

Draft

Choctawhatchee River and Bay System Watershed Characterization



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Prepared by:



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Table of Contents

<u>Section</u>	<u>Page</u>
1.0 Introduction.....	1
1.1 SWIM Program Background, Goals, and Objectives.....	1
1.2 Purpose and Scope of 2017 SWIM Plan	2
2.0 Watershed Description	4
2.1 Introduction	4
2.2 Geographic Characteristics.....	5
2.2.1 Geography	5
2.2.2 Land Use and Population	9
2.3 Physical Characteristics.....	12
2.3.1 Physiographic Region	12
2.3.2 Ecoregions	13
2.3.3 Climate	17
2.3.4 Geology	17
2.3.5 Soils.....	18
2.4 Hydrologic Characteristics	21
2.4.1 Major Rivers, Tributaries, and Coastal Waterbodies	21
2.4.2 Gulf Intracoastal Waterway (GIWW).....	23
2.4.3 Sandhill and Coastal Dune Lakes.....	25
2.4.4 Springs.....	26
2.4.5 Groundwater Systems	29
2.5 Ecosystem Services	29
2.5.1 Hydrologic Functions	30
2.5.2 Nutrient Cycling.....	32
2.5.3 Sediment Stabilization.....	32
2.5.4 Commercially and Recreationally Important Fish and Wildlife	32
2.5.5 Recreation and Aesthetic Value	35
2.6 Ecological Resources	36
2.6.1 Seagrass Beds	36
2.6.2 Oyster Reefs	39
2.6.3 Emergent Marsh	39
2.6.4 Palustrine, Riparian, and Floodplain Habitats.....	41
2.6.5 Coastal Barrier Systems	41

2.6.6	Terrestrial Communities.....	41
2.6.7	Coastal Dune Lakes.....	42
2.6.8	Steepheads.....	42
2.6.9	Springs.....	43
2.6.10	Migratory Bird Flyways.....	43
2.6.11	Terrestrial Communities.....	44
3.0	Current Watershed Conditions and Water Resource Issues.....	45
3.1	Introduction.....	45
3.2	Water Quality.....	45
3.2.1	Impaired Waters.....	45
3.2.2	Total Maximum Daily Loads (TMDLs).....	49
3.2.3	Point Source Pollution.....	54
3.2.4	Nonpoint Source (NPS) Pollution.....	59
3.2.5	Ecological Indicators of Water Quality.....	69
3.3	Habitat Quality in Receiving Waters.....	73
3.3.1	Subtidal Communities.....	73
3.3.2	Intertidal Communities.....	74
3.3.3	Freshwater Systems.....	74
3.4	Floodplains.....	74
3.4.1	Flood Prone Areas.....	75
3.4.2	Recent Flood Events.....	75
3.4.3	Floodplain Management.....	76
3.5	Unique Features and Special Resource Management Designations.....	77
3.5.1	Conservation Lands.....	77
3.5.2	Critical Habitat Strategic Habitat Conservation Areas (SHCAs).....	80
3.5.3	Aquatic Preserves.....	81
3.5.4	Outstanding Florida Waters (OFWs).....	81
3.5.5	Gulf Ecological Management Sites (GEMS).....	82
4.0	Implementation and Achievements of the Previous SWIM Plan.....	83
4.1	Previous SWIM Plan Issues and Priorities.....	83
4.2	Progress toward Meeting Plan Goals and Objectives.....	83
5.0	Related Resource Management Activities.....	86
5.1	Deepwater Horizon: RESTORE Act, Natural Resource Damage Assessment (NRDA), and NFWF Projects.....	86
5.1.1	RESTORE.....	86
5.1.2	Natural Resource Damage Assessment (NRDA).....	87
5.1.3	National Fish and Wildlife Foundation (NFWF).....	88

5.1.4 The Nature Conservancy (TNC): Watershed Management Planning.....88

5.2 Water Quality Monitoring89

5.2.1 FDEP/NFWMD.....90

5.2.2 FDEP Northwest District90

5.2.3 Florida Department of Agriculture and Consumer Services (FDACS)91

5.2.4 Florida Department of Health (FDOH).....91

5.2.5 Choctawhatchee Basin Alliance (CBA)91

5.2.6 Aqualab (Okaloosa County).....92

5.2.7 Alabama Water Watch92

5.3 Submerged Aquatic Vegetation (SAV) Monitoring.....92

5.4 Water Quality Restoration and Protection Programs93

5.4.1 Total Maximum Daily Loads (TMDLs).....93

5.4.2 National Pollutant Discharge Elimination System (NPDES) Permitting.....93

5.4.3 Domestic and Industrial Wastewater Permits94

5.4.4 Best Management Practices (BMPs).....94

5.4.5 Environmental Resource Permitting (ERP)95

5.4.6 Regional Mitigation for State Transportation Projects.....96

5.4.7 FDEP Ecosystem Restoration Section96

5.4.8 Florida Forever Work Plan.....96

5.4.9 Minimum Flows and Levels (MFLs)97

5.4.10 Spring Protection and Restoration.....98

5.4.11 Natural Resource Management at Eglin AFB.....99

5.4.12 University of Florida Institute of Food and Agricultural Sciences Extension (UF-IFAS)99

5.4.13 Planning and Coordination within Alabama100

5.4.14 County and City Initiatives100

5.4.15 Other Programs and Actions101

9.0 References.....103

Appendices

Appendix A Geology and Soils in the Choctawhatchee River and Bay Watershed A-1

Appendix B Threatened and Endangered Species within the WatershedB-1

Appendix C Habitats and Natural CommunitiesC-1

Appendix D 2014 FDEP Verified Impaired Waterbody Segments in the Choctawhatchee River and Bay Watershed D-1

Appendix E Conservation Lands within Florida’s Portion of the Choctawhatchee River and Bay Watershed.....E-1

Appendix F Projects Funded by the National Fish and Wildlife Foundation in the Choctawhatchee River and Bay Watershed..... F-1

List of Tables

<u>Table</u>	<u>Page</u>
Table 2-1 2012-2013 Land Cover within the Choctawhatchee River and Bay Watershed (Florida Portion)	11
Table 2-2 Population in the Choctawhatchee River and Bay Watershed (Florida’s Portion) (Based on Census Blocks).....	12
Table 2-3 Hierarchy of USGS Physiographic Regions and EPA Level 3 and 4 Ecoregions in the Watershed	14
Table 3-1 Florida Waterbodies in Watershed Removed from Impaired Waters List.....	49
Table 3-2 TMDLs.....	51
Table 3-3 Florida Solid Waste Facilities in the Watershed.....	57
Table 4-1 2002 SWIM Plan Project Schedule and Cost Estimates.....	84

List of Figures

<u>Figure</u>	<u>Page</u>
Figure 2-1 Percent Area of Entire Watershed by State	5
Figure 2-2 Percent Area of Watershed by County (Florida Portion Only)	5
Figure 2-3 Greater Choctawhatchee River and Bay Watershed.....	8
Figure 2-4 General Land Use of Greater Choctawhatchee Bay Watershed (including Alabama).....	9
Figure 2-5 Land Use and Land Cover for the Florida Portion of the Choctawhatchee River and Bay Watershed	10
Figure 2-6 Level 3 and 4 Ecoregions in the Florida Portion of the Choctawhatchee River and Bay Watershed	16
Figure 2-7 Hydric Soils	20
Figure 2-8 Stratification of an Estuary	22
Figure 2-9 Current and Former Location of Destin Pass	23
Figure 2-10 Topography and Major Waterbodies	24
Figure 2-11 Dune Lakes	26
Figure 2-12 Major Springs Located within the Florida Portion of the Watershed.....	28
Figure 2-13 Floodplains and Wetlands	31
Figure 2-14 Blue Crabs	32
Figure 2-15 Approved Shellfish Harvesting Areas	34
Figure 2-16 Seagrass Coverage in the Watershed.....	38
Figure 2-17 Saltmarsh Coverage in the Watershed.....	40
Figure 3-1 TMDLs in Florida's Portion of the Watershed, Excepting Mercury	53
Figure 3-2 Permitted Wastewater Facilities within the Choctawhatchee River and Bay Watershed ...	56
Figure 3-3 New Septic System Installations by Year.....	63
Figure 3-4 Septic Tank Locations in the Choctawhatchee River and Bay Watershed.....	65
Figure 3-5 Bioaccumulation of Methyl-Mercury.....	68
Figure 3-6 Eutrophication Process	70
Figure 3-7 Public and Conservation Lands	79

Abbreviations and Acronyms List

ACWP	Alabama Clean Water Partnership
ADEM	Alabama Department of Environmental Management
AFB	Air Force Base
BMAP	Basin Management Action Plan
BMP	best management practice
BOD	biochemical oxygen demand
CBA	Choctawhatchee Basin Alliance
CWA	Clean Water Act
DO	dissolved oxygen
EDC	Economic Development Council
EPA	U.S. Environmental Protection Agency
ERP	Florida - Environmental Resource Permitting
ESA	Endangered Species Act
°F	Fahrenheit
F.A.C.	Florida Administrative Code
FDACS	Florida Department of Agriculture and Consumer Services
FDEC	Florida Demographic Estimating Conference
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
FHWA	Federal Highway Administration
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
GIWW	Gulf Intracoastal Waterway

GSA	Geological Survey of Alabama
HAB	harmful algal blooms
INRMP	Integrated Natural Resources Management Plan
IWR	Impaired Surface Waters Rule
MFLs	Minimum Flows and Levels
MS4s	municipal separate storm sewer systems
NFWF	National Fish and Wildlife Foundation
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPS	nonpoint source
NRC	National Resource Council
NRCS	Natural Resources Conservation Service
NRDA	Natural Resource Damage Assessment
NFWWMD	Northwest Florida Water Management District
OFWs	Outstanding Florida Waters
OSTDS	on-site sewage treatment and disposal systems
PCBs	polychlorinated biphenyls
RESTORE Act	Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States Act
RWSP	Regional Water Supply Plan
SAV	submerged aquatic vegetation
SEAS	Shellfish Environmental Assessment Section
SHCAs	Strategic Habitat Conservation Areas
SIMM	Seagrass Integrated Mapping and Monitoring
SLAMM	Sea Level Affecting Marshes Model
SMZs	Special Management Zones
START	Solutions To Avoid Red Tide
STORET	STORage and RETrieval database
SWIM	Surface Water Improvement and Management
SWTV	Surface Water Temporal Variability
TEEB	The Economics of Ecosystems and Biodiversity
TMDL	total maximum daily load
TN	total nitrogen
TNC	The Nature Conservancy
TP	total phosphorus
Trust Fund	Gulf Coast Restoration Trust Fund

UF-IFAS	University of Florida Institute of Food and Agricultural Sciences Extension
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USDOC	U.S. Department of Commerce
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

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1

1.1 SWIM Program Background, Goals, and Objectives

1.2 Purpose and Scope of 2017 SWIM Plan

1.0 Introduction

This watershed characterization has been prepared in support of an update to the Surface Water Improvement and Management (SWIM) plan for the Choctawhatchee River and Bay watershed. The SWIM plan 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 (NFWFMD 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 1996 (NFWFMD 1996) and updated in 2002 (NFWFMD 2002).

The Choctawhatchee River begins in southern Alabama and extends into Florida and southward to the Gulf of Mexico. Within Florida, the watershed encompasses all of Holmes County, as well as large portions of Walton and Washington counties, with smaller, but significant portions occurring in Okaloosa, Bay, and Jackson counties (Figure 2-1). Although much of the watershed is in Alabama, the scope of this plan, for implementation purposes, is limited to the Florida portion.

1.1 SWIM Program Background, Goals, and Objectives

SWIM Plans have been developed pursuant to the SWIM Act, which was 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 programs to provide improved management of surface waters and associated resources;
- Develop plans identifying current conditions and processes affecting the quality of surface waters;
- Identify 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.

The SWIM program addresses overarching goals and priorities through the identification and implementation of projects that are vetted and prioritized by the District and local stakeholders, with public input. Projects may include stormwater treatment and floodplain restoration for water quality improvement, wetland and aquatic habitat restoration, resource assessments, public outreach and awareness initiatives, among others.

SWIM 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 that are more generally outlined in the District’s strategic plan.

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: Land Acquisitions and Capital Improvements for Conservation or Recreation
- 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 62-302, Florida Administrative Code (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

1.2 Purpose and Scope of 2017 SWIM Plan

Development of the 2017 Choctawhatchee River and Bay SWIM Plan update (hereafter called 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.

The 2002 Choctawhatchee River and Bay Watershed SWIM Plan update identified broad and diverse issues, limited funding, and coordination across multiple counties as the watershed’s primary challenges. The plan also established five goal-oriented objectives:

1. Improve treatment of stormwater runoff;
2. Prevent nonpoint source (NPS) pollution;
3. Improve management and treatment of domestic and industrial wastewater;
4. Protect habitat; and
5. Restore habitats/ecosystems.

This 2017 SWIM Plan assesses progress made toward implementation of actions identified in the 2002 Plan, while also addressing new issues, ongoing challenges, and opportunities for achieving

In the Choctawhatchee River and Bay watershed, major stakeholders include:

- The NFWFMD
- U. S. Department of Agriculture (USDA)
- U.S. Fish and Wildlife Service (USFWS)
- Florida Department of Environmental Protection (FDEP)
- Florida Fish and Wildlife Conservation Commission (FWC)
- Florida Department of Agriculture and Consumer Services (FDACS)
- Florida Department of Economic Opportunity
- West Florida Regional Planning Council (WFRPC)
- The Nature Conservancy (TNC)
- The NFWF
- Bay, Washington, Holmes, Walton, Jackson, and Okaloosa counties
- Municipalities including DeFuniak Springs, Bonifay, Vernon, Chipley, Graceville, Niceville, Destin, Freeport, Valparaiso, Shalimar, Caryville, Cinco Bayou, Westville, and Fort Walton Beach
- Various unincorporated communities
- Eglin Air Force Base (AFB) and Hurlburt Field
- Choctawhatchee Basin Alliance (CBA)
- Florida Lake Watch
- And many others

watershed protection and restoration. Further, the 2017 SWIM Plan provides a detailed description of the watershed's physical characteristics and natural resources, provides an assessment of the watershed's current condition, and identifies priority challenges affecting watershed resources and functions. The 2017 SWIM Plan also prescribes a set of management actions to meet those challenges and needs. Management actions are generally limited to those within the mission and scope of the NFWFMD SWIM program recognizing the ongoing initiatives and needs of local communities and other agencies.

For the purposes of the SWIM program, watersheds are the logical ecological and geographical units for planning and managing restoration efforts along Florida's Gulf Coast. Successful watershed

management requires coordination and implementation of complementary programs and projects under the purview of all jurisdictions and agencies involved in the watershed. Among these are local, state, and federal regulatory and management agencies; conservation lands management organizations; non-governmental organizations; and other interested stakeholders.

The 2017 SWIM Plan identifies projects and opportunities to leverage funding from many sources; integrating the efforts of local governments, state and federal agencies, and private entities to pool resources and achieve mutual objectives and goals; and to present innovative, sustainable solutions to watershed issues.

2

2.1 Introduction

2.2 Geographic Characteristics

2.3 Physical Characteristics

2.4 Hydrologic Characteristics

2.5 Ecosystem Services

2.6 Ecological Resources

2.0 Watershed Description

2.1 Introduction

The Choctawhatchee River and Bay watershed covers approximately 3.3 million acres across the central Florida Panhandle and southern Alabama. Approximately 40 percent of the watershed (1,341,588 acres) is in Florida, while the remaining 60 percent falls within Alabama. Florida’s portion of the watershed alone spans six U.S. Environmental Protection Agency (EPA) Level 4 ecoregions (described further in Section 2.3.2) and encompasses 35 unique habitat types recognized by the Florida Natural Areas Inventory (FNAI). These habitats include freshwater lakes, streams, rivers, and springs; and coastal features such as bays, estuaries, barrier islands, and dune lakes. Choctawhatchee Bay is influenced primarily by the Choctawhatchee River, the largest river in the watershed.

Choctawhatchee River and Bay watershed statistics:

- ✓ Two states: Florida and Alabama
- ✓ Six Florida counties
- ✓ Six EPA Level III ecoregions
- ✓ 35 Unique natural communities
- ✓ 3.3 million acres

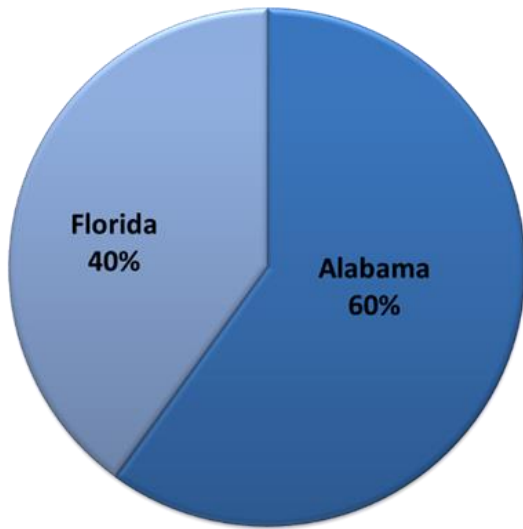
The Choctawhatchee River receives flow from several tributaries in northern Florida and southern Alabama, as well as the Pea River basin and groundwater discharge from the Floridan aquifer, before emptying into Choctawhatchee Bay approximately 27 miles from its headwaters. The unique ecosystems comprising the Choctawhatchee River and Bay watershed fall under the jurisdiction of multiple local and county governments, regional agencies, state, and federal agencies. These entities not only manage natural resources, but also shape their expression across the landscape by establishing conservation lands, implementing land use and land management regulations, and establishing best management practices (BMPs) that directly influence water quality and habitat integrity.

This section provides an overview of the physical, hydrological, and ecological characteristics of the Choctawhatchee River and Bay watershed, as well as the ecosystem services that those resources provide to the watershed’s residents and communities.

2.2 Geographic Characteristics

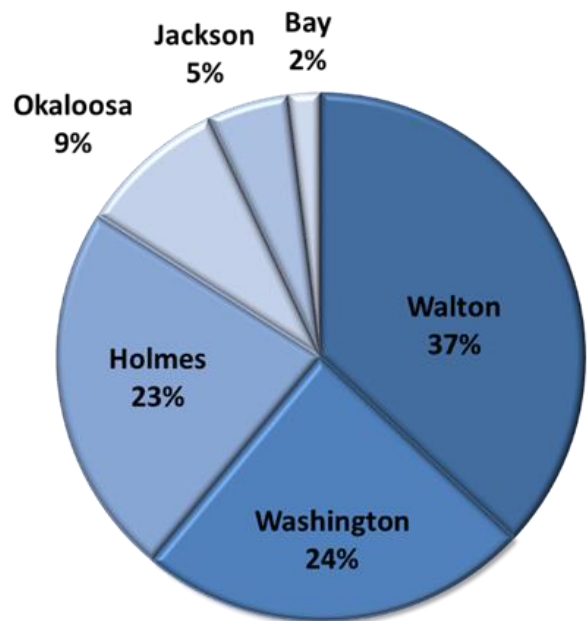
2.2.1 Geography

The Greater Choctawhatchee River and Bay watershed spans portions of Alabama and Florida before emptying into the Gulf of Mexico. The watershed covers approximately 3.4 million acres, with 40 percent of the watershed located within the central Florida Panhandle, and the remaining 60 percent in Alabama (Figures 2-1 and 2-2) (NFWWMD 2002). The Choctawhatchee River’s headwaters originate just south of Highway 82 in Bullock County, Alabama, approximately 27 miles north of where it empties into Choctawhatchee Bay. All of Holmes County and portions of Washington, Walton, Jackson, Bay, and Okaloosa counties make up Florida’s portion of the watershed (NFWWMD 2002).



Source: NFWWMD 2002.

Figure 2-1 Percent Area of Entire Watershed by State

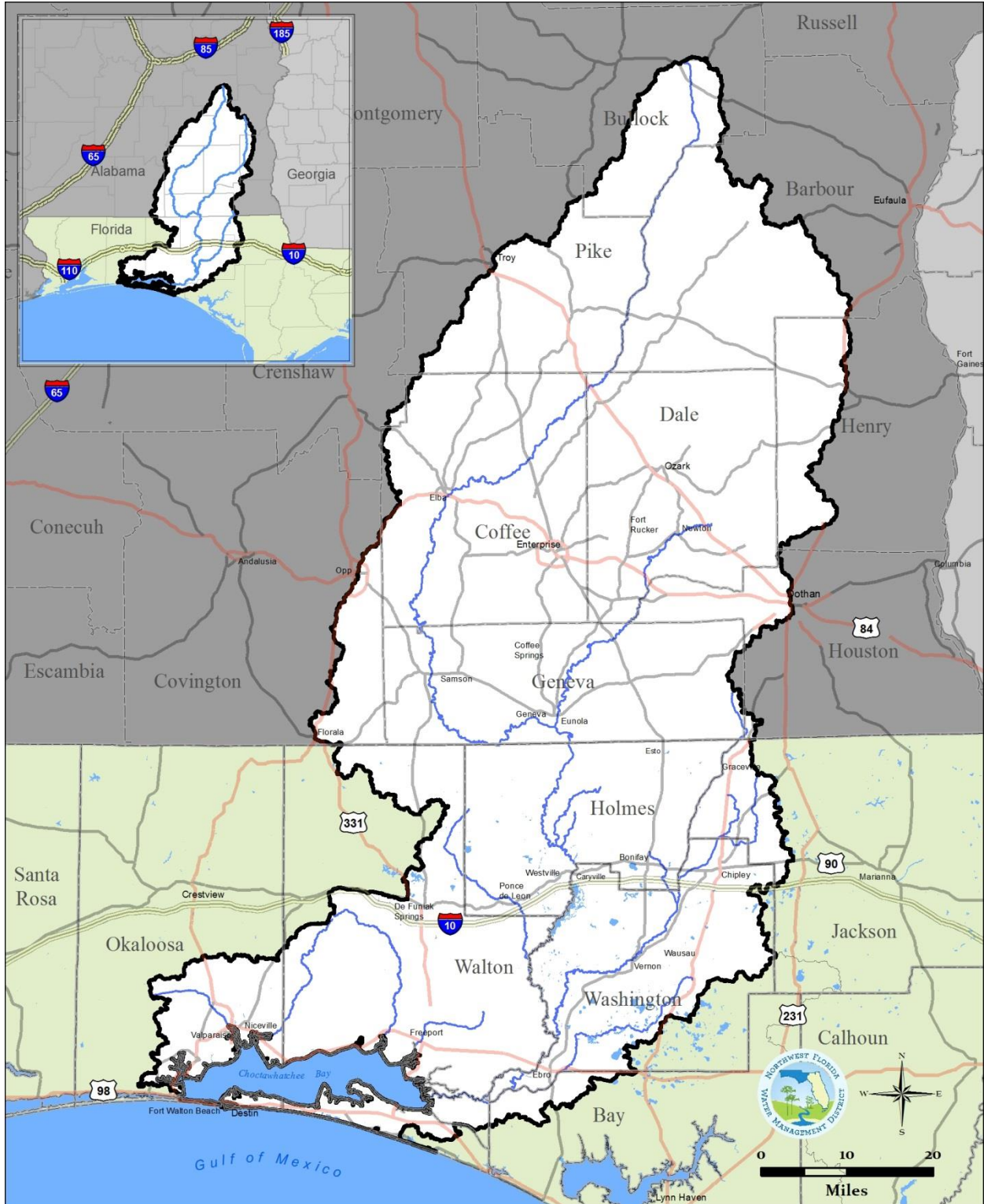


Source: NFWWMD 2002.

Figure 2-2 Percent Area of Watershed by County (Florida Portion Only)

Municipalities within Alabama's portion of the watershed include Dothan, Geneva, Troy, and Enterprise. The Fort Rucker U.S. Army post and U.S. Army Aviation Center of Excellence is also in Alabama's portion of the watershed. Florida's municipalities, including the City of DeFuniak Springs in Walton County, and the cities of Chipley and Bonifay in Holmes County, are found in the watershed's upper reaches north of Interstate 10. Smaller towns such as Westville and Ebro are located on the Choctawhatchee River. Ponce de Leon is located along Sandy Creek, and the towns of Vernon and Wausau are located on or near Holmes Creek. The towns of Noma and Esto and the City of Graceville are located east of the Choctawhatchee River near the Alabama border. Major cities in the coastal portion of the watershed include Destin, Fort Walton Beach, Niceville, and Freeport, which are all located on Choctawhatchee Bay (Figures 2-3). Smaller bayside communities include the Town of Shalimar, City of Valparaiso, and the Town of Cinco Bayou. Unincorporated coastal communities, which are located on the watershed's barrier peninsulas, include Seaside, Miramar Beach, and Santa Rosa Beach. Choctawhatchee Bay has a single direct opening to the Gulf of Mexico at East Pass adjacent to Destin (further discussed in Section 2.4). Like many other watersheds in the NFWMD, development is most heavily concentrated in the coastal portion of the watershed.

Holmes, Washington, and Walton counties make up the largest portion of the watershed; together these three counties account for 84 percent of the total land area within Florida's portion of the basin. Okaloosa, Bay, and Jackson counties make up approximately nine percent, two percent, and five percent of the total Florida watershed area, respectively. Jackson County occurs in the upper reaches of the watershed, adjacent to Holmes County, while Bay and Okaloosa counties occupy downstream areas of the basin near the bay and Gulf coast. Although Okaloosa County makes up a relatively small portion of the watershed, its influence is among the most important, since it contains most of the older developed areas of Fort Walton Beach, Niceville, Destin, and Eglin AFB. Such areas have had historical impacts on water quality, including from point source discharges, untreated stormwater runoff, and outdated infrastructure. Given Walton County's large portion of the watershed and its location along the coast and lower Choctawhatchee River basin, changes in its population have the potential to substantially affect the river and bay, both directly through stormwater, wastewater, transportation facilities, and recreation, and indirectly through changes in land use and land management.

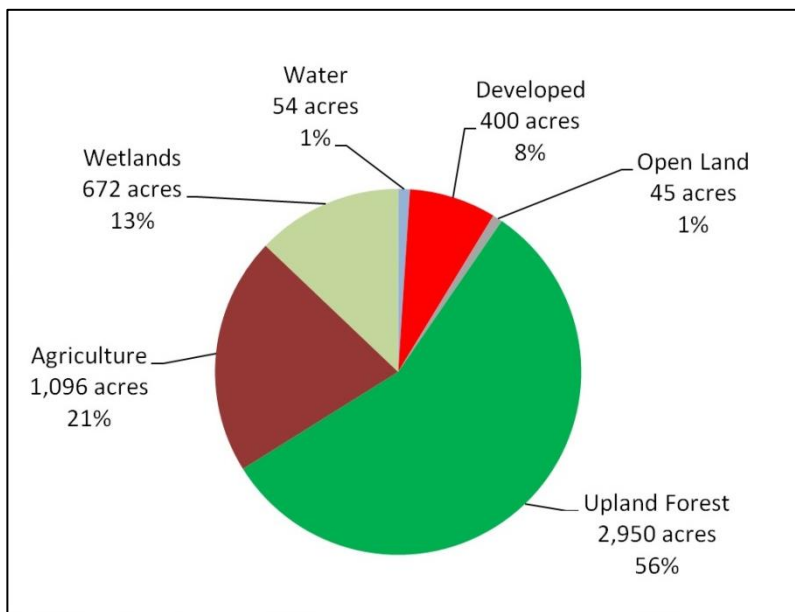


Sources: Federal Highway Administration ([FHWA] 2014; National Oceanic and Atmospheric Administration (NOAA) 2015; U.S. Geological Survey (USGS) 2015.

Figure 2-3 Greater Choctawhatchee River and Bay Watershed

2.2.2 Land Use and Population

Within Florida’s portion of the watershed, most of the land cover consists of upland forest with wetland systems along the Choctawhatchee River and its tributaries (Figures 2-4 and 2-5; Table 2-1). In Alabama and along the northern Florida border, much of the area is rural and designated for agriculture, including silviculture, farming, livestock, and rural residential uses. Large tracts of agricultural land also occur between Freeport and Rock Hill in the southern portion of the watershed, and near Mossy Head in the southwestern portion.

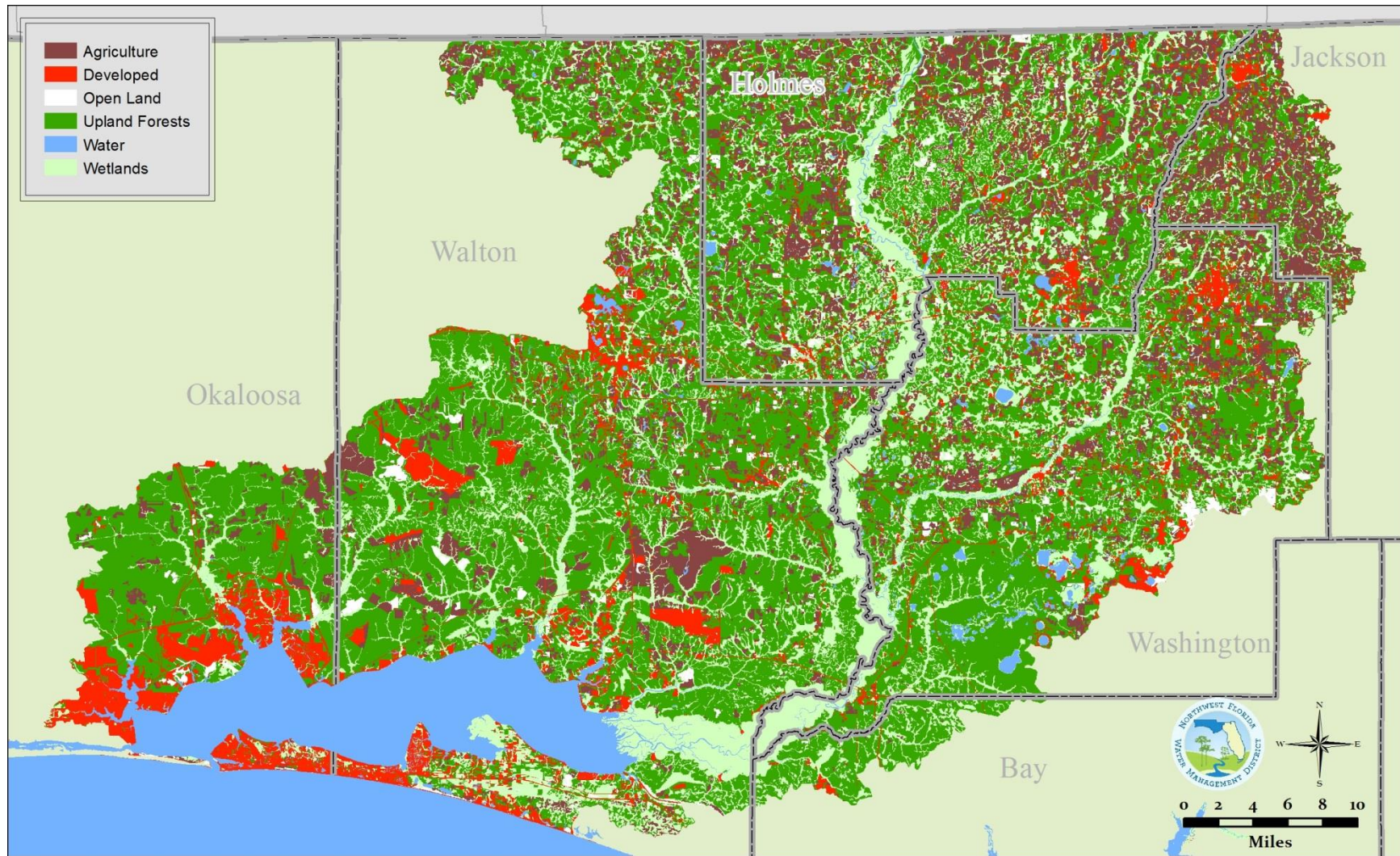


Sources: FDEP 2015a; MRCL NLCD 2011.

Figure 2-4 General Land Use of Greater Choctawhatchee Bay Watershed (including Alabama)

In the southern portion of the watershed near Choctawhatchee Bay and the coast, there is a higher concentration of urban and residential areas due to the popularity of the beaches and coastline. This is particularly evident in Walton County, where the major employment sectors are tourism and hospitality; comprising approximately 23 percent of the workforce for the county. These patterns of land use throughout the watershed area are generally consistent with areas of population and growth. Additional land use includes conservation areas comprised of parks, forests, and preserves and are explained in more detail in Section 3.5.1.

The watershed contains significant and strategic military land use with both Eglin AFB and Hurlburt Field. The military’s management of this land greatly influences watershed functions and values, due to the large footprint of these facilities (17 percent of Florida portion of the watershed), as well as their proximity to major waterways.



Sources: FDEP 2015a; NOAA 2015a; USGS 2015, 2016a.

Figure 2-5 Land Use and Land Cover for the Florida Portion of the Choctawhatchee River and Bay Watershed

Table 2-1 2012-2013 Land Cover within the Choctawhatchee River and Bay Watershed (Florida Portion)

General Land Use Category	Estimated Square Miles	Percent of Basin (Florida Portion)
Agriculture	334	1.3
Developed	191	9.1
Open Land	42	2.0
Upland Forests	1032	49.2
Water	28	15.9
Wetlands	469	22.4

Source: FDEP 2015a.

Populations in both the Alabama and Florida portions of the watershed have increased and are projected to increase in the future, in part to serve the needs of the projected realignment of military installations (Table 2-2) (Center for Business and Economic Research (CBER) 2016; Florida Demographic Estimating Conference [FDEC] 2015; U.S. Census Bureau 2010). These estimates project growth in almost all counties, except for Barbour County, Alabama. The populations of all counties in Florida are projected to grow through 2025. Walton County is projected to increase by approximately 21 percent from 60,687 in 2015 to a population of 77,173; and Bay County is projected to increase by almost 11 percent from 173,310 to a population of 191,876 (FDEC 2015).

Table 2-2 Population in the Choctawhatchee River and Bay Watershed (Florida's Portion) (Based on Census Blocks)

County	Population 2010
Holmes	19,927
Okaloosa	95,955
Washington	21,964
Walton	43,109
Bay	169
Jackson	6,838
Total	187,962

Source: U.S. Census Bureau 2010.

2.3 Physical Characteristics

The Choctawhatchee River and Bay watershed can be characterized geographically by its physiographic regions and ecoregions. First introduced by Nevin Fenneman and extensively mapped by the U.S. Geological Survey (USGS), physiographic regions are based on landforms and the geologic formations responsible for their expression across the landscape. Defined by the EPA, ecoregions are geographic areas with similar ecosystems that are used for research, management, monitoring, and assessment. Ecoregions can be similar in extent to physiographic regions due to the interactions between geology, hydrology, and ecology; but unlike physiographic regions, ecoregions are defined by both their biotic and abiotic characteristics. Ecoregions are identified by analyzing patterns in soils, vegetation, climate, land use, wildlife, and hydrology, as well as geology and landforms (Omernik 1995).

2.3.1 Physiographic Region

Gulf Coastal Plain

The Choctawhatchee River and Bay 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 flood plains underlain by sediments of sand, gravel, porous limestone, chalk, marl, and clay. Within the Gulf Coastal Plain, the Florida portion of the watershed contains three localized physiographic regions: the Western Highlands, the Gulf Coastal Lowlands, and the River Valley Lowlands (USDA 1989, 1989, 2014; USGS 2013).

The Western Highlands region is located across the northern portion of the watershed (including Holmes and northern Walton and Washington counties) and extends southward to its termination point at a relic escarpment located approximately 30 to 40 miles south of the Alabama-Florida state line. The Western Highlands are characterized by rolling hills, from 100 to over 300 feet above sea level, composed of Pliocene-Pleistocene delta deposits that are overlain by Pleistocene marine terrace deposits in the southern part of Walton County. Steepheads form in the Western Highlands where groundwater emerges from the base of a steep-walled bluff (USDA 1975, 1989, 2014). Steepheads form when groundwater begins to collect underground and flow along a gradient, causing erosion of the slope base and the beginnings of a groundwater fed stream in the underside of a hill (FNAI 2010).

The estuarine embayments of the watershed are located within the Gulf Coastal Lowlands region; a series of successively higher, parallel terraces rising from the coast. Terraces of the Gulf Coastal Lowlands formed during the Pleistocene Epoch (Great Ice Age) 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 (USDA 1989).

