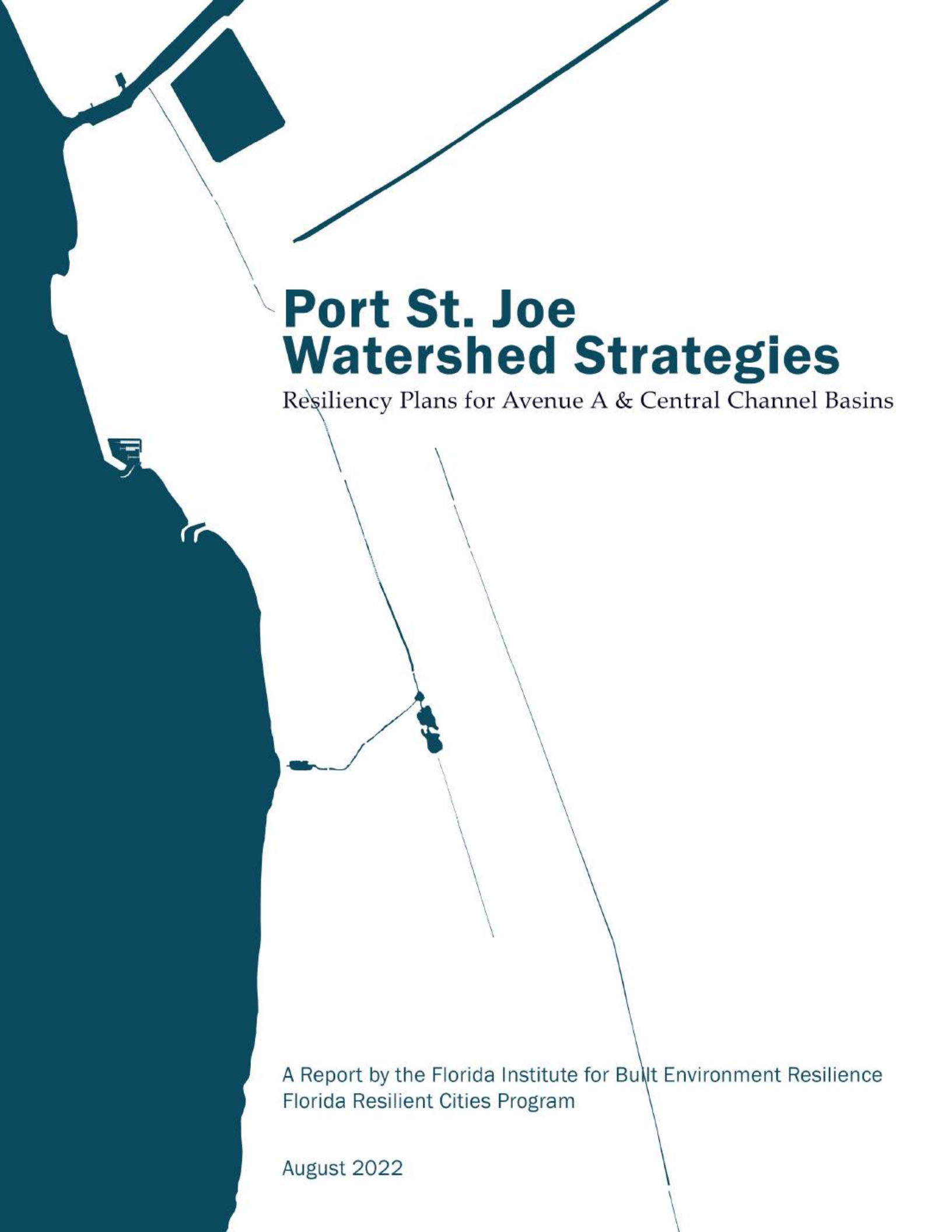

Port St. Joe Watershed Strategies

Resiliency Plans for Avenue A & Central Channel Basins

A Report by the Florida Institute for Built Environment Resilience
Florida Resilient Cities Program

August 2022

Acknowledgments

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CONTENTS

Forward

Florida Resilient Cities

The Florida Resilient Cities Program (FRC), led by The Florida Institute for Built Environment Resilience (FIBER), helps communities across Florida develop the capacity to be more prepared for, and more resilient to increased risk. The program bridges community needs with design research being accomplished by the University of Florida Faculty and Students in the College of Design, Construction, and Planning, partnered with faculty from across the University of Florida.

Project Timeline

Port St. Joe 2019-2020

FRC has been working with the community of Port St. Joe since 2019. The program's focus on current chronic concerns in Florida such as nuisance flooding, housing shortages, and water quality issues in addition to long-term resiliency to hurricanes and sea level rise pairs well with the challenges Port St. Joe is facing. In 2019 FRC kicked off what would be a three year collaboration with a workshop around long-term visioning, values, and assessment of needs. The community narratives from the workshop led to seven research projects in 2020 that focused on aspects of cultural preservation, infrastructure, and a city-wide park system studio.

North Port St. Joe 2021

In 2021 FRC focused its work on North Port St. Joe by examining the neighborhood's nuisance flooding, revitalization goals, and concerns around affordable housing. This work resulted in strategic planning for housing, stormwater, and the historic Martin Luther King Blvd. The focus on the stormwater system in the Northern part of the city led to a desire for greater understanding of the city's main watershed and canal system. A report on this workshop was published for public review. Please see the North Port St. Joe Community Workshop on the FRC website. https://dcp.ufl.edu/frc/products/

Stormwater Focus 2022

In 2022 FRC completed an in depth analysis of the stormwater system by reviewing previous stormwater master plan recommendations, completing a walking workshop through the city's main watersheds, producing assessments of current and future flooding risks, and overall has made strategic recommendations for the communities living on the Central Channel basin and the Avenue A basin. The 2022 work is detailed in this report and will lead to further planning and implementation efforts.

Process

To create a comprehensive strategic plan that addresses stormwater flooding while creating public space, various assessments were completed. The first assessment was a complete analysis of the Dewberry Stormwater Master Plan. The plan details the drainage system and specific infrastructural recommendations to combat tidal flooding. The second assessment completed was a walking workshop through the entire city along the two main drainage channels. Along this workshop we gathered information on the environmental conditions as well as community desires and concerns. The final assessment was an analysis of flooding depths across the city. We reviewed the FEMA high risk flood zones and areas inundated from 2070 sea level rise. Additional information was compiled on the watershed systems to strategize solutions to best fit the urban and natural systems. The information compiled includes ecosystems, hydrologic systems, stormwater systems, land uses, connectivity, and architectural conditions. These detailed maps led to strategic nature-based and housing adaptation solutions that reduce risk and improve drainage. The overall goal of this work is to address various flood risks while improving open space.

Executive Summary

Port St Joe has important stormwater management issues to address and plan to increase resiliency. The work in this report outlines watershed and neighborhood strategies to reduce risk, coupled with a preliminary assessment of at-risk resources. Findings include the following interventions based on priority and time execution:

- Short-term projects prioritize homeowner-specific housing adaptations, homeowner strategies that reduce flood risk, and city-wide recreation improvements such as reforestation.

- Mid-Term projects prioritize the development of the civic center, accommodating substantial city-wide growth, and preparing for future sea level rise through wetland parks and green infrastructure.

- Long-Term goals focus on managing infrastructure for increased sea level rise, storm frequency, and increase in flooding from rainfall. Maintain tree canopy and existing green infrastructure.

Specific city sections were defined where the following key points should be considered relative to resilience planning and phasing within the watershed:

- Battles Street faces subsidence and stormwater flooding challenges. Bioswales, stormwater parks, and elevating utilities offer opportunities of reducing overall risk while revitalizing the neighborhood with green spaces.

- Forest Park faces stormwater flooding, tidal flooding, and storm surge challenges. Bioswales, stormwater parks, restoring marsh areas, stabilizing shorelines, and elevating buildings offer opportunities of reducing flood risk while enhancing existing green spaces.

- St. Joseph Bay faces stormwater flooding, tidal flooding, storm surge, and erosion challenges. Restoring marsh and dune areas, stabilizing shorelines, and elevating buildings reduce flood risk while enhancing natural areas near residential developments.

Chapter 1:
Review of Stormwater Masterplan

Port St. Joe Watersheds

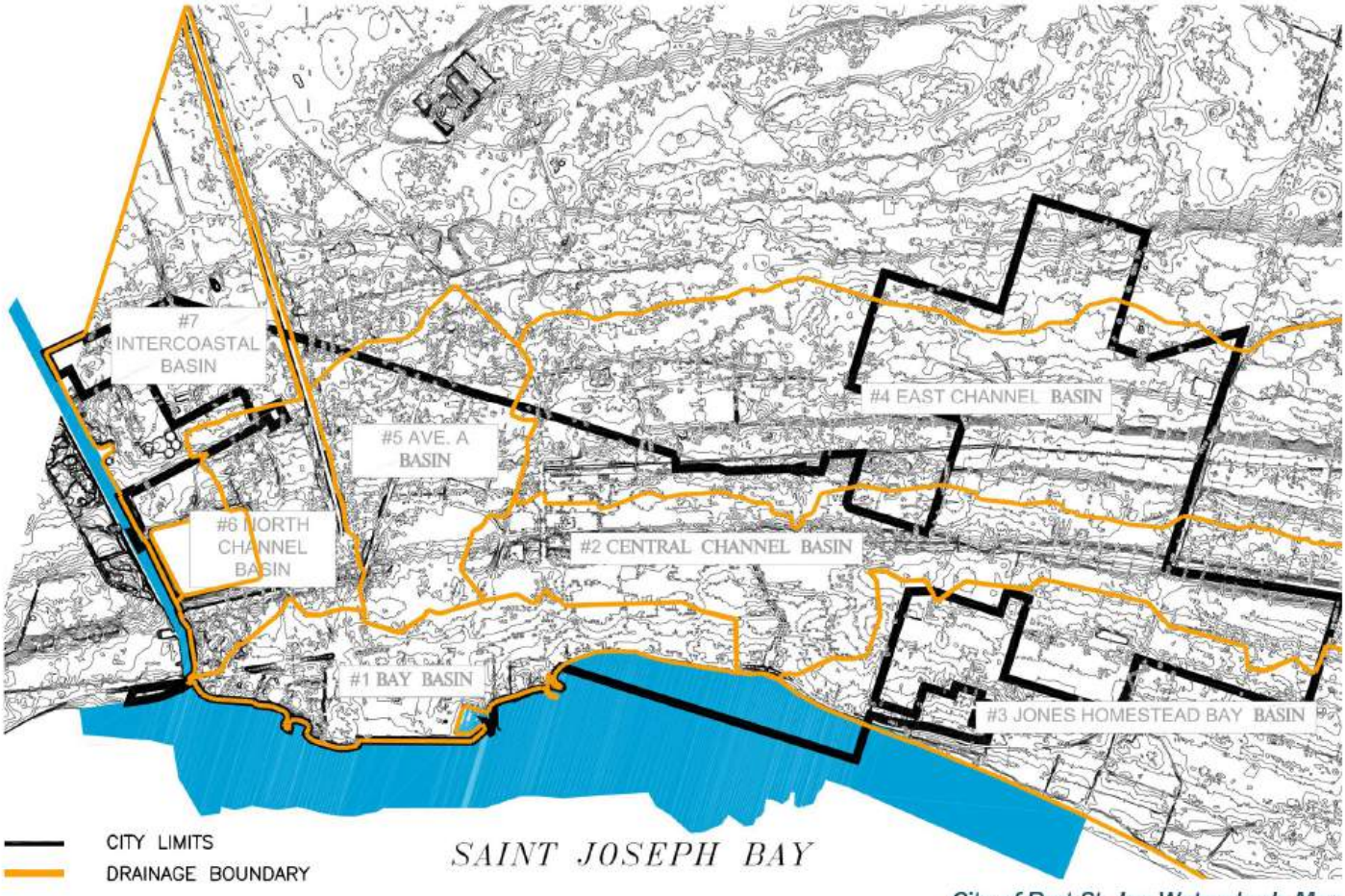
In 2021 a Stormwater Master Plan for the City of Port St. Joe was completed by Dewberry Engineering. The plan reviewed the city's seven stormwater basins, their deficiencies, made infrastructure recommendations, discussed receiving water bodies, and made policy recommendations. The seven watersheds in the city are the Bay basin, Central Channel basin, Jones Homestead Bay basin, East Channel Basin, Avenue A Basin, North Channel Basin, and the Intracoastal Basin. The basins that flow to St. Joseph's Bay includes the Bay Basin, Central Channel Basin, and the Jones Homestead Bay Basin. The Bay and Jones Homestead Bay Basins border St. Joseph's Bay and the Central Channel Basin sits just behind these coastal watersheds and contains the city's main drainage canal which connects directly to the Bay. Avenue A, North Channel, and Intercoastal Basins all flow North to the Intracoastal Waterway. These watersheds all sit on the northern end of the city, Avenue A encompasses the North Port St. Joe (NPSJ) Neighborhood. The North Channel and the Intercoastal Basins are vacant industrial/timber areas north of the NPSJ neighborhood and south of the intracoastal waterway/Gulf County Canal. The East Channel Basin flows to depot creek, a large drainage and wetland area east of the city.

