GOOSE CREEK – DICKERSON BAY SUB-BASIN WORK PLAN

Low Tide on Dickerson Bay

NORTHWEST FLORIDA WATERSHEDS PARTNERSHIP PROGRAM
ST. MARKS RIVER AND APALACHEE BAY WATERSHED
JANUARY 2026

NORTHWEST FLORIDA WATER MANAGEMENT DISTRICT

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Acknowledgements

The Northwest Florida Water Management District (District) watershed planning effort relies on a large team of District professionals. Primary authors and contributors are noted below.

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Executive Summary

The **Northwest Florida Watersheds Partnership Program (Program)** is a collaborative, multi-party initiative to proactively address critical water resource issues within priority sub-basins of the Northwest Florida Water Management District (District). The Program is being implemented in coordination with local and county governments, regional entities, and other interested parties to maximize effectiveness.

The Goose Creek-Dickerson Bay sub-basin was selected as the priority sub-basin within the St. Marks River and Apalachee Bay watershed. The sub-basin covers more than 59,000 acres in Wakulla County, and includes the community of Panacea and drainages to Dickerson, Dickson, Levy, Oyster, and Goose Creek bays. This work plan describes the sub-basin's characteristics, critical water resource issues, and strategies and proposed projects that can be implemented to address these issues.

The Goose Creek-Dickerson Bay sub-basin's estuarine waters are highly productive and include extensive tidal marshes, oyster reefs, seagrass beds, and tidal creeks. About 13% of the sub-basin consists of residential, commercial, and transportation land uses. The remainder of the sub-basin predominantly consists of wetlands and forestland. Over 35% of the sub-basin's area is within the St. Marks National Wildlife Refuge.

The sub-basin's population in 2020 was 10,964. It is projected to reach 14,758 by 2045, an increase of 35%.

Current Issues and Challenges

Water quality in the Goose Creek-Dickerson Bay sub-basin is affected by stormwater runoff across the landscape picking up pollutants from diffuse sources. Common pollutants include nutrients, sediments, bacteria, fertilizers, herbicides, insecticides, oils and greases. The sub-basin includes approximately 3,315 known and likely septic systems, which may also be a source of nutrients and bacteria.

Water quality impairments include:

Dickerson Bay (Fecal coliform bacteria)
Dickson Bay (Nutrients, Fecal coliform bacteria)
Gulf waters (Fecal coliform bacteria)
Oyster Bay (Nutrients, Fecal coliform bacteria)
Purify Creek (Fecal coliform bacteria)
Otter Creek (Dissolved oxygen)

The sub-basin is highly susceptible to coastal flooding, including storm surge associated with hurricanes and tropical storms. Additionally, the seagrass, salt marsh, and oyster habitats so important to the estuarine environment and regional economy are vulnerable to anthropogenic impacts and environmental change.

Strategies and Solutions

The Work Plan summarizes management strategies to address the water resource challenges affecting the Goose Creek-Dickerson Bay sub-basin. Each approach identified addresses multiple issue areas and objectives, reflecting the interrelated nature of water resource attributes and conditions. Proposed strategies include stormwater system upgrades, central wastewater and septic system improvements, potable water system upgrades and ecosystem restoration.

Addressing critical water resource issues will require a multi-year effort. Future projects, in addition to those identified within this work plan, will likely be needed to fully address the water resource issues and challenges within described in the work plan. Many projects provide multiple water resource benefits. As of January 2026, fifteen projects have been proposed, at an estimated total cost of $80,903,461. The current unmet funding need is $62,501,558. Project types currently proposed include:

- Central wastewater and septic to sewer projects
- Oyster reef establishment
- Water quality assessment
- Potable and reuse water system improvements

For more information please visit: https://nwfwater.com/water-resources/surface-water-improvement-and-management/

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I. Introduction

The Northwest Florida Watersheds Partnership Program is a collaborative, multi-party initiative to proactively address critical water resource issues within priority sub-basins within the Northwest Florida Water Management District (District). While shovel-ready projects will be a high priority for implementation, funding is also anticipated to be available for design, feasibility studies, planning, and, where needed, data collection to determine causes of water resource issues or to track improvements. For the first year of the program, efforts will focus on one priority sub-basin within each of the District's seven major watersheds. The program is being implemented in coordination with local and county governments, regional entities, and other interested parties to maximize effectiveness. Partners include the Florida Department of Environmental Protection; Florida Department of Agriculture and Consumer Services; the Florida Fish and Wildlife Conservation Commission; the Choctawhatchee Basin Alliance; and the three Panhandle Estuary Programs: Pensacola and Perdido Bays, Choctawhatchee Bay, and St. Andrew and St. Joseph Bays.

To select priority sub-basins, objective criteria were developed using best-available geographic information system (GIS) datasets and applied to evaluate and rank the 114 sub-basins within the District's seven major watersheds. Evaluation criteria focused on water quality, aquatic habitat restoration, and water supply and considered factors such as water quality impairments, established total maximum daily loads, population growth, and location within a Water Resource Caution Area or Area of Resource Concern. The highest-ranked candidate sub-basins within each watershed were presented at a series of six public workshops held in October 2025. Input received during the workshops and through on-line surveys, together with information regarding proposed projects, was also utilized in the evaluation process to select a single priority sub-basin within each major watershed. Additional details regarding evaluation process can be found in Appendix A.

The Goose Creek-Dickerson Bay sub-basin was selected as the priority sub-basin within the St. Marks River and Apalachee Bay watershed. This sub-basin encompasses approximately 59,356 acres in Wakulla County, Florida, including the community of Panacea and drainages to Dickerson, Dickson, Levy, Oyster, and Goose Creek bays. This work plan describes the sub-basin's characteristics, critical water resource issues, and strategies and proposed projects that can be implemented to address these issues.

The goal of this work plan is to provide an integrated framework for a multi-year collaborative effort to improve the environmental resources, ecological functions, and public benefits of the Goose Creek-Dickerson Bay sub-basin.

Specific objectives of the program and this work plan include:

- Describe critical water resource issues, with a focus on water quality, aquatic habitat, and water supply needs,
- Determine strategies and projects needed to address the most critical issues including project costs and funding needs,
- Provide an integrated and holistic approach framework that recognizes and incentivizes projects with multiple resource benefits,
- Secure and leverage funding and associated resources needed to implement priority strategies and projects,

- Protect and improve the quality of waters directly influenced by the Goose Creek-Dickerson Bay sub-basin area, as well as within the larger St. Marks River and Apalachee Bay watershed,
- Enhance, protect and sustain aquatic and wetland habitats with the Goose Creek-Dickerson Bay sub-basin, together with their economic, recreational, and other societal benefits for the community and for natural systems,
- Enhance the resilience and sustainability of aquatic habitats and water supplies,
- Track project implementation metrics and trends in environmental conditions to monitor and evaluate success and inform an adaptive management approach to enhance strategies and maximize the program's effectiveness.

Accomplishing these objectives will require extensive collaboration and coordination among state and local government agencies, federal agencies, nonprofit organizations, and the private sector to maximize synergy between projects and achieve lower overall restoration costs.

II. Overview of the St. Marks River and Apalachee Bay Watershed

The focus of this work plan, the Goose Creek-Dickerson Bay sub-basin, is a component drainage basin (sub-basin) of the St. Marks River and Apalachee Bay watershed (Figure 1). A watershed is a geographic area of land that drains to a common destination, in this case the St. Marks River and Apalachee Bay. As described by Lewis *et al*. (2009) and the Northwest Florida Water Management District (2017), the St. Marks River watershed covers about 1,170 square miles. The surface water drainage basin begins in Thomas County, Georgia, and extends approximately 52 miles to the south, terminating at Apalachee Bay. The majority of the watershed (about 91 percent) is within Leon, Wakulla, and Jefferson counties in the Florida Panhandle.

The St. Marks River begins as a blackwater stream, receiving water from wetlands, the water table, and surface runoff in the city of Tallahassee and unincorporated Leon County. The river submerges at Natural Bridge and then reemerges about a half mile to the south at St. Marks River Rise, its flow greatly increased by the addition of groundwater. The river's major tributary, the Wakulla River, begins in northern Wakulla County with flow from Wakulla Spring and Sally Ward Spring, and joins with the St. Marks River about five miles north of Apalachee Bay. Other surface water features within the watershed include lakes Miccosukee, Lafayette, and Munson, and the coastal receiving waters of Apalachee Bay.

In addition to surface water drainage from the watershed, groundwater provides a substantial amount of the flow into both rivers and Apalachee Bay. The regional groundwater contribution area encompasses about 1,963 square miles, roughly 68 percent larger in area than the surface watershed. The physical extent of this contribution area may fluctuate slightly depending on pumping and climatic variability, which affect recharge and the potentiometric surface of the Floridan aquifer.

Topographically, the watershed is within the Gulf Coastal Plain physiographic region, with two localized physiographic regions: the Northern Highlands, north of the Cody Scarp, and the Gulf Coastal Lowlands to the south. The Cody Scarp extends across southern Leon County and is identified by a significant drop in elevation between the Northern Highlands and the coastal plain. The Northern Highlands are characterized by greater topographic relief with sand and clay overlying limestone bedrock. Within the watershed, this region is described as the Tallahassee Hills subdivision. South of the Cody Scarp, the Gulf Coastal Lowlands is an expansive, gently sloping plain dominated by karst features, regionally defined as the Woodville Karst Plain.

The St. Marks River/Apalachee Bay watershed has three first magnitude (more than 100 cubic feet per second [cfs] discharge) springs: Wakulla Spring, St. Marks River Rise, and the Spring Creek Springs Group, and three second magnitude (10-100 cfs discharge) springs. Approximately 23 swallets have been identified north of the Cody Scarp, with about 31 swallets and 47 springs mapped below the scarp (NWFWMD 2017). There are also numerous unmapped sinkholes within the watershed's groundwater contribution area.

The St. Marks River and Apalachee Bay watershed, including its geography, hydrogeology, ecosystems, and setting within the human community, is described in detail by the NWFWMD (2017). Lewis *et al*. (2009) provides an in-depth discussion of natural systems dependent on the system's freshwater and estuarine ecosystems.

