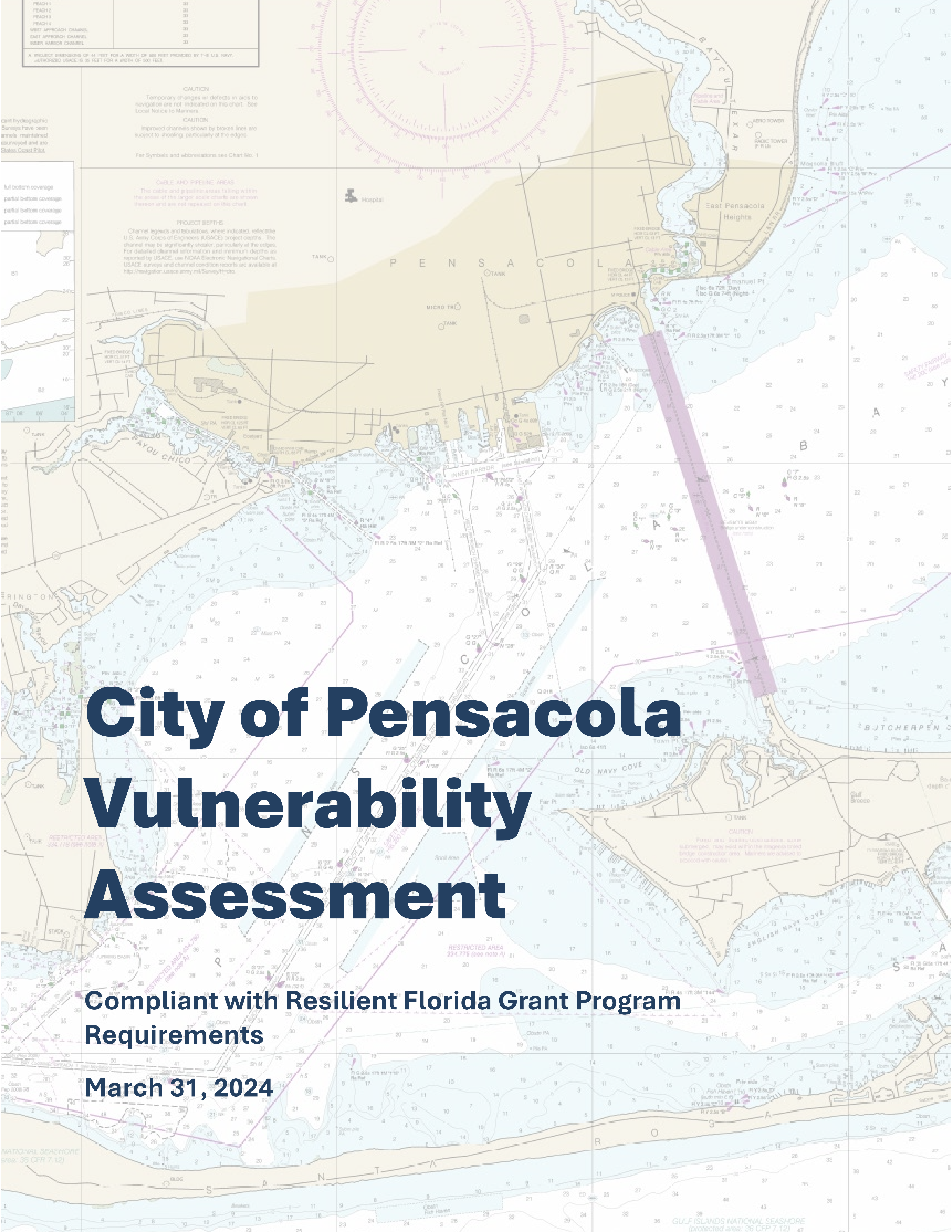


City of Pensacola Vulnerability Assessment

Compliant with Resilient Florida Grant Program Requirements

March 31, 2024

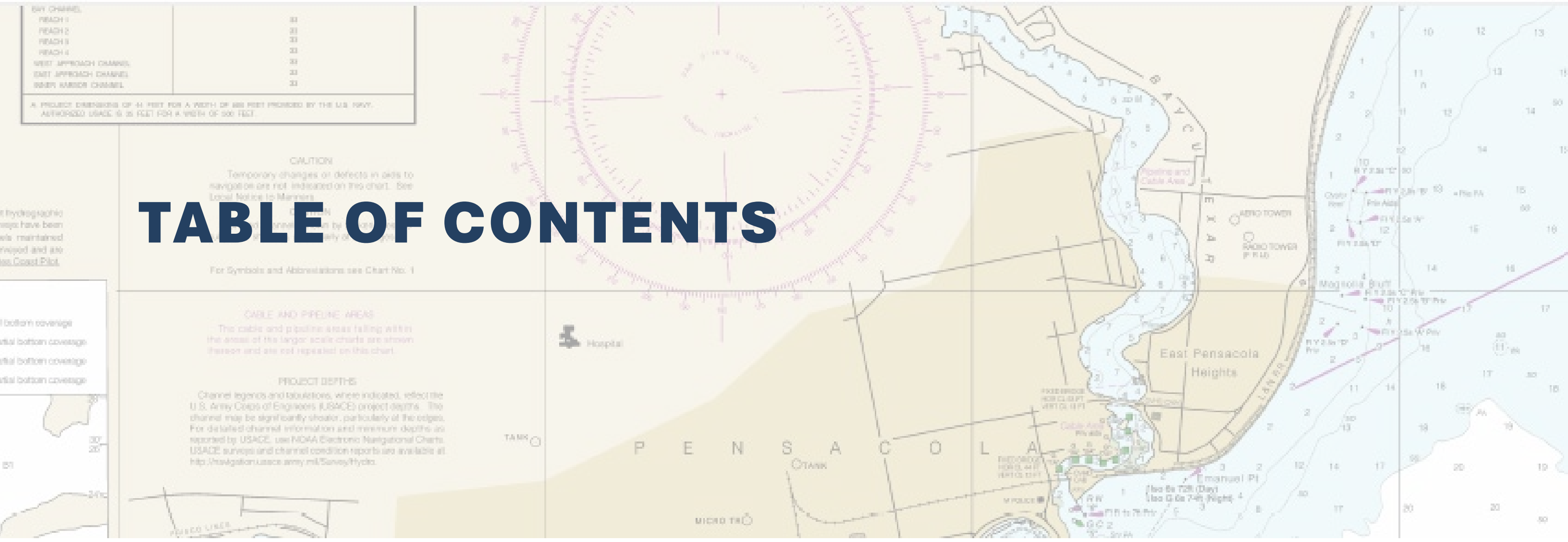
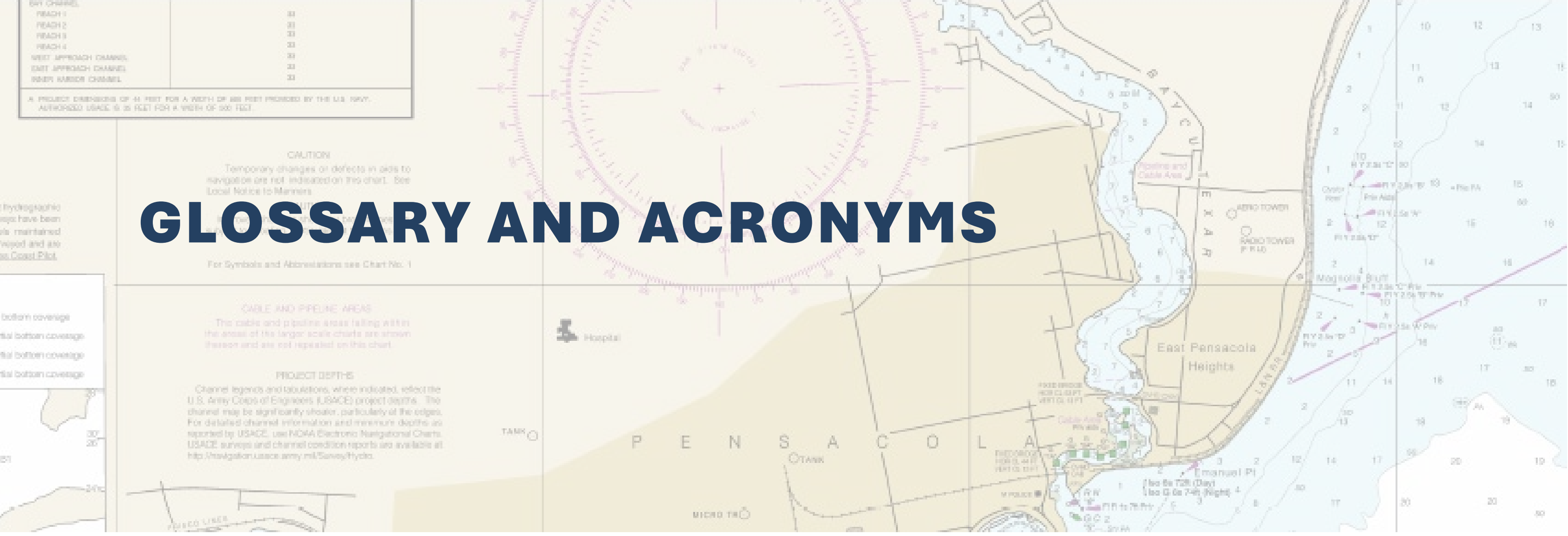


TABLE OF CONTENTS

Note: For compliance with the Americans with Disabilities Act, this document has been formatted to be screen reader-friendly. As such, margins, tables and text have been adjusted to be more easily readable by a screen reader.

LIST OF TABLES

LIST OF FIGURES



GLOSSARY AND ACRONYMS

Adaptation (to climate change) - The process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities. Adaptive capacity is the ability to make these adjustments.

Assets - People, resources, ecosystems, infrastructure, and the services they provide. Assets are the tangible and intangible things people or communities' value.

Bathtub Method / Model - The projected sea level rise at a point in time is added to the current water elevation and overlaid on the existing topography to identify inundated areas.

Climate Change - The increasing changes in the measures of climate over a long period of time - including precipitation, temperature, and wind patterns.

CRS - Community Rating System, a FEMA program that encourages communities to prepare for flooding events by awarding FEMA flood insurance premium discounts for completing floodplain management and other flood mitigation activities.

Exposure - The presence of people, assets, and ecosystems in places where they could be adversely affected by hazards.

FEMA - Federal Emergency Management Agency.

Global Warming - The rise in global temperatures due mainly to the increasing concentrations of greenhouse gases in the atmosphere.

Hazard - An event or condition that may cause injury, illness, or death to people or damage to assets.

Hazard Mitigation - When used by the Federal Emergency Management Agency (FEMA), the effort to reduce loss of life and property by lessening the impact of near future disasters.

IPCC AR5 RCP 8.5 Scenario - This condition is known as a representative concentration pathway for the concentration and trajectory of greenhouse gases was developed and intended by members of the Intergovernmental Panel on Climate Change (IPCC) to be a “very high baseline emission scenario” representing the 90th percentile of the volume of emissions that could occur in various future years if society does not make efforts to reduce greenhouse gas emissions. It is a “business as usual” scenario.

Impacts - Effects on natural and human systems that result from hazards. Evaluating potential impacts is a critical step in assessing vulnerability.

King Tide - A non-scientific term describing an especially high tide caused by alignment of the gravitational pull between the sun and moon. A King Tide usually occurs three to four times a year.

Mitigation (of climate change) - A human intervention to reduce emissions or enhance the sinks of greenhouse gases.

NIH - NOAA Intermediate-High Sea Level Projection.

NIL - NOAA Intermediate-Low Sea Level Projection.

NOAA - National Oceanographic and Atmospheric Administration.

Projections - The 2019 Unified Sea Level Rise Projections published by the Southeast Florida Regional Climate Change Compact. Potential future climate conditions calculated by computer-based models of the earth system. Projections are based on sets of assumptions about the future scenarios that may or may not be realized.

Relative Sea Level Rise - The way the height of the ocean rises or falls relative to the land at a particular location.

Resilience - The capacity of a community, business, or natural environment to prevent, withstand, respond to, and recover from a disruption.

Risk - The potential total cost if something of value is damaged or lost, considered together with the likelihood of that loss occurring. Risk is often evaluated as the probability of a hazard occurring multiplied by the consequences that would result if it did happen.

Scenarios - A set of assumptions about the future regarding the level of mitigation efforts and other physical processes that have a level of uncertainty.

Sea Level Rise (Absolute Sea Level Rise) - The height of the ocean surface above the center of the earth, without regard whether nearby land is rising or falling.

Sensitivity - The degree to which a system, population, or resource is or might be affected by hazards.

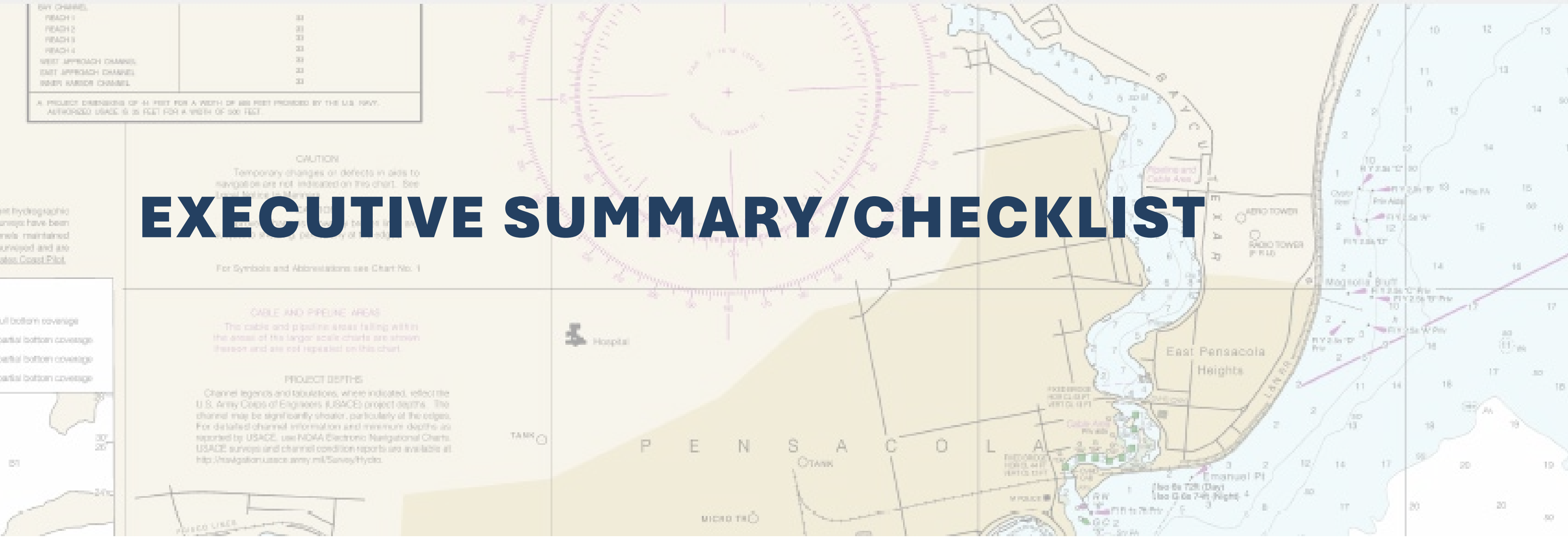
SLR - Sea level rise.

Uncertainty - A state of incomplete knowledge. Uncertainty about future climate arises from the complexity of the climate system and the ability of models to represent it, as well as the inability to predict the decisions that society will make.

Vulnerable populations - Vulnerable groups of people include those with low income, some communities of color, immigrant groups (including those with limited English proficiency), indigenous peoples, children and pregnant women, older adults, vulnerable occupational groups, persons with disabilities and persons with pre-existing or chronic medical conditions.

Vulnerability - The propensity or predisposition of assets to be adversely affected by hazards. Vulnerability encompasses the degree of exposure, sensitivity, potential impacts, and adaptive capacity.

Vulnerability Assessment - A process for identifying who or what is impacted by climate change. It is the combination of exposure, sensitivity, and adaptive capacity.



EXECUTIVE SUMMARY/CHECKLIST

This section serves as both an Executive Summary of the full Vulnerability Assessment Report, as well as an outline corresponding to the items in the Resilient Florida Grant Program Vulnerability Assessment Compliance Checklist Certification document distributed by the Florida Department of Environmental Protection (DEP). Headings and subheadings of sections in bold and / or italics with alphabetic letters in parentheses indicate the item identified in the DEP Checklist.

Final Vulnerability Assessment Report (a)

The complete Vulnerability Assessment Report can be found after this Executive Summary.

Results

The main takeaways of the Vulnerability Assessment:

- Sea-level rise is significantly elevating flooding risk, particularly in low-lying areas.
- Vital stormwater and transportation infrastructure, along with critical assets, face considerable disruption risks.
- Flooding threatens to inflict potentially severe effects on the local economy and vulnerable populations now and in the future.
- Implementation of adaptation strategies is crucial for the City to become a more resilient community.

Conclusions and recommendations

Based on this vulnerability assessment, the City of Pensacola may wish to consider the following recommendations to improve its climate resilience:

- Target resilience investments to priority areas by focusing on the flooding hot spots identified in this document, as part of the City's capital improvements and budgeting processes.

- Expand the 50-year useful life language for stormwater systems to include future conditions related to changing rainfall conditions and a reduced tailwater condition due to sea level rise.

- Incorporate higher frequency critical duration storm events in more advanced stormwater modeling.

- Strengthening the City's Floodplain Management Ordinance in Chapter 12-9, including enhancing freeboard requirements in certain areas of the City or for substantial improvements.

- Requiring pervious surfaces in landscaping requirements and higher thresholds in the Community Redevelopment area (CRS) urban design overlay district.

- Adopting a shoreline ordinance that harmonizes concepts of seawall heights, promoting living or hybrid shorelines in key locations and tying useful life of shoreline improvements to future flood risk.

Electronic Mapping Data

Geospatial data (b)

Per FDEP requirements, a list of assets is included in the report. See Appendix A for a complete list of the data types/layers/sources.

GIS metadata (c)

GIS information supplied to FDEP contains the required metadata.

Critical assets impacted by flooding and sea level rise (d)

The GIS analysis underpinning this Vulnerability Assessment incorporates layers including critical municipal and regionally-significant assets. Critical assets generally are those owned and maintained by the City or are essential for the functioning of the City. It should be noted that some critical assets may not be owned or maintained by the City, for instance, health care or certain utility assets. Regionally significant assets are those that may not be owned by the City but are no less critical to its functionality. These may be Federal, state or County assets.

Data summary for municipal assets

The following sources of data were collected and evaluated for the project:

1. **Transportation Assets and Evacuation Routes**: airports, bridges, bus terminals, bus routes, boat ramps, major roadways, evacuation routes, port facilities, marinas, rail facilities, and railroad bridges.

2. **Critical Infrastructure**: wastewater conveyance structures and lift stations, potable water conveyance structures, stormwater drainage infrastructure and stormwater ponds, electric production and supply facilities, military installations, post offices, communications facilities, and disaster debris management sites.

3. **Critical Community and Emergency Facilities**: childcare facilities, schools, colleges, universities, assisted housing, community centers, emergency medical service facilities, fire stations, emergency management services, health care facilities, hospitals, law enforcement facilities, risk shelters, local government facilities, and state government facilities.

4. **Natural, Cultural, and Historical Resources**: This category is dedicated to preserving and protecting natural areas and cultural/historical sites, including historic buildings and cemeteries, places of worship, and other historical and cultural assets, city and county parks, shorelines, surface waters, wetlands, and other terrestrial and aquatic natural areas.

5. **Supplementary Information**: This category includes additional data not explicitly required by Subsection 380.093, F.S., but valuable for a detailed vulnerability assessment. It encompasses FEMA's flood insurance study, flood zones, frequently flooded areas, soils, impervious surface areas, seawalls, land cover, land use, and property values.

Regionally-significant assets

Multiple asset types listed above would be considered regionally significant assets; they are due special attention. Given their specific mention in the statutory language which refers to critical assets that support the needs of communities spanning multiple geopolitical jurisdictions and, in this case, include:

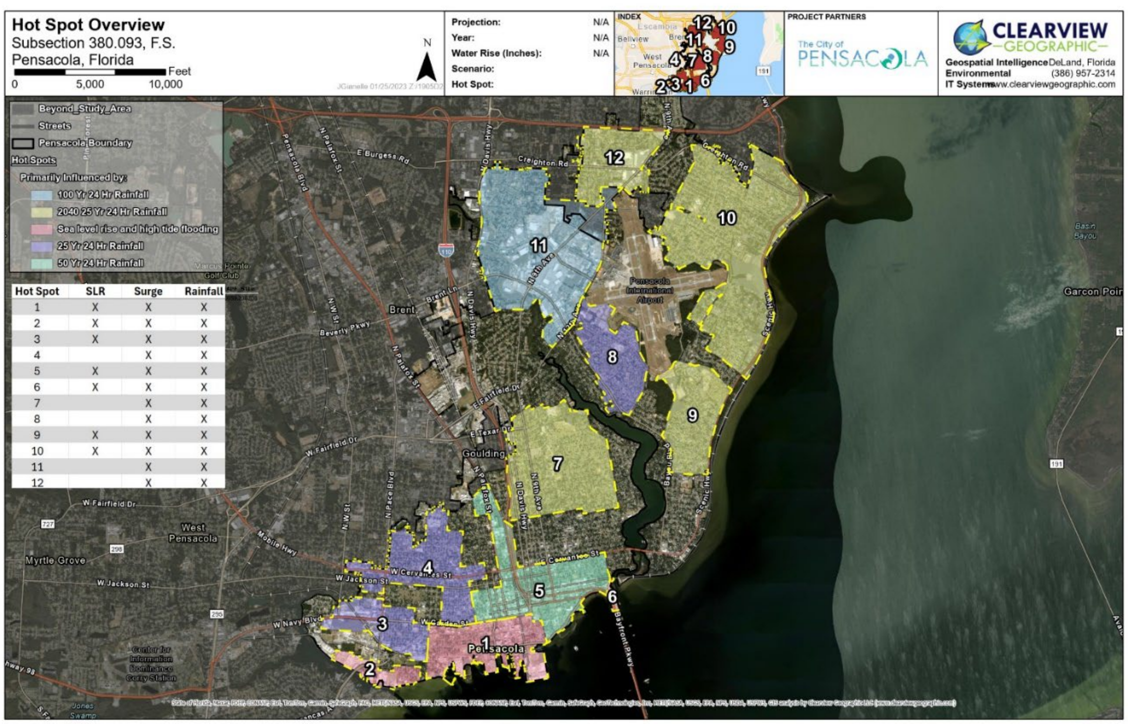
- Commercial and Strategic Intermodal System (SIS) ports
- Railroads (SIS)
- Rail bridges

- Airports (SIS)
- Bus terminals
- Evacuation routes
- Electric power transmission lines
- Drainage assets (including those maintained by water management district)
- Stormwater ponds
- Public water supply tanks
- Emergency medical services facilities
- Risk shelters

Asset layers were compiled initially in a baseline asset inventory. This baseline asset inventory was reviewed multiple times without the data compilation process. During this exchange, the importance and relevance to resilience was discussed and a critical asset inventory was established. This serves as a foundation that is further analyzed in the vulnerability assessment. A more prioritized map series was produced which focused on the highest priority assets within the community and can be found in the Critical Asset Inventory.

Areas Prioritized in the Analysis

Figure 1 - Hot Spot Map



Hot Spot	SLR	Surge	Rainfall
1	X	X	X
2	X	X	X
3	X	X	X
4		X	X
5	X	X	X
6	X	X	X
7		X	X
8		X	X
9	X	X	X
10	X	X	X
11		X	X
12		X	X

The project team identified 12 flooding "hot spots" based on the intensity of projected flooding caused by rainfall and storm events and future sea level rise and the concentration of assets identified by the city of Pensacola. The analysis reviewed approximately 4,500 assets contained within these hot spots, which were then prioritized based on level of flood impacts. In addition, items of immediate need within the hot spots were also highlighted. Specifically:

- 323 assets were prioritized as the highest level 1-3, with 1 rated the most critical, based upon criticality and threat (top 15% most vulnerable).
- 755 assets were prioritized as levels 4-5 (level 4 covering the 15-25% most vulnerable and level 5 the 25-50% most vulnerable).
- 3,235 assets were not prioritized (the 50% least vulnerable).

The "Hot Spot" Maps can be found in the Sensitivity Map Series.

Areas of Immediate Need

Based on the generated hot spots and collaboration with City of Pensacola staff, the project team has prepared a list of areas that were identified as areas of immediate need and made recommendations for potential project improvements to alleviate impacts and increase the resiliency of each hot spot area. The selected locations are areas that are currently within City-identified Flood Prone Areas or are projected to be intensely impacted by future sea level rise. Combining the two data sources provides insights into known and future areas of impact. Suggested improvements in Hot Spots should be further investigated at the engineering level for feasibility, design, cost and overall ability to alleviate current or future flooding risk.

Table 1 - Potential Improvements in Hot Spots

Hot Spot	Potential Improvements
Hot Spot 1	• West Gimble Street Lift Station • South Jefferson St. / Palafox St. Intersection • Corrine Jones Park Improvements
Hot Spot 2	• S K Street/Cypress St/I St Drainage
Hot Spot 3	• Navy Blvd/ S L St/ Zargossa St to Tanyard Area Wide Improvements
Hot Spot 4	• Cervantes St and N F St/Lee St Intersection
Hot Spot 5	• Palafox St to N 9th Ave /Coastal Drainage Pathway

Hot Spot 6	• Pensacola Bay Area Convention and Visitors Bureau Improvements
Hot Spot 7	• N 11th to E Texar to Drainage to Bayou
Hot Spot 8	• Bayou Blvd./Piedmont Rd./Tronjo Rd • Roger Scott Athletic Center & Vickrey Resource Center
Hot Spot 9	• Inverness Utility Systems Hardening
Hot Spot 10	• Scenic Hwy Flow Way Improvements and Living Shoreline Restoration
Hot Spot 11	• Cordova Mall/Sacred Heart Hospital Major Transit Corridor Improvements
Hot Spot 12	• Tippin Ave/ 9th Ave Drainage Improvements

Peril of Flood Compliance Plan amendments (e)

The City of Pensacola Comprehensive Plan already complies with paragraph 163.3178(2)(f), Florida Statutes, pertaining to Peril of Flood; therefore, Peril of Flood amendments are not included within this Vulnerability Assessment.

Tidal Flooding

In the context of planning for future tidal flooding events, the Vulnerability Assessment Report for Pensacola incorporates detailed modeling techniques to predict how rising sea levels and high tide events will impact the area over several planning horizons. This modeling is particularly important given the city's vulnerability to climate change-induced phenomena. The assessment uses the North American Vertical Datum of 1988 (NAVD 88) as a benchmark for all elevations, ensuring accuracy and consistency in projection data.

Key to this analysis is the scenario list above, included in each of the following sections of this executive summary, which include combinations of sea level rise and high tide flooding, alongside projections of the number of days tidal flooding is expected to occur. The scenarios are based on NOAA's Intermediate-Low (NIL) and Intermediate-High (NIH) Sea Level Rise Projections from 2017, which were the required scenarios at the initiation of this Vulnerability Assessment. These projections provide a framework for understanding the range of possible future conditions, enabling the city to prepare for a variety of outcomes.

The analysis employs geospatial temporal modeling techniques, leveraging tools like ArcGIS Pro and the VDATUM tool for datum conversion, to assist with simulating tidal flooding scenarios. This methodology employs the National Oceanic and Atmospheric Administration's (NOAA) mapping sea level rise inundation methodology, ensuring the assessment accurately captures the complexities of tidal flooding under various future scenarios.

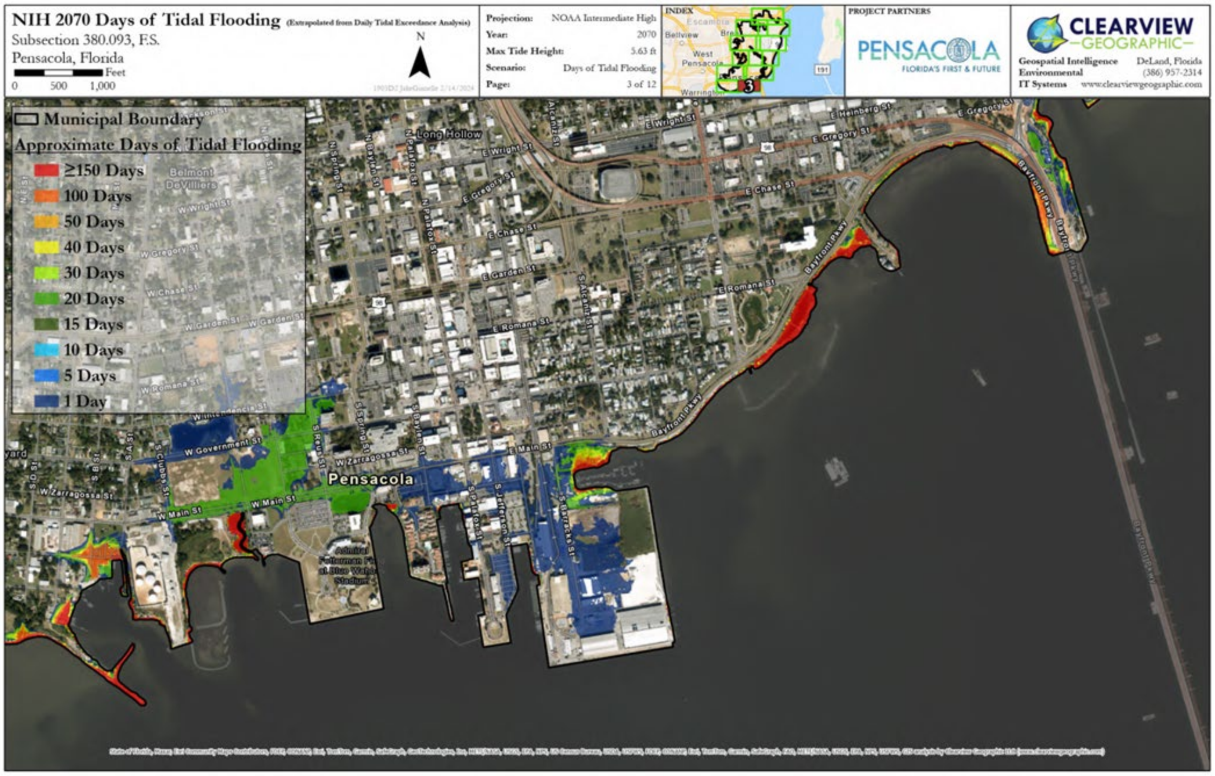
Figure 2 - Sample Tidal Flooding Scenario Map

NIH 2070 SLR Projection and High Tide Flooding

This methodology also includes a representation of the analysis depicting a geographical display of the number of tidal flood days expected for each scenario and planning horizon in the map series entitled “Days of Tidal Flooding” in the Exposure Map series, supplemental to the two-foot mean higher high-water threshold established by FDEP. This combination offers a nuanced view of the days each year that are expected to experience tidal flooding, contributing to a more comprehensive understanding of the temporal dynamics of flood risk.

Figure 3 - Approximate Number of Days of Tidal Flooding

Days of Tidal Flooding = SLR Projection and High Tide Flooding



This scenario utilizes the FDEP's recommendation to add two feet to the MHHW mark, enhancing predictions for future tidal flooding by accounting for increased sea levels and high tide events. This conservative approach aids in planning for more frequent and severe flooding, underscoring the need for robust coastal defenses like seawalls and natural barriers.

Building on the previous analysis, this section projects the number of days expected to experience tidal flooding, emphasizing its impact on daily life and the economy. It highlights the importance of comprehensive flood risk management strategies to mitigate these effects, aiming to ensure Pensacola's resilience and sustainable development amidst rising sea levels and changing climate conditions.

The scenarios of Sea Level Rise + High Tide Flooding and Days of Tidal Flooding together guide Pensacola's climate resilience strategy. They highlight expected changes along coastlines and low-lying areas, steering the conversation towards adapting urban plans, emergency readiness, and strengthening community resilience. Integrating these insights into Pensacola's long-term planning enables proactive responses to sea level rise and tidal flooding challenges, aiming for sustainable development and a resilient future for the community.

Storm Surge Flooding

This analysis leverages FEMA's storm surge data and the HAZUS-MH software, adjusting historical data monumented within the most recent effect Flood Insurance Study (FIS) based on future sea level rise projections. It offers a detailed understanding of future storm surge impacts by integrating these projections with existing FEMA FIS data.

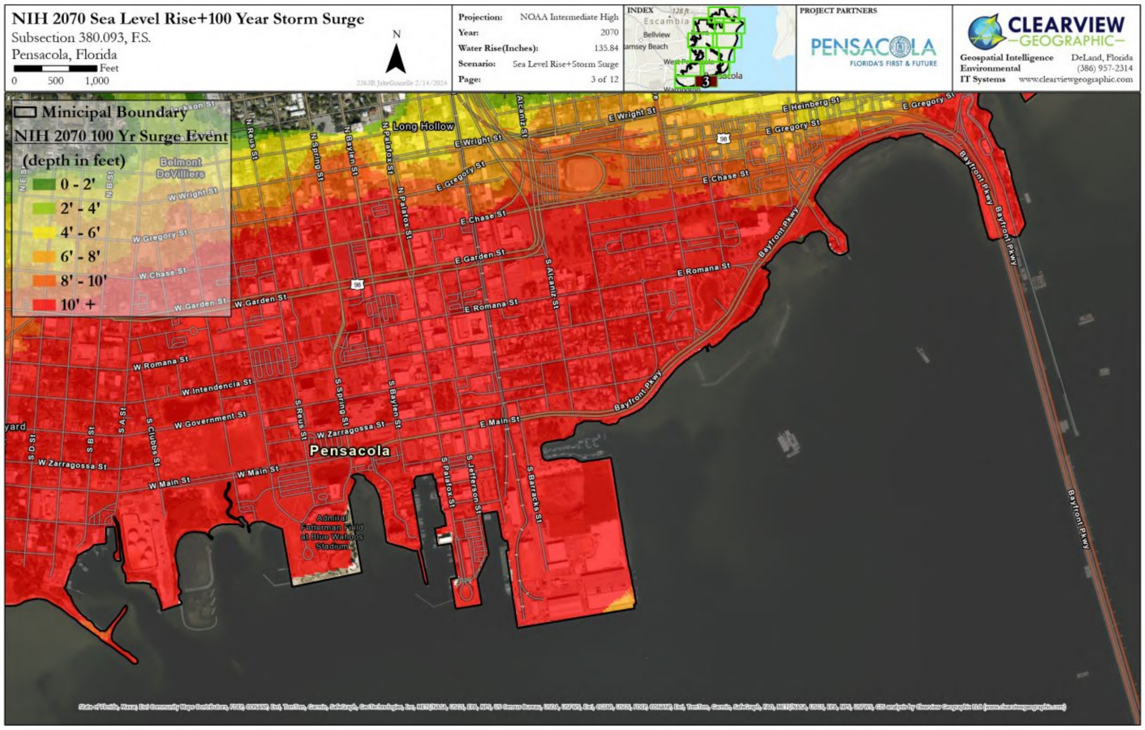
Depth of current and future storm surge flooding (h)

Using FEMA's comprehensive storm surge data in conjunction with HAZUS-MH software, historical storm surge events were adjusted to align with projected sea level increases for 2040, 2070, and 2100 planning horizons. This process enabled the prediction of storm surge depths across different timelines, providing a granular view of how storm surge flooding may evolve. The outcomes reveal significant increases in storm surge depths, underscoring the urgent need for adaptive infrastructure and planning measures to mitigate the impacts on vulnerable coastal communities.

Initial storm surge event equals or exceeds current 100-year flood event (i)

The initial storm surge event analyzed in this assessment equals or exceeds the magnitude of the current 100-year flood event as required by statute. This comparison highlights a stark increase in the severity and frequency of storm surge events, likely attributable to ongoing climatic changes and sea level rise. This implies that an event previously considered to be a once-in-a-century occurrence may now happen more frequently, requiring a reevaluation of flood risk assessments and flood zone designations. This finding is critical for updating building codes, insurance rates, and disaster preparedness plans to better reflect the heightened risk of significant storm surge flooding in the future. All storm surge maps can be found in the Exposure Map series.

Figure 4 - NIH 2070 SLR + 100-Year Storm Surge



The 100-year and 500-year storm surge scenarios are critical to understanding Pensacola's flood risks, with the former having a 1% annual chance of occurrence and the latter a 0.2% chance. These scenarios, crucial for urban and infrastructure resilience planning, consider the compounded impacts of climate change on storm surge risks using FEMA data and HAZUS-MH software, adjusted for future sea level rise. They provide a foundation for developing flood defenses, revising building codes, and crafting evacuation strategies. This comprehensive risk assessment aids Pensacola in proactive planning against storm surge flooding, ensuring a holistic approach by integrating with tidal flooding and sea level rise projections. It is a strategic effort to bolster the city's resilience, protect its community, and maintain infrastructure integrity in the face of climate change.

Rainfall-induced Flooding (k)

Following the requirements of Section 380.093(3), F.S., this Vulnerability Assessment employs a spatiotemporal analysis, leveraging existing modeling results and developing new simulations to assess flood risk accurately. Use of the Hydrologic Engineering Center's River Analysis System (HEC-RAS) tool allows for detailed rainfall simulation and runoff computation. The integration of NOAA’s Atlas 14 precipitation data and the Department of Defense's (DoD) future rainfall change factors facilitates a comprehensive evaluation of potential future scenarios of rainfall-induced flooding. This methodological approach ensures that the assessment adheres to legislative requirements while providing a robust framework for predicting flood elevations under various conditions. All rainfall maps can be found in the Exposure Map series.

In the progression of the Vulnerability Assessment Report for Pensacola, attention shifts towards an equally pivotal domain: rainfall-induced flooding. This section meticulously outlines scenarios ranging from the more frequent 25-year events to the rare but devastating 1000-year events, alongside adjusted projections that take into account anticipated changes in climate patterns. Each scenario represents a distinct level of flood risk based on the probability and intensity of rainfall over a 24-hour period, thereby providing a comprehensive spectrum of potential flood hazards.

Future boundary conditions (l)

To account for the evolving nature of flood risk due to climate change, the future boundary conditions for this analysis have been carefully adjusted via overlays and change coefficient multipliers. These modifications incorporate elements of sea level rise and high tide conditions to the extent practicable, ensuring that the assessment reflects the most accurate and relevant scenarios for evaluating future flood risks. By doing so, the study aligns its predictions with the latest climate science, providing a more realistic projection of flood elevations and areas at risk.

The assessment adjusts the 25-year and 100-year 24-hour scenarios to reflect the impact of climate change on rainfall patterns, offering a forward-looking analysis of flood risks. By incorporating projections of increased rainfall intensity and frequency, these scenarios provide a clearer picture of potential future flood hazards. This comprehensive approach enables Pensacola to adapt its infrastructure and policies to the realities of a changing climate, ensuring informed decision-making in flood mitigation and resilience planning. This effort is vital for maintaining community well-being and sustainable development amidst the challenges posed by more frequent and intense rainfall events.

Depth of rainfall-induced flooding (m)

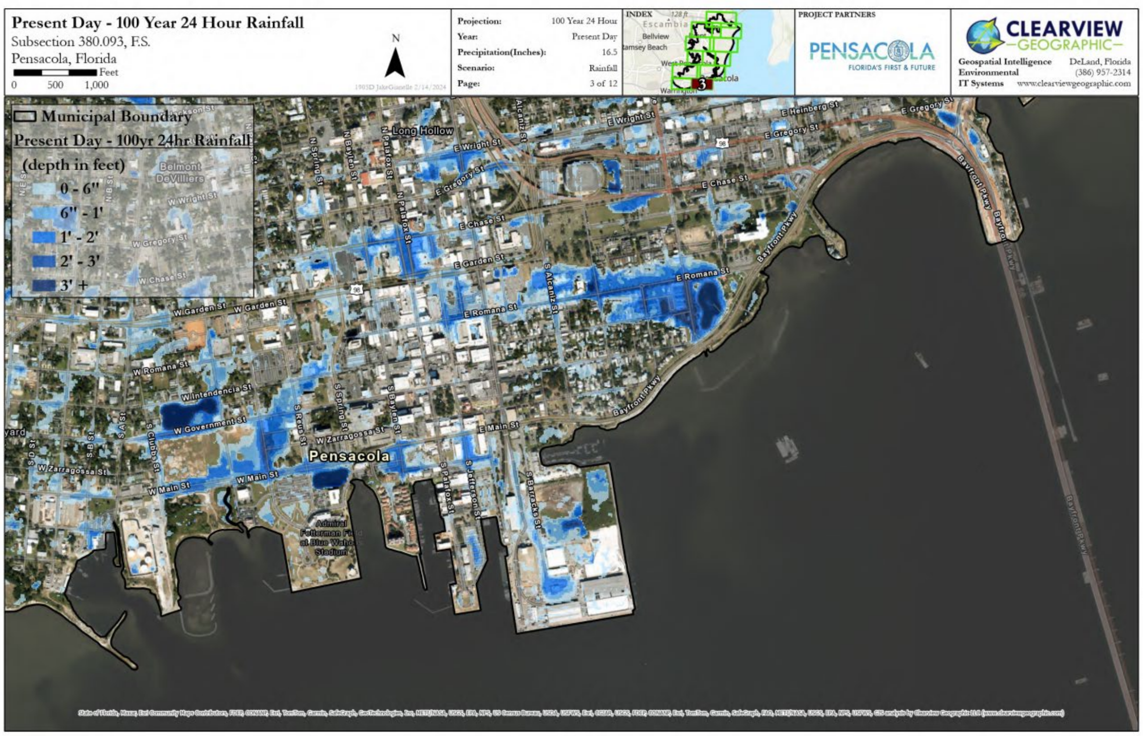
The analysis delves into the projected depths of rainfall-induced flooding for significant storm events, specifically the 25-year, 50-year, 100-year, 500-year, and 1000-year storms. By examining these scenarios, the study identifies critical areas that are likely to experience substantial flooding, thus presenting a clear picture of the potential impact on infrastructure and communities. The depth of flooding is quantified through detailed maps and tables, offering valuable insights into the spatial distribution of flood risks.

The study presents its findings through a series of maps and tables that visualize the depth and extent of rainfall-induced flooding for all storm scenarios within the exposure series. These mapped visual aids facilitate a better understanding of the spatial distribution of flood risks, enabling stakeholders to identify high-risk areas and prioritize mitigation efforts accordingly.

100-year storm

This scenario predicts the extent and depth of flooding likely to occur with a 1% chance of throughout any given year providing a baseline for flood risk management and urban planning. This concept is widely used in flood risk management and planning to design standards for infrastructure resilience, such as levees, dams, and floodplains.

Figure 5 - Present Day - 100-Year 24-Hour Rainfall



The 100-year 24-hour scenario, modeling a severe storm with a 1% annual occurrence chance, is essential for guiding flood risk management and urban development strategies. It informs the creation of flood mitigation infrastructure, zoning laws, and insurance policies, pinpointing areas for strategic investments to lower flood risks and bolster community resilience.

500-year storm

An assessment of the more extreme but less frequent 500-year storm event gives insights into the potential for catastrophic flooding, informing long-term resilience strategies. It signifies a storm that has a 0.2% chance of occurring in any given year. This statistical measure is used to describe the severity and likelihood of extreme weather events, helping in the planning and construction of infrastructure designed to withstand such rare but potentially devastating storms.

Figure 6 - Present Day - 500-Year 24-Hour Rainfall

The 500-year 24-hour scenario, modeling an extreme rainfall event with a 0.2% annual chance, is vital for assessing the maximum flood risk potential, identifying areas and infrastructure at risk of severe flooding. This scenario underscores the need for extensive planning and advanced mitigation efforts to prepare for and reduce the impacts of such catastrophic events.

Higher frequency storm analyzed for exposure of a critical asset (j)

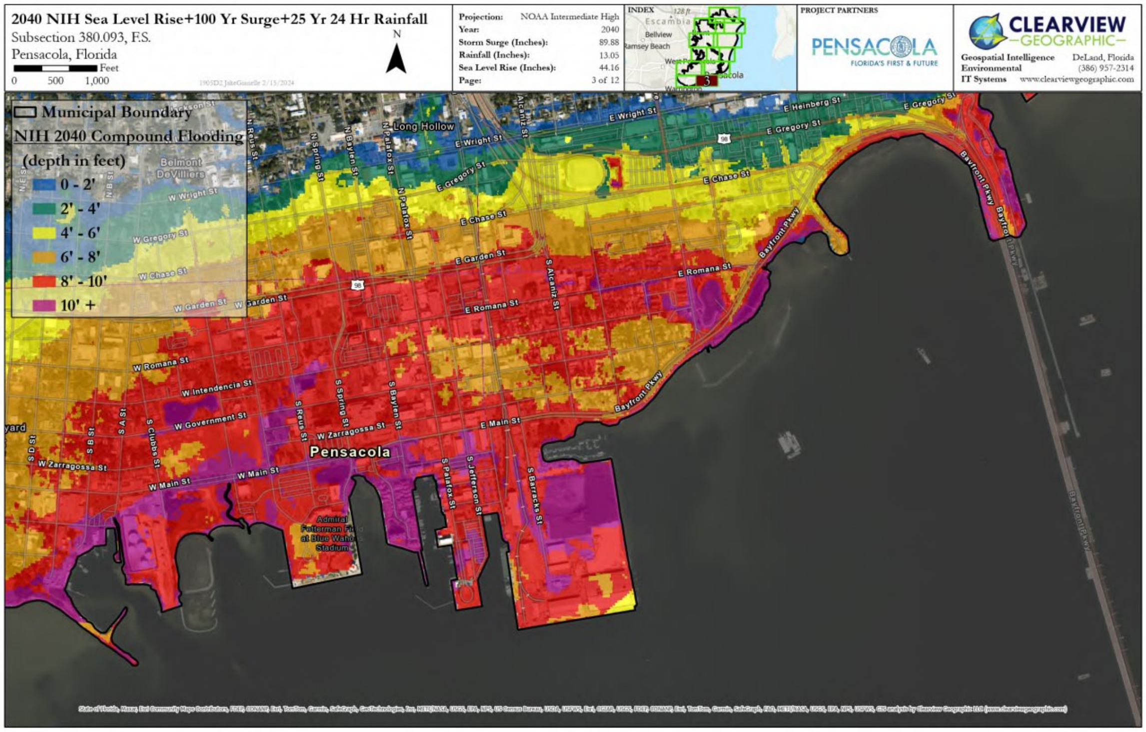
In addition to the standard 100-year and 500-year storm scenarios, the analysis also includes a detailed examination of higher frequency storms to assess the exposure of critical infrastructure and assets. This focused analysis helps in identifying vulnerabilities and planning for protective measures to safeguard essential services and facilities against the impact of more frequent, higher-intensity flooding events. Further exploring a range of storm events, including the 25-year, 50-year, 100-year, 500-year, 1,000-year storms, provides a more comprehensive overview of flood risks over a spectrum of probabilities meeting and exceeding the statutory requirements for Vulnerability Assessments. This detailed assessment, summarized in accompanying tables, aids in the development of a nuanced flood risk management strategy that addresses both common and severe flooding scenarios.

The rainfall scenarios ranging from 25-year to 1000-year events provide a comprehensive spectrum of flood risk assessments essential for Pensacola's flood management and urban planning. The 25-year scenario, with a 4% annual chance, highlights moderate flooding risks, emphasizing the need for improved drainage and community preparedness. Progressing in severity, the 50-year scenario (2% chance) evaluates the adequacy of flood defenses and critical infrastructure resilience. The 100-year scenario is a key benchmark in flood risk management, guiding urban development, flood mitigation, and zoning with a 1% occurrence chance. It calls for strategic investments to enhance community resilience. The 500-year scenario, reflecting a 0.2% chance of extreme rainfall, and the 1000-year scenario, with a 0.1% chance, both underscore the importance of comprehensive planning and robust mitigation to address the highest levels of flood risk and potential catastrophic impacts. Collectively, these scenarios underscore the necessity of a forward-looking approach to urban planning, emergency management, and resilience building against increasing flood risks.

Compound/Combined Flooding (n)

This segment addresses the compound effects of tidal, storm surge, and rainfall-induced flooding under various scenarios primarily focused on the 100-year and 500-year storm surge events plus 25-year and 100-year rainfall events with the compounding effect of sea level rise. It involves overlaying depth grids from various scenarios, acknowledging the resource and time constraints of the project. Combined flooding maps can be found in the Exposure Map series.

Figure 7 - NIH 2040 SLR + 100-Year Surge + 25-Year 24-Hour Rainfall



Through the comprehensive analysis of these compounded scenarios, the report underscores the importance of integrating multidimensional flood risk assessments into urban planning and infrastructure development. Such detailed projections facilitate the strategic implementation of adaptation and mitigation strategies, ensuring that communities are better prepared and more resilient to the increasingly complex and severe flooding challenges posed by climate change.

Scenario Development Specifications

North American Vertical Datum of 1988 (o)

All elevations referenced in and analyzed for this Vulnerability Assessment are expressed in North American Vertical Datum of 1988 (NAVD 88) values. Any exceptions are limited and are specifically noted in the Vulnerability Assessment and further appendices.

Local Sea Level Rise Scenarios (p)

The sea-level rise scenarios included in the Vulnerability Assessment include the

2017 NOAA Intermediate-Low (NIL) Sea Level Rise Projection and the 2017 NOAA Intermediate-High (NIH) Sea Level Rise Projection. These scenarios were the required scenarios when this Vulnerability Assessment was initiated prior to July 1, 2024. As of the writing of this document, it should be noted that legislation adopted by the Florida Legislature in 2024[1] would shift these required scenarios to the 2022 NOAA Intermediate Low and Intermediate scenarios. These new scenarios will apply to Vulnerability Assessments initiated after July 1, 2024; and as such, the City should consider this in future updates to this Vulnerability Assessment. It should be noted that for near-term scenarios the NOAA 2022 scenarios align for 2040. But for the 2070 and 2100 scenarios, the NOAA 2017 scenarios are higher and thus more conservative for planning purposes.

The benefit of evaluating a range of conditions is that the City can determine the tolerance for risk for any adaptation strategy decision and act upon data from this analysis that reflects a wider range of conditions. For assets, adaptation projects and policy decisions where there is a higher criticality for that decision, the higher end of the projections and output should be considered. Where there is a lower tolerance for flood impact, the lower end of the projections could be considered. The range provides options needed for more place-based and flood impact decision-making.

Planning horizons (q)

The planning horizons for this assessment coincide with NOAA's forecasting years: 2040, 2070 and 2100. While Section 380.093(3), F.S., only requires the 2040 and 2070 planning scenarios currently, this Vulnerability Assessment also includes the 2100 condition.

Sea level data selection (r)(s)

The City of Pensacola is fortunate to have a NOAA tide gauge (Station ID 8729840) located at its port. Installed in 1923, the tide gauge has supplied data for over a century, providing a rich and highly accurate record of water levels in the City.

Given this, there is no need for interpolation of local sea level data between the two closest NOAA tide gauges, or the selection of the closest NOAA tide gauge with the highest mean sea level. The Pensacola tide gauge data can be used without modification.

[1] Not yet signed by the Governor, as March 31, 2024.

VULNERABILITY ASSESSMENT REPORT

Introduction

This City of Pensacola Vulnerability Assessment (2024) represents the latest in a series of steps taken by the City of Pensacola (City) to build its resilience to the impacts of climate change, most notably sea level rise, precipitation and combined flooding impacts. In addition to serving as an update to, and expansion of, the initial Vulnerability Assessment completed in June 2021, this document also complies with the criteria established by the State of Florida in 2021 for eligibility for resiliency infrastructure grants annually evaluated and ranked for appropriations in the Statewide Flooding and Sea Level Rise Resilience Plan. Those requirements, detailed in subsection 380.093(3), F.S., name the "components, scenarios, data, and information" that must be included for a vulnerability assessment to be considered complete.

Even more importantly, however, this Vulnerability Assessment assists the City of Pensacola in protecting its residents, infrastructure, properties, natural landscapes, and way of life from the threats of sea level rise and extreme flooding.

Pensacola knows that the need for climate adaptation and mitigation planning does not exist in a vacuum, but rather stems from evidence of increasing sea levels and damaging rain and storm events, recognition of serious future risks, and the stark damage flooding is already causing in the region. Faced with these realities, the City and its regional partners are pursuing an aggressive and overarching planning strategy to address underlying climate change threats.

Background

The City's resilience planning process began with the establishment of the Climate Mitigation and Adaptation Task Force (Task Force) in 2017. The report produced by the Task Force continues to provide a general outline of the direction for the City of Pensacola and the region to undertake specific actions to counter the impacts of sea level rise and extreme weather and evidences a historical commitment to proactive planning.

In keeping with the Task Force's goals and objectives to advance adaptation strategies and offset program costs through grant funding, Pensacola applied for and received a Resilience Planning Grant (RPG R2116) from the Florida Department of Environmental Protection (DEP) in 2020 to create the 2021 Vulnerability Assessment and develop draft comprehensive plan amendments to comply with Florida's "Peril of Flood" legislation. In addition to the 2021 Vulnerability Assessment, the Resilience Planning Grant work also included a list of recommendations tailored for the City and public engagement tool known as a "story map."

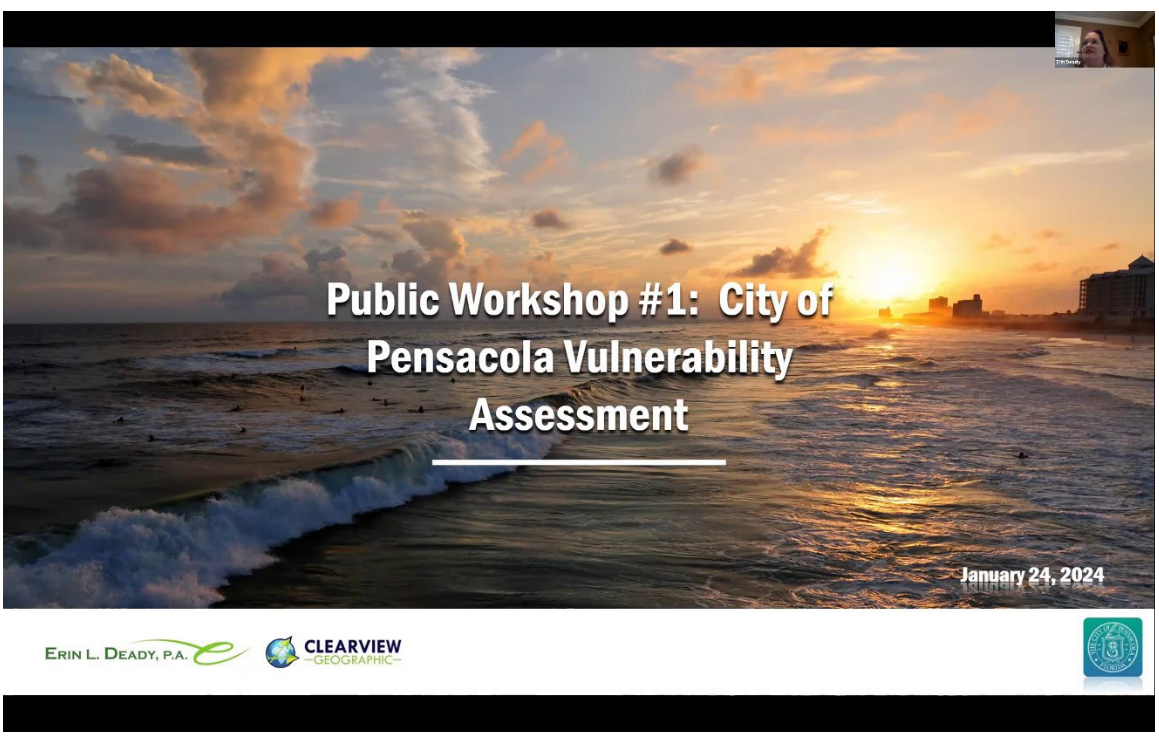
This current Vulnerability Assessment is funded through the Resilient Florida program, established by the Statewide Flooding and Sea Level Rise Resilience Act (SB 1954/HB 7019) approved by the Legislature in April 2021 and Governor DeSantis in May 2021, now Section 380.093, F.S. Among many other provisions, the legislation established the Resilient Florida Grant Program to provide funding to local governments for resilience planning grants and creation of the process to establish the annual Statewide Flooding and Sea Level Rise Resilience Plan appropriating annual funding for resilient infrastructure upgrades. State funding is predicated on local governments identifying assets at risk via vulnerability assessments conducted according to requirements detailed in the legislation and providing prioritized lists of proposed projects to the state. DEP is also charged with creating a statewide vulnerability assessment based on the local assessments.

Public Participation and Engagement

Community resilience is the capacity of governments, individuals, organizations, institutions, and businesses to plan for, respond to, withstand, and bounce back from acute and chronic stressors related to climate change impacts, including sea level rise, flooding, and more intense storms. To successfully build long-term community resilience, stakeholders must be consulted and invited to shape planning processes and decisions about adaptation measures and infrastructure investments. Otherwise, these policies will lack the broad-based public support needed to sustain them over the long term and through political or economic challenges.

To inform this Vulnerability Assessment, the City of Pensacola held a virtual resilience planning meeting in January 2024 and an in-person meeting in February 2024. The former event introduced the project and approach. The latter event focused on critical and regionally-significant assets located in the City and solicited public input regarding the “hot spots” of at-risk assets that the City should prioritize in planning and investment decisions. The VA was also discussed at City Council meetings in January and March 2024, providing additional public participation opportunities.

Figure 8 - Screenshot from January 2024 Public Workshop



The 2021 Vulnerability Assessment included similar municipal and public participation, including internal staff and partner meetings, and a city commission presentation and public meeting held on the same day in May 2021. An online sea level rise “story map” developed as part of the 2021 Vulnerability Assessment continues to provide virtual content to residents, business owners, and other stakeholders, allowing them to easily access interactive maps and images that demonstrate current and future sea level rise impacts. The 2024 Vulnerability Assessment builds upon the results of the 2021 Vulnerability Assessment, expanding on exposure models, asset inventories and other project assumptions.

Resilience Initiatives in Pensacola

2018 Climate Action Recommendations

Pensacola appointed its Climate Mitigation and Adaptation Task Force (Task Force) in 2017. The Task Force was appointed as part of the planning process by the City and its regional partners, including counties and other local governments, in their pursuit to develop an aggressive and overarching climate-planning objective that responds to modern threats. Membership and appointed advisors to the Task Force included stakeholders from environmental groups, Naval Air Station Pensacola, universities, Santa Rosa and Escambia Counties, the Florida Department of Transportation, and the Emerald Coast Utilities Authority.

The mission of the Task Force is articulated in the following three goals and objectives:

1. Advance adaptation and mitigation strategies to enhance the City's and regional resilience and preparedness for withstanding the likely adverse effects of climate change, including flooding resulting from heavy precipitation, rising sea levels, intense hurricanes, heat waves, and other extreme weather events.

2. Promote a program of education, incentives, and public outreach to encourage residents, business owners, governments, and organizations to participate in the Climate Adaptation and Mitigation Plan.

3. Generate suggestions to obtain federal and state grants, investments in energy efficiency and other financial resources to offset program costs. Measures may include initiatives to conserve energy and reduce greenhouse gas (GHG) emissions within government operations and incentives for homeowners, businesses and organizations to save energy, reduce costs and decrease GHG emissions.

The Task Force produced a "blueprint for addressing climate change at the municipal level" with its 2018 report entitled "Climate Action Recommendations." The recommendations are wide-ranging and inclusive of short-, medium-, and long-term goals on a variety of environmental issues. This Project advances many of the recommendations included in the Task Force report related to resiliency: revisions to the City's comprehensive plan, public education, consideration of sea level rise projections and mapping of municipal infrastructure and planning for improvements are some of the many examples of City objectives that are furthered by this Project. Specifically, conducting a Vulnerability Assessment was one of the recommendations from the Task Force report. The 2021 Vulnerability Assessment and this current Vulnerability Assessment carry out that recommendation.

Furthermore, the data gathered for these efforts provides a substantial foundation of information on which the City can base its ongoing resilience planning and action.

Stormwater Improvements

The current City of Pensacola Stormwater Management Plan (SWMP) was finalized in July of 2019. The SWMP analysis and recommendations were based upon an (Interconnected Channel and Pond Routing Model) ICPR4 model of the City stormwater infrastructure which included over 6000 sub-basins, nodes and links. The City of Pensacola is approximately at 96% of build-out, therefore, the ICRP4 modeling completed for the SWMP did not include evaluation of “future” conditions.

As indicated in the SWMP report, future development within the City of Pensacola will largely be in the form of redevelopment of existing sites. Given that the City of Pensacola stormwater management requirements have only become more stringent over time, any redevelopment of existing sites should act to reduce stormwater flow rates from the sites and result in improvements to downstream stormwater system performance. Considering these previous findings, planned stormwater modelling efforts for an updated stormwater modeling effort as part of a Florida Department of Emergency Management (FDEM)-funded effort to create the City of Pensacola Watershed Management Plan which includes:

1. Update of the ICPR4 model to the current version of the software, now branded as StormWise.

2. Review and update of the previous ICPR4 model to include improvements/modifications to City of Pensacola stormwater systems which have been made since completion of the model.

3. Review and update of previous elevation assumptions based upon area specific elevation data collection and/or latest available LIDAR topographic data.

4. Simulation of 10, 25 or 50, and 100-Year design storm events each with 1, 2, 4, 8 and 24-hr durations for existing conditions.

5. Simulation of the same design storm events for existing conditions considering sea level rise for NOAA intermediate 2100 sea-level rise and two other sea-level rise scenarios up to 2100.

6. Development of a limited number of recommended capital improvement projects to alleviate predicted flooding to levels consistent with adopted City of Pensacola levels of service.

Pensacola is also already investing in modernizing its stormwater infrastructure to improve water quality, system efficiency, and flood prevention. Several examples of those investments are described here. The City is currently working to remove an estimated 15.3 tons of pollutant solids annually to prevent environmentally-harmful discharges into Bayou Texar. The City of Pensacola's Public Works and Facilities Department recently completed the following projects as part of the City's ongoing efforts to improve local water quality:

- East Cross, Yates, Escambia, and Osceola Outfalls at Bayou Texar Stormwater Treatment Enhancement Project - an estimated 6.1 tons of pollutants to be removed annually.

- Scott, Yates, Lakeview and Strong Outfalls to Bayou Texar Stormwater Treatment Enhancement Project - Estimated 5.8 tons of pollutants to be removed annually.

- Bayou Boulevard, Perry, Blount and Avery Outfalls at Bayou Texar Stormwater Treatment Enhancement Project - an estimated 3.4 tons of pollutants to be removed annually.

These projects provide treatment for several stormwater basins that previously discharged into Bayou Texar with no form of treatment. All stormwater treatment units installed through these projects collect stormwater runoff and trap sediment, trash, oils, greases, and other pollutants inside and allow cleaner water to be discharged into Bayou Texar and Pensacola Bay. In addition to providing stormwater treatment, previous issues with standing water along the shoulder of Bayou Boulevard were addressed through the Bayou Boulevard, Perry, Blount, and Avery Outfalls at Bayou Texar Stormwater Treatment Enhancement Project, making the roadway safer for both motorists and cyclists.

The City of Pensacola's Public Works and Facilities Department recently completed an additional three stormwater infrastructure projects to rehabilitate and repair existing, aging pipes:

- B Street and Gimble Street Stormwater Rehabilitation

- Spring Street Stormwater Infrastructure Improvement

- 9th Avenue Manhole Rehabilitation

The B Street and Gimble Street project included rehabilitating a large 54-inch metal stormwater pipe that runs from B Street and Gimble Street beneath the Joe Patti’s Seafood business parking lot and discharges into the A Street ditch. The Spring Street Stormwater Infrastructure Improvement Project repaired and rehabilitated an existing 36-inch pipe and two connecting stormwater manholes located at the intersections of Spring Street and Wright Street as well as Spring Street and Gregory

Street. The 9th Avenue Manhole Rehabilitation Project repaired and rehabilitated two stormwater manholes located near the intersection of 9th Avenue and Colfax Street. All three projects replaced stormwater assets that were several decades old and in significant disrepair. The completion of these projects is part of the City's ongoing stormwater infrastructure improvement and water quality improvement program.

FEMA Community Rating System

Since its creation in 1968, the National Flood Insurance Program (NFIP) has provided federally-backed flood insurance in communities that enact and enforce floodplain regulations. By requiring communities to plan for and protect against a 1%-average-annual-chance flood event (also known as a 100-year flood event), the NFIP encourages the regulation of development in flood areas.

The Federal Emergency Management Agency (FEMA) oversees the NFIP and administers its Community Rating System, a voluntary program that offers NFIP insurance rate reductions for property owners in communities that exceed the minimum NFIP participation requirements through certain additional floodplain management and conservation activities. Local governments are classified according to their total CRS scores. With 1,715 points, the City of Pensacola is currently ranked Class 7 in the program. The City of Pensacola entered the NFIP in 1977 and the CRS in 2002. Upon its 2002 entrance into the CRS, the City earned a Class 8 rating, winning a 10% discount on NFIP insurance premiums. Over the past two decades, the City made additional progress on its flood preparedness, rising to Class 7 status, which provides a 15% discount on NFIP insurance policies. Table 2 below shows CRS participation in Florida and the percentage reduction in flood insurance rates associated with each rating class.

Table 2 - CRS Participation in Florida

CRS Class	Number of Florida Communities	NFIP Discount
9	17	5%
8	40	10%
7	53	15%
6	72	20%
5	58	25%
4	1	30%
3	4	35%

Discounted flood insurance provides a powerful incentive for communities to take steps that will reduce flood damage to existing buildings and manage development in certain unmapped areas, encouraging the restoration and preservation of the natural functions of floodplains.

CRS provides both incentives and tools to further the goals of providing flood insurance to property owners, reducing flood loss, and saving taxpayers' money. With the City participating in the program, property owners can receive discounted flood insurance premium rates; with effective floodplain management, the community becomes more resilient.

These rate reductions are due, in part, to the City's initiatives that help to implement three basic CRS goals:

1. Reduce flood damage to insurable property. The CRS program encourages communities to reduce the exposure of existing buildings (and their contents) to flood damage, especially properties that have flooded multiple times. Standards exceeding the minimum criteria of the NFIP may be needed to protect buildings and contents from flood hazards. The CRS encourages communities to map and provide data on their flood hazards and employ such data in their regulatory programs.

2. Strengthen and support the insurance aspects of the NFIP. Communities are awarded CRS points for activities that support accurate risk rating of flood insurance premiums, through mapping and information programs that help assess individual property risk and reduce repetitive flood losses. Local governments can receive additional points for informing residents of their flood risk and inducing them to purchase and maintain flood insurance policies.

3. Encourage a comprehensive approach to floodplain management. The CRS program encourages communities to use all available tools to implement comprehensive local floodplain management programs, which can address concerns beyond the protection of insurable property. The CRS program recognizes local efforts that protect lives; advance public health, safety, and welfare; minimize damage and disruption to infrastructure and critical facilities; preserve and restore the natural functions and resources of floodplains and coastal areas; and ensure that new development does not shift adverse impacts to other parts of the watershed or other properties. Understanding the physical and biological processes that form and alter floodplains and watersheds allows communities to appropriately address flooding, erosion, habitat loss, water quality, and special flood-related hazards. The "comprehensive approach" envisioned by the CRS program includes planning, public information, regulations, financial support, open space protection, public works activities, emergency management, and other appropriate techniques.

CRS Requirements and Creditable Activities

In recognition of the fact that "floodplains and watersheds change over time" due to "many natural and manmade changes," the CRS Manual introduced a series of credit options for "community efforts to anticipate" future flood risk in relation to climate change. Because sea level rise is expected to be an increasingly critical issue for floodplain management, many of the credit options and assessment criteria for coastal communities specifically refer to studies of sea level rise impacts on future hydrologic conditions and local drainage systems.

These options are summarized in section 116.c of the CRS Manual as:

1. Credit is provided in Section 322.c for communities that provide information about areas (not mapped on the Flood Insurance Rate Map (FIRM) that are predicted to be susceptible to flooding in the future because of climate change or sea level rise.

2. To achieve CRS Class 1, a community must receive credit for using regulatory flood elevations in the V and coastal A Zones that reflect future conditions, including sea level rise.

3. Credit is provided in Section 342.d when prospective buyers of a property are advised of the potential for flooding due to climate changes and/or sea level rise.

4. Credit is provided in Section 412.d when the community's regulatory map is based on future-conditions hydrology, including sea level rise.

5. Credit is provided in Section 432.k when a community accounts for sea level rise in managing its coastal A Zones.

6. Credit is provided in Section 452.b for a coastal community whose watershed master plan addresses the impact of sea level rise.

7. Credit is provided in Section 512.a, Steps 4 and 5, for flood hazard assessment and problem analyses that address areas likely to flood and flood problems that are likely to get worse in the future, including (1) changes in floodplain development and demographics, (2) development in the watershed, and (3) climate change or sea level rise.

There are 19 creditable CRS activities organized under four categories as reflected in Table 3. Each of the 19 activities has one or more elements. The CRS Manual assigns credit points based on the extent to which each activity advances the goals of the CRS, which are 1) to reduce and avoid flood damage to insurable property, 2) to strengthen and support the insurance aspects of the NFIP, and 3) to foster comprehensive floodplain management. As of its 2020 CRS submittal, the City participated in 10 activities within 3 of the 4 categories, meeting 24 elements.

From its current 1,715 points, reaching Class 6 would require earning an additional 285 points (2,000 points total). Class 5 would require an additional 785 points (2,500 points total). CRS Class 6 or Class 5 status would win an additional 5% or 10% premium discount, respectively, for qualified NFIP policyholders within the Special Flood Hazard Area.

Pensacola's current Class 7 rating was achieved under the guidelines of the 2017 CRS Coordinator's Manual that was in effect when the City was evaluated in 2020. In January 2021, FEMA released an Addendum to the 2017 CRS Coordinator's Manual, which set forth new prerequisites for participation in the CRS program. The City of Pensacola is due for a CRS Cycle Verification in 2025, at which time the City's activities will be reevaluated under the most current CRS program rules.

Table 3 - Pensacola CRS Activities

CRS Activity Number	CRS Activity	Points Earned by Pensacola in Activity
310	Elevation Certificates	Yes
320	Map Information	Yes
330	Outreach Projects	Yes
340	Hazard Disclosure	No
350	Flood Protection Information	Yes
360	Flood Protection Assistance	Yes
370	Flood Insurance Promotion	No
410	Flood Hazard Mapping	No
420	Open Space Preservation	Yes
430	Higher Regulatory Standards	Yes
440	Flood Data Maintenance	Yes
450	Stormwater Management	Yes
510	Floodplain Management Planning	Yes
520	Acquisition and Relocation	No
530	Flood Protection	No
540	Drainage System Maintenance	No
610	Flood Warning and Response	No
620	Levee Safety	No
630	Dam Safety	No

Good floodplain management acknowledges and thinks about how floodplains might look over time. This includes many factors such as rising sea levels. The CRS Manual incorporates acknowledgement of—and credit for—community efforts to anticipate future flood risk and climate resilience and to take actions to mitigate adverse impacts. The City of Pensacola will be well situated to earn CRS points related to sea level rise, not only by completing this Vulnerability Assessment, but also undertaking other efforts, such as the City's current work on its FDEM-funded Watershed Management Plan.