Deficiencies & Solutions

The main system deficiencies reported are corroded infrastructure, insufficient pipe sizing, incomplete infrastructure, tidal impacts to the system, lack of maintenance, and stormwater pollution to the St. Joseph Bay. The basins that were classified as high priority for improvement are Bay Basin, Central Channel Basin, and Avenue A basin. The main issues to be addressed in the Bay Basin include localized flooding and water quality. The Central Channel Basin issues to be addressed include localized flooding, water quality, and a narrow canal channel. For both the Bay Basin and the Central Channel Basin Dewberry recommends baffle boxes for water quality, tidal check valves for tidal flooding, and in the central channel, larger pipe sizes and channel enlargement is recommended to reduce stormwater flooding. Avenue A Basin was prioritized due to its fragmented and incomplete stormwater infrastructure system. Dewberry recommends establishing connectivity and conveyance within the existing system in addition to system maintenance. The Dewberry report specifically cites tidal flooding and sea level rise as an issue of concern for the the City of Port St. Joe. Other areas where tidal check valves and baffle boxes are recommended include the North Channel Basin to reduce tidal flooding and pollution at the northern end of the city from the Gulf County Canal/ Intracoastal system.

Policy Recommendations

In addition to infrastructure improvements the Dewberry Master Plan includes three main policy recommendations. The plan advises adopting a Modified Critical Duration Design Storm instead of using a standard 25-year frequency & 24-hour storm duration for infrastructure planning and pipe-sizing. The plan recommends adopting and enforcing stormwater performance standards and criteria. Performance goals can be established to meet certain storm events. The plan also recommends that minimum maintenance standards be developed and adopted. Overall Dewberry recommends maintaining drainage ditches and swales at the city level. Additionally, they recommend requiring property owners to maintain stormwater treatment and conveyance features on their property and to not impede



City of Port St. Joe Watersheds Map

Chapter 2:
Port St. Joe Chickenhouse Creek Warteshed Walk.
City-Wide Community Engagement

On March 18th, 2022 a walking workshop was held in Port St. Joe. Over the course of one day we visited 5 different areas connected to the city's main stormwater system. At each area of interest, we conducted a short walk where local participants discussed specific characteristics, memories, and landmarks on the site.

Discussions with local participants provided insight into community values and shed light on concerns and visions around the stormwater system. Participants voiced concerns about incomplete infrastructure and subsidence in North Port St. Joe and concerns about forest park flooding and coastal erosion. Throughout the walk the community expressed visions of One Port St. Joe, increasing green spaces, areas of passive recreation, and a stormwater system that is resilient to future sea level rise.

In addition to local participants, government officials and professionals from various regional organizations attended. The organizations in attendance included St. Andrew and St. Joseph Bays Estuary Program, The Nature Conservancy, NorthWest Florida Water Management District, Apalachicola Regional Planning Council, Bay County Habitat for Humanity, Citizens of Gulf County Recovery Team, West Florida Research and Education Center. These professionals provided expertise in hydrology, the local watershed system, the importance of nature-based systems, as well as community-based solutions for housing and disaster recovery.

Using this knowledge of community visions, concerns, professional expertise, and documentation from site surveying the Florida Resilient Cities team has put together specific watershed strategies for the Central Channel and Avenue A basins that reduce flood risk while creating meaningful public spaces.

North Port St. Joe

Forest Park

St. Joseph's Bay

Chapter 3:
Flood Risk & Built Environment Assessments

3.1 Hydrologic Systems Assessment

Ecosystems
Hydrologic Systems
Stormwater Systems

3.2 Built Environment Assessment

Land Use
Connectivity
Building Conditions

3.3 Flood Risk Assessment

FEMA High Risk Zones
2070 Sea Level Rise

3.1 Hydrologic Systems Assessment

Hydrologic Systems

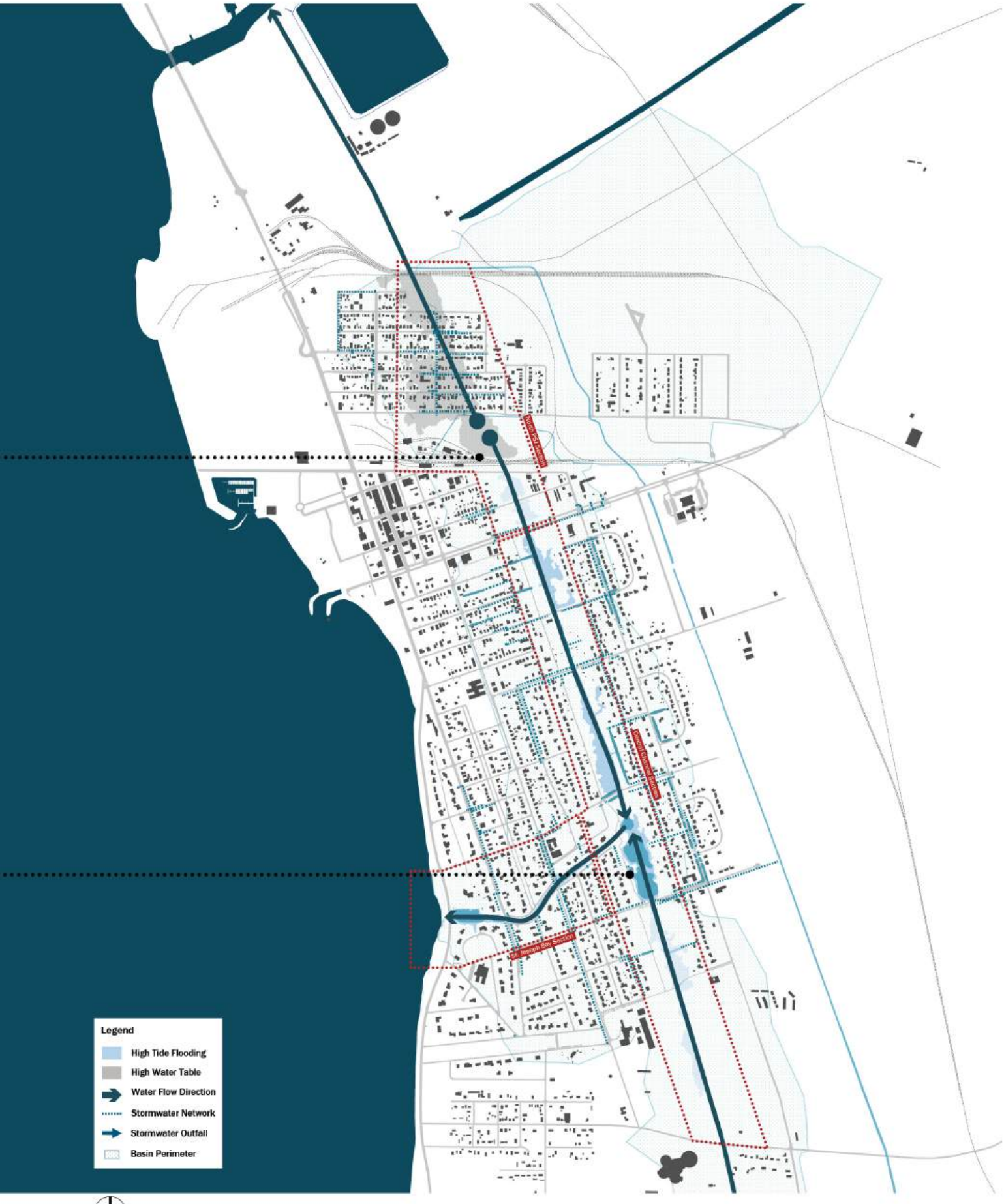
Port St Joe has a variety of natural and manmade hydrologic systems which affect water management within the City, including St Joseph Bay to the west and wetland and canal systems to the east. Chicken House and Depot creeks run perpendicular to St Joseph Bay within the City, and the outlet to St. Joseph Bay tidally influences Chicken House Creek. Both creeks have been converted to canals or culverted where they run through the City. The northern portion of the watershed through which Chicken House Creek runs is the Avenue A watershed, and the southern part where it runs through Forest Park is the Central Channel watershed.

Chicken House Creek flows north into the Gulf County Canal within the Avenue A watershed. Passing through North Port St. Joe creates issues with soil saturation and flooding within the residential neighborhood.

The southern canal system running through Forest Park (the Central Channel watershed) is a primary stormwater collection basin for the City of Port St. Joe. The canal flows southward into St. Joseph Bay but also experiences tidal influences from the Bay. St. Joseph Bay to the west is formed by the Cape San Blas barrier island, which arches further out into the Gulf of Mexico beyond Port St Joe. The Bay is considered an impaired water body by the state and is a stormwater outfall location for most of Port St. Joe.

Avenue A Basin

Central Channel Basin


Legend
High Tide Flooding
High Water Table
Water Flow Direction
Stormwater Network
Stormwater Outfall
Basin Perimeter
0
0.50
1 mile

3.2 Built Environment Assessment

Land Use

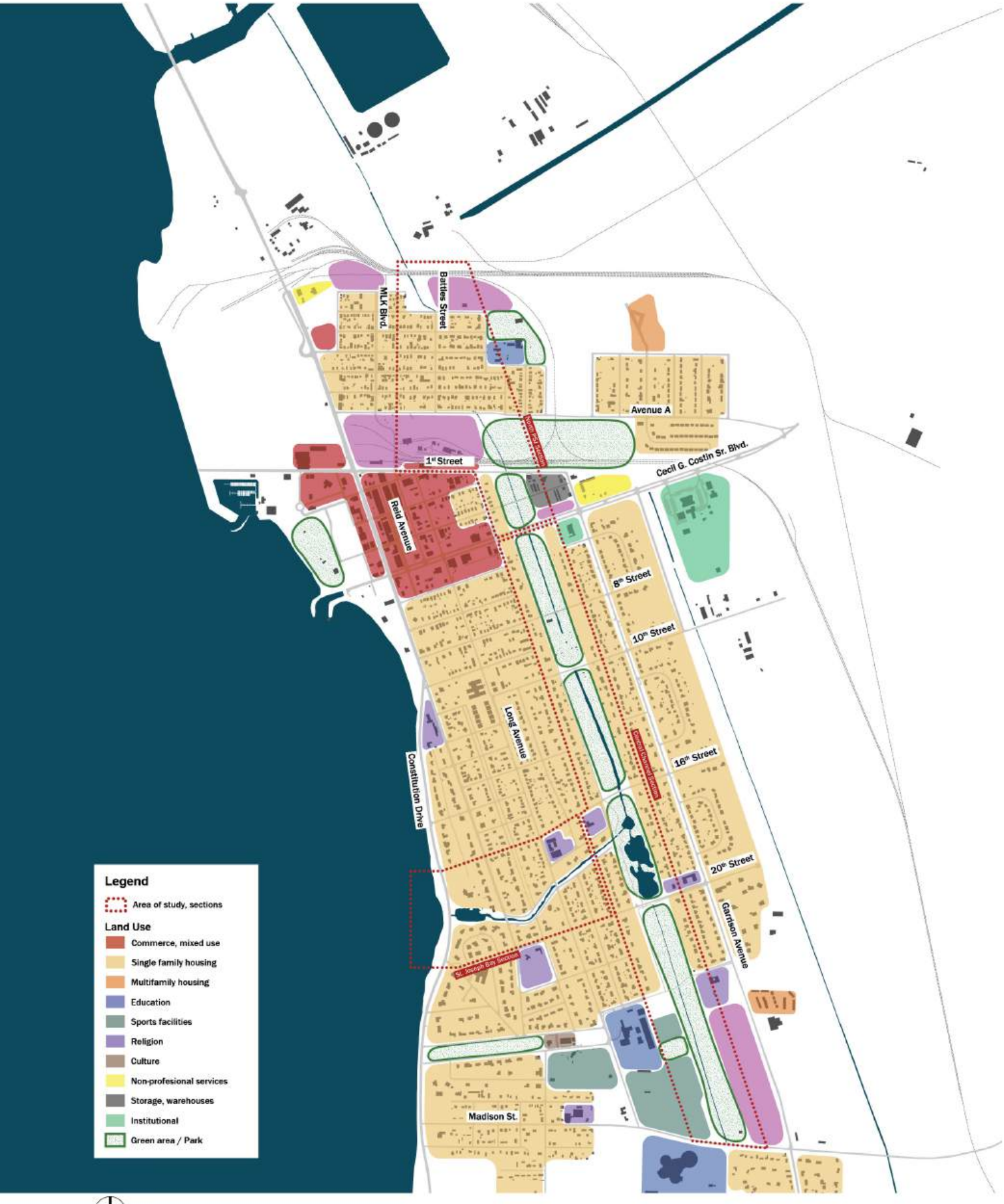
The separation of uses in residential and non-residential is strongly defined by the zoning policies in the city of Port St. Joe. Therefore, besides downtown, it is impossible to find mixed used areas in other parts of the city or zones in the neighborhoods with complementary uses to housing, such as housing-related services and commerce. The distribution of uses city-wide allows characterizing the city in the following functional areas: touristic Port St Joe, retail zone, education zone, living, industry, and non-professional services.

The downtown concentrates most of the small-scale non-housing uses, focusing on tourism, commerce, restaurants, and non-professional services. Big-scale retail and financial services are located along Cecil G. Costin Sr. Boulevard. To the west of downtown concentrates some industry-related uses along the First St. like repair workshops and storage. The south of Port St. Joe is defined mainly by educational facilities like elementary and high schools. Further south, the Gulf Coast State College and sports facilities are concentrated. The rest of the city is mainly defined as a homogeneous single-family house use area with few non-housing uses related. The central channel and the railway constitute essential disruptions to the homogeneous housing fabric, but they primarily represent vacant land.

Concerning the study perimeter, The North Port St. Joe Battles Street section is defined mainly by single family housing use with some spread vacant plots, with religious facilities as the primary non-housing existing use. On the south battles street, two big pieces of vacant land are located, the first is part of the Apalachicola Northern Rail Road, and the second is a group of vacant plots in the industry and storage area. This area does not have proximity to recreation uses and green spaces.

