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Pennsville Township Coastal Vulnerability Assessment

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NJ Climate Resilience Corps

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Overview

- Pennsville Township Overview
- NJDEP Flood Inundation Models
- Land Parcels Vulnerable to Flooding – Various Scenarios
- FEMA-FIRM Flood Zones
- Hurricane Sandy - TWL
- Overburdened Communities
- Social Vulnerability
- Critical Infrastructure

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Caveats

- The data and maps in this analysis illustrate the scale of potential flooding, not the exact location, and do not account for erosion, subsidence, or future construction. As with all remotely sensed data, all features should be verified with a site visit.
- The data, maps, and information provided here should be used only as a screening-level tool for management decisions and not for navigation, permitting, or other legal purposes.
- The flood modeling does not include flood protection structures, such as berms, levees, dikes, floodwalls, etc.
- For parcel flooding, the building footprint data is not used. Instead, a parcel is considered flooded only if the inundation covers at least 50% of the parcel.
- The land and improvement values come from MOD IV data and are for the entire parcel. We do not have data to consider only basement and/or first-floor flooding.

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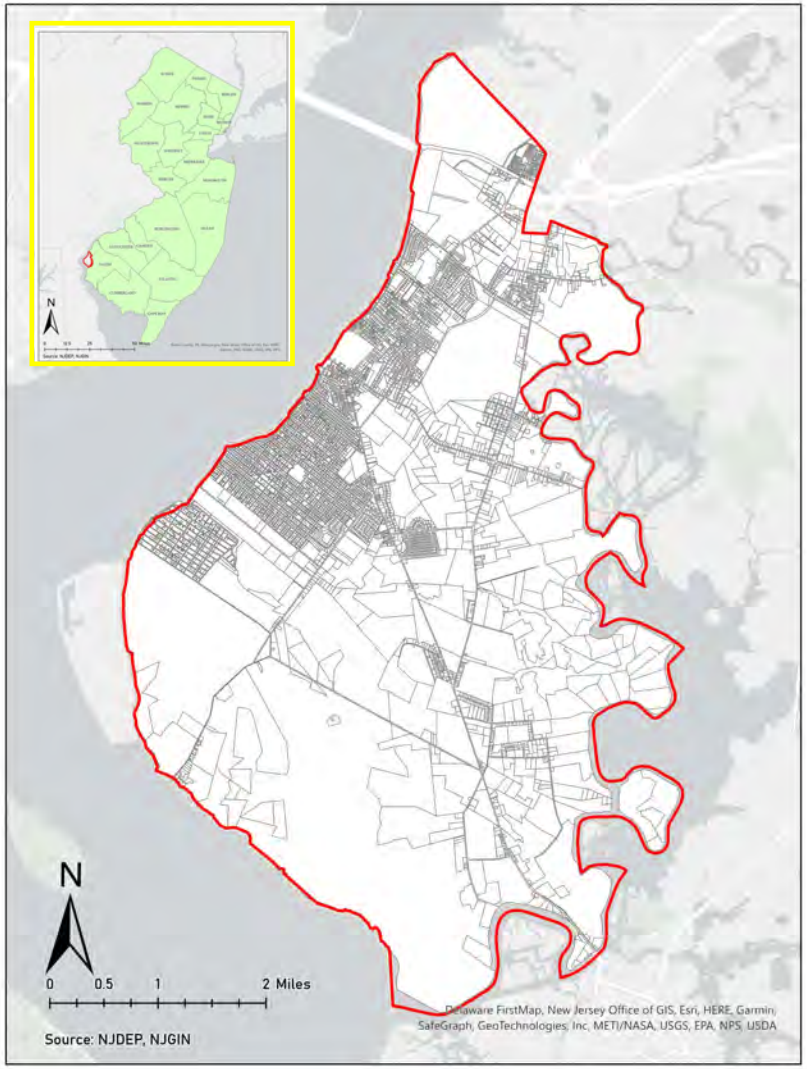
Pennsville Township, Salem County, NJ



Demographics (ACS, 2020 5 Year Estimates)	
Population	12,291
Growth Since 2010	-5.9%
Area	24.58 sq. mile.
Pop. Density	500/ sq. mile
Average HH Size	2.40
Housing Units / Occupied	5,841 / 5,129 (87.8%)
Owner Occupied Units	3,764 (73.4% of all occupied)
Median HH Income	$67,906
Poverty	7.9%
Unemployment Rate (16 y/o and older)	7.1%
Median Rental Cost	$1,018 /month
Median House Value	$157,100
Median Age	45.6 years
White Population (alone)	90.7%
Non-White Population	9.3%
Less than HS Education	7.84%

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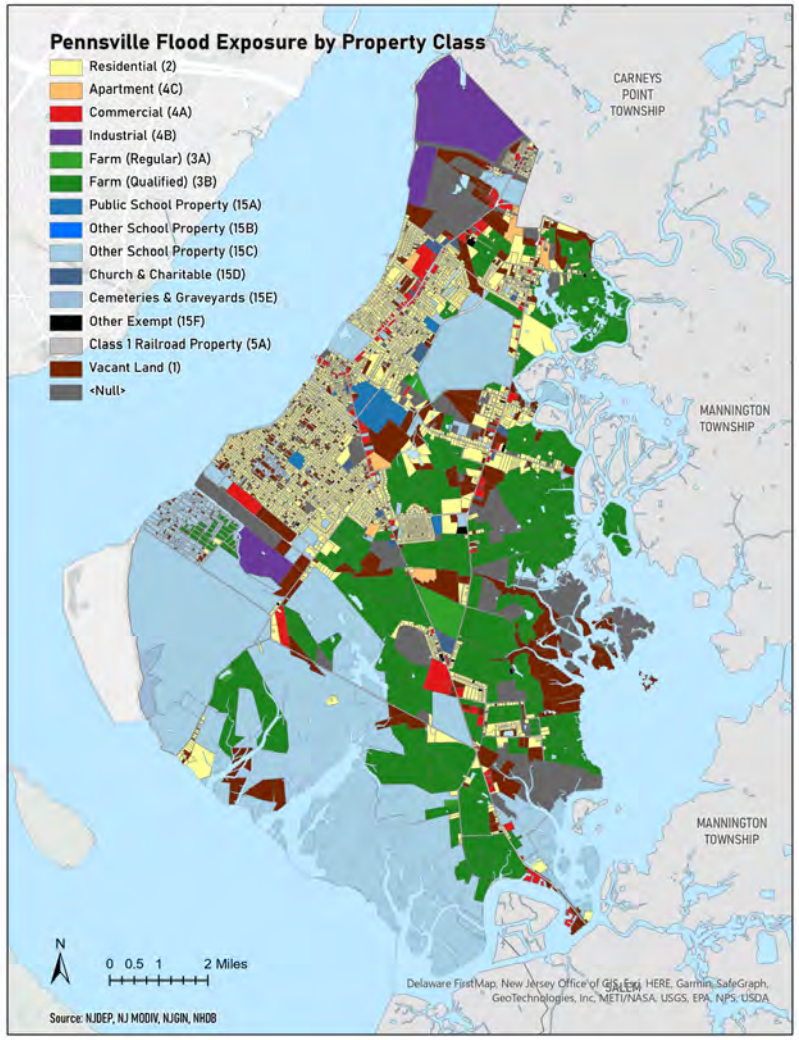

74	# PARCELS TOTAL
Residential (2)	4622
Apartment (4C)	16
Commercial (4A)	183
Industrial (4B)	3
Farm Total (3A & 3B)	163
School and School Property (15A, 15B, 15C)	465
Church & Charitable (15D)	37
Cemeteries & Graveyards (15E)	3
Other Exempt (15F)	43
Class I Railroad Property (5A)	2
Vacant (1)	660

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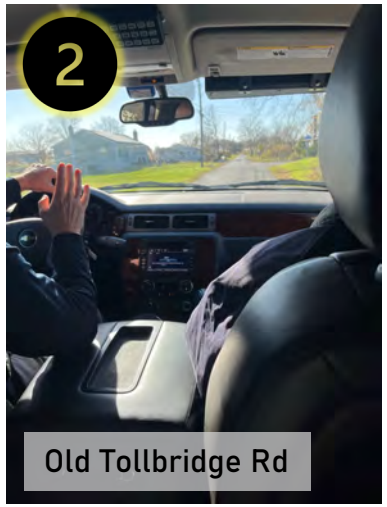
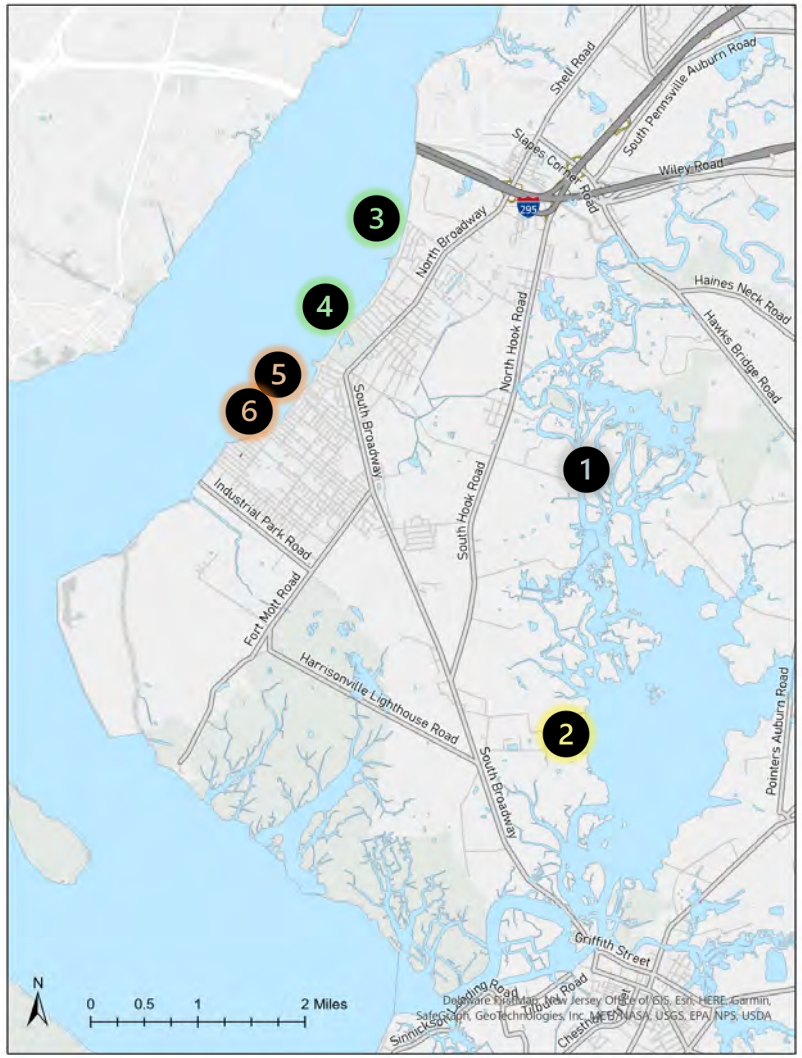
Site Visit Takeaways





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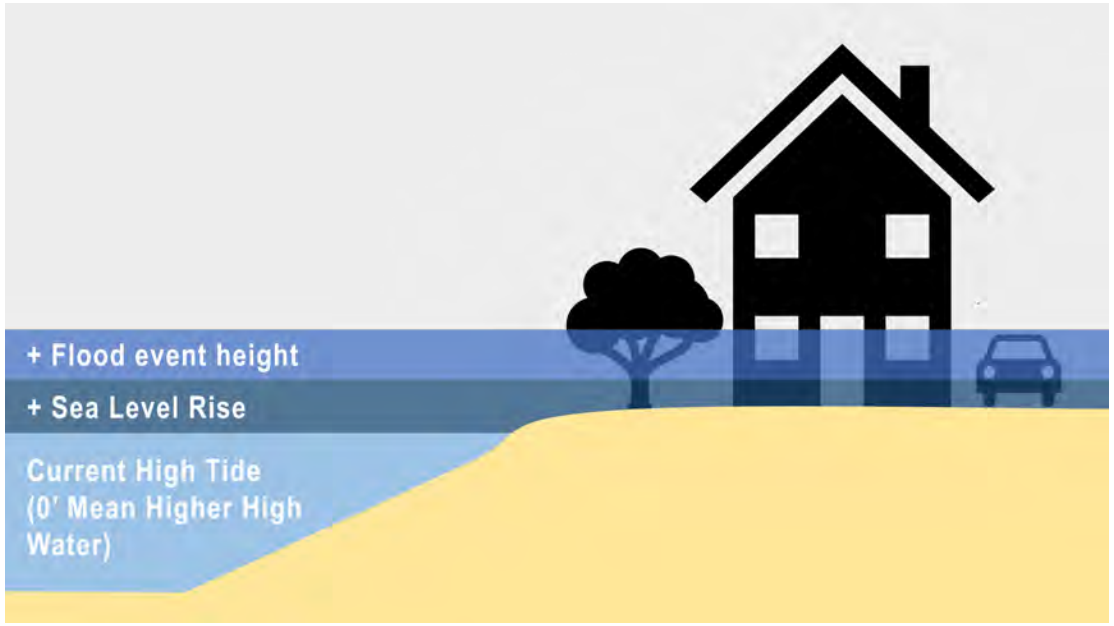
Total Water Level (above Mean Higher High Water)

- Mean Higher High Water (MHHW) is a tidal datum developed by the National Oceanic and Atmospheric Administration (NOAA). It is the average of the higher high water height of each tidal day observed over the National Tidal Datum Epoch.

- Total Water Level – The 'still water' inundation above Mean Higher High Water (MHHW). These water levels allow you to visualize the impact of future sea level rise combined with potential flood events up to 20ft of inundation.

- **Seawater that rises past the MHHW line is considered inundation**, and therefore water level measurements relative to MHHW can be considered as proxies for measurements of inundation.



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2, 3, 5, 7 Total Water Level

Year	Low End	At least a 66% chance between			High End
	Greater than a 95% chance SLR exceeds	*Greater than an 83% chance SLR exceeds*	*~50% chance SLR exceeds*	*Less than a 17% chance SLR exceeds*	*Less than a 5% chance SLR exceeds*
2000			0		
2010			0.2 ft		
2020	0.1 ft	0.3 ft	0.5 ft	0.7 ft	0.9 ft
2030	0.3 ft	0.5 ft	0.8 ft	1.1 ft	1.3 ft
2040	0.5 ft	0.7 ft	1.1 ft	1.5 ft	1.9 ft
2050	0.7 ft	0.9 ft	1.4 ft	2.1 ft	2.6 ft
2060	0.8 ft	1.2 ft	1.8 ft	2.5 ft	3.1 ft
2070	1.0 ft	1.4 ft	2.2 ft	3.1 ft	3.8 ft
2080	1.1 ft	1.6 ft	2.6 ft	3.8 ft	4.8 ft
2090	1.2 ft	1.8 ft	3.0 ft	4.4 ft	5.8 ft
2100	1.3 ft	2.0 ft	3.3 ft	5.1 ft	6.9 ft
2110	1.6 ft	2.3 ft	3.7 ft	5.7 ft	8.1 ft
2120	1.6 ft	2.4 ft	4.1 ft	6.4 ft	9.4 ft
2130	1.7 ft	2.6 ft	4.5 ft	7.1 ft	10.9 ft
2140	1.9 ft	2.9 ft	4.9 ft	7.7 ft	12.4 ft
2150	2.1 ft	3.1 ft	5.2 ft	8.3 ft	13.8 ft

Notes: All values are 19-year means and are measured with respect to a 1991-2009 baseline. Projections are 19-year

- Sea Level Rise (SLR) projections in feet for New Jersey from **2000 to 2150** under a moderate emissions scenario.
- The table gives the planning thresholds for the various years. Collectively, the 2ft, 3ft, 5ft, and 7ft levels are **standard state planning benchmarks**.
- NJDEP SLR Guidance for NJ recommends that planners analyze
  - 2ft SLR that is likely unavoidable
  - 5.1ft SLR sufficient to plan for most activities in a community, and
  - 6.9ft SLR for those **critical activities*** for which damages would have debilitating effects on public health and safety.

***Activities with less risk tolerance should plan for the upper end of the likely range (<17% Chance SLR exceeds).** These include most activities including single and multi-family residential structures, commercial developments, most energy transmission and water treatment infrastructure, evacuation routes and bridges, hospitals, or public transit facilities.

The state thinks about it in terms of SLR, we use TWL

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Pennsville Inundation Maps

- 2', 3', 5', 7' Total Water Levels
- 1% & 0.2% FEMA Scenarios

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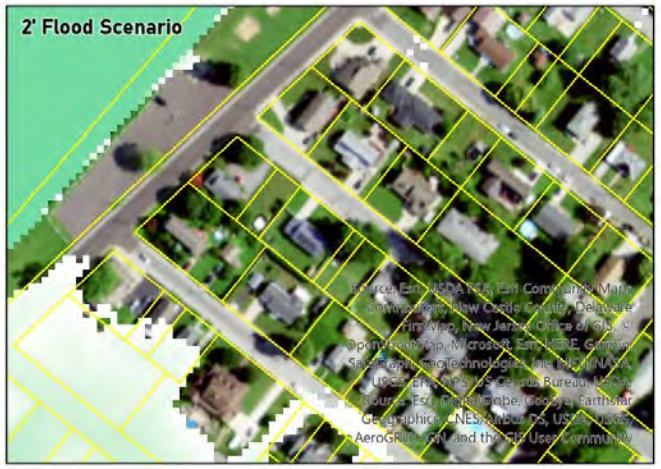
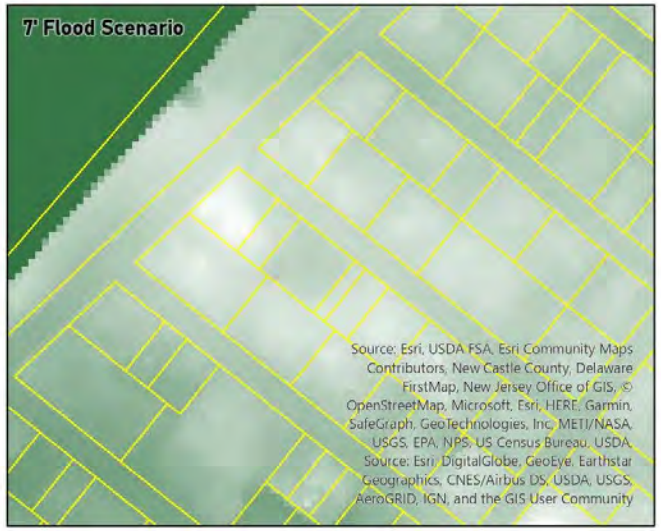
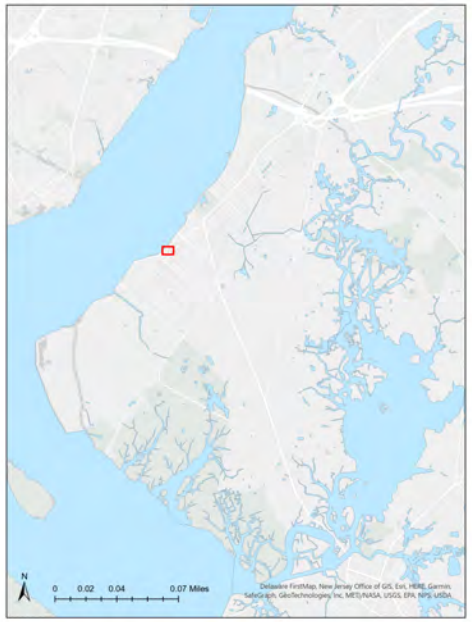
Inundation Analysis Criteria





- For analysis: 50% inundation standard
- Small, residential parcels



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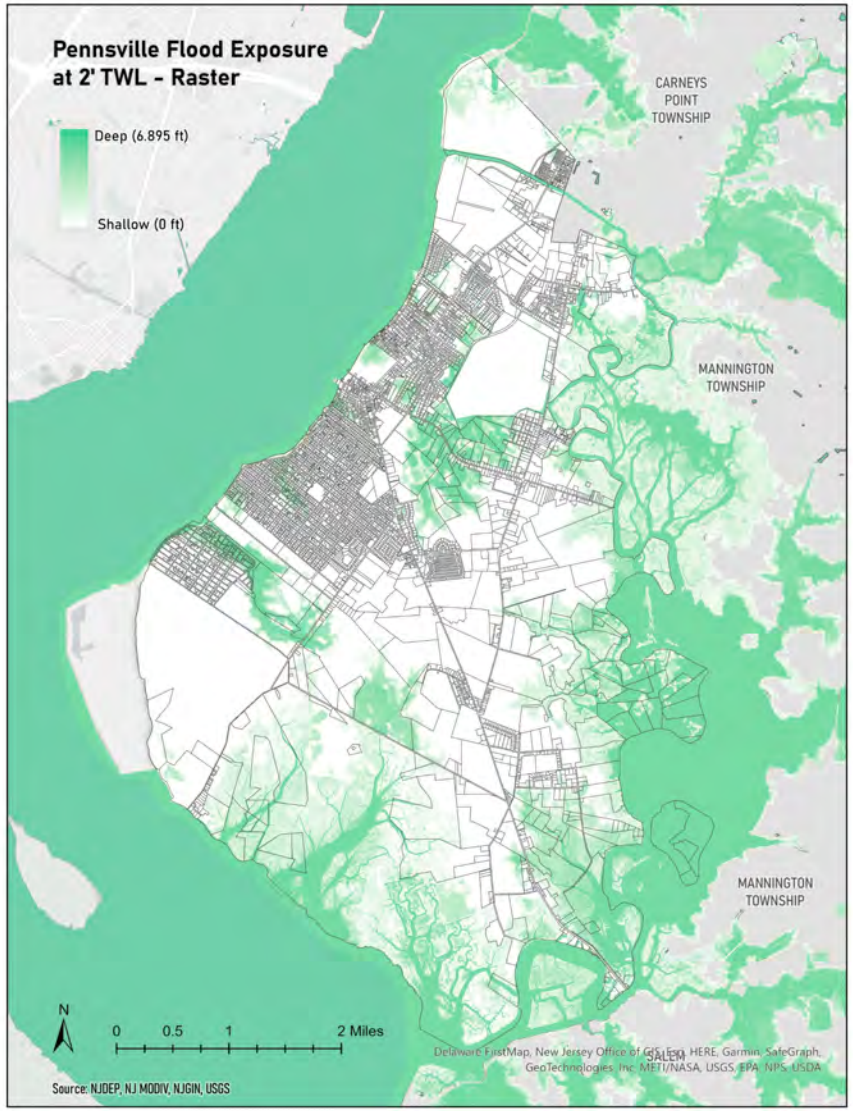
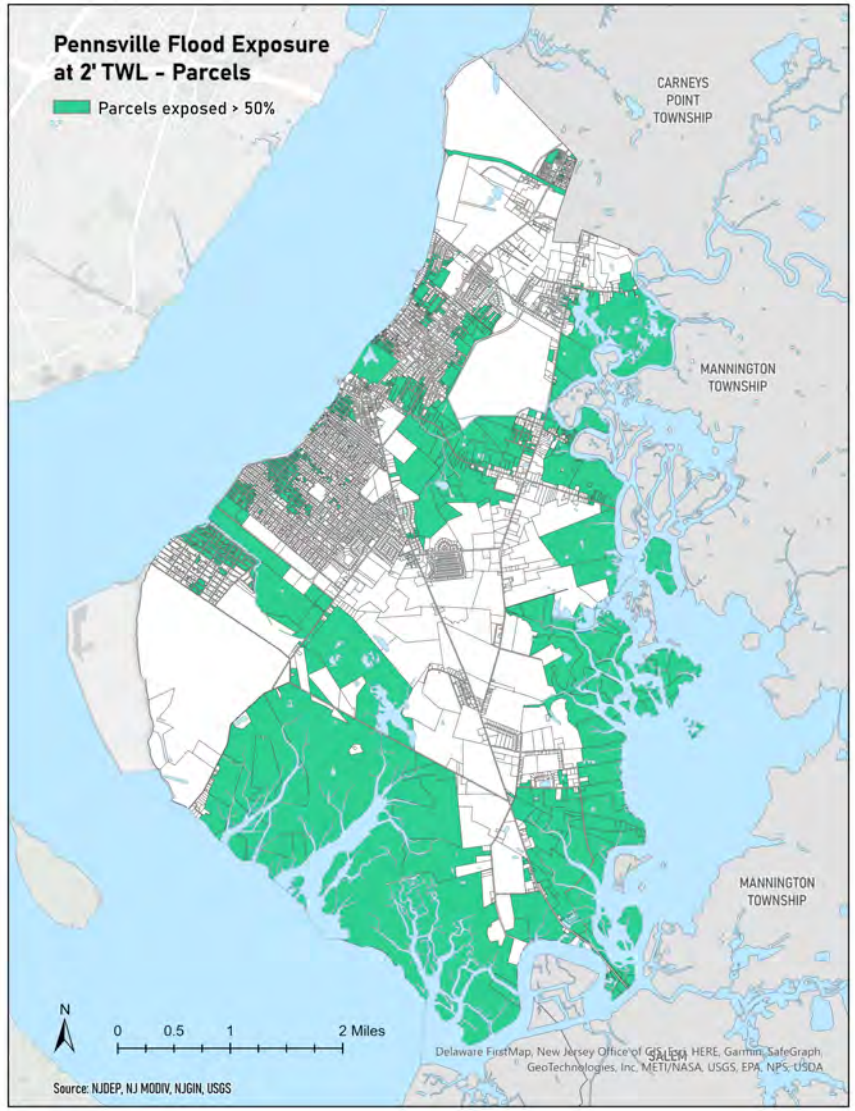
2' TWL





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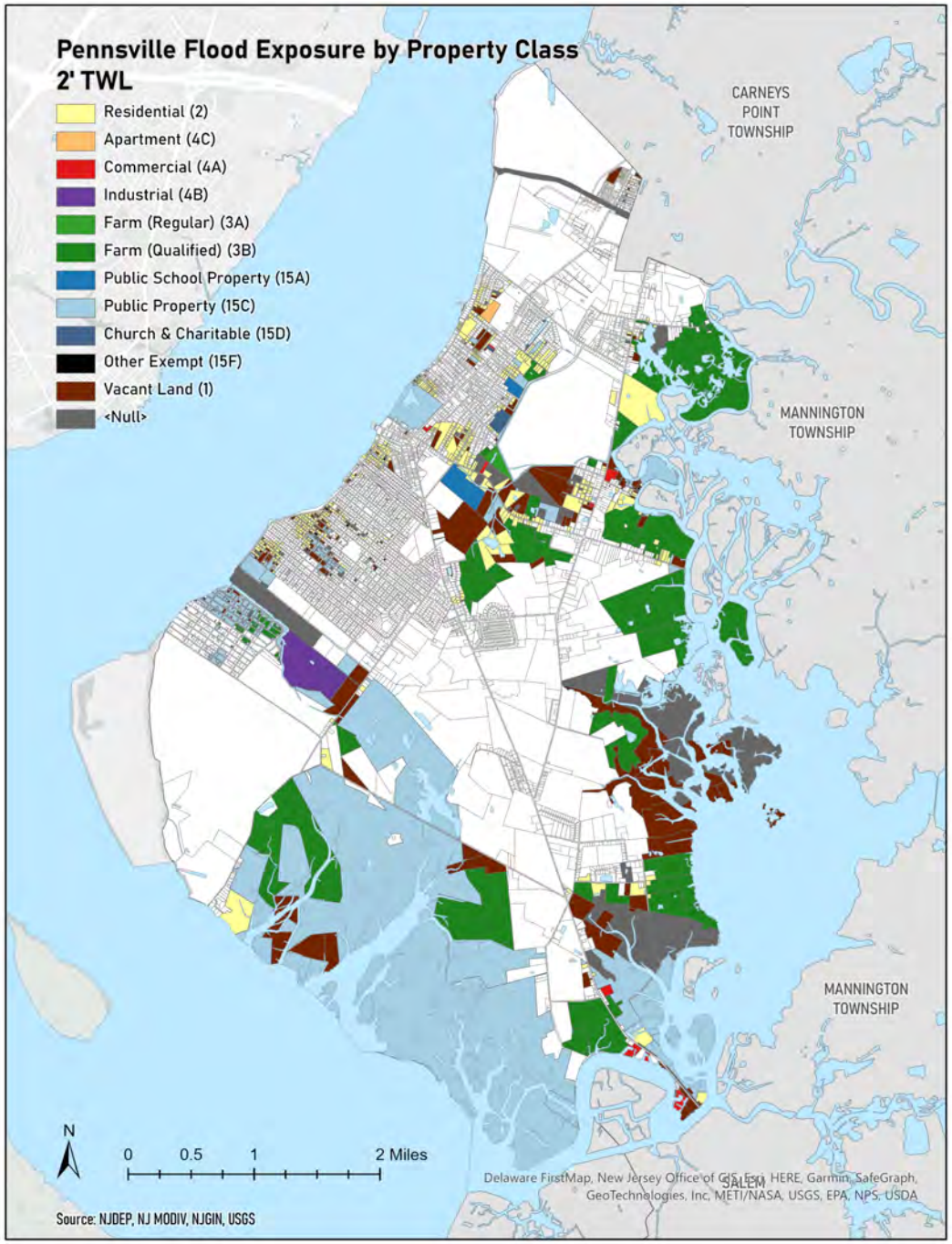
2' TWL Land Parcels

PROPERTY CLASS	# PARCELS FLOODED (% within property class)	**IMPROVEMENT $ VALUE, FLOODED**	**LAND $ VALUE, FLOODED**	FLOODED PARCELS W/ $0 VALUE
Residential (2)	610 (1.3%)	$61,876,800.00	$32,294,949.00	0
Apartment (4C)	1 (6.3%)	$2,615,900.00	$984,100.00	0
Commercial (4A)	10 (5.5%)	$883,800.00	$1,248,300.00	0
Industrial (4B)	1 (33.3%)	$10,053,900.00	$6,128,000.00	0
Farm Total (3A & 3B)	56 (34.3%)	$238,900.00	$541,700.00	25
Public and School Property (15A, 15B, 15C)	229 (49.2%)	$15,084,400.00	$11,134,900.00	35
Church & Charitable (15D)	2 (5.4%)	$1,281,700.00	$141,400.00	0
Other Exempt (15F)	6 (14.0%)	$558,700.00	$300,700.00	0
Vacant (1)	211 (31.9%)	$0.00	$4,129,900.00	0
TOTAL	**1126**	**$92,594,100.00**	**$56,903,949.00**	**60**



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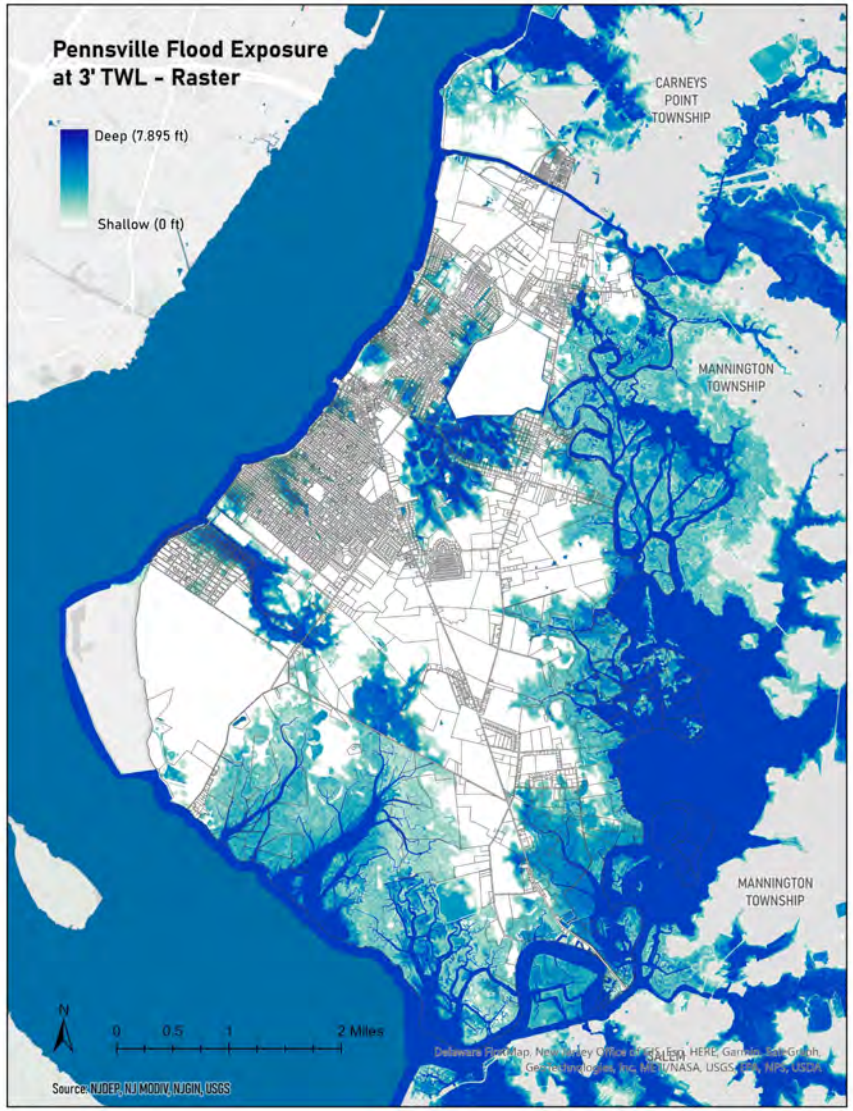
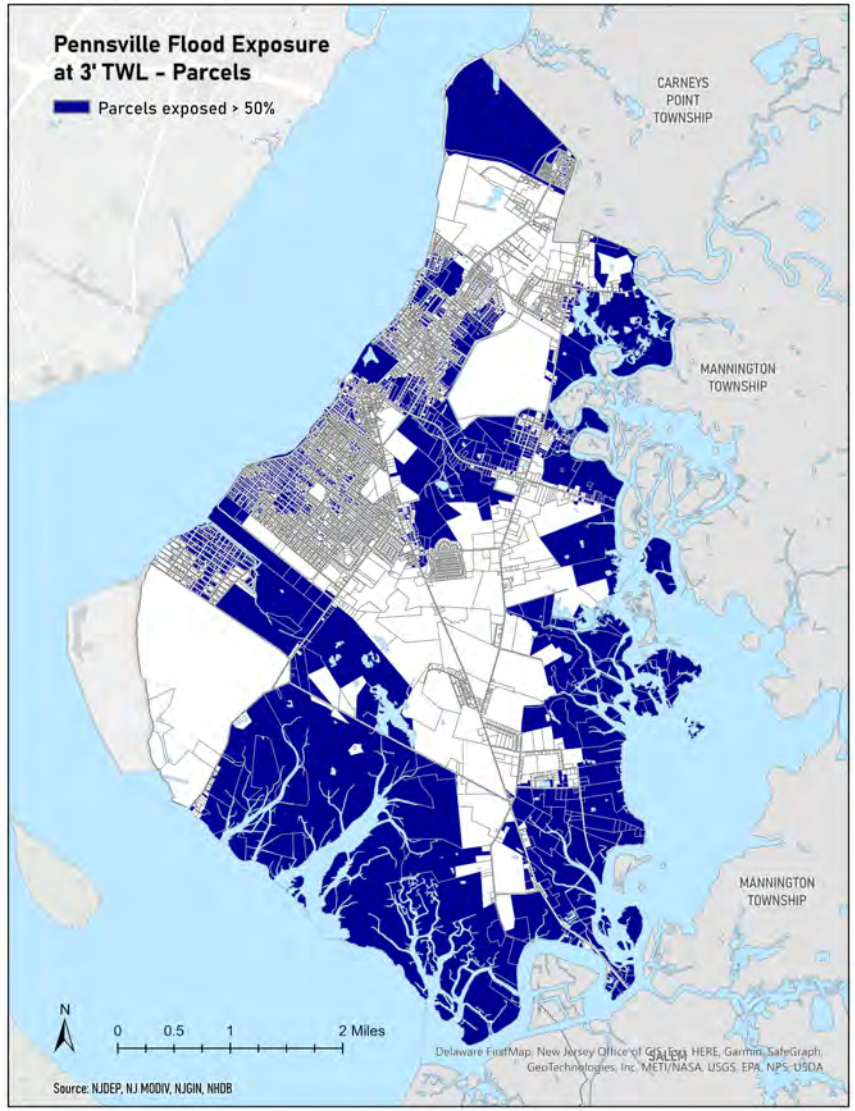
3' TWL





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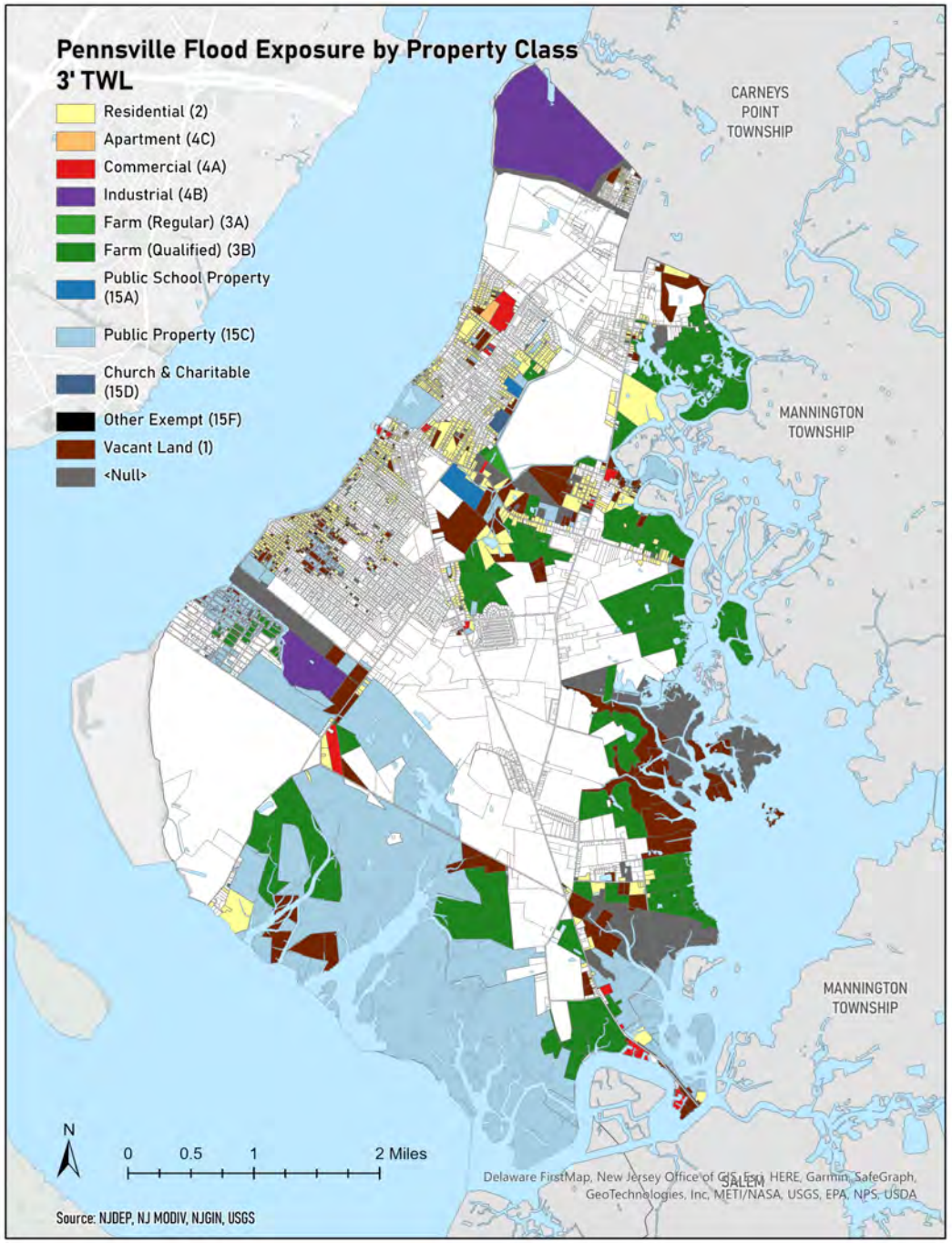
3' TWL Land Parcels