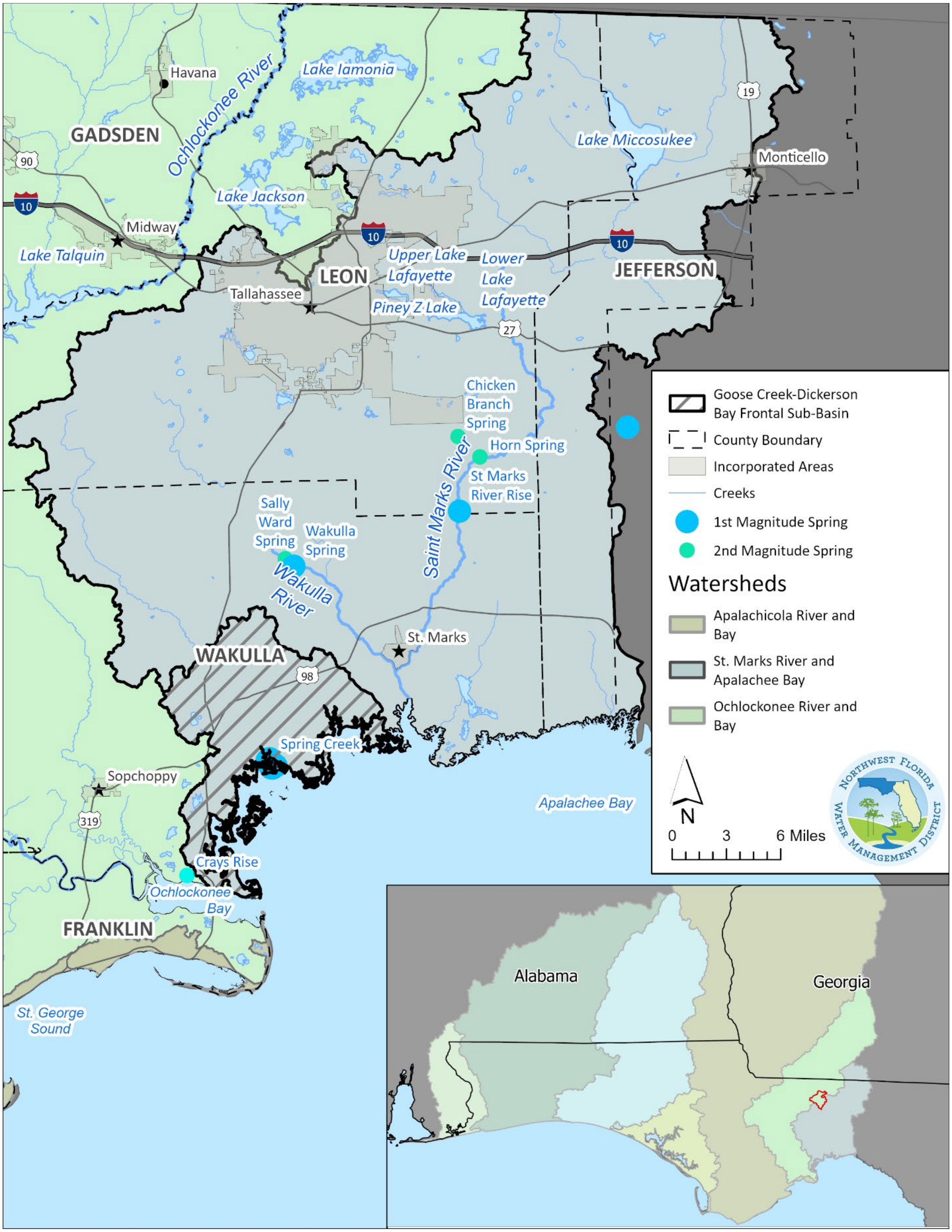

Figure 1. Location of Goose Creek – Dickerson Bay Sub-basin within the Marks River and Apalachee Bay Watershed

III. Goose Creek-Dickerson Bay Sub-Basin Characteristics

The Goose Creek-Dickerson Bay sub-basin (Figure 2) encompasses approximately 59,356 acres in southern Wakulla County. It includes the community of Panacea, much of the community of Medart, Shell Point, and a portion of the St. Marks National Wildlife Refuge.

The Goose Creek-Dickerson Bay sub-basin is positioned within the Gulf Coastal Lowlands subregion of the Gulf Coastal Plain physiographic region. As described above, this is an expansive, gently sloping plain dominated by karst features and extensive coastal wetlands. The geography of the sub-basin is depicted by Figure 2. Land elevations range from sea level to approximately 63 feet (NAV88) in the northwestern extent of the sub-basin. The sub-basin includes three separate subwatersheds (Table 1) draining tidal creeks and wetlands. Estuarine receiving waters include Dickerson, Dickson, Levy, Oyster, and Goose Creek bays, with numerous smaller embayments and tidal creeks, all opening into Apalachee Bay.

Table 1. Goose Creek-Dickerson Bay Subwatersheds

HUC-12 Subwatershed	Receiving Waters	Area (Acres)
Old Creek-Skipper Creek Frontal	Dickerson, Levy, Oyster, and Dickson bays	21,402
Springs Creek	Oyster Bay	18,834
Goose Creek-Walker Creek Frontal	Goose Creek Bay	19,121
Total Area		59,356

A watershed management approach encompassing the Goose Creek-Dickerson Bay sub-basin and larger encompassing watershed is described by the Northwest Florida Water Management District's St. Marks River and Apalachee Bay Surface Water Improvement and Management (SWIM) Plan (NWFWMD 2017). The SWIM plan describes characteristics of the overall watershed, and details watershed issues, responsive strategies, and recommended project approaches.

Over 35 percent of the sub-basin's area is within the St. Marks National Wildlife Refuge. Habitats and functions of the refuge are described in detail by the St. Marks National Wildlife Refuge Comprehensive Conservation Plan (USFWS 2006). Additionally, the planning area extends into the Big Bend Seagrasses Aquatic Preserve. Programmatic responsibilities and management of the Preserve are described in the Big Bend Seagrasses Aquatic Preserve Management Plan (DEP 2015).

The Florida Fish and Wildlife Conservation Commission (FWC) is responsible for freshwater and marine resource management. The FWC Florida Fish and Wildlife Research Institute conducts seagrass monitoring and management, tracking of coastal harmful algal blooms (red tides), and the Oyster Integrated Mapping and Monitoring Program. The Florida Department of Agriculture and Consumer Services, Division of Aquaculture, monitors, evaluates, and classifies shellfish harvesting areas and is responsible for developing and enforcing regulations governing commercial aquaculture.

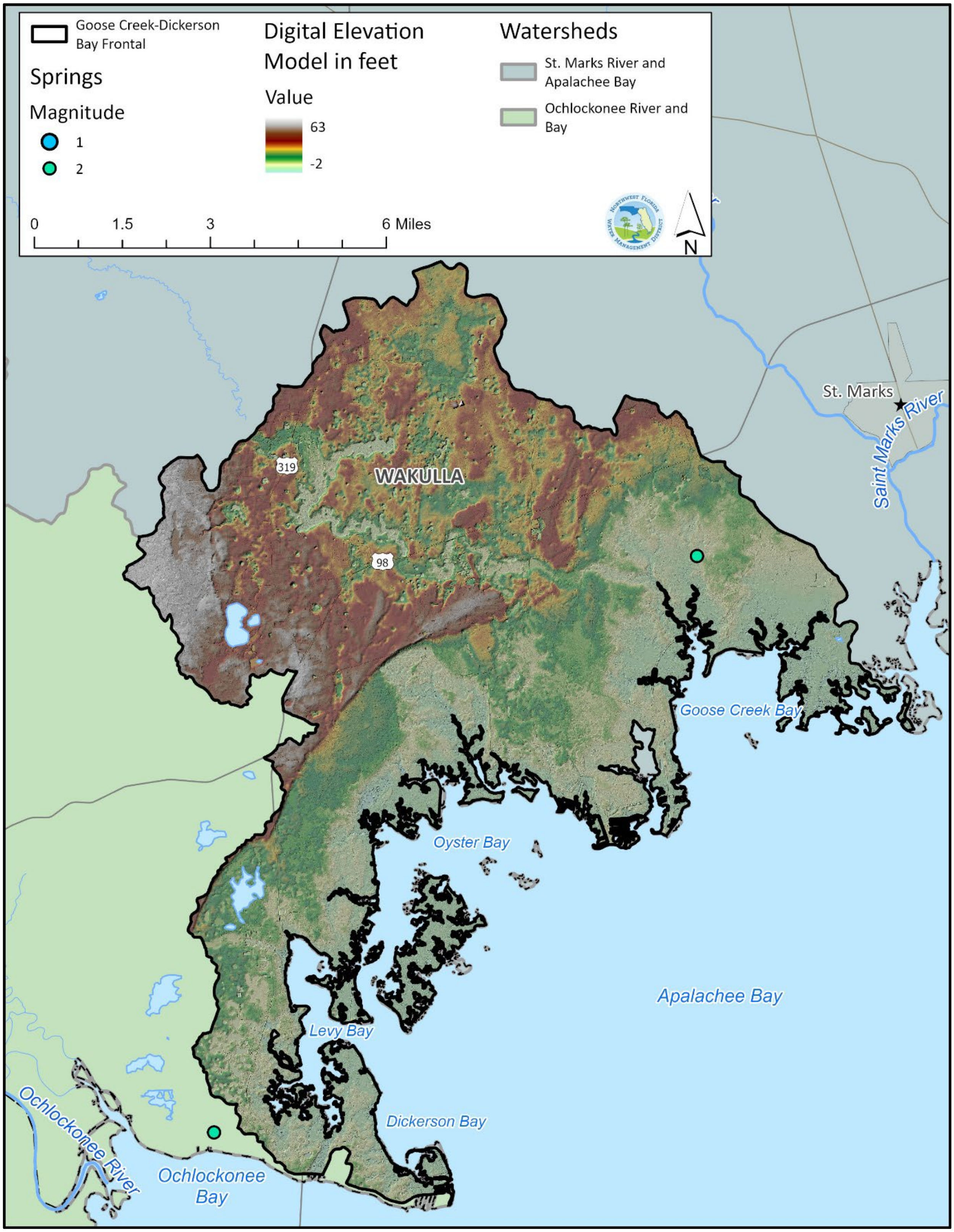

Figure 2. Land surface elevations within the Goose Creek-Dickerson Bay Sub-basin

The Florida Department of Environmental Protection (FDEP) regulates water quality, wastewater, and septic systems, and it owns and manages state parks and coordinates other environmental programs at the state level. The Northwest Florida Water Management District (NWFWMD, or District) is responsible for environmental resource permitting and regulation of wells and consumptive uses of water, as well as land management, grant programs, and nonregulatory water resource programs.

Wakulla County is responsible for land use and land development regulations within a broad array of other local government responsibilities. The watershed is also within the region served by the Apalachee Regional Planning Council (ARPC), which coordinates economic development, emergency and environmental planning, housing, transportation, and other services cooperatively with local governments across a nine-county area of northwest Florida.

3.1 Sub-basin Functions and Benefits

Ecosystem services and benefits provided by the water and related resources of the Goose Creek-Dickerson Bay sub-basin include fish and wildlife resources, recreational opportunities, aesthetic qualities, surface and groundwater storage and regulation, and the economic benefits of all of these. Wetlands and floodplains protect water quality and provide floodwater storage and flood protection, important fish and wildlife habitat, shoreline stabilization, and coastal resilience. The sub-basin's conservation lands are a resource for public access and recreational and educational opportunities, and protect coastal communities from tropical storms and hurricanes, store flood waters, and provide an effective buffer to protect water quality and aquatic habitats.

3.2 Hydrology

The major sources of freshwater inflow to the sub-basin's receiving waters are the St. Marks River and the Spring Creek Spring Group. The St. Marks River discharges adjacent to the eastern border of the sub-basin with an average annual flow of approximately 671 cubic feet per second (cfs).[1] Smaller sources of freshwater inflow include Spring Creek (surface water component), Purify Creek, and tidal creeks along the estuarine fringe, as well as stormwater runoff from the basin area. Estuarine waters are also influenced by inflow from the Ochlockonee River and, at high flows, the Apalachicola River (Yarbro and Carlson 2018).

