

APPENDIX B
ENVIRONMENTAL RESOURCES

TABLE OF CONTENTS

B.1	Affected Environment	B.1-1
B.1.1	Air Quality	B.1-3
B.1.2	Greenhouse Gases	B.1-7
B.1.3	Climate	B.1-9
B.1.4	Noise	B.1-9
B.1.5	Hydrology	B.1-10
B.1.6	Groundwater	B.1-14
B.1.7	Surface Water Quality	B.1-15
B.1.8	Vegetation	B.1-17
B.1.9	Wetlands	B.1-33
B.1.10	Invasive Species	B.1-38
B.1.11	Essential Fish Habitat	B.1-45
B.1.12	Threatened and Endangered Species	B.1-47
B.1.13	Fish and Wildlife	B.1-68
B.1.14	Geology and Soils	B.1-75
B.1.15	Hazardous, Toxic, and Radioactive Waste	B.1-81
B.1.16	Land Use and Real Estate	B.1-84
B.1.17	Visual Resources	B.1-91
B.1.18	Transportation and Traffic	B.1-98
B.1.19	Infrastructure and Utilities	B.1-100
B.1.20	Socioeconomics	B.1-107
B.1.21	Cultural Resources	B.1-120
B.2	Future Without Project Conditions	B.2-1
B.3	Environmental Consequences	B.3-1
B.3.1	Air Quality	B.3-1
B.3.2	Greenhouse Gases	B.3-10
B.3.3	Climate	B.3-14
B.3.4	Noise	B.3-14
B.3.5	Hydrology	B.3-25
B.3.6	Groundwater	B.3-65
B.3.7	Surface Water Quality	B.3-74
B.3.8	Vegetation	B.3-83
B.3.9	Wetlands	B.3-90
B.3.10	Invasive Species	B.3-92
B.3.11	Essential Fish Habitat	B.3-94
B.3.12	Threatened and Endangered Species	B.3-98
B.3.13	Fish and Wildlife	B.3-104
B.3.14	Geology and Soils	B.3-112
B.3.15	Hazardous, Toxic, and Radioactive Waste	B.3-122
B.3.16	Land Use and Real Estate	B.3-128
B.3.17	Visual Resources	B.3-138
B.3.18	Transportation and Traffic	B.3-143
B.3.19	Infrastructure and Utilities	B.3-146
B.3.20	Socioeconomics	B.3-164
B.3.21	Cultural Resources	B.3-170
B.4	Environmental Compliance	B.4-1

B.4.1	Environmental Laws	B.4-1
B.4.2	Executive Orders.....	B.4-10
B.4.3	Clean Water Act Section 404(b)(1) Evaluation	B.4-15
B.4.4	Coastal Zone Management Act Consistency Statement	B.4-43
B.5	References.....	B.5-1

LIST OF TABLES

Table B.1-1.	National Ambient Air Quality Standards.....	B.1-4
Table B.1-2.	Common Sounds and their A-weighted Decibel Levels	B.1-9
Table B.1-3.	C&SF Section 203 Study Area—Managed Upstream Watershed Basins, Primary Canals, and Water Control Structures.....	B.1-13
Table B.1-4.	Primary and Other WCA Canals TMDLs in the Study Area.	B.1-15
Table B.1-5.	Florida Land Cover Classification System Class Names, Codes, Acreages, and Relative Coverage within the Study Area.....	B.1-18
Table B.1-6.	Invasive Vegetation and Noxious Weeds within Broward and Palm Beach Counties.	B.1-39
Table B.1-7.	FLCCS Invasive Community Types within the Study Area	B.1-43
Table B.1-8.	Federally Listed Species with the Potential to Occur in the Study Area.	B.1-48
Table B.1-9.	Florida Natural Area Inventory Rare Species List for Broward and Palm Beach Counties.	B.1-69
Table B.1-10.	Geologic Summary for the Water Control Structures in the Study Area.	B.1-78
Table B.1-11.	Soil Characteristics at the Water Control Structures.	B.1-80
Table B.1-12.	Land Uses with the Study Area.	B.1-87
Table B.1-13.	Summary of Land Uses within 1,000-foot Radius of Each Water Control Structure.	B.1-89
Table B.1-14.	Bureau of Land Management Visual Resource Management Class Objectives.....	B.1-92
Table B.1-15.	Bureau of Land Management Degree of Contrast Criteria.	B.1-93
Table B.1-16.	Water Control Structures and Traffic Counts.	B.1-100
Table B.1-17.	Water Control Structures in the C&SF Section 203 Study Area.	B.1-100
Table B.1-18.	Water Control Structures and Associated Primary Canals that are part of the C&SF Section 203 Study.	B.1-101
Table B.1-19.	Description of Water Control Structures and Associated Primary Canals.	B.1-103
Table B.1-20.	Population in 2013 and 2023, Population Change, and Median Age.	B.1-110
Table B.1-21.	Population Change in Broward County from 2024 to 2029.	B.1-111
Table B.1-22.	Labor Force and Employment.	B.1-111
Table B.1-23.	Percentage of Workforce (16 years and over) by Industry Sector.....	B.1-112
Table B.1-24.	Real Gross Domestic Product (In Millions of Chained Dollars) and Percentage Change from Preceding Period.	B.1-114
Table B.1-25.	Broward County: Contributions to Percent Change in Real GDP by Industry Sector between 2022 and 2023.....	B.1-114
Table B.1-26.	Palm Beach County: Contributions to Percent Change in Real GDP by Industry Sector Between 2022 and 2023.....	B.1-115
Table B.1-27.	2023 Per Capita Income.	B.1-116

Table B.1-28.	Per Capita Income of Major Cities in the Study Area in 2023.....	B.1-117
Table B.1-29.	Per Capita Income of Broward County Census Tracts in 2024 and 2029.	B.1-117
Table B.1-30.	2023 Housing Units.....	B.1-118
Table B.1-31.	Home Values in Broward County Census Tracts.....	B.1-118
Table B.1-32.	Property Taxes in 2024 to 2025 by Major Cities in Broward County.....	B.1-118
Table B.1-33.	Broward County Taxes in 2024 to 2025 by Authority.....	B.1-119
Table B.1-34.	NRI Environmental and Socioeconomic Indicators for Broward and Palm Beach Counties.	B.1-119
Table B.1-35.	Cultural Resources Recorded within the C&SF Section 203 Study Area.	B.1-120
Table B.1-36.	Cultural Resources Associated with C&SF Section 203 Study Water Control Structures and Proposed Features.....	B.1-121
Table B.2-1.	Future Without Project Conditions.....	B.2-2
Table B.3-1.	Estimated Construction Emissions under Alternative A.	B.3-4
Table B.3-2.	Estimated Operations Emissions under Alternative A.	B.3-5
Table B.3-3.	Estimated Construction Emissions under Alternative B.....	B.3-6
Table B.3-4.	Estimated Dredging Emissions under Alternative B.....	B.3-7
Table B.3-5.	Estimated Operations Emissions under Alternative B.	B.3-7
Table B.3-6.	Estimated Construction Emissions under Alternative C.....	B.3-8
Table B.3-7.	Estimated Dredging Emissions under Alternative C.....	B.3-8
Table B.3-8.	Estimated Operations Emissions under Alternative C.	B.3-9
Table B.3-9.	Estimated Construction Emissions under Alternative RO.	B.3-9
Table B.3-10.	Estimated Dredging Emissions under Alternative RO.	B.3-10
Table B.3-11.	Estimated Operations Emissions under Alternative RO.....	B.3-10
Table B.3-12.	Annual Greenhouse Gas Emissions during Construction under All Action Alternatives.	B.3-11
Table B.3-13.	Annual Steady State Greenhouse Gas Emissions (starting in 2031) during Operations under All Action Alternatives.	B.3-12
Table B.3-14.	Construction Equipment Noise Levels.	B.3-17
Table B.3-15.	Alternative A: Potential Construction Noise Impacts at Noise Sensitive Receptors. ..	B.3-17
Table B.3-16.	Alternative A: Potential Operational Noise Impacts at Noise Sensitive Receptors.....	B.3-20
Table B.3-17.	Alternative B: Potential Construction Noise Impacts at Noise Sensitive Receptors. ..	B.3-20
Table B.3-18.	Alternative B: Potential Operational Noise Impacts at Noise Sensitive Receptors.....	B.3-22
Table B.3-19.	Alternative C: Potential Operational Noise Impacts at Noise Sensitive Receptors.....	B.3-23
Table B.3-20.	Alternative RO: Potential Operational Noise Impacts at Noise Sensitive Receptors.	B.3-25
Table B.3-21.	Effects of Alternative A on Hydrology in the Upstream Watershed Basins.	B.3-27
Table B.3-22.	Alternative A Breakdown of Change in Inundation Depth in the Upstream Watershed Basins in Acres.	B.3-31
Table B.3-23.	Effects of Alternative B on Hydrology by Location.....	B.3-36
Table B.3-24.	Alternative B Breakdown of Change in Inundation Depth by Location in Acres.....	B.3-40
Table B.3-25.	Effects of Alternative C on Hydrology by Location.....	B.3-45
Table B.3-26.	Alternative C Breakdown of Change in Inundation Depth by Location in Acres.....	B.3-51

Table B.3-27.	Effects of Alternative RO on Hydrology by Location.	B.3-55
Table B.3-28.	Alternative RO Breakdown of Change in Inundation Depth by Location in Acres.	B.3-60
Table B.3-29.	Effects of Alternative A on Groundwater by Location.....	B.3-65
Table B.3-30.	Effects of Alternative B on Groundwater by Location.....	B.3-67
Table B.3-31.	Effects of Alternative C on Groundwater by Location.....	B.3-69
Table B.3-32.	Effects of Alternative RO on Groundwater by Location.	B.3-72
Table B.3-33.	Effects of Alternative A on Surface Water Quality by Location.....	B.3-75
Table B.3-34.	Effects of Alternative B on Surface Water Quality by Location.	B.3-77
Table B.3-35.	Effects of Alternative C on Surface Water Quality by Location.	B.3-79
Table B.3-36.	Effects of Alternative RO on Surface Water Quality by Location.	B.3-82
Table B.3-37.	Potential Land Disturbance under Alternative A.	B.3-84
Table B.3-38.	Potential Land Disturbance under Alternative B.....	B.3-86
Table B.3-39.	Potential Land Disturbance under Alternative C.....	B.3-87
Table B.3-40.	Potential Land Disturbance under Alternative RO.....	B.3-89
Table B.3-41.	Construction Effects to Federally Listed Threatened and Endangered Species from the Action Alternatives.....	B.3-100
Table B.3-42.	OMRR&R Effects to Federally Listed Threatened and Endangered Species from the Action Alternatives	B.3-101
Table B.3-43.	Differences in Terrestrial Habitat Inundation in Upstream Watershed Basins across All Alternatives.....	B.3-104
Table B.3-44.	Alternative A Land Ranking and Land Cover Type.	B.3-106
Table B.3-45.	Alternative B Land Ranking and Land Cover Type.....	B.3-108
Table B.3-46.	Alternative C Land Ranking and Land Cover Type.....	B.3-110
Table B.3-47.	Alternative RO Land Ranking, Land Cover Type, and Effects on Wildlife.	B.3-111
Table B.3-48.	Potential Soil Disturbance for Improvements under Alternative A.	B.3-113
Table B.3-49.	Potential Soil Disturbance for Improvements under Alternative B.....	B.3-116
Table B.3-50.	Potential Soil Disturbance for Improvements under Alternative C.....	B.3-118
Table B.3-51.	Potential Soil Disturbance for Improvements under Alternative RO.	B.3-121
Table B.3-52.	Predicted Terrestrial Habitat Inundation in Upstream Watershed Basins in the Future Without Project (No Action Alternative) Condition.	B.3-129
Table B.3-53.	Temporary Displacement Days in the Future Without Project (No Action) Alternative under Three Modeled Scenarios.....	B.3-129
Table B.3-54.	Land Use Impacts Summary.....	B.3-129
Table B.3-55.	Predicted Terrestrial Habitat Inundation in Upstream Watershed Basins across Alternatives A, B, C, and RO.	B.3-132
Table B.3-56.	Temporary Displacement Days under Alternatives A, B, C, and RO under Three Modeled Scenarios.	B.3-132
Table B.3-57.	Real Estate Impacts Summary, Alternatives A, B, and C.	B.3-134
Table B.3-58.	Real Estate Impacts of Alternative RO.	B.3-136
Table B.3-59.	Pump Stations Proposed Under the Action Alternatives.....	B.3-143
Table B.3-60.	Vehicle-Miles Traveled and Vehicle-Hours Traveled due to Flood-related Closures in FWOP in an Intermediate Flooding Scenario in 2085.	B.3-144

Table B.3-61.	Vehicle-Miles Traveled and Vehicle-Hours Traveled Due to Flood-related Closures Across Alternatives A through C in an Intermediate Flooding Scenario in 2085.	B.3-145
Table B.3-62.	Truck and Automobile Vehicle-Miles Traveled and Vehicle-Hours Traveled Due to Flood-related Closures for Alternative RO in an Intermediate Flooding Scenario in 2085.	B.3-146
Table B.3-63.	Critical Infrastructure Impacts in FWOP.	B.3-147
Table B.3-64.	Septic Tanks with Flood Values in FWOP.	B.3-147
Table B.3-65.	Alternative A Proposed Improvements.	B.3-148
Table B.3-66.	Critical Infrastructure Impacts in Alternative A.	B.3-148
Table B.3-67.	Percent Reductions in Flood Depths under Alternative A in Areas where Sanitary Sewer Overflows Occur.	B.3-149
Table B.3-68.	Septic Tanks with Flood Values in Alternative A.	B.3-149
Table B.3-69.	Alternative B Proposed Improvements.	B.3-152
Table B.3-70.	Critical Infrastructure Impacts in Alternative B.	B.3-153
Table B.3-71.	Percent Reductions in Flood Depths under Alternative B in Areas where Sanitary Sewer Overflows Occur.	B.3-153
Table B.3-72.	Septic Tanks with Flood Values in Alternative B.	B.3-154
Table B.3-73.	Alternative C Proposed Improvements.	B.3-156
Table B.3-74.	Critical Infrastructure Impacts in Alternative C.	B.3-157
Table B.3-75.	Percent Reductions in Flood Depths under Alternative C in Areas where Sanitary Sewer Overflows Occur.	B.3-158
Table B.3-76.	Septic Tanks with Flood Values in Alternative C.	B.3-158
Table B.3-77.	Alternative RO Proposed Improvements.	B.3-160
Table B.3-78.	Critical Infrastructure Impacts in Alternative RO.	B.3-161
Table B.3-79.	Percent Reductions in Flood Depths under Alternative RO in Areas where Sanitary Sewer Overflows Occur.	B.3-162
Table B.3-80.	Septic Tanks with Flood Values in the Alternative RO.	B.3-163
Table B.3-81.	Summary of Hydrological Data in Association with Cultural Resources within the Study Area.	B.3-172
Table B.4-1.	Recommended Plan Compliance with Environmental Laws.	B.4-7
Table B.4-2.	Recommended Plan Compliance with Executive Orders.	B.4-13
Table B.4-3.	C&SF Section 203 Study Area—Managed Watershed Basins, Primary Canals, and Water Control Structures.	B.4-17
Table B.4-4.	Proposed Recommended Plan Features.	B.4-20
Table B.4-5.	Recommended Plan Canal Excavation Dredged Materials Use, Volumes, and Characteristics.	B.4-27
Table B.4-6.	Estimated Period of Construction.	B.4-33
Table B.4-7.	Physical Effects on Surface Water Quality.	B.4-34

LIST OF FIGURES

Figure B.1-1.	C&SF Section 203 Study Area.....	B.1-2
Figure B.1-2.	National Ambient Air Quality Standards Process Flow Chart (EPA 2023).	B.1-4
Figure B.1-3.	Florida Department of Environmental Protection Air Quality Monitoring Locations in and near the Study Area.	B.1-6
Figure B.1-4.	Broward County Countywide Greenhouse Gas Inventory 2015-2018 (Broward County 2024a).....	B.1-8
Figure B.1-5.	South Florida’s Water Conservation Areas (SFWMD 2024a).	B.1-12
Figure B.1-6.	Florida CLC Types within the Study Area (Northern).	B.1-22
Figure B.1-7.	Florida CLC Types within the Study Area (Central).	B.1-23
Figure B.1-8.	Florida CLC types within the Study Area (Western).	B.1-24
Figure B.1-9.	Florida CLC types within the Study Area (Southern).	B.1-25
Figure B.1-10.	National Wetland Inventory Wetland Types within the Study Area.	B.1-28
Figure B.1-11.	Invasive Species Coverage within the Study Area.	B.1-44
Figure B.1-12.	Essential Fish Habitat within the Study Area.	B.1-46
Figure B.1-13.	Protected Species Consultation Areas within the Study Area.	B.1-50
Figure B.1-14.	Federally Listed Species Occurrences within the Study Area.	B.1-53
Figure B.1-15.	Protected Species Range within the Study Area.	B.1-54
Figure B.1-16.	Species Critical Habitat within the Study Area.....	B.1-58
Figure B.1-17.	Sea Turtle Nesting Density within the Study Area.	B.1-63
Figure B.1-18.	Manatee Accessible Waters within the Study Area.	B.1-66
Figure B.1-19.	Generalized Stratigraphic Column for the Study Area.	B.1-79
Figure B.1-20.	Representative Satellite Photo of Two Water Control Structures: G-56 and G-54 Gated Spillways.	B.1-89
Figure B.1-21.	Right of Way Zones.	B.1-91
Figure B.1-22.	National Land Cover Database (NLCD) Inventory of the Study Area.	B.1-95
Figure B.1-23.	Representative Photo of Three Water Control Structures: G-56, S-37A, and S-36 Gated Spillways.	B.1-97
Figure B.1-24.	Percent Change in Metropolitan Statistical Area Population: July 1, 2022, to July 1, 2023.	B.1-109
Figure B.1-25.	FEMA NRI Risk Index Ratings for Census Tracts in Broward and Palm Beach Counties in and near the Study Area.	B.1-120
Figure B.3-1.	Change in Inundation Peak Depths in the Study Area under Alternative A and the Worst Case Scenario (100-year surge, 100-year rainfall, high SLR). X and Y axes represent easting and northing coordinates, respectively.....	B.3-33
Figure B.3-2.	Change in Inundation Peak Depths in the Study Area under Alternative A and the Intermediate Case Scenario (2-year surge, 25-year rainfall, intermediate SLR). X and Y axes represent easting and northing coordinates, respectively.....	B.3-34
Figure B.3-3.	Change in Inundation Peak Depths in the Study Area under Alternative B and the Worst Case Scenario (100-year surge, 100-year rainfall, high SLR). X and Y axes represent easting and northing coordinates, respectively.....	B.3-42

Figure B.3-4.	Change in Inundation Peak Depths in the Study Area under Alternative B and the Intermediate Case Scenario (2-year surge, 25-year rainfall, intermediate SLR). X and Y axes represent easting and northing coordinates, respectively.....	B.3-43
Figure B.3-5.	Change in Inundation Peak Depths in the Study Area under Alternative C and the Worst Case Scenario (100-year surge, 100-year rainfall, high SLR). X and Y axes represent easting and northing coordinates, respectively.....	B.3-52
Figure B.3-6.	Change in Inundation Peak Depths in the Study Area under Alternative C and the Intermediate Case Scenario (2-year surge, 25-year rainfall, intermediate SLR). X and Y axes represent easting and northing coordinates, respectively.....	B.3-53
Figure B.3-7.	Change in Inundation Peak Depths in the Study Area under Alternative RO and the Worst Case Scenario (100-year surge, 100-year rainfall, high SLR). X and Y axes represent easting and northing coordinates, respectively.....	B.3-61
Figure B.3-8.	Change in Inundation Peak Depths in the Study Area under Alternative RO and the Intermediate Case Scenario (2-year surge, 25-year rainfall, intermediate SLR). X and Y axes represent easting and northing coordinates, respectively.	B.3-62
Figure B.3-9.	Comparison across all Action Alternatives of Predicted Change in Area of Inundation of Upstream Watershed Basins by Depth Range.....	B.3-64
Figure B.3-10.	Tidal Waters in the C&SF Section 203 Study Area.	B.3-96
Figure B.4-1.	C&SF Section 203 Study Area.....	B.4-16
Figure B.4-2.	Features of the C&SF Section 203 Study Recommended Plan.	B.4-18
Figure B.4-3.	G-08 (Hillsboro) Canal Improvements Excavation and Fill Areas.	B.4-29
Figure B.4-4.	C-14 (Cypress Creek) Canal Improvements Excavation and Fill Areas.	B.4-30
Figure B.4-5.	C-11 (South New River) Canal (C-11 West Basin) Improvements Excavation and Fill Areas.....	B.4-31
Figure B.4-6.	C-11 (South New River) Canal (C-11 East Basin) Improvements Excavation and Fill Areas.	B.4-32

ACRONYMS AND ABBREVIATIONS

AADT	Annual Average Daily Traffic
ac	acre(s)
ACAM	Air Conformity Applicability Model
ACS	American Community Survey
Action Area	Approximately 302 square miles of managed upstream watersheds with nine water control structures owned and operated by the SFWMD
BEBR	Bureau of Economic and Business Research
BMP	best management practice
BOEM	Bureau of Ocean Energy Management
BWSER	Bureau of Workforce Statistics and Economic Research
C&SF	Central and Southern Florida
C&SF Project	Central and Southern Florida Project
CAA	Clean Air Act
CFR	Code of Federal Regulations
cfs	cubic foot (feet) per second
CLC	Florida Cooperative Land Cover Map
CO	carbon monoxide
dB	decibel
dBA	A-weighted decibel
EFH	Essential Fish Habitat
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act of 1973
FAC	Florida Administrative Code
FAS	Floridan Aquifer System
FDEP	Florida Department of Environmental Protection
FDOT	Florida Department of Transportation
FEC	Florida East Coast
FEMA	Federal Emergency Management Agency
FLAM	Florida Landscape Assessment Model
FLCCS	Florida Land Cover Classification System

FNAI	Florida Natural Areas Inventory
FR	Federal Register
F.S.	Florida Statutes
ft	foot, feet
FWC	Florida Fish and Wildlife Conservation Commission
FWOP	Future Without Project
GCR	General Conformity regulations
GDP	gross domestic product
GHG	greenhouse gas
H&H	hydrologic and hydraulic
HP	horsepower
HTRW	hazardous, toxic, and radioactive waste
IBA	Important Bird Area
ICW	Intracoastal Waterway
IDE	industrial/commercial exposure limits
ISO	International Organization for Standardization
kg	kilogram
LEC	Lower East Coast
LPG	liquified petroleum gas
mg	milligram
MSA	metropolitan statistical area
NAAQS	National Ambient Air Quality Standards
NAICS	North American Industry Classification System
NAVD88	North Atlantic Vertical Datum of 1988
NEPA	National Environmental Policy Act
NLCD	National Land Cover Database
NMFS	National Marine Fisheries Service
NO ₂	nitrogen dioxide
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places

NSR	noise sensitive receptor
NWI	National Wetlands Inventory
O ₃	ozone
OMRR&R	operation, maintenance, repair, replacement, and rehabilitation
Pb	lead
PEC	Probable Effective Concentrations
PED	preconstruction engineering and design
RDE	residential exposure limits
RO	resilience optimized
ROI	region of influence
ROW	right-of-way
SAS	Surficial Aquifer System
SCTL	Soil Cleanup Target Level
C&SF Section 203 Study	Central and Southern Florida Flood Resiliency (Section 203) Study for Broward Basins
FWMD	South Florida Water Management District
SGCN	Species of Greatest Conservation Need
SHPO	State Historic Preservation Office
SMCL	secondary maximum contaminant level
SPF	Standard Project Flood
SO ₂	sulfur dioxide
SQAG	Sediment Quality Assessment Guidelines
Study Area	Approximately 420 square miles in eastern Broward County and southern Palm Beach County, encompassing 15 watershed basins, 7 primary canals, and 9 water control structures
SWPPP	stormwater pollution prevention plan
TEC	Threshold Effective Concentrations
TMDL	Total Maximum Daily Load
U.S.C.	United States Code
USACE	U.S. Army Corps of Engineers
USCB	U.S. Census Bureau
USFWS	U.S. Fish and Wildlife Service

USGS	U.S. Geological Survey
VHT	Vehicle-Hours Traveled
VMT	Vehicle-Miles Traveled
VRM	Visual Resource Management
UST	underground storage tank
WCA	Water Conservation Area
WCS	water control structure(s)

B.1 Affected Environment

This appendix outlines the affected environment, encompassing the natural, physical, and economic resources within the geographic area where the proposed actions and alternatives are expected to have an impact. It serves as a baseline for comparing the potential environmental and economic effects of these actions. The C&SF Section 203 Study Area (Study Area) spans approximately 420 square miles within the eastern portion of Broward County and a small portion of southern Palm Beach County. The Study Area includes nine upstream and six downstream watershed basins, interconnected by a network of seven primary canals managed by nine water control structures (WCS), seven of which are coastal structures, in addition to other existing WCS not directly relevant in this C&SF Section 203 Study. The C&SF Section 203 Action Area (Action Area) consists of 302 square miles of managed upstream watersheds with nine WCS owned and operated by the SFWMD. The nine upstream watersheds within the Action Area include Hillsboro Canal Basin, Pompano Canal Basin, C-14 West Basin, C-14 East Basin, C-13 West Basin, C-12 West Basin, North New River Canal West Basin, C-11 West Basin, and C-11 East Basin. The C&SF Section 203 Action Area is the area of emphasis for evaluating improvements to the WCS functionality and capacity to reduce flood damages.

Figure B.1-1 illustrates the C&SF Section 203 Study Area, where data on natural, physical, and economic resources were analyzed.

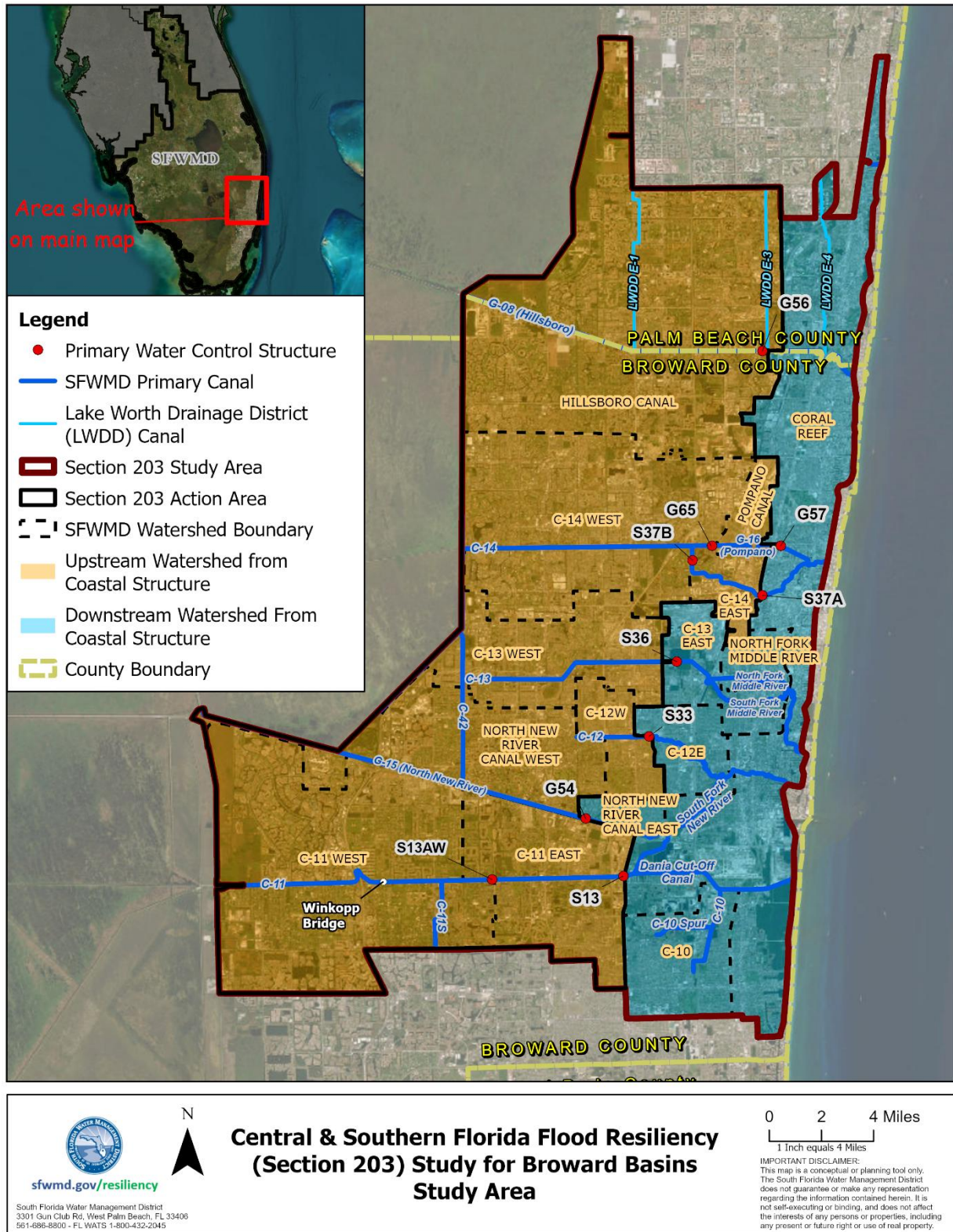


Figure B.1-1. C&SF Section 203 Study Area.

B.1.1 Air Quality

Air quality describes the level of contaminants in the air. Air pollution is a general term that refers to one or more chemical substances that degrade the quality of the atmosphere. Individual air pollutants degrade the atmosphere by reducing visibility, damaging property, reducing the productivity or vigor of crops or natural vegetation, and/or harming human or animal health. The Clean Air Act (CAA) (42 USC §7401 et seq. (1970), as amended), is the basis for most federal air pollution control programs. The U.S. Environmental Protection Agency (EPA), under the CAA, regulates air quality nationally. Under the authority of the CAA, the EPA established a set of National Ambient Air Quality Standards (NAAQS) for various “criteria” air pollutants. The CAA requires states to develop a general plan to attain and maintain the NAAQS in all areas of the country and the State Implementation Plan (SIP) to attain the standards for each area that the EPA has designated nonattainment for a NAAQS.

The Study Area is in attainment for all criteria pollutants, meaning that air quality meets or is better than the NAAQS set by EPA. Although each state has the authority to adopt standards stricter than those established under the federal program, Florida has accepted the federal standards (Florida Administrative Code [FAC] Chapter 62-204 Air Pollution Control - General Provisions). The Florida SIP is a comprehensive plan developed by the state to ensure compliance with the NAAQS set by the EPA under the CAA. Florida’s latest modification to the SIP was approved and adopted on October 1, 2023 (EPA 2023). It outlines how a state will monitor, control, and reduce air pollution from various sources to meet federal air quality standards. The SIP includes regulations, enforcement measures, emission limits, and strategies tailored to the state’s specific air quality challenges. When approved by the EPA, the SIP becomes legally enforceable. States can update their SIPs as needed to address new pollution concerns or regulatory changes.

Figure B.1-2 illustrates the NAAQS CAA process, tracing its progression from federal legislation to SIPs, outlining key regulatory steps and compliance measures. Specifically, the EPA is responsible for setting the primary and secondary NAAQS (40 Code of Federal Regulations [CFR] Part 50), which defines the maximum permissible concentrations of six key air pollutants, known as criteria pollutants. These include particulate matter—both PM₁₀ (particles with a diameter of 10 microns or less) and PM_{2.5} (particles with a diameter of 2.5 microns or less)—as well as sulfur dioxide (SO₂), carbon monoxide (CO), nitrogen dioxide (NO₂), ozone (O₃), and lead (Pb) (**Table B.1-1**). These permissible concentrations address both acute and chronic health risks, the NAAQS include short-term exposure limits (covering 1-hour, 8-hour, and 24-hour periods) for pollutants that pose immediate health hazards, as well as long-term exposure limits (based on annual averages) for pollutants linked to prolonged health effects.

The General Conformity Rule mandates that a federal agency cannot take any action in a nonattainment or maintenance area that interferes with a state's ability to attain, maintain, or comply with the NAAQS. This rule, established under the CAA, ensures that federal projects do not contribute to air quality violations or hinder a state’s efforts to meet air pollution reduction goals. Agencies must conduct conformity determinations to assess the potential air quality impacts of their proposed actions, demonstrating compliance with SIPs designed to achieve and sustain NAAQS levels.

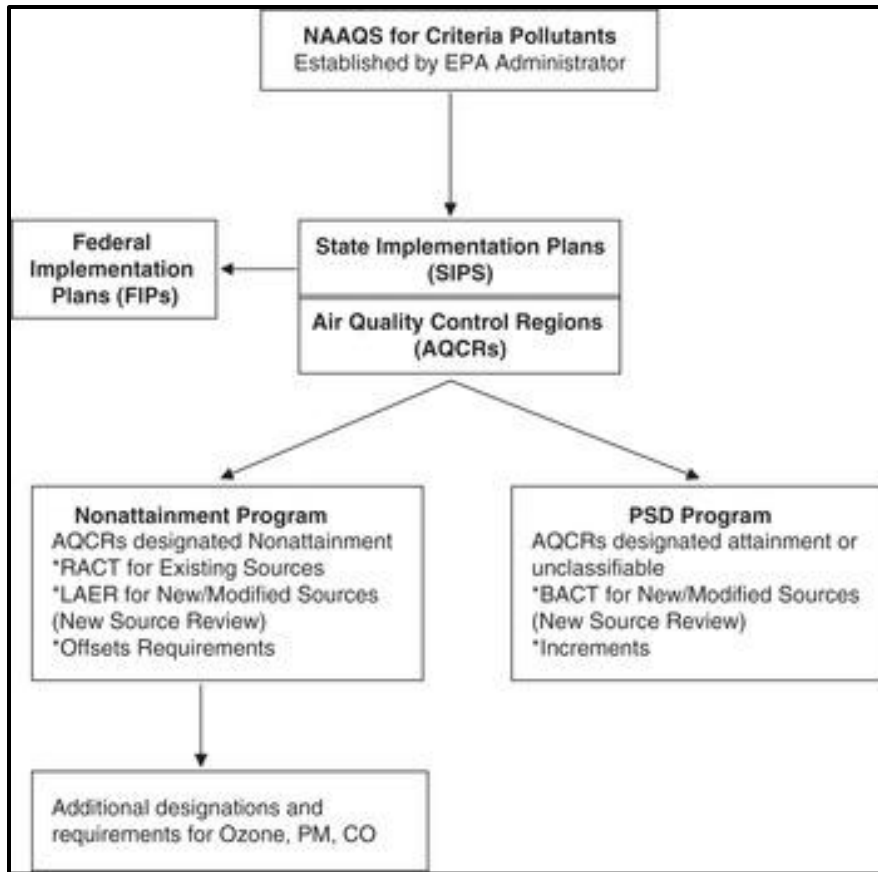


Figure B.1-2. National Ambient Air Quality Standards Process Flow Chart (EPA 2023).

Table B.1-1. National Ambient Air Quality Standards.

Pollutant	Primary/Secondary	Averaging Time	Level	Form
Carbon Monoxide (CO)	Primary	8-hour	9 ppm	Not to be exceeded more than once a year
Carbon Monoxide (CO)	Primary	1-hour	35 ppm	Not to be exceeded more than once a year
Lead (Pb)	Primary and Secondary	Rolling 3-month average	0.15 µg/m ³	Not to be exceeded
Nitrogen Dioxide (NO ₂)	Primary	1-hour	100 ppb	98th percentile of 1- hour daily maximum concentrations, averaged over 3 years
Nitrogen Dioxide (NO ₂)	Primary and Secondary	Annual	53 ppb	Annual mean
Ozone (O ₃)	Primary and Secondary	8-hour	0.070 ppm	Annual fourth highest daily maximum 8-hour concentration, averaged over 3 years
Particulate Matter (PM _{2.5})	Primary	Annual	12 µg/m ³	Annual mean, averaged over 3 years
Particulate Matter (PM _{2.5})	Secondary	Annual	15 µg/m ³	Annual mean, averaged over 3 years
Particulate Matter (PM _{2.5})	Primary and Secondary	24-hour	35 µg/m ³	98th percentile, averaged over 3 years
Particulate Matter (PM ₁₀)	Primary and Secondary	24-hour	150 µg/m ³	Not to be exceeded more than once per year on average over 3 years

Source: 40 CFR 50.1-50.12, EPA 2024a

Notes: ppb = parts per billion; ppm = parts per million; µg/m³ = micrograms per cubic meter

Through ongoing monitoring, enforcement, and regulatory oversight, both the EPA and Florida Department of Environmental Protection (FDEP) work to ensure compliance with air quality standards, thereby safeguarding public health and the environment across the state. Federal regulations designate Air Quality Control Regions in violation of the NAAQS as nonattainment areas and Air Quality Control Regions with levels below the NAAQS as attainment areas. While the Study Area is currently in attainment, ongoing monitoring and regulatory efforts are essential to prevent future nonattainment, particularly in urban areas where pollution levels may fluctuate due to population growth and industrial activities. Florida's compliance is attributed to strict emissions regulations, clean energy initiatives, improved vehicle emissions technology, and consistent air monitoring managed by the FDEP and EPA. **Figure B.1-3** illustrates FDEP air monitoring locations in and near the Study Area.

The EPA NAAQS designate nitrogen dioxide (NO_2) as the primary indicator for the broader category of nitrogen oxides (NO_x), which includes both nitric oxide (NO) and NO_2 . This designation is because NO_2 is the most harmful of the nitrogen oxides in terms of direct human exposure and environmental impact, including respiratory health effects and its role in forming ground-level ozone and fine particulate matter. For the purposes of this C&SF Section 203 Study, a 100 percent conversion rate of NO_x to NO_2 will be assumed as a conservative approach to estimating emissions and potential air quality impacts. NO_x emissions primarily consist of NO , which gradually converts to NO_2 in the atmosphere through chemical reactions with ozone (O_3) and other oxidants. However, since this conversion process is variable and influenced by environmental conditions such as sunlight, temperature, and atmospheric composition, assuming full conversion to NO_2 ensures that the Study does not underestimate potential air quality impacts. Throughout the analysis, all NO_x emissions will be expressed as NO_2 emissions, ensuring a worst-case scenario evaluation for regulatory compliance, impact assessments, and air quality modeling. This approach aligns with conservative environmental assessment practices, prioritizing public health and regulatory accountability.

Table B.1-1 summarizes these standards, and further information about these "criteria pollutants" is provided later in this section. The EPA established "primary" standards to protect the public health and "secondary" standards to protect the nation's welfare and account for air pollutant effects on soil, water, visibility, materials, vegetation, and other aspects of the general welfare.

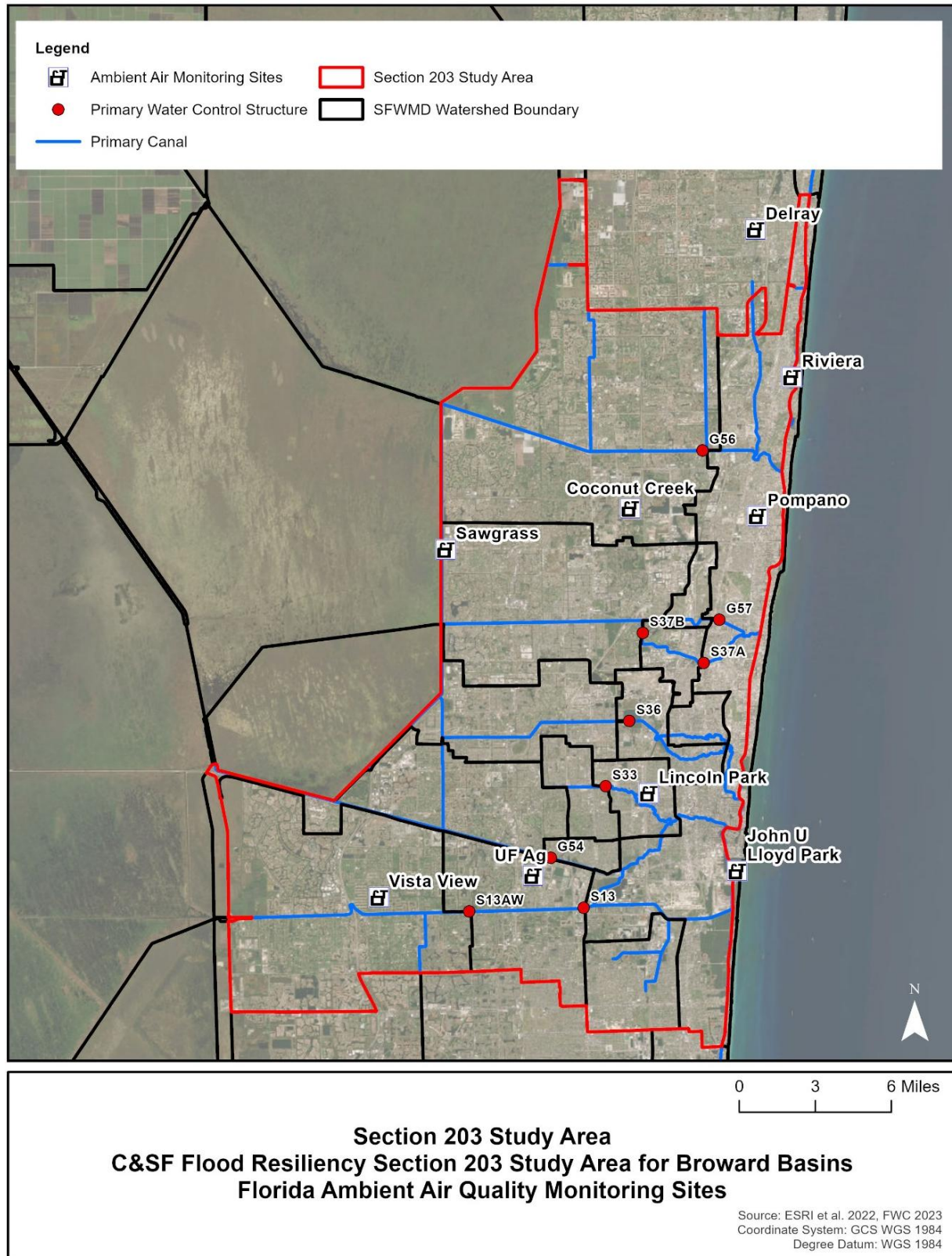


Figure B.1-3. Florida Department of Environmental Protection Air Quality Monitoring Locations in and near the Study Area.

B.1.2 Greenhouse Gases

Greenhouse gases (GHGs) such as carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O) trap heat in the atmosphere and significantly influence global climate patterns. Since the Industrial Revolution began about 250 years ago, global GHG emissions have risen steadily, with rapid acceleration during the 20th century (Climate Watch 2022).

In 2023, the United States emitted an estimated 2.58 billion metric tons of carbon dioxide equivalent (BMTCO₂e) from human activities (EPA 2023). Broward County, home to approximately 1.94 million people in 2021 (U.S. Census), recorded per capita emissions of 10 metric tons of CO₂e—a 10 percent decrease from 2018 levels. This decline reflects ongoing efforts to cut emissions through local regulations and sustainability initiatives (Broward County 2023a). However, total countywide emissions still reached about 20 million metric tons (MMTCO₂e) in 2021, underscoring the need for continued action.

Broward County has adopted aggressive climate goals, aiming to reduce annual emissions to 3.4 MMTCO₂e by 2050—a target that supports an 80 percent reduction based on projected population growth to 2.2 million residents by mid-century. **Figure B.1-4** illustrates the county's current emissions inventory and progress toward these goals (Broward County 2024a).

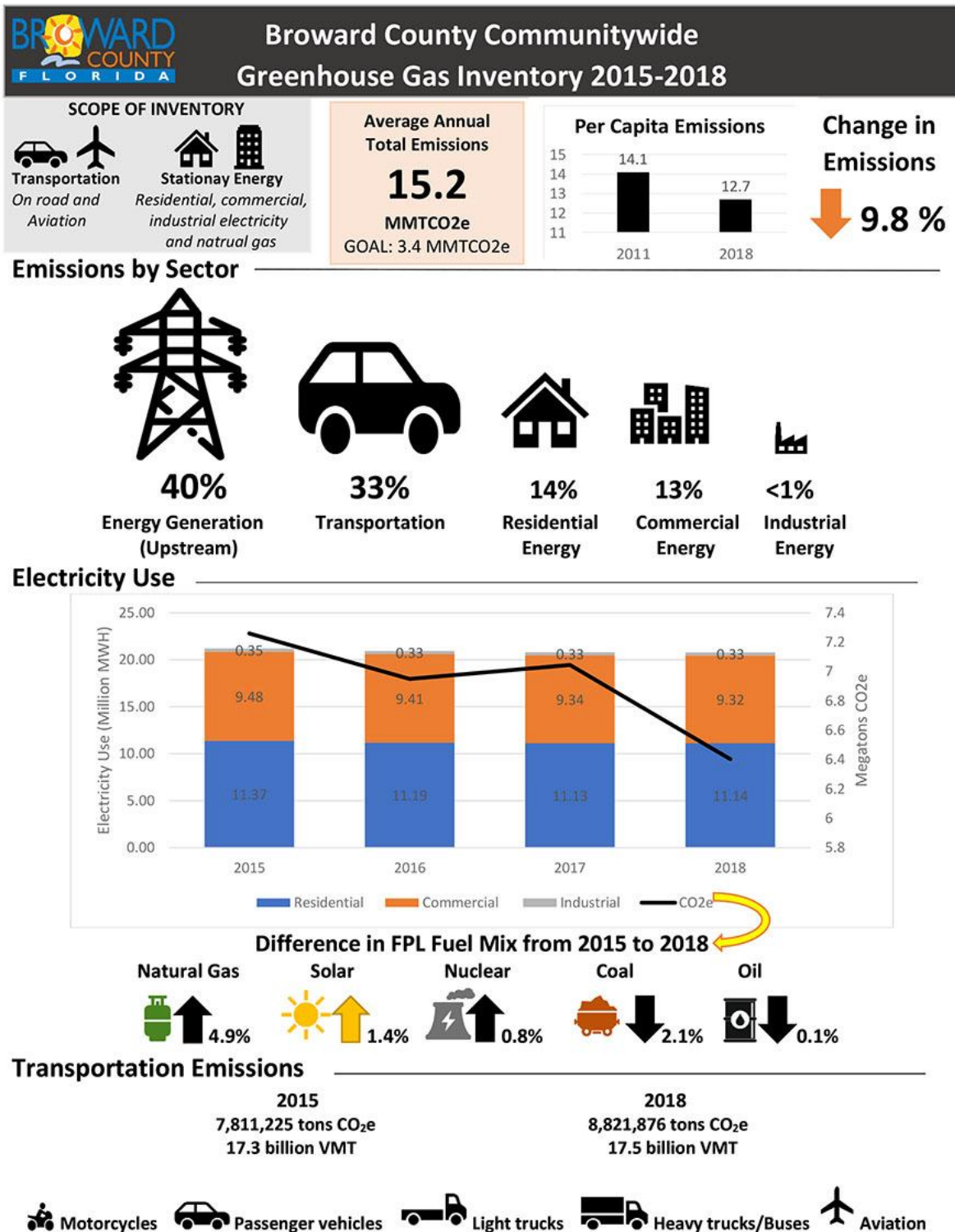


Figure B.1-4. Broward County Communitywide Greenhouse Gas Inventory 2015-2018 (Broward County 2024a).

B.1.3 Climate

South Florida has a tropical climate with distinct wet and dry seasons. The wet season, from May to October, brings high humidity, warm temperatures, increased rainfall, frequent afternoon thunderstorms, and occasional tropical storm systems that help cool the region. During this period, yearly average temperatures range from 77°F to 88°F (NOAA 2025a). NOAA dubbed 2023 the warmest year on record by far, with persistent heat documented in Broward County and across the South Florida region. Local stations measured record-breaking temperatures at Miami International Airport with the total number of hours exceeding a heat index at or above 105°F surpassing 160 hours, compared to the historical average of just 9.3 hours across the period of record (Broward County 2023b). The dry season, from November to April, features cooler temperatures, lower humidity, and little rainfall—ideal conditions for outdoor activities. Average temperatures during the dry season range from 64°F to 77°F. Throughout the year, South Florida’s location between the Gulf of America and the Atlantic Ocean helps maintain relatively moderate temperatures.

B.1.4 Noise

Noise is defined as any sound that is undesirable because it interferes with communication, is intense enough to damage hearing, or is otherwise intrusive. Human response to noise varies depending on the type and characteristics of the noise, distance between the noise source and the receptor, receptor sensitivity, and time of day. Noise is often generated by activities essential to a community’s quality of life, such as construction and vehicular traffic.

Sound varies by both intensity and frequency. Sound pressure levels, measured in decibels (dB), are used to quantify sound intensity. The decibel is a logarithmic unit that expresses the ratio of a sound pressure level to a standard reference level. Hertz are used to quantify sound frequency. The human ear responds differently to different frequencies. “A-weighting,” measured in A-weighted decibels (dBA), approximates a frequency response expressing the perception of sound by humans. **Table B.1-2** provides sounds encountered in daily life and their dBA levels.

Table B.1-2. Common Sounds and their A-weighted Decibel Levels

Sound Source	Sound Level (dBA)
Motorcycle, subway train	100
Steel Pile Driving	97
Tractor, garbage disposal	90
Noisy restaurant, blender	85
Downtown (large city), ringing phone	80
Pumps	77
Generator (<25KVA)	73
Freeway traffic, TV audio	70
Normal conversation, sewing machine	60
Rainfall, refrigerator	50
Quiet residential area, library	40

Source: Harris 1998, FHWA 2006, NRC 2020

The A-weighted decibel noise metric describes steady noise levels, although very few noises are, in fact, constant. Therefore, A-weighted day-night sound level has been developed. “Day-night sound level” is defined as the average sound energy in a 24-hour period with a 10-dB penalty added to the nighttime

levels (10:00 p.m. to 7:00 a.m.). Day-night sound level is a useful descriptor for noise because it averages ongoing yet intermittent noise and measures total sound energy over a 24-hour period. In addition, the equivalent sound level (L_{eq}) is often used to describe the overall noise environment. L_{eq} is the average sound level in decibels.

The Noise Control Act (42 USC §4901 et seq. (1972)) directs federal agencies to comply with applicable federal, state, and local noise control regulations. In 1974, EPA provided information suggesting continuous and long-term noise levels more than day-night sound level 65 dBA are normally unacceptable for noise-sensitive land uses such as residences, schools, churches, and hospitals. Broward County maintains a noise ordinance that prohibits any unreasonably loud noise originating from a facility authorized to operate with a Broward County air license or State of Florida air permit from which construction noise is exempt between 7:00 a.m. and 7:00 p.m. There is no measurement or noise level required for a violation of this ordinance.

Noise levels are associated with surrounding land use. No known ambient noise monitoring has been conducted in the Study Area; consequently, no quantitative data on noise levels within the Study Area are available for analysis.

The Study Area is primarily residential with some commercial businesses present. The S-37A Gated Spillway and G-54 Gated Spillway are located within a mile of schools, with the S-37A Gated Spillway approximately 2,000 feet from a school, and the G-54 Gated Spillway 2,300 feet away. The G-57 Gated Spillway is approximately 600 feet from a church with a highway to separate them, but no other sites have sensitive buildings nearby. Operational sound generated by the S-37A, G-54, and G-57 Gated Spillways is expected to be low level and likely at or below ambient sound levels during normal operation where sound sources are limited to that produced from the water flow and mechanical components. During infrequent atypical operation, a standby generator may be needed, which produces a sound pressure level of approximately 85 dBA at a distance of 23 feet from the generator. In the event of a power loss, if a standby generator must operate at the S-37A Gated Spillway, the resultant received sound level at the nearest school would be approximately 46 dBA. Similarly, for the G-54 and G-57 Gated Spillways, the resultant received sound levels would be 45 dBA at 2,300 feet and 57 dBA at 600 feet, respectively.

There are no significant noise generating land users within the Study Area. Existing sources of noise are limited to the vehicular traffic travelling on roads adjacent to and cutting through the Study Area. Sound levels are typically in the range of 85 to 100 dB for heavy duty trucks passing 15 feet away (Berger et al. 2010).

B.1.5 Hydrology

The major contributors to southeast Florida's hydrology include (1) local rainfall, which is the primary contributor of south Florida's fresh water; (2) evapotranspiration; (3) management of canal levels through operation of WCS; (4) low and flat topography in coastal areas subject to coastal risks including tidal elevations, surge, and sea level rise; and (5) the highly permeable and shallow Biscayne Aquifer allowing close interaction between surface water and subsurface/groundwater levels. Broward County is highly susceptible to flooding due to these factors (Decker 2022). Broward County has an average annual rainfall of over 57 inches, with most rainfall occurring during the wet season (May 1 to November 1).

The west side of Broward County is largely undeveloped and includes Water Conservation Areas (WCA) managed by the South Florida Water Management District (SFWMD) and U.S. Army Corps of Engineers (USACE). **Figure B.1-5** below illustrates the locations of WCA one, two, and three. The eastern third of the county is highly urbanized and is separated from the WCAs (and the Everglades) by a protective levee, with water levels within the WCAs maintained approximately 4 feet higher than the east side of the levee. This allows for gravity to drain water from west to east (Broward County 2019). WCA-1, WCA-2, and WCA-3 are 218 square miles, 207 square miles, and 925 square miles respectively. WCA-1 is located adjacent to the northern portion of the study area. WCA-2 and WCA-3 are located immediately west of the levee. WCA-2 consists of a sawgrass wetland with an area of approximately 210 square miles. WCA-3 is located to the south of WCA-2 and contains an area of approximately 915 square miles. These WCAs provide crucial functions such as flood control, water supply, and natural habitat.

In Broward County, the SFWMD also manages a network of canals, spillways, dikes and levees, culverts, and pump stations to manipulate the flow of water to protect regional water supplies and provide flood control. The SFWMD manages the primary drainage system—the Central and Southern Florida Project (C&SF Project) features—in Broward County. Secondary canals are managed by local drainage and water control districts that are responsible for flood control within a specific jurisdiction that drain into the primary system. Tertiary canals move water into secondary canals from neighborhood surface water features (such as ponds), and are managed by local governments, homeowner’s associations, or through coordination with a local drainage and water control district. The system is operated to prevent urban flooding while also maintaining sufficiently high groundwater levels to prevent saltwater intrusion near water-supply wells (Renken et al. 2005). However, urbanization, changing environmental conditions, sea level rise, and frequency of extreme rainfall and drought events are anticipated to impact the operation and long-term performance of the existing regional system.

Select primary canals and WCS in Broward County watersheds are the focus of this C&SF Section 203 Study. The Study Area is contained within Hydrologic Unit Code 03090206. The landscape is relatively flat, with an elevation slightly above sea level (2 to 10 feet on average). The Study Area consists of nine upstream and six downstream watershed basins with a network of seven primary canals managed by nine WCS (seven of which are coastal structures) (**Figure B.1-5**). The upstream watershed basins, primary canals, WCS within the Study Area, and a description of each WCS are provided in **Table B.1-3**.

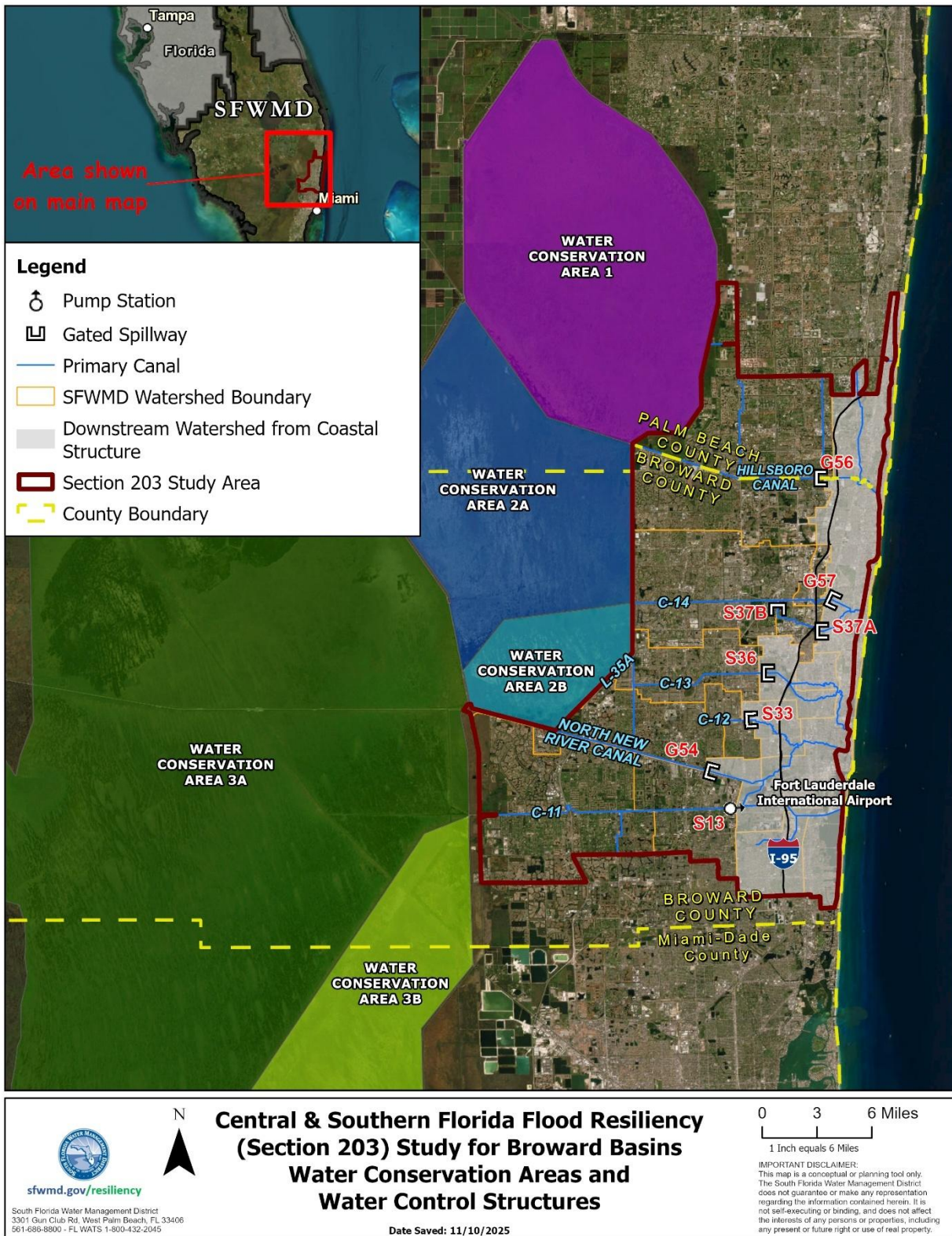


Figure B.1-5. South Florida's Water Conservation Areas (SFWMD 2024a).

Table B.1-3. C&SF Section 203 Study Area—Managed Upstream Watershed Basins, Primary Canals, and Water Control Structures.

Managed Upstream Watershed Basin	Primary Canal	Primary Water Control Structure	Description of Water Control Structure ^{b/}
Hillsboro Canal Basin	G-08 (Hillsboro) Canal	G-56 Gated Spillway	Built in 1991 to replace Deerfield lock structure Three gates, each 12.2 feet (ft) high (H) x 20.0 ft wide (W) Total Design Discharge Capacity is 3,760 cubic feet per second (cfs) Operated to maintain water level of 5.9 ft ^{c/}
Pompano Canal Basin	G-16 (Pompano) Canal	G-57 Gated Spillway	Built in 1987 Two gates, each 6.5 ft H x 14.7 ft W Total Design Discharge Capacity is 375 cfs Operated to maintain water level of 2.9 ft
C-14 West Basin	C-14 (Cypress Creek) Canal	S-37B Gated Spillway ^{a/}	Built in 1959 1 ft tall plate added to top of gates in 1990, and gate operators modified from stem to cable drum in 2004 Two gates, each 6.6 ft H x 25.75 ft W Total Design Discharge Capacity is 3,390 cfs Operated to maintain water level of 5.4 ft
C-14 East Basin	C-14 (Cypress Creek) Canal	S-37A Gated Spillway	Built in 1959 Two gates, each 12.8 ft H x 25.8 ft W Total Design Discharge Capacity is 3,890 cfs Operated to maintain water level of 2.4 ft
C-13 West Basin	C-13 (Middle River) Canal	S-36 Gated Spillway	Built in 1954 One gate, 14.0 ft H x 25.0 ft W Total Design Discharge Capacity is 1,090 cfs Operated to maintain water level of 2.9 ft
C-12 West Basin	C-12 (Plantation) Canal	S-33 Gated Spillway	Built in 1954 One gate, 9.0 ft H x 22.0 ft W Total Design Discharge Capacity is 920 cfs Operated to maintain water level of 1.9 ft
North New River Canal West Basin	G-15 (North New River) Canal	G-54 Gated Spillway	Built in 1992 to replace Sewell lock structure Three gates, each 9.5 ft H x 16.0 ft W Total Design Discharge Capacity is 1,600 cfs Operated to maintain water level of 2.4 ft
C-11 West Basin	C-11 (South New River) Canal	S-13AW Gated Culvert ^{a/}	Built in 2007 to replace S-13A Two gated concrete box culverts each 5.0 ft H x 10.0 ft W Total Design Gravity Discharge Capacity is 500 cfs Operated to maintain water level of 1.4 to 2.0 ft
C-11 East Basin	C-11 (South New River) Canal	S-13 Pump Station and Gated Spillway	Built in 1954 One gate, 11.0 ft H x 16.0 ft W Three 180-cfs pumps, each 60-inch diameter Total Design Gravity Discharge Capacity is 540 cfs Total Design Pump Discharge Capacity is 540 cfs Operated to maintain water level of 0.0 ft

Notes: C = canal; G = gate; S = structure

a/ The S-37B Gated Spillway and S-13AW Gated Culvert are non-coastal structures; all others are coastal structures

b/ Source: SFWMD 2021a

c/ Water levels are measured using the North Atlantic Vertical Datum of 1988 (NAVD88)

A system-wide review of regional water management infrastructure was completed by the SFWMD for the nine upstream watershed basins in 2021 to determine the flood protection level of service provided under current and future conditions and identified deficiencies in the system (SFWMD 2021b). Several watershed canals are shown to be insufficiently capable of handling the recurrence interval of flooding respective to the design conditions. The flood protection level of service ratings identify current flood vulnerabilities in urban areas and signify the relevance and urgency of this C&SF Section 203 Study.

B.1.6 Groundwater

The majority of Broward County is low and flat, with most land-surface elevations between 2 and 10 feet above North Atlantic Vertical Datum of 1988 (NAVD88; Broward County 2009). Land-surface elevation and groundwater levels are generally higher to the north than to the south, which results in a historical groundwater surface that generally slopes from the northwest to the southeast. Localized cones of depression, which form around major production-well locations, are superimposed on a low-gradient water level surface (Renken et al. 2005).

Groundwater is produced from two major aquifer systems: the Surficial Aquifer System (SAS) and the underlying Floridan Aquifer System (FAS). The SAS, including the Biscayne Aquifer, is the primary source of fresh, potable water in southeastern Florida. It is approximately 300 feet thick, with the thickest deposits occurring at the coast that thins to the west under the Everglades. The Biscayne aquifer is highly permeable – composed of limestone and sandstone – and is the primary drinking water source for Broward County. Below the SAS is the Hawthorn Group sediments, which is considered a confining unit, meaning that it does not readily transmit water, with a thickness of 600 to 700 feet. Below the Hawthorn Group confining sediments are the geologic units (i.e., limestone, dolomite) that comprise the FAS with an approximate thickness of 2,500 feet. Some public supply utilities tap the FAS as a brackish, alternative water source and treat it with reverse osmosis to make it suitable for drinking water purposes.

Recharge to the Biscayne Aquifer is primarily by local rainfall and surface water flows, including groundwater seepage from the WCAs, and surface water deliveries from the WCAs. When sufficient water is available, surface water from Lake Okeechobee also can be routed to the WCAs, then to regional canals and local water control districts to maintain water levels and recharge the aquifer (SFWMD 2024b). Recharge is highest during the wet season from May to November. A water budget developed by the U.S. Geological Survey (USGS) for the Biscayne Aquifer in Broward County indicates that about 78 percent of the 60-inch annual average rainfall reaches the Biscayne Aquifer. Based on the calibrated model water budget, discharge from the Biscayne Aquifer is primarily into canals, accounting for roughly 54 percent of all discharge. Evapotranspiration and well withdrawals accounted for another 24 and 20 percent, respectively (Decker 2022).

The SFWMD developed the 2023-2024 Lower East Coast (LEC) Water Supply Plan to assess projected water demands and potential sources of water for the period from 2021 to 2045. The 2023-2024 LEC Water Supply Plan update was approved in September 2024. The LEC Water Supply planning area encompasses all of Palm Beach, Broward, and Miami-Dade counties. Counties within the LEC planning area rely on traditional water sources such as surface water and fresh groundwater to meet residential and agricultural demands. The Biscayne Aquifer produces high-quality fresh water from relatively shallow wells. In 2021, fresh groundwater supplied 81 percent of Broward County's total water demand

(SFWMD 2023). Alternative water supply sources include brackish groundwater from the Floridan Aquifer, reuse strategies, water conservation, and others. Fresh groundwater accounts for 91 percent of the region’s public supply demand within the LEC Water Supply planning area in 2021 (SFWMD 2024b). To meet the 2045 projected demand of public supply utilities, the 2023-2024 LEC Water Supply Plan update identifies additional reverse osmosis water treatment plant projects to treat brackish water from the FAS. Currently, 15 operating reverse osmosis water treatment plants have a combined capacity of 79.5 million gallons per day and account for 6 percent of public supply utilities within the LEC planning area (SFWMD 2024b). Nine of these reverse osmosis water treatment plants are within the C&SF Section 203 Study Area.

B.1.7 Surface Water Quality

Urban development heavily influences water quality in the Study Area. Extensive levees and canals have disrupted natural drainage patterns, further degrading water quality. Nutrient pollution—primarily total nitrogen, total phosphorus, and fecal coliform bacteria—contributes to water quality impairment. The Biscayne Aquifer, Broward County’s primary freshwater source, is highly permeable limestone, making it vulnerable to contamination from urban runoff and saltwater intrusion from the Atlantic Ocean. Its high transmissivity allows for rapid recharge from surface water sources like the Everglades but also makes it susceptible to quick drawdown during droughts. With limited freshwater storage capacity, Broward County has proposed redirecting surface water flow from canals that currently discharge into the Atlantic Ocean to help restore the southern Everglades, enhance storage, and improve water quality (Broward County 2019). To address nutrient pollution, FDEP has established numeric nutrient criteria for many state water bodies. FDEP also identifies impaired waters and develops Total Maximum Daily Loads (TMDLs) which set pollutant reduction targets. These targets are implemented through Basin Management Action Plans and regulatory programs including the National Pollutant Discharge Elimination System (NPDES). Additionally, FDEP administers the NPDES program to regulate point source discharges and ensure compliance with water quality standards. All seven primary canals and several additional canals in the Study Area are subject to state-adopted and EPA-approved TMDLs, as summarized in **Table B.1-4**.

Table B.1-4. Primary and Other WCA Canals TMDLs in the Study Area.

Primary Canal	WBID ^{a/}	WBID Area (acres/square miles)	TMDL Parameter	Pollutant	TMDL Status
G-08 (Hillsboro) Canal ^{b/}	3264A	12,982/20.3	Bacteria	Fecal coliform	State adopted and EPA approved TMDLs
G-16 (Pompano) Canal ^{c/}	3271	3,795/5.9	Nutrient	Total nitrogen and total phosphorous	State adopted and EPA approved TMDLs
C-14 (Cypress Creek) Canal ^{d/}	3270	35,884/56.1	Bacteria	Fecal coliform	State adopted and EPA approved TMDLs
C-13 (Middle River) Canal ^{d/}	3273	13,188/20.6	Bacteria	Fecal coliform	State adopted and EPA approved TMDLs
C-12 (Plantation) Canal ^{d/}	3276	5,621/8.8	Bacteria	Fecal coliform	State adopted and EPA approved TMDLs
G-15 (North New River) Canal ^{d/}	3277C	5,555/8.7	Bacteria	Fecal coliform	State adopted and EPA approved TMDLs
C-11 (South New River) Canal ^{d/}	3279	45.367/70.9	Bacteria	Fecal coliform	State adopted and EPA approved TMDLs

Primary Canal	WBID ^{a/}	WBID Area (acres/square miles)	TMDL Parameter	Pollutant	TMDL Status
C-11 (East) Canal ^{d/}	3281	14.623/22.8	Bacteria	Fecal coliform	State adopted and EPA approved TMDLs
Dania Cut-off Canal ^{d/}	3277E	4,719/7.4	Bacteria	Fecal coliform	State adopted and EPA approved TMDLs
New River Canal (South) ^{d/}	3277A	10,281/16.1	Bacteria	Fecal coliform	State adopted and EPA approved TMDLs
New River (North Fork) ^{d/}	3276A	4,523/7.1	Bacteria	Fecal coliform	State adopted and EPA approved TMDLs
C-13 (East Middle River) Canal ^{d/}	3274	9,723/15.2	Bacteria	Fecal Coliform	State adopted and EPA approved TMDLs

a/ WBID = Water Body Identification Number

b/ Source: FDEP 2012a

c/ Source: FDEP 2007

d/ Source: FDEP 2012b

Note: Additional information on the status and implementation of TMDLs within the Study Area can be found at

<https://www.dep.state.fl.us/water/tmdl/>.

The Safe Drinking Water Act (42 USC § 300f et seq. (1974)) as amended, was established to protect the quality of drinking water in the United States. The Act authorizes EPA to establish minimum standards to protect tap water and requires all owners or operators of public water systems to comply with these primary (health-related) standards. The EPA regulates the National Primary Drinking Water Regulations, which set mandatory water quality standards for drinking water contaminants. These water quality standards are enforceable standards called maximum contaminant levels. The EPA also regulates National Secondary Drinking Water Standards, called secondary maximum contaminant levels (SMCLs). SMCLs are not enforceable but establish guidelines for 15 contaminants to assist public water systems in managing drinking water parameters. Exceedance of SMCLs for some of the 15 contaminants requires the public water supply to provide notice to persons served no later than 12 months from the day the exceedance is discovered (Dunn 2001).

To mitigate drinking water contamination, Broward County established the Wellfield Protection Program in 1984. Broward County's Environmental Permitting Division oversees and enforces the wellfield program. The program protects recharge areas within three wellfield zones. Zone One includes a 250-foot radius buffer around the well, Zone Two extends to 500 feet, and Zone Three reaches 1,320 feet. Businesses within these zones may need Hazardous Material Management Facility licenses and site-specific monitoring (Broward County 2022).

Broward County comprises over 266 miles of fresh and estuarine waterways. The Broward County Ambient Water Quality program includes 46 sites across canals and the Intracoastal Waterway (ICW), which are monitored quarterly to determine the overall water quality and impairment status of the county's water resources. The Broward County Environmental Monitoring Lab performs quarterly water quality testing for fecal bacteria and physical and biogeochemical parameters (total nitrogen, total phosphorous, turbidity, chlorophyll-a, salinity, and conductivity) at 46 sites from canals and intracoastal waterways throughout the county.

Fecal bacteria data and surface water quality data has been collected historically as part of the Environmental Monitoring Lab's Ambient Water Quarterly Monitoring Program, the goal of which is to establish baseline levels and characterize surface water pollution from agricultural and other land-based

sources including discharges from public sewer, septic systems, and stormwater pipes. The Water Quality Monitoring Program measures chemical, physical, and biological surface water conditions to establish baseline levels, and characterize pollution from public sewer, septic systems, and stormwater discharge pipes. Water quality samples are collected and analyzed using standard methods and utilize best practices assessing water pollution in ambient surface water. Samples for fecal testing utilize standard microbiological culture techniques and utilize best practices for assessing fecal pollution in ambient surface water. The laboratory operates in accordance with EPA and FDEP recommendations to characterize fecal pollution in saline or brackish waters by analyzing for enterococci and *E. coli* in freshwater, and in accordance with EPA and FDEP recommendations to characterize water quality in saline or brackish waters. The most recently published water quality data shows that *E. coli* exceedances of the FDEP statistical threshold value of 410 cfu/100 mL were found at 1 of the 46 sites monitored (Broward County 2024b). *Enterococci* exceedances were found at 14 monitoring stations during the same period.

Nutrients such as phosphorus and nitrogen compounds are also a concern in the WCAs to the west of the Study Area since they result in an imbalance of flora and fauna. WCA-2 and WCA-3 are classified as Class III waters, but they have additional phosphorus constraints that do not apply to other Class III waters. According to FAC 62-302.540, “the numeric phosphorus criterion for Class III waters in the EPA shall be a long-term geometric mean of 10 ppb but shall not be lower than the natural conditions of the EPA and shall take into account spatial and temporal variability. Achievement of the criterion shall be determined by the methods in this subsection. Exceedances of the provisions of this subsection shall not be considered deviations from the criterion if they are attributable to the full range of natural spatial and temporal variability, statistical variability inherent in sampling and testing procedures or higher natural background conditions.” Total phosphorous is the primary nutrient of concern within WCA-3 (USACE 2020). In central and western Palm Beach and Broward counties, high salinities in the SAS are attributed to relict seawater (connate water) in less transmissive and deeper portions of the SAS. This underlying saline water affects some public supply wellfields and irrigation well withdrawals. Higher salinities also are found in some WCA canals where portions of the canals are within the aquifer (SFWMD 2024b).

B.1.8 Vegetation

The following section describes the biological characteristics of vegetation communities within the C&SF Section 203 Study Area. A discussion of regional and localized land use characteristics, including categories of land use and cover (e.g., agricultural, commercial, and residential), is presented in **Sections B.1.16 Land Use and Real Estate** and **B.1.17 Visual Resources**.

The vegetation communities within the Study Area have been greatly altered during the last century. Agriculture is Florida’s second largest industry behind tourism, and it has influenced land use patterns and altered the natural landscape (Volk et al. 2017). Sugarcane crops and orange groves were originally planted predominantly in northeast and central Florida in the sixteenth century, but the industry began moving south in the twentieth century due to freezes and soil conditions (Volk et al. 2017). In addition to conversion of land for agricultural purposes, large areas of wetlands were drained and converted for other land uses, such as residential, transportation, commercial, and recreational use. Except for the historic coastal ridge, which runs along Dixie Highway and U.S. Federal Highway 1, most of Florida’s

southern peninsula was once part of the Everglades ecosystem (Broward County 2021). The Everglades ecosystem is a mosaic of sawgrass marshes, freshwater ponds, prairies, and forested uplands. Historically, the natural vegetation was a mix of intra-tidal (mangrove) wetlands, beach/shore, hardwood swamp, medium-hydroperiod marsh, wet prairie, wet prairie with scattered trees, mesic hammock, mesic pine flatwoods, dry prairie, and scrub. Although some of these natural areas still exist within the Study Area, the introduction of controlled drainage for land development has resulted in a significantly different set of land cover types.

Currently, disturbed lands still occupy the majority of the Study Area (95 percent); however, agriculture accounts for only 2.3 percent of the Study Area (**Table B.1-5**). The top three land uses within the Study Area landscape are Urban land use (primarily residential) with 58.5 percent, Transportation (highways, airports, etc.) with 21.4 percent, and Cultural-Lacustrine (primarily artificial impoundments/reservoirs) with 6.2 percent. Natural land uses (unaltered wetlands, uplands, and lakes) occupy only 5 percent of the Study Area. **Sections B.1.8.1** and **B.1.8.2** below provide further detail on current land use.

Table B.1-5 lists the Florida Fish and Wildlife Conservation Commission (FWC) Florida Land Cover Classification System (FLCCS) class types by acreage and relative percent cover within the Study Area. The FLCCS was created to incorporate classifications currently used by the FWC, Florida Natural Areas Inventory (FNAI), and Florida's water management districts and can be cross walked among the currently used and maintained classifications (FWC 2018). The Florida Cooperative Land Cover Map (CLC) is a partnership between the FWC and FNAI to develop ecologically based statewide land cover from existing sources and expert review of aerial photography. The CLC map uses the FLCCS to classify land cover types. **Figure B.1-6** through **Figure B.1-9** provide CLC map data showing the various FLCCS land cover types within the Study Area.

Table B.1-5. Florida Land Cover Classification System Class Names, Codes, Acreages, and Relative Coverage within the Study Area.

FLCCS Class Name	FLCCS Class Code	Area (acres)	Relative Percent Cover within Study Area (%)	FLCCS Class Code/Name ^{a/}
Mesic Hammock	1120	933	0.3	1100-Hardwood Forested Uplands
Prairie Mesic Hammock	1122	9	<0.1	1100-Hardwood Forested Uplands
Rockland Hammock	1130	180	0.1	1100-Hardwood Forested Uplands
Total Hardwood Forested Uplands Relative Coverage			0.4	
Scrub	1210	606	0.2	1200-High Pine and Scrub
Sand Pine Scrub	1213	1	<0.1	1200-High Pine and Scrub
Total High Pine and Scrub Relative Coverage			0.2	
Mesic Flatwoods	1311	413	0.2	1300-Pine Flatwoods and Dry Prairie
Scrubby Flatwoods	1312	132	<0.1	1300-Pine Flatwoods and Dry Prairie
Palmetto Prairie	1340	220	0.1	1300-Pine Flatwoods and Dry Prairie
Total Pine Flatwoods and Dry Prairie Relative Coverage			0.3	
Mixed Hardwood-Coniferous	1400	111	<0.1	1400-Mixed Hardwood-Coniferous

FLCCS Class Name	FLCCS Class Code	Area (acres)	Relative Percent Cover within Study Area (%)	FLCCS Class Code/Name ^{a/}
Shrub and Brushland	1500	719	0.3	1500-Shrub and Brushland
Cultural – Terrestrial	1800	391	0.1	1800-Cultural - Terrestrial
Mowed Grass	1810	141	<0.1	1810-Mowed Grass
Vegetative Berm	1811	197	0.1	1810-Mowed Grass
Highway Rights of Way	1812	0.18	<0.1	1810-Mowed Grass
Total Mowed Grass Relative Coverage			0.1	
Low Intensity Urban	1821	994	0.4	1820-Urban
Urban Open Forested	182111	21	<0.1	1820-Urban
Urban Open Land	18211	5419	2.0	1820-Urban
Residential, Low Density	18212	5626	2.1	1820-Urban
Grass	18213	156	0.1	1820-Urban
Parks and Zoos	182131	5073	1.9	1820-Urban
Golf courses	182132	10129	3.8	1820-Urban
Ballfields	182133	8	<0.1	1820-Urban
Cemeteries	182134	492	0.2	1820-Urban
Community rec. facilities	182135	210	0.1	1820-Urban
High Intensity Urban	1822	5	<0.1	1820-Urban
Residential, Med. Density - 2-5 Dwelling Units/AC	18221	62736	23.3	1820-Urban
Residential, High Density > 5 Dwelling Units/AC	18222	29512	11.0	1820-Urban
Commercial and Services	18223	25211	9.4	1820-Urban
Industrial	18224	2556	1.0	1820-Urban
Institutional	18225	8993	3.3	1820-Urban
Total Urban Relative Coverage			58.5	
Rural Open	1831	260	0.1	1830-Rural
Oak - Cabbage Palm Forests	183111	37	<0.1	1830-Rural
Rural Structures	1832	3281	1.2	1830-Rural
Total Rural Relative Coverage			1.3	
Row Crops	183311	2462	0.9	1833-Agricultural
Field Crops	183312	5	<0.1	1833-Agricultural
Improved Pasture	183313	1056	0.4	1833-Agricultural
Unimproved/Woodland Pasture	183314	267	0.1	1833-Agricultural
Orchards/Groves	18332	6	<0.1	1833-Agricultural
Citrus	183321	10	<0.1	1833-Agricultural
Pecan	183323	36	<0.1	1833-Agricultural
Fallow Orchards	183324	25	<0.1	1833-Agricultural
Vineyard and Nurseries	18334	5	<0.1	1833-Agricultural
Tree Nurseries	183341	649	0.2	1833-Agricultural
Ornamentals	183343	952	0.4	1833-Agricultural
Specialty Farms	183352	641	0.2	1833-Agricultural
Total Agricultural Relative Coverage			2.3	
Transportation	1840	57544	21.4	1840-Transportation
Communication	1850	131	<0.1	1850-Communication

FLCCS Class Name	FLCCS Class Code	Area (acres)	Relative Percent Cover within Study Area (%)	FLCCS Class Code/Name ^{a/}
Utilities	1860	2488	0.9	1860-Utilities
Extractive	1870	69	<0.1	1870-Extractive
Sand and Gravel Pits	1872	43	<0.1	1870-Extractive
Total Extractive Relative Coverage			<0.1	
Bare Soil/Clear Cut	1880	7	<0.1	1880-Bare Soil/Clear Cut
Mixed Scrub-Shrub Wetland	2112	1961	0.7	2100-Freshwater Non-Forested Wetlands
Marshes	2120	3149	1.2	2100-Freshwater Non-Forested Wetlands
Basin Marsh	21212	34	<0.1	2100-Freshwater Non-Forested Wetlands
Glades Marsh	2125	6	<0.1	2100-Freshwater Non-Forested Wetlands
Floating/Emergent Aquatic Vegetation	2140	132	<0.1	2100-Freshwater Non-Forested Wetlands
Total Freshwater Non-Forested Wetlands Relative Coverage			2.0	
Cypress/Tupelo (including mixed Cypress/Tupelo)	2210	199	0.1	2200-Freshwater Forested Wetlands
Cypress	2211	327	0.1	2200-Freshwater Forested Wetlands
Wet Flatwoods	2221	47	<0.1	2200-Freshwater Forested Wetlands
Hydric Pine Flatwoods	22211	35	<0.1	2200-Freshwater Forested Wetlands
Other Hardwood Wetlands	2230	0.10	<0.1	2200-Freshwater Forested Wetlands
Bay Swamp	22311	3	<0.1	2200-Freshwater Forested Wetlands
Hydric Hammock	2232	17	<0.1	2200-Freshwater Forested Wetlands
Cabbage Palm Hammock	22323	35	<0.1	2200-Freshwater Forested Wetlands
Mixed Wetland Hardwoods	2233	1331	0.5	2200-Freshwater Forested Wetlands
Mixed Hardwood-Coniferous Swamps	2240	295	0.1	2200-Freshwater Forested Wetlands
Total Freshwater Forested Wetlands Relative Coverage			0.9	
Cultural – Palustrine	2400	764	0.3	2400-Cultural - Palustrine
Lacustrine	3000	10	<0.1	3000-Lacustrine
Cultural – Lacustrine	3200	286	0.1	3200-Cultural - Lacustrine
Artificial/Farm Pond	3210	28	<0.1	3200-Cultural - Lacustrine
Aquacultural Ponds	3211	6	<0.1	3200-Cultural - Lacustrine
Artificial Impoundment/Reservoir	3220	15024	5.6	3200-Cultural - Lacustrine
Quarry Pond	3230	182	0.1	3200-Cultural - Lacustrine
Sewage Treatment Pond	3240	468	0.2	3200-Cultural - Lacustrine
Stormwater Treatment Areas	3250	28	<0.1	3200-Cultural - Lacustrine
Industrial Cooling Pond	3260	598	0.2	3200-Cultural - Lacustrine
Total Cultural – Lacustrine Relative Coverage			6.2	
Cultural – Riverine	4200	1	<0.1	4200-Cultural - Riverine
Canal	4210	4543	1.7	4200-Cultural - Riverine

FLCCS Class Name	FLCCS Class Code	Area (acres)	Relative Percent Cover within Study Area (%)	FLCCS Class Code/Name ^{a/}
Total Cultural – Riverine Relative Coverage			1.7	
Estuarine	5000	76	0.3	5000-Estuarine
Mangrove Swamp	5250	1434	0.5	5000-Estuarine
Total Estuarine Relative Coverage			0.8	
Cultural – Estuarine	5300	2802	1.0	5300-Cultural - Estuarine
Estuarine Ditch/Channel	5310	34	<0.1	5300-Cultural - Estuarine
Total Cultural – Estuarine Relative Coverage			1.1	
Exotic Plants	7000	147	0.1	7000-Exotic Plants
Australian Pine	7100	281	0.1	7000-Exotic Plants
Melaleuca	7200	884	0.3	7000-Exotic Plants
Brazilian Pepper	7300	1156	0.4	7000-Exotic Plants
Exotic Wetland Hardwoods	7400	606	0.2	7000-Exotic Plants
Total Exotic Plants Relative Coverage			1.1	
Natural Lands Total Relative Coverage			5	
Disturbed Lands Total Relative Coverage			95	
Total Acres	~268,097 ac			

a/ FLCCS class code/name as shown in **Figure B.1-6** through **Figure B.1-9**. Higher class level names were used (i.e., subclasses condensed) in figures to enhance visual clarity.

Source: FWC 2018, 2023a

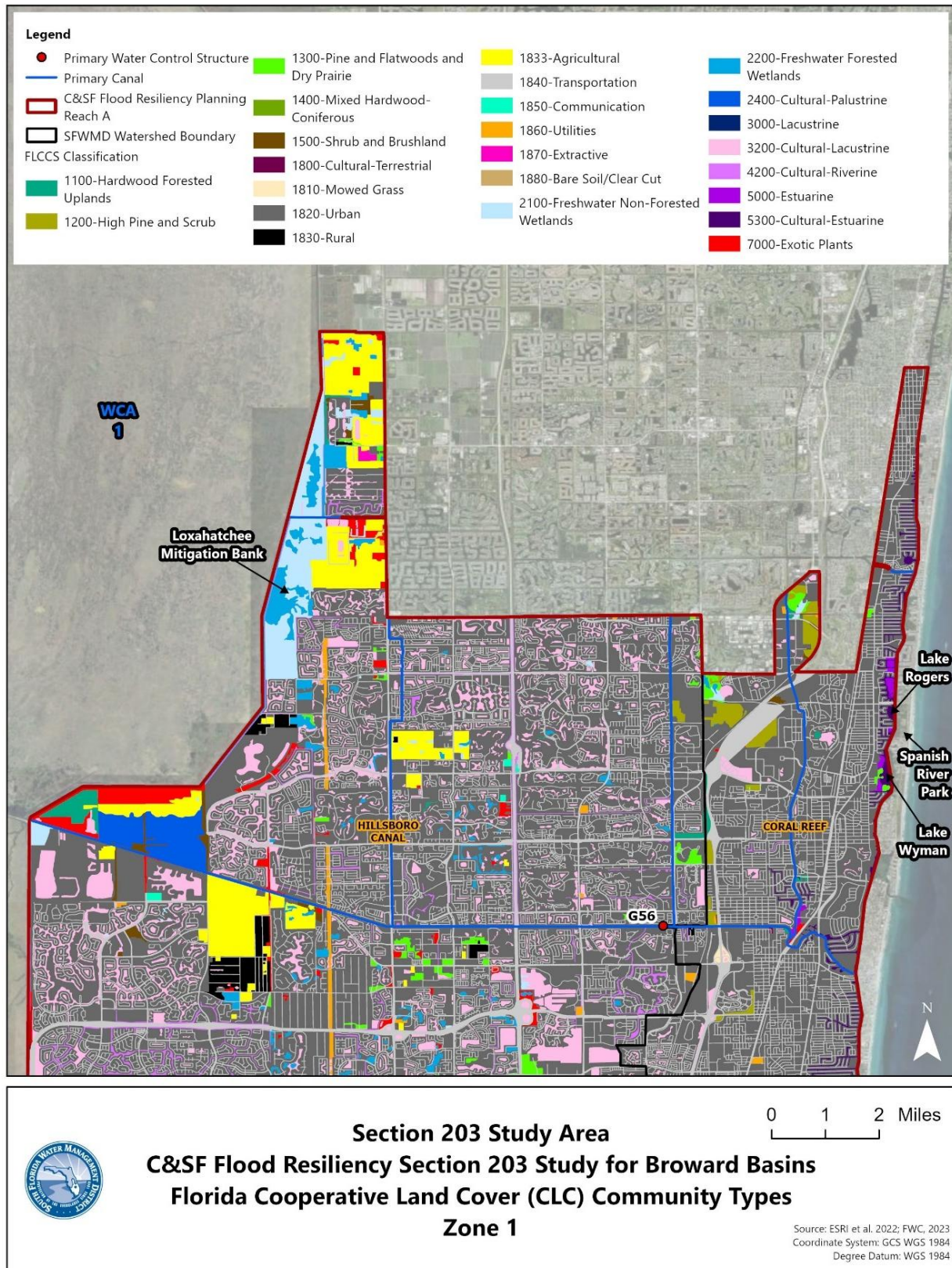


Figure B.1-6. Florida CLC Types within the Study Area (Northern).

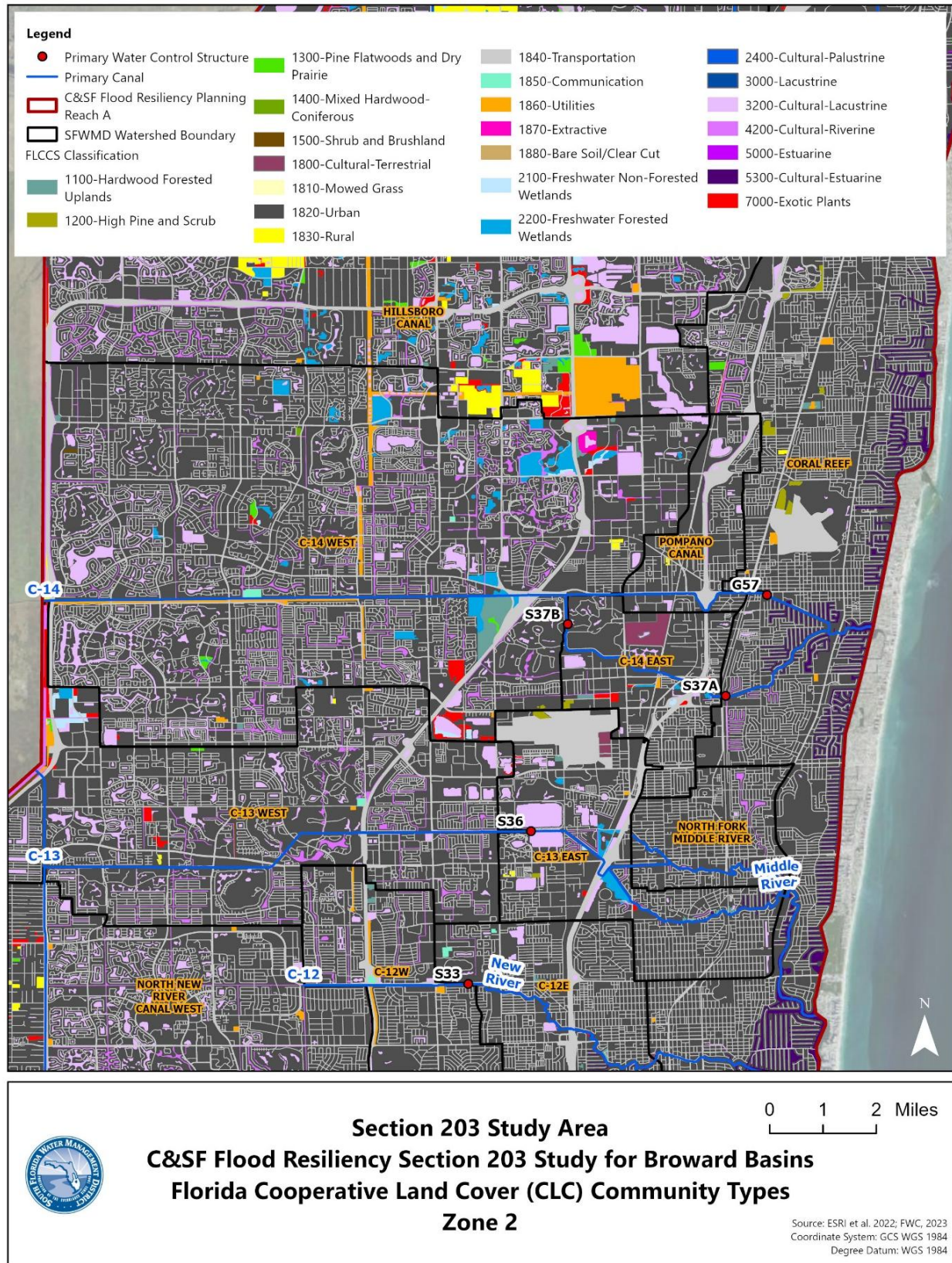


Figure B.1-7. Florida CLC Types within the Study Area (Central).

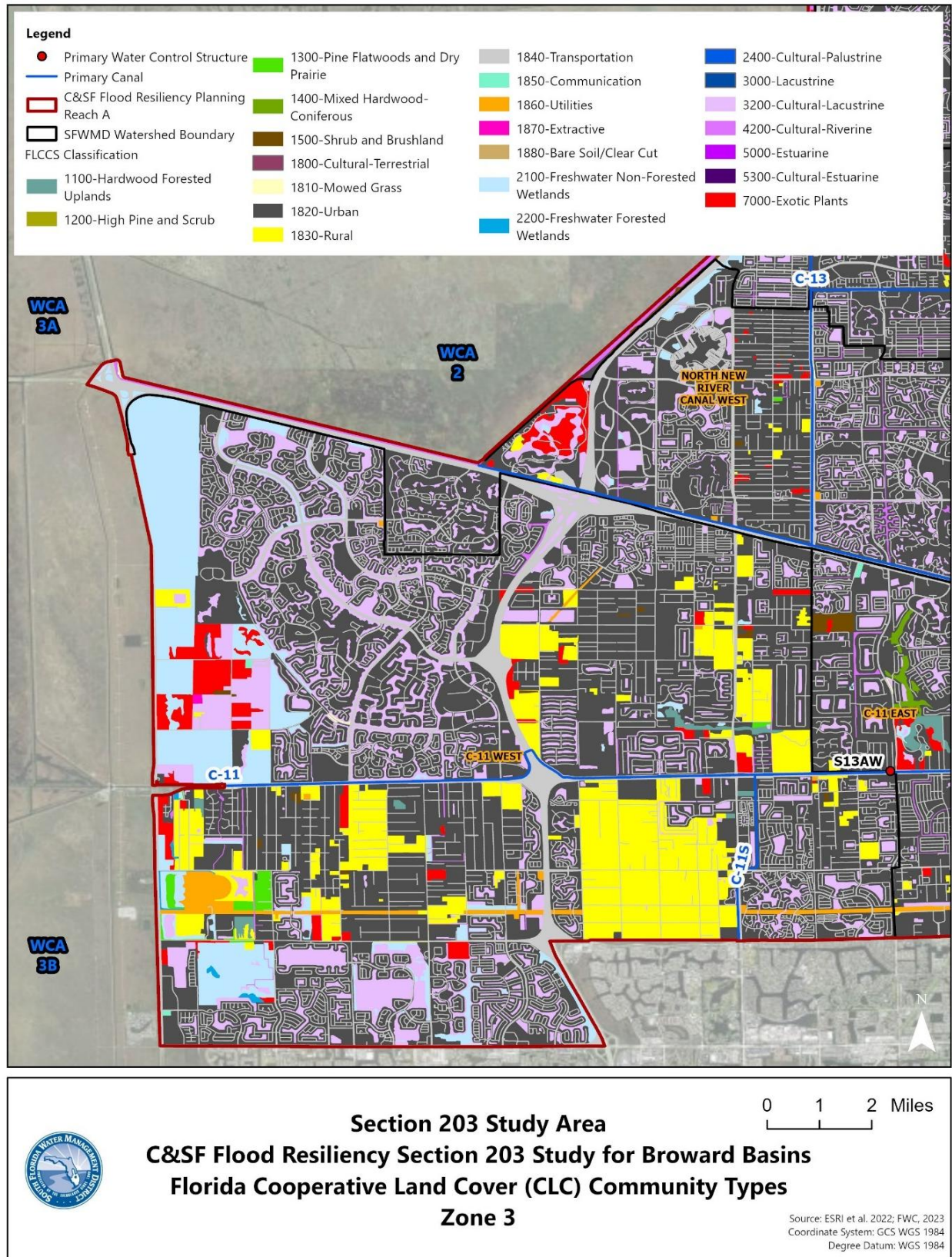


Figure B.1-8. Florida CLC types within the Study Area (Western).

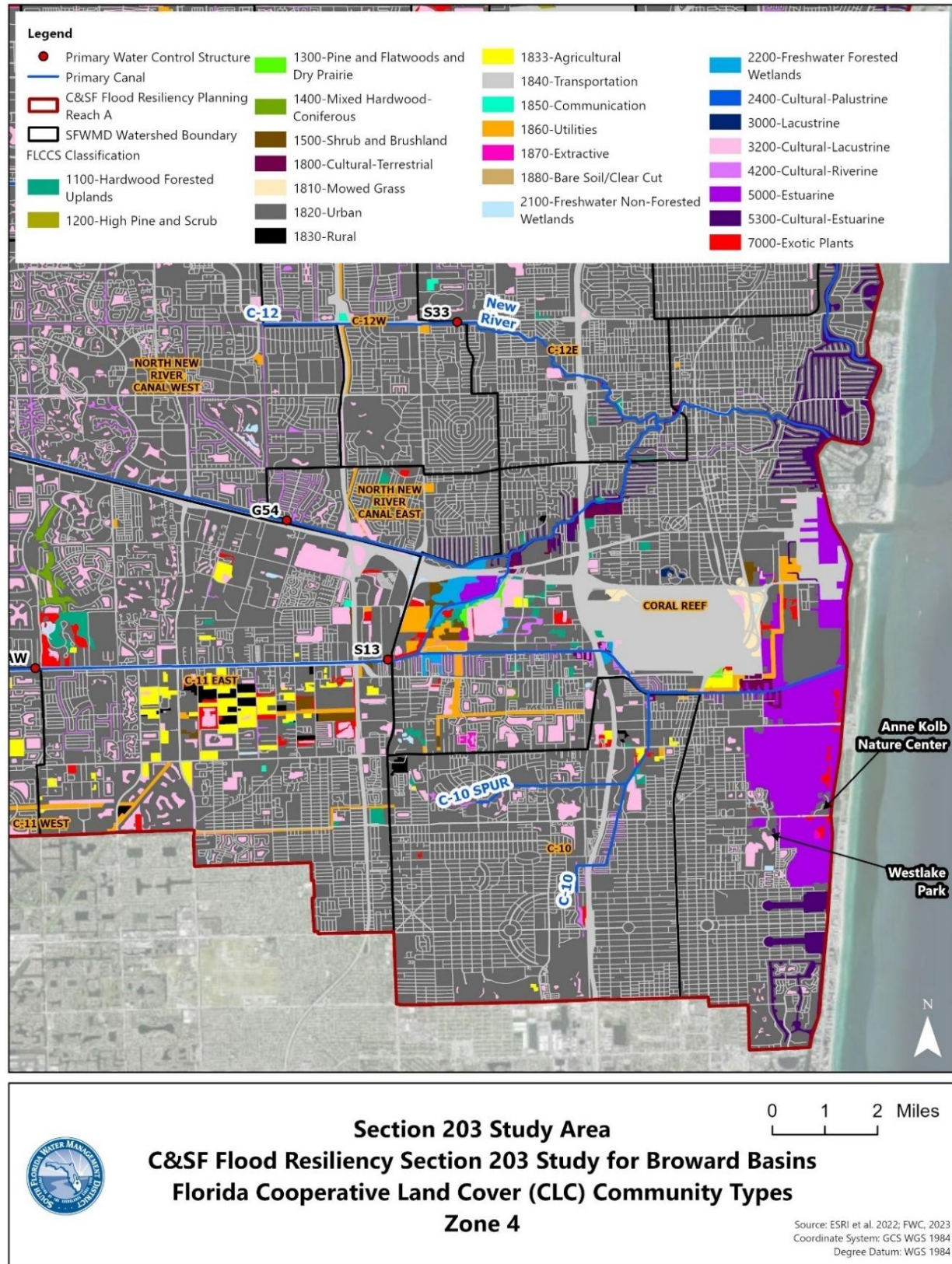


Figure B.1-9. Florida CLC types within the Study Area (Southern).

B.1.8.1 Disturbed Lands

Disturbed lands occupy approximately 95 percent of the total Study Area (**Table B.1-5**). Disturbed land uses within the Study Area are described below in decreasing order of abundance.

Urban land uses comprise the majority of the Study Area (approximately 58.5 percent **Table B.1-5**). Most Urban land use (23.3 percent) is in the Medium Density Residential (two to five dwelling units per acre) category and includes rural and recreational types of subdivisions (FWC 2018). The remaining Urban land uses constitute approximately 35.1 percent of the Study Area and include, in decreasing order of abundance: High Density Residential (more than five dwelling units per acre) (11.0 percent), Commercial and Services (9.4 percent), Golf Courses (3.8 percent), Institutional (3.3 percent), Low Density Residential (2.1 percent), Urban Open Land (2.0 percent), Parks and Zoos (1.9 percent), and Industrial (1.0 percent). All other Urban land uses have less than one percent cover and collectively account for 0.7 percent cover within the Study Area.

The transportation class accounts for approximately 21.4 percent of the Study Area (**Table B.1-5**).

Transportation land use includes highways and areas used for interchanges, limited access rights-of-way (ROWS), and service facilities; rail-oriented facilities (stations, roundhouses, repair and switching yards and related areas); airport facilities (including runways, intervening land, terminals, service buildings, navigational aids, fuel storage, parking lots and a limited buffer zone); and shipping facilities (ports, docks, shipyards, dry docks, locks and water course control structures designed for transportation purposes, associated buildings, piers, parking lots, and surrounding green areas [FWC 2018]).

Cultural-Lacustrine land uses occupy approximately 6.2 percent of the Study Area landscape (**Table B.1-5**). This classification includes the Artificial/Farm Pond, Aquacultural Ponds, Artificial Impoundment/Reservoir, Quarry Pond, Sewage Treatment Pond, Stormwater Treatment Areas, and Industrial Cooling Pond subclasses.

The Agricultural class accounts for approximately 2.3 percent of the Study Area (**Table B.1-5**). Agricultural land use includes the Row Crops, Improved Pasture, Ornamentals, Tree Nurseries, and Specialty Farms subclasses, among others.

Cultural-Riverine land uses constitute approximately 1.7 percent of the landscape. This classification includes the Canal subclass and other “communities that are either created and maintained by human activities or are modified by human influence on such a degree that stream flow, morphometry, water chemistry, or the biological composition of the resident community are substantially different from the character of the stream community as it existed prior to human influence” (FWC 2018).

Rural land use accounts for approximately 1.3 percent of the Study Area (**Table B.1-5**). Rural Structures (barns, residences, etc. in a rural setting), Rural Open (herbaceous or shrubby vegetated areas in a rural setting), and Oak-Cabbage Palm Forests (closed canopy of hardwood species, primarily Live Oak and Cabbage Palm that has been heavily impacted by human activity, primarily cleared for agriculture and urbanization) comprise the Rural class.

The Exotic Plants class occupies approximately 1.1 percent of the Study Area and includes the subclasses Australian Pine, Melaleuca, Brazilian Pepper, and Exotic Wetland Hardwoods. The 7000-Exotic Plants class accounts for upland and wetland areas dominated by non-native trees that were planted or have escaped and invaded native plant communities. This class includes sites known to be vegetated by non-native species but for which the actual species composition could not be determined (FWC 2018).

Cultural-Estuarine land uses occupy approximately 1.1 percent of the Study Area landscape. This classification includes the Estuarine Ditch/Channel subclass and other “communities that are either created and maintained by human activities or are modified by human influence on such a degree that the physical conformation of the substrate, or the biological composition of the resident community is substantially different from the character of the substrate or community as it existed prior to human influence” (FWC 2018).

The remaining seven disturbed land use classes each account for less than one percent relative cover within the Study Area; their cumulative cover is approximately 1.6 percent. These classes include, in descending order of abundance: Utilities, Cultural-Palustrine, Cultural-Terrestrial, Mowed Grass, Communication, Extractive, and Bare Soil/Clear Cut.

B.1.8.2 Natural Lands

Natural lands (i.e., unaltered uplands and wetlands) and open water (lakes) occupy approximately 5 percent of the total Study Area (**Table B.1-5**). Natural lands within the Study Area are described below in decreasing order of abundance.

Freshwater Non-Forested Wetlands account for approximately 2.0 percent of the Study Area landscape. Subclasses include Marshes, Mixed Scrub-Shrub Wetland, Basin Marsh, Glades Marsh, and Floating/Emergent Aquatic Vegetation.

The Forested Wetlands class constitutes approximately 0.9 percent of the Study Area. Forested Wetlands include Mixed Wetland Hardwoods, Mixed Hardwood-Coniferous Swamps, Cypress/Tupelo, Cypress, Wet Flatwoods, Hydric Pine Flatwoods, Other Wetland Hardwoods, Bay Swamp, Hydric Hammock, and Cabbage Palm Hammock.

Estuarine Wetlands occupy approximately 0.8 percent of the landscape. The Estuarine Wetlands class includes the Mangrove Swamps subclass and other “deepwater tidal habitats and adjacent tidal wetlands that are usually semi-enclosed by land but have open, partly obstructed, or sporadic access to the ocean, with ocean-derived water at least occasionally diluted by freshwater runoff from the land” (FWC 2018).

The remaining six natural land use classes each account for approximately less than 0.5 percent relative cover within the Study Area; their cumulative cover is approximately 1.2 percent. These classes include, in descending order of abundance: Hardwood Forested Uplands, Pine Flatwoods and Dry Prairie, Shrub and Brushland, High Pine Scrub, Mixed Hardwood-Coniferous, and Lacustrine.

B.1.8.3 Upstream/Western Watershed Basins (Hillsboro Canal Basin, Pompano Canal Basin, C-14 West Basin, C-14 East Basin, C-13 West Basin, C-12 West Basin, North New River Canal West Basin, C-11 West Basin, and C-11 East Basin)

The nine upstream watershed basins have freshwater canals that discharge eastward to estuarine sections through coastal salinity control structures depending on water elevations. Therefore, the wetlands and waterbodies within the upstream basins are freshwater wetlands consisting primarily of freshwater marshes, mixed scrub-shrub wetlands, mixed wetland hardwoods, and cypress swamps and artificial/maintained freshwater lakes/ponds. The National Wetlands Inventory (NWI) indicates that there are 5,535 acres of riverine wetlands within the Study Area (**Figure B.1-10**); however, the FLCCS/CLC categorizes 4,544 acres of riverine wetlands as canals (**Figure B.1-6** through **Figure B.1-9**).