Current Context of Vulnerability

Climate Change and Sea Level Rise

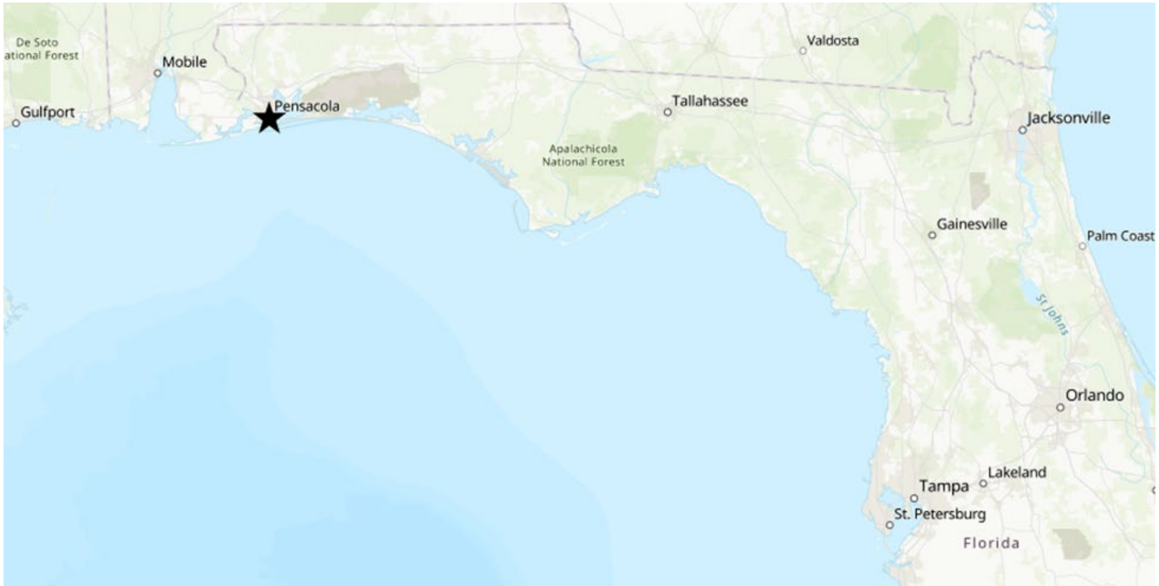
Globally, climate change presents a monumental challenge, characterized by rising temperatures, shifting weather patterns, and increased frequency of extreme weather events. In the context of Pensacola, these global trends manifest in specific regional impacts that directly affect the city's environmental and socioeconomic fabric. Pensacola faces unique challenges due to its geographical location, with climate change exacerbating existing environmental vulnerabilities. The assessment specifically focuses on understanding these local implications, including how shifts in climate patterns are influencing the city's natural ecosystems, urban infrastructure, and socio-economic dynamics.

In the case of Pensacola, Florida, climate change presents a multifaceted set of challenges that demand careful examination and proactive response. Characterized by rising global temperatures, altered weather patterns, and a heightened frequency of extreme events, these changes have direct and indirect effects on Pensacola, impacting various aspects of the region's environment, economy, and society.

One notable consequence is the increase in sea levels, which is primarily driven by the thermal expansion of seawater and the melting of polar ice caps and glaciers. As sea levels continue to rise, Pensacola's coastal areas face escalating risks, including coastal erosion, more frequent and severe flooding, and compromised infrastructure. These impacts are compounded by the city's low-lying topography and its reliance on a robust coastal economy, making it particularly vulnerable to sea-level rise.

Sea-level rise is a critical concern for coastal cities like Pensacola, posing significant risks to its infrastructure, ecosystems, and communities. Pensacola's geographical location along the Gulf of Mexico makes it susceptible to the effects of sea-level rise. The city's coastline, characterized by its shorelines and vital economic assets, is under threat as sea levels encroach further inland. Coastal erosion and compromising drainage system operations are two consequences of these impacts likely to increase in the future.

Figure 9 - Regional Context of Pensacola



Furthermore, the increased frequency and intensity of storms, including hurricanes and tropical cyclones, pose a substantial risk to Pensacola's coastal areas. Rising sea levels exacerbate the storm surge effect, magnifying the potential for devastating inundation during these events.

Additionally, the economic vitality of Pensacola, with its reliance on tourism, fisheries, and maritime industries, is intricately linked to its coastal assets. As sea levels rise and coastal vulnerabilities grow, these sectors face increasing uncertainty and disruption.

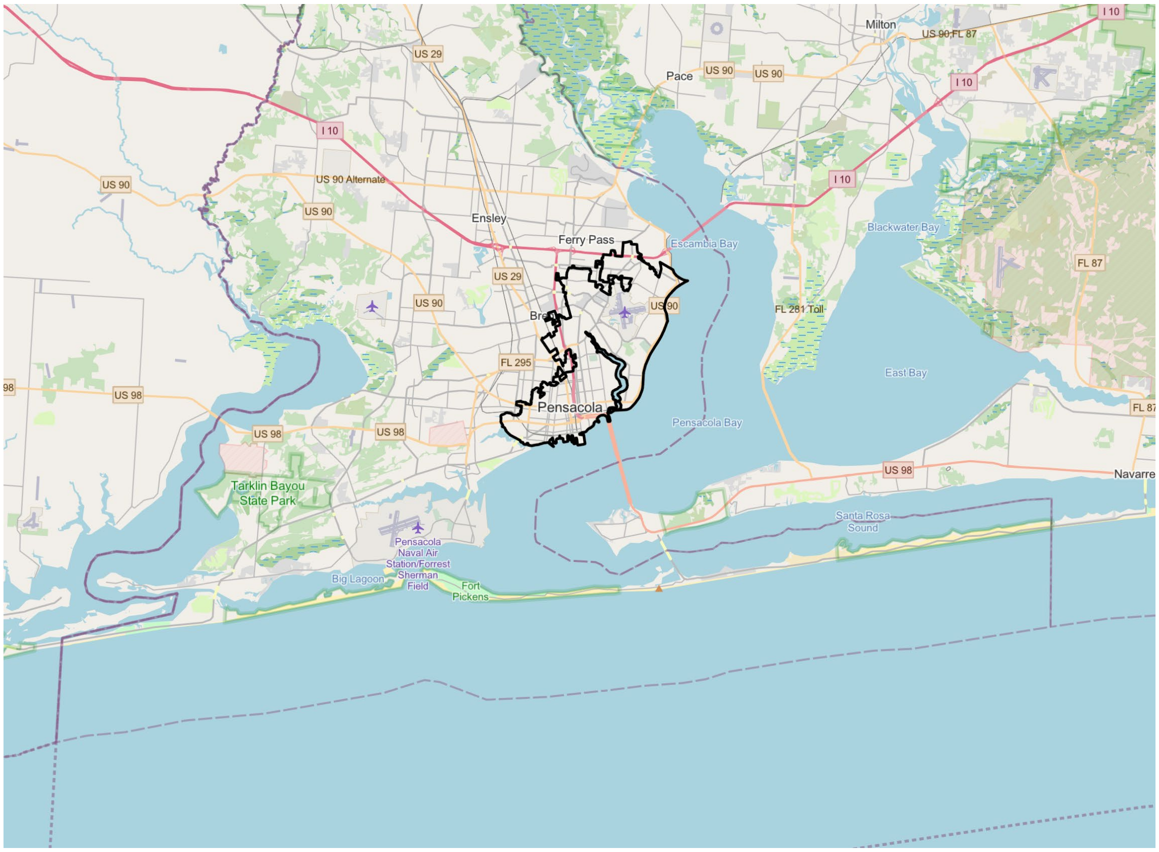
Physical Descriptors of Area

Geographical Setting and Characteristics

Pensacola's geographical characteristics render it particularly susceptible to climate change impacts. These characteristics include:

Coastal Location: Pensacola's location along the Gulf of Mexico makes it highly susceptible to a range of coastal hazards. This includes the threat of sea-level rise, which can lead to temporary or permanent inundation of coastal areas, and storm surges from tropical storms and hurricanes. Additionally, by increasing the base water level, sea level rise elevates the risk of flooding during daily and seasonal high tides.

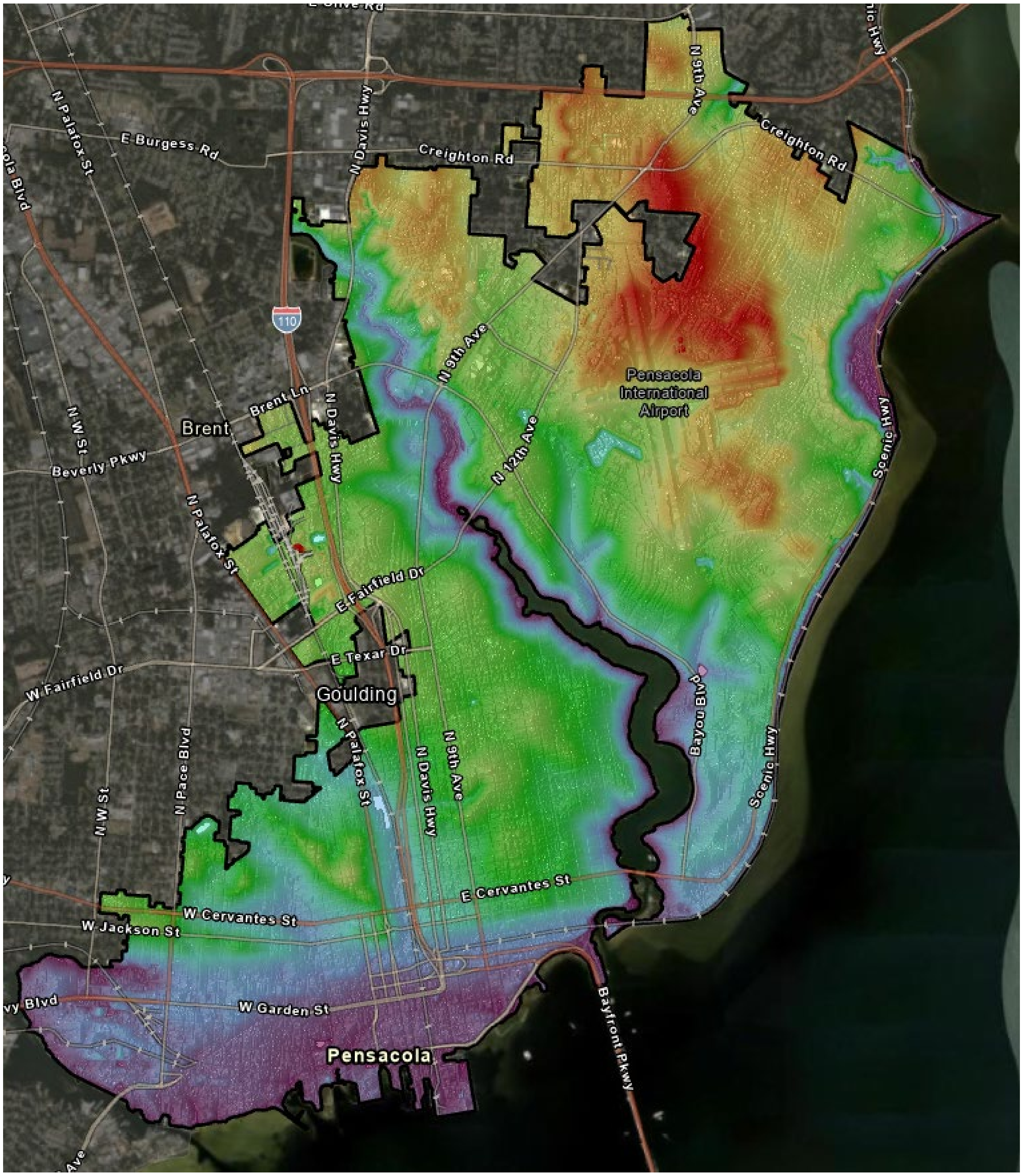
Figure 10 - Vicinity Map of Pensacola



Elevation and Topography: While some parts of the city feature relatively flat terrain, others exhibit slightly elevated landscapes. These topographical differences greatly influence flood risk and drainage patterns. Low-lying areas with minimal elevation are at greater risk of flooding, while elevated regions may experience comparatively lower flood risk. Within the city's boundaries, low-lying areas are predominantly situated along the coastline and adjacent to water bodies such as rivers and estuaries. Due to their lower elevation, these regions face a heightened risk of inundation during extreme weather events.

Figure 11 - Elevation

Lower elevations in purple, higher elevations in red



Demographic Overview

Understanding the demographic characteristics of Pensacola is crucial for evaluating the city population's vulnerability in the face of climate change. This comprehensive analysis provides insights into the population dynamics, growth trends, socioeconomic factors, and the application of tools like the Social Vulnerability Index and the Location Affordability Index, offering a multifaceted understanding of the challenges and potential solutions for climate resilience.

Population Dynamics and Distribution

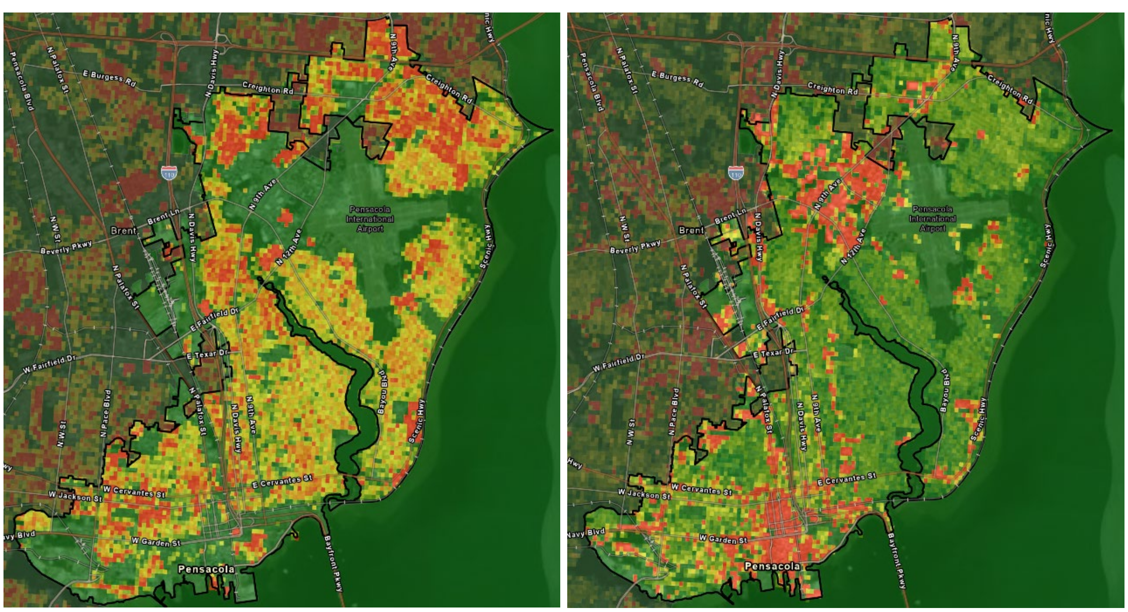
Pensacola's diverse population spans urban and suburban areas, with distribution patterns critical for assessing flood related impacts. The concentration of populations in different areas varies between day and night, influencing the risk exposure during flood-related events. During the day, the urban core experiences high population densities as people converge on workplaces, schools, and commercial areas. At night, the population disperses into residential neighborhoods, where concentrations are lower. These patterns are depicted in Figure 12, using color coding (red for high concentration, yellow for medium, and green for low) to indicate population density at different times of the day.

- **Daytime Activities:** Include bustling traffic, busy workplaces, shopping, and dining, with an influx of people from the suburbs.

- **Nighttime Quietude:** Characterized by reduced traffic, closed businesses, and a population retreating to suburban homes.

Figure 12 - Daytime (L) and Nighttime (R) Population Concentration

Red indicates high concentration, yellow medium, and green low



These insights underscore the importance of considering the dynamic nature of population distribution in climate vulnerability assessments. Where populations migrate throughout the day and night shows a reliance on assets and infrastructure that could be subject to more flooding impact.

Population Growth Trends

Examining Pensacola's population growth trends is vital for understanding future vulnerability. Despite a relatively stable population of approximately 55,000, a slight growth rate of 0.11% by 2028 suggests a mature community with limited expansion potential. This information, drawn from the American Community Survey (ACS) and the U.S. Census Bureau, indicates a need for targeted infrastructure development and resilience planning to accommodate the current and slowly increasing population. Appendix H contains demographic information extracted from the American Community Survey and US Census Bureau.

Figure 13 - Pensacola Population Trends, 2020-2023

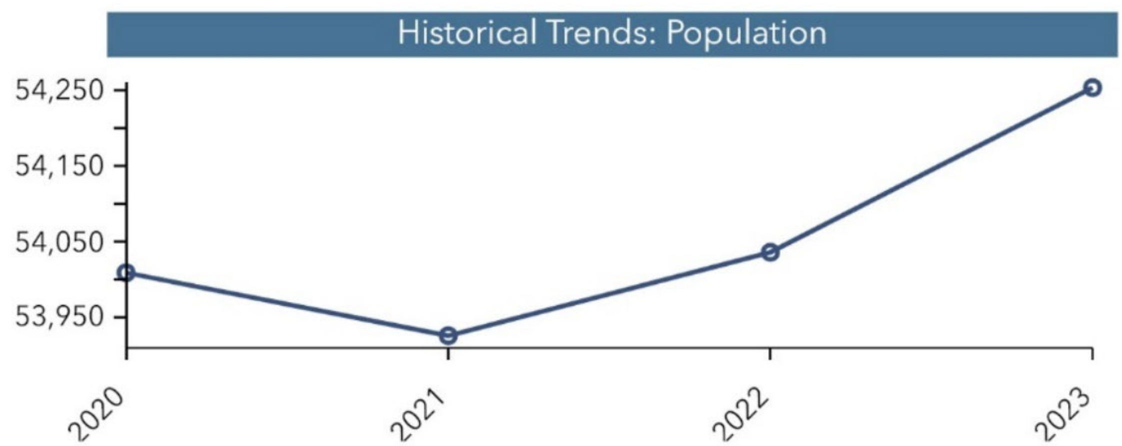


Figure 14 - Population and Growth Rate Infographic

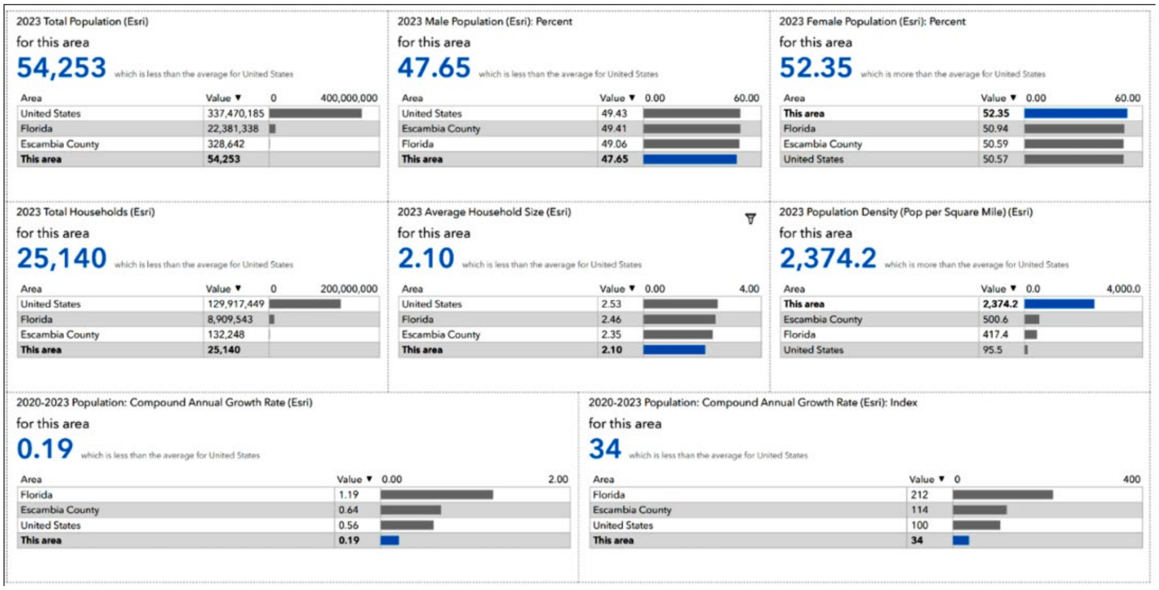
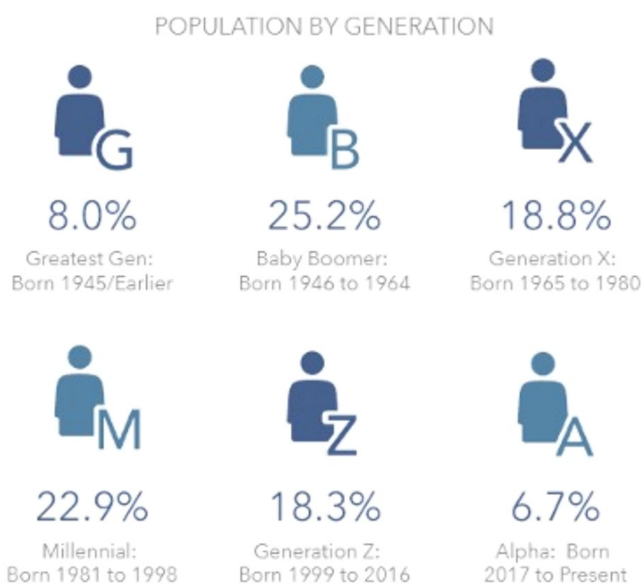


Figure 15 - Percent of Population By Generation

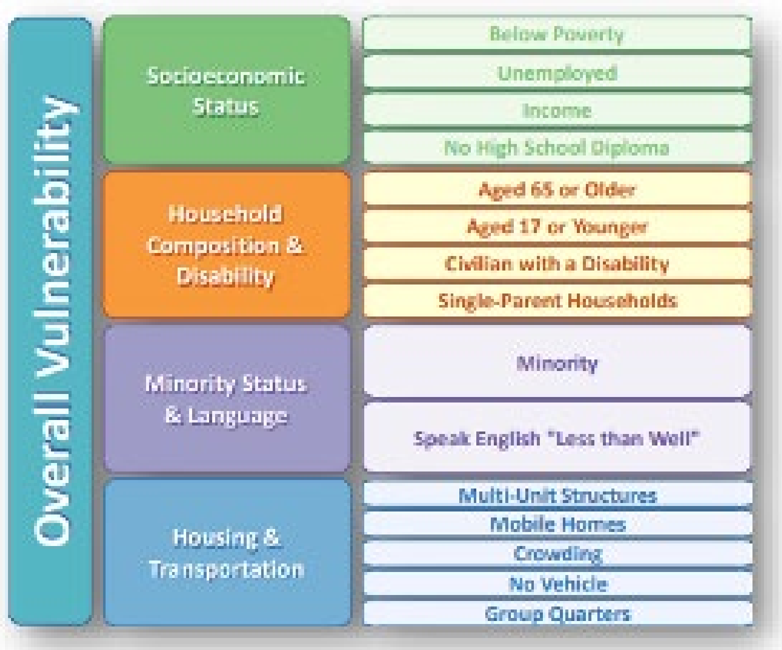


Socioeconomic Vulnerability

Socioeconomic disparities significantly influence community resilience to flood risk. Vulnerable populations may face disproportionate impacts from flooding and climate change due to limited resources and resilience. It is essential to identify and address socioeconomic disparities to ensure an equitable response to climate-related and increased flood-risk related challenges.

Socioeconomic disparities play a crucial role in determining a community's resilience to climate change. Vulnerable populations, identified through the most recent Centers for Disease Control and Prevention (CDC) Social Vulnerability Index (SVI), are at increased risk due to factors such as poverty, lack of vehicle access, and crowded housing conditions. The SVI provides a comprehensive assessment across four key themes—socioeconomic status, minority status and language, housing composition and disability, and housing and transportation—offering valuable insights for emergency preparedness, supply estimation, shelter identification, and evacuation planning in the face of sea-level rise and potential flooding scenarios. See Figure 16. The latest SVI data highlights Pensacola's at-risk communities, emphasizing the need for targeted support and intervention.

Figure 16 - Components of Social Vulnerability Index



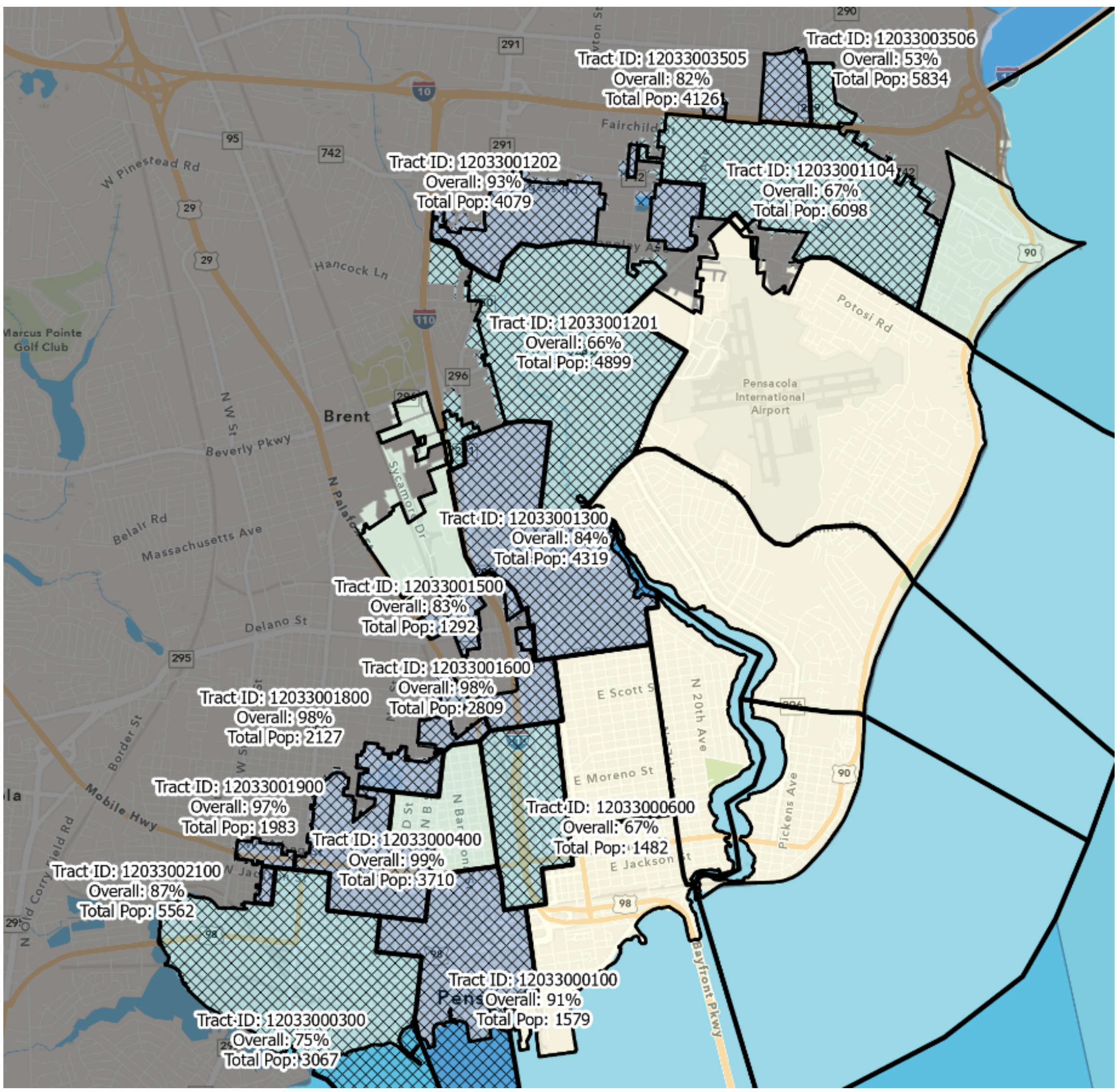
The SVI was utilized to identify vulnerable populations and serve as a framework to discuss population characteristics that are exacerbated by flooding under future flooding conditions.

The CDC's SVI database and mapping tools can assist with emergency preparedness in several ways. It can be used to estimate the amount of necessary supplies, such as food, water, medicine, and bedding, as well as how many emergency personnel are needed to assist at specific sites. The tool can also identify areas in need of emergency shelters and generically, in the preparation of evacuation plans, accounting for those with special needs, and highlighting those communities that may need continued support to recover from a natural disaster.

As reflected in Figure 17, the analysis of the City's social vulnerability using the 2020 CDC's SVI utilizes U.S. Census data to analyze the social vulnerability of every census tract. Each census tract is ranked on 15 social factors, including poverty, lack of vehicle access, and crowded housing, and groups them info four related themes to create an average score between 0% - 100%.

Figure 17 - CDC Social Vulnerability Index Map

Most vulnerable populations highlighted w/hatching and labeling (<50% overall percentile ranking)



The U.S. Department and of Housing and Urban Development (HUD) with the help of the Department of Transportation launched the Location Affordability Index (LAI) which identifies areas based on cost estimates of housing and transportation for eight different household profiles (see Table 4). Furthermore, the LAI presents advanced insights into housing and transportation costs, which are critical for flood risk planning and enhancing climate resilience. By leveraging simultaneous equation modeling and an extensive dataset, the LAI accurately estimates costs for a variety of household profiles. This includes considerations of auto ownership, housing expenses, and transit usage, providing a nuanced understanding of affordability challenges faced by residents.

Table 4 - Location Affordability Index Household Income Profiles

Household Profile	Median Household Income for a Given Area (MHHI)
1. Median-Income Family	MHHI
2. Very Low-Income Individual	National Poverty Line
3. Working Individual	50% of MHHI
4. Single Professional	135% of MHHI
5. Retired Couple	80% of MHHI
6. Single-Parent Family	50% of MHHI
7. Moderate-Income Family	80% of MHHI
8. Dual-Professional Family	150% of MHHI

The term "Working Individual - 50% of MHHI" and others like it refer to metrics used to describe the income level of a working individual in relation to the Median Household Income (MHHI) of a given area. Here is a breakdown of what this means and its significance:

- MHHI (Median Household Income): This is the median income of all households in a specific area. The median is the middle value when you line up all the households by income, meaning half the households earn more than the MHHI and half earn less. It is a commonly used measure to understand the average income level of an area.

- 50% of MHHI: When an individual's income is described as "50% of MHHI," it means their income is half the median household income for their area. This is a relative measure indicating the individual's earnings compared to the average household in the community.

These metrics have significance in the context of flooding and vulnerability assessments:

- Economic Vulnerability: Individuals earning a low percentage of the MHHI may have less financial flexibility to recover from flood damage or to invest in preventative measures such as insurance or home improvements that reduce flood risk.

- Resource Allocation: Understanding the income levels of affected individuals or households in relation to the MHHI helps in tailoring flood resilience and recovery programs. It highlights populations that may need more support in terms of subsidies, grants, or other assistance.

- Planning and Preparedness: Identifying areas where a significant portion of the population earns a lower percentage of MHHI can inform emergency management agencies and local governments about potential needs for evacuation assistance, shelters, and other support services during and after a flooding event.

The incorporation of income levels as a percentage of MHHI in vulnerability assessments helps to paint a more detailed picture of risk and resilience within a community. It underscores the interconnectedness of socioeconomic status and disaster vulnerability, emphasizing the need for targeted approaches in resilience planning and support. The LAI scores across Pensacola identify areas of varying affordability and detail the distribution of owner-occupied versus renter-occupied housing (see Figure 18 below), illustrating the intersections of affordability, vulnerability, and climate risk. Higher renter areas are generally associated with more social vulnerability or where certain populations may be exponentially impacted by flooding. This comprehensive approach informs strategic planning and interventions, aiming to mitigate the impacts of climate change on the most vulnerable segments of the population. These enhancements, along with a broader dataset, make the LAI a robust tool for understanding and planning around housing and transportation affordability, potentially aiding in flood risk planning by highlighting areas where affordability and risk intersect.

In the context of flood risk, the correlation between higher rates of renters in a community and increased social vulnerability takes on an even more critical dimension. Renters often reside in areas more susceptible to flooding, either due to the lower cost of housing in such locations or due to limited availability of affordable options in safer areas. This situation places them at a disproportionate risk during flood events, not only in terms of immediate physical danger but also regarding the longer-term repercussions on their stability and well-being.

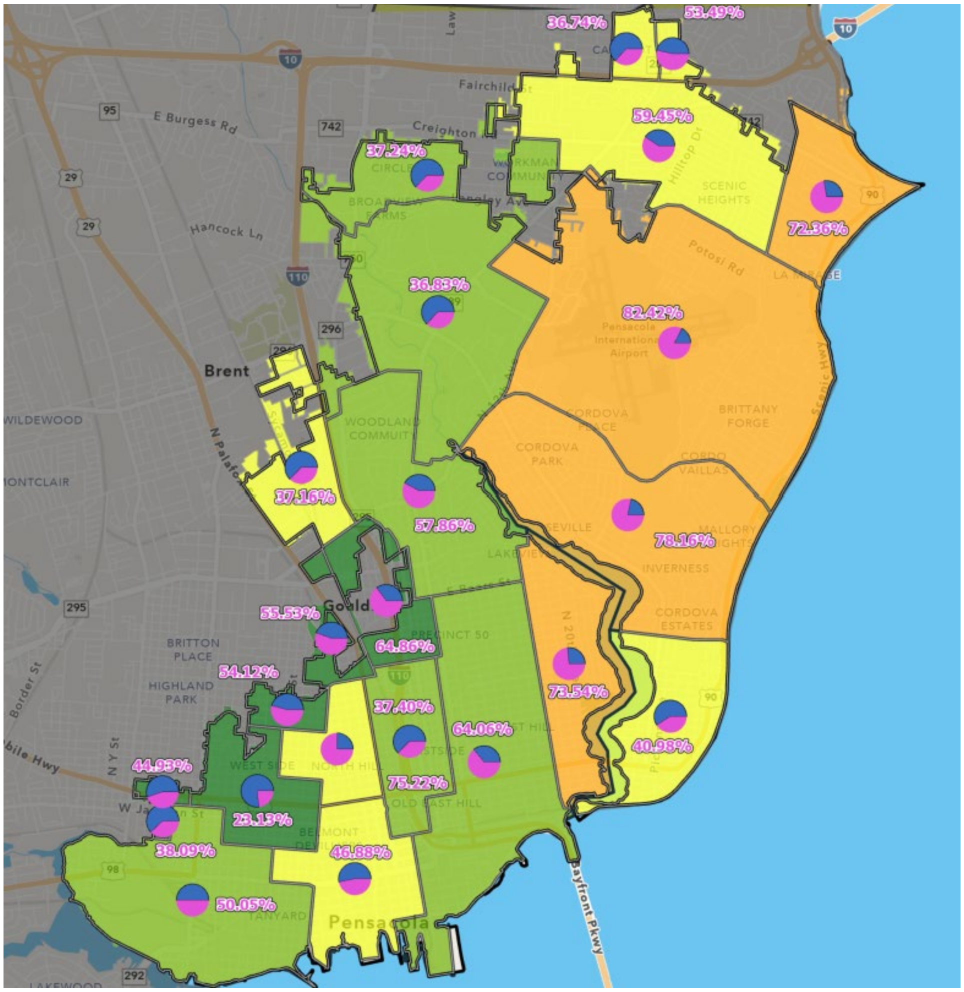
The transient nature of rental housing means that renters may have less knowledge about local flood risks and less incentive to invest in long-term flood preparedness measures. Furthermore, the financial instability associated with renting can exacerbate the challenges of recovering from flood damage. Renters may lack the insurance coverage, savings, or resources to quickly rebound from the loss of property or displacement caused by flooding. This can lead to significant disruptions in their lives, including the loss of employment, educational discontinuity, and mental health stresses.

Moreover, the areas with high concentrations of rental properties may receive less attention in terms of flood mitigation infrastructure and services. Investment in flood defenses, such as levees, floodwalls, and green infrastructure, is often prioritized in areas with higher property values and stronger political influence, which can leave renter-dominated neighborhoods more exposed and vulnerable.

Given these dynamics, addressing the flood risk in communities with a high proportion of renters requires targeted policies and interventions. This includes not only enhancing the physical infrastructure to withstand flooding but also improving the resilience of the rental population through education on flood risks, access to affordable flood insurance, and the establishment of support systems for post-disaster recovery. Policies aimed at ensuring the availability of affordable, flood-resilient housing in safer areas are also crucial. Such comprehensive approaches can help mitigate the impact of floods on socially vulnerable populations, thereby reducing the overall risk and enhancing community resilience against climate change and natural disasters.

Figure 18 - HUD LAI Scores across Pensacola

More affordable areas are green, less affordable are orange. Pie chart overlays represent the ratio of total owner-occupied housing in blue and renter occupied housing in purple.



<u>Key Infrastructure and Assets</u>

Pensacola's critical infrastructure and assets are the backbone of the city's functionality and are integral to the vulnerability assessment. They are also required components of the analysis pursuant to statute divided out into four major "asset classes."

- Transportation assets and evacuation routes:

- Critical infrastructure:

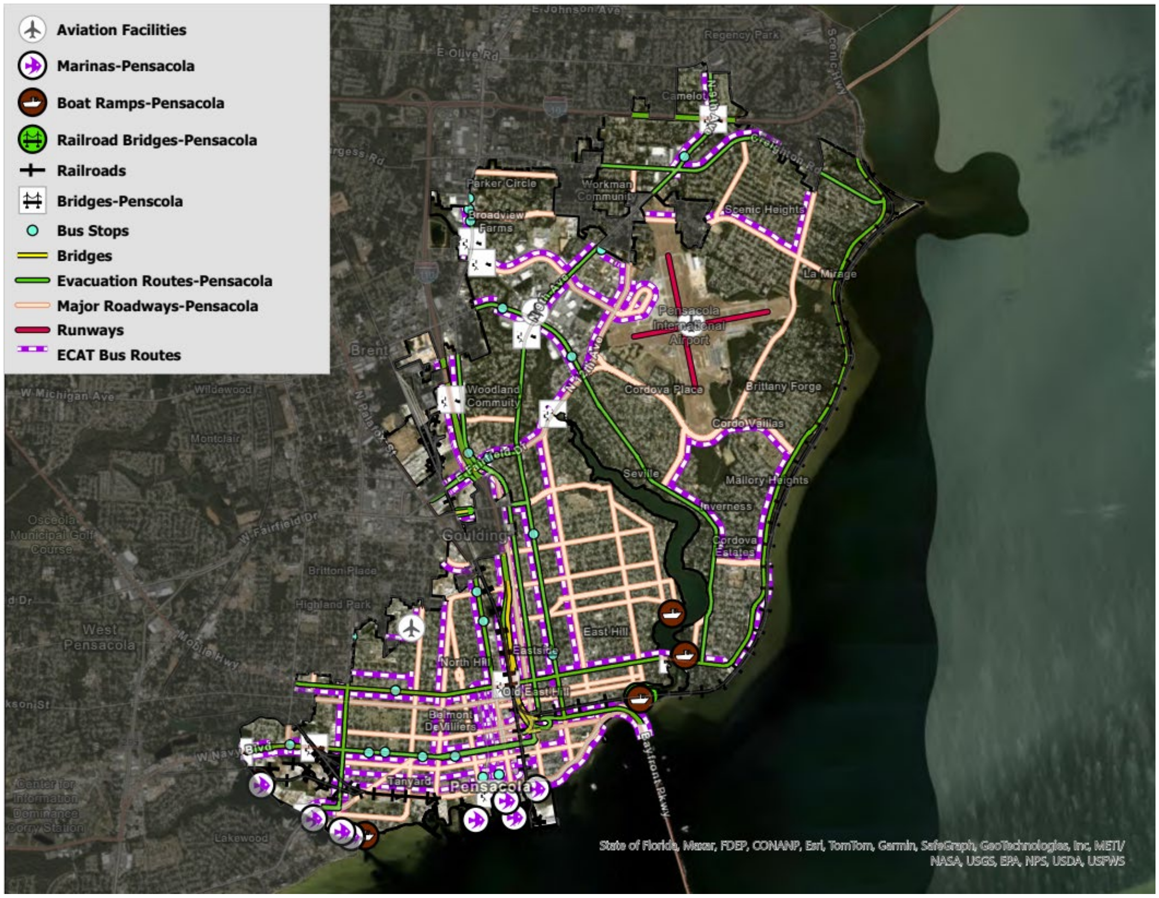
- Critical community and emergency facilities:

- Natural, cultural, and historical resources:

These assets encompass a wide range of essential components:

Transportation Infrastructure: Pensacola includes a network of vital transportation assets, including bridges, airports, and major roadways. These arteries of connectivity are not only essential for daily life but also play a critical role in emergency response and evacuation during climate-related events. These include 83 major roadways, including interstates, US highways, state roads and evacuation routes. Pensacola International Airport and two emergency helipads make up the City's air transport infrastructure, with the Port of Pensacola, yacht clubs, and marinas comprising the marine facilities.

Figure 19 - Map of Transportation Infrastructure



Critical Infrastructure: The city relies on a robust network of utilities that includes stormwater components, wastewater treatment facilities, water supply systems, and electrical infrastructure. These utilities are indispensable for maintaining essential services, and their vulnerability to climate-related disruptions can have cascading effects on the community. Some are owned by the City and some are regionally owned. These assets are included in Figures 20-23.

Figure 20 - Map of Stormwater Infrastructure

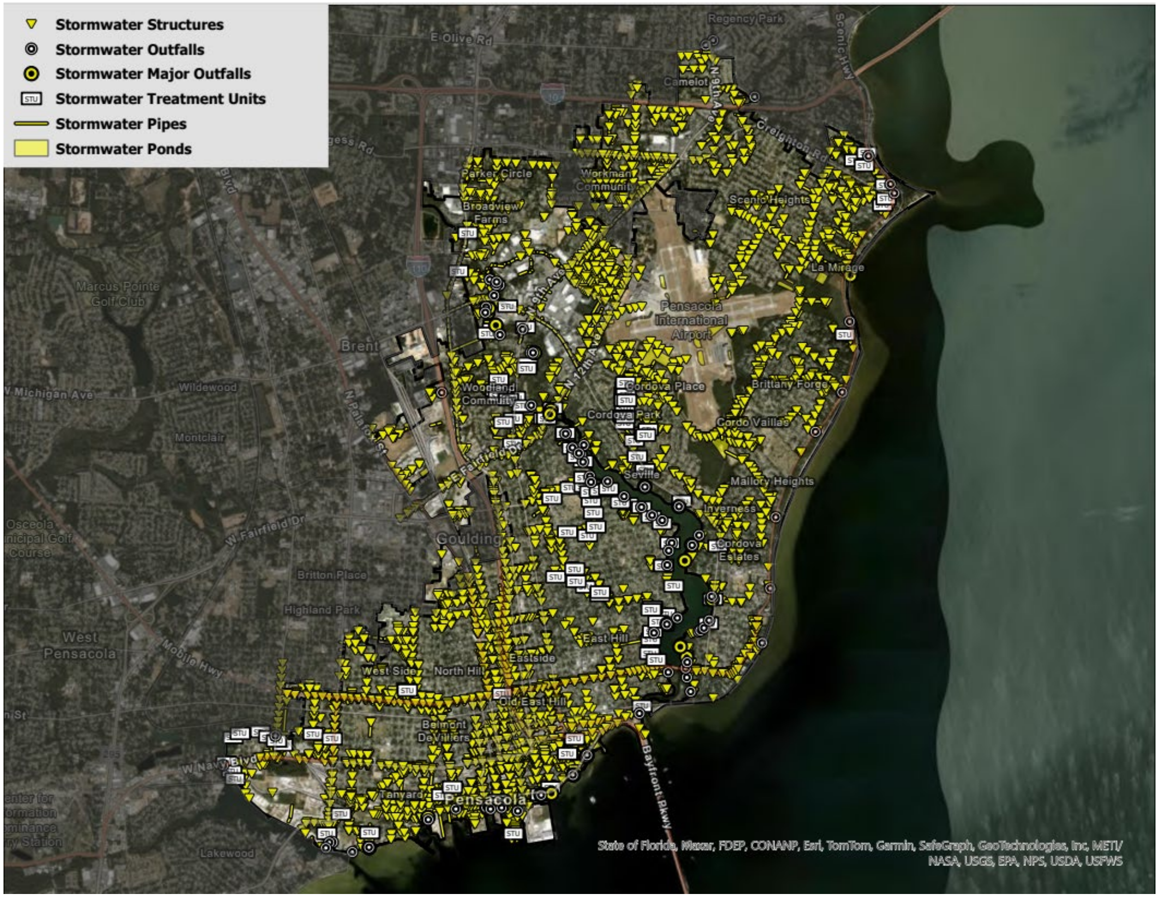


Figure 21 - Map of Sanitary Sewer Infrastructure

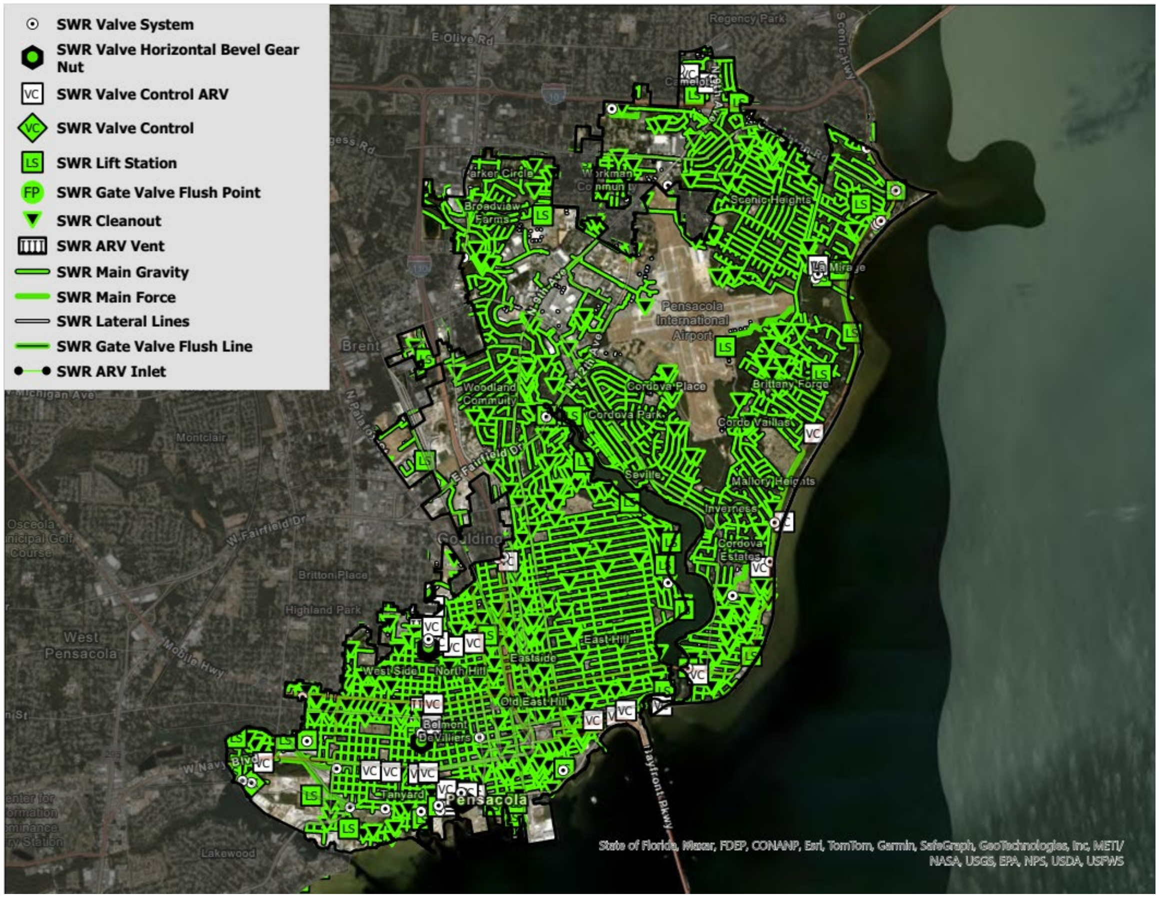


Figure 22 - Map of Potable Water Infrastructure

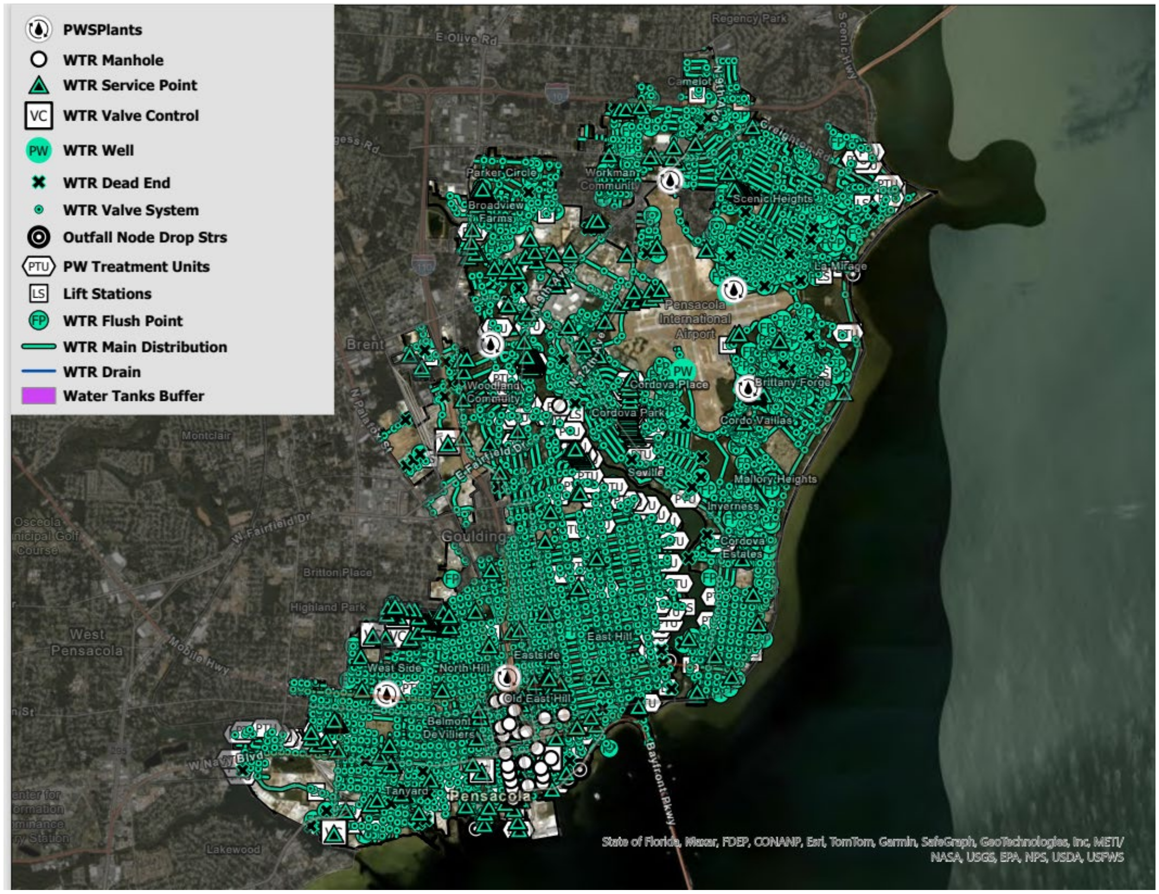
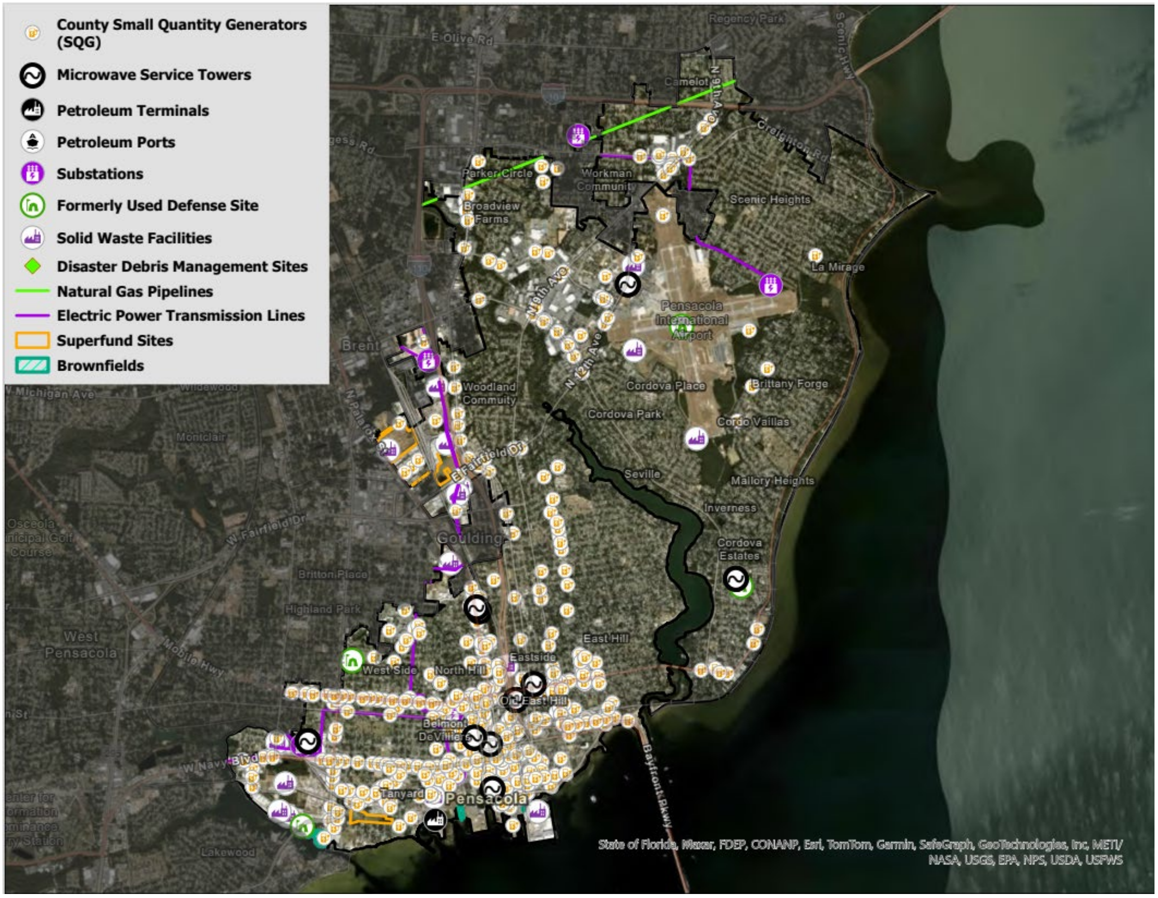
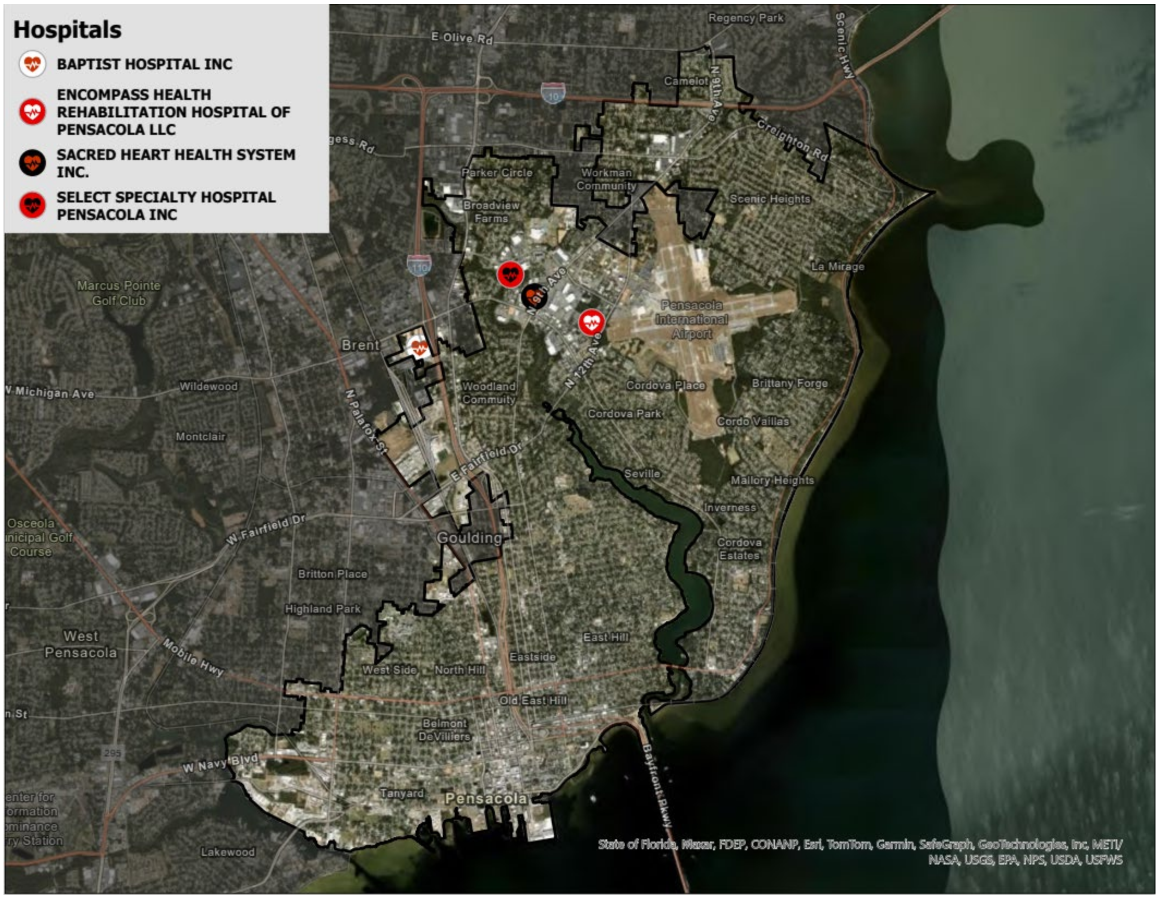


Figure 23 - Map of Other Critical Infrastructure Assets



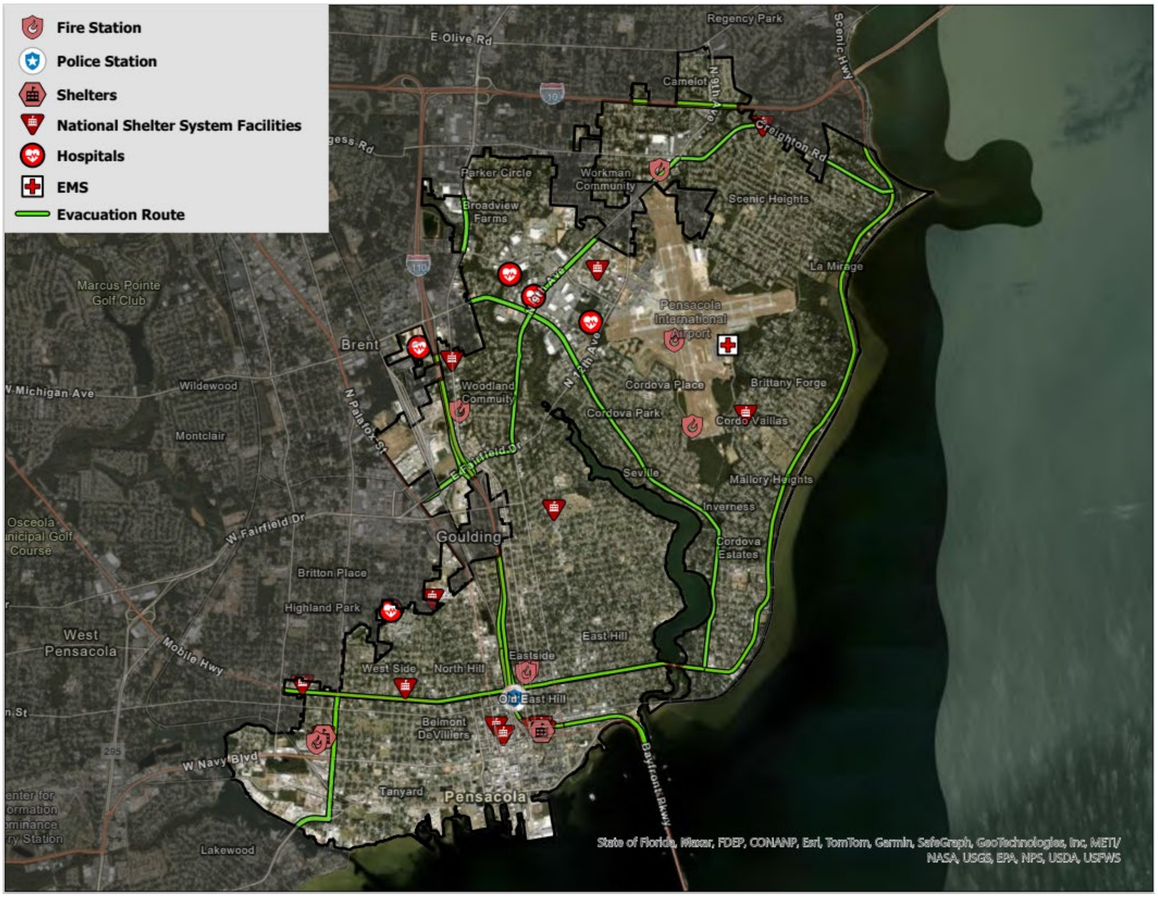
Critical Emergency and Community Facilities: Hospitals and healthcare facilities, while generally not owned and maintained by the City, are lifelines during disaster response and recovery, especially in the face of extreme weather events. Their ability to function without interruption is vital for the well-being of the community. They are also required to be evaluated per statute.

Figure 24 - Map of Health Care Providers



Similarly, emergency response centers serve as command hubs for coordinating emergency response efforts. They are pivotal in disaster management and require robust infrastructure and connectivity to ensure effective response during climate-related emergencies.

Figure 25 - Map of Emergency Management Infrastructure



Natural and Cultural Resources: Pensacola's natural areas, cultural assets, and historical sites contribute significantly to its identity and quality of life. These resources are not only important for the well-being of the community but also need protection against climate change impacts to preserve the city's heritage.

Figure 26 - Map of Park Systems and Natural Areas

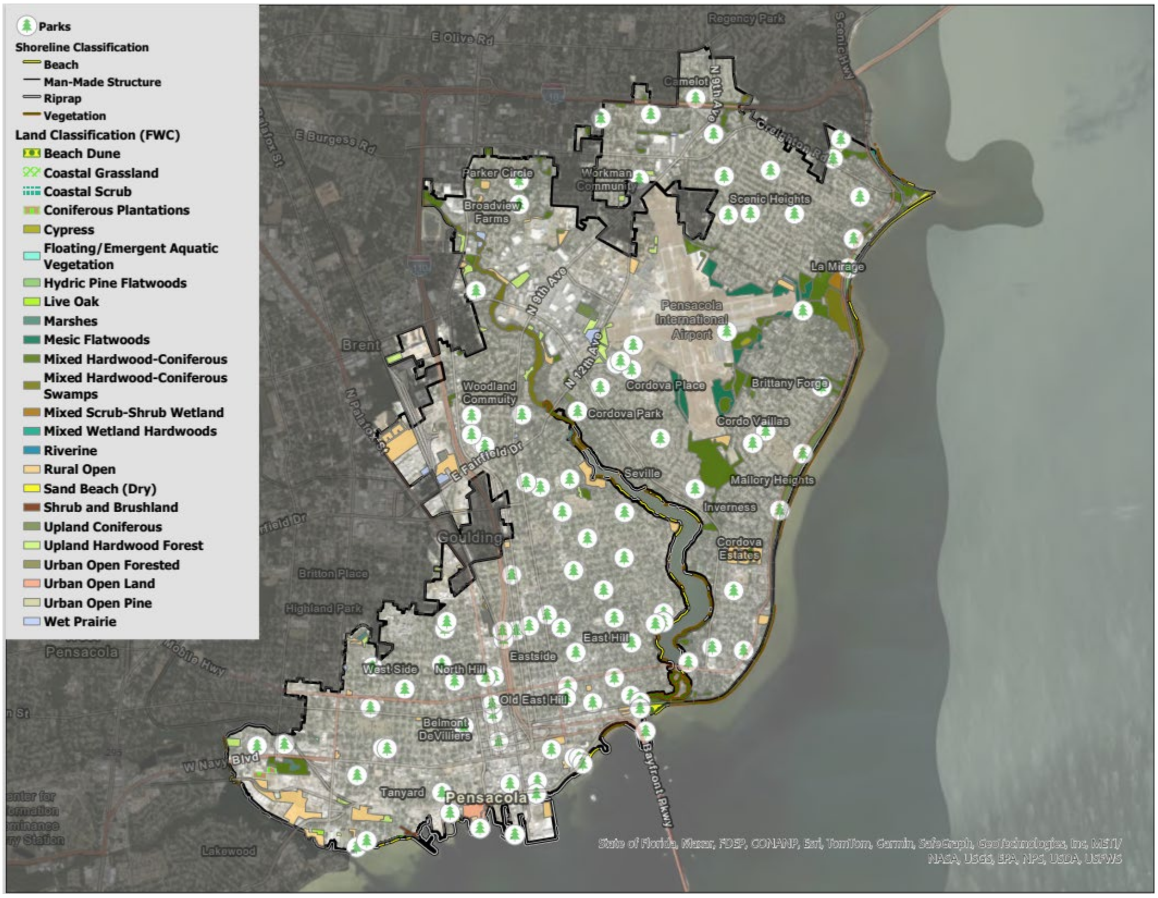
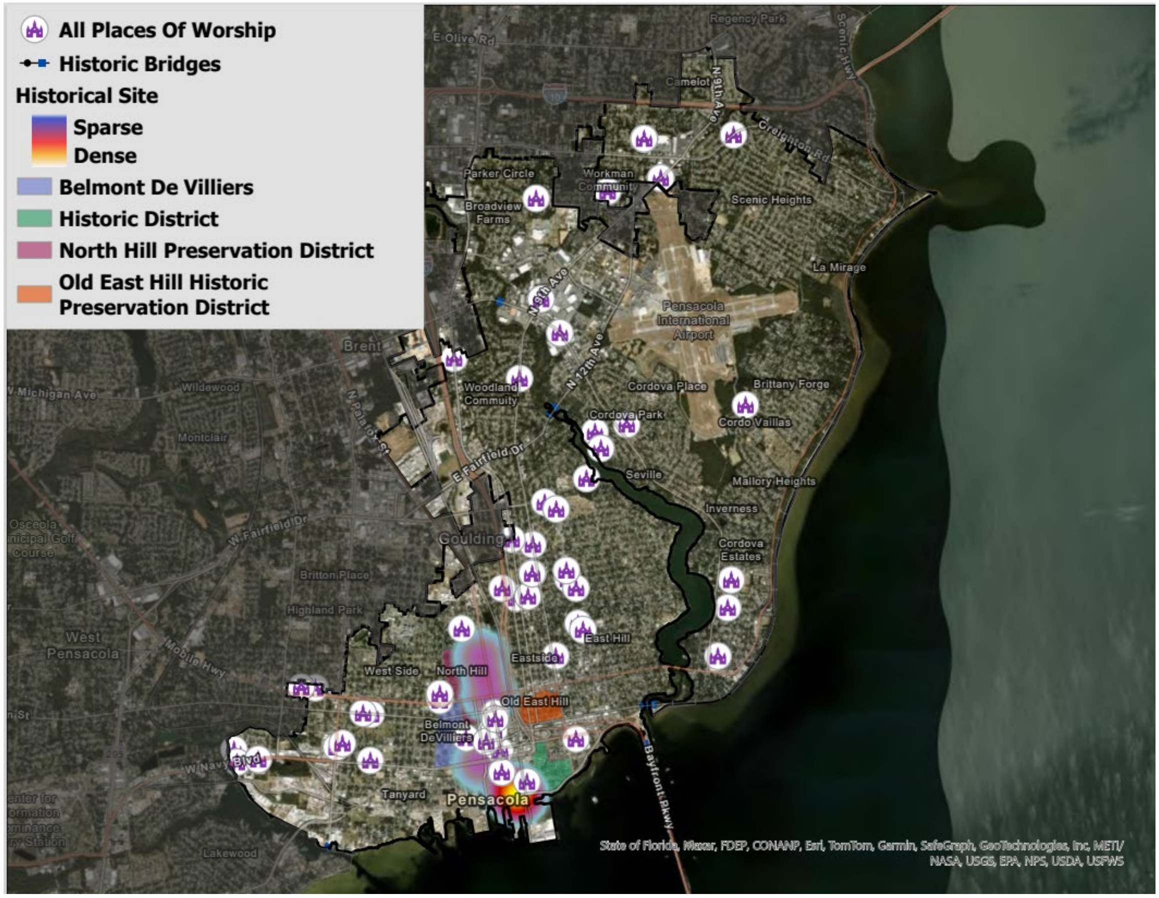


Figure 27 - Map of Cultural and Historic Assets



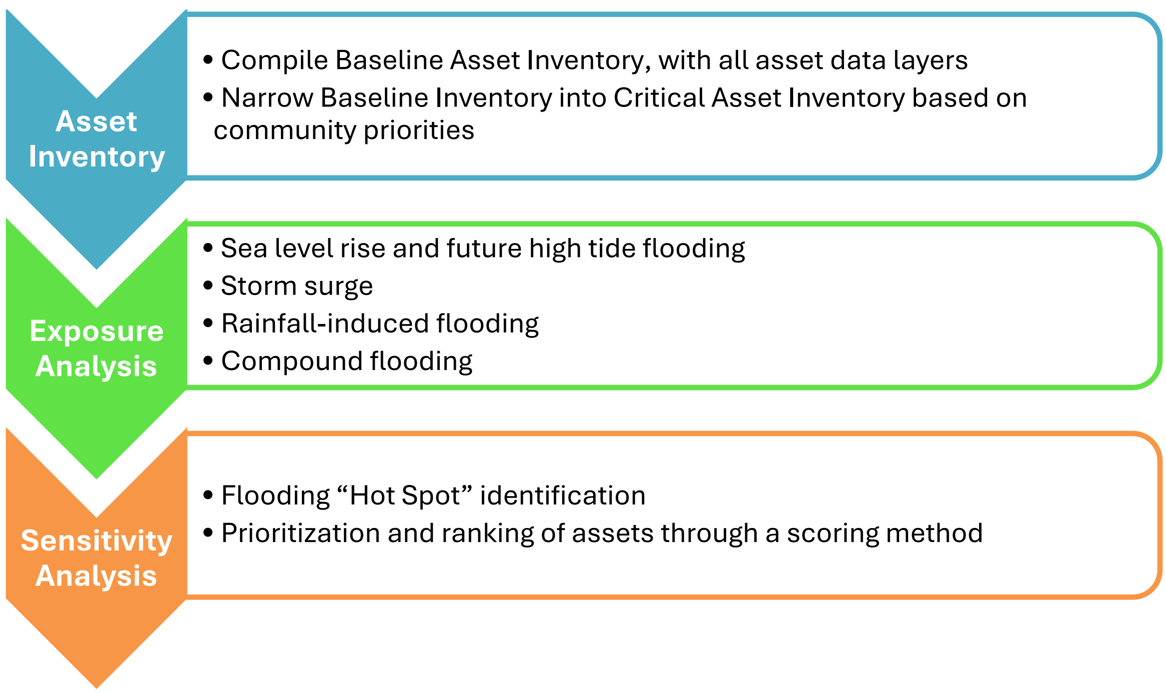
Regionally Significant Assets: As defined in Subsection 380.093, F.S., regionally significant assets are critical facilities that serve a broader geographic area, including neighboring communities, and are not necessarily owned and maintained by the city. These assets may encompass water resource facilities, regional medical centers, emergency operation centers, regional utilities, major transportation hubs, airports, and seaports. Identifying and safeguarding these assets is crucial for regional resilience and response coordination.

