Draft

Pensacola Bay System Surface Water Improvement and Management Plan

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Abbreviations and Acronyms

AFB	Air Force Base
BARC	Bay Area Resource Council
BFA	Bream Fishermen Association
BMAP	Basin Management Action Plan
BMP	best management practice
cfs	cubic feet per second
CWA	Clean Water Act
DO	dissolved oxygen
ECUA	Emerald Coast Utilities Authority
EECT	Environmental Education Coordination Team
EPA	U.S. Environmental Protection Agency
ERP	Environmental Resource Permitting
ESA	Endangered Species Act
°F	Degree Fahrenheit (temperature)
F.A.C.	Florida Administrative Code
FDACS	Florida Department of Agriculture and Consumer Services
FDEP	Florida Department of Environmental Protection
FDOH	Florida Department of Health
FDOT	Florida Department of Transportation
FEMA	Federal Emergency Management Agency
FGS	Florida Geological Survey
FNAI	Florida Natural Areas Inventory
F.S.	Florida Statutes
FWC	Florida Fish and Wildlife Conservation Commission
FWRI	Fish and Wildlife Research Institute
GEBF	Gulf Environmental Benefit Fund
GEMS	Gulf Ecological Management Site
GIS	Geographic Information Systems
GSA	Geological Survey of Alabama
I-10	Interstate 10
IWR	Impaired Surface Waters Rule
LOST	local option sales tax
MFLs	minimum flows and minimum water levels
mgd	million gallons per day
MS4s	municipal separate storm sewer systems
NAS	Naval Air Station
NFWF	National Fish and Wildlife Foundation
NPS	nonpoint source (pollution)
NRC	National Research Council
NRCS	Natural Resources Conservation Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRDA	Natural Resource Damage Assessment
NWFWMD	Northwest Florida Water Management District
OFWs	Outstanding Florida Waters
OSTDS	onsite sewage treatment and disposal systems
PERCH	Partnership for Environmental Research and Community Environmental Health
RESTORE	Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States (Act)
SAV	submerged aquatic vegetation
SEAS	Shellfish Environmental Assessment Section
SHCA	Strategic Habitat Conservation Area
SIMM	Seagrass Integrated Mapping and Monitoring
SMZs	Special Management Zones
SWIM	Surface Water Improvement and Management
SWTV	Surface Water Temporal Variability
TMDL	total maximum daily load
TNC	The Nature Conservancy
UF-IFAS	University of Florida Institute of Food and Agricultural Sciences
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WBID	Waterbody identification number
WFRPC	West Florida Regional Planning Council
WMA	water management area
WWTF	wastewater treatment facility
WWTP	wastewater treatment plant

1.0 Introduction

The Surface Water Improvement and Management (SWIM) plan for the Pensacola Bay system is intended to provide a framework for resource management, protection, and restoration using a watershed approach. The SWIM Program is administered through the Northwest Florida Water Management District (NWFWMD or District) and includes management actions to address water quality, natural systems, and watershed functions and benefits. This plan is an update to the original plan developed in 1990 and updated in 1997 (NWFWMD 1997).

The Pensacola Bay system is inclusive of the interconnected estuarine waterbodies of Escambia Bay, Pensacola Bay, Blackwater Bay, East Bay and Santa Rosa Sound; the Escambia, Blackwater, East Bay Yellow, and Shoal rivers; and the greater contributing watershed. The watershed extends from southern Alabama south to the Gulf of Mexico. Within Florida, it includes portions of Escambia, Santa Rosa, Okaloosa, and Walton counties. Although about two-thirds of the contributing watershed is within Alabama, the scope of this plan for implementation purposes is limited to the Florida portion.

The Pensacola Bay system provides important environmental functions with numerous benefits and services for surrounding communities. Among watershed services are water storage and flood attenuation, groundwater recharge, regulation of discharge to receiving waters, water quality protection, cycling of energy and nutrients, erosion control, and stream bank stabilization. Additional human benefits are usable surface and ground waters, fish and wildlife resources, recreational opportunities, aesthetic characteristics, and associated economic benefits.

1.1 SWIM Program Background, Goals, and Objectives

Surface Water Improvement and Management plans are developed pursuant to the SWIM Act, enacted by the Florida Legislature in 1987 and amended in 1989 through sections 373.451-373.459, Florida Statutes (F.S.). Through this Act, the Legislature recognized threats to the quality and function of the state's surface water resources. The Act authorized the state's five water management districts to:

- Develop plans and programs to improve management of surface waters and associated resources;
- Identify current conditions and processes affecting the quality of surface waters;
- Develop strategies and management actions to restore and protect waterbodies; and
- Conduct research to improve scientific understanding of the causes and effects of the degradation of surface waters and associated natural systems.

In addition to the SWIM Act of 1987, the following Florida statutes and rules support and complement the SWIM program:

- Chapter 259, F.S.: Florida Forever Act
- Chapter 375, F.S.: Land Acquisition Trust Fund
- Section 403.067(7)(a)4, F.S.: Total Maximum Daily Loads (TMDLs)
- Section 373.042, F.S.: Minimum Flows and Minimum Water Levels
- Chapter 62-43, Florida Administrative Code (F.A.C.): Surface Water Improvement and Management Act
- Chapter 62-302, F.A.C.: Surface Water Quality Standards
- Chapter 62-303, F.A.C.: Identification of Impaired Surface Waters; and
- Chapter 62-304, F.A.C.: TMDLs

For the purposes of SWIM, watersheds are the hydrological, ecological, and geographical units for planning and managing restoration efforts along Florida's Gulf Coast. Watershed management requires coordination of complementary programs among jurisdictions, agencies, and stakeholders, including local, state, and federal governments, non-governmental organizations, and private citizens.

The SWIM program addresses watershed priorities by identifying management options and supporting cooperative project implementation. Projects may include stormwater retrofits for water quality improvement, wetland and aquatic habitat restoration, resource assessments, and wastewater management improvements, among others.

Surface Water Improvement and Management plans integrate complementary programs and activities to protect and restore watershed resources and functions. They are also designed to address water quality and natural systems challenges more broadly outlined in the District's strategic plan.

In the Pensacola Bay system, major stakeholders include:

- The Northwest Florida Water Management District
- Florida Department of Environmental Protection
- Florida Fish and Wildlife Conservation Commission
- Florida Department of Agriculture and Consumer Services
- Florida Department of Economic Opportunity
- West Florida Regional Planning Council
- The Bay Area Resource Council
- Escambia, Santa Rosa, Okaloosa, and Walton counties
- Municipalities including Pensacola, Jay, Gulf Breeze, Milton, Paxton, Mary Esther, Laurel Hill, Century, and Crestview
- Emerald Coast Utilities Authority
- Unincorporated communities, including Pace, Ferry Pass, Bagdad, Holley, Navarre, Holt, and Allentown
- The Bream Fisherman Association
- The Bayou Chico Association
- U.S. Environmental Protection Agency
- U. S. Department of Agriculture
- U.S. Department of the Interior
- U.S. Fish and Wildlife Service
- The Nature Conservancy
- The National Fish and Wildlife Foundation
- And many others

1.2 Purpose and Scope

Development of the 2017 Pensacola Bay system SWIM Plan update (hereafter the 2017 SWIM Plan) is funded by a grant from the National Fish and Wildlife Foundation's (NFWF) Gulf Environmental Benefit Fund (GEBF), with the intent to further the purpose of the GEBF to remedy harm and eliminate or reduce the risk to Gulf resources affected by the Deepwater Horizon oil spill.

This 2017 SWIM Plan continues support for actions identified in the 1997 Plan, while also addressing new issues, ongoing challenges, and opportunities for achieving watershed protection and restoration. Further, the 2017 SWIM Plan describes the watershed's physical characteristics and natural resources, provides an assessment of current conditions, and identifies priority challenges affecting watershed resources and functions.

To support implementation, the 2017 SWIM Plan prescribes a set of management actions and strategies to meet the identified challenges. Management actions included are primarily those within the mission and scope of the NWFWMD SWIM program, recognizing the ongoing initiatives and needs of local communities and other agencies. The strategies outlined are intended to leverage funding from many sources; integrating the efforts of local governments, state and federal agencies, and private entities to achieve mutual objectives and goals; and to present innovative solutions to watershed issues.

2.0 Watershed Description

2.1 Geographic and Geological Characteristics

Pensacola Bay system watershed attributes:

- Two states: Alabama and Florida
- 4,371,534 acres
- Five interconnected estuarine waterbodies
- Three major river systems
- Four Florida counties
- 31 distinct natural communities

The contributing watershed of the Pensacola Bay system covers approximately 4,371,534 acres extending from southern Alabama through the western Florida Panhandle. The watershed includes three major rivers: the Escambia, Blackwater, and Yellow rivers, as well as the smaller East Bay River. These, in turn, discharge into the estuarine component of the watershed, which includes Escambia Bay, Pensacola Bay, Blackwater Bay, East Bay, and Santa Rosa Sound. The Escambia River, the largest in the watershed, begins as the Conecuh River in Alabama. The Blackwater and Yellow rivers also have their origins in southern Alabama.

Within Florida, the watershed encompasses the majority of Escambia, Santa Rosa, and Okaloosa counties and the northwest quadrant of Walton County (Figure 2-1). In Alabama, the watershed is mostly located in Covington, Escambia, and Conecuh counties; with smaller areas in Butler, Crenshaw, Pike, Montgomery, and Bullock counties.

Florida municipalities in the watershed include the cities of Pensacola, Gulf Breeze, Milton, Crestview, Century, Jay, Paxton, Laurel Hill, and Mary Esther. Unincorporated communities include Pensacola Beach, Warrington, Pace, Navarre, Navarre Beach, and Holt. The watershed also includes Naval Air Station (NAS) Pensacola and NAS Whiting Field, and a portion of the Eglin Air Force Base (AFB) reservation.

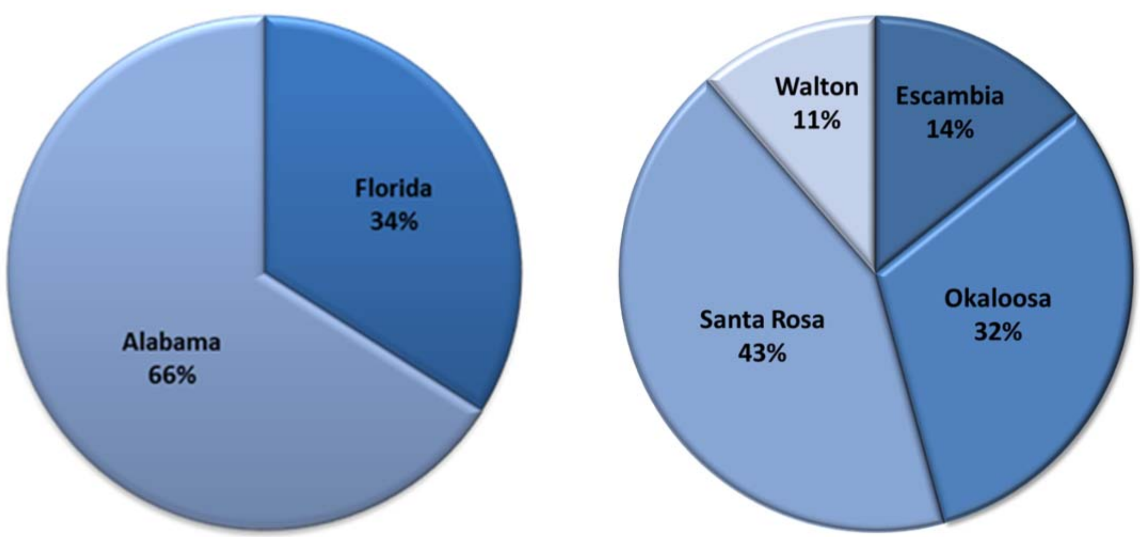


Figure 2-1 Proportion of the Pensacola Bay Watershed by State and Florida Counties

Source: FHWA 2014; NOAA 2015a; USGS 2015, 2016a.

Figure 2-2 Features of the Pensacola Bay Watershed (Florida Portion)

The overall watershed, including Alabama's portion, lies within the Gulf Coastal Plain physiographic region, which is characterized by gently rolling hills, sharp ridges, prairies, and alluvial floodplains underlain by sediments of sand, gravel, porous limestone, chalk, marl, and clay. Within this greater physiographic region, the Florida portion of the watershed contains two localized physiographic regions: the Western Highlands and the Gulf Coastal Lowlands (USGS 2013).

The Escambia, Blackwater, and Yellow river basins are within the Western Highlands subsection of the Northern Highlands, which spans the northern Panhandle. The Northern Highlands region is characterized by greater topographic relief than the Gulf Coastal Lowlands and contains extensive clay deposits overlying limestone bedrock of the Citronelle formations, ancient delta deposits of clays, clayey sands, and gravel. The Western Highlands extend from 378 feet in elevation in Alabama down to a relict marine terrace of approximately 100 feet (Rupert 1993). The rolling hills of the Western Highlands have sandy soils and generally dry conditions, with groundwater emerging from lower slopes to create hillside seepage bogs (Wolfe *et al.* 1988).

The estuarine embayments are within the Gulf Coastal Lowlands; a region of successively higher, parallel terraces rising from the coast. Terraces of the Gulf Coastal Lowlands formed during the Pleistocene Epoch when fluctuating sea levels were associated with the growth and melting of ice caps. Dunes, barrier islands, beach ridges, and other topographical features were stranded inland as seas receded. Land surfaces are generally level and less than 100 feet above sea level. Substantial areas are less than 30 feet above sea level and are characterized by extensive wetlands. Higher elevations are present in the general area of Pensacola, on the west side of Escambia Bay and the north side of Pensacola Bay.

The watershed of the Pensacola Bay system follows much of the general stratigraphy of the western Florida Panhandle. Many of the watershed's geologic features are a product of prehistoric marine deposition during periods when sea level was higher than the present. Near-surface formations within Florida's portion of the watershed include dolomitic limestones, sandy clayey limestones, shell beds, clayey sands, and sands (Scott 2001). Overlying most geologic formations are unconsolidated Holocene (11,700 years ago to the present) siliciclastic sediments (nearly pure quartz sands with minor heavy mineral sands) (Scott 2001). These were deposited during sea level fluctuations and are presently found on the barrier islands.

In the upper portion of the watershed, the Citronelle Formation forms the stream-incised hills of the Western Highlands and forms a distinct bluff at Bay Bluff, along the western shore of Escambia Bay (USDA 2004). Additionally, the Miocene (origins 23.3 to 5.3 million years before present) Alum Bluff Group is found along the upper reaches of the Yellow and Shoal rivers.

Most of the southern boundary of Escambia and East bays is formed by the Fairpoint Peninsula, a sandy coastal barrier feature. The southern boundary of the system is formed by Santa Rosa Island, which is approximately 50 miles long and varying between approximately 1,000-1,500 feet wide (Morang 1992). The island is made up of Holocene quartz sands, between 15 and 30 feet thick, overlying a Pleistocene (2.6 million years to 11,000 years before present) core.

Soils in the southern portion of the watershed, in the vicinity of the estuary are predominantly of sandy composition. Soils in the northern reaches typically contain more organic matter and are of moderate permeability. Hydric soils are predominantly found along the floodplains of the major rivers and tributaries and other wetland systems. Detailed information about the watershed's physiography, geology, and soils is provided in Appendix C.

2.2 Hydrologic Characteristics

2.2.1 Major Streams and Tributaries

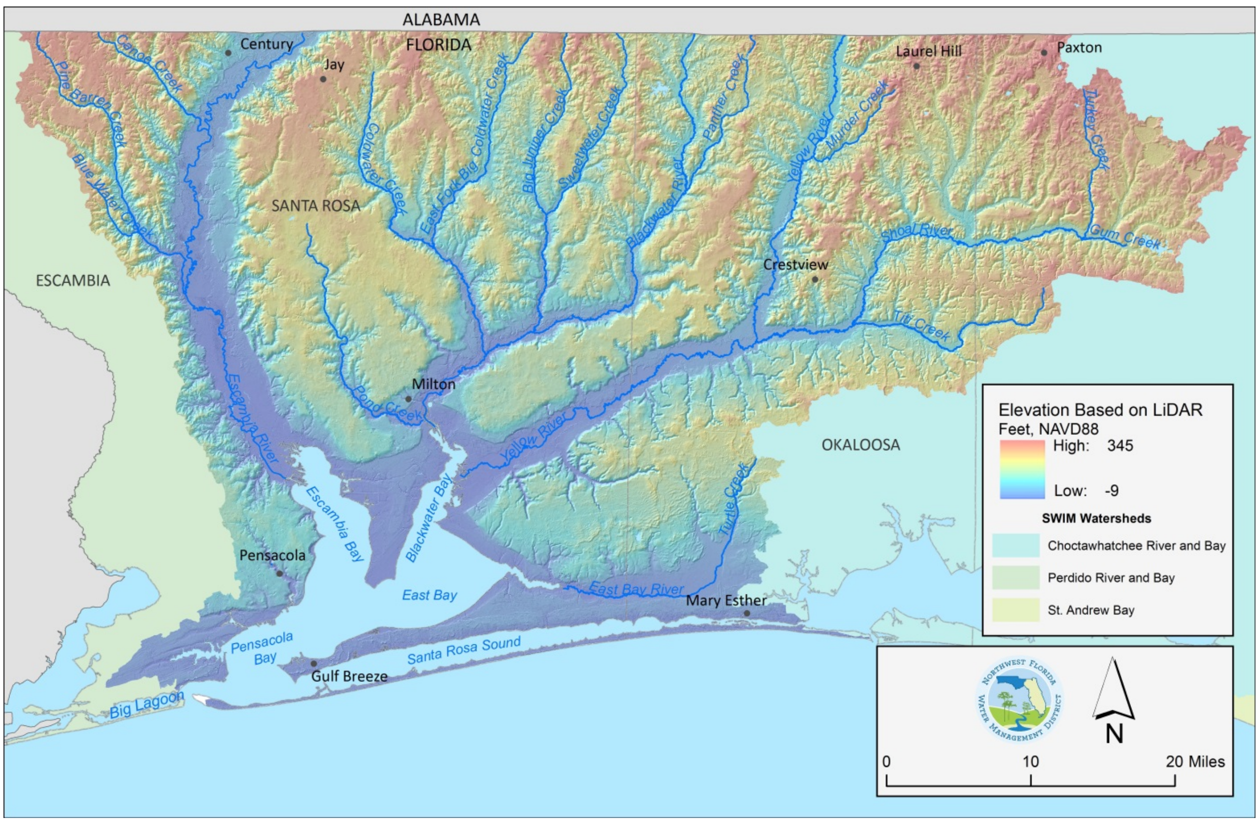
The three major river systems of the watershed begin as blackwater streams in southern Alabama. Of these, the Escambia River is the largest, extending 240 miles from Escambia Bay to Pike County, Alabama, draining over 4,200 square miles across both states (90 percent within Alabama). The Yellow River extends approximately 110 miles from the eastern shore of Blackwater Bay to a point northeast of Andalusia, Alabama. The Yellow River is joined by its major tributary, the 33-mile Shoal River, near the City of Crestview. The Yellow River drainage basin covers 1,365 square miles, with 64 percent within Florida. The Blackwater River flows approximately 60 miles and drains 860 square miles, of which 81 percent is in Santa Rosa and Okaloosa counties. East Bay River, a smaller 15-mile river located in coastal Santa Rosa and Okaloosa counties, enters East Bay near Navarre and Eglin AFB. Average annual flows of the major river systems discharging into the Pensacola Bay system are listed in Table 2-1. Surface water features are shown in Figure 2-3.

Table 2-1 Average Annual Flow of the Major Rivers

River	Period of Record	Average Annual Discharge*
Escambia River near Century	1935-2016	6,070
Yellow River near Milligan	1938-2016	1,147
Shoal River near Crestview	1938-2017	1,094
Blackwater River near Baker	1950-2016	348

* Cubic feet per second
Source: U.S. Geological Survey, National Water Information System

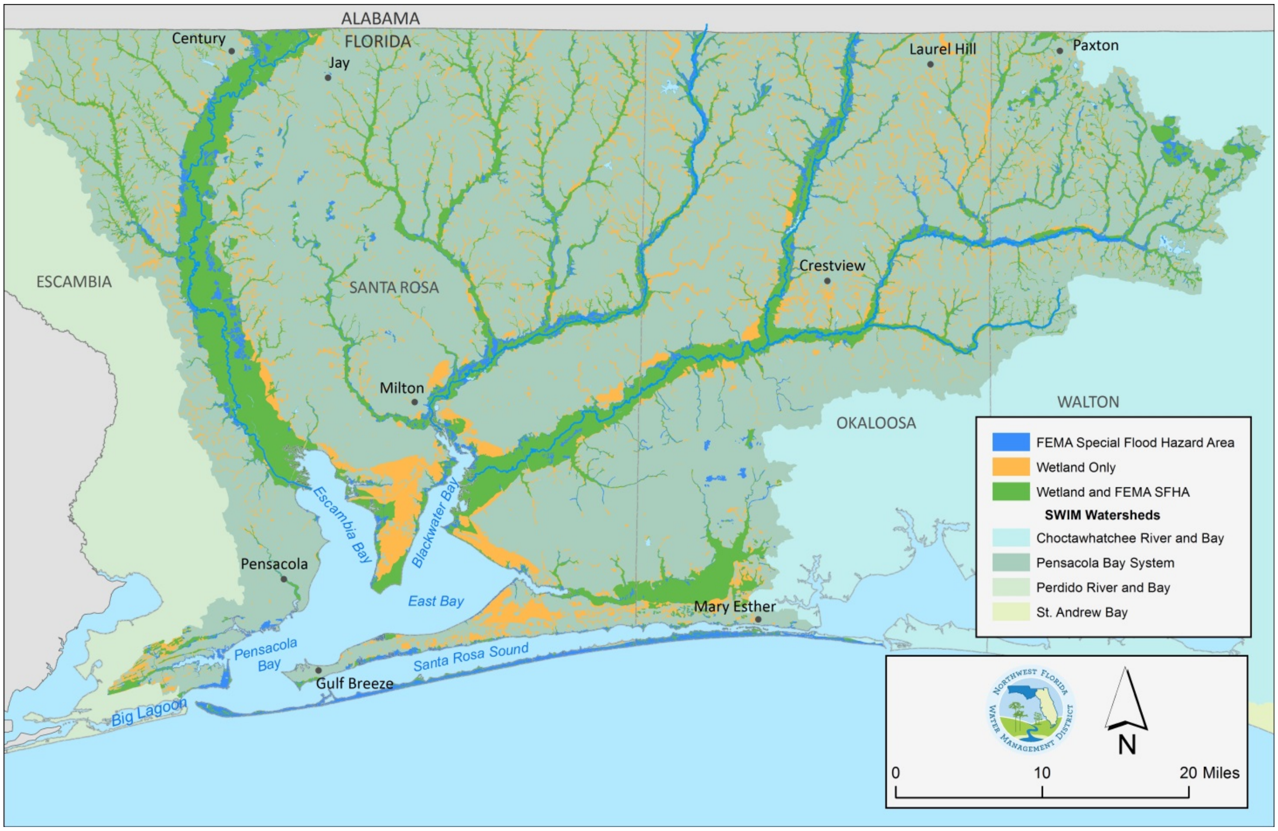
In addition to the major rivers, there are numerous smaller tributaries of the rivers and estuary. Among these are Carpenter Creek, Pond Creek, Big Coldwater Creek, Pine Barren Creek, and Titi Creek, as well as drainages through numerous smaller embayments (bayous) along Pensacola, Escambia, East, and Blackwater bays.



Source: NWFWMD 2010
Figure 2-3 Topography and Major Waterbodies

2.2.2 Floodplains and Wetlands

As illustrated by Figure 2-4, extensive floodplains encompass the lengths of the Escambia and Yellow Rivers. Major wetland systems are also within the Garcon Point and Fairpoint peninsulas, and within the headwaters of the East Bay River. Most of the floodplains within the watershed correspond with wetlands. Wetland communities are described further in Section 2.4.



Source: FEMA 2017, FDEP 2015a, and USFWS 2016b
Figure 2-4 Floodplains and Wetlands

2.2.3 Coastal Waterbodies

Estuarine waters of the Pensacola Bay system, including Pensacola Bay, Escambia Bay, Blackwater Bay, East Bay, and Santa Rosa Sound, encompass approximately 187 square miles. The estuary exhibits a low tidal range with limited flushing and circulation and vertical salinity stratification (Olinger *et al.* 1975). Conditions in Escambia, Pensacola, Blackwater, and East bays are heavily influenced by riverine inflow.

Pensacola Bay is located in Escambia and Santa Rosa counties and has an approximately one-half mile wide pass to the Gulf of Mexico. Escambia and East Bays adjoin Pensacola Bay, along with bayous Texar, Chico, and Grande. Escambia Bay is immediately north of Pensacola Bay and covers roughly 36 square miles between Garcon Point on the east and Magnolia Point to the west. The primary source of fresh water inflow to Escambia and Pensacola bays is the Escambia River. Additional freshwater sources are Pace Mill Creek, Carpenter Creek, and Jones Creek, as well as the contributing basins of several bayous.

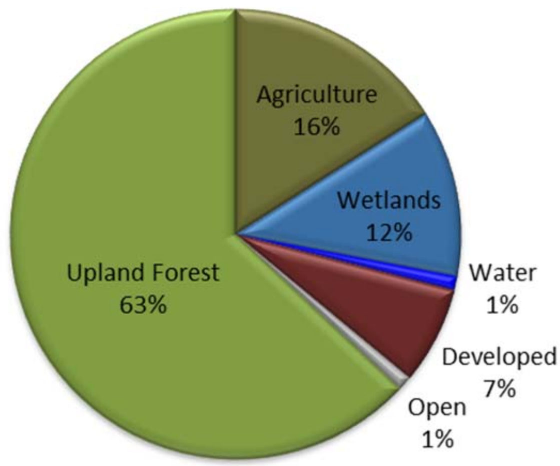
Located at the mouth of the Blackwater River, Blackwater Bay covers approximately 10 square miles and is influenced by inflow from the Blackwater and Yellow rivers. East Bay adjoins Blackwater Bay at Escribano Point and Pensacola Bay between Garcon Point and Redfish Cove. The shoreline along Escribano Point and areas of Garcon Point are largely undeveloped.

Santa Rosa Sound is a 42-square-mile lagoon extending from Pensacola Bay and Gulf Breeze in the west to its confluence with Choctawhatchee Bay. The Sound is bordered to the north by the Fairpoint Peninsula and Santa Rosa Island to the south.

A prominent characteristic of the Pensacola Bay system estuary is a series of bayous that define much of the littoral zone. Bayous Grande, Chico, and Texar intersect with the City of Pensacola and NAS Pensacola. The drainage basins contributing to these bayous include Jones Swamp and Creek and Carpenter Creek. Major bayous on Escambia Bay in Santa Rosa County are Mulatto Bayou and Indian Bayou. The City of Gulf Breeze also has large bayous on the south shore of Pensacola Bay.

2.3 Land Use and Population

Land use and land cover across the greater Pensacola Bay system watershed, including Alabama, is predominantly upland forest, with substantial portions also consisting of wetlands, agricultural lands, and developed areas (Figure 2-5).



Source: FDEP 2015a, USGS 2011

Figure 2-5 Interstate Land Cover: Pensacola Bay System Watershed

Within Florida, upland forest encompasses nearly half of the watershed. Wetlands encompass nearly 20 percent of the watershed, with agricultural and developed lands each comprising approximately 14 percent of the watershed (Table 2-2).

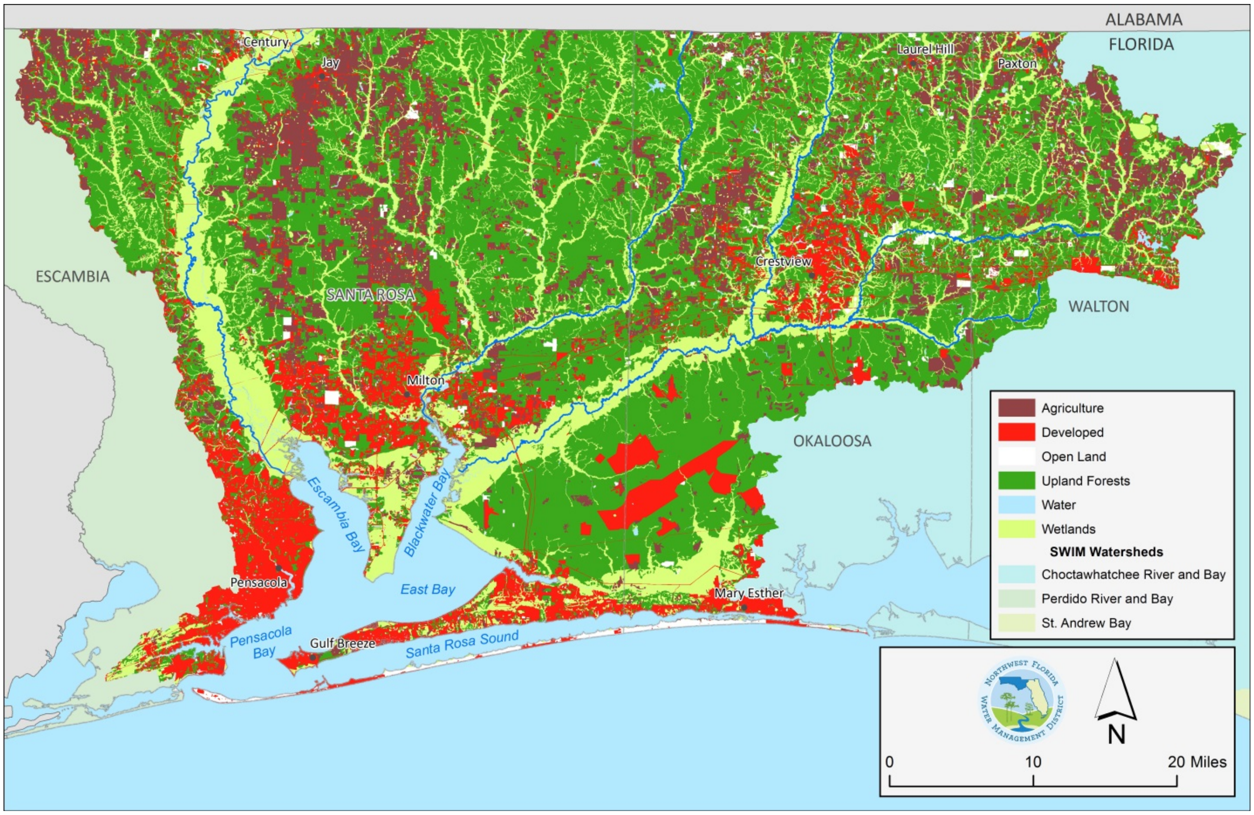
Table 2-2 2012-2013 Land Use and Land Cover Within the Pensacola Bay Watershed (Florida)

General Land Use Category	Approximate Area[1]	Percent of Basin
Agriculture	330.5	14.2
Developed	315.4	13.5
Open Land	38.1	1.6
Upland Forests	1161.0	49.7
Water	27.3	1.2
Wetlands	462.5	19.8

Source: FDEP 2015a
[1]Square miles

Urban development is concentrated in the southern and southwestern portion of the watershed, mostly within the Pensacola metropolitan area. This development extends south and east from the City of Pensacola to include Navarre, Pace, Pensacola Beach, Milton, and Gulf Breeze. Urban development in the northern portion of the watershed is mostly localized around the City of Crestview in Okaloosa County.

Agricultural lands are concentrated in northern Escambia County, central and northern Santa Rosa and Okaloosa counties, and northern Walton County. Floodplains and wetlands are concentrated along the Escambia and Yellow Rivers, Garcon Point, and the East Bay River and Jones Creek basins. Generalized land use and land cover within Florida are presented in Figure 2-6.



Source: FDEP 2015a

Figure 2-6 2012-2013 Land Use and Land Cover

Public lands in the watershed include the Blackwater, Escambia, and Yellow River water management areas (WMAs), Gulf Islands National Seashore, Blackwater River State Forest, several state parks, and U.S. Department of Defense lands. These lands provide a buffer system that helps protect water quality, provide flood protection, and sustain integrated terrestrial and aquatic ecosystems. The District's WMA lands cover approximately 55,592 acres along the Escambia, Blackwater, and Yellow rivers and the Garcon Point peninsula. Gulf Islands National Seashore encompasses approximately 3,000 acres on Santa Rosa Island. Among state lands in the watershed are the Escribano Point Wildlife Management Area, Blackwater River State Forest, and the Blackwater River and Yellow River Marsh Preserve state parks. Public and conservation lands are discussed in more detail in Appendix G.

The largest concentrations of population in the watershed are within Escambia and Santa Rosa counties. Table 2-3 displays population estimates for the watershed, based on spatial analysis of 2010 U.S. Census data, together with projections to 2030 calculated based on countywide population growth projections from the University of Florida's Bureau of Economic and Business Research (UF BEBR 2016).

Table 2-3 Watershed Population Estimates: 2010-2030

County	2010	2020	2030
Escambia	178,766	188,743	196,279
Santa Rosa	151,372	178,731	205,142
Okaloosa	84,867	94,431	100,580
Walton	9,481	11,937	14,538
Total	**424,486**	**473,842**	**516,538**

2.4 Natural Communities

This section provides a summary of habitats and natural communities found in the watershed, particularly those most-influenced by surface water management activities, as well as information about some of the more important biological resources associated with them. More detailed information on the habitats and natural communities observed in the Pensacola Bay watershed, as well as the species those habitats support, are described in Appendices D and E.

Lewis *et al.* (2016) estimate that the Pensacola Bay system supports at least 1,400 estuarine plant and animal species, in addition to migratory species. Aquatic habitats within the watershed include salt marshes, seagrass beds, and oyster reefs. These habitats support wintering migratory waterfowl and many marine organisms, including juvenile sea turtles and commercially and recreationally important fish and shellfish. More than 200 species of fish and shellfish have been reported in the waters of the Pensacola Bay system, including five diadromous species: Alabama shad (*Alosa alabamae*), skipjack herring (*Alosa chrysochloris*), hogchocker (*Trinectes maculatus*), Gulf sturgeon (*Acipenser oxyrhynchus desotoi*), and American eel (*Anguilla rostrate*) (FDACS 2013b).

2.4.1 Terrestrial Communities

Terrestrial habitats within the Pensacola Bay watershed include bluffs, longleaf pine-wiregrass forests, mesic flatwoods, sandhill and scrub communities, scrubby flatwoods, slope forests, upland hardwood forests, wet flatwoods, and xeric hammock. The conditions of these habitats vary widely across the watershed, depending on land use, land management, and other factors.

Many of the native pine forests have been cut for timber, cleared for agriculture, or intensively managed for silviculture. As a result, the watershed's uplands are now a mosaic of natural regeneration forests, pine plantations, agricultural lands, and developed areas (NWFWMD 1990). Terrestrial communities also support a number of threatened and endangered species. Federally listed species within the watershed include the gopher tortoise (*Gopherus polyphemus*), gopher frogs (*Rana capito*), the reticulated flatwoods salamander (*Ambystoma bishopi*), the eastern indigo snake (*Drymarchon corais couperi*), and the red-cockaded woodpecker (*Picoides borealis*). All have been documented on the watershed's conservation lands including the Blackwater River State Park (FDEP 2016a). The Blackwater River State Forest is part of a series of contiguous conservation lands, including the Conecuh National Forest and Eglin AFB. Together, these lands constitute the largest remaining contiguous area of the mature longleaf pine forest ecosystem in the world and support one of the largest populations of red-cockaded woodpecker habitat on public lands (FDACS 2013b).

2.4.2 Major Rivers

The Escambia River is a large alluvial river that carries a heavy sediment load and has substantial variation in flows and a diversity of aquatic and wetland habitat types. The upper river (within Florida) is sand-bottomed, with sand bars and beaches forming along the inside arcs of river bends. According to Bass (1990), in-stream vegetation tends to be lacking, with habitat primarily provided by snags, exposed tree roots, and undercut banks. Bottomland hardwood forest and oxbow lakes border the main river, and pine forest occupies much of the riparian zone.

