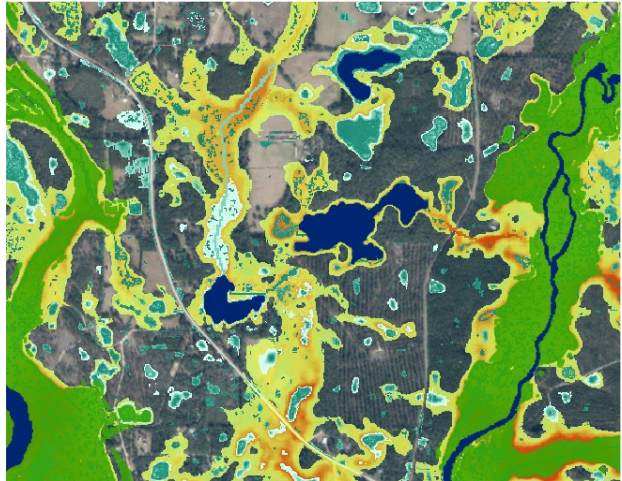


TOWN OF EBRO

VULNERABILITY ASSESSMENT



AUGUST 2024

DEP AGREEMENT NO. 24RRE03

Emerald Coast Regional Council Resilience Project

TOWN OF EBRO VULNERABILITY ASSESSMENT



8/30/2024

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Acronyms

CORDEX	Coordinated Regional Climate Downscaling Experiment
DEM	Digital Elevation Model
ECRC	Emerald Coast Regional Council
FEMA	Federal Emergency Management Agency
FFE	Finished Floor Elevation
FDEM	Florida Division of Emergency Management
FDEP	Florida Department of Environmental Protection
GIS	Geographic Information Systems
LiDAR	Light Detection and Ranging
LULC	Land Use Land Cover
NAVD88	North American Vertical Datum of 1988
NHD	National Hydrography Dataset
NOAA	National Oceanic and Atmospheric Administration
NWS	National Weather Service
SLR	Sea Level Rise
SSURGO	Soil Survey Geographic Database
USGS	U.S. Geological Survey
VA	Vulnerability Assessment

Executive Summary

The Town of Ebro is proactively addressing the challenges posed by extreme weather events, specifically focusing on the increased risk of flooding due to extreme rainfall. Ebro and the Emerald Coast Regional Council (ECRC) have obtained a grant from the Florida Department of Environmental Protection (FDEP) for a comprehensive vulnerability assessment. This report summarizes the data, methodology, and analyses conducted by Ebro and the Project Team.

Resilient Florida was established as part of a statewide initiative to enhance Florida's resilience against the impacts of sea level rise, intensified storms, and flooding. A key aspect of the Resilient Florida Program is the creation of Vulnerability Assessments. These assessments are critical for communities seeking access to state resilience funding. They provide a detailed analysis of a community's specific vulnerabilities to climate-related hazards including flooding, sea level rise, and extreme weather events. They are essential for identifying high-risk areas, assessing the potential impacts on infrastructure, and determining the most effective strategies for mitigation and adaptation.

By conducting Vulnerability Assessments, communities not only gain a deeper understanding of their unique risks, but also align with the state's requirements for accessing resilience funding. This funding is instrumental in supporting local governments to plan, prepare, and implement resilience projects. It ensures that communities are better equipped to protect their infrastructure from adverse weather events.

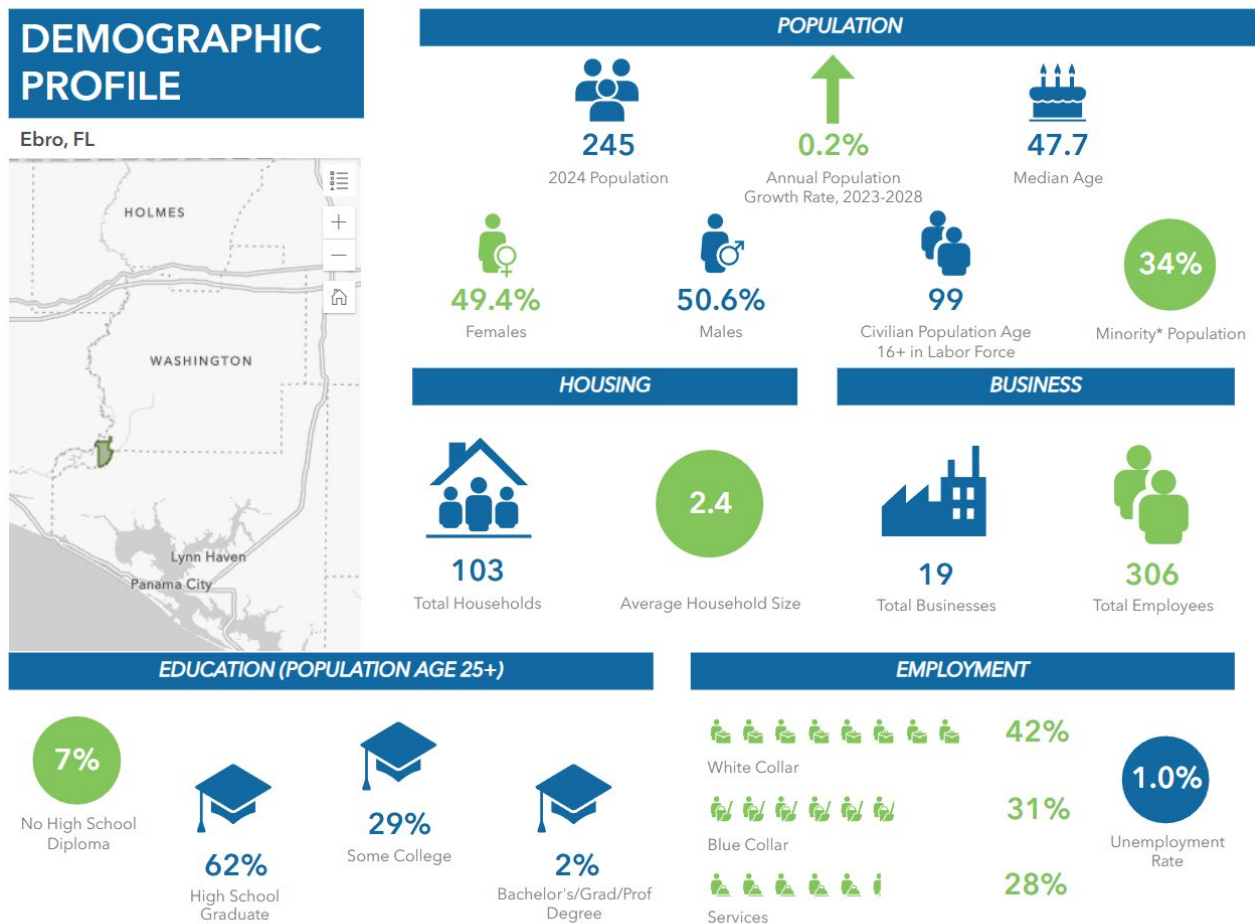
For the purposes of this assessment, the Project Team used the Inundate! GIS modeling tool to analyze potential flooding under the state's required future precipitation scenarios. The methodology adopted allows for a detailed understanding of how changes in rainfall patterns can affect public facilities and critical infrastructure in Ebro and identifies target areas prone to flooding. Throughout the process, the Project Team coordinated with Michael Baker International, as they were working on Washington County's Vulnerability Assessments concurrently. Data was shared in cases of municipal assets located outside of town limits.

Overall, the Town of Ebro's Critical Assets are not vulnerable to modeled flooding. The only Critical Assets affected in the Town of Ebro are small portions of Obies Street and Strickland Road. Both roads show projected flooding in all four modeled scenarios. It would be advisable for the Town of Ebro or Washington County to conduct a detailed assessment to understand the specific vulnerabilities of these assets and to develop plans to minimize any potential impacts on the community.

I. Overview

Background

Founded in 1967 (Florida League of Cities), Ebro is located at the intersection of two crucial regional state roads, State Road 20 and State Road 79. The current population is estimated to be 245 individuals (Esri). The Town of Ebro is most well-known for the Ebro Card Casino & Racebook, Washington County's only gaming facility and one of its largest private employers.



This infographic contains data provided by Esri and Infogroup. The vintage of the data is 2024, 2029 (Esri estimates and projections). *Minority population = Total Population - White, Non-Hispanic Population

Resilient Florida Program

This Vulnerability Assessment was funded in part through a grant agreement from the Florida Department of Environmental Protection's Office of Resilience and Coastal Protection Resilient Florida Program. The Resilient Florida Program was created as a result of Senate Bill 1954 and House Bill 7019, passed in 2021. This legislation, codified as Florida Statute 380.093, directs all municipalities and counties to create assessments to inform state and local planning, ensuring that adaptation and mitigation strategies are grounded in current and projected risks.

The Emerald Coast Regional Council developed this assessment concurrent with Vulnerability Assessments for the Town of Century in Escambia County and the municipalities of Caryville, Vernon, Wausau, and Chipley in Washington County.

Goals and Objectives

The purpose of this report is threefold:

To Identify and Analyze Risks: The Emerald Coast region, like many others, is increasingly susceptible to a range of natural hazards. In this assessment, the potential impact of future extreme rainfall events is modeled. This allows the community and project team to identify critical assets that may be vulnerable to inundation in the future.

To Inform and Guide Resilience Planning: The information gathered in this report is vital for developing effective strategies to enhance community resilience. It can serve as a foundational document to guide policymakers, planners, and stakeholders in making informed decisions. The information in this report should be applied when constructing or upgrading infrastructure, revising development ordinances, or enhancing emergency response plans.

To Engage and Educate the Community: Awareness and understanding are key components in building a resilient community. This Vulnerability Assessment is not only a technical document, but also a tool that can be used to engage the community. By specifically identifying critical assets at risk and target areas, the assessment can be used to help determine future priorities.

Kickoff Meeting & Outreach

After initial outreach to all the municipalities in Washington County, a single kickoff meeting was held in Chipley on Tuesday, May 7th, 2024. All communities participating in the Vulnerability Assessment process were provided with draft materials and invited to attend. Washington County staff also attended to share insights from their ongoing Vulnerability Assessment and to facilitate coordination concerning county assets within municipal boundaries. The primary goal of this meeting was to introduce the project, outline its objectives, and set the stage for a comprehensive approach to assessing and addressing regional vulnerabilities to flooding from extreme rain events.

During the meeting, Emerald Coast Regional Council (ECRC) staff presented an overview of the project, detailing the scope, expected outcomes, and the critical role of the Vulnerability Assessment in guiding resilience planning. Attendees were provided with draft asset lists and maps, and critical assets as defined by Florida Statutes were discussed. Stakeholders were encouraged to share their knowledge and experiences, contributing valuable data on local environmental conditions, infrastructure vulnerabilities, and community needs. Representatives from Michael Baker International, who were working on the Vulnerability Assessment for unincorporated Washington County, attended virtually and shared insights from their ongoing project.

During and after the meeting, ECRC staff consulted with the communities regarding details of their asset lists and gathered feedback on the draft inundation model results. Because they were unable to attend in person, a virtual make-up meeting was conducted with the Ebro Town Clerk on June 6th to ensure comprehensive stakeholder engagement.

Work Plan

The agreement with the Florida Department of Environmental Protection to perform the Vulnerability Assessments contained the following tasks:

Task 1: Kickoff Meeting

Develop an overall project management plan and address initial actions. Conduct a kickoff meeting to discuss the project scope, goals, schedule, key milestones, and deliverables. Prepare meeting materials, including the sign-in sheet and project schedule.

Task 2: Acquire Background Data

Research and compile data necessary for the Vulnerability Assessment (VA), including critical and regionally significant asset inventory, topographic data, and flood scenario-related data. Identify and rectify any data gaps to ensure comprehensive data coverage.