PROPERTY CLASS	# PARCELS FLOODED	IMPROVEMENT $ VALUE, FLOODED	LAND $ VALUE, FLOODED	FLOODED PARCELS W/ $0 VALUE
Residential (2)	1169 (25.3%)	$116,653,800.00	$60,743,587.00	2
Apartment (4C)	1 (6.3%)	$2,615,900.00	$984,100.00	0
Commercial (4A)	27 (14.8%)	$6,790,500.00	$4,581,400.00	0
Industrial (4B)	2 (66.7%)	$81,952,900.00	$24,229,000.00	0
Farm Total (3A & 3B)	80 (49.1%)	$238,900.00	$637,400.00	42
Public and School Property (15A, 15B, 15C)	281 (60.4%)	$15,093,600.00	$13,767,200.00	38
Church & Charitable (15D)	3 (8.1%)	$1,281,700.00	$171,800.00	0
Other Exempt (15F)	7 (16.3%)	$638,600.00	$346,700.00	0
Vacant (1)	305 (46.2%)	$0.00	$6,057,800.00	0
TOTAL	**1875**	**$225,265,900.00**	**$111,518,987.00**	**82**



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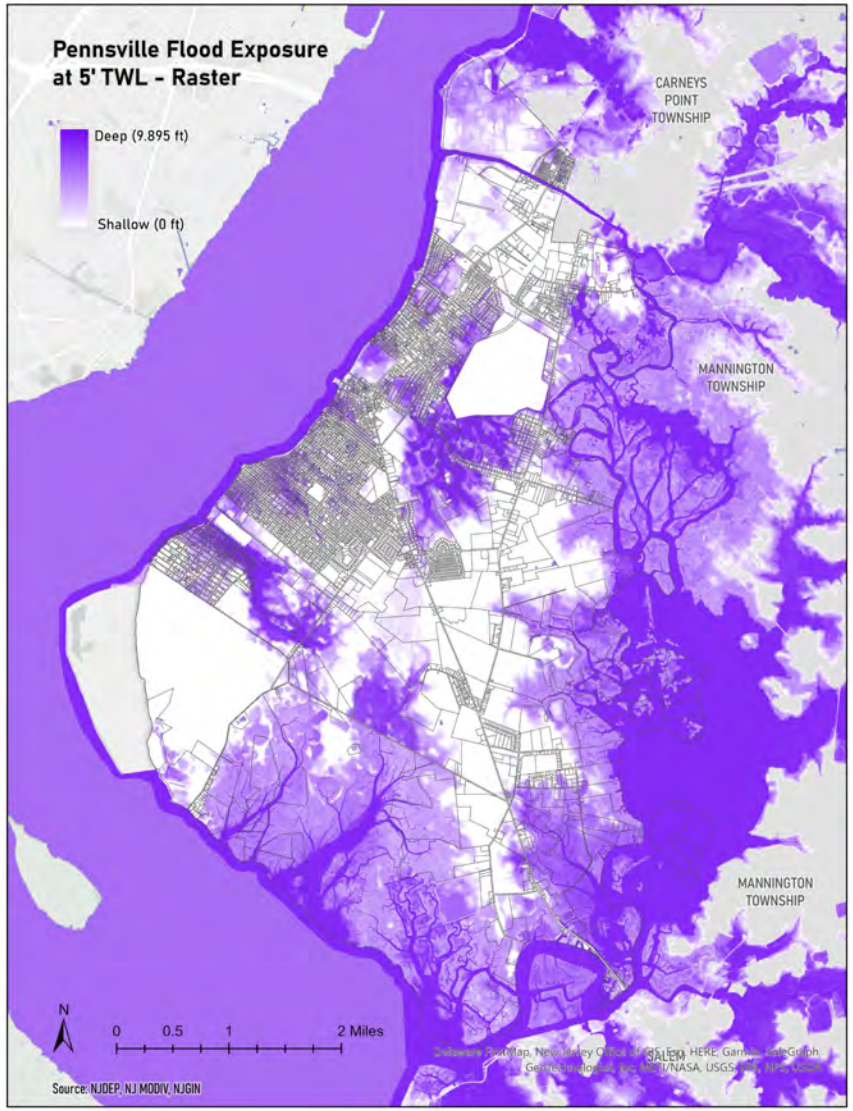
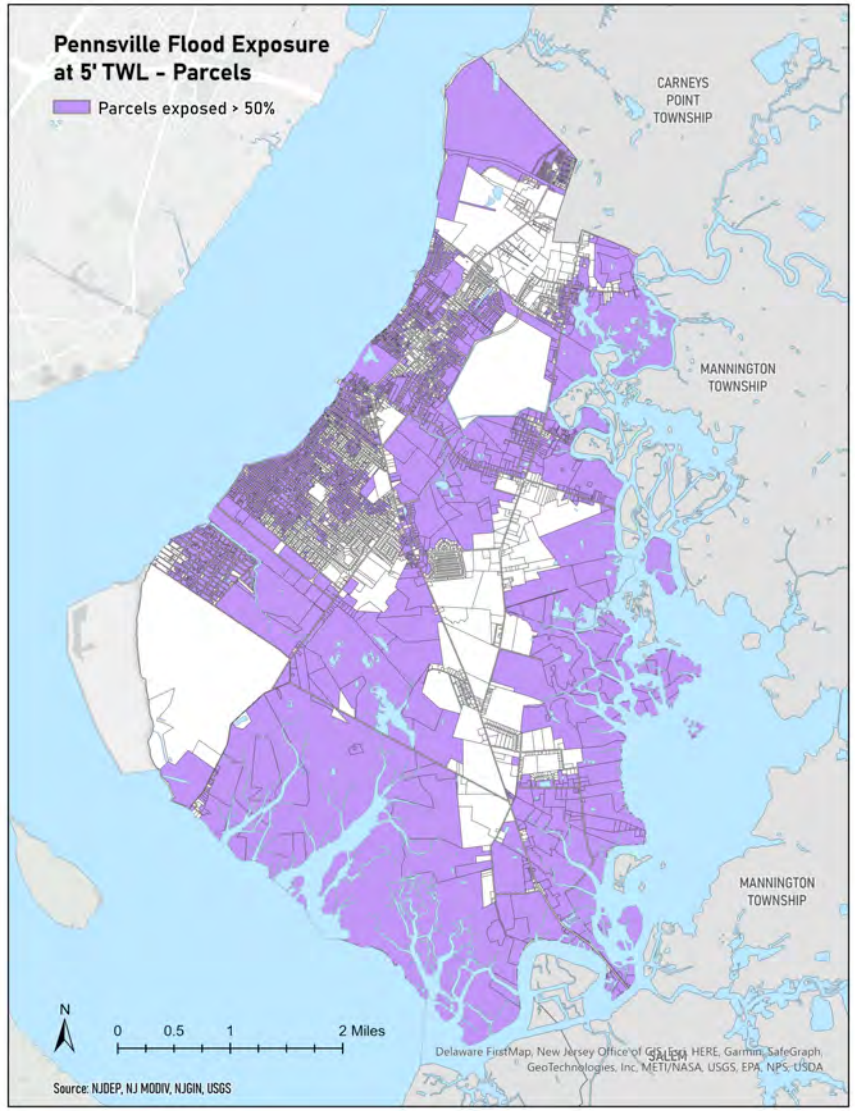
5’ TWL





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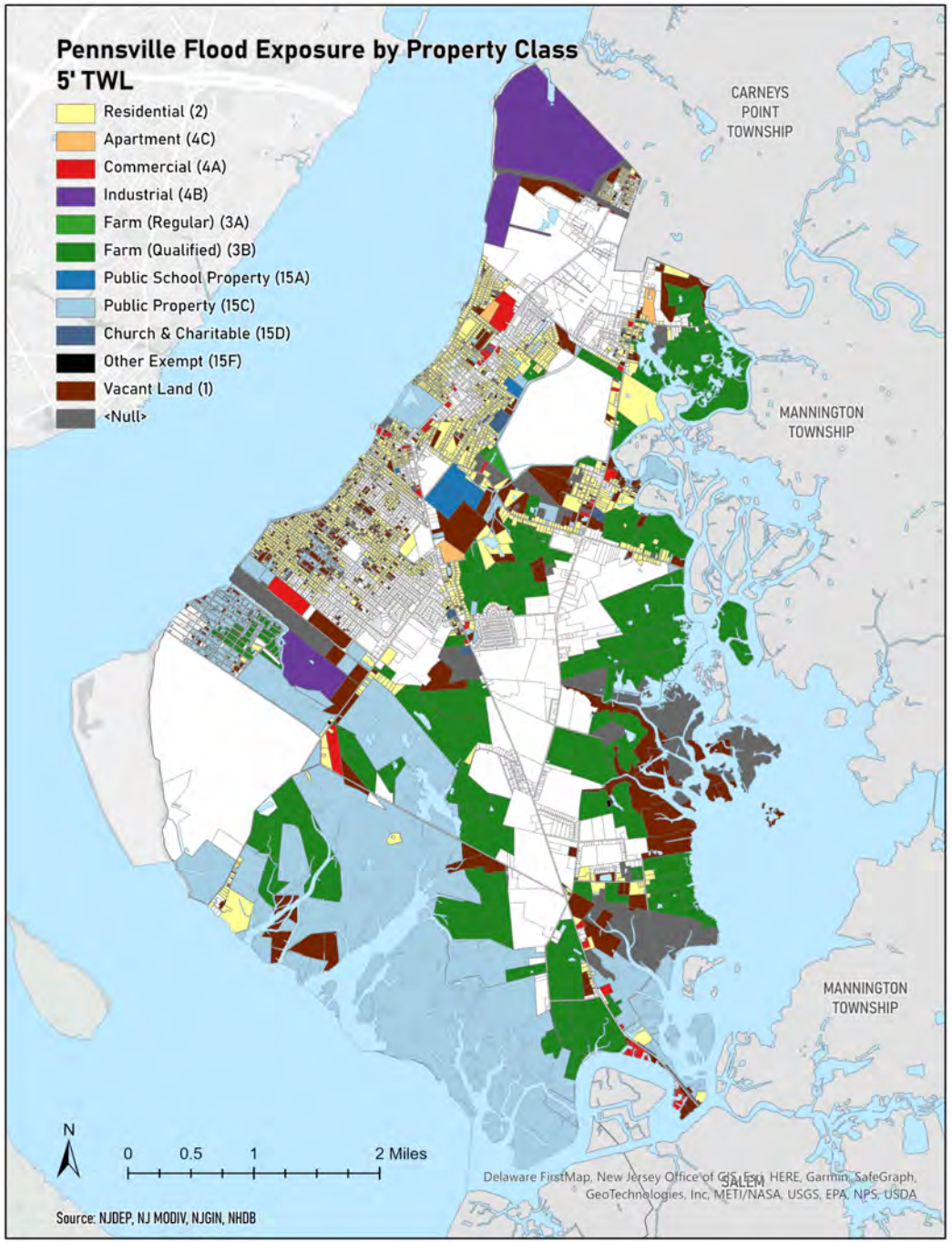
5' TWL Land Parcels

PROPERTY CLASS	# PARCELS FLOODED	IMPROVEMENT $ VALUE, FLOODED	LAND $ VALUE, FLOODED	FLOODED PARCELS W/ $0 VALUE
Residential (2)	2465 (53.3%)	$247,521,500.00	$125,025,343.00	0
Apartment (4C)	5 (31.3%)	$9,974,800.00	$5,355,200.00	0
Commercial (4A)	61 (33.3%)	$16,811,300.00	$10,388,000.00	0
Industrial (4B)	3 (100%)	$82,952,900.00	$34,161,600.00	0
Farm Total (3A & 3B)	118 (72.3%)	$238,900.00	$1,019,300.00	56
Public and School Property (15A, 15B, 15C)	379 (81.5%)	$27,470,600.00	$17,633,200.00	57
Church & Charitable (15D)	16 (43.2%)	$8,779,200.00	$1,406,800.00	0
Other Exempt (15F)	21 (48.8%)	$2,498,300.00	$982,400.00	0
Vacant (1)	485 (73.5%)	$0.00	$10,958,000.00	1
TOTAL	**3553**	**$396,247,500.00**	**$206,929,843.00**	**114**



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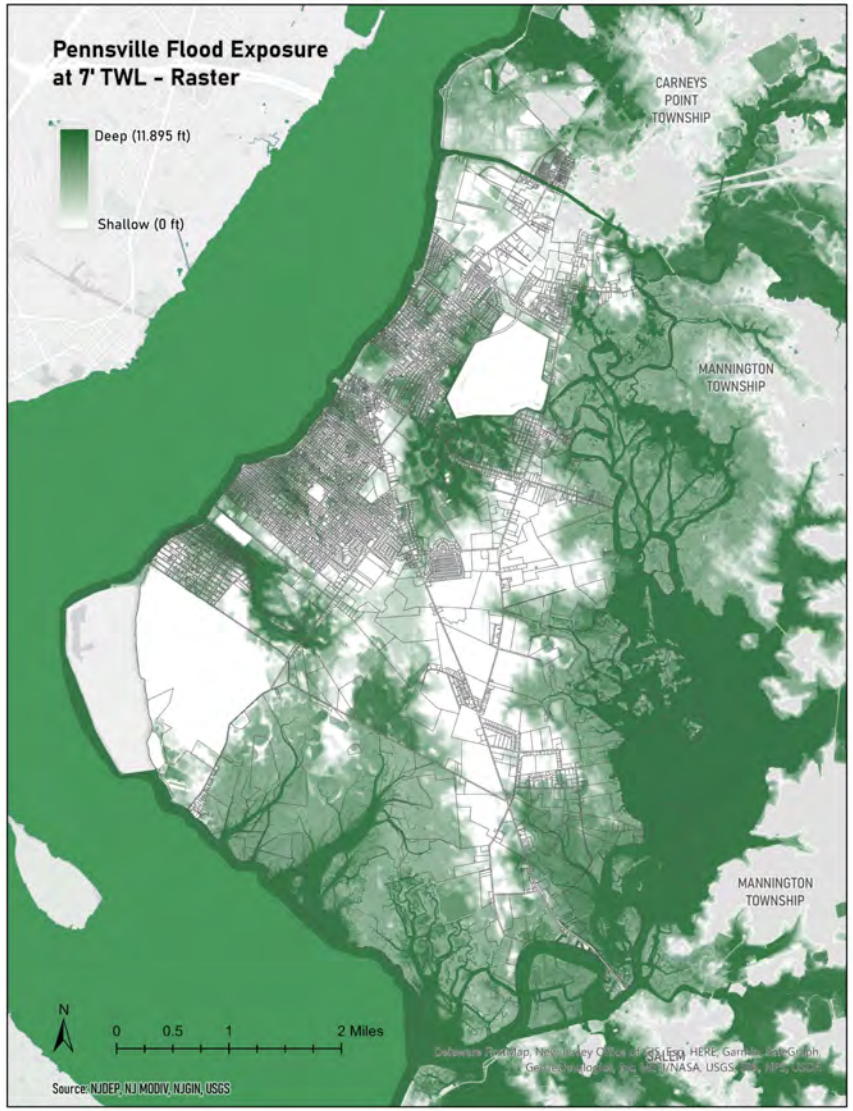
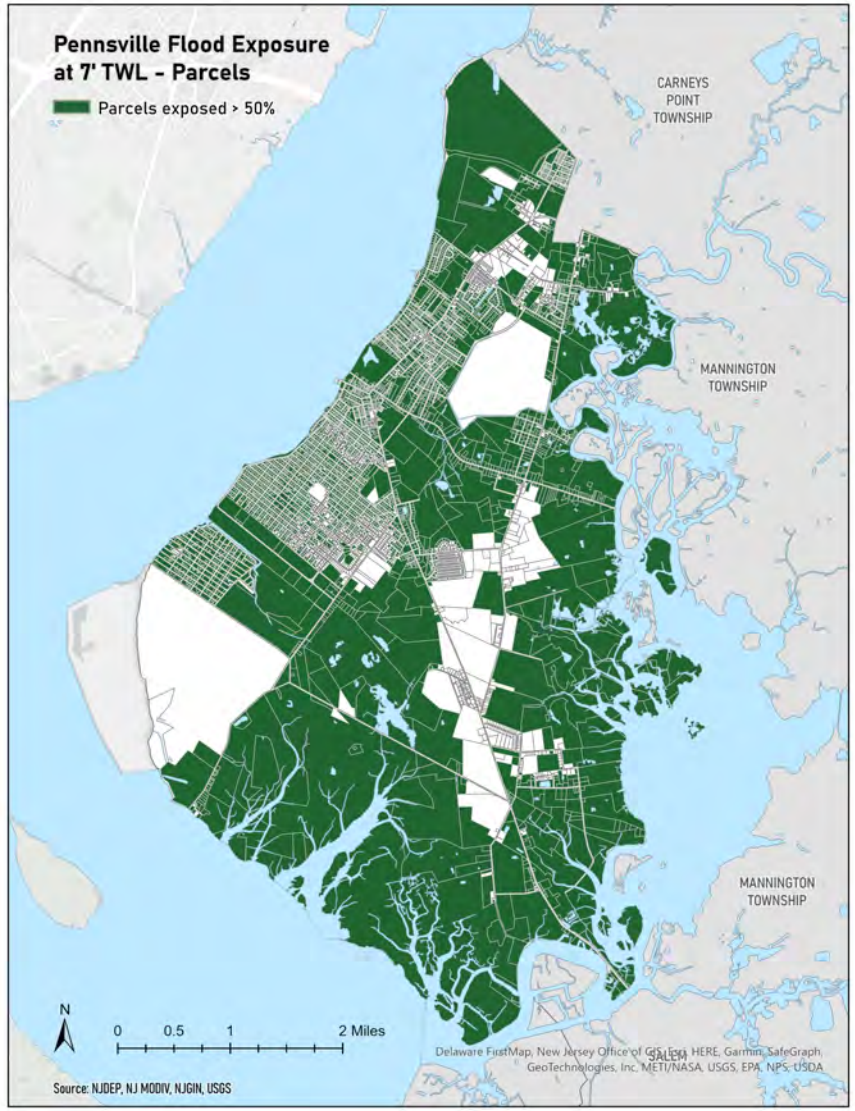
7' TWL





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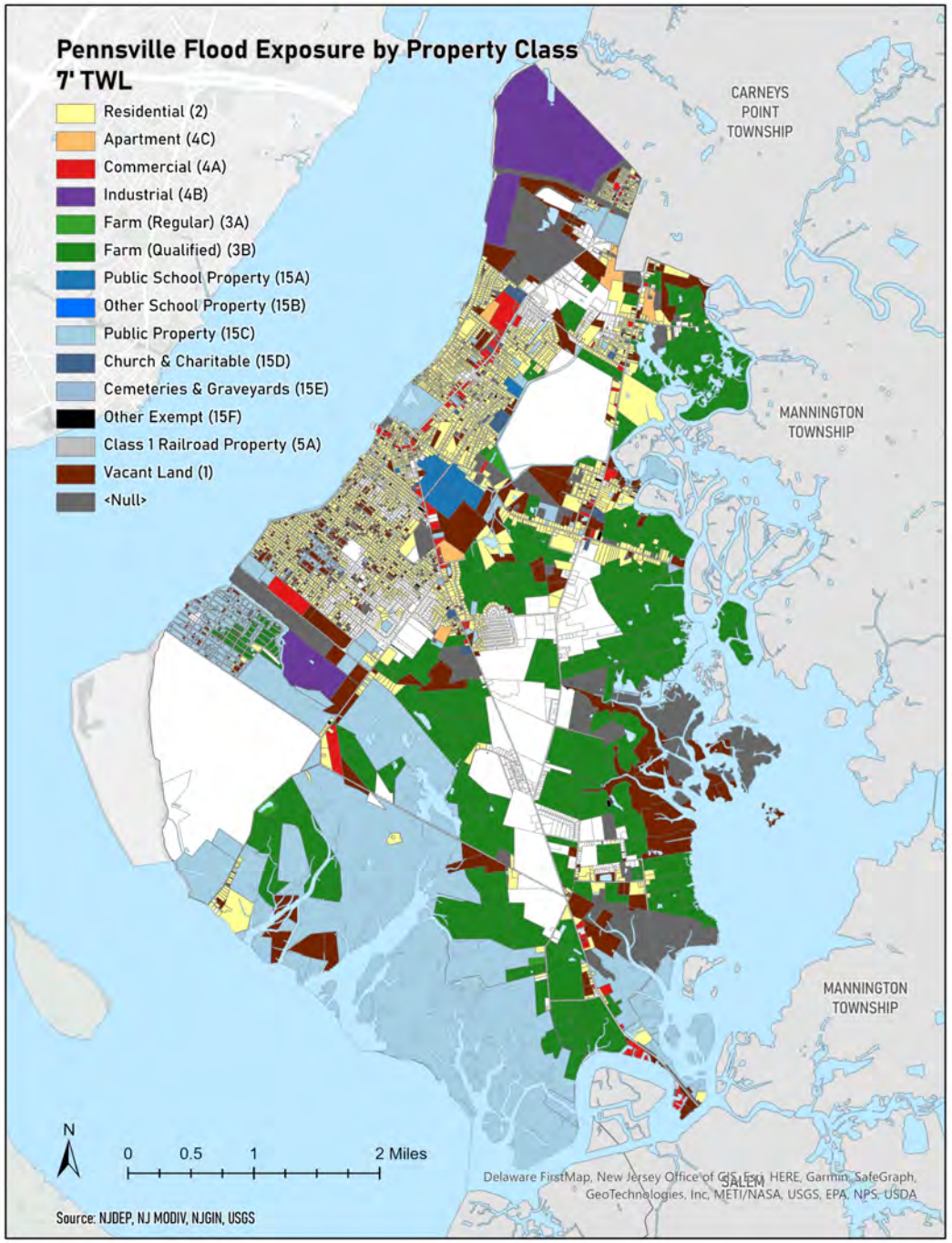
7' TWL Land Parcels

PROPERTY CLASS	# PARCELS FLOODED	IMPROVEMENT $ VALUE, FLOODED	LAND $ VALUE, FLOODED	FLOODED PARCELS W/ $0 VALUE
Residential (2)	3520 (76.2%)	$358,786,200.00	$175,336,143.00	0
Apartment (4C)	12 (75.0%)	$13,163,200.00	$7,966,900.00	0
Commercial (4A)	128 (69.9%)	$35,654,000.00	$20,411,700.00	0
Industrial (4B)	3 (100%)	$82,952,900.00	$34,161,600.00	0
Farm Total (3A & 3B)	140 (85.9%)	$599,000.00	$1,350,600.00	59
Public and School Property (15A, 15B, 15C)	441 (95.7%)	$48,154,100.00	$23,510,600.00	65
Church & Charitable (15D)	26 (70.3%)	$12,544,600.00	$2,453,100.00	0
Cemeteries & Graveyards (15E)	2 (66.7%)	$0.00	$104,800.00	0
Other Exempt (15F)	29 67.4%)	$3,533,600.00	$1,561,700.00	0
Class I Railroad Property (5A)	2 (100%)	$0.00	$152,100.00	0
Vacant (1)	580 (87.9%)	$0.00	$16,163,532.00	1
TOTAL	**4883**	**$555,387,600.00**	**$283,172,775.00**	**125**



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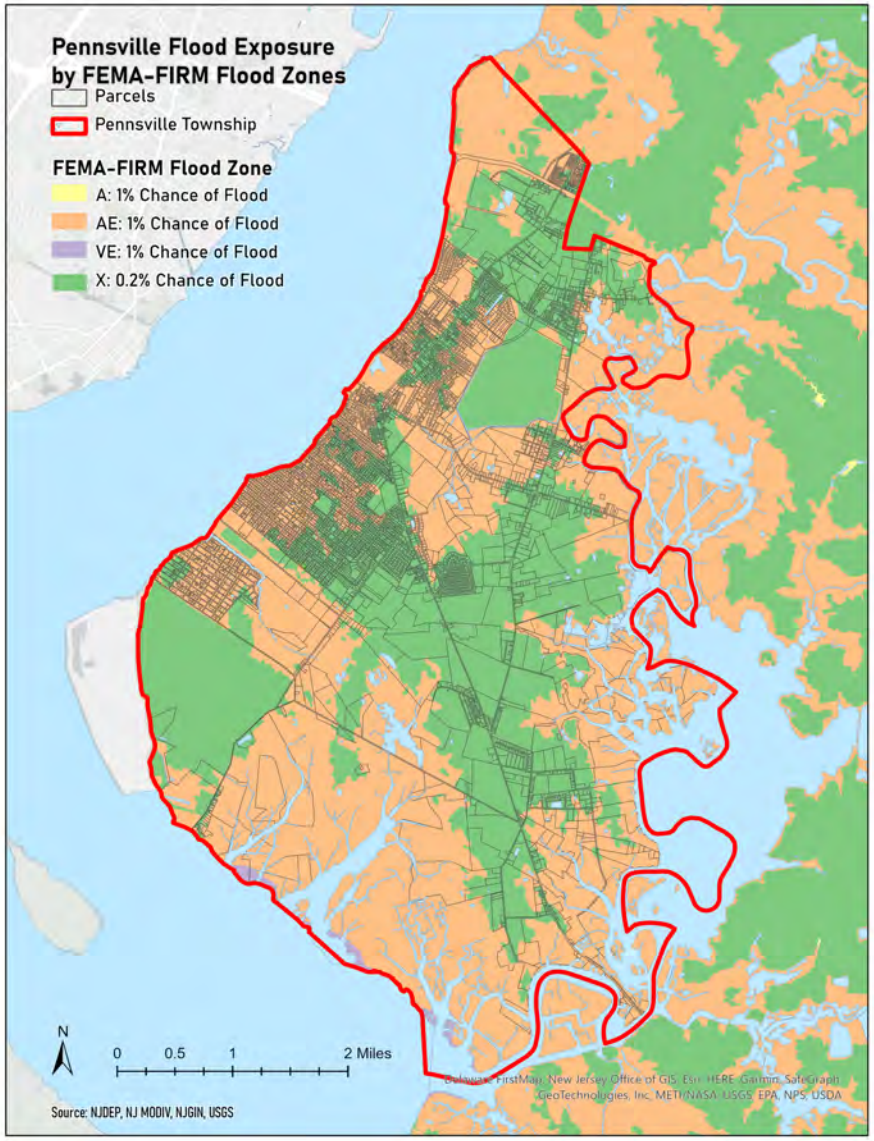
FEMA FIRM Flood Zones



- Flood zones are geographic areas that the FEMA has defined according to varying levels of flood risk.
- These zones are depicted on a community's Flood Insurance Rate Map (FIRM) or Flood Hazard Boundary Map.
- Each zone reflects the severity or type of flooding in the area.
- Flood Zones include A, AE, VE which are 1% chance of flood zones (High Risk Zones), the X-500 or the 0.2% chance of flood (Low Risk Zone) , and X which is the least risk zone

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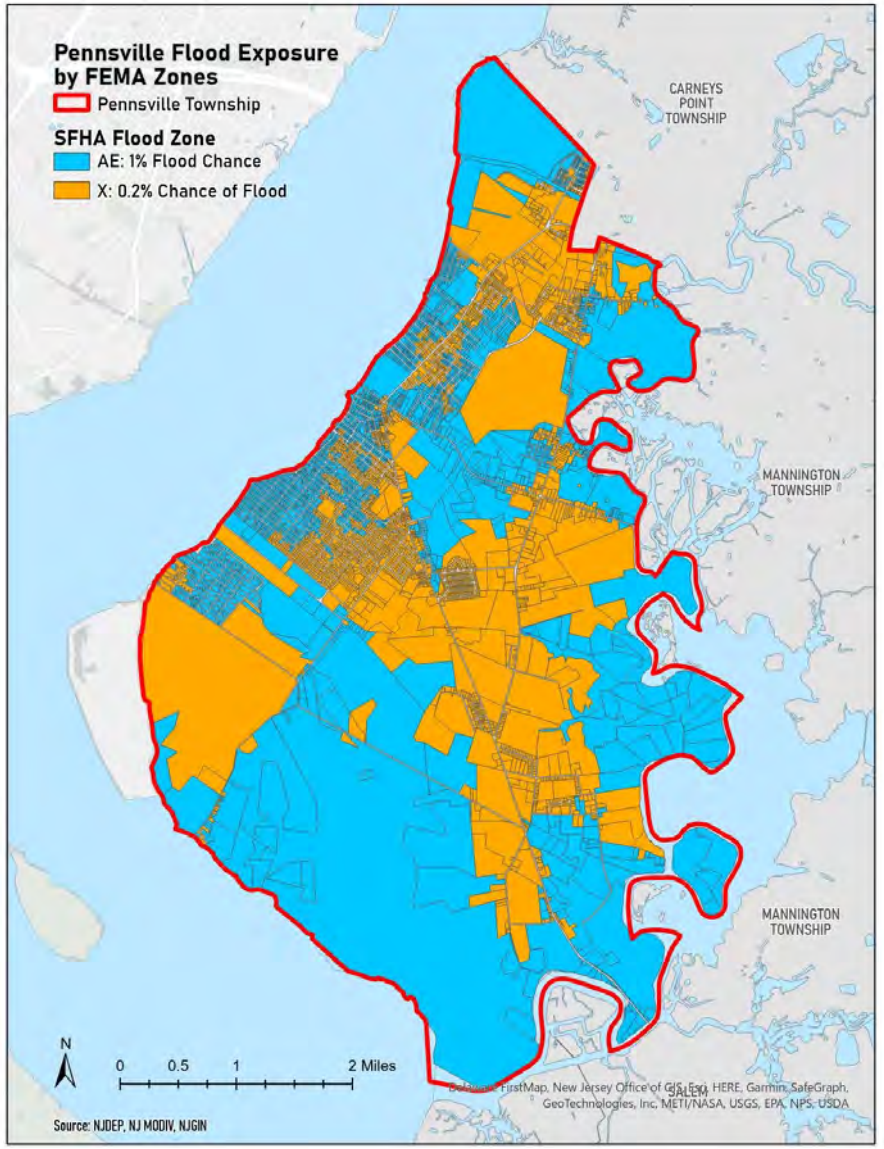
100-Year (1%) and 500-Year (0.2%) Event Parcels



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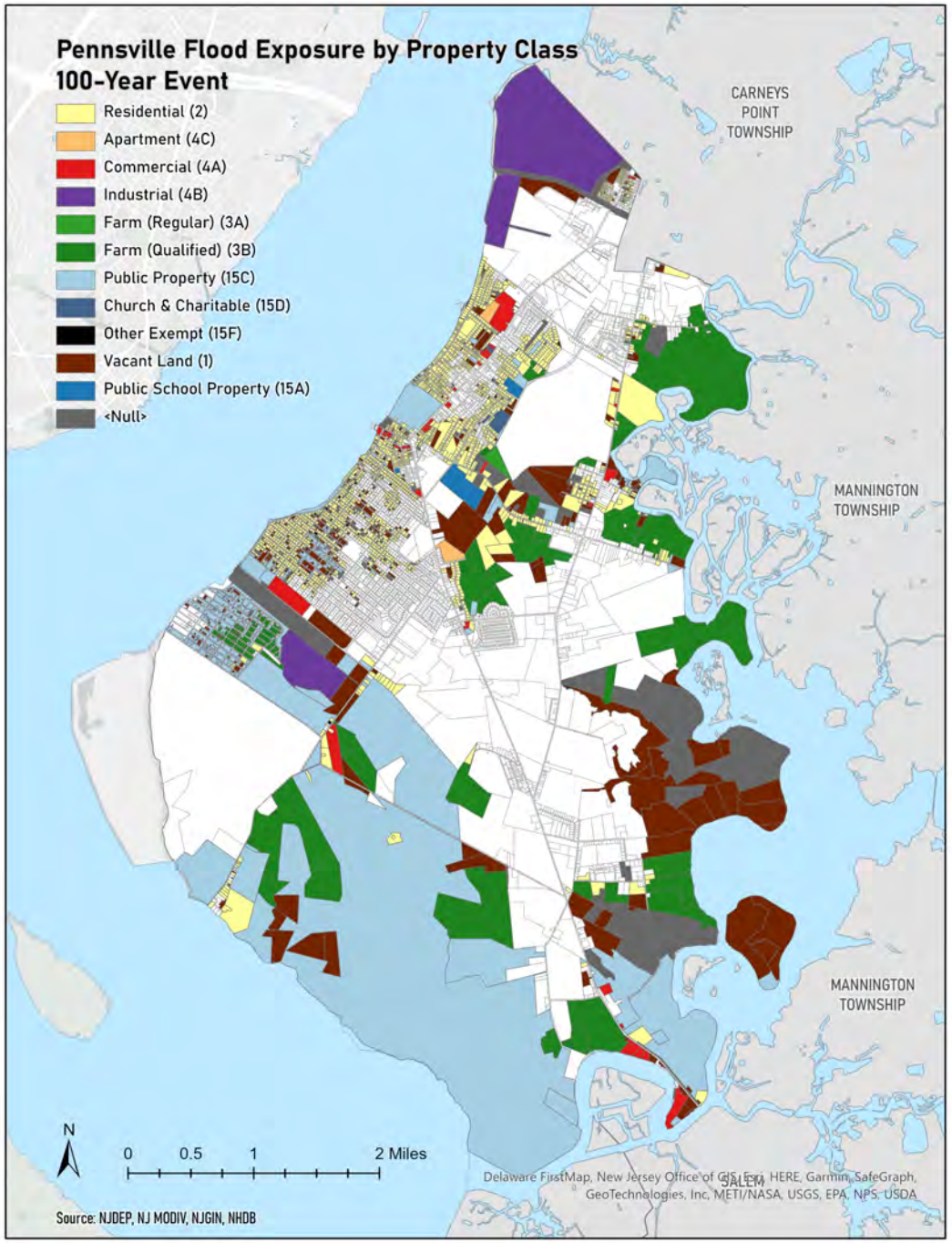
100-Year (1%) Event

PROPERTY CLASS	# PARCELS FLOODED	IMPROVEMENT $ VALUE, FLOODED	LAND $ VALUE, FLOODED	FLOODED PARCELS W/ $0 VALUE
Residential (2)	2179 (64.1%)	$220,356,200.00	$112,664,143.00	0
Apartment (4C)	3 (18.8%)	$8,387,500.00	$4,219,800.00	0
Commercial (4A)	46 (25.1%)	$14,308,400.00	$8,346,700.00	0
Industrial (4B)	3 (100%)	$82,952,900.00	$34,161,600.00	0
Farm Total (3A & 3B)	94 (57.7%)	$238,900.00	$559,100.00	58
Public and School Property (15A, 15B, 15C)	372 (80%.0)	$16,682,300.00	$15,684,500.00	60
Church & Charitable (15D)	10 (27%)	$4,974,700.00	$567,200.00	0
Other Exempt (15F)	17 (39.5%)	$1,737,000.00	$781,800.00	0
Vacant (1)	425 (64.4%)	$0.00	$8,997,100.00	1
TOTAL	**3149**	**$349,637,900.00**	**$185,981,943.00**	**119**



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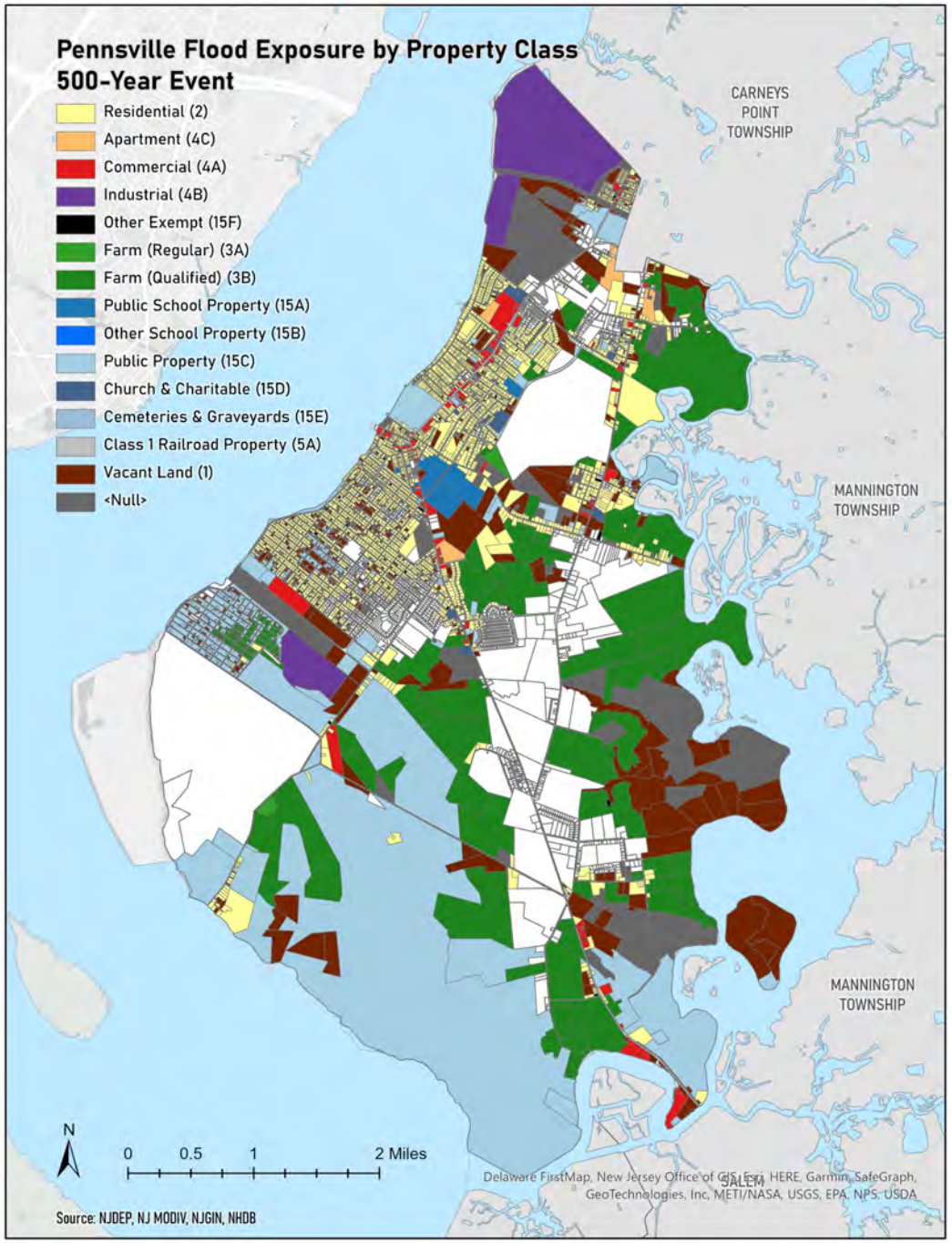
500-Year (0.2%) Event

