



RESILIENCY REDEVELOPMENT PLAN

City of Mexico Beach

During the recovery efforts, the City with funding from the Florida Department of Environmental Protection, has developed a draft Resilient Redevelopment Plan. This Plan details the City's vulnerability to flood, storm surge, high wind, and sea level rise; chronicles the City's recovery and resilience efforts to date; and then provides a road map of projects and adaptation actions to address the vulnerability.

The draft plan is posted and we would like public input on it before the final plan is produced. Please take a moment to review the document and provide feedback by emailing Margaret Walton at

Margaret.Walton@atkinsglobal.com, by July 24, 2020. We appreciate your time.

City of Mexico Beach Resilient Redevelopment Plan



June 30, 2020

*** PUBLIC REVIEW DRAFT ***

Florida Department of Environmental Protection

Florida Resilient Coastlines Program

Please note: In accordance with the Privacy Act, any property-level data has been redacted prior to being made available for public review.

Acknowledgements

The process of rebuilding after a major disaster like Hurricane Michael is quite literally a herculean effort. For a city the size of Mexico Beach with disaster costs that dwarf the City's normal budget, it is an even greater challenge. The City has made tremendous strides in its recovery and overall goal to rebuild stronger and safer. This plan is a reflection of that can-do spirit and drive to restore the City and make it an even better place to live and visit.

We would like to recognize the Florida Department of Environmental Protection, especially Whitney Gray, Faith Clarke, and Angel Baratta, for their support to Mexico Beach and providing the funding needed to prepare this Resilient Redevelopment Plan.

Thank you to Mayor Al Cathey and the Mexico Beach City Council for leading the City through this difficult time.

We would like to thank the following individuals in the preparation of this plan:

- Mario Gisbert, City Manager
- Dina Bautista, Senior Engineer, ACDC Consulting
- Atkins Team of
 - Lawrence Frank
 - Margaret Walton
 - Erin Capps
 - Ryan Fennell
 - Rodney Isbell
 - Charles Dugger
 - Chris Zambito
 - Dave Conrad
 - Sara Seremak

Thank you to the following individuals for their contributions to resilience in the City:

- Lindsay Hovind, City of Mexico Beach
- Thomas Wilson, City of Mexico Beach
- Alyssa Carrier, ACDC Consulting

And thank you to the Bay County Local Mitigation Strategy led by Frankie Lumm for their leadership, coordination, and support of Mexico Beach during the post-disaster mitigation grant process

Special recognition in the memory of Andy Anderson, previous City Manager, who helped start this process and to Tanya Castro, the City Manager during Hurricane Michael, who supported the FDEP grant application.

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Executive Summary

Overview

The beautiful and charming City of Mexico Beach was devastated by the impacts of Hurricane Michael on October 10, 2018. Immediately after the storm, while surveying the extensive damage, the City resolved itself to rebuild stronger but also to maintain its unique character. The ultimate vision for Mexico Beach is to rebuild and redevelop in a manner that encourages resiliency and sustainability which can lead to greater prosperity to secure the City's long-term success.

This vision entails actions that protect infrastructure, lifelines, homes, businesses, and facilities damaged by Michael along with co-benefits of enhanced economic development, recreation, and community services.

Mexico Beach will use the momentum generated during the recovery, as documented in this plan, to continue addressing resiliency into the future. This plan is both the story of the City's resilient recovery to date as well as a vision for the next 5 to 10 years to achieve comprehensive resilience.



Figure 1. Post Michael damage. Source: Atkins staff photo.

Blessed and challenged by water

The City occupies an enviable location along the beautiful white sands of the Gulf of Mexico buffered by Tyndall Air Force Base to the northwest and St. Joe Paper Company land to the north and northeast. That same water body, which provides so much appeal to residents and visitors during blue sky days, can transform into a destructive behemoth when storms landfall. The City is vulnerable to impacts of storm surge and high wind as well as general flooding when extreme rainfall exceeds conveyance and storage capacity. The inlets carved into the beach for navigable and stormwater outfall purposes provide a pathway for surge adding additional vulnerability. In assessing future risk, while the impacts of stillwater sea level rise are projected to not be as severe in Mexico Beach as other parts of Florida, the continual pressure from the rise of the ocean's water level, like adding more height to storm surge, will make the impacts of these flood and wind hazards more severe in the future without resilience measures in place.

Below is the relative risk rating of these four hazards, deemed to have the most significant impact on the city in the future:

Hazard	Category/Degree of Risk					
	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Storm Surge	Likely	Catastrophic	Large	More than 24 hours	Less than one week	3.3
High Wind	Highly Likely	Critical	Large	More than 24 hours	Less than 6 hours	3.1
Flooding	Highly Likely	Limited	Moderate	6 to 12 hours	Less than 24 hours	2.9
Sea Level Rise	Highly Likely	Minor	Small	More than 24 hours	More than one week	2.4

Any PRI score over 2.0 indicates a serious hazard while those near or above 3.0 reach severe or even catastrophic proportions. See the **Vulnerability Assessment** and **Focus Areas** sections for detailed information.

Response to Michael

Hurricane Michael's impact to Mexico Beach was total with approximately 95 percent of the City's geographic area inundated by storm surge. The storm caused significant impacts to the City's water and sewer systems, critical municipal lifelines, which took several weeks to restore. City amenities and attractions essential to the City's economy were destroyed including the City Pier, all of the City's seven public parks, and the City's public beach access points. Critical facilities including police and fire structures were substantially damaged and inoperable. In addition, storm surge impacted transportation access throughout the City causing two City bridges to be impassable (Canal Parkway at Salt Creek and Highway 98 at 8th Street Canal).

The following data provides additional overview of the destruction Hurricane Michael brought to the City:

- All public facilities and infrastructure were damaged and out of service for a period of time. All businesses were impacted.
- 760 out of 1,690 structures were substantially damaged (over 50%), including 498 structures in the Shaded X zone which is typically not regulated.
- An additional 119 homes were close to being substantially damaged (40-49%), 751 homes were between 0% and 39% damaged; and only 166 had no damage.
- Over \$60 million of debris removal was required.



Figure 2. Extensive damage to the City Marina from Michael's storm surge. Source: City photo

Mexico Beach took immediate action after the storm to revise ordinances to leverage resilience into the rebuilding, perhaps the most effective approach to achieving long-term protection. For example, the Flood Ordinance was revised to update flood risk data, establish a higher vertical elevation standard, and expand the reach of regulated floodplain to include the Shaded X zone where so much of the damage occurred. Stormwater and high wind protections were also increased by way of ordinance and code revision.

Mexico Beach also vigorously pursued the post-disaster assistance that was immediately available. The City has applied for 24 Public Assistance grants to rebuild damaged public facilities and infrastructure, as well as seeking resilience components for several of these grants. It also received other grants to help in rebuilding and stabilizing the dune and beach. The State of Florida provided financial assistance as well including the funding for the development of this plan. See **Post-Michael Needs, Opportunities and Strategies**, and **Resilience Actions Completed or Underway** sections for detailed information.

Working together to rebuild stronger

To gather public input on the rebuilding process and the preparation of this plan, the City organized public engagement during 2020 Annual Gumbo Cookoff which was heavily attended after being canceled in 2019 due to Michael. A constant flow of traffic to the City's resilience booth facilitated an opportunity to explain the resilience actions both undertaken and proposed. The attending members of the public provided input through interactive project boards and comment cards. The results of this engagement showed a strong preference for community-level projects like infrastructure protection. See the **Planning Process** section for detailed information.



Figure 3. Resilience plan public engagement at the Annual Gumbo Cook-off. Source: Atkins team photo

Road map for resilience

As of June 2020, when this plan was finalized, the City has made extensive progress with rebuilding and resilience measures. While much has been accomplished, due to the level of destruction and the local commitment to comprehensive resilience, the City is setting its sights for the next round of resilience opportunities that will assist with a total rebuild of the city and an even higher level of resilience. A couple of the significant programs for which the City has submitted project applications or entered into effective partnerships to seek assistance include:

- Hazard Mitigation Grant Program (HMGP) projects – Includes five major projects to protect critical infrastructure like the wastewater system and the Police and Fire Stations,

augment stormwater protection, and provide protection at the canal inlet and back canal area.

- Recovery and Resiliency Partnership – a multi-agency partnership to provide increased resiliency and recreation across the city.

The high priority items emerging out of this planning process where immediate funding opportunities will be sought are:

- Critical Infrastructure Mitigation – Water System Protection / Redundancy
- Blue Trail Canal Slope Stabilization
- Stormwater Master Drainage System Components
- City Marina Seawall Mitigation
- Additional CRS Participation and Activities
- Canal Parkway Burial of Power Lines
- Community Survey
- Living Breakwaters (e.g., Oyster Reef) near the Canal Opening
- Beachfront Enhancement including Beach Renourishment

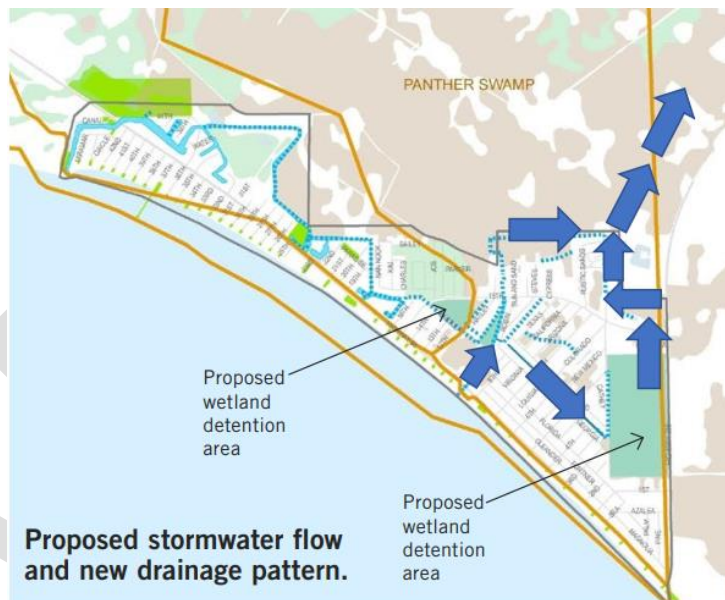


Figure 4. Proposed regional stormwater drainage concept. Source: Mexico Beach Recovery and Resiliency Partnership Stormwater Management and Greenspace Project

The additional priority resilience items will be actively pursued as the pursuit strategies for the high priority items are shaped:

- Protection of Critical Evacuation Routes
- Parking / Roadway Protection / Surge Barrier
- Elevation / Mitigation Reconstruction
- Flood Warning/Response
- Storm Surge Study

See **Implementation Plan for Projects and Actions** and **A Look Forward - Additional Project Ideas to Address Gaps** sections for detailed information.

Overall, this plan provides a strategic and tactical approach for the City to address its risk to major natural hazards as well as chronicling what it has already accomplished. The City will use this road map to implement its vision of greater resilience. As progress continues and new information becomes available, it will periodically update the plan.

Introduction

Plan Purpose

The Florida Department of Environmental Protection (FDEP), through the Florida Resilient Coastlines Program (FRCP), provided financial assistance aimed at preparing coastal Florida communities for current and future effects of rising sea levels, including coastal flooding, erosion, and ecosystem changes. The purpose of the FRCP Resilience Planning Grants (RPG) is to promote community resilience planning and vulnerability assessments and to address adaptation plans and comprehensive plan goals, objectives, policies, regional coordination, along with environmental justice. (source: FDEP website)

The Resilient Redevelopment Plan builds off the information in the Vulnerability Assessment to be a guiding force for the planning process and more importantly the actual needs of the community for the infrastructure and other recovery support functions to focus on strategies. The funding sources for the strategies will aid in not only recovery but also redevelopment in a stronger more sustainable way. This will allow the City of Mexico Beach to address their more pertinent needs and outline the best mechanisms for implementation of the strategies required to actually put the Plan into practice.

Outreach is also a key part of the planning process to obtain public involvement. Meetings and posting of plan drafts foster a discussion of the potential needs and opportunities and were utilized to develop projects and actions for implementation.

Plan Goals and Objectives

- Rebuild safer and stronger
- Maintain the community's unique character
- Protect critical infrastructure
- Enhance community appeal
- Provide a long-term vision and be opportunistic for shorter-term projects and opportunities

Study Area – The City of Mexico Beach

The project is focused on the City of Mexico Beach, which is located 25 miles southeast of Panama City, Florida. The City is located along the Gulf of Mexico in Bay County and is approximately 1.81 square miles of land directly on the coastline. The City's geographic center is positioned at 29.94124 degrees N, -85.40838 degrees. Its western border is Tyndall Air Force Base and its eastern border is Gulf County (unincorporated St. Joe Beach). Its northern border is St. Joe Paper Company land that is currently used for timber growth and harvest.

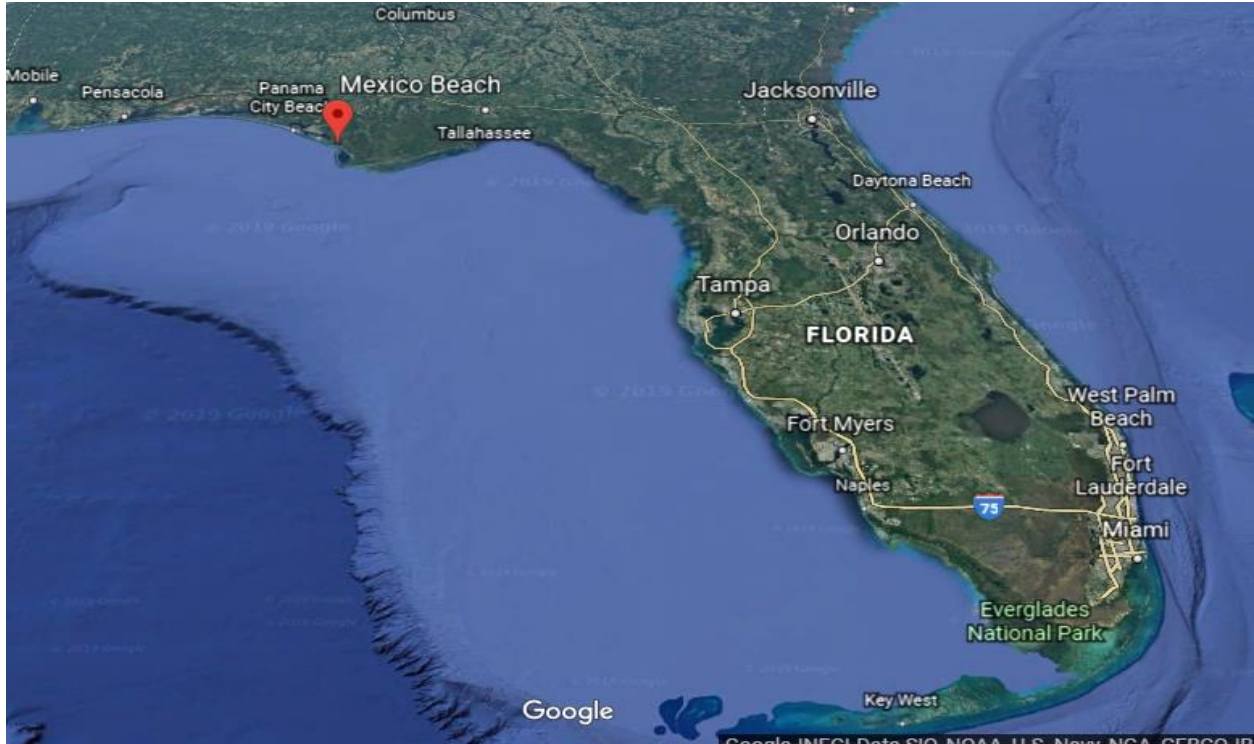


Figure 5. Mexico Beach's location along the Florida Panhandle coast

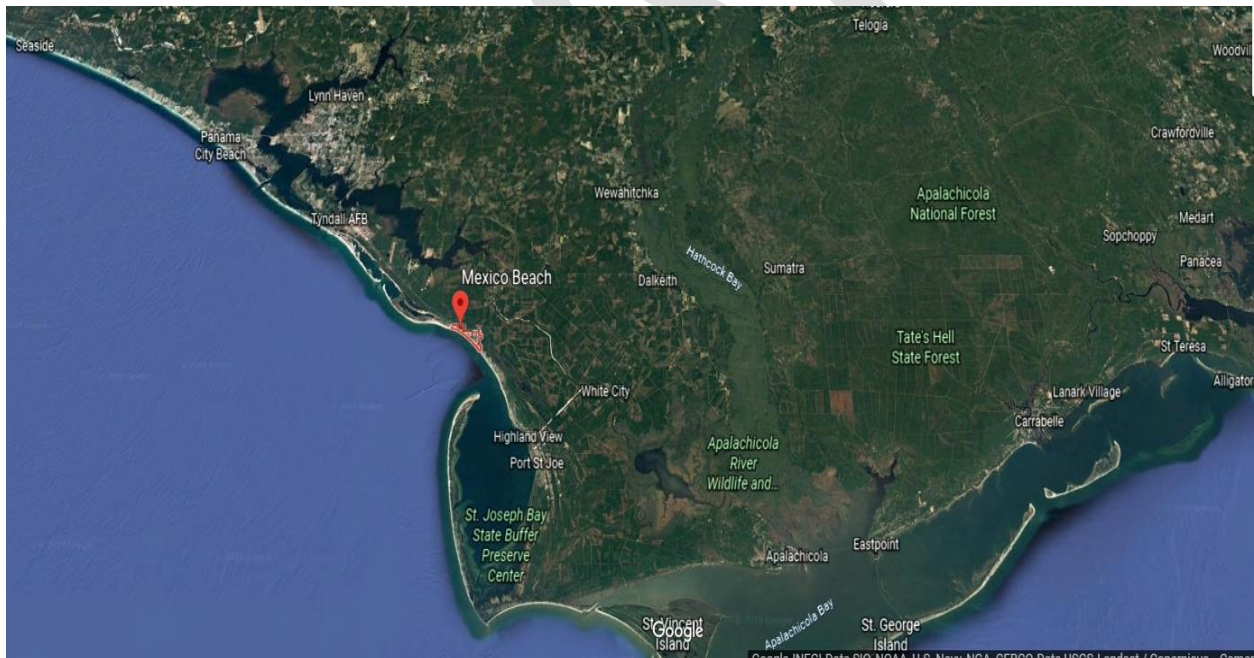


Figure 6. Proximity of Mexico Beach to neighboring cities in the Panhandle

The City was incorporated in 1966 and prides itself on its unique, non-corporate culture. On a day-to-day basis, this small, beachside community has a population of less than 2,000 residents, but during their tourist season (typically summer), the population swells to between 8,000 and 15,000 people. Almost all of the stores are locally owned, and there are no chain

restaurants or stores within the City limits. Most of the residents know each other, and the City is known as the “Mayberry by the Sea.” It is important for the City, during this difficult rebuilding process after Hurricane Michael, to maintain the Mexico Beach character, which its residents cherish, to the extent possible. The primary residents live in the City throughout the year. Many have lived there for multiple years while others have found it a good location to retire and make their primary residence. The most recent US Census survey data shown below in **Table 1** was taken before Hurricane Michael and therefore reflects a pre-disaster condition. Another source of data, the University of Florida’s Bureau of Economic and Business Research (BEBR), was conducted post-Michael and shows Mexico Beach’s 2019 population at 627, a dramatic drop off from 2018 (<https://www.bebr.ufl.edu/population>). In addition, the costs of recovery have stressed the financial resources of all the residents impacted by the storm so there is also a change in available income post-Michael. The City intends to get a better picture of current information through an updated survey, once an opportunity to do this becomes available.

Category	Data	Source
2018 Population Estimates	1,223	US Census Vintage 2018 Population Estimates
Median Household Income	\$57,917	2013-2017 American Community Survey 5-Year Estimates
Persons in poverty, percent	10.7%	2013-2017 American Community Survey 5-Year Estimates
Educational attainment: Percent high school graduate or higher	93.4%	2013-2017 American Community Survey 5-Year Estimates
Persons without health insurance, percent	9.4%	2013-2017 American Community Survey 5-Year Estimates
Median Housing Value	\$214,200	2013-2017 American Community Survey 5-Year Estimates
Total Housing Units	2.076	2013-2017 American Community Survey 5-Year Estimates
Male Median Income	\$34,866	2013-2017 American Community Survey 5-Year Estimates
Female Median Income	\$21,516	2013-2017 American Community Survey 5-Year Estimates

Table 1. Mexico Beach US Census information (source: <https://www.census.gov/search-results.html?searchType=web&cssp=SERP&q=Mexico%20Beach%20city,%20FL>)

To provide an additional baseline of information of city data, the U.S. Department of Housing and Urban Development (HUD) provides low to moderate income (LMI) information for the City derived from the 2011-2015 American Community Survey (ACS) and based on Census 2010 geography (from <http://hub.arcgis.com/datasets/HUD::low-to-moderate-income-population-by-tract?geometry=-85.852%2C29.881%2C-84.985%2C30.089>):

- 450 people are categorized as LMI in Mexico Beach’s Census Tract (Tract #000600; State 12; County 005)
- 38.14% of the overall population are categorized as LMI in this tract

The current state of the economy is tourism based due to the City’s beautiful beaches and location on the Gulf of Mexico. As mentioned above, the businesses are mostly locally owned and consist of hardware stores, accommodations, restaurants, as well as souvenir and gift

shops. There are no national chains or large commercial centers, except for fueling stations, within the community. Due to the economy of the City, it is expected that the tourism will increase once the community recovers from the hurricane damage. The locally owned nature of the businesses presents challenges in a major storm event as the residents are impacted by the storm and cannot rely on tourism to bolster the local economy. Additionally, the impact of infrastructure damages has negatively influenced the City's fishing launch points and sites, although the City is prioritizing those infrastructure projects first and foremost.

Figure 7 depicts the City's zoning map, and it identifies the areas of commercial activity, tourist commercial areas, as well as residential areas. It is important to note that the commercial areas that are identified include the local retail-type businesses and also residences that are either rental properties or are part of a homeowners' association. This further validates the small number of commercial areas within the City and indicates that these locations are where most future growth will occur. The vulnerability of these areas combined with the importance to the economic engine of the community supports the consideration of more stringent regulations and ordinances. Following Hurricane Michael, the Land Development Regulations were updated (in February 2019) to outline requirements for all types of development.

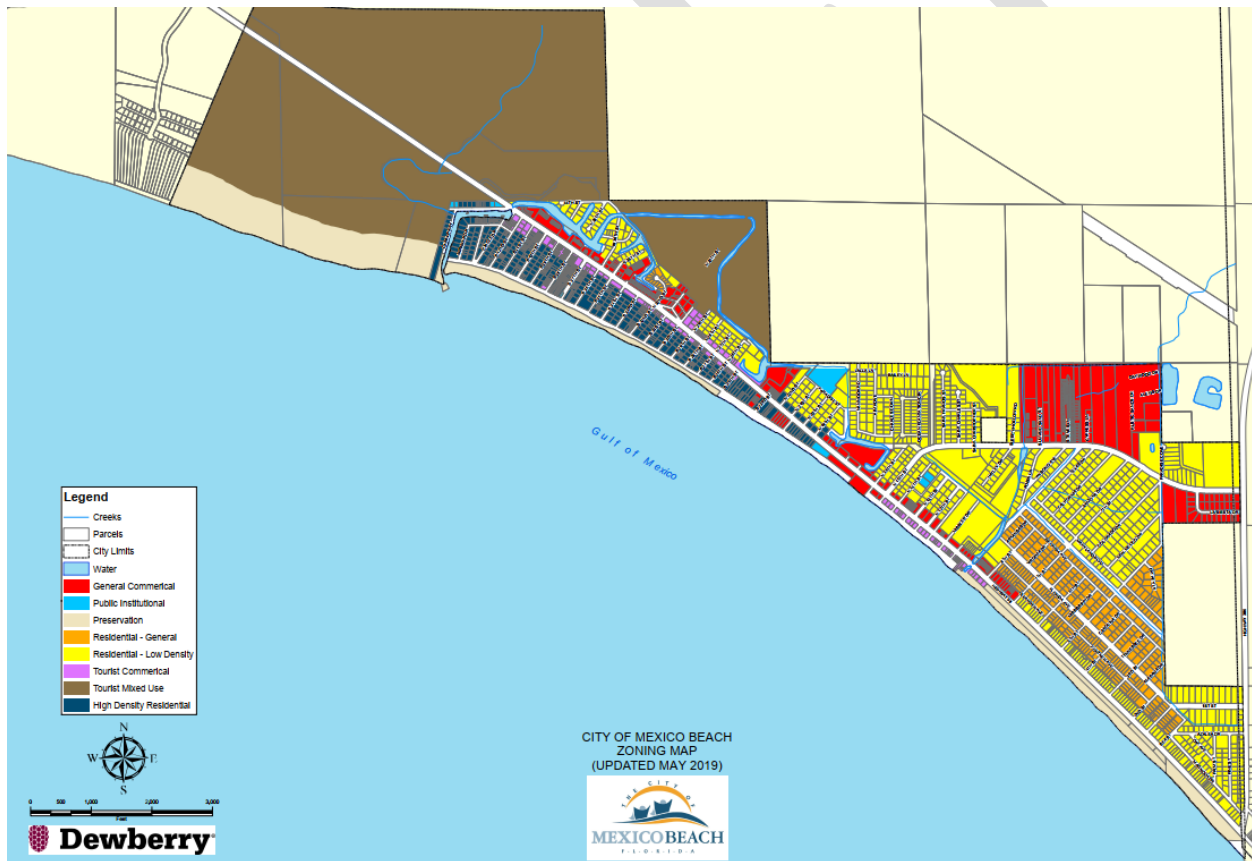


Figure 7. City Zoning Map

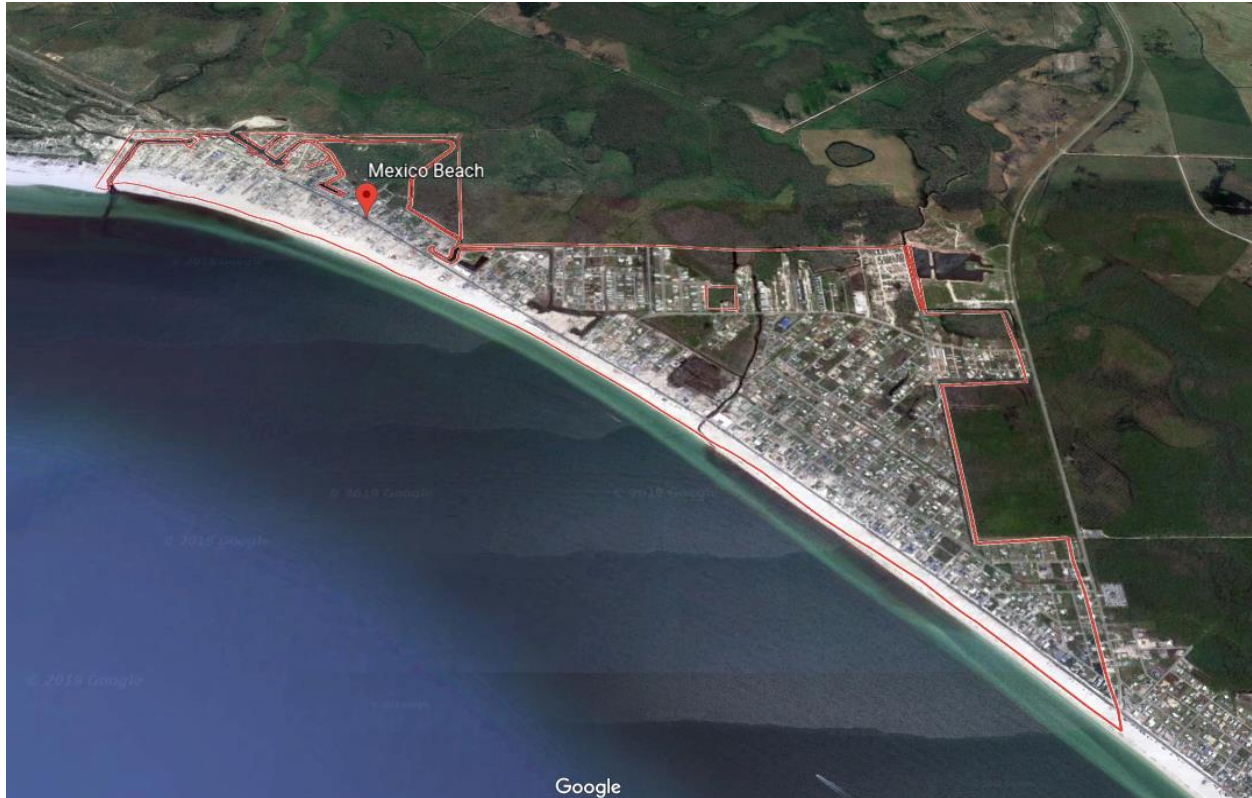


Figure 8. Map of Mexico Beach from Google Earth

Hurricane Michael Impacts

Hurricane Michael, a Category 5 storm, was the strongest hurricane on record to make landfall in the Florida Panhandle. Mexico Beach and neighboring Tyndall Air Force Base were ground zero for the center of the hurricane's landfall. The maximum winds were 161 mph and the storm surge rose 9 to 14 feet from Mexico Beach to Indian Pass in the east. Mexico Beach had approximately 70% of its structures destroyed and lost all of its infrastructure. Approximately 95% of the City's geographic area was inundated by storm surge. The storm caused significant impacts to the City's water and sewer systems which took weeks to restore. Recreational and green space infrastructure vital to the City's economy were decimated including the City Pier, all of the City's seven public parks and the City's public beach accesses. Critical facilities including police and fire structures were substantially damaged and inoperable. Storm surge also impacted accesses throughout the City causing two City bridges to be impassable (Canal Parkway at Salt Creek and Hwy 98 at 8th Street Canal). **Figure 9** depicts the incredible power of Michael's surge and **Figure 10** provides overall storm statistics.

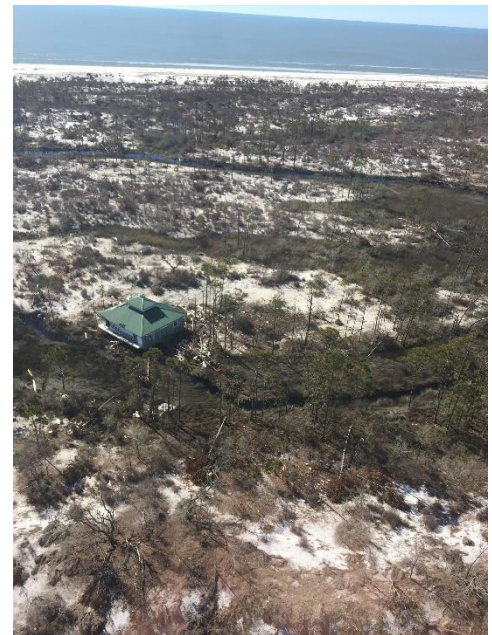


Figure 9. A house that floated 1000 feet up Salt Creek, a feeder body to the navigable canal, due to storm surge

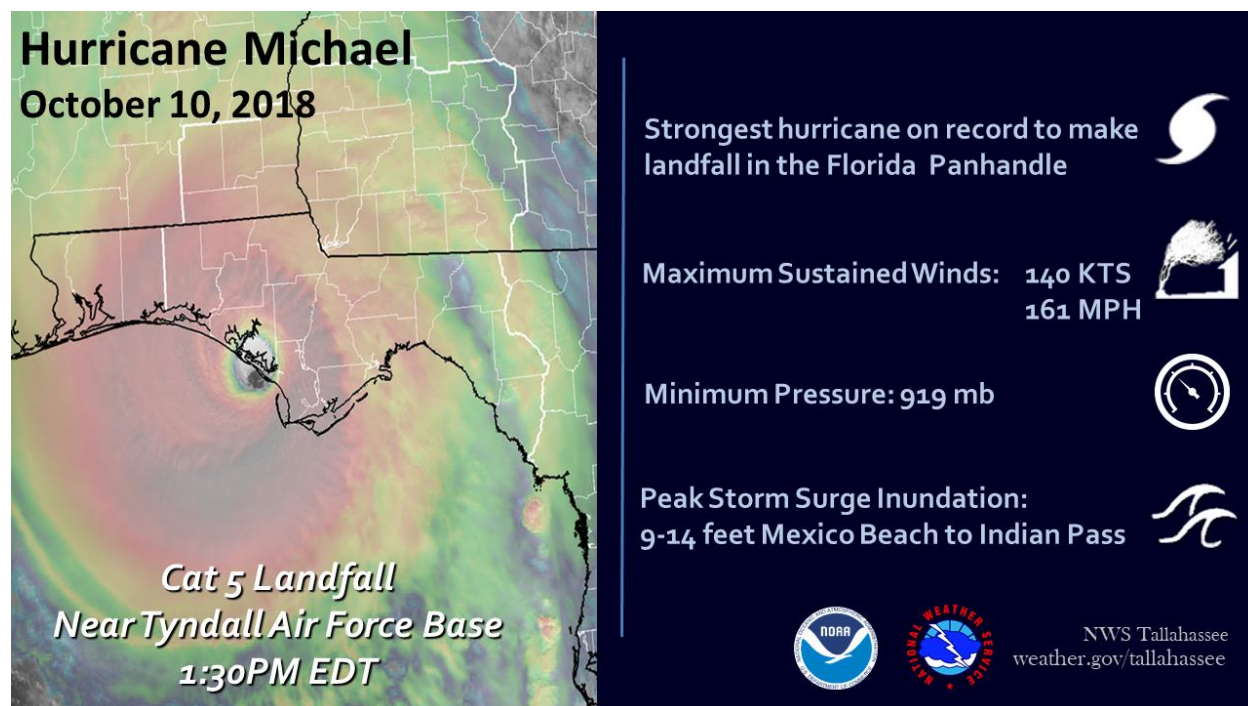


Figure 10. Hurricane Michael information (source: www.weather.gov/tae/HurricaneMichael2018)

The storm left a tremendous amount of debris; within two weeks, the debris bill was already \$10 million for a city with cash reserves of \$1 million. Over 30,000 dangerous trees/limbs were removed and approximately 1.2 million cubic yards of debris were removed resulting in an estimated \$55-65 million in debris costs. The total estimated cost of damage is approximately \$200 million. The Florida Division of Emergency Management (FDEM) awarded Mexico Beach \$1.1 million to support first responders as part of the Hurricane Michael State Recovery Grant Program. The City lost all of its infrastructure during the storm, except for City Hall and the Public Works building which were damaged but not a total loss. City employees worked countless hours to respond to the emergency with the resources available. The City's water tower, which is next to City Hall, was toppled by the event and likely caused additional flooding to the adjacent Public Works Building. City Hall had approximately six inches to one foot of water from the flood while the Public Works building had two feet of water. The debris removal effort, as well as restoration of utilities, was the critical first step to clear roads and lots. This allowed safe utility connections for rebuilding and repair to begin.

Volunteers and non-profit organizations contributed a tremendous amount of time and sweat equity in the form of clearing lots and cleaning up debris. Overall, volunteer agencies, groups, and individuals donated more than 780,000 hours to the City's recovery. Material and supply donations were valued at approximately \$1 million and monetary donations have exceeded \$200,000. Additional impacts from the storm were the tremendous loss of trees and vegetation altering the natural landscape. In addition to marring the natural beauty of the area, the loss of trees will likely make high winds a greater hazard to the structures that are on the landward side of US 98. The loss of trees takes away a barrier that helps break up the wind. The loss of trees and other vegetation also takes away water-loving plants that help absorb stormwater; thus, this reduction could also contribute to higher stormwater risk.

The City’s consultant, Atkins, performed a substantial damage assessment of all the structures in Mexico Beach after Hurricane Michael by Atkins which resulted in the following table that identifies which flood zone each of the substantially damaged properties was located in (out of a total of 1,690 structures evaluated):

Flood Zone	Number of Residential Substantially Damaged Properties	Percentage of Damage Flood Zone Properties
A, AE, VE	196	25.7%
Shaded X	498	65.5%
Unshaded X	66	8.8%
Total (All Zones)	760	

Table 2. Substantially damaged properties by flood zone

An additional 119 homes were close to being substantially damaged (40-49%). 751 homes were between 0% and 39% damaged; out of this group, 166 had no damage. The table below identifies the 760 substantially damaged properties per the primary hazard causing the damage.

Primary Cause of Damage	Number of Residential Substantially Damaged Properties	Percentage of Overall Damaged Properties by Hazard
Flood	581	76.4%
Wind	80	10.5%
Flood and Wind	99	13.0%

Table 3. Substantially damaged properties by hazard type

The FEMA Mitigation Assessment Team (MAT) Report for Hurricane Michael (Tables 3-2 and 3-3 in that report) provided information on the number of flood insurance claims in the jurisdictions most heavily impacted by Hurricane Michael including Mexico Beach. The average Mexico Beach claim, \$125,836, was the highest for these five communities:

Community	Zone V	Zone A	Zone X	Total Number of Claims	Average NFIP Claim Amount
Port St. Joe	165	382	197	744	\$71,089
Panama City	23	403	277	703	\$17,463
St. George Island	277	132	13	422	\$9,824
Mexico Beach	0	129	290	419	\$125,836
Lynn Haven	9	107	186	302	\$19,540

Table 4. Comparison of flood insurance claims from five hard-hit communities in Hurricane Michael

A surprising number in this chart is the overall small number (zero in Mexico Beach) of claims in the V zone, which was recognized in the MAT report but an explanation was not provided. From the Mexico Beach perspective, the low number of V zone claims shown in this table could be due to the following reasons:

- The data in this table was gathered around the summer of 2019 and does not represent any new claims since then.
- The number of structures in the V zone was relatively small to begin with (approximately 60)

- For some of the properties, the damage may have primarily been wind.
- Some of the properties may have been owned outright and thus did not have the mandatory insurance requirement that comes with a federally backed mortgage.

Figures 11 and 12 on the following pages depict the level of damage from Michael through aerial imagery. Hyperlinks are provided below the imagery to view the original imagery on the National Oceanic and Atmospheric Administration (NOAA) website. This site has the aerial imagery captured in the immediate aftermath of the event as well as images with sliders that let the user “slide” back and forth between pre- and post-event imagery.

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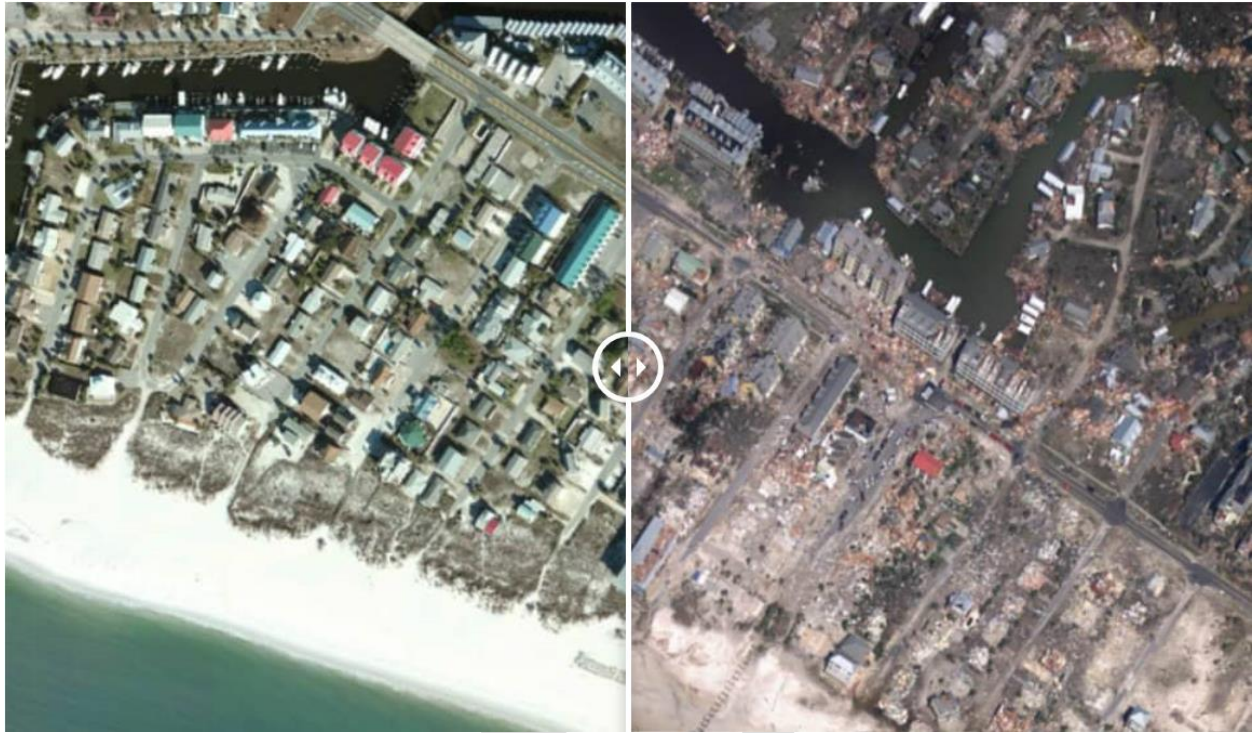


Figure 11. Hurricane Michael before/after photos – Canal Area (source: NOAA <https://oceanservice.noaa.gov/news/oct18/michael-storm-imagery.html>)

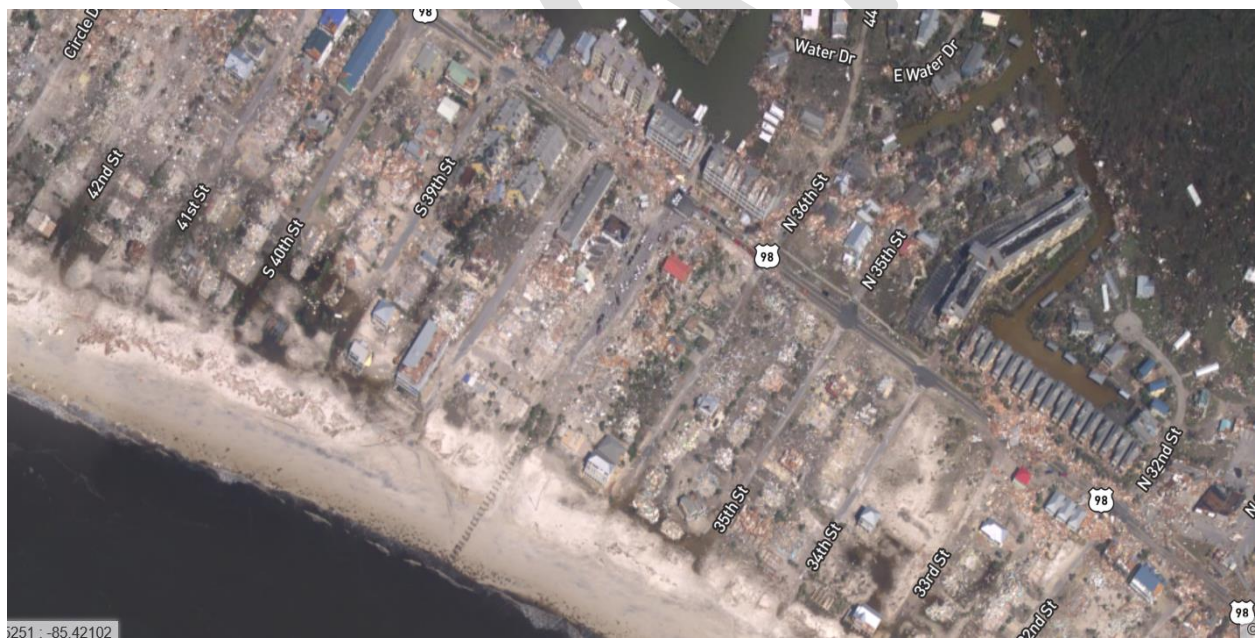


Figure 12. Additional after imagery (source: NOAA <https://storms.ngs.noaa.gov/storms/michael/index.html#14/29.9427/-85.3911>)

The imagery in **Figures 11** and **12** shows the level of devastation of the storm from the beach to Highway 98 after Hurricane Michael. Most of the structures in this area were completely destroyed, yet many of them are not in the FEMA Special Flood Hazard Area (SFHA). The SFHA is also known as the 100-year, or 1% annual chance, flood zone. Instead, these

structures are within the Shaded X zone, which is more commonly known as the 500-year, or 0.2% annual chance, flood zone. Additional imagery showing the extent of damage from Hurricane Michael is located in **Appendix A**.