Assessment Methodology

Approach to Vulnerability Assessment

The methodology employed in this Vulnerability Assessment adheres to Subsection 380.093, F.S., and uses a comprehensive set of data sources and modeling techniques. This approach is designed to provide a detailed analysis of the city's vulnerability to climate change and sea-level rise. The primary components of this methodology are described in Figure 28.

Figure 28 - Vulnerability Assessment Process Steps



It is important to acknowledge the limitations of this methodology. While it provides a valuable foundational assessment, it is not a substitute for detailed, site-specific studies. Future studies involving engineering-grade hydrologic and hydraulic modeling are recommended for more localized flood risk understanding.

Data Collection & Asset Inventory Evaluation Process

To ensure accuracy and comprehensiveness, this Vulnerability Assessment employed an exhaustive data collection strategy. Data was gathered from various authoritative sources, including federal agencies such as the Department of

Homeland Security (DHS), National Oceanic and Atmospheric Administration (NOAA), and the Federal Emergency Management Agency (FEMA); state authorities such as the Florida Department of Environmental Protection (FDEP), Department of Transportation (FDOT) and the Fish and Wildlife Conservation Commission (FWC); and local authorities, including City of Pensacola staff. The collected data was categorized as follows:

1. **Transportation Assets and Evacuation Routes**: airports, bridges, bus terminals, boat ramps, major roadways, evacuation routes, port facilities, waterways, marinas, rail facilities, and railroad bridges.

2. **Critical Infrastructure:** wastewater treatment facilities and lift stations, stormwater treatment facilities and pump stations, drinking water facilities, water utility conveyance systems, drainage infrastructure and stormwater ponds, electric production and supply facilities, solid and hazardous waste facilities, military installations, post offices, communications facilities, and disaster debris management sites.

3. **Critical Community and Emergency Facilities**: schools, colleges, universities, assisted housing, community centers, correctional facilities, disaster recovery centers, emergency medical service facilities, emergency operation centers, fire stations, health care facilities, hospitals, law enforcement facilities, local government facilities, logistical staging areas, affordable public housing, general-population risk shelters, special-needs risk shelters, and state government facilities.

4. **Natural, Cultural, Historical Resources**: This category is dedicated to preserving and protecting natural areas and cultural/historical sites, including conservation lands, historic buildings and cemeteries, national and state parks, shorelines, surface waters, wetlands, and historical and cultural assets.

5. **Supplementary Information**: This category includes additional data not explicitly required by Subsection 380.093, F.S., but valuable for a detailed vulnerability assessment. It encompasses FEMA's flood insurance study, flood zones, frequently flooded structures, photos of flooding, green infrastructure, impervious surface areas, seawalls, and more. Geomorphological features and socioeconomic environment data are also included.

Additionally, multiple asset types listed above would be considered regionally-significant assets; they are due special attention, given their specific mention in the statutory language which refers to critical assets that support the needs of communities spanning multiple geopolitical jurisdictions. These assets include Commercial and Strategic Intermodal System (SIS) ports, spaceports, waterways, railroad crossings, railroads, rail terminals, rail bridges, bus terminals, evacuation routes, electric power plants, electric power transmission lines, dams, and drainage assets maintained by water management districts. Additionally, stormwater ponds, wastewater facilities, public water supply tanks, public water supply plants (non-federal), emergency medical services facilities, emergency operations centers, risk shelters for the general population, and risk shelters for those with special needs are considered crucial in supporting the infrastructure and safety requirements of multiple regions.

Supplemental Information is included to augment resilience planning, capturing assets not explicitly identified in the statutory framework. This structured approach facilitates a comprehensive understanding and effective addressal of climate change adaptation and resilience challenges.

Data Request

The data collection and evaluation process for Pensacola's Vulnerability Assessment was methodical and robust, involving a variety of authoritative sources. The effort gathered topographical, hydrological, climatic, and tidal data via a standardized data request document directed to agencies including DHS, NOAA, FEMA, local authorities, and research institutions. The collected data was categorized into four primary categories, tracking the State’s defined asset classes, with a fifth supplementary category to enhance resilience planning efforts.

Data Gap Analysis

The Gap Analysis conducted for the Pensacola Vulnerability Assessment identified key areas of data insufficiency and proposed strategic solutions and pathways to obtain more information. These included enhancing geospatial data through mapping and system integration, improving infrastructure data with departmental reviews and responsible data management, and updating information on natural, cultural, and historic resources through community involvement. The analysis also recommended standardizing terminologies and developing comprehensive metadata to address inconsistencies and unclear data coverage. Employing a range of methods such as satellite imagery, government record analysis, and statistical modeling, the approach aims to achieve a thorough and dependable assessment to close gaps described in the Gap Analysis now and into the future.

Exposure Analyses: Tools and Models Used

The methodology of the Vulnerability Assessment Report encompasses a detailed analysis of the 2040, 2070 and 2100 planning horizons using advanced tools and models, meticulously aligned with compliance requirements. This section delves into four key aspects:

Future High Tide Modeling: This involves sophisticated modeling techniques using ArcGIS Pro and NOAA's methodology. The process includes creating VDATUM conversion surfaces and utilizing algorithms for tidal variability interpolation, ensuring accurate future high tide flood mapping accounting for the tidal flooding threshold of 2' above mean higher high water. This Analysis also includes a representation of the number of tidal flood days that is expected for each scenario as well as planning horizon in the map series titled "Days of Tidal Flooding" in the Exposure Map series, which is supplemental to the 2' mean higher high-water threshold established by DEP.

Storm Surge Analysis: Utilizing FEMA's storm surge data and HAZUS-MH software, this analysis adjusts the historical storm surge data by the future sea level rise projections discussed in the report. The approach integrates these projections with the community's existing FEMA Flood Insurance Study data, offering a nuanced understanding of future storm surge impacts.

Rainfall-Induced Flooding Evaluation: Adhering to specific legislative requirements, this part employs the Hydrologic Engineering Center's River Analysis System (HEC-RAS) for rainfall simulation and runoff computation. It incorporates NOAA's Atlas 14 data, enriched with DoD's change factors[2], to create baseline rainfall depth grids essential for a comprehensive evaluation of potential future rainfall-induced flooding.

Compound Flooding Assessment: This segment addresses the compound effects of tidal, storm surge, and rainfall-induced flooding. It involves overlaying depth grids from various scenarios, acknowledging the resource and time constraints of the project.

Each of these components is detailed over multiple pages in the report, providing an exhaustive, data-driven approach to assess Pensacola's vulnerability to climate-induced changes. The methodology is crafted to not only meet compliance standards but also to provide a deep, actionable insight into the city's potential future flooding scenarios.

Scenario Development and Assumptions for Evaluations/Modeling

North American Vertical Datum of 1988

All elevations referenced in and analyzed for this Vulnerability Assessment are expressed in North American Vertical Datum of 1988 (NAVD 88) values.

[2] https://precipitationfrequency.ncics.org/index.html

Local sea level rise scenarios

The sea-level rise scenarios included in the Vulnerability Assessment include the 2017 NOAA Intermediate-Low Sea Level Rise Projection and the 2017 NOAA Intermediate-High Sea Level Rise Projection. These scenarios were the required scenarios when this Vulnerability Assessment was initiated prior to July 1, 2024. Legislation adopted by the Florida Legislature in 2024[3] will shift these required scenarios to the 2022 NOAA Intermediate Low and Intermediate scenarios. These new scenarios will apply to Vulnerability Assessments initiated after July 1, 2024.

The benefit of evaluating a range of conditions is that the City can determine the tolerance for risk for any adaptation strategy decision and act upon data from this analysis that reflects a wider range of conditions. For assets, adaptation projects and policy decisions where there is a higher criticality for that decision, the higher end of the projections and output should be considered. Where there is a lower tolerance for flood impact, the lower end of the projections could be considered. The range provides options needed for more place-based and flood impact decision-making.

In the context of flood risk planning, the significance of assessing and preparing for risks varies significantly across different types of assets, reflecting the underlying concept of risk tolerance. This differentiation becomes particularly evident when contrasting the planning requirements for infrastructure with widely divergent risk profiles and societal impacts, such as recreational facilities versus nuclear power plants.

Recreational facilities, for example, though valuable for community well-being and local economies, generally represent assets with a relatively lower criticality in the broader scope of city-wide emergency preparedness and long-term resilience planning. The risk tolerance for such facilities is comparatively higher, meaning that while flood impacts are undesirable, they are less likely to cause widespread or long-lasting harm. Therefore, in the adaptation strategy for these assets, a balanced approach may be adopted, potentially aligning with the lower end of sea-level rise projections. This approach prioritizes cost-effectiveness and practicality, acknowledging the lower relative impact of flooding on these facilities.

Conversely, the planning and risk assessment for nuclear facilities demand an exceptionally low tolerance for risk due to the potential for catastrophic consequences in the event of flooding. The critical nature of such infrastructure—not only in terms of energy supply but also considering the immense implications for public health, safety, and environmental protection—necessitates that adaptation strategies are aligned with the most conservative projections and models available. In this case, the higher end of sea-level rise scenarios would be a prudent basis for

[3] The legislation had not been signed into law by the Governor as of the publication of this Vulnerability Assessment.

planning, reflecting a commitment to safeguarding against even the most unlikely events. The imperative to ensure the utmost level of resilience against flooding underscores the non-negotiable demand for stringent precautionary measures in the context of nuclear planning.

Planning horizons

The planning horizons for this assessment coincide with NOAA's forecasting years: 2040, 2070 and 2100. While Section 380.093(3), F.S only requires the 2040 and 2070 planning scenarios, currently, this Vulnerability Assessment also includes the 2100 condition.

Sea level data selection

The City of Pensacola is fortunate to have a NOAA tide gauge (Station ID 8729840) located at its port. Installed in 1923, the tide gauge has supplied data for over a century, providing a rich and highly accurate record of water levels in the City.

Given this, there is no need for interpolation of local sea level data between the two closest NOAA tide gauges, or the selection of the closest NOAA tide gauge with the highest mean sea level. The Pensacola tide gauge data can be used without modification.

The datum chart (Figure 29) below is a visual representation of various reference levels (datums) related to the Pensacola Tide Gauge. These datums are standardized elevations used to serve as reference points for measuring water levels. Each datum is related to specific tidal conditions and is used to predict tidal flooding, navigate ships, and for coastal and marine engineering. Here is a brief explanation of common datums on Figure 29:

- **Mean Higher High Water (MHHW):** This is the average elevation of the higher high tides over a specific period. It is important for construction and development in coastal zones as it indicates the highest average water level that can be expected.

- **Mean High Water (MHW):** This is the average of all the high-water heights observed over the National Tidal Datum Epoch (usually a period of 19 years).

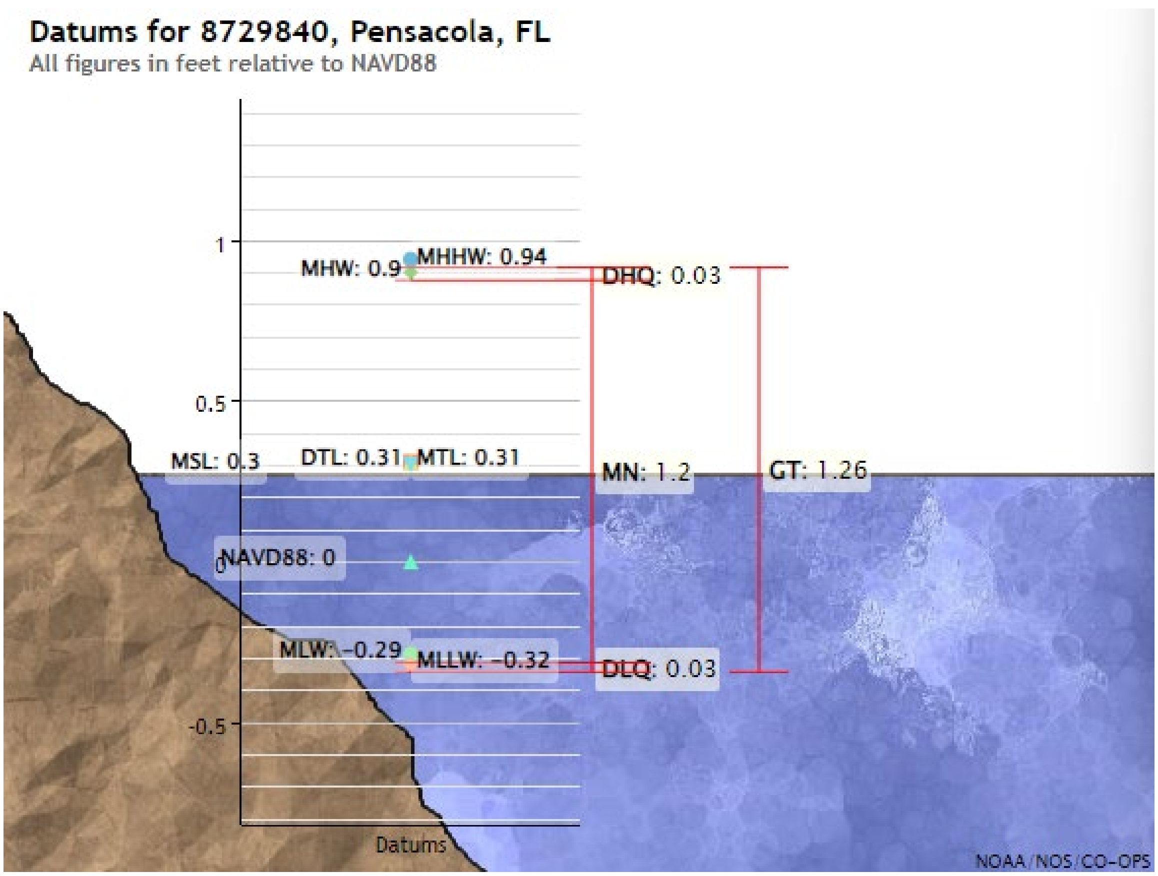
- **Mean Sea Level (MSL):** This is the average sea level. The mean level of the ocean's surface, calculated from hourly tidal heights measured over extended periods.

- **Mean Low Water (MLW) and Mean Lower Low Water (MLLW):** These represent the average of the lowest tides and the lowest average tide recorded, respectively, and are often used for navigational purposes to ensure boats and ships don't run aground.

The specific values and their vertical relationship to each other provide critical information for a range of activities, including coastal planning, construction, and navigation. The chart is typically set against the North American Vertical Datum of 1988 (NAVD88), which is a standard geodetic datum for elevations used in the United States for mapping and construction.

The exact purpose and usage of these datums can vary depending on the context, such as flood risk assessment, where knowing the heights of various tide conditions is essential for preparing for potential flooding events.

Figure 29 - Datums for Pensacola Tide Gauge



Datum charts in the context of water levels and elevations serve as a reference for understanding both current and future conditions. The following explains their usage and significance:

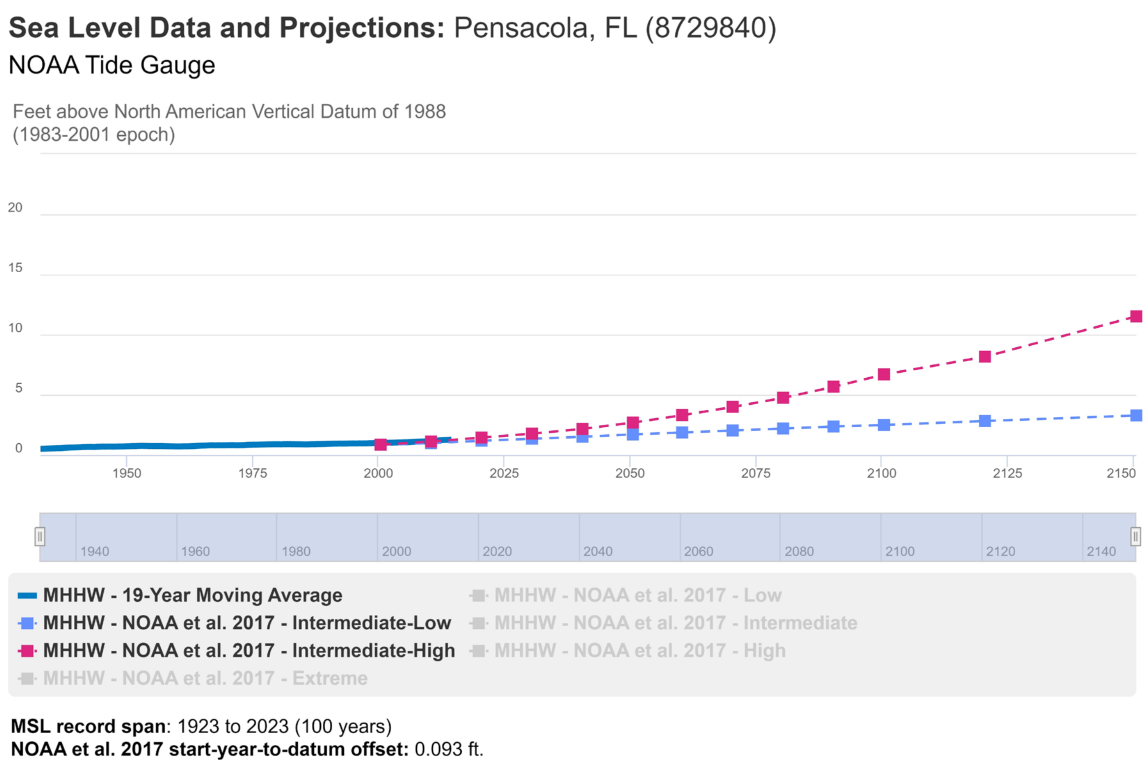
- **Current Water Levels (Datum Charts and Tide Gauge Record):** Datum charts represent the baseline or reference points from which water levels and land elevations are measured. These charts are crucial for a wide range of activities, including navigation, construction, and environmental management. They provide a snapshot of existing conditions, serving as a benchmark for comparing changes over time.

- **Projections in the Charts (Future Water Levels for NIL and NIH):** The projections found within these charts are predictive models that estimate future changes in water levels due to various factors, most notably climate change and sea-level rise. These projections are based on data analysis and simulation models that account for different scenarios, including greenhouse gas emission trajectories, polar ice melt rates, and ocean temperature changes.

In essence, datum charts provide a "ground truth" of current conditions against which future changes can be measured and predicted. These future projections are essential for planning and preparing for impacts related to rising sea levels, such as coastal flooding, habitat loss, and infrastructure vulnerability. They help policymakers, urban planners, and communities make informed decisions to mitigate risks and adapt to changing environmental conditions.

Understanding the difference between current conditions and future projections is crucial for effective environmental management and resilience planning. It allows for proactive measures to be put in place, reducing the potential damage and disruption caused by natural phenomena and climate change.

Figure 30 - Pensacola Tide Gauge Sea Level Data and Projections



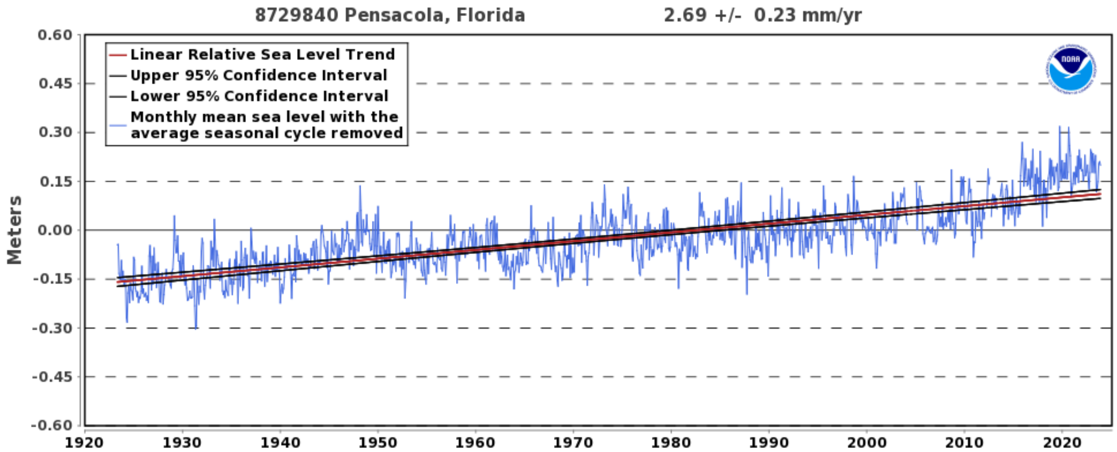
The USACE Sea Level Change Curve Calculator[4] and Sea Level Analysis Tool[5] were utilized to calculate the sea level rise values required for NOAAs method for mapping sea level rise[6] with the most recent digital elevation model and VDATUM[7] derived tidal surfaces. After reviewing the closest tide gauges available within the USACE Sea Level Change Curve Calculator, the NOAA tide gauge, referenced as “Pensacola, FL” (NOAA Gauge Station ID: 8729840, 2024) was selected for its proximity to the study area. The Pensacola tide gauge indicates a relative sea-level trend of 2.69 millimeters/year with a 95% confidence interval of +/- 0.23 mm/year based on data from 1923 to 2023 (Figure 31).

---

[4] USACE Sea Level Change Curve Calculator: https://cwbi-app.sec.usace.army.mil/rccslc/slcc_calc.html
[5] https://climate.sec.usace.army.mil/slat/
[6] Detailed Method for Mapping Sea Level Rise Inundation (NOAA, 2017): https://coast.noaa.gov/data/digitalcoast/pdf/slr-inundation-methods.pdf
[7] NOAA Vertical Datum Transformation: https://vdatum.noaa.gov/welcome.html

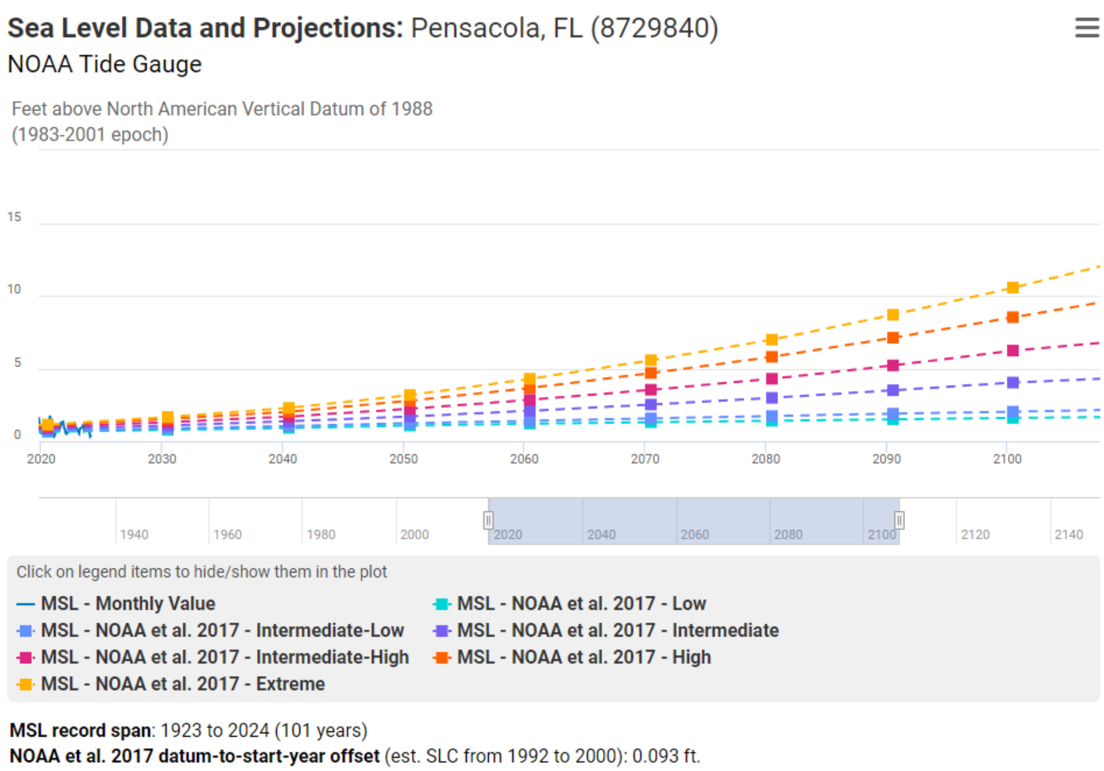
Figure 31 - Sea Level Increase from 1923 to 2023

(2.69 +/- 0.23 mm/year), equivalent to 0.88 ft in 100 years



The plots (Figure 31 and Figure 32) above and below describe the observed and future projected increase in sea levels within the region. Each of the curves *(Low, Intermediate-Low, Intermediate, Intermediate-High, and High)* in Figure 32 correspond with 0.4 m (or 15.75 inches), 0.6 m (or 23.62 inches), 1.05 m (or 41.34 inches), 1.5 m (or 59.06 inches) and 2 m (or 78.74 inches) of global mean sea level change, respectively.

Figure 32 - Mean Sea Level Projections for Pensacola



Exposure: Future High Tide

Using a planning-grade static coastal hydrology sea level rise modeling approach (NOAA, 2017), the project team assessed the area for its vulnerability to sea level rise (SLR) inundation, leveraging the latest version of ArcGIS Pro for data analysis and cartographic representation (Environmental Systems Research Institute, 2022). By following this comprehensive modeling process, detailed future high tide flooding maps are generated that account for both regional and local variations in tidal flooding, and specifically identify areas with similar elevation that are not tidally connected according to the elevation surface. These areas may still be vulnerable to flooding, especially if they are connected to tidally connected coastal systems via stormwater conveyance or some other type of groundwater/surface water connection not captured within elevation data.

The table below outlines Pensacola's sea-level rise projections over the coming decades, utilizing the latest available data and climate models. These projections serve as a crucial foundation for the risk assessment, enabling evaluation of the potential consequences of rising sea levels in the context of this specific locale.

Table 5 - SLR with High Tide Flooding Modeling Scenarios

Timeframe	NOAA Intermediate Low 2017 (feet NAVD88)	NOAA Intermediate High 2017 (feet NAVD88)
Present Day	2.69	2.96
2040	3.02	3.68
2070	3.55	5.52
2100	4.01	8.21

The Future High Tide section makes use of ArcGIS Pro and NOAA's methods to predict flooding. It involves adjusting measurements for differences in sea level at various points and using algorithms to fill in gaps between these points. This process helps to accurately predict how high tides can rise, considering both current and future sea levels. Combining information on sea level rise with existing tide patterns yields detailed maps that show where and how high tide flooding could happen in the future. This method provides a clear picture of the risks of future high tide flooding.

Figure 33 - Vertical Datum Interpolation Surface

The above graphic shares the results of the tide gauge interpolation using NOAA's VDATUM tool. This surface, and others like it, is utilized within the modeling to convert between datums, specific to this assessment, conversions between NAVD88, and mean higher high water (MHHW) and mean sea level (MSL) all common place benchmarks in floodplain management. Utilizing derivatives of this tool, local tide records, future change factors and a digital elevation model the exposure analysis was conducted considering both the elevation of current storms but also and adjustment of current heights to projected future condition.

Pensacola's vulnerability to climate change, particularly concerning sea-level rise, necessitates a meticulous examination of projections tailored specifically to this coastal city. The analysis of sea-level rise projections and potential impacts is greatly enhanced by the incorporation of Pensacola-specific data and scenarios, especially those focused on the City's location along the coast. In Pensacola, as in many other coastal cities, the imminent threat of sea-level rise has the potential to significantly impact communities, infrastructure, and environment.

Exposure: Depth of Tidal Flooding, including Future High Tide Flooding

Incorporating the Florida Department of Environmental Protection's (FDEP) guideline of adding a +2 feet to the Mean Higher High Water (MHHW) mark for determining the tidal flooding threshold, the "Sea Level Rise + High Tide Flooding Scenario" offers an enhanced perspective on anticipating future tidal flooding events. This adjustment to the MHHW benchmark is pivotal, as it provides a more conservative and therefore safer standard for assessing and preparing for tidal flooding risks. It acknowledges the potential for sea level rise to substantially elevate baseline water levels, which, when combined with high tide events, significantly intensifies the frequency and severity of tidal flooding.

This scenario, therefore, extends beyond merely understanding the dynamics of sea level rise and high tides; it actively incorporates FDEP's forward-looking standard to ensure that the projected impacts reflect a scenario where the threshold for tidal flooding is higher. This approach is critical for urban and infrastructure planning, highlighting the necessity for resilient coastal defense mechanisms designed to withstand not just current sea levels and tidal variations but also future increases. By integrating the +2 feet adjustment, the analysis underlines the imperative for seawalls, tide gates, and natural barriers that are not only effective under present conditions but are also robust enough to offer protection as sea levels continue to rise.

The following maps identify which communities, infrastructures, and natural areas are at increased risk due to high tide flooding in the present day and under future conditions based on the NIL and NIH[8] sea level rise curves.

[8] [1] Section 380.093(3)(d)2.b. requires: At least two local sea level rise scenarios, which must include the 2017 National Oceanic and Atmospheric Administration intermediate-low and intermediate-high sea level rise projections.

Figure 34 - NIH 2070 SLR with High Tide Flooding

Days of Tidal Flooding Analyses

Expanding upon the sea level rise and high tide flooding scenario, this part of the analysis focuses on quantifying the expected number of days experiencing tidal flooding under various future conditions. This projection is instrumental in understanding the temporal dimension of tidal flood risks, shifting the perspective from theoretical to tangible impacts on the community's day-to-day life. By estimating the frequency of tidal flooding days, the assessment highlights potential disruptions to transportation, economic activities, and the overall quality of life, especially in low-lying and waterfront areas. This scenario emphasizes the urgency of implementing comprehensive flood risk management strategies, including early warning systems, community education programs, and infrastructure resilience enhancements, to reduce the societal and economic impacts of increased tidal flooding.

The assessment of tidal flooding is an essential element of comprehensive vulnerability evaluations aimed at understanding the impacts of sea level rise on coastal communities. This analysis is meticulously conducted through the collection and examination of high and low tide data spanning at least 19 years, a period that encompasses the full metonic cycle, from specific NOAA tide gauges, such as the Pensacola Tide Gauge. The objective is to extrapolate high tide values from historical data, project them forward using the observed sea level trend, and then assess the potential frequency of tidal flooding events in the future.

Table 6 - Statistical Analysis of Historical Tide Record

Calculating the number of days where water elevations surpassed a "critical elevation"

1992-2011 (NAVD88)	2004-2022 (NAVD88)	Approximate Days of Tidal Flooding Observed
2.77	3.31	1
2.19	2.54	5
2.02	2.34	10
1.88	2.15	15
1.79	2.05	20
1.69	1.94	30
1.62	1.86	40
1.51	1.75	50
1.34	1.57	100
1.03	1.25	≥150

The above analysis employs statistical methods to correlate historic tide records with observed and projected days of tidal flooding, as illustrated in the provided table. Table 6 above reveals the changes in tide elevations over two distinct periods, 1992-2011 and 2004-2022, and associates these elevations with the observed frequency of tidal flooding events. The elevations are presented in feet NAVD88. A key observation from this data is the trend of increasing tide elevations over time, indicating rising sea levels and, consequently, an increased risk of tidal flooding.

Table 7 - Future Tidal Flooding Frequency

(feet NAVD88)

Approx. Days	NIL 2040	NIL 2070	NIL 2100	NIH 2040	NIH 2040	NIH 2040
1	3.62	4.41	4.96	4.30	6.57	9.28
5	2.93	3.63	4.28	3.73	5.96	8.80
10	2.70	3.40	4.06	3.54	5.71	8.60
15	2.54	3.22	3.94	3.39	5.51	8.46
20	2.46	3.09	3.84	3.29	5.42	8.35
30	2.34	2.98	3.74	3.17	5.28	8.23

Approx. Days	NIL 2040	NIL 2070	NIL 2100	NIH 2040	NIH 2040	NIH 2040
40	2.26	2.90	3.66	3.06	5.16	8.10
50	2.15	2.78	3.53	2.92	5.00	7.92
100	1.97	2.60	3.36	2.71	4.76	7.65
≥150	1.65	2.27	3.04	2.30	4.30	7.07

Understanding the implications of these findings is crucial. The elevations for the two periods underscore not just the absolute rise in sea levels but also the increasing likelihood of flooding events as these levels continue to rise. The observed days of tidal flooding serve as a direct indicator of how frequently communities might experience such events, given current and projected sea level rises.

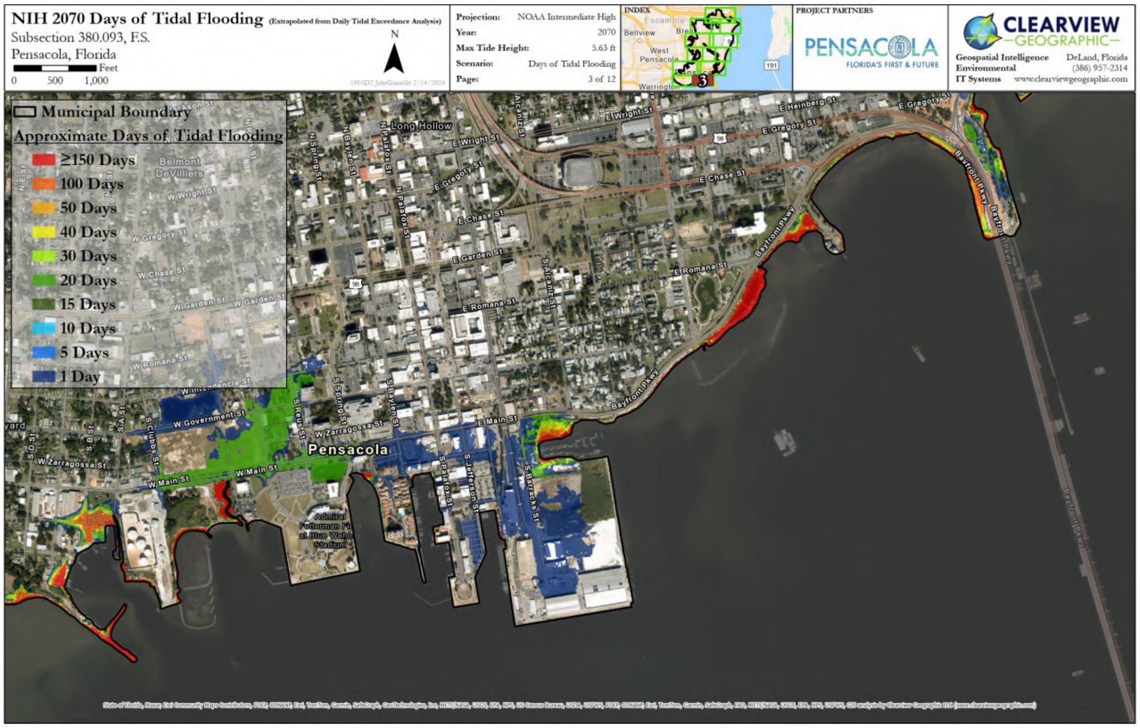
The vulnerability assessment further contextualizes these findings by projecting future sea level rises under different NOAA scenarios, including both intermediate-low and intermediate-high projections for the years 2040, 2070, and 2100. These projections enable the estimation of future tidal flooding events' frequency, providing invaluable insights for planning and adaptation strategies. For instance, the NOAA intermediate-low scenario estimates that by 2040, sea level rise will reach 3.62 feet, escalating to 4.96 feet by 2100. The intermediate-high scenario paints a more severe picture, with projections of up to 9.28 feet by 2100.

This forward-looking analysis is vital for urban planners, policymakers, and the community at large, offering a data-driven basis for understanding the risks associated with sea level rise and tidal flooding. By identifying the elevations at which tidal flooding becomes a significant risk and estimating the frequency of such events under various sea level rise scenarios, the assessment highlights the critical need for adaptive measures. These measures may include infrastructure improvements, policy adjustments, and community preparedness initiatives designed to mitigate the impacts of tidal flooding and enhance resilience against the growing threat of sea level rise.

Tidal flood days expected for each scenario and planning horizon

These maps, which can be found in the Exposure Map series, identify which communities, infrastructure, and natural areas are at increased risk due to multiple days of tidal flooding, capturing the various vulnerabilities from the range of tides based on the NIL and NIH sea level rise projections.

Figure 35 - NIH 2070 Days of Tidal Flooding



Exposure: Storm Surge

Storm Surge modeling in this context uses FEMA's data and HAZUS-MH[9] software, adapted for future sea level rise. The approach integrates historical storm surge data from FEMA's Flood Insurance Study[10] with projections of sea level rise, creating models of adjusted storm surge inundation. This methodology is crucial to understand and anticipate the augmented impacts of storm surges in the future, enabling effective planning and resilience strategies against these events. The models suggest how rising sea levels could intensify storm surges, which is essential for informed decision-making and mitigation efforts. Unlike sea level rise and tidal flooding, storm surge is a less permanent condition, but due to the force and depth of flooding can be extremely debilitating to a community.

[9] https://www.fema.gov/flood-maps/products-tools/hazus

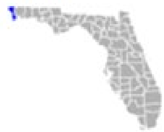
[10] Specifically adjusting the 100-year stillwater elevations by the rate of sea level change.

Figure 36 - FEMA Flood Insurance Study Non-Coastal Stillwater Elevations

FLOOD INSURANCE STUDY

FEDERAL EMERGENCY MANAGEMENT AGENCY

VOLUME 1 OF 1



ESCAMBIA COUNTY, FLORIDA

AND INCORPORATED AREAS

COMMUNITY NAME	NUMBER
CENTURY, TOWN OF	120084
ESCAMBIA COUNTY, UNINCORPORATED AREAS	120080
PENSACOLA, CITY OF	120082
PENSACOLA BEACH - SANTA ROSA ISLAND AUTHORITY	125138

FEMA

REVISED:

PRELIMINARY

1/27/2017

Table 11: Summary of Non-Coastal Stillwater Elevations

Flooding Source	Location	Elevations (feet NAVD88)				
		10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Lake Charlene	At 30.408783, -87.302663	*	*	*	29.2	*
Lake Charlene	At 30.407615, -87.303881	*	*	*	30	*
Lake Charlene	At 30.403983, -87.302707	*	*	*	28.1	*
Lake Charlene	At 30.405478, -87.302669	*	*	*	28.1	*
Lake Charlene	At 30.406264, -87.302640	*	*	*	28.1	*
Lake Charlene	At 30.407323, -87.302576	*	*	*	28.1	*
Lake Charlene	At 30.403044, -87.301976	*	*	*	28.1	*
Lake Charlene	At 30.407694, -87.305258	*	*	*	30	*
Lake Charlene	At 30.408936, -87.301548	*	*	*	28.5	*

*Not calculated for this Flood Risk Project

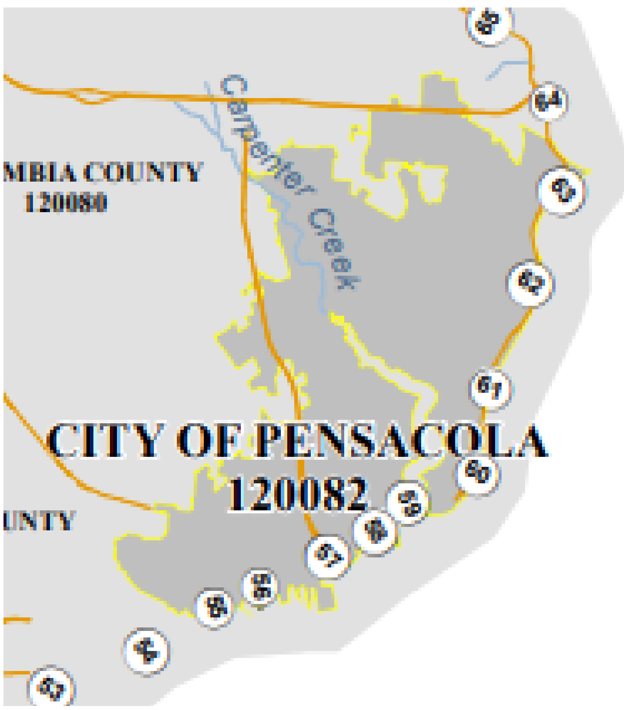
Stillwater Elevations[11]

The transects taken from the Flood Insurance Study are integral to the HAZUS-MH framework, which is designed to estimate storm surge and its potential impacts by modeling how surges of varying heights could affect both natural landscapes and urban development. The transects are used in the model to establish the still water elevations for the modeling to project surge. This process, depicted in Figure 37, is critical for urban planners and emergency management professionals as it aids in

[11] Stillwater elevations refer to the level of water in a body of water, such as a lake or river, under conditions of no wave action or minimal disturbance. This measurement is crucial in understanding water levels for purposes like flood prediction, navigation safety, and water resource management. It represents the height of the water surface when it is not affected by wind or tidal forces, providing a baseline for gauging water levels and their potential impacts.

anticipating the extent of possible flooding and crafting preemptive measures. While HAZUS-MH offers robust modeling capabilities, it does not factor in elements such as landscape friction, the carrying capacity of stormwater systems, the protective effects of shoreline armoring or the effects of employing nature-based shoreline resilience strategies — all variables that can dampen the real-world effects of storm surge. Consequently, the tool may present an overestimated scope of surge impact, highlighting the importance of contextual adaptation of its findings. Despite this, the results from HAZUS-MH provide valuable insights for vulnerability assessments, laying the groundwork for informed, risk-conscious planning and the evolution of resilient infrastructure strategies.

Figure 37 - Transect Location Map



Stillwater elevations across the coastal transects identified within the FEMA 2017 Escambia County Flood Insurance Study (“2017 Escambia FIS”) were also averaged and adjusted by both NOAA Intermediate Low and Intermediate High Sea level change. Baseline still water elevations for the various return interval flood events (10-, 50-, 100-, and 500-year) were sourced from the 2017 Escambia FIS.

Table 8 - Critical Average Stillwater Elevations

Planning Horizon	100-Year (feet NAVD88)	500-Year (feet NAVD88)
Present Day Average Stillwater	6.25	8.01
NIL 2040 Adjusted Average Stillwater	7.08	8.67
NIL 2070 Adjusted Average Stillwater	7.57	9.16
NIL 2100 Adjusted Average Stillwater	8.00	9.59
NIH 2040 Adjusted Average Stillwater	9.47	10.78
NIH 2070 Adjusted Average Stillwater	11.32	12.62
NIH 2100 Adjusted Average Stillwater	12.02	13.78

Using the outputs from the HAZUS-MH software, depth grids representing the maximum surge elevation (and corresponding flood depth) are created for a comparative overlay analysis with the critical asset inventory. Critical elevations utilized with the coastal floodplain module of HAZUS-MH are provided in Table 8 above.

Exposure: Depth of Current and Future Storm Surge Flooding

These maps identify the areas at increased risk from the combined effects of storm surges and sea level rise, combining the 2040, 2070, and 2100 NIH SLR projections with 100-year (1.0% annual chance) and 500-year (0.2% annual chance) storms. In the figures below, by 2070, flooding from even the 100-year storm inundates nearly the entire area at a depth of 10 feet or more.

Figure 38 - NIH 2040 SLR + 100-Year Storm Surge

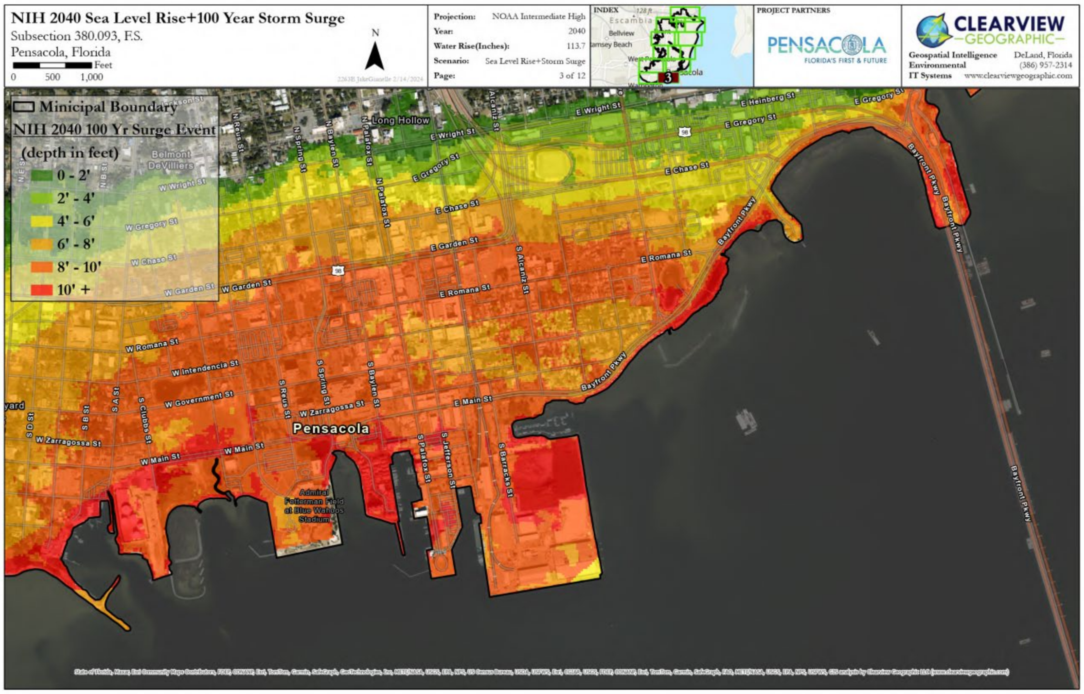
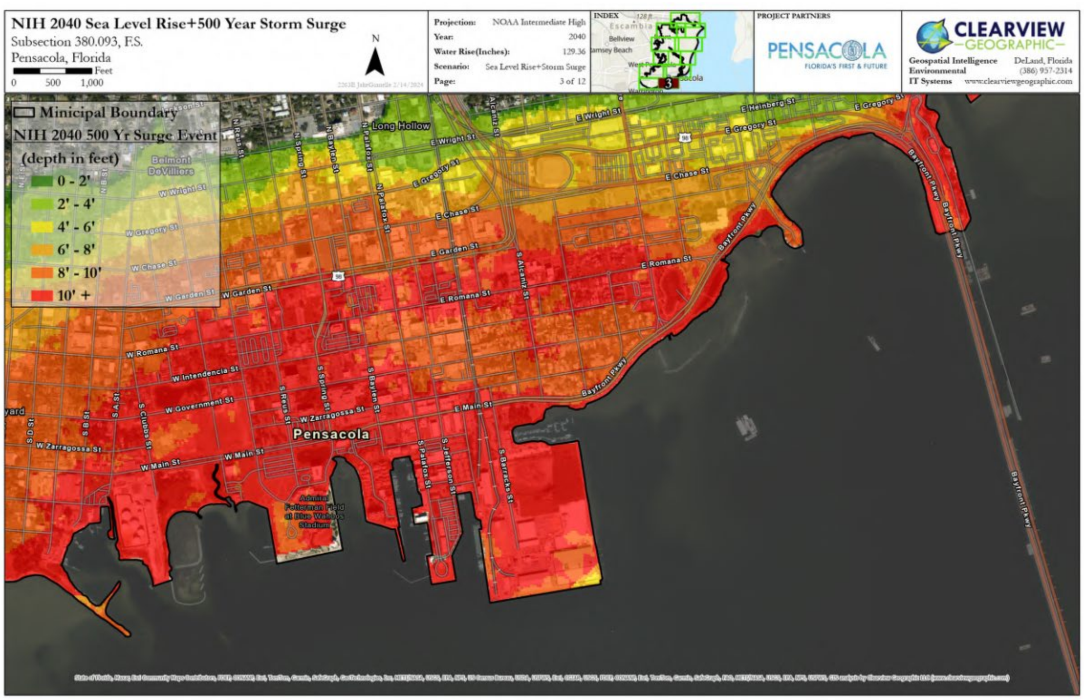


Figure 39 - NIH 2070 SLR + 100-Year Storm Surge



100-Year Storm Surge Scenario

The 100-year storm surge scenario encapsulates a storm event that has a 1% chance of occurring in any given year. This scenario is instrumental in determining the maximum expected storm surge flooding level over the planned horizons, providing a crucial benchmark for urban planning and infrastructure resilience. By integrating this scenario with future sea level rise projections, the assessment illuminates the compounded effects of climate change on storm surge risks. The analysis leverages FEMA's storm surge data and employs the HAZUS-MH software, adjusted for future sea level rise projections, to predict the depth and extent of flooding across various parts of the city. This scenario serves as a foundation for designing flood defense systems, updating building codes, and developing evacuation plans to mitigate the impacts of such extreme events on the community and critical infrastructure.

500-Year Storm Surge Scenario

Expanding the scope of the analysis, the 500-year storm surge scenario examines the impacts of a more severe but less frequent storm event, with a 0.2% chance of occurring in any given year. This scenario is crucial for stress-testing the city's resilience against catastrophic storm surge events, offering insights into potential worst-case flooding scenarios. Similar to the 100-year scenario, this analysis incorporates adjustments based on projected sea level rises, employing advanced modeling techniques to provide detailed projections of storm surge depths and inundation extents. The outcome of this scenario analysis aids in the strategic placement of critical infrastructure, the design of more robust flood protection measures, and the prioritization of areas for targeted resilience enhancements.

Both the 100-year and 500-year storm surge scenarios are essential components of a comprehensive risk assessment framework, enabling Pensacola to proactively plan for and mitigate the risks associated with storm surge flooding. By accounting for these scenarios in conjunction with tidal flooding and sea level rise projections, the assessment offers a holistic view of the city's flood risk landscape. This approach ensures that resilience planning is informed by a thorough understanding of the range and severity of potential flooding events, guiding investments in infrastructure, emergency preparedness, and community resilience initiatives. Ultimately, by preparing for these scenarios, Pensacola can enhance its ability to withstand and recover from storm surge events, safeguarding the well-being of its residents and the integrity of its critical assets against the challenges posed by a changing climate.

Exposure: Rainfall

The rainfall analysis in the Vulnerability Assessment employs HEC-RAS software for rainfall simulation and runoff computation. This part of the assessment integrates NOAA’s Atlas 14 data and DoD change factors to create baseline rainfall depth grids, aligning with legislative requirements without relying on developing entirely new hydrologic and hydraulic (H&H) modeling. This comprehensive approach makes it possible to understand and prepare for future climate impacts, especially in areas with both coastal and non-coastal characteristics. This approach meets and exceeds the statutory requirements for rainfall evaluation in vulnerability assessments.

NOAA Atlas 14 provides high-quality data based on ongoing investigations of historical rainfall patterns across the United States. It offers site-specific rainfall distributions, which are essential for accurate hydrologic modeling. Compared to previous volumes, Atlas 14 estimates have longer periods of record and greater station density. NOAA Atlas 14 defines standard design rainfall distributions based on nesting high-intensity short durations within longer, lower-intensity durations. These distributions are used in hydrologic models to estimate rainfall intensity for specified durations and annual exceedance probabilities (Figure 40). The NOAA Atlas 14 serves as a guideline to assess flood potential in waterways and design stormwater infrastructure. The accuracy of rainfall data provided by NOAA Atlas 14 allows engineers and planners to make informed decisions when designing and managing infrastructure.

This document delineates the process of model development, touching upon terrain modeling, design storms, infiltration, runoff dynamics, soil conditions, boundary conditions, and the resultant analysis outputs.

Figure 40 - NOAA Atlas 14 Rainfall Time Series Table for Pensacola

PDS-based precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.571** (0.489-0.673)	**0.658** (0.563-0.776)	**0.797** (0.679-0.943)	**0.909** (0.769-1.08)	**1.06** (0.855-1.29)	**1.17** (0.920-1.45)	**1.28** (0.963-1.63)	**1.39** (0.990-1.82)	**1.52** (1.04-2.06)	**1.62** (1.07-2.24)
10-min	**0.836** (0.716-0.986)	**0.963** (0.824-1.14)	**1.17** (0.994-1.38)	**1.33** (1.13-1.58)	**1.55** (1.25-1.89)	**1.71** (1.35-2.13)	**1.87** (1.41-2.39)	**2.03** (1.45-2.66)	**2.23** (1.52-3.01)	**2.38** (1.57-3.28)
15-min	**1.02** (0.873-1.20)	**1.18** (1.00-1.39)	**1.42** (1.21-1.68)	**1.62** (1.37-1.93)	**1.89** (1.53-2.31)	**2.09** (1.64-2.59)	**2.28** (1.72-2.91)	**2.48** (1.77-3.25)	**2.72** (1.85-3.68)	**2.90** (1.91-4.00)
30-min	**1.57** (1.34-1.85)	**1.78** (1.52-2.10)	**2.14** (1.82-2.53)	**2.43** (2.06-2.89)	**2.86** (2.32-3.51)	**3.19** (2.51-3.98)	**3.52** (2.66-4.52)	**3.87** (2.78-5.11)	**4.34** (2.97-5.90)	**4.71** (3.11-6.50)
60-min	**2.16** (1.85-2.55)	**2.44** (2.08-2.88)	**2.91** (2.48-3.44)	**3.32** (2.81-3.95)	**3.92** (3.19-4.84)	**4.40** (3.48-5.52)	**4.91** (3.71-6.31)	**5.44** (3.91-7.20)	**6.18** (4.23-8.42)	**6.76** (4.47-9.34)
2-hr	**2.75** (2.37-3.23)	**3.09** (2.66-3.63)	**3.68** (3.15-4.33)	**4.21** (3.58-4.97)	**4.98** (4.08-6.13)	**5.62** (4.47-7.01)	**6.29** (4.79-8.06)	**7.01** (5.07-9.24)	**8.02** (5.52-10.9)	**8.82** (5.86-12.1)
3-hr	**3.14** (2.71-3.66)	**3.52** (3.04-4.12)	**4.22** (3.62-4.94)	**4.84** (4.13-5.70)	**5.78** (4.76-7.11)	**6.57** (5.24-8.18)	**7.41** (5.66-9.47)	**8.31** (6.03-10.9)	**9.59** (6.63-13.0)	**10.6** (7.09-14.5)
6-hr	**3.78** (3.28-4.38)	**4.29** (3.71-4.97)	**5.22** (4.50-6.07)	**6.09** (5.22-7.12)	**7.44** (6.18-9.15)	**8.59** (6.91-10.7)	**9.85** (7.59-12.6)	**11.2** (8.22-14.7)	**13.2** (9.21-17.8)	**14.8** (9.97-20.2)
12-hr	**4.42** (3.85-5.09)	**5.08** (4.42-5.85)	**6.33** (5.49-7.32)	**7.55** (6.50-8.76)	**9.48** (7.95-11.7)	**11.2** (9.05-13.9)	**13.0** (10.1-16.6)	**15.1** (11.1-19.8)	**18.1** (12.7-24.4)	**20.6** (13.9-27.8)
24-hr	**5.10** (4.47-5.84)	**5.94** (5.20-6.80)	**7.56** (6.59-8.68)	**9.16** (7.92-10.6)	**11.7** (9.90-14.4)	**14.0** (11.4-17.3)	**16.5** (12.9-20.9)	**19.3** (14.3-25.1)	**23.3** (16.5-31.2)	**26.7** (18.2-35.8)
2-day	**5.90** (5.20-6.71)	**6.88** (6.05-7.83)	**8.80** (7.70-10.0)	**10.7** (9.29-12.2)	**13.7** (11.7-16.7)	**16.4** (13.4-20.2)	**19.4** (15.2-24.4)	**22.7** (16.9-29.4)	**27.5** (19.6-36.6)	**31.6** (21.6-42.1)
3-day	**6.46** (5.71-7.32)	**7.44** (6.56-8.43)	**9.39** (8.24-10.7)	**11.3** (9.88-12.9)	**14.5** (12.4-17.6)	**17.3** (14.2-21.2)	**20.4** (16.1-25.6)	**23.9** (17.9-30.8)	**29.1** (20.8-38.5)	**33.4** (22.9-44.2)
4-day	**6.92** (6.12-7.82)	**7.89** (6.97-8.91)	**9.83** (8.65-11.1)	**11.8** (10.3-13.4)	**14.9** (12.8-18.2)	**17.8** (14.7-21.8)	**21.0** (16.6-26.3)	**24.6** (18.5-31.6)	**29.9** (21.4-39.4)	**34.3** (23.6-45.3)
7-day	**8.04** (7.14-9.03)	**9.04** (8.02-10.2)	**11.0** (9.74-12.4)	**13.0** (11.4-14.7)	**16.2** (13.9-19.5)	**19.1** (15.8-23.2)	**22.3** (17.7-27.8)	**25.9** (19.6-33.1)	**31.2** (22.5-41.0)	**35.6** (24.7-46.9)
10-day	**9.01** (8.02-10.1)	**10.1** (8.98-11.3)	**12.2** (10.8-13.7)	**14.2** (12.5-16.0)	**17.4** (15.0-20.8)	**20.3** (16.8-24.4)	**23.4** (18.7-29.0)	**26.9** (20.4-34.2)	**32.0** (23.2-41.8)	**36.3** (25.3-47.6)
20-day	**11.7** (10.5-13.0)	**13.2** (11.8-14.6)	**15.6** (13.9-17.4)	**17.9** (15.8-20.0)	**21.1** (18.1-24.7)	**23.9** (19.8-28.2)	**26.7** (21.3-32.5)	**29.8** (22.6-37.3)	**34.1** (24.7-43.9)	**37.6** (26.3-48.9)
30-day	**14.0** (12.5-15.4)	**15.7** (14.1-17.4)	**18.6** (16.6-20.6)	**21.0** (18.6-23.4)	**24.4** (20.9-28.2)	**27.1** (22.6-31.8)	**29.9** (23.8-35.9)	**32.7** (24.9-40.5)	**36.5** (26.5-46.6)	**39.5** (27.8-51.2)
45-day	**16.7** (15.0-18.4)	**18.9** (17.0-20.8)	**22.3** (20.0-24.7)	**25.1** (22.3-27.9)	**28.8** (24.6-32.9)	**31.7** (26.3-36.7)	**34.4** (27.5-41.0)	**37.1** (28.2-45.6)	**40.6** (29.5-51.4)	**43.2** (30.5-55.8)
60-day	**19.0** (17.2-20.9)	**21.5** (19.4-23.7)	**25.5** (22.9-28.1)	**28.6** (25.5-31.7)	**32.7** (27.9-37.2)	**35.7** (29.7-41.3)	**38.6** (30.9-45.8)	**41.4** (31.5-50.5)	**44.8** (32.6-56.5)	**47.3** (33.5-60.9)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

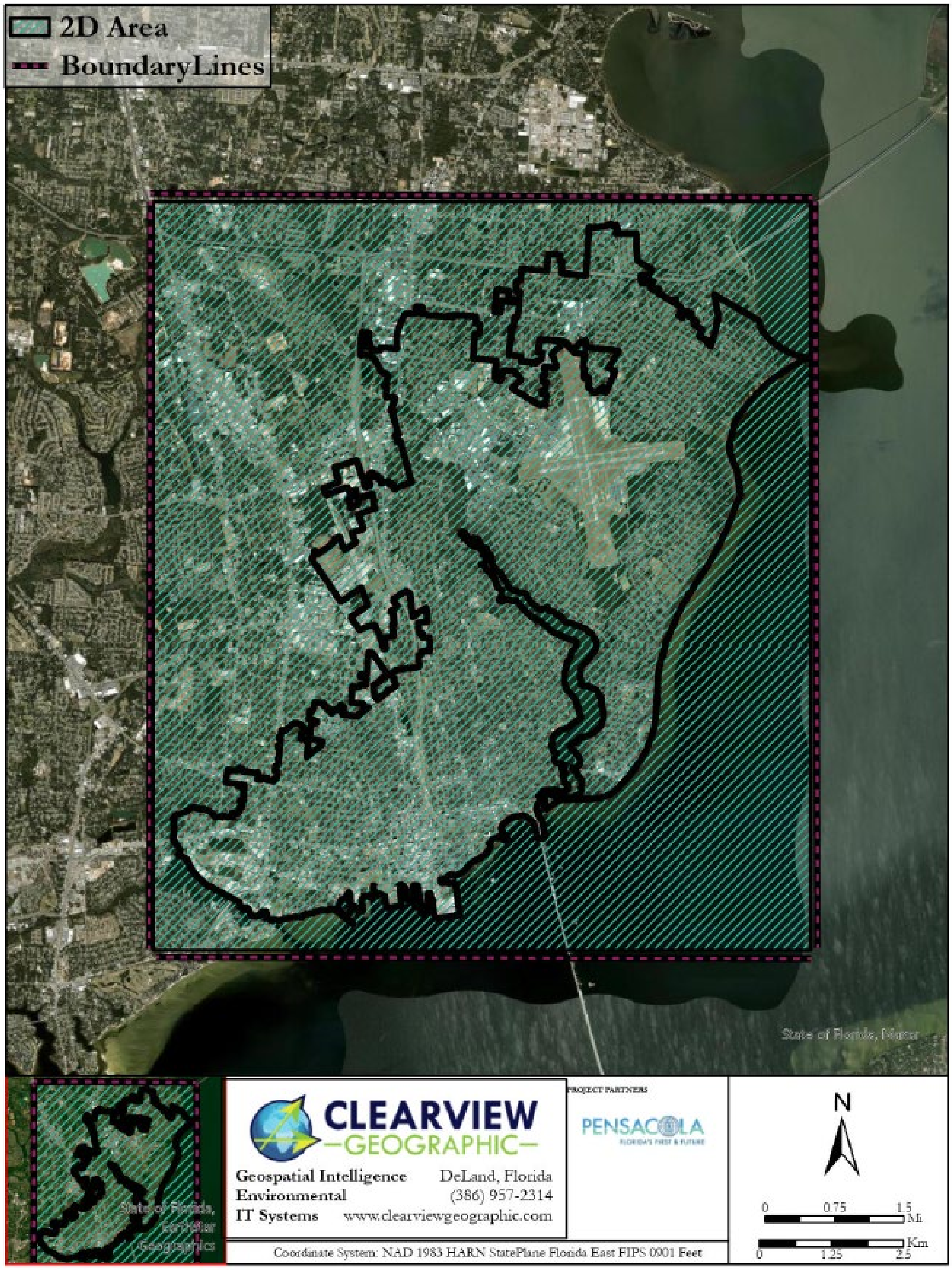
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Terrain

To accurately capture the nuances of the terrain's elevation and slope, a model was constructed utilizing digital elevation models (DEMs). These DEMs serve as a foundational element in mapping and understanding the area's physical characteristics. The elevation data within these models adhere to the North American Vertical Datum of 1988 (NAVD88). Figure 41 is the outline of the 2D DEM area and the boundary condition lines used in conjunction with the DEM as terrain inputs in the modeling environment.

Figure 41 - LiDAR Data Extent and Boundary Condition Lines for N, S, E, and W Boundaries



Design Storms

The Precipitation Data files were generated using Intensity/Precipitation curves derived from the FDOT Drainage manual for 24-hourdesign storms. The design storms represent current (2023) rainfall patterns: 500-, 100-, 50-, and 25-year return interval 24-hour rainfall events and the rainfall depths representing each 24-hour hypothetical storm event were taken from National Oceanic and Atmospheric Administration (NOAA) Atlas 14 annual maxima series to represent 2023 rainfall patterns (NOAA, 2023). Future rainfall depths were computed using the current precipitation depths in Table 9 and deriving the intensity for the respective future conditions by using the department of defense change factors to arrive at the projected precipitation in Table 10. The current and projected precipitation depths are then subjected to the storm design criteria in Table 11 below to arrive at a storm design that is suitable for varying present and future conditions.

Table 9 - Precipitation for 24-Hour Storm Duration - Present Day

Year	Scenario	Precipitation (inches)[12]
Present Day	25-Year	11.7
Present Day	50-Year	14.0
Present Day	100-Year	16.5
Present Day	500-Year	26.7

Table 10 - Projected Precipitation for 24-Hour Storm Duration

Year	Scenario	Precipitation (inches)
2040	25-Year	13.05
2040	100-Year	18.82
2070	25-Year	14.15

[12] 1 (NOAA, 2023)

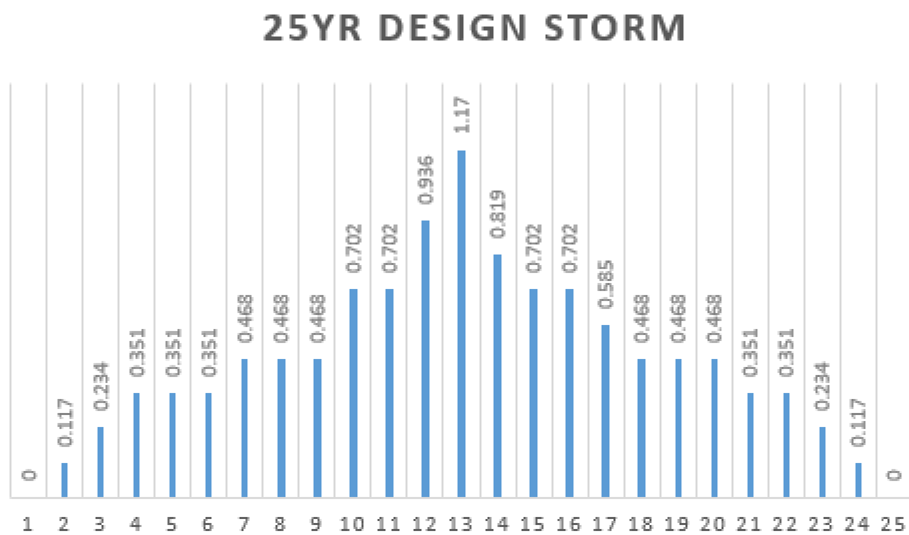
Year	Scenario	Precipitation (inches)
2070	100-Year	20.28
2100	25-Year	15.61
2100	100-Year	22.34

Table 11 - Rainfall Design Storm Criteria for Varying Storm Events[13]

T hours	I/P Total	25-Year Intensity	50-Year Intensity	100-Year Intensity	500-Year Intensity
0	0	0	0	0	0
1	0.01	0.117	0.14	0.165	0.267
2	0.02	0.234	0.28	0.330	0.534
3	0.03	0.351	0.42	0.495	0.801
4	0.03	0.351	0.42	0.495	0.801
5	0.03	0.351	0.42	0.495	0.801
6	0.04	0.468	0.56	0.660	1.068
7	0.04	0.468	0.56	0.660	1.068
8	0.04	0.468	0.56	0.660	1.068
9	0.06	0.702	0.84	0.990	1.602
10	0.06	0.702	0.84	0.990	1.602
11	0.08	0.936	1.12	1.320	2.136
12	0.10	1.170	1.40	1.650	2.670
13	0.07	0.819	0.98	1.155	1.869
14	0.06	0.702	0.84	0.990	1.602
15	0.06	0.702	0.84	0.990	1.602
16	0.05	0.585	0.70	0.825	1.335
17	0.04	0.468	0.56	0.660	1.068
18	0.04	0.468	0.56	0.660	1.068
19	0.04	0.468	0.56	0.660	1.068
20	0.03	0.351	0.42	0.495	0.801
21	0.03	0.351	0.42	0.495	0.801
22	0.02	0.234	0.28	0.330	0.534
23	0.01	0.117	0.14	0.165	0.267
24	0	0	0	0	0

[13] FDOT drainage manual for design storms, https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/roadway/drainage/files/idfcurves.pdf

Figure 42 - 25-Year Design Storm Criteria for Pensacola



Infiltration and Runoff

The infiltration method employed in this HEC-RAS model utilizes the Soil Conservation Service (SCS) Curve Number (CN) method, designed to estimate direct runoff and infiltration rates from rainfall events. This approach is particularly suitable for varying soil conditions, and land use offering a comprehensive understanding of how different terrains respond to precipitation.

The SCS CN method is based on empirical data, correlating soil type and land use to a curve number that represents the potential for runoff. This method simplifies the calculation of effective rainfall (precipitation that contributes to runoff) by considering the initial abstraction and potential maximum retention after runoff begins.

Infiltration rates are dynamically adjusted for each simulation. This adaptation ensures the model's responsiveness to varying hydrological conditions, offering a more nuanced depiction of infiltration and runoff dynamics within the study area. Manning's n roughness and percent impervious values were assigned to each USGS National Land Cover Database (NLCD) land cover category representing 2021 conditions (USGS, 2023a) (Figure 44). Manning's n roughness ranges were taken from the HEC-RAS technical reference guide (USACE, 2021) Table 13 shows the land cover categories, Manning's n roughness, percent impervious, and area within the modeled 2D flow area.

Soil Classification

The Gridded Soil Survey Geographic (gSSURGO) Database was used to identify the soil texture and hydrologic soils group for soils within the 2D flow area (USDA-NRCS, 2023). Figure 43 shows the gSSURGO soil map classifications in the 2D flow area. Within the municipal boundaries, the soil texture is primarily sand. Muck soils were described as frequently ponded if undrained. Muck soils have a limited capacity to transmit water because of the shallow depth of the water table. When drained, muck soils tend to have a much higher saturated hydraulic conductivity. Typically muck soils carry dual hydrologic soil group with soil group A or B applying to the drained condition and soil group whereas D would apply to the undrained condition. The sandy soil was well drained and without frequent ponding. Sandy soils are classified as hydrologic soil group A with low runoff potential.