The Blackwater River and its tributaries are relatively shallow sand-bottomed streams. The lower river is tidally influenced, with large basins that provide additional habitat diversity. The Yellow River intersects the Western Highlands Region, creating substantial bluffs, prior to discharging into Blackwater Bay from the east. The Yellow River is described as a sand bottom river and is characterized by shallow clear-tan waters. Its primary tributary, the Shoal River, originates in Walton County. Titi Creek is the major tributary of the Shoal River.

The Escambia and Conecuh rivers, as well as several tributaries, are designated as critical habitat for the threatened Gulf sturgeon (*Acipenser oxyrinchus desotoi*). Additional critical habitat area is within the lower Blackwater River, the Yellow River, and the Shoal River from its confluence with the Yellow River to the U.S. Highway 85 overpass. Within the critical habitat are discrete areas that serve as potential spawning locations during the spring high flow events, and as summertime holding areas. These summertime holding areas are extremely important to the survival of the sturgeon, since the fish do not migrate to the estuary and gulf until the fall. The quality of the holding areas is also thought to be a significant factor in the reproductive health of the female sturgeon.

The main channel holding areas are often moderately deep to deep (~3-7 meters) runs, glides, gradual bends, or pool tail-outs. Main channel areas occurring immediately downstream of springs, tributaries, or distributary confluences are sometimes selected as holding areas, perhaps due to the water depth, water velocity, cool water influences of the tributary, or water chemistry. The second primary river habitat where sturgeon can be found are off-channel areas that are sheltered from the primary current of the main channel. These mesohabitats are often described as sloughs, bowls, or basins and typically have a deep and open connection to the main channel (Kaeser, 2016). Estuarine waters within the Pensacola Bay system are also designated critical habitat for the Gulf sturgeon, providing important winter habitat.

The Escambia, Yellow, and Shoal rivers provide critical habitat for several species of threatened and endangered freshwater mussels. The Escambia River includes critical habitat for the Round ebonyshell (*Fusconaia rotulata*), Choctaw bean (*Villosa choctawensis*), fuzzy pigtoe (*Pleurobema strodeanum*), southern kidneyshell (*Ptychobranchus jonesi*), southern sandshell (*Hamiota australis*), and narrow pigtoe (*Fusconaia burkei*). The Escambia River in Alabama also includes critical habitat for the Alabama Pearlshell (*Margaritifera marrianae*). The Yellow River system includes critical habitat for the Choctaw bean, narrow pigtoe, southern sandshell, and fuzzy pigtoe.

2.4.3 Riparian, Palustrine, and Floodplain Habitats

Riparian habitats include those areas along waterbodies that serve as an interface between terrestrial and aquatic ecosystems. Riparian areas are important fish and wildlife habitats that promote ecological diversity and assist in mitigating or controlling NPS pollution. Riparian vegetation can be effective in removing excess nutrients and sediment from surface runoff and shallow groundwater and in shading streams to optimize light and temperature conditions for aquatic plants and animals. Riparian vegetation, especially trees, is also effective in stabilizing streambanks and slowing flood flows, resulting in reduced downstream flood peaks. Major floodplains within the watershed are found along the Escambia, Yellow, Shoal, and Blackwater rivers.

Pitcher plant bogs can be found scattered throughout the Blackwater River State Forest, Yellow River Marsh Preserve State Park, and Garcon Point Water Management Area (FDACS 2013b; Florida Division of Recreation and Parks 2016c; FNAI 2010). They occur in isolated depressions of somewhat poorly drained soils and contain a high diversity of rare plants. American chaffseed (*Schwalbaea americana*), a federally endangered species, has been documented at one of the seepage slopes in the Blackwater State River Forest (FDACS 2013b).

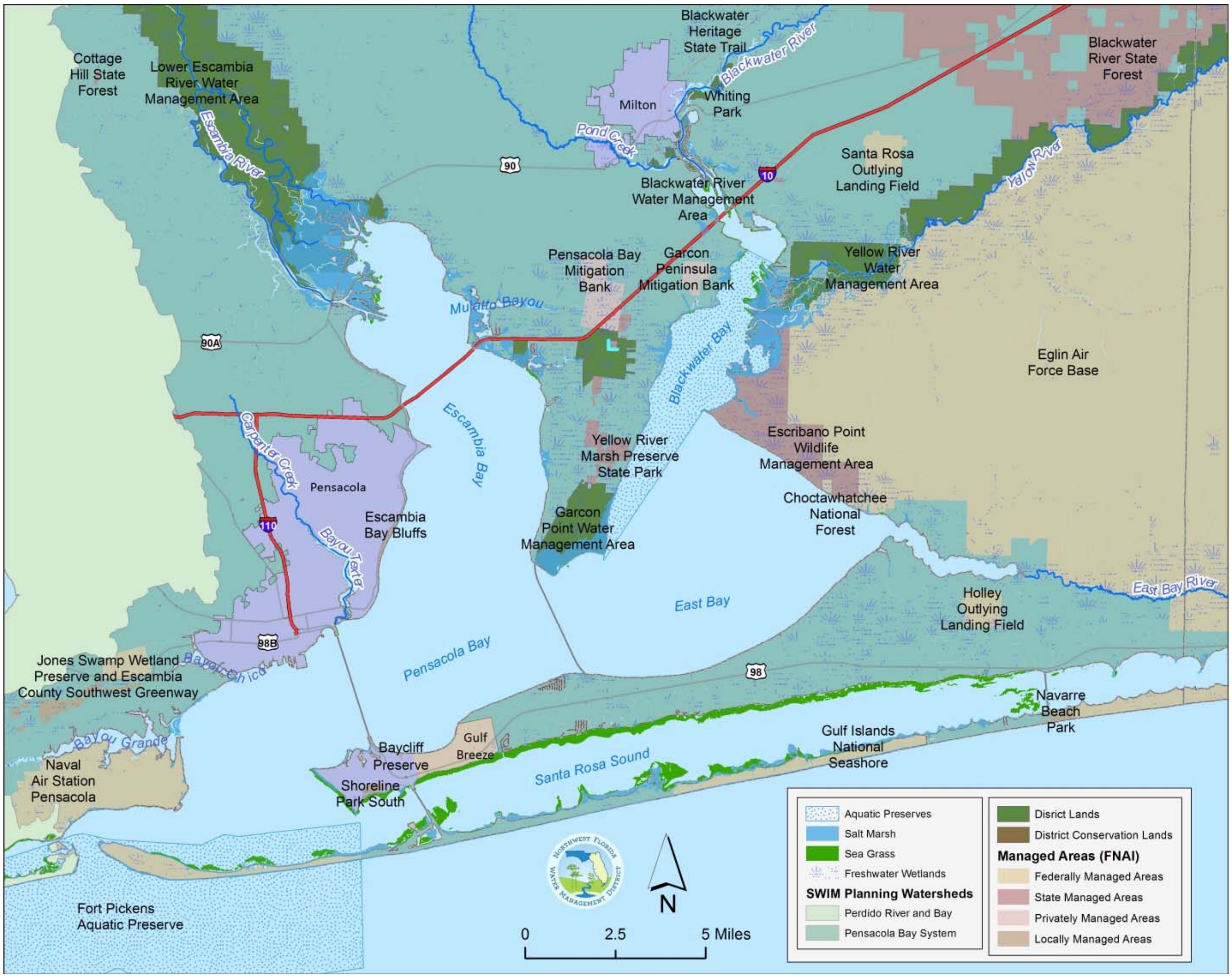
The Yellow River Marsh Preserve State Park includes tracts of wet prairie classified by the FNAI as imperiled habitats in the State of Florida because of their rarity (Florida Division of Recreation and Parks 2016c; FNAI 2010). Nearly 20 rare and endangered species of plants and animals make their homes in the wet prairies, dome swamps, and flatwoods of the park. Wet prairies support some of the most diverse plant communities in the southeast including a population of unique carnivorous plants (Florida Division of Recreation and Parks 2016c).

2.4.4 Emergent Marsh

In the salt marshes and nearshore tidal areas, species are adapted to the highly variable temperatures and salinities. Some species migrate in and out as necessary to take advantage of the food and shelter derived from the primary coastal habitats such as oyster reefs, marshes, and seagrasses (Lewis *et al.* 2016). Salt marsh communities within the Pensacola Bay watershed include both tidal marsh and floodplain marsh. Marsh species composition is influenced by a combination of salinity tolerance and differences in soil type, elevations, and competitive interactions. Salt marshes are similar to brackish marshes in that they serve as a transition between terrestrial and marine systems. Generally, salt marshes are intertidal and develop along relatively low energy shorelines. Unlike brackish marshes, they may be found under significantly more saline conditions. Salt marshes in the Florida Panhandle are usually characterized by large, fairly homogeneous expanses of dense black needlerush (*Juncus roemerianus*). Often, they are accompanied on the water-ward side by smooth cordgrass (*Spartina alterniflora*). The *Juncus* and *Spartina* zones are distinctive and can be separated easily by elevation.

Salt marshes are among the most productive plant communities on Earth (Fernald and Purdum 1998). Among the species found in salt marshes are mussels, oysters, fiddler crabs (*Uca sp*.), marsh periwinkles (*Littoraria irrorata*), crown conchs (*Melogena corona*), mullet, and blue crabs. Emergent freshwater and brackish marshes are dominated by sawgrass (*Cladium jamaicense*), maidencane (*Panicum hemitomon*), giant cutgrass (*Zizaniopsis miliacea*), and cattails (*Typha spp*.), but may contain large interspersed patches of black needlerush. In contrast with more coastal salt marshes, these sites lack the extensive salt flats of saltgrass (*Distichlis spicata*), glasswort (*Salicornia spp.*), and salt barrens. Thirteen species of common waterfowl also winter in Pensacola Bay salt marshes (Lewis 1986).

Floodplain marsh occurs in the floodplains of the watershed's major river systems. These marshes are seasonally inundated and are dominated by maidencane, pickerelweed (*Pontederia cordata*), sagittaria, buttonbush (*Cephalanthus occidentalis*), wax myrtle (*Myrica spp.*), and other mixed emergent vegetation. Floodplain marsh covers approximately 2,400 acres at the mouth of the Yellow River. In addition to the marsh species, patchy stands of hardwoods and water tolerant pine trees have become established on small "islands" of higher elevation in the marsh (Gardner 1991).



Source: FWC 2011, 2015b; FNAI2016b; USFWS 2016b

Figure 2-7 Coastal Natural Features in the Watershed

2.4.5 Seagrass Beds

Seagrass beds in the Pensacola Bay watershed (Figure 2-7) provide protective and foraging habitat for many marine species and are critical to the spawning cycle of many fish and invertebrate species, some of which are of great commercial and recreational significance. Among these are shrimp, spotted seatrout, Gulf menhaden, red drum or redfish, blue crab, Gulf flounder (*Paralichthys albigutta*), striped mullet (*Mugil cephalus*), and white mullet (Lewis *et al.* 2016). Seagrass meadows are largely limited to Santa Rosa Sound (Lewis *et al.* 2016). Seagrass beds are a protected habitat recognized by both the state and federal agencies. Five species of submerged aquatic vegetation have been found in Pensacola Bay and include: widgeon grass (*Ruppia maritime*), shoal grass (*Halodule wrightii*), manatee grass (*Syringodium filiforme*), star grass (*Halophila engelmannii*), and turtle grass (*Thalassia testudinum*) (Schwenning *et al.* 2002).

2.4.6 Oyster Reefs

The availability of hard substrate for colonization is a determining factor for the establishment of oyster reefs. Although hard substrate is not particularly common in the Pensacola Bay system, East Bay has historically supported healthy oyster populations. Oyster reefs have been widely demonstrated to improve water quality, protect shorelines by abating wave energy, stabilize bottom sediments, and provide habitat for fish, crab, and other invertebrates (Lewis *et al.* 2016). The most current assessments report approximately 235 to 245 acres of oyster reef habitat within the Pensacola Bay system, including reefs that are closed for harvesting. Of this total area, it is estimated that approximately 75 percent of oyster reefs occur in East Bay (Lewis *et al*. 2016).

2.4.7 Coastal Barrier Systems

The Pensacola Bay watershed has a coastal barrier system consisting of Santa Rosa Island. The barrier system consists of many unique habitats and natural systems including beaches, foredune and relic dunes habitat, tidal marsh, brackish ponds and lagoons, coastal grasslands, and upland forest and scrub communities (National Park Service 2014). Barrier islands and peninsulas buffer adjacent bays and coastal areas from storm impacts and create calm saline conditions in landward waters, which promotes seagrass establishment. The majority of Santa Rosa Island is managed by the National Park Service as part of the Gulf Islands National Seashore. Pensacola Beach and Navarre Beach divide tracts of National Park Service land on the island.

3.0 Watershed Assessment and Water Resource Issues

3.1 Water Quality

3.1.1 Impaired Waters

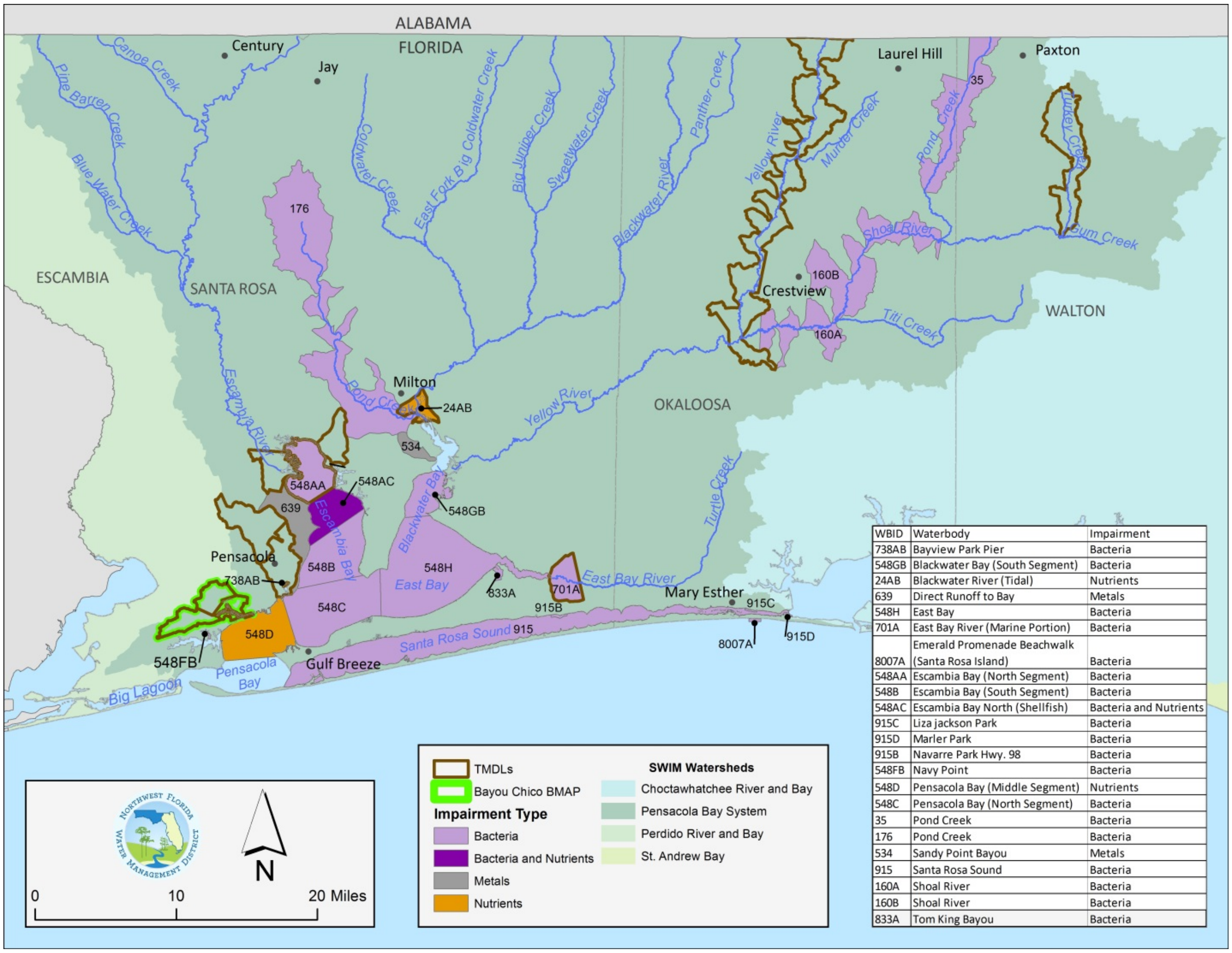
Of 350 waterbody segments in Florida's portion of the Pensacola Bay system, the FDEP has identified 23 impaired segments with 26 total impairments, including 22 segments for bacteria (five for fecal coliforms, six for beach advisories, seven for shellfish harvesting classification, two for enterococci, one for Escherichia coli, and one for bacteria in shelfish), two segments for nutrients, and two segments for metals (FDEP 2017). Most estuarine waters have been listed as impaired for bacteria, and Escambia Bay has been listed for nutrients. Additional bacteria impairments are concentrated in the Yellow River and Blackwater River basins (Figure 3-1). The overall list of impaired waters may be found in Appendix F.

The FDEP identified seven waterbody segments as impaired for bacteria in the Pensacola Bay watershed, based on shellfish classifications issued by the FDACS (FDEP 2017):

- Escambia Bay North (waterbody identification number [WBID] 548AC;
- Escambia Bay (South Segment) (WBID 548B;
- Pensacola Bay (North Segment) (WBID 548C);
- Blackwater Bay (South Segment (WBID 548GB);
- East Bay (WBID 548H);
- East Bay River (Marine Portion) (WBID 701A);
- Tom King Bayou (WBID 833A); and

County health departments monitor recreational beaches for bacterial contamination and issue health advisories closing beaches when bacterial counts are too high. Beaches with more than 21 closures in a year are identified as impaired by FDEP. Six beach segments were identified as impaired for bacteria in the Pensacola Bay system, based on beach closures by local health departments (FDEP 2014a):

- Navy Point (WBID 548FB);
- Bayview Park Pier (WBID 738AB);
- Emerald Promenade Beachwalk (WBID 8007A);
- Navarre Park Highway 98 (WBID 915B);
- Liza Jackson Park (WBIB 915C); and
- Marler Park (WBID 915D).



Source: FDEP 2017

Figure 3-1 Impaired Waters and TMDLs

Total Maximum Daily Loads (TMDLs) adopted for the Pensacola Bay system include 12 for fecal coliform, four for nutrients, one for DO, and 81 for mercury (Figure 3-1; Table 3-1) (FDEP 2016b). A TMDL represents the maximum amount of a given pollutant a waterbody can assimilate and still meet water quality standards, including applicable water quality criteria and designated uses. Established TMDLs identify specific reductions in pollutant loading required to restore water quality and meet restoration goals.

Total Maximum Daily Loads are implemented through Basin Management Action Plans (BMAPs), which identify specific management actions necessary to accomplish required pollutant reductions. Basin Management Action Plans are developed by local stakeholders (public and private) in close coordination with FDEP. A BMAP was adopted by FDEP in 2011 to implement five fecal coliform TMDLs and restore water quality in Bayou Chico located in the southern end of Escambia County (FDEP 2011, 2016d). The waterbodies addressed by the BMAP include Bayou Chico, which adjoins Pensacola Bay, and five additional waterbody segments that drain to Bayou Chico and the bay: Jones Creek, Jackson Creek, Bayou Chico Drain, Bayou Chico Beach (at Lakewood Park), and Sanders Beach (FDEP 2008a, 2008b, 2011b).

The BMAP was developed by FDEP in partnership with the City of Pensacola, Escambia County; the Escambia County Health Department, the Emerald Coast Utilities Authority (ECUA); the Florida

Department of Transportation (FDOT); the Bayou Chico Association; the U.S. Navy, and the Bay Area Resource Council.

Table 3-1 Adopted TMDLs[1]

Waterbody	WBID(s)[2]	Waterbody	WBID(s)
Bacteria		Nutrients	
Bayou Chico	846	North Escambia Bay	548AA
Jones Creek	846A	Judges Bayou	493B
Jackson Creek	846B	Bayou Chico	846
Bayou Chico Beach	846CB	Bayou Chico	846C
Sanders Beach	848DA	Dissolved Oxygen	
Escambia River	10F	Judges Bayou	493A
Texar Bayou	738		
Carpenter Creek	676		
Blackwater River (Tidal)	24AB		
Yellow River	30		
Turkey Creek	117		
East Bay River (Marine)	701A		

[1]Not including mercury
[2]Waterbody Identification Number

The FDEP adopted a statewide TMDL for reducing human health risks associated with consuming fish taken from waters impaired for mercury. Mercury impairments are based on potential human health risks, not exceedances of water quality criteria. The primary source of mercury is atmospheric deposition, with 30 percent from natural sources and 70 percent from anthropogenic international sources outside of North America. It is estimated that approximately 0.5 percent of mercury from anthropogenic sources is from Florida (FDEP 2013b). Only a small part of mercury in the environment is in the form of methylated mercury, which is biologically available to the food chain. The statewide TMDL for mercury includes a reduction target for fish consumption by humans and by wildlife and an 86 percent reduction in mercury from mercury sources in Florida (FDEP 2013b).

3.1.2 Pollution Sources

Nonpoint source (NPS) pollution is generated when stormwater runoff collects pollutants from across the landscape (lawns, pavement, highways, dirt roads, buildings, farms, forestry operations, and construction sites, etc.) and carries them into receiving waters. Pollutants entering the water in this way include nutrients, microbial pathogens, sediment, petroleum products, metals, pesticides, and other contaminants. Typical sources of NPS pollution include stormwater runoff from urban and agricultural lands and erosion and sedimentation from construction sites, unpaved roads, and destabilized stream banks. Atmospheric deposition of nitrogen, sulfur, mercury, and other substances via fossil fuel combustion also contribute to NPS pollution.

Stormwater runoff is the primary source of NPS pollution, and it is closely associated with land use. Urban land use, especially medium- to high-density residential, commercial, and industrial, generates the greatest NPS pollution per acre due to impervious surfaces that increase runoff. In urban areas, lawns, roadways, buildings, parking lots, and commercial and institutional properties all contribute to NPS pollution. Urban areas are largely concentrated within the coastal area, including the Pensacola metropolitan area, as well as the vicinity of Milton, the Fairpoint peninsula, portions of Santa Rosa Island, and nearby unincorporated communities. In addition to these established areas, the urban-rural fringe hosts new development and construction sites, introducing new NPS pollution sources impervious surface area within the watershed.

In the Pensacola Bay watershed, a number of entities currently hold Municipal Separate Storm Sewer System ([MS4] NPDES Stormwater) permits for stormwater conveyances that discharge to waters of the state. These include the following:

- Hurlburt Field
- Eglin AFB
- University of West Florida
- NAS Pensacola
- City of Ft. Walton Beach
- Santa Rosa County
- Okaloosa County
- City of Mary Esther
- Walton County
- City of Gulf Breeze
- City of Milton
- City of Pensacola
- Town of Century
- Escambia County

In 1991, Escambia County established a Stormwater Master Plan Program to reduce the frequency and severity of flooding and to improve water quality in receiving surface waters (Curb 2011). Among the project needs identified were road paving, restoring streams, and installing stormwater retrofits in established neighborhoods. Projects have been funded primarily through the county's local option sales tax (LOST). The City of Pensacola has also prioritized needed stormwater improvements, including within such areas as Piedmont Road area, Aragon Court, downtown Pensacola, Long Hollow Basin, and others.

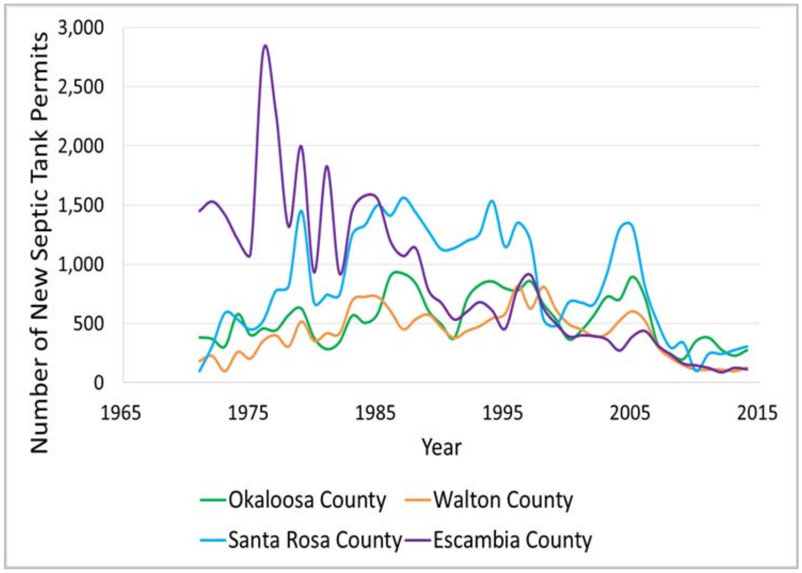
Fertilizer application, ditching, road construction, and harvesting associated with agriculture and silviculture can also cause NPS pollution, erosion, sedimentation, and physical impacts to streams and lakes (Stanhope *et al.* 2008). Within the watershed, agricultural lands are concentrated most prominently in northern Escambia County, central and northern Santa Rosa and Okaloosa counties, and northern Walton County (Figure 2-6). Silviculture is widespread across all non-urban areas of the watershed.

Erosion and sedimentation are natural phenomena that can be accelerated by human activities, with undesirable water quality consequences. Factors such as highly-erodible soils, unstable slopes, and high rainfall intensities are important factors in erosion and sedimentation. Construction activities, unpaved roads, abandoned clay pits, and agricultural and silvicultural practices lacking proper BMPs are common sources of sedimentation. Accelerated stream bank erosion caused by runoff associated with impervious surfaces can also be a significant source of sedimentation into receiving waters.

Freshwater streams across the watershed have been impacted by the erosion of dirt roads and deposition of sediment into waterways. In addition to benthic habitat impacts, this sedimentation causes turbidity within the directly affected streams and downstream receiving waters, extending into the major rivers and estuarine waterbodies.

Onsite sewage treatment and disposal systems are widespread sources of nutrients and other pollutants. Concentrations of OSTDS can degrade the quality of groundwater and proximate surface waters. While conventional OSTDS can control pathogens, surfactants, metals, and phosphorus, mobility in the soil prevents complete treatment and removal of nitrogen. Dissolved nitrogen is frequently exported from drainfields through the groundwater (NRC 2000). Additionally, OSTDS in areas with high water tables or soil limitations may not effectively treat other pollutants. Pollutants can enter surface waters as seepage into drainage ditches, streams, lakes, and estuaries (EPA 2015d; NRC 2000).

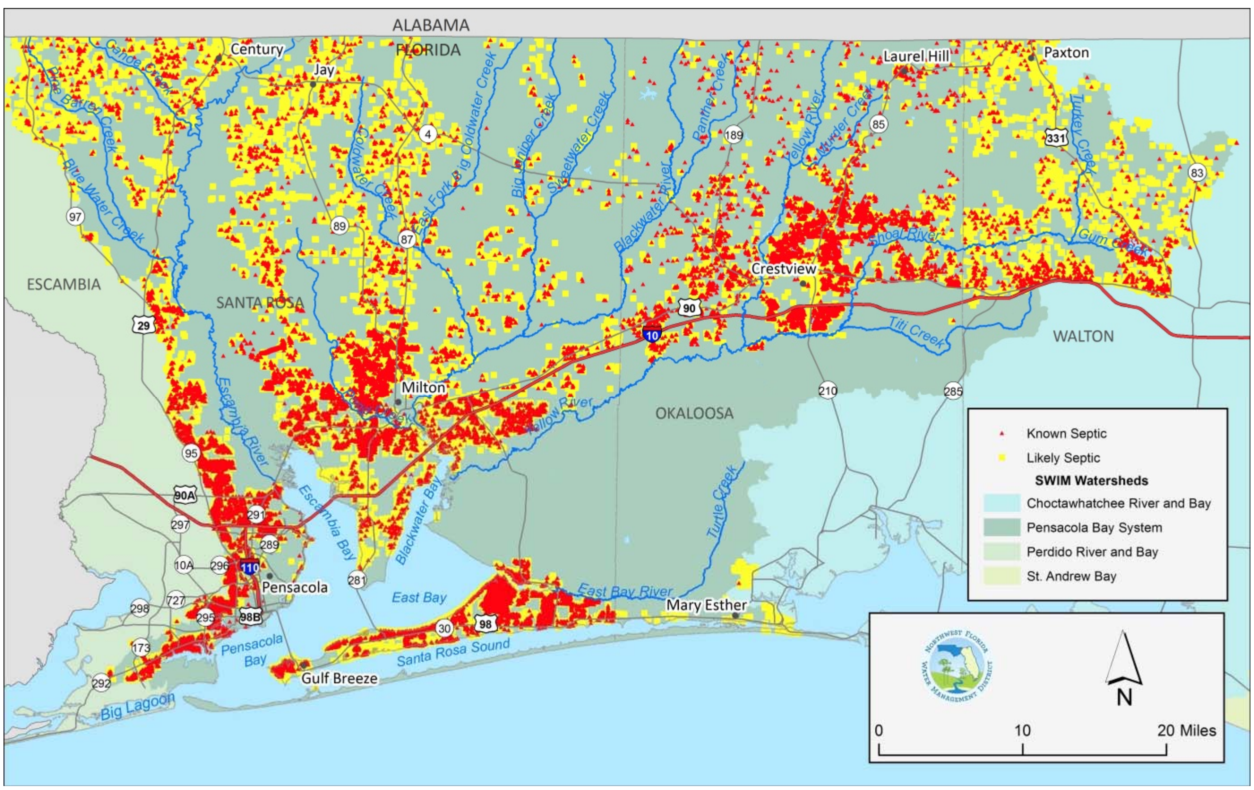
In the Pensacola Bay watershed, most rural and unincorporated communities and a number of suburban communities rely on OSTDS for wastewater treatment. New septic installations have declined since the late 1970s. By the early 1990s, new septic installations in Escambia County had declined by 50 percent (Figure 3-2); however, other counties in the watershed have replaced septic systems more slowly (FDOH 2015b).



Source: FDOH 2015b.

Figure 3-2 Number of New Septic Tank Permits by Year

Florida Water Management Inventory data indicate approximately 54,000 known or likely septic systems in the watershed (FDOH 2016). Known septic is based on permit data combined with inspection records. Likely septic is based on results of the review of nine criteria, but without inspection verification. Figure 3-3 shows the approximate locations of septic tanks as of 2015 (FDOH 2015b).



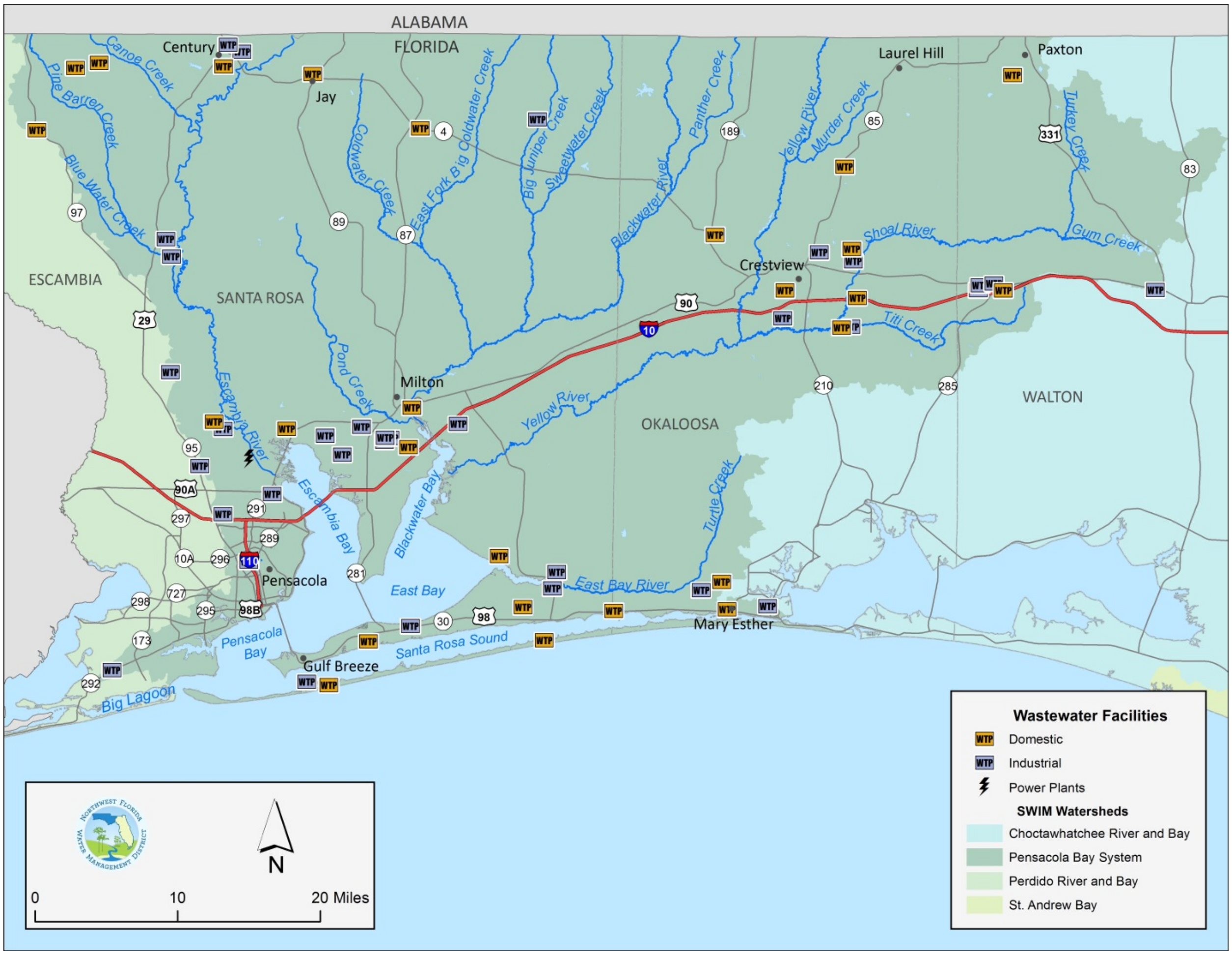
Source: FDOH 2015a

Figure 3-3 Septic Tank Locations in the Pensacola Bay Watershed

Marinas may be a source of NPS pollution from typical activities, such as boat maintenance, fueling, and marine sewage discharge, and due to runoff from parking lots. Pollution from marinas can depend on the availability of pump-out facilities and the level and consistency of marina BMP implementation. At the time of this writing, there are nine FDEP-certified Clean Marinas in the watershed.

Some pollutants, such as nitrogen and mercury, are also contributed to the landscape and waterbodies by atmospheric deposition. Most oxidized-nitrogen emissions are deposited close to the emission source and can especially impact surface water proximate to urban areas (Howarth *et al.* 2002a, 2002b, 2002c; NRC 2000).

There are 26 permitted domestic wastewater facilities and 33 industrial wastewater facilities within the watershed, as well as one power plant (Figure 3-5). Since completion of the previous SWIM plan update, a major accomplishment has been the relocation of the ECUA's Main Street WWTF in downtown Pensacola to its current location as the Central Water Reclamation Facility, located near Cantonment. The previous facility had a permitted surface water discharge of 20 million gallons per day. With the new facility, all surface water discharge into the bay has been eliminated, and 100% water reclamation is being achieved. The majority of the reclaimed water is being reused for beneficial purposes. Domestic wastewater facilities in the Pensacola Bay system watershed are listed in Table 3-2.