Plan Benefits

This Redevelopment Plan is a community-driven plan to rebuild better, safer, and smarter after the impacts of Hurricane Michael. The Plan is integral to the City's rebuilding effort by providing a boost to existing efforts and to continue rebuilding in a resilient fashion throughout a critical phase of the City's recovery. It is also intended to help maintain the City's unique character. The first part of the Plan is a robust vulnerability assessment that reflects current and future risk to the most significant natural hazards to help the community adapt to it. The second part of the Plan includes actions to help become more resilient and generally aligns with the National Disaster Recovery Framework by capturing needs, opportunities, and measures in several of the recovery support function (RSF) categories.

In recognition that resources, in the form of funding and technical assistance, generally follow organization at the community level, this plan is an umbrella document that is built on current efforts and helps identify remaining needs, opportunities, and potential projects with community input. While the hurricane has imposed untold hardship on the community and its residents, the rebuilding presents a unique chance to re-shape the community towards a dynamic future. The planning process is set up to comprehensively review opportunities, both post-disaster ones and others, so that the relevant and feasible ones are identified.

The first part of the Plan, the Vulnerability Assessment, evaluates both current and future risk to flooding, hurricanes, and high wind; helps the community understand its risk; and then sets the stage for the review and vetting of opportunities to determine if they are a good match for Mexico Beach. As funding organizations beyond FEMA and the State consider places in which to invest for their programs, this planning process has a list of actions and projects ready to be developed in detail. The development of this plan demonstrates the City's commitment to resilience in the face of increasing future risk, which is critical for the long-term sustainability of the community but is also emerging as an increasingly important financial factor (e.g., companies like Moody's consider it when establishing municipal bond credit ratings).

Most importantly, it is an opportunity for the City and its stakeholders to 'step back' and evaluate the best ways to assure a prosperous and successful future of Mexico Beach that fits its traditional character. Experience has shown that sustained and successful long-term recovery processes started with a well-organized plan.

A summary of benefits of the Plan include:

- **Provides a road map to the future – mitigation is a continuous process.** Provides guidance on selecting from a range of potential future actions that are staggered in time.
- **Analyzes current and future risk as well as lessons learned from Michael.** In addition to the current risk, the Plan identifies where and how the risk to flooding and wind is increasing so this can be factored into the protection level of structures and infrastructure during the rebuilding process.
- **Catalogs which resilience actions have been completed and identifies remaining gaps toward achieving greater resiliency.** Preparation for the next wave of resilience and recovery grant opportunities includes assessing what has been done and what is in

the works and identifying additional project needs for recovery and resilience. It provides basic scoping of projects for multiple grant sources including FEMA's Hazard Mitigation Grant Program (HMGP) and new upcoming Building Resilient Infrastructure and Communities (BRIC) program as the next wave of disaster and mitigation grants become available.

- **Helps set up the City for CDBG-DR funding opportunities.** The potential magnitude of the CDBG-DR funding for Michael warrants special attention, and this plan helps outline what could potentially be submitted for CDBG-DR funding in a systematic way.
- **Presents an opportunity to evaluate Community Rating System (CRS) opportunities.** The City is interested in building and advancing its National Flood Insurance Program (NFIP) CRS program which has the potential, if enough CRS Credit Points are accrued, to lower flood insurance premiums for the City's policyholders. The second part of the Plan identifies the actions that could obtain credit points within three out of the four of the main credit point areas:
 - Part 300 – Public Information Activities
 - Section 440 – Stormwater Management
 - Part 500 – Flood Reduction Activities including aligning with the Activity 510 Floodplain Management Plan criteria

With Hurricane Michael, the City of Mexico Beach has faced devastation like never before. The City, which depends on tourism, lost all businesses and government buildings except for City Hall and the Public Works building. Homeowners returned to witness the devastation and formulated plans for alternative housing during the rebuilding phase. The City has already taken significant steps forward like modifying its flood ordinance to include the Shaded X zone in the SFHA in order to trigger a more resilient rebuilding process. This Resilient Redevelopment Plan (Redevelopment Plan or Plan) represented a window of opportunity to conduct an in-depth analysis of what happened as a result of the storm, where vulnerabilities to flood and high wind are greatest, and what additional activities and projects are needed to attain a more resilient city. Some of the issues are not within the City's control (e.g., power supply), and some issues are up to the individual property owners. Collectively, the City and its stakeholders in resilience can use this plan to help support a more resilient future.

Planning Process

The plan development process for the Resilient Redevelopment Plan started on September 20, 2019 with a kickoff meeting with the Mexico Beach City Manager. In this meeting, documents, data, and information important to this planning process were discussed. This discussion included data needed to conduct the vulnerability assessment, other grants, and projects in progress and being contemplated. The rest of the discussion included best practices for adaptation and mitigation. Additional documents that were needed were noted, such as the current County Local Mitigation Strategy (LMS), the status of the EPA grant, potential projects for the HMGP, and the 2019 update of the Comprehensive Plan.

Previous discussions with City Staff and information from Atkins' staff embedded in the recovery operation provided additional data and information like Public Assistance (PA) projects and the effort to join the CRS. Also, an Atkins planner was involved with the development of HMGP projects, so information was also gathered from that process.

The first steps in the planning process were to take data from the Substantial Damage Estimate (SDE), preliminary FIRMs, and other information from the City to develop the Vulnerability Assessment. The Bay County Local Mitigation Strategy (LMS) coordinator was also contacted periodically throughout the process, and the 2020 update of the LMS, a work in progress, was reviewed. Relevant information from these related documents and programs were incorporated as needed.

Below is a list documenting the key events that have occurred during the development of this plan:

- Kickoff meeting on September 20, 2019 – City goals and ideas were collected and captured in the Plan.
- Visit to the City on December 11, 2019 by Florida Department of Environmental Protection (FDEP) – Plan background information and draft Vulnerability Assessment information was presented to FDEP, the City, and Bay County Local Mitigation Strategy (LMS) leadership.
- Vulnerability Assessment draft due to FDEP by December 31, 2019 (This was originally scheduled for October 31, 2019, but due to a later than expected start, a change order moved it to December 31, 2019. It was later modified to January 20, 2020 to accommodate a change in the order of tasks within the scope of work.)
- Community Workshop at the City's Gumbo Festival on February 22, 2020
- Due to the COVID-19 Pandemic, FDEP approved a Period of Performance (PoP) extension from April 30, 2020 to June 30, 2020 since conducting a public meeting in April was not feasible and many interested parties had to adjust how they conducted business during the outbreak.
- Review of final draft plan – a review of the draft material and a final engagement (conducted virtually due to COVID-19 constraints)

Presentation of Initial Vulnerability Assessment Findings

On December 11, 2019, FDEP made a site visit to the City of Mexico Beach to check on the status of the Plan and the overall process for delivering the scoped items based on the grant. The FDEP Resilient Coastlines team of Whitney Gray and Faith Clarke were present. Also, in attendance were:

- Mario Gisbert, City Manager
- Thomas Wilson, City Utilities Superintendent
- Dina Bautista, City Engineer on retainer
- Frankie Lumm, Bay County Local Mitigation Strategy Lead
- Michele Moore, K2 Project Management Solutions, LLC / CDR Maguire (consultant to Bay County during the Hurricane Michael Recovery)

Atkins presented the findings of the report and a detailed discussion ensued.

Public Engagement and Outreach

As with any publicly available community plan, it is extremely important to conduct outreach to share findings and solicit input. Stakeholders within the community provide valuable input regarding the jurisdiction in which they live and work. The technical portion of the Plan itself has been informed with information from city officials who are working daily on projects and grants as well as the use of data to estimate vulnerability and determine appropriate strategies for implementation as well as define which funding opportunities are applicable.

The outreach for this plan consisted of three opportunities for engagement:

- Resilient Redevelopment Plan Introduction
- Vulnerability Assessment Review and Selection of Potential Projects
- Final Draft Plan Presentation

February 22, 2020 Public Outreach Event

The Mexico Beach Annual Gumbo Cook-off is one of the City's biggest events each year. It is an annual event that has a two-decade tradition. The only year it was not held was 2019 as it was right after Hurricane Michael, so the 2020 event, the 21st recurrence of the event, was a very poignant, emotional, and powerful gathering as the Mexico Beach rebuild continues. In 2020, the event took place on February 22 at the Boat Ramp Park, which is a new, larger venue that is centrally located just off Highway 98. Normally this event would be held in Sunset Park, but this area was still completely destroyed and not available for the event. The Boat Ramp park had plenty of parking and a nice location along the canal waterway and provided an adequate substitute. During the cook-off, individuals prepare their version of gumbo or Brunswick stew and sell samples of the food. The gumbo and Brunswick stew are tasted and judged for awards in multiple categories. The funds raised from the endeavor support the local 4th of July fireworks celebration. The City has made it a priority to return the event back to a beachside location when feasible. **Figures 13** and **14** show examples of how the City promoted the event.



Figure 13. Facebook notification of the Gumbo Cookoff

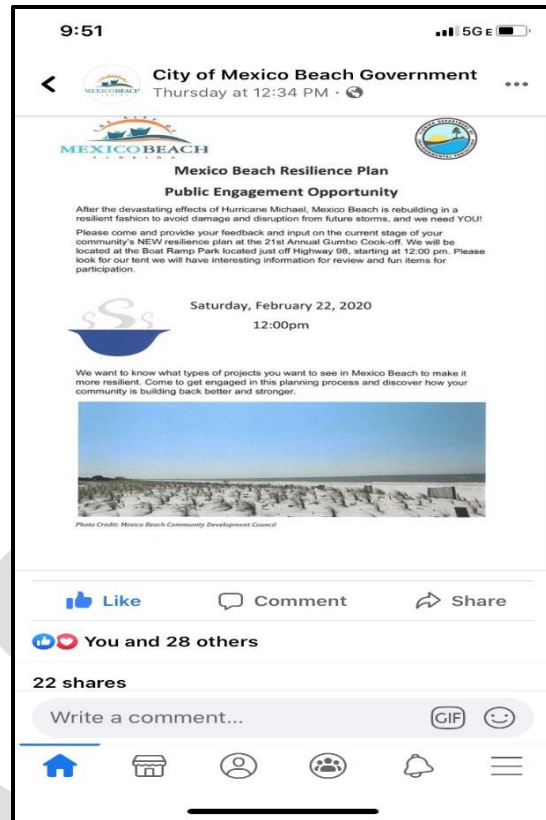


Figure 14. Facebook notification of the Resilience Plan Engagement Opportunity at the Cook-off

On February 22, the Gumbo Cook-off drew a large audience of supporters; possibly the largest since the initiation of the event. This may have been due to the lapse in the event being held for one year because of the destruction of Hurricane Michael. The size of the event was also due to neighboring communities rallying to support the morale and economy of the City. This particular cook-off was also unique in that the local citizens and frequent visitors to the community were given several opportunities to learn more about the recovery and resiliency intent in the City, along with the current efforts and potential projects for rebuild. Various organizations, including the City, its partners, and the Mexico Beach Artificial Reef Association, were present showcasing materials for the Recovery and Resiliency Partnership (RRP), a city partnership with FEMA and the U.S. Environmental Protection Agency that includes a design to overhaul the master storm water system, and this Redevelopment Plan.

During this public engagement effort, Atkins prepared numerous materials for use that included the following (these are available for viewing in **Appendix D**):

- Double-sided flyer
- Storm surge map
- Sea level rise map
- Two poster boards identifying 12 potential project types
- Feedback and comment form

An information booth was set up with these materials laid out under a tent with tables. The sign-in sheet, along with the flyer and feedback and comment form, were on a table at the front of the area. The flyer provided specific instructions as to exactly what individuals were being asked to do at the booth on the front side. The bullets on the back side of the flyer listed data used to prepare the Plan and provided general information on the potential projects as well actions that the City has already taken. Relevant examples from other Florida communities were also described. Finally, the specifics on the posting location of the Final Plan for review was listed.

At the back of the area, the storm surge and sea level rise maps were laid flat on tables to enable individuals to write on the maps. On adjacent tables, colored dot adhesives, post-it notes, flags, and pens were spread out beneath two 24" x 36" boards that displayed images of potential projects for Mexico Beach. Underneath each image, a description of the action as well as examples were outlined. **Figures 15** and **16** depict the set-up inside and outside the tent.

At the entrance to the booth, an Atkins staff member met individuals showing an interest in the signage and space, shared the double-sided flyer, and asked each person to sign-in. The staff member then explained that a storm surge map labeled based on the hurricane category was available for comment. Individuals were asked to provide information based on factual details of the occurrences during and following Hurricane Michael. The sea level rise map, showing the more likely scenarios of 1-2 feet and 2-4 feet, was also provided as an additional reference. During the event, 38 people signed in and the total number of visitors that reviewed the information is likely over 60 people. See **Appendix E** for the sign-in sheets.



Figure 15. Getting a visitor acquainted with the information



Figure 16. Welcome sign to the tent at the Gumbo Cook-off

The staff member then guided the individuals over to two potential project boards containing the following projects:

- Structure Elevation
- Mitigation Reconstruction (demolishing existing building and rebuilding a code compliant one in the approximate original footprint)
- Stormwater Infrastructure Improvement
- Community Infrastructure and Lifelines (includes protection to first responder facilities)
- Road Elevation/Protection
- Utility Mitigation/Wastewater System Protection
- Dune Restoration
- Surge Gate
- Jetty Improvement
- Wind Retrofit-Property Protection
- Power System Support
- Planning and Regulations

Individuals were asked to review the boards and consider the options to determine which one or ones they felt might be viable for Mexico Beach. Upon making a decision, individuals were able to place a colored adhesive dot on the chosen picture(s) as shown in **Figures 17** and **18**.



Figure 17. Review of the project boards by the public



Figure 18. Review of the project boards by the public

At this meeting, the following tasks were accomplished:

- Disseminate basic vulnerability assessment information
- Review the Task 1 vulnerability assessment draft

Planning Process

- Receive input on initial draft list of projects
- Identify other information that is needed

The results of the public's input on the project is below in **Figures 19** and **20** (each participant was given three stickers to indicate their preferred options):



Figure 19. Project board showing results – first board

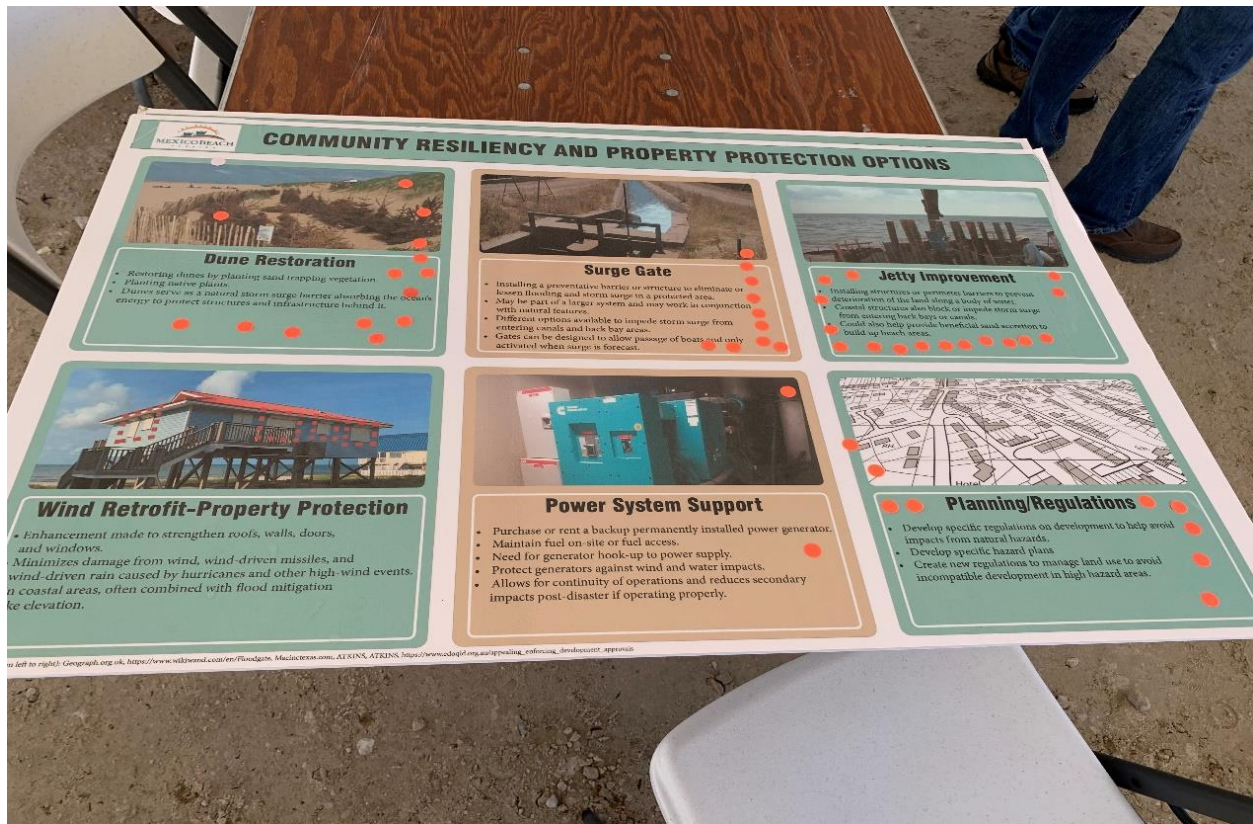


Figure 20. Project board showing results – second board

The tallied results from the project board public review are found below in **Table 5**. There was a clear preference for the community-level projects. The projects that received the most interest (over 10 stickers) were the jetty improvement, community infrastructure and lifelines, stormwater infrastructure improvement, dune restoration, and surge gate. This outreach activity attained its objective of obtaining insightful feedback from the community residents.

Projects	Number of Dots (3 per person)
Community Level Projects	
Jetty Improvement	16
Community Infrastructure and Lifelines	16
Stormwater Infrastructure Improvement	15
Dune Restoration	14
Surge Gate	10
Planning/Regulations	9
Utility Mitigation/Wastewater System Protection (Pumps)	9
Road Elevation/Protection	5
Power System Support	2
Individual Property Projects	
Mitigation Reconstruction	1
Structure Elevation	0
Wind Retrofit – Property Protection	0

Table 5. Results of public review of the project boards

March 17, 2020 Posting of Vulnerability Assessment

As a follow up to the February 22 outreach event, the draft Vulnerability Assessment that was submitted to FDEP was posted on the City of Mexico Beach’s website. The maps that showed locations of damaged individual properties were redacted to protect personal information.

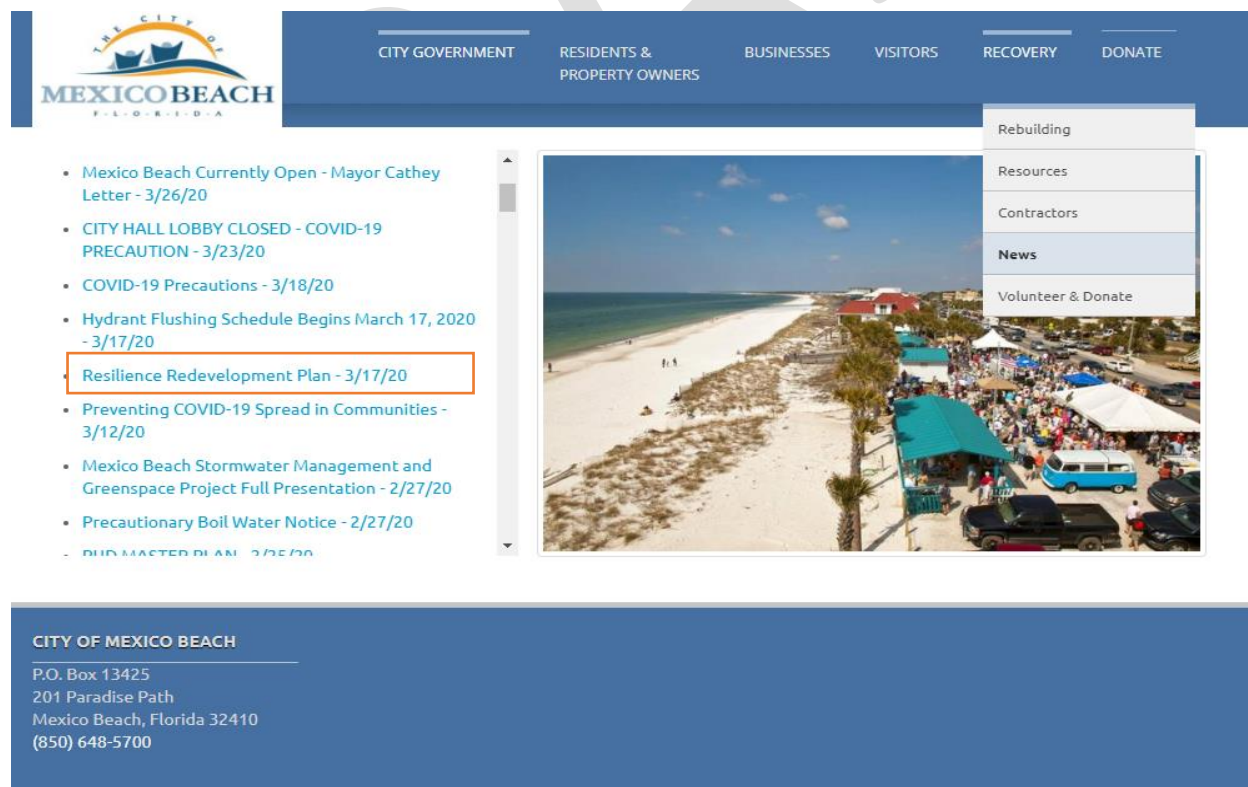


Figure 21. Mexico Beach website screenshot with Resilience Plan posted

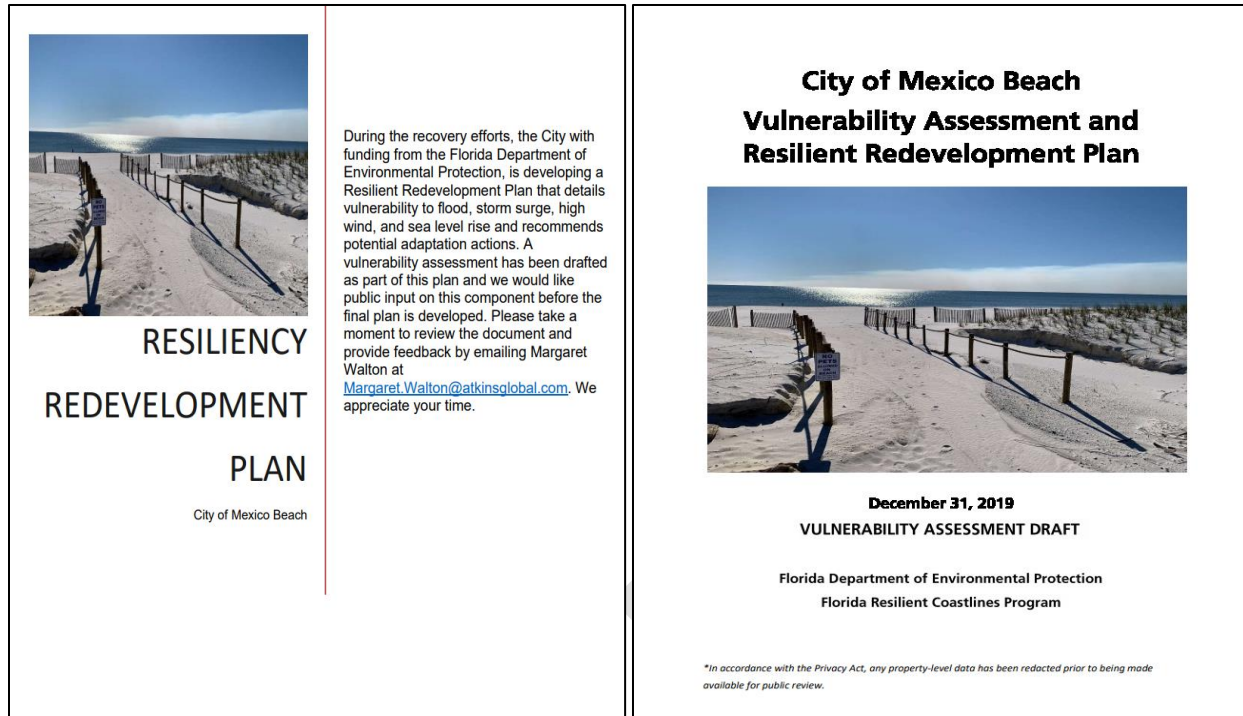


Figure 22. Mexico Beach website Resilience Plan notification Figure 23. Screenshot of the posted Vulnerability Assessment

Comments received revolved around specific adaptation options for the focus areas within the vulnerability assessment. Most importantly, City residents were concerned about potential funding sources for the various projects for the infrastructure and rebuild of Mexico Beach. Individuals inquired as to not only the funding sources but the initial costs and share that the City would have to invest and how the exact cost estimates would be determined. Lastly, concerned citizens wanted to ensure that they would continue to be part of the process moving forward when projects are chosen and the resiliency plan is adopted. **Figures 21 to 23** document the City’s posting and notification efforts for the draft Vulnerability Assessment.

The Plan was also presented on the May 13, 2020 FDEP Coastal Resilience Forum Quarterly Webinar which attracts a diverse audience of government, academics, and the private sector.

June 2020 Posting of Complete Draft Plan

This plan is being posted on the City’s website for public comment and feedback. Once public input is received and the plan has been revised with the comments, an updated version will be sent to FDEP. The goal is to post on the Mexico Beach website by July 6, 2020 and receive comments after a two-week period. Previous interested parties will be contacted specifically to notify them of the opportunity to review the final draft plan.

Final Public Engagement

Pre-recorded information will be developed for a virtual public engagement event scheduled for July 2020. The public comments on the plan will be reviewed which may result in some changes to the final plan which is anticipated to be ready by the end of July 2020.

Vulnerability Assessment

The Vulnerability Assessment identifies the present and potential future flood hazards of flash floods, storm surge, stormwater runoff, high tide events, and the effects of sea level rise as well as high wind events (particularly those caused by tropical storms and hurricanes). Once the hazards were assessed, potential scenarios were evaluated examining the exposure and sensitivity of the City to the hazards. The ability of key city assets and infrastructure to adapt to address the effects of the hazards was also examined. This process also looked at the impacts on the critical assets of the City and how many are truly vulnerable to these particular hazards and events. The Vulnerability Assessment provides the detailed impacts and maps to depict the risk. This sets the stage for the review of needs and opportunities in the second part of the Resilient Redevelopment Plan.

History of Major Storms in Bay County (from 2015 LMS):

In the past, Bay County has experienced a tropical hurricane, on average, once every 3.5 years. In the past 30 years, the County has been hit by several major storms in addition to Hurricane Michael in 2018.

Hurricane Eloise

In 1975, damage from Hurricane Eloise in Bay County totaled US \$50 million (1975 dollars) and is attributed with 4 deaths, all indirectly associated to the storm. ([Quarterly Journal of Engineering Geology & Hydrogeology](#); November 1979; v. 12; no. 4; p. 281-290)

Hurricane Kate

In November 1985, Hurricane Kate crossed through the County with over 100 mile an hour winds though damage to structures and beaches was not considered severe. (<http://redcross.tallytown.com/kate.html>.)

Hurricane Opal

Hurricane Opal in October of 1995 caused 125 mile an hour wind gusts along with estimated seven-foot storm surges in the County. Bay County sustained the most overall damage in the Panhandle, with damage to 341 coastal structures, due to the high density of development and large number of structures which were not designed and constructed adequately to withstand the impacts of a major (e.g., 100-year frequency) hurricane. The CCCL for Bay County had not been reestablished prior to Opal as it had been for the other Panhandle counties; therefore, habitable structures in Bay County were not required to meet the more stringent siting and design standards of the State's CCCL program intended to prevent structural damage caused by a major storm event such as hurricane Opal. (http://www.floridadisaster.org/BRM/Mit_Success/ms_cccl_buildings_survive_opal.htm.)

Tropical Storm Barry

During Tropical Storm Barry in August 2001, Panama City reported as much as 11 inches of rain and heavy damage caused by waves, and storm surge was extreme. Storm surges and tides associated with Tropical Storm Barry were two to three feet along Bay County beaches. (<http://www.nhc.noaa.gov/2001barry.html>)

Hurricane Ivan

Hurricane Ivan struck in September 2004 causing over 2.5 million cubic yards of sand loss to

the beach areas. The erosion impact and structural damage to the County's coastal development was significant, though not severe. The protective buffer of the Panama City Beaches Beach Erosion Control and Storm Damage Reduction Project can be credited with reducing losses to beachfront development. The project, which was completed in April 1999, consisted of the placement of 9 million cubic yards of sand over an approximate 17.5-mile shoreline length. Prior to Ivan, the project area still retained roughly 91% of its original volume. Although a significant volume of sand was lost from the beach area into offshore areas as a result of Ivan, the beach project did the job it was intended to do in providing storm protection to upland development in the Panama City beaches area (*Coastal Planning and Engineering, Inc., Post Ivan Storm report December 2004*).

Hurricane Dennis

Hurricane Dennis of July 2005 caused flooding to a significant number of homes and businesses along the coast in Bay County in Panama City, Panama City Beach, and Lynn Haven (*CNN.com*).

Both Ivan and Dennis caused considerable erosion to the project area, and the erosion losses appear to have been comparable to the losses sustained during Opal of 1995; however, in comparison to the very severe coastal construction damage that was caused by Opal, Ivan and Dennis inflicted only a minor erosion, even though the storm tide conditions were essentially the same. The beach restoration project proved to provide adequate protection. (*Keehn and Armbruster, 2005*)

Hurricane Katrina

Hurricane Katrina of August 2005 exacerbated the coastal erosion situation. No damage to any structures was reported. (*Coastal Planning and Engineering, Inc., 2005 Hurricane Impact and 2007 Renourishment Project Design Analysis Panama City Beaches, May 2007*)

Tropical Storm Alberto: On June 12, 2006, Tropical Storm Alberto hit, and storm tides averaged one to two feet. Winds knocked down several trees and power lines resulting in power outages.

Tropical Storm Fay: On August 22, 2008, the storm made landfall to the east of Bay County near Tallahassee, FL. A resident of the County lost control of their car due to heavy rainfall and crashed into a tree resulting in their death. There were several reports of downed trees and power lines throughout the County.

Tropical Storm Fay also resulted in heavy rainfall and gusty winds in Gulf County. A six-foot storm surge occurred, washing out Indian Pass Road on the eastern edge of the County. Rainfall caused localized flooding, power outages, and some damages to businesses and homes. (*2015 Gulf County Local Mitigation Strategy*)

Tropical Storm Claudette: Tropical Storm Claudette made landfall on August 16th, 2009, and sporadic wind damage was reported in the County. A resident lost their life as a result of strong surf.

Hurricane Ida: On November 9, 2011, the storm made landfall west of Bay County. Power outages from downed trees and power lines affected portions of the County.

Tropical Storm Debby: Tropical Storm Debby made landfall on June 24, 2012. Moderate beach erosion occurred with a storm surge value at Panama City measured at 1.50 feet with a storm tide of 2.42 feet.

Other Events

Bay County experienced record rainfall in late April and early May of 2014 as part of the presidentially declared disaster DR-4177. Rainfall measured from 6 to 10 inches across the County. Many roads in the County sustained damage, and the heavy rainfall eventually led to a breach of the Intracoastal Waterway at the Bay-Walton County line. This resulted in a shutdown of barge traffic for a short period of time and caused a local gas shortage. The U.S. Army Corps of Engineers (USACE) estimated that a permanent fix would cost up to \$5 million dollars.

Another significant, previously recorded event includes a rainfall event in February 2008. Rainfall measured from 3 inches to 11 inches across the County within a 24-hour period. The maximum documented rainfall in such a localized event has been one foot. As evidenced by the flood event occurring on February 22, 2008, and similar events, 11 inches of rain could cause a flash flood of a depth of over 24" +/- depending upon time, site percolation capability, water table, elevation, drainage away from the site, and cessation of continued rainfall.

Analysis of Hazard Effects

Hazard identification – Exposure Analysis

The predominant hazards affecting Mexico Beach are flooding, including stormwater flooding and storm surge, and high winds. The changing climate will impact future hazard risk. The Plan evaluated how it effects the studied hazards, namely stormwater flooding and storm surge, as well as the hazard of sea level rise. The Exposure Analysis provides a baseline of these identified risks in terms of spatial extent, severity, and the level of exposure for the community. This helps visually depict where and how the hazard will occur based on projections.

This section is subdivided by the major natural hazards expected to impact Mexico Beach: high wind, flood, storm surge, and sea level rise. Each hazard subsection includes additional information on maps that depict the current understanding of the risk along with how Hurricane Michael impacted specific properties in the City which can help ‘ground-truth’ risk data. Where the information was available, this section also analyzes which resilience measures were effective in reducing damages in the high stress test of Hurricane Michael. The next section, “Focus Areas,” builds off this information to drill down into how community facilities, key economic drivers, and critical infrastructure are projected to be impacted by the hazards.

High wind

High winds associated with tropical storms and hurricanes can directly damage a structure and also drive debris which can cause further damage. The 2015 Bay County LMS also describes how the mobile homes throughout the County are particularly vulnerable to hurricane and tropical storm force winds. Dislocation of residents could occur during a significant event requiring the use of emergency shelters. While evacuation zones are driven by storm surge, Mexico Beach’s proximity to the Gulf also means that its residents should seek shelter during a major hurricane event away from the City with the threat of both wind and flood.

Hurricane-force winds can easily destroy poorly constructed or older buildings and mobile homes. All areas of the County and the municipalities have mobile homes as well as older dwelling units that are particularly susceptible to wind damage. During hurricanes, debris such as signs, roofing material, and small items left outside may be carried by these winds at very high speeds. Extensive wind damage to trees, towers, water and underground utility lines (from uprooted trees), and fallen poles cause considerable disruption. **Table 6**, from the 2015 Bay County LMS, uses Hazus-MH 2.2 information that shows the expected speed of high wind by frequency type for the Maximum 3-Second Wind Gust (MPH) by Return Period (e.g., 10-year, 20-year, etc.). This table was not updated in the 2020 Bay County LMS and it is believed that Mexico Beach is at higher risk from wind than shown in this information as shown in the wind contours displayed in **Figure 24**.

Jurisdiction	10-yr	20-yr	100-yr	500-yr
Mexico Beach	61	75	101	118
Panama City	70	80	109	132
Panama City Beach	67	82	110	128
Parker	68	81	110	129
Callaway	66	79	107	125
Unincorporated Bay County	69	82	112	128

Table 6. Expected high wind speed by frequency type

Overall, the probability of wind damage occurring in Mexico Beach is high, particularly since most of the City is near the Gulf of Mexico where structures have a higher probability of experiencing the impacts of hurricane force winds. (See **Figure 24** showing wind speed contours for Risk Category III buildings which include medical centers.)

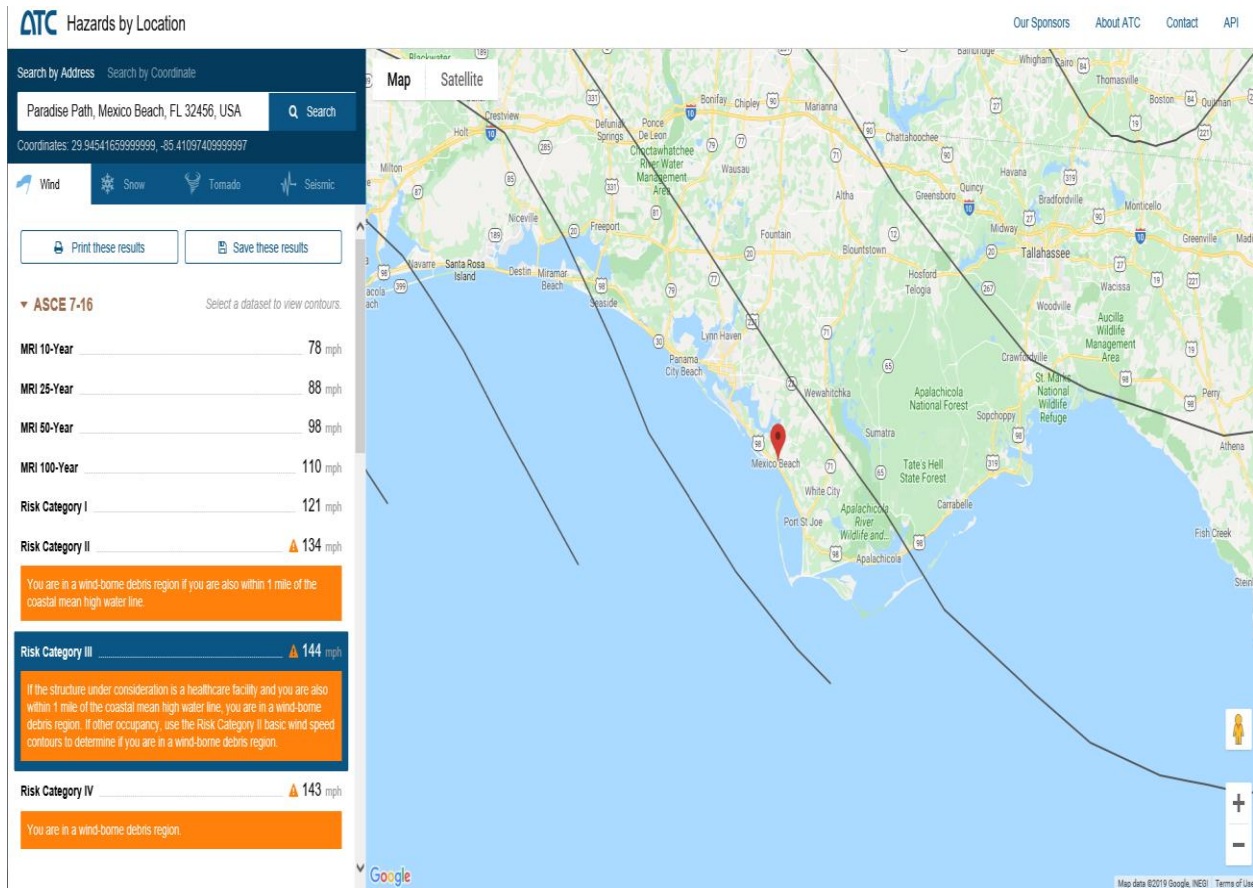


Figure 24. Wind speed contours

Damage from Michael and Wind Maps

According to the 2015 Bay County LMS, before Hurricane Michael, Bay County had never experienced a direct hit from hurricane winds rated higher than a Category 2. This obviously changed with Hurricane Michael which, as a Category 5 storm, left a trail of wreckage from both wind and storm surge. The company RMS, a risk modeling and consulting firm, identified that 3-second peak gusts for Hurricane Michael in Mexico Beach were between 130 and 140 mph, well above design-level wind speeds specified for this area by ASCE 7. The estimated maximum sustained winds associated with Michael were up to 160 mph. City Ordinance 713 addressed wind load ratings and requires all new construction or repairs to substantially damaged structures meet wind loads of 140 mph.

It is interesting to note that of the 760 properties substantially damaged by Hurricane Michael, approximately 80 of these (over 10 percent) were damaged by wind only. Most of these that were solely damaged by wind are located in the southern and eastern part of the City toward Port St. Joe Beach (see Wind Maps 7 and 8 below). These maps provide a breakdown by the source of damage (e.g., flood only, wind only, flood and wind combination). Maps 1 through 6 from this analysis are found in **Appendix B** since much of the other damage was flood or a combination of wind and flood. The maps are organized from west to east and the numbering is based on this position (maps with lower numbers are in the west and higher numbers are in the east).

The maps use information captured during the substantial damage estimation process as well as newly updated preliminary flood zone information, which uses improved topographic data, updated development information, as well as a more complete historical record, from <http://portal.nfwmdfloodmaps.com/> (“the Northwest Florida Water Management District Post-Michael Adapted Preliminary Flood Map for Bay County”). These maps have been adopted, along with an increased vertical height requirement and extended spatial extent of the SFHA, as a higher standard by the City in its Ordinance 719 (Floodplain and Building Requirements). The City’s commitment to this higher standard will aid in a more resilient rebuild by using more current risk data rather than the current effective 2009 Flood Insurance Rate Maps. The NFWFMP portal link above can be used to find these newer flood map layers as they are not accessible through FEMA’s Map Service Center.

