



Coastal Hazards & Sea-Level Rise Asset Vulnerability Assessment for Independence National Historical Park, Edgar Allen Poe National Historic Site, Thaddeus Kosciuszko National Memorial, and Gloria Dei Church National Historic Site

Summary of Results

NPS 391/188379, NPS 478/188379, NPS 455/188379, NPS 004/188379, May 2023



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Independence Hall at Independence National Historical Park

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Program for the Study of Developed Shorelines
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Executive Summary

This document presents the results of the **Coastal Hazards & Sea-Level Rise (SLR) Asset Vulnerability Assessment (VA)** completed by Western Carolina University at Independence National Historical Park, Edgar Allen Poe National Historic Site, Thaddeus Kosciuszko National Memorial, and Gloria Dei Church National Historic Site (referred to as INDE-EDAL-THKO-GLDE) in 2022. In this VA, we evaluate the vulnerability (as a combination of exposure and sensitivity) of NPS buildings and transportation assets¹ to identified coastal hazards and climate change factors, approximately to the year 2050 (for full methodology, see Peek et al. 2022).

We assessed 62 buildings (including housing, parking garages, historic structures, and monuments), and 26 transportation assets (parking and paved trails) at INDE-EDAL-THKO-GLDE. Most assets have minimal vulnerability to the assessed coastal hazards and SLR, while three assets have moderate vulnerability (Paved Trails and Dock Street Parking in the Merchants Exchange Block of INDE, and Paved Trails at GLDE). Scoring details and results for all assets evaluated are reported in the provided Excel sheets.

Exposure Results

Exposure is a measure of the character, magnitude, and rate of changes a target may experience (e.g., from the impacts of climate change or a natural hazard influenced by climate change; NPS 2021). In this VA, we evaluate the exposure of each asset to the following coastal hazard indicators: flooding potential, shoreline change, SLR inundation, extreme event flooding, and reported coastal hazards (Table 1).

Table 1. Exposure indicators and hazard data sources used.

Exposure Indicator (Description)	INDE-EDAL-THKO-GLDE Data (Citation)
Flooding potential (1% annual-chance)	Effective FEMA VE & A zones (FEMA 2015)
Shoreline change (coastal proximity)	30-m shoreline proximity buffer (Peek et al. 2022)
SLR inundation (2050 proxy) *	NPS 2100 4.5 RCP SLR model; 0.62 m rise (Caffrey et al. 2018)
Extreme event flooding (category 3 surge)	NPS storm surge inundation model (Caffrey et al. 2018)
Reported coastal hazards (historic flooding)	Questionnaire results & discussions (Peek et al. 2022)

*See Unique Considerations

¹ The NPS Facility Management Software System (FMSS) database defines assets as “...a physical structure or grouping of structures, land features, or other tangible property that has a specific service or function, such as a farm, cemetery, campground, marina, or sewage treatment plant. The term ‘asset’ shall also be applied to movable items, such as vehicles and equipment.”

Assets with high exposure are within at least four exposure indicator hazard zones. Assets with moderate exposure are within two or three exposure indicator hazard zones. Assets with low exposure are within only one exposure indicator hazard zone. The asset could still be seriously impacted by this hazard. Assets with minimal exposure are not in any exposure indicator hazard zone. This does not mean that the asset has no exposure to coastal hazards, but it is not within the exposure hazard data used in this study.

All but three assets evaluated at INDE-EDAL-THKO-GLDE have minimal exposure to the assessed coastal hazards and SLR (Table 2). Only the Paved Trails at GLDE have moderate exposure (located within the Federal Emergency Management Agency AE and storm surge category 3 hazard zones). Two assets, the Paved Trails and Dock Street Parking at Merchants Exchange Block of INDE, have low exposure (located within only the storm surge category 3 hazard zone).

Table 2. INDE-EDAL-THKO-GLDE exposure results. Sum of percentages may not equal 100 due to rounding.