PROPERTY CLASS	# PARCELS FLOODED	IMPROVEMENT $ VALUE, FLOODED	LAND $ VALUE, FLOODED	FLOODED PARCELS W/ $0 VALUE
Residential (2)	3399 (73.5%)	$344,423,500.00	$169,394,743.00	0
Apartment (4C)	12 (75%)	$11,491,600.00	$6,575,400.00	0
Commercial (4A)	129 (70.5%)	$34,260,100.00	$19,835,100.00	0
Industrial (4B)	3 (100%)	$82,952,900.00	$34,161,600.00	0
Farm Total (3A & 3B)	126 77.3%)	$481,700.00	$1,160,000.00	59
Public and School Property (15A, 15B, 15C)	433 (93.1%)	$48,172,300.00	$23,235,700.00	66
Church & Charitable (15D)	26 (70.3%)	$12,032,500.00	$2,364,200.00	0
Cemeteries & Graveyards (15E)	2 (66.7%)	$0.00	$104,800.00	0
Other Exempt (15F)	29 (67.4%)	$3,635,500.00	$1,548,900.00	0
Class I Railroad Property (5A)	2 (100%)	$0.00	$152,100.00	0
Vacant (1)	573 (86.8%)	$0.00	$15,902,732.00	1
TOTAL	**4734**	**$537,450,100.00**	**$274,435,275.00**	**126**



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Hurricane Sandy

Data Overview, Extent of Flooding, 4' TWL Analysis

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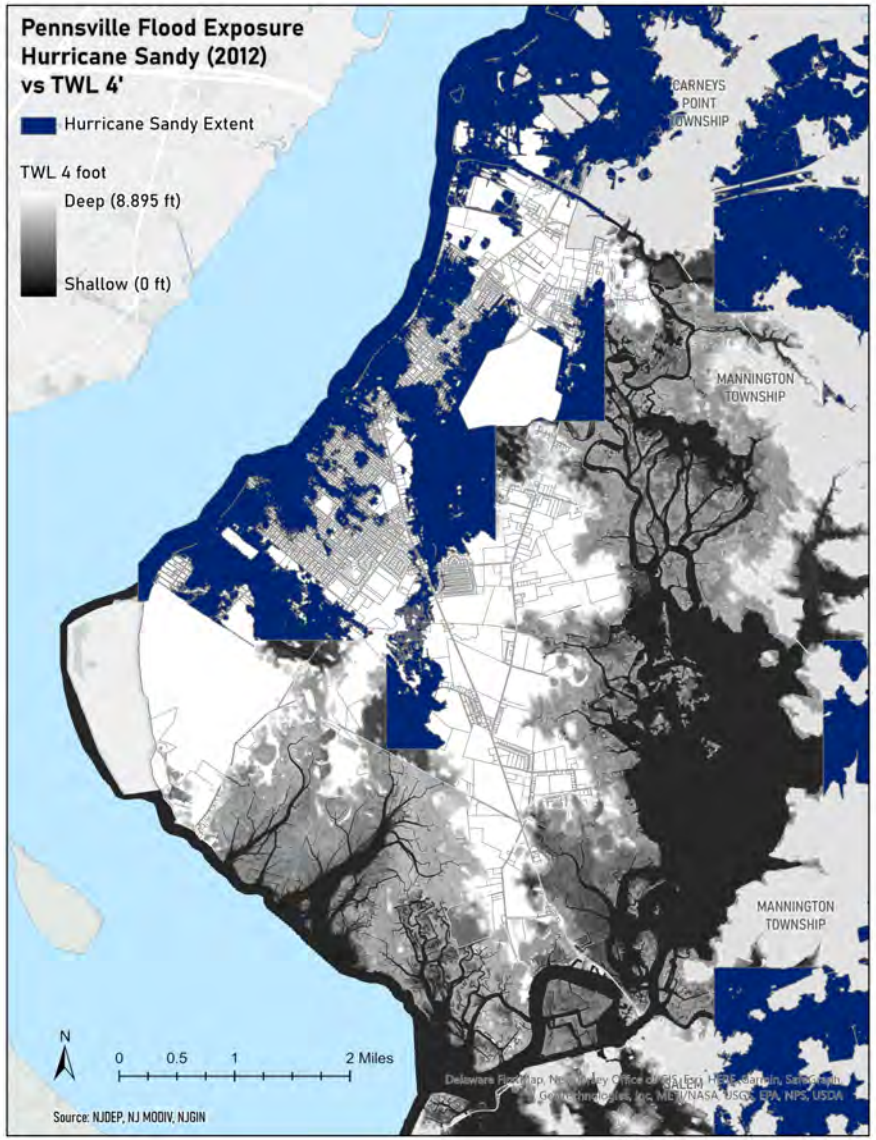
4' TWL vs. Sandy Data



- Sandy data improperly digitized
- Used 4' TWL data as a proxy

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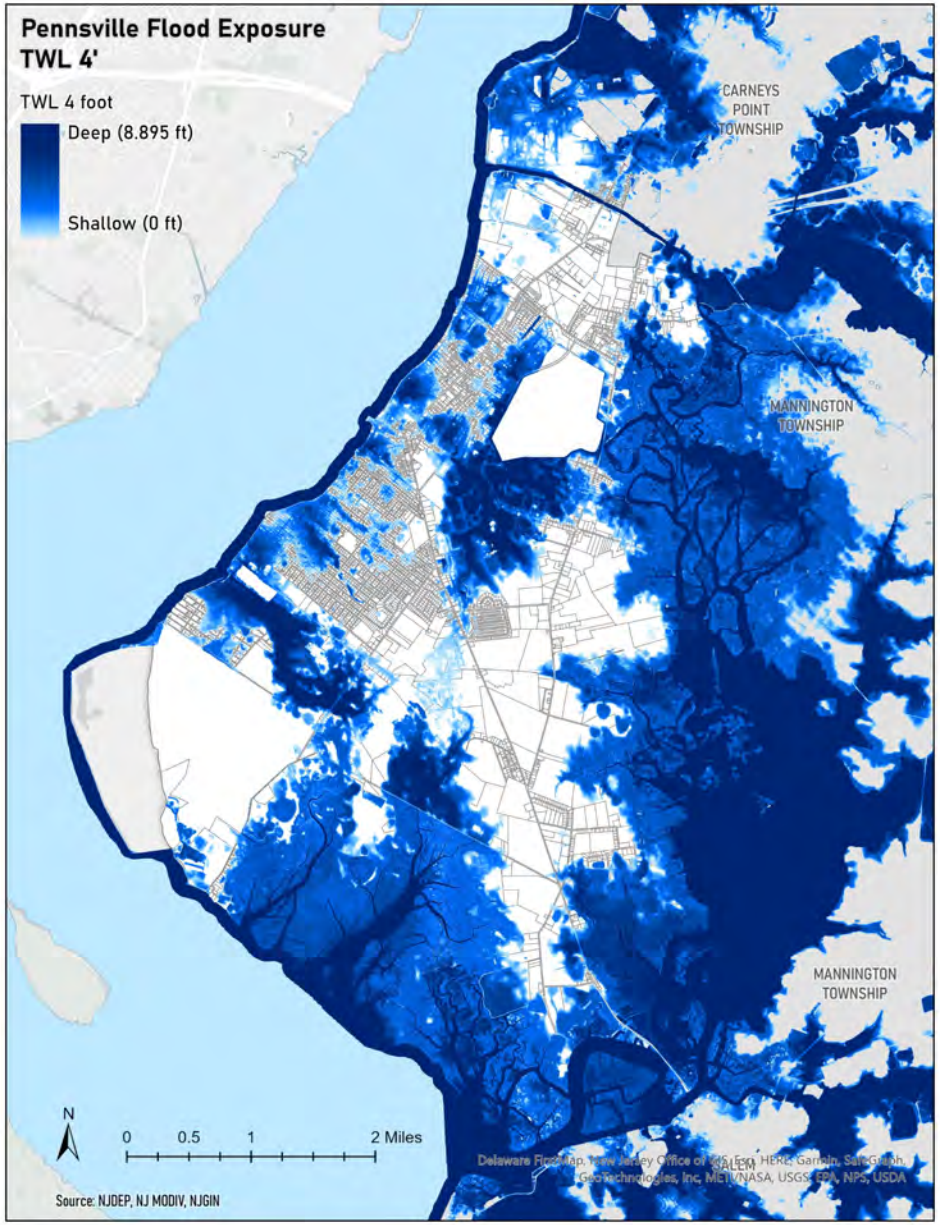
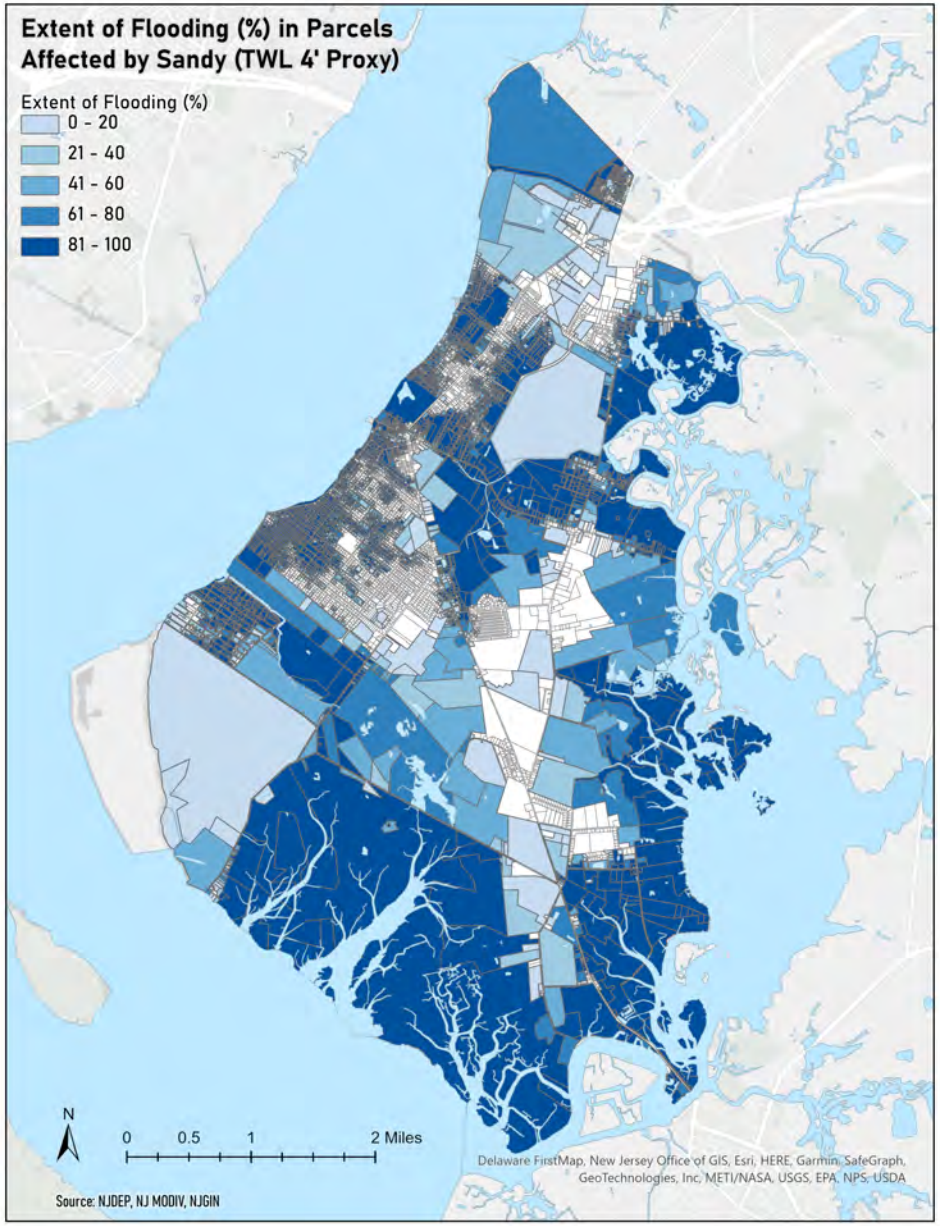
Extent of Flooding TWL 4' (Sandy Proxy)





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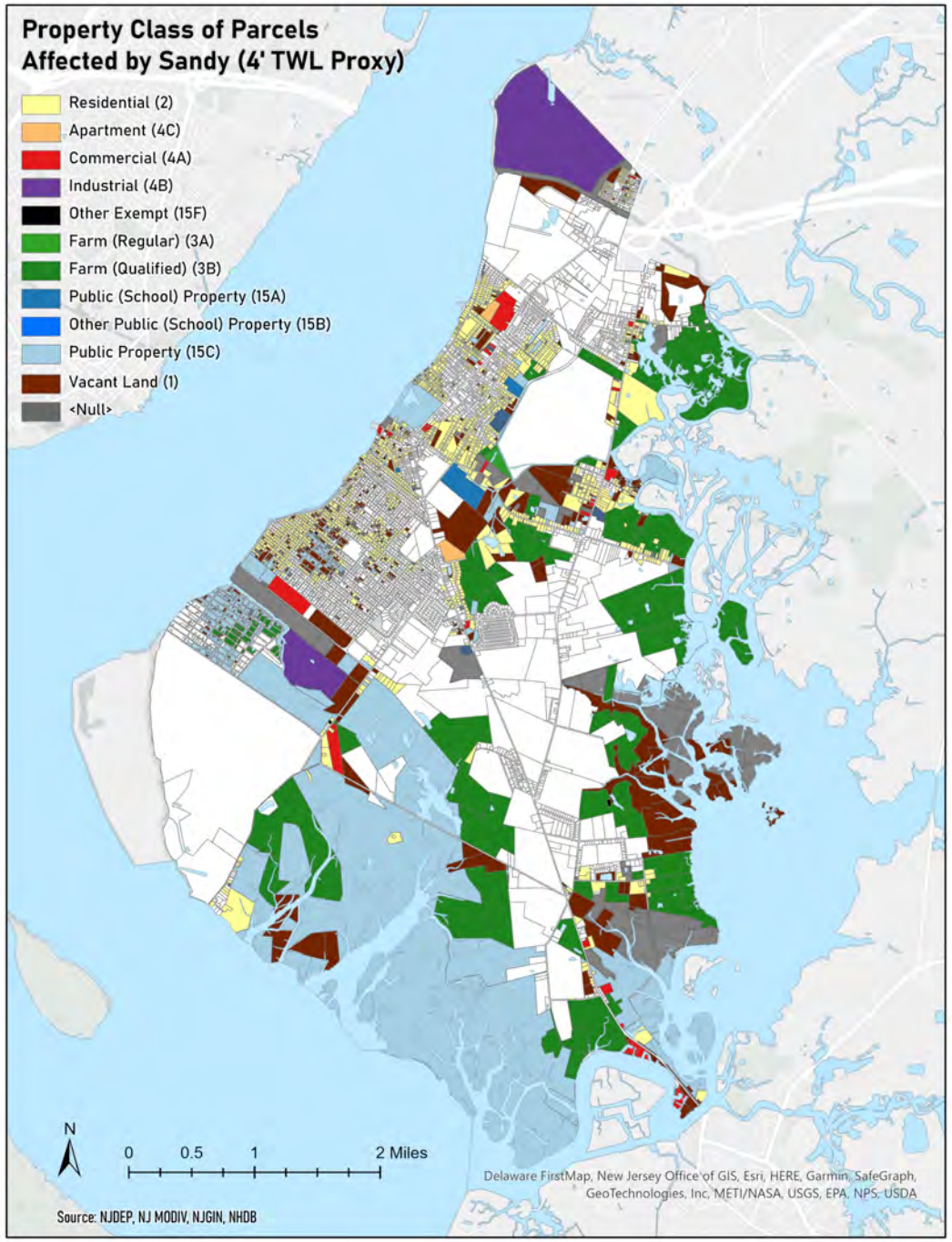
TWL 4' Event

PROPERTY CLASS	# PARCELS FLOODED	IMPROVEMENT VALUE, FLOODED	LAND VALUE, FLOODED
Residential (2)	1831	$182,510,900.00	$93,896,575.00
Apartment (4C)	3	$8,387,500.00	$4,219,800.00
Commercial (4A)	40	$10,639,200.00	$7,358,600.00
Industrial (4B)	2	$81,952,900.00	$24,229,000.00
Farm Total (3A & 3B)	96	$238,900.00	$730,900.00
School and School Property (15A, 15B, 15C)	328	$15,526,300.00	$14,939,700.00
Church & Charitable (15D)	8	$4,227,100.00	$923,500.00
Other Exempt (15F)	13	$1,365,700.00	$583,000.00
Vacant (1)	398	$0.00	$8,944,100.00
TOTAL	**2719**	**$304,848,500.00**	**$155,825,175.00**



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Pennsville Bulkhead Analysis

Extent of Flooding, 7', 8', 9' Parcel Analyses

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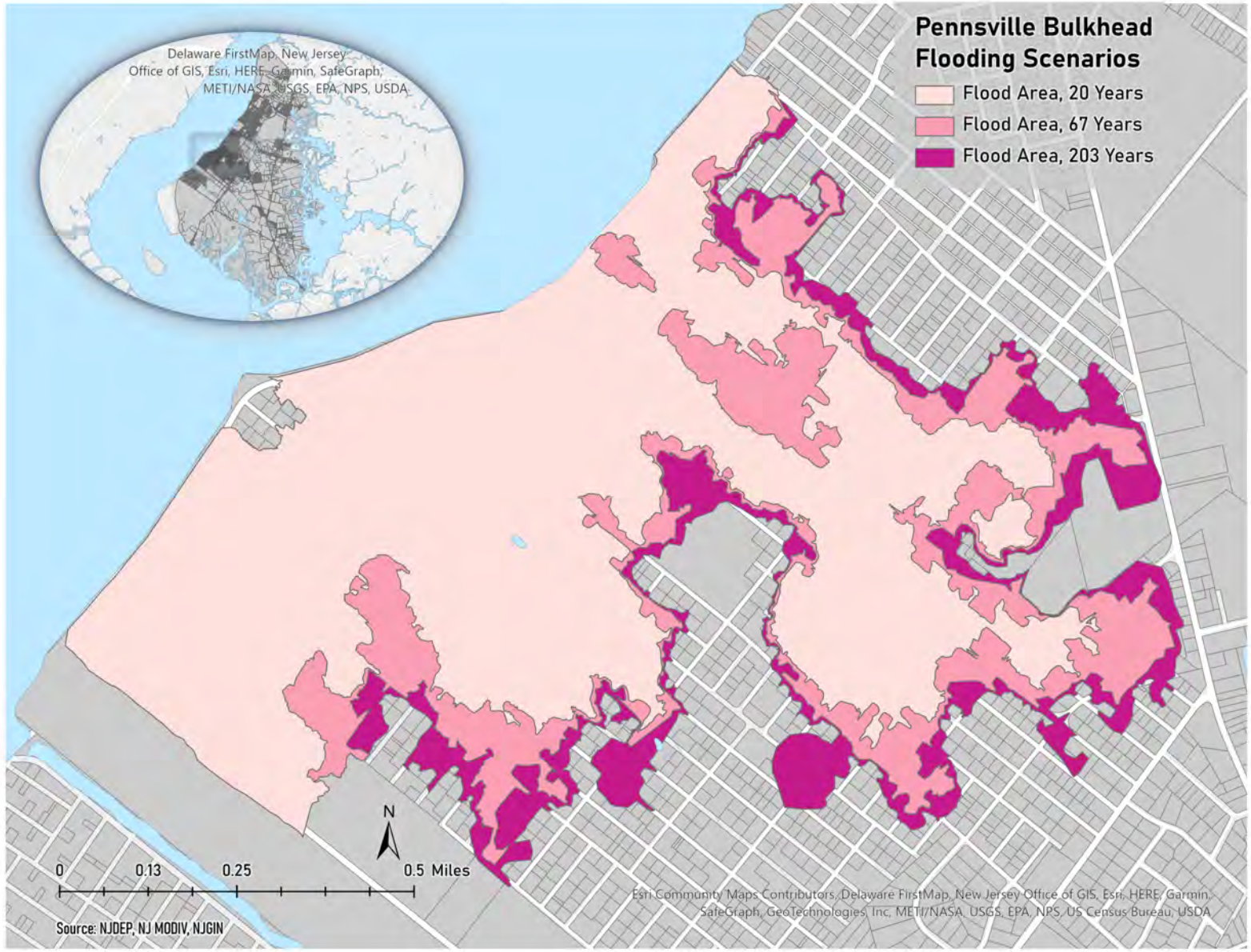
Pennsville Bulkhead Flood Events (7', 8', 9')

- Analysis conducted at request of township



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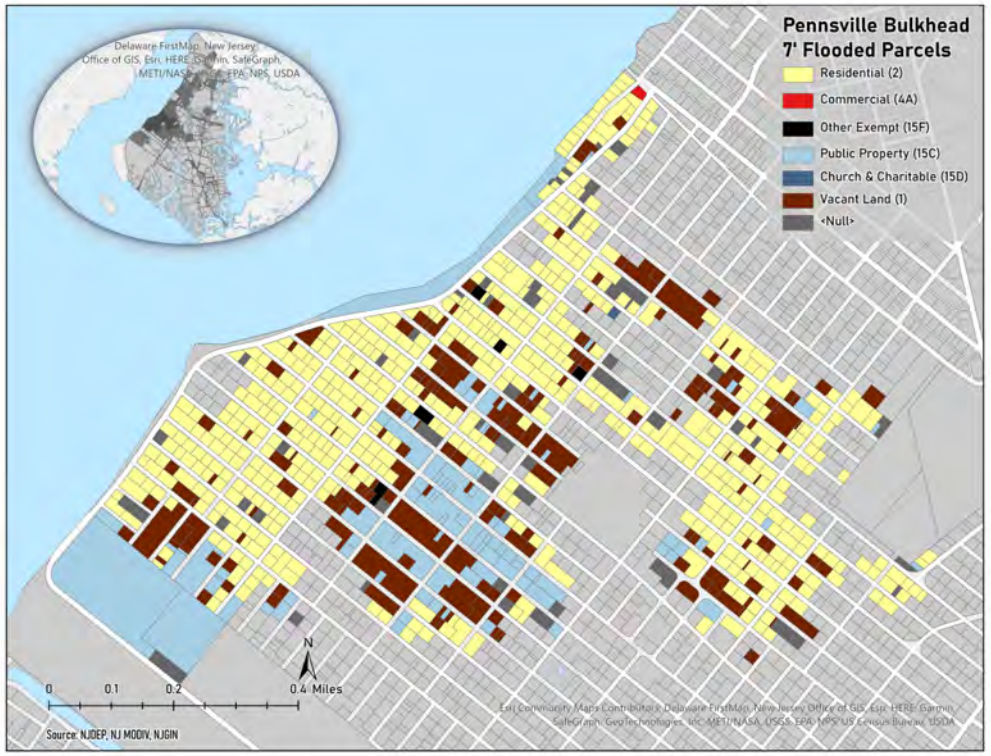
Pennsville Bulkhead 20-Year Event / 7' TWL



PROPERTY CLASS	# PARCELS FLOODED	IMPROVEMENT VALUE	LAND VALUE	FLOODED PARCELS W/ $0 VALUE
Residential (2)	555	$54,251,700.00	$27,068,300.00	0
Commercial (4A)	1	$169,500.00	$50,600.00	0
School and Public Property (15A, 15B, 15C)	95	$590,100.00	$3,174,500.00	0
Church & Charitable (15D)	1	$116,600.00	$46,000.00	0
Other Exempt (15F)	5	$509,100.00	$245,700.00	0
Vacant (1)	183	$0.00	$3,053,200.00	0
NULL	69	$0.00	$0.00	69
TOTAL	**909**	**$55,637,000.00**	**$33,638,300.00**	**69**

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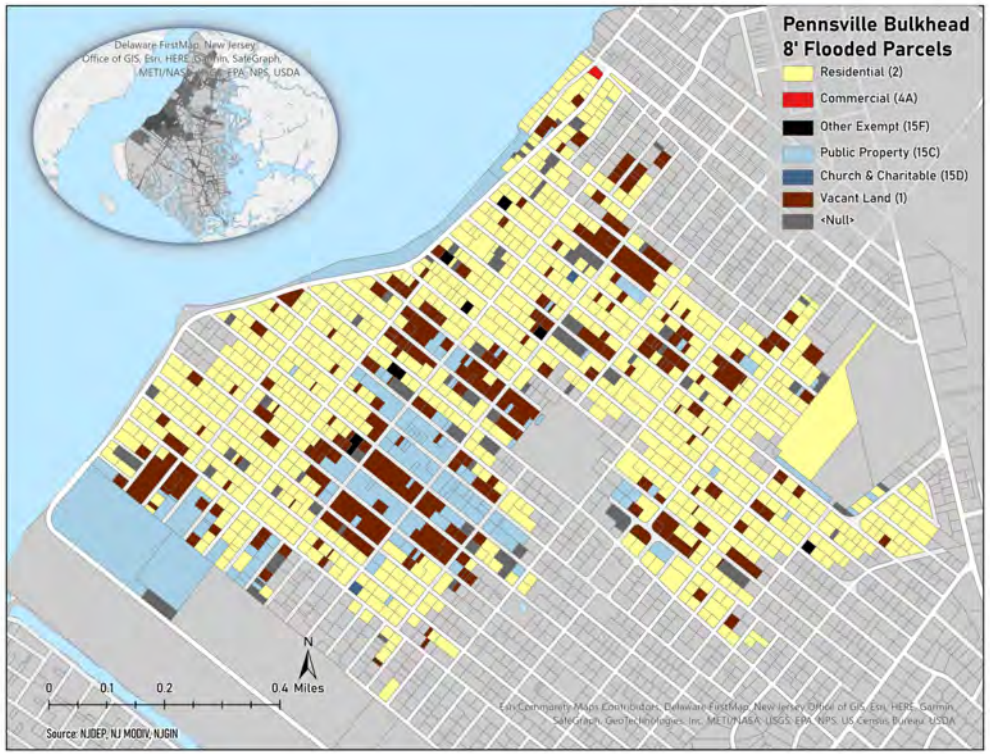
Pennsville Bulkhead 67-Year Event / 8' TWL



PROPERTY CLASS	# PARCELS FLOODED	IMPROVEMENT VALUE	LAND VALUE	PARCELS W/ $0 VALUE
Residential (2)	815	$81,347,300.00	$39,653,900.00	0
Commercial (4A)	1	$169,500.00	$50,600.00	0
School and Public Property (15A, 15B, 15C)	110	$590,100.00	$3,457,800.00	0
Church & Charitable (15D)	2	$272,900.00	$96,000.00	0
Other Exempt (15F)	7	$726,900.00	$345,700.00	0
Vacant (1)	228	$0.00	$3,762,000.00	0
NULL	91	$0.00	$0.00	91
TOTAL	**1254**	**$83,106,700.00**	**$47,366,000.00**	91

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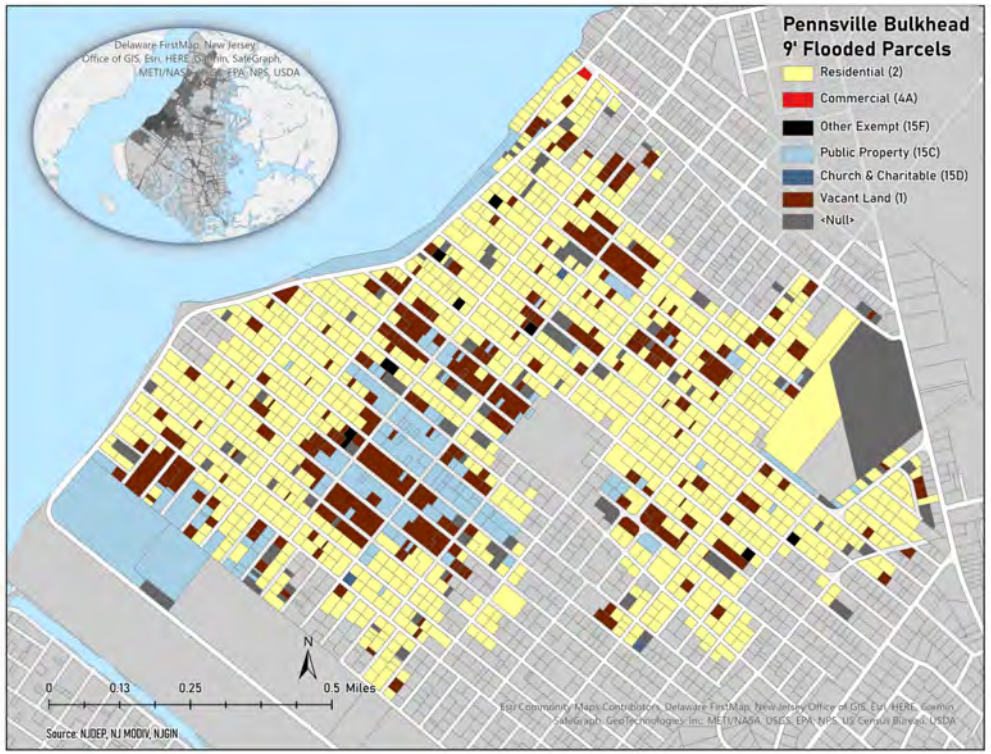
Pennsville Bulkhead 203-Year Event / 9' TWL



PROPERTY CLASS	# PARCELS FLOODED	IMPROVEMENT VALUE	LAND VALUE	PARCELS W/ $0 VALUE
Residential (2)	957	$95,812,400.00	$46,418,800.00	0
Commercial (4A)	1	$169,500.00	$50,600.00	0
School and Public Property (15A, 15B, 15C)	112	$590,100.00	$3,470,800.00	0
Church & Charitable (15D)	3	$345,300.00	$146,000.00	0
Other Exempt (15F)	8	$811,900.00	$395,700.00	0
Vacant (1)	246	$0.00	$4,115,300.00	0
NULL	115	$0.00	$0.00	115
TOTAL	**1442**	**$97,729,200.00**	**$54,597,200.00**	115

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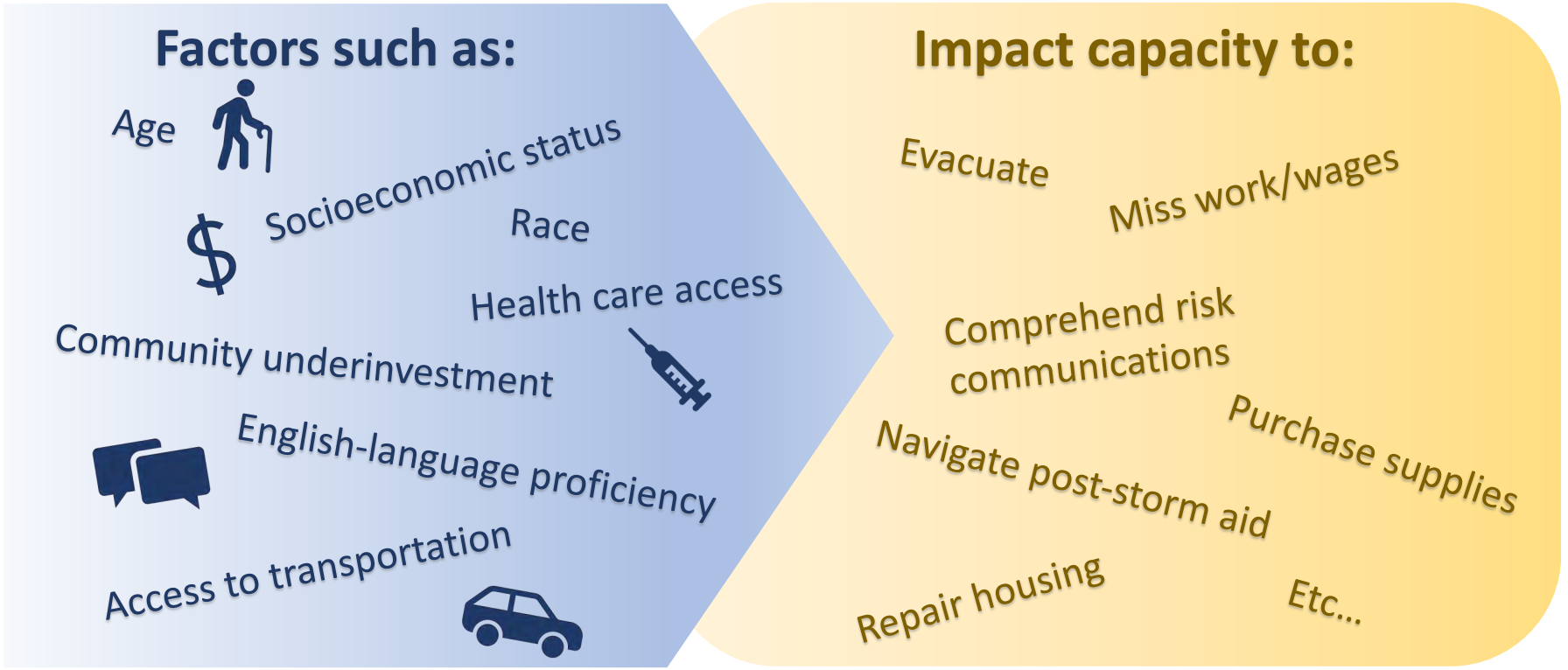
Social Vulnerability Index (SVI) Concept

- Some people are disproportionately impacted by flooding. socio-economic
- Existing factors make it harder to prepare and/or recover.



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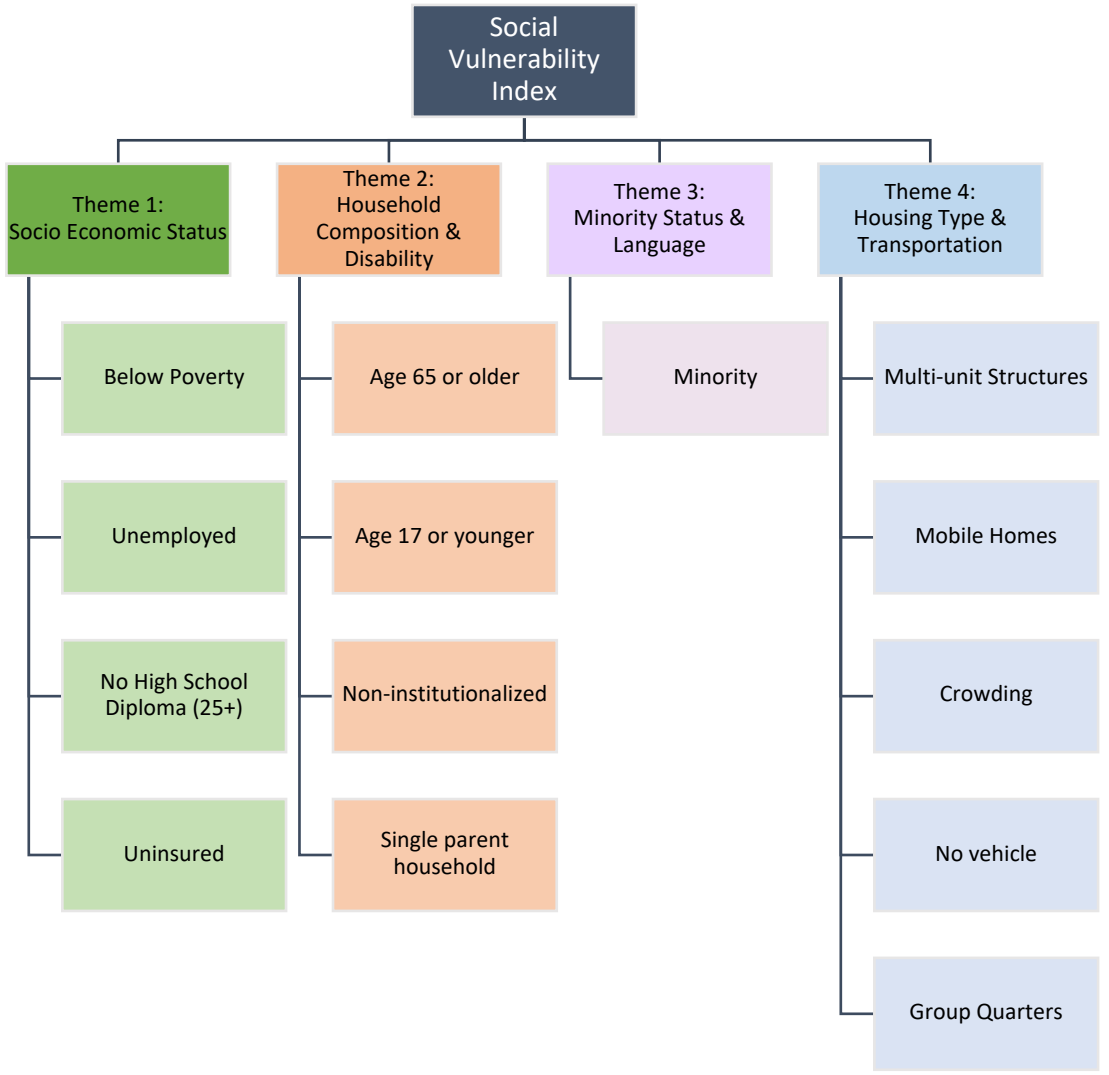
Social Vulnerability Index (SVI) Concept

- The Social Vulnerability Index (CDC/ATSDR SVI) is maintained by the **Geospatial Research, Analysis, and Services Program** (GRASP)
- Measures the social vulnerability of US communities to disasters, including natural disasters, disease outbreaks, and public health emergencies.
- The percentile ranking values range from **0 to 1**, with higher values indicating greater vulnerability.
- SVI calculates a single vulnerability score for each community based on demographic, socioeconomic, and household/housing characteristics.
- Each tract receives a separate ranking for each of the four themes.