Source: FDEP 2015b

Figure 3-4 Permitted Wastewater Facilities within the Pensacola Bay Watershed

Table 3-2 Domestic Wastewater Facilities

Facility Name	County	Permitted Flow (mgd)	2015 Flow (mgd)	Discharge Type*
Bratt Elementary School WWTP	Escambia	0.01	0.002	RIB
Century WWTF	Escambia	0.68	0.44	Surface Water
ECUA Central WRF	Escambia	22.5	14.351	Sprayfield; industrial reuse; reuse at WRF
ECUA Pensacola Beach WWTP	Escambia	2.40	0.88	Surface water; landscape irrigation; reuse at WWTP
Ernest Ward Middle School WWTP	Escambia	0.01	0.002	RIB
Northview High School WWTP	Escambia	0.03	0.005	RIB
Berrydale Forest Camp WWTF	Santa Rosa	0.05	0.02	Sprayfield
Holley WRF	Santa Rosa	0.25	0.08	RIB
Holley-Navarre WWTF	Santa Rosa	2.99	1.11	Golf course irrigation; other landscape irrigation
Jay WWTP	Santa Rosa	0.12	0.06	RIB
Navarre Beach WWTP	Santa Rosa	0.93	0.29	Surface water; reuse at WWTP
Milton WWTF	Santa Rosa	2.50	1.62	Surface water
Pace Water System, Inc. WWTP	Santa Rosa	2.00	1.49	Wetlands; residential and other landscape irrigation
South Santa Rosa Utilities System WWTF	Santa Rosa	2.00	1.49	Sprayfield; golf course, residential, other landscape irrigation; reuse at WWTF
Sundial Utilities WWTP	Santa Rosa	0.25	0.08	RIB
Baker High School WWTP	Okaloosa	0.02	0.005	RIB
Bob Sikes WRF	Okaloosa	1.00	0.09	RIB
Crestview WWTF	Okaloosa	2.75	1.48	Sprayfield; RIB; reuse at WWTF
FDOT Okaloosa I-10 Rest Area WWTP	Okaloosa	0.20	0.03	RIB
Hurlburt Field AWTP	Okaloosa	1.00	0.59	Wetlands; residential and other landscape irrigation; reuse at AWTP
Mary Esther WWTP	Okaloosa	1.10	0.40	Sprayfield
North Okaloosa WRF	Okaloosa	0.03	**	RIB
Okaloosa Correctional Institution WWTF	Okaloosa	0.23	0.17	RIB
Russell F.W. Stephenson WWTF	Okaloosa	0.98	0.39	RIB
Paxton WWTP	Walton	0.08	0.02	Sprayfield
Walton County Commerce Park at Mossy Head WWTF	Walton	0.02	**	Absorption fields

Mining and extraction activities near waterbodies have the potential to cause turbidity, sedimentation, and smothering. Mining activities within the watershed are concentrated in the vicinity of the Town of Century, in the Pensacola metropolitan area, and south of Milton. The USGS recognizes nine major mining operations within the watershed, including one perlite mine, two sulfur mines, and six sand and gravel mines. FDEP identifies 59 mines and borrow pits within the watershed; many are located near streams, creeks, tributaries, and other waterbodies (FDEP 2014d, 2015c). Of these, there are 42 sand mines, four clay mines, and 13 sand and clay mines.

The extensive and historical industrial and manufacturing facilities in the Pensacola urban area have had a profound effect on the bay system. Degradation of water and/or sediment by toxic chemicals, such as those used in industrial and manufactural processes, can impact surface water quality and the health of associated upland and aquatic habitats and generate contaminated food chains in which top predators are most significantly harmed. Chemical contaminants can also be harmful to humans, particularly through consumption of seafood containing elevated quantities of mercury, polychlorinated biphenyls, dioxin, and other harmful chemicals.

There are currently five U.S. EPA National Priority List (NPL) Superfund sites within the Pensacola Bay watershed:

- Agrico Chemical Co.;
- American Creosote Works, Inc.;
- Escambia Treating Co.;
- NAS Pensacola; and
- NAS Whiting Field.

The Agrico Chemical Company and Escambia Wood-Pensacola sites are about one mile west of Bayou Texar. Contaminated groundwater from these sites appears to be migrating into Bayou Texar (Mohrherr *et al.* 2005). The American Creosote Works site covers 1.5 acres in Pensacola, Florida, about 0.3 miles north of where Bayou Chico joins with Pensacola Bay. The USGS identified phenols in groundwater associated with American Creosote Works (USGS 1986). Efforts to identify, evaluate, and clean up contaminant sites at NAS Pensacola and NAS Whiting field are outlined by EPA (2016d).

In Florida's portion of the watershed, there are 28 hazardous waste facilities registered as EPA Biennial Reporter facilities. Of these, 14 are in Pensacola. Biennial Reporter facilities handle hazardous waste and are required to report to the EPA at least once every two years (EPA 2016c). Additionally, 389 active petroleum contamination tracking sites within the watershed are registered with the state's Storage Tank and Petroleum Contamination Monitoring (STCM) database. There are 34 contaminated dry cleaning sites within the basin eligible for the state-funded Dry Cleaning Solvent Cleanup Program. The majority of STCM and dry cleaning sites are located in historically developed areas in Pensacola and Milton, with additional sites in other developed areas, including Crestview, Jay, Gulf Breeze, Baker, and other unincorporated communities.

There are also 19 non-NPL Superfund sites located within the basin, 14 are located in Pensacola. A non-NPL site is a Superfund site that has not been placed on the NPL list through the EPA's formal process for assessing hazardous waste sites; however, the EPA can take short-term cleanup actions on non-NPL sites under the emergency removal program.

3.2 Natural Systems

Eutrophication has been documented in several waterbodies across the Pensacola Bay watershed, primarily in the bays and estuaries of the watershed. Compared to other eutrophic estuaries, concentrations of nutrients within Pensacola Bay are relatively low (Bricker *et al.* 2007). Some nutrient concentrations have been declining within the Pensacola Bay system, reaching levels below the concentrations of concern for aquatic vegetation (FDEP 2012). The State of Florida water quality criterion for chlorophyll-*a* and aquatic life designated use is ≤ 20 micrograms per liter, which is well above most measured concentrations for the Pensacola Bay system (FDEP 2010). However, despite relatively low nutrient concentrations, Pensacola Bay exhibits some classic eutrophication symptoms, including summer hypoxia, significant loss of sea grass habitat, and phytoplankton dynamics indicative of variations in freshwater flows (Caffrey and Murrell 2016).

Hypoxia commonly occurs within the Pensacola Bay estuarine system, particularly in stratified waters in Escambia and East bays (Hagy and Murrell 2007). The extent of this condition, at times affecting up to 30% of the estuary, suggests it could be a significant factor structuring biological communities and habitat. Contributing factors may include salinity stratification associated with tidal and freshwater inflow and nutrient enrichment of plankton and sediments (Murrell *et al.* 2009).

Chemical contaminants within the sediments have been observed in many areas of the estuary, particularly within bayous Chico and Texar and in Escambia Bay. DeBusk, *et al.* (2002) details compiled monitoring results, describing fairly consistent patterns of contaminant distribution. Shuba (2012) describes monitoring and recommendations related to polychlorinated biphenyl (PCB) enrichment. Metals, polycyclic aromatic hydrocarbons (PAHs), and dichlorodiphenyltrichloroethane (DDT)-related compounds were consistently found to be elevated in bayous Chico and Texar and in Escambia Bay, and to a lesser extent in Bayou Grande and East Bay. Polychlorinated biphenyls, which entered the system apparently through a spill in 1969 (NWFWMD 1997), have continued to be found in the sediments of the lower Escambia River and Escambia Bay. Lewis *et al.* (2016) and U.S. EPA (1998), further describe sediment contaminants and toxicity in bayous Texar and Chico, Escambia Bay, and elsewhere within the Pensacola Bay estuary. Pensacola's urbanized bayous have long been subject to extensive stormwater runoff and NPS pollution, as well as historical point source discharges and industrial development. As a result, water and sediment quality in these areas have been significantly impacted. These contaminants, substantially representing historical pollutant discharges, represent a source of legacy pollutants that may continue to degrade benthic habitats and be subject to resuspension with availability to the water column.

In 2010, portions of Pensacola Bay, particularly near Pensacola Pass and proximate locations in Santa Rosa Sound and Big Lagoon, were repeatedly exposed to crude oil and weathered residue from the Deepwater Horizon oil spill.

Sedimentation more broadly affects benthic habitats in portions of the watershed due to poor flushing and the input of large sediment loads from the river basins and from stormwater runoff. George (1988) concluded that the percentage of fine-grained sediments (clays and silts) increased since the 1960s, with the percentage of fine-grained sediments in East Bay doubling between 1968 and 1988. Another example is Carpenter Creek, which suffers from streambank erosion and channelization, thus impact in receiving waters in Bayou Texar.

Between 1950 and 1980, about 95 percent of seagrass habitat disappeared from the Pensacola Bay system (Yabro and Carlson 2016). Recognizing the importance of seagrasses for fisheries and for human benefits, Lewis et al. (2016) estimated that losses in seagrass habitat from 1960-2010 equate to an economic loss of approximately $104 million per year (1991 dollars) in ecosystem services.

Yabro and Carlson (2016) report that from 2003 to 2010 and found that coverage in Pensacola Bay in 2010 was approximately 1,053 acres, an increase of approximately 51 percent from 2003. An increase was noted in Pensacola Bay, in particular. Losses of about five percent, however, were reported from Santa Rosa Sound. Ongoing stressors of seagrasses in the Pensacola Bay system may include effects of hypoxia, salinity changes, and burial from sediments (Yabro and Carlson 2016).

Central and southern East Bay and shoreline areas of Escambia Bay suffered nearly complete losses of seagrasses since the 1940s (Olinger et al. 1975; Yabro and Carlson 2016). In some areas, water quality may have recovered sufficiently to support seagrasses; thus, additional efforts to identify barriers and strategies for recovery are warranted.

Estimates of recent oyster reef coverage (approximately 245 acres) in the Pensacola Bay system are lower than published estimates from the 1970s-1990s, which report coverage of several thousands of acres (Lewis *et al.* 2016). From the 1960s-1980s, shellfish (primarily oysters) reportedly experienced significant declines, attributed to fungal parasites, poor water quality, heavy rainfall, and dredging. The Florida Department of Natural Resources, now FDEP, reported periodic crashes in oyster populations within the Yellow River Marsh Aquatic Preserve, with near 100 percent mortality rate (Gardner 1991).

Lewis *et al.* (2016) estimated 2014 salt marsh area at 6,697 acres. Portions of the bay system have experienced increases in salt marsh coverage. Salt marsh coverage increased from 1,400 to 1,794 acres in Blackwater Bay, 3,750 to 4,519 acres in Escambia Bay and from 59 to 103 acres in Pensacola Bay. Coverage has remained relatively stable for East Bay. Total salt marsh coverage across the basin has increased 19 percent (1995-2010) and is expected to further increase due to sea level rise if not restricted by anthropogenic barriers such as roadways, and armored shorelines (Lewis *et al.* 2016).

In rural areas, land clearing associated with agriculture, silviculture, and recreation, as well as dirt road erosion, have increased sedimentation in the Blackwater River basin. The heavy use of vehicles on unpaved roads in Blackwater River State Forest has increased soil erosion, leading to higher turbidity in streams and smothered aquatic habitat (FDACS 2013b). Agricultural land use, unpaved roads, and heavy rain events have also caused turbidity in Yellow river (FDEP 2016d).

3.3 Floodplains and Floodplain Management

Floodplains protect water quality by allowing storage of floodwaters, reducing runoff velocity and preventing erosion and sedimentation. Floodplains also attenuate potential flood effects while providing an ecological link between aquatic and upland ecosystems and habitat for many terrestrial and aquatic species. Development of and encroachment into floodplains reduces water storage capacity, increases flood heights and velocities, and degrades natural systems in areas beyond the encroachment itself.

Maintaining the hydrological integrity of the floodplain benefits surface water systems in drought conditions, as well as flood conditions. Floodplain vegetation reduces evaporation and increases soil water storage capacity. Riparian wetlands, marshes, and floodplain forests help to slow stormwater runoff, protecting water quality and regulating the release of water into streams and aquifers.

Riverine floods are common along the watershed's major rivers and tributaries. Wetlands, low-lying areas, and coastal areas are also subject to significant flooding. Federal Emergency Management Agency flood maps delineate 269,577 acres (approximately 18 percent) of the Pensacola Bay watershed as Special Flood Hazard Area (Figure 2-4). Lands most prone to flooding are predominantly on Santa Rosa Island, Garcon Point, Escribano Point, and along the major rivers.

The coastline within the Pensacola Bay watershed is protected by offshore barrier islands and peninsulas; however, the coastal areas of Santa Rosa, Escambia, and Okaloosa counties are subject to flooding from coastal surges associated with hurricanes (FEMA 2006). Another flooding source is the East Bay River. Flooding in the Blackwater River Basin is caused by stream overbank flow and hurricane storm surges, and sometimes a combination of both. Riverine flooding occurs frequently and is prevalent throughout the reach of the river where the riverbanks are low and the floodplain is wide. The coastline in Santa Rosa County is subject to widespread flooding resulting from storm surges that accompany hurricanes and other severe storms from one or more of the following flooding sources: the Gulf of Mexico, East Bay, Escambia Bay, Pensacola Bay, Blackwater Bay, and Santa Rosa Sound (FEMA 2014).

4.0 Watershed Protection and Restoration

4.1 Management Practices

Watershed protection and restoration is inherently a collaborative effort on the part of state, regional, and federal agencies; local governments; nongovernment organizations; the business community; and the public. Implementation is conducted at the watershed, sub-watershed, and local scale. Recommended management strategies are described below.

4.1.1 Nonpoint Source Pollution Abatement

Addressing NPS pollution is a vital part of watershed management in the Pensacola Bay system. As described above, stormwater runoff carries pollutants from the landscape that diminish water quality, and it can physically impact streams and aquatic habitats. Multiple strategies can be employed to collectively reduce NPS pollution and protect and improve water quality and watershed resources.

Stormwater Retrofit

Among the most effective means of reducing NPS pollution is to retrofit existing stormwater management systems to add treatment and restore or approximate natural hydrology. In addition to improving water quality, appropriately designed retrofit projects improve flood protection, reduce physical disturbance from erosion and sedimentation, and provide aesthetic and recreational use benefits.

Implementation may include a mixture of traditional and nonstructural approaches. There are numerous methods of stormwater management and treatment, among which are wet and dry detention ponds, infiltration systems, stormwater harvesting, wetland treatment systems, stormwater separator units, vegetated swales and buffers, pervious pavement, bioretention, ditch blocks, green roofs, and chemical (alum) treatment. Specific measures employed depend on site conditions, including soils, water table conditions, flow, intended uses, and available land area. Optimally, a treatment train approach is employed, addressing hydrology and water quality treatment across a basin. Implementation is best accomplished within a wider, watershed context that incorporates initiatives such as Florida Friendly Landscaping (section 373.185, F.S.) and public outreach and awareness.

Within the Pensacola Bay watershed, the greatest need and potential for stormwater retrofit efforts is within municipal and fringe areas with relatively dense development and significant areas of impervious surface. Examples include the Pensacola metropolitan area, Gulf Breeze, Navarre, Mary Esther, Milton, and Crestview. Local governments normally take the lead in implementing stormwater retrofit projects, as they most commonly own, operate, and maintain stormwater management systems.

Agricultural Best Management Practices

Best management practices are practical measures that act together or individually to protect water resources and fish and wildlife habitat. Such practices were pioneered for agriculture but have also been developed and effectively applied to silvicultural and urban land uses. Best management practices reduce soil loss, nutrient enrichment, sedimentation, discharge of chemical pollutants, and other adverse impacts (see, for example, Wallace *et al.* 2017, among many others). Implementation also often benefits stream bank stability and fish and wildlife habitat. In addition to protecting water and habitat quality and conserving water, BMPs can reduce costs to producers by increasing operational efficiency and effectiveness.

Agricultural BMPs include both structural and nonstructural controls. Examples are cover crops, contour farming, terracing, tree planting, integrated pest management, mobile irrigation laboratory applications, sod-based crop rotation, fertigation, and many other tools and services. The Florida Department of Agriculture and Consumer Services has developed, evaluated, and approved BMPs specific to individual agricultural operations within Florida watersheds. Guidance for and assistance in enrolling in approved BMPs are provided by FDACS. Cost share programs are also conducted both by FDACS and the District. Additionally, FWC provides technical assistance to private landowners through its Landowner Assistance Program.

Implementation of approved BMPs or water quality monitoring is required in basins with adopted BMAPs. Whether required or not, however, BMPs are effective means of protecting and restoring watershed resources and functions and are recommended land use practices for implementation of this plan.

Within the Pensacola Bay watershed, the most extensive and concentrated areas of agricultural land use are within northern Escambia and Santa Rosa counties, notably including the Pine Barren Creek, Moore Creek, and Coldwater Creek sub-basins (Figure 2-6). Within these areas in particular, application of agricultural BMPs have significant potential to further protect and improve water quality and aquatic habitat conditions.

<u>Silviculture Best Management Practices</u>

The Florida Forest Service (FDACS 2008) defines silviculture BMPs as “the minimum standards necessary for protecting and maintaining the State’s water quality as well as certain wildlife habitat values, during forestry activities.” These practices are protective of water resources, including streams, downstream receiving waters, sinkholes, lakes, and wetlands. The FFS provides specific guidance on BMPs and has established compliance monitoring requirements and procedures. FDEP (1997) evaluated the effectiveness of silviculture BMPs and concluded that forestry operations conducted in accordance with the BMP manual resulted in no major adverse habitat alterations.

The primary BMPs established for forestry are special management zones (SMZs). These zones provide buffering, shade, bank stability and erosion-control, as well as detritus and woody debris. They are intended to protect water quality by reducing or eliminating sediment, nutrients, logging debris, chemicals, and water temperature fluctuations. They also maintain forest attributes that provide wildlife habitat. Widths of SMZs vary depending on the type and size of the waterbody, soils, and slope. Specific SMZs are described as follows.

1) The **Primary Zone** varies between 35 and 200 feet and applies to perennial streams, lakes, and sinkholes, OFWs, Outstanding Natural Resource Waters (ONRW), Class I Waters, and, in some cases, wetlands. A primary zone generally prohibits clear-cut harvesting within 35 feet of perennial waters and within 50 feet of waters designated OFW, ONRW, or Class I. Other operational prescriptions also apply to forestry practices to protect water and natural resources.
2) The **Secondary Zone** applies to intermittent streams, lakes, and sinkholes. Unrestricted selective and clear-cut harvesting is allowable, but mechanical site preparation, operational fertilization, and aerial application or mist blowing of pesticide, are not. Loading decks or landings, log bunching points, road construction other than to cross a waterbody, and site preparation burning on slopes exceeding 18 percent are also prohibited. These zones vary in width between 0 and 300 feet.
3) The **Stringer** provides for trees to be left on or near both banks of intermittent streams, lakes, and sinkholes to provide food, cover, nesting, and travel corridors for wildlife.

Other BMPs detailed in the Florida silviculture BMP manual include practices for forest road planning, construction, drainage, and maintenance; stream crossings; timber harvesting; site preparation and planting; fire line construction and use; pesticide and fertilizer use; waste disposal; and wet weather operations. The BMP manual further includes specific provisions to protect wetlands, sinkholes, and canals. Associated with the BMP manual are separate forestry wildlife best management practices for state imperiled species (FDACS 2014).

Given that the Pensacola Bay watershed is substantially forested, silviculture BMPs are some of the most important tools for protecting water quality and wetland and aquatic habitat quality within the watershed. The significant relief that exists within the upper watershed (Figure 2-3) suggests application of SMZs may be particularly useful for protecting downstream aquatic habitats from further impacts.

Low Impact Development

Inclusive of green infrastructure, urban best management practices, and Florida Friendly landscaping, low impact development represents a framework for implementing innovative stormwater management, water use efficiency, and other conservation practices during site planning and development. Benefits include reduced runoff and NPS pollution, improved flood protection, and reduced erosion and sedimentation. Some specific practices include the following.

- Minimized effective impervious area
- Vegetated swales and buffers
- Bioretention cells
- Rain gardens
- Infiltration and exfiltration systems
- Community greenways
- Green roofs
- Certification programs, such as Florida Water Star[SM], and the Florida Green Building Coalition

For transportation infrastructure, practices recommended to protect water quality and floodplain and wetland functions include incorporating bridge spans that accommodate bank-full stream flows while maintaining intact floodplain, wetland, and wildlife passage functions. Minimizing structural alteration of low-lying, flood-prone lands is also an important strategy for protecting water quality and providing flood protection. Such properties can be used for other purposes, such as passive parks and other public use areas.

Riparian Buffers

A riparian buffer zone is an overlay that protects an adjoining waterbody from effects of adjacent development, such as runoff, NPS pollution, erosion, and sedimentation. A buffer zone in this context refers to an area along the shoreline that is maintained in or restored to generally natural vegetation and habitat. In this condition, an intact buffer zone helps to simultaneously achieve three important goals: water quality protection, shoreline stability, and fish and wildlife habitat. Associated with these are other benefits, including aesthetic improvements and public access and recreation. These benefits are achievable for riparian areas along all types of waterbodies: stream/riverine, estuarine, lacustrine, wetlands, and karst features.

In general, the wider the buffer zone, the better these goals may be achieved, although specific requirements are defined based on community goals. Limited areas, for example, might be developed into recreational sites, trails, or other access points. Table 4-1 is a representation of generalized buffer zones, adapted from USFWS documentation, listing benefits provided by buffers of successively larger widths. Complicating buffer zone design is the fact that different sites have different ecological and physical characteristics. These characteristics (type of vegetation, slope, soils, etc.), when accounted for, would lead to different buffer widths for any given purpose. Alternatives to fixed-width buffer policies include tiered systems that can be adapted to multiple goals and site-specific characteristics and uses. Wenger (1999) and Wenger and Fowler (2000) provide additional background, detail, and guidance for the design of buffer zone systems and policies.

Table 4-1 Generalized Buffer Zone Dimensions

	Buffer Width:					
Benefit Provided:	**30 ft**	**50 ft**	**100 ft**	**300 ft**	**1,000 ft**	**1,500 ft**
Sediment Removal - Minimum	💧	💧	💧	💧	💧	💧
Maintain Stream Temperature	🐟	🐟	🐟	🐟	🐟	🐟
Nitrogen Removal - Minimum		💧	💧	💧	💧	💧
Contaminant Removal		💧	💧	💧	💧	💧
Large Woody Debris for Stream Habitat		🐟	🐟	🐟	🐟	🐟
Effective Sediment Removal			💧	💧	💧	💧
Short-Term Phosphorus Control			💧	💧	💧	💧
Effective Nitrogen Removal			💧	💧	💧	💧
Maintain Diverse Stream Invertebrates			🐟	🐟	🐟	🐟
Bird Corridors				🐦	🐦	🐦
Reptile and Amphibian Habitat					🐦	🐦
Habitat for Interior Forest Species					🐦	🐦
Flatwoods Salamander Habitat – Protected Species						🦎

Key
Water quality protection 💧 *Terrestrial riparian habitat* 🐦
Aquatic habitat enhancement 🐟 *Vulnerable species protection* 🦎

Adapted from USFWS 2001.

Basinwide Sedimentation Abatement

Unpaved roads frequently intersect and interact with streams, creating erosion and runoff conditions that transport roadway materials directly into streams, smothering habitats and impacting water quality and the physical structure of the waterbodies. Borrow pits have also caused progressive erosion conditions that smother streams, severely damaging or destroying habitats and diminishing water quality. Existing impacts and future risks are most pronounced in the upper portion of the Pensacola Bay watershed, given the slopes and prevalent soils.

Given the site specific and physical nature of the impacts, efforts taken at the local and regional level can lead to significant restoration of aquatic habitat conditions and improved water quality. Corrective actions may include replacing inadequate culverts with bridge spans maintain floodplains and flows, hilltop-to-hilltop paving, use of pervious pavement, establishment of catch basins to treat and manage stormwater, and establishment of vegetated or terraced basins to eliminate gulley erosion.

In addition to addressing unpaved roads and gully erosion sites, application of construction BMPs, to include sediment and erosion controls, protects water and habitat quality, as well as the physical structure of streams and other waterbodies. Extremely heavy and sustained precipitation events are common in northwest Florida; thus, for large-scale construction and transportation projects, protective BMPs are ideally capable of accommodating and preventing erosion and sedimentation during large storm systems, which frequently overwhelm conventional erosion controls.

4.1.2 Ecological Restoration

A wide array of measures may be employed to restore natural and historic functions to former or degraded wetland, aquatic, stream, riparian, and estuarine habitats. Enhancement actions, such as improving vegetation conditions, invasive exotic plant removal, and prescribed fire, are also often discussed in the context of restoration. Wetland, hydrologic, floodplain, shoreline, and stream restoration are discussed further below.

Wetland, Hydrologic and Floodplain Restoration

Wetland restoration includes actions to reestablish wetland habitats, functions, and hydrology. It frequently involves substrate composition and profile restoration and vegetation community reestablishment, including shrub reduction, exotic species removal, application of prescribed fire, and replanting.

Hydrologic and floodplain restoration include actions to reestablish pathways and the timing of surface water flow. Actions include removing fill, replacing bridges and culverts with appropriate designs, establishing low-water crossings, restoring pre-impact topography and vegetation, and abandoning unneeded roads through fill removal and replanting. Restoration activities can have broad water resource benefits, including improved water quality, enhanced fish and wildlife habitat, and other restored wetland functions.

Hydrologic restoration is important for altered wetlands and waterbodies in urbanized areas, as well as for riverine systems and for larger wetland systems. Wetland restoration, including habitat enhancements and vegetation restoration, is broadly applicable at both large and smaller scales throughout the watershed.

Shoreline Restoration

Shoreline restoration refers to measures taken to restore previously altered shorelines and to protect eroding or threatened shorelines. Such restoration is accomplished using "living shorelines" techniques, which are a set of evolving practices that incorporate intertidal and shoreline habitats to protect shorelines while also enhancing or restoring natural communities, processes, and productivity. When planned and implemented appropriately, such efforts result in direct and tangible benefits for residents and the larger community, including fish and wildlife, improved water quality, shoreline protection, and aesthetic improvements. Including biodiversity-building habitats and incorporating adjacent transitional and floodplain areas within restoration planning can increase resiliency and adaptability to anticipated changes in climate, sea levels, and shoreline configuration, as well as potential future occurrences of impacts from invasive species.

Shoreline restoration in this context is particularly applicable as a strategy along altered and/or eroding estuarine shorelines along Pensacola Bay, Escambia Bay, and East Bay. Some of the urbanized bayous may offer restoration opportunities along relatively low-energy shorelines.

Stream Restoration

Stream restoration includes actions to restore the hydrology, aquatic habitat, and riparian vegetation of stream systems that may have been impacted by inadequate culverts, road crossings, instream impoundments, erosion and sedimentation, runoff or other hydrologic effects of adjacent or upstream developments. This may also include developing more natural hydrology, wetlands, storage/treatment, and riparian vegetation along stormwater conveyances. In stream restoration may include efforts to reestablish natural channel and floodplain process and should accompany efforts to address offsite processes (erosion, sedimentation, etc.) that created the original impacts.

The topographic relief within the upper watershed, as well as surrounding land uses, suggests that stream restoration may be a particularly appropriate strategy within this area. Additionally the Carpenter Creek basin and other urban drainages offer opportunities for stream restoration, often in association with stormwater retrofit and other actions.

Estuarine Habitat Restoration

Implementation of wetland and shoreline restoration, as described above, as well as aquatic habitat restoration and enhancement can be implemented in a complementary manner to improve and restore estuarine habitat and productivity. Well-established, contiguous marshes; seagrass beds; and oyster reefs provide habitat for a wide range of marine species, including recreational and commercially valuable seafood species.

Emergent marshes and oyster reefs serve as an important buffer between uplands and estuaries, filtering pollutants and consuming nutrients before they enter the water and reducing waves before they reach land. These communities promote sediment accumulation and shoreline stabilization, attenuate wave energy, protect marsh habitat, and buffer upland areas against wind and wave activity that expedite erosion. Each oyster can filter vast quantities of water, removing suspended particles that would otherwise reduce sunlight penetration needed for healthy seagrass beds.

While some recovery of seagrasses in Pensacola Bay have been observed, extensive areas of East Bay and Escambia Bay, which formerly supported seagrass, have had no recovery. Approaches to restoring seagrass habitat in the Pensacola Bay system, as identified by Yabro and Carlson (2016), include restoration of shoreline vegetation on Santa Rosa Sound to prevent further burial of vegetation, as well as investigating the extent and effects of hypoxia in the estuary and evaluating long-term effects of salinity changes on submerged aquatic vegetation in the upper reaches of the estuarine system. Results of the ongoing Roadblocks to Seagrass Recovery project may help identify strategies to facilitate recovery in these areas.

4.1.3 Wastewater Management and Treatment Improvements

Septic to Sewer Connections

Among the promising approaches for correcting impacts and impairments are actions to improve the management and treatment of domestic wastewater. While expensive and engineering-intensive, such actions are technically feasible, proven approaches to improving water quality and aquatic habitat conditions, as well as public uses and benefits.

Extending sewer service to areas that currently rely on conventional onsite treatment and disposal systems for wastewater treatment and disposal is effective in reducing nutrient loading to ground and surface water source. As outlined above, there are over 54,000 known or likely conventional septic systems in the

Pensacola Bay watershed. As illustrated by Figure 3-4, these are particularly concentrated around Pensacola Bay and Santa Rosa Sound, and within their contributing basins; within the vicinities of the Blackwater, Yellow, Shoal, and Escambia Rivers; and within the Bayou Chico BMAP area. Connecting residences and businesses in these areas to centralized wastewater treatment systems has the potential to substantially improve wastewater treatment and reduce loading of nutrients and other pollutants to these waterbodies and to downstream receiving waters.

Advanced Onsite Systems

Where extension of sewer service is not economically feasible due to the spatial distribution of rural populations, there is potential for installation of advanced onsite systems that achieve water quality treatment that exceeds that provided by conventional systems. In particular, advanced passive systems are being developed to provide cost-effective and practical systems for reducing nitrogen and other pollutants from onsite sewage systems (FDOH 2015b). Pilot projects are underway in different regions of the state.

Water Reclamation and Reuse

For the purposes of this plan, water reuse refers to the application of reclaimed water for a beneficial purpose, with reclaimed water receiving at least secondary treatment and basic disinfection (Chapter 62-10, F.A.C.; Section 373.019, F.S.). Beneficial purposes include reusing reclaimed water to offset a current or known future potable water demand or other documented watershed and water resource challenges. Specific purposes include landscape and golf course irrigation, industrial uses, and other applications (FDEP 2015f). Water reuse can be a key strategy in reducing or eliminating wastewater discharges and associated pollution of surface waters.

Centralized Wastewater Treatment Upgrade and Retrofit

For centralized wastewater treatment systems, conversion to advanced wastewater treatment has proven to be an effective means of reducing the discharge of nutrients and other pollutants into surface and ground waters. Specific treatment or process upgrades may also help improve treatment of contaminants of emerging concern, such as pharmaceuticals, surfactants, and unregulated trace chemicals. Additionally, in many areas there is a need to rehabilitate existing sewer systems, including to correct inflow and infiltration problems and to reduce the number and severity of sanitary sewer overflow incidents. Accomplishing these actions can be expensive, given the need to retrofit existing systems in often highly developed areas. Upon completion, however, notable improvements can be achieved for water quality, public recreational uses, and fisheries.

4.1.4 Land Conservation

While the Pensacola Bay watershed benefits from extensive public land areas that protect water quality and wetland and aquatic habitats and provide for public access and use, there are still opportunities to further protect water resources through the conservation of sensitive areas, including riverine, stream-front, and estuarine shorelines. Conservation can be achieved through less than fee, as well as fee simple acquisition. Additionally resource conservation can be accomplished at a sub-basin or project-level scale to augment other strategies, including stormwater retrofit and hydrologic restoration, and to provide for compatible public access and recreation.

As demonstrated through the Florida Forever program and other state, federal, local, and private initiatives, preserving sensitive lands can be an effective part of protecting water quality and habitat, as well as preserving floodplain and wetland functions. Where land is acquired fee simple by public agencies, other benefits, such as public access and recreation, are also achieved. Resource protection can be achieved through less than fee, as well as fee simple acquisition.

4.1.5 Public Awareness and Education

Public awareness and education efforts span multiple purposes and are an essential component of many of the other actions described here. Among the purposes of awareness and education efforts are:

- Technical outreach to assist in implementing specific programs (for example, best management practices);
- Informing members of the public about the purpose and progress of implementation efforts;
- Providing opportunities for public engagement and participation, as well as public feedback and program accountability; and
- Providing broad-based educational efforts to inform members of the public and specific user groups about watershed resources, their benefits, and personal practices to ensure their protection.

Examples of educational activities include technical training for BMPs, school programs (e.g., Grasses in Classes), public events, citizen science and volunteer programs, and project site visits.

Watershed stewardship initiatives can bring together multiple partners such as federal, state, and local agencies; non-profit groups; and citizen volunteers by identifying common program goals and intended outcomes. Having a variety of participants may offer important insight and expertise, shared experiences through lessons learned, and pooling of available resources to implement projects. Specific program examples include, but are not limited to: Walk the WBIDs; Grasses in Classes; homeowner oyster gardening program; rain garden/rain barrel workshops; storm drain labeling; marina BMPs; landowner cost-share assistance programs for living shorelines; elected official information and training sessions; spring break restoration projects; and messaging through outlets such as public service announcements, social media, events, and festivals.

4.1.6 Options for Further Study and Analysis

Additional work is needed to further advance the scientific understanding of resource conditions and restoration needs and opportunities. Additional analytical work can also support improved project planning and application of innovative methods for improved resource management.

- Develop improved and more detailed assessments of environmental conditions and trends, to include water quality, biology, and habitat.
- Develop a watershed-wide NPS pollution potential assessment at the 12-digit HUC level, to include analysis of land uses, applied loading rates, and potential BMP application.
- Identify estuarine sites with the potential for seagrass or other benthic habitat restoration through improved water quality treatment and water management within specific contributing basins.
- Complete a current, basin-wide analysis and prioritization of sedimentation sources and sites, to include unpaved road stream crossings, borrow pits, gulley erosion sites, and other erosion and sedimentation sources.
- Develop a spatial analysis of OSTDS, to include pollutant loading estimates and estimates of potential pollutant load reduction and average receiving waterbody pollutant concentrations following connection to central sewer and/or conversion to advanced onsite systems. Delineate target areas for central sewer connections and for advanced onsite systems.

- Develop a hydrodynamic model to improve the understanding of estuarine circulation, with application for estuarine and littoral restoration planning.
- Develop updated, regionally specific storm surge, floodplain, and sea level rise models to support project planning, floodplain protection, and adaptation planning, and to further the understanding of drivers of coastal habitat change.
- Evaluate the feasibility and potential benefits of proposed innovative and large-scale projects. Also identify and evaluate the potential for unintended adverse effects. Examples of such projects may include, but are not limited to:
  - Pumped and tidal flow-through circulation systems
  - Regional-scale shoreline habitat development proposals
  - Stream channel reconfiguration
  - Dredged material removal and disposal
  - Benthic dredging
- Develop improved metrics for monitoring and evaluating projects, programs, and environmental conditions and trends.
- Develop proposed scope of work, for multi-agency and peer evaluation, to address PCB contamination within Escambia Bay.
- Evaluate integrated water resource management approaches with application to specific water resource challenges in northwest Florida, potentially further developing plans for the reuse of reclaimed water and stormwater harvesting.
- Evaluate the extent and effects of seasonal hypoxia and the long-term effects of salinity change on submersed aquatic vegetation in the upper portions of the estuary.
- Develop analysis of oyster/shellfish habitat, conditions, and trends.
- Establish a framework for detecting the effects of climate change and ocean acidification on coastal marine resources in the region.
- Conduct monitoring and evaluate potential effects of herbicides, pharmaceuticals, endocrine disruptors, and other contaminants that have received relatively little historical attention in the Pensacola Bay system.
- Review past projects completed, identifying specific outcomes and lessons learned.
- Identify locally sensitive indicators of biological condition (biocriteria) for dominant diversity-building habitats (tidal wetlands, oyster reefs, and seagrass).
- Conduct future analysis within areas of the bay system with more limited environmental databases, such as East and Blackwater bays and Bayou Grande.
- Develop updated baseline study of current environmental conditions by conducting a one-time, multi-seasonal, multi-metric, and system-wide environmental analysis.
- Develop online consolidation of past and present environmental information, including natural resource coverages, research activities, restoration progress, monitoring results, TMDL updates, and regulatory actions.