Task 3: Exposure Analysis

Perform an exposure analysis to determine the depth of water caused by various flood scenarios, including tidal flooding, storm surge flooding, and rainfall-induced flooding. Detail the modeling processes and provide results through tables and maps.

Task 4: Sensitivity Analysis

Measure the impact of flooding on assets using data from the exposure analysis. Evaluate the impact of flood severity on each asset class and assign a risk level. Provide detailed findings and an initial list of impacted critical and regionally significant assets.

Task 5: Identify Focus Areas

Identify focus areas based on the exposure and sensitivity analyses. Assign focus areas to locations or assets that are particularly vulnerable and require adaptation strategies. Provide justification, tables, maps, and GIS files for the identified focus areas.

Task 6: Final Vulnerability Assessment Report, Maps, and Tables

Finalize the VA report, incorporating results from the exposure and sensitivity analyses, identified risks, and focus areas. Compile a list of critical and regionally significant assets impacted by flooding and specify the flood scenarios affecting each asset. Include GIS files and metadata in the final report.

Task 7: Public Presentation

Present the final VA results to local governing boards, technical committees, and other stakeholders. Share findings, provide recommendations for adaptation strategies, and inform the public about future risks. Prepare and distribute meeting materials and summarize meeting outcomes.

II. Data Collection

Critical/Regionally Significant Asset Data

The data collection process began with identifying and obtaining GIS datasets for critical and regionally significant assets. The Florida Statewide Resilience Dataset from FDEP was used as a starting point. It was compiled in 2023 and includes critical assets sourced from state, federal, and regional datasets, as well as locally provided asset data where available. Local government staff were consulted to identify the critical assets within this dataset that are owned and/or managed by the municipality, as well as any critical assets missing from the dataset. ECRC staff also utilized the Washington County Property Appraiser's record search to identify ownership of potential critical assets.

Critical Assets were identified by the four categories defined by 380.093(2)(a), Florida Statutes:

1. **Transportation assets and evacuation routes**, including airports, bridges, bus terminals, ports, major roadways, marinas, rail facilities, and railroad bridges.
2. **Critical infrastructure**, including wastewater treatment facilities and lift stations, stormwater treatment facilities and pump stations, drinking water facilities, water utility conveyance systems, electric production and supply facilities, solid and hazardous waste facilities, military installations, communications facilities, and disaster debris management sites.
3. **Critical community and emergency facilities**, including schools, colleges, universities, community centers, correctional facilities, disaster recovery centers, emergency medical service facilities, emergency operation centers, fire stations, health care facilities, hospitals, law enforcement facilities, local government facilities, logistical staging areas, affordable public housing, risk shelter inventory, and state government facilities.
4. **Natural, cultural, and historical resources**, including conservation lands, parks, shorelines, surface waters, wetlands, and historical and cultural assets.

Table 1 provides a summary of critical assets identified for the Town of Ebro. Some assets, as in the case of the Ebro Town Hall, may appear more than once if they serve multiple critical functions.

Town of Ebro Vulnerability Assessment

Table 1. Critical Assets Inventory

Transportation Assets and Evacuation Routes			
Name	Type	Owner/Operator	Elevation*
OBIES ST	Major Roadways	Town of Ebro (maintained by County)	66.14'
STRICKLAND RD	Major Roadways	Town of Ebro (maintained by County)	66.16'
JIFFY LN	Major Roadways	Town of Ebro (maintained by County)	69.59'
Critical Infrastructure			
Name	Type	Owner/Operator	Elevation
WELL (EBRO COMMUNITY CENTER)	Drinking Water Facilities	Town of Ebro	78.92'
PLANT (EBRO COMMUNITY CENTER)	Drinking Water Facilities	Town of Ebro	78.92'
TANK #1 (EBRO COMMUNITY CENTER)	Water Utility Conveyance Systems	Town of Ebro	78.92'
EBRO VOLUNTEER FIRE DEPT	Hazardous Waste Facilities	Town of Ebro	71.23'
Critical Community and Emergency Facilities			
Name	Type	Owner/Operator	Elevation
EBRO TOWN HALL	Disaster Recovery Centers	Town of Ebro	77.74'
EBRO VOLUNTEER FIRE DEPT	Fire Stations	Town of Ebro	71.23'
EBRO TOWN HALL	Local Government Facilities	Town of Ebro	77.74'
Natural, Cultural, and Historical Resources			
Name	Type	Owner/Operator	Elevation*
EBRO COMMUNITY CEMETERY	Historical Assets	Town of Ebro	71.65'

**Elevations for linear (roadway) and polygon (cemetery) features are averages across the length or area within the town limits.*

Town of Ebro Vulnerability Assessment

Local stakeholders also had the opportunity to identify Regionally Significant Assets, as defined by 380.093(2)(d), Florida Statutes:

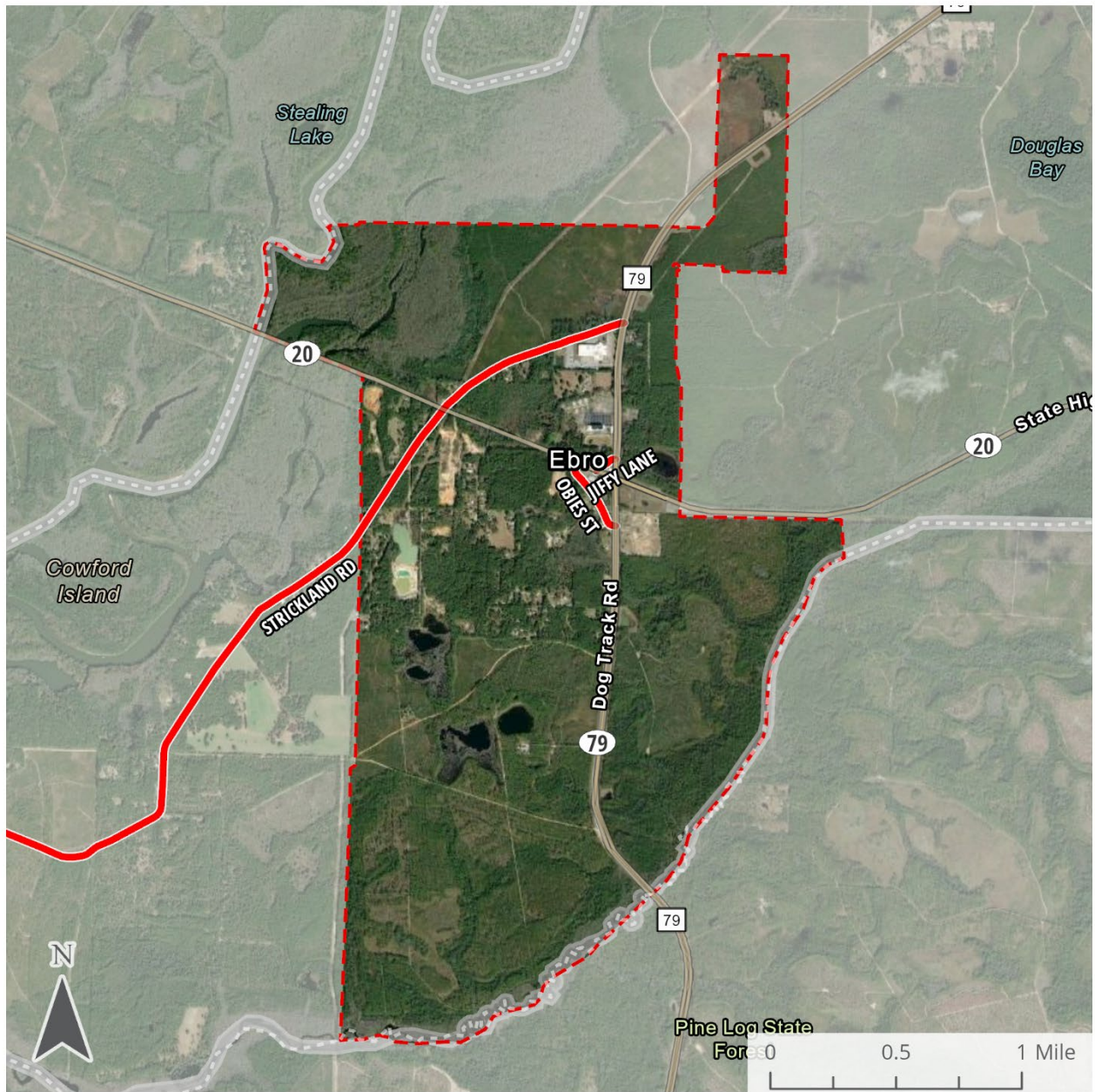
“Regionally significant assets” means critical assets that support the needs of communities spanning multiple geopolitical jurisdictions, including, but not limited to, water resource facilities, regional medical centers, emergency operations centers, regional utilities, major transportation hubs and corridors, airports, and seaports.

Ebro did not identify any additional Regionally Significant Assets.

Table 2. Regionally Significant Assets

Regionally Significant Assets
None identified.

Figure 1. Critical Assets - Transportation and Evacuation Routes



Town of Ebro - Transportation and Evacuation Routes




— Major Roadways

Source: ECRC, FDEP, Town of Ebro
7/9/2024

Figure 2. Critical Assets - Critical Infrastructure

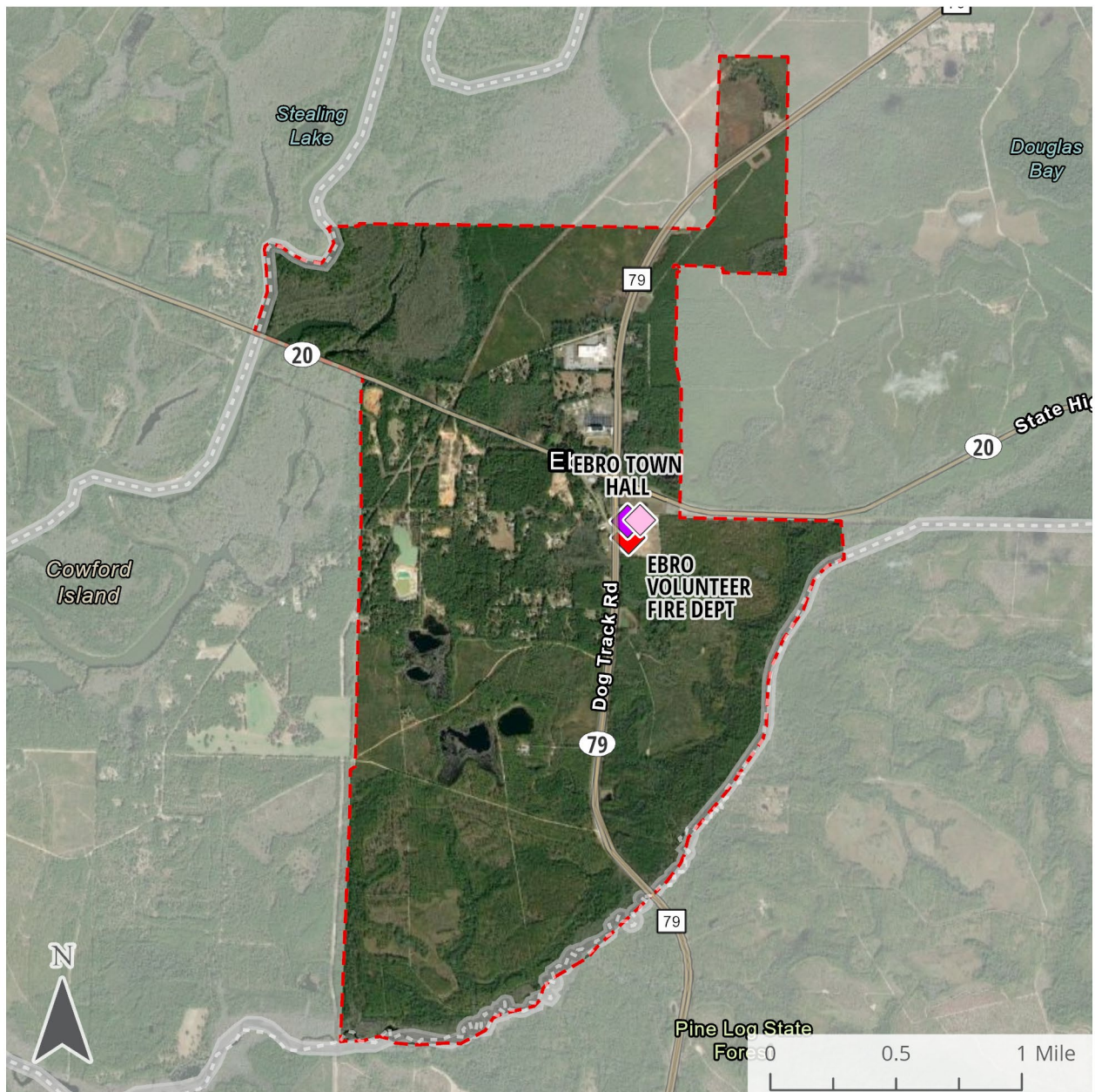


Town of Ebro - Critical Infrastructure

-  Drinking Water Facilities
-  Water Utility Conveyance Systems
-  Solid and Hazardous Waste Facilities