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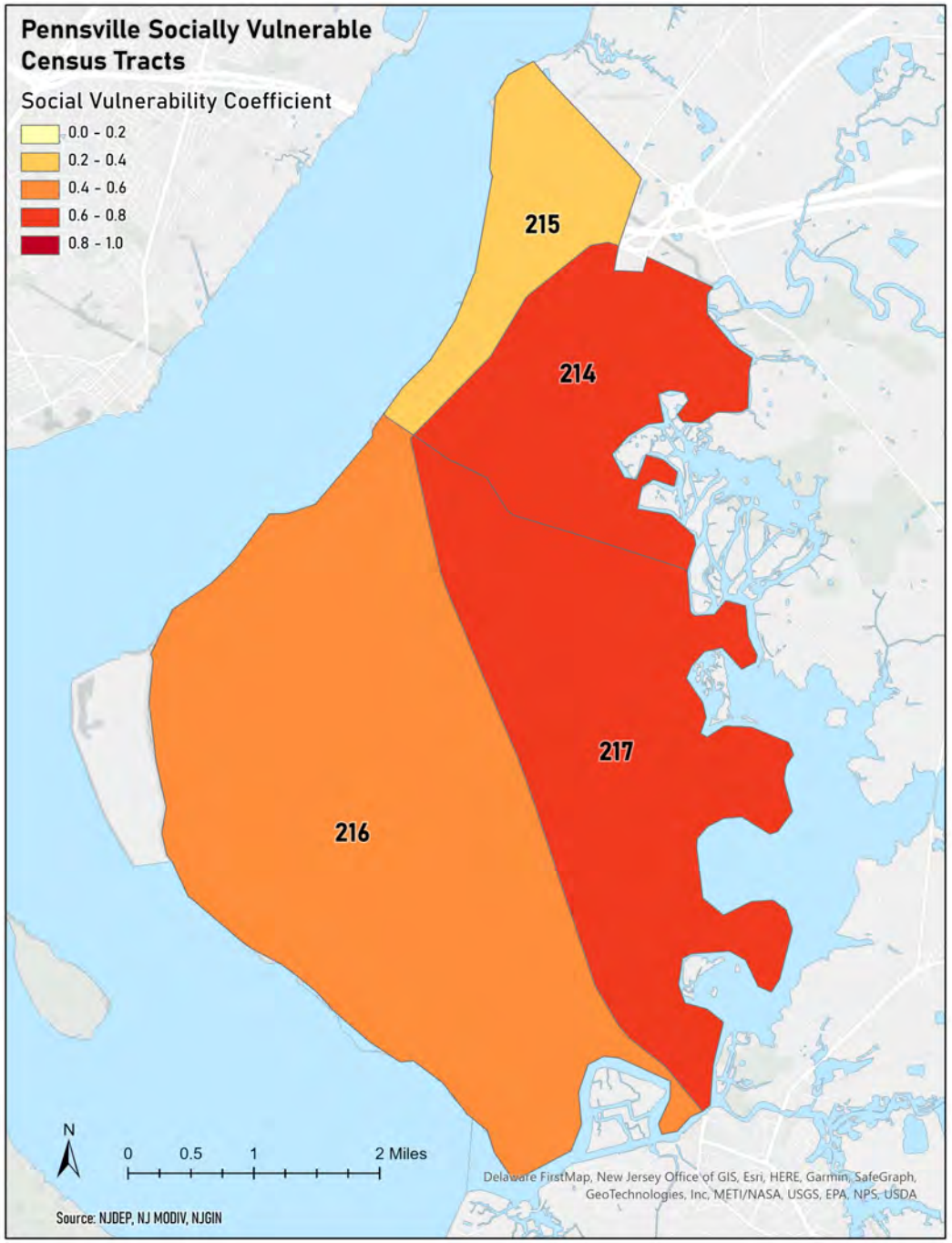
Social Vulnerability Index

Overall Social Vulnerability Index Scores for Pennsville by Census Tract:

- 214: 0.6234
- 215: 0.3905
- 216: 0.5739
- 217: 0.6465



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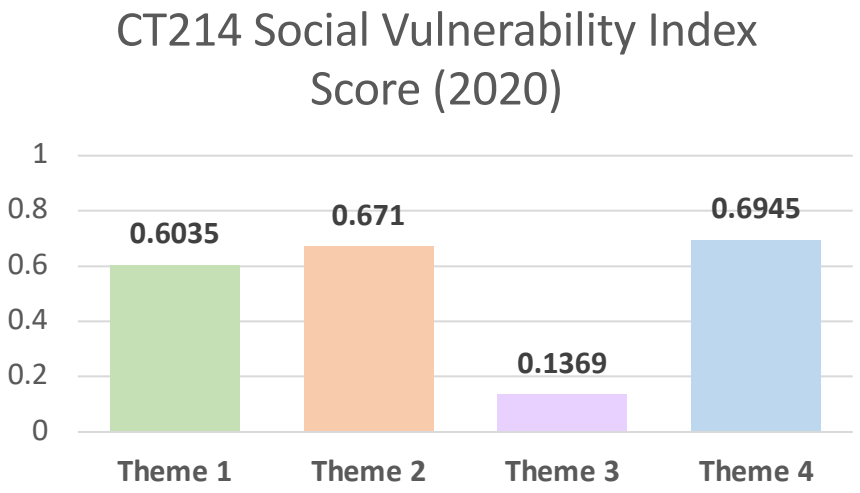
Social Vulnerability in Census Tract 214 - Pennsville

- Overall Social Vulnerability Index Score for Census Tract 214 in 2020 = 0.6234 (62.34 percentile)

(Source: CDC and ACS 5-year estimates 2016-20)

- **SVI Score = 0.6234** indicates a moderate level of vulnerability in the tract



Overall Social Vulnerability (Tract Level)	Themes	15 Variables (Census)	Estimate	Percentage	Percentile
	Theme 1: Socioeconomic Status	Below 150% Poverty	599	17.1%	0.6404
		Unemployed	112	6.2%	0.6188
		Housing-burdened units	336	24.3%	0.3628
		No High School Diploma (age 25+)	297	12.1%	0.7036
		Uninsured	180	5.2%	0.4866
	Theme 2: Household Characteristics	Age 65 or older	730	20.9%	0.8022
		Age 17 or younger	789	22.6%	0.5846
		Noninstitutionalized Disabled	527	15.1%	0.8295
		Single-parent Household	55	4%	0.4417
	Theme 3: Racial & Ethnic Minority Status	Minority	452	12.9%	0.1369
	Theme 4: Housing Type & Transportation	Multi-unit Structures	111	6.8%	0.4394
		Mobile Homes	235	14.5%	0.982
		Crowding	30	2.2%	0.5611
		No Vehicle	93	6.7%	0.5222
		Group Quarters	0	0	0.0

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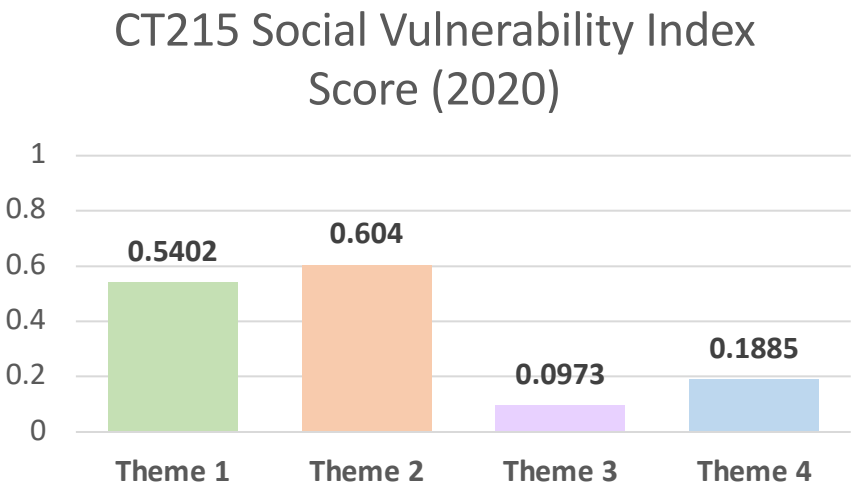
Social Vulnerability in Census Tract 215 – Pennsville

- Overall Social Vulnerability Index Score for Census Tract 215 in 2020 = 0.3905 (39.05 percentile)

(Source: CDC and ACS 5-year estimates 2016-20)

- SVI Score = 0.3905 indicates a low to moderate level of vulnerability in the tract



Overall Social Vulnerability (Tract Level)	Themes	15 Variables (Census)	Estimate	Percentage	Percentile
	Theme 1: Socioeconomic Status	Below 150% Poverty	274	14.8%	0.5888
		Unemployed	52	5.3%	0.5323
		Housing-burdened units	222	30.4%	0.2988
		No High School Diploma (age 25+)	58	4.4%	0.5901
		Uninsured	126	5.2%	0.4866
	Theme 2: Household Characteristics	Age 65 or older	265	14.3%	0.4375
		Age 17 or younger	389	21%	0.4707
		Noninstitutionalized Disabled	248	13.4%	0.7477
		Single-parent Household	57	7.8%	0.7118
	Theme 3: Racial & Ethnic Minority Status	Minority	193	10.4%	0.0973
	Theme 4: Housing Type & Transportation	Multi-unit Structures	86	10.6%	0.5459
		Mobile Homes	0	0%	0.0
		Crowding	0	0%	0.0
		No Vehicle	76	10.4%	0.4238
		Group Quarters	0	0	0.0

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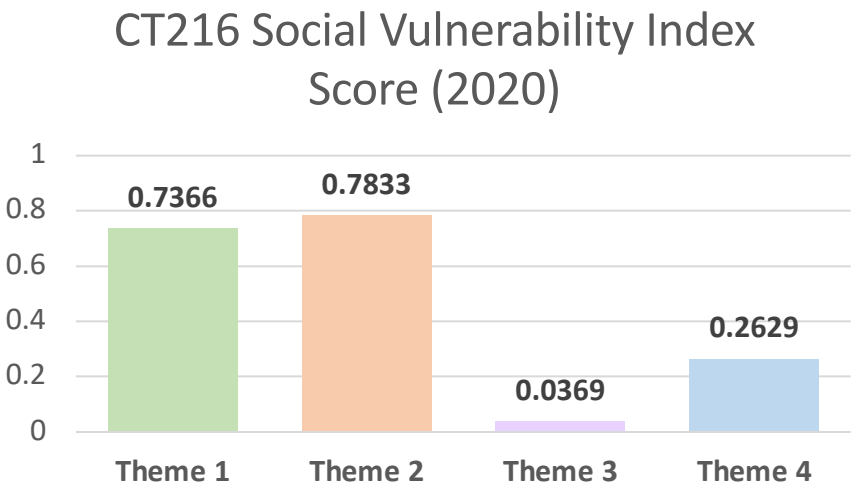
Social Vulnerability in Census Tract 216 – Pennsville

- Overall Social Vulnerability Index Score for Census Tract 216 in 2020 = 0.5739 (57.39 percentile)

(Source: CDC and ACS 5-year estimates 2016-20)

- **SVI Score = 0.5739** indicates a moderate level of vulnerability in the tract



Overall Social Vulnerability (Tract Level)	Themes	15 Variables (Census)	Estimate	Percentage	Percentile
	Theme 1: Socioeconomic Status	Below 150% Poverty	1300	26.1%	0.7916
		Unemployed	177	7.5%	0.7301
		Housing-burdened units	857	41%	0.7796
		No High School Diploma (age 25+)	426	11.3%	0.6796
		Uninsured	210	4.2%	0.403
	Theme 2: Household Characteristics	Age 65 or older	1152	23.1%	0.8598
		Age 17 or younger	1064	21.3%	0.4878
		Noninstitutionalized Disabled	672	13.5%	0.756
		Single-parent Household	127	6.1%	0.6183
	Theme 3: Racial & Ethnic Minority Status	Minority	295	5.9%	0.0369
	Theme 4: Housing Type & Transportation	Multi-unit Structures	288	11.6%	0.5735
		Mobile Homes	0	0%	0.0
		Crowding	25	1.2%	0.4265
		No Vehicle	102	4.9%	0.4238
		Group Quarters	0	0%	0.0

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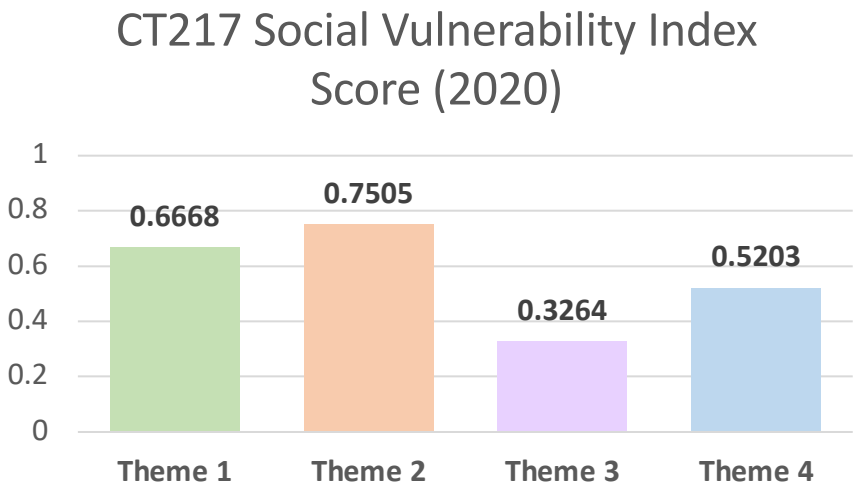
Social Vulnerability in Census Tract 217 - Pennsville

- Overall Social Vulnerability Index Score for Census Tract 217 in 2020 = 0.6465 (64.65 percentile)

(Source: CDC and ACS 5-year estimates 2016-20)

- **SVI Score = 0.6465** indicates a moderate level of vulnerability in the tract



Overall Social Vulnerability (Tract Level)	Themes	15 Variables (Census)	Estimate	Percentage	Percentile
	Theme 1: Socioeconomic Status	Below 150% Poverty	303	14	0.5662
		Unemployed	98	8.3	0.7745
		Housing-burdened units	424	41.8	0.7907
		No High School Diploma (age 25+)	137	8	0.5376
		Uninsured	99	4.6	0.4413
	Theme 2: Household Characteristics	Age 65 or older	502	23.2	0.8612
		Age 17 or younger	281	13	0.0788
		Noninstitutionalized Disabled	599	27.9	**0.9871***
		Single-parent Household	42	4.1	0.4514
	Theme 3: Racial & Ethnic Minority Status	Minority	532	24.5	0.3264
	Theme 4: Housing Type & Transportation	Multi-unit Structures	257	24.2	0.7796
		Mobile Homes	0	0	0
		Crowding	43	4.2	0.7132
		No Vehicle	92	9.1	0.6104
		Group Quarters	0	0	0

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Overburdened Communities

An Overburdened Community (OBC), as defined by the law, is any census block group, as determined by the most recent United States Census, in which:

1. **at least** 35 percent of the households qualify as low-income households (at or below twice the poverty threshold as determined by the United States Census Bureau);
2. **at least** 40 percent of the residents identify as minority or as members of a State recognized tribal community; or
3. **at least** 40 percent of the households have limited English proficiency (without an adult that speaks English "very well," according to the United States Census Bureau).

New Jersey's Environmental Justice Law (N.J.S.A. 13:1D-157) passed on **September 18, 2020**, requires NJDEP **to assess the impact of facilities on overburdened communities'** environmental and public health.

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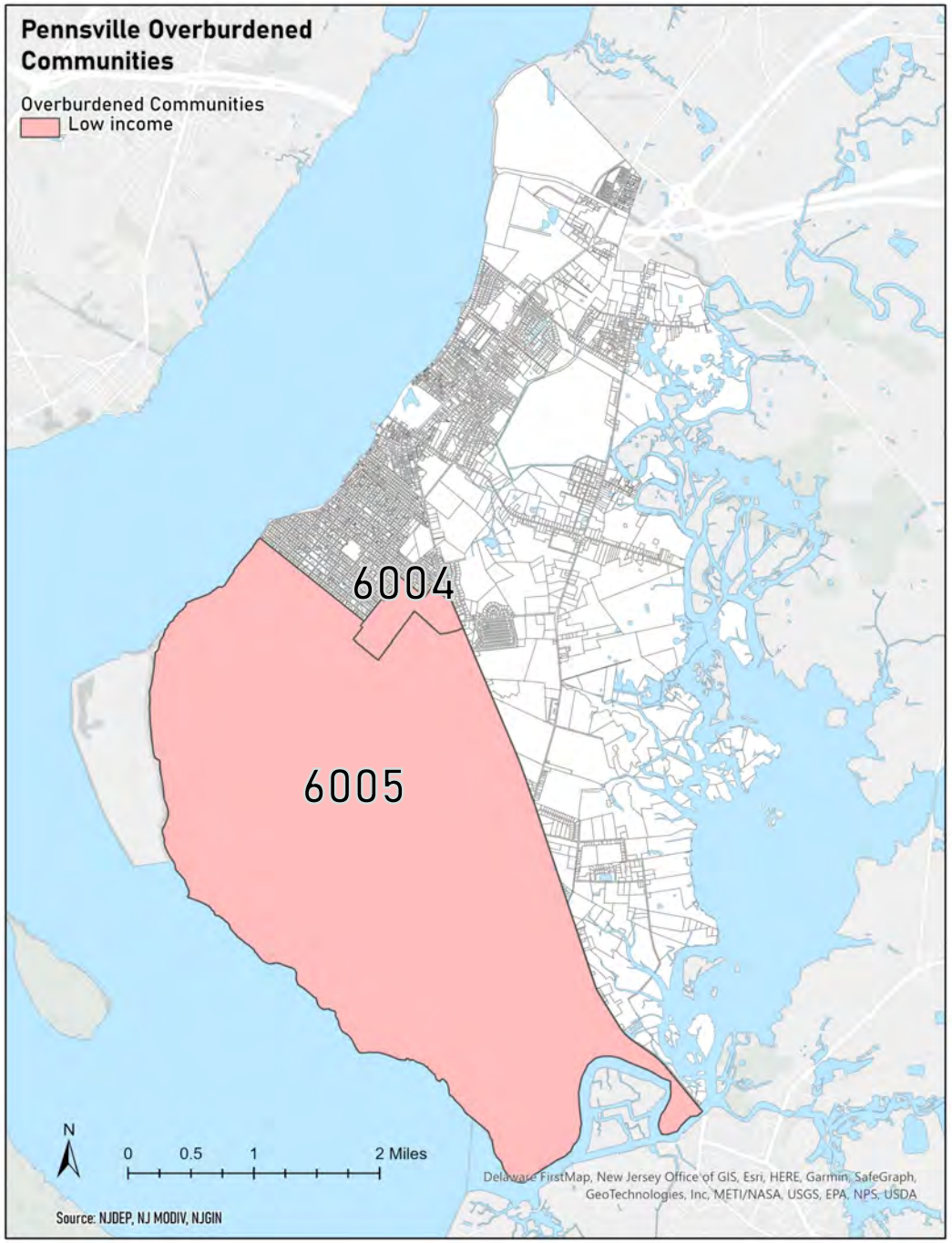
Overburdened Communities

Overburdened Community Block Group Identifier	340330216004	340330216005
Total Population	692	1147
Total Households (HHs)	322	346
Low-Income Population	270 (39.02 %)	779 (67.91 %)
Minority Population	30 (4.34 %)	0 (0.00 %)
HHs with limited English Proficiency	0	0

Combined, two OBCs = 14.96% of the township population



Overburdened Communities

- Critical assets play a crucial role in education, care, and public safety and may be vulnerable to flooding.
- Built infrastructure, such as bridges and evacuation routes, may also be at risk of flooding, and its exposure must be understood to aid in community flood planning.
- Understanding their exposure to flood events and access roads is important for community planning.

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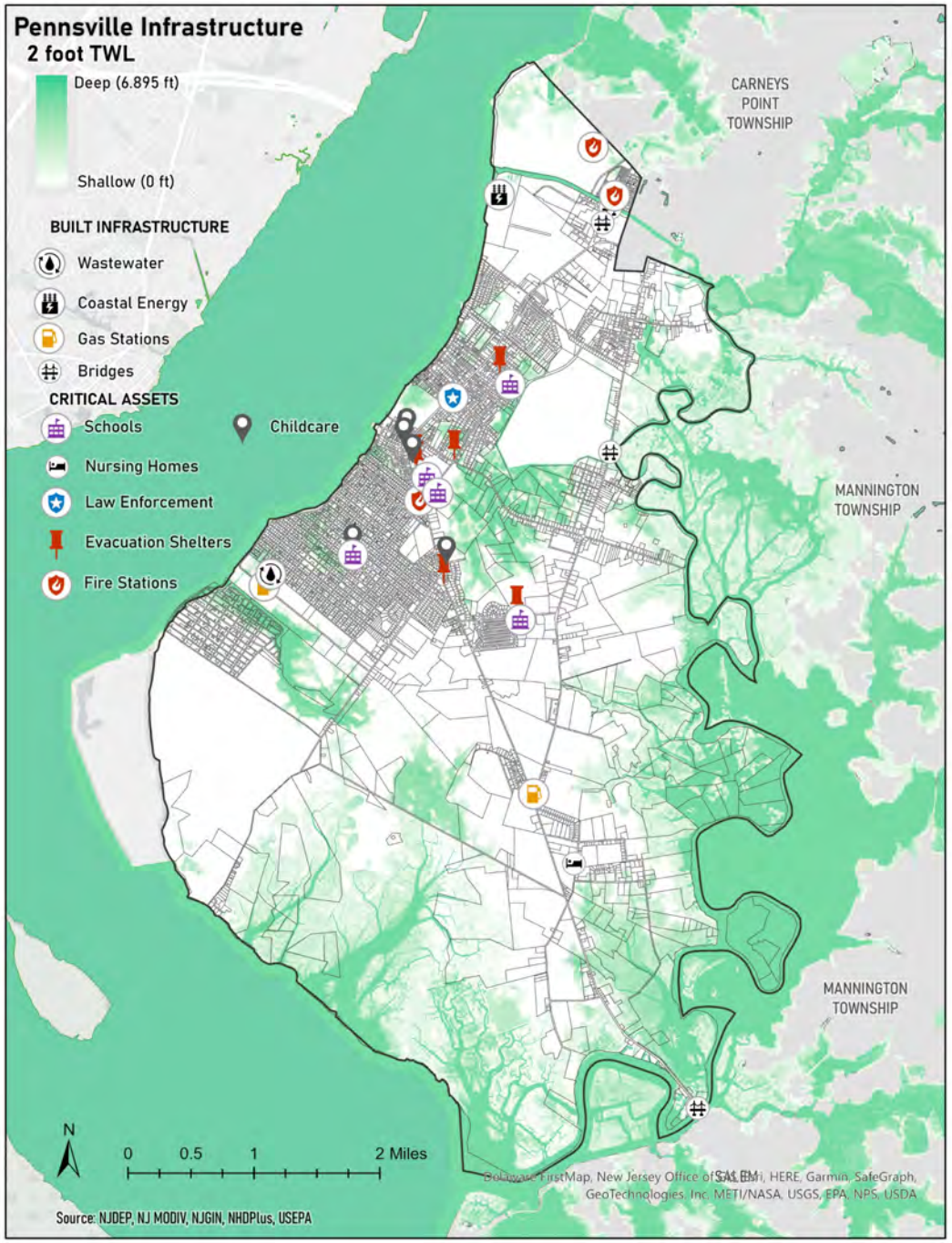
Inundated Critical Infrastructure, 2' TWL

The sea level rise by 2150 (greater than 50% chance) + today's annual flood or 100-year flood by 2070



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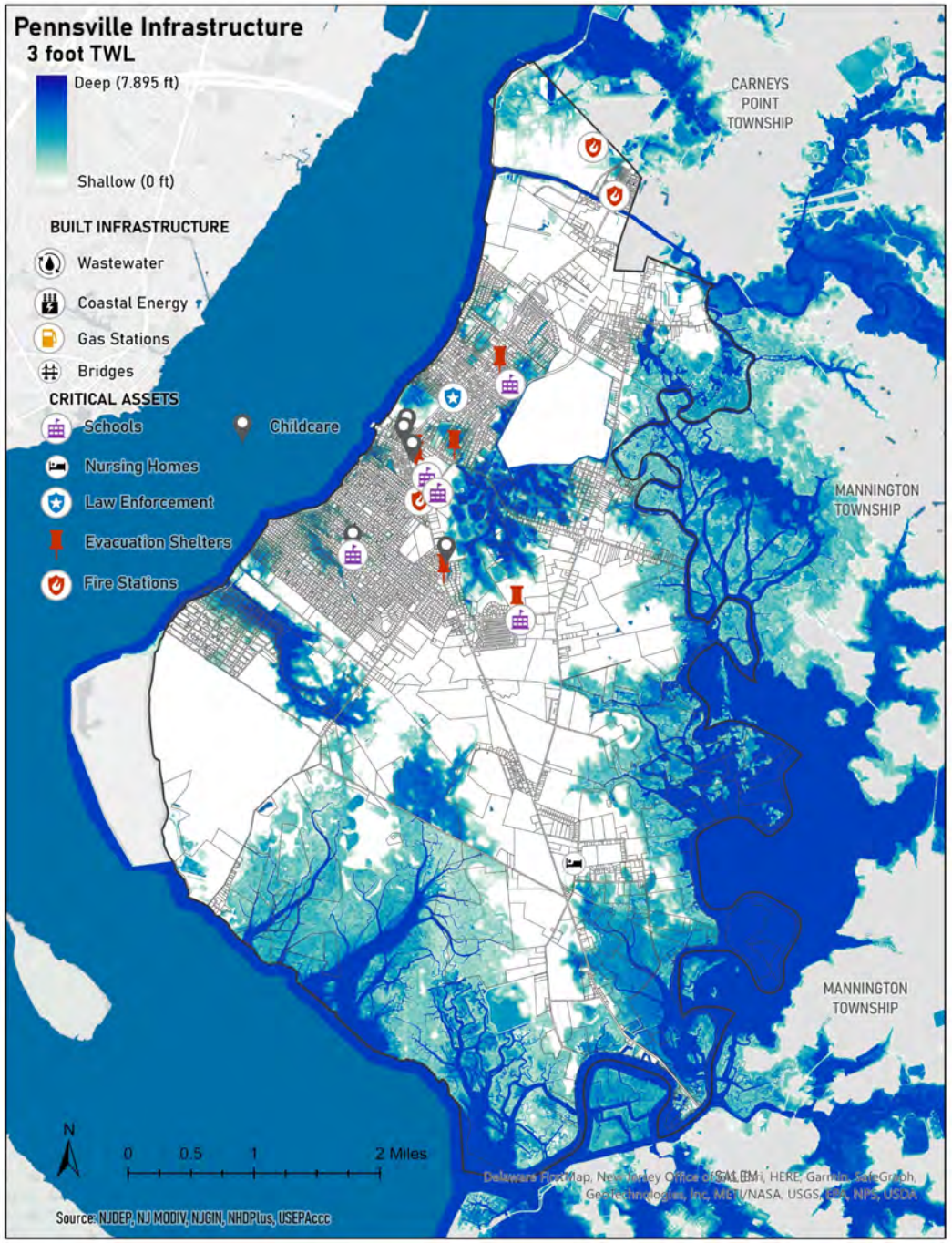
Inundated Critical Infrastructure, 3' TWL

Permanent inundation by the year 2150 (greater than 83% chance) under a moderate inundation scenario or today's 10-year flood.



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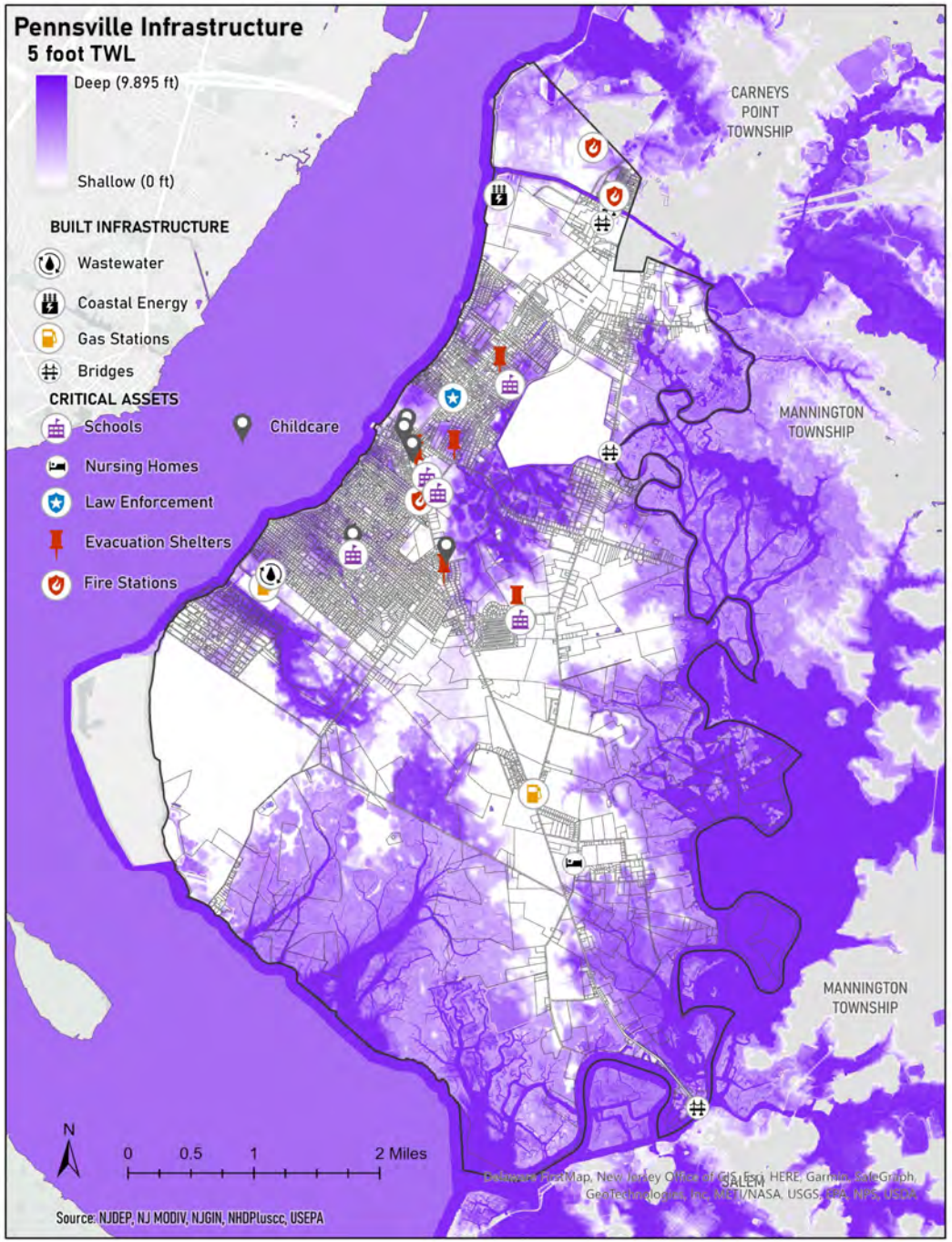
Inundated Critical Infrastructure, 5' TWL

Permanent inundation by the year 2150 (greater than 50%chance) under a moderate inundation scenario or today's100-year flood.



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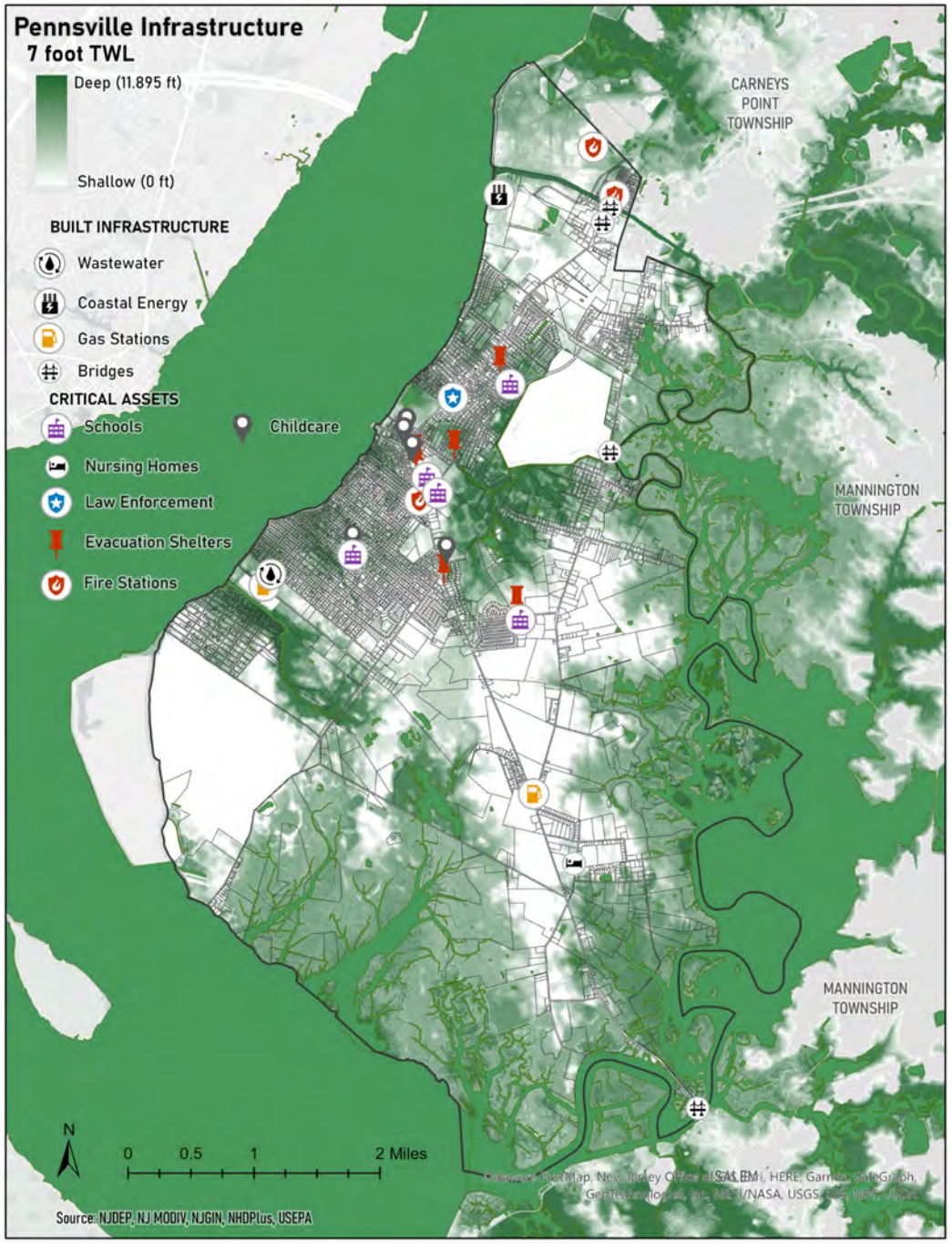
Inundated Critical Infrastructure, 7' TWL

The sea level rise by 2150 (greater than 50% chance) +today's annual flood or 100-year flood by 2070



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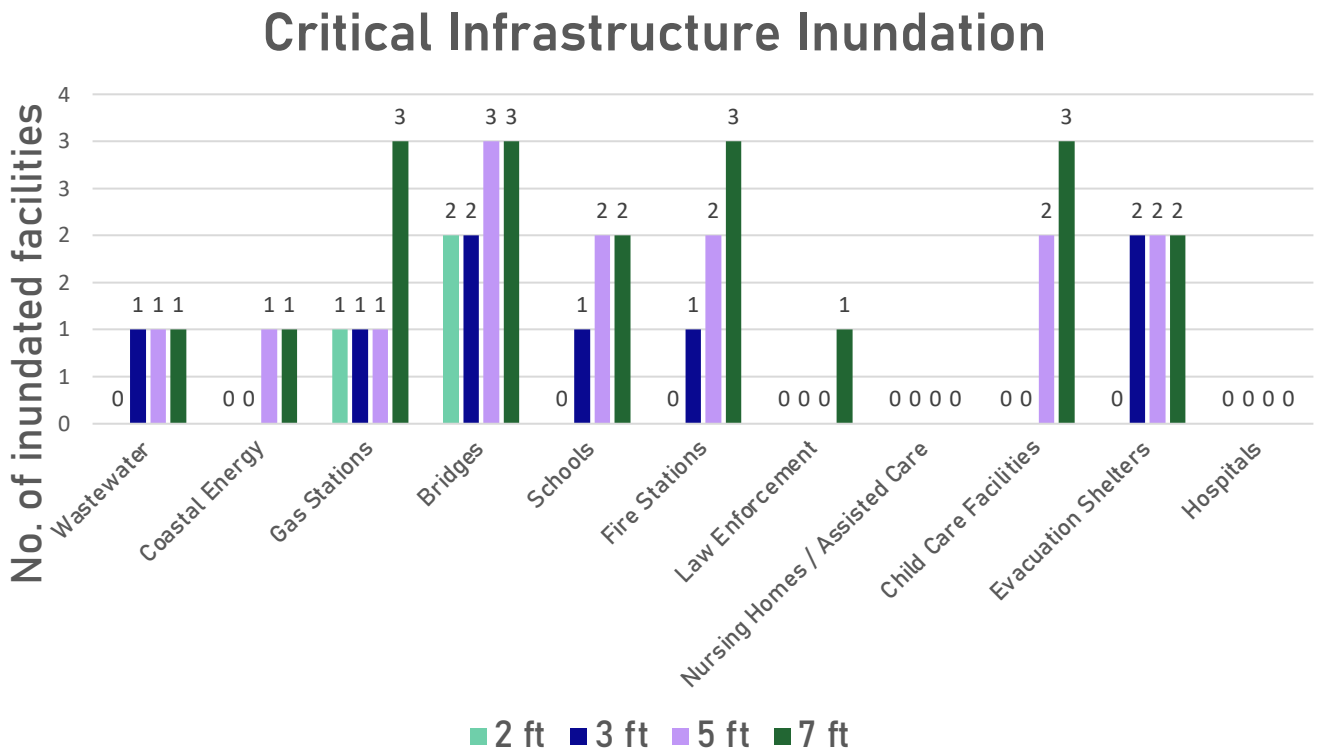
Critical Infrastructure

Critical Facilities inundated at various flooding scenarios

Category	2 ft	3 ft	5 ft	7 ft	Total in municipality
Wastewater	0	1	1	1	1
Coastal Energy	0	0	1	1	1
Gas Stations	1	1	1	3	5
Bridges	2	2	3	3	4
Schools	0	1	2	2	5
Fire Stations	0	1	2	3	3
Law Enforcement	0	0	0	1	1
Nursing Homes / Assisted Care	0	0	0	0	1
Child Care Facilities	0	0	2	3	5
Evacuation Shelters	0	2	2	2	7



FLOOD ASSESSMENT

FOR

PENNSVILLE TOWNSHIP, SALEM COUNTY, NEW JERSEY

MARCH 2023

Assessment Completed by Rutgers Climate Corps

RUTGERS
New Jersey Climate Change Resource Center

Climate Resilience Corps
njclimateresourcecenter.rutgers.edu

TABLE OF CONTENTS

PURPOSE

The goal of this Coastal Vulnerability Assessment (CVA) is to analyze and summarize the possible impacts of different coastal (tidally-influenced) flooding scenarios in Pennsville Township, New Jersey (hereafter "Pennsville"). Using various tools and documents, a team from the Rutgers Climate Resilience Corps (hereafter "Rutgers") identified current vulnerabilities associated with housing, local economy, public assets, and natural resources, among other social and physical Pennsville assets. This CVA will help relevant NJ state agencies understand the potential impacts of coastal flooding in Pennsville.