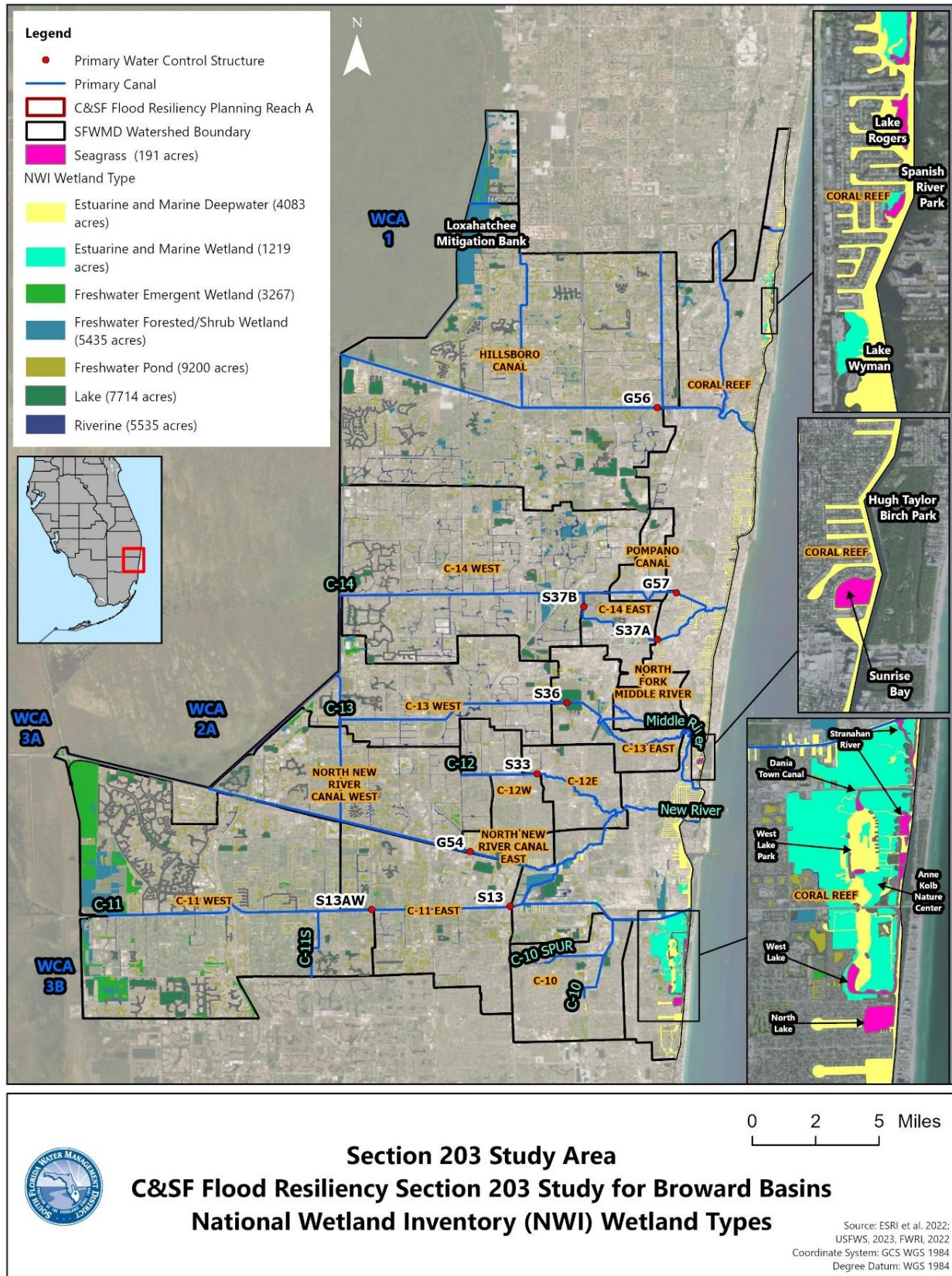


Figure B.1-10. National Wetland Inventory Wetland Types within the Study Area.

B.1.8.4 Downstream/Eastern Watershed Basins (Coral Reef Basin, C-14 East Basin, C-13 East Basin, North Fork Middle River Basin, C-12 East Basin, North New River Canal East Basin, C-11 East Basin, and C-10 Basin)

The eastern, non-managed watershed basins downstream of each WCS generally drain into the ICW through their respective canals. An exception is the western segment of the C-11 Canal, which is typically back-pumped into the WCAs (Broward County 2021).

Wetlands in these eastern basins are classified as estuarine—semi-enclosed water bodies with a free connection to the sea and a freshwater source. Some canals, such as the G-08 (Hillsboro) Canal, contain both freshwater and estuarine segments with direct or indirect connections to the ICW. However, estuarine wetlands, including mangrove swamps, are primarily located in the southeastern and northeastern extents of the Coral Reef Basin within the Study Area.

According to the NWI, the Study Area includes 4,083 acres of Estuarine and Marine Deepwater wetlands. However, the Florida Land Cover Classification System/Cooperative Land Cover (FLCCS/CLC) identifies 2,836 of those acres as artificial or maintained ditches and channels. These systems have been so extensively modified that the physical characteristics and biological communities differ significantly from their pre-disturbance state (FWC 2018).

Figure B.1-6 through **Figure B.1-9** show the CLC wetland types in the Study Area, while **Figure B.1-10** displays the NWI classifications.

Several structures—including the S-13 Pump Station and Gated Spillway, G-54 Gated Spillway, and S-33 Gated Spillway—connect to the ICW via the South Fork of the New River, South Fork New River/New River Main, and New River Main canals, respectively. In South Florida, the New River is considered a tidal estuary, though it is not a natural river. Instead, it is a network of artificial canals that connect to the Everglades and eventually discharge into the ICW and Atlantic Ocean at Port Everglades Cut in Fort Lauderdale.

The New River system forms from the junction of three primary canals originating in the Everglades:

The North New River Canal, which flows south from Lake Okeechobee along U.S. 27 and east along State Road 84/I-595

The South New River Canal, which flows east along Griffin Road and Orange Drive

A third canal that runs east along Sunrise Boulevard

Although the C-10 Basin lies within an estuarine system, the FLCCS does not identify any estuarine or freshwater wetlands within it. Other wetland types found in the downstream basins include Mixed Scrub-Shrub Wetland, Marshes, Cypress Swamp, Other Hardwood Wetlands, Hydric Hammock, Mixed Wetland Hardwoods, Basin Marsh, and Bay Swamp.

B.1.8.5 Upland Communities

The seven types of **vegetated** upland communities found within the Study Area are described below; **non-vegetated** land uses are described in **Section B.1.16**. The percent cover of all upland land use classes within the Study Area is presented in **Table B.1-5**. **Figure B.1-6** through **Figure B.1-9** illustrate the CLC upland community types within the Study Area.

Hardwood Forested Uplands

Hardwood Forested Uplands are Mesic or xeric forests dominated mainly by hardwood trees (FWC 2018). These uplands occupy approximately 0.4 percent of the Study Area landscape and contain the subclasses Mesic Hammock, Prairie Mesic Hammock, and Rockland Hammock. The FLCCS Hardwood Forested Uplands class and its subclasses are listed below and in **Table B.1-5**. **Figure B.1-6** through **Figure B.1-9** illustrate the CLC Hardwood Forested Uplands communities that occur throughout the Study Area.

Mesic Hammock

The mesic hammock community is found in small, scattered patches throughout the Study Area (accounting for 0.35 percent cover) in every basin except the North Fork Middle River and Pompano Canal Basins. Mesic hammock is a well-developed evergreen hardwood and/or palm forest on soils that are rarely inundated. The canopy is typically closed and dominated by live oak (*Quercus virginiana*), with cabbage palm (*Sabal palmetto*) generally common in the canopy and subcanopy. The overstory in southern Florida may contain a few tropical species such as gumbo limbo (*Bursera simaruba*) and satinleaf (*Chrysophyllum oliviforme*). Water oak (*Quercus nigra*) and laurel oak (*Quercus laurifolia*) may also be frequent in this community. The shrubby understory may be dense or open, tall or short, and is typically composed of a mix of saw palmetto, American beautyberry (*Callicarpa americana*), American holly (*Ilex opaca*), gallberry, sparkleberry (*Vaccinium arboreum*), hog plum (*Ximenia americana*), common persimmon (*Diospyros virginiana*), highbush blueberry (*Vaccinium corymbosum*), Carolina laurel cherry (*Prunus caroliniana*), yaupon (*Ilex vomitoria*), wild olive (*Osmanthus americanus*), and/or wax myrtle. In the central and southern peninsula, abundant epiphytes on live oaks and cabbage palms are a characteristic feature of mesic hammocks. In addition to Spanish moss (*Tillandsia usneoides*) and other air-plants (*Tillandsia* spp.), epiphytic ferns such as resurrection fern (*Pleopeltis michauxiana*), golden polypody (*Phlebodium aureum*), and shoestring fern (*Vittaria lineata*) are common in undisturbed stands (FNAI 2010).

Prairie Mesic Hammock

Prairie mesic hammock accounts for less than 0.1 percent cover within the Study Area and is found in the Coral Reef Basin downstream from the S-13 Pump Station and Gated Spillway along the southern branch of the New River Canal. Prairie mesic hammock consists of isolated patches of mesic hammock occurring within a larger matrix of pyrogenic vegetation, usually dry prairie, or mesic flatwoods, but occasionally on higher rises within a basin marsh, wet prairie, or wet flatwoods. These hammocks may experience low intensity fires on a regular basis, leading to canopy of low species diversity, such as cabbage palm, live oak, or a mixture of the two species, with saw palmetto common in the understory (FWC 2018).

Rockland Hammock

The entirety of the Rockland hammock community (0.1 percent of the Study Area) is in one area within the C-14 West Basin upstream of the S-37B Gated Spillway on the south side of the C-14 (Cypress Creek) Canal. The forest floor is largely covered by leaf litter with varying amounts of exposed limestone and has few herbaceous species. Rockland hammocks typically have larger more mature trees in the interior,

while the margins can be almost impenetrable in places with dense growth of smaller shrubs, trees, and vines (FNAI 2010). Characteristic species include gumbo limbo, pigeon plum (*Coccoloba diversifoli*), and stoppers (*Eugenia* spp.) (FNAI 2010).

High Pine and Scrub

Scrub/Sand Pine Scrub

Scrub habitat occupies approximately 0.2 percent of the Study Area and is in the C-13 East, C-14 East and West, Hillsboro Canal, and Coral Reef Basins. Scrub is a community composed of evergreen shrubs, with or without a canopy of pines, and is found on dry, infertile, sandy ridges. The signature scrub species are Florida rosemary (*Ceratiola ericoides*) and sand pine (*Pinus clausa*). The most common form of scrub is oak scrub, dominated by myrtle oak (*Quercus myrtifolia*), sand live oak (*Quercus geminate*), and Chapman's oak (*Quercus chapmanii*), interspersed with rusty staggerbush (*Lyonia ferruginea*) and saw palmetto (FNAI 2010).

Sand Pine Scrub is a variant of the Scrub community type. It is present in the northern extent of the Coral Reef Basin (less than 0.1 percent cover within the Study Area) between Interstate 95 and Congress Avenue and accounts for only 1 acre. Sand pine scrub is found on ridges throughout the state with a canopy of sand pine and an understory of the three shrubby oaks (myrtle oak, Chapman's oak, sand live oak), or less commonly, Florida rosemary (FWC 2018).

Pine Flatwoods and Dry Prairie

Mesic Flatwoods

The mesic flatwoods community (0.2 percent cover) occurs in the C-13 West, C-14 West, Hillsboro Canal, and Coral Reef Basins within the Study Area. Mesic flatwoods are characterized by an open canopy of tall pines and a dense understory of low shrubs, grasses, and forbs. Longleaf pine is the principal canopy tree in northern and Central Florida, and South Florida slash pine forms the canopy south of Lake Okeechobee. Characteristic shrubs include saw palmetto, gallberry, coastalplain staggerbush (*Lyonia fruticosa*), and fetterbush (*Lyonia lucida*). The herbaceous layer is predominantly grasses, including wiregrass (*Aristida stricta*), dropseeds (*Sporobolus curtissii*), panicgrasses (*Dichanthelium* spp.), and broomsedges (*Andropogon* spp.), plus many showy forbs. Mesic flatwoods is the most widespread natural community in Florida, covering the flat sandy terraces left behind by former high stands of sea level during the Plio-Pleistocene (FNAI 2010).

Scrubby Flatwoods

Scrubby flatwoods account for less than 0.1 percent cover within the Study Area and occur in the Hillsboro Canal Basin and Coral Reef Basin, just north and south of the G-08 (Hillsboro) Canal and G-56 Gated Spillway. The scrubby flatwoods community has an open canopy of widely spaced pine trees and a low, shrubby understory dominated by scrub oak (*Quercus inopina*) and saw palmetto, often interspersed with areas of barren white sand. Characteristic species include longleaf pine, slash pine (or South Florida slash pine), sand live oak, myrtle oak (or scrub oak), Chapman's oak, saw palmetto, and wiregrass (FNAI 2010).

Palmetto Prairie

Palmetto prairie occupies 0.1 percent cover within the Study Area and is present within the C-11 West, C-13 West, C-14 West, Hillsboro Canal, and Coral Reef Basins. The palmetto prairie occurs in areas that are seldomly flooded with a substrate of dry sand, and characterized by a dominance of saw palmetto. Other species common in the palmetto prairie include fetterbush, tar flower (*Bejaria racemosa*), gallberry, wiregrass, and brown grasses (FWC 2018).

Mixed Hardwood-Coniferous

The mixed hardwood-coniferous communities occupy less than 0.1 percent of the Study Area and occur in the C-11 East and C-14 West Basins. These upland forests occur on sandy clay soils with a mixture of mature pine and oak trees. Groundcover vegetation is often absent under the dense canopy and is replaced by a thick layer of leaves that retains moisture. This habitat may represent either area of natural pinelands into which hardwoods have invaded because of fire suppression, or floodplain forest and other hardwood-dominated systems into which pines have invaded due to drainage and altered hydrology. These communities contain well developed associations of longleaf pine, slash pine, and loblolly pine (*Pinus taeda*) in mixed company with live oak, laurel oak, and water oak, together with other hardwood species (FWC 2012).

Shrub and Brushland

The shrub and brushland community type accounts for approximately 0.3 percent cover within the Study Area and occurs in small, scattered patches in the C-11 West, C-11 East, Coral Reef, North New River Canal West, C-13 West, C-14 West, and Hillsboro Canal Basins. The scrub and brushland community type typically occurs in areas that have been disturbed from clear-cutting commercial pinelands, land clearing, or fire, and are recovering through natural successional processes. The shrub and brushland community type is characterized by an early condition of old-field succession, and various shrubs, tree saplings, and lesser amounts of grasses and herbs dominate the community. Common species include wax myrtle, saltbush (*Baccharis* spp.), sumac (*Rhus* spp.), elderberry (*Sambucus nigra*), saw palmetto, blackberry (*Rubus* spp.), gallberry, fetterbush, staggerbush, broomsedge, dog fennel (*Eupatorium capillifolium*), and other tree seedlings or saplings (FWC 2018).

Oak-Cabbage Palm Forests

The oak-cabbage palm community occurs within the Study Area (less than 0.1 percent cover) in two locations: one in the southern portion of the Coral Reef Basin and one within the southern extent of the Hillsboro Canal Basin. The oak-cabbage palm community characterized by a closed canopy of hardwood species, primarily live oak, and cabbage palm, which are naturally protected from fire by its position on the landscape. The community has been heavily impacted by human activity, primarily clearing for agriculture and urbanization. Soils and understory vegetation, which are often the only shaded habitat in a landscape of prairie, pasture, pineland, or marsh, are often trampled and compacted by cattle (FWC 2018). FLCCS categorizes Oak-Cabbage Palm Forests under the Rural class due to its disturbed nature; therefore, it is depicted as “Rural” along with the other Rural subclasses in the FLCCS **Figure B.1-9**.

Exotic Plants

The Exotic Plants class consists of upland and wetland areas dominated by non-native trees that were planted or have escaped and invaded native plant communities. These exotics include melaleuca, Australian pine, Brazilian pepper, and eucalyptus. This class includes sites known to be vegetated by non-native but for which the actual species composition could not be determined (FWC 2018). The Exotic Plants class (subclasses not included) accounts for approximately 0.1 percent within the Study Area. The subclasses Australian Pine, Melaleuca, Brazilian Pepper, and Exotic Wetland Hardwoods cumulatively contribute another 1.1 percent relative cover. Exotics are found in every basin in the Study Area except for the Pompano Canal, North Fork Middle River, and C12-West basins. Exotic plants are discussed in further detail in the following section.

B.1.9 Wetlands

The wetland communities found within the Study Area are described below, along with their respective subclasses. Their percent cover within the Study Area is presented in **Table B.1-5**. **Figure B.1-6** through **Figure B.1-9** illustrate the seven collective CLC wetland community types (Freshwater Non-Forested Wetlands, Freshwater Forested Wetlands, Estuarine, Cultural-Estuarine, Lacustrine, Cultural-Lacustrine, and Cultural Riverine) within the Study Area; **Figure B.1-10** depicts the NWI wetland types and the FWC-mapped seagrass habitat within the Study Area.

Freshwater Non-Forested Wetlands

Freshwater Non-Forested Wetlands are herbaceous or shrubby palustrine communities in floodplains or depressions; canopy trees, if present, are very sparse and often stunted (FWC 2018). These wetlands occupy approximately 2.0 percent of the Study Area landscape. The FLCCS freshwater non-forested wetland classes/subclasses are listed below and in **Table B.1-5**. **Figure B.1-6** through **Figure B.1-9** illustrate the CLC Freshwater Non-Forested wetland types that occur throughout the Study Area while **Figure B.1-10** depicts the NWI Freshwater Emergent Wetlands.

Marshes

Freshwater marshes cover about 1.2 percent of the Study Area, primarily along the western edge of the C-11 West Basin near WCA 3B (WCA-3B) (**Figure B.1-6** through **Figure B.1-9**). These low-elevation wetlands have long hydroperiods and fall into two subclasses: Basin Marsh and Glades Marsh. They typically feature grasses, sedges, broadleaf emergents, floating aquatic plants, or shrubs. Common species include wiregrass (*Aristida stricta*), Gulf Coast spikerush (*Eleocharis cellulosa*), beaksedges (*Rhynchospora* spp.), yellow-eyed grasses (*Xyris* spp.), St. John's wort (*Hypericum* spp.), and pitcherplants (*Sarracenia* spp.).

Basin Marshes, covering less than 0.1 percent of the Study Area, appear in the northern part of the Coral Reef Basin (**Figure B.1-6** through **Figure B.1-9**). These freshwater herbaceous wetlands form in isolated or semi-isolated depressions and remain regularly inundated. Their diverse plant communities include submerged, floating-leaved, emergent, and grassy species arranged by water depth. Shrubs may grow in small patches. Typical plants include American white waterlily (*Nymphaea odorata*), maidencane (*Panicum hemitomon*), sawgrass (*Cladium jamaicense*), bulltongue arrowhead (*Sagittaria lancifolia*), pickerelweed (*Pontederia cordata*), and sand cordgrass (*Spartina bakeri*) (FNAI 2010).

Glades Marshes, also covering less than 0.1 percent of the Study Area, are found only in the North New River Canal West Basin adjacent to WCA-3A and WCA-3B (**Figure B.1-6** through **Figure B.1-9**). These marshes occur in broad, shallow depressions or channels with peat or marl overlying limestone. They are seasonally inundated, support stagnant or slow-moving water, and are common in the Everglades region south of Lake Okeechobee (FNAI 2010). Glades marshes are primarily herbaceous and often dominated by dense, tall stands of sawgrass. Deeper areas may support a mix of emergent vegetation, including sparse sawgrass, maidencane, Tracy's beaksedge (*Rhynchospora tracyi*), and Gulf Coast spikerush.

Mixed Scrub-Shrub Wetland

Mixed scrub-shrub wetland communities account for 0.73 percent cover within the Study Area and are found in the western portions of the C-11 West and North New River Canal basins, the eastern portion of the C-14 West Basin, and nearly exclusively within the Loxahatchee Mitigation Bank in Palm Beach County abutting WCA-1 in the Hillsboro Canal Basin, included in the Study Area. Mixed scrub-shrub wetlands are dominated by woody vegetation less than 20 feet in height and are often located in transitional or disturbed communities on drier sites.

Floating/Emergent Aquatic Vegetation

Floating/emergent aquatic vegetation communities are present in the C-11 West, North New River Canal West, and C-14 West basins within the Study Area and account for less than 0.1 percent cover (**Table B.1-5; Figure B.1-6** through **Figure B.1-9**). Floating/emergent aquatic vegetation includes both floating vegetation and vegetation which is found either partially or completely above the surface of water (FWC 2018). This community type includes the subcategories slough and pond apple slough. Sloughs are described as broad, shallow channels with flowing water, which are inundated except during droughts. Sloughs are sparsely canopied or with emergent or floating plants such as alligator flag (*Thalia geniculata*) and American white waterlily (*Nymphaea odorata*) and have a substrate of peat (FNAI 2010). Pond apple sloughs are canopied sloughs dominated by pond apple (*Annona glabra*), often with abundant epiphytes (FNAI 2010). Additional floating/emergent aquatic subcategories are differentiated by dominant species such as water-lettuce (*Pistia stratiotes*), spatterdock (*Nuphar advena*), common water-hyacinth (*Eichhornia crassipes*), duckweed (*Lemna* spp.), American white waterlily, and other species.

Freshwater Forested Wetlands

Freshwater Forested Wetlands are floodplain or depression wetlands dominated by hydrophytic trees (FWC 2018). These wetlands occupy approximately 0.9 percent of the Study Area landscape. The FLCCS Freshwater Forested wetland classes/subclasses are listed below and in **Table B.1-5. Figure B.1-6** through **Figure B.1-9** illustrate the CLC Freshwater Forested wetland types that occur throughout the Study Area; the NWI classifies these wetlands as Freshwater Forested/Shrub Wetlands in **Figure B.1-10**.

Other Hardwood Wetlands

The Other Hardwood Wetlands class cumulatively accounts 0.5 percent of the Study Area and is in the western portion of the Coral Reef Basin. These wetlands are dominated by a mix of hydrophytic

hardwood trees with cypress (*Taxodium* spp.) or tupelo (*Nyssa* spp.) occasionally occurring in the canopy and have a short hydroperiod (FWC 2018). Other Hardwood Wetlands include the Bay Swamp, Hydric Hammock, Cabbage Palm Hammock, and Mixed Wetland Hardwoods subclasses (discussed below).

The Mixed Wetland Hardwoods subclass alone constitutes the majority of Other Hardwood Wetlands having 0.5 percent cover within the Study Area. They are scattered throughout the C-11 West Basin, Coral Reef Basin (near the S-13 Pump Station and Gated Spillway), C-13 East Basin (near the S-36 Gated Spillway), C-14 East Basin (near the S-37A Gated Spillway), C-14 West Basin (upstream of the S-37B Gated Spillway), C-13 West Basin, and Hillsboro Canal Basins. Mixed Wetland Hardwoods are composed of a large variety of hardwood species that are tolerant of hydric conditions yet exhibit an ill-defined mixture of species (FWC 2018). These communities are often connected or adjacent to a riverine community and occasionally inundated.

The Bay Swamp, Hydric Hammock, and Cabbage Palm Hammock subclasses each account for less than 0.1 percent cover within the Study Area. Bay Swamp is found within the Hillsboro and Coral Reef basins while Hydric Hammock and Cabbage Palm Hammock only occurs within the Coral Reef Basin.

Cypress/Tupelo (including Mixed Cypress/Tupelo)/Cypress

The Cypress/Tupelo and Cypress communities cumulatively account for approximately 0.2 percent cover in the Study Area and are in the C-14 West, C-13 East, and Hillsboro basins. They are dominated entirely by cypress and/or tupelo and have a long hydroperiod (FWC 2018). Air plants (*Tillandsia* spp.), ferns, orchids (*Bauhinia* spp., *Dendrophylax porrectus*, *Eltroplectris calcarata*, *Encyclia tampensis*, *Epidendrum* spp., etc.) and lilies (*Crinum americanum*, *Hymenocallis* spp.) are often found attached to cypress tree buttresses and limbs within these swamps.

Mixed Hardwood-Coniferous Swamps

Mixed hardwood-coniferous swamps account for approximately 0.1 percent cover in the Study Area and are found in the C-14 West and Hillsboro basins. They are a mixture of hardwoods and conifers, and neither achieve a 66 percent dominance of the crown canopy composition (FWC 2018). They are often found in low-lying areas that are flooded at least part of the year (short hydroperiod), and are characterized by a dense, shady canopy that reduces air circulation and traps humidity, further contributing to the damp conditions.

Wet Flatwoods/Hydric Pine Flatwoods

Wet Flatwoods and Hydric Pine Flatwoods community types make up less than 0.1 percent of the Study Area and only exist in the C-14 West Basin. Wet flatwoods are pine forests with a sparse or absent midstory and a dense groundcover of hydrophytic grasses, herbs, and low shrubs. The pine canopy typically consists of one or a combination of longleaf pine (*Pinus palustris*) and/or slash pine (*Pinus elliottii*). The subcanopy, if present, consists of scattered sweetbay (*Magnolia virginiana*), swamp bay (*Persea palustris*), loblolly bay (*Gordonia lasianthus*), pond-cypress (*Taxodium ascendens*), dahoon (*Ilex cassine*), titi (*Cyrtia racemiflora*), wax myrtle (*Morella cerifera*), saw palmetto (*Serenoa repens*) and gallberry (*Ilex glabra*). Herbs include wiregrass, blue maidencane (*Amphicarpum muhlenbergianum*), and/or hydrophytic species such as toothache grass (*Ctenium aromaticum*), coastalplain yellow-eyed

grasses, Carolina redroot (*Lachnanthes caroliana*), beaksedges (*Rhynchospora* spp.), and pitcherplants (FNAI 2010).

Estuarine

The Estuarine class is characterized as deepwater tidal habitats and adjacent tidal wetlands that are usually semi-enclosed by land but have open, partly obstructed, or sporadic access to the ocean, with ocean-derived water at least occasionally diluted by freshwater runoff from the land (FWC 2018). These wetlands occupy 0.3 percent of the Study Area and are only found in the Coral Reef Basin. The Estuarine class includes the Mangrove Swamp subclass (described below), which combined cover 0.8 percent within the Study Area. **Figure B.1-6** through **Figure B.1-9** illustrate the CLC Estuarine communities that occur throughout the Study Area. The NWI classifies these wetlands as Estuarine and Marine Wetlands in **Figure B.1-10**.

Mangrove Swamp

Mangrove swamps account for approximately 0.5 percent of the Study Area and are found in five locations, all within the Coral Reef Basin: Westlake Park and Anne Kolb Nature Center and downstream of the S-13 Pump Station and Gated Spillway in the southern portion of the basin, along the west side of the ICW; just north of Lake Rogers, across from Spanish River Park, and west of Lake Wyman; and south of the G-56 Gated Spillway near the termination of the G-08 (Hillsboro) Canal in the northern portion of the basin. Mangrove swamps are estuarine wetlands on muck, sand, or limestone substrate that are inundated with saltwater by daily tides (FWC 2018). Mangroves typically occur in dense stands occurring along relatively flat, low wave energy, marine and estuarine shorelines but may be sparse, particularly in upper tidal reaches where salt marsh species predominate. The dominant plant species are red mangrove (*Rhizophora mangle*), black mangrove (*Avicennia germinans*), white mangrove (*Laguncularia racemosa*), and buttonwood (*Conocarpus erectus*). Mangrove swamps often exist with no understory, although shrubs such as seaside oxeye (*Borrchia arborescens*, *B. frutescens*) and vines including gray nicker (*Caesalpinia bonduc*), coinvine (*Dalbergia ecastaphyllum*), and rubbervine (*Rhabdadenia biflora*), and herbaceous species such as saltwort (*Batis maritima*), shoregrass (*Distichlis littoralis*), and nodding pinweed (*Lechea cernua*) can occur in the understory (FNAI 2010).

Cultural-Estuarine

The Cultural-Estuarine land cover type consists of communities that are either created and maintained by human activities or are modified by human influence on such a degree that the physical conformation of the substrate, or the biological composition of the resident community is substantially different from the character of the substrate or community as it existed prior to human influence (FWC 2018). This cover type accounts for approximately 1.0 percent of the Study Area and is found within the Coral Reef, Pompano Canal, C-12 East, C13-East, North Fork Middle River, and North New River Canal East basins. The Cultural-Estuarine class includes the Estuarine Ditch/Channel subclass (described below), which combined cover 1.1 percent within the Study Area. **Figure B.1-6** through **Figure B.1-9** illustrate the CLC Cultural-Estuarine communities that occur in the Study Area; the NWI classifies these communities as Estuarine and Marine Deepwater in **Figure B.1-10**.

Estuarine Ditch/Channel

The Estuarine Ditch/Channel subclass is defined as an aquatic community of a ditch or narrow channel excavated in an estuarine marsh (FWC 2018). This subclass accounts for less than 0.1 percent of the Study Area and is primarily found within the eastern portion of Coral Reef Basin. Estuarine wetlands and estuarine ditches/channels are found in the vicinity of mangrove swamps and/or submerged aquatic vegetation habitat (described below) along the southeast and northeast portions of the Coral Reef Basin.

Lacustrine

The Lacustrine class is defined by FLCCS as wetlands and deepwater habitats situated in a topographic depression or dammed river channel; lacking trees, shrubs, persistent emergents, emergent mosses, or lichens with greater than 30 percent areal coverage; and whose total area exceeds 8 hectares (20 acres); or area less than 8 hectares if the boundary is active wave-formed or bedrock or if water depth in the deepest part of the basin exceeds 2 meters (6.6 feet) at low water (FWC 2018). This classification accounts for less than 0.1 percent cover in the Coral Reef Basin of the Study Area (**Table B.1-5**). **Figure B.1-6** through **Figure B.1-9** illustrate the CLC Lacustrine communities that occur throughout the Study Area. The NWI classifies Lacustrine communities as Lakes and Freshwater Ponds (**Figure B.1-10**).

Cultural-Lacustrine

Cultural-Lacustrine communities are either created and maintained by human activities or are modified by human influence on such a degree that the trophic state, morphometry, water chemistry, or biological composition of the resident community are substantially different from the character of the lake community as it existed prior to human influence. The Cultural-Lacustrine class is found in every basin within the Study Area and accounts for approximately 6.2 percent of the Study Area, the majority of which are artificial impoundments/reservoirs (5.6 percent). Other subclasses include Sewage Treatment Pond, Industrial Cooling Pond, and Quarry Ponds. The Cultural-Lacustrine class and subclasses are listed in **Table B.1-5**. **Figure B.1-6** through **Figure B.1-9** illustrate the CLC Cultural-Lacustrine land use types that occur throughout the Study Area. The NWI classifies the Cultural-Lacustrine communities as Lakes and Freshwater Ponds (**Figure B.1-10**).

Cultural-Riverine

Cultural-Riverine communities are either created and maintained by human activities or are modified by human influence on such a degree that stream flow, morphometry, water chemistry, or the biological composition of the resident community are substantially different from the character of the stream community as it existed prior to human influence (FWC 2018). Canals are a subclass of the Cultural-Riverine class and are found in every basin within the Study Area, accounting for approximately 1.7 percent of the Study Area. The Cultural-Riverine class and its subclass, Canals, are listed in **Table B.1-5**. **Figure B.1-6** through **Figure B.1-9** illustrate the CLC Cultural-Riverine communities that occur throughout the Study Area. The NWI classifies the Cultural-Riverine communities as Riverine (**Figure B.1-10**).

Seagrass Habitat

The FWC “Seagrass Habitat in Florida” GIS dataset was developed to represent the most recent seagrass mapping available in Florida for current statewide display and analysis. This data set represents a compilation of statewide seagrass data from various source agencies and scales. Not all data in this compilation are mapped from photography; some are the results of field measurements (FWC 2025).

Patchy, discontinuous seagrass habitat accounts for 0.1 percent cover within the NWI Estuarine and Marine Deepwater and Estuarine and Marine Wetland types (**Figure B.1-10**). Seagrass occurs in discontinuous patches of small beds along the eastern portion of the Coral Reef Basin within the following locations: the northeastern extent of the basin in the ICW; just north of and within Lake Rogers and west of Spanish River Park within the ICW; numerous locations south of the G-56 Gated Spillway and termination of the G-08 (Hillsboro) Canal in the northern portion of the basin; within Sunrise Bay, west of Hugh Taylor Birch State Park and the ICW; and in the Stranahan River, Dania Town Canal, West Lake, and North Lake south of the terminus of the C-11 (South New River) Canal and downstream of the S-13 Pump Station and Gated Spillway in the southern portion of the basin, along the west side of the ICW.

Seagrass beds provide food and habitat for fish, sea turtles, manatees, myriad invertebrates, and other species and improve water quality by removing nutrients, dissipating the effects of waves and currents, and stabilizing bottom habitats (thereby reducing suspended solids). Many commercial and recreational fisheries (e.g., clams, shrimp, lobster, and fish) are associated with healthy seagrass beds. Currently, many seagrass beds are stressed by extreme salinity fluctuations, increased turbidity, sedimentation, dredging, damage from boats, and nutrient enrichment, the latter which may cause cyanobacteria blooms that restrict light penetration (USACE 2024).

B.1.10 Invasive Species

Executive Order 13112 defines an invasive species as a non-native organism—plant, animal, fungus, or pathogen—that, when introduced into an ecosystem, causes or is likely to cause environmental, economic, or human health harm. In contrast, native species are those that occur naturally within a given ecosystem and are not the result of human introduction.

Extensive research shows that invasive plants have severely degraded South Florida’s ecosystems (Doren et al. 2001). These species crowd out native plants, alter soil and water chemistry, disrupt natural processes such as nutrient cycling, fire regimes, and carbon sequestration, and reduce genetic diversity. Although the full impact of invasive animals is less documented, their harmful effects are increasingly evident across the region. Invasive species also threaten public health, reduce agricultural yields and property values, degrade recreational and scenic resources, and compromise infrastructure such as navigation channels, levees, dams, and WCS (USACE 2024).

Florida is especially vulnerable to biological invasions due to its subtropical climate, major ports of entry, dense urban areas, and thriving pet, aquarium, and ornamental plant industries. Human-driven disturbances—such as urban development, agriculture, and flood control—further increase susceptibility. On average, 10 new non-native species establish themselves in Florida each year, often with harmful consequences. About 90 percent of these introductions enter the United States through

the Port of Miami (SFWMD 2024c). One estimate puts the number of exotic species introduced to Florida at over 32,000—eight times the number of native terrestrial species in the state (USACE 2024).

Florida is home to more than 4,700 native or naturalized plant species, with around 3,200 considered native and 230 endemic. Roughly 1,500 are non-native and self-sustaining. The Florida Invasive Species Council classifies 83 of these as Category I, meaning they actively invade and disrupt native ecosystems, and 89 as Category II, meaning they show potential to do so (Wunderlin et al. 2024).

In Broward and Palm Beach counties, the University of South Florida's Atlas of Florida Plants identifies 525 non-native plant species, including 136 invasives—67 in Category I and 69 in Category II (**Table B.1-6**)¹. Thirty-five of these species are also listed as Florida Noxious Weeds. Under the FLCCS, habitats are first categorized as Upland, Wetland, or Exotic. The Exotic subclass includes areas dominated by invasive trees such as melaleuca (*Melaleuca quinquenervia*), Australian pine (*Casuarina equisetifolia*), Brazilian pepper (*Schinus terebinthifolia*), and eucalyptus (*Eucalyptus* spp.). Some sites are vegetated by exotics with unidentified species (FWC 2018). The FWC Florida Cooperative Land Cover map (**Figure B.1-6** through **Figure B.1-9**) identifies FLCCS Exotic class code areas, and **Table B.1-7** provides FLCCS invasive community types by acreage and percent cover within the Study Area, including:

- Brazilian pepper (Category I)
- Melaleuca (Category I)
- Exotic Wetland Hardwoods (Category I/II)
- Australian pine (Category I)
- Unidentified exotic species (Category I/II)

Invasive vegetation occurs in nearly every basin except C-12 West, North Fork Middle River, and Pompano Canal. The highest concentrations appear in:

- C-11 West Basin (Exotic Wetland Hardwoods)
- North New River Canal West Basin (Melaleuca, Australian pine, Brazilian pepper)
- Hillsboro Canal Basin (Melaleuca)

FLCCS data show most invasive vegetation lies upstream of WCS, concentrated in the central and western parts of the Study Area (**Figure B.1-11**). A notable exception is the S-13 Pump Station and Gated Spillway, located between the C-11 East and Coral Reef Basins, which has a high downstream concentration of invasive species.

Table B.1-6. Invasive Vegetation and Noxious Weeds within Broward and Palm Beach Counties.

Common Name	Scientific Name	Category I ^{a/} (Y/N)	Category II ^{a/} (Y/N)	Florida Noxious Weed ^{b/} (Y/N)
Air-potato	<i>Dioscorea bulbifera</i>	Y	N	Y
Alexander palm; solitaire palm	<i>Ptychosperma elegans</i>	N	Y	N
Alligatorweed	<i>Alternanthera philoxeroides</i>	N	Y	Y
American evergreen	<i>Syngonium podophyllum</i>	Y	N	N
Arrowleaf elephant's ear	<i>Xanthosoma sagittifolium</i>	N	Y	N

¹ Since only a portion of each of Broward and Palm Beach counties are included in the Study Area, some county-level data presented in this section may be over- or under-represented.

Common Name	Scientific Name	Category I ^{a/} (Y/N)	Category II ^{a/} (Y/N)	Florida Noxious Weed ^{b/} (Y/N)
Asian sword fern	<i>Nephrolepis brownii</i>	Y	N	N
Australian almond	<i>Terminalia muelleri</i>	N	Y	N
Australian umbrella tree; octopus tree	<i>Heptapleurum actinophyllum</i>	Y	N	N
Australian-pine; horsetail casuarina	<i>Casuarina equisetifolia</i>	Y	N	Y
Balsampear	<i>Momordica charantia</i>	N	Y	N
Bamboo palm	<i>Chamaedorea seifrizii</i>	N	Y	N
Basketplant	<i>Callisia fragrans</i>	N	Y	N
Beach naupaka	<i>Scaevola taccada</i>	Y	N	Y
Black mimosa	<i>Mimosa pigra</i>	Y	N	Y
Bowstring hemp; mother-in- law's tongue	<i>Dracaena hyacinthoides</i>	N	Y	N
Brazilian jasmine; jazmin de trapo	<i>Jasminum fluminense</i>	Y	N	N
Brazilian pepper	<i>Schinus terebinthifolia</i>	Y	N	Y
Britton's wild petunia; Mexican bluebell	<i>Ruellia simplex</i>	Y	N	N
Browne's blechum; green shrimp plant	<i>Ruellia blechum</i>	N	Y	N
Burmareed; silkreed	<i>Neyraudia reynaudiana</i>	Y	N	Y
Burrnut; Jamaican feverplant	<i>Tribulus cistoides</i>	N	Y	N
Caesarweed	<i>Urena lobata</i>	Y	N	N
Carrotwood	<i>Cupaniopsis anacardioides</i>	Y	N	N
Castorbean	<i>Ricinus communis</i>	N	Y	N
Catclawvine	<i>Dolichandra unguis-cati</i>	Y	N	Y
Cathedral bells; life plant	<i>Kalanchoe pinnata</i>	N	Y	N
Chinaberrytree	<i>Melia azedarach</i>	N	Y	N
Chinese fan palm	<i>Livistona chinensis</i>	N	Y	N
Chinese ladder brake	<i>Pteris vittata</i>	N	Y	N
Chinese violet	<i>Asystasia gangetica subsp. gangetica</i>	N	Y	N
Coat buttons	<i>Tridax procumbens</i>	N	N	Y
Cogongrass	<i>Imperata cylindrica</i>	Y	N	Y
Common water-hyacinth	<i>Eichhornia crassipes</i>	Y	N	Y
Coral vine; queen's jewels	<i>Antigonon leptopus</i>	N	Y	N
Council tree	<i>Ficus altissima</i>	N	Y	N
Creeping oxeye	<i>Sphagneticola trilobata</i>	N	Y	N
Crested floatingheart	<i>Nymphoides cristata</i>	Y	N	Y
Cuban bulrush	<i>Cyperus blepharoleptos</i>	Y	N	N
Dayflowering jessamine	<i>Cestrum diurnum</i>	N	Y	N
Deviltree	<i>Alstonia macrophylla</i>	N	Y	N
Downy maiden fern; downy shield fern	<i>Thelypteris dentata</i>	N	Y	N
Durban crowfootgrass	<i>Dactyloctenium aegyptium</i>	N	Y	N
Dwarf papyrus; miniature flatsedge	<i>Cyperus prolifer</i>	N	Y	N
Dwarf rotala; roundleaf toothcup	<i>Rotala rotundifolia</i>	N	Y	N
Earleaf acacia	<i>Acacia auriculiformis</i>	Y	N	N
Elegant dutchman's-pipe; calico flower	<i>Aristolochia elegans</i>	N	Y	N
Elephantgrass; napiergrass	<i>Cenchrus purpureus</i>	Y	N	N

Common Name	Scientific Name	Category I ^{a/} (Y/N)	Category II ^{a/} (Y/N)	Florida Noxious Weed ^{b/} (Y/N)
Flamegold	<i>Koeleruteria elegans</i> subsp. <i>formosana</i>	N	Y	N
Fountaingrass	<i>Cenchrus setaceus</i>	N	Y	N
Giant brake	<i>Pteris tripartite</i>	N	Y	N
Gold coast jasmine	<i>Jasminum dichotomum</i>	Y	N	N
Governor's plum	<i>Flacourtia indica</i>	N	Y	N
Gray sheoak; suckering Australian-pine	<i>Casuarina glauca</i>	Y	N	Y
Guava	<i>Psidium guajava</i>	Y	N	N
Guineagrass	<i>Urochloa maxima</i>	N	Y	N
Incised halberd fern	<i>Tectaria incisa</i>	Y	N	N
Indian laurel	<i>Ficus microcarpa</i>	Y	N	N
Indian rosewood	<i>Dalbergia sissoo</i>	N	Y	N
Indian swampweed	<i>Hygrophila polysperma</i>	Y	N	N
Itchgrass	<i>Rottboellia cochinchinensis</i>	N	N	Y
Japanese climbing fern	<i>Lygodium japonicum</i>	Y	N	Y
Japanese honeysuckle	<i>Lonicera japonica</i>	Y	N	Y
Jaragua	<i>Hyparrhenia rufa</i>	N	Y	N
Java plum	<i>Syzygium cumini</i>	Y	N	N
Javanese bishopwood	<i>Bischofia javanica</i>	Y	N	N
Kudzu	<i>Pueraria montana</i> var. <i>lobata</i>	Y	N	Y
Lantana; shrubverbena	<i>Lantana strigocamara</i>	Y	N	N
Largeflower Mexican clover	<i>Richardia grandiflora</i>	N	Y	N
Latherleaf; Asian nakedwood	<i>Colubrina asiatica</i>	Y	N	Y
Limpograss	<i>Hemarthria altissima</i>	N	Y	N
Little bell	<i>Ipomoea triloba</i>	N	N	Y
Madagascar rubbervine	<i>Cryptostegia madagascariensis</i>	N	Y	N
Malabar plum; rose apple	<i>Syzygium jambos</i>	N	Y	N
Molassesgrass	<i>Melinis minutiflora</i>	N	Y	N
Moses-in-the-cradle; oyster-plant; boatlily	<i>Tradescantia spathacea</i>	Y	N	N
Mother-of-millions	<i>Kalanchoe x houghtonii</i>	N	Y	N
Nettleleaf velvetberry	<i>Stachytarpheta cayennensis</i>	N	Y	N
Orange jessamine	<i>Murraya paniculata</i>	N	Y	N
Orchid tree; mountain ebony	<i>Bauhinia variegata</i>	Y	N	N
Paper mulberry	<i>Broussonetia papyrifera</i>	N	Y	N
Paragrass	<i>Urochloa mutica</i>	Y	N	N
Peruvian primrosewillow	<i>Ludwigia peruviana</i>	Y	N	N
Pink tabebuia; white cedar	<i>Tabebuia heterophylla</i>	N	Y	N
Portia tree	<i>Thespesia populnea</i>	Y	N	N
Princess-of-the-night	<i>Selenicereus pteranthus</i>	N	Y	N
Punktree	<i>Melaleuca quinquenervia</i>	Y	N	Y
Queen palm	<i>Syagrus romanzoffiana</i>	N	Y	N
Red beadtrees; red sandalwood	<i>Adenanthura pavonina</i>	N	Y	N
Redflower ragleaf	<i>Crassocephalum crepidioides</i>	N	Y	N
River sheoak	<i>Casuarina cunninghamiana</i>	N	Y	Y
Rosary pea; blackeyed susan	<i>Abrus precatorius</i>	Y	N	Y
Rose myrtle	<i>Rhodomyrtus tomentosa</i>	Y	N	Y
Rose natalgrass	<i>Melinis repens</i>	Y	N	N
Santa maria; galba; Antilles calophyllum	<i>Calophyllum antillanum</i>	Y	N	N
Sapodilla	<i>Manilkara zapota</i>	Y	N	N
Scratchthroat	<i>Ardisia crenata</i>	Y	N	Y

Common Name	Scientific Name	Category I ^{a/} (Y/N)	Category II ^{a/} (Y/N)	Florida Noxious Weed ^{b/} (Y/N)
Sea hibiscus; mahoe	<i>Talipariti tiliaceum</i> var. <i>tiliaceum</i>	N	Y	N
Senegal date palm	<i>Phoenix reclinata</i>	N	Y	N
Serpent fern; wart fern	<i>Microsorium grossum</i>	Y	N	N
Sessile joyweed	<i>Alternanthera sessilis</i>	N	N	Y
Sewervine	<i>Paederia cruddasiana</i>	Y	N	Y
Shoebuttton	<i>Ardisia elliptica</i>	Y	N	Y
Shrubby false buttonweed	<i>Spermacoce verticillata</i>	N	Y	N
Silverthorn; thorny olive	<i>Elaeagnus pungens</i>	N	Y	N
Simpleleaf chastetree	<i>Vitex trifolia</i>	N	Y	N
Sisal hemp	<i>Agave sisalana</i>	N	Y	N
Skunkvine	<i>Paederia foetida</i>	Y	N	Y
Small leaf climbing fern	<i>Lygodium microphyllum</i>	Y	N	Y
Spanish arborvine; yellow morning-glory	<i>Distimake tuberosus</i>	N	Y	N
Sprenger's asparagus-fern	<i>Asparagus aethiopicus</i>	Y	N	N
Spurgecreeper	<i>Dalechampia scandens</i>	N	Y	N
Staghorn fern	<i>Platynerium bifurcatum</i>	N	Y	N
Strawberry guava	<i>Psidium cattleianum</i>	Y	N	N
Surinam cherry	<i>Eugenia uniflora</i>	Y	N	N
Torpedograss	<i>Panicum repens</i>	Y	N	N
Trompetilla; west Indian marshgrass	<i>Hymenachne amplexicaulis</i>	Y	N	N
Tropical nutrush	<i>Scleria macrocarpa</i>	Y	N	N
Tropical soda apple	<i>Solanum viarum</i>	Y	N	Y
Trumpet tree	<i>Cecropia palmata</i>	N	Y	N
Tuberous sword fern	<i>Nephrolepis cordifolia</i>	Y	N	N
Turkeyberry	<i>Solanum torvum</i>	N	Y	Y
Twoleaf nightshade	<i>Solanum diphyllum</i>	N	Y	N
Twolobe passionflower	<i>Passiflora biflora</i>	N	Y	N
Umbrella plant	<i>Cyperus involucratus</i>	N	Y	N
Valamuerto	<i>Senna pendula</i> var. <i>glabrata</i>	Y	N	N
Washington fan palm	<i>Washingtonia robusta</i>	N	Y	N
Water spangles	<i>Salvinia minima</i>	Y	N	N
Water-lettuce	<i>Pistia stratiotes</i>	Y	N	N
Waterhyme; hydrilla	<i>Hydrilla verticillata</i>	Y	N	Y
Wax begonia; club begonia	<i>Begonia cuellata</i>	N	Y	N
West Indian almond	<i>Terminalia catappa</i>	N	Y	N
West Indian dropseed	<i>Sporobolus jacquemontii</i>	Y	N	N
West Indian pennisetum; missiongrass	<i>Cenchrus polystachios</i>	N	Y	N
White leadtree	<i>Leucaena leucocephala</i>	N	Y	Y
White yam	<i>Dioscorea alata</i>	Y	N	Y
Wild bushbean	<i>Macroptilium lathyroides</i>	N	Y	N
Wild taro; dasheen; coco yam	<i>Colocasia esculenta</i>	Y	N	N
Woman's tongue	<i>Albizia lebbek</i>	Y	N	N
Wright's nutrush	<i>Scleria lacustris</i>	Y	N	N
n/a	<i>Eulophia graminea</i>	Y	N	Y
Totals		67	69	35

a/ Source: Wunderlin et al. 2024

b/ Source: FAC Rule 5B-57.007, Noxious Weed List. The total number of Florida noxious weeds is included within the combined totals of Category I and II Exotics.

Note: Since only a portion of each of Broward and Palm Beach counties are included in the Study Area, some county-level data presented in this section may be over- or under-represented.

Table B.1-7. FLCCS Invasive Community Types within the Study Area

FLCCS Class Name^{a/b/}	FLCCS Class Code^{a/b/}	FLCCS Description[/]	Acreage (ac)^{b/}	Percent Cover within Study Area (%)
Brazilian pepper	7300	Exotic, pestilent tree species found in Florida from the Tampa Bay area southward. Commonly found on disturbed sites, aggressive invader of Florida's plant communities. Communities often established along borrow-pits, levees, dikes, and old disturbed fields.	1,156	0.4
Melaleuca	7200	Exotic tree species occurring in almost pure stands. Aggressive competitor, invading and often taking over a site. Forms dense, impenetrable stands. Canopy closure must be 25% or more with at least 67% or more dominance.	884	0.3
Exotic wetland hardwoods	7400	Wetland with dominant exotic species such as Brazilian pepper, melaleuca, or other exotic species. Dominant species not specified.	606	0.2
Australian pine	7100	Canopy closure is 25% or more with at least 67% dominance by Australian pine trees. Trees average at least 20 feet tall and form tall, dense monocultures that preclude other vegetation.	281	0.1
Exotic Plants ^{c/}	7000	Upland and wetland areas dominated by non-native trees that were planted or have escaped and invaded native plant communities.	147	0.1

a/ Source: FWC 2018

b/ Source: FWC 2023

c/ While the description for FLCCS Class Code 7000, Exotic Plants, notes that exotics include melaleuca, Australian pine, Brazilian pepper, and eucalyptus, this class code is used for sites known to be vegetated by non-native plants (including those species) but for which the actual species composition could not be determined. Therefore, the total acreage and percent cover within the Study Area for FLCCS Class Code 7000 is not inclusive of the total acreage and percent cover for Class Codes 7100, 7200, 7300, and 7400.

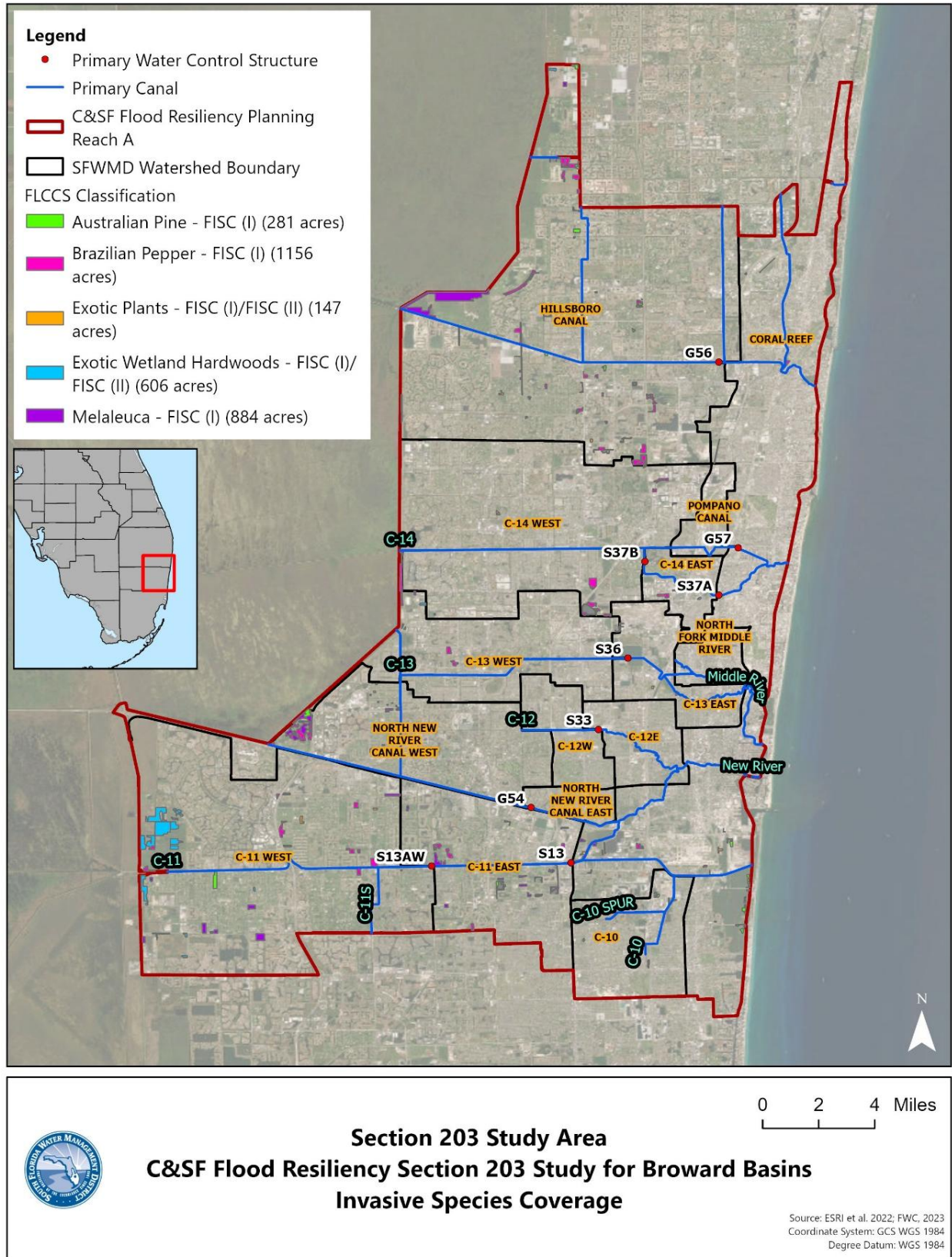


Figure B.1-11. Invasive Species Coverage within the Study Area.

B.1.11 Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act of 1976 (16 U.S.C. §§ 1801 et seq.) as amended, is the primary law governing marine fisheries in U.S. federal waters. It defines Essential Fish Habitat (EFH) as “waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity” (16 U.S.C. § 1802[10]). The Act applies to federally managed species, even within state waters, and requires federal agencies to identify and assess potential impacts on EFH from proposed projects.

Section 302 of the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. § 1852) established eight regional fishery management councils. The Study Area falls under the jurisdiction of the South Atlantic Fishery Management Council (SAFMC), which manages eight fisheries along the Atlantic Coast from North Carolina to Key West, in waters from 3 to 200 nautical miles offshore. These include:

- Coastal migratory pelagics (e.g., mackerel and cobia)
- Coral and live bottom habitat
- Dolphin and wahoo
- Golden crab
- Sargassum
- Shrimp
- Snapper-grouper complex
- Spiny lobster

Using the NOAA Fisheries Essential Fish Habitat Mapper (2024), EFH has been identified within tidal waters of the Study Area, which include the Atlantic ICW and connecting inland canals. Species with designated EFH in these waters include snapper and grouper complex; spiny lobster; penaeid shrimp; and coastal migratory pelagics (**Figure B.1-12**). A fragment of Atlantic Highly Migratory Species EFH (restricted to blacktip, bull, lemon, nurse, spinner, and tiger sharks) occurs in the easternmost fringe of the Study Area at Port Everglades (5.8 miles downstream of the nearest project WCS [S-33 Gated Spillway]). Additionally Coral and Hardbottom EFH occurs in the easternmost fringes of the Study Area nearby the ocean inlets, but intermittently low salinity prevents Coral and Hardbottom EFH upstream of the ICW. No portions of the Study Area meet the definitions for any HAPC.

The four EFH within tidal waters of the Study Area include Penaeid Shrimp EFH, Snapper-Grouper EFH, Spiny Lobster EFH, and Coastal Migratory Pelagic EFH. Tidal waters of the Study Area provide only a limited number of EFH habitat constituents. These constituents include tidal creeks; estuarine scrub/shrub (mangrove fringe); unconsolidated bottom; attached macroalgae; submerged rooted vascular plants (seagrasses); estuarine emergent vegetated wetlands (saltmarshes, brackish marsh); oyster reefs and shell banks; and flood tide shoal complexes.

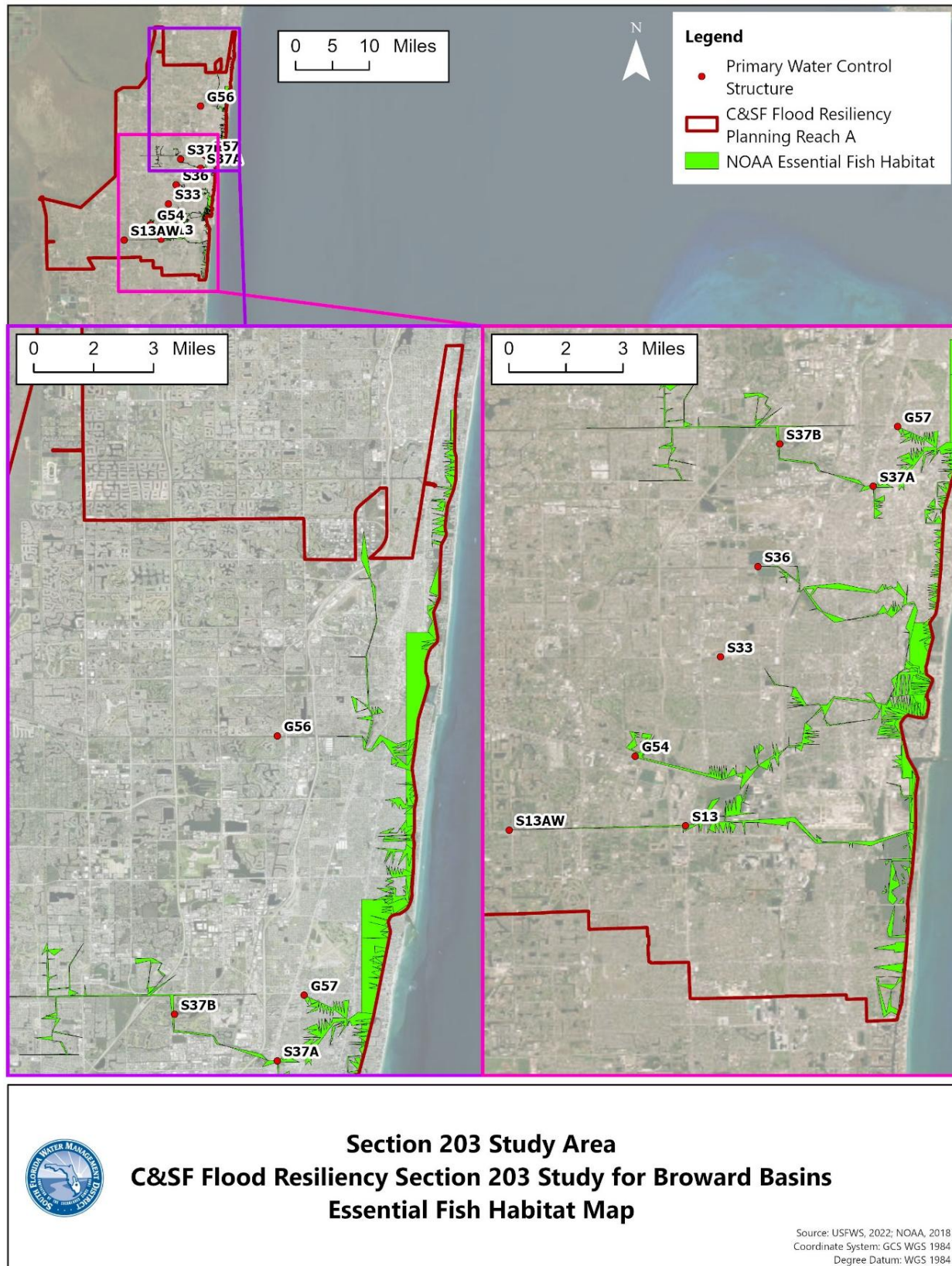


Figure B.1-12. Essential Fish Habitat within the Study Area.

Habitat loss has already impacted many managed fisheries and their habitats through overfishing, land conversion, altered hydroperiods, invasive species, and water quality decline. Within the Study Area, important EFH habitat constituents like mangroves are impacted from storm surges, drought, and lack of space for inland migration. Future changes will degrade these habitat constituents and may affect their viability as EFH.

The WCS are situated at the inshore-most ends of their associated canals, at the inshore-most limit of tidal influence. The nine WCS and their approximate distance from the ICW (i.e., tidal influence) are as follows:

- G-56 Gated Spillway located 4 miles upstream of the ICW
- G-57 Gated Spillway located 2 miles upstream of the ICW
- S-37B Gated Spillway located 6 miles upstream of the ICW
- S-37A Gated Spillway located 2.9 miles upstream of the ICW
- S-36 Gated Spillway located 6.8 miles upstream of the ICW
- S-33 Gated Spillway located 6 miles upstream of the ICW
- G-54 Gated Spillway located 8.5 miles upstream of the ICW
- S-13AW Gated Culvert located 10.7 miles upstream of the ICW
- S-13 Pump Station and Gated Spillway located 6.2 miles upstream of the ICW

B.1.12 Threatened and Endangered Species

The Endangered Species Act (ESA) 16 U.S.C. § 1531 *et seq.* (1973), as amended, protects species at risk of extinction and conserves the ecosystems they depend on. The U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) administer the ESA, which authorizes the listing of species as “endangered” or “threatened” and the designation of “critical habitat” under 50 CFR Part 424. Critical habitat includes areas essential for the survival and recovery of listed species. The ESA also prohibits unauthorized “take” of any listed species.

Federally listed threatened and endangered species are either known or likely to occur within the Study Area and may be affected by the C&SF Section 203 Study. Many listed species in Florida have already experienced habitat loss from land conversion, wetland drainage, altered hydroperiods, and water quality degradation.

A list of potentially affected federally listed species provided in **Table B.1-8** was generated using the USFWS Information for Planning and Consultation (IPaC) database (USFWS 2024a) and the National ESA Critical Habitat Mapper (NOAA 2023), provided in **Appendix H: Endangered Species Act Coordination and Consultation**. **Figure B.1-13** shows the Protected Species Consultation Areas within the Study Area.

Species identified to have a moderate or high potential of occurrence to occur in the Study Area will be carried forward for further analysis.

Table B.1-8. Federally Listed Species with the Potential to Occur in the Study Area.

Common Name	Scientific Name	Federal Status	Species-Habitat Associations	Likelihood of Occurrence ^{a/}
Mammals				
Florida bonneted bat	<i>Eumops floridanus</i>	Endangered	Forages in open habitats including pine and hardwood forests, agricultural areas, golf courses, and neighborhoods. Roost in natural pine tree cavities, under barrel roofing tiles, and in bat houses. Commonly use forests, wetlands, open water, and residential and urban areas. In Florida, most likely to occur in semitropical forests with tropical hardwood, pineland, and mangrove habitats, as well as man-made areas such as golf courses and neighborhoods.	High
Florida panther	<i>Puma (=Felis) concolor coryi</i>	Endangered	Utilizes a diversity of warm climate habitat, living in wetlands, swamps, upland forests, and strands of saw palmetto. In South Florida, panthers prefer mature upland forests (hardwood hammocks and pinelands). Upland forests provide dry ground for resting and denning, and prey density is higher.	Low
Southeastern beach mouse	<i>Peromyscus polionotus niveiventris</i>	Threatened	Inhabits sand dunes along the Florida Atlantic Coast from Volusia south to Martin County.	Low
Tricolored bat	<i>Perimyotis subflavus</i>	Proposed Endangered	Forages near or directly over water, in fields, and along forest edges. Common in Pine Rocklands in the Greater Everglades during the warm-wet season. Roosts in caves, culverts, bridges, trees, and other structures. Will also roost in Spanish moss and dead tree leaves.	Moderate
West Indian (Florida) manatee	<i>Trichechus manatus</i>	Threatened	Inhabits Florida’s coastal waters, rivers, and springs year-round. Migrates to Florida’s warm water habitats including artesian springs and power plant discharge canals during colder months. Found where their food sources (seagrasses and other marine or freshwater vegetation) are abundant.	High
Birds				
Crested caracara (Note the listed entity is Audubon’s crested caracara)	<i>Caracara plancus</i> (Note the listed entity is: <i>Polyborus plancus audubonii</i>)	Threatened	Inhabits wet prairies with cabbage palms. Also found in wooded areas with saw palmetto, cypress, scrub oaks, and pastures.	High
Eastern black rail	<i>Laterallus jamaicensis</i> ssp. <i>jamaicensis</i>	Threatened	Requires dense vegetative cover that allows movement underneath the canopy. Occurs in a variety of marsh habitats that can be tidally or non-tidally influenced. Typically found in salt and brackish marshes with dense cover and in upland areas of these marshes. Shrub densities that become too high become unsuitable for the species. Soils are moist to saturated with very shallow water.	Low ^{b/}
Everglade snail kite	<i>Rostrhamus sociabilis plumbeus</i>	Endangered	Inhabits shallow freshwater marshes and shallow grassy shorelines of lakes, especially areas with high volumes of apple snails. Primarily found in WCA-2A, -2B, -3A, and -3B in Broward, Palm Beach, and Dade counties. Also found in the Kissimmee Valley, St. Johns River headwaters, Lake Okeechobee, Loxahatchee National Wildlife Refuge, and sections of Big Cypress National Preserve and Everglades National Park.	High
Florida grasshopper sparrow	<i>Ammodramus savannarum floridanus</i>	Endangered	Inhabits dry open prairies that contain bunch grasses, low shrubs, and saw palmetto. Found in south-central Florida in Polk, Osceola, Highlands, and Okeechobee County.	Low
Florida scrub-jay	<i>Aphelocoma coerulescens</i>	Threatened	Inhabits sand pine and xeric oak scrub, and scrubby flatwoods, which occur in some of the highest and driest areas of Florida – ancient sandy ridges that run down the middle of the state, old sand dunes along the coasts, and sandy deposits that contain large quantities of oak shrubs. Only bird species endemic to Florida.	Moderate
Piping plover	<i>Charadrius melodus</i>	Threatened	Inhabits sandy beaches, sand flats, and mudflats along coastal areas.	High
Reptiles				
American crocodile	<i>Crocodylus acutus</i>	Threatened	Occurs at the northern end of their range in south Florida. Inhabit brackish or saltwater areas, and can be found in ponds, coves, and creeks in mangrove swamps. Occasionally encountered inland in freshwater areas of southeast Florida coast due to the extensive canal system.	High
Eastern indigo snake	<i>Drymarchon couperi</i>	Threatened	Inhabits pine flatwoods, hardwood forests, moist hammocks, and areas that surround cypress swamps. Found throughout Peninsular Florida.	High
Green sea turtle	<i>Chelonia mydas</i>	Threatened	Found in subtropical and temperate oceans of the world. Florida hosts one of the largest groupings of green sea turtle nests in the western Atlantic. Occupy shallow flats and seagrass meadows during the day. Rests in rock ledges, oyster bars, and coral reefs during evenings.	Moderate
Hawksbill sea turtle	<i>Eretmochelys imbricata</i>	Endangered	Found in subtropical and temperate oceans of the world. Common in warm tropical seas where sponges are found. In Florida, the species is mostly found on reefs in the Florida Keys and along the southeastern Atlantic coast.	Low
Kemp’s Ridley	<i>Lepidochelys kempii</i>	Endangered	Inhabit nearshore coastal habitats with muddy or sandy bottoms and nest in northeastern Mexico; after hatching, the young swim offshore, spending 1 to 2 years in the Gulf of Mexico or drifting via the Gulf Stream to the Atlantic, then settling into shallow coastal areas of the Gulf of Mexico or the northwestern Atlantic.	Moderate
Leatherback sea turtle	<i>Dermochelys coriacea</i>	Endangered	Found in marine waters throughout the Atlantic, Pacific, and Indian Oceans, where they nest along sandy beaches. Nesting in the United States usually occurs in Florida, Puerto Rico, and St Croix. Found in Florida’s coastal waters, with a small number nesting here, mostly along the Atlantic coast. Nesting occurs on sandy beaches from late February and peaks in May.	Low
Loggerhead sea turtle	<i>Caretta caretta</i>	Threatened	Found in subtropical and temperate oceans of the world. Florida’s sandy Atlantic and Gulf of Mexico beaches host one of the largest loggerhead nesting aggregations in the world. Mates in shallow marine waters near nesting beaches and along migratory corridors between April and September.	Moderate
Fish				
Giant manta ray	<i>Mobula birostris</i>	Threatened	Found worldwide in tropical, subtropical, and temperate bodies of water and is commonly found offshore, in oceanic waters, and in productive coastal areas. Have also been observed in estuarine waters, oceanic inlets, and within bays and intracoastal waterways	Low

Common Name	Scientific Name	Federal Status	Species-Habitat Associations	Likelihood of Occurrence ^{a/}
Smalltooth sawfish	<i>Pristis pectinata</i>	Endangered	Most often found off the southwest coast of Florida, from about Charlotte Harbor through the Everglades and Florida Keys region at the southern tip of the state. Juveniles live in estuaries and the smaller habitats within them, such as shallow portions of bays, lagoons, and rivers. They begin moving out of the shallow estuaries into more coastal habitats as they reach adulthood.	Moderate
Invertebrates				
Miami blue butterfly	<i>Cyclargus thomasi bethunebakeri</i>	Endangered	Inhabits tropical hardwood hammocks, tropical pine rocklands, and beachside scrub in Miami-Dade and Monroe Counties, Florida.	Low
Monarch butterfly	<i>Danaus plexippus</i>	Proposed Threatened	Occurs in a variety of habitats where milkweed plants grow. The species relies on milkweed during all life stages and breeds year-round in southern Florida (including the Study Area), but there also are migrating populations that come to southern Florida.	High
Queen conch	<i>Aliger gigas</i>	Threatened	Occur throughout the Caribbean Sea, the Florida Keys, and around Bermuda. In the Gulf of Mexico, they can be found in the Flower Garden Banks National Marine Sanctuary. They use different habitat types including seagrass beds, sand flats, algal beds, and rubble areas.	Low
Flowering Plants				
Beach jacquemontia	<i>Jacquemontia reclinata</i>	Endangered	Restricted to southeastern coast of Florida. Primary habitats include beach coastal strand and maritime hammock.	Low
Florida prairie-clover	<i>Dalea carthagenensis floridana</i>	Endangered	Grows in pine rocklands, edges of rockland hammocks, coastal uplands, marl prairie, and disturbed portions of these areas such as roadsides. Found in Miami, Dade and Monroe counties and the Collier County portion of the Big Cypress National Preserve.	Low
Four-petal pawpaw	<i>Asimina tetramera</i>	Endangered	Grows in sand pine scrub habitats in Martin and Palm Beach counties on the Atlantic Coastal Ridge in southeast Florida. Inhabits sand pine scrub and open scrub on excessively drained sands of Pleistocene dunes. Plants may persist under the canopy of pines and in dense oaks and palmettos until the overstory is removed by fire or mechanical means.	Low
Tiny polygala	<i>Polygala smallii</i>	Endangered	Found in Florida’s pine rocklands and scrub ecosystems along the southeastern coast of the peninsula. Thrives when these areas are maintained by regular fire cycles. Only found in quartz sand soils (also known as sugar sands).	Low
Lichen				
Florida perforate cladonia	<i>Cladonia perforata</i>	Endangered	Found in high, well-drained sands in white sand rosemary and sand pine scrub. Restricted to a handful of scattered populations in Palm Beach, Martin, St. Lucie, Broward and Miami-Dade Counties.	Low

a/ Likelihood of Occurrence: Low–species range overlaps with Study Area and marginally suitable habitat in Study Area vicinity; Moderate–species range overlaps with Study Area and suitable habitat present in Study Area, or species known to occur in habitat similar to Study Area; High–highly suitable habitat present in Study Area, known populations exist in Study Area, USFWS Critical Habitat within or adjacent to Study Area, or USFWS Consultation Area overlaps the Study Area.

b/ Species is discussed further in section below, due to the limited information on species distribution/occupancy within their range

Note: Since only a portion of each of Broward and Palm Beach counties are included in the Study Area, some county-level data presented in this section may be over- or under-represented.

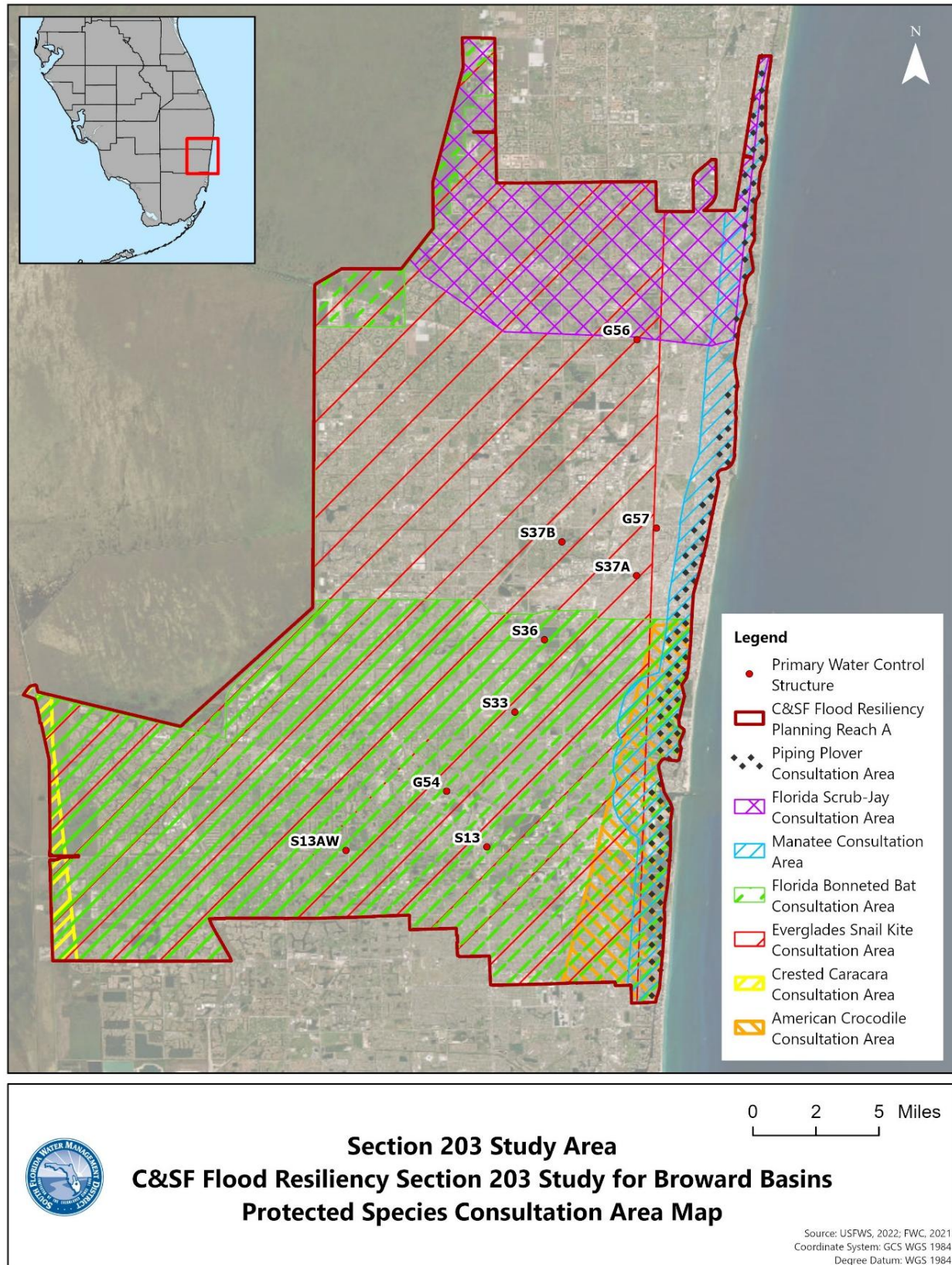


Figure B.1-13. Protected Species Consultation Areas within the Study Area.

B.1.12.1 American Crocodile

The federally threatened American crocodile is a large, saltwater-tolerant species which inhabits coastal waters of south Florida, as well as waters further south outside the territorial bounds of the United States. The American crocodile was listed primarily because of hunting, nest disturbance, and loss of habitat. The American crocodile was listed as endangered in 1975, when only about 300 adults were inhabiting Florida waters. Their listing was reclassified as threatened in 2007, and there are now over 2,000 adults today (Harvey et al. 2019).

In Florida, American crocodiles primarily inhabit mangrove swamps, though the species can be found in other areas such as shorelines, mudflats, nearshore salt waters, and both fresh water and estuarine swamps. Crocodiles have a higher salinity tolerance than alligators and tend to inhabit more estuarine waters, though they can be found in fresh water (IFAS 2024). Crocodiles have adapted well to development and urbanization in Florida and are now commonly observed in artificial habitats such as canals and man-made ponds in commercial and residential areas (USFWS 2022). The canals provide suitable travel corridors and prey for crocodiles, and canal banks, along with seawalls, piers, and other structures, provide suitable basking habitat. The crocodile's diet includes fish, crabs, birds, turtles, snakes, and small mammals (FWC 2024a).

Nesting habitat includes creek banks, sandy beaches, and human-made structures such as canal banks, earthen berms, and marl canal plugs. American crocodiles are not known to nest north of Virginia Key on the eastern coast of Florida. Current nest locations are concentrated between northeast Florida Bay and southern Biscayne Bay, over 40 miles south of the Study Area. American crocodiles begin courting in late January and early February and nesting occurs in late April and early May. Their soil nests are built on land and above high tide markings.

Figure B.1-13 shows the American crocodile's USFWS Consultation Area within the Study Area. The Study Area also overlaps the current range for American crocodiles.

B.1.12.2 Audubon's Crested Caracara

The federally threatened Audubon's crested caracara (*Polyborus plancus audubonii*) is a unique raptor in the family *Falconidae* that reaches the northern limit of its geographic range in the southern United States. In Florida, this raptor occurs as an isolated populations in the south-central region of the state.

Currently, much of the caracara population is found almost exclusively in cabbage palms on improved or semi-improved pastures on private cattle ranches in the south and central portion of Florida. Available evidence suggests that the most serious threat to Florida's caracara population is loss or degradation of nesting and feeding habitat. Such loss is most commonly due to conversion of pasture and other grassland habitats and wetlands to citrus, sugar cane, other agriculture, and urban development.

Adult caracaras exhibit high site and mate fidelity; therefore, extensive loss of habitat within their home range, particularly of the nesting site itself, may cause the pair to abandon that home range, or at least the nesting site (Morrison and Humphrey 2001). Nests are constructed with sticks, dry weed stalks, and long and narrow segments of vines typically well concealed in a cabbage palm tree that are over 15 feet in height, with large, full, closed crowns. New nests are constructed each year, but often in the same tree. Egg laying has been documented as early as September and as late as June; peak activity occurs

from late December through February (Morrison and Humphrey 2001). Clutch size is two to three eggs, with an incubation period of 32 to 33 days. Double brooding can occur if a nest is lost early in the season. Fledging occurs at 8 weeks. Young are dependent on parents for at least 2 months post-fledging and may remain in the natal territory for up to 10 months. Most juveniles leave their natal territory after 4 to 6 months and form groups of up to 30 individuals.

The caracara is an opportunistic feeder, preying on insects, small reptiles and amphibians, small mammals, eggs, and carrion. Caracaras often walk through pastures searching for prey items, particularly after disturbance, such as mowing or plowing, or in recently burned areas. Hunting takes place from conspicuous perches or while in flight (Morrison 1996; Morrison and Humphrey 2001). **Figure B.1-13** shows the crested caracara's USFWS Consultation Area within the Study Area. One crested caracara occurrence was documented in 2015 along the northwest boundary of the Study Area, along an active agricultural site (**Figure B.1-14**). Potential habitat for the crested caracara is in the northwest and southwest portions of the Study Area.

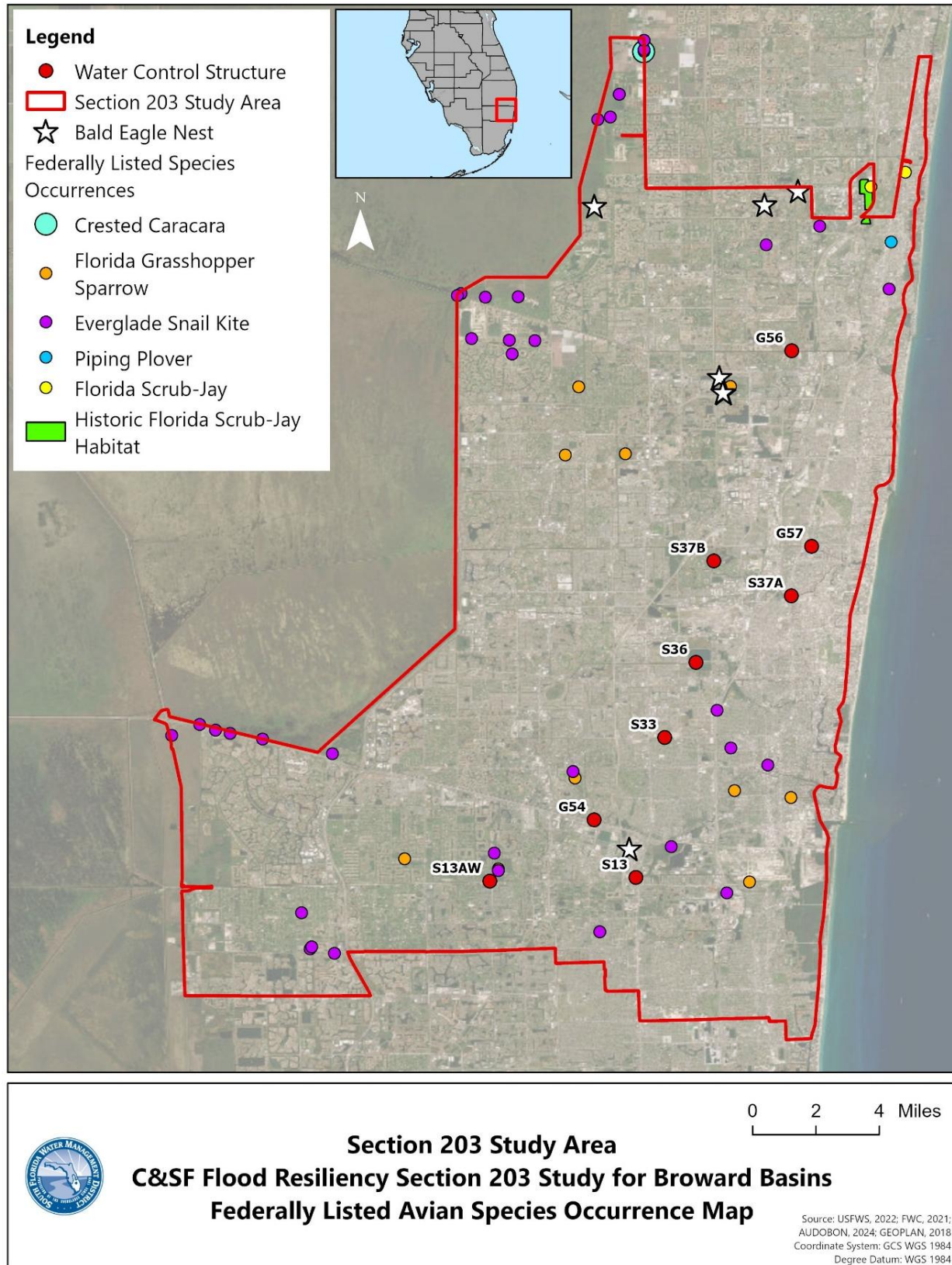


Figure B.1-14. Federally Listed Species Occurrences within the Study Area.

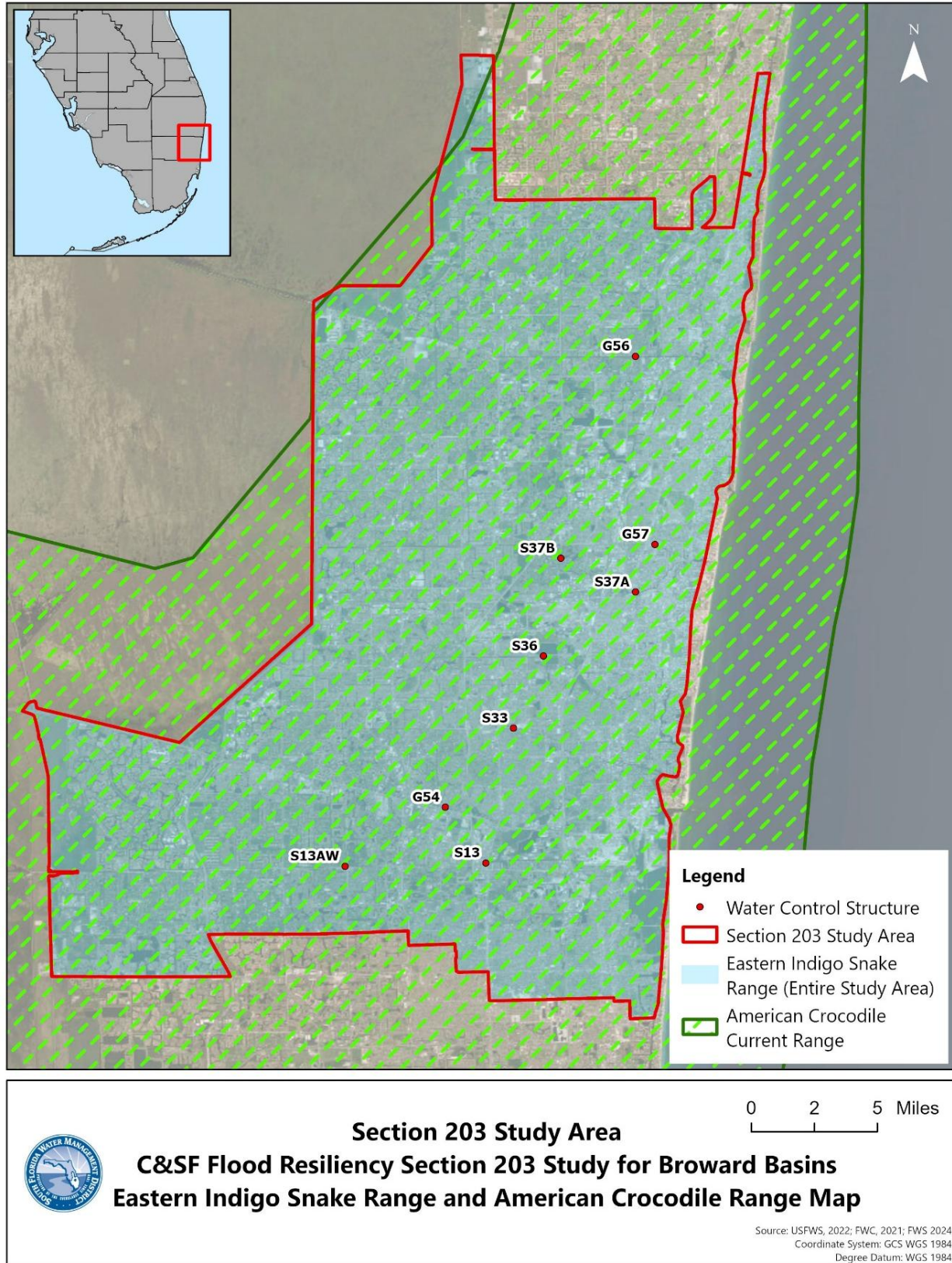


Figure B.1-15. Protected Species Range within the Study Area.

B.1.12.3 Bald Eagle

Bald eagles (*Haliaeetus leucocephalus*) are federally protected by the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. Bald eagles are opportunistic foragers that feed on a wide variety of prey that primarily includes fish, but they may also feed on other aquatic and terrestrial vertebrates and carrion (Buehler 2022). Foraging habitat for bald eagles has a diversity and abundance of prey, including access to shallow water and tall trees or structures for perching. Bald eagles typically nest near large bodies of open water with adequate prey and tall trees for nesting and roosting, such as lakes, marshes, seacoasts, and rivers. Florida has one of the densest concentrations of nesting bald eagles in the lower 48 states, and their nesting territories are concentrated around inland lake and river systems. Nesting occurs from December or early January through late April or May. Most of Florida's breeding bald eagles remain in the state year-round. Potentially suitable nesting and foraging habitat for bald eagles occur within the Study Area. **Figure B.1-14** shows six known bald eagle nests located within the Study Area.

B.1.12.4 Eastern Black Rail

The federally threatened eastern black rail (*Laterallus jamaicensis* ssp. *jamaicensis*) is a sparrow-sized bird and is the rarest and smallest of all rail species. Eastern black rail is a highly secretive bird that resides in marsh habitats, is rarely seen in flight, and will walk or run throughout their marsh habitat along narrow paths created by rodents. No critical habitat has been designated for the eastern black rail.

Eastern black rail's range in the United States extends along the coastal areas of the eastern states, from New Jersey to the southern tip of Florida, along the gulf coast from Florida to Texas, and in the midwestern states, extending from Michigan to eastern Colorado (USFWS 2023a). Within its range, the species has historically been most concentrated along the Atlantic Coast, along coastal salt marshes from Connecticut to Florida.

In Florida, eastern black rail is a year-round resident throughout the coastal areas and the full southern half of the state. Habitat for the species is characterized by shallow, densely vegetated, marshes in salt, brackish, and freshwater environments (USFWS 2023a). The species appears to be limited to specific habitat characteristics in marsh environments, including persistent water coverage and depth, very dense herbaceous vegetation, and topographic variation (ACJV 2020). Habitats supporting black rail typically have water levels around 3 centimeters (0.4 inch) in depth, which is persistent. If water levels pool up seasonally or become too low or dry up in the summer months, the species will abandon the site. Vegetation structure is also an important habitat characteristic, and typically includes greater than 80 percent grasses, and includes bulrushes, sedges, and cattails. Topographic variation is an important characteristic in black rail habitat to allow for escape when water levels rise and to allow greater foraging opportunity for invertebrate food sources that rails depend on. Small numbers of black rails have also been documented in impoundments, freshwater wetlands, coastal prairies, and grassy fields, where there are suitable habitat conditions present.

Nesting occurs from mid-March through August, and the species constructs their nests on or near the ground in very dense vegetation over water or moist soil or in shallow water (Watts 2022). Clutch size is typically around seven eggs, and the eggs are incubated for 17 to 20 days. The nestlings leave the nest within 1 day and the parents are believed to care for the young and feed them.

Freshwater marshes are primarily found along the western portion of C-11 West Basin of the Study Area, adjacent to WCA-3B (**Figure B.1-6** through **Figure B.1-9**). They contain low-growing species such as grasses, sedges, rushes, and forbs. These areas could provide potentially suitable habitat for the eastern black rail.

B.1.12.5 Eastern Indigo Snake

The threatened eastern indigo snake (*Drymarchon couperi*) is the largest native non-venomous snake in North America. It is an isolated subspecies occurring in southeastern Georgia and throughout peninsular Florida. The eastern indigo snake prefers drier habitats but may be found in a variety of habitats from xeric sandhills to cabbage palm hammocks, to hydric hardwood hammocks (Schaefer and Junkin 1990). The species has also been found in citrus groves and sugar cane. Eastern indigo snakes need relatively large areas of undeveloped land to maintain their population. In warm months, eastern indigo snakes use a variety of natural areas and have large home ranges (Moler 1992; USFWS 1999). Eastern indigo snakes occupy larger home ranges in the summer than in the winter. Information on snakes in Florida indicates adult males have home ranges as high as 553 acres (224 hectares) in the summer (Moler 1992). Because it is such a wide-ranging species, the eastern indigo snake is especially vulnerable to habitat fragmentation that makes travel between suitable habitats difficult. The main reason for its decline is habitat loss due to development. Further, as habitats become fragmented by roads, eastern indigo snakes become increasingly vulnerable to highway mortality as they travel through their large territories (Schaefer and Junkin 1990).

In South Florida, the eastern indigo snake is thought to be widely distributed. Given their preference for upland habitats, eastern indigo snakes are not commonly found in great numbers in wetland complexes, although they have been found in pinelands, tropical hardwood hammocks, and mangrove forests in extreme South Florida (Duellman and Schwartz 1958; Steiner et al. 1983).

Within the range of the gopher tortoise, tortoise burrows are favorite refugia for eastern indigo snakes. They are known to use burrows made by cotton rats and land crabs, hollows at bases of trees and stumps, ground litter, trash piles and rock piles lining banks of canals, and pipes or culverts. Breeding occurs from November to April with females laying 4 to 12 eggs in May through June (Moler 1992). Most hatching of eggs occurs from August to September, with yearling activity peaking in April and May (USFWS 1999).

Potentially suitable habitat for eastern indigo snake occurs in cabbage palm hammocks and hydric hardwood hammocks within the Study Area. **Figure B.1-15** shows the eastern indigo snake's USFWS Range within the Study Area.

B.1.12.6 Everglade Snail Kite

The Everglade snail kite (*Rostrhamus sociabilis plumbeus*) is listed as an endangered species by the USFWS. It is a medium-sized raptor characterized by its long, narrow wings and distinctive hooked beak, which is adapted for extracting apple snails (*Pomacea* sp.) from their shells. Adult males typically exhibit a dark gray plumage with a lighter, almost white head and a distinctive red eye. Females and juveniles are generally browner and have streaked underparts. Although previously located in freshwater marshes over a considerable area of peninsular Florida, the range of the snail kite is now limited to central and southern portions of Florida. Six large freshwater systems are located within the current

range of the snail kite: Upper St. Johns marshes, Kissimmee Chain of Lakes, Lake Okeechobee, Loxahatchee Slough, the Everglades, and the Big Cypress basin (FWC 2024b).

The Everglade snail kite's apple snail diet is dependent on the hydrology and water quality of the watersheds. Foraging habitat requires shallow open-area ponds with low marsh areas; nesting/roosting sites are located over water. Foraging conditions have expanded recently due to the increase in exotic apple snail population (since about 2010). As a result, the Everglade snail kite breeding season has lengthened (sometimes into fall) and some previous unsuitable foraging areas now have the exotic apple snail and are being used by kites. Everglade snail kite nests are built in tall vegetation near water with nesting season usually occurring from late winter to early summer, with females laying two to four eggs. Both parents participate in incubating the eggs and feeding the chicks once they hatch.

Figure B.1-13 shows the Everglade snail kite's USFWS Consultation Area within the Study Area, and **Figure B.1-16** shows designated critical habitat for the Everglade snail kite, which is located outside the Study Area, adjacent to the western boundary. **Figure B.1-14** shows occurrences of the Everglade snail kite within the western and southern portions of the Study Area.

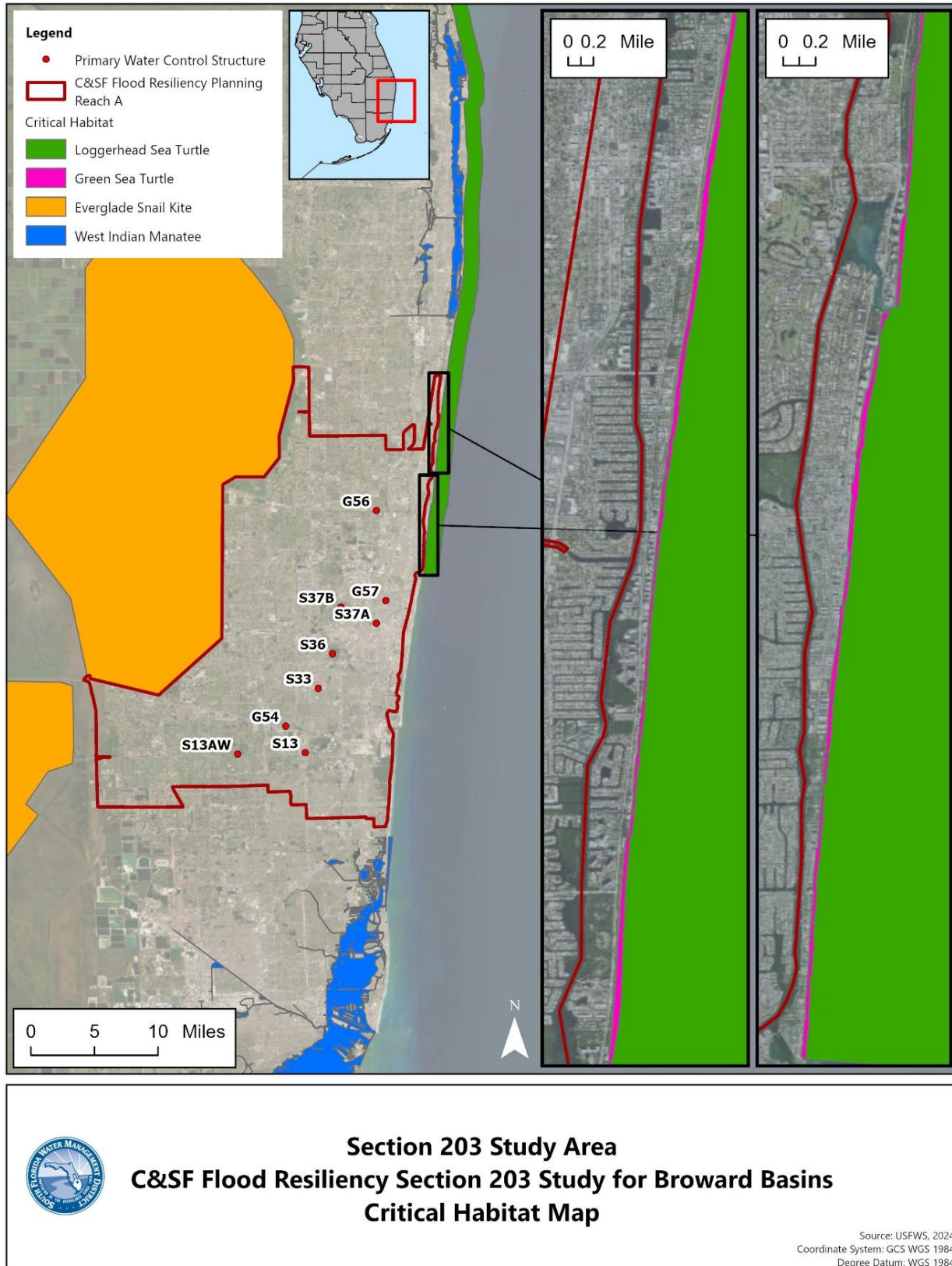


Figure B.1-16. Species Critical Habitat within the Study Area.

B.1.12.7 Florida Bonneted Bat

The endangered Florida bonneted bat (*Eumops floridanus*) is Florida's largest bat, weighing approximately 1.1 to 2.0 ounces, with a 19- to 21-inch wingspan and a body length of 5.1 to 6.5 inches. The species has dark brown fur and large broad ears that join and slant forward over the eyes. Roosting habitat in central and southern Florida include pine rocklands (South Florida rockland, rockland pine forest, rockland hammock); cypress communities (cypress swamps, strand swamps, domes, sloughs, ponds); hydric pine flatwoods (wet flatwoods); mesic pine flatwoods; and high pine. Florida bonneted bats roost in tree cavities, rocky outcrops, and foliage (FWC 2013) . In residential communities, the bats roost in Spanish tile roofs, but have also been found in attics, rock or brick chimneys, and fireplaces of old buildings (FWC 2011a). Colonies are small, with the largest reported as just a few dozen individuals. Diverse, open foraging habitats (e.g., prairies, riverine habitat) are also important. This large bat relies on swarms of larger insects for feeding; thus, foraging habitat for the Florida bonneted bat consists of areas that hatch and concentrate insects of this size, including vegetated areas and waterways. These bats also frequently feed on insects from agricultural areas and golf courses (Bailey et al. 2017). Female bats give birth to a single pup from June through September (FWC 2011a); however, limited data suggests that a female may undergo a second birthing season possibly in January or February.

The Florida bonneted bat is Florida's only endemic bat. Based on the results of numerous surveys conducted across southern Florida since 2003, this species appears to occur predominately in central, southwest, and extreme south (mainland) Florida, with the core range primarily consisting of habitat within Polk, Charlotte, Lee, Collier, Monroe (mainland), and Miami-Dade counties. Recent data also indicate use of portions of Highlands, Okeechobee, Glades, Palm Beach, and Broward counties and possible use of areas within Osceola, Sarasota, and De Soto counties (USFWS 2018). Loss of suitable habitat is believed to be the primary cause of population declines. Other perceived threats include pesticide and herbicide use, which decrease populations of insects, the bat's primary prey.

Potentially suitable habitat for Florida bonneted bat occurs in the rockland hammock, cypress swamps, and hydric and mesic pine forests within the Study Area. **Figure B.1-13** shows the Florida bonneted bat's USFWS Consultation Area within the Study Area.

B.1.12.8 Florida Grasshopper Sparrow

The Florida grasshopper sparrow (*Ammodramus savannarum floridanus*) is federally listed as endangered and is one of four subspecies of grasshopper sparrows in North America. The Florida grasshopper sparrow is a year-round resident of Florida and is endemic to the dry prairie of central and southern Florida. This subspecies is extremely habitat specific and relies on fire every 2 to 3 years to maintain its habitat. Florida grasshopper sparrow is named for one of its calls, a quiet buzz that sounds much like a grasshopper. Male sparrows sing only a few months of the year during the nesting season, for a few hours each day. The Florida grasshopper sparrow nests in spring (April to July) on the ground, under palmettos, or in grass clumps. The female lays three to five eggs, and young fledge within 9 to 10 days. The male sings from a low perch to defend its territory—about the only time they are readily visible--and helps raise the young. Diet includes seeds and invertebrates. It is thought that most individuals live their entire lives within a few miles of their place of birth.

Florida grasshopper sparrow habitat consists of large (greater than 123 acres [50 hectares]), treeless, relatively poorly drained grasslands that have a history of frequent fires (Delany et al. 2007; USFWS 1988). The dry prairie habitats where grasshopper sparrow occurs are typically characterized by the presence of bluestem grasses, St. John's wort, and wiregrasses (*Aristida* spp.; Delany et al. 1985) and interspersed with saw palmetto and dwarf live oaks (*Quercus minima*) ranging from 12 to 28 inches in height. These dry prairies are relatively flat and are moderately to poorly drained. Thus, dry prairies may become flooded for short periods during the rainy season but remain dry for the remainder of the year. The water table in these prairies is normally found between several centimeters and a meter below the soil surface.

Grasshopper sparrows cannot tolerate tree densities as high as one tree per acre. Some dry prairies may be artifacts of clearcutting, unnaturally frequent burning, livestock grazing, and alteration of hydrology (Abrahamson and Hartnett 1990). Prairie habitat may also have disappeared due to infrequent burn regimes from fire prevention and from planting of slash pine.

When compared with habitat of other grasshopper sparrows, habitat used by Florida grasshopper sparrow is characterized by a larger percentage of shrub and bare ground, a smaller percentage of tall vegetation, and less litter (Delany et al. 1985). Because the sparrows are ground-dwelling birds, they usually require at least 20 percent bare ground for unrestricted movement and foraging but need enough vegetation to provide nesting cover (Whitmore 1979; Vickery 1996). Large areas of prairie habitat between 593 to 3,331 acres (240 to 1,348 hectares) are needed to maintain populations of 50 breeding pairs (Delany et al. 2007). Florida grasshopper sparrows are also documented to be reproductively successful in pastures that are overgrown or ungrazed. As pastures become more heavily grazed, however, sparrow populations have been documented to decrease or disappear.

Historically, Florida grasshopper sparrows were distributed across Collier, Miami-Dade, DeSoto, Glades, Hendry, Highlands, Polk, Okeechobee, and Osceola counties (USFWS 1999). As reported in the species 5-year status review in 2023, the subspecies range had become restricted to Highlands, Okeechobee, Osceola, and Polk counties (USFWS 2023b). Notably in recent years, the number of locations where the species was known to occur has increased. Previously, the species had been documented at three discrete locations: the Three Lakes Wildlife Management Area, Kissimmee Prairie Reserve State Park, and Avon Park (USFWS 2023b). In recent years, the DeLuca Preserve and Corrigan Ranch were protected for the species, both of which share a common border with Kissimmee Prairie Preserve State Park (USFWS 2023b). Species occurrence in the Study Area for the grasshopper sparrow was last documented from 2007 to 2016 and known locations for the Florida grasshopper sparrow today are more than 100 miles from the Study Area. The absence of recent observations combined with the distance from known populations suggests a minimal to unlikely potential for species occurrence within the Study Area.

B.1.12.9 Florida Scrub-Jay

The federally listed threatened Florida scrub-jay (*Aphelocoma coerulescens*) is a medium-sized bird, measuring about 9 to 12 inches in length. It is characterized by its blue plumage on the wings, tail, and head, with a grayish-brown body and a white throat and forehead (FWC 2024c).

The Florida scrub-jay is endemic to Florida and primarily inhabits scrub habitats, including scrub oak and sand pine ecosystems, which occur in some of the highest areas in Florida. These areas are characterized

by low-growing vegetation and sandy soils, which are essential for the species' foraging and nesting behaviors. It is highly dependent on fire-maintained ecosystems, as periodic fires help to rejuvenate their habitat.

Florida scrub-jays are social birds that often live in family groups that consist of a breeding pair and their offspring. They exhibit cooperative breeding behavior, where non-breeding individuals assist in raising the young of their parents. Breeding typically occurs from March to June. The female lays a clutch of two to five eggs, which are incubated for about 16 to 18 days. Both parents participate in feeding the chicks, which fledge approximately 25 to 30 days after hatching (Cornell Lab 2024).

Florida scrub-jays are omnivorous and have a varied diet that includes insects, fruits, seeds, and small vertebrates (FWC 2024c). They are known for their caching behavior, where they store food items in the ground for later consumption, which is crucial for their survival, especially during food-scarce periods (Cornell Lab 2024)

The Florida scrub-jay's USFWS Consultation Area overlaps the northern section of the Study Area, **Figure B.1-13**. Florida scrub-jay historical habitat was documented in the north section of the Study Area (**Figure B.1-14**), within the Yamato Scrub Natural Area, which is a 217-acre natural area consisting of native scrub habitat atop the Atlantic Coastal Ridge in Palm Beach County. The Florida scrub-jay has also been recorded at the Yamato Scrub Natural Area (Palm Beach County 2024a), and therefore, has a moderate likelihood to occur within the Study Area with minimal effects.

B.1.12.10 Piping Plover

The piping plover (*Charadrius melodus*) is federally listed as threatened. Piping plover is a small migrant shorebird that occurs along the gulf coast states and Mexico, along the Atlantic Coast from Florida to Newfoundland, and in the Great Lakes region of Michigan and Wisconsin, as well as the northern Great Plains from Nebraska to Canada. There are no piping plover breeding pairs documented in Florida, but the species winters along the eastern and gulf coasts of Florida and in the Florida Keys. The main threat to piping plovers is habitat loss due to coastal development and predation (USFWS 2024b).

Wintering habitat includes sandy beaches, mudflats, sandflats, barrier island beaches, dredged material islands, dunes, and sand or algal flats in protected bays of coastal areas (Wilkinson and Spinks 1994). Primary foraging habitats include sandy mud flats, ephemeral pools, and seasonally emergent seagrass beds with abundant invertebrates. On the Atlantic Coast, the species is most often found foraging in areas adjacent to large inlets and passes. Piping plover diet consists primarily of insects, crustaceans, and marine worms (FWC 2024d), and the species forages by running along the beach and using their bills to probe the sand for food.

Figure B.1-13 shows the piping plover's USFWS Consultation Area within the Study Area. One piping plover occurrence was documented in 2014 in an urban area within the northeast section of the Study Area, depicted in **Figure B.1-14**.

B.1.12.11 Sea Turtles (Green Sea Turtle, Kemp's Ridley Sea Turtle, Loggerhead Sea Turtle)

Sea turtles (*Cheloniidae* spp.) are marine reptiles with streamlined shells and large, paddle-like flippers that are well-adapted to life in the ocean. Sea turtles are known for their unique behaviors including

long migrations between feeding grounds and beach nesting sites, where females return to the same nesting sites to lay their eggs. Females tend to return every 2 or more years, depositing multiple nests (clutches) per season.

In U.S. waters, there are six species of sea turtles, of which three have the potential to occur in the Study Area. This includes the federally listed threatened green sea turtle (*Chelonia mydas*), federally listed endangered Kemp's ridley sea turtle (*Lepidochelys kempii*), and the federally listed threatened loggerhead sea turtle (*Caretta caretta*).