The River Valley Lowlands physiographic region follows the floodplain of the Choctawhatchee River and reflects Pleistocene sea level fluctuations including down-cutting, significant erosional features, and fluvial terraces (1989). Additional details on the geology and soils of these physiographic regions can be found in Appendix A.

2.3.2 Ecoregions

Southeastern Plains and Southern Coastal Plain

Two EPA Level 3 ecoregions occur in the Choctawhatchee River and Bay watershed: the Southeastern Plains and Southern Coastal Plain. Level 4 ecoregions are smaller divisions of Level 3 ecoregions. Divisions at this scale allow for the identification of locally defining characteristics, and the formulation of specific, locally oriented management strategies (Omernik 1995). The portion of the watershed lying within the Southeastern Plains ecoregion (Level 3) includes three Level 4 sub-regions: the Dougherty Plain, the Southern Pine Plains and Hills, and the Floodplains and Low Terraces. The Southern Coastal Plain includes three (Level 4) sub-regions: the Gulf Coast Flatwoods, Floodplains and Low Terraces, and Gulf Barrier Islands and Coastal Marshes (Table 2-3 and Figure 2-6) (EPA 2013a, 2013b; Griffith *et al.* n.d.).

Table 2-3 Hierarchy of USGS Physiographic Regions and EPA Level 3 and 4 Ecoregions in the Watershed

USGS Physiographic Region	Sub-Regions
Gulf Coastal Plains	Northern Highlands
	Gulf Coastal Lowlands
	River Valley Lowlands
EPA Level 3 Ecoregion	Level 4 Ecoregion
Southeastern Plains	Dougherty Plain
	Southern Pine Plains and Hills
	Southeastern Floodplains and Low Terraces
Southern Coastal Plain	Gulf Coast Flatwoods
	Gulf Barrier Islands and Coastal Marshes
	Floodplains and Low Terraces

Sources: EPA 2013b, 2013b, 2013c.

Southeastern Plains

As the largest ecoregion in the east, these irregular plains extend from near the Gulf of Mexico in the south to Maryland in the north. This expansive ecoregion includes broad interstream areas and are covered by a mosaic of cropland, pasture, forest, and wetland. Prone to abundant rainfall and a long growing season, relatively poor sandy soils found in much of the ecoregion limit agricultural competitiveness with many other regions. Natural forests of pine, hickory, and oak once covered most of the ecoregion, but much of the natural forest cover has been replaced by heavily-managed timberlands. The Southeastern Plains are divided in to three sub-regions described below.

- **Dougherty Plain.** The Dougherty Plain makes up the upper-most reaches of the watershed in Holmes, Washington and Walton counties. The Dougherty Plain is a generally flat to gently rolling area of karst topography, largely influenced by limestone near the soil surface. Numerous sinkholes interrupt the karst topography and are the sites of numerous ponds and marshes, with relatively few streams in the flatter part of the plain. In Washington and Walton counties, the Dougherty Plain encompasses the Sand Hill Lakes region, as well as Spring Lake. Land-cover is primarily cropland and pasture with some smaller areas of mixed forest.
- **Southern Pine Plains and Hills.** The Southern Pine Plains and Hills sub-region can be found in east-central Walton County north of the Rock Hill area. Once described as

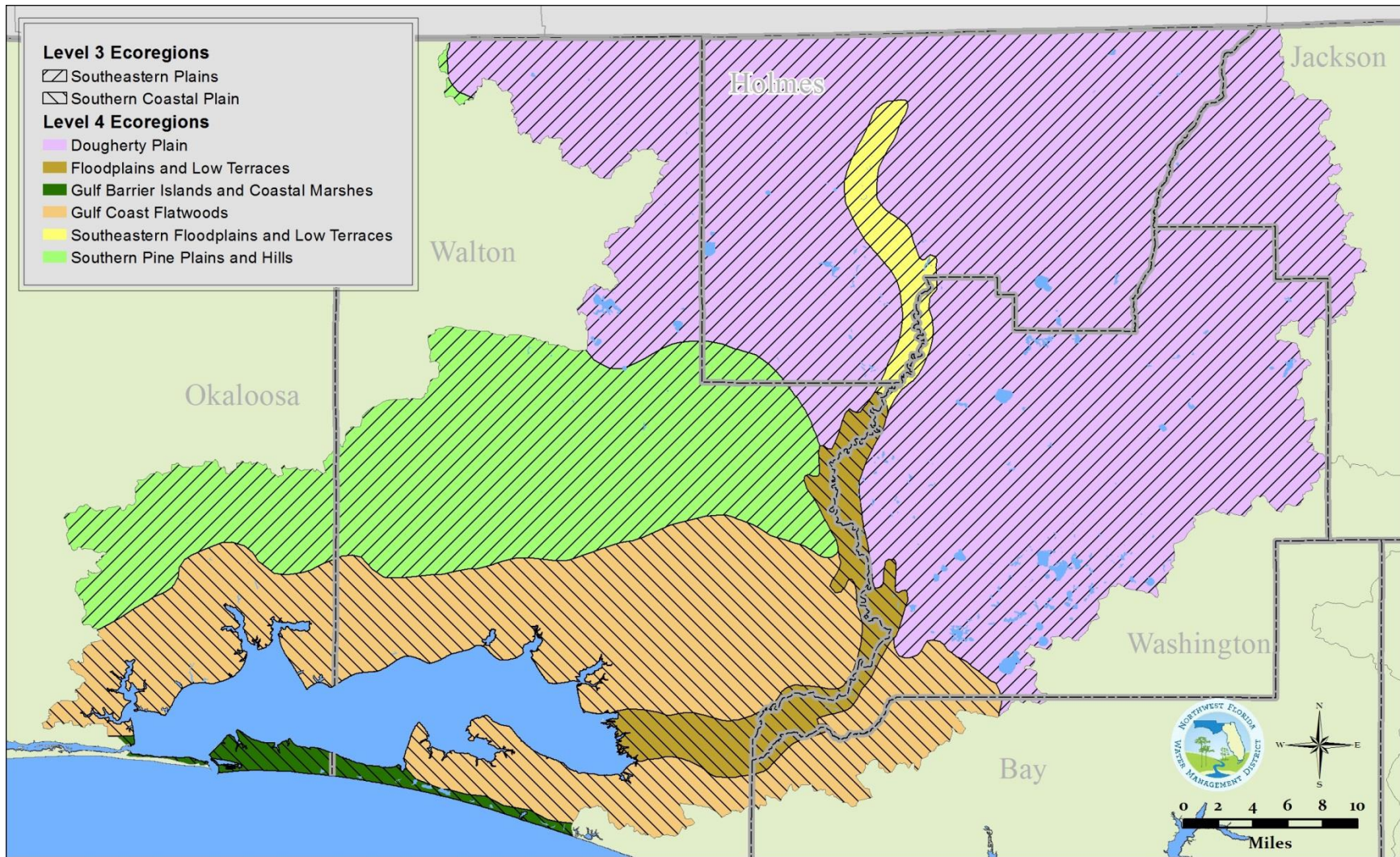
almost all southern mixed forest and longleaf pine forests, this ecoregion has since been replaced mostly by slash and loblolly pine plantations. Soils are well- to moderately-drained ultisols and alfisols with fine sandy loam or silt loam surface texture.

- **Southeastern Floodplains and Low Terraces.** The Southeastern Floodplains and Low Terraces can be found along the flood plain of the upper Choctawhatchee River in Holmes County. This riverine ecoregion is described as having large sluggish rivers and backwaters with ponds, swamps, and oxbow lakes, which are prevalent along the upper Choctawhatchee and its tributaries. River swamp forests of cypress and tupelo and oak-dominated bottomland hardwood forests provide important wildlife corridors and habitat.

Southern Coastal Plain and Subregions

The Southern Coastal Plain Level 3 ecoregion makes up the southern portion of the Choctawhatchee River and Bay watershed, from central Walton County to the coastal barrier islands and east towards Bay County's portion of the watershed. The Southern Coastal Plain is divided in to three sub-regions described below and makes up approximately half of the watershed. This ecoregion is generally lower in elevation, with less relief and wetter soils than the Southeastern Plains. Though predominantly flat plains, this ecoregion also contains barrier islands, coastal lagoons, marshes, and swampy lowlands. In the Choctawhatchee River and Bay watershed, much of the Southern Coastal Plain region is developed land, including several coastal municipalities and military installations, such as Eglin AFB.

- **Gulf Coast Flatwoods.** The Gulf Coast Flatwoods make up the southern portion of the Choctawhatchee River and Bay watershed, adjacent to the Choctawhatchee Bay in Okaloosa, Walton, and Bay counties, as well as the southwestern tip of Washington County nearest the Choctawhatchee River. This includes Point Washington State Forest, which exemplifies the ecoregion in this watershed. The Gulf Coast Flatwoods ecoregion is a narrow region of nearly level terraces and alluvial and deltaic deposits composed of Quaternary sands and clays. The wet sandy flats and broad depressions of this ecoregion are typically poorly drained and swampy in nature. Many of the more well-drained areas in the ecoregion have been cleared for use as pasture or cropland.
- **Floodplains and Low Terraces.** Floodplains and Low Terraces occur on the floodplain of the lower Choctawhatchee River and along the Choctawhatchee River delta in Washington, Bay, and Walton counties. This ecoregion is a continuation of the Southeastern Floodplains and Low Terraces and is primarily composed of stream alluvium and terrace deposits of sand, silt, clay, and gravel, along with some organic muck and swamp deposits.



Sources: EPA 2013b, 2013c; NOAA 2015a; USGS 2015.

Figure 2-6 Level 3 and 4 Ecoregions in the Florida Portion of the Choctawhatchee River and Bay Watershed

- **Gulf Barrier Islands and Coastal Marshes.** The Gulf Barrier Islands and Coastal Marshes Region makes up the entire coastline of the Choctawhatchee River and Bay watershed adjacent to the Gulf of Mexico. This includes Okaloosa Island, coastal Walton, Okaloosa, and Bay counties, and the barrier islands and barrier peninsulas seaward of Choctawhatchee Bay. The Gulf Barrier Islands and Coastal Marshes region contains salt and brackish marshes, dunes, beaches, and barrier islands. Topsail Hill State Preserve and the surrounding area exemplify this ecoregion. Cordgrass (*Spartina spp.*) and saltgrass (*Distichlis spp.*) are common in the intertidal zone, while xeric coastal strand and pine scrub vegetation occurs on parts of the dunes, spits, and barrier islands.

2.3.3 Climate

The climate of the Choctawhatchee River and Bay watershed is largely determined by its subtropical latitude (30°-31°N) and proximity to the Gulf of Mexico. Daily temperature variations tend to be less along the coast relative to areas of the watershed further inland, which are less moderated by the Gulf. Summers are often hot and humid and winters cool and dry. Based on records from Eglin AFB, the warmest months in the watershed have historically been July and August where the average daily low temperature is 71 degrees Fahrenheit (°F) and the average daily high temperature is 91 °F. The watershed's coolest month is January with an average daily low temperature is 37 °F and an average daily high temperature of 61 °F (Intellicast 2016). The total annual precipitation is about 59 inches, with the majority of rainfall occurring in April through September (USDA 2014a). Summers are often hot and humid and winters cool and dryer. Wind conditions are typically northerly through the winter and southerly during the summer months, but vary with the passage of major air masses and thermal convection (sea breezes). Hurricanes and tropical storms occasionally influence the summer and fall weather of the watershed, bringing extremes in wind, rainfall, and tides.

2.3.4 Geology

The Choctawhatchee River and Bay watershed follows much of the general stratigraphy of the western Florida Panhandle, consisting of several thousands of feet of clays and calcareous sand deposits overlain by sandy limestones, as well as sandy-clayey and dolomitic limestones, buried under surficial deposits of unconsolidated sands, clay, and shells. The weathering of these deposits by wave energy and the down-cutting of younger rivers and streams have created relic marine terraces with incised valleys. Many of these geologic processes are a product of prehistoric marine deposition during periods when sea level was higher than the present. The larger stream valleys within most of the watershed commonly contain deposits of Pleistocene- and Holocene-aged alluvium. Most of these sediments are derived from erosion of Citronelle

Formation, as well as upstream sources of undifferentiated sands, clays, and gravels (Green *et al.* 2002). More details on the geology of the watershed may be found in Appendix A.

In the upper Choctawhatchee River and Bay watershed, limestone karst landscapes lead to hydrologic connectivity to the Floridan aquifer through a series of springs and sinkholes, particularly in Washington and Bay counties. The Floridan aquifer also discharges through springs and seeps along the Choctawhatchee River. The hydrologic characteristics of these springs and seeps are discussed further in Section 2.4.

2.3.5 Soils

Soils are an important natural resource across the Choctawhatchee River and Bay watershed, and are some of the best in Florida for farming. In Walton County alone, more than a third of the soils are used for crops and pasture grasses, and in Washington County, roughly a fifth of the soils are used for crops and pastureland (USDA 1992, 2014a). In 2007, about 73,836 acres, or 19 percent, of Washington County was used for crops and pasture including managed forests, cropland, pasture, livestock, and nurseries (USDA 2014a). In the Choctawhatchee River and Bay watershed there are over 260,000 acres of soils classified as *Prime Farmland* and *Farmland of Local Importance*, which includes soils with an adequate and dependable water supply from precipitation or irrigation, as well as a favorable temperature and growing season (USDA 2013).

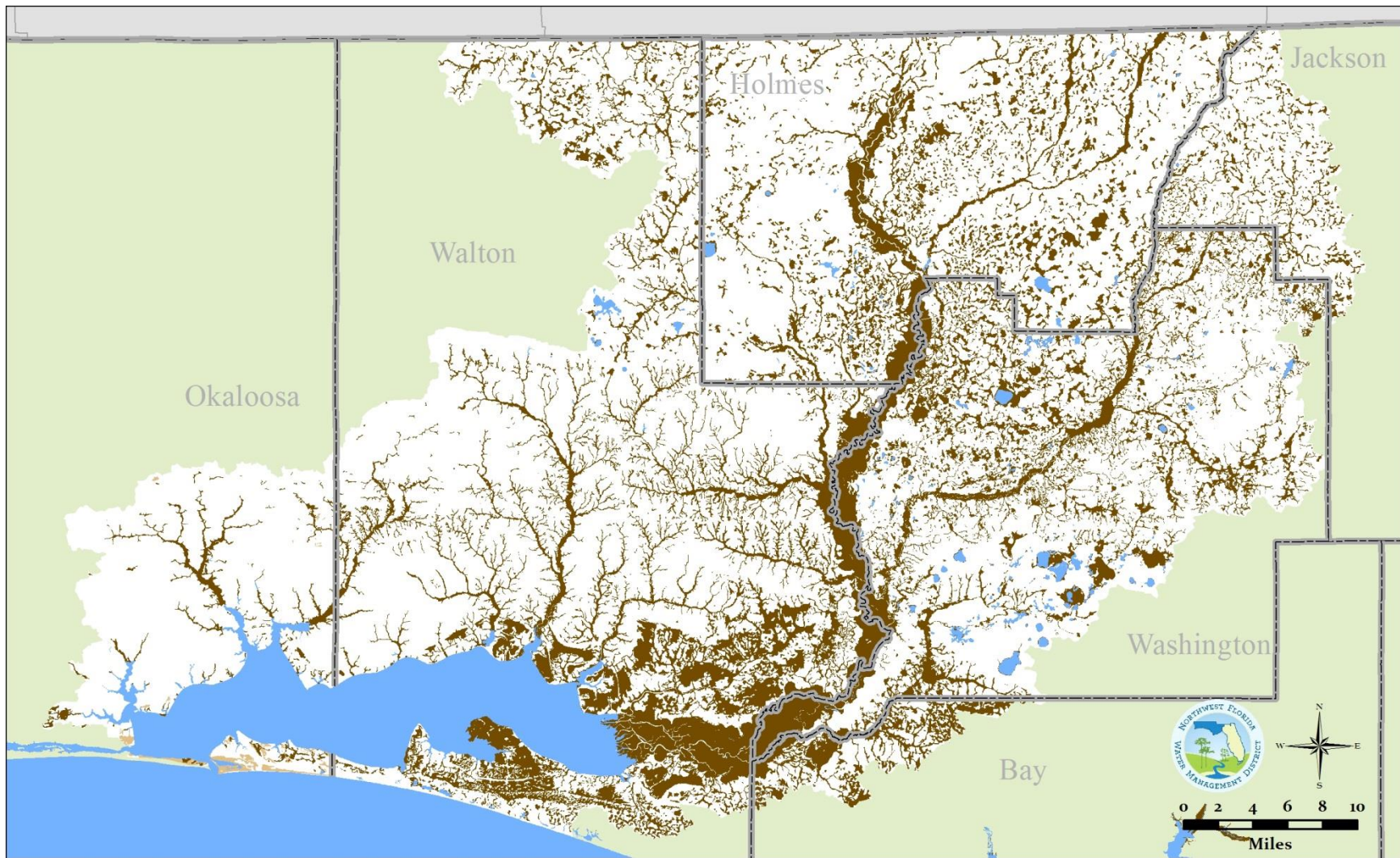
In addition to serving a critical role in forest and agricultural production and management, soils intercept and absorb surface water runoff; thereby, preventing erosion and water quality impairments when properly managed. Qualities of the soil, such as erodibility and permeability, greatly influence factors such as runoff or groundwater recharge and the potential for groundwater contamination. The pH and clay content of the soil also influence the soils cation exchange capacity and potential to retain certain contaminants. Additionally, carbon in soil decreases the concentration of the greenhouse gas carbon dioxide in the atmosphere. On a global scale, soil can store four times more carbon than living biomass (trees, grasses, etc.) (Vasques and Grunwald 2007).

Upland soils within the northern Choctawhatchee River and Bay watershed have formed on beds of clayey and sandy parent materials and are typically well developed, with distinct horizons that exhibit the vertical movement of iron and organic materials (Collins 2010; USDA 2014a). Heavily leached soils that form in coastal pine forests can be found adjacent to the Choctawhatchee Bay near Freeport and on the bay side of Shell Island. These soils form in sandy parent material and are heavily influenced by coastal erosion/deposition, as well as the chemistry of their over-story vegetation. Hydric (wetland) soils occur throughout the watershed,

particularly across the lower Choctawhatchee River floodplain and delta (Collins 2010). Younger poorly developed soils can be found along the coast line and along the banks of the upper Choctawhatchee River where erosional and depositional processes are still active. Detailed information about soils within the watershed is provided in Appendix A.

When soils erode from the landscape, they contribute sediment to surface waters, which changes hydrology of streams and impacts habitat and water quality. The effects of sedimentation and erosion on water quality are further discussed in Section 3.2. However, well managed soils can contribute to improved water quality. Soils store rainwater, runoff, and stormwater in pore spaces, which regulates groundwater recharge, helps mitigate flooding, and increases the duration that water is available for plant uptake. Soils can be amended with organic material to create agricultural benefits, but unlike the vegetation they support, mature soils are not generally considered to be renewable resources on human time scales. The formation of soils that can support ecologically distinct communities can take anywhere from hundreds to thousands of years, depending on the environment.

Hydric soils, which are common throughout the watershed, are defined as soils “formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part” (USDA 2016a). Soils that exhibit hydric properties are important indicators of wetlands and floodplains. Hydric soils, in conjunction with hydrophytic vegetation and hydrologic properties, are used to define the jurisdictional boundaries of wetlands in the National Food Security Act Manual (USDA 1994) and the U.S. Army Corps of Engineers (USACE) Wetlands Delineation Manual (USACE Environmental Laboratory 1987). Understanding the distribution of hydric soils is useful for agricultural purposes, land-use planning, conservation planning, and assessment of potential wildlife habitat (USDA 2016a). Hydric soils are predominantly found along the floodplains of the watershed’s major rivers and tributaries (Figure 2-8). Hydric soils occur extensively throughout the Choctawhatchee River Wildlife Management Area (WMA).



Sources: NOAA 2015a; USDA 2013; USGS 2015.

Figure 2-7 Hydric Soils

2.4 Hydrologic Characteristics

2.4.1 Major Rivers, Tributaries, and Coastal Waterbodies

The Choctawhatchee River, the fourth largest river in the state of Florida in terms of flow (Fernald and Purdum 1998), is the main source of freshwater for the Choctawhatchee Bay. The river contributes approximately 90 percent of freshwater to the system, with an annual discharge of 8,580 cubic feet per second (243 cubic meters per second) (NFWFMD 1996). The Choctawhatchee River receives its flow from multiple tributaries including the Pea River in Alabama, and Wrights Creek, Pine Log Creek, Seven Runs, Holmes Creek, and Bruce Creek in Florida, as well as groundwater contributions from springs and seeps of the Floridan aquifer. These include Florida's Washington Blue Spring, Morrison Spring, and springs associated with Holmes Creek, including Beckton Spring, Cypress Spring, Hightower Spring, Jack Paul Headspring, Mullet Spring, and others.

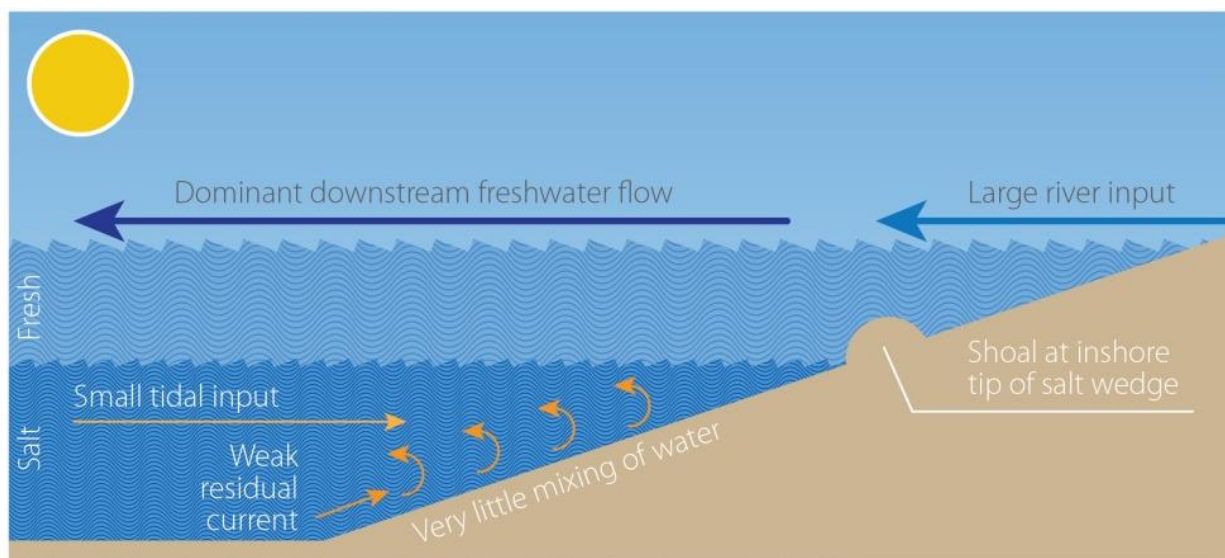
Choctawhatchee Bay is more than 27 miles (43 kilometers) long, following an east-west orientation through Okaloosa and Walton counties, and is often divided into three segments: western, middle, and eastern (Ruth and Handley 2006).

Western Choctawhatchee Bay is described as those areas west of the Highway 293 Mid-Bay Bridge to Brooks Bridge (where the Santa Rosa Sound begins). The western segment includes Cinco Bayou, Garnier Bayou, Garnier Creek, and Joe's Bayou. In the Niceville and Valparaiso area, Turkey and Juniper Creeks enter Boggy Bayou, Toms Creek flows to Toms Bayou, and Rocky Creek enters Rocky Bayou. This segment also includes East Pass, the connection to the Santa Rosa Sound, and the western continuation of the Gulf Coast Intracoastal Waterway (Ruth and Handley 2006).

Middle Choctawhatchee Bay includes those areas between the State Road 331 Bridge and the Mid-Bay Bridge. Mullet Creek, Trout Creek, Eagle Creek, the portion of Basin Creek to Basin Bayou, and the portion to Alaqua Creek to Alaqua Bayou make up this portion of the Bay. East Branch Fourmile Creek, Lafayette Creek, and Ramsey Branch drain through LaGrange Bayou and the southern portions of the middle segment of the Bay, which also includes Horseshoe and Hogtown bayous (Ruth and Handley 2006).

Eastern Choctawhatchee Bay includes all areas east of the State Road 331 Bridge. Camp Creek, Black Creek, as well as the Choctawhatchee River, drain directly into the eastern segment, which also includes the eastern continuation of the Gulf Coast Intracoastal Waterway from West Bay (Ruth and Handley 2006).

Choctawhatchee Bay is considered a stratified estuarine system (Figure 2-9) with low tidal energy and limited flushing (Blaylock 1983; Livingston 1986). This limited flushing is largely due to the bay's single direct opening to the Gulf of Mexico: East Pass located adjacent to Destin. Freshwater influence, primarily from the Choctawhatchee River, accompanied by the narrow East Pass connection to the Gulf of Mexico, results in the Bay's significantly fluctuating salinity level, which depends largely upon river flow and local precipitation. East Pass was created in 1929 and significantly upgraded in 1951 and 1977. Between 1931 and 1991, East Pass was dredged over 40 times, with tens to hundreds of thousands of cubic yards of sediment being removed during each dredging event (Morang 1992).



Source: Graphic by Ecology & Environment, Inc.

Figure 2-8 Stratification of an Estuary

To promote flushing of Destin Harbor, the City of Destin and the District installed the Destin Harbor Pumping Facility, completed in 1992. This system consists of an 84-inch diameter underground pipe and intermittent pump, which provides enhanced circulation and tidal flow via direct connection of the east end of Destin Harbor to the Gulf of Mexico (City of Destin n.d.; Indian River Lagoon Advocate 2013).

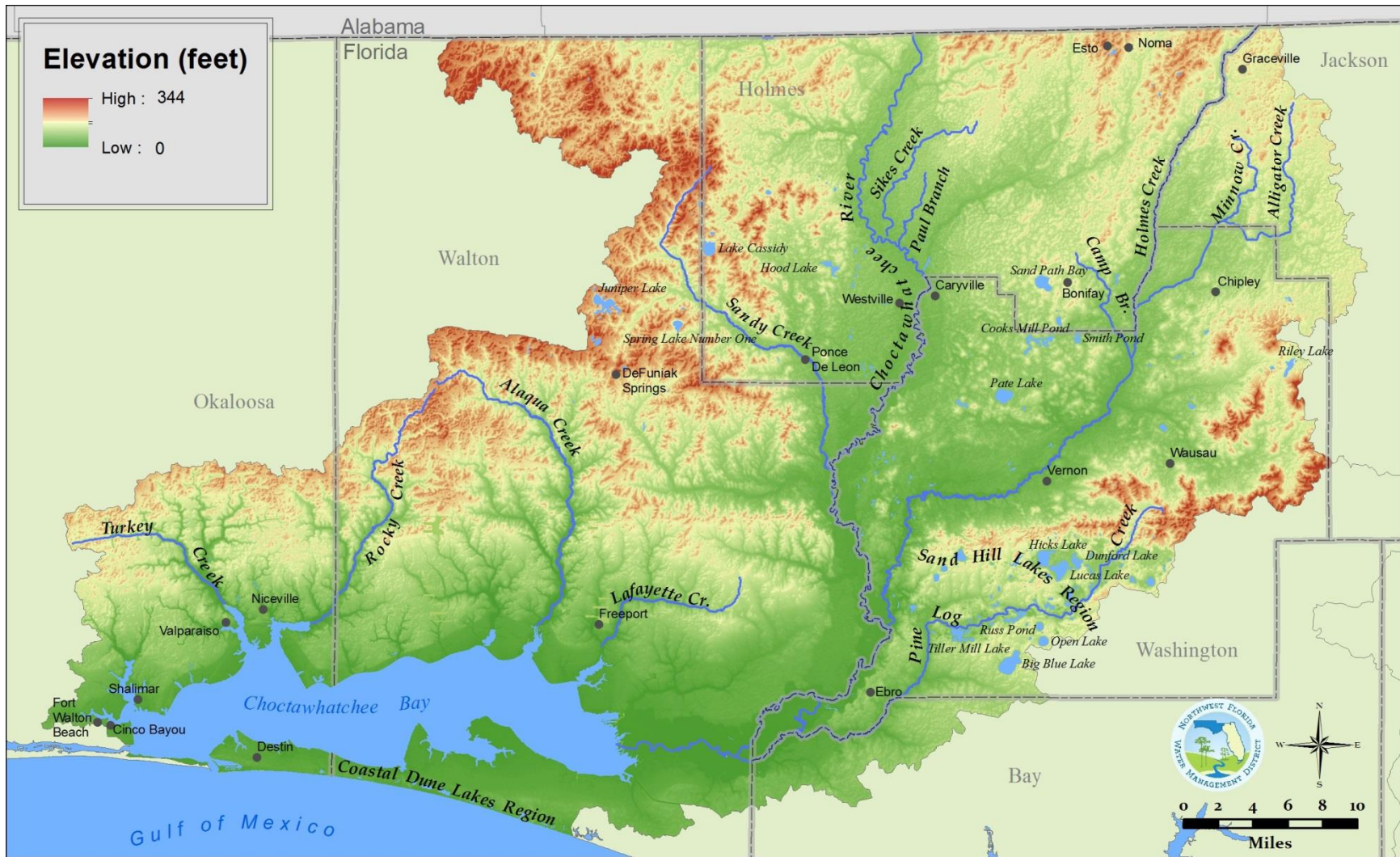


Sources: ESRI *et al.* 2016; FHWA; 2014 Morang 1992;

Figure 2-9 Current and Former Location of Destin Pass

2.4.2 Gulf Intracoastal Waterway (GIWW)

The GIWW is a 1,300-mile system of inland navigational channels and tributaries traversing the Gulf Coast from Brownsville, Texas, to St. Marks, Florida, with the Florida portion spanning 374 miles (Florida Department of Transportation [FDOT] 2008; The Gulf Intracoastal Canal Association 2016). The Waterway was constructed to provide a fast and safe route for ships and imported cargo along the Gulf Coast, similar to the Intracoastal Waterway along the eastern coast of the U.S. When the segment connecting West Bay to Choctawhatchee Bay was completed in 1938, it allowed uninterrupted passage along a protected waterway from Apalachicola to New Orleans (Alperin 1983). The Gulf Intracoastal Canal Association provides oversight and guidance for the GIWW in Texas, Louisiana, Mississippi, Alabama, and Florida (FDOT 2008; The Gulf Intracoastal Canal Association 2016). Impacts of the GIWW on water quality can be found in Section 3.2.2.



Sources: Florida Geological Survey (FGS) 2015; NOAA 2015a; USGS 2015, 2016a, 2016b (lakes).

Figure 2-10 Topography and Major Waterbodies

2.4.3 Sandhill and Coastal Dune Lakes

The northern portion of the Choctawhatchee River and Bay watershed within Florida includes portions of the Sand Hill Lakes region, as well as other natural and impounded lakes. The Sand Hill Lakes region is an important recharge area for the Floridan aquifer and has more than 200 lakes, some small steep-walled, round-bottomed sinks, as well as larger flat-bottomed pools. Notable lakes in the watershed include Lake Cassidy, Lake DeFuniak, Spring Lake Number One, Jack Bay, and Padgett Bay.

Among the distinctive and nearly unique features of the Choctawhatchee River and Bay watershed is the series of coastal dune lakes located south of Choctawhatchee Bay, primarily in Walton County. Coastal dune lakes are naturally-formed fresh water basins, intermittently connected to the Gulf of Mexico. Given the cyclical nature of their hydrology, these lakes are known to have a high biodiversity, with species characteristic of fresh, estuarine, and the marine environment. Aside from their rarity and beauty, coastal dune lakes are a unique natural resource, as they provide an important stopover point for migrating neo-tropical birds, habitat for aquatic and marine animals, freshwater for aquatic plants, and fish and recreation for residents and visitors.

When these lakes experience a critical pre-flood level, breaching water forms an outlet through the dunes. These outlets are formed by three principal mechanisms: 1) the water level in the lake rises to an elevation higher than the beach dune and simply overflows onto the beach, following the path of least resistance and forming a distinct channel via scour; 2) the water level rises sufficiently to saturate the sand between the lake and the source of salt water, causing a condition in which the water may then flow through the sand, destabilizing the sand and eventually forming a channel; and 3) erosion from the beach side erodes the berm between the lake and source of salt water, causing a breach of the berm (Browder and Dean 1998).

Moving from west to east, the following coastal dune lakes are within the Choctawhatchee River and Bay watershed: Fuller, Morris, Campbell, Stallworth, Allen, Oyster, Draper, Big Redfish, Little Redfish, Alligator, Western, Eastern, Deer, and Camp Creek (see Figure 2-12).



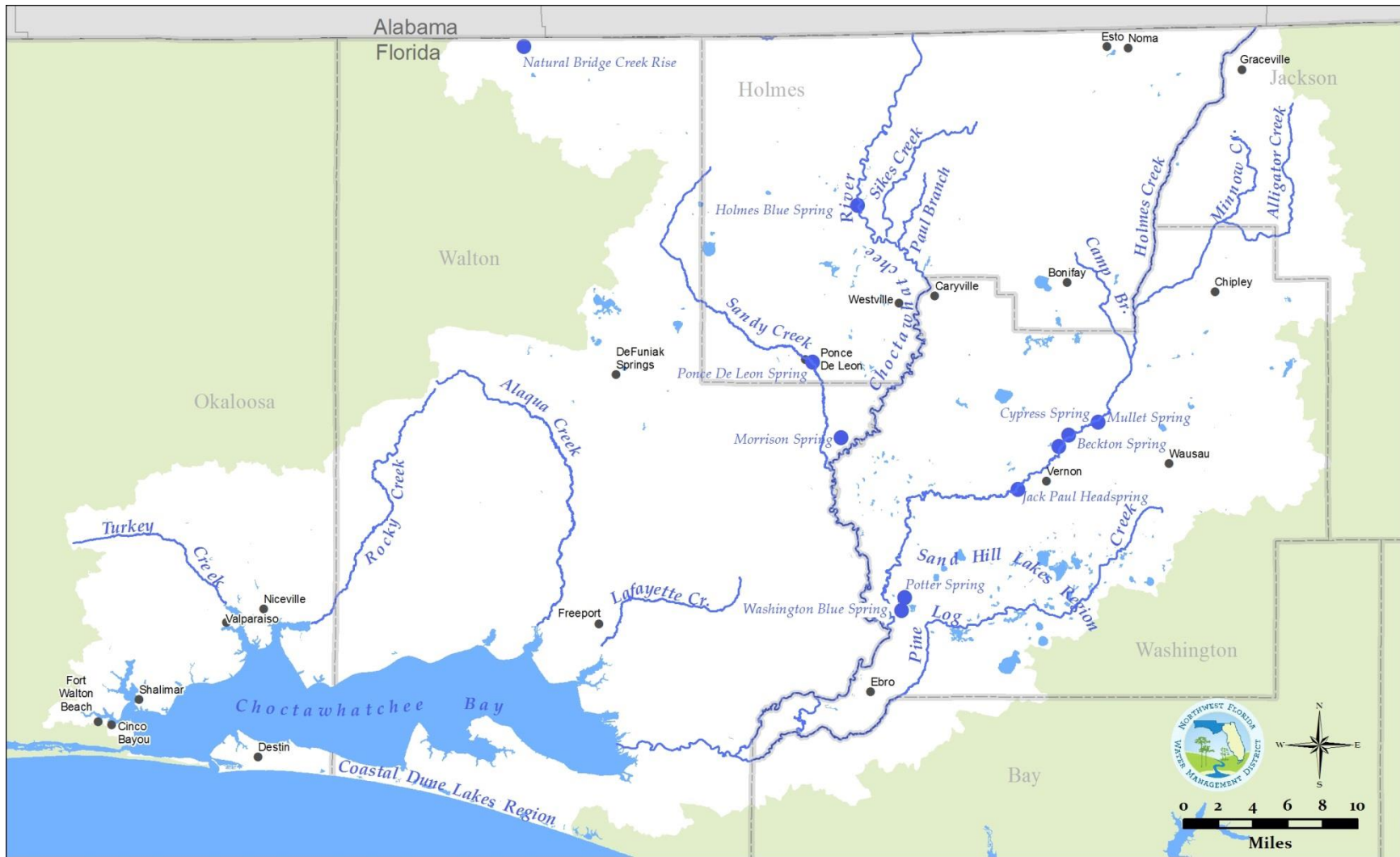
Sources: ESRI *et al.* 2016; FHWA 2014; USGS 2016a;

Figure 2-11 Dune Lakes

2.4.4 Springs

Springs are features where underground water emerges onto the earth’s surface (Copeland 2003). The major springs in the Choctawhatchee River and Bay watershed discharge freshwater from the Floridan aquifer system, which, in the Dougherty Karst Region, lies approximately 100 feet above mean sea level and is thinly confined (Barrios 2005). Typical fissure-type vent springs can be found throughout the watershed, along with springs that incorporate areas of diffuse upward percolating groundwater into pools and runs, and springs that discharge laterally at or near the surface level of the creek (i.e., seep springs) (Barrios 2005; Copeland 2003). Notable springs in the Choctawhatchee River and Bay watershed include Morrison Spring, Vortex Spring, Ponce de Leon Spring, Pate Spring, Holmes Blue Spring, Jack Paul Headspring, Mullet Spring, Cypress Spring, Washington Blue Spring, Waver Spring, Ray Hill Seep Spring, Wrights-Blue Spring, Pleasant Ridge Seep, and Weaver Seep Spring (see Figure 2-13). Among the most significant spring systems in the watershed is the series of springs that discharge into Holmes Creek. The Holmes Creek drainage area covers approximately 85,600 acres and is known for its aquatic biodiversity. As described by the NFWMD (2002), Floridan aquifer springs are particularly

important to the character of and biological resources associated with Holmes Creek, and ultimately Choctawhatchee Bay. Steepheads, which are defined by their geomorphology at the head of deep valleys, are unique ravine features (see Section 2.6.8). Steepheads differ from gully-eroded valleys and seep springs due to their geological provenience and position on the landscape (Means 2000).