4.2 Implementation

Table 4-2 outlines the planning progression of priorities, objectives, and selected management options and approaches for the Pensacola Bay system. These, in turn, inform and guide specific SWIM projects listed in Section 4.3. Following the discussion of watershed issues provided above, priorities and objectives are organized by major priority areas: water quality, floodplain functions, and natural systems. Education and outreach is included as well, since it is applicable to all priority areas.

Table 4-2 Watershed Priorities, Objectives, and Management Options

Watershed Priorities	Objectives	Management Options
Water Quality • Stormwater runoff and NPS pollution • Inadequate treatment from conventional OSTDS • Aging infrastructure (leaky pipes, inflow and infiltration, etc.) • Point source discharges • Needs and opportunities for improved wastewater collection and treatment • Sedimentation and turbidity from unpaved roads and other erosion sources • Water quality impairments for listed stream and estuarine waters, to include nutrients, dissolved oxygen, and bacteria • Historic losses of seagrass and oyster beds • Long-term degradation of water quality in urban bayous and Escambia Bay • Vulnerability of seagrasses, bayous, and other estuarine habitats	Improve treatment of urban stormwater, including from: - Urban bayou basins - Carpenter Creek and Jones Creek basins - Municipalities and fringe areas - Pensacola metropolitan area Protect and, as needed, restore water quality in impacted or designated priority areas: - Urban bayous - Escambia Bay - OFWs Restore water quality in impaired riverine, stream, and estuarine waters to meet state standards. Reduce basinwide NPS pollution from agricultural areas and erosion sites basin-wide. Reduce sedimentation from unpaved roads, borrow pits, and landscape erosion. Develop updated analyses of conditions and trends in East Bay and Blackwater Bay.	Stormwater retrofit projects Conversion of septic systems to central sewer Agricultural and silvicultural BMPs Evaluation and deployment of advanced passive onsite systems Upgrades to wastewater infrastructure Fee simple and less-than-fee protection of floodplains, riparian habitats, and other sensitive lands Floodplain and wetland restoration Riparian buffer zones Water reclamation and reuse Evaluate, prioritize, and address unpaved roads and associated erosion at stream crossings. Evaluate and address other erosion sites, such as borrow pits and gullies Continued monitoring and analytical efforts to further establish conditions and trends

Table 4-2 Watershed Priorities, Objectives, and Management Options

Watershed Priorities	Objectives	Management Options
Floodplain Functions • Headwater degradation and channelization • Diminished or disconnected floodplain area • Riparian buffer loss	Protect and reestablish functional floodplain area. Prioritize and correct hydrological alterations, including channelized streams.	Natural channel stream restoration Fee simple and less-than-fee protection of floodplains, riparian habitats, and other sensitive lands Protection and enhancement of riparian buffer zones Development and dissemination of detailed elevation (LiDAR) data Stormwater retrofit projects Continued flood map updates and detailed flood risk studies Hydrologic restoration to restore floodplain functions and restore natural hydrology Fee simple and less-than-fee protection of floodplains, riparian habitats, and other sensitive lands

Table 4-2 Watershed Priorities, Objectives, and Management Options

Watershed Priorities	Objectives	Management Options
Natural Systems • Wetland loss and degradation • Physically altered and impacted tributary streams • Legacy pollutants within estuarine substrate • Vulnerability of estuarine habitats • Saltwater intrusion that could alter brackish and freshwater habitats • Shoreline destabilization and erosion • Need for improved understanding of current and potential effects of sea level rise	Protect and as necessary restore major wetlands and floodplains, including: - Escambia, Yellow, and Blackwater river floodplains - Littoral marsh habitat - Jones Swamp and Jones Creek basin - Garcon and Fairpoint peninsulas - Carpenter Creek Protect and restore riparian and littoral habitats along streams, lakes, and estuarine shorelines. Where needed, restore wetland and stream hydrology. Restore tributary stream channels and floodplain connection, including bayou drainages, other tidal creeks, and tributaries in agricultural areas. Ensure restoration projects are compatible with coastal change. Restore and enhance estuarine benthic habitats. Restore seagrass beds, including through water quality improvement. Reduce sedimentation from unpaved roads, borrow pits, and landscape erosion. Protect and restore riparian habitats.	Wetland hydrologic and vegetation restoration and enhancement Protection and enhancement of riparian buffer zones Living shorelines techniques for shoreline protection and restoration Natural channel stream restoration Fee simple and less-than-fee protection of floodplains, riparian habitats, and other sensitive lands Development and dissemination of detailed elevation (LiDAR) data Benthic habitat restoration where water quality and hydrologic conditions are appropriate; may include seagrass beds and oyster reef habitats and potentially sediment removal Evaluate, prioritize, and address unpaved roads and associated erosion at stream crossings. Evaluate and address other erosion sites, such as borrow pits and gullies Coastal adaptation and land use planning Coastal infrastructure retrofits to enhance adaptation capacity Enhancement and application of tools to identify resources most vulnerable to sea level rise effects

Table 4-2 Watershed Priorities, Objectives, and Management Options

Watershed Priorities	Objectives	Management Options
Education and Outreach • Needs for: - Public understanding of practices to protect water resources - Opportunities for public participation - Improved BMP technical support	Support agricultural, silvicultural, and urban BMPs. Expand education and outreach about watershed resources and personal practices to protect water and habitat quality. Create long-term partnerships among stakeholders, including government, academic institutions, non-governmental organizations, businesses, residents, and others, to maximize effectiveness of project implementation. Build the capacity of landowners, agricultural producers, and others to protect watershed resources, functions, and benefits.	Technical BMP education and training Demonstration projects Collaborative community initiatives, with opportunities for business participation and sponsorship Internet access for public participation and to make program information and resource data continually available Dissemination of information about watershed resources and benefits via multiple approaches – Internet, publications, school programs, and workshops. Dissemination of information about resource programs, outcomes, and opportunities for participation Classroom programs, including hands-on restoration activities Community awareness and education events and programs Hands-on, citizen science, including volunteer participation monitoring and restoration programs Education and technical training workshops and resources for local government officials Opportunities for volunteer participation in data collection and project implementation

4.3 Priority Projects

Projects proposed to address above-described priorities and objectives are listed below and described in more detail on the following pages. Priority projects, as described herein, comprise strategies intended to address identified issues that affect watershed resources, functions, and benefits. These are intended to support numerous site-specific tasks and activities, implemented by governmental and nongovernmental stakeholders for years to come. Most address multiple priorities, as indicated in Table 4-3. The projects included are generally limited to those within the scope and purview of the SWIM program. With each project, conceptual scopes of work are presented, as are planning level cost estimates. Specific details, tasks, and costs will be developed and additional actions may be defined to achieve intended outcomes as projects are implemented. No prioritization or ranking is implied by the order of listing. Project evaluation and ranking will occur in multiple iterations in the future and will vary based on funding availability, specific funding source eligibility criteria, and cooperative participation.

Table 4-3 Recommended Projects: Pensacola Bay System SWIM Plan

PROJECT	WATERSHED PRIORITIES			
	WQ	FLO	NS	EDU
Stormwater Planning and Retrofit	✓	✓	✓	
Septic Tank Abatement	✓			
Advanced Onsite Treatment Systems	✓			
Agriculture and Silviculture BMPs	✓	✓	✓	✓
Basinwide Sedimentation Abatement	✓	✓	✓	
Riparian Buffer Zones	✓	✓	✓	✓
Hydrologic and Wetland Restoration	✓	✓	✓	
Estuarine Habitat Restoration	✓		✓	✓
Strategic Land Conservation	✓	✓	✓	
Watershed Stewardship Initiative	✓	✓	✓	✓
Sub-basin Restoration Plans	✓	✓	✓	✓
Wastewater Treatment and Management Improvements	✓		✓	
Interstate Coordination	✓			
Analytical Program Support	✓	✓	✓	✓
Comprehensive Monitoring Program	✓	✓	✓	✓

WQ – Water Quality
FLO – Floodplain Functions
NS – Natural Systems
EDU – Education and Outreach

Stormwater Planning and Retrofit

Description:

This strategy consists of retrofitting stormwater management systems to improve water quality, as well as to improve flood protection and accomplish other associated benefits. In addition to constructing new facilities, the project includes evaluation and improvement of existing systems and adding additional BMPs within a treatment train to improve overall performance within a given basin.

Scope of Work:

1. Prioritize basins and sites based on water quality, hydrologic, and land use data, together with consideration of local priorities, opportunities for partnerships, and other factors (as outlined in Section 4.4).
2. Support stormwater master planning at the local and regional level.
3. Develop project-specific implementation targets and criteria, to include pollutant load reductions, success criteria, and measurable milestones.
4. Develop a public outreach and involvement plan to engage citizens in the project's purposes, designs, and intended outcomes. The plan should include immediate neighbors that would be affected by the proposed project and other interested citizens and organizations.
5. Develop detailed engineering designs, with consideration of multipurpose facilities, innovative treatment systems where applicable, and treatment train approaches for basin-level stormwater management and treatment.
6. Install/construct individual retrofit facilities.
7. Monitor local water quality, including upstream/downstream and/or before and after implementation, as well as trends in receiving waters.
8. Analyze data to identify water quality trends in receiving waters.

Outcomes/Products:

1. Completed stormwater retrofit facilities
2. Improved water quality and flood protection
3. Data evaluation and system validation, with lessons applicable to future projects

Strategic Priorities:

- ✓ Water Quality
- ✓ Floodplain Functions
- ✓ Natural Systems

Supporting Priorities:

- ✓ Stormwater runoff and NPS pollution
- ✓ Water quality impairments for listed stream and estuarine waters
- ✓ Vulnerability of estuarine habitats

Objectives:

- ✓ Improve treatment of urban stormwater.
- ✓ Protect and, as needed, restore water quality in impacted or designated priority areas.
- ✓ Restore water quality in impaired riverine, stream, and estuarine waters to meet state standards.

Lead Entities:

- ✓ Local governments
- ✓ Estuary Program

Geographic Focus Areas:

Developed areas of the watershed, including but not limited to:

- ✓ Basins of urbanized and developing bayous
- ✓ Escambia, Pensacola, Blackwater, and East bays
- ✓ Carpenter Creek
- ✓ Santa Rosa Sound

Planning Level Cost Estimate:

>$50,000,000

Septic Tank Abatement

Description:

This strategy consists of converting OSTDS to central sewer to reduce pollutant export and improve surface and ground water quality. To facilitate accomplishment, among the project goals is to reduce or eliminate connection costs to homeowners.

Scope of Work:

1. Prioritize areas of need through spatial analysis of OSTDS distribution, proximity to karst and other sensitive resources, proximity to existing infrastructure, and resource monitoring data.
2. In cooperation with local governments and utilities, complete alternatives analysis, considering sewer extension, advanced onsite systems, and other approaches as appropriate.
3. Develop project-specific implementation targets and criteria, to include pollutant load reductions, success criteria, and measurable milestones.
4. Initiate a public outreach and involvement plan to engage the public in the project's purposes, designs, and intended outcomes.
5. Work with directly affected residents throughout the project; coordinate with neighborhoods and individual homeowners.
6. Install sewer line extensions, connect residences and businesses, and abandon septic tanks.
7. Monitor bacteria, nutrients, and other parameters in nearby groundwater and surface waterbodies.
8. Analyze data to identify changes in trends of target pollutants.

Outcomes/Products:

1. Completed implementation plans, prioritizing areas for septic-to-sewer conversion
2. Improved surface and groundwater quality

Strategic priority:
✓ Water Quality ✓ Natural Systems
Supporting Priorities:
✓ Inadequate treatment from conventional OSTDS ✓ Needs and opportunities for improved wastewater collection and treatment ✓ Water quality impairments for listed stream and estuarine waters ✓ Vulnerability of estuarine habitats
Objectives:
✓ Protect and, as needed, restore water quality in impacted or designated priority areas. ✓ Restore water quality in impaired riverine, stream, and estuarine waters to meet state standards. ✓ Reduce pollutant loading from aging infrastructure
Lead Entities:
✓ Utilities, local governments
Geographic Focus Areas:
✓ Bayou Grande basin ✓ City of Pensacola fringe areas ✓ Santa Rosa Sound ✓ Fairpoint Peninsula ✓ Yellow River basin ✓ Residential lands widely distributed across the northern watershed
Planning Level Cost Estimate:
>$20,000,000

Advanced Onsite OSTDS

Description:

This strategy consists of installation of advanced OSTDS to reduce pollutant loading. This approach is most appropriate in areas remote from existing central sewer infrastructure or likely extensions. It may be considered an adjunct to the Septic Tank Abatement project.

Scope of Work:

Planning

1. Prioritize areas of need through spatial analysis of OSTDS distribution, proximity to karst and other sensitive resources, proximity to existing infrastructure, and resource monitoring data.
2. In cooperation with FDOH and FDEP, evaluate passive technology onsite systems.
3. In cooperation with local governments, conduct outreach to property owners to facilitate installation of advanced onsite systems as an alternative to conventional OSTDS.
4. Develop project-specific implementation targets and criteria, to include pollutant load reductions, success criteria, and measurable milestones.
5. Install/construct advanced OSTDS based on prioritization of sites and funding availability.
6. Monitor bacteria, nutrients, and other parameters in nearby groundwater and surface waterbodies.
7. Analyze data to identify changes in trends of target pollutants.

Outcomes/Products:

1. Improved surface and groundwater quality

Strategic priority:
✓ Water Quality ✓ Natural Systems
Supporting Priorities:
✓ Inadequate treatment from conventional OSTDS ✓ Needs and opportunities for improved wastewater collection and treatment ✓ Water quality impairments for listed stream and estuarine waters ✓ Vulnerability of estuarine habitats
Objectives:
✓ Protect and, as needed, restore water quality in impacted or designated priority areas. ✓ Restore water quality in impaired riverine, stream, and estuarine waters to meet state standards. ✓ Reduce pollutant loading from aging infrastructure
Lead Entities:
✓ Utilities, local governments
Geographic Focus Areas:
✓ Escambia River Basin ✓ Blackwater River Basin ✓ Yellow River basin ✓ Residential lands widely distributed across the northern watershed
Planning Level Cost Estimate:
$15,000,000 (initial implementation)

Agriculture and Silviculture BMPs

Description:

This strategy consists of development and implementation of agriculture and silviculture BMPs to reduce basinwide NPS pollution, protect habitat, and promote water use efficiency.

Scope of Work:

1. In consultation with FDACS and NRCS, develop a comprehensive inventory of employed agriculture and silviculture BMPs and identify potential gaps and/or potential improvements for implementation in the watershed.
2. In cooperation with FDACS FFS, evaluate relationships between forest management practices and hydrologic and water quality effects.
3. Based on funding resources, develop plans for cost-share or other assistance for implementation.
4. Develop an outreach plan to engage agricultural producers and forestry practitioners; supporting technical training and participation in developing implementation strategies.
5. Conduct program outreach to support implementation of property-specific approved BMPs, potentially including annual cost-share grant cycles as defined by funding sources.
6. Work with FDACS to offer free technical assistance in the design and implementation of property- and resource-specific BMPs.
7. Monitor local water quality, including upstream/downstream and/or before and after project implementation, as well as trends in receiving waters. Additionally, conduct monitoring of participant experiences, encouraging feedback throughout and following implementation.
8. Analyze data to identify water quality trends.

Outcomes/Products:

1. Improved water quality
2. Improved capacity on the part of landowners to implement practices protective of water quality and watershed resources

Strategic Priorities:

- ✓ Water quality
- ✓ Floodplain Functions
- ✓ Natural Systems
- ✓ Education and Outreach

Supporting Priorities:

- ✓ Sedimentation and turbidity from unpaved roads and other erosion sources
- ✓ Water quality impairments for listed stream and estuarine waters, to include nutrients, dissolved oxygen, and bacteria
- ✓ Headwater degradation and channelization
- ✓ Riparian buffer loss

Objectives:

- ✓ Protect and, as needed, restore water quality in priority areas.
- ✓ Restore water quality in impaired waters to meet state standards.
- ✓ Reduce basinwide NPS pollution from agricultural areas and erosion sites.
- ✓ Reduce sedimentation from unpaved roads, borrow pits, and landscape erosion.
- ✓ Protect and restore riparian habitats.

Lead Entities:

- ✓ NWFWMD
- ✓ FDEP
- ✓ FDOH
- ✓ FWC
- ✓ Private landowners
- ✓ NRCS
- ✓ IFAS
- ✓ Estuary Program

Geographic Focus Areas:

For agriculture, the primary focus is within the northern watershed. For silviculture BMPs, the focus is basinwide.

Planning Level Cost Estimate:

- ✓ $1,000,000 annually

Basinwide Sediment Abatement

Description:

This strategy consists of development and implementation of activities related to sedimentation abatement to improve surface water quality and aquatic habitat quality. It may include any or all activities aimed at preventing and mitigating sedimentation and restoring impacted sites.

Scope of Work:

1. Review existing inventories of sedimentation sites and identify gaps.
2. Prioritize sites based on inventory and site evaluation, as well as consideration of water quality, other resource data, severity of impacts, and cumulative sub-basin effects.
3. Consider annual grant program for local governments to address high priority sites.
4. Develop individual site plans; detail proposed improvements and cost estimates.
5. Execute on-the-ground construction projects.
6. Implement complementary initiatives that may include education and outreach, development of new/improved BMPs, inspection programs, cost-share programs, training, demonstration projects, and maintenance.
7. Incorporate individual site improvements within geodatabase.
8. Monitor local water quality and habitat quality, including upstream/downstream and/or before and after implementation.
9. Analyze data to identify water quality trends.

Strategic Priorities:
✓ Water Quality ✓ Floodplain Functions ✓ Natural Systems
Supporting Priorities:
✓ Stormwater runoff and NPS pollution ✓ Sedimentation and turbidity from unpaved roads and other erosion sources
Objectives:
✓ Protect and, as needed, restore water quality in impacted or designated priority areas ✓ Restore water quality in impaired riverine, stream, and estuarine waters to meet state standards ✓ Reduce basinwide NPS pollution from agricultural areas and erosion sites basin-wide. ✓ Reduce sedimentation from unpaved roads, borrow pits, and landscape erosion.
Lead Entities:
✓ Local governments ✓ State and federal agencies ✓ Estuary Program
Geographic Focus Areas:
✓ Watershed-wide, particularly within rural areas ✓ Major erosion sites, including: – Julian Mill Creek – Clear Creek – Ferry Pass Bayou
Planning Level Cost Estimate:
$3,000,000 annual cost

Outcomes/Products:

1. Improved water quality, both onsite and in receiving riverine and estuarine waters
2. Improved aquatic habitat quality, including for sensitive species such as Gulf Sturgeon and freshwater mussels

Riparian Buffer Zones

Description:

This strategy consists of protection and restoration of riparian buffers to protect or improve water quality, habitat, and shoreline stability.

Scope of Work:

1. Coordinate planning and implementation with other projects to achieve overarching objectives.
2. Conduct screening evaluation of riparian areas; classify sites based on character and function.
3. Prioritize sites based on potential for protection or restoration of riparian habitat and function.
4. Conduct outreach to local governments and private landowners to identify sites for implementation. Develop site specific implementation options, including overlay zones and vegetation restoration.
5. Develop individual site plans, which detail proposed improvements and cost estimates.
6. Coordinate and support implementation by property owners and local governments.
7. Implement complementary initiatives that may include education and outreach, inspection programs, training, demonstration projects, and maintenance.
8. Conduct outreach by providing signage, tours, public access amenities, or similar for specific sites.
9. Monitor local water quality and habitat quality, including upstream/downstream and/or before and after project implementation.
10. Analyze data to identify water quality trends.

Outcomes/Products:

1. Improved protection of water quality, habitat, and shoreline stability
2. Establishment of demonstration sites to promote additional implementation of buffer zone concepts by private landowners and local governments

Strategic Priorities
✓ Water Quality ✓ Floodplain Functions ✓ Natural Systems ✓ Education and Outreach
Supporting Priorities:
✓ Stormwater runoff and NPS pollution ✓ Sedimentation and turbidity of unpaved roads and other erosion sources ✓ Headwater degradation and channelization ✓ Riparian buffer loss ✓ Vulnerability of estuarine habitats ✓ Shoreline destabilization and erosion
Objectives:
✓ Protect and, as needed, restore water quality in impacted or designated priority areas ✓ Protect and if necessary restore major wetlands and floodplains. ✓ Protect and restore riparian and littoral habitats along streams and estuarine shorelines. ✓ Support agricultural, silvicultural, and urban BMPs. ✓ Ensure restoration projects are compatible with coastal change. ✓ Restore and enhance estuarine benthic habitats.
Lead Entities:
✓ Private landowners ✓ Local governments ✓ Estuary Program ✓ Bay Area Resource Council
Geographic Focus Areas:
✓ Moore Creek basin ✓ Bayou Grande ✓ Santa Rosa Sound ✓ Headwater streams ✓ Shoal River basin
Planning Level Cost Estimate:
TBD* *Variable; includes passive implementation by property owners.

Hydrologic and Wetland Restoration

Description:

This strategy consists of implementation of a broad array of hydrologic and wetland protection and restoration measures to improve and protect surface water quality and to restore aquatic and wetland habitats. Such measures include but are not limited to vegetation reestablishment, restoration and enhancement of hydrologic connectivity, stream channel restoration, and floodplain reconnection and restoration.

Target areas include sites where floodplain storage has been diminished or where wetland hydrology has been disrupted. Additional focus areas include sites containing impediments to hydrological function such as culverts, dikes, levees, barriers to tidal flow, and barriers to freshwater exchange.

Scope of Work:

1. Conduct a site inventory and evaluation, to include channelized streams, drained/filled wetlands, road fill, and other areas conveying water. Evaluate freshwater and tidal drainage patterns and any restrictions in tidal flow. This includes initial desktop data collection and analysis, together with field data collection and site evaluation.
2. Identify restoration options, to include hydrologic reconnection (e.g., fill removal, low water crossings), tidal creek restoration, natural channel stream restoration, floodplain reestablishment, vegetation community reestablishment, tidal and riparian marsh restoration, and other options based on site characteristics and historic habitats.
3. Prioritize sites based on inventory and site evaluation, as well as consideration of water quality, other site and resource data, severity of impacts, cumulative effects, land ownership, and accessibility.
4. Conduct public outreach adaptable to specific project sites. Characterize individual projects with a list of stakeholders for each site. For project sites adjacent to communities or private property, as well as those with significant public visibility, consider demonstration sites, public meetings, site visits, project website, and other forms of engagement.

Strategic Priorities:

- ✓ Water Quality
- ✓ Floodplain Functions
- ✓ Natural Systems

Supporting Priorities:

- ✓ Water quality impairments for listed stream and estuarine waters, to include nutrients, dissolved oxygen, and bacteria
- ✓ Headwater degradation and channelization
- ✓ Diminished or disconnected floodplain area
- ✓ Wetland loss and degradation
- ✓ Physically altered and impacted tributary streams

Objectives:

- ✓ Restore water quality in impaired riverine, stream, and estuarine waters to meet state standards.
- ✓ Protect and reestablish functional floodplain area.
- ✓ Prioritize and correct hydrological alterations, including channelized streams.
- ✓ Protect and if necessary restore major wetlands and floodplains
- ✓ Ensure restoration projects are compatible with coastal change

Lead Entities:

- ✓ FWC
- ✓ NWFWMD
- ✓ FDEP
- ✓ USFWS
- ✓ Estuary Program

Geographic Focus Areas:

- ✓ Jones Swamp
- ✓ Bayou Chico basin
- ✓ Bayou Texar basin
- ✓ Tributary streams affected by road crossings and channelization
- ✓ Urbanized drainage basins
- ✓ Major erosion sites, for example:
  - – Julian Mill Creek
  - – Clear Creek
  - – Ferry Pass Bayou

Planning Level Cost Estimate:

TBD*

*Costs variable depending on specific sites.

5. Develop detailed site restoration designs for priority sites, taking into account public input and preferences.
6. Execute on-the-ground restoration projects.
7. Monitor local water quality and physical and biological site characteristics, including before and after implementation.
8. Analyze data to identify water quality trends.
9. Communicate results to watershed stakeholders and participating agencies.

Outcomes/Products:

1. Restored wetland, aquatic, and floodplain habitats and functions
2. Improved protection of water quality and natural systems
3. Established demonstration sites to promote additional implementation by private landowners and local governments

Estuarine Habitat Restoration

Description:

This strategy consists of activities related to estuarine habitat restoration to improve surface water quality, aquatic habitats, and coastal resiliency. Implementation should be coordinated with other project options, to include stormwater retrofits and other NPS pollution abatement, and upstream wetland and hydrologic restoration.

Scope of Work:

1. Conduct a site inventory and evaluation, to include evaluation of such factors as need for stabilization, habitat stability, stressors impacting shorelines, projected sea level rise, shoreline profile, ecosystem benefits, property ownership, public acceptance, and feasibility.
2. Identify project options, which may include, but are not limited to:
   a) Restoration/establishment of riparian and littoral vegetation communities
   b) On previously altered shorelines, establishment of living shorelines, which may include oyster or limerock breakwaters, substrate augmentation, and marsh vegetation establishment
   c) Restoration/creation of oyster reefs.
   d) Restoration of seagrass beds.
   e) Removal of barriers to fish passage.
   f) Identify and evaluate estuarine shorelines susceptible to erosion and at risk of hardening or other alteration.
   g) In cooperation with resource agencies, develop BMPs for living shoreline projects.
   h) Implement public outreach and education on options for protecting and restoring functional and resilient littoral habitats.
3. Prioritize sites based on inventory and site evaluation, as well as consideration of water quality, other site and resource data, severity of impacts, cumulative effects, land ownership, and accessibility. Coordinate directly with riparian landowners.
4. Develop of demonstration projects on public lands.
5. Conduct public outreach adaptable to specific project sites. For project sites adjacent to communities or private property, as well as those with significant public visibility, consider demonstration sites, public meetings, site visits, volunteer

Strategic priorities:
✓ Water Quality ✓ Floodplain Functions ✓ Natural Systems
Supporting Priorities:
✓ Stormwater runoff and NPS pollution ✓ Inadequate treatment from conventional OSTDS ✓ Needs and opportunities for improved wastewater collection and treatment ✓ Sedimentation and turbidity from unpaved roads and other erosion sources ✓ Historic losses of seagrass and oyster beds ✓ Vulnerability of seagrasses, bayous, and other estuarine habitats
Objectives:
✓ Protect and restore water quality in impacted or designated priority areas. ✓ Improve treatment of urban stormwater. ✓ Ensure restoration projects are compatible with coastal change. ✓ Restore and enhance estuarine benthic habitats. ✓ Restore seagrass beds, including through water quality improvement. ✓ Reduce sedimentation from unpaved roads, borrow pits, and landscape erosion.
Lead Entities:
✓ FWC ✓ FDEP ✓ USFWS ✓ Estuary Program
Geographic Focus Areas:
✓ Pensacola Bay system and tidal tributaries ✓ Bayou Chico ✓ East Bay ✓ Bayou Texar ✓ Escambia Bay
Planning Level Cost Estimate:
TBD* *Cost estimates will await completion of site inventory and evaluation.

participation, project website, and other forms of engagement. Extend opportunities for participation to property owners, local governments, and other stakeholders.

6. Develop detailed site restoration designs for priority sites, taking into account public input and preferences.
7. Execute on-the-ground restoration projects.
8. Monitor water quality and habitat conditions before and after construction
9. Compile and evaluate data to determine trends and to objectively measure project benefits and outcomes.
10. Evaluate and implement needed design adjustments or maintenance needs, such as the need to replant certain areas or remove invasive species.

Outcomes/Products:

1. Restored wetland and estuarine habitats and functions
2. Improved protection of water quality and natural systems
3. Establishment of demonstration sites to promote additional implementation by private landowners and local governments

Strategic Land Conservation

Description:

This strategy supports protection of floodplains, riparian areas, and other lands with water resource value to protect and improve surface water quality, with additional benefits for floodplain function and fish and wildlife habitat.

Scope of Work:

1. Use approved management plans and lists (such as the Florida Forever Work Plan) to complete an inventory of potential acquisition projects.
2. Evaluate whether potential sites augment other projects.
3. Identify potential funding sources that allow land acquisition as a component of achieving stated goals.
4. Where landowners have expressed interest, conduct a site analysis to include potential for achieving intended outcomes and potential for augmenting other projects.
5. Accomplish acquisition in accordance with statutory requirements.
6. Develop and implement restoration/ enhancement plans if appropriate.
7. Implement long-term monitoring program for conservation easements.

Outcomes/Products:

1. Improved long-term protection of water quality, habitat, and floodplain functions

Strategic priorities:

- ✓ Water Quality
- ✓ Floodplain Functions
- ✓ Natural Systems

Supporting Priorities:

- ✓ Stormwater runoff and NPS pollution
- ✓ Sedimentation and turbidity from unpaved roads and other erosion sources
- ✓ Water quality impairments for listed stream and estuarine waters, to include nutrients, dissolved oxygen, and bacteria
- ✓ Headwater degradation and channelization
- ✓ Diminished or disconnected floodplain area
- ✓ Riparian buffer loss
- ✓ Wetland loss and degradation
- ✓ Vulnerability of estuarine habitats
- ✓ Shoreline destabilization and erosion

Objectives:

- ✓ Protect and, as needed, restore water quality in impacted or designated priority areas.
- ✓ Protect and if necessary restore major wetlands and floodplains.
- ✓ Protect and restore riparian and littoral habitats along streams, lakes, and estuarine shorelines.

Lead Entities:

- ✓ FDEP
- ✓ Private landowners and working forests
- ✓ Local governments

Geographic Focus Areas:

- ✓ Jones Swamp/Perdido Pitcher Plant Prairie
- ✓ Coastal Headwaters Longleaf Forest
- ✓ Clear Creek – Whiting Field
- ✓ Upper Shoal River
- ✓ Garcon Ecosystem
- ✓ Wolfe Creek Forest

Planning Level Cost Estimate:

$33,000,000*

*Generally 50% of DEP-estimated land value for designated projects

Watershed Stewardship Initiative

Description:

The purpose of the watershed stewardship initiative is to create experiences that result in action-oriented tasks leading to improvements in water quality, tangible improvements in habitat quality, and public knowledge of and appreciation of watershed resources and functions. Outreach activities should be well structured, project-oriented, and include hands-on activities, as well as education about personal practices to protect watershed resources.

Scope of Work:

1. Develop a comprehensive inventory of current watershed stewardship and education efforts underway within the watershed, including funding sources for each.
2. Evaluate initiatives ongoing elsewhere within the state and the country.
3. Analyze the feasibility of combining efforts and resources, where practical and beneficial, with existing community-based initiatives.
4. Identify potential gaps and/or additional areas of focus.
5. Continue existing programs and implement new individual programs based on availability of funding.
6. Include hands-on activities, such as vegetation planting, invasive species removal, site tours, project demonstrations, and monitoring.
7. Implement technical training for landowners, including for implementation of agricultural and silvicultural BMPs, as well as urban BMPs and pollution prevention practices.
8. Monitor program accomplishments and outcomes, including through feedback from participant and citizen surveys.

Outcomes/Products:

1. Improved long-term protection of water quality, habitat, and floodplain functions
2. Improved capability on the part of property owners to implement BMPs
3. Improved public understanding of watershed resources, functions, and public benefits
4. Improved public understanding of, and participation in, resource programs and projects

Strategic priorities:

- ✓ Water Quality
- ✓ Floodplain Functions
- ✓ Natural Systems
- ✓ Education and Outreach

Supporting Priorities:

- ✓ Water quality impairments for listed stream and estuarine waters
- ✓ Vulnerability of estuarine habitats
- ✓ Needs for improved public understanding and participation; as well as for improved BMP technical support

Objectives:

- ✓ Restore water quality in impaired riverine, stream, and estuarine waters to meet state standards.
- ✓ Expand education and outreach about watershed resources and personal practices to protect water and habitat quality
- ✓ Create long-term partnerships among stakeholders, including government, academic institutions, non-governmental organizations, businesses, residents, and others, to maximize effectiveness of project implementation.
- ✓ Build the capacity of landowners, agricultural producers, and others to protect watershed resources, functions, and benefits.

Lead Entities:

✓ Estuary Program	✓ FDACS
✓ Local governments	✓ NWFWMD
✓ FDEP	✓ FWC
✓ BARC	✓ IFAS

Geographic Focus Areas:

- ✓ Watershed-wide

Planning Level Cost Estimate:

$200,000 annually

Sub-basin Restoration Plans

Description:

1. Evaluate and identify priority sub-basins in cooperation with local initiatives, state and federal agencies, and local governments.
2. Develop a scoping document outlining actions to be undertaken, customized for specific areas and needs.
3. Develop a public outreach and engagement plan to facilitate participation by affected neighborhoods and stakeholders.
4. With public and agency participation, identify specific goals for waterbody protection and restoration.
5. Incorporate separate strategies, including stormwater retrofit planning; OSTDS abatement; floodplain, wetland and hydrologic restoration; monitoring; and public outreach and engagement.
6. Identify separate actions and project types that can cumulatively achieve identified goals.
7. Implement public outreach and engagement by conducting field visits, public meetings, and providing innovative hands-on engagement opportunities. Coordinate with established watershed groups.
8. Implement selected actions.
9. Monitor program accomplishments and outcomes, including through feedback from participants and surveys of affected residents. Conduct monitoring pre- and post-implementation and of environmental trends within affected waterbodies.

Strategic priorities:
✓ Water Quality ✓ Floodplain Functions ✓ Natural Systems ✓ Education and Outreach
Supporting Priorities:
✓ All supporting priorities
Objectives:
✓ All identified objectives
Lead Entities:
✓ Local governments ✓ Estuary Program ✓ Bay Area Resource Council ✓ FDEP ✓ FWC ✓ NWFWMD
Geographic Focus Areas:
Targeted sub-basins within the watershed, including, but not limited to: ✓ Bayou Chico/Jones Creek ✓ Bayou Texar/Carpenter Creek ✓ All urban bayou sub-basins ✓ Santa Rosa Sound ✓ Shoal River ✓ Blackwater River
Planning Level Cost Estimate:
TBD* *Costs depend on specific projects included

Outcomes/Products:

1. Focused restoration plans, specific to priority waterbodies and basins
2. Improved water quality and aquatic and wetland habitat quality

Wastewater Treatment and Management Improvements

Strategic priorities:
✓ Water Quality
Supporting Priorities:
✓ Inadequate treatment from conventional OSTDS ✓ Point source discharges ✓ Needs and opportunities for improved wastewater collection and treatment
Objectives:
✓ Protect and, as needed, restore water quality in impacted or designated priority areas. ✓ Restore water quality in impaired riverine, stream, and estuarine waters to meet state standards.
Lead Entities:
✓ Local governments ✓ Utilities
Geographic Focus Areas:
✓ Watershed-wide ✓ Wastewater utilities with opportunities for water reclamation and reuse and integrated water resource management Systems proximate to coastal drainages ✓ Pensacola metropolitan area ✓ Milton area ✓ Pensacola Beach ✓ Santa Rosa Sound
Planning Level Cost Estimate:
>$100,000,000

Description:

This strategy consists of development and implementation of upgrades to centralized wastewater treatment collection systems to reduce pollutant loading within the watershed. Additional opportunities exist for water reclamation and reuse.

Scope of Work:

1. In cooperation with utilities and local governments, evaluate existing wastewater systems to identify areas and components with upgrade opportunities, as well as sewer service extension needs.
2. Prioritize systems based on factors such as age, pollutant discharge, apparent leakage, capacity, and access.
3. Develop detailed cost estimates. Show cost estimates for areas with outdated sewer systems that need to be upgraded, areas with a high density of septic tanks that can connect to a central water system, and areas where upgrades are needed, but are determined to be lower in priority.
4. Implement/construct enhanced wastewater treatment and water reclamation and reuse systems.
5. In accordance with wastewater permits, monitor water quality in proximate surface and ground waters.
6. Evaluate data to identify trends of target pollutants.

