Assessing the Potential of a Sea Wall to Reduce Sea-Level Rise Impacts in Downtown Brunswick

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INTRODUCTION

Coastal regions like downtown Brunswick, GA (Figure 1) are increasingly vulnerable to flooding due to rising sea levels and extreme weather events (NOAA, 2020). The risk of flooding threatens the local economy, infrastructure, and historic properties in downtown Brunswick (Esri, 2024).The goal of this project is to simulate the possible trajectory of flooding in downtown Brunswick to bring awareness of the damage with and without flood barriers.

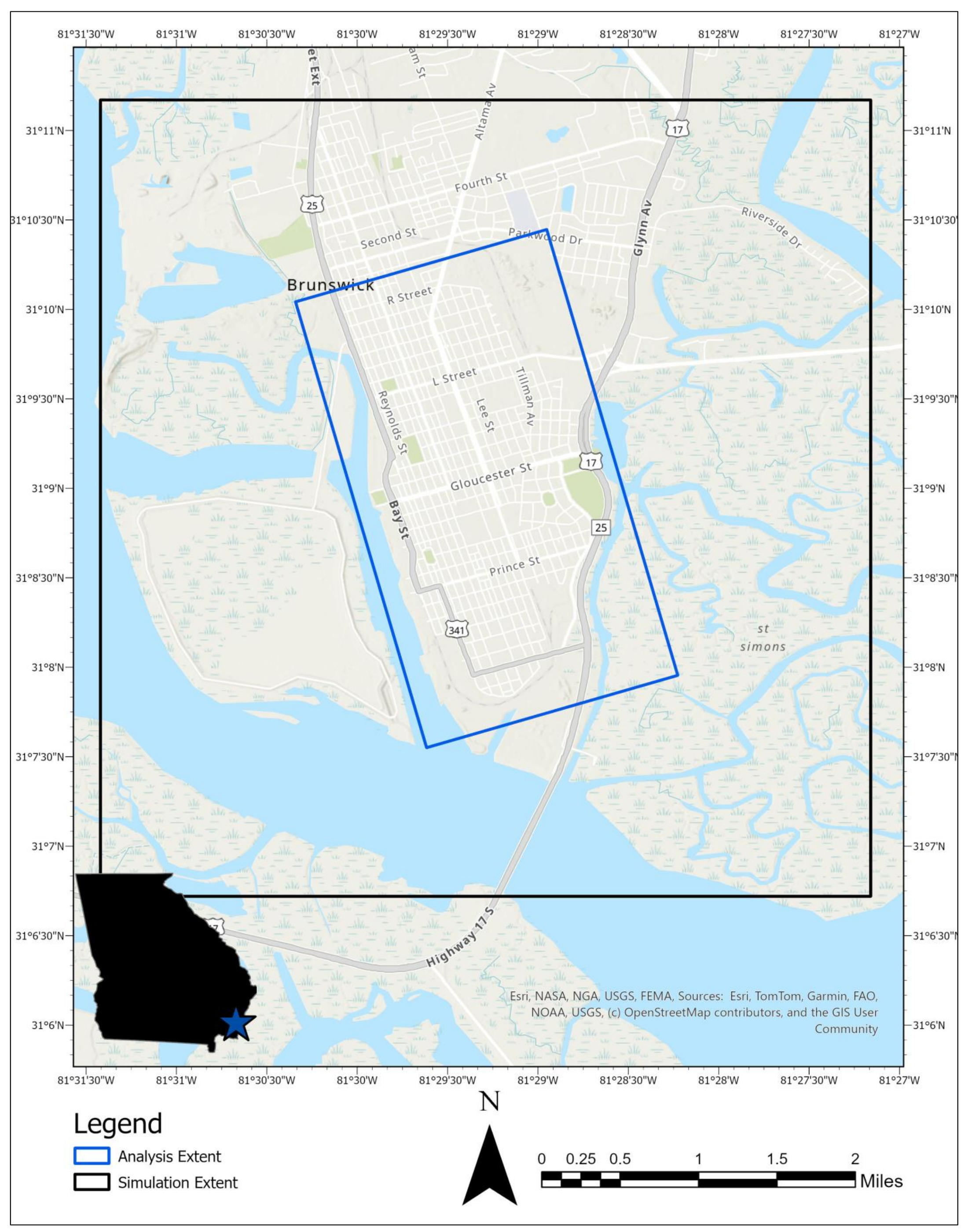


Figure 1. Concept Map of Simulation Area, showing Downtown Brunswick and analysis area.