The central channel section is also defined by single-family housing use with bigger plots than North Port St. Joe, with the baseball fields and the forest park being the main non-housing uses along the channel. The south part of the ponds is considered vacant housing land use but is currently mainly a forested area. The St. Joseph bay section also corresponds to single-family housing use with some religious facilities close to the forest park area. Large size housing plots characterize the seaside area.

Within the whole city, the central channel corresponds to a distinctive feature in the homogeneous single-family urban fabric, which has the capacity to define the spatial framework to develop complementary housing uses besides recreation. At the city-wide scale, the channel is the only potentially uninterrupted urban element that connects the different use thematic areas of the city from education in the south, housing in the middle to mixed use, industry, and housing in the north.


MLK Blvd.
Battles Street
Avenue A
1st Street
Cecil G. Costin Sr. Blvd.
Reid Avenue
8th Street
10th Street
Long Avenue
16th Street
Constitution Drive
20th Street
Garrison Avenue
Madison St.
Legend
Area of study, sections
Land Use
Commerce, mixed use
Single family housing
Multifamily housing
Education
Sports facilities
Religion
Culture
Non-profesional services
Storage, warehouses
Institutional
Green area / Park
0
0.50
1 mile

3.2 Built Environment Assessment

Connectivity

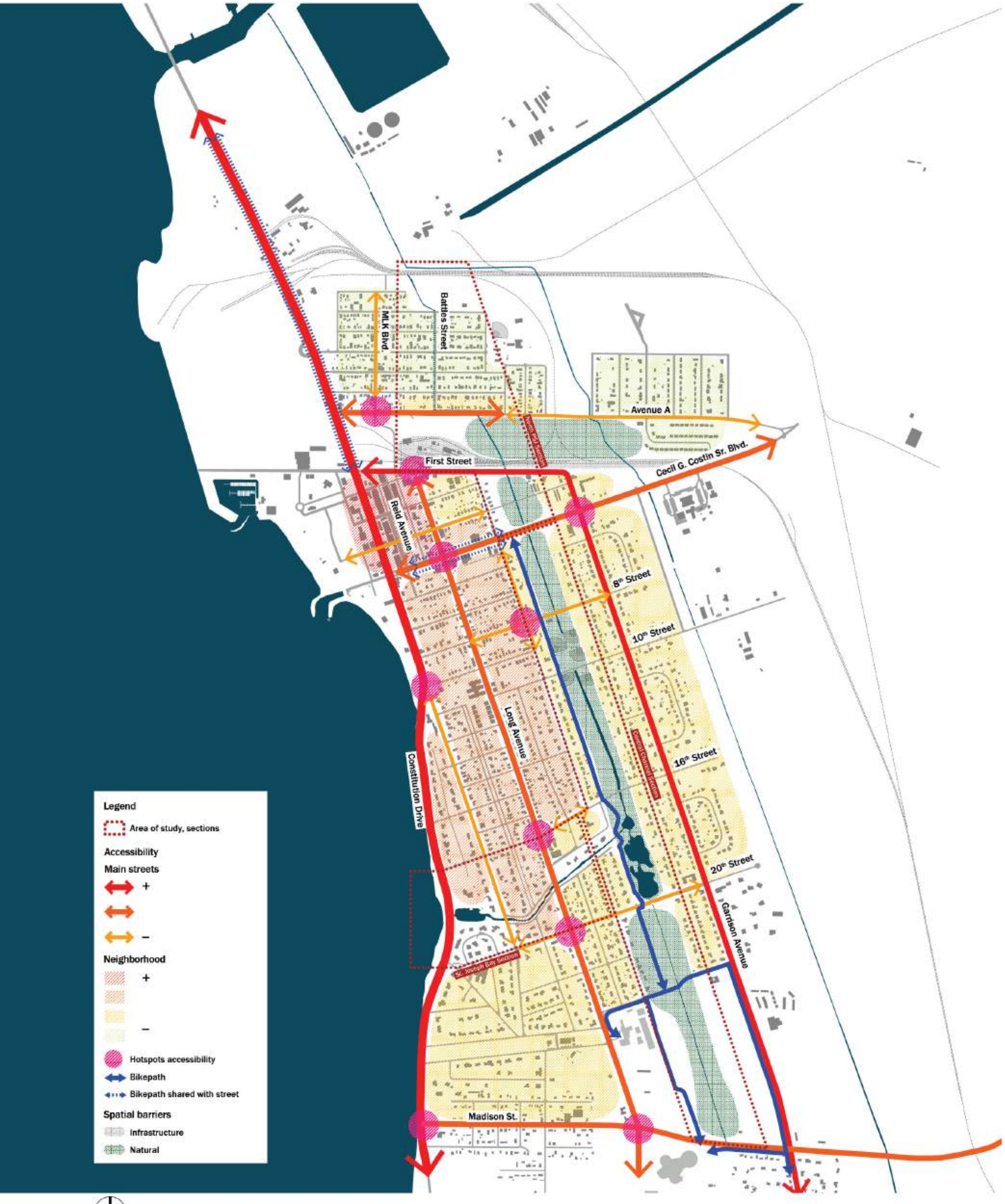
The city of Port St. Joe has an elongated shape with a north-south direction prevalence in the street layout where the Constitution Drive, Long Avenue, and Garrison Avenue represent the primary connections in the city. The main east-west main connections the Madison Street, 20th Street, Cecil G. Costin Boulevard, and Avenue A. The most accessible neighborhoods are along the west side of the central channel, directly connected to Long Avenue, Monument Avenue, and the Constitution Drive. Although the Long and Garrison avenues are highly accessible in the city-wide street layout, they mostly do not have non-housing uses; this probably has to be to the allowed uses defined in the Zoning Plan.

Concerning the perimeter of the study, in the north part of the city, the old railways represent a disruption to the street layout and the north-south connectivity, which strongly affects the accessibility of the North Port St. Joe. The south part of Martin Luther King Boulevard is a medium-accessible area, and the rest of the neighborhood has lower values of accessibility.

The Central Channel section has lower accessibility in the areas directly adjacent to the channel due to the few cross-connections over the central channel and the natural barrier it represents. In contrast, the St. Joseph Bay section is highly accessible due to its direct relation to important longitudinal and cross connections in the street layout, except for the area close to the central channel, which is medium accessible.

Some accessibility hotspots have also been identified. These areas could have the potential to introduce complementary uses to housing and redevelopment opportunities. In the North Port St. Joe section, one accessibility hotspot is the intersection of Avenue A - Martin Luther King Boulevard. In the Central Channel section, the intersections are Cecil G. Costin Sr. Boulevard – Garrison Avenue, and 8th Street - Woodward Avenue; and in the St. Joseph Bay section, Long Avenue – 16th Street and Long Avenue – 20th Street.

In terms of bike connectivity, the bike-dedicated infrastructure is mainly located along the central channel. It connects the main educational infrastructure in the south: Port St. Joe Elementary School, Port St. Joe High School, and the Gulf State College. The bike path is interrupted in the north, ends north at the Cecil G. Costin Sr. Boulevard, and connects to the downtown with a shared path along the boulevard. The North Port St. Joe is not connected to this network.


Legend
Area of study, sections
Accessibility
Main streets
+
–
Neighborhood
+
–
Hotspots accessibility
Bikepath
Bikepath shared with street
Spatial barriers
Infrastructure
Natural
Martin Luther King Blvd.
Battles Street
Avenue A
Bayou Texar Section
First Street
Cecil G. Costin Sr. Blvd.
Reid Avenue
8th Street
10th Street
Long Avenue
Constitution Drive
Bayou Chico Section
16th Street
20th Street
Garrison Avenue
St. Joseph Bay Section
Madison St.
0
0.50
1 mile

3.3 Flood Risk Assessment

FEMA 100-Year Flood Zone

Base Flood Elevations and Topographic Elevations were analyzed in using spatial analysis and mapping software (ArcGIS) to calculate the location specific flood depth. The difference between a LIDAR elevation obtained from the state was subtracted from the Base Flood Elevation (BFE) provided from FEMA. For example, an area that is 9ft in elevation can be subtracted by the BFE at that location. If that BFE is 13 feet, then the flood depth at that location is 4 feet. This information was used to create the high risk flood map (right) to show the flood depths at areas.

The data used to calculate location specific flood depths include LIDAR Data from the Florida Geographic Data Library (FGDL) and the Flood Insurance Rate Map GIS data from the National Flood Hazard Layer ArcGIS Viewer. The Digital Elevation Model (DEM) used was a 2013 data set Provided by the University of Florida GeoPlan Center (University of Florida GeoPlan Center, 2013). This DEM dataset is available for the entire state of Florida, for the purposes of this analysis, data from Gulf County was downloaded. This DEM dataset is a five-meter cell size with units in feet and was created from four different sources of data. The data that were mosaicked include the Northwest Florida Water Management District (NWFWMD) DEM, Florida LIDAR Coastal DEM, Statewide Florida Fish and Wildlife Conservation Commission (FWC) DEM, and Contour derived DEM.

The Flood Insurance Rate Map (FIRM) geospatial data was downloaded from the National Flood Hazard Layer (NFHL) Viewer, a geospatial database that contains current flood hazard data. This current flood hazard data is provided to support the National Flood Insurance Program. From this database FEMA 100-year high risk flood zones were obtained, these zones each have a base flood elevation in a high-risk event. The Base flood elevation is the flood depth from zero elevation, and this data does not denote location specific flood depth. This analysis allowed us to map location specific flood depths in response to topographic change. Watershed strategies in this report not only respond to issues such as erosion and water quality, but respond specifically to types of flooding and their potential depths (FEMA, 2021).

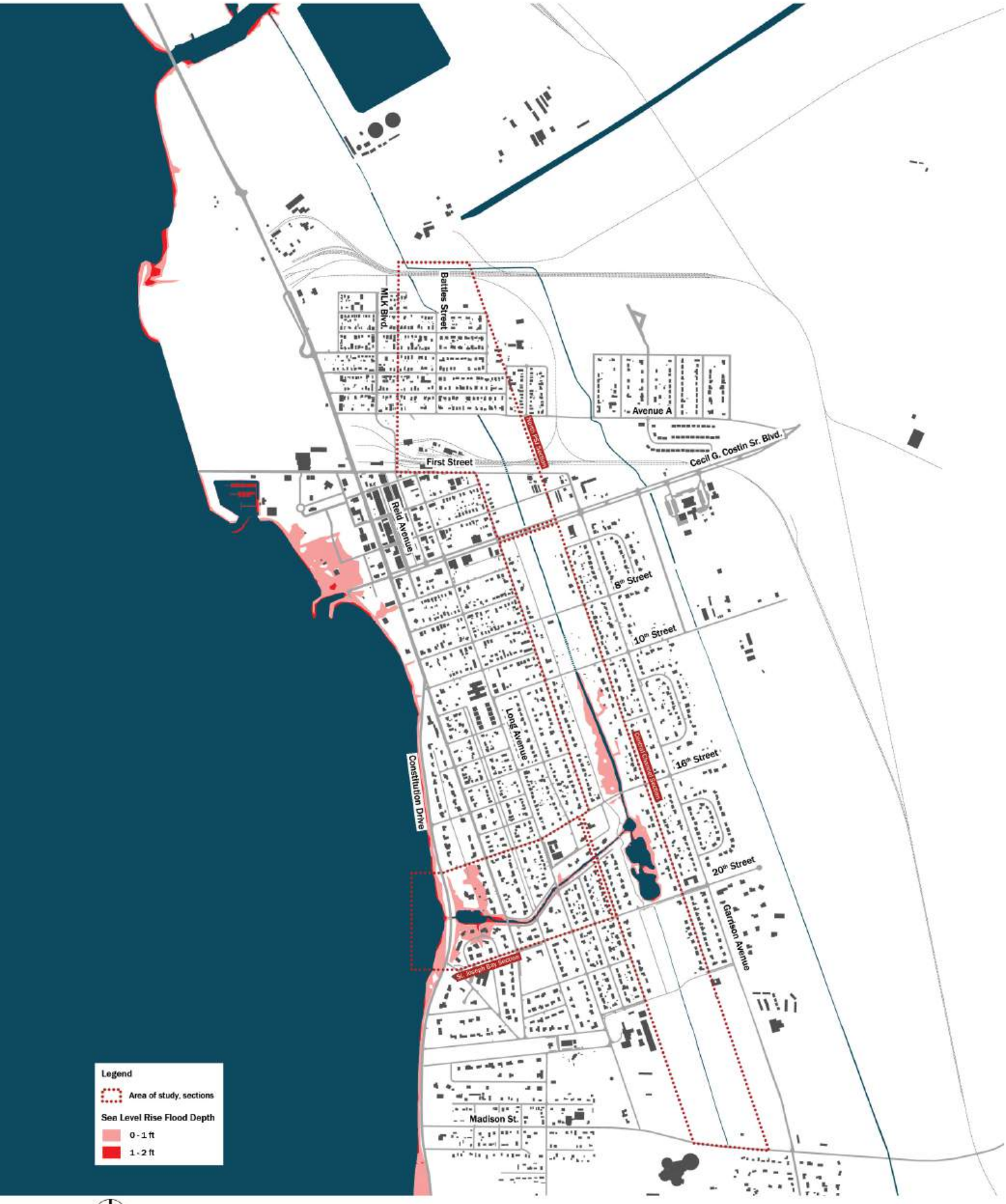

MLK Blvd.
Battles Street
Avenue A
Cecil G. Costin Sr. Blvd.
First Street
Reid Avenue
8th Street
10th Street
Long Avenue
16th Street
20th Street
Garrison Avenue
Constitution Drive
Madison St.
Legend
Area of study, sections
100-Year Flood Depths
0 - 3 ft
3 - 6 ft
6 - 9 ft
>9 ft
0
0.50
1 mile

3.3 Flood Risk Assessment

2070 Sea Level Rise

2070 intermediate high Sea Level Rise from NOAA is one of the data sets mandated by the State of Florida for a state-wide vulnerability assessment. Globally this rise in sea level will be 3 feet, however the actual depth of water at specific locations depends entirely on the topography. For this map we have found that in Port St. Joe global average sea level rise of 3 ft has a flooding depth no more than 2 ft due to topographic change.