Outcomes/Products:

1. Improved water and aquatic habitat quality
2. Reduced wastewater discharges into the environment, coupled with improved conservation of potable water resources

Interstate Coordination

Description:

This strategy consists of activities related to interstate coordination to improve and protect surface water quality in the basin

Scope of Work:

1. Develop a comprehensive plan for coordination between interstate agencies within the watershed. Evaluate case studies of successful interstate programs.
2. Develop a comprehensive list that contains contact information for the various jurisdictions within the watershed. Develop an email distribution list, SharePoint group, and/or website to foster easy file and information sharing. Partnership entities should include USDA, Alabama Department of Economic and Community Affairs Office of Water Resources, other state agencies, local government, and non-profit organizations.
3. Compare areas of study and possible gaps in information.
4. Coordinate with Covington, Escambia, and Conecuh counties in Alabama on development of sub-basin plans, agricultural/silvicultural BMPs, and sediment abatement issues.
5. Continually inform and engage all stakeholders during progress or discussions of watershed issues. Hold regular open joint meetings between stakeholders from both states.
6. Coordinate closely on all implementation projects for stormwater management, hydrologic alteration/restoration, sedimentation, agricultural BMPs, etc. Utilize a publicly shared file and discussion tool (such as a website) to house the status and outcome(s) of all implementation projects within the watershed (within both states).

Strategic priorities:
✓ Water Quality ✓ Natural Systems ✓ Education and Outreach
Supporting Priorities:
✓ Stormwater runoff and NPS pollution ✓ Sedimentation and turbidity from unpaved roads and other erosion sources ✓ Needs for improved BMP technical support, opportunities for public participation, and public understanding of practices to protect water resources
Objectives:
✓ Reduce basinwide NPS pollution from agricultural areas and erosion sites basin-wide. ✓ Reduce sedimentation from unpaved roads, borrow pits, and landscape erosion. ✓ Create long-term partnerships among stakeholders, including government, academic institutions, non-governmental organizations, businesses, residents, and others, to maximize effectiveness of project implementation.
Lead Entities:
✓ NWFWMD ✓ FDEP ✓ Estuary Program
Geographic Focus Areas:
Watershed-wide with focus on northern extents of the watershed where Florida and Alabama interface
Planning Level Cost Estimate:
$25,000 annually

Outcomes/Products:

1. Progress toward basin approach to watershed protection
2. Expanded public participation and knowledge of watershed resources and management needs

Analytical Program Support

Strategic Priorities:
✓ All identified program priorities
Supporting Priorities:
✓ All identified program priorities
Objectives Addressed:
✓ All watershed objectives
Lead Entities:
✓ FFWC ✓ FDEP ✓ US EPA ✓ USFWS ✓ NWFWMD ✓ Educational and research institutions ✓ Estuary Program
Geographic Focus Areas:
Watershed-wide, including across jurisdictional boundaries
Planning Level Cost Estimate:
TBD* *Costs highly variable

Description:

This strategy is intended to support dedicated scientific assessment and analysis to improve watershed management, protection, and restoration. The tasks involved are inherently progressive and will therefore change and be redefined as information is developed and in response to ongoing and future conditions and management actions.

Scope of Work:

Integral components of this strategy include but are not limited to the actions presented below.

1. For specific resource functions and at the sub-basin level, develop and refine metrics for evaluating conditions and guiding implementation
2. In support of Urban Stormwater Retrofits, develop a stormwater pollutant loading analysis to include NPS pollutant loading estimates at the sub-basin level and pollutant load reduction estimates based on proposed or potential BMPs and facilities. Develop planning level estimates of potential water quality effects (pollutant concentrations) for receiving waterbodies.
3. Also in support of Urban Stormwater Retrofits, evaluate existing stormwater management systems to identify potential or needed improvements.
4. Evaluate innovative methods and designs to improve stormwater treatment, wastewater treatment and management, and ecological restoration.
5. In support of Septic Tank Abatement and implementation of Advanced Onsite Systems, develop a spatial analysis of OSTDS to include pollutant loading estimates and estimates of potential pollutant load reduction following connection to central sewer and/or conversion to advanced onsite systems. In cooperation with local governments and utilities, delineate proposed target areas for central sewer connections and for advanced onsite systems.
6. In support of Agricultural and Silvicultural BMPs, develop an agricultural NPS pollution abatement plan. For this purpose, develop nonpoint source pollutant loading estimates at the sub-basin level for watershed areas that are substantially agricultural in land use, and develop pollutant load reduction estimates and targets based on application of proposed or potential BMPs. Develop planning level estimates of water quality effects (pollutant concentrations) for receiving waterbodies.
7. Inventory, evaluate, and prioritize unpaved road stream crossings and other sedimentation sites in support of Basinwide Sedimentation Abatement.
8. Evaluate the site-specific feasibility and potential benefits and impacts of proposed innovative and/or large-scale projects, which may include but are not necessarily limited to:
   a. Regional-scale shoreline habitat development proposals
   b. Passive and/or pumped estuarine flushing systems
   c. Proposals for major hydrologic alterations, such as causeway alterations, locks and dams, and barrier island pass alteration and maintenance

   d. Stream channel reconfiguration
   e. Benthic dredging
   f. Dredged material removal and disposal

9. Identify estuarine sites with the potential for seagrass or other benthic habitat restoration through improved water quality treatment and water management within specific contributing basins.
10. Identify and describe the conditions, status, and trends of oyster and shellfish habitat within the bay.
11. Develop proposed scope of work, for multi-agency and peer evaluation, to address PCB contamination within Escambia Bay
12. Develop and refine hydrodynamic and water quality modeling tools. Develop specific management applications in cooperation with resource agencies and other public and nonprofit initiatives.
13. Evaluate effects of land use and management, to include forest management practices, on water quality. Identify and/or refine management options to protect and improve water quality.
14. Identify and describe long-term trends with respect to wetland and aquatic habitats, aquatic plants, and water chemistry. Identify management implications and recommendations.
15. Develop improved quantitative and qualitative metrics, to include biocriteria, for evaluating conditions and guiding program and project implementation.
16. Conduct a review of past projects completed, identifying specific project outcomes and lessons learned.
17. Develop an updated baseline study of current environmental conditions by conducting a one-time, multi-seasonal, multi-metric, and system-wide environmental analysis. Include evaluation of areas and metrics for which current information is lacking, inadequate or outdated.
18. Establish a research and monitoring framework for detecting the effects of climate change and ocean acidification on coastal marine resources in the region.

Outcomes/Products:

1. Improved understanding of watershed challenges and opportunities
2. Updated project priorities
3. Innovative project planning
4. Improvement in scientific basis for management strategies and actions
5. Improved understanding of quantitative potential of and expectations for environmental change in response to resource management
6. Improved metrics for evaluating conditions and guiding and tracking program implementation
7. Reduced risks of unintended adverse environmental or economic effects

Comprehensive Monitoring Program

Strategic priorities:
✓ All identified program priorities
Supporting Priorities:
✓ All identified program priorities
Objectives:
✓ All watershed objectives
Lead Entities:
✓ State resource agencies ✓ NWFWMD ✓ Federal resource agencies ✓ Local governments ✓ Bream Fishermen Association and other Community-based watershed monitoring initiatives ✓ Estuary Program or other cooperative, public-private initiatives ✓ Institutions of higher education; other environmental and watershed organizations
Geographic Focus Areas:
✓ Watershed-wide
Planning Level Cost Estimate:
$300,000 annually

Description:

This strategy provides for monitoring of program and project implementation, project outcomes, water quality, and habitat quality.

Scope of Work:

1. Identify appropriate parameters, to include environmental conditions and trends, and program parameters.
2. Establish a comprehensive and cumulative geodatabase of projects.
3. Further clarify and incorporate indicators at the watershed and subwatershed level.
4. Delineate sensitive/priority areas, e.g., proximity to surface waters and karst.
5. Develop public outreach application/website to communicate program implementation, outcomes, and trend data.
6. Develop updated inventory of organizations (and associated contacts) that currently or previously conducted field monitoring within the watershed, including funding sources for each. Evaluate the feasibility of combining efforts and resources, where practical and beneficial.
7. Identify potential gaps and/or additional areas of focus.
8. Develop core sampling designs for field monitoring. Determine optimal site distribution.
9. If appropriate, develop and implement a volunteer pool and volunteer training program.
10. Establish cooperative efforts with existing community initiatives and state and local agencies.
11. Support equipment acquisition where needed.
12. Where existing initiatives are not in place, consider developing a citizen water quality monitoring volunteer pool for target areas within the watershed.
13. Periodically conduct a comprehensive evaluation, at the watershed level, of program implementation, outcomes, and resource trends.

Outcomes/Products:

1. Improved long-term protection of water quality, habitat, and floodplain functions
2. Evaluations of project and program effectiveness, facilitating feedback and adaptive management
3. Improved public understanding of watershed resources, functions, and public benefits
4. Communication of program accomplishments to the public, elected officials, and stakeholders
5. Improved program accountability to the public and stakeholders
6. Improved public understanding of, and participation in, resource programs and projects

4.4 Project Criteria and Guidelines

This section outlines recommended guidelines to be applied to project development and prioritization. These items are not intended to be pass-fail for projects, but rather identify provisions that should receive consideration in project development and evaluation. Criteria specific to any given prioritization or funding decision are often defined, at least in part, by the funding resources under consideration. Individual sources of funding often are guided by criteria and guidelines established by statute or program documentation.

Generally suggested criteria for project evaluation are as follows.

1. Projects with responsible parties that will implement, operate, and maintain the completed facilities should be given priority consideration. Responsible parties optimally have dedicated sources of funding that will facilitate long-term operation and maintenance. Examples may include stormwater utilities and local option sales taxes.
2. Restoration that is substantially self-sustaining should be considered. Optimally, funded projects should not require continual or frequent human intervention beyond basic maintenance.
3. Responsible parties should support long-term monitoring to facilitate verification, lessons learned, and adaptive management. Long-term monitoring is also beneficial to support verification, lessons learned, and adaptation.
4. For restoration projects, sites and systems should be selected such that they reflect and are adaptable to natural variability. Restored habitats, for example, should be adaptable to cyclic climatic conditions (e.g., seasonal, hydrologic), discrete events (e.g., coastal storms), and long-term changes in the environment (e.g., climate change and sea level rise).
5. Cost effectiveness, technical feasibility, and regulatory factors are criteria to be considered in any prioritization and funding decision.

4.5 Funding Sources

Funding sources change over time. An outline of current funding sources, including descriptions of eligibility and project types contemplated, is provided in Table 4-4. These include Deepwater Horizon related sources and state, federal, and local government programs. Private funding sources, including from nonprofit organizations and private grant programs, may also be available.

Table 4-4 Funding Sources and Eligibility

Funding Source	Eligibility	Project Types
RESTORE Act		
Equal State Allocation (also known as Direct Component or Bucket/Pot 1)	75% of funds allocated to the eight disproportionately affected Panhandle coastal counties: Bay, Escambia, Franklin, Gulf, Okaloosa, Santa Rosa, Wakulla, and Walton. Remainder of funds allocated to the 15 non-disproportionately affected Gulf Coast counties, including Jefferson County in northwest Florida.	• Restoration and protection of the natural resources, ecosystems, fisheries, marine and wildlife habitats, beaches and coastal wetlands; • Mitigation of damage to fish, wildlife and natural resources; • Implementation of a federally-approved conservation management plan; • Workforce development and job creation; • Improvements to state parks located in coastal areas affected by the *Deepwater Horizon* oil spill; • Infrastructure projects benefitting the economy or ecological resources; including port infrastructure; • Coastal flood protection and related infrastructure; • Promotion of tourism and Gulf seafood consumption; or • Administrative costs and planning assistance.
Gulf Coast Ecosystem Restoration Council (also known as The RESTORE Council or Bucket/Pot 2)	Project selection based on Comprehensive Plan developed by the RESTORE Council with input from the public.	The Initial Comprehensive Plan adopts five goals: • Restore and Conserve Habitat; • Restore Water Quality; • Replenish and Protect Living Coastal and Marine Resources; • Enhance Community Resilience; or • Restore and Revitalize the Gulf Economy.
Oil Spill Restoration Impact Allocation (also known as The Gulf Consortium, or Bucket/Pot 3)	The Gulf Consortium, consisting of 23 Gulf Coast counties, is developing the State Expenditure Plan for Florida that must be submitted by the Governor to the RESTORE Council for its review and approval.	All projects, programs, and activities in the State Expenditure Plan that contribute to the overall ecological and economic recovery of the Gulf Coast (same project types as listed under the Equal State Allocation above).
NOAA RESTORE Act Science Program (also known as Bucket/Pot 4)	• Institutions of higher education • Non-profit organizations • Federal, state, local and tribal governments • Commercial organizations; • U.S. territories.	Research, observation, and monitoring to support the long-term sustainability of the ecosystem, fish stocks; fish habitat; and the recreational, commercial, and charter fishing industry in the Gulf of Mexico, including: • Marine and estuarine research; • Marine and estuarine ecosystem monitoring and ocean observation; • Data collection and stock assessments; • Pilot programs for fishery independent data and reduction of exploitation of spawning aggregations; • Cooperative research; or • Administrative costs.

<table>
<tr><th>Funding Source</th><th>Eligibility</th><th>Project Types</th></tr>
<tr><td>Centers of Excellence
(also known as Bucket/Pot 5)</td><td>University of South Florida, Florida Institute of Oceanography is administering Florida's Centers of Excellence Program.</td><td>• Coastal and deltaic sustainability, restoration, and protection, including solutions and technology that allow citizens to live in a safe and sustainable manner in a coastal delta in the Gulf Coast Region;
• Coastal fisheries and wildlife ecosystem research and monitoring in the Gulf Coast Region;
• Offshore energy development, including research and technology to improve the sustainable and safe development of energy resources in the Gulf of Mexico;
• Sustainable and resilient growth, economic and commercial development in the Gulf Coast Region; and
• Comprehensive observation, monitoring, and mapping of the Gulf of Mexico.</td></tr>
<tr><td colspan="3">Other Deepwater Horizon Funding</td></tr>
<tr><td>Natural Resource Damage Assessment
(NRDA)</td><td>Trustee Implementation Groups develop restoration projects guided by the programmatic restoration plan finalized in 2016. Public may submit project ideas & comment on plans.</td><td>The final plan takes a comprehensive and integrated ecosystem-level approach to restoring the Gulf of Mexico:
• Restore and Conserve Habitat
• Restore Water Quality
• Replenish and Protect Living Coastal and Marine Resources
• Provide and Enhance Recreational Opportunities</td></tr>
<tr><td>National Fish and Wildlife Foundation
(NFWF)</td><td>NFWF manages the Gulf Environmental Benefit (GEBF) fund established in 2013. In consultation with FWC and FDEP, NFWF identifies priority restoration and conservation projects for GEBF funding.</td><td>Projects that:
• Restore and maintain the ecological functions of landscape-scale coastal habitats, including barrier islands, beaches & coastal marshes;
• Restore and maintain the ecological integrity of priority coastal bays and estuaries; and
• Replenish and protect living resources including oysters, red snapper and other reef fish, Gulf Coast bird populations, sea turtles and marine mammals.</td></tr>
<tr><td colspan="3">Federal Sources</td></tr>
<tr><td>NOAA Coastal Resilience Grants</td><td>• Non-profit organizations
• Institutions of higher education
• Regional organizations
• Private entities
• States, territories and federally recognized Indian tribes
• Local governments</td><td>• Strengthening Coastal Communities: activities that improve capacity of coastal jurisdictions (states, counties, municipalities, territories, and tribes) to prepare and plan for, absorb impacts of, recover from, and/or adapt to extreme weather events and climate-related hazards.
• Habitat Restoration: activities that restore habitat to strengthen the resilience of coastal ecosystems and decrease the vulnerability of coastal communities to extreme weather events and climate-related hazards.</td></tr>
<tr><td>NOAA Office of Education Grants</td><td>Educational institutions and organizations for education projects and programs</td><td>• Environmental Literacy Program provides grants and in-kind support for programs that educate and inspire people to use Earth systems science to improve ecosystem stewardship and increase resilience to environmental hazards.
• Bay Watershed Education and Training (B-WET) provides competitive funding to support meaningful watershed educational experiences for K–12 audiences
• Cooperative Science Centers provide awards to educate and graduate students who pursue degree programs with applied research in NOAA mission-related scientific fields.</td></tr>
</table>

Funding Source	Eligibility	Project Types
US EPA Environmental Education Grants	• Local education agencies • State education or environmental agencies • Colleges or universities • Non-profit organizations • Noncommercial educational broadcasting entities • Tribal education agencies	Environmental education projects that promote environmental awareness and stewardship and help provide people with the skills to take responsible actions to protect the environment. This grant program provides financial support for projects that design, demonstrate, and/or disseminate environmental education practices, methods, or techniques.
US EPA – Exchange Network Grant Program	States, territories and federally recognized Indian tribes	Promotes improved access to, and exchange of, high-quality environmental data from public and private sector sources.
US EPA - Water Infrastructure Finance and Innovation Act (WIFIA) Program	• States, territories and federally recognized Indian tribes • Partnerships and joint ventures • Corporations and trusts • Clean Water and Drinking Water State Revolving Fund (SRF) programs	Accelerates investment in water infrastructure by providing long-term, low-cost supplemental loans for regionally and nationally significant projects.
State Sources		
FDEP (WMDs) Spring Restoration Program	•Local governments •Public and non-profit utilities •Private landowners	State Spring Restoration funding efforts include land acquisition and restoration, septic to sewer conversion, and other projects that protect or restore the quality or quantity of water flowing from Florida’s springs.
FDEP Special Management Area Grants	State agencies and water management districts	Research or coordination efforts in areas of special management. Examples of areas of special management would include, but not be limited to Areas of Critical State Concern, Critical Wildlife Areas, Aquatic Preserves, National Estuary Programs, and Surface Water Improvement and Management waterbodies
FDEP Coastal Partnership Initiative	Coastal counties and municipalities within their boundaries required to include a coastal element in the local comprehensive plan	Coastal resource stewardship and working waterfronts projects.
FDEP Beach Management Funding Assistance (BMFA) Program	• Local governments • Community development districts • Special taxing districts	Beach restoration and nourishment activities, project design and engineering studies, environmental studies and monitoring, inlet management planning, inlet sand transfer, dune restoration and protection activities, and other beach erosion prevention related activities consistent with the adopted Strategic Beach Management Plan.
FDEP Florida Communities Trust	Local governments and eligible non-profit organizations	Acquisition of land for parks, open space, greenways and projects supporting Florida's seafood harvesting and aquaculture industries.
Florida Forever	Funding is appropriated by the legislature distributed by the FDEP to state agencies	Acquisition of public lands in the form of parks, trails, forests, wildlife management areas, and more.
FDEP Coastal and Estuarine Land Conservation Program	States that have a coastal zone management program approved by NOAA or a National Estuarine Research Reserve (NERR)	Acquisition of property in coastal and estuarine areas that have significant conservation, recreation, ecological, historical, or aesthetic values, or that are threatened by conversion from a natural or recreational state to other uses.

Funding Source	Eligibility	Project Types
FDEP Clean Vessel Act Grants	Facilities that provide public access to pump-out equipment	Construction, renovation or installation of pump out equipment or pump out vessels.
FDEP Clean Water State Revolving Fund Loan Program (CWSRF)	Project sponsors	Planning, designing, and constructing water pollution control facilities.
FDEP Clean Water State Revolving Fund Program Small Community Wastewater Construction Grants	Small communities and wastewater authorities	This grant program assists in planning, designing, and constructing wastewater management facilities. An eligible small community must be a municipality, county, or authority with a total population of 10,000 or less, and have a per capita income (PCI) less than the State of Florida average of $26,503.
FDEP 319 grants	• State and local governments • Special districts, including water management districts • Nonprofit public universities and colleges • National Estuary Programs	Projects or programs that reduce NPS pollution. Projects or programs must be conducted within the state's NPS priority watersheds, including SWIM watersheds and National Estuary Program waters. All projects should include at least a 40% nonfederal match.
FDEP 319 Education Grants	Local governments in Florida	For projects that provide education and outreach about nonpoint source pollution in the adopted Basin Management Action Plan (BMAP) areas.
FDEP TMDL Water Quality Restoration Grants	Local governments and water management districts	Projects that: • Reduce NPS loadings from urban areas affecting verified impaired waters. • Are at least the 60% design phase. • Have permits issued or pending. • Include storm monitoring to verify load reduction. • Will be completed within three years of appropriation. • Include a minimum of 50% match with at least 25% provided by the local government. • Allocate grant funds to construction of BMPs, monitoring, or related public education.
FDACS Rural and Family Lands Protection Program	Agricultural landowners	State conservation easements that: • Protect valuable agricultural lands. • Ensure sustainable agricultural practices and reasonable protection of the environment. • Protect natural resources in conjunction with economically viable agricultural operations.
FDACS Forest Stewardship Program	Private forest landowners with at least 20 acres of forest land	Cost-share grants for implementation of stewardship to improve and maintain timber, wildlife, water, recreation, aesthetics, and forage resources.
FDACS Endangered and Threatened Plant Conservation Program	Private individuals and non-federal government entities	Actions that restore and maintain populations of listed plants on public land and on private lands managed for conservation purposes.

Funding Source	Eligibility	Project Types
Natural Resources Conservation Service	Private agricultural producers, landowners, and local governments	• Conservation Innovation Grants (CIG) stimulate development and adoption of innovative conservation approaches and technologies. • The Environmental Quality Incentives Program (EQIP) provides financial and technical assistance to agricultural producers that address natural resource concerns and improve water and air quality, conserve ground and surface water, reduce soil erosion and sedimentation, or improve or create wildlife habitat • Emergency Watershed Protection Program includes assistance to remove debris from streams, protect streambanks, establish cover on critically eroding lands, repair conservation practices, and purchase of floodplain easements.
Florida Fish and Wildlife Conservation Commission Wildlife Grants Program	State fish and wildlife agencies	Projects identified within State Wildlife Action Plan, including fish and wildlife surveys, species restoration, habitat management, and monitoring.
Florida Fish and Wildlife Conservation Commission Landowner Assistance Program	Private landowners	Cooperative and voluntary effort between landowners, the FWC, and the USFWS to improve habitat conditions for fish and wildlife.
Local Governments		
Local Government General Revenue	Defined by local statute. Generally local projects as approved by elected body, frequently leveraging state, federal, and other funding sources.	Defined by local statute and elected board.
Utility Funds – Stormwater and Wastewater	Utility projects benefiting rate payers. May leverage other local, state, and federal funding.	Stormwater and wastewater capital improvement and maintenance projects.

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Appendix A Implementation and Achievements of the Previous SWIM Plan

Previous SWIM Plan Issues and Priorities

The NWFWMD developed a SWIM Plan for the Pensacola Bay in 1988 and updated the plan in 1990 and 1997. The priority issues identified in the plan include the following (NWFWMD 1997):

- Water and Sediment Quality
- Habitat Quality
- Administration, Planning, and Coordination
- Public Education and Awareness

The 1997 SWIM plan identified 20 projects and proposed a spending plan to address these issues (see Table A-1.). The spending plan was provided for planning purposes only, and the actual spending varied, depending on available funding.

Table A-1 1997 SWIM Plan Projects

ID	Projects	FY 1998-2000
	Nonpoint source Program	
WSQ 1.0	Tributary monitoring	$172,000
WSQ 2.0	Land use/loading rate analysis	$80,000
WSQ 3.0	Bayou Chico restoration	$258,000
WSQ 4.0	Septic tank impact assessment	$20,000
WSQ 5.0	Bayou Texar retrofit	$75,400
WSQ 6.0	Gulf Breeze Bayous	$100,000
WSQ 7.0	Palafox/Cole restoration	$55,400
WSQ 8.0	Role of bay sediments	$92,100
WSQ 9.0	Pollutant load reduction goals	$100,000
	Habitat Program	
HAB 1.0	Tidal marsh preservation	$60,000
HAB 2.0	Bottomland hardwood preservation	$82,200
HAB 3.0	Biological Monitoring	$67,300
HAB 4.0	Circulation study	$0
	Coordinating Program	
APC 1.0	Administration and planning	$56,400
APC 2.0	Institutional and regulatory assessment	$7,000
APC 3.0	Interstate coordination	$87,600
APC 4.0	GIMS integration and coordination	$94,000
	Public Education and Awareness Program	
ED 1.0	Strategy development	$10,000
ED 2.0	Media and community relations	$30,000
ED 3.0	WaterWays video	$54,250

Source: NWFWMD 1997

Progress toward Meeting Plan Goals and Objectives

Specific SWIM projects and related cooperative projects previously implemented or ongoing in the watershed are listed in Table A-2. The District's Consolidated Annual Reports (http://www.nwfwater.com/Data-Publications/Reports-Plans/Consolidated-Annual-Reports) provide listings and descriptions of specific projects that have been completed under the auspices of the SWIM and Florida Forever programs.

Table A-2 Project Implementation

Project	General Description	Lead Entity	Corresponding SWIM Project[1]	Status[2]
Sediment Quality in the Pensacola Bay System	Compilation and analysis of sediment monitoring data for the Pensacola Bay system, detailed in DeBusk *et al*. 2002	NWFWMD	Role of Bay Sediments	Complete 2002
Biological Monitoring in the Pensacola Bay System: 1990-2000	Compilation and analysis of biological data for the Pensacola Bay system, detailed in Von Appen and Winter 2000; provides an update to Collard 1991	NWFWMD	Biological Monitoring	Complete 2000
Clear Creek Restoration	Stabilization of 45 acres of eroding gully	Blackwater SWCD	Basinwide Sedimentation Abatement (2017 plan update)	Complete 2004
Carpenter Creek Basin Stormwater Retrofit Project	Installation of stormwater treatment vault and three stormwater treatment units to reduce sediment entering Carpenter Creek and Bayou Texar	City of Pensacola	Bayou Texar Retrofit	Complete 2005
Big Escambia Creek Restoration	Restoration of stream to original channel	Three Rivers RC&D	Hydrologic and Wetland Restoration (2017 plan update)	Complete 2004
Palafox Basin Alum Injection System	Retrofit of "L" Street Pond with installation of alum injection system	City of Pensacola	Palafox/Coyle Restoration	Complete 2001
Bayou Chico Restoration	Maggie's Ditch stormwater retrofit project	NWFWMD	Bayou Chico Restoration	Complete 1999
Main Street WWTP Relocation	Major state-local-federal WWTP relocation project to move the main plant in Pensacola outside of the floodplain/hurricane zone	ECUA	Wastewater Treatment and Management Improvements (2017 plan update)	Complete 2010
Project Greenshores Phase I	Restoration of 15-20 acres of saltmarsh along Pensacola Bay shoreline	FDEP	Estuarine Habitat Restoration (2017 plan update)	Complete 2003
17th Avenue Stormwater Pond	Construction of a stormwater treatment system, to reduce pollutant loading to Bayou Texar	City of Pensacola	Bayou Texar Retrofit	Complete 2003
Bayou Chico Restoration	Removal of sediment (187,000 cubic yards) from Bayou Chico	NWFWMD	Bayou Chico Restoration	Complete 2004
19th Avenue and Brainerd Street Stormwater Retrofit	Installation of stormwater treatment facilities for 160 acre drainage basin discharging into Pensacola Bay	City Of Pensacola	Bayou Texar Retrofit	Complete 2004

Project	General Description	Lead Entity	Corresponding SWIM Project[1]	Status[2]
Bayou Texar Retrofit	Stormwater retrofit of I-110 Pond	City of Pensacola	Bayou Texar Retrofit	Complete 2001
Stormwater Drainage Improvement (Gulf Breeze)	Construction of an exfiltration system and other stormwater improvements at five sites to reduce runoff and nonpoint surface water discharge to Santa Rosa Sound	City of Gulf Breeze	Gulf Breeze Bayous	Complete 2006
Second and Sunset Wetland Water Quality Improvement	Stormwater retrofit urbanized 33 acre contributing basin to Davenport Bayou/Pensacola Bay. Project will create a wetland treatment system, including planting of vegetation and installation of dissipation structures	Escambia County	Stormwater Planning and Retrofit (2017 plan update)	Complete 2008
Holley-Navarre Water System Golf Course Re-Use Line Replacement	Replace an existing 13,000 LF of 10" reclaimed water line with a 12" line, serving the Hidden Creek Golf Course and surrounding residential neighborhood	Holley-Navarre Water System, Inc.	Wastewater Treatment and Management Improvements (2017 plan update)	Complete 2015
South Santa Rosa Utility System Reclaimed Water Elevated Storage Tank	Construction of elevated reclaimed water storage tank for an existing system	City of Gulf Breeze	Wastewater Treatment and Management Improvements (2017 plan update)	Complete 2014
ECUA Pensacola Beach Reclaimed Water System Expansion	Planning, design and construction of a ground storage tank; pump station; and associated piping, valves, and other system components to expand the Pensacola Beach reclaimed water system	ECUA	Wastewater Treatment and Management Improvements (2017 plan update)	In progress
City of Mary Esther Reclaimed Water Feasibility	Planning and evaluation for reclaimed water reuse program	City of Mary Esther	Wastewater Treatment and Management Improvements (2017 plan update)	In Progress

[1]1997plan projects unless otherwise indicated
[2]As of July 2017

In addition to the projects listed above, local governments and state and regional agencies have completed a number of initiatives and projects that directly correspond to and advance SWIM plan implementation. Several of the more prominent efforts are described below. Other related resource management activities are described in Appendix B.

Escambia County Dirt Road Project – With U.S. EPA 319(h) program funding, Escambia County evaluated alternative pavements for unpaved roads and implemented paving projects to reduce sediment erosion and runoff to streams. Work was completed in 2011 (Fabre Engineering and Surveying 2016).

Big Escambia Creek Restoration – About 40 years ago, a major storm rerouted the Big Escambia Creek from its original braided streams and floodplain through a series of sandpits. The new channel lacked a floodplain and stable riparian areas, thus, allowing increased velocity and sedimentation. The sedimentation impacts reached several miles downstream into the Escambia River. The USACE, in partnership with the states of Alabama and Florida, the NWFWMD, Three Rivers Resource Conservation and Development Council, and the Alabama Rural Development Council, completed a large-scale project that restored the creek back to its natural channel within the wetland floodplain (FDEP 2009).

Project Greenshores – Two habitat restoration projects on the north shore of Pensacola Bay created salt marsh, seagrass, and oyster reef habitat along the shoreline. It is a partnership between the FDEP's Northwest District Office Ecosystem Restoration Section, the City of Pensacola, the Ecosystem Restoration Support Organization, federal and local agencies, businesses, and community volunteers. The first habitat restoration site (Site I) provides eight acres of salt marsh habitat and seven acres of oyster reef. The second site (Site II), when completed, will provide an additional 14 acres of salt marsh and 13 acres of oyster reef habitat. Project Greenshores received the Coastal America Partnership Award for its extensive community involvement (FDEP 2016g).

City of Pensacola Transportation/Stormwater Plan Projects – Numerous stormwater retrofits, reconstruction, drainage improvements, and other projects have been completed, as follows (City of Pensacola 2016):

- Government Street Regional Stormwater Pond;
- Guillemard Street Storm Sewer Reconstruction
- Long Hollow/Cervantes Street Stormwater Pond
- Carpenter Creek Retrofit
- 17th Avenue Park and Drainage Improvement
- Sewell Street Stormwater Drainage Easement Acquisition
- Chipley Street Drainage Improvement
- L and Zarrogossa Street Drainage Improvement
- Government Street/Jones Park Drainage Improvement
- Zarrogossa and C Street Drainage Improvement
- 9th Avenue Baars Drainage Improvement
- Sanders Beach Storm Sewer Reconstruction
- Longhollow Pond Reconstruction
- 9th Avenue and Texar Drainage Improvement
- Burgess Road and Sanders Drainage Improvement
- Carpenter Creek/Bayou Texar stormwater management assessment
- East Hill Drainage Improvement

Bayou Chico Restoration Projects – Over the past 20 years, several water quality improvement projects have been undertaken by the FDEP's Northwest District Ecosystem Restoration Section, Escambia County, NWFWMD, and Bayou Chico Association. Projects include the removal of the old Barrancas Street drawbridge, removal of the old CSX train trestle, construction of a sediment basin at W Street, construction of the Maggie's Ditch stream restoration, and several emergent marsh restoration projects along the bayou's shoreline.

Wayside Park Restoration Project – The City of Gulf Breeze, FDEP, and the USACE constructed an offshore rock breakwater and seagrass/emergent marsh at the south end of Three Mile Bridge (FDEP 2007).

Deadman's Island Restoration Project – With funding assistance from the U.S. Army Corps of Engineers, the City of Gulf Breeze completed restoration of approximately 13 acres of littoral habitat, including an oyster reef breakwater and salt marsh (Reed 2017). The project included demonstration and evaluation of alternative restoration techniques and accomplished protection of habitats affected by historical bridge construction, dredging, and shoreline armoring.

Appendix B Related Resource Management Activities

Much of the progress to date is attributable to cooperative efforts made on the part of local governments; state, federal, and regional agencies; and private initiatives. Many programs and projects share common goals, and their implementation is most frequently accomplished through coordinated planning, funding, management, and execution. This section describes historical and ongoing activities and programs to address resource issues within the watershed.

Special Resource Management Designations

Outstanding Florida Waters

The FDEP designates Outstanding Florida Waters (OWFs) under section 403.061(27), F.S., which are then approved by the Environmental Regulation Commission. An OFW is defined by FDEP as a waterbody "…worthy of special protection because of its natural attributes." A number of waterbodies and segments in the watershed have been recognized and receive additional regulatory protection through designation as OFWs, per Section 62-302.700, F.A.C. Designated OFWs include:

- Yellow River Marsh Aquatic Preserve
- Fort Pickens Aquatic Preserve
- Gulf Islands National Seashore
- Escambia Bay Bluffs
- Blackwater River State Park
- Yellow River Marsh Preserve State Park
- Clear Creek between Milton and Whiting Field

Aquatic Preserves

Florida currently has 41 aquatic preserves, encompassing approximately 2.2 million acres of submerged lands protected for their biological, aesthetic, and scientific value. As described in Chapter 18-20, F.A.C., aquatic preserves were established for the purpose of being preserved in an essentially natural or existing condition so that their aesthetic, biological, and scientific values may endure for the enjoyment of future generations. The Pensacola Bay system includes two aquatic preserves: the Yellow River Marsh Aquatic Preserve, and the Fort Pickens Aquatic Preserve.

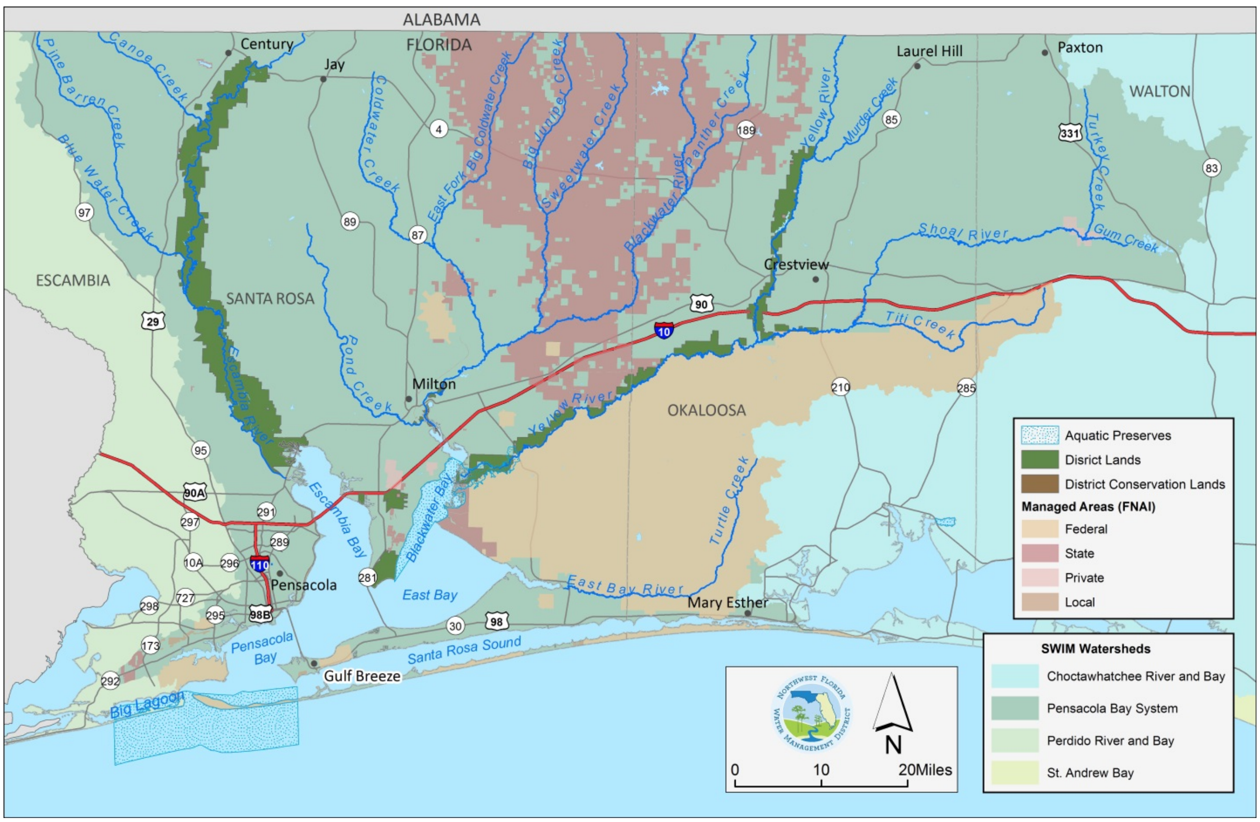
The Yellow River Marsh Aquatic Preserve encompasses approximately 11,000 acres of the Yellow River, Blackwater Bay, and East Bay. The aquatic preserve is among the watershed's least impacted natural areas and includes more than 3,000 acres of salt and freshwater marshes and approximately 5,000 acres of forested wetlands. The remainder of the preserve is open water. Eglin AFB and the NWFWMD manage almost half of the uplands adjacent to the preserve, which further protects water quality (FDEP 2016f).