OBJECTIVES

The objectives of this study are to:

1. Create a flood simulation of downtown Brunswick
2. Estimate total impact of a flood scenario in downtown Brunswick.
3. Estimate total cost for building seawalls around downtown Brunswick.
4. Create a product suited for public communication of this issue.

METHODS

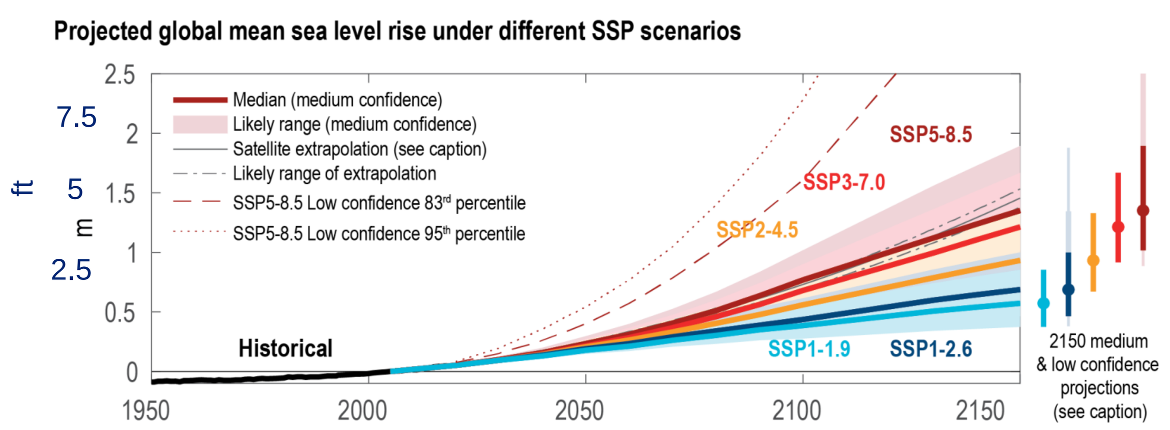


Figure 2. IPCC projection of sea-level rise by 2150

- ArcGIS Pro Flood Simulation was used to create simulated flood scenarios of downtown Brunswick, GA.
- Topobathymetric data were collected from NOAA to accurately simulate flow dynamics of Glynn County.
- Sea-level rise rasters were created referencing a 5-ft sea-level rise (SLR) projection and with Mean Higher High Water (MHHW) Level (Figure 2).
- Infiltration rates were estimated based on local topography.
- Created different flood barrier placement across unique simulations by hand to test effectiveness of barrier placement, height, and width.
- Barrier length was calculated, and costs were estimated.
- Water Depth Simulation Results were exported into individual maps (Figures 3-4).
- Results of finalized simulations were exported onto ArcGIS Story Maps.
- Flow Renderer Visualization was coded and applied onto vector field results for better communication.
- Completed Visualizations were uploaded to ArcGIS Online for public access.

Model Assumptions:

- Seawalls are immovable, impenetrable objects.
- Estimated infiltration rate for wet sand.
- Seawalls may not encompass fully realistic start and end points
- No rainfall rates

RESULTS (FIGURES)