The data, maps, and information provided here should be used only as a screening-level tool for management decisions and not for navigation, permitting, or other legal purposes. Pennsville should not rely on these data to analyze monetary losses from a specific event on individual properties or parcels.

In this report, Rutgers provides a flood exposure analysis for neighborhood-level planning and identification of potential flood exposure. The information in this report may be used to support the requirements of the New Jersey Office of Planning Advocacy (NJOPA) Plan Endorsement process, which aims to ensure that municipalities comply with state regulations and policies in their planning efforts. The information in this report may also be used to partially support the requirements of the New Jersey Municipal Land Use Law (Section 19 of P.L. 1975 c.291 C.40:55D-28) for municipalities to incorporate a Climate Change Related Hazard Vulnerability Assessment (CCRHVA) into the land use plan element adopted as part of municipal master plan updates.

The report focuses on flooding scenarios arising from sea level rise, storm surge, and high tides and does not encompass flooding from heavy rainfall/stormwater events. The data used in this CVA is not a substitute for property-specific flood hazard modeling and engineering studies that consider detailed building elevations and hydrodynamic conditions. Instead, the CVA provides a broader understanding of the regional flooding implications for future assessments.

For site-specific questions, please contact Stephen J. Krough, Emergency Management Coordinator, at pvpdoem@pvtwp.com or phone at 856-678-3089, extension 159.

1. Introduction and Methodology of Analysis

Water Levels

Rutgers assessed the impact of **2, 3, 5, and 7 feet of flooding using a Total Water Level (TWL) approach**.[1,2] Total Water Level represents the "still water" inundation above Mean Higher High Water (MHHW) during a flood event. These water levels allow one to visualize the impact of future sea level rise combined with potential flood events (Figure 1). MHHW is the high-water tidal elevation determined by averaging the higher of each day's two high tides at a particular tide station over the National Tidal Datum Epoch, which is typically a 19-year period.[3]

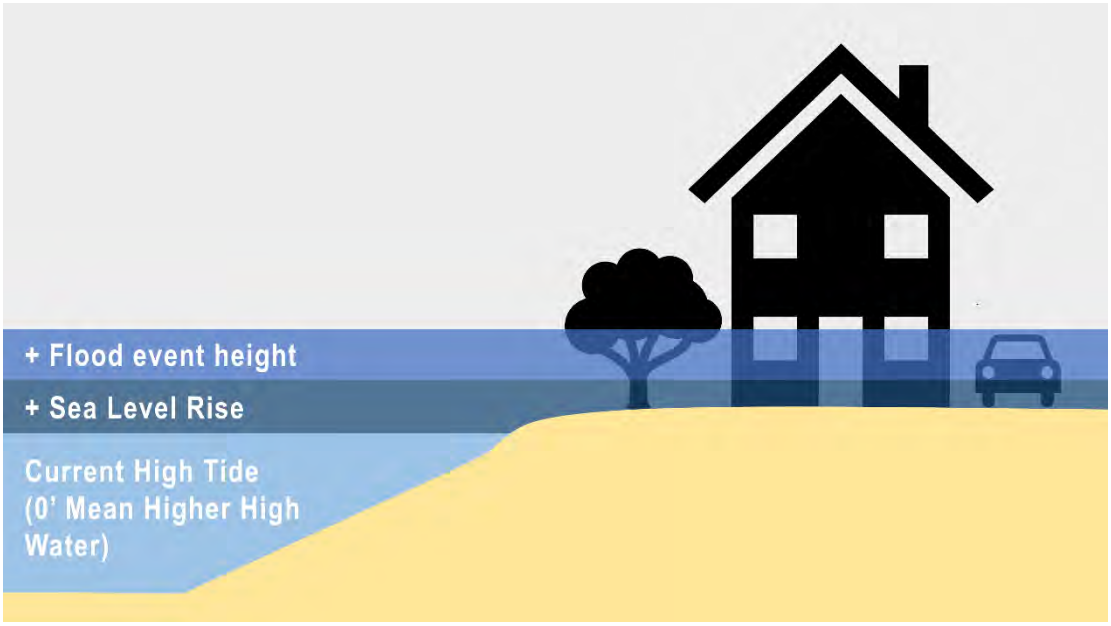


Figure 1: Total Water Level Approach

Thus, in this report, a 2-foot flood scenario indicates there are two additional feet of TWL (above the local MHHW level). In other words, a tidally-influenced waterbody's surface would be approximately two feet higher than the typical daily high tide.

Water levels above the MHHW can be caused by periodic tidal cycles, short-term storm surge events, gradual phenomena such as sea-level rise, or any of these in combination. In the future, the same water levels that occur during storm surge floods today may appear as high-tide flooding (HTF) during sunny days because of sea-level rise.

The four flooding scenarios used in this CVA follow the NJDEP's Sea-Level Rise Guidance for New Jersey which recommends to "utilize 2100 as a planning horizon." Each of the flooding scenarios is within the

[1] Alvin Chin et al., "The Climate Planning Tool - Flooding Primer," ArcGIS StoryMaps, October 14, 2022, https://storymaps.arcgis.com/stories/261ed651c9124ce29947512e94e14b1f.
[2] R.E. Kopp et al., "New Jersey's Rising Seas and Changing Coastal Storms: Report of the 2019 Science and Technical Advisory Panel" (Trenton, NJ: Rutgers, The State University of New Jersey, 2019), https://njclimateresourcecenter.rutgers.edu/wp-content/uploads/2020/03/STAP_FINAL_FINAL_12-4-19.pdf.
[3] NOAA, https://tidesandcurrents.noaa.gov/datum_options.html. See also National Hurricane Center blogpost 1/29/2016.

likely range of impacts projected for 2100, meaning that there is at least a 66% chance that 2 to 5 feet of sea-level rise will occur by 2100.[4]

Collectively, the four water levels used in this analysis should be thought of as State planning benchmarks. NJDEP's guidance recommends that planners analyze: (1) 2 feet of sea-level rise that "is likely unavoidable," (2) 5.1 feet of sea-level rise sufficient to plan for most activities in a community, and (3) a high-end estimate of 6.9 feet for those critical activities for which damages would have "debilitating effects" on public health and safety.[5]

Sources of Data

Rutgers conducted this analysis using publicly available data and ESRI ArcGIS, a GIS software that allows users to work with maps and geographic information. ArcGIS data is commonly available as a shapefile (*i.e.,* a series of unique points, lines, or polygons which store information about a given area or object) or raster (*i.e.,* continuous data that can be overlayed on top of a given area). The following resources were used for this CVA and mapped on the "NAD_1983_Stateplane _New_ Jersey_FIPS_2900_Feet" coordinate system:

- New Jersey Municipal Boundaries shapefile.[6]
- Total Water Level. These show the extent and depth of flood inundation for different levels above MHHW (2-, 3-, 5-, and 7-feet). Source: NJDEP.[7]
- Flood Insurance Rate Map (FIRM) National Flood Hazard Layer shapefile. These show the extents of flood hazard zones. Source: FEMA.[8]
- MOD-IV Statewide Parcels shapefile. MOD-IV is the New Jersey Property Tax System, and this dataset provides information regarding where each property is located, the property's class (*e.g.,* whether the property is residential, commercial, etc.), the net value[9] of each property, and other relevant information. The statewide composite of parcels data for New Jersey was developed during the Parcels Normalization Project in 2008-2014 by the NJ Office of Information Technology, Office of GIS.[10]
- New Jersey 2020 Social Vulnerabilities Index shapefile. The CDC's Social Vulnerability Index created by the Geospatial Research, Analysis Services Program (GRASP) aimed at helping public health officials and emergency response planners to identify and map the communities that will

[4] NJDEP, "Sea-Level Rise Guidance for Planning & Decision-Making," June 2021, https://www.nj.gov/dep/bcrp/resilientnj/docs/dep-guidance-on-sea-level-rise-2021.pdf.
[5] NJDEP.
[6] New Jersey Office of GIS, "Municipal Boundaries of NJ" (NJGIN Open Data, August 23, 2022), https://njogis-newjersey.opendata.arcgis.com/datasets/3d5d1db8a1b34b418c331f4ce1fd0fef_2.
[7] "Total Water Level (0-20 Ft)," 2017, https://njmaps1.rad.rutgers.edu/arcgis/rest/services/CoastalFlooding.
[8] FEMA, "Flood Maps" (FEMA), accessed March 2, 2023, https://www.fema.gov/flood-maps.
[9] Net value here is equivalent to the appraised value determined by the NJ MOD-IV taxation database. The net value is the sum of the appraised value of the land and improvements to the property (e.g., the value of the building). A net value is not, and should not be interpreted as, the replacement value of a structure destroyed or damaged by a flooding event.
[10] New Jersey Office of GIS, "Parcels and Mod-IV Composit of NJ (Download)" (NJGIN Open Data), accessed November 10, 2022, https://njogis-newjersey.opendata.arcgis.com/documents/406cf6860390467d9f328ed19daa359d.

most likely need support before, during, and after a hazardous event. 2020 American Community Survey data is mapped onto 2010 Census Tract geographies. [11]

- US Geological Survey NHDPlus High Resolution. The National Hydrography Dataset depicts flow of water at 1:24,000 scale. Rutgers uses the data to depict floodways and open water.[12]
- Overburdened communities under the New Jersey Environmental Justice Law. As designated by the NJDEP,[13] an "overburdened community" refers to any Census block group in which:
    - at least 35% of the households qualify as low-income households;
    - at least 40% of the residents identify as a minority or as members of a State-recognized tribal community; or
    - at least 40% of the households have limited English proficiency.
- Rutgers Climate Snapshot. This dataset provides location data for exposed critical infrastructure for all New Jersey municipalities.[14]

Consideration of Social Vulnerability

The range of assets evaluated in this report highlight the intersectionality of disaster events and reflect the fact that flooding may trigger cascading and compounding effects in coastal communities. This is especially true for socially vulnerable and/or overburdened individuals and communities. For example, the structural impacts of floods, which include damage to homes and displacement of residents, could also exacerbate existing health issues for certain communities when mold grows under carpets after flooding events. These negative health impacts can be compounding, especially for the disabled, elderly, or others with existing medical conditions and/or with limited capacity to address health concerns when they arise.

Physical flooding damage may also deteriorate mental health from the stresses of repetitive loss and prolonged recovery; enable the outbreak of waterborne and mosquito-borne disease; cause residential displacement that ruptures the social safety networks of families, friends, and neighbors. Potential physical effects of flooding include disruptions and structural damage to coastal assets such as buildings, water and sewer utilities, power and electricity outages, and local transportation systems. Any or all of these may impede the efficiency of rescue efforts and slow post-disaster recovery. Economically, flooding may inhibit businesses reopening, which could also lead to social and health complications for community members.[15]

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[11] "CDC/ATSDR Social Vulnerability Index (SVI)," November 16, 2022, https://www.atsdr.cdc.gov/placeandhealth/svi/index.html.

[12] U.S. Geological Survey, "USGS National Hydrography Dataset Plus High Resolution (NHDPlus HR) for 4-Digit Hydrologic Unit - 0204 (Published 20180813)," August 13, 2018, http://viewer.nationalmap.gov/basic/.

[13] NJDEP, "What Are Overburdened Communities (OBC)?" (NJDEP), accessed March 2, 2023, https://dep.nj.gov/ej/communities/.

[14] Rutgers University, the State University of New Jersey, "Climate Snapshots" (Rutgers University, the State University of New Jersey), accessed March 2, 2023, https://climatesnapshots.rutgers.edu/.

[15] See pp.4-6 in B.E. Flanagan et al., "A Social Vulnerability Index for Disaster Management," *Journal of Homeland Security and Emergency Managmenent* 8, no. 1 (2011), https://doi.org/10.2202/1547-7355.1792.

2. How to Interpret Maps

Following the methodology and data sources outlined in the previous section, Rutgers created four types of flood hazard maps for Pennsville Township in its entirety. This section is dedicated to helping readers understand how to interpret each map type.

Type 1 Map – Spatial Extent of Flooding Scenarios

The first type of map represents the spatial extent of flooding for 2ft, 3ft, 5ft and 7ft Total Water Level (TWL) scenarios, using raster data overlaid on the parcels within the Township.

Each map in this category represents a flooding scenario. Darker shading represents deeper water at that location. The areas that are unshaded in the map indicate that there is no flooding there.

Type 2 Map – Flood Level Exposure of Parcels

The second type of map is a more detailed version of the first type which shows the parcels whose area is more than **50 percent** flooded in a given scenario. Rutgers chose to analyze flooded parcels based on 50% inundation due to the concentration of small residential parcels in Pennsville. At 50% inundation, many of these parcels, with homes taking up most of the parcel, are flooded. See Figure 2 below for a visual example of this phenomenon.

Figure 2: Inundation Analysis Criteria

The flooding at 2ft and 3ft flood scenarios is less severe than the other higher water levels included in this analysis, but also more likely to occur.

In contrast, the higher 5ft and 7ft flood scenarios are less likely to occur. As such, the flooding in these scenarios is dangerous more in terms of magnitude, rather than frequency.

Type 3 Map – Parcel Class Inundation, by Scenario

These maps build on the previous types by additionally identifying the property classification of the inundated parcels. The parcels are visually represented by property class, using the color-coding scheme within the American Planning Association's Land-Based Classification Scheme standards.[16]

Type 4 Map – FEMA Flood Hazard Zones

The fourth type of map displays the spatial extent of flood zones designated by the Federal Emergency Management Agency (FEMA). FEMA prepares Flood Insurance Rate Maps (FIRMs) illustrating the extent of flood hazards in flood-prone communities for flood insurance and risk assessment purposes.[17] To generate these maps, FEMA conducted engineering studies referred to as Flood Insurance Studies. Collectively, these maps are known as the National Flood Hazard Layer (NFHL).

Using the information gathered in these studies, FEMA engineers and cartographers delineate Special Flood Hazard Areas (SFHAs) on flood maps. SFHAs are subject to inundation by floods that have a 1% or greater chance of being equaled or exceeded during any given year. This type of flood is commonly referred to as the 100-year flood or the base flood. Areas inundated by these floods are identified on the FIRMs as Zones A, AE, AH, AO, AR, V, VE, B, and C. (An additional identified zone, X, is also mapped but is not part of the SFHA as it has a lower annual chance threshold of only 0.2%.) Only four FIRM zones are designated in Pennsville Township, but all zones' descriptions are provided below for reference.

While these SFHAs delineate flood insurance requirements and/or regulate local, state, and federal management of coastal land development, the engineering studies upon which they are based may not have been updated to account for climate change-related flood hazards. Therefore, these Flood Hazard Zone maps are meant to complement the TWL scenario maps.

It is important to note a 100-year flood is not a flood that occurs once every 100 years. In fact, the 100-year flood has a 26 percent chance of occurring during a 30-year period. The 100-year flood is a regulatory standard used by Federal agencies and most states to administer floodplain management programs. The 100-year flood is used by the National Flood Insurance Program (NFIP) as the basis for insurance requirements nationwide.

The FEMA Flood Zone types are listed below. Only the **bolded Zones** are present within Pennsville:

- **Zone A – The flood insurance rate zone that corresponds to the 100-year floodplain that is determined in the Flood Insurance Study by approximate methods. In these areas, detailed hydraulic analyses are not performed.**
    - *This zone is present only in a narrow strip along Kings Hwy-County Rd 551S.*

[16] American Planning Association, "LBCS Standards," American Planning Association, accessed March 2, 2023, https://www.planning.org/lbcs/standards/.
[17] https://www.fema.gov/sites/default/files/2020-07/how-to-read-flood-insurance-rate-map-tutorial.txt

- **Zone AE – The flood insurance rate zone that corresponds to the 100-year floodplain that is determined in the Flood Insurance Study by detailed methods.** (AE is listed as either "AE: 1% annual flood chance" or "AE: Floodway." The "AE: 1% annual flood chance" zone is consistent with the AE description listed above, while "AE: Floodway" is described below.)
- Zone AH **–** The flood insurance rate zone that corresponds to the areas of the 100-year shallow flooding with a constant water-surface elevation (usually areas of ponding) where average depths are between 1 and 3 feet.
- Zone AO **–** The flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet.
- Zone AR **–** The flood insurance rate zone that results from the decertification of a previously accepted flood protection system that is being restored to provide protection from the 100-year or greater flood event.
- Zone V **–** The flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Approximate hydraulic analyses are performed for such areas.
- **Zone VE – The flood insurance rate zone that corresponds to the 100-year coastal floodplain that have additional hazards associated with storm waves. Detailed hydraulic analyses are performed in this zone.**
- **Zone X – The flood insurance rate zone that corresponds to areas outside the 100-year floodplains, areas of 100-year sheet flow flooding where average depths are less than 1 foot, areas of 100-year stream flooding where the contributing drainage area is less than 1 square mile, or areas protected from the 100-year flood by levees. Zone X is not counted as part of the SFHA.**
- **Floodway – This designation is specific to areas that a riverine floodplain depends on to carry deeper, faster moving water.[18] It consists of the stream's channel and the adjacent lands that must remain free from obstruction so that the 100-year flood can be conveyed downstream without increasing the water surface height.**
- **Open Water – A body of open water, such as a pond, lake, ocean, etc., located within a community's jurisdictional limits, that has no defined flood hazard (may also be labeled Undescribed or Undesignated Flood Hazard).**
    - *This zone occurs in Pennsville only in the waters of the Delaware River.*

See Figure 3 for a map of FEMA flood zones in Pennsville.

[18] https://www.fema.gov/pdf/floodplain/nfip_sg_unit_5.pdf

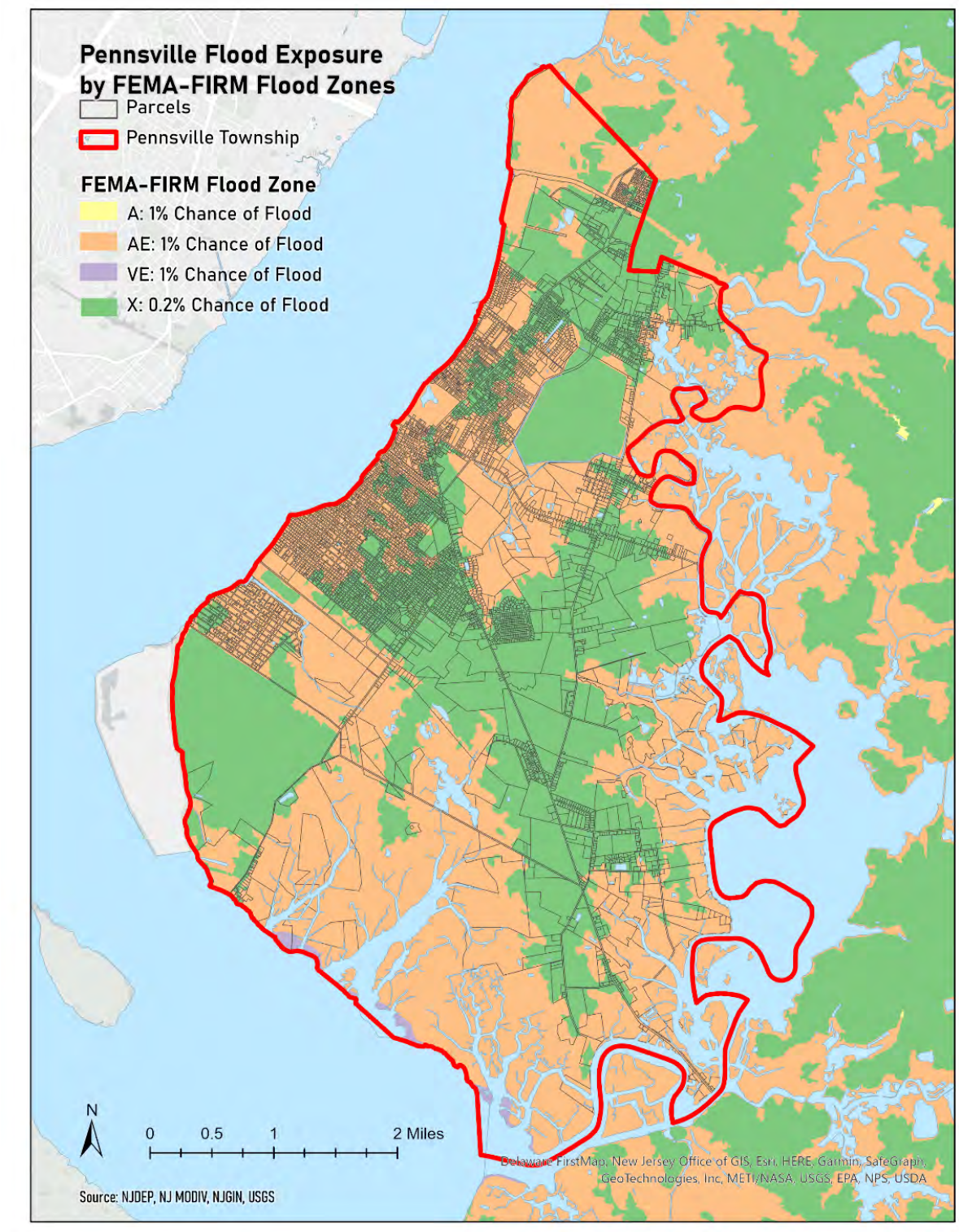

Figure 3: FEMA Flood Zones in Pennsville, NJ

3. FLOOD ASSESSMENT

Identified Exposures Summary

This assessment reveals patterns of flooding and its impacts on people and property at municipal and neighborhood scales. At a municipal spatial scale, three underlying patterns were observed:

Several rivers, creeks, and meadows in Pennsville, including the Delaware River, Salem River, Mannington Meadow, Kates Creek Meadow, and Salem River Wildlife Management Area, are subject to flooding during periods of heavy rainfall or storms. Furthermore, coastal areas like those near Delaware River are susceptible to flooding during storm surges and high tides.

The areas in Pennsville most vulnerable to flooding are riverside locations near Delaware Bay to the west of Broadway, including Central Park. Low-lying areas close to the Salem River, Kates Creek Meadow, and Salem River Wildlife Management Area are also at risk for inundation. Pennsville has identified arterial Hook Road as currently consistently inundated.

Location and Context

Pennsville is in western Salem County, surrounded by the municipalities of (clockwise from north) Carneys Point Township, Pilesgrove Township, Mannington Township, the City of Salem, and Elsinboro Township, and lastly, from north to south, New Castle and Delaware City, DE, across the Delaware River.

Due to Pennsville's geographic situation — within the marine- and tidally-influenced Delaware Estuary and bordered on three sides by the waters of the Delaware River, Salem River, Mannington Meadow, Kates Creek Meadow, and Salem River Wildlife Management Area — Pennsville's riverfront and low-lying areas are exposed to high tide flooding, as well as flooding during storm events. High tide flooding in this case refers to coastal flooding that occurs on a predictable tidal cycle basis and is commonly referred to as nuisance flooding. During a storm surge event, water levels are pushed higher by the impacts of local wind stress and a change in barometric pressure.

Notably, public property covers about 35% of Pennsville's area, making up the plurality. Next is farmland, at almost 24% of the area. Residential parcels are 12.77%, and vacant parcels are 11%.

Pennsville is divided into three informal districts: Valley Park, Central Park, and Deep Water. Deep Water is affected by the Salem River canal, which is owned by the Chemours Company FC, LLC, according to 2022 MOD IV tax record data.[19]

Demographics

According to the American Community Survey (2020) five-year estimates, Pennsville has a total population of 12,291. Since 2010, Pennsville experienced a population growth rate decline of 5.9%.

[19] Rutgers University, the State University of New Jersey, "MOD IV ID # 2765728 : Year 2022" (Rutgers University, the State University of New Jersey, 2022), https://modiv.rutgers.edu/print-record/2022/2765728/.

The population density is 500 persons per square mile. The average household size is 2.4 and there are 5,481 housing units, 5,129 (87.8%) of which are occupied. Approximately 73% of the occupied housing units are owner-occupied and the median household income is $67,906. The poverty rate in Pennsville is 7.9%, and the unemployment rate for individuals aged 16 years and older is 7.1%.

The median rental cost in Pennsville Township is $1,018 per month, while the median house value is $157,100. The median age of the township's residents is 45.6 years, with 90.7% identifying as white alone and 9.3% identifying as non-white.

Parcels and Property Classes

Table 1 shows a breakdown of the property classes in Pennsville, including the total number of parcels associated with each property class. Figure 4 shows that most residential parcels are located along the Delaware River. Farmland is mostly along the eastern boundary of the municipality. There are 6,197 parcels in the township.

The "Residential" property class includes 4,622 parcels, or approximately 74% of all parcels. Typically, this classification includes single-family homes, duplexes, and townhouses. The next largest property class is the bundled "Public and School Property" class group, which includes 456 parcels, or 7.5% of all parcels.

The other property classes listed in the table include "Residential (Apartments)," "Commercial," "Industrial," "Education," "Church and Charitable," "Cemeteries," "Farmlands," "Transportation," "Other Exempt," and “Vacant.” Each of these classifications represents a smaller proportion of the total parcels in the township.

PROPERTY CLASS	# PARCELS TOTAL
Residential (2)	4622
Apartment (4C)	16
Commercial (4A)	183
Industrial (4B)	3
Farm Total (3A & 3B)	163
Public and School Property (15A, 15B, 15C)	465
Church & Charitable (15D)	37
Cemeteries & Graveyards (15E)	3
Other Exempt (15F)	43
Class I Railroad Property (5A)	2
Vacant (1)	660

Table 1: Parcels and Property Classes

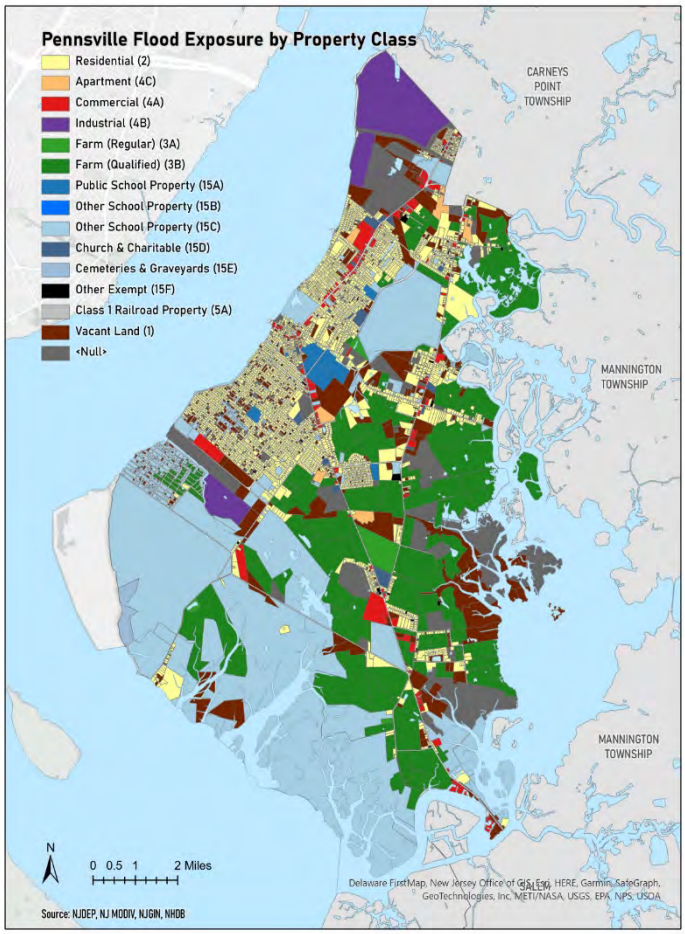

Figure 4: Parcels by Property Class

2 Ft Scenario Total Water Level

Figure 5 presents a raster layer map illustrating the 2-Foot Total Water Level (TWL) flood scenario for Pennsville. The maps indicate that in this scenario, the low-lying areas west of Broadway, along Hook Road, and bordering the Kates Creek Meadow and Salem River are at the greatest risk of flooding.

Figure 6 displays 1,126 of 6,197 parcels (18.2%) exposed to flooding at 2 feet TWL.[20]

The 2019 Rutgers Science and Technical Advisory Panel (STAP) guide provides information on the likelihood of sea level rise in the future. Under a moderate greenhouse gas emission scenario ("low and high emissions scenarios correspond to global-mean warming by 2100 of 2°C and 5°C"), it indicates that there is a 5% chance that sea level will rise by 2 feet between 2040-2050, a 66% chance that sea level will rise to 2 feet by 2070, and an 83% chance that it will increase by at least 2 feet by 2100.[21]

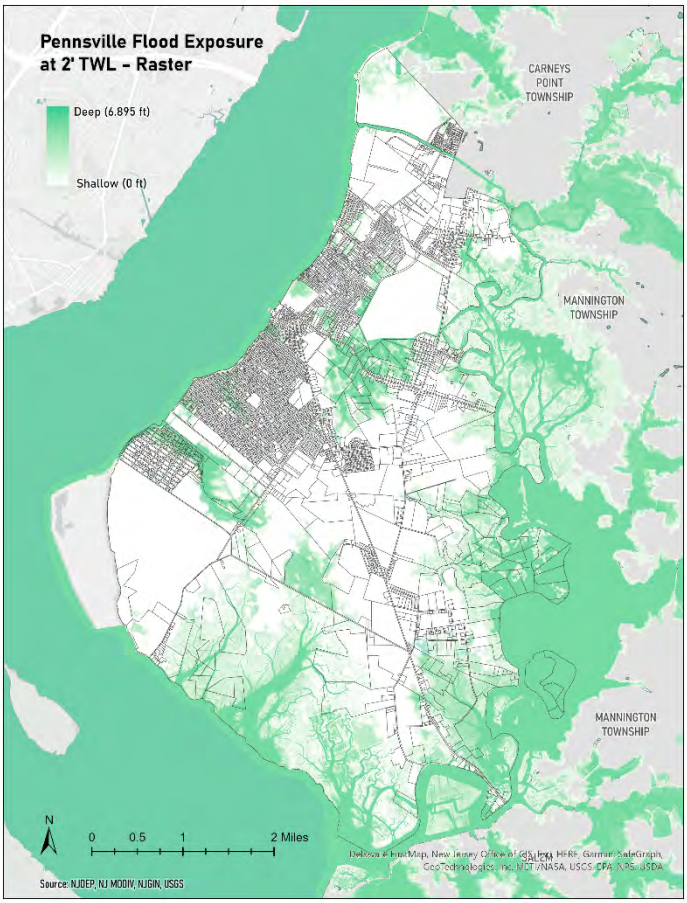

Figure 6: Spatial Extent of Flooding,2' TWL

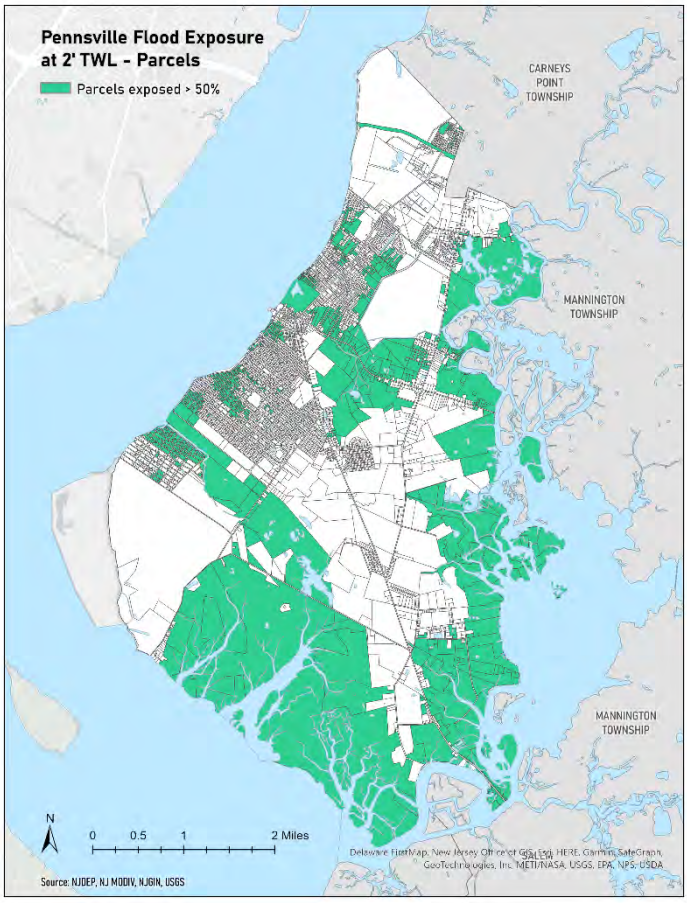

Figure 5: Parcel Flood Exposure, 2' TWL

[20] As stated above in Section 3, the criteria for a parcel to be considered flooded is 50% of parcel area inundated.
[21] Kopp et al., "New Jersey's Rising Seas and Changing Coastal Storms: Report of the 2019 Science and Technical Advisory Panel."

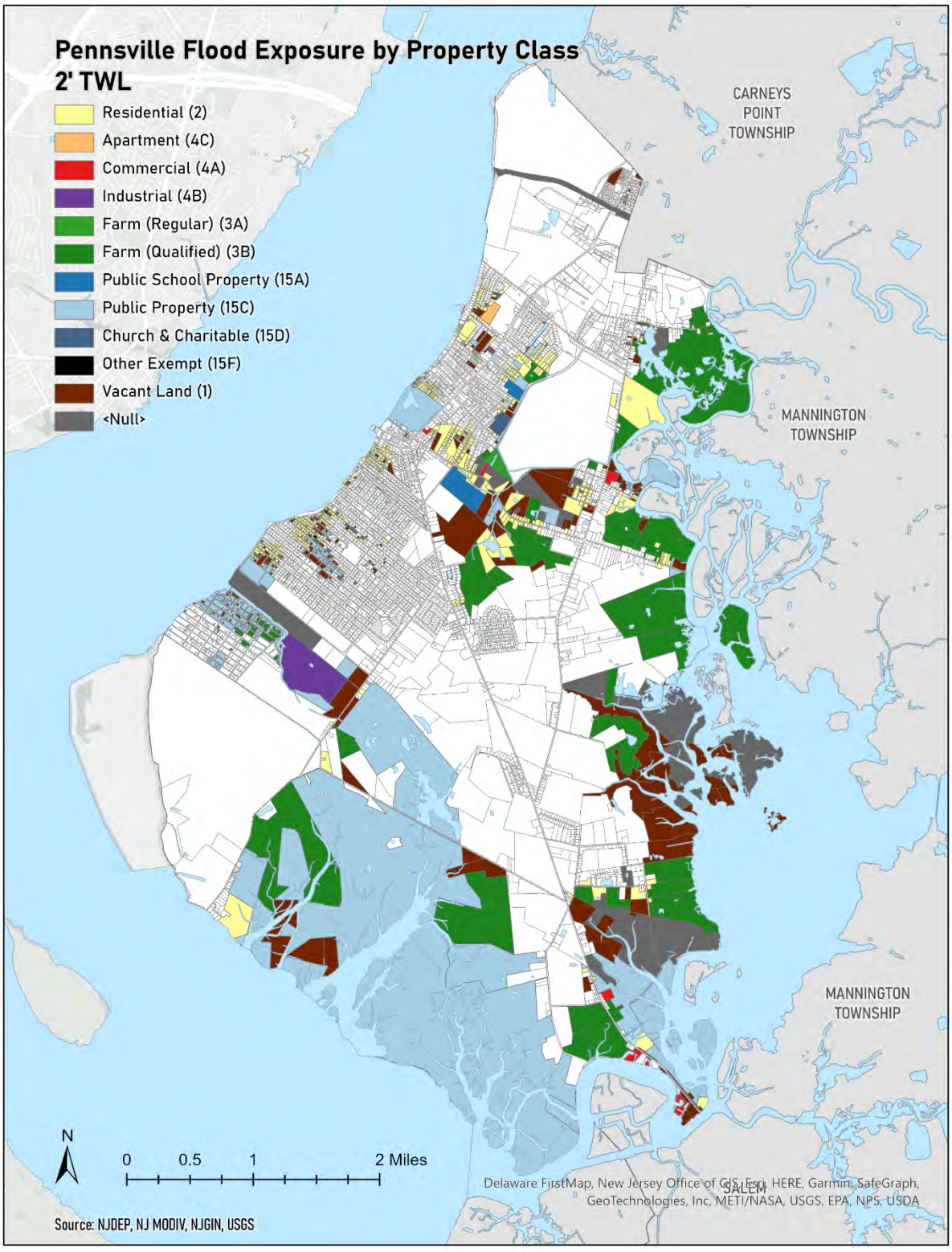

Figure 7: Flood Exposure by Property Class, 2' TWL

PROPERTY CLASS	# PARCELS FLOODED	IMPROVEMENT $ VALUE, FLOODED	LAND $ VALUE, FLOODED	# FLOODED PARCELS W/ $0 VALUE
Residential (2)	610 (1.3%)	$61,876,800.00	$32,294,949.00	0
Apartment (4C)	1 (6.3%)	$2,615,900.00	$984,100.00	0
Commercial (4A)	10 (5.5%)	$883,800.00	$1,248,300.00	0
Industrial (4B)	1 (33.3%)	$10,053,900.00	$6,128,000.00	0
Farm Total (3A & 3B)	56 (34.3%)	$238,900.00	$541,700.00	25
Public and School Property (15A, 15B, 15C)	229 (49.2%)	$15,084,400.00	$11,134,900.00	35
Church & Charitable (15D)	2 (5.4%)	$1,281,700.00	$141,400.00	0
Other Exempt (15F)	6 (14.0%)	$558,700.00	$300,700.00	0
Vacant (1)	211 (31.9%)	$0.00	$4,129,900.00	0
TOTAL	**1126**	**$92,594,100.00**	**$56,903,949.00**	**60**

Table 2: Parcels Exposed, 2' TWL

For each property class, Table 2 presents the number and percentage of flooded parcels and the total value of improvements and land. Improvement values represent the value of physical structures on the property, while land values represent the value of the land itself.