Green sea turtle nesting occurs primarily from June through late September. Females return to the nesting beach and lay an average of 3.6 nests in a season (Witherington et al. 2006). A nest averages about 128 eggs. Nesting activity has been recorded in almost every coastal county in Florida but is most concentrated along the southeast coast of Florida. Kemp's ridley sea turtles are the smallest sea turtles and primarily occupy nearshore coastal habitats that include muddy or sandy bottoms where their preferred prey of small animals and plants are found. Kemp's ridley sea turtles nest in northeastern Mexico from April through July. After emerging from the nests, hatchlings enter the water and swim offshore, remaining in the Gulf of Mexico while others are swept out of the Gulf, around Florida, and into the Atlantic Ocean by the Gulf Stream where they take refuge, rest, and feed on small prey and plants among floating Sargassum algae for 1 to 2 years or until they reach about 8 inches in length. After this oceanic stage, Kemp's ridley sea turtles move into nearshore waters of the Gulf of Mexico or the northwestern Atlantic, where they settle into shallow coastal areas and predominantly feed on crab. In Florida, the majority of the loggerhead sea turtle nesting occurs in five counties on the east coast (Brevard, Indian River, St. Lucie, Martin, and Palm Beach Counties) and they typically nest from April to September with each nest containing an average of 114 eggs (Brost et al. 2015).

Sea turtle populations are at risk due to loss and degradation of nesting and foraging habitats due to coastal development, shifting climate patterns, and pollution. Other threats include bycatches in commercial and recreational fisheries, poaching, vessel strikes, and entanglement in marine debris (NOAA 2024). The aquatic portions of the Study Area, including the Atlantic ICW, potentially can provide foraging habitats for sea turtles. Beach habitats have the potential to provide nesting grounds for the sea turtles but are located outside the Study Area. Critical habitat for green sea turtle and loggerhead sea turtle are located directly to the east of the Study Area along the Atlantic Coast shoreline. Additionally, coastal areas directly east of the Study Area are mapped as having a medium nesting density for the loggerhead sea turtle, medium and high nesting density for the leatherback sea turtle, and low and medium nesting density for the green sea turtle (**Figure B.1-17**). No data has been mapped for the hawksbill sea turtle.

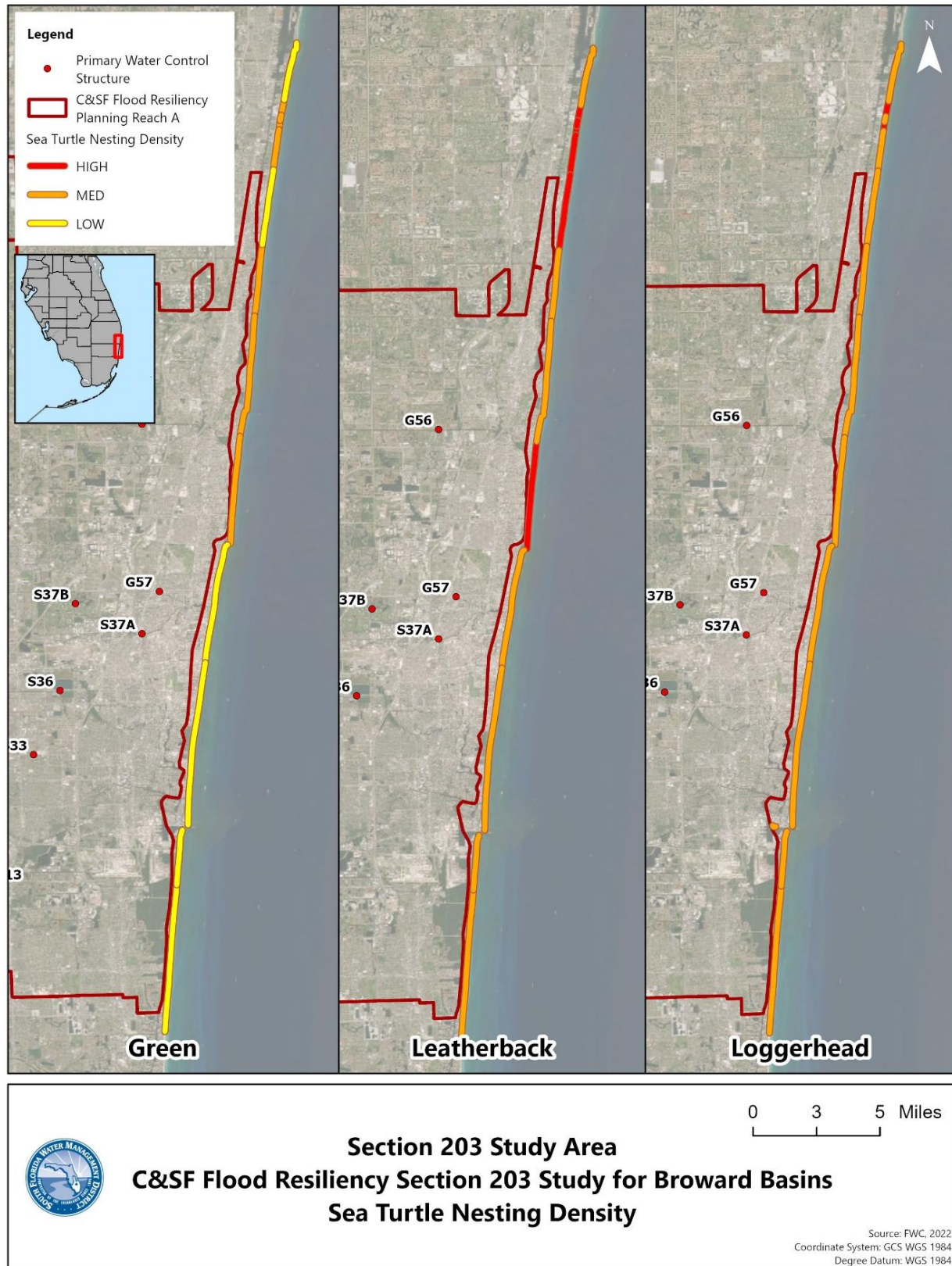


Figure B.1-17. Sea Turtle Nesting Density within the Study Area.

B.1.12.12 *Smalltooth Sawfish*

The federally listed endangered smalltooth sawfish (*Pristis pectinata*) are large, cartilaginous rays in the elasmobranch family distinguished by a long, toothed rostrum used both to slash and electro-detect prey. Adults, olive-gray above and white below, reach lengths of 11 to 20 feet and carry 22 to 29 teeth on each side of their “saw” (NOAA 2025b).

Historically distributed from North Carolina through Texas and across the tropical Atlantic, they now persist mainly in Florida’s coastal and estuarine waters, with juveniles, less than 3 years old, inhabiting shallow, mangrove-lined bays and rivers and adult fish moving into deeper coastal and offshore reefs. They feed chiefly on fish and invertebrates, use yolk-sac viviparity to birth litters of seven to fourteen 2-foot length pups, and reach sexual maturity at about 7 years (NOAA 2025b).

Smalltooth sawfish declined precipitously in the late twentieth century due to coastal development that destroyed nursery habitat and heavy bycatch in gill nets, trawls, and longlines (NOAA 2025b). The aquatic portions of the Study Area, including the Atlantic ICW, potentially can provide foraging habitats for smalltooth sawfish.

B.1.12.13 *West Indian Manatee*

The West Indian (Florida) manatee (*Trichechus manatus latirostris*) is a large, plant-eating aquatic mammal that can be found in the shallow coastal waters, rivers, and springs of Florida. The West Indian manatee was listed as endangered throughout its range for both the Florida and Antillean subspecies (*T. manatus latirostris* and *T. manatus manatus*) in 1967 and received federal protection with the passage of the ESA in 1973. The manatee was designated as an endangered species prior to enactment of the ESA; therefore, no formal listing package identifying threats to the species was required by ESA Section 4(a)(1). On January 14, 2025, the USFWS published in the Federal Register (90 FR 3131) a proposed rule to maintain the federal listing of threatened for the Florida manatee and extend the ESA’s protection to the Florida manatee.

Florida manatees can be found throughout the southeastern United States; however, within this region, they are at the northern limit of their range (Lefebvre et al. 2000; USFWS 2001). Because they are a subtropical species with little tolerance for cold, they remain near warm water sites in peninsular Florida during the winter. During periods of intense cold, Florida manatees will remain at these sites and will tend to congregate in warm springs and outfall canals. During warm interludes, Florida manatees move throughout the coastal waters, estuaries, bays, and rivers of both coasts of Florida and are usually found in small groups. During warmer months, Florida manatees may disperse great distances. Florida manatees have been sighted as far north as Massachusetts and as far west as Texas and in all states in between (Rathbun et al. 1982; Fertl et al. 2005). Warm weather sightings are most common in Florida and coastal Georgia. They will once again return to warmer waters when the water temperature is too cold (Hartman 1979; Stith et al. 2006). Florida manatees live in freshwater, brackish, and marine habitats, and can move freely between salinity extremes. They can be found in both clear and muddy water. Water depths of at least 3 to 7 feet (1 to 2 meters) are preferred and flats and shallows are avoided unless adjacent to deeper water. They also depend on canals as transit from one habitat to another, sources of freshwater, and resting sites.

Figure B.1-13 shows the Florida manatee’s USFWS Consultation Area within the Study Area. The species has the potential to occur within the ICW and throughout the extensive canal system in the Study Area; see **Figure B.1-18** for the approximate extent of waters that can be accessible to the Florida manatee. Critical habitat has been designated for the Florida manatee, which is located south of the Study Area, depicted in **Figure B.1-16**. On September 24, 2024, the USFWS published in the Federal Register (89 FR 78134) a proposed rule to revise the critical habitat for the Florida manatee under the ESA. The new proposed critical habitat is within the Study Area and would require Section 7 consultation with the USFWS.

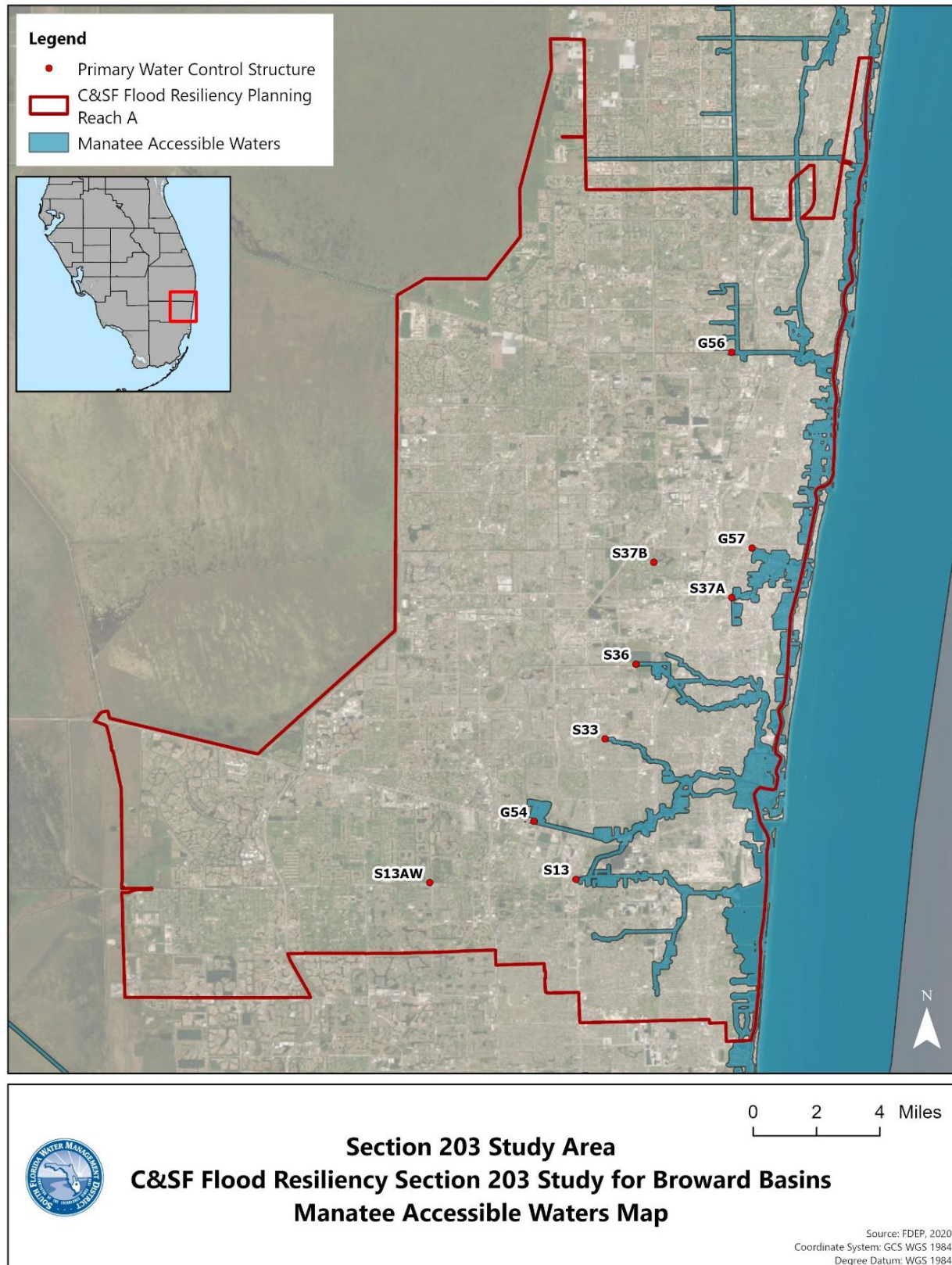


Figure B.1-18. Manatee Accessible Waters within the Study Area.

B.1.13 Fish and Wildlife

Florida has high ecological diversity and is home to approximately 16,000 native species (across all phyla) owing to its geography and climate (Muller et al. 1989; FWC 2019a) of which the Study Area is within the tropical rainforest Köppen climate zone (FWC 2019a). Furthermore, the Study Area is primarily within the Miami Ridge/Atlantic Coastal Strip EPA Level IV Ecoregion (Griffith et al. 2001), which is heavily urbanized and where the elevation ranges from sea level to 25 feet above mean sea level, and which meets up with the Everglades Level IV ecoregion in the west. Habitat in the Study Area was originally part of the Everglades ecosystem (except for the historic coastal ridge), which had extensive habitat for aquatic macroinvertebrates, marsh fish, sportfish, mammals, amphibians and reptiles, and birds (especially wading birds). Over the last century, wetlands were drained for agricultural purposes, followed by conversion to residential and other urban uses. As mentioned in **Section B.1.8**, natural lands and open water occupy only 5 percent of the Study Area while developed land areas occupy about 95 percent. Generally, biodiversity has suffered in southern Florida (SFWMD 2010) with these large-scale ecosystem changes. Additionally, urbanization coupled with low elevations leaves wildlife more susceptible to risks from changing weather patterns (e.g., sea level rise and increased storm intensities). Some species require niche habitats that make them even more vulnerable (e.g., the Florida grasshopper sparrow, which utilizes wet and dry prairies), while others can use a wider range of habitat (e.g., Florida black bear [*Ursus americanus floridanus*]) or adapt better to urban areas (e.g., mallards [*Anas platyrhynchos*]).

Remaining wildlife habitat is made up of Everglades ecosystems in the western part of the Study Area (sawgrass marsh, freshwater ponds, prairies, and forested uplands) to others spread throughout such as estuarine wetlands, mangrove swamp, and parks/urban open lands (**Figure B.1-6** through **Figure B.1-9** for vegetation community types and **Figure B.1-10** for wetland types in the Study Area). The Study Area basins discharge into the Atlantic Ocean, where a unique coral habitat is found. An overview of this suitable habitat is provided by the Florida Landscape Assessment Model (FLAM), which ranks landscape based on both natural resources and fish and wildlife habitat, with the highest value of 10 indicating the highest quality landscape (FWC 2019b). Most of the Study Area WCS have a ranking of 1, though the S-13 Pump Station and Gated Spillway falls within a FLAM ranking of 2. Higher FLAM rankings are generally found downstream of the structures along the coast and upstream adjacent to the WCAs. Two areas with FLAM rankings of 5 and 7 are downstream of the G-54 Gated Spillway and S-13 Pump Station and Gated Spillway, which are made up of mangroves and other habitat. Areas with a higher FLAM ranking are found along the western edge of the managed upstream watershed basins, especially Hillsboro Canal Basin and C-11 West Basin, corresponding with natural areas like marshes and wetlands.

FWC is responsible for protecting and managing native fish and wildlife species. In 2019, the FWC published the *State Wildlife Action Plan* as required by any states aiming to receive funds from Congress' State and Tribal Wildlife Grant Program. The State and Tribal Wildlife Grant Program is designed to help states manage populations proactively in hopes they do not become imperiled and end up being listed under the ESA. The 2019 *State Wildlife Action Plan* details habitat types and associated Species of Greatest Conservation Need (SGCN), which have been identified as potentially becoming imperiled in the future but do not currently receive any regulatory protection. Species lists that contribute to the designation of SGCN include federal and state listed species, International Union for Conservation of Nature Red List Ranked species ("vulnerable" or above), NatureServe rankings (S1, G1, or S2G2), and

taxa of concern. The FNAI rare animal list contributes to the SGCN list. FNAI's species lists by county (FNAI 2024) are shown in **Table B.1-9** with those that qualify as SGCN specified. In Broward County, the FNAI list includes 25 invertebrates and 29 vertebrates, and in Palm Beach County, the list includes 31 invertebrates and 50 vertebrates².

Table B.1-9. Florida Natural Area Inventory Rare Species List for Broward and Palm Beach Counties.

Common Name	Scientific Name	Broward County FNAI List	Palm Beach County FNAI List	SGCN Species
Amphibians				
Gopher frog	<i>Lithobates capito</i>	N	Y	Y
Ants, Bees, and Wasps				
Florida Panurgine Bee	<i>Perdita (Hexaperdita) graenicheri</i>	N	Y	Y
Beetles				
Ataenius beetle	<i>Ataenius brevicollis</i>	N	Y	Y
Bicolored burrowing scarab beetle	<i>Bolbocerosoma hamatum</i>	N	Y	N
Dark tiny sand-loving scarab	<i>Geopsammodius fuscus</i>	N	Y	Y
Elizoria June beetle	<i>Phyllophaga elizoria</i>	N	Y	Y
Elongate June beetle	<i>Phyllophaga elongata</i>	Y	Y	N
Fig seed diving beetle	<i>Desmopachria cenchramis</i>	Y	Y	Y
Florida intertidal firefly	<i>Micronaspis floridana</i>	Y	N	N
Gopher tortoise copris beetle	<i>Copris gopheri</i>	N	Y	Y
Gopher tortoise hister beetle	<i>Chelyoxenus xerobatis</i>	N	Y	N
Little gopher tortoise scarab beetle	<i>Alloblackburneus troglodytes</i>	N	Y	N
Little silky June beetle	<i>Serica tantula</i>	N	Y	N
Miami chafer beetle	<i>Cyclocephala miamiensis</i>	Y	N	Y
Punctate gopher tortoise Onthophagus beetle	<i>Onthophagus polyphemi polyphemi</i>	N	Y	N
Sand pine scrub Ataenius beetle	<i>Haroldiataenius saramari</i>	N	Y	N
Scrub tiger beetle	<i>Cicindela scabrosa</i>	Y	N	N
Three-spotted pleasing fungus beetle	<i>Ischyrus dunedinensis</i>	Y	N	N
Birds				
American redstart	<i>Setophaga ruticilla</i>	N	Y	N
Bachman's sparrow	<i>Peucaea aestivalis</i>	Y	Y	Y
Bald eagle	<i>Haliaeetus leucocephalus</i>	Y	Y	N
Black-crowned night-heron	<i>Nycticorax nycticorax</i>	Y	Y	N
Black-whiskered vireo	<i>Vireo altiloquus</i>	Y	N	Y
Black rail	<i>Laterallus jamaicensis</i>	Y	Y	Y
Crested caracara	<i>Caracara plancus</i>	Y	Y	Y
Florida burrowing owl	<i>Athene cunicularia floridana</i>	Y	Y	Y
Florida sandhill crane	<i>Antigone canadensis pratensis</i>	N	Y	Y
Florida scrub-jay	<i>Aphelocoma coerulescens</i>	N	Y	Y
Glossy ibis	<i>Plegadis falcinellus</i>	Y	Y	N
Hairy woodpecker	<i>Dryobates villosus</i>	N	Y	Y
Least tern	<i>Sterna antillarum</i>	Y	Y	Y
Limpkin	<i>Aramus guarauna</i>	Y	Y	Y
Little blue heron	<i>Egretta caerulea</i>	Y	Y	Y
Osprey	<i>Pandion haliaetus</i>	N	Y	N
Painted bunting, eastern population	<i>Passerina ciris</i> pop. 1	N	Y	Y
Red-cockaded woodpecker	<i>Dryobates borealis</i>	N	Y	Y

² Since only a portion of each of Broward and Palm Beach counties are included in the Study Area, some county-level data presented in this section may be over- or under-represented.

Common Name	Scientific Name	Broward County FNAI List	Palm Beach County FNAI List	SGCN Species
Roseate spoonbill	<i>Platalea ajaja</i>	Y	Y	Y
Sandwich tern	<i>Thalasseus sandvicensis</i>	N	Y	N
Snail kite	<i>Rostrhamus sociabilis</i>	Y	Y	N
Snowy egret	<i>Egretta thula</i>	Y	Y	Y
Swallow-tailed kite	<i>Elanoides forficatus</i>	N	Y	Y
Tricolored heron	<i>Egretta tricolor</i>	Y	Y	Y
White ibis	<i>Eudocimus albus</i>	Y	Y	Y
White-tailed kite	<i>Elanus leucurus</i>	Y	Y	Y
Wood stork	<i>Mycteria americana</i>	Y	Y	Y
Yellow-crowned night-heron	<i>Nyctanassa violacea</i>	N	Y	N
Butterflies and Moths				
Amethyst hairstreak	<i>Chlorostymon maesites</i>	Y	N	Y
Atala	<i>Eumaeus atala</i>	Y	Y	N
Cuban crescent	<i>Anthanasia frisia</i>	N	Y	Y
Florida white	<i>Appias drusilla</i>	N	Y	Y
Helicta satyr	<i>Neonympha helicta dadeensis</i>	Y	Y	N
Lyside sulphur	<i>Kricogonia lyside</i>	Y	N	Y
Malachite	<i>Siproeta stelenes</i>	Y	N	N
Martial scrub-hairstreak	<i>Strymon martialis</i>	Y	Y	N
Pink-spot sulphur	<i>Aphrissa neleis</i>	Y	Y	N
Statira sulphur	<i>Aphrissa statira</i>	Y	Y	N
Tropical buckeye	<i>Junonia zonalis</i>	Y	N	N
Caddisflies				
Tavares white miller caddisfly	<i>Nectopsyche tavana</i>	N	Y	N
Clams and Mussels				
Florida rainbow	<i>Villosa amygdala</i>	Y	Y	N
Corals and Allies				
Boulder star coral	<i>Orbicella annularis</i>	Y	Y	Y
Large flower coral	<i>Mussa angulosa</i>	Y	Y	N
Staghorn coral	<i>Acropora cervicornis</i>	Y	N	Y
Crabs, Crayfishes, and Shrimps				
Mangrove root crab	<i>Goniopsis cruentata</i>	Y	Y	N
Dragonflies and Damselflies				
Blue striped spreading	<i>Lestes tenuatus</i>	Y	Y	Y
Lucifer swampdamsel	<i>Leptobasis lucifer</i>	Y	N	N
Purple skimmer	<i>Libellula jesseana</i>	N	Y	Y
Fishes				
Bigmouth sleeper	<i>Gobiomorus dormitor</i>	N	Y	N
Mangrove rivulus	<i>Rivulus marmoratus</i>	Y	N	Y
Opossum pipefish	<i>Microphis brachyurus</i>	N	Y	N
Spottail goby	<i>Ctenogobius stigmaturus</i>	N	Y	Y
Striped croaker	<i>Corvula sanctaeluciae</i>	N	Y	N
Grasshoppers and Allies				
East Coast scrub grasshopper	<i>Melanoplus indicifer</i>	N	Y	Y
Mammals				
Florida Black bear	<i>Ursus americanus floridanus</i>	Y	Y	N
Florida manatee	<i>Trichechus manatus latirostris</i>	Y	Y	Y
Florida mouse	<i>Podomys floridanus</i>	N	Y	Y
Florida panther	<i>Puma concolor coryi</i>	Y	Y	Y
Round-tailed muskrat	<i>Neofiber alleni</i>	N	Y	Y
Southeastern fox squirrel	<i>Sciurus niger niger</i>	N	Y	N
Reptiles				

Common Name	Scientific Name	Broward County FNAI List	Palm Beach County FNAI List	SGCN Species
American alligator	<i>Alligator mississippiensis</i>	Y	Y	N
Eastern diamondback rattlesnake	<i>Crotalus adamanteus</i>	N	Y	N
Eastern indigo snake	<i>Drymarchon couperi</i>	N	Y	Y
Florida kingsnake	<i>Lampropeltis getula floridana</i>	Y	Y	N
Florida scrub lizard	<i>Sceloporus woodi</i>	Y	Y	Y
Gopher tortoise	<i>Gopherus polyphemus</i>	Y	Y	Y
Green sea turtle	<i>Chelonia mydas</i>	Y	Y	Y
Hawksbill sea turtle	<i>Eretmochelys imbricata</i>	Y	Y	Y
Kemp's Ridley sea turtle	<i>Lepidochelys kempii</i>	N	Y	Y
Leatherback sea turtle	<i>Dermochelys coriacea</i>	Y	Y	Y
Loggerhead sea turtle	<i>Caretta caretta</i>	Y	Y	Y
Pine snake	<i>Pituophis melanoleucus</i>	N	Y	N
Snails and Allies				
Caribbean birddrop	<i>Sterkia eyriesii</i>	Y	N	Y
Queen conch	<i>Aliger gigas</i>	Y	Y	N
Stock Island tree snail	<i>Orthalicus reses reses</i>	N	Y	Y
Truncate urocoptid	<i>Cochlodinella poeyana</i>	Y	N	Y
Spiders				
Red widow spider	<i>Latrodectus bishopi</i>	N	Y	N

Note: Since only a portion of each of Broward and Palm Beach counties are included in the Study Area, some county-level data presented in this section may be over- or under-represented.

Within or near the WCS, rare wildlife listed by FNAI with documented occurrences are Florida burrowing owl (*Athene cunicularia floridana*), Miami chafer beetle (*Cyclocephala miamiensis*) at the G-54 Gated Spillway, and statira (*Aphrissa statira*) at the S-36 Gated Spillway. The Florida manatee has a documented historical occurrence at the S-13 Pump Station and Gated Spillway; however, research-grade volunteer observations have documented manatee occurrences across the Study Area within the last 5 years (iNaturalist 2025). Two species, wood stork and gopher tortoise, were listed as likely to occur, since both are known to occur. Numerous wood stork occurrences have been documented within the Study Area, as can be seen on **Figure B.1-14**. Gopher tortoise has also been found throughout the Study Area according to research-grade volunteer observations (iNaturalist 2025). Other species listed with the potential to occur across multiple WCS including spottail goby (*Ctenogobius stigmaturos*), truncate urocoptid (*Cochlodinella poeyana*), eastern indigo snake, rim-rock crowned snake, gopher frog, Florida scrub lizard (*Sceloporus woodi*), wood stork (*Mycteria americana*), Florida bonneted bat, Florida mouse (*Peromyscus floridanus*), elongate June beetle (*Phyllophaga elongata*), and scrub tiger beetle (*Cicindela scabrosa*). Florida burrowing owl, gopher tortoise, and rim-rock crowned snake are state listed species. Florida manatee, Florida bonneted bat, and eastern indigo snake are federally listed species (see **Section B.1.12** for more information).

B.1.13.1 Marine/Estuarine Wildlife

Coral reefs form some of the most biodiverse ecosystems on earth and are important for protecting shorelines from wave energy, which is particularly notable in the context of sea level rise and increased storm frequency impacts (NOAA 2020). The coastal area adjacent to the Study Area is made up of the Kristin Jacobs Coral Aquatic Preserve and is a conservation area that has over 6,000 marine species including fish, stony corals, gorgonians, sponges, and marine invertebrates (FDEP 2024a). The following

coral species found within coastal marine waters are listed as federally threatened: staghorn coral (*Acropora cervicornis*), elkhorn coral (*Acropora palmata*), boulder star coral (*Orbicella franksi*), lobed star coral (*Orbicella annularis*), mountainous star coral (*Orbicella faveolata*), pillar coral (*Dendrogyra cylindrus*), and rough cactus coral (*Mycetophyllia ferox*). Pillar coral is also proposed to be listed as endangered under the ESA (FWC 2022; NOAA 2025a).

Coral ecosystems allow for sediment accumulation, which helps form mangrove ecosystems, another important habitat for wildlife within an estuarine environment. Mangroves provide habitat for fish, crustaceans, and shellfish, and food for various species like tarpon (*Megalops atlanticus*) and mangrove tree crab (*Aratus pisoni*). It is estimated that 75 percent of game fish and 90 percent of commercial species in southern Florida rely on mangrove ecosystems during their lifespan (FMNH 2024). Saltwater intrusion has been an ongoing issue in the Study Area and creates increased saline conditions that decreases suitable habitat for juvenile sport fish like spotted seatrout (*Cynoscion nebulosus*), tarpon, and red drum (*Sciaenops ocellatus* [USACE 1999]). Estuarine environments are also important for shellfish like blue crabs, hard clams, oysters, and shrimp species.

B.1.13.2 Fish

Fish are found throughout the Study Area's canal system and natural water habitats. The canal system in the Study Area is a mixture of Canal, Cultural–Riverine, and Cultural–Estuarine land classes, as defined by the Florida Cooperative Land Cover Map (**Figure B.1-6** through **Figure B.1-9**). The “cultural” part of the definition refers to habitats that are influenced by human disturbance or maintained in a non-natural manner (FWC 2023). Natural water habitats for fish in the Study Area include estuarine and marine waters (deepwater and wetlands), freshwater emergent wetlands, and freshwater ponds, lakes, and rivers (**Table B.1-5**). The canals within the Study Area support freshwater and saltwater fish that provide unique sportfishing opportunities for residents and tourists. Common sportfish species known to occur in the Study Area include Florida largemouth bass (*Micropterus salmoides floridanus*), snook (*Centropomus undecimalis*), tarpon, channel catfish (*Ictalurus punctatus*), bluegill (*Lepomis macrochirus*), black crappie/speckled perch (*Pomoxis nigromaculatus*), butterfly peacock (*Cichla ocellaris*), and exotic species such as Goldline snakehead (*Channa* spp.), oscar (*Astronotus ocellatus*), spotted tilapia (*Tilapia mariae*), and Mayan cichlid (*Mayaheros urophthalmus* [FWC 2015a,b,c, 2024e]). Fish are stocked in two locations within the Study Area: Central Broward Regional Park South Lake just north and adjacent to the S-33 Gated Spillway, and Plantation Heritage Park Lake Fish Management Area less than a mile north of the G-54 Gated Spillway (FWC 2024f).

Largemouth bass is a widely popular game fish species across North America, and this is especially true for Florida. The FWC published the *Black Bass Management Plan* in 2011 to ensure Florida remains the “Bass Fishing Capital of the World” in the long-term (FWC 2011b). In the Study Area, Florida largemouth bass is present and unique because of its rapid growth, making it a trophy fish species for anglers. Largemouth bass typically thrive in warmer eutrophic systems with high amounts of vegetation (Procopio 2019). The C-14 (Cypress Creek) Canal, which runs just north of the S-37B Gated Spillway, holds more largemouth bass than most other canals within southeast Florida (FWC 2015a).

Smaller marsh fishes are intermediate trophic level species that provide food for larger fish, alligators, and wading birds. These smaller fish process algae, plankton, macrophytes and macroinvertebrates, contributing to the food chain. Marsh fish have been negatively impacted over time by the region's

large-scale hydrologic alterations, causing diminished populations of species. In and near the Study Area, marsh fish include golden topminnow (*Fundulus chrysotus*), bluefin killifish (*Lucania goodei*), sailfin molly (*Poecilia latipinna*), mosquitofish (*Gambusia holbrooki*), oscar, flagfish (*Jordanella floridae*), and smaller sunfish (e.g., bluegill). Associated aquatic macroinvertebrates that play roles in the cycling of energy and nutrients include amphipods (*Hyallela aztecus*), freshwater prawn (*Palaemonetes paludosus*), crayfish (*Procambarus alleni*), and apple snail (*Pomacea paludosa* [USACE 1999]).

B.1.13.3 Birds

Native birds are protected under the Migratory Bird Treaty Act of 1918 (16 U.S.C. 703-712), which prohibits the “take” (i.e., killing, capturing, selling, trading, and transport) of protected migratory bird species without prior authorization by the USFWS and is an international conservation measure aimed at maintaining sustainable bird populations (USFWS 2024c). According to a comprehensive regional list provided by eBird verified records, there are 355 bird species that have been documented in Broward County and 410 bird species in Palm Beach County (Cornell University 2024). The slow-moving waters of the Everglades from its headwaters to its outlets historically provided abundant wetland habitat for wading birds, which have seen a 90 to 95 percent reduction in their populations (SFWMD 2010). Remaining wetland habitat in the Study Area provides home for several wading bird species, including wood stork, white ibis (*Eudocimus albus*), roseate spoonbill, little blue heron, tri-colored heron, black-crowned night heron (*Nycticorax nycticorax*), and snowy egret (*Egretta thula*). Secretive marsh birds found in similar habitats include species such as king rail (*Rallus elegans*), American bittern (*Botaurus lentiginosus*), and limpkin (*Aramus guarauna*). Critical food and habitat for these birds are fishes that occupy marshes and lower salinity/estuarine mangroves.

Other birds present in the Study Area include waterfowl, shorebirds, birds of prey, songbirds, and pelagic species. The Study Area falls within the Atlantic Flyway, acting as a critical rest stop for migratory passerines like warblers; examples include prothonotary warbler (*Protonotaria citrea*) and Cape May warbler (*Setophaga tigrina*), as well as vireos like the yellow-throated vireo (*Vireo flavifrons*). The distribution of birds of prey is dependent on suitable nest and perch sites and availability of prey. Common birds of prey in the Study Area include black vulture (*Coragyps atratus*), turkey vulture (*Cathartes aura*), osprey (*Pandion haliaetus*), cooper’s hawk (*Astur cooperii*), and red-shouldered hawk (*Buteo platypterus*). Birds have already been responding to changing weather patterns by changing the timing of their migration and biological life cycle. Sea level rise and storm surges are expected to impact coastal habitats, directly impacting wading birds. Additionally, there may be a northern shift in species ranges as temperatures rise and habitat and resources change with climate impacts (Pearlstine 2009).

Important Bird Areas (IBAs) are designated by National Audubon Society as places that birds are critically dependent upon for migration, breeding, or nonbreeding habitat. Within the Study Area, there are two IBAs. Along the coast is the Southern Atlantic Migrant Stopover IBA, which encompasses three coastal parks (Hugh Taylor Birch State Park, John U. Lloyd Beach State Park, and Spanish River Park), providing stopover habitat for neotropical migrants. The Northern Everglades IBA, providing vast areas of marshes for birds, borders most of the Study Area to the west, and one portion extends into the C-11 West Basin (Audubon 2024).

Like the SGCN-designated species at a state level, Birds of Conservation Concern are identified by the USFWS as birds that are likely to become candidates under the ESA. Birds of Conservation Concern that

have the potential to occur in the Study Area (USFWS 2024a) include American kestrel (*Falco sparverius paulus*), black skimmer, chimney swift (*Chaetura pelagica*), Florida burrowing owl, great blue heron (*Ardea herodias*), gull-billed tern (*Gelochelidon nilotica*), king rail, least tern, lesser yellowlegs (*Tringa flavipes*), magnificent frigatebird (*Fregata magnificens*), mangrove cuckoo (*Coccyzus minor*), painted bunting (*Passerina ciris*), prairie warbler (*Setophaga discolor*), red-headed woodpecker (*Melanerpes erythrocephalus*), reddish egret, ruddy turnstone (*Arenaria interpres morinella*), semipalmated sandpiper (*Calidris pusilla*), short-billed dowitcher (*Limnodromus griseus*), swallow-tailed kite (*Elanoides forficatus*), white-crowned pigeon (*Patagioenas leucocephala*), willet (*Tringa semipalmata*), and Worthington's marsh wren (*Cistothorus palustris griseus*).

B.1.13.4 Mammals

Mammals are susceptible to habitat loss and changes in prey availability due to shifting climate patterns (Pearlstine et al. 2009). There are a variety of FNAI-listed mammals that have the potential to occur in the Study Area, such as the Florida black bear and southeastern fox squirrel (*Sciurus niger niger*) (FNAI 2024). Common species that occur in the Study Area include eastern gray squirrel (*Sciurus carolinensis*), river otters (*Lontra canadensis*), raccoons (*Procyon lotor*), gray fox (*Urocyon cinereoargenteus*), Virginia opossums (*Didelphis virginiana*), and coyotes (*Canis latrans* [iNaturalist 2025]). Threatened or endangered mammals in the Study Area, like Florida bonneted bat and West Indian manatee, are discussed in **Section B.1.12**.

Florida black bears are currently protected under FAC 68A-4.009 Florida Black Bear Conservation Rule. An estimated 4,000 bears are present in the state. Encountering a bear within the Study Area would be rare; however, there has been a road mortality of a black bear along the western edge of the Study Area as well as a bear capture, and numerous bear-related calls in Broward County within the Study Area. Black bears can be found across a diversity of habitats but generally prefer habitats containing trees and shrubs that provide fruits and nuts, and those with dense understories (FWC 2024g).

Mammals that use aquatic habitats include river otters (living in burrows along the banks of water bodies, where they feed on fish and crustaceans [FWC 2024h]). Other species found near water include raccoons and white-tailed deer (*Odocoileus virginianus* [iNaturalist 2025; Appendix C, SFWMD 2024d]). White-tailed deer are Florida's most important game species with an approximate population of 700,000 in the state. They typically occur in forest edge habitats and open areas in grasslands or oak hammocks. There is no hunting of white-tailed deer permitted in the Study Area, and there are no Wildlife Management Areas present (FWC 2024i).

B.1.13.5 Amphibians and Reptiles

There is a great diversity of amphibians and reptiles throughout the Study Area, and they are an important food source for wading birds, alligators, and predatory fish. According to the Atlas of Amphibians and Reptiles in Florida (Krysko et al. 2011), there are 66 verified native species and 38 non-native species that have been documented in Broward County and 72 verified native species and 22 non-native species found in Palm Beach County. Generally, native amphibian and reptile species diversity decreases moving southward along the peninsula of Florida. Freshwater wetlands (i.e., marshes, swamps, mangrove estuaries) are one of the primary habitats for amphibians and reptiles.

Terrestrial habitats like forests and grasslands are also important for certain species of amphibians like toads and reptiles like lizards.

Species that have the potential to occur within the Study Area include, for example, brown anole (*Anolis sagrei*), green anole (*Anolis carolinensis*), northern curly-tailed lizard (*Leiocephalus carinatus*), Florida softshell turtle (*Apalone ferox*), common snapping turtle (*Chelydra serpentina*), loggerhead sea turtle, gopher tortoise, banded/southern watersnake (*Nerodia fasciata*), Brahminy blindsnake (*Indotyphlops braminus*), eastern narrow-mouthed toad (*Gastrophryne carolinensis*), southern leopard frog, and American alligator (*Alligator mississippiensis*). The American alligator is a keystone species, leaving holes and trails that turn into ponds, which creates habitat for fish and resultant food for wading birds. Alligators in turn prey on fish, invertebrates, amphibians, birds, and mammals. They are also an indicator species as they are very sensitive to changes in hydrological conditions (USACE 1999). Overall, amphibians and reptiles are some of the most sensitive groups of species to shifting weather patterns, particularly in response to changes in temperature and hydro patterns (Pearlstine et al. 2009).

B.1.14 Geology and Soils

The region of influence (ROI) for geology and soils is generally limited to the operational footprint for nine WCS within the Study Area, and the adjacent upgradient and downgradient areas of the primary canals associated with these structures. This discussion of geology and soils includes general geology, geological resources, geological hazards, and soils. General geology refers to topography, structural geology, and stratigraphy. Geological resources include aggregate deposits, minerals, and oil production. Geological hazards include a discussion of sinkholes and seismicity (earthquake potential). The discussion of soils includes a description of soils present at the WCS.

B.1.14.1 Geology

The WCS are in the Everglades Geomorphic District, which encompasses the southernmost portion of the Florida peninsula. The Everglades District includes some of the youngest geologic strata and landscapes in Florida and is underlain by Pliocene-Pleistocene sediments (deposited 5.4 million to 11,700 years ago) to Holocene sediments (deposited 11,700 years ago to present). The Everglades District is characterized by the following: (1) geologically young, (2) landforms are closely related to Pliocene-Pleistocene coastal and marine shelf sedimentation and Holocene wetland development, and (3) drainage is largely by way of sloughs³, sheet flow in wetlands, and poorly defined stream systems (FGS 2022).

Elevations within the Everglades District gradually decrease from north to south. Lowest elevations in the Everglades District are at sea level along the coastlines. The Everglades District is further divided into 11 provinces, of which the Atlantic Coastal Ridge Province contains nearly all the project ROI. The Atlantic Coastal Ridge Province parallels and, over much of its extent, is adjacent to the Atlantic Ocean (FGS 2022).

The Atlantic Coastal Ridge Province includes a larger Pleistocene coastal ridge and associated smaller ridges. In Broward County, the ridge is interrupted by low, west to east channels with wetlands. These low areas were late Pleistocene tidal channels that have been modified by karst processes. These

³ A slough is a low-lying area of land that channels water through the Everglades.

ancient tidal channels, known as transverse glades, drain overflow from the Everglades eastward toward the Atlantic Ocean. Although elevations in the Atlantic Coastal Ridge Province range from sea level to approximately 40 feet above mean sea level, nearly 95 percent of the land-surface elevations range between 5 feet and 20 feet above mean sea level. The median elevation is 10 feet above mean sea level. Six of the project WCS are located within the Atlantic Coastal Ridge Province and three are located within the Everglades Province, immediately adjacent to the western boundary of the Atlantic Coastal Ridge Province (FGS 2022).

The surficial geology of Atlantic Coastal Ridge Province in the Study Area is predominantly composed of shelly quartz sand, coquina, and limestone, identified as the Miami Limestone. This geologic material also comprises the SAS, including the Biscayne Aquifer, which is the primary source of fresh, potable water in southeastern Florida. The surficial Holocene to Pliocene aged units associated with the Miami Limestone and Biscayne Aquifer are approximately 300 feet in thickness, with the thickest deposits occurring at the coast that thins to the west under the Everglades. Below this, the Hawthorn Group sediments consist of interbedded sand, silt, gravel, clay, carbonate, and phosphatic sand and carbonate mudstone, claystone, and dolomite, approximately 800 feet in thickness. Most of the Hawthorn Group is considered a confining unit, meaning that it does not readily transmit water. Below this are the geologic units that comprise the FAS that include the Oligocene-aged Suwannee Limestone and the Eocene-aged Ocala Limestone, Avon Park Formation, and Oldsmar Formation. The FAS consists of a range of fossil-containing deposits, limestone (mud, packstone, grainstone), and dolomitic limestone approximately 2,500 feet in thickness. The underlying Paleocene-aged Cedar Keys Formation forms the base of the FAS. (USGS 2013).

Southeastern Florida has not been seismically active in recent times, with no earthquakes recorded since 1900 (USGS 2024a). No faults at land surface are identified within southeastern Florida (USGS 2021). The USGS rates ground motions using peak ground acceleration, which is the maximum acceleration experienced during an earthquake and is measured in units of acceleration due to gravity ("g"). USGS data indicate that an earthquake causing 0.02g peak horizontal ground acceleration has a 2 percent probability of exceedance in 50 years; and an earthquake causing 0.006g peak horizontal ground acceleration has a 10 percent probability of exceedance in 50 years (USGS 2024b). Earthquakes of that magnitude would be unlikely to cause any damage (FEMA 2020).

Karst is a type of landscape formed from the dissolution of soluble rocks, primarily limestone and dolomite. It is characterized by unique features such as sinkholes and subsidence, caves, underground drainage systems, and springs. Within the Study Area, sinkhole features are present; however, they are few, shallow, of small diameter, and develop gradually. Cover-subsidence sinkholes dominate (FDEP 2024b).

The Study Area does not contain any active mining or oil/gas extraction wells (FDEP 2024c,d).

Table B.1-10 summarizes geomorphology province, ground elevation, surficial geology, and karst risk for the WCS. **Figure B.1-19** shows the generalized stratigraphic column for Broward County.

Table B.1-10. Geologic Summary for the Water Control Structures in the Study Area.

Water Control Structure	Ground Elevation (ft) (MSL)	Geomorphology Province	Surficial Geology	Lithology	Age	Florida Sinkhole Types
G-56 Gated Spillway	12	Atlantic Coastal Ridge Province	Miami Limestone	Limestone, sand	Pleistocene	Cover is 30 to 200 ft thick. Consists mainly of incohesive and permeable sand. Sinkholes are few, shallow, of small diameter and develop gradually. Cover-subsidence sinkholes dominate.
G-57 Gated Spillway	8	Atlantic Coastal Ridge Province	Miami Limestone	Limestone, sand, medium fine sand and silt	Pleistocene	Cover is 30 to 200 ft thick. Consists mainly of incohesive and permeable sand. Sinkholes are few, shallow, of small diameter and develop gradually. Cover-subsidence sinkholes dominate.
S-37B Gated Spillway	8	Atlantic Coastal Ridge Province	Miami Limestone	Limestone, sand	Pleistocene	Cover is 30 to 200 ft thick. Consists mainly of incohesive and permeable sand. Sinkholes are few, shallow, of small diameter and develop gradually. Cover-subsidence sinkholes dominate.
S-37A Gated Spillway	7	Atlantic Coastal Ridge Province	Miami Limestone	Limestone, sand	Pleistocene	Cover is 30 to 200 ft thick. Consists mainly of incohesive and permeable sand. Sinkholes are few, shallow, of small diameter and develop gradually. Cover-subsidence sinkholes dominate.
S-36 Gated Spillway	10	Atlantic Coastal Ridge Province	Miami Limestone	Limestone, sand	Pleistocene	Cover is 30 to 200 ft thick. Consists mainly of incohesive and permeable sand. Sinkholes are few, shallow, of small diameter and develop gradually. Cover-subsidence sinkholes dominate.
S-33 Gated Spillway	5	Everglades Province	Miami Limestone	Limestone, sand	Pleistocene	Cover is 30 to 200 ft thick. Consists mainly of incohesive and permeable sand. Sinkholes are few, shallow, of small diameter and develop gradually. Cover-subsidence sinkholes dominate.
G-54 Gated Spillway	8	Everglades Province	Miami Limestone	Limestone, sand	Pleistocene	Bare or thinly covered limestone. Sinkholes are few, generally shallow and broad and develop gradually. Solution sinkholes dominate.
S-13AW Gated Culvert	7	Everglades Province	Miami Limestone	Limestone, sand	Pleistocene	Bare or thinly covered limestone. Sinkholes are few, generally shallow and broad and develop gradually. Solution sinkholes dominate.
S-13 Pump Station and Gated Spillway	6	Atlantic Coastal Ridge Province	Miami Limestone	Limestone, sand	Pleistocene	Cover is 30 to 200 ft thick. Consists mainly of incohesive and permeable sand. Sinkholes are few, shallow, of small diameter and develop gradually. Cover-subsidence sinkholes dominate.

Note: MSL = mean sea level

Source: FGS 2022, FDEP 2024b

Series		Geologic formation or lithostratigraphic unit		Lithology	Hydrogeologic unit		Approximate thickness, in feet	
Holocene to Pliocene		Holocene-age undifferentiated and Pleistocene-age formations ¹		Quartz sand; silt; clay; shell; limestone; sandy shelly limestone	Surficial aquifer system	Biscayne aquifer		200–450
		Tamiami Formation ²		Silt; sandy clay; sandy, shelly limestone; calcareous sandstone; and quartz sand/ planktic foraminiferal limestone		Confining beds		
Miocene to possibly Late Oligocene		Stock Island Formation ³				Intermediate confining unit	Gray limestone aquifer	
		Hawthorn Group	Peace River Formation		Confining unit		500–830	
			Arcadia Formation	Upper				Carbonate mudstone to grainstone; claystone; shell beds; dolomite; phosphatic and quartz sand; silt; and clay
				Lower				Sandy, molluscan limestone; phosphatic quartz sand, sandstone, and limestone
Eocene	Middle	Avon Park Formation	Upper	Floridan aquifer system	Upper Floridan aquifer (UFA)		40–350	
			Middle		Upper	150–500		700–1,200
					Lower	35–210		
			Early		?	?	Lower	Middle semiconfining unit 2 (MC2)
	?	Lower Floridan aquifer (includes permeable zones and confining units)					35–310	1,700–2,000
		Oldsmar Formation		Micritic limestone, dolomitic limestone, and dolomite	Boulder Zone		400–650	
Paleocene		Cedar Keys Formation		Dolomite and dolomitic limestone	Sub-Floridan confining unit		1,200?	
				Massive anhydrite beds				

¹ Pleistocene-age formations in southeastern Florida (Pamlico Sand, Miami Limestone, Anastasia Formation, Fort Thompson Format

² Tamiami Formation (Pinecrest Sand Member, Ochopee Limestone Member).

³ Stock Island Formation, after Cunningham and others, 1998.

EXPLANATION

LF1 Uppermost major permeable zone of the Lower Floridan aquifer

Source: USGS 2013

Figure B.1-19. Generalized Stratigraphic Column for the Study Area.

B.1.14.2 Soils

Soils adjacent to the WCS consist of the following soil types: Udorthents; Immokalee-Urban land complex; Urban land; Basinger fine sand; Immokalee, limestone substratum-Urban land complex; Margate fine sand; and Lauderhill muck. In general, these soil types consist of fine, gravelly, and cobbly sands (NRCS 2024). None of these soils are considered prime farmland. Soil characteristics for these soil units are summarized in **Table B.1-11**.

There are no FDEP cleanup sites in the vicinity of the WCS (FDEP 2024e).

Table B.1-11. Soil Characteristics at the Water Control Structures.

Water Control Structure	Soil Unit Name	Drainage	Frequency of Flooding/Ponding	Depth to Restrictive Layer	Depth to Water Table	Runoff Potential	Hydric	Susceptibility to Water Erosion	Susceptibility to Wind Erosion	Construction Suitability	Farmland Classification	Typical Profile
G-56 Gated Spillway	Udorthents	Well-drained	None	>80 inches	>80 inches	Negligible	No	Low	High	Very Limited	Not prime farmland	0 to 57 inches: cobbly sand
	Udorthents, 2 to 35 percent slopes	Well-drained	None	>80 inches	>80 inches	Negligible	No	Low	High	Very Limited	Not prime farmland	0 to 80 inches: gravelly sand
G-57 Gated Spillway	Immokalee-Urban land complex	Poorly drained	None	>80 inches	6 to 18 inches	High	No	Low	High	Very Limited	Not prime farmland	0 to 72 inches: fine sand
	Urban land, 0 to 2 percent slopes	No rating	No rating	No rating	No rating	No rating	No rating	No rating	No rating	No rating	Not prime farmland	No rating
S-37B Gated Spillway	Udorthents, shaped	Somewhat poorly drained	None	40 to 72 inches to paralithic bedrock	24 to 48 inches	Low	No	Low	High	Not limited	Not prime farmland	0 to 30 inches: gravelly sand; 30 to 50 inches: sand; 50 to 54 inches: weathered bedrock
S-37A Gated Spillway	Urban land, 0 to 2 percent slopes	No rating	No rating	No rating	No rating	No rating	No rating	No rating	No rating	No rating	Not prime farmland	No rating
	Basinger fine sand, 0 to 2 percent slopes	Poorly drained	None/frequent	>80 inches	0 to 12 inches	Negligible	Yes	Low	High	Very Limited	Not prime farmland	0 to 80 inches: fine sand
S-36 Gated Spillway	Udorthents	Well-drained	None	>80 inches	>80 inches	Negligible	No	Low	High	Very Limited	Not prime farmland	0 to 57 inches: cobbly sand
S-33 Gated Spillway	Immokalee, limestone substratum-Urban land complex	Poorly drained	None	40 to 72 inches to paralithic bedrock	6 to 18 inches	High	No	Low	High	Very Limited	Not prime farmland	0 to 5 inches: fine sand; 5 to 48 inches: fine sand; 48 to 58 inches: fine sand; 58 to 62 inches: weathered bedrock
	Margate fine sand, occasionally ponded, 0 to 1 percent slopes	Poorly drained	None	20 to 40 inches to lithic bedrock	0 to 18 inches	Negligible	Yes	Low	High	Very Limited	Not prime farmland	0 to 8 inches: fine sand; 8 to 16 inches: fine sand; 16 to 28 inches: fine sand; 28 to 32 inches: very gravelly fine sand; 32 to 42 inches: bedrock
G-54 Gated Spillway	Margate fine sand, occasionally ponded, 0 to 1 percent slopes	Poorly drained	None	20 to 40 inches to lithic bedrock	0 to 18 inches	Negligible	Yes	Low	High	Very Limited	Not prime farmland	0 to 8 inches: fine sand; 8 to 16 inches: fine sand; 16 to 28 inches: fine sand; 28 to 32 inches: very gravelly fine sand; 32 to 42 inches: bedrock
	Udorthents	Well-drained	None	>80 inches	>80 inches	Negligible	No	Low	High	Very Limited	Not prime farmland	0 to 57 inches: cobbly sand
S-13AW Gated Culvert	Hallandale fine sand, 0 to 2 percent slopes	Poorly drained	None	2 to 20 inches to lithic bedrock	About 3 to 18 inches	Very high	Yes	Low	High	Very Limited	Not prime farmland	0 to 12 inches: fine sand; 12 to 22 inches: bedrock
	Plantation, ponded-Matlacha-Urban land complex, 0 to 2 percent slopes	Very poorly drained	None/frequent	20 to 40 inches to lithic bedrock	About 0 inches	Negligible	Yes	No rating	High	Very Limited	Not prime farmland	0 to 10 inches: muck; 10 to 16 inches: fine sand; 16 to 33 inches: fine sandy loam; 33 to 43 inches: bedrock
	Matlacha, limestone substratum-Urban land complex	Somewhat poorly drained	None	40 to 60 inches to lithic bedrock	About 24 to 36 inches	Low	No	Low	High	Very Limited	Not prime farmland	0 to 23 inches: gravelly fine sand; 23 to 48 inches: fine sand; 48 to 52 inches: unweathered bedrock
	Margate fine sand, occasionally ponded, 0 to 1 percent slopes	Poorly drained	None	20 to 40 inches to lithic bedrock	0 to 18 inches	Negligible	Yes	Low	High	Very Limited	Not prime farmland	0 to 8 inches: fine sand; 8 to 16 inches: fine sand; 16 to 28 inches: fine sand; 28 to 32 inches: very gravelly fine sand; 32 to 42 inches: bedrock
S-13 Pump Station and Gated Spillway	Urban land, 0 to 2 percent slopes	No rating	No rating	No rating	No rating	No rating	No rating	No rating	No rating	No rating	Not prime farmland	No rating
	Lauderhill muck, frequently ponded, 0 to 1 percent slopes	Very poorly drained	None/frequent	16 to 36 inches to lithic bedrock	0 inches	Negligible	Yes	No rating	Low	Very Limited	Not prime farmland	0 to 31 inches: muck; 31 to 41 inches: bedrock

Source: NRCS 2024

B.1.15 Hazardous, Toxic, and Radioactive Waste

This section reviews conditions regarding the presence of hazardous and toxic chemicals and materials at the WCS under consideration for improvement. Work on these structures may require the removal of materials and sediments that contain harmful and regulated substances, resulting in hazardous, toxic, and radioactive wastes (HTRW). In accordance with Resource Conservation and Recovery Act, Toxic Substances Control Act, and FAC 62-730, administered by the FDEP, wastes of these types must be handled appropriately once characterized.

The canals of the Study Area have been subjected to various pollutants for more than 70 years from both point and non-point sources. Many chemical constituents do not degrade over that time and may persist in canal sediments. Each WCS is physically positioned on a small area of land. Footprints for the operational facilities are small while the administrative boundary of the canal and land associated with each facility varies in size from less than 5 acres to more than 50 acres.

To determine contamination from pollutants within the canals and at each WCS, sampling and testing was conducted in Phase I and II Environmental Site Assessments (ESA). The full report of the Phase I and II ESAs sampling methodologies and analyses are included in **Appendix I, Hazardous, Toxic and Radioactive Waste**. The Phase I ESA identifies conditions which materially affect the subject facility's function and operational status as well as past, current, and potential compliance issues. The Phase II ESA provides analytical results of sediment and soil sampling, identifying any constituents which exceed specific limits for surface water and groundwater standards and which may pose a risk to workers during the proposed action. Industrial/Commercial and Residential Exposure limits (IDE and RDE) from Soil Cleanup Target Levels (SCTL) and the Threshold and Probable Effective Concentrations (TEC and PEC) from the Sediment Quality Assessment Guidelines (SQAG) and were referenced during the review of analytical data to determine the impact of activities proposed. The surface water leachability criteria was also used as a factor to understand potential for contaminant release.

Assessing the affected environment included conducting Phase I ESAs at eight of the nine WCS in the Study Area and Phase II ESAs at eight of the nine sites for soil and sediment sampling to characterize the level of hazardous contamination of each site. Phase I ESAs included identification of potential findings in the vicinity of the WCS and associated facilities and Tier 1 vapor encroachment screening. In the Phase II ESAs, soil samples were collected from the banks of the waterways, both upstream and downstream of each facility, near the top of bank. A total of 38 soil borings were completed, which were composited where appropriate, resulting in 19 samples analyzed. Sediment samples were collected from both the upstream and downstream sections of the waterway near each WCS. There were a total of 10 sediment samples collected. The results of the Phase I and II ESA are further detailed below by watershed basin.

G-56 Gated Spillway / Hillsboro Canal Basin. This basin is influenced by a variety of land uses but is overall highly developed. Some farmland is directly located along the G-08 (Hillsboro) Canal. It is reasonable to expect a low risk of contamination based on development characteristics and land use. The G-56 Gated Spillway facility consists of 17.3 acres of land and canal within the G-08 (Hillsboro) Canal. The operational facility is a reinforced concrete structure spanning the width of the canal. The control building is a small single-story concrete building on the south bank of the canal. It also contains a backup generator powered by propane, which is stored in an underground storage tank (UST) on the site.

No potential findings or recognized conditions were identified in the Phase I ESA. Soil and sediment sampling conducted at this site indicated the presence of Arsenic and Chromium in the soil only. Arsenic was found in the soil above the RDE SCTL of 2.1 mg/kg at 2.4 mg/kg. Chromium was found in the soil above the Solid Waste Leachability Criteria of 4.2 mg/kg at 4.8 mg/kg. There is an adjacent golf course on the south bank which has existed and operated since the early 1970s. The playing surfaces of the golf course are located on the bank of the canal for a 0.75-mile segment directly west of the facility. Another drainage originating and flowing through the golf course and adjacent residential area ties in and contributes to the G-08 (Hillsboro) Canal upstream of the G-56 Gated Spillway.

G-57 Gated Spillway / Pompano Canal Basin. The Pompano Canal Basin is very small in comparison to other basins in the Study Area and is characterized by urban and transportation-related development. A small basin that is fully urbanized contributing to a small waterway could be a risk for contaminants. The G-57 Gated Spillway facility consists of 4.5 acres of land and canal, in two sections, within the G-16 (Pompano) Canal. The operational facility, located in the east section, is a reinforced concrete structure spanning the width of the canal. Two single-story concrete control buildings are located on the northeast bank of the canal near the spillway. A backup generator powered by propane, which is stored in a UST is also present on the site.

The west section of this facility includes a stretch of the G-16 (Pompano) Canal that was converted to a culverted system, backfilled, and paved over or developed in the late 1980s or early 1990s. The far east section of the facility remains open water canal.

There is one site upstream of the spillway but adjacent to the west section of the facility which has recent known contamination in groundwater samples. In soil and sediment samples collected, the only contaminant detected was Chromium. The level was found above surface water leachability criteria of 4.2 mg/kg at 6.8 mg/kg for sediment and 6 mg/kg for soil but well below RDE (SCTL) of 210 mg/kg.

S-37B Gated Spillway / C-14 West Basin. The C-14 West Basin is the largest in the Study Area and is comprised mostly of residential and commercial development. The S-37B Gated Spillway consists of 10.3 acres of land and water within the C-14 (Cypress Creek) Canal. The operational facility is a reinforced concrete structure spanning the width of the canal. The control building is a small single-story concrete building on the east bank of the canal. It also contains a backup generator powered by propane, which is stored in a UST on the site.

No known issues were identified in the Phase I ESA nor were any potential issues identified in vicinity of the facility. Barium was present in sediment samples, exceeding the TEC SQAG for Barium of 20 mg/kg at 21 mg/kg. Chromium was present in both sediment and soil samples, exceeding the surface water leachability criteria of 4.2 mg/kg with a range of 4.6 to 5.4 mg/kg, but not above SCTL. Golf courses have been in operation along both sides of this stretch of Cypress Creek Canal since the early 1970s.

S-37A Gated Spillway / C-14 East Basin. This small basin is mostly urbanized with some open space elements. The S-37A Gated Spillway facility consists of 7.9 acres of land and water within the C-14 (Cypress Creek) Canal. The operational facility is a reinforced concrete structure spanning the width of the canal. The control building is a small single-story concrete building on the south bank of the canal. It also contains a backup generator powered by propane, which is stored in a UST on the site.

No known issues were identified in the Phase I ESA nor were any potential issues identified in the vicinity of the facility. Sediment sampling results indicated the presence of Arsenic, Barium, Chromium, Selenium, and 4,4-DDE all below the SCTL. Chromium in sediment was above surface water leachability criteria of 4.2 mg/kg at 4.6 mg/kg. Selenium in sediment was above surface water leachability criteria of 0.5 mg/kg at 1.3 mg/kg. Arsenic was also found in sediment samples above the TEC SQAG of 9.8 mg/kg and the RDE SCTL of 2.1 mg/kg at 10 mg/kg. Additionally, a pesticide, 4,4-DDE was found in sediment above the TEC SQAG of 3.2 micrograms/kg at 4.49 micrograms/kg. Soil sampling results indicated the presence of Chromium below the SCTL but above surface water leachability criteria of 4.2 mg/kg with a range of 4.3 to 8.9 mg/kg. Silver in the soil was found below SCTL but above the surface water leachability criteria of 0.01 mg/kg at 0.088 mg/kg.

S-36 Gated Spillway / C-13 West Basin. This very large basin is highly urbanized. The S-36 Gated Spillway facility consists of 7.9 acres of land and water within the C-13 (Middle River) Canal. The operational facility is a reinforced concrete structure spanning the width of the canal. The control building is a small single-story concrete building on the north bank of the canal, very close to the road. It also contains a backup generator powered by propane, which is stored in a UST on the site.

No known issues were identified in the Phase I ESA nor were any potential issues identified in vicinity of the facility. Sediment sampling results indicated Arsenic and Chromium while soil sampling results indicated only Chromium. In both samples, Chromium was above the surface water leachability criteria of 4.2 mg/kg at range of 4.7 to 6.2 mg/kg in sediment and 4.6 to 5.4 mg/kg in soil, but below all SCTL. The Arsenic indicated in the sediment was above the RDE SCTL of 2.1 mg/kg at 3.8 mg/kg.

S-33 Gated Spillway / C-12 West Basin. The small C-12 West Basin is influenced heavily by urban and transportation related development. The S-33 Gated Spillway consists of 6.7 acres of land and water within the C-12 (Plantation) Canal. The operational facility is a reinforced concrete structure spanning the width of the canal. The control building is a small single-story concrete building on the south bank of the canal. It also contains a backup generator powered by propane, which is stored in a UST on the site.

A compliance issue was identified at the S-33 Gated Spillway regarding a closed and abandoned UST that is missing tank closure documents. Sediment samples collected at the site included Arsenic above RDE SCTL of 2.1 mg/kg at 2.3 mg/kg, but below SQAG. Chromium was indicated above surface water leachability criteria of 4.2 mg/kg at 6.5 mg/kg for sediment and 6.5 to 8.5 mg/kg for soil, but below SCTL. Silver was found in the soil above surface water leachability criteria of 0.01 mg/kg at 0.51 mg/kg, but below SCTL of 410 mg/kg.

G-54 Gated Spillway / North New River Canal West Basin. This basin is influenced mostly by dense residential development and transportation corridors. Without testing specific sites, there is a low risk for the basin to have contamination of hazardous constituents. The G-54 Gated Spillway facility consists of 58.3 acres of land and canal within the G-15 (North New River) Canal. The operational facility is a reinforced concrete structure spanning the width of the canal. The control building is a small single-story concrete building on the south bank of the canal. It also contains a backup generator powered by propane, which is stored in a UST on the site. A public park, Sewall Lock Park, is located on the south bank, where picnic tables and parking are available.

The Phase I ESA did not identify any potential findings or recognized conditions. There are no existing compliance issues with this site or with neighboring sites by which this site would be affected. Chromium was found in both sediment and soil samples above surface water leachability criteria of 4.2 mg/kg at 5.8 mg/kg for sediment and 4.7 to 5.1 mg/kg for soil, but below SCTL of 210 mg/kg. Selenium was indicated in soil samples above surface water leachability criteria of 0.5 mg/kg at 0.77 mg/kg. Arsenic was found in the soil above the RDE SCTL of 2.1 mg/kg at 2.3 mg/kg.

S-13AW Gated Culvert / C-11 West Basin and S-13 Pump Station and Gated Spillway / C-11 East Basin.

The C-11 (South New River) Canal basin is very large and is the southernmost basin in the Study Area, including a wide variety of land uses and development types. The S-13 Pump Station and Gated Spillway facility consists of 12 acres of land and water in the canal. The operational facility is a pump station and spillway which includes three diesel powered pumps and an in-stream trash rake located on a peninsula in the canal. The S-13 Pump Station and Gated Spillway also includes aboveground storage tanks for storing diesel fuel, a control building, and a generator building.

No known issues were identified in the Phase I ESA nor were any potential issues identified in vicinity of the facility. Both soil and sediment sampling results indicated presence of Arsenic. In sediment, this was analyzed at 11 mg/kg, above the TEC SQAG of 9.8 mg/kg and RDE SCTL of 2.1 mg/kg. In soil, the arsenic was analyzed 2.4 mg/kg, above RDE SCTL of 2.1 mg/kg.. Chromium was also present in the soil results above the surface water leachability criteria of 4.2 mg/kg at 6.3 to 7.4 mg/kg, but below SCTL.

B.1.16 Land Use and Real Estate

Region of Influence, Definition, and Methodology. This section details the regional and localized land use characteristics, beginning with an overview of land use patterns across Broward County and Palm Beach County. Following this, the analysis narrows its focus to the Study Area, which encompasses eastern, developed regions of Broward County and southern Palm Beach County⁴ and the WCS infrastructure. Finally, it provides a detailed examination of the immediate surroundings of the nine primary WCS within the Study Area. This approach provides a tiered perspective on land use and real estate, moving from county-level considerations to the specific land use contexts surrounding each WCS.

Land use describes the human use of land. It represents current use and plans and programs that guide the future use and development of an area. Categories of land use include agricultural, commercial, industrial, military, mixed-use, natural, recreational, and residential. In addition to discussing existing land uses immediately surrounding each WCS, this section also addresses adopted land use designations, ownership, and management of the surrounding areas. Owners and managers of land in the ROI include federal, state, and local governments as well as private organizations and individuals.

Affected Environment. Land uses in the Study Area vicinity are identified through a review of existing federal, state, county, and community-level land use plans. There are no comprehensive federal regulations that address all land use categories. Communities limit allowable land uses in certain areas by implementing general plans and zoning codes. Land use planning ensures compatible land uses and predictable future development.

⁴ Only a portion of each of Broward and Palm Beach counties are included in the Study Area. Approximately 28 percent of Broward County and approximately 3 percent of Palm Beach County (by area) are within the Study Area.

Figure B.1-1 shows the location and boundaries of the Study Area as well as the individual WCS.

B.1.16.1 Broward County

Broward County is the second-most populous county in Florida, following Miami-Dade County, and is one of three counties comprising the Miami metropolitan area. The county encompasses a total land area of 1,322 square miles. Historically, Broward County's development has followed a suburban model, characterized by auto-oriented, low-density, and functionally segregated land uses, resulting in sprawling development patterns. Today, however, Broward County's urbanized "developable" area, consisting of approximately 431 square miles in the eastern portion of the County, can be characterized as essentially built-out (Broward County 2024c). The western two-thirds of the county consists primarily of undeveloped conservation lands, including the Everglades and the Francis S. Taylor Wildlife Management Area.

The county's land use framework is structured to integrate high-density urban and residential zones near commercial hubs, while lower-density suburban neighborhoods are situated at greater distances from major economic centers. Key transportation corridors, including Interstate 95 and the Florida Turnpike, serve as critical infrastructure, facilitating regional connectivity, economic activity, and industrial development.

Broward County's strategic planning initiative, BrowardNext, prioritizes the preservation of green spaces, effective water management, and resilience against sea level rise through comprehensive coastal zone management and flood mitigation strategies (Broward County 2024c). The initiative seeks to balance sustainable development with community-centered urban planning by governing the allocation of land to meet housing, commercial, and industrial needs while safeguarding environmental resources. BrowardNext fosters adaptive land use management that supports growth and enhances community resilience, with key priorities focused on transportation infrastructure improvements and climate adaptation strategies.

B.1.16.2 Palm Beach County

Approximately 3 percent of Palm Beach County is included in the Study Area. In its entirety, Palm Beach County, which is contiguous to Broward County to the north, spans approximately 2,378 square miles, making it the largest county in the state by land area. It has a population of over 1.5 million residents, the third-most populous county in Florida (Behind Miami-Dade and Broward counties). The county features a diverse landscape, including coastal areas along the Atlantic Ocean, the southeastern quadrant of Lake Okeechobee, extensive wetlands fed by the lake, and numerous other lakes and canals, which are critical for water management and flood control. The land area within Palm Beach County, contiguous to and extending from Lake Okeechobee, comprises substantial agricultural holdings. As reported in the 2022 Census of Agriculture County Profile, the county contains 1,368 farms, encompassing a total of 460,575 acres, which constitutes approximately 37 percent of the county's total land area (USDA 2022). Palm Beach County's proximity to both Miami and the Treasure Coast enhances its regional significance, with major infrastructure such as Palm Beach International Airport and the Port of Palm Beach contributing to its economic and transportation networks.

Land use in the eastern, developed portions of Palm Beach County is an extension of neighboring Broward County. Land use planning in both counties prioritizes water management and flood control, given their shared proximity to the coast and extensive canal systems. Palm Beach County's land use plan, as outlined in the Palm Beach County Comprehensive Plan, supports a mix of residential, commercial, and industrial development, while promoting conservation of critical environmental resources and ensuring adequate infrastructure to support growth in both urban and rural zones. This complementary land use strategy strengthens the regional framework, facilitating coordinated development between the counties (Palm Beach County 2024b).

B.1.16.3 C&SF Section 203 Study Area

The C&SF Section 203 Study Area encompasses approximately 420 square miles in eastern Broward County and southern Palm Beach County (**Figure B.1-1**). As detailed in **Table B.1-3**, the Study Area consists of nine upstream watershed basins, with a network of seven primary canals managed by nine WCS. Additionally, the area includes six non-managed watersheds located downstream of each WCS. The focus of the C&SF Section 203 Study is the 302 square mile Action Area of managed upstream watersheds with nine WCS owned and operated by the SFWMD.

The boundaries of the Study Area are defined by the respective watersheds and contiguous urban zones within Reach A (SFWMD 2024e). Hydrologic, hydraulic, and hydrodynamic modeling for the area has identified critical vulnerabilities in infrastructure within the C&SF Project system in Broward County. The region is characterized by a relatively flat landscape, situated slightly above sea level, with highly dense urban areas that rely on the C&SF Project features for flood control and water management.

The C&SF Project flood control system, which was designed and constructed over 60 years ago, is approaching the end of its expected design life. Originally designed to accommodate a population of 2 million, the system now serves a population exceeding 6 million, placing significant strain on its infrastructure. Flooding events result in substantial property damage, impacting residences, businesses, and critical infrastructure, while also posing health and life safety risks, exacerbating saltwater intrusion, and threatening vital economic activities. The system's spillways, ROW areas, Water Management District levees, and the canals within these levees are integral components of the C&SF Project infrastructure. These elements require ongoing assessment and potential improvements to address evolving flood risks and infrastructure demands in the region.

Section B.1.8 Vegetation, presents a detailed analysis of land cover within the Study Area, informed by spatial data sourced from the FWC and classified according to the FLCCS. The resulting data were consolidated and are presented in **Table B.1-12**, which categorizes and quantifies the predominant land uses observed. The table delineates eight primary land use categories, listed in descending order of spatial extent: urban, transportation, engineered waters, natural waters, rural/agricultural, natural lands, infrastructure, and engineered lands. These categories provide a general representation of land use patterns within the Study Area and support the environmental analysis herein.

Developed and human-modified land uses predominate, with the urban, transportation, and infrastructure categories comprising approximately 81 percent of the Study Area (**Table B.1-12**). Natural lands and waters, defined as areas remaining largely undisturbed or unaltered, account for approximately six percent. The remaining 13 percent consists of engineered or modified lands and

waters, such as canals, detention areas, or other human-altered features. This distribution reflects a Study Area that is largely characterized by intensive development and infrastructure, with limited remaining natural cover types.

Table B.1-12. Land Uses with the Study Area.

Land Use Category	Acreage	Percentage
Urban	157,141	58.5%
Transportation	57,544	21.4%
Engineered Water (e.g., canal, ponds, retention channels)	24,774	9.2%
Natural waters (e.g., wetlands, lakes, estuary)	9,768	3.6%
Rural/Agricultural	9,692	3.6%
Natural lands (e.g., forests, scrub, vegetation)	6,398	2.4%
Infrastructure (e.g. utilities, communications)	2,619	1.0%
Engineered lands (e.g., extractive industries, clear cuts)	848	0.3%
TOTAL:	268,784	100%

Land uses surrounding the nine WCS that are the focus of the C&SF Section 203 Study are further described below.

G-56 Gated Spillway (location: 26.327972°N, 80.131583°W) / **Hillsboro Canal Basin.** The G-56 Gated Spillway is the northernmost WCS analyzed in this Study. Positioned along the G-08 (Hillsboro) Canal, it serves the Hillsboro Canal Basin. The Hillsboro Canal acts as a natural boundary between Broward and Palm Beach counties for much of its course. The G-56 Gated Spillway straddles this county line with nearby land uses reflecting a range of residential densities: higher-density housing developments are more prevalent to the immediate north in Palm Beach County, while lower-density single-family homes are found to the south near the Deer Creek Golf Club in Broward County.

G-57 Gated Spillway (location: 26.230850°N, 80.121525°W) / **Pompano Canal Basin.** The G-57 Gated Spillway is situated along the G-16 (Pompano) Canal and serves the Pompano Canal Basin. Land uses immediately abutting the G-16 (Pompano) Canal at the G-57 Gated Spillway are primarily low- to medium-density residential developments. Nearby land uses are varied and include higher density residential developments, commercial developments, public uses, and places of worship. The City of Pompano Beach's government offices and cultural center are located approximately 500 feet to the west of this WCS.

S-37B Gated Spillway (location: 26.223689°N, 80.170163°W) / **C-14 West Basin.** The S-37B Gated Spillway is situated along the C-14 (Cypress Creek) Canal and serves the C-14 West Basin. The land uses immediately surrounding the S-37B Gated Spillway are predominantly residential and recreational, including various housing developments and golf courses that are part of the Palm Aire Country Club. This area encompasses a range of residential densities, from single-family homes to multi-family residential buildings.

S-37A Gated Spillway (location: 26.206246°N, 80.131641°W) / **C-14 East Basin.** The S-37A Gated Spillway is situated along the C-14 (Cypress Creek) Canal and serves the C-14 East Basin. The land uses immediately surrounding the S-37A Gated Spillway are incredibly varied. The Pine Crest School occupies a large swath of land to the south with single family homes along the canal to the west of the WCS. To the immediate west is SR 811, Dixie Highway, and Interstate 95. Between these major transportation

arteries are the Cyprus Creek Mobile Home Park, an office park, a hotel, other low density commercial establishments, and additional residential developments.

S-36 Gated Spillway (location: 26.173183°N, 80.179122°W) / **C-13 West Basin**. The S-36 Gated Spillway is situated along the C-13 (Middle River) Canal and serves the C-13 West Basin. It is situated directly between Emerald Lake and Blue Heron Lake. The immediate surroundings are primarily medium-density residential areas, including developments along NW 39th Street and the Lakeview Club Condominium community, which borders the C-13 (Middle River) Canal adjacent to the spillway. Additionally, Lauderdale Lakes Middle School and Boyd H. Anderson High School are located approximately 1,500 feet and 2,000 feet northwest of the WCS, respectively.

S-33 Gated Spillway (location: 26.135942°N, 80.194494°W) / **C-12 West Basin**. The S-33 Gated Spillway is situated along the C-12 (Plantation) Canal and serves the C-12 West Basin. The land uses surrounding the S-33 Gated Spillway include extensive single-family residential developments located to the south of the C-12 (Plantation) Canal, with commercial establishments situated to the north across Sunrise Boulevard. Approximately 1,000 feet north of the WCS, beyond the commercial development, is the Paris Saint-Germain Academy Pro Residency Florida, a youth soccer training facility.

G-54 Gated Spillway (location: 26.095082°N, 80.229682°W) / **North New River Canal West Basin**. The G-54 Gated Spillway is situated along the G-15 (North New River) Canal and serves the North New River Canal West Basin. The G-54 Gated Spillway is located along I-595, Port Everglades Expressway, a major transportation artery. North of the WCS are extensive single-family developments as well as the Seminole Middle School, located approximately 2,200 feet to the north of the WCS. South of the G-54 Gated Spillway and across Interstate 595 are transportation yards, storage facilities, and other commercial and light industrial uses.

S-13AW Gated Culvert (location: 26.064633°N, 80.281512°W) / **C-11 West Basin**. The S13-AW WCS is a double-box, concrete culvert situated along the C-11 (South New River) Canal and serving the C-11 West Basin. Land uses in the immediate vicinity are predominately single-family residential developments. Aside from the residential developments, there is a medium-density commercial development across Griffin Road (SR-818) to the south and the 243-acre “Tree Tops Park” owned and managed by Broward County approximately 500 feet east. There is also a place of worship, the Kingdom Hall of Jehovah’s Witnesses, in the intervening land between the WCS and Tree Tops Park.

S-13 Pump Station and Gated Spillway (location: 26.066360°N, 80.208858°W) / **C-11 East Basin**. The S-13 WCS is a gated spillway and pump station situated along the C-11 (South New River) Canal and serving the C-11 East Basin. Surrounding land uses are diverse, including the Fort Lauderdale Florida Power and Light power plant, a 1,200-megawatt natural gas-fired facility immediately northeast of the S-13 Pump Station and Gated Spillway. The area also includes various commercial and light industrial developments, as well as several residential communities located to both the north and south of the canal. State Road 7 lies immediately to the east of the WCS, while Florida Turnpike is situated approximately 2,000 feet to the west. Additionally, Fort Lauderdale-Hollywood International Airport, located around 2.5 miles north-northeast of the WCS, has an outsized influence on regional land use patterns due to its proximity and associated infrastructure needs.

Figure B.1-20 presents a satellite image illustrating typical development patterns in the vicinity of the WCS. This figure highlights the surrounding land uses near the G-56 Gated Spillway and G-54 Gated Spillway, which were selected as representative examples due to their diverse adjacent land uses. Collectively, these areas encompass a range of development types found within the Study Area, including varying densities of residential neighborhoods, commercial developments, Interstate 595, a cemetery, and parkland (i.e., the Deer Creek Golf Club).

A summary of land uses within a 1,000-foot radius of each WCS is provided in **Table B.1-13**.



Note: Images are from Google Maps 2025

Figure B.1-20. Representative Satellite Photo of Two Water Control Structures: G-56 and G-54 Gated Spillways.

Table B.1-13. Summary of Land Uses within 1,000-foot Radius of Each Water Control Structure.

Water Control Structure	Residential – Single Family	Residential – multi-family	Commercial – Low Density	Commercial – Medium/High Density	Industrial - Light	Industrial – Medium/Heavy	School	Place of Worship/Cemetery	Park
G-56 Gated Spillway	●	●							● ^{a/}
G-57 Gated Spillway	●	●	●	●			●	●	●
S-37B Gated Spillway	●	●							● ^{b/}

Water Control Structure	Residential – Single Family	Residential – multi-family	Commercial – Low Density	Commercial – Medium/High Density	Industrial - Light	Industrial – Medium/Heavy	School	Place of Worship/Cemetery	Park
S-37A Gated Spillway	●	●	●	●	●		●		●
S-36 Gated Spillway	●	●							
S-33 Gated Spillway	●		●		●		●		
G-54 Gated Spillway	●		●					●	●
S-13AW Gated Culvert	●		●						●
S-13 Pump Station and Gated Spillway	●	●	●		●	● ^{c/}			●

a/ Deer Creek Golf Club

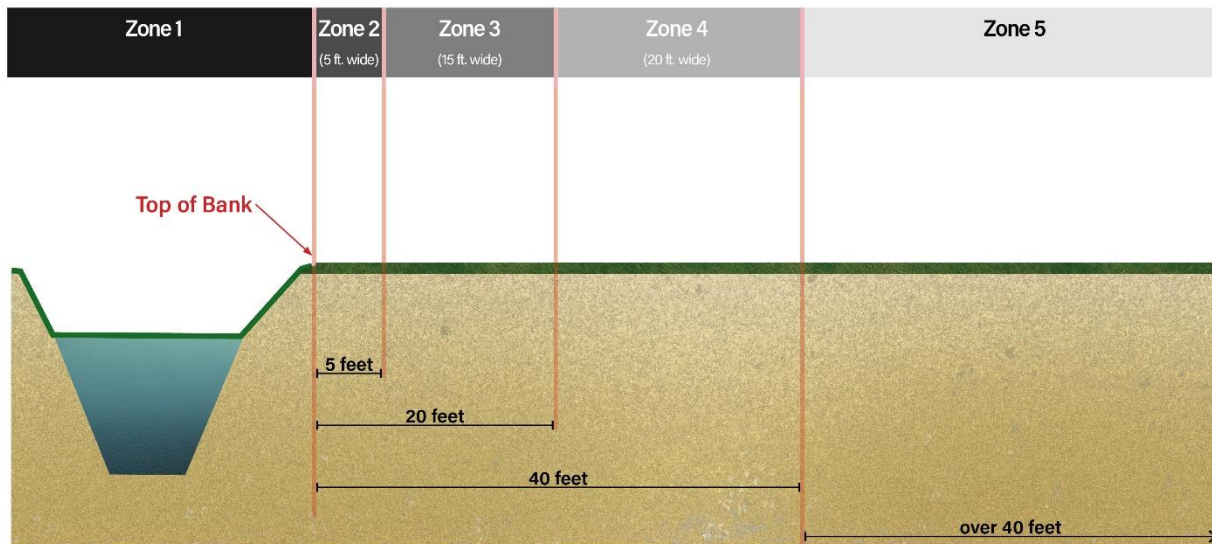
b/ Palm Aire Country Club

c/ Wheelabrator South Broward Waste to Energy Plant, a 66-megawatt biopower project

B.1.16.4 Rights of Way

A ROW refers to a strip of land designated for transportation, utilities, or infrastructure purposes, providing legal access for specific uses, such as roadways, utility lines, or canal maintenance areas. In the context of the SFWMD, ROWs are lands owned or controlled by the SFWMD (e.g., easement or reservation) to facilitate the construction, operation, and maintenance of flood control works, including canals, levees, WCS, and associated access roads. ROWs serve essential functions: they ensure unobstructed access for maintenance, emergency operations, and inspections; allow the placement of infrastructure where not in conflict with SFWMD needs, such as utilities; and maintain open pathways for flood control and water management. The SFWMD requires ROW permits for any encroachment or use within the ROW, aligning these uses with SFWMD objectives to ensure ROW activities do not interfere with flood protection, water quality, or environmental preservation.

SFWMD classifies ROW lands along its canals into five operational zones, each with specific guidelines to balance land use, maintenance needs, and environmental protection (**Figure B.1-21**). Zone 1 encompasses the canal itself, extending from one bank to the opposite, and is strictly reserved for flood control and unobstructed water flow. Zone 2 is a narrow 5-foot strip adjacent to the top of the bank, primarily used for inspection and limited maintenance. Zone 3 spans from 5 to 20 feet from the top of the bank and allows certain maintenance activities while preserving vegetation for environmental purposes. Zone 4, located from 20 to 40 feet landward, provides space for maintenance equipment and emergency response vehicle access. Finally, Zone 5 covers areas more than 40 feet from the bank, often used for utilities or other activities that do not interfere with canal operations or flood control. These zones allow SFWMD to maintain operational flexibility while accommodating certain land uses that align with maintenance and environmental criteria.



Source: SFWMD 2024e

Figure B.1-21. Right of Way Zones.

Housing developments, commercial buildings, or permanent structures are prohibited within the SFWMD's ROWs to maintain SFWMD's operational integrity. The ROW guidelines restrict permanent above-ground installations within a clear 40-foot strip adjacent to canals and WCS to prevent interference with flood control, maintenance access, and other essential functions. Temporary or small structures like sheds may be allowed in designated zones (e.g., Zone 5) but must meet strict criteria, including being removable without machinery and not impacting SFWMD maintenance activities.

For any existing or previously authorized structures within the ROW, such permits are limited and revocable if they impede SFWMD's operations. These rules ensure that residential and commercial developments near the ROW do not compromise flood protection and maintenance requirements critical to the C&SF Project flood control system.

B.1.17 Visual Resources

Region of Influence, Definition, and Methodology. The visual ROI includes the full extent of the Study Area, with a particular emphasis placed on the individual WCS facilities and operations and views of the WCS from public viewpoints. Special consideration is given to actions within visually sensitive locations and viewpoints from visually sensitive locations.

Visual resources are natural and human-made features that give a particular "landscape" (visible features of an area of land) or "viewshed" (view on an area from a vantage point) its character and aesthetic quality. The scenic quality or character of an area consists of the landscape features and social environment from which they are viewed. The landscape features that define an area of high visual quality may be natural, such as mountain views, or human-made, such as city skyline. To assess the quality of visual resources, this section describes the overall visual character and distinct visual features on or in the viewshed of the Study Area.

Affected Environment. To rate the scenic quality of the Study Area and the areas surrounding the WCS, the Bureau of Land Management's Visual Resource Management (VRM) Classification System was used. Although this classification system is designed for undeveloped and open land managed by the Bureau of Land Management, the system is valid in the analysis of VRM and planning activities. Selecting the VRM system as the basis for this analysis is an established means for determining visual values based on a set of objectives. **Table B.1-14** outlines the objectives of the four VRM classes.

Table B.1-14. Bureau of Land Management Visual Resource Management Class Objectives.

Class	Objective	Change Allowed (relative level)	Relationship of Activities to the Casual Observer
I	Preserves the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity.	Very Low	Activities should not be visible and must not attract attention.
II	Retains the existing character of the landscape. Management activities may be seen but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.	Low	Activities may be visible but should not attract attention.
III	Partially retains the existing character of the landscape. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.	Moderate	Activities may attract attention but should not dominate the view.
IV	Provides for management activities which require major modification of the existing character of the landscape. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements.	High	Activities may attract attention, may dominate the view but are still mitigated.

Source: BLM 1986

The degree to which development affects the aesthetic quality of a landscape depends on the contrast created between the project elements and the existing landscape. This analysis uses the Bureau of Land Management's degree of contrast criteria to assess the level of contrast between the proposed or existing element and the landscape in which it sits (**Table B.1-15**). The four levels of contrast (i.e., none, weak, moderate, and strong) correspond to the VRM class objectives, I, II, III, and IV, respectively. For example, a "moderate" contrast rating is generally acceptable in a Class III area but may also meet the VRM objectives for a Class IV area when there are accumulating elements.

Table B.1-15. Bureau of Land Management Degree of Contrast Criteria.

Degree of Contrast	Criteria
None	The element contrast is not visible or perceived.
Weak	The element contrast can be seen but does not attract attention.
Moderate	The element contrast begins to attract attention and begins to dominate the characteristic landscape.
Strong	The element contrast demands attention, will not be overlooked, and is dominant in the landscape.

Source: BLM 1986

A sensitivity level analysis is an important component of the VRM. Sensitivity levels are a measure of public concern, and lands are assigned high, medium, or low sensitivity levels. A sensitivity analysis is

conducted by evaluating the following factors: types of users, amount of use, public interest, adjacent land use, special areas, distance zones (foreground to midground, background, and seldom seen), and other dynamics.

C&SF Section 203 Study Area. The Study Area encompasses the heavily developed eastern portions of Broward County and a small portion of southern Palm Beach County as shown in **Figure B.1-1**. The Study Area extends from the WCAs in the western portions of each county. Large undeveloped parcels are rare within the Study Area, with most found in the western margins of the Study Area adjacent to the WCAs, as illustrated in **Figure B.1-22**, the National Land Cover Database (NLCD) inventory.

Land cover plays a role in visual resources. USGS maintains the NLCD, which inventories the existing character of a landscape, level of development, and degree of contrast.^{5,6} **Figure B.1-22**, based on data from the NLCD, illustrates the land cover composition of the Study Area. The Study Area is dominated by extensive development, with a heavy presence of low-, medium-, and high-intensity developed land, represented in varying shades of red. This level of development contributes significantly to the region's visual resources by creating a highly urbanized landscape with limited natural or undeveloped areas.

The NLCD data categorizes land cover types to reflect the landscape's existing character, allowing an assessment of the visual contrast in the region. While open water bodies and scattered patches of green spaces, such as forests and wetlands, are visible, these areas are relatively small and isolated. The high concentration of developed land within the Study Area suggests a dense urban environment, which impacts the visual quality and scenic resources by reducing natural land cover and increasing visual uniformity associated with urban infrastructure. This heavy development footprint results in a landscape with high levels of contrast from the built environment, shaping the visual experience of the Study Area.

The extensive development, supporting infrastructure, and pronounced built contrast in the Study Area result in a VRM Class IV rating—the highest classification—indicating the dominance of the built environment, which visually supersedes the natural landscape across the Study Area. While limited views of natural landscapes exist at the periphery, such as the beaches and Atlantic Ocean to the east and the Everglades to the west, these do not mitigate the overwhelming visual impact of urban development. The degree of landscape modification within the Study Area is so significant that natural features are virtually absent, making the built environment the prevailing visual element and creating a high visual contrast aligned with urban characteristics.

⁵ The NLCD data is current as of 2021.

⁶ Land Cover is also addressed in Section B.1.8, Vegetation, with specific reference to Table B.1-5. Discrepancies between the data presented in Section B.1.8 and B.1.17 is attributed to the granularity of the dataset. The NLCD dataset is produced at a 30-meter spatial resolution, meaning each pixel represents a 30m x 30m area (900 square meters or ~0.22 acres per pixel). This level of detail provides a broad classification of land cover types across the United States with a moderate spatial scale suitable for regional and landscape-level analysis.

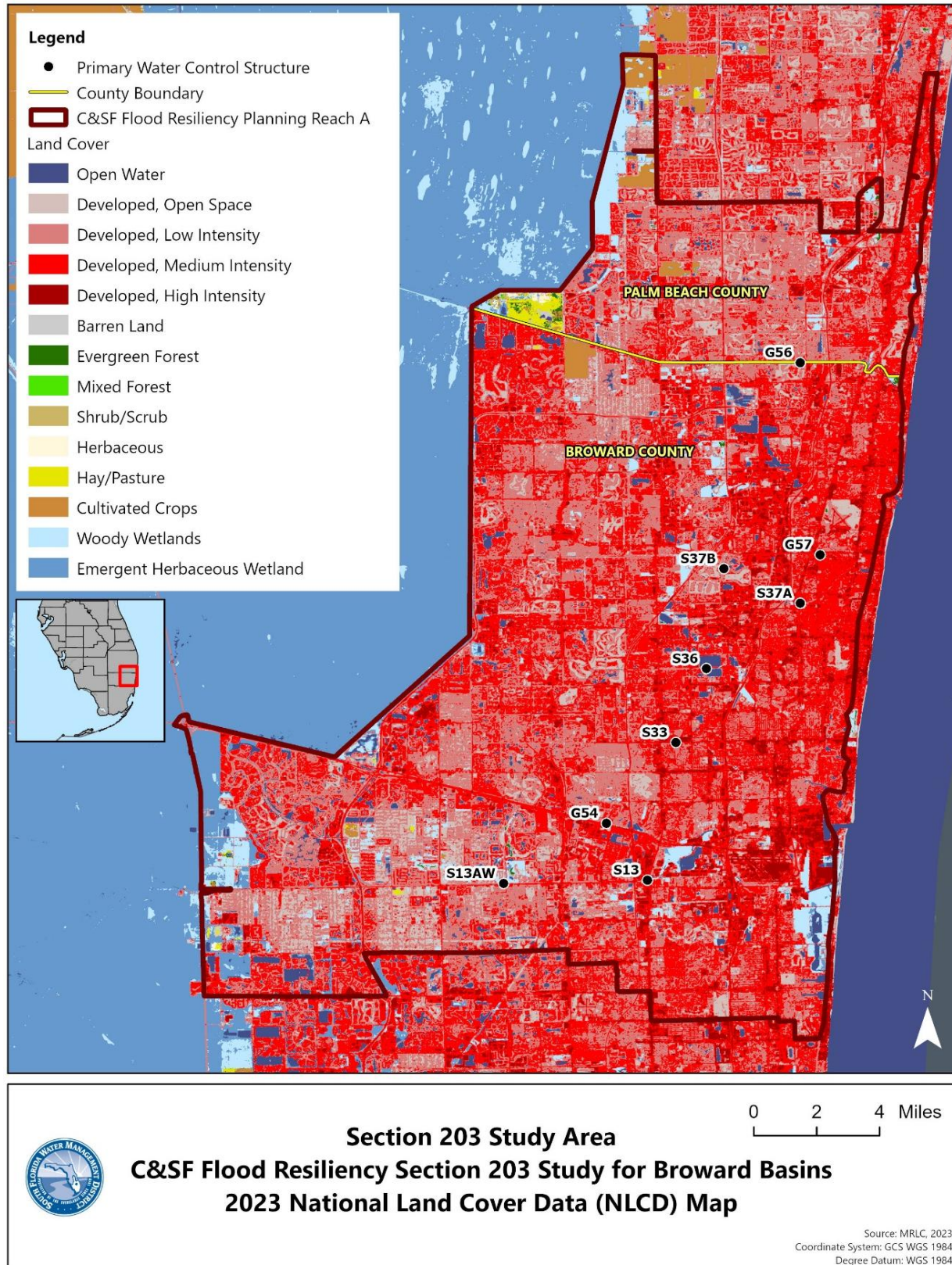


Figure B.1-22. National Land Cover Database (NLCD) Inventory of the Study Area.

Water Control Structures. A WCS is an engineered structure designed to manage water flow within canals, regulating water levels and mitigating flood risks. These structures are functional and utilitarian by design, often featuring large concrete components, metal fencing, railings, and signage, which add a distinctly industrial visual element to the landscape. The canals extending from the WCS, while visually blending into the environment, display uniform, straight lines and consistent dimensions that reveal their human-made origins, distinguishing them from naturally occurring waterways that typically have more organic, irregular shapes.

Figure B.1-23 depicts three distinct WCS highlighting the range of location-specific and capacity-driven design considerations inherent to regional water management infrastructure. The WCS share a common, utilitarian design language; however, each structure is uniquely engineered to regulate water flow within its respective basin. The S-37A Gated Spillway is a larger, gated structure with a conspicuous above-grade profile, whereas the S-36 Gated Spillway is a smaller, low-head structure with minimal visible infrastructure. The G-56 Gated Spillway represents an intermediate design, balancing structural scale and hydraulic capacity between the two.

Each WCS shares a consistent context within the Study Area's developed landscape, contributing similarly to the region's visual character. The WCS are situated in highly developed settings, characterized by dense infrastructure and proximity to major transportation routes, in alignment with the broader visual environment of the Study Area. Due to the uniformity in their immediate surroundings and the similar visual characteristics of each WCS, the visual analysis for these structures was aggregated to avoid redundancy.

The WCS are prominent features within the Study Area that command attention. Seven of the WCS consist of gated spillways with compact infrastructure and one of the WCS is a culvert that is visually like the other seven spillways. The remaining WCS, S-13 Pump Station and Gated Spillway, is a gated spillway with an additional pump station, presenting a significantly larger footprint with taller, more imposing features. Each WCS, regardless of size, disrupts the natural landscape and is visually dominant within its setting, meriting a VRM Class IV rating. This rating reflects the high level of visual contrast introduced by these conspicuous structures, which offer minimal integration with their natural surroundings.



Figure B.1-23. Representative Photo of Three Water Control Structures: G-56, S-37A, and S-36 Gated Spillways.

B.1.18 Transportation and Traffic

Region of Influence, Definition, and Methodology. The ROI for the traffic and transportation analysis includes the full extent of the Study Area, with a special emphasis placed upon the individual WCS facilities and surrounding traffic and transportation patterns. In the context of the Study Area, “transportation” refers to the infrastructure systems utilized for the movement of goods and people within the area, including road networks, mass transit, rail lines, airports, and waterways. “Traffic” pertains to the flow of vehicles and other modes of transportation on the network, as well as the related operational conditions. This includes the Annual Average Daily Traffic (AADT) data for local roads and highways, which serves as an indicator of traffic volumes, congestion, and patterns of use by commuters and travelers. AADT data is used in this analysis to assess the operational conditions of roads in proximity to the nine WCS.

B.1.18.1 Affected Environment.

C&SF Section 203 Study Area. The Study Area encompasses the densely developed eastern portions of Broward County and a small portion of southern Palm Beach County, two of the three most populous counties in Florida. This area is characterized by substantial urbanization, with extensive supporting traffic and transportation infrastructure. Given the population density and economic significance of the region⁷, the Study Area houses a comprehensive transportation network, including road infrastructure, mass transit, rail, a major airport, commercial shipping channels and port, and the ICW. The following sections provide an analysis of these modules, establishing baseline conditions for the Study Area’s transportation infrastructure.

Road Network. The road network within the Study Area is extensive, comprising 5,128 miles of public roads in Broward County alone, with residents and visitors traveling over 43 million miles each day on these routes (Broward MPO 2024). Major highways, such as Interstate 95, the Florida Turnpike, and State Road 7 traverse the area, facilitating north-south travel and connecting to local roadways that provide access to residential and commercial areas. Given the high population density, traffic congestion is a prevalent issue, especially during peak hours. This road network also supports emergency vehicle response routes and evacuation pathways, which are crucial in this region prone to tropical storms and hurricanes.

Mass Transit. Mass transit in the Study Area includes a comprehensive local bus service operated by Broward County Transit, which covers a 410 square mile area. Broward County Transit services accommodate approximately 130,000 passenger trips daily, or nearly 40 million annually (Broward MPO 2024). Express Bus services, developed in collaboration with the Florida Department of Transportation (FDOT), connect Broward County with Miami, carrying nearly 2,000 passengers daily on six routes, including the popular 595 Express (Broward MPO 2024).

Rail Network. The rail network within the Study Area is a critical component of both passenger and freight transportation, enhancing connectivity across Broward and Palm Beach counties. The Study Area is served by two primary rail corridors: the Florida East Coast (FEC) Railway, primarily handling freight, and the South Florida Rail Corridor, which supports both passenger and freight operations (Broward

⁷ Broward County had an annual Gross Domestic Product (GDP) of \$147 billion in 2022. This made it the second-largest GDP in Florida and the 25th largest in the United States (source: <https://fred.stlouisfed.org/series/GDPALL12011>). See Section B.1.20 for additional discussion of socioeconomic resources in the Study Area.

MPO 2024). Tri-Rail, operated by the South Florida Regional Transportation Authority, provides commuter rail service along the South Florida Rail Corridor, connecting Miami, Fort Lauderdale, and West Palm Beach. This service accommodates more than 4.4 million annual passengers (Broward MPO 2024). Brightline, a privately operated intercity rail service along the FEC corridor, serves major South Florida cities and offers seamless access to local transit options. Amtrak's Silver Service and Palmetto routes also utilize the South Florida Rail Corridor.

Freight rail operations play a substantial role in the Study Area's economic infrastructure. The FEC Railway operates a major freight corridor parallel to the coast, linking Port Everglades with domestic and international markets. The FEC, in partnership with Port Everglades, constructed the Intermodal Container Transfer Facility in 2014, streamlining freight transfers between ships, trains, and trucks, thereby reducing truck traffic on local roadways and enhancing the port's competitiveness. CSX Transportation also provides freight service on the South Florida Rail Corridor, facilitating cargo movement through connections to the Fort Lauderdale-Hollywood International Airport and Port Everglades, Broward's primary cargo hubs. This integrated freight network supports efficient goods distribution while minimizing environmental impacts and congestion on regional roads.

Air. Fort Lauderdale-Hollywood International Airport is a major transportation hub within the Study Area, serving as a large-hub airport with significant daily passenger volume. In 2018, Fort Lauderdale-Hollywood International Airport recorded over 17.6 million enplanements, with an average of 80,000 passengers traveling daily through its facilities (Broward MPO 2024). The airport hosts over 30 airlines and operates more than 700 flights daily. Fort Lauderdale-Hollywood International Airport plays a substantial economic role in the region, generating an estimated \$2.4 billion annually and supporting approximately 37,000 jobs (Broward MPO 2024).

Waterways. Water transportation is an established and historic mode of transit in the Study Area, which includes: (1) the ICW, accommodating smaller boat traffic; (2) miles of inland canals; and (3) Port Everglades, a major commercial shipping port (Broward MPO 2024). In 2023, Port Everglades handled over 1 million Twenty-Foot Equivalent Units (TEU), ranking as the top perishables port in Florida and the 15th busiest container port in the United States (Port Everglades 2024). The ICW, a navigable channel maintained by the USACE, runs through this area and supports a wide range of recreational and commercial boating activities along Florida's eastern coast. Water transportation services in the Study Area also include the Riverwalk Water Trolley, operated by the Downtown Fort Lauderdale Transportation Management Association, which provides free public access along the New River. Additionally, the Water Taxi, a privately owned, year-round shuttle service, offers further water transportation options (Broward MPO 2024).

Water Control Structures. The WCS in the Study Area are critical infrastructure elements serving the canals within the designated area. While the canals provide recreational opportunities, such as fishing and boating, they were not conceived or ever intended for transportation purposes. None of the nine WCS in the Study Area are designed to accommodate boat traffic, as they lack locks or bypass routes. Consequently, the WCS effectively isolate each side of the canals they traverse, preventing access between the two canal segments.

Table B.1-16 lists the AADT counts for the last five years with the average for the three closest transportation routes with data for each of the nine WCS. AADT counts are the total volume of traffic on a highway segment for one year, divided by the number of days in the year.

Table B.1-16. Water Control Structures and Traffic Counts.

Water Control Structure			Annual Average Daily Traffic					
	County	Road/Site	2019	2020	2021	2022	2023	Average
G-56 Gated Spillway	Palm Beach	Powerline Rd (930016)	38,000	37,000	34,500	36,000	36,500	36,400
		SW 18th St (938552)	24,500	23,500	23,500	24,500	25,500	24,300
	Broward	Military Tr (869347)	27,000	21,000	20,900	20,800	27,000	23,340
G-57 Gated Spillway	Broward	Atlantic Blvd (860071)	43,000	41,000	42,500	41,500	40,500	41,700
		Dixie Hwy (860025)	27,000	26,000	25,500	23,500	24,000	25,200
		NE 18th Ave (867424)	22,500	15,700	15,700	15,500	19,900	17,860
S-37B Gated Spillway	Broward	Florida's Tpke (971916)	123,300	105,700	105,300	124,200	129,500	117,600
		Atlantic Blvd (867493)	51,500	48,500	49,500	52,500	54,500	51,300
		SW 36th Ave (869590)	7,900	5,400	5,400	5,400	7,900	6,400
S-37A Gated Spillway	Broward	Dixie Hwy (860501)	23,500	20,200	25,400	20,500	21,000	21,120
		Cypress Creek Rd (860301)	42,500	40,500	35,500	39,000	39,000	39,300
		NE 18th Ave (869277)	22,000	21,000	20,000	19,800	19,100	20,380
S-36 Gated Spillway	Broward	Oakland Park Blvd (860479)	60,000	56,000	57,500	52,500	58,000	56,800
		NW 31st Ave (867441)	31,000	24,500	24,500	24,500	34,000	27,700
		NW 39th St (867087)	6,800	3,500	3,500	3,500	7,300	4,920
S-33 Gated Spillway	Broward	Sunrise Blvd (860487)	52,500	59,500	53,500	50,500	57,000	54,600
		SR-7/US-441 (860103)	53,000	50,500	50,000	49,000	48,500	50,200
		MLK Jr Ave (860430)	28,500	23,000	24,000	27,500	26,500	25,900
G-54 Gated Spillway	Broward	I-595 (860380)	159,413	123,536	145,812	148,903	151,408	145,814
		Davie Rd (865313)	46,500	20,600	20,500	20,500	43,000	30,220
		SR-84 (860630)	17,500	16,500	16,000	19,000	11,500	16,100
S-13AW Gated Culvert	Broward	SR-818 (860115)	37,500	35,500	25,500	38,500	31,500	33,700
		Nob Hill Rd (869241)	22,500	18,200	18,000	17,800	21,500	19,600
		SW 95th Ave (867277)	6,200	3,700	3,700	3,700	5,400	4,540
S-13 Pump Station and Gated Spillway	Broward	Florida's Tpke (971904)	147,000	130,100	133,600	150,200	158,200	143,820
		SR-7/US-441 (860089)	52,500	53,500	49,500	48,500	50,500	50,900
		Orange Dr (867036)	14,700	8,000	7,900	7,900	9,400	9,580

Source: FDOT 2024

B.1.19 Infrastructure and Utilities

This section describes flood control infrastructure within the Study Area. Many of these structures were constructed by the USACE as part of the C&SF Project from 1950 through the 1970s (SFWMD 2021a). There are a total of 27 WCS in the Study Area (**Table B.1-17**). The nine primary WCS that are the focus of this C&SF Section 203 Study and their associated primary canals are listed in **Table B.1-18**. In addition to the C&SF Project structures, Broward County contains 23 Drainage Districts, 29 Sewer Service Areas, and 30 Water Service Areas to manage potable water, wastewater, and stormwater within the Study Area, all of which are affected by flooding risks.

Table B.1-17. Water Control Structures in the C&SF Section 203 Study Area.