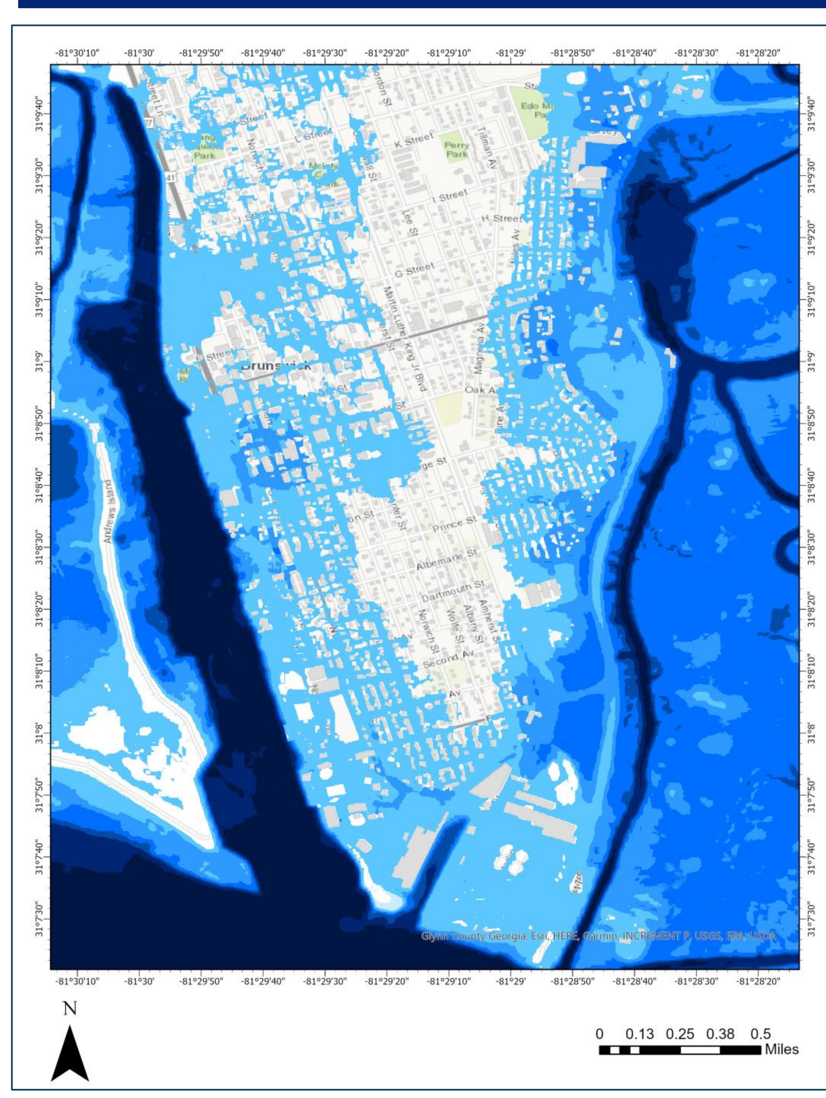
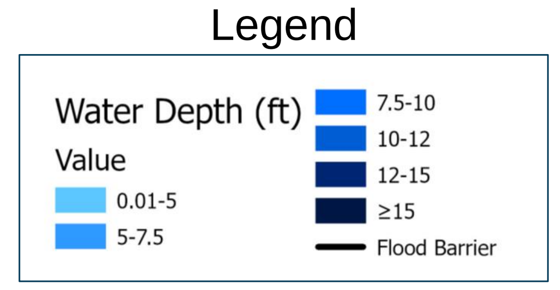


Figure 3. (Left) Results of a Flood Scenario with 5 feet of sea level rise at MHHW after 3 hours with no barriers.