The Spring Creek Spring Group (SCSG) is a first-magnitude submarine springs group with 14 known individual vents discharging into upper Oyster Bay. Flow processes associated with the SCSG are complex and determined by aquifer levels, changes in coastal water surface elevation (tidal flux, sea level rise, seasonal variations, etc.), and variations in salinity between coastal and aquifer waters. The SCSG is thought to be connected to numerous karst features in the area including Wakulla Spring and multiple conduits connecting Lost Creek, Fisher Creek, and other surface waters (Davis and Verde 2014). The SCSG is characterized by large variations in flow due to its interconnectedness to the other systems, which can result in flow reversals potentially lasting several months. Davis and Verdi (2014) provide additional detail and discussion of the flow dynamics and interconnections of the SCSP to other karst features.

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[1] Average annual flow for the St. Marks River at Newport, 1956-2024. https://waterdata.usgs.gov/monitoring-location/USGS-02326900/statistics/#selectedDataTypes=daily-00060-0

3.3 Aquatic and Terrestrial Habitats

Estuarine waters within the Goose Creek-Dickerson Bay sub-basin are highly productive and include extensive tidal marshes, oyster reefs, seagrass beds, and tidal creeks, as illustrated in Figure 3 and discussed further below. Extensive salt marshes comprise a major portion of the estuarine fringe of the planning area.

Salt Marshes

Low energy shorelines within the planning area support extensive salt marshes which form an intertidal transition between terrestrial and marine environments. Salt marshes provide nursery habitat and refuge for a variety of invertebrates and fish, as well as habitat for birds, reptiles, mammals, and other wildlife. Additionally, salt marshes are important for nutrient cycling, water quality protection, shoreline stability, floodwater storage, and coastal resilience. By storing floodwater and providing an extensive shoreline buffer area, the salt marshes across the Apalachee Bay region provide important protection for coastal communities.

Salt marshes in the region are characterized by relatively homogenous expanses of black needlerush (*Juncus roemerianus*), with smooth cordgrass (*Spartina alterniflora*) frequently at deeper elevations along the water's edge. Saltmeadow cordgrass (*Spartina patens*) populates higher elevations with less frequent tidal inundation. Additional species include salt grass (*Distichlis spicata*) and other herbaceous and woody species. Higher elevations within the salt marsh area may host hammocks of oak (*Quercus* spp.), cabbage palm (*Sabal palmetto*), red cedar (*Juniperus virginiana*), various shrubs, and other species. Lewis *et al*. (2009) and USFWS (2006) provide detailed descriptions of salt marsh and associated vegetation communities within the planning area.

Oysters

Oyster reefs are the major hard bottom habitat types within Apalachee Bay (Lewis *et al*. 2009), with the only reef-building oyster being the Eastern oyster (*Crassostrea virginica*) (Radabaugh, *et al*. 2019). Much of the estuarine portion of the planning area is classified as Conditionally Approved or Conditionally Restricted for oyster harvesting (FDACS 2015). Dickerson Bay, Stuart Cove, and the estuarine portion of Purify Creek are classified Prohibited. Aquaculture use zones have been established in the vicinity of Piney Island (Cramer *et al*. 2025). In addition to supporting commercial fisheries, oysters provide important habitat structure within the estuary, enhance coastal resilience through promoting sediment and shoreline stability and wave attenuation, and improve water quality through filtering large quantities of water.

Cramer *et al*. (2025) mapped oyster habitats within Dickerson, Dickson, Levy, Oyster, and Goose Creek bays, as well as adjacent waters in Apalachee and Ochlockonee bays. Oyster Bay and Goose Creek Bay were found to support both living and nonliving oyster beds. Many of the reefs are linear, often containing areas of live oyster within larger areas of shell or shell hash. Additionally, an oyster restoration site with 1,000 concrete oyster domes has been established within western Oyster Bay by the Wakulla Environmental Institute of Tallahassee State College.

Seagrasses

Seagrass beds are a highly productive component of the Apalachee Bay estuary (Lewis *et al*. 2009; Yarbro and Carlson 2018). They provide important habitat and food for fish, shellfish, manatees, sea turtles, and waterfowl. Many economically significant species of fish and shellfish depend on seagrasses during critical life stages. Seagrass beds in Apalachee Bay also provide important development habitat for juvenile Kemp's ridley sea turtles (*Lepidochelys kempii*) (Schmid and Barichivich 2005; DEP 2015). Additionally, seagrasses help stabilize sediments and thereby protect water quality (Orth *et al*. 2020).

Within the planning area, continuous and patchy seagrass beds are found in Dickerson, Dickson, Levy, Oyster, and Goose Creek bays and adjacent waters in Apalachee Bay. Species within the planning area include manateegrasss (*Syringodium filiforme*), shoalgrass (*Halodule wrightii*), and turtlegrass (*Thalassia testudinum*) (Yarbro and Carlson 2018). Stargrass (*Halophila engelmannii*) is less common, and widgeongrass (*Ruppia maritima*) is observed in lower salinity areas.

Soft Bottom Habitats

As described by Lewis *et al*. (2009), unvegetated soft bottom habitats comprise a substantial portion of Apalachee Bay. Such areas host productive infaunal communities and provide important feeding areas for a variety of finfish and shellfish.

Terrestrial Habitats

Terrestrial habitats within the Goose Creek-Dickerson Bay sub-basin include those described by USFWS (2006) for the St. Marks National Wildlife Refuge. These can be summarized as follows:

- Longleaf Pine-Turkey Oak Sandhill – Well-drained xeric habitat on relict coastal sand bars hosting longleaf pine (*Pinus palustris*), various oaks (*Quercus* spp.) and a low understory of wiregrass (*Aristida beyrichiana*) and other herbaceous species.
- Scrubby Flatwoods – Xeric flatwoods community with an open longleaf pine canopy and a diverse understory of woody and herbaceous species.
- Xeric Hammock – Small habitat areas hosting live oaks (*Quercus virginiana*) or sand-live oaks (*Q. geminata*) and a mixed understory.
- Mesic Flatwoods – Predominantly longleaf pine overstory, with other pine species and hardwoods such as cabbage palm (*Sabal palmetto*), oaks, and red cedar (*Juniperus silicicola*). Supports a varying understory with such species as saw palmetto (*Serenoa repens*), St. John's wort (*Hypericum galioides*), and gallberry (*Ilex coriacea*).
- Mesic Hammock – Mixed hardwood or pine canopies developed in the absence of frequent fires. Supports a mixture of canopy and mid-story trees sparse to moderate groundcover.
- Wet Flatwoods – Generally open overstory of longleaf or slash pine (*P. elliottii*) with groundcover dominated by wiregrass but supporting a range of other herbaceous species.
- Evergreen Shrub Bog – Bogs occurring in hydric depressions with slash pine and pond cypress (*Taxodium ascendens*), as well as shrubs, sphagnum moss (*Sphagnum* spp.), and limited groundcover.
- Hydric Hammock – Characterized by hardwood trees, sawgrass (*Cladium jamaicense*), and other species adapted to hydric soils. These communities can be subdivided into separate subcommunities, as described in detail by USFWS (2006).
- Swamp – Forested wetlands dominated by pond cypress (*Taxodium ascendens*) and/or black gum (*Nyssa sylvatica*). Midstory trees may include slash pine, red maple (*Acer rubrum*), cabbage palm, and others. The understory is generally open, but includes clumped bamboo vine (*Smilax laurifolia*), sphagnum moss, sawgrass, and other species.

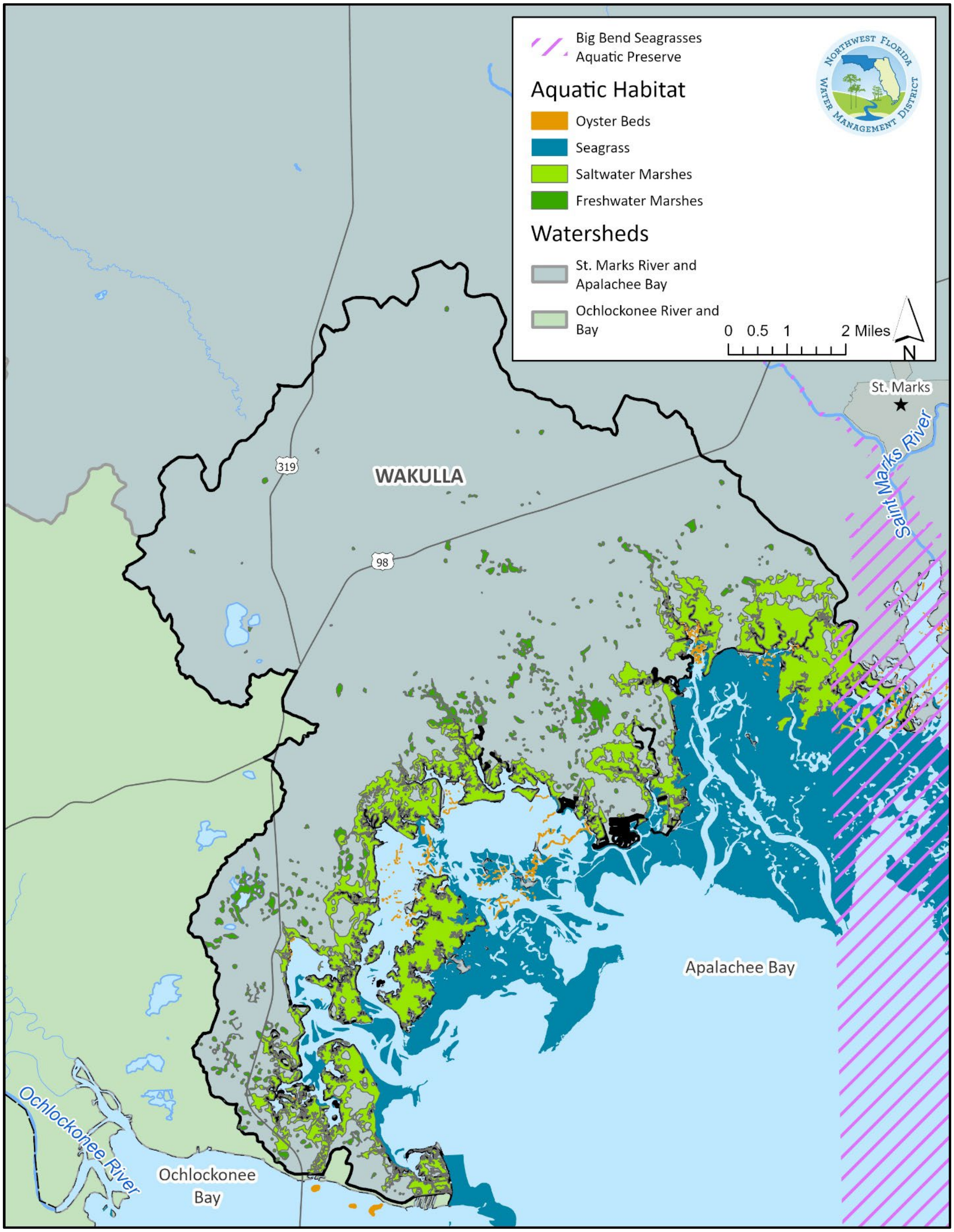

Figure 3. Aquatic Habitats within the Goose Creek-Dickerson Bay Sub-basin

- Freshwater Marsh – Freshwater marsh areas are interspersed with forested habitats. They are dominated by herbaceous plants, including sawgrass, cattail (*Typha* spp.), arrowhead (*Sagittaria* spp.), and pickerelweed (*Pontederia cordata*), among others.
- Salt Marshes – Extensive tidally-influenced habitats, as described above.