Source: ECRC, FDEP, Town of Ebro
7/9/2024

Figure 3. Critical Assets - Critical Community & Emergency Facilities

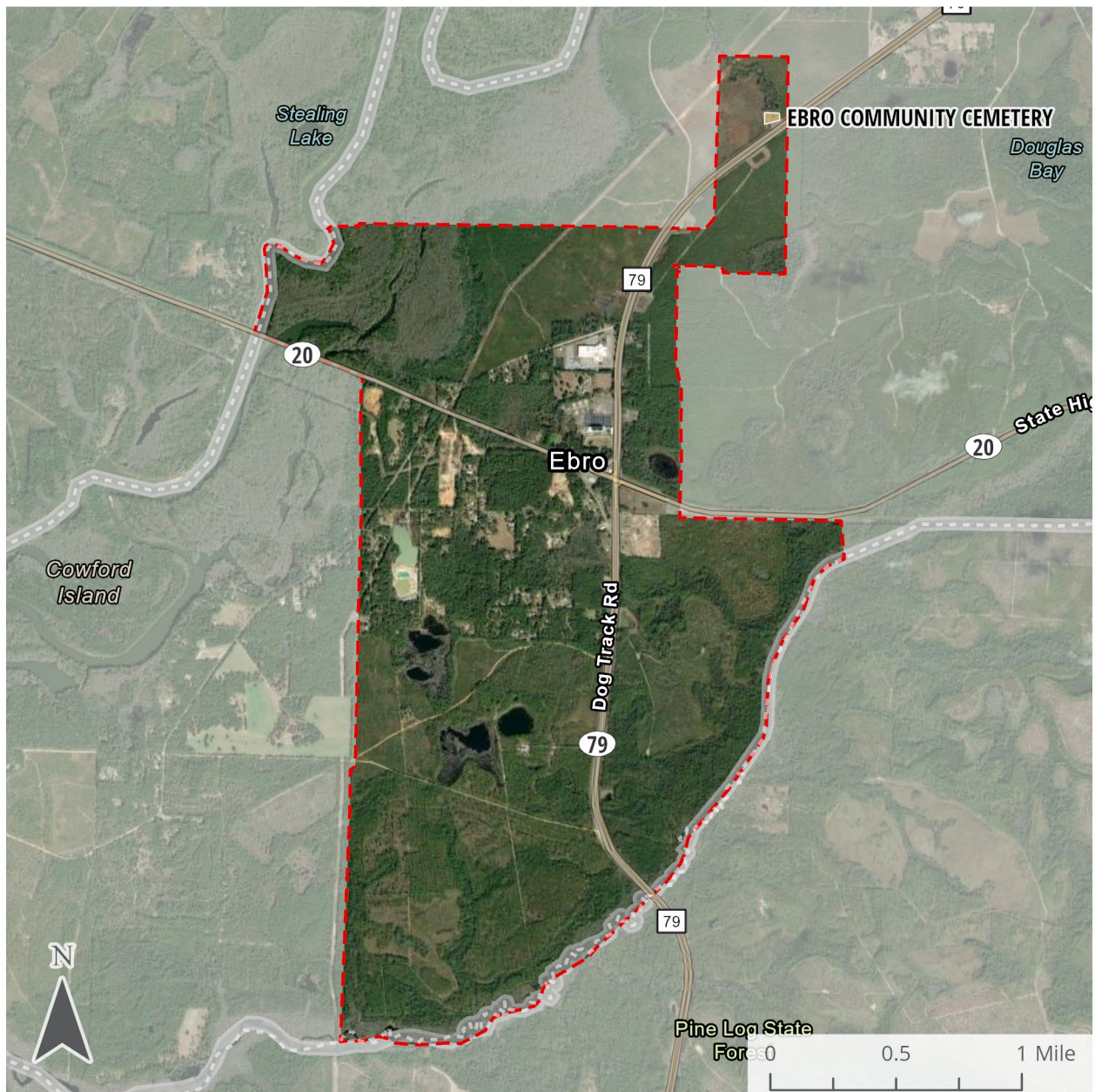


Town of Ebro - Critical Community & Emergency Facilities

-  Disaster Recovery Centers
-  Fire Stations
-  Local Government Facilities

Source: ECRC, FDEP, Town of Ebro
7/9/2024

Figure 4. Critical Assets - Natural, Cultural, and Historical Resources



Town of Ebro - Natural, Cultural, and Historical Resources

Source: ECRC, FDEP, Town of Ebro
7/9/2024

Topographic Data

A digital elevation model (DEM) was obtained from USGS. The Florida Peninsular Hurricane Michael Supplemental DEM (2020) covers the majority of Washington County at a resolution of 2.5 feet. The DEM elevations are relative to the North American Vertical Datum of 1988 (NAVD88).

Flood Scenario-Related Data

Storm Surge

Storm surge data was sourced from both NOAA's National Storm Surge Risk Maps (v.3, 2022) and the Florida Statewide Regional Evacuation Study Program (a joint effort between FDEM and Florida's Regional Planning Councils, updated in 2020).

Sea Level Rise

Sea Level Rise data was collected from NOAA's 2017 Intermediate-High SLR projections for 2040 and 2070.

Precipitation

Precipitation data was sourced from NOAA Atlas 14. To derive future scenarios, CORDEX Near and Far 23rd percentile change factors were applied to the 24-hour, 100- and 500-year rain events from Atlas 14. This allowed for representation of extreme rain events under the 2040 and 2070 future time horizons.

Data Gap Analysis

An accurate Vulnerability Analysis requires complete and current data to represent current and future conditions and allow communities to be better prepared for future inundation hazards. The purpose of the Data Gap Analysis is to 1) review data obtained and identify any critical missing data or low-quality information that may limit the Vulnerability Assessment's extent or reduce the accuracy of results, and 2) rectify any gaps in necessary data.

The tables below summarize the data included within the vulnerability assessments and indicate the availability of the data as follows:

- **Available** - Data Readily Available
- **Not Available** - Data Not Available
- **Partial** - Data Partially Obtained

Table 3. Transportation Assets & Evacuation Routes

Dataset	Availability	Source / Type	Comments
Airports	Available	FDEP Critical Assets Dataset with review and edits/additions from local government staff	Missing assets (as identified by local government staff) were added as GIS features based on addresses provided and/or aerial imagery/Google Street View.
Bridges	Available		
Bus Terminals	Available		Not all asset types are applicable or present within Ebro.
Ports	Available		
Major Roadways	Available		Town Staff requested the addition of Jiffy Ln.
Marinas	Available		
Rail Facilities	Available		
Railroad Bridges	Available		

Table 4. Critical Infrastructure

Dataset	Availability	Source / Type	Comments
Wastewater Treatment Facilities & Lift Stations	Available	FDEP Critical Assets Dataset (Geodatabase) with review and edits from local government staff	Many privately owned and controlled assets were included. These were removed after consultation with town staff.
Stormwater Treatment Facilities & Pump Stations	Available		
Drinking Water Facilities	Available		
Water Utility Conveyance Systems	Available		Not all infrastructure types are applicable or present within Ebro.
Electric Production & Supply Facilities	Available		
Solid & Hazardous Waste Facilities	Available		
Military Installations	Available		
Communications Facilities	Available		
Disaster Debris Management Sites	Available		

Table 5. Critical Community & Emergency Facilities

Dataset	Availability	Source / Type	Comments
Schools	Available	FDEP Critical Assets Dataset (Geodatabase) with review and edits/additions from local government staff	Only two assets were identified in the FDEP Critical Assets Dataset in this category.
Colleges & Universities	Available		
Community Centers	Available		
Correctional Facilities	Available		
Disaster Recovery Centers	Available		
Emergency Medical Service Facilities	Available		Town staff did not identify any missing Critical Community and Emergency Facilities.
Emergency Operations Centers	Available		
Fire Stations	Available		
Health Care Facilities	Available		
Hospitals	Available		
Law Enforcement Facilities	Available		Not all facility types are applicable or present within Ebro.
Local Government Facilities	Available		
Logistical Staging Areas	Available		
Affordable Public Housing	Available		
Risk Shelters	Available		
State Government Facilities	Available		

Table 6. Natural, Cultural, & Historical Resources

Dataset	Availability	Source / Type	Comments
Conservation Lands	Available	FDEP Critical Assets Dataset (Geodatabase) with review and edits/additions from local government staff	Many private or state-owned and controlled assets included in the FDEP were removed from analysis. Not all resource types are applicable or present within Ebro. Only the cemetery was owned by the town.
Parks	Available		
Shorelines	Available		
Surface Waters	Available		
Wetlands	Available		
Historical & Cultural Assets	Available		

Table 7. Topographic Data

Dataset	Availability	Source	Type	Comments
LiDAR, DEM	Available	Florida Peninsular Hurricane Michael Supplemental (2020), 2.5ft resolution	Raster	Inundate! Model input
Finished Floor Elevation (FFE)	Not Available	-	-	No structures were located in inundated areas.

Table 8. Flood Scenario Related Data

Dataset	Availability	Source	Type	Comments
Precipitation	Available	NOAA Atlas 14	Raster	Inundate! Model input
Groundwater Level	Available	Inundate! Model	Raster	Available water storage is calculated within model
Sea Level Rise (SLR)	Available	NOAA Intermediate-High	Raster	Not applicable
Tidal Flooding	Available	NOAA	Raster	Not applicable
Storm Surge	Available	NOAA, FDEM	Raster, GIS Shapefile (polygon)	Not applicable
River Channel Cross-Sections	Available	Inundate! Model	GIS Shapefile (line)	Transects are created within model
Land Use	Available	USGS	Raster	Inundate! Model input
Evapotranspiration	Available	USGS	Raster	Not utilized in model
Soil Classification	Available	Soil Conservation Service (SSURGO)	Raster	Inundate! Model input
Lake Points	Available	USGS NHD	GIS Shapefile (point)	Inundate! Model input. Layer was edited to include missing lake points.
Change Factors	Available	CORDEX 24hr 100yr NEAR (2040) and FAR (2070) rasters	Raster	Inundate! Model input
Impervious Surfaces	Available	NOAA	Raster	Inundate! Model input
Building Footprints	Available	Microsoft	GIS Shapefile (polygon)	Inundate! Model input. Layer was edited to include missing footprints.
Burn Lines	Available	USGS NHD and user-defined (ECRC)	GIS Shapefile (line)	Inundate! Model input

Data Gap Summary and Recommendations

The majority of data required for the vulnerability assessment was publicly available for download and use.