Table 12 - Extent of Soil Textures

Soil Texture	Acres
Fine sand	98.08
Fine sandy loam	30.58
Loamy sand	157.91
Muck	89.82
Sand	13736.36
Sandy loam	287.69

Figure 43 - Soil Texture Categories

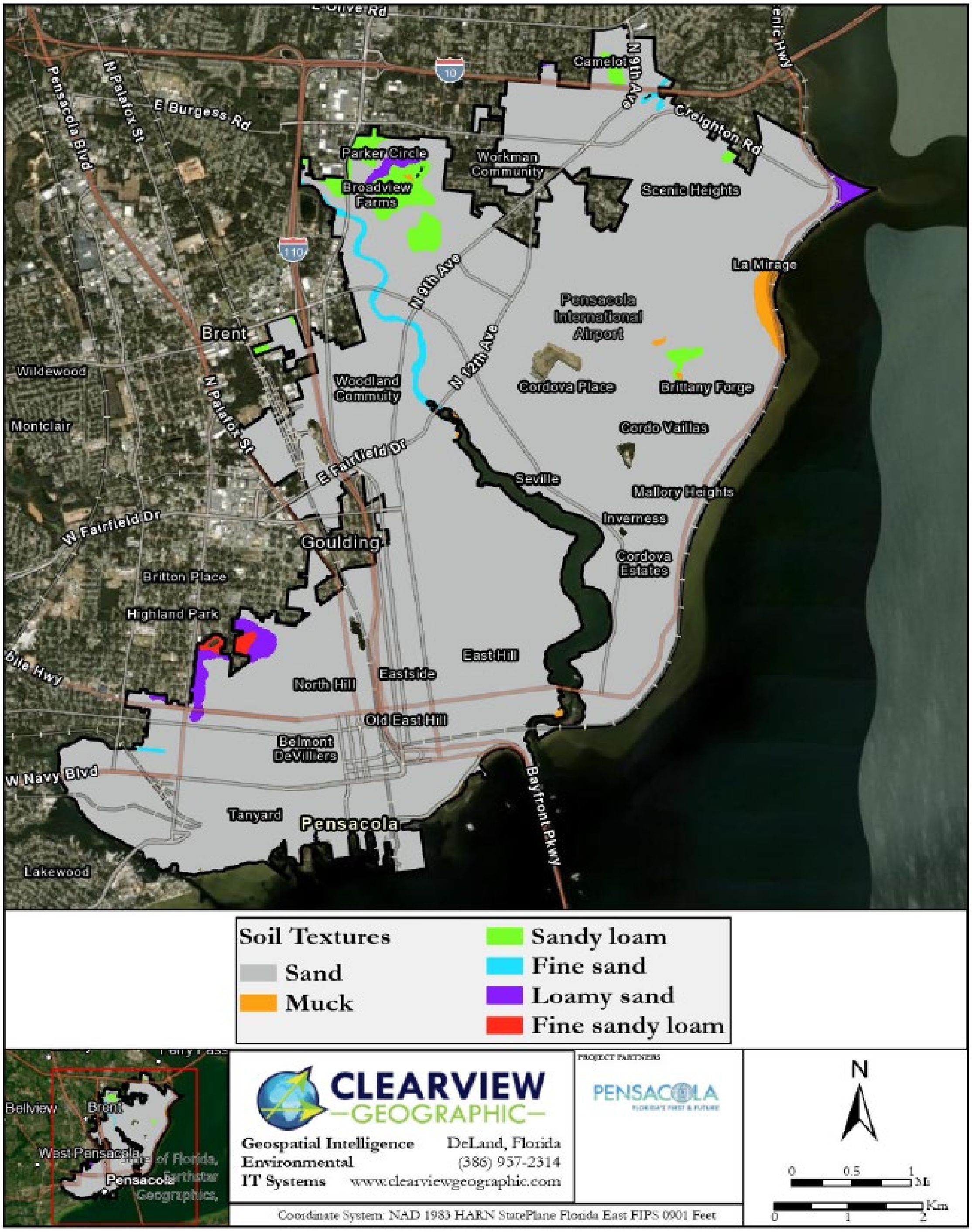


Figure 44 - Land Cover Categories

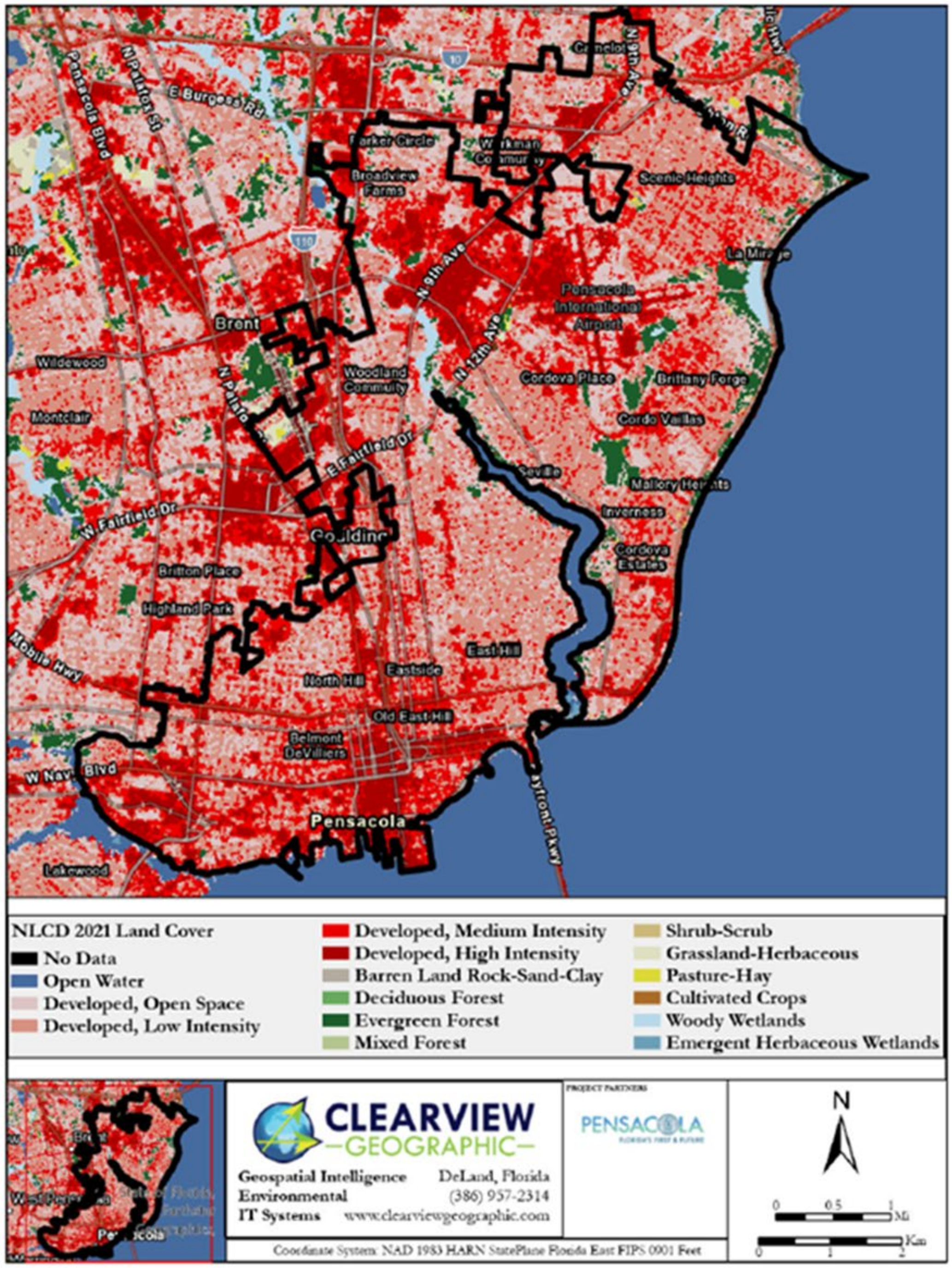


Table 13 - Land Cover Category - Manning's N Roughness and Impervious Surface[14]

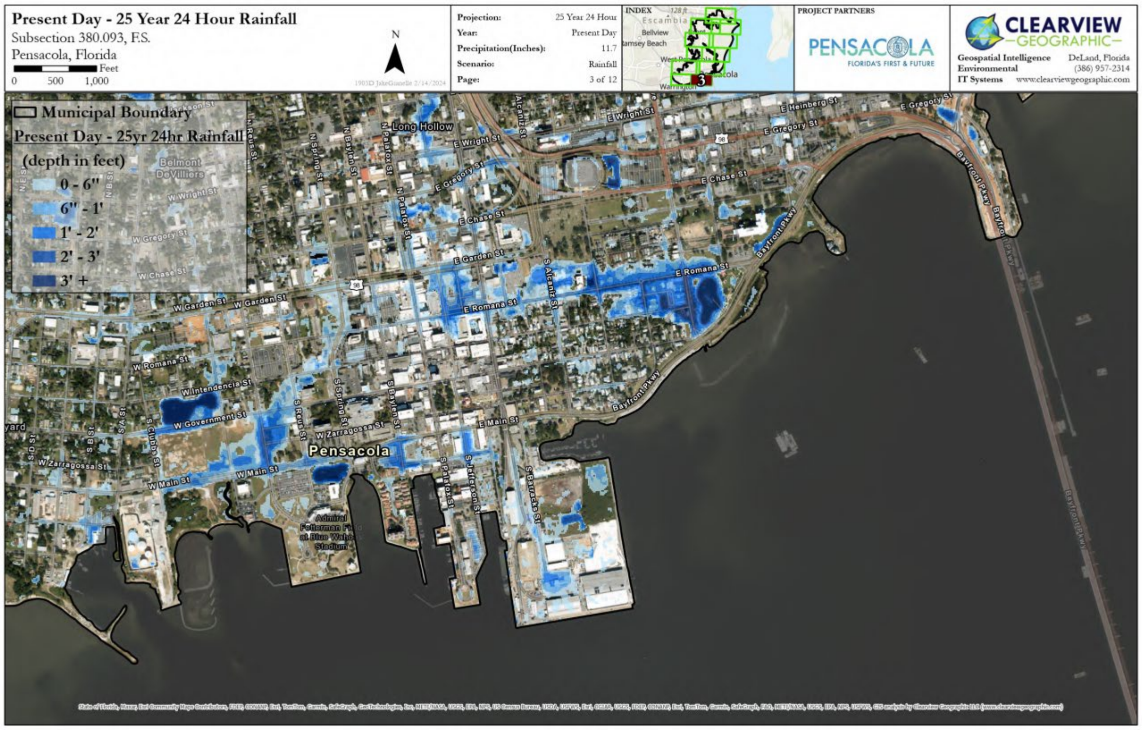
ID	Name	Manning's n Range[1]	Mannings n[2]	Impervious Surface %[3]
31	Barren Land Rock-Sand-Clay	0.023-0.030	0.030	0
82	Cultivated Crops	0.020-0.050	0.050	0
24	Developed, High Intensity	0.120-0.200	0.150	80
22	Developed, Low Intensity	0.060-0.120	0.080	40
23	Developed, Medium Intensity	0.080-0.160	0.120	60
21	Developed, Open Space	0.030-0.050	0.035	0
95	Emergent Herbaceous Wetlands	0.050-0.085	0.070	75
42	Evergreen Forest	0.080-0.160	0.150	0
71	Grassland-Herbaceous	0.025-0.050	0.040	0
43	Mixed Forest	0.080-0.200	0.120	0
11	Open Water	0.025-0.050	0.035	100
81	Pasture-Hay	0.025-0.050	0.045	0
52	Shrub-Scrub	0.070-0.160	0.080	0
90	Woody Wetlands	0.045-0.150	0.100	50

The modeling approach uses generally accepted analysis and modeling techniques, which meet and exceed the requirements of Section 380.093(3)(d)2.c., F.S. Rainfall precipitation data sourced from NOAA's Atlas 14 provides the baseline rainfall depth

[14] USACE Creating Land Cover, Manning's N Values, and % Impervious Layers (USACE, 2021).

grids and depth duration hydrographs for different storm events (25-year, 50-year, 100-year, and 500-year).

Figure 45 - 25-Year 24-Hour Rainfall - Present Day



25-Year 24-Hour Scenario

This scenario models a storm event with a 4% chance of happening in any given year. It provides insights into moderate but significant flooding risks that can disrupt daily life and damage less resilient infrastructure. The analysis of this frequency helps in identifying flood-prone areas that require improved drainage, enhanced stormwater management systems, and community flood preparedness programs.

50-Year 24-Hour Scenario

Elevating the analysis, the 50-year 24-hour scenario, with a 2% annual occurrence probability, examines the impacts of more intense rainfall. This scenario assists in evaluating the adequacy of existing flood defenses and identifying critical infrastructure that might be at risk during such events. It also underscores the need for robust emergency response strategies and infrastructure resilience against more severe flooding.

100-Year 24-Hour Scenario

A cornerstone of flood risk management, the 100-year 24-hour scenario represents a severe storm event with a 1% chance of occurring in any given year. This scenario is crucial for urban planning and development, guiding the design standards for flood mitigation infrastructure, zoning regulations, and insurance requirements. It highlights areas where strategic investments can significantly reduce flood risks and enhance community resilience.

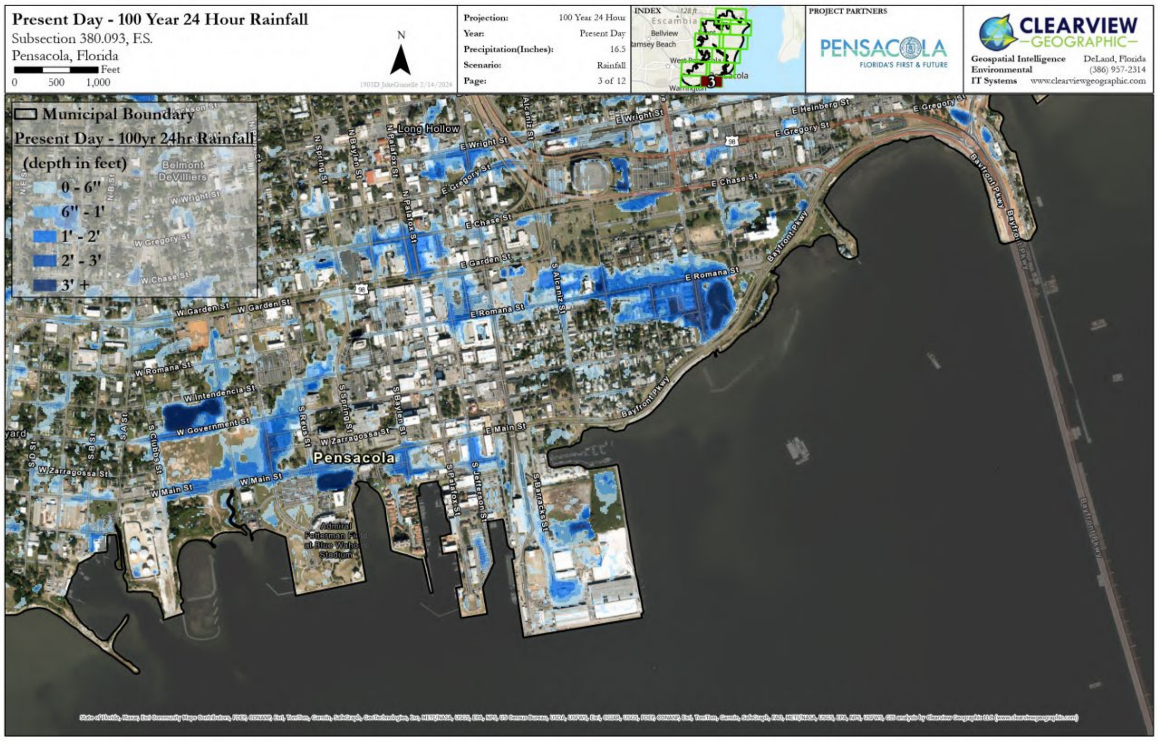
500-Year 24-Hour Scenario

The 500-year 24-hour scenario represents an extreme rainfall event with a 0.2% chance of occurring in any given year. This scenario is crucial for understanding the upper limits of flood risk, highlighting areas and infrastructure that could be subjected to unprecedented water levels. The potential for catastrophic flooding under this scenario demands comprehensive planning and robust mitigation strategies, far beyond the routine flood management measures.

1,000-Year 24-Hour Scenario

This scenario represents an exceptionally rare and extreme rainfall event with a 0.1% chance of occurring in any given year, offering a detailed examination of the potential for catastrophic flooding. The 1,000-year scenario is critical for comprehensive risk assessment and planning, necessitating advanced preparedness and mitigation strategies to safeguard lives, property, and critical infrastructure. The profound implications of such an event underscore the importance of forward-looking, resilient urban planning and the development of robust emergency management systems to handle potential catastrophic impacts.

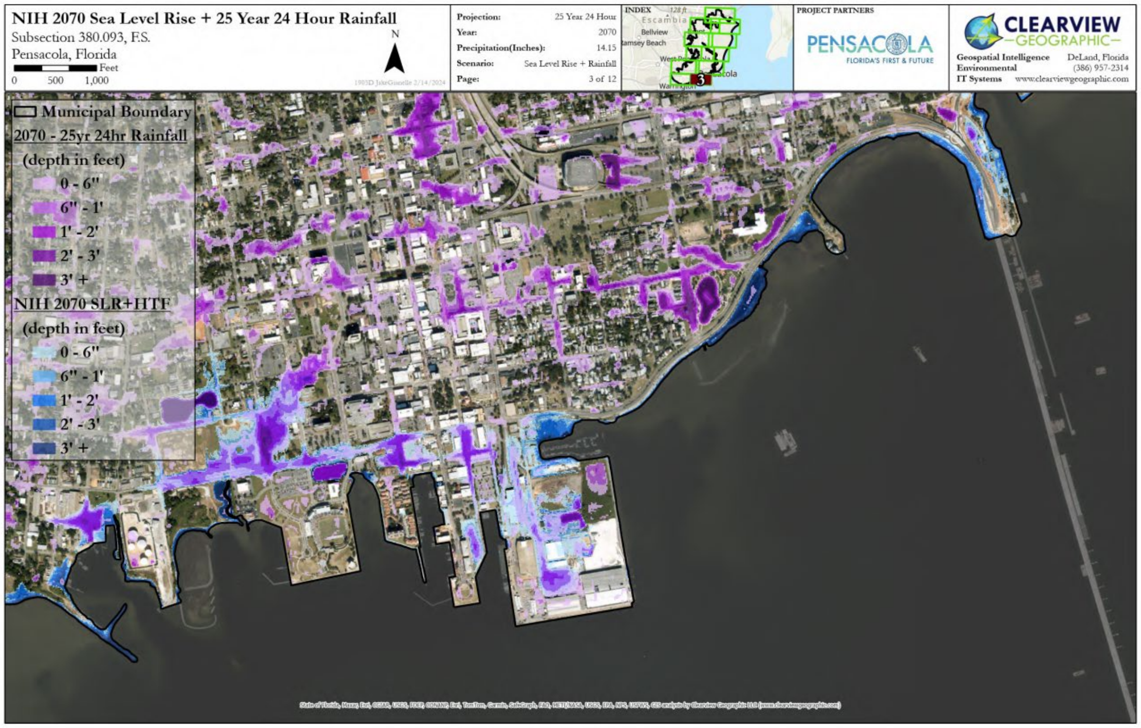
Figure 46 - 100-Year 24-Hour Rainfall - Present Day



Future Rainfall-Induced Flooding

These baseline depth grids are then adjusted by the sea level rise projection data based on NOAA's Intermediate Low and Intermediate High projections for the respective timeframes and rainfall precipitation by the DoD's published change factors. These predict approximately 1.12 times more rain in 2040 than present day conditions, 1.22 times more rain in 2070, and 1.34 times more rain in 2100. It should be noted that coastal communities are not required to include rainfall-induced flooding in their vulnerability assessments per Section 380.093(3), F.S. However, non-coastal communities must perform a rainfall-induced flooding assessment. Since Pensacola has tidally connected non-coastal areas, the rainfall-induced flooding analysis is included to provide a comprehensive VA over the entire area.

Figure 47 - NIH 2070 SLR + 25-Year 24-Hour Rainfall



Adjusted 25-Year and 100-Year 24-Hour Scenarios

Recognizing the influence of climate change on weather patterns, the assessment includes adjusted scenarios for the 25-year and 100-year events. These adjusted models take into account the anticipated increase in rainfall intensity and frequency, offering a forward-looking perspective on flood risks. By integrating climate change projections, these scenarios provide a more accurate reflection of future flood hazards, guiding the development of adaptive infrastructure and policies that are resilient to changing climatic conditions.

Together, these rainfall-induced flooding scenarios form a critical component of Pensacola's comprehensive flood risk assessment. By encompassing a broad range of event frequencies and intensities, the analysis equips city planners, policymakers, and community leaders with the data necessary to make informed decisions about flood mitigation, emergency preparedness, and climate adaptation strategies. The detailed examination of both standard and adjusted scenarios ensures that the city's resilience planning remains dynamic and responsive to both current and future flood risks, safeguarding the well-being of the community and the sustainability of its development in the face of increasing rainfall events.

Compound Modeling

The compound modeling section of the Vulnerability Assessment focuses on assessing the combined impacts of various flooding scenarios. This includes high tide flooding, storm surge, and rainfall-induced flooding. The methodology involves overlaying depth grids from each scenario to identify compounded flood heights at a well-defined scale. The approach is designed to provide a comprehensive understanding of the potential cumulative impacts of different flooding events simultaneously occurring, aiding in effective planning and mitigation strategies. This planning process, however, does not simulate the hydrologic interactions between these events or the stormwater management system's response. This could be done with a more complex engineering-based model.

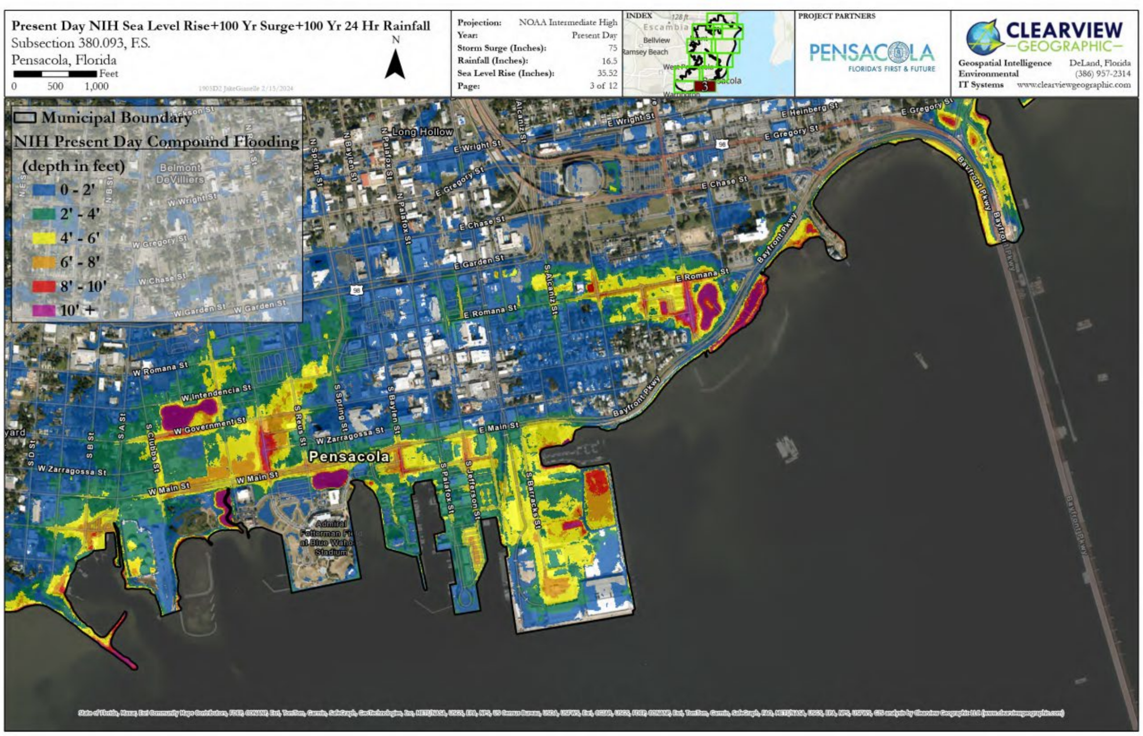
Sea level rise inundation modifies the "coastline," representing an approximate new coastal boundary under mean higher high water (MHHW) or the highest high tide of the day. Stormwater structures along coastal waters, inundated by sea level rise are expected to no longer function and exacerbate flooding. Surge impacts are large but temporary in nature, caused by the force of storm pushing water onto the terrain.

Table 14 - NOAA Intermediate Low and High Combined Flood Scenario Water Rise Impacts

Sea Level Rise Scenario	Surge Scenario	Rainfall Scenario	Combined Water Rise (ft)
NIL Present Day	100-Year	25-Year 24-Hour	10.13
NIL Present Day	100-Year	100-Year 24-Hour	10.53
NIL Present Day	500-Year	25-Year 24-Hour	11.68
NIL Present Day	500-Year	100-Year 24-Hour	12.12
NIH Present Day	100-Year	25-Year 24-Hour	10.19
NIH Present Day	100-Year	100-Year 24-Hour	10.59
NIH Present Day	500-Year	25-Year 24-Hour	11.95
NIH Present Day	500-Year	100-Year 24-Hour	12.35
NIL 2040	100-Year	25-Year 24-Hour	11.20
NIL 2040	100-Year	100-Year 24-Hour	11.68
NIL 2040	500-Year	25-Year 24-Hour	12.79
NIL 2040	500-Year	100-Year 24-Hour	13.27
NIH 2040	100-Year	25-Year 24-Hour	12.26
NIH 2040	100-Year	100-Year 24-Hour	12.74
NIH 2040	500-Year	25-Year 24-Hour	14.02
NIH 2040	500-Year	100-Year 24-Hour	14.50
NIL 2070	100-Year	25-Year 24-Hour	12.31
NIL 2070	100-Year	100-Year 24-Hour	12.82

Sea Level Rise Scenario	Surge Scenario	Rainfall Scenario	Combined Water Rise (ft)
NIL 2070	500-Year	25-Year 24-Hour	13.90
NIL 2070	500-Year	100-Year 24-Hour	14.41
NIH 2070	100-Year	25-Year 24-Hour	16.03
NIH 2070	100-Year	100-Year 24-Hour	16.54
NIH 2070	500-Year	25-Year 24-Hour	17.79
NIH 2070	500-Year	100-Year 24-Hour	18.30
NIL 2100	100-Year	25-Year 24-Hour	13.33
NIL 2100	100-Year	100-Year 24-Hour	13.89
NIL 2100	500-Year	25-Year 24-Hour	14.92
NIL 2100	500-Year	100-Year 24-Hour	15.48
NIH 2100	100-Year	25-Year 24-Hour	21.53
NIH 2100	100-Year	100-Year 24-Hour	22.09
NIH 2100	500-Year	25-Year 24-Hour	23.29
NIH 2100	500-Year	100-Year 24-Hour	23.85

Figure 48 - Present Day SLR + 100-Year Storm Surge + 25-Year Rainfall



Sea Level Rise + 100-Year Storm Surge with 25-Year + 100-Year Rainfall Scenarios

This scenario amalgamates the risks of significant sea level rise, a century-scale storm surge, and both moderate and severe rainfall events, offering a detailed perspective on flooding risks over a broad spectrum of frequencies and intensities.

Sea Level Rise + 500-Year Storm Surge with 25-Year + 100-Year Rainfall Scenarios

By considering a more extreme storm surge event alongside the same rainfall probabilities within the context of rising sea levels, this scenario highlights the utmost extents of potential flooding impacts, emphasizing the critical need for robust resilience planning.

Sea Level Rise with 100-Year + 500-Year Storm Surge Scenarios

This scenario focuses on the compounded effects of sea level rise and both the 100-year and 500-year storm surge events, providing a stark overview of the most extreme surge events' potential amplification due to rising sea levels.

Sensitivity: Ranked Prioritization in Hot Spots

The sensitivity analysis helps prioritize resilience adaptation efforts based on how the various sea level rise projections affect critical assets within key geographic areas in the City of Pensacola. The assessment should be utilized to guide land use regulations, building codes, land development policies, emergency response strategies and inform various justice, equity, diversity and inclusion (JEDI) initiatives[15] that are associated with climate resilience adaptation planning.

The information provided by this assessment allows decision makers to implement measures that reduce vulnerability and mitigate future harms in a staged manner. The vulnerability assessment also aims to facilitate collaboration between communities surrounding the long-term goals of sustainable coastal management and environmental conservation. Regions that are highly exposed to multiple flood scenarios are identified as a flooding “hot spot” area. These hot spots contain a mix of government facilities, commerce areas, critical transportation hubs, and residential neighborhoods where there is a high concentration of publicly owned assets. By mapping these hot spots and prioritizing the assets within them, resources can be focused where multiple risks intersect, identifying a highly vulnerable asset creating an adaptation plan that is both prioritized by geographic area and immediate need.

Ranked Flood Exposure Tiers

To add context to the flood exposure analysis, the team developed the following table

[15] https://www.cdc.gov/climateandhealth/JEDI.htm

in tandem with city officials. It defines the flood thresholds used to assign no, low, medium, high, and very high flood exposure levels based on the GIS modeling.

Table 15 - Exposure Descriptions

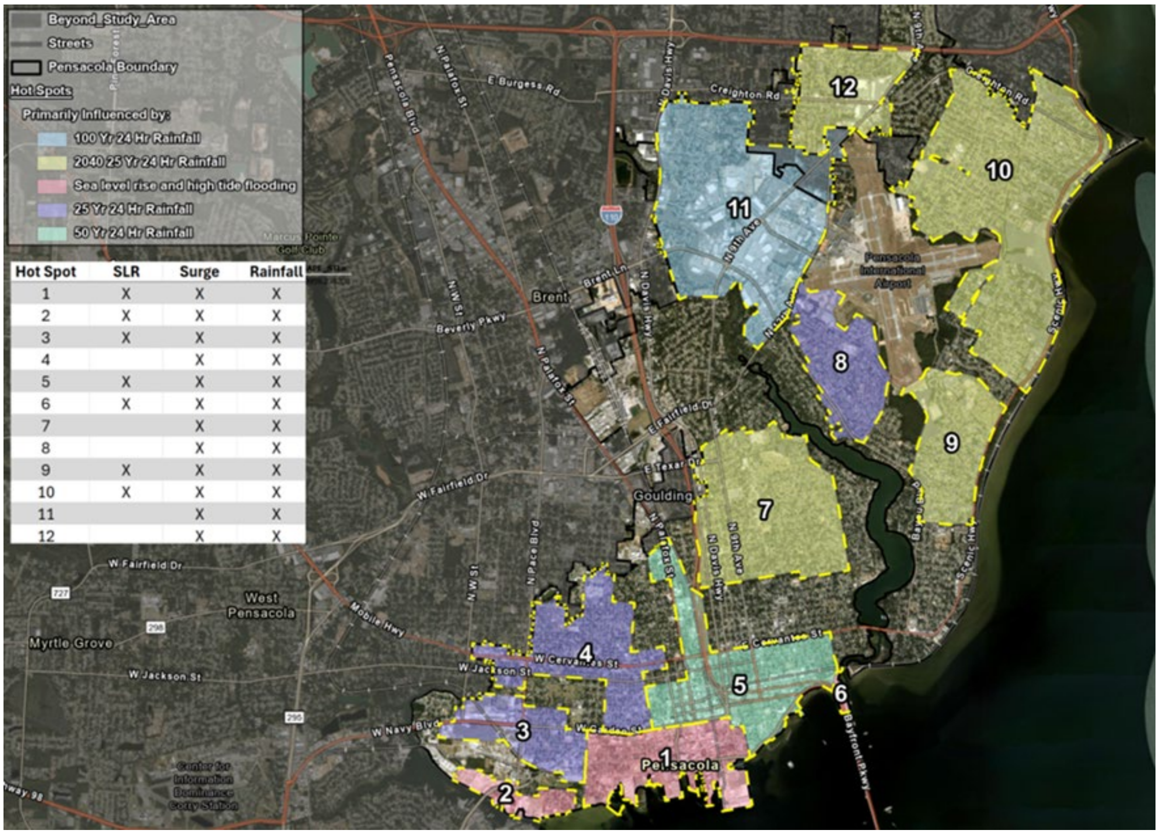
Flood Depth	Exposure Ranking	Description
0 feet	No Exposure	No flooding detected. Areas with no impact from sea level rise or flooding.
0 to 0.5 feet	Low Exposure	Minor flooding. Shallow inundation typically causing minimal impact.
0.5 feet to 1.0 foot	Medium Exposure	Moderate flooding. Likely to impact structures and disrupt daily life.
1.0 foot to 3.0 feet	High Exposure	Significant flooding. Serious degree of inundation causing damage and major disruptions.
More than 3.0 feet	Very High Exposure	Severe flooding. Extensive inundation posing critical threats and causing extensive damage.

Table 15 above outlines Pensacola's determined exposure levels for this project. These ranking levels serve as a crucial foundation for the risk assessment, enabling evaluation of the potential consequences of rising sea levels and overall flooding impact in Pensacola's specific context.

Identifying High-Risk Areas with Hot Spots

Identification of high-risk areas and assets is a cornerstone of this vulnerability assessment. Based on modeling and the concentration of critical assets, high-risk areas within Pensacola have been identified, as reflected in Figure 49, Hot Spot Map of Pensacola. This map series reflects the areas where 1) there are aggregations of critical assets that are 2) subject to some level or multiple levels of flood risk. The map is color coded to reflect the type of flood risk and the approximate year that area will be impacted by that flood risk. A summary table is embedded that shows each hot spot breakdown and which flood scenarios impact that hot spot. The hot spots are numbered according to their priority of impact based on need and geography as defined in FDEP's Vulnerability Assessment Checklist and by statute.

Figure 49 - Hot Spot Map of Pensacola



Hot Spot	SLR	Surge	Rainfall
1	X	X	X
2	X	X	X
3	X	X	X
4		X	X
5	X	X	X
6	X	X	X
7		X	X
8		X	X
9	X	X	X
10	X	X	X
11		X	X
12		X	X

Modeling Impact to Assets

Within the highest risk areas, quantitative analysis was performed on the critical assets to assign the flood depths derived from the exposure modeling directly to the assets within the underlying data tables. This impact modeling contributes directly to the method of prioritization discussed later in this section and aligns with FDEP Vulnerability Assessment Checklist criteria and the methodologies outlined in the assessment framework, ensuring a meticulous and precise identification process for asset risk and enables the identification of specific flood scenarios each asset is impacted by.

Prioritizing Based on Flood Risk

Assets are ranked based on their Flood Risk Index scores, with a tiered system identifying those at highest risk. This prioritization informs resource allocation and intervention strategies by delineating areas of high vulnerability where adaptation strategies can be the most impactful.

Table 16 - Flood Risk Metric Weighting

Metric	Weight
Rain and Sea Level Rise Combo	0.35
Sea Level Rise Impact	0.25
Rain, Sea Level Rise and Storm Surge	0.15
Number of Times Asset is Exposed	0.10
Average Flood Depth	0.10
Average Flood Depth Percentile Rank	0.05
Total	**1.00**

Employing the index described above, the hot spot prioritization analysis assigned a priority 1 through 5, or not prioritized, ranking based on the indexed score. Table 17 provides the index thresholds used to assign the priorities.

Table 17 - Flood Risk Index Scores and Prioritization

Flood Risk Index Score Threshold	Assigned Priority
Top 5% Highest Values	1
5-10%	2
10-15%	3
15-25%	4
25-50%	5
Below 50%/Median Value - Not Prioritized	0

These derived outputs, together, provide the prioritized asset inventory when linked back to the critical asset inventory and the assets unique identifier.

To carry the prioritization process into the various high-risk areas and provide numerical calculations that harmonize various Resilient Florida Grant criteria, the analysis results were then re-ordered by the overall risk determination, assigned based on percentages of land area inundated and the number of critical assets affected in the identified hot spots, as described in Table 18 below.

Table 18 - Hot Spot Risk Assessment Criteria

Overall Risk Assessment	Land Area Inundated (% of Census Tract or Neighborhood)	Critical Assets Affected (% of Total Assets or Within Each Asset Category)
None	0%	0%
Low	Less than 25%	Less than 25%
Medium	25-50%	25-50%
High	50-75%	50-75%
Very High	More than 75%	More than 75%

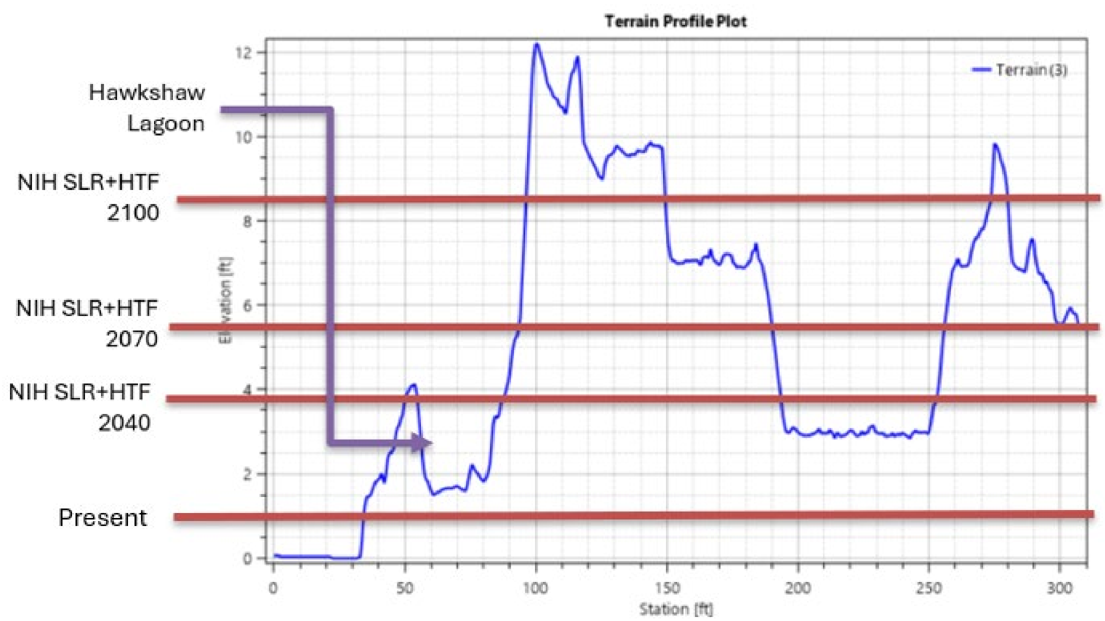
Results and Analysis

This vulnerability assessment extends beyond numerical projections and embraces the intricacies of Pensacola's unique physical landscape. Guided by the FDEP Vulnerability Assessment Checklist, this comprehensive vulnerability assessment considers specific data related to Pensacola and its critical assets. Pensacola's geographical location along the Gulf of Mexico makes it particularly susceptible to a range of climate-related hazards.

Flood Vulnerability

The elevation profile provided below is of Veterans Memorial Park within Pensacola and is designed to assist with the visualization process in applying critical elevations to coastal planning. This profile is an essential tool for understanding the varying heights and depths that characterize coastal landscapes, offering insights into how different elevations can impact both natural and built environments. By examining these profiles, planners and developers can make informed decisions about where and how to construct infrastructure, considering factors such as flood risk, sea level rise, and coastal erosion. The goal is to promote resilient coastal development that accounts for the unique challenges posed by critical elevations, ensuring that communities are better prepared to face the impacts of climate change and protect valuable ecosystems.

Figure 50 - Veterans Memorial Park Shoreline Profile



The analysis described above was applied to the land area within Pensacola utilizing the sea level rise and high tide flooding thresholds and the elevation at which the tides for the given year are anticipated to be at for at least 90 days throughout the planning horizons to determine the acres of landward inundation that Pensacola is expected to experience based on future sea level rise projections.

Table 19 - Area of Inundation

Based on SLR and Tide Extent 90 Days of Year

Projection	NIL SLR + High Tide Flooding (in acres)	NIL 90 days	NIH SLR + HTF	NIH 90 Days

2040	111.28	30.84	140.62	59.97
2070	94.75	56.03	318.05	147.00
2100	155.20	86.84	706.15	500.89

Sea Level Rise (SLR) and High Tide Flooding (HTF) in Table 19 above are both terms used in the context of climate change and its impact on coastal and low-lying areas. However, they refer to slightly different phenomena:

- **Sea Level Rise (SLR)** is a gradual increase in the average level of the world's oceans. It is caused by factors such as the melting of ice sheets and glaciers, and the thermal expansion of seawater as it warms. SLR is a long-term change that occurs over years and decades, contributing to the permanent alteration of coastal landscapes. It can exacerbate coastal erosion, increase the risk of coastal flooding, and lead to the loss of habitat for plants, animals, and even humans.

- **High Tide Flooding (HTF)**, sometimes referred to as "nuisance flooding" or "sunny day flooding," occurs when tides reach two feet above the mean higher high water via FDEP Threshold and begin to flood onto streets or flood areas that are historically dry. It is more immediate and often associated with specific high tide events that can cause flooding in coastal areas even in the absence of storms or rainfall. HTF is becoming more frequent in many areas as sea levels rise and can disrupt daily life by flooding roads, overwhelming drainage systems, and damaging property.

- **90 Days of Tidal Inundation** refers to a specific metric used to assess the impact of SLR and HTF, indicating the number of days within a given year when tidal levels exceed a certain threshold, leading to flooding conditions. This metric is useful for understanding how often an area might experience tidal flooding under current and future sea level conditions. It helps in planning and preparing for increased flooding events, identifying vulnerable infrastructure, and implementing adaptation strategies.

In summary, SLR is about the long-term increase in sea levels affecting coastlines and oceans globally, while HTF deals with the more immediate effects of unusually high tides leading to flooding. The 90 days of tidal inundation metric helps quantify the extent and frequency of HTF and its potential increase due to SLR, providing crucial data for resilience planning and mitigation efforts.

Critical and Prioritized Assets in Flooding Hot Spots

By identifying various hot spots of vulnerability, each with unique assets and inherent risks, the assessment embarks on a critical mission to prioritize actions and strategies for bolstering collective resilience. Through this lens, the exploration covers four critical domains: transportation infrastructure, critical infrastructure, critical community and emergency facilities, and the preservation of natural, cultural, and historical resources. This section critically examines Pensacola's key infrastructures and services, vital for the city's functionality, and their susceptibility to flood-related vulnerabilities. It provides an in-depth analysis of the vulnerabilities of essential assets, forming a core part of the broader climate change vulnerability assessment. The findings here are crucial for guiding effective mitigation and adaptation strategies, enhancing Pensacola's resilience and sustainability. Each section describes the types of assets that can be found within the various flooding hot spots. This does not include every asset evaluated, only those found within the hot spots.

Within these high-risk areas, further in-depth analysis of the assets was conducted to determine their potential impacts and prioritize them within the identified hotspots. This approach aligns with DEP Checklist criteria and methodologies outlined in the assessment framework, ensuring a meticulous and precise identification process. This comprehensive approach guarantees the accurate identification of the most vulnerable areas and assets in Pensacola, providing a robust foundation for the development of targeted mitigation and adaptation strategies.

In addressing the critical and prioritized assets within flooding hot spots in Pensacola, as identified in collaboration with Jeffrey Needle, PE of Climate Resilience Engineering Design Inc (CRED), the nuanced vulnerabilities and strategic recommendations for each key domain are explored. This collaborative effort is aimed at enhancing the city's resilience against flood-related risks by pinpointing and prioritizing interventions for the most vulnerable infrastructures and services. The discussions below explore each domain, outline the critical assets impacted, and recommend project interventions developed during this project.

1. Transportation Infrastructure

Assets Impacted:

- Bridges and culverts that are crucial for maintaining the city's connectivity but are at risk of being compromised during flooding events.
- Roadways, particularly those that serve as primary evacuation routes or

critical access points to essential services.

Recommendations:

- **Elevate and Reinforce Bridges**: Increase the height and structural integrity of bridges and culverts to withstand floodwaters and prevent collapse or blockage.
- **Improve Drainage Systems**: Enhance road drainage systems to manage runoff more effectively, reducing the risk of flooding on major roadways.
- **Create Elevated Pathways**: Develop elevated pathways for critical evacuation routes to ensure they remain passable during flood events.

2. Critical Infrastructure

Assets Impacted:

- Water treatment facilities and sewage systems that are essential for public health but can be overwhelmed by floodwaters, leading to contamination and service disruptions.
- Electrical substations and distribution networks that risk damage from flooding, causing widespread power outages.

Recommendations:

- **Flood-proofing Utilities**: Implement flood-proofing measures at water and sewage treatment plants, including barriers and elevated structures.
- **Secure and Elevate Electrical Infrastructure**: Elevate substations and waterproof critical components of the electrical distribution network to ensure continuity of service during floods.

3. Critical Community and Emergency Facilities

Assets Impacted:

- Hospitals and healthcare facilities that must remain operational to provide emergency services during disaster situations.
- Emergency response facilities, including fire stations and police departments, that are crucial for disaster response and recovery efforts.

Recommendations:

- **Hardening of Facilities**: Strengthen the infrastructure of hospitals and emergency facilities to ensure they can withstand flood events.

- **Emergency Power Solutions**: Equip critical facilities with reliable emergency power sources, such as generators, to maintain operations during power outages.
- **Flood Response Planning**: Develop and implement comprehensive flood response plans that include evacuation strategies and service continuity protocols for these facilities.

4. Preservation of Natural, Cultural, and Historical Resources

Assets Impacted:

- Parks and natural habitats that play a vital role in the city's ecological balance but are susceptible to damage from flooding.
- Cultural and historical sites that are irreplaceable parts of the city's heritage and may be vulnerable to floodwaters.

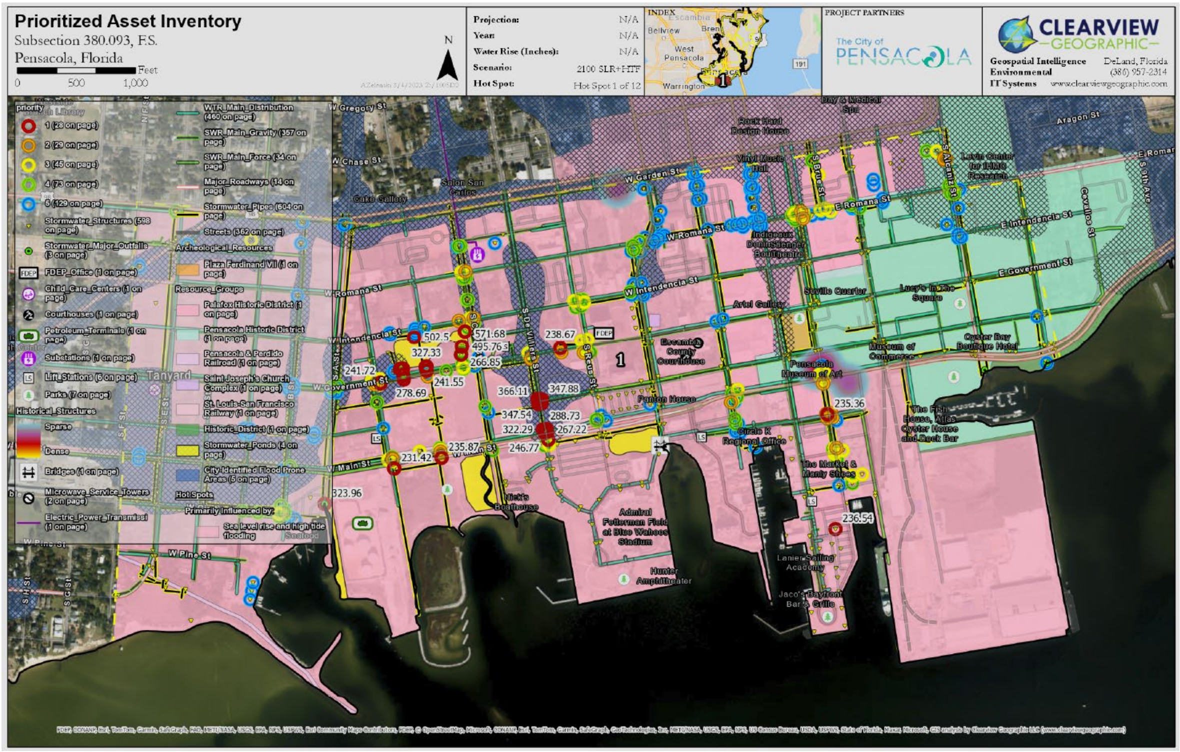
Recommendations:

- **Protective Landscaping**: Utilize natural and engineered landscaping techniques to protect parks and natural habitats from erosion and flooding.
- **Elevation and Barriers for Cultural Sites**: Elevate structures and install barriers around cultural and historical sites to protect them from flood damage.
- **Community Engagement and Education**: Engage the community in preservation efforts and educate on the importance of protecting these resources against flood risks.

The collaboration with Jeffrey Needle, PE, and the comprehensive assessment of Pensacola's flooding hot spots and assets impacted within each hot spot highlight the importance of a targeted approach to infrastructure resilience. By prioritizing interventions within these critical domains, Pensacola can enhance its preparedness for flood events, safeguard its essential services and cultural heritage, and build a more resilient community in the face of climate change.

Hot Spot 1

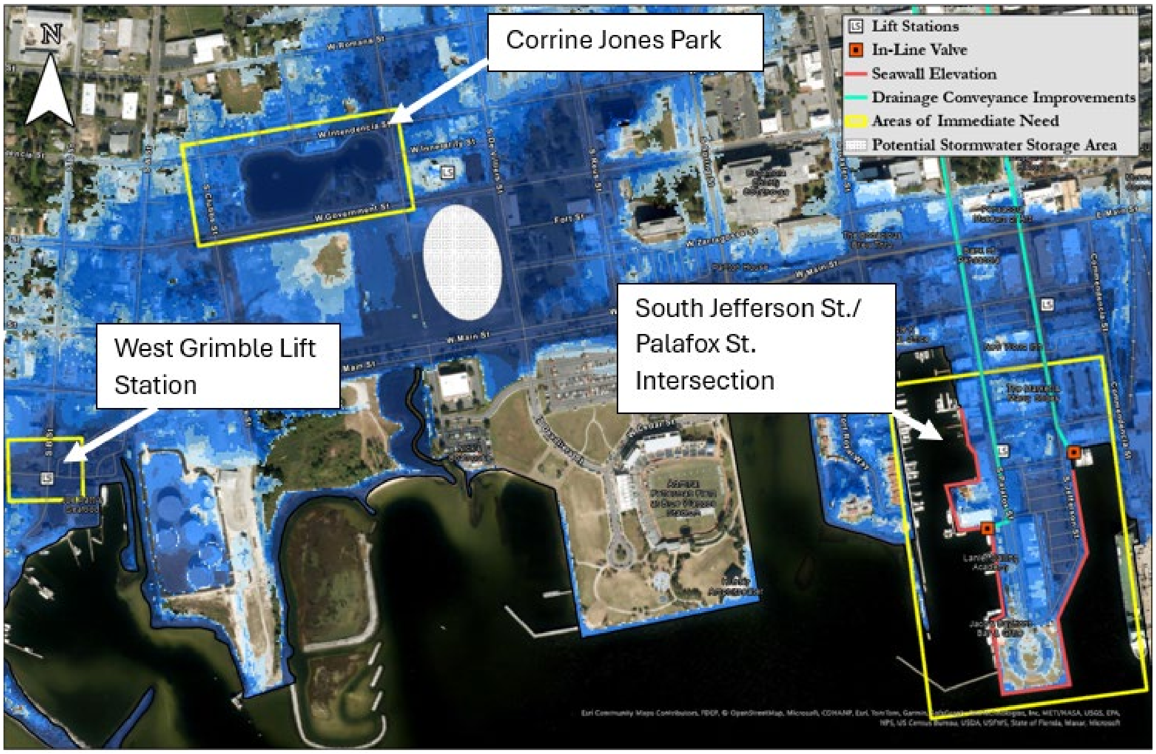
Figure 51 - Prioritized Assets in Hot Spot 1



Port of Pensacola and surrounding industrial and commercial area. Based on data collected from the City of Pensacola, this area is prone to stormwater flooding and based on future sea level rise projections this area will experience intense tidal inundation by 2100. It will also be subject to intermittent surge and tidal flooding impacts over time based on event conditions. This area encompasses multiple critical infrastructure assets such as a port facility, a petroleum terminal, roads, lift stations, and other stormwater structures, as well as critical community, historical, and natural assets such as local government facilities, historic structures, and parks.

Appendix G contains the list of prioritized critical assets within this hotspot.

Figure 52 - Hot Spot 1: Conceptual Improvement Sites



West Gimble Street Lift Station

- **Hardening**: Consider hardening the lift station or raising it above the flood elevation grade. Should consider detailed hydrologic and hydraulic modeling.

South Jefferson St. / Palafox St. Intersection

- **Tailwater Elevation Management:** Adjust tailwater elevations to reflect expected sea-level rise, ensuring that any enhancements to stormwater infrastructure such as increased pipe capacity are effective under future conditions.

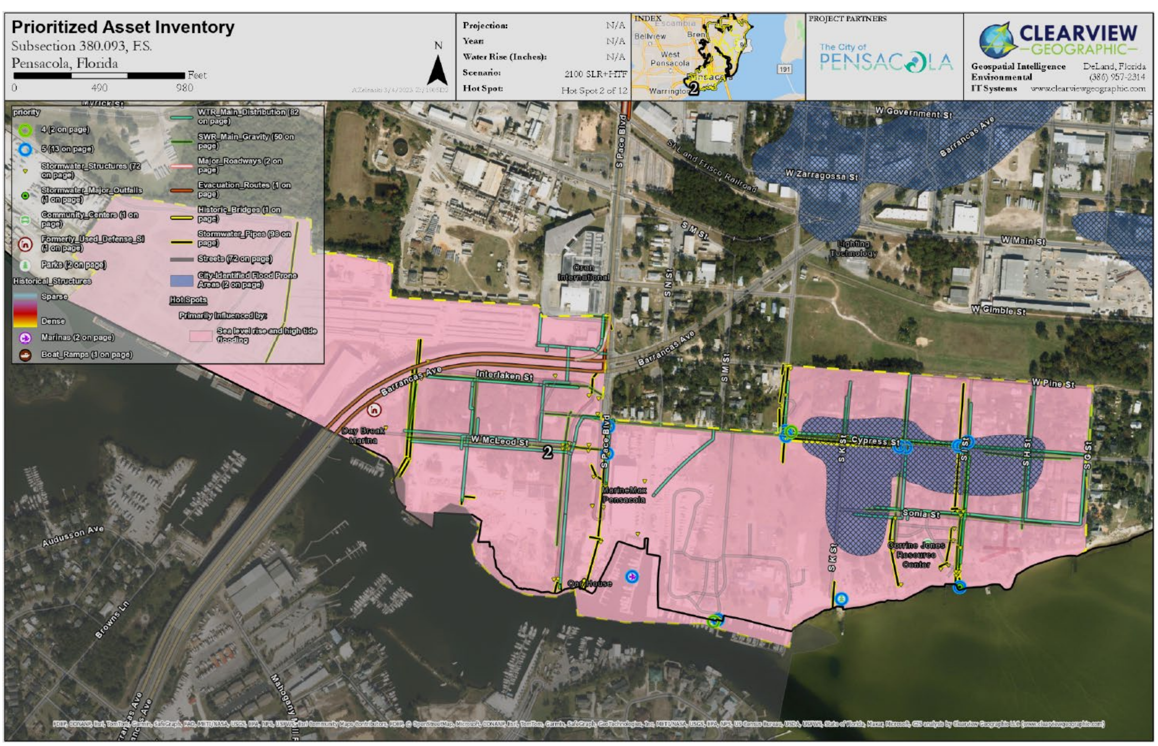
- **Seawall and Terrain Elevation Strategy:** Consider a dual approach that not only proposes increasing the height of the seawall to combat storm surge and sea-level rise but also evaluates the elevation of the land immediately behind the seawall. This holistic perspective aims to prevent water retention due to sheet flow blockages and ensure effective water egress into the Bay.

Corrine Jones Park Improvements

- **Stormwater Storage Expansion:** Increase the capacity of the Government Street Regional Stormwater Pond to handle larger volumes of runoff, thereby reducing the risk of overflow and flooding.
- **Elevation and Reinforcement of Infrastructure:** Assess and potentially raise the elevation of existing stormwater structures, such as inlets and pipes, to accommodate projected increases in flood depths and enhance their resilience against sea-level rise.
- **Sediment Control Measures:** Implement sediment capture and removal strategies, including dredging of the pond and installing sediment traps or silt screens, to ensure that waterways remain clear, and the efficiency of the stormwater system is not compromised.
- **Enhanced Drainage/Green Infrastructure Systems:** Introduce drainage solutions, such as bioswales, permeable pavements, additional green spaces or rain gardens in and around the park to improve infiltration and reduce surface runoff.

Hot Spot 2

Figure 53 - Prioritized Assets in Hot Spot 2

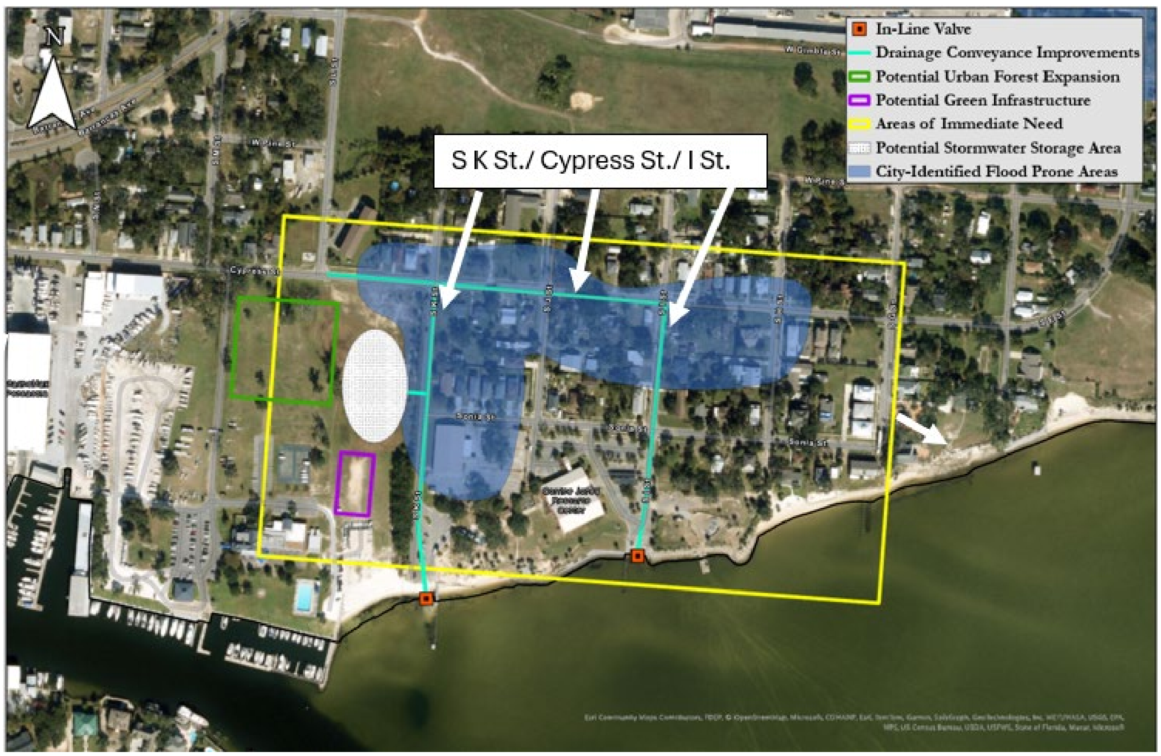


West of the Port of Pensacola industrial and residential area. Based on data collected from the City of Pensacola the residential area encompassed within this area is prone to stormwater flooding and based on future sea level rise projections both the residential and industrial area will be moderately impacted by tidal inundation by 2100. It will also be subject to intermittent surge and tidal flooding impacts over time based on event conditions. This hot spot encompasses City-identified assets such as marinas, parks, roads, water conveyance systems, and a community center.

Appendix G contains the list of prioritized critical assets within this hotspot.

Project Recommendations

Figure 54: Hot Spot 2: Conceptual Improvement Sites

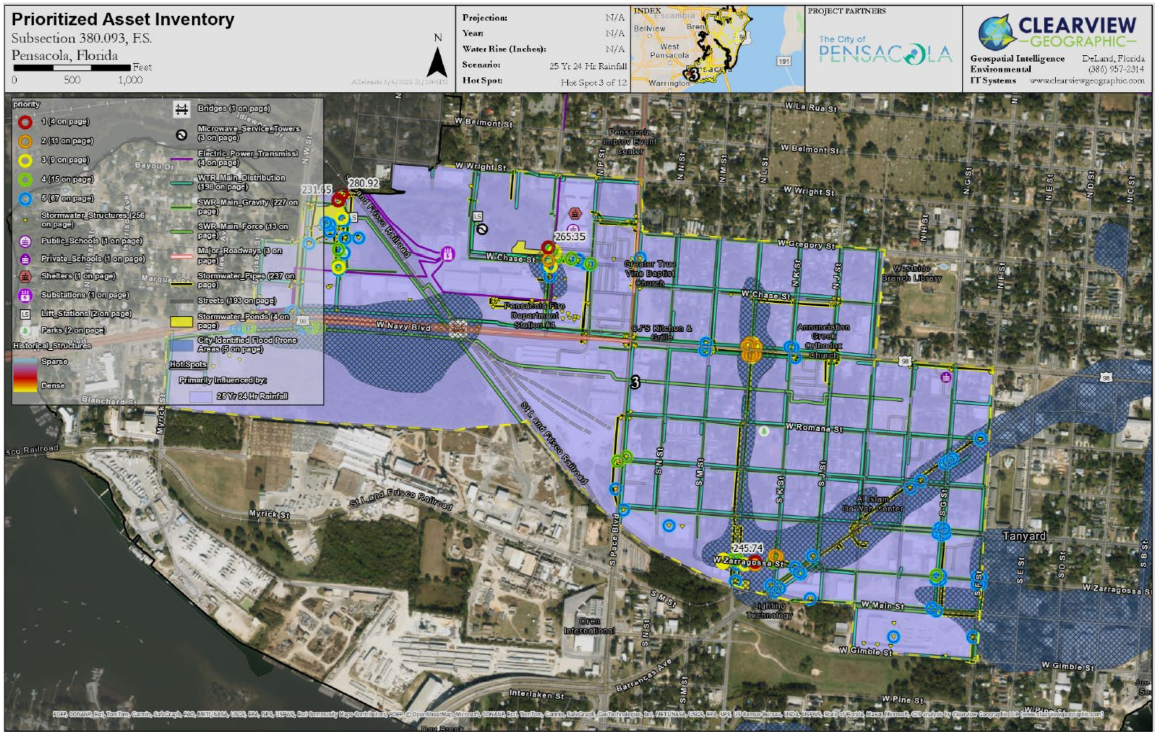


S K Street/Cypress St/I ST Drainage

- **Green Infrastructure:** Utilize natural vegetation and permeable materials to manage stormwater, reduce runoff, and increase groundwater recharge.
- **Urban Forest Expansion:** Plant and maintain diverse tree species to improve air quality, provide shade, and reduce the urban heat island effect.

Hot Spot 3

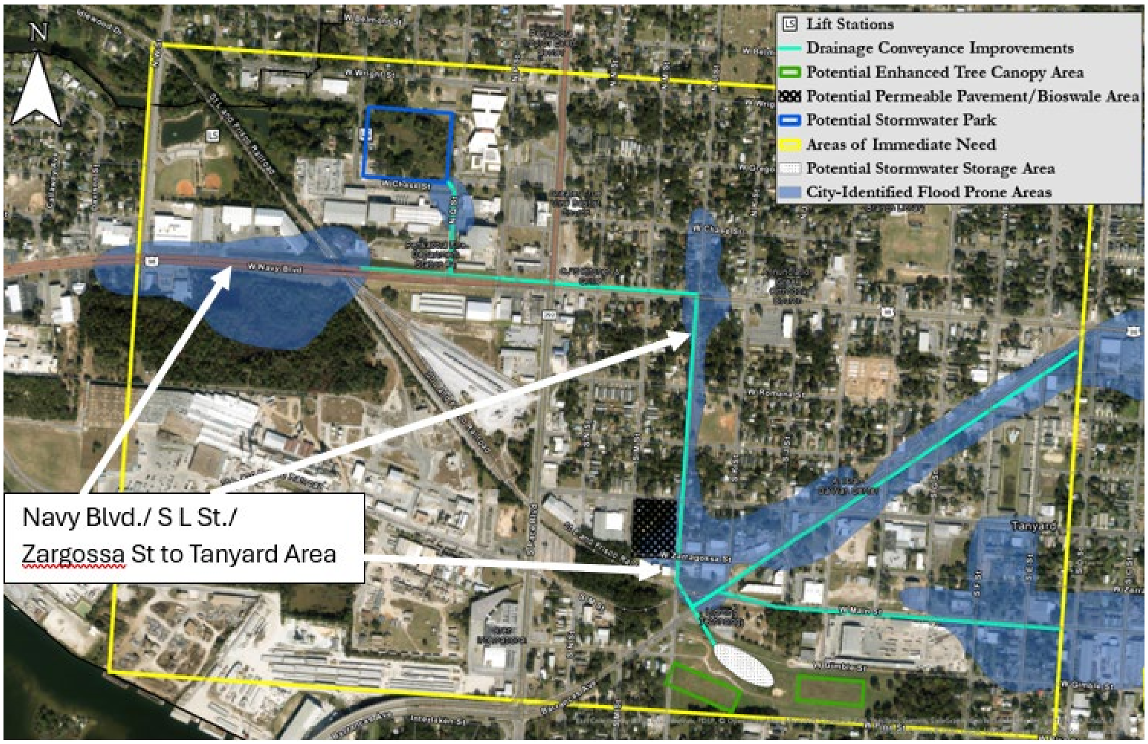
Figure 55 - Prioritized Assets in Hot Spot 3



West Navy Boulevard industrial and residential area. Based on data collected from the City of Pensacola this area is prone to stormwater flooding and based on rainfall projections this area moderate levels of flooding during a 25-year rainfall event. This hot spot encompasses City-identified assets such as a fire station, local government facility, school/risk shelter, and parks as well as stormwater drainage structures and other water conveyance structures.

Appendix G contains the list of prioritized critical assets within this hotspot.

Figure 56: Hot Spot 3: Conceptual Improvement Sites

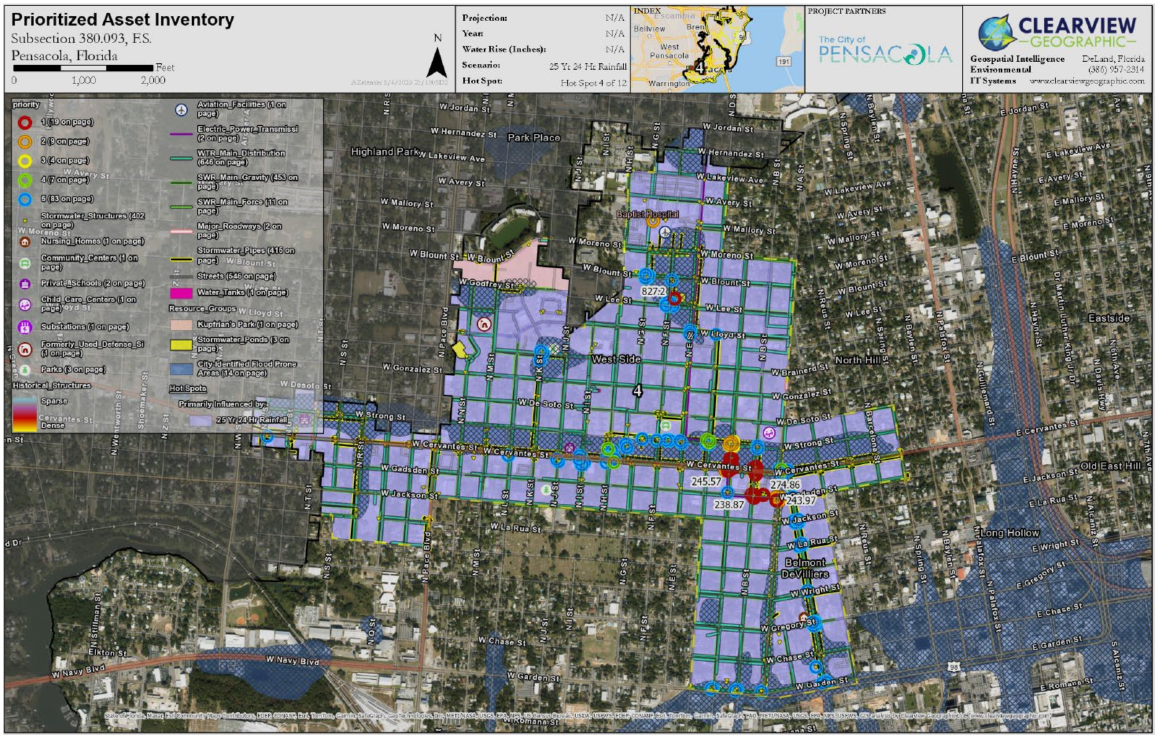


Navy Blvd/ S L St/ Zargossa St to Tanyard Area Wide Improvements

- **Permeable Paving:** Employ permeable paving materials in parking lots and sidewalks to allow for natural water infiltration and reduce surface runoff.
- **Bioswales and Rain Gardens:** Integrate these in green spaces to enhance stormwater filtration and groundwater recharge, reducing runoff and improving water quality.
- **Enhanced Tree Canopy:** Expand the tree canopy along streets and in public spaces to provide shade, reduce the urban heat island effect, and absorb excess rainfall.
- **Stormwater Parks:** Develop multi-use spaces that function both as recreational areas and flood mitigation zones, capable of storing large volumes of water during heavy rainfall events.

Hot Spot 4

Figure 57 - Prioritized Assets in Hot Spot 4

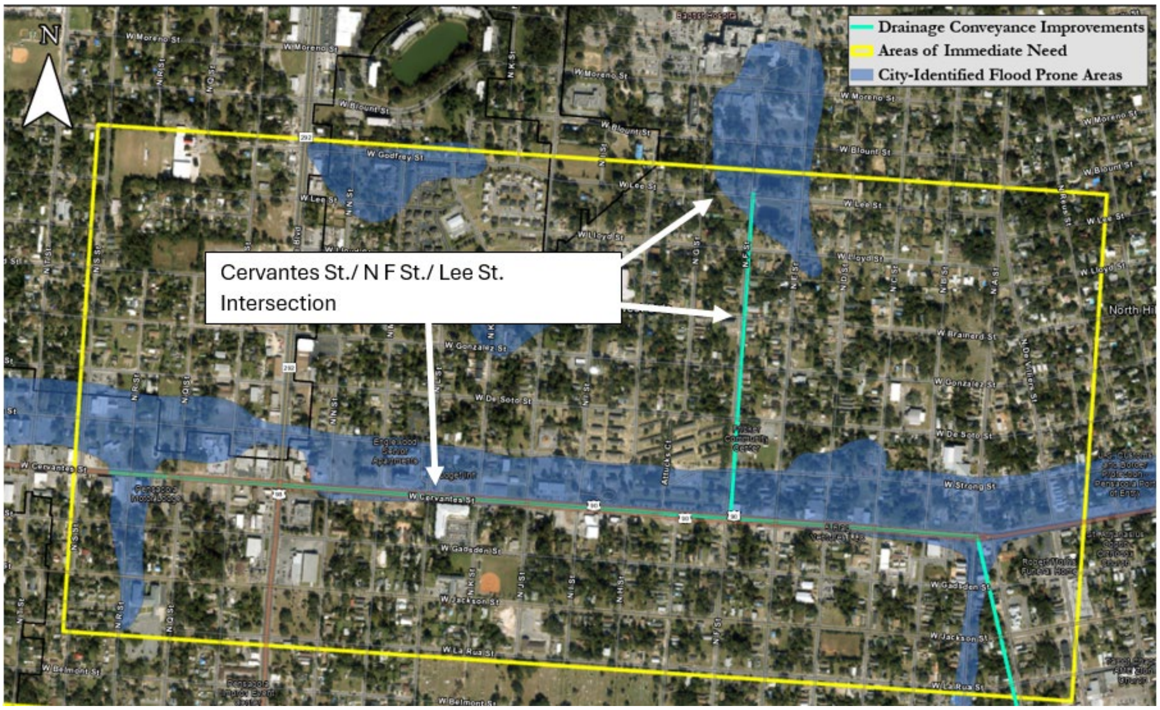


Baptist Hospital and residential area to the south. Based on data collected from the City of Pensacola this area is prone to stormwater flooding and based on rainfall projections this area moderate levels of flooding during a 25-year rainfall event. This hot spot encompasses City-identified assets such as local government facilities, a hospital, community centers, parks, schools, roads, stormwater drainage structures and other water conveyance systems, and portions of the Belmont De Villers neighborhood and North Hill Preservation District.

