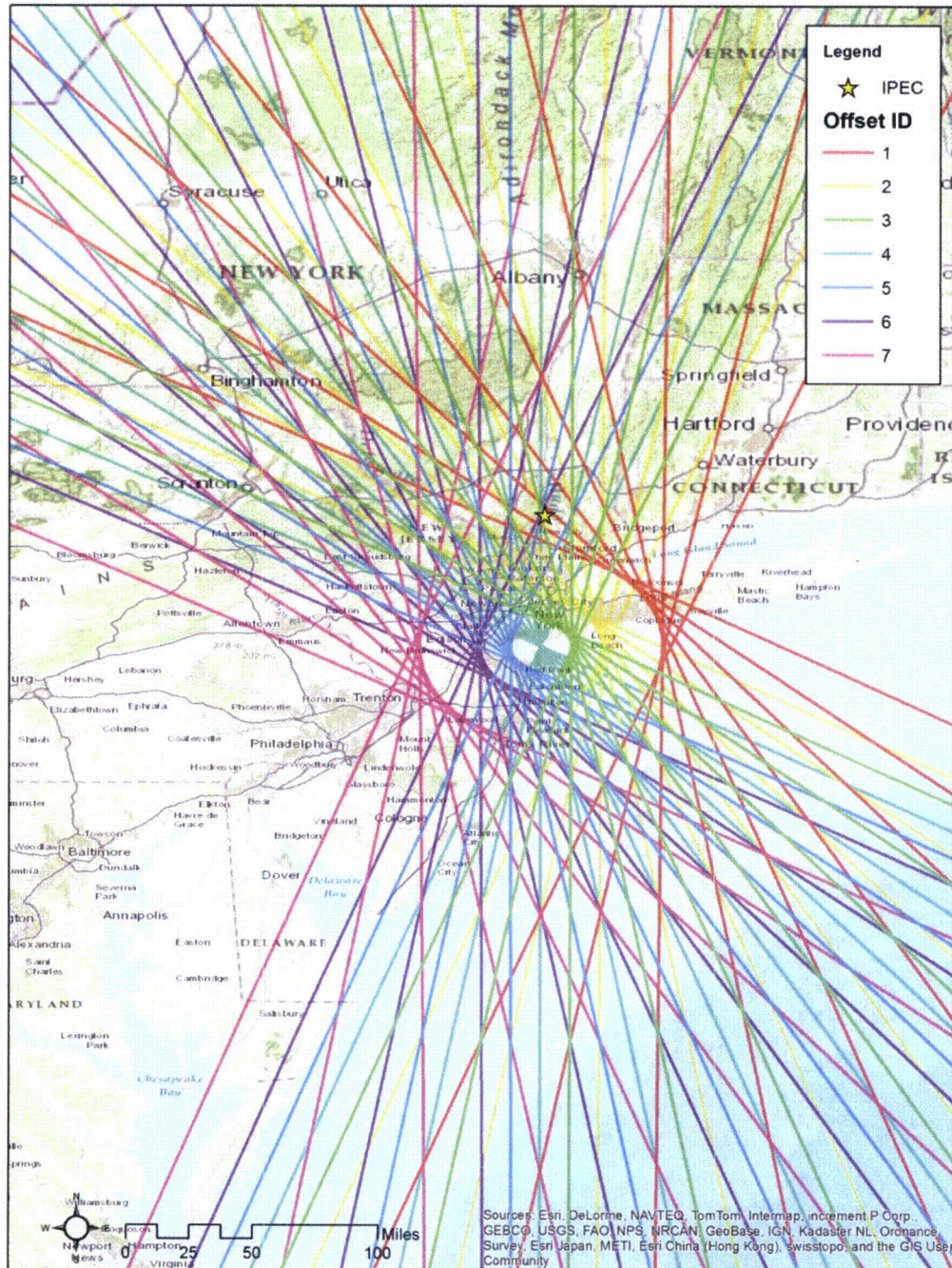


Figure 3.4-34: Storm Tracks (R_{max} = 16 nautical miles) for the JPM Synthetic Storms

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Flood Hazard Reevaluation Report for Indian Point Energy Center (IPEC) Units 2 and 3

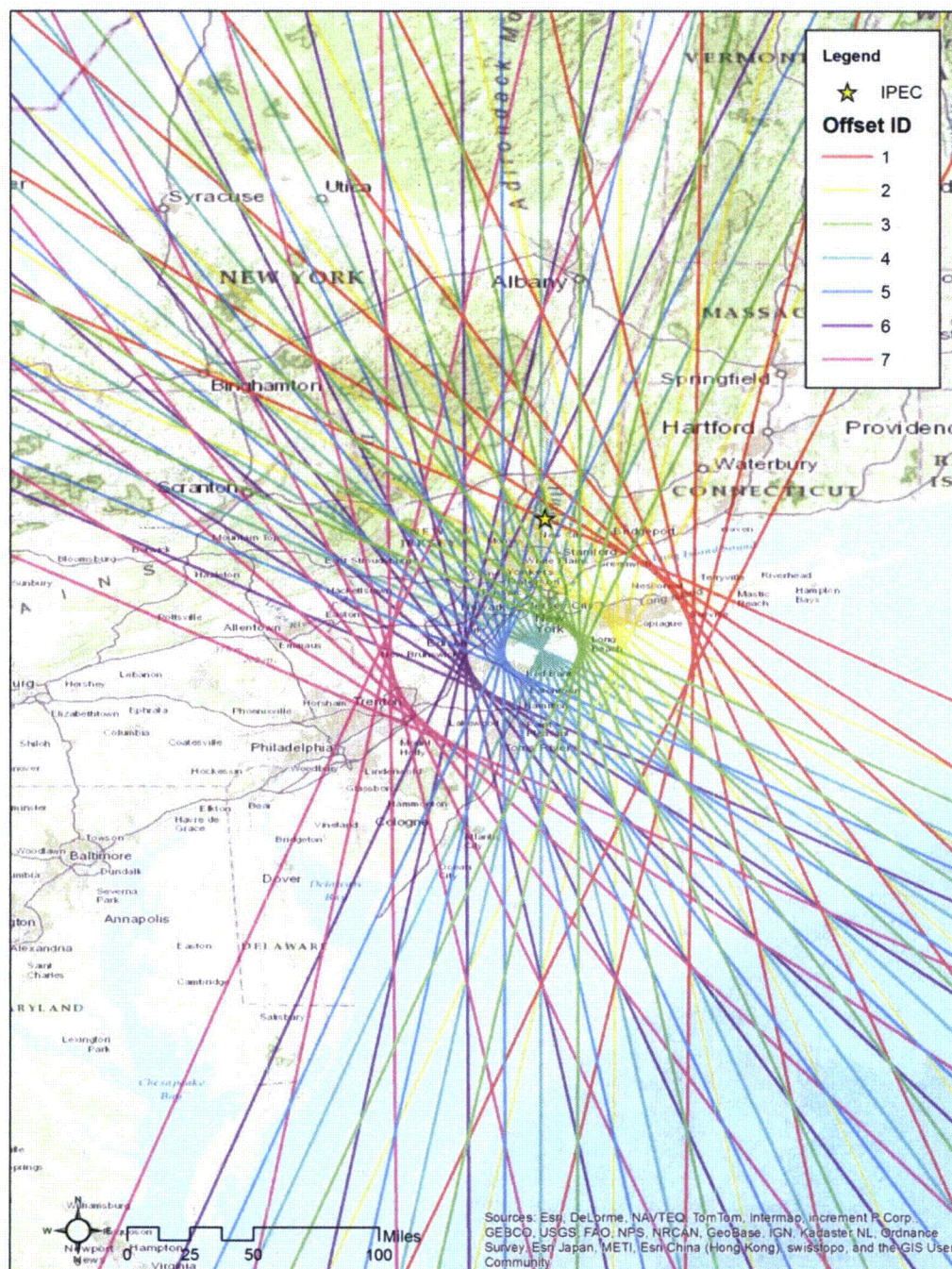


Figure 3.4-35: Storm Tracks (R_{max} = 20 nautical miles) for the JPM Synthetic Storms