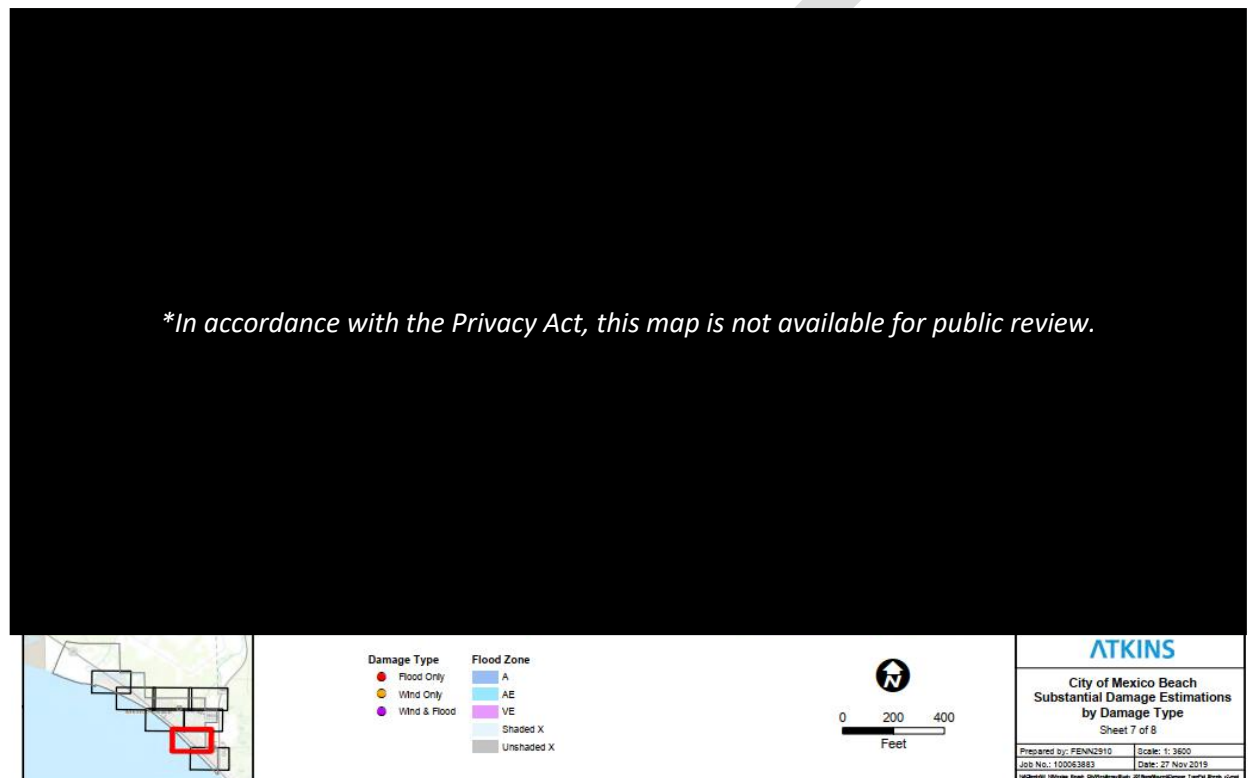


Figure 25. SDE Wind Map 7

Wind Map 7 shows that many of the homes substantially damaged in the southern and eastern part of the City were damaged by wind.

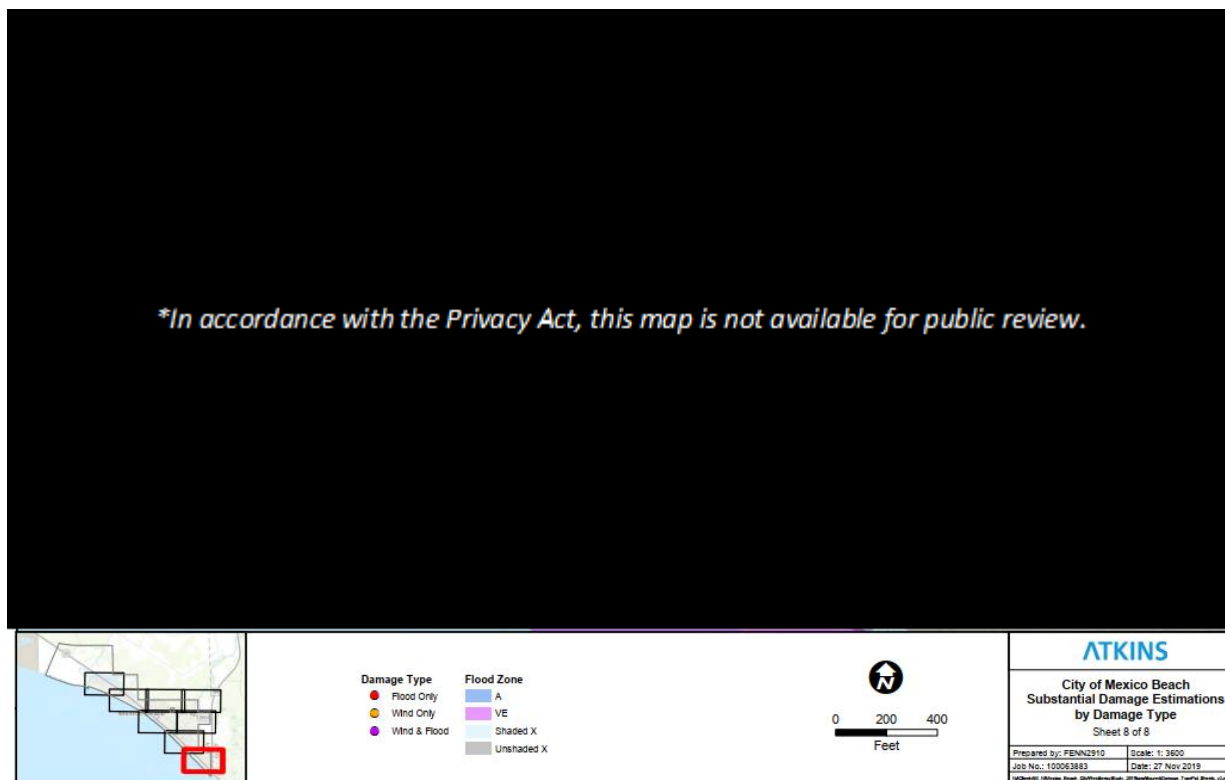


Figure 26. SDE Wind Map 8

Wind Map 8 shows that many of the homes substantially damaged in the southern and eastern part of the City were damaged by wind.

Wind Maps 1-6 are found in **Appendix B**.

Flood Exposure

According to the 2015 Bay County LMS (currently, this plan utilizes the older, identified flood zones) that includes the City, residential and commercial properties are the most vulnerable to flooding in Mexico Beach. However, the VE zone also known as the coastal high hazard area (CHHA) of the City contains multiple land uses including residential, commercial, and government land uses, but the majority of these structures within the City are located outside of Zone VE. The City’s coastal zone is typical of the Florida panhandle: limited VE zone along the shore, followed inshore by a narrow AE zone running parallel to the VE zone. Flood Zone A and AE areas contain mainly residential land use. Approximately 40% of residential structures are located in the A, AE, and V zones (**Table 7**). The Special Flood Hazard Area (SFHA) has been modified in the current Mexico Beach flood ordinance to also include the Shaded X zone; see the **Resilience Actions Completed or Underway** section for more information. In addition, approximately 38% of government land uses in Mexico Beach are located in the A, AE, and V zones (**Table 7**). According to the County LMS, almost all of Mexico Beach is located within one of the five storm surge zones and nearly the entire community is vulnerable to storm surge (**Table 9**).

Occupancy	Number of Parcels	Number of Structures	Value of Structures	Value of Contents
Residential	692	700	\$129,679,492	\$64,839,746
Commercial	16	24	\$12,033,035	\$12,033,035
Industrial	6	9	\$1,629,544	\$2,444,316
Institutional	8	9	\$920,148	\$920,148
Government	3	3	\$3,108,093	\$3,108,093
TOTAL	725	745	\$147,370,312	\$83,345,338

Table 7. Mexico Beach, flood vulnerability in A, AE, and V zones, 100-year event (1% annual chance)

Occupancy	Number of Parcels	Number of Structures	Value of Structures	Value of Contents
Residential	692	700	\$129,679,492	\$64,839,746
Commercial	17	24	\$12,165,975	\$12,165,975
Industrial	6	9	\$1,629,544	\$2,444,316
Institutional	8	9	\$920,148	\$920,148
Government	3	3	\$3,108,093	\$3,108,093
TOTAL	726	745	\$147,503,252	\$83,478,278

Table 8. Mexico Beach, flood vulnerability in A, AE, and V zones, 500-year event (0.2% annual chance)

Occupancy	Number of Parcels	Number of Structures	Value of Structures	Value of Contents
Residential	1,655	1,674	\$266,760,842	\$133,380,421
Commercial	57	66	\$20,900,287	\$20,900,287
Industrial	7	10	\$1,766,539	\$2,649,809
Institutional	14	15	\$1,397,701	\$1,397,701
Government	8	8	\$4,051,378	\$4,051,378
TOTAL	1,741	1,773	\$294,876,747	\$162,379,596

Table 9. Mexico Beach storm surge zone vulnerability

The 2015 LMS indicates over 30 reported flood events have occurred within the County within the period of 2009-2014. Property damage estimates were at least \$1.2 million in losses from the events as this is documented in the National Centers for Environmental Information (formerly the National Climatic Data Center).

The largest hazard event to impact the County and Mexico Beach was the historic storm surge from Hurricane Michael. The following map (**Figure 27**), compiled from data from the United States Geological Survey and FEMA, shows the approximate extent of the storm surge flooding as well as high water marks. The maps in **Figures 28 to 35**, show the juxtaposition of the flood risk maps with level of damage from Hurricane Michael to structures. The results indicate that while the flood maps are important and convey risk, that risk may be greater than what is depicted and information from actual events points to the need for higher standards like greater flood protection in the floodplain ordinance.



Figure 27. Hurricane Michael Storm Surge map in Mexico Beach (Source: United States Geological Survey and FEMA)

Series of Maps – Flood Zones and Damage from Michael

The following map sections are oriented from west to east with the updated flood zones as well as the damaged properties from Hurricane Michael by category of damage. According to data from the SDE conducted after the event, there were 942 structures affected by the disaster. The structures were in the following flood zones:

Flood Zone	No. of Structures	Percentage of Total Affected Structures in the Flood Zone
A Zone	52	5.5%
AE Zone	131	13.9%
AO Zone	0	0%
VE Zone	58	6.1%
X Zone	507	53.8%
TOTAL	942	

Table 10. Structures in the flood zone

To depict the flood risk, the City is broken down into eight map sections that show the flood zones of A, AE, VE, Shaded X (0.2 % annual chance), and Unshaded X.

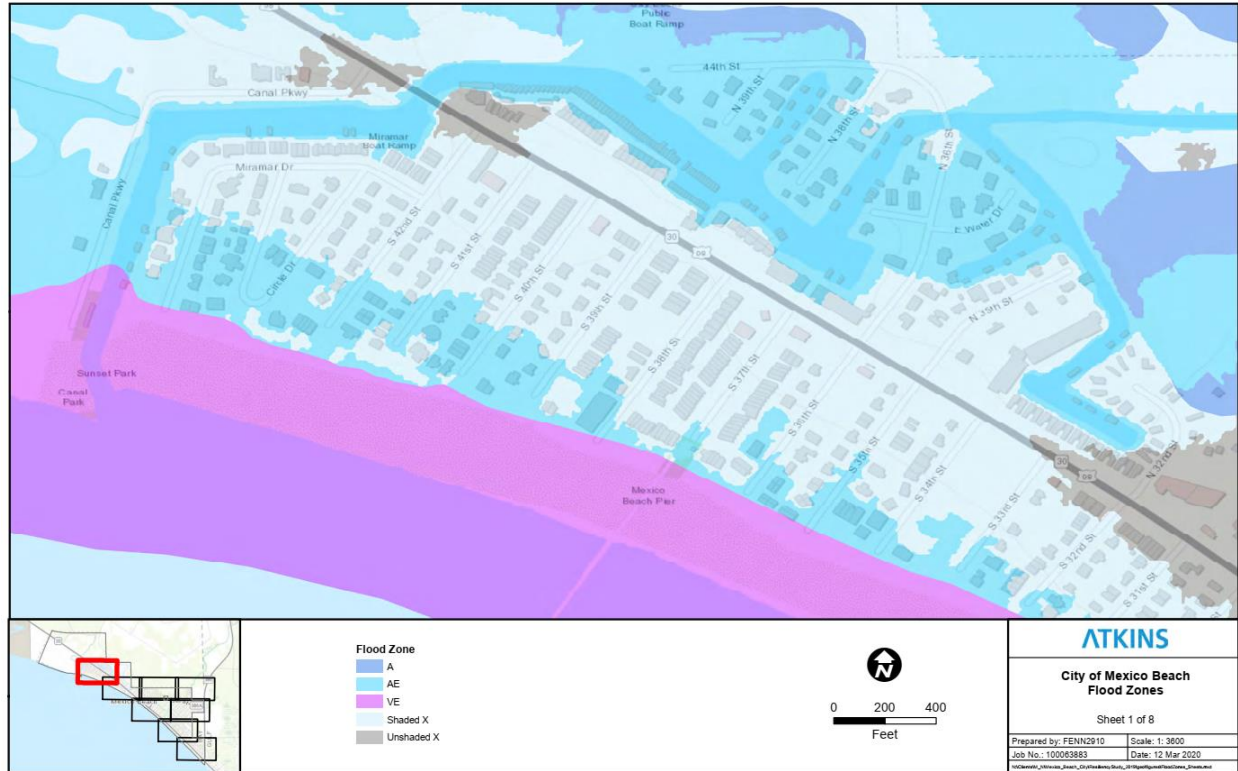


Figure 28. SDE Flood Map 1

Flood Map 1 demonstrates that the majority of the homes along the coast in the AE zone were substantially damaged at the level of 50% or greater. Approximately 50 homes were in the AE zone that experienced this damage. However, a significant number of the structures were not in the A or V zones but suffered substantial damage due to surge (7 to 9 feet). Many of these structures are in the Shaded X zone which is now part of the regulatory floodplain (SFHA). There was also some wind damage in this area. Among some of the significantly damaged areas along Miramar Drive, three condos received less damage because they were built to higher standards demonstrating the results of mitigating a structure. The red dots laid very closely together indicate apartments that are part of single structures.

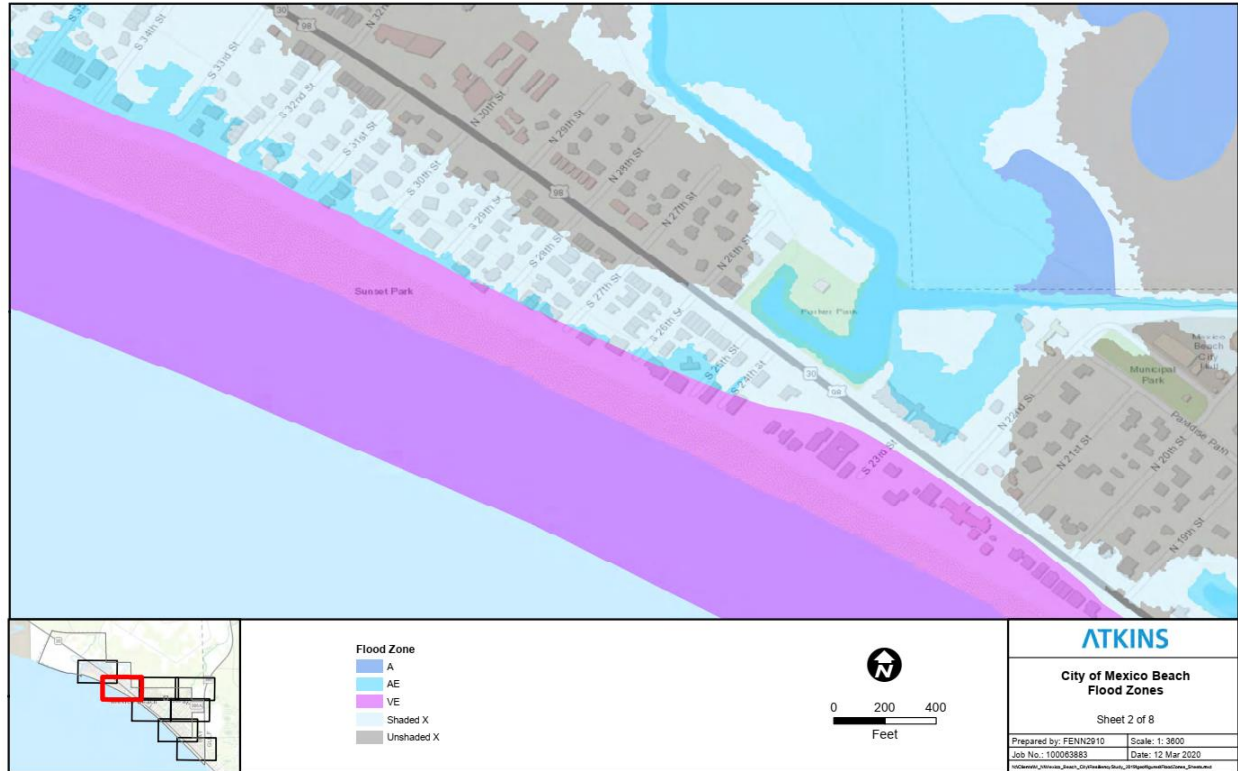


Figure 29. SDE Flood Map 2

Flood Map 2 examines the coastline and signifies that most of the structures along that stretch within the VE zone experienced substantial damage with a few outliers that were newer homes in the southeast of the map and built to higher standards. Approximately 20 structures in the VE zone, generally the highest level of flood risk, experienced 50% or more damage. A few of these structures were commercial properties. However, over 80 structures that were in the Unshaded X zone, the lowest area of flood risk, had over 40% or more damage (red or yellow). Many structures in the Shaded X zone were substantially damaged.



Figure 30. SDE Flood Map 3

Flood Map 3 is farther removed from the coastline of the City and felt lesser effects of the flooding and wind damage. Only 25 homes were deemed to be substantially damaged. However, 41 structures suffered at least 40 percent damage but due to wind primarily. In the center of this map section surrounding Ocean Plantation Drive, it is noted that many structures did not sustain any damage. This is due to the homes being built on stemwalls and piles with much less effect from surge [only 2 to 3 feet and little surge impact above the Finish Floor Elevation (FFE)]. This strong performance points to the value of extending higher flood protection standards to the Shaded X zone where a majority of the flood damage occurred. Some of the homes adopted higher standards which were reported to be to Miami-Dade County's standards which exceeded current wind standards. This also points to the value of why the City adopted higher standards after Michael. Another reason these structures suffered less damage is that they are not located within shaded X zone (the subdivision was elevated on fill above surrounding areas). Therefore, recorded surge in this area was less than in most places City-wide and was only 2 to 3 feet. These homes are built on stemwalls and piles therefore 2 to 3 feet of surge caused less damage and most of these did not experience surge above Finish Floor Elevation (FFE).



Figure 31. SDE Flood Map 4

Flood Map 4 represents the most northeastern portion of the City. Most of this area was outside the pre-Michael Special Flood Hazard Area (which was then the A, AE, and V zones). Many of the damaged structures were in the Shaded X zone which after Hurricane Michael, was added to the SFHA and now regulated. The locations sited without any damage or vacant on this map section are within a recreational vehicle (RV) lot, so many of the pads could have easily been vacant during the time of Hurricane Michael. However, there are some structures around Oakwood Drive that received damage because the flow of water took a particular path that touched the structures and resulted in 40 percent or greater damage. These structures were manufactured homes and not RVs. On the far left of this map section, the structures that received minimal damage are apartment homes. This area (north of 15th Street) experienced recorded surge of 13 to 14 feet which is approximately 3 to 5 feet of inundation depth within this area. Oakwood Drive may have experienced deeper inundation because it is adjacent to the City's canal.



Figure 33. SDE Flood Map 6

Flood Map 6 is a map section of the City that is a little more inland. The portion of this map that is largely vacant within the Flood Zone A to the east is owned by the St. Joe Paper Company. Most of the structures around those flood zones are a mixture of structures between single-family dwellings and manufactured homes. In this area, 15 homes were substantially damaged. The area shown in Flood Map 6 where there was substantial damage, while in the Shaded X Zone, was affected by the Canal at 8th Street which serves as a major stormwater collection channel and discharges to the Gulf at the 8th Street Bridge on Highway 98. However, during a storm event, the flow of water is reversed and surge pushes water upstream throughout the tidal canal system. During Hurricane Michael, the 8th Street Canal acted a major conduit for storm surge, causing areas to flood north of Hwy 98 despite the Highway acting as a levee to otherwise mitigate surge directly from the Gulf.



Figure 34. SDE Flood Map 7

Flood Map 7 depicts a map section of the City directly on the coastline with a few commercial structures that suffered substantial damage. Approximately 116 structures withstood significant damage to the level of 50 percent or greater due to wind speeds. Another 40 structures suffered wind damage of 40 percent or greater to their homes.

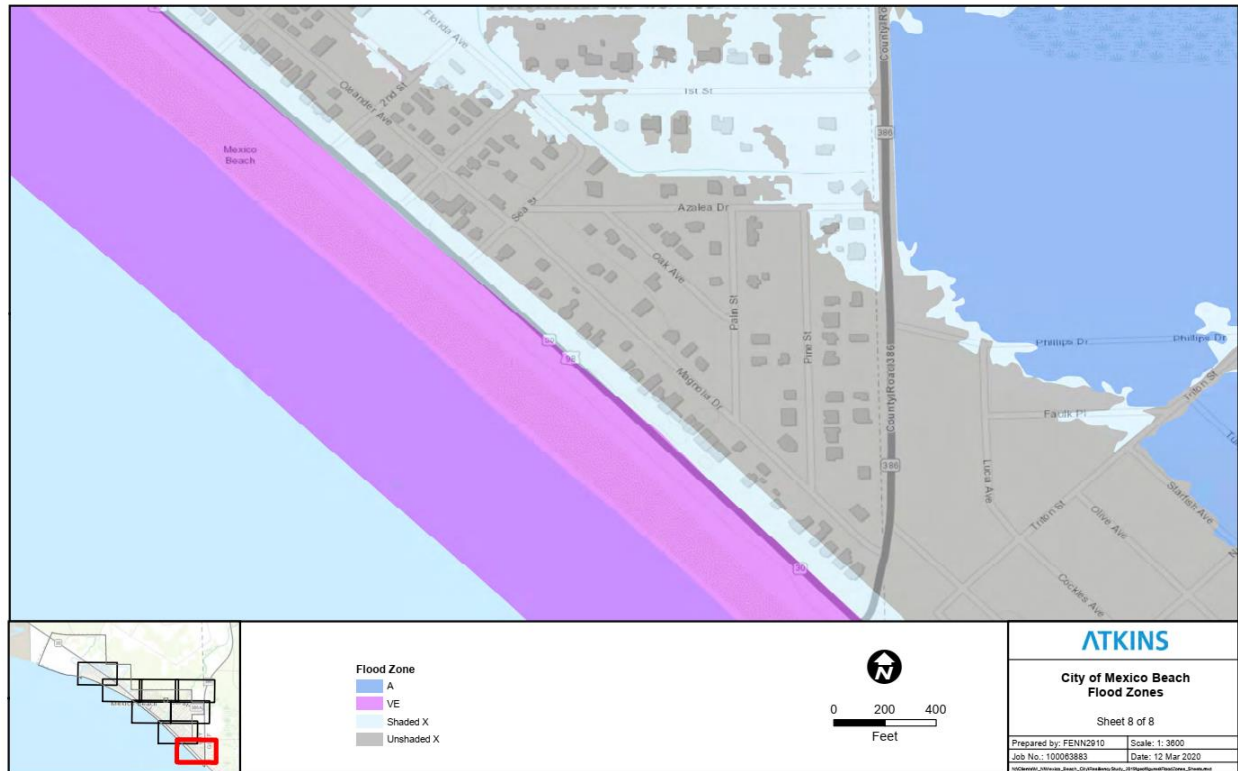


Figure 35. SDE Flood Map 8

Flood Map 8 is also along the coastline of Mexico Beach. The VE flood zone is highlighted but no structures or homes are identified in that zone because this is the City’s dedicated public beach. No construction is allowed on the South side of Highway 98 throughout this area. This portion of the beach previously included a significant natural dune system which protected the structures on the north side of the highway from storm surge and erosion prior to Hurricane Michael. The homes and buildings that suffered the most damage did so initially from the wind speeds and if the structure was in a lower-lying area eventual water flowed in and damaged the structures as well. Almost 25 structures were substantially damaged. Less than 10 structures received between 40 and 50 percent damage but again due to wind.

Stormwater Flooding

Stormwater flooding is a chronic problem within the City; however, these problem areas are only worsened when storm surge occurs because of all of the blockages and debris. Also, these areas have become more of an issue since Hurricane Michael. The end of 1st Street and County Road 386 has a blockage and floods the lots surrounding that intersection. The corner of 7th Street and Maryland Avenue has a stormwater system pipe that is damaged and full of sand increasing the level of flooding. In addition, the two canal openings to the Gulf pose a risk that surge will enter the City during storms and high tide events and compound the stormwater flooding issue.

Future Stormwater Flood Risk

The 2018 National Climate Assessment (NCA) shows a general trend of increased extreme rainfall events in the future for the Southeastern United States:

Extreme rainfall events have increased in frequency and intensity in the Southeast, and there is high confidence they will continue to increase in the future. The region as a whole has experienced increases in the number of days with more than 3 inches of precipitation and a 16% increase in observed 5-year maximum daily precipitation (the amount falling in an event expected to occur only once every 5 years).

Therefore, the stormwater flooding currently experienced by Mexico Beach is likely to become worse over time. In addition, the NCA states how the combination of sea level rise and higher tide events will compound the stormwater flooding risk (2 excerpts):

The Southeast's coastal plain and inland low-lying regions support a rapidly growing population, a tourism economy, critical industries, and important cultural resources that are highly vulnerable to climate change impacts. The combined effects of changing extreme rainfall events and sea level rise are already increasing flood frequencies, which impacts property values and infrastructure viability, particularly in coastal cities. Without significant adaptation measures, these regions are projected to experience daily high tide flooding by the end of the century.

The growing number of extreme rainfall events is stressing the deteriorating infrastructure in the Southeast. Many transportation and storm water systems have not been designed to withstand these events. The combined effects of rising numbers of high tide flooding and extreme rainfall events, along with deteriorating storm water infrastructure, are increasing the frequency and magnitude of coastal and lowland flood events.

An important element of Mexico Beach's resiliency is factoring in future conditions and adapt policies and develop projects that consider the changing risks so that infrastructure and structures are resilient throughout their useful lifecycle.

Storm Surge

Storm surge occurs when the water level of a tidally influenced body of water increases above the normal astronomical high tide and are most common in conjunction with coastal storms with massive low-pressure systems with cyclonic flows such as hurricanes, tropical storms, and nor'easters. The low barometric pressure associated with these storms cause the water surface to rise, and storms making landfall during peak tides have surge heights

Canals – Outlets to the Sea and Ingress for Storm Surge

Mexico Beach has two cuts in the beach that each serve a purpose: 1) the one at Canal Parkway near the Tyndall AFB border is an outlet to the Gulf that provides a navigable channel for boats and leads to the marina located in the back canal area; 2) the one at 8th Street is an outfall into the Gulf to drain a canal that conveys stormwater. While each serves an important purpose, these canals allow storm surge to penetrate deep into the City and cause extensive damage.



Figure 36. City canal opening showing extensive damage post Michael

and more extensive flood inundation limits. Storm surges will inundate coastal floodplains by dune overwash, tidal elevation rise in inland bays and harbors, and backwater flooding through coastal river mouths. The duration of a storm is the most influential factor affecting the severity and impact of storm surges.

Often storm surge is the most detrimental and immediate form of destruction that a coastal community must face. There can be a great deal of variability on the height and extent of the surge based on when it makes landfall during the tide cycle. Hurricanes making landfall during high tide can add several additional feet of water to the surge. The effects of storm surge impact everything in its path including structures, infrastructure, vegetation, dunes, and the beach itself which can be severely eroded after a large event.

Mexico Beach suffered severe damage from storm surge in addition to the initial wind and flood effects. The Hurricane Michael FEMA Mitigation Assessment Team (MAT) report showed that storm surge damaged the structures in multiple ways: wave action, scouring foundation ties causing the home to break away, water-borne debris impacts, lack of hydrostatic equalization in slab-on-grade structures (unequal water pressure inside and outside the home which damages or collapses the foundation), and rising water within the structure if they still stood. As the storm surge receded, the same structures were impacted by the flow of water back to the Gulf.

The storm surge that was examined for the City is based on the categories of storm from a 1 to 5 with a Category 5 having the most far reaching effects inland. The evacuation zones are also noted in the following maps and are closely aligned with the potential storm surge in various areas.

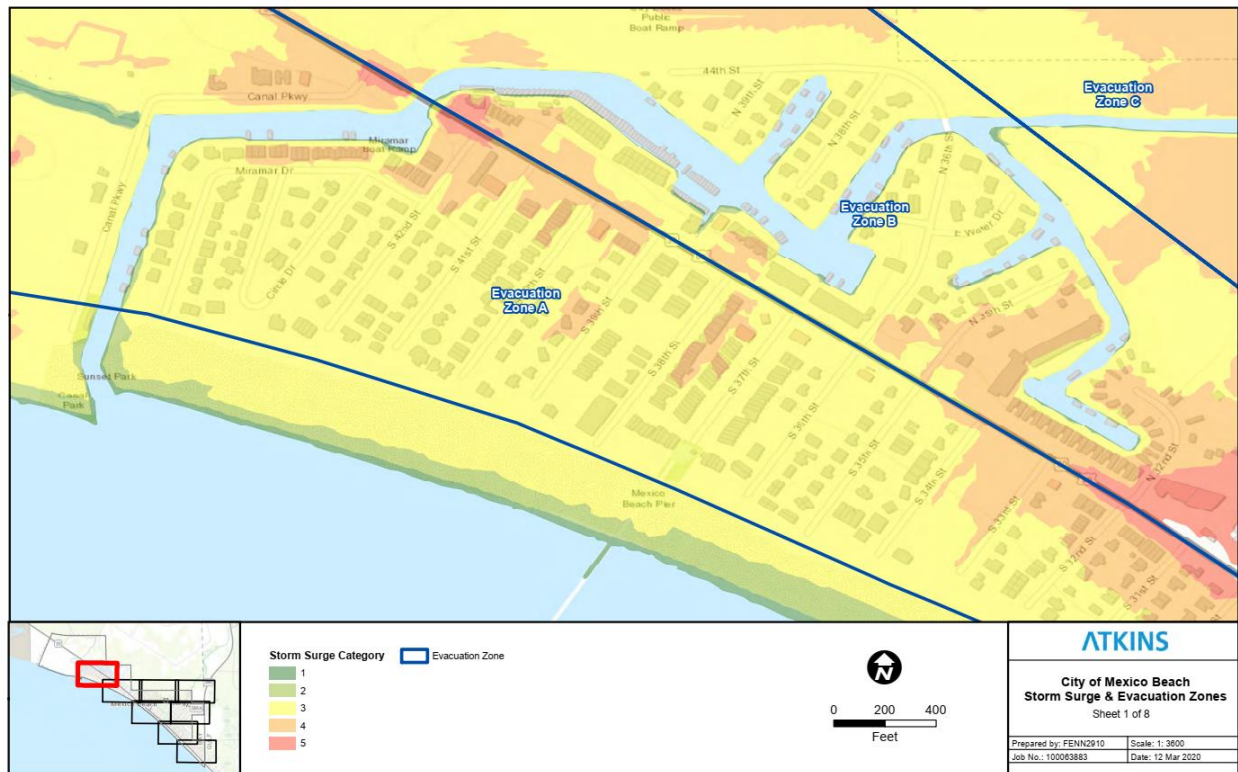


Figure 37. SDE Surge Map 1

Surge Map 1 shows that the storm surge had a significant impact for several rows of streets on the Gulf side of US 98. In this part of the City, storm surge flooding was the primary cause of substantial damage.

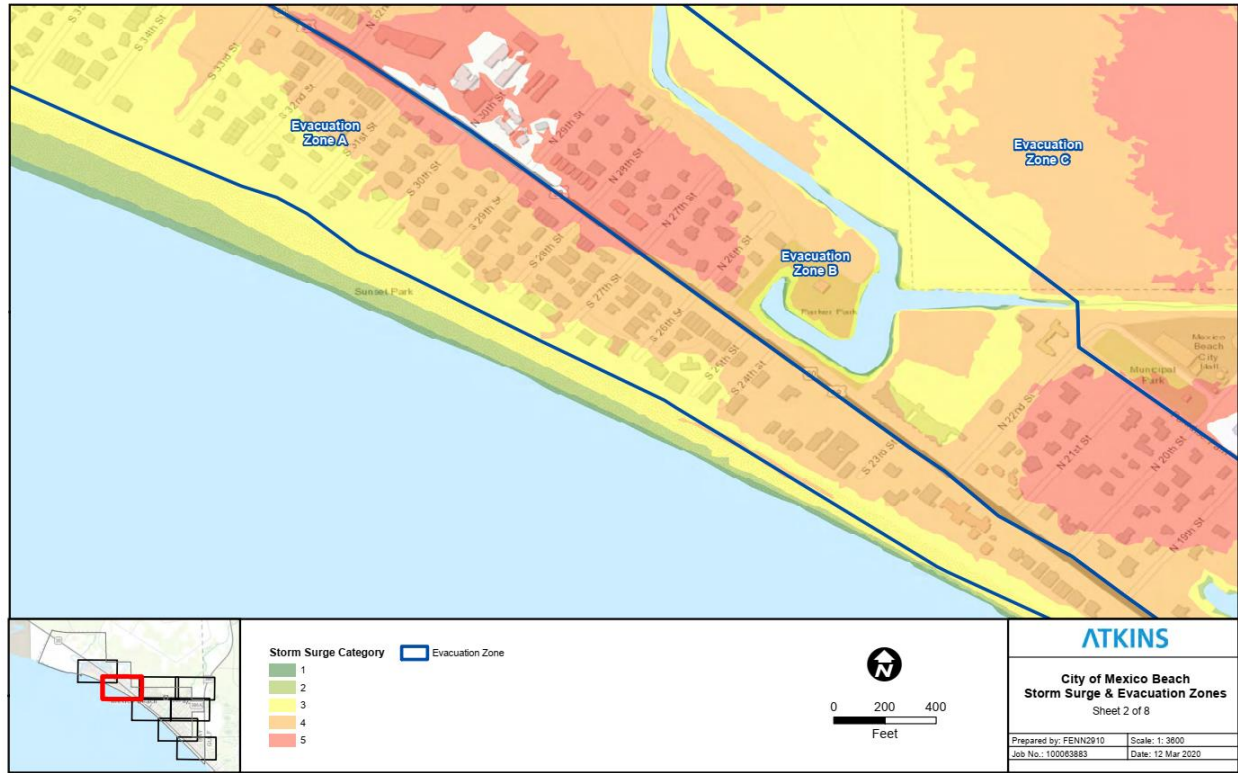


Figure 38. SDE Surge Map 2

Surge Map 2 shows the map section of the City that experienced more damage based on the combination of flood and wind. The storm surge effects were also very significant within this map section especially as the categories elevated.

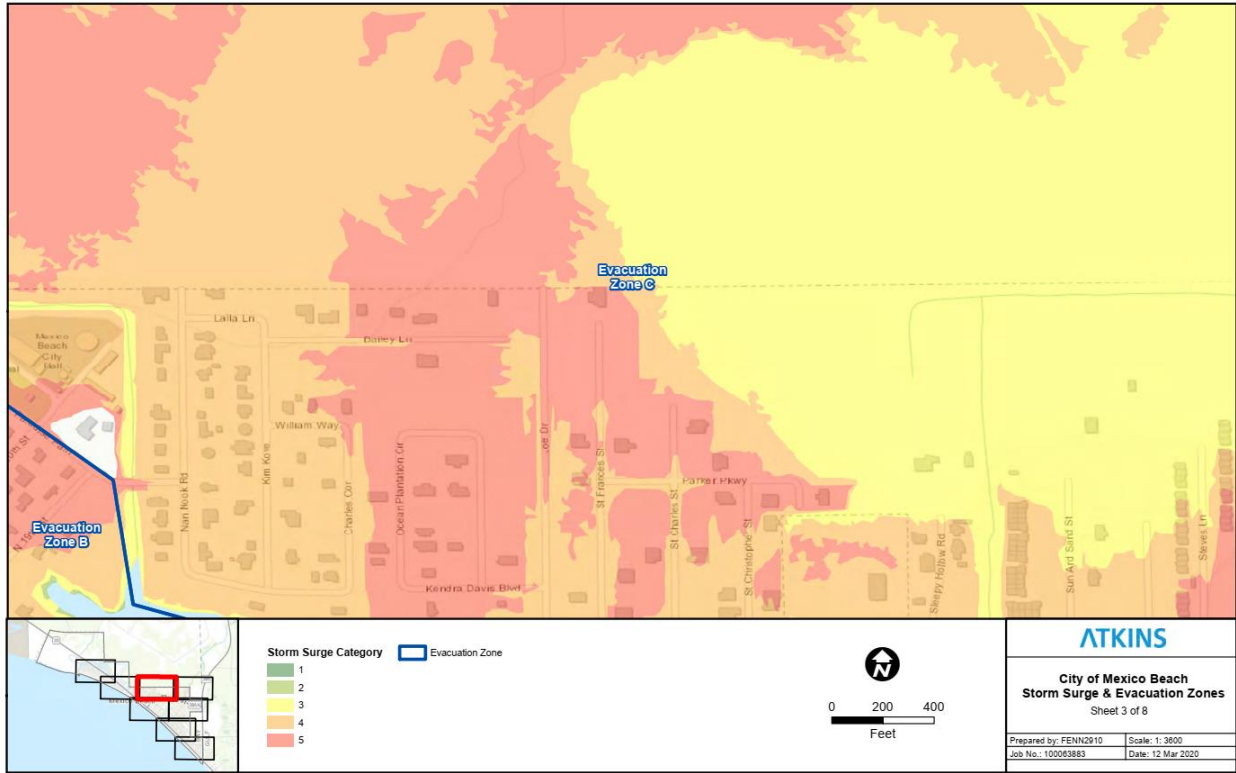


Figure 39. SDE Surge Map 3

Surge Map 3. In this map of the City, all of the damage is a result of flooding and the impact from the higher categories of storm surge is extreme and clearly outlines why the areas should be evacuated.

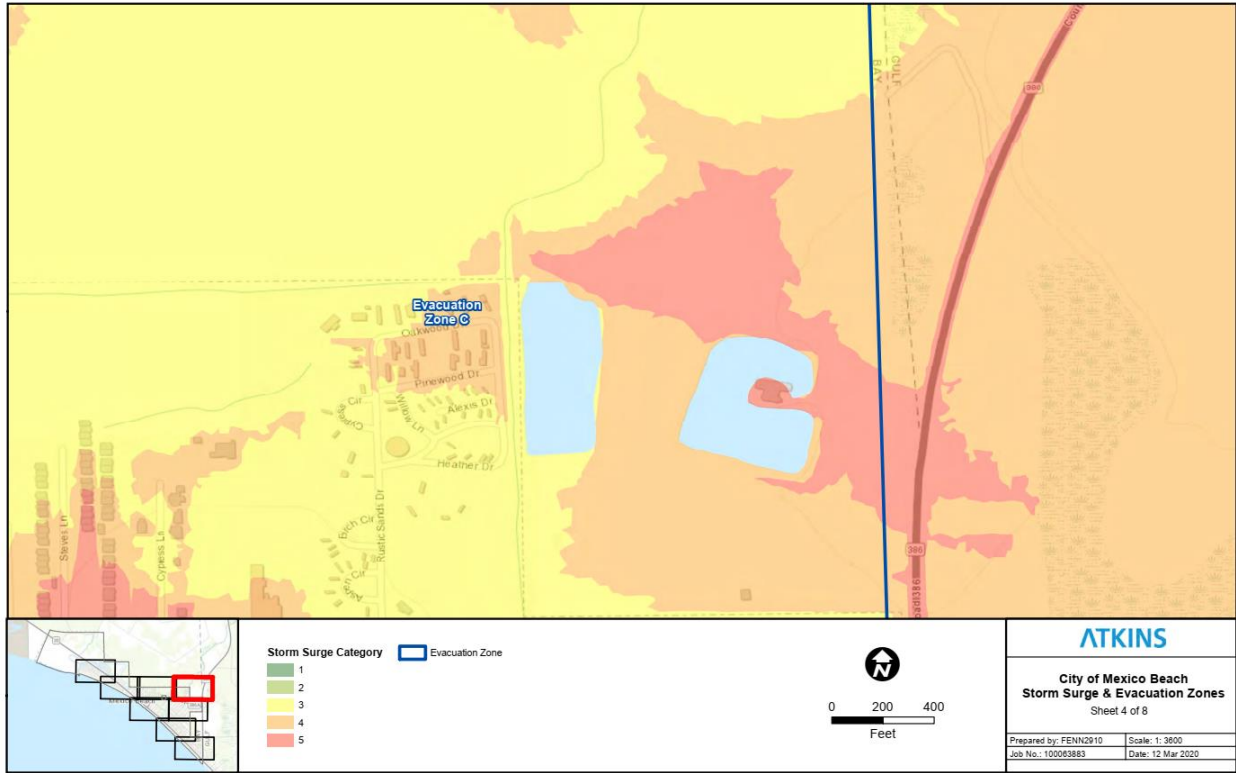


Figure 40. SDE Surge Map 4

Surge Map 4. In this map, the damage is mainly due to flooding except for one outlier subjected to wind damage. The storm surge occurring from Category 3 and above is very intense in this area.