Assets	High exposure		Moderate Exposure		Low Exposure		Minimal Exposure		Total
	#	%	#	%	#	%	#	%	#
Buildings	0	0%	0	0%	0	0%	62	100%	62
Transportation	0	0%	1	4%	2	8%	23	88%	26
All Assets	0	0%	1	1%	2	2%	85	97%	88

Sensitivity Results

Sensitivity reflects the degree to which a resource is affected by exposure (NPS 2021). In this VA, we assess the following sensitivity indicators: flood damage potential/elevated, storm resistance and condition, historic damage, and protective engineering. In general, assets with high sensitivity have unfavorable determinations for 3 or 4 of these indicators, moderate-sensitivity assets have unfavorable determinations for 2 indicators, and low-sensitivity assets have unfavorable determinations for 0 or 1 indicator. Assets with minimal exposure are not analyzed for sensitivity (this is the case for 85 assets at INDE-EDAL-THKO-GLDE).

Only three assets at INDE-EDAL-THKO-GLDE were evaluated for sensitivity (Table 3). The Paved Trails and Dock Street Parking (both in the Merchants Exchange Block of INDE) have high sensitivity to coastal hazards and SLR. These assets are in poor condition and are not elevated, storm resistant, or protected by engineering. The Paved Trails at GLDE were reported to be in good condition and, therefore, have moderate sensitivity.

Table 3. INDE-EDAL-THKO-GLDE sensitivity results. Sum of percentages may not equal 100 due to rounding.

Assets	High Sensitivity		Moderate Sensitivity		Low Sensitivity		Total Analyzed	Excluded*
	#	%	#	%	#	%	#	#
Buildings	0	0%	0	0%	0	0%	0	62
Transportation	2	67%	1	33%	0	0%	3	23
All Assets	2	67%	1	33%	0	0%	3	85

*Minimal exposure assets were excluded from the sensitivity analysis; total number analyzed is different for sensitivity.

Vulnerability Results

Vulnerability is a measure of the degree to which park resources and assets are “susceptible to harm from direct and indirect effects of climate change, including variability and extremes” (NPS 2021). In this VA, we evaluate the vulnerability of infrastructure assets as a simple combination of exposure and sensitivity ratings. It should be noted that the vulnerability of any asset can change with time (e.g., due to adaptation actions or the result of geomorphic change).

Most assets (97%) evaluated at INDE-EDAL-THKO-GLDE have minimal vulnerability to the assessed coastal hazards and SLR (Table 4). Three assets have moderate vulnerability: Paved Trails and Dock Street Parking in the Merchants Exchange Block of INDE, and Paved Trails at GLDE (Table 4, and Figure 1). Both moderate vulnerability assets at INDE have a high asset priority index (API \geq 80, as reported in FMSS).

Table 4. INDE-EDAL-THKO-GLDE vulnerability results. Sum of percentages may not equal 100 due to rounding.

Assets	High Vulnerability		Moderate Vulnerability		Low Vulnerability		Minimal Vulnerability		Total
	#	%	#	%	#	%	#	%	#
Buildings	0	0%	0	0%	0	0%	62	100%	62
Transportation	0	0%	3	12%	0	0%	23	88%	26
All Assets	0	0%	3	3%	0	10%	85	97%	88