The data seen in this map has been downloaded from NOAA for gulf county. Depths were categorized between 0 and 1 feet as well as 1 to 2 feet in sea level rise. This map can better aid designers and planners when creating a site plan that strategically accounts for future inundation (NOAA, 2020).


MLK Blvd.
Battles Street
Avenue A
Cecil G. Costin Sr. Blvd.
First Street
Reid Avenue
8th Street
10th Street
Long Avenue
16th Street
20th Street
Garrison Avenue
Constitution Drive
Madison St.
Legend
Area of study, sections
Sea Level Rise Flood Depth
0 - 1 ft
1 - 2 ft
0
0.50
1 mile

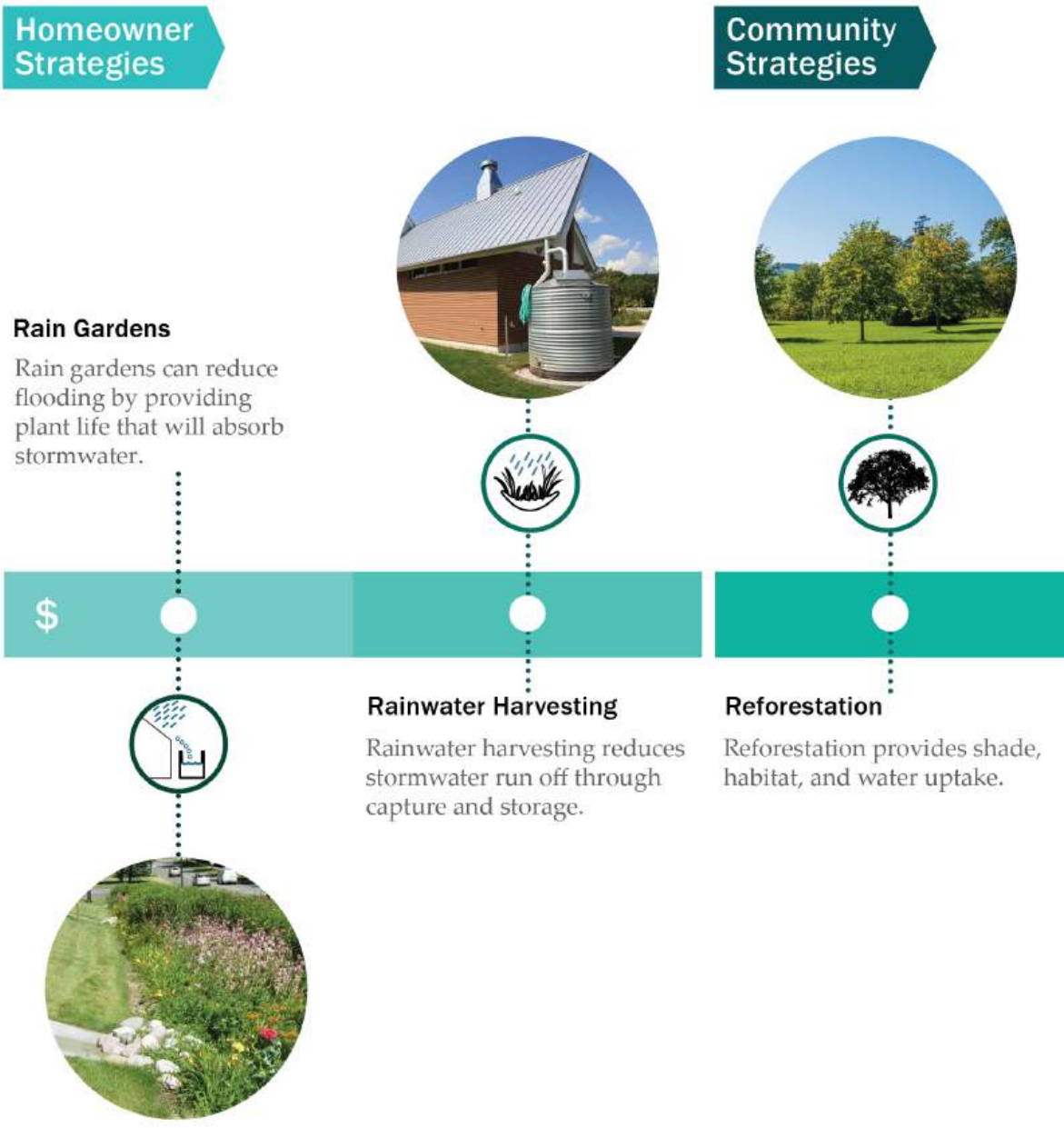
Chapter 4:
Strategies to Reduce Risk & Improve Drainage

4.1 Nature Based Flood Mitigation Strategies

4.2 Building Flood Miigation Strategies

4.1 Nature Based Flood Mitigation Strategies

In response to flood risks, stormwater flooding, water quality, and ecosystem decline, the application feasibility of nature-based solutions that address various flooding issues at the local parcel and city-wide have been studied. The homeowner strategies consist of interventions at the plot scale that reduce stormwater runoff by collecting and absorbing it locally. They include rain gardens, which foster habitat, and rainwater harvesting, reducing runoff while conserving water. The community strategies consist of a group of landscape and public space interventions on a city-wide scale, including Marsh and wetland restoration, Dune restoration, Bioretention Swales, and Shoreline stabilization. The combined application of these strategies can increase the water retention capacity in the system, restore ecosystems and create native habitats, reduce water pollution, and improve public space's spatial quality and functionality.



Bioretention Swales

Swales capture and slow water during rain events. Bioretention swales can treat and slow stormwater eventually connecting it back into the traditional stormwater system.

Shoreline Stabilization

Various materials can be used to stabilize shorelines from erosion and large displacement. The materials in focus are gabions, plant material, and rocks.

Marsh & Wetland Restoration

Restoring natural ecosystems helps treat stormwater quality, reduces erosion, and helps foster native habitat.

$$$

Dune Restoration

Erosion is a natural coastal phenomenon, however, as we build on the coast this development is at risk. Restoring Dunes can protect areas from storm surge, flooding, and erosion.

City-Wide Nature-Based Solutions

Nature-Based Solutions respond to two main flood risks, sea level rise of 2070 and FEMA 100-year flood risk. Strategies were placed throughout the main watersheds that respond to specific flood depths and other environmental challenges.

The challenges for North Port St. Joe include stormwater flooding and drainage issues. The nature-based solutions recommended include an open street bioswale as well as marsh restoration. This is supplemental to infrastructure improvements like enlarged stormwater pipes and tidal check valves.

The central part of the city, or development along chicken house creek south faces challenges of stormwater flooding, drainage issues, sea level rise, and erosion. The solutions recommended in response to these issues are an open bioswale, rain gardens & rainwater harvesting, marsh restoration, wetland restoration, and shoreline stabalization. Traditional infrastructure to supplement this strategy include enlarging stormwater pipes.

The area of the main watershed that outfalls to the St. Joseph Bay sees issues of drainage, sea level rise, risks of storm surge, and erosion. The strategies to resolve these issues include marsh restoration, rain gardens & rainwater harvesting, dune restoration along the coast, and shoreline stabilization. Traditional infrastructure that would be apart of this solution include tidal check valves.

Challenges

Solutions

Nature-Based

Traditional Infrastructure

Chicken House Creek North

Stormwater Flooding

Drainage issues

- Open Bioswale
- Marsh Restoration
- Rain gardens & Rainwater harvesting
- Enlarged Stormwater Pipes
- Tidal Check Valves

Chicken House Creek South

Stormwater Flooding

Drainage issues & Sea Level Rise

Erosion

- Open Bioswale
- Rain gardens & Rainwater harvesting
- Marsh Restoration
- Wetland Restoration
- Shoreline Stabilization
- Enlarged Stormwater Pipes

St. Joseph Bay

Drainage issues & Sea Level Rise

Storm Surge

Erosion

- Marsh Restoration
- Rain gardens & Rainwater harvesting
- Dune Restoration
- Shoreline Stabilization
- Tidal Check Valves

4.2 Building Flood Mitigation Strategies

Local geography and physical features of soil, which impacts water permeability, absorbency, and drainage, are important elements that influence building damage and living issues during floods. One of the main aspects that impact flood damage is the quality of housing, which includes water-resistant materials, structural capabilities, and housing style. If the houses are not long-lasting and are located in a flood zone, such as low-income houses and communities, the possibility of flooding damage and other difficulties increases (Nachawit Tikul, 2018).

Nature-based solutions and housing adaptations address stormwater flooding both at the general and local scale. To provide guidance, This research offers strategies into two categories:

Individual measures and community measures. These strategies include locating structural systems (the superstructure and the foundation), critical systems (mechanical, electrical and plumbing systems) and using materials to help create resiliency.

Homeowner Strategies

Backflow Control Valve

Flooding can cause sewage to back up through drain. Investing in a sewer backfow valve is a safe strategy to prevent this potential health hazard.

Elevate Utilities

Elevating building utility systems to the BFE or above, utilizing a number of strategies such as transferring equipment to higher floors or attic areas, and building an elevated utility room, would be beneficial in protecting utilities from damage or loss of operation due to flooding.

Wet Floodproof

Opening for water penetration and exit in the uninhabited portions of the structure reduces the damage to the structure since water is allowed to enter and balances the hydrostatic pressure on both sides of the walls and floors.

Dry Floodproof

Dry Floodproofing involves sealing the building using waterproof coatings or coverings, install waterproof shields, and install devices that prevent sewer and drain backup to prevent floodwaters from entering. .

Community Strategies

Elevate Building

This measure involves elevating the lowest interior floor within a residential building with high ceilings.The space below elevated floor, must be either filled to create a stem wall or retrofitted with flood openings.

Flood Walls

Flood walls are self-supprting barrier to flood water with a substantial foundation. They keep the building dry and protects them from unequal pressure and erosion as well as damage from floating debris.

Property Acquisition

An strategy that is commonly used to reduce a locality's vulnerability to flooding by which communities can remove development from vulnerable areas by purchasing properties from willing owners.

Relocation

Moving of people from their vulnerable original habitat to safer areas to reduce the risks of disasters and enable communities to adapt.

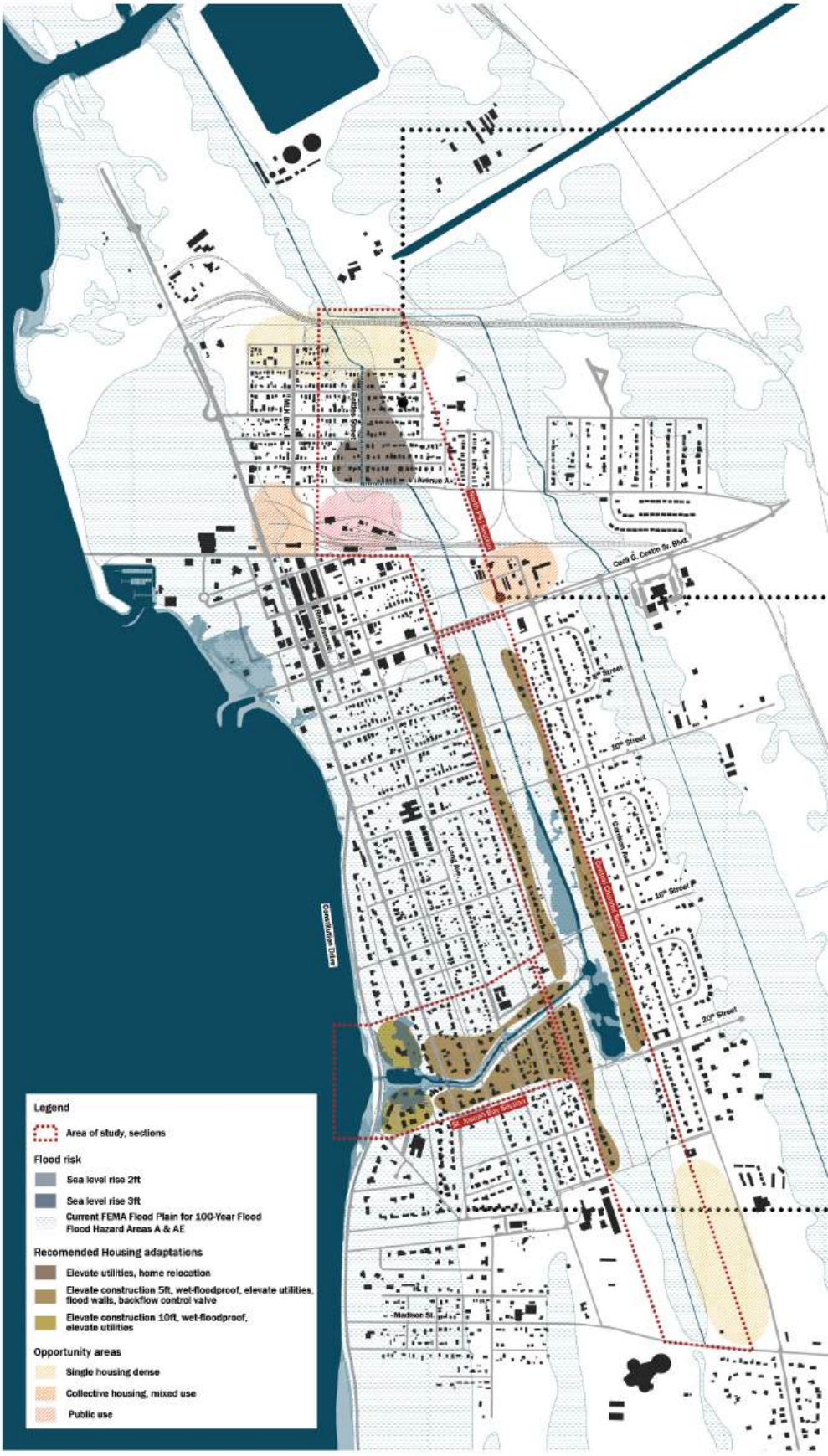
$$$

City-Wide Building Adaptations

Housing in coastal communities is always a problematic matter and Port St. Joe shares these same concerns. Flooding is one of the major concerns for determining residentially developable regions in a coastal community. FEMA Flood Zones are generally used to identify high-risk regions near the shore. Zones AE and A, on the other hand, extend further inland, overlapping with residential areas in certain places. Storm surge following a hurricane and probable storm water management system failures are two more potential sources of flooding. To solve the housing issues, we addressed the study region by selecting three parts where the housing challenges overlap, based on our research and field observations: North Chicken House Creek, South Chicken House Creek and the St. Joseph Bay.