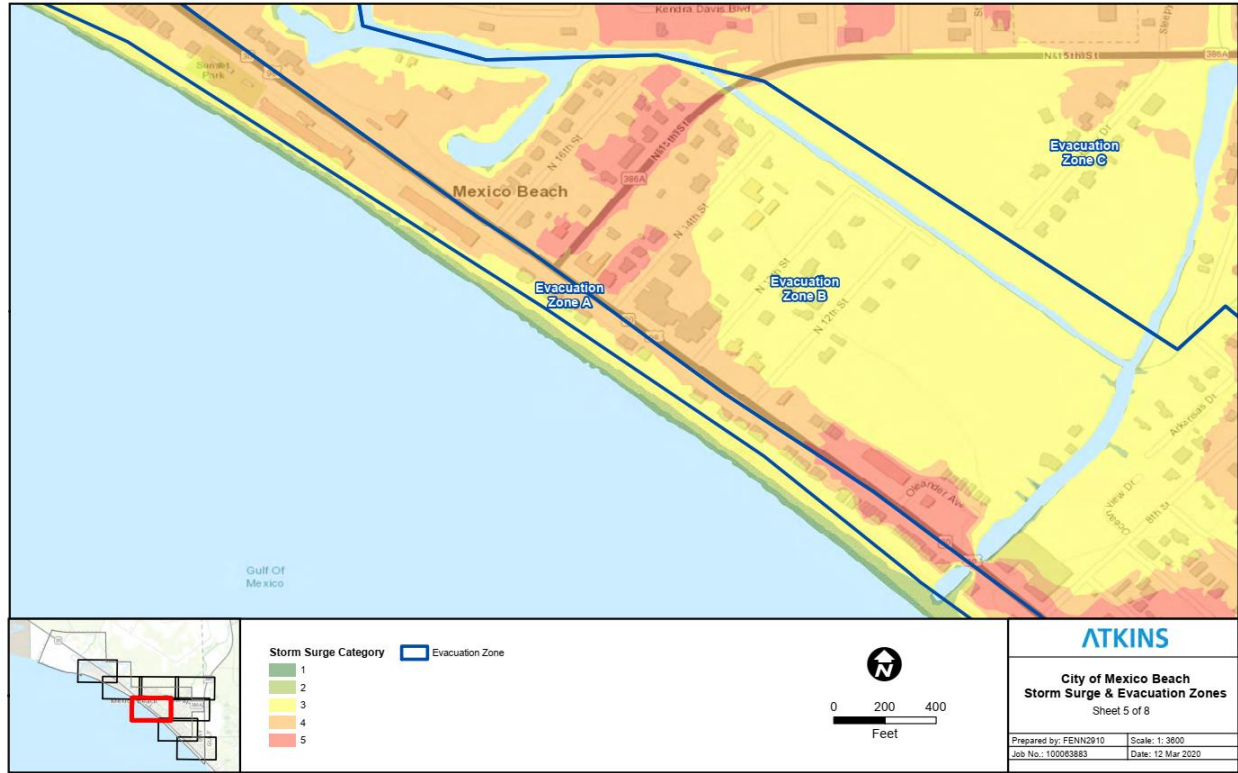


Figure 41. SDE Surge Map 5

Surge Map 5. This map depicts an area directly on the coast of Mexico Beach. Interestingly, the substantial damage on the actual coastline was due to the hazards of flood and wind. Only four structures sustained wind damage only.

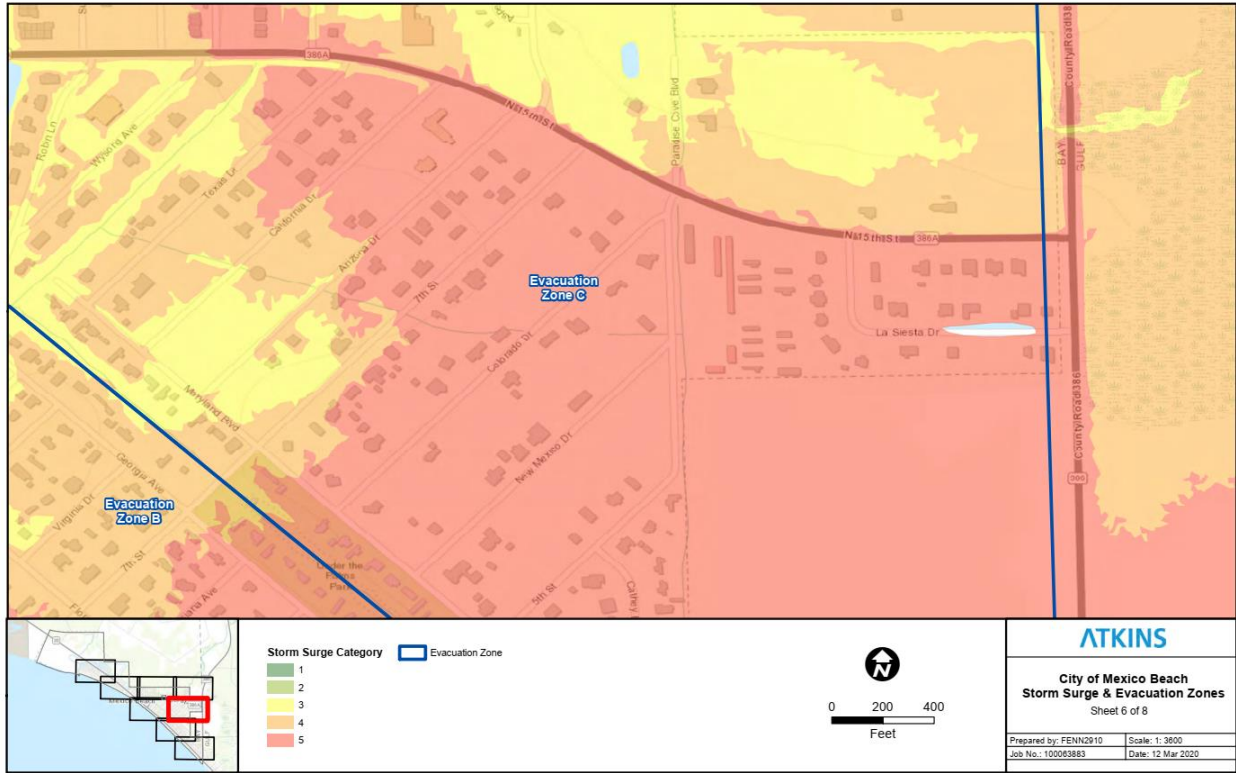


Figure 42. SDE Surge Map 6

Surge Map 6. This map section is further inland and shows damage occurring from only wind or flood to structure but not from both hazards. The storm surge is very noteworthy.

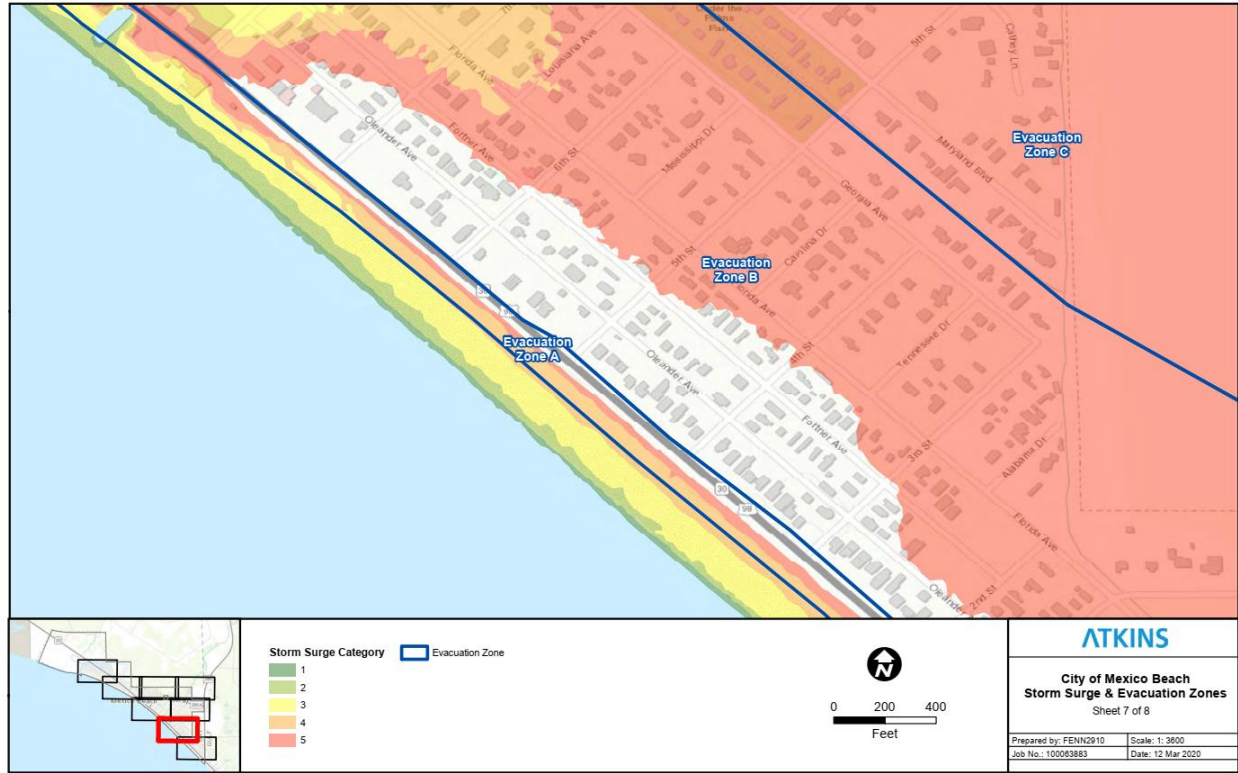


Figure 43. SDE Surge Map 7

Surge Map 7. This map is along the coastline and the damage incurred is from both flood and wind. However, a portion of the City’s coast (northeast of US 98 on this map with no shading) was not affected much by the actual storm surge and, in that area, the majority of the damage was attributed to wind only. The area behind it in color shading was heavily impacted by Michael’s storm surge and this is attributable to the surge travelling up the 8th Street canal. The majority of the City is susceptible to inundation due to storm surge starting at a Category 3 storm. From a Category 5 storm, nearly the entire City is inundated by surge as was observed during Hurricane Michael.

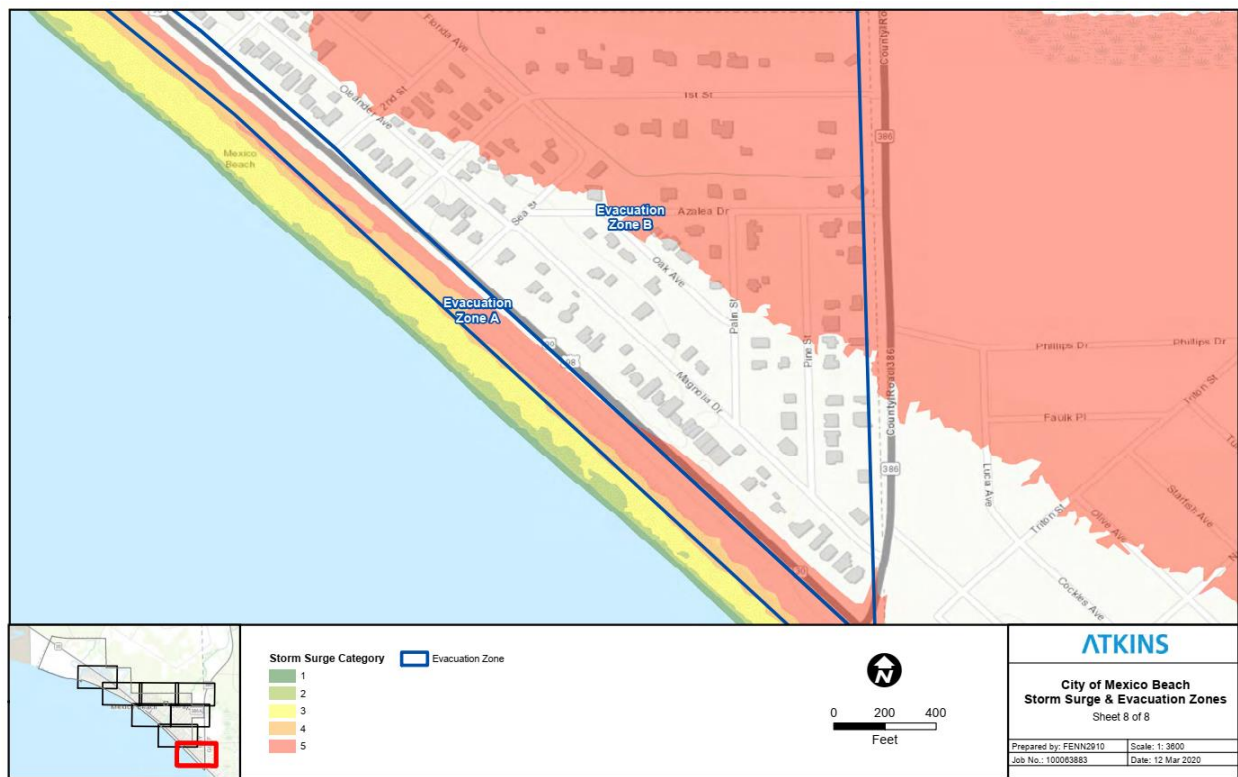


Figure 44. SDE Surge Map 8

Surge Map 8. This map resembles the previous map section in which the adjacent area to the actual beach did not have storm surge and only suffered minor wind damage.

Sea level rise – Future Flood Risk

Climate impacts are inherently difficult to project as our understanding of the dynamics and variables influencing them are ever evolving (e.g., accelerating ice shelf melting, release of methane as the tundra thaws). The primary challenge to coastal communities from a changing climate is sea level rise. The Florida Adaptation Planning Handbook states the challenge accurately for coastal Florida communities:

While the coast may be the State’s greatest asset, Florida’s communities are at significant risk from coastal hazards including the slow moving, steady, and arguably irreversible threat of sea level rise. Within the area at risk from one foot of projected sea level rise sits more than 65,000 homes and as many as 121,909 people (Climate Central, 2014). The ability to adapt to and with a changing coastline is vital for the state’s sustainability and continued prosperity over the next century.

The Florida Panhandle is different geologically than the rest of the state and is generally not as prone to stillwater sea level rise (sea level rise in non-storm events). It has higher elevations along the coastline, which limits the spatial extent of the impact, and does not have the porous limestone subsurface which allows greater subsurface saltwater intrusion.

To estimate how the stillwater sea level rise impacts Mexico Beach, projections in nearby cities in Bay and Franklin Counties were used. According to the USACE sea level change calculator,

the projections for Panama City are that, by the year 2040, the sea level rise is likely to be close to one foot as shown in **Figure 45**.

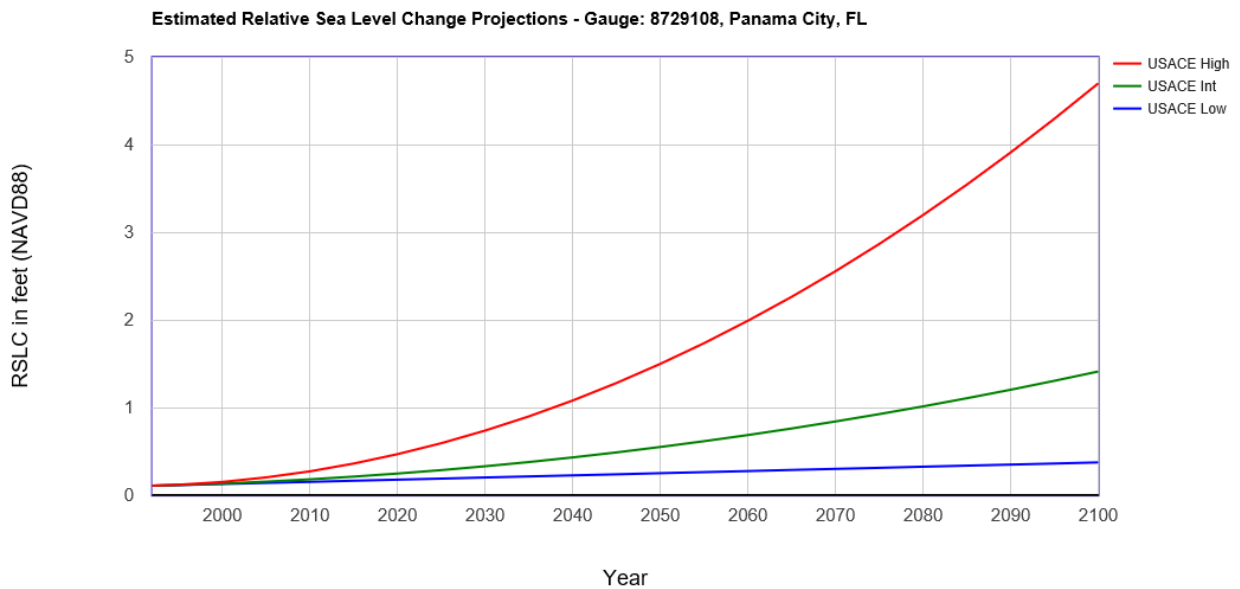


Figure 45. Sea Level Rise Projections for Mexico Beach

For a combined projection that uses both USACE and NOAA forecasts, sealevelrise.org provides two forecasts for Apalachicola (**Figure 46**) and Panama City (**Figure 47**). These graphs show the range of the NOAA and USACE high and intermediate forecasts. The USACE high forecast, seen as the darkest red line in the graph, is considered the most likely projection. In Apalachicola, the most probable impact is 15 inches of sea level rise by 2050. Panama City show a similar 13- to 14-inch increase by 2050.

While the stillwater sea level rise impacts are not as severe in Mexico Beach as in other parts of Florida, even a rise of 12-15 inches will add to the severity of any future storm surge events as documented in the Florida Oceans and Coastal Council's *Climate Change and Sea-Level Rise in Florida: An Update of the Effects of Climate Change on Florida's Ocean & Coastal Resources* (p.11):

As sea level continues to rise, deeper waters near shore will translate to higher storm surge, faster flow, higher waves, and hydrodynamic pressure and wave impact loads on buildings near the shoreline, which are likely to exceed their designed capacities by wide margins and suffer significant damage and loss of function.

The greatest near-term risk from sea level rise are increased impacts from storm surge. Based on the City of Mexico Beach's topography, the effects of still water sea level rise are localized. However, when sea level rise is combined with storm surge, a large portion of the City is vulnerable. Wave action combined with sea level rise causes structures to be vulnerable if

basing elevations on the FEMA 100-year flood maps.

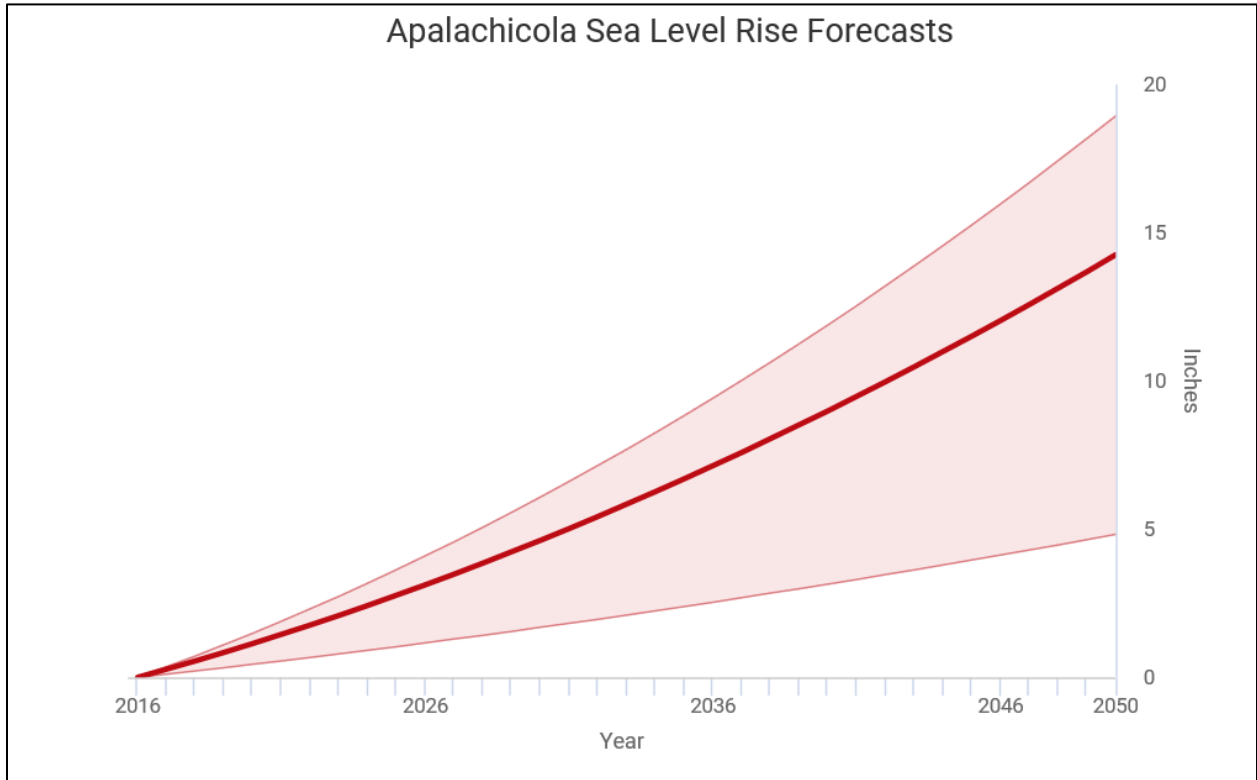


Figure 46. Sea level rise forecast in Apalachicola (from sealevelrise.org) represents the range of USACE and NOAA forecasts

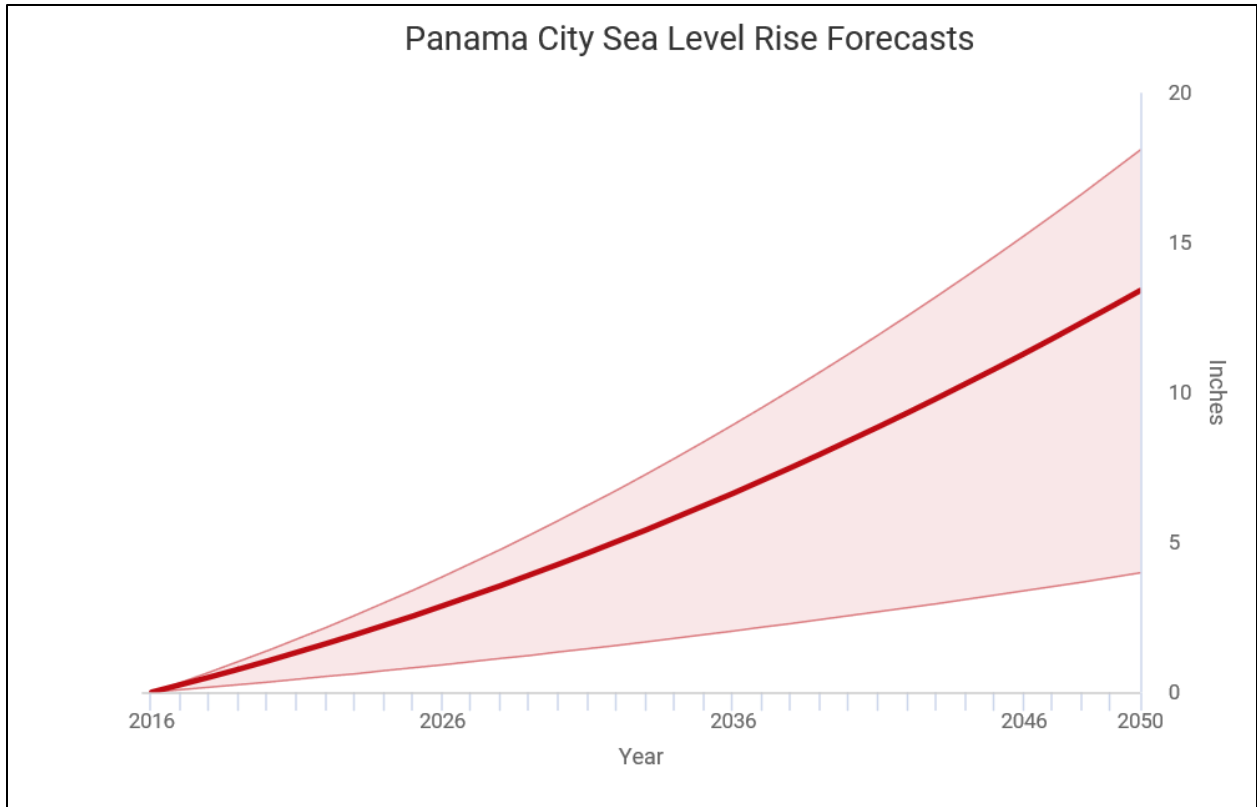


Figure 47. Sea level rise forecast in Panama City (from sealevelrise.org) represents the range of USACE and NOAA forecasts

To see the spatial impacts of sea level rise as projected in Mexico Beach, the NOAA Sea Level Rise Viewer was used to display the potential sea level rise based on the mean higher high-water (MHHW) level. Based on tide gauge information for Mexico Beach, the MHHW is at 1.68 feet.



Figure 48. NOAA Sea Level Rise Viewer at 1 foot

The viewer tool demonstrates the vulnerability and low-lying areas in increments of feet. At one foot above MHHW, **Figure 48** shows only shows inundation of the immediate coast and into some of the canals and drainage areas of Mexico Beach. As a result, properties and areas of development along the coastal and inland waterways are becoming more vulnerable to SLR.



Figure 49. NOAA Sea Level Rise Viewer at 2 feet

At two feet of SLR above MHHW, a few additional areas of the City are vulnerable, but this is mostly still contained to the low-lying areas like canals, wetlands, and drainage areas. These vulnerable areas with a high level of exposure require attention because they are also the primary conveyance areas of stormwater and storm surge. These more probable SLR scenarios would compound the impacts of major hurricane and rainfall events.

Based on the research reflecting the current trends that are being observed in relation to sea level rise, there are inland areas in Mexico Beach that are also prone to sea level rise (SLR). The two canals within the City that will feel the effects of SLR as if it were actually on the coast. **Figures 48** and **49** show this risk.

Therefore, the two potential SLR scenarios that are selected for this plan are:

- The projected rise of 1-2 feet by 2050
- A less optimistic projection of 3-5 feet of rise by 2050

The following maps use information from the NOAA Sea Level Rise Viewer depicting the two SLR scenarios. It is imperative for Mexico Beach to implement resilience measures in the areas affected by sea level rise to offset the impacts of the stillwater sea level rise as well as the increased risk from storm surge. The maps show the areas within Mexico Beach most prone to SLR; the remaining SLR maps are in **Appendix C**.

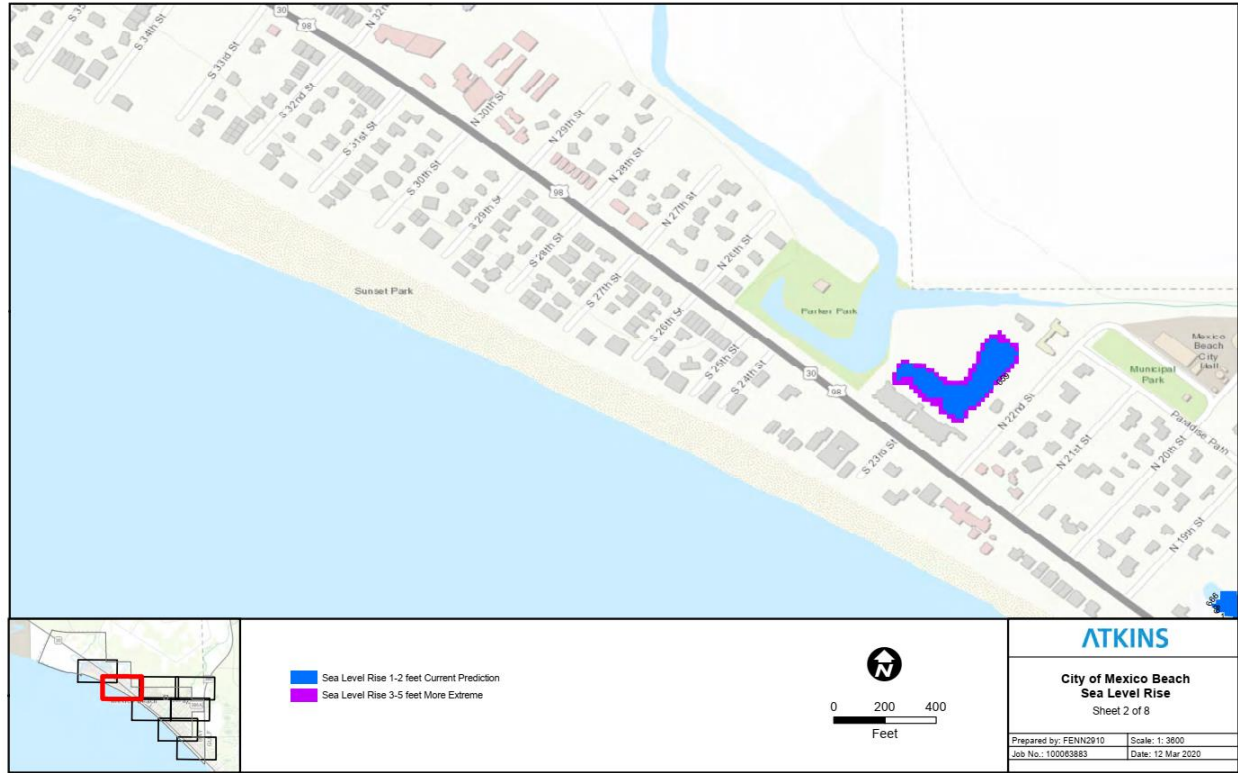


Figure 50. SDE SLR Map 2

SLR Map 2. This map demonstrates that the low-lying area that the NOAA SLR viewer identified will actually experience up to five feet of SLR on the perimeter of the small body of water that is adjacent to North 22nd Street.

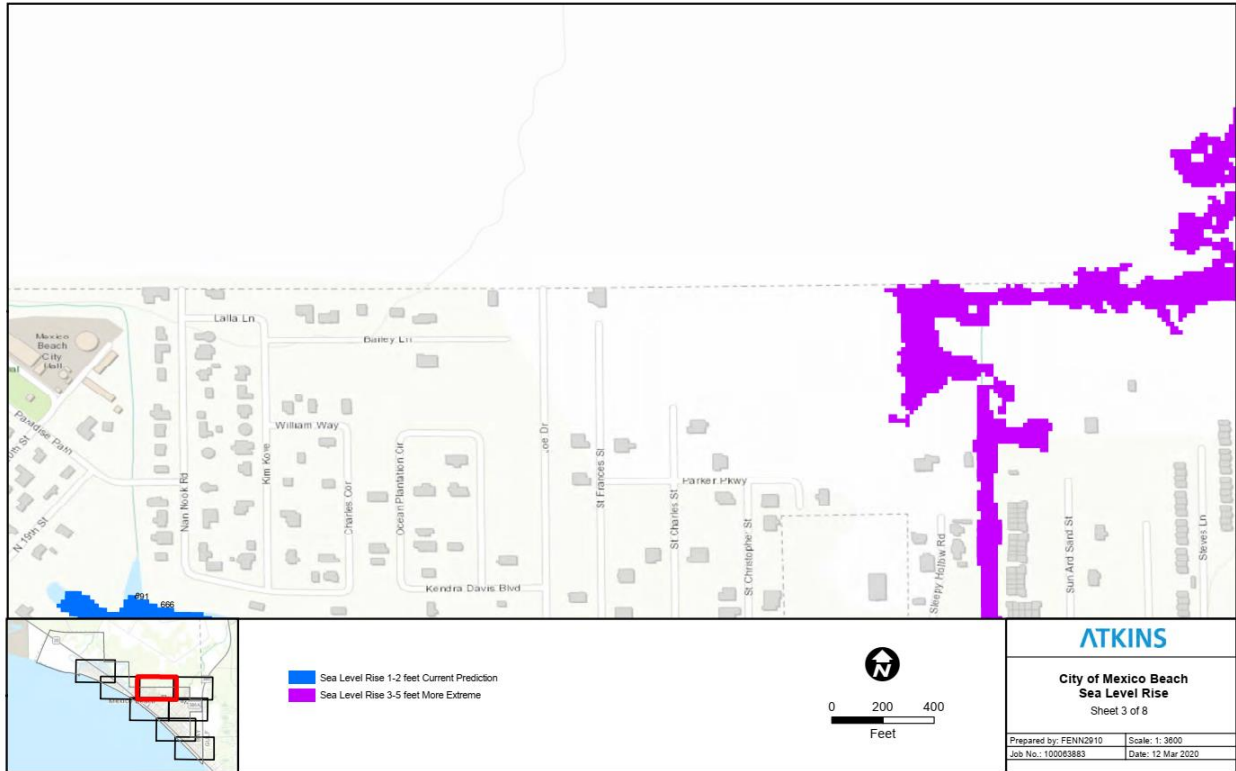


Figure 51. SDE SLR Map 3

SLR Map 3. The area identified in this map section of the map shows SLR from three to five feet in an area surrounding smaller bodies of water on either side of 15th Street as well along the canal and additional waterways surrounding the Rustic Sands Resort Campground. The map also depicts SLR of one to two feet which is the current prediction near the 17th Street body of water closer in proximity to the coastline.

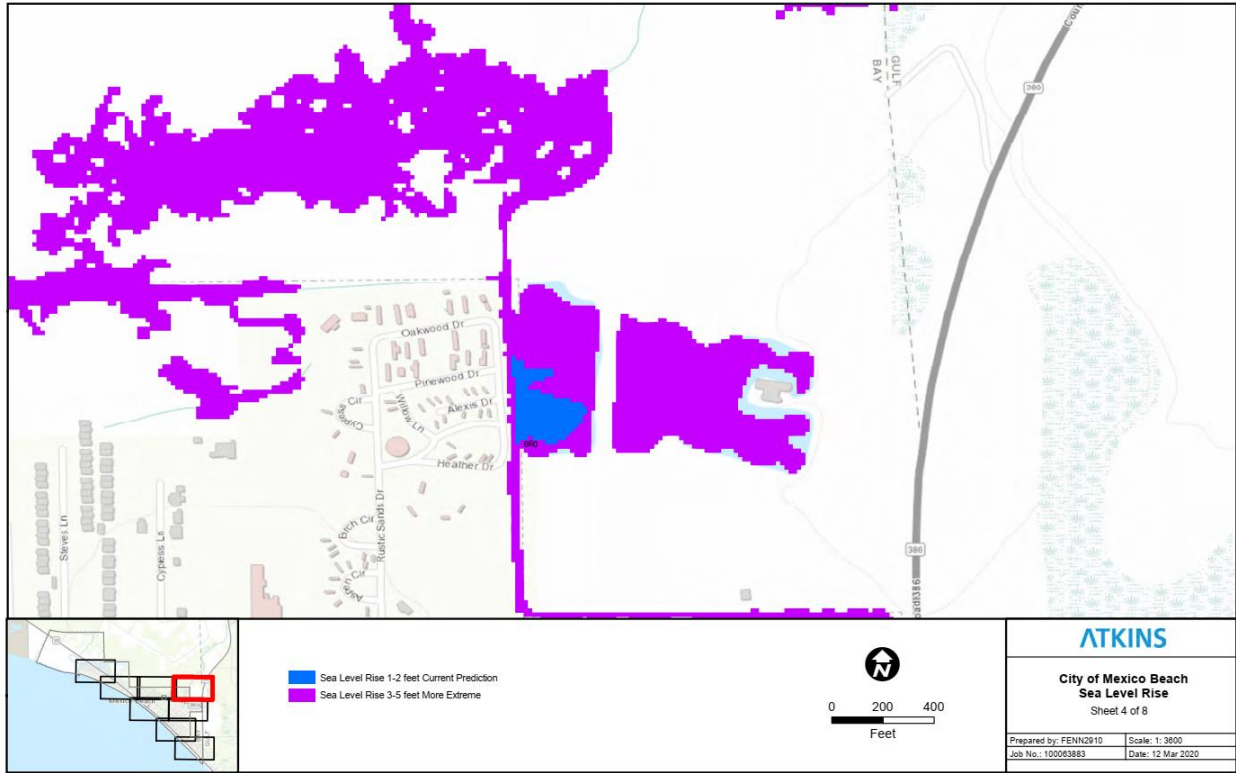


Figure 52. SDE SLR Map 4

SLR Map 4. This map outlines intense amounts of SLR, mostly from three to five feet, surrounding the bodies of water to the west of County Road 386 and along the channel of water that flows south towards the coast. There is also a large area to the north of the City that is undeveloped that would experience extreme SLR as well.



Figure 53. SDE SLR Map 5

SLR Map 5. This map demonstrates that the current SLR prediction of one to two feet will still occur in the low-lying areas as well as the canal that outflows to the coast. However, an area to the southeast of 12th Street will experience extreme SLR that was not previously noted as an area of concern because it is wetlands. This area is zoned as low density residential. Therefore, as it develops, the susceptibility to sea level rise must be accounted for in order to avoid future impacts and damage.

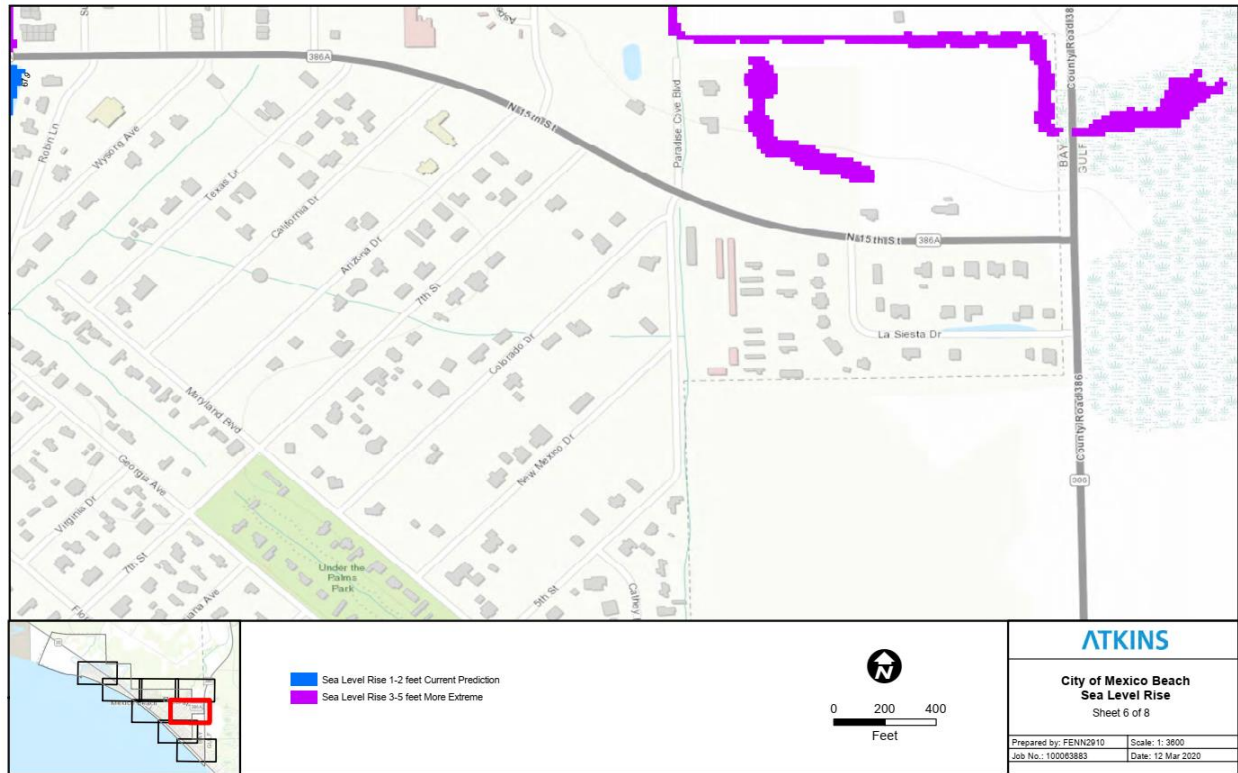


Figure 54. SDE SLR Map 6

SLR Map 6. In the map, an area of extreme SLR is shown north of 15th Street where it ends at County Road 386. It is undeveloped at this time but is surrounded by smaller bodies of water and runs up to the Bay and Gulf County line.

Priority Risk Index

In order to draw some meaningful planning conclusions on the four hazards of flood, high winds, storm surge, and sea level rise for Mexico Beach, the results of the hazard profiling process were used to generate countywide hazard classifications according to a “Priority Risk Index” (PRI). The purpose of the PRI is to categorize and prioritize the aforementioned hazards for the City as high, moderate, or low risk. Combined with the sensitivity analysis provided in the next section, the summary hazard classifications generated through the use of the PRI allows for the prioritization of potential adaptation strategies for implementation and opportunities for funding sources to consider as part of the overall resiliency strategy.

The prioritization and categorization of the four hazards for Mexico Beach is based principally on the PRI, a tool used to measure the degree of risk for identified hazards in a particular planning area. The PRI is not scientifically based but is rather meant to be utilized as an objective planning tool for classifying and prioritizing hazard risks in the City based on standardized criteria.

The application of the PRI results in numerical values that allow identified hazards to be ranked against one another (the higher the PRI value, the greater the hazard risk). PRI values are obtained by assigning varying degrees of risk to five categories for each hazard (probability, impact, spatial extent, warning time, and duration). Each degree of risk has been assigned a value (1 to 4) and an agreed upon weighting factor which can easily be adjusted as needed by the City,

as summarized in the following **Table 11**. To calculate the PRI value for a given hazard, the assigned risk value for each category is multiplied by the weighting factor. The sum of all five categories equals the final PRI value as demonstrated in the example equation below:

$$\text{PRI VALUE} = [(\text{PROBABILITY} \times .30) + (\text{IMPACT} \times .30) + (\text{SPATIAL EXTENT} \times .20) + (\text{WARNING TIME} \times .10) + (\text{DURATION} \times .10)]$$

According to the weighting scheme and point system applied, the highest possible value for any hazard is 4.0. When the scheme is applied for the City of Mexico Beach, the highest PRI value is 3.2 (storm surge).

DRAFT

PRI Category	Degree of Risk			Assigned Weighting Factor
	Level	Criteria	Index Value	
Probability	Unlikely	Less than 1% annual probability	1	30%
	Possible	Between 1 and 10% annual probability	2	
	Likely	Between 10 and 100% annual probability	3	
	Highly Likely	100% annual probability	4	
Impact	Minor	Very few injuries, if any. Only minor property damage and minimal disruption on quality of life. Temporary shutdown of critical facilities.	1	30%
	Limited	Minor injuries only. More than 10% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for more than one day.	2	
	Critical	Multiple deaths/injuries possible. More than 25% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for more than one week.	3	
	Catastrophic	High number of deaths/injuries possible. More than 50% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for 30 days or more.	4	
Spatial Extent	Negligible	Less than 1% of area affected	1	20%
	Small	Between 1 and 10% of area affected	2	
	Moderate	Between 10 and 50% of area affected	3	
	Large	Between 50 and 100% of area affected	4	
Warning Time	More than 24 hours	Self-explanatory	1	10%
	12 to 24 hours	Self-explanatory	2	
	6 to 12 hours	Self-explanatory	3	
	Less than 6 hours	Self-explanatory	4	
Duration	Less than 6 hours	Self-explanatory	1	10%
	Less than 24 hours	Self-explanatory	2	
	Less than one week	Self-explanatory	3	
	More than one week	Self-explanatory	4	

Table 11. Priority risk index factors for Mexico Beach

Priority Risk Index Results

Table 12 summarizes the degree of risk assigned to each category for all initially identified hazards based on the application of the PRI. Assigned risk levels were based on the hazard information developed for this section. The results were then used in calculating PRI values and making final determinations for the risk assessment.