The property classes with the highest percentage of flooded parcels are "Public and School Property 15A, 15B & 15C" at 49.2%, followed by "Farm Total 3A & 3B" at 34.3%, "Industrial 4B" at 33.33%, and "Vacant Land 1," at 31.9%.

The three most affected property classes based on total improvement value are "Residential 2" with a value of $61,876,800.00, "Public and School Property 15A, 15B & 15C" with a value of $11,134,900, and "Industrial 4B" with a value of $10,053,900.

In terms of land value, the three most affected property classes are "Residential 2," with a value of $32,294,949, "Public Property 15A, 15B, & 15C," with a value of $11,134,900; and "Industrial 4B," with a value of $6,128,000.

The information provided is vital for understanding the potential impact of flooding on the community and identifying areas that may require additional attention to mitigate flood damage.

3 Ft Scenario Total Water Level

Figure 8 presents a raster layer map illustrating the 3-Foot TWL flood scenario for Pennsville. The maps shows slightly more flooding relative to the 2-foot scenario, especially in the low-lying areas west of Broadway, along Hook Road, and bordering the Kates Creek Meadow and Salem River.

Figure 9 displays 1875 of 6,197 parcels (30.3%) exposed to flooding at 3 feet TWL.[22] There is a 66% increase in flooded parcels relative to the 2-foot TWL scenario.

According to the STAP, there is a 5 percent probability that sea level will rise by 3 feet by 2060 and a 66% probability that sea level will increase by 3 feet by 2090.

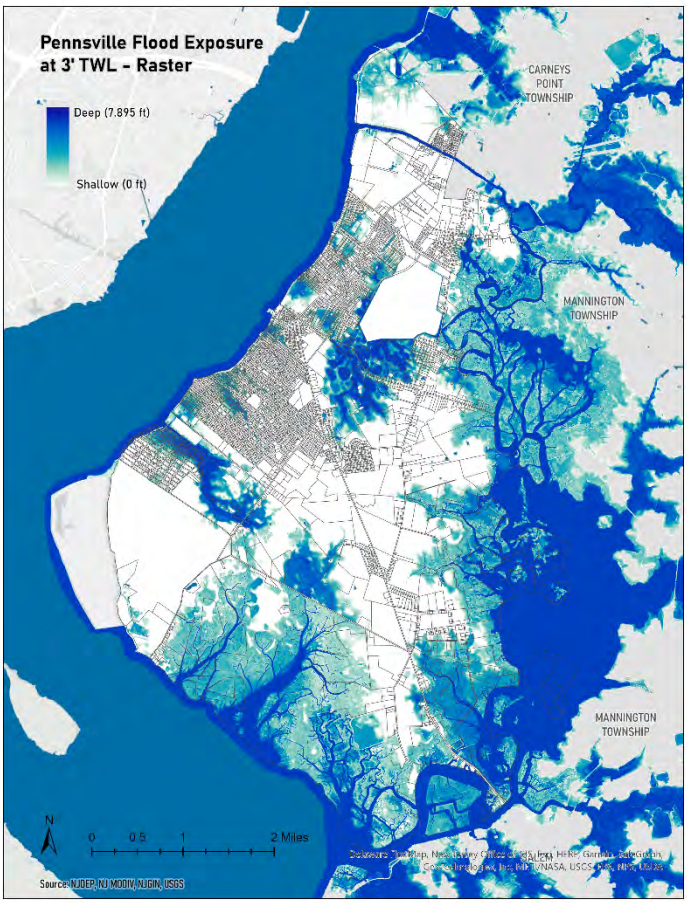

Figure 8: Spatial Extent of Flooding, 3' TWL

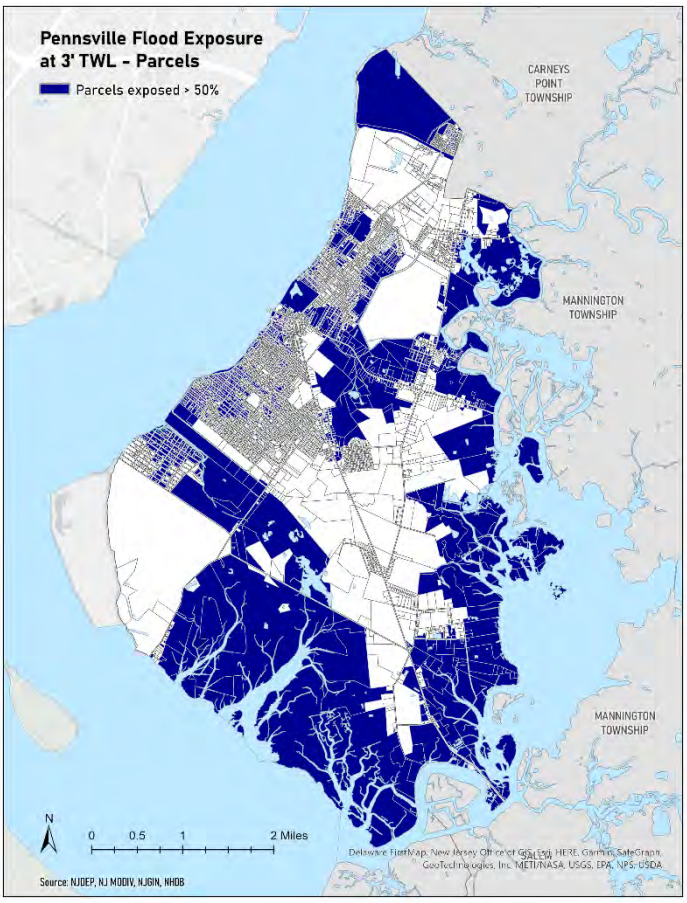

Figure 9: Parcel Flood Exposure, 3' TWL

[22] As stated above in Section 3, the criteria for a parcel to be considered flooded is 50% of parcel area inundated.

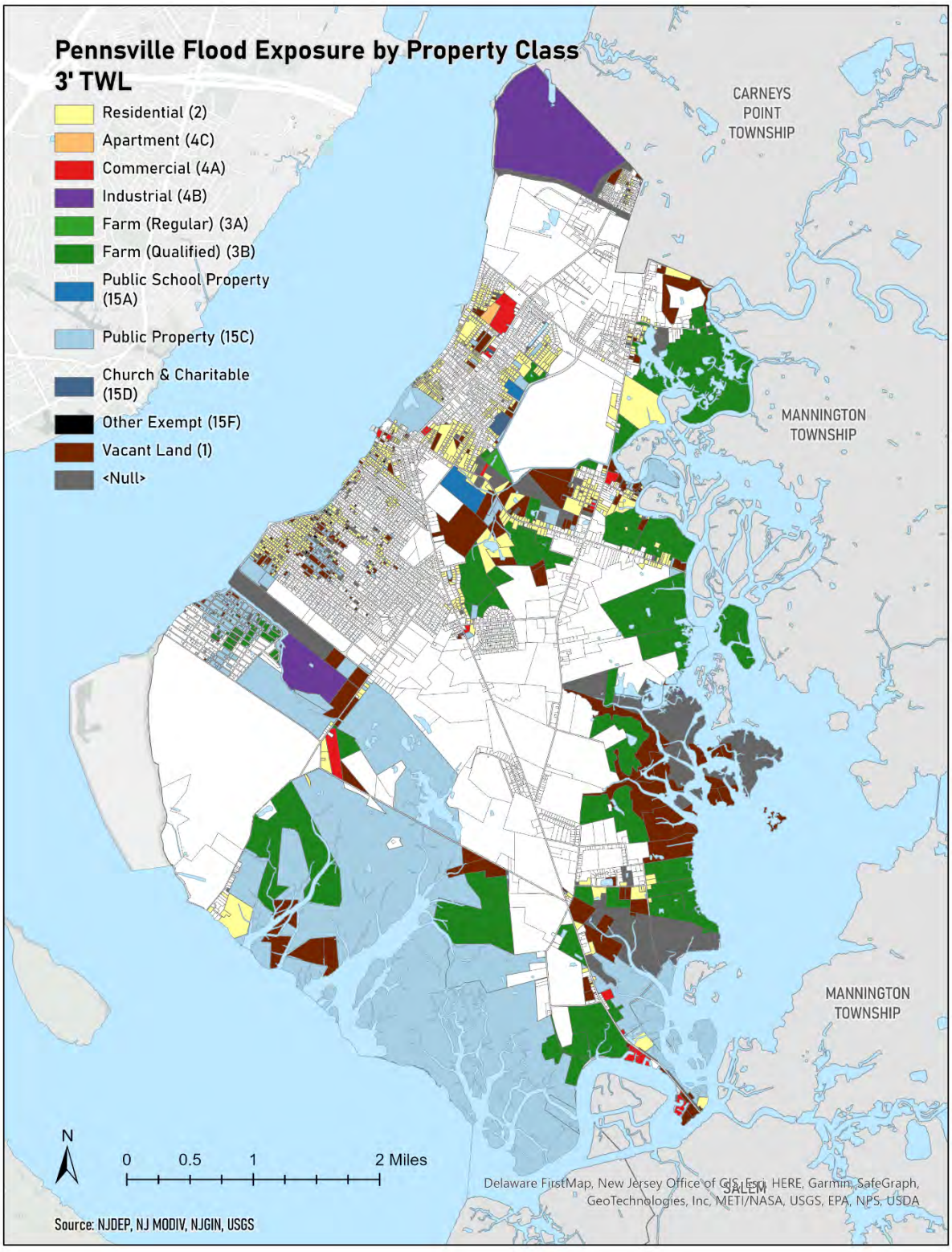

Figure 10: Flood Exposure by Property Class, 3' TWL

PROPERTY CLASS	# PARCELS FLOODED	IMPROVEMENT $ VALUE, FLOODED	LAND $ VALUE, FLOODED	# FLOODED PARCELS W/ $0 VALUE
Residential (2)	1169 (25.3%)	$116,653,800.00	$60,743,587.00	2
Apartment (4C)	1 (6.3%)	$2,615,900.00	$984,100.00	0
Commercial (4A)	27 (14.8%)	$6,790,500.00	$4,581,400.00	0
Industrial (4B)	2 (66.7%)	$81,952,900.00	$24,229,000.00	0
Farm Total (3A & 3B)	80 (49.1%)	$238,900.00	$637,400.00	42
Public and School Property (15A, 15B, 15C)	281 (60.4%)	$15,093,600.00	$13,767,200.00	38
Church & Charitable (15D)	3 (8.1%)	$1,281,700.00	$171,800.00	0
Other Exempt (15F)	7 (16.3%)	$638,600.00	$346,700.00	0
Vacant (1)	305 (46.2%)	$0.00	$6,057,800.00	0
TOTAL	**1875**	**$225,265,900.00**	**$111,518,987.00**	**82**

Table 3: Parcels Exposed, 3' TWL

For each property class, Table 3 presents the number and percentage of flooded parcels and the total value of improvements and land.

The property classes with the highest percentage of flooded parcels are "Industrial 4B" at 66.7%, "Public and School Property 15A, 15B & 15C" at 60.4%, and "Farm 3A & 3B" at 49.1%.

The three most affected property classes based on total improvement value are "Residential 2" with a value of $116,653,800, "Industrial 4B" with a value of $81,952,900, and "Public and School Property 15A, 15B & 15C" with a value of $15,093,600.

In terms of land value, the three most affected property classes are "Residential 2," with a value of $60,743,587, "Industrial 4B," with a value of $24,229,000, and "Public Property 15A, 15B, & 15C," with a value of $13,767,200.

5 Ft Scenario Total Water Level

Figure 11 presents a raster layer map illustrating the 5-Foot TWL flood scenario for Pennsville. This scenario indicates additional inundation west of S Broadway and Fort Mott Rd, as well in as the residential areas east and west of N Broadway.

Figure 12 shows 3,553 of 6,197 (57.3%) parcels exposed to flooding at 5 feet TWL.[23] There is an 89.4% increase in flooded parcels relative to the 3-foot TWL scenario.

According to the STAP, the likelihood of 5 feet of sea level rise by 2100 is less than 17 percent.

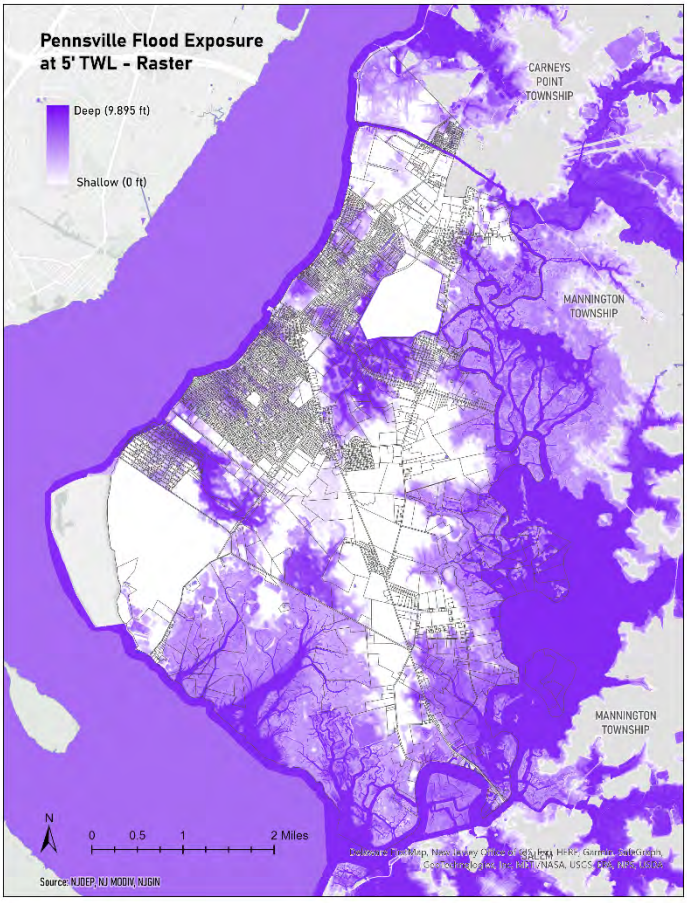

Figure 12: Spatial Extent of Flooding, 5' TWL

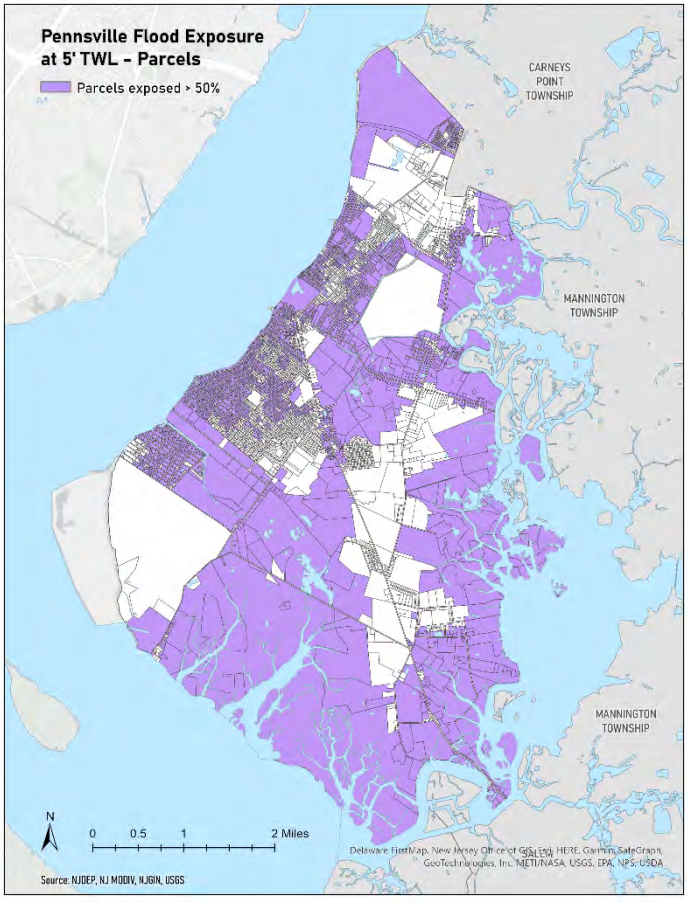

Figure 11: Parcel Flood Exposure, 5' TWL

[23] As stated above in Section 3, the criteria for a parcel to be considered flooded is 50% of parcel area inundated.

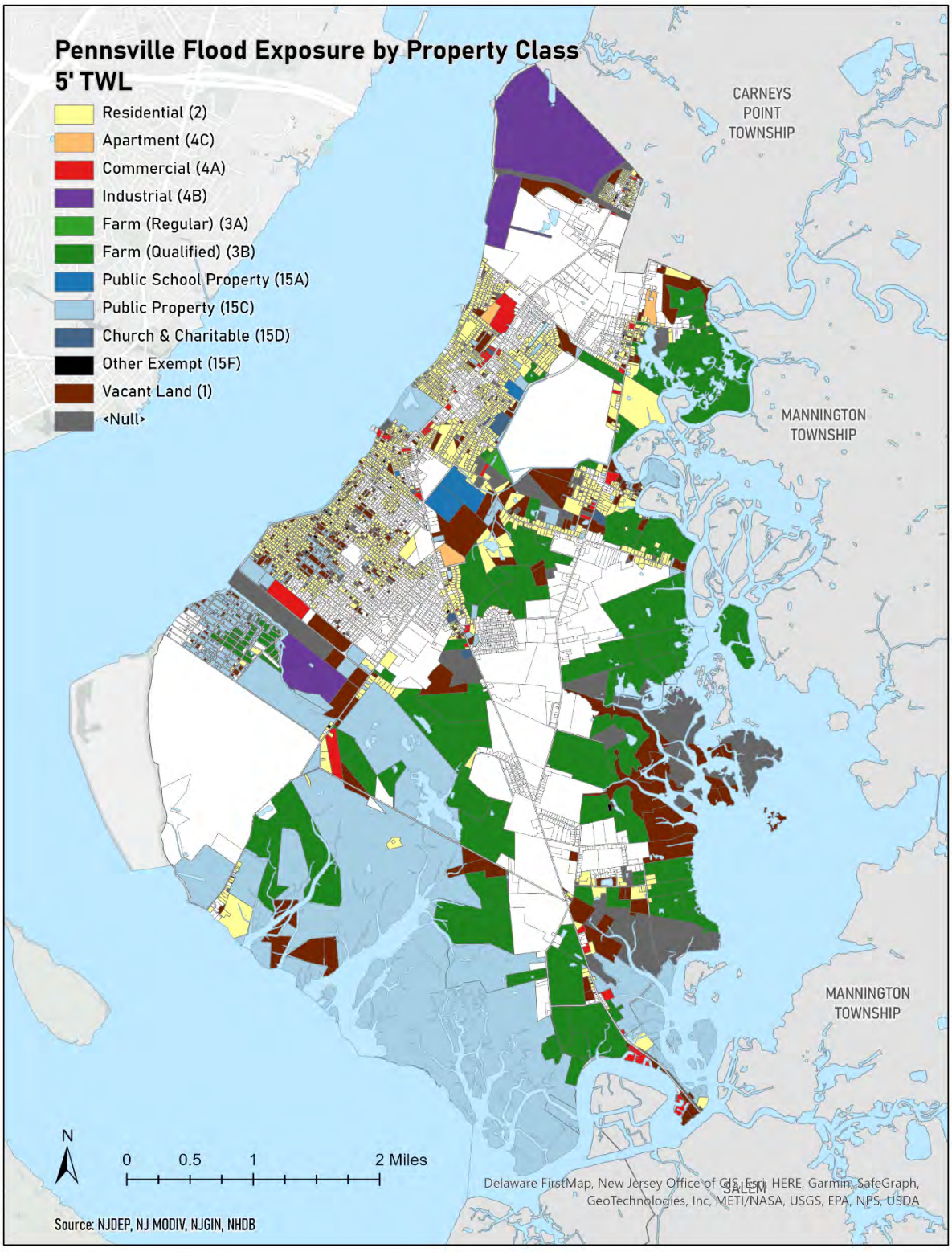

Figure 13: Flood Exposure by Parcel Class, 5' TWL

PROPERTY CLASS	# PARCELS FLOODED	IMPROVEMENT $ VALUE, FLOODED	LAND $ VALUE, FLOODED	FLOODED PARCELS W/ $0 VALUE
Residential (2)	2465 (53.3%)	$247,521,500.00	$125,025,343.00	0
Apartment (4C)	5 (31.3%)	$9,974,800.00	$5,355,200.00	0
Commercial (4A)	61 (33.3%)	$16,811,300.00	$10,388,000.00	0
Industrial (4B)	3 (100%)	$82,952,900.00	$34,161,600.00	0
Farm Total (3A & 3B)	118 (72.3%)	$238,900.00	$1,019,300.00	56
Public and School Property (15A, 15B, 15C)	379 (81.5%)	$27,470,600.00	$17,633,200.00	57
Church & Charitable (15D)	16 (43.2%)	$8,779,200.00	$1,406,800.00	0
Other Exempt (15F)	21 (48.8%)	$2,498,300.00	$982,400.00	0
Vacant (1)	485 (73.5%)	$0.00	$10,958,000.00	1
TOTAL	**3553**	**$396,247,500.00**	**$206,929,843.00**	**114**

Table 4: Parcels Exposed, 5' TWL

For each property class, Table 4 presents the number and percentage of flooded parcels and the value of improvements and land.

The property classes with the highest percentage of flooded parcels are "Industrial 4B" at 100%, "Public and School Property 15A, 15B & 15C" at 81.5%, and "Farm 3A & 3B" at 72.3%.

The three most affected property classes based on total improvement value are "Residential 2" with a value of $247,521,500, "Industrial 4B" with a value of $82,952,900, and "Public and School Property 15A, 15B & 15C" with a value of $27,470,600.

In terms of land value, the three most affected property classes are "Residential 2," with a value of $125,025,343, "Industrial 4B," with a value of $34,161,600, and "Public Property 15A, 15B, & 15C," with a value of $17,633,200.

7 Ft Scenario Total Water Level

Figure 14 presents a raster layer map illustrating the 7-Foot TWL flood scenario for Pennsville. Almost all the parcels in the Deepwater and Central Park neighborhoods experience inundation in this scenario. In Valley Park, there are additional flooded parcels south of East Pittsfield Rd relative to the 5-foot scenario.

Figure 15 displays 4,883 of 6,197 parcels (78.8%) exposed to flooding at 7 feet TWL.[24] There is a 37.4% increase in flooded parcels relative to the 5-foot TWL scenario.

At the 7-foot TWL scenario, about 78.8% of the township's parcels are flooded. The impact of this flooding could have significant consequences for property owners and the wider community, including potential damage to infrastructure, loss of property value, and disruption to everyday life.

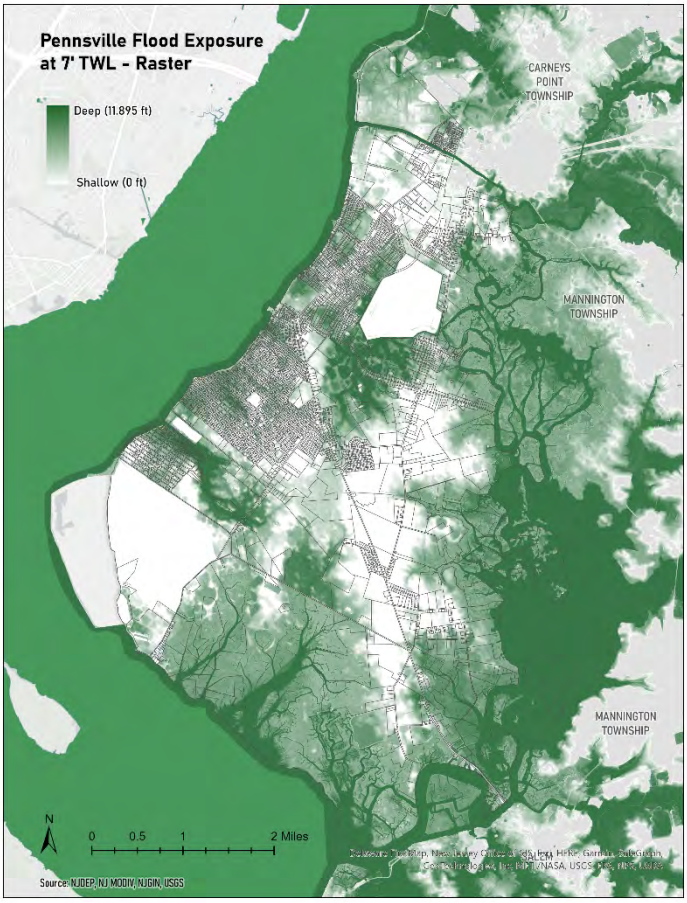

Figure 15: Spatial Extent of Flooding, 7' TWL

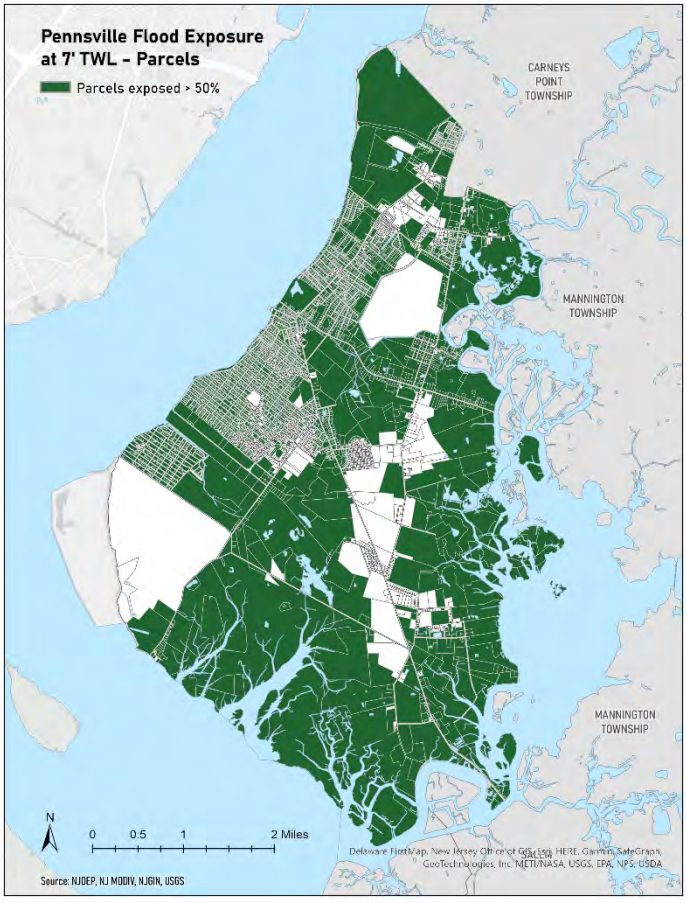

Figure 14: Parcel Flood Exposure, 7' TWL

[24] As stated above in Section 3, the criteria for a parcel to be considered flooded is 50% of parcel area inundated.

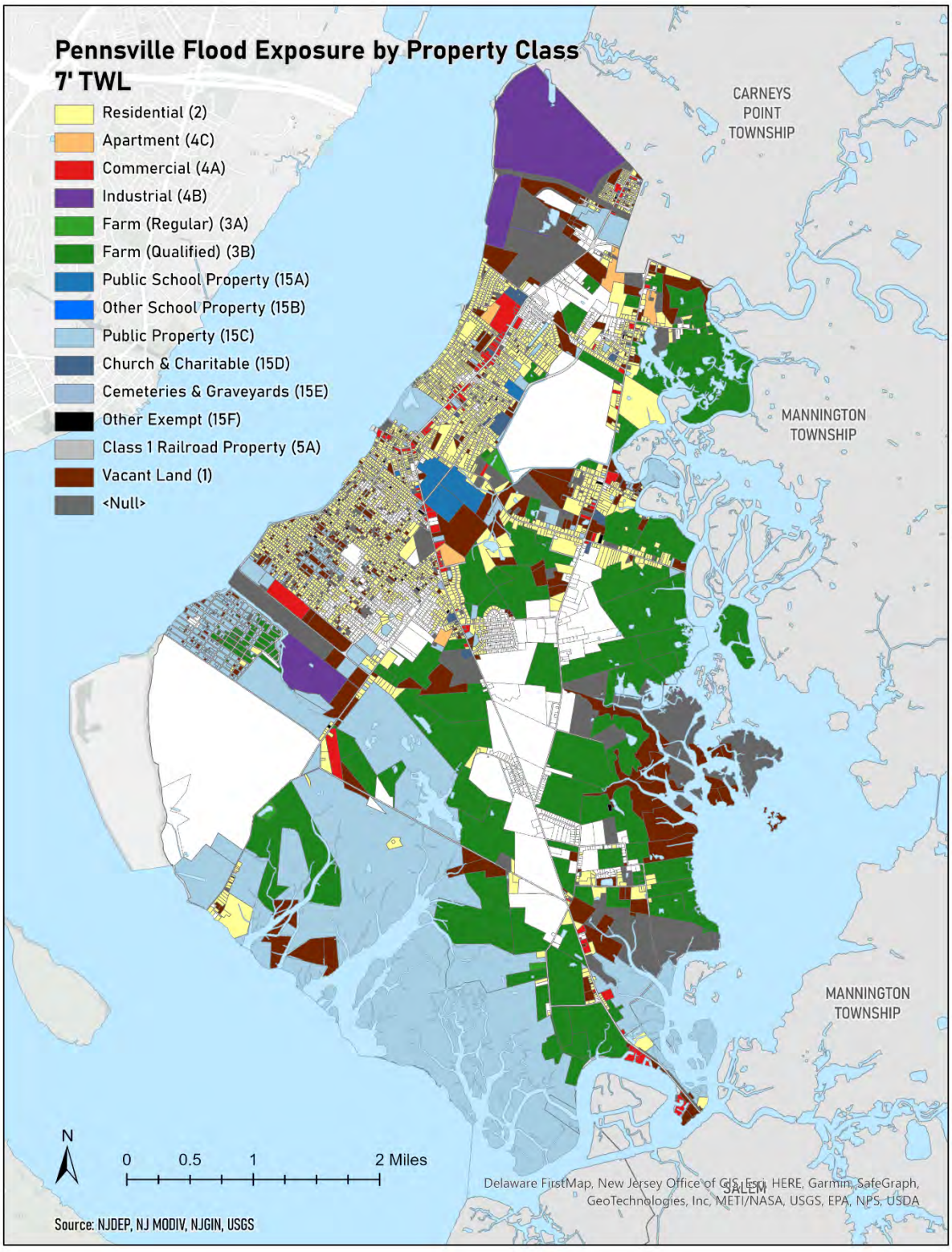

Figure 16: Flood Exposure by Parcel Class, 7' TWL

PROPERTY CLASS	# PARCELS FLOODED	IMPROVEMENT $ VALUE, FLOODED	LAND $ VALUE, FLOODED	FLOODED PARCELS W/ $0 VALUE
Residential (2)	3520 (76.2%)	$358,786,200.00	$175,336,143.00	0
Apartment (4C)	12 (75.0%)	$13,163,200.00	$7,966,900.00	0
Commercial (4A)	128 (69.9%)	$35,654,000.00	$20,411,700.00	0
Industrial (4B)	3 (100%)	$82,952,900.00	$34,161,600.00	0
Farm Total (3A & 3B)	140 (85.9%)	$599,000.00	$1,350,600.00	59
Public and School Property (15A, 15B, 15C)	441 (95.7%)	$48,154,100.00	$23,510,600.00	65
Church & Charitable (15D)	26 (70.3%)	$12,544,600.00	$2,453,100.00	0
Cemeteries & Graveyards (15E)	2 (66.7%)	$0.00	$104,800.00	0
Other Exempt (15F)	29 67.4%)	$3,533,600.00	$1,561,700.00	0
Class I Railroad Property (5A)	2 (100%)	$0.00	$152,100.00	0
Vacant (1)	580 (87.9%)	$0.00	$16,163,532.00	1
TOTAL	**4883**	**$555,387,600.00**	**$283,172,775.00**	**125**

Table 5: Parcels Exposed, 7' TWL

For each property class, Table 5 presents the number and percentage of flooded parcels and the value of improvements and land.

The property classes with the highest percentage of flooded parcels are Industrial 4B" at 100%, "Public and School Property 15A, 15B & 15C" at 95.7%, and "Vacant 1" at 87.9%.

The three most affected property classes based on total improvement value are "Residential 2" with a value of $358,786,200, "Industrial 4B" with a value of $82,952,900, and "Public and School Property 15A, 15B & 15C" with a value of $48,154,100.

In terms of land value, the three most affected property classes are "Residential 2," with a value of $175,336,143, "Industrial 4B," with a value of $34,161,600, and "Public Property 15A, 15B, & 15C," with a value of $23,510,600.

100-Year Event Scenario – 1% Chance

The FEMA 100-Year event scenario describes a flood event with a 1% chance of occurring in any given year. FEMA uses this scenario to assess the potential risk of flooding in different areas and develop floodplain maps.

The floodplain map for this scenario shows 3,149 parcels (50.8% of the total) in the township as likely to be inundated in a flood that meets the FEMA 100-Year event scenario.

The number of parcels exposed to flooding in the FEMA 100-Year event scenario closely aligns with the 5-foot TWL scenario.

Using the FEMA 100-Year event scenario and the corresponding floodplain map is essential for assessing flood risk and developing strategies to mitigate potential damage.

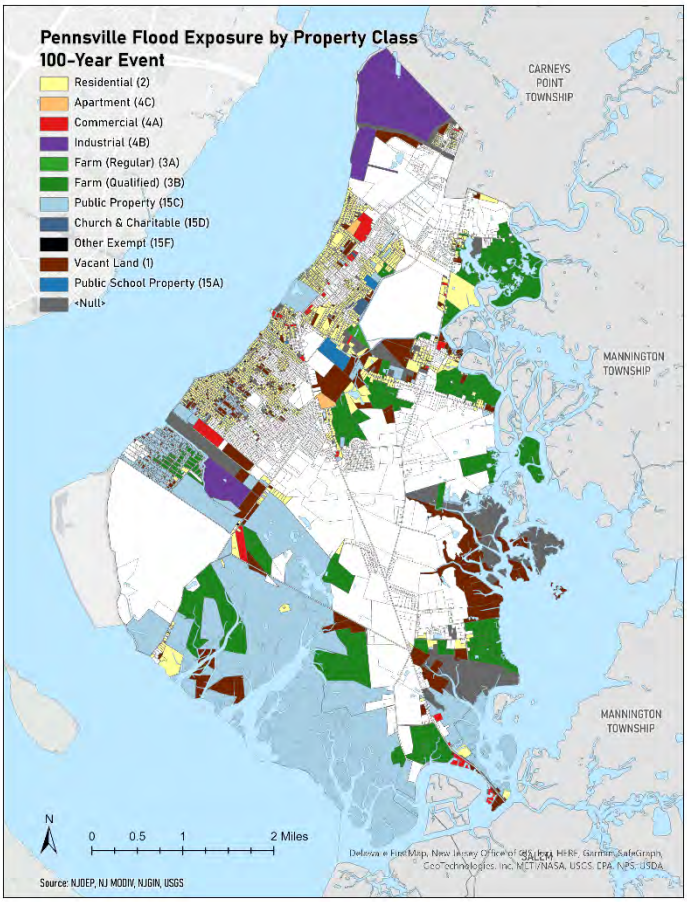

Figure 18: Flood Exposure by Parcel Class, 100-year, 1% Event

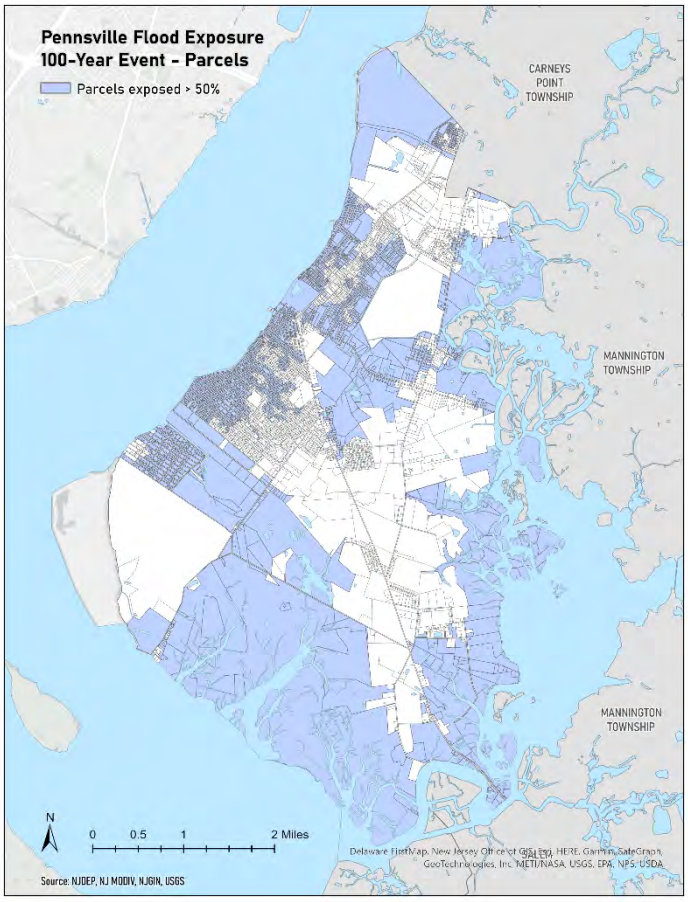

Figure 17: Parcel Flood Exposure, 100-year, 1% Event

PROPERTY CLASS	# PARCELS FLOODED	IMPROVEMENT $ VALUE, FLOODED	LAND $ VALUE, FLOODED	FLOODED PARCELS W/ $0 VALUE
Residential (2)	2179 (64.1%)	$220,356,200.00	$112,664,143.00	0
Apartment (4C)	3 (18.8%)	$8,387,500.00	$4,219,800.00	0
Commercial (4A)	46 (25.1%)	$14,308,400.00	$8,346,700.00	0
Industrial (4B)	3 (100%)	$82,952,900.00	$34,161,600.00	0
Farm Total (3A & 3B)	94 (57.7%)	$238,900.00	$559,100.00	58
Public and School Property (15A, 15B, 15C)	372 (80%.0)	$16,682,300.00	$15,684,500.00	60
Church & Charitable (15D)	10 (27%)	$4,974,700.00	$567,200.00	0
Other Exempt (15F)	17 (39.5%)	$1,737,000.00	$781,800.00	0
Vacant (1)	425 (64.4%)	$0.00	$8,997,100.00	1
TOTAL	**3149**	**$349,637,900.00**	**$185,981,943.00**	**119**

Table 6: Parcels Exposed, 100-year, 1% Event

For each property class, Table 6 presents the number and percentage of flooded parcels and the value of improvements and land.

The property classes with the highest percentage of flooded parcels are “Industrial 4B" at 100%, “Public and School Property 15A, 15B & 15C" at 80%, and "Vacant 1" at 64.4%.