Sources: FGS 2015c; NOAA 2015a; NFWMD 2016a; USGS 2015, 2016a, 2016b.

Figure 2-12 Major Springs Located within the Florida Portion of the Watershed

2.4.5 Groundwater Systems

Groundwater fills the pores and interstitial spaces in subsurface rocks and sediments, with recharge generally occurring from higher topographic elevations to discharge areas along streams, bays, and the Gulf of Mexico. There are two major sources of groundwater for the Choctawhatchee River and Bay watershed: the surficial aquifer system, also referred to as the sand-and-gravel aquifer, and the Floridan aquifer system. The Floridan aquifer is the primary source of potable water within the Florida portion of the Choctawhatchee River and Bay watershed (NFWMD 2013). The surficial aquifer system provides water for some domestic and coastal irrigation uses.

The surficial aquifer system is generally a thin, unconfined aquifer composed of discontinuous mixtures of Pleistocene and Recent alluvium and terrace deposits. Water in the surficial aquifer system is recharged through direct infiltration of rainwater and, therefore, fluctuates in elevation due to droughts or seasonal differences in rainfall. In central Walton County within the Choctawhatchee River and Bay watershed, the surficial aquifer system thickens to the west into Okaloosa County providing increased yields to wells. The surficial aquifer system is susceptible to anthropogenic contamination due to its proximity to land surface. Underlying the surficial aquifer, the intermediate system generally forms an effective confining unit for the Floridan aquifer. As described by the NFWMD (2014), the Floridan aquifer system consists of a thick sequence of carbonate sediments of varying permeability, the top of which dips from the northeast to the southwest, with the elevation of the top of the system ranging from approximately 100 feet above sea level to more than 1,200 feet below sea level. Within the watershed, the highest rates of recharge to the Floridan aquifer are within the Dougherty Karst region. The Floridan aquifer also receives a minor amount of recharge from the overlying surficial aquifer system.

2.5 Ecosystem Services

The Choctawhatchee River and Bay watershed supports ecological resources and provides benefits and services for people within the watershed. The ecological resources include the watershed's associated rivers, streams, and bays; upland forests and wetlands, and provides habitat for various plant and wildlife species, many rare and

Services Provided by Healthy Ecosystems of the Choctawhatchee River and Bay watershed include:

- Water purification
- Flood control
- Streambank stabilization
- Buffering of coastal storms
- Nutrient cycling
- Fish and wildlife resources
- Long-term resiliency

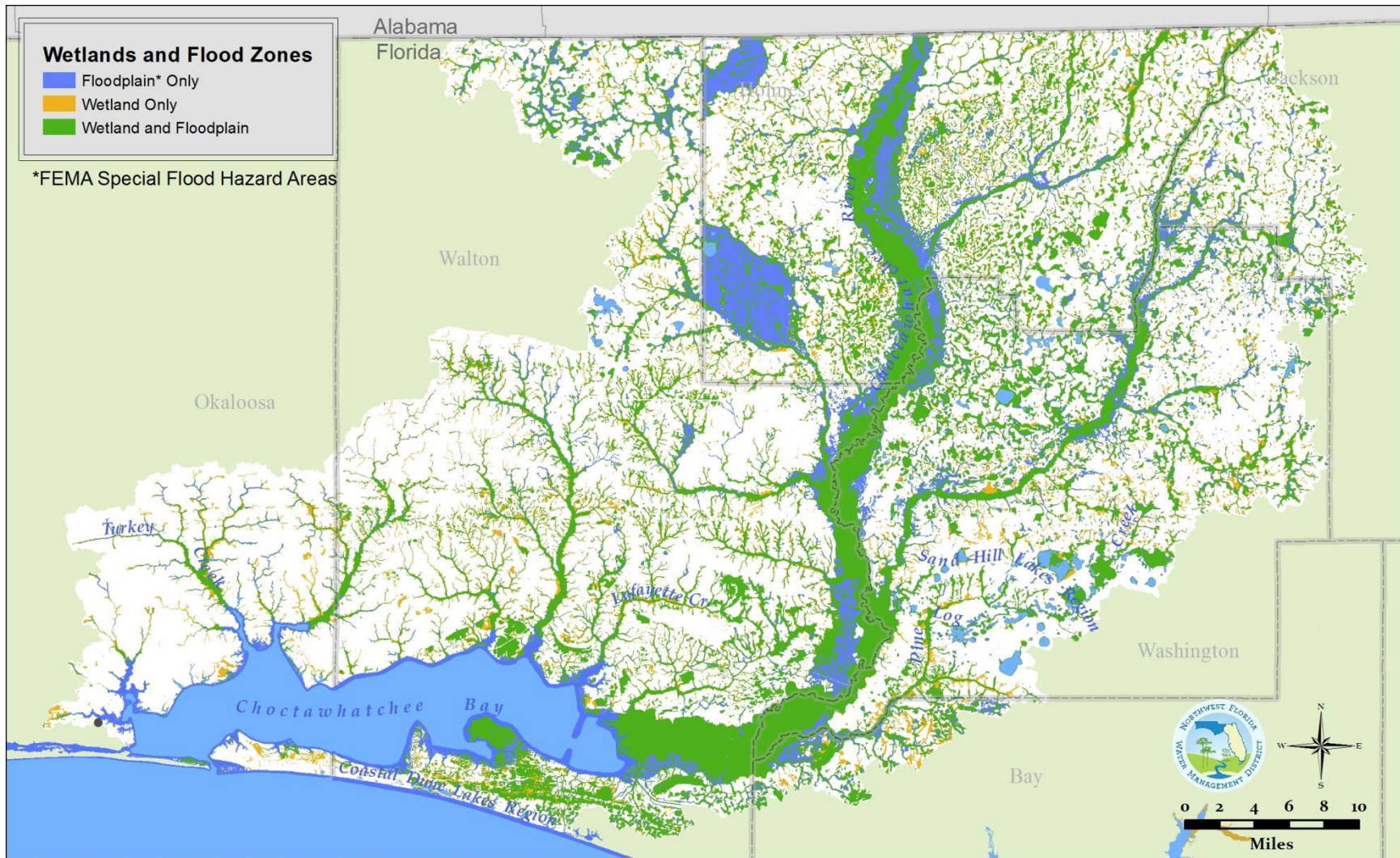
protected. Human benefits include tourism, recreational opportunities, fisheries, and the economic benefits related to each.

Watersheds, and the unique ecosystems that comprise them, play an important part in the global hydrological cycle (The Economics of Ecosystems and Biodiversity [TEEB] 2016). Healthy watersheds provide services such as water purification, groundwater and surface flow regulation, erosion and flood control, and streambank stabilization. Healthy watersheds can also be financially valuable when the cost of protecting ecosystems for improved water quality is compared with investment in major restoration efforts; oftentimes investing in the management of natural resources for improved water quality is less expensive and more efficient than infrastructure (USDA 2015). Watersheds also provide significant value through their role in production of fish and wildlife resources.

2.5.1 Hydrologic Functions

Interrelated functions performed by wetlands and associated natural systems are widely recognized and have been described by numerous authors (National Research Council [NRC] 2001; Novitzki *et al.* n.d.). Wetland functions can be grouped into three general categories: hydrologic, water quality protection and improvement, and fish and wildlife habitat (Abbruzzese and Leibowitz 1997). Hydrologic functions include water storage, flood attenuation, and regulation of discharge to surface and groundwaters.

Floodplains along the watershed's rivers and other tributaries reduce runoff energy, which in turn reduces erosion and protects water quality downstream. Healthy riparian ecosystems within the watershed support vegetative communities that can aid in the absorption of potential flooding, and attenuate and reduce wave energy during storms (Conservation Tools 2016; TEEB 2016). Figure 2-14 shows the correlation between the location of Special Flood Hazard Areas and floodplains. While floodplains have extensive ecological benefits, development within floodplains can be detrimental to both the hydrologic cycle of the watershed and to the buildings and structures within the floodplain.



Sources: FEMA, FDEP and USFWS 2016*; NOAA 2015a. *Note: Data compiled in 2016 by NFWMD staff using 2015 FEMA Special Flood Hazard Area data, 2016 preliminary FEMA Special Flood Hazard Area data (for Okaloosa and Walton Counties), 2013 wetlands land use data, and 2014 National Wetlands Inventory data.

Figure 2-13 Floodplains and Wetlands

2.5.2 Nutrient Cycling

Wetlands, floodplains, and riparian areas aid in distributing nutrients from their overstory vegetation litter to the wider ecosystem during flooding events. Wetland and riparian vegetation and associated root systems also aid in the attenuation of excess nutrients in stormwater runoff from upland areas, as well as reduce the amount of exposed soil, thus reducing the potential for erosion and downstream sedimentation.

2.5.3 Sediment Stabilization

Coastal features of the Choctawhatchee River and Bay system aid in the buffering of storm impacts, shoreline erosion, and sedimentation in Florida and Alabama. An important function of Santa Rosa Island and the Moreno Point peninsula is to help protect the mainland from the harsh effects of coastal storms and erosion (Florida Division of Recreation and Parks 2016a). Among the essential functions of natural coastal features is to ensure long-term resiliency, including adapting to coastal change and protecting human communities and natural systems from shoreline erosion. Riparian vegetation can also aid in shoreline stabilization. Increased root systems will also reduce the amount of exposed soil, reducing the potential for erosion and sediment loading.

2.5.4 Commercially and Recreationally Important Fish and Wildlife

The numerous waterbodies and wetlands within the Choctawhatchee River and Bay watershed are critical to the health of economically important fisheries in the area. Freshwater rivers, lakes, streams, and some swamps within the watershed provide a variety of recreational fishing opportunities. The Choctawhatchee River supports bluegill (*Lepomis macrochirus*), largemouth bass (*Micropterus salmoides*), sunshine bass (hybrid striped bass), striped bass, and redear sunfish (shellcracker). Holmes Creek offers an abundance of longear sunfish, spotted sunfish (stumpknockers), redbreast sunfish, warmouth, and shellcrackers, as well as the newly described Choctaw bass (*Micropterus sp. cf. punctulatus*) (FWC 2016a). Freshwater systems also provide habitat for many species of migratory waterfowl of interest to recreational hunters in the region including rails, common



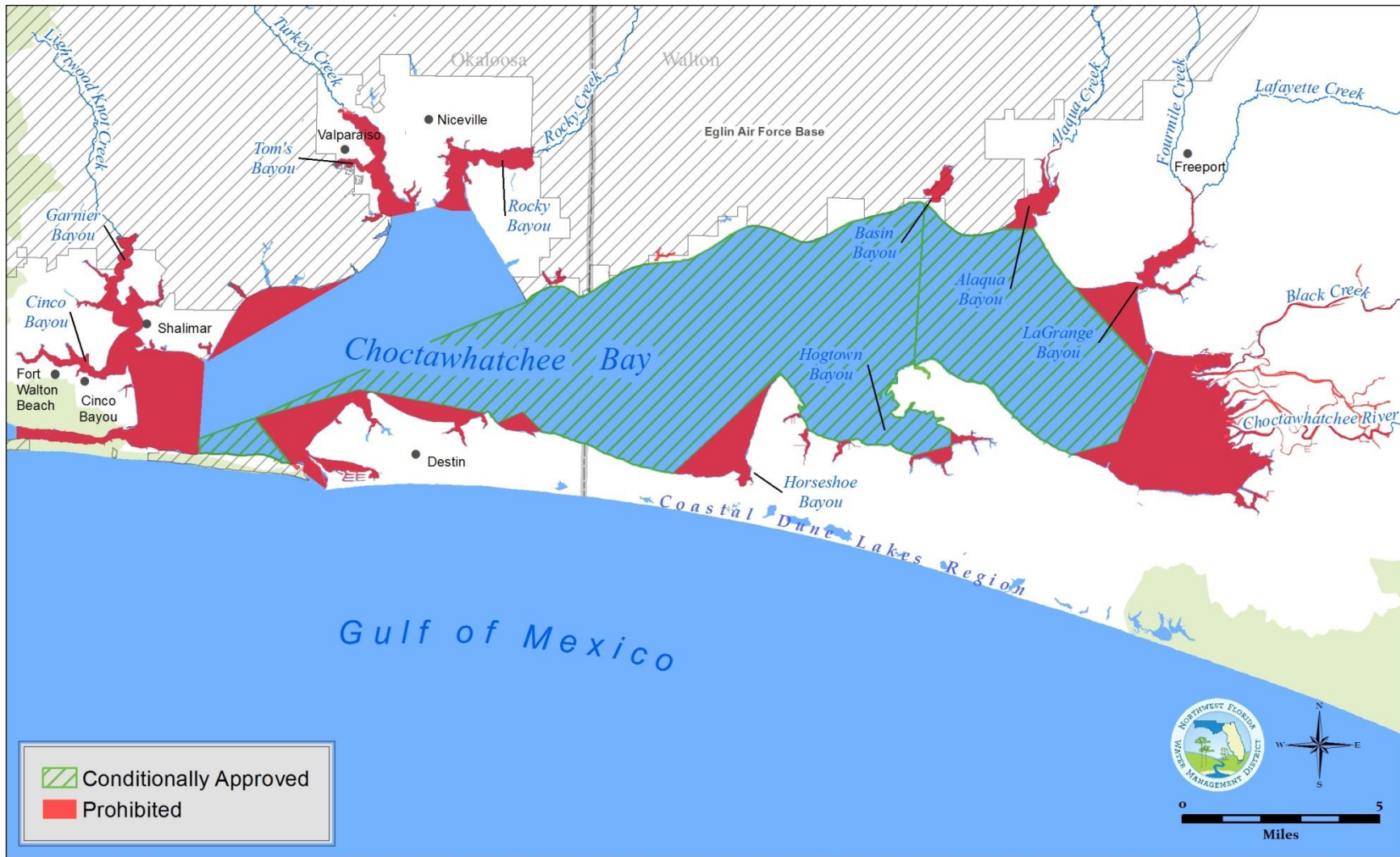
Photo by Jade Marks

Figure 2-14 Blue Crabs

moorhen, snipe, ducks, geese, coot, and woodcock (FWC 2015a). In addition to the commercial shellfish (Figure 2-15) and seafood industries, recreational fishing generated \$691,547 in total sales in Gulf Coastal Florida, making it a major economic driver in the region (U.S. Department of Commerce [USDOC] 2012). Due to the prevalence of these industries in the watershed, federal and state authorities monitor water quality impacts on marine life, and post fish consumption advisories, as necessary. Details on current advisories can be found in Water Quality Section 3.2.

Waterbodies within the Choctawhatchee River and Bay watershed also support local subsistence fisheries. Subsistence fishing refers to fishing carried out primarily for the purpose of obtaining food (or money for food), rather than participation in the commercial or strictly recreational fishing industry. A study sponsored by Impact Assessment, Inc., under contract from National Marine Fisheries Service in 2003, focused on Florida's west coast, investigating fishing-dependent communities (Huang 2003). These communities experienced a decline due to increases in shoreline development, overfishing, and permit requirements (Huang 2003). The health and public access of the waterbodies within the Choctawhatchee River and Bay watershed (and other Florida watersheds) are essential for those utilizing fisheries for subsistence.

Most surface waters within the Choctawhatchee River and Bay watershed are classified by the state of Florida (FDEP) as Class II or shellfish propagation/harvesting waters because they include commercially viable oyster beds that are safe for harvesting due to suitable water quality. Class II waterbodies are afforded the second highest degree of water quality protection from the state. Although shellfish harvesting is prohibited in many bayous of the Choctawhatchee Bay, restoration and maintenance of the oyster beds, seagrasses, and wetland areas will improve water quality before it reaches the shell fishing areas of the central portion of the basin (Figure 2-16). All other waters in the Pensacola Bay watershed are designated Class III or recreation/propagation/fish and wildlife waters as they do not meet the same water quality standards as Class II waters. Recreational fishing occurs throughout the Choctawhatchee River and Bay watershed including the Gulf Islands National Seashore and the Rocky Bayou Aquatic Preserve; however, commercial fishing, including shrimping and crabbing, is prohibited within waters of the National Seashore and the Aquatic Preserve (National Parks Service 2016a, 2016b).



Sources: FDACS 2016b; NOAA 2015a; USGS 2015, 2016a.

Figure 2-15 Approved Shellfish Harvesting Areas

The watershed contains significant areas that are approved or conditionally approved for shellfish harvesting (see Figure 2-16). All waters in Choctawhatchee River and the Rocky Bayou Aquatic Preserve are designated “Outstanding Florida Waters” (OFWs) and receive additional protection to maintain ambient conditions with no degradation. Some commercially and recreationally important fish and shellfish of Choctawhatchee Bay include shrimp, eastern oysters, spotted seatrout, Gulf menhaden, red drum or redfish, blue crab, Gulf flounder, striped mullet, and white mullet (Ruth and Handley 2006).

2.5.5 Recreation and Aesthetic Value

The waterbodies and wetlands within the Choctawhatchee River and Bay watershed offer other important recreational values besides fishing, as tourists are attracted to the Florida Panhandle for the mild climate, beaches, golfing, hunting, boating, and other water sports (FWC 2014). Increases in visitors utilizing water resources leads to economic growth in surrounding communities, as visitors will financially contribute not only to recreational activities associated with the water, but also to hotels, restaurants, and retail establishments.

As observed in many coastal areas, ecotourism is an increasingly important component of the economic health of communities within the watershed. Resources such as state and national parks, preserves, conservation lands, and management areas (described in Section 3.5) attract tourists, leading to increased awareness and protection of valuable natural resources. The presence of diverse habitats, as well as rare, imperiled, endemic, and protected species, are additional drivers for people to visit and contribute to the watershed.

According to the Florida State Parks System Direct Economic Impact Assessment, state parks within the watershed, including the Topsail Hill, Ponce de Leon Springs, Rocky Bayou, Falling Waters, and Grayton Beach state parks, hosted a cumulative total of 557,000 visitors in the 2013/2014 FDEP fiscal year and generated total economic impacts of approximately \$43 million while directly supporting over 600 jobs (FDEP 2014a). The total economic impact for state parks across the watershed in the 2013/2014 fiscal year nearly doubled from the 2010/2011 fiscal year (FDEP 2011a, 2014a) when the parks generated \$22 million and attracted approximately 450,000 visitors. Topsail Hill State Park generated the highest total direct economic impact and attracted the most visitors in both fiscal years (2010/2011 and 2013/2014), followed by Grayton Beach and Rocky Bayou State Parks. State parks and other conservation lands within the watershed are discussed in Section 3.5 and Appendix E. The documented increase in visitation and direct economic impact suggests that there is a high demand for pristine natural areas for recreation visits in the watershed.

The Choctawhatchee River and Bay watershed also provides visual aesthetics, thereby, facilitating local art and community-based activities. Nature has always played a role in creative expression, and Florida, in particular, has influenced countless artists (both local and visiting). By working to conserve natural areas, communities can nurture the artistic spirit and promote future generations to continue preserving and utilizing nature for artistic expression (TNC 2016a). Art museums, festivals, fishing tournaments, and arts and craft vendors in Florida and southern Alabama host numerous events revolving around local art, seafood and other cultural affairs, thereby, bringing communities together. Some of these events include the Okaloosa County Arts and Culture Fest, the Walton County ArtsQuest, the Holmes County Down Home Street Festival, the Panhandle Watermelon Festival, the Destin Seafood Festival, and various freshwater and saltwater fishing tournaments.

2.6 Ecological Resources

The Choctawhatchee River and Bay watershed supports a diversity of natural habitats including upland, coastal, transitional, wetland, aquatic, estuarine, and marine communities (FNAI 2010). Natural Communities are characterized and defined by a combination of physiography, vegetation structure and composition, topography, land form, substrate, soil moisture condition, climate, and fire. They are named for their most characteristic biological or physical feature (FNAI 2010). Based on Geographic Information Systems (GIS) analysis of the Choctawhatchee River and Bay watershed, there are 35 unique natural communities within 15 broader community categories recognized by the FNAI (FNAI 2010, 2016a, 2016b).

The Choctawhatchee River and Bay watershed supports a wide array of biological resources and habitats and; therefore, many species of flora and fauna. Among these resources are expansive seagrass beds and other habitats supporting diverse populations of fish and invertebrates, migratory birds utilizing the Atlantic Flyway, and a multitude of commercial and recreationally important fish and shellfish species.

2.6.1 Seagrass Beds

According to 2003 aerial photography, Choctawhatchee Bay supported over 2,623 acres of seagrass habitat (down from 4,261 acres in 1992) (Figure 2-17) (FWC 2015b). These seagrass beds are extremely important as they support an abundance of fish and invertebrates, many of which are commercially and recreationally important species. Among these are shrimp, eastern oysters, spotted seatrout, Gulf menhaden, red drum or redfish, blue crab, Gulf flounder, striped mullet, and white mullet (Ruth and Handley 2006). Seagrass beds are a protected habitat recognized by both the state and federal agencies. Two species of seagrass, shoal grass (*Halodule*

wrightii) and widgeon grass (*Ruppia maritima*), dominate the seagrass beds of Choctawhatchee Bay. Shoal grass, which prefers higher salinity waters, is the most common species in the bay (CBA 2016a). Additional information about the status and trends of seagrasses in the bay, as well as the relationship between submerged aquatic vegetation (SAV) and water quality can be found in Section 3.3.



Sources: FWC 2015c; NOAA 2015a; USGS 2015, 2016a.

Figure 2-16 Seagrass Coverage in the Watershed

2.6.2 Oyster Reefs

The availability of hard substrate for colonization is a determining factor for the establishment of oyster reefs. 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. There is limited data available regarding the area of this habitat in the bay, but efforts are underway to increase the extent of oyster reefs in the form of living shoreline projects by groups such as the CBA.

2.6.3 Emergent Marsh

Marshland is abundant in the Choctawhatchee River and Bay watershed and includes both salt (brackish) marsh in the coastal reaches, as well as freshwater emergent marsh along the Choctawhatchee River floodplain and delta (FNAI 2010). Marsh species composition is influenced by a combination of salinity tolerance and differences in soil type, elevations, and competitive interactions. Salt marshes serve as a transition between terrestrial and marine systems. Generally, salt marshes are intertidal and develop along relatively low energy shorelines (Figure 2-18). 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 very distinctive and can be separated easily by elevation.

Salt marshes are among the most productive plant communities on Earth (Fernald 1998). Among the most abundant species found in salt marshes are mussels (*Mytilidae*), oysters, fiddler crabs (*Uca sp.*), marsh periwinkles (*Littoraria irrorata*), crown conchs (*Melogenia 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.



Sources: FWC 2011; NOAA 2015a; USGS 2015, 2016a.

Figure 2-17 Saltmarsh Coverage in the Watershed

2.6.4 Palustrine, Riparian, 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 Choctawhatchee River.

2.6.5 Coastal Barrier Systems

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. Okaloosa Island serves as a coastal barrier system for Choctawhatchee Bay and the lower reaches of its tributaries. 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).

2.6.6 Terrestrial Communities

Upland communities, which include mesic flatwoods, sandhill, scrub, scrubby flatwoods, upland hardwood forests, wet flatwoods, and xeric hammocks, provide important habitat, as well as economic and other resources (FNAI 2010). Federally listed species supported by upland communities within the watershed include the gopher tortoise (*Gopherus polyphemus*), the reticulated flatwoods salamander (*Ambystoma bishopi*), the eastern indigo snake (*Drymarchon corais couperi*), and the red-cockaded woodpecker (*Picoides borealis*), all of which have been documented on the watershed's conservation lands.

Historically, the Choctawhatchee River and Bay watershed has been used primarily for agriculture and silviculture. Widespread silviculture activities have caused significant alterations to the landscape and associated hydrology through the construction of dirt roads, overharvest of the native longleaf pine (*Pinus palustris*), and conversion of natural forest lands to slash and sand pine plantations. Major development of the basin began following the acquisition of lands for Eglin AFB in the early 1900s (Ruth and Handley 2006). Within the remaining natural forested areas, there are significant opportunities to improve these ecosystems by implanting more frequent prescribed burning intervals that target larger tracts of forest (USDA 1999).

2.6.7 Coastal Dune Lakes

The Choctawhatchee River and Bay watershed contains over a dozen named coastal dune lakes (further described in Section 2.4 and shown in Figure 2-12), which are unique geographical features found elsewhere only in Madagascar, Australia, New Zealand, and Oregon in the U.S. (Walton County 2016). These lakes are fed by streams, groundwater seepage, rain, and storm surge and have intermittent outfall connections with the Gulf of Mexico, acting as flood control measures when needed (Walton County 2016). These coastal dune lakes are managed locally by the Coastal Dune Lakes Advisory Board, partnered with the CBA. Water quality is regularly monitored, and the data is used to manage and regulate the lakes. For thousands of years, these lakes have adapted to natural processes such as hurricanes, droughts, and land subsidence. Due to their sparing existence, they have been identified as globally rare and imperiled by the FNAI and others (FNAI 2010).

There are 14 coastal dune lakes in the Choctawhatchee River and Bay watershed (see Figure 2-12). Aside from their rarity and beauty, coastal dune lakes provide an important stopover point for migrating neo-tropical birds, habitat for aquatic and marine animals, freshwater for aquatic plants, and fish and recreation for residents and visitors. Coastal dune lakes provide habitat for a number of listed species, including migratory birds such as piping plovers (*Charadrius nivosus*) and red knots (*Calidris canutus*), which use the lakeshore edges and outfalls for foraging during their winter migration. Snowy plovers (*Charadrius nivosus*) and least terns (*Sternula antillarum*) use dune habitats adjacent to the lakes for nesting and quality foraging habitat for their chicks (FDEP 2014b).

2.6.8 Steepheads

Steepheads are relatively small springs which form when groundwater begins to collect underground and flow along a relatively impermeable layer. Where this layer intersects a sloping ground surface it can cause erosion of the slope base. This process can ultimately form the beginnings of a groundwater fed stream in the underside of a hill (FNAI 2010). Such streams usually have shallow channels containing little to no aquatic vegetation. They often form the headwaters of alluvial and blackwater streams and are known for their biological diversity. Steepheads are the heads of distinctly deep valleys, usually forming in Plio-Pleistocene, barrier island complexes (Means 2000). Steephead ravine communities can be found at throughout the Apalachicola National Forest (FNAI 2010, 2016a, 2016b).

2.6.9 Springs

Florida's springs are significant natural resources as they can support entire ecosystems and protected species, can indicate special water quality and recreational use, and feed rivers, estuaries, or nearshore waters dependent on clean, clear, fresh water. Florida has more springs than any other state due to underlying geologic formations containing porous marine limestone that holds and transports water, making the Floridan aquifer system one of the most productive freshwater aquifer systems in the world (Florida's Springs 2016).

Florida's springs are also plentiful due to significant local rainfall dissolving the underground limestone, causing joints and fractures that develop into caverns, tunnels, and conduits that form drainage systems (Florida's Springs 2016). Sinkholes can also form, creating direct connections between land and aquifer. High concentrations of springs and seeps within the watershed occur along Holmes Creek, with other springs occurring along Blue Creek, Mill Branch, and the Choctawhatchee River. Prominent springs within the watershed include Morrison Spring on the Choctawhatchee River and Ponce de Leon Spring on Sandy Creek. Springs within the watershed are described further in Section 2.4.4. Where springs and sinkholes exist, groundwater and surface water interactions make water quality particularly important.

2.6.10 Migratory Bird Flyways

The Florida Panhandle falls within two major migratory bird biological flyways; the Atlantic Flyway and the Mississippi Flyway. "Biological" flyways delineate the major migration corridors, while "administrative" flyways are based on the state jurisdictional boundaries that best mimic biological flyways for management purposes. The state of Florida falls within the Atlantic administrative flyway, and the Choctawhatchee watershed is predominantly within the Atlantic biological flyway. The Atlantic flyway is a migratory route that generally follows the Atlantic Coast of North America and the Appalachian Mountains (Bird Nature 2001). Millions of individuals representing over 500 bird species use this route, because there is little extreme mountainous terrain and it has good sources of water, food, and cover over its entire length. Forty percent of the species that use the Atlantic flyway are federally recognized species of conservation concern (Audubon 2011). Many of these species including least terns, piping plovers, American oystercatchers, and hundreds of other bird species occur throughout the Choctawhatchee River and Bay watershed and across a wide variety of habitats. Many of these species are area transients, using this area as a resting/feeding ground for summer or winter migrations. Others are accidental visitors, far from their native ranges.

2.6.11 Terrestrial Communities

Upland communities, which include bluffs, mesic flatwoods, sandhill, scrub, scrubby flatwoods, upland hardwood forests, wet flatwoods, and xeric hammocks, provide important habitat, as well as economic and other resources. Federally listed species supported by upland communities within the watershed include the gopher tortoise (*Gopherus polyphemus*), the reticulated flatwoods salamander (*Ambystoma bishopi*), the eastern indigo snake (*Drymarchon corais couperi*), and the red-cockaded woodpecker (*Picoides borealis*), all of which have been documented on the watershed's conservation lands.

Historically, the Choctawhatchee River and Bay watershed has been used primarily for agriculture and silviculture. Widespread silviculture activities have caused significant alterations to the landscape and associated hydrology through the construction of dirt roads, overharvest of the native longleaf pine (*Pinus palustris*), and conversion of natural forest lands to slash and sand pine plantations.

3

3.1 Introduction

3.2 Water Quality

3.3 Habitat Quality in Receiving Waters

3.4 Floodplains

3.5 Unique Features and Special Resource Management Designations

3.0 Current Watershed Conditions and Water Resource Issues

3.1 Introduction

Increasing population, industrialization, and development in northwest Florida and southern Alabama are correlated with land use changes and an increased need for added infrastructure. The Choctawhatchee River and Bay watershed experiences water quality challenges across both states. Within Florida, agricultural and silviculture activities are concentrated in the inland portions of the watershed, while urban land uses are predominantly in the coastal portion of the watershed (Figure 2-5). Both agricultural and urban land uses can generate NPS pollution and cause physical impacts that present long-term challenges for the watershed. With proper planning and management practices, the impacts of human activities and development, which can diminish the overall health of the ecosystem and its many benefits for the people and communities, can be reduced.

The following summary of issues related to water quality, point and NPS pollution, eutrophication, harmful algal blooms (HABs), conserved and managed lands, and floodplains is provided to inform future planning, development, preservation, and restoration efforts within the watershed. Further discussion of ongoing management activities for water quality protection and improvement, including BMPs, land use planning, and other water quality protection and improvement techniques, can be found in Section 6.0.

3.2 Water Quality

The following subsections identify impaired waterbodies (per FDEP) throughout the Choctawhatchee River and Bay watershed, the potential sources of pollution responsible for those impairments, and ecological indicators of water quality.

3.2.1 Impaired Waters

All states are required to submit lists of impaired waters (waters too polluted or degraded to meet state water quality standards, including applicable water quality criteria and designated uses such as drinking water, recreation, and shellfish harvesting) to the EPA under Section 303(d) of the

Clean Water Act (CWA) (EPA 2016a). In Florida, the FDEP is responsible for fulfilling this function.

According to the Florida and Alabama verified 303(d) impaired waters (Alabama Department of Environmental Management [ADEM] 2014a; FDEP 2014c), the most prevalent water quality concerns for the Choctawhatchee River and Bay watershed are mercury, fecal coliform, and bacteria along the beaches (ADEM 2014a; FDEP 2014c). In the Choctawhatchee River and Bay watershed, the FDEP has identified 34 impaired segments, and five have TMDL reports (discussed in Section 3.2.2). The impaired waterbodies list serves to help prioritize water quality management activities and is not an exhaustive list of all waterbodies that have impairments (FDEP 2014c, 2014d). Impairments by segment and waterbody identification number (WBID) identified by FDEP in October 2016 are listed below. Additional detail may be found in Appendix D.

- Flat Creek (WBID 337) Fecal Coliform
- Cypress Springs (WBID 348Z) Nutrients (Nitrate-Nitrite)
- Alaqua Creek (WBID 351) Fecal Coliform
- Turkey Creek (WBID 495A) Iron
- Choctawhatchee River (WBID 49B) Iron
- Choctawhatchee River (WBID 49F) Iron
- Wrights Creek (WBID 54) Iron
- Holmes Creek (Lower Segment) (WBID 59D) Nutrients (Algal Mats)
- Boggy Bayou (WBID 692) Nutrients (Total Nitrogen)
- Boggy Bayou (WBID 692) Nutrients (Chlorophyll-a)
- Rocky Bayou (WBID 722) Nutrients (Total Nitrogen)
- Alaqua Bayou (WBID 731) Nutrients (Chlorophyll-a)
- Eagle Creek (WBID 751) Fecal Coliform
- Choctawhatchee Bay (Lower Segment) (WBID 778A) Nutrients (Total Nitrogen)
- Choctawhatchee Bay (Lower Segment) (WBID 778A) Nutrients (Total Phosphorus)
- Clement E. Taylor Park (WBID 778AD) Bacteria (Beach Advisories)
- Choctawhatchee Bay (Middle Segment1) (WBID 778B) Nutrients (Chlorophyll-a)
- Choctawhatchee Bay (Middle Segment1) (WBID 778B) Nutrients (Total Nitrogen)
- Choctawhatchee Bay (Middle Segment2) (WBID 778C) Fecal Coliform (3)
- Choctawhatchee Bay (Middle Segment2) (WBID 778C) Nutrients (Total Nitrogen)
- Choctawhatchee Bay (Upper Segment) (WBID 778D) Dissolved Oxygen (Percent Saturation)

- Choctawhatchee Bay (Upper Segment) (WBID 778D) Nutrients (Chlorophyll-a)
- Choctawhatchee Bay (Upper Segment) (WBID 778D) Nutrients (Total Nitrogen)
- Bass Lake (WBID 786A) Dissolved Oxygen (Percent Saturation)
- Bass Lake (WBID 786A) Nutrients (Total Nitrogen)
- Little Creek (WBID 80) Fecal Coliform
- Henderson Park Beach (WBID 8008B) Bacteria (Beach Advisories)
- Dune Allen Beach (WBID 8009A) Bacteria (Beach Advisories)
- Blue Mountain Beach (WBID 8010A) Bacteria (Beach Advisories)
- Grayton Beach (WBID 8010B) Bacteria (Beach Advisories)
- Holley Street Beach (WBID 8010C) Bacteria (Beach Advisories)
- Direct Runoff to Bay (WBID 881A) Fecal Coliform
- Direct Runoff to Bay (WBID 881A) Fecal Coliform (3)
- Mack Bayou (WBID 937) Fecal Coliform
- Limestone Branch (WBID 94) Iron

Previously listed Florida impaired waters that have been delisted are included in Table 3-1, with water segment names, identification, and description of previous impairment and/or why the water segment is no longer listed. It is important to recognize that delisted waterbody segments may still have impairments, but they are removed from the list of impaired waterbodies once a TMDL is developed to address the impairment (FDEP 2014d).