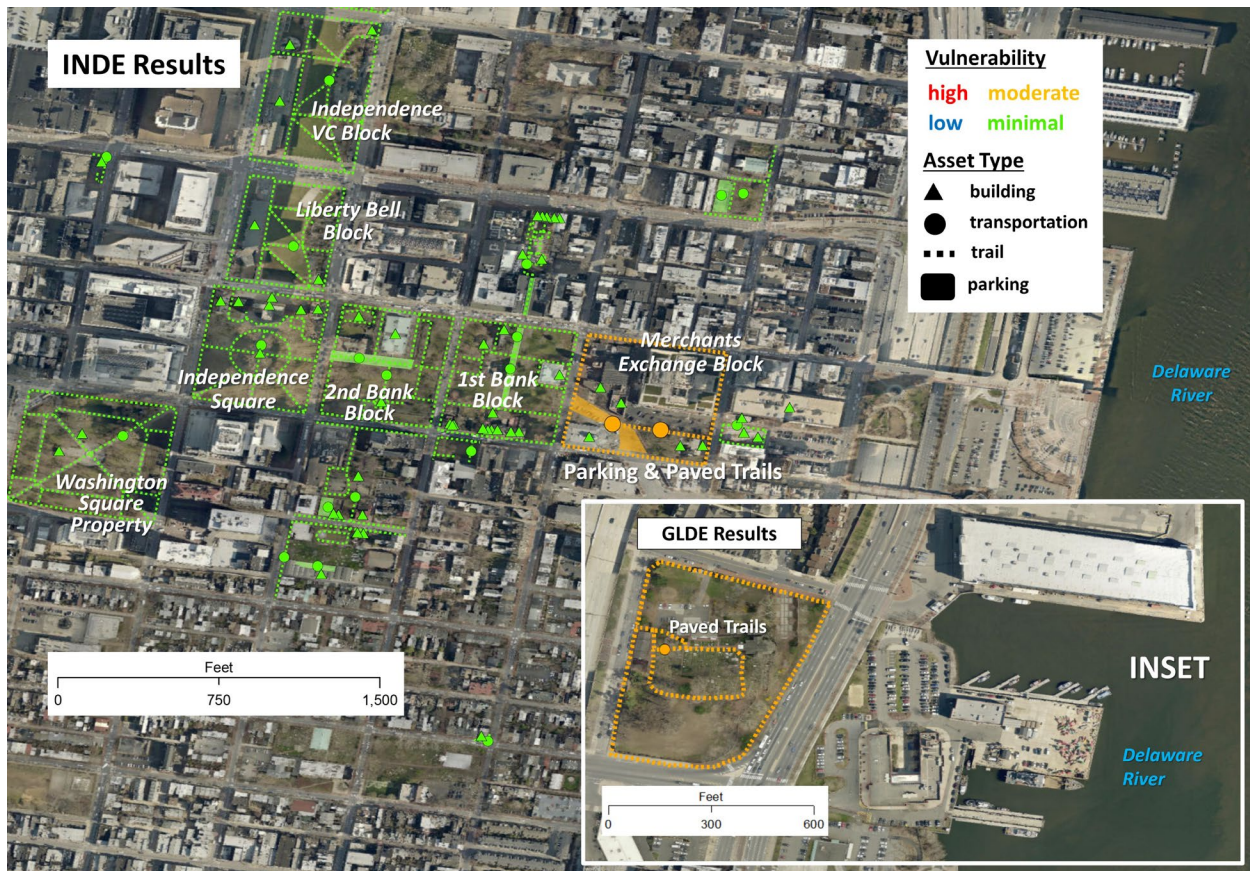


Figure 1. INDE vulnerability results summary, near downtown Philadelphia. Only select areas and moderate vulnerability assets are labeled. Inset shows GLDE vulnerability results. Background is ESRI streaming imagery.

INDE-EDAL-THKO-GLDE Unique Considerations

Shoreline change: United State Geological Survey or other shoreline erosion rate data are not available for the coastlines within INDE-EDAL-THKO-GLDE. As a result, we used a simple coastal proximity buffer of 30 meters, which accommodates an erosion rate up to 1m/year and assumes that infrastructure near the coast is likely to experience multiple coastal hazards within the 30-year (2050) timeframe of this analysis (Peek et al. 2022).

SLR data: We used the 2100 4.5 Representative Concentration Pathway SLR projections and inundation model from Caffrey et al. (2018) developed specifically for NPS units to score exposure for this indicator (0.62 m rise for INDE-EDAL-THKO-GLDE). These data are used as a proxy for 2050 SLR to accommodate higher SLR projections recently released by the National Oceanic and Atmospheric Administration (see Peek et al. 2022).

Linear assets: Paved trails INDE-EDAL-THKO-GLDE were not segmented, as most are relatively short features or have a small geographic footprint (e.g., within a city block). Therefore, each paved trail has only one score for exposure, sensitivity, and vulnerability. Any statistics or estimates of value represent the entire asset, even if only a small portion has high exposure or vulnerability.

References

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