Listed Species

Terrestrial habitats, wetlands, freshwater aquatic habitats, and estuarine waters within the planning area are important for sustaining the biological diversity of the region, including a number of species federally listed under the Endangered Species Act (Table 2).

Table 2. Listed Species Potentially Occurring within the Goose Creek – Dickerson Bay Sub-basin

Common Name	Scientific Name	Federal Status
Godfrey's butterwort	*Pinguicula ionantha*	Threatened
Monarch Butterfly	*Danaus plexippus*	Proposed Threatened
Frosted Flatwoods Salamander	*Ambystoma cingulatum*	Threatened
Loggerhead Sea Turtle	*Caretta caretta*	Threatened
Green Sea Turtle	*Chelonia mydas*	Endangered
Leatherback Sea Turtle	*Dermochelys coriacea*	Endangered
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*	Endangered
Alligator Snapping Turtle	*Macrochelys temminckii*	Proposed Threatened
Eastern Indigo Snake	*Drymarchon couperi*	Threatened
Piping Plover	*Charadrius melodus*	Threatened
Red-cockaded Woodpecker	*Dryobates borealis*	Threatened
Black Rail	*Laterallus jamaicensis*	Threatened
West Indian Manatee	*Trichechus manatus*	Threatened
Gulf Sturgeon	*Acipenser oxyrinchus desotoi*	Threatened
Sources: Florida Natural Areas Inventory (2025); U.S. Fish and Wildlife Service (2006)		

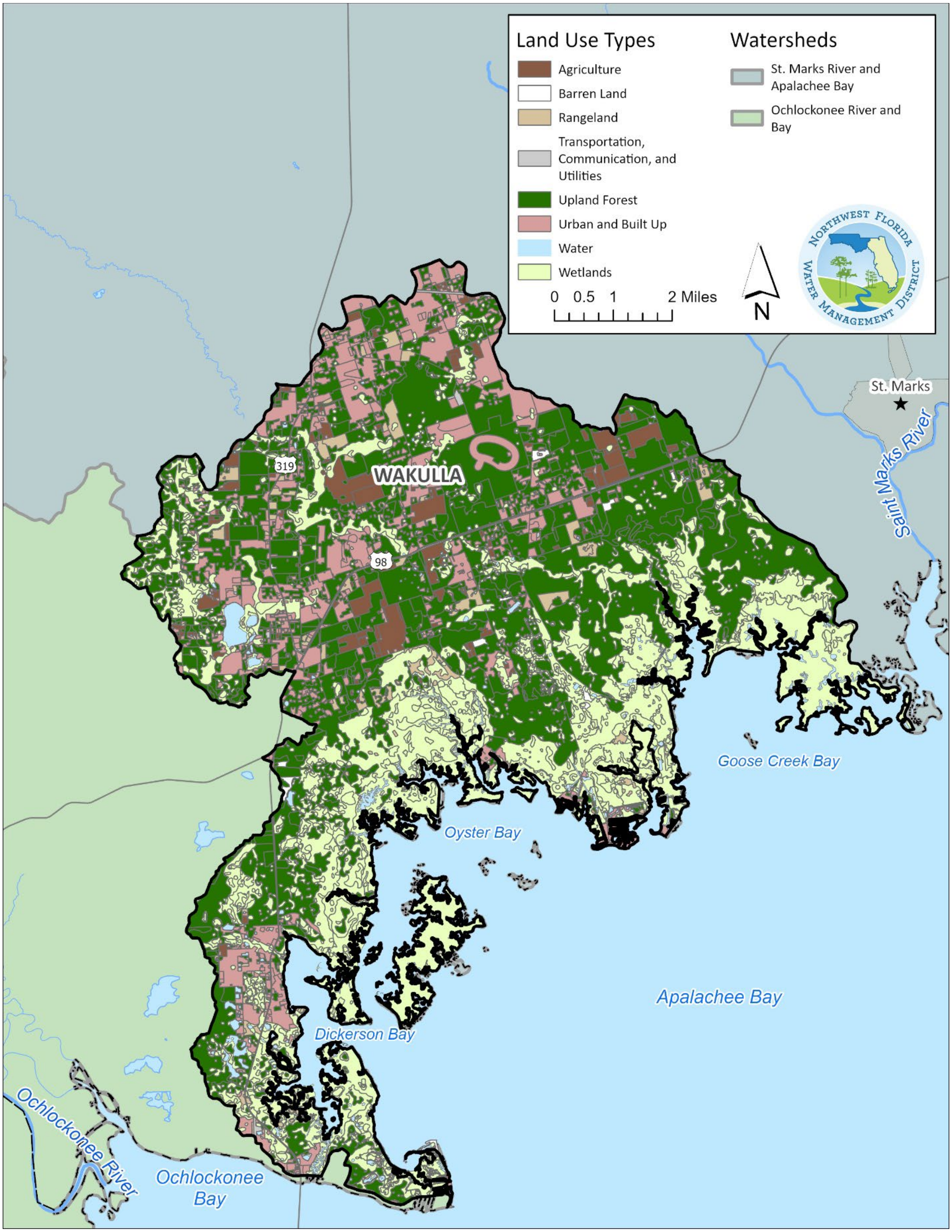

Figure 3. Land Use and Land Cover within the Goose Creek-Dickerson Bay Sub-basin

3.4 Land Use and Land Cover

Land use and land cover are listed in Table 3 and depicted in Figure 3. Upland forests and wetlands together comprise more than 71 percent of the sub-basin, with residential, commercial, and industrial uses, aggregated as Urban and Built-Up, comprising another 12 percent. These areas are primarily associated with the communities of Panacea and Medart.

Table 3. Land Use and Land Cover in the Goose Creek – Dickerson Bay Sub-basin

Land Use/Cover	Area (acres)	Percent
Upland Forest	22,746	38.32
Wetlands	19,931	33.58
Urban and Built-Up	7,049	11.88
Water	5,971	10.06
Agriculture	1,963	3.31
Rangeland	1,146	1.93
Transportation, Communication, Utilities	325	0.55
Barren Land	225	0.38
Total	59,356	100.00

More than 35 percent of the Goose Creek-Dickerson Bay sub-basin is within the St. Marks National Wildlife Refuge (Figure 4). About 190 acres of state lands managed by Wakulla County as Mashes Sands Beach border the southern periphery of the planning area. Other publicly managed lands in the sub-basin include about 980 acres managed by the Northwest Florida Water Management District. In addition to sustaining fish and wildlife populations and a diverse array of interdependent ecosystems, these public lands serve as a resource for public use and recreation and provide an extensive coastal buffer protecting water quality and coastal aquatic habitats. Coastal resilience benefits include floodwater storage, hurricane storm surge protection, reduction of wave energy associated with other coastal storms, and protection of communities from coastal erosion.

3.5 Population and Growth

The University of Florida Bureau of Economic and Business Research (BEBR) (2024) estimated the 2024 population for Wakulla County at 37,313. The population growth rate for the county from 2020 to 2024 was estimated at approximately 10.5 percent. Analysis of 2020 U.S. Census point data indicates a sub-basin population of 10,964, an increase of 1,691 (18 percent) over 2010. The 2023 American Community Survey population estimate for the community of Panacea was 735 (U.S. Census Bureau 2023).

3.6 Water Supply

The Floridan aquifer system is the potable water supply source for the Goose Creek-Dickerson Bay sub-basin. The Floridan aquifer system is comprised of carbonate and dolomitic rocks that reach nearly 1,700 feet in thickness in southern Wakulla County (NWFWMD 2023). Most water production occurs from the St. Marks Formation and the Suwannee Limestone, which comprise the productive upper portion of the aquifer.

The hydrogeology in southern Wakulla County is characterized by high aquifer recharge and groundwater availability. The gradient is relatively flat, with aquifer water levels generally less than 20 feet NAVD88. Local recharge has resulted in the dissolution of carbonate minerals within the aquifer and karst features such as sinkholes, springs, swallets, and phreatic caves are prevalent. Northeast of the sub-basin, approximately 45 miles of phreatic caves have been mapped in the Wakulla cave system by the Woodville Karst Plain Project (C. McKinlay, personal communication, March 14, 2023). Groundwater flows toward the south and discharges to the springs and the Gulf of America. The Spring Creek Spring Group, a first magnitude submarine spring with 14 known vents, is located offshore.

Complex groundwater flow dynamics exist between Wakulla Spring, located approximately five miles northeast of the sub-basin, and the Spring Creek Spring Group (Davis and Verdi, 2014). Following periods of low rainfall, freshwater discharge from Spring Creek Spring Group and head pressure in the Floridan aquifer is not great enough to overcome the equivalent freshwater head of seawater at the coast. As a result, the equivalent freshwater head in the Floridan aquifer increases at the coast and the gradient and direction of groundwater flow reverse. Data indicates saline water from the Spring Creek Spring Group is transported to the Wakulla Spring vent causing an increase in salinity (NWFWMD 2023). Additionally, some groundwater that would have flowed toward the coast appears to be redirected toward Wakulla Spring. An increase in discharge is typically observed at Wakulla Spring following the reversal of Spring Creek Spring Group, although there is a time lag between the flow reversal at Spring Creek Spring Group and subsequent changes in flow and salinity at Wakulla Spring (NWFWMD 2023). Spring Creek reversal events last from days to months (NWFWMD 2023). This is a natural process that has been occurring for at least several decades but has the potential to affect water quality in the Floridan aquifer system.

Water supply service is provided within the planning area by the Panacea Area Water System which serves the unincorporated community of Panacea; the town of Sopchoppy, which serves communities of Crawfordville, Medart, and unincorporated Wakulla County in the western portion of the sub-basin; and Talquin Electric Cooperative, Inc./Wakulla Regional Water System, which serves unincorporated Wakulla County in the eastern portion of the sub-basin including Spring Creek, Shell Point, and Live Oak Point. The NWFWMD (2023) estimated a service area population for the three utilities combined at 22,769 persons. Some residents in the area are served by private wells. Water demand growth is projected to be approximately 25 percent from 2020 to 2045 (NWFWMD 2023).