Water Control Structure ^{a/}	Location (Latitude, Longitude)	C&SF Section 203 Study Structure
CS NO 1 Spillway ^{b/}	26.483401°N, 80.212158°W	No
G-94A Gated Culvert	26.435024°N, 80.229933°W	No
CS NO 3 Weir	26.434912°N, 80.215763°W	No
S-40 Gated Spillway	26.421560°N, 80.072445°W	No
S-39 Gated Spillway	26.355739°N, 80.297653°W	No
S-39A Gated Culvert	26.355409°N, 80.297395°W	No
LWDD 17W Spillway ^{c/}	26.328366°N, 80.170654°W	No
LWDD 17W Pump	26.328365°N, 80.170733°W	No
G-56 Gated Spillway	26.327972°N, 80.131583°W	Yes
S-38B Gated Culvert	26.287706°N, 80.297819°W	No
G-57 Gated Spillway	26.230850°N, 80.121525°W	Yes
S-38A Gated Culvert	26.229939°N, 80.298139°W	No
S-38 Gated Culvert	26.229461°N, 80.298517°W	No
S-38C Gated Culvert	26.228659°N, 80.298161°W	No
S-37B Gated Spillway	26.223689°N, 80.170163°W	Yes
G-65 Gated Culvert	26.230905°N, 80.159510°W	No
S-37A Gated Spillway	26.206246°N, 80.131641°W	Yes
S-36 Gated Spillway	26.173183°N, 80.179122°W	Yes
S-125 Gated Culvert	26.164253°N, 80.297985°W	No
S-34E Gated Culvert	26.149784°N, 80.442377°W	No
S-33 Gated Spillway	26.135942°N, 80.194494°W	Yes
S-124 Gated Culvert	26.129263°N, 80.365700°W	No
G-54 Gated Spillway	26.095082°N, 80.229682°W	Yes
S-13AW Gated Culvert	26.064633°N, 80.281512°W	Yes
S-13 Pump Station and Gated Spillway	26.066360°N, 80.208858°W	Yes
S-381 Gated Weir	26.061598°N, 80.419523°W	No
G-87 Gated Culvert	26.029438°N, 80.312959°W	No

a/ Most structures designed and built by the USACE are preceded by the letter "S," such as S-37, while most structures designed and built by the SFWMD are preceded by the letter "G," such as G-56.

b/ CS = Control Structure

c/ LWDD = Lake Worth Drainage District

Table B.1-18. Water Control Structures and Associated Primary Canals that are part of the C&SF Section 203 Study.

Water Control Structure ^{a/}	Primary Canal
G-56 Gated Spillway	G-08 (Hillsboro) Canal
G-57 Gated Spillway	G-16 (Pompano) Canal
S-37B Gated Spillway	C-14 (Cypress Creek) Canal
S-37A Gated Spillway	C-14 (Cypress Creek) Canal
S-36 Gated Spillway	C-13 (Middle River) Canal
S-33 Gated Spillway	C-12 (Plantation) Canal
G-54 Gated Spillway	G-15 (North New River) Canal
S-13AW Gated Culvert	C-11 (South New River) Canal
S-13 Pump Station and Gated Spillway	C-11 (South New River) Canal

In general, the WCS are situated on primary canals that flow from west to east (**Figure B.1-1**). The gated spillway structures are used to control the headwater elevation along the canals on which they are located. During dry periods, the structure's spillway gate can be lowered, reducing, or eliminating flow through the structure to raise headwater elevation for water conservation purposes. During a flood event, or for regulatory releases, the gate can be raised, passing water flow through the structure to

maintain a lower-than-normal head water elevation. In addition to maintaining upstream freshwater control as described above, automatic operational features are used to close the gate and prevent upstream migration of salt water during high tide events, whenever the differential between the head and tail water pool elevations reaches a certain number (default differential value is 0.1 foot) (SFWMD 2021a).

B.1.19.1 Gated Spillway Structures and Primary Canals

This section summarizes the major features and operations of each gated spillway structure as described below, proceeding from the northernmost to southernmost structure. **Table B.1-19** summarizes additional specific information concerning design specifications, discharge capacity, physical facilities, and primary canal dimensions. **Section B.1.16 Land Use and Real Estate** describes the land use around each WCS.

G-56 Gated Spillway and G-08 (Hillsboro) Canal

The G-56 WCS is a three-bay, reinforced concrete, gated spillway located on the G-08 (Hillsboro) Canal. The structure consists of three 12.2-foot-high by 20.0-foot-wide gates with sill elevations of -5.1 feet NAVD88. The discharge from this structure is controlled by hydraulically driven cable operated vertical lift gates. The gates can either be remotely operated from the SFWMD Operation Control Center or controlled on-site. The structure was completed in 1991 to replace the old Deerfield Lock Structure. The structure is currently maintained by the Fort Lauderdale Field Station. This structure is operated to maintain optimum upstream stages in the G-08 (Hillsboro) Canal. It passes basin flows or regulatory releases from WCA-1 while limiting the upstream stage and channel velocity (SFWMD 2022a).

Table B.1-19. Description of Water Control Structures and Associated Primary Canals.

Water Control Structure	G-56 Gated Spillway	G-57 Gated Spillway	S-37B Gated Spillway	S-37A Gated Spillway	S-36 Gated Spillway	S-33 Gated Spillway	G-54 Gated Spillway	S-13AW Gated Culvert	S-13 Gated Pump Station and Gated Spillway
Design Specifications									
Year Built	1991	1987	1959	1959	1954	1954	1992	2007	1954, Pump station refurbished in 2017
Design Discharge (cubic feet per second)	3,760	375	3,390	3,890	1,090	920	1,600	500	1,080 (540 via 3 pumps and 540 via 1 gate)
Optimum Headwater Elevation (ft NAVD88)	5.9	2.9	5.4	2.4	2.9	1.9	2.4	1.4 to 2.0	0.0
Design Discharge Flow Type	Uncontrolled submerged	Controlled submerged	Uncontrolled submerged	Controlled submerged	Uncontrolled submerged	Uncontrolled submerged	Uncontrolled submerged	Submerged	Uncontrolled submerged (for gate) and pumped
Generator Room/Building Finished Floor Elevation (ft NAVD88)	12.9	8.3	9.9	7.4	13.1	11.9	8.9	7.7	7.0
Water Level which will Bypass Structure (ft NAVD88)	12.4	7.4	9.9	6.4	9.9	8.4	6.4	6.6	6.4
Number of Spillway/Culvert Gates	3	2	2	2	1	1	3	2	1
Gate Type	Vertical slide	Vertical lift	Vertical lift	Vertical lift	Vertical lift	Vertical lift	Vertical slide	Vertical-lift sluice	Vertical lift
Gate Lift Mechanism Type	Hydraulic cable lift hoist	Cable drum	Electric driven cable drum	Hydraulic cable lift hoist	Direct drive electric motor gear, connected to cables	Cable drum	Hydraulic cable lift hoist	Stem-driven	Cable lift
Manatee Protection Pressure Sensors ^{a/}	No	No	No	No	No	Yes	No	No	No ^{b/}
Gate Lift Normal Power Source	Commercial electricity	Commercial electricity	Commercial electricity	Commercial electricity	Commercial electricity	Commercial electricity	Commercial electricity	Commercial electricity	Commercial electricity

Water Control Structure	G-56 Gated Spillway	G-57 Gated Spillway	S-37B Gated Spillway	S-37A Gated Spillway	S-36 Gated Spillway	S-33 Gated Spillway	G-54 Gated Spillway	S-13AW Gated Culvert	S-13 Gated Pump Station and Gated Spillway
Gate Lift Backup Power Source	LPG engine-driven generator	LPG engine-driven generator	LPG engine-driven generator	LPG engine-driven generator	LPG engine-driven generator	LPG engine-driven generator	LPG engine-driven generator	LPG engine-driven generator	2 diesel engine-driven generators (1 primary, 1 backup)
Canal Description									
Primary Canal	G-08 (Hillsboro) Canal	G-16 (Pompano) Canal	C-14 (Cypress Creek) Canal	C-14 Cypress Creek) Canal	C-13 (Middle River) Canal	C-12 (Plantation) Canal	G-15 (North New River) Canal	C-11 (South New River) Canal	C-11 (South New River) Canal
Bottom Width (upstream, downstream) (ft)	80.0	20.0	20.0, 30.0	45.0, 80.0	20.0	10.0	100, 72.5	40.0	40.0
Bottom Elevation (upstream, downstream) (ft NAVD88)	-12.6, -18.6	-8.6	-16.1, -16.6	-16.6	-9.6, -10.6	-4.6, -6.6	-7.6, -9.6	-5.6	-10.6

a/ Where manatee protection pressure sensors do not exist, WCS can be operated in such a manner as to exclude manatees (e.g., 2.5-foot minimum gate openings).

b/ Although the S-13 Pump Station and Gated Spillway gate does not include manatee protection sensors, it does include a metal grating within its spillway discharge bay that functions as a physical barrier to prevent manatees from contacting the S-13 spillway gate.

Note: LPG = liquified petroleum gas

Source: As-built drawings of structures and SFWMD 2022a-h

G-57 Gated Spillway and C-16 (Pompano) Canal

The G-57 WCS is a two-bay, reinforced concrete gated spillway, located on C-16 (Pompano) Canal. The structure consists of two 6.5-foot-high by 14.7-foot-wide gates. The discharge from this structure is controlled by an electric driven cable drum operated vertical lift gate. The gates can either be remotely operated from the SFWMD Operation Control Center or controlled on-site. The structure was completed in 1987, and it is currently maintained by the Fort Lauderdale Field Station. This structure maintains optimum upstream stages in the C-16 (Pompano) Canal. It passes the design flood without exceeding the upstream flood design stage and channel velocities to non-damaging levels, and it prevents saltwater intrusion during periods of high tides (SFWMD 2022b).

S-37B Gated Spillway and C-14 (Cypress Creek) Canal

The S-37B WCS is a two-bay, reinforced concrete gated spillway, located on C-14 (Cypress Creek) Canal. The structure consists of two 6.58-foot-high by 25.75-foot-wide gates with sill elevations of -1.6 feet NAVD88. The discharge from this structure is controlled by an electric driven cable drum operated vertical lift gate. The gates can either be remotely operated from the SFWMD Operation Control Center or controlled on-site. The structure was completed in 1959, and a 1-foot plate was added on top of the gates around 1990. The gate operators were modified from stem to cable drum in 2004. The structure is currently maintained by the Fort Lauderdale Field Station. This structure maintains optimum upstream stages in C-14 (Cypress Creek) Canal. It was designed to pass 40 percent of the Standard Project Flood (SPF) from the western agricultural portion of the drainage basin and 60 percent SPF of eastern urban area without exceeding the upstream flood design stage, restrict downstream flood stages and channel velocities to non-damaging levels, and prevent saltwater intrusion (SFWMD 2022c).

S-37A Gated Spillway and C-14 (Cypress Creek) Canal

The S-37A WCS is a two-bay, reinforced concrete gated spillway, located on C-14 (Cypress Creek) Canal. The structure consists of two 12.8-foot-high by 25.8-foot-wide gates with sill elevations of -9.3 feet NAVD88. The discharge from this structure is controlled by an electric driven cable drum operated vertical lift gate (gates' operator base and platform were overhauled in 2004). The gates can either be remotely operated from the SFWMD Operation Control Center or controlled on-site. The structure was completed in 1959, and it is currently maintained by the Fort Lauderdale Field Station. This structure maintains optimum upstream stages in the C-14 (Cypress Creek) Canal. It was designed to pass 40 percent of the SPF from the western agricultural portion of the drainage basin and 60 percent SPF of eastern urban area without exceeding the upstream flood design stage, restrict downstream flood stages and channel velocities to non-damaging levels, and prevent saltwater intrusion during periods of high tides (SFWMD 2022d).

S-36 Gated Spillway and C-13 (Middle River) Canal

The S-36 WCS is a one-bay, reinforced concrete gated spillway, located on the C-13 (Middle River) Canal. The structure consists of one 14.0-foot-high by 25.0-foot-wide gate with a sill elevation of -8.6 feet NAVD88. The discharge from this structure is controlled by an electric driven cable drum operated vertical lift gate. The gate can either be remotely operated from the SFWMD Operation Control Center or controlled on-site. The structure was completed in 1954, and it is currently maintained by the Fort

Lauderdale Field Station. This structure maintains optimum upstream stages in the C-13 (Middle River) Canal. It was designed to pass 50 percent of the SPF without exceeding upstream flood design stage, restrict downstream flood stages and discharge velocities to non-damaging levels, and prevent saltwater intrusion during periods of high tides (SFWMD 2022e).

S-33 Gated Spillway and C-12 (Plantation) Canal

The S-33 WCS is a one-bay, reinforced concrete gated spillway, located on C-12 (Plantation) Canal. The structure consists of one 9.0-foot-high by 22.0-foot-wide gate with a sill elevation of -3.6 feet NAVD88. The discharge from this structure is controlled by an electric driven cable drum operated vertical lift gate. The gate can either be remotely operated from the SFWMD Operation Control Center or controlled on-site. The structure was completed in 1954, and it is currently maintained by the Fort Lauderdale Field Station. This structure maintains optimum upstream stages in the C-12 (Plantation) Canal. It was designed to pass 50 percent of the SPF without exceeding the upstream flood design stage, restrict downstream flood stages and channel velocities to non-damaging levels, and prevent saltwater intrusion during periods of high tides (SFWMD 2022f).

G-54 Gated Spillway and G-15 (North New River) Canal

The G-54 WCS is a reinforced concrete gated spillway, located on the G-15 (North New River) Canal. The structure consists of three 9.5-foot-high by 16-foot-wide gates with a sill elevation of -5.6 feet NAVD88. The discharge from this structure is controlled by hydraulically driven cable operated vertical lift gates. The gates can either be remotely operated from the SFWMD Operation Control Center or controlled on-site. Construction of the G-54 WCS was completed in 1992 to replace the old Sewell Lock Structure. Normal operational range is from 1.9 to 2.9 feet NAVD88. This structure maintains optimum water control stages in the G-15 (North New River) Canal and controls upstream migration of saline water. The G-54 Gated Spillway passes watershed flows or regulatory releases from WCA-2 while limiting the upstream stage and channel velocity (SFWMD 2022g).

S-13AW Gated Culvert and C-11 (South New River) Canal

The S-13AW WCS is a double-box, concrete culvert with discharge controlled by two sluice vertical lift gates. The S-13AW Gated Culvert is located on the C-11 (South New River) Canal about 4.5 miles upstream from the S-13 WCS. The structure can either be remotely operated from the SFWMD Operation Control Center or controlled on-site. The S-13AW WCS was built by SFWMD in 2007 to replace the S-13A WCS. This was due to a change in flood control operation initiated in July 2003, when the S-13A WCS began more frequently releasing excess water from the C-11 West Basin to be discharged to tide through the S-13 WCS. This structure functions together with the S-13 WCS to discharge excess water to tide from the C-11 West Basin to reduce pumping by the S-9/S-9A WCS into WCA-3A. During the dry season, the S-13AW Gated Culvert will allow water supply releases to the areas east of the structure. The design flow is also increased from 120 cubic feet per second (cfs) to 500 cfs.

S-13 Pump Station and Gated Spillway and C-11 (South New River) Canal

This structure is a pumping station with a gated spillway that can control flows that bypass the pumps. The structure is in the C-11 (South New River) Canal and is a reinforced concrete structure with concrete

block superstructure. The pumping station is equipped with three Fairbanks Morse 60-inch Figure 6310W vertical propeller pumps each having a rated capacity of 180 cfs at a 4-foot static head. Each pumping unit is driven through a Bradfoot Gear Works two-stage right-angle reducer by a Detroit Diesel V-71 285 horsepower in-line diesel engine. At the south side of the station, there is a 16-foot-wide by 11-foot-high vertical lift gate that is raised or lowered by means of Baldor 3 Phase stem hoists. Operation of the gate hoist is normally controlled automatically but may be controlled manually during emergencies or for servicing. Other equipment includes a Wright 5-ton manually operated overhead bridge crane for general maintenance and a dual water stage recorder. The purpose of the structure is to release flood runoff from, prevent over drainage of, and saltwater intrusion into the agricultural area served by the C-11 (South New River) Canal west of the WCS. The purpose of the pumping units in the WCS is to pump surplus water through C-11 from the agricultural area west of the structure at the rate of 3/4 inch per day from the tributary drainage area, to keep water level in the canal west of the structure at optimum elevation of 2.2 feet above mean sea level, as practicable (SFWMD 2022h).

B.1.19.2 Structure Inspection Program

The WCS are inspected on a regular basis by SFWMD, at least once every 5 years, per the operation, maintenance, repair, replacement, and rehabilitation requirements established by USACE. SFWMD also makes additional improvements when feasible. The most recent inspections were conducted in 2021, with exception to the S-13 Pump Station and Gated Spillway, in which structure components (gates, crane, and pump station engines), were inspected from 2022 to 2024. The inspections review civil, structural, mechanical, and underwater components of the WCS. The WCS vary in size and number of gates, but in general have a similar layout. All the structures have a control building, which houses a backup generator and the electronics for manual gate operation; gate operation can also be controlled remotely. The backup generator is powered by liquefied petroleum gas, except for the S-13 Pump Station and Gated Spillway which uses diesel-powered generators. The inspections review the integrity of the structure: wingwalls and tiebacks, pier walls, retaining walls, cathodic protection system, gate lift system, dewatering structure, electrical system, and general site conditions. The most recent inspections identify some deficiencies and provide recommendations for repair. In general, the inspections indicate that the structures are operational but have passed or are passing their life expectancy (SFWMD 2020, 2021c-i, 2022i). The drainage system was not originally designed to accommodate the combined effects of increased runoff due to urbanization, sea level rise averaging 6 to 8 inches, and heightened storm surge and high tides resulting from more frequent and intense storms, as well as extreme rainfall events. As the system relies on gravity, its efficiency, capacity, and ability to provide flood protection have been reduced due to more frequent inundation.

B.1.20 Socioeconomics

B.1.20.1 Overview

The socioeconomic resources of the communities in which the C&SF Section 203 Study will take place are in eastern Broward County and a small portion of southern Palm Beach County. Since only a portion of each of Broward and Palm Beach counties are included in the Study Area, some county-level data presented in this section may over- or under-represent certain socioeconomic parameters. Data by census tract, when available, are also provided.

The Study Area includes 397 total census tracts: 338 census tracts in Broward County and 59 census tracts in Palm Beach County. The Study Area does not include the very large census tract (census tract 9800) west of the Study Area that includes the Everglades Agricultural Area, WCAs, and Miccosukee Tribe of Indians of Florida reservation land. It also does not include the southeastern census tracts in Broward County, in the communities of Hallandale Beach, Miramar, or Pembroke Pines. Socioeconomic data are provided by state, county, and where applicable, city or municipality and census tract.

Definitions

Census tracts are subdivisions of a county, averaging approximately 4,000 people. Tracts are designed to be relatively homogenous in terms of population characteristics, economic status, and living conditions at the time they are established.

Chained dollars gross domestic product is the result of multiplying the current-dollar value of an aggregator component for its corresponding chain-type quantity index and then dividing by 100 to calculate growth rates (BEA 2018).

Industry as used in this report is defined by the North American Industry Classification System (NAICS), which is the standard used by federal statistical agencies to classify business establishments for their scope of work (BLS 2023).

B.1.20.2 Technical Approach/Methods

Data on demographics, population, labor force and employment, gross domestic product, income, housing, social vulnerability from natural hazards, and risk index ratings were gathered from multiple sources to characterize socioeconomic resources. Data sources include the following:

- U.S. Census Bureau's (USCB) American Community Survey (ACS; USCB 2013a,b, 2018, 2019, 2022a-c, 2023a-o, 2024a,b): The ACS includes social, economic, demographic, and housing data collected annually (ACS) by the U.S. Census Bureau.
- Federal Emergency Management Agency (FEMA) National Risk Index for Natural Hazards: The National Risk Index for Natural Hazards (NRI) is an interactive tool that shows which communities are most at risk to natural hazards (FEMA 2022a,b). Data include expected annual losses to individual natural hazards, social vulnerability, and community resilience.
- U.S. Bureau of Economic Analysis (BEA 2024a-f) economic data including gross domestic product by NAICS code.
- Florida Department of Commerce, Bureau of Workforce Statistics and Economic Research (BWSER 2024a,b) for workforce statistics for Broward and Palm Beach counties.
- University of Florida, Bureau of Economic and Business Research (BEBR 2023, 2024) for population estimates by county.

Data from the FEMA NRI were reviewed at the county and census tract level. Data from the USCB ACS, BEA, Florida Department of Commerce BWSER, and University of Florida Bureau of Economic and Business Research (BEBR) were reviewed at the state and county levels as those sources do not provide data at the census tract level. Where available and applicable, data was reviewed at the city or municipality level to fully document socioeconomic resources.

Population Characteristics

Demographics

U.S. Census Bureau's ACS data indicate that an average of 12.7 percent of the Broward County population is below the national poverty level (USCB 2024b), with black or African American people representing the highest percentage of people below the poverty level (17.4 percent). In Palm Beach County, an average of 10.7 percent of the population is below the national poverty level, with the highest percentage of people below the poverty level (20.4 percent) identified as non-white (USCB 2024b).

Population and Median Age

According to the U.S. Census Bureau, there has been a general population migration to the south with Florida being the epicenter of this growth. Four of the five metropolitan statistical areas (MSAs) with the fastest growing populations in the nation are in Florida (USCB 2024c). This includes the Miami-Fort Lauderdale-West Palm Beach MSA that added 43,387 residents between 2022 and 2023 and covers the Study Area. **Figure B.1-24** shows the percent change in population by MSA in Florida between 2022 and 2023.

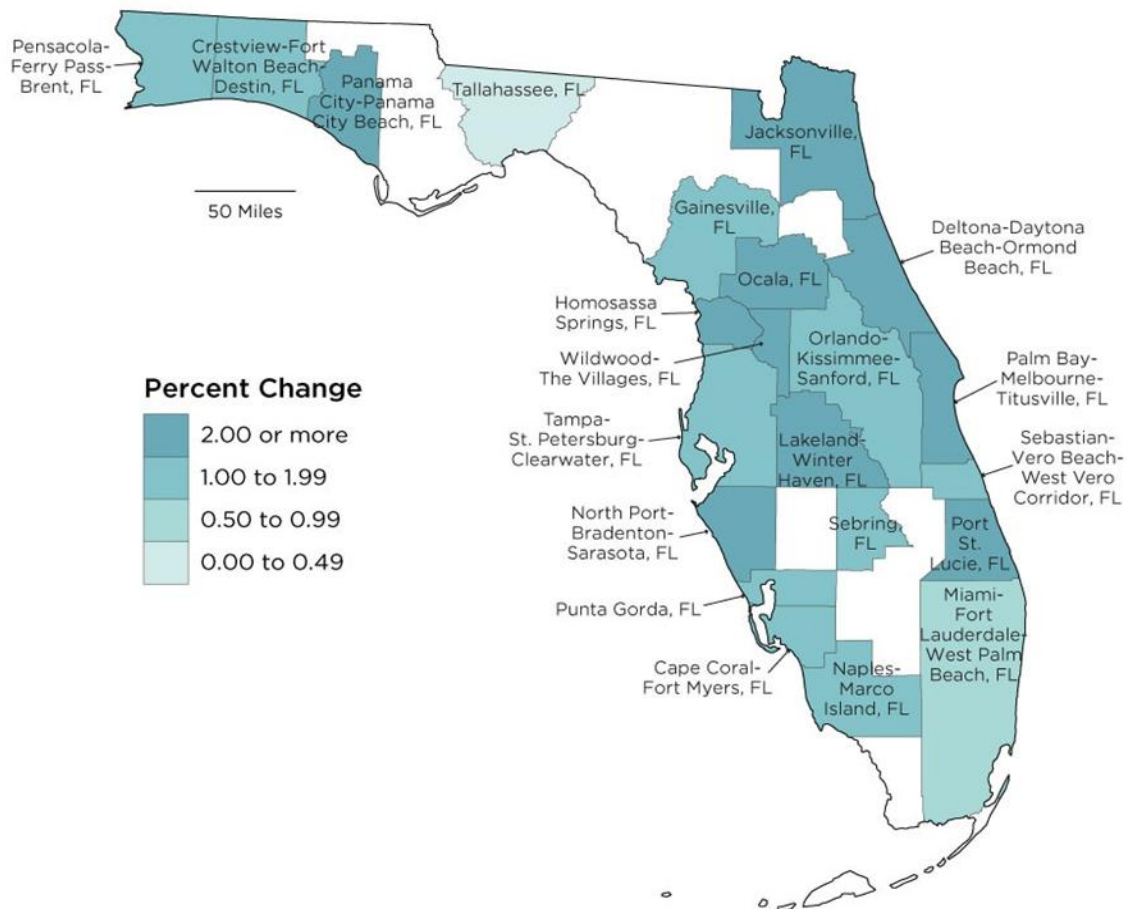


Figure B.1-24. Percent Change in Metropolitan Statistical Area Population: July 1, 2022, to July 1, 2023.

Table B.1-20 summarizes the population from 2013 (USCB 2013a) to 2023 (USCB 2023a) of the counties that fall within the Study Area, along with an overview of the state of Florida for contextualization of the presented data. According to the Census Bureau, Broward County and Palm Beach County are respectively the second and third most populated counties in Florida. Of the two counties, Broward is smaller geographically. Both counties demonstrated overall population growth, which supported the observable population growth of the state of Florida. Despite Broward County having a larger population, in the examined 10-year period, it had less population growth than Palm Beach County. The median age of Palm Beach County was also higher than both Broward County and the state average, but not to any significant, notable degree.

Table B.1-20. Population in 2013 and 2023, Population Change, and Median Age.

Population	State of Florida	Broward County	Palm Beach County
Population 2013	19,552,860	1,838,844	1,372,171
Population 2023	22,610,726	1,962,531	1,533,801
Population Change 2013-2023	13%	6%	10%
Median Age	42.8	41.5	45.6

Source: USCB 2013a, USCB 2023a

The Broward County portion of the Study Area contains four of the 25 most populace cities in Florida, according to 2023 U.S. Census data (USCB 2023m) estimates: Fort Lauderdale (184,255 people; median age 43.6), Hollywood (153,859 people; median age 42.3), Coral Springs (134,906 people; median age 38.3), and Pompano Beach (113,619 people; median age 44.6). The same data also indicates that the two largest cities in the Palm Beach County portion of the Study Area are Boca Raton (99,974 people; median age 46.3) and Delray Beach (67,536 people; median age 51.9).

BEBR projects growth for all Florida counties, including Broward and Palm Beach counties, through 2050 (BEBR 2024). In addition, BEBR produced population projection estimates through 2075 for all counties that fall entirely or partially within the boundaries of the SFWMD (BEBR 2023). In Broward County, BEBR projects that the population will increase 12.2 percent between 2023 and 2050 (BEBR 2024), with a total population of 2.4 million people in 2075 based on medium series projections (BEBR 2023). The Hispanic population is expected to increase 44.6 percent and non-Hispanic black population 28.5 percent between 2023 and 2050, while the non-Hispanic white population is projected to decrease 35.3 percent. Population growth in Palm Beach County will outpace Broward County by increasing an estimated 17.5 percent between 2023 and 2050 (BEBR 2024). The total population in Palm Beach County is projected to be 1.9 million people in 2075 based on medium series projections (BEBR 2023). Like Broward County, minority group populations are expected to increase in Palm Beach County, specifically with the Hispanic population increasing 42.3 percent and non-Hispanic black population 29.8 percent while the non-Hispanic white population will increase slightly by 0.9 percent between 2023 and 2050 (BEBR 2024).

Table B.1-21 demonstrates total expected population growth from 2024 to 2029 within Broward County census tracts. In the 5-year period from 2024 to 2029 the Broward County population is anticipated to grow by 41,420 individuals. The census tract with the highest population is expected to grow by 850 individuals in a 5-year period. The census tract with the lowest population is expected to grow by two individuals in a five-year period (USCB 2024b).

Table B.1-21. Population Change in Broward County from 2024 to 2029.

Year	Population — All Census Tracts	Highest Population Census Tract	Lowest Population Census Tract
2024	2,097,008	26,612	634
2029	2,138,428	27,462	636
Change 2024 to 2029	41,420	850	2

Note: Data are for all Broward County census tracts (minus those census tracts where data were not available); only a portion of Broward County is within the Study Area.

Source: USCB 2024b

Employment and Economic Conditions

Labor Force and Employment

Table B.1-22 demonstrates the labor force and employment rates (USCB 2023j,k) of the total population 16 years of age and over in the selected counties, the state of Florida, and the United States.

Broward County demonstrated a higher rate of labor force participation than the United States and Florida averages, while Palm Beach demonstrated roughly the same as the state average, falling just short. All four demonstrated similar unemployment rates. Broward County showed a notably higher labor force participation rate while simultaneously displaying a higher unemployment rate than the state. Of the examined areas, Palm Beach had the lowest labor force participation rate, and a higher unemployment rate compared to Broward County and Florida, but on par with the unemployment rate of the nation.

Table B.1-22. Labor Force and Employment.

Labor Force and Employment	United States	State of Florida	Broward County	Palm Beach County
Total Population 16 Years and Over	271,122,729	18,768,460	1,605,669	1,284,051
Population 16 Years and Over in Labor Force	173,038,795	11,267,928	1,069,433	768,650
Labor Force Participation Rate	63.8%	60.0%	66.60%	59.90%
Unemployment Rate	4.30%	4.1%	4.20%	4.30%

Source: USCB 2023j,k

According to the U.S. Census Bureau's ACS (USCB 2023j,k), of the cities in the Broward County Study Area, in 2023, Fort Lauderdale had a labor force participation rate of 65.5 percent and an unemployment rate of 3.3 percent, Hollywood city had labor force participation rate of 62.6 percent and an unemployment rate of 3.9 percent, Coral Springs had a labor force participation rate of 71.9 percent and an unemployment rate of 2.2 percent, and Pompano Beach had a labor force participation rate of 62.6 percent and an unemployment rate of 1.8 percent. The same data also shows that of the cities in the Palm Beach County portion of the Study Area, Boca Raton had a labor force participation rate of 57.8 percent and an unemployment rate of 2.4 percent, and Delray Beach had a labor force participation rate of 60.6 percent and an unemployment rate of 3.6 percent.

The population aged 16 years and over in the labor force can be broken into 13 industry sectors defined by the NAICS and utilized by the ACS. Table B.1-23 is a breakdown of the employed civilian population aged 16 years and over and the percentage of that total population that make up each industry sector in the United States, Florida, Broward County, and Palm Beach County.

Table B.1-23. Percentage of Workforce (16 years and over) by Industry Sector.

Industry Sector	United States	State of Florida	Broward County	Palm Beach County
Agriculture, forestry, fishing and hunting, and mining	1.6%	0.9%	0.2%	0.9%
Construction	6.9%	8.1%	6.7%	8.6%
Manufacturing	9.9%	5.4%	4.9%	4.3%
Wholesale trade	2.0%	2.2%	2.9%	2.1%
Retail trade	10.6%	11.6%	11.4%	11.6%
Transportation and warehousing, and utilities	6.0%	6.5%	7.5%	5.7%
Information	1.9%	1.5%	1.6%	1.3%
Finance and insurance, and real estate and rental and leasing	6.6%	8.4%	8.6%	9.1%
Professional, scientific, and management, and administrative and waste management services	12.8%	14.4%	15.5%	15.6%
Educational services, and health care and social assistance	23.5%	20.7%	20.1%	20.8%
Arts, entertainment, and recreation, and accommodation and food services	8.8%	11.1%	11.8%	10.1%
Other services, except public administration	4.8%	5.2%	5.1%	6.3%
Public administration	4.6%	4.0%	3.6%	3.5%

Source: USCB 2023j,k

The highest percentages all fell under the “Educational services, and health care and social assistance” category, accounting for above 20 percent of employment at the U.S. and state level, as well as in each of the two counties. The lowest percentages all fell under “Agricultural, forestry, fishing and hunting, and mining,” although the U.S. percentage of 1.6 was higher than both the Florida and Palm Beach County percentage of 0.9, and much higher than the Broward County percentage of 0.2. From there, each region (United States, Florida, and counties) begins to show further distinction in their percentages of industry sector. “Professional, scientific, and management, and administrative waste management services” was another unanimously important industry sector with the second highest percentages in both counties, and with both Broward County and Palm Beach County rising above the state and U.S. averages. “Retail trade” had a higher percentage for all regions, but “Arts, entertainment, and recreation” was third highest in Broward County (11.8 percent), slightly above its fourth highest “Retail Trade” percentage of 11.4 percent. Meanwhile, “Arts, entertainment, and recreation” was lower in Palm Beach County and fourth highest at 10.1 percent while “Retail Trade” was the third highest percentage and matched the state percentage of 11.6 percent.

The Florida Department of Commerce, Bureau of Workforce Statistics and Economic Research (BWSER) provides workforce projections through 2032. For both Broward (BWSER 2024a) and Palm Beach (BWSER 2024b) counties, when all industries are totaled BWSER projects positive job growth. In Broward County, job totals are expected to increase 5.1 percent between 2024 and 2032 (BWSER 2024a). Employment is expected to increase across almost all industries with the greatest increases occurring in the information (17.5 percent) and professional and business services (10.8 percent) sectors. The county is projected to see decreases in the construction (0.4 percent) and government (0.6 percent) sectors. Occupations with the biggest expected increases include data scientists (43.3 percent), nurse practitioners (39.6 percent), information security analysts (32.7 percent), software developers (29.0 percent), and software quality assurance analysts and testers (25.2 percent). In Palm Beach County, the

number of jobs is expected to increase 7.1 percent from 762,323 in 2024 to 816,358 in 2032 (BWSER 2024b). Industries projected to see the highest growth in Palm Beach County are the professional and business services industry (13.2 percent). The only industries expected to decrease are agriculture, forestry, fishing, and hunting (12.7 percent decrease) and mining (9.5 percent decrease). Job types with the biggest projected increases in hiring include nurse practitioners (40.8 percent), data scientists (30.0 percent), information security analysts (28.7 percent), veterinary technologists and technicians (26.7 percent), and veterinary assistants and laboratory animal caretakers (26.2 percent).

Top Employers

The top employers in Broward County, based on number of employees, are ranked by the Greater Fort Lauderdale Alliance (2024a). The largest private sector employers are First Service Residential (4,869 employees), HEICO (4,532 employees), Nova Southeastern University (4,089 employees), American Express (3,500 employees), and Spirit Airlines (2,734 employees). The largest public sector employers in Broward County are Broward County Public Schools (27,781 employees) and Broward County Government (12,928 employees), followed by Memorial Health Care System (16,167) and Broward Health (8,769). The remaining public sector employees for which County-level data is available employ less than 3,000 full-time staff each. Based on 2022 revenue (Greater Fort Lauderdale Alliance 2024b), the largest Broward County employers are AutoNation (\$26.99 billion), Chewy (\$10.1 billion), and Spirit Airlines (\$5.07 billion). Greater Fort Lauderdale Alliance also reports that the fastest growing companies in southern Florida (as measured by gross revenue increase in two years) include MyFBA Prep in Sunrise (711.4 percent increase), Stretch Zone in Fort Lauderdale (355.93 percent increase), Entech Network Solutions in Coral Springs (339.29 percent increase), NationsBenefits Holding, LLC in Plantation (331.61 percent increase), and CareStaff Partners in Plantation (331.61 percent increase).

The Business Development Board in Palm Beach County tracks the top (by number of employees) goods-producing and service-providing businesses in the county. Based on 2024 data (Greater Fort Lauderdale Alliance 2024b), the top goods-producing employers are Florida Crystals Corporation and Pratt & Whitney, an RTX Company, both with approximately 2,000 employees. U.S. Sugar (1,300 employees) and Lockheed Martin and Sikorsky (1,052 employees) rank third and fourth, respectively, demonstrating that the top four goods-producing companies in this county are from the agriculture and aerospace sectors. The county has also been dubbed “Wall Street South” due to its location quotient of financial institutions that are concentrated in the county as well as wage location quotient for having between twice (investment banking) and seven times (open-ended investment funds) as many financial jobs in the county than the national average. The top service-providing employers in Palm Beach County include the Palm Beach County School District (22,218 employees), Florida Atlantic University (6,335 employees), and Palm Beach County Board of County Commissioners (5,873 employees). This follows similar trends from Broward County where public sector employees exceed those of private corporations.

Gross Domestic Product and Contribution by Industry Sector

Table B.1-24 shows the gross domestic product (GDP) of the area in millions of chained dollars over a 10-year period and the percentage change from the preceding period. Broward County (BEA 2024b) consistently displayed a higher GDP than Palm Beach County (BEA 2024d) over the course of the decade.

Both counties demonstrated growth at similar levels, increasing roughly 30 million dollars between their 2012 GDP and their 2022 GDP.

Table B.1-24. Real Gross Domestic Product (In Millions of Chained Dollars) and Percentage Change from Preceding Period.

Year	Florida	Percentage Change	Broward County	Percentage Change	Palm Beach County	Percentage Change
2012	\$857,861,342	1.0%	\$90,161,425	0.3%	\$67,636,630	1.3%
2013	\$880,183,486	2.6%	\$91,488,536	1.5%	\$70,171,271	3.7%
2014	\$905,648,485	2.9%	\$94,364,607	3.1%	\$72,150,280	2.8%
2015	\$945,929,031	4.4%	\$98,710,123	4.6%	\$76,561,321	6.1%
2016	\$978,989,749	3.5%	\$101,145,721	2.5%	\$79,105,008	3.3%
2017	\$1,014,866,863	3.7%	\$104,770,308	3.5%	\$82,713,425	4.6%
2018	\$1,050,433,812	3.5%	\$107,817,123	3.0%	\$85,555,960	3.4%
2019	\$1,079,271,045	3.3%	\$111,228,607	3.2%	\$87,095,128	1.8%
2020	\$1,068,377,540	-1.4%	\$109,429,320	-1.6%	\$87,415,511	0.4%
2021	\$1,164,778,182	9.4%	\$119,327,415	9.0%	\$96,812,350	10.7%
2022	\$1,218,430,197	5.9%	\$124,843,480	4.6%	\$100,113,799	3.4%

Source: BEA 2024a,b,c,d,e,f

As per **Table B.1-25**, contributions to GDP in Broward County (BEA 2024e) increased 4.1 percent between 2022 and 2023. The greatest increases were in private industries, which increased 3.89 percent from the previous year's level, and primarily in services-producing industries which accounted for 3.85 percent of the increase whereas private goods-producing industries accounted for the remaining 0.04 percent increase. Specific industries showing growth included finance, insurance, real estate, rental, and leasing at 0.78 percent, and professional and business services at 0.75 percent. Declines in industry sectors were generally minimal with the largest decline impacting "other services."⁸

Table B.1-25. Broward County: Contributions to Percent Change in Real GDP by Industry Sector between 2022 and 2023.

Industry Sector	Contributions to Percent Change
All industry total (percent change)	4.1
Private industries	3.89
Agriculture, forestry, fishing, and hunting	0.02
Mining, quarrying, and oil and gas extraction	0.00
Utilities	0.26
Construction	-0.02
Manufacturing	0.04
<i>Durable goods manufacturing</i>	<i>0.06</i>
<i>Nondurable goods manufacturing</i>	<i>-0.02</i>
Wholesale trade	0.12

⁸ Definition from U.S. Bureau of Economic Analysis: "The Other services (except government and government enterprises) NAICS sector comprises establishments engaged in providing services not specifically provided for elsewhere in the classification system. Establishments in this sector are primarily engaged in activities, such as equipment and machinery repairing, promoting or administering religious activities, grant-making, advocacy, and providing dry-cleaning and laundry services, personal care services, death care services, pet care services, photofinishing services, temporary parking services, and dating services. Private households that engage in employing workers on or about the premises in activities primarily concerned with the operation of the household are included in this sector. For a complete list of regional statistics, see [Regional Definitions](#)."

Industry Sector	Contributions to Percent Change
Retail trade	0.94
Transportation and warehousing	0.14
Information	0.47
Finance, insurance, real estate, rental, and leasing	0.78
<i>Finance and insurance</i>	-0.06
<i>Real estate and rental and leasing</i>	0.84
Professional and business services	0.75
<i>Professional, scientific, and technical services</i>	0.46
<i>Management of companies and enterprises</i>	0.18
<i>Administrative and support and waste management and remediation services</i>	0.11
Educational services, health care, and social assistance	0.37 ^{a/}
<i>Educational services</i>	0.10
<i>Health care and social assistance</i>	0.26
Arts, entertainment, recreation, accommodation, and food services	0.15
<i>Arts, entertainment, and recreation</i>	0.03
<i>Accommodation and food services</i>	0.12
Other services (except government and government enterprises)	-0.11
Government and government enterprises	0.25
Natural resources and mining	0.02
Trade	1.06
Transportation and utilities	0.39
Manufacturing and information	0.51
Private goods-producing industries ^{b/}	0.04
Private services-providing industries ^{c/}	3.85

Source: BEA 2024e

a/ CAGDP11 Contributions to percent change in real GDP 1, Broward County) lists the overall Contributions to Percent Change for the category, "Educational Services, health care, and social assistance," as 0.37 even though this is slightly greater than the sum of the two sub-categories listed underneath it.

b/ The private goods-producing industries consist of agriculture, forestry, fishing, and hunting; mining, quarrying, and oil and gas extraction; construction; and manufacturing.

c/ The private services-producing industries consist of utilities; wholesale trade; retail trade; transportation and warehousing, excluding Postal Service; information; finance and insurance; real estate, rental, and leasing; professional, scientific, and technical services; management of companies; administrative and support and waste management and remediation services; educational services; health care and social assistance; arts, entertainment, and recreation; accommodation and food services; and other services (except government and government enterprises). Metropolitan Areas are defined (geographically delineated) by the Office of Management and Budget (OMB) bulletin no. 20-01 issued March 6, 2020. Last updated: December 4, 2024-- new statistics for 2023; revised statistics for 2019-2022.

Contributions to Percent Change GDP in Palm Beach County (BEA 2024f) was slightly higher than Broward County. **Table B.1-26** shows that GDP in Palm Beach County increased 4.8 percent between 2022 and 2023 with much of that growth attributed to private industries and private services-providing industries. Like Broward County, declines by industry sector were generally low with the greatest declines occurring in "other services."

Table B.1-26. Palm Beach County: Contributions to Percent Change in Real GDP by Industry Sector Between 2022 and 2023.

Industry Sector	Contributions to Percent Change
All industry total (percent change)	4.8
Private industries	4.69
Agriculture, forestry, fishing, and hunting	0.23
Mining, quarrying, and oil and gas extraction	-0.01
Utilities	0.17
Construction	-0.04
Manufacturing	0.11

Industry Sector	Contributions to Percent Change
<i>Durable goods manufacturing</i>	0.10
<i>Nondurable goods manufacturing</i>	0.01
Wholesale trade	0.30
Retail trade	0.77
Transportation and warehousing	0.11
Information	0.24
Finance, insurance, real estate, rental, and leasing	0.76
<i>Finance and insurance</i>	-0.2
<i>Real estate and rental and leasing</i>	0.79
Professional and business services	1.22
<i>Professional, scientific, and technical services</i>	0.47
<i>Management of companies and enterprises</i>	0.86
<i>Administrative and support and waste management and remediation services</i>	-0.12
Educational services, health care, and social assistance	0.75
<i>Educational services</i>	0.03
<i>Health care and social assistance</i>	0.72
Arts, entertainment, recreation, accommodation, and food services	0.25
<i>Arts, entertainment, and recreation</i>	0.12
<i>Accommodation and food services</i>	0.13
Other services (except government and government enterprises)	-0.17
Government and government enterprises	0.12
Natural resources and mining	0.22
Trade	1.07
Transportation and utilities	0.28
Manufacturing and information	0.35
Private goods-producing industries	0.29
Private services-providing industries	4.40

Source: BEA 2024f

Income

Table B.1-27 demonstrates the estimated 2013, 2018, and 2023 per capita income (USCB 2013b, 2018, 2023e) and the mean income in the past 12 months for all households (USCB 2023c) in the state of Florida, Broward County, and Palm Beach County.

Table B.1-27. 2023 Per Capita Income.

Income	State of Florida	Broward County	Palm Beach County
Per Capita Income 2013	\$25,834	\$27,804	\$32,690
Per Capita Income 2018	\$31,359	\$32,368	\$38,805
Per Capita Income 2023	\$41,902	\$42,000	\$52,754
Mean Income Past 12 Months All Households	\$103,634	\$105,969	\$130,324

Source: USCB 2013b, 2018, 2023c,e

In the past 10 years, Palm Beach County has had the consistently highest per capita income. In 2013, Palm Beach County had a 14 percent higher per capita income than Broward County and a 20 percent higher per capita income than the state of Florida. In 2018, those percentages changed to 16 percent higher income than Broward County and 19 percent higher than the State of Florida.

In 2013, Broward County had a 7 percent higher per capita income than the state of Florida; and in 2018 that number dropped to 3 percent higher. In 2023, Broward County showed a marginally higher, less than 1 percent, per capita income compared with the state of Florida. Palm Beach County showed a

higher per capita income than the others, 20 percent higher than the state of Florida and Broward County. This is reflected in the higher mean income of Palm Beach households.

This indicates comparatively slightly slower per capita income growth in Broward County, as from 2013 to 2023 its per capita income only increased by \$14,000 while the state of Florida increased by \$16,000 and Palm Beach County increased by \$20,000.

Table B.1-28 shows that of the major cities within the Study Area (Boca Raton, Coral Springs, Delray Beach, Fort Lauderdale, Hollywood, and Pompano Beach), Hollywood City in Broward County had the lowest per capita Income in 2023 (USCB 2023d). The highest per capita income was from Boca Raton in Palm Beach County. The two cities in the Study Area in Palm Beach County had either nearly as high per capita income or much higher per capita income than the four cities in Broward County.

Table B.1-28. Per Capita Income of Major Cities in the Study Area in 2023.

City	Per Capita Income
Hollywood, Broward County	\$34,490
Pompano Beach, Broward County	\$38,585
Coral Springs, Broward County	\$40,363
Delray Beach, Palm Beach County	\$56,993
Fort Lauderdale, Broward County	\$58,071
Boca Raton, Palm Beach County	\$75,475

Source: USCB 2023d

Table B.1-29 provides the per capita income of Broward County census tracts for 2024 and as estimated for 2029. In 2024, the maximum per capita income value across all Broward County census tracts was \$118,673 higher than the minimum value. In 2029, that difference is predicted to widen to \$138,733. The difference between the maximum value and the average value was \$89,612 in 2024 and is anticipated to widen to \$104,776 by 2029. These values indicate non-proportional per capita income growth rates and a widening income margin between areas (USCB 2024b).

Table B.1-29. Per Capita Income of Broward County Census Tracts in 2024 and 2029.

Average Per Capita Income Ranking	Per Capita Income 2024	Per Capita Income 2029 (estimated)	Change in Per Capita Income 2024 to 2029
Minimum	\$14,355	\$17,696	\$3,341
Maximum	\$133,028	\$156,429	\$23,401
<i>Difference between minimum and maximum</i>	<i>\$118,673</i>	<i>\$138,733</i>	<i>\$20,060</i>
Average of census tracts	\$43,416	\$51,653	\$8,237
<i>Difference between average and maximum</i>	<i>\$89,612</i>	<i>\$104,776</i>	<i>\$15,164</i>

Note: Data are for all Broward County census tracts (minus those census tracts where data were not available); only a portion of Broward County is within the Study Area.

Source: USCB 2024b

Housing

As shown in **Table B.1-30**, in 2023, Broward County had more total housing units than Palm Beach County (USCB 2023i). Palm Beach had roughly 100,000 less housing units but more vacant housing units overall. More units were owner-occupied as opposed to rented, and the median value of a house in

Palm Beach County was higher than both the state and Broward County averages. Although the median home value in Palm Beach was 10 percent more than in Broward, the median gross rent in Palm Beach was only 1 percent more.

Table B.1-30. 2023 Housing Units.

Housing	State of Florida	Broward County	Palm Beach County
Total Housing Units	10,451,823	868,151	725,849
Vacant Housing Units	1,485,421	109,298	120,717
Owner-occupied	68.1%	63.9%	71.8%
Renter-occupied	31.9%	36.1%	28.2%
Median Home Value	\$381,000	\$439,100	\$491,500
Median Gross Rent	\$1,719	\$1,961	\$1,982
Homeowner Vacancy Rate	1.20%	0.70%	1.90%
Rental Vacancy Rate	7.60%	6.50%	9.40%
Total Housing Vacancy Rate	14.20%	12.60%	16.60%

Source: USCB 2023I

Broward County census tracts were examined for their home value. **Table B.1-31** shows the minimum, maximum, and average value of homes in Broward County census tracts. Each census tract was averaged for their home value, and then the averages of all census tracts were examined against each other to obtain the lowest and highest home values. These values were then further averaged to a single value reflective of the entire county. The lowest average home value, \$42,021, was in census tract 12011050309, located at the junction of Florida Turnpike South and North State Road 7 in Tamarac City. The highest average home value, \$1,611,370, was in census tract 12011042000 in east Fort Lauderdale. The average of all census tracts was a home value of \$512,389.

Table B.1-31. Home Values in Broward County Census Tracts.

Average Home Value Ranking	Census Tract	Home Value
Minimum	12011050309	\$42,021
Maximum	12011042000	\$1,611,370
Average	All	\$512,389

Note: Data are for all Broward County census tracts (minus those census tracts where data were not available); only a portion of Broward County is within the Study Area.

Source: USCB 2024b

Much of Florida's tax revenue is generated through property tax. **Table B.1-32** demonstrates the property taxes levied in Broward County's four major cities by property type. In all four cities, residential homes and non-homestead types levied the highest percentage of taxes by a notable margin. Of the cities examined, Fort Lauderdale levied the highest amount of taxes while Coral Springs levied the least.

Table B.1-32. Property Taxes in 2024 to 2025 by Major Cities in Broward County.

Taxes Levied by Property Type	Hollywood	Pompano	Coral Springs	Fort Lauderdale
Total Taxes Levied	\$189,745,736	\$110,730,734	\$91,181,206	\$243,153,073
Residential Homestead	27.1%	21.6%	45.1%	29.3%
Residential Non-Homestead	41.9%	40.8%	32.7%	42.3%
Residential Vacant Lots	0.5%	0.7%	0.1%	1.4%
Commercial	17.7%	12.1%	14.7%	20.0%

Taxes Levied by Property Type	Hollywood	Pompano	Coral Springs	Fort Lauderdale
Industrial	5.3%	19.5%	4.6%	4.4%
Institutional	0.8%	0.9%	0.3%	0.3%
Agricultural	0.0%	0.0%	0.0%	0.0%
Other	0.2%	0.2%	0.0%	0.1%
Tangible personal property	6.3%	4.0%	2.5%	2.1%
Centrally Assessed property	0.0%	0.1%	0.0%	0.1%

Source: Florida Department of Revenue 2024

Table B.1-33 breaks down the taxes levied by different tax authorities in Broward County. Aside from the broader category of Broward County Board of County Commissioners, the highest quantity of taxes levied was by Fire/Rescue, with the lowest amount of taxes levied by Water Management District 4A.

Table B.1-33. Broward County Taxes in 2024 to 2025 by Authority.

Taxing Authority	Taxes Levied
Broward County Board of County Commissioners	\$1,672,018,434
Cocomar Water Control District	\$953,271
Fire/Rescue	\$3,559,030
Street Lighting	\$296,265
Unincorporated County Municipal Service District	\$3,173,381
Water Management District 2	\$803,491
Water Management District 3	\$578,277
Water Management District 4A	\$12,229
Water Management District 4B	\$41,992
Water Management District 4C	\$387,481

Source: Florida Department of Revenue 2024

National Risk Index for Natural Hazards

Data from FEMA's NRI illustrate communities across each country that are most at risk for 18 natural hazards. A risk index score for each community (by census tract) is calculated using an equation that combines scores for expected annual loss due to natural hazards, social vulnerability, and community resilience.

Using the NRI in Broward County, 43 census tracts scored as very high risk and another 261 census tracts as relatively high risk, while 112 census tracts scored lower (i.e., less risk) (FEMA 2024). FEMA NRI data scored 33 census tracts in Palm Beach County as very high risk, with another 233 census tracts scored as relatively high risk; only 105 census tracts scored lower (i.e., less risk) (FEMA 2024). **Table B.1-34** summarizes environmental and socioeconomic considerations for Broward and Palm Beach counties.

Table B.1-34. NRI Environmental and Socioeconomic Indicators for Broward and Palm Beach Counties.

Metric	Broward County Ranking	Palm Beach County Ranking
Below national poverty level	12.7%	10.7%
FEMA NRI "very high risk" census tracts	43	33

Source: FEMA 2024, USCB 2024b

When examining just the census tracts in the Study Area, FEMA NRI data scored 37 census tracts in Broward County very high risk and 8 tracts in Palm Beach County as very high risk. **Figure B.1-25** shows

the risk index for census tracts in both counties in and near the Study Area. Importantly, the risk index for almost every census tract in the Study Area is rated as Relatively Moderate or above.

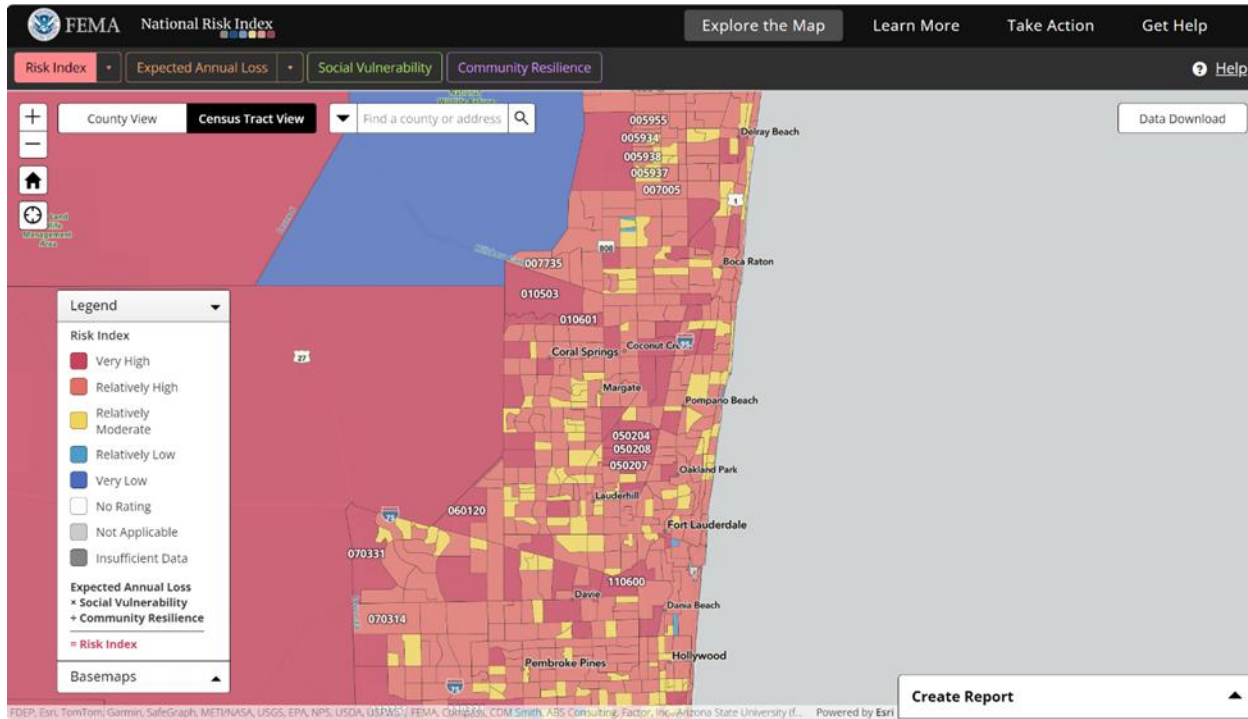


Figure B.1-25. FEMA NRI Risk Index Ratings for Census Tracts in Broward and Palm Beach Counties in and near the Study Area.

B.1.21 Cultural Resources

A cultural resources assessment survey was completed in February 2025 in the areas surrounding the eight WCS that are the focus of the C&SF Section 203 Study. In addition, a search of the Florida Master Site File (FMSF) revealed there are 7,944 recorded cultural resources present within the Study Area. These cultural resources include historic buildings, bridges, structures, cemeteries, and archaeological sites and range in origin from the Archaic period to the 20th century. One hundred and eighty-three of the recorded cultural resources are eligible for the National Register of Historic Places (NRHP), and an additional 20 resources are potentially NRHP-eligible. **Table B.1-35** includes a summary of the cultural resources recorded within the Study Area.

Table B.1-35. Cultural Resources Recorded within the C&SF Section 203 Study Area.

Cultural Resource Type	Number of Resources	Age	NRHP-eligible	NRHP-potentially eligible	NRHP-ineligible	NRHP-not evaluated
Archaeological site	107	Prehistoric	10	1	16	80
Archaeological site	35	Prehistoric and historic	3	1	2	29
Archaeological site	24	Historic	0	0	6	18

Cultural Resource Type	Number of Resources	Age	NRHP-eligible	NRHP-potentially eligible	NRHP-ineligible	NRHP-not evaluated
Archaeological site	7	Undetermined	0	0	0	7
Bridge	54	20th century	17	0	25	12
Cemetery	2	19th century	1	0	0	1
Cemetery	11	20th century	1	0	3	7
Resource group	1	Prehistoric and 20th century	1	0	0	0
Resource group	3	19th century	0	0	1	2
Resource group	11	19th to 20th century	5	0	4	2
Resource group	89	20th century	16	1	44	28
Resource group	29	20th century to present	3	0	15	11
Resource group	1	20th to 21st century	0	0	1	0
Resource group	3	19th and 20th century to present	1	0	1	1
Resource group	8	Undetermined	0	0	5	3
Structure	1	19th century	0	0	0	1
Structure	6819	20th century	119	14	1900	4786
Structure	739	Undetermined	6	3	64	666

As of September 2025, there have been 604 cultural resource surveys conducted within the Study Area. Of the nine WCS that are the focus of the C&SF Section 203 Study, eight have been fully surveyed for cultural and historical resources, through either field or desktop surveys. In addition, approximately 164 feet of the G-56 Gated Spillway has been surveyed along the eastern edge abutting South Military Trail. Based on the data provided through the FMSF and these surveys, the affected environment consists of 20 cultural resources that are in the direct vicinity of structural and nature-based measures being considered in the C&SF Section 203 Study. **Table B.1-36** provides additional information about these 20 cultural resources associated with each C&SF Section 203 Study feature.

Table B.1-36. Cultural Resources Associated with C&SF Section 203 Study Water Control Structures and Proposed Features.

Cultural Resource (FMSF number)	Associated Water Control Structure or Feature	Archaeological Survey Date(s)	National Register of Historic Places Eligibility
G-08 (Hillsboro) Canal (8PB10311)	G-56 Gated Spillway	1999, 2004, 2006, 2007, 2008, 2009, 2010, 2012, 2013, 2018, 2019, 2024	Eligible
Deerfield Lock (8BD10412)	G-56 Gated Spillway	2025	Eligible
E-3 (N-5) Canal (8PB10953)	G-56 Gated Spillway	2003	Ineligible
Military Trail (8PB13795)	G-56 Gated Spillway	2008, 2015, 2016, 2016, 2017, 2019, 2019, 2021	Ineligible
Hillsboro Canal Bridge	G-56 Gated Spillway	1996, 2014	Not evaluated

Cultural Resource (FMSF number)	Associated Water Control Structure or Feature	Archaeological Survey Date(s)	National Register of Historic Places Eligibility
(8BD3042/8PB08214)			
Seaboard Air Line Railroad (8PB12917)	G-56 Gated Spillway	2005, 2006, 2010, 2010, 2016, 2016, 2016, 2016, 2017, 2017, 2018, 2019, 2019, 2020	Eligible
Bridge #860184 (8BD4647)	G-56 Gated Spillway	2009	Ineligible
E-2 Canal (8PB7704)	G-56 Gated Spillway	2003,2006, 2008, 2010, 2012, 2012, 2015, 2020, 2024	Not evaluated
C-14 (Cypress Creek) Canal (8BD3226)	G-57 Gated Spillway, S-37B Gated Spillway and S-37A Gated Spillway	1999, 2006, 2012, 2012, 2015, 2016, 2017, 2022	Ineligible
Dixie Highway (8BD4227)	G-57 Gated Spillway	2006, 2006, 2014, 2015, 2016, 2019, 2020, 2023, 2023, 2024	Eligible
FEC Railway Tracks (8BD4087)	G-57 Gated Spillway and S-37A Gated Spillway	2004, 2006, 2007, 2012, 2012, 2014, 2015, 2023	Eligible
FEC Bridge (8BD4860)	S-37A Gated Spillway	2012,	Eligible
C-13 (Middle River) Canal (8BD3225)	S-36 Gated Spillway	1999, 2016	Ineligible
C-12 (Plantation) Canal (8BD4253)	S-33 Gated Spillway	2006	Ineligible
Lock No. 1 (8BD0058)	G-54 Gated Spillway	2006	Listed
G-15 (North New River) Canal (8BD3279)	G-54 Gated Spillway	1999, 2005	Eligible
C-11 (South New River) Canal (8BD4153)	S-13AW Gated Culvert and S-13 Pump Station and Gated Spillway	2004, 2006, 2007, 2011, 2012, 2014, 2017, 2018, 2021	Eligible
S-13 Pump Station and Gated Spillway (8BD10424)	S-13 Pump Station and Gated Spillway	2025	Eligible
Site 8BD182	Markham Park Stormwater Storage Capacity	1993, 2004	Not evaluated
Site 8BD183	Markham Park Stormwater Storage Capacity	1993, 2004	Not evaluated

Source: FMFSweb 2025

Note: FMSF = Florida Master Site File

The G-08 (Hillsboro) Canal (8PB10311) is a small portion of the larger, 51-mile Hillsboro Canal. The canal began construction in 1913 and was completed in 1917. The canal is one of the six major drainages of the Everglades Drainage District project. The canal is currently managed by the South Florida Water Drainage District. The site has been visited for cultural resource surveys 12 times from 1999 and 2024. The Florida SHPO determined the canal to be NRHP-eligible in 2025. The canal maintains engineering significance as an early example of a water management system and primary canal of the Everglades Drainage District. The G-08 Canal is also historically significance as a contributing factor in the development of South Florida (FMSFweb 2025). The G-08 Canal intersects with the proposed G-56 Gated Spillway construction area. While the G-56 Gated Spillway replaced the spillway component of the lock structure, the original 1920 Deerfield Lock (8BD10412) is still present the G-56 Gated Spillway. The concrete structure is an example of the early locks associated with the six major canals of the

Evergreen Drainage District. The structure has been subject to a single, 2025 cultural resource survey. As a result of the most recent survey, it was determined that the lock is ineligible for the NRHP as an individual structure as it lacks integrity of design, use, and materials, but is eligible as a contributing structure to an NRHP-eligible resource, the G-08 Canal. Consultation on this determination with the Florida SHPO and appropriate recognized tribes is ongoing.

The E-3 (N-5) Canal (8PB10953) was initially dug around 1910 as part of the Lake Worth Drainage District. The canal has historically been used for drainage rather than navigable functions. A 2003 cultural resource survey included an analysis of the canal. The results of the survey indicated the E-3 Canal was ineligible for the NRHP as it has a common design, construction methods, and maintenance procedures. The Florida SHPO concurred with the results of the survey (FMSFweb 2025). The E-3 Canal intersects with the eastern-most boundary of the G-56 Gated Spillway construction area. The Military Trail (8PB13795) is a Seminole War-era trail between Forts Jupiter, Lauderdale, and Dallas. The trail was constructed by Tennessee Volunteers and Major William Lauderdale. The Military Trail was an important overland route used for military movements and later to connect settlements. Eight cultural resource surveys of the route were completed between 2008 and 2021. In 2021, the Florida SHPO determined the Military Trail was ineligible for the NRHP because the original route has been altered and overlaid with modern roadways over time (FMSFweb 2025). The Military Trail is located above the proposed G-56 Gated Spillway dredging area. The Hillsboro Canal Bridge (8BD3042/8PB08214) is a steel swing span bridge that was built by the American Bridge Company and Virginia Bridge and Iron Company around 1926. The bridge was significantly altered when the G-08 Canal switched functions from navigation to drainage control. By 1996, the swing mechanism on the bridge was removed so that the structure remained fixed in place. The Hillsboro Canal Bridge was surveyed in 1996 and 2014. The Florida SHPO determined that the structure was not eligible for the NRHP as it lacked integrity and historical relevance because of the alterations (FMSFweb 2025). The Hillsboro Canal Bridge intersects with the proposed G-56 Gated Spillway dredging area. The portion of the Seaboard Air Line Railroad (8PB12917) that overhangs the proposed G-56 Gated Spillway dredging area was constructed in 1925 to connect Central and South Florida and was operational in 1926. The railway was the first to run across the entirety of Florida and was one of the largest railroads in 1920s Florida. There have been 16 cultural resource surveys from 2005 to 2020 that include an analysis of the railway. In 2021, the Florida SHPO determined the Seaboard Air Line Railroad was NRHP-eligible due to its importance in the development and transportation of the area (FMSFweb 2025). Bridge #860184 (8BD4647) is a reinforced concrete bridge that was initially constructed in 1956 and reconstructed in 1985. The bridge was the subject of a cultural resource survey in 2009. The Florida SHPO determined Bridge #860184 to be ineligible for the NRHP due to a lack of integrity (FMSFweb 2025). Bridge #860184 intersects with the proposed G-56 Gated Spillway dredging area.

The E-2 Canal (8PB7704) was constructed in 1956 in conjunction with Florida's Turnpike as part of the Lake Worth Drainage District. The mid-century canal was an expansion of the 1921 E-2W Canal. Nine cultural resource surveys between 2003 and 2024 have included analysis of the E-3 Canal. Despite these surveys, the Florida SHPO requires additional information on the resource for an eligibility determination (FMSFweb 2025). The E-2 Canal intersects with the proposed dredging area for the G-56 Gated Spillway. The portion C-14 (Cypress Creek) Canal (8BD3226) that intersects with the G-57, S-37B, and S-37A Gated Spillways was constructed around 1960. The canal was constructed as a branch of the

circa 1912 portion of the canal. The 1960 portion of the canal has been subject of eight cultural resource surveys from 1999 to 2022. Based on the results of the surveys, the Florida SHPO determined the C-14 Canal is ineligible for the NRHP due to a lack of notable features and/or historical associations (FMSFweb 2025).

Construction of the 26-mile stretch of the Dixie Highway (8BD4227) in Broward County began in 1922. The original roadway consisted of two lanes that ran parallel to the FEC Railway. The highway was expanded to include four lanes around 1961. The initial purpose of the Dixie Highway was to create a road system north to south that would promote development and tourism along the route. The portion of the Dixie Highway in Broward County has been subject to 10 cultural resource surveys from 2006 to 2024. In 2025, the Florida SHPO determined the resource was NRHP-eligible based on its importance to the development of the region (FMSFweb 2025). A portion of the Dixie Highway runs above the proposed G-57 Gated Spillway project area.

The FEC (Florida East Coast) Railway Tracks (8BD4087) were built circa 1896 after the line had expanded south from Jacksonville and Daytona, Florida in the proceeding years. The railway was used to ship various goods that had been transported down the New River. There have been eight cultural resource surveys between 2004 and 2023 that included an analysis of the FEC Railway Tracks. In 2016, the Florida SHPO determined the resource was NRHP-eligible due to its significance in the development, community planning, and transportation within and throughout the region (FMSFweb 2025). The FEC Railway Tracks intersect with the G-57 and S-37A Gated Spillway project areas.

The FEC (Florida East Coast) Bridge (8BD4860) is a 1960 concrete slab fixed railway bridge that was built to allow for the FEC Railway tracks to cross over the C-14 Canal. The 2012 survey of the structure argued that the bridge was eligible for the NRHP as a contributing component a potential FEC Railway Linear Historic District. In 2012, the Florida SHPO determined the bridge to be NRHP-eligible as an individual structure. The FEC Bridge intersects with the proposed project area of the S-37A Gated Spillway.

The C-13 (Middle River) Canal (8BD3225) was constructed from 1913 to 1927 as part of the Everglades Drainage District. The canal has been subject of two cultural resource surveys in 1999 and 2016. Following both surveys, the Florida SHPO determined that the canal was ineligible for the NRHP because it lacked notable engineering features and it had also been modified. The C-13 Canal intersects with the S-36 Gated Spillway.

The C-12 (Plantation) Canal (8BD4253) is a 1954 canal that was constructed as part of the Central and South Florida Project. A 2006 survey of the canal noted that while the resource was notable as part of a larger regional drainage system, the canal did not retain any significant engineering and/or historical attributes. In 2008, the Florida SHPO determined that the C-12 Canal was ineligible for the NRHP. (FMSFweb 2025). The C-12 Canal intersects with the proposed S-33 Gated Spillway project area.

Lock No. 1 (8BD0058), or Sewell Lock, is an NRHP listed structure that is located within the G-54 Gated Spillway project area. The Furst-Clark Construction Company began building the poured concrete structure in 1911 and it was first operational in 1912. The lock was built to assist in maintaining the water levels and traffic on the North New River Canal. While only the western gate of Lock No. 1 is remaining component of the lock, the structure was added to the NRHP in 1978 due to its notable

engineering features and its importance to the development of the area. In addition, Lock No. 1 has been subject to one 2006 survey (FMSFweb 2025).

The G-15 (North New River) Canal (8BD3279) began construction in 1906 as part of the Everglades Drainage District. The canal has historically been used to support drainage and manage water levels in the Everglades. In addition, the lock system throughout the canal facilitated travel and commerce on the canal route. Cultural resource surveys conducted in 1999 and 2005 included analyses of the G-15 Canal. In 2001, the Florida SHPO determined the G-15 Canal to be NRHP-eligible because of its importance to the development of the region and its notable engineering features (FMSFweb 2025). The G-15 Canal intersects with the G-54 Gated Spillway project area.

The C-11 (South New River) Canal (8BD4153) was constructed between 1907 and 1915 as part of the Everglades Drainage District. The canal has historically been used to facilitate drainage throughout the region. Nine cultural resource surveys from 2004 to 2021 have included an analysis of the C-11 Canal. The results of those surveys demonstrated the canal's notable engineering attributes and importance to the development of South Florida. In 2022, the Florida SHPO determined the C-11 Canal to be NRHP-eligible (FMSFweb 2025). The C-11 Canal intersects with the S-13AW Gated Spillway and S-13 Pump Station and Gated Spillway project areas.

The S-13 Pump Station and Gated Spillway (8BD10424) was built in 1954 and is part of the larger C-11 (South New River) Canal, which was constructed between 1907 and 1915 as part of the Everglades Drainage Project and, in its entirety, runs 15.7 miles from WCA-3A and along Griffin Road to the New River. The S-13 Pump Station and Gated Spillway was surveyed in 1991 by FDOT, in 1993 and 1995 by Broward County Office of Planning, and in 2004 by Vertex Engineering Service, Inc. Due to its integrity and connection to early water management in South Florida, the C-11 (South New River) Canal was determined eligible for inclusion on the NRHP.

The S-13AW Gated Culvert was constructed in 2007 to replace the previous S-13A double-box concrete culvert. Like WCS S-13, the S-13AW Gated Culvert is part of the larger C-11 (South New River) Canal, which was built between 1907 and 1915 as part of the Everglades Drainage Project. In 2004, the C-11 (South New River) Canal was determined to be eligible for the NRHP due to its integrity and connection to early water management systems in South Florida. The entirety of the S-13AW Gated Culvert was included in a 1993 Phase II archaeological survey by the Broward County Office of Planning. Robert H. Miller & Associates conducted an additional archaeological survey adjacent to the eastern border of the WCS in 1989.

The proposed construction of the Markham Park Stormwater Storage Capacity Improvement Project is associated with two archaeological sites, 8BD182 and 8BD183. The entirety of Markham Park has been subject to cultural resource surveys in 1993 and 2004. Site 8BD182 is a multicomponent habitation, midden, and burial mound site that was occupied during the Glades Period. Site 8BD183 is a multicomponent camp, procurement, midden, and burial mound site that was occupied throughout the Archaic, Glades, and Seminole Periods. Both sites are known to include prehistoric human remains and have not been evaluated by the Florida SHPO.

B.2 Future Without Project Conditions

The environmental conditions within the C&SF Section 203 Study Area are expected to change over time, regardless of whether the proposed action is implemented. These changes may either compound, offset, or have no noticeable effect on environmental conditions in the Study Area. **Table B.2-1** presents the expected or likely future conditions of the environmental resources in 2085 based on reasoned estimates of future conditions.

Table B.2-1. Future Without Project Conditions.

Resource Area	Future Without Project Conditions
Air Quality	Air quality in the Study Area is expected to improve over time as cleaner energy generation and increased electric vehicle use reduce emissions. These trends should enhance long-term air quality without directly impacting SFWMD infrastructure management. However, more frequent and intense flooding from climate-related events could indirectly affect air quality by releasing terrestrial carbon, accumulating waste, and requiring emissions-intensive cleanup and repairs. In residential areas, reconstruction efforts may temporarily increase localized emissions. Without mitigation, these episodic impacts could partially offset long-term air quality improvements.
Greenhouse Gases	Greenhouse gas emissions would be expected to continue to be uncertain. Uncertainty in efforts to sequester carbon and/or reduce future emissions would be expected to influence the future climate conditions and would influence management of SFWMD infrastructure. Flooding may increase greenhouse gas (GHG) emissions through terrestrial carbon release, waste accumulation, debris handling, and the use of heavy equipment for cleanup and repairs. In residential areas, flood damage may require reconstruction, leading to temporary increases in localized GHG emissions from construction activity, material transport, and energy use. If not mitigated, these episodic effects could partially offset long-term reductions in emissions.
Climate	Climate conditions in the Study Area are expected to remain uncertain, particularly regarding the frequency and duration of extreme precipitation. Continued flooding may significantly impact both the physical and economic environment and directly affect how the South Florida Water Management District (SFWMD) manages its infrastructure. Future climate projections indicate rising sea levels and increased rainfall associated with more frequent and intense tropical weather events. These trends are expected to exacerbate flooding risks, especially in low-lying and coastal areas. Combined sea level rise and heavier precipitation may lead to prolonged inundation, reduced drainage capacity, and increased strain on stormwater and flood control infrastructure.
Noise	Noise in the Study Area would not be expected to change over time. The affected area would continue to be predominantly high density residential with noise from traffic and other urban infrastructure.
Hydrology	Major hydrological drivers in the region, including rainfall, evapotranspiration, groundwater levels, and sea levels, would be expected to change in the future. These changing climatic conditions will significantly impact stormwater runoff (intensity, duration, frequency), resulting in a reduction of the system efficiency and future flood protection level of service. Flooding events result in property damage to residences, businesses, and critical infrastructure, present health and life safety risks, and threaten significant economic activities.
Groundwater	Rising sea levels will likely degrade groundwater quality, composition, and overall supply in the Study Area. As saltwater intrusion progresses, wells tapping the Biscayne Aquifer near the coast may need to be relocated or replaced with wells tapping the brackish Floridan Aquifer, requiring new water treatment systems. Additionally, increased salinity in Biscayne Aquifer wells will raise treatment costs for potable water production. A study by the Water Utility Climate Alliance (2019) estimates that by 2060, 16% of Broward County's public supply wells will be at risk of saltwater intrusion. Several wellfields have already been decommissioned due to rising salinity levels.
Surface Water Quality	Surface water quality in the Study Area will likely degrade over time as sea levels rise and saltwater intrusion becomes a primary factor. Broward County, currently the second most populous in Florida, is projected to grow by 12% by 2050 (BEBR 2024). This population increase will contribute to conditions that negatively affect water quality. While Broward County has numerous ordinances to manage impervious surfaces, rising percentages of impervious surfaces can be expected to boost runoff, worsening water quality and heightening contamination risks. An increase in rainfall duration and intensity, along with a projected rise in sea level, leads to an increase in the inflow and infiltration of the wastewater system, resulting in overloads (FTL 2024). Exceedances of <i>E.coli</i> thresholds will likely increase due to anthropogenic and climatic changes.
Vegetation	The 5% cover by natural lands is significantly constrained by urban development. Future Without Project (FWOP) conditions are likely to cause remnant natural vegetation to convert into other types of vegetation cover, but in general no net loss is expected. Vegetative communities in the Study Area are vulnerable to sea level rise, flooding, land use change, and fragmentation. Remnant natural communities with the highest overall relative vulnerability score within the Study Area account for 0.3% of the Study Area and include Glades Marsh (Vulnerability Score 4=Very High), Rockland Hammock (Vulnerability Score 3=High), and Scrub/Sand Pine Scrub (Vulnerability Score 3=High). These communities will likely be among the first to convert into

Resource Area	Future Without Project Conditions
	less complex communities that are more vulnerable to invasive species. Additionally, existing vegetation in low-lying areas will be among the first to convert into mangrove and other salt-tolerant communities.
Wetlands	FWOP conditions are unlikely to result in net freshwater or estuarine wetland losses. Hydric conditions that facilitate wetland emergence will remain. However, the specifics of those hydric conditions (duration of inundation, salinity, etc.) are likely to change in response to storm events, sea level rise, and flooding, shifting the dominant wetland vegetation and type. Wetland communities in the Study Area are vulnerable and changes such as sea level rise and flooding represent significant risks. The Glades Marsh community has a very high relative vulnerability score (Vulnerability Score 4). This community can be expected to be less resilient to change and more rapidly convert into less complex communities.
Invasive Species	It is expected that increased summer and winter minimum temperatures, increased extreme tropical systems, sea level rise, and changing weather patterns (e.g., droughts, floods) will enhance invasive species colonization, from introduction through establishment and expansion. Both Broward and Palm Beach counties have ongoing programs to minimize the impacts of invasive plants and animals. FWOP conditions are unlikely to change the uncontrollable inputs of invasive species from the Everglades, homes, and unmanaged private lands. Therefore, the change in environmental conditions within the Study Area is expected to compound the negative effects from invasive species to a minor/moderate degree in the FWOP Conditions.
Essential Fish Habitat	It is predicted that the Study Area's high density urban landscape will remain largely intact, and the amount of EFH will be relatively unchanged. The quality of EFH is expected to degrade due to disruptions from flood control and lack of regulated freshwater flows between the present and 2085. Important EFH habitat constituents like mangroves would also be negatively impacted from storm surges, drought, and lack of space for inland migration. Predicted changes will degrade these habitats and may affect their viability as EFH.
Federally Threatened and Endangered Species	Federally threatened and endangered species are either known to exist or potentially exist within the Study Area. In the future, it is predicted that the Study Area's high density urban landscape will remain largely intact, limiting the amount of habitat available for these species. As sea level rises, the remaining habitats face encroachment from saltwater intrusion and erosion, shrinking the already scarce natural areas where these species can survive. Strong storms and hurricanes will become more frequent and intense, reshaping coastlines and threatening ecosystems. Low-lying areas and coastal habitats will face persistent flooding and erosion, potentially leading to the disappearance of many habitats that support threatened and endangered species.
Fish and Wildlife	Fish and wildlife are expected to be heavily impacted by the year 2085 due to shifting climate patterns in the highly urbanized Study Area. Saltwater intrusion and changes to salinity and temperature levels would change freshwater/saltwater fish species distributions and associated angler opportunities. Habitat loss for coastal-dependent species like wading birds and marine fish is expected as sea level rises and storm surges erode shorelines. Important habitat like mangroves would also be negatively impacted from storm surges, drought, and lack of space for inland migration. Species on watch lists for the potential to become endangered or threatened, such as endemic species and those that time breeding according to hydrological cycles, may be negatively impacted. Shifts in migration, ranges, and breeding time are expected (and are already being documented for some species) for birds, amphibians, reptiles, mammals, and insects.
Geology and Soils	Geologic conditions in the Study Area are not expected to change over time. The general topography, structural geology, and stratigraphy would remain the same. There are no active mines or oil/gas production within the Study Area. Seismic risk would remain low. Soil erosion would increase from increased frequency of extreme precipitation events and flooding.
Hazardous, Toxic, and Radioactive Waste	It is expected that by 2085, the accumulation of contaminants in the Study Area sediments and soils would be exacerbated relative to current conditions and may migrate or expand beyond the current extent. This could result in higher maintenance and cleanup costs as the current structures age and require refurbishment or replacement, the water level rises and requirements regarding hazardous and toxic materials evolve over time.
Land Use and Real Estate	Land use patterns in the Study Area may be significantly impacted by future land development, increased flooding, saltwater intrusion, and shifting water levels. As sea levels rise and extreme weather events become more frequent, the flood risk management system may no longer be able to effectively manage water volumes, resulting in more frequent and severe flooding of surrounding lands. This could lead to widespread infrastructure damage, including the deterioration of roads, utilities, and buildings due to increased flooding and saltwater intrusion. The built environment would face more frequent and severe damage, potentially resulting in higher repair and maintenance costs. Development in low-lying areas may become less

Resource Area	Future Without Project Conditions
	feasible, leading to reduced density or abandonment of vulnerable parcels. Some lands could transition to open space or stormwater management areas to enhance flood storage capacity, while zoning and land use regulations may shift to favor flood-resilient design, stricter building codes, and expanded conservation zones. Additionally, the severance of essential services, such as water supply, drainage systems, and transportation routes, could further impede existing and planned developments.
Visual Resources	Visual resources in the Study Area may be significantly degraded because of rising sea levels, increased flooding, and saltwater intrusion. As water levels rise and more frequent extreme weather events occur, the natural landscapes, scenic views, and coastal features could be altered or eroded, diminishing the area's aesthetic appeal. The built environment, including infrastructure and development, could become more costly to maintain and ultimately fall into various states of disrepair, further detracting from the visual integrity of the built environment.
Transportation and Traffic	The transportation network in the Study Area may experience significant strain in the future. Roads and transportation routes could become more prone to disruption from rising water levels, which would impede vehicle access and increase travel times. The existing road network may not be able to accommodate the growing demands of both local and commuter traffic, leading to congestion and diminished mobility. Additionally, essential transportation infrastructure, such as bridges and drainage systems, including drainage associated with airports and the port, may be vulnerable to damage, further compromising the efficiency and reliability of the transportation network. As a result, traffic flow and accessibility could be severely impacted.
Infrastructure and Utilities	Sea level rise, saltwater intrusion, extreme rainfall, and drought will intensify and place increasing stress on the Study Area's WCS. These structures currently manage flooding, block saltwater from moving upstream, conserve freshwater, and regulate water levels both upstream and downstream. As sea levels and rainfall volumes rise, water levels in primary canals will exceed the WCS design capacity. When that occurs, the structures will no longer control flows effectively, and flood events will become more frequent and severe. The system's reduced performance will compromise water management across the region. Flooding events will further affect the potable water, wastewater, and stormwater utilities managed by Broward County. There is an expectation of increased infiltration and inflow events, which will disrupt treatment and distribution processes. Wellfields are likely to become more vulnerable to saltwater intrusion, potentially necessitating their relocation or abandonment in favor of new water supply sources. Additionally, the frequency of sanitary sewer overflows is expected to rise, along with greater challenges in stormwater management drainage.
Socioeconomics	As part of a national trend, populations in the Study Area are expected to continue to grow through 2075. This growth will drive demand for both the filling of vacant housing units and the construction of additional units. At the same time, sea level rise is likely to inundate more neighborhoods and homes, leading to property sales or abandonment and creating associated economic challenges. In Broward and Palm Beach counties, overall positive job growth (totaled across all industries) is expected through 2032. Despite net growth, Broward County projects a decrease in certain industry sectors by 2032, including construction and government. Palm Beach County projects a decrease in agriculture, forestry, fishing, hunting, and mining within the same time frame. These decreases are likely to be exasperated further in the future by natural hazards that make it difficult to produce outputs due to potential lack of habitable construction areas and fishable water. The future trajectory of natural hazard risks is uncertain, but it is likely that these risks will worsen in the future, resulting in further socioeconomic impacts on Study Area communities. If left unaddressed, impacts from environmental stressors such as flooding and saltwater intrusion will exacerbate economic challenges.
Cultural Resources	There are 7,944 recorded cultural resources present within the Study Area and it is probable that additional resources will be identified in the future. Preservation studies have shown that there is an increasing threat of disturbance, damage, and/or destruction to cultural resources, especially in coastal areas, due to sea level rise, flooding, storm surges, and associated erosional activities. These environmental situations are likely to impact cultural resources through, at a minimum, ground disturbance, weathering over time, water damage, and structural damage. These impacts have the potential of diminishing the integrity of these cultural resources. The future of natural hazard risks is uncertain, but it is likely that the risks will worsen in the future, resulting in further threat to cultural resources within the Study Area. If left unaddressed, impacts from the environmental stressors, including sea level rise and flooding, will increase the threat to cultural resources.

B.3 Environmental Consequences

The various structural and nature-based measures proposed under the final array of alternatives (Alternatives A, B, C, and Alternative Resilience Optimized (RO)) and for the C&SF Section 203 Study were analyzed for their potential effects on natural, physical, and economic environmental resources. For the purposes of this effects analysis, resource areas that would experience effects from changed hydrology are analyzed from either an intermediate modeling scenario or a “worst case” modeling scenario. The intermediate scenario includes hydrologic and hydraulic (H&H) modeling results for a 2-year storm surge, 25-year rainfall event, and future intermediate sea level rise scenario at peak depths across the Study Area at the end of the period of analysis (2085). The “worst case” scenario includes H&H modeling results for a 100-year storm surge, 100-year rainfall event, and future high sea level rise scenario at peak depths across the Study Area at the end of the period of analysis (2085). Where applicable, data from other modeling scenarios are provided to adequately examine the effects of the various alternatives. In addition, where applicable, effects to resources are analyzed separately for the construction period of 2028 to 2034, and for the operation, maintenance, repair, replacement, and rehabilitation (OMRR&R or implementation) period of 2035 to 2085.

The H&H modeling used in this analysis is an integrated/coupled surface-groundwater MIKE SHE/MIKE Hydro (Version 2022) model that was created by the SFWMD and was used to generate flood hazard information for use in the flood damage assessment. This 2D H&H model covers the entire Study Area and extends past the tidal boundary condition to the east. The focus in this C&SF Section 203 Study is the primary canal system; however, the model includes a high level of detail within the secondary and tertiary canal systems. A Model Documentation Report (**Appendix A, Engineering Appendix**) describes the assumptions, model implementation steps, and observed outcomes associated with modeling representations of both the current and FWOP conditions baseline model scenarios as well as the proposed alternatives as simulated with the MIKE SHE/MIKE Hydro software.

B.3.1 Air Quality

The potential impacts to air quality within the C&SF Section 203 Study Area that could result from implementing the final array of alternatives, including the No Action Alternative, are analyzed below.

B.3.1.1 Methodology

Air emissions from construction and operational engines were simulated through the Air Conformity Applicability Model (ACAM), which measures the total reasonably foreseeable net direct and indirect emissions associated with each alternative on a calendar-year basis, beginning with the start of the action, which is the worst-case emissions operating year, and continuing until “steady-state” emissions are reached, no net gain or loss occurs, and the action is fully implemented. ACAM is a robust computer model developed and used primarily by U.S. Air Force planners in analyzing environmental impacts. It accommodates all these activities, providing a consistent method for evaluating potential emissions.

ACAM was used to calculate emissions from constructing and demolishing facilities, grading land, and construction-related transportation including construction workers commuting. These air emissions were compared to the EPA’s General Conformity regulations (GCR) de minimis threshold values to assess potential effects on air quality. Alternatives were then analyzed for conformity as required under

40 CFR Part 93, Subpart B to demonstrate that a proposed federal action conforms to the State Implementation Plan for air quality, ensuring it will not cause or contribute to violations of National Ambient Air Quality Standards (NAAQS). ACAM standardizes and simplifies emissions calculations based on the proposed activities, incorporating default assumptions for emissions from construction equipment and personnel. ACAM offers summarized and detailed outputs that include the assumptions and equations used to calculate emissions.

Where applicable, potential emissions from sediment removal or dredging were simulated using the Bureau of Ocean Energy Management's (BOEM) dredging emission calculator (ENVIRON International Corp. and Woods Hole Group 2013), since the emission factors in ACAM do not fully account for wet sediment conditions during stream improvements, such as those proposed within canals under some of the alternatives.

Appendix L, Air Quality Supporting Information, provides a list of assumptions and the full ACAM and conformity analyses.

Construction

Emissions were estimated for fugitive dust, on- and off-road diesel equipment and vehicles, worker trips, demolition, architectural coatings, shoreline restoration, and paving off-gases. The ACAM assumptions include site grading to account for air emissions from construction and demolition activities. It typically includes materials such as asphalt, asphalt shingles, concrete, brick and clay tile, drywall and plaster, steel, and wood products (EPA 2024b). ACAM's default settings were used.

Operation, maintenance, repair, replacement, and rehabilitation

Operational emissions refer to the ongoing emissions generated during the normal functioning of a project once it becomes active. For the final array of alternatives, these emissions include those from power systems for the pumping stations or auxiliary power units typically fueled by diesel fuel. They also encompass emissions from onsite fuel storage, including potential fugitive emissions due to volatilization during refueling. Operational emissions account for any net change in emissions compared to baseline conditions; this could include emission increases from new sources as well as emission reductions resulting from decommissioned or upgraded systems. Evaluating these components is essential to determine the combined incremental impact on air quality and to assess the potential for significance. ACAM's default settings were used.

B.3.1.2 Future Without Project Conditions (No Action Alternative)

Under the No Action Alternative, existing flood control infrastructure would not be upgraded, and legacy systems including diesel- and gasoline-powered pumps, generators, and control equipment would remain in operation. Continued reliance on outdated engine technology would result in the sustained emission of criteria pollutants such as nitrogen oxides (NO_x), carbon monoxide (CO), particulate matter (PM_{2.5} and PM₁₀), and volatile organic compounds (VOCs), which contribute to the formation of ground-level ozone and degrade regional air quality. In contrast to modern, cleaner-burning engines or electric-powered alternatives typically installed during system upgrades, legacy combustion units are less efficient and often lack emissions control technologies such as diesel particulate filters or selective catalytic reduction systems. Failure to implement engine replacements or upgrades also represents a

missed opportunity to align with state and federal air quality goals, including the Clean Air Act National Ambient Air Quality Standards (NAAQS). In areas designated as nonattainment or maintenance zones for ozone or PM_{2.5}, continued operation of inefficient engines may exacerbate local air quality issues and contribute to cumulative impacts on vulnerable populations, particularly near communities that are disproportionately exposed to mobile and stationary source pollution.

B.3.1.3 Alternative A

Under Alternative A, short-term, minor adverse effects on air quality would be expected as compared to the No Action Alternative. Short-term effects would result from air emissions generated during construction, and long-term beneficial effects would result from reduced operational emissions from upgraded infrastructure.

The increase in efficiency of new engines installed at the S-13 Pump Station and Gated Spillway and the removal of units that produce greater emissions during their operation have greatly reduced emissions and the resulting effects on air quality under this alternative, as compared to the No Action Alternative, where upgrades to the S-13 Pump Station and Gated Spillway would not occur. Alternative A would not generate emissions that would exceed the GCR insignificant threshold values or contribute to a violation of any federal, state, or local air regulation. Criteria pollutants would be expected to remain below de minimis levels and meet permitted limits when combined with existing facility-wide emissions under Alternative A. None of the estimated annual net emissions from these actions would exceed insignificance indicators; therefore, the action would not cause or contribute to a conformity exceedance.

Construction

Short-term, less-than-significant adverse effects on air quality are expected during the construction of Alternative A. Emission models were simulated for Alternative A for the proposed new S-37A Gated Spillway, S-36 Gated Spillway, S-33 Gated Spillway, and S-13 Pump Station and Gated Spillway. Hardening and resiliency improvements to the G-56 Gated Spillway, G-57 Gated Spillway, and G-54 Gated Spillway are included in the GCR determination for Alternative A. Various construction and site preparation activities would occur under Alternative A across at the WCS, including soil removal, demolition, land disturbance, tree removal, new building construction, dewatering, riprap installation, structural backfill, asphalt pavement removal, and topsoil stripping. Dewatering is the most voluminous activity, with 2.5 million units consistently reported across nearly all construction sites, excluding the S-37A Gated Spillway and G-56 Gated Spillway. Land disturbance and new construction also represent large-scale efforts, particularly at the S-33 Gated Spillway and G-57 Gated Spillway. Demolition activities are prominent at the S-13 Pump Station and Gated Spillway, S-33 Gated Spillway, and S-37B Gated Spillway. In contrast, tree removal is minimal and largely confined to the S-13 Pump Station and Gated Spillway, S-33 Gated Spillway, S-36 Gated Spillway, and S-37B Gated Spillway. Riprap and backfill installation, along with pavement removal and topsoil stripping, would be varied across the WCS under Alternative A, reflecting localized needs for erosion control, structural support, and surface preparation. No canal cross section improvements are proposed under Alternative A; however, minor canal profile changes (i.e., limited bank excavation and canal bottom grading when a new WCS is constructed) were factored into the analysis. As explained in **Appendix L**, cumulative emissions for all construction phases

(including demolition, site clearing, grading, and debris haul off) were assumed to occur in a single year at each WCS. This single year output was averaged over a 5-year period for the GCR analysis. The model's default parameters were assumed, except for construction hauling trips, construction vendor trips, and personnel and construction commute distances. Construction hauling and worker commutes were assumed to average 40 miles round trip (20 miles one way). This assumption is based on the average commute times from the U.S. Census Bureau's one-way travel times for Florida (USCB 2024a).

Table B.3-1 presents the estimated air pollutant emissions from Alternative A construction activities. ACAM includes the least restrictive insignificance thresholds for criteria pollutants to determine the level of effects of these emissions sources. As shown in the table, the total emissions would remain below de minimis levels and under the insignificance thresholds for each of the criteria pollutants; therefore, Alternative A's effects on air quality during construction would be greater than the No Action Alternative, but would be short-term and less than significant.

Table B.3-1. Estimated Construction Emissions under Alternative A.

Alternative	VOC	NH ₃	SO _x	NO _x	CO	PM ₁₀	PM _{2.5}	Pb	Exceedance
De minimis threshold	250.00	250.00	250.00	250.00	250.00	250.00	250.00	25.00	No
Alternative A (5-year annual)	0.321	0.008	0.033	2.560	2.847	62.97	0.111	0	No

Source: ACAM reports (Appendix L).

Notes: All values are provided as tons per year. VOC = volatile organic compound; NH₃ = ammonia; SO_x = sulfur oxides; NO_x = nitrogen oxides; CO = carbon monoxide; PM₁₀ = inhalable particulate matter with a diameter generally 10 µm or smaller; PM_{2.5} = fine inhalable particulate matter with a diameter generally 2.5 micrometers (µm) or smaller; Pb = lead

Reasonable precautions and best management practices (BMPs) would be used to prevent airborne dust, including the use of water to control dust from building construction, demolition, land clearing, and road grading. Cleared or graded areas would be seeded or vegetated promptly to minimize fugitive dust. Given the sustained potential for emissions over an averaged 12-month construction period, SFWMD would coordinate with construction teams to ensure that these BMPs are effectively implemented.

Operation, Maintenance, Repair, Replacement, and Rehabilitation

Long-term, minor, beneficial effects on air quality are expected during OMRR&R under Alternative A as compared to the No Action Alternative. The annualized steady-state operational emissions assumes that operations would commence the year following construction. Operations would not exceed GCR insignificance thresholds or violate any federal, state, or local air regulations. There is significant reduction in emissions compared to the No Action Alternative due to the upgraded engines as the main source of power for pumping water at the S-13 Pump Station and Gated Spillway. Evaluating these components is essential to determine the combined incremental impact on air quality and to assess the potential for significance. ACAM's default settings were used.

All new large horsepower (HP) engines are assumed to be internal combustion. Engines greater than 500 HP must meet FDEP air permitting requirements and federal standards New Source Performance Standards (Subpart JJJ for spark ignition; Subpart IIII for compression ignition) and National Emission Standards for Hazardous Air Pollutants ZZZZ covering emission limits, maintenance/hour limits, testing,

and recordkeeping. Backup pump engines in Florida typically qualify as minor sources when limited to emergency use and periodic testing, and must also meet general state requirements (e.g., opacity). During OMRR&R, criteria pollutants would remain below de minimis levels and within permitted limits when combined with existing facility-wide emissions.

OMRR&R emissions include backup power and fuel usage (see **Appendix L**). **Table B.3-2** presents the estimated annual net OMRR&R emissions under Alternative A. Alternative A assumes, as a worst case, that all existing pump engines are diesel and would be replaced with electric motors, with internal combustion driven backup units. Alternative A emissions would be below the insignificance indicators; therefore, OMRR&R under Alternative A would not be expected to cause or contribute to any exceedance NAAQS and would have a long-term, beneficial effect on air quality as compared to the No Action Alternative.

Table B.3-2. Estimated Operations Emissions under Alternative A.

Alternative	VOC	NH ₃	SO _x	NO _x	CO	PM ₁₀	PM _{2.5}	Pb	Exceedance
De minimis threshold	250.00	250.00	250.00	250.00	250.	250.00	250.00	25.00	No
Alternative A	-0.460	0	-0.480	1.775	-0.481	-0.380	0	0	No

Source: ACAM reports (Appendix L).

Notes: All values are provided as tons per year. VOC = volatile organic compound; NH₃ = ammonia; SO_x = sulfur oxides; NO_x = nitrogen oxides; CO = carbon monoxide; PM₁₀ = inhalable particulate matter with a diameter generally 10 µm or smaller; PM_{2.5} = fine inhalable particulate matter with a diameter generally 2.5 micrometers (µm) or smaller; Pb = lead

B.3.1.4 Alternative B

The effects on air quality under Alternative B are the same as under Alternative A:

- Short-term effects would result from air emissions generated during construction, which would be greater than the No Action Alternative (since no construction would occur under that alternative).
- Long-term beneficial effects would result from reduced operational emissions due to upgraded infrastructure, as compared to the No Action Alternative.
- Emissions would not exceed the GCR insignificant threshold values or contribute to a violation of any federal, state, or local air regulation.
- Criteria pollutants would be expected to remain below de minimis levels and meet permitted limits.
- Annual net emissions would not exceed insignificance indicators and the action would not cause or contribute to a conformity exceedance.

Construction

Emission models were simulated for Alternative B in the same manner as Alternative A, but using inputs based on the WCS improvements proposed under this alternative. As with Alternative A, cumulative emissions for all construction phases were assumed to occur in a single year at each WCS and then this single year output was averaged over a 5-year period for the GCR analysis (see **Appendix L** for a full discussion of assumptions). Construction and site preparation activities under Alternative B are the

same as those under Alternative A, with slight differences in location and scope based on the site-specific improvements proposed.

Table B.3-3 presents the estimated air pollutant emissions from Alternative B construction activities. This includes the least restrictive insignificance thresholds for criteria pollutants to determine the level of effects of these emissions sources. As shown in the table, the total emissions would remain below de minimis levels and under the insignificance thresholds for each of the criteria pollutants; therefore, Alternative B's effects on air quality during construction, while greater than the No Action Alternative, would still be short-term and less than significant. As with Alternative A, SFWMD would coordinate with construction teams to ensure that BMPs for air emissions are effectively implemented.

Table B.3-3. Estimated Construction Emissions under Alternative B.

Alternative	VOC	NH ₃	SO _x	NO _x	CO	PM ₁₀	PM _{2.5}	Pb	Exceedance
De minimis threshold	250.00	250.00	250.00	250.00	250.00	250.00	250.00	25.00	No
Alternative B (5-year annual)	1.855	0.008	0.002	1.021	1.253	22.860	0.035	0	No

Source: ACAM reports (Appendix L).

Notes: All values are provided as tons per year. VOC = volatile organic compound; NH₃ = ammonia; SO_x = sulfur oxides; NO_x = nitrogen oxides; CO = carbon monoxide; PM₁₀ = inhalable particulate matter with a diameter generally 10 µm or smaller; PM_{2.5} = fine inhalable particulate matter with a diameter generally 2.5 micrometers (µm) or smaller; Pb = lead

Canal Improvements

In addition to upgrades at the WCS, Alternative B proposes canal conveyance improvements (i.e., dredging) in the G-08 (Hillsboro) Canal, C-14 (Cypress Creek) Canal, and C-11 (South New River) Canal. Emissions were calculated based on a 1-year dredging schedule and averaged over a 5-year analysis period to reflect the project's long-term operational context. The BOEM dredging calculator was employed to estimate emissions associated with the physical removal of sediment, while the ACAM was used to quantify emissions from associated shore-side upgrades and sediment disposal operations.

Based on the proposed dredge volumes, a comprehensive evaluation was conducted addressing key environmental considerations, including air quality, transportation logistics, noise impacts, and land use compatibility. A primary constraint identified is the offsite disposal of dredged or excavated material, as the projected sediment volumes may exceed the storage and reuse capacity of onsite containment areas. A critical factor in this analysis is the "fluffing" or bulking effect that occurs during sediment excavation. When sediment is disturbed, it becomes aerated and loses compaction, resulting in a typical one third increase in volume. This volumetric expansion significantly exacerbates spatial limitations and must be carefully accounted for during planning. Even with a proposed elevation increase of up to 9 feet at containment sites, the available land area is likely insufficient to accommodate the total expanded volume of excavated material. Additionally, the physical characteristics of dredged sediment present further challenges. The material is unlikely to compact effectively, increasing the potential for sloughing or return flow into adjacent canal systems. These conditions may compromise containment integrity and necessitate additional sediment control measures or re-handling operations. For the purposes of this air quality analysis, it is therefore conservatively assumed that all excavated sediment would be transported offsite and disposed of at a local, permitted landfill. This assumption informs the projected air emissions from truck hauling. Emissions from transporting dredged material offsite were incorporated into the ACAM analysis for construction of Alternative B, the results of which are included in **Table B.3-3**.

Table B.3-4 presents the estimated air pollutant emissions from Alternative B canal conveyance improvements. This includes the least restrictive insignificance thresholds for criteria pollutants to determine the level of effects of these emissions sources. While Alternative B canal conveyance improvements result in some emissions as compared to the No Action Alternative, as shown in the table, the total emissions would remain below de minimis levels and under the insignificance thresholds for each of the criteria pollutants. Therefore, the effects of canal conveyance improvements on air quality during construction would be short-term and less than significant.

Table B.3-4. Estimated Dredging Emissions under Alternative B.

Alternative	VOC	NH ₃	SO _x	NO _x	CO	PM ₁₀	PM _{2.5}	Pb	Exceedance
De minimis threshold	250.00	250.00	250.00	250.00	250.00	250.00	250.00	25.00	No
Alternative B (5-year annual)	0.732	0.69	0.69	44.98	17.03	1.616	1.568	0	No

Source: Bureau of Ocean Energy Management (BOEM) dredging emission calculator (ENVIRON International Corp. and Woods Hole Group 2013)

Notes: All values are provided as tons per year. VOC = volatile organic compound; NH₃ = ammonia; SO_x = sulfur oxides; NO_x = nitrogen oxides; CO = carbon monoxide; PM₁₀ = inhalable particulate matter with a diameter generally 10 µm or smaller; PM_{2.5} = fine inhalable particulate matter with a diameter generally 2.5 micrometers (µm) or smaller; Pb = lead

Operation, Maintenance, Repair, Replacement, and Rehabilitation

Alternative B is similar to Alternative A because long-term, minor, beneficial effects on air quality are expected during OMRR&R as compared to the No Action Alternative. The same assumptions were made under Alternative B's air emissions analysis for OMRR&R activities as for Alternative A. Alternative B emissions (**Table B.3-5**) would also be below the insignificance indicators; therefore, OMRR&R under Alternative B would not be expected to cause or contribute to any exceedance NAAQS and would have a long-term, beneficial effect on air quality.

Table B.3-5. Estimated Operations Emissions under Alternative B.

Alternative	VOC	NH ₃	SO _x	NO _x	CO	PM ₁₀	PM _{2.5}	Pb	Exceedance
De minimis threshold	250.00	250.00	250.00	250.00	250.00	250.00	250.00	25.00	No
Alternative B (annual)	0.050	0	-0.135	7.092	1.611	0.095	0.095	0	No

Source: ACAM reports (Appendix L).

Notes: All values are provided as tons per year. VOC = volatile organic compound; NH₃ = ammonia; SO_x = sulfur oxides; NO_x = nitrogen oxides; CO = carbon monoxide; PM₁₀ = inhalable particulate matter with a diameter generally 10 µm or smaller; PM_{2.5} = fine inhalable particulate matter with a diameter generally 2.5 micrometers (µm) or smaller; Pb = lead

B.3.1.5 Alternative C

The effects on air quality under Alternative C would be similar to those under Alternative B, with short-term effects from air emissions generated during construction and long-term beneficial effects from reduced operational emissions as compared to the No Action Alternative.

Construction

The same emission models and assumptions applied under Alternatives A and B were used for Alternative C construction, but using inputs based on the WCS improvements proposed under this alternative.

Air quality effects from construction of Alternative C would be similar in nature and magnitude to those under Alternative B. **Table B.3-6** presents the estimated air pollutant emissions from Alternative C

construction activities. This includes the least restrictive insignificance thresholds for criteria pollutants to determine the level of effects of these emissions sources. While greater than the No Action Alternative, as shown in the table, the total emissions would remain below de minimis levels and under the insignificance thresholds for each of the criteria pollutants; therefore, Alternative C's effects on air quality during construction would be short-term and less than significant.

Table B.3-6. Estimated Construction Emissions under Alternative C.

Alternative	VOC	NH ₃	SO _x	NO _x	CO	PM ₁₀	PM _{2.5}	Pb	Exceedance
De minimis threshold	250.00	250.00	250.00	250.00	250.00	250.00	250.00	25.00	No
Alternative C (5-year annual)	1.497	0.044	0.004	1.978	2.285	32.931	0.010	0	No

Source: ACAM reports (Appendix L).

Notes: All values are provided as tons per year. VOC = volatile organic compound; NH₃ = ammonia; SO_x = sulfur oxides; NO_x = nitrogen oxides; CO = carbon monoxide; PM₁₀ = inhalable particulate matter with a diameter generally 10 µm or smaller; PM_{2.5} = fine inhalable particulate matter with a diameter generally 2.5 micrometers (µm) or smaller; Pb = lead

Canal Improvements

Like Alternative B, Alternative C proposes canal conveyance improvements (i.e., dredging) but in additional canals. Alternative C canal improvements are proposed for the G-08 (Hillsboro) Canal, C-14 (Cypress Creek) Canal, C-13 (Middle River) Canal, C-12 (Plantation) Canal, G-15 (North New River), and C-11 (South New River) Canal. Emissions were calculated based on a 1-year dredging schedule and averaged over a 5-year analysis period to reflect the project's long-term operational context. The BOEM dredging calculator was employed to estimate emissions associated with the physical removal of sediment, while the ACAM was used to quantify emissions from associated shore-side upgrades and sediment disposal operations. Assumptions and considerations in the dredging evaluation are the same as those noted under Alternative B. Emissions from transporting dredged material offsite were incorporated into the ACAM analysis for construction of Alternative C, the results of which are included in **Table B.3-6**.

Table B.3-7 presents the estimated air pollutant emissions from Alternative C canal conveyance improvements. This includes the least restrictive insignificance thresholds for criteria pollutants to determine the level of effects of these emissions sources. While Alternative C canal conveyance improvements result in some emissions as compared to the No Action Alternative, as shown in the table, the total emissions would remain below de minimis levels and under the insignificance thresholds for each of the criteria pollutants; therefore, the effects of canal conveyance improvements on air quality during construction would be short-term and less than significant.

Table B.3-7. Estimated Dredging Emissions under Alternative C.

Alternative	VOC	NH ₃	SO _x	NO _x	CO	PM ₁₀	PM _{2.5}	Pb	Exceedance
De minimis threshold	250.00	250.00	250.00	250.00	250.00	250.00	250.00	25.00	No
Alternative C (5-year annual)	1.70	1.61	1.70	98.81	29.88	3.58	3.47	0	No

Source: BOEM dredging emission calculator (ENVIRON International Corp. and Woods Hole Group 2013)

Notes: All values are provided as tons per year. VOC = volatile organic compound; NH₃ = ammonia; SO_x = sulfur oxides; NO_x = nitrogen oxides; CO = carbon monoxide; PM₁₀ = inhalable particulate matter with a diameter generally 10 µm or smaller; PM_{2.5} = fine inhalable particulate matter with a diameter generally 2.5 micrometers (µm) or smaller; Pb = lead

Operation, maintenance, repair, replacement, and rehabilitation

The same emission models and assumptions applied under Alternatives A and B were used for Alternative C OMRR&R, but using inputs based on the WCS improvements proposed under this alternative. Like Alternatives A and B, emissions from OMRR&R under Alternative C would be below the insignificance indicators; therefore, OMRR&R under Alternative C would not be expected to cause or contribute to any exceedance NAAQS and would have a long-term, beneficial effect on air quality as compared to the No Action Alternative. **Table B.3-8** presents the estimated annual net OMRR&R emissions under Alternative C.