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Flood Hazard Reevaluation Report for Indian Point Energy Center (IPEC) Units 2 and 3**

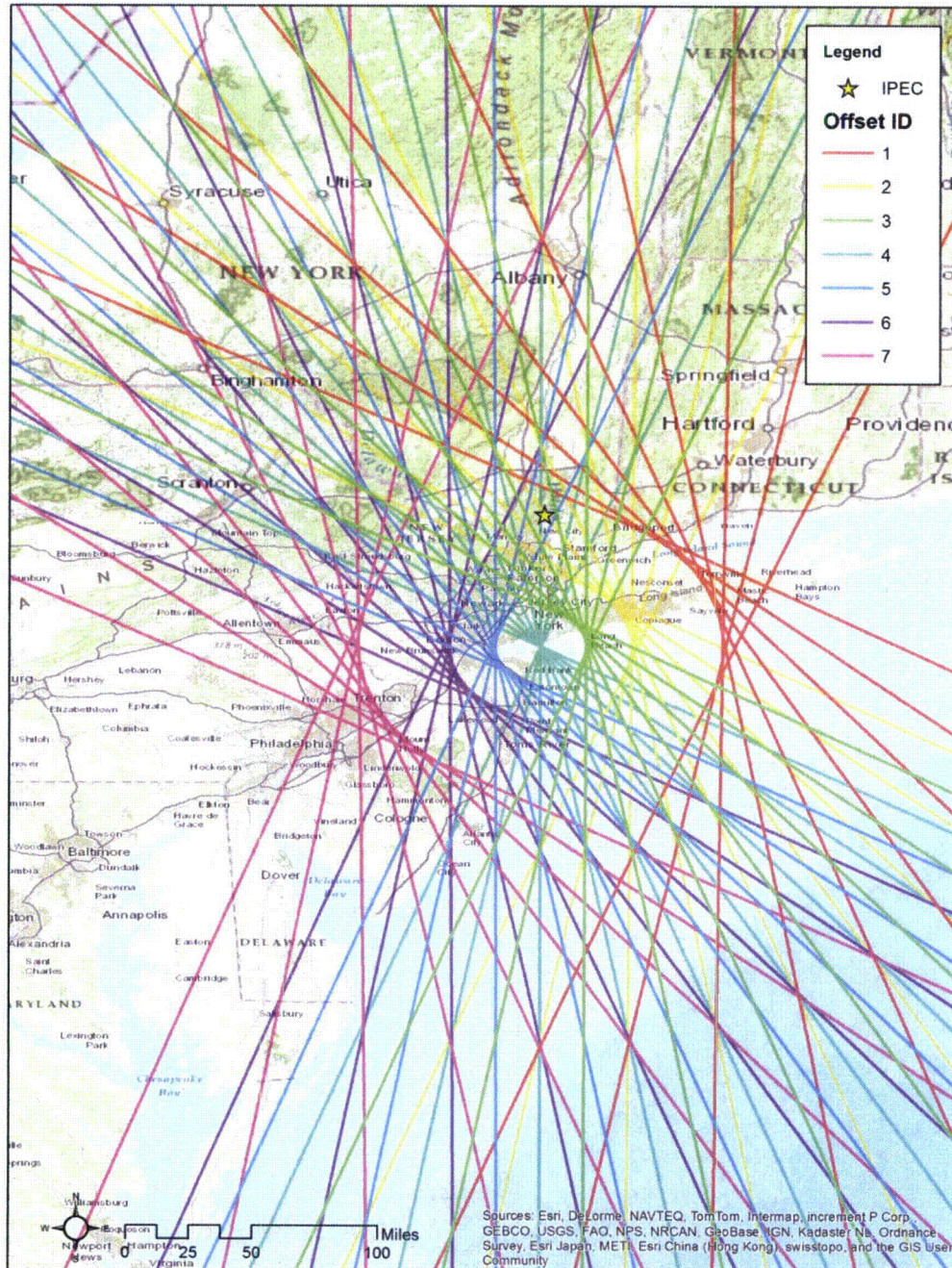


Figure 3.4-36: Storm Tracks ($R_{max} = 24$ nautical miles) for the JPM Synthetic Storms

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Flood Hazard Reevaluation Report for Indian Point Energy Center (IPEC) Units 2 and 3**

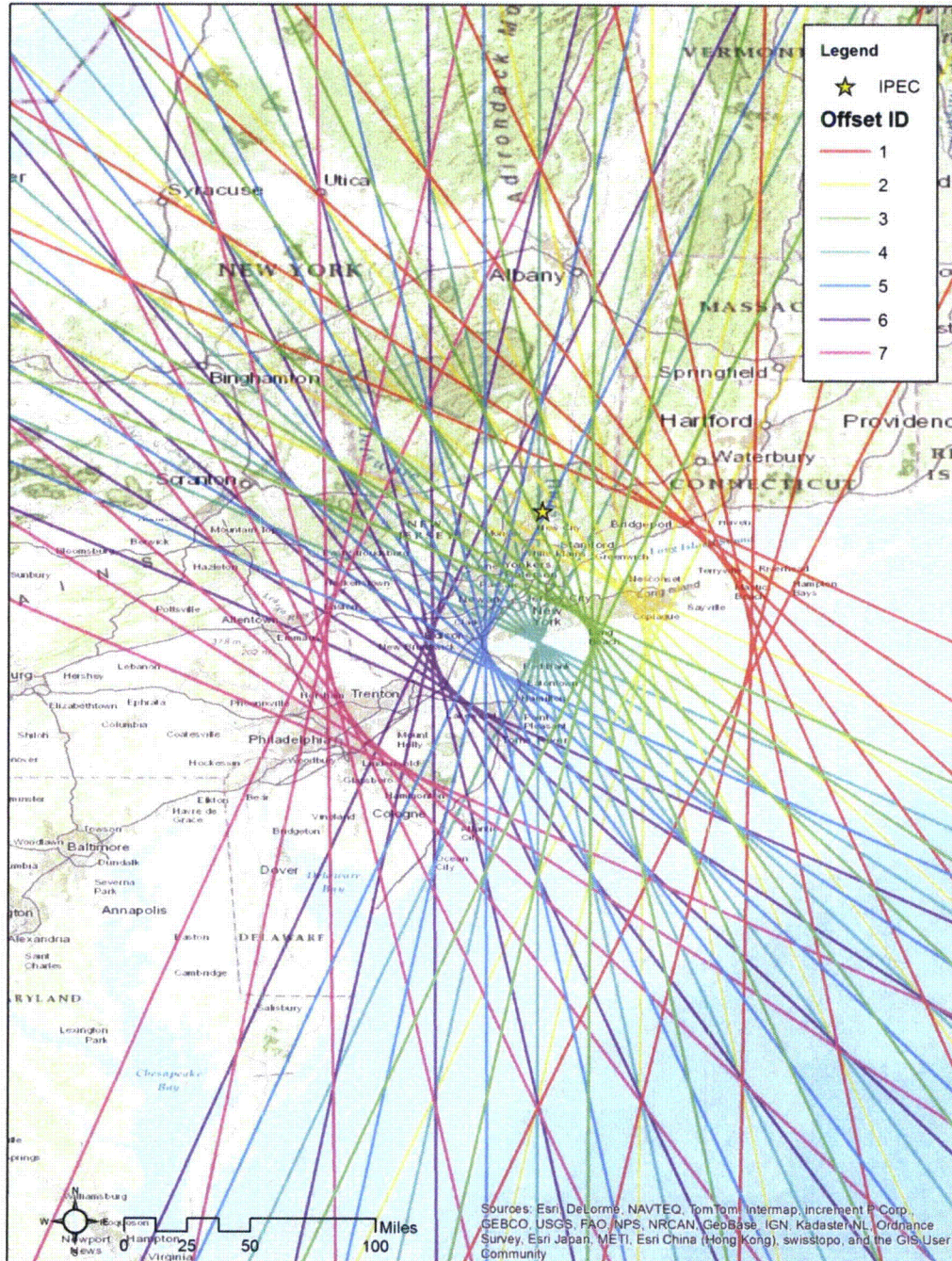


Figure 3.4-37: Storm Tracks ($R_{max} = 28$ nautical miles) for the JPM Synthetic Storms