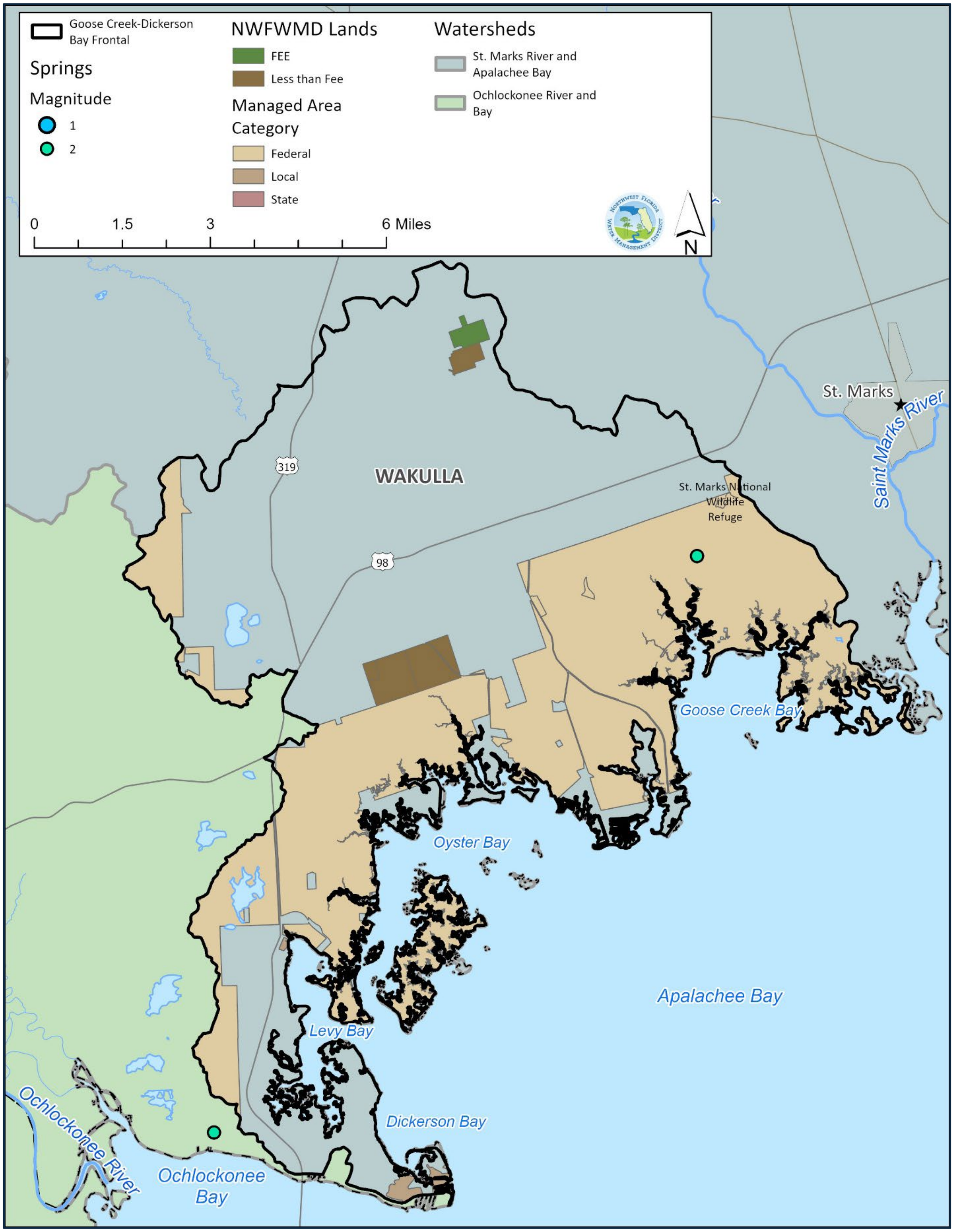

Figure 4. Managed Lands within the Goose Creek – Dickerson Bay Sub-basin

IV. Current Issues and Challenges

Challenges affecting the Goose Creek-Dickerson Bay sub-basin include water quality, aquatic and wetland habitats, public water supply, and flooding and coastal resilience. These issue areas and responsive management strategies are closely interrelated. Water quality, for example, directly influences habitat quality and sustainability. Similarly, healthy aquatic, wetland, and upland ecosystems directly support water quality. Functional floodplains and wetland systems each provide flood protection for surrounding communities, provide fish and wildlife habitat, and protect and improve water quality.

4.1 Monitoring and Trends

Florida's Seagrass Integrated Mapping and Monitoring (SIMM) Program conducts periodic updates to maps and assessments of seagrasses in Florida's estuarine waters, including Apalachee Bay (Yarbro and Carlson 2018). Water-quality data are collected as part of the assessments, including salinity, temperature, depth, Secchi depth, pH, and dissolved oxygen concentration, together with optical water quality parameters — light attenuation, chlorophyll-a concentration, turbidity, total suspended solids, and color. Seagrass conditions and trends are discussed below.

The Florida Department of Agriculture and Consumer Services, Division of Aquaculture, monitors shellfish harvesting areas for the presence of fecal coliform bacteria as an indicator of the possible presence of other pathogens. Water quality issues are discussed in the next section.

4.2 Water Quality

The Goose Creek-Dickerson Bay sub-basin and receiving waters are subject to threats to water quality common to Florida waters, including stormwater runoff and nonpoint source pollution, and challenges associated with wastewater management and treatment. Given that much of the watershed is well protected by conservation lands, such threats are relatively limited within the Goose Creek-Dickerson Bay sub-basin. Nonpoint source pollution is still an issue, however, in developed communities, such as Panacea, and in developing areas. Nonpoint source pollution is generated by stormwater runoff across the landscape carrying pollutants from diffuse sources to receiving waters. Common pollutants include nutrients, sediments, bacteria, pet and wildlife waste, fertilizers, herbicides, insecticides, oils and greases, effluent from onsite sewage treatment and disposal systems (OSTDS), and litter. Sources include residential yards, commercial and industrial sites, streets and parking lots, agricultural areas, construction sites, atmospheric deposition, and erosion sites. The highest rates of pollutant loading, including for nutrients, suspended solids, and biochemical oxygen demand, are typically associated with residential, commercial, industrial, and agricultural land uses (Harper 1999).

The Goose Creek-Dickerson Bay sub-basin includes approximately 3,315 known and likely OSTDS (Figure 5). Additionally, inflow and infiltration into the sanitary sewer system reflecting interactions with shallow groundwater have been identified as a challenge within the planning area.

In addition to pollutant sources within the sub-basin, estuarine receiving waters in the planning area receive considerable freshwater inflow from the St. Marks River and the Spring Creek Spring Group and are therefore influenced by watershed conditions across the larger watershed and the combined Wakulla Spring-Spring Creek groundwater contribution area, as well as more localized runoff and inflow.

Impairments listed by the state of Florida within the Goose Creek-Dickerson Bay planning area include fecal coliform, where shellfish harvesting waters are not fully approved, and nutrients. Waterbodies listed as not attaining standards at the time of this writing are as follows (Table 4).

Table 4. Waters Not Attaining Standards in the Goose Creek – Dickerson Bay Sub-basin

Waterbody	WBID*	Parameters Not Attaining Standards
Dickerson Bay	1223	Fecal coliform (Shellfish harvesting area classified Prohibited)
Dickson Bay	1239	Nutrients (Chlorophyll a) Fecal coliform (Shellfish harvesting area classified Conditionally Restricted [south] and Conditionally Approved [north])
Gulf Waters (Wakulla County, Apalachee Bay)	8026C	Fecal coliform (Shellfish harvesting area classified Conditionally Approved)
Oyster Bay	1176C	Nutrients (Chlorophyll a) Fecal coliform (Shellfish harvesting area classified Conditionally Restricted)
Purify Creek	1176B	Fecal coliform (Shellfish harvesting area classified Prohibited)
Otter Creek	1165	Dissolved Oxygen

* Waterbody Identification Number

Sources:

DEP, Division of Environmental Assessment and Restoration – Impaired Waters, TMDLs, and Basin Management Action Plans Interactive Map
https://floridadep.gov/dear/water-quality-restoration/content/impaired-waters-tmdls-and-basin-management-action-plans

FDACS, Division of Aquaculture – Shellfish Harvesting Area Classification Map #22
https://www.fdacs.gov/Agriculture-Industry/Aquaculture/Shellfish-Harvesting-Area-Classification/Shellfish-Harvesting-Area-Information

The most prominent parameters identified as causing water quality impairment within the sub-basin are bacteria and nutrients. Sources of bacteria and other pathogens potentially include pet and wildlife waste within surface runoff and seepage of groundwater affected by septic tanks and leaking sanitary sewer lines. Nutrients, such as nitrogen and phosphorus, are natural components of aquatic ecosystems and are essential to their productivity. While nitrogen and phosphorus contributions are significantly increased by anthropogenic sources, however, nutrient enrichment has the potential to cause eutrophication, degrading water quality and the quality and extent of important aquatic habitats.