Table B.3-8. Estimated Operations Emissions under Alternative C.

Alternative	VOC	NH ₃	SO _x	NO _x	CO	PM ₁₀	PM _{2.5}	Pb	Exceedance
De minimis threshold	250.00	250.00	250.00	250.00	250.00	250.00	250.00	25.00	No
Alternative C (annual)	0.172	0	-0.091	9.889	2.437	02.20	0.220	0	No

Source: ACAM reports (Appendix L).

Notes: All values are provided as tons per year. VOC = volatile organic compound; NH₃ = ammonia; SO_x = sulfur oxides; NO_x = nitrogen oxides; CO = carbon monoxide; PM₁₀ = inhalable particulate matter with a diameter generally 10 µm or smaller; PM_{2.5} = fine inhalable particulate matter with a diameter generally 2.5 micrometers (µm) or smaller; Pb = lead

B.3.1.6 Alternative RO

The effects on air quality under Alternative RO would be similar to those under Alternatives B and C, with short-term effects from air emissions generated during construction and long-term beneficial effects from reduced operational emissions, as compared to the No Action Alternative.

Construction

The same emission models and assumptions applied under Alternatives B and C were used for Alternative RO construction, but using inputs based on the selected improvements proposed under this alternative. There was a reduction in the amount of dredging to be completed compared to Alternatives B and C, but an increase in canal bank stabilization work to be performed. Air quality effects from construction of Alternative RO would be lower in nature and magnitude to those under Alternatives B and C. **Table B.3-9** presents the estimated air pollutant emissions from Alternative RO construction activities. This includes the least restrictive insignificance thresholds for criteria pollutants to determine the level of effects of these emissions sources. As shown in the table, the total emissions would remain below de minimis levels and under the insignificance thresholds for each of the criteria pollutants. Therefore, while Alternative RO's effects on air quality during construction would be greater than the No Action Alternative, the effects would still be short-term and less than significant.

Table B.3-9. Estimated Construction Emissions under Alternative RO.

Alternative	VOC	NH ₃	SO _x	NO _x	CO	PM ₁₀	PM _{2.5}	Pb	Exceedance
De minimis threshold	250.00	250.00	250.00	250.00	250.00	250.00	250.00	25.00	No
Alternative RO (5-year annual)	0.2996	0.002	0.11	0.777	1.332	46.892	0.078	0	No

Source: ACAM reports (Appendix L).

Notes: All values are provided as tons per year. VOC = volatile organic compound; NH₃ = ammonia; SO_x = sulfur oxides; NO_x = nitrogen oxides; CO = carbon monoxide; PM₁₀ = inhalable particulate matter with a diameter generally 10 µm or smaller; PM_{2.5} = fine inhalable particulate matter with a diameter generally 2.5 micrometers (µm) or smaller; Pb = lead

Canal Improvements

Canal conveyance improvements (i.e., dredging) under Alternative RO are less than those proposed under Alternative B. Emissions from transporting dredged material offsite were incorporated into the ACAM analysis for construction of Alternative RO, the results of which are included in **Table B.3-9**.

Table B.3-10 presents the estimated air pollutant emissions from Alternative RO canal conveyance improvements. This includes the least restrictive insignificance thresholds for criteria pollutants to determine the level of effects of these emissions sources. As shown in the table, the total emissions would remain below de minimis levels and under the insignificance thresholds for each of the criteria pollutants. Therefore, the effects of canal conveyance improvements on air quality during Alternative RO construction, while greater than the No Action Alternative, would be short-term and less than significant.

Table B.3-10. Estimated Dredging Emissions under Alternative RO.

Alternative	VOC	NH ₃	SO _x	NO _x	CO	PM ₁₀	PM _{2.5}	Pb	Exceedance
De minimis threshold	250.00	250.00	250.00	250.00	250.00	250.00	250.00	25.00	No
Alternative RO (5-year annual)	0.313	0.297	0.297	18.402	4.590	0.67	0.659	0	No

Source: BOEM dredging emission calculator (ENVIRON International Corp. and Woods Hole Group 2013)

Notes: All values are provided as tons per year. VOC = volatile organic compound; NH₃ = ammonia; SO_x = sulfur oxides; NO_x = nitrogen oxides; CO = carbon monoxide; PM₁₀ = inhalable particulate matter with a diameter generally 10 µm or smaller; PM_{2.5} = fine inhalable particulate matter with a diameter generally 2.5 micrometers (µm) or smaller; Pb = lead

Operation, Maintenance, Repair, Replacement, and Rehabilitation

The same emission models and assumptions applied under Alternatives B and C were used for Alternative RO OMRR&R, but using inputs based on the WCS improvements proposed under this alternative. Like Alternatives A and B, emissions from OMRR&R under Alternative RO would be below the insignificance indicators. Therefore, OMRR&R under Alternative RO would not be expected to cause or contribute to any exceedance NAAQS and would have a long-term, beneficial effect on air quality as compared to the No Action Alternative. **Table B.3-11** presents the estimated annual net OMRR&R emissions under Alternative RO.

Table B.3-11. Estimated Operations Emissions under Alternative RO.

Alternative	VOC	NH ₃	SO _x	NO _x	CO	PM ₁₀	PM _{2.5}	Pb	Exceedance
De minimis threshold	250.00	250.00	250.00	250.00	250.00	250.00	250.00	25.00	No
Alternative RO (annual)	0.064	0	-0.040	3.937	0.963	0.084	0.084	0	No

Source: ACAM reports (Appendix L).

Notes: All values are provided as tons per year. VOC = volatile organic compound; NH₃ = ammonia; SO_x = sulfur oxides; NO_x = nitrogen oxides; CO = carbon monoxide; PM₁₀ = inhalable particulate matter with a diameter generally 10 µm or smaller; PM_{2.5} = fine inhalable particulate matter with a diameter generally 2.5 micrometers (µm) or smaller; Pb = lead

B.3.2 Greenhouse Gases

The potential impacts to GHGs within the C&SF Section 203 Study Area that could result from implementing the final array of alternatives, including the No Action Alternative, are analyzed below.

B.3.2.1 Methodology

The GHG produced by fossil fuel combustion are primarily carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O). These three GHGs represent more than 97 percent of all U.S. GHG emissions. Emissions of GHG are typically quantified and regulated in units of carbon dioxide equivalents (CO₂e). For the C&SF Section 203 Study, all GHG emissions estimates were derived from various emission sources using the methods, algorithms, emission factors, and global warming potential from the most current *Air Emissions Guide for Air Force Stationary Sources*, *Air Emissions Guide for Air Force Mobile Sources*, and/or *Air Emissions Guide for Air Force Transitory Sources* (AFCEC 2025a,b,c).

B.3.2.2 Future Without Project Conditions (No Action Alternative)

Under the No Action Alternative, there would not be beneficial air quality outcomes associated with reduced fuel consumption and improved combustion efficiency of the upgraded WCS. Lower GHG emissions (e.g., CO₂ and CH₄) would not be realized. In addition, the lack of modernization of aging WCS may hinder opportunities for electrification or integration of renewable energy sources into flood control operations. Therefore, while the No Action Alternative may avoid short-term construction-related GHG emissions, it would result in sustained or increasing long-term emissions that would negatively affect regional air quality and public health.

B.3.2.3 Alternative A

Construction

GHG emissions from Alternative A are estimated to occur from 2027 to 2031. The year 2031 represents the beginning of the steady state where the same emissions would be repeated for the life of the WCS pump stations. While GHG emissions would be greater than under the No Action Alternative (under which no construction would occur), GHG emissions would be negligible when compared to both state and national GHG emission totals. Individually, CO₂, CH₄, and N₂O emissions from Alternative A would also be well below 0.00001 percent of corresponding state and U.S. totals, indicating that the implementation of this alternative would have no meaningful contribution to overall GHG emissions and would not be considered significant under regulatory thresholds.

A summary of GHG emissions expected from the construction of Alternative A on a calendar-year basis through the projected steady state of the action are presented in **Table B.3-12**. A full analysis of GHG emissions under Alternative A is provided in **Appendix L**.

Table B.3-12. Annual Greenhouse Gas Emissions during Construction under All Action Alternatives.

		CO ₂	CH ₄	N ₂ O	CO ₂ e
2027-2031	State Total	1,137,023,235	2,762,139	290,244	1,291,277,861
2027-2031	U.S. Total	25,682,270,895	128,134,558	7,503,538	31,258,476,148
Alternative A Total GHG Relative Significance (mtpy)					
2027-2031	Action Years	5,516	0.198555	0.172522	5,495
Percent of State Totals		0.000485126%	0.000007188%	0.00005944%	0.000425547%
Percent of U.S. Totals		0.000%	0.000%	0.000%	0.000%
Alternative B Total GHG Relative Significance (mtpy)					
2027-2031	Action Years	10,234	0.165622	0.209337	10,234

		CO ₂	CH ₄	N ₂ O	CO ₂ e
Percent of State Totals		0.00090007%	0.000005996%	0.000072124%	0.000792548%
Percent of U.S. Totals		0.000%	0.000	0.000%	0.000%
Alternative C Total GHG Relative Significance (mtpy)					
2027-2031	Action Years	10,234	0.165622	0.209337	10,234
Percent of State Totals		00090007%	0.000005996%	0.000072124%	0.000792548%
Percent of U.S. Totals		0.000%	0.000%	0.000%	0.000%
Alternative RO Total GHG Relative Significance (mtpy)					
2027-2031	Action	4,280	0.04235	0.044718	4,280.100
Percent of State Totals		0.000376421%	0.000001533%	0.000015407%	0.000331462%
Percent of U.S. Totals		0.000016665%	0.000000033%	0.000000596%	0.000013692%

Source: ACAM reports (Appendix L).

Notes: mtpy = metric tons per year. CO₂e = carbon dioxide equivalents (accounting for the global warming potential of each GHG)

Operation, Maintenance, Repair, Replacement, and Rehabilitation

Beginning in the year 2031 and during the OMRR&R phase, annual emissions from the WCS pump stations would remain the same; this is referred to as steady state emissions. The annual steady state GHG emissions for Alternative A are provided in **Table B.3-13**. The table illustrates the anticipated reduction in GHG emissions during steady-state operations as compared to the No Action Alternative following the replacement of four large diesel generators with grid-supplied electricity. There is sizable reduction due to lower aggregated run time with data indicating the proposed operational emissions are below quantifiable calculation thresholds, resulting in de minimis impacts on overall GHG output. Because grid electricity is derived from a mix of renewable and lower-carbon energy sources, emissions per unit of energy are substantially lower than those from onsite diesel generation. Overall, this conversion would meaningfully reduce direct GHG emissions during normal operations as compared to the No Action Alternative, improving the carbon profile while maintaining compliance with applicable air quality and climate standards.

Table B.3-13. Annual Steady State Greenhouse Gas Emissions (starting in 2031) during Operations under All Action Alternatives.

Alternative	CO ₂	CH ₄	N ₂ O	CO ₂ e	Threshold	Exceedance
Alternative A	-300	-0.01207498	-0.00241489	-347	68,039	No
Alternative B	-300	-0.01207498	-0.00241489	-347	68,039	No
Alternative C	-275	-0.01106699	-0.0022133	-318	68,039	No
Alternative RO	-300	-0.01207498	-0.00241489	-347	68,039	No

Source: ACAM reports (Appendix L).

Notes: All quantities are in metric tons per year (mtpy). CO₂e = carbon dioxide equivalents (accounting for the global warming potential of each GHG)

B.3.2.4 Alternative B

Construction

GHG emissions from Alternative B are estimated to occur from 2027 to 2031. While GHG emissions would be greater than under the No Action Alternative, emissions would be negligible when compared to both state and national totals. Individually, CO₂, CH₄, and N₂O emissions from Alternative B would also be well below 0.001 percent of corresponding state and U.S. totals, indicating that the implementation of Alternative B would have no meaningful contribution to overall GHG emissions and would not be considered significant under regulatory thresholds. A summary of GHG emissions expected

from the implementation of Alternative B on a calendar-year basis through the projected steady state of the action are presented in **Table B.3-12**. A full analysis of GHG emissions under Alternative B is provided in **Appendix L**.

Operation, Maintenance, Repair, Replacement, and Rehabilitation

Beginning in the year 2031 and during the OMRR&R phase, annual emissions from the WCS pump stations would remain the same. The annual steady state GHG emissions for Alternative B are provided in **Table B.3-13**. Like Alternative A, an overall reduction in direct GHG emissions during normal operations is expected from Alternative B as compared to the No Action Alternative.

B.3.2.5 Alternative C

Construction

GHG emissions under Alternative C would be similar in nature and magnitude to those under Alternative B, but would be greater than the No Action Alternative. A summary of GHG emissions expected from the implementation of Alternative C on a calendar-year basis through the projected steady state of the action are presented in **Table B.3-12**. A full analysis of GHG emissions under Alternative C is provided in **Appendix L**.

Operation, Maintenance, Repair, Replacement, and Rehabilitation

Beginning in the year 2031 and during the OMRR&R phase, annual emissions from the WCS pump stations would remain the same. The annual steady state GHG emissions for Alternative C are provided in **Table B.3-13**. Alternative C would result in an overall reduction in direct GHG emissions during normal operations as compared to the No Action Alternative.

B.3.2.6 Alternative RO

Construction

GHG emissions under Alternative RO would be similar in nature and magnitude to those under Alternatives B and C, and would be greater than the No Action Alternative. A summary of GHG emissions expected from the implementation of Alternative RO on a calendar-year basis through the projected steady state of the action are presented in **Table B.3-12**. A full analysis of GHG emissions under Alternative RO is provided in **Appendix L**.

Operation, Maintenance, Repair, Replacement, and Rehabilitation

Beginning in the year 2031 and during the OMRR&R phase, annual emissions from the WCS pump stations would remain the same. The annual steady state GHG emissions for Alternative RO are provided in **Table B.3-13**. Alternative RO would result in an overall reduction in direct GHG emissions during normal operations as compared to the No Action Alternative.

B.3.3 Climate

B.3.3.1 Future Without Project Conditions (No Action Alternative)

Climatological conditions in South Florida are expected to continue along a trajectory of intensifying weather patterns, including stronger storms and increased flood events. These climate trends will persist regardless of the implementation of the project.

B.3.3.2 Alternative A

Climatological conditions in South Florida will continue to intensify, with stronger storms and floods, unaffected by the proposed upgrading of flood control infrastructure under Alternative A.

B.3.3.3 Alternative B

Climatological conditions in South Florida will continue to intensify, with stronger storms and floods, unaffected by the proposed upgrading of flood control infrastructure under Alternative B.

B.3.3.4 Alternative C

Climatological conditions in South Florida will continue to intensify, with stronger storms and floods, unaffected by the proposed upgrading of flood control infrastructure under Alternative C.

B.3.3.5 Alternative RO

Climatological conditions in South Florida will continue to intensify, with stronger storms and floods, unaffected by the proposed upgrading of flood control infrastructure under Alternative RO.

B.3.4 Noise

The potential noise impacts within the C&SF Section 203 Study Area that could result from implementing any of the alternatives under consideration in the final array of alternatives for the C&SF Section 203 Study, including the No Action Alternative, are analyzed below. Particular focus is provided on potential impacts to noise sensitive receptors (NSRs) including, but not limited to, nearby residences, schools, libraries, hospitals, nursing home facilities, and recreational areas. Construction and operational noise is evaluated using two separate modeling approaches. Construction noise is evaluated using a screening-level analysis approach that follows guidelines provided by the EPA while operational noise is analyzed using CadnaA.

B.3.4.1 Construction Noise Modeling Approach

Acoustic emission levels for activities associated with construction were based upon typical ranges of energy equivalent noise levels at construction sites, as documented by the EPA (EPA 1971) and the EPA's "Construction Noise Control Technology Initiatives" (EPA 1980). The EPA methodology distinguishes between type of construction and construction phase. Using those energy equivalent noise levels as input to a basic propagation model, construction noise levels were calculated at the closest NSRs.

The basic model assumed spherical wave divergence from a point source located at the acoustic center of the construction site. Furthermore, the model conservatively assumed that all pieces of construction

equipment associated with an activity would operate simultaneously for the duration of that activity. An additional level of conservatism was built into the construction noise model by excluding potential shielding effects due to intervening structures and buildings along the propagation path from the construction site to receiver locations.

B.3.4.2 Operational Noise Modeling Approach

The CadnaA computer noise model is used to calculate sound pressure levels associated with OMRR&R. An industry standard, CadnaA was developed by DataKustik GmbH to provide an estimate of sound levels at distances from sources of known emission (DataKustik 2024). It is used by acousticians and acoustic engineers because it has the capability to accurately describe noise emission and propagation from complex facilities and developments, and it in most cases yields conservative sound pressure level results.

The current International Organization for Standardization (ISO) standard for outdoor sound propagation, ISO 9613 Part 2, “Attenuation of Sound during Propagation Outdoors,” is used within CadnaA. The method described in this standard calculates sound attenuation under weather conditions that are favorable for sound propagation, such as downwind propagation or atmospheric inversion. The calculation of sound propagation from source to receiver locations consists of full octave-band sound frequency algorithms that incorporate the following physical effects:

- Geometric spreading wave divergence
- Reflection from surfaces
- Atmospheric absorption at 10 degrees Celsius and 70 percent relative humidity
- Screening by topography and obstacles
- Effects of terrain features including relative elevations of noise sources
- Sound power levels from stationary and mobile sources
- Locations of noise-sensitive land use types
- Intervening objects including buildings and barrier walls to the extent included in a project’s design
- Ground effects due to areas of pavement and unpaved ground
- Sound power at multiple frequencies
- Source directivity factors
- Multiple noise sources and source type (point, area, and/or line
- Average of a predicted sound levels over a given time period

Topographical information is imported into the acoustic model using the official U.S. Geological Survey digital elevation dataset to accurately represent terrain in three dimensions. Terrain conditions, vegetation type, ground cover, and the density and height of foliage can also influence the absorption that takes place when sound waves travel over land. The ISO 9613-2 standard accounts for ground absorption rates by assigning a numerical coefficient of $G=0$ for acoustically hard, reflective surfaces and $G=1.0$ for absorptive surfaces and soft ground. If the ground is hard-packed dirt, which is typically found in industrial complexes, pavement, and bare

rock, or for sound traveling over water, the absorption coefficient is defined as $G=0.0$ to account for reduced sound attenuation and higher reflectivity. In contrast, ground covered in vegetation, including suburban lawns and agricultural fields (both fallow with bare soil and planted with crops), will be acoustically absorptive and aid in sound attenuation (i.e., $G=1.0$). A combination of reflective ($G=0$) and mixed/semi-reflective ($G=0.5$) ground factors are used in this acoustic modeling analysis. In addition to geometrical divergence, attenuation factors include topographical features, terrain coverage, and/or other natural or anthropogenic obstacles that can affect sound attenuation and result in acoustical screening. To be conservative, sound attenuation through foliage and diffraction around and over existing anthropogenic structures such as buildings is ignored.

B.3.4.3 Future Without Project Conditions (No Action Alternative)

Under the No Action Alternative, structural measures (including operational activities, such as pre-storm drawdown of water in canals) and nature-based measures would not be constructed or undertaken. The existing WCS and primary canals that are the focus of this C&SF Section 203 Study would not be improved in any way. Since there would be no construction activities or other WCS improvements, associated noise emissions and OMRR&R sound levels would remain consistent with existing conditions.

B.3.4.4 Alternative A

Construction

Noise impacts from construction are dependent on the noise generated by the construction equipment and the location and sensitivity of affected land uses, as well as the timing and duration of the activities. Noise levels adjacent to active construction sites would increase during construction. Construction equipment can be stationary and mobile. Stationary equipment operates at one location for various periods of time with fixed-power operation, such as pumps, generators, and compressors, or a variable noise operation, such as pile drivers, rock drills, and pavement breakers.

Mobile equipment moves around the construction site such as bulldozers, graders, and loaders (FHWA 2006). The primary mobile equipment used in the C&SF Section 203 Study would include heavy trucks, dozers, loaders, and excavators. For the purposes of noise impact analysis, all construction equipment is assumed to be powered by diesel engines. Typical maximum noise levels and duty cycles generated by various pieces of construction equipment are listed in **Table B.3-14**.

As shown in **Table B.3-14**, maximum noise levels ($L_{\max}$) range from 70 to 95 dBA at 50 feet. In typical construction projects, grading and impact activities typically generate the highest noise levels. Grading involves the largest heaviest equipment and typically includes bulldozers, excavators, dump trucks, front-end loaders, and graders.

Each phase of construction has a specific equipment mix, depending on the work to be accomplished during that phase. Each phase also has its own noise characteristics; some phases will have higher continuous noise levels than others, and some have high-impact noise levels. The L_{eq} of each phase is determined by combining the L_{eq} contributions from each piece of equipment used in that phase (FTA 2006). Typical construction projects, with equipment moving from one point to another, work breaks, and idle time, have hourly average noise levels that are lower than loud short-term, or instantaneous, peak noise events, as shown in **Table B.3-14**. Hourly average noise levels are approximately 75 to 80 dBA L_{eq} at 50 feet from the construction activity. For purposes of this analysis, a maximum 1-hour average

noise level of 80 dBA L_{eq} at 50 feet from the center of the construction site is assumed to occur; noise levels of other activities would be less. However, maximum noise levels of 90 dBA L_{max} at 50 feet may occur during grading and excavation, when several pieces of equipment are operating in combination with backup alarms, near the construction site periphery.

Table B.3-14. Construction Equipment Noise Levels.

Equipment	Typical Duty Cycle	Maximum Sound Pressure Level at 50 feet (dBA)
Crawler Crane	16%	85
Off-road Truck	40%	85
Water Truck	40%	80
Front End Loader	40%	80
Dump Truck	40%	84
Roller	20%	85
Dozer	40%	85
Excavator	40%	85
Skid Steer	40%	80

No construction noise-related impacts are expected for the C-14 West Basin and the C-11 West Basin watersheds under Alternative A, since there are no structural or nature-based measures proposed. For these watersheds, noise effects would be the same as under the No Action Alternative. The other seven watersheds (Hillsboro Canal Basin, Pompano Canal Basin, C-14 East Basin, C-13 West Basin, C-12 West Basin, North New River Canal West Basin, and the C-11 East Basin) would require construction to support the planned WCS improvements. CadnaA was used to calculate predicted received sound levels at the closest NSRs assuming the average noise level of 80 dBA L_{eq} at 50 feet from the center of the construction area. **Table B.3-15** presents the results of the acoustic modeling analysis for Alternative A construction activities at the seven identified watersheds. At all these watersheds, noise impacts would be greater than under the No Action Alternative.

Table B.3-15. Alternative A: Potential Construction Noise Impacts at Noise Sensitive Receptors.

Watershed Name	Water Control Structure	Approximate Distance to Closest NSR (feet) and Direction	Type of NSR	Predicted Received Sound Level (dBA)
C-11 West Basin	S-13AW Gated Culvert	337 (NE)	Church (Kingdom Hall of Jehovah's Witnesses)	No construction planned
North New River Canal West Basin	G-54 Gated Spillway	130 (NE)	Residence	71
C-11 East Basin	S-13 Pump Station and Gated Spillway	279 (SW)	Residence	64
C-12 West Basin	S-33 Gated Spillway	210 (SW)	Residence	67
C-13 West Basin	S-36 Gated Spillway	141 (SW)	Apartment/Condominium Complex	71
C-14 East Basin	S-37A Gated Spillway	197 (S)	Park (Baseball Field)	69
C-14 West Basin	S-37B Gated Spillway	278 (W)	Apartment/Condominium Complex	No construction planned
Pompano Canal Basin	G-57 Gated Spillway	80 (SW)	Apartment/Condominium Complex	77
Hillsboro Canal Basin	G-56 Gated Spillway	176 (N)	Residence	71

Note: NSR = noise sensitive receptor

Traffic noise generated during construction on and offsite would also add to overall sound levels. Construction activity would generate traffic having potential noise effects, such as trucks traveling to and from the construction site on public roads; however, such noise would be short term. Construction may generate noise levels that exceed the ambient levels and has the potential to cause a temporary and short term disturbance. Noise impacts during construction activities would be minimized by employing best management practices (BMPs), such as the following:

- Noisy equipment would be located as far from possible from NSRs.
- Contractors would limit the operational equipment on-site to only that necessary for construction.
- Contractors and subcontractors would be required to properly maintain their equipment and have quality mufflers installed.
- Where practicable and feasible, particularly noisy equipment would be fitted with additional noise control measures, including silencers or mufflers on equipment exhausts, and/or shrouds or wraps on equipment engines or motors.
- Construction-related vehicles containing a compression brake system or systems (e.g., jake brakes) would not be permitted to use their compression brakes while operating on a public road or ROW except under emergency conditions.
- Contractors would be required to comply with signage posted on local roads used to access and depart the site.
- Where practicable and feasible and as allowed by applicable laws and regulations, backup alarm noise on the site would be minimized.
- Dump trucks, muck bins, and other containers used to transport soil or rock to, from, or around the site would be outfitted with rubberized liners to reduce the amount of noise generated from materials being loaded into the containers.
- Traffic associated with each upcoming construction task would be examined to determine whether there would be a way to alter the schedule or route of the traffic to reduce the amount of noise generated at sensitive receptors by off-site traffic trips.
- Pertinent stakeholders would be informed of the time and dates of any exceptional truck activity (oversized/weight transport of loads) and other noise activities (e.g., hoe ram operation) and coordinate with the appropriate entities to ensure safe and efficient traffic conditions on the roadways in the area.
- A noise complaint resolution program would be developed to address resident complaints during construction.

Operation, Maintenance, Repair, Replacement, and Rehabilitation

OMRR&R of Alternative A facilities varies by watershed. For the C-11 West Basin, North New River Canal West Basin, C-13 West Basin, C-14 West Basin, Pompano Canal Basin, and Hillsboro Canal Basin, there are no new facilities proposed for construction or new facility construction would be limited to installing new spillways or modifying existing spillways. Sound generated by gated spillways is expected to be low level and likely at or below ambient sound levels during normal operation, where sound sources are

limited to that produced from the water flow and mechanical components. During infrequent atypical operation, a standby generator may be needed, which produces a sound pressure level of approximately 85 dBA at a distance of 23 feet from the generator; however, any resultant impacts at NSRs would be short-term and temporary. Noise effects from OMRR&R at these watersheds is therefore expected to be the same as the No Action Alternative.

For the C-14 East Basin, C-12 West Basin, and C-11 East Basin, new pump stations would be installed. Pump stations consist of several essential components that work together to transport water as needed between two locations. The pumps themselves generate sound associated with the mechanical energy needed to move water. Different types of pumps, such as axial flow, centrifugal or submersible pumps, are selected based on the specific requirements of the system. The pumps and the motors that drive the pumps are sized to provide the optimal pump performance and efficiency and can contribute to overall noise levels. Lastly, pump stations are connected to an intricate network of pipelines and valves, which transport water to and from the station, regulate flow rates, and control water distribution. Vibrations within the pump and/or associated pipeline can occur due to imbalances in the system that can cause resonance, amplifying the noise emitted by the pump. The potential operational noise impacts associated with those sites is described in the following subsections.

The C-11 East Basin watershed would have a new pump station that would house four 473-HP main pumps (two 115-cfs pumps and two 235-cfs pumps) and one 235-cfs auxiliary pump, which would increase the total design discharge capacity to 700 cfs. The closest NSR relative to the C-11 East Basin is 279 feet away and the predicted received sound level from the new pump station is 38 dBA.

The C-12 West Basin watershed would also have a new pump station constructed, which would house three 297-HP main pumps (170 cfs each) and one 170-cfs auxiliary pump, for a total design discharge capacity of 510 cfs. The closest NSR relative to the C-12 West Basin is 210 feet away and the predicted received sound level from the new pump station is 39 dBA.

The pump station that would be installed at the C-14 East Basin watershed would house three 755-HP main pumps that are each 400 cfs capacity and one 400-cfs auxiliary pump, for a total design discharge capacity of 1,200 cfs. The closest NSR relative to the C-14 East Basin is 197 feet away and the predicted received sound level from the new pump station is 44 dBA.

The pumps at all pump stations would be housed within a building constructed of reinforced concrete. Auxiliary pumps were not included as part of the acoustic modeling analysis as they are not expected to operate under normal conditions. **Table B.3-16** summarizes the potential acoustic impacts at NSRs related to Alternative A operations. For C-14 East Basin, C-12 West Basin, and C-11 East Basin, noise impacts from OMRR&R under Alternative A are expected to be greater than under the No Action Alternative due to the proposed new pump stations; however, such impacts are expected to be minor.

Table B.3-16. Alternative A: Potential Operational Noise Impacts at Noise Sensitive Receptors.

Watershed Name	Water Control Structure	Approximate Distance to Closest NSR (feet) and Direction	Type of NSR	Predicted Received Sound Level (dBA)
C-11 West Basin	S-13AW Gated Culvert	337 (NE)	Church (Kingdom Hall of Jehovah's Witnesses)	N/A
North New River Canal West Basin	G-54 Gated Spillway	130 (NE)	Residence	N/A
C-11 East Basin	S-13 Pump Station and Gated Spillway	279 (SW)	Residence	38
C-12 West Basin	S-33 Gated Spillway	210 (SW)	Residence	39
C-13 West Basin	S-36 Gated Spillway	141 (SW)	Apartment/Condominium Complex	N/A
C-14 East Basin	S-37A Gated Spillway	197 (S)	Park (Baseball Field)	44
C-14 West Basin	S-37B Gated Spillway	278 (W)	Apartment/Condominium Complex	N/A
Pompano Canal Basin	G-57 Gated Spillway	80 (SW)	Apartment/Condominium Complex	N/A
Hillsboro Canal Basin	G-56 Gated Spillway	176 (N)	Residence	N/A

Note: NSR = noise sensitive receptor

B.3.4.5 Alternative B

Construction

Under Alternative B, construction noise impacts are expected to be relatively comparable to those analyzed for Alternative A (and greater than the No Action Alternative) except that construction is also proposed for the C-14 West Basin and the C-11 West Basin watersheds.

Under Alternative B, structural measures to the C-14 West Basin would include building a new gated spillway with three 25-foot-wide roller gates approximately 230 feet north (upstream) of the existing S-37B Gated Spillway. Additionally, an approximately 1.2-linear-mile section of the C-14 (Cypress Creek) Canal, extending north and then west of the S-37B Gated Spillway, would be excavated to enlarge the canal cross section. For the C-11 West Basin, structural measures would include excavating an approximately 8.4-linear-mile section of the C-11 (South New River) Canal in both the C-11 West Basin and C-11 East Basin, between the Winkopp Bridge and the S-13 Pump Station and Gated Spillway.

Table B.3-17 presents the results of the acoustic modeling analysis for Alternative B construction activities at the seven identified watersheds. The BMPs outlined under the Alternative A discussion would be implemented as part of Alternative B construction, as feasible.

Table B.3-17. Alternative B: Potential Construction Noise Impacts at Noise Sensitive Receptors.

Watershed Name	Water Control Structure	Approximate Distance to Closest NSR (feet) and Direction	Type of NSR	Predicted Received Sound Level (dBA)
C-11 West Basin	S-13AW Gated Culvert	337 (NE)	Church (Kingdom Hall of Jehovah's Witnesses)	63

Watershed Name	Water Control Structure	Approximate Distance to Closest NSR (feet) and Direction	Type of NSR	Predicted Received Sound Level (dBA)
North New River Canal West Basin	G-54 Gated Spillway	130 (NE)	Residence	71
C-11 East Basin	S-13 Pump Station and Gated Spillway	279 (SW)	Residence	64
C-12 West Basin	S-33 Gated Spillway	210 (SW)	Residence	67
C-13 West Basin	S-36 Gated Spillway	141 (SW)	Apartment/Condominium Complex	71
C-14 East Basin	S-37A Gated Spillway	197 (S)	Park (Baseball Field)	69
C-14 West Basin	S-37B Gated Spillway	278 (W)	Apartment/Condominium Complex	65
Pompano Canal Basin	G-57 Gated Spillway	80 (SW)	Apartment/Condominium Complex	77
Hillsboro Canal Basin	G-56 Gated Spillway	176 (N)	Residence	71

Note: NSR = noise sensitive receptor

Operation, Maintenance, Repair, Replacement, and Rehabilitation

Alternative B differs from Alternative A because the new pump station in the C-11 East Basin would house a greater pump capacity consisting of two 347-HP 180-cfs pumps, two 675-HP 360-cfs pumps, and one 360-cfs auxiliary pump. The total design discharge capacity would be 1,080 cfs. The closest NSR relative to the C-11 East Basin is 279 feet away and the predicted received sound level from the new pump station is 41 dBA.

Changes to operations at C-12 West Basin is the same as described under Alternative A.

The C-13 West Basin would also have a new pump station, which would house three 260-HP main pumps (170 cfs each) and one 170-cfs auxiliary pump, for a total design discharge capacity of 510 cfs. The closest NSR relative to the C-13 West Basin is 141 feet away and the predicted received sound level from the new pump station is 41 dBA.

C-14 East Basin would house a greater pump capacity than Alternative A, consisting of three 991-HP, 500-cfs main pumps and one 500-cfs auxiliary pump, for a total design discharge capacity of 1,500 cfs. The closest NSR relative to the C-14 East Basin is 197 feet away and the predicted received sound level from the new pump station is 46 dBA.

Under Alternative B, the North New River Canal West Basin would not have a new pump station but there would be one constructed as part of a nature-based measure, the Markham Park Stormwater Storage Capacity Improvement project. However, the specifications of that pump station have not been determined at this stage of alternatives development.

No modifications that would result in potential operational noise impacts would occur at the C-11 West Basin, North New River Canal West Basin, C-14 West Basin, Pompano Canal Basin, and Hillsboro Canal Basin. **Table B.3-18** summarizes the potential acoustic impacts at NSRs related to Alternative B operations. Overall, OMRR&R noise impacts under Alternative B are expected to be greater than the No Action Alternative due to proposed new pump stations; however, such impacts are expected to be minor.

Table B.3-18. Alternative B: Potential Operational Noise Impacts at Noise Sensitive Receptors.

Watershed Name	Water Control Structure	Approximate Distance to Closest NSR (feet) and Direction	Type of NSR	Predicted Received Sound Level (dBA)
C-11 West Basin	S-13AW Gated Culvert	337 (NE)	Church (Kingdom Hall of Jehovah's Witnesses)	N/A
North New River Canal West Basin	G-54 Gated Spillway	130 (NE)	Residence	N/A
C-11 East Basin	S-13 Pump Station and Gated Spillway	279 (SW)	Residence	41
C-12 West Basin	S-33 Gated Spillway	210 (SW)	Residence	39
C-13 West Basin	S-36 Gated Spillway	141 (SW)	Apartment/Condominium Complex	41
C-14 East Basin	S-37A Gated Spillway	197 (S)	Park (Baseball Field)	46
C-14 West Basin	S-37B Gated Spillway	278 (W)	Apartment/Condominium Complex	N/A
Pompano Canal Basin	G-57 Gated Spillway	80 (SW)	Apartment/Condominium Complex	N/A
Hillsboro Canal Basin	G-56 Gated Spillway	176 (N)	Residence	N/A

Note: NSR = noise sensitive receptor

B.3.4.6 Alternative C

Construction

Under Alternative C, construction noise impacts are expected to be relatively comparable to those analyzed under Alternative B, and greater than the No Action Alternative. Construction may generate noise levels that exceed ambient levels and has the potential to cause a temporary and short-term disturbance. BMPs would be implemented to minimize the impact of noise resulting from construction activities, as discussed above.

Operation, Maintenance, Repair, Replacement, and Rehabilitation

Alternative C for the North New River Canal West Basin would include a new pump station adjacent to the new gated spillway. The pump station would house three 447-HP main pumps (270 cfs each) and one 270-cfs auxiliary pump, for a total design pumping capacity of 810 cfs. The closest NSR relative to the North New River Canal West Basin is 130 feet away and the predicted received sound level from the new pump station is 48 dBA.

For C-11 East Basin, Alternative C differs from Alternatives A and B because the new pump station would have greater pump capacity, consisting of two 460-HP 250-cfs pumps, two 961-HP 500-cfs pumps, and one 500-cfs auxiliary pump. The total design discharge capacity would be 1,500 cfs. The closest NSR relative to the C-11 East Basin is 279 feet away and the predicted received sound level from the new pump station is 43 dBA.

The pump station for C-12 West Basin under Alternative C would have greater capacity than in Alternatives A or B, with three 443-HP main pumps (235 cfs each) and one 235-cfs auxiliary pump, for a total pumping design capacity of 705 cfs. The closest NSR relative to the C-12 West Basin is 210 feet away and the predicted received sound level from the new pump station is 42 dBA.

For C-13 West Basin, Alternative C is like Alternative B because a new pump station would be constructed; however, under Alternative C, the pump station would have greater capacity, with three 295-HP main pumps (200 cfs each) and one 200-cfs auxiliary pump, for a total design discharge capacity of 600 cfs. The closest NSR relative to the C-13 West Basin is 141 feet away and the predicted received sound level from the new pump station is 42 dBA.

The C-14 East Basin would have the same pump configuration as proposed under Alternative A, with the same resulting noise impacts as Alternative A.

Under Alternative C, Pompano Basin would have a new pump station that would house three 169-HP main pumps (100 cfs each) and one 100-cfs auxiliary pump, for a total design pumping capacity of 300 cfs. Alternative C is the only alternative that includes a pump station for the new G-57 Gated Spillway. The closest NSR relative to the Pompano Basin is 80 feet away and the predicted received sound level from the new pump station is 46 dBA.

Under Alternative C, for the Hillsboro Canal Basin, a new pump station would be constructed adjacent to the new gated spillway. The pump station would house three 505-HP main pumps (335 cfs each) and one 335-cfs auxiliary pump, for a total design pumping capacity of 1,005 cfs. The closest NSR relative to the Hillsboro Canal Basin is 176 feet away and the predicted received sound level from the new pump station is 50 dBA. There would also be a pump station constructed as part of a nature-based measure, the Hillsboro Watershed Stormwater Storage Capacity Improvement project. However, the specifications of that pump station have not been determined at this stage of alternatives development.

No modifications that would result in potential operational noise impacts would occur at the C-11 West Basin and C-14 West Basin. **Table B.3-19** summarizes the potential acoustic impacts at NSRs related to Alternative C operations. OMRR&R noise impacts under Alternative C are expected to be greater than the No Action Alternative due to proposed new pump stations; however, such impacts are expected to be minor.

Table B.3-19. Alternative C: Potential Operational Noise Impacts at Noise Sensitive Receptors.

Watershed Name	Water Control Structure	Approximate Distance to Closest NSR (feet) and Direction	Type of NSR	Predicted Received Sound Level (dBA)
C-11 West Basin	S-13AW Gated Culvert	337 (NE)	Church (Kingdom Hall of Jehovah's Witnesses)	N/A
North New River Canal West Basin	G-54 Gated Spillway	130 (NE)	Residence	48
C-11 East Basin	S-13 Pump Station and Gated Spillway	279 (SW)	Residence	43
C-12 West Basin	S-33 Gated Spillway	210 (SW)	Residence	42
C-13 West Basin	S-36 Gated Spillway	141 (SW)	Apartment/Condominium Complex	42
C-14 East Basin	S-37A Gated Spillway	197 (S)	Park (Baseball Field)	44
C-14 West Basin	S-37B Gated Spillway	278 (W)	Apartment/Condominium Complex	N/A
Pompano Canal Basin	G-57 Gated Spillway	80 (SW)	Apartment/Condominium Complex	46

Watershed Name	Water Control Structure	Approximate Distance to Closest NSR (feet) and Direction	Type of NSR	Predicted Received Sound Level (dBA)
Hillsboro Canal Basin	G-56 Gated Spillway	176 (N)	Residence	50

Note: NSR = noise sensitive receptor

B.3.4.7 Alternative RO

Construction

Under Alternative RO, construction noise impacts are expected to be relatively comparable to those analyzed under Alternatives B and C, and greater than under the No Action Alternative. Construction may generate noise levels that exceed ambient levels and has the potential to cause a temporary and short-term disturbance. BMPs would be implemented to minimize the impact of noise resulting from construction activities, as discussed above.

Operation, Maintenance, Repair, Replacement, and Rehabilitation

For Alternative RO, the North New River Canal West Basin would include a new pump station adjacent to the new gated spillway. The pump station would house three 447-HP main pumps (270 cfs each) and one 270-cfs auxiliary pump, for a total design pumping capacity of 810 cfs. The closest NSR relative to the North New River Canal West Basin is 130 feet away and the predicted received sound level from the new pump station is 48 dBA. Operational noise impacts are identical to those predicted for Alternative C.

For C-11 East Basin, a new pump station will be installed with a pump capacity consisting of two 347-HP 180-cfs pumps, two 675-HP 360-cfs pumps, and one 360-cfs auxiliary pump. The total design discharge capacity would be 1,080 cfs. The closest NSR relative to the C-11 East Basin is 279 feet away and the predicted received sound level from the new pump station is 41 dBA. Operational noise impacts are identical to those predicted for Alternative B.

The C-12 West Basin watershed would also have a new pump station constructed, which would house three 297-HP main pumps (170 cfs each) and one 170-cfs auxiliary pump, for a total design discharge capacity of 510 cfs. The closest NSR relative to the C-12 West Basin is 210 feet away and the predicted received sound level from the new pump station is 33 dBA. Predicted operational noise impacts at the C-12 West Basin will be lower than those predicted at Alternatives A, B, and C.

The C-13 West Basin would also have a new pump station, which would house three 260-HP main pumps (170 cfs each) and one 170-cfs auxiliary pump, for a total design discharge capacity of 510 cfs. The closest NSR relative to the C-13 West Basin is 141 feet away and the predicted received sound level from the new pump station is 41 dBA. Operational noise impacts are identical to those predicted for Alternative B.

The pump station that would be installed at the C-14 East Basin watershed would house three 755-HP main pumps that are each 400-cfs capacity and one 400-cfs auxiliary pump, for a total design discharge capacity of 1,200 cfs. The closest NSR relative to the C-14 East Basin is 197 feet away and the predicted

received sound level from the new pump station is 44 dBA. Operational noise impacts are identical to those predicted for Alternative C.

No modifications that would result in potential operational noise impacts would occur at the C-11 West Basin, C-14 West Basin, Pompano Canal Basin, and Hillsboro Canal Basin. **Table B.3-20** summarizes the potential acoustic impacts at NSRs related to Alternative RO operations. Overall, OMRR&R noise impacts under Alternative RO are expected to be greater than the No Action Alternative due to proposed new pump stations; however, such impacts are expected to be minor.

Table B.3-20. Alternative RO: Potential Operational Noise Impacts at Noise Sensitive Receptors.

Watershed Name	Water Control Structure	Approximate Distance to Closest NSR (feet) and Direction	Type of NSR	Predicted Received Sound Level (dBA)
C-11 West Basin	S-13AW Gated Culvert	337 (NE)	Church (Kingdom Hall of Jehovah's Witnesses)	N/A
North New River Canal West Basin	G-54 Gated Spillway	130 (NE)	Residence	48
C-11 East Basin	S-13 Pump Station and Gated Spillway	279 (SW)	Residence	41
C-12 West Basin	S-33 Gated Spillway	210 (SW)	Residence	33
C-13 West Basin	S-36 Gated Spillway	141 (SW)	Apartment/Condominium Complex	41
C-14 East Basin	S-37A Gated Spillway	197 (S)	Park (Baseball Field)	44
C-14 West Basin	S-37B Gated Spillway	278 (W)	Apartment/Condominium Complex	N/A
Pompano Canal Basin	G-57 Gated Spillway	80 (SW)	Apartment/Condominium Complex	N/A
Hillsboro Canal Basin	G-56 Gated Spillway	176 (N)	Residence	N/A

B.3.5 Hydrology

An analysis of the potential impacts to hydrology from the No Action Alternative and implementation of the action alternatives is presented below.

B.3.5.1 Future Without Project Conditions (No Action Alternative)

Under the No Action Alternative, there would be no improvements to the existing WCS. Without structural improvements, there would be a negative impact on hydrology within the Study Area. Increased rainfall intensity, duration, and frequency, and increases in sea level are expected within the region in the future. These changing conditions would result in a reduction of the C&SF system efficiency and a resulting reduction in future flood protection levels of service.

B.3.5.2 Alternative A

Alternative A represents the least complex alternative. **Table B.3-21** below details the effects of Alternative A on hydrology by location in each of the upstream watershed basins. The table also presents a high-level summary of H&H modeling results including the total acres over which a decrease in inundation has been predicted through modeling and the total area over which an increase in inundation depth is predicted for each of the upstream watershed basins. Modeling results are

presented for two cases: a worst case scenario assuming a 100-year surge event, 100-year rainfall event, and high 2085 sea level rise (100S100R85H) and an intermediate case scenario assuming a 2-year surge, 25-year rainfall event, and intermediate 2085 sea level rise (2S25R85I). **Table B.3-22** provides a breakdown in the change of inundation in acres in each of the upstream watershed basins. This is followed by change in inundation depth maps for the entire Study Area (upstream and downstream watershed basins) for the two scenarios (**Figure B.3-1** and **Figure B.3-2**).

Table B.3-21. Effects of Alternative A on Hydrology in the Upstream Watershed Basins.

WCS	Watershed / Canal	Effects on Hydrology	Total Acres with Decreased Inundation Depth		Total Acres with Increased Inundation Depth	
			Worst Case	Intermediate Case	Worst Case	Intermediate Case
G-56 Gated Spillway	Hillsboro Canal Basin / G-08 (Hillsboro) Canal	Replacing existing gates with taller gates, adding a new concrete cap on top of the existing concrete cap on the top of existing wingwalls, and raising the elevation of the spillway service bridge deck would increase water storage capacity, reducing flooding within the Study Area during the OMRR&R phase. Temporary negative effects during the construction phase due to reduced flow may occur as compared to the No Action Alternative; however, such effects are expected to be negligible. Model results suggest significant benefit would be provided to the Hillsboro Canal Basin through the implementation of Alternative A as compared to the No Action Alternative, with over 3,200 acres experiencing a reduction in inundation depth under the worst case scenario and over 2,500 acres under the intermediate case scenario. Some areas would experience a small increase in inundation depth; however, for the majority of this area, the increase would be less than 0.05 ft.	3,219	2,511	569	352
G-57 Gated Spillway	Pompano Canal Basin / G-16 (Pompano) Canal	Replacing existing gates with taller gates, adding a new concrete cap on top of the existing concrete cap on the top of existing wingwalls, and raising the elevation of the spillway service bridge deck would increase water storage capacity, reducing flooding within the Study Area during the OMRR&R phase. Adding two 10-foot-diameter culverts parallel to the existing 10-foot-diameter culvert would reduce the likelihood of water levels exceeding the WCS design capacity and increase water holding capacity and water conveyance. Temporary negative effects during the construction phase due to reduced flow may occur as compared to the No Action Alternative; however, such effects are expected to be negligible. Over 300 acres would experience a reduction in inundation depth during the worst-case scenario and over 100 acres would experience a reduction in inundation during the intermediate case under Alternative A as compared to the No Action Alternative. Some areas would experience an increase in inundation depth; however, for all but 2 acres, this increase would be less than 0.05 ft.	303	105	65	5
S-37B Gated Spillway	C-14 West Basin / C-14 (Cypress Creek) Canal	Alternative A does not include improvements for the S-37B Gated Spillway. However, model results suggest significant benefits would be provided to the C-14 West Basin through the implementation of	4,369	2,159	433	501

WCS	Watershed / Canal	Effects on Hydrology	Total Acres with Decreased Inundation Depth		Total Acres with Increased Inundation Depth	
			Worst Case	Intermediate Case	Worst Case	Intermediate Case
		Alternative A with over 4,300 acres experiencing a reduction in inundation depth under the worst case scenario and over 2,100 acres experiencing a reduction in inundation depth under the intermediate case scenario as compared to the No Action Alternative. Some areas would experience a small increase in inundation depth; however, for most of this area, the increase would be less than 0.05 ft.				
S-37A Gated Spillway	C-14 East Basin / C-14 (Cypress Creek) Canal	Temporary negative effects during the construction phase due to reduced flow may occur as compared to the No Action Alternative; however, such effects are expected to be negligible since construction would be phased with bypass channels to maintain level of service. During the OMRR&R phase, upgrading from two 25-foot floodgates to four 25-foot floodgates would improve water flow regulation, allowing for more efficient discharge during high water events, which can reduce the risk of flooding upstream as compared to the No Action Alternative. The new floodgates would improve the structure's responsiveness to rapidly changing conditions and facilitate better water management. Implementing a new pump station consisting of three 400-cfs pumps and one 400-cfs auxiliary pump would enable the rapid removal of excess water during heavy rainfall events, thereby reducing the risk of flooding in the surrounding area. Model results suggest significant benefit will be provided to the C-14 East Basin through the implementation of Alternative A with over 2,200 acres experiencing a reduction in inundation depth under the worst-case scenario and over 300 acres experiencing a reduction in inundation depth under the intermediate case scenario as compared to the No Action Alternative. Some areas would experience a small increase in inundation depth; however, for most of this area, the increase would be less than 0.05 ft.	2,273	309	0	10
S-36 Gated Spillway	C-13 West Basin / C-13 (Middle River) Canal	Temporary negative effects during the construction phase due to reduced flow may occur as compared to the No Action Alternative; however, such effects are expected to be negligible since construction would be phased with bypass channels to maintain level of service. During the OMRR&R phase, upgrading from one 25-foot floodgate to two 25-foot floodgates would improve water flow regulation, allowing for more efficient discharge during high water events, which can reduce the risk of flooding upstream. The new floodgates would improve the	2,813	1,186	175	115

WCS	Watershed / Canal	Effects on Hydrology	Total Acres with Decreased Inundation Depth		Total Acres with Increased Inundation Depth	
			Worst Case	Intermediate Case	Worst Case	Intermediate Case
		structure's responsiveness to rapidly changing conditions and facilitate better water management. Model results suggest significant benefit would be provided to the C-13 West Basin through the implementation of Alternative A with over 2,800 acres experiencing a reduction in inundation depth under the worst-case scenario and over 1,100 acres experiencing a reduction in inundation depth under the intermediate case scenario as compared to the No Action Alternative. Some areas would experience a small increase in inundation depth; however, for most of this area, the increase would be less than 0.05 ft.				
S-33 Gated Spillway	C-12 West Basin / C-12 (Plantation) Canal	Temporary negative effects during the construction phase due to reduced flow may occur as compared to the No Action Alternative; however, such effects are expected to be negligible since construction would be phased with bypass channels to maintain level of service. During the OMRR&R phase, implementing a new pump station consisting of three 170-cfs pumps and one 170-cfs auxiliary pump would enable the rapid removal of excess water during heavy rainfall events, thereby reducing the risk of flooding in the surrounding area. Model results suggest significant benefit will be provided to the C-12 West Basin through the implementation of Alternative A with over 2,000 acres experiencing a reduction in inundation depth under the worst-case scenario and over 800 acres experiencing a reduction in inundation depth under the intermediate case scenario as compared to the No Action Alternative. Some areas would experience a small increase in inundation depth during the worst-case scenario; however, the predicted increase would be less than 0.05 ft.	2,073	802	46	0
G-54 Gated Spillway	North New River Canal West Basin / G-15 (North New River) Canal	Replacing existing gates with taller gates, adding a new concrete cap on top of the existing concrete cap on the top of existing wingwalls, and raising the elevation of the spillway service bridge deck would increase water storage capacity, reducing flooding within the Study Area during the OMRR&R phase. In addition, the proposed canal excavation (approximately 100 feet upstream to 100 feet downstream of the G-54 Gated Spillway) would enlarge the canal cross-sectional flow area, resulting in improved water conveyance. Model results suggest significant benefit would be provided to the New River Canal West Basin through the implementation of Alternative A with over 5,300 acres	5,322	2,009	19	4

WCS	Watershed / Canal	Effects on Hydrology	Total Acres with Decreased Inundation Depth		Total Acres with Increased Inundation Depth	
			Worst Case	Intermediate Case	Worst Case	Intermediate Case
		experiencing a reduction in inundation depth under the worst-case scenario and over 2,000 acres experiencing a reduction in inundation depth under the intermediate case scenario as compared to the No Action Alternative. A relatively small area would experience an increase in inundation depth, and for most of this area, the predicted increase would be less than 0.05 ft.				
S-13AW Gated Culvert	C-11 West Basin / C-11 (South New River) Canal	Effects would be the same as the No Action Alternative because no improvements are proposed under Alternative A. Model results suggest significant benefit would be provided to the C-11 West Basin through the implementation of Alternative A with over 3,700 acres experiencing a reduction in inundation depth under the worst-case scenario and over 3,200 acres experiencing a reduction in inundation depth under the intermediate case scenario as compared to the No Action Alternative. Some areas would experience a small increase in inundation depth; however, for the majority of this area the increase would be less than 0.05 ft.	3,709	3,244	1,602	165
S-13 Pump Station and Gated Spillway	C-11 East Basin / C-11 (South New River) Canal	Temporary negative effects during the construction phase due to reduced flow may occur as compared to the No Action Alternative; however, such effects are expected to be negligible since construction would be phased with bypass channels to maintain level of service. During the OMRR&R phase, implementing a new pump station consisting of two 115-cfs pumps, two 235-cfs pumps, and one 235-cfs auxiliary pump would enable the rapid removal of excess water during heavy rainfall events, thereby reducing the risk of flooding in the surrounding area. During the OMRR&R phase, upgrading the 16-foot gate to a 25-foot gate would improve water flow regulation, allowing for more efficient discharge during high water events, which can reduce the risk of flooding upstream. The new floodgates would improve the structure's responsiveness to rapidly changing conditions and facilitate better water management as compared to the No Action Alternative. Model results suggest significant benefit would be provided to the New C-11 East Basin through the implementation of Alternative A with over 7,200 acres experiencing a reduction in inundation depth under the worst-case scenario and over 1,800 acres experiencing a reduction in inundation depth under the intermediate case scenario as compared to	7,291	1,882	14	164

WCS	Watershed / Canal	Effects on Hydrology	Total Acres with Decreased Inundation Depth		Total Acres with Increased Inundation Depth	
			Worst Case	Intermediate Case	Worst Case	Intermediate Case
		the No Action Alternative. Some areas would experience a small increase in inundation depth; however, for the majority of this area, the increase would be less than 0.05 ft.				

Notes: OMRR&R = operation, maintenance, repair, replacement, and rehabilitation; WCS = water control structure; cfs = cubic feet per second

Table B.3-22. Alternative A Breakdown of Change in Inundation Depth in the Upstream Watershed Basins in Acres.

Scenario	Basin	<-0.5 to -0.25 ft	<-0.25 to -0.05 ft	<-0.05 to -0.0 ft	No Change	<0.1 ft	0.1 to <0.3 ft	0.3 to <0.5 ft	0.5 to <1.0 ft	1.0 to <1.5 ft	1.5 to <2.0 ft	2.0 to <4.0 ft	4.0 to <6.0 ft	>6.0 ft
Worst Case - 100 Year Surge, 100 Year Rainfall, High Sea Level Rise 2085	Hillsboro	4	90	475	52,912	1,548	974	348	338	10	1	0	0	0
	C-14 W	1	19	413	26,853	1,836	1,729	399	327	75	2	0	0	0
	C-14 E	0	0	0	1,144	100	1,407	415	352	0	0	0	0	0
	Pompano	0	2	63	1,991	144	144	13	1	0	0	0	0	0
	C-13 W	0	7	168	11,644	1,501	1,138	77	76	16	3	2	0	0
	C-12 W	0	0	46	2,455	1,224	771	61	13	3	0	0	0	0
	North New River	1	2	16	11,799	2,221	2,202	760	121	11	6	1	0	0
	C-11 W	3	46	1,554	36,230	1,875	1,693	128	14	0	0	0	0	0
	C-11 E	0	1	13	9,234	811	2,406	2,942	1,109	21	2	0	0	0
	Total	9	168	2,747	154,262	11,260	12,464	5,143	2,351	136	15	3	0	0
Intermediate Case - 2 Year Surge, 25 Year Rainfall, Intermediate	Hillsboro	0	45	307	53,837	1,159	833	105	335	76	3	0	0	0
	C-14 W	24	83	395	28,994	1,015	619	124	283	100	17	0	0	0
	C-14 E	0	0	10	3,099	257	50	2	0	0	0	0	0	0
	Pompano	0	1	3	2,249	45	52	8	0	0	0	0	0	0
	C-13 W	9	47	59	13,331	476	582	86	41	1	0	0	0	0

Scenario	Basin	<-0.5 to - 0.25 ft	<-0.25 to - 0.05 ft	<-0.05 to -0.0 ft	No Change	<0.1 ft	0.1 to <0.3 ft	0.3 to <0.5 ft	0.5 to <1.0 ft	1.0 to <1.5 ft	1.5 to <2.0 ft	2.0 to <4.0 ft	4.0 to <6.0 ft	>6.0 ft
Sea Level Rise 2085	C-12 W	0	0	0	3,772	594	134	37	24	8	5	0	0	0
	North New River	0	0	4	15,127	922	773	196	99	16	3	1	0	0
	C-11 W	1	0	165	38,132	1,568	1,334	296	46	0	0	0	0	0
	C-11 E	0	8	155	14,494	734	864	219	63	1	0	0	0	0
	Total	34	185	1,098	173,035	6,770	5,240	1,073	890	203	28	1	0	0

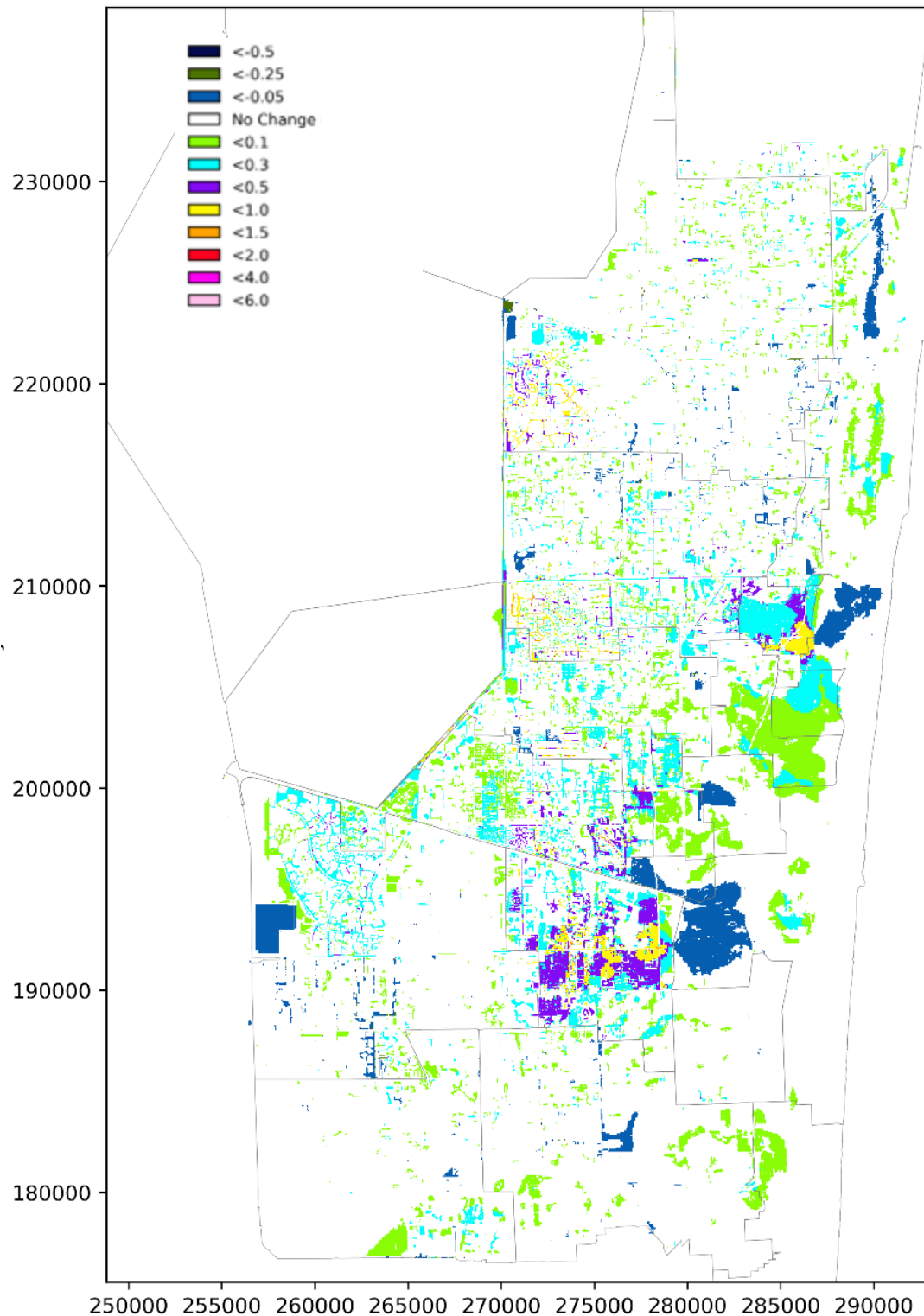


Figure B.3-1. Change in Inundation Peak Depths in the Study Area under Alternative A and the Worst Case Scenario (100-year surge, 100-year rainfall, high SLR). X and Y axes represent easting and northing coordinates, respectively.

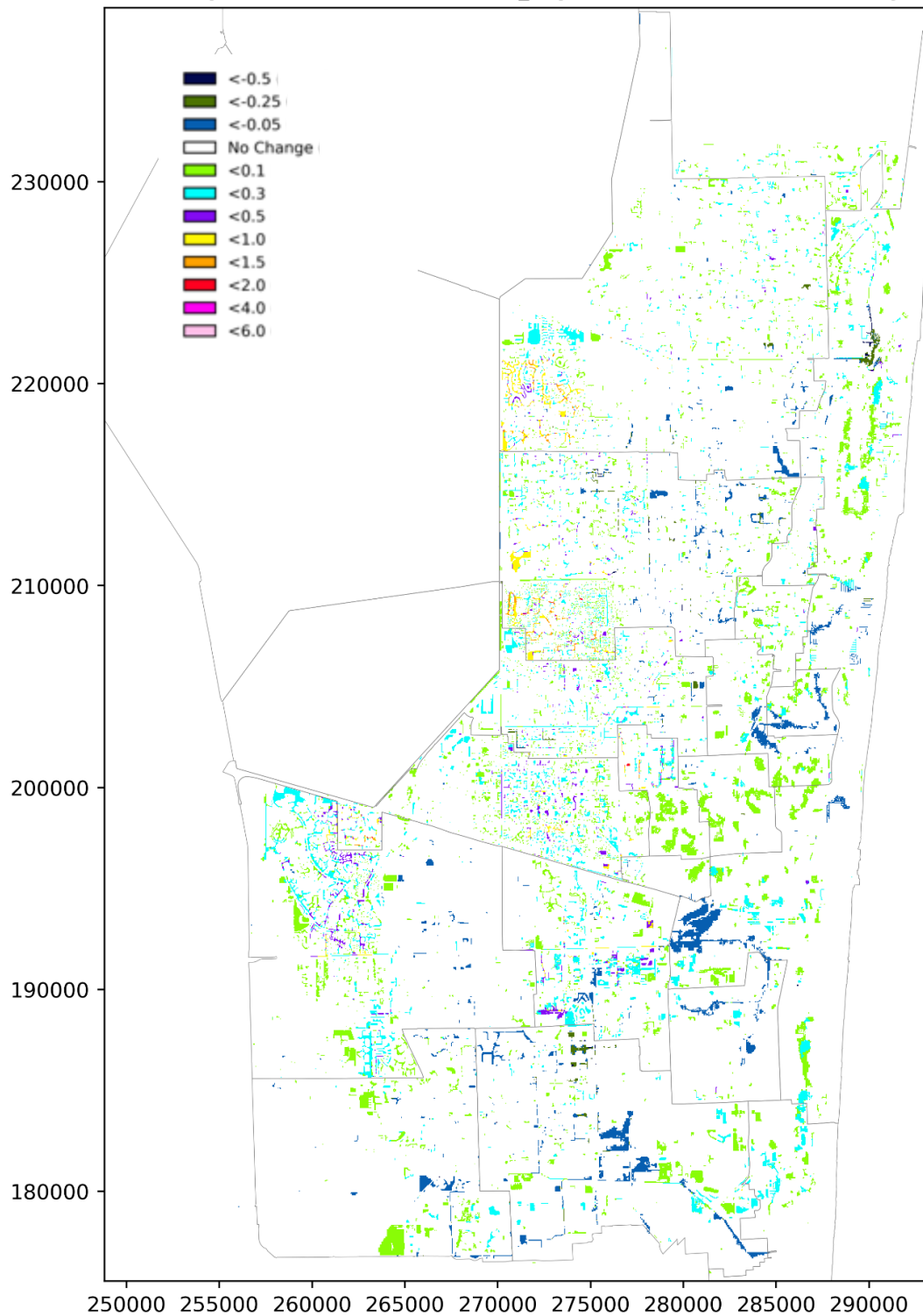


Figure B.3-2. Change in Inundation Peak Depths in the Study Area under Alternative A and the Intermediate Case Scenario (2-year surge, 25-year rainfall, intermediate SLR). X and Y axes represent easting and northing coordinates, respectively.

B.3.5.3 Alternative B

Alternative B represents an intermediate alternative where the number of proposed measures is greater than Alternative A but fewer than Alternative C. **Table B.3-23** below details the effects of Alternative B on hydrology by location. The table also presents a high-level summary of H&H modeling results including the total acres over which a decrease in inundation has been predicted through modeling and the total area over which an increase in inundation depth is predicted for each of the upstream basins. Modeling results are presented for the same two scenarios as under Alternative A. **Table B.3-24** provides a breakdown in the change of inundation in acres in each of the upstream watershed basins. This is followed by change in inundation depth maps for the entire Study Area (upstream and downstream watershed basins) for the two scenarios (**Figure B.3-3** and **Figure B.3-4**).

Table B.3-23. Effects of Alternative B on Hydrology by Location.

WCS	Watershed / Canal	Effects on Hydrology	Total Acres with Decreased Inundation Depth		Total Acres with Increased Inundation Depth	
			Worst Case	Intermediate Case	Worst Case	Intermediate Case
G-56 Gated Spillway	Hillsboro Canal Basin / G-08 (Hillsboro) Canal	Temporary negative effects during the construction phase due to reduced flow may occur as compared to the No Action Alternative; however, such effects are expected to be negligible since construction would be phased with bypass channels to maintain level of service. During the OMRR&R phase, upgrading from three 20-foot roller gates to four 25-foot roller gates would improve water flow regulation, allowing for more efficient discharge during high water events, which can reduce the risk of flooding upstream. The new floodgates would improve the structure's responsiveness to rapidly changing conditions and facilitate better water management as compared to the No Action Alternative. Excavation of the 5.5-linear-mile section in the canal would allow for channel enlargement, allowing for a higher flow capacity and reducing flooding conditions during high-energy events. Model results suggest significant benefit would be provided to the Hillsboro Canal Basin through the implementation of Alternative B with over 2,300 acres experiencing a reduction in inundation depth under the worst-case scenario and over 2,500 acres experiencing a reduction in inundation depth under the intermediate case scenario as compared to the No Action Alternative. Some areas would experience a small increase in inundation depth; however, for most of this area the increase would be less than 0.05 ft.	2,319	2,575	686	349
G-57 Gated Spillway	Pompano Canal Basin / G-16 (Pompano) Canal	Temporary negative effects during the construction phase due to reduced flow may occur as compared to the No Action Alternative; however, such effects are expected to be negligible since construction would be phased with bypass channels to maintain level of service. During the OMRR&R phase, upgrading from two 4-foot roller gates to four 21-foot roller gates would improve water flow regulation, allowing for more efficient discharge during high water events, which can reduce the risk of flooding upstream. The new floodgates would improve the structure's responsiveness to rapidly changing conditions and facilitate better water management as compared to the No Action Alternative. Adding two 10-foot-diameter culverts parallel to the existing 10-foot-diameter culvert would reduce the likelihood of water levels exceeding the WCS design capacity and increase water holding capacity and water conveyance. Over 300 acres would experience a reduction in inundation depth during the worst-case scenario and over 100 acres would experience a reduction in inundation during the intermediate case as compared to the No Action Alternative. Some areas will	309	108	64	4

WCS	Watershed / Canal	Effects on Hydrology	Total Acres with Decreased Inundation Depth		Total Acres with Increased Inundation Depth	
			Worst Case	Intermediate Case	Worst Case	Intermediate Case
		experience an increase in inundation depth; however, for all but 2 acres this increase would be less than 0.05 ft.				
S-37B Gated Spillway	C-14 West Basin / C-14 (Cypress Creek) Canal	Temporary negative effects during the construction phase due to reduced flow may occur as compared to the No Action Alternative; however, such effects are expected to be negligible since construction would be phased with bypass channels to maintain level of service. During the OMRR&R phase, upgrading to three 25-foot roller gates would improve water flow regulation, allowing for more efficient discharge during high water events, which can reduce the risk of flooding upstream. The new floodgates would improve the structure's responsiveness to rapidly changing conditions and facilitate better water management as compared to the No Action Alternative. Excavation of the 1.2-linear-mile section in the canal would allow for channel enlargement, allowing for a higher flow capacity and reducing flooding conditions during high-energy events. Model results suggest significant benefit would be provided to the C-14 West Basin through the implementation of Alternative B with over 4,700 acre experiencing a reduction in inundation depth under the worst case scenario and over 2,700 acres experiencing a reduction in inundation depth under the intermediate case scenario as compared to the No Action Alternative. Some areas would experience a small increase in inundation depth; however, for the majority of this area, the increase would be less than 0.05 ft.	4,708	2,768	403	307
S-37A Gated Spillway	C-14 East Basin / C-14 (Cypress Creek) Canal	Temporary negative effects during the construction phase due to reduced flow may occur as compared to the No Action Alternative; however, such effects are expected to be negligible since construction would be phased with bypass channels to maintain level of service. During the OMRR&R phase, implementing a new pump station consisting of three 500-cfs pumps and one 500-cfs auxiliary pump would enable the rapid removal of excess water during heavy rainfall events, thereby reducing the risk of flooding in the surrounding area. The pump station in Alternative B has 300 more cfs than Alternative A, allowing for the conveyance of a larger volume of water. Model results suggest significant benefit would be provided to the C-14 East Basin through the implementation of Alternative B with over 2,200 acres experiencing a reduction in inundation depth under the worst case scenario and over 500 acres experiencing a reduction in inundation depth under the intermediate case scenario as compared to the No Action Alternative. Some areas would experience a small increase in inundation	2,265	503	0	22

WCS	Watershed / Canal	Effects on Hydrology	Total Acres with Decreased Inundation Depth		Total Acres with Increased Inundation Depth	
			Worst Case	Intermediate Case	Worst Case	Intermediate Case
		depth under the intermediate scenario; however, the increase would be less than 0.05 ft.				
S-36 Gated Spillway	C-13 West Basin / C-13 (Middle River) Canal	Temporary negative effects during the construction phase due to reduced flow may occur as compared to the No Action Alternative; however, such effects are expected to be negligible since construction would be phased with bypass channels to maintain level of service. During the OMRR&R phase, implementing a new pump station consisting of three 170-cfs pumps and one 170-cfs auxiliary pump would enable the rapid removal of excess water during heavy rainfall events, thereby reducing the risk of flooding in the surrounding area as compared to the No Action Alternative. Model results suggest significant benefit would be provided to the C-13 West Basin through the implementation of Alternative B with over 4,500 acres experiencing a reduction in inundation depth under the worst-case scenario and over 1,700 acres experiencing a reduction in inundation depth under the intermediate case scenario as compared to the No Action Alternative. Some areas would experience a small increase in inundation depth; however, for most of this area, the increase would be less than 0.05 ft.	4,540	1,755	42	53
S-33 Gated Spillway	C-12 West Basin / C-12 (Plantation) Canal	Temporary negative effects during the construction phase due to reduced flow may occur as compared to the No Action Alternative; however, such effects are expected to be negligible since construction would be phased with bypass channels to maintain level of service. During the OMRR&R phase, upgrading from one 2-foot roller gate to two 20-foot roller gates would improve water flow regulation, allowing for more efficient discharge during high water events, which can reduce the risk of flooding upstream. The new floodgates would improve the structure's responsiveness to rapidly changing conditions and facilitate better water management as compared to the No Action Alternative. During the OMRR&R phase, implementing a new pump station consisting of three 170-cfs pumps and one 170-cfs auxiliary pump would enable the rapid removal of excess water during heavy rainfall events, thereby reducing the risk of flooding in the surrounding area. Model results suggest significant benefit would be provided to the C-12 West Basin through the implementation of Alternative B with over 2,100 acres experiencing a reduction in inundation depth under the worst-case scenario and over 800 acres experiencing a reduction in inundation depth under the intermediate case scenario as compared to the No Action Alternative. Some areas would experience a small increase in inundation depth for the worst case scenario; however, the increase would be less than 0.05 ft.	2,117	814	44	0

WCS	Watershed / Canal	Effects on Hydrology	Total Acres with Decreased Inundation Depth		Total Acres with Increased Inundation Depth	
			Worst Case	Intermediate Case	Worst Case	Intermediate Case
G-54 Gated Spillway	North New River Canal West Basin / G-15 (North New River) Canal	Temporary negative effects during the construction phase due to reduced flow may occur as compared to the No Action Alternative; however, such effects are expected to be negligible since construction would be phased with bypass channels to maintain level of service. During the OMRR&R phase, upgrading from three 16-foot roller gates to four 20-foot roller gates would improve water flow regulation, allowing for more efficient discharge during high water events, which can reduce the risk of flooding upstream. The new floodgates would improve the structure's responsiveness to rapidly changing conditions and facilitate better water management as compared to the No Action Alternative. Additionally, this alternative includes the Markham Park Stormwater Storage Capacity Improvement Project. This nature-based project would significantly improve the hydrological dynamics of the North New River Canal West Basin by increasing stormwater storage capacity within the Markham Park lakes. The new 105-cfs pump station would allow for efficient transfer of stormwater during periods of high rainfall intensity, thereby reducing the risk of flooding within the site. The addition of two 84-inch diameter culverts with fixed upstream weirs would provide overflow capacity. A modified stormwater outfall structure would regulate the flow between Markham Park and the G-15 (North New River) Canal. Model results suggest significant benefit would be provided to the North New River Canal Basin through the implementation of Alternative B with over 5,300 acres experiencing a reduction in inundation depth under the worst-case scenario and over 2,100 acres experiencing a reduction in inundation depth under the intermediate case scenario as compared to the No Action Alternative. Some areas would experience a small increase in inundation depth; however, for most of this area, the increase would be less than 0.05 ft.	5,379	2,171	151	348
S-13AW Gated Culvert	C-11 West Basin / C-11 (South New River) Canal	Excavation of the 8.4-linear-mile section in the canal would allow for channel enlargement, allowing for a higher flow capacity and reducing flooding conditions during high-energy events. Model results suggest significant benefit would be provided to the C-11 West Basin through the implementation of Alternative B with over 3,800 acres experiencing a reduction in inundation depth under the worst-case scenario and over 3,400 acres experiencing a reduction in inundation depth under the intermediate case scenario as compared to the No Action Alternative. Some areas would experience a small increase in inundation depth; however, for most of this area, the increase would be less than 0.05 ft.	3,860	3,435	1,624	55

WCS	Watershed / Canal	Effects on Hydrology	Total Acres with Decreased Inundation Depth		Total Acres with Increased Inundation Depth	
			Worst Case	Intermediate Case	Worst Case	Intermediate Case
S-13 Pump Station and Gated Spillway	C-11 East Basin / C-11 (South New River) Canal	Temporary negative effects during the construction phase due to reduced flow may occur as compared to the No Action Alternative; however, such effects are expected to be negligible since construction would be phased with bypass channels to maintain level of service. During the OMRR&R phase, implementing a new pump station consisting of two 180-cfs pumps, two 360-cfs pumps, and one 360-cfs auxiliary pump would enable the rapid removal of excess water during heavy rainfall events, thereby reducing the risk of flooding in the surrounding area. The pump station in Alternative B has 380 more cfs than Alternative A, allowing for the conveyance of a larger volume of water. During the OMRR&R phase, upgrading the 16-foot gate to a 25-foot gate would improve water flow regulation, allowing for more efficient discharge during high water events, which can reduce the risk of flooding upstream as compared to the No Action Alternative. Excavation of the 8.4-linear-mile section in the canal would allow for channel enlargement, allowing for a higher flow capacity and reducing flooding conditions during high-energy events. Model results suggest significant benefit would be provided to the C-11 East Basin through the implementation of Alternative B with over 7,300 acres experiencing a reduction in inundation depth under the worst-case scenario and over 2,000 acres experiencing a reduction in inundation depth under the intermediate case scenario as compared to the No Action Alternative. Some areas would experience a small increase in inundation depth; however, for most of this area, the increase would be less than 0.05 ft.	7,344	2,019	15	155

Notes: OMRR&R = operation, maintenance, repair, replacement, and rehabilitation; WCS = water control structure; cfs = cubic feet per second

Table B.3-24. Alternative B Breakdown of Change in Inundation Depth by Location in Acres.

Scenario	Basin	<-0.5 to 0.25 ft	<-0.25 to 0.05 ft	<-0.05 to 0.0 ft	No Change	<0.1 ft	0.1 to <0.3 ft	0.3 to <0.5 ft	0.5 to <1.0 ft	1.0 to <1.5 ft	1.5 to <2.0 ft	2.0 to <4.0 ft	4.0 to <6.0 ft	>6.0 ft
Worst Case - 100 Year Surge,	Hillsboro	5	98	583	53,694	936	711	326	336	9	1	0	0	0
	C-14 W	3	17	383	26,544	1,754	1,634	727	503	86	3	0	0	0

Scenario	Basin	<-0.5 to 0.25 ft	<-0.25 to 0.05 ft	<-0.05 to 0.0 ft	No Change	<0.1 ft	0.1 to <0.3 ft	0.3 to <0.5 ft	0.5 to <1.0 ft	1.0 to <1.5 ft	1.5 to <2.0 ft	2.0 to <4.0 ft	4.0 to <6.0 ft	>6.0 ft
100 Year Rain, High Sea Level Rise 2085	C-14 E	0	0	0	1,153	92	654	1,145	375	0	0	0	0	0
	Pompano	0	2	62	1,986	148	146	13	1	0	0	0	0	0
	C-13 W	0	5	37	10,050	1,024	2,311	844	300	51	6	4	0	0
	C-12 W	0	0	44	2,413	1,237	727	135	14	2	2	0	0	0
	North New River	8	33	110	11,610	1,197	2,922	948	285	21	5	1	0	0
	C-11 W	3	47	1,574	36,057	1,942	1,745	138	33	1	0	0	0	0
	C-11 E	0	0	15	9,181	740	2,182	2,637	1,681	90	11	3	0	0
	Total	19	202	2,808	152,688	9,070	13,033	6,913	3,528	261	27	8	0	0
Intermediate Case - 2 Year Surge, 25 Year Rain, Intermediate Sea Level Rise 2085	Hillsboro	0	38	311	53,774	1,184	876	102	331	80	3	0	0	0
	C-14 W	12	53	241	28,579	1,253	967	160	259	112	17	0	0	0
	C-14 E	0	0	22	2,893	330	171	2	0	0	0	0	0	0
	Pompano	0	1	3	2,247	46	53	8	0	0	0	0	0	0
	C-13 W	1	13	40	12,824	623	615	352	162	3	0	0	0	0
	C-12 W	0	0	0	3,760	602	125	41	28	13	5	0	0	0
	North New River	65	102	182	14,621	955	842	223	104	43	4	1	0	0
	C-11 W	1	3	51	38,052	1,695	1,390	298	51	0	0	0	0	0
	C-11 E	0	8	147	14,365	575	904	239	267	29	6	0	0	0
	Total	79	219	996	171,115	7,262	5,944	1,424	1,201	280	36	2	0	0

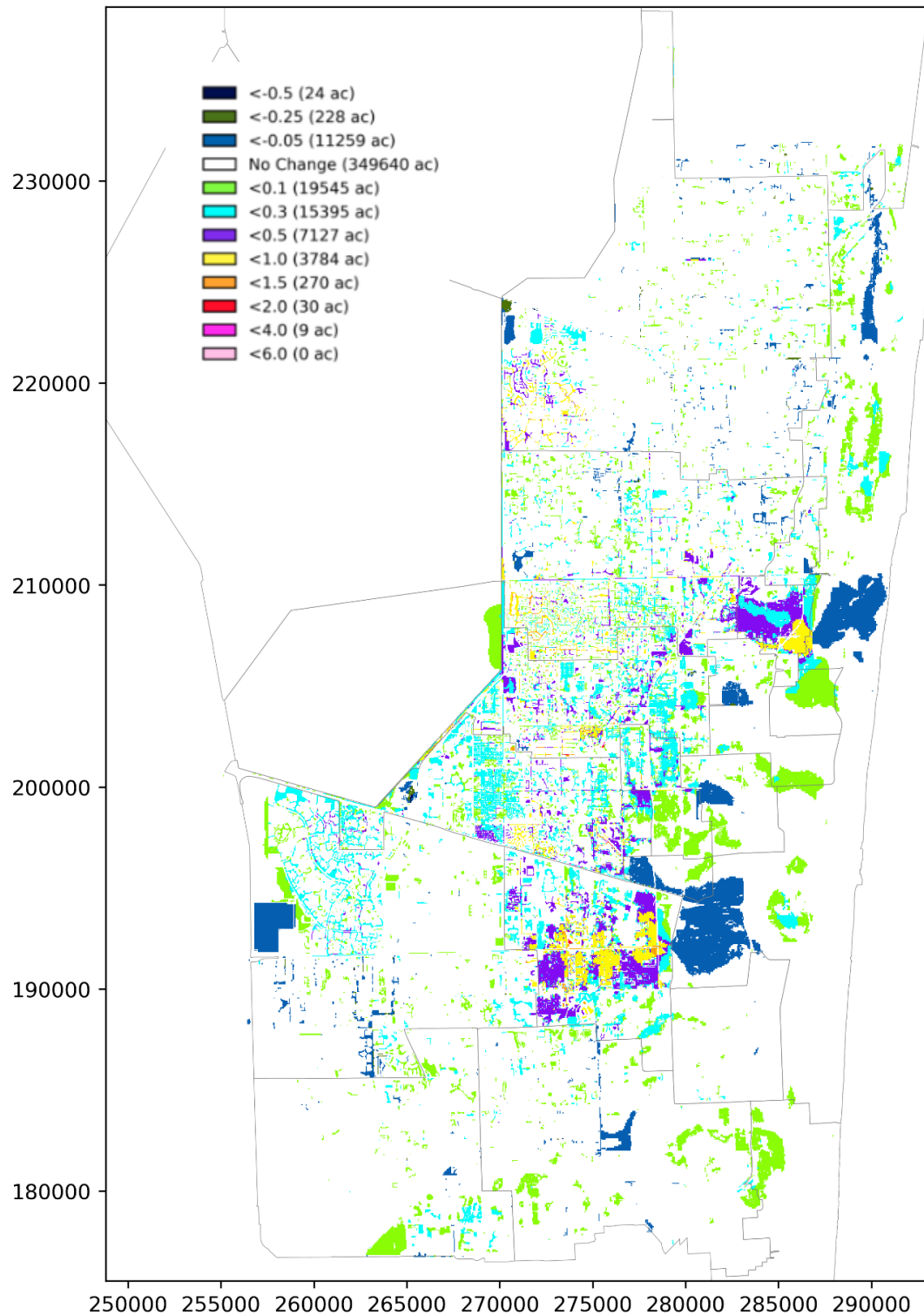


Figure B.3-3. Change in Inundation Peak Depths in the Study Area under Alternative B and the Worst Case Scenario (100-year surge, 100-year rainfall, high SLR). X and Y axes represent easting and northing coordinates, respectively.

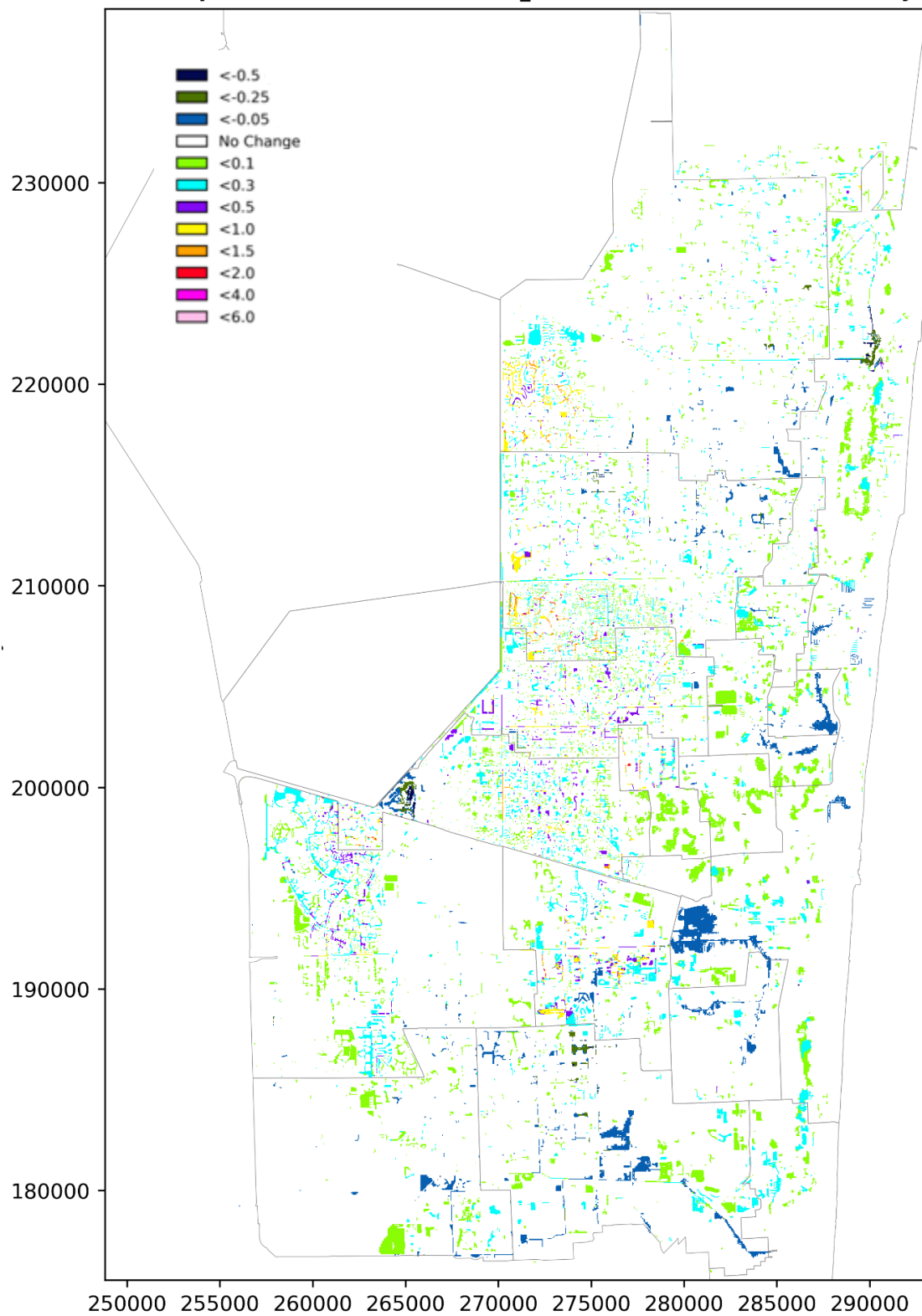


Figure B.3-4. Change in Inundation Peak Depths in the Study Area under Alternative B and the Intermediate Case Scenario (2-year surge, 25-year rainfall, intermediate SLR). X and Y axes represent easting and northing coordinates, respectively.

B.3.5.4 Alternative C

Alternative C represents the most complex scenario involving the greatest number of measures. **Table B.3-25** below details the effects of Alternative C on hydrology by location. The table also present a high-level summary of model results including the total acres over which a decrease in inundation has been predicted though H&H modeling and the total area over which an increase in inundation depth is predicted for each of the upstream basins. Modeling results are presented for the same two scenarios as under Alternative A. **Table B.3-26** provides a breakdown in the change of inundation in acres in each of the upstream watershed basins. This is followed by change in inundation depth maps for the entire Study Area (upstream and downstream watershed basins) for the two scenarios (**Figure B.3-5** and **Figure B.3-6**).

Table B.3-25. Effects of Alternative C on Hydrology by Location.

WCS	Watershed / Canal	Effects on Hydrology	Total Acres with Decreased Inundation Depth		Total Acres with Increased Inundation Depth	
			Worst Case	Intermediate Case	Worst Case	Intermediate Case
G-56 Gated Spillway	Hillsboro Canal Basin / G-08 (Hillsboro) Canal	Temporary negative effects during the construction phase due to reduced flow may occur as compared to the No Action Alternative; however, such effects are expected to be negligible since construction would be phased with bypass channels to maintain level of service. During the OMRR&R phase, upgrading from three 20-foot roller gates to four 25-foot roller gates would improve water flow regulation, allowing for more efficient discharge during high water events, which can reduce the risk of flooding upstream. The new floodgates would improve the structure's responsiveness to rapidly changing conditions and facilitate better water management as compared to the No Action Alternative. During the OMRR&R phase, implementing a new pump station consisting of three 335-cfs pumps and one 335-cfs auxiliary pump would enable the rapid removal of excess water during heavy rainfall events, thereby reducing the risk of flooding in the surrounding area. Excavation of the 5.5-linear-mile section in the canal would allow for channel enlargement, allowing for a higher flow capacity and reducing flooding conditions during high-energy events. Additionally, this alternative includes the Hillsboro Watershed Stormwater Storage Capacity Improvement project. This nature-based measure would significantly impact the hydrology of the Hillsboro Canal Watershed. The construction of the perimeter levee and seepage canal would store stormwater up to 4 feet above the ground surface, effectively reducing peak water levels in the G-08 (Hillsboro) Canal during storm events. Implementing a 600-cfs pump station would facilitate the efficient transfer of stormwater, reducing the risk of flooding during high rainfall events. Model results suggest significant benefit would be provided to the Hillsboro Canal Basin through the implementation of Alternative C with over 3,800 acres experiencing a reduction in inundation depth under the worst-case scenario and over 3,000 acres experiencing a reduction in inundation depth under the intermediate case scenario as compared to the No Action Alternative. Model predictions indicate that some areas would experience an increase in inundation depth. A significant portion of this area is predicted to experience an increase in excess of 0.25 ft for the worst-case scenario.	3,886	3,083	1,009	852

WCS	Watershed / Canal	Effects on Hydrology	Total Acres with Decreased Inundation Depth		Total Acres with Increased Inundation Depth	
			Worst Case	Intermediate Case	Worst Case	Intermediate Case
G-57 Gated Spillway	Pompano Canal Basin / G-16 (Pompano) Canal	Temporary negative effects during the construction phase due to reduced flow may occur as compared to the No Action Alternative; however, such effects are expected to be negligible since construction would be phased with bypass channels to maintain level of service. During the OMRR&R phase, implementing a new pump station consisting of three 100-cfs pumps and one 100-cfs auxiliary pump would enable the rapid removal of excess water during heavy rainfall events, thereby reducing the risk of flooding in the surrounding area. During the OMRR&R phase, upgrading from two 4-foot roller gates to four 21-foot roller gates would improve water flow regulation, allowing for more efficient discharge during high water events, which can reduce the risk of flooding upstream. The new floodgates would improve the structure's responsiveness to rapidly changing conditions and facilitate better water management as compared to the No Action Alternative. Adding two 10-foot-diameter culverts parallel to the existing 10-foot-diameter culvert would reduce the likelihood of water levels exceeding the WCS design capacity and increase water holding capacity and water conveyance. Over 400 acres would experience a reduction in inundation depth during the worst-case scenario and over 100 acres would experience a reduction in inundation during the intermediate case as compared to the No Action Alternative. Some areas would experience an increase in inundation depth; however, for all but 2 acres, this increase would be less than 0.05 ft.	460	101	146	6
S-37B Gated Spillway	C-14 West Basin / C-14 (Cypress Creek) Canal	Excavation of the 6.8-linear-mile section in C-14 (Cypress Creek) Canal would allow for more flow, reducing flooding conditions during high-energy events. Model results suggest significant benefit will be provided to the C-14 West Basin through the implementation of Alternative C with over 4,600 acres experiencing a reduction in inundation depth under the worst case scenario and over 2,800 acres experiencing a reduction in inundation depth under the intermediate case scenario as compared to the No Action Alternative. Some areas would experience a small increase in inundation depth; however, for the majority of this area, the increase would be less than 0.05 ft.	4,621	2,811	691	302
S-37A Gated Spillway	C-14 East Basin / C-14 (Cypress Creek) Canal	Temporary negative effects during the construction phase due to reduced flow may occur as compared to the No Action Alternative; however, such effects are expected to be negligible since construction would be phased	2,282	578	0	0

WCS	Watershed / Canal	Effects on Hydrology	Total Acres with Decreased Inundation Depth		Total Acres with Increased Inundation Depth	
			Worst Case	Intermediate Case	Worst Case	Intermediate Case
		with bypass channels to maintain level of service. During the OMRR&R phase, upgrading from two 25-foot floodgates to four 25-foot floodgates would improve water flow regulation, allowing for more efficient discharge during high water events, which can reduce the risk of flooding upstream. The new floodgates would improve the structure's responsiveness to rapidly changing conditions and facilitate better water management as compared to the No Action Alternative. Implementing a new pump station consisting of three 400-cfs pumps and one 400-cfs auxiliary pump would enable the rapid removal of excess water during heavy rainfall events, thereby reducing the risk of flooding in the surrounding area. Excavation of the 6.8-linear-mile section in the canal would allow for channel enlargement, allowing for a higher flow capacity and reducing flooding conditions during high-energy events. Model results suggest significant benefit would be provided to the C-14 East Basin through the implementation of Alternative C with over 2,200 acres experiencing a reduction in inundation depth under the worst-case scenario and over 500 acres experiencing a reduction in inundation depth under the intermediate case scenario as compared to the No Action Alternative. Model predictions suggest no areas would experience an increase in inundation depth.				
S-36 Gated Spillway	C-13 West Basin / C-13 (Middle River) Canal	Temporary negative effects during the construction phase due to reduced flow may occur as compared to the No Action Alternative; however, such effects are expected to be negligible since construction would be phased with bypass channels to maintain level of service. During the OMRR&R phase, upgrading from one 25-foot floodgate to two 25-foot floodgates would improve water flow regulation, allowing for more efficient discharge during high water events, which can reduce the risk of flooding upstream. The new floodgates would improve the structure's responsiveness to rapidly changing conditions and facilitate better water management as compared to the No Action Alternative. During the OMRR&R phase, implementing a new pump station consisting of three 200-cfs pumps and one 200-cfs auxiliary pump would enable the rapid removal of excess water during heavy rainfall events, thereby reducing the risk of flooding in the surrounding area. Excavation of the 4.3-linear-mile section in the canal would allow for channel enlargement, allowing for a higher flow capacity and reducing flooding conditions during high-energy	5,219	2,224	59	11

WCS	Watershed / Canal	Effects on Hydrology	Total Acres with Decreased Inundation Depth		Total Acres with Increased Inundation Depth	
			Worst Case	Intermediate Case	Worst Case	Intermediate Case
		events. Model results suggest significant benefit would be provided to the C-13 West Basin through the implementation of Alternative C with over 5,200 acres experiencing a reduction in inundation depth under the worst-case scenario and over 2,200 acres experiencing a reduction in inundation depth under the intermediate case scenario as compared to the No Action Alternative. A relatively small area would experience a small increase in inundation depth; however, for the majority of this area, the increase would be less than 0.05 ft.				
S-33 Gated Spillway	C-12 West Basin / C-12 (Plantation) Canal	Temporary negative effects during the construction phase due to reduced flow may occur as compared to the No Action Alternative; however, such effects are expected to be negligible since construction would be phased with bypass channels to maintain level of service. During the OMRR&R phase, upgrading from one 2-foot roller gate to two 20-foot roller gates would improve water flow regulation, allowing for more efficient discharge during high water events, which can reduce the risk of flooding upstream. The new floodgates would improve the structure's responsiveness to rapidly changing conditions and facilitate better water management as compared to the No Action Alternative. During the OMRR&R phase, implementing a new pump station consisting of three 235-cfs pumps and one 235-cfs auxiliary pump would enable the rapid removal of excess water during heavy rainfall events, thereby reducing the risk of flooding in the surrounding area. Excavation of the 0.5-linear-mile section in the canal would allow for channel enlargement, allowing for a higher flow capacity and reducing flooding conditions during high-energy events. Model results suggest significant benefit would be provided to the C-12 West Basin through the implementation of Alternative C with over 2,100 acres experiencing a reduction in inundation depth under the worst-case scenario and over 800 acres experiencing a reduction in inundation depth under the intermediate case scenario as compared to the No Action Alternative. A relatively small area would experience a small increase in inundation depth under the worst case scenario; however, the increase would be less than 0.05 ft.	2,113	830	94	0
G-54 Gated Spillway	North New River Canal West Basin /	Temporary negative effects during the construction phase due to reduced flow may occur as compared to the No Action Alternative; however, such effects are expected to be negligible since construction would be phased	6,116	2,924	138	298

WCS	Watershed / Canal	Effects on Hydrology	Total Acres with Decreased Inundation Depth		Total Acres with Increased Inundation Depth	
			Worst Case	Intermediate Case	Worst Case	Intermediate Case
	G-15 (North New River) Canal	with bypass channels to maintain level of service. During the OMRR&R phase, implementing a new pump station consisting of three 270-cfs pumps and one 270-cfs auxiliary pump would enable the rapid removal of excess water during heavy rainfall events, thereby reducing the risk of flooding in the surrounding area. During the OMRR&R phase, upgrading from three 16-foot roller gates to four 20-foot roller gates would improve water flow regulation, allowing for more efficient discharge during high water events, which can reduce the risk of flooding upstream. The new floodgates would improve the structure's responsiveness to rapidly changing conditions and facilitate better water management as compared to the No Action Alternative. Additionally, this alternative includes the Markham Park Stormwater Storage Capacity Improvement Project. This nature-based measure would significantly improve the hydrological dynamics of the North New River Canal West Basin by increasing stormwater storage capacity within the Markham Park lakes. The new 105-cfs pump station would allow for efficient transfer of stormwater during periods of high rainfall intensity, thereby reducing the risk of flooding within the site. The addition of two 84-inch diameter culverts with fixed upstream weirs would provide overflow capacity. A modified stormwater outfall structure would regulate the flow between Markham Park and the G-15 (North New River) Canal. Excavation of the 13.9-linear-mile section in the canal would allow for channel enlargement, allowing for a higher flow capacity and reducing flooding conditions during high-energy events. Model results suggest significant benefit would be provided to the North New River Basin through the implementation of Alternative C with over 6,100 acres experiencing a reduction in inundation depth under the worst-case scenario and over 2,900 acres experiencing a reduction in inundation depth under the intermediate case scenario as compared to the No Action Alternative. Some areas would experience a small increase in inundation depth. For the intermediate scenario, model predictions suggest a significant portion of this area would experience an increase in excess of 0.25 ft.				
S-13AW Gated Culvert	C-11 West Basin / C-11 (South New River) Canal	Excavation of the 8.4-linear-mile section in the canal would allow for channel enlargement, allowing for a higher flow capacity and reducing flooding conditions during high-energy events. Model results suggest significant benefit would be provided to the C-11 West Basin through the	5,464	4,113	2,244	45

WCS	Watershed / Canal	Effects on Hydrology	Total Acres with Decreased Inundation Depth		Total Acres with Increased Inundation Depth	
			Worst Case	Intermediate Case	Worst Case	Intermediate Case
		implementation of Alternative C with over 5,400 acres experiencing a reduction in inundation depth under the worst-case scenario and over 4,100 acres experiencing a reduction in inundation depth under the intermediate case scenario as compared to the No Action Alternative. Some areas would experience a small increase in inundation depth; however, for most of this area, the increase would be less than 0.05 ft.				
S-13 Pump Station and Gated Spillway	C-11 East Basin / C-11 (South New River) Canal	Temporary negative effects during the construction phase due to reduced flow may occur as compared to the No Action Alternative; however, such effects are expected to be negligible since construction would be phased with bypass channels to maintain level of service. During the OMRR&R phase, implementing a new pump station consisting of two 250-cfs pumps, two 500-cfs pumps, and one 500-cfs auxiliary pump would enable the rapid removal of excess water during heavy rainfall events, thereby reducing the risk of flooding in the surrounding area. The pump station in Alternative C has 380 more cfs than Alternative A, allowing for the conveyance of a larger volume of water. During the OMRR&R phase, upgrading the 16-foot gate to a 25-foot gate would improve water flow regulation, allowing for more efficient discharge during high water events, which can reduce the risk of flooding upstream as compared to the No Action Alternative. Excavation of the 8.4-linear-mile section in the canal would allow for channel enlargement, allowing for a higher flow capacity and reducing flooding conditions during high-energy events. Model results suggest significant benefit would be provided to the C-11 West Basin through the implementation of Alternative C with over 7,100 acres experiencing a reduction in inundation depth under the worst-case scenario and over 2,200 acres experiencing a reduction in inundation depth under the intermediate case scenario as compared to the No Action Alternative. Some areas would experience a small increase in inundation depth; however, for most of this area, the increase would be less than 0.05 ft.	7,146	2,267	146	99

Notes: OMRR&R = operation, maintenance, repair, replacement, and rehabilitation; WCS = water control structure; cfs = cubic feet per second

Table B.3-26. Alternative C Breakdown of Change in Inundation Depth by Location in Acres.

Scenario	Basin	<-0.5 to - 0.25 ft	<-0.25 to - 0.05 ft	<-0.05 to -0.0 ft	No Change	<0.1 ft	0.1 to <0.3 ft	0.3 to <0.5 ft	0.5 to <1.0 ft	1.0 to <1.5 ft	1.5 to <2.0 ft	2.0 to <4.0 ft	4.0 to <6.0 ft	>6.0 ft
Worst Case - 100 Year Surge, 100 Year Rain, High Sea Level Rise 2085	Hillsboro	716	35	259	51,804	1,649	1,151	128	711	217	31	1	0	0
	C-14 W	1	15	674	26,342	1,840	1,618	594	476	80	12	0	0	0
	C-14 E	0	0	0	1,136	103	731	792	655	0	0	0	0	0
	Pompano	0	0	146	1,752	134	283	41	3	0	0	0	0	0
	C-13 W	0	1	58	9,355	1,087	1,698	1,234	958	163	42	31	6	0
	C-12 W	0	0	94	2,367	1,196	457	411	39	8	1	1	0	0
	North New River	2	18	118	10,886	953	1,863	1,723	1,264	206	81	25	0	0
	C-11 W	13	96	2,135	33,834	2,650	2,550	215	43	6	0	0	0	0
	C-11 E	0	1	145	9,246	599	1,862	2,518	2,027	124	13	3	0	0
	Total	732	167	3,629	146,721	10,211	12,214	7,655	6,176	805	180	62	6	0
Intermediate Case - 2 Year Surge, 25 Year Rain, Intermediate Sea Level Rise 2085	Hillsboro	699	24	128	52,765	1,319	1,209	118	343	91	3	0	0	0
	C-14 W	10	57	235	28,541	1,217	1,031	152	278	113	19	0	0	0
	C-14 E	0	0	0	2,840	272	274	7	17	5	1	0	0	0
	Pompano	0	3	4	2,252	43	50	8	0	0	0	0	0	0
	C-13 W	2	1	7	12,397	720	677	328	392	93	14	1	0	0
	C-12 W	0	0	0	3,744	614	90	70	32	17	6	1	0	0
	North New River	63	80	155	13,917	1,002	1,187	444	226	57	6	1	0	0
	C-11 W	0	5	40	37,384	2,064	1,669	310	69	0	0	0	0	0
	C-11 E	0	8	90	14,173	494	1,040	387	225	104	15	2	0	0
	Total	775	178	661	168,014	7,746	7,227	1,826	1,582	479	65	5	0	0

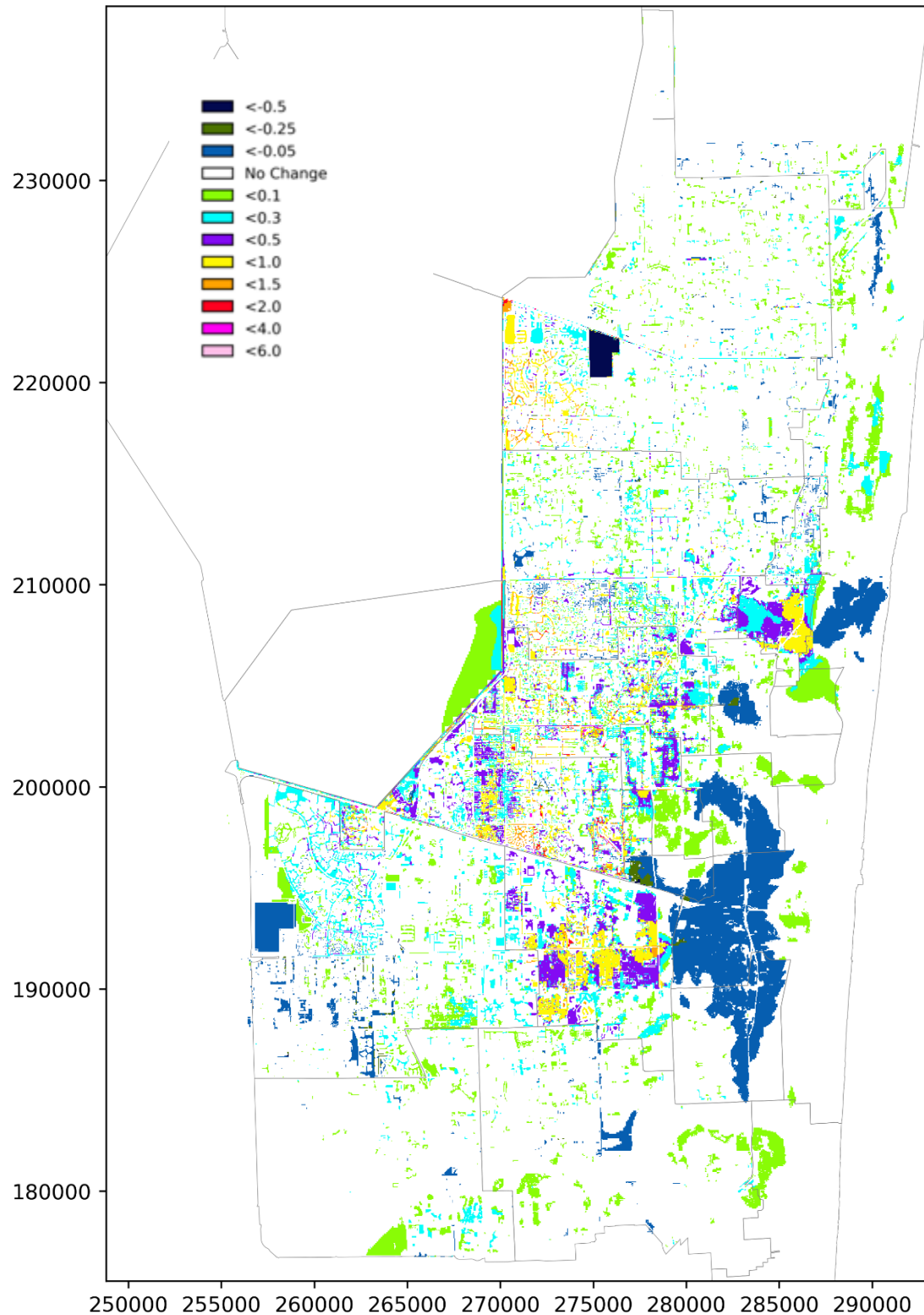


Figure B.3-5. Change in Inundation Peak Depths in the Study Area under Alternative C and the Worst Case Scenario (100-year surge, 100-year rainfall, high SLR). X and Y axes represent easting and northing coordinates, respectively.