Due to potential fluctuations in water quality, authorities in Florida and Alabama issue human consumption advisories for fish and shellfish, when needed. In Florida, the Florida Department of Health (FDOH) issues necessary human consumption advisories through cooperation with the FWC and FDEP. In Alabama, the Alabama Department of Health issues advisories through cooperation with the ADEM, the Alabama Department of Conservation and Natural Resources, and the Tennessee Valley Authority. Additional shellfish harvesting advisories are determined by the FDACS and the Alabama Department of Conservation and Natural Resources. Current fish consumption advisories within the Choctawhatchee River and Bay watershed can be found on the Alabama Department of Public Health website (www.adph.org), and the FDOH website (www.floridahealth.gov). Shellfish advisories and seasonal closures can be found on the Alabama Department of Conservation and Natural Resources website (www.outdooralabama.com), the FWC website (www.myfwc.com), and the FDACS website (<http://www.freshfromflorida.com/Divisions-Offices/Aquaculture/Shellfish-Harvesting-Area-Classification>).

The Pea River begins in Alabama and flows south to the Florida boarder before bending north again and joining with the Choctawhatchee River in Geneva, Alabama. Approximately 110 square miles of the Pea River drainage area lies in Florida, while the remainder of the basin falls within Alabama. In 2007, the Pea River was identified as verified impaired for mercury in fish. Land uses in the upstream segments of the watershed in Alabama, including certain agricultural and aquaculture practices, municipal wastewater, urban runoff, and storm sewers, are potential sources of bacteria, DO, nutrients, and unknown toxicity to the downstream segments in Florida (ADEM 2014a). Verified impaired waters include three small creeks for nutrients (Beaver Creek, Dowling Branch, and Blanket Creek), two small creeks for siltation (habitat alteration) (Harrand Creek and Indian Camp Creek), and four segments of the Choctawhatchee for mercury in fish (ADEM 2014a). It should be noted that Alabama water quality criteria for fecal coliform bacteria are much higher than Florida: 2,000 colony forming units per 100 milliliters of water for Florida versus 400 colony forming units per 100 milliliters of water for Alabama (FDEP 2006a).

In the Florida portion of the Choctawhatchee River, impairments are due to coliforms, DO, nutrients, and mercury (in fish tissue). Potential sources include erosion, agriculture, municipal wastewater, residuals, and stormwater. Several sewage treatment plants discharge to Holmes Creek and its tributaries including Alligator Creek and Camp Branch Creek which ultimately affect the lower portion of the Choctawhatchee River (FDEP 2006a). Potential impairments in Choctawhatchee Bay include coliforms, HABs with fish and dolphin kills, and nutrients. Potential sources include urban runoff from rapid development and septic tanks (FDEP 2006a).

Table 3-1 Florida Waterbodies in Watershed Removed from Impaired Waters List

Water Segment Name	WBID ¹	Reason for Delisting
Choctawhatchee River	49F	Removed for bacteria due to TMDL adopted by FDEP for fecal and total coliform (discussed further in Section 6.0)
Boggy Bayou	692	Removed for bacteria due to reduction in documented beach advisories in Rocky Bayou State Park (WBID 722B)
East Pass	778AB	Removed for mercury in fish
Gulf Island National Seashore	778AC	Removed for mercury in fish
Choctawhatchee Beach County Park	778CA	Removed for mercury in fish
Choctawhatchee Bay	778D	Removed for mercury in fish
Garniers Park	843B	Removed for mercury in fish
Holiday Isle Aegean	8008A	Removed for mercury in fish
Henderson Park Beach	8008B	Removed for mercury in fish
County Park	8008D	Removed for mercury in fish
Choctawhatchee Bay Gulf Mid	8009	Removed for mercury in fish
Blue Mountain Beach	8010A	Removed for mercury in fish
Grayton Beach	8010B	Removed for mercury in fish
Holley Street Beach	8010C	Removed for mercury in fish
James Lee Park	8008C	Removed for mercury in fish
Wayside East Park	8008E	Removed for mercury in fish

Source: FDEP 2014d

In the Florida portion of the Choctawhatchee River, impairments are due to coliforms, DO, nutrients, and mercury (in fish tissue). Potential sources include erosion, agriculture, municipal wastewater, residuals, and stormwater. Several sewage treatment plants discharge to Holmes Creek and its tributaries including Alligator Creek and Camp Branch Creek which ultimately affect the lower portion of the Choctawhatchee River (FDEP 2006a). Potential impairments in Choctawhatchee Bay include coliforms, HABs with fish and dolphin kills, and nutrients. Potential sources include urban runoff from rapid development and septic tanks (FDEP 2006a).

3.2.2 Total Maximum Daily Loads (TMDLs)

A TMDL is a tool used by the EPA and the State to establish the maximum amount of a pollutant that a waterbody can receive and still meet state water quality standards. For impaired waters, TMDLs are used to identify the pollution reduction required to restore water quality. The FDEP has developed specific guidance for implementing fecal coliform TMDLs that focus on identifying and removing bacteria sources (FDEP 2011b). Five TMDLs have been adopted by

the FDEP for fecal coliform and DO in the Choctawhatchee River and Bay watershed (FDEP 2016a):

- Choctawhatchee River (WBID 49F) -- Fecal and total coliform;
- Alligator Creek (WBID 123) -- Fecal coliforms;
- Minnow Creek (WBID 130) -- Fecal coliforms, DO;
- Sikes Creek (WBID 142) -- Fecal coliforms, DO; and
- Camp Branch (WBID 251) -- Fecal coliforms.

The FDEP has provided TMDL reports for fecal and total coliform in Choctawhatchee River, fecal coliforms in Alligator Creek, fecal coliforms and DO in Minnow Creek and Sikes Creek, and fecal coliforms in Camp Branch (FDEP 2016a). The FDEP has also adopted a statewide TMDL for restoring water quality in segments impaired by mercury. There are no pending or adopted Basin Management Action Plans (BMAPs) to implement the adopted TMDLs in the Choctawhatchee River and Bay watershed (FDEP 2016b).

The FDEP has adopted a statewide TMDL for reducing the human health risks associated with consuming fish taken from waters that are considered impaired due to elevated mercury levels. Mercury impairments are based upon potential human health risks (fish consumption advisories), not exceedances of water quality criteria (FDEP 2013). There are no known relationships between environmental and ecological conditions and mercury levels in fish. 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 (FDEP 2013). It is estimated that approximately 0.5 percent of mercury from anthropogenic sources are from Florida (FDEP 2013). Only a very small part of mercury in the environment is in the form of methylated mercury, which is biologically available and able to enter the food chain. For these reasons, the statewide TMDL that FDEP has adopted 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 2013).

Table 3.2 and Figure 3.2 show the FDEP's adopted TMDLs for restoring water quality for the Choctawhatchee River and Bay watershed (FDEP 2016a). The FDEP is scheduled to develop an additional 18 bacteria TMDLs and one nutrient TMDL over the next ten years for the Choctawhatchee River and Bay watershed.

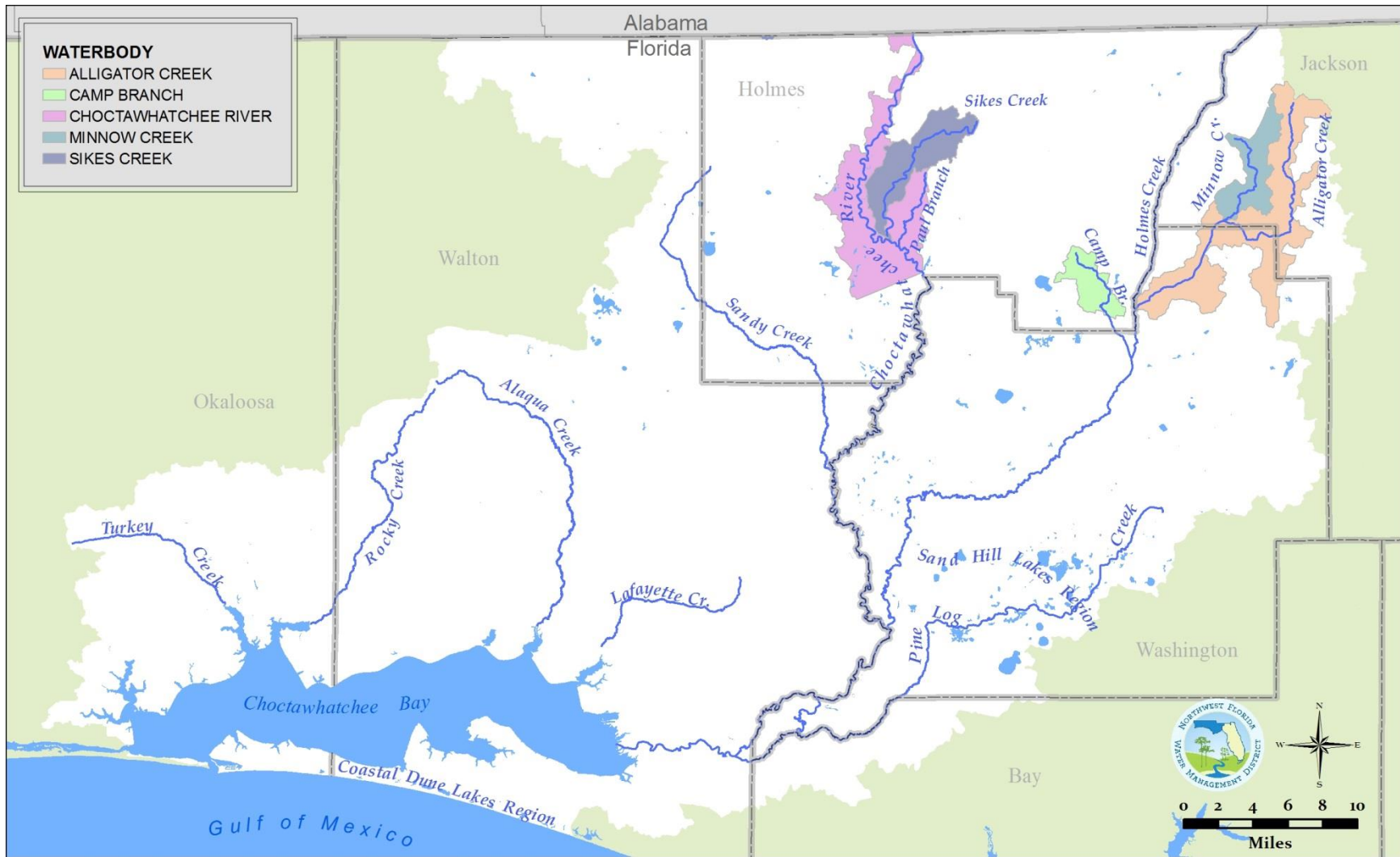
Table 3-2 TMDLs

Waterbody Name	WBID(s)
Bacteria	
Choctawhatchee River	49F (for fecal and total coliform)
Alligator Creek	123 (for fecal coliforms)
Camp Branch	251 (for fecal coliforms)
Dissolved Oxygen	
Minnow Creek	130
Sikes Creek	142
Mercury	
Choctawhatchee River	49, 49A, 49B, 49C, 49D, 49E, 49F
Sand Hammock Pond	61A
Double Pond	210A
Lake Juniper	283
Boggy Bayou	692
Rocky Bayou	722
Alaqua Bayou	731
Poquito Bayou	754
Alaqua Creek Outlet	770
Choctawhatchee Bay	778A
Choctawhatchee Bay	778B
Choctawhatchee Bay	778C
Garnier Bayou	786
Lagrange Bayou	789
Joes Bayou	906
Indian Bayou	917
Destin Harbor	917A
Mack Bayou	937
Hewett Bayou	944
Mussett Bayou	957
Bowman Bayou	972
Little Bayou	978
McQuage Bayou	980
Choctawhatchee Bay Gulf West	8008
Dune Allen Beach	8009A
Choctawhatchee Bay Gulf East	8010

Source: FDEP 2014d

Once a TMDL or Reasonable Assurance Plan is adopted by the state, the waterbody segment is removed from the state's impaired waters list. That being said, these waters remain a priority for restoration and state restoration funding. In the case of the 22 segments with mercury TMDLs, consumption of fish from these waters should be limited to protect human health as directed by

the FDOH. This is important, as these segments will be removed from the impaired waters list when it is updated in 2021. There are no pending or adopted BMAPs in the Choctawhatchee River and Bay watershed (2016c).



Sources: FDEP 2014c; NOAA 2015a; USGS 2015, 2016a.

Figure 3-1 TMDLs in Florida's Portion of the Watershed, Excepting Mercury

DRAFT WORKING DOCUMENT

3.2.3 Point Source Pollution

The EPA defines point source pollution as any discernible, confined, and discrete conveyance from which pollutants are or may be discharged, including, but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft (EPA 2015a). Examples of point sources include industrial facilities, landfills, wastewater treatment facilities (WWTFs), mines and borrow pits, and marinas, among others. The National Pollutant Discharge Elimination System (NPDES), administered by the EPA, is the permitting program authorized to regulate point source pollution. Within Florida, this permitting has been delegated to the FDEP.

Permits for point source facilities are reviewed and renewed at designated intervals. Specific permits are issued based on the results of water quality based effluent limit studies. The NPDES Permit Writers' Manual encourages permit writers to consider the impact of every proposed surface water discharge on the quality of the receiving water.

There are currently 848 facilities permitted through the NPDES in the Choctawhatchee River and Bay watershed including construction permits and other discharges. Together, these facilities hold a total of 909 permits, with some facilities holding multiple permits for multiple types of discharges. For example, a WWTF may be registered in two different NPDES databases and hold a permit for both bio-solids and stormwater.

The majority of permitted facilities are concentrated around the incorporated areas of Destin and Fort Walton Beach; along the barrier peninsula from Seaside to Sandestin and Miramar Beach; as well as near Eglin AFB, Niceville, and Freeport. Except for the incorporated area of DeFuniak Springs, NPDES facilities are sparse in the upper reaches of the watershed.

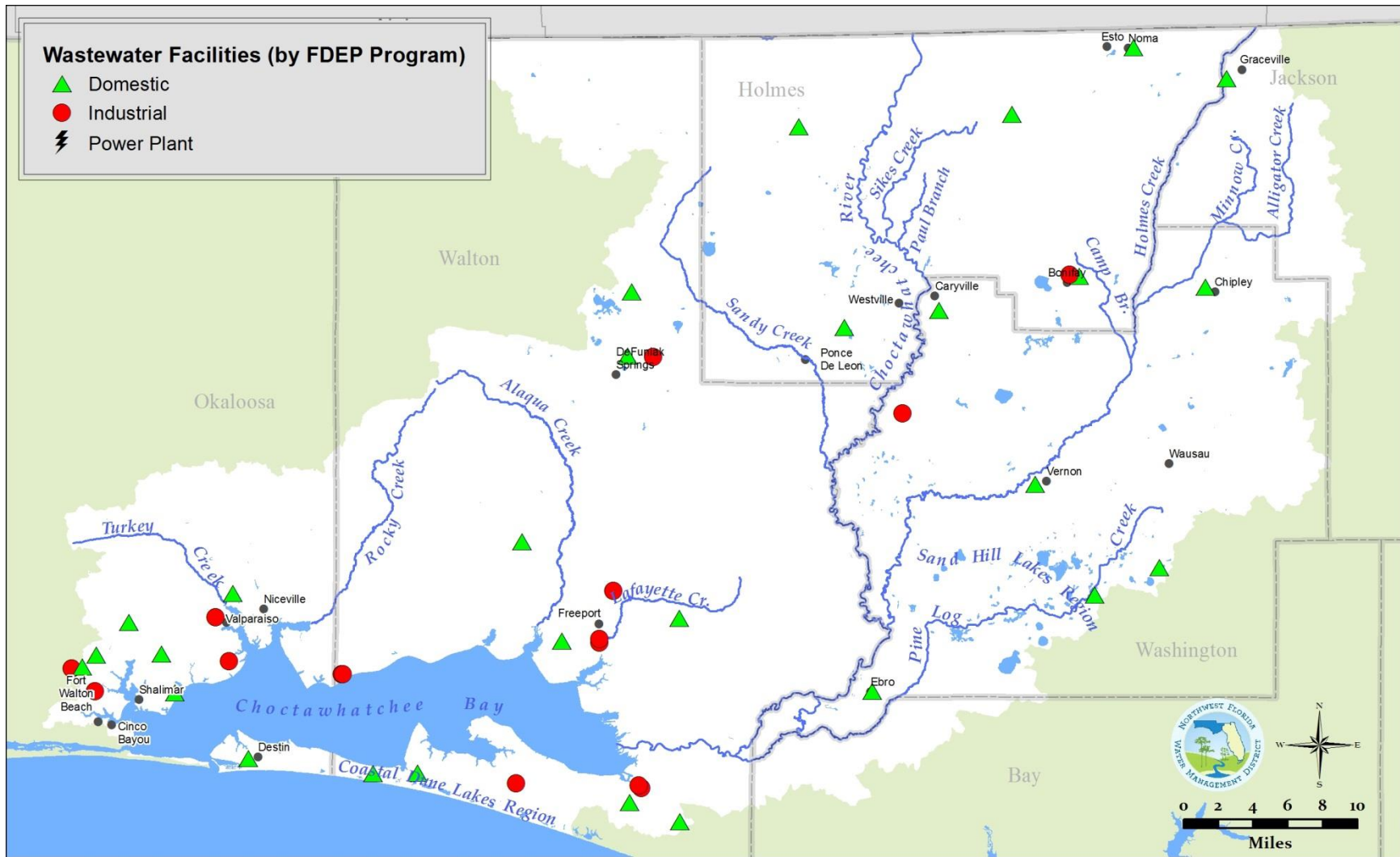
Wastewater Treatment Facilities

Wastewater treatment facilities (WWTFs), particularly those near streams, rivers, and the coast, as well as those constructed on highly permeable soil and karst geology, are a potential source of nutrients, pathogens, and other pollutants. Wastewater disposal can contribute to point source pollution by introducing nitrogen, bacteria, and other pathogens to groundwaters and surface waters. There are 28 Florida permitted domestic wastewater facilities and 15 industrial wastewater facilities located throughout the watershed (Figure 3-3). Wastewater treatment facilities are located in densely populated areas, with the highest concentration of facilities located in the vicinity of Fort Walton Beach. Although the Holmes Creek basin is less intensively developed than other areas of the Choctawhatchee River and Bay watershed, past

studies of the creek have suggested that water quality may have been impacted by WWTF discharges (NFWWMD 2002). Updating a WWTF to Advanced Wastewater Treatment standards to accommodate reuse, storage, and redirecting wastewater discharges to beneficial uses on land, has the potential to reduce pollution in surface waters and groundwaters and reduce potable water demand.

There are three central sewer systems in Washington County located in Vernon and Chipley. The City of Chipley WWTF has historically discharged treated effluent into Alligator Creek, a tributary of Holmes Creek (Washington County 2000a). In December 2015, the City of Chipley (Washington County) was authorized a \$3.4 million loan to fund the construction of a WWTF from the Clean Water State Revolving Fund (Rish 2015). The Vernon WWTF discharges treated effluent to treatment ponds. In recent years, the Vernon WWTF ponds have experienced overflows, causing the city to redirect its discharge to surface water (Washington County 2000b).

Wastewater reclamation that supports beneficial reuse has the potential to decrease pollution in surface waters, while also limiting or reducing water demands on aquifers and surface waters. For facilities that already have reuse programs, finding additional recipient sites could reduce surface water discharges. Potential recipient sites include irrigated public areas, such as recreational fields and landscaped areas of public facilities, roadway medians, greenway trails, and irrigated agricultural fields, as well as golf courses.



Sources: FDEP 2015b; NOAA2015a; USGS 2015, 2016a.

Figure 3-2 Permitted Wastewater Facilities within the Choctawhatchee River and Bay Watershed

Landfills and Solid Waste Disposal Facilities

Landfills and solid waste disposal facilities are a potential source of contamination to surface waters and groundwaters through the percolation of rainwater into waste materials and the leaching of soluble toxins. In the Choctawhatchee River and Bay watershed, there are a total of 252 landfills and solid waste disposal facilities recognized by the FDEP (Table 3-3).

Most landfills and solid waste disposal facilities in the watershed are near the major developed areas along the Choctawhatchee Bay, including Destin, Fort Walton Beach, Eglin AFB, unincorporated beach communities, Niceville and Freeport. Additionally, DeFuniak Springs has a dense concentration of closed sites that were formerly landfills. A comprehensive list of the solid waste facilities, their location, and status is maintained by the Solid Waste Section of the FDEP (FDEP 2016c).

Along with reducing the total quantity of waste entering landfills through recycling programs, proper BMPs and infrastructure are necessary to minimize percolation through the landfill waste and protect groundwaters and surface waters from contamination. Even after landfills have been closed and are no longer actively receiving waste materials, the sites remain a potential point source of pollution through leaching and degradation of protective barriers. Replacing conventional covers with evapotranspiration tree covers may offer an effective means of protecting groundwater from contamination by landfill leachates (Abichou *et al.* 2012).

Mines and Borrow Pits

Mining and extraction activities near waterbodies can cause turbidity, sedimentation, and

Table 3-3 Florida Solid Waste Facilities in the

Type of landfill/solid waste facility	Number of Facilities
Active Sites	31
Not Permitted/Registered	15
Inactive (Registered and Non-Registered)	68
No-Further Action facilities	17
Closed facilities	102
Cleanup sites where waste has been removed	8
Complaint is under investigation	4
Exempt from permitting	2
Status yet to be determined	2

Source: FDEP 2016c.

smothering if not managed appropriately. The Red Bay Plant Sand and Gravel Mine in Walton County, is the only mine recognized by the USGS within the Choctawhatchee River and Bay watershed. Other small-scale mines and borrow pits within the watershed have been identified by the FDEP including 29 mines or borrow pits in Walton County and two mines or borrow pits in Holmes County (FDEP 2014e). Sand is the predominant material mined in the watershed; however, several limestone and clay mines also exist within the watershed boundaries (FDEP 2014e).

Industrial Facilities and Superfund Sites

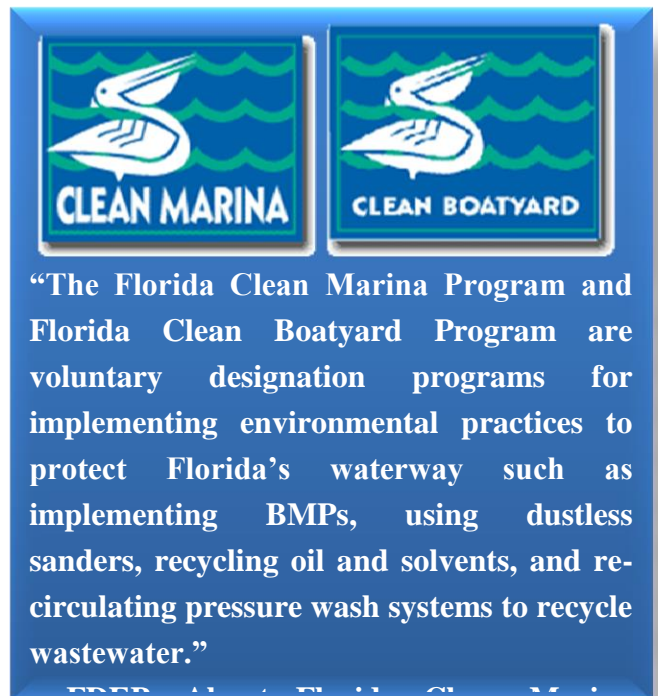
Degradation of water and/or sediment by toxic chemicals can cause significant impacts to surface water quality and the health of associated upland and aquatic habitats and generate contaminated food chains in which top predators are most significantly harmed. Chemical contaminants can also be harmful to humans, particularly through consumption of seafood containing elevated quantities of mercury, polychlorinated biphenyls (PCBs), dioxin and other harmful chemicals. Public health agencies monitor concentration levels of undesirable chemicals that occur in public natural resource land and recreational waters (EPA 2015b, 2015c).

The Environmental Response, Compensation, and Liability Act, commonly known as “Superfund,” was enacted in 1990 to deal with the dangers posed by hazardous waste sites by providing federal authority to respond directly to the releases or threatened releases of hazardous substances that may endanger public health or the environment. There are currently no Superfund sites located within the Choctawhatchee River and Bay watershed; however, one facility (the former West Florida Scrap Metal in Fort Walton Beach) is registered under the state-funded cleanup program. The state-funded cleanup program is designed to address sites where there are no viable responsible parties; the site poses an imminent hazard; and the site does not qualify for Superfund or is a low priority for the EPA. Remediation efforts are triggered when a FDEP district office requests adoption of a site for state-funded cleanup. West Florida Scrap Metal is a former landfill located approximately 1.5 miles northwest of Bass Lake, which feeds into Dons Bayou and eventually the Choctawhatchee Bay.

In the Choctawhatchee River and Bay watershed, there are also 416 petroleum contamination tracking sites registered with the Petroleum Contamination Monitoring database, as well as seven contaminated dry-cleaning sites eligible for the state-funded Dry-cleaning Solvent Cleanup Program; many of which are located in heavily developed areas around the Choctawhatchee Bay including Destin, Fort Walton Beach, Niceville, and Freeport.

Marinas

Due to the location of marinas at the water's edge, there is a strong potential for marina waters to become contaminated with pollutants generated from the various activities that occur at marinas—such as boat cleaning, fueling operations, and marine head (sanitary sewage) discharge—or from the entry of stormwater runoff from parking lots and hull maintenance and repair areas into marina basins. Although some of these would be considered NPS pollution, many of them are point sources (e.g., hull painting, engine maintenance, etc.). Such facilities have the potential to release pollutants, including vessel wastewater, oil and grease, heavy metals, and other pollutants. Actual pollution from marinas can depend on the availability of pump-out facilities and the level and consistency of marina BMP implementation (FDEP 2015c, 2015d, 2016d, 2016e). Currently, there are nine FDEP-certified Clean Marinas in the Choctawhatchee River and Bay watershed, more than in any other watershed of the NFWMD (FDEP 2016e). Clean marinas are located in Sandestin, Fort Walton Beach, Niceville, Shalimar, and Destin (FDEP 2012, 2016e). Water quality will likely continue to improve if additional marinas implement BMPs and become certified under the Florida Clean Marina Program.



3.2.4 Nonpoint Source (NPS) Pollution

Nonpoint source pollution is generated when 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, toxic metals, pesticides, and other contaminants. Pollutants entering the groundwater may also emerge in surface waters via seepage and spring discharges. Typical categories of NPS pollution include surface runoff and stormwater from agricultural areas and urban lands, leaching of on-site sewage treatment and disposal systems (OSTDS) (e.g., septic tanks), and erosion and sedimentation from un-vegetated lands, construction sites, or unpaved roads. Atmospheric deposition of nitrogen, sulfur, mercury, and other toxic substances via fossil fuel combustion may also contribute to NPS pollution.

In addition to causing current water quality challenges, NPS pollution is likely to be one of the most significant threats to future environmental quality in the Choctawhatchee River and Bay watershed.

The Choctawhatchee River and Bay watershed continues to experience rapid development, especially along the eastern and southern shores of the bay. Increased development and the resulting increase in impervious surfaces threatens the water quality by reducing water infiltration and increasing runoff rates, nutrient inputs, and the addition of other pollutants into the bay. Additionally, as the population increases along the bay coastline, additional docks and seawalls are changing the hydrological patterns in the bay. These changes lead to erosion and sedimentation in seagrass beds, which causes increased turbidity, reduces light available to plants, and smothers and restricts growth of SAV.

Increased population also leads to increased nutrients through additional use of fertilizer on lawns and a higher concentration of on-site sewage treatment systems (septic tanks), which leads to algal blooms and epiphytic algae that also restricts light availability to SAV. Septic systems along Hogtown Bayou are an area of concern and have shown increasing nutrient trends, as well as the Freeport area north of LaGrange Bayou. Stormwater runoff and increased residential development are responsible for increased nutrient loading to the bay. These NPS inputs exacerbate problems in the bayous where water quality is generally worse (CBA 1998),

Basins dominated by upland forest, wetland-cover, and low densities of impervious surface tend to be associated with good water and habitat quality (Allan *et al.* 1997; Wang *et al.* 1997). Vegetation provides habitat, regulates runoff, maintains surface and surficial groundwater flow, prevents erosion, and moderates effects of floods and droughts. Wetland functions include floodwater storage, sediment and shoreline stabilization, and fish and wildlife habitat. Riparian and in-stream vegetation contribute to nutrient cycling and primary production, which may remove nutrient pollutants transported by stormwater, such as nitrogen and phosphorus, from surface waterbodies. Urban areas typically have less vegetation and wetland areas that moderate flows and provide recharge, storage, and treatment for runoff. Additionally, vegetated areas within urban zones tend to be heavily managed landscaped tracts where the use of fertilizers, pesticides, and herbicides pose additional concerns for NPS pollution and water quality (EPA 1993).

Urbanization and Stormwater

Stormwater runoff is the main contributor to NPS pollution and is closely associated with land use. Urban land use, especially medium- to high-density residential, commercial, and industrial

uses have the highest NPS pollution per acre due to increased impervious surface area that increases runoff and generates stormwater (EPA 2016b). In urban areas, lawns, roadways, buildings, commercial, and institutional properties all contribute to NPS pollution (EPA 2016b). Potential pollutants associated with stormwater include solids, oxygen-demanding substances, nutrients such as nitrogen and phosphorus, pathogens, petroleum hydrocarbons, metals, and synthetic organics (EPA 2016b). Urbanization causes the most severe environmental impacts associated with NPS pollution, including degraded water and sediment quality and physical degradation of benthic and littoral communities (Booth and Jackson 1997; Ferguson and Suckling 1990).

Hardened, outdated stormwater infrastructure moves sediments, nutrients, petroleum products, toxic metals, and other stormwater contaminants directly from roads and impervious surfaces and transports them directly to surface waters with little to no treatment. Urbanization leads to the channeling of surface water, increased erosion, and habitat loss. Resulting hydrologic effects include increased peak discharge volume and velocity, decreased time for runoff to reach receiving waters, increased frequency and severity of flooding, a lowered water table, and reduced dry weather stream flow (EPA 1993). Lowering of the water table in urban streams causes disconnection between the stream channel and adjacent riparian vegetation and floodplains. This ultimately leads to reduced hydrologic function and reduced ecosystem services such as denitrification and flood control (Walsh *et. al.* 2005).

Urban areas of the Choctawhatchee River and Bay watershed are largely concentrated around the Choctawhatchee Bay and the cities of Fort Walton Beach, Destin, Freeport, and Niceville; as well as in coastal communities such as Miramar Beach, Santa Rosa Beach, and Seaside. While these developments contribute significantly to NPS pollution, the expansive urban-rural fringe, which hosts new development and construction sites, introduces new NPSs and expands the extent of impervious surfaces in the watershed.

In the Choctawhatchee River and Bay watershed, eight municipalities currently hold Municipal Separate Storm Sewer System (MS4) NPDES Stormwater permits for stormwater conveyance (not combined with sewer) that discharges to “waters of the State” including Eglin AFB, the City of Niceville, the City of Destin, the City of Valparaiso, Bay County, the City of Fort Walton Beach, Okaloosa County, and Walton County. Although existing problems are being addressed through retrofit efforts, stormwater discharges will continue to increase with population growth and urbanization.

Many of the direct-discharge stormwater structures in the watershed were constructed prior to the enactment of modern stormwater treatment regulations and standards (NFWMD 2002).

Additionally, hardened, outdated stormwater infrastructure carries petroleum products, toxic metals, and other stormwater contaminants directly from roads and impervious surfaces and transports them straight into surface waters with little to no treatment. Vegetated buffers and softer stormwater management techniques are needed to slow and treat stormwater, reducing stormwater discharge velocities through green infrastructure facilitating bioremediation and biological uptake/storage of pollutants.

While existing urban areas contribute significantly to NPS pollution, the expansive urban-rural fringe, which hosts new development and construction sites, introduces new NPS, and expands the extent of impervious surfaces in the watershed.

Silviculture and Agriculture

In northwest Florida, forest products and services have been valued at approximately \$1.21 billion per year (Hodges *et al.* 2005). These forests also support recreational opportunities for residents and millions of visitors to the state, bolstering the tourism and ecotourism industries. Managed forests also provide important environmental services such as biodiversity, hydrologic function, and mitigation of global climate change by sequestering 5.8 million tons of atmospheric carbon per year statewide (FDACS 2014; Hodges *et al.* 2005).

Tree production, farming, and livestock are major economic drivers across the Choctawhatchee River and Bay watershed, particularly in the watershed's upper reaches. In 2007, about 19 percent of Washington County was used for agriculture, with the majority of farmland concentrated around Chipley (USDA 2014). Of the acreage of farmland, 46 percent is woodland, 31 percent is cropland, 13 percent is permanent pasture, and 10 percent is used for livestock, nurseries, or other uses (USDA 2014). As of 2013, lumber/wood products were the number one export in Washington and Jackson counties (FDOT 2013a, 2013b). Lumber and wood products are Walton County's number three export (at nearly 93,000 tons of lumber exported annually) and Holmes County's number four export (over 48,000 tons exported annually) (FDOT 2013c, 2013d). The main agricultural crops across the watershed are soybean, peanuts, corn, grains, watermelons, and vegetables (USDA 2014).

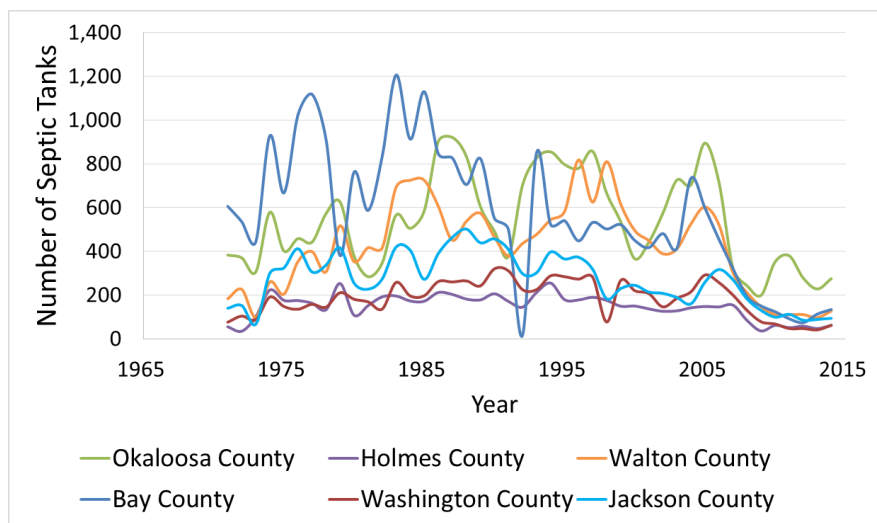
Silvicultural practices such as ditching, landscape alteration, road construction, fertilizer application, and harvesting can result in effects such as habitat fragmentation, stream channelization, erosion, sedimentation, nutrient enrichment, discharge of untreated runoff, as well as effects on water temperature, DO, and pH (EPA 2016e; Stanhope *et al.* 2008). Where appropriate, BMPs such as those developed and coordinated by FDACS are employed and silviculture has been found to be consistent with the maintenance of excellent water quality

(FDEP 1997; NFWMD 1998). Silvicultural BMPs establish Special Management Zones (SMZs) that consist of specific areas associated with waterbodies within which certain activities are limited. Implementation of SMZs and other BMPs protect water quality by reducing discharges of sediments, nutrients, logging debris, and chemicals, as well as by reducing water temperature fluctuations and riparian habitat disturbance.