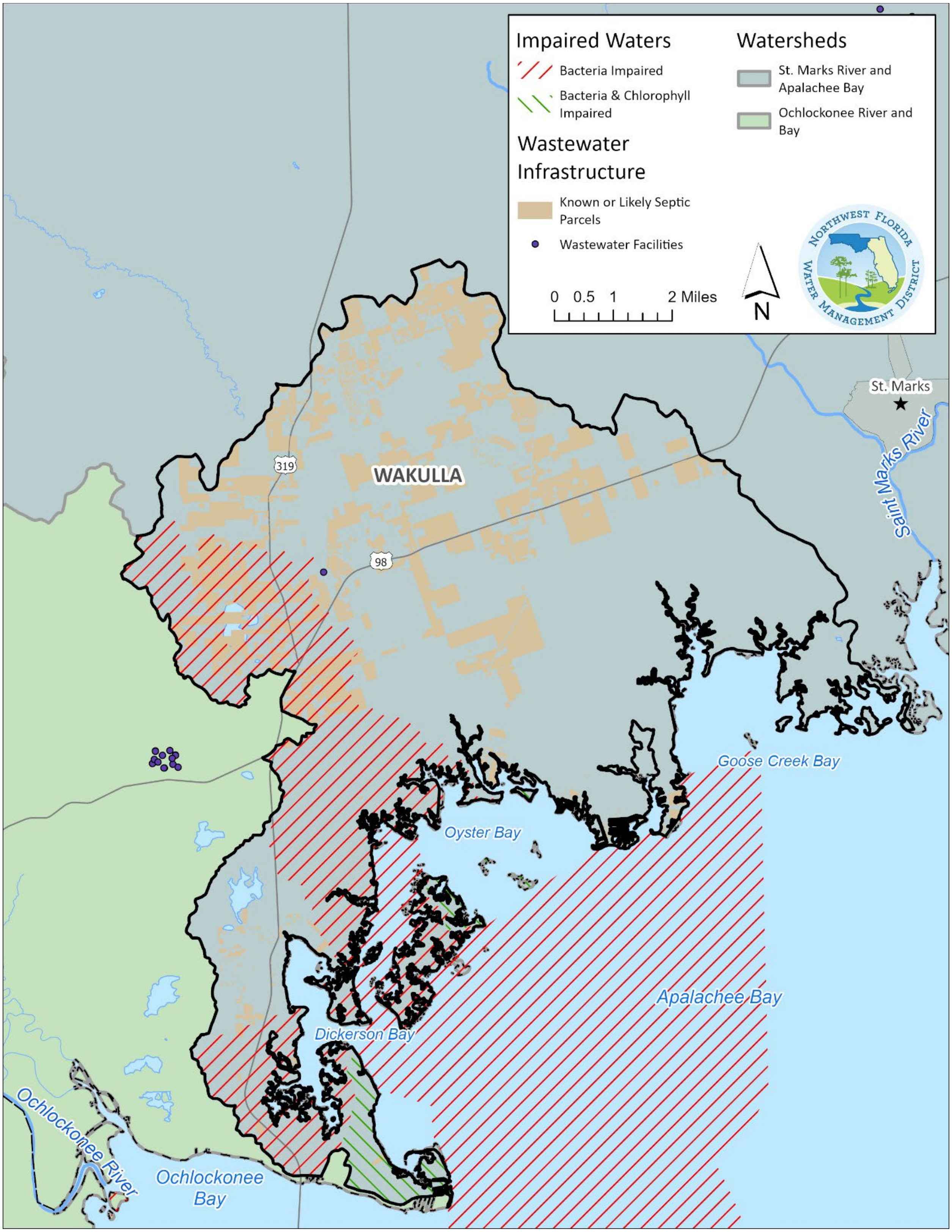

Figure 5. Water Quality Issues within the Goose Creek Dickerson Bay Sub-basin

To address water quality impairment within the greater St. Marks River and Apalachee Bay watershed, the Florida Department of Environmental Protection (2018) has developed a Basin Management Action Plan (BMAP) for the upper Wakulla River and Wakulla Spring. The objective of the BMAP is to reduce nitrate concentrations, enabling the waterbody to achieve the designated total maximum daily load (DEP 2012) (TMDL) and fully meet Florida's numeric nutrient criteria.

4.3 Aquatic and Wetland Habitats

Seagrasses

Seagrasses have proven vulnerable worldwide to water quality impairments, changing climatic conditions, and physical impacts. Orth *et al*. (2006) describes a number of causative stressors, including nutrient enrichment, sediment runoff, invasive species, hydrological alterations, coastal armoring, and sea level rise. Because much of the sub-basin is well protected by conservation lands, the effects of some of these stressors may be comparatively limited in the Goose Creek-Dickerson Bay sub-basin. Climatological risks include increases in sea surface temperature, sea level, and frequency and intensity of storms and associated water quality effects. In addition to their intrinsic importance, seagrass communities are an effective indicator of broader environmental conditions and changes (Orth *et al*. 2006). Seagrass beds integrate environmental effects over time, and changes can therefore signal broader effects on estuarine resources and conditions.

Yarbro and Carlson (2018) indicated seagrass density and species diversity are declining in Apalachee Bay. Stressors noted include diminished optical water quality attributed to phytoplankton concentrations and color, as well as tropical cyclones and heavy rains causing rivers to discharge large volumes of darkly colored, nutrient-rich water. Given their functional importance, diminished area or quality of seagrass communities can cause indirect impacts to commercially important fish and shellfish populations, marine mammals, and water quality.

Oysters

Seavey *et al*. (2011) assessed trends in oyster habitat in the Big Bend region of Florida between 1982 and 2011. The authors found a 66-percent net loss of oyster bar area, with losses concentrated in offshore bars, followed by nearshore and inshore bars. Marsh oyster bars area were found to be most resilient. The authors suggest changes may be attributable to decreased freshwater inputs, acting to make existing bars vulnerable to wave action and sea-level rise. Lewis (2009) discusses oyster reefs and other habitats in the planning area, noting that predation and disease contribute to mortality, affect oyster population dynamics and are related to salinity.

In addition to being valuable as a commercially harvested food source, oysters provide a range of ecosystem services critical to the health and productivity of northwest Florida's estuaries (Radabaugh *et al*. 2019). They improve water quality and clarity through the filter feeding process, improve coastal resiliency by reducing erosion, and they provide important habitat and food for fish, invertebrates, and birds.

Radabaugh *et al*. (2019) described factors essential to the sustainability of oyster populations, including with respect to salinity conditions, runoff and sedimentation, and the rate of shell deposition from new growth relative to the rate of shell loss (the "shell budget"). Oyster populations were noted as having suffered major declines statewide. Principle contributors to this loss and continuing threats include:

- Hydrologic alterations causing unsuitable salinity conditions, both in pulses and in long-term trends.
- Sedimentation, burying oysters and impacting filter feeding and respiration.
- Coastal development and shoreline armoring, increasing sedimentation and runoff, diminishing water quality, reducing available habitat area, and constraining the ability of oysters to migrate shoreward in response to sea level rise.
- Predation and disease, particularly at higher salinity levels.
- Effects of changing climate conditions, including sea level rise, warming, low oxygen levels, and acidification.

Salt Marshes

Salt marshes can be particularly vulnerable to sea-level rise where coastal construction prevents migration of marshes inland along an elevation gradient. Coastal Wakulla County, however, is substantially protected from such impacts due to the presence of the St. Marks National Wildlife Refuge, which provides an extensive buffer area with a continuum of integrated upland and wetland habitats. That said, rising sea levels can increase erosion, undercutting the seaward edges of existing marshes, and cause losses in marsh coverage due to inundation.

4.4 Flooding and Coastal Resilience

The entire planning area is highly susceptible to coastal flooding, including storm surge associated with hurricanes and tropical storms (Wakulla County 2025). Sixty-three percent of the planning area is within the Special Flood Hazard Area (one percent annual chance of flooding), with 29 percent within the VE zone, indicating impacts from waves and high velocity waters during hurricanes and tropical storms (Figure 6). Recent hurricanes causing direct impacts to the planning area include hurricanes Dennis (2005), Hermine (2016), Michael (2018), Idalia (2023), and Helene (2024). The storm surge in the planning area from Hurricane Helene exceeded 12 feet. Other recent storms affecting the planning sub-basin include tropical storms Fay (2008), Debby (2012), and Mindy (2021).

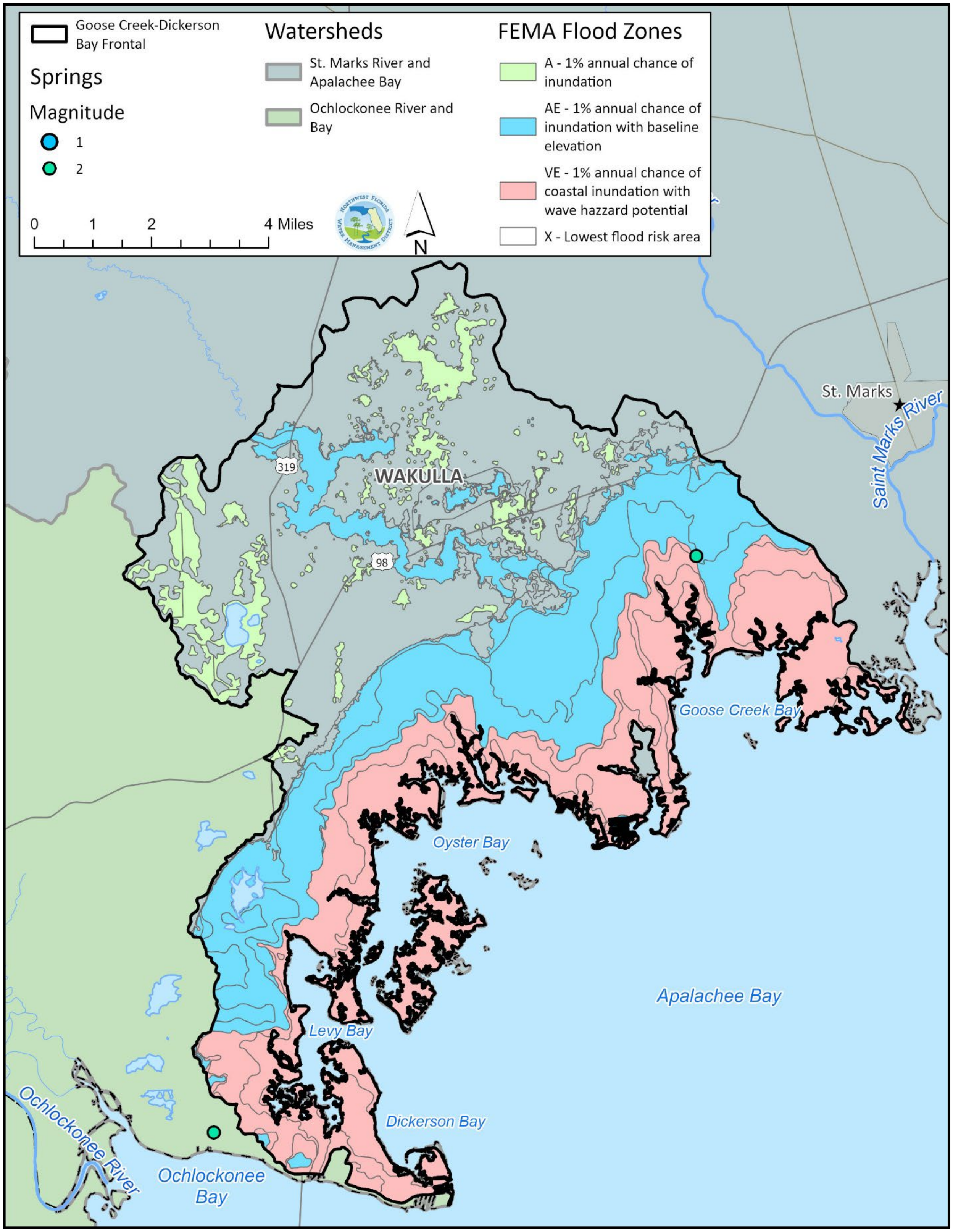

Figure 6. Flood Prone Areas within the Goose Creek – Dickerson Bay Sub-basin

4.5 Water Supply

Challenges potentially faced by water utilities in the planning area include:

- Groundwater quality – Although groundwater availability is good, water quality is a limitation in some areas. The thickness of the uppermost freshwater zone, where the total dissolved solids concentration is below 10,000 mg/L, is relatively thin, at approximately 400 feet or less (NWFWMD 2023). At a deep monitor well installed by the District near U.S. 98 and Spring Creek Highway, water sampled exceeds drinking water standards for total dissolved solids at a depth of 250 feet.
- Coastal well sustainability – Coastal wells are susceptible to coastal flooding and storm surge and, potentially, long-term risks from saltwater intrusion. Mechanisms for saltwater intrusion in this sub-basin include lateral movement, thinning of the freshwater lens as sea levels rise and movement of saline water through the cave system associated with flow reversals of the Spring Creek Spring Group (JSA 2016). The District (2023) analyzed data from coastal wells in Panacea and found no long-term trends with respect to chloride or total dissolved solid concentrations suggesting that water quality may be fairly stable in this area. Prior work identified elevated chloride values at some Panacea and Sopchoppy wells from 2007-2009, which may have been related to drought (JSA 2016). Elevated chloride levels at an inland Talquin well during this same period may have been associated with drought and/or Spring Creek Spring Group flow reversals (JSA 2016). Two water supply production wells located near Shell Point have been abandoned, largely due to high hydrogen sulfide levels.
- Infrastructure retrofit and maintenance – Aging water system pipes can be subject to leakage and infiltration, necessitating repair or replacement. Population growth and new development may also require increased pipe diameters or water line extensions. Associated improvements may include booster pumps, modernized metering and data systems, and looping and sectionalization of water distribution systems.
- Source water protection – Because the Floridan aquifer system is unconfined or semi-confined throughout the Goose Creek-Dickerson Bay sub-basin, the aquifer is vulnerable to impacts from land surface activities (Baker, et. al. 2009).
- Changes in regulated contaminants – Water utilities must track and plan for potential changes in drinking water regulations. An area of ongoing concern for most utilities is changes in regulations regarding per- and polyfluoroalkyl substances (PFAS). PFAS is a category of human-made chemicals that have been widely used in a variety of products and industries, such as firefighting foams, protective coatings, and surfactant applications among many other uses and products (National Groundwater Association 2024).