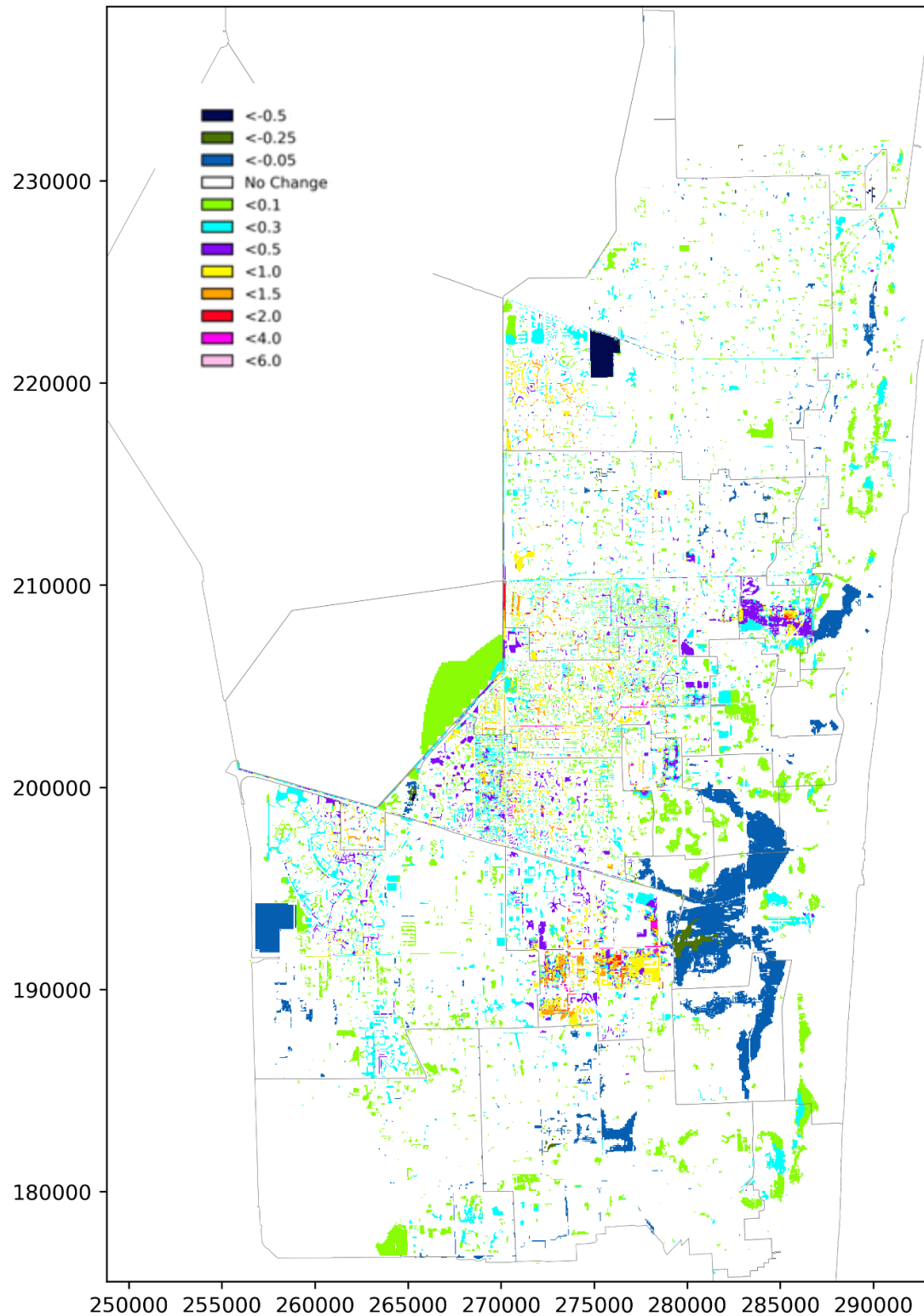


Figure B.3-6. Change in Inundation Peak Depths in the Study Area under Alternative C and the Intermediate Case Scenario (2-year surge, 25-year rainfall, intermediate SLR). X and Y axes represent easting and northing coordinates, respectively.

B.3.5.5 Alternative RO

Alternative RO represents a combination of structural measures derived from Alternatives A through C. **Table B.3-27** below details the effects of Alternative RO on hydrology by location. The table also presents a high-level summary of H&H modeling results including the total acres over which a decrease in inundation has been predicted through modeling and the total area over which an increase in inundation depth is predicted for each of the upstream basins. Modeling results are presented for the same two scenarios as under Alternative A. **Table B.3-28** provides a breakdown in the change of inundation in acres in each of the upstream watershed basins. This is followed by change in inundation depth maps for the entire Study Area (upstream and downstream watershed basins) for the two scenarios (**Figure B.3-7** and **Figure B.3-8**).

Table B.3-27. Effects of Alternative RO on Hydrology by Location.

WCS	Watershed / Canal	Effects on Hydrology	Total Acres with Decreased Inundation Depth		Total Acres with Increased Inundation Depth	
			Worst Case	Intermediate Case	Worst Case	Intermediate Case
G-56 Gated Spillway	Hillsboro Canal Basin / G-08 (Hillsboro) Canal	Temporary negative effects during the construction phase due to reduced flow may occur as compared to the No Action Alternative; however, such effects are expected to be negligible since construction would be phased with bypass channels to maintain level of service. During the OMRR&R phase, upgrading from three 20-foot roller gates to four 25-foot roller gates would improve water flow regulation, allowing for more efficient discharge during high water events, which can reduce the risk of flooding upstream. The new floodgates would improve the structure's responsiveness to rapidly changing conditions and facilitate better water management as compared to the No Action Alternative. Excavation of the 1.1-linear-mile section in the canal would allow for channel enlargement, allowing for a higher flow capacity and reducing flooding conditions during high-energy events. Model results suggest significant benefit would be provided to the Hillsboro Canal Basin through the implementation of Alternative RO with over 2,300 acres experiencing a reduction in inundation depth under the worst-case scenario and over 2,500 acres experiencing a reduction in inundation depth under the intermediate case scenario as compared to the No Action Alternative. Some areas would experience a small increase in inundation depth; however, for most of this area, the increase would be less than 0.05 ft.	3,505	2,538	504	202
G-57 Gated Spillway	Pompano Canal Basin / G-16 (Pompano) Canal	Temporary negative effects during the construction phase due to reduced flow may occur as compared to the No Action Alternative; however, such effects are expected to be negligible since construction would be phased with bypass channels to maintain level of service. During the OMRR&R phase, upgrading from two 4-foot roller gates to two 21-foot roller gates would improve water flow regulation, allowing for more efficient discharge during high water events, which can reduce the risk of flooding upstream. The new floodgates would improve the structure's responsiveness to rapidly changing conditions and facilitate better water management as compared to the No Action Alternative. Adding two 10-foot diameter culverts parallel to the existing 10-foot diameter culvert would reduce the likelihood of water levels exceeding the WCS design capacity and increase water holding capacity and water conveyance. Over 300 acres would	194	42	73	3

WCS	Watershed / Canal	Effects on Hydrology	Total Acres with Decreased Inundation Depth		Total Acres with Increased Inundation Depth	
			Worst Case	Intermediate Case	Worst Case	Intermediate Case
		experience a reduction in inundation depth during the worst-case scenario and over 100 acres would experience a reduction in inundation during the intermediate case scenario as compared to the No Action Alternative. Some areas would experience an increase in inundation depth; however, for all but 2 acres, this increase would be less than 0.05 ft.				
S-37B Gated Spillway	C-14 West Basin / C-14 (Cypress Creek) Canal	Temporary negative effects during the construction phase due to reduced flow may occur as compared to the No Action Alternative; however, such effects are expected to be negligible since construction would be phased with bypass channels to maintain level of service. During the OMRR&R phase, upgrading to two 25-foot roller gates would improve water flow regulation, allowing for more efficient discharge during high water events, which can reduce the risk of flooding upstream. The new floodgates would improve the structure's responsiveness to rapidly changing conditions and facilitate better water management as compared to the No Action Alternative. Excavation of the 1.2-linear-mile section in the canal would allow for channel enlargement, allowing for a higher flow capacity and reducing flooding conditions during high-energy events. Model results suggest significant benefit would be provided to the C-14 West Basin through the implementation of Alternative RO with over 4,700 acres experiencing a reduction in inundation depth under the worst case scenario and over 2,700 acres experiencing a reduction in inundation depth under the intermediate case scenario as compared to the No Action Alternative. Some areas would experience a small increase in inundation depth; however, for the majority of this area, the increase would be less than 0.05 ft.	4,432	2,669	564	358
S-37A Gated Spillway	C-14 East Basin / C-14 (Cypress Creek) Canal	Temporary negative effects during the construction phase due to reduced flow may occur as compared to the No Action Alternative; however, such effects are expected to be negligible since construction would be phased with bypass channels to maintain level of service. During the OMRR&R phase, implementing a new pump station consisting of three 400-cfs pumps and one 400-cfs auxiliary pump would enable the rapid removal of excess water during heavy rainfall events, thereby reducing the risk of flooding in the surrounding area as compared to the No Action Alternative. Model results suggest significant benefit would be provided to the C-14 East Basin through the implementation of Alternative RO with over 2,200	2,267	481	0	98

WCS	Watershed / Canal	Effects on Hydrology	Total Acres with Decreased Inundation Depth		Total Acres with Increased Inundation Depth	
			Worst Case	Intermediate Case	Worst Case	Intermediate Case
		acres experiencing a reduction in inundation depth under the worst case scenario and over 500 acres experiencing a reduction in inundation depth under the intermediate case scenario as compared to the No Action Alternative. Some areas would experience a small increase in inundation depth under the intermediate scenario; however, the increase would be less than 0.05 ft.				
S-36 Gated Spillway	C-13 West Basin / C-13 (Middle River) Canal	Temporary negative effects during the construction phase due to reduced flow may occur as compared to the No Action Alternative; however, such effects are expected to be negligible since construction would be phased with bypass channels to maintain level of service. During the OMRR&R phase, implementing a new pump station consisting of three 170-cfs pumps would enable the rapid removal of excess water during heavy rainfall events, thereby reducing the risk of flooding in the surrounding area as compared to the No Action Alternative. Model results suggest significant benefit will be provided to the C-13 West Basin through the implementation of Alternative RO with over 4,500 acres experiencing a reduction in inundation depth under the worst-case scenario and over 1,700 acres experiencing a reduction in inundation depth under the intermediate case scenario as compared to the No Action Alternative. Some areas would experience a small increase in inundation depth; however, for most of this area, the increase would be less than 0.05 ft.	4,998	1,998	4	12
S-33 Gated Spillway	C-12 West Basin / C-12 (Plantation) Canal	Temporary negative effects during the construction phase due to reduced flow may occur as compared to the No Action Alternative; however, such effects are expected to be negligible since construction would be phased with bypass channels to maintain level of service. During the OMRR&R phase, upgrading from one 2-foot roller gate to two 20-foot roller gates would improve water flow regulation, allowing for more efficient discharge during high water events, which can reduce the risk of flooding upstream. The new floodgates would improve the structure's responsiveness to rapidly changing conditions and facilitate better water management as compared to the No Action Alternative. Implementing a new pump station consisting of three 170-cfs pumps and one 170-cfs auxiliary pump would enable the rapid removal of excess water during heavy rainfall events, thereby reducing the risk of flooding in the surrounding area. Model results suggest significant benefit would be provided to the C-12 West Basin	1,888	811	2	0

WCS	Watershed / Canal	Effects on Hydrology	Total Acres with Decreased Inundation Depth		Total Acres with Increased Inundation Depth	
			Worst Case	Intermediate Case	Worst Case	Intermediate Case
		through the implementation of Alternative RO with over 2,100 acres experiencing a reduction in inundation depth under the worst-case scenario and over 800 acres experiencing a reduction in inundation depth under the intermediate case scenario as compared to the No Action Alternative. Some areas would experience a small increase in inundation depth for the worst case scenario; however, the increase would be less than 0.05 ft.				
G-54 Gated Spillway	North New River Canal West Basin / G-15 (North New River) Canal	Temporary negative effects during the construction phase due to reduced flow may occur as compared to the No Action Alternative; however, such effects are expected to be negligible since construction would be phased with bypass channels to maintain level of service.. During the OMRR&R phase, upgrading from three 16-foot roller gates to four 20-foot roller gates would improve water flow regulation, allowing for more efficient discharge during high water events, which can reduce the risk of flooding upstream. The new floodgates would improve the structure's responsiveness to rapidly changing conditions and facilitate better water management as compared to the No Action Alternative. Implementing a new pump station consisting of three 270-cfs pumps would enable the rapid removal of excess water during heavy rainfall events, thereby reducing the risk of flooding in the surrounding area. Model results suggest significant benefit will be provided to the North New River Canal Basin through the implementation of Alternative RO with over 5,300 acres experiencing a reduction in inundation depth under the worst-case scenario and over 2,100 acres experiencing a reduction in inundation depth under the intermediate case scenario as compared to the No Action Alternative. Some areas would experience a small increase in inundation depth; however, for most of this area, the increase would be less than 0.05 ft.	6,076	3,129	19	6
S-13AW Gated Culvert	C-11 West Basin / C-11 (South New River) Canal	Excavation of the 1.5-linear-mile section in the canal would allow for channel enlargement, allowing for a higher flow capacity and reducing flooding conditions during high-energy events. Model results suggest significant benefit will be provided to the C-11 West Basin through the implementation of Alternative RO with over 3,800 acres experiencing a reduction in inundation depth under the worst-case scenario and over 3,400 acres experiencing a reduction in inundation depth under the intermediate case scenario as compared to the No Action Alternative.	5,618	3,462	1,076	39

WCS	Watershed / Canal	Effects on Hydrology	Total Acres with Decreased Inundation Depth		Total Acres with Increased Inundation Depth	
			Worst Case	Intermediate Case	Worst Case	Intermediate Case
		Some areas would experience a small increase in inundation depth; however, for most of this area, the increase would be less than 0.05 ft.				
S-13 Pump Station and Gated Spillway	C-11 East Basin / C-11 (South New River) Canal	Temporary negative effects during the construction phase due to reduced flow may occur as compared to the No Action Alternative; however, such effects are expected to be negligible. During the construction phase, the canal would be narrower to accommodate a temporary cofferdam surrounding the new gated spillway structure. During the OMRR&R phase, implementing a new pump station consisting of two 180-cfs pumps, two 360-cfs pumps, and one 360-cfs auxiliary pump would enable the rapid removal of excess water during heavy rainfall events, thereby reducing the risk of flooding in the surrounding area as compared to the No Action Alternative. Excavation of 0.5 miles in the canal would allow for channel enlargement, allowing for a higher flow capacity and reducing flooding conditions during high-energy events. Model results suggest significant benefit would be provided to the C-11 East Basin through the implementation of Alternative RO with over 7,300 acres experiencing a reduction in inundation depth under the worst-case scenario and over 2,000 acres experiencing a reduction in inundation depth under the intermediate case scenario as compared to the No Action Alternative. Some areas would experience a small increase in inundation depth; however, for most of this area, the increase would be less than 0.05 ft.	7,060	1,380	13	312

Notes: OMRR&R = operation, maintenance, repair, replacement, and rehabilitation; WCS = water control structure; cfs = cubic feet per second

Table B.3-28. Alternative RO Breakdown of Change in Inundation Depth by Location in Acres.

Scenario	Basin	<-0.5 to - 0.25 ft	<-0.25 to - 0.05 ft	<-0.05 to -0.0 ft	No Change	<0.1 ft	0.1 to <0.3 ft	0.3 to <0.5 ft	0.5 to <1.0 ft	1.0 to <1.5 ft	1.5 to <2.0 ft	2.0 to <4.0 ft	4.0 to <6.0 ft	>6.0 ft
Worst Case - 100 Year Surge, 100 Year Rain, High Sea Level Rise 2085	Hillsboro	2	71	432	52,690	1,596	1,168	392	336	10	1	1	0	0
	C-14 W	3	28	534	26,658	1,970	1,734	335	311	81	2	0	0	0
	C-14 E	0	0	0	1,151	152	1,858	257	0	0	0	0	0	0
	Pompano	0	3	70	2,092	112	72	9	0	0	0	0	0	0
	C-13 W	0	0	4	9,630	1,807	2,288	641	198	53	7	3	0	0
	C-12 W	0	0	2	2,685	1,273	609	3	1	1	0	0	0	0
	North New River	0	4	15	11,045	1,076	3,172	1,455	328	30	14	1	0	0
	C-11 W	1	5	1,070	34,848	2,931	2,483	186	18	0	0	0	0	0
	C-11 E	0	1	12	9,466	805	4,724	1,281	248	2	0	0	0	0
	Total	5	112	2,139	150,265	11,722	18,109	4,557	1,442	177	25	5	0	0
Intermediate Case - 2 Year Surge, 25 Year Rain, Intermediate Sea Level Rise 2085	Hillsboro	0	23	179	53,959	1,141	878	104	331	81	3	0	0	0
	C-14 W	14	77	267	28,628	1,274	858	131	277	112	18	0	0	0
	C-14 E	0	2	96	2,839	343	138	0	0	0	0	0	0	0
	Pompano	0	0	3	2,314	24	18	0	0	0	0	0	0	0
	C-13 W	0	1	10	12,622	704	661	323	285	24	0	0	0	0
	C-12 W	0	0	0	3,762	603	138	36	17	11	5	0	0	0
	North New River	0	1	5	14,005	1,074	1,391	448	155	56	4	1	0	0
	C-11 W	0	3	36	38,041	1,737	1,379	298	48	0	0	0	0	0
	C-11 E	2	13	297	14,847	791	562	25	2	0	0	0	0	0
	Total	16	121	892	171,017	7,692	6,025	1,364	1,115	284	30	1	0	0

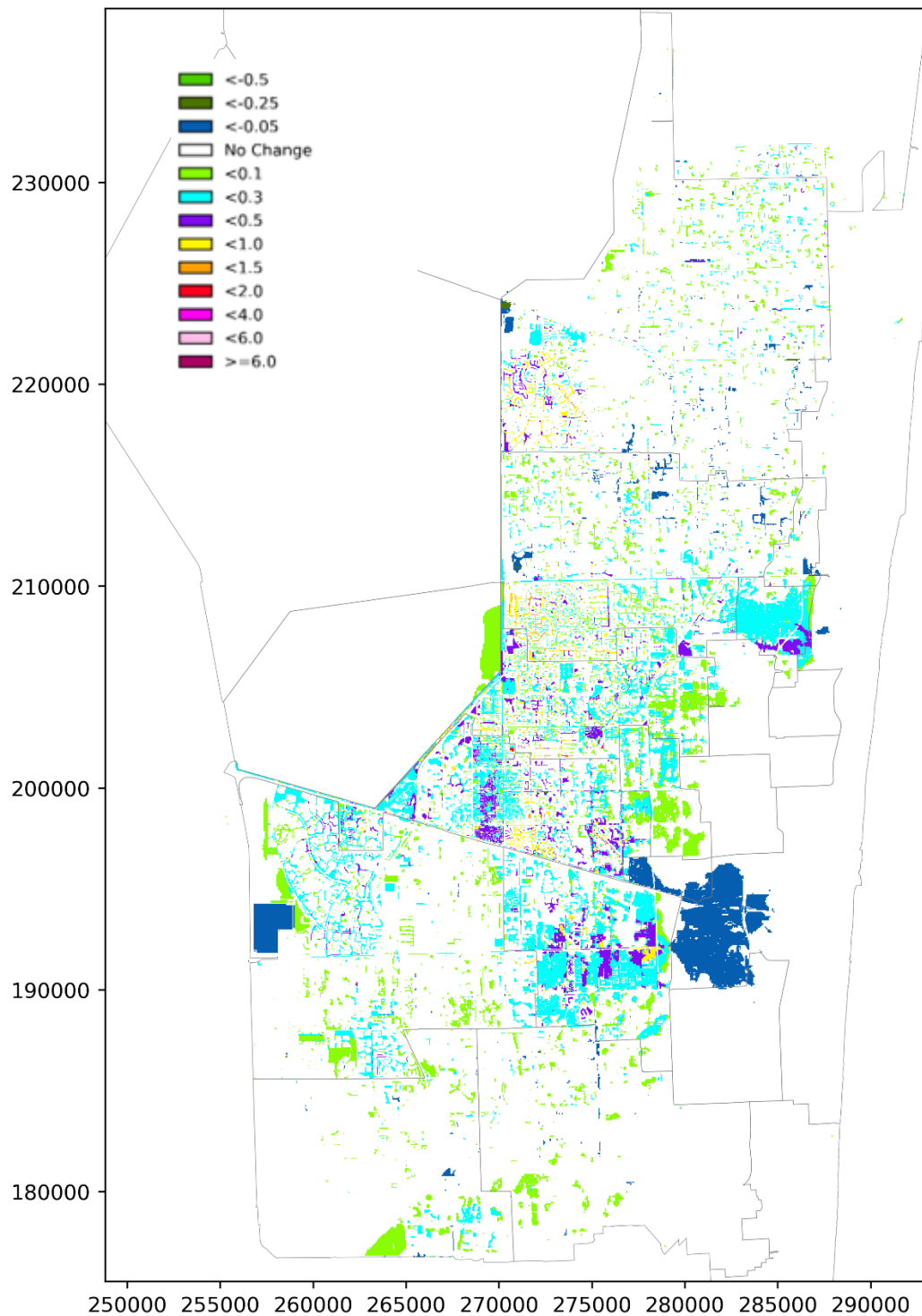


Figure B.3-7. Change in Inundation Peak Depths in the Study Area under Alternative RO and the Worst Case Scenario (100-year surge, 100-year rainfall, high SLR). X and Y axes represent easting and northing coordinates, respectively.

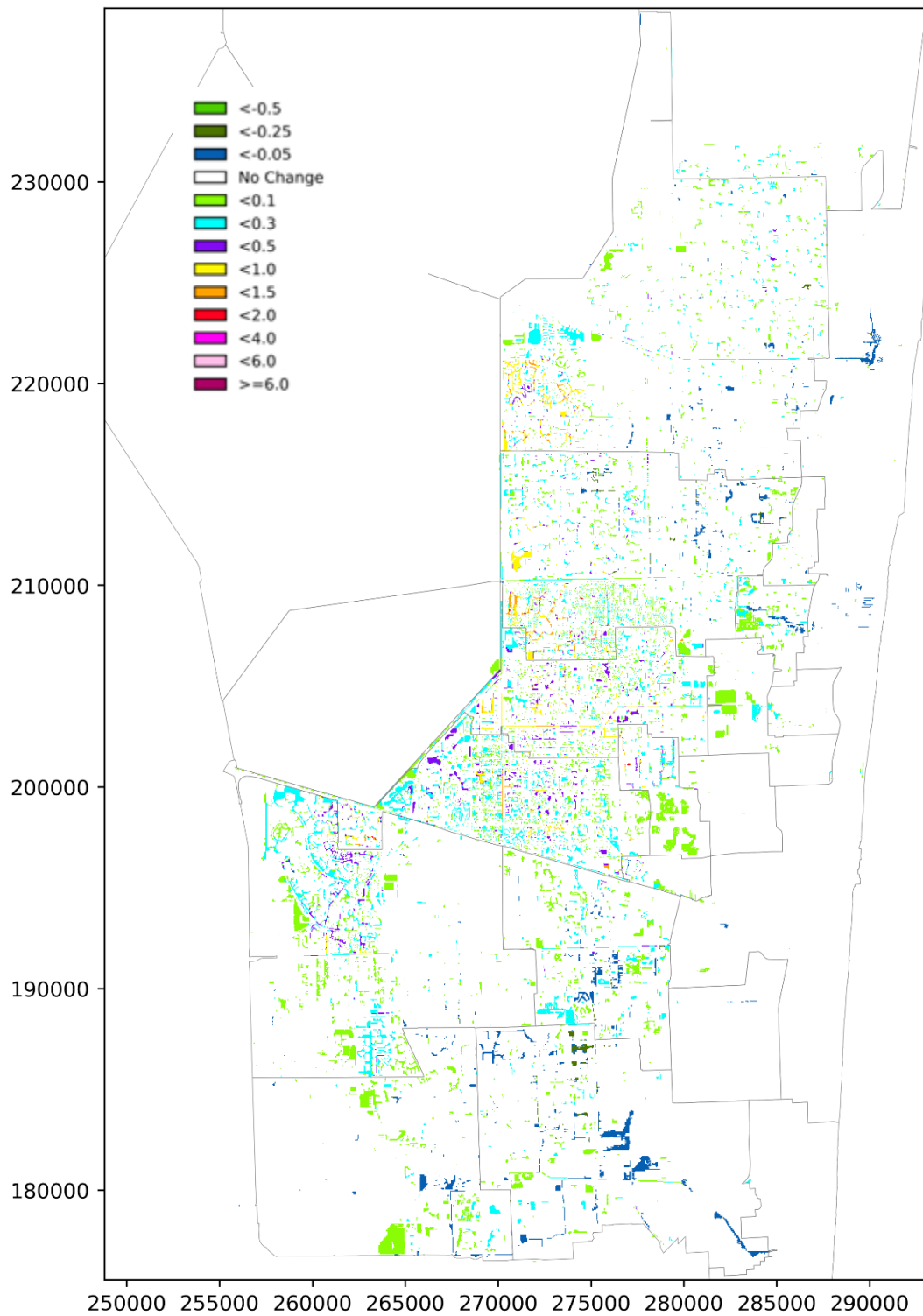


Figure B.3-8. Change in Inundation Peak Depths in the Study Area under Alternative RO and the Intermediate Case Scenario (2-year surge, 25-year rainfall, intermediate SLR). X and Y axes represent easting and northing coordinates, respectively.

B.3.5.6 Comparison of Impacts to Hydrology between all Action Alternatives

Figure B.3-9 presents the change in the area of inundation of the upstream watershed basins for the four action alternatives broken down by the range in change of depth. For the worst case scenario involving a 100-year surge, 100-year rainfall, and high sea level rise, Alternative RO provides the greatest area for a reduction in the range of 0.1 to 0.3 feet. However, Alternative RO provides the lowest area for higher reductions in depth. In addition, for the worst case scenario, Alternative RO has the lowest area predicted to have an increase in inundation depth. For the intermediate case scenario involving a 2-year surge, 25-year rainfall event, and intermediate sea level rise, predicted changes in inundation are generally similar to those for Alternative B.

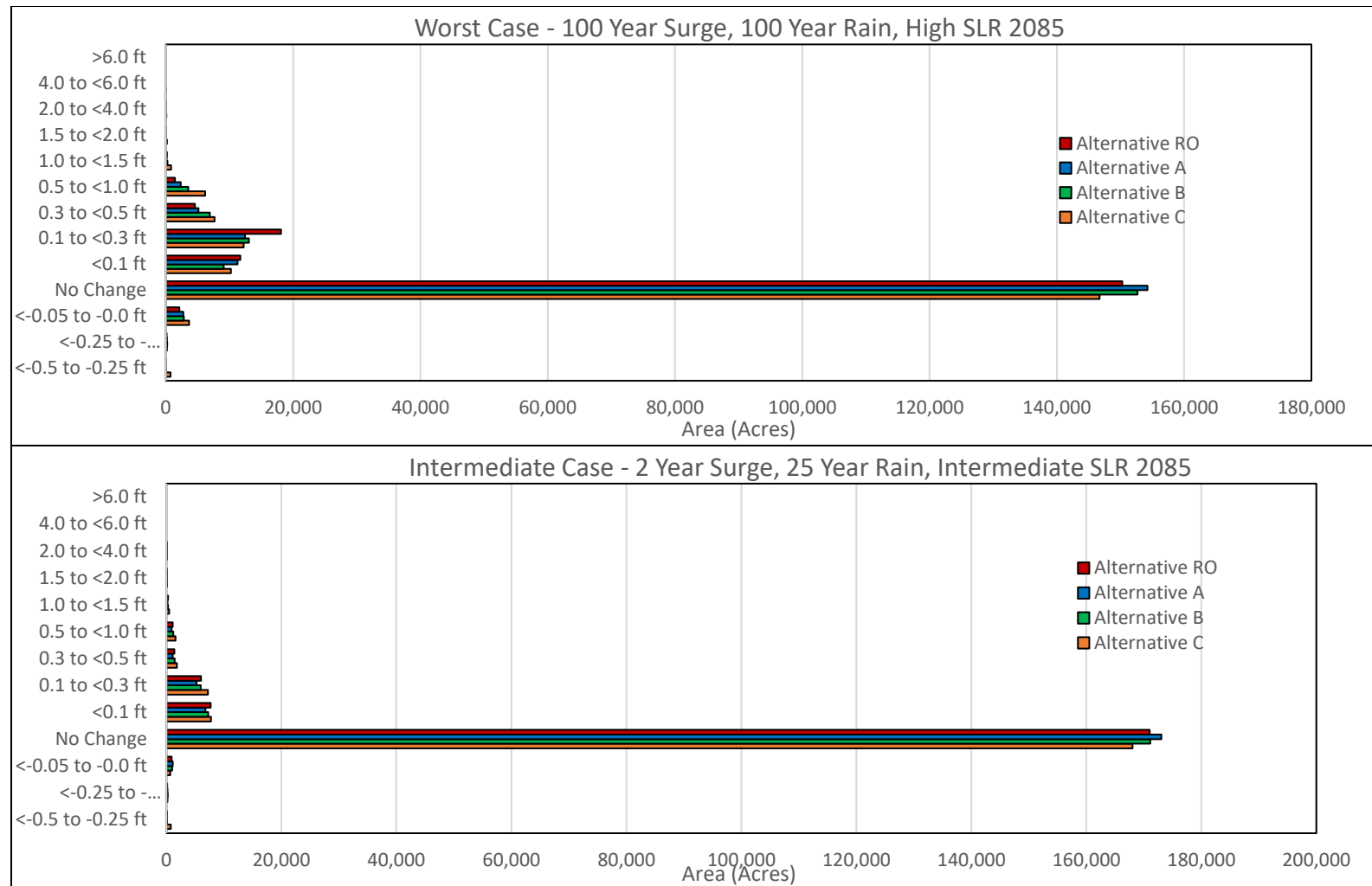


Figure B.3-9. Comparison across all Action Alternatives of Predicted Change in Area of Inundation of Upstream Watershed Basins by Depth Range.

B.3.6 Groundwater

An analysis of the potential impacts to groundwater from the No Action Alternative and implementation of the action alternatives is presented below.

B.3.6.1 Future Without Project Conditions (No Action Alternative)

Under the No Action Alternative, there would be no improvements or modifications made to any of the WCS. As noted in **Section B.3.5 Hydrology**, rainfall intensity, duration, and frequency are expected to increase, and sea level is expected to rise within the region in the future. The WCS currently impedes saltwater from moving upstream and allows fresh water in the canals to recharge the Biscayne Aquifer. Without improvements to the WCS, tidal water levels would likely exceed WCS design capacity, increasing infiltration and inflow from storm events that contribute to increased saltwater intrusion. Excessive withdrawal of freshwater from the aquifer reduces water pressure, allowing the denser saltwater from the coast to move inland and displace freshwater. As saltwater intrusion progresses, wellfields tapping the Biscayne Aquifer are likely to become more vulnerable to saltwater intrusion, potentially necessitating their relocation inland or abandonment in favor of new freshwater supply sources and treatment systems such as reverse osmosis water treatment plants. Increased salinity in Biscayne Aquifer wells would raise treatment costs for potable water production. A study by the Water Utility Climate Alliance estimates that by 2060, 16 percent of Broward County's public supply wells will be at risk of saltwater intrusion (WUCA 2019). Several wellfields have already been decommissioned due to rising salinity levels.

B.3.6.2 Alternative A

Alternative A represents the least complex alternative. **Table B.3-29** below details the effects of Alternative A on groundwater by location.

Table B.3-29. Effects of Alternative A on Groundwater by Location.

WCS	Watershed / Canal	Effects on Groundwater
G-56 Gated Spillway	Hillsboro Canal Basin / G-08 (Hillsboro) Canal	The raised WCS would allow for increased holding capacity and reduced likelihood of tidal water levels exceeding the WCS design capacity, and therefore reduced potential for saltwater intrusion as compared to the No Action Alternative. Temporary negative effects during the construction phase due to reduced flow are expected to be negligible.
G-57 Gated Spillway	Pompano Canal Basin / G-16 (Pompano) Canal	The raised WCS would allow for increased holding capacity and reduced likelihood of tidal water levels exceeding the WCS design capacity, and therefore reduced potential for saltwater intrusion as compared to the No Action Alternative. Temporary negative effects during the construction phase due to reduced flow are expected to be negligible.
S-37B Gated Spillway	C-14 West Basin / C-14 (Cypress Creek) Canal	Effects would be the same as the No Action Alternative because no improvements are proposed under Alternative A.
S-37A Gated Spillway	C-14 East Basin / C-14 (Cypress Creek) Canal	The new WCS would allow for increased holding capacity and decreased potential for overflow and backflow, and an increase in pump capacity and flow conveyance from gated spillway replacement and a new pump station. This is expected to result in reduced potential for saltwater intrusion as compared to the No Action Alternative. Construction will be phased with a bypass channel to maintain level of service throughout the construction period. Therefore, any temporary negative effects during the construction phase due to reduced flow, while may be greater than the No

WCS	Watershed / Canal	Effects on Groundwater
		Action Alternative, are expected to be negligible. Construction dewatering may temporarily alter groundwater flow-paths locally; however, Phase I ESA findings did not identify any known issues associated with this site or in its vicinity (refer to Section B.1.15). In addition, the use of a coffer dam bottom (tremie) seal (refer to Section A.8.11.1) has been recommended, which would significantly reduce the amount of dewatering needed.
S-36 Gated Spillway	C-13 West Basin / C-13 (Middle River) Canal	The new WCS would allow for increased holding capacity and reduced likelihood of tidal water levels exceeding the WCS design capacity, and therefore, reduced potential for saltwater intrusion as compared to the No Action Alternative. Construction will be phased with a bypass channel to maintain level of service throughout the construction period. Therefore, any temporary negative effects during the construction phase due to reduced flow, while may be greater than the No Action Alternative, are expected to be negligible. Construction dewatering may temporarily alter groundwater flow-paths locally; however, Phase I ESA findings did not identify any known issues associated with this site or in its vicinity (refer to Section B.1.15). In addition, the use of a coffer dam bottom (tremie) seal (refer to Section A.8.11.1) has been recommended, which would significantly reduce the amount of dewatering needed.
S-33 Gated Spillway	C-12 West Basin / C-12 (Plantation) Canal	The new WCS would allow for increased holding capacity and decreased potential for overflow and backflow, and an increase in pump capacity and flow conveyance from gated spillway replacement and a new pump station. This is expected to result in reduced potential for saltwater intrusion as compared to the No Action Alternative. Construction will be phased with a bypass channel to maintain level of service throughout the construction period. Therefore, any temporary negative effects during the construction phase due to reduced flow, while may be greater than the No Action Alternative, are expected to be negligible. Construction dewatering may temporarily alter groundwater flow-paths locally. Phase I ESA findings identified a compliance issue with a UST in the area (refer to Section B.1.15). This will require further evaluation and consideration prior to construction. The use of a coffer dam bottom (tremie) seal (refer to Section A.8.11.1) has been recommended, which would significantly reduce the amount of dewatering needed.
G-54 Gated Spillway	North New River Canal West Basin / G-15 (North New River) Canal	The raised WCS would allow for increased holding capacity and reduced likelihood of tidal water levels exceeding the WCS design capacity, and therefore reduced potential for saltwater intrusion as compared to the No Action Alternative. Temporary negative effects during the construction phase due to reduced flow, while greater than the No Action Alternative, are expected to be negligible.
S-13AW Gated Culvert	C-11 West Basin / C-11 (South New River) Canal	Effects would be the same as the No Action Alternative because no improvements are proposed under Alternative A.
S-13 Pump Station and Gated Spillway	C-11 East Basin / C-11 (South New River) Canal	The new WCS would allow for increased holding capacity and decreased potential for overflow and backflow, and an increase in pump capacity and flow conveyance from gated spillway replacement and a new pump station. This is expected to result in reduced potential for saltwater intrusion as compared to the No Action Alternative. Construction will be phased with a bypass channel to maintain level of service throughout the construction period. Therefore, any temporary negative effects during the construction phase due to reduced flow, while may be greater than the No Action Alternative, are expected to be negligible. Construction dewatering may temporarily alter groundwater flow-paths locally; however, Phase I ESA findings did not identify any known issues associated with this site or in its vicinity (refer to Section B.1.15). In addition, the use of a coffer dam bottom (tremie) seal (refer to Section A.8.11.1) has been recommended, which would significantly reduce the amount of dewatering needed.

Note: WCS = water control structure

B.3.6.3 Alternative B

Alternative B represents an intermediate alternative where the number of proposed measures is greater than Alternative A but fewer than Alternative C. **Table B.3-30** below details the effects of Alternative B on groundwater by location.

Table B.3-30. Effects of Alternative B on Groundwater by Location.

WCS	Watershed / Canal	Effects on Groundwater
G-56 Gated Spillway	Hillsboro Canal Basin / G-08 (Hillsboro) Canal	The new WCS would allow for increased holding capacity and reduced likelihood of tidal water levels exceeding the WCS design capacity, and therefore, reduced potential for saltwater intrusion as compared to the No Action Alternative. Excavation of the 5.5-linear-mile section in the canal would allow for channel enlargement, allowing for higher water retention and reducing flooding conditions during high-energy events. Deepening the canal would increase the surface area for conductance within the channel. This can result in a potential increase in groundwater recharge rates. Construction will be phased with a bypass channel to maintain level of service throughout the construction period. Therefore any, temporary negative effects during the construction phase due to reduced flow, while may be greater than the No Action Alternative, are expected to be negligible. Construction dewatering may temporarily alter groundwater flow-paths locally, however Phase I ESA findings did not identify a recognized conditions associated with this site (refer to Section B.1.15). In addition, the use of a coffer dam bottom (tremie) seal (refer to Section A.8.11.1) has been recommended, which would significantly reduce the amount of dewatering needed.
G-57 Gated Spillway	Pompano Canal Basin / G-16 (Pompano) Canal	The new WCS would allow for increased holding capacity and reduced likelihood of tidal water levels exceeding the WCS design capacity, and therefore, reduced potential for saltwater intrusion as compared to the No Action Alternative. Construction will be phased with a bypass channel to maintain level of service throughout the construction period. Therefore any, temporary negative effects during the construction phase due to reduced flow, while may be greater than the No Action Alternative, are expected to be negligible. Construction dewatering may temporarily alter groundwater flow-paths locally. Phase I ESA findings identified a contaminated groundwater in the vicinity of this site (refer to Section B.1.15). This will require further evaluation and consideration prior to construction. The use of a coffer dam bottom (tremie) seal (refer to Section A.8.11.1) has been recommended, which would significantly reduce the amount of dewatering needed and should mitigate any impacts to plume migration.
S-37B Gated Spillway	C-14 West Basin / C-14 (Cypress Creek) Canal	The new WCS would allow for increased holding capacity and reduced likelihood of tidal water levels exceeding the WCS design capacity, and therefore, reduced potential for saltwater intrusion as compared to the No Action Alternative. Excavation of the 1.2-linear-mile section in the canal would allow for channel enlargement, allowing for higher water retention and reducing flooding conditions during high-energy events. Deepening the canal would increase the surface area for conductance within the channel. This can result in a potential increase in groundwater recharge rates. Construction will be phased with a bypass channel to maintain level of service throughout the construction period. Therefore, any temporary negative effects during the construction phase due to reduced flow, while may be greater than the No Action Alternative, are expected to be negligible. Construction dewatering may temporarily alter groundwater flow-paths locally; however, Phase I ESA findings did not identify any known issues associated with this site or in its vicinity (refer to Section B.1.15). In addition, the use of a coffer dam bottom (tremie) seal (refer to Section A.8.11.1) has been recommended, which would significantly reduce the amount of dewatering needed.

WCS	Watershed / Canal	Effects on Groundwater
S-37A Gated Spillway	C-14 East Basin / C-14 (Cypress Creek) Canal	The new WCS would allow for increased holding capacity and decreased potential for overflow and backflow, and an increase in pump capacity and flow conveyance from gated spillway replacement and a new pump station. This is expected to result in reduced potential for saltwater intrusion as compared to the No Action Alternative. Construction will be phased with a bypass channel to maintain level of service throughout the construction period. Therefore, any temporary negative effects during the construction phase due to reduced flow, while may be greater than the No Action Alternative, are expected to be negligible. Construction dewatering may temporarily alter groundwater flow-paths locally; however, Phase I ESA findings did not identify any known issues associated with this site or in its vicinity (refer to Section B.1.15). In addition, the use of a coffer dam bottom (tremie) seal (refer to Section A.8.11.1) has been recommended, which would significantly reduce the amount of dewatering needed.
S-36 Gated Spillway	C-13 West Basin / C-13 (Middle River) Canal	The new WCS would allow for increased holding capacity and decreased potential for overflow and backflow, and an increase in pump capacity and flow conveyance from gated spillway replacement and a new pump station. This is expected to result in reduced potential for saltwater intrusion as compared to the No Action Alternative. Construction will be phased with a bypass channel to maintain level of service throughout the construction period. Therefore, any temporary negative effects during the construction phase due to reduced flow, while may be greater than the No Action Alternative, are expected to be negligible. Construction dewatering may temporarily alter groundwater flow-paths locally; however, Phase I ESA findings did not identify any known issues associated with this site or in its vicinity (refer to Section B.1.15). In addition, the use of a coffer dam bottom (tremie) seal (refer to Section A.8.11.1) has been recommended, which would significantly reduce the amount of dewatering needed.
S-33 Gated Spillway	C-12 West Basin / C-12 (Plantation) Canal	The new WCS would allow for increased holding capacity and decreased potential for overflow and backflow, and an increase in pump capacity and flow conveyance from gated spillway replacement and a new pump station. This is expected to result in reduced potential for saltwater intrusion as compared to the No Action Alternative. Construction will be phased with a bypass channel to maintain level of service throughout the construction period. Therefore, any temporary negative effects during the construction phase due to reduced flow, while may be greater than the No Action Alternative, are expected to be negligible. Construction dewatering may temporarily alter groundwater flow-paths locally. Phase I ESA findings identified a compliance issue with a UST in the area (refer to Section B.1.15). This will require further evaluation and consideration prior to construction. The use of a coffer dam bottom (tremie) seal (refer to Section A.8.11.1) has been recommended, which would significantly reduce the amount of dewatering needed.
G-54 Gated Spillway	North New River Canal West Basin / G-15 (North New River) Canal	The new WCS would allow for increased holding capacity and reduced likelihood of tidal water levels exceeding the WCS design capacity, and therefore, reduced potential for saltwater intrusion as compared to the No Action Alternative. This alternative includes a nature-based project, the Markham Park Stormwater Storage Capacity Improvement Project. This nature-based feature would influence groundwater levels positively. Features of the project include implementing a new 105-cfs pump station and two 84-inch diameter culverts with fixed upstream weirs. The Markham Park stormwater project would increase stormwater retention, which would increase groundwater recharge. Construction will be phased with a bypass channel to maintain level of service throughout the construction period. Therefore, any temporary negative effects during the construction phase due to reduced flow, while may be greater than the No Action Alternative, are expected to be negligible. Construction dewatering may temporarily alter groundwater flow-paths locally; however, Phase I ESA findings did not identify any known issues associated with this site or in its vicinity (refer to Section B.1.15). In addition, the use of a coffer dam bottom (tremie) seal (refer to Section A.8.11.1) has been recommended, which would significantly reduce the amount of dewatering needed.

WCS	Watershed / Canal	Effects on Groundwater
S-13AW Gated Culvert	C-11 West Basin / C-11 (South New River) Canal	Excavation of the 8.4-linear-mile section in the canal would allow for channel enlargement, allowing for increased water retention, higher flow capacity, and reducing flooding conditions during high-energy events. Deepening the canal would increase the surface area for conductance within the channel. This can result in a potential increase in groundwater recharge rates as compared to the No Action Alternative.
S-13 Pump Station and Gated Spillway	C-11 East Basin / C-11 (South New River) Canal	The new WCS would allow for increased holding capacity and decreased potential for overflow and backflow, and an increase in pump capacity and flow conveyance from gated spillway replacement and a new pump station. This is expected to result in reduced potential for saltwater intrusion. Excavation of the 8.4-linear-mile section in the canal would allow for channel enlargement, allowing for higher water retention and reducing flooding conditions during high-energy events. Deepening the canal would increase the surface area for conductance within the channel. This can result in a potential increase in groundwater recharge rates as compared to the No Action Alternative. Construction will be phased with a bypass channel to maintain level of service throughout the construction period. Therefore, any temporary negative effects during the construction phase due to reduced flow, while may be greater than the No Action Alternative, are expected to be negligible. Construction dewatering may temporarily alter groundwater flow-paths locally; however, Phase I ESA findings did not identify any known issues associated with this site or in its vicinity (refer to Section B.1.15). In addition, the use of a coffer dam bottom (tremie) seal (refer to Section A.8.11.1) has been recommended, which would significantly reduce the amount of dewatering needed.

Note: WCS = water control structure

B.3.6.4 Alternative C

Alternative C represents the most complex scenario involving the greatest number of measures. **Table B.3-31** below details the effects of Alternative C on groundwater by location.

Table B.3-31. Effects of Alternative C on Groundwater by Location.

WCS	Watershed / Canal	Effects on Groundwater
G-56 Gated Spillway	Hillsboro Canal Basin / G-08 (Hillsboro) Canal	The new WCS would allow for increased holding capacity and decreased potential for overflow and backflow, and an increase in pump capacity and flow conveyance from gated spillway replacement and a new pump station. This is expected to result in reduced potential for saltwater intrusion. Excavation of the 5.5-linear-mile section in the canal would allow for channel enlargement, allowing for higher water retention and reducing flooding conditions during high-energy events. Deepening the canal would increase the surface area for conductance within the channel. This can result in a potential increase in groundwater recharge rates as compared to the No Action Alternative. Additionally, this alternative includes the Hillsboro Watershed Stormwater Storage Capacity Improvement project. This nature-based feature has the potential to enhance groundwater recharge. Features of the project include implementing a 600-cfs pump station and the construction of the perimeter levee and seepage canal. This would act to store stormwater up to four feet above the ground surface, effectively reducing peak water levels and increasing stormwater retention in the G-08 (Hillsboro) Canal as compared to the No Action Alternative. Construction will be phased with a bypass channel to maintain level of service throughout the construction period. Therefore any, temporary negative effects during the construction phase due to reduced flow, while may be greater than the No Action Alternative, are expected to be negligible. Construction dewatering may temporarily alter groundwater flow-paths locally; however, Phase I ESA findings did not identify a recognized conditions associated with this site (refer to Section B.1.15). In addition, the use of a coffer dam bottom (tremie) seal (refer to Section A.8.11.1)

WCS	Watershed / Canal	Effects on Groundwater
		has been recommended, which would significantly reduce the amount of dewatering needed.
G-57 Gated Spillway	Pompano Canal Basin / G-16 (Pompano) Canal	The new WCS would allow for increased holding capacity and decreased potential for overflow and backflow, and an increase in pump capacity and flow conveyance from gated spillway replacement and a new pump station. This is expected to result in reduced potential for saltwater intrusion as compared to the No Action Alternative. Construction will be phased with a bypass channel to maintain level of service throughout the construction period. Therefore any, temporary negative effects during the construction phase due to reduced flow, while may be greater than the No Action Alternative, are expected to be negligible. Construction dewatering may temporarily alter groundwater flow-paths locally. Phase I ESA findings identified contaminated groundwater in the vicinity of this site (refer to Section B.1.15). This will require further evaluation and consideration prior to construction. The use of a coffer dam bottom (tremie) seal (refer to Section A.8.11.1) has been recommended, which would significantly reduce the amount of dewatering needed and should mitigate any impacts to plume migration..
S-37B Gated Spillway	C-14 West Basin / C-14 (Cypress Creek) Canal	No improvements are proposed to the S-37B Gated Spillway under Alternative C, so the effect on groundwater would be the same as the No Action Alternative. However, excavation of a 6.8-linear-mile section of the C-14 (Cypress Creek) Canal would allow for channel enlargement, allowing for higher water retention and reducing flooding conditions during high-energy events. Deepening the canal would increase the surface area for conductance within the channel. This can result in a potential increase in groundwater recharge rates as compared to the No Action Alternative.
S-37A Gated Spillway	C-14 East Basin / C-14 (Cypress Creek) Canal	The new WCS would allow for increased holding capacity and decreased potential for overflow and backflow, and an increase in pump capacity and flow conveyance from gated spillway replacement and a new pump station. This is expected to result in reduced potential for saltwater intrusion as compared to the No Action Alternative. Excavation of a 6.8-linear-mile section of the C-14 (Cypress Creek) Canal would allow for channel enlargement, allowing for higher water retention and reducing flooding conditions during high-energy events. Deepening the canal would increase the surface area for conductance within the channel. This can result in a potential increase in groundwater recharge rates as compared to the No Action Alternative. Construction will be phased with a bypass channel to maintain level of service throughout the construction period. Therefore, any temporary negative effects during the construction phase due to reduced flow, while may be greater than the No Action Alternative, are expected to be negligible. Construction dewatering may temporarily alter groundwater flow-paths locally; however, Phase I ESA findings did not identify any known issues associated with this site or in its vicinity (refer to Section B.1.15). In addition, the use of a coffer dam bottom (tremie) seal (refer to Section A.8.11.1) has been recommended, which would significantly reduce the amount of dewatering needed.
S-36 Gated Spillway	C-13 West Basin / C-13 (Middle River) Canal	The new WCS would allow for increased holding capacity and decreased potential for overflow and backflow, and an increase in pump capacity and flow conveyance from gated spillway replacement and a new pump station. This is expected to result in reduced potential for saltwater intrusion as compared to the No Action Alternative. Excavation of a 4.3-linear-mile section of the C-13 (Middle River) Canal would allow for channel enlargement, allowing for higher water retention and reducing flooding conditions during high-energy events. Deepening the canal would increase the surface area for conductance within the channel. This can result in a potential increase in groundwater recharge rates as compared to the No Action Alternative. Construction will be phased with a bypass channel to maintain level of service throughout the construction period. Therefore, any temporary negative effects during the construction phase due to reduced flow, while may be greater than the No Action Alternative, are expected to be negligible. Construction dewatering may temporarily alter groundwater flow-paths locally; however, Phase I ESA findings did not identify any known issues associated with this site or in its vicinity (refer to Section B.1.15). In addition, the use of a coffer dam bottom (tremie) seal (refer to

WCS	Watershed / Canal	Effects on Groundwater
		Section A.8.11.1) has been recommended, which would significantly reduce the amount of dewatering needed.
S-33 Gated Spillway	C-12 West Basin / C-12 (Plantation) Canal	The new WCS would allow for increased holding capacity and decreased potential for overflow and backflow, and an increase in pump capacity and flow conveyance from gated spillway replacement and a new pump station. This is expected to result in reduced potential for saltwater intrusion as compared to the No Action Alternative. Excavation of a 0.5-linear-mile section of the C-12 (Plantation) Canal would allow for channel enlargement, allowing for higher water retention and reducing flooding conditions during high-energy events. Deepening the canal would increase the surface area for conductance within the channel. This can result in a potential increase in groundwater recharge rates as compared to the No Action Alternative. Construction will be phased with a bypass channel to maintain level of service throughout the construction period. Therefore, any temporary negative effects during the construction phase due to reduced flow, while may be greater than the No Action Alternative, are expected to be negligible. Construction dewatering may temporarily alter groundwater flow-paths locally. Phase I ESA findings identified a compliance issue with a UST in the area (refer to Section B.1.15). This will require further evaluation and consideration prior to construction. The use of a coffer dam bottom (tremie) seal (refer to Section A.8.11.1) has been recommended, which would significantly reduce the amount of dewatering needed.
G-54 Gated Spillway	North New River Canal West Basin / G-15 (North New River) Canal	The new WCS would allow for increased holding capacity and decreased potential for overflow and backflow, and an increase in pump capacity and flow conveyance from gated spillway replacement and a new pump station. This is expected to result in reduced potential for saltwater intrusion as compared to the No Action Alternative. Excavation of a 13.9-linear-mile section of the G-15 (North New River) Canal would allow for channel enlargement, allowing for higher water retention and reducing flooding conditions during high-energy events. Deepening the canal would increase the surface area for conductance within the channel. This can result in a potential increase in groundwater recharge rates as compared to the No Action Alternative. Additionally, this alternative includes a nature-based project, the Markham Park Stormwater Storage Capacity Improvement Project. This nature-based feature would influence groundwater levels positively. Features of the project include implementing a new 105-cfs pump station and two 84-inch diameter culverts with fixed upstream weirs. The Markham Park stormwater project would increase stormwater retention, which would increase groundwater recharge. Construction will be phased with a bypass channel to maintain level of service throughout the construction period. Therefore, any temporary negative effects during the construction phase due to reduced flow, while may be greater than the No Action Alternative, are expected to be negligible. Construction dewatering may temporarily alter groundwater flow-paths locally; however, Phase I ESA findings did not identify any known issues associated with this site or in its vicinity (refer to Section B.1.15). In addition, the use of a coffer dam bottom (tremie) seal (refer to Section A.8.11.1) has been recommended, which would significantly reduce the amount of dewatering needed.
S-13AW Gated Culvert	C-11 West Basin / C-11 (South New River) Canal	Excavation of an 8.4-linear-mile section of the C-11 (South New River) Canal would allow for channel enlargement, allowing for higher water retention and reducing flooding conditions during high-energy events. Deepening the canal would increase the surface area for conductance within the channel. This can result in a potential increase in groundwater recharge rates as compared to the No Action Alternative.
S-13 Pump Station and Gated Spillway	C-11 East Basin / C-11 (South New River) Canal	The new WCS would allow for increased holding capacity and decreased potential for overflow and backflow, and an increase in pump capacity and flow conveyance from gated spillway replacement and a new pump station. This is expected to result in reduced potential for saltwater intrusion as compared to the No Action Alternative. Excavation of an 8.4-linear-mile section of the C-11 (South New River) Canal would allow for channel enlargement, allowing for higher water retention and reducing flooding conditions during high-energy events. Deepening the canal would increase the surface area for conductance within the channel. This can result in a potential increase in groundwater recharge rates as compared to the No Action Alternative.

WCS	Watershed / Canal	Effects on Groundwater
		Construction will be phased with a bypass channel to maintain level of service throughout the construction period. Therefore, any temporary negative effects during the construction phase due to reduced flow, while may be greater than the No Action Alternative, are expected to be negligible. Construction dewatering may temporarily alter groundwater flow-paths locally; however, Phase I ESA findings did not identify any known issues associated with this site or in its vicinity (refer to Section B.1.15). In addition, the use of a coffer dam bottom (tremie) seal (refer to Section A.8.11.1) has been recommended, which would significantly reduce the amount of dewatering needed.

Note: WCS = water control structure

B.3.6.5 Alternative RO

Alternative RO represents a combination of structural measures from all three alternatives. **Table B.3-32** below details the effects of Alternative RO on groundwater by location.

Table B.3-32. Effects of Alternative RO on Groundwater by Location.

WCS	Watershed / Canal	Effects on Groundwater
G-56 Gated Spillway	Hillsboro Canal Basin / G-08 (Hillsboro) Canal	The new WCS would allow for increased holding capacity and reduced likelihood of water levels exceeding the WCS design capacity, and therefore, reduced potential for saltwater intrusion. Excavation of the 1.1-linear-mile section in the canal would allow for channel enlargement, allowing for higher water retention and reducing flooding conditions during high-energy events. Deepening the canal would increase the surface area for conductance within the channel. This can result in a potential increase in groundwater recharge rates as compared to the No Action Alternative. Construction will be phased with a bypass channel to maintain level of service throughout the construction period. Therefore any, temporary negative effects during the construction phase due to reduced flow, while may be greater than the No Action Alternative, are expected to be negligible. Construction dewatering may temporarily alter groundwater flow-paths locally; however, Phase I ESA findings did not identify a recognized conditions associated with this site (refer to Section B.1.15). In addition, the use of a coffer dam bottom (tremie) seal (refer to Section A.8.11.1) has been recommended, which would significantly reduce the amount of dewatering needed.
G-57 Gated Spillway	Pompano Canal Basin / G-16 (Pompano) Canal	The new WCS would allow for increased holding capacity and reduced likelihood of water levels exceeding the WCS design capacity, and therefore, reduced potential for saltwater intrusion as compared to the No Action Alternative. Construction will be phased with a bypass channel to maintain level of service throughout the construction period. Therefore any, temporary negative effects during the construction phase due to reduced flow, while may be greater than the No Action Alternative, are expected to be negligible. Construction dewatering may temporarily alter groundwater flow-paths locally. Phase I ESA findings identified a contaminated groundwater in the vicinity of this site (refer to Section B.1.15). This will require further evaluation and consideration prior to construction. The use of a coffer dam bottom (tremie) seal (refer to Section A.8.11.1) has been recommended, which would significantly reduce the amount of dewatering needed and should mitigate any impacts to plume migration.

WCS	Watershed / Canal	Effects on Groundwater
S-37B Gated Spillway	C-14 West Basin / C-14 (Cypress Creek) Canal	The new WCS would allow for increased holding capacity and reduced likelihood of water levels exceeding the WCS design capacity, and therefore, reduced potential for saltwater intrusion as compared to the No Action Alternative. Excavation of the 1.2-linear-mile section in the canal would allow for channel enlargement, allowing for higher water retention and reducing flooding conditions during high-energy events. Deepening the canal would increase the surface area for conductance within the channel. This can result in a potential increase in groundwater recharge rates as compared to the No Action Alternative. Construction will be phased with a bypass channel to maintain level of service throughout the construction period. Therefore, any temporary negative effects during the construction phase due to reduced flow, while may be greater than the No Action Alternative, are expected to be negligible. Construction dewatering may temporarily alter groundwater flow-paths locally; however, Phase I ESA findings did not identify any known issues associated with this site or in its vicinity (refer to Section B.1.15). In addition, the use of a coffer dam bottom (tremie) seal (refer to Section A.8.11.1) has been recommended, which would significantly reduce the amount of dewatering needed
S-37A Gated Spillway	C-14 East Basin / C-14 (Cypress Creek) Canal	The new WCS would allow for increased holding capacity and decreased potential for overflow and backflow, and an increase in pump capacity and flow conveyance from gated spillway replacement and a new pump station. This is expected to result in reduced potential for saltwater intrusion as compared to the No Action Alternative. Construction will be phased with a bypass channel to maintain level of service throughout the construction period. Therefore, any temporary negative effects during the construction phase due to reduced flow, while may be greater than the No Action Alternative, are expected to be negligible. Construction dewatering may temporarily alter groundwater flow-paths locally; however, Phase I ESA findings did not identify any known issues associated with this site or in its vicinity (refer to Section B.1.15). In addition, the use of a coffer dam bottom (tremie) seal (refer to Section A.8.11.1) has been recommended, which would significantly reduce the amount of dewatering needed.
S-36 Gated Spillway	C-13 West Basin / C-13 (Middle River) Canal	The new WCS would allow for increased holding capacity and decreased potential for overflow and backflow, and an increase in pump capacity and flow conveyance from gated spillway replacement and a new pump station. This is expected to result in reduced potential for saltwater intrusion as compared to the No Action Alternative. Construction will be phased with a bypass channel to maintain level of service throughout the construction period. Therefore, any temporary negative effects during the construction phase due to reduced flow, while may be greater than the No Action Alternative, are expected to be negligible. Construction dewatering may temporarily alter groundwater flow-paths locally; however, Phase I ESA findings did not identify any known issues associated with this site or in its vicinity (refer to Section B.1.15). In addition, the use of a coffer dam bottom (tremie) seal (refer to Section A.8.11.1) has been recommended, which would significantly reduce the amount of dewatering needed.
S-33 Gated Spillway	C-12 West Basin / C-12 (Plantation) Canal	The new WCS would allow for increased holding capacity and decreased potential for overflow and backflow, and an increase in pump capacity and flow conveyance from gated spillway replacement and a new pump station. This is expected to result in reduced potential for saltwater intrusion as compared to the No Action Alternative. Construction will be phased with a bypass channel to maintain level of service throughout the construction period. Therefore, any temporary negative effects during the construction phase due to reduced flow, while may be greater than the No Action Alternative, are expected to be negligible. Construction dewatering may temporarily alter groundwater flow-paths locally. Phase I ESA findings identified a compliance issue with a UST in the area (refer to Section B.1.15). This will require further evaluation and consideration prior to construction. The use of a coffer dam bottom (tremie) seal (refer to Section A.8.11.1) has been recommended, which would significantly reduce the amount of dewatering needed.

WCS	Watershed / Canal	Effects on Groundwater
G-54 Gated Spillway	North New River Canal West Basin / G-15 (North New River) Canal	The new WCS would allow for increased holding capacity and reduced likelihood of water levels exceeding the WCS design capacity, and therefore, reduced potential for saltwater intrusion as compared to the No Action Alternative. Construction will be phased with a bypass channel to maintain level of service throughout the construction period. Therefore, any temporary negative effects during the construction phase due to reduced flow, while may be greater than the No Action Alternative, are expected to be negligible. Construction dewatering may temporarily alter groundwater flow-paths locally; however, Phase I ESA findings did not identify any known issues associated with this site or in its vicinity (refer to Section B.1.15). In addition, the use of a coffer dam bottom (tremie) seal (refer to Section A.8.11.1) has been recommended, which would significantly reduce the amount of dewatering needed.
S-13AW Gated Culvert	C-11 West Basin / C-11 (South New River) Canal	Excavation of the 1.5-linear-mile section in the canal would allow for channel enlargement, allowing for increased water retention, higher flow capacity, and reducing flooding conditions during high-energy events. Deepening the canal would increase the surface area for conductance within the channel. This can result in a potential increase in groundwater recharge rates as compared to the No Action Alternative.
S-13 Pump Station and Gated Spillway	C-11 East Basin / C-11 (South New River) Canal	The new WCS would allow for increased holding capacity and decreased potential for overflow and backflow, and an increase in pump capacity and flow conveyance from gated spillway replacement and a new pump station. This is expected to result in reduced potential for saltwater intrusion as compared to the No Action Alternative. Excavation of 0.5 miles in the canal would allow for channel enlargement, allowing for higher water retention and reducing flooding conditions during high-energy events. Deepening the canal would increase the surface area for conductance within the channel. This can result in a potential increase in groundwater recharge rates as compared to the No Action Alternative. Construction will be phased with a bypass channel to maintain level of service throughout the construction period. Therefore, any temporary negative effects during the construction phase due to reduced flow, while may be greater than the No Action Alternative, are expected to be negligible. Construction dewatering may temporarily alter groundwater flow-paths locally; however, Phase I ESA findings did not identify any known issues associated with this site or in its vicinity (refer to Section B.1.15). In addition, the use of a coffer dam bottom (tremie) seal (refer to Section A.8.11.1) has been recommended, which would significantly reduce the amount of dewatering needed.

Note: WCS = water control structure

B.3.7 Surface Water Quality

The potential impacts to surface water quality from the No Action Alternative and implementation of the action alternatives is presented below.

B.3.7.1 Future Without Project Conditions (No Action Alternative)

Under the No Action Alternative, no improvements or modifications would be made to any of the WCS. Increasing sea level and increasing rainfall intensity, duration, and frequency in the future would result in a reduction in efficiency of the C&SF system and decreased future flood protection levels of service. WCS would not be able to handle an increase in runoff, resulting in worsening water quality and heightened contamination risks. Additionally, the frequency of sanitary sewer overflows is expected to rise, along with greater challenges in stormwater management and drainage.

B.3.7.2 Alternative A

Alternative A represents the least complex alternative. **Table B.3-33** below details the effects of Alternative A on surface water quality by location.

Table B.3-33. Effects of Alternative A on Surface Water Quality by Location.

WCS	Watershed / Canal	Effects on Surface Water Quality
G-56 Gated Spillway	Hillsboro Canal Basin / G-08 (Hillsboro) Canal	Riprap placed along the sides of the canal would reduce erosion during high surge events. Temporary access roads can impact surface water quality. Construction activities can often disturb soil, leading to increased erosion. Sediment can wash off the roads and into the canal during high rainfall events. While greater than the No Action Alternative (under which no construction would occur), this impact during the construction phase is expected to be minimal to negligible.
G-57 Gated Spillway	Pompano Canal Basin / G-16 (Pompano) Canal	Riprap placed along the sides of the canal would reduce erosion during high surge events. Temporary access roads can impact surface water quality. Construction activities can often disturb soil, leading to increased erosion. Sediment can wash off the roads and into the canal during high rainfall events. While greater than the No Action Alternative, this impact during the construction phase is expected to be minimal to negligible. This alternative includes adding two 10-foot diameter culverts parallel to the existing 10-foot diameter culvert, which would reduce the likelihood of water levels exceeding the WCS design capacity and increase water holding capacity and water conveyance. Effects on water quality from the addition of the two culverts are expected to be negligible.
S-37B Gated Spillway	C-14 West Basin / C-14 (Cypress Creek) Canal	Effects would be the same as the No Action Alternative because no improvements are proposed under Alternative A.
S-37A Gated Spillway	C-14 East Basin / C-14 (Cypress Creek) Canal	Demolishing the existing WCS may cause sediment loads, increasing turbidity. These effects would be experienced during the construction phase and are expected to be minimal to negligible. Temporary access roads can impact surface water quality. Construction activities can often disturb soil, leading to increased erosion. Sediment can wash off the roads and into the canal during high rainfall events. While greater than the No Action Alternative, this impact during the construction phase is expected to be minimal to negligible. During the OMRR&R phase, the operation of three new main pumps and one auxiliary pump could alter water quality by managing sediment transport, thereby reducing the buildup of sediment at the gated spillway. However, pumps may also create localized currents, resulting in sediment resuspension and thereby increasing turbidity as compared to the No Action Alternative. These effects during the OMRR&R phase are expected to be negligible.
S-36 Gated Spillway	C-13 West Basin / C-13 (Middle River) Canal	Demolishing the existing WCS may cause sediment loads, increasing turbidity. These effects would be experienced during the construction phase and are expected to be minimal to negligible. Temporary access roads can impact surface water quality. Construction activities can often disturb soil, leading to increased erosion. Sediment can wash off the roads and into the canal during high rainfall events. While greater than the No Action Alternative, this impact during the construction phase is expected to be minimal to negligible. No new pumps would be implemented under this alternative; therefore, the effects are the same as the No Action Alternative during the OMRR&R phase.

WCS	Watershed / Canal	Effects on Surface Water Quality
S-33 Gated Spillway	C-12 West Basin / C-12 (Plantation) Canal	Demolishing the existing WCS may cause sediment loads, increasing turbidity. These effects would be experienced during the construction phase and are expected to be minimal to negligible. Temporary access roads can impact surface water quality. Construction activities can often disturb soil, leading to increased erosion. Sediment can wash off the roads and into the canal during high rainfall events. While greater than the No Action Alternative, this impact during the construction phase is expected to be minimal to negligible. During the OMRR&R phase, the operation of three new main pumps and one auxiliary pump could alter water quality by managing sediment transport, thereby reducing the buildup of sediment at the gated spillway. However, pumps may also create localized currents, resulting in sediment resuspension and thereby increasing turbidity as compared to the No Action Alternative. These effects during the OMRR&R phase are expected to be negligible.
G-54 Gated Spillway	North New River Canal West Basin / G-15 (North New River) Canal	Riprap placed along the sides of the canal would reduce erosion during high surge events. Temporary access roads can impact surface water quality. Construction activities can often disturb soil, leading to increased erosion. Sediment can wash off the roads and into the canal during high rainfall events. While greater than the No Action Alternative, this impact during the construction phase is expected to be minimal to negligible. No new pumps would be implemented under this alternative; therefore, the effects are the same as No Action Alternative during the OMRR&R phase.
S-13AW Gated Culvert	C-11 West Basin / C-11 (South New River) Canal	Effects would be the same as the No Action Alternative because no improvements are proposed under Alternative A.
S-13 Pump Station and Gated Spillway	C-11 East Basin / C-11 (South New River) Canal	Demolishing the existing WCS may cause sediment loads, increasing turbidity. These effects would be experienced during the construction phase and are expected to be minimal to negligible. Temporary access roads can impact surface water quality. Construction activities can often disturb soil, leading to increased erosion. Sediment can wash off the roads and into the canal during high rainfall events. While greater than the No Action Alternative, this impact during the construction phase is expected to be minimal to negligible. During the OMRR&R phase, the operation of four new main pumps and one auxiliary pump could alter water quality by managing sediment transport, thereby reducing the buildup of sediment at the gated spillway. However, pumps may also create localized currents, resulting in sediment resuspension and thereby increasing turbidity as compared to the No Action Alternative. These effects during the OMRR&R phase are expected to be negligible.

Notes: OMRR&R = operation, maintenance, repair, replacement, and rehabilitation; WCS = water control structure; cfs = cubic feet per second

B.3.7.3 Alternative B

Alternative B represents an intermediate alternative where the number of proposed measures is greater than Alternative A but fewer than Alternative C. **Table B.3-34** below details the effects of Alternative B on surface water quality by location.

Table B.3-34. Effects of Alternative B on Surface Water Quality by Location.

Site	Watershed / Canal	Effects on Surface Water Quality
G-56 Gated Spillway	Hillsboro Canal Basin / G-08 (Hillsboro) Canal	Demolishing the existing WCS may cause sediment loads, increasing turbidity. These effects would be experienced during the construction phase and are expected to be minimal to negligible. Temporary access roads can impact surface water quality. construction activities can often disturb soil, leading to increased erosion. Sediment can wash off the roads and into the canal during high rainfall events. While greater than the No Action Alternative, this impact during the construction phase is expected to be minimal to negligible. No new pumps would be implemented under this alternative; therefore, the effects are the same as no action. Excavation of the 5.5-linear-mile section in the canal would allow for channel enlargement, allowing for higher water conveyance as compared to the No Action Alternative. During construction, localized resuspension of sediment would be monitored and controlled. Effects on water quality from the canal enlargement are expected to be negligible.
G-57 Gated Spillway	Pompano Canal Basin / G-16 (Pompano) Canal	Demolishing the existing WCS may cause sediment loads, increasing turbidity. These effects would be experienced during the construction phase and are expected to be minimal to negligible. Temporary access roads can impact surface water quality. construction activities can often disturb soil, leading to increased erosion. Sediment can wash off the roads and into the canal during high rainfall events. While greater than the No Action Alternative, this impact during the construction phase is expected to be minimal to negligible. No new pumps would be implemented under this alternative; therefore, the effects are the same as no action during the OMRR&R phase. This alternative includes adding two 10-foot diameter culverts parallel to the existing 10-foot diameter culvert, which would reduce the likelihood of water levels exceeding the WCS design capacity and increase water holding capacity and water conveyance as compared to the No Action Alternative. Effects on water quality from the addition of the two culverts are expected to be negligible.
S-37B Gated Spillway	C-14 West Basin / C-14 (Cypress Creek) Canal	Temporary access roads can impact surface water quality. construction activities can often disturb soil, leading to increased erosion. Sediment can wash off the roads and into the canal during high rainfall events. While greater than the No Action Alternative, this impact during the construction phase is expected to be minimal to negligible. No new pumps would be implemented under this alternative; therefore, the effects are the same as no action during the OMRR&R phase. Excavation of the 1.2-linear-mile section in the canal would allow for channel enlargement, allowing for higher water conveyance as compared to the No Action Alternative. During construction, localized resuspension of sediment would be monitored and controlled. Effects on water quality from the channel enlargement are expected to be negligible.
S-37A Gated Spillway	C-14 East Basin / C-14 (Cypress Creek) Canal	Demolishing the existing WCS may cause sediment loads, increasing turbidity. These effects would be experienced during the construction phase and are expected to be minimal to negligible. Temporary access roads can impact surface water quality. Construction activities can often disturb soil, leading to increased erosion. Sediment can wash off the roads and into the canal during high rainfall events. While greater than the No Action Alternative, this impact during the construction phase is expected to be minimal to negligible. During the OMRR&R phase, the operation of three new main pumps and one auxiliary pump could alter water quality by managing sediment transport, thereby reducing the buildup of sediment at the gated spillway. However, pumps may also create localized currents, resulting in sediment resuspension and thereby increasing turbidity as compared to the No Action Alternative. These effects during the OMRR&R phase are expected to be negligible.

Site	Watershed / Canal	Effects on Surface Water Quality
S-36 Gated Spillway	C-13 West Basin / C-13 (Middle River) Canal	Demolishing the existing WCS may cause sediment loads, increasing turbidity. These effects would be experienced during the construction phase and are expected to be minimal to negligible. Temporary access roads can impact surface water quality. Construction activities can often disturb soil, leading to increased erosion. Sediment can wash off the roads and into the canal during high rainfall events. While greater than the No Action Alternative, this impact during the construction phase is expected to be minimal to negligible. The implementation of three new main pumps and one auxiliary pump can alter water quality by managing sediment transport, thereby reducing the buildup of sediment at the gated spillway. Sediment management of pumps can create currents resulting in sediment resuspension, increasing turbidity as compared to the No Action Alternative. These effects during the OMRR&R phase are expected to be negligible.
S-33 Gated Spillway	C-12 West Basin / C-12 (Plantation) Canal	Demolishing the existing WCS may cause sediment loads, increasing turbidity. These effects would be experienced during the construction phase and are expected to be minimal to negligible. Temporary access roads can impact surface water quality. Construction activities can often disturb soil, leading to increased erosion. Sediment can wash off the roads and into the canal during high rainfall events. While greater than the No Action Alternative, this impact during the construction phase is expected to be minimal to negligible. During the OMRR&R phase, the operation of three new main pumps and one auxiliary pump could alter water quality by managing sediment transport, thereby reducing the buildup of sediment at the gated spillway. However, pumps may also create localized currents, resulting in sediment resuspension and thereby increasing turbidity as compared to the No Action Alternative. These effects during the OMRR&R phase are expected to be negligible.
G-54 Gated Spillway	North New River Canal West Basin / G-15 (North New River) Canal	Demolishing the existing WCS may cause sediment loads, increasing turbidity. These effects would be experienced during the construction phase and are expected to be minimal to negligible. Temporary access roads can impact surface water quality. Construction activities can often disturb soil, leading to increased erosion. Sediment can wash off the roads and into the canal during high rainfall events. While greater than the No Action Alternative, this impact during the construction phase is expected to be minimal to negligible. No new pumps would be implemented under this alternative; therefore, the effects are the same as no action. This alternative includes the Markham Park Stormwater Storage Capacity Improvement Project. Features of the project include implementing a 105-cfs pump station, two 84-inch diameter culverts, and a modified outfall structure. This nature-based feature may have positive effects on water quality. By increasing stormwater storage capacity, the project would help mitigate peak water stages during high-energy storm events. This would lead to better control over runoff and reduce the risk of flooding, which can help maintain consistent water quality as compared to the No Action Alternative. The Markham project's impacts on water quality are expected to be minimal.
S-13AW Gated Culvert	C-11 West Basin / C-11 (South New River) Canal	Excavation of the 8.4-linear-mile section in the canal would allow for channel enlargement, allowing for higher water conveyance as compared to the No Action Alternative. Effects on water quality from the channel enlargement are expected to be negligible.

Site	Watershed / Canal	Effects on Surface Water Quality
S-13 Pump Station and Gated Spillway	C-11 East Basin / C-11 (South New River) Canal	Demolishing the existing WCS may cause sediment loads, increasing turbidity. These effects would be experienced during the construction phase and are expected to be minimal to negligible. Temporary access roads can impact surface water quality. Construction activities can often disturb soil, leading to increased erosion. Sediment can wash off the roads and into the canal during high rainfall events. While greater than the No Action Alternative, this impact during the construction phase is expected to be minimal to negligible. During the OMRR&R phase, the operation of four new main pumps and one auxiliary pump could alter water quality by managing sediment transport, thereby reducing the buildup of sediment at the gated spillway. However, pumps may also create localized currents, resulting in sediment resuspension and thereby increasing turbidity as compared to the No Action Alternative. These effects during the OMRR&R phase are expected to be negligible. Excavation of the 8.4-linear-mile section in the canal would allow for channel enlargement, allowing for higher water conveyance as compared to the No Action Alternative. During construction, localized resuspension of sediment would be monitored and controlled. Effects on water quality from the channel enlargement are expected to be negligible.

Note: OMRR&R = operation, maintenance, repair, replacement, and rehabilitation

B.3.7.4 Alternative C

Alternative C represents the most complex scenario involving the greatest number of measures. **Table B.3-35** below details the effects of Alternative C on surface water quality by location.

Table B.3-35. Effects of Alternative C on Surface Water Quality by Location.

WCS	Watershed / Canal	Effects on Surface Water Quality
G-56 Gated Spillway	Hillsboro Canal Basin / G-08 (Hillsboro) Canal	Demolishing the existing WCS may cause sediment loads, increasing turbidity. These effects would be experienced during the construction phase and are expected to be minimal to negligible. Temporary access roads can impact surface water quality. Construction activities can often disturb soil, leading to increased erosion. Sediment can wash off the roads and into the canal during high rainfall events. While greater than the No Action Alternative, this impact during the construction phase is expected to be minimal to negligible. During the OMRR&R phase, the operation of three new main pumps and one auxiliary pump could alter water quality by managing sediment transport, thereby reducing the buildup of sediment at the gated spillway. However, pumps may also create localized currents, resulting in sediment resuspension and thereby increasing turbidity as compared to the No Action Alternative. These effects during the OMRR&R phase are expected to be negligible. Additionally, this alternative includes the Hillsboro Watershed Stormwater Storage Capacity Improvement project. Features of the project include implementing a 600 cfs inflow pump station that would pump stormwater from the Hillsboro canal to the new stormwater storage area, and the construction of the perimeter levee and seepage canal. This would act to store stormwater up to four feet above the ground surface, effectively reducing peak water levels and increasing stormwater retention. This can improve surface water quality by preventing sediment and pollutants from washing into the canal during high-energy rain events as compared to the No Action Alternative. The Hillsboro stormwater storage project is expected to have minimal effects on water quality.
G-57 Gated Spillway	Pompano Canal Basin / G-16 (Pompano) Canal	Demolishing the existing WCS may cause sediment loads, increasing turbidity. These effects would be experienced during the construction phase and are expected to be minimal to negligible. Temporary access roads can impact surface water quality. Construction activities can often disturb soil, leading to increased erosion. Sediment can wash off the roads and into the canal during high rainfall events. While greater than the No Action Alternative, this impact during the construction phase is expected to be minimal to negligible. During the OMRR&R phase, the operation of three new main pumps and one auxiliary pump could alter water quality by managing sediment

WCS	Watershed / Canal	Effects on Surface Water Quality
		transport, thereby reducing the buildup of sediment at the gated spillway. However, pumps may also create localized currents, resulting in sediment resuspension and thereby increasing turbidity as compared to the No Action Alternative. These effects during the OMRR&R phase are expected to be negligible.
S-37B Gated Spillway	C-14 West Basin / C-14 (Cypress Creek) Canal	Temporary access roads can impact surface water quality. Construction activities can often disturb soil, leading to increased erosion. Sediment can wash off the roads and into the canal during high rainfall events. While greater than the No Action Alternative, this impact during the construction phase is expected to be minimal to negligible. No new pumps would be implemented under this alternative; therefore, the effects are the same as no action during the OMRR&R phase. Excavation of the 6.8-linear-mile section in the canal would allow for channel enlargement, allowing for higher water conveyance as compared to the No Action Alternative. Effects on water quality from the channel enlargement are expected to be negligible.
S-37A Gated Spillway	C-14 East Basin / C-14 (Cypress Creek) Canal	Demolishing the existing WCS may cause sediment loads, increasing turbidity. These effects would be experienced during the construction phase and are expected to be minimal to negligible. Temporary access roads can impact surface water quality. Construction activities can often disturb soil, leading to increased erosion. Sediment can wash off the roads and into the canal during high rainfall events. While greater than the No Action Alternative, this impact during the construction phase is expected to be minimal to negligible. During the OMRR&R phase, the operation of three new main pumps and one auxiliary pump could alter water quality by managing sediment transport, thereby reducing the buildup of sediment at the gated spillway. However, pumps may also create localized currents, resulting in sediment resuspension and thereby increasing turbidity as compared to the No Action Alternative. These effects during the OMRR&R phase are expected to be negligible. Excavation of the 6.8-linear-mile section in the canal would allow for channel enlargement, allowing for higher water conveyance as compared to the No Action Alternative. During construction, localized resuspension of sediment would be monitored and controlled. Effects on water quality from the channel enlargement are expected to be negligible.
S-36 Gated Spillway	C-13 West Basin / C-13 (Middle River) Canal	Demolishing the existing WCS may cause sediment loads, increasing turbidity. These effects would be experienced during the construction phase and are expected to be minimal to negligible. Temporary access roads can impact surface water quality. Construction activities can often disturb soil, leading to increased erosion. Sediment can wash off the roads and into the canal during high rainfall events. While greater than the No Action Alternative, this impact during the construction phase is expected to be minimal to negligible. During the OMRR&R phase, the operation of three new main pumps and one auxiliary pump could alter water quality by managing sediment transport, thereby reducing the buildup of sediment at the gated spillway. However, pumps may also create localized currents, resulting in sediment resuspension and thereby increasing turbidity as compared to the No Action Alternative. These effects during the OMRR&R phase are expected to be negligible. Excavation of the 4.3-linear-mile section in the canal would allow for channel enlargement, allowing for higher water conveyance as compared to the No Action Alternative. During construction, localized resuspension of sediment would be monitored and controlled. Effects on water quality from the channel enlargement are expected to be negligible.
S-33 Gated Spillway	C-12 West Basin / C-12 (Plantation) Canal	Demolishing the existing WCS may cause sediment loads, increasing turbidity. These effects would be experienced during the construction phase and are expected to be minimal to negligible. Temporary access roads can impact surface water quality. Construction activities can often disturb soil, leading to increased erosion. Sediment can wash off the roads and into the canal during high rainfall events. While greater than the No Action Alternative, this impact during the construction phase is expected to be minimal to negligible. During the OMRR&R phase, the operation of three new main pumps and one auxiliary pump could alter water quality by managing sediment transport, thereby reducing the buildup of sediment at the gated spillway. However, pumps may also create localized currents, resulting in sediment resuspension and thereby increasing turbidity as compared to the No Action Alternative. These effects during the OMRR&R phase are expected to be negligible. Excavation of the 0.5-linear-

WCS	Watershed / Canal	Effects on Surface Water Quality
		mile section in the canal would allow for channel enlargement, allowing for higher water conveyance as compared to the No Action Alternative. During construction, localized resuspension of sediment would be monitored and controlled. Effects on water quality from the channel enlargement are expected to be negligible.
G-54 Gated Spillway	North New River Canal West Basin / G-15 (North New River) Canal	Demolishing the existing WCS may cause sediment loads, increasing turbidity. These effects would be experienced during the construction phase and are expected to be minimal to negligible. Temporary access roads can impact surface water quality. Construction activities can often disturb soil, leading to increased erosion. Sediment can wash off the roads and into the canal during high rainfall events. While greater than the No Action Alternative, this impact during the construction phase is expected to be minimal to negligible. During the OMRR&R phase, the operation of three new main pumps and one auxiliary pump could alter water quality by managing sediment transport, thereby reducing the buildup of sediment at the gated spillway. However, pumps may also create localized currents, resulting in sediment resuspension and thereby increasing turbidity as compared to the No Action Alternative. These effects during the OMRR&R phase are expected to be negligible. This alternative includes the Markham Park Stormwater Storage Capacity Improvement Project. Features of the project include implementing a 105-cfs pump station, two 84-inch diameter culverts, and a modified outfall structure. This nature-based project can have positive effects on water quality. By increasing stormwater storage capacity, the project would help mitigate peak water stages during high-energy storm events. This would lead to better control over runoff and reduce the risk of flooding, which can help maintain consistent water quality as compared to the No Action Alternative. The Markham project's impacts on water quality are expected to be minimal. Excavation of the 13.9-linear-mile section in the canal would allow for channel enlargement, allowing for higher water conveyance as compared to the No Action Alternative. During construction, localized resuspension of sediment would be monitored and controlled. Effects on water quality from the channel enlargement are expected to be negligible.
S-13AW Gated Culvert	C-11 West Basin / C-11 (South New River) Canal	Excavation of the 8.4-linear-mile section in the canal would allow for channel enlargement, allowing for higher water conveyance as compared to the No Action Alternative. Effects on water quality from the channel enlargement are expected to be negligible.
S-13 Pump Station and Gated Spillway	C-11 East Basin / C-11 (South New River) Canal	Demolishing the existing WCS may cause sediment loads, increasing turbidity. These effects would be experienced during the construction phase and are expected to be minimal to negligible. Temporary access roads can impact surface water quality. Construction activities can often disturb soil, leading to increased erosion. Sediment can wash off the roads and into the canal during high rainfall events. While greater than the No Action Alternative, this impact during the construction phase is expected to be minimal to negligible. During the OMRR&R phase, the operation of four new main pumps and one auxiliary pump could alter water quality by managing sediment transport, thereby reducing the buildup of sediment at the gated spillway. However, pumps may also create localized currents, resulting in sediment resuspension and thereby increasing turbidity as compared to the No Action Alternative. These effects during the OMRR&R phase are expected to be negligible. Excavation of the 8.4-linear-mile section in the canal would allow for channel enlargement, allowing for higher water conveyance as compared to the No Action Alternative. During construction, localized resuspension of sediment would be monitored and controlled. Effects on water quality from the channel enlargement are expected to be negligible.

Notes: OMRR&R = operation, maintenance, repair, replacement, and rehabilitation; WCS = water control structure

B.3.7.5 Alternative RO

Alternative RO blends various structural measures from Alternatives A through C to provide an optimized solution for flood risk management. **Table B.3-36** below details the effects of Alternative RO on surface water quality by location.

Table B.3-36. Effects of Alternative RO on Surface Water Quality by Location.

Site	Watershed / Canal	Effects on Surface Water Quality
G-56 Gated Spillway	Hillsboro Canal Basin / G-08 (Hillsboro) Canal	Demolishing the existing WCS may cause sediment loads, increasing turbidity. These effects would be experienced during the construction phase and are expected to be minimal to negligible. Temporary access roads can impact surface water quality. construction activities can often disturb soil, leading to increased erosion. Sediment can wash off the roads and into the canal during high rainfall events. While greater than the No Action Alternative, this impact during the construction phase is expected to be minimal to negligible. No new pumps would be implemented under this alternative; therefore, the effects are the same as no action. Excavation of the 1.1-linear-mile section in the canal would allow for channel enlargement, allowing for higher water conveyance as compared to the No Action Alternative. Effects on water quality from the canal enlargement are expected to be negligible.
G-57 Gated Spillway	Pompano Canal Basin / G-16 (Pompano) Canal	Demolishing the existing WCS may cause sediment loads, increasing turbidity. These effects would be experienced during the construction phase and are expected to be minimal to negligible. Temporary access roads can impact surface water quality. construction activities can often disturb soil, leading to increased erosion. Sediment can wash off the roads and into the canal during high rainfall events. While greater than the No Action Alternative, this impact during the construction phase is expected to be minimal to negligible. No new pumps would be implemented under this alternative; therefore, the effects are the same as no action during the OMRR&R phase. This alternative includes adding two 10-ft-diameter culverts parallel to the existing 10-ft-diameter culvert, which would reduce the likelihood of water levels exceeding the WCS design capacity and increase water holding capacity and water conveyance as compared to the No Action Alternative. Effects on water quality from the addition of the two culverts are expected to be negligible.
S-37B Gated Spillway	C-14 West Basin / C-14 (Cypress Creek) Canal	Excavation of the 1.2-linear-mile section in the canal would allow for channel enlargement, allowing for higher water conveyance as compared to the No Action Alternative. During construction, localized resuspension of sediment would be monitored and controlled. Effects on water quality from the channel enlargement are expected to be negligible.
S-37A Gated Spillway	C-14 East Basin / C-14 (Cypress Creek) Canal	Demolishing the existing WCS may cause sediment loads, increasing turbidity. These effects would be experienced during the construction phase and are expected to be minimal to negligible. Temporary access roads can impact surface water quality. Construction activities can often disturb soil, leading to increased erosion. Sediment can wash off the roads and into the canal during high rainfall events. While greater than the No Action Alternative, this impact during the construction phase is expected to be minimal to negligible. During the OMRR&R phase, the operation of three new main pumps and one auxiliary pump could alter water quality by managing sediment transport, thereby reducing the buildup of sediment at the gated spillway. However, pumps may also create localized currents, resulting in sediment resuspension and thereby increasing turbidity as compared to the No Action Alternative. These effects during the OMRR&R phase are expected to be negligible.
S-36 Gated Spillway	C-13 West Basin / C-13 (Middle River) Canal	Demolishing the existing WCS may cause sediment loads, increasing turbidity. These effects would be experienced during the construction phase and are expected to be minimal to negligible. Temporary access roads can impact surface water quality. Construction activities can often disturb soil, leading to increased erosion. Sediment can wash off the roads and into the canal during high rainfall events. While greater than the No Action Alternative, this impact during the construction phase is expected to be minimal to negligible. The implementation of three new main pumps can alter water quality by managing sediment transport, thereby reducing the buildup of sediment at the gated spillway. Sediment management of pumps can create currents resulting in sediment resuspension, increasing turbidity as compared to the No Action Alternative. These effects during the OMRR&R phase are expected to be negligible.

Site	Watershed / Canal	Effects on Surface Water Quality
S-33 Gated Spillway	C-12 West Basin / C-12 (Plantation) Canal	Demolishing the existing WCS may cause sediment loads, increasing turbidity. These effects would be experienced during the construction phase and are expected to be minimal to negligible. Temporary access roads can impact surface water quality. Construction activities can often disturb soil, leading to increased erosion. Sediment can wash off the roads and into the canal during high rainfall events. While greater than the No Action Alternative, this impact during the construction phase is expected to be minimal to negligible. During the OMRR&R phase, the operation of three new main pumps and one auxiliary pump could alter water quality by managing sediment transport, thereby reducing the buildup of sediment at the gated spillway. However, pumps may also create localized currents, resulting in sediment resuspension and thereby increasing turbidity as compared to the No Action Alternative. These effects during the OMRR&R phase are expected to be negligible.
G-54 Gated Spillway	North New River Canal West Basin / G-15 (North New River) Canal	Demolishing the existing WCS may cause sediment loads, increasing turbidity. These effects would be experienced during the construction phase and are expected to be minimal to negligible. Temporary access roads can impact surface water quality. Construction activities can often disturb soil, leading to increased erosion. Sediment can wash off the roads and into the canal during high rainfall events. While greater than the No Action Alternative, this impact during the construction phase is expected to be minimal to negligible. During the OMRR&R phase, the operation of three new main pumps and one auxiliary pump could alter water quality by managing sediment transport, thereby reducing the buildup of sediment at the gated spillway. However, pumps may also create localized currents, resulting in sediment resuspension and thereby increasing turbidity as compared to the No Action Alternative. These effects during the OMRR&R phase are expected to be negligible.
S-13AW Gated Culvert	C-11 West Basin / C-11 (South New River) Canal	Excavation of the 1.5-linear-mile section in the canal would allow for channel enlargement, allowing for higher water conveyance as compared to the No Action Alternative. During construction, localized resuspension of sediment would be monitored and controlled. Effects on water quality from the channel enlargement are expected to be negligible.
S-13 Pump Station and Gated Spillway	C-11 East Basin / C-11 (South New River) Canal	Demolishing the existing WCS may cause sediment loads, increasing turbidity. These effects would be experienced during the construction phase and are expected to be minimal to negligible. Temporary access roads can impact surface water quality. Construction activities can often disturb soil, leading to increased erosion. Sediment can wash off the roads and into the canal during high rainfall events. While greater than the No Action Alternative, this impact during the construction phase is expected to be minimal to negligible. During the OMRR&R phase, the operation of four new main pumps and one auxiliary pump could alter water quality by managing sediment transport, thereby reducing the buildup of sediment at the gated spillway. However, pumps may also create localized currents, resulting in sediment resuspension and thereby increasing turbidity as compared to the No Action Alternative. These effects during the OMRR&R phase are expected to be negligible. Excavation of 0.5 miles in the canal would allow for channel enlargement, allowing for higher water conveyance as compared to the No Action Alternative. During construction, localized resuspension of sediment would be monitored and controlled. Effects on water quality from the channel enlargement are expected to be negligible.

B.3.8 Vegetation

An analysis of the potential effects on vegetation from the No Action Alternative and implementation of the action alternatives is provided below.

B.3.8.1 Future Without Project Conditions (No Action Alternative)

Under the No Action Alternative, no improvements would be made to the existing WCS. There would be no land disturbance from the construction of WCS improvements, and therefore, no impacts to vegetation would occur. OMRR&R activities at the existing WCS would continue, which would minimally disturb vegetation (e.g., mowing). Vegetation communities in the Study Area are vulnerable to sea level rise, flooding, land use change, and fragmentation. Without improvements to the WCS, water levels would likely exceed WCS design capacity more frequently due to rising sea levels and increased storm intensity, with an ensuing increase in flooding and soil erosion. Urbanization and controlled drainage systems have replaced over 95 percent of the original landscape, leaving only fragmented remnants of wetland and upland vegetation. The dominant remnant natural communities within the Study Area account for 0.3 percent of the Study Area and include Glades Marsh, Rockland Hammock, and Scrub/Sand Pine Scrub. These communities would likely be among the first to convert into less complex communities that are more vulnerable to invasive species. Additionally, existing vegetation in low-lying areas would be among the first to convert into salt-tolerant communities.

B.3.8.2 Alternative A

Alternative A is the least complex alternative with the smallest number of proposed measures. As shown in **Table B.3-37**, three existing WCS would be raised to prevent backflow, existing gated spillways would be demolished and replaced at four WCS, and three new pump stations would be constructed at existing WCS sites. In addition, a new culvert would be constructed in the G-16 (Pompano) Canal, upstream of WCS G-57 Gated Spillway. All land-disturbing activities are assumed to temporarily disturb the existing vegetation within construction footprints. Additionally, the nature of the land disturbance may permanently alter the nature of the vegetation communities (e.g., changing slopes or drainage).

Table B.3-37. Potential Land Disturbance under Alternative A.

WCS	Approximate Construction Land Disturbance (acres)	Alternative A General Description
G-56 Gated Spillway	0.5	Raise structure components to prevent backflow.
G-57 Gated Spillway	0.5	Raise structure components to prevent backflow.
S-37B Gated Spillway	0	No proposed changes.
S-37A Gated Spillway	3.6	Existing gated spillway would be demolished, and new pump station and new spillway would be constructed in the same location.
S-36 Gated Spillway	1.9	Existing gated spillway would be demolished, and new spillway would be constructed in the same location.
S-33 Gated Spillway	3.0	Existing gated spillway would be demolished, and new pump station and new spillway would be constructed in adjacent, upstream location.
G-54 Gated Spillway	0.5	Raise structure components to prevent backflow.
S-13 Pump Station and Gated Spillway	3.6	Existing gated spillway and pump station would be demolished, and new pump station and new spillway would be constructed in adjacent, upstream location.
Total	13.6	Temporary land disturbance for construction under Alternative A
Canals		
G-16 (Pompano) Canal	1.0	Construct two, 10-ft-diameter culverts parallel to existing 10-ft-diameter culvert located upstream of G-57 Gated Spillway. Existing 10-ft-diameter culvert to remain.

Note: WCS = water control structure

Construction

Construction activities are assumed to temporarily disturb existing vegetation within construction footprints. The following tree-clearing, grading, excavation, and other site development activities would cause soil disturbance:

- Excavating existing WCS abutments and retaining walls within the SFWMD ROW to provide room for construction of new spillways and pump stations;
- Excavating and grading the canal bottom upstream and/or downstream of new spillways and/or pump stations to match existing canal depths;
- Placing excavated material (i.e., dredged material) on uplands within existing SFWMD ROWs to raise the height of structures, canal banks, access roads, and parking areas;
- Constructing new or modifying existing retaining walls within the SFWMD ROW to connect new structures to existing retaining walls; and
- Demolishing existing WCS and ancillary structures when new spillways and/or pump structures are constructed.

No remnant natural vegetation communities would be lost from construction activities because vegetation communities within the construction footprints are highly altered and urbanized. Estimates for land disturbance at each WCS under Alternative A are shown in **Table B.3-37**. A total of approximately 13.6 acres of land disturbance would occur during construction as compared to the No Action Alternative. Site contours would be permanently changed at sites where a replacement WCS is proposed, primarily for excavation and construction of the WCS foundations and modification of retaining walls. None of these lands are remnant natural communities, and vegetation communities at WCS sites have been previously disturbed. However, construction may permanently alter the nature of the existing highly altered vegetation communities because of soil disturbance and changes to slope and drainage. At minimum, disturbed areas would be re-vegetated to reduce erosion. Overall, impacts to vegetation from construction of Alternative A features, while greater than the No Action Alternative, are expected to be negligible.

Operation, Maintenance, Repair, Replacement, and Rehabilitation

OMRR&R would occur from 2035 to 2085. Although occasional maintenance activities during operation would disturb vegetation (e.g., mowing or temporary construction lay-down areas), these impacts are anticipated to be minimal. Furthermore, such activities would not result in any greater effects than would occur under the No Action Alternative, where OMRR&R at existing WCS would also occur. During OMRR&R, enhanced operational water conveyance would reduce terrestrial inundation from sea level rise by 545 acres across all upstream watersheds relative to the No Action Alternative under an intermediate scenario (2-year storm surge, 25-year rainfall event, and intermediate sea level rise). However, benefits from this reduced inundation are expected to be negligible since approximately 95 percent of the Study Area consists of disturbed lands with only minimal vegetative communities.

B.3.8.3 Alternative B

Alternative B represents an intermediate scenario where the number of proposed measures is greater than in Alternative A but fewer than in Alternative C. As shown in **Table B.3-38**, all eight existing gated

spillways would be demolished and replaced, and four new pump stations would be constructed adjacent to the new gated spillways. Three canals would be dredged to increase flow capacity. In addition, the Markham Park Stormwater Storage Capacity Improvement would be implemented. **Table B.3-38** lists acreages for estimated land disturbance during construction.

Table B.3-38. Potential Land Disturbance under Alternative B.

WCS	Approximate Construction Land Disturbance (acres)	Alternative B General Description
G-56 Gated Spillway	3.7	Existing gated spillway would be demolished, and new gated spillway would be constructed in adjacent, downstream location.
G-57 Gated Spillway	0.8	Existing gated spillway would be demolished, and new gated spillway would be constructed in adjacent, upstream location.
S-37B Gated Spillway	4.0	Existing gated spillway would be demolished, and new gated spillway would be constructed in adjacent, upstream location.
S-37A Gated Spillway	3.7	Existing gated spillway would be demolished, and new pump station and new gated spillway would be constructed in the same location.
S-36 Gated Spillway	1.9	Existing gated spillway would be demolished, and new pump station and new gated spillway would be constructed in the same location.
S-33 Gated Spillway	3.0	Similar to Alternative A, demolition of existing gated spillway; new gated spillway and pump station would be located adjacent and upstream, bank improvements on south side.
G-54 Gated Spillway	2.0	Demolition of existing gated spillway; new gated spillway would be located adjacent and upstream.
S-13 Pump Station and Gated Spillway	4.8	Demolition of existing gated spillway and pump station; new gated spillway and new pump station would be located adjacent and upstream.
Total	23.9	Temporary land disturbance for construction under Alternative B.
Canals		
G-16 (Pompano) Canal	1.0	Construct two, 10-ft-diameter culverts parallel to existing 10-ft-diameter culvert located upstream of G-57 Gated Spillway. Existing 10-ft-diameter culvert to remain.
G-08 (Hillsboro) Canal, C-14 (Cypress Creek) Canal, C-11 (South New River) Canal	155	Enlarge cross-sectional flow area of these canals via dredging within canal segments to improve water conveyance. Dredged material is temporarily placed alongside canal embankments and then removed by truck-haul.
Stormwater Storage Capacity Improvement		
Markham Park	1.0	Construct structures so that the Markham Park lake system can temporarily store stormwater from the G-15 (North New River) Canal during storm events, beyond the stormwater that the existing lake system is designed and permitted to store, to reduce peak flood stages in the G-15 (North New River) Canal.

Construction

The types of activities that would temporarily disturb existing vegetation within construction footprints are the same as those described under Alternative A. Approximately 23.9 acres of vegetation would be temporarily disturbed within the construction footprints under Alternative B as compared to the No Action Alternative. All land-disturbing activities are assumed to temporarily disturb the existing vegetation within construction footprints. As with Alternative A, the vegetation communities that would be affected by construction have been previously disturbed. Nonetheless, construction may permanently alter the nature of these existing highly altered vegetation communities due to soil disturbance and changes to slope and drainage. Disturbed areas would be re-vegetated to reduce

erosion. Overall, impacts to vegetation from construction of Alternative B features, while greater than the No Action Alternative, are expected to be minimal.

Operation, Maintenance, Repair, Replacement, and Rehabilitation

OMRR&R activities under Alternative B would be effectively the same as those activities under Alternative A and would not result in any greater effects than would occur under the No Action Alternative. Also similar to Alternative A, enhanced operational water conveyance would reduce terrestrial inundation from sea level rise, with a reduction across 643 acres in the upstream watersheds relative to the No Action Alternative (also under an intermediate scenario). However, like Alternative A, any associated benefits from reduced inundation are expected to be negligible given the minimal vegetative communities present in the Study Area.

B.3.8.4 Alternative C

Alternative C represents the most complex scenario where the number of proposed measures are the greatest. As shown in **Table B.3-39**, seven gated spillways would be demolished and replaced, and seven new pump stations would be constructed adjacent to the new gated spillways. In addition, the Markham Park and Hillsboro Watershed Stormwater Storage Capacity Improvement projects would be implemented. **Table B.3-39** also list acreages for estimated land disturbance during construction.

Table B.3-39. Potential Land Disturbance under Alternative C.

WCS	Approximate Construction Land Disturbance (acres)	Alternative C General Description
G-56 Gated Spillway	4.2	Land disturbance would increase compared to Alternative B. Existing gated spillway would be demolished, and new gated spillway would be constructed in adjacent, downstream location.
G-57 Gated Spillway	1.3	Land disturbance would increase compared to Alternative B. Existing gated spillway would be demolished, and new gated spillway would be constructed in adjacent, upstream location.
S-37B Gated Spillway	0	No proposed changes.
S-37A Gated Spillway	3.7	Land disturbance would be the same as Alternative B. Existing gated spillway would be demolished, and new pump station and new gated spillway would be constructed in the same location.
S-36 Gated Spillway	1.9	Land disturbance would be similar to Alternative B. Demolition of existing spillway, and construction of new pump station and new gated spillway would be in same location as existing gated spillway. Spillway and pump station capacity would increase; however, overall land disturbance would be similar.
S-33 Gated Spillway	3.0	Land disturbance would increase compared to Alternative B because banks and slopes would change. Existing gated spillway would be demolished, and new pump station and new spillway would be constructed in adjacent, upstream location. Bank improvements would be made on south side of the canal. Pump station capacity would increase.
G-54 Gated Spillway	2.6	Land disturbance would increase compared to Alternative B because banks and slopes would change. Existing gated spillway would be demolished, and new gated spillway would be constructed in adjacent, upstream location.
S-13 Pump Station and Gated Spillway	4.8	Land disturbance would be the same as Alternative B. Existing gated spillway and pump station would be demolished, and new gated spillway

WCS	Approximate Construction Land Disturbance (acres)	Alternative C General Description
		and pump station would be constructed in adjacent, upstream location. Pump station capacity would increase.
Total	21.5	Temporary land disturbance for WCS construction.
Canals		
G-16 (Pompano) Canal	1.0	Construct two, 10-ft-diameter culverts parallel to existing 10-ft-diameter culvert located upstream of G-57 Gated Spillway. Existing 10-ft-diameter culvert to remain.
G-08 (Hillsboro) Canal, C-11 (South New River) Canal, C-12 (Plantation) Canal, C-13 (Middle River) Canal, C-14 (Cypress Creek) Canal, G-15 (North New River) Canal	240	Enlarge cross-sectional flow area of these canals via dredging within canal segments to improve water conveyance. Dredged material is temporarily placed alongside canal embankments and then removed by truck-haul.
Stormwater Storage Capacity Improvement		
Markham Park	1.0	Construct structures so that the Markham Park lake system can temporarily store stormwater from the G-15 (North New River) Canal during storm events, beyond the stormwater that the existing lake system is designed and permitted to store, to reduce peak flood stages in the G-15 (North New River) Canal.
Hillsboro Watershed	706	Convert existing agricultural property within Hillsboro Watershed into an aboveground stormwater storage area.

Note: WCS = water control structure

Construction

Potential impacts to vegetation under Alternative C would be similar to those under Alternative B for construction because the total area of vegetation disturbance would be similar. Approximately 21.5 acres of vegetation would be temporarily disturbed within the WCS construction footprints under Alternative C as compared to the No Action Alternative. As with Alternatives A and B, the vegetation communities that would be affected by construction have been previously disturbed. However, construction may permanently alter the nature of these existing highly altered vegetation communities due to soil disturbance and changes to slope and drainage. Disturbed areas would be re-vegetated to reduce erosion. Additionally, the Hillsboro Watershed stormwater storage project would permanently convert 706 acres of raised-bed row crop farmland into intermittently submerged land available for natural vegetation. Overall, impacts to vegetation from construction of Alternative C features, while greater than the No Action Alternative, are expected to be minimal, and the Hillsboro Watershed project may be beneficial by providing additional acreage that supports wetland vegetation.

Operation, Maintenance, Repair, Replacement, and Rehabilitation

OMRR&R activities under Alternative C would be effectively the same as those under Alternatives A and B, and would not result in any greater effects than would occur under the No Action Alternative. Enhanced operational water conveyance would reduce terrestrial inundation from sea level rise across 148 acres under Alternative C in the upstream watersheds relative to the No Action Alternative (under an intermediate scenario). As with Alternatives A and B, any associated benefits from reduced inundation are expected to be negligible given the minimal vegetative communities present in the Study

Area. The Hillsboro Watershed project would provide an additional 706 acres that could support wetland vegetation, resulting in potentially beneficial effects to vegetative communities compared to the No Action Alternative, though any such effects are expected to be negligible given the small size of this feature compared to the entire Study Area (approximately 0.26 percent of the 420-square-mile Study Area).

B.3.8.5 Alternative RO

Alternative RO represents a hybrid of Alternatives A, B, and C. As shown in **Table B.3-40**, all eight existing gated spillways would be demolished and replaced, and five new pump stations would be constructed adjacent to the new gated spillways. Alternative RO is similar to Alternative B, but adds a pump station at G-54 Gated Spillway and one extra spillway gate each at S-37A Gated Spillway, S-36 Gated Spillway, and S-13 Pump Station and Gated Spillway. Similar to Alternative B, three canals would be dredged to increase flow capacity. The Markham Park and Hillsboro Watershed Stormwater Storage Capacity Improvement Projects, as described in Alternatives B and C, would not be implemented under Alternative RO.

Table B.3-40. Potential Land Disturbance under Alternative RO.

