Polk County Vulnerability Assessment Additional Flood Modeling Project

CHNEP Work Assignment for the CFRPC

Charlotte County Purchase Order Number: 25000387

Technical Memorandum

From: Adrian F. Santiago Tate, CEO, HighTide Intelligence
To: Central Florida Regional Planning Council and Coastal & Heartland National Estuary Partnership
Subject: Task 3 – Technical Memorandum on 3D Visualization Process and Results
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1. Purpose

This memorandum documents the methodology and results of three-dimensional (3D) visualizations developed for the Polk County Extreme Rainfall Modeling project. These visualizations illustrate modeled flooding for the 200-year and 500-year, 24-hour rainfall events, each evaluated under standard and saturated ground conditions. They support stakeholder understanding of flood risk and complement the technical results presented in the main report.

2. 3D Visualization Process

The 3D visualizations translate modeled flood results into spatially accurate representations of inundation at critical locations across Polk County. They were produced using Blender, an open-source 3D modeling platform with Python integration for automated, repeatable workflows that ensure consistency across all sites and flood scenarios.

Table 1 summarizes the 24-hour rainfall depths from NOAA Atlas 14 used in the hydraulic model. The table lists both the return period and its equivalent Annual Exceedance Probability (AEP). The Areal Reduction Factor (ARF) adjusts the total rainfall depth to represent the average rainfall expected across a larger watershed area rather than at a single point.

Table 1. NOAA Atlas 14 24-Hour Precipitation Data

Return Period	AEP	Rainfall Depth (in)	Rainfall Depth w/ ARF (in)
100-year	1%	10.5	9.98
200-year	0.5%	12.3	11.69
500-year	0.2%	14.8	14.06

Each 3D scene was constructed using a combination of geospatial and visual reference data:

- Digital Elevation Model (DEM): Provided ground elevations.
- Building Footprints: Used to generate structure geometries.
- Flood Elevation Rasters: Represented modeled water surface.
- Aerial Imagery: Supplied accurate land-use and surface context.
- Google Street View Imagery: Informed fine-scale alignment and texture reference.

The workflow for each site began by defining a region of interest and importing the DEM, flood elevation rasters, and building footprints to reconstruct the physical landscape. Building geometries were extruded to approximate structure heights, and minor terrain adjustments ensured smooth transitions between ground and water surfaces. Limited contextual features, such as roads and vegetation, were added for spatial realism.

Python scripting automated material, lighting, and camera settings to maintain visual consistency. Water surfaces were calibrated for realistic reflectivity and transparency, and standardized lighting enabled direct comparison across sites and scenarios.

Finished Floor Elevation (FFE) data were unavailable for this study; future efforts could integrate surveyed or LiDAR-derived FFE data to refine structure-level accuracy for priority assets.

3. Site Selection

Representative sites were selected to illustrate flooding from the 200-year and 500-year 24-hour rainfall events, each evaluated under standard and saturated ground conditions. Sites were chosen from assets with modeled exposure and informed by stakeholder input.

Bartow Wastewater Treatment Facility (WTF)

- 200-year: Flooding present on site (parking and storage areas); no building inundation.
- 200-year, saturated: Flooding expands on site; no building inundation.
- 500-year: Flooding present; building areas begin to be impacted.
- 500-year, saturated: Greatest extent and depth; multiple on-site areas and structures impacted.

Power Substation (North Bartow, near Walmart)

- 200-year: Flooding present across the yard and access road.
- 200-year, saturated: Flooding increases; building and yard depths rise.
- 500-year: Flooding present across the facility and access road.
- 500-year, saturated: Greatest extent and depth; inundation confirmed by 2024 aerial imagery following Hurricane Milton provided by Polk County.

Highway 92, south of Lake Parker (Lakeland)

- 200-year: Limited, localized flooding along turn lane and adjacent low areas.
- 200-year, saturated: Slightly greater ponding; localized roadway impacts increase.
- 500-year: Partial lane inundation in locations; adjacent low areas deepen.
- 500-year, saturated: Greatest extent and depth; localized lane overtopping increases.

Highway 60 Corridor (East Polk County)

- 200-year: Roadway segments and adjacent natural areas flood; canal depths increase.
- 200-year, saturated: Roadway flooding expands; depths in adjacent areas increase.
- 500-year: Roadway flooding and adjacent floodplain deepen; canal remains elevated.
- 500-year, saturated: Greatest extent and depth along roadway and adjacent floodplain.

These sites collectively depict how extreme rainfall affects critical infrastructure and key transportation corridors under both standard and saturated antecedent conditions for the 200-year and 500-year 24-hour events.

4. Notes and Assumptions

These visualizations and analyses should be reviewed in conjunction with the *Polk County CVA: 200-Year Rainfall Flood Scenarios Report*, the *Polk County CVA: 500-Year Rainfall Flood Scenarios Report*, the Halff Associates (2025) report *Polk County Countywide Hydraulic Model, Hydrologic and Hydraulic Modeling of 200-Year and 500-Year Frequency Events*, and the *Task 2 Deliverables* prepared under this project to provide full modeling and analytical context.

- The flood model assumes spatially uniform rainfall across Polk County for the stated event totals listed in Table 1.
- The visualizations represent modeled flood depths and do not include localized drainage infrastructure.
- Differences between modeled and observed flooding may reflect small-scale variations in rainfall intensity or local drainage conditions not represented in the model.
- FFE data were unavailable for this study. Incorporating surveyed or LiDAR-derived elevations in future efforts could improve structure-level accuracy for priority assets.

5. Funding Acknowledgement

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