4.6 Data and Knowledge Gaps

- Water Quality – Water quality can be highly variable, depending on precipitation, freshwater inflow, and seasonal conditions. Infrequent sampling may be inadequate for capturing effects of individual events or evaluating trends over a period of months or years. Additionally, localized conditions may not be captured by widely distributed monitoring stations. Currently, there is not a regular monitoring program focusing on waters within the Goose Creek-Dickerson Bay sub-basin. Substantially increasing the temporal and spatial density of water quality monitoring, at least for one-to-two years, would provide an improved assessment of water quality in the sub-basin.

- Sediment Quality – Sediment data are indicative of the quality of benthic habitats, as well as potential effects from sedimentation, nutrient enrichment, or contaminants. Sediments integrate processes over time and can therefore be useful in assessing long-term impacts. Legacy sediment quality data published by DEP (Seal *et al*. 1994) indicates a single station in the planning area.
- Biological Data – Continued periodic updates to evaluations and maps of seagrass and oyster reef distributions and conditions would facilitate identifying trends and risks for water quality, habitat quality, and coastal resilience.

4.7 Risks and Vulnerabilities

Current issues and vulnerabilities are discussed above. Future risks and ongoing vulnerabilities are summarized as follows:

- Water Quality – Continued population growth and development will bring additional stormwater and wastewater management challenges. It is important to effectively prevent pollutant loading from point and nonpoint sources within a changing landscape. Coastal waters are otherwise vulnerable to eutrophication and harmful algal blooms.
- Seagrasses – The health and extent of Apalachee Bay's important seagrass communities can be impacted by poor water quality conditions and physical impacts. Seagrass bed area at the deeper edges can also be lost due to sea level rise.
- Oysters – Oysters are similarly susceptible to being impacted by pollutant loading and sedimentation. Additionally, oysters can be vulnerable to changing climatic conditions, including warming, low oxygen levels, and acidification.
- Salt Marshes – Salt marshes and littoral habitats are likely to continue to be lost due to sea level rise (both submergence and erosion). Salt marshes are also vulnerable to loss where coastal development and shoreline armoring precludes shoreward migration as sea levels rise.
- Habitat – Fragmentation and Loss. Loss or fragmentation of wetland area within the sub-basin will dimmish beneficial functions of wetlands, including floodwater storage, water quality improvement, and fish and wildlife habitat.
- Storm Surge – The planning area is highly susceptible to coastal flooding, including storm surge associated with hurricanes and tropical storms. Coastal wells are susceptible to flooding and storm surge and potentially vulnerable to saltwater intrusion. Wells in a semi-confined environment are also potentially vulnerable to contamination from land-based sources. Water distribution lines can be subject to leakage and infiltration, requiring repair and replacement.

V. Management Strategies and Projects

Table 5 summarizes management strategies recommended to address the water resource challenges described above. Each approach identified addresses multiple issue areas and objectives, reflecting the interrelated nature of water resource attributes and conditions and the fact that most projects can be designed to achieve multiple complementary outcomes.

Consistent with the SWIM plan (2017), the management strategies and projects incorporated within this work plan are based on a watershed approach to protecting and restoring water resources. A watershed approach is predicated on recognition that the character and quality of a waterbody are defined by conditions across the contributing drainage basin. In other words, managing pollutant sources and protecting the extent and functions of floodplains, wetlands, upland forests, and tributary stream systems across a watershed are essential for protecting a given waterbody and downstream receiving waters.

Table 5. Recommended Management Strategies

Management Strategy	Issue Areas Addressed	Objectives	Description
Stormwater Retrofits	• Water Quality • Aquatic and Wetland Habitats • Flooding and Coastal Resilience	• Improved water quality • Improved flood protection and resilience • Sustained aquatic and wetland ecosystems	Retrofit stormwater systems to incorporate BMPs to improve flood protection and downstream water quality. Identify and implement specific BMPs effective for treating bacteria, suspended solids, and nutrients
Septic Tank Abatement	• Water Quality • Aquatic and Wetland Habitats	• Improved water quality • Sustained aquatic and wetland ecosystems	Connect structures served by OSTDS to central sewer systems, where feasible. Alternatively, modern nutrient reducing septic systems can be installed. Either approach would require funding to incentivize connections or conversions.
Sanitary Sewer System Improvements	• Water Quality • Aquatic and Wetland Habitats	• Improved water quality • Sustained aquatic and wetland ecosystems	Design, permitting, and construction of retrofits to existing sanitary sewer systems to reduce inflow and infiltration of stormwater.
Green Infrastructure	• Water Quality • Aquatic and Wetland Habitats • Flooding and Coastal Resilience	• Improved water quality • Improved flood protection and resilience • Sustained aquatic and wetland ecosystems • Improved public access	Apply "nature-based," green infrastructure methods for multipurpose projects. Projects frequently involve integrating stormwater BMPs, buffer zones, greenways, and living shorelines into public parks and transportation systems.
Water Transmission and Distribution Improvements	• Water Supply	• Enhance system reliability • Provide improved service for existing and future populations • Reduce water loss	Construct water line replacements where existing lines have reached the end of their service lines. Additionally, complete water line replacements, where needed, for public safety and to address water loss, and extend distribution lines to serve growth areas.

Management Strategy	Issue Areas Addressed	Objectives	Description
Well Construction	• Water Supply	• Improve source protection and sustainability	Construct new wells as needed as needed to ensure long-term source sustainability.
Monitoring and Assessment	• Water Quality • Aquatic and Wetland Habitats • Flooding and Coastal Resilience	• Improved understanding of current conditions and trends	Intensive water quality monitoring over the course of one-two years will provide a reliable assessment of current conditions and trends. Periodic updates to assessments and maps of seagrasses and oysters will identify trends and risks for water quality, habitat quality, and coastal resilience.
Ecosystem(s) Restoration	• Aquatic and Wetland Habitats	• Sustained aquatic and wetland ecosystems	Oyster ecosystem restoration Living shorelines restoration Seagrass restoration Wetland restoration

Preliminary project recommendations known at the time of this writing are listed in Table 6. Most of the projects indicated address wastewater challenges, including addressing sewer line inflow and infiltration and the prevalence of septic systems, which may be problematic in a low-lying coastal area. Additional projects address needs to upgrade and improve water service infrastructure. Projects listed, details, and cost estimates will be updated in cooperation with local governments and other cooperators within the planning area.

Table 6. Proposed Projects and Funding Needs Identified within the Goose Creek – Dickerson Bay Sub-basin

Project Name	Project Lead and Partners	Water Resource Benefits	Description	Estimated Total Cost	Funding Need
Talquin Sewer Facility	Wakulla County	Improve water quality in Oyster Bay and Live Oak Island.	The County will purchase Talquin's sewer facility serving Shell Point, and upgrade and expand the system to Oyster Bay and Live Oak Island.	$25,289,135	$25,289,135
Oyster Reef Restoration	Wakulla County Environmental Institute of Tallahassee State College	Create oyster habitat for reef formation. Improve water quality.	The project involves creating oyster habitat by deploying concrete domes to serve as substrate for reef formation. Also provides water quality benefits.	$1,466,358	$1,466,358
Panacea Sewer System Improvements	Wakulla County	Reduce inflow and infiltration (I&I) from stormwater in coastal areas. Improve water quality.	Wakulla County is seeking to rehabilitate the gravity sewer collection system in the unincorporated area of Panacea. Due to its location near Dickerson Bay, Panacea's portion of the County sewer system is subject to I &I of stormwater.	$3,009,062	$3,009,062
Wakulla County Public Access Reuse System	Wakulla County	Provide public-access reclaimed water Reduce demand on potable supplies	This project entails the design and construction of a public access reuse system utilizing effluent from Otter Creek Wastewater Treatment Plant, including a new pumping station and service connections.	$1,375,064	$1,375,064
Panacea Water Main Relocation	Panacea Water System	Maintain reliable water supply during bridge reconstruction.	FDOT is rebuilding Otter Creek Bridge, on which a 10" water main is attached. It must be relocated via directional bore.	$500,000	$500,000
Lake Ellen Septic to Sewer	Wakulla County	Connect ~403 lots to central sewer. Abandon septic tanks to reduce nutrient pollution.	The County is seeking funding for a septic-to-sewer project for the Lake Ellen Proper and Lake Ellen Estates Unit 1 subdivisions adjacent to Lake Ellen.	$15,615,071	$2,534,171
Crawfordville East Phase I Septic to Sewer	Wakulla County	Connect ~41 lots to central sewer. Abandon septic tanks.	Funding for cost overruns on septic-to-sewer project for Eagles Ridge Unit 2 subdivision (some DEP funding already received).	$3,240,017	$1,454,114

Project Name	Project Lead and Partners	Water Resource Benefits	Description	Estimated Total Cost	Funding Need
Crawfordville East Phase III Septic to Sewer	Wakulla County	Connect ~120 lots to central sewer Abandon septic tanks.	Funding for cost overruns on septic-to-sewer project for The Park subdivision (some DEP funding already received).	$10,178,490	$6,643,390
Kirkland Estates Septic to Sewer	Wakulla County	Connect ~71 lots to central sewer. Abandon septic tanks.	Septic-to-sewer project for the Kirkland Estates subdivision.	$8,546,258	$8,546,258
Wildwood Phase II Septic to Sewer	Wakulla County	Connect ~62 lots to central sewer. Abandon septic tanks.	Construction funding for septic-to-sewer project in Wildwood Acres Unit 2 subdivision.	$7,113,006	$7,113,006
Panacea Water Meter Overhaul	Panacea Water System	Replace 1,200 failing meters with AMR. Improve leak detection, accuracy, and maintenance efficiency.	Complete overhaul of 1,200 meters to automatic meter reading technology.	$500,000	$500,000
New Well for Panacea Water System	Panacea Water System	Secure new well to replace expiring lease. Reduce flood risk and saltwater intrusion risk. Improve system reliability and resilience.	Well #6 lease ends in 2029 with no renewal. Design and construct new inland, higher elevation well with updated SCADA system.	$1,700,000	$1,700,000
Emergency Power for Panacea Water System	Panacea Water System	Replace failing 1970 generator. Ensure safe water quality and supply during emergencies. Improve system reliability and resilience.	Emergency power generator replacement for reliable backup.	$100,000	$100,000

Project Name	Project Lead and Partners	Water Resource Benefits	Description	Estimated Total Cost	Funding Need
Water Quality Assessment	NWFWMD ANERR Wakulla County	Understanding long-term needs for water quality protection and improvement	Intensive two-year water quality assessment, with weekly samples collected throughout the embayments and drainages within the sub-basin. Includes water chemistry and statistical analysis and reporting.	$350,000	$350,000
Panacea Distribution System Upgrade	Panacea Water System	Replace ~6,000 ft of aging asbestos (transite) piping. Reduce water loss by up to 50 percent. Improve water quality and fire flow.	Upgrade aging, flood-prone transite piping and loop dead-end lines bordering Dickerson Bay.	$1,921,000	$1,921,000
Total				**$80,903,461**	**$62,501,558**

VI. Monitoring, Metrics, and Next Steps

Setting clear resource protection and restoration goals with associated metrics and monitoring to evaluate progress are essential for achieving the stated objectives. Metrics will be developed cooperatively with local governments and other cooperators to track completion and quantify the benefits of funded projects and monitor trends in environmental indicators. This sub-basin work plan will be updated periodically using adaptive management principles to ensure continued effectiveness.