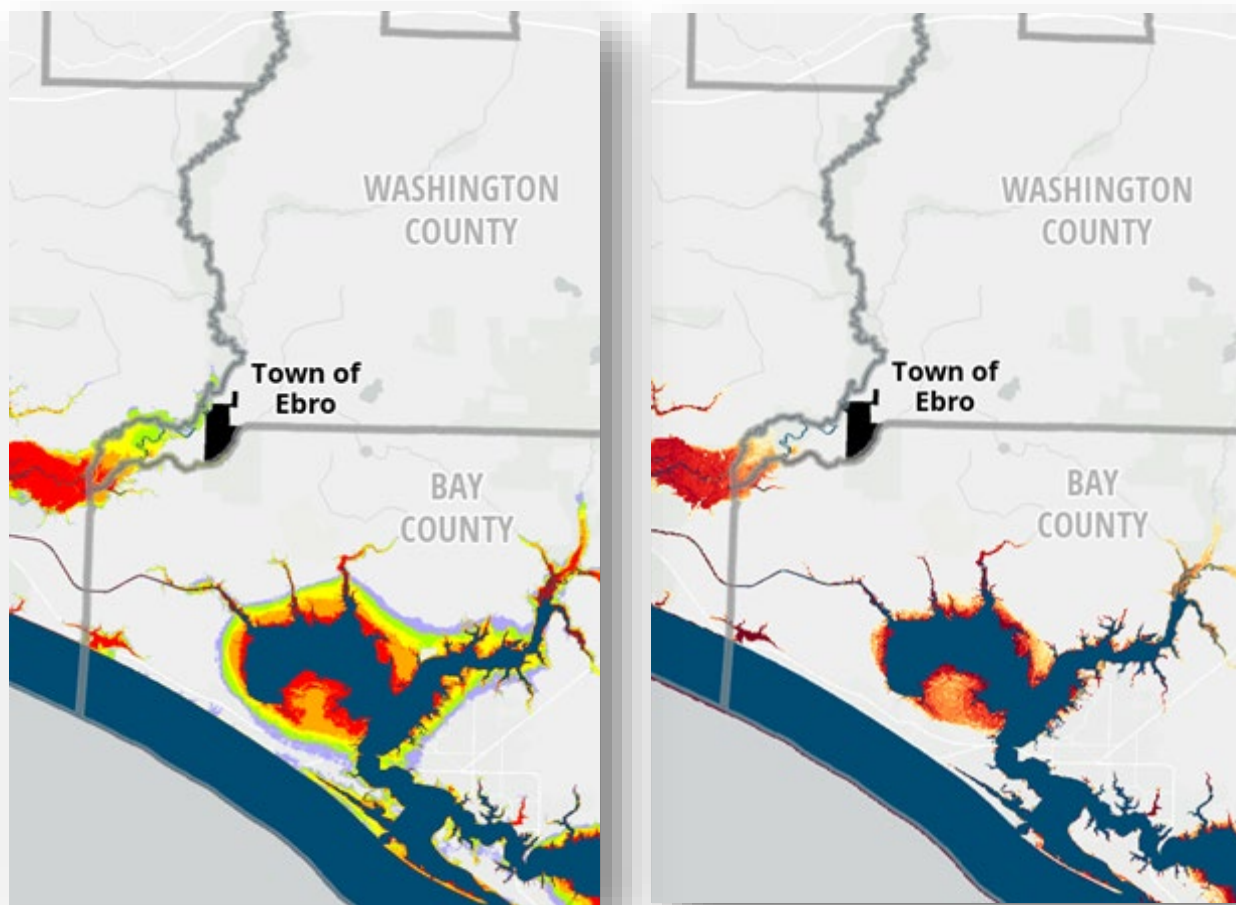
There were challenges obtaining Finished Floor Elevation (FFE) data for structures. Many municipalities could not provide the required documentation, often due to the limited availability of records or resource constraints. The cost to obtain accurate elevation data can be significant, and not all communities have the resources or systems to collect and maintain this information comprehensively.

The absence of FFE data impacts the precision of the sensitivity analysis. This gap may lead to less accurate predictions regarding the vulnerability of certain assets. Fortunately, in most cases for Washington County municipalities, flooding around structures is minimal or is located on the parcel away from the structure itself.

To address this limitation, municipalities may consider grant opportunities or regional partnerships to ensure that FFE data is more readily available for future assessments.

III. Exposure Analysis

Due to the Town of Ebro's inland location, and after consultation with FDEP staff, it was not deemed vulnerable to sea-level rise or storm surge hazards. Therefore, those risks were not analyzed as part of the Vulnerability Assessment. Inland communities should, however, remain aware of how hazards like sea level rise can transform water levels along rivers and should continue to evaluate potential impacts in the future. Of all communities in Washington County, the Town of Ebro is the closest to any potential future impacts from extreme storm surge or rising sea levels due to its location along the Choctawhatchee River. Minor storm surge does appear along the Choctawhatchee River and the East River/Pine Log Creek in the far northwestern and southern edges of Ebro. However, there is no critical infrastructure present in these areas.



Town of Ebro in relation to category 1-5 storm surge (left) and intermediate-high sea level rise (right).

For the Town of Ebro, the vulnerability analysis focused on the risk of flooding due to future extreme rainfall events.

Modeling Process

Rainfall-induced flooding was modeled using the Inundate! Tool. Inundate! was developed by FlynnMetrics, LLC and is based upon previous inundation tools developed for the Florida Division of Emergency Management's Statewide Regional Evacuation Study Program. It runs as an add-on within Esri's ArcView Desktop software, and the rainfall model module utilizes Esri's ArcHydro tools.

Multiple input data variables and user-defined parameters work together to create possible flood scenarios for three inundation types: Storm Surge from hurricanes, Sea Level Rise from climate change, and Inland Rain Flooding from future precipitation. As noted above, because Ebro is not deemed vulnerable to storm surge or sea level rise, this Vulnerability Assessment focuses only on inland flooding from precipitation.

Model Inputs:

- Digital Elevation Model (DEM) raster
 - Florida Peninsular Hurricane Michael Supplemental (2020), 2.5ft resolution
- Soil Survey Geographic Database (SSURGO) raster - Soil Conservation Service
- Land Use Land Cover (LULC) raster - USGS
- Rain Surface raster – NWS 24hr100yr and NWS 24hr500yr
- Change Factor raster - CORDEX 24hr100yr NEAR (2040) and CORDEX 24 hr100yr FAR (2070)
- Impervious Surfaces - NOAA
- Lake Points – USGS NHD w/user edits
- Relation Tables:
 - Soil Component table
 - Soil Aggregate table
 - Runoff table
- Burn Line layers - USGS NHD and user-defined

The Inundate! Tool produces output comprised of two parts based on the hydrology modeling used. One part is a flow model that uses a hybrid combination of dendritic (stream and synthetic stream) and deranged (lake and wetland) hydrology to produce the inundation in the associated watershed catchments. The other part is ponding, or sometimes called blue-spot hydrology, which is based solely on water gathering and filling depressions with no flow involved.

Model Outputs:

- Water Bodies (Lakes, Rivers, Flat Water Areas)
- Swamps
- Drainage Flow Depth

- Ponding Depth

It is important to note that Inundate! is not an engineering scale model. It is surface based with no attention to sub-surface stormwater infrastructure. The inundation output data is used by the project team in the screening process to determine possible areas where future extreme rain events may result in hazardous flooding. It is most useful at the local government scale to identify where communities may want to carry out more detailed engineering assessments for infrastructure improvement strategies. Like all models, results are only approximations and should be used for planning purposes only.

Scenarios

The following Rainfall-Induced Flood Scenarios were modeled using the Inundate! GIS Tool. They are aimed at providing future extreme conditions, with corresponding future flooding results.

Near-Term 2040 Planning Horizon:

- 100-year, 24-hour rainfall event
- 500-year, 24-hour rainfall event

Far-Term 2070 Planning Horizon:

- 100-year, 24-hour rainfall event
- 500-year, 24-hour rainfall event

The maximum precipitation over the modeled area for each scenario is shown in Table 9.

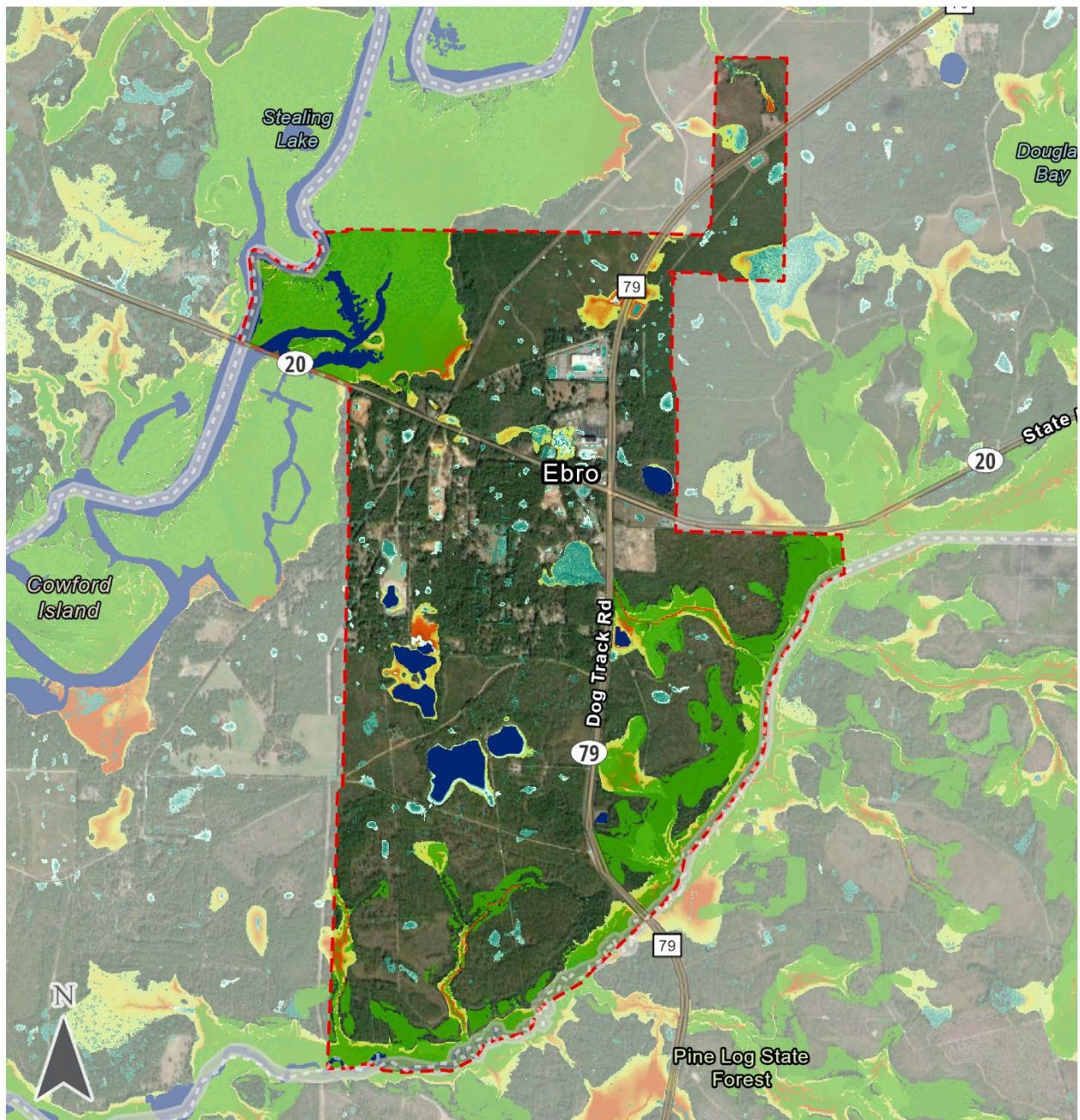
Table 9. Maximum Precipitation by Rainfall Scenario

24-Hour Rainfall Scenario	100-Year		500-Year	
	2040	2070	2040	2070
Maximum Precipitation (inches)*	19.89"	26.31"	27.26"	35.71"

**over the modeled area*

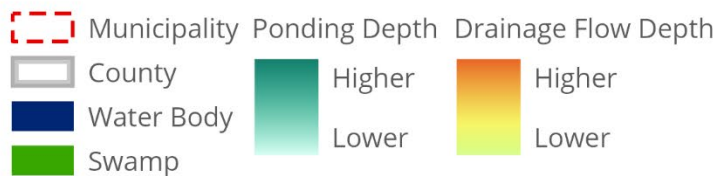
Figures 5-8 illustrate the Inundate! outputs for each of the four modeled scenarios.