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Flood Hazard Reevaluation Report for Indian Point Energy Center (IPEC) Units 2 and 3**

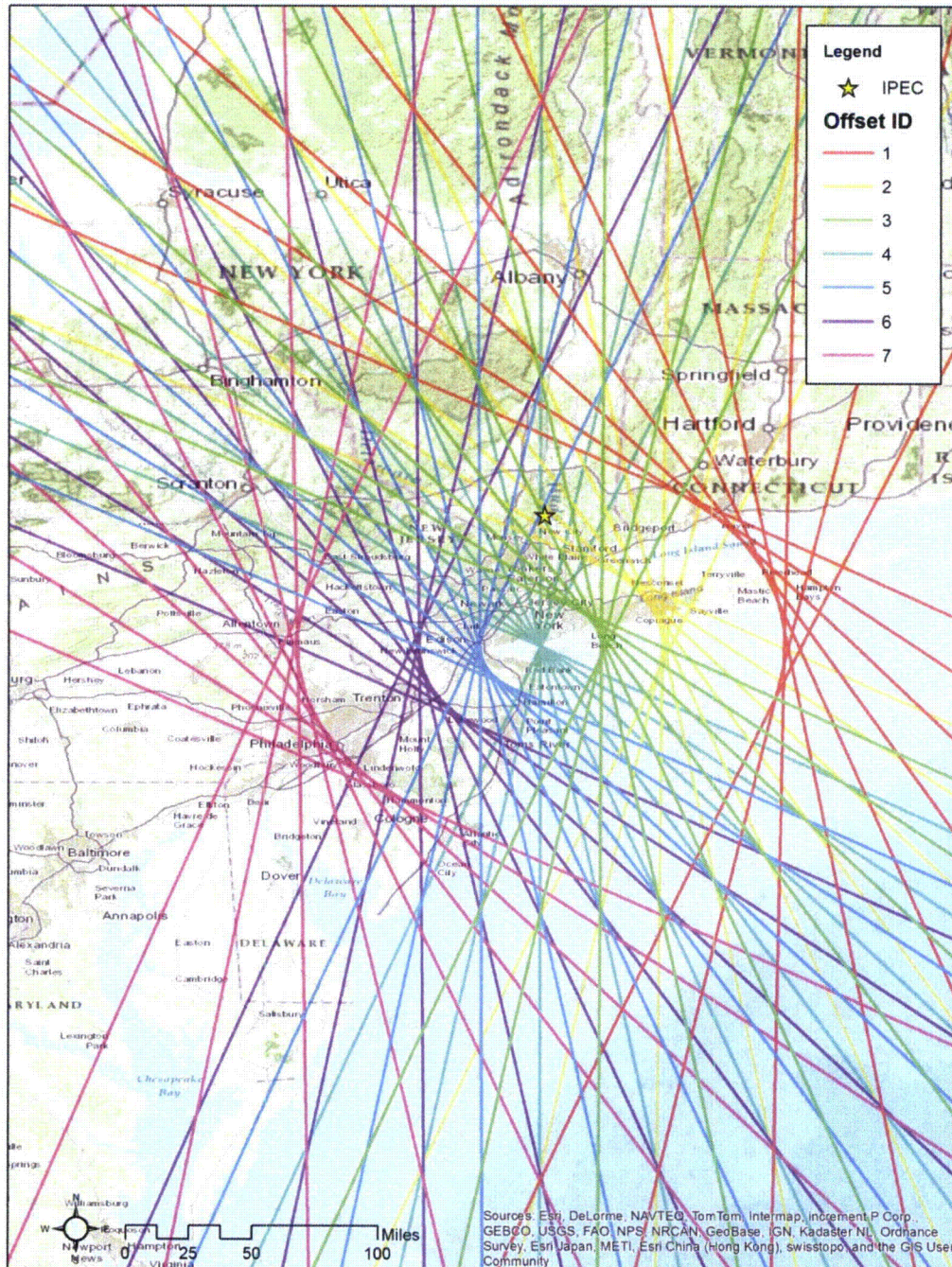


Figure 3.4-38: Storm Tracks ($R_{max} = 32$ nautical miles) for the JPM Synthetic Storms

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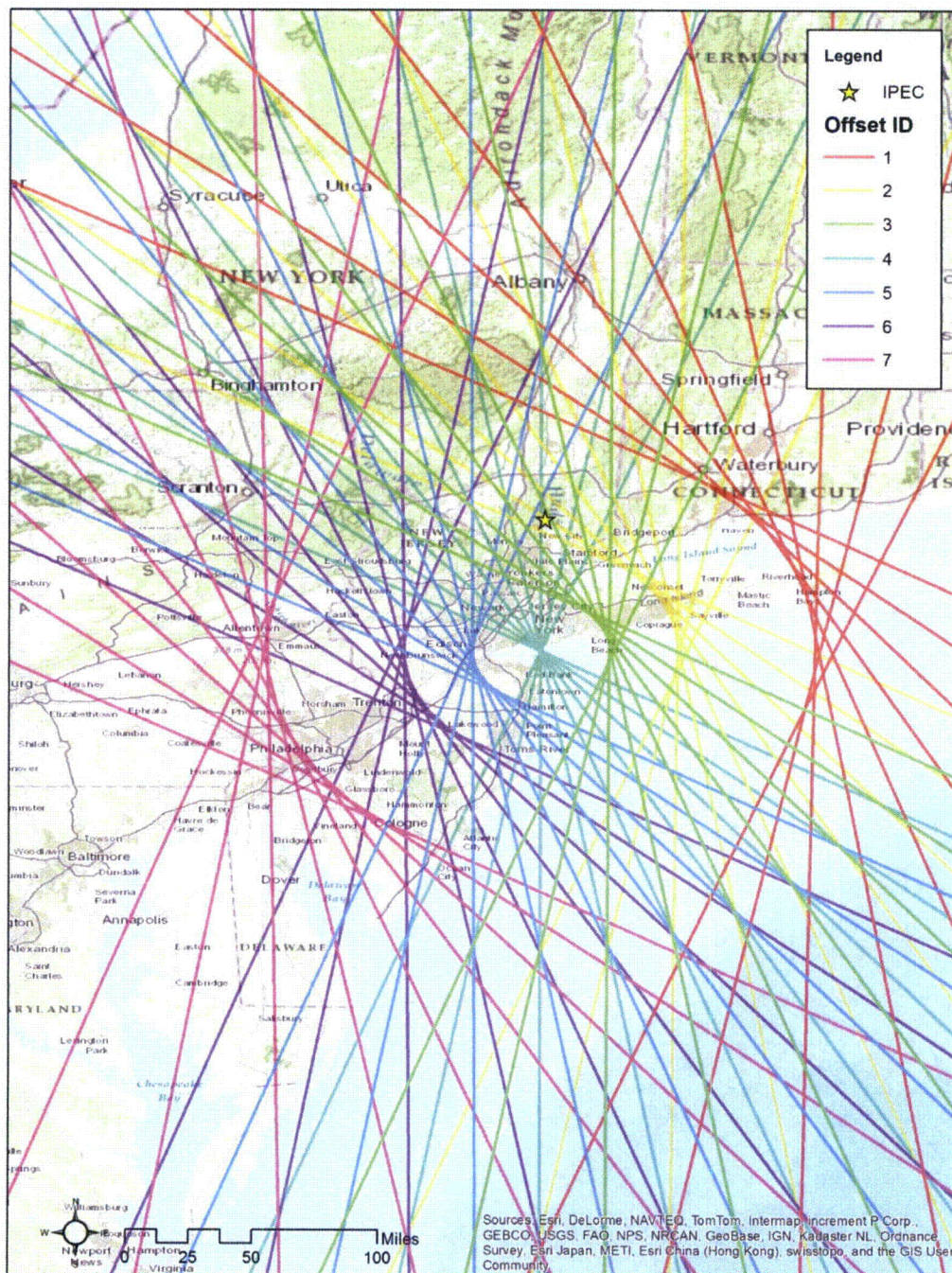