Starting in the north, which is partially in flood zones A and AE, subsidence is a problem that threatens buildings and has led to their abandonment, according to observations. In this instance, relocation would be the best option. Other solutions, such as raising the structure or at the very least elevating the critical utilities, can be successful in flood zones when no signs of subsidence have been found.

Following the course, another issue that dwellings confront is habitable portions that are lower than the FEMA-provided Base Flood Elevation (BFE). According to Florida Building Code, the base elevation of houses in flood zones must be at least 1 foot higher than the BFE for the flood zone in which the structure is located. The elevation of the building structure or utilities, as well as the installation of a backflow control, are all viable options. Also, to prevent water from entering into the foundation levels, plan and install strong structures surrounding the building, and use waterproof materials and seal the building to prevent damage. Housing issues exist in the St. Joseph Bay area, which is mostly located in flood-prone locations with residential areas that are more than 3 feet below the BFE. All of the preceding options, particularly elevating the utilities or the structure if possible, would be the safest option in this case.



Challenges

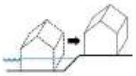
Solutions

Chicken House Creek North

Buildings with subsidence issues

Buildings with no subsidence issues

Property acquisition



Relocation

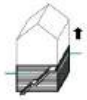
Elevate utilities

Chicken House Creek South

Buildings with the lowest livable floor under BFE and pier foundation

Buildings with the lowest livable floor under BFE and slab foundation

Elevate utilities



Elevate construction

Backflow control valve

Flood walls

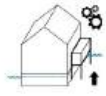
St. Joseph Bay

Buildings with the lowest livable floor 3 ft under BFE and slab foundation

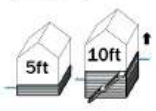
Buildings with the lowest livable floor 3 - 9 ft under BFE and pier foundation

Backflow control valve

Flood walls



Elevate utilities



Elevate construction

Chapter 5:
Neighborhood Specific Strategies

5.1 The Overall Watershed Strategy

5.2 Battles Street

5.3 Forest Park

5.4 St. Joseph Bay

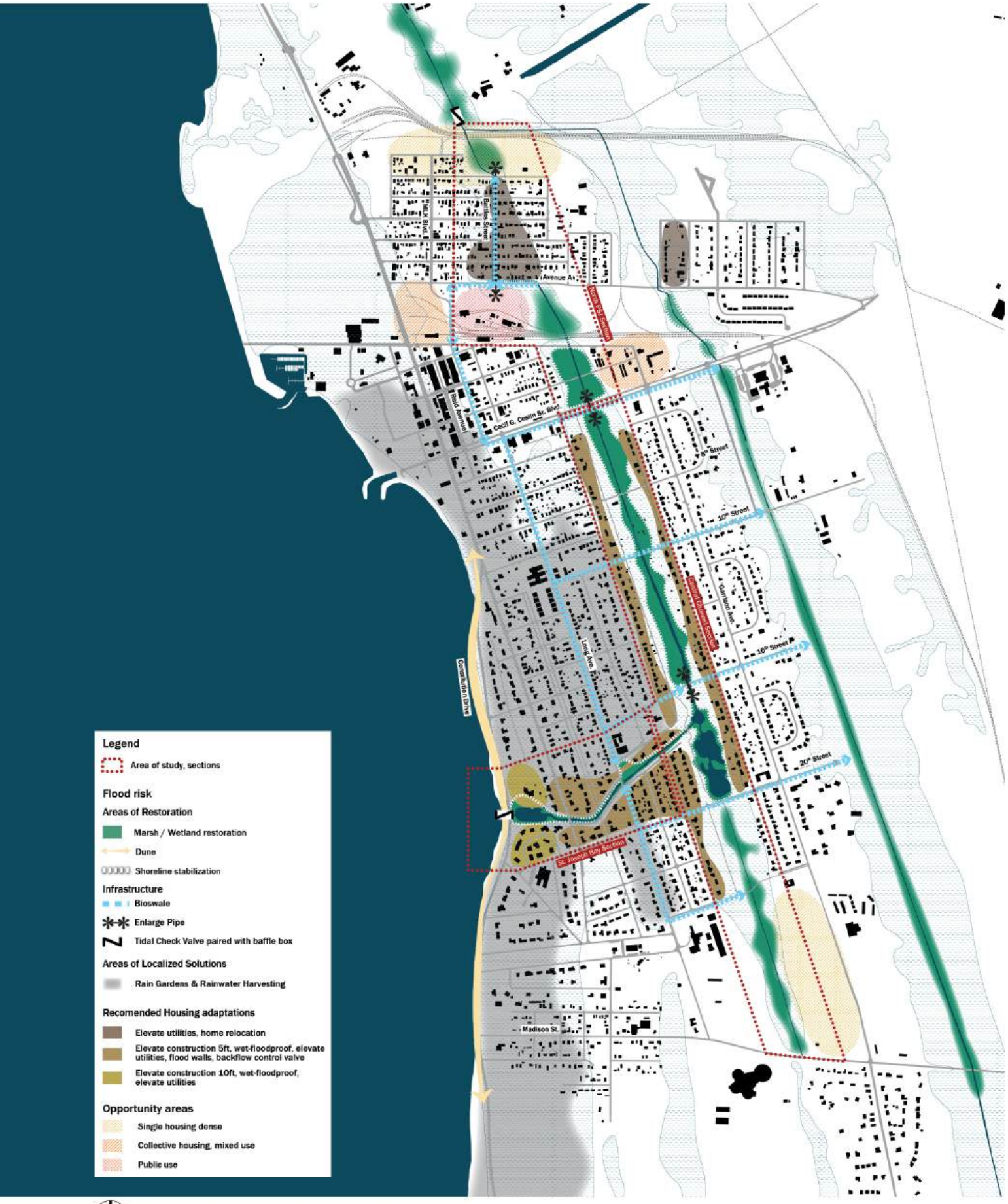
5.1 The Overall Watershed Strategy

The Port St. Joe watershed strategy is conceived not only as a medium of flood risk mitigation but also enhances the existing urban layout structure and produces new landscape qualities. It provides tools that create diverse landscape conditions, public space types and connect different neighborhoods and land uses.

In terms of flood risk management and landscape, the restructure of the Battles Street section in North Port St. Joe, and the implementation of bio-swales will feed the two marsh parks in the north and south and increase the retention capacity of the neighborhood. In the case of the central channel, section enlargement, shoreline stabilization, and marsh restoration are recommended. These measures are intended to develop as well diverse landscape qualities and open space functions. Additionally, a complementary network of bio-swales connected to the channel will increase the retention capacity in every neighborhood.

Concerning street network connectivity and integration, the primary focus is the creation of pedestrian and bike infrastructure to improve the connectivity between the two sides of the central channel, providing several circulation alternatives. An essential intervention is the railway vacant land area. Its objective is to connect the Central Channel to the restored Battles Street to improve the integration of North Port St. Joe in the citywide network. The bio-swale network will enhance the street layout structure, providing hierarchy to the urban layout and improving street section functionality by implementing street forestation and infrastructure for pedestrians and bikes.

The housing adaptation strategy is categorized into three zones according to flood elevation and construction types. New housing development potential has been identified in areas with low flood risk, adequate accessibility, and low land ownership complexity. These areas are primarily located in the city's northern part and one large area in the southern part of the Forest Park close to the educational facilities.


Legend
Area of study, sections
Flood risk
Areas of Restoration
Marsh / Wetland restoration
Dune
Shoreline stabilization
Infrastructure
Bioswale
Enlarge Pipe
Tidal Check Valve paired with baffle box
Areas of Localized Solutions
Rain Gardens & Rainwater Harvesting
Recomended Housing adaptations
Elevate utilities, home relocation
Elevate construction 5ft, wet-floodproof, elevate utilities, flood walls, backflow control valve
Elevate construction 10ft, wet-floodproof, elevate utilities
Opportunity areas
Single housing dense
Collective housing, mixed use
Public use
Barrios Street
MLK Blvd.
Avenue A
North FEH Section
Cecil G. Costin Sr. Blvd.
Reid Avenue
8th Street
10th Street
Gardner Avenue
Central Avenue Section
16th Street
20th Street
Long Ave.
Constitution Drive
St. Joseph Bay Section
Madison St.
0
0.50
1 mile

5.2 Battles Street

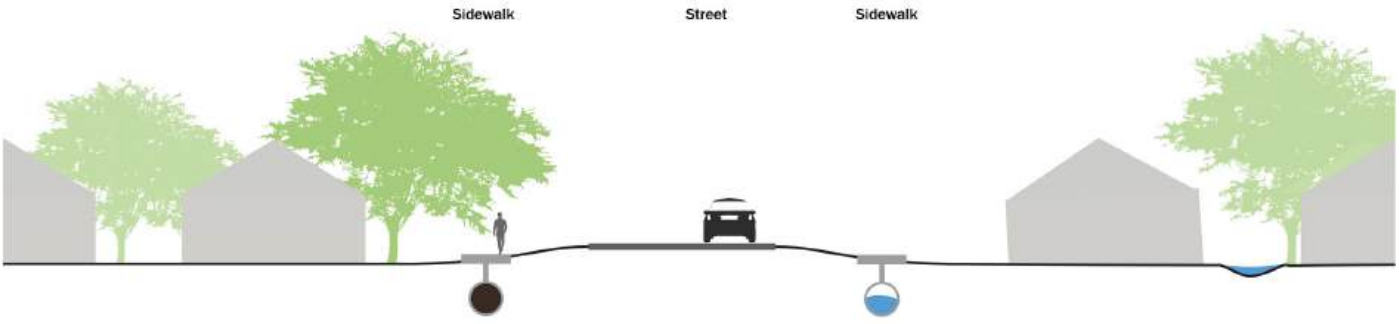
The primary measure proposed for North Port St. Joe is to surround the neighborhood with two significant wetland restoration areas, which will work for stormwater retention for Chicken House Creek. In the north, at the end of Battles St., and in the south, the adjacent area to the future Civic Center. The latter is essential in setting the spatial conditions for bike and pedestrian infrastructure to connect the Central Channel neighborhood with Battles Street and North Port St. Joe neighborhood. Due to the high accessibility of these areas to any part of North Port St. Joe, these spaces could work as parks and recreation places besides water retention.

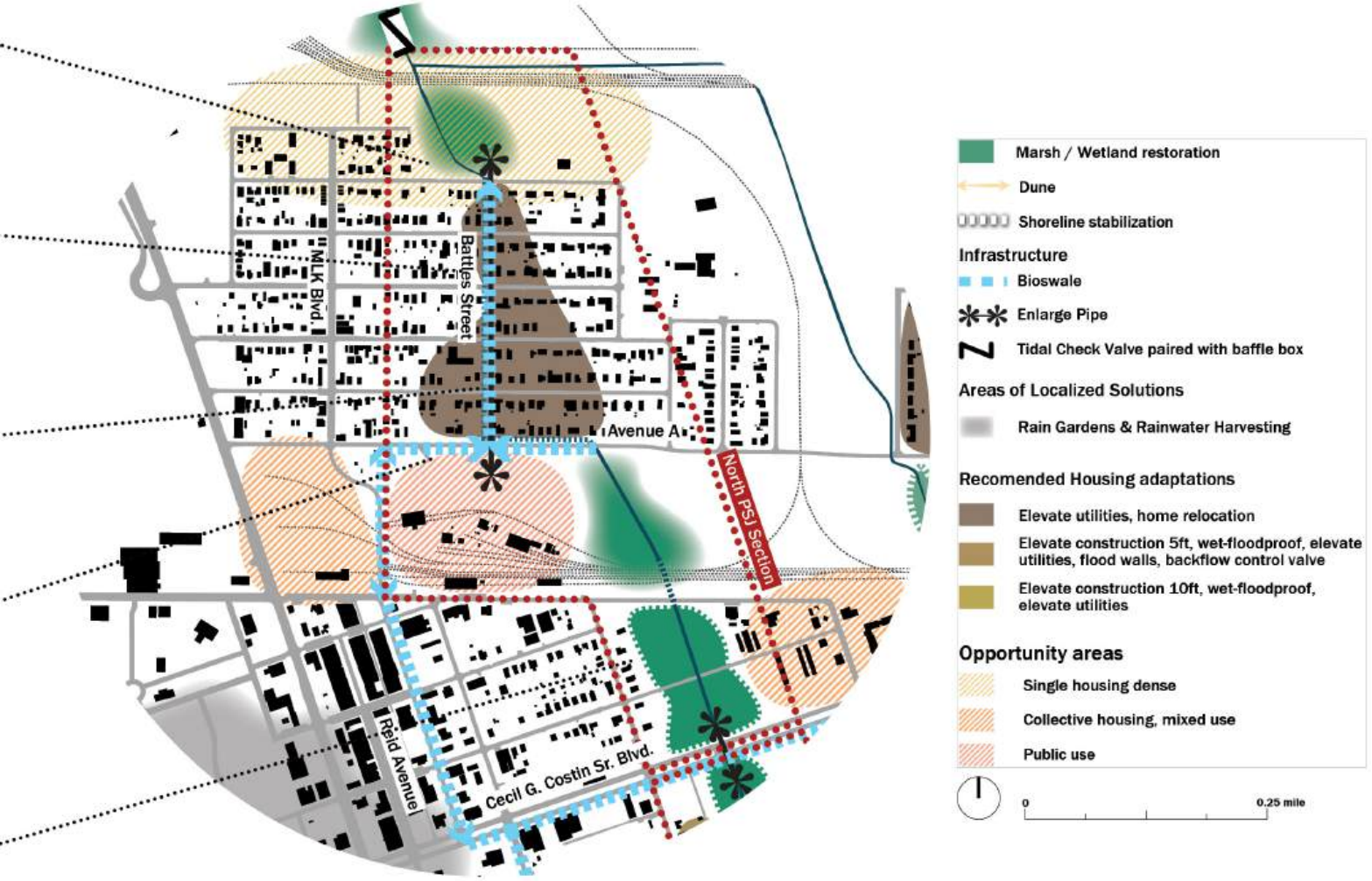
In terms of traditional infrastructure, the strategy proposes to restore the underground piping system to improve flow capacity to address the issues of surface water and soil saturation along Battles Street. This measure must be complemented with the street section re-structure, bioswales, street forestation, and pedestrian and biking infrastructure. The whole intervention will address stormwater management and act as a connector of the two new retention parks, setting the base of a green space network.