Figure 5. 100-Year, 24-Hour Rainfall – 2040 Scenario



Town of Ebro - 100-Year, 24-Hour Rainfall Flooding - 2040 Scenario

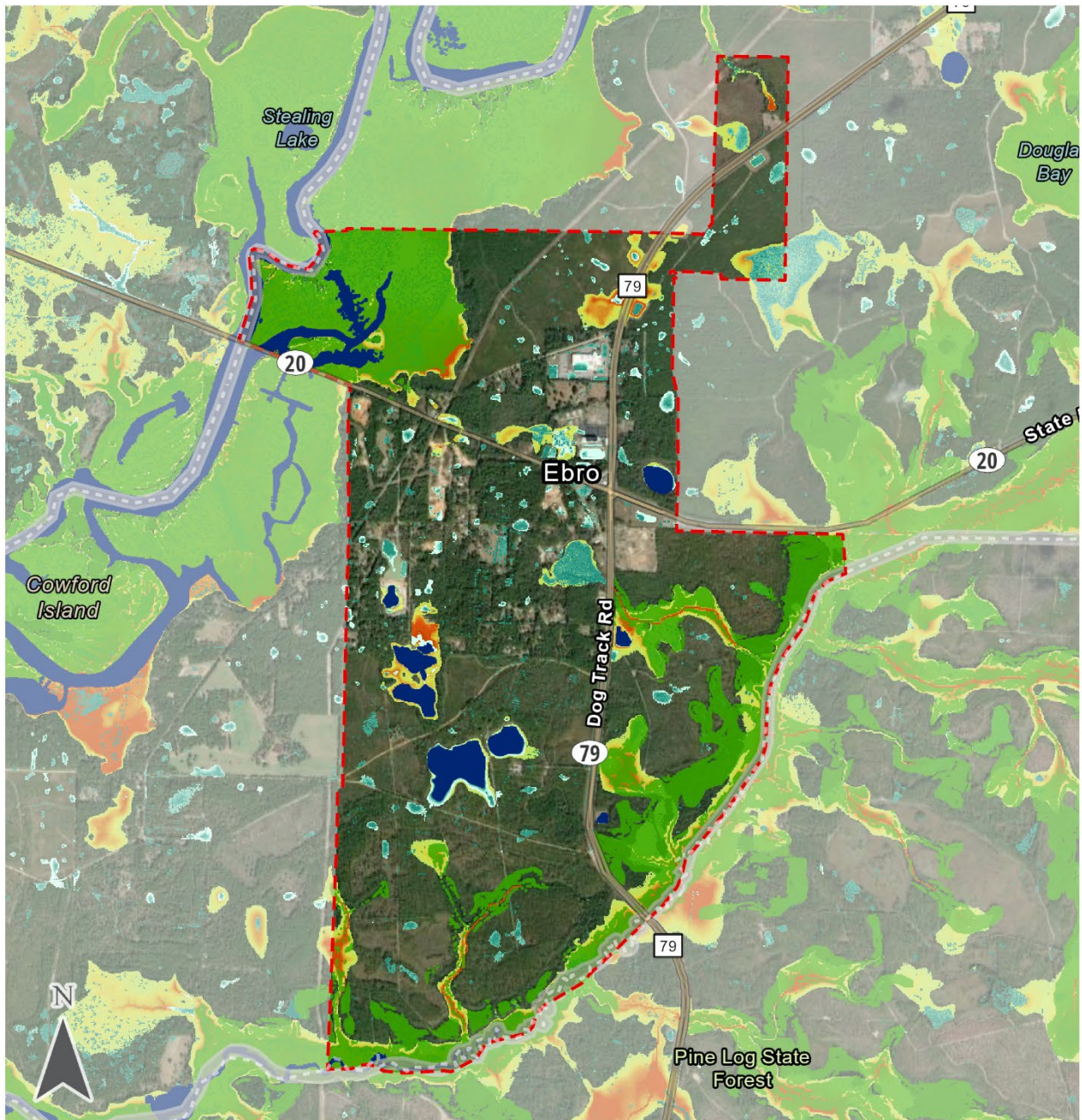
7/5/2024



Disclaimer: This figure is not intended to show the exact location of flooding and does not account for all variables affecting future flooding. Actual future flooding may differ from this graphic. This graphic is strictly a planning reference tool and is not for navigation, permitting, insurance rating, or other legal or regulatory purposes.

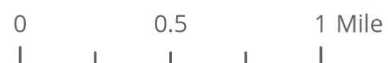
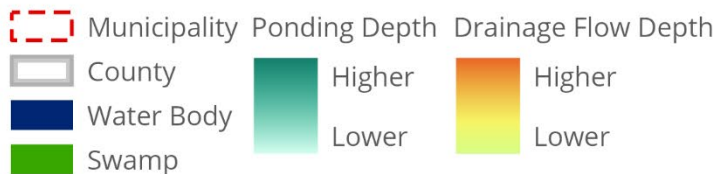
Source: ECRC, Basemap (Earthstar Geographics, Bay County, FDEP, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA, USFWS)

Figure 6. 100-Year, 24-Hour Rainfall - 2070 Scenario



Town of Ebro - 100-Year, 24-Hour Rainfall Flooding - 2070 Scenario

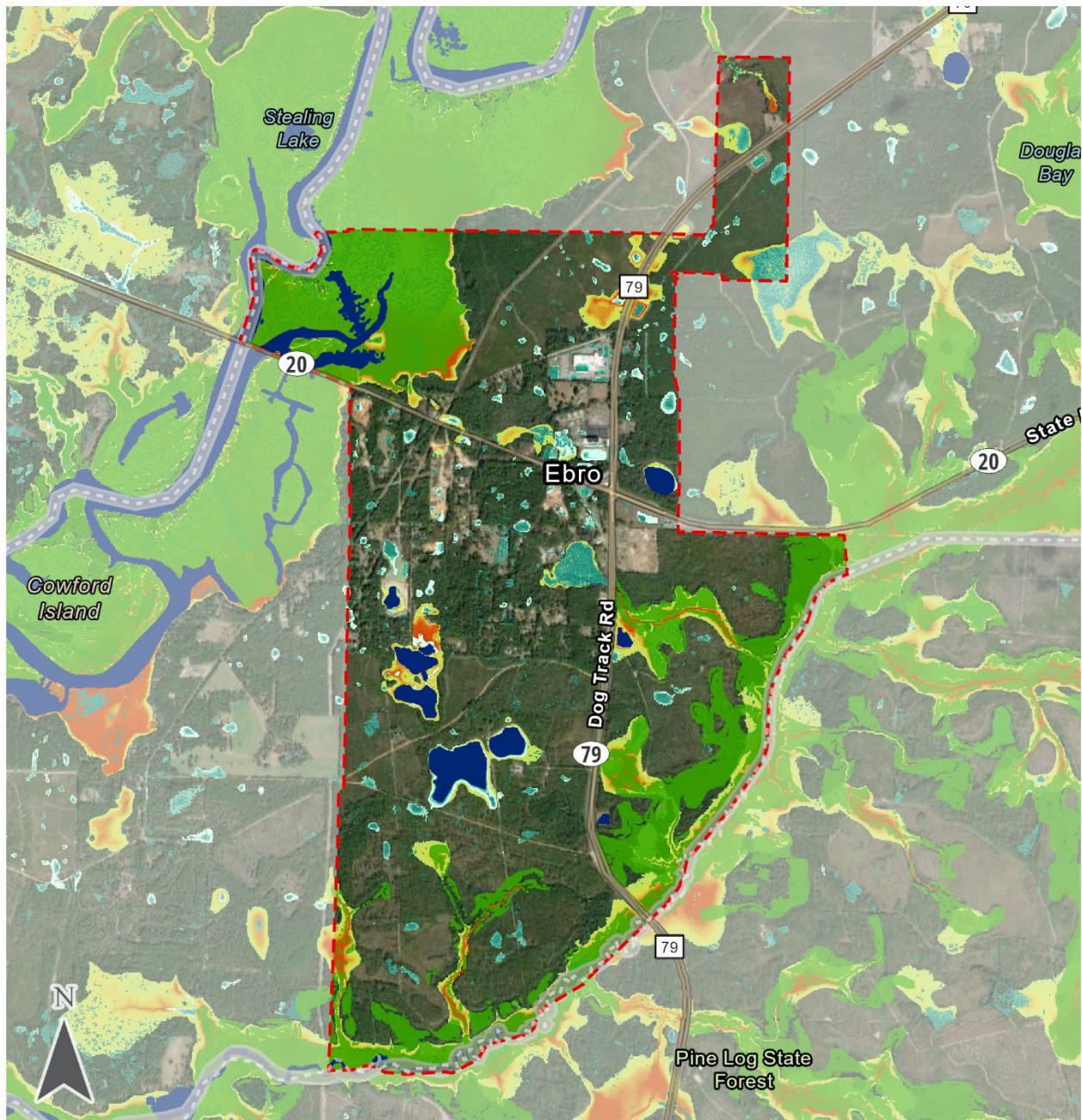
7/5/2024



Disclaimer: This figure is not intended to show the exact location of flooding and does not account for all variables affecting future flooding. Actual future flooding may differ from this graphic. This graphic is strictly a planning reference tool and is not for navigation, permitting, insurance rating, or other legal or regulatory purposes.

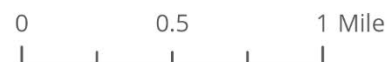
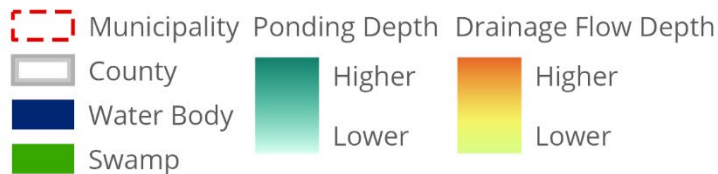
Source: ECRC, Basemap (Bay County, FDEP, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/ NASA, USGS, EPA, NPS, USDA, USFWS, Maxar)

Figure 7. 500-Year, 24-Hour Rainfall Flooding - 2040 Scenario



Town of Ebro - 500-Year, 24-Hour Rainfall Flooding - 2040 Scenario

7/5/2024



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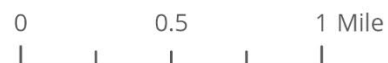
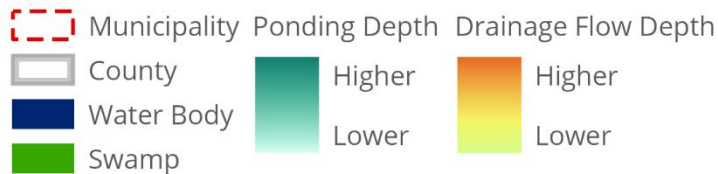
Source: ECRC, Basemap (Bay County, FDEP, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/ NASA, USGS, EPA, NPS, USDA, USFWS, Maxar)

Figure 8. 500-Year, 24-Hour Rainfall Flooding - 2070 Scenario



Town of Ebro - 500-Year, 24-Hour Rainfall Flooding - 2070 Scenario

7/5/2024



Disclaimer: This figure is not intended to show the exact location of flooding and does not account for all variables affecting future flooding. Actual future flooding may differ from this graphic. This graphic is strictly a planning reference tool and is not for navigation, permitting, insurance rating, or other legal or regulatory purposes.