Examples of metrics for the Goose Creek-Dickerson Bay sub-basin may include:

- Sub-basin-level:
  - Water quality data and trends
  - Aquatic habitat area and trends
- Project level:
  - Project status (percent complete)
  - Quantifiable project benefits achieved (e.g., acres of habitat improved)
  - Project targets/objectives met
- Funding and expenditures:
  - Percent of current budget allocated
  - Percent of budget remaining
  - Total estimated project funding cost
  - Total estimated remaining project funding needs

Maintaining a publicly accessible website for the program will facilitate effective monitoring of work plan implementation, project status and metrics, funding needs, and water quality and habitat trends. Additionally, the website will enhance public awareness regarding water resources within the Goose Creek-Dickerson Bay sub-basin. The website will include information regarding:

- Project status
- Funding and expenditures
- Water quality trends

During 2026, the District, local governments, and state and regional agencies will work collaboratively to refine and prioritize critical water resource issues, as well as the strategies and projects to address the identified issues within the Goose Creek-Dickerson Bay sub-basin. This work plan is anticipated to be finalized by the summer of 2026. As program funding is obtained, the District and project partners will implement the prioritized projects approved by the District's Governing Board. Work plans will be updated periodically to reflect progress achieved, new information, or additional proposed projects and remaining funding needs.

A program website will be created to track project progress, metrics, and expenditures and to share information regarding trends in water quality and aquatic habitat and water supply improvements achieved by program implementation.

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Appendix A. Sub-basin Prioritization Process

Overview of Prioritization Process

The District's 114 HUC-10 sub-basins were analyzed for water quality, water supply, and natural areas criteria using multiple different GIS layers. From this initial analysis, the top-ranked basins from each watershed were selected based on a natural break in scores within each watershed. In total, 34 HUC-10 candidate basins were selected from the seven watersheds. The District then hosted public workshops for each watershed to discuss the candidate sub-basins with the public. Online surveys were also created to expand the opportunity for public input on the sub-basins. The District also reviewed planned projects within the 34 candidate sub-basins based on available information from local governments and utilities. The public feedback from the workshops, online surveys, and project information were then scored and added to each sub-basin's GIS analysis scores to create the final overall scores. The top-ranked candidate sub-basin per watershed was then recommended for the development of a sub-basin workplan. The recommended priority sub-basins were presented to and approved by the District Governing Board on December 10, 2025. Additional details regarding the prioritization process are provided below.

Public Input

During October 2025, the District hosted public workshops for each of the seven watersheds to share information about the program and obtain input regarding the prioritization of sub-basins for work plan development. In addition to the public meetings, the District solicited public input regarding the selection of priority sub-basins within each watershed including water resource areas of concern via online surveys. This public input was a major component in the prioritization process. Scoring was based on survey priority rank responses where basins receiving the highest priority votes for their watershed were awarded the highest points.

Consideration of Proposed Projects

The availability of proposed projects within sub-basins was also considered in the prioritization process. The District requested and reviewed information on current and future projects related to water quality improvement, habitat restoration, and water supply from the public, local governments, and utility companies. Scoring was based on project status where basins including shovel-ready projects received the highest points.

Water Quality Criteria

GIS Layers Assessed: FDEP Statewide Basin Management Action Plan (BMAP) General Areas, FDEP Waters Not Attaining Standards (WNAS), FDEP Alternative Restoration Plans, FDEP Total Maximum Daily Load (TMDL), EPA Established Total Maximum Daily Load (TMDL), NWFWMD Drinking Water Facilities, NWFWD Locally Provided Water Infrastructure, NWFWMD Treatment and Pump Stations, FDEM Storm Surge Zones Tiled, FEMA Flood Special Hazard Area

Analysis Process:

GIS layers depicting the features BMAP area, WNAS, Alternative Restoration Plans, FL TMDL, EPA TMDL, and Storm Surge Zones were overlayed on the District HUC-10 layer and inspected to verify what basins contain each target feature. All basins containing the targeted feature were then awarded points for that parameter.

The FEMA Flood Special Hazard layer was queried to isolate areas susceptible to a 1% chance of annual flooding. The new layer was then spatially isolated to the District HUC-10 basin layer. The sub-basins were then evaluated for total acreage and percent of the sub-basin represented by floodplain and scored using a four-quartile system.

The NWFWMD Drinking Water Facilities, Locally Provided Water Infrastructure, and Treatment and Pump Stations (critical assets) were spatially isolated to the FEMA Flood Special Hazard layer then spatially joined to the District HUC 10 layer. The count of each identified critical asset in the FEMA Flood Special Hazard Layer was then summed per sub-basin and scored using a using a four-quartile system.
Scores for all water quality fields were then summed to create the sub-basins overall water quality score.

<u>**Water Supply Criteria**</u>
GIS Layers Assessed: NWFWMD Planning Region 2, NWFWMD Water Resource Caution Areas, NWFWMD Areas of Resource Concern, FGS Potentiometric Surface Map, Census Bureau 2010 and 2020 Census Block Points

Analysis Process:
GIS layers depicting the features NWFWMD Planning Region 2, Water Resource Caution Areas, Areas of Resource Concern, and FGS Potentiometric Surface Map were overlayed on the District HUC-10 layer and inspected to verify what basins contain the target feature. The FGS Potentiometric Surface Map was analyzed by identifying all sub-basins intersecting and located south of the zero-contour line. All basins containing the targeted feature were then awarded points for that parameter.

The 2010 and 2020 Census Block points were both joined to the District HUC-10 layer and exported to excel. The difference in population and the percent change from 2010 to 2020 was then calculated and sorted from largest to smallest. Each sub-basin was then scored individually for both parameters where 1 equals the smallest amount of population or percent of population change. The two scores were then averaged together and re-scored using a 1-to-10-point scale where 1 represents the lowest 10% of the averaged population score. Additionally, an estimated future population change was also conducted by analyzing BEBR data. The 2020 Census Block Points were joined with the District counties layer and exported. All exported points were then sorted by county and summed. The percent of the county population was calculated for each point's unique ID number. The determined percentage was then multiplied by the estimated 2045 BEBR County Population Estimate to give each point its estimated 2045 estimated population. Using the points' unique ID number, each point was matched to its sub-basin using the previous join to the District HUC-10 layer. The populations for each sub-basin were then summed. The future estimated population was then assessed using the same process as the one described above for the other population analyses. The sum of both scores was then averaged.
Scores for all water supply fields were then summed to create the sub-basins overall water supply score.

<u>**Natural Areas Criteria**</u>
GIS Layers Assessed: NWFWMD 2010 Land Use, NWFWMD 2022 Land Use

Analysis Process:
All 6000 level Florida Land Cover Classification System (FLUCCS) codes were isolated for the 2010 and 2022 layers. Both revised layers were then isolated to the District HUC-10 basins. The natural areas exported were then summed by sub-basin. The total acreage difference and percent acreage change was then calculated for each sub-basin and scored on a 1 to point 10 scale where 1 represents the least amount of natural area change. The two scores for each sub-basin were then added together.

Table A.1 GIS Layers Assessed Reference Table

Layer Name	Year Data Updated	Location
FDEP Statewide Basin Management Action Plan (BMAP) General Areas	2025	Statewide Basin Management Action Plan (BMAP) General Areas | Florida Department of Environmental Protection Geospatial Open Data
FDEP Waters Not Attaining Standards (WNAS)	2025	Waters Not Attaining Standards (WNAS) | Florida Department of Environmental Protection Geospatial Open Data
FDEP Alternative Restoration Plans	2025	Alternative Restoration Plans | Florida Department of Environmental Protection Geospatial Open Data
FDEP Total Maximum Daily Load (TMDL)	2025	Florida Total Maximum Daily Load (TMDL) | Florida Department of Environmental Protection Geospatial Open Data
EPA Established Total Maximum Daily Load (TMDL)	2025	EPA Established Total Maximum Daily Loads (TMDLs) | Florida Department of Environmental Protection Geospatial Open Data
NWFWMD Drinking Water Facilities (Isolated from parent data set by District)	2024	Critical Infrastructure | Florida Department of Environmental Protection Geospatial Open Data
NWFWD Locally Provided Water Infrastructure (Isolated from parent data set by District))	2024	Critical Infrastructure | Florida Department of Environmental Protection Geospatial Open Data
NWFWMD Treatment and Pump Stations (Isolated from parent data set by District)	2024	Critical Infrastructure | Florida Department of Environmental Protection Geospatial Open Data
FDEM Storm Surge Zones Tiled	2022	Storm Surge Zones | Florida State Emergency Response Team
FEMA Flood Special Hazard Area	2024	FEMA Flood Zones | Florida Department of Environmental Protection - MapDirect
NWFWMD Planning Regions	2023	Water Supply Planning Regions | NWFWMD - Open Data
NWFWMD Water Resource Caution Areas	2023	Water Resource Caution Area | NWFWMD - Open Data

NWFWMD Areas of Resource Concern	2023	Resource Concern Area | NWFWMD - Open Data
FGS Potentiometric Surface Map (Isolated from parent data set by District)	2025	Upper Floridan Aquifer Potentiometric Surface | Florida Department of Environmental Protection Geospatial Open Data
US Census Bureau 2010 Block Points	2025	USA Census BlockGroup Points - Overview
US Census Bureau 2022 Block Points	2025	USA Census Block Points - Overview
NWFWMD 2010 Land Use	2024	District Land Use 2010 | NWFWMD - Open Data
NWFWMD 2022 Land Use	2024	NWFWMD 2022 Land Use | Florida Department of Environmental Protection Geospatial Open Data