



# Coastal Hazards & Sea-Level Rise Asset Vulnerability Assessment for Charles Pinckney National Historic Site and Reconstruction Era National Historical Park

## *Summary of Results*

NPS 345/187359, NPS 550/187359, January 2023



PROGRAM FOR  
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**ON THE COVER**

Snee Farm House at Charles Pinckney National Historic Site

Photo credit: NPS

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Program for the Study of Developed Shorelines  
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*This document has been developed by the NPS Climate Change Response Program and Park Facilities Management Division in partnership with Western Carolina University through a Task Agreement with the Southern Appalachian Cooperative Ecosystems Studies Unit.*

Please cite this publication as:

Peek, K.M., B.R. Tormey, H.L. Thompson, and R.S. Young. 2023. Coastal Hazards & Sea-Level Rise Asset Vulnerability Assessment for Charles Pinckney National Historic Site and Reconstruction Era National Historical Park: Summary of Results. NPS 345/187359, NPS 550/187359. Program for the Study of Developed Shorelines, Western Carolina University, Cullowhee, N.C.

# 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 Charles Pinckney National Historic Site and Reconstruction Era National Historical Park (together referred to as CHPI-REER) in 2021. In this VA, we evaluate the vulnerability (as a combination of exposure and sensitivity) of NPS buildings and transportation assets<sup>1</sup> to identified coastal hazards and climate change factors, approximately to the year 2050 (for full methodology, see Peek et al. 2022).

We assessed nine buildings/structures at CHPI-REER (including a house, curatorial building, barn, comfort station, hall, restroom, church, and firehouse) and four transportation assets (three roads and a parking lot). None of the assets analyzed have high vulnerability to the evaluated coastal hazards and SLR. Four of the analyzed assets (all at CHPI) have moderate vulnerability, while six have low vulnerability. Three assets (all at REER) have minimal vulnerability, which means they are not in any of the evaluated hazard zones. Scoring details and results for all assets evaluated at CHPI-REER 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.

| <b>Exposure Indicator (Description)</b>      | <b>CHPI-REER Data (Citation)</b>                                                                                   |
|----------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| Flooding potential (1% annual-chance)        | Effective FEMA VE & A zones (FEMA 2021)                                                                            |
| Shoreline change (coastal proximity)         | 35-m shoreline proximity buffer (Peek et al. 2022)                                                                 |
| SLR inundation (2050)                        | NPS 8.5 RCP SLR model, 0.25 m rise (Caffrey et al. 2018); NOAA 2-ft SLR (NOAA 2022)                                |
| Extreme event flooding (category 3 surge)    | NPS storm surge inundation model (Caffrey et al. 2018), NOAA national storm surge hazard maps (Zachry et al. 2015) |
| Reported coastal hazards (historic flooding) | Questionnaire results & discussions (Peek et al. 2022)                                                             |

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<sup>1</sup> 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.

No assets evaluated at CHPI-REER have high exposure to the assessed coastal hazards (Table 2), and only four have moderate exposure (Snee Farm Barn, Corn Crib, and NHS Parking area at CHPI). These results are primarily because no assets are within either the 2050 SLR or the erosion/coastal proximity hazard zone, and only a few are within the Federal Emergency Management Agency (FEMA) AE flood zone (1% annual chance flood) or were reported to have been flooded by past coastal storms. The most widespread hazard zone at CHPI-REER is Category 3 storm surge, which impacted all eight assets at CHPI and two (of the five) assets at REER. Three assets at REER (Darrah Hall, Restroom, and Driveway) have minimal exposure.

**Table 2.** CHPI-REER 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% | 3                 | 33% | 4            | 44% | 2                | 22% | 9     |
| Transportation | 0             | 0% | 1                 | 25% | 2            | 50% | 1                | 25% | 4     |
| All Assets     | 0             | 0% | 4                 | 31% | 6            | 46% | 3                | 23% | 13    |

## 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 3 assets at CHPI-REER).

All assets analyzed at CHPI-REER currently have moderate sensitivity to coastal hazards and SLR (Table 3). None of the assets are elevated or have protective engineering, and most are not storm resistant. However, all are in good condition and have not been significantly damaged by coastal flooding in the past. Only one asset, the Brick Baptist Church at REER, was reported as storm resistant. Three assets at REER had minimal exposure: Darrah Hall, Darrah Hall Restroom, and Darrah Hall Driveway.