Figure 3.4-39: Storm Tracks (R_{max} = 36 nautical miles) for the JPM Synthetic Storms

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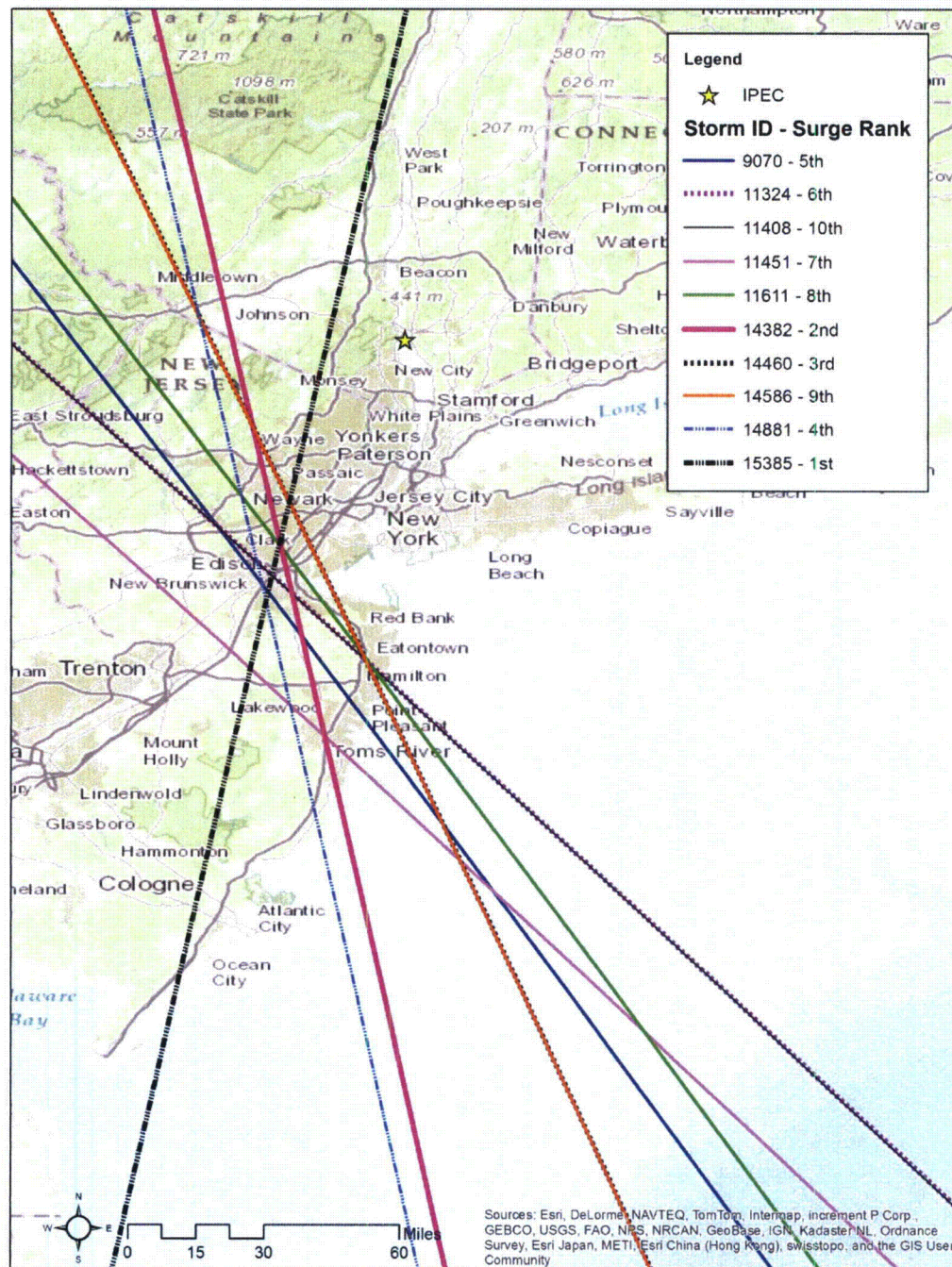


Figure 3.4-40: Tracks for Top 10 SLOSH-Calculated Surge Events at IPEC Shown by Numeric Storm Identification and Surge Ranking

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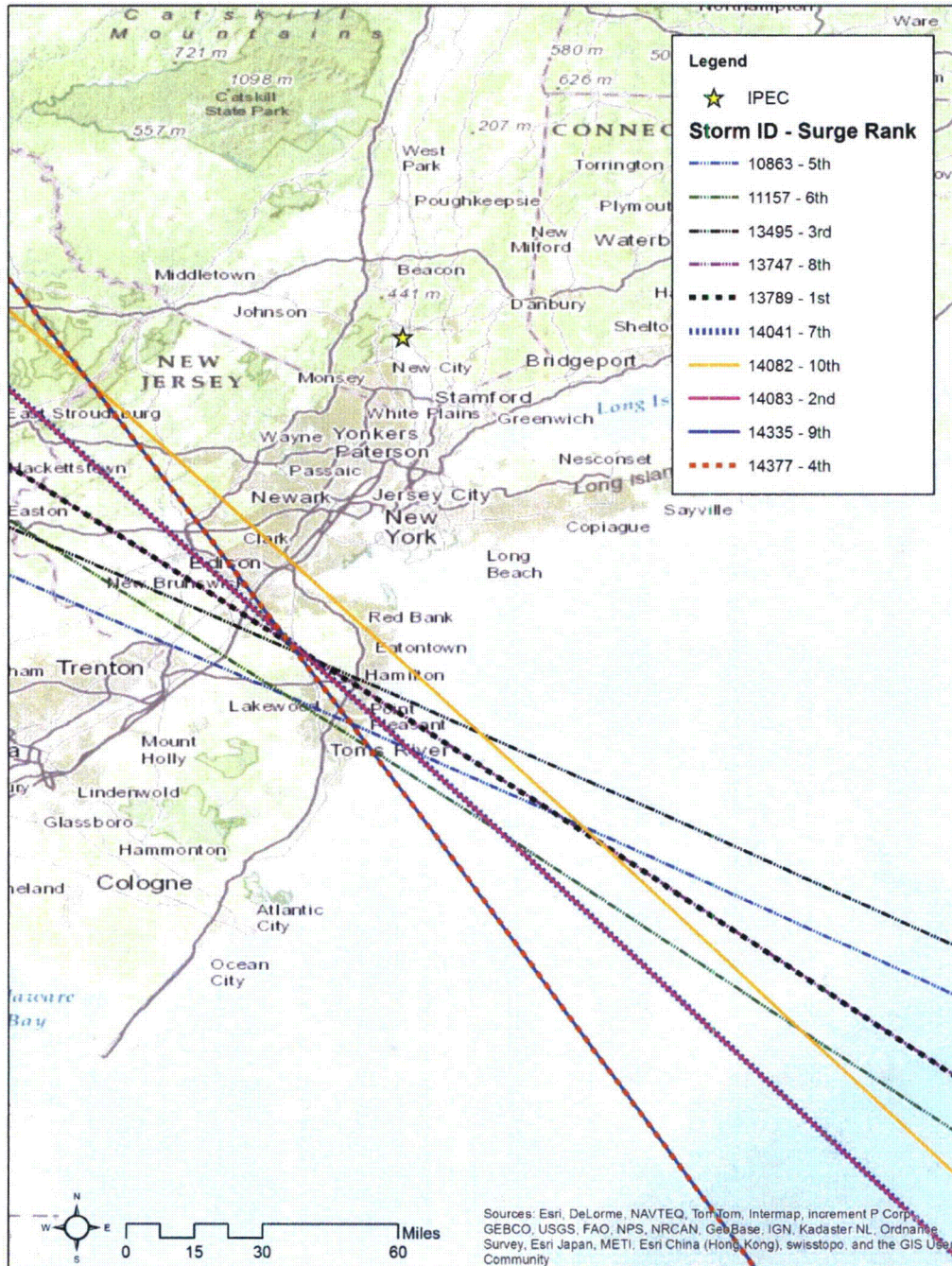