Fort Pickens Aquatic Preserve includes 34,000 acres of submerged lands adjacent to Gulf Islands National Seashore. The preserve includes sandy bottom and seagrass bed habitats that are for numerous species, including the loggerhead turtle (*Caretta caretta*), the southeastern snowy plover (*Charadrius nivosus*), the least tern, and the black skimmer (*Rynchops niger*). Fort Pickens Aquatic Preserve includes portions of Santa Rosa Sound, Pensacola Bay, and Big Lagoon, extending northward to the Gulf Intracoastal Waterway. The preserve also includes submerged lands in the Gulf of Mexico up to three miles south of the coastline (FDNR 1992).

Conservation Lands

Approximately 520,000 acres, or 35 percent, of the watershed in Florida consists of public and conservation lands. These are listed with short descriptions in Appendix G.

The NWFWMD owns and manages over 55,000 acres within the watershed. The Yellow River, Escambia River, Blackwater River, and Garcon Point WMAs are public lands that provide joint conservation and recreational use. The District also manages 19 acres in the watershed as conservation easements, maintaining private ownership while protecting water resources. The Yellow, Blackwater, and Escambia River WMA tracts are also managed by FWC as Wildlife Management Areas. These areas are managed to protect and restore wildlife habitat, while also providing a resource for compatible public recreation. Land-management activities include prescribed burning, timber management, groundcover restoration, reforestation, and other activities (FWC 2016d, NWFWMD 2016b). The FWC also manages the Lake Stone Fish Management Area in Escambia County.



Source: FDEP 2011b; FNAI 2016b

Figure B-1 Conservation Lands within the Pensacola Bay Watershed

The National Park Service owns and manages the Gulf Islands National Seashore, established in 1971. The seashore supports an abundance of natural habitats, including coastal dunes, scrub, and estuarine marsh ecosystems. Portions of the military lands within the watershed are managed as conservation areas, including 10,738 acres owned and managed by the U.S. Navy and 229,743 acres owned and managed by the U.S. Air Force (FNAI 2010).

State lands in the watershed include the Blackwater River State Forest, Fort Pickens State Park, and Blackwater River State Park. The Blackwater River State Forest covers over 210,000 acres in northern Santa Rosa and Okaloosa counties, including significant portions of the Blackwater River and Yellow

River watersheds. These park and forest lands protect water and other natural resources, while also providing important opportunities for public use and recreation. The state forest is also a resource for timber production, with harvesting following silvicultural BMPs.

Garcon Peninsula Mitigation Bank and Pensacola Bay Mitigation Bank are privately owned wetland mitigation banks within the Pensacola watershed. The Pensacola Bay Mitigation bank consists primarily of mixed hardwood and pine flatwoods and hosts a healthy population of carnivorous pitcher plants, while Garcon Peninsula Mitigation Bank consists primarily of pitcher plant prairie (Garcon Peninsula Mitigation Bank, LLC 2001; Westervelt Ecological Services 2016). The Garcon Peninsula Mitigation Bank is northwest Florida's first wetlands mitigation bank and includes over 330 acres within the watershed (FNAI 2010, 2016a).

Jones Swamp Preserve was purchased by Escambia County in 1996 as part of Bayou Chico restoration efforts to provide buffering and protection of water quality in the Pensacola Bay area. The Jones Swamp Wetland Preserve consists of over 580 acres within the Jones Creek watershed, at the urban interface within the Bayou Chico drainage (Escambia County 2016a). More than 60 percent of the Jones Swamp Preserve is covered by forested wetlands, including hardwood swamp, bay swamp, cypress swamp, and mixed wetland forest communities. The Preserve is managed for wetland, groundwater, and surface water quality protection and restoration; hydrological restoration, including floodplain restoration; preservation and conservation of natural resources; environmental education; and outdoor recreation.

Critical Habitat and Strategic Habitat Conservation Areas

The Pensacola Bay system sustains numerous listed species, as designated under the Endangered Species Act (ESA). The ESA also provides special protection for Critical Habitat of certain species, which may include an area that is not currently occupied by the species, but that will be needed for its recovery.

As described above, the Pensacola Bay system includes federally designated critical habitat for the threatened Gulf sturgeon and several species of freshwater mussels. The watershed also supports the threatened piping plover, the endangered reticulated flatwoods salamander, and the blackmouth shiner, which is considered endangered by the state of Florida (FNAI 2001).

Certain natural areas within the watershed have been identified by the FWC as Strategic Habitat Conservation Areas (SHCAs). SHCAs are important habitats in Florida that do not have conservation protection, which would increase the security of rare and imperiled species if they were protected. Within the Pensacola Bay watershed, SHCAs have been identified for several species, including the Florida black bear (*Ursus americanus floridanus*), pine barrens tree frog (*Hyla andersonii*), seal salamander (*Desmognathus monticola*), and others (Endries *et al.* 2009)

Portions of the estuary adjacent to the Gulf of Mexico also provide habitat for three species of threatened and endangered sea turtles, and beach and dune communities alo provide habitat for the endangered Santa Rosa Beach mouse (*Peromyscus polionotus leucocephalus*) (USFWS 2016a).

The FDACS publishes a list of the protected plants of Florida, including those species listed as federally threatened and endangered by the USFWS (Weaver and Anderson 2010). The table in Appendix D provides a list of species that are protected for the watershed, as well as their habitat requirements.

Gulf Ecological Management Sites

The watershed includes two Gulf Ecological Management sites (GEMS), the Yellow River Marsh Fort Pickens aquatic preserves. The GEMS Program is an initiative of the Gulf of Mexico Foundation, the

EPA Gulf of Mexico Program, and the five Gulf of Mexico states (Gulf of Mexico Foundation 2015). Designated GEMS are considered high priority for protection, restoration, and conservation by state and federal authorities due to unique ecological qualities such as habitats significant to fish, wildlife, or other natural resources (Gulf of Mexico Foundation 2015).

Deepwater Horizon: RESTORE Act, Natural Resource Damage Assessment (NRDA), and NFWF Projects

The FDEP and the FWC are the lead state agencies in Florida for responding to the impacts of the Deepwater Horizon oil spill and the resulting restoration process. Restoration projects submitted through the FDEP are considered for funding under the Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast Act (RESTORE Act) Comprehensive Plan Component, the NRDA, and the NFWF's GEBF.

RESTORE

The RESTORE Act of 2012 allocates to the Gulf Coast Restoration Trust Fund 80 percent of the CWA administrative and civil penalties resulting from the oil spill. The major means of allocation under the RESTORE Act are as follows:

Direct Component Funds ("Bucket 1"): Seven percent of these funds will be directly allocated to counties affected in Florida (5.25 percent to the eight disproportionately affected counties in the Panhandle from Escambia to Wakulla counties; and 1.75 percent to the non-disproportionately impacted Gulf Coastal counties). To receive funds under the Direct Component, each county is required to submit a Multiyear Implementation Plan, subject to review by the U.S. Department of the Treasury, detailing the county's plan to expend funds for a set of publically vetted projects and goals (FDEP 2016h).

Comprehensive Plan Component ("Bucket 2"): A portion of RESTORE funds will go toward projects with a wider geographic benefit (multiple states). These projects are selected by the Gulf Coast Ecosystem Restoration Council, which includes the five Gulf States and six federal agencies. Projects can be submitted by the Council members and federally recognized Native American tribes.

Spill Impact Component ("Bucket 3"): Each of the five Gulf states will receive these funds to implement a State Expenditure Plan. In Florida, this plan is being developed through the Gulf Consortium, which was created by inter-local agreement among Florida's 23 Gulf Coast counties. Projects will be submitted by each of the 23 counties on Florida's Gulf Coast.

National Resource Damage Assessment (NRDA)

The Oil Pollution Act of 1990 authorizes certain state and federal agencies to evaluate the impacts of the Deepwater Horizon oil spill. This legal process, known as NRDA, determines the type and amount of restoration needed to compensate the public for damages caused by the oil spill. The FDEP, along with the FWC, are co-trustees on the Deepwater Horizon Trustee Council.

National Fish and Wildlife Foundation

The National Fish and Wildlife Foundation (NFWF) established the GEBF to administer funds arising from plea agreements that resolve the criminal cases against BP and Transocean. The purpose of the GEBF, as set forth in the plea agreements, is to remedy harm and eliminate or reduce the risk of future harm to Gulf Coast natural resources. The plea agreements require NFWF to consult with state and federal resource agencies in identifying projects. The FWC and the FDEP work directly with the NFWF to identify projects for the state of Florida, in consultation with the USFWS and the NOAA. From 2013 to 2018, the GEBF will receive a total of $356 million for natural resource projects in Florida. However, the allocation of funds is not limited to five years. NFWF funded the development of the 2017 SWIM plan updates through the GEBF.

The Nature Conservancy (TNC): Watershed Management Planning

To achieve comprehensive and long-term success for Gulf restoration, TNC facilitated a community-based watershed management planning process in 2014 and 2015 along Florida's Gulf Coast for the following six watersheds: Perdido Bay, Pensacola Bay, Choctawhatchee Bay, St. Andrew and St. Joseph bays, Apalachicola to St. Marks, and the Springs Coast. The process was designed to develop watershed-based plans that identify environmental issues affecting each watershed and solutions that address the issues. The process was also intended to create long-term partnerships among stakeholders in each watershed and across the regions to maximize effectiveness of project implementation and funding efforts and to provide a screening tool to evaluate priorities for potential funding (TNC 2014).

The TNC Plan developed for the Pensacola Bay system identifies 43 separate projects to address seven major actions (TNC 2014):

- Protect, restore, create and/or manage natural habitat and resources and increase buffer areas;
- Increase cooperation and coordination for management, monitoring, funding, implementation, outreach, and enforcement;
- Reduce impacts to groundwater and ensure adequate fresh water availability;
- Reduce and treat stormwater;
- Reduce nutrient loading;
- Reduce sedimentation; and
- Increase economic diversification.

To complete the planning process and ensure that all of the priority issues are identified and addressed, the plan recommended updating the 1997 Pensacola Bay System SWIM Plan (TNC 2014).

Monitoring Programs

The majority of the monitoring data in the Pensacola Bay system, including chemical and biological data, has been collected by the FDEP Northwest District staff and the Bream Fishermen Association (BFA) (FDEP 2007). Data-gathering activities include working with environmental monitoring staff in the NWFWMD and local and county governments to obtain applicable monitoring data from their routine monitoring programs and special water quality projects in the basin. All of the data collected by the FDEP and its partners is uploaded to the statewide water quality database for assessment.

Several water quality monitoring programs are ongoing in the watershed. These include the FDEP Trend and Status Networks; FDACS Shellfish Environmental Assessment Section (SEAS); the FDOH Florida Healthy Beaches monitoring program; and the BFA.

The following subsections provide an overview of these programs and some of their relevant findings.

FDEP/NWFWMD

Long-term trends in water quality are monitored by FDEP's Surface Water Temporal Variability (SWTV) and Groundwater Temporal Variability (GWTV) monitoring networks. These are statewide networks of fixed sites selected to reflect the water quality impacts across the state. The SWTV network includes data collection at 78 fixed sites, including seven sites in the Pensacola Bay system (FDEP 2016j, 2016k):

- Escambia River – two sites: one in Century, near the Alabama-Florida state line, and one downstream at a site that is representative of the watershed's land use activities.
- Blackwater River – two sites: one in the upstream, undeveloped portions of the river. And one on Big Coldwater Creek, a tributary of the Blackwater River.
- Yellow River – two sites: one near the Alabama-Florida state line, and one downstream, near East Bay, at a site that is representative of the watershed's land use activities.
- East Bay River – one site near East Bay that is representative of the watershed's land use activities.

Parameters monitored include color alkalinity, turbidity, suspended and dissolved solids, nutrients, total organic carbon, chlorides, sulfate, metals (calcium, potassium, sodium, magnesium), pH, conductivity, temperature, DO, total coliform bacteria, fecal coliform bacteria, enterococci bacteria, and Escherichia bacteria (FDEP 016i, 2016j).

The GWTV network includes data collection at 49 fixed stations statewide (24 unconfined aquifer wells, 23 confined aquifer wells, and two spring vents), including one unconfined aquifer well sampled monthly, located north of Bayou Grande and the Pensacola NAS.

Water quality data are maintained and made available through the Storage and Retrieval (STORET) database.

FDEP Northwest District

The FDEP's Northwest District has collected considerable biological data and conducted biological evaluations of numerous stream and other aquatic habitat sites throughout the watershed (FDEP 2007). The biological data collected by the FDEP Northwest District includes Stream Condition Index, Stream Habitat Assessment, Stream Linear Vegetation Index, Stream Rapid Periphyton Survey, Wetland Condition Index, and Bioassessment data, all are reported and accessible via STORET.

Florida Department of Agriculture and Consumer Services

To minimize the risk of shellfish-borne illness, FDACS continually monitors and evaluates shellfish harvesting areas and classifies them accordingly. It also ensures the proper handling of shellfish sold to the public. Under the SEAS program, FDACS collects and analyzes data from 1,200 bacteriological sampling stations in 39 shellfish harvesting areas encompassing 1.4 million acres in Florida, including five shellfish harvesting areas in the Pensacola Bay system. The FDACS monitors bottom and surface temperature, salinity, DO, surface pH, turbidity, fecal coliform bacteria, water depth, and wind direction and speed at monitoring stations in Pensacola Bay, Escambia Bay, East Bay, East Bay River, and Blackwater Bay. The dataset begins in 1985 and continues to the present. These stations are monitored at least monthly and often more frequently (FDACS 2016b).

The FDEP identified eight waterbody segments as verified impaired for bacteria in the Pensacola Bay watershed, based on shell fish classifications issued by the FDACS (see Section 3.2).

Florida Department of Health

The Florida Healthy Beaches Program was initiated by the FDOH as a pilot beach monitoring program in 1998 with expansion to include all the state's coastal counties in August 2000 (FDOH 2005). The

Escambia County and Santa Rosa County health departments participate in the program with weekly monitoring of beaches for enterococcus and fecal coliform bacteria at 14 local beaches. County health departments issue health advisories or warnings when bacterial counts are excessive (FDEP 2007). Beaches with more than 21 closures in a year are identified as impaired by FDEP.

Bream Fishermen Association

The Bream Fishermen Association (BFA) is an organization of local fishermen and residents that assists the city, county, state, and region as an environmental steward in protecting northwest Florida and south Alabama waters by performing regular water quality monitoring. The BFA was established in the mid-1960s and was chartered as a non-profit organization in 1970. Today, the BFA collects samples at 48 quarterly stations in Escambia, Santa Rosa, and Okaloosa counties (BFA 2016).

Submerged Aquatic Vegetation Monitoring

In the late 1990s, FDEP Northwest District's Ecosystem Restoration Section conducted a study to monitor the health of seagrasses in Big Lagoon and Santa Rosa Sound. The study concluded with a management plan, which included recommendations for improving the health of SAVs in the study area (FDEP 2001). The USGS published a report on the status and trends of seagrasses along the Gulf Coast, including the Pensacola Bay system (USGS 2006). The FWC's FWRI currently evaluates changes in the extent, density, and quality of seagrasses in Pensacola Bay, Big Lagoon, and Santa Rosa Sound as part of the statewide SIMM program. The maps are generated through photointerpretation of high-resolution imagery. The general status of seagrasses for the bays is discussed in Section 3.3.1 (FWC 2015c).

Environmental Restoration and Protection Programs

Water quality in the Pensacola Bay watershed is protected through several programs working together to restore water quality and prevent degradation. These programs include FDEP's adopted TMDLs; BMPs for silviculture, agriculture, construction, and other activities related to land use and development; regulatory programs including NPDES, domestic and industrial wastewater permits, stormwater permits, and ERP; and local efforts to retrofit stormwater infrastructure to add or improve water quality treatment. Additionally, water quality is protected through a number of conservation, mitigation, and management programs that protect water resources, aquifer recharge areas, floodplains, and other natural systems within the watershed. These programs include Florida Forever Work Plan, regional mitigation for state transportation projects, and spring protection and restoration. The following section provides an overview of these programs and their contribution to water quality restoration and protection.

Total Maximum Daily Loads

As described above, TMDLs are developed for waterbodies that are verified as not meeting adopted water quality standards to support their designated use. They provide important water quality restoration goals to guide restoration activities. They identify the reductions in pollutant loading required to restore water quality. Total daily maximum loads are implemented through the development and adoption of BMAPs that identify the management actions necessary to reduce the pollutant loads. Basin Management Action Plans are developed by local stakeholders (public and private) in close coordination with FDEP. Although water segments with adopted TMDLs are removed from the state's impaired waters list, they remain a high priority for restoration. Impaired waters and TMDLs are described in greater detail in Chapter 3 and Appendix F.

National Pollutant Discharge Elimination System Permitting

Point sources that discharge to surface waterbodies require a National Pollutant Discharge Elimination System (NPDES) permit. These permits can be classified into two types: domestic or industrial wastewater discharge permits, and stormwater permits. An NPDES permit includes limits on the composition and quantity of a discharge, monitoring and reporting requirements, and other provisions to ensure that the discharge does cause pose a threat to human health or quarter quality. All NPDES permits include “reopener clauses” that allow the FDEP to incorporate new discharge limits when a TMDL is established. These new limitations may be incorporated into a permit when a TMDL is implemented or at the next permit renewal, depending on the timing of the permit renewal and workload. For NPDES municipal stormwater permits, the FDEP will insert the following statement once a BMAP is completed (FDEP 2007):

> *The permittee shall undertake those activities specified in the (Name of Waterbody) BMAP in accordance with the approved schedule set forth in the BMAP.*

The FDEP implements the NPDES stormwater program in Florida under delegation from the EPA. The program requires the regulation of stormwater runoff from MS4s generally serving populations of more than 10,000 and denser than 1,000 per square mile, construction activity disturbing more than one acre of land, and ten categories of industrial activity. An MS4 can include roads with drainage systems, gutters, and ditches, as well as underground drainage, operated by local jurisdictions, the FDOT, universities, local sewer districts, hospitals, military bases, and prisons. Escambia County, Pensacola, and Century are Phase 1 co-permittees with the FDOT District 3. Stormwater management for other local governments, military bases, and educational institutes within the Pensacola Bay system is covered under Phase 2 MS4 permits. Phase 2 permits are general permits and are not written for a specific local government. Phase 2 permit holders in the Pensacola Bay system include: Pensacola NAS, Eglin AFB, Hulbert Field (U.S. Air Force), University of West Florida, Okaloosa and Santa Rosa counties, and the cities of Niceville, Gulf Breeze, and Milton (FDEP 2007).

As part of the MS4 program, Escambia County’s Stormwater Program has delineated the county into 41 drainage basins. The basins have been numerically ranked based on the severity of water quality and drainage issues to establish an order of priority for remediation. A countywide Stormwater Master Plan has been completed (Hatch Mott MacDonald 2004). Countywide drainage plans have either been completed or are under way for 23 individual drainage basins. Each plan describes current stormwater structural controls and identifies and recommends water quality and drainage improvement projects. Funding for stormwater retrofits is provided by a local option sales tax, which was approved by Escambia County voters in 1992. The intent of the tax is to help pay for capital improvement projects that address flooding, improve access to residential and commercial properties (improve transportation), and improve stormwater quality. It became effective June 1, 1992, and was renewed by a voter referendum in 1999. It was reapproved by voters in 2008 and will be in effect until December 31, 2017. Revenue generated by the tax has provided money to pave dirt roads and improve drainage and transportation. As of February 2003, $37.3 million had been spent for projects to primarily improve drainage, $28.4 million to primarily improve transportation, and $16.2 million to pave dirt roads (Hatch Mott McDonald 2004).

Domestic and Industrial Wastewater Permits

In addition to NPDES-permitted facilities, all discharge to surface waters, Florida also regulates domestic and industrial wastewater discharges to groundwater via land application. Since groundwater and surface water are so intimately linked in much of the state, reductions in loadings from these facilities may be needed to meet TMDL limitations for pollutants in surface waters. If such reductions are identified in the BMAP, they would be implemented through modifications of existing state permits.

Best Management Practices

Best management practices may include structural controls (such as retention areas or detention ponds) or non-structural controls (such as street sweeping or public education). Many BMPs have been developed for urban stormwater to reduce pollutant loadings and peak flows. These BMPs accommodate site-specific conditions, including soil type, slope, depth to groundwater, and the use designation of receiving waters (such as drinking water, recreation, or shellfish harvesting).

The passage of the 1999 Florida Watershed Restoration Act (Chapter 99-223, Laws of Florida) increased the emphasis on implementing BMPs to reduce NPS pollutant discharges from agricultural operations. It authorized the FDEP and the FDACS to develop interim measures and agricultural BMPs. While BMPs are adopted by rule, they are voluntary if not covered by regulatory programs. If they are adopted by rule and the FDEP verifies their effectiveness, then implementation provides a presumption of compliance with water quality standards, similar to that granted a developer who obtains ERP (FDACS 2016c).

Over the last several years, the FDACS has worked with farmers, soil and water conservation entities, the University of Florida’s Institute of Food and Agricultural Sciences, and other interests to improve product marketability and operational efficiency of agricultural BMPs, while at the same time promoting water quality and water conservation objectives. In addition, programs have been established and are being developed to create a network of state, local, federal, and private sources of funds for developing and implementing BMPs. BMPs have been adopted by rule for silviculture, row crops, container plants, cow calf, and dairies. The BMP manuals can be accessed on the FDACS website (FDACS 2016c).

Florida Environmental Resource Permitting Program

Florida established the Environmental Resource Permitting (ERP) program to prevent stormwater pollution of Florida’s rivers, lakes, and streams, and to protect wetland functions and provide flood protection. The ERP program regulates the management and storage of surface waters and provides protection for the vital functions of wetlands and other surface waters. Environmental resource permits are designed to obtain 80 percent average annual load reduction of total suspended solids. In northwest Florida, the ERP program is jointly implemented by the NWFWMD and the FDEP.

Regional Mitigation for State Transportation Projects

Under Section 373.4137, F.S., the NWFWMD offers mitigation services, as an option, to the FDOT for transportation projects with unavoidable wetland impacts when the use of private **mitigation banks** is not feasible. As required by this statute, a regional mitigation plan has been developed and is updated annually to address FDOT mitigation needs submitted to the NWFWMD. Components of the Umbrella Plan include the federally permitted “In-Lieu Fee Program” instrument and other mitigation projects (NWFWMD 2016a). The District does not compete with private mitigation banks. The District’s mitigation plan is developed and implemented in consultation with the FDOT, the FDEP, the USACE, the EPA, the USFWS, the U.S. National Marine Fisheries Service, and the FWC and is maintained and available for review at http://www.nwfwmdwetlands.com/.

Since 1997, the NWFWMD has implemented mitigation at seven sites in the Pensacola Bay system: Bluff Springs, Brewer, Cotton Creek Road, Jones Swamp, Mystic Springs, Rogers, and Yellow River Ranch (NWFWMD 2016c).

FDEP Ecosystem Restoration Section

The FDEP (through funding from the USFWS Coastal Program and other sources) has established living shoreline restoration sites within the Pensacola Bay system to aid in shoreline stabilization, biodiversity, and water quality (FDEP 2015e). Living shorelines are constructed of oyster shells, limestone rock, or other substrate conductive to the natural environment. These created shorelines provide a physical barrier for the mainland during storms, and aid in sediment stabilization through the use of planted native vegetation (FDEP 2015e).

Florida Forever

Florida Forever is Florida's conservation and recreation lands acquisition program. Under section 373.199, F.S., and the NWFWMD Florida Forever 2016 Five Year Work Plan, a variety of projects may be implemented, including capital projects, land acquisition, and other environmental projects. Since its inception, the District's land acquisition program has sought to bring as much floodplain as possible of the major rivers and creeks under public ownership and protection. The District's Florida Forever Five Year Plan identifies land acquisition priorities along the Escambia River, Garcon Point Peninsula, the Blackwater River, and the Yellow River. Additional information is available at http://www.nwfwater.com/Lands/Land-Acquisition/Forever-Florida-Land-Aquisition-Work-Plans.

Minimum Flows and Minimum Water Levels

Section 373.042, F.S., requires each water management district to develop minimum flows and minimum water levels (MFLs) for specific surface and groundwaters within their jurisdiction. A minimum flow or minimum water level for a given waterbody is the limit below which further withdrawals would be significantly harmful to the water resources or ecology of the area. Minimum flows and minimum water levels are calculated using best available data and consider natural seasonal fluctuations; non-consumptive uses; and environmental values associated with coastal, estuarine, riverine, spring, aquatic, and wetlands ecology as specified in Section 62-40.473, F.A.C.

The process of establishing MFLs involves a series of steps including identification of priority waterbodies, data collection, technical assessments, peer review, rule-making and rule adoption. Adopted MFLs are considered when reviewing consumptive use permit applications. A recovery or prevention strategy must be developed for any waterbody where consumptive uses are currently or anticipated to result in flows or water levels below adopted MFLs.

A technical assessment for an MFL for the Floridan aquifer, Coastal Region II, in Santa Rosa, Okaloosa, and Walton counties was initiated in 2014. The Shoal River system MFL technical assessment was initiated in 2017. The current status of planning and development of MFLs in northwest Florida may be found at http://www.nwfwater.com/Water-Resources/Minimum-Flows-Levels.

EPA Gulf Ecology Division

The EPA, Gulf Ecology Division Laboratory in Gulf Breeze, Florida, is a primary research facility of the EPA's Office of Research and Development National Health and Environmental Effects Research Laboratory. The lab assesses the ecological condition, ecological services and values of estuaries, coastal wetlands, seagrass, and coral ecosystems of the Gulf of Mexico and the southeastern U.S.; determines causes of ecological impairment; predicts future risk to populations, communities and ecosystems from multiple aquatic stressors; supports the development of criteria to protect coastal environments; and transfers scientific technology to federal and state agencies, industry, and the public (EPA 2016f).

Natural Resource Management at Eglin AFB

The U.S. military, represented by the Air Force at Eglin AFB and Hurlburt Field, and the Navy at NAS Pensacola and NAS Whiting Field, occupies about 241,000 acres in the Pensacola Bay system. Eglin AFB is the largest forested military reservation in the U.S. and provides habitat for numerous rare and endangered species, including the red-cockaded woodpecker and reticulated flatwoods salamanders. The AFB spans 20 miles of the Gulf of Mexico shoreline, and includes 55 acres of lakes and 186 miles of streams. The property also hosts 34 of the FNAI recognized natural communities (FWC 2016e; Secretary of Defense 2013). Consequently, management actions on Air Force property have the potential to substantially influence water and habitat quality at the scale of the drainage basin.

Large tracts of Eglin AFB are managed for habitat conservation and the protection of endangered species. Extensive tracts of mature longleaf pine (*Pinus palustris*) forest are still present, particularly in the Conecuh National Forest–Blackwater River State Forest–Eglin AFB corridor (FDEP 2007).

Since 2009, TNC and Eglin AFB, with funding from the Legacy Program, have worked with military bases in Florida to establish six Cooperative Invasive Species Management Areas (CISMAs). These CISMAs are designed to help to decrease the re-infestation from invasive species at six Florida bases (U.S. Department of Defense [DOD] 2011). As a result of this initiative, a report called *Utilizing Cooperative Invasive Species Management Areas (CISMAs) to Effectively Reduce Re-infestation of Invaders on Six (6) Military Bases and Adjacent Lands in Florida* was developed. The report details the development of the CISMAs, their accomplishments, project monitoring, and strategic plans.

About 404,000 acres of Eglin AFB are managed under the Integrated Natural Resources Management Plan, which is updated every five years and is signed by Eglin, the FWC, and the USFWS. Additionally, Eglin AFB's Jackson Guard maintains an interactive web-based Integrated Natural Resources Management Plan that functions as an adaptive management tool (Secretary of Defense 2013). In 2013, Eglin's Natural Resources Team exceeded the goal of rehabilitating wetland riparian and 20 threatened and endangered species sites as specified in the Integrated Natural Resources Management Plan Erosion Control Component Plan. Other ongoing initiatives at the AFB include fish and wildlife management, invasive species control and pest management, and forest management using prescribed fires and other BMPs (Secretary of Defense 2013).

Bay Area Resource Council

The Bay Area Resource Council (BARC) was created from the Escambia/Santa Rosa Coast Resource Planning and Management Committee in 1985 by then Governor Bob Graham. An interlocal agreement between Escambia and Santa Rosa counties and the cities of Pensacola and Gulf Breeze was established in May 1987 to establish an entity that could accept funding and promote the goals of the committee. The City of Milton has since joined the BARC. Advisory committees for citizens and scientists were established to begin the development of a management plan for the Pensacola Bay system. The Pensacola Bay Watershed Management Guide, completed in 1998, contained 50 action plans. The BARC Technical Advisory Committee completed an update of the plan in late 2004 (Pensacola Bay Watershed Partnership and BARC 2005). The BARC's goal is improving the area's quality of life and the waters of the Pensacola Bay basin through community participation and coordination with local governments, citizens, academia, and the private sector. The WFRPC serves as staff to the BARC (WFRPC 2016b).

University of Florida Institute of Food and Agricultural Sciences Extension (UF-IFAS)

The UF/IFAS is a federal-state-county partnership that focuses on research, teaching, and extension to "*develop knowledge in agriculture, human and natural resources, and the life sciences, and enhance and sustain the quality of human life by making that information accessible*."

Many UF/IFAS programs and partnerships help protect water resources across the Pensacola Bay watershed and the state of Florida. Such programs and partnerships include the Fisheries and Aquatic Sciences and Marine Sciences Program, the Aquatic and Invasive Plants Center, the Florida Cooperative Fish and Wildlife Research Unit., the Florida Partnership for Water, Agriculture and Community Sustainability, the Natural Resources Leadership Institute, the Wetland Biogeochemistry Laboratory, and the Shellfish Aquaculture Extension among others.

To promote environmentally sound forestry practices, the UF/IFAS offers the voluntary Forest Stewardship Program, which seeks to help private landowners develop a plan to increase the economic value of their forestland while maintaining its environmental integrity (UF-IFAS 2016b). The Extension also works with farmers and property owners across the state to minimize the need for commercial pesticides and fertilizers, through environmentally friendly BMPs.

Local Government Planning Initiatives

Escambia County Land Development Code and Comprehensive Plan for Wetlands and Environmentally Sensitive Lands – Escambia County's land development regulations limit adverse impacts and discourage development that may adversely affect wetlands and other sensitive areas. The county implemented a wetland ordinance in 2001 that provides protection standards, presents local permitting and mitigation programs, and establishes an environmental lands trust fund (Escambia County 2014).

Santa Rosa County Land Development Code for Environmentally Sensitive Lands – The County's land development regulations add protection of environmentally sensitive lands. Sensitive lands recognized include aquatic preserves, OFWs, functioning wetlands, fish and marine habitats, habitats of threatened or endangered plants and animals, and potable wells (Santa Rosa County 2016).

Escambia County Wellhead Protection Ordinance – Escambia County's wellhead protection zone ordinance restricts or prohibits certain land use activities within buffers around protected wells or within the seven- or 20-year time of travel contours around protected wells (FDEP 2007).

Okaloosa County Wellhead Protection Ordinance – Okaloosa County's wellhead protection ordinance prohibits certain land use activities within a 200-foot radius buffer of public supply water wells with a permitted capacity of 100,000 gallons or more per day (FDEP 2007).

Walton County Wellhead Protection – Walton County's wellhead protection zone limits land uses in wellhead protection zones and/or aquifer recharge areas, to include protection of a 400-foot radius around public potable water wells (FDEP 2007).

Santa Rosa County Wellhead Protection – Santa Rosa County wellhead protection zones were established for public supply wells, consisting of a 200-foot radius Floridan aquifer wells and a 500-foot radius for sand-and-gravel aquifer wells (FDEP 2007).

East Milton Wellfield Protection Area Zoning Overlay District – Santa Rosa County established an overlay district encompassing almost 51 square miles in the inland sand and gravel aquifer wellfield area (Santa Rosa County 2013).

Other Programs and Initiatives

As described in the preceding section, local governments and organizations are active participants in the restoration projects being or expected to be funded through the RESTORE Act, the NRDA, and the NFWF. These organizations have been longstanding partners in monitoring water quality and environmental health throughout the watershed. They have also been key partners in developing stormwater master plans and retrofit projects to reduce and treat stormwater, as well as building community support for watershed protection through the creation of citizen advisory councils and volunteer organizations.

Numerous citizen or citizen-government groups with a primary interest in protecting or enhancing water resources are active in the Pensacola Bay system. Most organizations have a specific geographic focus at either the watershed or waterbody level. Among local and regional organizations and initiatives are the following:

Bayou Chico Association – The Bayou Chico Association is involved in educating the public, seeking grants, and initiating various projects to promote the restoration and preservation of Bayou Chico. The Association has worked for many years in partnership with local governments and the District to advance efforts to protect and restore Bayou Chico.

Bayou Texar Foundation – The mission of the Bayou Texar Foundation is to protect and improve the bayou. Its members have worked with the City of Pensacola to implement a stormwater utility to fund stormwater retrofits. The Foundation has educated its members and other area residents about stormwater runoff and what each citizen can do to improve the water quality of this urban bayou (BTF 2016).

Environmental Education Coordination Team (EECT) – A partnership of representatives of more than 20 public and private organizations, as well as individual community members, the EECT was formed to consolidate the efforts of members' environmental education activities in the community. In 2002, the EECT became a subcommittee on the BARC Technical Advisory Committee (WFRPC 2016b).

Pensacola Environmental Advisory Board (EAB) – The Pensacola City Council created this group of appointed citizen volunteers in November 2001 to provide policy advice and recommendations on environmental matters to the City Council and city staff (Pensacola EAB 2016).

Escambia County Citizens Environmental Committee – The Escambia County Citizens Environmental Committee provides professional advice, based on citizen input, to Escambia County through its Board of County Commissioners on matters of environmental concern (land, air, and water). The County Administrator appoints one member and each commissioner appoints two members, with their terms running concurrently with that of the commissioner who appointed them. Monthly meetings are open to the public (FDEP 2007).

Escambia County Storm-Water Advisory Team – In response to the large flooding event in April 2014, the Storm-Water Advisory Team was created to identify conditions associated with the April 2014 flooding and to assist Escambia County staff. The rainfall caused damage to both public and private stormwater facilities across the county, but mostly in the southern area. A needs assessment and a county-wide stormwater recommendation report were drafted to rank priority drainage projects and provide recommendations for stormwater within Escambia County (Escambia County 2016b).

Emerald Coastkeeper – The Emerald Coastkeeper is a part of the Waterkeeper Alliance, working to protect and restore area waterbodies. The Emerald Coastkeeper has participated in efforts to restore Carpenter Creek and Bayou Texar, among other activities.