Concerning housing adaptations, to address the most critical subsidence conditions, a building assessment process will identify which buildings and land need to be acquired and provide measures to preserve existing structures. The elevation of utilities is a recommended measure for the rest of the constructions.

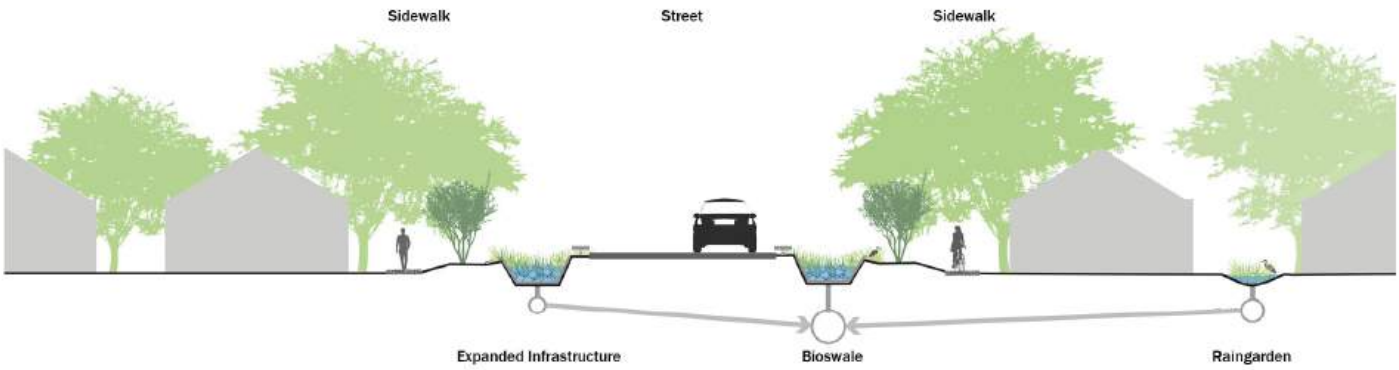
Three potential areas for new housing development have been identified according to land availability, flood risk, connectivity, and proximity to public space infrastructure. The first is located on the east and west side of Stormwater Park. Due to its moderate connectivity and available land, single-family dense housing typology is recommended for this area. In the south part of the section, two areas are located with similar characteristics to the previous but with very high connectivity on the east and west side of First Avenue. Mixed-use collective housing typology is recommended for these areas.

Before




MLK Blvd.
Battles Street
Avenue A
North PSJ Section
Reid Avenue
Cecil G. Costin Sr. Blvd.
Marsh / Wetland restoration
Dune
Shoreline stabilization
Infrastructure
Bioswale
Enlarge Pipe
Tidal Check Valve paired with baffle box
Areas of Localized Solutions
Rain Gardens & Rainwater Harvesting
Recomended Housing adaptations
Elevate utilities, home relocation
Elevate construction 5ft, wet-floodproof, elevate utilities, flood walls, backflow control valve
Elevate construction 10ft, wet-floodproof, elevate utilities
Opportunity areas
Single housing dense
Collective housing, mixed use
Public use
0
0.25 mile

After


Sidewalk
Street
Sidewalk
Expanded Infrastructure
Bioswale
Raingarden

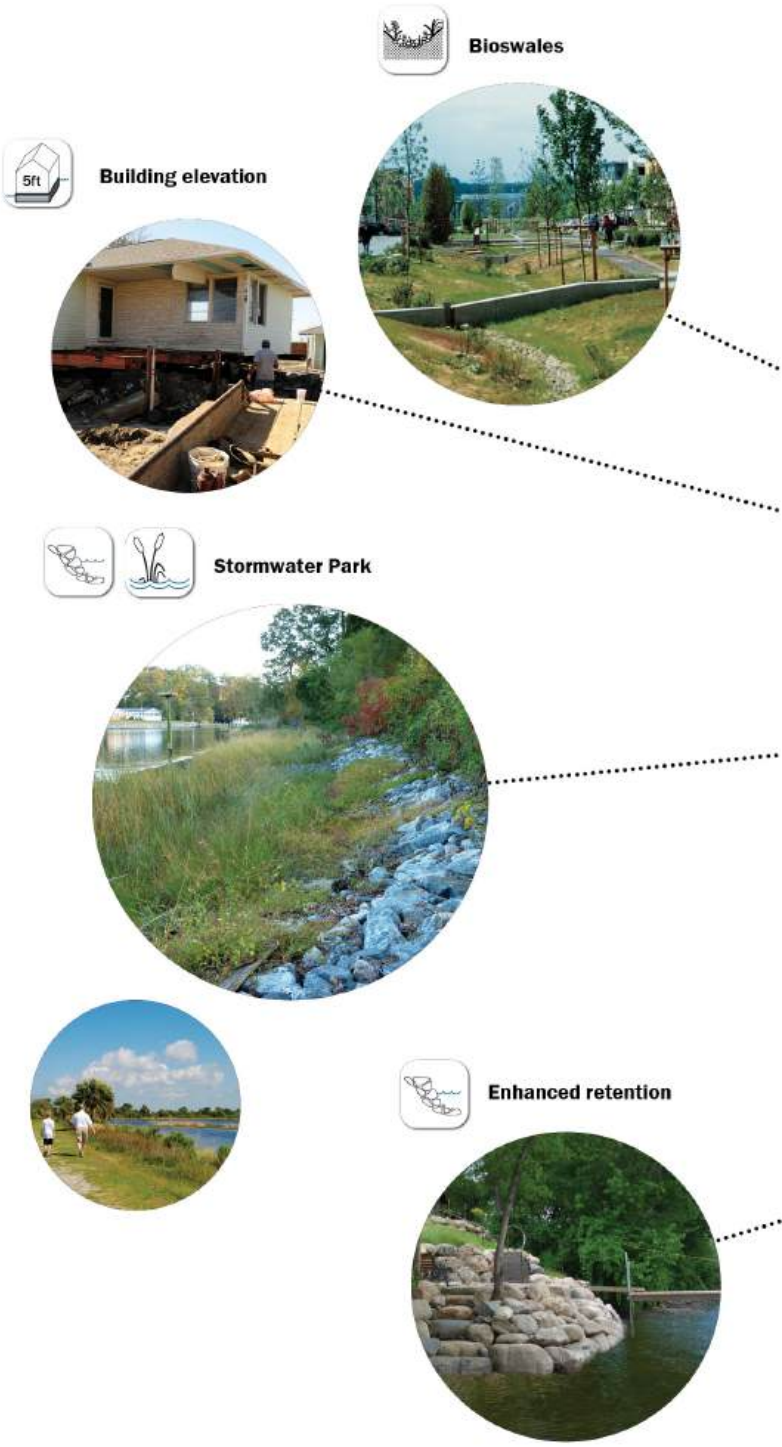
5.3 Forest Park

The water channel at the Forest Park is a fundamental spatial element in the structure of the City of Port St. Joe. On one side, it works as the city's main stormwater collector; on the other, it defines the neighborhood layout and connects diverse land uses along it.

The spatial strategy for this area defines an extensive marsh restoration along the whole section and shoreline stabilization coupled with increasing the channel section in some areas to increment retention capacity. These measures include relocating the baseball fields to allow a continuous open water course and avoid the current bottleneck situation of the channel. It is also necessary to add flood protection functionality to the bike path, using it also as a berm to protect the housing area on the east side of the channel.

Complementary, a network of bioswales will be set to discharge to the Central Channel; it consists in transforming primary east-west street connections in the city that cross over the channel into bio boulevards. This intervention will reinforce the current street layout hierarchy and provide new pedestrian and bike-friendly infrastructure. A transfer capacity from the central channel to the depot creek is a potential flood protection measure that needs to be proved in detail.

Regarding housing adaptations, elevating buildings and utilities are the primary measure for constructions with pier foundation. In the case of slab foundation, backflow control valves and flood walls are recommended. For new housing development opportunities, the southwest area of the forest park has land available highly connected to educational facilities and moderate connected to housing complementary uses and commerce. A feasibility study for Single-family dense housing settlement is recommended for this area.



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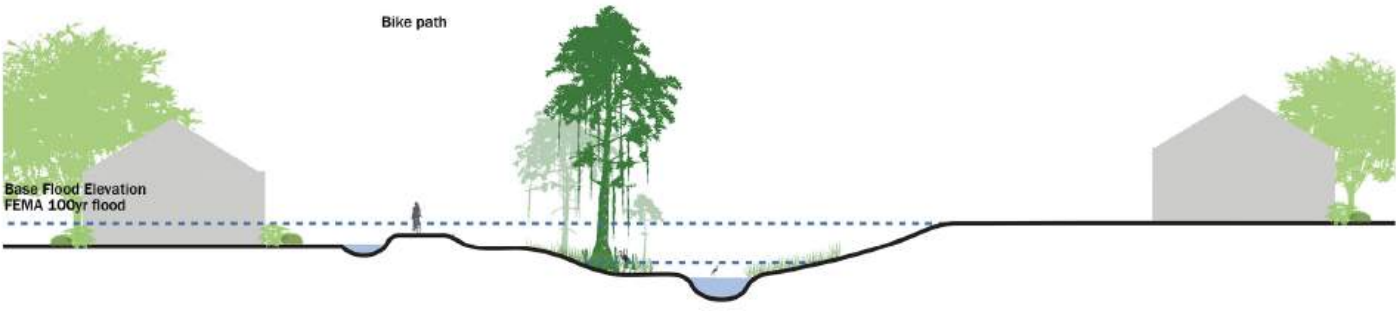
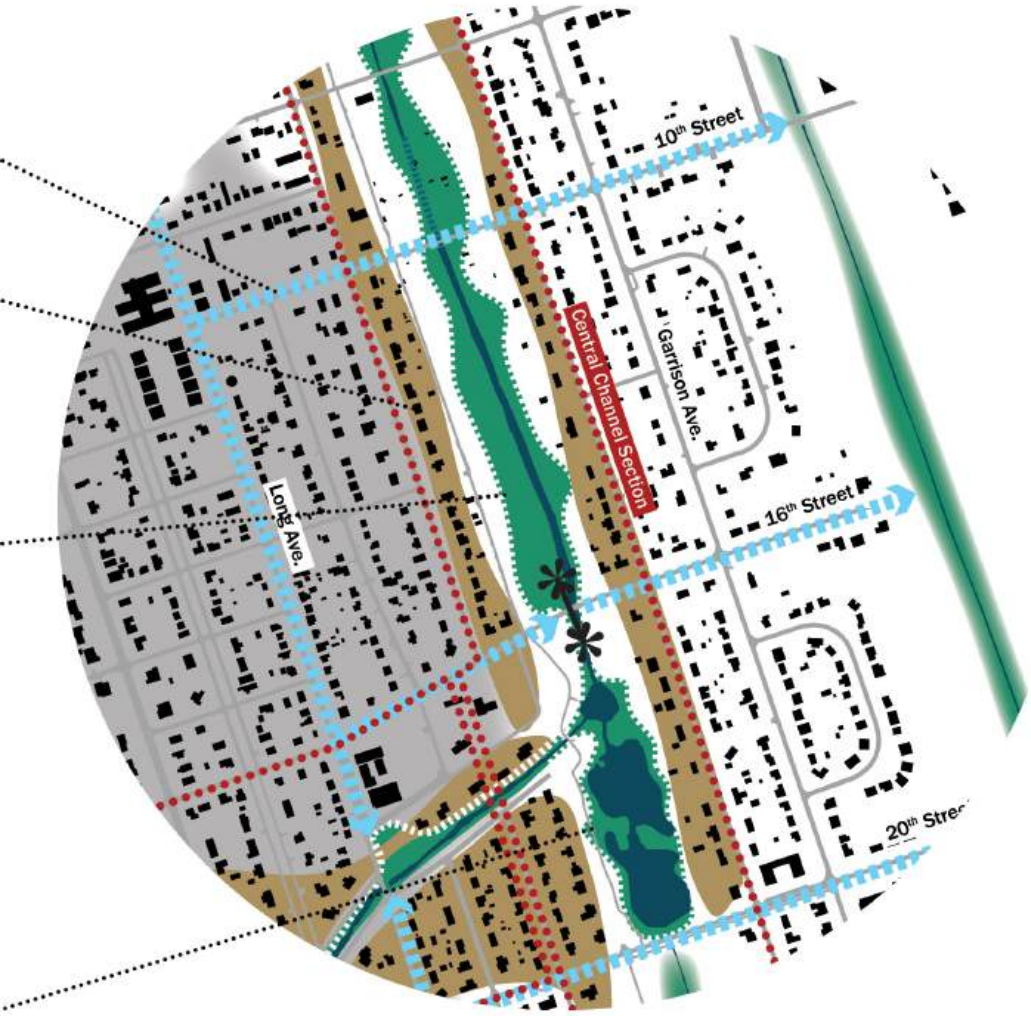