**Table 3.** CHPI-REER 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% | 7                    | 100% | 0               | 0% | 7              | 2         |
| Transportation | 0                | 0% | 3                    | 100% | 0               | 0% | 3              | 1         |
| All Assets     | 0                | 0% | 10                   | 100% | 0               | 0% | 10             | 3         |

\*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).

The vulnerability results at CHPI-REER are identical to the exposure results, as all assets evaluated scored a moderate for sensitivity (Table 4, and Figures 1-2). This lack of variability in sensitivity means that the vulnerability of assets at CHPI-REER is primarily controlled by exposure. No assets evaluated at CHPI-REER have high vulnerability to the assessed coastal hazards, four have moderate, six have low, and three have minimal vulnerability. Two assets (Snee Farm House and Farm Barn at CHPI) have moderate vulnerability and a high asset priority index ( $API \geq 80$ , as reported in FMSS).

**Table 4.** CHPI-REER 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% | 3                      | 33% | 4                 | 44% | 2                     | 22% | 9     |
| Transportation | 0                  | 0% | 1                      | 25% | 2                 | 50% | 1                     | 25% | 4     |
| All Assets     | 0                  | 0% | 4                      | 31% | 6                 | 46% | 3                     | 23% | 13    |

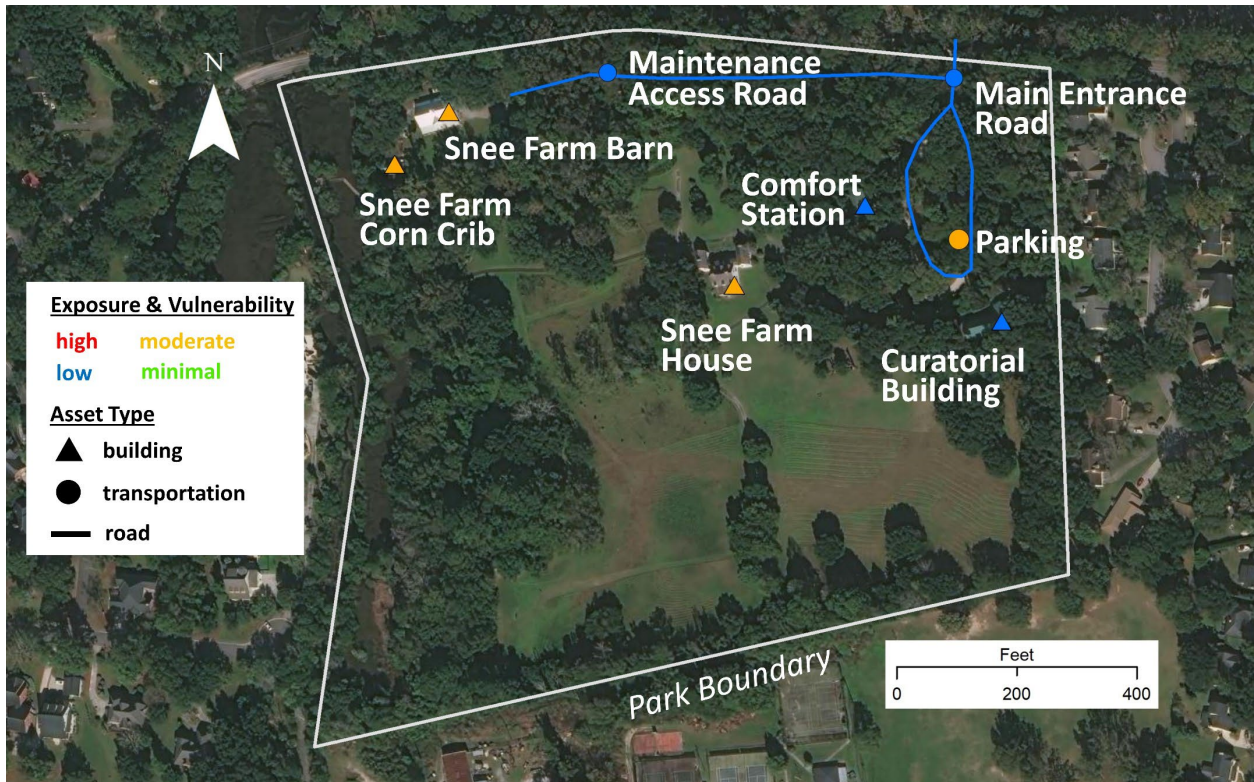


Figure 1. CHPI exposure and vulnerability results. Background is ESRI streaming imagery.