Partnership for Environmental Research and Community Environmental Health (PERCH) – This group, funded by federal appropriation grants, was formed to provide input to the University of West Florida regarding environmental health studies, and investigate questions pertaining to environmental pollution and how it may affect human health (University of West Florida PERCH 2016).

Gulf Coastal Plain Ecosystem Partnership – Formed in 1996, this is a cooperative environmental management partnership between the NWFWMD, Blackwater River State Forest, Conecuh National Forest, Nokuse Plantation, Eglin AFB, International Paper, FDEP, and TNC. The Partnership's initial focus was to restore and protect longleaf pine habitat. The partners currently manage more than 950,000 acres in northwest Florida and southern Alabama, including the Pensacola Bay system. The partnership provides a collaborative approach to preservation and management of natural lands through a set of land management principles directed at ecosystem preservation including prescribed burning, recovering listed species, restoring aquatic habitat, providing public outreach, and sharing and exchanging relevant information and technology on new land management and protection techniques. Through collaboration and the pooling of resources, the partners are able to leverage the purchase of additional conservation lands (The Longleaf Alliance 2016).

Ecosystem Restoration Support Organization, Inc. – Formed in 1998, this 501(c)(3) citizen support organization provides financial and volunteer support for the FDEP's Northwest District Ecosystem Restoration Section. Fundraising and grant-writing efforts have provided over $1 million to Project GreenShores and the FDEP's seagrass tissue culture lab and greenhouses (FDEP 2016f).

Appendix C Geology and Soils in the Pensacola Bay System

The Pensacola Bay system encompasses two localized physiographic regions in Florida: the Western Highlands subdivision of the Northern Highlands and the Gulf Coastal Lowlands. Both physiographic regions exhibit unique geology and soils. The Northern Highlands are underlain by the Citronelle formation, ancient delta deposits of clays, clayey sands, and gravel, deposited on limestone bedrock. The Coastal Lowlands are described as a flat, weakly dissected alluvial plain formed by deposition of continental sediments onto a submerged, shallow continental shelf, that were later exposed by sea level subsidence. In the Coastal Lowlands, ancient marine geomorphic features including beach ridges, spits, bars, dunes, and terraces make up the modern topography. Terraces represent wave-cut platforms and depositional features that formed during still sands of the sea.

The area surrounding the Pensacola Bay system is underlain by thin undifferentiated alluvium and Pleistocene terrace deposits that dip southwestward at 30 to 40 feet per mile (Marsh 1966). Stratigraphically, these sediments are underlain by the Pliocene Citronelle Formation and Tertiary beds of sand, silt, and limestone. Three Pleistocene-age marine terraces can be recognized in the area: the Pamlico terrace at 30 feet, the Penholoway terrace at 70 feet, and a seaward sloping upland surface with elevations ranging from 60 to 200 feet. Remnants of these terraces are preserved as upland plateaus, flat-topped hills, and low coastal plains (Marsh 1966).

Santa Rosa Island is a bay barrier bar with a straight seaward margin. The island is approximately half a mile wide with sand dunes that reach elevations of 50 feet above sea level. Santa Rosa Island also has two backshore terraces likely formed during storm events.

The mineralogy of sediments within Pensacola Bay is controlled by erosion throughout the watershed, which has taken place since the Pleistocene Epoch. During the Pleistocene, the Citronelle deposits were reworked and intermixed with marine terrace deposits (Marsh 1966). These marine deposits, as well as Miocene and Pleistocene terrace deposits, are now actively eroding. Because the watershed's streams pass largely through Neogene Coastal Plain formations, the bay's sediments consist almost entirely of sand, silt, and clay eroded from these older units (George 1988).

The mineral suite for the Pensacola Bay system is made up of largely reworked, stable, heavy minerals dominated by zircon, tourmaline, staurolite, and kyanite. Unstable heavy minerals, such as hornblende, garnet, pyroxene, and epidote are lacking. Clay mineral analyses indicate that the Escambia River carries mainly kaolinite, with lesser amounts of montmorillonite, vermiculite, illite, and gibbsite (Isphording *et al.* 1989). The deposition of sediments in the Pensacola Bay system has significantly changed over recent time. Borings collected during construction of local bridges generally indicate a vegetative "muck" layer in places as deep as 60 feet with cleaner fine to coarse sands below. These deposits are evidence of plant growth at a lower stand of sea level (approximately 6,000 years ago).

The changes in the sedimentary regime of the system are primarily due to the geologically recent rise in sea level. The presence of silty clays, similar to the central bay floor sediment today, suggests that the present sediments were deposited on bay-lagoon deposits behind late Pleistocene barrier islands further offshore.

Soils within the watershed have been used extensively for crop production, silviculture, and pastureland. Along with being a valuable agricultural resource, soils also protect water quality by absorbing runoff, store soil organic carbon, and help mitigate flooding. The following soils are found in the Florida portion of the watershed:

Ultisols – Ultisols are intensely-weathered soils of warm and humid climates, and are usually formed on older geologic formations in parent material that is already extensively weathered (i.e., upland areas of the watershed). They are generally low in natural fertility and high in soil acidity, but contain subsurface clay accumulations that give them a high nutrient retention capacity. In the Pensacola Bay watershed, ultisols form in the majority of non-coastal, interior locations where the landscape has been relatively stable over recent geologic time (Collins 2010). Ultisols are the primary agricultural and silvicultural soils of the watershed, as their high clay content contributes to nutrient and water retention, when properly managed and are found extensively in the northern reaches of the entire watershed.

Entisols – Entisols are young soils that show little development, have no diagnostic horizons, and are largely unaltered from their parent material, which can be unconsolidated sediment or rock (USDA 2014). Entisols are found in the floodplain of the Escambia River and on Santa Rosa Sound where surficial processes are active (Collins 2010).

Spodosols – Spodosols are sandy, acidic soils, often found in cool, moist climates such as coastal conifer forests (USDA 2014). They are easily identified by their strikingly-colored horizons, which form as a result of leaching and accumulation processes. Spodosols can be found throughout the coastal portion of the watershed, particularly on the Fairpoint Peninsula, along the Blackwater and Yellow rivers near Blackwater Bay, and throughout the Garcon Point WMA (Collins 2010). The presence of spodosols usually indicates an area that was historically dominated by a pine over-story.

Inceptisols – Inceptisols are described as soils in the beginning stages of soil profile development, as the differences between soil horizons are just beginning to appear in the form of color variation due to accumulations of small amounts of clay, salts, and organic material. Inceptisols occur predominantly along the floodplains of the watershed's various rivers and tributaries, as well as on Santa Rosa Sound and the tip of Garcon Point (Collins 2010).

Histosols – Histosols are described as soils without permafrost and predominantly composed of organic material in various stages of decomposition. These soils are usually saturated, resulting in anaerobic conditions, slower rates of decomposition, and increased organic matter accumulation. Histosols generally consist of at least half organic materials and are common in wetlands (USDA 2014). Histosols in the watershed occur along the eastern coast of East Bay, along the Escambia River, and along East River near Holley (Collins 2010; USDA 2014). Histosols cover approximately 6,155 square miles in the state of Florida and store more organic carbon than any other soil type (Kolka *et al.* 2016; Vasques *et al.* 2010). Drainage of wetland areas and the associated decomposition of organic matter stored in histosols is a well-documented source of atmospheric carbon dioxide and methane.

Appendix D Listed Species within the Watershed

The Pensacola Bay system supports a wide array of biological resources and habitats and; therefore, many species of flora and fauna. This Appendix provides a list of species that are protected and tracked for the watershed, as well as their habitat requirements (FNAI 2010; FWC 2016f; USFWS 2016a).

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
Plants					
Agrimonia incisa	Incised Groove-bur	S2	T	N	Terrestrial Habitat(s): Forest/Woodland, Woodland - Conifer, Woodland - Mixed
Andropogon arctatus	Pine-woods Bluestem	S3	T	N	Lacustrine: wet pine flatwoods, seepage wetlands, bogs, wet pine savannas
Asclepias viridula	Southern Milkweed	S2	T	N	Estuarine Habitat(s): Bay/sound Terrestrial Habitat(s): Savanna
Baptisia calycosa var. villosa	Hairy Wild Indigo	S3	T	N	N/A
Calamintha dentata	Toothed Savory	S3	T	N	Terrestrial: longleaf pine-deciduous oak sandhills, planted pine plantations, sand, open and abandoned fields, and roadsides
Calamovilfa curtissii	Curtiss' Sandgrass	S3	T	N	Palustrine: mesic and wet flatwoods, wet prairie, depression marsh Terrestrial: mesic flatwoods
Calopogon multiflorus	Many-flowered Grass-pink	S2S3	T	N	Palustrine Habitat(s): Bog/fen, forested wetland, herbaceous wetland Terrestrial Habitat(s): Forest Edge, Forest/Woodland, Grassland/herbaceous, Savanna, Woodland - Conifer
Carex baltzellii	Baltzell's Sedge	S3	T	N	Terrestrial Habitat(s): Forest/Woodland, Woodland - Mixed
Carex tenax	Sandhill Sedge	S3	N	N	Dry sandy sites in turkey oak/bluejack oak woods; Longleaf pine/turkey oak sandhills; ruderal in sandy fields and roadsides; Dry, coarse soils
Cladium mariscoides	Pond Rush	S1	N	N	Occurs in open, sunny, wet areas dominated by sedges. Its habitats include the following: calcareous and saline marshes and swamps; patterned water tracks, spring fens, and calcareous fens; and wetlands and swales of the Atlantic coastal plain and the Great Lakes
Coelorachis tuberculosa	Piedmont Jointgrass	S3	T	N	Lacustrine Habitat(s): Shallow water Palustrine Habitat(s): herbaceous wetland, temporary pool
Epigaea repens	Trailing Arbutus	S2	E	N	N/A

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
Fothergilla gardenii	Dwarf Witch-alder	S1	E	N	Wet edges of baygalls, shrub swamps, pocosins, Carolina bays, Atlantic white cedar forests, pitcher plant bogs, and wet savannas and flatwoods
Hexastylis arifolia	Heartleaf	S3	T	N	N/A
Hymenocallis henryae	Panhandle Spiderlily	S2	E	N	Palustrine Habitat(s): Bog/fen, herbaceous wetland Terrestrial Habitat(s): Forest/Woodland
Ilex amelanchier	Serviceberry Holly	S2	T	N	N/A
Lachnocaulon digynum	Bog Button	S3	T	N	Riverine Habitat(s): Pool Palustrine Habitat(s): Bog/fen, forested wetland
Lilium iridollae	Panhandle Lily	S2	E	N	Palustrine Habitat(s): Bog/fen, herbaceous wetland, Riparian, scrub-shrub wetland
Linum westii	West's Flax	S1	E	N	Palustrine Habitat(s): Bog/fen, forested wetland, herbaceous wetland Terrestrial Habitat(s): Forest/Woodland, Woodland - Mixed
Litsea aestivalis	Pondspice	S2	E	N	Palustrine Habitat(s): Bog/fen
Lobelia boykinii	Boykin's Lobelia	S1	E	N	Palustrine Habitat(s): Forested wetland, herbaceous wetland, scrub-shrub wetland Terrestrial Habitat(s): Forest/Woodland, Savanna, Woodland - Conifer
Lupinus westianus	Gulf Coast Lupine	S3	T	N	Terrestrial: beach dune, scrub, disturbed areas, roadsides, blowouts in dunes
Macranthera flammea	Hummingbird Flower	S2	E	N	Palustrine: seepage slope, dome swamp edges, floodplain swamps Riverine: seepage stream banks Terrestrial: seepage slopes
Magnolia ashei	Ashe's Magnolia	S2	E	N	Terrestrial: slope and upland hardwood forest, ravines
Matelea alabamensis	Alabama Spiny-pod	S2	E	N	Terrestrial Habitat(s): Cliff, Forest - Hardwood, Forest - Mixed, Forest Edge, Forest/Woodland, Woodland - Hardwood, Woodland - Mixed
Nuphar advena ssp. ulvacea	West Florida Cowlily	S2	N	N	Riverine Habitat(s): Medium river, spring/spring brook
Oxypolis greenmanii	Giant Water-dropwort	S3	E	N	Palustrine: dome swamp, wet flatwoods, ditches: in water
Panicum nudicaule	Naked-stemmed Panicgrass	S3	T	N	N/A

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
Myriophyllum laxum	Piedmont Water Milfoil	S3	N	N	Riverine Habitat(s): Creek, pool, spring/spring brook Palustrine Habitat(s): Riparian, temporary pool
Pinguicula primuliflora	Primrose-flowered Butterwort	S3	E	N	Palustrine: bogs, pond margins, margins of spring runs
Platanthera integra	Yellow Fringeless Orchid	S3	E	N	Palustrine: bogs, wet flatwoods Terrestrial: bluff
Polygonella macrophylla	Large-leaved Jointweed	S3	T	N	Terrestrial: scrub, sand pine/oak scrub ridges
Potamogeton floridanus	Florida Pondweed	S1	E	N	Riverine Habitat(s): Low gradient, spring/spring brook
Pteroglossaspis ecristata	Giant Orchid	S2	T	N	Terrestrial Habitat(s): Forest Edge, Forest/Woodland, Old field, Savanna, Shrubland/chaparral, Woodland - Conifer
Quercus arkansana	Arkansas Oak	S3	T	N	Sandy or sandy clay uplands or upper ravine slopes near heads of streams in deciduous woods
Rhexia parviflora	Small-flowered Meadow-beauty	S2	E	N	Palustrine Habitat(s): Bog/fen, forested wetland, scrub-shrub wetland
Rhexia salicifolia	Panhandle Meadow-beauty	S2	T	N	Lacustrine: full sun in wet sandy or sandy-peaty areas of sinkhole pond shores, interdunal swales, margins of depression, marshes, flatwoods, ponds and sandhill upland lakes
Rhododendron austrinum	Florida Flame Azalea	S3	E	N	Lacustrine: shaded ravines & in wet bottomlands on rises of sandy alluvium or older terraces
Rhynchospora crinipes	Hairy-peduncled Beaksedge	S2	E	N	Palustrine Habitat(s): Riparian
Ruellia noctiflora	Nightflower-ing Wild Petunia	S2	E	N	Lacustrine: moist to wet coastal pinelands, bogs, low meadows, open pine savannahs
Sarracenia leucophylla	White-top Pitcherplant	S3	E	N	Palustrine: wet prairie, seepage slope, baygall edges, ditches
Sarracenia rubra	Sweet Pitcherplant	S3	T	N	Palustrine: bog, wet prairie, seepage slope, wet flatwoods Riverine: seepage stream banks
Stewartia malacodendron	Silky Camellia	S3	E	N	Palustrine: baygall Terrestrial: slope forest, upland mixed forest; acid soils
Tephrosia mohrii	Pineland Hoary-pea	S3	T	N	Longleaf pine-turkey oak sandhills; driest sites

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
Xyris longisepala	Karst Pond Xyris	S2S3	E	N	Palustrine Habitat(s): Herbaceous wetland, riparian, temporary pool
Xyris scabrifolia	Harper's Yellow-eyed Grass	S3	T	N	Palustrine: seepage slope, wet prairie, bogs
Xyris stricta var. obscura	Kral's Yellow-eyed Grass	S1	N	N	Lacustrine: sandhill upland lake margins
Animals					
Amblema plicata	Threeridge	S1	N	N	Riverine Habitat(s): big river, creek, High gradient, Low gradient, medium river, Moderate gradient, Pool, Riffle Lacustrine Habitat(s): Deep water, Shallow water
Fusconaia escambia	Narrow Pigtoe	S1S2	FT	LT	Riverine Habitat(s): big river, creek, Low gradient, medium river, Pool, Riffle
Attenella attenuata	Hirsute Mayfly	S1S2	N	N	N/A
Baetisca becki	A Mayfly	S2	N	N	Riverine Habitat(s): medium river
Baetisca gibbera	A Mayfly	S1S2	N	N	Freshwater
Dolania americana	American Sand-burrowing Mayfly	S2	N	N	Riverine Habitat(s): big river, creek, High gradient, medium river
Homoeoneuria dolani	Blue Sand-river Mayfly	S1S2	N	N	Riverine Habitat(s): big river, High gradient, medium river
Stenacron floridense	A Mayfly	S3S4	N	N	Freshwater
Hetaerina americana	American Rubyspot	S2	N	N	N/A
Acroneuria evoluta	A Stonefly	S1S2	N	N	N/A
Hydroperla phormidia	A Stonefly	S2	N	N	N/A
Helopicus subvarians	A Stonefly	S1S2	N	N	N/A
Phyllophaga elongata	Elongate June Beetle	S3	N	N	N/A
Selonodon santarosae	Santa Rosa Cebrionid Beetle	S1	N	N	Terrestrial
Agarodes ziczac	Zigzag Blackwater River Caddisfly	S2	N	N	Riverine Habitat(s): creek, medium river, spring/spring brook

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
Cheumatopsyche gordonae	Gordon's Little Sister Sedge Caddisfly	S1S2	N	N	Presumably, small clear streams with moderate stream flow in wooded areas or below a small impoundment
Cheumatopsyche petersi	Peters' Cheumatopsyche Caddisfly	S2	N	N	Small, clear lower coastal plain streams with moderate flow
Nyctiophylax morsei	Morse's Dinky Light Summer Sedge	S2	N	N	Riverine Habitat(s): creek, Moderate gradient
Oxyethira elerobi	Elerob's Microcaddisfly	S2S3	N	N	Riverine Habitat(s): creek, medium river, spring/spring brook
Amblyscirtes alternata	Dusky Roadside-Skipper	S2	N	N	Habitat seems to always be open grassy pine woods but may range from moist to dry, includes moist flatwoods, savannas, and sandhill ridges
Amblyscirtes reversa	Reversed Roadside-Skipper	S1	N	N	Palustrine Habitat(s): forested wetland, Riparian Terrestrial Habitat(s): Forest - Mixed, Woodland - Mixed
Callophrys hesseli	Hessel's Hairstreak	S2	N	N	Palustrine Habitat(s): Bog/fen, forested wetland, Riparian
Cupido comyntas	Eastern Tailed Blue	S2	N	N	Palustrine Habitat(s): Riparian Terrestrial Habitat(s): Cropland/hedgerow, Grassland/herbaceous, Old field, Savanna, Shrubland/chaparral, Suburban/orchard, Woodland - Conifer, Woodland - Hardwood, Woodland - Mixed
Erynnis martialis	Mottled Duskywing	S1	N	N	Terrestrial Habitat(s): Grassland/herbaceous, Shrubland/chaparral, Woodland - Conifer, Woodland - Hardwood, Woodland - Mixed
Hesperia meskei straton	Eastern Meske's Skipper	S2S3	N	N	N/A

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
Villosa choctawensis	Choctaw Bean		E	E	Riverine Habitat
Pleurobema strodeanum	Fuzzy Pigtoe		E	T	Riverine Habitat
Hamiota australis	Southern Sandshell		E	T	Riverine Habitat
Acipenser oxyrinchus desotoi	Gulf Sturgeon	S2	FT	LT	Estuarine: various Marine: various habitats Riverine: alluvial and blackwater streams
Atractosteus spatula	Alligator Gar	S3	N	N	Riverine: sluggish pools of large rivers and their bayous, oxbow lakes, swamps, and backwaters, rarely brackish or marine waters along the coast
Crystallaria asprella	Crystal Darter	S1	ST	N	Riverine Habitat(s): creek, medium river, Moderate gradient
Etheostoma histrio	Harlequin Darter		SSC		Riverine Habitat(s): creek, medium river, Moderate gradient
Etheostoma proeliare	Cypress Darter	S2	N	N	Riverine Habitat(s): creek, Low gradient, medium river, Pool Lacustrine Habitat(s): Shallow water Palustrine Habitat(s): forested wetland
Hybognathus hayi	Cypress Minnow	S1S2	N	N	Riverine Habitat(s): creek, Low gradient, medium river, Pool Lacustrine Habitat(s): Shallow water Palustrine Habitat(s): forested wetland
Fundulus jenkinsi	Saltmarsh Topminnow	S2	ST	SC	Estuarine Habitat(s): Herbaceous wetland, Lagoon, Tidal flat/shore Palustrine Habitat(s): herbaceous wetland
Moxostoma carinatum	River Redhorse	S1S2	N	N	Riverine Habitat(s): creek, High gradient, medium river, Moderate gradient, Pool
Macrhybopsis sp. 2	Florida Chub	S2	N	N	N/A
Notropis melanostomus	Blackmouth Shiner	S1	ST	N	Riverine Habitat(s): creek, Low gradient, medium river, Pool Lacustrine Habitat(s): Shallow water Palustrine Habitat(s): forested wetland
Percina austroperca	Southern Logperch	S2	N	N	Riverine Habitat(s): creek, Low gradient, medium river, Moderate gradient
Pteronotropis welaka	Bluenose Shiner	S3S4	ST	N	Riverine Habitat(s): creek, Low gradient, medium river, Pool
Ambystoma bishopi	Reticulated Flatwoods Salamander	S2	FE	LE	Terrestrial: slash and longleaf pine flatwoods that have a wiregrass floor and scattered wetlands

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
Amphiuma pholeter	One-toed Amphiuma	S3	N	N	Riverine Habitat(s): creek, Low gradient, spring/spring brook Palustrine Habitat(s): forested wetland, Riparian, scrub-shrub wetland, temporary pool
Hyla andersonii	Pine Barrens Treefrog	S3	ST	N	Riverine Habitat(s): Low gradient, Pool Palustrine Habitat(s): Bog/fen, forested wetland, herbaceous wetland, riparian, scrub-shrub wetland Terrestrial Habitat(s): Woodland - Mixed
Lithobates capito	Gopher Frog	S3	N	N	Palustrine Habitat(s): herbaceous wetland, Riparian, temporary pool Terrestrial Habitat(s): Forest - Mixed, Savanna, Woodland - Hardwood, Woodland - Mixed
Alligator mississippiensis	American Alligator	S4	FT (S/A)	T	Estuarine: herbaceous wetland Riverine: big river, creek, low gradient, medium river, pool, spring/spring brook Lacustrine: shallow water Palustrine: forested wetland, herbaceous wetland, riparian, scrub-shrub wetland
Caretta caretta	Atlantic Loggerhead Turtle	S3	FT	T	Terrestrial: sandy beaches; nesting
Chelonia mydas	Atlantic Green Turtle	S2	FE	E	Terrestrial: sandy beaches; nesting
Crotalus adamanteus	Eastern Diamondback Rattlesnake	S3	N	N	Palustrine: riparian Terrestrial: grassland/herbaceous, old field, savanna, shrubland/chaparral, woodland - conifer, woodland - hardwood, woodland - mixed
Dermochelys coriacea	Leatherback Turtle	S2	FT	T	Terrestrial: sandy beaches; nesting
Drymarchon kolpobasileus	Eastern Indigo Snake	S3	FT	T	Estuarine: tidal swamp Palustrine: hydric hammock, wet flatwoods Terrestrial: mesic flatwoods, upland pine forest, sandhills, scrub, scrubby flatwoods, rockland hammock, ruderal
Gopherus polyphemus	Gopher Tortoise	S3	ST	N	Terrestrial: sandhills, scrub, scrubby flatwoods, xeric hammocks, coastal strand, ruderal
Graptemys ernsti	Escambia Map Turtle	S2	N	N	Riverine Habitat(s): big river, Low gradient, medium river, Pool Palustrine Habitat(s): Riparian Terrestrial Habitat(s): Sand/dune

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
Heterodon simus	Southern Hognose Snake	S2	N	N	Palustrine Habitat(s): Riparian Terrestrial Habitat(s): Grassland/herbaceous, Old field, Savanna, Woodland - Conifer, Woodland - Hardwood, Woodland - Mixed
Lepidochely kempii	Kemp's Ridley	S1	E	E	Terrestrial: sandy beaches; nesting
Macrochelys temminckii	Alligator Snapping Turtle	S3	SSC	N	Estuarine: tidal marsh Lacustrine: river floodplain lake, swamp lake Riverine: alluvial stream, blackwater stream
Nerodiaclarkii clarkii	Gulf Salt Marsh Snake	S3	N	N	Estuarine: herbaceous wetland, scrub-shrub wetland
Pituophis melanoleucas mugitus	Florida Pine Snake	S3	ST	N	Lacustrine: ruderal, sandhill upland lake Terrestrial: sandhill, scrubby flatwoods, xeric hammock, ruderal
Athene cunicularia floridana	Florida Burrowing Owl	S3	ST	N	Terrestrial Habitat(s): Grassland/herbaceous, Sand/dune
Calidris canutus rufa	Red knot	S2	N	T	Estuarine: bays, tidal flats, salt marshes Terrestrial: sandy beaches Marine: aerial, near shore
Charadrius alexandrius	Snowy Plover	S2	ST	N	Estuarine: exposed unconsolidated substrate Marine: exposed unconsolidated substrate Terrestrial: dunes, sandy beaches, and inlet areas.
Charadrius melodus	Piping Plover	S2	T	T	Estuarine: exposed unconsolidated substrate Marine: exposed unconsolidated substrate Terrestrial: dunes, sandy beaches, and inlet areas. Mostly wintering and migrants
Cistothorus Palustris marianae	Marian's Marsh Wren	S3	ST	N	N/A
Haliaeetus leucocephala	Bald Eagle	S3	T	T	Estuarine: marsh edges, tidal swamp, open water Lacustrine: swamp lakes, edges Palustrine: swamp, floodplain Riverine: shoreline, open water Terrestrial: pine and hardwood forests

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
Myctera americana	Wood Stork	S2	E	E	Estuarine: marshes Lacustrine: floodplain lakes, marshes (feeding), various Palustrine: marshes, swamps, various
Peucaea aestivalis	Bachman's Sparrow	S3	N	N	Terrestrial Habitat(s): Old field, Savanna, Woodland - Conifer, Woodland - Hardwood
Leuconotopicus borealis	Red-cockaded Woodpecker	S2	FE	LE	Terrestrial Habitat(s): Woodland - Conifer
Corynorhinus rafinesquii	Rafinesque's Big-eared Bat	S2	N	N	Palustrine Habitat(s): Riparian Terrestrial Habitat(s): Forest - Hardwood, Suburban/orchard, Urban/edificarian, Woodland – Hardwood Subterranean Habitat(s): Subterrestrial
Mustela frenata olivacea	Southeastern Weasel	S3	N	N	Palustrine: forested wetland, riparian Terrestrial: forest - hardwood, old field, woodland - conifer, woodland - hardwood, woodland - mixed
Myotis austroriparius	Southeastern Bat	S3	N	N	Riverine Habitat(s): Aerial Palustrine Habitat(s): Aerial, forested wetland, Riparian Terrestrial Habitat(s): Forest - Conifer, Forest - Hardwood, Forest - Mixed, Forest Edge, Forest/Woodland, Suburban/orchard, Urban/edificarian, Woodland - Conifer, Woodland - Hardwood, Woodland - Mixed Subterranean Habitat(s): Subterrestrial
Neofiber alleni	Round-tailed Muskrat	S3	N	N	Estuarine Habitat(s): Herbaceous wetland Lacustrine Habitat(s): Shallow water Palustrine Habitat(s): Bog/fen, herbaceous wetland
Peromyscus polionotus leucocephalus	Santa Rosa Beach Mouse	S1	N	N	Terrestrial Habitat(s): Grassland/herbaceous, Sand/dune
Peromyscus polionotus trissyllepsis	Perdido Key Beach Mouse	S1	FE	LE	Terrestrial Habitat(s): Grassland/herbaceous, Sand/dune
Trichechus manatus	West Indian Manatee	S2	E	E	Estuarine: submerged vegetation, open water Marine: open water, submerged vegetation
Ursus americanus floridanus	Florida Black Bear	S2	N	N	Palustrine: forested wetland, riparian Terrestrial: forest - hardwood, forest - mixed

Sources: FNAI 2010; FWC 2016f; USFWS 2016.

Key:
FNAI STATE ELEMENT RANK
S1 = Critically imperiled in Florida because of extreme rarity (5 or fewer occurrences or less than 1000 individuals) or because of extreme vulnerability to extinction due to some natural or man-made factor.
S2 = Imperiled in Florida because of rarity (6 to 20 occurrences or less than 3000 individuals) or because of vulnerability to extinction due to some natural or man-made factor.
S3 = Either very rare and local in Florida (21-100 occurrences or less than 10,000 individuals) or found locally in a restricted range or vulnerable to extinction from other factors.
S4 = Apparently secure in Florida (may be rare in parts of range).
S5 = Demonstrably secure in Florida.
SH = Of historical occurrence in Florida, possibly extirpated, but may be rediscovered (e.g., ivory-billed woodpecker).
SX = Believed to be extirpated throughout Florida.
SU = Unrankable; due to a lack of information no rank or range can be assigned.
SNA = State ranking is not applicable because the element is not a suitable target for conservation (e.g. a hybrid species).
SNR = Element not yet ranked (temporary).

FEDERAL LEGAL STATUS
C = Candidate species for which federal listing agencies have sufficient information on biological vulnerability and threats to support proposing to list the species as Endangered or Threatened.
E = Endangered: species in danger of extinction throughout all or a significant portion of its range.
E, T = Species currently listed endangered in a portion of its range but only listed as threatened in other areas
E, PDL = Species currently listed endangered but has been proposed for delisting.
E, PT = Species currently listed endangered but has been proposed for listing as threatened.
E, XN = Species currently listed endangered but tracked population is a non-essential experimental population.
T = Threatened: species likely to become Endangered within the foreseeable future throughout all or a significant portion of its range.
PE = Species proposed for listing as endangered
PS = Partial status: some but not all of the species' infraspecific taxa have federal status
PT = Species proposed for listing as threatened
SAT = Treated as threatened due to similarity of appearance to a species which is federally listed such that enforcement personnel have difficulty in attempting to differentiate between the listed and unlisted species.
SC = Not currently listed, but considered a "species of concern" to USFWS.

STATE LEGAL STATUS
C = Candidate for listing at the Federal level by the U. S. Fish and Wildlife Service
FE = Listed as Endangered Species at the Federal level by the U. S. Fish and Wildlife Service
FT = Listed as Threatened Species at the Federal level by the U. S. Fish and Wildlife Service
FXN = Federal listed as an experimental population in Florida
FT(S/A) = Federal Threatened due to similarity of appearance
ST = State population listed as Threatened by the FFWCC. Defined as a species, subspecies, or isolated population which is acutely vulnerable to environmental alteration, declining in number at a rapid rate, or whose range or habitat is decreasing in area at a rapid rate and as a consequence is destined or very likely to become an endangered species within the foreseeable future.
SSC = Listed as Species of Special Concern by the FFWCC. Defined as a population which warrants special protection, recognition, or consideration because it has an inherent significant vulnerability to habitat modification, environmental alteration, human disturbance, or substantial human exploitation which, in the foreseeable future, may result in its becoming a threatened species. (SSC* for Pandion haliaetus (Osprey) indicates that this status applies in Monroe county only.)
N = Not currently listed, nor currently being considered for listing.

Plants: Definitions derived from Sections 581.011 and 581.185(2), Florida Statutes, and the Preservation of Native Flora of Florida Act, 5B-40.001. FNAI does not track all state-regulated plant species; for a complete list of state-regulated plant species, call Florida Division of Plant Industry, 352-372-3505 or see: http://www.doacs.state.fl.us/pi/.
E = Endangered: species of plants native to Florida that are in imminent danger of extinction within the state, the survival of which is unlikely if the causes of a decline in the number of plants continue; includes all species determined to be endangered or threatened pursuant to the U.S. Endangered Species Act.
T = Threatened: species native to the state that are in rapid decline in the number of plants within the state, but which have not so decreased in number as to cause them to be Endangered.
N = Not currently listed, nor currently being considered for listing.

Appendix E Habitats and Natural Communities

The FNAI defines a natural community as a distinct and recurring assemblage of populations of plants, animals, fungi, and microorganisms naturally associated with each other and their physical environment. Based on GIS analysis, there are 31 unique natural communities recognized by the FNAI within the Pensacola Bay watershed (FNAI 2010). Habitats and Natural Communities were identified using the 2010 Florida Land Use, Cover and Forms Classification System (FLUCFS) data from the NWFWMD as well as the 2004-2013 Statewide Land Use Land Cover datasets created by the five (5) Water Management Districts in Florida. Data were modified and refined based on aerial photograph signatures and field observations. Below are community descriptions (excerpts from FNAI 2010) with site-specific information about many of the communities in the watershed.

Upland Communities	
Bluff	Bluff is a habitat characterized as a steep slope with rock, sand, and/or clay substrate that supports sparse grasses, herbs, and shrubs. This community type can be found along the watersheds' major rivers. In Okaloosa County, the Yellow River cuts through the Western Highlands province, characterized in some areas by bluffs as high as 40 feet (Gardner 1991).
Mesic Flatwoods	Mesic flatwoods can be found on the flat sandy terraces left behind by Plio-Pleistocene high sea level stands. Mesic flatwoods consist of an open canopy of tall pines (commonly longleaf pine or slash pine) and a dense, low ground layer of shrubs, grasses (commonly wiregrass), and forbs. The most widespread natural community in Florida, mesic flatwoods are home to many rare plants and animals such as the frosted flatwoods salamander (*Ambystoma cingulatum*), the reticulated flatwoods salamander (*Ambystoma bishop*) the Red-cockaded woodpecker (*Leuconotopicus borealis*) and many others. Mesic flatwoods require frequent fire (two to four years) and all of its constituent plant species recover rapidly from fire, including many rare and endemic plants. In the Panhandle north of the Cody Scarp, mesic flatwoods occupy relatively small, low-lying areas (FNAI 2010). Within the Pensacola Bay watershed, healthy mesic flatwoods occur in the Elevenmile Creek watershed and Escribano Point.
Sandhill	Sandhill communities are characterized by broadly-spaced pine trees with a deciduous oak understory, sparse midstory of deciduous oaks, and a moderate to dense groundcover of grasses, herbs, and low shrubs. Species typical of sandhill communities include longleaf pine (*Pinus palustris*), turkey oak (*Quercus laevis*), and wiregrass (*Aristida stricta var. beyrichiana*). Sandhill is observed on crests and slopes of rolling hills and ridges with steep or gentle topography. Sandhill communities are important for aquifer recharge, as sandy soils allow water to infiltrate rapidly, resulting in sandy, dry soil, with little runoff evaporation. Fire is a dominant environmental factor in sandhill ecology and is essential for the conservation of native sandhill flora and fauna (FNAI 2010). Within the Pensacola Bay watershed, exemplary sandhill communities can be found on Eglin AFB.
Scrub	Scrub is a community composed of evergreen shrubs, with or without a canopy of pines, and is found on well-drained, infertile, narrow sandy ridges distributed parallel to the coastline. Signature scrub species include three species of shrubby oaks, Florida rosemary (*Ceratiola ericoides*), and sand pine (*Pinus clausa*), which may occur with or without a canopy of pines. Scrub is characterized by burn intervals of five to 40 years, depending on the dominant vegetation. This community type can be found in the Gulf Islands National Seashore.