Source: ECRC, Basemap (Earthstar Geographics, Bay County, FDEP, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA, USFWS)

IV. Sensitivity Analysis

The Sensitivity Analysis measures the impact of modeled flooding on the identified critical assets. The aim is to evaluate the severity of flooding impacts on each asset under the four modeled flood scenarios.

Exposure of the assets (identified in Tables 1 and 2) was evaluated against each flood type and scenario by using a GIS overlay approach, where the mapped flooding extents were overlaid on top of assets. Figures 9-24 illustrate the modeled rainfall flooding scenarios in relation to the identified critical assets.

Of all the critical assets analyzed, the only assets affected in the Town of Ebro are small portions of Obies Street and Strickland Road. Both Obies Street and Strickland Road show small areas of ponding in all four projected scenarios (see Table 12). It would be advisable for the Town of Ebro or Washington County to conduct a detailed assessment to understand the specific vulnerabilities of these assets and the potential impact on the community.



Ponding (circled) on Strickland Road (L) and Obies Street (R) in the 500-year 2070 rainfall scenario

Flooding can cause both immediate and long-term damage to roadways. In the short term, inundated roads can become impassable, disrupting daily traffic and potentially stranding vehicles. Over time, frequent or prolonged flooding can degrade the structural integrity of roadways, leading to issues such as erosion of the road base, weakening of the pavement, and the development of potholes and cracks. This deterioration can increase maintenance costs and lead to more frequent road closures, reducing the reliability of the transportation network. Additionally, standing water on road surfaces can increase the likelihood of accidents and reduce the lifespan of road materials, further escalating repair and replacement costs.

Table 10 categorizes the risk levels of critical assets by evaluating the percentage of assets exposed to flooding under various scenarios. Risk levels—None, Low, Medium, High, and Extreme—are assigned based on the percentage of affected assets in each asset class. These percentages may be somewhat misleading given the small number of identified assets overall, but they provide a metric that allows prioritization of future adaptation actions.

Table 10. Risk Assessment Percentages

Risk Assessment	Critical Assets Affected (% of Total Assets within each Asset Class)
None	0%
Low	1-25%
Medium	26 – 50%
High	51 – 75%
Extreme	>75%

All of Ebro’s exposed assets are in the Transportation Assets and Evacuation Routes asset class (Table 11). Of the three assets included for analysis, two (67%) are exposed to flooding in all four extreme rainfall scenarios. Transportation Assets are therefore classified as ‘High’ risk. Ebro has no affected assets in the Critical Infrastructure; Critical Community and Emergency Facilities; or Natural, Cultural, and Historical Resources Asset Classes.

Table 11. Percentage of Critical Assets Affected by Asset Class and Scenario

Asset Class	Critical Assets Evaluated	Assets Affected by Rainfall Scenario			
		100-Year		500-Year	
		2040	2070	2040	2070
Transportation Assets and Evacuation Routes	3	2 (67%)	2 (67%)	2 (67%)	2 (67%)
Critical Infrastructure	4	0	0	0	0
Critical Community and Emergency Facilities	3	0	0	0	0
Natural, Cultural, and Historical Resources	1	0	0	0	0

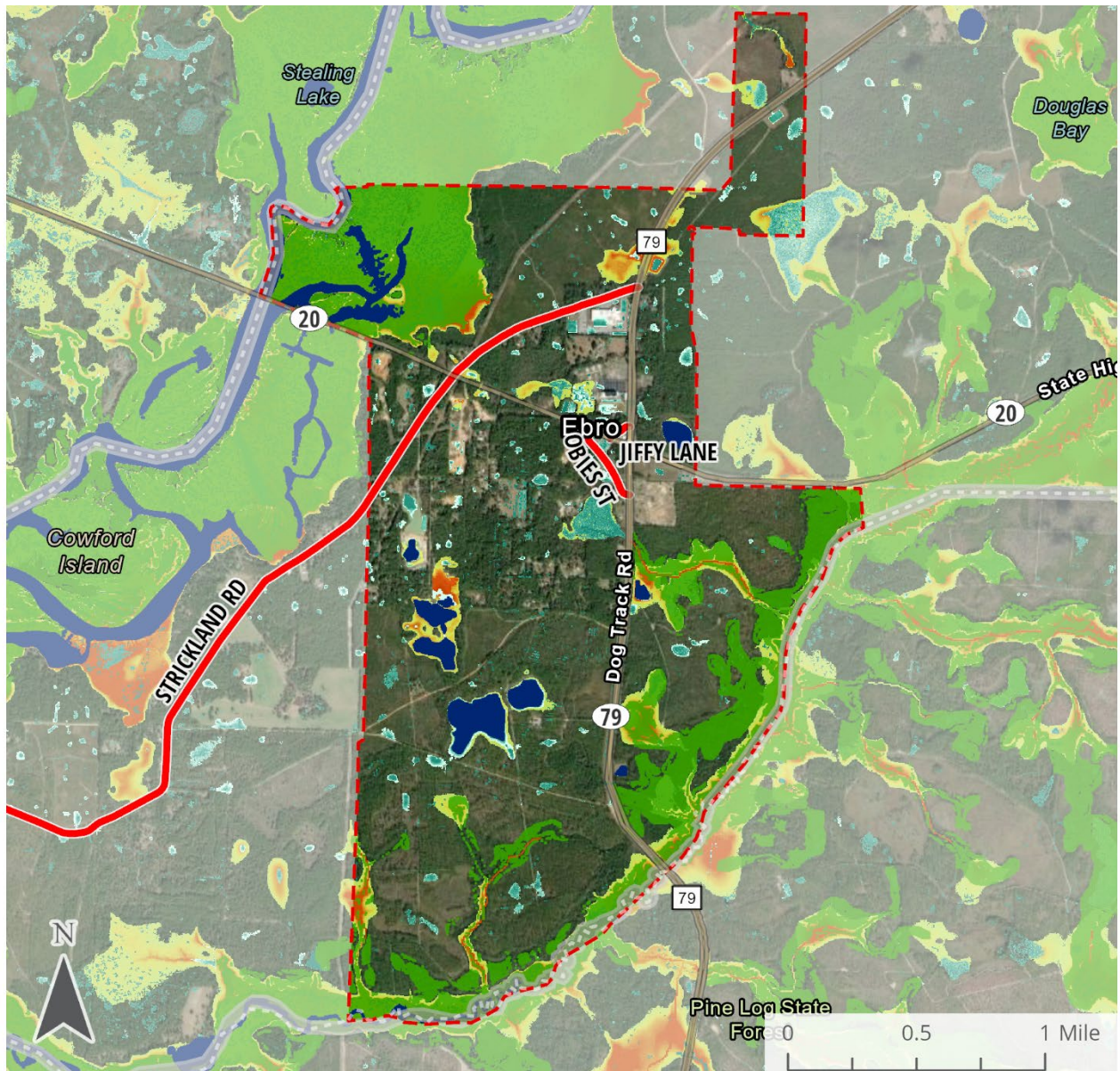
Table 12. Flood Depths by Scenario for Affected Assets

Asset (in Priority Order)	Address	Finished Floor Elevation	Rainfall Scenario Flood Depth*			
			100-Year		500-Year	
			2040	2070	2040	2070
1. STRICKLAND RD	Near Lewis Bear parking entrance & appx. 400' west of Lewis Bear property	NA	1.84'	2.28'	2.45'	3.04'
2. OBIES ST	Appx. 250' SE of Dollar General entrance	NA	0.81'	1.26'	1.42'	2.03'

**Depths for linear (roadway) and features are maximum modeled depths across the length or area within the town limits.*

Of the affected assets in Table 12, Strickland Road is assigned the highest priority due to the deeper and multiple areas of modeled flooding under the four extreme rainfall scenarios.

Figure 9. Transportation and Evacuation Routes – 100-Year, 2040 Scenario



Town of Ebro - 100-Year, 24-Hour Rainfall Flooding - 2040 Scenario

Transportation and Evacuation Routes

— Major Roadways

 	Municipality	Ponding Depth	Drainage Flow Depth
 	County	 Higher	 Higher
	Water Body	 Lower	 Lower
	Swamp		

Disclaimer: This figure is not intended to show the exact location of flooding and does not account for all variables affecting future flooding. Actual future flooding may differ from this graphic. This graphic is strictly a planning reference tool and is not for navigation, permitting, insurance rating, or other legal or regulatory purposes.

Source: ECRC, FDEP, Town of Ebro

7/1/2024

Figure 10. Critical Infrastructure – 100-Year, 2040 Scenario



Town of Ebro - 100-Year, 24-Hour Rainfall Flooding - 2040 Scenario

Critical Infrastructure

- ▲ Drinking Water Facilities
- ▲ Water Utility Conveyance Systems
- ▲ Solid and Hazardous Waste Facilities

 	Municipality	Ponding Depth	Drainage Flow Depth
 	County	 Higher	 Higher
	Water Body	 Lower	 Lower
	Swamp		

Disclaimer: This figure is not intended to show the exact location of flooding and does not account for all variables affecting future flooding. Actual future flooding may differ from this graphic. This graphic is strictly a planning reference tool and is not for navigation, permitting, insurance rating, or other legal or regulatory purposes.

Source: ECRC, FDEP, Town of Ebro

7/1/2024

Figure 11. Critical Community & Emergency Facilities - 100-Year, 2040 Scenario



Town of Ebro - 100-Year, 24-Hour Rainfall Flooding - 2040 Scenario

Critical Community & Emergency Facilities

- ◆ Disaster Recovery Centers
- ◆ Fire Stations
- ◆ Local Government Facilities

 	Municipality	Ponding Depth	Drainage Flow Depth
 	County	 Higher	 Higher
	Water Body	 Lower	 Lower
	Swamp		

Disclaimer: This figure is not intended to show the exact location of flooding and does not account for all variables affecting future flooding. Actual future flooding may differ from this graphic. This graphic is strictly a planning reference tool and is not for navigation, permitting, insurance rating, or other legal or regulatory purposes.

Source: ECRC, FDEP, Town of Ebro

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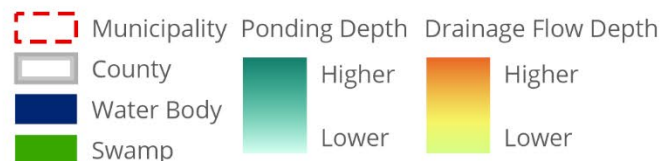
Figure 12. Natural, Cultural, and Historical Resources - 100-Year, 2040 Scenario



Town of Ebro - 100-Year, 24-Hour Rainfall Flooding - 2040 Scenario

Natural, Cultural, and Historical Resources

Historical and Cultural Assets



Disclaimer: This figure is not intended to show the exact location of flooding and does not account for all variables affecting future flooding. Actual future flooding may differ from this graphic. This graphic is strictly a planning reference tool and is not for navigation, permitting, insurance rating, or other legal or regulatory purposes.

Source: ECRC, FDEP, Town of Ebro

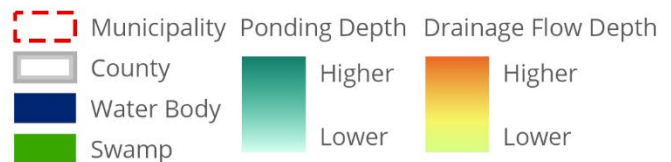
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Figure 13. Transportation and Evacuation Routes - 100-Year, 2070 Scenario



Town of Ebro - 100-Year, 24-Hour Rainfall Flooding - 2070 Scenario
Transportation and Evacuation Routes

— Major Roadways



Disclaimer: This figure is not intended to show the exact location of flooding and does not account for all variables affecting future flooding. Actual future flooding may differ from this graphic. This graphic is strictly a planning reference tool and is not for navigation, permitting, insurance rating, or other legal or regulatory purposes.