Hazard	Category/Degree of Risk					
	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Storm Surge	Likely	Catastrophic	Large	More than 24 hours	Less than one week	3.3
High Wind	Highly Likely	Critical	Large	More than 24 hours	Less than 6 hours	3.1
Flooding	Highly Likely	Limited	Moderate	6 to 12 hours	Less than 24 hours	2.9
Sea Level Rise	Highly Likely	Minor	Small	More than 24 hours	More than one week	2.4

Table 12. Priority risk index for Mexico Beach

Focus Areas – Conducting Sensitivity Analysis and Adaptive Capacity

The next part of the Plan's Vulnerability Assessment focuses on the impact of the hazards on the City's key assets and key economic areas. These are referred to as Focus Areas and are the emphasis of the focus/emphasis for how Mexico Beach adapts during redevelopment to become more resilient. Many of the Focus Areas were heavily impacted or destroyed by Hurricane Michael. The post-Michael period, with the provisions of additional resources from the state and federal governments, represents a window of opportunity to retrofit, protect, and/or rebuild these assets in a more resilient fashion.

Selecting Focus Areas helps Mexico Beach prioritize a place to advance the adaptation process and crystallize the use of resources to build a track record of implementation. As stated in the Florida Climate Adaptation Handbook, "Focus Areas are established where critical facilities or infrastructure are located and/or where the highest affected population resides."¹

The sensitivity analysis and subsequent adaptive capacity analysis looked at the vulnerability of the parcel of land on which the asset sits, the adaptive capacity of the structure (if it still remains), or the type of resilience measures that should be adopted if it is a retrofit or rebuild. The latter part (resilience measures) is covered in detail in the Resilience Actions Completed or Underway section and Implementation Plan for Projects and Actions Funding Context section of the Plan. This section provides the vulnerability analysis that feeds into the resilience measure recommendation. The analysis focused on the following areas:

- **Jetty and Opening of the Mexico Beach Canal** (navigable canal on the western side of the City by Salt Creek) – This is an area where a tremendous amount of storm surge came through and damaged the jetty, the canal itself, the US 98 bridge, and development in the back canal. This area also experienced significant surge and erosion which completely destroyed the Canal Parkway Bridge. This area including residences, the City Marina and beach was inaccessible to vehicular traffic for nearly 8 months post-storm.
- **City Pier** – The pier was completely washed away, and storm surge completely crested over the pier.
- **City Canal area** – The surge came up the western canal at the jetty inlet into a shallow and caused tremendous damage, and the backflow again inundated the canal areas.
- **Commercial Area along US 98** – The surge came over and washed away all of the dunes across the highway and severely damaged the primary city commercial district which is along US 98.
- **City Hall** – While set a fair distance from the Gulf, the City Hall still had some minor flooding.
- **Civic Center** – The City's Civic Center was destroyed by a combination of wind and surge. This was the City's public meeting space for Council, Planning/Zoning, and the City's voting location. Post-storm, these services had to be conducted in a relatively small conference room in City Hall.

¹ Florida Adaptation Planning Guidebook, available at: <https://www.adaptationclearinghouse.org/resources/florida-adaptation-planning-guidebook.html>

- **City Water Tower** – The City Water Tower is next to the City Hall and was knocked over during Hurricane Michael.
- **Police and Fire Facilities** – Both of these first responder facilities were in a higher risk location and were destroyed by Michael.
- **Water / Wastewater System** – This critical system was severely impacted by Hurricane Michael and rendered inoperable for several weeks.
- **Beach Erosion and Dune System** – Prior to the storm, the City’s beach had an extensive dune system when created critical habitat and protected against surge and erosion in smaller events. Loss of the dunes makes the City more vulnerable to surge and erosion post-Michael. A section of the City’s beach (bounded by approximately 8th Street to 37th Street) was classified by FDEP as critically eroded prior to Hurricane Michael. This section of beach was further eroded during the storm and will require beach renourishment in order prevent risk to existing structures as beach continues to erode.

Overall Sensitivity Analysis

The sensitivity analysis builds upon the exposure analysis and examines the major assets within the community. The aspects of location, elevation, and the date the structure was built were all evaluated, and each structure or asset’s purpose, usage, and population were reviewed for the effects from the selected hazards and potential sea level rise in the jurisdiction.

Due to the City’s canal system, hydric soils, and topography (low-lying areas) several locations were identified as specifically vulnerable to storm surge and sea level rise/flooding as well as information from the exposure analysis, the specific areas that are subject to inundation are located along the coastline, along 22nd Street and US Highway 98, and along the areas surrounding 17th, 16th, and 15th Streets moving south towards Missler and Ditch Roads. These areas also included the residential area along the marina on the north side of Hwy 98 bounded by 32nd Street and 44th Street. Storm surge in this area was observed at 6 to 9 feet during Hurricane Michael.

The canal is also a major area of concern that can suffer from the effects flooding and storm surge as well as the expected sea level rise. The Mexico Beach Police Department was very close to the canal area along 14th Street, which was detrimental during Michael.

As shown in the previous map sections, a significant amount of housing was damaged, and the needs are widespread. Not one residential area was selected as a focus area, but a few are highlighted in this section to provide examples of the needs and challenges. Some highlighted residential areas that are especially vulnerable to flood are the area north of Highway 98 and west of 36th Street and the residential area south of 15th over to County Road 386.

Adaptive Capacity

While examining adaptive capacity, a community’s systems and assets are evaluated for their ability to be modified and/or cope to the changing climate and impacts of sea level rise. Often, an entire system, asset, or piece of infrastructure cannot be changed completely with one project or effort so evaluating the components that make up that system individual determines how projects for adaptation can be outlined. During the examination of adaptive capacity for each focus area, typically a series of assessments were performed:

1. Regulatory and planning capabilities (e.g., protection of human life, development and redevelopment restrictions, coastal management regulations, hazard mitigation, sustainability, shoreline management, post-disaster recovery/emergency plans, infrastructure placement, and financial impacts);
2. Administrative and technical capabilities (e.g., the number of sea level rise experts, planners, engineers, GIS and mapping resources, and modeling capabilities);
3. Fiscal capacity (e.g., taxes, bonds, grants, impact fees, withholding spending in hazard zones, and insurance); and
4. Infrastructure (e.g., flood and erosion control structures, evacuation routes and redundant water, wastewater, and power systems).

This form of assessment allows for all the capacities to be determined and weighed against their current usage in the community. The assessment for the Mexico Beach Focus Areas emphasized the specific physical components of these systems and where they are vulnerable.

Assess Adaptive Capacities: Regulatory Assessment

The regulatory assessment provides an opportunity to catalogue capacities that are currently being used but are not yet known or recognized as sea level rise adaptation planning.

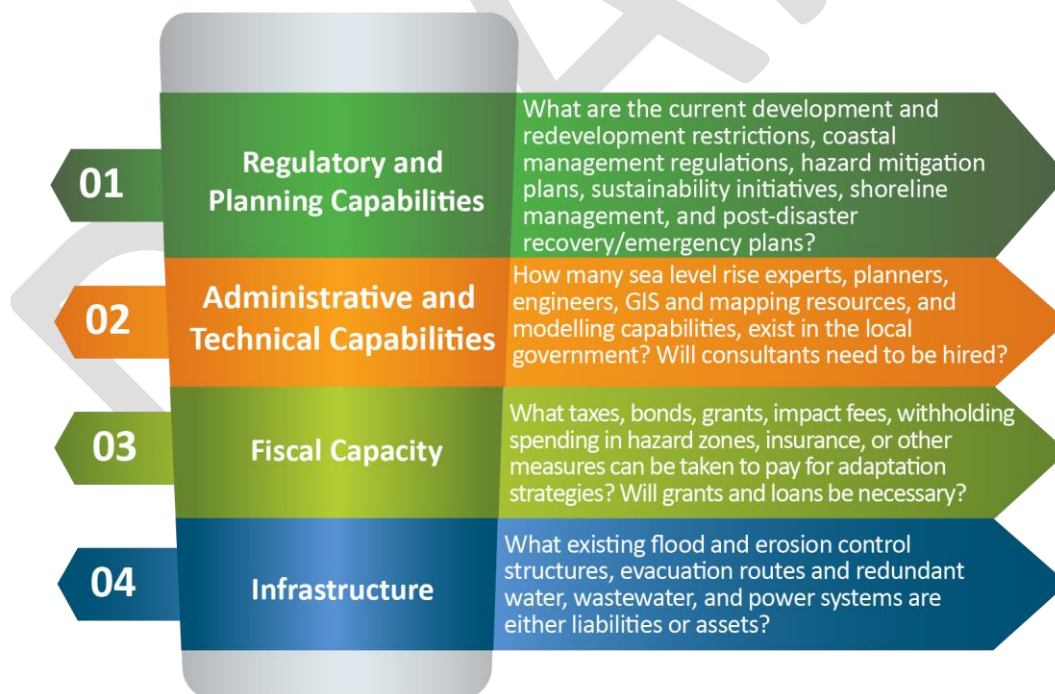


Figure 55. Adaptive Capacity Analysis from FDEP's Florida Adaptation Planning Guidebook

Jetty and Opening of the Mexico Beach Canal



Figure 56. Coastal opening of the canal into the ocean

On the west side of the canal opening, the majority of the riprap running along the edge was pulled away and moved into the center of the canal opening becoming a blockage. The east side of the canal's riprap was pulled from the side and was completely lost or buried within the sand in the canal. A lot of sand that was deposited in the opening made an actual bridge across the canal and ultimately will require dredging. Part of the pier traveled from the coast and landed on a private dock in this area. The canal was inundated with a vast amount of debris to include pieces of boats and homes. To make the canal operational, it had to be completely cleaned out and dredged.

Jetty/Canal Opening Sensitivity Analysis

Asset Components	Sensitivity to Wind	Sensitivity to Flood	Sensitivity to Surge	Sensitivity to Sea Level Rise
Ingress/Egress channel	Potential blockage of vessel passage	Potential blockage of vessel passage	Potential blockage of vessel passage	Limited
Riprap structures	Potential destruction	Potential destruction	Potential destruction	Loss of functionality

Jetty/Canal Opening Adaptive Capacity

Asset Components	Wind Protection Needs	Flood Protection Needs	Surge Protection Needs	Sea Level Rise Protection Needs
Ingress/Egress channel	Extend the east jetty	Extend the east jetty	Extend the east jetty and provide additional	Extend the east jetty

Asset Components	Wind Protection Needs	Flood Protection Needs	Surge Protection Needs	Sea Level Rise Protection Needs
			armoring or breakwaters	
Riprap structures	Larger armoring (rubble) for eastern jetty and extend jetty	Larger armoring (rubble) for eastern jetty	Larger armoring (rubble) for eastern jetty	5-year analysis for reinforcement

City Pier

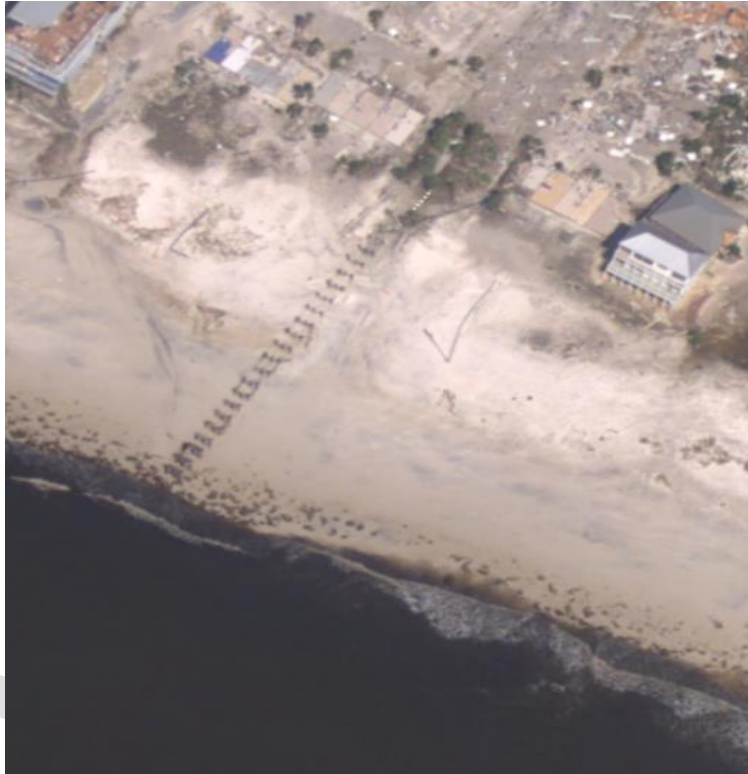


Figure 57. Remnants of the City Pier following Hurricane Michael

In July 2008, the City doubled the length of the pier and added 278 feet to the pier. During Hurricane Michael, the City’s pier was completely demolished and cannot be repaired but will need to be rebuilt as a brand-new structure.

Pier Sensitivity Analysis

Asset Components	Sensitivity to Wind	Sensitivity to Flood	Sensitivity to Surge	Sensitivity to Sea Level Rise
Parking lot; egress	Limited	Limits usage	Limits usage	Limited exposure
The pilings	Weakens structure	See storm surge	Severely weakens	None
The pier surface	Damages or weakens surface decking	Limited	May severely damage	Limited
Structures on the pier	Roof damage or destruction	Weakening effects	Limited	None

Pier Adaptive Capacity

Asset Components	Wind Protection Needs	Flood Protection Needs	Surge Protection Needs	Sea Level Rise Protection Needs
Parking lot; egress	Limited	Limited	Limited	Potential elevation
The pilings	Replace with concrete piles/substructure	Replace with concrete piles/substructure	Replace with concrete piles/substructure	Moderate effect when sea level rise combined with surge and wave action
The pier surface	Break away composite decking	Break away composite decking	Break away composite decking	Potential elevation
Structures on the pier	Utilization of stronger materials	Utilization of stronger materials	Reinforcement on a periodic cycle	N/A

City Canal (Regional Stormwater Detention and the 8th Street Discharge)



Figure 58. Aerial image of the canal flowing from the coast throughout the City

The City Canal on the western side of the municipality is on the back side of Highway 98 along a residential area. During Hurricane Michael, water topped the canal and flowed over the Highway 98 bridge. Part of the pier traveled from the coast and landed on a private dock in this area. The canal was inundated with a vast amount of debris to include pieces of boats and homes. To make the canal operational, it had to be completely cleaned out and dredged.

From a more global perspective of the entire canal system (from 8th Street to the Marina), there is the need for regional detention to address water quality and the project to redirect the discharge at 8th Street back to its original drainage pattern (discharge to Cypress Creek). This eliminates the 8th Street canal discharge which could then be armored with a dune and prevent surge from moving through this area like it did during Michael (flooding all of the structures north of Hwy 98).

City Canal Sensitivity Analysis

Asset Components	Sensitivity to Wind	Sensitivity to Flood	Sensitivity to Surge	Sensitivity to Sea Level Rise
Canal body	N/A	Severe damage, overtopping and erosion	Severe damage, overtopping and erosion	Erosion
Stormwater collection channel	Limited	Limited	Overtopping will occur	Overtopping may occur eventually

City Canal Adaptive Capacity

Asset Components	Wind Protection Needs	Flood Protection Needs	Surge Protection Needs	Sea Level Rise Protection Needs
Canal body	N/A	Surge gate, wider channels, detention areas, and slope stabilization	Surge gate and slope stabilization	Slope stabilization
Stormwater collection channel	N/A	Install regional detention	Redirect final discharge to restore natural drainage patterns and eliminate 8 th Street Canal	Redirect final discharge to restore natural drainage patterns and eliminate 8 th Street Canal

Commercial Area along US 98

The commercial area along US Highway 98 consists of a restaurant, a marine supply retail store, and condominiums. The restaurant was completely destroyed and has not been reconstructed. The marine supply business was closed for a prolonged period of time and finally repaired and reopened. All of the condominiums have not been restored for habitation but are being repaired slowly and opening back up for residents as they are restored.



Figure 59. Damaged commercial area of the City following Hurricane Michael

The commercial area around 31st Street also had two local restaurants and a store. The restaurant on the far west was destroyed and has been cleared. The other restaurant and store flooded up to the roof. The damaged structures are still onsite and awaiting removal and to be potentially rebuilt. A local hardware store was also destroyed in this area and was just relocated temporarily until a new location is reconstructed.

Commercial Area Sensitivity Analysis

Asset Components	Sensitivity to Wind	Sensitivity to Flood	Sensitivity to Surge	Sensitivity to Sea Level Rise
Roadways	Will damage and prevent use	Will damage and prevent use	Will damage and prevent use	N/A
Building structures	Severe damage may occur	Standing water within the structure	Will weaken the structural components	Limited
Building roofs	May be damaged or lost	N/A	Depending on height may experience damage	N/A
Doors and windows	Unprotected windows, doors, and roof susceptible to high wind	Flood penetration around doors	Flood penetration around doors	Limited exposure

Commercial Area Adaptive Capacity

Asset Components	Wind Protection Needs	Flood Protection Needs	Surge Protection Needs	Sea Level Rise Protection Needs
Roadways	Frequent repairs	Frequent repairs and elevation	Frequent repairs and elevation and articulated block	Potential elevation
Building structures	Stronger materials and reinforcement	Water resistant materials; potential elevation or floodproofing	Water resistant materials; potential elevation or floodproofing	Water resistant materials; potential elevation or floodproofing
Building roofs	Reinforcement	N/A	Limited	N/A
Doors and windows	Shutters or protective film	Floodproofing of doors	Floodproofing of doors	N/A

City Hall

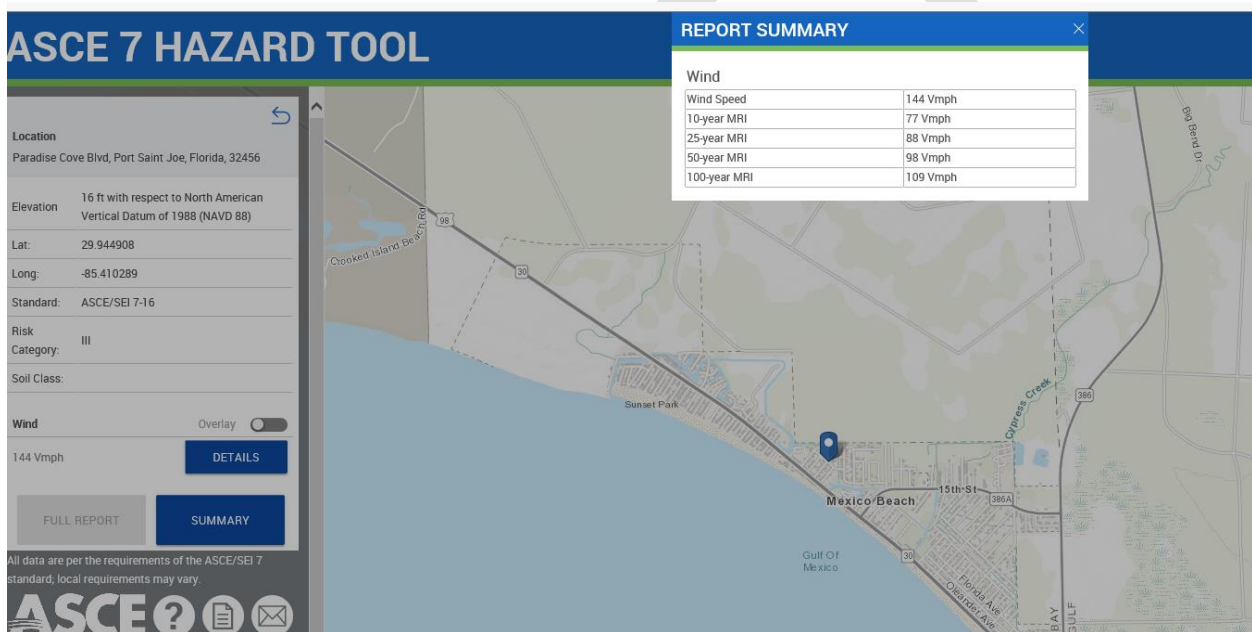


Figure 60. Report Summary from ASCE software depicting the wind speed at City Hall from Hurricane Michael.

City Hall is one of the newest facilities in the City and built to higher standards, so it fared well during Hurricane Michael with less damage than most of the City. One foot of water was inside City Hall and one window was shattered due to a flying object. Several of the gutters were damaged but easily repaired.

City Hall Sensitivity Analysis

Asset Components	Sensitivity to Wind	Sensitivity to Flood	Sensitivity to Surge	Sensitivity to Sea Level Rise
Parking lot; egress	Limited	Limits usage	Limits usage	Limited exposure
Roof	Minor damage	Minor damage	Limited damage	N/A
Structural components	Minor damage	Minor damage	Limited damage	Limited exposure

Asset Components	Sensitivity to Wind	Sensitivity to Flood	Sensitivity to Surge	Sensitivity to Sea Level Rise
Doors and windows	Unprotected windows and doors susceptible to high wind	Flood penetration around doors	Flood penetration around doors	Limited exposure

City Hall Adaptive Capacity

Asset Components	Wind Protection Needs	Flood Protection Needs	Surge Protection Needs	Sea Level Rise Protection Needs
Parking lot; egress	Limited	Impervious materials	Limited	N/A
Roof	Frequent inspections and reinforcement as needed	N/A	Limited	N/A
Structural components	Frequent inspections and reinforcement as needed	Install appropriate flood protection	Limited	N/A
Doors and windows	Shutters or protective film	Floodproofing of doors	Floodproofing of doors	N/A

Civic Center

The City’s Civic Center is to the northeast of 31st Street and was completely destroyed by winds and storm surge from Hurricane Michael. The structure has now been demolished. A new facility will be built to accommodate the City’s needs.

Civic Center Sensitivity Analysis

Asset Components	Sensitivity to Wind	Sensitivity to Flood	Sensitivity to Surge	Sensitivity to Sea Level Rise
Parking lot; egress	Limited	Limits usage	Limits usage	Limited exposure
Roof	Major damage	Major damage	Major damage	N/A
Structural components	Major damage	Major damage	Major damage	Limited exposure
Doors and windows	Major damage	Major damage	Major damage	Limited exposure

Civic Center Adaptive Capacity

Asset Components	Wind Protection Needs	Flood Protection Needs	Surge Protection Needs	Sea Level Rise Protection Needs
Parking lot; egress	Limited	Impervious materials	Limited	N/A
Roof	Frequent inspections and reinforcement as needed	N/A	Limited	N/A
Structural components	Frequent inspections and reinforcement as needed	Install appropriate flood protection	Limited	N/A
Doors and windows	Shutters or protective film	Floodproofing of doors	Floodproofing of doors	N/A

Redundant Water Supply



Figure 61. Topped City water tower following Hurricane Michael

Due to the winds, the City’s water tower toppled over and flooded the canal nearby and the Public Works Department (approximately two feet of water in the building). A private company was able to break down the metal from the water tower and remove it. In analyzing how the water tower and water supply were affected by Hurricane Michael, and considering how the City is dependent on a 25-mile route of pressurized lines from Bay County, the City is re-evaluating how it wants to secure a redundant and backup source of water. The current idea is to not replace the water tower and instead, seeks a backup source with the nearby Gulf County water supply system. The City’s pre-Michael water system consisted of the 100,000-gallon elevated tank combined with a 1-million-gallon ground storage tank. The City would like to explore

replacing the elevated tank with a second ground storage tank (more resilient than elevated tank). In addition, the City is considering working with City of Port St Joe to provide an alternate source of water to the City if Bay County’s system is inoperable.

Water Tower Sensitivity Analysis

Asset Components	Sensitivity to Wind	Sensitivity to Flood	Sensitivity to Surge	Sensitivity to Sea Level Rise
Water tank	Loss of water	Limited	Limited	N/A
Tower legs	Failure to uphold tank under high wind load	N/A	N/A	N/A
Pump	Loss of power to operate	Loss of power to operate	Loss of power to operate	N/A
Water supply to the tower by pressurized lines	N/A (lines are buried)	Loss of power to operate	Loss of power to operate	Loss of power to operate

Water Tower Adaptive Capacity

Asset Components	Wind Protection Needs	Flood Protection Needs	Surge Protection Needs	Sea Level Rise Protection Needs
Water tank	Replace with Ground Storage Tank – Add redundant water supply	N/A	N/A	N/A
Tower legs	Replace with Ground Storage Tank	Replace with Ground Storage Tank	Replace with Ground Storage Tank	N/A
Pump	Backup generator	Elevated Backup generator	Elevated Backup generator	N/A
Water supply to the tower by pressurized lines	N/A (lines are buried)	Secure the lines or identify secondary supply water source	Secure the lines or identify secondary supply water source	Secure the lines or identify secondary supply water source

Police and Fire Facilities



Figure 62. Aerial image of the Police and Fire Department facility and parking lot following Hurricane Michael

The Police and Fire Department were in a low-lying area and suffered extreme damage. The Fire Department had also just been repaired from a previous flood prior to Michael. All of the facilities were destroyed and were demolished. Currently, the Police Department contracts out services to Bay County and their staff utilize a portion of City Hall for their services. There is a temporary site for the Fire Department in the public works building as a space is being repaired and the second floor is being built out. Eventually, to move these first responders' facilities out of harm's way, the City plans to relocate the functions of these facilities to a new upland area in a new building that will also house the Emergency Operations Center.

Police and Fire Facilities Sensitivity Analysis

Asset Components	Sensitivity to Wind	Sensitivity to Flood	Sensitivity to Surge	Sensitivity to Sea Level Rise
Parking lot; egress	N/A	Damage and loss of use	Damage and loss of use	N/A
Access road	Blockage and limited use	Blockage and limited use	Blockage and limited use	N/A
Roof	Severe damage	Limited	Limited	N/A
Structural components	Severe damage and loss of facility	Repetitive damage	Severe damage and loss of facility	Limited

Police and Fire Facilities Adaptive Capacity

Asset Components	Wind Protection Needs	Flood Protection Needs	Surge Protection Needs	Sea Level Rise Protection Needs
Parking lot; egress	N/A	Improved drainage	Limited	N/A
Access road	Repair	Improved drainage	Limited	N/A
Roof	Reinforcement with stronger materials, hurricane straps/anchoring	N/A	N/A	N/A
Structural components	Reinforcement with stronger materials	Replace with moisture resistant materials; appropriate floodproofing and/or relocation	Appropriate elevation or relocation	Limited

Wastewater System

The entire system was inoperable after Hurricane Michael due to loss of power and sedimentation infiltrating the system. Due to the City’s proximity to the coast, the City’s entire wastewater collection system relies on 27 lift stations throughout the city and pump to a Master Lift Station which then sends wastewater 25 miles to Bay County’s treatment plant. Therefore, without power, the entire system, including the master station was inoperable. Overflows occurred and residents were without sanitation services.

Water / Wastewater System Sensitivity Analysis

Asset Components	Sensitivity to Wind	Sensitivity to Flood	Sensitivity to Surge	Sensitivity to Sea Level Rise
Lift stations	Loss of power and functionality	Loss of power and functionality	Loss of power and functionality	N/A

Water / Wastewater System Adaptive Capacity

Asset Components	Wind Protection Needs	Flood Protection Needs	Surge Protection Needs	Sea Level Rise Protection Needs
Life stations	Backup generator and bypass system	Backup generator and bypass system	Backup generator, elevation, and bypass system	Elevation

Beach Erosion and Dune System

Prior to Hurricane Michael, the City’s beach had an extensive dune system which not only provided critical habitat for native species and enhanced the City’s beauty but also served as surge protection and beach stabilization against storm surge and erosion. The City recognized the value of this natural buffer system and for this reason, purchased approximately 1 mile of beachfront to dedicate to open preservation space to ensure this section of beach remains

natural and undeveloped. Before the hurricane, a section of beach bounded by approximately 8th Street to 26th Street was designated as critically eroded by FDEP.

Beach Erosion and Dune System Sensitivity Analysis

Asset Components	Sensitivity to Wind	Sensitivity to Flood	Sensitivity to Surge	Sensitivity to Sea Level Rise
Beach Dunes/width of beach	Moderate	Limited	Severe damage and loss of function	Moderate

Beach Erosion and Dune System Adaptive Capacity

Asset Components	Wind Protection Needs	Flood Protection Needs	Surge Protection Needs	Sea Level Rise Protection Needs
Beach Dunes/width of beach	Establish vegetation/dune planting	Limit direct stormwater discharges	Beach renourishment and construction of permanent dunes	N/A

Post-Michael Needs

While Mexico Beach was making some progress with resilience prior to Hurricane Michael, the tremendous devastation left by the storm plus the need to rebuild many facilities, structures, and houses has put resilience to the forefront. Mexico Beach faces several critical issues, identified in the Michael recovery process by City staff and leadership.

The following needs have been captured in the planning process and follow the six Recovery Support Functions established through the National Disaster Recovery Framework (NDRF). This plan addresses the needs, risks, and opportunities related to the Recovery Support Functions: Community Planning and Capacity Building, Economic Development, Health and Social Services, Housing, Infrastructure, and Natural and Cultural Resources. These functions represent the key subject areas that drive the well-being and prosperity of the whole community. As described in the NDRF, these six Recovery Support Functions are the “coordinating structure for key functional areas of assistance.”

Needs and Issues

The needs and issues identified below draw from discoveries in the Vulnerability Assessment and inform the opportunities and strategies in the Plan. The issues are formulated in problem statements following NDRF recovery functions to serve as a bridge between the identification of vulnerabilities and the list of resilience actions:

Infrastructure Systems Needs and Issues

- The area around the 8th Street Canal has areas that repetitively flood even during moderate coastal storms and rainfall events. The outfall to the Gulf allows storm surge to come back up through the canal creating another flood hazard. In addition, the outfall to the Gulf results in tannins and contaminants draining into nearshore waters next to City’s beaches. This area is also at the highest risk to sea level rise and increased flooding.
- Stormwater drainage is a challenge as the topography of the City is relatively flat and a good portion of the City is covered by impervious surfaces. In several areas, a regional detention system with restored wetlands and Best Management Practices (BMPs) are needed to help transform the “grayscape” to “greenscape” which will also help improve water quality.
- City-wide utilities are at risk, including wastewater, and power. These utilities were damaged after Michael which led to loss of service. Some of these utilities received damage even in smaller events. A key piece of infrastructure, the City’s water tower was knocked over during the hurricane.
- City-wide roads, streets, and bridges were damaged during Hurricane Michael. Storm surge undermined the pavement and has caused settling, cracking, and wear. Multiple bridges were damaged including the Canal Parkway bridge which was completely washed out by storm surge.
- Highway 98 is the City’s ‘Main Street.’ It was damaged by Hurricane Michael but also served as a surge barrier for part of the community. A future vision of the corridor is a ‘complete street’ that could serve multiple functions – increased capacity as a main street and increased capacity as a surge barrier.

- Power was out for several weeks, which resulted in no street lighting and unsafe living conditions including mold/mildew and extreme heat for elderly residents without air conditioning. In addition, without electric grid, the City's pumps for water distribution were inoperable and all of the City's 27 lift stations were inoperable until bypass pumps and generators could be obtained through Bay County EOC. The damage to the grid was at both the transmission and distribution level: 1) transmission line towers, the large structures that bring electricity to substations in route to neighborhoods, were severely damaged or knocked over; 2) several power substations were damaged; and 3) the local distribution system (individual wires and poles) in Mexico Beach was severely damaged. There were countless disrupted connections to individual homes. While the components of the grid that serves Mexico Beach are vulnerable in areas beyond Mexico Beach, there are a few items that the City could work with Duke Energy to address. For example, backup or alternative power lighting (e.g., solar-powered lighting) is needed. Potential future considerations are burial of power lines.
- Storm surge entered the Canal at the inlet to the Marina and damaged the jetty at its entrance. Infrastructure facilities and structures along the canal, including the US 98 bridge and marina, suffered tremendous damage.

Housing Needs and Issues

- Many homes were substantially damaged by Michael, including those in areas that were not part of the regulatory floodplain prior to the storm. The City appropriately updated its flood ordinance and many of these homes need to be elevated to be protected and stay in compliance with the update.
- Related to the required elevation and other post-Michael issues, housing is now more expensive in Mexico Beach, resulting in housing affordability needs. Additional housing financial aid and reconstruction assistance are needed. Many property owners are also still battling with insurance companies which has slowed down the rebuild process.
- As of June 2020, there are still many Mexico Beach residents displaced by Hurricane Michael that have not returned to the City.

Economic Development Needs and Issues

- Additional waterfront-related and water-dependent uses are needed to capitalize on the City's beachfront and canal assets (also could be under "Natural and Cultural Resources").
- Several businesses continue to struggle post-Michael. As of October 2019, the City's economy was at about 30% of its pre-storm level (<https://weather.com/photos/news/2019-10-10-mexico-beach-one-year-anniversary-photos>).
- The City takes pride in its almost complete lack of chain stores and the presence of many locally owned small businesses. It strives to maintain this proportion of small businesses in the future and will continue to support the rebuild of small businesses while attracting new ones.
- The City Pier was a community focal point and needs to be rebuilt after being destroyed by Michael. An improved and more resilient pier is needed to meet future community needs.

Natural and Cultural Resources Needs and Issues

- The dunes protecting the beachfront were completely destroyed; replanting and dune fencing have helped build up new dunes which are, as of June 2020, relatively small but growing. A mature dune system is needed to protect against storm surge.
- Beach renourishment to restore the beachfront to pre-Michael size (or greater) and address future erosion are priorities to allow more space for recreational activities and a mature dune system.
- The City's beach accesses and city-wide parks must be replaced to allow residents and visitors recreational access to the City's natural amenities.
- Many trees were lost during Hurricane Michael. The trees add beauty, provide a wind break, and help soak up stormwater.
- All of the city parks to include the one where community events are held were destroyed with the occurrence of Hurricane Michael and need to be redeveloped.

Health and Social Services Needs and Issues

- The City's first responder facilities were in high-risk areas and did not have sufficient protection.
- The City does not have designated community assistance centers for residents where they can gather post-disaster in emergency situations for help, news updates, and mutual support.
- Key social service assets are still in need of further mitigation to prevent future flooding.

Community Planning and Capacity Building Needs and Issues

- The City faces post-disaster because it is geographically isolated 25 miles from the Bay County EOC and 12.5 miles from the Gulf County EOC. Due to this isolation, the City requires its own EOC after a disaster because it cannot have a representative present in the Bay County EOC during a disaster and then travel back to the City to respond to urgent and possibly life-critical needs once the storm has passed. The City has emergency operation and management needs, including a secure emergency operations center and emergency communications equipment.
- City facilities need to be protected to ensure continuity of operations.
- Need for evacuation resources to get vulnerable populations go to Bay County shelter or shelters north of I-10.
- Emergency preparedness plans need to be updated to prepare for future events and coordinated with surrounding jurisdictions in Bay and Gulf Counties.

Opportunities and Strategies

The ultimate vision for Mexico Beach is to rebuild and redevelop in a manner that addresses resiliency, sustainability, and greater prosperity to secure the City’s long-term success. This vision entails actions that protect homes, businesses, and facilities damaged by Michael while providing a blueprint for enhanced economic development, recreation, and community services. Mexico Beach will use the momentum generated during the recovery, as documented in this plan, to continue addressing resiliency into the future.

Mexico Beach will incorporate resiliency efforts in its other plans, including its comprehensive plan, to continue addressing the risk posed by events like Hurricane Michael as well as other more frequent coastal and stormwater flooding. As described in the National Disaster Recovery Framework (NDRF), recovery efforts should address other areas important to a community’s vitality, such as economic development, in addition to resiliency.

Literature Review to Identify Existing Projects and Approaches

Table 13 is a review of Mexico Beach’s existing planning documents as well as other relevant reports developed following Hurricane Michael. The review of these documents provided an understanding of the historical context regarding the community’s recurring and remaining needs and opportunities. The following section, “Regional Perspectives and Coordination,” provides additional information to understand a larger context. By reviewing these plans and studies, the planning team could incorporate these project ideas, if still suitable after Michael, and set the stage for additional needed actions. Following the table are brief summaries of relevant plans prepared before and after Hurricane Michael that relate to resilience and rebuilding issues. The table provides notations on whether the reviewed plans were developed prior to Michael since much has changed since those plans were developed.

Reviewed Plan/Study	Date	Relevant Information
Comprehensive Plan Amendment DCA No. 06-1; Ordinance Nos: 510, 511, 512, 513	September 2006	This amendment adopted a revised future land use map and textual amendments adopting the Coastal Management Element.
Comprehensive Plan Amendment PA-01; Ordinance No. 533	August 2007	This update adopted a revised zoning map and textual amendments.
Comprehensive Plan Map Amendment 17-ESR	December 2017	Large Scale Map amendment designating land use categories for parcels of property
Mexico Beach LSPA 19-02 (Coastal Management Element and maps) – Ordinance No. 695	March 2019	This adopted amendment deleted sub area policy restrictions applicable to 486 acres and moved to utilize regular tourist mixed use requirements.
Comprehensive Plan Amendment LSPA 19-01; Ordinance No. 710	February 2019	This amendment adopted textual updates in the introduction, community profile, revising public participation, amending the future land use element, and

Reviewed Plan/Study	Date	Relevant Information
		updating language and definitions throughout the comprehensive plan.
City of Mexico Beach Stormwater Master Plan	May 2015	This plan is an analysis of the City’s existing stormwater management system to assess options for improvements based on known areas of flooding, areas with water quality issues, and deficiencies within it. It identifies non-structural solutions that are prioritized with cost estimates. It was identified as a mitigation action in the 2015 Bay County LMS.
City of Mexico Beach Land Development Code	August 2019	This is an updated code to be in alignment with the updated version of the comprehensive plan following the impact of Hurricane Michael.
2019 Mexico Beach Comprehensive Plan	2019	In response to Hurricane Michael, the City updated their Comprehensive Plan again and maintained the Coastal Management Element component that was adopted in 2017. See “Integration – Peril of Flood Requirement” in the “Resilience Actions Completed or Underway” for more information.
Mexico Beach Vulnerability Assessment of Coastal Areas	December 2017	This plan is a technical analysis that supports policy updates to the Mexico Beach Comprehensive Plan, and its Coastal Management Element, describing coastal flood risk variables including high tides, coastal storm surge, sea level rise, or extensive flooding due to a rare storm event. This study has evaluated the State’s “Peril of Flood” requirements. A major finding of the plan is that the City is not going to be severely impacted by sea level rise for approximately 100 years and until SLR will reach six feet. The plan also includes description of utilities, utility agreements, and future land use areas.
Mexico Beach Post-Michael Substantial Damage Estimate Report	October / November 2018	The report is the summary of an assessment of xx properties post-Michael to determine if they were substantially damaged by the storm. This information is critical for the NFIP, post-disaster rebuilding and beneficial for grant efforts.
Recovery and Resiliency Partnership (RRP) Mexico Beach	December 2019	The plan built off the 2015 Stormwater Master Plan. The Interagency Recovery Coordination (IRC) identified opportunities for enhancing the long- term recovery efforts of the City. Because of the identification of potential Brownfields, stormwater issues, and recreational and economic needs, the City committed to developing the RRP as a technical assistance tool for addressing issues and identifying opportunities. The results of this collaborative process are discussed later in this plan.
FEMA Hurricane Michael in Florida Mitigation Assessment Team (MAT) Report	February 2020	Provides multiple recommendations for resilience after lengthy investigations into the impacts from Michael in Florida. Several of these recommendations for local

Reviewed Plan/Study	Date	Relevant Information
		communities are captured in the “Resilience Actions to Date” (if done) or “Gaps” (if not yet realized).
State of Florida Action Plan for Disaster Recovery (DEO submittal to HUD for Hurricane Michael recovery and CDBG-DR funding)	February 2020 (check this date)	Provides overview of disaster impacts by county; provides standards for CDBG-DR funded projects like Elevation Standards on p. 14; Program budget funding on p.20
Feasibility Study for Beach Restoration and Inlet Bypassing	April 2017	This study examined different solutions to address armoring the east jetty and minimize sedimentation at the inlet to the marina. In addition, it provided an analysis for addressing beach erosion in the critically eroded portion of the City’s beach.

Table 13. Plans reviewed with relevant information

Overall, Mexico Beach seeks to protect and then revitalize the community while maintaining its special character. The next section provides a larger context in which Mexico Beach should consider opportunities, strategies, and ultimately, actions.

Regional Perspectives and Coordination

In addition to considering the elements from the City’s plans listed in **Table 13**, mitigating the risk of damage from future storms to increase resiliency and rebuilding stronger will require regional as well as local actions. Mexico Beach, while part of Bay County, is somewhat isolated from the more populated areas. It is surrounded by Tyndall Air Force Base to the northwest and St. Joe Paper Company land to the northeast. Although Mexico Beach is an incorporated city within Bay County and has many of its own capabilities and authorities, it does have several of its utilities through Bay County like water and wastewater. It shares a southern/eastern border with unincorporated areas in Gulf County, designated on maps as Beacon Hill, and then farther down the road, St. Joe Beach. Port St. Joe in Gulf County is the closest city and is approximately 11 miles away on US 98. In the inland area northeast from Mexico Beach, Wewahitchka in Gulf County is the nearest city, approximately 21 miles away. On the Bay County side to the west, Parker (19.9 miles) and Callaway (20.5 miles) are the closest cities.

To better understand the planning context of Mexico Beach, several plans from Bay and Gulf Counties were reviewed along with pertinent regional and state plans (**Table 14**). Some issues cross political jurisdictions and need to be coordinated on a regional basis. All mitigation grant projects must go through the Bay County Local Mitigation Strategy (LMS) so that multi-discipline, countywide working group has been involved in understanding these projects. The County LMS Coordinator attended the Resilience Plan briefing held on December 11, 2019 along with FDEP.