Appendix G contains the list of prioritized critical assets within this hotspot.

Project Recommendations

Figure 58 - Hot Spot 4: Conceptual Improvement Sites

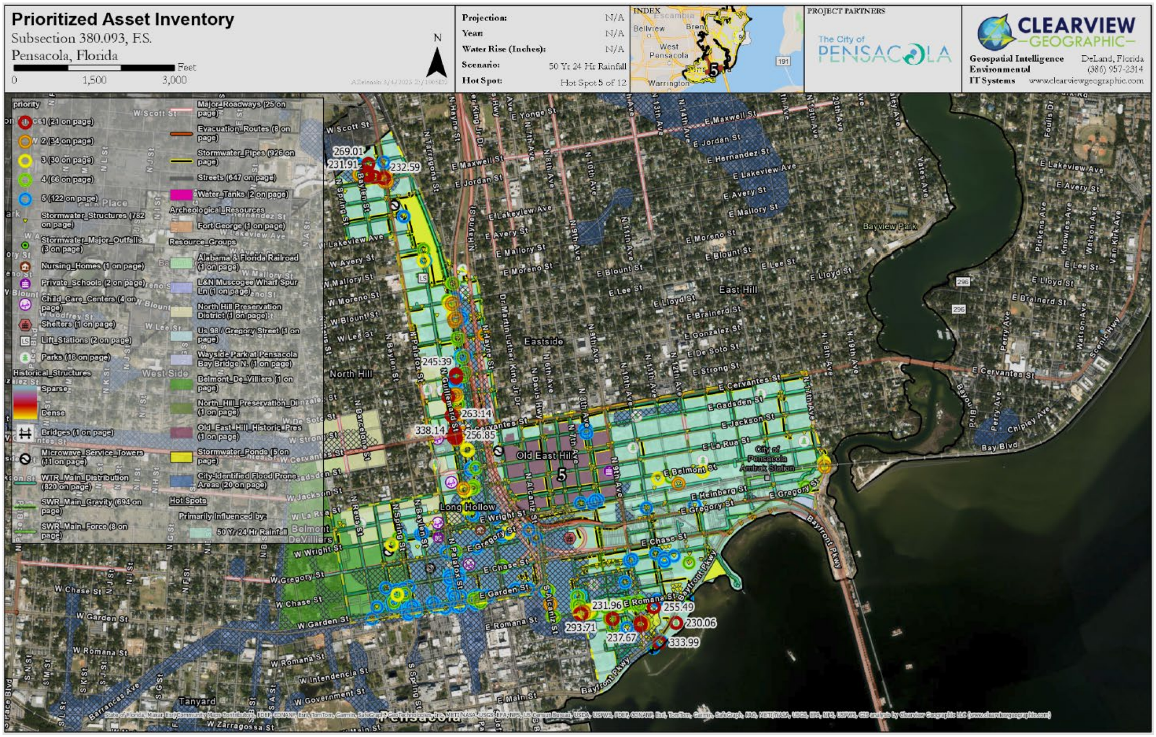


Cervantes St and N F St/Lee St Intersection

- **Critical Infrastructure Elevation:** Elevate essential services and infrastructure to prevent disruption during floods.

Hot Spot 5

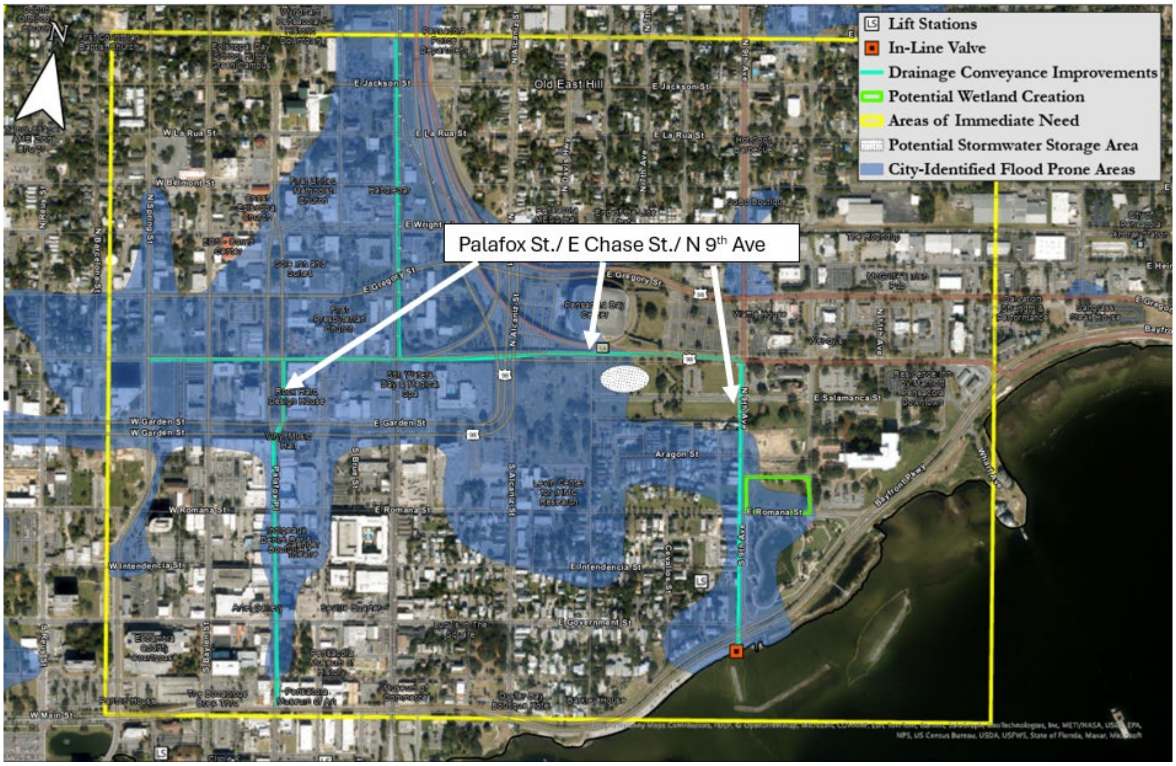
Figure 59 - Prioritized Assets in Hot Spot 5



Old East Hill and surrounding residential and commercial areas. Based on data collected from the City of Pensacola and rainfall projections this area is prone to stormwater flooding and is likely to experience flooding during a 25-year rainfall event especially along Interstate 110. This hot spot encompasses Pensacola-identified assets such as parks, schools and childcare centers, local law enforcement, the Pensacola Bay risk shelter, water conveyance system and lift stations, stormwater drainage structures, roads, and historic neighborhoods such as the Old East Hill District and portions of the North Hill Preservation District.

Appendix G contains the list of prioritized critical assets within this hotspot.

Figure 60 - Hot Spot 5: Conceptual Improvement Sites



Palafox St to N 9th Ave/Coastal Drainage Pathway

- **Wetland Creation and Restoration:** Develop new or restore existing wetlands along coastline and divert flood waters to this area to naturally mitigate flooding and provide habitat for wildlife.

- **Floodable Open Spaces:** Design open spaces that can safely flood and contain excess water during peak rainfall, reducing pressure on urban drainage systems.

- **Erosion Control Measures:** Integrate natural and engineered solutions to stabilize soil and prevent erosion along waterways and in flood-prone areas.

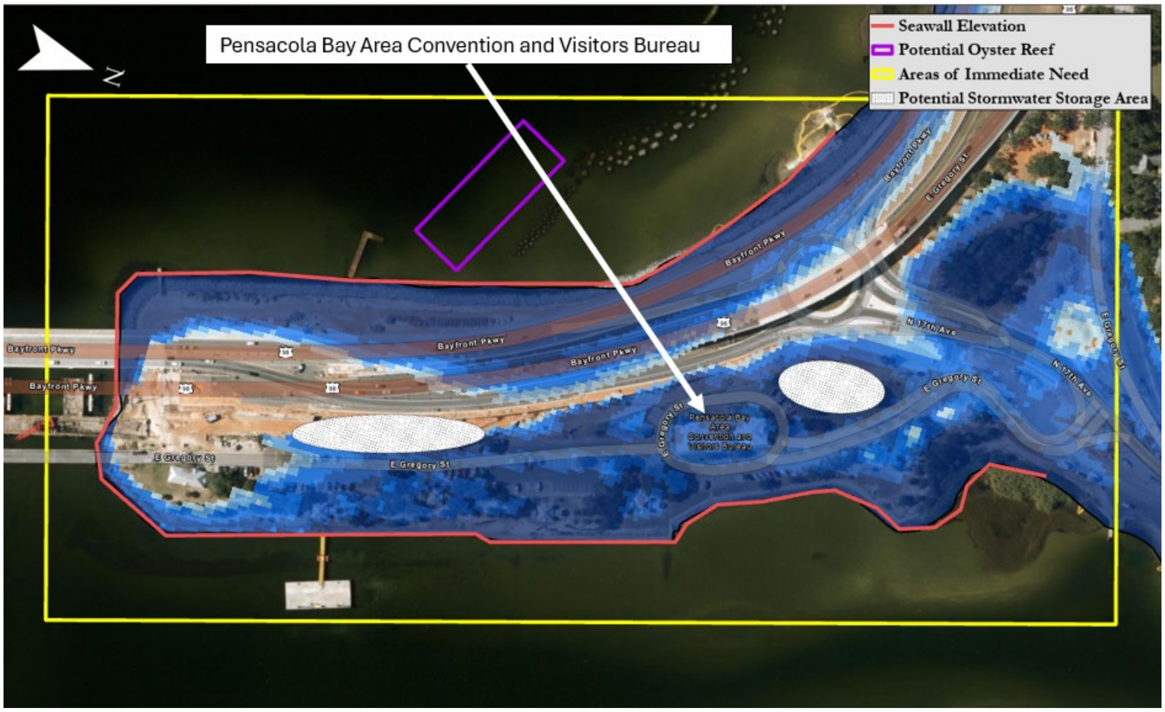
Hot Spot 6

Figure 61 - Prioritized Assets in Hot Spot 6

Pensacola Bay Area and surrounding park area. Based on future sea level rise projections this area will experience intense tidal flooding by the year 2100. It will also be subject to intermittent surge and tidal flooding impacts over time based on event conditions. This hot spot encompasses a small area but includes the primary evacuation route for southern Escambia County, the Pensacola Visitor Center, and Wayside East Park.

Appendix G contains the list of prioritized critical assets within this hotspot.

Figure 62 - Hot Spot 6: Conceptual Improvement Sites

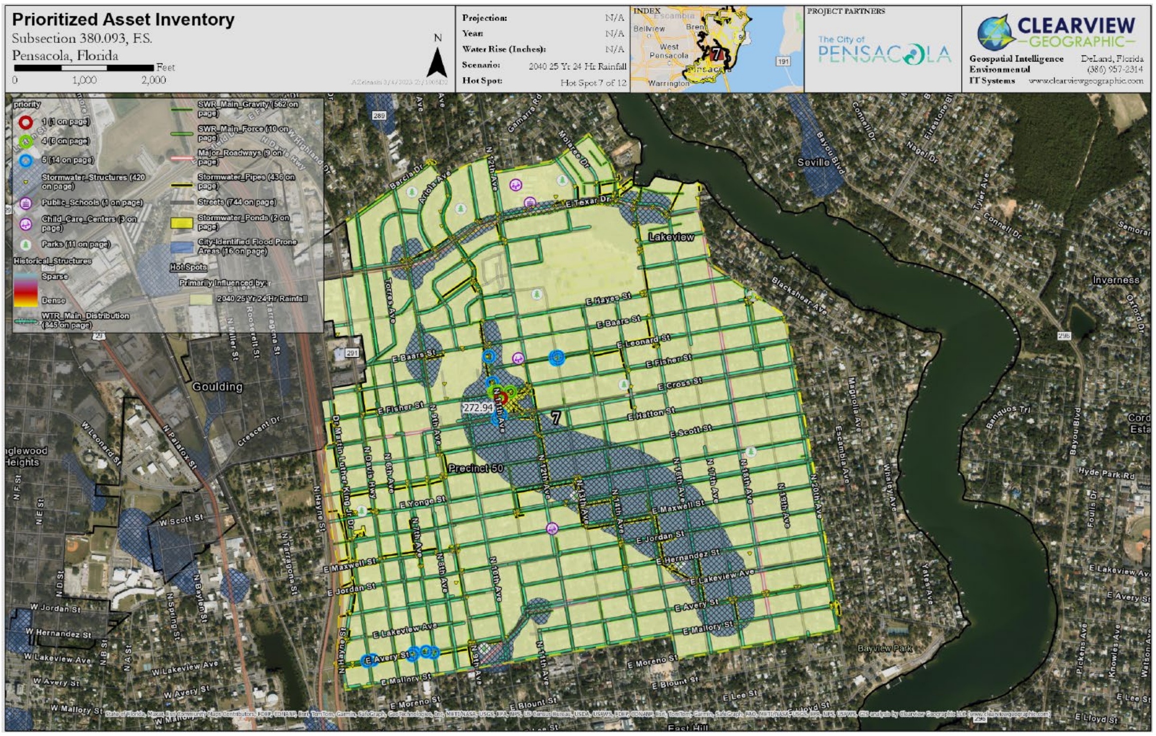


Pensacola Bay Area Convention and Visitors Bureau Improvements

- **Oyster Reefs:** Create oyster reefs to act as natural breakwaters, reducing wave energy and protecting shorelines from erosion.
- **Floating Gardens:** Implement floating garden systems that can absorb excess nutrients and provide additional stormwater filtration.
- **Amphibious Architecture:** Design buildings in flood-prone areas that can float or remain functional in the event of flooding.
- **Subsurface Water Storage:** Install underground storage systems to capture excess stormwater and release it slowly, mitigating flood risks.

Hot Spot 7

Figure 63 - Prioritized Assets in Hot Spot 7



East of 110 interstate commercial and residential area. Based on data collected from the City of Pensacola this area is prone to moderate stormwater flooding and based on rainfall projections this area would experience intense flooding during a 50-year or 100-year rainfall event. This hot spot is comprised mostly residential and the assets within this area are mainly parks, schools, roads, stormwater drainage structures, and water conveyance systems.

Appendix G contains the list of prioritized critical assets within this hotspot.

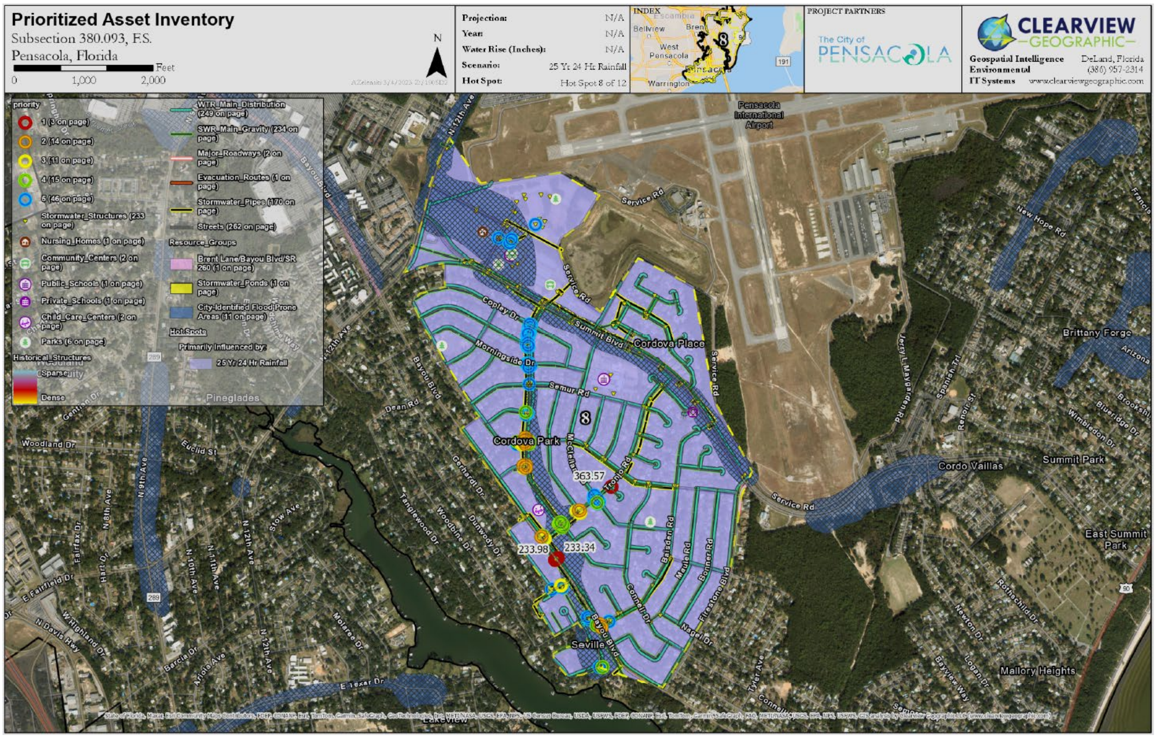
Figure 64 - Hot Spot 7: Conceptual Improvement Sites

N 11th to E Texar to Drainage to Bayou

- **Urban Water Detention:** Create multi-functional urban spaces that can detain stormwater during peak events, doubling as public squares or parks under normal conditions.

Hot Spot 8

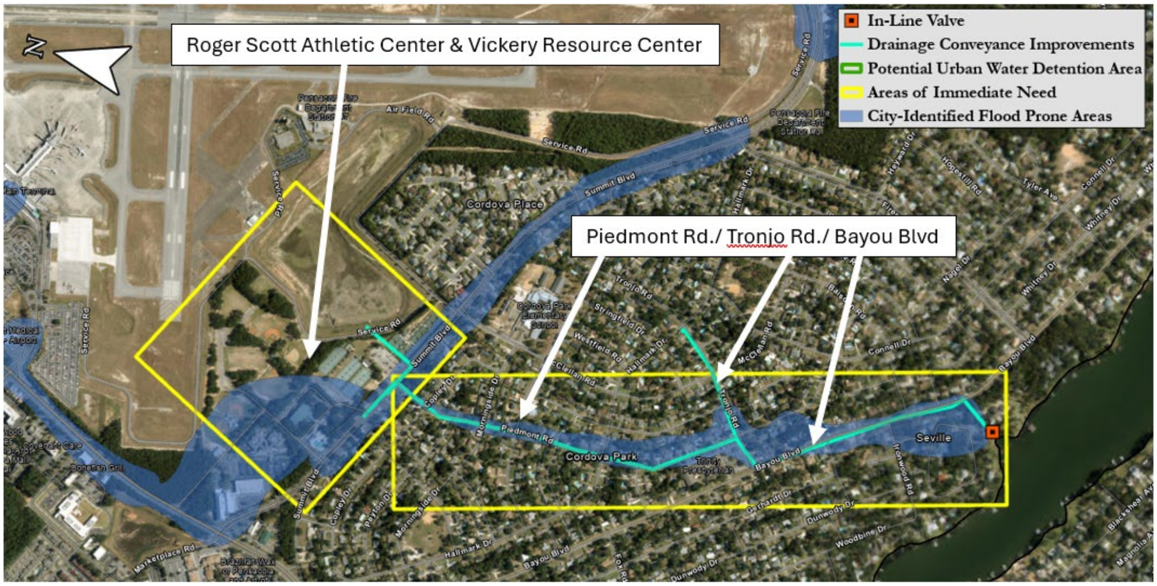
Figure 65 - Prioritized Assets in Hot Spot 8



Cordova Park residential area. Based on data collected from the City of Pensacola this area is prone to stormwater flooding and based on rainfall projections this area is likely to experience moderate flooding during a 100-year rainfall event. This hot spot is comprised mostly of residential and the assets within this area include parks, community centers, schools, senior housing, road, stormwater drainage structures, and water conveyance systems.

Appendix G contains the list of prioritized critical assets within this hotspot.

Figure 66 - Hot Spot 8: Conceptual Improvement Sites



Bayou Blvd./Piedmont Rd./Tronjo Rd

- **Increase Stormwater Conveyance Capacity:** Location on Bayou Blvd outfall just southeast of Seville Dr. from outfall to Piedmont Rd. at Tronjo then along Piedmont to Summit. And along Tronjo to Semur Rd. The most important “choke” in the system is the south right of way of Bayou from Gumwood to Baisden.

- **Install a Tidal Backflow Device:** Location at discharge into Bayou Texar (river/tributary running Northwest through the City).

- **Dredge Sediment Deposits:** Location in receiving water from existing outfall.

- **Install Sediment Traps:** Location at existing stormwater inlets to reduce sediment transport to outfall.

Roger Scott Athletic Center & Vickrey Resource Center

- **Increased Drainage Capacity:** Location should be towards stormwater pond to east.

- **Optimized Grate Design and Placement:** Review the design and placement of grates to ensure they maximize water capture without becoming easily clogged. Consider elevating or adding a subsurface storage system beneath to temporarily hold excess water.

- **Flood Barriers and Levees:** Erect temporary or permanent flood barriers to protect against water ingress from known flood zones. This may include levees or movable barriers that can be deployed in anticipation of flood events.

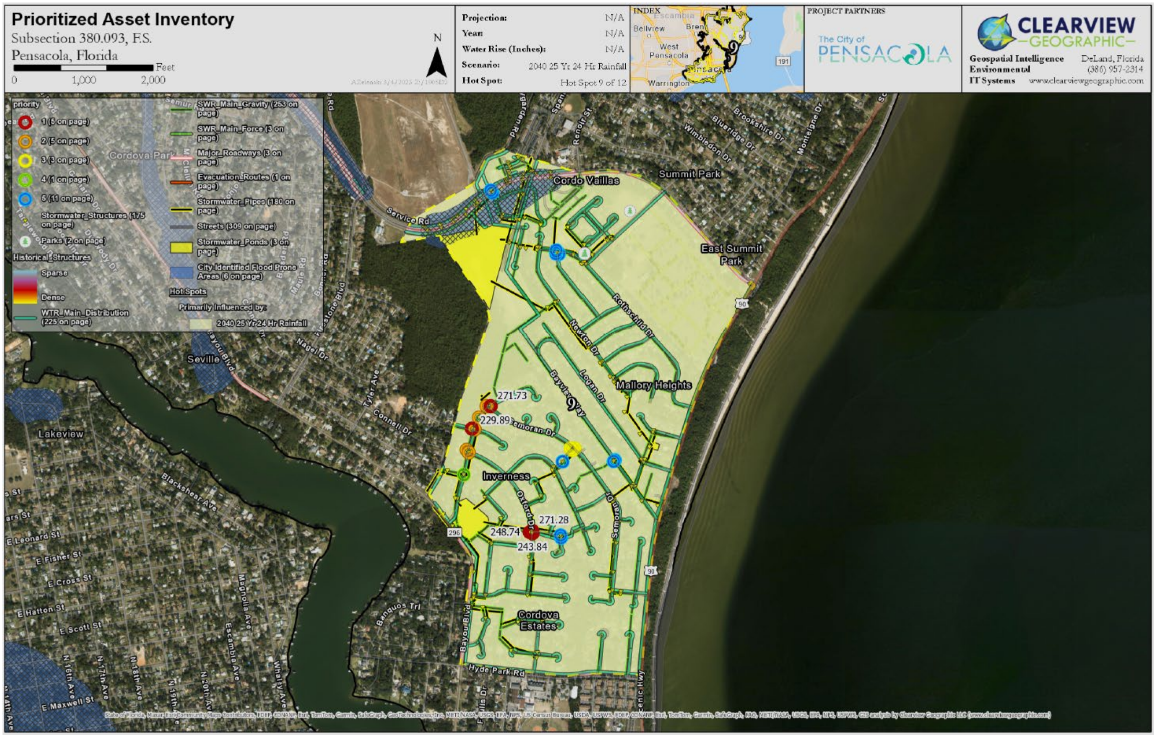
- **Enhanced Maintenance Schedule**: If not already optimized, implement and more rigorous inspection and maintenance schedule for all structures within the flood-prone area to ensure they are clear of debris and functioning optimally, particularly before expected heavy rainfall or storm surge events.

- **Enhanced Drainage/Green Infrastructure Systems:** Introduce advanced drainage solutions, such as bioswales, permeable pavement, additional green spaces or rain gardens in and around the park to improve infiltration and reduce surface runoff.

- **Upgraded Infrastructure with Backflow Preventers:** For structures which have manholes with a high flood risk index, consider installation of backflow preventers to stop floodwaters from interfering with functionality in low lying areas.

Hot Spot 9

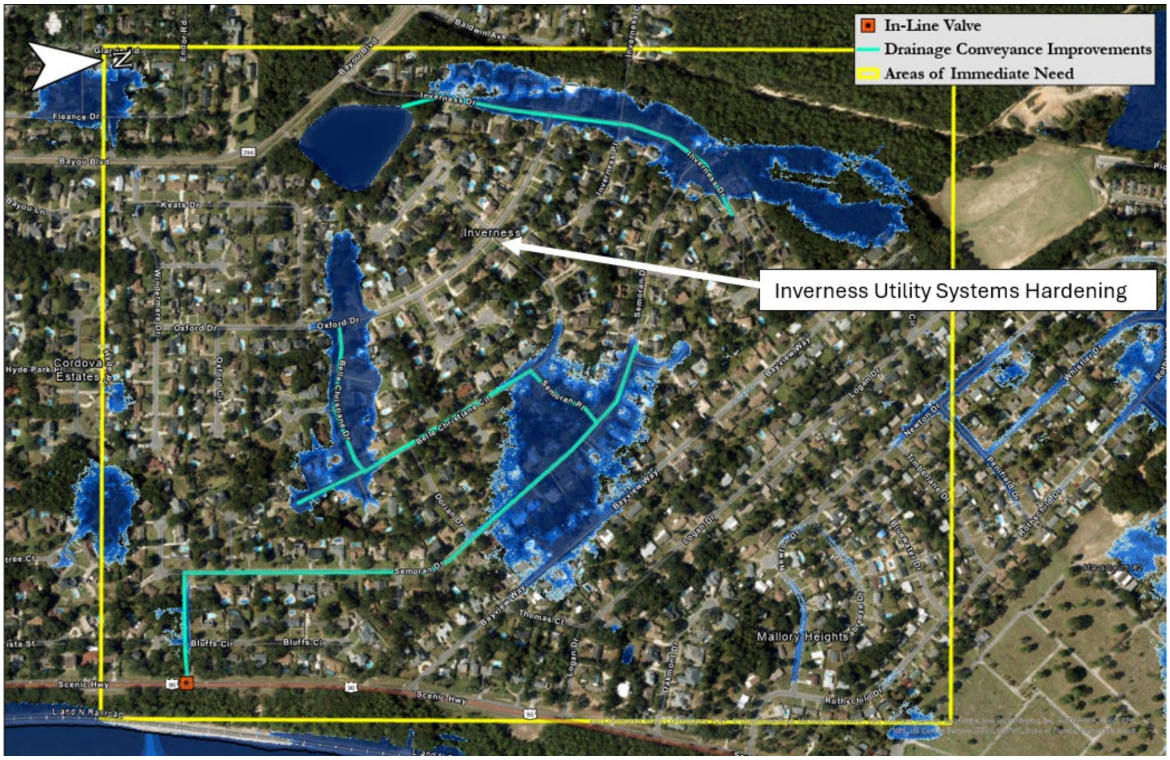
Figure 67 - Prioritized Assets in Hot Spot 9



Mallory Heights and Cordova Estates residential area. Based on future rainfall projections this area is likely to experience moderate flooding during a future 25-year rainfall event. This hot spot is comprised mostly of residential and the assets within this area include parks, roads, stormwater drainage structures, and water conveyance systems.

Appendix G contains the list of prioritized critical assets within this hotspot.

Figure 68 - Hot Spot 9: Conceptual Improvement Sites

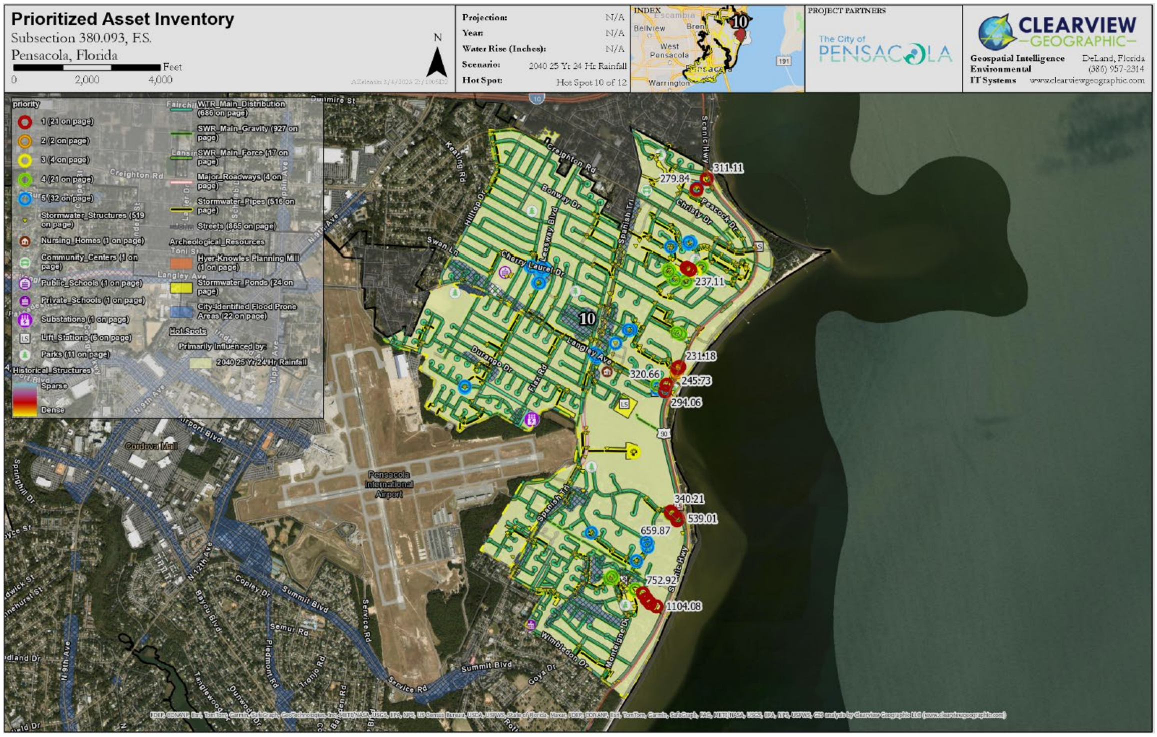


Inverness Utility Systems Hardening

- **Integrated Water Management:** Employ integrated water management strategies that utilize nearby green spaces for stormwater management, incorporating features such as bioswales and constructed wetlands.

Hot Spot 10

Figure 69 - Prioritized Assets in Hot Spot 10



East of Pensacola International Airport residential area. Based on data collected from the City of Pensacola this area is prone to stormwater flooding and based on future rainfall projections this area is likely to experience moderate flooding during a future 25-year rainfall event. This hot spot is comprised mostly of residential and the assets within this area include parks, schools, community centers, electrical substations, roads, stormwater drainage structures, and water conveyance systems and lift stations.

Appendix G contains the list of prioritized critical assets within this hotspot.

Figure 70 - Hot Spot 10: Conceptual Improvement Sites

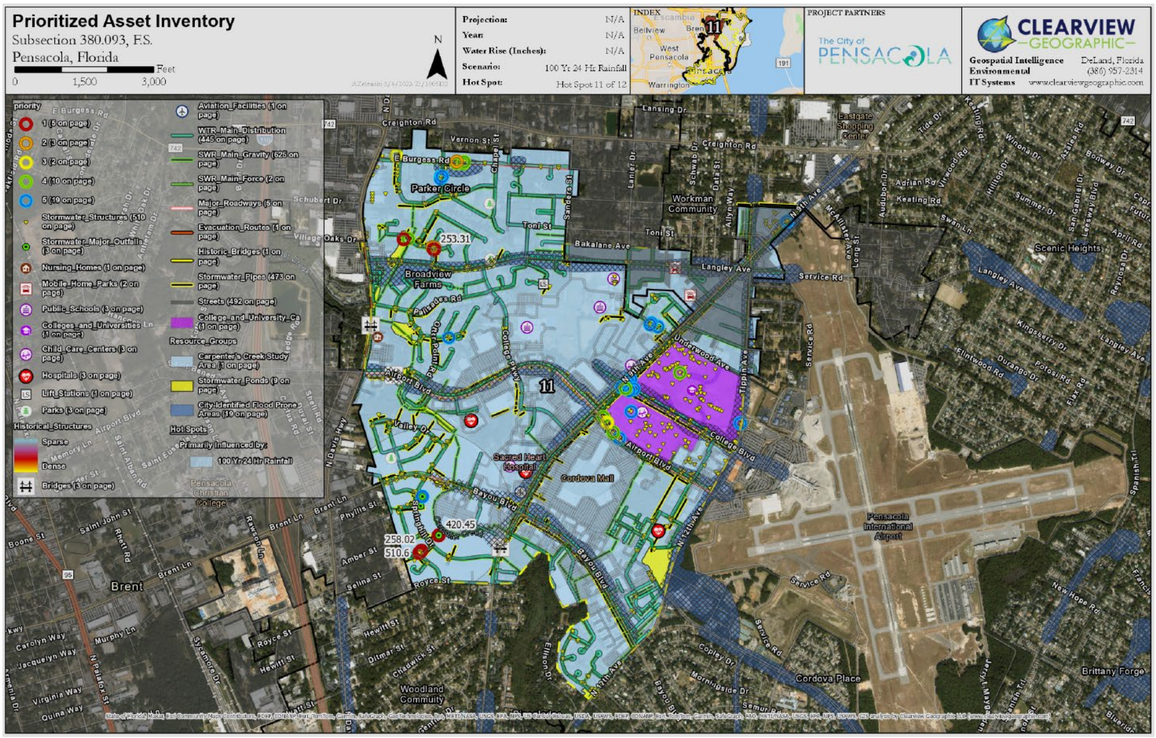
Project Recommendations

Scenic Hwy Flow Way Improvements and Living Shoreline Restoration

- **Install Tidal Backflow Devices:** Installing tidal backflows along the shoreline will prevent tidal waters from overflowing drainage outlets.
- **Increased Vegetation along the Shoreline**: Installing vegetation along the shoreline can prevent erosion, increase protection against storm surge, and increase habitat.

Hot Spot 11

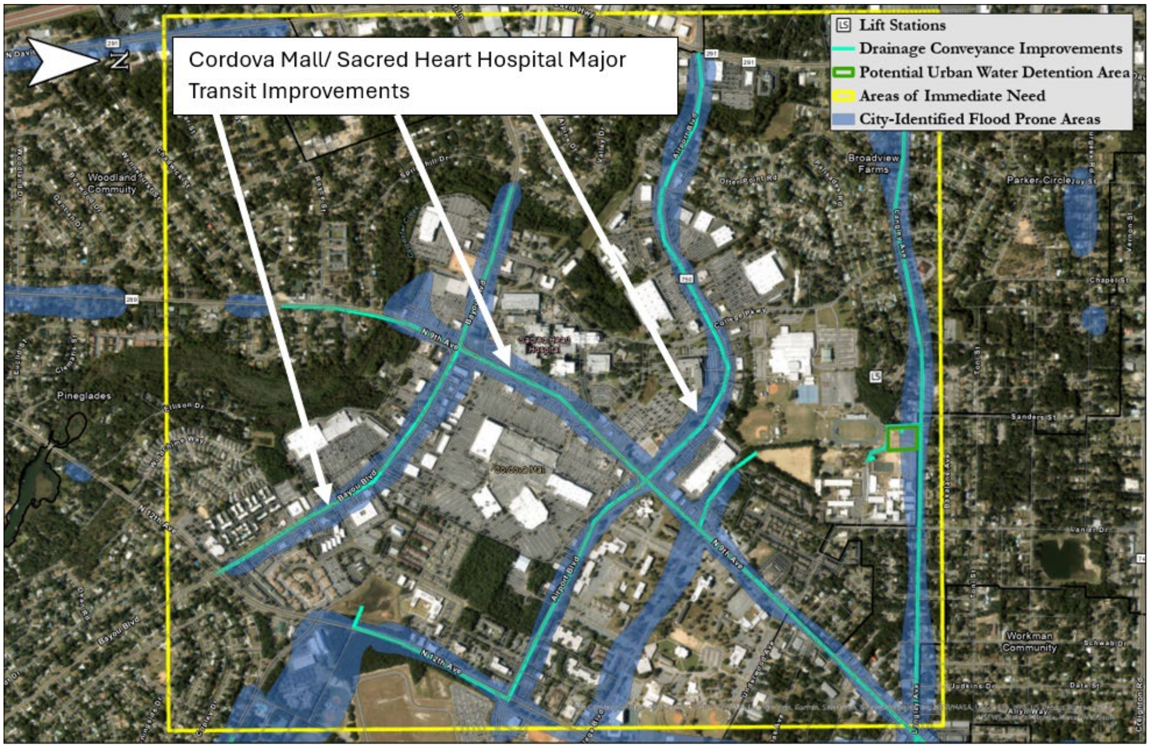
Figure 71 - Prioritized Assets in Hot Spot 11



Cordova Mall and the surrounding commercial area. Based on data collected from the City of Pensacola Langley Ave, Airport Blvd, Bayou Blvd, and N 9th Ave are prone to stormwater flooding and based on rainfall projections this area is likely to experience moderate flooding during a 50-year rainfall event especially around Cordova Mall. This hot spot is comprised mostly of commercial and includes hospitals, Pensacola State College, schools, parks, roads, water conveyance systems and lift stations, and stormwater drainage structures.

Appendix G contains the list of prioritized critical assets within this hotspot.

Figure 72 - Hot Spot 11: Conceptual Improvement Sites

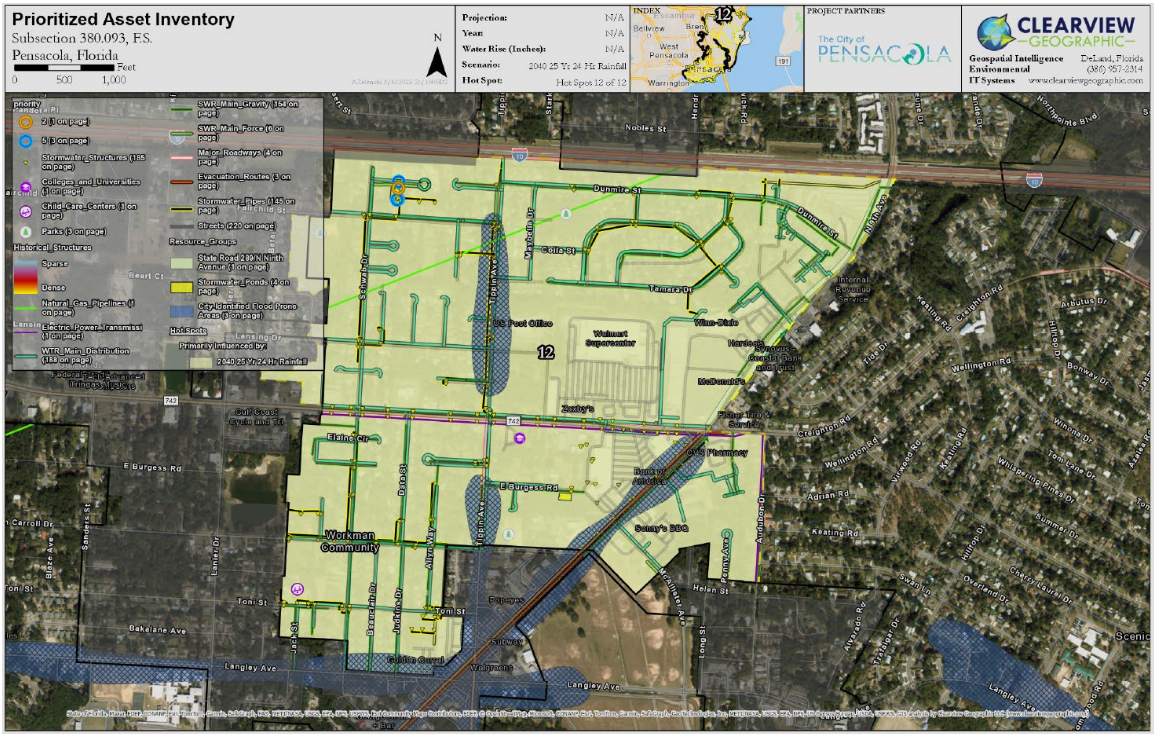


Cordova Mall/Sacred Heart Hospital Major Transit Corridor Improvements

- **Increased Drainage Capacity:** Disperse stormwater drainage to the 3 existing stormwater ponds.
- **Urban Water Detention:** Create multi-functional urban spaces that can detain stormwater during peak events, doubling as public squares or parks under normal conditions.

Hot Spot 12

Figure 73 - Prioritized Assets in Hot Spot 12

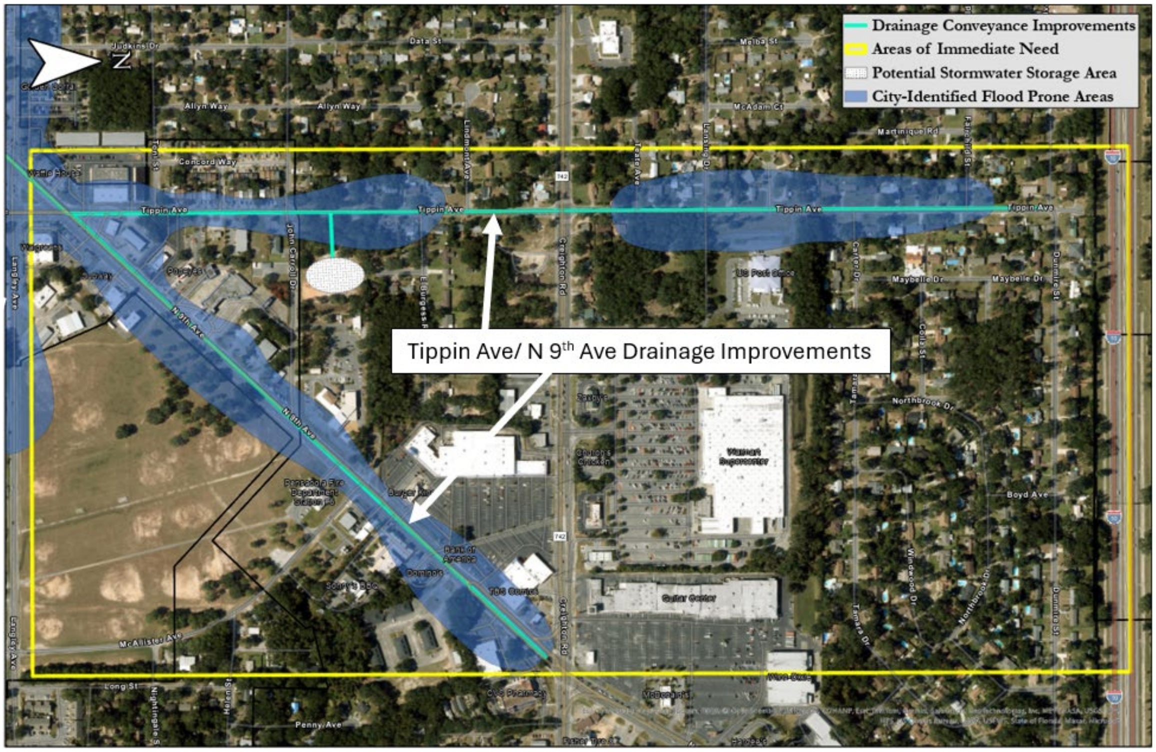


North of Pensacola International Airport residential and commercial area. Based on data collected from the City of Pensacola Tippen Ave and N 9th Ave are prone to stormwater flooding and based on future rainfall projections this area is likely to experience moderate flooding during a future 25-year rainfall event. The assets within this hot spot include a fire station, schools, parks, roads, water conveyance systems and lift stations, and stormwater drainage structures.

Appendix G contains the list of prioritized critical assets within this hotspot.

Project Recommendations

Figure 74 - Hot Spot 12: Conceptual Improvement Sites



Tippin Ave/ 9th Ave Drainage Improvements

- **Enhanced Drainage/Green Infrastructure Systems:** Introduce advanced drainage solutions, such as bioswales, permeable pavement, additional green spaces or rain gardens in and around the park to improve infiltration and reduce surface runoff.

- **Increased Flood Storage Capacity:** Install stormwater retention ponds in distributed undeveloped areas to increase water storage.

Habitat Change Due to Sea Level Rise

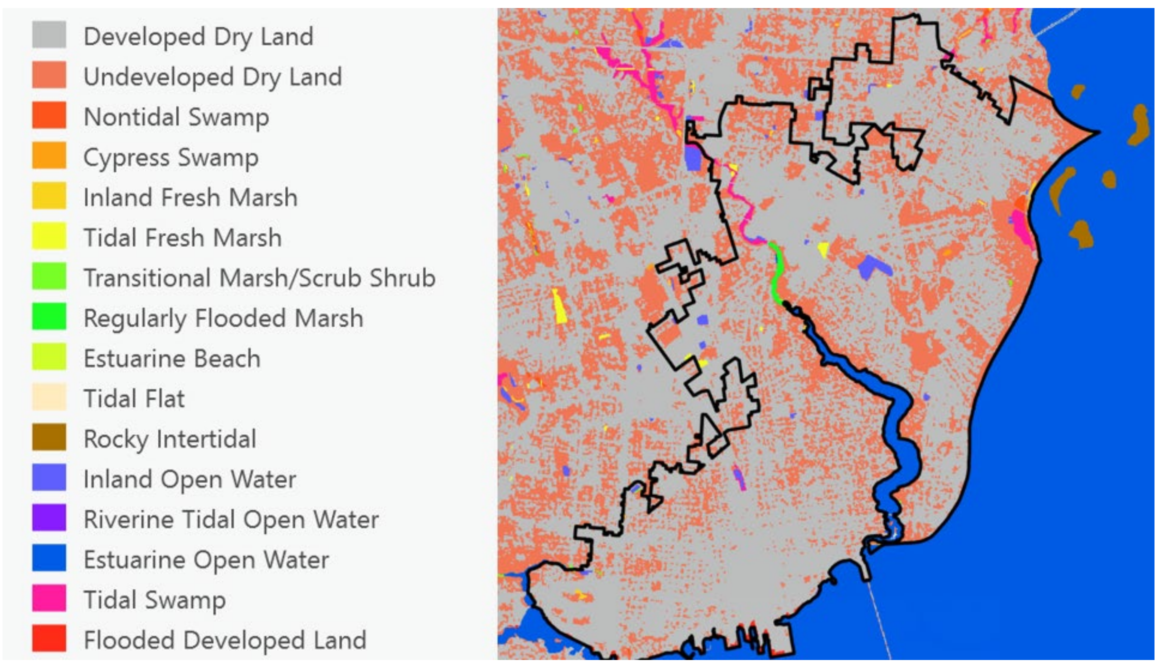
Pensacola's environmental and ecological well-being are integral to its resilience in the face of climate change. This evaluation of environmental vulnerabilities includes a habitat change analysis due to shifting ecological conditions from sea level rise. This is only an evaluation based on sea level rise impacts.

The Sea Level Affecting Marshes Model (SLAMM) is an advanced land cover and ecosystem change tool (Warren Pinnacle Consulting, Inc., 2016). SLAMM, unlike other flood vulnerability assessment methods, integrates long-term hydrologic functions and ecosystem parameters to provide projections about future changes to tidal habitat types, such as saltwater marshes, mangroves, and other coastal wetlands, which are already subjected to regular tidal flooding.

The sea level rise-induced habitat change projections were conducted in SLAMM using a variety of data inputs: Florida Fish & Wildlife Conservation Commission's 2019 Cooperative Land Cover Database, a digital elevation model-derived slope raster, and other parameters were either obtained during the data collection effort, taken from the County's previous Vulnerability Assessment or derived from calculation. Default values within the program and the 2019 land cover database quantified a total amount of carbon sequestration change.

Below the baseline condition is detailed within the SLAMM modeling in relation to the NOAA Intermediate Low and Intermediate High Sea level rise projections.

Figure 75 - NIH SLAMM Baseline Overview Map



The tabular outputs below provide total acreages and percent change from the baseline year by habitat type within the study area for the NOAA Intermediate Low and NOAA Intermediate High Sea level rise projections. Tables 20 and 21 show the sum of all changes by habitat type in hectares model-wide. A negative value in the "Change from Present Day" in the last three columns represents a loss of that habitat type due to sea level rise for that scenario year. There is more loss associated with the NOAA Intermediate High sea level rise scenarios than the NOAA Intermediate Low scenarios.

Table 20 - Habitat Change under NOAA Intermediate-Low SLR Scenario

SLAMM Category	GIS Num	Present Day Hectares	2040 Hectares	2070 Hectares	2100 Hectares	Change from Present Day to 2040	Change from Present Day to 2040	Change from Present Day to 2040
Developed Dry Land	1	98960.6	98845.6	98804.0	98726.8	-12%	-16%	-24%
Undeveloped Dry Land	2	52837.7	52807.9	52797.9	52773.3	-6%	-8%	-12%
Swamp	3	365.5	365.0	365.0	364.6	-12%	-14%	-23%
Cypress Swamp	4	53.7	53.7	53.7	53.7	0%	0%	0%
Inland-Fresh Marsh	5	328.7	328.7	328.7	328.7	0%	0%	0%
Tidal-Fresh Marsh	6	359.8	359.8	359.8	359.8	0%	0%	0%
Trans. Salt Marsh	7	174.0	184.6	186.2	193.7	612%	705%	1131%
Regularly-Flooded Marsh	8	59.2	173.2	11.2	10.0	19252%	-8108%	-8307%
Estuarine Beach	10	67.5	67.8	66.7	66.6	51%	-121%	-128%
Tidal Flat	11	29.7	47.0	199.8	15.3	5827%	57220%	-4867%
Rocky Intertidal	14	779.2	752.9	743.9	726.4	-337%	-452%	-677%
Inland Open Water	15	2360.3	2360.3	2360.3	2360.3	0%	0%	0%
Riverine Tidal	16	2.7	2.5	2.4	2.3	-815%	-1082%	-1647%
Estuarine Open Water	17	91247.4	91323.4	91351.4	91572.3	8%	11%	36%
Irreg.-Flooded Marsh	20	161.5	0.0	0.0	0.0	-10000%	-10000%	-10000%
Tidal Swamp	23	1896.9	1896.9	1896.9	1896.9	0%	0%	0%
Flooded Developed Dry Land	25	36.2	151.2	192.9	270.1	31738%	43226%	64536%
Aggregated Non Tidal	NA	151834.6	151804.8	151794.7	151770.1	-2%	-3%	-4%
Freshwater Non-Tidal	NA	747.9	747.5	747.4	747.0	-6%	-7%	-11%
Open Water	NA	93610.4	93686.1	93714.0	93934.9	8%	11%	35%
Low Tidal	NA	876.4	867.8	1010.4	808.3	-98%	1529%	-777%
Saltmarsh	NA	59.2	173.2	11.2	10.0	19252%	-8108%	-8307%
Transitional	NA	335.5	184.6	186.2	193.7	-4497%	-4448%	-4227%
Freshwater Tidal	NA	2256.8	2256.8	2256.8	2256.8	0%	0%	0%
GHG (10^3 Kg)	NA	-15036.4	-15231.7	-17027.7	-23579.3	130%	1324%	5681%

Table 21 - Habitat Change under NOAA Intermediate-High SLR Scenario

SLAMM Category	GIS Num	Present Day Hectares	2040 Hectares	2070 Hectares	2100 Hectares	Change from Present Day to 2040	Change from Present Day to 2040	Change from Present Day to 2040
Developed Dry Land	1	98927.2	98690.3	98374.1	97532.1	-24%	-56%	-141%
Undeveloped Dry Land	2	52831.8	52762.1	52663.9	52362.1	-13%	-32%	-89%
Swamp	3	365.3	364.3	363.1	359.9	-28%	-61%	-149%
Cypress Swamp	4	53.7	53.7	53.7	50.2	0%	0%	-650%
Inland-Fresh Marsh	5	328.7	328.6	328.4	327.0	-3%	-9%	-50%
Tidal-Fresh Marsh	6	359.8	359.8	359.8	359.8	0%	0%	0%
Trans. Salt Marsh	7	176.1	206.3	246.9	444.4	1715%	4021%	15239%
Regularly-Flooded Marsh	8	31.1	160.3	0.2	0.2	41518%	-9928%	-9927%
Estuarine Beach	10	67.8	70.9	75.4	84.6	449%	1119%	2476%
Tidal Flat	11	47.4	24.0	160.0	1.8	-4948%	23749%	-9619%
Rocky Intertidal	14	770.6	718.8	661.6	546.7	-673%	-1416%	-2906%
Inland Open Water	15	2360.3	2360.3	2360.0	2294.2	0%	-2%	-280%
Riverine Tidal	16	2.7	2.2	1.5	0.7	-1785%	-4518%	-7329%
Estuarine Open Water	17	91270.0	91415.8	91552.5	91991.7	16%	31%	79%
Irreg.-Flooded Marsh	20	161.5	0.0	0.0	58.1	-10000%	-10000%	-6400%
Tidal Swamp	23	1896.9	1896.9	1896.9	1838.8	0%	0%	-306%
Flooded Developed Dry Land	25	69.7	306.5	622.7	1464.8	33985%	79364%	200204%
Flooded Forest		0.0	0.0	0.0	3.5			
Aggregated Non Tidal		151828.6	151759.0	151660.7	151359.0	-5%	-11%	-31%
Freshwater Non-Tidal		747.7	746.6	745.2	737.1	-15%	-33%	-142%
Open Water		93633.0	93778.2	93913.9	94286.6	16%	30%	70%
Low Tidal		885.9	813.6	897.0	633.1	-816%	126%	-2854%
Saltmarsh		31.1	160.3	0.2	0.2	41518%	-9928%	-9927%
Transitional		337.6	206.3	246.9	506.1	-3889%	-2686%	4991%
Freshwater Tidal		2256.8	2256.8	2256.8	2198.6	0%	0%	-258%
GHG (10^3 Kg)		-15306.4	-16049.4	-18066.6	-24043.8	485%	1803%	5708%

In the face of accelerating climate change, coastal ecosystems are undergoing profound transformations, reshaping the very fabric of their landscapes and the biodiversity they support. This report delves into the intricate dynamics of habitat alteration under the NOAA Intermediate-High Sea Level Rise (SLR) Scenario, focusing on the period leading up to the year 2100. Through a detailed examination of shifts in various ecosystems—from undeveloped dry lands and swamps to transitional marshes and estuarine open waters—this analysis illuminates the multifaceted impacts of rising sea levels and changing environmental conditions.

The transition of undeveloped dry land to transitional marsh/scrub shrub habitat, the expansion of trans. salt marsh, the decline of swamp and cypress swamp areas, the dramatic increase in flooded developed dry land, and the rise in estuarine open water are but a few examples of the ongoing shifts that underscore the urgent need for adaptive management strategies. Each of these changes carries significant implications for biodiversity, ecosystem services, and human communities. By providing a comprehensive overview of these habitat changes, this report aims to inform policymakers, conservationists, and the public about the critical challenges and opportunities that lie ahead in managing and protecting invaluable coastal ecosystems in an era of unprecedented environmental change.

1. **Transition of Undeveloped Dry Land to Transitional Marsh/Scrub Shrub Habitat:**

   Undeveloped Dry Land is diminishing slightly from 52831.8 hectares to 52362.1 hectares by 2100, partially transitioning into transitional marsh/scrub shrub habitat. This transformation is significant because transitional habitats play a critical role in supporting diverse wildlife species, serving as essential breeding and feeding grounds. However, the reduction in undeveloped dry land is detrimental because it decreases the availability of habitat for species that rely on dry, undeveloped areas, potentially leading to a decrease in biodiversity and disrupting established ecosystems.

2. **Expansion of Trans. Salt Marsh:**

   The Trans. Salt Marsh is projected to increase significantly from 176.1 hectares to 444.4 hectares by 2100. This expansion is crucial because Trans. Salt Marshes are vital for carbon sequestration, helping to mitigate climate change, and provide protection against storm surges by acting as natural barriers. However, the rapid expansion could be detrimental to adjacent habitats by potentially overtaking areas previously occupied by other important ecosystems, leading to a loss of biodiversity and habitat displacement.

3. **Decrease in Swamp and Cypress Swamp Areas:**

   Swamp areas are expected to decrease from 365.3 hectares to 359.9 hectares, and Cypress Swamp from 53.7 hectares to 50.2 hectares by 2100. Swamps, including cypress swamps, are important because they serve as crucial water filtration systems, improve water quality, and provide habitat for a wide range of species. The decline in these areas is detrimental because it signifies a loss of these critical functions, potentially leading to increased water pollution and reduced biodiversity.

4. **Dramatic Increase in Flooded Developed Dry Land:**

   The area categorized as Flooded Developed Dry Land is projected to experience a dramatic increase from 69.7 hectares to 1464.8 hectares by 2100. This change is significant because it underscores the increasing risk and vulnerability of developed areas to flooding, likely due to rising sea levels and climate change. The change is detrimental as it could result in substantial economic losses, displacement of communities, and destruction of infrastructure.

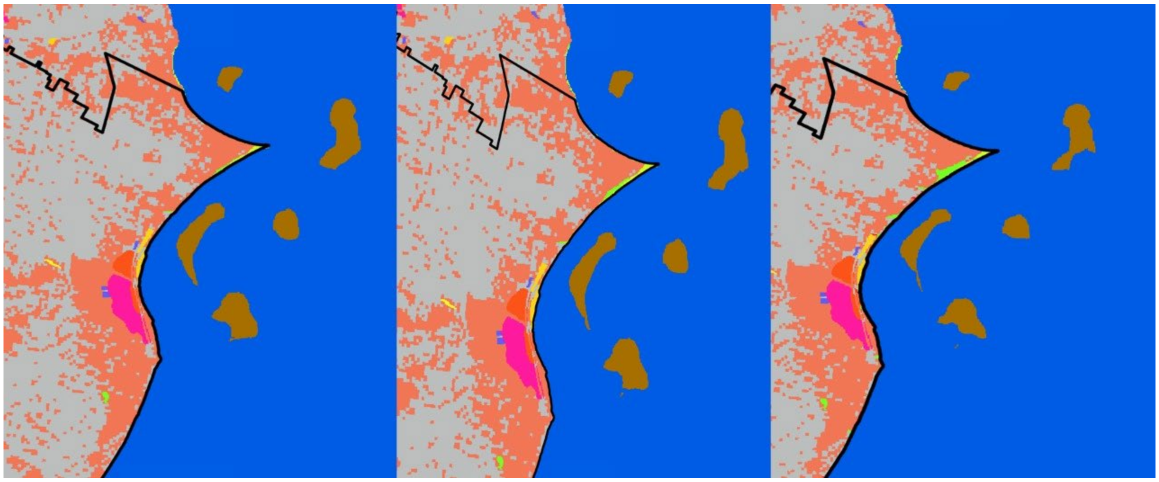
5. **Rise in Estuarine Open Water:**

   Estuarine Open Water is predicted to increase from 91270.0 hectares to 91991.7 hectares by 2100. This increase is important because estuarine open waters are critical for marine life, providing essential habitats for fish and shellfish, and playing a key role in nutrient cycling. However, the expansion of open water at the expense of other habitats can be detrimental by reducing the area of habitats like marshes and swamps, crucial for biodiversity and ecosystem services.

These examples demonstrate the complex interplay between different habitats under changing environmental conditions and highlight the importance of managing and protecting these ecosystems in the face of climate change. Based on the generated SLAMM outputs 3 natural area types reflect where there is a high risk of habitat change caused by future sea level rise.

Based on the generated SLAMM outputs, 3 natural area types reflect where there is a high risk of habitat change caused by future sea level rise. Significant habitat transitions may not be visible at this map scale but are more apparent in from the full map series found in Appendix D for Exposure.

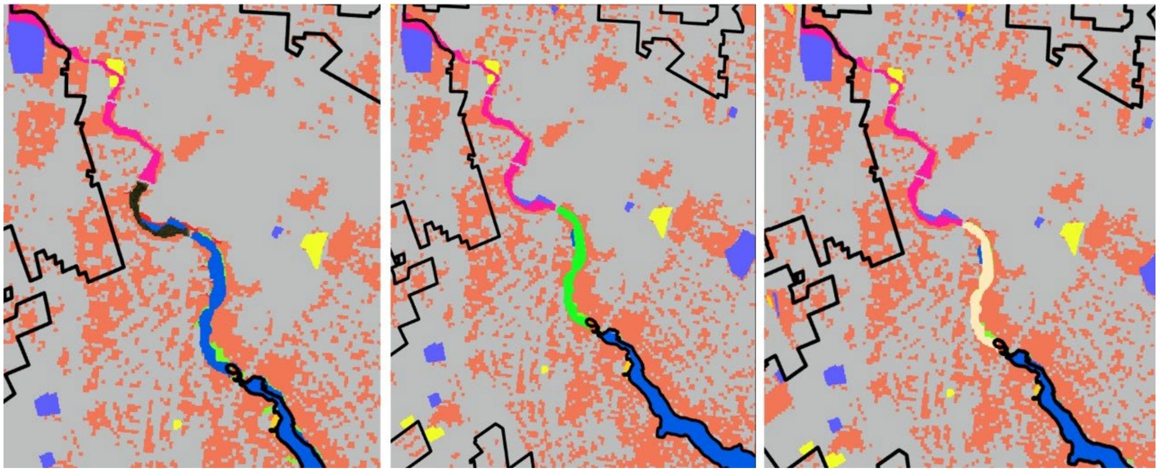
Figure 76 - Habitat Change East of Pensacola Airport



- **Rocky Intertidal Area Off-shore of Scenic Heights:** The SLAMM (Sea Level Affecting Marshes Model) forecasts indicate that the rocky intertidal area offshore of Scenic Heights is facing an increased threat of frequent inundation due to rising sea levels. Characterized by their exposure during low tides and submersion at high tides, these rocky intertidal zones are crucial for a diverse array of species, including birds, crustaceans, and fish, serving as vital foraging grounds and hatcheries. The preservation of these habitats is not only essential for maintaining the biodiversity of the area but also for supporting the fisheries around coastal Pensacola. With the anticipated continual sea level rise, these zones risk permanent inundation, losing the tidal fluctuations essential for the ecosystem services they provide. It is imperative to initiate comprehensive monitoring and strategic planning to safeguard this valuable habitat against the impacts of future sea level rise.

- **Tidal Swamp and Inland Freshwater Marsh East of Pensacola International Airport:** According to SLAMM projections, the tidal swamp and inland freshwater marsh located east of Pensacola International Airport are increasingly vulnerable to more frequent and extensive flooding due to escalating sea levels, potentially leading to significant habitat alterations. These areas thrive on the natural ebb and flow of waters, which nourish their distinct vegetative and wildlife communities. However, the anticipated rise in sea levels threatens to disrupt these natural cycles, causing prolonged inundation. Such conditions could severely impact the vegetation and wildlife, leading to a shift in the ecosystem's composition as saltwater encroachment alters the freshwater marsh and the tidal swamp's vegetative landscape. Proactive monitoring and adaptive planning are crucial to mitigate the adverse effects of sea level rise on these critical habitats.

Figure 77 - Habitat Change in North Texar Bayou



- **Marshes North of 12th Ave in Texar Bayou:** SLAMM analysis reveals that the irregularly flooded marsh north of 12th Ave is on a trajectory towards significant ecological transformation due to sea level rise. Presently classified as an irregularly flooded marsh, projections indicate a dramatic shift in this habitat's character over the coming decades. By 2040, it is expected to evolve into a transitional marsh/scrub; by 2070, it could become a rocky intertidal habitat, and by 2100, it may transition to an estuarine open water habitat. Such rapid environmental changes threaten to undermine the diversity and resilience of the native wildlife populations. It is essential to deploy targeted monitoring and planning initiatives aimed at preserving the ecological integrity of this area in the face of impending sea level rise.

Shoreline Assessment

Pensacola's proximity to tidally influenced waters increases its risk of suffering from shoreline erosion, inland flooding, and infrastructure damage caused by storm surge. Storm surge is the result of hurricanes and tropical storms with strong wind gusts that force high volumes of sea water inland eroding beaches and dunes, damaging seawalls, roadways, and properties, and costing millions of dollars in beach and dune refurbishment and infrastructure repair. However, though storm surge can be the most destructive component of storm damages, the implementation of living shorelines, natural resource restoration and hybrid shorelines has been shown to greatly reduce the destructive wave energy that is associated with storm surge and in turn greatly reduce the damage that is caused by it. The aim of this shoreline assessment is to identify areas along Pensacola's shoreline that have historically been impacted by storm surge and that may benefit from the installation of a shoreline defense strategy.

Historic Storm Data

Based on data retrieved from the Florida Department of Environmental Protection (FDEP) between 1979 and 2020 Escambia County has been affected by 8 hurricanes, 5 of these storms registered increased tide levels at the Pensacola NOAA tide gauge during the time of the storm.

Figure 78 - Pensacola Tide Gauge: Hurricane Opal, 1995

Verified Tide Height: 5.65 feet NAVD88

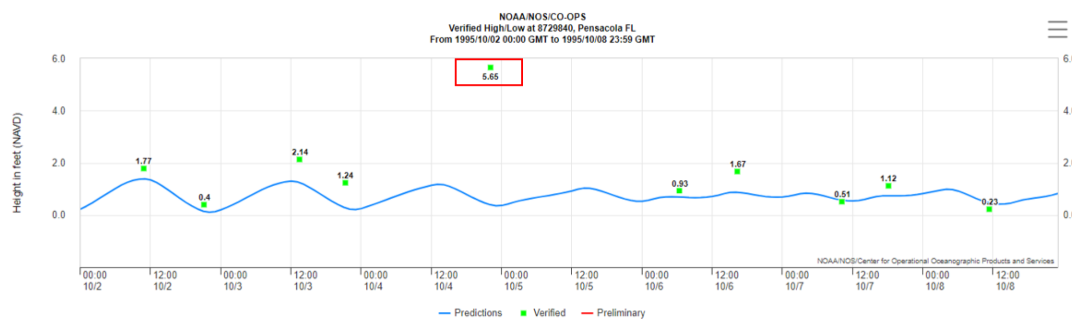


Figure 79 - Pensacola Tide Gauge: Hurricane Ivan, 2004

Verified Tide Height Prior to Station Shut Down: 6.45 feet NAVD88
Verified Tide Height After Station Shut Down: 10.14 feet NAVD88

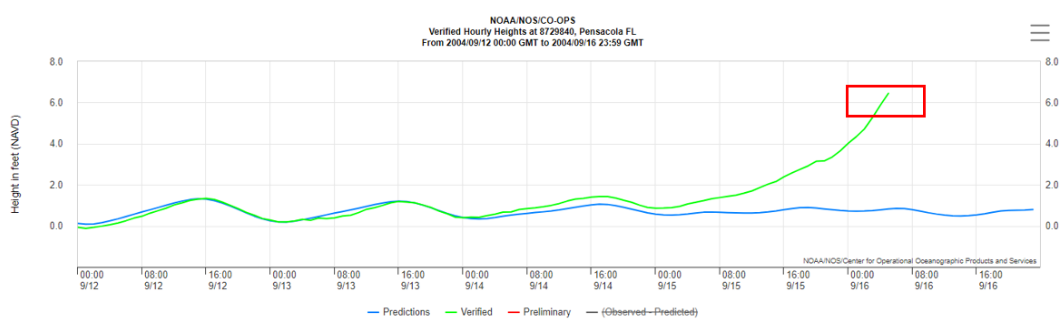


Figure 80 - Pensacola Tide Gauge: Hurricane Katrina, 2005

Verified Tide Height: 6.36 feet NAVD88

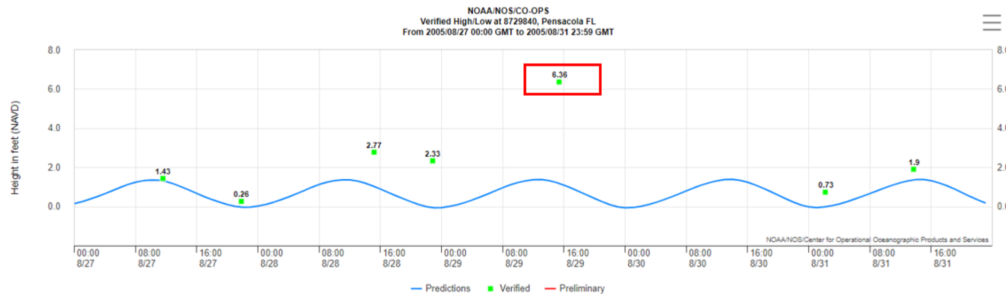
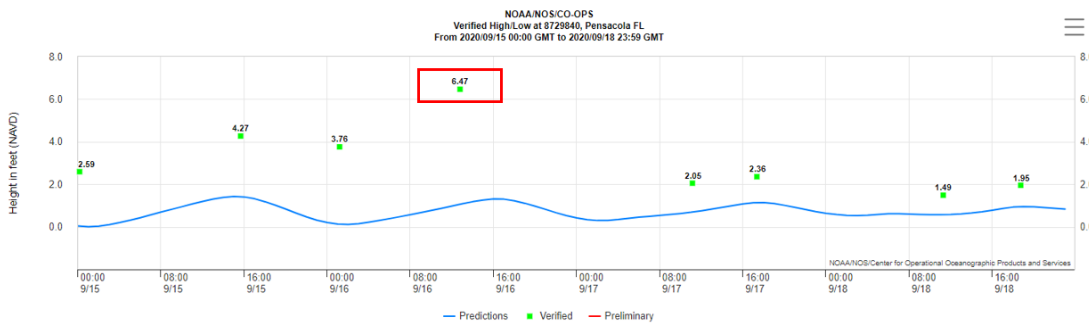


Figure 81 - Pensacola Tide Gauge: Hurricane Sally, 2020

Verified Tide Height: 6.47 feet NAVD88



Leveraging the verified tide height measurements, depth grids of historical storms were generated utilizing the same modeling techniques applied in forecasting flooding from future sea level rise. This analysis combined the generated storm depth grids, existing FEMA flood hazard zones, Pensacola's latest Light Detection and Ranging (LiDAR) digital elevation model (DEM), and current shoreline data. This comprehensive approach established a foundational understanding of regions most vulnerable to storm surge. It also pinpointed areas where the introduction of native vegetation could play a crucial role in mitigating future erosion and flood impacts.

By employing the latest LiDAR DEMs, detailed topographical contours and shorelines in the lowest elevation zones and those with the most direct exposure to coastal forces were meticulously mapped. These areas, often nearest to the coastal waters, emerged as the most at risk to the perils of storm surges. This identification process is vital in developing strategic interventions to fortify these critical zones against the increasing threats of flooding and coastal erosion.