On-Site Sewage Treatment and Disposal Systems (OSTDS)

On-site sewage treatment and disposal (or septic) systems are potential widespread sources of nutrients and other pollutants. Significant concentrations of OSTDS can result in degraded water quality in groundwater and proximate surface waters. Well-designed and maintained septic systems are effective for containing pathogens, surfactants, metals, and phosphorus. However, greater mobility of nitrogen in soils prevents complete treatment and removal of nitrogen. Dissolved nitrogen is frequently exported from drainfields through the groundwater (NRC 2000). Additionally, OSTDSs in areas with high water tables or soil limitations may not effectively treat other pollutants, including microbial pathogens. These pollutants enter surface waters as seepage into drainage ditches, streams, lakes, and estuaries (NRC 2000; EPA 2015d).

Across the watershed, new septic installations have declined significantly since the early 2000s. Coastal counties within the watershed have historically had more new septic system installations annually than the sparsely populated counties in the watershed’s northern reaches (Figure 3-3) (FDOH 2015a).



Source: FDOH 2015a.

Figure 3-3 New Septic System Installations by Year

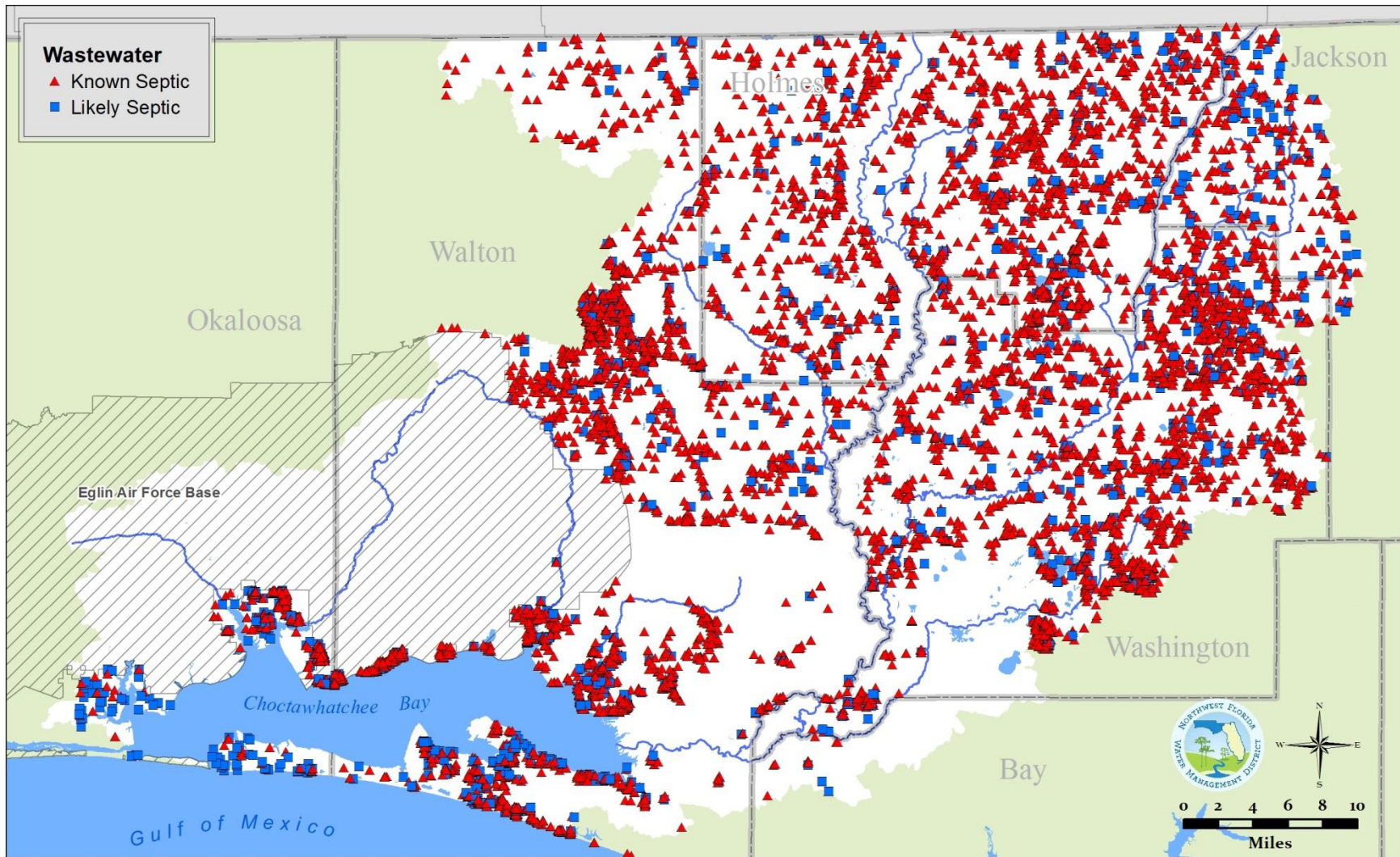
According to 2012 FDOH permitting data, there are an estimated 33,135 septic tanks in the Florida portion of the Choctawhatchee River and Bay watershed; however, at least 640 permits have been issued to abandon septic tanks, presumably due to connection to a centralized sewer collection system (FDOH 2012). Figure 3-4 shows the approximate locations of septic tanks as of 2015 (FDOH 2015b).

Several areas in the vicinity of Choctawhatchee Bay and the upstream river watershed are dependent on OSTDSs for treatment and disposal of domestic wastewater (Couch *et. al.* 2001). These include the Rocky Bayou, Blue Water Bay and Choctaw Beach, La Grange Bayou, and Hogtown Bayou basins and their general vicinities. Couch *et. al.* (2001) also identified 1,665 shoreline residences and businesses that are serviced by septic systems in the watershed. According to 2012 FDOH permit data, many of the septic systems in the communities along western Choctawhatchee Bay have been abandoned. The communities of Freeport, Bruce, DeFuniak Springs, and Ponce de Leon Springs in the upper portion of the watershed have “package plants,” small wastewater treatment plant systems that discharge less than one million gallons per day.

Erosion and Sedimentation

Erosion and sedimentation are natural phenomena that can be significantly accelerated by human activities, with resulting undesirable water quality consequences. Natural factors such as highly erodible soils, steep unstable slopes, and high rainfall intensities, are important factors in erosion and sedimentation (Reckendorf 1995). However, natural erosion is generally a very slow process which takes place over geologic time. Human-induced or accelerated erosion and associated increases in sediment inputs to surface waters result in major increases in sediment flux. 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 increased runoff associated with impervious surfaces, can also be a significant and increasing source of sedimentation into receiving waters.

Sedimentation from unpaved roads, particularly at stream crossings, has been recognized as a widespread problem across the Choctawhatchee River and Bay watershed (SAIC 2006). Sedimentation from unpaved roads can frequently diminish water quality, smother benthic habitats, and cause physical changes to stream channels. Some crossing structures may also act as physical barriers to the movement of fish and other species. Over 200 road-stream crossings in the Florida portion of the Choctawhatchee watershed were identified in an assessment completed in 2006 (SAIC 2006).



Sources: FDOH 2015b; FHWA 2014; NOAA 2015a; USGS 2015, 2016a

Figure 3-4 Septic Tank Locations in the Choctawhatchee River and Bay Watershed

The NRCS has calculated rates of erosion for various land use types including cropland (8.3 tons/acre/year), pasture/hayland (0.5 tons/acre/year), and forest land (0.8 tons/acre/year); however, the NRCS recognizes gullies and cropland as the largest erosion sources, followed by dirt roads, forest land, other uses, pasture, and streambanks (Coastal Conservancy 2009). Sedimentation results in significant water quality and other socio-economic impacts in the watershed (Reckendorf 1995). The Choctawhatchee River and Bay watershed has the greatest topographic relief of all watersheds in Florida, making this area highly susceptible to erosion, particularly during road construction and agricultural activities, which remove vegetative covers and expose bare soil (Ruth and Handley 2006).

On the main stem of the Choctawhatchee River, sediment loading due to changes in land use and land management has been a concern since the early 1980s. According to a 1993 Cooperative Study, 5.5 million tons of sediment enter Choctawhatchee River and its tributaries each year; 70 percent of which is derived from gullies and unimproved roads and 22 percent from cropland. Additional sources of sediment include logging and other eroding areas (Coastal Conservancy 2009). An additional source of sediment is the GIWW, which connects the Choctawhatchee Bay to West Bay of the St. Andrew Bay watershed. Approximately five percent of the total sediment load (about 600,000 tons) received by local waterways reaches the Choctawhatchee Bay (Coastal Conservancy 2009). Sediments in areas with high industrial/maritime activity often contain chemical pollutants, which may pose a risk to human health and the health of surrounding ecosystems.

The GIWW must be dredged intermittently to maintain the channel depth and banks along most of the GIWW are undeveloped and dotted with dredged sediments. The GIWW is a potential source of sediment pollution from maintenance dredging activities and resuspension of sediments by large vessels. From Apalachee Bay to Mobile, Alabama, the GIWW moved 12,503,000 tons of cargo in 2006, with the segment that passes through the Choctawhatchee River and Bay watershed (Panama City to Pensacola) moving 3,635,000, tons of cargo (FDOT 2008).

East Pass, which leads from the main channel of Choctawhatchee Bay to Destin's harbor, was dredged over 40 times from 1931 to 1991, and the quantity of dredged material increased steadily over the approximately 60 years the pass was open. From 1931 to 1951, approximately 17,000 cubic yards of sand was dredged per year to maintain a 6-foot-deep by 100-foot-wide channel. From 1951 to the 1988, the quantity of dredged material increased to 97,000 cubic yards of sand per year to maintain a 12-foot by 180-foot channel. East Pass has since been closed due to natural sedimentation and an artificial drainage system has been installed. East Pass dredging

activities has affected the flushing and sediment loading in the bay for nearly 90 years (Morang 1992).

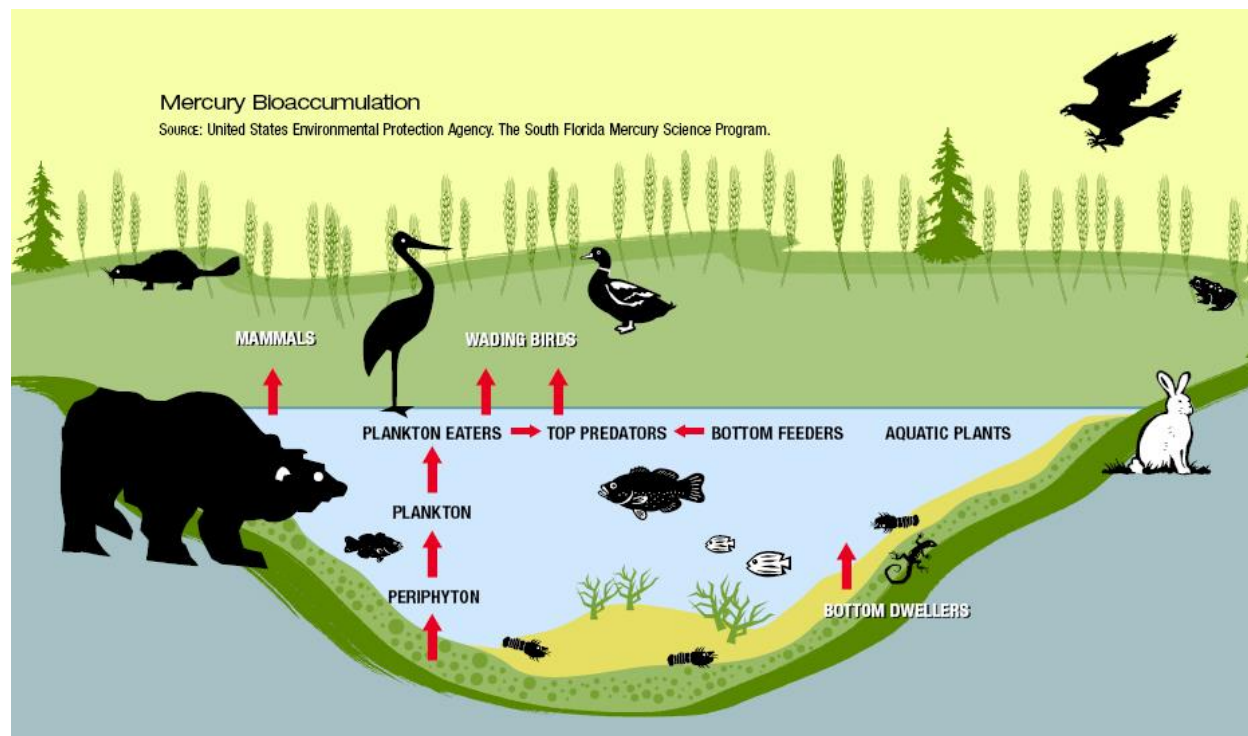
Adverse impacts associated with sedimentation include smothering of SAV and other benthic habitats, degraded shellfish beds and tidal flats, fill in riffle pools, and increased levels of turbidity and nutrients in the water column. Additionally, increased sediment accumulation in surface waters changes the hydrology and holding capacity of waterbodies by reducing channel depth and accommodation space and altering channel morphology, which exacerbates flooding issues. Sediment accumulation in channels and waterways also impedes navigation and increases the need for costly dredging activities (Reckendorf 1995).

Atmospheric Deposition

While many impacts to water quality result from direct input to surface waters, either as point source or NPS, some pollutants such as nitrogen and mercury can enter surface waters through atmospheric deposition.

Florida is particularly susceptible to mercury contamination of fish, due in part to the state's latitude, geographical setting, and meteorology, which allows a high rate of mercury deposition from the atmosphere onto its lands and surface waters. Additionally, biochemical conditions in Florida waterbodies and sediment are conducive to the conversion of mercury from atmospheric deposition, to the more toxic and bio-accumulative methyl-mercury form (EPA 1997).

Therefore, mercury contamination is an issue in most waterbodies in northwest Florida from a human health perspective. Although atmospheric and biochemical conditions are conducive to mercury accumulation, only a small part of mercury in the environment is in a biologically available form and able to enter the food chain (FDEP 2013; USEPA 1997). Mercury impairments are based on potential human health risks, as there are no known relationships between mercury levels in fish and environmental quality (FDEP 2013).



Source: Adapted from EPA South Florida Science Program.

Figure 3-5 Bioaccumulation of Methyl-Mercury

Mercury deposition becomes an issue in aquatic ecosystems when it is converted into the bioavailable form, methyl-mercury, by anaerobic bacteria that occur in saturated soil and waterbody sediments. Methyl-mercury is a very toxic mercury compound and biomagnifies as it moves up the aquatic food chain (Figure 3-6). Although the concentration of mercury in waters of lakes, streams, and coastal waters is usually very low, levels in fish tissue may be 100,000 or 1,000,000 times higher, and reach concentrations that may be toxic to humans who consume fish. Methyl-mercury exposure can be particularly detrimental to women of childbearing age and young children. In children, it poses an increased risk of learning disabilities and may increase the risk of heart attacks in adults. Besides human health concerns regarding methyl-mercury, there are concerns regarding wildlife in the aquatic food web (e.g., otters, egrets, ibis, ospreys, eagles, panthers) (EPA 1997).

Thirty-four of the 61 monitored waterbodies within the Choctawhatchee River and Bay watershed including seven segments of the Choctawhatchee River, three lakes, 18 estuaries, three streams, and three locations on the Gulf of Mexico, are listed as impaired due to elevated mercury levels found in sampled fish tissue. While agricultural, urban, and residential stormwater NPS are all potential sources of contaminants, atmospheric deposition due to fossil fuel combustion is the most significant source of mercury.

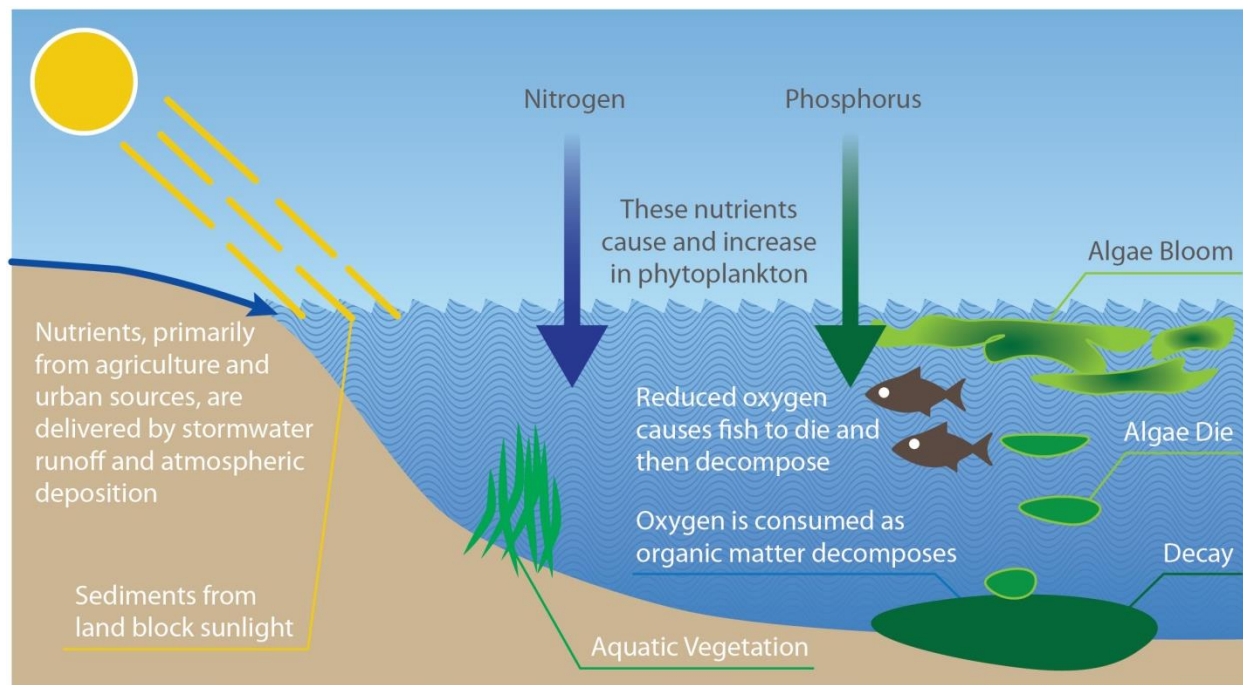
Nitrogen inputs from industry, sewage and wastewater treatment discharges, and agriculture are most likely the primary point source discharge of nutrients to waterways in the Choctawhatchee River and Bay watershed. However, atmospheric deposition of nitrogen from fossil fuel combustion may also be a source within the watershed. Most oxidized-nitrogen emissions are deposited close to the emission source and can especially impact surface water in urban areas within the watershed (Howarth *et. al.* 2002b, 2002c; NRC 2000).

3.2.5 Ecological Indicators of Water Quality

Eutrophication

Eutrophication is defined as an increase in the rate of supply of organic matter to an ecosystem, characterized by excessive plant and algal growth due to the increased availability of one or more limiting growth factors needed for photosynthesis (Nixon 1995; Schindler 2006). Both point and NPS pollution have accelerated the rate and extent of eutrophication through increased loadings of limiting nutrients, such as nitrogen and phosphorus, into aquatic ecosystems (Chislock *et al.* 2013). Although nitrogen is necessary for the function of all ecosystems, in excess, it is also a nutrient pollutant that can cause damage to aquatic systems. Nutrient loading over-stimulates the production of planktonic algae (floating), epiphytic algae (those attached to surfaces), and macrophytes (large plants) and leads to dense nuisance and toxic blooms.

Eutrophication is also associated with major changes in aquatic community structure as a result of changes in ratios of key plant nutrients (e.g., nitrogen and phosphorus). These changes result in food webs that are less efficient in supporting key fisheries and favor algal blooms, including those toxic to fish, marine mammals, birds, and people. Algal blooms can lead to low DO levels, loss of beneficial SAV, fish kills, and habitat degradation. These symptoms of eutrophication impact public health and the use of coastal ecosystems for recreation, tourism, and commercially important fisheries (Bricker *et. al.* 1999). The estimated cost of damage caused by eutrophication in the U.S. alone is approximately \$2.2 billion annually (Dodds *et. al.* 2009). Figure 3-7 illustrates how the eutrophication process can occur.



Source: Graphic by Ecology and Environment, Inc.

Figure 3-6 Eutrophication Process

The primary symptoms of eutrophication include high levels of chlorophyll-*a*, increases in epiphytic algae, and macroalgae blooms (Bricker *et. al.* 1999). High concentrations of chlorophyll-*a* can indicate problems related to the overproduction of algae, epiphytes that become too dense and cause the loss of SAV and reduce light penetration, and macroalgae blooms that can either block sunlight which kills SAV and/or smother other species. Any of these primary symptoms can impact tourism by degrading environmental conditions for swimming, fishing, and boating opportunities. Secondary symptoms can include low DO, loss of SAV, and HAB (Bricker *et. al.* 1999). Low DO can cause fish kills, habitat loss, and degraded aesthetic value. Loss of SAV may occur from decreased light and poor water quality associated with the overgrowth of algae, and the loss of grasses resulting in decreased available habitat vital for many fisheries. While some algal blooms are naturally occurring, many times HABs are caused by a change in the natural mixture of nutrients, often associated with long-term increases in nutrients (further discussed in Section 3.2.5).

Choctawhatchee Bay is a stratified estuarine system (Figure 2-9) with low tidal energy, limited flushing, and a halocline (Blaylock 1983; Livingston 1986). Previous studies have identified low DO in Choctawhatchee Bay and associated bayous, likely a result of the convergence of fresh and marine waters (Livingston 1987, U.S. Department of Commerce and NOAA 1997). When freshwater becomes layered over the saltier bottom waters, mixing and gas exchange are

inhibited. This reduces the resupply of oxygen from the surface to deeper waters where oxygen concentrations are naturally lower (Livingston 1987).

As early as the 1980s, urban development, stormwater runoff, causeway construction, marina development, overfishing, river-borne agricultural pesticides and fertilizers, and military activities were identified as potential causes and compounding factors, that reduce DO in the Choctawhatchee Bay system (Livingston 1986).

Older developed areas, including Fort Walton Beach, Valparaiso, Niceville, Eglin AFB main base, and the earlier Destin developments along western Choctawhatchee Bay, have had historical impacts on water quality. During the 1970s, this area displayed eutrophication, increased algal blooms, loss of SAV, and fish kills (Young and Butts 1984). Sewage treatment plants in the surrounding bayous and eastern Santa Rosa Sound were identified as the main contributing factor to these eutrophic conditions. However, discharges have been converted to upland disposal, which led to improved water quality, expanded shoal grass beds, and increased macroinvertebrate species richness in the western bay (Young and Butts 1984).

Submerged aquatic vegetation losses have also been caused by decreased light penetration in the water column. Human activities that could impact seagrasses include dredging and related sediment suspension and deposition, operation of recreational and commercial watercraft, and sedimentation from construction and other land-based activities (Livingston 1986).

In western Choctawhatchee Bay, nutrient enrichment, phytoplankton, and coliform concentrations indicated that eutrophication has historically been human-induced. However, a recent study in Choctawhatchee Bay concluded that light does not appear to be limiting the abundance of aquatic plants in the Choctawhatchee Bay system (Hoyer *et. al.* 2015).

In 1999, the National Oceanic and Atmospheric Administration (NOAA) completed a comprehensive assessment of the scale, scope, and characteristics of nutrient enrichment and eutrophic conditions in 38 estuaries along the Gulf of Mexico, including Choctawhatchee Bay (Bricker *et. al.* 1999). Choctawhatchee Bay was identified as exhibiting strong symptoms of eutrophication, with conditions projected to worsen by year 2020 (Bricker *et. al.* 1999). Symptoms of eutrophication identified in the bay include high epiphyte abundance, loss of seagrass beds, low DO, and nuisance and toxic algal blooms. Choctawhatchee Bay may be at risk of eutrophication due to relatively low flushing rates, warm water, long algal growing seasons, and significant and increasing nutrient loading (Bricker *et. al.* 1999; NFWFMD 2002).

Harmful Algal Blooms (HABs) and Aquatic Life Mortality Events

Harmful algal blooms periodically occur in coastal Gulf of Mexico waters. Harmful algal bloom monitoring resources include federal and state advisories and bulletins. Although the NOAA is the predominant national source for HAB monitoring data, the FWC's Fish and Wildlife Research Institute (FWRI) also conducts *Karenia brevis* (*K. brevis*) HAB monitoring and currently maintains Florida's HAB Monitoring Database, one of the longest continually recorded datasets of red tide in the U.S., for more than 170 years. State- and county-level monitoring can also be a resource to citizens looking for HAB information and updates (NOAA 2014b).

Harmful algal blooms occur when colonies of certain types of algae grow at increased rates within the water column and produce toxins at concentrations that have harmful effects on marine life and humans (NOAA 2014b). Red tide, caused by the microscopic algae *K. brevis*, is one of the more common HABs in the bays and estuaries along the Gulf Coast of Florida (Solutions to Avoid Red Tide [START] 2016). *K. brevis* produces a neurotoxin that kills fish, shellfish, and marine mammals. Airborne toxins can also cause respiratory and skin irritation (START 2016). Red tide is a natural occurrence; however, increased nutrient loading, pollution, food web alterations, introduced species, water flow changes, and climate change influence the frequency and duration of blooms (NOAA 2015b). In FWC's summary of HAB events in Florida within the last several years (FWC 2016b), two events were within and offshore of the Choctawhatchee River and Bay system. In February 2011, reports from NOAA indicated orange, discolored water offshore from Fort Walton Beach east to Topsail, and volunteers located discolored waters two miles off Destin Harbor in Okaloosa County (FWC 2016b). Water samples contained *Noctiluca scintillans*, a large, bloom-forming dinoflagellate that is nontoxic; however, the species has been linked to aquatic life mortality from toxic levels of ammonia that accumulate in surrounding waters. No fish kills or other impacts were reported during this event.

Scientists at NOAA monitor and study HABs to detect and forecast red tide blooms to warn communities in advance of possible environmental and health effects (NOAA 2014b). The NOAA is authorized by the Harmful Algal Bloom and Hypoxia Research and Control Act to assist in the control of possible HABs through research centers, labs, and funding (NOAA 2015b). Citizens can visit NOAA's Harmful Algal Bloom Operational Forecast System Operational Conditions Reports for updates on any known HAB colonies from southwest Florida to the Texas coastline (NOAA 2016). The NOAA also posts HAB bulletins with conditions reports and analyses of HABs in the Gulf of Mexico.

3.3 Habitat Quality in Receiving Waters

Across the Choctawhatchee River and Bay watershed, conservation lands account for approximately 26 percent of total land area. These conservation areas protect high quality habitats, support a diversity of wildlife, and promote surface water quality. Undeveloped lands, that are responsibly managed, act as a buffer to provide protection to the rivers and coastal environment.

3.3.1 Subtidal Communities

Three subtidal communities exist in the Choctawhatchee River and Bay watershed: seagrass beds, oyster/mollusk reefs, and unconsolidated (marine) substrate.

Sediments in areas with high industrial/maritime activity often contain chemical pollutants, which may pose a risk to human health and the health of surrounding ecosystems. The U.S. Department of Commerce and NOAA (1997) evaluated sediment toxicity in Florida Panhandle estuaries. Sediment samples were collected at 37 sites in Choctawhatchee Bay in 1994. Of these, all samples were evaluated based on multiple toxicity tests, and 21 samples were analyzed for chemistry. Evidence of sediment toxicity was found at all stations. The highest levels of toxicity were found in Cinco, Garnier, Boggy, Tom's, Rocky, and LaGrange bayous and Destin Harbor. Concentrations of contaminants were generally higher in bayous than in the main bay. The highest polycyclic aromatic hydrocarbon concentrations were found in Cinco Bayou. Concentrations of PCBs were found to be high at stations in Cinco and Boggy bayous, and lead and mercury concentrations were relatively high in Garnier, Cinco, Boggy, and Rocky bayous. These contaminants can enter and bioaccumulate as they move up the aquatic food chain and may pose a risk to human health. Contaminated sediment in surface waters also risk altering the metabolic processes of the aquatic species that they host (Castro and Reckendorf 1995).

The status of seagrass in the Choctawhatchee Bay has been studied as part of the Florida Seagrass Integrated Mapping and Monitoring (SIMM) Program (FWC 2015b). Data indicate a 38 percent reduction in seagrass area in Choctawhatchee Bay from 1992-2003. The majority of remaining seagrass beds are located in the western portions of the bay. Seagrass monitoring by FWC in 2009 suggested further declines, although the area was not calculated. Additionally, heavy rainfall associated with the 2009–2010 El Niño may have resulted in further reductions in seagrass cover in this system (FWC 2015b). Additional information about seagrass monitoring efforts and the relationship between SAV and water quality can be found in Section 6.0.

3.3.2 Intertidal Communities

Intertidal communities within the Choctawhatchee River and Bay watershed include salt (brackish) marsh and un-vegetated intertidal mud flats, which occur throughout the bay system, including the coastal barrier complex.

The Nature Conservancy conducted a joint analysis of St. Andrew and Choctawhatchee bays using the Sea Level Affecting Marshes Model (SLAMM) to evaluate changes in community composition under five different scenarios ranging from 0.39 to 2.0 meters of sea level rise by the year 2100. The SLAMM model indicates that under all five sea-level rise scenarios (0.39 to 2.0 meters), rocky intertidal, tidal fresh marsh, and irregularly flooded marsh communities were the most heavily impacted (TNC 2011). SLAMM simulations indicate that marshes are very susceptible to sea level rise under more extreme scenarios, with 89 percent of irregularly flooded marsh lost under the 1.5 meter scenario and 96 percent lost under the 2 meter scenario (TNC 2011).

3.3.3 Freshwater Systems

In rural areas, land clearing associated with agriculture, silviculture, and recreation, as well as dirt road erosion, have led to increased soil erosion and sedimentation in the Choctawhatchee River drainage basin. Habitat quality in freshwaters systems is largely dependent upon local water quality conditions (further discussed in Section 3.2).

Although it is not a primary component of the scope of this plan, it should be noted that the negative impacts of invasive plant species on native communities has been widely recognized (Florida Exotic Pest Plant Council 2005). The proliferation of non-native species poses a significant threat to biodiversity as non-native species modify ecosystem structure and contribute to the decline of native species, particularly in aquatic systems (Florida Exotic Pest Plant Council 2005; FWC 2015d; Mack *et al.* 2000; Vitousek 1986). The Florida Fish and Wildlife Conservation Commission, Invasive Plant Management Section is the lead agency for coordinating control of invasive aquatic and upland plants on public conservation lands and surface waters.

3.4 Floodplains

Floodplains provide important functions for water resources, as well as for the human community. Properly functioning floodplains protect water quality by allowing storage of floodwaters, reducing runoff velocity, and preventing erosion and sedimentation. They also provide important habitat for many terrestrial and aquatic species.

In addition to impacting water resources, development and encroachment into flood-prone areas puts residents and property at significant risk. Floodplain encroachment decreases floodplain function by reducing the flood-carrying capacity, increasing flood heights and velocities, increasing flood hazards, and degrading natural systems in areas beyond the encroachment itself. Floodplains offer a way to attenuate potential flood effects, while also providing an ecological link between aquatic and upland ecosystems. Economic gain from floodplain development should be balanced against the resulting increase in flood hazard and associated costs (Federal Emergency Management Administration [FEMA] 2014).

While severe rainfall events can lead to flooding and flood-related impacts on surface waters, drought can have severe impacts on water supply, aquifer recharge, water chemistry, DO concentrations, and other parameters that affect water quality and in-stream habitat. Maintaining the hydrological integrity of the floodplain can benefit 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 forest areas absorb high flows and stormwater runoff, then filter and slowly release it to streams and aquifers, moderating against dry times (TNC 2016b). Floodplain protection is important to support not only recharge and water storage, but also protect the quality of groundwater that may emerge later as surface water.

3.4.1 Flood Prone Areas

Northwest Florida, with its extensive river networks and other water resources, has a long history of flooding events, which makes it clear that such events will re-occur and that it is necessary to plan accordingly. Riverine floods are significant and common in northwest Florida and tend to occur along major river systems and their tributaries. Within the Choctawhatchee River and Bay watershed, major riverine systems, streams, wetlands, low-lying areas, coastal areas, and closed basins are subject to significant flooding. FEMA digital flood maps indicate that 404,299 acres (approximately 30 percent) of the watershed are delineated as Special Flood Hazard Area. Flooding can be particularly problematic in high-growth and densely populated areas. Flooding impacts appear to be aggravated by inadequate public awareness of the potential for flooding events and associated consequences. Residents and visitors must be aware of the implications of building, living, working, and recreating in areas prone to flooding.

3.4.2 Recent Flood Events

Major sustained flooding occurred during the summer of 1994, when tropical storms Alberto and Beryl passed inland between Destin and Fort Walton Beach within weeks of each other, followed

in October by a tropical depression. The Choctawhatchee, Apalachicola, Shoal, Pea, Ochlockonee, Chipola, Blackwater, and Yellow rivers and Holmes Creek all experienced major floods. The Escambia and St. Marks rivers experienced minor flooding. Sheet floods, saturated soils, and sustained standing water developed in many areas of the District (NFWFMD 1998).

Additionally, coastal areas of Okaloosa and Walton counties also suffered damage to structures during hurricanes Opal (1995), Ivan (2004), Dennis (2005), and Katrina (2005). Hurricane Opal inflicted 14-foot storm surges in coastal Okaloosa County, eroding significant areas around Fort Walton Beach. Along the entire Walton County coast, debris lines from Hurricane Opal reached elevations exceeding 20 feet National Geodetic Vertical Datum of 1929.. Between Fort Walton Beach and Destin, the storm tides of Opal and Ivan caused a major breach through U.S. Highway 98 and significant flooding in the Lands End Drive area in Destin. The high-water mark for Walton County during Hurricane Ivan was over 10 feet, and storm surges caused substantial beach and dune erosion throughout the county (FDEP 2006b).

3.4.3 Floodplain Management

Flood protection needs within the Choctawhatchee River and Bay watershed are closely related with stormwater management, as well as land use planning and land development regulation. Thus, for both retrofit and new development, flood protection and water quality treatment efforts must be closely coordinated through protection of floodplains, wetlands, natural hydrology, and recharge. Where necessary and appropriate, both retrofit needs and stormwater management for new development should be addressed through construction of facilities that provide both flood protection and water quality treatment.

To facilitate protection of floodplain and wetland resources, the District and FEMA have identified flood hazards through the Flood Hazard Map Modernization program (originally), the FEMA Risk MAP program (currently), county and watershed based Flood Insurance Studies, the SWIM program, storm surge modeling, and other cooperative efforts. Additionally, ongoing land acquisition efforts serve to protect floodplains, wetlands, and associated public benefits. Restoration efforts implemented through SWIM and wetland mitigation also help restore natural hydrology, with benefits for flood protection, habitat, and water quality.

Finally, implementation of the Environmental Resource Permitting (ERP) program in northwest Florida helps ensure flood protection is addressed in an integrated manner with water quality protection. Florida's ERP Program regulates activities that alter surface water flows, including activities in uplands that generate stormwater runoff, and dredging and filling in wetlands and surface waters. In addition to the state wetlands permitting process, Section 404 of the CWA establishes a federal wetlands program administered by the USACE.

3.5 Unique Features and Special Resource Management Designations

3.5.1 Conservation Lands

The Choctawhatchee River and Bay watershed contains numerous conservation and protected lands, particularly along the Choctawhatchee River (Figure 3-8). Over 376,000 acres, or 26 percent, of the watershed consists of conservation lands which are listed with short descriptions in Appendix E (FNAI 2016a, 2016b).

The National Park Service owns and manages the Gulf Islands National Seashore, established in 1971, which includes nearly 40 acres of uplands, as well as larger areas of submerged lands adjacent to the eastern end of Okaloosa Island. The Seashore holds an abundance of natural resources, including seagrass and estuarine marsh ecosystems, as well as a plethora of marine species, and birds (National Park Service 2016b).

Within Alabama's portion of the watershed, conservation lands include one wildlife management area (Geneva State Forest Wildlife Management Area), managed by the state of Alabama, and portions of the Conecuh National Forest managed by the U.S. Forest Service (Alabama Division of Wildlife and Freshwater Fisheries 2016; USDA 2016b).