The three most affected property classes based on total improvement value are "Residential 2" with a value of $220,356,200, "Industrial 4B" with a value of $82,952,900, and "Public and School Property 15A, 15B & 15C" with a value of $16,682,300.

In terms of land value, the three most affected property classes are "Residential 2," with a value of $112,664,143, "Industrial 4B," with a value of $34,161,600, and "Public Property 15A, 15B, & 15C," w a with a value of $15,684,500.

500-Year Event Scenario – 0.2% Chance

The FEMA 500-Year event scenario describes a flood event that has a 0.2% chance of occurring in any given year. This scenario is more catastrophic than the FEMA 100-Year event scenario, representing a less likely but more severe flood event.

The floodplain map for the FEMA 500-Year event scenario indicates that a total of 4,734 parcels would be flooded.

Furthermore, the report indicates that the impact of the FEMA 500-year event scenario can be compared to the 7-foot TWL scenario. Based on this, the potential damage from the FEMA 500-Year event scenario may be like a flood with a 7 ft TWL.

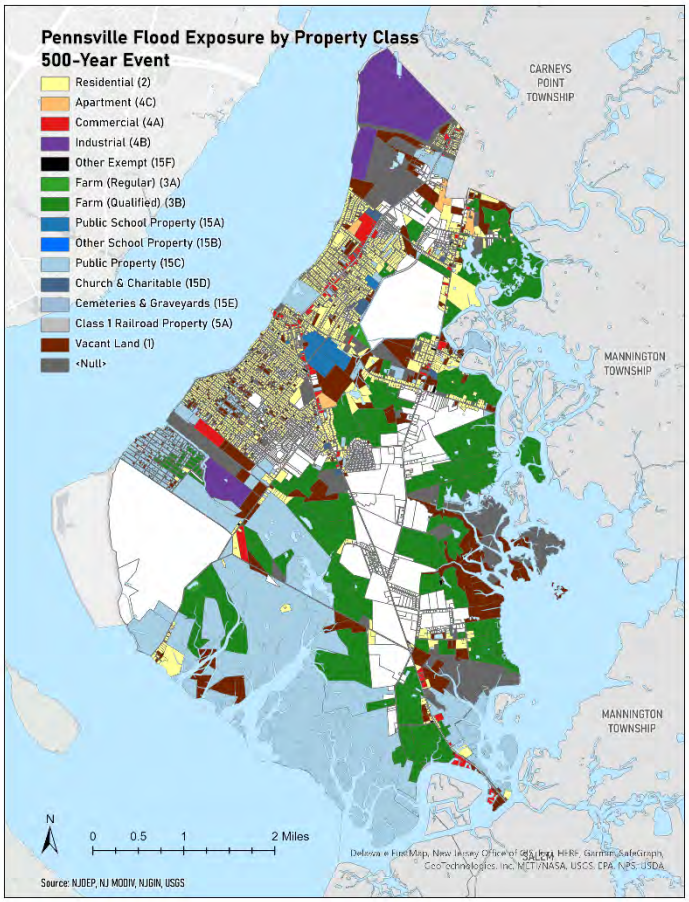

Figure 19: Flood Exposure by Parcel Class, 500-year, 0.2% Event

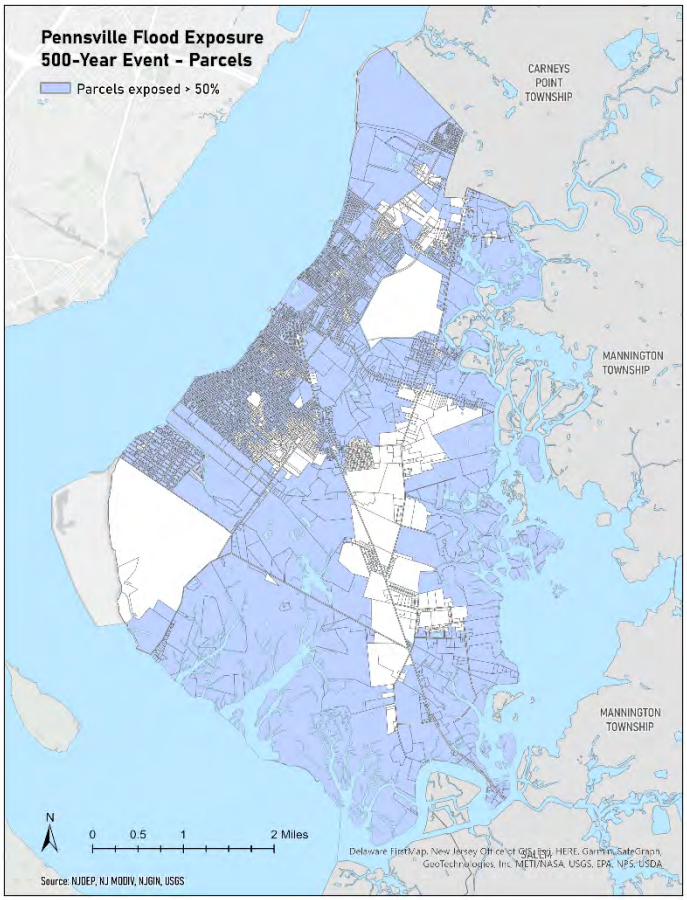

Figure 20: Parcel Flood Exposure, 500-year, 0.2% Event

PROPERTY CLASS	# PARCELS FLOODED	IMPROVEMENT $ VALUE, FLOODED	LAND $ VALUE, FLOODED	FLOODED PARCELS W/ $0 VALUE
Residential (2)	3399 (73.5%)	$344,423,500.00	$169,394,743.00	0
Apartment (4C)	12 (75%)	$11,491,600.00	$6,575,400.00	0
Commercial (4A)	129 (70.5%)	$34,260,100.00	$19,835,100.00	0
Industrial (4B)	3 (100%)	$82,952,900.00	$34,161,600.00	0
Farm Total (3A & 3B)	126 77.3%)	$481,700.00	$1,160,000.00	59
Public and School Property (15A, 15B, 15C)	433 (93.1%)	$48,172,300.00	$23,235,700.00	66
Church & Charitable (15D)	26 (70.3%)	$12,032,500.00	$2,364,200.00	0
Cemeteries & Graveyards (15E)	2 (66.7%)	$0.00	$104,800.00	0
Other Exempt (15F)	29 (67.4%)	$3,635,500.00	$1,548,900.00	0
Class I Railroad Property (5A)	2 (100%)	$0.00	$152,100.00	0
Vacant (1)	573 (86.8%)	$0.00	$15,902,732.00	1
TOTAL	**4734**	**$537,450,100.00**	**$274,435,275.00**	**126**

Table 7: Parcels Exposed, 500-year, 0.2% Event

For each property class, Table 7 presents the number and percentage of flooded parcels and the value of improvements and land.

The property classes with the highest percentage of flooded parcels are “Industrial 4B" at 100%, “Public and School Property 15A, 15B & 15C" at 93.1%, and "Vacant 1" at 86.8%.

The three most affected property classes based on total improvement value are "Residential 2" with a value of $344,423,500, "Industrial 4B" with a value of $82,952,900, and "Public and School Property 15A, 15B & 15C" with a value of $16,682,300.

In terms of land value, the three most affected property classes are "Residential 2," with a value of $112,664,143, "Industrial 4B," with a value of $34,161,600, and "Public Property 15A, 15B, & 15C," with a value of $15,684,500.

Hurricane Sandy Proxy – 4 Ft TWL Scenario

Figure 21 shows the areas impacted by the storm surge during Hurricane Sandy. This map was created using USGS field-verified High-Water Marks (HWMs) and Storm Surge Sensor data, commonly used to assess flood extents.

Rutgers selected the 4-foot Total Water Level data as a proxy for Hurricane Sandy due to the incompleteness of the latter's dataset. See below for an overlaid map of both scenarios.

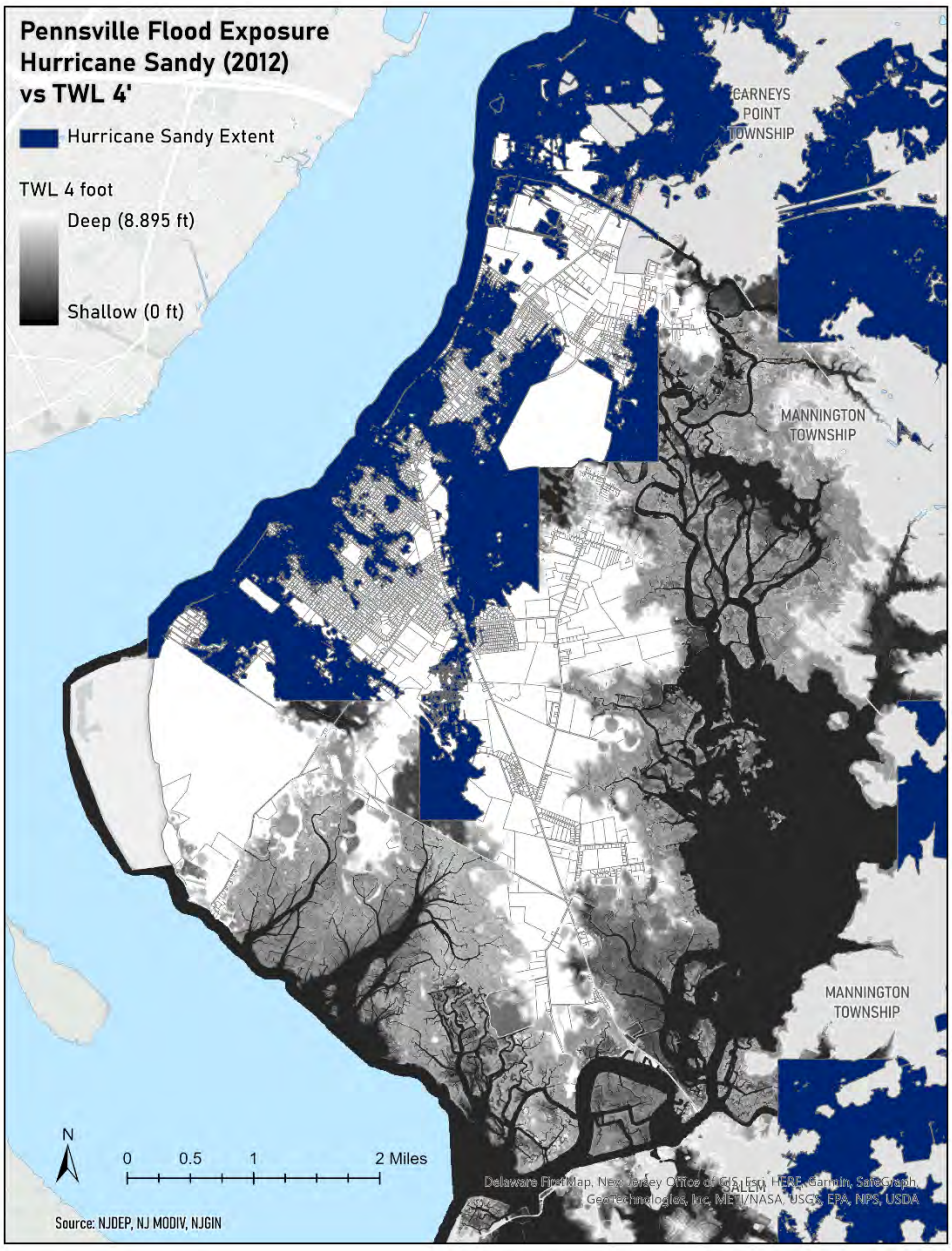

Figure 21: Comparison of Hurricane Sandy exposure data with TWL 4'

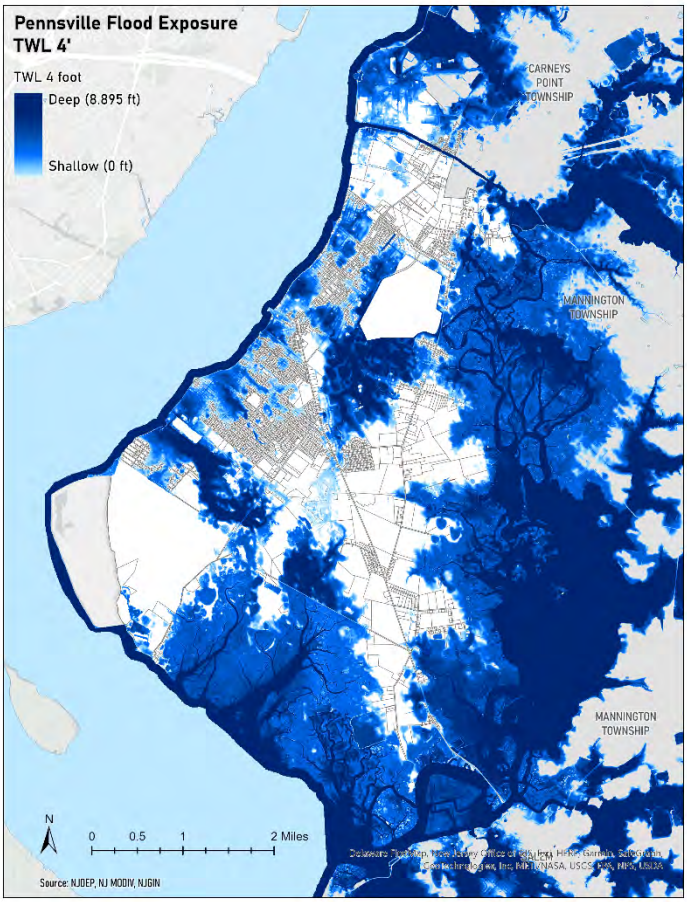

Figure 22: Spatial Extent of Flooding, 4' TWL

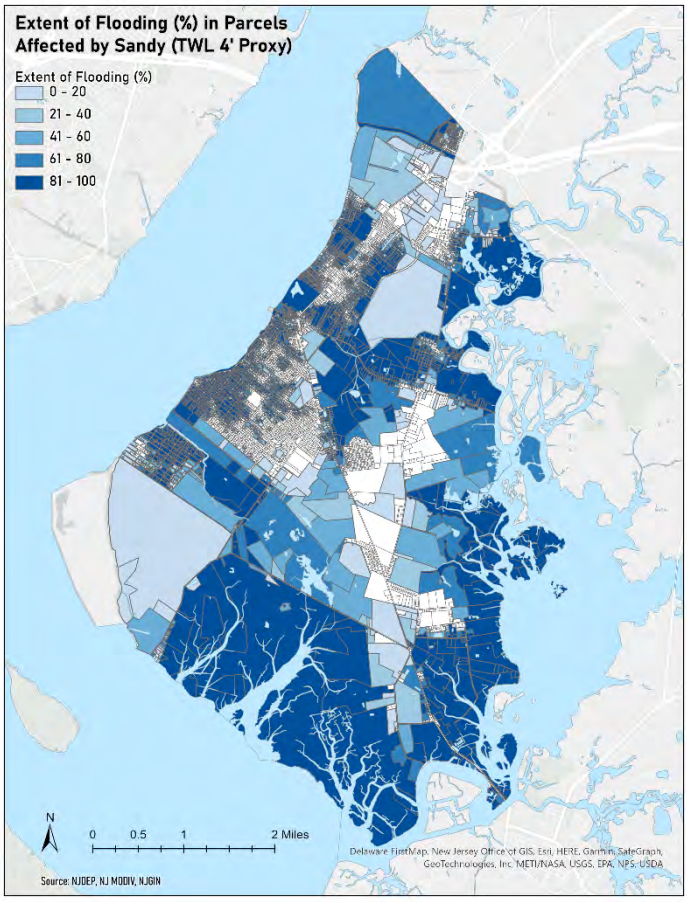

Figure 23: Flooding by Percent of Parcel Inundated, 4' TWL

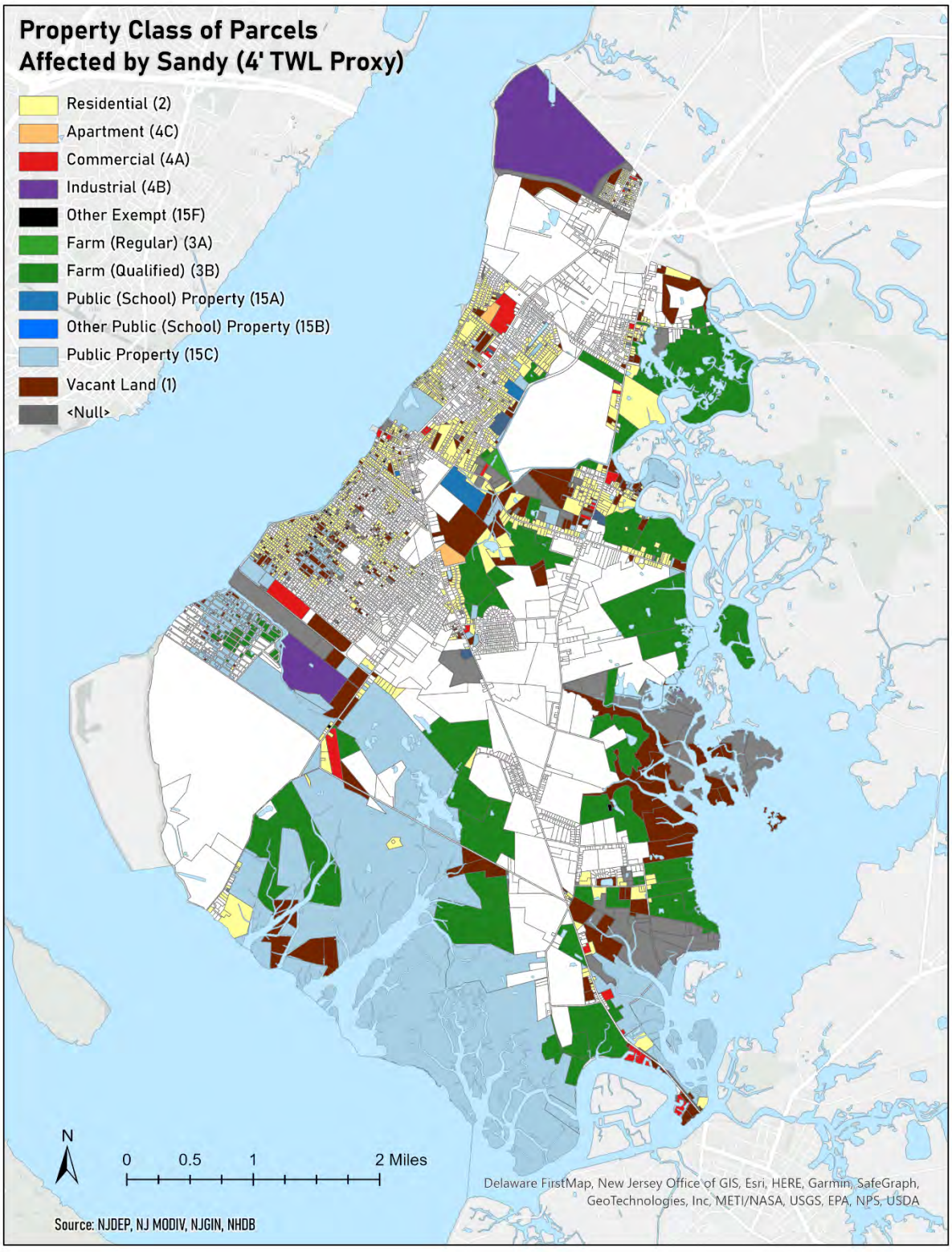

Figure 23: Flood Exposure by Parcel Class, 4' TWL

PROPERTY CLASS	# PARCELS FLOODED	IMPROVEMENT $ VALUE, FLOODED	LAND $ VALUE, FLOODED	FLOODED PARCELS W/ $0 VALUE
Residential (2)	1831	$182,510,900.00	$93,896,575.00	0
Apartment (4C)	3	$8,387,500.00	$4,219,800.00	0
Commercial (4A)	40	$10,639,200.00	$7,358,600.00	0
Industrial (4B)	2	$81,952,900.00	$24,229,000.00	0
Farm Total (3A & 3B)	96	$238,900.00	$730,900.00	59
Public and School Property (15A, 15B, 15C)	328	$15,526,300.00	$14,939,700.00	66
Church & Charitable (15D)	8	$4,227,100.00	$923,500.00	0
Other Exempt (15F)	13	$1,365,700.00	$583,000.00	0
Vacant (1)	398	$0.00	$8,944,100.00	1
TOTAL	**2719**	**$304,848,500.00**	**$155,825,175.00**	**126**

Table 8: Parcels Exposed, 4' TWL (Hurricane Sandy Proxy)

For each property class, Table 8 presents the number and percentage of flooded parcels and the value of improvements and land.

Bulkhead, Pennsville Delaware Bay Analysis

At the request of Pennsville Township, Rutgers conducted an analysis of parcels affected by inundation surrounding the township's shoreline protection bulkhead. The bulkhead is in the Penn Beach area of Pennsville, where there is a concentration of single-family detached homes with high land values.

Figure 25 represents the approximate limits of inundation behind the bulkhead, including flood elevations at 7, 8, and 9 feet. Note that Rutgers does not have access to data to visualize the bulkhead extent, nor is this analysis a hydrological model with precise elevation data or land cover/soil composition. Rather, the purpose of this analysis is to estimate the number and net land/improvement values of affected parcels in the event of inundation.

The following maps present data of affected parcels for three inundation events, calculated by the township engineer using data from the FEMA Flood Insurance Study (FIS). The associated tables for each inundation scenario present information about the various property classes, number of flooded parcels, and value of improvements and land.

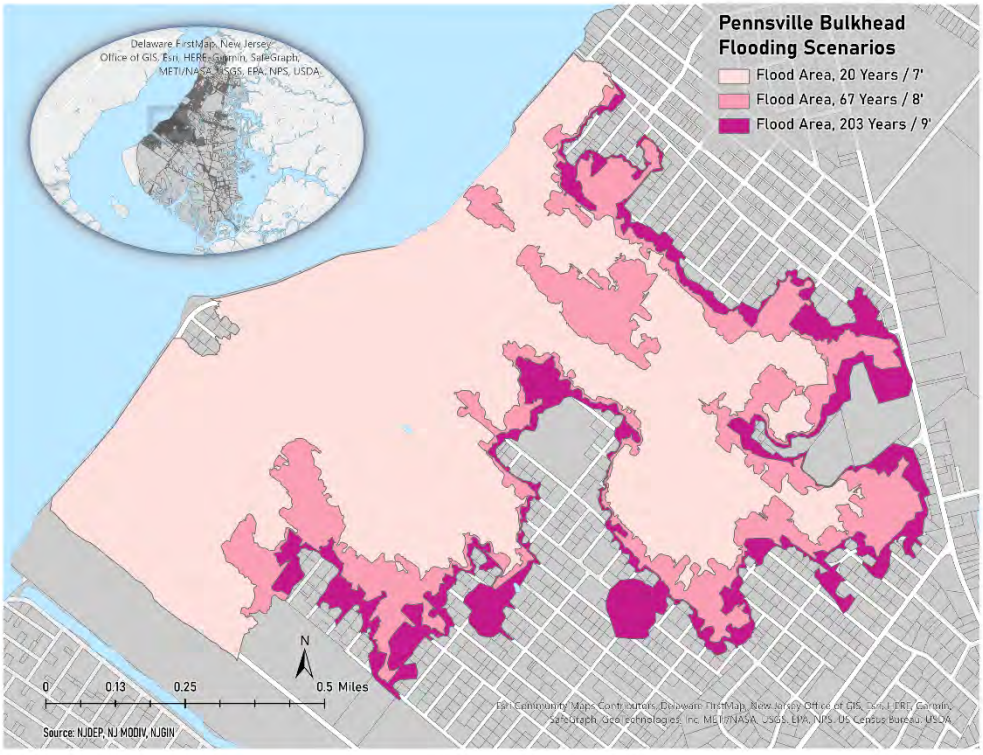

Figure 24: Pennsville Bulkhead Inundation Scenarios, Overview

a. Bulkhead, 7 ft Flood Elevation Scenario (20-year event)

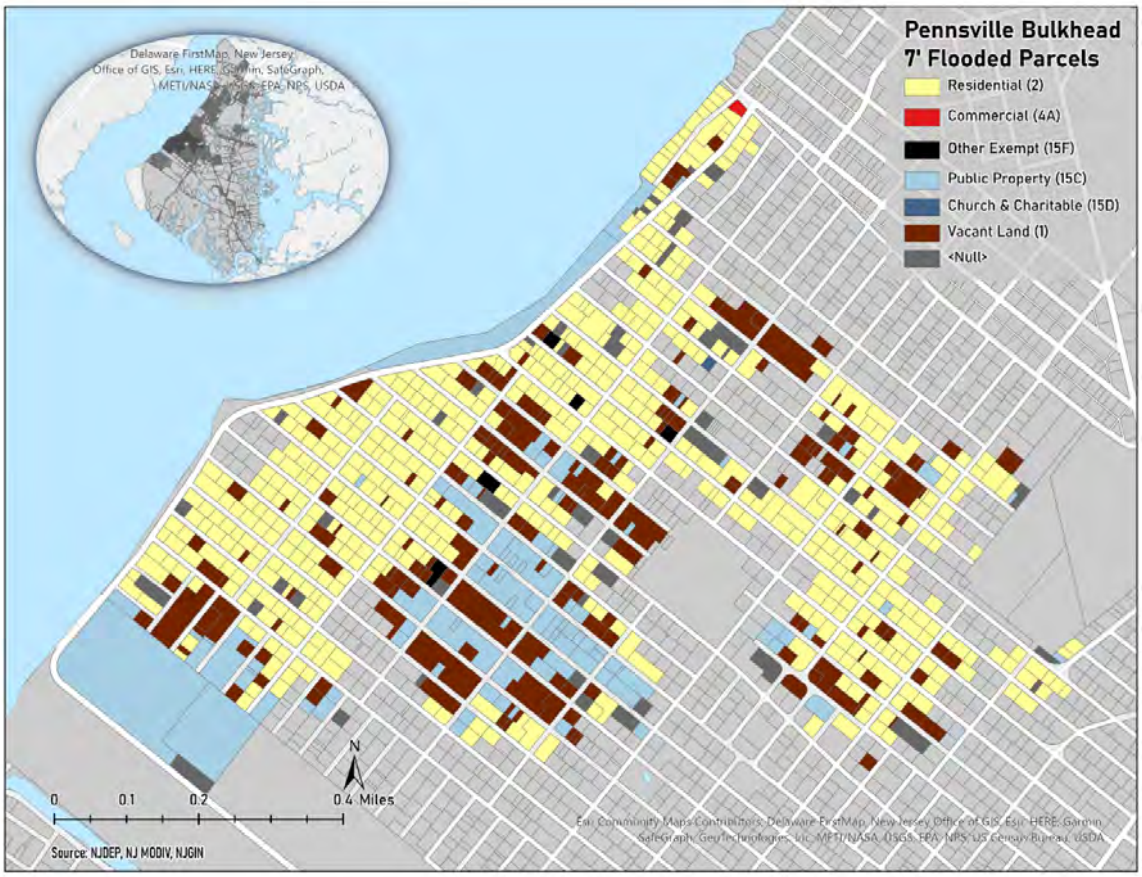

Figure 25: Pennsville Bulkhead 7' Scenario

PROPERTY CLASS	# PARCELS FLOODED	IMPROVEMENT VALUE	LAND VALUE	FLOODED PARCELS W/ $0 VALUE
Residential (2)	555	$54,251,700.00	$27,068,300.00	0
Commercial (4A)	1	$169,500.00	$50,600.00	0
Public and School Property (15A, 15B, 15C)	95	$590,100.00	$3,174,500.00	0
Church & Charitable (15D)	1	$116,600.00	$46,000.00	0
Other Exempt (15F)	5	$509,100.00	$245,700.00	0
Vacant (1)	183	$0.00	$3,053,200.00	0
NULL	69	$0.00	$0.00	69
TOTAL	**909**	**$55,637,000.00**	**$33,638,300.00**	**69**

Table 9: Parcels Exposed, 7' Bulkhead Scenario

b. Bulkhead, 8 Ft Flood Elevation Scenario (67-year event)

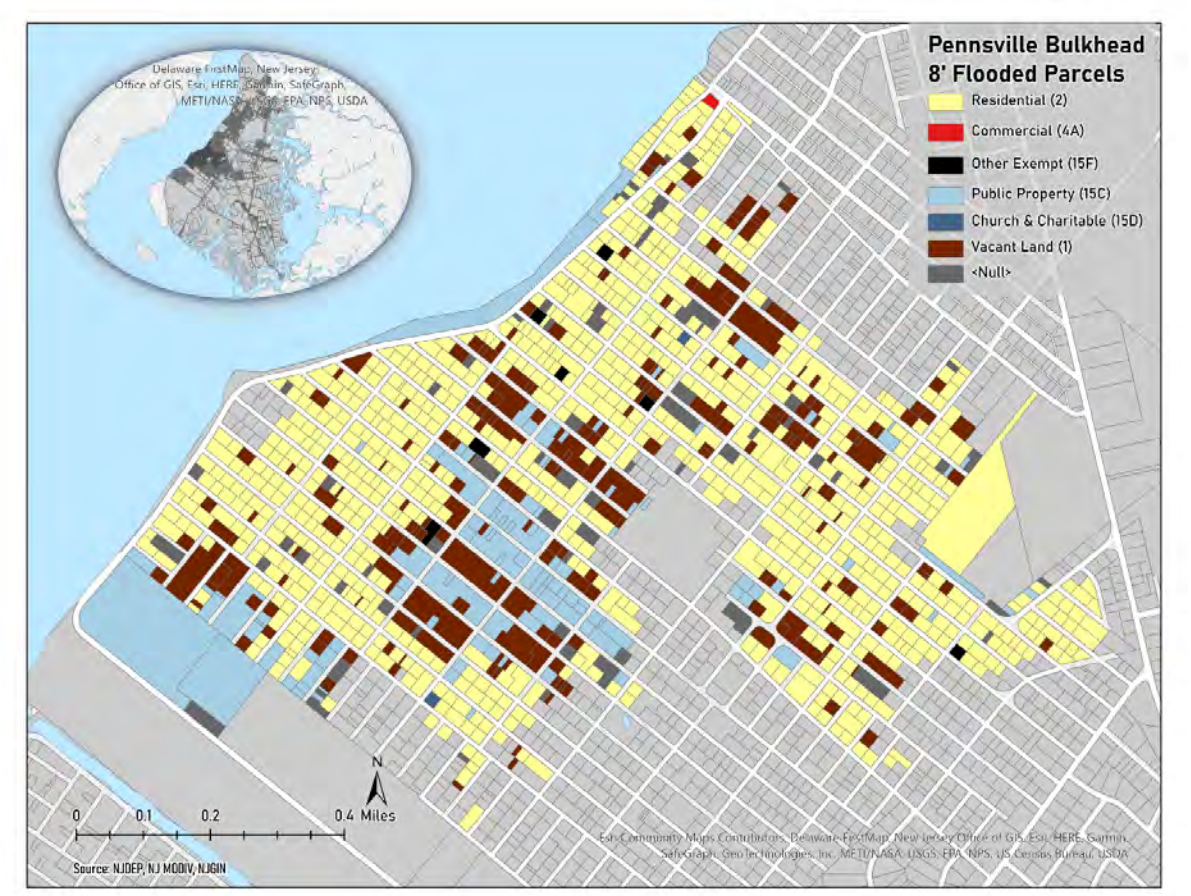

Figure 26: Pennsville Bulkhead 8' Scenario

PROPERTY CLASS	# PARCELS FLOODED	IMPROVEMENT VALUE	LAND VALUE	PARCELS W/ $0 VALUE
Residential (2)	815	$81,347,300.00	$39,653,900.00	0
Commercial (4A)	1	$169,500.00	$50,600.00	0
Public and School Property (15A, 15B, 15C)	110	$590,100.00	$3,457,800.00	0
Church & Charitable (15D)	2	$272,900.00	$96,000.00	0
Other Exempt (15F)	7	$726,900.00	$345,700.00	0
Vacant (1)	228	$0.00	$3,762,000.00	0
NULL	91	$0.00	$0.00	91
TOTAL	**1254**	**$83,106,700.00**	**$47,366,000.00**	**91**

Table 10: Parcels Exposed, 8' Bulkhead Scenario

c. Bulkhead, 9 Ft Flood Elevation Scenario (203-year Event)

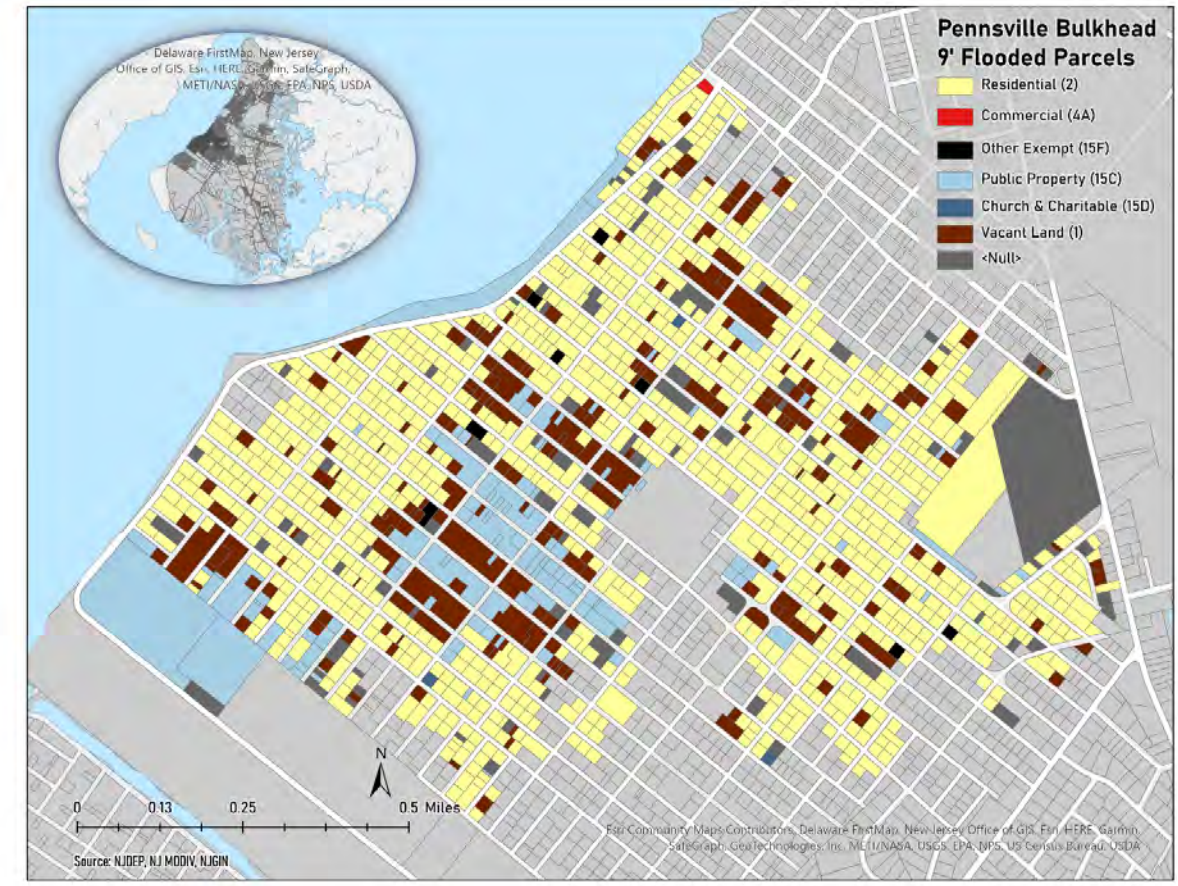

Figure 27: Pennsville Bulkhead 9' Scenario

PROPERTY CLASS	# PARCELS FLOODED	IMPROVEMENT VALUE	LAND VALUE	PARCELS W/ $0 VALUE
Residential (2)	957	$95,812,400.00	$46,418,800.00	0
Commercial (4A)	1	$169,500.00	$50,600.00	0
Public and School Property (15A, 15B, 15C)	112	$590,100.00	$3,470,800.00	0
Church & Charitable (15D)	3	$345,300.00	$146,000.00	0
Other Exempt (15F)	8	$811,900.00	$395,700.00	0
Vacant (1)	246	$0.00	$4,115,300.00	0
NULL	115	$0.00	$0.00	115
TOTAL	**1442**	**$97,729,200.00**	**$54,597,200.00**	**115**

Table 11: Parcels Exposed, 9' Bulkhead Scenario

Socially Vulnerable Populations

Social vulnerability is a critical factor that must be considered in hazard planning, as not all individuals or communities are affected equally when disasters occur. Socially vulnerable populations have compounding challenges, making it more difficult to recover from natural or manmade disasters, disease outbreaks, or other public health emergencies. As a result, officials in various areas, such as disaster preparedness, public health, and emergency response, have increasingly relied on the Social Vulnerability Index (SVI) developed by the Centers for Disease Control and Prevention.

Initially designed to target public health policies to specific communities, the SVI has since been applied to identify communities that may require assistance in preparing for, or recovering from, natural disasters such as storms or flooding. This index considers a wide range of social factors, including income, education, housing, access to transportation, and other factors that can impact a community's ability to cope with and recover from a disaster (Figure 29).

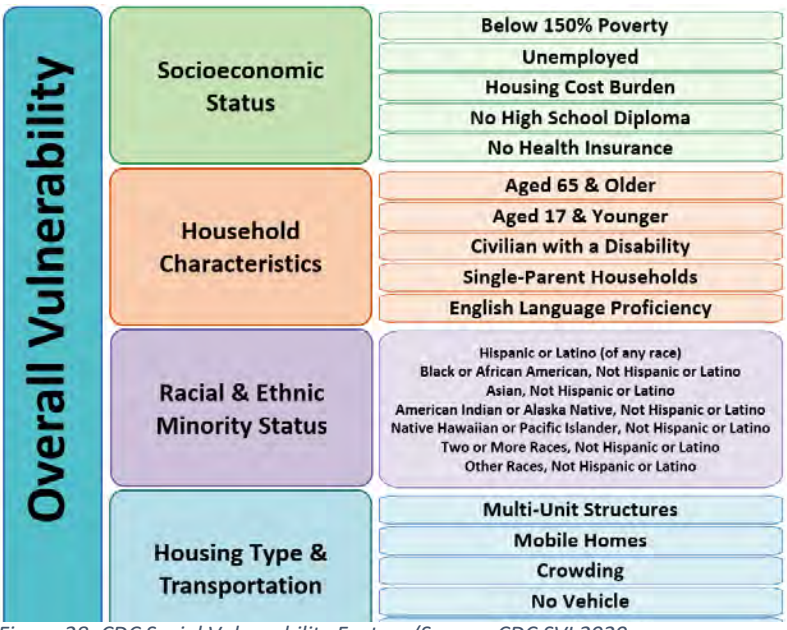

Figure 28: CDC Social Vulnerability Factors (Source: CDC SVI 2020 Documentation)

By using the SVI, public officials can more effectively target resources to the communities most in need and help ensure that vulnerable populations are not overlooked or left behind in the wake of a disaster. Ultimately, the use of the SVI is an essential tool for promoting more equitable disaster planning and response and helping to ensure that all community members have the resources and support they need to prepare for, respond to, and recover from disasters.