Figure 82 - Elevation Map of Pensacola with Shoreline Resilience Sites

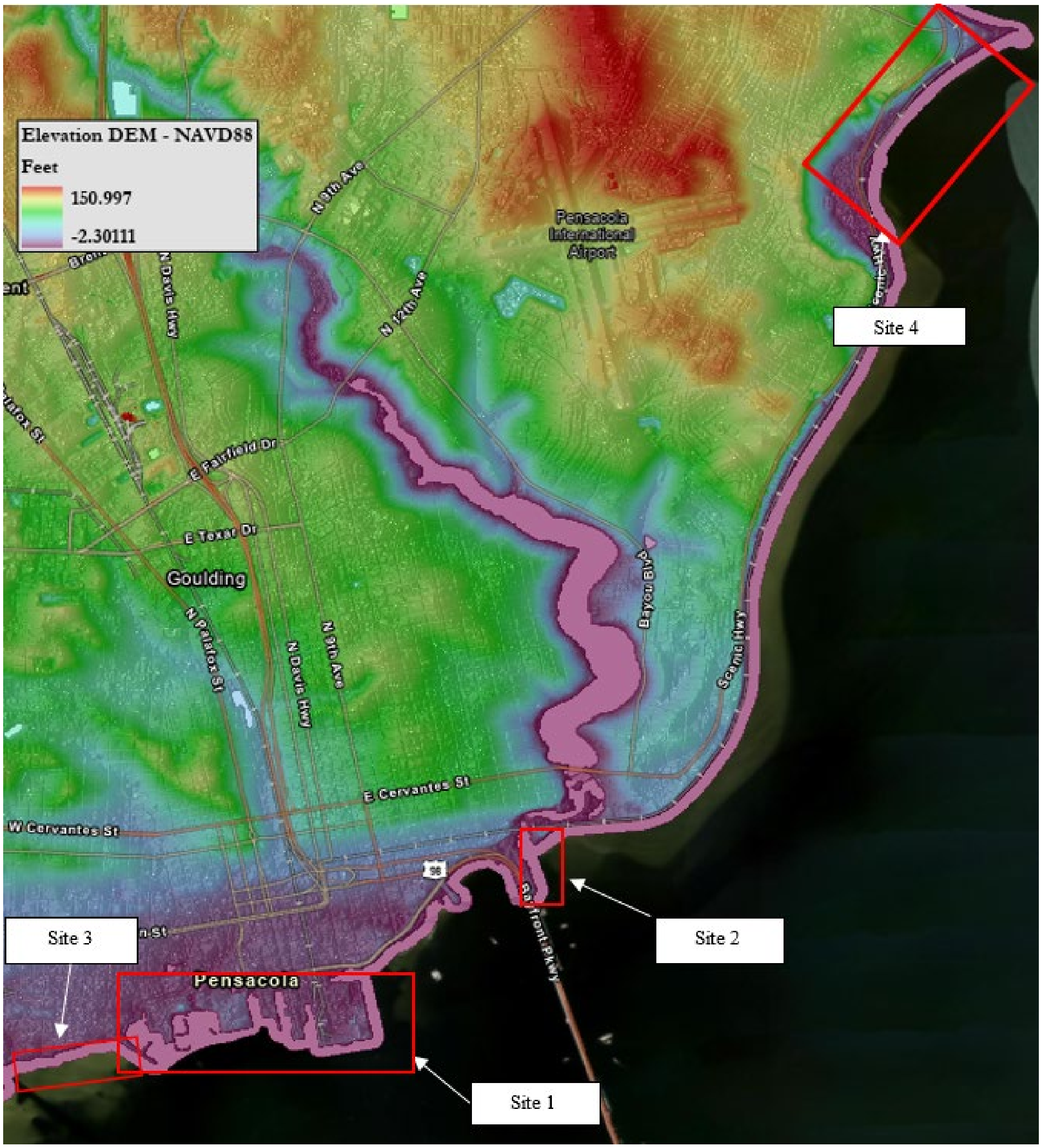
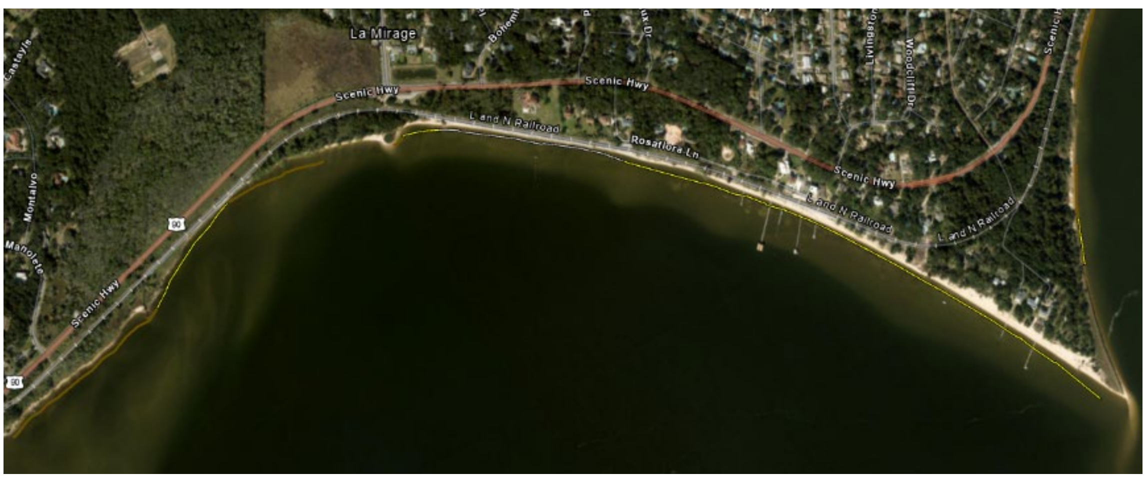


Figure 83 - Shoreline Resilience Improvement Site 1

Figure 84 - Shoreline Resilience Improvement Site 2

Figure 85 - Shoreline Resilience Improvement Site 3

Figure 86 - Shoreline Resilience Improvement Site 4



Comparing the elevation of the sites with the results of the FEMA Flood Hazard Layer reinforces the basis for selecting the four sites. The blue coloration on the figures below reflects a 1% chance storm derived from the FEMA Flood Hazard layer. A 1% chance storm is equivalent to a 100-year storm surge event. This therefore provides an idea of how impacted these shorelines could be under current sea level conditions if a major storm event was to occur.

Figure 87 - Shoreline Resilience Improvement Site 1: Flood Exposure

Figure 88 - Shoreline Resilience Improvement Site 2: Flood Exposure

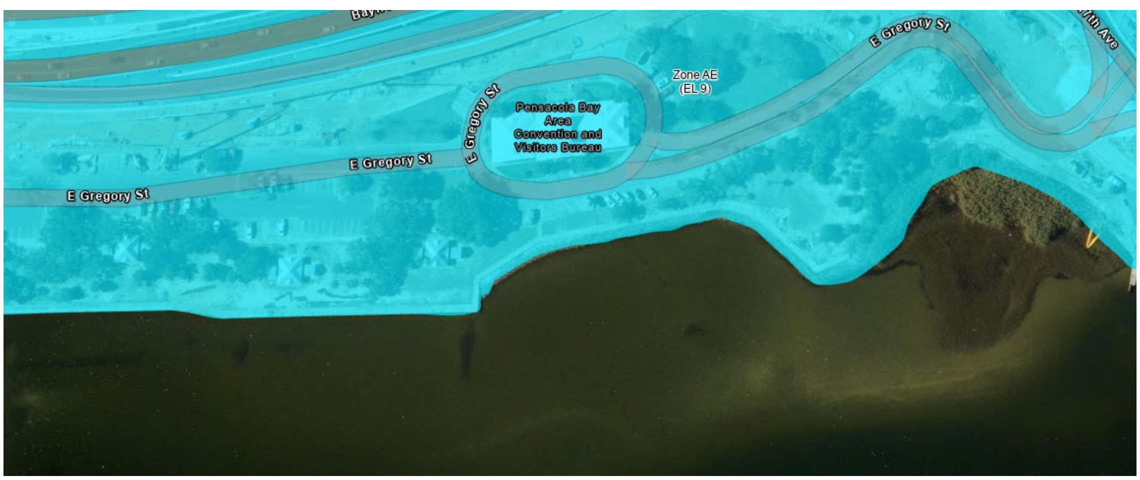


Figure 89 - Shoreline Resilience Improvement Site 3: Flood Exposure

Figure 90 - Shoreline Resilience Improvement Site 4: Flood Exposure

Based on data collected from the Florida Fish & Wildlife Conservation Commission (FWC), the project team determined the composition of the shoreline. The current composition of the shoreline is reflected as either beach, man-made structure, rip rap or vegetation. Identifying the composition of the shoreline in parallel with the shoreline's elevation and its susceptibility to storm events can assist in determining for which areas restoration projects or seawall improvement may be best suited. Shorelines comprised of beaches could benefit from the installation of natural vegetation on the beach and offshore to reduce the impacts of sediment erosion associated with storm surge events. Installation of salt marsh habitat, oyster reefs, or breakwater in shallow areas around man-made structures and riprap could reduce wave energy associated with storm surge events, which could support the reduction of infrastructure damage.

Figure 91 - Shoreline Resilience Improvement Site 1: Shoreline Composition

Figure 92 - Shoreline Resilience Improvement Site 2: Shoreline Composition

Figure 93 - Shoreline Resilience Improvement Site 3: Shoreline Composition

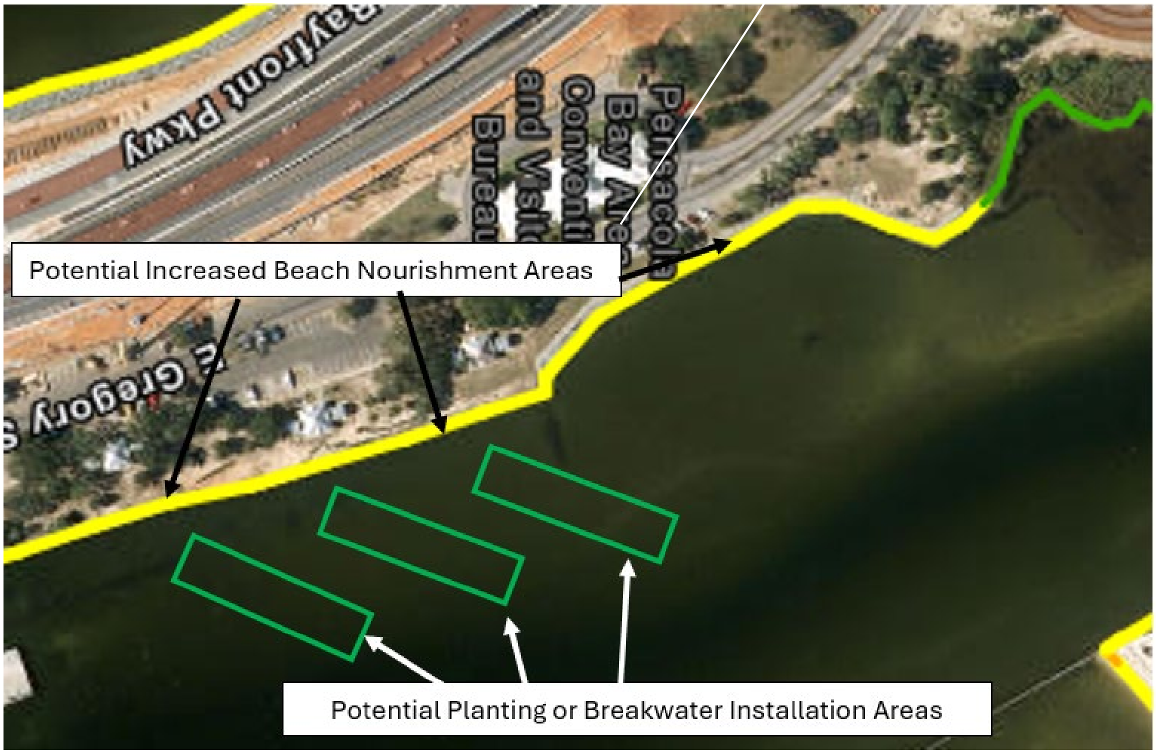
Figure 94 - Shoreline Resilience Improvement Site 4: Shoreline Composition

Based on data collected from Pensacola, the majority of Site 1's shoreline is limited to modification due to how much of the area is highly developed (red line), this combined with the deep bathymetry makes it difficult and costly to install aquatic vegetation or breakwaters to reduce storm surge energy. However, the three areas identified by green squares on the image are locations where aquatic vegetation or breakwaters could potentially be installed to provide protection from storm surge.

Figure 95 - Shoreline Resilience Improvement Site 1 : Project Recommendation

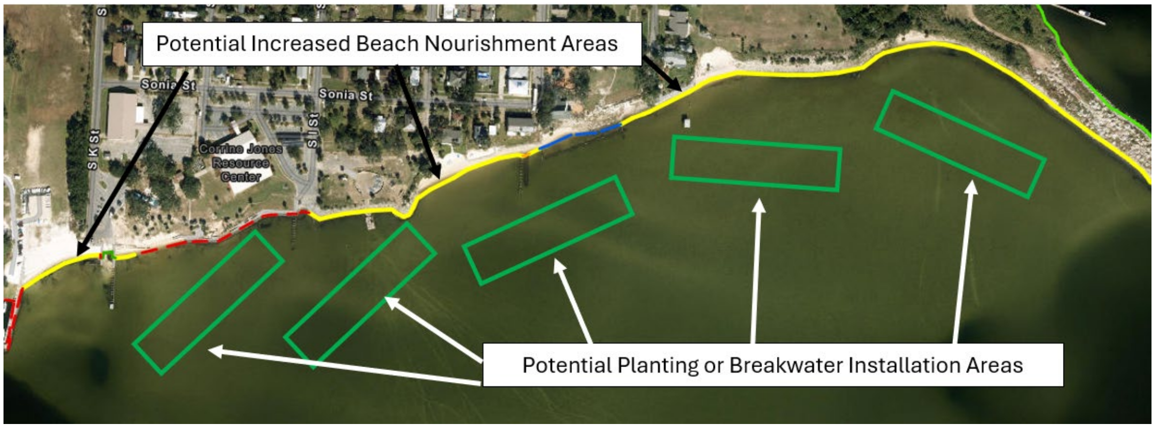
The recommendation for Site 2's shoreline is to remove the existing shoreline structures (seawall and riprap), increase beach nourishment (yellow line) and consider installing offshore breakwaters or vegetation to decrease wave energy.

Figure 96 - Shoreline Resilience Improvement Site 2 : Project Recommendation



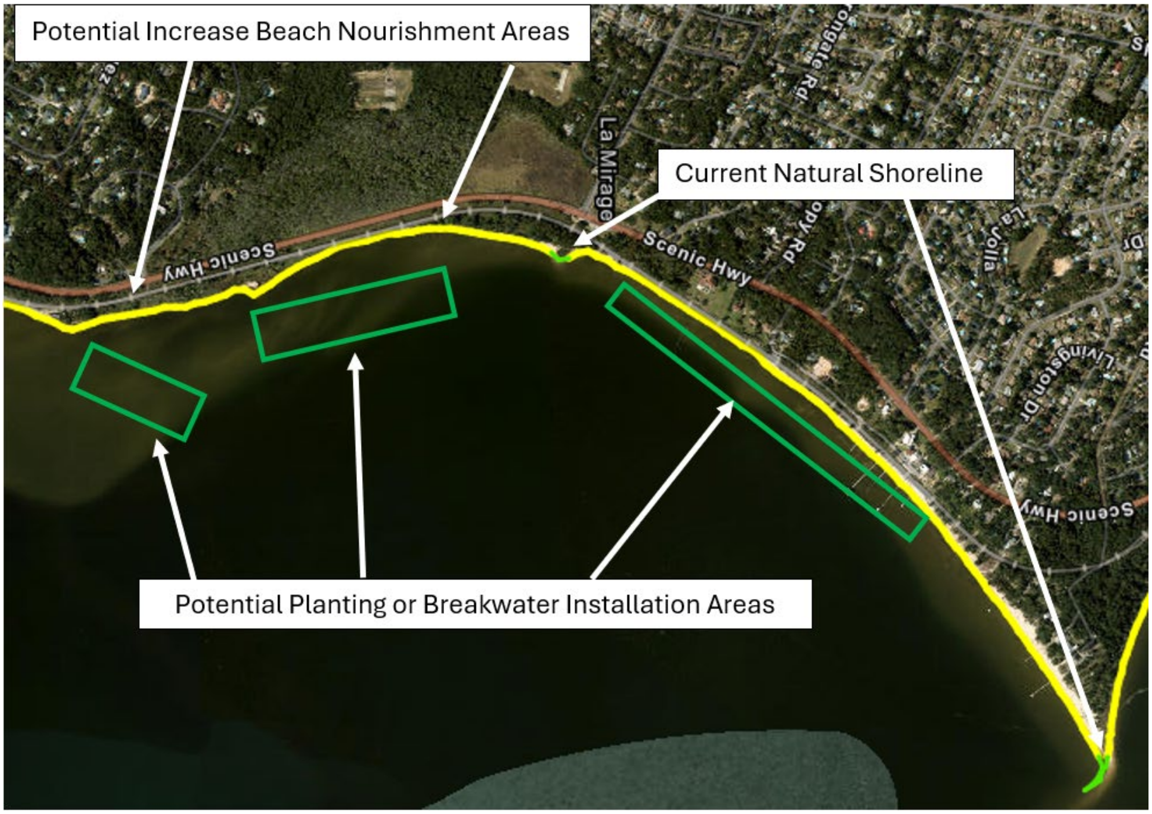
The recommendation for Site 3's shoreline is to remove the existing shoreline structures (riprap), increase beach nourishment (yellow line) and consider installing offshore breakwaters or vegetation (green squares) to decrease wave energy.

Figure 97 - Shoreline Resilience Improvement Site 3 : Project Recommendation



The recommendation for Site 4's shoreline is to remove the existing shoreline structures (riprap), maintain current natural shoreline elements (green line), increase beach nourishment (yellow line) and consider installing offshore breakwaters or vegetation (green squares) to decrease wave energy.

Figure 98 - Shoreline Resilience Improvement Site 4 : Project Recommendation



Socioeconomic Vulnerability

A comprehensive vulnerability assessment encompasses not only physical factors but also socioeconomic considerations. These considerations reveal the increased risks faced by a communities most vulnerable communities.

This section presents an analysis aimed at understanding the impact of flood vulnerability on the city's people. Spanning both urban and suburban communities' special attention is paid to identifying vulnerable populations. Those with limited resources or access to essential services require additional focus and call for special delineation of resources. Tailoring effective flood mitigation strategies specifically for these groups is critical.

A census tract is a geographic region defined for population study. Census tracts are used in this analysis to identify particularly vulnerable populations within flooding hot spots.

Social Vulnerability Index

Vulnerability is based on the percentage of the hot spot with a Social Vulnerability Index value of 50% or greater. Table 22 below ranks these areas by the percentage of their territory exhibiting a Social Vulnerability Index of 50% or greater. This value indicates a higher susceptibility to flood-related adversities. This detailed breakdown serves as a critical tool for prioritizing action and directing resources towards the most vulnerable sectors of the population. Ensuring that mitigation efforts are both efficient and equitable is crucial for protecting vulnerable communities.

Table 22 - Five Most Vulnerable Census Tracts in Hot Spots

Census Tract	Land Area (in square miles)	% of Hot Spot with 50% or Greater SVI
12033000100 - West Garden Street	0.92	90.2%
12033001201 - Sacred Heart Hospital and Cordova Mall Area	2.57	68.1%
12033000400 - US 90 West	0.77	67.5%
12033000600 - I-110	0.67	64.2%
12033000300 - S Pace Blvd	1.74	63.8%

Location Affordability Index

The Location Affordability Index (LAI) provides a comprehensive view of the cost burdens of housing and transportation on different household profiles and analyzes them to determine the true cost of living, not just in terms of rent and/or mortgages but also commuting and travel expenses. This index is a key factor when analyzing the vulnerability of a community. Metrics for each household profile identified within the analyzed census tracts are detailed below.

Household Profiles

The 2024 Vulnerability Assessment for Pensacola introduces several household profiles to better understand the socioeconomic fabric of the city and tailor resilience strategies accordingly. Each profile encapsulates distinct economic realities, from those barely making ends meet to families enjoying financial stability.

Very Low-Income Individuals: These are residents at the lowest economic tier within the community, earning significantly less than the majority. They represent the segment most in need of comprehensive support and intervention, reflecting profound financial challenges that necessitate targeted assistance programs to ensure their well-being and societal integration. This suggests significant economic challenges and a potential need for targeted financial assistance and social services to improve their quality of life and economic stability.

Working Individuals: This group includes a broad spectrum of the workforce, from those employed full-time to part-time across various sectors. Their economic situation is somewhat stable, yet precarious, marked by a delicate balance between earnings and expenditure that could be easily disrupted by unforeseen financial demands or economic downturns. This group likely includes a mix of full-time and part-time workers in various sectors, possibly facing moderate financial constraints with some disposable income but also vulnerabilities to economic downturns or unexpected expenses.

Retired Couples: Enjoying the fruits of their lifelong labor, retired couples generally occupy a more comfortable economic position, buoyed by pensions, savings, or other retirement benefits. While they are less vulnerable to immediate financial shocks, they may require support with healthcare and aging-related services to maintain their quality of life. This suggests that they likely have a stable source of retirement income, such as pensions or savings, positioning them relatively comfortably in terms of economic security. This group may have fewer financial vulnerabilities but could still require services geared towards healthcare and aging.

Single-Parent Families: Single parents navigate the complexities of raising children on a single income, a challenge compounded by the costs associated with childcare and education. This group's economic positioning, while not at the bottom, is fraught with unique pressures that call for policies aimed at easing their financial and caregiving burdens. Despite being in the middle-income bracket, the demands of single parenting, including childcare and educational expenses, can strain their financial resources, highlighting the need for supportive policies that address childcare, education, and healthcare.

Moderate Income Families: Representing a relatively comfortable middle ground in the economic spectrum, families in this category have a stable income that supports a decent standard of living. However, they are not immune to financial strains, particularly regarding housing, education, and healthcare expenses, underscoring the need for adaptable support systems.

Table 23 - LAI Household Profiles of Interest and their Median Household Income

Household Profile	Median Household Income for a Given Area (MHHI)
2. Very Low-Income Individual	National Poverty Line
3. Working Individual	50% of MHHI

Household Profile	Median Household Income for a Given Area (MHHI)
5. Retired Couple	80% of MHHI
6. Single-Parent Family	50% of MHHI
7. Moderate-Income Family	80% of MHHI

Each of these profiles plays a crucial role in shaping Pensacola's approach to building a resilient and inclusive community. By acknowledging the diverse economic realities of its residents, the city can devise targeted strategies that not only address immediate vulnerabilities but also lay the groundwork for sustainable development and prosperity.

Top Five Most Vulnerable Census Tracts

The exploration of Pensacola's flood risk planning through the lens of socioeconomic vulnerability uncovers the nuanced challenges faced by the city's most exposed communities. This approach, centered around the Social Vulnerability Index (SVI) and Location Affordability Index (LAI), emphasizes the importance of tailored flood mitigation strategies. By focusing on the top five most vulnerable census tracts, identified by their significant SVI scores, the assessment prioritizes areas with the highest need for intervention. These areas include West Garden Street, the vicinity of Sacred Heart Hospital and Cordova Mall, US 90 West, I-110, and S Pace Blvd, each presenting unique challenges due to their geographic and socioeconomic compositions.

Incorporating LAI into the analysis adds depth, revealing how housing and transportation costs impact the financial stability of various household profiles. From very low-income individuals to moderate-income families, each group's economic reality underscores the importance of integrated planning that considers both flood risks and affordability. This comprehensive approach ensures that flood resilience measures are not only effective in reducing physical vulnerabilities but also in supporting the economic well-being of Pensacola's residents.

The findings underscore the critical need for Pensacola to adopt a multi-faceted approach to flood risk planning. By acknowledging the intersection of physical vulnerabilities with socioeconomic factors, the city can develop more inclusive and sustainable strategies. These strategies should aim to not only protect infrastructure and property but also to enhance the resilience of communities, particularly those who are most vulnerable to the adverse effects of flooding. Through targeted interventions and supportive policies, Pensacola can work towards a future where all residents, regardless of their economic status, are safeguarded against the impacts of climate change and sea-level rise.

Efforts to address these vulnerabilities must consider the complex interplay of factors that contribute to the community's risk, prioritizing strategies that support the most affected populations through financial assistance, social services, and inclusive policymaking. This targeted approach is essential for improving quality of life and ensuring equitable access to resources and support in the face of climate change and flood risks.

Census Tract 12033000100 - W Garden St.

Census Tract 12033000100, encompassing W Garden St. in Pensacola, exhibits a high degree of social vulnerability, with a 91% overall impact rating derived from the CDC's Social Vulnerability Index. This area, with a population of approximately 1,579, stands out for its significant challenges across various metrics: socioeconomic status, household composition and disability, minority status/language, and housing & transportation. Specifically, it shows high vulnerability in areas such as poverty, unemployment, income levels, educational attainment, disability, single-parent households, minority population percentage, lack of vehicle access, and living in multi-unit structures or crowded conditions.

This census tract's high social vulnerability is especially pronounced with a 90.2% portion of its area within a flood hot spot, indicating a pressing need for targeted interventions. The household profiles within this tract vary widely, from very low-income individuals and working individuals to retired couples, single-parent families, and moderate-income families. Each group faces distinct challenges, suggesting a multifaceted approach is necessary for enhancing their resilience and economic stability.

Figure 99 - Map of Census Tract 12033000100

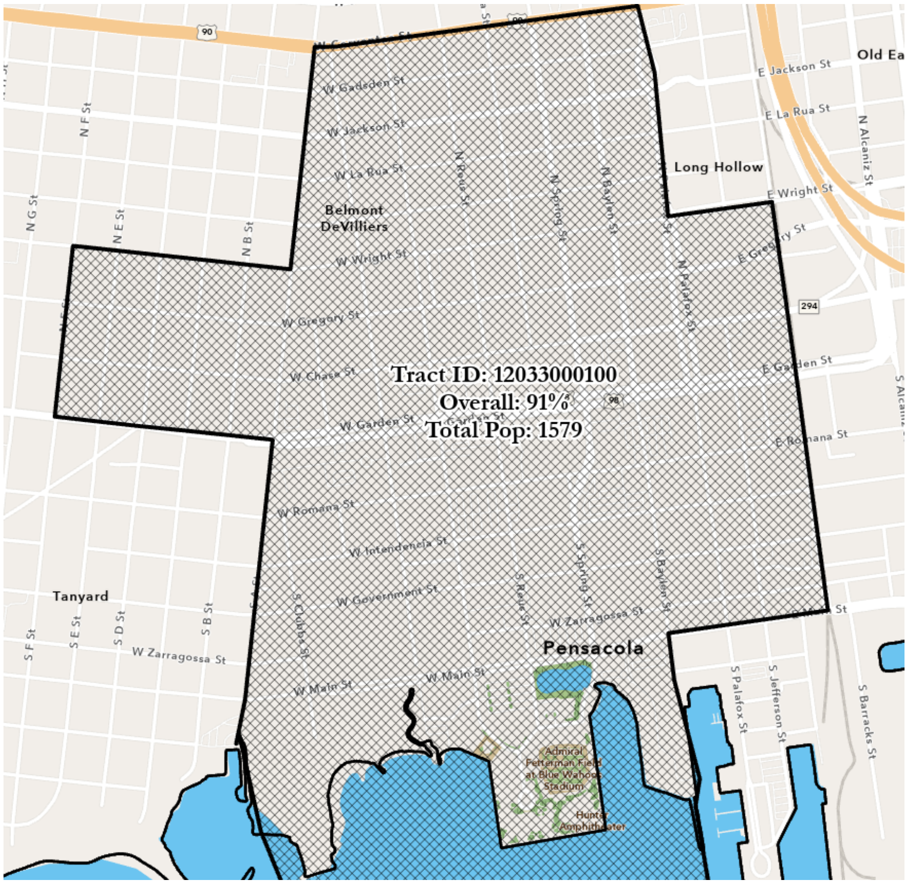


Table 24 - SVI Summary for Census Tract 12033000100

SVI Criteria Theme	SVI Percentile
Socioeconomic	77.02
Household Composition & Disability	90.78
Minority Status & Language	65.54
Housing & Transportation	92.54

Table 25 - Socioeconomic Metrics in Census Block 12033000100

Metric	Percentile Ranking of People within Census Block
Below Poverty	67.91
Unemployed	28.86
Income (per capita percentile)	81.03
No High School Diploma	83.86

Table 26 - Household Composition & Disability Metrics in Census Block 12033000100

Metric	Percentile Ranking of People within Census Block
Age 65 or Older	86.84
Age 17 or Younger	35.16
Older than Age 5 w/ Disability	97.02
Single-Parent Households	62.95

Table 27 - Minority Status & Language Metrics in Census Block 12033000100

Metric	Percentile Ranking of People within Census Block
Minority	65.54
Speaks English "Less than Well"	47.94

Table 28 - House Type and Transportation Metrics in Census Block 12033000100

Metric	Percentile Ranking of People within Census Block
Multi-Unit Structures	82.98
Mobile Homes	47.18
Crowding	32.37

Metric	Percentile Ranking of People within Census Block
No Vehicle	93.05
Group Quarters	89.21

Table 29 - LAI Household Profile Income Percentiles in Census Block 12033000100

Household Profile 2: Very Low-Income Individual	**9.79 Percentile** This profile represents individuals with very low incomes, positioned in the lower third of the income distribution, with their income being higher than only about 10% of the population.
Household Profile 3: Working Individual	**27.83 Percentile** Working individuals in this category have a median income higher than 30% of the population, placing them in the mid-range of the income spectrum.
Household Profile 5: Retired Couple	**47.50 Percentile** Retired couples are among the higher earners, with their income surpassing about 48% of the population.
Household Profile 6: Single-Parent Family	**27.83 Percentile** Single-parent families, with a median income higher than 30% of the population, face unique challenges.
Household Profile 7: Moderate Income Family	**47.50 Percentile** Families in the moderate-income category are well above the median, with incomes higher than approximately 48% of the population.

The Social Vulnerability Index (SVI) for Census Tract 12033000100 in Pensacola highlights significant challenges across various metrics, revealing a community highly susceptible to socioeconomic, disability, minority status/language, and housing & transportation issues. With a total SVI impact rating of 91%, the detailed breakdown includes:

Key Vulnerabilities Identified:

- **Socioeconomic:** High levels of poverty and unemployment, low income, and educational attainment.
- **Household Composition & Disability:** Notable vulnerabilities related to disability, single-parent households, and minority population percentages.

- **Housing & Transportation:** Significant issues with lack of vehicle access and living conditions in multi-unit structures or crowded environments.

Implications and Approach: The pronounced social vulnerability necessitates targeted interventions to enhance resilience and economic stability, with a focus on supporting very low-income individuals, working individuals, retired couples, single-parent families, and moderate-income families through comprehensive planning that addresses both flood risks and affordability.

Census Tract 12033001201 - Sacred Heart Hospital and Cordova Mall Area

For Census Tract 12033001201, a 2.57 square mile area is identified at a rating of 66% total social vulnerability impact which is an average score of the four related theme groups listed above. The total population of the census tract is approximately 4,899. Below is a table with their ratings in each theme and the specific social factors with the highest vulnerability impact rating. If the average from the "theme group" is higher than 50% the attributes within that theme group are further outlined in the subsequent tables below.

This census tract's high social vulnerability is especially pronounced with a 68.1% portion of its area within a flood hot spot, indicating a pressing need for targeted interventions. The household profiles within this tract vary widely, from very low-income individuals and working individuals to retired couples, single-parent families, and moderate-income families. Each group faces distinct challenges, suggesting a multifaceted approach is necessary for enhancing their resilience and economic stability.

Figure 100 - Map of Census Tract 12033001201

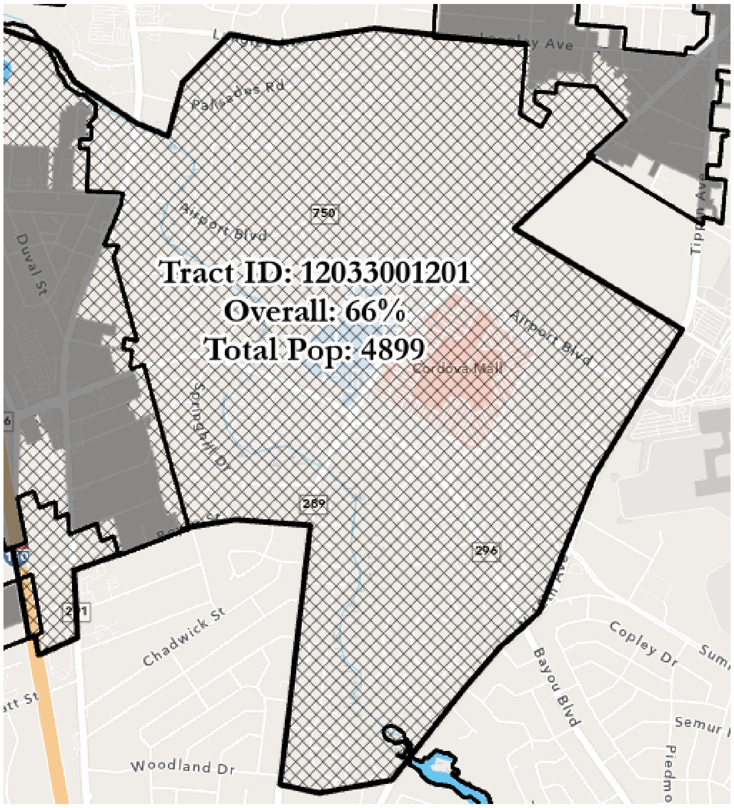


Table 30 - SVI Summary for Census Tract 12033001201

SVI Criteria Theme	SVI Percentile Ranking (%)
Socioeconomic	68.47
Household Composition & Disability	22.42
Minority Status & Language	60.81
Housing & Transportation	80.58

Table 31 - Socioeconomic Metrics for Census Tract 12033001201

Metric	Percentile Ranking of People within Census Block
Below Poverty	67.17
Unemployed	6.41

Metric	Percentile Ranking of People within Census Block
Income (per capita percentile)	82.52
No High School Diploma	64.70

Table 32 - Household Composition & Disability Metrics in Census Block 12033001201

Metric	Percentile Ranking of People within Census Block
Age 65 or Older	14.54
Age 17 or Younger	52.84
Older than Age 5 w/ Disability	21.74
Single-Parent Households	85.00

Table 33 - Minority Status & Language Metrics in Census Block 12033001201

Metric	Percentile Ranking of People within Census Block
Minority	60.81
Speaks English “Less than Well”	25.80

Table 34 - House Type and Transportation Metrics in Census Block 12033001201

Metric	Percentile Ranking of People within Census Block
Multi-Unit Structures	82.98
Mobile Homes	71.59
Crowding	63.78
No Vehicle	18.72
Group Quarters	63.99

Table 35 - LAI Household Profile Income Percentiles in Census Block 12033001201

Household Profile 2: Very Low-Income Individual	**11.98 Percentile** This profile represents individuals with very low incomes, positioned in the lower third of the income distribution, with their income being higher than only about 12% of the population.
Household Profile 3: Working Individual	**36.98 Percentile** Working individuals in this category have a median income higher than 37% of the population, placing them in the mid-range of the income spectrum.
Household Profile 5: Retired Couple	**56.20 Percentile** Retired couples are among the higher earners, with their income surpassing about 56% of the population.
Household Profile 6: Single-Parent Family	**36.98 Percentile** Single-parent families, with a median income higher than 37% of the population, face unique challenges.

Census Tract 12033001201, encompassing the Sacred Heart Hospital and Cordova Mall Area in Pensacola, is evaluated with a 66% total social vulnerability impact based on the CDC's Social Vulnerability Index. This area, with a notable population of approximately 4,899, presents distinct vulnerabilities across socioeconomic factors, household composition and disability, minority status/language, and housing & transportation needs.

Key Vulnerabilities Identified:

- **Socioeconomic:** Considerable portion living below the poverty line, low unemployment rates, and disparities in income and education levels.
- **Household Composition & Disability:** Lower vulnerability in this area, but single-parent households emerge as a significant concern.
- **Housing & Transportation:** High residency in multi-unit structures and mobile homes, with moderate challenges related to vehicle access.

Implications and Approach: Given the multifaceted vulnerabilities, especially concerning socioeconomic conditions and household composition, interventions should aim at enhancing the community's resilience and economic stability, prioritizing the needs of varied household profiles.

Census Tract 12033000400 - US 90 West

For Census Tract 12033000400, a 0.77 sq mi area is identified at a rating of 99% total social vulnerability impact which is an average score of the four related theme groups listed above. The total population of the census tract is approximately 3,710. Below is a table with their ratings in each theme and the specific social factors with the highest vulnerability impact rating. If the average from the "theme group" is higher than 50% the attributes within that theme group are further outlined in the subsequent tables below.

This census tract's high social vulnerability is especially pronounced with a 67.5% portion of its area within a flood hot spot, indicating a pressing need for targeted interventions. The household profiles within this tract vary widely, from very low-income individuals and working individuals to retired couples, single-parent families, and moderate-income families. Each group faces distinct challenges, suggesting a multifaceted approach is necessary for enhancing their resilience and economic stability.

Figure 101 - Map of Census Tract 12033000400

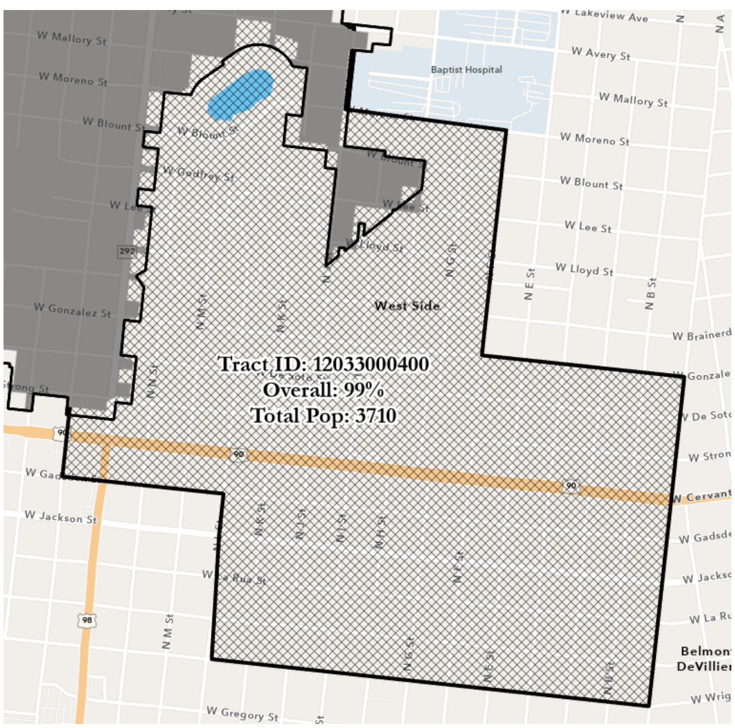


Table 36 - SVI Summary for Census Tract 12033000400

SVI Criteria Theme	SVI Percentile Ranking (%)
Socioeconomic	98.48
Household Composition & Disability	97.46
Minority Status & Language	87.80
Housing & Transportation	86.83

Table 37 - Socioeconomic Metrics for Census Tract 12033000400

Metric	Percentile Ranking of People within Census Block
Below Poverty	97.37
Unemployed	98.53
Income (per capita percentile)	96.26
No High School Diploma	90.65

Table 38 - Household Composition & Disability Metrics for Census Tract 12033000400

Metric	Percentile Ranking of People within Census Block
Age 65 or Older	79.31
Age 17 or Younger	94.58
Older than Age 5 w/ Disability	96.70
Single-Parent Households	95.22

Table 39 - Minority Status & Language Metrics for Census Tract 12033000400

Metric	Percentile Ranking of People within Census Block
Minority	87.80
Speaks English “Less than Well”	0.00

Table 40 - House Type and Transportation Metrics for Census Tract 12033000400

Metric	Percentile Ranking of People within Census Block
Multi-Unit Structures	86.91
Mobile Homes	0.00
Crowding	53.72
No Vehicle	95.70
Group Quarters	85.41

Table 41 - LAI Household Profile Income Percentiles in Census Tract 12033000400

Household Profile 2: Very Low-Income Individual	**30.42 Percentile** This profile represents individuals with very low incomes, positioned in the lower third of the income distribution, with their income being higher than only about 30% of the population.
Household Profile 3: Working Individual	**56.15 Percentile** Working individuals in this category have a median income higher than 56% of the population, placing them in the mid-range of the income spectrum.
Household Profile 5: Retired Couple	**82.84 Percentile** Retired couples are among the higher earners, with their income surpassing about 83% of the population.
Household Profile 6: Single-Parent Family	**56.15 Percentile** Single-parent families, with a median income higher than 56% of the population, face unique challenges.
Household Profile 7: Moderate Income Family	**82.84 Percentile** Families in the moderate-income category are well above the median, with incomes higher than approximately 83% of the population.

Census Tract 12033000400, covering an area along US 90 West in Pensacola, exhibits an exceptionally high social vulnerability with a 99% total impact score according to the CDC's Social Vulnerability Index (SVI). This tract, with its 3,710 residents, faces significant challenges that span socioeconomic issues, household composition and disability, minority status/language, and housing &

transportation—making it one of the areas most in need of targeted support within the community.

Key Vulnerabilities Identified:

- **Socioeconomic:** Extreme poverty and unemployment rates, low income, and lack of high school education.
- **Household Composition & Disability:** Universal vulnerability with a focus on disabilities and single-parent households.
- **Housing & Transportation:** Dependence on multi-unit structures and a lack of vehicle access, highlighting mobility and housing challenges.

Implications and Approach: Addressing the tract's vulnerabilities requires not only immediate aid and services but also long-term socioeconomic improvements, enhanced education access, and housing and transportation solutions to ensure community resilience.

Census Tract 12033000600 - I-110

For Census Tract 12033000600, a 0.67 square mile area is identified at a rating of 67% total social vulnerability impact, which is an average score of the four related theme groups listed above. The total population of the census tract is approximately 1,482. Below is a table with their ratings in each theme and the specific social factors with the highest vulnerability impact rating. If the average from the "theme group" is higher than 50% the attributes within that theme group are further outlined in the subsequent tables below.

This census tract's high social vulnerability is especially pronounced with a 64.2% portion of its area within a flood hot spot, indicating a pressing need for targeted interventions. The household profiles within this tract vary widely, from very low-income individuals and working individuals to retired couples, single-parent families, and moderate-income families. Each group faces distinct challenges, suggesting a multifaceted approach is necessary for enhancing their resilience and economic stability.

Figure 102 - Map of Census Tract 12033000600

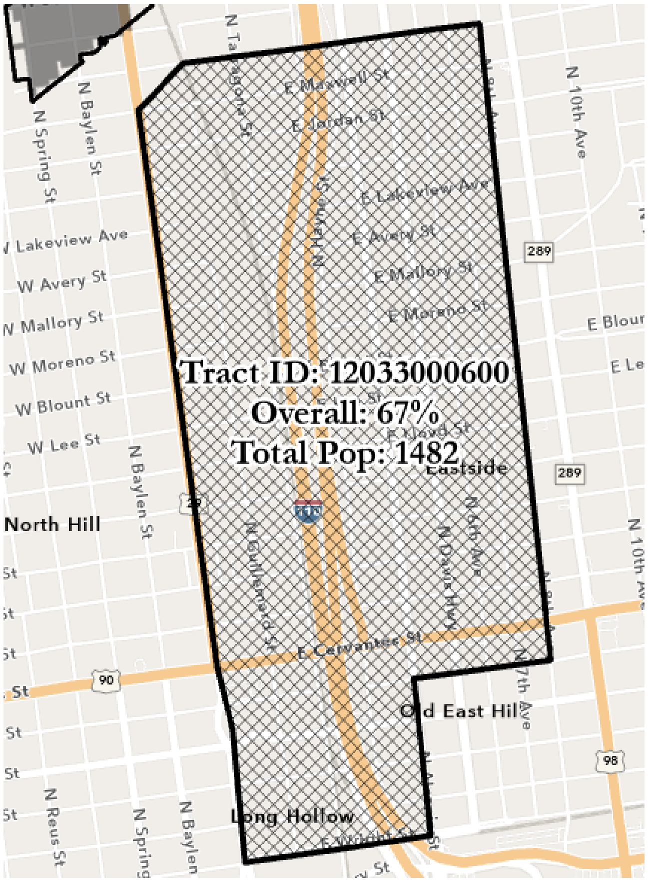


Table 42 - SVI Summary for Census Tract 12033000600

SVI Criteria Theme	SVI Percentile Ranking (%)
Socioeconomic	90.93
Household Composition & Disability	18.40
Minority Status & Language	75.11
Housing & Transportation	40.83

Table 43 - Socioeconomic Metrics for Census Tract 12033000600

Metric	Percentile Ranking of People within Census Block

Below Poverty	55.94
Unemployed	96.93
Income (per capita percentile)	86.46
No High School Diploma	62.93

Table 44 - Household Composition & Disability Metrics for Census Tract 12033000600

Metric	Percentile Ranking of People within Census Block
Age 65 or Older	26.29
Age 17 or Younger	14.73
Older than Age 5 w/ Disability	80.61
Single-Parent Households	45.82

Table 45 - Minority Status & Language Metrics for Census Tract 12033000600

Metric	Percentile Ranking of People within Census Block
Minority	75.11
Speaks English "Less than Well"	23.43

Table 46 - House Type and Transportation Metrics for Census Tract 12033000600

Metric	Percentile Ranking of People within Census Block
Multi-Unit Structures	0.00
Mobile Homes	0.00
Crowding	56.22
No Vehicle	82.81
Group Quarters	66.12

Table 47 - LAI Household Profile Income Percentiles in Census Tract 12033000600

Household Profile 2: Very Low-Income Individual	**11.86 Percentile** This profile represents individuals with very low incomes, positioned in the lower third of the income distribution, with their income being higher than only about 12% of the population.
Household Profile 3: Working Individual	**45.99 Percentile** Working individuals in this category have a median income higher than 46% of the population, placing them in the mid-range of the income spectrum.
Household Profile 5: Retired Couple	**58.25 Percentile** Retired couples are among the higher earners, with their income surpassing about 58% of the population.
Household Profile 6: Single-Parent Family	**45.99 Percentile** Single-parent families, with a median income higher than 46% of the population, face unique challenges.
Household Profile 7: Moderate Income Family	**58.25 Percentile** Families in the moderate-income category are well above the median, with incomes higher than approximately 58% of the population

Census Tract 12033000600, located near I-110 in Pensacola, has been identified with a significant social vulnerability impact of 67% according to the Social Vulnerability Index (SVI). This area, home to approximately 1,482 residents, shows pronounced disparities across various aspects such as socioeconomic conditions, minority status/language, and housing & transportation.

Key Vulnerabilities Identified:

- **Socioeconomic:** High unemployment and poverty rates, alongside challenges in income levels and educational attainment.
- **Household Composition & Disability:** Notable portion with disabilities, highlighting the need for accessible support services.
- **Housing & Transportation:** Limited issues with housing structure but significant challenges in vehicle access.

Implications and Approach: A multi-layered intervention strategy is essential, focusing on immediate support needs and broader challenges in socioeconomic, housing, and transportation areas to foster a more inclusive and resilient community.

Census Tract 12033000300 - S Pace Blvd

For Census Tract 12033000300, a 1.74 square mile area is identified at a rating of 75% total social vulnerability impact which is an average score of the four related theme groups listed above. The total population of the census tract is approximately 3,067. Below is a table with their ratings in each theme and the specific social factors with the highest vulnerability impact rating. If the average from the "theme group" is higher than 50% the attributes within that theme group are further outlined in the subsequent below.

This census tract's high social vulnerability is especially pronounced with a 63.8% portion of its area within a flood hot spot, indicating a pressing need for targeted interventions. The household profiles within this tract vary widely, from very low-income individuals and working individuals to retired couples, single-parent families, and moderate-income families. Each group faces distinct challenges, suggesting a multifaceted approach is necessary for enhancing their resilience and economic stability.

Figure 103 - Map of Census Tract 12033000300

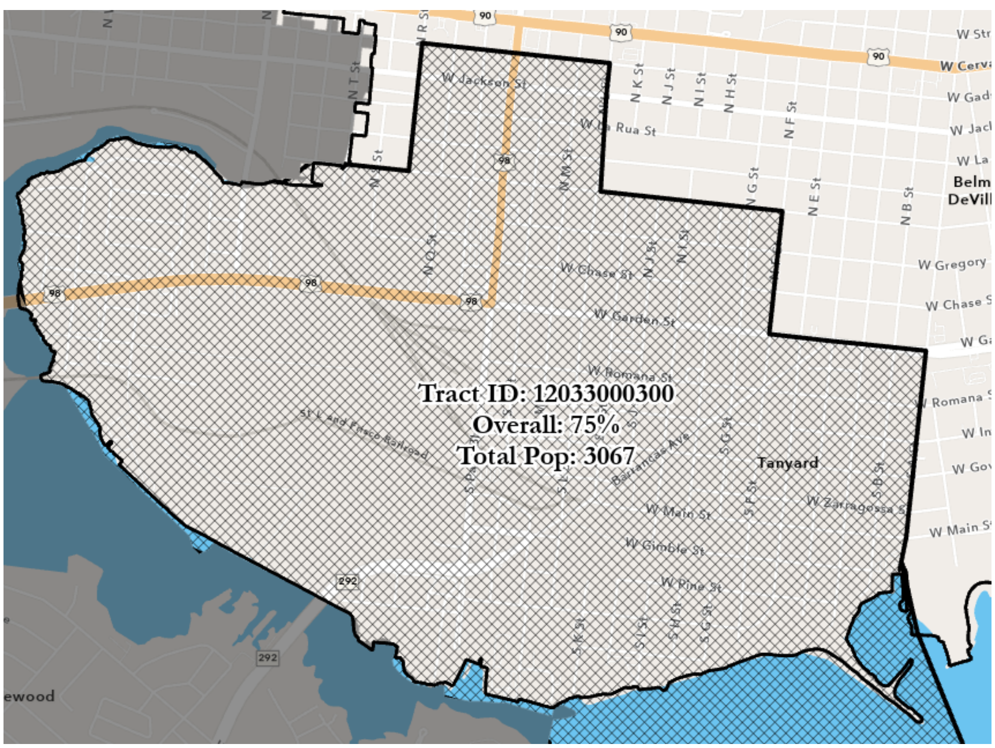


Table 48 - SVI Summary for Census Tract 12033000300

SVI Criteria Theme	SVI Percentile Ranking (%)
Socioeconomic	76.01
Household Composition & Disability	88.72
Minority Status & Language	61.98
Housing & Transportation	43.59

Table 49 - Socioeconomic Metrics for Census Tract 12033000300

Metric	Percentile Ranking of People within Census Block
Below Poverty	83.04
Unemployed	45.83
Income (per capita percentile)	69.75
No High School Diploma	56.31

Table 50 - Household Composition & Disability Metrics for Census Tract 12033000300

Metric	Percentile Ranking of People within Census Block
Age 65 or Older	31.92
Age 17 or Younger	91.99
Older than Age 5 w/ Disability	68.37
Single-Parent Households	86.43

Table 51 - Minority Status & Language Metrics for Census Tract 12033000300

Metric	Percentile Ranking of People within Census Block
Minority	61.98
Speaks English "Less than Well"	44.26

Table 52 - House Type and Transportation Metrics for Census Tract 12033000300

Metric	Percentile Ranking of People within Census Block
Multi-Unit Structures	54.43
Mobile Homes	0.00
Crowding	91.47
No Vehicle	66.13
Group Quarters	0.00

Table 53 - LAI Household Profile Income Percentiles in Census Tract 12033000300

Household Profile 2: Very Low-Income Individual	**14.97 Percentile** This profile represents individuals with very low incomes, positioned in the lower third of the income distribution, with their income being higher than only about 15% of the population.
Household Profile 3: Working Individual	**35.07 Percentile** Working individuals in this category have a median income higher than 35% of the population, placing them in the mid-range of the income spectrum.
Household Profile 5: Retired Couple	**55.37 Percentile** Retired couples are among the higher earners, with their income surpassing about 55% of the population.
Household Profile 6: Single-Parent Family	**35.07 Percentile** Single-parent families, with a median income higher than 35% of the population, face unique challenges.
Household Profile 7: Moderate Income Family	**55.37 Percentile** Families in the moderate-income category are well above the median, with incomes higher than approximately 55% of the population.

Census Tract 12033000300, encompassing the S Pace Blvd area in Pensacola, demonstrates a marked level of social vulnerability with a 75% overall impact rating based on the CDC's Social Vulnerability Index (SVI). With an estimated population of 3,067, this tract highlights pressing needs in several critical areas: socioeconomic status, household composition and disability, minority status/language, and housing

& transportation.

Key Vulnerabilities Identified:

- **Socioeconomic:** Significant levels of poverty and unemployment, with additional challenges in income and education.
- **Household Composition & Disability:** High vulnerability in single-parent households and disabilities.
- **Housing & Transportation:** Concerns with crowding and vehicle access, impacting mobility and living conditions.

Implications and Approach: Addressing the tract's complex vulnerabilities requires comprehensive strategies that not only provide financial and social support but also aim at structural improvements to build a resilient and inclusive community.

Policy, Land Use and Development

When conducting a vulnerability assessment, an immense amount of data and analysis is generated, but even more important than the information is what the community does with it. A key mechanism that a community can make better decisions based on the outcomes of a vulnerability assessment is through its budget, infrastructure design, and land use / land development policies. Each of these examples is discussed in this section.

Budget Implications

This vulnerability assessment can help the City target investments into priority areas by focusing on the flooding hot spots identified. The flooding hot spots show current and increasing flood risk based on the type of flooding. For hot spots subject to tidal flooding, shoreline defense strategies might include living shorelines or controlling other tidal impacts through backflow prevention on stormwater outfalls. These strategies can help protect the critical assets identified in those hot spots, as well as the property and business owners relying on those assets for their day-to-day quality of life. Hot spots where rainfall is the primary driver of current and future flood risk are generally already known to be flood-prone areas, so any updated, more advanced hydrological modeling will serve as a further check and balance on stormwater improvement priorities. Prioritizing investments in these areas can maintain or improve stormwater levels of service defined with the City’s Comprehensive Plan and Code and again assist in targeting investments to the areas that will be impacted the soonest. These prioritization strategies of prioritization would essentially take place as part of the City’s existing capital improvements and budgeting processes.

Infrastructure Design

When designing infrastructure in the City, there are two basic concepts: the actual design of a project and the level of service it provides. A couple of examples from the City's Code and Comprehensive Plan can demonstrate this concept and how this vulnerability assessment can help shape those policies based on its outcomes.

Stormwater

In Sec. 12-8-6 of the Code of Ordinances, the City prescribes design standards for stormwater management systems. Relevant provisions include:

- All stormwater management facilities shall be designed for a minimum of 50-year life, have low maintenance cost and easy legal access for periodic maintenance.

- Stormwater management facilities with approved positive outfall shall be designed to attenuate the 100 year/critical duration storm event. The city engineer may waive or reduce this requirement if the stormwater management facility discharges directly into a natural outfall after treatment, does not contribute to potential or existing flooding conditions and does not increase pollutant loading.

- Retention facilities that fall within a closed drainage basin and have no positive outfall shall retain the entire runoff volume from a 100-year storm event and shall include all storm durations up to and including the 24-hour duration. This retention volume must be recovered within 72 hours of the contributing storm event by natural percolation or other approved means.

In terms of applying relevant outcomes from this vulnerability assessment to these existing design standards, the City should consider the following:

- How will stormwater systems need to manage for different conditions over the next 50 years due to changing rainfall conditions? Or, in some areas, how will sea level rise impact those operations throughout a rising tailwater condition? One recommendation would be to modify the 50-year useful life language to include not only a 50-year useful life, but also future conditions related to changing rainfall conditions and a reduced tailwater condition due to sea level rise. Pinellas County has incorporated tailwater conditions into its Code to address this issue.

- Is the 100 year/critical duration storm event sufficient for design decisions, given that longer-duration events are occurring more frequently? In certain parts of the City, this design standard may not be enough, or may be compromised by increased tidal flooding from sea level rise. One recommendation may be to incorporate higher frequency critical duration storm events in more advanced stormwater modeling. Notably, the City is currently undertaking this type of modeling process in pursuit of a CRS Watershed Management Plan under a separate grant. This information could help identify areas of the City where the stormwater system may be compromised by more frequent, higher volume rain or storm events.

In the City's 2011 Comprehensive Plan found online, Objective PF-1.1 defines the level of service for drainage:

Drainage - LOS A - tolerates street flooding to a depth of 3 inches or less in the gutters when the rest of the pavement is passable, and allows open or green space flooding of up to 12" as long as there is no threat to public health or safety, or permanent impediment to the intended use of the property; LOS B - tolerates flooding of entire street surface up to 4"; LOS C - tolerates structure flooding; based on the following design criteria:

- *In existing developments adequate drainage capacity to accommodate run-off associated with a 3-year, 12-hour design storm for collection systems;*
- *In new developments adequate drainage capacity to accommodate a 25-year, 12-hour design storm for collection systems and for retention and detention ponds. As a minimum the first 1/2" of runoff must be retained on the site of the development. At the discretion of the City Engineer, retention standards may be increased beyond the 1/2" minimum standards on a site-specific basis.*

Assuming this is still the City's adopted level of service for drainage, two things are important to note. First, the existing development level of service for a 3-year, 12-hour design storm may be a very low level of service, but as City is 96% built out, the only opportunities to improve this level of service would be through new capital projects or larger redevelopment projects. Additionally, the 25-year, 12-hour design storm also may be low, considering that the Code directs projects to be designed for a minimum 50-year life. The results of the vulnerability assessment indicate potentially higher volume rainfall events (1.12 times more rainfall in 2040 than the present day and 1.22 times more rainfall in 2070, i.e., roughly the 50-year life). Another recommendation would be to reevaluate these adopted level of service standards in the Comprehensive Plan, based upon the information in this vulnerability assessment, and in conjunction with the more advanced modeling being conducted in the CRS Watershed Management Plan currently underway.

Land Use / Land Development

Land use and land development policies generally control how communities develop and where. Again, the City is 96% built out, so the potential to address new development is limited in terms of large-scale planned unit developments or larger projects. That said, redevelopment opportunities do exist, and there are also implications for affordable housing projects given the outputs of the vulnerability assessment.

Recommended policies that the City should examine in relation to increasing flood risk include:

- The City's Floodplain Management Ordinance in Chapter 12-9. Key provisions may include enhanced freeboard in certain areas of the City or for substantial improvements.

- Requiring—not just encouraging—pervious surfaces in Landscaping standards (Sec. 12-6-3) and requiring higher thresholds in the Community Redevelopment area (CRS) urban design overlay district (Sec. 12-3-31).

- Adopting a shoreline ordinance that harmonizes concepts of seawall heights, promoting living or hybrid shorelines in key locations and tying useful life of shoreline improvements to future flood risk.

Finally, the Live Local Act in 2023 (SB 102) changed the local government approval process for affordable housing. This vulnerability assessment, particularly the sections of social vulnerability and location affordability index, provides information that the City can use to target redevelopment projects, mindful of the current and future flood risk that exists at present and will exist in the future. The City should work with any affordable housing developers on projects in these locations to consider the outcomes of this vulnerability assessment so that flood risk does not exacerbate social and economic stress on the populations that will live there. The Florida Housing Coalition can be a resource for facilitating affordable housing projects that take into account varying and changing flooding risks.

Conclusion

In summary, this comprehensive vulnerability assessment has illuminated critical insights into Pensacola's susceptibility to climate change and sea-level rise. These findings underscore the urgent need for proactive measures to safeguard the city's communities, infrastructure, and environment.

By conducting an in-depth analysis of physical, socio-economic, and environmental vulnerabilities specific to Pensacola, this vulnerability assessment equips decision-makers with a holistic understanding of the city's susceptibility to climate change impacts. This knowledge forms the basis for tailored mitigation and adaptation strategies aimed at enhancing the city's resilience and sustainability.

Pensacola's coastal location exposes it to the relentless forces of sea-level rise, storm surges, and high tide flooding. The potential impacts on critical infrastructure, communities, and the economy are significant and cannot be ignored. By further developing these types of adaptation strategy recommendations and working together, Pensacola can fortify its defenses against the growing threats of climate change.

References

Adger, W. N., Hughes, T. P., Folke, C., Carpenter, S. R., & Rockström, J. (2005). Social-ecological resilience to coastal disasters. Science, 309(5737), 1036-1039. https://doi.org/10.1126/science.1112122

Barnett, J., & Adger, W. N. (2003). Climate dangers and atoll countries. Climatic Change, 61(3), 321-337. https://doi.org/10.1023/B:CLIM.0000004559.08755.88

Beck, M. W., Losada, I. J., Menéndez, P., Reguero, B. G., Díaz-Simal, P., & Fernández, F. (2018). The global flood protection savings provided by coral reefs. Nature Communications, 9(1), 2186. https://doi.org/10.1038/s41467-018-04568-z

Brody, S. D., Zahran, S., Highfield, W. E., Grover, H., & Vedlitz, A. (2008). Identifying the impact of the built environment on flood damage in Texas. Disasters, 32(1), 1-18. https://research-legacy.arch.tamu.edu/epsru/pdf/FL_TX.pdf

Brown, S., Nicholls, R. J., Lowe, J. A., & Hinkel, J. (2016). Spatial variations of sea-level rise and impacts: An application of DIVA. Climatic Change, 134(3), 403-416. https://doi.org/10.1007/s10584-013-0925-y

Cazenave, A., & Le Cozannet, G. (2014). Sea level rise and its coastal impacts. Earth's Future, 2(2), 15-34. https://doi.org/10.1002/2013EF000188

Church, J. A., & White, N. J. (2006). A 20th-century acceleration in global sea-level rise. Geophysical Research Letters, 33(1). https://doi.org/10.1029/2005GL024826

Cutter, S. L., Boruff, B. J., & Shirley, W. L. (2003). Social vulnerability to environmental hazards. Social Science Quarterly, 84(2), 242-261. https://doi.org/10.1111/1540-6237.8402002

Douglas, E. M., Kirshen, P. H., & Paolisso, M. (2012). Coastal flooding, climate change and environmental justice: Identifying obstacles and incentives for adaptation in two metropolitan Boston Massachusetts communities. Mitigation and Adaptation Strategies for Global Change, 17(5), 537-562. https://doi.org/10.1007/s11027-011-9340-8

Esteban, M., Takagi, H., & Shibayama, T. (2015). Handbook of Coastal Disaster Mitigation for Engineers and Planners. Elsevier. ISBN: 9780128010600. https://www.elsevier.com/books/handbook-of-coastal-disaster-mitigation-for-engineers-and-planners/esteban/978-0-12-801060-0

Federal Emergency Management Agency. (n.d.). HAZUS-MH Flood Model. Retrieved from https://www.fema.gov/hazusa

Frazier, T. G., Thompson, C. M., Dezzani, R. J., & Butsick, D. (2014). Spatial and temporal quantification of resilience at the community scale. Applied Geography, 53, 95-107.

https://www.researchgate.net/publication/256972265_Spatial_and_temporal_quantification_of_resilience_at_the_community_scale

Hallegatte, S., Green, C., Nicholls, R. J., & Corfee-Morlot, J. (2013). Future flood losses in major coastal cities. Nature Climate Change, 3(9), 802-806. https://doi.org/10.1038/nclimate1979

Hauer, M. E., Evans, J. M., & Mishra, D. R. (2016). Millions projected to be at risk from sea-level rise in the continental United States. Nature Climate Change, 6(7), 691-695. https://doi.org/10.1038/nclimate2961

Hinkel, J., Lincke, D., Vafeidis, A. T., Perrette, M., Nicholls, R. J., Tol, R. S. J., ... & Levermann, A. (2014). Coastal flood damage and adaptation costs under 21st-century sea-level rise. Proceedings of the National Academy of Sciences, 111(9), 3292-3297. https://doi.org/10.1073/pnas.1222469111

Hydrologic Engineering Center, U.S. Army Corps of Engineers. (n.d.). HEC-RAS River Analysis System. Retrieved from https://www.hec.usace.army.mil/software/hec-ras/

Intergovernmental Panel on Climate Change (IPCC). (2014). Climate Change 2014: Impacts, Adaptation, and Vulnerability. Cambridge University Press. https://www.ipcc.ch/report/ar5/wg2/

Intergovernmental Panel on Climate Change (IPCC). (2019). Special Report on the Ocean and Cryosphere in a Changing Climate. Retrieved from https://www.ipcc.ch/srocc/

IPCC. (2021). Global and Regional Sea Level Rise Scenarios for the United States. National Oceanic and Atmospheric Administration. https://www.noaa.gov/slr

Kirshen, P., Ruth, M., & Anderson, W. (2008). Interdependencies of urban climate change impacts and adaptation strategies: A case study of Metropolitan Boston USA. Climatic Change, 86(1-2), 105-122. https://doi.org/10.1007/s10584-007-9252-5

Klein, R. J. T., Nicholls, R. J., & Thomalla, F. (2003). Resilience to natural hazards: How useful is this concept? Environmental Hazards, 5(1-2), 35-45. https://doi.org/10.1016/j.hazards.2004.02.001

Lenton, T. M., Held, H., Kriegler, E., Hall, J. W., Lucht, W., Rahmstorf, S., & Schellnhuber, H. J. (2008). Tipping elements in the Earth's climate system. Proceedings of the National Academy of Sciences, 105(6), 1786-1793. https://doi.org/10.1073/pnas.0705414105

McGranahan, G., Balk, D., & Anderson, B. (2007). The rising tide: Assessing the risks of climate change and human settlements in low elevation coastal zones. Environment and Urbanization, 19(1), 17-37. https://doi.org/10.1177/0956247807076960

National Oceanic and Atmospheric Administration. (n.d.). Sea Level Rise and Coastal Flooding Impacts. Retrieved from https://coast.noaa.gov/slr/

National Research Council. (2012). Sea-Level Rise for the Coasts of California, Oregon, and

Washington: Past, Present, and Future. The National Academies Press. ISBN: 9780309255943. https://www.oxnard.org/wp-content/uploads/2021/06/Sea-Level-Rise-for-the-Coasts.pdf

Neumann, B., Vafeidis, A. T., Zimmermann, J., & Nicholls, R. J. (2015). Future coastal population growth and exposure to sea-level rise and coastal flooding - A global assessment. PLOS ONE, 10(3), e0118571. https://doi.org/10.1371/journal.pone.0118571

Nicholls, R. J., & Cazenave, A. (2010). Sea-level rise and its impact on coastal zones. Science, 328(5985), 1517-1520. https://doi.org/10.1126/science.1185782

NOAA. (2021). Global and Regional Sea Level Rise Scenarios for the United States. National Oceanic and Atmospheric Administration. https://www.noaa.gov/slr

Oppenheimer, M., Glavovic, B. C., Hinkel, J., van de Wal, R., Magnan, A. K., Abd-Elgawad, A., ... & Sebesvari, Z. (2019). Sea-level rise and implications for low-lying islands, coasts, and communities. In IPCC Special Report on the Ocean and Cryosphere in a Changing Climate. https://doi.org/10.1017/9781009157964.007

Pelling, M., & Blackburn, S. (2014). Megacities and the coast: Risk, resilience, and transformation. Routledge. https://www.researchgate.net/publication/261511434_Megacities_and_the_Coast_Risk_Resilience_and_Transformation

Reguero, B. G., Losada, I. J., & Méndez, F. J. (2015). A recent increase in global wave power as a consequence of oceanic warming. Nature Communications, 10(1), 205. https://doi.org/10.1038/s41467-018-08066-0

Rosenzweig, C., Solecki, W. D., Hammer, S. A., & Mehrotra, S. (2010). Cities lead the way in climate-change action. Nature, 467(7318), 909-911. https://doi.org/10.1038/467909a

Sallenger, A. H., Doran, K. S., & Howd, P. A. (2012). Hotspot of accelerated sea-level rise on the Atlantic coast of North America. Nature Climate Change, 2(12), 884-888. https://doi.org/10.1038/nclimate1597

Shepard, C., Agostini, V. N., Gilmer, B., Allen, T., Stone, J., Brooks, W., & Beck, M. W. (2012). Assessing future risk: Quantifying the effects of sea-level rise on storm surge risk for the southern shores of Long Island, New York. Natural Hazards, 60(2), 727-745. https://doi.org/10.1007/s11069-011-0046-8

Shepard, C. C., Crain, C. M., & Beck, M. W. (2011). The protective role of coastal marshes: A systematic review and meta-analysis. PLOS ONE, 6(11), e27374. https://doi.org/10.1371/journal.pone.0027374

Stive, M. J. F., Aarninkhof, S. G. J., Hamm, L., Hanson, H., Larson, M., Wijnberg, K. M., ... & Capobianco, M. (2002). Variability of shore and shoreline evolution. Coastal Engineering, 47(2), 211-235. https://doi.org/10.1016/S0378-3839(02)00126-6

Sweet, W. V., Kopp, R. E., Weaver, C. P., Obeysekera, J., Horton, R. M., Thieler, E. R., & Zervas, C. (2017). Global and regional sea-level rise scenarios for the United States. NOAA Technical Report NOS CO-OPS 083. National Oceanic and Atmospheric Administration. https://tidesandcurrents.noaa.gov/publications/techrpt83_Global_and_Regional_SLR_Scenarios_for_the_US_final.pdf

Titus, J. G., & Richman, C. (2001). Maps of lands vulnerable to sea-level rise: Modeled elevations along the U.S. Atlantic and Gulf coasts. Climate Research, 18, 205-228. https://doi.org/10.3354/cr018205

U.S. Climate Resilience Toolkit. (n.d.). Steps to Resilience. Retrieved from https://toolkit.climate.gov/steps-to-resilience

U.S. Department of Agriculture, Natural Resources Conservation Service. (2004, July). Part 630: Hydrology. In National Engineering Handbook. Retrieved from https://www.flrules.org/Gateway/reference.asp?No=Ref-02983

U.S. Environmental Protection Agency. (2019). Creating Resilient Water Utilities Initiative. Retrieved from https://www.epa.gov/crwu

U.S. Geological Survey. (2019). Coastal Change Hazards: Hurricanes and Extreme Storms. Retrieved from https://www.usgs.gov/natural-hazards/coastal-marine-hazards-and-resources/science/coastal-change-hazards-hurricanes-and

U.S. Geological Survey. (n.d.). USGS Water Resources. Retrieved from https://www.usgs.gov/mission-areas/water-resources

Wahl, T., Haigh, I. D., Nicholls, R. J., Arns, A., Dangendorf, S., Hinkel, J., & Slangen, A. B. A. (2017). Understanding extreme sea levels for broad-scale coastal impact and adaptation analysis. Nature Communications, 8, 16075. https://doi.org/10.1038/ncomms16075

Wong, P. P., Losada, I. J., Gattuso, J. P., Hinkel, J., Khattabi, A., McInnes, K. L., ... & Saito, Y. (2014). Coastal systems and low-lying areas. In Climate Change 2014: Impacts, Adaptation, and Vulnerability. Cambridge University Press. https://doi.org/10.1017/CBO9781107415379.010

Woodruff, S. C., Irish, J. L., & Campanella, R. (2013). Coastal flooding by tropical cyclones and sea-level rise. Nature, 504(7478), 44-52. https://doi.org/10.1038/nature12855

Yohe, G., & Schlesinger, M. (2002). The economic geography of the impacts of climate change. Journal of Economic Geography, 2(3), 311-341. https://doi.org/10.1093/jeg/2.3.311

Yohe, G., & Tol, R. S. J. (2002). Indicators for social and economic coping capacity—moving toward a working definition of adaptive capacity. Global Environmental Change, 12(1), 25-40. https://doi.org/10.1016/S0959-3780(01)00026-7

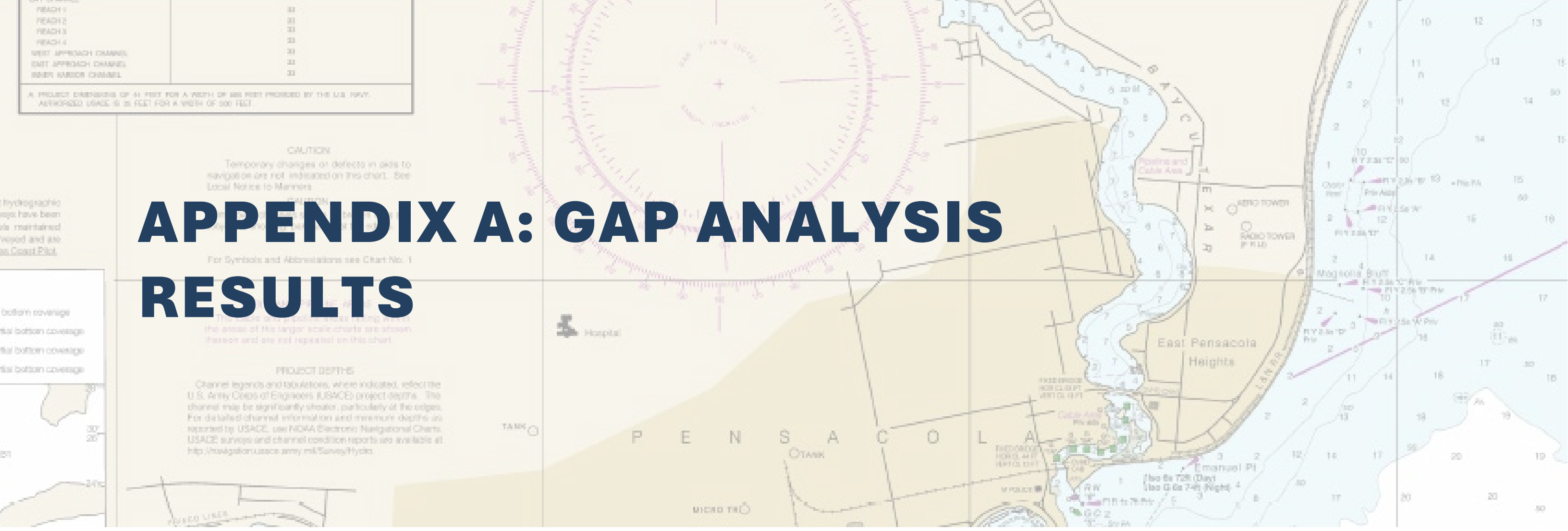
Zhang, K., & Leatherman, S. P. (2011). Barrier island population along the U.S. Atlantic and Gulf coasts. Journal of Coastal Research, 27(2), 356-363. https://www.researchgate.net/publication/261792950_Barrier_Island_Population_along_the_US_Atlantic_and_Gulf_Coasts

Zhang, K., Douglas, B. C., & Leatherman, S. P. (2004). Global warming and coastal erosion. Climatic Change, 64(1-2), 41-58. https://doi.org/10.1023/B:CLIM.0000024690.32682.48

Zhou, Q., Leng, G., & Feng, L. (2021). Global urban expansion offsets climate-driven increases in terrestrial net primary productivity. Nature Communications, 12(1), 610. https://www.nature.com/articles/s41467-019-13462-1

Zhou, Y., Wang, J., & Li, Q. (2010). Resilience to natural hazards: A geographic perspective. Natural Hazards, 53(1), 21-41. https://www.researchgate.net/publication/226540281_Resilience_to_natural_hazards_A_geographic_perspective

Zoppou, C. (2001). Review of urban stormwater models. Environmental Modelling & Software, 16(3), 195-231. https://doi.org/10.1016/S1364-8152(00)00084-0



APPENDIX A: GAP ANALYSIS RESULTS

A thorough gap analysis was conducted to identify areas where data were insufficient or missing. This analysis played a crucial role in identifying regions and parameters that required additional data or alternative approaches to fill the gaps.