Scrubby Flatwoods	Scrubby flatwoods have an open canopy of widely-spaced pine trees (commonly longleaf or slash pines) and a low, shrubby understory which differ structurally from scrub communities in the respect that scrub flatwoods lack continuous shrubby oak cover. Understory vegetation consists largely of scrub oaks and saw palmetto, often interspersed with barren areas of exposed sand. Scrubby flatwoods occur on slight rises within mesic flatwoods and in transitional areas between scrub and mesic flatwoods. Scrubby flatwoods are inhabited by several rare plant and animal species including the Florida mouse (*Podomys floridanus*), Florida scrub-jay (*Aphelocoma coerulescens*) (Peninsular Florida only), gopher tortoise (*Gopherus polyphemus*), the Florida gopher frog (*Rana capito*), goldenaster (*Chrysopsis floridana*), and large-plumed beaksedge (*Rhynchospora megaplumosa*) (FNAI 2010). Within the Pensacola Bay watershed, scrubby flatwood communities can be found in the Gulf Islands National Seashore.
Slope Forest	Slope forest is a well-developed, highly diverse, dense canopy forest of upland hardwoods that occurs on steep slopes, bluffs, and in sheltered ravines. In slope forests, high density and diversity is driven by competition for space, water, sunlight, and nutrients. The combination of densely shaded slopes and cool, moist microclimates produces conditions that are conducive for the growth of many plant species that are more typical of the Piedmont and Southern Appalachian Mountains (FNAI 2010).
Terrestrial Caves	Terrestrial caves are cavities below the surface that lack standing water. These caves develop in areas of karst topography; water moves through underlying limestone, dissolving it and creating fissures and caverns. Most caves have stable internal environments with temperature and humidity levels remaining fairly constant. In areas where light is present, some plants may exist, although these are mostly limited to mosses, liverworts, ferns, and algae. Subterranean natural communities such as terrestrial caves are extremely fragile because the fauna they support are adapted to stable environments and do not tolerate environmental changes (FNAI 2010).
Upland Hardwood Forests	Upland hardwood forests are described as having a well-developed, closed-canopy dominated by deciduous hardwood trees such as southern magnolia (*Magnolia grandiflora*), pignut hickory (*Carya glabra*), sweetgum (*Liquidambar styraciflua*), Florida maple (*Acer saccharum ssp. floridanum*), live oak (*Quercus virginiana*), American beech (*Fagus grandifolia*), white oak (*Q. alba*), and spruce pine (*Pinus glabra*), and others. This community occurs on mesic soils in areas sheltered from fire, on slopes above river floodplains, in smaller areas on the sides of sinkholes, and occasionally on rises within floodplains. It typically supports a diversity of shade-tolerant shrubs, and a sparse groundcover. Upland hardwoods occur throughout the Florida Panhandle and can be found in upper portions of the watershed.
Wet Flatwoods	Wet flatwoods are pine forests with a sparse or absent midstory. The typically dense groundcover of hydrophytic grasses, herbs, and low shrubs occurring in wet flatwoods can vary depending on the fire history of the system. Wet flatwoods occur in the ecotones between mesic flatwoods and shrub bogs, wet prairies, dome swamps, or strand swamps and are common throughout most of Florida. Wet flatwoods also occur in broad, low flatlands, frequently within a mosaic of other communities. Wet Flatwoods often occupy large areas of relatively inaccessible land, providing suitable habitat for the Florida black bear (*Ursus americanus floridanus*) as well as a host of rare and endemic plant species (FNAI 2010). This community type is found throughout Eglin AFB.
Xeric Hammock	Xeric hammock is an evergreen forest typically dominated by sand live oak (*Quercus geminata*), found on deep, fine sand substrate, where fire exclusion allows for the establishment of an oak canopy. In these areas, xeric hammock can form extensive stands or as small patches within or near sandhill or scrub. These forests are also found on high islands within flatwoods or less commonly on a high, well-drained ridge within a floodplain where fire-exclusion allows for the establishment of an oak canopy. Xeric hammocks are inhabited by several rare animals including the gopher frog (*Rana capito*), gopher tortoise (*Gopherus polyphemus*), eastern diamondback rattlesnake (*Crotalus adamanteus*), and the Florida pine snake (*Pituophismelanoleucus mugitus*). Xeric hammock is most common in the central peninsula of Florida and is less common north of the Cody Scarp where clay-rich soils create mesic conditions (FNAI 2010). This community type can be found throughout Eglin AFB.

Coastal Communities	
Beach	The beach is the immediate shoreline area of the Gulf of Mexico and consists of white quartz sand. It has few plants, except along the extreme inner edge at the base of the dunes. Organic marine debris, including seaweed and driftwood, typically form a wrack line on the shore. The upper beach area at the base of the foredune is an unstable habitat and is continually re-colonized by annuals, trailing species, and salt-tolerant grasses (FNAI 2010). Beach habitat is found along the entire Gulf front, especially at tidal passes, and some bay front shorelines in the watershed.
Beach Dune	The beach dune community includes seaward dunes that have been shaped by wind and water movement. This community is composed primarily of herbaceous plants such as pioneer grasses and forbs, many are coastal specialists. The vegetated upper beach and foredune are often sparsely covered by plants adapted to withstand the stresses of wind, water, and salt spray, or to rapidly recolonize after destruction. Many rare shorebirds use the Florida Panhandle's beach dunes for nesting. This community is also a major nesting area for loggerhead, green, Kemp's Ridley, and leatherback sea turtles. Beach dune habitat can be found south of the Santa Rosa Sound and the Gulf Islands National Seashore.
Coastal Grasslands	Coastal grassland, found primarily on broad barrier islands and capes, is a predominantly herbaceous community found in the drier portion of the transition zone between the beach dune and coastal strand or maritime hammock communities. Several rare animals use coastal grasslands for foraging and nesting, including neo-tropical migratory birds and the Santa Rosa beach mouse (*Peromyscus polionotus leucocephalus*), one of four rare subspecies of beach mouse along the Florida Panhandle coast. Coastal grassland can form from two major processes: the seaward build-up of a barrier island, which protects inland ridges from sand burial and salt spray, or the development of a new foredune ridge, which protects the previously overwashed area behind it (FNAI 2010). This community type can be found throughout Eglin AFB and the Gulf Islands National Seashore.
Coastal Strand	Coastal strand is an evergreen shrub community growing on stabilized coastal dunes, often with a smooth canopy due to pruning by wind and salt spray. It usually develops as a band between dunes dominated by sea oats along the immediate coast, and maritime hammock, scrub, or mangrove swamp (in peninsular Florida) communities further inland. This community is very rare on the Florida Panhandle coast where the transition zone is occupied by scrub or coastal grassland communities (FNAI 2010). This community type can be found in the Gulf Islands National Seashore.
Maritime Hammock	Maritime hammock is a predominantly evergreen hardwood forest that occurs on deep well-drained sandy soils or sandy soils mixed with shell fragments. Maritime hammock forests grow on stabilized coastal dunes at various distances from the shoreline. Maritime hammocks provide migrating songbirds with crucial resting and foraging areas on their fall and spring migrations to and from the tropics. On the Florida Panhandle coast, maritime hammock is found only in isolated pockets where shell is mixed with sandy substrate (FNAI 2010). Within the Pensacola Bay watershed, this community type can be found in the Pensacola NAS.
Transitional and Wetland Communities	
Basin Marsh	Basin marshes, unlike depression marshes, are marshes that lack a fire-maintained matrix community and rather occur in relative isolation as larger landscape features. Basin marshes are regularly inundated freshwater from local rainfall, as they occur around fluctuating shorelines, on former "disappearing" lake bottoms, and at the bead of broad, low basins marking former embayments of the last high-sea level stand. Species composition is heterogeneous both within and between marshes and generally includes submerged, floating, and emergent vegetation with intermittent shrubby patches. Common species include maidencane (*Panicum hemitomon*), sawgrass (*Cladium sp.*), bulltongue arrowhead (*Sagittaria lancifolia*), pickerelweed (*Pontederia cordata*), and cordgrass (*Spartina sp.*) (FNAI 2010).

Basin Swamp	Basin swamp is a wetland vegetated with hydrophytic trees, commonly including pond cypress (*Taxodium ascendens*) and swamp tupelo (*Nyssa sylvatica var. biflora*) and shrubs that can withstand an extended hydro-period. Basin swamps are characterized by highly variable species composition and are expressed in a variety of shapes and sizes due to their occurrence in a variety of landscape positions including old lake beds or river basins, or ancient coastal swales and lagoons that existed during higher sea levels. Basin swamps can also exist around lakes and are sometimes headwater sources for major rivers. Many basin swamps have been heavily harvested and undergone significant hydrological changes due to the conversion of adjacent uplands to agricultural and silvicultural lands (FNAI 2010). An exemplary basin swamp community is located in the Blackwater River State Park near the entrance station (FDEP 2016a).
Baygall	Baygall is an evergreen-forested wetland dominated by bay species including loblolly bay (*Gordonia lasianthus*), sweetbay (*Magnolia virginiana*), and/or swamp bay (*Persea palustris*). This community can be found on wet soils at the base of slopes or in depressions; on the edges of floodplains; and in stagnant drainages. Baygalls are not generally influenced by flowing water, but may be drained by small blackwater streams. Most baygalls are small; however, some form large, mature forests, called “bay swamps.” The dominance of evergreen bay trees rather than a mixture of deciduous and evergreen species can be used to distinguish baygall from other forested wetlands (FNAI 2010). An exemplary baygall community is located in the Blackwater River State Park.
Bog	Bog habitat typically includes areas of saturated substrates, often deep peat, and acidic conditions, with the dominant vegetation consisting of sedges and grasses. Bog habitat is often surrounded by a transition zone of trees and shrubs between the bog and upland area (FNAI 2010). In the Pensacola Bay watershed, this community type can be found along many of the watersheds’ major rivers.
Coastal Interdunal Swales	Coastal interdunal swales are marshes, moist grasslands, dense shrublands, or damp flats in linear depressions that occur between successive dune ridges as sandy barrier islands, capes, or beach plains. Dominant species tend to vary based on local hydrology, substrate, and the age of the swale, but common species include sawgrass (*Cladium sp.*), hairawn muhly (*Muhlenbergia capillaris*), broomsedge (*Andropogon virginicus*), seashore paspalum (*Paspalum vaginatum*), sand cordgrass (*Spartina bakeri*), and saltmeadow cordgrass (*Spartina patens*). For example, hurricanes and large storm events can flood swales with saltwater, after which they become colonized, often temporarily, by more salt-tolerant species. Saltwater intrusion and increased sand movement after storm events can reset successional processes of interdunal swale communities (FNAI 2010). This community type can be found in the Gulf Islands National Seashore.
Dome Swamp	Dome swamp is an isolated, forested, and usually small depression wetland consisting of predominantly pond cypress (*Taxodium ascendens*) and/or swamp tupelo (*Nyssa sylvatica var. biflora*). This community occurs within a fire-maintained community such as mesic flatwoods and commonly occupies depressions over a perched water table. Smaller trees grow on the outer edge of the swamp where the water is shallow, while taller trees grow deeper in the swamp interior creating the characteristic dome shape. Shrubs are typically sparse to moderate, but dome swamps with high fire frequencies or fire exclusion, the shrub layer may be absent. Many dome swamps form when poor surface drainage causes the dissolution of limestone bedrock, creating depressions which fill in with peat or marl. Surficial runoff from the surrounding uplands supplies much of the water within dome swamps. Consequently, water levels in these communities fluctuate naturally with seasonal rainfall changes. Dome swamps may also be connected directly to the aquifer, where groundwater influences the hydrological regime. Thus, dome swamps can function as reservoirs that recharge the aquifer. Logging, nutrient enrichment, pollution from agricultural runoff, ditching, impoundment, and invasive exotic species invasion have degraded dome swamps. Some dome swamps have been used as treatment areas for secondarily-treated wastewater (FNAI 2010).

Hydric Hammock	Hydric hammock is an evergreen hardwood and/or palm forest with a variable understory typically dominated by palms and ferns. This community occurs on moist soils, often with limestone very near the surface. While species composition varies, the community generally has a closed-canopy of oaks and palms, an open understory, and a sparse to a moderate groundcover of grasses and ferns. Hydric hammock occurs on low, flat, wet sites where limestone may be near the surface and soil moisture is kept high mainly by rainfall accumulation on poorly-drained soils. During heavy rains, sheet flow is slowed across the forested-floor of a hammock, resulting in greater absorption into the soil. Hammocks adjacent to salt marshes protect inland areas from damage during hurricanes and major storms (FNAI 2010). This community type is found on in the Pensacola NAS.
Floodplain Swamp	Floodplain swamp is a closed-canopy forest community of hydrophytic trees such as bald cypress (*Taxodium distichum*), water tupelo (*Nyssa aquatica*), swamp tupelo (*N. sylvatica var. biflora*), or ogeechee tupelo (*N. ogeche*). Floodplain swamp occurs on frequently- or permanently-flooded hydric soils adjacent to stream and river channels and in depressions and oxbows within the floodplain. The understory and groundcover are sparse in floodplain swamps, which can also occur within a complex mosaic of communities including alluvial forest, bottomland forest, and baygall. As rivers meander, they create oxbows and back swamps that are important breeding grounds for fish when high water connects them to the river. Floodplain swamp communities provide important wildlife habitat, contribute to flood attenuation, and help protect the overall water quality of streams and rivers. These communities may also transform nutrients or act as a nutrient sink depending on local conditions. This makes floodplain swamps useful for the disposal of partially-treated wastewater. Artificial impoundments on rivers can severely limit the seasonal flooding effects that maintain healthy floodplain systems; particularly, the stabilization of alluvial deposits and the flushing of detritus (FNAI 2010). Floodplain swamp communities are distributed along most creeks and streams within the watershed, particularly along the Yellow, Blackwater, and Escambia rivers. Exemplary sites include the floodplain swamps within the Yellow River Marsh Aquatic Preserve (Gardner 1991). Floodplain swamp occurs along both sides of the Backwater River in the Blackwater River State Park from the edge of the river to about 40 feet in elevation (FDEP 2016a).
Seepage Slope	Seepage slope is an open, grass sedge-dominated community consisting of wiregrass (*Aristida stricta*), toothache grass (*Ctenium aromaticum*), pitcher plants, plumed beaksedge (*Rhynchospora plumose*), flattened pipewort (*Eriocaulon compressum*), and woolly huckleberry (*Gaylussacia mosieri*). Seepage slopes are kept continuously moist by groundwater seepage. This community occurs in topographically variable areas, with 30- to 50-foot elevational gradients, frequently bordered by well-drained sandhill or upland pine communities. The soil is often soft and mucky underfoot, in contrast to the firm texture of the bordering sandhill and upland pine soils. Seepage slopes range from the Alabama border eastward to Calhoun County in the inland portions of the Florida Panhandle. Within the Pensacola Bay watershed, seepage slopes can be found throughout Eglin AFB.
Wet Prairie	Wet prairie is an herbaceous community usually occurring on acidic, continuously wet, but not inundated, soils. This community can be found on somewhat flat or gentle slopes between lower lying depression marshes, shrub bogs, or dome swamps or on slightly higher wet or mesic flatwoods. Wet prairies in northern Florida are some of the most diverse communities in the U.S., with an average of over 20 species per square meter in some places and over 100 total species in any given stand. The Panhandle is a hotspot for rare plants of the wet prairie community with 25 out of the 30 rare species found in this community; 12 of these are endemic to the Panhandle (FNAI 2010). This community type is found along the watershed's major rivers and Eglin AFB.

Aquatic Communities	
Blackwater Streams	Blackwater streams are perennial or intermittent seasonal watercourses laden with tannins (natural organic chemicals), particulates, and dissolved organic matter and iron. These dissolved materials result from the streams' origins in extensive wetlands with organic soils that collect rainfall and discharge it slowly to the stream. The dark-colored water reduces light penetration, inhibits photosynthesis, and prevents the growth of submerged aquatic plants. Blackwater streams are frequently underlain by limestones and have sandy bottoms overlain by organics that have settled out of suspension. Blackwater streams are the most widely distributed and numerous riverine systems in the southeast Coastal Plain (FNAI 2010) and found draining into most creeks, streams and bayous in the watershed. Many of the watershed's smaller tributaries are true blackwater streams, including several streams that traverse the Blackwater River State Park.
Seepage Streams	Seepage streams may be perennial or intermittent seasonal as they originate from shallow groundwater percolating through sandy upland soils. Seepage streams are small magnitude features, and unlike other stream communities in Florida, they lack a deep aquifer water source and extensive swamp lowlands surrounding their head waters. Seepage streams are generally sheltered by a dense overstory of broad-leaved hardwoods which block out most sunlight. Filamentous green algae occur sporadically within the stream, while vegetation at the water's edge may include mosses, ferns and liverworts. Seepage streams are often associated with seepage slope and slope forest communities near their head waters, and bottomland forest, alluvial forest and floodplain swamp communities near their mouths. The waters of seepage streams is filtered by percolation through deep soils which slows the release of rainwater and buffers temperature extremes, creating low flow rates of clear, cool, unpolluted water. Seepage streams are generally confined to areas where topographic relief is pronounced such as northern Florida (FNAI 2010). Within the Pensacola Bay watershed, seepage streams are found along the watersheds' major rivers and Eglin AFB. Seepage streams run throughout the Blackwater River State Park. The Hynote Branch is one example of a seepage stream in the park that is good to excellent condition (FDEP 2016a).
Estuarine and Marine Communities	
Salt Marsh	Salt marsh is a largely herbaceous tidal zone community commonly consisting of saltmarsh cordgrass (*Spartina alterniflora*), which dominates the seaward edge, and needle rush (*Juncus roemerianus*), which dominates higher, less frequently flooded areas. Salt marshes form where the coastal zone is protected from large waves, either by the topography of the shoreline, a barrier island, or by location along a bay or estuary. Salt marshes support a number of rare animals and plants, and provide nesting habitat for migratory and endemic bird species. Many of Florida's extensive salt marshes are protected in aquatic preserves, but the loss of marshes and adjacent seagrass beds due to human impacts such as shoreline development, ditching, and pollution and natural stressors, such as sea level rise, have vastly reduced their numbers. Salt marshes are instrumental in attenuating wave energy and protecting shorelines from erosion (FNAI 2010) and are found in the coastal/ estuarine portion of the watershed. Salt marsh communities are common throughout the Pensacola Bay watershed and are particularly extensive at the Yellow River Marsh Aquatic Preserve (Gardner 1991).
Seagrass Beds	Seagrass beds consist of expansive stands of submerged aquatic vascular plants including turtlegrass (*Thalassia testudinum*), manateegrass (*Syringodium filiforme*), and shoalgrass (*Halodule wrightii*), which occur predominantly in subtidal zones in clear low-energy coastal waters. Seagrass beds occur on unconsolidated substrates and are highly susceptible to changes in water temperature, salinity, wave-energy, tidal activity, and available light. This natural community supports a wide variety of animal life including manatees, marine turtles, and many fish, particularly spotted sea trout (*Cynoscion nebulosus*), spot (*Micropogonias undulates*), sheepshead, (*Archosargus probatocephalus*), and redfish (*Sciaenops ocellatus*). Pollution, particularly sedimentation and wastewater/sewage, have led to the widespread loss of seagrasses in nearly every bay in the Florida Panhandle (FNAI 2010). Seagrass beds have historically been widespread throughout the Pensacola Bay system, but declined substantially in the mid-1900s due to poor water quality.

Oyster/Mollusk Reef	Oyster/mollusk reef consists of expansive concentrations of sessile mollusks, which settle and develop on consolidated substrates including rock, limestone, wood, and other mollusk shells. These communities occur in both the intertidal and subtidal zones to a depth of 40 feet. In Florida, the American oyster (*Crassostrea virginica*) dominates mollusk reef communities, but other organisms including species of sponge, anemones, mussels, the burrowing sponge anemones, mussels, clams, barnacles, crabs, amphipods, and starfish live among or within the reef itself. Mollusks are filter-feeders that remove toxins from polluted waters and improve overall water quality (FNAI 2010).
Unconsolidated (Marine) Substrate	Unconsolidated (marine) substrate consists of coralgal, marl, mud, mud/sand, sand or shell deposited in expansive, open areas of subtidal, intertidal, and supratidal zones. Unconsolidated substrates support large populations of tube worms, sand dollars, mollusks, isopods, amphipods, burrowing shrimp, and an assortment of crabs, but lack dense populations of sessile plant and animal species. Unconsolidated substrates are an important feeding ground for bottom-feeding fish, shorebirds, and invertebrates. These areas also grade into a variety of other natural communities, making them the foundation for the development of other marine and estuarine habitats. Unconsolidated substrate communities are found throughout the estuarine and riverine portions of the watershed. They are susceptible to many types of disturbances including vehicle traffic, low DO levels, as well as the accumulation of metals, oils, and pesticides in the sediment (FNAI 2010). Unconsolidated (marine) substrate can be found throughout Escambia Bay, Pensacola Bay, and Big Lagoon.

Source: FNAI 2010.

Appendix F 2014 FDEP-verified Impaired Waterbody Segments in the Pensacola Bay Watershed

All states are required to submit lists of impaired waters that are too polluted or degraded to meet water quality standards and their designated use (potable, recreational, shellfish harvesting) to the EPA under section 303(d) of the CWA (EPA 2016b). The following table provides a list of impaired waters in the Pensacola Bay system. The list is based on data current through June 2012 (FDEP 2017).

Waterbody Segment ID	Water Segment Name	County	Waterbody Class[1]	Parameters Assessed Using the Impaired Waters Rule (IWR)
738AB	Bayview Park Pier	Escambia	3M	Bacteria (Beach Advisories)
548GB	Blackwater Bay (South Segment)	Santa Rosa	2	Bacteria (Shellfish Harvesting Classification)
548GB	Blackwater Bay (South Segment)	Santa Rosa	2	Fecal Coliform
24AB	Blackwater River (Tidal)	Santa Rosa	3M	Nutrients (Total Nitrogen)
639	Direct Runoff to Bay	Escambia	3F	Fecal Coliform
639	Direct Runoff to Bay	Escambia	3F	Lead
548H	East Bay	Santa Rosa	2	Bacteria (Shellfish Harvesting Classification)
701A	East Bay River (Marine Portion)	Santa Rosa	2	Bacteria (Shellfish Harvesting Classification)
701A	East Bay River (Marine Portion)	Santa Rosa	2	Enterococci
8007A	Emerald Promenade Beachwalk (Santa Rosa Island)	Okaloosa	3M	Bacteria (Beach Advisories)
548AA	Escambia Bay (North Segment)	Escambia, Santa Rosa	3M	Enterococci
548B	Escambia Bay (South Segment)	Escambia, Santa Rosa	2	Bacteria (Shellfish Harvesting Classification)
548AC	Escambia Bay North (Shellfish)	Escambia, Santa Rosa	2	Bacteria (Shellfish Harvesting Classification)
915C	Liza Jackson Park	Okaloosa	3M	Bacteria (Beach Advisories)
915D	Marler Park	Okaloosa	3M	Bacteria (Beach Advisories)
915B	Navarre Park Hwy. 98	Santa Rosa	3M	Bacteria (Beach Advisories)
548FB	Navy Point	Escambia	3M	Bacteria (Beach Advisories)
548D	Pensacola Bay (Middle Segment)	Escambia, Santa Rosa	3M	Nutrients (Chlorophyll-a)
548C	Pensacola Bay (North Segment)	Escambia, Santa Rosa	2	Bacteria (Shellfish Harvesting Classification)
176	Pond Creek	Santa Rosa	3F	Fecal Coliform
35	Pond Creek	Okaloosa, Walton	3F	Fecal Coliform
534	Sandy Point Bayou	Santa Rosa	3F	Iron

Waterbody Segment ID	Water Segment Name	County	Waterbody Class[1]	Parameters Assessed Using the Impaired Waters Rule (IWR)
915	Santa Rosa Sound	Escambia, Okaloosa, Santa Rosa	2	Bacteria (in Shellfish)
160A	Shoal River	Okaloosa	3F	Escherichia coli
160B	Shoal River	Okaloosa	3F	Fecal Coliform
833A	Tom King Bayou	Santa Rosa	3M	Nutrients (Historic Chlorophyll-a)

Source: FDEP 2017.

Notes:
* = new Florida listings since 2003
Footnote 1 - Florida's waterbody classifications:
- 1 - Potable water supplies
- 2 - Shellfish propagation or harvesting
- 3F - Recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife in fresh water
- 3M - Recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife in marine water
- 4 - Agricultural water supplies
- 5 - Navigation, utility, and industrial use

Footnote 2 - TSI = trophic state index

Appendix G Conservation Lands within the Pensacola Bay Watershed

Within the Pensacola Bay watershed, there are approximately 519,702 acres of conservation lands including 245,154 acres of federally managed lands; 269,585 acres of state-managed lands; 1,218 acres of locally managed lands; and 3,158 acres of privately managed lands. Six conservation lands within the Pensacola Bay watershed span multiple counties and several extend into other watersheds. The details of these conservation lands are presented in the following table (FNAI 2016a, 2016b):

Conservation Land	Managing Agency	County(ies)	Description	Website	Acres Within Watershed
Federally Managed					
Air Force Special Operations Command, Hurlburt Field	U.S. Dept. of Defense, Air Force	Okaloosa	This facility is dominated by mesic flatwoods and floodplain swamp; it supports a large population of reticulated flatwoods salamanders.	http://www.hurlburt.af.mil/	6,165.83
Choctawhatchee National Forest	U.S. Dept. of Agriculture, Forest Service	Okaloosa Santa Rosa	Several small parcels of nationally protected forest located north of Choctawhatchee Bay and Pensacola Beach, east of Pensacola Bay, and south of Interstate 10.	http://www.fs.fed.us	139.02
Eglin Air Force Base	U.S. Dept. of Defense, Air Force	Escambia Okaloosa Santa Rosa Walton	Largest forested military reservation in the free world. Extends 51 miles east-west and 19 miles north-south. 86% is forested, 81% of that is sandhill, 15% is forested wetlands, flatwoods, or baygall. Contains 35 natural communities and 64 rare plant species	http://www.eglin.af.mil/	229,743
Gulf Islands National Seashore	U.S. Dept. of the Interior, National Park Service	Escambia Okaloosa Santa Rosa	This national seashore stretches 150 miles from Mississippi into Florida. In Florida, it extends from the eastern end of Perdido Key, across the mouth of Choctawhatchee Bay, to the east end of Santa Rosa Island. It also includes other barrier islands, historic sites on the Florida mainland, as well as the waters in between. Florida acreage within the national seashore boundary includes 28,893.68 acres of federal land and 37,655.56 acres of other public land.	http://www.nps.gov	4,531.32

Conservation Land	Managing Agency	County(ies)	Description	Website	Acres Within Watershed
Harold Outlying Landing Field	U.S. Dept. of Defense, Navy	Santa Rosa	Naval reservation with grassy airfield surrounded by good quality sandhill. A small steephead ravine occurs in the northwest corner. Included in the Naval Air Station (NAS) Whiting Field.	http://www.cnic.navy.mil/regions/cnrse/installations/nas_whiting_field.html	582.21
Holley Outlying Landing Field	U.S. Dept. of Defense, Navy	Santa Rosa	Naval reservation with airfield. A large wet prairie/wet flatwoods mosaic in the southern portion contains many rare plants and animals including flatwoods salamander, Chapman's butterwort, white-topped pitcher plant, and Florida black bear. Included in the NAS Whiting Field.	http://www.cnic.navy.mil/regions/cnrse/installations/nas_whiting_field.html	661.44
NAS Pensacola	U.S. Dept. of Defense, Navy	Escambia	This facility is located at the mouth of Pensacola Bay on a peninsula formed by Bayou Grande and the bay. Although most of the site has been developed for mission-related activities, a wide variety of habitats remain. Natural communities include beach dune, maritime hammock, sand pine scrub, mesic flatwoods, and sandhill. Includes Bronson Outlying Landing Field and Blue Angel Recreation Park.	http://www.cnic.navy.mil/regions/cnrse/installations/nas_pensacola.html	4,769.05
NAS Whiting Field	U.S. Dept. of Defense, Navy	Santa Rosa	Most of this facility has been developed for mission-related activities; few natural features remain. An interpretive boardwalk is located within a large beaver-impounded wetland on the western boundary. The facility includes the main base plus six outlying landing fields (Harold, Holley, Pace, Santa Rosa, Site 8A, and Spencer) and Whiting Park.	http://www.cnic.navy.mil/regions/cnrse/installations/nas_whiting_field.html	3,461.43
Naval Technical Training Center Corry Station	U.S. Dept. of Defense, Navy	Escambia	Inactive naval air field that contains approximately 100 acres of planted pines and 0.5 acres of wetlands. The property also has a naval hospital and naval housing. There are a few isolated patches of second growth forest on-site.	http://www.netc.navy.mil/centers/ceninfodom/corry/	565.53

Conservation Land	Managing Agency	County(ies)	Description	Website	Acres Within Watershed
Patterson Natural Area	U.S. Dept. of Defense, Air Force	Okaloosa	150-200 year old longleaf pine stand. The natural area is part of Eglin Air Force Base.	http://www.eglin.af.mil/	290.51
Santa Rosa Outlying Landing Field	U.S. Dept. of Defense, Navy	Santa Rosa	A naval reservation that is primarily a single airfield, but does contain large forested areas in the northeast and southeast corners. Gopher frog and Florida pine snake occur here. Included in the NAS Whiting Field.	http://www.cnic.navy.mil/regions/cnrse/installations/nas_whiting_field.html	693.26
Whiting Park	U.S. Dept. of Defense, Navy	Santa Rosa	Naval recreation area along Blackwater River with boat launch and picnic facilities. Included in the NAS Whiting Field.	http://www.cnic.navy.mil/regions/cnrse/installations/nas_whiting_field/ffr/things_to_do/recreation/parks_and_picnic_areas.html	5.47
State Managed					
Blackwater Heritage State Trail	FDEP Division of Recreation and Parks	Santa Rosa	This is an 8.1-mile long paved recreational trail located along a former railroad corridor. It is the westernmost rail-trail in Florida and part of an integrated statewide network of trails and ecological greenways.	http://www.floridastateparks.org/	586.08
Blackwater River State Forest	USDA Florida Forest Service	Okaloosa Santa Rosa	This is the largest expanse of sandhills, longleaf pine upland forests, and seepage slopes in state ownership.	http://www.floridaforestservice.com/index.html	635.83
Blackwater River State Park	FDEP Division of Recreation and Parks	Santa Rosa	Ponds, swamps, scrubby ridges; high pineland and pine flatwoods; Atlantic white cedars; on the Blackwater River.	http://www.floridastateparks.org/	635.11
Blackwater River Water Management Area	NWFWMD	Santa Rosa	Primarily cut-over paper lands in the uplands, but nice areas of floodplain forest and bottomland forest along the river. Rare plants include Florida flame azalea.	http://www.nwfwater.com/	386.46
Cottage Hill State Forest	USDA Florida Forest Service	Escambia	A small tract of state forest land managed through the Blackwater Forestry Center Field Unit, south of McKenzie Road, west of Chavers Road, and east of Gainey Lane.	http://www.floridaforestservice.com/index.html	30.83

Conservation Land	Managing Agency	County(ies)	Description	Website	Acres Within Watershed
Escribano Point Wildlife Management Area	FWC	Santa Rosa	Southern region has large expanses of wet flatwoods with lots of pitcher plants grading into baygall. Northern region is an impenetrable thicket of titi that has regenerated after the site was logged in the 1990s.	http://myfwc.com	3,924.52
FWC Mitigation Parcel	FWC	Okaloosa	Mitigation parcel surrounded by Blackwater River State Forest.	http://myfwc.com	110.37
Garcon Point Water Management Area	NWFWMD	Santa Rosa	This is a peninsula separating East Bay and Escambia Bay. It is an example of high quality wet prairie habitat that contains several very rare species, as well as carnivorous pitcher plants. Includes 78 acres less-than-fee.	http://www.nwfwater.com/	3,222.80
Gillis Road Tract	Undesignated State Land (not currently assigned to a managing agency)	Santa Rosa	Land formerly managed by FDACS, Division of Forestry, north of Old Hickory Hammock Road, west of Black Oak Road, and southeast of Interstate 10.	http://data.labins.org/mapping/FNAI/identify_list2.cfm?MA_ID=1188	19.97
Lake Stone Fish Management Area	FWC	Escambia	A 130-acre lake surrounded by 119 acres of uplands with a mixture of upland mixed forest and baygall. This lake is intensively managed for fish production. Jointly managed by FWC and Escambia County.	http://myfwc.com	248.02
Lower Escambia River Water Management Area	NWFWMD	Escambia Santa Rosa	Floodplain forest, bottomland forest, and some uplands along almost the entire length of the Escambia River near Pensacola. Several rare fish, reptiles, and amphibians have been documented here.	http://www.nwfwater.com/	36,666.89
Watson Conservation Easement	NWFWMD	Escambia	A conservation easement with no public access and all less-than-fee. Easement is located immediately west of the Lower Escambia River Water Management Area, east of North Century Boulevard/U.S.-29, north of Milstead Road, south of Brown Road.	http://www.nwfwater.com/	15.81

Conservation Land	Managing Agency	County(ies)	Description	Website	Acres Within Watershed
Yellow River Marsh Preserve State Park	FDEP Division of Recreation and Parks	Santa Rosa	Also known as Garcon Point Prairie, this is perhaps the largest intact wet prairie (pitcher plant prairie) in northwest Florida. The preserve adjoins Northwest Florida Water Management District lands. Hydrologic restoration is planned to offset impacts of past ditching and drainage.	http://www.floridastateparks.org/	832.14
Yellow River Water Management Area	NWFWMD/FWC	Okaloosa Santa Rosa	A tremendously diverse tract of land with upland pine forest, upland hardwood forest, seepage slopes, floodplain marsh, tidal marsh, streams, and lakes.	http://www.nwfwater.com/	16,643.05
Locally Managed					
Bay Bluffs Park	City of Pensacola	Escambia	Located on the west shore of Escambia Bay, this park is bordered on the north and south by Escambia Bay Bluffs.	http://cityofpensacola.com/Facilities/Facility/Details/Bay-Bluffs-Preserve-18	19.79
Baycliff Preserve	City of Gulf Breeze	Santa Rosa	This site is a natural wetlands area with a nature trail and public beach access.	http://cityofgulfbreeze.us/	6.81
Escambia Bay Bluffs	City of Pensacola	Escambia	Three parcels on west shore of Escambia Bay.	http://pensacolascenicbluffs.org/	41.73
Jones Swamp Wetland Preserve and Escambia County Southwest Greenway	Escambia County Community and Environment Department	Escambia	This preserve and greenway is located in a 1,300-acre watershed targeted for acquisition to provide wetland buffering and protection for the Pensacola Bay area. The greenway is available for passive use recreation and has several miles of boardwalk and hiking trails.	http://www.myescambia.com/government/departments/ce	581.90
Mallory Heights Park #3	City of Pensacola	Escambia	Located on the west shore of Escambia Bay, this park is bordered on the north and south by Escambia Bay Bluffs.	http://cityofpensacola.com/132/Parks-Recreation?parkID=13246	7.01
Navarre Beach Park	Santa Rosa County	Santa Rosa	Restored coastal dunes located within the Gulf Islands National Seashore, south of Navarre Parkway, west of the Navarre Beach Pier and east of Bahia Drive.	http://www.santarosa.fl.gov/	136.90

Conservation Land	Managing Agency	County(ies)	Description	Website	Acres Within Watershed
Shoal River Land Acquisition	Okaloosa County	Okaloosa	Restrictive use easement purchased by Okaloosa County Water and Sewer located north of the Eglin Air Force Base Conservation Land, intersected in its northern portion by Interstate 10, east of Balboa Road and south of James Kennedy Road.	http://www.co.okaloosa.fl.us/ws/home	321.18
Shoreline Park South	City of Gulf Breeze	Santa Rosa	This park is a mostly wooded area that extends from Shoreline Drive south to the edge of Santa Rosa Sound. An open area near the water contains a boat ramp, picnic tables, fishing pier, swimming area, and a large gazebo. A nature trail winds through the property.	http://cityofgulfbreeze.us/parks-and-recreation-department/	103.24
Privately Managed					
Camp Kolomoki	Girl Scouts of America	Walton	This site is used as a Girl Scout Camp. It contains a pitcher plant prairie.	http://www.gscfp.org/camps.html	1,635.26
Garcon Peninsula Mitigation Bank	Garcon Peninsula Mitigation Bank, LLC	Santa Rosa	Mitigation bank land owned by private individuals, located west of Blackwater Bay, north and west of Robinson Point Road (which runs east/west then turns and runs north/south), south of Trease Road, and east of Garcon Point Road.	http://www.garconmitigationbank.com/	334.70
Pensacola Bay Mitigation Bank	Westervelt Ecological Services	Santa Rosa	Mitigation bank. The site is in the Pensacola Bay Basin in a flat, near-coastal landscape adjacent to low-density residential and preservation lands with a major highway dividing two parcels. The site consisted of fire-suppressed, overgrown, but intact (with wiregrass) wet prairie and wet flatwoods, with some ORV-damaged areas. Also contains cypress dome/stringer depressions and a titi-baygall area isolated from fire.	http://www.wesmitigation.com/mitigation-conservation-projects/pensacola-bay-mitigation-bank.cfm#page=general	1188.73

Source: FNAI 2016