Figure 3.4-41: Tracks for Top 10 SLOSH-Calculated Surge Events at The Battery Shown by Numeric Storm Identification and Surge Ranking

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Flood Hazard Reevaluation Report for Indian Point Energy Center (IPEC) Units 2 and 3

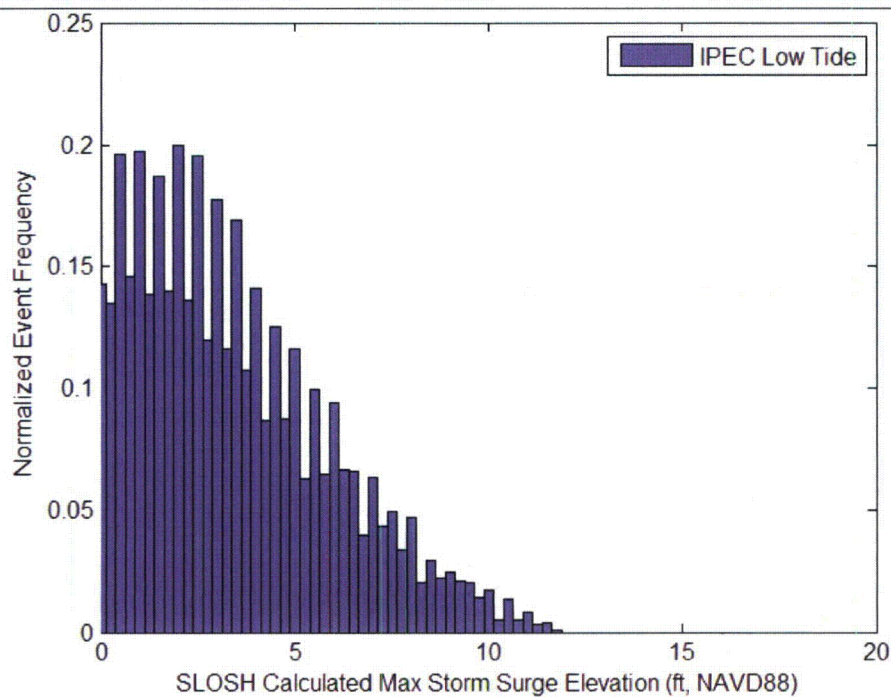


Figure 3.4-42: Histogram of Maximum Storm Surge at IPEC at Low Tide

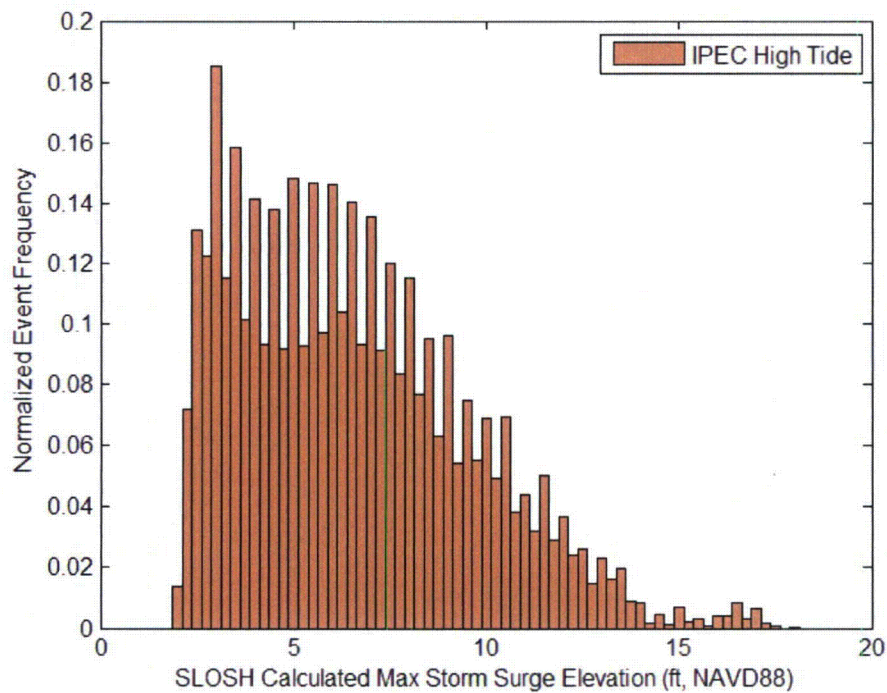


Figure 3.4-43: Histogram of Maximum Storm Surge at IPEC at High Tide

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Flood Hazard Reevaluation Report for Indian Point Energy Center (IPEC) Units 2 and 3