Reviewed Plan/Study	Date	Relevant Information
State Hazard Mitigation Plan	June 2018	Identifies hazards based on the history of disasters within the state and details goals, objectives, strategies, and actions for reducing future losses. Demonstrates that the state has

Reviewed Plan/Study	Date	Relevant Information
		<p>developed a comprehensive mitigation program, effectively uses available mitigation funding, and is capable of managing all funding, including that which results from achieving enhanced status. Identifies federal, state, and local resources and programs that can be utilized by Mexico Beach to fund projects.</p> <p>State Mitigation Bureau vision is to: <i>Make Florida a hazard resilient and resistant state.</i></p> <p>State Mitigation Strategy is to: <i>Reduce the impacts of all hazards within the State of Florida through effective administration of all mitigation grant programs and a coordinated approach to mitigation planning and floodplain management through federal, state, regional, and local initiatives.</i></p>
State DEO Comp Plan	2018	Provides long-range policy guidance for the orderly social, economic, and physical growth of the state. Includes a public safety goal to protect the public by protecting lives and property from natural and manmade disasters and two policies that require local governments, in cooperation with regional and state agencies, to prepare advance plans for the safe evacuation of coastal residents and to adopt plans and policies to protect public and private property and human lives from the effects of natural disasters. Additional goals and policies address water resources (including floodplain management), coastal and marine resources, and natural systems and recreational lands (including watershed protection and erosion control).
DEO Areas of Critical Concern	1972	The City of Mexico Beach is not located within any of the designated areas of critical state concern per the Florida Environmental Land and Water Management Act of 1972.
Northwest Florida Water Management District Surface Water Improvement Plan	2017	The plan discusses how riparian wetlands, marshes, and floodplain forests help to slow stormwater runoff, protecting water quality and regulating the release of water into streams and aquifers. The plan promotes Low Impact Development practices and lists oyster reef restoration and stormwater retrofits as a good management practice (p. 40-41).
Emerald Coast Regional Council or ECRC (includes Bay County and formerly called West Florida RPC)	The topic areas have various dates	Disaster Recovery plan for ECRC will be available soon. Relevant information from the 2018-2022 Comprehensive Economic Development Strategy: ECRC also directs FDEM's Hurricane Loss Mitigation Program (HLMP) for the region. HLMP provides wind mitigation retrofits and upgrades to residences to meet Florida Building Code requirements for hurricane-force wind resistance. With Florida DEM, coordinates the Florida Statewide Regional Evacuation Study Program for the West Florida Region and has documents on its website.
Bay County Comprehensive Plan	2009	Contains the goals, objectives, and policies representing the adopted growth management strategies to guide future development in Bay County. Contains strategies to promote economic development, provide open space and recreational opportunities, conserve and protect environmental resources,

Reviewed Plan/Study	Date	Relevant Information
		and insure the adequate provision of utilities and infrastructure. The Future Land Use Map assigns land use designations to all parcels of land in unincorporated Bay County. Land Development Regulations implement the Comprehensive Plan by establishing zoning categories consistent with the Future Land Use Map. The Coastal Management Element identifies objectives and policies to restrict development that will damage or destroy significant dunes, prevent shoreline erosion and minimize potential property damage caused by coastal storms, restrict development in the Coastal High-Hazard Area (CHHA), and maintain the Post-Disaster Redevelopment component of the Bay County LMS.
Bay County Local Mitigation Strategy	2015	Provides background, past disaster information and multi-hazard risk information for Mexico Beach. Also contains several project recommendations. In process of being updated.
Tyndall Rebuild Plan	2019	The Tyndall Rebuild Plan is being developed; an article on it describes how rebuilding after Michael gives the base the chance to rebuild its infrastructure with advanced technology like 5G wireless networks and advanced power backup systems. To address future emergencies and impacts from future storms, buildings will be designed to serve multiple purposes, structures will be raised to provide flood protection, and walls and roofs will employ reinforced construction techniques. Lessons learned from Michael will be used to guide future decisions like which types of structures fared well in Michael's 150-mph winds (e.g., flat-roofed sunshades for outdoor aircraft maintenance did poorly while open-ended Quonset-style structures survived with less damage). The base will look to exceed the local building codes following the example of other Florida airports, like Miami International, where facilities are built to withstand up to 200 mph winds. Backup power to maintain continuity of operations is critical; options like smart grid technology, advanced turbine power systems, and compact nuclear systems are being considered. From https://www.airforcemag.com/article/Tyndalls-New-Rebuild-Plan-The-Base-of-the-Future/
Tyndall AFB Master Plan	2019	Will guide the rebuilding and reshaping of Tyndall Air Force Base post Hurricane Michael. Planning guidance includes: improve functional compatibility and enhance organizational efficiency, reduce future operating costs, reduce rebuilding costs, improve perimeter security, improve traffic flow and reduce auto reliance, improve safety, and minimize downtime after disruption. Three or the seven primary districts across the base have associated development plans.
Apalachee Regional Planning Council (includes Gulf County)	The topic areas have various dates	In Disaster Resilience section of Economic Development, it mentions the EDA funds from Hurricane Michael.
Gulf County LMS	2015	Priority projects that could possibly be coordinated with Mexico Beach and Bay County include County wide beach nourishment

Reviewed Plan/Study	Date	Relevant Information
		and dune restoration and conduct a shoreline erosion mitigation study to determine possible initiatives that can be undertaken to reduce future coastal erosion. Design and facilitate a Disaster Resistant Business initiative to educate local business owners on the need to be prepared for future disasters (these 3 are top 10). Post signs indicating high-water marks in coastal and river flood hazard areas. Also includes Extend city sewer lines to Beacon Hill to prevent repetitive damage to septic tanks. Funding sources p.90-91
Gulf County Comprehensive Plan	2011	Contains the goals, objectives, and policies representing the adopted growth management strategies to guide future development in Gulf County.
Port St Joe Economic Development	Ongoing	Selected as a pilot community for the Competitive Florida Partnership with the Department of Economic Opportunity. As part of this program, the City is preparing an Action Plan to promote economic development and identify their assets to help redefine the City. Similar actions may be beneficial for Mexico Beach.
Gulf County Flood Response Plan	September 2016	Primarily focused on flood warning and immediate response. Due to the proximity of the coastal populated area of Gulf County to Mexico Beach, it would be worth coordinating on warning and response.

Table 14. County/Regional/State plans surveyed

No CRS Flood Mitigation Plans were found in Bay or Gulf County. Panama City had prepared a post-disaster redevelopment plan in 2008 which was reviewed. The Panhandle Watershed Alliance and the St Andrew Bay Watch were also both contacted. The Panhandle Watershed Alliance described a Florida RESTORE Act Centers of Excellence Project being conducted in the Northwest Florida bays for science, technology, and monitoring.

Opportunities and Strategies

To address its issues and greatest vulnerability, Mexico Beach, like most coastal cities, needs to consider multiple lines of defense to protect against the awesome power of hurricane-driven storm surge. Wind and stormwater flooding are also a major concern. In addition, multi-objective projects should be considered to both make the most use out of facilities and infrastructure while potentially benefiting from combined funding sources. This section outlines opportunities and strategies that build on the “focus area analysis” and “needs identification” portions of the Plan to set the stage for targeted resilience actions. It takes into consideration the available grant funding as well as the need to balance maintaining the City’s character while seeking economic enhancement. This section is also organized by the National Disaster Recovery Framework’s six Recovery Support Functions.

Infrastructure Systems Opportunities and Strategies

Infrastructure systems represent the critical lifelines in a community that form the backbone of basic and essential services that serve virtually every residence, business, non-profit, and government structure. Mexico Beach’s infrastructure systems include stormwater systems,

transportation systems, water supply and sewage systems, electrical power systems including lighting, and communication systems. From the Focus Area section, this includes the jetty, the canal area (Regional Detention and Surge Protection at 8th Street), a redundant water supply, the wastewater system, and beach renourishment. Specific opportunities include:

- Expand/build stormwater detention capacity while restoring native wetlands. Install water quality measures into stormwater projects to prevent contaminated runoff from entering into the Gulf of Mexico.
- Protect the canal and marina area by creating multiple barriers to dissipate wave energy, reduce the reach of storm surge, and control storm water.
- Address multiple needs at once when replacing or redeveloping infrastructure, (e.g., combine modifications to underground utilities, including stormwater and sewer lines, during road construction). For example, streetscape improvements (including parking and bike lanes and pedestrian accommodations) can be implemented when sewer lines are replaced. Major roadways could also serve as a surge barrier. Implementation of Complete Streets initiatives and stormwater drainage can be accomplished simultaneously, which will help ensure that emergency ingress/egress routes remain open and accessible to residents while encouraging economic revitalization through improvements to streetscapes.
- Develop dual-purpose facilities such as using space within police/fire stations as an emergency operations center. Community center could serve as post-disaster staging areas.
- Implement beach renourishment and dune construction/vegetation project to protect City beach from erosion due to wind and surge.

Housing Opportunities and Strategies

Housing assets include multifamily and single-family dwellings as well as any affordable and senior housing. As typical in many coastal communities, many of the homes in Mexico Beach are available for vacation rentals. From the Focus Area section, this includes the areas referenced in the Sensitivity Analysis like the Rustic Sands area. Specific opportunities include:

- It was observed after Michael that homes that were protected to Miami-Dade standards survived the storm. While compliance with a high-level stringent standard may create untenable additional financial hardship during the sensitive period after Michael, setting a higher standard of wind and flood protection is critical during the rebuilding period. The City will evaluate ways to help homeowners comply with elevating homes to meet the new Floodplain Ordinance (1.5 feet above 500-yr) as this will create a hardship for some.
- Increase housing affordability during a time when construction and compliance costs are increasing and property owners have suffered from lost revenue to damage and missed economic opportunities.

Economic Development Opportunities and Strategies

Economic assets maintain or generate employment and have the potential to generate additional revenue through future development by attracting more visitors. From the Focus Area section, this includes the City Pier and the commercial area along US 98. Specific opportunities include:

- Protect businesses and expand economic, mobility, and recreational opportunities like development of ‘blue trails,’ sidewalks and greenways. The existing sidewalks are predominantly located along Highway 98 and there has been repeated public support and requests for installation of sidewalks along 15th Street to create residential corridor for access to the beach. Evaluate needs along the City’s canal network to increase recreational, flood control and natural habitat opportunities.
- Add more attractions to the City Pier to enhance its appeal.
- Help small businesses prepare for future catastrophic storms. An opportunity is for Mexico Beach small businesses to explore creating a continuity of operations plan through the website Bay County has established:
<https://www.baycountyfl.gov/168/Continuity-of-Operations-Plan-COOP-Softw>
- Attract locally/individually owned type businesses to the City.
- If the Gulf Coast Parkway, a conceptual idea that would connect US 231 north of Panama City to US 98 east of Mexico Beach (and providing a bypass of Tyndall), is advanced as a proposal, the current US 98 could be converted into more of a “Main Street’. Seemingly at odds with this concept is a project currently on the books in the *2040 Bay County Long-Range Transportation Plan* (prepared in 2016 by the Bay County TPO), where US 98 is slated to be widened to a 4-lane highway (Project ID#19, Gulf to Bay Highway).
- Maximize the use of the land when development/redevelopment occurs in strategic areas. Rebuilding in a better, smarter manner means utilizing sustainable and resilient approaches. Developments should be geared toward supporting and accommodating existing residents and businesses while addressing affordable housing and growing desirable new businesses.

Health and Social Services Opportunities and Strategies

Health and social services assets provide vital community services to residents, especially in emergencies. Ensuring that health and social services remain available before, during, and after storm events is very important to protecting the health and safety of Mexico Beach’s residents. From the Focus Area section, this includes the police and fire facilities. Specific opportunities include:

- Protect first responder facilities to a code-plus level. Create a safe room that would allow key city personnel and first responders to ride out a storm and be positioned to expedite response and recovery after major storms.
- Provide community assistance to those that may have trouble evacuating during an upcoming hurricane (e.g., elderly, disabled, low income). An opportunity for residents with special needs is to enter their information in the Bay County Special Needs Registry (<https://snr.flhealthresponse.com/>).

Natural and Cultural Resources Opportunities and Strategies

As a coastal city with waterfront access on the Gulf and canal, Mexico Beach possesses natural resources that are some of its greatest assets for both residents and guests. Specific opportunities include:

- Create additional protection along the beach (robust dune system) and protect nearshore waters from contamination.

- Evaluate off-shore surge barriers and living breakwaters like oyster reefs that could also serve as artificial reefs.

Community Planning and Capacity Building Opportunities and Strategies

Community capacity building assets provide ability of the City to provide important city services. They generally enable and enhance the other recovery functions. From the Focus Area section, this includes City Hall which houses many important functions. Specific opportunities include:

- Expand Mexico Beach's emergency preparedness operations. Strengthen emergency management capabilities connection with Bay County and Gulf County.
- For City facilities, consider going higher than mandatory 144 mph wind speed. Other surrounding facilities have gone to higher standards: the Bay County Emergency Operations Center is designed to 146 mph winds and survived the approximately 119 mph winds it experienced (FEMA MAT report) and the Tyndall AFB Recreation Center which was one of the few facilities on the base to survive intact.
- Look for opportunities to institutionalize grassroots and neighborhood connectedness.
- Join the FEMA CRS Program which provides incentives for flood risk reduction.

Resilience Actions Completed or Underway

Since Hurricane Michael left its devastating wake in Bay and Gulf Counties, Mexico Beach has been extremely active in taking steps to recover from the event and rebuild/redevelop in a resilient fashion. This section captures what has been accomplished so far including completed recovery actions plus ones that are in process. These actions include both FEMA funded efforts as well as community-driven ones like changes to ordinances. Due to Michael's significant damage to many areas not in the pre-storm regulatory flood zone, the City realized that more robust measures to protect against flooding were needed. The revisions to ordinances leverage the recovery window to rebuild stronger and avoid damage in future storms. Below is a synopsis of actions completed or underway by category.

Immediate Response Activities

Debris removal. While debris removal is not normally considered a rebuild or redevelopment activity, it is an essential first step in the recovery process. The tremendous levels of debris seen in a catastrophic storm like Michael provide a difficult challenge for a smaller city to address. At the time of the preparation of this plan, debris removal has been estimated at \$60 million while the City has a \$2 million annual budget, indicating the magnitude of the effort.

Substantial damage estimation (SDE). The City conducted substantial damage estimates for every property in the City a few weeks after the landfall of Michael. Substantial damage estimates are critical pieces of information to trigger the rebuild and contribute greatly to reporting of unmet needs for Community Development Block Grant – Disaster Recovery (CDBG-DR) funding as well as use for mitigation project applications. The results of the SDE for Mexico Beach are captured in the Vulnerability Assessment.

Integration – Peril of Flood Requirement

Update Coastal Management Element of Comprehensive Plan for 2015 “Peril of Flood” Compliance. In 2015, Florida Legislature directed jurisdictions to have a Coastal Management Element as part of their comprehensive plan. The statute mandates that all communities address current and future flooding in their jurisdiction by including a redevelopment component with principles that must be used to eliminate inappropriate and unsafe development in coastal areas if the opportunity is present. The requirement states that any form of development or redevelopment in a Florida community must examine strategies and engineering solutions that reduce the flood risk in coastal areas. The flood risk could be due to a high tide event, tsunami, storm surge, flash flood, stormwater runoff, and/or sea level rise.

The Peril of Flood requirements for a comprehensive plan can be grouped into two parts with the first portion addressing more development-related components. These requirements are for strategies to be identified within the community and included in the plan. They are as follows:

1. Include development and redevelopment principles, strategies, and engineering solutions that reduce the flood risk in coastal areas which results from high tide events, storm surge, flash floods, stormwater runoff, and the related impacts of sea level rise.

2. Encourage the use of best practices development and redevelopment principles, strategies, and engineering solutions that will result in the removal of coastal real property from flood zone designations established by the Federal Emergency Management Agency.
3. Identify site development techniques and best practices that may reduce losses due to flooding and claims made under flood insurance policies issued in this state.

The second part of the Peril of Flood requirements is focused on policies that can be adopted and integrated into the comprehensive plan reinforcing the previous three requirements. They are as follows:

4. Be consistent with, or more stringent than, the flood-resistant construction requirements in the Florida Building Code and applicable flood plain management regulations set forth in 44 C.F.R. part 60.
5. Require that any construction activities seaward of the coastal construction control lines established pursuant to s.161.053 be consistent with chapter 161.
6. Encourage local governments to participate in the National Flood Insurance Program Community Rating System administered by the Federal Emergency Management Agency to achieve flood insurance premium discounts for their residents.

All of these requirements can take various tangible forms at the local jurisdictional level but must be mandated within a community as they create overall planning guidance for their community.

The City of Mexico Beach was awarded a technical assistance grant from the Florida Department of Economic Opportunity (DEO) to update the Coastal Management Element of their comprehensive plan that was originally created and adopted in 1991. The City contracted out to The Planning Collaborative to prepare a vulnerability assessment of the coastal areas within the jurisdiction as the initial step in the process. It was completed in December 2017, and the end result of the assessment provided data and a specific analysis to guide policy updates for the City's Comprehensive Plan. The assessment was prepared in order to identify the most vulnerable areas due to flood hazards and present findings that could inform the Coastal Management Element. At that time, the key findings of the vulnerability assessment noted the following:

- The City's vulnerability to sea level rise is relatively low and is most prevalent on the west side of the City beside the canal.
- A flood event resulting in a six-foot rise in the water level will produce significant impacts.
- Development of the land southwest of Highway 98 – mitigation practices should be evaluated to address flooding and sea level rise.

The information from the assessment was utilized to create the contents of the Coastal Management Element for inclusion into an update of the Comprehensive Plan. Goals with specific objectives and policies were developed to foster the requirements of the Peril of Flood statute. The goals established were:

- Maintain or improve the quality of coastal resources
- Reduce the risks of natural hazards damage to life and property
- Ensure adequate access to waterfront resources

- Ensure the availability of infrastructure consist with the level of service standards

A set of policies was detailed for each goal and two additional maps were created providing a visual addition with the coastal high hazards and storm surge depicted.

Once the Coastal Management Element was completed, public outreach was conducted for review and comments in February 2018, and in May, the City Council voted to move the amendment of the Coastal Management Element update to DEO. The document was then redlined with the changes and submitted, and the policies, as they pertained to the grant agreement requirements, were extracted and outlined for review as well. DEO accepted the proposed amendment and it was accepted in May 2018.

In 2019 and in response to Hurricane Michael, the City updated their Comprehensive Plan again and maintained the Coastal Management Element component that was adopted in 2017. The Land Use Ordinance was also updated to be in alignment with the Comprehensive Plan. The changes in this rendition were minimal in the Future Land Use Element and Transportation Element sections of the plan. The resilience actions that the City has achieved and are pursuing at the time of the drafting of this plan show additional commitment to reducing future flood risk.

City-Driven Actions

Stormwater Ordinance Revision. The City of Mexico Beach has adopted Ordinance 720 to address stormwater treatment and attenuation associated with new development. The changes to the ordinance including the following:

- Private residences and properties exempted from installing a stormwater management facility must grade their property so it drains toward a drainage structure, street, or permanent body of water and not toward another property unless it has proper conveyance.
- Larger developments (over 9,000 square feet of building space combined with 4,000 square feet of parking/drive areas) are required to install a stormwater management facility.
- Stormwater attenuation facilities must be designed so that post-development runoff does not exceed pre-development runoff.
- Stormwater management facilities shall be designed to water quality criteria in accordance with the most current standard of the Northwest Florida Water Management District.
- Development that is landward of the Coastal Construction Control Line and in the Unshaded X zone must have its finished floor one foot above the crown of the road or curb

Floodplain Ordinance Revision. Newly adopted Ordinance 719 minimizes the placement of fill within the floodplain and requires elevating new construction or substantially improved structures 18 inches above the 0.2% annual chance (500-year) flood elevation. The City adopted the preliminary FEMA Flood Insurance Rate Map (FIRM) information in development as best available data and extended the Special Flood Hazard Area Requirements to the entire Shaded X zone (the 0.2% annual chance flood zone where 498 structures were substantially damaged). The City used best available data, increased the vertical height requirement, and

extended the horizontal extent of the regulatory floodplain as a three-fold higher standard. The preliminary FIRM information can be found at <http://portal.nwfwmdfloodmaps.com>.

The floodplain ordinance revision also requires that all critical actions (e.g., location of critical facilities) be placed outside the SFHA, which includes the 0.2% annual chance floodplain, to the extent practicable. If there is no land available outside the 0.2% annual chance floodplain, then the critical action must be elevated 3 feet above the 0.2% annual chance level (or dry floodproofed to that level). The stormwater and floodplain ordinance revisions address one of the major FEMA Mitigation Assessment Team (MAT) report recommendations (p. vi):

FL-9. Communities should consider more stringent building requirements for development or reconstruction in the unshaded Zone X (area of minimal flood hazard) and shaded Zone X (area of moderate flood hazard).

Updated Comprehensive Plan. As described in the Peril of Flood section of this plan, the City updated its Comprehensive Plan in 2019 and has addressed the State's Peril of Flood requirement.

Building Code Revision. After Hurricane Michael, Mexico Beach strengthened the wind protection by adopting Florida Building Codes (FBC) latest Building Code requirements that adopt the International Codes (FBC-18). As identified in an after-action report, buildings built to a higher code fared well during the storm. Homes built to Miami-Dade standards survived and served to indicate this as a good model to follow with City going to higher standards. This resulted in a revision to the local building code requiring structures to be protected to the 140-mph wind load (formerly was 130 mph). In Ordinance 712, the City Council vote to adopt technical amendments to the "Florida Building Code, Building" and the "Florida Building Code, Residential" to increase minimum elevation requirements (Freeboard) using FEMA's draft best available data map. Ordinance 713 amended the Mexico Beach City Code related to building regulations and amended Chapter 151 to identify wind speed lines in the City.

FEMA Community Rating System (CRS) program. The City sent a letter of interest to the State of Florida on April 22, 2020 to express its intent to join the CRS program, an important first step to fulfilling one of the recommendations from the 2015 Stormwater Plan. This program, a voluntary program in the NFIP, is where communities can receive credit for additional flood risk reduction activities beyond the minimum requirements. The credits are in the form of points; sufficient accumulation of points results in flood insurance premium discounts for flood insurance policyholders across the community. For example, obtaining 500 credit points equates to a 5 percent discount, 1,000 points to a 10 percent discount, and so on up to the rare occurrence of a maximum potential 45 percent discount. Most programs enter at Class 10 and then initiate the documentation process to demonstrate completed credit point activities.

FEMA outlines three goals of CRS:

- Reduce flood damage to insurable property;
- Strengthen and support the insurance aspects of the National Flood Insurance Program; and
- Encourage a comprehensive approach to floodplain management.

In addition, Florida DEM is supportive of the CRS program and offers assistance to communities. The State lists additional benefits of CRS participation:

- Activities credited by the CRS provide direct benefits to the community, including enhanced public safety, reduction in flood damage, and environmental protection.
- Residents are reminded that the community is working to protect them from flood losses.
- Public information activities will build a knowledgeable constituency interested in supporting and improving flood protection measures.
- Money stays in the community instead of being spent on insurance premiums.

One advantage of the program is that the City can continue investing effort into eligible activities into the coming years. More ideas on where credit points could be generated will be discussed later in this plan.

Recovery Funds

City Pier Rebuild. The City Pier will be rebuilt with Public Assistance funding divided into two projects: one, the design of it and the second, the construction. **Stormwater Management and Greenspace Project, Recovery and Resiliency Partnership.**

The City, in a partnership with FEMA and the IRC (Interagency Recovery Coordination) performed a study and public out-reach project to produce a planning/vision document. To assist with the numerous challenges of rebuilding and addressing stormwater impacts, the City entered into a partnership with FEMA and the U.S. Environmental Protection Agency. With this initial partnership, called the Recovery and Resiliency Partnership (RRP), the City took multiple initiatives and partnered with other agencies. First and foremost, the City wanted public engagement as part of the process and held two public hearings to gain input on decisions regarding various critical projects for the recovery efforts of the City and its citizens. The idea was to provide visual depictions of what the community would look like once the projects were implemented. The City wanted to glean input from residents that could be incorporated into the design of the projects. These meetings took place May 29 and 30, 2019, with one being during business hours and one being in the early evening. More than 125 people attended these meetings and provided input. This effort identified the following projects: additional amenities and economic development at the pier, regional stormwater detention, wetland restoration, and city-wide greenway/blue way to connect City parks

With the RRP, the City also, in released a 52-page study about plans for all seven of the City's parks. The study included a design for a master storm water system which will be a complete overhaul of the system. City officials and other RRP representatives presented the seven projects at the February 22, 2020 Gumbo Cook-Off. A big part of the stormwater project will be to close the stormwater outlet to the Gulf, which also created a pathway for storm surge to cause damage. Another objective is to recreate the natural drainage of the stormwater to move away from the Gulf. The stormwater project is described in more detail in the following section entitled "Implementation Plan for Projects and Actions."

Along with this project is the USACE study of the shore area including hydrology, needs for beach renourishment, canal opening and canal, and where the stormwater outfalls into the Gulf.

Rebuild of the Dunes. The FEMA Mitigation Assessment Team (MAT) report for Hurricane Michael, dated February 2020, conducted a review of aerial imagery of the City's beach and dune system. This review indicated a healthy beach and dune system prior to the hurricane. However, after the hurricane, the MAT report states, "a significant portion of the beach and dune

system was removed by wave action and erosion, allowing greater inundation and penetration of wave action of the area” (p. 3-6). One of the critical first steps was to begin restoring this system because it serves as the initial line of defense for the City against storm surge. In June 2019, FEMA approved \$3,566,397 for emergency protective measures after Hurricane Michael which includes building an emergency beach berm, including replacing sand, installing fencing, planting vegetation, and building beach access walkways. Building the berm, including a gradual sloping of the dunes and the installation of sand fencing, helps capture wind-blown sand to continue building up the dunes over time.

In June 2019, the City partnered with Duke Energy to start the process of restoring its beaches; they provided funding to purchase sea oats and organized the volunteer process. Several hundred volunteers came out to help plant the sea oats. In a press release announced early in 2020 (the 2020 National Fish and Wildlife Fund (NFWF) “Grant Slate 2020” release), Mexico Beach received a grant award from NFWF Emergency Coastal Resilience Fund to do Wetland Restoration and Dune Installation project. According to the release, the City received \$335,908, with matching funds of \$3,736,000. The release’s project description describes the work:

“Restore 45 acres of wetlands to address flood control, water quality and habitat restoration, and complete design of a beach dune to protect against storm surge and establish beach vegetation habitat for the benefit of species. Project will conduct planning, design and permitting required to get the project construction-ready and implement wetland restoration.”



Figure 63. Dune regeneration progress (February 2020) (source: Atkins)



Figure 64. Dune regeneration progress (February 2020) (source: Atkins)

FEMA Public Assistance Projects

The FEMA Public Assistance (PA) program is the primary program for restoring damaged public infrastructure and facilities after a presidentially declared disaster. Due to the widespread damage in Mexico Beach, there were many PA projects pursued and where possible, mitigation was incorporated into the project. Below is a listing of the PA projects in process or proposed as of June 2020:

Public Assistance Projects in Process or Proposed		
Project	Description	Status (as of June 2020)
Citywide Roads	The City will utilize contractors to repair asphalt pavement, grading, shoulder embankments, and erosion control for all damaged city roads.	Ongoing
Sand Bypassing System	The City will use contractor labor, equipment, and materials plus Force Account labor for the repair and/or replacement of the Mexico Beach Sand Bypassing System and its components within the existing footprint.	Ongoing
15th Street Box Culvert	Applicant will use contractor labor, equipment, and materials for the repair and/or replacement of the 15th Street Box Culvert components to include a retaining wall, concrete wing wall, embankment, and the guard rail, posts, and blocks.	Ongoing

Public Assistance Projects in Process or Proposed		
Project	Description	Status (as of June 2020)
15th Street Bridge	Applicant will use contractor labor, equipment, and materials for the repair and/or replacement of the 15 th Street Bridge components to include utility conduit, asphalt paving, road base and embankment, and guard rail, posts, and blocks as well as signage.	Ongoing
Emergency Berm on Beach	This project includes construction of an emergency dune project for a segment of beach between R-127.8 to R-144 (16,200 feet; 3.1 miles). This project consists of the placement of clean white beach compatible sand totaling an approximate 95,000 cubic yards as well as the installation of multiple dune vegetation species totaling approximately 282,400 plants and approximately 15,600 linear feet of sand fencing along the project shoreline.	Ongoing
Canal Parkway Bridge/Culvert	This project is for the surveying, designing, and engineering of repair and reconstruction of the bridge/culvert to its pre-existing condition to be bid upon for the construction phase. The components consist of seawalls and bank armoring. Associated road damage and the appropriate guard railing will also be repaired and/or replaced.	Ongoing
Mexico Beach - Fire Station, Police Station, & Civic Center, plus Contents, Supplies, Equipment, & Parking	<p>The City will use contractor labor, equipment, and materials for the repair and/or replacement of the Civic Center Parking Lot components and the Fire and Police Station Parking Lot components.</p> <p>The City also used this project to demolish the damaged structure and replace it with a new stucco coated facility to include cabinetry and countertops within the facility that meets local and state building code.</p> <p>The City also requested that the Civic Center contents and equipment be replaced due to the damage incurred.</p> <p>The City requested that the Fire Station Building be demolished and replaced within its existing footprint to include all of the structural</p>	Ongoing

Public Assistance Projects in Process or Proposed		
Project	Description	Status (as of June 2020)
	<p>necessities. The equipment and supplies were also requested to be replaced including all appliances and electrical supplies.</p> <p>The City requested that the Police Station portion of the building be demolished and replaced within its existing footprint to all interior contents and supplies.</p>	
City Marina	The City requests to restore the Marina facility back to its pre-disaster design, function, and capacity within the existing footprint to include the landings, power and breaker box, lamp post, wooden seawall, embankment, finger pier, pump out station, pavilion, storm drain, canal parkway, and irrigation system.	Ongoing
Municipal Fishing Pier	The City is seeking to replace the wooden piling/deck municipal pier including four sets of double-sided benches, fish cleaning station, lighting, signage, and restroom facilities.	Ongoing
Storm Water Treatment & Collection System	The City is requesting repairs to the City-Wide Storm Water Treatment facilities. This includes inspection services, removal, and replacement of damaged piping components. In addition, this will include removal of approximately 13,650 cubic yards of sediment deposits plus removal of vegetative material from grates. In areas of erosion, this will include fill to replace eroded material.	Ongoing
Mexico Beach Parks	The City is requesting to restore Sunset Park, Parker Park, the 7 th Street Beach restroom building, Under the Palms Park, and Municipal Park.	Ongoing
Municipal Boat Access and Fish Cleaning Station	The City is requesting the repair of the City boat ramp park. All work is to be completed in-kind and within the existing footprint to return the facility to its pre-disaster design, use, and function using current codes and standards.	Ongoing
Water Treatment System and Public Works Building	The City is requesting repair and/or replacement of the City Public Works building and its equipment. All work is to be completed in-kind and within the existing footprint to return the facility to its pre-disaster design, use, and	Force Account Labor portion is complete.

Resilience Actions Completed or Underway

Public Assistance Projects in Process or Proposed		
Project	Description	Status (as of June 2020)
	function. Force Account Labor was used to muck out the Public Works building.	
Demolition & Removal of Private Residential Structures	FEMA has approved the demolition request of residential structures. The City provided a list of structures and supporting documentation.	Completed
City Wide - Substantial Damage Inspection for Floodplain Management Ordinance	The City inspected 1690 structures (residential & commercial) for a determination of Substantial Damage under the community's floodplain management ordinance.	Completed
Canal Dredging	This project includes removing approx. 84,798 ccubic yards of sand/sediment deposited by Hurricane Michael within the City harbor/boat canals to alleviate hazardous conditions and to restore the public waterways to pre-hurricane condition. The waterways include the harbor area and canals throughout the City.	80% of the public waterways is complete
Mexico Beach Harbor Canal Jetties	Storm surge damaged both eastern and western jetties at the Municipal Harbor entrance along with a concrete walking path located at the crest of the western jetty for which the City is requesting to repair and replacement the necessary components.	Ongoing
Wastewater Collection System	The City is requesting to repair the components of their wastewater collection system to include: 141 Manholes and 3 sections of sewer line, totaling 5,982 linear feet, removal of sedimentation (clogged lines) from gravity and force mains totaling 25,038 linear feet, and a total of 688 laterals (city-wide) that were damaged.	Manhole work is completed
Sewer Lift Stations and Control Panels	The City is repairing 25 sewer lift stations, control panels, pumps, surface mount controls and components, piping, electrical conduit, sensors, controls, and gauges.	Repair of the 25 sewer lift stations has been completed.
Municipal Water System, Meters, Meter boxes, Meter Taps, Lines	The City is requesting to repair or replace all damaged and destroyed water lines, water mains, meter boxes, and meters city wide.	Meter box repair and replacement is completed.
Sewer Lift Station	The City is utilized funding to contract engineering services to determine the necessary repairs to the lift station to restore it to its pre-existing condition.	Completed

Public Assistance Projects in Process or Proposed		
Project	Description	Status (as of June 2020)
Wooden seawalls - 36th Street North	The City is seeking funding for labor, equipment, and materials for the repair and/or replacement of the wooden seawall at 36 th Street North and its components.	Ongoing
8th Street Bridge Water and Sewer Mains	The City will utilize contract for repairs to the 8th Street Bridge water and sewer mains to furnish and replace 1 each of ductile iron pipe sewer line, 200 feet long x 10 inch in diameter.	Completed
Mexico Beach - City Hall Building, Content, Supplies, Equipment, & Parking	The City is repairing windows, floor coverings, and rekeying doors and locks of the City Hall building.	Completed
Elevated Water Storage Tank (100,000 gallon)	The City will furnish and replace 100,000 gauge of steel above ground water storage tank, 30 feet wide x 100 feet high.	Ongoing

Table 15. Public Assistance projects

Implementation Plan for Projects and Actions

While Mexico Beach was making steady progress with resilience prior to Hurricane Michael with activities like the Stormwater master plan and updated Comprehensive Plan, the tremendous devastation left by the storm, plus the need to rebuild many facilities, structures, and houses, has put resilience to the forefront.

Current Project List

Five projects were determined to be the highest priority mitigation projects for Mexico Beach; all five have been submitted to the Bay County LMS and then to the State of Florida Division of Emergency Management on March 10, 2020 for funding consideration under the Hazard Mitigation Grant Program (HMGP). While Hurricane Michael is clearly the largest storm event to impact Mexico Beach, for the purposes of meeting eligibility of the mitigation programs including the FEMA HMGP, it was critical to show that these projects would also protect against the impacts of lesser, more repetitive storms too because it is generally not cost effective to design projects to only protect against large storms. Therefore, the following HMGP projects were carefully selected to have some of the greatest mitigation value in both the smaller but more frequent and larger storms. The community attendees at the February 22nd public outreach event also reflected the preference for community-level resilience projects.

Regional Stormwater Detention

Project Purpose. Like many coastal cities in Florida, Mexico Beach is flat and stormwater does not drain well. The City's Stormwater Master Plan, completed in 2015, identified flooding and infrastructure deficiencies within the City's stormwater management system as well as water quality issues. These stormwater management issues were further compounded by Hurricane Michael.

The 2015 Plan describes the Mexico Beach system and its challenges in its Executive Summary:

The majority of stormwater runoff in Mexico Beach drains directly into the man-made Mexico Beach Canal system which traverses nearly the entire length of Mexico Beach (west to east). The City's infrastructure also includes a series of smaller ditches, pipe systems, and large culverts, all of which, ultimately drain into the canal. The canal provides minimal water quality treatment before entering the Gulf of Mexico, other than the sedimentation which occurs as the water travels throughout the length of the canal itself. The Mexico Beach Canal system not only acts as the principal drainage system for stormwater from the City, but also acts as the downstream channel for two creek systems; Salt Creek which enters the main canal at the City Marina, and Cypress Creek which enters the City at the 15th Street Bridge located between Hatley Drive and Robin Lane. The watersheds for both creeks are located nearly entirely outside of the Mexico Beach municipal boundaries and the contributing drainage areas for both creeks are largely undeveloped, low-lying wooded areas. The major body of water which receives stormwater runoff (either directly or indirectly) from the City of Mexico Beach is the Gulf of Mexico. The Stormwater Master Plan documents three outfalls to the canal

system within the City that are currently experiencing localized flooding and drainage problems.

Development in lower-lying areas near the 8th Street canal, which is fed by Cypress Creek, prior to the adoption of a floodplain management ordinance leaves many residential structures vulnerable to stormwater flooding. In addition, the City's existing drainage ditch system in this area outfalls into the Gulf and provides a conduit for storm surge to come back up the canal and flood structures, so there is a dual risk from flooding. Hurricane Michael storm surge caused a tremendous amount of damage to structures along the canal.

This project is needed to both capture localized stormwater flooding to prevent it from flooding structures and to block storm surge that can travel back up through the stormwater outlet into the Gulf and flood houses that way. Localized flooding is at least partially attributable to prior development decisions within the floodplain (especially those occurring before the adoption of the NFIP), filling in wetlands, and absence of a regional stormwater detention facility. In addition, the City's ditch system creates conduit for storm surge at the discharge into the Gulf of Mexico. The project will reduce localized flooding and protect against storm surge. The proposed detention area is located within the 100-year floodplain and by implementing the project, it ensures that this area will not be developed and the natural function of the floodplain is preserved.

Project Description. This project includes construction of a regional stormwater facility that will discharge to a restored wetland area for additional treatment. The stormwater facility consists of two pond locations that are hydraulically connected by a concrete box culvert (already in place). The purpose of the detention pond is to attenuate stormwater floods up to the 100-year flood event and to provide water treatment for the City's stormwater runoff. Through implementation of this project, the City's existing ditch system will be modified to eliminate a direct discharge into the Gulf of Mexico. This part includes a berm along the beach to block storm surge and tidal waters from coming up the canal. This will improve water quality in the Gulf and along the City beach. The project will eliminate the discharge by collecting the water upstream and allowing detention areas to outfall to an existing drainageway (Cypress Creek) which also restores the natural drainage condition (prior to the City's construction of ditches/canals, this area drained toward Cypress Creek). Finally, eliminating the discharge reduces vulnerability of storm surge at this location by blocking a low-lying conduit for storm surge to travel up into the City. The stormwater detention areas will be preserved and will help restore habitat for wetlands vegetation and associated species.

Protection Provided. The proposed regional stormwater detention project will reduce repetitive, localized flooding from stormwater runoff. The current system is undersized and needs to be upgraded to address the increased risk from larger scale rainfall events expected in the future. This project could potentially close off the 8th street canal area reducing amount of vulnerable area. In addition, this project will protect against storm surge and larger high tide events as well as the expected 1-2 feet of sea level rise (NOAA prediction) by blocking off the canal's outlet to the Gulf of Mexico. The proposed project is primarily located within the 100-year floodplain and will protect structures and infrastructure within the project's service area. The acquired area in the proposed project will be used to detain stormwater instead of possibly be developed in the future. By implementing this project, it ensures that development and fill will not impact the floodplain further exacerbating the stormwater flooding issue.

The project will protect approximately 1,102 structures from the 100-year flood.

Project Alternative. Due to the existing drainage patterns, current development, and nature of the project (to utilize open area within floodplain and prevent development within this area), there is no alternative identified for a different project location. However, as an alternative to the proposed project, less area could be impacted by limiting construction to include only the regional detention ponds, without including the wetland restoration downstream of the ponds. This would allow localized flooding to be addressed and would minimize the footprint of the project. In addition, this would reduce project costs. The disadvantage of this option is that the project will not obtain the same water quality downstream of the ponds as the proposed project. In addition, this alternative would have the disadvantage of not including wetland restoration. Therefore, habitat destroyed by Hurricane Michael due to loss of vegetation would not be replaced with this alternative.

Other complementary projects. The HMGP project will be complemented by other projects. As described above, the City adopted Ordinance 720 to address stormwater treatment and attenuation associated with new development.

As part of a bigger vision for stormwater management in the City, the RRP in the Regional Partnership had numerous design strategies in the overall approach to stormwater management to including co-benefits like environmental restoration and attracting additional tourism that will boost Mexico Beach in the rebuild:

- Managing Stormwater for Resiliency and Recreation
- Making Connections: Citywide Greenway/Blueway Trail System
- Expanding Community Spaces and Local Economy

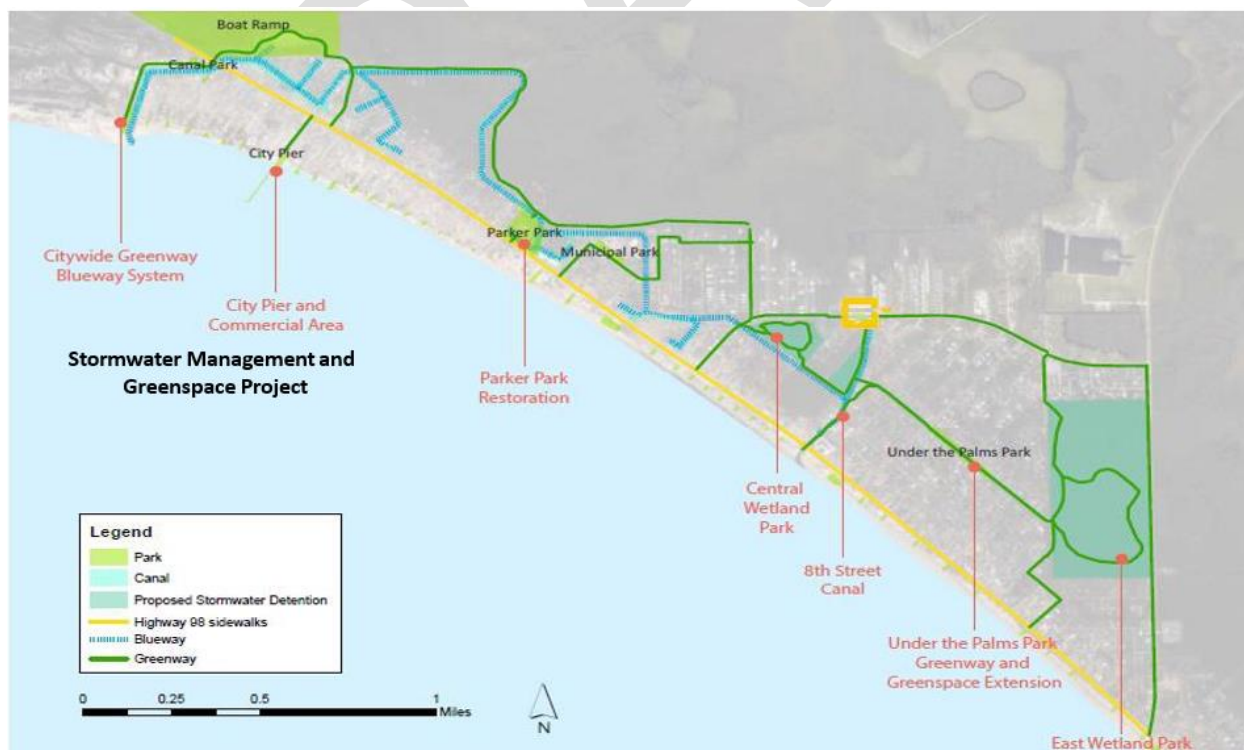


Figure 65. Source: FEMA-EPA quarterly partnership call presentation November 19, 2019

The Partnership vigorously sought community input, including a presentation at the February 22nd Gumbo Cookoff, and considered multi-objectives in the design process. Many sustainability and resilience features are included in the project like vegetated swales, waterway restoration, and pervious pavement. Not only will these features help restore and beautify the area, making it more attractive to residents and tourists, they will also slow down and better absorb stormwater runoff thereby reducing the damaging effects of excessive runoff.

Other federal agencies like EPA and USACE partnered with FEMA on this and actively support this overall vision for the area and are looking to provide financial support as well. Multiple grants are being sought to fully fund the vision of this comprehensive project.