By pinpointing data deficiencies, the assessment team was able to prioritize efforts to collect missing data or explore alternative methods to estimate the required information. This iterative process allows for continuous refinement of the data collection strategy and ensures the assessment is built on the most reliable and comprehensive data available.

The analysis focused on comparing available data against the information required for effective vulnerability assessment. The identified gaps can be broadly categorized into five challenges, with potential solutions to each.

6. **INSUFFICIENT GEOSPATIAL DATA:** Geospatial data provides a geographic dimension to the analysis. The data was insufficient or missing in certain regions, impacting the ability to map and visualize spatial relationships between different entities, such as transportation networks, critical infrastructure, and natural resources. Another example of this is seemingly more relevant to older communities and is exemplified in areas where infrastructure (like stormwater systems) may have been installed but are not mapped within presently available datasets.

   Solution to Consider: Create maps of the areas missing asset data to direct field teams. Utilize permitting systems where possible to extract geospatial data and fill gaps where practicable (for example: stormwater management systems).

7. **INCOMPLETE INFRASTRUCTURE AND FACILITIES DATA:** Data within attribute tables were incomplete. This gap affects the assessment of potential vulnerabilities these critical infrastructures may face due to changing

environmental conditions. Including more specific components about each asset within geospatial databases allows for those components to be analyzed in similar studies.

Solution to Consider: Perform department specific assessments on most frequently utilized data, encourage data stewardship, and assign specific "owners" for maintaining data quality. Additionally, assigning a data owner enables the public to interact with a particular person, division, branch, or department rather than the general organization.

8. **LACK OF UPDATED NATURAL, CULTURAL, AND HISTORIC RESOURCES DATA:** The existing data for some natural, cultural, and historic resources might be outdated or missing, creating gaps in assessing the impact of climate change and sea-level rise on these resources. Generally speaking, this data is traditionally limited to land use inventories, protected species inventories, and protected structures.

   Solution to Consider: Solicit community input on identifying/locating socially and/or culturally significant natural areas, cultural assets, and historic resources within the community. Connecting with people and understanding the landscape from a "boots on the ground" perspective is critical.

9. **TERMINOLOGY AND NAMING CONVENTION DISCREPANCIES:** A significant challenge that arose during the gap analysis was discrepancies in naming conventions and terminologies across different data sources. For instance, certain datasets might refer to an asset under a different name or categorize it under a different heading. This inconsistency makes it difficult to ascertain whether a critical asset is truly missing from the data, or whether it's simply listed under a different term.

   Solution to Consider: Coordinate with data providers to clarify what assets are included in each data category. Develop a standardized nomenclature and taxonomy for the assets and facilities. This approach can help reduce ambiguity and ensure a consistent understanding across all data sources. Additionally, consider creating a cross-reference glossary of terminologies used by different data sources to mitigate the risk of overlooking critical assets due to naming discrepancies. This can be done in collaboration with data providers to ensure the terminologies align with industry standards and local context. To assist with addressing challenge area 5, including this information within associated metadata would help future analytics teams.

10. **INCONCLUSIVE DATA COVERAGE AND METAINFORMATION:** In some cases, it is unclear whether certain databases include certain types of critical assets. For example, bus stops and routes may be included under the general heading of 'Bus Routes' or 'Streets,' but without more specific information, it

is difficult to be sure.

Solution to Consider: If the data is not available, consider commissioning targeted surveys or studies to gather the necessary data. The development of metadata, providing detailed information about each dataset, can be a great way to enhance understanding of data coverage. Consider including a percentage of total assets mapped under that specific data type as an element of this metadata to help outside consultants understand if they are working with a dataset that contains 25%, 50%, 75%, or some other percentage of that particular asset.

In light of these gaps, the project team utilized a range of strategies to fill as many data voids as practicable within the assessment timeline. This included tapping into additional data sources not previously considered, such as satellite imagery for geospatial data, government records for infrastructure and facilities data, conservation databases for natural, cultural, and historic resources data, and census data for socioeconomic data. Furthermore, the team may have leveraged methods like statistical estimation or modeling to fill in gaps when direct data collection is not feasible. This comprehensive approach ensures a robust, reliable, and inclusive vulnerability assessment.

To provide clear organization and readability, the project team created a table that indicates data that has or has not been received. As stated in the previously provided Data Request, to be compliant with the FDEP's metadata standards geospatial data submitted must follow the Federal Geographic Data Committee Content Standard for Digital Geospatial Metadata (FGDC CSDGM). Minimum standards the metadata must provide include the following information:

1. Name of Entity
2. Unique ID
3. Asset Name, Type and Class
4. Asset Owners/Operators
5. Asset Elevation
6. Asset Size/Capacity

If metadata associated with the provided data does not possess the above criteria, the project team is not responsible for filling out incomplete data due to various constraints that make it impracticable to do so within the project timeline. The project team will provide metadata for the climatic projections and will do so meeting DEP's requirements.

Metadata Quality Scale:

Great: Metadata that encompasses the majority of the data required to meet FGDC CSDGM standards. (Contains 1-6)

Good: Metadata that is incomplete but encompasses the some of the data required to meet FGDC CSDGM standards. (Contains 1-4)

Fair: Metadata that is highly incomplete and encompasses only a few of the data required to meet FGDC CSDGM standards. (Contains 1-2)

None: No metadata provided within file.

Transportation Assets and Evacuation Routes

The following section is a list of transportation asset data that has been submitted by Pensacola or is publicly available data that has been collected by the project team. The table represents the data that was received, the file source of the data, and indicates if the following information is provided in the data's attribute table: identification data, location data, asset elevation data if applicable, and classifies the metadata's quality. Data that was not provided will also be included in the table below. Geospatial data pertaining to Transportation and Evacuation Route assets can also be authoritatively sourced from the Florida Division of Emergency Management, the Florida Department of Environmental Protection, the Florida Department of Transportation, the USGS National Transportation Dataset, the National Transportation Atlas Database, and the USDOT Bureau of Transportation Statistics however additional sources may be necessary.

Transportation Assets and Evacuation Routes						
File Name	Storage Path	Identifying Info	Location Info	Elevation (Better than Ground Level)	Metadata Quality	Notes
Streets	\2_Data Response\Pensacola Upload - 2023 0210\OTHER\DataRequest.gdb	YES	YES	NO	FAIR	Received from Pensacola 2/10/2023
Public Sidewalks	\2_Data Response\Pensacola Upload - 2023 0210\OTHER\DataRequest.	YES	YES	NO	FAIR	Received from Pensacola 2/10/2023

	gdb					
City Owned Streetlights	\2_Data Response\Pensacola Upload - 2023 0210\OTHER\SIGNS_LIGHTS.gdb	YES	YES	NO	FAIR	Received from Pensacola 2/10/2023
Escambia County Traffic Signals	\2_Data Response_GIS Data Pensacola\Pensacola Upload - 2023 0210\OTHER\SIGNS_LIGHTS.gdb	YES	YES	NO	GOOD	Received from Pensacola 2/10/2023
Major Roadways	\2_Data Response\Pensacola Upload - 2023 0210\OTHER\DataRequest.gdb	YES	YES	NO	FAIR	Received from Pensacola 2/10/2023
Evacuation Routes	\2_Data Response\Pensacola Upload - 2023 0210\OTHER\DataRequest.gdb	YES	YES	NO	FAIR	Received from Pensacola 2/10/2023
Bus Terminals	\2_Data Response\Pensacola Upload - 2023 0210\OTHER\DataRequest.gdb	NO	YES	NO	NONE	Received from Pensacola 2/10/2023
Port Facilities	\4_Baseline Layout\2020 1102 Pensacola Initial APRX\2020 1007 Pensacola Initial APRX.gdb	YES	YES	NO	FAIR	Received from Pensacola 2/10/2023
Boat Ramps	\2_Data Response\Pensacola Upload - 2023	NO	YES	NO	NONE	Received from Pensacola 2/10/2023

	0210\OTHER\DataRequest.gdb					
Bridges	\2_Data Response\Pensacola Upload - 2023 0210\OTHER\DataRequest.gdb	SOME	YES	NO	FAIR	Received from Pensacola 2/10/2023
Marinas	\2_Data Response\Pensacola Upload - 2023 0210\OTHER\DataRequest.gdb	YES	YES	NO	FAIR	Received from Pensacola 2/10/2023
Airports	\4_Baseline Layout\2020 1102 Pensacola Initial APRX\2020 1007 Pensacola Initial APRX.gdb	YES	YES	NO	GOOD	Received from Pensacola during previously conducted vulnerability assessment
Aviation Facilities	\2_Data Response\2023 Homeland Data Downloads\Aviation_Facilities_\Aviation_Facilities_.shp	YES	YES	NO	GOOD	This data was collected from the Homeland Security database
Railroads	\4_Baseline Layout\2020 1102 Pensacola Initial APRX\2020 1007 Pensacola Initial APRX.gdb	YES	YES	NO	FAIR	Received from Pensacola during previously conducted vulnerability assessment
Railroad Bridges	\2_Data Response\GIS Data\Bridges_TDA	NO	YES	NO	NONE	Received from Pensacola 2/10/2023
Ferry Terminals						Based on data collected from the Homeland

						Security database there are no ferry terminals located in Pensacola

Critical Infrastructure

The following section is a list of critical infrastructure asset data that has been submitted by Pensacola or is publicly available data that has been collected by the project team. The table represents the data that was received, the file source of the data, and indicates if the following information is provided in the data’s attribute table: identification data, location data, asset elevation data, if applicable, and classifies the metadata’s quality. Data that was not provided will also be included in the table below. Geospatial data pertaining to Critical Infrastructure assets can also be authoritatively sourced from The US Department of Homeland Security’s (DHS) Homeland Infrastructure Foundation-Level Data (HIFLD), the Florida Division of Emergency Management, USGS’s National Structures Dataset (NSD), USDOT Bureau of Transportation Statistics, the Florida Department of Environmental Protection, the US Environmental Protection Agency, the Florida Water Management Districts, and the US Army Corps of Engineers however additional sources may be necessary.

Critical Infrastructure						
File Name	**Storage Path**	**Identifying Info**	**Location Info**	**Elevation (Better than Ground Level)**	**Metadata Quality**	**Notes**
Communication Facilities and Infrastructure						
UPS Facilities	\2_Data Response\2023 Homeland Data Downloads\UPS_Facilities\UPS_Facilities.shp	YES	YES	NO	FAIR	This data was collected from the Homeland Security database
FedEx Facilities	\2_Data Response\2023 Homeland Data Downloads\FedEx_Facilities\FedEx_Facilities.shp	YES	YES	NO	FAIR	This data was collected from the Homeland Security database
DHL Facilities	\2_Data Response\2023 Homeland Data Downloads\D	YES	YES	NO	FAIR	This data was collected from the Homeland Security database

	HL_Facilities\DHL_Facilities.shp					
Land Mobile Broadcast Transmission Towers	\2_Data Response\2023 Homeland Data Downloads\Land_Mobile_Broadcast_Towers\Land_Mobile_Broadcast_Towers.shp	YES	YES	NO	FAIR	This data was collected from the Homeland Security database
Land Mobile Commercial Transmission Towers	\2_Data Response\2023 Homeland Data Downloads\Land_Mobile_Commercial_Transmission_Towers1\c401ad02afae44d3a27c43702f1cac21.gdb	YES	YES	NO	FAIR	This data was collected from the Homeland Security database
Microwave Service Towers	\2_Data Response\2023 Homeland Data Downloads\Microwave__Service__Towers\Microwave_Service_Towers.shp	YES	YES	NO	FAIR	This data was collected from the Homeland Security database
Weather Radar Stations						Based on data collected from the Homeland Security database there are no weather radar stations located in Pensacola
FM Transmission Towers						Based on data collected from the Homeland Security database there are no FM transmission towers located in Pensacola
Cellular Towers						Based on data collected from the Homeland Security database there are no cellular towers located in Pensacola
Military Facilities						
Formerly Used	\2_Data Response\202	YES	YES	NO	FAIR	This data was collected from the Homeland Security

Defense Sites	3 Homeland Data Downloads\Formerly_Used_Defense_Sites_(FUDS)_Public_Properties\FUDS_Property_Point.shp					database
Department of Defense Site						Based on data collected from Homeland Security there are no Department of Defense Sites located in Pensacola
Solid Waste and Debris Facilities						
Solid Waste Landfill Facilities	\4_Baseline Layout\0_Baseline APRX\Pensacola_City_Baseline.gdb	YES	YES	SOME	FAIR	Received from Pensacola during previously conducted vulnerability assessment
Solid and Hazardous Waste Facilities	\2_Data Response\Pensacola Upload - 2023 0210\OTHER\DataRequest.gdb	YES	YES	NO	FAIR	Received from Pensacola 2/10/2023
Disaster Debris Management Sites	\2_Data Response\Pensacola_City_Baseline.gdb	YES	YES	NO	FAIR	This data was collected from the FDEP database
Petroleum and Natural Gas Facilities and Infrastructure						
Petroleum Ports	\2_Data Response\2023 Homeland Data Downloads\Petroleum	YES	YES	NO	FAIR	This data was collected from the Homeland Security database
Petroleum Terminals	\2_Data Response\2023 Homeland Data Downloads\POL_Terminals\POL_Terminals.shp	YES	YES	NO	FAIR	This data was collected from the Homeland Security database
Natural Gas Pipeline	\2_Data Response\2023 Homeland Data Downloads\Natural_Gas_Pi	YES	YES	NO	GOOD	This data was collected from the Homeland Security database

	pelines\Natural_Gas_Pipelines.shp					
Petroleum Pumping Stations						Based on data collected from the Homeland Security database there are no petroleum terminals located in Pensacola.
Electric Production /Supply Facilities and Structures						
Power Facilites	\2_Data Response_GIS Data Pensacola\Pensacola_City_Baseline.gdb	YES	YES	NO	GOOD	Received from Pensacola during previously conducted vulnerability assessment
Electric Substations	\2_Data Response\2023 Homeland Data Downloads\Substations\Substations.shp	YES	YES	NO	FAIR	This data was collected from the Homeland Security database.
Electrical Transmission Lines	\2_Data Response\2023 Homeland Data Downloads\Electric__Power_Transmission_Lines\Electric__Power_Transmission_Lines.shp	YES	YES	NO	FAIR	This data was collected from the Homeland Security database
Public Water Supply/Drinking Water Facilities and Structures						
WTR Well	\2_Data Response\Pensacola_City_Baseline.gdb	YES	YES	NO	GOOD	Received from Pensacola during previously conducted vulnerability assessment
Fire Hydrants	\2_Data Response\Pensacola Upload - 2023 0210\OTHER\DataRequest.gdb	YES	YES	NO	GOOD	Received from Pensacola 2/10/2023
WTR Valve System	\2_Data Response\Pensacola_City_Baseline.gdb	YES	YES	SOME	GOOD	Received from Pensacola during previously conducted vulnerability assessment
WTR Valve Control	\2_Data Response\Pensacola_City_B	YES	YES	SOME	GOOD	Received from Pensacola during previously conducted vulnerability assessment

	aseline.gdb _City_Baseline.gdb					
WTR Service Point	\2_Data Response\Pensacola_City_Baseline.gdb	YES	YES	SOME	GOOD	Received from Pensacola during previously conducted vulnerability assessment
WTR Manhole	\2_Data Response\Pensacola_City_Baseline.gdb	YES	YES	SOME	GOOD	Received from Pensacola during previously conducted vulnerability assessment
WTR Hydrant	\2_Data Response\Pensacola_City_Baseline.gdb	YES	YES	SOME	GOOD	Received from Pensacola during previously conducted vulnerability assessment
WTR Flush Point	\2_Data Response\Pensacola_City_Baseline.gdb	YES	YES	SOME	GOOD	Received from Pensacola during previously conducted vulnerability assessment
WTR Fitting	\2_Data Response\Pensacola_City_Baseline.gdb	YES	YES	SOME	GOOD	Received from Pensacola during previously conducted vulnerability assessment
WTR Dead End	\2_Data Response\Pensacola_City_Baseline.gdb	YES	YES	SOME	GOOD	Received from Pensacola during previously conducted vulnerability assessment
Potable Water Old Treatment Units	\2_Data Response\Pensacola_City_Baseline.gdb	YES	YES	SOME	GOOD	Received from Pensacola during previously conducted vulnerability assessment
Potable Water Treatment Units	\2_Data Response\Pensacola_City_Baseline.gdb	YES	YES	SOME	GOOD	Received from Pensacola during previously conducted vulnerability assessment
WTR Zone Line	\2_Data Response\Pensacola_City_Baseline.gdb	YES	YES	NO	GREAT	Received from Pensacola during previously conducted vulnerability assessment
WTR Service Line	\2_Data Response\Pensacola_City_Baseline.gdb	YES	YES	NO	GREAT	Received from Pensacola during previously conducted vulnerability assessment
WTR Main Distribution	\2_Data Response\Pensacola_City_Baseline.gdb	YES	YES	NO	GREAT	Received from Pensacola during previously conducted vulnerability assessment
WTR Drain	\2_Data Response\Pensacola_City_Baseline.gdb	YES	YES	NO	GREAT	Received from Pensacola during previously conducted vulnerability assessment

WTR Casing	\2_Data Response\Pensacola_City_Baseline.gdb	YES	YES	NO	GREAT	Received from Pensacola during previously conducted vulnerability assessment
Potable Water Surface Flow	\2_Data Response\Pensacola_City_Baseline.gdb	NO	YES	NO	FAIR	Received from Pensacola during previously conducted vulnerability assessment
Potable Water Stormwater Pipes	\2_Data Response\Pensacola_City_Baseline.gdb	YES	YES	SOME	GREAT	Received from Pensacola during previously conducted vulnerability assessment
Water Tanks	\2_Data Response\Pensacola_City_Baseline.gdb	YES	YES	NO	GREAT	Received from Pensacola during previously conducted vulnerability assessment
Potable Water Retention Ponds	\2_Data Response\Pensacola_City_Baseline.gdb	YES	YES	NO	GOOD	Received from Pensacola during previously conducted vulnerability assessment
Outfall Nodes	\2_Data Response\Pensacola_City_Baseline.gdb	YES	YES	YES	GOOD	Received from Pensacola during previously conducted vulnerability assessment
Lift Stations	\2_Data Response\Pensacola_City_Baseline.gdb	YES	YES	SOME	GOOD	Received from Pensacola during previously conducted vulnerability assessment
Wastewater Treatment Facilities and Structures						
SWR Valve System	\2_Data Response\Pensacola_City_Baseline.gdb	YES	YES	SOME	GOOD	Received from Pensacola during previously conducted vulnerability assessment
SWR Valve Horizontal Level Gear Nut	\2_Data Response\Pensacola_City_Baseline.gdb	YES	YES	SOME	GOOD	Received from Pensacola during previously conducted vulnerability assessment
SWR Valve Control ARV	\2_Data Response\Pensacola_City_Baseline.gdb	YES	YES	SOME	GOOD	Received from Pensacola during previously conducted vulnerability assessment
SWR Valve Control	\2_Data Response\Pensacola_City_Baseline.gdb	YES	YES	NO	FAIR	Received from Pensacola during previously conducted vulnerability assessment
SWR Manhole	\2_Data Response\Pensacola_City_Baseline.gdb	YES	YES	SOME	GOOD	Received from Pensacola during previously conducted vulnerability assessment
SWR Lift Station	\2_Data Response\Pen	YES	YES	SOME	GOOD	Received from Pensacola during previously conducted

	sacola_City_Baseline.gdb					vulnerability assessment
SWR Gate Valve Flush	\2_Data Response\Pensacola_City_Baseline.gdb	YES	YES	SOME	GOOD	Received from Pensacola during previously conducted vulnerability assessment
SWR Fitting	\2_Data Response\Pensacola_City_Baseline.gdb	YES	YES	SOME	GOOD	Received from Pensacola during previously conducted vulnerability assessment
SWR Cleanout	\2_Data Response\Pensacola_City_Baseline.gdb	YES	YES	SOME	GOOD	Received from Pensacola during previously conducted vulnerability assessment
SWR ARV Vent	\2_Data Response\Pensacola_City_Baseline.gdb	YES	YES	NO	GOOD	Received from Pensacola during previously conducted vulnerability assessment
SWR Valve Horizontal Stem	\2_Data Response\Pensacola_City_Baseline.gdb	YES	YES	NO	FAIR	Received from Pensacola during previously conducted vulnerability assessment
SWR Gravity Main	\2_Data Response\Pensacola_City_Baseline.gdb	YES	YES	NO	FAIR	Received from Pensacola during previously conducted vulnerability assessment
SWR Force Main	\2_Data Response\Pensacola_City_Baseline.gdb	YES	YES	NO	FAIR	Received from Pensacola during previously conducted vulnerability assessment
SWR Lateral Line	\2_Data Response\Pensacola_City_Baseline.gdb	YES	YES	NO	GOOD	Received from Pensacola during previously conducted vulnerability assessment
SWR Gate Valve Flush	\2_Data Response\Pensacola_City_Baseline.gdb	YES	YES	NO	FAIR	Received from Pensacola during previously conducted vulnerability assessment
SWR Casing	\2_Data Response\Pensacola_City_Baseline.gdb	YES	YES	NO	GOOD	Received from Pensacola during previously conducted vulnerability assessment
SWR Treatment Plant	\2_Data Response\Pensacola_City_Baseline.gdb	YES	YES	NO	FAIR	Received from Pensacola during previously conducted vulnerability assessment
Stormwater Facilities and Structures						
Stormwater Treatment Units	\2_Data Response\Pensacola Upload - 2023	YES	YES	NO	FAIR	Received from Pensacola 2/10/2023

	0210\STORMWATER INFRASTRUCTURE\STORMWATER_INFRASTRUCTURE.gdb					
Stormwater Structures	\2_Data Response\Pensacola Upload - 2023 0210\STORMWATER INFRASTRUCTURE\STORMWATER_INFRASTRUCTURE.gdb	YES	YES	NO	FAIR	Received from Pensacola 2/10/2023
Stormwater Outfalls	\2_Data Response\Pensacola Upload - 2023 0210\STORMWATER INFRASTRUCTURE\STORMWATER_INFRASTRUCTURE.gdb	YES	YES	NO	FAIR	Received from Pensacola 2/10/2023
Stormwater Major Outfalls	\2_Data Response\Pensacola Upload - 2023 0210\STORMWATER INFRASTRUCTURE\STORMWATER_INFRASTRUCTURE.gdb	SOME	YES	NO	FAIR	Received from Pensacola 2/10/2023
Monitoring Wells	\2_Data Response\Pensacola Upload - 2023 0210\STORMWATER INFRASTRUCTURE\STORMWATER_INFRASTRUCTURE.gdb	SOME	YES	NO	NONE	Received from Pensacola 2/10/2023
Stormwater	\2_Data	YES	YES	NO	FAIR	Received from Pensacola

Pipes	Response\Pensacola Upload - 2023 0210\STORMWATER INFRASTRUCTURE\STORMWATER_INFRASTRUCTURE.gdb					2/10/2023

Critical Community and Emergency Facilities

The following section is a list of critical community and emergency asset data that has been submitted by Pensacola and publicly available data that has been collected by the project team. The table represents the data that was received, the file source of the data, and indicates if the following information is provided in the data's attribute table: identification data, location data, asset elevation data if applicable, and classifies the metadata's quality. Data that was not provided will also be included in the table below. Geospatial data pertaining to Critical Community and Emergency Facility assets can be also authoritatively sourced from The US Department of Housing and Urban Development, the Florida Division of Emergency Management, and the Florida Department of Environmental Protection however additional sources may be necessary.

Critical Community and Emergency Facilities						
File Name	**Storage Path**	**Identifying Info**	**Location Info**	**Elevation (Better than Ground Level)**	**Metadata Quality**	**Notes**
Community Facilities						
Community Centers	\2_Data Response\Previous Climate Data\Pensacola_CriticalFacilitiesWithSLRDepths.gdb	YES	YES	SOME	FAIR	Received from Pensacola during previously conducted vulnerability assessment
Public Schools	\2_Data Response\2023 Homeland Data Downloads\Public_Schools	YES	YES	NO	FAIR	This data was collected from the Homeland Security database

	(1)\PublicSchools.shp					
Private Schools	\2_Data Response\2023 Homeland Data Downloads\Private_Schools\Private_Schools.shp	YES	YES	NO	FAIR	This data was collected from the Homeland Security database
Child Care Centers	\2_Data Response\2023 Homeland Data Downloads\Child_Care_Centers\Child_Care_Centers.shp	YES	YES	NO	FAIR	This data was collected from the Homeland Security database
Colleges and Universities	\2_Data Response\2023 Homeland Data Downloads\Colleges_and_Universities\CollegesUniversities.shp	YES	YES	NO	FAIR	This data was collected from the Homeland Security database
Pharmacies	\2_Data Response\2023 Homeland Data Downloads\Pharmacies_(Archive)\Pharmacies_(Archive).shp	YES	YES	NO	FAIR	This data was collected from the Homeland Security database
Supplemental Colleges	\2_Data Response\2023 Homeland Data Downloads\Colleges_and_Universities\CollegesUniversities.s	YES	YES	NO	FAIR	This data was collected from the Homeland Security database

	hp					
Libraries	\2_Data Response\Pensacola Upload - 2023 0210\OTHER \DataRequest.gdb	YES	YES	NO	FAIR	Received from Pensacola 2/10/2023. Data is encompassed in Government layer
Nursing Homes	\2_Data Response\2023 Homeland Data Downloads\Nursing_Homes\Nursing_Homes.shp	YES	YES	NO	FAIR	This data was collected from the Homeland Security database
Local Government Facilities (City Hall and Government Buildings)	\2_Data Response\Pensacola Upload - 2023 0210\OTHER \DataRequest.gdb	YES	YES	NO	FAIR	Received from Pensacola 2/10/2023. Data is encompassed in Government layer
Mobile Home Parks	\2_Data Response\2023 Homeland Data Downloads\Mobile_Home_Parks\MobileHomeParks.shp	YES	YES	NO	FAIR	This data was collected from the Homeland Security database
State Government Facilities	https://ca.dep.state.fl.us/arcgis/rest/services/OpenData/FDEP_DISTRICT/MapServer	YES	YES	NO	GOOD	This data was collected from the FDEP database
Courthouses	\2_Data Response\2023 Homeland Data Downloads\Courthouses \Courthouses.shp	YES	YES	NO	FAIR	This data was collected from the Homeland Security database

Affordable Public Housing						
Correctional Facilities						
Emergency and Disaster Facilities and Sites						
Fire Stations	\2_Data Response\Pensacola Upload - 2023 0210\OTHER \DataRequest.gdb	YES	YES	NO	FAIR	Received from Pensacola 2/10/2023. Data is encompassed in Government layer
EMS Stations	\2_Data Response\2023 Homeland Data Downloads\Emergency_Medical_Service_(EMS)_Stations\Emergency_Medical_Service_(EMS)_Stations.shp	YES	YES	NO	FAIR	This data was collected from the Homeland Security database
Hospitals	\2_Data Response\2023 Homeland Data Downloads\Hospitals\Hospitals.shp	YES	YES	NO	FAIR	This data was collected from the Homeland Security database
Local Law Enforcement	\2_Data Response\Pensacola Upload - 2023 0210\OTHER \DataRequest.gdb	YES	YES	NO	FAIR	Received from Pensacola 2/10/2023. Data is encompassed in Government layer
National Shelter System Facilities	\2_Data Response\2023 Homeland Data Downloads\National_Shelter_System	YES	YES	NO	FAIR	This data was collected from the Homeland Security database

	_Facilities\National_Shelter_System_Facilities.shp					
Urgent Care Facilities						Based on data collected from Homeland Security there are no Urgent Care Facilities located in Pensacola
Veteran Health Facilities						Based on data collected from Homeland Security there are no Veteran Health Facilities located in Pensacola
Public Health Department						Based on data collected from Homeland Security there are no Public Health Departments located in Pensacola
Shelters	\2_Data Response_GIS Data Pensacola\Pensacola Shelters\Shelters.shp	YES	YES	NO	GOOD	Received from Pensacola 2/10/2023. Data is encompassed in Government layer
Emergency Operation Center						
Logistical Staging Area						

Natural, Cultural, and Historic Resources

The following section is a list of natural, cultural, and historical asset data that has been submitted by Pensacola and publicly available data that has been collected by the project team. The table represents the data that was received, the file source of the data, and indicates if the following information is provided in the data's attribute table: identification data, location data, asset elevation data if applicable, and classifies the metadata's quality. Data that was not provided will also be included in the table below. Geospatial data pertaining to Natural, Cultural, and Historic Resource assets can also be authoritatively sourced from the Florida Natural Areas Inventory (FNAI), the Bureau of Archaeological Research, the Florida Geographic Data Library, the USGS Bureau of Geographic Names and National Hydrology Dataset, the Florida Department of Environmental Protection, the National Transportation Atlas Database (NTAD), the Florida Fish and Wildlife Conservation Commission, and the US Fish and Wildlife Service however additional sources may be necessary.

Natural, Cultural, and Historic Resources						
File Name	**Storage Path**	**Identifying Info**	**Location Info**	**Elevation (Better than Ground Level)**	**Metadata Quality**	**Notes**
Natural Resources						
ESI Shorelines	4_Baseline Layout\GIS Data\ESI_Shoreline_Classification_Lines_Florida\ESI_Shoreline_Classification_Lines_Florida.shp	YES	YES	NO	FAIR	This data was collected from the FWC database
Seagrass Habitat	\4_Baseline Layout\0_Baseline APRX\2023 Pensacola 380 Natural Cultural Historical\2023 Pensacola 380 Natural Cultural Historical.gdb	YES	YES	NO	FAIR	This data was collected from the FWC database
Tidal Flats	https://atoll.floridamarine.org/arcgis/rest/services/FWC_GIS/OpenData_MarineEco/MapServer	YES	YES	NO	FAIR	This data was collected from the FWC database
Salt Marshes	https://atoll.floridamarine.org/arcgis/rest/services/FWC_GIS/OpenData_MarineEco/MapServer	YES	YES	NO	FAIR	This data was collected from the FWC database
ESI Marine Mammal Habitat Regions	\4_Baseline Layout\0_Baseline APRX\2023 Pensacola 380 Natural Cultural Historical\2023 Pensacola	YES	YES	NO	FAIR	This data was collected from the FWC database

	380 Natural Cultural Historical.gdb					
Municipal Parks	\2_Data Response\Pensacola Upload - 2023 0210\OTHER\DataRequest.gdb	YES	YES	NO	FAIR	Received from Pensacola 2/10/2023
Wetlands	4_Baseline Layout\GIS Data\FL_geodatabase_wetlands\FL_geodatabase_wetlands.gdb	YES	YES	NO	FAIR	This data was collected from U.S. Fish and Wildlife Services database
Surface Waters	\2_Data Response\Pensacola Upload - 2023 0210\CANOPY\GIS_Canopy.gdb	NO	YES	NO	FAIR	Received from Pensacola 2/10/2023. Data is encompassed in Geosyntech Canopy Vector layer
State Parks						Based on data obtained from FDEP, there are no state parks within Pensacola
Manatee Protection Zones						Based on FWC data there are no manatee protection zones
Conservation Lands	\2_Data Response_GIS Data State\FDEP\flma_202305\flma.shp	YES	YES	NO	GOOD	This data was collected from the Florida Natural Areas Inventory
Cultural and Historic Resources						
Places of Worship	\2_Data Response\2023 Homeland Data Downloads\All_Places_Of_Worship\AllPlacesOfWorship.shp	YES	YES	NO	FAIR	This data was collected from the Homeland Security database
Palafox Historic Business District	\2_Data Response\Pensacola Upload - 2023 0210\OTHER\DataRequest.	YES	YES	NO	FAIR	Received from Pensacola 2/10/2023

	gdb					
Old East Hill Historic Preservation District	\2_Data Response\Pensacola Upload - 2023 0210\OTHER\ DataRequest.gdb	YES	YES	NO	FAIR	Received from Pensacola 2/10/2023
North Hill Preservation District	\2_Data Response\Pensacola Upload - 2023 0210\OTHER\ DataRequest.gdb	YES	YES	NO	FAIR	Received from Pensacola 2/10/2023
Historic District	\2_Data Response\Pensacola Upload - 2023 0210\OTHER\ DataRequest.gdb	YES	YES	NO	FAIR	Received from Pensacola 2/10/2023
Belmont De Villers	\2_Data Response\Pensacola Upload - 2023 0210\OTHER\ DataRequest.gdb	YES	YES	NO	FAIR	Received from Pensacola 2/10/2023. According to data response, this is not officially considered a historic district but does possess several buildings of historic and cultural value
Contributing Structures	\2_Data Response\Pensacola Upload - 2023 0210\OTHER\ DataRequest.gdb	YES	YES	NO	FAIR	Received from Pensacola 2/10/2023
Historical Structures	\2_Data Response_GIS Data State\FDHR\results28\Counties\	YES	YES	NO	FAIR	This data was provided by the Florida Division of Historical Resources
Historical Bridges	\2_Data Response_GIS Data State\FDHR\results28\Counties\	YES	YES	NO	FAIR	This data was provided by the Florida Division of Historical Resources
Resource Groups	\2_Data Response_GIS Data State\FDHR\r	YES	YES	NO	FAIR	This data was provided by the Florida Division of Historical Resources

	esults28\Counties\					
Listed Natural Resources	\2_Data Response_GIS Data State\FDHR\results28\Counties\	YES	YES	NO	FAIR	This data was provided by the Florida Division of Historical Resources
Cemeteries	\2_Data Response_GIS Data State\FDHR\results28\Counties\	YES	YES	NO	FAIR	This data was provided by the Florida Division of Historical Resources

Supplemental Information

The following section is a list of supplemental information that has been submitted by Pensacola, this information is not statutorily required under Subsection 380.093, F.S., but will lead to a more detailed assessment, and in turn enhance resiliency planning efforts. The table represents the data that was received, the file source of the data, and indicates if the following information is provided in the data's attribute table: identification data, location data, asset elevation data if applicable, and classifies the metadata's quality. Data that was not provided will also be included in the table below.

Supplemental Information (not required for 380.093 compliance)						
File Name	**Storage Path**	**Identifying Info**	**Location Info**	**Elevation (Better than Ground Level)**	**Metadata Quality**	**Notes**
Pensacola Flood Analysis Data						
Frequently Flooded Structures/ Repetitive Loss	\2_Data Response\Pensacola Upload - 2023 0210\OTHER\DataRequest.gdb	NO	YES	NO	GOOD	Received from Pensacola 2/10/2023.
Storm Related Surge and Tidal Elevations, Maximum Extents, and Wave Heights	\2_Data Response\Pensacola Upload - 2023 0210\OTHER\DataRequest.gdb	YES	YES	NO	GOOD	Received from Pensacola 2/10/2023. Storm related surge, and tidal elevations is encompassed in the Coastal High Water Marks layer

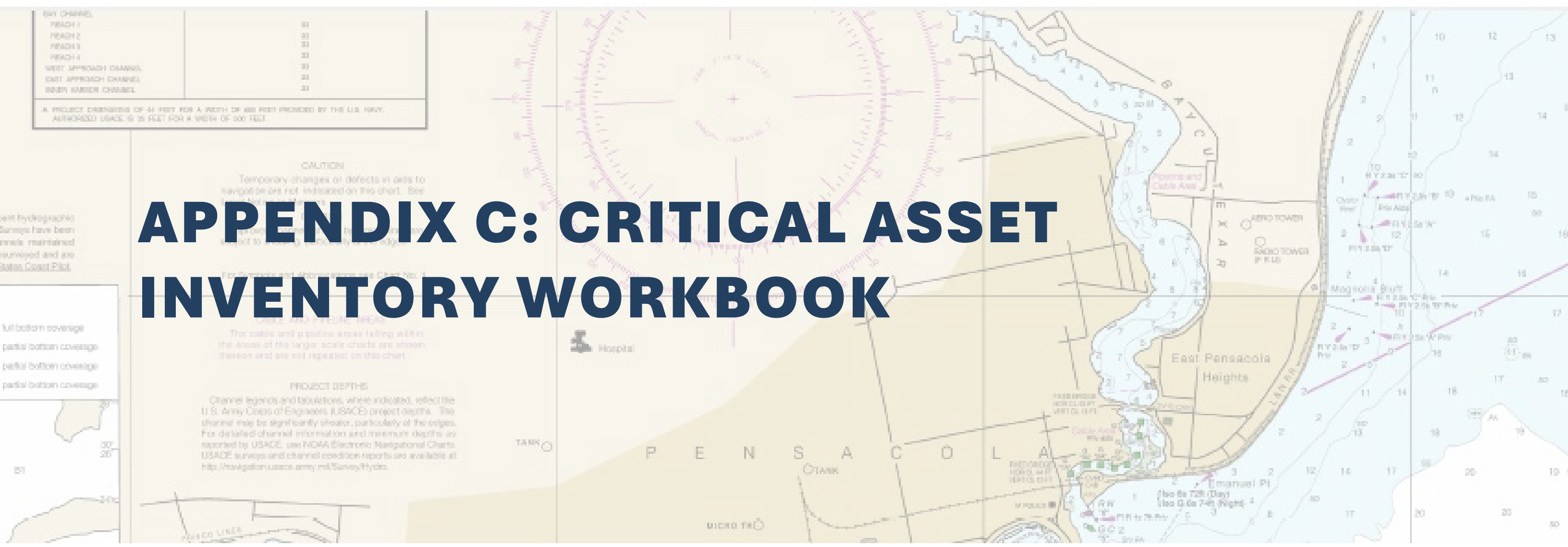
Coastal High-Water Marks	\2_Data Response\Pensacola Upload - 2023 0210\OTHER\ DataRequest.gdb	YES	YES	NO	GOOD	Received from Pensacola 2/10/2023
Localized Knowledge of Flood Areas	\2_Data Response\Pensacola Upload - 2023 0210\OTHER\ DataRequest.gdb	NO	YES	NO	GOOD	Received from Pensacola 2/10/2023
FEMA flood zone URL	\2_Data Response\GIS Data\	YES	YES	YES	GOOD	FEMA NFHL rest service
Elevations of Tidal Range Including King Tides						NOAA Tide Gauges at Tides and Currents
Previous Vulnerability Studies						Acquired
NFIP Policy Locations						This data is not required under Subsection 380.093, but will enhance quality of vulnerability assessment
Supporting Assessment Data						
Impervious Surface Areas	\2_Data Response\Pensacola Upload - 2023 0210\OTHER\ DataRequest.gdb	NO	YES	NO	FAIR	Received from Pensacola 2/10/2023
Major Pavement	\2_Data Response\Pensacola Upload - 2023 0210\OTHER\ DataRequest.gdb	NO	YES	NO	FAIR	Received from Pensacola 2/10/2023
Soils	\2_Data Response\GIS Data\SOILS\wss_aoi_2023-03-09_15-13-47\spatial\soilsf_p_aoi.shp	YES	YES	NO	GOOD	Obtained from websoilsurvey.sc.egov.usda.gov
Gas	\2_Data	YES	YES	NO	GOOD	Obtained from USDA

Stations	Response\2023 0309 GasStations_FL_FDACS\GasStations_FL_FDACS.shp					
Seawalls	\2_Data Response\GIS Data\ESI_Shoreline_Classification_Lines_Florida	YES	YES	NO	FAIR	Obtained from FWC
Green Infrastructure Types and Locations						This refers to stormwater systems that allow rainwater to infiltrate the ground where it lands instead of being immediately directed to a pipe. Examples of green infrastructure vegetated swales, rain gardens, exfiltration trenches, etc.
Geomorphological Features						
Tree Canopy	\2_Data Response\Pensacola Upload - 2023 0210\CANOPY\GIS_Canopy.gdb	NO	YES	NO	FAIR	Received from Pensacola 2/10/2023. Data is encompassed in Geosyntech Canopy Vector layer
Tree Inventory	\2_Data Response\Pensacola Upload - 2023 0210\TREE INVENTORY\COP_Tree_Inventory_Backup.gdb	YES	YES	NO	FAIR	Received from Pensacola 2/10/2023
LiDAR Digital Elevation Model (DEM)	\2_Data Response\GIS Data\DEM\LAZ					Obtained from USGS
Digital Elevation Model (DEM)	\2_Data Response\GIS Data\Baseline Unzips\2020 0921 FL_Escam_St_Rosa_DEM_2017_8683					Obtained from USGS
Land Cover	\2_Data Response\Pen	YES	YES	NO	FAIR	Received from Pensacola 2/10/2023

	sacola Upload - 2023 0210\CANOPY\GIS_Canopy.gdb					
Land Use	\2_Data Response\Pensacola Upload - 2023 0210\OTHER\DataRequest.gdb	YES	YES	NO	FAIR	Received from Pensacola 2/10/2023. Data is encompassed in Parcel layer
Depth to Water Table	FDEP	YES	YES	NO	FAIR	
Socioeconomic Environment						
Property Values	\2_Data Response\Pensacola Upload - 2023 0210\OTHER\DataRequest.gdb	YES	YES	NO	FAIR	Received from Pensacola 2/10/2023. Data is encompassed in Parcel layer
Business Locations						
Declared Professions						
Tax Wages/ Revenue						
Property Taxes						
CRS WMP Data						
Watershed Basins Areas	https://services5.arcgis.com/4S31IuHan7toVWys/arcgis/rest/services/SWIM_Priority_Watersheds/FeatureServer	YES	YES	NO	FAIR	This data was collected from the Mitigation Bank Group database
Building Footprints	\2_Data Response\Pensacola Upload - 2023 0210\OTHER\DataRequest.gdb	YES	YES	NO	FAIR	Received from Pensacola 2/10/2023
Hydrologic & Hydraulic Modeling						
Concrete Walls/ Levees						

APPENDIX B: BASELINE ASSET INVENTORY

Under separate cover.



APPENDIX C: CRITICAL ASSET INVENTORY WORKBOOK

Critical Assets and Regionally Significant Assets

Subsection 380.093, F.S. Compliance

The assessment process aligns with Subsection 380.093, F.S., utilizing the Florida Department of Environmental Protection's Critical Asset List. The categories of data collected, organized into four primary categories, are directly correlated with statutory compliance:

- **Transportation Assets** and evacuation routes, including airports, bridges, bus terminals, ports, major roadways, marinas, rail facilities, and railroad bridges.

Layer Name	Asset Type	Geometry	Count	Reg_Sig	Source
Aviation Facilities	Aviation	point	3		FDEM and FDOT
Bridges	Road	line	25		FDOT
Bus Terminals - FDEM	Road	point	1	Y	FDEM
Bus Routes	Road	line	234		Pensacola
Major Roadways	Road	line	83	Y	Pensacola
Streets	Road	line	6,717		Pensacola
Marinas	Water	point	8		Pensacola
Boat Ramps	Water	point	6		Pensacola
Commercial and SIS ports	Water	polygon	1	Y	Pensacola
SIS - railroads	Rail	line	257	Y	FDOT-SIS
Rail Bridges - FDEM	Rail	point	2	Y	Pensacola

- **Critical Infrastructure**, including wastewater treatment facilities and lift stations, stormwater treatment facilities and pump stations, drinking water facilities, water utility conveyance systems, electric production and supply facilities, solid and hazardous waste facilities, military installations, communications facilities, and disaster debris management sites.

Layer Name	Asset Type	Geometry	Count	REG_SIG	Source
DHS HIFLD - Substations	electric production and supply facilities	point	7		DHS-HIFLD
DHS HIFLD - Electric_Power_Transmission_Lines	electric production and supply facilities	line	13	Y	DHS-HIFLD
Formerly Used Defense Sites	military installations	point	4		DHS-HIFLD
Solid Waste Facilities	solid and hazardous waste facilities	point	32		FDEP
Disaster Debris Management Sites	solid and hazardous waste facilities	point	8		FDEP
EPA superfund and brownfield sites	solid and hazardous waste facilities	polygon	7		EPA
County SQGs	solid and hazardous waste facilities	point	773		FDEP
Post Offices	communication facilities	point	73		DHS-HIFLD
Microwave Service Towers	communication facilities	point	22		DHS-HIFLD
Stormwater Structures	stormwater Infrastructure	point	5,641	Y	Pensacola
Stormwater Treatment Units	stormwater infrastructure	point	116	Y	Pensacola
Stormwater Ponds	stormwater infrastructure	polygon	105	Y	Pensacola
Stormwater Outfalls	stormwater infrastructure	point	103	Y	Pensacola
Stormwater Pipes	stormwater infrastructure	line	5,488	Y	Pensacola
Stormwater Vaults	stormwater infrastructure	polygon	5	Y	Pensacola
Sanitary Sewer Lift Station	wastewater infrastructure	point	53	Y	Pensacola
Sanitary Sewer Valve Structures	wastewater infrastructure	point	137		Pensacola
Sanitary Sewer Cleanout	wastewater infrastructure	point	439		Pensacola
Sanitary Sewer Main Force	wastewater infrastructure	line	203	Y	Pensacola
Sanitary Sewer Main Gravity	wastewater infrastructure	line	8,631	Y	Pensacola
Public Water Supply Plants	potable water infrastructure	point	6	Y	FDEP
Potable Water Service Point	potable water infrastructure	point	523		Pensacola

Potable Water Valve Control	potable water infrastructure	point	8		Pensacola
Potable Water Well	potable water infrastructure	point	7		Pensacola
Fire Hydrants	water conveyance systems	point	1,982		Pensacola
Potable Water Dead End	potable water infrastructure	point	78		Pensacola
Potable Water Valve System	potable water infrastructure	point	4,862		Pensacola
Potable Water Treatment Units	potable water infrastructure	point	114		Pensacola
Lift Station	water conveyance system	point	36		Pensacola
Potable Water Flush Point	potable water infrastructure	point	282		Pensacola
Potable Water Main Distribution	potable water infrastructure	line	7,048	Y	Pensacola
Water Tanks	water conveyance systems	polygon	3		Pensacola
Potable Water Vaults	potable water infrastructure	Polygon	3		Pensacola

- **Critical Community and Emergency Facilities**, including schools, colleges, universities, community centers, correctional facilities, disaster recovery centers, emergency medical service facilities, emergency operation centers, fire stations, health care facilities, hospitals, law enforcement facilities, local government facilities, logistical staging areas, affordable public housing, risk shelter inventory, and state government facilities.

Layer Name	Asset Type	Geometry	Count	Reg_Sign	Source
Pharmacies	non-emergency medical	point	25		DHS-HIFLD
Nursing Homes	housing	point	7		DHS-HIFLD
Community Centers	community	point	10		Pensacola
City Owned Buildings	local government facilities	point	11		Pensacola
FDEP Office	state government facilities	point	1		FDEP
Public Schools	education	point	17		DHS-HIFLD
Private Schools	education	point	12		DHS-HIFLD
Colleges and Universities	education	point	3		DHS-HIFLD
Childcare Centers	education	point	25		DHS-HIFLD
Fire Stations	emergency	point	7		Pensacola
Emergency Medical Services	emergency	point	1		DHS-HIFLD
Hospitals	emergency	point	5	Y	DHS-HIFLD
Law Enforcement	law	point	1		Pensacola
Courthouses	law	point	1		DHS-HIFLD
Risk Shelters	emergency	point	2	Y	Pensacola
National Shelters System	emergency	point	16	Y	DHS-HIFLD

- **Natural, Cultural, Historical Resources**, including conservation lands, parks, shorelines, surface waters, wetlands, and historical and cultural assets.

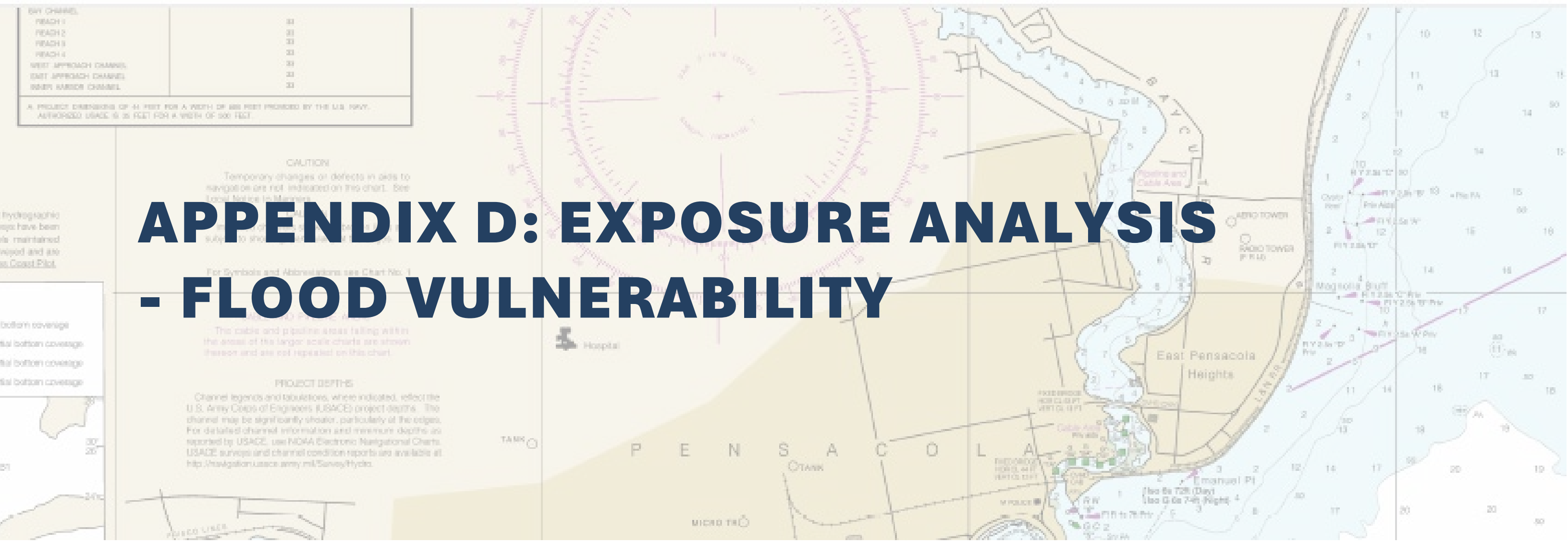
Layer Name	Asset Type	Geometry	Count	REG_SIG	Source
Historic Bridges in Florida	historical and cultural assets	line	6		FDHR
Historic Cemeteries in Florida	historical and cultural assets	polygon	14		FDHR
Resource Groups in Florida	historical and cultural assets	polygon	14		FDHR
Archeological Resources	historical and cultural assets	polygon	2		FDHR
Historical Structure Locations in Florida	historical and cultural assets	point	6		FDHR
All Places of Worship	historical and cultural assets	point	70		DHS-HIFLD
Historic Districts	historical and cultural assets	polygon	4		Pensacola
Parks	terrestrial	point	104		Pensacola
ESI Shoreline Classification Lines	shorelines	line	180		FWC
Natural Land Classification	terrestrial	polygon	24		FWC
NHD-Flowline	surface waters	line	55		USGS NHD
NHD-Waterbody and NHD-Area merge	surface waters	polygon	8		USGS NHD
Salt Marshes	aquatic	polygon	3		FWC
Tidal Flats	aquatic	polygon	17		FWC
Seagrass	aquatic	polygon	3		FWC
Marine Mammal Habitat	aquatic	polygon	2		FWC
Wetlands	aquatic	polygon	121		USFWS

- **Regionally Significant Assets:** As defined in Subsection 380.093, F.S., regionally significant assets are critical facilities that serve a broader geographic area, including neighboring communities. These assets may encompass water resource facilities, regional medical centers, emergency operation centers, regional utilities, major transportation hubs, airports, and seaports. Identifying and safeguarding these assets is crucial for regional resilience and response coordination.

Layer Name	Asset Group	Asset Type	Geometry	Count	Source
Risk Shelter Inventory	Critical Community	risk shelter inventory	point	2	Pensacola
National Shelter System Facilities	Critical Community	shelter system	point	12	DHS-HIFLD
Hospitals	Critical Community	hospitals	point	5	DHS-HIFLD
Shelters	Critical Community	shelter systems	point	2	Pensacola

Emergency Medical Services - FDEM	Critical Community	emergency medical service facilities	point	1	DHS-HIFLD
Stormwater Structures	Critical Infrastructure	stormwater infrastructure	point	5,641	Pensacola
Stormwater Pipes	Critical Infrastructure	stormwater infrastructure	line	5,488	Pensacola
Stormwater Treatment Units	Critical Infrastructure	stormwater infrastructure	point	116	Pensacola
Stormwater Ponds	Critical Infrastructure	stormwater infrastructure	polygon	105	Pensacola
Stormwater Outfalls	Critical Infrastructure	stormwater infrastructure	point	103	Pensacola
Electric Power Transmission Lines	Critical Infrastructure	electric production and supply facilities	line	13	DHS-HIFLD
WTR Well	Critical Infrastructure	drinking water facilities	point	7	Pensacola
Public Water Supply (PWS) Plants (Non-Federal)	Critical Infrastructure	drinking water facilities	point	6	FDEP
Stormwater Vaults	Critical Infrastructure	stormwater infrastructure	polygon	5	Pensacola
Water Tanks	Critical Infrastructure	water utility conveyance systems	polygon	3	Pensacola
PW Vaults	Critical Infrastructure	potable water infrastructure	polygon	3	Pensacola
Potable Water Main Distribution	Critical Infrastructure	potable water infrastructure	line	7,048	Pensacola
Sanitary Sewer Main Force	Critical Infrastructure	wastewater infrastructure	line	203	Pensacola
Sanitary Sewer Main Gravity	Critical Infrastructure	wastewater infrastructure	line	8,631	Pensacola
Railroads	Transportation	rail facilities	line	257	DHS-HIFLD
Evacuation Routes-Pensacola	Transportation	major roadways	line	25	Pensacola
Railroad Bridges-Pensacola	Transportation	railroad bridges	point	2	Pensacola
Port Facilities	Transportation	ports	polygon	1	Pensacola

This tabulation informs the resulting asset lists generated within the hot spots within this vulnerability assessment. Collaboration with local government entities will facilitate further identification of critical and regionally significant assets, ensuring a comprehensive assessment of potential climate risks and effective planning for the city's future.

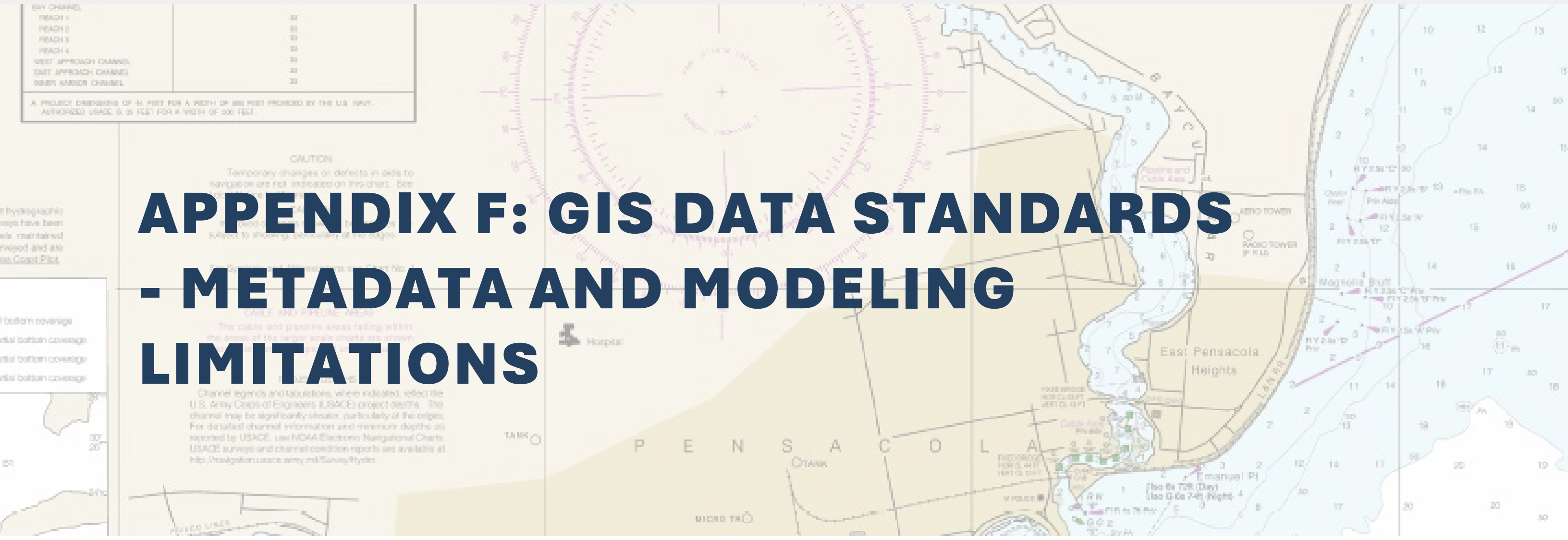


APPENDIX D: EXPOSURE ANALYSIS - FLOOD VULNERABILITY

Under separate cover.

APPENDIX E: SENSITIVITY ANALYSIS - PRIORITIZATION RESULTS

Under separate cover.



APPENDIX F: GIS DATA STANDARDS - METADATA AND MODELING LIMITATIONS

Resilient Florida Planning Grants GIS Data Standards

Pursuant to Section 380.093 (3)(c), Florida Statutes, grantees who receive funding to complete a vulnerability assessment shall submit to the Florida Department of Environmental Protection (DEP) all electronic mapping data used to illustrate the flooding and sea level rise impacts identified in the assessment. The grantees shall also submit the associated metadata for each geospatial item. These items must be compatible with DEP's Geographic Information System (GIS) infrastructure and tools and mapping coordinate reference systems. To aid in the compliance with this requirement, the following list has been compiled of acceptable digital data formats, metadata standards and required mapping datums.

Digital File Formats:

- Vector Data Formats:
    - File Geodatabase Feature Class - Feature classes are homogeneous collections of common features, each having the same spatial representation, and containing both the geometric shape of each feature as well as descriptive attributes. Feature classes can only be stored inside a geodatabase. This is an Esri proprietary format.
    - Shapefile - A shapefile is a vector data storage format that stores the location, shape, and attributes of geographic features with the same geometry type and the same spatial reference. This is an Esri

proprietary format.

  - KML - is an XML notation for expressing geographic annotation and visualization within two-dimensional maps and three-dimensional Earth browsers, initially developed for use with Google Earth. This in an open standard format.

  - GeoJSON - GeoJSON is a geospatial data interchange format designed to represent simple geographic features and their nonspatial attributes, based on JavaScript Object Notation (JSON). This in an open standard format.

- Raster Data Formats:

  - File Geodatabase Raster - Native data model for storing raster datasets inside a geodatabase. This is an Esri proprietary format.

  - TIFF/GeoTIFF - A TIFF is an image file format for storing raster graphic images. GeoTIFF is a is a metadata standard which allows georeferencing information to be embedded within a TIFF raster file. These are open standard formats.

  - Other - For a more detailed list of acceptable raster formats, please see *Supported Raster Formats* reference link.

- Data Package Formats:

  - Esri Project Package - A project package is a file that contains all maps and the data referenced by its layers, as well as folder connections, toolboxes, geoprocessing history, and attachments. This is an Esri proprietary format.

  - OGC GeoPackage - A GeoPackage is a platform-independent and standards-based data format for transferring geospatial information, implemented as an SQLite database container. This in an open standard format.

Datums and Coordinate Reference Systems:

- Geospatial data shall be delivered projected into the appropriate Florida State Plane Coordinate System.

- Horizontal Datum: North American Datum of 1983 with 1990 Adjustments (NAD83/90), or later.

- Vertical Datum: North American Vertical Datum of 1988 (NAVD88).

Metadata Standards:

- Metadata shall be compliant with the *Content Standard for Digital Geospatial Metadata* (CSDGM) developed by the Federal Geographic Data Committee (FGDC). Acceptable formats are:
  - File Geodatabase FGDC-CSDGM Metadata - format for creating and editing the metadata of Esri items. The metadata is embedded in the item it describes. This is an Esri proprietary format.
  - XML - Extensible Markup Language (XML) is a markup language and file format for storing, transmitting, and reconstructing arbitrary data. This in an open standard format.
- The Department encourages metadata to include the following information, as applicable:
  - Title - Name for the dataset.
  - Summary - Short summary of what the dataset represents.
  - Description - Basic information about the dataset and its purpose.
  - Process Summary - Steps in creating the dataset or layer.
  - Dates of Data Collection - Collection date of the dataset.
  - Date of Publication - Date of publishing or last update of the dataset.
  - Contact Person - Person responsible of the maintenance of the dataset.
  - Credits - Person or entity responsible for the compiling the dataset.
  - Use Limitation - Restrictions or legal prerequisites to using the dataset.

Critical Assets Attributes

- To standardize information for all the critical assets across the state, delivered critical asset datasets should have following attributes, as applicable:
  - Entity Name - Name of entity (i.e., County, city, local government, etc).
  - Asset Name - Asset label or description (i.e., hydrant, stormwater pipe,

cell tower, etc).

- Asset Type - Statutory asset type (i.e., airports, bridges, roadways, marinas, etc).
- Asset Class - Statutory asset group (i.e., transportation and evacuation route, critical infrastructure, critical community and emergency facilities, etc).
- Asset Owner/Operator - The owner or maintainer of the asset.
- Asset Elevation - Elevation of the asset.
- Asset Size/Capacity Data (i.e., capacity for wastewater facilities, acres, etc.)
- Asset Unique ID - Unique identifier of the asset.

Pursuant to 380.093(2) Definitions, **Asset Type** refers to the individual asset, and **Asset Class** refers to the broader asset category. See classification table below:

Asset Type	Asset Class
Airports	Transportation and Evacuation Routes
Bridges	Transportation and Evacuation Routes
Bus Terminals	Transportation and Evacuation Routes
Ports	Transportation and Evacuation Routes
Major Roadways	Transportation and Evacuation Routes
Marinas	Transportation and Evacuation Routes
Rail Facilities	Transportation and Evacuation Routes
Railroad Bridges	Transportation and Evacuation Routes
Wastewater Treatment Facilities and Lift Stations	Critical Infrastructure
Stormwater Treatment Facilities and Pump Stations	Critical Infrastructure
Drinking Water Facilities	Critical Infrastructure
Water Utility Conveyance Systems	Critical Infrastructure
Electric Production and Supply Facilities	Critical Infrastructure
Solid and Hazardous Waste Facilities	Critical Infrastructure
Military Installations	Critical Infrastructure
Communications Facilities	Critical Infrastructure
Disaster Debris Management Sites	Critical Infrastructure
Schools	Critical Community and Emergency Facilities
Colleges and Universities	Critical Community and Emergency Facilities
Community Centers	Critical Community and Emergency Facilities
Correctional Facilities	Critical Community and Emergency Facilities
Disaster Recovery Centers	Critical Community and Emergency Facilities
Emergency Medical Service Facilities	Critical Community and Emergency Facilities
Emergency Operation Centers	Critical Community and Emergency Facilities
Fire Stations	Critical Community and Emergency Facilities
Health Care Facilities	Critical Community and Emergency Facilities
Hospitals	Critical Community and Emergency Facilities
Law Enforcement Facilities	Critical Community and Emergency Facilities

Local Government Facilities	Critical Community and Emergency Facilities
Logistical Staging Areas	Critical Community and Emergency Facilities
Affordable Public Housing	Critical Community and Emergency Facilities
Risk Shelter Inventory	Critical Community and Emergency Facilities
State Government Facilities	Critical Community and Emergency Facilities
Conservation Lands	Natural, Cultural, and Historical Resource
Parks	Natural, Cultural, and Historical Resource

Shorelines	Natural, Cultural, and Historical Resource
Surface Waters	Natural, Cultural, and Historical Resource
Wetlands	Natural, Cultural, and Historical Resource
Historical and Cultural Assets	Natural, Cultural, and Historical Resource

CriticalAssetInventory.gdb

Overview

Item Description

Title

Critical Asset Inventory(.gdb)

Tags

Sea Level Rise, Vulnerability Assessment, Transportation Assets, Evacuation Routes, Pensacola, Florida, environment, location, planningCadastre, society, structure, transportation, economy, utilities, Communication

Summary (Purpose)

This geodatabase focuses on critical community and emergency response assets to assess vulnerabilities related to sea level rise in Pensacola, FL.

Description (Abstract)

This specialized database is intended for city planners, emergency services, and policymakers, offering targeted insights into the impact of sea level rise on critical community and emergency response facilities in Pensacola, FL.

Use Limitation

The data presented in this critical asset database are provided "as is" and based on the best available data, rigorous verification procedures, and in-depth research at the time of preparation. While the project exercised appropriate levels of due diligence, the project team cannot guarantee the accuracy, completeness, or applicability of this critical asset database to all situations. By utilizing the data and recommendations provided in this critical asset database, stakeholders and community members acknowledge and release the community, its partners, and consultants from any liability for damages, losses, or consequences that may arise from their use, interpretation, or implementation.

Topics and Keywords

Topic Categories

Economy, Environment, Location, Planning Cadastre, Society, Structure, Transportation, Utilities Communication

Theme Keywords

Sea Level Rise, Vulnerability Assessment, Transportation Assets, Evacuation Routes, Pensacola, FL

Thesaurus Citation

ISO 19115 Topic Categories

Citation

Title

Critical Asset Inventory

Publication Date

Published 2024-03-31 @00:00:00

Citation Contacts

Name:
Alex Zelenski, GISP

Organization:
Clearview Geographic, LLC.

Role:
Originator

Metadata

Contacts:

Name:
Alex Zelenski, GISP

Organization:
Clearview Geographic, LLC.

Role:
Point of Contact

Address Type:
Both

Address:
344 S. Woodland Blvd

City:
Deland

State:
FL

Postal Code:
32720

Country:
United States

Phone:
386-957-2314

Hours:
9 AM - 5 PM Eastern Time

Maintenance:

Update frequency

Not Planned

Constraints

Use Limitation

The data presented in this critical asset database are provided "as is" and based on the best available data, rigorous verification procedures, and in-depth research at the time of preparation. While the project exercised appropriate levels of due diligence, the project team cannot guarantee the accuracy, completeness, or applicability of this critical asset database to all situations. By utilizing the data and recommendations provided in this critical asset database, stakeholders and community members acknowledge and release the community, its partners, and consultants from any liability for damages, losses, or consequences that may arise from their use, interpretation, or implementation.

Resource

Details

Status Code:

Completed

Credit:

Data aggregated from relevant sources including the Department of Homeland Security, Florida Division of Emergency Management, Florida Department of Transportation, Florida Department of Environmental Protection, Florida Fish and Wildlife Conservation Commission, Florida Geographic Data Library, Florida Geographic Information Office, and other publicly available sources.

Extents

Bounding Box

West 087.148701

East 087.260934

South 30.398941

North 30.511539

Description

Pensacola, FL

Temporal Instant Extent

2024-03-31, 00:00:00

Points of Contact:

Name:
Alex Zelenski, GISP

Organization:
Clearview Geographic, LLC.