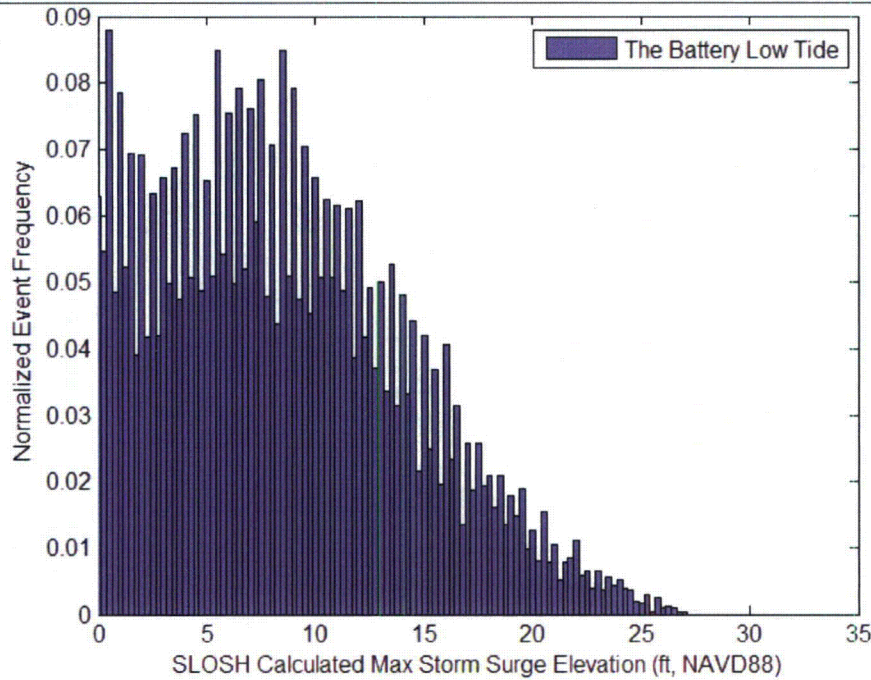


Figure 3.4-44: Histogram of Maximum Storm Surge at The Battery at Low Tide

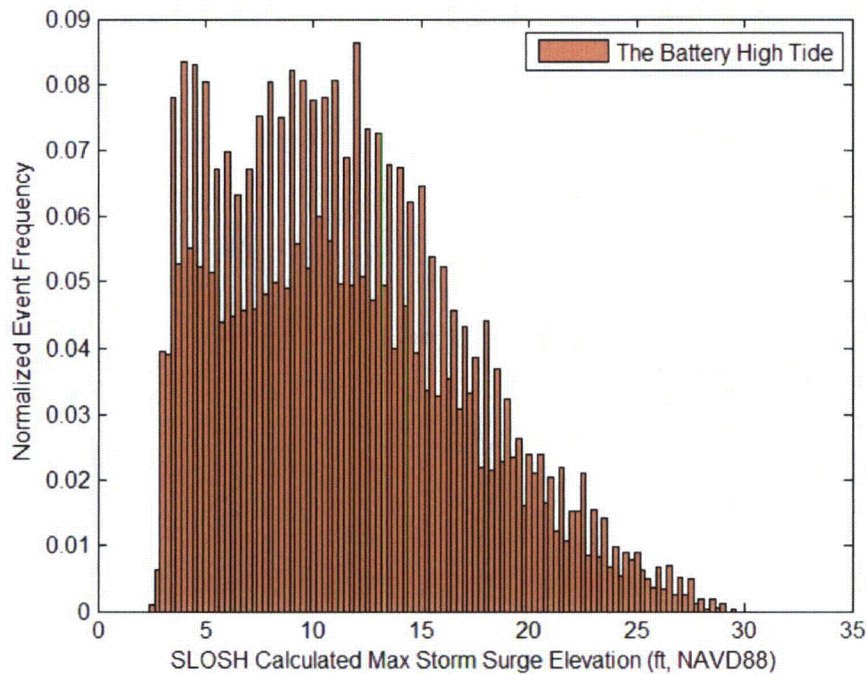


Figure 3.4-45: Histogram of Maximum Storm Surge at The Battery at High Tide

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Flood Hazard Reevaluation Report for Indian Point Energy Center (IPEC) Units 2 and 3

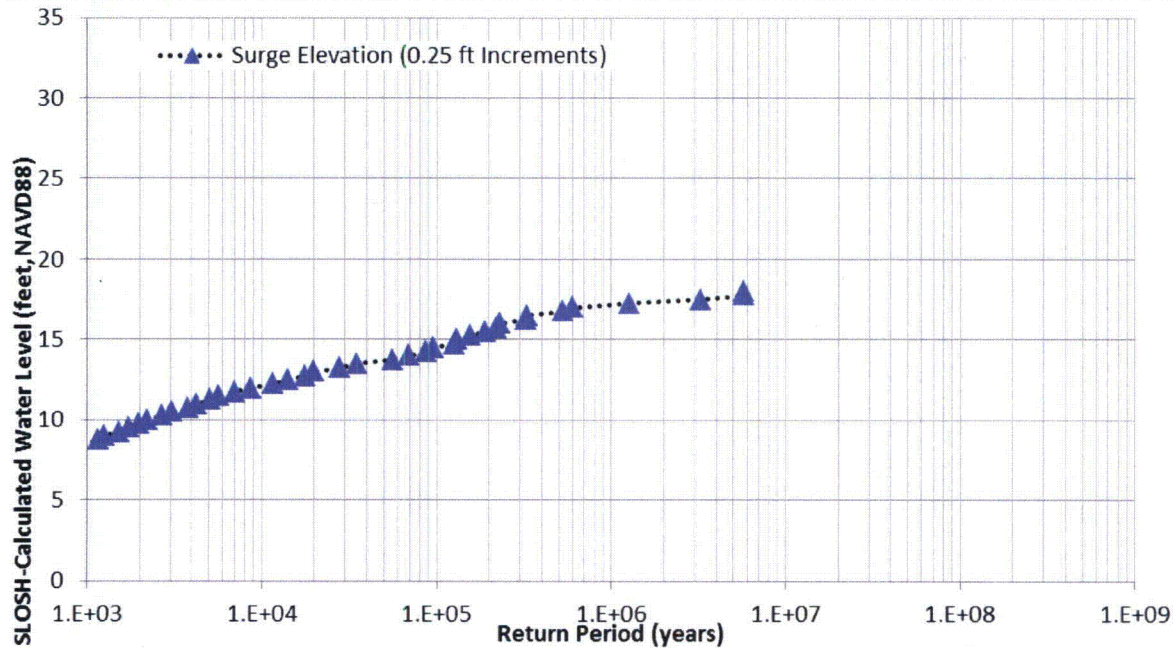


Figure 3.4-46: SLOSH-Calculated Storm Tide (Stillwater) Stage-Frequency Curve at IPEC

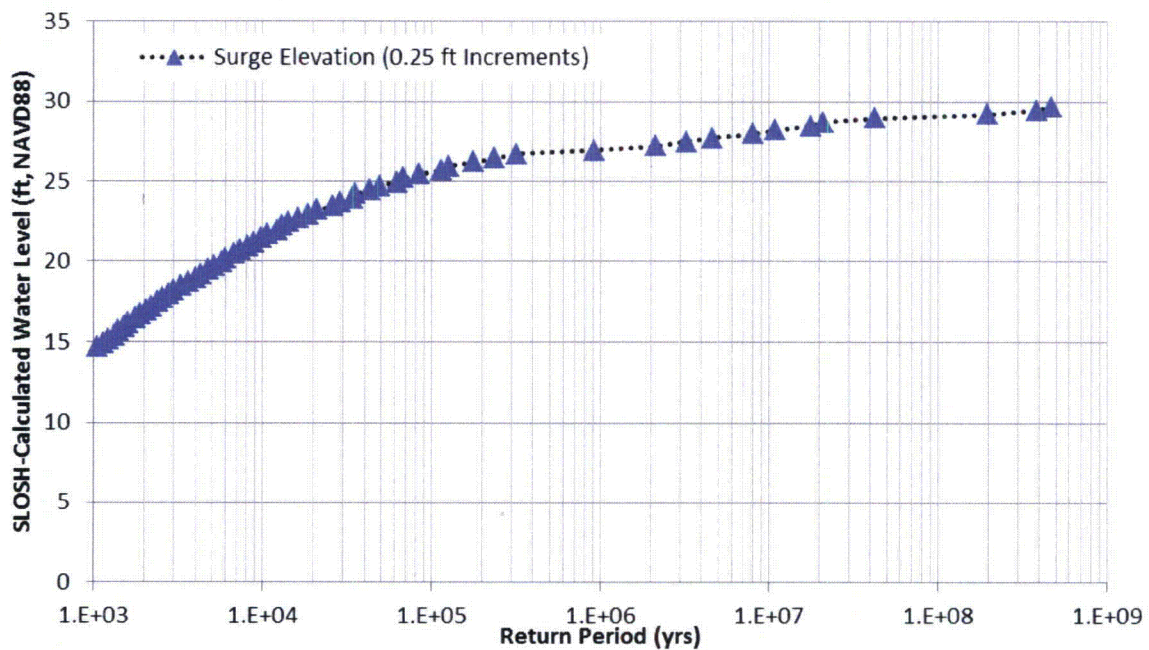


Figure 3.4-47: SLOSH-Calculated Storm Tide (Stillwater) Stage-Frequency Curve at The Battery

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Flood Hazard Reevaluation Report for Indian Point Energy Center (IPEC) Units 2 and 3