WCS	Approximate Construction Land Disturbance (acres)	Alternative RO General Description
G-56 Gated Spillway	3.7	Demolition of existing gated spillway; new gated spillway would be located adjacent and downstream.
G-57 Gated Spillway	0.8	Demolition of existing gated spillway; new gated spillway would be located adjacent and upstream.
S-37B Gated Spillway	4.0	Demolition of existing gated spillway; new gated spillway would be located adjacent and upstream.
S-37A Gated Spillway	3.7	Demolition of existing gated spillway; new pump station and new gated spillway would be in same location as existing gated spillway.
S-36 Gated Spillway	1.9	Demolition of existing gated spillway; new pump station and new gated spillway would be in same location as existing gated spillway.
S-33 Gated Spillway	3.0	Similar to Alternative A, demolition of existing gated spillway; new gated spillway and pump station would be located adjacent and upstream, bank improvements on south side.
G-54 Gated Spillway	2.6	Demolition of existing gated spillway; new gated spillway and new pump station would be located adjacent and upstream.
S-13 Pump Station and Gated Spillway	4.8	Demolition of existing gated spillway and pump station; new gated spillway and new pump station would be located adjacent and upstream.
Total	24.5	Temporary soil disturbance for WCS construction.
Canals		
G-16 (Pompano) Canal	1.0	Construct two 10-ft-diameter culverts parallel to existing 10-ft-diameter culvert located upstream of G-57 Gated Spillway. Existing 10-ft-diameter culvert to remain.
G-08 (Hillsboro) Canal, C-14 (Cypress Creek) Canal, C-11 (South New River) Canal	43	Enlarge cross-sectional flow area of these canals via dredging within canal segments to improve water conveyance.

Construction

Potential impacts to vegetation under Alternative RO would be similar to those under Alternative B for construction because the total area of vegetation disturbance would be similar. Approximately 24.5 acres of vegetation would be temporarily disturbed within the WCS construction footprints under Alternative RO as compared to the No Action Alternative. As with Alternatives A through C, the vegetation communities that would be affected by construction have been previously disturbed. However, construction may permanently alter the nature of these existing highly altered vegetation communities due to soil disturbance and changes to slope and drainage. Disturbed areas would be re-vegetated to reduce erosion. Neither the Markham Park nor Hillsboro Watershed stormwater storage project would be constructed under Alternative RO, which would result in fewer potentially beneficial effects than Alternative C, since new wetland habitat would not be created.

Operation, Maintenance, Repair, Replacement, and Rehabilitation

OMRR&R activities under Alternative RO would be effectively the same as those under Alternatives A and B, and would not result in any greater effects than what would occur under the No Action Alternative. Enhanced operational water conveyance would reduce terrestrial inundation from sea level rise across 582 acres under Alternative RO in the upstream watersheds relative to the No Action Alternative (under an intermediate scenario). However, any associated benefits from reduced inundation are expected to be negligible given the minimal vegetative communities present in the Study Area.

B.3.9 Wetlands

An analysis of the potential wetlands effects from the No Action Alternative and implementation of the action alternatives is provided below.

B.3.9.1 Future Without Project Conditions (No Action Alternative)

Under the No Action Alternative, no improvements would be made to the existing WCS or canals. There would be no wetland disturbance from the construction and therefore, no impacts would occur. OMRR&R activities at the existing WCS would continue, which would minimally disturb bank vegetation. Wetland communities in the Study Area could be affected by storm events, sea level rise, flooding, and further fragmentation. Without improvements to the WCS, water levels would likely exceed WCS design capacity more frequently due to rising sea levels. Increased storm intensity could also increase inundation, saltwater intrusion, and sedimentation. The existing fragmented wetlands remnants could shift dominant wetlands vegetation type, affecting the community's resilience and making it more vulnerable to other threats, such as invasive species.

B.3.9.2 Alternative A

Alternative A proposes to raise three existing WCS to prevent backflow, remove and replace gated spillways at four WCS, add three new pump stations at existing WCS sites, and construct a new culvert in the G-16 (Pompano) Canal, upstream of the G-57 Gated Spillway. Some changes, such as slope or drainage patterns necessary for construction, are assumed to be permanent. All land-disturbing activities are assumed to be temporary and within construction footprints.

Construction

No wetland communities are expected to be lost from construction activities because the construction footprints are located in highly altered, urbanized areas, and no wetlands are located within the construction footprint. No wetland effects from Alternative A are expected.

Operation, Maintenance, Repair, Replacement, and Rehabilitation

OMRR&R would occur throughout the project's lifespan. OMRR&R activities would not result in any greater effects than would occur under the No Action Alternative. Reduced inundation from sea level rise and flooding could prevent changes in dominant wetlands vegetation and classification over time. However, these benefits are expected to be minimal given the small percentage of wetlands within the Study Area.

B.3.9.3 *Alternative B*

Alternative B represents an intermediate scenario where the number of proposed measures is greater than in Alternative A but fewer than in Alternative C. Eight existing WCS would be removed and replaced, four new pump stations would be constructed, three canals would be excavated to increase flow capacity, and the Markham Park Stormwater Storage Capacity Improvement Project would be constructed and implemented.

Construction

As with Alternative A, Alternative B disturbance would be confined to previously disturbed construction footprints. All land-disturbing activities are assumed to be temporary. Construction may permanently alter physical conditions, such as drainage patterns and slope in the area, as compared to the No Action Alternative. The Markham Park Stormwater Storage Capacity Improvement Project could increase wetlands acreage within the Study Area. No other wetlands impacts from Alternative B construction are expected.

Operation, Maintenance, Repair, Replacement, and Rehabilitation

Alternative B OMRR&R activities are the same as OMRR&R activities under Alternative A. They would not result in any greater effects than would occur under the No Action Alternative. Enhanced operational water conveyance would reduce terrestrial inundation from sea level rise and flooding relative to the No Action Alternative, preventing changes to wetlands communities. However, these benefits are expected to be minimal given the small percentage of wetlands within the Study Area.

B.3.9.4 *Alternative C*

Alternative C represents the most complex alternative where the number of proposed measures are the greatest. Seven WCS would be removed and replaced, seven new pump stations would be constructed, and the Markham Park and Hillsboro Watershed Stormwater Storage Capacity Improvement Projects would be constructed and implemented.

Construction

As with Alternatives A and B, no wetlands would be affected by construction. Physical conditions in the Study Area may be permanently altered. Permanent conversion of 706 acres of raised-bed row crop farmland into intermittently submerged water storage under the Hillsboro Watershed Stormwater Storage Capacity Improvement Project could increase wetland acreage within the Study Area. Effects from construction of Alternative C features would be both beneficial and adverse, direct, short-term, and negligible.

Operation, Maintenance, Repair, Replacement, and Rehabilitation

OMRR&R activities under Alternative C would be effectively the same as those under Alternatives A and B, and would not result in any greater effects than would occur under the No Action Alternative. Enhanced operational water conveyance would reduce terrestrial inundation from sea level rise and flooding relative to the No Action Alternative, preventing changes to wetlands communities. These benefits are expected to be minimal given the small percentage of wetlands within the Study Area. The Hillsboro Watershed Stormwater Storage Capacity Improvement Project feature's additional 706 acres could support wetland vegetation, resulting in a small increase in productive wetlands acreage. These effects, while beneficial, are expected to be negligible given the small size of this feature relative to the entire Study Area (approximately 0.26 percent of the 420-square-mile Study Area).

B.3.9.5 Alternative RO

Alternative RO represents a hybrid of Alternatives A, B, and C. Eight existing WCS would be removed and replaced; five new pump stations would be constructed, and three canals would be excavated to increase flow capacity. The Markham Park and Hillsboro Watershed Stormwater Storage Capacity Improvement Projects would not be implemented under Alternative RO.

Construction

Areas affected by Alternative RO construction have been previously disturbed with no wetlands present in the construction footprint. Construction may permanently alter the physical conditions of these existing highly altered sites. Beneficial effects associated with the Markham Park and Hillsboro Watershed Stormwater Storage Capacity Improvement Projects would not occur because these features would not be constructed under Alternative RO, precluding new wetland habitat creation.

Operation, Maintenance, Repair, Replacement, and Rehabilitation

OMRR&R activities under Alternative RO would be effectively the same as those under Alternatives A, B, and C and would not result in any greater effects than what would occur under the No Action Alternative. Enhanced operational water conveyance would reduce terrestrial inundation from sea level rise and flooding. However, these benefits are expected to be minimal given the small percentage of wetlands within the Study Area.

B.3.10 Invasive Species

An analysis of the potential effects on invasive species from the No Action Alternative and implementation of the action alternatives is provided below.

B.3.10.1 Future Without Project Conditions (No Action Alternative)

Florida's subtropical climate, busy ports, and dense population make it a hotspot for invasions, with over 32,000 exotic species dwarfing its 4,000 to 5,000 native plants and animals. These invaders degrade ecosystems, endanger public health, and damage agriculture and infrastructure. Broward County exemplifies the crisis, hosting 121 invasive plant species—67 of which (Category I) aggressively displace native flora. Both Broward and Palm Beach counties have ongoing programs to minimize the impacts of invasive plants and animals. Because of uncontrollable inputs from the Everglades, homes, and unmanaged private lands, both counties report prevention of spread much more often than reporting reduction or eradication.

It is expected that increased summer and winter minimum temperatures, increased extreme tropical systems, sea level rise, and changing weather patterns (e.g., droughts, floods) would enhance invasive species colonization, from introduction through establishment and expansion. Conditions under the No Action Alternative are unlikely to change the uncontrollable inputs of invasive species from the Everglades, homes, and unmanaged private lands, even with ongoing programs.

B.3.10.2 Alternative A

Approximately 13.6 acres of vegetation and land would be temporarily disturbed within the combined WCS construction footprints under Alternative A. All land-disturbing activities are assumed to temporarily disturb the existing vegetation within the construction footprints. If left unmanaged, these disturbed areas could increase the spread of invasive plants and animals. However, because both construction and OMRR&R under Alternative A include vegetation and land management measures (e.g., mowing and structure maintenance), the spread of invasive plants and animals within construction footprints would not be greater than under the No Action Alternative.

B.3.10.3 Alternative B

Approximately 23.9 acres of vegetation and land would be temporarily disturbed within the combined WCS construction footprints under Alternative B. All land-disturbing activities are assumed to temporarily disturb the existing vegetation within the construction footprints. If left unmanaged, these disturbed areas could increase the spread of invasive plants and animals. However, because both construction and OMRR&R under Alternative B include vegetation and land management measures (e.g., mowing and structure maintenance), the spread of invasive plants and animals within construction footprints would not be greater than under the No Action Alternative.

B.3.10.4 Alternative C

Approximately 21.5 acres of vegetation and land would be temporarily disturbed within the combined WCS construction footprints under Alternative C. All land-disturbing activities are assumed to temporarily disturb the existing vegetation within the construction footprints. If left unmanaged, these disturbed areas could increase the spread of invasive plants and animals. Additionally, the Hillsboro Watershed stormwater storage project would permanently convert 706 acres of raised-bed row crop farmland into intermittently submerged land available for potential spread of invasive plants and animals. However, because both construction and OMRR&R under Alternative C include vegetation and

land management measures (e.g., mowing and structure maintenance), the spread of invasive plants and animals within construction footprints would not be greater than under the No Action Alternative.

B.3.10.5 *Alternative RO*

Approximately 24.5 acres of vegetation would be temporarily disturbed within the WCS construction footprints under Alternative RO. Effects from Alternative RO within C-14 East Basin are consistent with those described for Alternative A. Effects from Alternative RO within the Hillsboro Canal Basin, Pompano Canal Basin, C-14 West Basin, C-13 West Basin, C-12 West Basin, and C-11 East and West Basins are comparable to those described for Alternative B. Effects from Alternative RO within North New River Canal West Basin are consistent with those described for Alternative C. All land-disturbing activities are assumed to temporarily disturb the existing vegetation within the construction footprints. If left unmanaged, these disturbed areas could increase the spread of invasive plants and animals. However, because both construction and OMRR&R under Alternative RO include vegetation and land management measures (e.g., mowing and structure maintenance), the spread of invasive plants and animals within construction footprints would not be greater than under the No Action Alternative.

B.3.11 **Essential Fish Habitat**

An analysis of the potential effects on EFH from the No Action Alternative and implementation of the action alternatives is provided below.

Only a small portion of the Study Area is tidal, 7 square miles (1.7 percent) of the 420-square-mile Study Area. The tidal portions of canals in the Study Area include EFH for Snapper-Grouper Complex, Spiny Lobster, Penaeid Shrimp, and Coastal Migratory Pelagics. A fragment of Atlantic Highly Migratory Species EFH (restricted to blacktip, bull, lemon, nurse, spinner, and tiger sharks) occurs in the easternmost fringe of the Study Area at Port Everglades (5.8 miles downstream of the nearest project control structure [S-33 Gated Spillway]). Coral and Hardbottom EFH occurs in the easternmost fringes of the Study Area nearby the ocean inlets, but low salinity prevents Coral and Hardbottom EFH upstream of the ICW. **Figure B.3-10** shows the tidal limits within the Study Area.

B.3.11.1 *Future Without Project Conditions (No Action Alternative)*

Habitat loss has already impacted many managed fisheries and their habitats through overfishing, land conversion, altered hydroperiods, invasive species, and water quality decline. Under the No Action Alternative, the Study Area's high density urban landscape would remain largely intact and the amount of EFH would be relatively unchanged. The quality of EFH is expected to degrade due to disruptions from flood control and lack of regulated freshwater flows between the present day and 2085. Important EFH habitat constituents like mangroves would also be negatively impacted from storm surges, drought, and lack of space for inland migration. Predicted changes would degrade these habitats and may affect their viability as EFH.

B.3.11.2 *Alternative A*

Tidal waters of the Study Area (7 square miles) provide only a limited number of EFH habitat constituents. These constituents include tidal creeks, estuarine scrub/shrub (mangrove fringe), unconsolidated bottom, attached macroalgae, submerged rooted vascular plants (seagrasses), estuarine

emergent vegetated wetlands (saltmarshes, brackish marsh), oyster reefs and shell banks, and flood tide shoal complexes. No portions of the Study Area meet the definition for any Habitat Area of Particular Concern.

Under Alternative A, the only tidal waters directly affected by proposed construction are those on the downstream side of the WCS. The WCS are situated at the inshore-most ends of their associated canals, at the inshore-most limit of tidal influence. The nine WCS, their approximate distance from the ICW, and approximate length of earthworks that would occur within tidal waters at each WCS are as follows (**Figure B.3-10**):

- G-56 Gated Spillway located 4 miles upstream of the ICW, tidal footprint of earthworks is 870 linear feet
- G-57 Gated Spillway located 2 miles upstream of the ICW, tidal footprint of earthworks is 200 linear feet
- S-37A Gated Spillway located 2.9 miles upstream of the ICW, tidal footprint of earthworks is 360 linear feet
- S-37B Gated Spillway located 6 miles upstream of the ICW, tidal footprint of earthworks is 660 linear feet
- S-36 Gated Spillway located 6.8 miles upstream of the ICW, tidal footprint of earthworks is 1,000 linear feet
- S-33 Gated Spillway located 6 miles upstream of the ICW, tidal footprint of earthworks is 1,600 linear feet
- G-54 Gated Spillway located 8.5 miles upstream of the ICW, tidal footprint of earthworks is 330 linear feet
- S-13AW Gated Culvert located 10.7 miles upstream of the ICW, tidal footprint of earthworks is 260 linear feet
- S-13 Pump Station and Gated Spillway located 6.2 miles upstream of the ICW, tidal footprint of earthworks is 900 linear feet

Using an average canal width of 100 feet, the maximum footprint of earthworks within these tidal waters under Alternative A is approximately 0.002 square miles. Additionally, the habitat quality within the tidal footprint of earthworks is lowest relative to all other tidal waterways because the tidal footprint of earthworks contains highly-altered substrates (control structures and erosion controls), and is most proximate to undiluted freshwater inputs. During earthworks, BMPs would be employed to protect water quality, prevent erosion, and protect manatees; these BMPs would also ensure that EFH is not impacted.

Alternative A would have a minimal footprint of earthworks in highly-altered tidal waters, representing a negligible fraction of the total EFH within the Study Area. BMPs would be employed during construction. As a result, there would not be any adverse effects during construction to EFH under Alternative A as compared to the No Action Alternative.

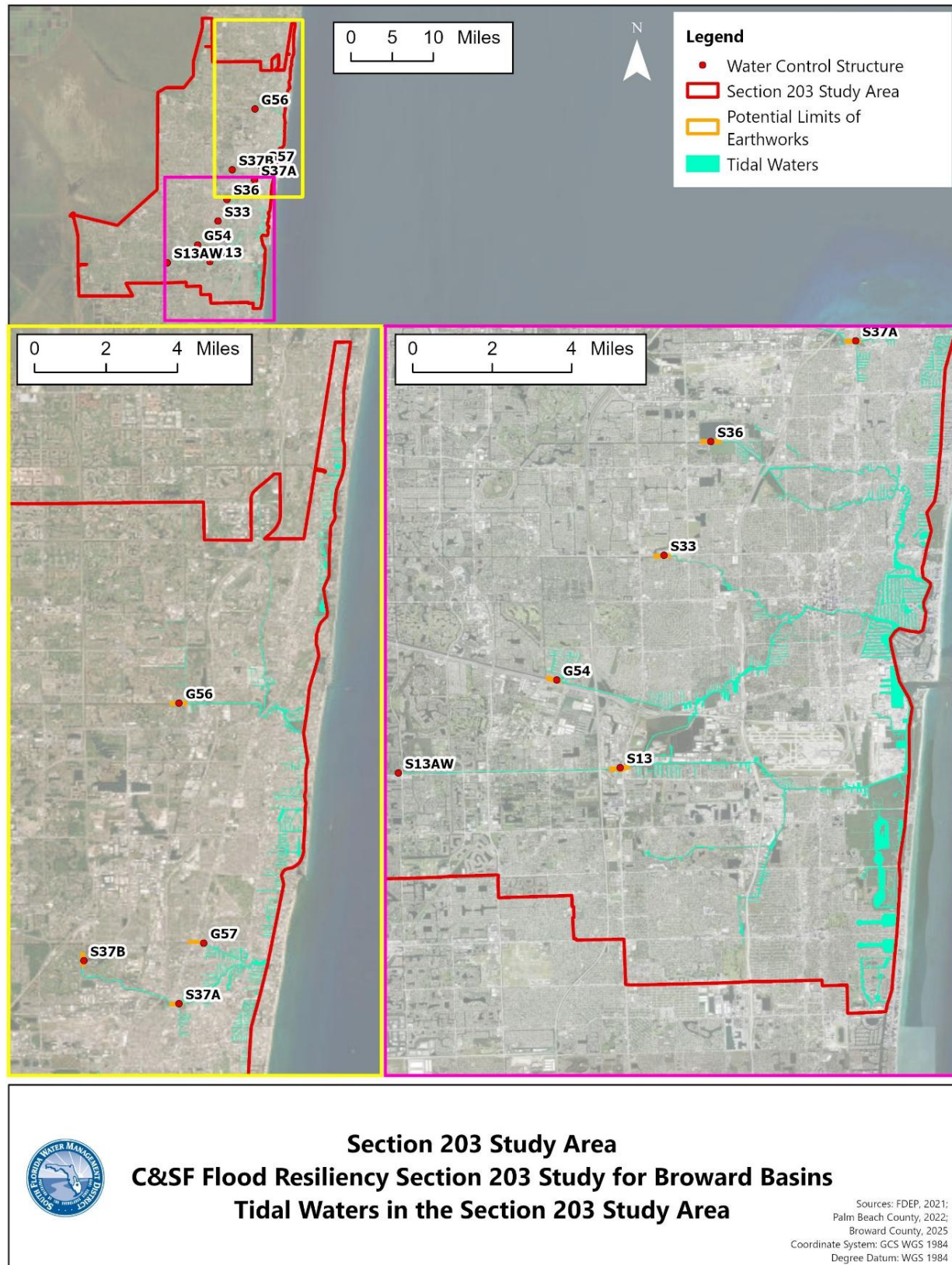


Figure B.3-10. Tidal Waters in the C&SF Section 203 Study Area.

Operational activities include drawing down water in the SFWMD-managed primary canals upstream of the WCS prior to a storm by discharging water in these canals from the upstream side of the WCS to the downstream side of the WCS, resulting in water from the canals being moved downstream to the ICW prior to storm events. Additionally, local water management entities would likely draw down water in secondary managed canals and move it into SFWMD-managed primary canals prior to storm events. It is important to note that pre-storm drawdown operations are already part of regular SFWMD operations and that these modified operations seek to recoup lost conveyance capacity resulting from changed sea level rise driven tailwater conditions, rather than significantly changing the overall volume of water discharged over the event relative to current conditions. As such, discharge differences will largely be observed as changes in timing relative to existing conditions and FWOP conditions. Despite these timing changes, there would be minimal expected change in the overall variability of the flow regime experienced by downstream systems. In Broward County, the discharges from the WCS are sent into downstream canals and the ICW rather than directly discharging into ecologically sensitive bays or lagoons. As such, these receiving bodies are already well adapted to the range of salinity, water quality, and temperature conditions created by varying existing WCS discharge rates (as well as downstream lateral inflow). Unlike other coastal areas in Southeast Florida, like Biscayne Bay to the south or Lake Worth Lagoon to the north, the “Restoration, Coordination, Verification” scientific group established as part of the Comprehensive Everglades Restoration Program has not identified ecosystem-based flow targets that consider the needs of seagrasses, spawning areas, or salinity transition zones for any of Broward County’s canal downstream areas. Given the nature of these receiving water bodies, there would not be any adverse operational effects to EFH under Alternative A as compared to the No Action Alternative.

B.3.11.3 Alternative B

Under Alternative B, the approximate length of earthworks that would occur within tidal waters at each WCS and resulting maximum disturbance to tidal waters during construction is the same as under Alternative A. As with Alternative A, pre-storm drawdowns under Alternative B would only change the timing of water movement; these operational adjustments are not expected to affect downstream natural resources, as receiving waters are already adapted to existing variability. As a result, there would not be any adverse effects to EFH under Alternative B as compared to the No Action Alternative.

B.3.11.4 Alternative C

Under Alternative C, the approximate length of earthworks that would occur within tidal waters at each WCS and resulting maximum disturbance to tidal waters during construction is the same as under Alternative A. As with Alternative A, pre-storm drawdowns under Alternative C would only change the timing of water movement; these operational adjustments are not expected to affect downstream natural resources, as receiving waters are already adapted to existing variability. As a result, there would not be any adverse effects to EFH under Alternative C as compared to the No Action Alternative.

B.3.11.5 Alternative RO

Under Alternative RO, the approximate length of earthworks that would occur within tidal waters at each WCS and resulting maximum disturbance to tidal waters during construction is the same as under Alternative A. Pre-storm drawdowns under Alternative RO would only change the timing of water

movement; these operational adjustments are not expected to affect downstream natural resources, as receiving waters are already adapted to existing variability. As a result, there would not be any adverse effects to EFH under Alternative RO as compared to the No Action Alternative.

B.3.12 Threatened and Endangered Species

An analysis of the potential effects on threatened and endangered species from the No Action Alternative and implementation of the action alternatives is provided below.

Federally threatened and endangered species, and species proposed to be listed as either threatened or endangered, which may occur within the Study Area include Florida bonneted bat (*Eumops floridanus*), Florida panther (*Puma concolor coryi*), southeastern beach mouse (*Peromyscus polionotus niveiventris*), tricolored bat (*Perimyotis subflavus*), Florida population of West Indian manatee and its critical habitat (Florida manatee) (*Trichechus manatus*), Audubon's crested caracara (*Polyborus plancus audubonii*), eastern black rail (*Laterallus jamaicensis* ssp. *Jamaicensis*), Everglade snail kite (*Rostrhamus sociabilis plumbeus*), Florida grasshopper sparrow (*Ammodramus savannarum floridanus*), Florida scrub-jay (*Aphelocoma coerulescens*), piping plover (*Charadrius melodus*), American crocodile (*Crocodylus acutus*), eastern indigo snake (*Drymarchon corais couperi*), green sea turtle (*Chelonia mydas*), hawksbill sea turtle (*Eretmochelys imbricata*), Kemp's ridley (*Lepidochelys kempii*), leatherback sea turtle (*Dermochelys coriacea*), loggerhead sea turtle (*Caretta caretta*), giant manta ray (*Mobula birostris*), smalltooth sawfish, Miami blue butterfly (*Cyclargus thomasi bethunebakeri*), monarch butterfly (*Danaus Plexippus*), queen conch (*Aliger gigas*), beach jacquemontia (*Jacquemontia reclinata*), Florida prairie-clover (*Dalea carthagenensis floridana*), four-petal pawpaw (*Asimina tetramera*), tiny polygala (*Polygala smallii*), and Florida Perforate Cladonia (*Cladonia performata*).

Informal consultation was completed on February 26, 2026 with the USFWS and March 9, 2026 with NMFS (**Appendix GH**). These consultation documents discuss which of the ESA-listed and proposed listed species and critical habitat in the Study Area are carried forward for further analysis, and provide rationale for species not carried forward for further analysis. The effects of the C&SF Section 203 Study alternatives described in the following sections focus only on those species that were carried forward for analysis in the consultations. Details on the life history of these species can be found in **Section B.1.12**.

B.3.12.1 Future Without Project Conditions (No Action Alternative)

The FWOP Conditions would involve no additional action beyond current or planned future actions to mitigate against sea level rise and extreme storm risk. The Study Area's high density urban landscape would remain largely intact, limiting the amount of habitat available for threatened and endangered species. Disturbances, noise, and habitat loss from past and planned future projects would continue to impact these species. As sea level rises, remaining habitats would face encroachment from saltwater intrusion and erosion, shrinking the already scarce natural areas where these species can survive. Strong storms and hurricanes will become more frequent and intense, reshaping coastlines and threatening ecosystems on which some threatened and endangered species rely. Low-lying areas and coastal habitats will face persistent flooding and erosion, potentially leading to the disappearance of many habitats that support threatened and endangered species. While the No Action/FWOP Conditions Alternative is not expected to result in direct impacts to threatened and endangered species since no

construction activities would occur, this alternative is expected to result in short- to long-term indirect impacts from increased flooding, sea level rise, and altered habitats.

B.3.12.2 Alternatives A, B, C and RO

Table B.3-41 compares the action alternatives with their potential construction effects on federally listed threatened and endangered species. Overall, construction may result in both direct and indirect effects, often involving temporary disturbances such as noise, turbidity, and habitat disruption. Construction impacts, while greater than the No Action Alternative (where construction would not occur), are expected to be insignificant across all species and alternatives.

OMRR&R may result in indirect effects that are neutral or beneficial, notably due to improved water conveyance during operations that reduces permanent terrestrial habitat loss from sea level rise and increased efficiency of pre-storm and storm drawdown events, which would help maintain habitat stability as compared to the No Action Alternative. **Table B.3-42** provides a comparison of the effects from OMRR&R on federally listed threatened and endangered species. **Table B.3-43** compares total acreage of terrestrial habitat inundation between the FWOP condition and the action alternatives. For the purposes of analyzing effects on threatened and endangered species, “inundation” is defined as peak depths exceeding 1 foot at terrestrial land cover types (using FLCCS Class Codes) during the intermediate (2-year surge, 25-year rainfall, intermediate sea level rise) or worst case (100-year surge, 100-year rainfall, high sea level rise) modeling scenarios in all upstream watershed basins.

None of the alternatives would result in adverse modification to West Indian manatee proposed critical habitat or green sea turtle proposed critical habitat.

Table B.3-41. Construction Effects to Federally Listed Threatened and Endangered Species from the Action Alternatives.

Species	Alternative A–Structural WCS Improvements Only	Alternative B–Structural WCS Improvements with Stormwater Storage Capacity Improvement No. 1 (Markham Park)	Alternative C–Structural WCS Improvements with Stormwater Storage Capacity Improvements No. 1 (Markham Park) and No. 2 (Hillsboro Watershed)	Alternative RO-Structural WCS Improvements Only
American crocodile	Both direct and indirect impacts are anticipated during construction, including disturbances that may cause American crocodile to avoid areas affected by increased turbidity, noise, and visual disruptions. This could temporarily disrupt their daily movement patterns, migration, or hunting within the Study Area. However, any potential effects are expected to be insignificant.	The impacts related to the structural WCS improvements would be similar to those described in Alternative A. The increased stormwater storage capacity from adding nature-based basins requires construction activities that may cause American crocodile to avoid areas affected by increased turbidity, noise, and visual disruptions. This could temporarily disrupt their daily movement patterns, migration, or hunting within the Study Area. However, any potential effects are expected to be insignificant.	The impacts would be similar to those described in Alternatives A and B.	Both direct and indirect impacts are anticipated during construction, including disturbances that may cause American crocodile to avoid areas affected by increased turbidity, noise, and visual disruptions. This could temporarily disrupt their daily movement patterns, migration, or hunting within the Study Area. However, any potential effects are expected to be insignificant.
Eastern black rail	There are no direct or indirect impacts expected during construction activities, which are outside eastern black rail habitat.	The impacts related to the structural WCS improvements would be similar to those described in Alternative A.	The impacts related to the structural WCS improvements would be similar to those described in Alternatives A and B.	There are no direct or indirect impacts expected during construction activities, which are outside eastern black rail habitat.
Eastern indigo snake	Both direct and indirect impacts are expected during construction but are anticipated to be insignificant. Activities may include disturbances to habitat used by the eastern indigo snake for shelter, foraging, and breeding.	The impacts related to the structural WCS improvements would be similar to those described in Alternative A. The increased stormwater storage capacity from adding nature-based basins requires construction activities that may impact eastern indigo snake habitat. Both direct and indirect impacts are expected during construction; however, any potential effects are expected to be insignificant.	The impacts would be similar to those described in Alternatives A and B.	Both direct and indirect impacts are expected during construction but are anticipated to be insignificant. Activities may include disturbances to habitat used by the eastern indigo snake for shelter, foraging, and breeding.
Florida bonneted bat	Both direct and indirect impacts are expected during construction due to what may exceed 0.5 acre of tree removal. However, any potential effects are expected to be insignificant.	The impacts would be similar to those described in Alternative A.	The impacts would be similar to those described in Alternatives A and B.	Both direct and indirect impacts are expected during construction due to what may exceed 0.5 acre of tree removal. However, any potential effects are expected to be insignificant.
Everglade snail kite	There are no direct or indirect impacts expected during construction activities, which occur outside Everglade snail kite habitat.	The increased stormwater storage capacity from adding nature-based basins requires construction activities that may impact Everglade snail kite. Both direct and indirect impacts are expected during construction; however, any potential effects are expected to be insignificant.	The impacts would be similar to those described in Alternatives A and B.	There are no direct or indirect impacts expected during construction activities, which occur outside Everglade snail kite habitat.
Monarch butterfly	Both direct and indirect impacts are expected during construction but they are anticipated to be insignificant. Activities may include disturbances to habitats, including flowering plants, used by the monarch butterfly.	The impacts related to the structural WCS improvements would be similar to those described in Alternative A. The increased stormwater storage capacity from adding nature-based basins requires construction activities that may impact monarch butterfly habitat.	The impacts would be similar to those described in Alternatives A and B.	Both direct and indirect impacts are expected during construction but they are anticipated to be insignificant. Activities may include disturbances to habitats, including flowering plants, used by the monarch butterfly.
Sea turtles (green sea turtle, kemp’s ridley sea turtle, loggerhead sea turtle)	Both direct and indirect impacts are anticipated during construction, including disturbances that may cause sea turtles to avoid areas affected by increased turbidity, noise, and visual disruptions. This could temporarily disrupt their daily movement patterns, migration, or foraging within the Study Area. However, any potential effects are expected to be insignificant.	The impacts related to the structural WCS improvements would be similar to those described in Alternative A. The increased stormwater storage capacity from adding nature-based basins would entail construction outside the canal system accessible to sea turtles; therefore, construction activities are not expected to have any effect on the species.	The impacts would be similar to those described in Alternatives A and B.	Both direct and indirect impacts are anticipated during construction, including disturbances that may cause sea turtles to avoid areas affected by increased turbidity, noise, and visual disruptions. This could temporarily disrupt their daily movement patterns, migration, or foraging within the Study Area. However, any potential effects are expected to be insignificant.
Smalltooth sawfish	Both direct and indirect impacts are anticipated during construction, including disturbances that may cause smalltooth sawfish to avoid areas affected by increased turbidity, noise, and visual disruptions. This could temporarily disrupt their daily movement patterns, migration, or foraging within the Study Area. However, any potential effects are expected to be insignificant.	The impacts related to the structural WCS improvements would be similar to those described in Alternative A. The increased stormwater storage capacity from adding nature-based basins would entail construction outside the canal system accessible to smalltooth sawfish; therefore, construction activities are not expected to have any effect on the species.	The impacts would be similar to those described in Alternatives A and B.	Both direct and indirect impacts are anticipated during construction, including disturbances that may cause smalltooth sawfish to avoid areas affected by increased turbidity, noise, and visual disruptions. This could temporarily disrupt their daily movement patterns, migration, or foraging within the Study Area. However, any potential effects are expected to be insignificant.
Tricolored bat	Both direct and indirect impacts are expected during construction due to what may exceed 0.5 acre of tree removal	The impacts would be similar to those described in Alternative A.	The impacts would be similar to those described in Alternatives A and B.	Both direct and indirect impacts are expected during construction due to what may exceed 0.5 acre of tree removal

Species	Alternative A—Structural WCS Improvements Only	Alternative B—Structural WCS Improvements with Stormwater Storage Capacity Improvement No. 1 (Markham Park)	Alternative C—Structural WCS Improvements with Stormwater Storage Capacity Improvements No. 1 (Markham Park) and No. 2 (Hillsboro Watershed)	Alternative RO-Structural WCS Improvements Only
	at times. However, any potential effects are expected to be insignificant.			at times. However, any potential effects are expected to be insignificant.
West Indian manatee (Florida)	Both direct and indirect impacts are anticipated during construction, including disturbances that may cause manatees to avoid areas affected by increased turbidity, noise, and visual disruptions. This could temporarily disrupt their daily movement patterns, migration, or foraging within the Study Area. However, any potential effects are expected to be insignificant.	The impacts related to the structural WCS improvements would be similar to those described in Alternative A. The increased stormwater storage capacity from adding nature-based basins would entail construction outside the canal system accessible to the Florida manatee; therefore, construction activities are not expected to have any effect on the species.	The impacts would be similar to those described in Alternatives A and B.	Both direct and indirect impacts are anticipated during construction, including disturbances that may cause manatees to avoid areas affected by increased turbidity, noise, and visual disruptions. This could temporarily disrupt their daily movement patterns, migration, or foraging within the Study Area. However, any potential effects are expected to be insignificant.

Notes: WCS = water control structure; FWOP = Future Without Project

Table B.3-42. OMRR&R Effects to Federally Listed Threatened and Endangered Species from the Action Alternatives

Species	Alternative A—Structural WCS Improvements Only	Alternative B—Structural WCS Improvements with Stormwater Storage Capacity Improvement No. 1 (Markham Park)	Alternative C—Structural WCS Improvements with Stormwater Storage Capacity Improvements No. 1 (Markham Park) and No. 2 (Hillsboro Watershed)	Alternative RO - Structural WCS Improvements Only
American crocodile	During OMRR&R, terrestrial habitat inundation would be reduced by 2,313 acres in the worst-case scenario and by 545 acres in the intermediate-case scenario compared to the FWOP (No Action Alternative) condition ^{a/} . Because the American crocodile is an aquatic species, this reduction is expected to have negligible effects on the American crocodile and no operational activities under Alternative A are projected to impact the species.	During OMRR&R, terrestrial habitat inundation would be reduced by 2,800 acres in the worst-case scenario and by 643 acres in the intermediate-case scenario compared to the FWOP (No Action Alternative) condition. Because the American crocodile is an aquatic species, this reduction is expected to have negligible effects on the American crocodile and no operational activities under Alternative B are projected to impact the species. Incorporating nature-based basins would add 1 acre of habitat capacity, enhancing suitability for American crocodiles and potentially yielding beneficial effects.	During OMRR&R, terrestrial habitat inundation would be reduced by 2,925 acres in the worst-case scenario and by 148 acres in the intermediate-case scenario compared to the FWOP (No Action Alternative) condition. Because the American crocodile is an aquatic species, this reduction is expected to have negligible effects on the American crocodile and no operational activities under Alternative C are projected to impact the species. Incorporating nature-based basins would add 706 acres of habitat capacity, enhancing suitability for American crocodiles and potentially yielding beneficial effects.	During OMRR&R, terrestrial habitat inundation would be reduced by 2,265 acres in the worst-case scenario and by 582 acres in the intermediate-case scenario compared to the FWOP (No Action Alternative) condition^{a/}. Because the American crocodile is an aquatic species, this reduction is expected to have negligible effects on the American crocodile and no operational activities under Alternative RO are projected to impact the species.
Eastern black rail	Enhanced operational water conveyance would reduce permanent terrestrial habitat inundation from sea level rise by 2,313 acres in the worst-case scenario and by 545 acres in the intermediate-case scenario compared to the FWOP (No Action Alternative) condition, potentially yielding beneficial effects for the eastern black rail.	Enhanced operational water conveyance would reduce permanent terrestrial habitat inundation from sea level rise by 2,800 acres in the worst-case scenario and by 643 acres in the intermediate-case scenario compared to the FWOP (No Action Alternative) condition, potentially yielding beneficial effects for the eastern black rail. Incorporating nature-based basins would add 1 acre of habitat capacity, enhancing suitability for eastern black rail and potentially yielding beneficial effects.	Enhanced operational water conveyance would reduce permanent terrestrial habitat inundation from sea level rise by 2,925 acres in the worst-case scenario and by 148 acres in the intermediate-case scenario compared to the FWOP (No Action Alternative) condition, potentially yielding beneficial effects for the eastern black rail. Incorporating nature-based basins would add 706 acres of habitat capacity, enhancing suitability for eastern black rail and potentially yielding beneficial effects.	Enhanced operational water conveyance would reduce permanent terrestrial habitat inundation from sea level rise by 2,265 acres in the worst-case scenario and by 582 acres in the intermediate-case scenario compared to the FWOP (No Action Alternative) condition, potentially yielding beneficial effects for the eastern black rail.
Eastern indigo snake	Enhanced operational water conveyance would reduce permanent terrestrial habitat inundation from sea level rise by 2,313 acres in the worst-case scenario and by 545 acres in the intermediate-case scenario compared to the FWOP (No Action Alternative) condition, potentially yielding beneficial effects for the eastern indigo snake.	Enhanced operational water conveyance would reduce permanent terrestrial habitat inundation from sea level rise by 2,800 acres in the worst-case scenario and by 643 acres in the intermediate-case scenario compared to the FWOP (No Action Alternative) condition, potentially yielding beneficial effects for the eastern indigo snake. No direct or indirect impacts are expected, as the operational changes from this measure would not alter the current conditions. All water discharges would continue to comply with existing basin and regional storage specifications.	Enhanced operational water conveyance would reduce permanent terrestrial habitat inundation from sea level rise by 2,925 acres in the worst-case scenario and by 148 acres in the intermediate-case scenario compared to the FWOP (No Action Alternative) condition, potentially yielding beneficial effects for the eastern indigo snake	Enhanced operational water conveyance would reduce permanent terrestrial habitat inundation from sea level rise by 2,265 acres in the worst-case scenario and by 582 acres in the intermediate-case scenario compared to the FWOP (No Action Alternative) condition, potentially yielding beneficial effects for the eastern indigo snake.
Florida bonneted bat	Enhanced operational water conveyance would reduce permanent terrestrial habitat inundation from sea level rise by 2,313 acres in the worst-case scenario and by 545 acres in the intermediate-case scenario compared to the FWOP (No Action Alternative) condition, potentially yielding beneficial effects for the Florida bonneted bat.	Enhanced operational water conveyance would reduce permanent terrestrial habitat inundation from sea level rise by 2,800 acres in the worst-case scenario and by 643 acres in the intermediate-case scenario compared to the FWOP (No Action Alternative) condition, potentially yielding beneficial effects for the Florida bonneted bat.	Enhanced operational water conveyance would reduce permanent terrestrial habitat inundation from sea level rise by 2,925 acres in the worst-case scenario and by 148 acres in the intermediate-case scenario compared to the FWOP (No Action Alternative) condition, potentially yielding beneficial effects for the Florida bonneted bat.	Enhanced operational water conveyance would reduce permanent terrestrial habitat inundation from sea level rise by 2,265 acres in the worst-case scenario and by 582 acres in the intermediate-case scenario compared to the FWOP (No Action Alternative) condition, potentially yielding beneficial effects for the Florida bonneted bat.

Species	Alternative A—Structural WCS Improvements Only	Alternative B—Structural WCS Improvements with Stormwater Storage Capacity Improvement No. 1 (Markham Park)	Alternative C—Structural WCS Improvements with Stormwater Storage Capacity Improvements No. 1 (Markham Park) and No. 2 (Hillsboro Watershed)	Alternative RO - Structural WCS Improvements Only
Everglade snail kite	Enhanced operational water conveyance would reduce permanent terrestrial habitat inundation from sea level rise by 2,313 acres in the worst-case scenario and by 545 acres in the intermediate-case scenario compared to the FWOP (No Action Alternative) condition, potentially yielding beneficial effects for the Everglade snail kite.	Enhanced operational water conveyance would reduce permanent terrestrial habitat inundation from sea level rise by 2,800 acres in the worst-case scenario and by 643 acres in the intermediate-case scenario compared to the FWOP (No Action Alternative) condition, potentially yielding beneficial effects for the Everglade snail kite. Incorporating nature-based basins would add 1 acre of habitat capacity, enhancing suitability for Everglade snail kite and potentially yielding beneficial effects.	Enhanced operational water conveyance would reduce permanent terrestrial habitat inundation from sea level rise by 2,925 acres in the worst-case scenario and by 148 acres in the intermediate-case scenario compared to the FWOP (No Action Alternative) condition, potentially yielding beneficial effects for the Everglade snail kite. Incorporating nature-based basins would add 706 acres of habitat capacity, enhancing suitability for Everglade snail kite and potentially yielding beneficial effects.	Enhanced operational water conveyance would reduce permanent terrestrial habitat inundation from sea level rise by 2,265 acres in the worst-case scenario and by 582 acres in the intermediate-case scenario compared to the FWOP (No Action Alternative) condition, potentially yielding beneficial effects for the Everglade snail kite.
Monarch butterfly	Enhanced operational water conveyance would reduce permanent terrestrial habitat inundation from sea level rise by 2,313 acres in the worst-case scenario and by 545 acres in the intermediate-case scenario compared to the FWOP (No Action Alternative) condition, potentially yielding beneficial effects for the monarch butterfly.	Enhanced operational water conveyance would reduce permanent terrestrial habitat inundation from sea level rise by 2,800 acres in the worst-case scenario and by 643 acres in the intermediate-case scenario compared to the FWOP (No Action Alternative) condition, potentially yielding beneficial effects for the monarch butterfly. No direct or indirect impacts are expected from OMRR&R.	Enhanced operational water conveyance would reduce permanent terrestrial habitat inundation from sea level rise by 2,925 acres in the worst-case scenario and by 148 acres in the intermediate-case scenario compared to the FWOP (No Action Alternative) condition, potentially yielding beneficial effects for the monarch butterfly.	Enhanced operational water conveyance would reduce permanent terrestrial habitat inundation from sea level rise by 2,265 acres in the worst-case scenario and by 582 acres in the intermediate-case scenario compared to the FWOP (No Action Alternative) condition, potentially yielding beneficial effects for the monarch butterfly.
Sea turtles (green sea turtle, kemp’s ridley sea turtle, loggerhead sea turtle)	During OMRR&R, terrestrial habitat inundation would be reduced by 2,313 acres in the worst-case scenario and by 545 acres in the intermediate-case scenario compared to the FWOP (No Action Alternative) condition. Because sea turtles are aquatic species, this reduction is expected to have negligible effects on sea turtles, and no operational activities under Alternative A are projected to impact the species.	During OMRR&R, terrestrial habitat inundation would be reduced by 2,800 acres in the worst-case scenario and by 643 acres in the intermediate-case scenario compared to the FWOP (No Action Alternative) condition. Because sea turtles are aquatic species, this reduction is expected to have negligible effects on sea turtles, and no operational activities under Alternative B are projected to impact the species. No direct or indirect impacts are expected from OMRR&R.	During OMRR&R, terrestrial habitat inundation would be reduced by 2,925 acres in the worst-case scenario and by 148 acres in the intermediate-case scenario compared to the FWOP (No Action Alternative) condition. Because sea turtles are aquatic species, this reduction is expected to have negligible effects on sea turtles, and no operational activities under Alternative C are projected to impact the species.	During OMRR&R, terrestrial habitat inundation would be reduced by 2,265 acres in the worst-case scenario and by 582 acres in the intermediate-case scenario compared to the FWOP (No Action Alternative) condition. Because sea turtles are aquatic species, this reduction is expected to have negligible effects on sea turtles, and no operational activities under Alternative RO are projected to impact the species.
Smalltooth sawfish	During OMRR&R, terrestrial habitat inundation would be reduced by 2,313 acres in the worst-case scenario and by 545 acres in the intermediate-case scenario compared to the FWOP (No Action Alternative) condition. Because smalltooth sawfish are aquatic species, this reduction is expected to have negligible effects on the smalltooth sawfish, and no operational activities under Alternative A are projected to impact the species.	During OMRR&R, terrestrial habitat inundation would be reduced by 2,800 acres in the worst-case scenario and by 643 acres in the intermediate-case scenario compared to the FWOP (No Action Alternative) condition. Because smalltooth sawfish are aquatic species, this reduction is expected to have negligible effects on the smalltooth sawfish, and no operational activities under Alternative B are projected to impact the species. No direct or indirect impacts are expected from OMRR&R.	During OMRR&R, terrestrial habitat inundation would be reduced by 2,925 acres in the worst-case scenario and by 148 acres in the intermediate-case scenario compared to the FWOP (No Action Alternative) condition. Because smalltooth sawfish are aquatic species, this reduction is expected to have negligible effects on the smalltooth sawfish, and no operational activities under Alternative C are projected to impact the species.	During OMRR&R, terrestrial habitat inundation would be reduced by 2,265 acres in the worst-case scenario and by 582 acres in the intermediate-case scenario compared to the FWOP (No Action Alternative) condition. Because smalltooth sawfish are aquatic species, this reduction is expected to have negligible effects on the smalltooth sawfish, and no operational activities under Alternative RO are projected to impact the species.
Tricolored bat	Enhanced operational water conveyance would reduce permanent terrestrial habitat inundation from sea level rise by 2,313 acres in the worst-case scenario and by 545 acres in the intermediate-case scenario compared to the FWOP (No Action Alternative) condition, potentially yielding beneficial effects for the tricolored bat.	Enhanced operational water conveyance would reduce permanent terrestrial habitat inundation from sea level rise by 2,800 acres in the worst-case scenario and by 643 acres in the intermediate-case scenario compared to the FWOP (No Action Alternative) condition, potentially yielding beneficial effects for the tricolored bat.	Enhanced operational water conveyance would reduce permanent terrestrial habitat inundation from sea level rise by 2,925 acres in the worst-case scenario and by 148 acres in the intermediate-case scenario compared to the FWOP (No Action Alternative) condition, potentially yielding beneficial effects for the tricolored bat.	Enhanced operational water conveyance would reduce permanent terrestrial habitat inundation from sea level rise by 2,265 acres in the worst-case scenario and by 582 acres in the intermediate-case scenario compared to the FWOP (No Action Alternative) condition, potentially yielding beneficial effects for the tricolored bat.
West Indian manatee (Florida)	During OMRR&R, terrestrial habitat inundation would be reduced by 2,313 acres in the worst-case scenario and by 545 acres in the intermediate-case scenario compared to the FWOP (No Action Alternative) condition. Because the Florida manatee is an obligate aquatic species, this reduction is expected to have negligible effects on the Florida manatee, and no operational activities under Alternative A are projected to impact the species. Under Alternative A, each new WCS would include a manatee protection system to avoid impact to this species during OMRR&R.	During OMRR&R, terrestrial habitat inundation would be reduced by 2,800 acres in the worst-case scenario and by 643 acres in the intermediate-case scenario compared to the FWOP (No Action Alternative) condition. Because the Florida manatee is an obligate aquatic species, this reduction is expected to have negligible effects on the Florida manatee, and no operational activities under Alternative B are projected to impact the species. No direct or indirect impacts are expected from OMRR&R. Under Alternative B, each new WCS would include a manatee protection system to avoid impact to this species during OMRR&R.	During OMRR&R, terrestrial habitat inundation would be reduced by 2,925 acres in the worst-case scenario and by 148 acres in the intermediate-case scenario compared to the FWOP (No Action Alternative) condition. Because the Florida manatee is an obligate aquatic species, this reduction is expected to have negligible effects on the Florida manatee, and no operational activities under Alternative C are projected to impact the species. Under Alternative C, each new WCS would include a manatee protection system to avoid impact to this species during OMRR&R.	During OMRR&R, terrestrial habitat inundation would be reduced by 2,265 acres in the worst-case scenario and by 582 acres in the intermediate-case scenario compared to the FWOP (No Action Alternative) condition. Because the Florida manatee is an obligate aquatic species, this reduction is expected to have negligible effects on the Florida manatee, and no operational activities under Alternative RO are projected to impact the species. Under Alternative RO, each new WCS would include a manatee protection system to avoid impact to this species during OMRR&R.

Notes: WCS = water control structure; FWOP = Future Without Project

a/ Comparisons of terrestrial habitat inundation acreage between the action alternatives and FWOP are based on the worst case (100 year surge/100 year rainfall/high SLR) and intermediate (2 year surge/25 year rainfall/intermediate SLR) modeling scenarios across all upstream watershed basins when peak depths exceed 1 foot.

Table B.3-43. Differences in Terrestrial Habitat Inundation in Upstream Watershed Basins across All Alternatives.

Alternative	Worst Case Scenario (acres)	Intermediate Scenario (acres)
FWOP	24,615	12,641
Alternative A	22,302	12,096
Reduction in Inundation ^{a/}	2,313	545
Alternative B	21,815	11,998
Reduction in Inundation	2,800	643
Alternative C	21,690	12,493
Reduction in Inundation	2,925	148
Alternative RO	22,350	12,059
Reduction in Inundation	2,265	582

a/ "Reduction in inundation" equals acres inundated under FWOP conditions minus acres inundated under each alternative. Inundation assumes peak depths exceed 1 foot.

Note: FWOP = Future Without Project

B.3.13 Fish and Wildlife

An analysis of the potential effects on aquatic species (i.e., Florida largemouth bass (*Micropterus salmoides floridanus*), snook (*Centropomus undecimalis*), tarpon (*Megalops atlanticus*), channel catfish (*Ictalurus punctatus*), bluegill (*Lepomis macrochirus*), black crappie/speckled perch (*Pomoxis nigromaculatus*), butterfly peacock (*Cichla ocellaris*), Goldline snakehead (*Channa* spp.), oscar (*Astronotus ocellatus*), spotted tilapia (*Tilapia mariae*), Mayan cichlid (*Mayaheros urophthalmus*), golden topminnow (*Fundulus chrysotus*), bluefin killifish (*Lucania goodei*), sailfin molly (*Poecilia latipinna*), mosquitofish (*Gambusia holbrooki*), flagfish (*Jordanella floridae*), sunfish (e.g., bluegill), amphipods (*Hyalella aztecus*), freshwater prawn (*Palaemonetes paludosus*), crayfish (*Procambarus alleni*), apple snail (*Pomacea paludosa*), softshell turtle (*Apalone ferox*), common snapping turtle (*Chelydra serpentina*), American alligator (*Alligator mississippiensis*), banded/southern water snake (*Nerodia fasciata*), and river otters (*Lontra canadensis*)), and terrestrial species (i.e., white ibis (*Eudocimus albus*), roseate spoonbill (*Platalea ajaja*), little blue heron (*Egretta caerulea*), tri-colored heron (*Egretta tricolor*), black-crowned night heron (*Nycticorax nycticorax*), snowy egret (*Egretta thula*), king rail (*Rallus elegans*), American bittern (*Botaurus lentiginosus*), limpkin (*Aramus guarauna*), prothonotary warbler (*Protonotaria citrea*), Cape May warbler (*Setophaga tigrina*), yellow-throated vireo (*Vireo flavifrons*), black vulture (*Coragyps atratus*), turkey vulture (*Cathartes aura*), osprey (*Pandion haliaetus*), cooper's hawk (*Astur cooperii*), red-shouldered hawk (*Buteo platypterus*), American kestrel (*Falco sparverius*), black skimmer, chimney swift (*Chaetura pelagica*), Florida burrowing owl (*Athene cunicularia floridana*), great blue heron (*Ardea herodias*), gull-billed tern (*Gelochelidon nilotica*), least tern (*Sterna antillarum*), lesser yellowlegs (*Tringa flavipes*), magnificent frigatebird (*Fregata magnificens*), mangrove cuckoo (*Coccyzus minor*), painted bunting (*Passerina ciris*), prairie warbler (*Setophaga discolor*), red-headed woodpecker (*Melanerpes erythrocephalus*), reddish egret (*Egretta rufescens*), ruddy turnstone (*Arenaria interpres morinella*), semipalmated sandpiper (*Calidris pusilla*), short-billed dowitcher (*Limnodromus griseus*), swallow-tailed kite (*Elanoides forficatus*), white-crowned pigeon (*Patagioenas leucocephala*), willet (*Tringa semipalmata*), Worthington's marsh wren (*Cistothorus palustris griseus*), Florida black bear (*Ursus americanus floridanus*), southeastern fox squirrel (*Sciurus niger niger*), eastern

gray squirrel (*Sciurus carolinensis*), raccoon (*Procyon lotor*), gray fox (*Urocyon cinereoargenteus*), Virginia opossums (*Didelphis virginiana*), coyotes (*Canis latrans*), brown anole (*Anolis sagrei*), green anole (*Anolis carolinensis*), northern curly-tailed lizard (*Leiocephalus carinatus*), gopher tortoise (*Gopherus polyphemus*), banded/southern watersnake (*Nerodia fasciata*), Brahminy blindsnake (*Indotyphlops braminus*), eastern narrow-mouthed toad (*Gastrophryne carolinensis*), and southern leopard frog (*Lithobates sphenoccephalus*) from the No Action Alternative and implementation of the action alternatives is provided below.

B.3.13.1 Future Without Project Conditions (No Action Alternative)

There would be no improvements or changes to the WCS under the No Action Alternative. The No Action Alternative would not have impacts on aquatic and terrestrial species as no construction activity would occur, and routine operation and maintenance would continue at the existing WCS. However, as the Study Area historically consisted of the Everglades ecosystem (except for the coastal ridge) with extensive habitat for wildlife and is now primarily made up of urban cover (covering 95 percent of the Study Area), little space remains for aquatic and terrestrial species to flourish. Sea level rise and increased storm events will worsen over time and cause saltwater intrusion, erosion, and flooding that would change the make-up, or result in a complete loss of, currently existing habitat and ecosystems for certain aquatic and terrestrial species in the Study Area. As a result, some species populations would decrease or geographically shift their location based on preferred habitat. For example, since habitats may be lost, mammals, reptiles, amphibians, fish, and wading birds that prefer freshwater or less saline conditions (e.g. river otters, Florida softshell turtle, southern leopard frog, golden topminnow, and little blue herons), would need to find new habitats or may otherwise become extirpated from their currently occupied habitats in the Study Area. Another consequence may be the reduced ability for native species to survive ecosystem changes while more resilient, non-native species take over. A study examining the saltwater intrusion on biomass of prey-based fish for wading birds and other species in the southwestern coastal Everglades found that fish biomass declined with increased salinity, the biomass of non-native species increased with higher salinities, and wading birds could benefit from a 10 percent reduction in current salinity levels indicating a need for greater freshwater flows (Romañach et al. 2019).

B.3.13.2 Alternative A

Alternative A consists of structural improvements to three WCS, the G-56 Gated Spillway, G-57 Gated Spillway, and G-54 Gated Spillway, with the aim of preventing backflow through and around the WCS. The G-15 (North New River) Canal would also be enlarged approximately 100 feet upstream and downstream of the G-54 Gated Spillway. Four of the WCS (S-37A Gated Spillway, S-36 Gated Spillway, S-33 Gated Spillway, and S-13 Pump Station and Gated Spillway) would be demolished and rebuilt to new specifications including new gated spillways, forward pump stations, and site hardening to prevent backflows.

The construction proposed under Alternative A would temporarily disturb aquatic species by causing increased turbidity in the water, potential sedimentation from dredged material, and noise and visual disruptions that can impact species movement, feeding, and breeding patterns. Aquatic species using the canals (such as American alligator, river otter, largemouth bass, bluegill/sunfish, peacock bass, oscar, and cichlid) and terrestrial species directly adjacent to the footprint of construction

would be impacted. However, the FLAM ranking (identifying ecologically significant land with 10 being the highest value) for the area of expected construction for all WCS is low (**Table B.3-44**). Additionally, a study of South Florida canals evaluating biological traits found habitat and benthic macroinvertebrate communities (stream condition index) to be poor (Payne 2019).

Table B.3-44. Alternative A Land Ranking and Land Cover Type.

Water Control Structure or Feature	Construction Land FLAM Ranking	Direct and Adjacent Construction CLC Land Cover Types [FNAI Type]
G-56 Gated Spillway	1	Cultural – Riverine [Canal/Ditch]; High Intensity Urban; Low Intensity Urban [Developed]
G-57 Gated Spillway	1	Cultural – Estuarine; Cultural – Riverine [Canal/Ditch]; High Intensity Urban [Developed]
S-37B Gated Spillway	N/A	N/A
S-37A Gated Spillway	1	Cultural – Riverine [Canal/Ditch]; High Intensity Urban [Developed]
S-36 Gated Spillway	1	Cultural – Riverine [Canal/Ditch]; Cultural – Lacustrine [Artificial Impoundment]; High Intensity Urban [Developed]
S-33 Gated Spillway	1	Cultural – Riverine [Canal/Ditch]; High Intensity Urban [Developed]; Transportation
G-54 Gated Spillway	1	Cultural – Riverine [Canal/Ditch]; High Intensity Urban [Developed]; Transportation
S-13 Pump Station and Gated Spillway	2	Cultural – Riverine [Canal/Ditch]; High Intensity Urban [Developed]

Notes: CLC = Cooperative Land Cover; FLAM = Florida Landscape Assessment Model; FNAI = Florida Natural Areas Inventory

Aquatic Species, such as American alligators, may be more impacted in their daily movement patterns through the canals. Terrestrial species such as white ibis, herons, snowy egret, glossy ibis, American bittern, limpkin, black rail, king rail, wood stork, snapping turtle, crayfish, and raccoon (as well as other mammals, birds, reptiles, and invertebrates) using the green spaces and trees areas adjacent to canals would be disturbed by noise and land/soil disturbance from construction vehicles and staging. For those WCS which would be demolished, there would be greater land area impacts and thus greater habitat impacts on terrestrial species. Tree removal may indirectly impact some terrestrial species such as migratory birds (passerines, birds of prey, etc.) and bats. Impacts to rarer invertebrates previously found to occur near some WCS, such as the Miami chafer beetle and statira sulphur butterfly, may also occur with construction, though given the limited occurrence of these species, such impacts are expected to be minor to negligible.

Of note when considering construction at WCS is the potential presence of state-listed species. The Florida burrowing owl, which is state-listed but also a Bird of Conservation Concern, has been documented near multiple WCS and canals within the Study Area by Florida Natural Areas Inventory (FNAI) element occurrence data. The Florida burrowing owl's nesting and foraging habitat (open and tree-less areas on the ground) could be affected by ground-disturbing activities. Other state-listed birds known to occur in the Study Area with less frequency than the burrowing owl, with locations near WCS and canals, include black skimmers and least terns. Another state-listed species, the gopher tortoise, has been found throughout the Study Area and could be present in areas of construction that are open or

undeveloped (e.g., residential yards). Similar to the burrowing owl, they nest in open areas and in burrows on the ground. The rim-rock crowned snake has the potential to occur, though this is unlikely because their preferred habitat (pine rockland, rockland hammock) is not present surrounding the WCS; therefore, impacts are not expected. Surveys for terrestrial species presence would occur prior to construction at WCS so avoidance measures may be implemented, as applicable. Overall, while impacts to aquatic and terrestrial species from construction would be greater than under the No Action Alternative, impacts are expected to be minimal and/or limited to less sensitive species.

Current conditions would be maintained during OMRR&R for the WCS. Pre-storm drawdowns under Alternative A would improve efficiency in moving water through the system but would not significantly change the overall discharge volume compared to current operations. OMRR&R changes would primarily affect timing rather than quantity of flows, and downstream flow variability is expected to remain consistent with existing conditions. Receiving waters in Broward County are already adapted to the range of salinity and water quality associated with current discharge patterns, and no ecosystem-based flow targets have been identified for these areas. Therefore, the modified operations are not anticipated to cause adverse effects on downstream aquatic and terrestrial species. Improvements to the prevention of backflows and increased flow conveyance would reduce future expected flooding impacts from extreme storm events and sea level rise. This would reduce the threat of permanent habitat loss, particularly wetlands and upland habitats, for aquatic and terrestrial species. No impacts to aquatic and terrestrial species are expected with OMRR&R under Alternative A, and some minor beneficial effects may occur as compared to the No Action Alternative.

B.3.13.3 Alternative B

Alternative B consists of demolishing all WCS except for S-37B Gated Spillway and re-building WCS to new specifications including new gated spillways, pump stations, and site hardening to prevent backflows. A new gated spillway would be constructed for S-37B Gated Spillway. Certain canals would also be modified to increase flow capacities including G-08 (Hillsboro) Canal (primarily upstream of G-56 Gated Spillway), C-14 (Cypress Creek) Canal (upstream of S-37B Gated Spillway), and C-11 (South New River) Canal (upstream of S-13 Pump Station and Gated Spillway). Additional stormwater storage capacity improvements would also occur on the G-15 (North New River) Canal, upstream of G-54 Gated Spillway at Markham Park.

The following locations near the proposed construction areas under Alternative B have potential to support aquatic and terrestrial species:

- Hillsboro Pineland Natural Area, which contains one of the last remaining significant stands of pine flatwoods (FNAI type: mesic flatwood] in Broward County: approximately 600 feet from the G-08 (Hillsboro) Canal;
- Fern Forest Nature Center made up of a mixed forest wetland (FNAI types: rockland hammock, freshwater forested wetlands, and mesic flatwoods [palmetto prairie CLC type]) and a Great Florida Birding Trail site: approximately 200 feet from the C-14 (Cypress Creek) Canal;
- Central Broward Regional Park (with a stocked fish pond): adjacent to the S-33 Gated Spillway;
- Sunny Lake Bird Sanctuary, which is made up of an artificial impoundment and identified as a Rare Species Habitat Conservation Priority Area: adjacent to the C-11 (South New River) Canal;

- Robbins Open Space Preserve: adjacent to the C-11 (South New River) Canal;
- Vista View Park: adjacent to the C-11 (South New River) Canal;
- Tree Tops Regional Park, which is made up of live oak ridge, marsh, and wetlands (FNAI types: invasive exotic monoculture, hardwood forested upland [mesic hammock CLC type], freshwater marsh, and an artificial impoundment) and is a Great Florida Birding Trail site: adjacent to the C-11 (South New River) Canal; and
- Pine Island Ridge Natural Area, which is made up of high ridge hammock, live oak, and slash pine: adjacent to the C-11 (South New River) Canal.

Under Alternative B, construction impacts are anticipated to be similar to those described in Alternative A and greater than under the No Action Alternative (where construction would not occur). However, because there is a larger construction footprint under Alternative B, there is a greater potential for impacts to habitat used by terrestrial species. Additionally, the FLAM rankings in the construction footprints are slightly higher than Alternative A, particularly at Markham Park (**Table B.3-45**), and the state-listed Florida burrowing owl has been found adjacent to the C-11 (South New River) Canal. As with Alternative A, surveys for sensitive aquatic and terrestrial species presence would occur prior to construction so avoidance measures may be implemented. Overall, impacts to aquatic and terrestrial species from construction under Alternative B are expected to be minimal and/or limited to less sensitive species but greater than under the No Action Alternative.

Impacts to aquatic and terrestrial species from OMRR&R under Alternative B are expected to be similar to those described in Alternative A, with minor beneficial effects occurring as compared to the No Action Alternative due a reduction in future flooding impacts of from extreme storm events and sea level rise and a resulting reduction in permanent habitat loss.

Table B.3-45. Alternative B Land Ranking and Land Cover Type.

Water Control Structure or Feature	Construction Land FLAM ranking	Direct and Adjacent Construction CLC Land Cover Type [FNAI Type]
G-56 Gated Spillway	1, 2	Cultural – Riverine; Cultural – Estuarine [Canal/Ditch]; High Intensity Urban; Low Intensity Urban [Developed]; Scrub [Scrub]; Rural [Ruderal]
G-57 Gated Spillway	1	Cultural – Estuarine; Cultural – Riverine [Canal/Ditch]; High Intensity Urban [Developed]
S-37B Gated Spillway	1, 2	Cultural – Riverine [Canal/Ditch]; High Intensity Urban; Low Intensity Urban [Developed]; Transportation; Freshwater Forested Wetland [many FNAI possible]
S-37A Gated Spillway	1	Cultural – Riverine [Canal/Ditch]; High Intensity Urban [Developed]; Transportation
S-36 Gated Spillway	1, 2	Cultural – Riverine [Canal/Ditch]; Cultural – Lacustrine [Artificial Impoundment]; High Intensity Urban [Developed]; Transportation
S-33 Gated Spillway	1	Cultural – Riverine [Canal/Ditch]; High Intensity Urban; Low Intensity Urban [Developed]; Transportation
G-54 Gated Spillway	1	Cultural – Riverine [Canal/Ditch]; High Intensity Urban [Developed]; Transportation

Water Control Structure or Feature	Construction Land FLAM ranking	Direct and Adjacent Construction CLC Land Cover Type [FNAI Type]
S-13 Pump Station and Gated Spillway	1, 2	Cultural – Riverine [Canal/Ditch]; High Intensity Urban [Developed]; Transportation; Exotic Plants [Invasive Exotic Monoculture]; Shrub and Brushland [many FNAI possible]
Markham Park Storage	1–4	Cultural – Riverine [Canal/Ditch]; Cultural Lacustrine [Artificial Impoundment]; Low Intensity Urban [Developed]; Transportation; Exotic Plants [Invasive Exotic Monoculture]; Prairies and Bogs [Mixed Scrub-Scrub Wetland, many FNAI types possible]; Vineyard and Nurseries [Agriculture]; Marshes [Freshwater Marsh]

Notes: CLC = Cooperative Land Cover; FLAM = Florida Landscape Assessment Model; FNAI = Florida Natural Areas Inventory

B.3.13.4 Alternative C

Alternative C consists of demolishing all WCS except for S-37B Gated Spillway and re-building WCS to new specifications including new gated spillways, pump stations, and site hardening to prevent backflows. Certain canals would also be modified to increase flow capacities including G-08 (Hillsboro) Canal (primarily upstream of the G-56 Gated Spillway), C-14 (Cypress Creek) Canal (upstream of the S-37B Gated Spillway to downstream of the S-37A Gated Spillway), C-13 (Middle River) Canal (downstream and upstream of the S-36 Gated Spillway), C-12 (Plantation) Canal (upstream of the S-33 Gated Spillway), G-15 (North New River) Canal (upstream of the G-54 Gated Spillway), and C-11 (South New River) Canal (upstream of the S-13 Pump Station and Gated Spillway). Additional stormwater storage capacity improvements would also occur on the G-15 (North New River) Canal and G-08 (Hillsboro) Canal, upstream of the G-54 Gated Spillway at Markham Park and the G-56 Gated Spillway in the Hillsboro Watershed, respectively. The Hillsboro Watershed Stormwater Storage Project would convert existing property into an aboveground stormwater storage area.

As explained under Alternative B, certain state-listed species have been previously detected adjacent to some of the canals where construction is proposed. Similarly, various parks, preserves, and nature sanctuaries are adjacent to these canals.

Because Alternative C proposes the greatest number of improvements, construction impacts are potentially the greatest across all the alternatives and would be greater than the No Action Alternative. The FLAM rankings in construction footprints for Alternative C are presented in **Table B.3-46**. As with Alternatives A and B, surveys for sensitive aquatic and terrestrial species presence would occur prior to construction so avoidance measures may be implemented. Canal conveyance improvements in the C-14 (Cypress Creek) Canal have the largest excavation footprint compared to all other canal sites, which carries greater potential impacts to aquatic and terrestrial species inhabiting these environments and nearshore coastal habitats. Best management practices would be employed during in-water work to ensure that impacts are avoided and minimized to the greatest extent possible. Overall, while impacts to aquatic and terrestrial species from construction under Alternative C would be greater than under either Alternatives A or B, and greater than no impacts under the No Action Alternative, such impacts are still expected to be short-term, localized, and insignificant.

Impacts to aquatic and terrestrial species from OMRR&R under Alternative C are expected to be similar to those described in Alternatives A and B, with minor beneficial effects as compared to the No Action Alternative. Additionally, the conversion of agricultural land to a freshwater wetland under the Hillsboro

Watershed Stormwater Storage Capacity Improvement Project would provide additional, high quality habitat in the long-term for aquatic and terrestrial species such as wading birds, the river otter and the American alligator.

Table B.3-46. Alternative C Land Ranking and Land Cover Type.

Water Control Structure or Feature	Construction Land FLAM ranking	Direct and Adjacent Construction CLC Land Cover Type [FNAI Type]
G-56 Gated Spillway	1, 2	Cultural – Riverine; Cultural - Estuarine [Canal/Ditch]; High Intensity Urban; Low Intensity Urban [Developed]; Scrub [Scrub]; Rural [Ruderal]
G-57 Gated Spillway	1	Cultural – Estuarine; Cultural – Riverine [Canal/Ditch]; High Intensity Urban [Developed]
S-37B Gated Spillway	1, 2	Cultural – Riverine [Canal/Ditch]; High Intensity Urban; Low Intensity Urban [Developed]; Transportation; Freshwater Forested Wetland [many FNAI possible]
S-37A Gated Spillway	1	Cultural – Riverine; Cultural - Estuarine [Canal/Ditch]; High Intensity Urban; Low Intensity Urban [Developed]; Transportation; Freshwater Forested Wetland [Freshwater Forested Wetland]
S-36 Gated Spillway	1, 2, 4	Cultural – Riverine [Canal/Ditch]; Cultural – Lacustrine [Artificial Impoundment]; High Intensity Urban [Developed]; Transportation; Freshwater Forested Wetland [many FNAI possible]
S-33 Gated Spillway	1, 2	Cultural – Riverine [Canal/Ditch]; High Intensity Urban [Developed]; Transportation; Utilities [Utility Corridor]
G-54 Gated Spillway	1, 2	Cultural – Riverine [Canal/Ditch]; Cultural – Terrestrial [Ruderal]; High Intensity Urban; Low Intensity Urban [Developed]; Transportation; Exotic Plants [Invasive Exotic Monoculture]; Vineyard and Nurseries [Agriculture]; Transportation; Utilities [Utility Corridor]
S-13 Pump Station and Gated Spillway	1, 2	Cultural – Riverine [Canal/Ditch]; Cultural – Lacustrine [Artificial Impoundment]; High Intensity Urban; Low Intensity Urban [Developed]; Transportation; Exotic Plants [Invasive Exotic Monoculture]; Shrub and Brushland [many FNAI possible]; Rural; Vineyard and Nurseries [Agriculture]; Improved Pasture [Agriculture]
Markham Park Stormwater Storage Feature	1–4	Cultural – Riverine [Canal/Ditch]; Cultural Lacustrine [Artificial Impoundment]; Low Intensity Urban [Developed]; Transportation; Exotic Plants [Invasive Exotic Monoculture]; Prairies and Bogs [Mixed Scrub-Scrub Wetland, many FNAI types possible]; Vineyard and Nurseries [Agriculture]; Marshes [Freshwater Marsh]
Hillsboro Watershed Stormwater Storage Feature	1, 2, 3	Cropland/Pasture; High Intensity Urban [Developed]; Transportation; Rural; Exotic Plants [Invasive Exotic Monoculture]

Notes: CLC = Cooperative Land Cover; FLAM = Florida Landscape Assessment Model; FNAI = Florida Natural Areas Inventory

B.3.13.5 Alternative RO

Alternative RO is a mixture of the alternatives that includes new gated spillways with increased spillway capacities (except for S-37B Gated Spillway that would keep the existing spillway capacity), new pump stations at select spillways, culvert conveyance improvement at G-57 Gated Spillway, and local canal improvements (as needed) upstream of G-56 Gated Spillway, S-37B Gated Spillway, and S-13 Pump Station and Gated Spillway. Construction would cause temporary noise and visual disruptions, increased

turbidity in canals, and direct impacts to habitat where work is occurring as discussed in previous sections on alternatives impacts. Noise on land and within the canals can elicit responses in aquatic and terrestrial species such as changes in frequency and duration of vocalizations, avoidance of habitat and/or change in spatial movement, and increase in stress hormones (Shannon et al. 2016). Increased turbidity can cause similar issues like changes in spatial movement and predator-prey interactions for aquatic species. While impacts would be greater than under the No Action Alternative, construction impacts are anticipated to have minimal impacts to aquatic and terrestrial species and/or to be limited to less sensitive species based on overall FLAM rankings and wildlife presence (**Table B.3-47**). Surveys for state-listed and rare species would occur prior to construction at WCS and canals so avoidance measures may be implemented, as applicable. The impacts from Alternative RO during future OMRR&R are expected to be negligible, with potential beneficial effects on terrestrial and aquatic species as compared to the No Action Alternative due to a reduction in future flooding impacts of from extreme storm events and sea level rise and a resulting reduction in permanent habitat loss.

Table B.3-47. Alternative RO Land Ranking, Land Cover Type, and Effects on Wildlife.

Water Control Structure	Construction Land FLAM Ranking	Direct and Adjacent Construction CLC Land Cover Type [FNAI Type]	Effects on Wildlife
G-56 Gated Spillway	1, 2	Cultural – Riverine; Cultural – Estuarine [Canal/Ditch]; High Intensity Urban; Low Intensity Urban [Developed]; Scrub [Scrub]; Rural [Ruderal]; Transportation	Temporary noise and visual disturbance, increased turbidity, and direct habitat impacts during construction as compared to the No Action Alternative. FLAM rankings are low, so overall impacts are expected to be minimal. There is increased risk of indirect impacts to terrestrial species at Hillsboro Pineland Natural Area, which contains one of the last remaining significant stands of pine flatwoods in Broward County. OMRR&R impacts are expected to be negligible, with potential beneficial effects from reduced habitat loss as compared to the No Action Alternative.
G-57 Gated Spillway	1	Cultural – Estuarine; Cultural – Riverine [Canal/Ditch]; High Intensity Urban [Developed]; Transportation	Temporary noise and visual disturbance, increased turbidity, and direct habitat impacts during construction as compared to the No Action Alternative. FLAM rankings are low, so overall impacts are expected to be minimal. OMRR&R impacts are expected to be negligible, with potential beneficial effects from reduced habitat loss as compared to the No Action Alternative.
S-37B Gated Spillway	1, 2	Cultural – Riverine [Canal/Ditch]; High Intensity Urban; Low Intensity Urban [Developed]; Transportation; Freshwater Forested Wetland [many FNAI possible]	Temporary noise and visual disturbance, increased turbidity, and direct habitat impacts during construction as compared to the No Action Alternative. FLAM rankings are low, so overall impacts are expected to be minimal. There is increased risk of indirect impacts to nearby terrestrial species at Fern Forest Nature Center, a mixed forest wetland. OMRR&R impacts are expected to be negligible, with potential beneficial effects from reduced habitat loss as compared to the No Action Alternative.
S-37A Gated Spillway	1	Cultural – Riverine [Canal/Ditch]; High Intensity Urban [Developed]; Transportation	Temporary noise and visual disturbance, increased turbidity, and direct habitat impacts during construction as compared to the No Action Alternative. FLAM rankings are low, so overall impacts are expected to be minimal. OMRR&R impacts are expected to be negligible, with potential beneficial effects from reduced habitat loss as compared to the No Action Alternative.

Water Control Structure	Construction Land FLAM Ranking	Direct and Adjacent Construction CLC Land Cover Type [FNAI Type]	Effects on Wildlife
S-36 Gated Spillway	1, 2	Cultural – Riverine [Canal/Ditch]; Cultural – Lacustrine [Artificial Impoundment]; High Intensity Urban [Developed]; Transportation	Temporary noise and visual disturbance, increased turbidity, and direct habitat impacts during construction as compared to the No Action Alternative. FLAM rankings are low, so overall impacts are expected to be minimal. OMRR&R impacts are expected to be negligible, with potential beneficial effects from reduced habitat loss as compared to the No Action Alternative.
S-33 Gated Spillway	1	Cultural – Riverine [Canal/Ditch]; High Intensity Urban; Low Intensity Urban [Developed]; Transportation	Temporary noise and visual disturbance, increased turbidity, and direct habitat impacts during construction as compared to the No Action Alternative. FLAM rankings are low, so overall impacts are expected to be minimal. There is increased risk of indirect impacts to nearby wildlife in Central Broward Regional Park, which includes a stocked fish pond. OMRR&R impacts are expected to be negligible, with potential beneficial effects from reduced habitat loss as compared to the No Action Alternative.
G-54 Gated Spillway	1, 2	Cultural – Riverine [Canal/Ditch]; Cultural – Terrestrial [Ruderal]; High Intensity Urban; Low Intensity Urban [Developed]; Transportation; Exotic Plants [Invasive Exotic Monoculture]; Vineyard and Nurseries [Agriculture]; Transportation; Utilities [Utility Corridor]	Temporary noise and visual disturbance, increased turbidity, and direct habitat impacts during construction as compared to the No Action Alternative. FLAM rankings are low, so overall impacts are expected to be minimal. OMRR&R impacts are expected to be negligible, with potential beneficial effects from reduced habitat loss as compared to the No Action Alternative.
S-13 Pump Station and Gated Spillway	1, 2	Cultural – Riverine [Canal/Ditch]; High Intensity Urban [Developed]; Transportation; Exotic Plants [Invasive Exotic Monoculture]; Shrub and Brushland [many FNAI possible]	Temporary noise and visual disturbance, increased turbidity, and direct habitat impacts during construction as compared to the No Action Alternative. FLAM rankings are low, so overall impacts are expected to be minimal. There is increased risk of indirect impacts to nearby terrestrial species at Sunny Lake Bird Sanctuary, which includes an artificial impoundment and is a rare species habitat conservation priority area; Robbins Open Space Preserve; Vista View Park; and Tree Tops Regional Park & Pine Island Ridge Natural Area. OMRR&R impacts are expected to be negligible, with potential beneficial effects from reduced habitat loss as compared to the No Action Alternative.

B.3.14 Geology and Soils

An analysis of the potential impacts to geology and soils from the No Action Alternative and implementation of the action alternatives is presented below. This analysis considers the alternatives' potential for adverse impacts on geological and soil resources during construction and operations from the following:

- Permanent or long-term loss of mineral resources;
- Permanent or long-term loss of soil resources, or reduction in productivity or suitability of soils for use; and

- Increases in soil erosion through increased susceptibility to water or wind erosion during or after construction activities, or through a large increase of impervious surface area that would increase the amount of surface water runoff during precipitation events.
- The analysis also considers the potential for geologic and soil resources to have adverse impacts on the alternatives in the following ways:
- Seismic activity of sufficient magnitude that could result in damage to proposed structures, potentially with resultant injuries or loss of life, unless structures are designed and built to withstand reasonably foreseeable seismic events;
- Soil properties that could result in damage to structure foundations unless measures are taken to mitigate the effects; and
- Potential for severe erosion or slope stability that could result in damage to foundations, roads, or other structures.

The potential for impacts from the proposed alternatives are described in further detail below.

B.3.14.1 Future Without Project Conditions (No Action Alternative)

Under the No Action Alternative, no improvements to the existing WCS would be performed. There would be no soil disturbance from WCS improvement, and therefore, no impacts to geology and soils would occur. OMRR&R of the existing WCS would continue. Without improvements to the WCS, water levels would likely exceed WCS design capacity more frequently due to rising sea level and increased storm intensity, with an ensuing increase in flooding and soil erosion.

B.3.14.2 Alternative A

Alternative A represents the least complex alternative in that the smallest number of measures are proposed. As shown in **Table B.3-48**, three existing WCS would be raised to prevent backflow, existing gated spillways would be demolished and replaced in four WCS, and three new pump stations would be constructed at existing WCS sites. In addition, a new culvert would be constructed in the G-16 (Pompano) Canal, upstream of WCS G-57 Gated Spillway. **Table B.3-48** also list acreages for estimated soil disturbance during construction.

Table B.3-48. Potential Soil Disturbance for Improvements under Alternative A.

WCS	Construction Soil Disturbance (acres)	Alternative A General Description
G-56 Gated Spillway	0.5	Raise structure components to prevent backflow presents low potential for soil disturbance and erosion.
G-57 Gated Spillway	0.5	Raise structure components to prevent backflow presents low potential for soil disturbance and erosion.
S-37B Gated Spillway	0	No proposed changes.
S-37A Gated Spillway	3.6	Existing gated spillway would be demolished, and new pump station and new spillway would be constructed in the same location.
S-36 Gated Spillway	1.9	Existing gated spillway would be demolished, and new spillway would be constructed in the same location.

WCS	Construction Soil Disturbance (acres)	Alternative A General Description
S-33 Gated Spillway	3.0	Existing gated spillway would be demolished, and new pump station and new spillway would be constructed in adjacent, upstream location.
G-54 Gated Spillway	0.5	Raise structure components to prevent backflow presents low potential for soil disturbance and erosion.
S-13 Pump Station and Gated Spillway	3.6	Existing gated spillway and pump station would be demolished, and new pump station and new spillway would be constructed in adjacent, upstream location.
Total	13.6	Temporary soil disturbance for WCS construction.
Canals		
G-16 (Pompano) Canal	1.0	Construct two, 10-ft-diameter culverts parallel to existing 10-ft-diameter culvert located upstream of G-57 Gated Spillway. Existing 10-ft-diameter culvert to remain.

Note: WCS = water control structure

Construction (2028 to 2034)

Water Control Structures. Construction activities would cause minor impacts to the existing geologic and soil conditions at the WCS as compared to the No Action Alternative. The near-surface geologic conditions and existing soil column would be disturbed by construction and demolition, especially within the facility footprint. The following tree-clearing, grading, excavation, and other site development activities would cause soil disturbance:

- Excavating existing WCS abutments and retaining walls within the SFWMD ROW to provide room for construction of new spillways and pump stations;
- Excavating and grading the canal bottom upstream and/or downstream of new spillways and/or pump stations to match existing canal depths;
- Placing excavated material (i.e., dredged material) on uplands within existing SFWMD ROWs to raise the height of structures, canal banks, access roads, and parking areas;
- Constructing new or modifying existing retaining walls within the SFWMD ROW to connect new structures to existing retaining walls; and
- Demolishing existing WCS and ancillary structures when new spillways and/or pump structures are constructed.

Elevations at the bottom of the pump stations would range from approximately -12 feet to -25 feet NAVD88. WCS sites were generally found to be underlain by very loose to medium dense, fine-grained sand and highly weathered sandy limestone from ground surface to depths of approximately 100 feet (WIRX 2025a-d). Estimates for soil disturbance at each WCS are shown in **Table B.3-48**. A total of approximately 13.6 acres of soil disturbance would occur during construction. Site contours would be permanently changed at WCS sites where a replacement WCS is proposed, primarily for excavation and construction of the WCS foundations and modification of retaining walls. However, these changes would be limited in extent and the sites would generally remain level. Soils adjacent to the WCS generally consist of fine, gravelly, and cobbly sands (NRCS 2024). None of these soils are considered prime farmland, and soils at WCS sites have been previously disturbed. These soils have low susceptibility to water erosion and high susceptibility to wind erosion. However, because of soil disturbance, the

potential for increased soil erosion due to stormwater runoff and wind would increase during construction. While impacts would be greater than under the No Action Alternative, where construction would not occur, adverse impacts to geology and soils are not expected from construction.

Coverage under the NPDES stormwater permit for large construction activity is required for construction activities that disturb 5 acres or greater of land. As such, a permit for large construction activity would be required for implementation of Alternative A. The permit requires BMPs such as properly managing stormwater flow and discharge, techniques to minimize erosion and sedimentation and control wastes to prevent runoff of pollution, and development of a site-specific stormwater pollution prevention plan (SWPPP). In general, potential impacts from erosion would be minimized through implementation of the site-specific SWPPP, which would contain an erosion and sediment control plan for construction. The SWPPP would also contain a revegetation plan for areas disturbed by construction. Although the soils at the WCS are not classified as prime farmland, site topsoil would be stripped and conserved prior to grading activities, and reapplied post-construction to facilitate revegetation. Soils in areas used to stage equipment and materials have the potential to be compacted; such areas would be mechanically de-compacted prior to the revegetation phase of the project to facilitate regrowth. Once construction is complete, areas used for laydown would be restored to pre-construction conditions. Meanwhile, open areas around the WCS would be cleaned up, restored, and revegetated. With implementation of the above measures, impacts to geology and soils during construction would be minimized.

Hazards posed by geological conditions are expected to be very low. Southeast Florida has not been seismically active in recent times, with no earthquakes recorded since 1900 (USGS 2024a). No faults at land surface are identified within southeast Florida (USGS 2021). The USGS rates ground motions using peak ground acceleration, which is the maximum acceleration experienced during an earthquake and is measured in units of acceleration due to gravity ("g"). USGS data indicate that an earthquake causing 0.02g peak horizontal ground acceleration has a 2 percent probability of exceedance in 50 years; and an earthquake causing 0.006g peak horizontal ground acceleration has a 10 percent probability of exceedance in 50 years (USGS 2024b). Earthquakes of that magnitude would be unlikely to cause any damage (FEMA 2020).

Other potential hazards such as subsidence from karst and landslides are low risk. Within the Study Area, sinkhole features are present; however, they are few, shallow, of small diameter, and develop gradually. Cover-subsidence sinkholes dominate (FDEP 2024b). The probability of a sinkhole developing in the vicinity of WCS sites is considered very low. Landslide risk is low because of the flat topography. Geotechnical studies conducted in 2025 indicated that site soils are classified as slightly corrosive for concrete and steel while canal water is classified as extremely corrosive for concrete and steel, based on lab measurements (WIRX 2025a-d). However, there are no anticipated issues with facility construction due to the existing geologic and soil conditions.

Canals. An additional 1,400-foot-long, double culvert would be constructed for the G-16 (Pompano) Canal immediately upstream of WCS G-57 Gated Spillway. Construction would most likely occur by jack-and-bore method or similar trenchless installation methods under South Dixie Highway (SR 811) and Florida East Coast Railroad, and via an open-cut trench in areas on either side of the roadway and railway. During trenching, dredged material would be windrowed along the ground adjacent to the trench within temporary workspace. Sediment controls would be required for stockpiled soils. Upon

installation of the culvert, excavated material would be used as backfill, and the area would be restored to grade. Excess dredged material would be transported off-site for disposal at an approved facility. Soil disturbance is expected to be approximately 1 acre and would occur primarily along the open-cut section of the culvert installation, which would be approximately 1,000 feet in length. With the implementation of BMPs, impacts to geology and soils during culvert construction would be minimized, though such impacts would still be greater than under the No Action Alternative, where culvert construction would not occur.

Operation, Maintenance, Repair, Replacement, and Rehabilitation

OMRR&R would occur from 2035 to 2085. Although erosion from stormwater runoff and wind action would occur occasionally during operation, it is anticipated to be minimal. OMRR&R activities are not expected to cause any additional impacts to geology and soils as compared to the No Action Alternative.

B.3.14.3 Alternative B

Alternative B represents an intermediate scenario where the number of proposed measures is greater than in Alternative A but fewer than in Alternative C. As shown in **Table B.3-49**, all eight existing gated spillways would be demolished and replaced, and four new pump stations would be constructed adjacent to the new gated spillways. Three canals would be excavated to increase flow capacity. In addition, the Markham Park Stormwater Storage Capacity Improvement would be implemented. **Table B.3-49** lists acreages for estimated soil disturbance during construction.

Table B.3-49. Potential Soil Disturbance for Improvements under Alternative B.

WCS	Construction Soil Disturbance (acres)	Alternative B General Description
G-56 Gated Spillway	3.7	Demolition of existing gated spillway; new gated spillway would be located adjacent and downstream.
G-57 Gated Spillway	0.8	Demolition of existing gated spillway; new gated spillway would be located adjacent and upstream.
S-37B Gated Spillway	4.0	Demolition of existing gated spillway; new gated spillway would be located adjacent and upstream.
S-37A Gated Spillway	3.7	Demolition of existing gated spillway; new pump station and new gated spillway would be in same location as existing gated spillway.
S-36 Gated Spillway	1.9	Demolition of existing gated spillway; new pump station and new gated spillway would be in same location as existing gated spillway.
S-33 Gated Spillway	3.0	Similar to Alternative A, demolition of existing gated spillway; new gated spillway and pump station would be located adjacent and upstream, bank improvements on south side.
G-54 Gated Spillway	2.0	Demolition of existing gated spillway; new gated spillway would be located adjacent and upstream.
S-13 Pump Station and Gated Spillway	4.8	Demolition of existing gated spillway and pump station; new gated spillway and new pump station would be located adjacent and upstream.
Total	23.9	Temporary soil disturbance for WCS construction.
Canals		

WCS	Construction Soil Disturbance (acres)	Alternative B General Description
G-16 (Pompano) Canal	1.0	Construct two, 10-ft-diameter culverts parallel to existing 10-ft-diameter culvert located upstream of G-57 Gated Spillway. Existing 10-ft-diameter culvert to remain.
G-08 (Hillsboro) Canal, C-14 (Cypress Creek) Canal, C-11 (South New River) Canal	155	Enlarge cross-sectional flow area of these canals via dredging within canal segments to improve water conveyance.
Stormwater Storage Capacity Improvement		
Markham Park	1.0	Construct structures so that the Markham Park lake system can temporarily store stormwater from the G-15 (North New River) Canal during storm events, beyond the stormwater that its existing lake system is designed and permitted to store, to reduce peak flood stages in the G-15 (North New River) Canal.

Note: WCS = water control structure

Construction (2028 to 2034)

Water Control Structures. Potential impacts for Alternative B from construction of WCS would be similar to Alternative A; however, total soil disturbance would increase. Approximately 23.9 acres of soil would be disturbed during construction for the WCS, due to the additional upgrades associated with Alternative B.

As with Alternative A, coverage under the NPDES stormwater permit for large construction activity is required for construction activities that disturb 5 acres or more of land. As such, a permit for large construction activity would be required for implementation of Alternative B. Similar to Alternative A, clearing, grading, and excavation would disturb site soils and near surface geology. However, potential impacts from erosion would be minimized through implementation of the site-specific SWPPP which would contain an erosion and sediment control plan for construction. The SWPPP would also contain a revegetation plan for areas disturbed by construction. Site topsoil would be stripped and conserved prior to grading activities, and reapplied post-construction to facilitate revegetation. Soils in areas used to stage equipment and materials have the potential to be compacted; such areas would be mechanically de-compacted prior to the revegetation phase of the project to facilitate regrowth. With implementation of the above measures, impacts to geology and soils during construction would be minimized, though such impacts would be greater than under the No Action Alternative.

Canals. Under Alternative B, the double culvert for the G-16 (Pompano) Canal would be constructed as under Alternative A. In addition, the existing topography along G-08 (Hillsboro) Canal, C-14 (Cypress Creek) Canal, and C-11 (South New River) Canal would be altered from excavation. Dredged material from dredging would be placed and compacted within the canal's ROW. Excavation would result in soil disturbance and elevation increase adjacent to the banks of the canal to accommodate dredged material. In general, the dredged material would be windrowed and contoured to form a berm adjacent to the top of the canal bank, effectively raising the elevation of the banks. Approximately 15.2 miles of canals would be dredged, with approximately 155 acres of canal ROW that could potentially be disturbed during dredging and dredged material management. As part of the SWPPP, erosion control and revegetation plans would be implemented during and post-construction. No adverse impacts to geology

and soils are expected from construction though such impacts would still be greater than under the No Action Alternative, where canal excavation would not occur.

Stormwater Storage Capacity Improvement. The Markham Park Stormwater Storage Capacity Improvement Project would construct features so that the Markham Park lake system can temporarily store stormwater from the G-15 (North New River) Canal during storm events, beyond the stormwater that its existing lake system is designed and permitted to store, to reduce peak stages in the G-15 (North New River) Canal. This project would include a new 100 cfs inflow pump station, two 84-inch diameter culverts to serve as overflow structures, a modified stormwater outfall control structure that includes an automated 2.5-foot-wide by 2.5-foot-tall gate that would close when the 100-cfs pump is operating, and two larger culverts upstream of the existing Markham Park stormwater outfall control structure. Approximately 1 acre of soil disturbance would occur during construction. Potential impacts from soil disturbance would be mitigated in similar fashion as the WCS construction. With the implementation of BMPs, impacts to geology and soils during construction of the Markham Park Stormwater Storage Capacity Improvement Project would be minimized, though such impacts would still be greater than under the No Action Alternative.

Operation, Maintenance, Repair, Replacement, and Rehabilitation

OMRR&R would occur from 2035 through 2085. Although erosion from stormwater runoff and wind action would occur occasionally during operation, it is anticipated to be minimal. Operations and maintenance activity is not expected to cause any additional impacts to geology and soils as compared to the No Action Alternative.

B.3.14.4 Alternative C

Alternative C represents the most complex scenario having the highest number of proposed measures. As shown in **Table B.3-50**, seven gated spillways would be demolished and replaced, and seven new pump stations would be constructed adjacent to the new gated spillways. In addition, the Markham Park and Hillsboro Watershed Stormwater Storage Capacity Improvement projects would be implemented. **Table B.3-50** also lists acreages for estimated soil disturbance during construction.

Table B.3-50. Potential Soil Disturbance for Improvements under Alternative C.

WCS	Construction Soil Disturbance (acres)	Alternative C General Description
G-56 Gated Spillway	4.2	Soil disturbance would likely increase compared to Alternative B. Demolition of existing gated spillway, new gated spillway and pump station would be located adjacent and downstream.
G-57 Gated Spillway	1.3	Soil disturbance would likely increase compared to Alternative B. Demolition of existing spillway, new gated spillway and new pump station would be located adjacent and upstream.
S-37B Gated Spillway	0	No proposed changes.
S-37A Gated Spillway	3.7	Soil disturbance would be similar to Alternative B. Demolition of existing spillway, and construction of new pump station and new gated spillway would be in same location as existing gated spillway. Spillway capacity would increase and pump station capacity would decrease; however, soil disturbance would be similar.

WCS	Construction Soil Disturbance (acres)	Alternative C General Description
S-36 Gated Spillway	1.9	Soil disturbance would be similar to Alternative B. Demolition of existing spillway, and construction of new pump station and new gated spillway would be in same location as existing gated spillway. Spillway and pump station capacity would increase; however, overall soil disturbance would be similar.
S-33 Gated Spillway	3.0	Soil disturbance would be similar to Alternative B. Demolition of existing spillway, and construction of new gated spillway would be located adjacent and upstream, bank improvements on south side. Pump station capacity would increase.
G-54 Gated Spillway	2.6	Soil disturbance would increase compared to Alternative B. Demolition of existing gated spillway, and construction of new gated spillway and new pump station would be located adjacent and upstream.
S-13 Pump Station and Gated Spillway	4.8	Soil disturbance would be similar to Alternative B. Demolition of existing gated spillway and pump station, and construction of new gated spillway and new pump station would be located adjacent and upstream. Pump station capacity increases.
Total	21.5	Temporary soil disturbance for WCS construction.
Canals		
G-16 (Pompano) Canal	1.0	Construct two, 10-ft-diameter culverts parallel to existing 10-ft-diameter culvert located upstream of G-57 Gated Spillway. Existing 10-ft-diameter culvert to remain.
Canals G-08 (Hillsboro) Canal, C-11 (South New River) Canal, C-12 (Plantation) Canal, C-13 (Middle River) Canal, C-14 (Cypress Creek) Canal, G-15 (North New River) Canal	240	Enlarge cross-sectional flow area of these canals via dredging within canal segments to improve water conveyance.
Stormwater Storage Capacity Improvement		
Markham Park	1.0	Construct facilities so that the Markham Park lake system can temporarily store stormwater from the G-15 (North New River) Canal during storm events, beyond the stormwater that its existing lake system is designed and permitted to store, to reduce peak flood stages in the G-15 (North New River) Canal.
Hillsboro Watershed	706	Convert existing property within Hillsboro Watershed into an aboveground stormwater storage area.

Note: WCS = water control structure

Construction (2028 to 2034)

Water Control Structures. Potential impacts for Alternative C would be similar to Alternative B and greater than the No Action Alternative. Approximately 21.5 acres of soil would be disturbed during construction for this alternative due to the additional upgrades associated with Alternative C.

Coverage under the NPDES stormwater construction general generic permit for large construction activity is required for construction activities that disturb 5 acres or greater of land. As such, a permit for large construction activity would be required for implementation of Alternative C. Similar to Alternatives

A and B, clearing, grading, and excavation would disturb site soils and near surface geology. However, potential impacts from erosion would be minimized through implementation of the site-specific SWPPP which would contain an erosion and sediment control plan for construction, and post-construction revegetation plan. Site topsoil would be stripped and conserved prior to grading activities, and re-applied post-construction to facilitate revegetation. Soils in areas used to stage equipment and materials have the potential to be compacted; such areas would be mechanically de-compacted prior to the revegetation phase of the project to facilitate re-growth. With implementation of the above measures, impacts to geology and soils during construction would be minimized but would remain greater than the No Action Alternative.

Canals. Under Alternative C, the double culvert for the G-16 (Pompano) Canal would be constructed, as proposed under Alternatives A and B. Under Alternative C, the existing topography along G-08 (Hillsboro) Canal, C-14 (Cypress Creek) Canal, C-13 (Middle River) Canal, C-12 (Plantation) Canal, G-15 (North New River) Canal, and C-11 (South New River) Canal would be altered from excavation. Similar to Alternative B, dredging would result in soil disturbance and elevation increase adjacent to the banks of the canal to accommodate dredged material. In general, the dredged material would be windrowed and contoured to form a berm adjacent to the top of the canal bank, effectively raising the elevation of the banks. A total of approximately 29 miles of canals would be dredged, resulting in approximately 240 acres of canal ROW that could be disturbed during dredging and dredged material management. As part of the SWPPP, erosion control and revegetation plans would be implemented during and post-construction. No adverse impacts to geology and soils are expected from construction.

Stormwater Storage Capacity Improvement. Under Alternative C, the Markham Park Stormwater Storage Capacity Improvement project would be constructed, as described under Alternative B. In addition, Alternative C includes the Hillsboro Watershed Stormwater Storage Capacity Improvement Project, which would convert existing property within Hillsboro Watershed into an aboveground stormwater storage area. This project would convert an existing agricultural property, Hendrix Farms, into an approximately 706-acre aboveground stormwater storage area.

The construction footprint for the stormwater storage area and associated control features would disturb the majority of the parcel. It is expected that a large portion of the parcel would be graded to create a basin-like structure to store excess stormwater. Topography would change during construction of perimeter berms. The terrain in the area is level; however, erosion control measures would be required in areas of active construction. Soil erosion would be minimized through implementation of the SWPPP. Within Hendrix Farm, the soil types are Boca fine sand and Hallandale fine sand, neither of which is classified as prime farmland. However, Hendrix Farm is one of the few remaining non-developed parcels in Broward County used for agricultural purposes. Once converted to stormwater storage, the parcel would no longer be suitable for agricultural use, as the soil structure would be altered during construction as compared to the No Action Alternative.

Operation, Maintenance, Repair, Replacement, and Rehabilitation

Although erosion from stormwater runoff and wind action would occur occasionally during OMRR&R, it is anticipated to be minimal. OMRR&R activity is not expected to cause any additional impacts to geology and soils as compared to the No Action Alternative. OMRR&R of the Hillsboro Watershed Stormwater Storage Capacity Improvement Project would result in the alteration of soil composition and

loss of arable soils, as the area would be filled with canal water before, during, and after major storm events.

B.3.14.5 Alternative RO

Alternative RO represents a hybrid of Alternatives A, B, and C. As shown in **Table B.3-51**, all eight existing gated spillways would be demolished and replaced, and five new pump stations would be constructed adjacent to the new gated spillways. Alternative RO is similar to Alternative B, but adds a pump station at G-54 Gated Spillway and one extra spillway gate each at S-37A Gated Spillway, S-36 Gated Spillway, and S-13 Pump Station and Gated Spillway, and as described under Alternative B, three canals would be dredged to increase flow capacity. Note, the Markham Park and Hillsboro Watershed Stormwater Storage Capacity Improvement projects, as described in Alternatives B and C, would not be implemented.

Table B.3-51. Potential Soil Disturbance for Improvements under Alternative RO.

WCS	Construction Soil Disturbance (acres)	Alternative RO General Description
G-56 Gated Spillway	3.7	Demolition of existing gated spillway; new gated spillway would be located adjacent and downstream.
G-57 Gated Spillway	0.8	Demolition of existing gated spillway; new gated spillway would be located adjacent and upstream.
S-37B Gated Spillway	4.0	Demolition of existing gated spillway; new gated spillway would be located adjacent and upstream.
S-37A Gated Spillway	3.7	Demolition of existing gated spillway; new pump station and new gated spillway would be in same location as existing gated spillway.
S-36 Gated Spillway	1.9	Demolition of existing gated spillway; new pump station and new gated spillway would be in same location as existing gated spillway.
S-33 Gated Spillway	3.0	Similar to Alternative A, demolition of existing gated spillway; new gated spillway and pump station would be located adjacent and upstream, bank improvements on south side.
G-54 Gated Spillway	2.6	Demolition of existing gated spillway; new gated spillway and new pump station would be located adjacent and upstream.
S-13 Pump Station and Gated Spillway	4.8	Demolition of existing gated spillway and pump station; new gated spillway and new pump station would be located adjacent and upstream.
Total	24.5	Temporary soil disturbance for WCS construction.
Canals		
G-16 (Pompano) Canal	1.0	Construct two, 10-ft-diameter culverts parallel to existing 10-ft-diameter culvert located upstream of G-57 Gated Spillway. Existing 10-ft-diameter culvert to remain.
G-08 (Hillsboro) Canal, C-14 (Cypress Creek) Canal, C-11 (South New River) Canal	43	Enlarge cross-sectional flow area of these canals via dredging within canal segments to improve water conveyance.

Construction (2028 to 2034)

Water Control Structures. Potential impacts for Alternative RO would be similar to Alternatives B and C and greater than the No Action Alternative. Approximately 24.5 acres of soil would be disturbed during construction for the WCS.

As with Alternatives A through C, coverage under the NPDES stormwater construction general generic permit for large construction activity is required for construction activities that disturb 5 acres or more of land. As such, a permit for large construction activity would be required for implementation of Alternative RO. Similar to Alternatives A through C, clearing, grading, and excavation would disturb site soils and near-surface geology. However, potential impacts from erosion would be minimized through implementation of the site-specific SWPPP, which would contain an erosion and sediment control plan for construction. The SWPPP would also contain a revegetation plan for areas disturbed by construction. Site topsoil would be stripped and conserved prior to grading activities, and reapplied post-construction to facilitate revegetation. Soils in areas used to stage equipment and materials have the potential to be compacted; such areas would be mechanically de-compacted prior to the revegetation phase of the project to facilitate regrowth. With implementation of the above measures, impacts to geology and soils during construction would be minimized though would still remain greater than if construction did not occur under the No Action Alternative.

Canals. Under Alternative RO, the double culvert for the G-16 (Pompano) Canal would be constructed as described under Alternative A. In addition, the existing topography along G-08 (Hillsboro) Canal, C-14 (Cypress Creek) Canal, and C-11 (South New River) Canal would be altered from dredging, as described under Alternative B. No adverse impacts to geology and soils are expected from construction.

Operation, Maintenance, Repair, Replacement, and Rehabilitation

OMRR&R would occur from 2035 through 2085. Although erosion from stormwater runoff and wind action would occur occasionally during operation, it is anticipated to be minimal. Operations and maintenance activity is not expected to cause any additional impacts to geology and soils as compared to the No Action Alternative.

B.3.15 Hazardous, Toxic, and Radioactive Waste

An analysis of the potential impacts to HTRW from the No Action Alternative and implementation of the action alternatives is provided below. Per USACE Engineering Regulation 1165-2-132, *Hazardous, Toxic and Radioactive Waste (HTRW) Guidance for Civil Works Projects*, the non-federal sponsor will be responsible for remediation prior to construction or at any time in any locations where HTRW is found to be above acceptable SQAG TEC/SQAG PEC levels.

B.3.15.1 Future Without Project Conditions (No Action Alternative)

Under the No Action Alternative, there would be no sediment removal from canals and waterways nor any disturbance to existing upland soils near the WCS within the Study Area. In the short term, there would be no need for additional testing or cautionary measures due to hazardous constituents in the sediment and soil, such as Arsenic and Chromium. Long term consequences include the continued

accumulation of hazardous constituents in the sediment and soil resulting in higher costs for maintenance in the future and the continued leaching of some constituents into surface water.

B.3.15.2 Alternative A

The specific structural measures proposed for each watershed basin under Alternative A and their effects on HTRW are analyzed below. All structural measures regardless of location would be implemented with appropriate sediment and erosion control plans, spill control plans, and BMPs specific to handling potentially contaminated materials to achieve a net zero effect. All soils to be removed from the sites would undergo additional analyses before removal.

Suggested BMPs which could be employed to minimize release of heavy metals and other contaminants to downstream waters include, but are not limited to turbidity curtains, silt fence, absorbent socks specific for heavy metals and toxics, and waterway dam and diversion methods.

Hillsboro Canal Basin

Arsenic and Chromium are present in the soil samples at the G-56 Gated Spillway. Arsenic was found in the soil above the RDE SCTL of 2.1 mg/kg at 2.4 mg/kg. Chromium was found in the soil above the Solid Waste Leachability Criteria of 4.2 mg/kg at 4.5 to 4.8 mg/kg. Activities planned under Alternative A would have short-term effects on HTRW from surface disturbances but no long-term effects on the current conditions of the site. Appropriate BMPs would be implemented to minimize soil erosion during activity. Compared to the No Action Alternative, Alternative A presents a greater effect.

Pompano Canal Basin

Chromium is present in sediment and soil at the G-57 Gated Spillway. The level was found above surface water leachability criteria of 4.2 mg/kg at 6.8 mg/kg for sediment and 6 mg/kg for soil but well below Residential Direct Exposure RDE SCTL of 210 mg/kg. The installation of new culverts would disturb sediments in the canal, which would have a short-term negative impact to HTRW due to disturbance of sediment and soils that are known to contain levels of Chromium below the Industrial Direct Exposure Soil Cleanup Target Level (SCTL). There are no anticipated long-term effects on HTRW. Appropriate BMPs would be implemented to minimize soil erosion during activity. Compared to the No Action Alternative, Alternative A presents greater short-term effects due to the disturbance of sediments and soils in construction activities. Long-term effects would be less than what is anticipated for the No Action Alternative as accumulation would be reduced through remediation efforts in construction.

C-14 West Basin

At the S-37B Gated Spillway, Barium was present in sediment samples, exceeding the TEC SQAG for Barium of 20 mg/kg at 21 mg/kg. Chromium was present in both sediment and soil samples, exceeding the surface water leachability criteria of 4.2 mg/kg with a range of 4.6 to 5.4 mg/kg, but not above SCTL. Under Alternative A, there are no structural improvements proposed at this WCS so there would be no short-term effects to HTRW. There are likely to be negative long-term effects due to continued accumulation of deposited constituents. Compared to the No Action Alternative, Alternative A presents similar short-term and long-term effects as there is no planned construction at the WCS.