The Social Vulnerability Index (CDC/ATSDR SVI) is a tool created by the Geospatial Research, Analysis, and Services Program (GRASP) that measures how vulnerable communities in the United States are to disasters, such as natural disasters, disease outbreaks, and public health emergencies. The SVI uses demographic, socioeconomic, and household/housing characteristics to calculate each community's vulnerability score. The percentile ranking values range from 0 to 1, with higher values indicating greater vulnerability. Each tract within a community receives a separate ranking for each of the four themes that the SVI measures. The SVI is a valuable tool for public officials in disaster preparedness, public health, emergency response, and other areas, as it helps to identify communities that may need assistance in preparing for or recovering from hazards such as storms or flooding.

The SVI for Pennsville is useful for highlighting areas that require attention and resources to address the factors contributing to vulnerability.

Census Tract #	Overall SVI	Socioeconomic Status	Household Characteristics	Racial & Ethnic Minority Status	Housing Type & Transportation
214	0.623	0.671	0.671	0.137	0.395
215	0.391	0.540	0.604	0.097	0.189
216	0.574	0.737	0.783	0.037	0.263
217	0.647	0.667	0.751	0.326	0.520

Table 11: The SVI scores of Pennsville's four Census Tracts.

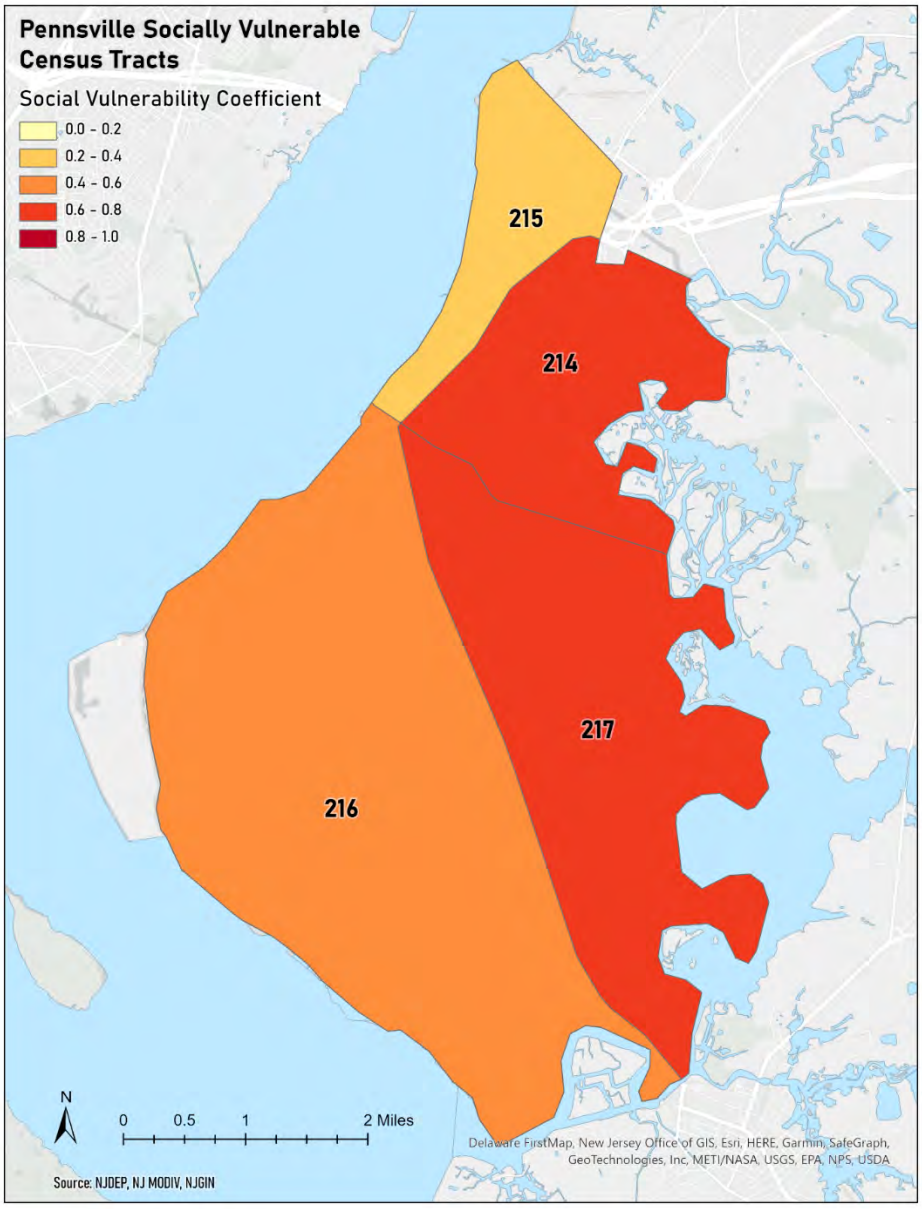

Figure 29: Pennsville's four 2020 Census Tracts, color-coded by Social Vulnerability Index

The next four sections (a) through (d) will briefly explain each theme of the SVI, connect it to disaster vulnerability, and identify any tract's SVI variables that the CDC has flagged as being in the 90th percentile or higher.

The fifth section (e) covers New Jersey's Overburdened Communities (OBCs), as defined on page 7 of this report. Per the New Jersey Environmental Justice Law of 2020, when regulated facilities (such as incinerators, landfills, sewage plants) apply for permits from the NJDEP, the NJDEP must consider the impacts of such facilities on OBCs. However, instead of such regulatory considerations, this analysis report uses the OBC designations themselves as another indicator of social vulnerability.

a. Socioeconomic Status

Socioeconomic Status (SES) variables include persons in poverty (measured as below 150% of the federal poverty line), persons aged 16 and higher unemployed, housing cost burden (households that spend 30% or more of annual income on housing costs), persons without high school diplomas (age 25 and higher), and persons without health insurance. Economically disadvantaged populations are severely affected by disasters such as flooding events and they have less capacity to prepare for and recover from disaster events. The relationship between vulnerability to disaster and education is less explicit—however, education is understood as being associated with income and poverty; those with lower educational attainment have limited access to disaster preparedness/recovery information.

All four Census Tracts rank above the median social vulnerability for the SES theme, but none of them are flagged as extremely high. Of the four, Tract 216 has the highest theme index due to comparatively higher percentage of population below 150% of the federal poverty level. Tract 217 has a moderate theme index for SES due to its moderately high percentage of housing-burdened units.

b. Household Characteristics

The Household Characteristics theme comprises age-related, single parenting, disability, and English-speaking variables. Minors, senior citizens, single-parent households, persons with disabilities, and persons (age 5 and higher) who speak English “less than well” are usually the groups more vulnerable to disasters. Often, they require more financial support, medical care, or assistance with the activities of daily living. Note that in Census Bureau definitions, disability can encompass several impairments related to movement, cognition, or sensory functions.

Of all social vulnerability themes, Household Characteristics stands out as being moderate-to moderately high for all four tracts in Pennsville. The CDC has flagged Tract 217 for this theme, due to the tract’s high percentage (27.9%) of its residents as persons noninstitutionalized disabled, relative to the rest of the state of New Jersey.

c. Minority Status & Language Barriers

Minority Status and Language is a vulnerability theme that consists of race, ethnicity, and English language proficiency variables. Such groups may be more vulnerable as they are socially and culturally marginalized. Moreover, disaster preparedness and recovery outreach/alerting require special efforts to reach limited-English individuals.

Relatively few individuals of minority or limited-English proficiency reside in Pennsville Township compared to the state. Limited English proficiency is rare

across all three tracts and comprises a total population of 261 individuals township-wide.

d. Housing Type & Transportation

The theme of Housing Type and Transportation includes housing type, crowding, and vehicle access variables. Housing quality is an important factor in disaster vulnerability because those who live in poorly constructed housing, mobile homes, or overcrowded conditions are especially at-risk during flooding events and recovery. Overcrowding, defined as more occupants than rooms in a housing unit, can complicate the search for temporary shelter or replacement housing. Furthermore, absent a robust public transportation option during evacuation conditions, household vehicle access may be critical.

The CDC has flagged Tract 214 as having a high percentage (14.5%) of its housing units as mobile homes, relative to the United States. This ranks it among the top 98.2% of parcels for this characteristic.

Census Tract 214 – Social Vulnerability

Overall Social Vulnerability (Tract Level)	Themes	15 Variables (Census)	Estimate	Percentage	Percentile
	Theme 1: Socioeconomic Status	Below 150% Poverty	599	17.1%	0.6404
		Unemployed	112	6.2%	0.6188
		Housing-burdened units	336	24.3%	0.3628
		No High School Diploma (age 25+)	297	12.1%	0.7036
		Uninsured	180	5.2%	0.4866
	Theme 2: Household Characteristics	Age 65 or older	730	20.9%	0.8022
		Age 17 or younger	789	22.6%	0.5846
		Noninstitutionalized Disabled	527	15.1%	0.8295
		Single-parent Household	55	4%	0.4417
	Theme 3: Racial & Ethnic Minority Status	Minority	452	12.9%	0.1369
	Theme 4: Housing Type & Transportation	Multi-unit Structures	111	6.8%	0.4394
		Mobile Homes	235	14.5%	0.982
		Crowding	30	2.2%	0.5611
		No Vehicle	93	6.7%	0.5222
		Group Quarters	0	0	0.0

Table 12: SVI scores. Census Tract 214

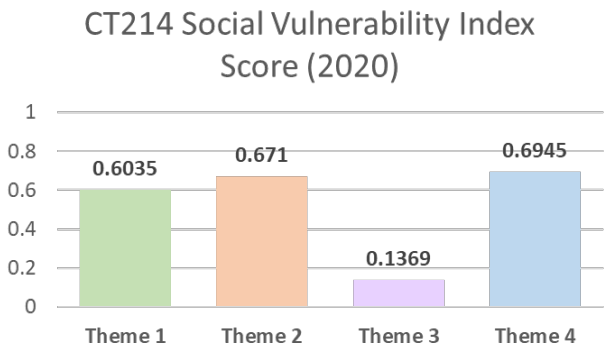

Figure 30: SVI Themes, Census Tract 214

Census Tract 215 – Social Vulnerability

Overall Social Vulnerability (Tract Level)	Themes	15 Variables (Census)	Estimate	Percentage	Percentile
	Theme 1: Socioeconomic Status	Below 150% Poverty	274	14.8%	0.5888
		Unemployed	52	5.3%	0.5323
		Housing-burdened units	222	30.4%	0.2988
		No High School Diploma (age 25+)	58	4.4%	0.5901
		Uninsured	126	5.2%	0.4866
	Theme 2: Household Characteristics	Age 65 or older	265	14.3%	0.4375
		Age 17 or younger	389	21%	0.4707
		Noninstitutionalized Disabled	248	13.4%	0.7477
		Single-parent Household	57	7.8%	0.7118
	Theme 3: Racial & Ethnic Minority Status	Minority	193	10.4%	0.0973
	Theme 4: Housing Type & Transportation	Multi-unit Structures	86	10.6%	0.5459
		Mobile Homes	0	0%	0.0
		Crowding	0	0%	0.0
		No Vehicle	76	10.4%	0.4238
		Group Quarters	0	0	0.0

Table 13: SVI scores, Census Tract 215

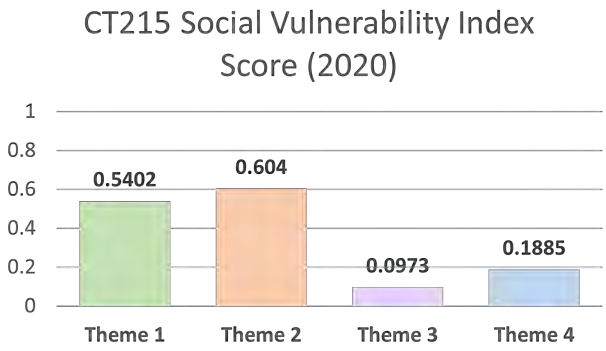

Figure 31: SVI Themes, Census Tract 215

Census Tract 216 – Social Vulnerability

Overall Social Vulnerability (Tract Level)	Themes	15 Variables (Census)	Estimate	Percentage	Percentile
	Theme 1: Socioeconomic Status	Below 150% Poverty	1300	26.1%	0.7916
		Unemployed	177	7.5%	0.7301
		Housing-burdened units	857	41%	0.7796
		No High School Diploma (age 25+)	426	11.3%	0.6796
		Uninsured	210	4.2%	0.403
	Theme 2: Household Characteristics	Age 65 or older	1152	23.1%	0.8598
		Age 17 or younger	1064	21.3%	0.4878
		Noninstitutionalized Disabled	672	13.5%	0.756
		Single-parent Household	127	6.1%	0.6183
	Theme 3: Racial & Ethnic Minority Status	Minority	295	5.9%	0.0369
	Theme 4: Housing Type & Transportation	Multi-unit Structures	288	11.6%	0.5735
		Mobile Homes	0	0%	0.0
		Crowding	25	1.2%	0.4265
		No Vehicle	102	4.9%	0.4238
		Group Quarters	0	0%	0.0

Table 14: SVI scores, Census Tract 216

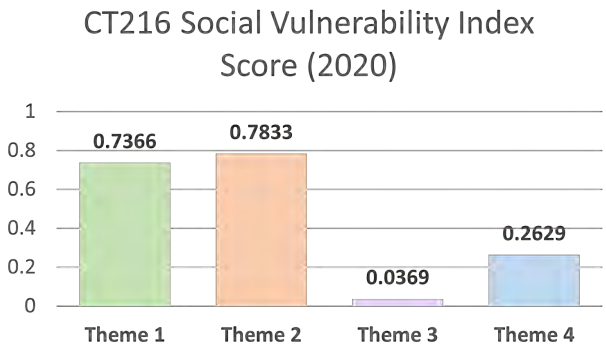

Figure 32: SVI Themes, Census Tract 215

Census Tract 217 – Social Vulnerability

Overall Social Vulnerability (Tract Level)	Themes	15 Variables (Census)	Estimate	Percentage	Percentile
	Theme 1: Socioeconomic Status	Below 150% Poverty	1300	26.1%	0.7916
		Unemployed	177	7.5%	0.7301
		Housing-burdened units	857	41%	0.7796
		No High School Diploma (age 25+)	426	11.3%	0.6796
		Uninsured	210	4.2%	0.403
	Theme 2: Household Characteristics	Age 65 or older	1152	23.1%	0.8598
		Age 17 or younger	1064	21.3%	0.4878
		Noninstitutionalized Disabled	672	13.5%	0.756
		Single-parent Household	127	6.1%	0.6183
	Theme 3: Racial & Ethnic Minority Status	Minority	295	5.9%	0.0369
	Theme 4: Housing Type & Transportation	Multi-unit Structures	288	11.6%	0.5735
		Mobile Homes	0	0%	0.0
		Crowding	25	1.2%	0.4265
		No Vehicle	102	4.9%	0.4238
		Group Quarters	0	0%	0.0

Table 15: SVI scores, Census Tract 217

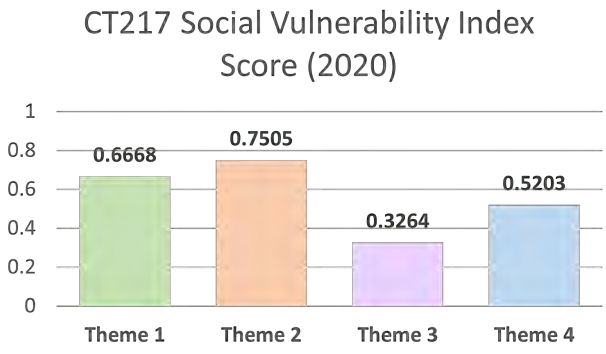

Figure 33: SVI Themes, Census Tract 217

NJDEP Overburdened Communities

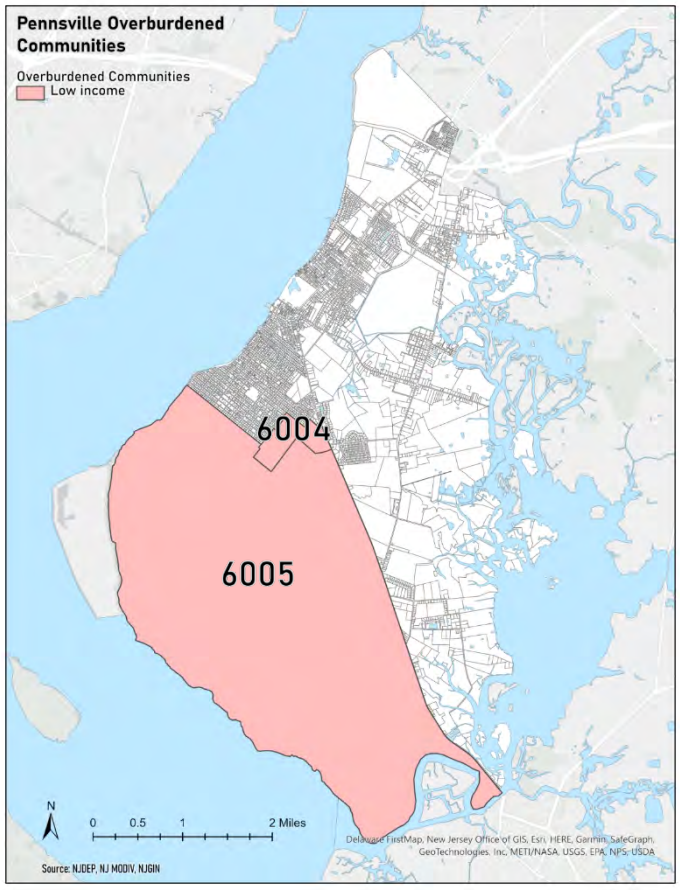

Figure 34: Pennsville Overburdened Census Block Groups

Following New Jersey's Environmental Justice Law, the state must consider the effects of facilities on communities' overburdened environmental and public health conditions. **An overburdened community is defined as any census block group identified in the most recent US Census where at least one of three conditions is met.**

Firstly, at least 35 percent of households qualify as low-income households, meaning their income is at or below twice the poverty threshold established by the United States Census Bureau. Secondly, at least 40 percent of the residents identify as a member of a minority group or as members of a State-recognized tribal community. Finally, at least 40 percent of households in the census block group have limited English proficiency, meaning that no adult speaks English "very well," according to the United States Census Bureau.

The law addresses the disproportionate burden of environmental and public health risks faced by low-income, minority, and non-English speaking communities.

Table 16 provides information about Overburdened Communities (OBCs) in Pennsville. Two census blocks are designated as OBCs due to their significant low-income populations.

The first column shows data for block group identifier 340330216004, including the total population, total households, and the percentage of low-income and minority populations. The block group has a total population of 692 and 322 households. Approximately 39 of the households in this block group qualify as low-income, while 4.34% of the population identifies as a minority.

The second column provides information for block group identifier 340330216005, including the total population, total households, and the percentage of low-income and minority populations. The block group has a total population of 1,147 and 346 households. Approximately 68% of the households in this block group qualify as low-income, while 0% of the population identifies as a minority.

Overburdened Community Block Group Identifier	340330216004	340330216005
Total Population	692	1147
Total Households (HHs)	322	346
Low-Income Population	270 (39.02 %)	779 (67.91 %)
Minority Population	30 (4.34 %)	0 (0.00 %)
HHs with limited English Proficiency	0	0

Table 16: Pennsville Overburdened Communities

Critical Infrastructure

Critical assets, including educational institutions, healthcare facilities, and public safety agencies, are essential to communities and their residents, particularly during natural disasters like floods. However, these critical assets may be vulnerable to flooding, which can significantly impact their ability to provide necessary services to the community. It is, therefore, crucial to identify these critical assets and assess their exposure to flood events.

Additionally, built infrastructure, such as bridges and evacuation routes, may be at risk of flooding. These assets are critical in facilitating emergency response and evacuation during flood events. Therefore, understanding their exposure to flood events and potential damages is crucial for effective community flood planning.

This report uses GIS to identify critical assets and assess their vulnerability to flooding events. GIS mapping enables the identification of flood-prone areas and the modeling potential flood scenarios to evaluate the potential impact on these assets. When planning and responding to floods in a community, it is critical to understand the extent to which essential infrastructure and assets are exposed to flooding and their accessibility during emergencies.

Notably, the electric substation, located in the northwest and operated by Calpine New Jersey, would be inundated in the 5-Foot and 7-Foot Total Water Level Scenarios depicted in the maps below.[25]

[25] Rutgers University, the State University of New Jersey, "MOD IV ID # 2765741 : Year 2022," 2022, https://modiv.rutgers.edu/print-record/2022/2765741/.

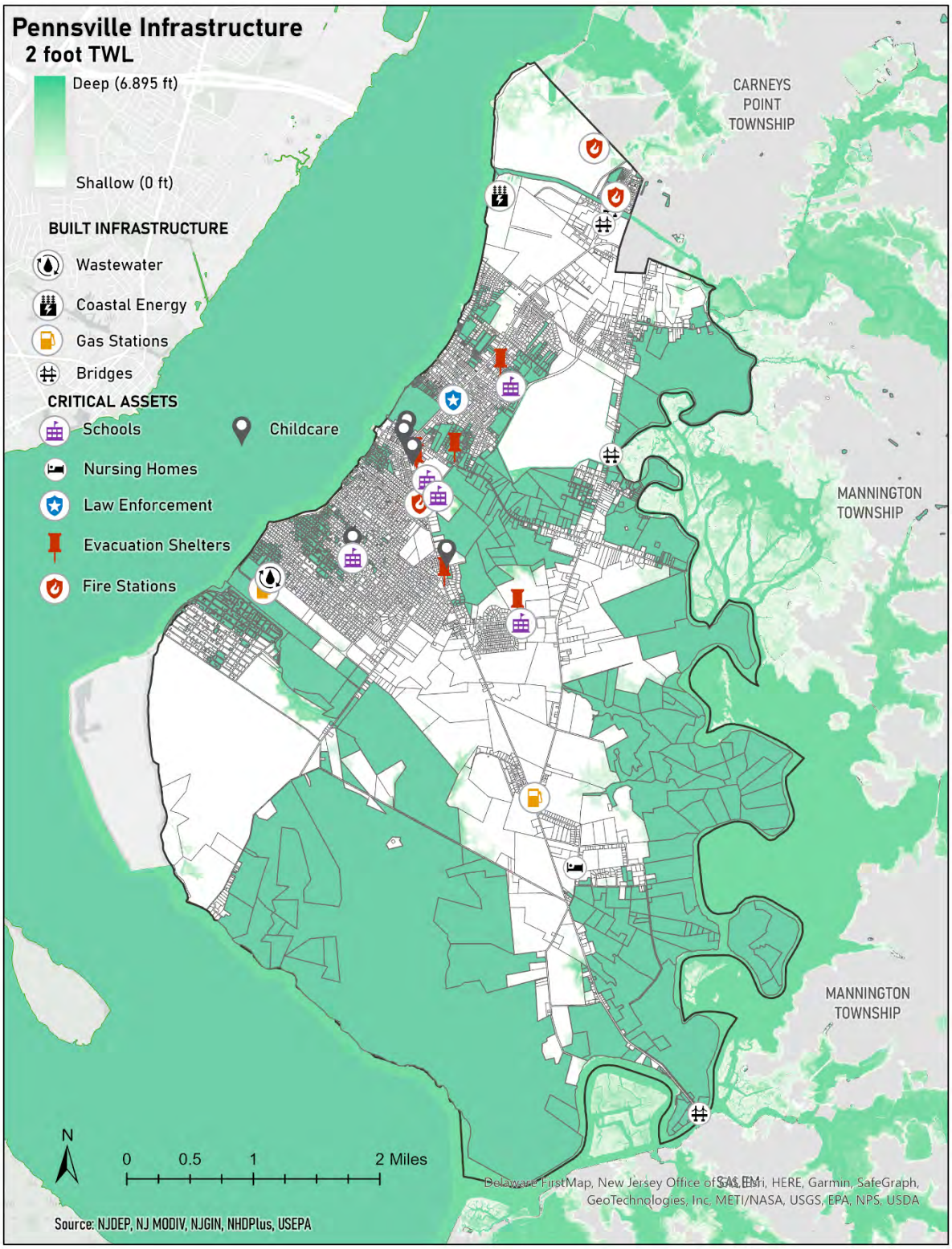

Figure 35: Parcel Flood Exposure, 2' TWL, with Critical Infrastructure

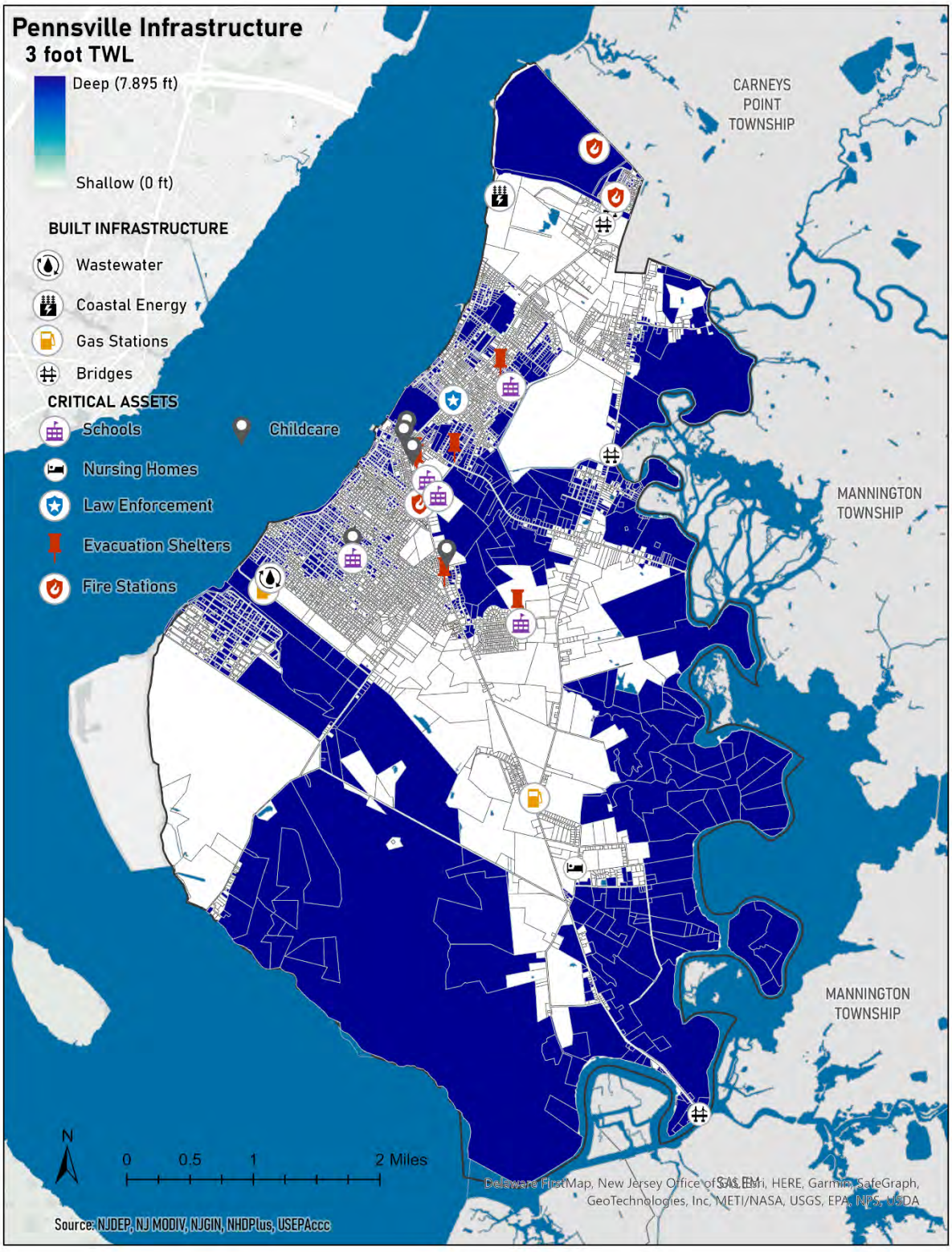

Figure 36: Parcel Flood Exposure, 3' TWL, with Critical Infrastructure

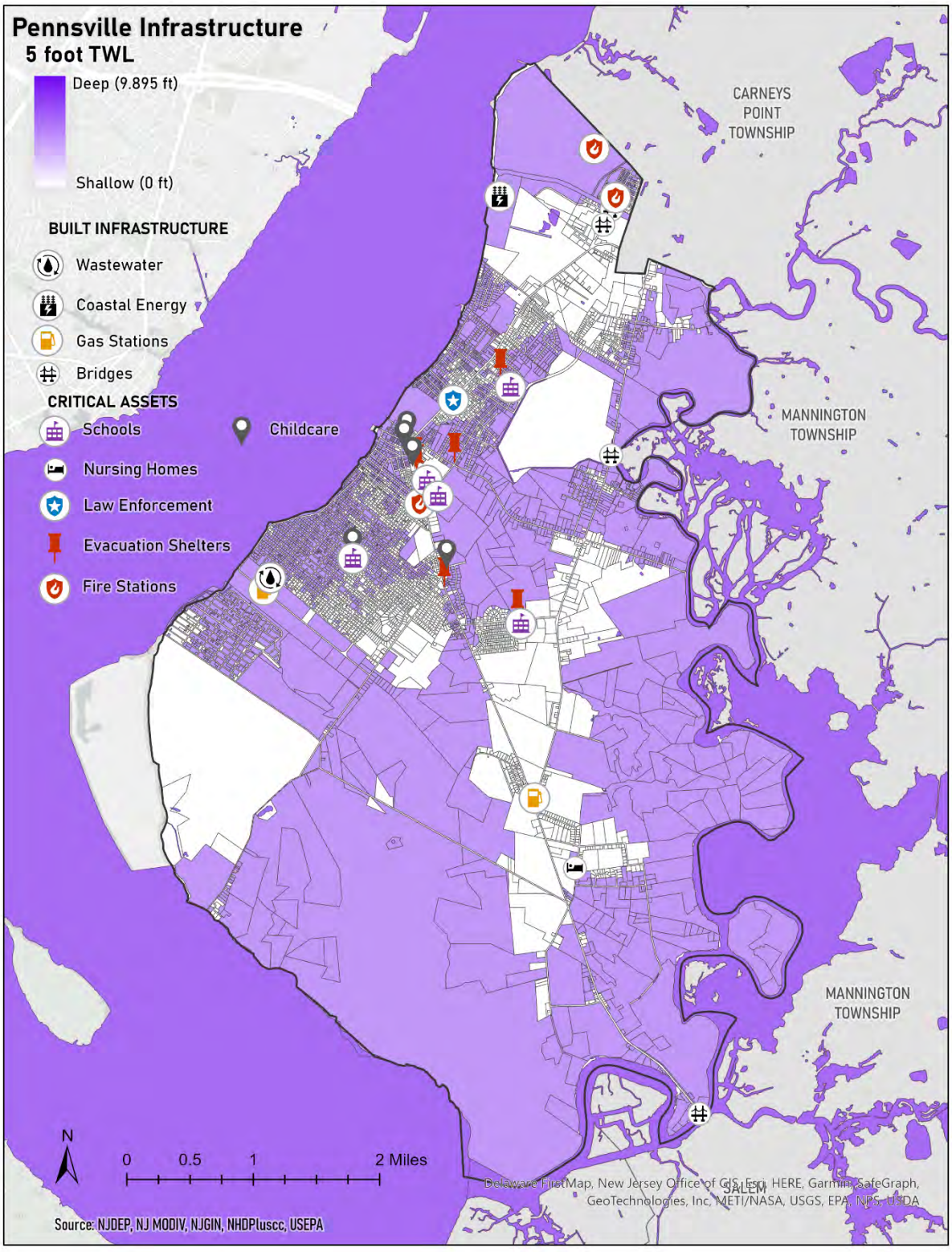

Figure 37: Parcel Flood Exposure, 5' TWL, with Critical Infrastructure

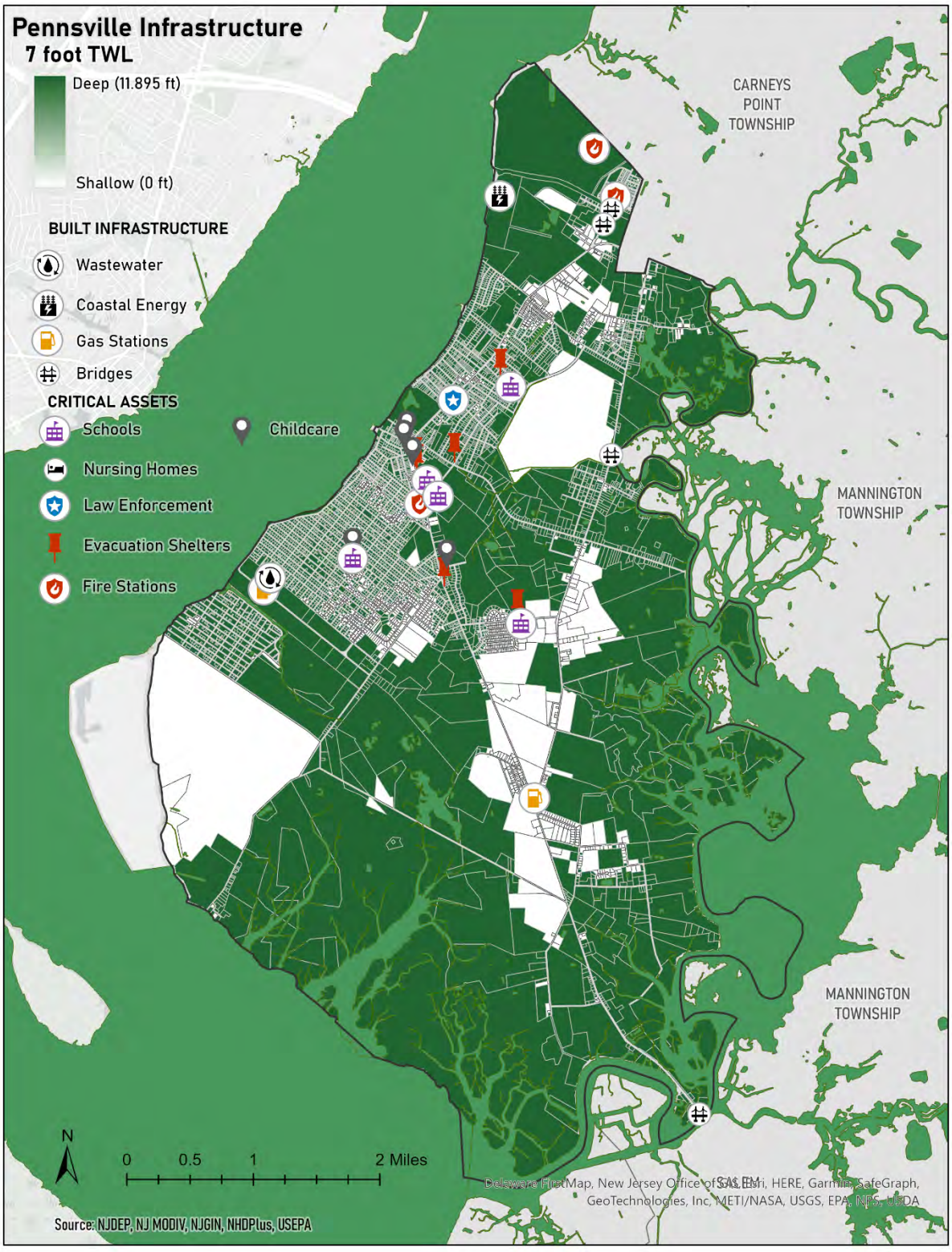

Figure 38: Parcel Flood Exposure, 7' TWL, with Critical Infrastructure

Table 17 shows the number of Pennsville Township critical facilities at risk of flooding at scenario. For instance, at 2 feet TWL, no childcare facilities, evacuation shelters, fire stations, law enforcement facilities, schools, wastewater facilities, or coastal energy facilities are at risk of flooding. However, a gas station and two bridges are at risk of flooding.

At 3 feet TWL, the number of schools, fire stations, and wastewater facilities exposed to flooding increase to one and evacuation shelters at risk increases to two. At 5 feet TWL, the number of bridges at risk of flooding increases to three and coastal energy and childcare facilities become exposed. If the water level rises to 7 feet TWL, all critical facilities identified (except the nursing home) will be exposed to flooding.

Understanding which facilities are at risk of flooding at different water levels is crucial in developing emergency response plans and taking preventive measures to minimize potential damage. When the water level reaches 7 feet TWL, emergency responders should be aware of the possibility of being unable to access fire stations, law enforcement facilities, and evacuation shelters. There may be a need to relocate or deploy additional resources in these areas.

Category	2 ft	3 ft	5 ft	7 ft	Total in municipality
Wastewater	0	1	1	1	1
Coastal Energy	0	0	1	1	1
Gas Stations	1	1	1	3	5
Bridges	2	2	3	3	4
Schools	0	1	2	2	5
Fire Stations	0	1	2	3	3
Law Enforcement	0	0	0	1	1
Nursing Homes / Assisted Care	0	0	0	0	1
Child Care Facilities	0	0	2	3	5
Evacuation Shelters	0	2	2	2	7

Table 17: Pennsville Critical Infrastructure by Flood Exposure

Conclusion

The flood assessment report conducted by the Rutgers Climate Corps provides crucial information regarding the risk of inundation hazards in Pennsville Township, NJ. Based on sea level rise guidance from the NJ Department of Environmental Protection and the Rutgers University Science and Technology Advisory Panel, the report identifies parcels that are exposed to flooding at various total water levels. Additionally, the report examines the affected parcels in proximity to an existing bulkhead in the event of a flood event, highlighting the importance of maintaining and upgrading existing infrastructure to mitigate the impact of flooding.

Moreover, the report provides quantified social vulnerability data from the CDC, which highlights vulnerable populations that are disproportionately impacted by flooding. The report also identifies overburdened communities in the township, which can be severely affected by flooding events, emphasizing the need for targeted and equitable mitigation efforts.

Finally, the report identifies critical infrastructure, such as substations, transportation nodes, and water treatment facilities, that are at risk of flooding. This information can assist local authorities in planning and implementing measures to protect these vital assets and ensure the continued provision of essential services.

In conclusion, the Rutgers Climate Corps' flood assessment report provides a comprehensive assessment of the inundation hazards in Pennsville Township, NJ. The report's findings can inform planning decisions and guide mitigation efforts to reduce the impact of flooding on vulnerable populations and critical infrastructure. The report highlights the importance of maintaining and upgrading existing infrastructure and the need for targeted and equitable mitigation efforts to address the social and economic impacts of flooding.