The NFWFMD owns and manages over 211,000 acres across the District and protects an additional 12,403 acres through conservation easements. Approximately 60,000 acres of the total property controlled by the District lies within the Choctawhatchee River and Bay watershed to protect water quality and water resource values and functions. The Choctawhatchee River and Holmes Creek WMA is managed to preserve natural systems, protect wetland and floodplain functions, facilitate groundwater recharge, improve surface and groundwater quality, and provide fish and wildlife habitat. Land management includes prescribed burning, pine timber management and harvest, groundcover restoration, reforestation, streambank restoration and protection, wetland mitigation restoration, and support for compatible public access and recreation (NFWFMD 2016b, 2016c). The Choctawhatchee River and Holmes Creek WMA consists primarily of floodplain forests and supports high species biodiversity, including many federal- and state-protected species.

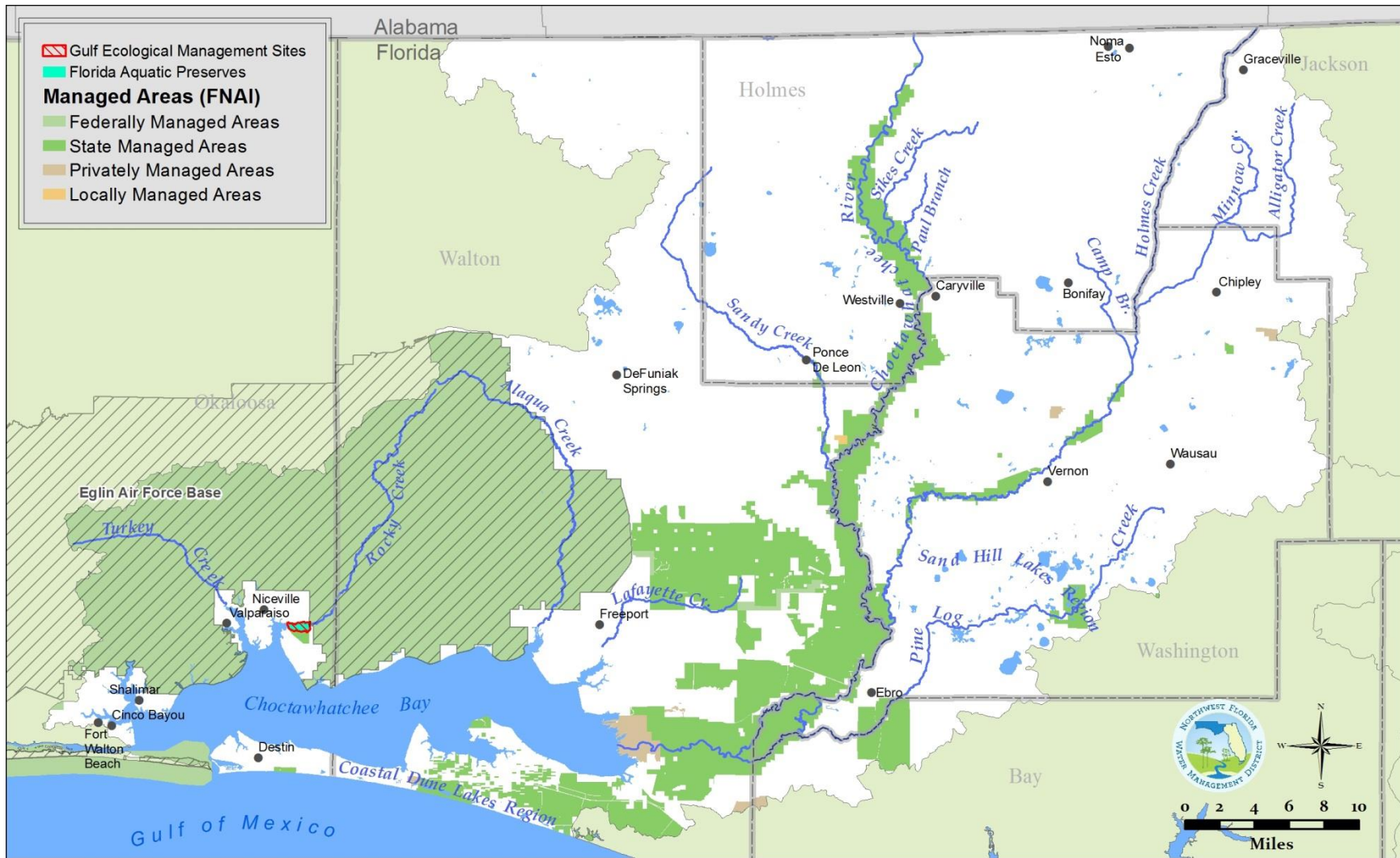
Also within Florida's portion of the watershed are 15 state parks, preserves, and forests (over 68,000 acres) managed by various branches of the FDEP and FDACS, including Grayton Beach, Falling Waters, Topsail Hill Preserve, and Eden Garden State Parks, as well as the Point Washington State Forest and Ponce de Leon Springs, Henderson Beach and Fred Gannon Rocky Bayou State Recreation Areas, among others. State-funded land acquisitions have been important

in securing conservation lands within the watershed. The Nature Conservancy of Florida has been instrumental in brokering many critical land acquisitions with state funding provided through various programs such as Preservation 2000 and Florida Forever (discussed further in Section 6.4.9). The Nature Conservancy owns and manages the Choctawhatchee River Delta Preserve at the mouth of the Choctawhatchee River and the Rock Hill Preserve in the upper reaches of the watershed near Chipley (FNAI 2016a, 2016b).

The watershed also includes the Devil's Swamp Mitigation Bank, a privately owned mitigation bank with a service area adjacent to the lower Choctawhatchee River. Devil's Swamp Mitigation Bank consists of hydric pine flatwoods, savannah, mixed forested wetland, cypress swamp, and upland pines that have been heavily altered by planting of slash or sand pine for silviculture (USACE n.d.).

The U.S. Department of Defense (Air Force) also owns and manages over 234,000 acres of property as conservation lands across the watershed. An ongoing land conservation effort named the Northwest Florida Greenway Project was established in 2001 through the partnership of the Economic Development Council (EDC) of Okaloosa County, Eglin AFB, the FDEP, and TNC (EDC 2016). The goal of this project is to protect and sustain existing military land and airspace, promote industry growth, preserve environmental quality and biodiversity, maintain economic viability of timber land, and create additional recreational value (EDC 2016). These goals will be obtained by creating a corridor connecting the Apalachicola National Forest and the region including Eglin AFB WMA, Blackwater River State Forest, and Conecuh National Forest that are already protected (Cooperative Conservation America 2016). The corridor will harbor common, protected, and endemic species, protect future water resources, provide storm buffers, and allow ecological adaptations to potential changes in sea level and rainfall (Blaustein 2008). Through ongoing efforts, the partner organizations and authorities are working to obtain the land necessary for the project's completion.

Another ongoing land conservation effort in the watershed is the Gulf Coastal Plain Ecosystem Partnership, a program for restoring and conserving longleaf pine ecosystems, which currently includes 13 public and private landowners and over 1.25 million acres (The Longleaf Alliance 2016).



Sources: FDEP 2011c; FNAI 2016b; NOAA 2015a; Texas A & M University 2013; USGS 2015, 2016a.

Figure 3-7 Public and Conservation Lands

3.5.2 Critical Habitat Strategic Habitat Conservation Areas (SHCAs)

The Choctawhatchee River and Bay watershed provides critical habitat for numerous rare, endemic, protected and/or species of special concern. The USFWS administers the Endangered Species Act (ESA) of 1973, which provides for the protection of species that are endangered or threatened throughout all or a significant portion of their range, and the conservation of the ecosystems on which they depend. In Florida, the FWC maintains the state list of animals designated as “Federally Designated Endangered or Threatened, State-designated Threatened, or State-designated Species of Special Concern,” in accordance with F.A.C. Rules 68A-27.003 and 68A-27.005, respectively.

The ESA also provides special protection for Critical Habitat of certain species. Critical Habitat is defined as specific geographic area(s) that contain features essential for the conservation of a threatened or endangered species and that may require special management and protection. Critical habitat may include an area that is not currently occupied by the species, but that will be needed for its recovery.

Certain natural areas within the watershed have been identified by the FWC as Strategic Habitat Conservation Areas (SHCAs). These areas are important habitats in Florida that do not have conservation protection and would increase the security of rare and imperiled species if they were protected. Within the Choctawhatchee River and Bay watershed, SHCAs have been identified for several species including the pine barrens frog (*Hyla andersonii*), the Gulf salt marsh snake (*Nerodia clarkii clarkii*), the Cooper’s hawk (*Accipiter cooperii*), the Scott’s seaside sparrow (*Ammodramus maritimus peninsulae*), and the Florida black bear (*Ursus americanus*). Strategic Habitat Conservation Areas occur along the watershed’s streams and tributaries in associated bay swamp, cypress/pine/cabbage palm wetland forests, and mixed forests; in Walton County

When considering what areas to designate as Critical Habitat for a given protected species, the USFWS considers features of the environment that provide the following:

- ✓ Space for individual and population growth and for normal behavior;
- ✓ Cover or shelter;
- ✓ Food, water, air, light, minerals, or other nutritional or physiological requirements;
- ✓ Sites for breeding and rearing offspring; and
- ✓ Habitats that are protected from disturbances or are representative of the historical, geographical, and ecological distributions of a species.

Source: USFWS 2015.

adjacent to the Choctawhatchee Bay near Live Oak Point; and lands adjacent to the Choctawhatchee River WMA (Endries *et al.* 2009).

The Choctawhatchee River and Bay are designated critical habitat for a variety of protected species including the threatened Gulf sturgeon, while many of the watershed's smaller streams are critical habitat for several threatened or endangered species of freshwater muscles. Within the upper reaches of the watershed, critical habitat occurs for the endangered reticulated flatwoods salamander.

The FDACS publishes a list of the protected plants of Florida (Weaver and Anderson 2010). The table in Appendix B provides the list of species that are protected and tracked for the watershed, as well as their habitat requirements.

3.5.3 Aquatic Preserves

The state of Florida currently has 41 aquatic preserves, encompassing approximately 2.2 million acres of submerged lands that are protected for their biological, aesthetic, and scientific value (FDEP 2016f). The Choctawhatchee River and Bay watershed includes one aquatic preserve: the Rocky Bayou Aquatic Preserve, located along the northern edge of Choctawhatchee Bay, which includes 367 acres of submerged lands in Okaloosa County (Florida Department of Natural Resources 1991).

Rocky Bayou receives freshwater input from Rocky Creek, as well as several smaller steephead streams. The bayou itself is a predominately brackish water system supporting a variety of fish and shellfish, while Rocky Creek is home to the federally endangered Okaloosa darter (*Etheostoma okaloosae*). Uplands to the northeast of the preserve are predominantly undeveloped areas associated with Eglin AFB; however, the northwest side of the preserve has been impacted by urban expansion of Niceville.

3.5.4 Outstanding Florida Waters (OFWs)

Of particular interest in the Choctawhatchee River and Bay watershed are waterbodies designated as Outstanding Florida Waters (OFWs). The FDEP designates OFWs (under section 403.061[27], F.S.), which are then approved by the Environmental Regulation Commission. The FDEP defines an OFW as "a water designated worthy of special protection because of its natural attributes." This special designation is applied to certain waters, and is intended to protect existing good water quality (FDEP 2015e). Outstanding Florida Waters within the Choctawhatchee River and Bay watershed include the Choctawhatchee River, Rocky Bayou Aquatic Preserve, and waters within the numerous state parks.

3.5.5 Gulf Ecological Management Sites (GEMS)

The Choctawhatchee River and Bay watershed also includes one designated GEMS, the Rocky Bayou Aquatic Preserve. 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).

4

4.1 Previous SWIM Plan Issues and Priorities

4.2 Progress toward Meeting Plan Goals and Objectives

4.0 Implementation and Achievements of the Previous SWIM Plan

4.1 Previous SWIM Plan Issues and Priorities

The Choctawhatchee River and Bay Watershed SWIM Plan was developed in 1996 to provide a framework and cooperative funding mechanism for the District to work with local governments, state and federal agencies, and private initiatives to address cumulative anthropogenic impacts on water quality and aquatic habitats. The priority issues identified in the plan include the need for improved stormwater treatment, the prevention of NPS pollution, continued improvement in the management and treatment of domestic and industrial wastewater, and habitat protection and restoration. When the plan was updated in 2002, the same issues were identified. The specific management priorities identified include:

- Reduce and minimize pollution from urban stormwater runoff and other NPSs;
- Implement cooperative restoration projects, focused on water quality and aquatic, wetland, and riparian habitats;
- Identify water and sediment quality and trends;
- Maintain historic freshwater inflow to the system;
- Inform residents within the watershed about preservation efforts and personal actions that can be taken to protect and restore watershed resources; and
- Facilitate resource management on a watershed basis, promoting coordination across local jurisdictional and state lines and agency areas of responsibility.

4.2 Progress toward Meeting Plan Goals and Objectives

The 18 projects identified in the 1996 SWIM Plan were carried forward to the 2002 updated plan. As shown in Table 4-1, the District proposed funding for 11 of the projects over the next five years (fiscal years 2001-2002 through 2005-2006) in an amount totaling approximately \$4.4 million.

Table 4-1 2002 SWIM Plan Project Schedule and Cost Estimates

ID	Projects	Fiscal Year Estimates (not necessarily funded)				
		01-02	02-03	03-04	04-05	05-06
	Water Quality					
Q1	Ecological Assessment					
Q2	Shoreline Buffer Zones		\$20,000	\$20,000		
Q3	Land Use/Land-cover Assessment					
Q4	NPS Pollution	\$10,000	\$200,000	\$200,000	\$200,000	\$200,000
Q5	Point Source Assessment					
Q6	Pollution Load Reduction Goals					
Q7	Urban Stormwater	\$250,000	\$600,000	\$500,000	\$500,000	\$500,000
Q8	Urban BMP Demonstration	\$170,000				
Q9	Long-Term Monitoring Plan					
	Biological Resources					
B1	Land Acquisition Assessment		\$15,000	\$15,000	\$15,000	\$15,000
B2	Ecological Restoration	\$250,000	\$100,000	\$100,000	\$100,000	\$100,000
B3	Seagrass Assessment		\$20,000	\$30,000		
B4	Tidal Marsh Assessment				\$20,000	\$20,000
B5	Recreational Impact Assessment					
B6	Erosion Assessment					
	Public Awareness					
P1	Public Awareness	\$35,000	\$25,000	\$25,000	\$25,000	\$25,000
	Coordination					
	Planning and Administration	\$25,000	\$10,000	\$10,000	\$10,000	\$10,000
	Interstate Coordination	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000
	TOTAL					
	Planned Expenditures 02-06	\$750,000	\$1,000,000	\$910,000	\$880,000	\$880,000

Source: NFWFMD 2002

Since the 2002 SWIM Plan, significant progress has been made on addressing a number of the issues and priorities identified. Reflecting the shared responsibility inherent in watershed management, accomplishments should be recognized on the part of numerous watershed stakeholders, including local governments, state and federal agencies, academic institutions, and others. Among the noteworthy accomplishments are:

- Implementation of dedicated plans and programs to retrofit stormwater systems and improve water quality treatment by the cities of Niceville, Fort Walton Beach, and Destin, as well as Okaloosa and Walton counties, and Eglin AFB;
- Implementation of ERP by the District and FDEP;

- Continued development and implementation of water and habitat quality monitoring, restoration, and public awareness programs by the CBA;
- Completion of assessments and implementation of initial projects to address sedimentation from unpaved roads throughout the watershed;
- Implementation of 16 local grant projects with grant funding from the Florida Forever program, including projects to achieve unpaved road sedimentation abatement, stormwater retrofit for water quality improvement, tidal creek restoration, and hydrologic restoration;
- Continued improvements in wastewater treatment and in developing the reuse of reclaimed water; and
- Implementation of habitat restoration projects to include living shoreline and shoreline marsh restoration and wetland restoration.

The District's Consolidated Annual Reports (<http://www.nfwfwater.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.

6

- 6.1 Deepwater Horizon: RESTORE Act, Natural Resource Damage Assessment (NRDA), and NFWF Projects
- 6.2 Water Quality Monitoring
- 6.3 Submerged Aquatic Vegetation (SAV) Monitoring
- 6.4 Water Quality Restoration and Protection Programs

5.0 Related Resource Management Activities

Over the years, management plans and activities in the Choctawhatchee River and Bay watershed have been implemented to eliminate wastewater discharges; reduce the discharges of polluted stormwater from urban and agricultural areas; and protect, preserve, and restore special areas. This section describes historical and ongoing activities and programs to address natural resource issues and water quality problems, including the impacts of the April 20, 2010, Deepwater Horizon explosion and oil spill.

Much of the progress in restoring the watershed is attributable to the District’s success in coordinating local, state, and regional efforts. Many plans and programs share common goals, and their implementation is based on multiple groups cooperating in planning, funding, managing, and executing projects. The District coordinates its efforts with these entities to obtain data, strengthen monitoring activities, and exchange information through periodic meetings. The local, state, and federal organizations and initiatives described in this section demonstrate the District’s leadership in restoring and protecting the watershed.

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

The FDEP is the lead state agency in Florida for responding to the impacts of the Deepwater Horizon oil spill and the resulting restoration process. Restoration projects submitted through FDEP are considered for funding under the Resources and Ecosystems Sustainability, Tourist Opportunities, and

Revived Economies of the Gulf Coast Act (RESTORE Act), the NRDA, and the NFWF.

5.1.1 RESTORE

The RESTORE Act of 2012 allocates to the Gulf Coast Restoration Trust Fund (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 the 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 Treasury, detailing the county's plan to expend funds for a set of publically vetted projects and goals (FDEP 2016g).

Council-selected Projects (“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 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 the Florida Association of Counties. Projects will be submitted by each of the 23 counties on Florida's Gulf Coast.

5.1.2 Natural 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 the 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.

The NRDA Trustees have selected one and possibly two regional projects in Okaloosa and Walton counties (FDEP 2016g). The first is the artificial reef creation and restoration project, which includes development of both deep water “nearshore reefs” within nine nautical miles of shore and shallower “snorkeling reefs” within 950 feet of shore and at depths of less than 20 feet. The second regional project that may be developed in the Choctawhatchee Bay is the scallop enhancement project, which is designed to increase scallop populations for recreational harvests.

In addition to the regional projects, the Trustees have selected two recreational use projects in Okaloosa County (FDEP 2016g). The Norriego Point Restoration and Recreation project (\$10,228,130), located in Destin, will re-establish the recreational opportunities at Norriego Point. The project involves the construction of erosion control structures to dissipate wave energy and protect the fill placed landward of a revetment to restore approximately eight acres of former upland area, as well as the development of two new embayments for swimming and

launching boats and kayaks. The Northwest Florida Estuarine Habitat Restoration, Protection, and Education project (\$4,643,547) on Fort Walton Beach will create an educational and interactive boardwalk that will allow public access to portions of Santa Rosa Sound. The project will also include several small natural resource and habitat enhancement projects, including a 0.1-acre expansion of an existing intertidal oyster reef and an approximately 0.4-acre restoration of a degraded salt marsh.

The Trustees have also selected seven recreational use projects in Walton County (FDEP 2016g). The projects, totaling almost \$1.2 million, include the expansion of public facilities at Deer Lake State Park (\$588,500); boardwalk and dune crossover improvement projects at Ed Walline Beach, Gulfview Heights Beach, and Palms of Dune Allen West Beach (\$386,291); and the extension of the Lafayette Creek boat dock (\$207,850).

5.1.3 National Fish and Wildlife Foundation (NFWF)

The NFWF established the GEBF to administer funds arising from plea agreements that resolve the criminal cases against British Petroleum and Transocean. The FWC and FDEP work directly with the NFWF to identify projects for the state of Florida, in consultation with the USFWS and the NOAA. Over the next five years, 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. 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 the NFWF to consult with state and federal resource agencies in identifying projects. NFWF funded the development of the 2017 SWIM plan updates through the GEBF.

5.1.4 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 the most pressing environmental issues affecting each watershed and solutions that address the issues, regardless of political jurisdiction and funding source.
- Create long term partnerships among stakeholders in each watershed and across the regions to maximize effectiveness of project implementation and funding efforts.

- Provide a screening tool to evaluate the project priorities of these watershed plans for potential RESTORE funding by the communities, FDEP, FWC, NFWF, Mitsui Oil Exploration Company, Ltd. (MOEX) Offshore, and the Gulf Coast Restoration Council (TNC 2014).

The TNC Plan developed for the Choctawhatchee Bay identifies 23 projects to address seven major actions:

- Protect, restore, create and/or manage natural habitat and resources and increase buffer areas;
- Increase cooperation and coordination for management, monitoring, funding, implementation, outreach, 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 the updating of the 2002 Choctawhatchee River and Bay Watershed SWIM Plan—the subject of this report (TNC 2014).

5.2 Water Quality Monitoring

The majority of the monitoring data in the watershed, including chemical and biological data, has been collected by, or for, the FDEP Northwest District staff (FDEP 2006a). Data-gathering activities include working with environmental monitoring staff in the NFWFMD 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 and determination of impairment.

Several on-going water quality monitoring programs in the watershed are conducted by entities such as the NFWFMD; the CBA and Florida LakeWatch; FDEP Surface Water Temporal Variability (SWTV) and Status Networks; FDACS Shellfish Environmental Assessment Section (SEAS); the FDOH Florida Healthy Beaches monitoring program; and Okaloosa County Aqualab.

In the Alabama portion of the watershed, surface water monitoring is conducted by Alabama Water Watch, other volunteer programs, the Geological Survey of Alabama (GSA), and ADEM (ADEM 2014b).

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

5.2.1 FDEP/NFWMD

As part of Florida's SWTV Network, the NFWMD assists the FDEP with the collection of monthly samples from two sites on the Choctawhatchee River, and one on Alaqua Creek, in addition to cyclical sampling to support the FDEP's Status Network. 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. These water quality stations are associated with stream discharge stations, allowing water quality to be correlated with precipitation, runoff, and other environmental conditions (FDEP 2006s).

The FDEP has also developed the Nitrogen Source Inventory and Loading Tool to identify and quantify the major contributing nitrogen sources to groundwater in areas of interest. This GIS- and spreadsheet-based tool provides spatial estimates of the relative contribution of nitrogen from various sources, and takes into consideration the transport pathways and processes affecting the various forms of nitrogen as they move from the land surface through soil and geologic strata that overlie and comprise the Upper Floridan aquifer (FDEP 2016b).

5.2.2 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. Some of this work has been conducted in partnership with Eglin AFB. Biological reconnaissance evaluations have been conducted at 44 stream sites (FDEP 2006a).

The biological data collected by the FDEP Northwest District includes Stream Condition Index ratings, Wetland Condition Index ratings, and Bioassessment data, all of which are reported and accessible in the STORage and RETrieval (STORET) database. The data is also included in the Impaired Surface Waters Rule (IWR) assessments. The most recent assessment IWR (Run 50)

can be found on the FDEP website: <http://www.dep.state.fl.us/water/watersheds/assessment/basin411.htm>.

5.2.3 Florida Department of Agriculture and Consumer Services (FDACS)

To minimize the risk of shellfish-borne illness, the 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 monitors bottom and surface temperature, salinity, DO, surface pH, turbidity, fecal coliform bacteria, water depth, and wind direction and speed at 58 sites in Choctawhatchee Bay. The data set for Choctawhatchee Bay begins in 1987 and continues to the present. County public health units also conduct biweekly monitoring of *enterococcus* and fecal coliform bacteria at 11 estuaries and ten Gulf sites in Okaloosa and Walton counties (FDOH 2005). The FDACS identified three waterbody segments in Choctawhatchee Bay (WBID 778A, 778B, and 778C) as verified impaired for bacteria in the watershed, based on shell fish classifications issued by FDACS (FDEP 2014c).

5.2.4 Florida Department of Health (FDOH)

The Florida Healthy Beaches Program was begun 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). Bay County and Gulf County health departments participate in the program with weekly monitoring of beaches for *enterococcus* and fecal coliform bacteria at seven estuary sites and ten Gulf of Mexico sites. County health departments issue health advisories or warnings when bacterial counts are too high (FDEP 2006a). Beaches that have more than 21 beach closures in a year are classified as "impaired" by FDEP. The FDEP identified nine beach segments as verified impaired for bacteria in the Choctawhatchee River and Bay watershed (see Section 3.2) (FDEP 2014c).

5.2.5 Choctawhatchee Basin Alliance (CBA)

The CBA of Northwest Florida State College was established in 1996. In 1998, the CBA, in cooperation with the FDEP, issued the ecosystem management plan, *Breaking New Ground: Management of the Choctawhatchee River and Bay Watershed* (CBA 1998). This document contains action plans for the following areas of concern: water quality monitoring, point source and NPS pollution, recycling in the watershed, growth management, water supply, and education and involvement. The CBA works with the University of Florida LakeWatch program to monitor water quality for Choctawhatchee Bay, tributaries, and coastal dune lakes.

Working with the University of Florida's Florida LakeWatch, the CBA of Northwest Florida State College is monitoring more than 140 sites in Choctawhatchee Bay, Choctawhatchee River, and Walton County's 15 coastal dune lakes. Parameters monitored at these sites include total nitrogen (TN), total phosphorus (TP), color, *Secchi* depth, and chlorophyll-*a*. Also monitored at the CBA sites are DO, temperature, salinity, turbidity, and pH. The data is entered in the FDEP's statewide water quality database, STORET (CBA 2016b).

5.2.6 Aqualab (Okaloosa County)

The Okaloosa Aqualab, a volunteer water quality monitoring program sponsored by the Okaloosa County Environmental Council, with technical and laboratory assistance provided by the FDEP, collects monthly samples from 28 sites in Choctawhatchee Bay, Destin Harbor, and the GIWW. Parameters monitored include BOD, chlorophyll-*a*, color, nutrients, pH, fixed solids, precipitation, salinity, *Secchi* depth, conductivity, temperature, turbidity, fecal coliform bacteria, wind direction, and velocity. The data is entered in the FDEP's statewide water quality database, STORET, and is summarized in a monthly report (Choctawhatchee Bay Water Quality Report) posted on the FDEP Northwest District website (Okaloosa County Environmental Council 2016).

5.2.7 Alabama Water Watch

Alabama Water Watch helps support the training and coordination of volunteer monitoring initiatives throughout Alabama. Basic parameters monitored include pH, temperature, total alkalinity, total hardness, DO, and turbidity. Additional monitoring of biological parameters is also conducted at some sites. Other monitoring activities in Alabama, including those conducted by the GSA and ADEM, measure a wide array of chemical, biological, and physical parameters, depending on specific program or project purposes (ADEM 2014b).

5.3 Submerged Aquatic Vegetation (SAV) Monitoring

The USGS published a report on the status and trends of seagrasses along the Gulf Coast, including the Choctawhatchee Bay system (Ruth and Handley 2006). Since 2009, the FWC's FWRI has monitored changes in the extent, density, and patchiness of seagrass in Choctawhatchee Bay as part of the statewide SIMM program. The maps are generated through photointerpretation of high-resolution imagery. The FWRI is currently conducting a study to identify the roadblocks to seagrass recovery, which may be different from the causes for the loss of seagrasses. The general status of seagrasses for the watershed is discussed in Section 3.3.1 (FWC 2015b).

5.4 Water Quality Restoration and Protection Programs

Water quality in the Choctawhatchee River and 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 the Florida Forever Work Plan, regional mitigation for state transportation projects, and spring protection and restoration. The following subsections provide an overview of these programs and their contribution to water quality restoration and protection.

5.4.1 Total Maximum Daily Loads (TMDLs)

A TMDL represents the maximum amount of a given pollutant a waterbody can assimilate and still meet water quality standards, including its applicable water quality criteria and designated uses (such as drinking water, recreation, and shellfish harvesting). Total maximum daily loads 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 also identify the reductions in pollutant loading required to restore water quality.

Total maximum daily loads are implemented through the development and adoption of BMAPs that identify the management actions necessary to reduce the pollutant loads. The BMAPs are developed by local stakeholders (public and private) in close coordination with the Water Management Districts and the FDEP. Although water segments with adopted TMDLs are removed from the state's impaired waters list, they remain a high priority for restoration. In the Choctawhatchee River and Bay watershed, the FDEP has adopted five TMDLs for fecal coliform and DO and a statewide TMDL for mercury (in fish tissue) (discussed in Section 3.2). There are no pending or adopted BMAPs in the watershed (FDEP 2016b). Verified impaired waters may be subject to TMDL development in the future.

5.4.2 National Pollutant Discharge Elimination System (NPDES) Permitting

All point sources that discharge to surface waterbodies require a 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 not pose a threat to human health or water 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 2006a):

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

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.

5.4.3 Domestic and Industrial Wastewater Permits

In addition to NPDES-permitted facilities, all of which 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 (FDEP 2006a).

5.4.4 Best Management Practices (BMPs)

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, and 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 FDACS to develop interim measures and agricultural BMPs. The existing authority for BMPs is provided in legislation on Nitrates and Groundwater (Section 576, F.S.), the Lake Okeechobee Protection Program (Section 373.4595, F.S.), Agricultural Water Conservation (Section 570.085, F.S.), and Florida Right to Farm Amendments (Section 823.14, F.S.). While BMPs are adopted by rule, they are voluntary if not covered by regulatory programs. If they are adopted by rule and FDEP verifies their effectiveness, then implementation provides a presumption of compliance with water quality standards, similar to that granted a developer who obtains an environmental resource permit (FDACS 2016).

Over the last several years, FDACS has worked with agriculturists, soil and water conservation entities, the University of Florida's Institute of Food and Agricultural Sciences, and other major interests to improve product marketability and operational efficiency by implementing 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.

Agricultural land use in Bay County is primarily silviculture with some pastures mixed in. Washington, Holmes, and Walton counties include row crop, cattle (beef and dairy), poultry, and other livestock, some nurseries and sod operations, and silviculture. Best management practices have been developed and adopted by rule for silviculture, row crops, container plants, cow/calf, and dairies (FDACS 1993, 2016). A statewide draft BMP for poultry has been developed and adoption is expected by late 2016 (FDACS 2016).

5.4.5 Environmental Resource Permitting (ERP)

Florida established the ERP program to prevent stormwater pollution to Florida's rivers, lakes, and streams, and to help 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 NFWMD and the FDEP.

5.4.6 Regional Mitigation for State Transportation Projects

Under section 373.4137, F.S., the NFWWMD offers mitigation services, as an option, to the FDOT for road projects with unavoidable wetland impacts when the use of private mitigation banks is not feasible. As required by this statute, a regional mitigation plan (a.k.a., Umbrella Plan) has been developed, and is updated annually, to address FDOT mitigation needs submitted to the NFWWMD. Components of the Umbrella Plan include the Sand Hill Lakes Mitigation Bank, which is located in part in the Choctawhatchee River and Bay watershed, the federally permitted “In-Lieu Fee Program” instrument, and other mitigation projects (NFWWMD 2016d). The District’s mitigation plan is developed and implemented in consultation with the FDOT, FDEP, USACE, EPA, USFWS, U.S. National Marine Fisheries Service, and the FWC and is maintained and available for review at: <http://www.nfwmdwetlands.com/>.

Since 1997, the NFWWMD has implemented mitigation at 29 sites, including six sites in the Choctawhatchee River and Bay watershed: Choctawhatchee-Caryville, Devils Swamp, Lafayette Creek, Live Oak Point, Plum Creek, and the Sand Hill Lakes Mitigation Bank (NFWWMD 2016e).

5.4.7 FDEP Ecosystem Restoration Section

The FDEP (through funding from the USFWS Coastal Program and other sources) has identified living shoreline restoration sites within the Choctawhatchee River and Bay watershed to aid in shoreline stabilization, biodiversity, and water quality (FDEP 2015f). Living shorelines are constructed of oyster shells, limestone rock, or other substrate conducive 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 2015f). Current living shoreline projects that have been either completed, or are underway, are located in Niceville (five properties), Freeport (eight properties), La Mar West Condos, Cunningham, Little, and Woodward (FDEP 2015f).

5.4.8 Florida Forever Work Plan

Florida’s conservation and recreation land acquisition program, Florida Forever, is the largest public land acquisition program in the U.S., with more than 718,126 acres of land purchased since the program’s inception in July 2001 (FDEP 2016h). Under Section 373.199, F.S., and the NFWWMD 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 watershed includes significant holding on the approved Florida Forever lands acquisition list including Florida's First Magnitude Springs, Natural Bridge Creek, and South Walton County Ecosystem projects (FDEP 2016h). Florida Forever, as well as its predecessor state funding programs, was a major funding source for the acquisition of the Choctawhatchee River and Holmes Creek WMA described above.

Much of the Choctawhatchee River floodplain is protected as public land. The District has acquired more than 63,000 acres of land along the river, Holmes Creek, and Choctawhatchee Bay to preserve the basin and its ecosystems and to provide for public access and use. Substantial conservation and recreation lands have also been acquired by the state in Walton, Bay, Okaloosa, and Washington counties (NFWWMD 2016g).

The District's priorities for future purchases are concentrated on parcels adjacent to existing District lands, around the river's mouth, designated tributaries such as Holmes Creek, and other projects that can mitigate for wetland impacts associated with FDOT highway construction. Approximately 55,064 acres have been identified for fee simple acquisition on the Choctawhatchee River and Holmes Creek, and 7,000 acres have been identified for possible less than fee acquisition on Holmes Creek (NFWWMD 2016g).

In 2015, voters in the state passed the Florida Land and Water Conservation Amendment (Amendment 1). The amendment funds the Land Acquisition Trust Fund to acquire, restore, improve, and manage conservation lands including wetlands and forests; fish and wildlife habitat; lands protecting water resources and drinking water sources, including the Everglades, and the water quality of rivers, lakes, and streams; beaches and shores; outdoor recreational lands; working farms and ranches; and historic or geologic sites, by dedicating 33 percent of net revenues from the existing excise tax on documents for 20 years. In 2016, the Florida Legislature appropriated \$15 million to Florida Forever for conservation easements and increasing water supplies.

5.4.9 Minimum Flows and Levels (MFLs)

Section 373.042, F.S., requires each water management district to develop MFLs for specific surface waters and groundwater systems within their jurisdiction. The MFLs for a given waterbody is the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area. Minimum flows and 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. (NFWWMD 2016h).

Establishment of an MFL involves a series of steps ranging from identification of priority waterbodies to the adoption of FDEP rules codifying each MFL. 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 levels below an adopted MFL.

The technical evaluation for each MFL is expected to require approximately five years of data collection and analysis. Data collection has begun and will occur concurrently for several waterbodies. Starting in 2018, one MFL assessment is expected to be completed annually within the NFWWMD. Within the Choctawhatchee River and Bay watershed the Floridan Aquifer Coastal Region II is scheduled for development in 2020 (NFWWMD 2016h).

5.4.10 Spring Protection and Restoration

In 1999, the Secretary of FDEP formed a multiagency Florida Springs Task Force to recommend strategies for protecting and restoring Florida's springs. The Task Force was composed of a group of 16 that included scientists, planners, and other citizens. Its recommendations included action steps for research and monitoring, education, and assistance with BMPs for landowners. In November 2002, the Florida Department of Community Affairs and FDEP published *Protecting Florida's Springs: Land Use Planning Strategies and Best Management Practices*. This manual was based on the recommendations developed by the Florida Springs Task Force.

In 2001, the legislature first approved funding for the Florida Springs Initiative, an effort to understand more about the water quality and quantity of over 30 first-magnitude springs throughout north and central Florida. The FDEP requested the assistance of the Northwest Florida, Suwannee River, and Southwest Florida Water Management Districts to help collect and interpret water quality and discharge data from first-magnitude springs within district boundaries. This effort includes activities such as sample collection and analysis, the delineation of spring recharge areas, the development of a groundwater monitoring network, and projects to help landowners reduce nutrient loading in spring recharge areas.

In 2005, the NFWWMD completed a spring inventory in the Choctawhatchee River and Bay watershed. Although the basin was included in the Florida Bureau of Geology (now the FGS) Bulletin 31 *Springs of Florida* (revised, 1977), local sources and the experience of NFWWMD and FGS staff indicated the presence of many more springs discharging to the Choctawhatchee River or its tributaries. The inventory determined there are at least 13 Floridan aquifer springs located in the watershed and possibly more that might be identified under lower stage conditions (NFWWMD 2005).

In 2016, the Florida legislature passed the Legacy Florida Act and appropriated \$50 million for springs restoration and protection, which is anticipated to result in significant benefits for this and other watersheds around the state.