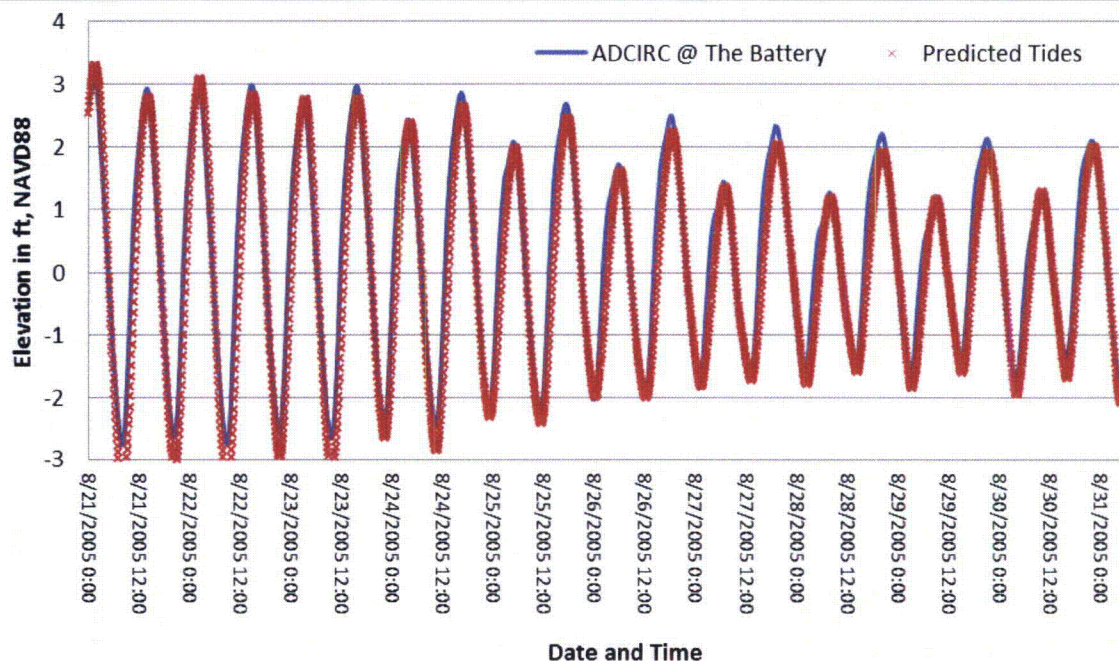


Figure 3.4-48: Comparison of ADCIRC Tidal Results to Predicted Tides at The Battery

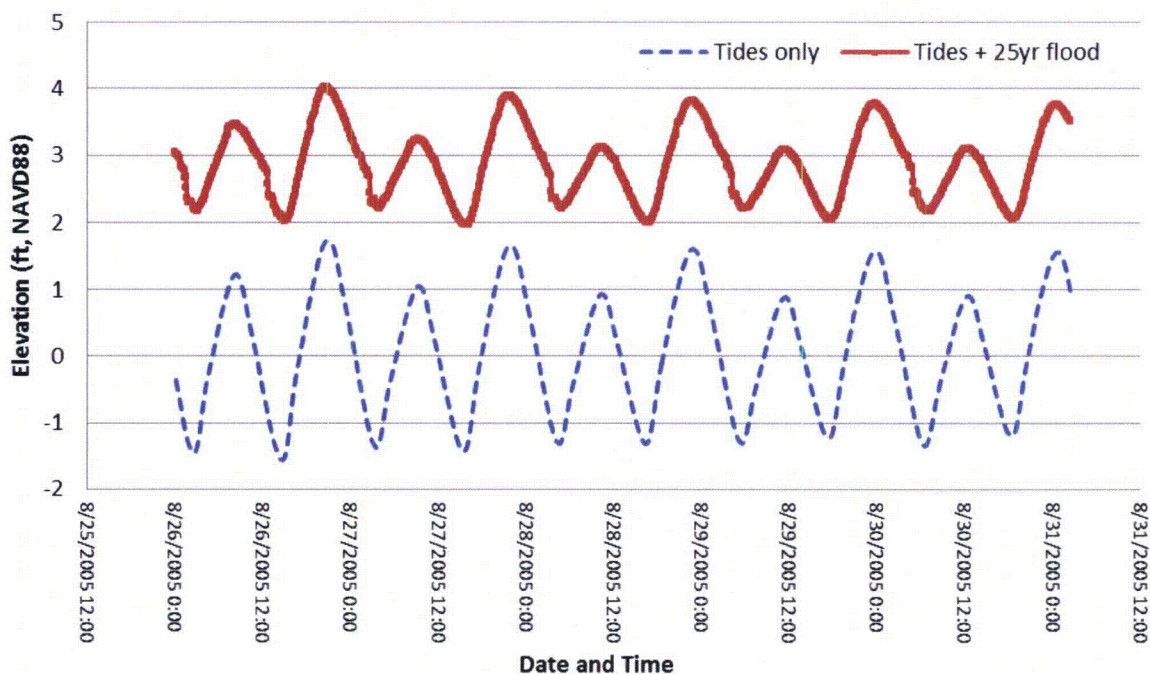


Figure 3.4-49: ADCIRC Tidal Results with 25-year Flood in the Hudson River at IPEC

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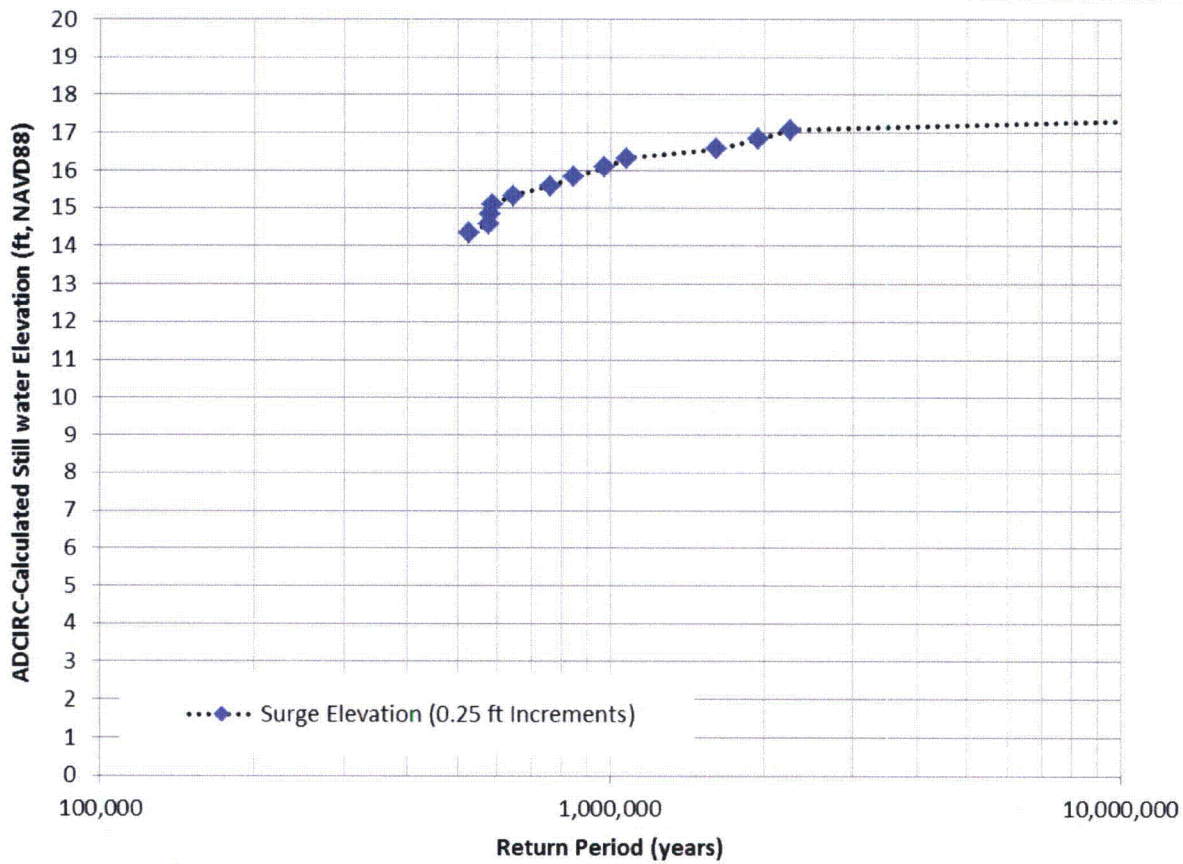
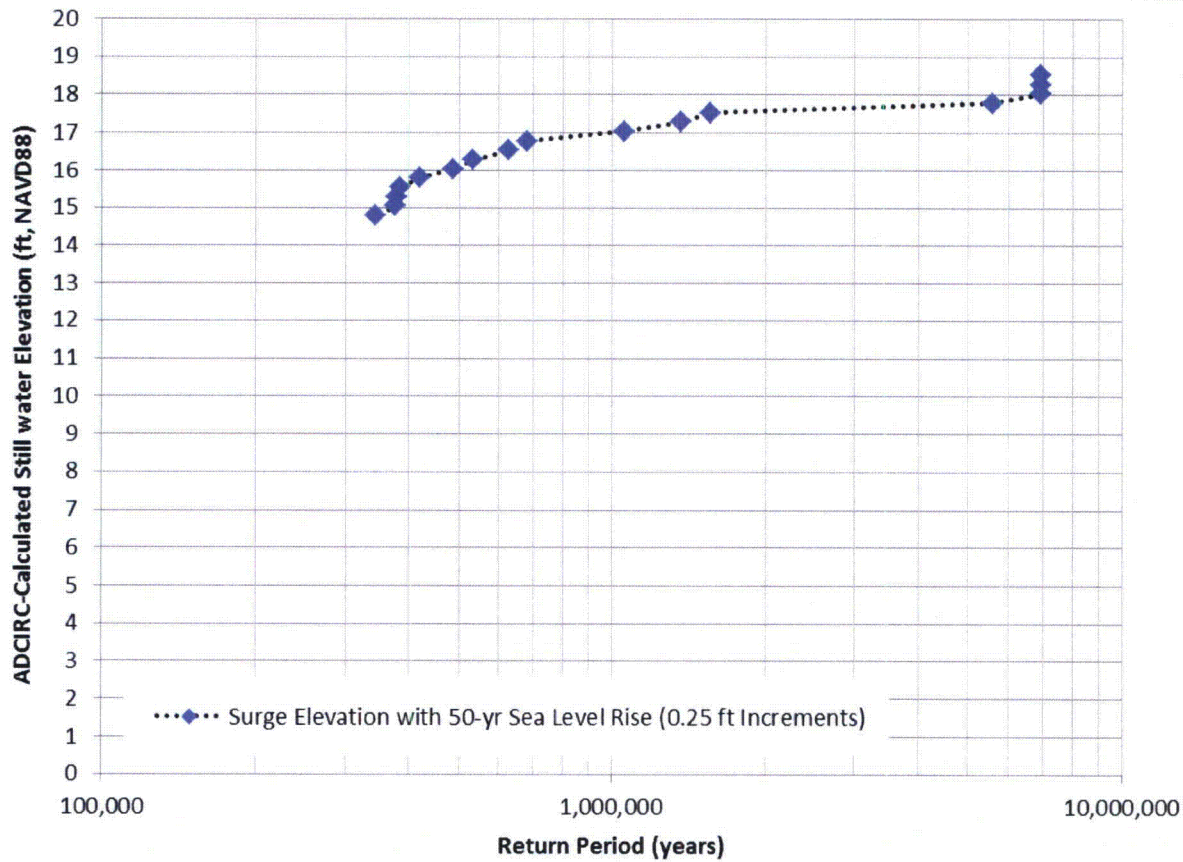