Role:
Point of Contact

Address Type:
Both

Address:
344 S. Woodland Blvd

City:
Deland

State:
FL

Postal Code:
32720

Country:
United States

Phone:
386-957-2314

Hours:
9 AM - 5 PM Eastern Time

Maintenance

Update Frequency:

Not Planned

Constraints

Use Limitation

The data presented in this critical asset database are provided "as is" and based on the best available data, rigorous verification procedures, and in-depth research at the time of preparation. While the project exercised appropriate levels of due diligence, the project team cannot guarantee the accuracy, completeness, or applicability of this critical asset database to all situations. By utilizing the data and recommendations provided in this critical asset database, stakeholders and community members acknowledge and release the community, its partners, and consultants from any liability for damages, losses, or consequences that may arise from their use, interpretation, or implementation.

Quality

Scope Level

Dataset

Report

Type: Conceptual Consistency

Measure, Description: Logical Consistency: Varies by original data provider but data was vetted to be applicable to planning study via comprehensive review.

Report

Type: Completeness Omission

Measure, Description:

Spatial Resolution: Varies by original data provider.

Attribute Accuracy: Varies by original data provider but data was vetted to be applicable to planning study via comprehensive review.

Lineage

Source Description:

Data compiled from numerous local, state, and federal sources.

Medium Name:

Unrecognized Value:none

Reference system, Code

CG1905D2P380VA-CAI

Source Extent, Description:

Data compiled from numerous local, state, and federal sources.

Bounding Box

West 087.148701

East 087.260934

South 30.398941

North 30.511539

Temporal Instant Extent

2024-03-31 @ 00:00:00

Process Step, Description:

1) Compile publicly available resources based on industry experience

2) Clip to city boundary containing Pensacola

3) package into final format

Process Step Date

2024-03-31 @ 00:00:00

Processor

Name:
Alex Zelenski, GISP

Organization:
Clearview Geographic, LLC.

Role:
Processor

Email:
azelenski@clearviewgeographic.com

Address Type:
Both

Address:
344 S. Woodland Blvd

City:
Deland

State:
FL

Postal Code:
32720

Country:
United States

Phone:
386-957-2314

Hours:
9 AM - 5 PM Eastern Time

Data Source, Source Description

Sourced from federal, state, and local.

Depth Grids (.tif)

Overview

Item Description

Title

Depth Grid Tifs - Exposure Analysis Inventory

Tags

Climate Change, Sea Level Rise, High Tide, Storm Surge, Rainfall-Induced Flooding, Compound Flooding, Vulnerability Assessment, Pensacola, Florida, Resilience Planning, Emergency Response, Flood Risk Management

Summary (Purpose)

This geodatabase is designed to encapsulate a comprehensive exposure analysis of Pensacola, FL, against the backdrop of climate change impacts. It integrates future high tide modeling, storm surge projections, rainfall-induced flooding evaluations, and compound flooding assessments to identify vulnerabilities across critical assets and infrastructure.

Description (Abstract)

Developed for urban planners, emergency managers, and decision-makers, this database provides an in-depth analysis of potential future flooding scenarios due to sea level rise, enhanced high tides, storm surges, and increased rainfall events. By leveraging advanced modeling techniques and a wide array of data sources, it offers a nuanced understanding of climate-induced risks, aiding in the development of targeted adaptation and resilience strategies.

Use Limitation

Data within this geodatabase are offered "as is," derived from extensive data collection, rigorous validation, and sophisticated modeling efforts. While comprehensive due diligence has been applied, accuracy, completeness, or suitability for all contexts cannot be guaranteed. Users acknowledge the inherent limitations and agree to absolve the creators of liability for any use or interpretation of the data.

Topics and Keywords

Topic Categories

Climate Change Adaptation, Flood Risk Management, Urban Planning, Emergency Preparedness, Infrastructure Resilience

Theme Keywords

Sea Level Rise, Future High Tide, Storm Surge, Rainfall-Induced Flooding, Compound Flooding Assessment, Pensacola, Climate Change Vulnerability, Critical Asset Protection

Thesaurus Citation

ISO 19115 Topic Categories

Citation

Title

Exposure Analysis Inventory/Depth Grids .tifs

Publication Date

Published 2024-03-31 @00:00:00

Citation Contacts

Name:
Alex Zelenski, GISP

Organization:
Clearview Geographic, LLC.

Role:
Originator

Metadata

Contacts:

Name:
Alex Zelenski, GISP

Organization:

Clearview Geographic, LLC.

Role:
Point of Contact

Address Type:
Both

Address:
344 S. Woodland Blvd

City:
Deland

State:
FL

Postal Code:
32720

Country:
United States

Phone:
386-957-2314

Hours:
9 AM - 5 PM Eastern Time

Maintenance:

Update frequency

Not Planned

Constraints

Use Limitation

Data within this geodatabase are offered "as is," derived from extensive data collection, rigorous validation, and sophisticated modeling efforts. While comprehensive due diligence has been applied, accuracy, completeness, or suitability for all contexts cannot be guaranteed. Users acknowledge the inherent limitations and agree to absolve the creators of liability for any use or interpretation of the data..

Resource

Details

Status Code:

Completed

Credit:

Data aggregated from relevant sources including the Department of Homeland Security, Florida Division of Emergency Management, Florida Department of Transportation, Florida Department of Environmental Protection, Florida Fish and Wildlife Conservation Commission, Florida Geographic Data Library, Florida Geographic Information Office, and other publicly available sources.

Extents

Bounding Box

West 087.148701

East 087.260934

South 30.398941

North 30.511539

Description

Pensacola, FL

Temporal Instant Extent

2024-03-31, 00:00:00

Points of Contact:

Name:
Alex Zelenski, GISP

Organization:
Clearview Geographic, LLC.

Role:
Point of Contact

Address Type:
Both

Address:
344 S. Woodland Blvd

City:
Deland

State:
FL

Postal Code:
32720

Country:
United States

Phone:
386-957-2314

Hours:
9 AM - 5 PM Eastern Time

Maintenance

Update Frequency:

Not Planned

Constraints

Use Limitation

Data within this geodatabase are offered "as is," derived from extensive data collection, rigorous validation, and sophisticated modeling efforts. While comprehensive due diligence has been applied, accuracy, completeness, or suitability for all contexts cannot be guaranteed. Users acknowledge the inherent limitations and agree to absolve the creators of liability for any use or interpretation of the data..

Quality

Scope Level

Dataset

Report

Type: Conceptual Consistency

Measure, Description: Logical Consistency: Varies by original data provider but data was vetted to be applicable to planning study via comprehensive review.

Report

Type: Completeness Omission

Measure, Description:

Spatial Resolution: Varies by original data provider.

Attribute Accuracy: Varies by original data provider but data was vetted to be applicable to planning study via comprehensive review.

Lineage

Source Description:

Data compiled from numerous local, state, and federal sources.

Medium Name:

Unrecognized Value:none

Reference system, Code

CG1905D2P380VA-CAI

Source Extent, Description:

Data compiled from numerous local, state, and federal sources.

Bounding Box

West 087.148701

East 087.260934

South 30.398941

North 30.511539

Processor

Name:
Alex Zelenski, GISP

Organization:
Clearview Geographic, LLC.

Role:
Processor

Email:
azelenski@clearviewgeographic.com

Address Type:
Both

Address:
344 S. Woodland Blvd

City:
Deland

State:
FL

Postal Code:
32720

Country:
United States

Phone:
386-957-2314

Hours:
9 AM - 5 PM Eastern Time

Data Source, Source Description

Sourced from federal, state, and local.

Prioritized Asset Inventory.gdb

Overview

Item Description

Title

Prioritized Asset Inventory (.gdb)

Tags

Sea Level Rise, Vulnerability Assessment, Transportation Assets, Evacuation Routes, Pensacola, Florida, environment, location, planningCadastre, society, structure, transportation, economy, utilities, Communication

Summary (Purpose)

The Prioritized Asset Inventory geodatabase is crafted to highlight and assess the vulnerabilities of key community and emergency response assets within Pensacola, FL, in the face of sea level rise and associated climate change impacts. This database aims to prioritize assets based on their criticality, aiding in strategic planning and resource allocation for resilience efforts..

Description (Abstract)

Designed for use by city planners, emergency services, and policymakers, this database provides a focused overview of how sea level rise may impact essential services and infrastructure. It facilitates a targeted approach to enhancing resilience, emphasizing the prioritization of assets critical to community safety and sustainability.

Use Limitation

Data within this geodatabase are presented "as is," compiled through rigorous data collection, validation, and modeling efforts. Despite thorough due diligence, the completeness, accuracy, or applicability for all contexts cannot be guaranteed. Users must acknowledge these limitations, releasing the creators from liability for any consequences arising from data use or interpretation

Topics and Keywords

Topic Categories

Economy, Environment, Location, Planning Cadastre, Society, Structure, Transportation, Utilities Communication

Theme Keywords

Sea Level Rise, Vulnerability Assessment, Transportation Assets, Evacuation Routes, Pensacola, FL

Theme Keywords

environment

location

planningCadastre

society

structure

transportation

economy

utilitiesCommunication

Thesaurus Citation

ISO 19115 Topic Categories

Citation

Title

Prioritized Asset Inventory

Publication Date

Published 2024-03-31 @00:00:00

Citation Contacts

Name:
Alex Zelenski, GISP

Organization:
Clearview Geographic, LLC.

Role:
Originator

Metadata

Contacts:

Name:
Alex Zelenski, GISP

Organization:
Clearview Geographic, LLC.

Role:
Point of Contact

Address Type:
Both

Address:
344 S. Woodland Blvd

City:
Deland

State:
FL

Postal Code:
32720

Country:
United States

Phone:
386-957-2314

Hours:
9 AM - 5 PM Eastern Time

Maintenance:

Update frequency

Not Planned

Constraints

Use Limitation

Data within this geodatabase are presented "as is," compiled through rigorous data collection, validation, and modeling efforts. Despite thorough due diligence, the completeness, accuracy, or applicability for all contexts cannot be guaranteed. Users must acknowledge these limitations, releasing the creators from liability for any consequences arising from data use or interpretation..

Resource

Details

Status Code:

Completed

Credit:

Data aggregated from relevant sources including the Department of Homeland Security, Florida Division of Emergency Management, Florida Department of Transportation, Florida Department of Environmental Protection, Florida Fish and Wildlife Conservation Commission, Florida Geographic Data Library, Florida Geographic Information Office, and other publicly available sources.

Extents

Bounding Box

West 087.148701

East 087.260934

South 30.398941

North 30.511539

Description

Pensacola, FL

Temporal Instant Extent

2024-03-31, 00:00:00

Points of Contact:

Name:
Alex Zelenski, GISP

Organization:
Clearview Geographic, LLC.

Role:
Point of Contact

Address Type:
Both

Address:
344 S. Woodland Blvd

City:
Deland

State:
FL

Postal Code:
32720

Country:
United States

Phone:
386-957-2314

Hours:
9 AM - 5 PM Eastern Time

Maintenance

Update Frequency:

Not Planned

Constraints

Use Limitation

Data within this geodatabase are presented "as is," compiled through rigorous data collection, validation, and modeling efforts. Despite thorough due diligence, the completeness, accuracy, or applicability for all contexts cannot be guaranteed. Users must acknowledge these limitations, releasing the creators from liability for any consequences arising from data use or interpretation..

Quality

Scope Level

Dataset

Report

Type: Conceptual Consistency

Measure, Description: Logical Consistency: Varies by original data provider but data was vetted to be applicable to planning study via comprehensive review.

Report

Type: Completeness Omission

Measure, Description:

Spatial Resolution: Varies by original data provider.

Attribute Accuracy: Varies by original data provider but data was vetted to be applicable to planning study via comprehensive review.

Lineage

Source Description:

Data compiled from numerous local, state, and federal sources.

Medium Name:

Unrecognized Value:none

Reference system, Code

CG1905D2P380VA-CAI

Source Extent, Description:

Data compiled from numerous local, state, and federal sources.

Bounding Box

West 087.148701

East 087.260934

South 30.398941

North 30.511539

Temporal Instant Extent

2024-03-31 @ 00:00:00

Process Step, Description:

1) Compile publicly available resources based on industry experience

2) Clip to city boundary containing Pensacola

3) package into final format

Process Step Date

2024-03-31 @ 00:00:00

Processor

Name:
Alex Zelenski, GISP

Organization:
Clearview Geographic, LLC.

Role:
Processor

Email:
azelenski@clearviewgeographic.com

Address Type:
Both

Address:
344 S. Woodland Blvd

City:
Deland

State:
FL

Postal Code:
32720

Country:
United States

Phone:
386-957-2314

Hours:
9 AM - 5 PM Eastern Time

Data Source, Source Description

Sourced from federal, state, and local.

Modeling Limitations

The examination of the limitations inherent to modeling, encompassing considerations such as this project's timeline, budget, scale, and objectives, is crucial for understanding the scope of the project, approach to the assessment, and its applicability in other areas of planning.

Hydrological models, which are designed to provide a macroscopic overview of water movement, focus on general aspects like the location, quantity, and flow paths of water. These models operate within the spatial and temporal scales pertinent to the studied system, offering a broad-brush depiction that overlooks the complexities of detailed flow dynamics, such as eddies or turbulence. They are built on foundational assumptions about processes like runoff, infiltration, and evapotranspiration, which may lead to a lack of precision in capturing localized variations or swift alterations in water movement.

On the other hand, hydrodynamic models delve into the minutiae of water flow by directly solving the fundamental fluid dynamics equations, for instance, the Navier-Stokes equations. These models are distinguished by their capacity to simulate intricate flow behaviors, including turbulence, wave interactions, and sediment dynamics, necessitating significant computational resources due to their focus on fine-scale features. The accuracy of hydrodynamic models hinges on the precise definition of boundary and initial conditions, offering detailed insights at the expense of greater resource demands. The constraints of the current assessment's timeline, budget, and scope precluded the application of hydrodynamic models.

Hydraulic models are specialized for analyzing fluid movement within controlled environments like channels, pipes, or engineered structures, addressing aspects of water transport and hydraulic responses. These models presuppose certain conditions regarding the geometry of channels, surface roughness, and flow boundaries. Although many hydraulic models are based on the assumption of steady-state flow, this simplification may not adequately reflect the reality of transient phenomena. Additionally, the omission of sediment transport in some models can further limit their applicability. The reliability of hydraulic modeling is heavily dependent on the quality of input data, such as cross-sectional profiles of water bodies.

A notable challenge in this project was the scarcity of readily available hydrological and hydraulic modeling results that could certainly bolster efforts to provide accurate, precise, and reliability-tested flood depths for the analysis of potential future scenarios, particularly concerning rainfall-induced flooding and combined flood events. This gap underscores the need for a strategic approach to data gathering, model selection, multi-departmental and multi-consulting team collaborations, ensuring that the chosen models align with the city's resilience adaptation goals while acknowledging the inherent limitations of each modeling framework as work to merge and corroborate modeling outputs is conducted.

APPENDIX G: LIST OF PRIORITIZED ASSETS IN FLOODING HOT SPOTS

Under separate cover.

APPENDIX H: OTHER SUPPORTING DOCUMENTATION

2020 Census Profile

Pensacola City Boundary_20240122 1
Area: 22.77 square miles

Prepared by Clearview Geographic LLC

	2010		2020		2023		Annual Rate		
	Number	Percent	Number	Percent	Number	Percent	2000-2020	2010-2020	2020-2023
Total Population	51,985	100.0%	53,923	100.0%	54,253	100.0%	-0.17%	0.37%	0.19%
Household Population	51,286	98.7%	52,524	97.4%	52,833	97.4%	-0.24%	0.24%	0.18%
Group Quarters	699	1.3%	1,399	2.6%	1,420	2.6%	3.42%	7.19%	0.46%
Population Density	2,260.2	-	2,359.7	-	2,374.2	-			
Total Housing Units	26,953	100.0%	27,918	100.0%	28,222	100.0%	0.18%	0.35%	0.33%
Total Households	23,749	88.1%	24,775	88.7%	25,140	89.1%	0.05%	0.42%	0.45%
Total Vacant	3,204	11.9%	3,222	11.5%	3,082	10.9%	1.47%	0.06%	-5.75%
Average Household Size	2.16	-	2.12	-	2.10	-	-		-

Population by Race	2020 Total		Non-Hispanic		Hispanic	
	Number	Percent	Number	Percent	Number	Percent
Total	53,923	100.0%	50,990	94.6%	2,933	5.4%
Population Reporting One Race	50,101	92.9%	48,514	90.0%	1,587	2.9%
White	35,473	65.8%	34,669	64.3%	805	1.5%
Black	12,229	22.7%	12,113	22.5%	116	0.2%
American Indian	236	0.4%	193	0.4%	43	0.1%
Asian	1,294	2.4%	1,242	2.3%	53	0.1%
Pacific Islander	47	0.1%	41	0.1%	6	0.0%
Some Other Race	822	1.5%	257	0.5%	565	1.0%
Population Reporting Two or More Races	3,822	7.1%	2,476	4.6%	1,346	2.5%
Diversity Index	56.0	-		-	-	-

Population 18+ by Race	2020 Total		Non-Hispanic		Hispanic	
	Number	Percent	Number	Percent	Number	Percent
Total	44,163	81.9%	42,089	82.5%	2,075	70.7%
Population Reporting One Race	41,551	77.1%	40,429	79.3%	1,122	38.3%
White	30,373	56.3%	29,828	58.5%	545	18.6%
Black	9,225	17.1%	9,150	17.9%	75	2.6%
American Indian	198	0.4%	166	0.3%	32	1.1%
Asian	1,086	2.0%	1,048	2.1%	38	1.3%
Pacific Islander	41	0.1%	35	0.1%	6	0.2%
Some Other Race	628	1.2%	201	0.4%	427	14.6%
Population Reporting Two or More Races	2,612	4.8%	1,660	3.3%	952	32.5%

Population <18 by Race	2020 Total		Non-Hispanic		Hispanic	
	Number	Percent	Number	Percent	Number	Percent
Total	9,760	18.1%	8,901	17.5%	859	29.3%
Population Reporting One Race	8,550	15.9%	8,085	15.9%	465	15.9%
White	5,101	9.5%	4,841	9.5%	260	8.9%
Black	3,004	5.6%	2,963	5.8%	41	1.4%
American Indian	38	0.1%	27	0.1%	11	0.4%
Asian	209	0.4%	193	0.4%	15	0.5%
Pacific Islander	6	0.0%	5	0.0%	1	0.0%
Some Other Race	193	0.4%	55	0.1%	138	4.7%
Population Reporting Two or More Races	1,210	2.2%	816	1.6%	394	13.4%

Data Note: Hispanic population can be of any race. Population density is measured in square miles. Esri's Diversity Index summarizes racial and ethnic diversity. The index shows the likelihood that two persons, chosen at random from the same area, belong to different race or ethnic groups. The index ranges from 0 (no diversity) to 100 (complete diversity).

Source: U.S. Census Bureau. U.S. Census Bureau 2020 decennial Census data.

January 22, 2024

Group Quarters Population	2020	
	Number	Percent
Total	1,399	2.6%
Institutionalized population	670	1.2%
Correctional facilities for adults	5	0.0%
Juvenile facilities	17	0.0%
Nursing facilities/Skilled-nursing	649	1.2%
Other institutional facilities	0	0.0%
Noninstitutionalized population	728	1.4%
College/University student housing	5	0.0%
Military Quarters	0	0.0%
Other noninstitutional	723	1.3%

Population by Sex	2020	
	Number	Percent
Male	25,343	47.0%
Female	28,580	53.0%

Population by Age	2020	
	Number	Percent
Total	53,923	**100%**
Age 0-4	2,727	5.1%
Age 5-9	2,670	5.0%
Age 10-14	2,694	5.0%
Age 15-19	2,646	4.9%
Age 20-24	2,997	5.6%
Age 25-29	3,862	7.2%
Age 30-34	3,820	7.1%
Age 35-39	3,450	6.4%
Age 40-44	2,895	5.4%
Age 45-49	2,905	5.4%
Age 50-54	3,146	5.8%
Age 55-59	3,742	6.9%
Age 60-64	4,187	7.8%
Age 65-69	3,793	7.0%
Age 70-74	3,199	5.9%
Age 75-79	2,100	3.9%
Age 80-84	1,444	2.7%
Age 85+	1,646	3.1%
Age 18+	44,163	81.9%
Age 65+	12,182	22.6%

Data Note: Hispanic population can be of any race. Population density is measured in square miles. Esri's Diversity Index summarizes racial and ethnic diversity. The index shows the likelihood that two persons, chosen at random from the same area, belong to different race or ethnic groups. The index ranges from 0 (no diversity) to 100 (complete diversity).

Source: U.S. Census Bureau. U.S. Census Bureau 2020 decennial Census data.

2020 Census Profile

Pensacola City Boundary_20240122 1
Area: 22.77 square miles

Prepared by Clearview Geographic LLC

Households by Type	2020	
	Number	Percent
Total	24,775	100%
Married Couple Households	8,766	35.4%
With Own Children <18	2,548	10.3%
Without Own Children <18	6,218	25.1%
Cohabitating Couple Households	1,630	6.6%
With Own Children <18	349	1.4%
Without Own Children <18	1,282	5.2%
Male Householder, No Spouse/Partner	5,280	21.3%
Living Alone	3,906	15.8%
65 Years and over	1,236	5.0%
With Own Children <18	267	1.1%
Without Own Children <18, With Relatives	639	2.6%
No Relatives Present	468	1.9%
Female Householder, No Spouse/Partner	9,098	36.7%
Living Alone	5,441	22.0%
65 Years and over	2,693	10.9%
With Own Children <18	1,331	5.4%
Without Own Children <18, With Relatives	1,936	7.8%
No Relatives Present	390	1.6%

Households by Size	2020	
	Number	Percent
Total	24,775	100%
1 Person Household	9,347	37.7%
2 Person Household	8,585	34.7%
3 Person Household	3,218	13.0%
4 Person Household	2,144	8.7%
5 Person Household	854	3.4%
6 Person Household	368	1.5%
7+ Person Household	259	1.0%

Population by Relationship	2020	
	Number	Percent
Total	53,923	100%
In Households	52,524	97.4%
Householder	24,740	47.1%
Opposite-Sex Spouse	8,556	16.3%
Same-Sex Spouse	208	0.4%
Opposite-Sex Unmarried Partner	1,450	2.8%
Same-Sex Unmarried Partner	169	0.3%
Biological Child	11,536	22.0%
Adopted Child	288	0.5%
Stepchild	435	0.8%
Grandchild	1,351	2.6%
Brother or Sister	632	1.2%
Parent	487	0.9%
Parent-in-law	106	0.2%
Son-in-law or Daughter-in-law	139	0.3%
Other Relatives	596	1.1%
Foster Child	47	0.1%
Other Nonrelatives	1,784	3.4%

Data Note: Hispanic population can be of any race. Population density is measured in square miles. Esri's Diversity Index summarizes racial and ethnic diversity. The index shows the likelihood that two persons, chosen at random from the same area, belong to different race or ethnic groups. The index ranges from 0 (no diversity) to 100 (complete diversity).

Source: U.S. Census Bureau. U.S. Census Bureau 2020 decennial Census data.

January 22, 2024

2020 Census Profile

Pensacola City Boundary_20240122 1
Area: 22.77 square miles

Prepared by Clearview Geographic LLC

Households by Age of Householder	2020	
	Number	Percent
Total	24,775	100%
Householder Age 15-24	1,029	4.2%
Householder Age 25-34	3,743	15.1%
Householder Age 35-44	3,473	14.0%
Householder Age 45-54	3,545	14.3%
Householder Age 55-59	2,251	9.1%
Householder Age 60-64	2,590	10.5%
Householder Age 65-74	4,636	18.7%
Householder Age 75-84	2,406	9.7%
Householder Age 85+	1,101	4.4%

Family Households by Race of Householder	2020	
	Number	Percent
Total	13,447	100%
Householder is White Alone	9,153	36.9%
Householder is Black Alone	2,932	11.8%
Householder is American Indian Alone	80	0.3%
Householder is Asian Alone	308	1.2%
Householder is Pacific Islander Alone	6	0.0%
Householder is Some Other Race Alone	194	0.8%
Householder is Two or More Races	774	3.1%
Households with Hispanic Householder	620	2.5%

Nonfamily Households by Race of Householder	2020	
	Number	Percent
Total	11,328	100%
Householder is White Alone	8,220	33.2%
Householder is Black Alone	2,221	9.0%
Householder is American Indian Alone	40	0.2%
Householder is Asian Alone	143	0.6%
Householder is Pacific Islander Alone	9	0.0%
Householder is Some Other Race Alone	97	0.4%
Householder is Two or More Races	599	2.4%
Households with Hispanic Householder	401	1.6%

Total Housing Units by Occupancy	2020	
	Number	Percent
Total	27,918	100%
Occupied Housing Units	24,775	88.7%
Vacant Housing Units	3,222	11.5%
For Rent	1,332	41.3%
Rented, not Occupied	113	3.5%
For Sale Only	378	11.7%
Sold, not Occupied	129	4.0%
For Seasonal/Recreational/Occasional Use	424	13.2%
For Migrant Workers	3	0.1%
Other Vacant	843	26.2%

Data Note: Hispanic population can be of any race. Population density is measured in square miles. Esri's Diversity Index summarizes racial and ethnic diversity. The index shows the likelihood that two persons, chosen at random from the same area, belong to different race or ethnic groups. The index ranges from 0 (no diversity) to 100 (complete diversity).

Source: U.S. Census Bureau. U.S. Census Bureau 2020 decennial Census data.

January 22, 2024

2020 Census Profile

Pensacola City Boundary_20240122 1
Area: 22.77 square miles

Prepared by Clearview Geographic LLC

Owner-Occupied Housing Units by Race of Householder	2020	
	Number	Percent
Total	14,867	100%
Householder is White Alone	11,442	77.0%
Householder is Black Alone	2,223	15.0%
Householder is American Indian Alone	60	0.4%
Householder is Asian Alone	269	1.8%
Householder is Pacific Islander Alone	7	0.0%
Householder is Some Other Race Alone	133	0.9%
Householder is Two or More Races	733	4.9%
Hispanic Householder	500	3.4%

Renter-Occupied Housing Units by Race of Householder	2020	
	Number	Percent
Total	9,908	100%
Householder is White Alone	5,931	59.9%
Householder is Black Alone	2,930	29.6%
Householder is American Indian Alone	60	0.6%
Householder is Asian Alone	181	1.8%
Householder is Pacific Islander Alone	9	0.1%
Householder is Some Other Race Alone	159	1.6%
Householder is Two or More Races	640	6.5%
Hispanic Householder	522	5.3%

Data Note: Hispanic population can be of any race. Population density is measured in square miles. Esri's Diversity Index summarizes racial and ethnic diversity. The index shows the likelihood that two persons, chosen at random from the same area, belong to different race or ethnic groups. The index ranges from 0 (no diversity) to 100 (complete diversity).

Source: U.S. Census Bureau. U.S. Census Bureau 2020 decennial Census data.

January 22, 2024

ACS Key Population & Household Facts

Pensacola City Boundary_20240122 1
Area: 22.77 square miles

Prepared by Clearview Geographic LLC

	2017-2021 ACS Estimate	Percent	MOE(±)	Reliability
TOTALS				
Total Population	53,173		1,932	high
Total Households	23,836		817	high
Housing Units	26,723		836	high
POPULATION 15+ BY MARITAL STATUS				
Total	43,269	100%	1,490	high
Never married	15,518	35.9%	848	high
Married	18,484	42.7%	777	high
Widowed	2,757	6.4%	302	high
Divorced	6,510	15.0%	474	high
POPULATION 25+ BY EDUCATIONAL ATTAINMENT				
Total	37,598	100%	1,361	high
No schooling	188	0.5%	54	medium
Nursery School	0	0.0%	0	
Kindergarden	20	0.1%	27	low
1st to 4th Grade	117	0.3%	94	low
5th to 8th Grade	241	0.6%	100	medium
Some High School	2,080	5.5%	265	high
High School Diploma	6,733	17.9%	568	high
GED	1,040	2.8%	163	high
Some College	7,783	20.7%	497	high
Associates degree	4,485	11.9%	384	high
Bachelors degree	8,507	22.6%	808	high
Masters degree	3,727	9.9%	364	high
Professional school degree	1,599	4.3%	325	medium
Doctorate degree	1,079	2.9%	254	medium

Source: U.S. Census Bureau, 2017-2021 American Community Survey

Reliability: high medium low

January 22, 2024

ACS Key Population & Household Facts

Pensacola City Boundary_20240122 1
Area: 22.77 square miles

Prepared by Clearview Geographic LLC

	2017-2021 ACS Estimate	Percent	MOE(±)	Reliability
CIVILIAN EMPLOYED POPULATION 16+ BY OCCUPATION				
Total	24,831	100%	1,078	high
Management	2,479	10.0%	297	high
Business and financial operations	1,337	5.4%	272	medium
Computer and mathematical	684	2.8%	167	medium
Architecture and engineering	547	2.2%	144	medium
Life, physical, and social science	208	0.8%	67	medium
Community and social services	503	2.0%	123	medium
Legal	625	2.5%	190	medium
Education, training, and library	1,742	7.0%	311	high
Arts, design, entertainment, sports, and media	579	2.3%	144	medium
Healthcare practitioner, technologists, and technicians	2,189	8.8%	297	high
Healthcare support	829	3.3%	182	medium
Protective service	452	1.8%	101	medium
Food preparation and serving related	1,969	7.9%	257	high
Building and grounds cleaning and maintenance	612	2.5%	144	medium
Personal care and service	679	2.7%	122	high
Sales and related	2,712	10.9%	296	high
Office and administrative support	2,758	11.1%	302	high
Farming, fishing, and forestry	19	0.1%	33	low
Construction and extraction	830	3.3%	158	high
Installation, maintenance, and repair	615	2.5%	147	medium
Production	665	2.7%	176	medium
Transportation and material moving	1,800	7.2%	282	high
CIVILIAN EMPLOYED POPULATION 16+ BY INDUSTRY				
Total	24,831	100%	1,078	high
Agriculture, forestry, fishing and hunting	34	0.1%	29	low
Mining, quarrying, and oil and gas extraction	20	0.1%	15	low
Construction	1,284	5.2%	187	high
Manufacturing	1,087	4.4%	221	medium
Wholesale trade	515	2.1%	153	medium
Retail trade	2,880	11.6%	289	high
Transportation and warehousing	1,199	4.8%	221	high
Utilities	122	0.5%	62	medium
Information	301	1.2%	106	medium
Finance and insurance	1,896	7.6%	245	high
Real estate and rental and leasing	672	2.7%	167	medium
Professional, scientific, and technical services	1,995	8.0%	305	high
Management of companies and enterprises	0	0.0%	1	
Administrative and support and waste management services	703	2.8%	138	high
Educational services	2,353	9.5%	342	high
Health care and social assistance	4,231	17.0%	392	high
Arts, entertainment, and recreation	463	1.9%	110	medium
Accommodation and food services	2,653	10.7%	288	high
Other services, except public administration	1,432	5.8%	257	high
Public administration	992	4.0%	189	high

Source: U.S. Census Bureau, 2017-2021 American Community Survey

Reliability: high medium low

January 22, 2024

ACS Key Population & Household Facts

Pensacola City Boundary_20240122 1
Area: 22.77 square miles

Prepared by Clearview Geographic LLC

	2017-2021 ACS Estimate	Percent	MOE(±)	Reliability
HISPANIC OR LATINO ORIGIN BY RACE				
Total	53,173	100%	1,932	high
Not Hispanic or Latino	50,468	94.9%	1,897	high
White alone	33,026	62.1%	1,526	high
Black or African American alone	12,863	24.2%	1,035	high
American Indian and Alaska Native alone	28	0.1%	34	low
Asian alone	995	1.9%	268	medium
Native Hawaiian and Other Pacific Islander alone	76	0.1%	104	low
Some other race alone	254	0.5%	118	medium
Two or more races	3,227	6.1%	486	high
Hispanic or Latino	2,705	5.1%	345	high
White alone	1,627	3.1%	285	high
Black or African American alone	70	0.1%	105	low
American Indian and Alaska Native alone	2	0.0%	9	low
Asian alone	99	0.2%	95	low
Native Hawaiian and Other Pacific Islander alone	21	0.0%	39	low
Some other race alone	330	0.6%	142	medium
Two or more races	555	1.0%	123	medium
RACE				
Total	53,173	100%	1,932	high
White alone	34,653	65.2%	1,562	high
Black or African American alone	12,932	24.3%	1,035	high
American Indian and Alaska Native alone	30	0.1%	34	low
Asian alone	1,094	2.1%	267	medium
Native Hawaiian and Other Pacific Islander alone	97	0.2%	104	low
Some other race alone	584	1.1%	183	medium
Two or more races	3,782	7.1%	506	high
TOTAL POPULATION BY AGE				
Total Population	53,173	100%	1,932	high
Under 5 years	3,445	6.5%	487	high
5 to 9 years	3,076	5.8%	383	high
10 to 14 years	3,382	6.4%	371	high
15 to 19 years	2,468	4.6%	305	high
20 to 24 years	3,204	6.0%	391	high
25 to 29 years	4,461	8.4%	484	high
30 to 34 years	4,209	7.9%	429	high
35 to 39 years	3,267	6.1%	360	high
40 to 44 years	2,355	4.4%	255	high
45 to 49 years	2,724	5.1%	279	high
50 to 54 years	2,929	5.5%	300	high
55 to 59 years	3,705	7.0%	391	high
60 to 64 years	3,583	6.7%	371	high
65 to 69 years	3,095	5.8%	321	high
70 to 74 years	3,192	6.0%	500	high
75 to 79 years	1,399	2.6%	180	high
80 to 85 years	1,298	2.4%	228	high
85 years and over	1,379	2.6%	172	high

Source: U.S. Census Bureau, 2017-2021 American Community Survey

Reliability: high medium low

January 22, 2024

ACS Key Population & Household Facts

Pensacola City Boundary_20240122 1
Area: 22.77 square miles

Prepared by Clearview Geographic LLC

	2017-2021 ACS Estimate	Percent	MOE(±)	Reliability
POPULATION BY SEX BY AGE				
Total	53,173	100%	1,932	high
Male Population	25,311	47.6%	1,169	high
Under 5 years	1,846	3.5%	359	high
5 to 9 years	1,806	3.4%	319	high
10 to 14 years	1,628	3.1%	269	high
15 to 19 years	1,003	1.9%	184	high
20 to 24 years	1,592	3.0%	303	high
25 to 29 years	2,231	4.2%	348	high
30 to 34 years	2,025	3.8%	300	high
35 to 39 years	1,848	3.5%	297	high
40 to 44 years	978	1.8%	158	high
45 to 49 years	1,579	3.0%	209	high
50 to 54 years	1,089	2.0%	185	high
55 to 59 years	1,733	3.3%	253	high
60 to 64 years	1,585	3.0%	262	high
65 to 69 years	1,308	2.5%	192	high
70 to 74 years	1,411	2.7%	325	medium
75 to 79 years	640	1.2%	119	high
80 to 85 years	583	1.1%	168	medium
85 years and over	427	0.8%	105	medium
Female Population	27,861	52.4%	1,104	high
Under 5 years	1,599	3.0%	330	medium
5 to 9 years	1,271	2.4%	213	high
10 to 14 years	1,754	3.3%	256	high
15 to 19 years	1,465	2.8%	221	high
20 to 24 years	1,612	3.0%	233	high
25 to 29 years	2,231	4.2%	336	high
30 to 34 years	2,184	4.1%	307	high
35 to 39 years	1,419	2.7%	203	high
40 to 44 years	1,377	2.6%	202	high
45 to 49 years	1,146	2.2%	185	high
50 to 54 years	1,840	3.5%	238	high
55 to 59 years	1,972	3.7%	298	high
60 to 64 years	1,998	3.8%	252	high
65 to 69 years	1,787	3.4%	243	high
70 to 74 years	1,781	3.3%	380	medium
75 to 79 years	759	1.4%	136	high
80 to 85 years	715	1.3%	154	medium
85 years and over	952	1.8%	137	high

Source: U.S. Census Bureau, 2017-2021 American Community Survey

Reliability: high medium low

January 22, 2024

ACS Key Population & Household Facts

Pensacola City Boundary_20240122 1
Area: 22.77 square miles

Prepared by Clearview Geographic LLC

	2017-2021 ACS Estimate	Percent	MOE(±)	Reliability
TOTAL HOUSEHOLDS BY INCOME				
Total	23,836	100%	817	high
Less than $10,000	1,775	7.4%	223	high
$10,000 to $14,999	1,165	4.9%	159	high
$15,000 to $19,999	930	3.9%	242	medium
$20,000 to $24,999	1,056	4.4%	264	medium
$25,000 to $29,999	1,165	4.9%	250	medium
$30,000 to $34,999	1,270	5.3%	212	high
$35,000 to $39,999	1,056	4.4%	283	medium
$40,000 to $44,999	1,027	4.3%	173	high
$45,000 to $49,999	807	3.4%	178	medium
$50,000 to $59,999	1,795	7.5%	248	high
$60,000 to $74,999	2,414	10.1%	321	high
$75,000 to $99,999	3,021	12.7%	315	high
$100,000 to $124,999	1,804	7.6%	229	high
$125,000 to $149,999	1,505	6.3%	302	medium
$150,000 to $199,999	1,446	6.1%	283	high
$200,000 or more	1,600	6.7%	274	high
Median Household Income	$59,160		N/A	low
Average Household Income	$84,321		$5,654	high
HOUSEHOLDS WITH HOUSEHOLDER AGE <25 YEARS BY INCOME				
Total	1,358	100%	267	high
Less than $10,000	87	6.4%	51	medium
$10,000 to $14,999	89	6.6%	56	medium
$15,000 to $19,999	78	5.7%	60	low
$20,000 to $24,999	220	16.2%	203	low
$25,000 to $29,999	140	10.3%	52	medium
$30,000 to $34,999	177	13.0%	103	medium
$35,000 to $39,999	51	3.8%	34	low
$40,000 to $44,999	102	7.5%	26	medium
$45,000 to $49,999	24	1.8%	48	low
$50,000 to $59,999	110	8.1%	65	medium
$60,000 to $74,999	149	11.0%	75	medium
$75,000 to $99,999	96	7.1%	61	medium
$100,000 to $124,999	15	1.1%	26	low
$125,000 to $149,999	0	0.0%	0	
$150,000 to $199,999	20	1.5%	29	low
$200,000 or more	0	0.0%	0	
Median Household Income for HHr <25	$31,597		N/A	low
Average Household Income for HHr <25	N/A		N/A	low

Source: U.S. Census Bureau, 2017-2021 American Community Survey

Reliability: high medium low

January 22, 2024

ACS Key Population & Household Facts

Pensacola City Boundary_20240122 1
Area: 22.77 square miles

Prepared by Clearview Geographic LLC

	2017-2021 ACS Estimate	Percent	MOE(±)	Reliability
HOUSEHOLDS WITH HOUSEHOLDER AGE 25-44 YEARS BY INCOME				
Total	7,566	100%	557	high
Less than $10,000	463	6.1%	122	medium
$10,000 to $14,999	138	1.8%	60	medium
$15,000 to $19,999	202	2.7%	215	low
$20,000 to $24,999	281	3.7%	90	medium
$25,000 to $29,999	264	3.5%	99	medium
$30,000 to $34,999	522	6.9%	136	medium
$35,000 to $39,999	307	4.1%	99	medium
$40,000 to $44,999	360	4.8%	103	medium
$45,000 to $49,999	326	4.3%	131	medium
$50,000 to $59,999	533	7.0%	150	medium
$60,000 to $74,999	727	9.6%	159	medium
$75,000 to $99,999	1,258	16.6%	227	high
$100,000 to $124,999	724	9.6%	150	medium
$125,000 to $149,999	598	7.9%	234	medium
$150,000 to $199,999	514	6.8%	201	medium
$200,000 or more	349	4.6%	113	medium
Median Household Income for HHr 25-44	$67,208		N/A	low
Average Household Income for HHr 25-44	N/A		N/A	low
HOUSEHOLDS WITH HOUSEHOLDER AGE 45-64 YEARS BY INCOME				
Total	8,029	100%	497	high
Less than $10,000	613	7.6%	134	medium
$10,000 to $14,999	375	4.7%	88	medium
$15,000 to $19,999	303	3.8%	71	medium
$20,000 to $24,999	268	3.3%	112	medium
$25,000 to $29,999	265	3.3%	97	medium
$30,000 to $34,999	278	3.5%	86	medium
$35,000 to $39,999	295	3.7%	87	medium
$40,000 to $44,999	366	4.6%	115	medium
$45,000 to $49,999	186	2.3%	89	medium
$50,000 to $59,999	556	6.9%	137	medium
$60,000 to $74,999	807	10.1%	173	medium
$75,000 to $99,999	1,008	12.6%	175	high
$100,000 to $124,999	687	8.6%	149	medium
$125,000 to $149,999	433	5.4%	113	medium
$150,000 to $199,999	672	8.4%	174	medium
$200,000 or more	919	11.4%	228	medium
Median Household Income for HHr 45-64	$68,740		N/A	low
Average Household Income for HHr 45-64	N/A		N/A	low

Source: U.S. Census Bureau, 2017-2021 American Community Survey

Reliability: high medium low

January 22, 2024

	2017-2021 ACS Estimate	Percent	MOE(±)	Reliability
HOUSEHOLDS WITH HOUSEHOLDER AGE 65+ BY INCOME				
Total	6,884	100%	502	high
Less than $10,000	612	8.9%	137	medium
$10,000 to $14,999	563	8.2%	106	high
$15,000 to $19,999	347	5.0%	88	medium
$20,000 to $24,999	287	4.2%	92	medium
$25,000 to $29,999	497	7.2%	208	medium
$30,000 to $34,999	294	4.3%	95	medium
$35,000 to $39,999	403	5.9%	252	medium
$40,000 to $44,999	200	2.9%	73	medium
$45,000 to $49,999	270	3.9%	82	medium
$50,000 to $59,999	597	8.7%	135	medium
$60,000 to $74,999	731	10.6%	200	medium
$75,000 to $99,999	658	9.6%	130	medium
$100,000 to $124,999	378	5.5%	87	medium
$125,000 to $149,999	475	6.9%	156	medium
$150,000 to $199,999	240	3.5%	101	medium
$200,000 or more	331	4.8%	99	medium
Median Household Income for HHr 65+	$49,368		N/A	low
Average Household Income for HHr 65+	N/A		N/A	low

Data Note: N/A means not available.

2017-2021 ACS Estimate: The American Community Survey (ACS) replaces census sample data. Esri is releasing the 2017-2021 ACS estimates, five-year period data collected monthly from January 1, 2017 through December 31, 2021. Although the ACS includes many of the subjects previously covered by the decennial census sample, there are significant differences between the two surveys including fundamental differences in survey design and residency rules.

Margin of error (MOE): The MOE is a measure of the variability of the estimate due to sampling error. MOEs enable the data user to measure the range of uncertainty for each estimate with 90 percent confidence. The range of uncertainty is called the confidence interval, and it is calculated by taking the estimate +/- the MOE. For example, if the ACS reports an estimate of 100 with an MOE of +/- 20, then you can be 90 percent certain the value for the whole population falls between 80 and 120.

Reliability: These symbols represent threshold values that Esri has established from the Coefficients of Variation (CV) to designate the usability of the estimates. The CV measures the amount of sampling error relative to the size of the estimate, expressed as a percentage.

- High Reliability: Small CVs (less than or equal to 12 percent) are flagged green to indicate that the sampling error is small relative to the estimate and the estimate is reasonably reliable.
- Medium Reliability: Estimates with CVs between 12 and 40 are flagged yellow-use with caution.
- Low Reliability: Large CVs (over 40 percent) are flagged red to indicate that the sampling error is large relative to the estimate. The estimate is considered very unreliable.

Business Summary

Pensacola City Boundary_20240122 1
Area: 22.77 square miles

Prepared by Clearview Geographic LLC

Data for all businesses in area				
Total Businesses:	4,642			
Total Employees:	58,448			
Total Residential Population:	54,253			
Employee/Residential Population Ratio (per 100 Residents)	108			

	Businesses		Employees	
by SIC Codes	**Number**	**Percent**	**Number**	**Percent**
Agriculture & Mining	61	1.3%	318	0.5%
Construction	233	5.0%	1,920	3.3%
Manufacturing	91	2.0%	1,397	2.4%
Transportation	86	1.9%	1,517	2.6%
Communication	36	0.8%	281	0.5%
Utility	9	0.2%	557	1.0%
Wholesale Trade	92	2.0%	947	1.6%
Retail Trade Summary	847	18.2%	12,109	20.7%
Home Improvement	24	0.5%	709	1.2%
General Merchandise Stores	33	0.7%	1,499	2.6%
Food Stores	93	2.0%	1,198	2.0%
Auto Dealers & Gas Stations	61	1.3%	489	0.8%
Apparel & Accessory Stores	86	1.9%	700	1.2%
Furniture & Home Furnishings	55	1.2%	524	0.9%
Eating & Drinking Places	281	6.1%	5,361	9.2%
Miscellaneous Retail	214	4.6%	1,630	2.8%
Finance, Insurance, Real Estate Summary	556	12.0%	4,190	7.2%
Banks, Savings & Lending Institutions	92	2.0%	877	1.5%
Securities Brokers	98	2.1%	524	0.9%
Insurance Carriers & Agents	106	2.3%	891	1.5%
Real Estate, Holding, Other Investment Offices	260	5.6%	1,899	3.2%
Services Summary	2,030	43.7%	29,886	51.1%
Hotels & Lodging	18	0.4%	487	0.8%
Automotive Services	46	1.0%	307	0.5%
Movies & Amusements	106	2.3%	2,650	4.5%
Health Services	463	10.0%	11,591	19.8%
Legal Services	236	5.1%	2,128	3.6%
Education Institutions & Libraries	59	1.3%	1,755	3.0%
Other Services	1,102	23.7%	10,968	18.8%
Government	158	3.4%	4,998	8.6%
Unclassified Establishments	444	9.6%	328	0.6%
Totals	4,642	100.0%	58,448	100.0%

Source: Copyright 2023 Data Axle, Inc. All rights reserved. Esri Total Residential Population forecasts for 2023.
Date Note: Data on the Business Summary report is calculated using **Esri's Data allocation method** which uses census block groups to allocate business summary data to custom areas.

January 22, 2024

Business Summary

Pensacola City Boundary_20240122 1
Area: 22.77 square miles

Prepared by Clearview Geographic LLC

	Businesses		Employees	
by NAICS Codes	**Number**	**Percent**	**Number**	**Percent**
Agriculture, Forestry, Fishing & Hunting	5	0.1%	12	0.0%
Mining	5	0.1%	23	0.0%
Utilities	5	0.1%	528	0.9%
Construction	251	5.4%	2,041	3.5%
Manufacturing	100	2.2%	1,037	1.8%
Wholesale Trade	91	2.0%	942	1.6%
Retail Trade	533	11.5%	6,456	11.0%
Motor Vehicle & Parts Dealers	49	1.1%	439	0.8%
Furniture & Home Furnishings Stores	29	0.6%	284	0.5%
Electronics & Appliance Stores	18	0.4%	227	0.4%
Building Material & Garden Equipment & Supplies Dealers	24	0.5%	709	1.2%
Food & Beverage Stores	77	1.7%	999	1.7%
Health & Personal Care Stores	59	1.3%	392	0.7%
Gasoline Stations & Fuel Dealers	13	0.3%	52	0.1%
Clothing, Clothing Accessories, Shoe and Jewelry Stores	111	2.4%	913	1.6%
Sporting Goods, Hobby, Book, & Music Stores	104	2.2%	880	1.5%
General Merchandise Stores	50	1.1%	1,561	2.7%
Transportation & Warehousing	51	1.1%	1,298	2.2%
Information	101	2.2%	1,278	2.2%
Finance & Insurance	299	6.4%	2,304	3.9%
Central Bank/Credit Intermediation & Related Activities	88	1.9%	860	1.5%
Securities & Commodity Contracts	102	2.2%	534	0.9%
Funds, Trusts & Other Financial Vehicles	108	2.3%	911	1.6%
Real Estate, Rental & Leasing	223	4.8%	1,773	3.0%
Professional, Scientific & Tech Services	635	13.7%	5,584	9.6%
Legal Services	256	5.5%	2,226	3.8%
Management of Companies & Enterprises	29	0.6%	69	0.1%
Administrative, Support & Waste Management Services	158	3.4%	1,950	3.3%
Educational Services	85	1.8%	1,950	3.3%
Health Care & Social Assistance	586	12.6%	13,995	23.9%
Arts, Entertainment & Recreation	105	2.3%	2,729	4.7%
Accommodation & Food Services	310	6.7%	5,940	10.2%
Accommodation	18	0.4%	487	0.8%
Food Services & Drinking Places	292	6.3%	5,453	9.3%
Other Services (except Public Administration)	464	10.0%	3,182	5.4%
Automotive Repair & Maintenance	32	0.7%	186	0.3%
Public Administration	161	3.5%	5,031	8.6%
Unclassified Establishments	444	9.6%	328	0.6%
Total	4,642	100.0%	58,448	100.0%

Source: Copyright 2023 Data Axle, Inc. All rights reserved. Esri Total Residential Population forecasts for 2023.
Date Note: Data on the Business Summary report is calculated using **Esri's Data allocation method** which uses census block groups to allocate business summary data to custom areas.

January 22, 2024

Community Profile

Pensacola City Boundary_20240122 1
Area: 22.77 square miles

Prepared by Clearview Geographic LLC

Population Summary	
2010 Total Population	51,985
2020 Total Population	53,923
2020 Group Quarters	1,399
2023 Total Population	54,253
2023 Group Quarters	1,420
2028 Total Population	54,549
2023-2028 Annual Rate	0.11%
2023 Total Daytime Population	80,644
Workers	54,251
Residents	26,393
Household Summary	
2010 Households	23,749
2010 Average Household Size	2.16
2020 Total Households	24,775
2020 Average Household Size	2.12
2023 Households	25,140
2023 Average Household Size	2.10
2028 Households	25,680
2028 Average Household Size	2.07
2023-2028 Annual Rate	0.43%
2010 Families	13,057
2010 Average Family Size	2.85
2023 Families	13,335
2023 Average Family Size	2.83
2028 Families	13,537
2028 Average Family Size	2.80
2023-2028 Annual Rate	0.30%
Housing Unit Summary	
2000 Housing Units	26,940
Owner Occupied Housing Units	57.6%
Renter Occupied Housing Units	33.5%
Vacant Housing Units	8.9%
2010 Housing Units	26,953
Owner Occupied Housing Units	53.7%
Renter Occupied Housing Units	34.4%
Vacant Housing Units	11.9%
2020 Housing Units	27,918
Owner Occupied Housing Units	53.3%
Renter Occupied Housing Units	35.5%
Vacant Housing Units	11.5%
2023 Housing Units	28,222
Owner Occupied Housing Units	53.3%
Renter Occupied Housing Units	35.8%
Vacant Housing Units	10.9%
2028 Housing Units	28,715
Owner Occupied Housing Units	54.1%
Renter Occupied Housing Units	35.3%
Vacant Housing Units	10.6%

Data Note: Household population includes persons not residing in group quarters. Average Household Size is the household population divided by total households. Persons in families include the householder and persons related to the householder by birth, marriage, or adoption. Per Capita Income represents the income received by all persons aged 15 years and over divided by the total population.

Source: Esri forecasts for 2023 and 2028. U.S. Census Bureau 2000 and 2010 decennial Census data converted by Esri into 2020 geography.

January 22, 2024

2023 Households by Income	
Household Income Base	25,140
<$15,000	13.9%
$15,000 - $24,999	9.1%
$25,000 - $34,999	9.8%
$35,000 - $49,999	10.9%
$50,000 - $74,999	16.5%
$75,000 - $99,999	11.9%
$100,000 - $149,999	14.5%
$150,000 - $199,999	5.8%
$200,000+	7.6%
Average Household Income	$88,924
2028 Households by Income	
Household Income Base	25,680
<$15,000	12.4%
$15,000 - $24,999	7.4%
$25,000 - $34,999	8.5%
$35,000 - $49,999	9.8%
$50,000 - $74,999	16.2%
$75,000 - $99,999	12.4%
$100,000 - $149,999	16.5%
$150,000 - $199,999	7.7%
$200,000+	9.0%
Average Household Income	$102,650
2023 Owner Occupied Housing Units by Value	
Total	15,033
<$50,000	2.1%
$50,000 - $99,999	4.5%
$100,000 - $149,999	5.8%
$150,000 - $199,999	9.5%
$200,000 - $249,999	15.6%
$250,000 - $299,999	11.9%
$300,000 - $399,999	23.9%
$400,000 - $499,999	8.8%
$500,000 - $749,999	11.8%
$750,000 - $999,999	4.9%
$1,000,000 - $1,499,999	1.1%
$1,500,000 - $1,999,999	0.1%
$2,000,000 +	0.1%
Average Home Value	$352,591
2028 Owner Occupied Housing Units by Value	
Total	15,541
<$50,000	2.1%
$50,000 - $99,999	7.7%
$100,000 - $149,999	2.3%
$150,000 - $199,999	9.3%
$200,000 - $249,999	14.5%
$250,000 - $299,999	10.4%
$300,000 - $399,999	23.1%
$400,000 - $499,999	9.7%
$500,000 - $749,999	13.2%
$750,000 - $999,999	6.1%
$1,000,000 - $1,499,999	1.4%
$1,500,000 - $1,999,999	0.1%
$2,000,000 +	0.1%
Average Home Value	$367,558

Data Note: Income represents the preceding year, expressed in current dollars. Household income includes wage and salary earnings, interest dividends, net rents, pensions, SSI and welfare payments, child support, and alimony.

Source: Esri forecasts for 2023 and 2028. U.S. Census Bureau 2000 and 2010 decennial Census data converted by Esri into 2020 geography.

Median Household Income	
2023	$57,420
2028	$66,394
Median Home Value	
2023	$302,730
2028	$315,811
Per Capita Income	
2023	$41,405
2028	$48,540
Median Age	
2010	42.5
2020	43.6
2023	44.9
2028	45.8
2020 Population by Age	
Total	53,923
0 - 4	5.1%
5 - 9	5.0%
10 - 14	5.0%
15 - 24	10.5%
25 - 34	14.2%
35 - 44	11.8%
45 - 54	11.2%
55 - 64	14.7%
65 - 74	13.0%
75 - 84	6.6%
85 +	3.1%
18 +	81.9%
2023 Population by Age	
Total	54,253
0 - 4	4.7%
5 - 9	4.8%
10 - 14	5.0%
15 - 24	10.3%
25 - 34	12.8%
35 - 44	12.3%
45 - 54	11.3%
55 - 64	14.5%
65 - 74	13.2%
75 - 84	7.5%
85 +	3.4%
18 +	82.5%
2028 Population by Age	
Total	54,550
0 - 4	4.8%
5 - 9	4.7%
10 - 14	4.9%
15 - 24	10.4%
25 - 34	11.1%
35 - 44	13.1%
45 - 54	11.6%
55 - 64	12.5%
65 - 74	13.7%
75 - 84	9.4%
85 +	3.7%
18 +	82.7%
2020 Population by Sex	

Source: Esri forecasts for 2023 and 2028. U.S. Census Bureau 2000 and 2010 decennial Census data converted by Esri into 2020 geography.

Males	25,343
Females	28,580
2023 Population by Sex	
Males	25,850
Females	28,403
2028 Population by Sex	
Males	25,889
Females	28,659
2010 Population by Race/Ethnicity	
Total	51,985
White Alone	66.3%
Black Alone	28.0%
American Indian Alone	0.6%
Asian Alone	1.9%
Pacific Islander Alone	0.1%
Some Other Race Alone	0.7%
Two or More Races	2.4%
Hispanic Origin	3.4%
Diversity Index	51.5
2020 Population by Race/Ethnicity	
Total	53,923
White Alone	65.8%
Black Alone	22.7%
American Indian Alone	0.4%
Asian Alone	2.4%
Pacific Islander Alone	0.1%
Some Other Race Alone	1.5%
Two or More Races	7.1%
Hispanic Origin	5.4%
Diversity Index	56.0
2023 Population by Race/Ethnicity	
Total	54,254
White Alone	65.0%
Black Alone	23.0%
American Indian Alone	0.4%
Asian Alone	2.6%
Pacific Islander Alone	0.1%
Some Other Race Alone	1.6%
Two or More Races	7.3%
Hispanic Origin	5.7%
Diversity Index	57.0
2028 Population by Race/Ethnicity	
Total	54,549
White Alone	63.8%
Black Alone	23.2%
American Indian Alone	0.5%
Asian Alone	2.8%
Pacific Islander Alone	0.1%
Some Other Race Alone	1.7%
Two or More Races	8.0%
Hispanic Origin	6.0%
Diversity Index	58.5

Data Note: Persons of Hispanic Origin may be of any race. The Diversity Index measures the probability that two people from the same area will be from different race/ethnic groups.

Source: Esri forecasts for 2023 and 2028. U.S. Census Bureau 2000 and 2010 decennial Census data converted by Esri into 2020 geography.

2020 Population by Relationship and Household Type	
Total	53,923
In Households	97.4%
Householder	45.9%
Opposite-Sex Spouse	15.9%
Same-Sex Spouse	0.4%
Opposite-Sex Unmarried Partner	2.7%
Same-Sex Unmarried Partner	0.3%
Biological Child	21.4%
Adopted Child	0.5%
Stepchild	0.8%
Grandchild	2.5%
Brother or Sister	1.2%
Parent	0.9%
Parent-in-law	0.2%
Son-in-law or Daughter-in-law	0.3%
Other Relatives	1.1%
Foster Child	0.1%
Other Nonrelatives	3.3%
In Group Quaters	2.6%
Institutionalized	1.2%
Noninstitutionalized	1.4%
2023 Population 25+ by Educational Attainment	
Total	40,723
Less than 9th Grade	1.4%
9th - 12th Grade, No Diploma	4.7%
High School Graduate	18.1%
GED/Alternative Credential	2.9%
Some College, No Degree	18.2%
Associate Degree	12.7%
Bachelor's Degree	24.0%
Graduate/Professional Degree	18.1%
2023 Population 15+ by Marital Status	
Total	46,318
Never Married	36.3%
Married	43.3%
Widowed	6.6%
Divorced	13.8%
2023 Civilian Population 16+ in Labor Force	
Civilian Population 16+	28,924
Population 16+ Employed	95.8%
Population 16+ Unemployment rate	4.2%
Population 16-24 Employed	11.6%
Population 16-24 Unemployment rate	5.3%
Population 25-54 Employed	58.7%
Population 25-54 Unemployment rate	5.2%
Population 55-64 Employed	18.3%
Population 55-64 Unemployment rate	1.6%
Population 65+ Employed	11.4%
Population 65+ Unemployment rate	1.9%

Source: Esri forecasts for 2023 and 2028. U.S. Census Bureau 2000 and 2010 decennial Census data converted by Esri into 2020 geography.

Pensacola City Boundary_20240122 1
Area: 22.77 square miles

Prepared by Clearview Geographic LLC

2023 Employed Population 16+ by Industry	
Total	27,703
Agriculture/Mining	0.2%
Construction	5.0%
Manufacturing	4.9%
Wholesale Trade	1.6%
Retail Trade	11.1%
Transportation/Utilities	6.2%
Information	1.4%
Finance/Insurance/Real Estate	10.6%
Services	54.7%
Public Administration	4.3%
2023 Employed Population 16+ by Occupation	
Total	27,704
White Collar	66.4%
Management/Business/Financial	16.7%
Professional	30.0%
Sales	9.6%
Administrative Support	10.1%
Services	17.3%
Blue Collar	16.2%
Farming/Forestry/Fishing	0.1%
Construction/Extraction	3.5%
Installation/Maintenance/Repair	2.2%
Production	3.1%
Transportation/Material Moving	7.3%
2020 Households by Type	
Total	24,775
Married Couple Households	35.4%
With Own Children <18	10.3%
Without Own Children <18	25.1%
Cohabitating Couple Households	6.6%
With Own Children <18	1.4%
Without Own Children <18	5.2%
Male Householder, No Spouse/Partner	21.3%
Living Alone	15.8%
65 Years and over	5.0%
With Own Children <18	1.1%
Without Own Children <18, With Relatives	2.6%
No Relatives Present	1.9%
Female Householder, No Spouse/Partner	36.7%
Living Alone	22.0%
65 Years and over	10.9%
With Own Children <18	5.4%
Without Own Children <18, With Relatives	7.8%
No Relatives Present	1.6%
2020 Households by Size	
Total	24,775
1 Person Household	37.7%
2 Person Household	34.7%
3 Person Household	13.0%
4 Person Household	8.7%
5 Person Household	3.4%
6 Person Household	1.5%
7 + Person Household	1.0%

Source: Esri forecasts for 2023 and 2028. U.S. Census Bureau 2000 and 2010 decennial Census data converted by Esri into 2020 geography.

January 22, 2024

Pensacola City Boundary_20240122 1
Area: 22.77 square miles

Prepared by Clearview Geographic LLC

2020 Households by Tenure and Mortgage Status	
Total	24,775
Owner Occupied	60.0%
Owned with a Mortgage/Loan	36.6%
Owned Free and Clear	23.4%
Renter Occupied	40.0%
2023 Affordability, Mortgage and Wealth	
Housing Affordability Index	80
Percent of Income for Mortgage	31.7%
Wealth Index	83
2020 Housing Units By Urban/ Rural Status	
Total	27,918
Urban Housing Units	100.0%
Rural Housing Units	0.0%
2020 Population By Urban/ Rural Status	
Total	53,923
Urban Population	100.0%
Rural Population	0.0%

Data Note: Households with children include any households with people under age 18, related or not. Multigenerational households are families with 3 or more parent-child relationships. Unmarried partner households are usually classified as nonfamily households unless there is another member of the household related to the householder. Multigenerational and unmarried partner households are reported only to the tract level. Esri estimated block group data, which is used to estimate polygons or non-standard geography.

Source: Esri forecasts for 2023 and 2028. U.S. Census Bureau 2000 and 2010 decennial Census data converted by Esri into 2020 geography.

January 22, 2024

Top 3 Tapestry Segments	
1.	Old and Newcomers (8F)
2.	In Style (5B)
3.	Exurbanites (1E)
2023 Consumer Spending	
Apparel & Services: Total $	$46,710,891
Average Spent	$1,858.03
Spending Potential Index	85
Education: Total $	$35,673,359
Average Spent	$1,418.99
Spending Potential Index	79
Entertainment/Recreation: Total $	$79,638,657
Average Spent	$3,167.81
Spending Potential Index	84
Food at Home: Total $	$145,509,218
Average Spent	$5,787.96
Spending Potential Index	85
Food Away from Home: Total $	$78,227,289
Average Spent	$3,111.67
Spending Potential Index	84
Health Care: Total $	$160,515,461
Average Spent	$6,384.86
Spending Potential Index	87
HH Furnishings & Equipment: Total $	$62,174,239
Average Spent	$2,473.12
Spending Potential Index	84
Personal Care Products & Services: Total $	$20,507,513
Average Spent	$815.73
Spending Potential Index	85
Shelter: Total $	$520,664,391
Average Spent	$20,710.60
Spending Potential Index	84
Support Payments/Cash Contributions/Gifts in Kind: Total $	$67,269,810
Average Spent	$2,675.81
Spending Potential Index	86
Travel: Total $	$46,454,181
Average Spent	$1,847.82
Spending Potential Index	82
Vehicle Maintenance & Repairs: Total $	$28,476,537
Average Spent	$1,132.72
Spending Potential Index	86

Data Note: Consumer spending shows the amount spent on a variety of goods and services by households that reside in the area. Expenditures are shown by broad budget categories that are not mutually exclusive. Consumer spending does not equal business revenue. Total and Average Amount Spent Per Household represent annual figures. The Spending Potential Index represents the amount spent in the area relative to a national average of 100.
Source: Consumer Spending data are derived from the 2019 and 2020 Consumer Expenditure Surveys, Bureau of Labor Statistics. Esri.

Source: Esri forecasts for 2023 and 2028. U.S. Census Bureau 2000 and 2010 decennial Census data converted by Esri into 2020 geography.

Housing Profile

Pensacola City Boundary_20240122 1
Area: 22.77 square miles

Prepared by Clearview Geographic LLC

Population		Households	
2020 Total Population	53,923	2023 Median Household Income	$57,420
2023 Total Population	54,253	2028 Median Household Income	$66,394
2028 Total Population	54,549	2023-2028 Annual Rate	2.95%
2023-2028 Annual Rate	0.11%		

	Census 2020		2023		2028	
Housing Units by Occupancy Status and Tenure	**Number**	**Percent**	**Number**	**Percent**	**Number**	**Percent**
Total Housing Units	27,918	100.0%	28,222	100.0%	28,715	100.0%
Occupied	24,775	88.7%	25,140	89.1%	25,680	89.4%
Owner	14,867	53.3%	15,033	53.3%	15,541	54.1%
Renter	9,908	35.5%	10,107	35.8%	10,139	35.3%
Vacant	3,222	11.5%	3,082	10.9%	3,035	10.6%

	2023		2028	
Owner Occupied Housing Units by Value	**Number**	**Percent**	**Number**	**Percent**
Total	15,034	100.0%	15,540	100.0%
<$50,000	314	2.1%	331	2.1%
$50,000-$99,999	669	4.4%	1,204	7.7%
$100,000-$149,999	873	5.8%	354	2.3%
$150,000-$199,999	1,430	9.5%	1,444	9.3%
$200,000-$249,999	2,349	15.6%	2,249	14.5%
$250,000-$299,999	1,784	11.9%	1,621	10.4%
$300,000-$399,999	3,590	23.9%	3,586	23.1%
$400,000-$499,999	1,326	8.8%	1,509	9.7%
$500,000-$749,999	1,773	11.8%	2,053	13.2%
$750,000-$999,999	732	4.9%	952	6.1%
$1,000,000-$1,499,999	165	1.1%	210	1.4%
$1,500,000-$1,999,999	18	0.1%	18	0.1%
$2,000,000+	11	0.1%	9	0.1%
Median Value	$302,730		$315,811	
Average Value	$352,591		$367,558	

Census 2020 Housing Units	**Number**	**Percent**
Total	27,918	100.0%
Housing Units In Urbanized Areas	27,910	100.0%
Rural Housing Units	8	0.0%

Census 2020 Owner Occupied Housing Units by Mortgage Status	**Number**	**Percent**
Total	14,866	100.0%
Owned with a Mortgage/Loan	9,078	61.1%
Owned Free and Clear	5,788	38.9%

Data Note: Persons of Hispanic Origin may be of any race.
Source: Esri forecasts for 2023 and 2028. U.S. Census Bureau 2020 decennial Census data.

January 22, 2024

Housing Profile

Pensacola City Boundary_20240122 1
Area: 22.77 square miles

Prepared by Clearview Geographic LLC

Census 2020 Vacant Housing Units by Status	Number	Percent
Total	3,222	100.0%
For Rent	1,332	41.3%
Rented- Not Occupied	113	3.5%
For Sale Only	378	11.7%
Sold - Not Occupied	129	4.0%
Seasonal/Recreational/Occasional Use	424	13.2%
For Migrant Workers	3	0.1%
Other Vacant	843	26.2%

Census 2020 Occupied Housing Units by Age of Householder and Home Ownership		Owner Occupied Units	
	Occupied Units	Number	% of Occupied
Total	24,775	14,867	60.0%
15-24	1,029	118	11.5%
25-34	3,743	1,268	33.9%
35-44	3,473	1,797	51.7%
45-54	3,545	2,169	61.2%
55-59	2,251	1,531	68.0%
60-64	2,590	1,828	70.6%
65-74	4,636	3,450	74.4%
75-84	2,406	1,874	77.9%
85+	1,101	832	75.6%

Census 2020 Occupied Housing Units by Race/Ethnicity of Householder and Home Ownership		Owner Occupied Units	
	Occupied Units	Number	% of Occupied
Total	24,775	14,867	60.0%
White Alone	17,373	11,442	65.9%
Black/African American Alone	5,153	2,223	43.1%
American Indian/Alaska Native	120	60	50.0%
Asian Alone	450	269	59.8%
Pacific Islander Alone	16	7	43.8%
Other Race Alone	292	133	45.5%
Two or More Races	1,373	733	53.4%
Hispanic Origin	1,022	500	48.9%

Census 2020 Occupied Housing Units by Size and Home Ownership		Owner Occupied Units	
	Occupied Units	Number	% of Occupied
Total	24,775	14,867	60.0%
1-Person	9,347	4,696	50.2%
2-Person	8,584	5,803	67.6%
3-Person	3,218	2,030	63.1%
4-Person	2,145	1,454	67.8%
5-Person	853	560	65.7%
6-Person	368	177	48.1%
7+ Person	259	147	56.8%

2023 Housing Affordability	
Housing Affordability Index	80
Percent of Income for Mortgage	31.7%

Data Note: Persons of Hispanic Origin may be of any race.
Source: Esri forecasts for 2023 and 2028. U.S. Census Bureau 2020 decennial Census data.

January 22, 2024

Time Series Profile

Pensacola City Boundary_20240122 1
Area: 22.77 square miles

Prepared by Clearview Geographic LLC

Population	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Total	52,079	52,107	52,165	52,343	52,449	52,597	52,790	53,007	53,203	53,424	54,009	53,926	54,036	54,253
Change	-	28	58	178	106	148	193	217	196	221	585	-83	110	217
Percent Change	-	0.1%	0.1%	0.3%	0.2%	0.3%	0.4%	0.4%	0.4%	0.4%	1.1%	-0.2%	0.2%	0.4%
Annual Rate	-	0.1%	0.1%	0.2%	0.2%	0.2%	0.2%	0.3%	0.3%	0.3%	0.4%	0.3%	0.3%	0.3%

Households	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Total	23,723	23,776	23,848	23,970	24,060	24,155	24,291	24,441	24,602	24,686	24,774	24,808	24,943	25,140
Change	-	53	72	122	90	95	136	150	161	84	88	34	135	197
Percent Change	-	0.2%	0.3%	0.5%	0.4%	0.4%	0.6%	0.6%	0.7%	0.3%	0.4%	0.1%	0.5%	0.8%
Annual Rate	-	0.2%	0.3%	0.3%	0.4%	0.4%	0.4%	0.4%	0.5%	0.4%	0.4%	0.4%	0.4%	0.4%

Housing Units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Total	26,951	26,990	27,044	27,167	27,248	27,334	27,472	27,619	27,785	27,860	27,944	27,969	28,086	28,222
Change	-	39	54	123	81	86	138	147	166	75	84	25	117	136
Percent Change	-	0.1%	0.2%	0.5%	0.3%	0.3%	0.5%	0.5%	0.6%	0.3%	0.3%	0.1%	0.4%	0.5%
Annual Rate	-	0.1%	0.2%	0.3%	0.3%	0.3%	0.3%	0.4%	0.4%	0.4%	0.4%	0.3%	0.3%	0.4%

Data Note: The Esri Vintage 2023 Time Series (2010 thru 2023) represents July 1 annual estimates in 2023 geography. With each annual release, the entire Time Series is revised.
Source: Esri forecasts for 2023 and 2028.

January 22, 2024