5.4.11 Natural Resource Management at Eglin AFB

The U.S. Air Force owns a total of 234,381 acres of conservation lands within the Choctawhatchee River and Bay watershed (FNAI 2016b). Eglin AFB, located on the Choctawhatchee Bay, is the largest forested military reservation in the U.S. and provides habitat for 106 rare and endangered species including animals such as the red-cockaded woodpecker and reticulated flatwoods salamander, as well as 55 state-listed plant species. The AFB spans 40 miles of Choctawhatchee Bay shore line and 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 watershed's 36 FNAI recognized natural communities (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.

404,000 acres of Eglin AFB are managed under the Base's Integrated Natural Resources Management Plan (INRMP), which is updated every five years and is signed by Eglin, the FWC, and the USFWS (Secretary of Defense 2013). Additionally, the Jackson Guard maintains an interactive web-based INRMP 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 INRMP Erosion Control Component Plan. Other ongoing initiatives at the base include fish and wildlife management, invasive species control and pest management, and forest management using prescribed fires and other BMPs (Secretary of Defense 2013).

5.4.12 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" (UF-IFAS 2016a).

Many UF-IFAS programs and partnerships help protect water resources across the Choctawhatchee River and 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, the Sea Grant, and the Shellfish Aquaculture Extension among others (UF-IFAS 2016a).

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.

5.4.13 Planning and Coordination within Alabama

The Choctawhatchee-Pea-Yellow Rivers Clean Water Partnership is part of the statewide river basin management initiative called the Alabama Clean Water Partnership, a coalition of public and private individuals, companies, organizations and governing bodies working together to protect and preserve water resources and aquatic ecosystems throughout the state and in the shared watersheds of neighboring states. The partnership, established in 2001, is sponsored by the Choctawhatchee, Pea, and Yellow Rivers Watershed Management Authority. Together, they developed the Choctawhatchee-Pea-Yellow Rivers Watershed Management Plan in 2006 (Alabama Clean Water Partnership [ACWP] 2006). The Authority developed a manual of recommended practices for maintenance and service of unpaved roads, and the Center for Environmental Research and Service at Troy State University facilitated education and training for local government officials and others concerning control of sediment from unpaved roads and other sources. The ADEM has conducted sub-watershed assessments in the Choctawhatchee–Pea River watershed and has developed TMDLs for sub-basins in Alabama considered impaired under Alabama water quality guidelines. Additional monitoring is being conducted by Alabama Water Watch and other volunteer organizations (ADEM 2016c).

5.4.14 County and City Initiatives

Okaloosa County has completed a stormwater master plan for both incorporated and unincorporated areas countywide. The City of Niceville has developed a stormwater master plan, as has the City of Destin. These local plans are coordinated with the county’s plan. Both cities and the county have implemented multiple stormwater retrofit projects to restore water quality and reduce environmental impacts. Walton County has a stormwater master plan that emphasizes Choctawhatchee Bay and the coastal dune lakes.

5.4.15 Other Programs and Actions

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 Choctawhatchee River and Bay watershed. Most organizations have a specific geographic focus at either the watershed or waterbody level. Identified groups and their activities are as follows:

- **Coastal Dune Lakes Advisory Board** – The Walton County Board of County Commissioners created the Coastal Dune Lakes Advisory Board in 2002.. In 2008, the county developed a management plan and manual to guide the Advisory Board and County Commissioners on protecting the 15 coastal dune lakes in the county (Hoyer and Canfield 2008). The protections include a Coastal Dune Lakes Protection Zone that encompasses all lands within an area beginning at the mean or ordinary high water line of the coastal dune lakes and their tributaries and extending 300 feet landward (Walton County 2012).
- **Gulf Coastal Plain Ecosystem Partnership** – The Gulf Coastal Plain Ecosystem Partnership is a voluntary partnership between ten private and public land owners in western Florida and includes the following governmental, business, and environmental interests: the U.S. Department of Defense, FDEP, Florida Division of Forestry, International Paper, Conecuh National Forest (in Alabama), Nokuse Plantation, NFWFMD, National Park Service, FWC, and TNC. The parties operate together under a 1996 Memorandum of Understanding for the management of about one million acres of northwest Florida and south Alabama (Albrecht 2006). The partnership provides a collaborative approach to the 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 (Long Leaf Alliance 2016).

- **Choctawhatchee Basin Alliance** - The CBA, discussed in Section 6.2, is also involved in ongoing restoration, outreach, and education efforts within the watershed CBA has conducted shoreline habitat demonstration projects around the bay to demonstrate the value and feasibility of establishing native shoreline vegetation.

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Appendix A Geology and Soils in the Choctawhatchee River and Bay Watershed

The Choctawhatchee River and Bay watershed encompasses two localized physiographic regions in Florida: the Northern Highlands and the Gulf Coastal Lowlands. Both physiographic regions exhibit unique geology and soils. The watershed follows much of the general stratigraphy of the western Florida Panhandle. Relic marine terraces characteristic of the watershed have been formed through erosion by marine currents and waves during sea level fluctuations, as well as through down-cutting by freshwater streams. Younger fluvial systems create incised stream valleys and ravines on the older sediments, often exposing deeper-lying limestone formations.

Near-surface formations include dolomitic limestones, sandy-clayey limestones, and finally, shell beds, clayey sands, and sands (Scott 2001; USDA 1975, 1979, 1989, 1995, 2014). Well-drained sandy soils that develop in the watershed's surface strata offer opportunities for development, while the Quaternary sands along the coast attract millions of visitors to the watershed's beaches and barrier islands each year.

Within Florida's portion of the watershed, the northern extent of the basin is underlain by the Miocene Alum Bluff group and Citronelle formations. Sediment of the Alum Bluff is generally composed of quartz sands, clays, and shell beds typical of a shallow water marine environment, and is generally covered by the younger Citronelle formation, unless the Citronelle sediments has been locally eroded. Deposits of the Citronelle formation range from clay through gravel, but sands are the most common size fraction. The deposits are commonly cross-bedded, lenticular, graveliferous sands with thin to thick discontinuous beds of clay and varying amounts of silt that can weakly indurate the sediment. Overlying most geologic formations in the watershed are unconsolidated Holocene siliciclastic sediments (nearly pure quartz sands with minor heavy mineral sands) (Scott 2001; USDA 1975, 1979, 1989, 1995, 2014). These sands were deposited during sea level fluctuations prior to the permanent land emergence of the Florida plateau during the Miocene epoch (23.3 to 5.3 million years ago) (Brown 2009). There are isolated exposures of Eocene-aged Ocala Limestone in the northern reaches of the Choctawhatchee River, as well as Wrights Creek near the Alabama border. Younger limestone outcrops occur along Holmes Creek. The Oligocene and Eocene formations, especially the Ocala Limestone, are typically massive, fossiliferous limestones, generally with well-developed secondary porosity and a greater ability to transmit water. These sediments are marine in origin and are primarily comprised of fossils that include foraminifera, mollusks, and echinoids (Green *et al.* 2002).

Soils are an important natural resource across the Choctawhatchee River and Bay watershed. They provide some of the best farming in Florida, protect water quality by intercepting runoff, store soil organic carbon, and help mitigate flooding. The following soils are found in the Florida portion of the Choctawhatchee River and Bay 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 Choctawhatchee River and Bay watershed, the majority of ultisols are found in upland areas and adjacent to the Choctawhatchee Bay where the landscape has been relatively stable over recent geologic time (Collins 2010). Ultisols are the primary agricultural soils of the watershed, as their high clay content contributes to nutrient and water retention, when properly managed.

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 occur in the upland portion of the watershed near Mossy Head and on the coast's barrier islands where surficial processes are active and parent materials have not undergone substantial weathering (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 occur near the Choctawhatchee Bay and older portions of the barrier peninsulas and barrier islands (Collins 2010). In these areas, the landscape is more stable and conducive to soil development. The presence of spodosols 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 near the Choctawhatchee Bay, the floodplain along the Choctawhatchee River, and on portions of the watershed's barrier peninsulas and barrier islands (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, faster 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 can be found along the Choctawhatchee River, its tributaries to the east, and throughout the Choctawhatchee River Water Management Area, which buffers the Choctawhatchee River throughout the watershed. Histosols cover approximately 15,943 square kilometers 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 (CO₂) and methane.

Sources: Collins 2010; Kolka *et. al.* 2016; USDA 2014; Vasques *et. al.* 2010.

Appendix B Threatened and Endangered Species within the Watershed

The Choctawhatchee River and Bay watershed 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 2016c; USFWS 2016):

Plants:

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
<i>Andropogon arctatus</i>	Pinewood Bluestem	S3	T	N	Lacustrine: wet pine flatwoods, seepage wetlands, bogs, wet pine savannas
<i>Asclepias viridula</i>	Green Milkweed	S2	T	N	Palustrine: wet prairie, seepage slope edges Riverine: seepage stream banks Terrestrial: mesic flatwoods, drainage ditches
<i>Asplenium verecundum</i>	Delicate Spleenwort	S1	E	N	Terrestrial: rockland hammocks, limestone outcrops, grottoes, and sinkholes.
<i>Aster hemisphericus</i>	Aster	S1	E	N	Terrestrial: upland mixed forest, on sandstone outcrop
<i>Aster spinulosus</i>	Pinewoods Aster	S1	E	N	Palustrine: seepage slope Terrestrial: sandhill, scrub and mesic flatwoods
<i>Baptisia megacarpa</i>	Apalachicola Wild Indigo	S2	E	N	Palustrine: floodplain forest Terrestrial: upland mixed forest, slope forest

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
<i>Bigelovia nuttallii</i>	Nuttall's Rayless Goldenrod	S1	E	N	Riverine: seepage stream banks Terrestrial: scrub, upland pine forest - sandstone outcrops
<i>Brickellia cordifolia</i>	Flyer's Nemesis	S1	E	N	Terrestrial: upland hardwood forest, near streams
<i>Sideroxylon lycioides</i>	Buckthorn	N	E	N	Palustrine: bottomland forest, dome swamp, floodplain forest Terrestrial: upland hardwood forest
<i>Sideroxylon thornei</i>	Thorn's Buckthorn	N	E	N	Palustrine: hydric hammock, floodplain swamp
<i>Arnoglossum diversifolia</i>	Indian-plantain	N	T	N	Palustrine: forested wetland
<i>Calamintha dentata</i>	Toothed Savory	S3	T	N	Terrestrial: longleaf pine-deciduous oak sandhills, planted pine plantations, sand, open and abandoned fields, and roadsides
<i>Calamovilfa curtissii</i>	Curtiss's Sandgrass	S3	T	N	Palustrine: mesic and wet flatwoods, wet prairie, depression marsh Terrestrial: mesic flatwoods
<i>Callirhoe papaver</i>	Poppy Mallow	S2	E	N	Terrestrial: upland mixed forest, roadsides; edge or understory
<i>Calycanthus floridus</i>	Sweetshrub	S2	E	N	Terrestrial: upland hardwood forest, slope forest, bluffs Palustrine: bottomland forest, stream banks, floodplains
<i>Calystegia catesbaeiana</i>	Catesby's Bindweed	SH	E	N	Terrestrial: Longleaf pine-wiregrass sandhill.

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
<i>Carex baltzellii</i>	Baltzell's Sedge	S3	T	N	Terrestrial: slope forest, moist sandy loam; moist sandy loam
<i>Cheilanthes microphylla</i>	Southern Lip Fern	S3	E	N	Terrestrial: upland mixed forest, shell mound, rockland hammock; on limestone
<i>Chrysopsis cruseana</i>	Cruise's Goldenaster	S2	E	N	Terrestrial: coastal dunes, coastal strand, coastal grassland; openings and blowouts
<i>Chrysopsis godfreyi</i>	Godfry's Goldenaster	S2	E	N	Terrestrial: grassland/herbaceous, sand/dune, shrubland/chaparral
<i>Cleistes divaricata</i>	Spreading Pogonia	N	T	N	Palustrine: wet flatwoods
<i>Coelorachis tuberculosa</i>	Florida Jointail	S3	T	N	Lacustrine: shallow water Palustrine: herbaceous wetland, temporary pool
<i>Coreopsis integrifolia</i>	Fringeleaf Tickseed	S1	E	N	Lacustrine: forested wetland, riparian
<i>Cornus alternifolia</i>	Pagoda Dogwood	S2	E	N	Palustrine: creek swamps Terrestrial: slope forest, upland hardwood forest, bluffs
<i>Crataegus phaenopyrum</i>	Washington Hawthorn	S1	E	N	Palustrine: basin swamp, basin marsh, edges of wet areas
<i>Cryptotaenia canadensis</i>	Honewort	S1	E	N	Palustrine: floodplain forest, bottomland forest Riverine: alluvial stream bank
<i>Cuphea aspera</i>	Tropical Waxweed	S1	E	N	Palustrine: wet prairie, seepage slope Terrestrial: mesic flatwoods

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
<i>Dirca palustris</i>	Leatherwood	S2	E	N	Terrestrial: shrub
<i>Drosera filiformis</i>	Threadleaf Sundew	S1	E	N	Lacustrine: exposed lake bottoms
<i>Drosera intermedia</i>	Water Sundew	S3	T	N	Lacustrine: sinkhole lake edges Palustrine: seepage slope, wet flatwoods, depression marsh Riverine: seepage stream banks, drainage ditches
<i>Eriocaulon nigrobacteatum</i>	Darkheaded Hatpins	S1	E	N	Palustrine: wet boggy seepage slopes, mucky soils
<i>Euphorbia commutata</i>	Wood Spurge	S2	E	N	N/A
<i>Forestiera godfreyi</i>	Godfrey's Swamp Privet	S2	E	N	Terrestrial: forest-hardwood, on wooded slopes of lake & river bluffs
<i>Gentiana pennelliana</i>	Wiregrass Gentian	S3	E	N	Palustrine: seepage slope, wet prairie, roadside ditches Terrestrial: mesic flatwoods, planted slash pine
<i>Hexastylis arifolia</i>	Heartleaf Wild Ginger	S3	T	N	Riverine: seepage stream bank Terrestrial: slope forest
<i>Hymenocallis henryae</i>	Henry's Spiderlilly	S2	E	N	Palustrine: dome swamp edges, wet prairie, wet flatwoods, baygall edges, swamp edges Terrestrial: wet prairies and flatwoods

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
<i>Hypericum lissophloeus</i>	Smoothbark St. John's-wort	S2	E	N	Lacustrine: sandhill upland lake margins Terrestrial: sandhill margins
<i>Ilex amelanchier</i>	Serviceberry Holly	S2	T	N	N/A
<i>Isotria verticillata</i>	Whorled Pogonia	S1	E	N	Terrestrial: sloped forest
<i>Juncus gymnocarpus</i>	Coville's Rush	S2	E	N	N/A
<i>Justicia crassifolia</i>	Thickleaved Waterwillow	S2	E	N	Palustrine: dome swamp, seepage slope Terrestrial: mesic flatwoods
<i>Kalmia latifolia</i>	Mountain Laurel	S3	T	N	Riverine: seepage stream bank Terrestrial: slope forest, seepage stream banks
<i>Lachnocaulon digynum</i>	Panhandle Bog Buttons	S3	T	N	Riverine: pool Palustrine: bog/fen, forested wetland
<i>Liatris provincialis</i>	Godfrey's Gayfeather	S2	E	N	Terrestrial: sandhill, scrub, coastal grassland; disturbed areas
<i>Lilium catesbaei</i>	Catesby Lily	N	T	N	Palustrine: wet prairie, wet flatwoods, seepage slope Terrestrial: mesic flatwoods, seepage slope; usually with grasses
<i>Lilium michauxii</i>	Carolina Lily	S2	E	N	N/A
<i>Linum westii</i>	West's Flax	S2	E	N	Palustrine: dome swamp, depression marsh, wet flatwoods, wet prairie, pond margins

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
<i>Lupinus westianus</i>	Gulf Coast Lupine	S2	T	N	Terrestrial: beach dune, scrub, disturbed areas, roadsides, blowouts in dunes
<i>Macranthera flammea</i>	Hummingbird Flower	S2	E	N	Palustrine: seepage slope, dome swamp edges, floodplain swamps Riverine: seepage stream banks Terrestrial: seepage slopes
<i>Magnolia ashei</i>	Ashe's Magnolia	S2	E	N	Terrestrial: slope and upland hardwood forest, ravines
<i>Magnolia pyramidata</i>	Pyramid Magnolia	S3	E	N	Terrestrial: slope forest
<i>Malaxis uniflora</i>	Green Addersmouth	S3	E	N	Palustrine: floodplain forest Terrestrial: slope forest, upland mixed forest
<i>Malus angustifolia</i>	Southern Crabapple	N	T	N	N/A
<i>Marshallia obovata</i>	Barbara's Buttons	S1	E	N	Terrestrial: sandhill, upland mixed forest
<i>Marshallia ramosa</i>	Barbara's Buttons	S1	E	N	Terrestrial: upland pine forest, with wiregrass
<i>Matelea alabamensis</i>	Alabama Spinypod	S2	E	N	Terrestrial: bluff, slope forest, upland hardwood forest; on slopes
<i>Matelea baldwiniana</i>	Baldwin's Spinypod	S1	E	N	Terrestrial: bluff, upland mixed forest, bottomland forest, roadsides; calcareous soil
<i>Matelea flavidula</i>	Yellowflower ed Spinypod	S1	E	N	Terrestrial: moist, nutrient-rich forests , wooded slopes

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
<i>Myriophyllum laxum</i>	Piedmont Water-milfoil	S3	N	N	Riverine: creek, pool, spring/spring brook Palustrine: riparian, temporary pool
<i>Nyssa ursina</i>	Bog Tupelo	S2	N	N	Open bogs, wet flatwoods, and swamps, often with titi
<i>Oxypolis greenmanii</i>	Giant Water-dropwort	S3	E	N	Palustrine: dome swamp, wet flatwoods, ditches: in water
<i>Pachysandra procumbens</i>	Allegheny Spurge	S1	E	N	Terrestrial: upland mixed forest, bluff; calcareous soil
<i>Panicum nudicaule</i>	Naked-stemmed Panicgrass	S3	LT	N	N/A
<i>Paronychia chartacea</i>	Papery Whitlow-wort	S1	E	T	Terrestrial: karst sandhill lake margins
<i>Pellaea atropurpurea</i>	Hairy Cliff-brake Fern	S1	E	N	Terrestrial: upland glade
<i>Phoebanthus tenuifolius</i>	Narrowleaf Phoebanthus	S3	LT	N	Terrestrial: sandy pinelands
<i>Physocarpus opulifolius</i>	Ninebark	S1	E	N	Riverine: seepage stream banks
<i>Pinckneya bracteata</i>	Fever Tree	N	T	N	Palustrine: creek swamps, titi swamps, bogs
<i>Pinguicula ionantha</i>	Panhandle Butterwort	S2	E	T	Palustrine: wet flatwoods, wet prairie, bog; in shallow water Riverine: seepage slope; in shallow water. Also, roadside ditches and similar habitat
<i>Pinguicula lutea</i>	Yellow Butterwort	N	T	N	Palustrine: flatwoods, bogs

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
<i>Pinguicula planifolia</i>	Swamp Butterwort	N	T	N	Palustrine: wet flatwoods, seepage slopes, bog, dome swamp, ditches; in water
<i>Pinguicula primuliflora</i>	Primrose-flowered Butterwort	S3	E	N	Palustrine: bogs, pond margins, margins of spring runs
<i>Platanthera blephariglottis</i>	Whitefringed Orchid	N	T	N	N/A
<i>Platanthera ciliaris</i>	Yellowfringed Orchid	N	T	N	Palustrine: bogs, wet flatwoods Terrestrial: bluff
<i>Platanthera clavellata</i>	Green Rein Orchid	SH	E	N	Lacustrine: seepages, springs (usually wooded); shrub borders of acid bogs; swamp woods; creek floodplains; occasionally open fens; and in the northern or mountainous part of its range, seepage slopes or sunlit stream beds, disturbed sites, such as abandoned quarries, roadbanks, ditches, and sandy-acid mine tailings
<i>Platanthera integra</i>	Orange Rein Orchid	S3	E	N	Palustrine: wet prairie, seepage slope Terrestrial: mesic flatwoods
<i>Plantanthera nivea</i>	Snowy Orchid	N	T	N	Palustrine: bogs
<i>Podophyllum peltatum</i>	Mayapple	S1	E	N	Terrestrial: mesic hardwood forests, dry-mesic oak-hickory forests
<i>Polygonella macrophylla</i>	Largeleaf jointweed	S2	T	N	Terrestrial: scrub, sand pine/oak scrub ridges

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
<i>Polymnia laevigata</i>	Tennessee Leaf-cup	S1	E	N	Terrestrial: rich wooded slopes in light to dense shade of mixed mesophytic woods
<i>Quercus arkansana</i>	Arkansas Oak	S3	T	N	Terrestrial: Sandy or sandy clay uplands or upper ravine slopes near heads of streams in deciduous woods.
<i>Rhexia parviflora</i>	Apalachicola Meadowbeauty	S2	E	N	Palustrine: dome swamp margin, seepage slope, depression marsh; on slopes; with hypericum
<i>Rhexia salicifolia</i>	Panhandle Meadowbeauty	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
<i>Rhododendron austrinum</i>	Florida Flame Azalea	S3	E	N	Lacustrine: shaded ravines & in wet bottomlands on rises of sandy alluvium or older terraces.
<i>Rhododendron chapmanii</i>	Chapman's Rhododendron	S1	E	E	Palustrine: seepage slope (titi bog) Terrestrial: mesic flatwoods; ecotone between flatwoods or more xeric longleaf communities and titi bogs
<i>Rhynchospora crinipes</i>	Hairypeduncled Beakrush	S1	N	N	Riverine: stream and riversides on narrow streamside shelves, sand-clay bars, and occasionally rooted in streambeds
<i>Rudbeckia nitida</i>	St. John's Susan	S2	E	N	Palustrine: wet flatwoods and prairies, roadside ditches

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
<i>Ruellia noctiflora</i>	Nightflowering Ruellia	S2	E	N	Lacustrine: moist to wet coastal pinelands, bogs, low meadows, open pine savannahs
<i>Salix eriocephala</i>	Hearleaved Willow	S1	E	N	Palustrine: floodplain swamp, alluvial woodlands
<i>Salvia urticifolia</i>	Nettle-leaved Sage	S1	E	N	Terrestrial: upland glade
<i>Sarracenia leucophylla</i>	Whitetop Pitcher Plant	S3	E	N	Palustrine: wet prairie, seepage slope, baygall edges, ditches
<i>Sarracenia psitticina</i>	Parrot Pitcher Plant	N	T	N	Palustrine: wet flatwoods, wet prairie, seepage slope
<i>Sarracenia purpurea</i>	Decumbent Pitcher Plant	N	T	N	Palustrine: bogs
<i>Sarracenia rubra</i>	Sweet Pitcher Plant	S3	N	LT	Palustrine: bog, wet prairie, seepage slope, wet flatwoods Riverine: seepage stream banks
<i>Scutellaria floridana</i>	Florida Skullcap	S1	E	T	Palustrine: seepage slope, wet flatwoods, grassy openings Terrestrial: mesic flatwoods
<i>Silene virginica</i>	Fire Pink	S1	E	N	N/A
<i>Spigelia gentianoides</i>	Gentian Pinkroot	S1	E	E	Terrestrial: mixed hardwood forest; rich humus
<i>Spiranthes laciniata</i>	Lace-lip Ladies'-tresses	N	T	N	Palustrine: wet flatwoods
<i>Stachydeoma graveolens</i>	Mock Pennyroyal	S2	E	N	Palustrine: forested wetland Terrestrial: forest edge, forest/woodland, savanna, woodland - conifer

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
<i>Stewartia malacodendron</i>	Silky Camelia	S3	E	N	Palustrine: baygall Terrestrial: slope forest, upland mixed forest; acid soils
<i>Trillium lancifolium</i>	Narrowleaf Trillium	S2	E	N	Palustrine: bottomland forest Terrestrial: upland mixed forest, slope forest
<i>Verbesina chapmanii</i>	Chapman's Crownbeard	S3	T	N	Palustrine: seepage slope Terrestrial: mesic flatwoods with wiregrass
<i>Xanthorhiza simplicissima</i>	Yellowroot	S1	E	N	Riverine: seepage stream; sandy banks
<i>Xyris isoetifolia</i>	Quillwort Yelloweyed Grass	S1	E	N	Lacustrine: sandhill upland lake margins Palustrine: wet flatwoods, wet prairie
<i>Xyris longisepala</i>	Kral's Yelloweyed Grass	S2	E	N	Lacustrine: sandhill upland lake margins
<i>Xyris stricta var. obscura</i>	Pineland Yelloweyed Grass	S1	N	N	N/A
<i>Xyris scabrifolia</i>	Harper's Yelloweyed Grass	S3	T	N	Palustrine: seepage slope, wet prairie, bogs

Animals:

Scientific Name	Common Name	Regulatory Designations			Natural Communities
		FNAI	State	Federal	
Invertebrates					
<i>Caecidotea sp. 8</i>	Econfina Springs Cave Isopod	S1	N	N	N/A
<i>Dasyscias franzi</i>	Shaggy Ghostsnail	S1	N	N	N/A
<i>Medionidus penincillatus</i>	Gulf Moccasinshell	S2	N	LE	Riverine: medium-sized creeks to large rivers with sand and gravel substrates in slow to moderated currents.
<i>Panopea bitruncata</i>	Atlantic Geoduck	S3?	N	N	N/A
<i>Pleurobrema pyriforme</i>	Oval Pigtoe	S?	N	LE	Riverine: medium-sized creeks to small rivers; various substrates; slow to moderate currents.
Fish					
<i>Acipenser oxyrhyncus desotoi</i>	Gulf Sturgeon	S2	SSC	T	Estuarine: various Marine: various habitats Riverine: alluvial and blackwater streams

<i>Scientific Name</i>	Common Name	Regulatory Designations			Natural Communities
		FNAI	State	Federal	
<i>Ameiurus serracanthus</i>	Spotted Bullhead	S3	N	N	Riverine: deep holes of small to medium rivers with slow to swift currents and rock substrates or sand bottoms; it also occurs over mud bottoms, typically near stumps, in impoundments
<i>Atractosteus spatula</i>	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
Amphibians					
<i>Ambystoma bishopi</i>	Reticulated Flatwoods Salamander	S2S3	N	T	Lacustrine: shallow water Palustrine: forested wetland, herbaceous wetland, riparian, scrub-shrub wetland, temporary pool Terrestrial: forest - conifer, forest/woodland, savanna, woodland - conifer
<i>Ambystoma cingulatum</i>	Flatwoods Salamander	S2S3	N	T	Lacustrine: shallow water Palustrine: forested wetland, herbaceous wetland, riparian, scrub-shrub wetland, temporary pool Terrestrial: forest - conifer, forest/woodland, savanna, woodland - conifer
<i>Rana capito</i>	Gopher Frog	S3	SSC	N	Terrestrial; sandhill, scrub, scrubby flatwoods, xeric hammock (reproduces in ephemeral wetlands within these communities)

Scientific Name	Common Name	Regulatory Designations			Natural Communities
		FNAI	State	Federal	
Reptiles					
<i>Alligator mississippiensis</i>	American Alligator	S4	SSC	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
<i>Caretta caretta</i>	Atlantic Loggerhead Turtle	S3	T	T	Terrestrial: sandy beaches; nesting
<i>Chelonia mydas</i>	Atlantic Green Turtle	S2	E	E	Terrestrial: sandy beaches; nesting
<i>Crotalis adamanteus</i>	Eastern Diamondback Rattlesnake	S3	N	N	Palustrine: riparian Terrestrial: grassland/herbaceous, old field, savanna, shrubland/chaparral, woodland - conifer, woodland - hardwood, woodland - mixed
<i>Dermochelys coriacea</i>	Leatherback Turtle	S2	T	T	Terrestrial: sandy beaches; nesting
<i>Drymarchon orias couperi</i>	Eastern Indigo Snake	S3	T	T	Estuarine: tidal swamp Palustrine: hydric hammock, wet flatwoods Terrestrial: mesic flatwoods, upland pine forest, sandhills, scrub, scrubby flatwoods, rockland hammock, ruderal
<i>Gopher polyphemus</i>	Gopher Tortoise	S3	SSC	N	Terrestrial: sandhills, scrub, scrubby flatwoods, xeric hammocks, coastal strand, ruderal

Scientific Name	Common Name	Regulatory Designations			Natural Communities
		FNAI	State	Federal	
<i>Graptomys barbouri</i>	Barbour's Map Turtle	S2	SSC	N	Palustrine: floodplain stream, floodplain swamp Riverine: alluvial stream
<i>Lepidochelys kempii</i>	Kemp's Ridley	S1	E	E	Terrestrial: sandy beaches; nesting
<i>Macrolemys temminckii</i>	Alligator Snapping Turtle	S3	SSC	N	Estuarine: tidal marsh Lacustrine: river floodplain lake, swamp lake Riverine: alluvial stream, blackwater stream
<i>Nerodiaclarkii clarkii</i>	Gulf Salt Marsh Snake	S3?	N	N	Estuarine: herbaceous wetland, scrub-shrub wetland
<i>Pituophis melanoleucas</i>	Florida Pine Snake	S3	SSC	N	Lacustrine: ruderal, sandhill upland lake Terrestrial: sandhill, scrubby flatwoods, xeric hammock, ruderal
Birds					
<i>Ammodramus maritimus peninsulae</i>	Scott's Seaside Sparrow	S2	SSC	N	N/A
<i>Aramus guarauna</i>	Limpkin	S3	SSC	N	Estuarine: scrub-shrub wetland Palustrine: forested wetland, herbaceous wetland, riparian
<i>Charadrius alexandrius</i>	Snowy Plover	S2	LT	N	Estuarine: exposed unconsolidated substrate Marine: exposed unconsolidated substrate Terrestrial: dunes, sandy beaches, and inlet areas.

Scientific Name	Common Name	Regulatory Designations			Natural Communities
		FNAI	State	Federal	
<i>Charadrius melodus</i>	Piping Plover	S2	T	T	Estuarine: exposed unconsolidated substrate Marine: exposed unconsolidated substrate Terrestrial: dunes, sandy beaches, and inlet areas. Mostly wintering and migrants.
<i>Cistothorus Palustris marianae</i>	Marian's Marsh Wren	S3	SSC	N	N/A
<i>Egretta caerulea</i>	Little Blue Heron	S4	SSC	N	Estuarine: herbaceous wetland, lagoon, scrub-shrub wetland, tidal flat/shore Riverine: low gradient Lacustrine: shallow water Palustrine: forested wetland, herbaceous wetland, riparian, scrub-shrub wetland
<i>Egretta rufescens</i>	Reddish Egret	S2	SSC	N	Estuarine: tidal swamp, depression marsh, bog, marl prairie, wet prairie Lacustrine: flatwoods/prairie lake, marsh lake Marine: tidal swamp
<i>Egretta thula</i>	Snowy Egret	S3	SSC	N	Estuarine: bay/sound, herbaceous wetland, lagoon, river mouth/tidal river, scrub-shrub wetland, tidal flat/shore Riverine: low gradient Lacustrine: shallow water Palustrine: forested wetland, herbaceous wetland, riparian

Scientific Name	Common Name	Regulatory Designations			Natural Communities
		FNAI	State	Federal	
<i>Egretta tricolor</i>	Tricolored Heron	S4	SSC	N	Estuarine: bay/sound, herbaceous wetland, lagoon, river mouth/tidal river, scrub-shrub wetland, tidal flat/shore Riverine: low gradient Lacustrine: shallow water Palustrine: forested wetland, herbaceous wetland, riparian
<i>Eudocimus albus</i>	White Ibis	S4	SSC	N	Estuarine: bay/sound, herbaceous wetland, lagoon, river mouth/tidal river, scrub-shrub wetland, tidal flat/shore Riverine: low gradient Lacustrine: shallow water Palustrine: forested wetland, herbaceous wetland, riparian
<i>Falco peregrinus</i>	Peregrine Falcon	S2	E	N	Marine: aerial Estuarine: aerial, bay/sound, herbaceous wetland, lagoon, river mouth/tidal river, tidal flat/shore Riverine: aerial Lacustrine: aerial Palustrine: aerial, herbaceous wetland, riparian Terrestrial: cliff, desert, shrubland/chaparral, tundra, urban/edificarian, woodland - conifer, woodland - hardwood, woodland - mixed
<i>Falco sparverius paulus</i>	Southeastern American Kestrel	S3	T	N	Estuarine: various habitats Palustrine: various habitats Terrestrial: open pine forests, clearings, ruderal, various

Scientific Name	Common Name	Regulatory Designations			Natural Communities
		FNAI	State	Federal	
<i>Haematopus palliatus</i>	American Oystercatcher	S2	SSC	N	Estuarine: tidal flat/shore Terrestrial: bare rock/talus/scree, sand/dune
<i>Haliaeetus leucocephala</i>	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
<i>Myctera americana</i>	Wood Stork	S2	E	E	Estuarine: marshes Lacustrine: floodplain lakes, marshes (feeding), various Palustrine: marshes, swamps, various
<i>Pandion haliaetus</i>	Osprey	S3S4	SSC	N	Marine: near shore Estuarine: bay/sound, herbaceous wetland, lagoon, river mouth/tidal river Riverine: big river, medium river Lacustrine: deep water, shallow water Palustrine: forested wetland, riparian Terrestrial: cliff
<i>Picoides borealis</i>	Red-cockaded Woodpecker	S2	T	E	Terrestrial: mature pine forests

Scientific Name	Common Name	Regulatory Designations			Natural Communities
		FNAI	State	Federal	
<i>Rhynchops niger</i>	Black Skimmer	S3	SSC	N	Marine: near shore Estuarine: bay/sound, herbaceous wetland, lagoon, river mouth/tidal river, tidal flat/shore Riverine: big river, low gradient Lacustrine: deep water, Shallow water Palustrine: riparian Terrestrial: sand/dune
<i>Sterna antillarum</i>	Least Tern	S3	T	N	Estuarine: various Lacustrine various Riverine: various Terrestrial: beach dune, ruderal. Nests common on rooftops
<i>Sterna maxima</i>	Royal Tern	S3	N	N	Marine: near shore Estuarine: bay/sound, lagoon, river mouth/tidal river, tidal flat/shore Terrestrial: sand/dune
<i>Sterna sandvicensis</i>	Sandwich Tern	S2	N	N	Marine: near shore Estuarine: bay/sound, lagoon, river mouth/tidal river, tidal flat/shore Terrestrial: sand/dune
Mammals					
<i>Mustela frenata olivacea</i>	Southeastern Weasel	S3	N	N	Palustrine: forested wetland, riparian Terrestrial: forest - hardwood, old field, woodland - conifer, woodland - hardwood, woodland - mixed
<i>Myotis grisescens</i>	Gray Bat	S1	E	E	Palustrine: caves, various Terrestrial: caves, various
<i>Myotis sodalis</i>	Indiana bat	SA	E	E	Palustrine: various Terrestrial: various

<i>Scientific Name</i>	Common Name	Regulatory Designations			Natural Communities
		FNAI	State	Federal	
<i>Peromyscus polionotus allophrys</i>	Choctawhatchee Beach Mouse	S1	E	E	Terrestrial: beach dune, coastal scrub
<i>Peromyscus polionotus peninsularis</i>	St. Andrews Beach Mouse	S1	E	N	Terrestrial: beach dune, coastal scrub
<i>Sciurus niger shermani</i>	Sherman's Fox Squirrel	S3	SSC	N	Terrestrial: woodland - conifer, woodland - mixed
<i>Trichechus manatus</i>	West Indian Manatee	S2	E	E	Estuarine: submerged vegetation, open water Marine: open water, submerged vegetation
<i>Ursus americanus floridanus</i>	Florida Black Bear	S2	N	N	Palustrine: forested wetland, riparian Terrestrial: forest - hardwood, forest - mixed

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

Appendix C 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 36 unique natural communities recognized by the FNAI within Florida’s portion of the Choctawhatchee River and 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 NFWFMD, as well as the 2004-2013 Statewide Land Use Land Cover datasets created by the five 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 some 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 can be found on the Gulf beaches of Walton County (Blue Mountain Beach) and the north shore of Choctawhatchee Bay along Highway 98.
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 (<i>Ambystoma cingulatum</i>), the reticulated flatwoods salamander (<i>Ambystoma bishop</i>) the red-cockaded woodpecker (<i>Leuconotopicus borealis</i>), 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).