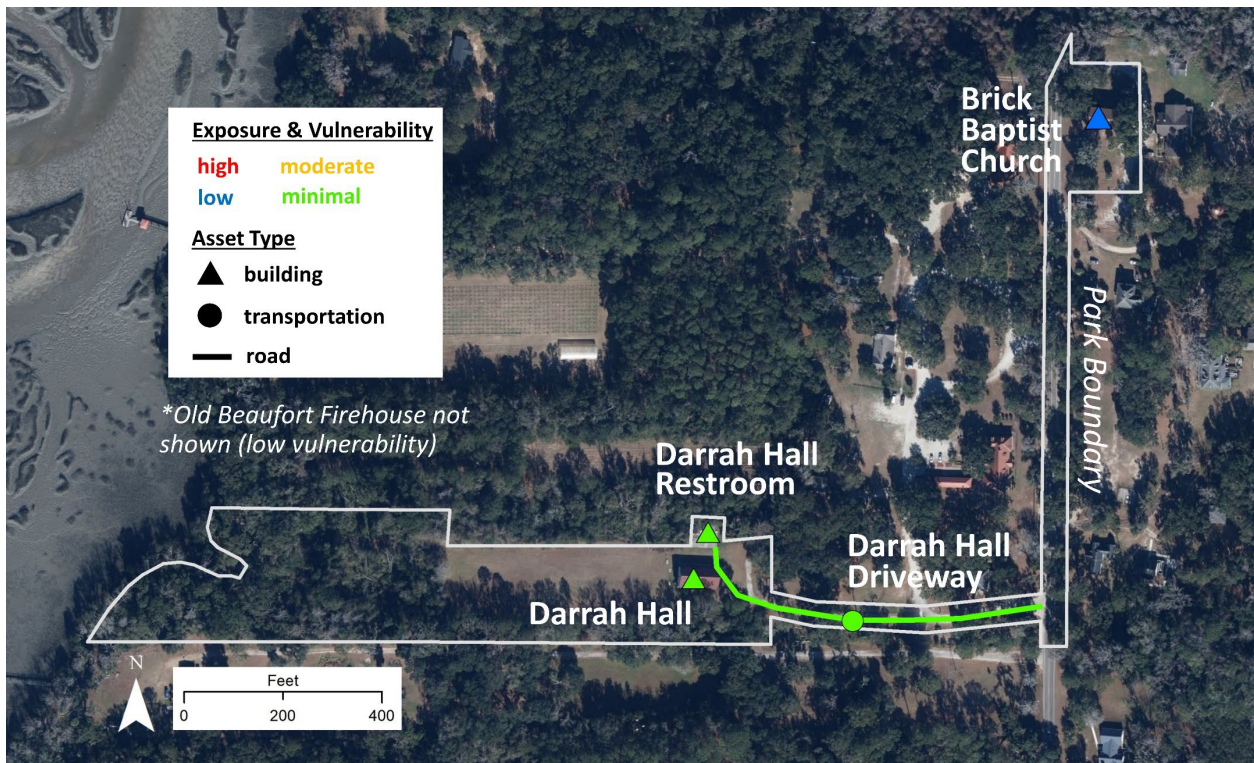


Figure 2. REER exposure and vulnerability results. Background is ESRI streaming imagery.

## CHPI-REER Unique Considerations

**Shoreline change:** United States Geological Survey (USGS) or other shoreline erosion rate data are not available for the coastlines within CHPI-REER. As a result, we used a simple coastal proximity buffer of 35 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 35-year (approximately 2050) timeframe of this analysis.

**SLR data:** For CHPI, we used the 2050 8.5 Representative Concentration Pathway SLR projection (0.25 m rise) and inundation model (Caffrey et al. 2018) developed specifically for NPS units to score exposure for this indicator. However, we also provided alternate scores using the 2100 4.5 SLR projection for comparison (0.57 m rise; Peek et al. 2022). These NPS data are not available for REER, and therefore, we used the National Oceanic and Atmospheric Administration (NOAA) 2-ft SLR layer (NOAA 2022) as a substitute for these assets.

**Extreme event flooding data:** In most cases, we use storm surge models produced by NPS Climate Change Response Program (CCRP; Caffrey et al. 2018) within this protocol; however, these data show are not available for REER. As a substitute, we used NOAA National Storm Surge Hazard Maps - Version 2 (Zachry et al. 2015).

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NPS 345/187359, NPS 550/187359, January 2023