Wastewater Bypass Pumps

Project Purpose. The City of Mexico Beach's sewer system consists of a combination of gravity sewer and force mains. The City has a total of 27 lift stations and the City's sewer system cannot function properly without these pump stations. During Hurricane Michael damage to the electrical grid caused the City's sewer system to be completely non-functional. In addition, 25 lift station control panels were damaged by storm surge. Due to complete failure of the City's sewer system during and in the weeks that followed Hurricane Michael, the City experienced multiple overflows. In addition to electrical failure, all but two of the City's lift station control panels were flooded by storm surge. This ultimately destroyed the City's electrical panels and 25 of 27 pump stations required replacement of the control panels due to surge.

The City does not currently have bypass pumps or backup generators for these pump stations (with the exception of the City's Master Lift Station). Therefore, the City's sewer system remains vulnerable in future storms or electrical outages.



Figure 66. Wastewater Lift Station PS - 13

During Hurricane Michael, damage to the electrical grid (caused the City's sewer system to be completely inoperable for a period of 24 days. In addition, 25 of the 27 lift station control panels were damaged by storm surge and required replacement. Due to complete failure of the City's sewer system during and in the weeks that followed Hurricane Michael, the City experienced multiple overflows causing additional damage and contamination in areas impacted by Hurricane Michael.

Project Description. The City has already incorporated mitigation measures in the PA project rebuild of the system to harden the sewer system which was severely damaged by Michael including replacement and elevation of all lift station control panels, water

resistant control cabinets, elevating control building, and providing elevated backup generator at

the City's Master Lift Station (MX-1). These projects combined with the proposed bypass pumps described below will positively impact and make the City's sewer system more resilient.

This project involves the purchase and installation of three permanent mount bypass pumps with six-inch suction/discharge. This project provides redundancy in the City's sewer system to ensure functionality during electrical outage, electrical surge, storm surge, etc. These bypass pumps or generators will be located at the following City lift stations: 14th Street, 6th & Florida, and 7th Street Lift Stations (PS9, PS13, PS11). The City prefers the use of permanently-mounted/elevated bypass pumps in lieu of backup generators because during significant storm surge, existing pumps are prone to filling with sediment/debris which makes the pumps inoperable, even if electrical power is provided by a backup generator.

Protection Provided. The proposed project will provide ongoing operations to key pump stations by installing three fixed/permanent mount bypass pumps at PS9, PS11 and PS13, three of the City's major lift stations, which remain vulnerable to surge and electrical outages. These pumps will provide backup pumping capacity and electrical service if the City system is down. The protection of these three stations helps keep the whole system functional therefore benefitting the whole city.

This will ensure the City's sewer system is hardened against future storms and electrical outages. In addition, the permanent-mount bypass pumps will be elevated above the 500-year flood event as determined by local floodplain ordinance requirements on platforms or elevated using the built-in double wall fuel tanks to ensure protection against storm surge. Electrical controls associated with these mitigation measures will also be elevated.

Project Alternative. A feasible alternative to this project is to utilize backup generators in lieu of the permanent-mount bypass pumps. The positive for this alternative is that it provides backup power to the lift stations. However, the challenges of this alternative is that backup generators do not address inoperable pumps. Many of the City's lift station pumps were inoperable post-Michael because surge caused significant sedimentation/debris within the wet wells that caused the pumps to fail. The alternative project is also expected to be slightly more costly than the proposed alternative. The proposed alternative addresses the sedimentation issue by providing both power source and external pump. A generator will only address the power supply outage.

Jetty Improvements

Project Purpose. Storm surge is washing away sand from the beach and the area is 'critically eroded'. The beach was severely eroded due to Hurricane Michael and the dunes are no longer protecting the inland structures. Erosion and storm surge threaten residential structures immediately adjacent to the beach within the project area. In addition, the City's Marina includes a maintained channel that was damaged during Hurricane Michael and continues to fill with sand, making the facility un-navigable due to sedimentation deposited seaward during the storm. This project would mitigate the damage to the City Marina/channel by preventing erosion and sedimentation in the channel.

Project Description. This project includes the extension of the eastern jetty. The jetty improvements would include installation of a fiberglass core seawall and placement of rip rap rubble to create breakwaters and armoring. The total length of jetty

improvements/extension would be approximately 1,020 linear feet. This will protect a vulnerable region of the City from storm surge, direct wave action, and erosion. The expansion will aid in the renourishment of the beach eastward of the jetty as well as the coastal residential areas. Maintenance dredging will also occur in the channel to allow safe travel for vessels coming in and out of the inlet. A vehicular sand bypassing system will be implemented along with the jetty improvements. These improvements will increase the volume of sand bypassed around the inlet, significantly reducing the flow of sand into the inlet and navigation channel from the east shoreline. Maintenance dredging will not be needed as often once these improvements are complete and the portion of critically eroded beach will be re-nourished. This project complements a PA project to rebuild the existing jetty.

Protection Provided. The Jetty Expansion will offer protection to the critically eroded shoreline on the western portion of Mexico Beach. These improvements to the jetty would protect the residential and tourist residential neighborhoods located in the surge zone. In addition, the jetty improvements would protect the City beach from erosion. Finally, the jetty improvements would mitigate damages to the City Marina (specifically the channel) as described above. The project will protect the beach, the canal itself and approximately 442 structures to the 100-year flood level.

Project Alternative. An alternative considered for the project would be to install groins on the beach. This option was determined to be an inappropriate measure for Mexico Beach's critically eroded beach because groins should not be considered along shorelines where cross-shore sediment transport is dominant as in Mexico Beach's case. In addition, this option was

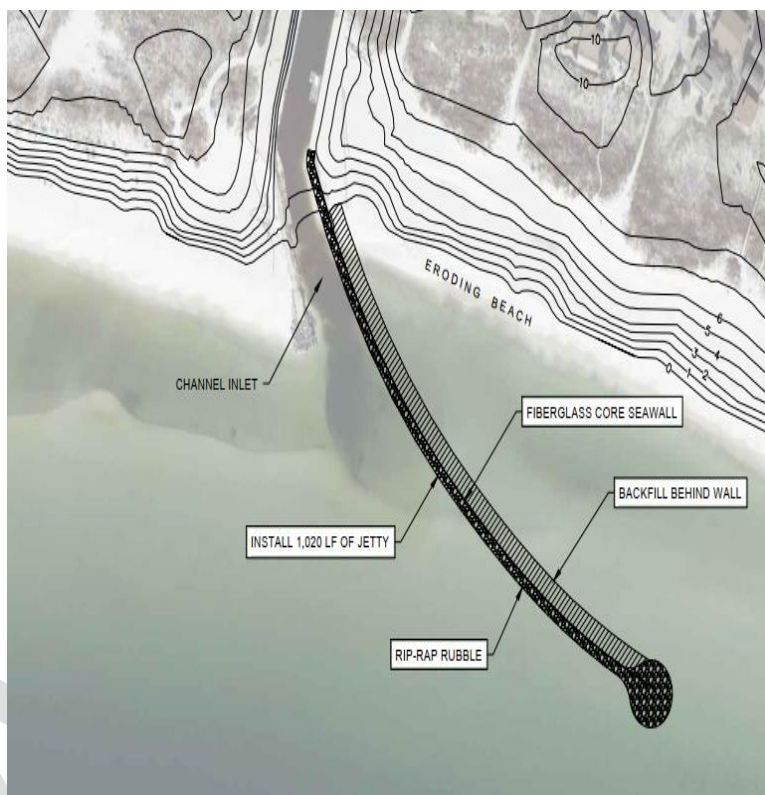


Figure 67. Proposed Jetty Improvements

considered to have a high cost to low benefit ratio. Therefore, this alternative is not considered most effective or cost effective. Finally, based on the low potential for trapping sand and the high potential for impacts to endangered species including sea turtles and Gulf sturgeon, it was determined that permit feasibility for this option would be more challenging than the proposed option.

Flood Control Project

Project Purpose. The City of Mexico Beach is susceptible to storm surge through a navigable canal which connects the Gulf of Mexico to the City Marina and continues inland. There are multiple residences along the canal which would be protected from storm surge if a retractable barrier is installed at the Parker Bridge on US 98 just downstream of these structures (land-side location on Parker Bridge was installed in the canal). Providing flood protection at this bridge would prevent flooding due to surge for the residences located north of the bridge. Additional important structures at risk and located upstream of the Parker Bridge include the boat ramp and Marina. There is also risk to increased stormwater flooding in the back canal area, especially during a high tide/king tide event, where tidal waters would increase the water level in the back canal area and reduce capacity for this area to receive stormwater as there is positive drainage in this area.



Figure 68. A sample type of flood control gate that could be used for Mexico Beach

Project Description. The project, also referred to as a 'surge gate,' would incorporate armoring embankments to prevent erosion and installation of a flood control gate that could close the existing channel during a storm surge or high tide event to prevent storm surge and tidal waters from moving inland. During the feasibility phase, the need for a pump will be evaluated to make sure that the back canal area retains sufficient capacity to receive stormwater during a rainfall event if the gate is closed. The project will be divided into two phases so that a detailed feasibility study, engineering design, and permitting study can be conducted to fully develop technical details of the project and provide information needed for the detailed environmental review.

Protection Provided. The existing bridge sits above the 500-year flood elevation. The project would provide protection by installing a flood control gate at the bridge which would close the channel during an event to prevent surge or a high tide from moving upstream through the channel under the Parker Bridge into the back canal area. This type of protection would provide flood protection to approximately 132 homes in the back canal area against the 100-year flood. It would also help protect the marina and boat ramp which are an important source of revenue for the City and costly to repair when damaged. Other facilities that would be protected by this project are the Welcome Center and a lift station. Using the gate to block a high tide would preserve capacity in the back canal to absorb stormwater and reduce flooding to adjacent structures.

Project Alternative. An alternative for this project is constructing a surge barrier in the Gulf of Mexico just outside the canal opening to dissipate energy and block surge. While this may be effective, the costs of a large infrastructure in the Gulf itself would likely be higher and the permitting much more complicated.

Hardened Fire & Police with Emergency Shelter (Higher Standards / First Responder Saferoom)

Project Purpose. The City of Mexico Beach's first responder critical facilities, its Police and Fire stations, were completely wiped out by Hurricane Michael. They were in vulnerable coastal areas and, in part, located as a result of development and limited sites available as the City continued to grow and was near full build out. In addition, the City does not have a designated Emergency Operations Center and a space built to the FEMA 361 Safe Room standards that would allow critical city personnel to ride out a storm safely and then be available to immediately respond to the event and ensure public safety and minimize any secondary impacts. The fire department and police station were located in coastal zones prone to flooding/storm surge and if they are rebuilt in the current site, they will continue to become incapacitated during and after a large storm if new buildings are not constructed in the proposed location and protected to a higher standard for future events.

Project Description. The current functions of critical government buildings including the police station and fire stations will be relocated further inland and consolidated on one site alongside other public buildings – the City Hall and the Civic Center. Most of this work will be done as a PA project. This HMGP (404 Mitigation) project portion will be a supplement to PA funding to build to a higher wind standard, typical for critical facilities in a coastal area. This includes strengthening to a higher wind speed rating, (code plus – at least 160 MPH) and elevation (3 feet about 500-year in compliance with City Floodplain Ordinance requirements) of these structures to protect from future wind and flood damage. The new proposed location is farther from the Gulf of Mexico. It will also add a City staff/first responder safe room within the facility so that essential personnel will be able to ride out the storm (200 mph winds) and then provide public safety functions after the event.



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Figure 69. Sketch of proposed police/fire along with other community facilities

Project Protection. The functions of fire and police will be relocated to a new site that is outside the FEMA Special Flood Hazard Area and within the Shaded X zone (500-year level),

yet farther away from the Gulf. The new building will be elevated to reflect the City's commitment to having all critical facilities elevated 3 feet about the 500-year level so that it will not be prone to flooding as well as hardened to account for high wind protection. Inside the consolidated police and fire building will be an Emergency Operations Center to monitor events as well as provide a safe room built to FEMA 361 standards for City leadership and emergency personnel only. This function will position the City to better respond to events, provide public safety services, and reduce secondary impacts brought on by the storm. The site of the relocated functions of police and fire, as well as the new EOC, will make sure that the building is away from the potential storm surge in order to sustain emergency response operations during and after a disaster.

Project Alternative. An alternative to this project is to harden police and fire stations in their original locations which is much closer to the Gulf of Mexico. This would result in additional project cost of approximately \$700,000 in order to elevate both structures 3 feet above the 500-year storm per the City's Codes and Ordinances. In addition, the total height would be approximately seven feet above grade (additional costs required for handicap access and elevation of structures). Therefore, the fire trucks would park under the building and would not be protected from flood (potential loss of critical equipment) during event. The location of the proposed project eliminates this risk.

A Look Forward - Additional Project Ideas to Address Gaps

This section charts a course for going beyond the completed and current activities to achieve greater resilience. The City has accomplished a tremendous amount in a relatively short amount of time. These projects represent efforts to address the remaining 'gaps' to bring the City to more comprehensive resilience. Several of these project work in coordination with completed/current projects. This section starts with a brief description of the projects, then has a section with potential funding sources, and ends with a matrix of the projects with key data like approximate timeframe, funding source options, and other important information.

Critical Infrastructure Mitigation – Water System Protection / Redundancy

Mexico Beach purchases its drinking water from Bay County and is serviced by a 25-mile water line. During Hurricane Michael, the water supply system was damaged and out for several weeks. Without water, buildings cannot be occupied and the recovery process is delayed at a sensitive time. To mitigate this operational loss of a critical lifeline, Mexico Beach is evaluating a mitigation project that would provide a secondary source of water supply to access in emergency situations. The proposed action would either involve an additional elevated water tank, mitigated against wind and water, to provide the needed water pressure or a connection to the water supply system in Gulf County to provide a secondary source of drinking water in times of emergency.

City Marina Seawall Mitigation

This project would provide mitigation to the City's Marina which is located on the Gulf side of US 98. Before Michael, a segment of the marina only had wooden wall to protect it and it was heavily damaged by Michael. An adjacent segment was reinforced by steel and a retaining wall on the land side which held up well during Michael. This area not only would protect the marina but also the surrounding land-side recreation area which is used for fishing and as a gathering

area. Parts of this project would also be part of the larger visions to provide greenspace connectivity. PA funding is currently being sought for the mitigation part but the outcome is not certain.

Stormwater Project Components

This project speaks to the need to identify funding sources for projects that make up the overall regional stormwater detention project outlined in the previous section including habitat restoration, boardwalks, and signage.

Mexico Beach Blue Trail Canal Slope Stabilization and Habitat Enhancement

The back canal system stretches for most of the length of inland part of Mexico Beach and provides several important functions including capturing and conveying stormwater as well as natural habitat for flora and fauna. It was heavily damaged by Hurricane Michael and has also suffered from invasive species encroachment and continual erosion. This project proposes to stabilize the slopes of the back canal system and evaluate the need to increase conveyance to better accommodate stormwater, improve water quality by reducing the inflow of turbid water, and allow for shifting natural habitats within the banks and outside them. The City has ownership of the canal system.



Figure 70. Extensive damage from Hurricane Michael in the back canal area. Source: City photo

Living Breakwaters (Oyster Reef) / Positioned near the Canal Opening

Mexico Beach is known for its bountiful marine life and the presence of many artificial reefs that support a variety of marine life. The Mexico Beach Artificial Reef Association (MBARA) has a mission to construct artificial reef habitat to enhance sustainable fisheries in the waters of the Gulf of Mexico. One of its goals is to establish 1,000 patch reefs, or small artificial reefs off Mexico Beach, Florida. MBARA surveys have shown that in addition to healthy populations of a variety of bottom-dwelling fish species, shellfish, including oysters, are also common. MBARA works closely with Mexico Beach, the Florida Fish and Wildlife Commission, and the US Army Corps of Engineers. It has made great progress on reach its goal. (<https://www.mbara.org/>)

These same types of artificial structures, designed to attract marine life like shellfish, are being used in other places to also provide benefits of surge attenuation and barriers to protect on-shore structures and infrastructure. These types of artificial reefs are also known as 'living breakwaters' because they attract oysters, corals, and other types of stationary creatures to colonize the structure. These creatures then help build up the barrier making it more effective at dispersing wave energy before storm surge makes landfall.

Studies have shown that living breakwaters provide hazard mitigation benefits:

Living breakwaters reduce the effects of storm surge and coastal erosion by absorbing wave energy during storm events. As waves break on the structure, their energy is reduced, calming waters on the shoreward side of the breakwater and reducing the direct impacts to the shoreline. (<http://nrcregionsolutions.org/living-breakwaters/>)

A proposed action to help Mexico Beach provide additional surge protection, especially in areas like the navigable canal outlet to the Gulf, is to strategically locate artificial reefs designed to attract oyster colonies near this entrance. Due to the fact that the hurricanes and large storms generate surge which can approach the coast from several directions, this type of project would enhance the mitigation value provided by the jetty improvement and flood control project described earlier in this plan. Another potential idea is to create a living shoreline along the jetty extension to both increase protection and improve the marine life value of the structure.

A few examples of where this type of nature-based solution has been used in other parts of the country:

- **Cedar Key, FL.** The City of Cedar Key and the University of Florida were already cooperating on activities to protect and preserve the community as the City had experienced recurring damage from hurricanes and understood that rising tide levels were only adding to the exposure to coastal damages. The City had taken measures to alter their approach to coastal exposure such as implementing an ordinance that prevented new seawalls and implementing a demonstration project for approximately \$60,000 that was supported with technical experts in the community who volunteered their time and expertise. One additional activity included a 3-D model of Cedar's Key downtown area to utilize as a risk communication tool to visualize storm surge and sea level rise. The City collaborated with University of Florida's Institute of Food and Agricultural Sciences to apply for the Gulf of Mexico Climate and Resilience Community of Practice grant funding of \$29,986. The funding was used to develop a Shoreline Management Master Plan (SMMP) and an accompanying ESRI Story Map to display the SMMP along with workshops to promote the tool. The City was a co-sponsor to the grant which utilized the [Living Shoreline](#) Suitability Model (LSSM) created by the Virginia Institute of Marine Science, or VIMS.
- **Staten Island, NY.** The storm surge from Superstorm Sandy devastated the coastline of New York and New Jersey in October 2012. The Tottenville community on the New York City borough of Staten Island experienced severe damage from storm waves. In addition to damage from large storm events like Sandy, the unprotected



Figure 71. Conceptual rendering of the living breakwaters project off Staten Island (Source: <https://stormrecovery.ny.gov/learn-more-about-living-breakwaters-project>)

shoreline has experienced ongoing erosion over the last 35 years. After the event, the US Department of Housing and Urban Development (HUD) launched a design competition called Rebuild by Design. Winning proposals would receive state and federal funding to design and build their project. One of the winning entries was “The Living Breakwaters Project.” This project featured the construction of off-shore breakwaters, including creating habitat for an oyster reef to make the coastline more resilient by protecting against storm surge, enhancing local ecology, and creating social resilience by building a community around education on what it means to be resilient in a coastal setting. For more information, see <https://www.cnbc.com/2019/10/08/oyster-reefs-making-a-comeback-to-protect-coasts-from-climate-change.html> and <https://stormrecovery.ny.gov/learn-more-about-living-breakwaters-project>.

Additional CRS Participation and Activities

As described earlier in the Plan, Mexico Beach has joined the NFIP CRS program. After the initial process of joining and receiving a class level, the City should continue to find areas to accumulate more points to reduce its flood risk and provide premium discounts to its policyholders. An initial source of this assistance may be the State.

From the DEM website, State CRS staff are available to help communities understand the CRS, identify eligible activities, review prerequisites, adopt requirements for new activities, understand the process to seek credits for new activities, and the application process. Specifically, it states how the State Floodplain Management Office supports communities in several ways (areas of particular interest to Mexico Beach are in **bold**):

- Help CRS communities to maintain or improve CRS class ratings.
- Support Florida’s several locally organized regional CRS User Groups by providing technical assistance and making presentations on specific topics and activities requested.
- Offer CRS training in conjunction with Florida Floodplain Managers Association (FFMA).
- **Work with ISO to verify State-Earned Credits available to all CRS communities based on Florida’s unique standards, regulations, and codes.**
- Provide timely Florida-specific CRS news through email blasts and digital newsletters.
- **Provide “What If” statements that show community-specific discounts for all CRS classes, showing how citizens would benefit if communities undertake more eligible activities.**
- Help communities obtain NFIP claims data to support Local Mitigation Strategy (LMS) and Repetitive Loss Area Analysis (RLAA) planning efforts.
- **Conduct reviews for communities not in the CRS to determine whether they will achieve the minimum 500 points for enrollment and help prepare initial CRS applications.**

Several adjacent communities are participating in CRS and have achieved a class level of 8 or better which is an attainable goal for Mexico Beach:

Community Name	Class	Discount
Bay County	5	25 percent
Panama City	6	20 percent

Community Name	Class	Discount
Panama City Beach	8	10 percent
Gulf County	8	10 percent
Franklin County	7	15 percent

Table 16. Neighboring communities with CRS class level and discount (as of April 2019 - source: https://www.fema.gov/media-library-data/1559830308363-e690ed2aea6606fb81826904e4a7bd7f/app-f_crs_508_apr2019.pdf)

To understand the potential community-wide impact of participating in the CRS, look at the example of annual savings from Bay County’s CRS Participation:

- Number of flood insurance policies: 14,384
https://crsresources.org/files/100/maps/states/florida_crs_map_october_2019.pdf
- Approximate average cost of a flood policy: \$700 (insurance.com)
- Approximate total cost of premiums: \$10,068,800
- CRS Discount: 25%
- Approximate annual savings: \$2,517,200

The following activity table was developed to provide ideas for where Mexico Beach could likely obtain CRS points as it progresses in the program:

CRS Activity	Maximum Possible Points	Applicability to Mexico Beach
Element 312: Maintain Elevation Certificates	116 points	Likely already being done
Element 320: Providing Map Information Service	150 points	Providing basic flood map and risk data
Element 330: Outreach Projects	350 points	Including designing outreach projects, forming a program for public information (PPI), getting other stakeholders to disseminate information. A PPI has waterfall effect and creates opportunities for increased points on other elements.
Element 340: Hazard Disclosure	Up to 80 points but only 65 if no PPI	Getting real estate agents to disclose flood hazard and disseminating information to prospective home buyers; an opportunity to communicate resilience steps that Mexico Beach has taken
Element 350: Flood Protection Information	Up to 125 points but only 100 if no PPI	Having a public information library available- more points if available on web
Element 360: Flood Protection Assistance	Up to 110 points but only 75 if no PPI	Providing advice/information on property protection and programs available to fund such measures
Element 370: Flood Insurance Promotion	Up to 110 points	Identifying flood insurance coverage in community, forming committee to develop coverage improvement plan, implementation of projects in plan
Element 410: Flood Mapping	Up to 850 points	Developing new flood studies and implementing higher standards within high risk areas

CRS Activity	Maximum Possible Points	Applicability to Mexico Beach
Element 420: Open Space Preservation	Up to 2,870 points	Keeping land vacant through ownership/regulations, deed restrictions. Also, credit for programs that incentivize open space protection or protect natural features
Element 430: Higher Regulatory Standards	Up to 2,462 points	Implementing standards like freeboard, prohibiting fill, cumulative substantial damage, and enclosure limits. An expanded SFHA that includes the Shaded X zone
Element 450: Stormwater Management	Up to 755 points	Includes stormwater management regulations activities (380 pts); preparation of a watershed master plan (315 pts); erosion and sedimentation control regulations (40 pts); and water quality regulations (20 pts)
Element 510: Floodplain Management Planning	Up to 622 points	Includes preparation of a floodplain management plan (382 pts); Repetitive Loss Area Analysis (140 pts); and a Natural Floodplain Functions Plan (100 pts)
Element 520: Acquisition and Relocation	Up to 2,250 points	Credit for buildings acquired in the SFHA, based largely on percent acquired. Consider the moving of first responder facilities a 'relocation' – critical facilities (relocating the function of the first responder the same as relocating the building)
Section 530 Flood Protection	Up to 1,600 points	Implementation of retrofitting/flood control measures based largely on percent protected. The activities under 530 include elevation, barrier (surge gate), channel modification (jetty improvement), storm sewer improvements (sewer system bypass pumps) all of which have been submitted by Mexico Beach
Element 540: Drainage System Maintenance	Up to 470 points	Implementation of programs to ensure streams, channels, etc. are kept clear of debris
State building code adoption		State's actions provide some immediate benefits to Florida CRS communities
CRS's Users Group if one is formed in the Panhandle area or between Bay, Gulf and Franklin		A future idea that could benefit multiple jurisdictions

Table 17. Potential CRS Activities for Mexico Beach

The following table shows the prerequisites that are necessary to achieve greater than a Class 9 level and then, at the bottom, a Class 6 or better:

CRS Activity	Maximum Possible Points	Applicability to Mexico Beach
TIER 1 – Class 7-9 Prerequisites - There are six prerequisites to become and stay a Class 9 or better community:		
The community must have been in the Regular Phase of the NFIP for at least one year.		
The community must be in full compliance with the minimum requirements of the NFIP.		

CRS Activity	Maximum Possible Points	Applicability to Mexico Beach
		The community must maintain FEMA Elevation Certificates on all new buildings and substantial improvements constructed in the Special Flood Hazard Area (SFHA) after the community applies for CRS credit.
		If there are one or more repetitive loss properties in the community, the community must take certain actions as specified in Sections 501–504.
		The community must maintain all flood insurance policies that it has been required to carry on properties owned by the community.
		If a coastal community receives a draft Flood Insurance Rate Map (FIRM) that delineates the Limit of Moderate Wave Action (LiMWA), the community must agree to show the LiMWA on its final published FIRM.
TIER 2 – Class 6 or better prerequisite:		
		To become a Class 6 or better community, a community must have received a classification of 5/5 or better under the Building Code Effectiveness Grading Schedule.

Table 18. CRS Key Pre-requisites

Beachfront Enhancement and Renourishment

Building back the beachfront and the dunes to a condition where this provides better protection to the structures behind will take time as sand accretes on the shoreline and in the dunes. Where possible, the beachfront width should be expanded along with the dune system. To explore this idea, Mexico Beach seeks a pilot project to demonstrate different beachfront typologies and ways to naturally increase the buildup of the beach and the dune system. There are other considerations that could help both better protect the City and to enhance its appeal to visitors, so this is a multi-objective project to involve aesthetics, storm protection, and ecology. An important part of this project would be funds to renourish the beach to build it back up to pre-Michael dimensions.

Protection of Critical Evacuation Routes

There are three critical hurricane evacuation routes for Mexico Beach: 1) County Road 386 to Highway 71; 2) US 98 East to Port St Joe to Highway 71; and 3) US 98 West to US 231. These routes should be evaluated for any segments that are more likely be flooded ahead of a storm that could impede evacuation or other types of emergency access.

Burial of Power Lines

While the power lines that run through Mexico Beach are the jurisdiction of Duke Energy, it would likely be beneficial to the City to have the power lines buried to protect against high wind events. The City has experienced power loss in smaller event as well as complete power loss after Hurricane Michael. A crude cost for burial of lines was derived from staff analysis of a bill proposed in the Florida State Legislature in 2019 (a storm-protection bill signed into law by Governor Ron DeSantis that allows FPL and other electric utilities to charge customers for putting neighborhood power lines underground). This analysis approximated FPL’s undergrounding program at \$632,000 per mile but this may vary widely by location. While burying power lines is effective at protecting against high winds, it may not be as effective in dealing with storm surge. A study would be required to see how appropriate this solution is for Mexico Beach and the feasibility of Duke Energy to participate.

The Canal Parkway has been selected as an initial pilot area for buried power lines. The City will seek funding for a study and then implementation of this project.

Parking / Roadway Protection / Surge Barrier

The City has considered a project that would create parking along US 98 and would have a dual purpose of building up a barrier along the parking area that would help served as a surge barrier. It is a conceptual project at this stage and the FEMA BRIC program, with its emphasis on infrastructure, may be a good fit for it.

Elevation / Mitigation Reconstruction

As stated earlier in the Plan, many homes in Mexico Beach were severely damaged and now need to be elevated to be in compliance with the revised flood ordinance.

Flood Warning / Response

Along with Bay County EM, Mexico Beach should coordinate with Gulf County on future development of its Flood Response Plan and share information on flood warning and immediate response.

Community Survey

To better estimate the City's population and economic demographics post-Michael, the City will conduct a community survey to collect important information that will allow it to better gauge current needs and to pursue grant funds.

Storm Surge Study

To better estimate the effect of sea level rise on increasing the magnitude of storm surge impacts, the City will seek assistance in the form of technical expertise and grants.

Potential Funding Sources

FEMA Building Resilient Infrastructure and Communities (BRIC) program – A program will support states, local communities, tribes, and territories as they undertake hazard mitigation projects reducing the risks they face from disasters and natural hazards. BRIC is a new FEMA pre-disaster hazard mitigation program that replaces the existing Pre-Disaster Mitigation (PDM) program and is a result of amendments made to Section 203 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act) by Section 1234 of the Disaster Recovery Reform Act of 2018 (DRRA). The BRIC program guiding principles are supporting communities through capability- and capacity-building; encouraging and enabling innovation; promoting partnerships; enabling large projects; maintaining flexibility; and providing consistency.

Additional HMGP funding – Typically, the State of Florida makes HMGP funding available to the declared counties on a pro-rata basis determined by the level of damage. If the initial funds are not used by these counties, it becomes first available to other affected counties and then statewide.

Flood Mitigation Assistance (FMA) Grant Program – This program is authorized by Section 1366 of the National Flood Insurance Act of 1968, which was amended with the goal of reduction or elimination of flood risk of severe repetitive or repetitive flood damage to structures

insured by the National Flood Insurance Program (NFIP). Funding through this program is provided to states, territories, federally recognized tribes, and local communities for efforts in the way of planning or projects that may reduce or eradicate the long-term risk of the NFIP insured buildings. Management costs may also be funded through this program.

FDEP Resilience Implementation Grants (RIG) – The Florida Department of Environmental Protection provides these grants solely for Florida communities that are mandated to have a coastal management component in their comprehensive plan. This funding source is intended to help communities in implementing of the projects in their adaptation or resilience plans and other nature-based options for erosion and flood control as well as elevation of public structures. There is a \$500,000 funding limit and the applications in the FY 2020 cycle are due October 9, 2020.

Hurricane Michael HUD Community Development Block Grant-Disaster Recovery (CDBG-DR) – This program is funded by the U.S. Department of Housing and Urban Development (HUD). The FL Department of Economic Opportunity was required to develop a state action plan to outline the strategy to support long-term recovery efforts and address unmet needs. Applicable mitigation funding programs are grouped into the categories of housing activities, economic revitalization, infrastructure, and administrative and planning costs. The HUD approved state plan is expected in the fall of 2020.

The State of Florida Action Plan for Disaster Recovery, submitted to HUD on May 14, 2020, provides the following information about the funding for CDBG-DR:

- “The communities to receive 80 percent of the funds include: Bay, Calhoun, Gulf, and Jackson counties; 32321, 32327, 32328, 32346, 32351, 32428 ZIP codes and the jurisdictions within the counties. DEO will ensure, as required and identified in the Federal Register, that at least 70 percent of the entire CDBG-DR funds will be used for activities benefiting low-to-moderate income (LMI) persons.” (p.19)
- “DEO will maximize the benefit achieved through the expenditure of CDBG-DR funds by allocating \$109,000,000 of the General Infrastructure Repair Program’s budget to match the FEMA’s Hazard Mitigation Grant Program (HMGP) to complete resilience projects.” (footnote on p. 20)

National Oceanic and Atmospheric Administration Office for Coastal Management Coastal Resilience Grant – This competitive grant program funds projects that are helping coastal communities and ecosystems prepare for and recover from extreme weather events, climate hazards, and changing ocean conditions. All project proposals undergo a rigorous merit review and selection process by a panel of subject matter experts from across the United States that include representatives of government, academia, and private industry. Funding is typically available on an **annual cycle**.

FDEP Beaches Funding Program. Funding for Florida's critically eroded beaches is managed by the Beach Management Funding Assistance Program. The program provides and manages grants to local governments (up to 75 percent of project costs) for planning and implementing beach and inlet management projects on the Gulf of Mexico, Atlantic Ocean, or Straits of Florida to protect upland structures and infrastructure, provide critical habitat for threatened and endangered species, provide recreational opportunities, and support local economies through tourism.

FDEP managed Federal Clean Water Act Section 319 (h) Grants and the State Water-quality Assistance Grants (FDEP) - Funding for control of water pollution from nonpoint sources is managed by the Nonpoint Source Management Program. Nonpoint source pollution, unlike pollution from industrial and sewage treatment plants, comes from many diffuse sources, including stormwater.

CARES Act - EDA has made funding available to communities during the COVID-19 crisis. The assistance will be made available through Regional Planning Councils. The following components are most relevant to the needs articulated in this Plan:

“Through the Public Works program, EDA provides catalytic investments to help distressed communities build, design, or engineer critical infrastructure and facilities that will help implement regional development strategies and advance bottom-up economic development goals to promote regional prosperity. The Public Works program provides resources to meet the construction and/or infrastructure design needs of communities to enable them to become more economically competitive. Prior examples of investments EDA has supported through the Public Works program include projects supporting water and sewer system improvements, industrial parks, high-tech shipping and logistics facilities, workforce training facilities, business incubators and accelerators, brownfield redevelopment, technology-based facilities, wet labs, multi-tenant manufacturing facilities, science and research parks, and telecommunications infrastructure and development facilities. As noted above, investments made through the Public Works program must be aligned with a current CEDS or equivalent EDA-accepted regional economic development strategy and clearly lead to the creation or retention of long-term high-quality jobs.”

Florida Department of Environmental Protection - Coastal Partnership Initiative (CPI) –

The Coastal Partnership Initiative was developed to promote the protection and effective management of Florida’s coastal resources in four specific priority areas: Resilient Communities, Coastal Resource Stewardship, Access to Coastal Resources, & Working Waterfronts. Florida’s 35 coastal counties and all municipalities within their boundaries that are required to include a coastal element in their comprehensive plan are eligible to apply. Florida’s public colleges, universities, regional planning councils, national estuary programs, and non-profit groups may also apply provided that an eligible local government agrees to participate as a partner. Applications are accepted once a year in response to a “Notice of Availability of Funds” published in the Florida Administrative Weekly. The funding year typically begins July 1 and ends June 30; however, this timeframe may be shifted if the grant cycle is delayed or postponed. Projects are to be completed within one year, no matter when the funding cycle begins.

Florida DEM Residential Construction Mitigation Program – Section 215.559, Florida Statutes, created the Hurricane Loss Mitigation Program, which funds the Residential Construction Mitigation Program (RCMP). Annually, the Legislature appropriates \$10 million from the Florida Hurricane Catastrophe Fund for different mitigation programs which is funded by insurance surcharges. Notice of Funding Availability (NOFA) is advertised in the Florida Administrative Weekly and all requests for proposals are issued via the www.myflorida.com Web portal. Application deadlines can also be found at www.floridadisaster.org/mitigation/rcmp/index.htm.

FDEP Florida Beach Erosion Control Program – The Florida Beach Erosion Control Program was established for the purpose of working in concert with local, state, and federal governmental sponsors to achieve the protection, preservation, and restoration of the coastal sandy beach resources of the state. Eligible activities of this grant-in-aid program include beach restoration and nourishment activities, project design and engineering studies, environmental studies and monitoring, inlet management planning, inlet sand transfer, dune restoration and protection activities, dune walkover construction, and other beach erosion prevention-related activities. All projects must be cost effective and compliant with the Florida Strategic Beach Management Plan.

Financial assistance in an amount up to 50 percent of the project costs for beach restoration projects and up to 75 percent for inlet management projects is available; other state grant-in-aid funds may not be used as a local match. The program requires submittal of funding request, including a long-range budget plan with supporting information for ranking as required by Rule 62B-36, Florida Administrative Code. Annual updates of budget plans are due September 1 of each year.

Florida Fish and Wildlife Conservation Commission (FWC) – Florida Boating Improvement Program (FBIP) – FBIP provides funding through competitive grants for boating access projects and other boating-related activities on coastal and inland waters of Florida. Projects eligible for funding through FBIP include recreational channel marking and other uniform waterway marking; publicly owned boat ramps, piers, docks, lifts, boats, hoists, marine railways, and other public launching facilities; derelict vessel removal; boater education; economic development initiatives that promote boating; and other local boating-related activities.

Funding is dependent upon annual appropriation by the Legislature. No cash match is required. Some non-cash (in-kind) match required. Eligible program participants include county governments, municipalities, and other governmental entities of the State of Florida.

DOC/Economic Development Administration Investment for Public Works and Economic Development Facilities – The Economic Development Administration (EDA) provides assistance to support the construction or rehabilitation of essential public infrastructure and facilities necessary to generate or retain long-term private sector jobs and investments, attract private sector capital, and promote regional competitiveness. Grants may be used for projects such as expanding and upgrading infrastructure to attract new industry, supporting technology-led development, redeveloping brownfield sites, promoting eco-industrial development, and supporting heritage preservation development. Generally, EDA investment assistance may not exceed 50% of the project cost. Projects may receive an additional amount that shall not exceed 30% based on the relative needs of the region in which the project will be located as determined by EDA. Additional financial limitations may apply depending on the recipient.

USACE – Hurricane and Storm Damage Reduction Projects – Authority for this action is provided under Section 103 of the River and Harbor Act of 1962 as amended. This authority may be used for protecting multiple public or private properties and facilities, and for the protection of single non-federal public properties against damages caused by storm-driven waves and currents. This authority allows federal participation in the cost of protecting the shores from hurricane and storm damage. The source is continuing authority given by

Congress to the USACE. There is a total of \$30 million available nationwide per fiscal year under this authority. The federal funding limit per project is \$5 million.

USACE- Flood Damage Reduction – Authority for this action is provided under Section 205 of the Flood Control Act of 1948 as amended. This program provides authority to plan, design, and construct certain small flood-control projects in accordance with current policies and procedures that have not already been specifically authorized by Congress. Both structural (e.g., levees, channels, or pumps) and non-structural (e.g., flood proofing or relocation of structures) solutions to reduce damages caused by over-bank flooding are considered.

A non-federal interest must be a public agency able to enter into an agreement in accordance with the requirements of Section 221 of the Flood Control Act of 1970. Section 221 specifies that the non-federal sponsor be a legally constituted public body with full authority and capability to perform the terms of its agreement and to pay damages, if necessary, in the event of failure to perform. There is a total of \$55 million available nationwide per fiscal year under this authority. The federal funding limit per project is \$7 million. The minimum non-federal share is 35 percent. The maximum non-federal contribution is 50 percent.

Rural Development Water and Waste Disposal Loan and Grant Program – The U.S. Department of Agriculture’s Rural Development Department provides long-term, low-interest loans and grants, as well as loan guarantees, to rural communities and small municipalities of 10,000 or less people. These loans and grants may be used to help fund new, upgraded, renovated, and expanded water-supply storage and distribution systems and waste-collection treatment and disposal systems, including wastewater, solid waste, and storm drainage. Applications may be filed with the Rural Development office serving your area; applications may be filed year-round. No match is required; however, joint funding of projects with private funds is encouraged.

National Science Foundation - Science, Engineering, and Education for Sustainability Program NSF-Wide Investment (SEES) – This addresses the challenge of building a sustainable future through promoting research and education. Research efforts are to include global community sustainability, sustainable energy, modeling, vulnerability, resilience, sensitivity to regional change, and public engagement.