Source: ECRC, FDEP, Town of Ebro

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Figure 14. Critical Infrastructure - 100-Year, 2070 Scenario



Town of Ebro - 100-Year, 24-Hour Rainfall Flooding - 2070 Scenario

Critical Infrastructure

- ▲ Drinking Water Facilities
- ▲ Water Utility Conveyance Systems
- ▲ Solid and Hazardous Waste Facilities

▬ Municipality	Ponding Depth	Drainage Flow Depth
▬ County	Higher	Higher
■ Water Body	Lower	Lower
■ Swamp		

Disclaimer: This figure is not intended to show the exact location of flooding and does not account for all variables affecting future flooding. Actual future flooding may differ from this graphic. This graphic is strictly a planning reference tool and is not for navigation, permitting, insurance rating, or other legal or regulatory purposes.

Source: ECRC, FDEP, Town of Ebro

7/1/2024

Figure 15. Critical Community & Emergency Facilities - 100-Year, 2070 Scenario



Town of Ebro - 100-Year, 24-Hour Rainfall Flooding - 2070 Scenario

Critical Community & Emergency Facilities

- ◆ Disaster Recovery Centers
- ◆ Fire Stations
- ◆ Local Government Facilities

 	Municipality		Ponding Depth		Drainage Flow Depth
 	County		Higher		Higher
	Water Body		Lower		Lower
	Swamp				

Disclaimer: This figure is not intended to show the exact location of flooding and does not account for all variables affecting future flooding. Actual future flooding may differ from this graphic. This graphic is strictly a planning reference tool and is not for navigation, permitting, insurance rating, or other legal or regulatory purposes.

Source: ECRC, FDEP, Town of Ebro

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Figure 16. Natural, Cultural, and Historical Resources - 100-Year, 2070 Scenario



Town of Ebro - 100-Year, 24-Hour Rainfall Flooding - 2070 Scenario
Natural, Cultural, and Historical Resources



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Source: ECRC, FDEP, Town of Ebro

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Figure 17. Transportation and Evacuation Routes - 500-Year, 2040 Scenario



**Town of Ebro - 500-Year, 24-Hour Rainfall Flooding - 2040 Scenario
Transportation and Evacuation Routes**

— Major Roadways

— Municipality	Ponding Depth	Drainage Flow Depth
— County	Higher	Higher
— Water Body	Lower	Lower
— Swamp		

Disclaimer: This figure is not intended to show the exact location of flooding and does not account for all variables affecting future flooding. Actual future flooding may differ from this graphic. This graphic is strictly a planning reference tool and is not for navigation, permitting, insurance rating, or other legal or regulatory purposes.

Source: ECRC, FDEP, Town of Ebro

7/1/2024

Figure 18. Critical Infrastructure - 500-Year, 2040 Scenario



Town of Ebro - 500-Year, 24-Hour Rainfall Flooding - 2040 Scenario

Critical Infrastructure

- ▲ Drinking Water Facilities
- ▲ Water Utility Conveyance Systems
- ▲ Solid and Hazardous Waste Facilities

 	Municipality	Ponding Depth	Drainage Flow Depth
 	County	 Higher	 Higher
	Water Body	 Lower	 Lower
	Swamp		

Disclaimer: This figure is not intended to show the exact location of flooding and does not account for all variables affecting future flooding. Actual future flooding may differ from this graphic. This graphic is strictly a planning reference tool and is not for navigation, permitting, insurance rating, or other legal or regulatory purposes.

Source: ECRC, FDEP, Town of Ebro

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Figure 19. Critical Community & Emergency Facilities - 500-Year, 2040 Scenario



Town of Ebro - 500-Year, 24-Hour Rainfall Flooding - 2040 Scenario

Critical Community & Emergency Facilities

- ◆ Disaster Recovery Centers
- ◆ Fire Stations
- ◆ Local Government Facilities

 	Municipality	Ponding Depth	Drainage Flow Depth
 	County	 Higher	 Higher
	Water Body	 Lower	 Lower
	Swamp		

Disclaimer: This figure is not intended to show the exact location of flooding and does not account for all variables affecting future flooding. Actual future flooding may differ from this graphic. This graphic is strictly a planning reference tool and is not for navigation, permitting, insurance rating, or other legal or regulatory purposes.

Source: ECRC, FDEP, Town of Ebro

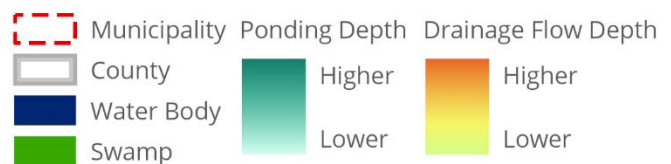
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Figure 20. Natural, Cultural, and Historical Resources - 500-Year, 2040 Scenario



**Town of Ebro - 500-Year, 24-Hour Rainfall Flooding - 2040 Scenario
Natural, Cultural, and Historical Resources**

Historical and Cultural Assets



Disclaimer: This figure is not intended to show the exact location of flooding and does not account for all variables affecting future flooding. Actual future flooding may differ from this graphic. This graphic is strictly a planning reference tool and is not for navigation, permitting, insurance rating, or other legal or regulatory purposes.

Source: ECRC, FDEP, Town of Ebro

7/1/2024

Figure 21. Transportation and Evacuation Routes - 500-Year, 2070 Scenario



Town of Ebro - 500-Year, 24-Hour Rainfall Flooding - 2070 Scenario

Transportation and Evacuation Routes

— Major Roadways

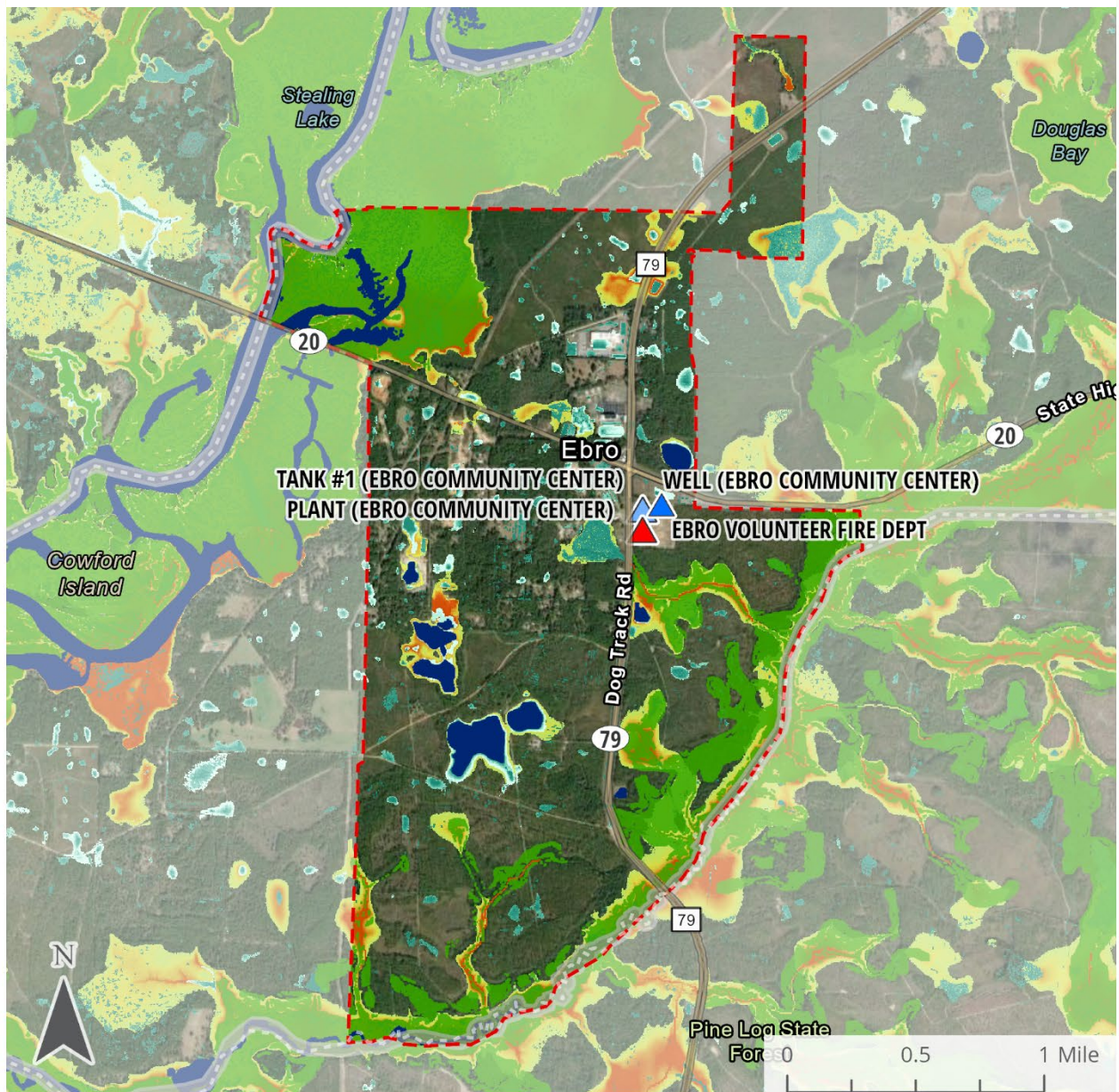
— Municipality	Ponding Depth	Drainage Flow Depth
— County	Higher	Higher
— Water Body	Lower	Lower
— Swamp		

Disclaimer: This figure is not intended to show the exact location of flooding and does not account for all variables affecting future flooding. Actual future flooding may differ from this graphic. This graphic is strictly a planning reference tool and is not for navigation, permitting, insurance rating, or other legal or regulatory purposes.

Source: ECRC, FDEP, Town of Ebro

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Figure 22. Critical Infrastructure - 500-Year, 2070 Scenario



Town of Ebro - 500-Year, 24-Hour Rainfall Flooding - 2070 Scenario

Critical Infrastructure

- ▲ Drinking Water Facilities
- ▲ Water Utility Conveyance Systems
- ▲ Solid and Hazardous Waste Facilities

 	Municipality	Ponding Depth	Drainage Flow Depth
 	County	 Higher	 Higher
	Water Body	 Lower	 Lower
	Swamp		

Disclaimer: This figure is not intended to show the exact location of flooding and does not account for all variables affecting future flooding. Actual future flooding may differ from this graphic. This graphic is strictly a planning reference tool and is not for navigation, permitting, insurance rating, or other legal or regulatory purposes.