Figure 3.4-50: ADCIRC-Calculated Storm Tide (Stillwater) Stage-Frequency Curve at IPEC without Sea Level Rise

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Flood Hazard Reevaluation Report for Indian Point Energy Center (IPEC) Units 2 and 3



Notes:

1. On Figure 51, each data point represents a set of storm simulations that falls within each surge increment.
2. Point stacking at the return period around 7×10^6 years is due to the gap between calculated storm tide values of 18.08 feet and 17.22 feet NAVD88.

Figure 51: ADCIRC-Calculated Storm Tide (Stillwater) Stage-Frequency Curve at IPEC with Sea Level Rise

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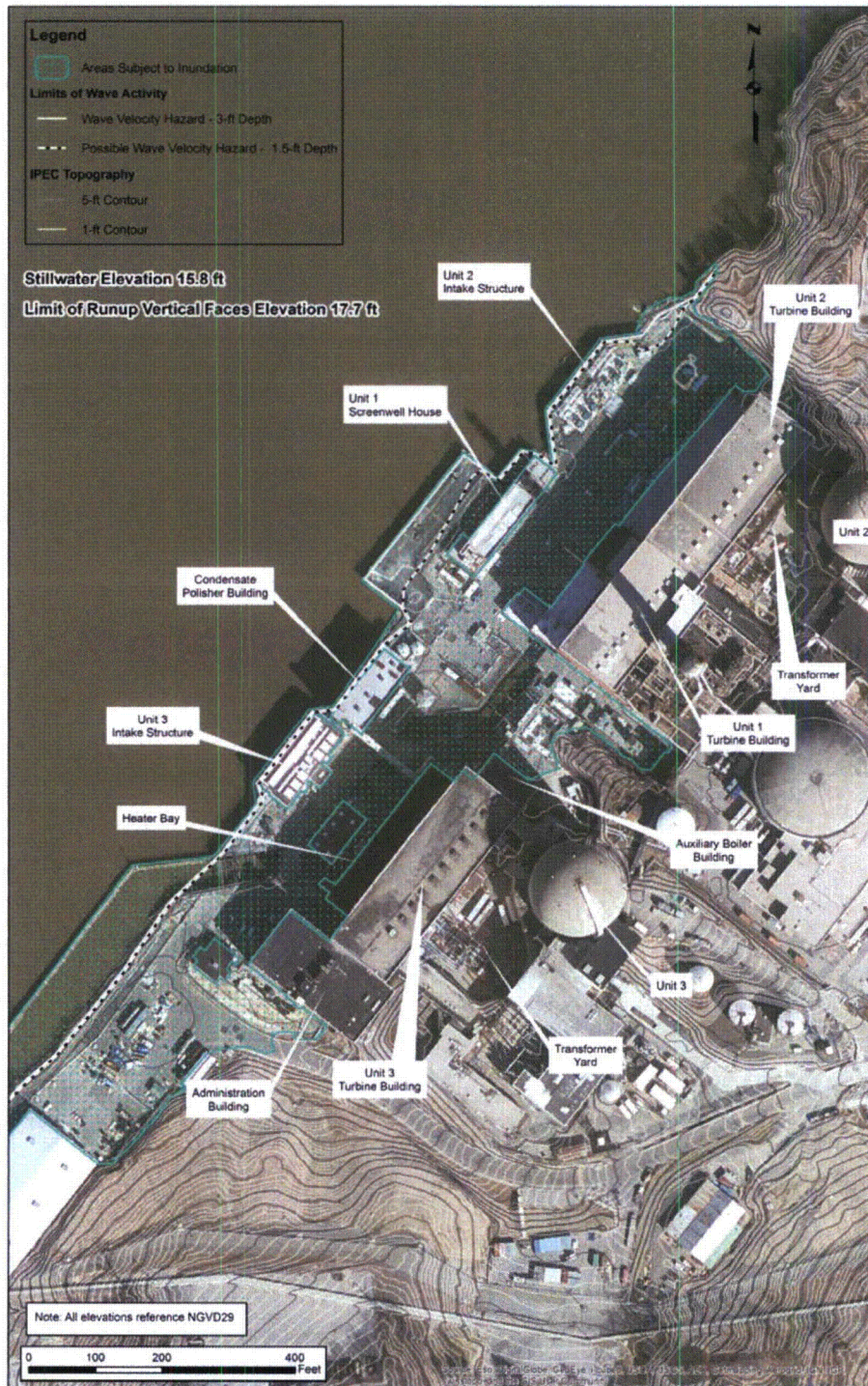


Figure 3.4-52: Inundation Map – Combined Effect Flood - Probabilistic Storm Surge