Summary of Potential Action Timeframe and Implementation Schedule

Potential Project	Approximate Cost*	Benefits	Potential Funding Source	Responsible Party	Timeframe
High Priority Projects					
Drinking Water Mitigation / Redundancy	High	Protect a critical asset during emergency	BRIC	Mexico Beach; Gulf County	1-3 years
Additional CRS Activities	Low	Tangible credit in insurance discounts for additional flood risk reduction	Staff time; FDEP RIG; BRIC capacity-building	Mexico Beach; FDEM for assistance	On-going and iterative

Implementation Plan for Projects and Actions

Canal Parkway Burial of Power Lines	\$50,000 for the study; higher to implement	Protect power supply	FDEP RIG for design; BRIC for implement	Mexico Beach; Duke Energy	1-3 years
Living Breakwaters to Protect Canal Entrance	Medium to High depending on scale	Additional mitigation for vulnerable part of city; natural solution	FDEP CPI for study / design; BRIC for implement	Mexico Beach; FDEP	1-3 years
City Marina Seawall Mitigation	Medium	Protect a vulnerable component of seawall	PA 406; HMGP; CDBG-DR	Mexico Beach	1-3 years
Blue Trail Canal Slope Stabilization	Medium	Protect canal against erosion; habitat and recreation benefits	FDEP RIG; CDBG-DR	Mexico Beach	1-3 years
Stormwater Components	Medium to High	Reduce flooding; add recreation	FDEP 319 and RIG; HMGP; BRIC; CDBG-DR	Mexico Beach; various landowners	1-3 years
Community Survey	Low	Better understand current economic conditions	CDBG-DR	Mexico Beach; state university	1 year
Beachfront Enhancement and Renourishment	Medium to High depending on scale	Help build more robust beach and dune system	FDEP CPI for study / design	Mexico Beach; USACE; State of Florida	3-5 years
Priority Projects					
Protection of Critical Evacuation Routes	Medium to High depending on scale	Secure evacuation and emergency corridor access	Depending on activity, BRIC; CDBG-DR	Bay County; Gulf County; Florida DOT	3-5 years
Parking / Roadway Protection / Surge Barrier	Medium	Build greater surge protection and increase parking	BRIC; CDBG-DR	Mexico Beach; Florida DOT	1-3 years
Elevation / Mitigation Reconstruction	Medium to High depending on scale	Protect residences from flood and wind	CDBG-DR	Mexico Beach; individual homeowners	1-3 years
Flood Warning/Response	Low	Better warning information on floods	Staff time	Mexico Beach; Gulf County	1-3 years
Storm Surge Study	Low to Medium	Better understand future risk	TBD	FEMA; State of Florida	1-3 years

Table 19. Projects table

* = Approximate Cost represented in three potential tiers: High (over \$5 million); Medium (\$100,000 to \$5 million); Low (less than \$100,000)

** = Timeframe

Appendix A

**Additional Maps Showing Damage from Hurricane Michael –
from NOAA Post-Michael Aerial Imagery at
(<https://storms.ngs.noaa.gov/storms/michael/index.html>)**

(west to east in the City)

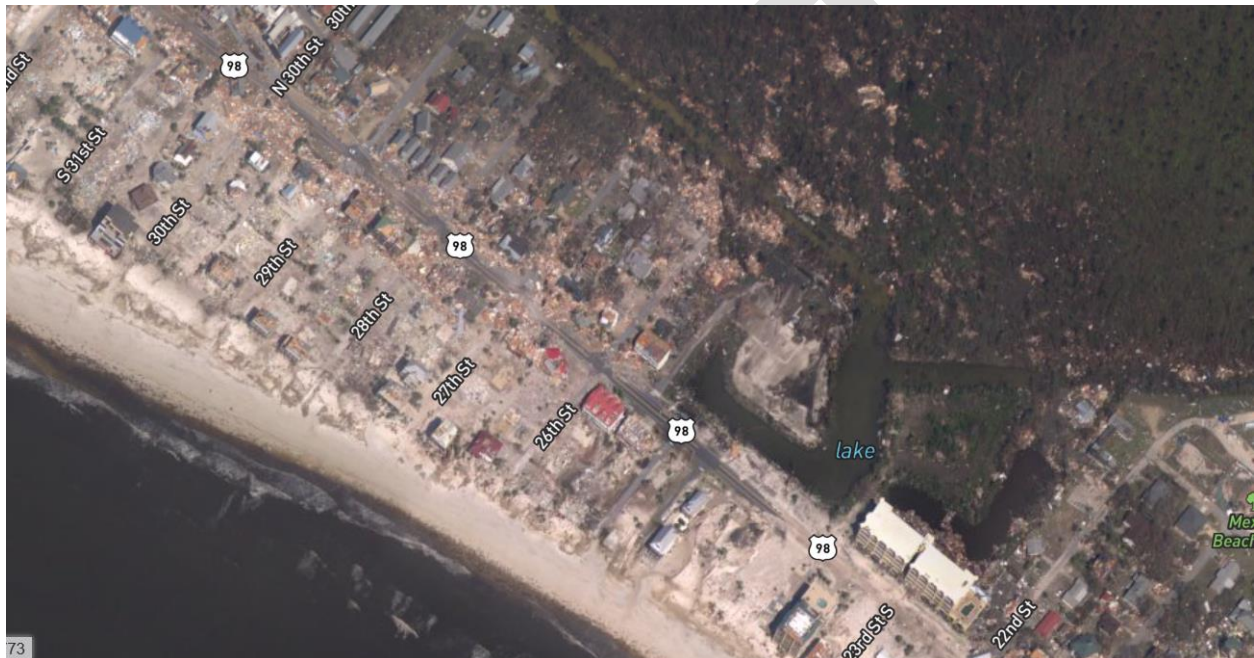


Figure A-1. Post Michael imagery



Figure A-2. Post Michael imagery

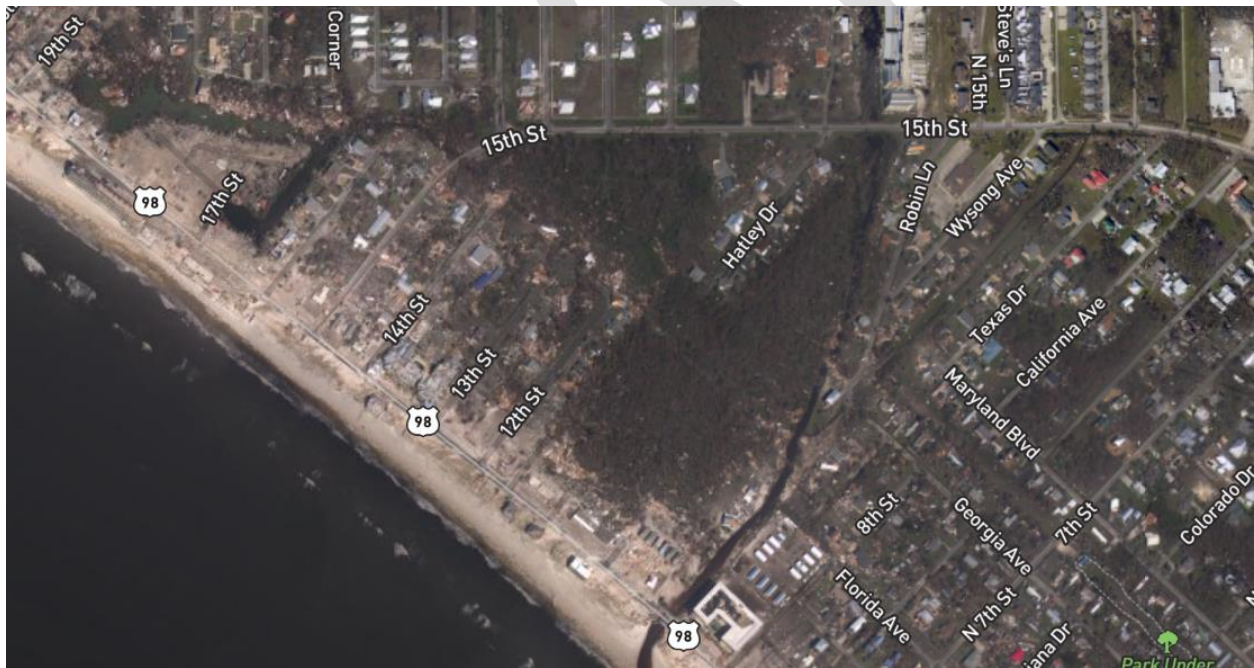


Figure A-3. Post Michael imagery

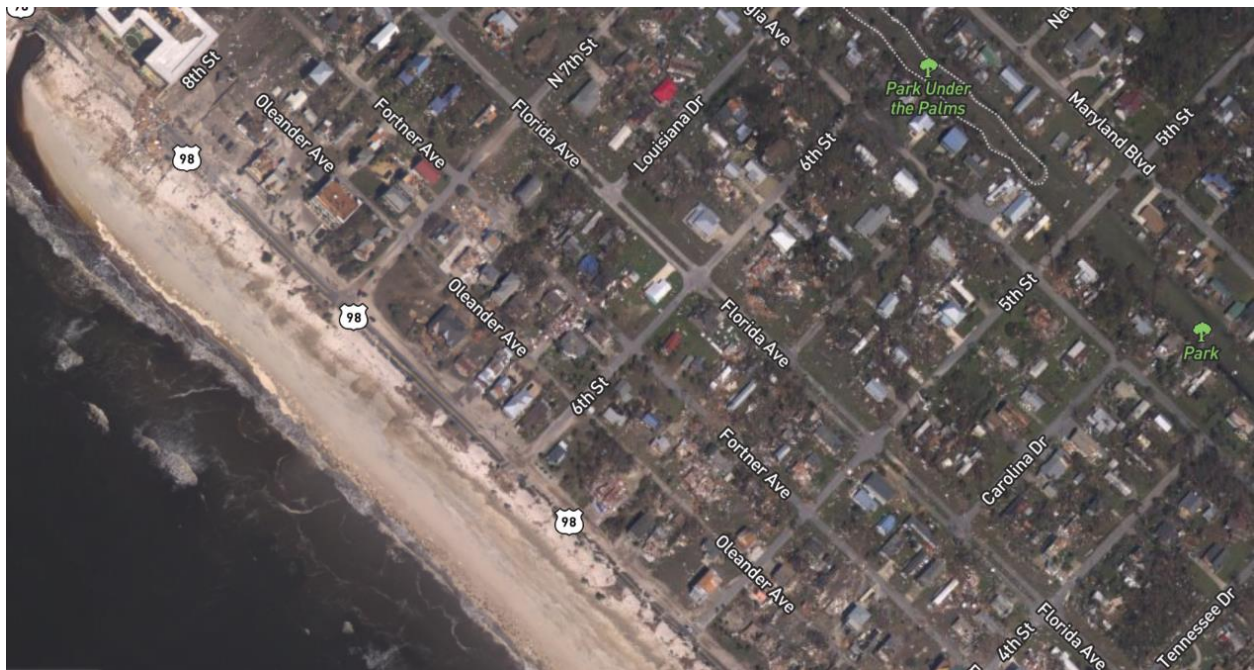


Figure A-4. Post Michael imagery

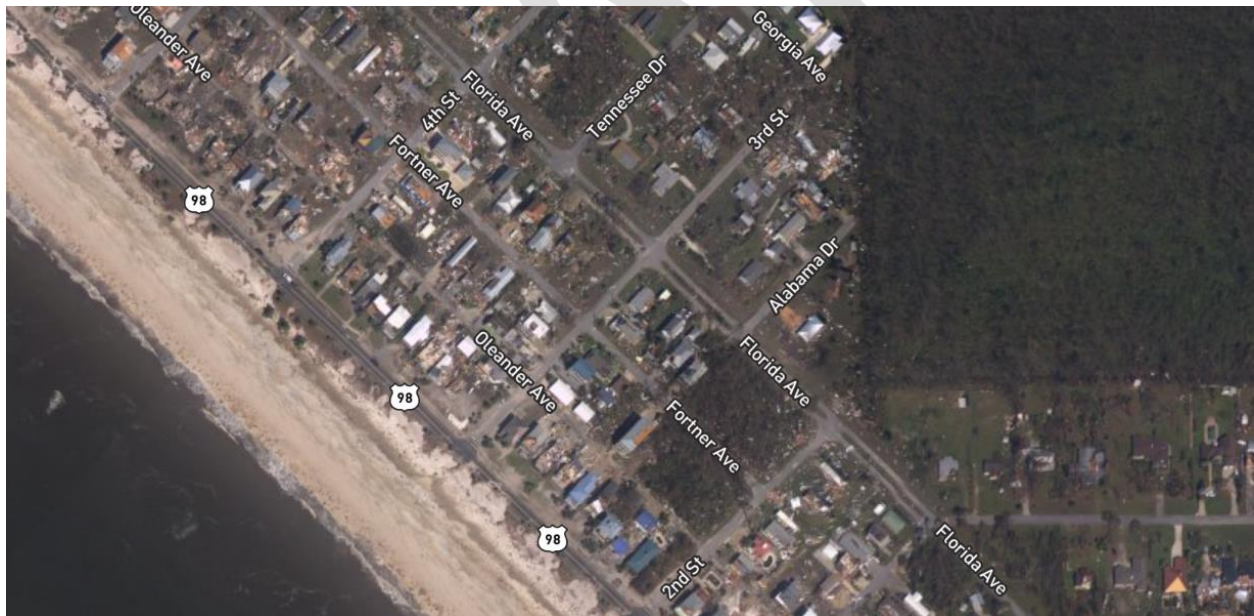


Figure A-5. Post Michael imagery

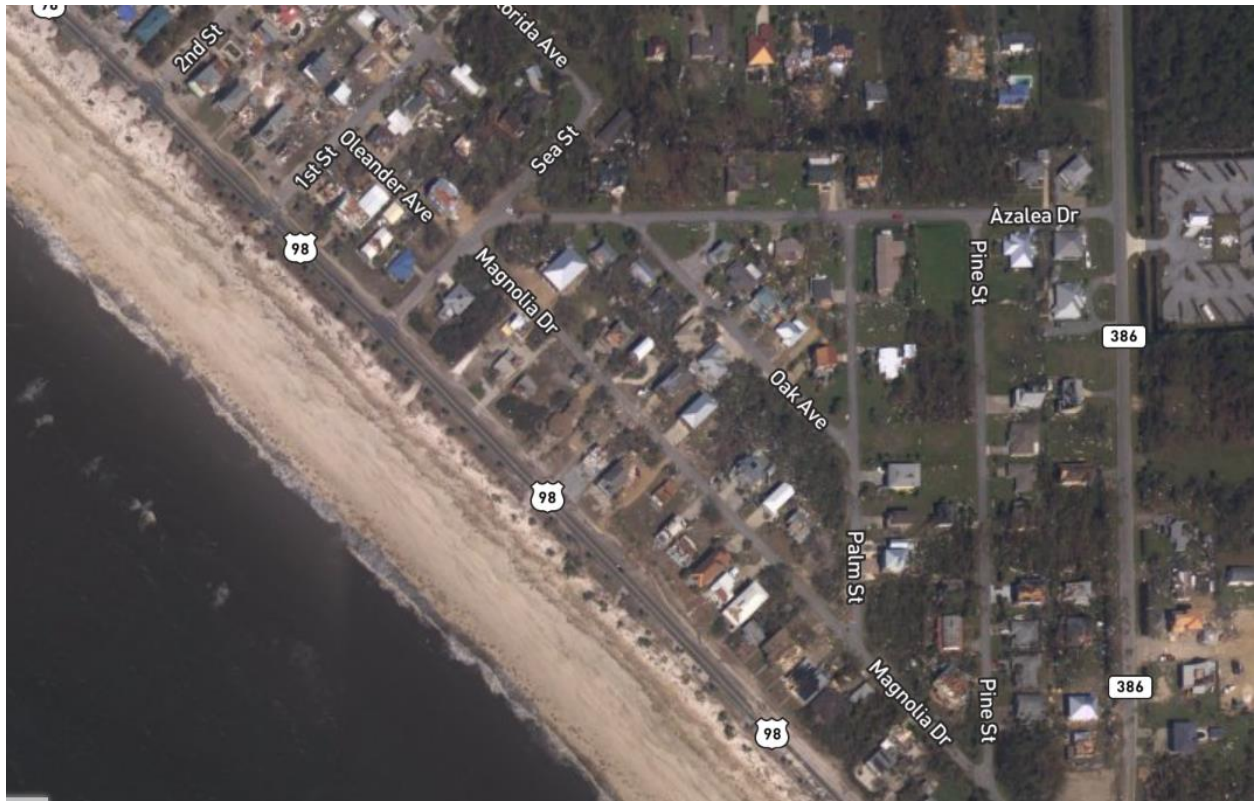


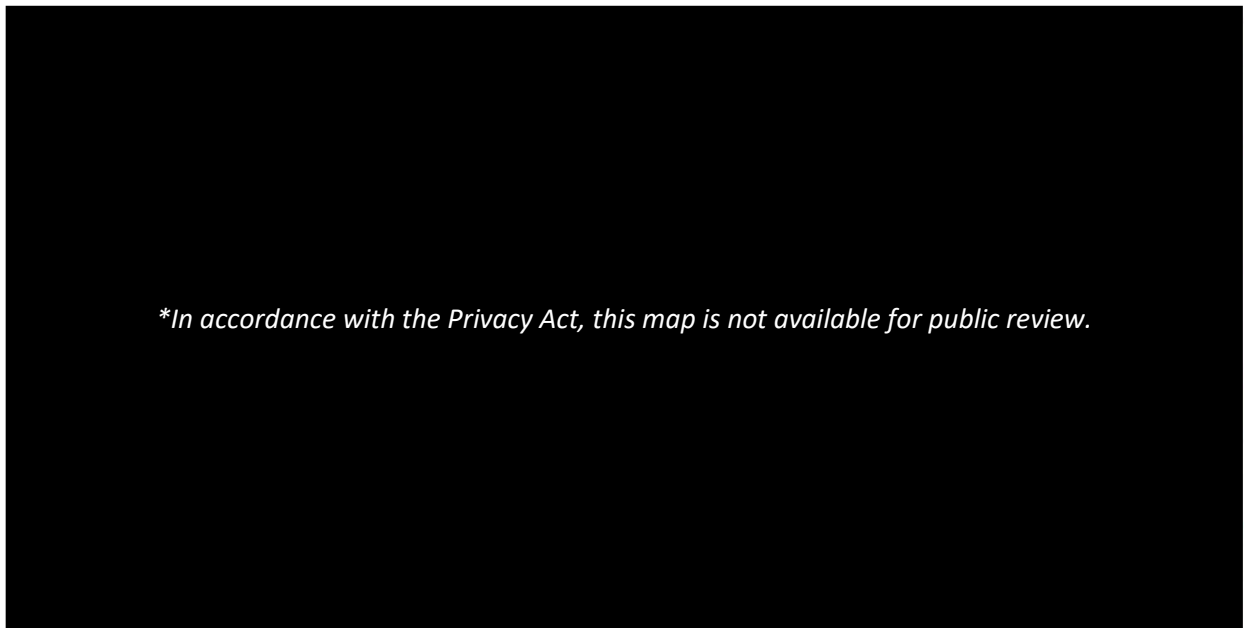
Figure A-6. Post Michael imagery



Figure A-7. Post Michael Aerial Imagery

Appendix B

Additional Wind Maps Showing Damage from Hurricane Michael (west to east in the City)



**In accordance with the Privacy Act, this map is not available for public review.*

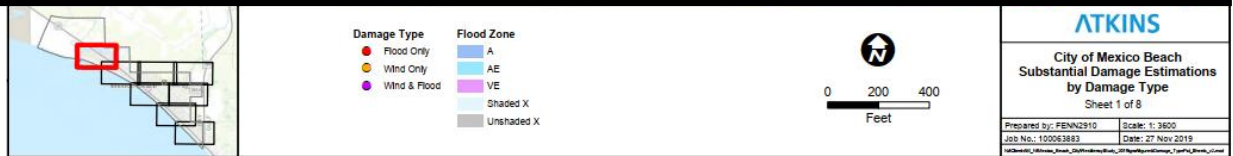


Figure B-1. SDE Wind Map 1

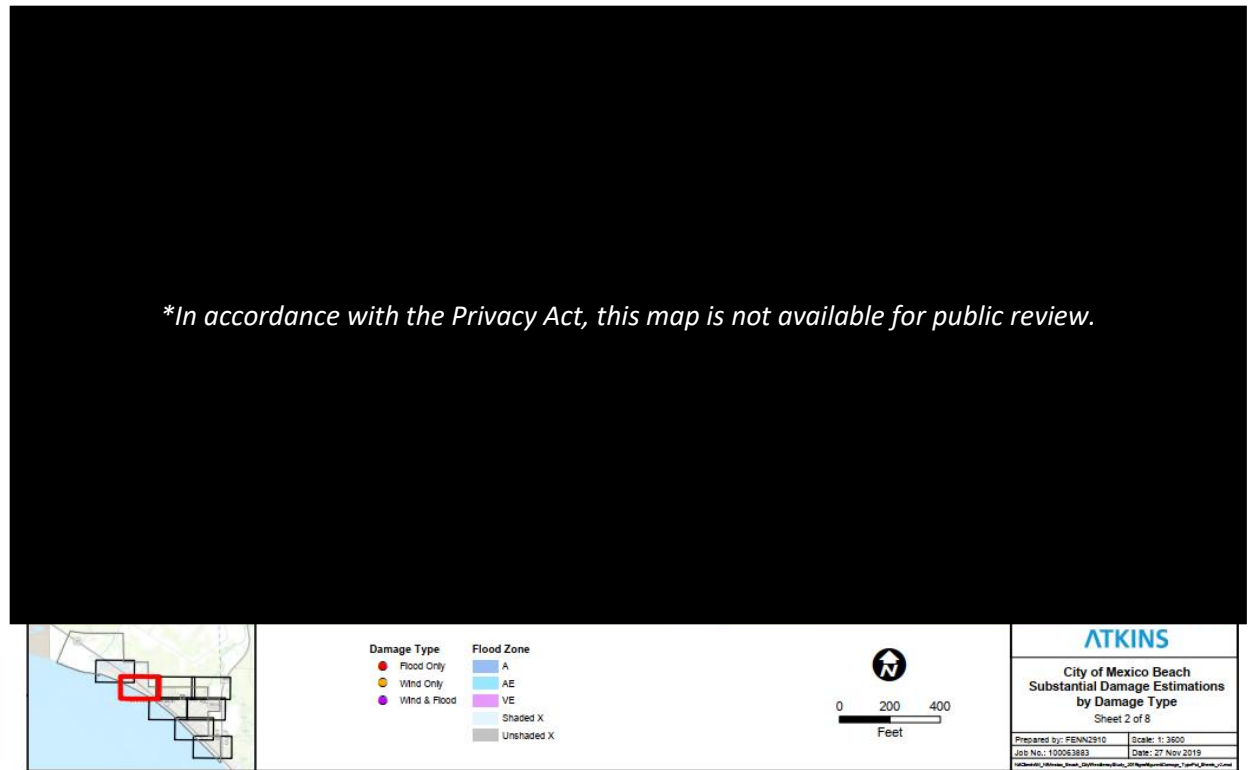


Figure B-2. SDE Wind Map 2

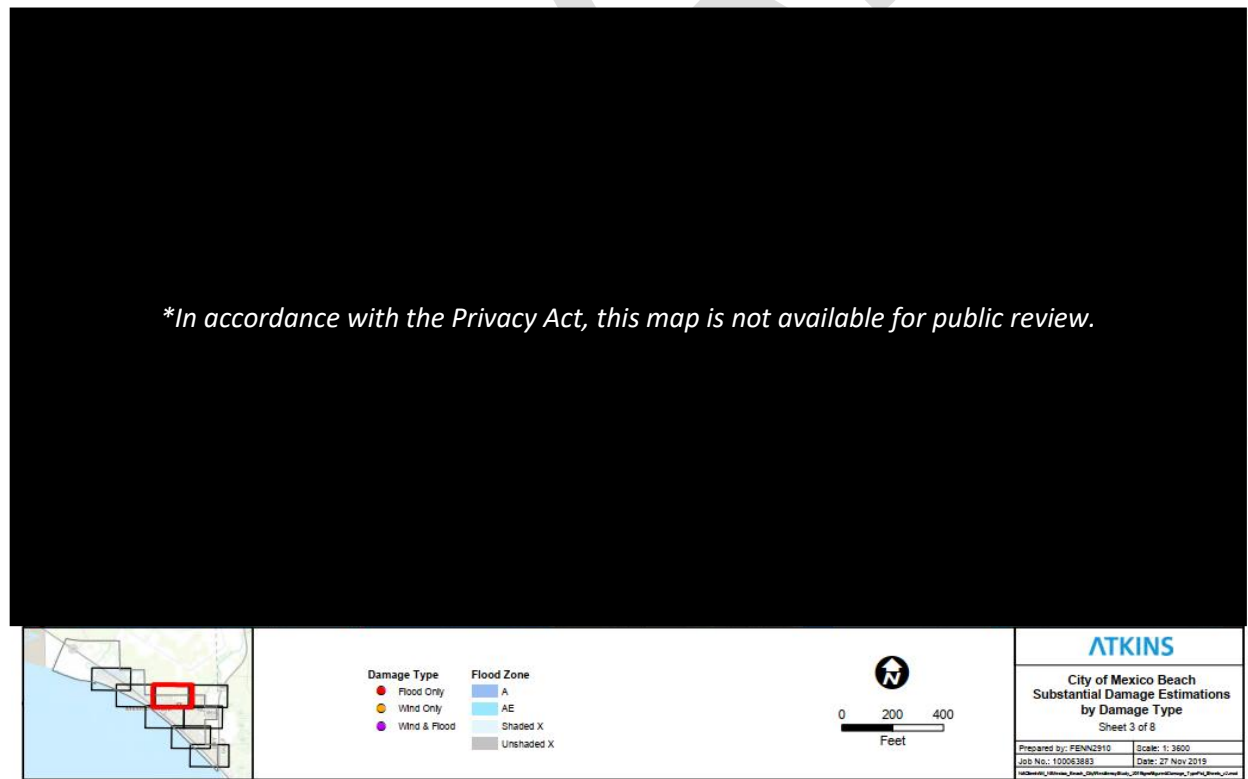


Figure B-3. SDE Wind Map 3

**In accordance with the Privacy Act, this map is not available for public review.*

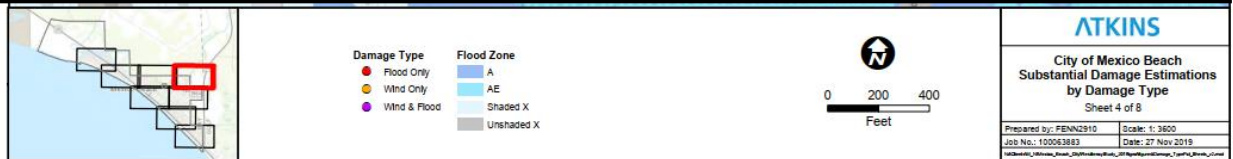


Figure B-4. SDE Wind Map 4

**In accordance with the Privacy Act, this map is not available for public review.*

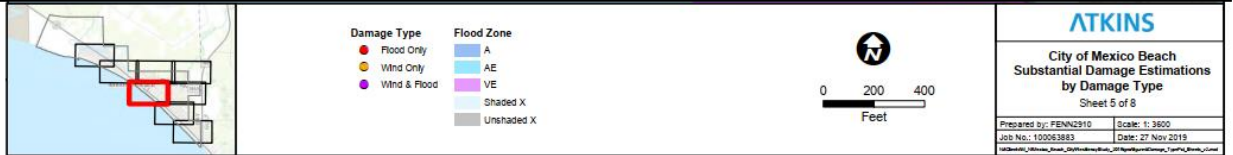


Figure B-5. SDE Wind Map 5

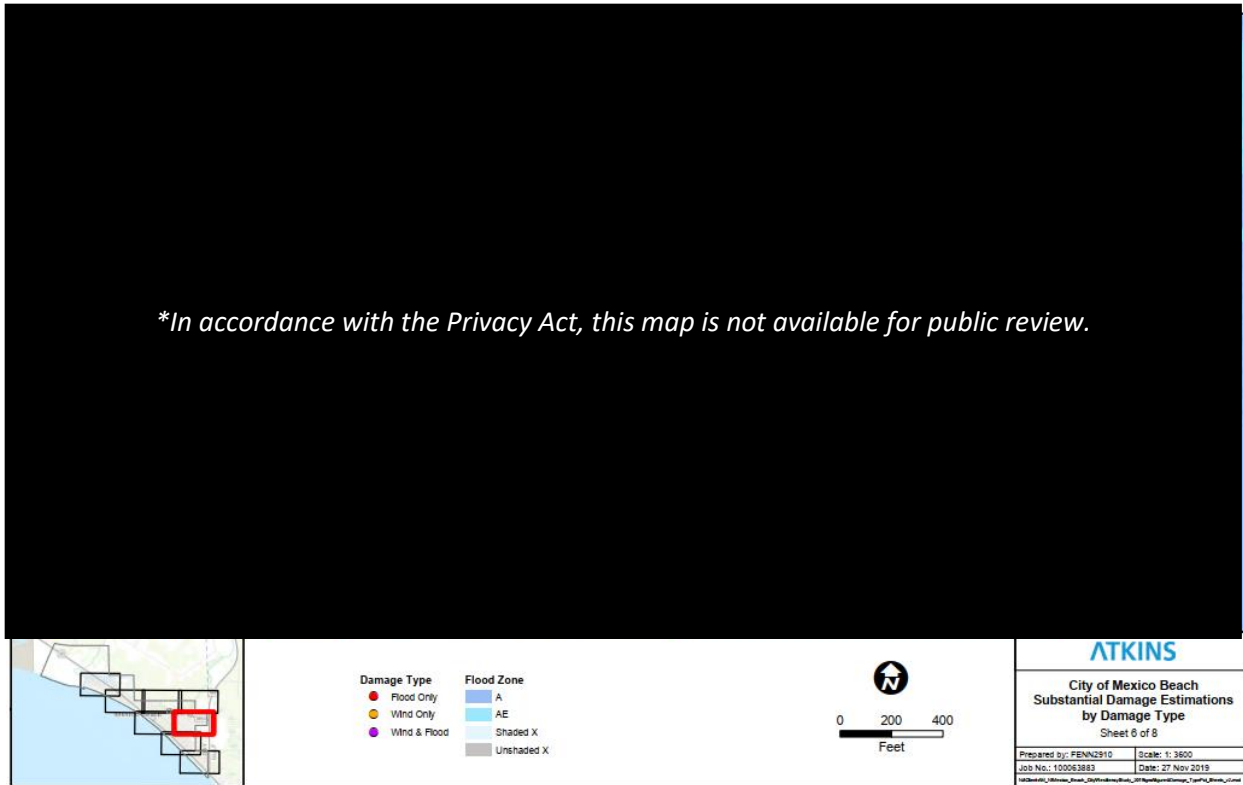


Figure B-6. SDE Wind Map 6

Appendix C

Additional Sea Level Rise Maps Showing Damage from Hurricane Michael (west to east in the City)

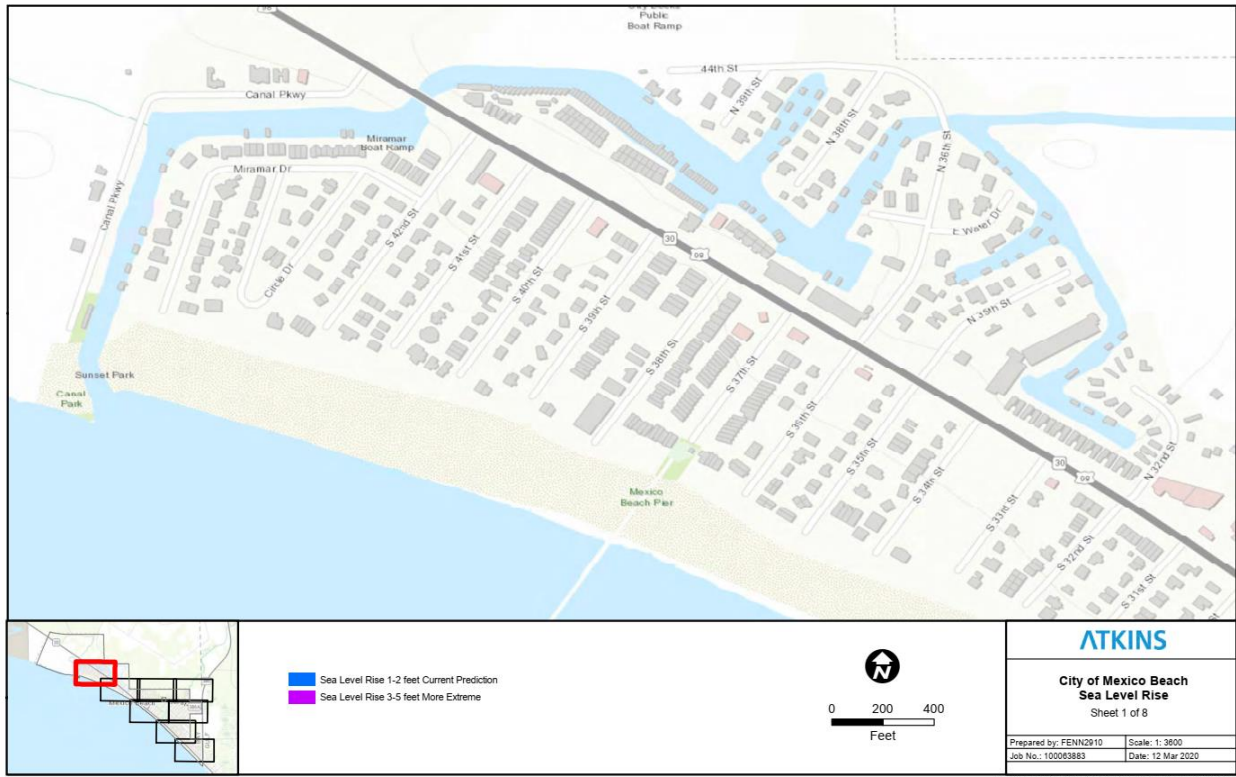


Figure C-1. SDE SLR Map 1



Figure C-2. SDE SLR Map 7



Figure C-3. SDE SLR Map 8

Appendix D

Exhibits from February 22, 2020 Public Meeting

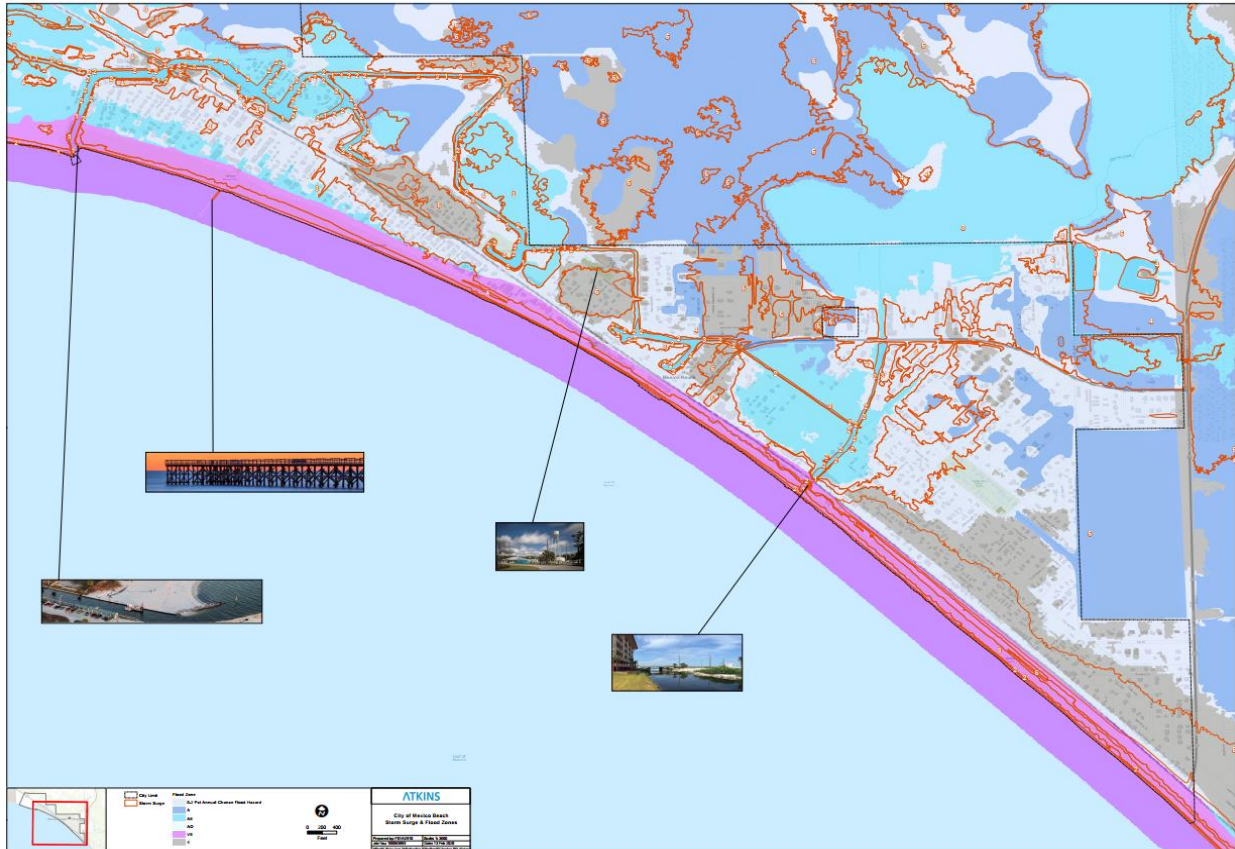


Figure D-1.

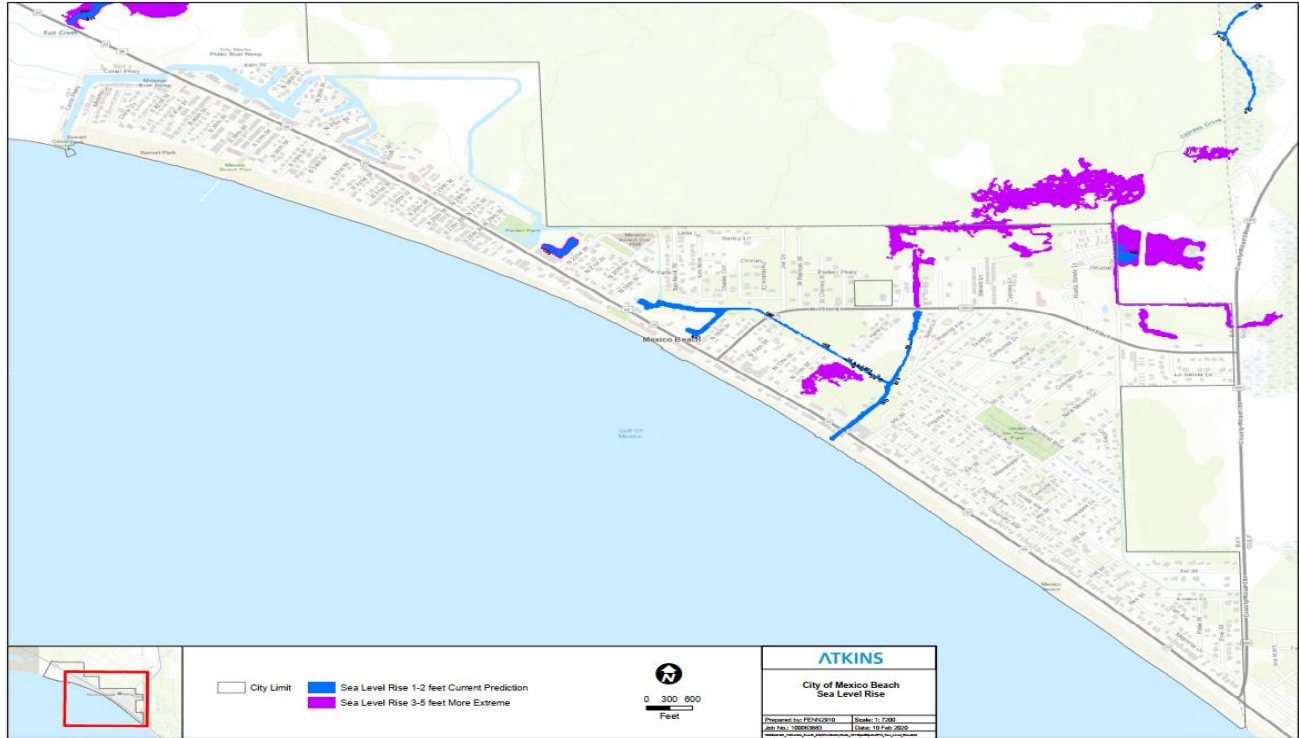


Figure D-2.

COMMUNITY RESILIENCY AND PROPERTY PROTECTION OPTIONS

<p style="text-align: center;">Structure Elevation</p> <ul style="list-style-type: none"> Physically raising an existing structure to base flood elevation or higher. Elevation on an open foundation such as piles, piers, posts, or columns. In coastal flood zones, elevated foundation needs cross-bracing. Protects structure from most flood events but not designed for habitation during event. 	<p style="text-align: center;">Mitigation Reconstruction</p> <ul style="list-style-type: none"> Construction of an improved, code-compliant elevated building on the same site where an existing building and/or foundation has been partially or completely demolished or destroyed. Only permitted for structures outside of the regulatory floodway or coastal high hazard area (Zone V) as identified by available flood hazard data. New structure must be within 10 percent of the square footage of existing one. 	<p style="text-align: center;">Stormwater Infrastructure Improvement</p> <ul style="list-style-type: none"> Retrofits to collect, filter, infiltrate and convey stormwater runoff. Captures excess stormwater runoff and safely contains it. Usually also provides water quality benefits and reduces runoff of contaminants into water bodies. Low-impact designs to streetscapes. Green infrastructure.
<p style="text-align: center;">Community Infrastructure and Lifelines</p> <ul style="list-style-type: none"> Structural measures to protect systems like first responders network and power, that allow critical government and essential business operations to continue. Lifelines include police and fire departments, hospitals, power plants, arterial roads, grocery stores, and the cellular towers that connect everything. 	<p style="text-align: center;">Road Elevation / Protection</p> <ul style="list-style-type: none"> Building up or elevating the height of a roadway or corridor to prevent flooding. Provide accessibility for emergency and response services. Reduces exposure of road bed to destructive flooding. Other protection options include flood barrier and armoring to protect from flood source. (e.g., articulated block as part of the barrier) 	<p style="text-align: center;">Utility Mitigation/Wastewater System Protection (Pumps)</p> <ul style="list-style-type: none"> Providing protection to critical utilities such as elevation of electrical panels at lift stations or pumps. Could also include bypass pumps to keep the system operational after a major flood event. Options also include generators to provide backup power.

Photo Credits (from left to right): ATKINS, <http://atkinsintl.com>, Mexico Beach/ATIS Recovery Plan and Resiliency Stormwater project, <https://www.dj1technics.com>, <http://www.dailypress.com>, ATKINS

Figure D-3.



Figure D-4.



**Welcome to the Mexico Beach Resilience Plan
Public Engagement Outreach Session!**

We want to hear from you! After the devastating effects of Hurricane Michael, Mexico Beach is rebuilding in a resilient fashion to lessen and avoid damage and disruption to future storms.

As part of this effort, the City with funding from the Florida Department of Environmental Protection, is developing a plan that details vulnerability to flood, storm surge, and high wind. It also details projects that are being currently being developed and other project types that are being considered. During this session, we would like you to:

- ◆ Grab a pen and add your name to the **Sign-in Sheet**, so we have a record of your attendance and can alert you on follow-up information.
- ◆ Look at our **Hazard Risk Maps** that show current and future risk; and let us know your story. What did you experience after Hurricane Michael or other storms? Mark up the map and fill out the comment card if this helps tell that story. Ask questions of our planning team about the maps.
- ◆ To receive a complimentary food/beverage ticket, please take three stickers, go to the **Community Resilience and Property Protection Options Poster**, and place them next to the types of projects that you think will best help protect the City from storms.
- ◆ Have a question or comment for this plan? Fill out the **Comment Card** and share your thoughts. A planner from the team is available to discuss questions and comments.

Please ask us any questions and see the reverse side for additional information. Thank you for coming!!



Figure D-5.



The Information Used to Prepare the Plan

Flood and Wind Risk

- Best available FEMA flood data
- Storm surge information
- NOAA sea level rise projections
- Local damage assessments post-Michael
- Wind data

What to Review in this Session

- Learn about resilience project types
 - Part of recovery process
 - Mitigation Grants
- Choose projects that you think would work best in Mexico Beach. These projects will fall into two general categories:
 - Property Protection - Residential Structures and City Facilities
 - City Infrastructure and Lifelines Protection



Both types of projects will be pursued.

Comment on the Final Plan!

We will post a draft Final Resilience Plan on the City of Mexico Beach's official website at <http://mexicobeachgov.com/>. The draft should be posted around mid-April. Watch the website for more details.

Representative Resilience Actions Undertaken by the City

- Updated Comprehensive Plan
- Higher floodplain standards - adopted the draft updated FEMA Flood Insurance Rate Map as best available data and extended the Special Flood Hazard Area requirements to the Shaded X zone
- Modifications to the Stormwater Management Ordinance
- Dune replanting

What Other Florida Cities Are Doing

- Navarre used FEMA grants to expand the outflow pipes in a detention pond to move stormwater more rapidly into nearby wetlands
- Cedar Key Living Shoreline
- Hallandale Beach is using a NOAA Decision Support Tool to assess to pinpoint the timing and location of stormwater system failures to prioritize resources
- St. Augustine home elevation and roof protection completed before Hurricane Irma and home survived
- Clearwater completed an adaptation plan



Figure D-6.

Appendix E

Sign Sheets from February 22, 2020 Public Meeting

[INSERT PDF OF COMPLETED SHEETS INTO FINAL PDF VERSION OF PLAN]

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Appendix F

May 13, 2020 Presentation from Coastal Resilience Forum

[INSERT PDF OF FINAL POWERPOINT INTO FINAL PDF VERSION OF PLAN]

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Appendix G

Presentation from Final Mexico Beach Presentation

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