Source: ECRC, FDEP, Town of Ebro

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Figure 23. Critical Community & Emergency Facilities - 500-Year, 2070 Scenario



Town of Ebro - 500-Year, 24-Hour Rainfall Flooding - 2070 Scenario

Critical Community & Emergency Facilities

- ◆ Disaster Recovery Centers
- ◆ Fire Stations
- ◆ Local Government Facilities

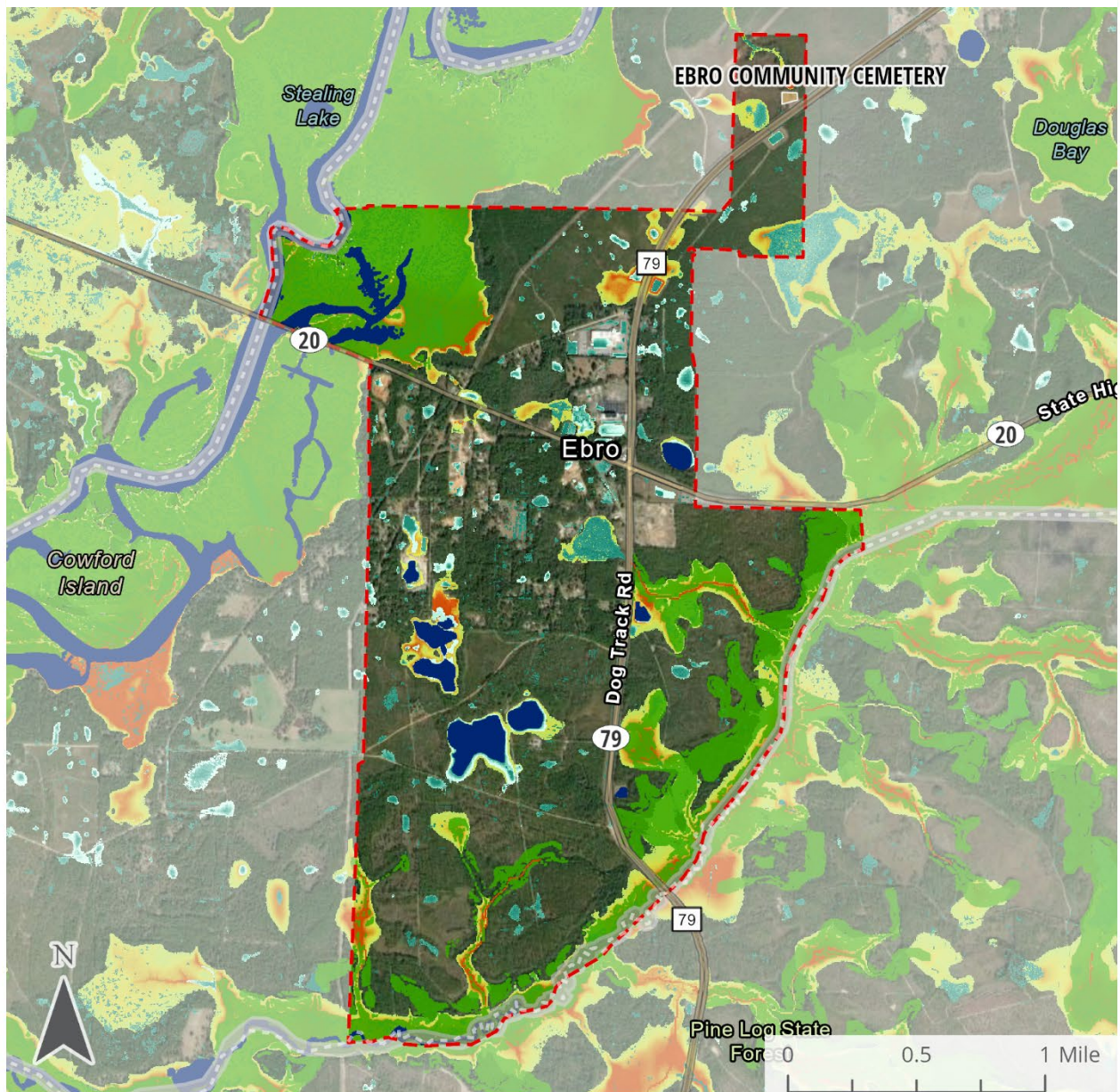
 	Municipality		Ponding Depth		Drainage Flow Depth
 	County		Higher		Higher
	Water Body		Lower		Lower
	Swamp				

Disclaimer: This figure is not intended to show the exact location of flooding and does not account for all variables affecting future flooding. Actual future flooding may differ from this graphic. This graphic is strictly a planning reference tool and is not for navigation, permitting, insurance rating, or other legal or regulatory purposes.

Source: ECRC, FDEP, Town of Ebro

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Figure 24. Natural, Cultural, and Historical Resources - 500-Year, 2070 Scenario



Town of Ebro - 500-Year, 24-Hour Rainfall Flooding - 2070 Scenario

Natural, Cultural, and Historical Resources



Disclaimer: This figure is not intended to show the exact location of flooding and does not account for all variables affecting future flooding. Actual future flooding may differ from this graphic. This graphic is strictly a planning reference tool and is not for navigation, permitting, insurance rating, or other legal or regulatory purposes.

Source: ECRC, FDEP, Town of Ebro

7/1/2024

V. Focus Area

For the most part, Critical Assets in the Town of Ebro are located outside of the inundated area shown in the model. The only two exceptions to this include small portions of Obies Street and Strickland Road.

Figure 25 shows the Focus Area established for the Town of Ebro. This area includes both areas of potential inundation on roadways as well as most of the Town of Ebro's critical assets. Before any action is taken, further assessments should be conducted to better understand the nature and severity of flooding on these critical transportation corridors.

Mitigation for Obies Street and Strickland Road could include enhancing stormwater drainage systems to handle increased water flow during heavy rainfall events and increasing the elevation of the roadways as part of future construction projects. Regular maintenance of any existing drainage infrastructure is essential to ensure optimal performance.

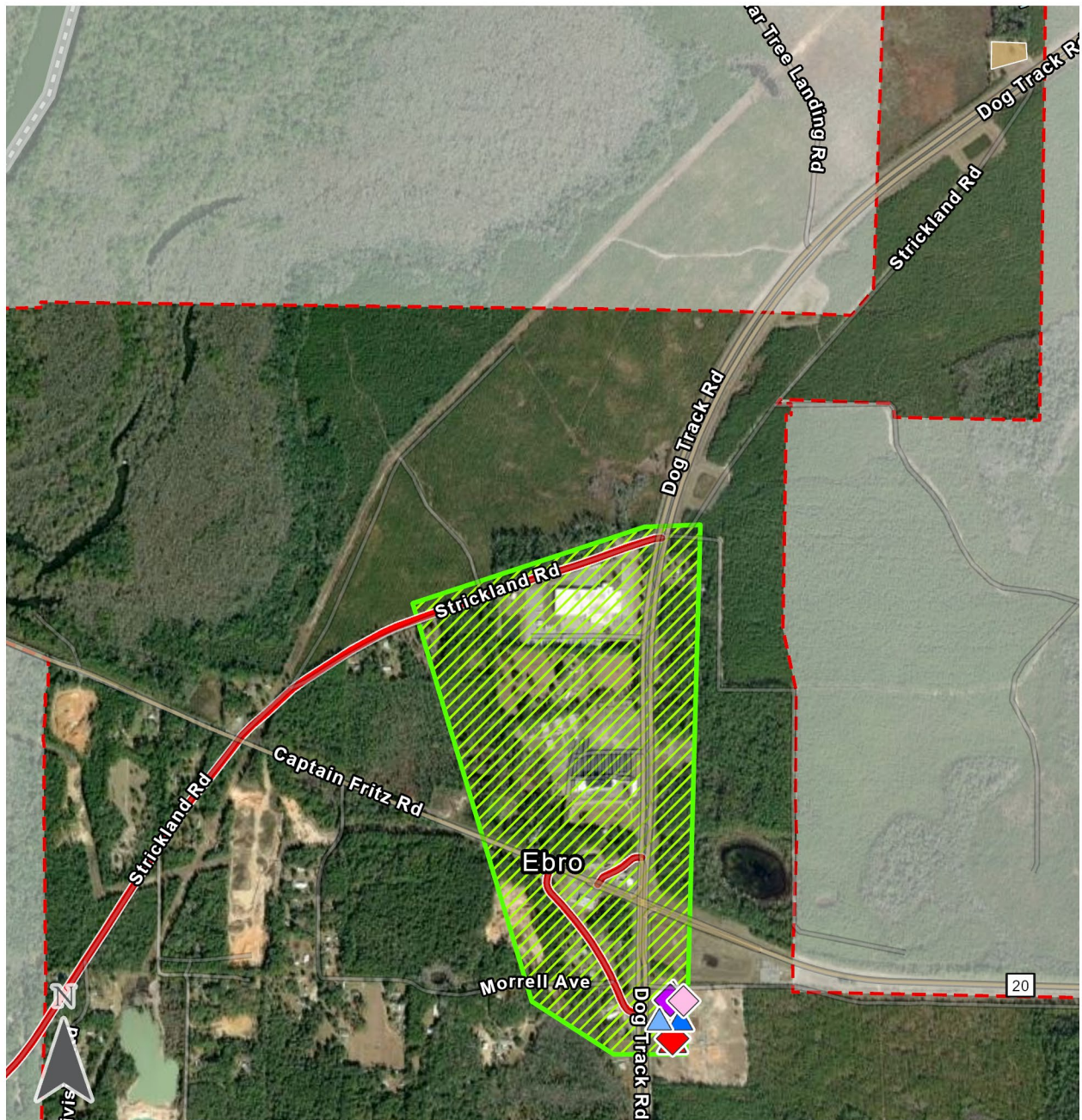
By focusing future adaptation planning in the town's Focus Area, the Town of Ebro can effectively reduce the adverse impacts of future flood events on these critical roadways, ensuring safer and more resilient transportation for residents even during extreme weather events.

Table 13. Focus Area and Critical Assets

Ebro Focus Area	
Asset Name	Owner/Operator
STRICKLAND RD	Town of Ebro
OBIES ST	Town of Ebro
WELL (EBRO COMMUNITY CENTER)	Town of Ebro
PLANT (EBRO COMMUNITY CENTER)	Town of Ebro
TANK #1 (EBRO COMMUNITY CENTER)	Town of Ebro
EBRO VOLUNTEER FIRE DEPT	Town of Ebro
EBRO TOWN HALL	Town of Ebro

The Ebro Community Center Well, Plant, and Tank; Volunteer Fire Dept, and Town Hall are within the focus area but were not affected by any modeled flooding.

Figure 25. Focus Areas and Critical Assets



Town of Ebro - Focus Areas and Critical Assets

7/24/2024

- | | |
|--------------------------------------|--------------------------------|
| Focus Area | Disaster Recovery Centers |
| Municipality | Fire Stations |
| County | Local Government Facilities |
| Drinking Water Facilities | Major Roadways |
| Water Utility Conveyance Systems | Historical and Cultural Assets |
| Solid and Hazardous Waste Facilities | |

0 0.25 0.5 Mile

Source: ECRC, FDEP, Town of Ebro

VI. Discussion

The results of the Town of Ebro's Vulnerability Assessment provide building blocks for the next phase of Adaptation Planning. This report highlights specific vulnerabilities to Critical Assets as identified in Florida Statutes, in particular, the susceptibility of Obies Street and Strickland Road to flooding under various extreme rainfall scenarios.

This report does not cover all possible future vulnerabilities. Future Vulnerability Assessments may take a wider lens and include privately owned assets alongside the Critical Assets examined here. Additionally, as climate projections evolve and more detailed data becomes available, the Town of Ebro may wish to update and expand its vulnerability assessment. Further, because of the possibility of storm surge and sea level rise impacts in the extreme southern areas of town, future vulnerability modeling may consider incorporating compound flood modeling.

Town staff, especially Town Clerk, Linda Marlow, was instrumental in providing feedback throughout the project. This collaborative effort ensured that the assessment accurately reflects local conditions and Critical Assets. The engagement of additional local stakeholders during the subsequent adaptation planning phase will be essential for ensuring that any future efforts are grounded in the community's needs and experiences.

The recommendations provided in this report serve as a starting point for developing a comprehensive adaptation strategy. Future steps should include detailed assessments for the prioritized areas, exploration of funding opportunities for resilience projects, and continued collaboration with regional partners and experts. The Town may also explore analyses focusing on areas which are vulnerable to inundation, but do not contain municipal assets. By taking these steps, the Town of Ebro can better prepare for and mitigate the impacts of future flooding events, ensuring the safety and well-being of its residents and the protection of its critical infrastructure.

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