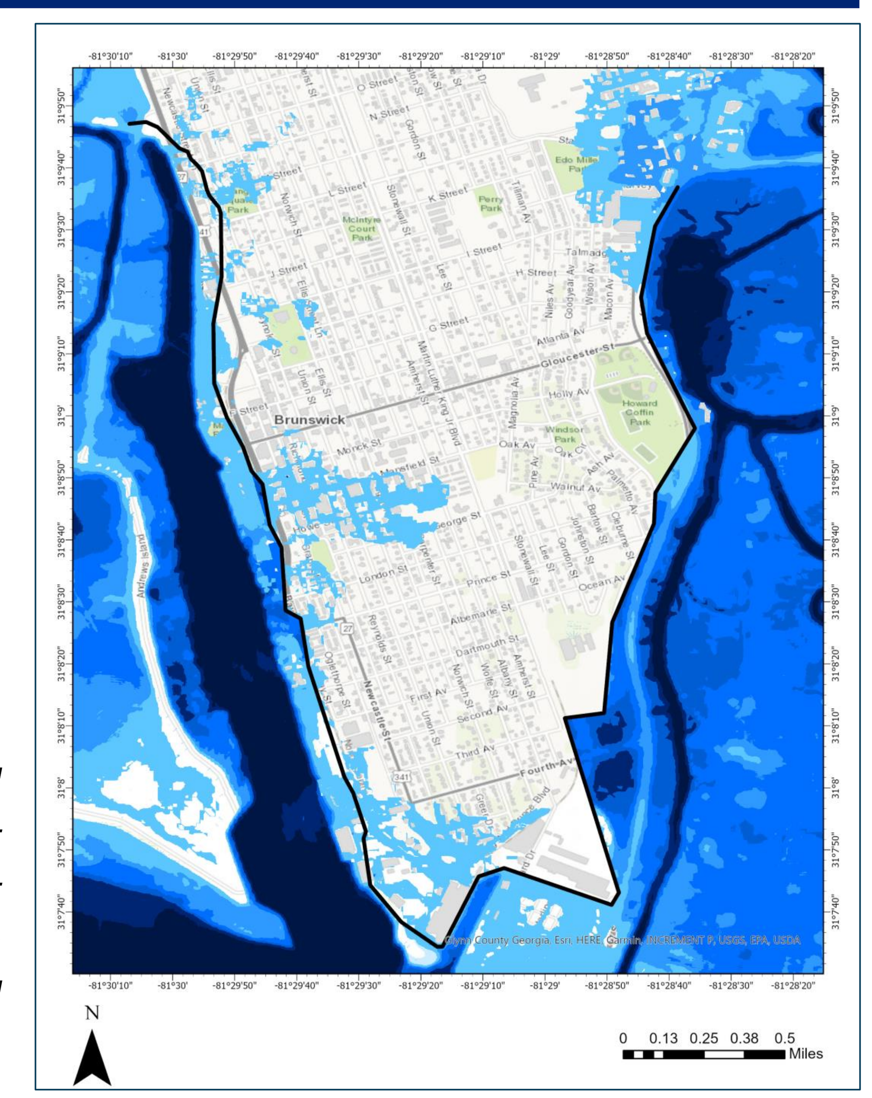


Figure 4. (Right) Results of a Flood Scenario with 5 feet of sea level rise at MHHW after 3 hours with 15-foot flood barriers.

Table 1. Estimated Seawall Cost around Downtown Brunswick, GA

Category	Length (ft)	Height (ft)	Width (ft)	Cost per ft³	Total Cost of Seawall
W/o Site Prep	31,024.0	15.0	7.5	$3.25	$11,343,150.00
W/ Site Prep	31,024.0	15.0	7.5	$3.47	$12,110,328.77
Maintenance Cost	Cost of Maintenance/ft³		Area of Seawall		Maintenance Cost/Year
Annual	$1.60		3,490,200.00		$5,584,320.00

Table 1. Estimated Seawall Cost listed with site preparation and without site preparation. Also includes the annual maintenance cost. Estimates based on US Army Corps of Engineers (1995).

RESULTS (EXPLANATION)

- The results of the unimpeded flood simulation show devastating damage to downtown Brunswick (Figure 3). The areas that are most vulnerable to flooding are the Brunswick Marina, the Georgia Ports Authority Building, and north of the Brunswick Port Society. This is prevalent in both simulation iterations.
- Flooding on the northern end of the seawall analysis extent is not accurate to real scenarios as the seawalls end prematurely (Figure 4).
- The funneling effect of Oglethorpe Bay enhances flooding beyond projected sea level rise, implying that we may reach SLR MHHW flood conditions specifically around downtown Brunswick before general SLR increases to the simulated degree.

CONCLUSIONS & DISCUSSION

- **Seawalls are not a viable option to mitigate flooding.** Both from a financial and physical standpoint.
- Glynn County made $73,633,718 in revenue in 2024 (Glynn County 2024). Constructing this exact sea wall from concrete would be 16% of the total revenue, with an additional 8% of that in annual maintenance (Table 1).

POSSIBLE MITIGATION PLAN

- One possibility for future policy focusing on the flooding of downtown Brunswick could be much cheaper but temporary mitigation practices.
- One method would be installing elevated pump houses around vulnerable areas, then planning a gradual migration of people inland over time.

SUGGESTED FUTURE WORK

- Future work could include researching estimated damage incurred from SLR flooding. These estimates could create a cost-benefit analysis of different flood mitigation facilities, such as channels, seawalls, pump houses, and more.
- Other work could also include refinement of the simulation, such as updating water depth raster georeferencing, making the simulation extent larger, adding rain and precise infiltration rates

REFERENCES & ACKNOWLEDGEMENTS

SCAN ME

I would like to thank the ENDEAVOR Center for funding this project and hosting a venue to present this product.