Marsh / Wetland restoration

Dune

Shoreline stabilization

Infrastructure

Bioswale

Enlarge Pipe

Tidal Check Valve paired with baffle box

Areas of Localized Solutions

Rain Gardens & Rainwater Harvesting

Recomended Housing adaptations

Elevate utilities, home relocation

Elevate construction 5ft, wet-floodproof, elevate utilities, flood walls, backflow control valve

Elevate construction 10ft, wet-floodproof, elevate utilities

Opportunity areas

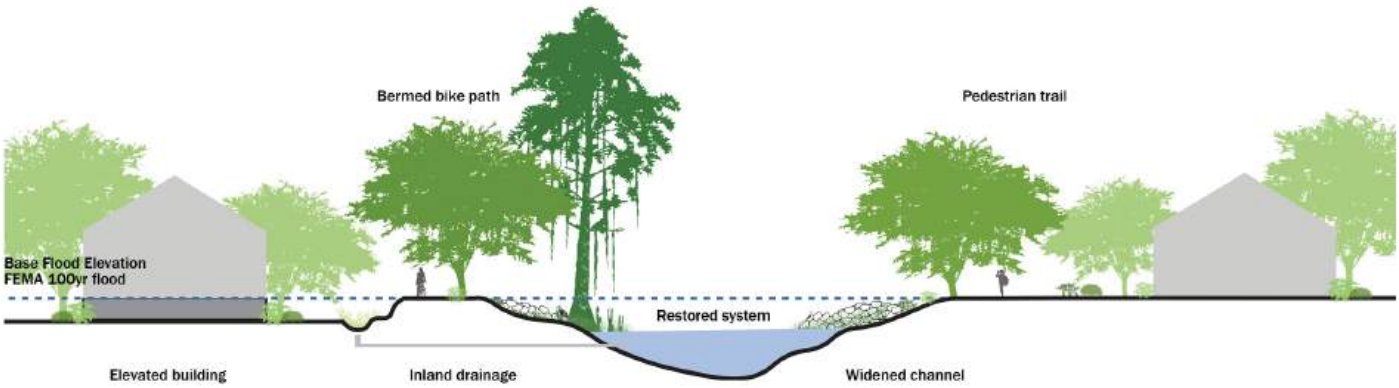
Single housing dense

Collective housing, mixed use

Public use

0 0.25 mile

After

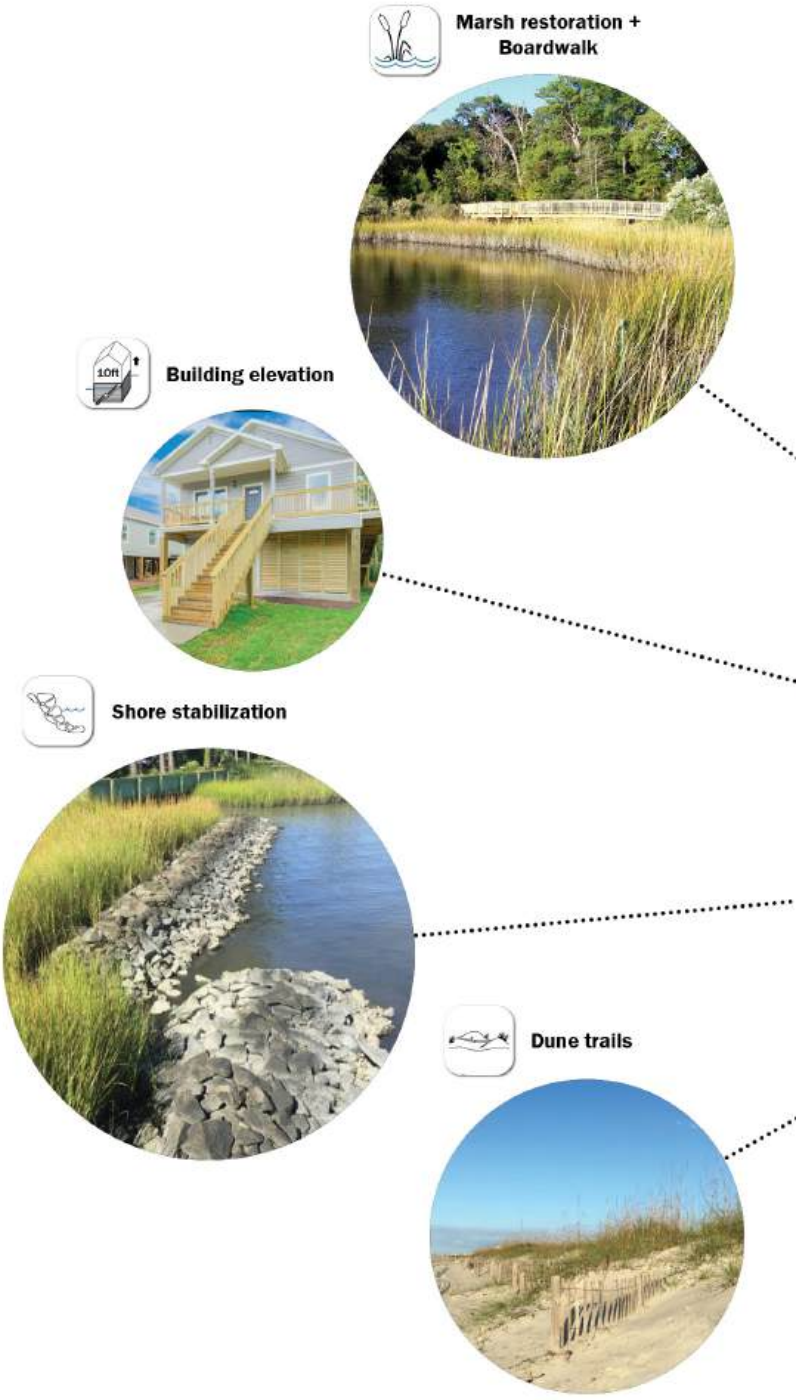


5.4 St. Joseph Bay

The St. Joseph Bay section is the outlet of the Central Channel to the bay; consequently, the effects of sea level rise, high tide, and storm surge have a more substantial influence on the neighborhood. The primary measure for this area is shoreline stabilization along the channel. In terms of low-level topography, both sides of the channel along Long Avenue are critical areas; therefore, a re-structure of the street section is necessary to implement bio-swales and street forestation. As this street is one of the main north-south connections, bike paths and pedestrian infrastructure are also recommended.

For the west side of this section, marsh restoration and shore stabilization are recommended at the pond area and dune restoration along the seaside. Coupling with these interventions, pedestrian paths, and a boardwalk can be implemented to access the exceptional landscape qualities of the pond. Regarding traditional infrastructure, in concordance with the Stormwater Masterplan, a tidal check valve paired with a baffle box needs to be implemented at the bay outlet of the channel.

Concerning housing adaptations, five feet building elevation and elevating utilities on the area along the channel are recommended; in the case of buildings with slab foundation, backflow control valves, and flood walls. On the west side of the neighborhood, due to the high flood elevation, ten feet building elevation coupled with wet floodproof and elevating utilities are recommended. No flood walls are applicable for the buildings adjacent to the marsh.



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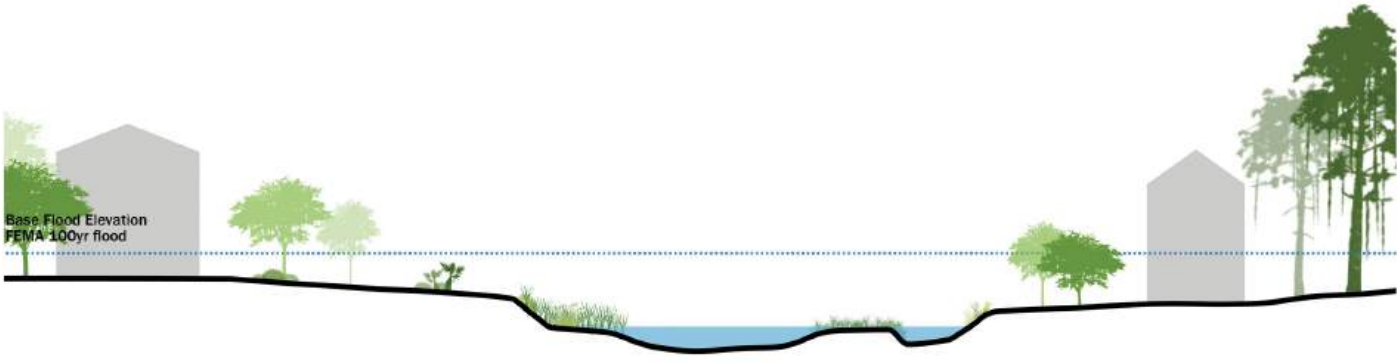
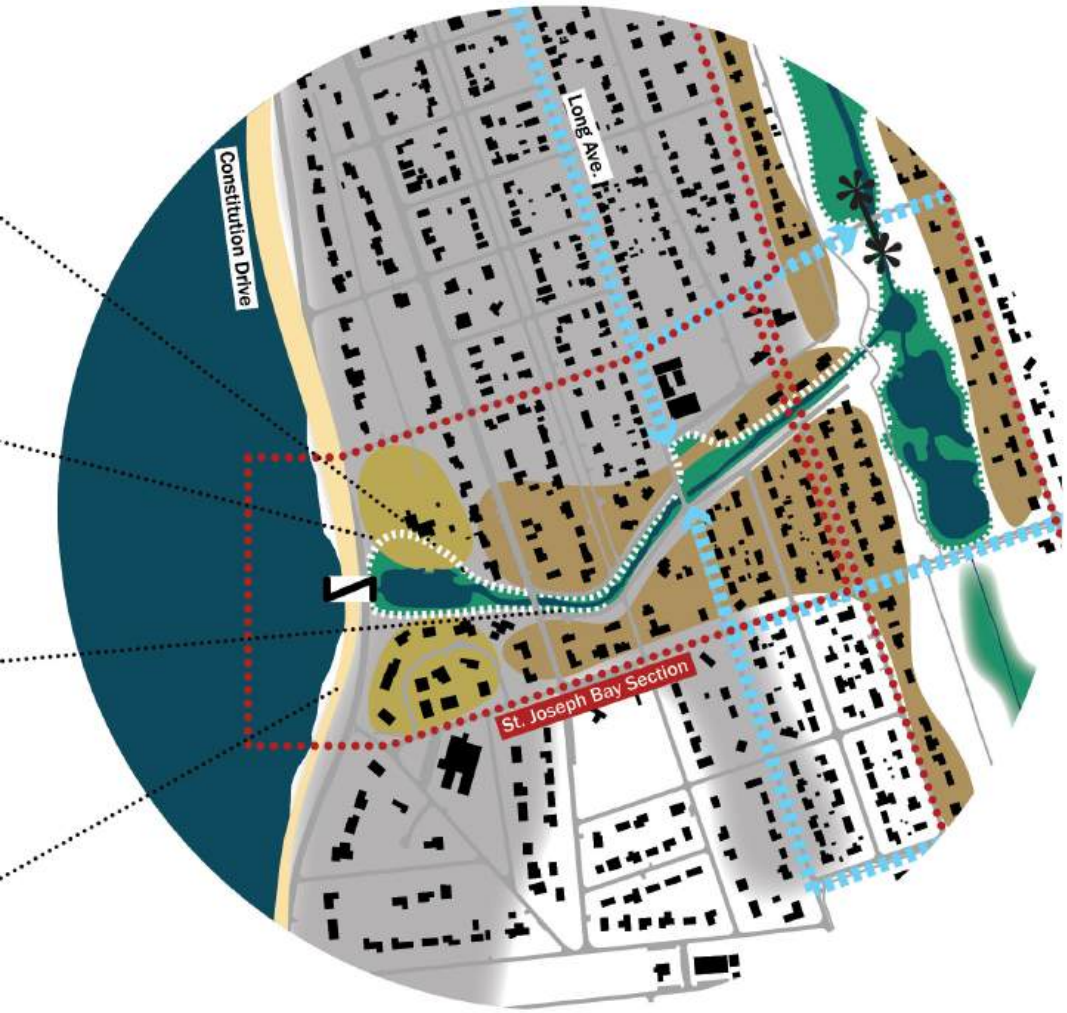