<p>Sandhill</p>	<p>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 (<i>Pinus palustris</i>), turkey oak (<i>Quercus laevis</i>), and wiregrass (<i>Aristida stricta</i> var. <i>beyrichiana</i>). 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. Conservation lands at Eglin AFB (Santa Rosa, Okaloosa, and Walton counties) host exemplary sandhill communities (FNAI 2010).</p>
<p>Scrub</p>	<p>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 (<i>Ceratiola ericoides</i>), and sand pine (<i>Pinus clausa</i>), 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. Within the Choctawhatchee River and Bay watershed, exemplary scrub community can be found at Topsail Hill State Park (Walton County) (FNAI 2010).</p>
<p>Scrubby Flatwoods</p>	<p>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 (<i>Podomys floridanus</i>), Florida scrub-jay (<i>Aphelocoma coerulescens</i>) (peninsular Florida only), gopher tortoise (<i>Gopherus polyphemus</i>), the Florida gopher frog (<i>Rana capito</i>), goldenaster (<i>Chrysopsis floridana</i>), and large-plumed beaksedge (<i>Rhynchospora megaplumosa</i>) (FNAI 2010).</p>
<p>Terrestrial Caves</p>	<p>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).</p>

<p>Upland Hardwood Forests</p>	<p>Upland hardwood forests are described as having a well-developed, closed-canopy dominated by deciduous hardwood trees such as southern magnolia (<i>Magnolia grandiflora</i>), pignut hickory (<i>Carya glabra</i>), sweetgum (<i>Liquidambar styraciflua</i>), Florida maple (<i>Acer saccharum ssp. floridanum</i>), live oak (<i>Quercus virginiana</i>), American beech (<i>Fagus grandifolia</i>), white oak (<i>Q. alba</i>), and spruce pine (<i>Pinus glabra</i>), 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 upland portions of the watershed (FNAI 2010).</p>
<p>Wet Flatwoods</p>	<p>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 (<i>Ursus americanus floridanus</i>) as well as a host of rare and endemic plant species (FNAI 2010). Good examples of this community type can be found in the Point Washington State Forest and many other areas within the watershed.</p>
<p>Xeric Hammock</p>	<p>Xeric hammock is an evergreen forest typically dominated by sand live oak (<i>Quercus geminata</i>), 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 (<i>Rana capito</i>), gopher tortoise (<i>Gopherus polyphemus</i>), eastern diamondback rattlesnake (<i>Crotalus adamanteus</i>), and the Florida pine snake (<i>Pituophismelanoleucus mugitus</i>). Xeric hammock is most common in the central peninsula and is less common north of the Cody Scarp where clay-rich soils create mesic conditions. Conservation lands at Eglin AFB (Santa Rosa, Okaloosa, and Walton counties) host exemplary xeric hammock communities (FNAI 2010).</p>

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 of which 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 Ridely, and leatherback sea turtles. Gulf Islands National Seashore (Okaloosa County) and Topsail Hill State Park (Walton County) host exemplary dune beach communities (FNAI 2010).
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 Choctawhatchee beach mouse (<i>Peromyscus polionotus allophrys</i>) - 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. In the Choctawhatchee River and Bay watershed, Gulf Islands National Seashore (Okaloosa County) and Topsail Hill State Park (Walton County) host exemplary coastal grassland communities (FNAI 2010).
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 exists in relatively small, remnant pockets within the watershed and in one large private parcel in the Seacrest area.

<p>Maritime Hammock</p>	<p>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). This community type can be found on the seaward side of old dune ridges in the city of Destin and extensively in the Camp Helen State Park.</p>
<p>Shell Mounds</p>	<p>Shell mounds are relics of generations of Native Americans who lived along the Florida coast and discarded clams, oysters, whelks, and other shells in small hills. These mounds of shell support an assemblage of calciphilic (calcium loving) plant species. Originally, there were many such shell mounds along coastal lagoons and near the mouths of rivers; however, due to the higher elevation and use of shell as construction material, undisturbed shell mounds are presently very rare. When found, they are surrounded by and restricted to salt marshes. Shell mounds are dispersed along the coast throughout Florida, including the Florida panhandle. The Fort Walton Temple Mound located in Fort Walton Beach (Walton County) is evidence that Native Americans inhabited the coastal Choctawhatchee River and Bay watershed, and as a result, the coastline is likely spotted with associated shell mound ecological communities (FNAI 2010).</p>
<p>Transitional and Wetland Communities</p>	
<p>Basin Marsh</p>	<p>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 head 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 (<i>Panicum hemitomon</i>), sawgrass (<i>Cladium sp.</i>), bulltongue arrowhead (<i>Sagittaria lancifolia</i>), pickerelweed (<i>Pontederia cordata</i>), and cordgrass (<i>Spartina sp.</i>) (FNAI 2010).</p>

<p>Basin Swamp</p>	<p>Basin swamp is a wetland vegetated with hydrophytic trees, commonly including pond cypress (<i>Taxodium ascendens</i>) and swamp tupelo (<i>Nyssa sylvatica</i> var. <i>biflora</i>) 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).</p>
<p>Baygall</p>	<p>Baygall is an evergreen-forested wetland dominated by bay species including loblolly bay (<i>Gordonia lasianthus</i>), sweetbay (<i>Magnolia virginiana</i>), and/or swamp bay (<i>Persea palustris</i>). 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).</p>
<p>Bog</p>	<p>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. This community type can be found on Eglin AFB as well as in north Walton County.</p>
<p>Coastal Interdunal Swales</p>	<p>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 (<i>Cladium</i> sp.), hairawn muhly (<i>Muhlenbergia capillaris</i>), broomsedge (<i>Andropogon virginicus</i>), seashore paspalum (<i>Paspalum vaginatum</i>), sand cordgrass (<i>Spartina bakeri</i>), and saltmeadow cordgrass (<i>Spartina patens</i>). For example, hurricanes and large storm events can flood swales with salt water, after which they become colonized, often temporarily, by more salt-tolerant species. Salt water intrusion and increased sand movement after storm events can reset successional processes of interdunal swale communities. Within the watershed, the Gulf Islands National Seashore (Okaloosa County) supports exemplary coastal interdunal swale communities (FNAI 2010).</p>

Dome Swamp	<p>Dome swamp is an isolated, forested, and usually small depression wetland consisting of predominantly pond cypress (<i>Taxodium ascendens</i>) and/or swamp tupelo (<i>Nyssa sylvatica</i> var. <i>biflora</i>). 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. Exemplary dome swamp communities can be found throughout conservation lands of the Eglin AFB (FNAI 2010).</p>
Hydric Hammock	<p>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). Good examples of this community type can be found in the Coffeen Nature Preserve located between Sandestin and Topsail Hill Preserve State Park within the watershed.</p>

<p>Floodplain Swamp</p>	<p>Floodplain swamp is a closed-canopy forest community of hydrophytic trees such as bald cypress (<i>Taxodium distichum</i>), water tupelo (<i>Nyssa aquatica</i>), swamp tupelo (<i>N. sylvatica</i> var. <i>biflora</i>), or ogeechee tupelo (<i>N. ogeche</i>). 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 throughout Florida’s river systems including the Choctawhatchee River and Holmes Creek, which support exemplary floodplain swamps.</p>
<p>Seepage Slope</p>	<p>Seepage slope is an open, grass sedge-dominated community consisting of wiregrass, toothache grass, pitcherplants, plumed beaksedge, flattened pipewort, and woolly huckleberry. 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. The conservation lands of Eglin AFB (Brier Creek; Okaloosa County) host exemplary seepage slope communities (FNAI 2010).</p>
<p>Wet Prairie</p>	<p>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).</p>

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 and, 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.

Coastal Dune Lakes

Coastal dune lakes are naturally-formed fresh water basins that exhibit cyclical hydrology through intermittent connectivity to sources of salt water. Consequently, coastal dune lakes are known to have a high biodiversity, with species characteristic of fresh, estuarine, and marine environments. Coastal dune lakes (listed in Section 2.3) provide an important stopover point for migrating neo-tropical birds and are popular recreation spots for the coastlines' residents and frequent visitors. These rare lakes have withstood natural processes such as hurricanes, droughts, and land subsidence, and have been identified as imperiled by the Florida Natural Areas Inventory due to their global rarity. Coastal dune lakes (listed in section 2.3 for the watershed) are extremely vulnerable to hydrological manipulations such as excessive withdrawals of ground water that could lower the water table, as well as saltwater intrusion. Groundwater pollution, especially chemical pollution from the surrounding coastal communities, could significantly alter the nutrient balance and produce devastating effects on the fauna and flora (FNAI 2010).

Sandhill Upland Lakes

Sandhill upland lakes are shallow-rounded solution depressions in sandy upland communities that lack significant surface inflows or outflows. Instead, water is largely derived from lateral ground water seepage and/or from artesian sources connected with the underlying limestone aquifer. Sandhill upland lakes are generally permanent water bodies, although water levels may fluctuate substantially. Vegetation is largely restricted to a narrow band along the shore, and may include hydrophytic grasses and herbs or a dense shrub thicket, depending on fire frequency and water fluctuations. Sandhill upland lakes are extremely vulnerable to hydrological manipulations such as excessive groundwater withdrawals that could lower the regional water table. Additionally, groundwater pollution can significantly alter the nutrient balance of sandhill upland lakes, causing significant damage to flora and fauna. Furthermore, chemical pollution in sandhill lakes can result in groundwater contamination because they often function as aquifer recharge areas (FNAI 2010). The northern portion of the Choctawhatchee River and Bay watershed (Walton and Washington counties) consists of the Sand Hill Lakes region, as well as Spring Lake, which are good examples of sandhill upland lakes.

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), but are also found on Eglin AFB as well as Deer Lake State Park.

<p>Sinkhole Lakes</p>	<p>Sinkhole lakes typically form in deep, funnel-shaped depressions in limestone bedrock and are moderately widespread in the karst regions of the Florida Panhandle. Sinkhole depressions are geologic features which are relatively permanent; however, water levels may fluctuate dramatically due to hydrologic connectivity with the aquifer. Sinkhole lakes are characterized by clear, alkaline water with high concentrations of calcium, bicarbonate, and magnesium. The vegetation in some sinkhole lakes is absent or limited to a narrow fringe of emergent species at the edge of the water, while other sinkhole lakes are completely covered by floating vegetation. Sinkhole Lakes are considered endangered in Florida due to the threat of erosion which destroys the surrounding vegetation and pollutes the aquifer with which these lakes are closely connected (FNAI 2010). Sinkhole lakes are rather rare in the Choctawhatchee River and Bay watershed.</p>
<p>Spring-run Streams</p>	<p>Spring-run streams generally have sandy or limestone bottoms and derive most of their water from artesian openings to the underlying aquifer, making their waters clear, circumneutral, mineral-rich, and cool. These conditions are highly conducive for plant growth, thus, spring-run streams are extremely productive aquatic habitats. Good examples in the watershed are listed and described in Section 2.3. Agricultural, residential, and industrial pollutants that enter the groundwater may infiltrate the deep aquifer that feeds a Spring-run stream. Herbicides applied to control aquatic plant growth are particularly detrimental because they can induce eutrophication in spring run streams. Overuse and misuse of spring-run streams from recreation is also a threat to this unique community (FNAI 2010).</p>
<p>Estuarine and Marine Communities</p>	
<p>Salt Marsh</p>	<p>Salt marsh is a largely herbaceous tidal zone community commonly consisting of saltmarsh cordgrass (<i>Spartina alterniflora</i>), which dominates the seaward edge, and needle rush (<i>Juncus roemerianus</i>), 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.</p>

<p>Seagrass Beds</p>	<p>Seagrass beds consist of expansive stands of submerged aquatic vascular plants including turtlegrass (<i>Thalassia testudinum</i>), manateeegrass (<i>Syringodium filiforme</i>), and shoalweed (<i>Halodule wrightii</i>), 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 (<i>Cynoscion nebulosus</i>), spot (<i>Micropogonias undulates</i>), sheepshead, (<i>Archosargus probatocephalus</i>), and redfish (<i>Sciaenops ocellatus</i>). Pollution, particularly sedimentation and wastewater/sewage, have led to the widespread loss of seagrasses in nearly every bay in the Florida Panhandle (FNAI 2010).</p>
<p>Oyster/Mollusk Reef</p>	<p>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 (<i>Crassostrea virginica</i>) 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). However, higher levels of toxins and bacteria can contaminate and close areas for commercial harvest and human consumption.</p>
<p>Unconsolidated (Marine) Substrate</p>	<p>Unconsolidated (marine) substrate consists of coralgall, 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-dissolved oxygen (DO) levels, as well as the accumulation of metals, oils, and pesticides in the sediment (FNAI 2010).</p>

Source: FNAI 2010.

Appendix D 2016 FDEP Verified Impaired Waterbody Segments in the Choctawhatchee River and 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 Clean Water Act (CWA) (EPA 2016a). The following table provides a list of 2016 FDEP designated and impaired waters in the Choctawhatchee River and Bay watershed.

Waterbody Segment ID	Water Segment Name	County	Waterbody Class¹	Parameters Assessed Using the Impaired Waters Rule (IWR)
49B	Choctawhatchee River	Walton, Washington	3F	Iron
49F	Choctawhatchee River	Holmes	3F	Iron
54	Choctawhatchee River Wrights Creek	Holmes	3F	Iron
59D	Choctawhatchee River Holmes Creek (Lower)	Walton, Washington	3F	Nutrients (Algal Mats)
80	Choctawhatchee River Little Creek	Holmes	3F	Fecal Coliform
94	Choctawhatchee River Limestone Branch	Holmes	3F	Iron
337	Choctawhatchee River Flat Creek	Washington	3F	Fecal Coliform
348Z	Choctawhatchee River Cypress Springs	Washington	3F	Nutrients (Nitrate-Nitrite)

Waterbody Segment ID	Water Segment Name	County	Waterbody Class¹	Parameters Assessed Using the Impaired Waters Rule (IWR)
351	Choctawhatchee Bay Alaqua Creek	Walton	3F	Fecal Coliform
495A	Choctawhatchee Bay Turkey Creek	Okaloosa	3F	Iron
692	Choctawhatchee Bay Boggy Bayou	Okaloosa	3M	Nutrients (Total Nitrogen)
692	Choctawhatchee Bay Boggy Bayou	Okaloosa	3M	Nutrients (Chlorophyll-a)
722	Choctawhatchee Bay Rocky Bayou	Okaloosa	2	Nutrients (Total Nitrogen)
731	Choctawhatchee Bay Alaqua Bayou	Walton	3M	Nutrients (Chlorophyll-a)
751	Choctawhatchee Bay Eagle Creek	Walton	2	Fecal Coliform
778A	Choctawhatchee Bay Lower Segment	Okaloosa	2	Nutrients (Total Nitrogen)
778A	Choctawhatchee Bay Lower Segment	Okaloosa	2	Nutrients (Total Phosphorous)
778AD	Choctawhatchee Bay Clement E. Taylor Park	Okaloosa	3M	Bacteria (Beach Advisories)
778B	Choctawhatchee Bay Middle Segment 1	Okaloosa	2	Nutrients (Chlorophyll-a)
778B	Choctawhatchee Bay Middle Segment 1	Okaloosa	2	Nutrients (Total Nitrogen)
778C	Choctawhatchee Bay Middle Segment 2	Walton	2	Fecal Coliform
778C	Choctawhatchee Bay Middle Segment 2	Okaloosa, Walton	2	Nutrients (Total Nitrogen)

Waterbody Segment ID	Water Segment Name	County	Waterbody Class¹	Parameters Assessed Using the Impaired Waters Rule (IWR)
778D	Choctawhatchee Bay Upper Segment	Walton	2	Dissolved Oxygen (Percent Saturation)
778D	Choctawhatchee Bay Upper Segment	Walton	2	Nutrients (Chlorophyll-a)
778D	Choctawhatchee Bay Upper Segment	Walton	2	Nutrients (Total Nitrogen)
786A	Choctawhatchee Bay Bass Lake	Okaloosa	3F	Dissolved Oxygen (Percent Saturation)
786A	Choctawhatchee Bay Bass Lake	Okaloosa	3F	Nutrients (Total Nitrogen)
8008B	Choctawhatchee Bay Henderson Park Beach	Okaloosa	3M	Bacteria (Beach Advisories)
8009A	Choctawhatchee Bay Dune Allen Beach	Walton	3M	Bacteria (Beach Advisories)
8010A	Choctawhatchee Bay Blue Mountain Beach	Walton	3M	Bacteria (Beach Advisories)
8010B	Choctawhatchee Bay Grayton Beach	Walton	3M	Bacteria (Beach Advisories)
8010C	Choctawhatchee Bay Holley Street Beach	Walton	3M	Bacteria (Beach Advisories)
881A	Choctawhatchee Bay Direct Runoff to Bay	Walton	2	Fecal Coliform
881A	Choctawhatchee Bay Direct Runoff to Bay	Walton	2	Fecal Coliform (3)

Waterbody Segment ID	Water Segment Name	County	Waterbody Class¹	Parameters Assessed Using the Impaired Waters Rule (IWR)
937	Choctawhatchee Bay Mack Bayou	Walton	2	Fecal Coliform

Sources: FDEP 2014c; ADEM 2014a.

Notes:

* = new Florida listings since 2006

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

Appendix E Conservation Lands Within Florida’s Portion of the Choctawhatchee River and Bay Watershed

Within Florida’s portion of the Choctawhatchee River and Bay watershed there are approximately 376,632 acres of conservation lands including 236,126 acres of federally-owned lands, 135,534 acres of state-owned lands, 207 acres of locally-owned lands, and 4,765 acres of privately owned lands, many of which are managed by public entities. Nine conservation lands within the Choctawhatchee River and Bay watershed span multiple counties, and several extend into other watersheds. The details of these conservation lands are presented in the following table:

Conservation Land	Managing Agency	County(ies)	Description	Website	Acreage Within Watershed
Federal					
Air Force Special Operations Command, Hurlburt Field	U.S. Dept. of Defense, Air Force	Okaloosa	The Hurlburt Field is dominated by mesic flatwoods and floodplain swamp. It supports a large population of reticulated flatwoods salamanders.		207
Eglin Air Force Base	US Dept. of Defense, Air Force	Escambia, Okaloosa, Santa Rosa, Walton	This WMA is managed in cooperation with the FWC and the U.S. Air Force, covering land in Santa Rosa, Okaloosa, and Walton counties.		234174

Conservation Land	Managing Agency	County(ies)	Description	Website	Acreage Within Watershed
Gulf Islands National Seashore	US 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.	http://www.nps.gov	40
M. C. Davis Conservation Easement	US Dept. of Agriculture, Forest Service	Walton	This conservation easement is a privately owned easement with no public access that is managed by the USDA Forest Service, and is located adjacent to the M. C. Davis - Seven Runs Creek Conservation Easement.	http://www.fs.usda.gov/fnst	1,705
State					
Bruner Bay Tract	Undesignated State Land (not currently assigned to a managing agency)	Washington	The Bruner Bay Tract was formerly managed by FDACS, Division of Forestry.		44

Conservation Land	Managing Agency	County(ies)	Description	Website	Acreage Within Watershed
Choctawhatchee River Tract	Undesignated State Land (not currently assigned to a managing agency)	Walton, Washington	Surrounded by NFWMD land, this tract is completely within the floodplain of the Choctawhatchee River. The Choctawhatchee River Tract was formerly managed by FDACS, Division of Forestry.		227
Choctawhatchee River Water Management Area	Northwest Florida Water Management District	Bay, Holmes, Walton, Washington	The NFWMD owns land along the Choctawhatchee River and Holmes Creek. This land provides habitat for a variety of wildlife including several protected species. The river itself serves as a breeding and migratory area for Alligator Gar and Gulf Sturgeon.	http://www.nfwwater.com/	62641
Econfina Creek Water Management Area	Northwest Florida Water Management District	Bay, Jackson, Washington	Econfina Creek and its surrounding forests are found on an unusual collection of geographic features such as bluffs, deep ravines, and springs giving it an unusually high diversity of rare plants and animals.	http://www.nfwwater.com/	2216
Eden Gardens State Park	FL Dept. of Environmental Protection, Div. of Recreation and Parks	Walton	This park includes the historic Wesley homestead land and the historic Wesley House, a renovated two-story building.	http://www.floridastateparks.org/	161

Conservation Land	Managing Agency	County(ies)	Description	Website	Acreage Within Watershed
Falling Waters State Park	FL Dept. of Environmental Protection, Div. of Recreation and Parks	Washington	Falling Waters State Park includes a cylindrical, smooth-walled sink, 100' deep by 15' wide, with an underground cavern. Natural communities include hardwood hammock and longleaf pine forest with wiregrass.	http://www.florida.stateparks.org/	166
Flatwoods Salamander Critical Habitat Conservation Easement	FL Dept. of Environmental Protection, Northwest District	Walton	This is a regulatory conservation easement within the USFWS critical habitat unit (CHU RFS 6A) for the reticulated flatwoods salamander.		208
Fred Gannon Rocky Bayou State Park	FL Dept. of Environmental Protection, Div. of Recreation and Parks	Okaloosa	Fred Gannon Rocky Bayou State Park is popular for boating and fishing and includes a tract of old-growth long-leaf pine trees.	http://www.florida.stateparks.org/	344
Glover Conservation Easement	Northwest Florida Water Management District	Washington	The Glover Conservation Easement is a privately owned easement on Holmes Creek that is privately owned but managed by the NFWMD. No public access.	http://www.nfwwater.com/	1136

Conservation Land	Managing Agency	County(ies)	Description	Website	Acreage Within Watershed
Grayton Beach State Park	FL Dept. of Environmental Protection, Div. of Recreation and Parks	Walton	Grayton Beach State Park features beach and lake access, boat ramps, fishing, and other water recreation and includes coastal forests of scrub oaks, magnolias, and pine flatwoods.	http://www.florida.stateparks.org/	757
Haddock Conservation Easement	Northwest Florida Water Management District	Washington	The Haddock Conservation Easement is a privately owned easement with no public access that is managed by the NFWMD. It is located along the upper reaches of Holmes Creek north of Vernon.	http://www.nfwmd.com/	337
Henderson Beach State Park	FL Dept. of Environmental Protection, Div. of Recreation and Parks	Okaloosa	Includes 6,000 feet of natural shoreline along the Gulf of Mexico, sand pines, scrub oaks, and dune rosemary. Recreational activities include nature trails, camp sites, boardwalks over habitat, and beach access.	http://www.florida.stateparks.org/	217

Conservation Land	Managing Agency	County(ies)	Description	Website	Acreage Within Watershed
Holmes Creek Tract	Undesignated State Land (not currently assigned to a managing agency)	Washington	Holmes Creek Tract, formerly managed by FL DACS, Division of Forestry, is currently owned by Trustees of the Internal Improvement Trust Fund and is located along Holmes Creek, upstream of the town of Vernon.		39
Intrawest Sandestin Company Conservation Easement	FL Dept. of Environmental Protection, Northwest District	Walton	This conservation easement is a privately owned easement with no public access that is managed by the NFWMD. It is located along Little Black Creek, east of Freeport near the Nokuse Plantation Conservation Easements.		1016
Loblolly Tract	Undesignated State Land (not currently assigned to a managing agency)	Washington	The Loblolly Tract, formerly managed by FL DACS, Division of Forestry, is currently owned by Trustees of the Internal Improvement Trust Fund and is located adjacent to the southwestern portion of the Haddock Conservation Easement.		38

Conservation Land	Managing Agency	County(ies)	Description	Website	Acreage Within Watershed
M. C. Davis - Seven Runs Creek Conservation Easement	FL Dept. of Environmental Protection, Div. of State Lands	Walton	This conservation easement is a privately owned easement with no public access that is managed by the FDEP Division of State Lands. The M. C. Davis - Seven Runs Creek Conservation Easement is located northeast of Freeport.	http://www.dep.state.fl.us/lands	21,228
Nokuse Plantation Conservation Easements	FL Dept. of Environmental Protection, Div. of State Lands	Walton, Washington	The largest private conservation project east of the Mississippi River, established in 2000 to preserve, protect, and restore natural landscape. The goal of this private land is to restore and preserve ecosystems that support native plants and animals (both common and endemic).	http://www.dep.state.fl.us/lands	18,884
Pine Log State Forest	FL Dept. of Agriculture and Consumer Services, Florida Forest Service	Bay, Washington	Includes forest managed for timber, wildlife, outdoor recreation, and ecological restoration.	http://www.floridaforests.com/index.html	6,871
Point Washington State Forest	FL Dept. of Agriculture and Consumer Services, Florida Forest Service	Walton	Made up of 10 natural communities, numerous plants and wildlife species, and outdoor recreational activities.	http://www.floridaforests.com/index.html	12,431

Conservation Land	Managing Agency	County(ies)	Description	Website	Acreage Within Watershed
Ponce de Leon Springs State Park	FL Dept. of Environmental Protection, Div. of Recreation and Parks	Holmes, Walton	Includes the Ponce de Leon Springs that are consistently 68°F, and is fed by a convergence of underground water flows. Recreational activities include hiking nature trails, swimming in the springs, and fishing.	http://www.florida.stateparks.org/	381
Seven Runs Creek Conservation Easement	FL Dept. of Environmental Protection, Div. of State Lands	Walton	The Seven Runs Creek Conservation Easement is a privately owned easement with no public access that is managed by the FDEP. The easement is located adjacent to the Choctawhatchee River Water Management Area.	http://www.dep.state.fl.us/lands	1,103
Topsail Hill Preserve State Park	FL Dept. of Environmental Protection, Div. of Recreation and Parks	Walton	Includes 3.2 miles of beaches with dunes, dune lakes, old-growth long-leaf pine, sand pine scrub, and wetlands. Recreational activities include water use, camping, and nature trails	http://www.florida.stateparks.org/	1,619

Conservation Land	Managing Agency	County(ies)	Description	Website	Acreage Within Watershed
TPL Seven Runs Creek Conservation Easement	FL Dept. of Environmental Protection, Div. of State Lands	Walton	The TPL Seven Runs Creek Conservation Easement is a privately owned easement with no public access that is managed by the FDEP. The easement is located adjacent to the Choctawhatchee River Water Management Area.	http://www.dep.state.fl.us/lands	2,334
Tupelo Tract	Undesignated State Land (not currently assigned to a managing agency)	Washington	The Tupelo Tract, formerly managed by FL DACS, Division of Forestry, is currently owned by Trustees of the Internal Improvement Trust Fund and is located adjacent to the Haddock Conservation Easement.		41
Walton Conservation Easement	Northwest Florida Water Management District	Walton	The Walton Conservation Easement is a privately owned easement with no public access that is managed by the NFWMD. It is located north of Freeport adjacent to the M. C. Davis - Seven Runs Creek Conservation Easement.	http://www.nfwwater.com/	1,094

Conservation Land	Managing Agency	County(ies)	Description	Website	Acreage Within Watershed
White Conservation Easement	Northwest Florida Water Management District	Washington	The White Conservation Easement is a privately owned easement with no public access that is managed by the NFWFMD. The easement is surrounded by Choctawhatchee River Water Management Area lands.	http://www.nfwwater.com/	1
Local					
Stallworth Lake Preserve	Walton County	Walton	The Stallworth Lake Preserve includes undeveloped beachfront property adjacent to Topsail Hill Preserve State Park. This site provides habitat for the Federally endangered Choctawhatchee beach mouse.	http://www.beachesofsouthwalton.com/todo_nature.aspx	2
Morrison Springs Recreational Facility	Walton County	Walton	The Morrison Springs Recreational Facility consists of spring surrounded by mature cypress trees and floodplain forest; upland areas consist of planted pine.	http://www.beachesofsouthwalton.com/todo_nature.aspx	199

Conservation Land	Managing Agency	County(ies)	Description	Website	Acreage Within Watershed
Grayton Dunes Park	Walton County	Walton	The park is a beach access that is undeveloped except for a boardwalk with an observation deck. The dunes are marked off, but vehicles are allowed on the beach. Western Lake, on the eastern edge of the park, opens periodically and exchanges water with the Gulf. The beach may provide nesting habitat for loggerhead sea turtles.		6
Private					
Rock Hill Preserve	The Nature Conservancy	Washington	Well-known by botanists and geologists, the sandstone outcroppings on this preserve are the only ones known in Florida. They support plants and lichens typically found in more northern areas and that are unusual or endemic to Florida.	http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/florida/index.htm	367
Sandhill Lakes Conservation Easement	Nokuse Plantation, Inc.	Walton	This conservation easement protects a series of sandhill lakes adjacent to Nokuse Plantation.	http://www.nokuse.org	130

Conservation Land	Managing Agency	County(ies)	Description	Website	Acreage Within Watershed
Beulah A. Laidlaw Preserve	Bay County Audubon Society, Inc.	Washington	Beulah A. Laidlaw Preserve is primarily comprised of wooded hills grading into cypress wetlands.	http://www.baycountyaudubon.org/	272
Coffeen Nature Preserve	Coffeen Land Trust	Walton	Coffeen Nature Preserve is a privately owned dune lake system; including hydric hammock, scrub, scrubby flatwoods, wet flatwoods, mesic flatwoods and beach dunes.		218
Devils Swamp Mitigation Bank	The St. Joe Company	Bay, Walton	This land is a mitigation bank to serve the Devil’s Swamp basin within the USACE Regional General Permit and FDEP’s Ecosystem Management Agreement, owned by the St. Joe Company.	http://www.joe.com/	620
Choctawhatchee River Delta Preserve	The Nature Conservancy	Walton	Part of the Gulf Coastal Plain Ecosystem Partnership (GCPEP) partnership lands, the Choctawhatchee River Delta Preserve is funded by the State Wildlife Grants Program under Florida’s Wildlife Legacy Initiative.	http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/florida/index.htm	3157

Sources: FNAI 2016a, 2016b; Florida Division of Recreation and Parks 2016a, 2016b, 2016c, 2016d, 2016e, 2016f 2016g; Gulf of Mexico Foundation 2015; Nokuse Preserve 2016; St. Joe Company 2016.

Appendix F Projects Funded by the National Fish and Wildlife Foundation in the Choctawhatchee River and Bay Watershed

NFWF established the GEBF to administer funds arising from plea agreements that resolve the criminal cases against British Petroleum and Transocean. The FWC and FDEP work directly with the NFWF to identify projects for the state of Florida, in consultation with the USFWS and the NOAA. Over the next five years, GEBF will receive a total of \$356 million for the following natural resource projects in Florida.

Project	Description
Projects within Choctawhatchee River and Bay watershed	
Boggy Bayou Watershed Water Quality Improvement (City of Niceville, Florida, \$4,223,000)	Elements of the project include the installation of sediment collection and treatment facilities at the outfall into Boggy Bayou, the addition of stormwater management controls at Thomas Branch, the creation of habitat and living shorelines, the removal of exotic species, and the restoration of emergent grasses at the headwaters of Boggy Bayou. Addressing stormwater treatment and the restoration of the Boggy Bayou headwaters will improve benthic habitat quality, increase biological diversity and productivity, and improve water quality to assist in seagrass recovery.

<p>Water Quality Improvements to Enhance Fisheries Habitat in the Lower Choctawhatchee River Basin: Phase I (FDEP \$931,600)</p>	<p>This initial phase will inventory, prioritize, and develop solutions to address the most significant source of sediment in the watershed—runoff associated with un-paved road stream crossings. The Choctawhatchee River and Bay are designated critical habitat for the threatened Gulf sturgeon and this assessment is expected to target locations where improvements will enhance access to their freshwater spawning habitat. Project partners include: FWS, FWC, NFWFMD, CBA, and Walton, Washington, and Holmes Counties.</p>
<p>Destin Harbor, Joe’s Bayou, and Indian Bayou Water Quality Improvement (City of Destin, Florida, \$3,593,600)</p>	<p>This project will establish a system of stormwater improvements, including roadside swales and exfiltration trenches to treat stormwater and recharge the shallow aquifer recharge prior to discharge; and repair poorly performing culverts. The reduction of sediment input into these three bays is anticipated to improve the viability of SAV in the southwestern portion of Choctawhatchee Bay, which supports diverse populations of fish and invertebrates, including many recreational and commercial species such as shrimp, eastern oysters, spotted sea trout, gulf menhaden, red drum, blue crab, gulf flounder and mullet.</p>
<p>Restoration of Florida’s Coastal Dune Lakes (FDEP, \$3,045,400)</p>	<p>This project will remove invasive species and use fire management to restore wetland habitat and increase freshwater flows into priority coastal dune lakes in the Florida Panhandle. Florida’s coastal dune lakes systems provide unique habitat for a wide variety of fish and wildlife, in particular, beach nesting shorebirds and estuarine fish species, and exist as a natural estuarine transition between the Gulf of Mexico and upland areas. Restoration of these lakes will improve wetland habitat, enhance freshwater flows and have significant benefit to adjacent benthic environments in Gulf waters. Project partners include: FWS, USDA, and FWC.</p>

Projects with benefits to all Gulf coastal communities, including Choctawhatchee Bay

Benthic Mapping, Characterization, and Assessment (University of South Florida, \$4,477,900)

This project will provide data on the extent and species utilization of offshore fishery habitats along the West Florida Continental Shelf – an area utilized by reef fish and sea turtle populations for shelter, feeding and spawning. It will inform sustainable fishing practices for red snapper and other reef fish, and future efforts to reduce bycatch of marine fish and sea turtles through improved management during periods of high utilization in these benthic habitats. Project partners: FWC, Florida Fish and Wildlife Research Institute, and Florida Institute of Oceanography.

Comprehensive Coastal Panhandle Bird Conservation (National Audubon, \$3,205,000)

This project will improve Panhandle beach-nesting bird habitat through nesting habitat enhancements and stewardship activities that will result in increased nesting, hatching, and rearing of chicks. These efforts will result in more effective and comprehensive success throughout the Florida Panhandle for important beach-nesting species such as Black Skimmer, American Oystercatcher, Least Tern, Piping Plover and Red Knot. Project partners: FWC, Florida Park Service, National Park Service, Department of Defense, Santa Rosa Island Authority, TNC, and State University of New York.

Florida Shorebird Conservation Initiative (FWC, \$1,489,800)

This proposal will sustain activities of the Florida Shorebird Alliance (FSA) to enhance shorebird and seabird populations along the Florida Gulf Coast for two years. The FSA is a statewide network of government and non-governmental organizations advancing shorebird and seabird conservation through coordinated and collaborative management, monitoring, education and outreach, and public policy activities. Partners: Florida Audubon Society.

<p>Enhanced Assessment for Gulf of Mexico Fisheries: Phases I-III (FWC, \$11,814,200)</p>	<p>This five-year project will expand the collection of data on both catch effort and stock assessment in the northern and eastern Gulf of Mexico. It is complementary to similar projects in Alabama and Mississippi. The data will be used to assess the recovery of reef fish stocks in association with restoration efforts implemented in response to the Deepwater Horizon oil spill, improve and expand single-species stock assessments for managed fish species, and foster improved ecosystem-based assessment and management capabilities. Project partners: NOAA and University of Florida.</p>
<p>Increased Capacity for Marine Mammal Response (FWC, NOAA, and other stranding organizations, \$4,400,000)</p>	<p>This project will improve capacity and data collection efforts for the FWC’s marine mammal field stations as well as eight marine mammal stranding response and research organizations working in the Gulf. The Gulf of Mexico is habitat for 22 species of marine mammals—many were directly impacted by the oil spill, all are listed under the Marine Mammal Protection Act and several are listed as endangered under the ESA. Given the high occurrence of annual marine mammal strandings along Florida’s Gulf Coast – more than 2,000 over the past five years – it is a management priority to enhance and sustain a viable stranding network.</p>
<p>Eliminating Light Pollution on Sea Turtle Nesting Beaches: Phases I and II (FWS, FWC, and Sea Turtle Conservancy, \$3,614,400)</p>	<p>This project will greatly increase sea turtle hatchling survivorship on Florida Panhandle nesting beaches by correcting problematic lights on private properties with a history of sea turtle disorientations. Florida hosts over 90 percent of all sea turtle nesting in the continental U.S., including the largest population of loggerheads in the Western Hemisphere and regionally significant nesting populations of the Kemp’s Ridley sea turtles.</p>

Source: FDEP 2016g.