Marsh / Wetland restoration

Dune

Shoreline stabilization

Infrastructure

Bioswale

Enlarge Pipe

Tidal Check Valve paired with baffle box

Areas of Localized Solutions

Rain Gardens & Rainwater Harvesting

Recomended Housing adaptations

Elevate utilities, home relocation

Elevate construction 5ft, wet-floodproof, elevate utilities, flood walls, backflow control valve

Elevate construction 10ft, wet-floodproof, elevate utilities

Opportunity areas

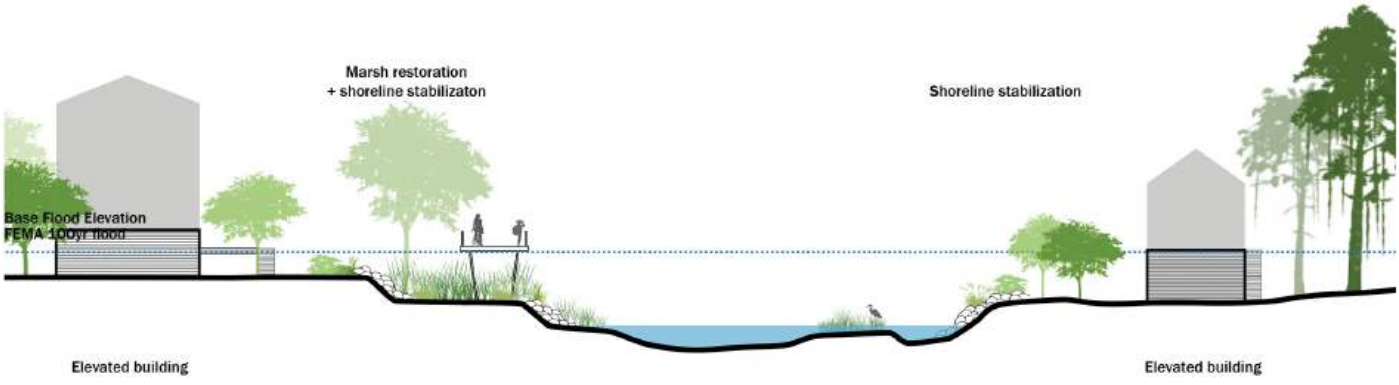
Single housing dense

Collective housing, mixed use

Public use

0 0.25 mile

After

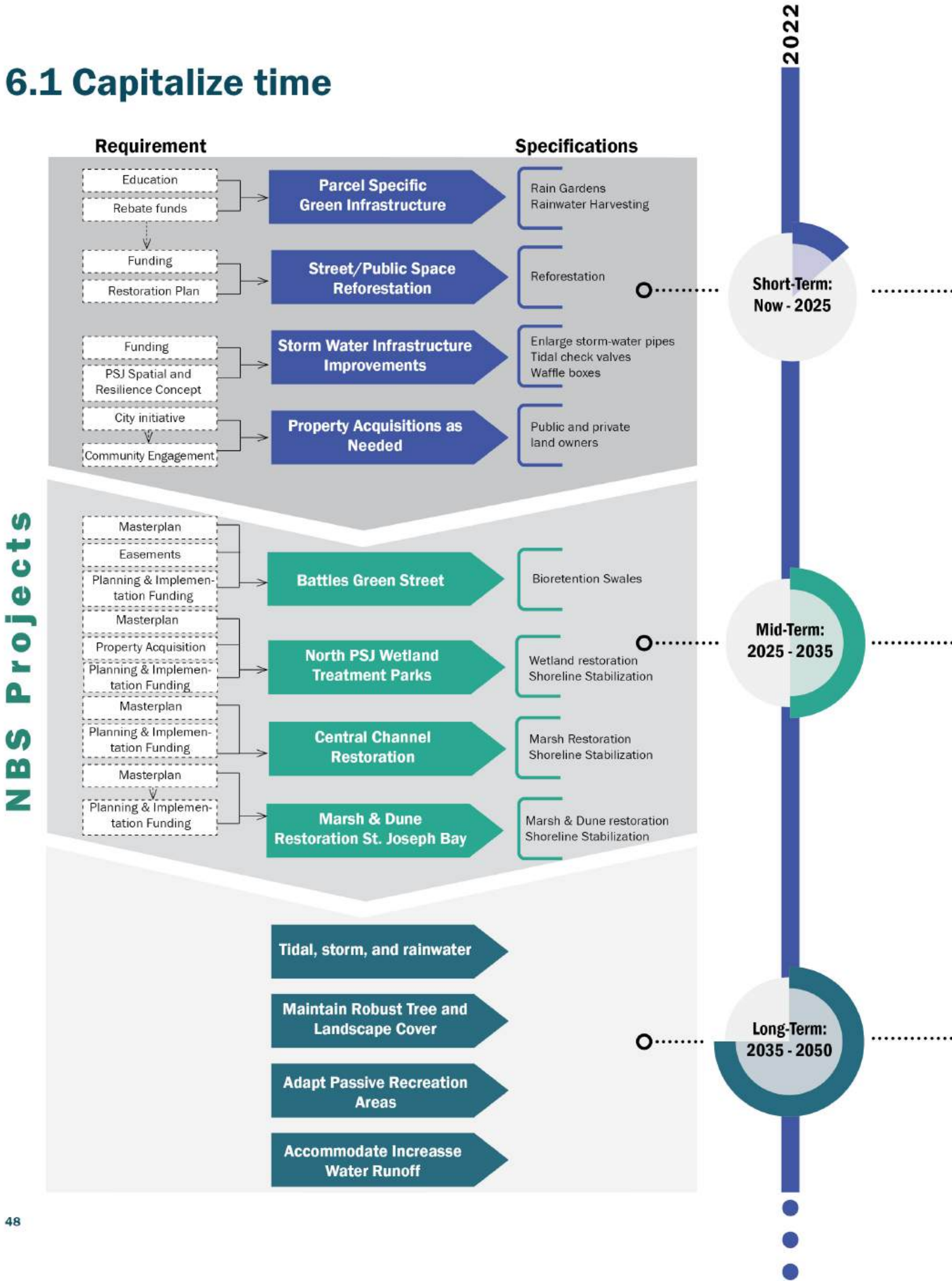


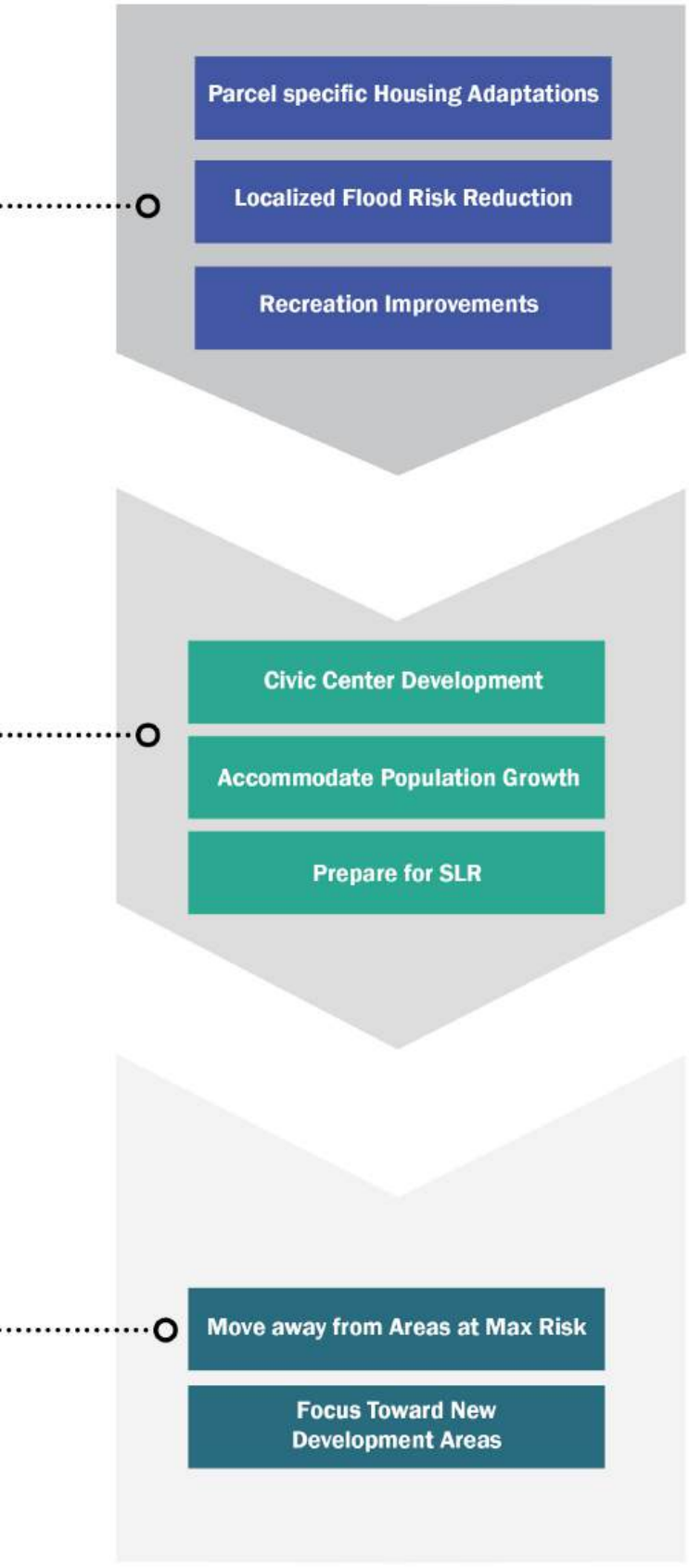
Chapter 6:
Strategic Phasing

6.1 Capitalize Time

6.2 Conclusion

6.1 Capitalize time





The resiliency plan is structured in three phases over the next three decades: short-term, mid-term, and long-term. Each phase contains nature-based projects and city development objectives proposed in a series of feasible steps to organize their execution. The individual projects have previous requirements, goals, and results based on the intervention scale and the report's scope.

The first phase consists in identifying priority areas and opportunities for green infrastructure. It introduces individuals and organizations to short-term projects such as rain gardens and rainwater collection that they can complete. Another initial step is to plan public space reforestation projects throughout the city, which can reduce stormwater runoff and flood risks while providing shade, reducing heat, and improving public spaces. The next step will be to improve the stormwater infrastructure by increasing drain and pipe sizes in targeted locations and installing tidal check valves in the creek outlets to prevent tidal inflow. Property buyouts from major landowners will be necessary to facilitate large open space improvement projects and potentially small landowners to reduce the risk for specific properties and mitigate future flood losses. These steps necessitate particular prerequisites, such as funding, the creation of a Port St. Joe Spatial and Resilience Concept, and community education.

Mid-term projects proposed in the next phase include converting Battles Street into a "green street" by designing bioretention swales to capture, treat, and infiltrate stormwater runoff as it moves downstream. Another project that should be considered during the mid-term period is restoring wetland storage and treatment areas within north Port St Joe by creating wetland treatment parks. Other major midterm strategies include restoring the Forest Park's water channel and marsh and dune restoration of the St. Joseph Bay Section.

The project's final phase entails managing tidal, storm, and rain flooding by protecting against and mitigating major flood events. Moving forward with long-term projects suggests relocating from areas at high risk of flooding and developing in less vulnerable areas. Promoting a consistent tree and landscape cover will increase evapotranspiration, infiltration and reduce stormwater runoff. Communities will mitigate better flood repercussions and profit from the adaptations by having better-connected neighborhoods and using passive recreation areas like parks, trails, and picnic areas.

6.2 Conclusion

Port St Joe has significant cultural, historic, and natural resources, all of which will change as risks increase from coastal storms and flooding

Existing infrastructure exists within the Central Channel and Avenue A (Chicken House Creek) watersheds that can help mitigate flood risks citywide, provide ecological benefits, and community amenities with careful design and planning.

This can occur through a combination of structural and nature-based solutions within the watershed, while providing for restoration of Chicken House Creek and reducing chronic health and environmental risks within the community.

More detailed analysis of future risks and potential design solutions is needed. But this document provides a template for future planning and design of structural and nature based solutions to reduce risk, improve ecological systems, and enhance community spaces and amenities.

References

FEMA. (2021). National Flood Hazard Layer Flood Insurance Rate Map (FIRM Panels 12045C0341H & 12045C0333H. Gulf County, Florida). [data file]. doi:https://hazards-fema.maps.arcgis.com/apps/webappviewer/index.html?id=8b0adb51996444d-4879338b5529aa9cd

NOAA. (2020). Sea Level Rise Depth (2070 Intermediate High; Gulf County, Florida). [data file]. doi:https://coast.noaa.gov/slrdata/

University of Florida GeoPlan Center. (2013). Florida Digital Elevation Model (DEM) Mosaic (5-Meter Cell Size. Elevation Units in Feet. Gulf County, Florida). [data file]. doi:https://www.fgdl.org/metadataexplorer/explorer.jsp

US EPA, R. 01. (2015, August 19). Soak Up the Rain: Trees Help Reduce Runoff [Collections and Lists]. https://www.epa.gov/soakuptherain/soak-rain-trees-help-reduce-runoff

Wolfcenter. (2021, July 23). What are the Benefits of Reforestation? The Wolf Center. https://www.wolfcenter.org/what-are-the-benefits-of-reforestation/

The World Bank (2021). A Catalogue of Nature-Based Solutions for Urban Resilience. https://openknowledge.worldbank.org/handle/10986/36507#:~:text=The%20catalogue%20of%20Nature%2Dbased,investments%20in%20nature%2Dbased%20solutions.

Department of City Planning City of New York. (2014). Coastal Climate Resiliency, Retrofitting Buildings for Flood Risk. https://www1.nyc.gov/assets/planning/download/pdf/plans-studies/retrofitting-buildings/retrofitting_complete.pdf