C-14 East Basin

Several hazardous constituents were found in sediments and soil along the C-14 (Cypress Creek) Canal and S-37A Gated Spillway. Chromium in sediment was above surface water leachability criteria of 4.2 mg/kg at 4.6 mg/kg. Selenium in sediment was above surface water leachability criteria of 0.5 mg/kg at 1.3 mg/kg. Arsenic was also found in sediment samples above the SQAG TEC of 9.8 mg/kg and the RDE SCTL of 2.1 mg/g at 10 mg/kg. Additionally, a pesticide, 4,4-DDE was found in sediment above the SQAG TEC of 3.2 micrograms/kg at 4.49 micrograms/kg. Soil sampling results indicated the presence of Chromium below the SCTL but above surface water leachability criteria of 4.2 mg/kg with a range of 4.3 to 8.9 mg/kg. Silver in the soil was found below SCTL but above the surface water leachability criteria of 0.01 mg/kg at 0.088 mg/kg. Structural measures planned under Alternative A would have short-term negative effects on HTRW due to the disturbance of sediment and soil and the risk involved in either reutilizing materials on-site or disposal off-site. Additional testing of sediment would be required for off-site disposal. There are no anticipated long-term effects on HTRW. Compared to the No Action Alternative, Alternative A presents greater short-term effects due to the disturbance of sediments and soils in construction activities. Long-term effects would be less than what is anticipated for the No Action Alternative as accumulation would be reduced through remediation efforts in construction.

C-13 West Basin

Arsenic and Chromium were found in sediment and soil along the C-13 (Middle River) Canal and S-36 Gated Spillway. In both samples, Chromium was above the surface water leachability criteria of 4.2 mg/kg at range of 4.7 to 6.2 mg/kg in sediment and 4.6 to 5.4 mg/kg in soil, but below all SCTL. The Arsenic indicated in the sediment was above the RDE SCTL of 2.1 mg/kg at 3.8 mg/kg. Structural measures planned under Alternative A would have short-term negative effects on HTRW due to the disturbance of sediment and soil at the current WCS. There are no anticipated long-term effects on HTRW. Compared to the No Action Alternative, Alternative A presents greater short-term effects due to the disturbance of sediments and soils in construction activities. Long-term effects would be less than what is anticipated for the No Action Alternative as accumulation would be reduced through remediation efforts in construction.

C-12 West Basin

The C-12 West Basin contains the S-33 Gated Spillway and the C-12 (Plantation) Canal, where Arsenic and Chromium were found in sediment and soil samples. Sediment samples indicated Arsenic above RDE SCTL of 2.1 mg/kg at 2.3 mg/kg, but below SQAG. Chromium was indicated above surface water leachability criteria of 4.2 mg/kg at 6.5 mg/kg for sediment and 6.5 to 8.5 mg/kg for soil, but below SCTL. Silver was found in the soil above surface water leachability criteria of 0.01 mg/kg at 0.51 mg/kg, but below SCTL of 410 mg/kg. Structural measures proposed under Alternative A would have short-term negative effects on HTRW by disturbing the sediment and soils of the site, potentially releasing hazardous constituents to surface water or exposing them to workers. There are no anticipated long-term effects on HTRW. Compared to the No Action Alternative, Alternative A presents greater short-term effects due to the disturbance of sediments and soils in construction activities. Long-term effects would be less than what is anticipated for the No Action Alternative as accumulation would be reduced through remediation efforts in construction.

North New River Canal West Basin

At the G-54 Gated Spillway, Chromium was found in both sediment and soil samples above surface water leachability criteria of 4.2 mg/kg at 5.8 mg/kg for sediment and 4.7 to 5.1 mg/kg for soil, but below SCTL of 210 mg/kg. Selenium was indicated in soil samples above surface water leachability criteria of 0.5 mg/kg at 0.77 mg/kg. Arsenic was found in the soil above the RDE SCTL of 2.1 mg/kg at 2.3 mg/kg.

The hardening and resiliency improvement proposed under Alternative A would have short-term effects on HTRW due to surface soil disturbance but no long-term effects. Appropriate BMPs would be implemented to minimize soil erosion during activity. Compared to the No Action Alternative, Alternative A presents greater short-term effects due to the disturbance of sediments and soils in construction activities. Long-term consequences would be less than what is anticipated for the No Action Alternative as accumulation would be reduced through remediation efforts in construction.

C-11 West Basin

No sediment or soil testing was conducted at the S-13AW Gated Culvert. Under Alternative A, there are no structural improvements proposed at this WCS so there would be no short-term effects to HTRW. There are likely to be negative long-term effects due to continued accumulation of deposited constituents. Compared to the No Action Alternative, Alternative A presents similar short-term and long-term effects as there is no planned construction at the WCS.

C-11 East Basin

The S-13 Pump Station and Gated Spillway is located in the C-11 East Basin, on the C-11 (South New River) Canal, where Arsenic and Chromium were found in sediment and soil samples. In sediment, Arsenic was analyzed at 11 mg/kg, above the TEC SQAG of 9.8 mg/kg and RDE SCTL of 2.1 mg/kg. In soil, the Arsenic was analyzed 2.4 mg/kg, above RDE SCTL of 2.1 mg/kg. Chromium was also present in the soil results above the surface water leachability criteria of 4.2 mg/kg at 6.3 to 7.4 mg/kg, but below SCTL.

Under Alternative A, there would be negative short-term effects to HTRW due to disturbance of sediments and soil from construction activities. There are no anticipated long-term effects on HTRW. Compared to the No Action Alternative, Alternative A presents greater short-term effects due to the disturbance of sediments and soils in construction activities. Long-term consequences would be less than what is anticipated for the No Action Alternative as accumulation would be reduced through remediation efforts in construction.

B.3.15.3 *Alternative B*

The effects of Alternative B on HTRW are explained below. Since soil and sediment disturbance is the primary activity expected to impact HTRW, many of the improvements proposed in Alternative B are likely to have similar effects as those outlined in Alternative A. All structural measures regardless of location would be implemented with appropriate sediment and erosion control plans, spill control plans, and BMPs specific to handling potentially contaminated materials to achieve a net zero effect.

Suggested BMPs which could be employed to minimize release of heavy metals and other contaminants to downstream waters include, but are not limited to turbidity curtains, silt fence, absorbent socks specific for heavy metals and toxics, and waterway dam and diversion methods.

The effects to HTRW in Alternative B are the same as under Alternative A in the Hillsboro Canal Basin, Pompano Canal Basin, C-14 East Basin, C-13 West Basin, C-12 West Basin, and C-11 East Basin. Alternative B presents greater short-term effects due to the disturbance of sediments and soils in construction activities. Long-term consequences would be less than what is anticipated for the No Action Alternative as accumulation would be reduced through remediation efforts in construction.

In the C-14 West Basin and C-11 West Basin, additional WCS and canal conveyance improvements may reduce erosion and deposition from local runoff, but any such effects would be negligible. Compared to the No Action Alternative and Alternative A, Alternative B presents greater short-term effects due to the disturbance of sediments and soils in construction activities. Long-term consequences would be less than what is anticipated for the No Action Alternative and Alternative A as accumulation would be reduced through remediation efforts in construction.

In the North New River Canal West Basin, additional enhancements to WCS and canal conveyance improvements versus what is proposed in Alternative A may reduce erosion and deposition from local runoff, but any such effects would be negligible. Compared to the No Action Alternative and Alternative A, Alternative B presents greater short-term effects due to the disturbance of sediments and soils across a greater footprint to include storage features. Long-term consequences would be less than what is anticipated for the No Action Alternative as accumulation would be reduced through remediation efforts in construction.

B.3.15.4 Alternative C

The effects of Alternative C on HTRW are explained below. Since soil and sediment disturbance is the primary activity expected to impact HTRW, many of the improvements proposed in Alternative C are likely to have similar effects as those outlined in either Alternatives A or B. As with the other alternatives, all structural measures regardless of location would be implemented with appropriate sediment and erosion control plans, spill control plans, and BMPs specific to handling potentially contaminated materials to achieve a net zero effect.

Suggested BMPs which could be employed to minimize release of heavy metals and other contaminants to downstream waters include, but are not limited to turbidity curtains, silt fence, absorbent socks specific for heavy metals and toxics, and waterway dam and diversion methods.

The effects to HTRW in Alternative C are the same as under Alternatives A and the No Action Alternative in the C-14 West Basin. Under Alternative C, there are no structural improvements proposed at this WCS so there would be no short-term effects to HTRW. Compared to the No Action Alternative and Alternative A, Alternative C presents similar short-term and long-term effects as there is no planned construction at the WCS. Long-term effects of Alternative C would be greater than what is anticipated for Alternative B.

The effects to HTRW in Alternative C are the same as Alternative A in the NNRW Basin. Alternative C presents greater short-term effects due than to the disturbance of sediments and soils in construction

activities than the No Action Alternative but less than what is anticipated for Alternative B. Long-term consequences would be less than what is anticipated for the No Action Alternative as accumulation would be reduced through remediation efforts in construction and comparable to what is anticipated for Alternatives A and B.

The effects to HTRW in Alternative C are the same as under Alternatives A and B in the Pompano Basin, C-14 East Basin, C-13 West Basin, C-12 Basin, and C-11 Basin. Alternative C presents greater short-term effects than the No Action Alternative due to the disturbance of sediments and soils in construction activities. Long-term effects would be less than what is anticipated for the No Action Alternative as accumulation would be reduced through remediation efforts in construction.

Under Alternative C, the Hillsboro Watershed Stormwater Storage Improvement Project would be constructed within the Hillsboro Basin in a 706-acre agricultural parcel. Phase I and II ESA were not conducted for this site but if this alternative is selected, such surveys would take place prior to construction and applicable measures would be implemented to reduce effects from HTRW. Alternative C presents a greater effect in comparison to the No Action Alternative, Alternative A, and Alternative B. Activities planned under Alternative C would have short-term effects on HTRW from surface disturbances but no long-term effects on the current conditions of the site.

B.3.15.5 Alternative RO

Effects to HTRW from Alternative RO within the Hillsboro and Pompano Basins are comparable to those described for Alternative B. Compared to the No Action Alternative, Alternative RO presents greater short-term effects due to the disturbance of sediments and soils in construction activities. Long-term consequences for Alternative RO would be less than what is anticipated for the No Action Alternative and Alternative A as accumulation would be reduced through remediation efforts in construction. In Pompano, the installation of new culverts would disturb sediments in the canal, resulting in short-term negative impacts to HTRW due to disturbance of sediment and soils containing chromium at levels below the Industrial Direct Exposure Soil Cleanup Target Level (SCTL). No long-term effects on HTRW are anticipated. All structural measures, regardless of location, would be implemented with appropriate sediment and erosion control plans, spill control plans, and BMPs specific to handling potentially contaminated materials, aiming to achieve a net zero effect.

In C-14 West Basin, effects to HTRW are comparable to the No Action Alternative and Alternative A. There are no structural improvements proposed at this WCS so there would be no short-term effects to HTRW. There are likely to be negative long-term effects due to continued accumulation of deposited constituents. Compared to the No Action Alternative and Alternative A, Alternative RO presents similar short-term and long-term effects as there is no planned construction at the WCS.

Effects to HTRW from Alternative RO within C-14 East Basin are consistent with those described for Alternative A. The planned gated structure for Alternative RO has been modified to a smaller footprint than that selected for Alternative A. Structural measures would result in short-term negative effects on HTRW due to disturbance of sediment and soil and the associated risks of either on-site reuse or off-site disposal. Additional testing would be required for off-site disposal. No long-term effects on HTRW are anticipated.

Effects to HTRW from Alternative RO within C-13 West Basin are comparable to those disclosed for Alternative B. The planned gated structure for Alternative RO has been reduced in footprint relative to Alternative B. Structural measures would cause short-term negative effects on HTRW due to disturbance of sediment and soil at the current WCS. No long-term effects on HTRW are anticipated.

Effects to HTRW from Alternative RO within C-13 West Basin, C-12 West Basin, and C-11 West Basin reflect those described for Alternative B, which are consistent with Alternative A. In C-13 West Basin, planned structural measures would cause short-term negative effects on HTRW due to disturbance of sediment and soil at the current WCS. In C-12 West Basin, structural measures would result in short-term negative effects on HTRW by disturbing sediment and soils, potentially releasing hazardous constituents to surface water or exposing workers. No long-term effects on HTRW are anticipated. In C-11 West Basin, long-term consequences would be less than what is anticipated for the No Action Alternative as accumulation would be reduced through remediation efforts in construction. No other long-term effects on HTRW from these actions are anticipated.

Effects to HTRW from Alternative RO within North New River Canal West Basin are consistent with those described for Alternative C. Additional WCS and canal conveyance improvements may reduce erosion and deposition from local runoff; however, any such effects would be negligible.

B.3.16 Land Use and Real Estate

An analysis of the potential impacts to land use and real estate from the No Action Alternative and implementation of the action alternatives is provided below.

B.3.16.1 Future Without Project Conditions (No Action Alternative)

Under the No Action Alternative, no construction or operational activities associated with the proposed action alternatives would occur. As a result, there would be no short-term impacts to land use or real estate related to temporary or permanent land acquisitions, construction staging, or site access. Existing land use patterns and zoning designations would remain unchanged in the near term, and there would be no disruption to ongoing development or land management activities.

Over the long term, however, aging WCS would continue to operate without modernization, reinforcement, or replacement, likely resulting in reduced effectiveness in managing water volumes during more intense and frequent weather events. As flood risks increase, surrounding areas may experience more frequent and severe flooding. This could result in infrastructure damage, including the degradation of roads, utilities, and buildings, particularly in low-lying and coastal zones—raising infrastructure repair and maintenance costs. Some areas may become less viable for development, prompting shifts in land use patterns, including reduced density, abandonment of vulnerable parcels, or conversion to open space or stormwater retention areas. In response, local governments may adopt more stringent building codes, revise zoning regulations to encourage flood-resilient development, and expand conservation or managed retreat zones.

H&H modeling was used to predict the number of acres that would experience an increase in inundation peak depths across the various alternatives, including FWOP conditions (No Action Alternative). **Table B.3-52** presents predicted terrestrial habitat inundation in the upstream watershed basins in the FWOP condition for two modeling scenarios. **Appendix A** provides full model results.

Table B.3-52. Predicted Terrestrial Habitat Inundation in Upstream Watershed Basins in the Future Without Project (No Action Alternative) Condition.

Alternative	Worst Case Scenario (acres)	Intermediate Scenario (acres)
FWOP	24,615	12,641

Notes: FWOP = Future Without Project. Inundation assumes peak depths exceed 1 foot.

To further examine the effects of potential flooding on land use and real estate, an analysis was conducted to determine the impact of flooding on residents and the costs they would incur to temporarily relocate while the flooding recedes and their homes are restored to habitable condition. “Temporary displacement days” were estimated for households located in upstream watershed basins affected by various rainfall and coastal return flood events that cause inundation above the first floor elevation. The displacement days were calculated based on flood depths derived from the Hazus Flood Technical Manual, which provides maximum restoration durations corresponding to flood depths ranging from -4 to +4 feet relative to the first floor elevation. The number of temporary displacement days for the FWOP condition under three scenarios are included in **Table B.3-53**. The full analysis is found in **Appendix D, Benefits Analyses**.

Table B.3-53. Temporary Displacement Days in the Future Without Project (No Action) Alternative under Three Modeled Scenarios.

	2 Year Surge, 25 Year Rainfall Event (0.033)		2 Year Surge, 100 Year Rainfall Event (0.009)		100 Year Surge, 100 Year Rainfall Event (0.002)	
	Intermediate SLR	High SLR	Intermediate SLR	High SLR	Intermediate SLR	High SLR
Future Without Project	30,414	42,330	24,378	33,190	6,655	12,173

B.3.16.2 Alternatives A, B, C, and RO Land Uses

The analysis of impacts to land use from Alternatives A, B, C, and RO considered seven distinct categories of activities based on the improvements proposed within each watershed basin: (1) general construction; (2) WCS retrofitting; (3) WCS new installation; (4) canal excavation; (5) bank reinforcement; (6) culvert construction; and (7) nature-based measures. **Table B.3-54** summarizes which categories of improvements and associated land use impacts would occur in each watershed basin. A qualitative assessment of the potential land use impacts associated with these seven categories is also provided.

Table B.3-54. Land Use Impacts Summary

Watershed Basin (WCS)	Alternative A	Alternatives B and RO ^{a/}	Alternative C
Hillsboro Canal Basin (G-56 Gated Spillway)	- general construction - WCS retrofitting - bank reinforcement	- general construction - WCS new installation - canal excavation	- general construction - WCS new installation - canal excavation - nature-based measures
Pompano Canal Basin (G-57 Gated Spillway)	- general construction - WCS retrofitting - bank reinforcement	- general construction - WCS new installation	- general construction - WCS new installation

Watershed Basin (WCS)	Alternative A	Alternatives B and RO ^{a/}	Alternative C
Pompano Canal (Culvert)	- general construction - culvert construction	- general construction - culvert construction	- general construction - culvert construction
C-14 West Basin (S-37B Gated Spillway)	none	- general construction - WCS new installation - canal excavation	- general construction - canal excavation
C-14 East Basin (S-37A Gated Spillway)	- general construction - WCS new installation	- general construction - WCS new installation	- general construction - WCS new installation - canal excavation
C-13 West Basin (S-36 Gated Spillway)	- general construction. - WCS new installation	- general construction - WCS new installation - bank reinforcement	- general construction - WCS new installation - bank reinforcement - canal excavation
C-12 West Basin (S-33 Gated Spillway)	- general construction - WCS new installation - culvert construction	- general construction - WCS new installation - culvert construction	- general construction - WCS new installation - canal excavation - culvert construction
North New River Canal West Basin (G-54 Gated Spillway)	- general construction - WCS retrofitting - bank reinforcement	- general construction - WCS new installation - culvert construction - nature-based measures	- general construction - WCS new installation - canal excavation - culvert construction - nature-based measures
C-11 West Basin (S-13AW Gated Culvert)	none	- general construction - canal excavation	- general construction - canal excavation
C-11 East Basin (S-13 Pump Station and Gated Spillway)	- general construction - WCS new installation - culvert construction	- general construction - WCS new installation - canal excavation	- general construction - WCS new installation - canal excavation

a/ Alternatives B and RO include similar structural measures so are combined for the purposes of this general description.

Note: WCS = water control structure

B.3.16.3 Land Use Impact Analysis

The following short- and long-term impacts to existing land uses are anticipated from the construction activities proposed under Alternatives A, B, C, and RO as compared to the No Action Alternative:

1. **General Construction.** Implementation of the proposed alternatives would result in both short-term (temporary) and long-term (permanent) impacts to land use within the immediate footprint of infrastructure such as canals and WCS. Construction and dredging activities would disturb previously stabilized or undeveloped areas, representing a material increase in activity intensity relative to existing baseline conditions. These activities would generate temporary land use disruptions, including increased noise, dust, and access limitations. Long-term impacts may include the conversion of land from passive or natural use to operational or maintenance-related purposes. All such disturbances are expected to be minor and confined to within the SFWMD ROW or to parcels proposed for real estate acquisition.
2. **WCS Retrofitting.** Retrofitting existing WCS facilities, such as raising structures or installing new pump stations, would result in short-term, localized land use impacts. These would primarily stem from the need for temporary easements to accommodate access, staging, and equipment/material laydown areas. As the footprint of these retrofitting activities is generally confined to existing infrastructure locations, the anticipated land use impacts are anticipated to be minor and reversible upon completion of construction.

3. **WCS New Installation.** The installation of new WCS facilities would result in land use impacts of a similar nature to those described under WCS retrofitting, but of greater spatial and temporal extent. The transition of land to structural or operational use could result in a permanent change to the land use classification, particularly if previously undeveloped lands are converted to utility or flood control infrastructure.
4. **Bank Reinforcing.** Bank reinforcement activities, such as riprap placement or retaining wall installation, would be implemented within existing canal corridors and are considered structural improvements to previously engineered features. While such measures may slightly alter the physical characteristics of the banks (e.g., change in height, slope, or material from vegetated berms to riprap), they are not anticipated to substantially modify the functional land use character of the existing canal system. Therefore, both short- and long-term impacts to land use are expected to be minor.
5. **Canal Excavation.** Canal excavation activities, including deepening or widening of existing canals, would generate short-term land use impacts related to construction equipment access, laydown areas, and material handling. Deepening would remain within the existing canal path and result in negligible long-term land use impacts. In contrast, widening would require a permanent increase in the physical canal footprint. These long-term impacts would be site-specific and their magnitude would depend on final design specifications.
6. **Culvert Construction.** Construction of new culverts would result in short-term, construction-phase land use impacts, primarily due to access constraints and temporary disturbance of surface land uses. Post-construction, affected areas would typically be restored to pre-disturbance conditions, and no long-term changes in land use are anticipated.
7. **Nature-based Measures.** Nature-based components include improvements to the Markham Park lake network to enhance temporary stormwater retention capacity (Alternatives B and C) and the conversion of an existing agricultural parcel in the Hillsboro Watershed Basin to a managed aboveground stormwater storage facility through the construction of a perimeter levee and seepage canal (Alternative C). The Markham Park improvements would occur within existing public lands and are not expected to substantially alter land use types. However, the agricultural land conversion of Hendrix Farms would constitute a permanent change in land use designation, from agricultural to stormwater management, and would represent a long-term shift in land use function and management.

Under all alternatives, land use impacts would be generally minor and localized, with overall beneficial long-term outcomes relative to the FWOP condition. Construction-related activities such as canal excavation, WCS retrofitting and installation, bank reinforcement, and culvert construction would generate short-term, temporary disruptions limited primarily to existing ROWs or parcels acquired for project implementation as compared to the No Action Alternative. Impacts would increase slightly from Alternative A to Alternative C as the number of structural features that are proposed for construction increases. Alternative RO represents a blended alternative incorporating elements of Alternatives A, B, and C. Permanent land use changes would occur where new infrastructure is installed or where agricultural land (e.g., Hendrix Farms) is converted to managed stormwater storage, representing a shift from agricultural to flood management use. Nature-based features, including enhancements to the

Markham Park lake network, would occur within existing public lands and maintain consistency with current land uses.

H&H modeling results for predicted terrestrial habitat inundation in upstream watershed basins in two modeling scenarios for the action alternatives are presented in **Table B.3-55**. “Inundation” is defined as peak depths exceeding 1 foot at terrestrial land cover types (using FLCCS Class Codes) during the worst case or intermediate modeling scenarios. **Appendix A** provides full model results.

The resulting reduction in inundation under Alternative A as compared to the FWOP condition is 2,313 acres under the worst-case scenario. Alternatives B and C have a reduction in inundation of 2,800 acres and 2,925 acres, respectively, as compared to the FWOP condition under the worst case scenario. Alternative RO results in a reduction of inundation of 2,265 acres as compared to the FWOP in the worst-case modeling scenario, also representing an improvement over FWOP.

Table B.3-55. Predicted Terrestrial Habitat Inundation in Upstream Watershed Basins across Alternatives A, B, C, and RO.

Alternative	Worst Case Scenario (acres)	Intermediate Scenario (acres)
Alternative A	22,302	12,096
Alternative B	21,815	11,998
Alternative C	21,690	12,493
Alternative RO	22,350	12,059

Note: Inundation assumes peak depths exceed 1 foot.

Alternatives A, B, C, and RO improve temporary displacement days as compared to FWOP with Alternative C providing the greatest reduction in temporary displacement days. The number of temporary displacement days for Alternatives A, B, C, and RO under three scenarios are included in **Table B.3-56**. The full analysis is found in **Appendix D**.

Table B.3-56. Temporary Displacement Days under Alternatives A, B, C, and RO under Three Modeled Scenarios.

	2 Year Surge, 25 Year Rainfall Event (0.033)		2 Year Surge, 100 Year Rainfall Event (0.009)		100 Year Surge, 100 Year Rainfall Event (0.002)	
	Intermediate SLR	High SLR	Intermediate SLR	High SLR	Intermediate SLR	High SLR
Alternative A	26,456	31,007	21,328	25,835	5,802	8,989
Alternative B	26,083	29,422	20,967	24,322	5,473	8,317
Alternative C	25,761	28,332	20,282	23,249	5,308	7,843
Alternative RO	26,500	30,566	21,197	25,520	5,882	9,498

Note: SLR = sea level rise

B.3.16.4 Alternatives A, B, C, and RO Real Estate Impacts

Real estate impacts differ from land use impacts in that they involve the potential for both short- and long-term acquisition of property rights. Under the alternatives, three types of real estate actions are proposed: (1) Temporary Easement, (2) Perpetual Easement, and (3) Fee Estate Acquisition. These acquisition types are defined below.

Definitions of Acquisition Types

Temporary Easement. Temporary Work Area Easement (Standard Estate No. 15). A temporary and assignable easement and ROW in, on, over, and across the described land for a specified period, used for construction, staging, or related activities necessary to complete the project. This estate permits the placement of equipment, materials, and temporary facilities, and authorizes all actions incidental to the performance of the work. Upon expiration or completion, the temporary rights terminate, and the premises are restored to the agreed condition.

Perpetual Easement. Flood Protection and Maintenance Easement (Standard Estate No. 8 or 9). A perpetual and assignable easement and ROW in, on, over, and across the land for the construction, operation, maintenance, repair, and replacement of flood-risk-management and drainage features. The easement includes the continuing right of ingress and egress for authorized personnel and equipment and to remove or control vegetation, obstructions, or improvements that may interfere with project purposes. Landowners retain the right to use the property in any manner that does not interfere with or abridge the easement holder's rights. The appropriate estate, Channel Improvement Easement (No. 8) or Flood Protection Levee Easement (No. 9), is determined by the nature of the feature and required maintenance access.

Fee Estate Acquisition (Standard Estate No. 1). A complete and permanent acquisition of real property in fee simple, subject only to existing public-utility or transportation easements. This estate transfers all rights, title, and interest to the acquiring entity and is used where full ownership is required to construct, operate, and maintain permanent project facilities such as pump stations, gated spillways, or control structures.

Table B.3-57 summarizes real estate impacts by watershed basin for Alternatives A through C. A qualitative analysis of the potential real estate impacts associated with these alternatives is provided after the table. Alternatives A through C would each result in real estate impacts greater than under the No Action Alternative.

Table B.3-57. Real Estate Impacts Summary, Alternatives A, B, and C.

Watershed Basin	Water Control Structure or Feature	Alternative A	Alternative B	Alternative C
		Type (Temporary Easement (TE), Perpetual Easement (PE), Fee Estate Acquisition (FEA)) - Public/Private size in square feet Owner		
Hillsboro Canal Basin	G-56 Gated Spillway	none	TE - Public 3,923 sf City of Deerfield Beach	TE - Public 3,923 sf City of Deerfield Beach
	Stormwater storage	none	none	FEA - Private 31,405,889 sf Hendrix Farm
Pompano Canal Basin	G-57 Gated Spillway (WCS improvements)	none	PE - Public 1,684 sf City of Pompano Beach	FEA - Public 12,661 sf City of Pompano Beach
			TE - Public 2,670 sf City of Pompano Beach	PE - Public 1,357 sf City of Pompano Beach
	G-57 Gated Spillway (culvert construction)	PE - Public 67,469 sf City of Pompano Beach	FEA - n/a 513 sf Unknown Owner	FEA - n/a 513 sf Unknown Owner
		PE - Private 9,871 sf Florida East Coast Railway	PE - Public 67,469 sf City of Pompano Beach	PE - Public 67,469 sf City of Pompano Beach
		PE - n/a 12,514 sf Unknown Owner	PE - Private 9,871 sf Florida East Coast Railway	PE - Private 9,871 sf Florida East Coast Railway
		TE - Public 6,668 sf City of Pompano Beach	PE - n/a 12,002 sf Unknown Owner	PE - n/a 12,002 sf Unknown Owner
		TE - Private 2,558 sf Florida East Coast Railway	TE - Public 6,668 sf City of Pompano Beach	TE - Public 6,668 sf City of Pompano Beach
		TE - n/a 2,786 sf Unknown Owner	TE - Private 2,558 sf Florida East Coast Railway	TE - Private 2,558 sf Florida East Coast Railway
			TE - n/a 2,786 sf Unknown Owner	TE - n/a 2,786 sf Unknown Owner
C-14 West Basin	S-37B Gated Spillway	none	none	none
C-14 East Basin	S-37A Gated Spillway	FEA- Private 12,315 sf Pine Crest School	FEA- Private 4,751 sf Pine Crest School	FEA - Private 12,315 sf Pine Crest School
		TE - Private 14,767 sf KD Realty Holdings of Pompano	TE - Private 14,767 sf KD Realty Holdings of Pompano	TE - Private 14,767 sf KD Realty Holdings of Pompano
C-13 West Basin	S-36 Gated Spillway	TE - Public 9,734 sf City of Oakland Park	FEA- Private 1,364 sf Cyprus Lakes Owner, LLC	FEA - Private 1,364 sf Cyprus Lakes Owner, LLC
			FEA - Public 15,030 sf City of Oakland Park	FEA - Public 15,030 sf City of Oakland Park
			TE - Public 13,226 sf City of Oakland Park	TE - Public 13,226 sf City of Oakland Park

Watershed Basin	Water Control Structure or Feature	Alternative A	Alternative B	Alternative C
		Type (Temporary Easement (TE), Perpetual Easement (PE), Fee Estate Acquisition (FEA)) - Public/Private size in square feet Owner		
C-12 West Basin	S-33 Gated Spillway	none	none	none
North New River Canal West Basin	G-54 Gated Spillway	none	none	none
	Stormwater storage	none	FEA - Public 182,952 sf Broward County	FEA - Public 182,952 sf Broward County
C-11 West Basin	S-13AW Gated Culvert	none	none	none
C-11 East Basin	S-13 Pump Station and Gated Spillway	FEA - Private 425 sf Swaying Palms, LLC	FEA - Private 425 sf Swaying Palms, LLC	FEA - Private 425 sf Swaying Palms, LLC

Table B.3-58 summarizes real estate impacts for Alternative RO by watershed basin. A qualitative analysis of the potential real estate impacts associated with Alternative RO is provided after the table.

Table B.3-58. Real Estate Impacts of Alternative RO.

Watershed Basin	Water Control Structure	Proposed Fee Estate Acquisitions (area ^{a/})	Proposed Perpetual Easements (area)	Proposed Temporary Work Area Easements	
				Area	Max. Duration (years)
Hillsboro Canal Basin	G-56 Gated Spillway	-	5,262	14,400	3
Pompano Canal Basin	G-57 Gated Spillway	898	2,693	2,018	3
Pompano Canal Basin	G-16 (Pompano) Canal Culvert	-	113,655	-	-
C-14 West Basin	S-37B Gated Spillway	-	-	5,577	3
C-14 East Basin	S-37A Gated Spillway	32,975	-	22,715	6
C-13 West Basin	S-36 Gated Spillway	30,361	-	12,975	5
C-12 West Basin	S-33 Gated Spillway	7,361	2,119	20,413	5
North New River Canal Basin	G-54 Gated Spillway	-	-	-	-
C-11 West Basin	S-13AW Gated Culvert	-	-	-	-
C-11 East Basin	S-13 Pump Station and Gated Spillway	2,056	-	19,791	7
Totals		73,651	123,729	97,889	-

a/ Area is provided in square feet

B.3.16.5 Real Estate Impacts Supporting Analysis

The following real estate impacts are anticipated from the construction activities proposed under Alternatives A, B, and C. Note that where no real estate acquisition is required, potential impacts to proximate property owners and land users would be consistent with those described in **Section B.3.16.2** for land use impacts.

Additionally, under all alternatives, adjacent and nearby properties in proximity to existing or proposed WCS that include encroachments into public ROWs—such as docks, mooring facilities, or vessels—may be adversely affected. These encroachments may lose functional access or be subject to removal or restriction, depending on the final design and operational requirements of the SFWMD. Such outcomes may result in the loss of use or value of these non-permitted or non-conforming structures.

Under all alternatives, real estate impacts would be greater than under the No Action Alternative. Real estate impacts would be the least under Alternative A and would be the greatest under Alternative RO. Impacts to real estate under Alternatives B and C involve limited property acquisitions and easements to support construction and long-term operations. No residential properties would be acquired or displaced under any alternative. Real estate costs would be associated with securing access and work areas, and contingencies would be included to address potential design refinements and legal uncertainties.

Hillsboro Canal Basin

No real estate acquisition is proposed under Alternative A. Under Alternatives B and C, a 3,923-square-foot Temporary Easement would be required from the City of Deerfield Beach. Under Alternative RO to support the replacement of the G-56 Gated Spillway, a 5,262 square-foot Perpetual Easement would be required from public lands owned by the City of Deerfield Beach, and a 14,400 square-foot Temporary Work Area Easement would be required from DCGC Properties, LLC, for a duration of 3 years.

Alternative C includes the acquisition and conversion of approximately 721 acres of currently active agricultural operations known as Hendrix Farms. The property is bisected by the Broward-Palm Beach County boundary, which runs parallel to West Hillsboro Road. The farm represents the largest remaining contiguous tract of undeveloped agricultural land in Broward County.

Under Alternative C only, Hendrix Farms would result in a change in land use designation from agricultural to stormwater management and ecological restoration. Specifically, the site would be developed into a nature-based stormwater retention area, including the construction of a perimeter levee and associated seepage canal. This infrastructure would establish an aboveground water storage area, with a maximum water elevation of up to 4 feet above the average grade. Supporting infrastructure (e.g., access roads, control structures, monitoring equipment) would also be developed as part of this conversion.

Given sustained residential and commercial development pressures in southeastern Florida, Hendrix Farms represents one of the last remaining large agricultural landholdings in the coastal region. As noted in **Section B.1.16**, the majority of similar agricultural activities are now situated in more inland regions of the state. Accordingly, implementation of Alternative C would constitute a permanent conversion of agricultural land to water management use. Land use impacts within Broward and Palm Beach counties would include the reduction of active agricultural acreage and a shift in land use compatibility and zoning classifications to reflect public infrastructure.

Pompano Canal Basin

No real estate acquisition is proposed under Alternative A. Alternative B would require the acquisition of a Perpetual Easement encompassing approximately 1,684 square feet and a Temporary Work Area Easement of approximately 2,670 square feet. Both easements would be obtained from a public property owner—the City of Pompano Beach—and would affect portions of Bill Keith Park. No transfer of land ownership would occur.

Under Alternative C, a smaller (1,357 square feet) Perpetual Easement would be required; however, this alternative would necessitate a Fee Estate Acquisition of approximately 12,661 square feet. The Fee Estate Acquisition would result in a reduction in the size and recreational utility of Bill Keith Park and would also impact a portion of SE 3rd Avenue. These impacts may alter existing public access and park functionality on a permanent basis.

Under Alternative RO to support replacement of the G-57 Gated Spillway, an 898-square-foot Fee Estate Acquisition would be required from a private owner; two separate 1,661-square-foot and 1,032-square-foot Perpetual Easements would be required from the City of Pompano Beach; and a 2,018-square-foot

Temporary Work Area Easement would be required from the City of Pompano Beach for a duration of 3 years.

In addition, under all alternatives real estate acquisition that includes both temporary and permanent interests would be required for culvert construction upstream of the G-57 Gated Spillway. The total area of required acquisitions is approximately 113,655 square feet, and is geographically limited to properties located south of the G-16 (Pompano) Canal. The majority of these acquisitions would consist of Perpetual Easements obtained from public landowners. Construction-related impacts on land use would result from both the physical footprint of the project and temporary disturbances associated with construction activities.

C-14 West Basin

No real estate acquisition is proposed under Alternatives A through C for C-14 West Basin. Under Alternative RO to support the replacement of the S-37B Gated Spillway, a 5,577 square-foot Temporary Work Area Easement would be required from the City of Pompano Beach for a duration of 3 years.

C-14 East Basin

All alternatives would necessitate the acquisition of real estate interests, including both Temporary Work Area Easements and Fee Estate Acquisitions. Alternatives A through C would require a 14,767-square-foot Temporary Work Area Easement from a private property owner, KD Realty Holdings of Pompano. In addition, Alternatives A through C would require a Fee Estate Acquisition from another private property owner, the Pine Crest School, with the affected area ranging from 4,751 square feet under Alternative B to 12,315 square feet under Alternatives A and C. The Fee Estate Acquisition area encompasses a portion of the school's recreational field, which may result in a reduction of the field's size and functionality or require reorientation of the field.

Under Alternative RO to support construction of a new pump station and gated spillway, a 14,386-square-foot Fee Estate Acquisition and a separate 5,057 square-foot Fee Estate Acquisition would be required from Pine Crest School, along with a 5,047 square-foot Fee Estate Acquisition from the City of Fort Lauderdale and an 8,485-square-foot Fee Estate Acquisition from KD Realty Holdings of Pompano. Two Temporary Work Area Easements would also be required, including a 762-square-foot Easement from A1A Mini-Storage for a duration of 1 year and a 21,953-square-foot Easement from KD Realty Holdings of Pompano for a duration of 6 years. Work would include the reconfiguration and relocation of the softball field and associated structures at the school, as well as reconstruction of the softball field's outfield wall.

C-13 West Basin

Under Alternative A, a Temporary Easement of 9,734 square feet would be required from the City of Oakland Park, a public property owner. Alternatives B and C would require both temporary and permanent real estate acquisitions, including a Fee Estate Acquisition of 1,364 square feet from a private property owner, Cyprus Lakes Owner, LLC; and a Fee Estate Acquisition of 15,030 square feet and a Temporary Easement of 13,226 square feet, both from the City of Oakland Park. The majority of the required acquisitions under these alternatives would affect publicly-owned land.

Under Alternative RO to support construction of a new pump station and gated spillway, a 7,532-square-foot Fee Estate Acquisition would be required from Cyprus Lakes Owner, LLC, along with a 22,829-square-foot Fee Estate Acquisition from the City of Oakland Park. In addition, a 12,975-square-foot Temporary Work Area Easement would be required from the City of Oakland Park for a duration of 5 years.

C-12 West Basin

No real estate acquisition is proposed under Alternatives A through C for C-12 West Basin.

Under Alternative RO to support construction of a new pump station and gated spillway, a 2,119-square-foot Fee Estate Acquisition would be required from the City of Lauderhill, along with both 4,420-square-foot and 822-square-foot Fee Estate Acquisitions from private owners. In addition, a 2,119-square-foot Perpetual Easement would be required from the City of Lauderhill, along with a 6,006-square-foot Temporary Work Area Easement from the City of Lauderhill, a 2,232-square-foot Temporary Work Area Easement from a private owner, and a 12,175-square-foot Temporary Work Area Easement from FDOT, each for a duration of 5 years.

North New River Canal West Basin

No real estate acquisition is proposed under any of the alternatives for the G-54 Gated Spillway. Under Alternatives B and C, a 182,952-square-foot Fee Estate Acquisition would be required from Broward County at Markham Park. This 4.2-acre area represents less than 1 percent of the 669-acre park.

C-11 West Basin

No real estate acquisition is proposed under any of the alternatives for C-11 West Basin.

C-11 East Basin

Alternatives A through C would require the acquisition of real estate interests in the form of a 425-square-foot Fee Estate Acquisition from a private property owner, Swaying Palms, LLC.

Under Alternative RO to support construction of a new pump station and gated spillway, a 1,759-square-foot and a 297-square-foot Fee Estate Acquisition would be required from Swaying Palms, LLC, and Southern Mobile Home Park, LLC, respectively. In addition, an 895-square-foot Temporary Work Area Easement from Swaying Palms, LLC and an 18,896-square-foot Temporary Work Area Easement from the Town of Davie would be required, each for a duration of 7 years.

B.3.17 Visual Resources

An analysis of the potential impacts to visual resources from the No Action Alternative and implementation of the action alternatives is presented below.

B.3.17.1 Future Without Project Conditions (No Action Alternative)

Under the No Action Alternative, the existing WCS would remain unchanged and no construction or modifications would occur. In the short term, this would benefit visual resources by avoiding temporary disruptions such as those from construction equipment, cleared vegetation, staging areas, and increased

visibility of larger and more prominent WCS. The current visual character of the landscape would remain intact, particularly in areas where WCS are screened or minimally visible.

However, over the long term, the lack of improvements could lead to visual degradation due to increased flooding, erosion, standing water, and damage to surrounding infrastructure and vegetation. As aging WCS lose functionality, more frequent flood events could alter the visual landscape, resulting in debris accumulation, deteriorated infrastructure, and unmanaged areas. These cumulative effects could reduce the aesthetic quality and scenic value of the area over time.

B.3.17.2 Alternatives A, B, and C Visual Resources Impacts

This section evaluates the potential impacts on visual resources associated with Alternatives A through C, including those arising from construction and OMRR&R activities. The area surrounding the canals and WCS is characterized as fully developed and has been assigned the highest Visual Resource Management classification, Class IV. As these areas are already assigned the highest Visual Resource Management classification, indicating the lowest level of visual sensitivity, additional development cannot result in a higher (i.e., more permissive) rating.

Given this context, the primary metric for assessing visual impacts is visual compatibility, which includes consideration of whether proposed actions would be consistent with the existing built environment, obstruct or alter established viewsheds, increase the visibility or prominence of built structures, introduce visual clutter, or generate glare or other forms of visual disturbance that may detract from the character of adjacent existing or planned residential developments. To the extent practicable, both short-term (construction-phase) and long-term (post-construction/operational) visual effects are addressed.

Visual impacts generally correlate with the level of activity proposed at each watershed basin. Watershed basins identified as having low or no activity are expected to experience minimal visual impacts, while those associated with more intensive construction or OMRR&R activities are anticipated to have correspondingly greater visual effects. **Table B.3-54** summarizes which categories of improvements would occur in each watershed basin. The visual impacts resulting from each category of improvement are summarized below.

General Construction

General construction activities would result in short-term visual impacts as compared to the No Action Alternative due to the presence of heavy construction equipment, active demolition and construction zones, exposed structural elements in various stages of completion, and possible dust generation. The use of tall construction equipment, such as cranes, and the establishment of temporary laydown and staging areas would further contribute to visual disruption. Although these activities may be observable by nearby property owners, recreational users, and site visitors, they are expected to be largely consistent with prior construction activities in the area and would not be visually prominent from long distances due to surrounding development and topographic screening.

Following the completion of construction and decontamination, decommissioning, and demolition activities, long-term visual impacts are anticipated to be minimal as compared to the No Action Alternative. The resulting built environment would be functionally driven and similar in scale, form, and

visual character to existing infrastructure in the area. While the intensity of development may increase incrementally, it would generally remain compatible with the visual setting and not result in adverse aesthetic effects.

WCS Retrofitting

Short-term visual impacts associated with WCS retrofitting would be similar in nature and duration to those described under general construction, including the presence of machinery, temporary work areas, and intermittent dust or debris. These impacts would be temporary and localized to the immediate area of activity, though they would be greater than under the No Action Alternative (since construction would not occur).

In the long term, visual impacts would be negligible as compared to the No Action Alternative, as retrofitting typically involves internal system upgrades or minor external modifications that do not materially alter the visual profile of the facility or introduce new visual elements. The retrofitted WCS would generally retain the same appearance as existing infrastructure, resulting in limited to no change in the surrounding viewshed.

WCS New Installations

The installation of new WCS facilities would result in short-term visual impacts during construction as compared to the No Action Alternative due to the presence of heavy equipment, cranes, cleared vegetation, staging areas, and other large-scale ground-disturbing activities. These temporary effects would be most noticeable from adjacent roadways, nearby residences, and other accessible public viewpoints, but would diminish upon completion of construction.

In the long term, the new pump stations proposed under Alternative RO would represent a more visually prominent change to the existing landscape compared to current conditions. The existing WCSs are predominately low-profile installations, whereas the new pump stations would be substantially larger, with building footprints ranging from approximately 5,000 to 12,000 square feet and heights of about 47 feet above grade. Of the existing WCSs, only the S-13 Pump Station and Gated Spillway currently contains an existing pump station. The remaining WCS locations lack pump infrastructure, and installation of new facilities at these sites would introduce distinctly new vertical and massing elements into the viewshed. These new pump stations would therefore appear more visually prominent within the surrounding landscape and could alter the perceived scale and form of the built environment, particularly in areas with nearby residential or recreational uses.

Despite their increased prominence, the new pump stations would be situated within an already highly modified flood-control landscape characterized by levees, canals, and existing utility infrastructure. Visual impacts from new pump stations would be greater than under the No Action Alternative. However, long-term visual impacts are expected to be minor and would not substantially degrade overall visual quality or the regional landscape character.

Canal Excavation

Canal excavation and dredging activities would result in short-term visual impacts, particularly during initial phases of earthmoving and sediment removal, as compared to the No Action Alternative. The

construction of cofferdams, temporary access roads, utilities, and material staging areas would introduce visible and temporary visual disturbances due to the presence of equipment, stockpiles, and dust emissions.

In the long term, visual impacts are expected to be minimal to negligible as compared to the No Action Alternative, as the bulk of the disturbance would occur below the waterline and would not substantially alter the visible landscape. The canal's surface-level appearance would remain largely unchanged, and any permanent support infrastructure that is constructed is anticipated to be modest in scale and integrated into the existing setting.

Bank Reinforcement

Bank reinforcement activities, such as riprap placement and retaining wall installation, would occur entirely within existing ROWs. Short-term impacts would mirror those of general construction, involving temporary disruption from construction equipment, material storage, and work crews along the canal edges. While such impacts would be minimal, they would be greater than under the No Action Alternative.

Long-term visual impacts could occur if the reinforcement substantially increases bank height, potentially altering sightlines from adjacent properties and public viewpoints as compared to the No Action Alternative. Depending on design and material selection, the new banks may introduce a more engineered or utilitarian appearance to the canal corridor, although such changes would likely remain visually compatible with other nearby flood control infrastructure.

Culvert Construction

Culvert construction would generate short-term visual impacts during the excavation, installation, and backfilling phases, including temporary disruptions from equipment and staging areas as compared to the No Action Alternative. As with other subsurface infrastructure projects, these activities would be temporary and contained within the construction footprint.

Long-term visual impacts would be negligible as compared to the No Action Alternative, as culverts are underground structures and not typically visible following project completion. Surface restoration efforts, such as pavement replacement or landscaping, would return the visual condition to a pre-construction or similar state.

Nature-based Measures

Nature-based components of Alternatives B and C include improvements to the Markham Park lake network to enhance temporary stormwater retention capacity, as well as the conversion of an existing agricultural parcel, Hendrix Farms, into a managed, aboveground stormwater storage facility through the construction of a perimeter levee and seepage canal.

Short-term visual impacts would result from construction-related activities, including site clearing, grading, levee and canal excavation, and the establishment of associated support infrastructure (e.g., control structures, access roads, and monitoring equipment). These impacts would include the temporary presence of construction equipment, material staging, and disruption of the existing visual landscape as compared to the No Action Alternative. In the case of the Markham Park lake

improvements, visual disturbances would be minor and largely screened from public view due to their location within existing public lands and surrounding vegetation. At the Hendrix Farms site, which is more open and visible from surrounding roadways and nearby properties, short-term construction activities would be more perceptible but would remain temporary in nature.

Long-term visual impacts would vary by location. At Markham Park, post-construction visual conditions would remain largely consistent with current land uses and landscape character, as improvements would be integrated into an already-developed and recreationally designated public space. As such, long-term visual impacts at this location are expected to be negligible to minor as compared to the No Action Alternative.

In contrast, the conversion of Hendrix Farms to an aboveground stormwater storage area would represent a permanent alteration of landscape character as compared to the No Action Alternative, with a transition from actively cultivated agricultural land to a publicly managed, nature-based water storage facility. The new levee system and associated infrastructure would introduce new vertical and engineered features into an otherwise flat and open landscape, resulting in a noticeable and lasting change to the site's visual profile. However, because the proposed facility would incorporate vegetated embankments, managed water levels, and green infrastructure techniques, the long-term visual character may remain generally compatible with adjacent open spaces and contribute to a more naturalized aesthetic over time. The overall visual effect would be one of functional transformation rather than intensive development, reducing industrial or urbanized visual intrusion.

B.3.17.3 Alternative RO

Under Alternative RO, visual impacts would remain minor overall as compared to the No Action Alternative and would be consistent with the developed character of the Study Area. Alternative RO proposes construction of five new pump stations at existing WCS locations. Four of these locations do not currently contain pump stations, and the new facilities would therefore introduce more visually prominent features on the landscape. The new pump stations would range from approximately 5,000 to 12,000 square feet in size, with a projected height of about 47 feet above grade (**Table B.3-59**). Temporary visual effects from construction activities—such as equipment operation, vegetation clearing, and material staging—would be localized and short-term. In the long term, the pump stations and other related infrastructure would be visually compatible with existing flood control and utility features, resulting in minimal change to the overall landscape character. Because Alternative RO does not include nature-based measures, no substantial alterations to open space or recreational visual settings would occur. While the overall visual impacts from Alternative RO would be greater than under the No Action Alternative, Alternative RO would not adversely affect regional visual quality.

Table B.3-59. Pump Stations Proposed Under the Action Alternatives.

Watershed Basin (WCS)	Existing Conditions		Proposed New Pump Station		
	Existing Pump Station	Existing WCS Height (feet)a/	Pump Station Proposed?	Size (square feet)	Height (feet)
Hillsboro Canal Basin (G-56 Gated Spillway)	no	31	Alt A: no Alt B: no Alt C: yes Alt RO: no	n/a	n/a
Pompano Canal Basin (G-57 Gated Spillway)	no	23	Alt A: no Alt B: no	n/a	n/a

Watershed Basin (WCS)	Existing Conditions		Proposed New Pump Station		
	Existing Pump Station	Existing WCS Height (feet)a/	Pump Station Proposed?	Size (square feet)	Height (feet)
			Alt C: yes Alt RO: no		
C-14 West Basin (S-37B Gated Spillway)	no	25	Alt A: no Alt B: no Alt C: no Alt RO: no	n/a	n/a
C-14 East Basin (S-37A Gated Spillway)	no	29	Alt A: yes Alt B: yes Alt C: yes Alt RO: yes	10,000	47
C-13 West Basin (S-36 Gated Spillway)	no	28	Alt A: no Alt B: yes Alt C: yes Alt RO: yes	9,100	47
C-12 West Basin (S-33 Gated Spillway)	no	22	Alt A: yes Alt B: yes Alt C: yes Alt RO: yes	9,900	47
North New River Canal West Basin (G-54 Gated Spillway)	no	25	Alt A: no Alt B: no Alt C: yes Alt RO: yes	5,900	47
C-11 East Basin (S-13 Pump Station and Gated Spillway)	yes	25	Alt A: yes Alt B: yes Alt C: yes Alt RO: yes	11,400	47

Note: Alt = Alternative

a/ Height to top of operating platform (feet)

B.3.18 Transportation and Traffic

An analysis of the potential impacts to transportation and traffic from the No Action Alternative, and implementation of the action alternatives is provided below. A full transportation model analysis that examines both impacts and potential benefits from the C&SF Section 203 Study alternatives and Alternative RO was completed and is provided in **Appendix D**.

B.3.18.1 Future Without Project Conditions (No Action Alternative)

Under the No Action Alternative, no construction or upgrades to WCS would occur, avoiding short-term disruptions to transportation routes. There would be no construction-related traffic, detours, or temporary road closures, and no resulting in short-term effects to local traffic flow and commuter travel. Existing roads and transit routes would continue to operate without interference from project activities.

Over the long term, however, the transportation network in the Study Area may experience increasing strain. Without improvements to WCS, roads and key transportation corridors could become more prone to disruption from rising water levels and flood events, reducing vehicle access and increasing travel times. In addition, critical infrastructure—such as bridges, drainage systems, and transportation assets tied to airports and port facilities—may be vulnerable to damage or failure, further compromising

the reliability and efficiency of the region's transportation network. These impacts could result in reductions in traffic flow, accessibility, and emergency vehicle response capabilities.

The transportation benefit model quantified the impacts of roadway flooding on travel performance and associated road-user costs. Impacts were measured as changes in Vehicle-Hours Traveled (VHT; representing additional delay), and Vehicle-Miles Traveled (VMT; representing additional travel distance) due to flood-related roadway closures. Results for the FWOP condition for a 25-year storm under intermediate sea level rise projections in 2085 are provided in **Table B.3-60**.

Table B.3-60. Vehicle-Miles Traveled and Vehicle-Hours Traveled due to Flood-related Closures in FWOP in an Intermediate Flooding Scenario in 2085.

Alternative	VMT	VHT
FWOP	54,661,000	30,941,000

Notes: FWOP = Future Without Project; VMT = Vehicle-Miles Traveled; VHT = Vehicle-Hours Traveled

B.3.18.2 Transportation and Traffic Impacts (Alternatives A, B, and C)

As described in **Section B.1.18**, existing traffic and transportation conditions within the region of influence were evaluated based on the following modal components: (1) roadway network, (2) mass transit infrastructure and service, (3) freight and passenger rail lines, (4) air travel facilities, and (5) navigable waterways. The baseline analysis also included Annual Average Daily Traffic data for three representative roadway segments located in proximity to each WCS.

Alternatives A, B, and C each include infrastructure measures intended to harden and expand the capacity of existing WCS facilities. While the scope and scale of improvements vary among the alternatives—with Alternative A representing the least intensive level of modification and Alternative C representing the most extensive—the variation in project magnitude is not sufficient to result in materially different impacts on the broader transportation system. Accordingly, traffic and transportation impacts are analyzed collectively for all three alternatives. For the purposes of presenting a conservative, bounding case of potential impacts, Alternative C, the most construction-intensive scenario, was selected as the basis for detailed analysis.

The Study Area encompasses portions of Broward and Palm Beach counties, two of the most densely populated counties in Florida and the nation.⁹ Because of this existing density and high baseline traffic volumes, the addition of construction-related traffic associated with the proposed improvements is not expected to meaningfully affect regional traffic patterns or transportation system performance. Even under Alternative C, the most construction-intensive scenario, construction activities would be of a limited enough scope, duration, and geographic extent to avoid system-wide transportation disruption. Alternative C does not introduce new public roadways, alter traffic signalization or intersection configurations, or change regional freight or transit patterns.

⁹ Based on U.S. Census Bureau data (2020), both Broward and Palm Beach counties rank within the top 10 percent of all U.S. counties in terms of population density, with Broward County falling within approximately the top 3 percent nationally.

Short-Term Construction Impacts

Localized, temporary traffic impacts are anticipated during the construction phase of the project as compared to the No Action Alternative. These include increased construction-related vehicle traffic (e.g., haul trucks, delivery vehicles, and equipment transport) near individual WCS sites, as well as potential lane closures or detours on adjacent roadways. Temporary Easements, Perpetual Easements, and Fee Estate Acquisitions would be required to accommodate staging areas, laydown yards, equipment access routes, and material storage. These real estate actions are described in detail in **Section B.3.16**.

Construction-related traffic impacts are expected to be localized to the vicinity of each WCS and temporary in nature. They may result in intermittent delays for nearby residents, businesses, or service providers but are not anticipated to significantly degrade overall traffic flow or level of service on collector or arterial roadways.

Long-Term Operational Impacts

Following completion of construction, no long-term adverse impacts to traffic or transportation networks are anticipated from OMRR&R as compared to the No Action Alternative. Once facilities transition to steady-state operations, construction-related activities and their associated traffic effects would cease entirely. Activities under Alternative C would not alter roadway geometry, introduce new traffic-generating land uses, or necessitate additional maintenance-related vehicle trips at a scale that would impact network performance.

In contrast, long-term beneficial effects to regional and local transportation systems are anticipated as compared to the No Action Alternative as an indirect effect of enhanced flood protection and stormwater management. By reducing the frequency, duration, and severity of roadway flooding during extreme precipitation events, the project is expected to improve roadway accessibility, reduce emergency vehicle response delays, and mitigate travel-time variability.

The transportation benefit model results for Alternatives A through C for a 25-year storm under intermediate sea level rise projections in 2085 are provided in **Table B.3-61**. In all alternatives, VHT and VMT are reduced as compared to the FWOP (No Action Alternative) condition. Full results are discussed in **Appendix D**.

Table B.3-61. Vehicle-Miles Traveled and Vehicle-Hours Traveled Due to Flood-related Closures Across Alternatives A through C in an Intermediate Flooding Scenario in 2085.

Alternative	VMT	VHT
Alternative A	53,454,000	22,599,000
Alternative B	54,012,000	25,098,000
Alternative C	53,455,000	25,798,000

Notes: VMT = Vehicle-Miles Traveled; VHT = Vehicle-Hours Traveled

B.3.18.3 Alternative RO

Under Alternative RO, traffic and transportation impacts would be minor and temporary as compared to the No Action Alternative. During construction, localized increases in vehicle traffic, including haul trucks and equipment transport, may cause intermittent delays near project sites, but these effects would be short-term and limited in extent. No long-term adverse impacts to the regional transportation network

are anticipated, as Alternative RO would not alter roadway configurations, introduce new traffic-generating uses, or affect regional freight or transit operations. In the long term, Alternative RO is expected to provide beneficial effects by reducing roadway flooding, improving accessibility, and decreasing travel delays during storm events as compared to the No Action Alternative. The transportation benefit model results for Alternative RO for a 25-year storm under intermediate sea level rise projections in 2085 are provided in **Table B.3-62**. The VHT and VMT are reduced as compared to the FWOP (No Action Alternative) condition. Full results are discussed in **Appendix D**.

Table B.3-62. Truck and Automobile Vehicle-Miles Traveled and Vehicle-Hours Traveled Due to Flood-related Closures for Alternative RO in an Intermediate Flooding Scenario in 2085.

Alternative	VMT	VHT
Alternative RO	16,021,000	7,440,000

Notes: VMT = Vehicle-Miles Traveled; VHT = Vehicle-Hours Traveled

B.3.19 Infrastructure and Utilities

This section discusses the potential impacts on infrastructure and utilities from the No Action Alternative and implementation of the action alternatives. This analysis evaluates utilities that would be required for the alternatives during construction and operation, including domestic water, sanitary sewer, electricity, communications, and petroleum fuel, and the ability of the current infrastructure to meet any potential increases in utility demands. In addition, this section discusses the improvements to the flood control infrastructure under the alternatives, and how these improvements would benefit flood control infrastructure.

B.3.19.1 Future Without Project Conditions (No Action Alternative)

Under the No Action Alternative, no improvements to the existing WCS would be performed. OMRR&R of the existing WCS would continue, and utilities usage would generally remain the same. Without improvements to the WCS, water levels would likely exceed WCS design capacity. Sea level rise, saltwater intrusion, extreme rainfall, and drought will intensify and place increasing stress on the Study Area's WCS. These structures currently manage flooding, block saltwater from moving upstream, conserve freshwater, and regulate water levels both upstream and downstream. As sea levels and rainfall volumes rise, water levels in primary canals would exceed the WCS design capacity. When that occurs, the structures would no longer control flows effectively, and flood events would become more frequent and severe. The system's reduced performance would compromise water management across the region. Flooding events would further affect the potable water, wastewater, and stormwater utilities managed by Broward County. There is an expectation of increased infiltration and inflow events, which would disrupt treatment and distribution processes. Wellfields are likely to become more vulnerable to saltwater intrusion, potentially necessitating their relocation or abandonment in favor of new water supply sources. Critical infrastructure, including essential facilities, within the FWOP scenario in several rainfall and coastal return flood events, is expected to experience structural damage above first-floor elevations during several rainfall and coastal return flood events in the upstream watershed basins. The anticipated impacted critical infrastructure with flood depths exceeding first-floor elevation is summarized in **Table B.3-63**. Sanitary sewer overflows release raw sewage containing pathogens, nutrients, organic matter, and potentially toxic substances into the urban environment. These overflows

degrade water quality in surrounding water bodies and are anticipated to increase in frequency in the FWOP scenario. Additionally, underground septic tanks and onsite sewage treatment and disposal systems may become more frequently inundated, increasing the risk of failures and environmental impacts. The impacts associated with septic tanks are summarized in **Table B.3-64**.

Table B.3-63. Critical Infrastructure Impacts in FWOP.

Watershed Basin	Critical Infrastructure (Number of Flooded Structures, Intermediate/High SLR)					
	2 year Surge, 25 year Rainfall		2 year Surge, 100 year Rainfall		100 year Surge, 100 year Rainfall	
	Int SLR	High SLR	Int SLR	High SLR	Int SLR	High SLR
C-11 East	2	2	2	3	2	5
C-11 West	0	0	0	0	0	0
C-12 West	1	1	1	1	1	1
C-13 West	0	0	0	0	0	0
C-14 East	0	1	5	8	6	15
C-14 West	0	0	0	0	0	0
Hillsboro Canal	1	1	1	1	1	1
North New River Canal West	0	0	0	0	0	0
Pompano Canal	0	0	1	2	2	4
Total	4	5	10	15	12	26

Notes: Int. = intermediate; SLR = sea level rise

Table B.3-64. Septic Tanks with Flood Values in FWOP.

Watershed Basin	Septic Tanks (Number of Flooded Structures, Intermediate/High SLR)								
	2 year Surge, 25 year Rainfall			2 year Surge, 100 year Rainfall			100 year Surge, 100 year Rainfall		
	2035 Int. SLR	2085 Int. SLR	2085 High SLR	2035 Int. SLR	2085 Int. SLR	2085 High SLR	2035 Int. SLR	2085 Int. SLR	2085 High SLR
C-11 East	4,477	4,499	4,669	5,261	5,332	5,497	5,307	5,374	5,637
C-11 West	1,564	1,570	1,592	1,846	1,841	1,890	1,847	1,853	1,882
C-12 West	197	198	198	215	215	215	215	215	215
C-13 West	11	11	12	13	13	14	13	13	14
C-14 East	13	13	15	18	18	18	18	18	18
C-14 West	36	36	36	44	44	44	44	44	44
Hillsboro Canal	1,269	1,269	1,270	1,483	1,483	1,487	1,484	1,485	1,489
North New River Canal West	240	251	269	326	335	362	331	345	389
Pompano Canal	6	7	10	21	21	23	21	21	25
Total	7,813	7,854	8,071	9,227	9,312	9,550	9,280	9,368	9,713

Notes: Int. = intermediate; SLR = sea level rise

B.3.19.2 Alternative A

Alternative A represents the least complex alternative in that the smallest number of measures are proposed. As shown in **Table B.3-65**, three existing WCS would be raised to prevent backflow, existing gated spillways would be demolished and replaced in four WCS, and three new pump stations would be constructed adjacent to the new gated spillways.

Table B.3-65. Alternative A Proposed Improvements.

WCS	General Description	Design Pumping Capacity (cfs)	Number of Spillway Gates	Pump Station
G-56 Gated Spillway	Raise structure components to prevent backflow.	Same as No Action (none)	Same as No Action (3)	No
G-57 Gated Spillway	Raise structure components to prevent backflow. Additional culvert to be installed.	Same as No Action (none)	Same as No Action (2)	No
S-37B Gated Spillway	Same as No Action, no proposed changes.	Same as No Action (none)	Same as No Action (2)	No
S-37A Gated Spillway	Existing gated spillway would be demolished, and new pump station and new spillway would be constructed in the same location.	1,200	4	Yes
S-36 Gated Spillway	Existing gated spillway would be demolished, and new spillway would be constructed in the same location.	Same as No Action (none)	2	No
S-33 Gated Spillway	Existing gated spillway would be demolished, and new pump station and new spillway would be constructed in adjacent, upstream location.	510	1	Yes
G-54 Gated Spillway	Raise structure components to prevent backflow.	Same as No Action (none)	Same as No Action (3)	No
S-13 Pump Station and Gated Spillway	Existing gated spillway would be demolished, and new pump station and new spillway would be constructed in adjacent, upstream location.	700	1	Yes
Canals	General Description			
G-16 (Pompano) Canal	Construct two 10-ft-diameter culverts parallel to existing 10-ft-diameter culvert located upstream of G-57 Gated Spillway. Existing 10-ft-diameter culvert to remain.			

Notes: WCS = water control structure; cfs = cubic feet per second

Critical infrastructure, including essential facilities, in the Alternative A scenario in several rainfall and coastal return flood events would experience less damaged structures above first-floor elevations in the upstream watershed basins in comparison to FWOP. Anticipated impacted critical infrastructure with flood depths above the first-floor elevation are included in **Table B.3-66** below.

Table B.3-66. Critical Infrastructure Impacts in Alternative A

Watershed Basin	Critical Infrastructure (Number of Flooded Structures, Intermediate/High SLR)					
	2 year Surge, 25 year Rainfall		2 year Surge, 100 year Rainfall		100 year Surge, 100 year Rainfall	
	Int SLR	High SLR	Int SLR	High SLR	Int SLR	High SLR
C-11 East	2	2	2	2	2	4
C-11 West	0	0	0	0	0	0
C-12 West	1	1	1	1	1	1
C-13 West	0	0	0	0	0	0
C-14 East	0	0	4	7	6	9
C-14 West	0	0	0	0	0	0
Hillsboro Canal	1	1	1	1	1	1
North New River Canal West	0	0	0	0	0	0

Watershed Basin	Critical Infrastructure (Number of Flooded Structures, Intermediate/High SLR)					
	2 year Surge, 25 year Rainfall		2 year Surge, 100 year Rainfall		100 year Surge, 100 year Rainfall	
	Int SLR	High SLR	Int SLR	High SLR	Int SLR	High SLR
Pompano Canal	0	0	0	2	1	4
Total, Alternative A	4	4	8	13	11	19
Alternative A Improvements in comparison to FWOP	0	1	2	2	1	7

Notes: Int. = intermediate; SLR = sea level rise; FWOP = Future Without Project

Sanitary sewer overflows are less likely to occur under Alternative A in comparison to FWOP. Estimated percent reduction in flood depths in areas where sanitary sewer overflows occur are included in **Table B.3-67**.

Table B.3-67. Percent Reductions in Flood Depths under Alternative A in Areas where Sanitary Sewer Overflows Occur.

	2 year Surge, 25 year Rainfall		2 year Surge, 100 year Rainfall		100 year Surge, 100 year Rainfall	
	Int. SLR	High SLR	Int. SLR	High SLR	Int. SLR	High SLR
Alternative A	2%	2%	2%	3%	2%	5%

Notes: Int. = intermediate; SLR = sea level rise

Septic tank impacts are less likely to occur under Alternative A in comparison to FWOP. Septic tanks with flood values in Alternative A are summarized in **Table B.3-68**.

Table B.3-68. Septic Tanks with Flood Values in Alternative A.

Watershed Basin	Septic Tanks (Number of Flooded Structures, Intermediate/High SLR)								
	2 year Surge, 25 year Rainfall			2 year Surge, 100 year Rainfall			100 year Surge, 100 year Rainfall		
	2035 Int. SLR	2085 Int. SLR	2085 High SLR	2035 Int. SLR	2085 Int. SLR	2085 High SLR	2035 Int. SLR	2085 Int. SLR	2085 High SLR
C-11 East	4,415	4,432	4,494	5,179	5,206	5,332	5,307	5,247	5,426
C-11 West	1,572	1,574	1,581	1,846	1,849	1,866	1,847	1,850	1,866
C-12 West	195	195	196	215	215	215	215	215	215
C-13 West	11	11	12	13	13	14	13	13	14
C-14 East	13	13	14	18	18	18	18	18	18
C-14 West	35	35	35	42	42	42	44	42	42
Hillsboro Canal	1,258	1,258	1,257	1,453	1,462	1,459	1,484	1,461	1,465
North New River Canal West	231	244	261	317	327	354	331	334	372
Pompano Canal	6	7	10	20	21	23	21	20	24
Total, Alternative A	7,736	7,769	7,860	9,103	9,153	9,323	9,280	9,200	9,442
Total, FWOP	7,813	7,854	8,071	9,227	9,312	9,550	9,280	9,368	9,713

Notes: Int. = intermediate; SLR = sea level rise; FWOP = Future Without Project

Construction (2028 to 2034)

Water Control Structures. Electricity, water, and petroleum fuel would be used during construction. During construction, electricity would be provided by portable generators. Water would be used for mixing concrete and periodic dust suppression. Diesel fuel would be required to power construction equipment. Portable toilets would be used for sanitary waste. In general, while the demand on Broward County utilities would be greater than under the No Action Alternative, demands would be low and mainly associated with a slight increase in water usage. There is sufficient available capacity to meet utility demand during construction. Utility demand from construction activities is not expected to result in adverse effects on infrastructure and utilities under Alternative A as compared to the No Action Alternative.

Canals. An additional 1,400-foot-long double culvert would be constructed for the G-16 (Pompano) Canal immediately upstream of the G-57 Gated Spillway. Utility requirements for culvert construction would be similar to WCS construction but overall would result in less demand due to the smaller scope of the work. No adverse impacts to infrastructure and utilities are expected from construction of the culvert as compared to the No Action Alternative.

Operation, Maintenance, Repair, Replacement, and Rehabilitation

OMRR&R under Alternative A would result in greater benefits compared to the No Action Alternative because of decreased potential for overflow and backflow from structure hardening, and an increase in pump capacity and flow conveyance from operation of new pump stations and gated spillways. No adverse impacts to infrastructure and utilities are expected from OMRR&R under Alternative A.

The WCS improvements under Alternative A would generally be implemented within the same operational footprint or within proximity to the existing WCS. The WCS would use existing public utility lines. Public utilities that would be connected to new spillways include electric power service and telecommunication (for phone and internet access). Public utilities connected to the new pump stations would include electric service, telecommunication, potable water service, and sanitary sewer service. Similar to the No Action Alternative, electricity would be used for the control buildings, spillway gates, and pump station water pumps. All primary and auxiliary pumps for each pump station would have a dual driver system, so that each pump would normally be driven by an electric motor and would only be driven by a diesel engine during electrical power outages or as part of its routine maintenance. In addition, there would be a separate diesel engine-driven back-up power system for each of these pump stations to run lights, fans, and instrumentation and control systems. All new spillways would normally be powered by electrical power from the grid. Spillway gates would be operated by electric motors, except during power outages, in which case the spillway would be powered by its liquified petroleum gas (LPG) engine-driven back-up power system. The LPG engine for this back-up power system would also be run periodically for routine maintenance.

Domestic water would be used for restroom facilities at the new pump stations. New pump stations would include potable water service, since each pump station would have a restroom for the pump station operators, which would include a toilet and a sink. At sites where only a new spillway is constructed, potable water service would not be included.

The pump station restrooms would be connected to the public sanitary sewer system where feasible; however, in some cases, when such a connection is not feasible, there would be an onsite septic system. If connection to the public sanitary sewer or an onsite septic system is not feasible, then the pump station would not include a restroom.

Natural gas service would not be provided to any of the WCS. For the alternatives with only a spillway structure, there would be an onsite buried LPG tank that would provide LPG to the LPG engine-driven back-up power system for the spillway.

Slight increases in domestic water use and electrical consumption would occur under Alternative A compared to the No Action Alternative. Domestic water use would be associated with restroom facilities at three pump stations. Increased electrical consumption would be associated primarily with pump operation at three pump stations, and to a lesser amount, the replacement gated spillways. However, because pump operation would be intermittent (and dependent on precipitation events and canal water levels), increases in electrical consumption would be minor, and no electrical capacity issues are expected. In addition, new electrical transformers would be installed at the new pump stations to handle power requirements. A backup power system powered by diesel fuel would be constructed for new pump stations to provide 7 days of operation at 100 percent load. Public utilities would have the capacity to provide the required utility service to each proposed facility (i.e., spillway and/or pump station), because all proposed improvements are located within urbanized Broward County, and many improvements would be located near similar existing water management infrastructure.

B.3.19.3 Alternative B

Alternative B represents an intermediate scenario where the number of proposed measures is greater than in Alternative A but fewer than in Alternative C. As shown in **Table B.3-69**, all eight existing gated spillways would be demolished and replaced, and four new pump stations would be constructed adjacent to the new gated spillways. Three canals would be dredged to increase flow capacity. In addition, the Markham Park Stormwater Storage Capacity Improvement Project would be implemented.

Table B.3-69. Alternative B Proposed Improvements.

WCS	General Description	Design Pumping Capacity (cfs)	Number of Spillway Gates	Pump Station
G-56 Gated Spillway	Existing gated spillway would be demolished, and new gated spillway would be constructed in adjacent, downstream location.	Same as No Action (none)	4	No
G-57 Gated Spillway	Existing gated spillway would be demolished, and new gated spillway would be constructed in adjacent, upstream location.	Same as No Action (none)	2	No
S-37B Gated Spillway	Existing gated spillway would be demolished, and new gated spillway would be constructed in adjacent, upstream location.	Same as No Action (none)	3	No
S-37A Gated Spillway	Existing gated spillway would be demolished, and new pump station and new gated spillway would be constructed in the same location.	1,500	2	Yes
S-36 Gated Spillway	Existing gated spillway would be demolished, and new pump station and new gated spillway would be constructed in the same location.	510	1	Yes

WCS	General Description	Design Pumping Capacity (cfs)	Number of Spillway Gates	Pump Station
S-33 Gated Spillway	Existing gated spillway would be demolished, and new pump station and new gated spillway would be constructed in adjacent, upstream location. Bank improvements on south side.	510	2	Yes
G-54 Gated Spillway	Existing gated spillway would be demolished, and new gated spillway would be constructed in adjacent, upstream location.	Same as No Action (none)	4	No
S-13 Pump Station and Gated Spillway	Existing pump station and gated spillway and would be demolished, and new pump station and gated spillways would be constructed in adjacent, upstream location.	1,080	1	Yes
Canal	General Description			
G-16 (Pompano) Canal	Construct two 10-ft-diameter culverts parallel to existing 10-ft-diameter culvert located upstream of G-57 Gated Spillway. Existing 10-ft-diameter culvert to remain.			
G-08 (Hillsboro) Canal, C-14 (Cypress Creek) Canal, C-11 (South New River) Canal	Enlarge cross-sectional flow area of these canals via dredging within canal segments to improve water conveyance.			
Stormwater Storage Capacity Improvement				
Construct structures/features so that the Markham Park lake system can temporarily store stormwater from the G-15 (North New River) Canal during storm events, beyond the stormwater that its existing lake system is designed and permitted to store, to reduce peak flood stages in the G-15 (North New River) Canal.				

Notes: WCS = water control structure; cfs = cubic feet per second

Critical infrastructure, including essential facilities, under Alternative B in several rainfall and coastal return flood events would experience less damaged structures above first-floor elevations in the upstream watershed basins in comparison to FWOP and Alternative A. Anticipated impacted critical infrastructure with flood depths above the first-floor elevation are included in **Table B.3-70** below.

Table B.3-70. Critical Infrastructure Impacts in Alternative B.

Watershed Basin	Critical Infrastructure (Number of Flooded Structures, Intermediate/High SLR)					
	2 year Surge, 25 year Rainfall		2 year Surge, 100 year Rainfall		100 year Surge, 100 year Rainfall	
	Int. SLR	High SLR	Int. SLR	High SLR	Int. SLR	High SLR
C-11 East	2	2	2	2	2	3
C-11 West	0	0	0	0	0	0
C-12 West	1	1	1	1	1	1
C-13 West	0	0	0	0	0	0
C-14 East	0	0	4	7	5	9
C-14 West	0	0	0	0	0	0
Hillsboro Canal	1	1	1	1	1	1
North New River Canal West	0	0	0	0	0	0
Pompano Canal	0	0	0	2	1	4
Total, Alternative B	4	4	8	13	10	18
Alternative B Improvements in Comparison to FWOP	0	1	2	2	2	8

Watershed Basin	Critical Infrastructure (Number of Flooded Structures, Intermediate/High SLR)					
	2 year Surge, 25 year Rainfall		2 year Surge, 100 year Rainfall		100 year Surge, 100 year Rainfall	
	Int. SLR	High SLR	Int. SLR	High SLR	Int. SLR	High SLR
Alternative B Improvements in Comparison to Alternative A	0	0	0	0	1	1

Notes: Int. = intermediate; SLR = sea level rise; FWOP = Future Without Project

Sanitary sewer overflow improvements in Alternative B are similar to Alternative A. Estimated percent reduction in flood depths in areas where sanitary sewer overflows occur are included in **Table B.3-71**.

Table B.3-71. Percent Reductions in Flood Depths under Alternative B in Areas where Sanitary Sewer Overflows Occur.

	2 year Surge, 25 year Rainfall		2 year Surge, 100 year Rainfall		100 year Surge, 100 year Rainfall	
	Int. SLR	High SLR	Int. SLR	High SLR	Int. SLR	High SLR
Alternative B	2%	2%	2%	3%	2%	5%
Alternative B Improvements in Comparison to Alternative A	0%	0%	0%	0%	0%	0%

Notes: Int. = intermediate; SLR = sea level rise

Septic tank impacts are less likely to occur under Alternative B in comparison to FWOP and Alternative A. Septic tanks with flood values in Alternative B are summarized in **Table B.3-72**.

Table B.3-72. Septic Tanks with Flood Values in Alternative B.

Watershed Basin	Septic Tanks (Number of Flooded Structures, Intermediate/High SLR)								
	2 year Surge, 25 year Rainfall			2 year Surge, 100 year Rainfall			100 year Surge, 100 year Rainfall		
	2035 Int. SLR	2085 Int. SLR	2085 High SLR	2035 Int. SLR	2085 Int. SLR	2085 High SLR	2035 Int. SLR	2085 Int. SLR	2085 High SLR
C-11 East	4,411	4,429	4,479	5,261	5,199	5,310	5,180	5,208	5,414
C-11 West	1,571	1,572	1,578	1,846	1,849	1,862	1,841	1,851	1,869
C-12 West	195	195	196	215	215	215	215	215	215
C-13 West	11	11	11	13	13	14	13	13	14
C-14 East	13	13	14	18	18	18	18	18	18
C-14 West	35	35	35	44	42	42	42	42	42
Hillsboro Canal	1,258	1,258	1,257	1,483	1,462	1,459	1,457	1,460	1,467
North New River Canal West	231	242	255	326	324	346	320	332	360
Pompano Canal	6	7	10	21	21	23	20	21	22
Total, Alternative B	7,731	7,762	7,835	9,227	9,143	9,289	9,106	9,160	9,421
Total, FWOP	7,813	7,854	8,071	9,227	9,312	9,550	9,280	9,368	9,713

Watershed Basin	Septic Tanks (Number of Flooded Structures, Intermediate/High SLR)								
	2 year Surge, 25 year Rainfall			2 year Surge, 100 year Rainfall			100 year Surge, 100 year Rainfall		
	2035 Int. SLR	2085 Int. SLR	2085 High SLR	2035 Int. SLR	2085 Int. SLR	2085 High SLR	2035 Int. SLR	2085 Int. SLR	2085 High SLR
Total, Alternative A	7,736	7,769	7,860	9,103	9,153	9,323	9,280	9,200	9,442

Notes: Int. = intermediate; SLR = sea level rise; FWOP = Future Without Project

Construction (2028 to 2034)

Water Control Structures. Under Alternative B, electricity, water, and petroleum fuel would be used during construction, as described under Alternative A. Because the scope of construction increases under Alternative B, there would be a corresponding increase in utility demand. Compared to Alternative A and the No Action Alternative, the use of portable generators for electricity, petroleum fuel for equipment, and sanitary waste generation (associated with a larger construction workforce) would increase. In general, the demand on Broward County utilities would be low and mainly associated with a slight increase in water usage. There is sufficient available capacity to meet utility demand during construction. Utility demand from construction activities is not expected to result in adverse effects on infrastructure and utilities under Alternative B.

Canals. Under Alternative B, the double culvert for the G-16 (Pompano) Canal would be constructed, as described under Alternative A. No adverse impacts to utility infrastructure would be expected as compared to the No Action Alternative.

In addition, the G-08 (Hillsboro) Canal, C-14 (Cypress Creek) Canal, and C-11 (South New River) Canal would be dredged to increase flow conveyance. Dredging would occur along an approximately 5.5-linear-mile section of the G-08 (Hillsboro) Canal, 1.2-linear-mile section of the C-14 (Cypress Creek) Canal, and 8.4-linear-mile section of the C-11 (South New River) Canal in both the C-11 West Basin and C-11 East Basin. Excavation would occur within the ROW of each canal, and excavated material would be placed on uplands in the ROW to raise the height of canal banks, access roads, and parking areas. Petroleum fuel would be required for construction equipment; however, fuel can be transported to the site(s) as needed. There are no expected demands on Broward County infrastructure during dredging, and therefore, no adverse impacts to infrastructure and utilities would be expected. Canal dredging would have the beneficial effect of improving flow conveyance within the canal, which would improve flood control.

Stormwater Storage Capacity Improvement. The Markham Park Stormwater Storage Capacity Improvement Project would construct features so that the Markham Park lake system can temporarily store stormwater from the G-15 (North New River) Canal during storm events, beyond the stormwater that its existing lake system is designed and permitted to store, to reduce peak stages in the G-15 (North New River) Canal. This project would include a new 100-cfs inflow pump station, two, 84-inch-diameter culverts to serve as overflow structures, a modified stormwater outfall control structure that includes an automated 2.5-foot-wide by 2.5-foot-tall gate that would close when the 100-cfs pump is operating, and two larger culverts upstream of the existing Markham Park stormwater outfall control structure. Utility

requirements for this construction would be similar but less than WCS construction requirements due to the smaller scope of the construction. No adverse impacts to infrastructure and utilities would be expected from construction of this feature.

Operation, Maintenance, Repair, Replacement, and Rehabilitation

OMRR&R under Alternative B would result in greater benefits compared to Alternative A because of the increase in pump capacity, flow conveyance (related to gated spillway and canal improvements), and increased stormwater storage capacity. Similar to Alternative A, no adverse impacts to infrastructure and utilities are expected from OMRR&R under Alternative B as compared to the No Action Alternative.

The WCS improvements under Alternative B would generally be implemented within the same operational footprint or within proximity to the existing WCS. In general, the WCS would tie in to existing utility lines for electric service, telecommunication, potable water service, and sanitary sewer service. The spillways and pump stations would require these utilities during normal operations and back-up power systems would be installed for emergencies, as described under Alternative A. Similar to Alternative A, electricity would be used for the control buildings, spillway gates, and water pumps, and domestic water would be used for restroom facilities. Slight increases in domestic water and electricity consumption would occur compared to the No Action Alternative and Alternative A. Domestic water usage would slightly increase due to additional restroom facilities at four pump stations. Increased electrical consumption would be associated primarily with pump operation at the four new pump stations, and to a lesser amount, the replacement gated spillways. However, because pump operation would be intermittent (and dependent on precipitation events and canal water levels) increases in electrical consumption would be minor, and no electrical capacity issues are expected.

Canal conveyance improvements at the G-08 (Hillsboro) Canal, C-14 (Cypress Creek) Canal, and C-11 (South New River) Canal would enlarge canal cross sections, which would improve flow capacity and flood control. OMRR&R would include ensuring stability of the banks and bermed areas along the canal ROW. No adverse impacts to infrastructure and utilities would be expected from OMRR&R as compared to the No Action Alternative.

Operation of the Markham Park Stormwater Storage Capacity Improvement Project would enable the Markham Park lake system to temporarily store additional stormwater from the G-15 (North New River) Canal during storm events, to reduce peak stages in the G-15 (North New River) Canal. This would have a beneficial effect of improving flood control. OMRR&R of facility equipment for the Markham Park Improvement would not adversely affect infrastructure and utilities as compared to the No Action Alternative.

B.3.19.4 Alternative C

Alternative C represents the most complex scenario where the number of proposed measures is the greatest. As shown in **Table B.3-73**, seven gated spillways would be demolished and replaced, and seven new pump stations would be constructed adjacent to the new gated spillways. Six canals would be dredged to increase flow capacity. In addition, the Markham Park and Hillsboro Watershed Stormwater Storage Capacity Improvement projects would be implemented.

Table B.3-73. Alternative C Proposed Improvements.

WCS	General Description	Design Pumping Capacity (cfs)	Number of Spillway Gates	Pump Station
G-56 Gated Spillway	Existing gated spillway would be demolished, and new gated spillway would be constructed in adjacent, downstream location.	1,005	4	Yes
G-57 Gated Spillway	Existing gated spillway would be demolished, and new gated spillway would be constructed in adjacent, upstream location.	300	2	Yes
S-37B Gated Spillway	Same as No Action, no proposed changes.	Same as No Action (none)	Same as No Action (2)	No
S-37A Gated Spillway	Existing gated spillway would be demolished, and new pump station and new gated spillway would be constructed in the same location.	1,200	4	Yes
S-36 Gated Spillway	Existing gated spillway would be demolished, and new pump station and new gated spillway would be constructed in the same location.	600	2	Yes
S-33 Gated Spillway	Existing gated spillway would be demolished, and new pump station and new gated spillway would be constructed in adjacent, upstream location.	705	2	Yes
G-54 Gated Spillway	Existing gated spillway would be demolished, and new gated spillway would be constructed in adjacent, upstream location.	810	4	Yes
S-13 Pump Station and Gated Spillway	Existing pump station and gated spillway and would be demolished, and new pump station and gated spillways would be constructed in adjacent, upstream location.	1,500	1	Yes
Canal	General Description			
G-16 (Pompano) Canal	Construct two 10-ft-diameter culverts parallel to existing 10-ft-diameter culvert located upstream of G-57 Gated Spillway. Existing 10-ft-diameter culvert to remain.			
G-08 (Hillsboro) Canal, C-11 (South New River) Canal, C-12 (Plantation) Canal, C-13 (Middle River) Canal, C-14 (Cypress Creek) Canal, G-15 (North New River) Canal	Enlarge the cross-sectional flow area of these canals through canal excavation within canal segments where the existing cross-sectional flow area is too restrictive to flow.			
Stormwater Storage Capacity Improvement				
Construct structures/features so that the Markam Park lake system can temporarily store stormwater from the G-15 (North New River) Canal during storm events, beyond the stormwater that its existing lake system is designed and permitted to store, to reduce peak flood stages in the G-15 (North New River) Canal.				
Convert existing property within Hillsboro Watershed into an aboveground stormwater storage area.				

Notes: WCS = water control structure; cfs = cubic feet per second

Critical infrastructure, including essential facilities, in Alternative C in several rainfall and coastal return flood events would experience less damaged structures above first-floor elevations in the upstream watershed basins in comparison to FWOP, Alternative A, and Alternative B. Anticipated impacted critical infrastructure with flood depths above the first-floor elevation are included in **Table B.3-74** below.

Table B.3-74. Critical Infrastructure Impacts in Alternative C.

Watershed Basin	Critical Infrastructure (Number of Flooded Structures, Intermediate/High SLR)					
	2 year Surge, 25 year Rainfall		2 year Surge, 100 year Rainfall		100 year Surge, 100 year Rainfall	
	Int. SLR	High SLR	Int. SLR	High SLR	Int. SLR	High SLR
C-11 East	2	2	2	2	2	3
C-11 West	0	0	0	0	0	0
C-12 West	1	1	1	1	1	1
C-13 West	0	0	0	0	0	0
C-14 East	0	0	4	7	4	9
C-14 West	0	0	0	0	0	0
Hillsboro Canal	1	1	1	1	1	1
North New River Canal West	0	0	0	0	0	0
Pompano Canal	0	0	0	2	1	2
Total, Alternative C	4	4	8	13	9	16
Alternative C Improvements in Comparison to FWOP	0	1	2	2	3	10
Alternative C Improvements in Comparison to Alternative A	0	0	0	0	2	3
Alternative C Improvements in Comparison to Alternative B	0	0	0	0	1	2

Notes: Int. = intermediate; SLR = sea level rise; FWOP = Future Without Project

Sanitary sewer overflow improvements in Alternative C are similar to Alternatives A and B. Estimated percent reduction in flood depths in areas where sanitary sewer overflows occur are included in **Table B.3-75**.

Table B.3-75. Percent Reductions in Flood Depths under Alternative C in Areas where Sanitary Sewer Overflows Occur.

	2 year Surge, 25 year Rainfall		2 year Surge, 100 year Rainfall		100 year Surge, 100 year Rainfall	
	Int. SLR	High SLR	Int. SLR	High SLR	Int. SLR	High SLR
Alternative C	2%	2%	2%	4%	2%	6%
Alternative C Improvements in Comparison to Alternative B	0%	0%	0%	1%	0%	1%
Alternative C Improvements in Comparison to Alternative A	0%	0%	0%	1%	0%	1%

Notes: Int. = intermediate; SLR = sea level rise

Septic tank impacts are less likely to occur under Alternative C in comparison to FWOP and Alternatives A and B. Septic tanks with flood values in Alternative C are summarized in **Table B.3-76**.

Table B.3-76. Septic Tanks with Flood Values in Alternative C.

Watershed Basin	Septic Tanks (Number of Flooded Structures, Intermediate/High SLR)								
	2 year Surge, 25 year Rainfall			2 year Surge, 100 year Rainfall			100 year Surge, 100 year Rainfall		
	2035 Int. SLR	2085 Int. SLR	2085 High SLR	2035 Int. SLR	2085 Int. SLR	2085 High SLR	2035 Int. SLR	2085 Int. SLR	2085 High SLR
C-11 East	4,407	4,421	4,466	5,181	5,192	5,288	5,177	5,202	5,405
C-11 West	1,568	1,570	1,577	1,840	1,846	1,870	1,836	1,848	1,869
C-12 West	195	195	195	215	215	215	215	215	215
C-13 West	11	11	11	13	13	14	13	13	14
C-14 East	13	13	14	18	18	18	18	18	18
C-14 West	35	35	35	42	42	42	42	42	42
Hillsboro Canal	1,256	1,256	1,256	1,440	1,440	1,441	1,440	1,440	1,441
North New River Canal West	222	224	236	305	310	323	310	314	323
Pompano Canal	6	7	8	20	20	23	20	20	23
Total, Alternative C	7,713	7,732	7,798	9,074	9,096	9,234	9,071	9,112	9,350
Total, FWOP	7,813	7,854	8,071	9,227	9,312	9,550	9,280	9,368	9,713
Total, Alternative A	7,736	7,769	7,860	9,103	9,153	9,323	9,280	9,200	9,442
Total, Alternative B	7,731	7,762	7,835	9,227	9,143	9,289	9,106	9,160	9,421

Notes: Int. = intermediate; SLR = sea level rise; FWOP = Future Without Project

Construction (2028 to 2034)

Water Control Structures. Under Alternative C, electricity, water, and petroleum fuel would be used during construction, as described under Alternative A. Because the scope of construction increases under Alternative C, there would be a corresponding increase in utility demand. In general, while greater than under the No Action Alternative, the demand on Broward County utilities would be low and mainly associated with a slight increase in water usage. The use of portable generators for electricity, petroleum fuel for equipment, and sanitary waste generation (associated with a larger construction workforce) would increase. However, fuel and portable toilets can be delivered as needed, so issues concerning available capacity are not expected. Utility demand from construction activities is not expected to result in adverse effects on infrastructure and utilities under Alternative C.

Canals. Under Alternative C, the double culvert for the G-16 (Pompano) Canal would be constructed, as described under Alternative A. No adverse impacts to infrastructure and utilities would be expected.

As described under Alternative B, G-08 (Hillsboro) Canal, C-11 (South New River) Canal, and C-14 (Cypress Creek) Canal would be dredged. Alternative C also includes dredging of C-12 (Plantation) Canal, C-13 (Middle River) Canal, and G-15 (North New River) Canal. Dredging of the C-12 (Plantation) Canal would occur along a 0.5-linear-mile section upstream of the proposed new WCS., The C-13 (Middle River) Canal would be excavated along 4.1 linear miles upstream of the S-36 Gated Spillway and 1.3

miles downstream of the S-36 Gated Spillway, and dredging of G-15 (North New River) Canal would occur along a 13.9-linear-mile section upstream of the proposed new WCS. Excavation would occur within the ROW of each canal, and excavated material would be placed on uplands in the ROW to raise the height of canal banks, access roads, and parking areas. No adverse impacts to infrastructure and utilities would be expected from dredging. The dredging would enlarge canal cross sections, which would improve flow capacity and flood control.

Stormwater Storage Capacity Improvement. As described under Alternative B, the Markam Park Stormwater Storage Capacity Improvement Project would be constructed. Alternative C also includes the Hillsboro Watershed Stormwater Storage Capacity Improvement Project, which would convert an existing agricultural property within Hillsboro Watershed into an aboveground stormwater storage area. This project would reduce peak stages in the G-08 (Hillsboro) Canal during certain storm events. The project would include construction of a perimeter levee and seepage canal, 600-cfs inflow pump station, 60-cfs seepage pump station, overflow weir structure, and gated outflow structure. Utility requirements for this construction would be similar to WCS requirements in that electricity, water, and petroleum fuel would be needed, but at lesser amounts, due to the smaller scope of the project. No adverse impacts to infrastructure and utilities would be expected from construction of this feature.

Operation, Maintenance, Repair, Replacement, and Rehabilitation

OMRR&R under Alternative C would result in the greatest benefits of the alternatives because of the overall increase in pump capacity, flow conveyance related to gated spillway and canal improvements, and increased stormwater storage capacity. Like Alternatives A and B, there are no adverse impacts to infrastructure and utilities are expected from OMRR&R under Alternative C as compared to the No Action Alternative.

The WCS improvements under Alternative C would generally be implemented within the same operational footprint or within close proximity to the existing WCS. In general, the WCS would tie in to existing utility lines for electric service, telecommunication, potable water service, and sanitary sewer service. The spillways and pump stations would require these utilities during normal operations, and back-up power systems would be installed for emergencies, as described under Alternative A. Similar to the No Action Alternative and Alternatives A and B, electricity would be used for the control buildings, spillway gates, and pump station water pumps. Domestic water would be used for restroom facilities. Increased usage of domestic water and electricity would occur compared to the No Action Alternative and Alternatives A and B. Slight increases in domestic water would be associated with additional restroom facilities at the seven pump stations. Increased electrical consumption would be associated primarily with the water pumps at seven new pump stations, and to a lesser amount, the six replacement gated spillways. However, because pump and gated spillway operation would be intermittent (and dependent on precipitation events and canal water levels), increases in electrical consumption would be minor, and no electrical capacity issues are expected.

Canal improvements at the G-08 (Hillsboro) Canal, C-11 (South New River) Canal, C-12 (Plantation) Canal, C-13 (Middle River) Canal, C-14 (Cypress Creek) Canal, and G-15 (North New River) Canal would enlarge canal cross sections to a greater extent than Alternative B, which would have a beneficial effect of further improving flow conveyance and flood control. Maintenance work would include ensuring

stability of the banks and bermed areas along the canal ROW. No adverse impacts to infrastructure and utilities would be expected from OMRR&R as compared to the No Action Alternative.

The operation of the Markham Park Stormwater Storage Capacity Improvement Project as described under Alternative B would be implemented under Alternative C. In addition, Alternative C includes operation of the Hillsboro Watershed Stormwater Storage Capacity Improvement Project, which would convert existing agricultural property within Hillsboro Watershed into an aboveground stormwater storage area. Operation of this project would reduce peak stages in the G-08 (Hillsboro) Canal during certain storm events and would provide stormwater storage capacity in the northern portion of the Study Area. OMRR&R for these features would not adversely affect infrastructure and utilities as compared to the No Action Alternative.

B.3.19.5 Alternative RO

Alternative RO represents a hybrid of Alternatives A, B, and C. As shown in **Table B.3-77**, all eight existing gated spillways would be demolished and replaced, and five new pump stations would be constructed adjacent to the new gated spillways. Alternative RO is similar to Alternative B, but adds a pump station at G-54 Gated Spillway and one extra spillway gate each at S-37A Gated Spillway, S-36 Gated Spillway, and S-13 Pump Station and Gated Spillway, and as described under Alternative B, three canals would be dredged to increase flow capacity. Note, the Markham Park and Hillsboro Watershed Stormwater Storage Capacity Improvement projects, as described in Alternatives B and C, would not be implemented.

Table B.3-77. Alternative RO Proposed Improvements.

WCS	General Description	Design Pumping Capacity (cfs)	Number of Spillway Gates	Pump Station
G-56 Gated Spillway	Existing gated spillway would be demolished, and new gated spillway would be constructed in adjacent, downstream location.	Same as No Action (none)	4	No
G-57 Gated Spillway	Existing gated spillway would be demolished, and new gated spillway would be constructed in adjacent, upstream location.	Same as No Action (none)	2	No
S-37B Gated Spillway	Existing gated spillway would be demolished, and new gated spillway would be constructed in adjacent, upstream location.	Same as No Action (none)	2	No
S-37A Gated Spillway	Existing gated spillway would be demolished, and new pump station and new gated spillway would be constructed in the same location.	1,200	3	Yes
S-36 Gated Spillway	Existing gated spillway would be demolished, and new pump station and new gated spillway would be constructed in the same location.	510	2	Yes
S-33 Gated Spillway	Existing gated spillway would be demolished, and new pump station and new gated spillway would be constructed in adjacent, upstream location. Bank improvements on south side.	510	2	Yes
G-54 Gated Spillway	Existing gated spillway would be demolished, and new pump station and new gated spillway would be constructed in adjacent, upstream location.	810	4	Yes
S-13 Pump Station and Gated Spillway	Existing pump station and gated spillway and would be demolished, and new pump station and	1,080	2	Yes

WCS	General Description	Design Pumping Capacity (cfs)	Number of Spillway Gates	Pump Station
	gated spillways would be constructed in adjacent, upstream location.			
Canal	General Description			
G-16 (Pompano) Canal	Construct two 10-ft-diameter culverts parallel to existing 10-ft-diameter culvert located upstream of G-57 Gated Spillway. Existing 10-ft-diameter culvert to remain.			
G-08 (Hillsboro) Canal, C-14 (Cypress Creek) Canal, C-11 (South New River) Canal	Enlarge cross-sectional flow area of these canals via dredging within canal segments to improve water conveyance.			

Notes: WCS = water control structure; cfs = cubic feet per second

Critical infrastructure, including essential facilities, in Alternative RO in several rainfall and coastal return flood events would experience less damaged structures above first-floor elevations in the upstream watershed basins in comparison to FWOP and Alternative A. Anticipated impacted critical infrastructure with flood depths above the first-floor elevation are included in **Table B.3-78**.

Table B.3-78. Critical Infrastructure Impacts in Alternative RO.

Watershed Basin	Critical Infrastructure (Number of Flooded Structures, Intermediate/High SLR)					
	2 year Surge, 25 year Rainfall		2 year Surge, 100 year Rainfall		100 year Surge, 100 year Rainfall	
	Int. SLR	High SLR	Int. SLR	High SLR	Int. SLR	High SLR
C-11 East	2	2	2	2	2	5
C-11 West	0	0	0	0	0	0
C-12 West	1	1	1	1	1	1
C-13 West	0	0	0	0	0	0
C-14 East	0	0	5	8	6	10
C-14 West	0	0	0	0	0	0
Hillsboro Canal	1	1	1	1	1	1
North New River Canal West	0	0	0	0	0	0
Pompano Canal	0	0	0	2	1	4
Total, Alternative RO	4	4	9	14	11	21
Alternative RO Improvements in Comparison to FWOP	0	1	1	1	1	5
Alternative RO Improvements in Comparison to Alternative A	0	0	-1	-1	0	-2
Alternative RO Improvements in Comparison to Alternative B	0	0	-1	-1	-1	-3
Alternative RO Improvements in Comparison to Alternative C	0	0	-1	-1	-2	-5

Notes: Int. = intermediate; SLR = sea level rise

Sanitary sewer overflow improvements in Alternative RO are similar to Alternative A and Alternative B. Estimated percent reduction in flood depths in areas where sanitary sewer overflows occur are included in **Table B.3-79**.

Table B.3-79. Percent Reductions in Flood Depths under Alternative RO in Areas where Sanitary Sewer Overflows Occur.

	2 year Surge, 25 year Rainfall		2 year Surge, 100 year Rainfall		100 year Surge, 100 year Rainfall	
	Int. SLR	High SLR	Int. SLR	High SLR	Int. SLR	High SLR
Alternative RO	2%	2%	2%	3%	2%	5%
Alternative RO Improvements in Comparison to Alternative A	0%	0%	0%	0%	0%	0%
Alternative RO Improvements in Comparison to Alternative B	0%	0%	0%	0%	0%	0%
Alternative RO Improvements in Comparison to Alternative C	0%	0%	0%	-1%	0%	-1%

Notes: Int. = intermediate; SLR = sea level rise

Septic tanks with flood values improvements in Alternative RO are similar to Alternatives A and B. Septic tanks with flood values in Alternative RO are summarized in **Table B.3-80**.

Table B.3-80. Septic Tanks with Flood Values in the Alternative RO.

Watershed Basin	Septic Tanks (Number of Flooded Structures, Intermediate/High SLR)								
	2 year Surge, 25 year Rainfall			2 year Surge, 100 year Rainfall			100 year Surge, 100 year Rainfall		
	2035 Int. SLR	2085 Int. SLR	2085 High SLR	2035 Int. SLR	2085 Int. SLR	2085 High SLR	2035 Int. SLR	2085 Int. SLR	2085 High SLR
C-11 East	4,421	4,436	4,515	5,185	5,245	5,338	5,240	5,295	5,470
C-11 West	1,573	1,574	1,578	1,836	1,838	1,861	1,832	1,840	1,860
C-12 West	194	194	195	215	215	215	215	215	215
C-13 West	11	11	11	12	13	14	12	13	14
C-14 East	13	13	15	18	18	18	18	18	18
C-14 West	34	34	34	41	41	41	41	41	41
Hillsboro Canal	1,259	1,259	1,259	1,443	1,443	1,445	1,443	1,460	1,462
North New River Canal West	224	233	240	310	318	327	316	329	345
Pompano Canal	6	7	9	20	21	23	21	21	24
Total	7,735	7,761	7,856	9,080	9,152	9,282	9,138	9,232	9,449
Total, FWOP	7,813	7,854	8,071	9,227	9,312	9,550	9,280	9,368	9,713
Total, Alternative A	7,736	7,769	7,860	9,103	9,153	9,323	9,280	9,200	9,442
Total, Alternative B	7,731	7,762	7,835	9,227	9,143	9,289	9,106	9,160	9,421
Total, Alternative C	7,713	7,732	7,798	9,074	9,096	9,234	9,071	9,112	9,350

Notes: Int. = intermediate; SLR = sea level rise; FWOP = Future Without Project

Construction (2028 to 2034)

Water Control Structures. Under Alternative RO, electricity, water, and petroleum fuel would be used during construction, as described under Alternative A. The scope of construction and corresponding utility demand would be slightly greater than Alternative B but less than Alternative C, and would be greater than the No Action Alternative. As such, the use of portable generators for electricity, petroleum fuel for equipment, and sanitary waste generation (associated with a larger construction workforce) would fall between Alternative B and Alternative C. In general, the demand on Broward County utilities would be low and mainly associated with a slight increase in water usage. There is sufficient available capacity to meet utility demand during construction. Utility demand from construction activities is not expected to result in adverse effects on infrastructure and utilities under Alternative RO.

Canals. Under Alternative RO, the double culvert for the G-16 (Pompano) Canal would be constructed, as described under Alternative A. No adverse impacts to utility infrastructure would be expected.

In addition, the G-08 (Hillsboro) Canal, C-14 (Cypress Creek) Canal, and C-11 (South New River) Canal would be dredged to increase flow conveyance. Dredging would occur along an approximately 1.1-linear-mile section of the G-08 (Hillsboro) Canal, 1.2-linear-mile section of the C-14 (Cypress Creek) Canal, 1.5-linear-mile section of the C-11 (South New River) Canal in the C-11 West Basin, and 0.5 linear miles (in two sections) of the C-11 (South New River) Canal in the C-11 East Basin. Excavation would occur within the ROW of each canal, and excavated material would be placed on uplands in the ROW to raise the height of canal banks, access roads, and parking areas. The excavated canal side slopes of the 1.5-mile section of the C-11 (South New River) Canal in the C-11 West Basin would be stabilized with riprap (approximately 66,124 neat cubic yards) underlaid by bedding stone (approximately 16,762 neat cubic yards) and filter fabric. Petroleum fuel would be required for construction equipment; however, fuel can be transported to the site(s) as needed. There are no expected demands on Broward County infrastructure during dredging, and therefore, no adverse impacts to infrastructure and utilities would be expected. Canal dredging would have the beneficial effect of improving flow conveyance within the canal, which would improve flood control.

Operation, Maintenance, Repair, Replacement, and Rehabilitation

OMRR&R under Alternative RO would result in greater benefits compared to Alternative A because of the increase in pump capacity, flow conveyance (related to gated spillway and canal improvements). No adverse impacts to infrastructure and utilities are expected from OMRR&R as compared to the No Action Alternative.

The WCS improvements under Alternative RO would generally be implemented within the same operational footprint or within proximity to the existing WCS. In general, the WCS would tie in to existing utility lines for electric service, telecommunication, potable water service, and sanitary sewer service. The spillways and pump stations would require these utilities during normal operations and back-up power systems would be installed for emergencies, as described under Alternative A. Similar to the other alternatives, electricity would be used for the control buildings, spillway gates, and water pumps, and domestic water would be used for restroom facilities. Slight increases in domestic water and electricity consumption would occur compared to the No Action Alternative and Alternative A. Domestic

water usage would slightly increase due to additional restroom facilities at five pump stations. Increased electrical consumption would be associated primarily with pump operation at the five new pump stations, and to a lesser amount, the replacement gated spillways. However, because pump operation would be intermittent (and dependent on precipitation events and canal water levels), increases in electrical consumption would be minor, and no electrical capacity issues are expected.

Canal conveyance improvements at the G-08 (Hillsboro) Canal, C-14 (Cypress Creek) Canal, and C-11 (South New River) Canal would enlarge canal cross sections, which would improve flow capacity and flood control. OMRR&R would include ensuring stability of the banks and bermed areas along the canal ROW. No adverse impacts to infrastructure and utilities would be expected from OMRR&R as compared to the No Action Alternative.

B.3.20 Socioeconomics

An analysis of the potential impacts to socioeconomics from the No Action Alternative and implementation of the action alternatives is provided below.

B.3.20.1 Future Without Project Conditions (No Action Alternative)

Population and Demographics

Population growth has been observed in both Broward County and Palm Beach County over roughly the last decade. This growth, while not proportional between the two counties, adds to an already large population in the Study Area. Broward County contains four of the 25 most populated cities in Florida. At the census tract level, further growth is projected with predictions of an additional approximately 40,000 individuals to the Study Area population over a 5-year period of 2024 through 2029. This growth trend is anticipated to continue through 2050, with the Bureau of Economic and Business Research predicting that in Broward County, the population will increase by 12.2 percent. By 2075, the total population of Broward County is anticipated to be 2.4 million, roughly 500,000 more than the 1.9 million currently residing there (BEBR 2024).

While this growth could stimulate the local economy, additional housing will be necessary to accommodate the growing population. Housing is going to be increasingly difficult to obtain with loss of habitable land due to extreme weather conditions and flooding as a result. Under the worst case modeling scenario (100-year surge, 100-year rainfall event, and high sea level rise), in 2085, peak depths in the Study Area range from less than 1 foot to just over 12 feet (closest to the coast) in the No Action Alternative. This is likely to cause migration further inland to avoid long-term impacts. The economic effects of this migration are unlikely to be immediately felt to their full extent by the entire population. Higher income levels are correlated with higher sea level rise vulnerability attributable to the fact that the wealthier people live in more geographically vulnerable areas (such as along the coast). However, over time, this vulnerability is expected to affect a larger and more diverse population (Bloetscher et al. 2016). Higher income residents also have greater ability to move inland to higher-elevation municipalities with lower fiscal climate exposure, while lower income individuals are more likely to experience gentrification and higher prices due to increased demand for inland properties (Aune et al. 2020).

Currently in Broward County, 12.7 percent of the population is below the national poverty level. These residents are likely to experience more adverse economic conditions related to extreme weather conditions and the changing housing market. Loss of habitable land will exacerbate wealth inequality as those in financial hardship are less likely to be able to relocate easily and will experience larger financial losses associated with losing their property and not being able to compete for new housing in a shifting market. Growing income disparity may also contribute to an increase in the total population below the national poverty level in the coming years.

Housing and Land Use

Additional housing will be necessary to accommodate the growing population, which will become increasingly difficult to obtain with loss of habitable land due to extreme weather conditions and flooding. Economically-disadvantaged residents are likely to experience more adverse economic conditions related to extreme weather conditions and the changing housing market. As weather events become more extreme, and flooding of habitable land becomes more common, the state's appeal for retirees and second homeowners is likely to continue to decline, affect the state's GDP and local economies. The market demand for housing is likely to shift with movement away from previously-desirable coastal property to more inland areas, and resulting shifts in tax revenue. In the Tampa Bay area, a 3.5-foot sea level rise is estimated to cost the region \$7.5 billion in taxable property by 2060 (TBRPC 2021). While direct losses to Broward County cannot be estimated from that value, it is reasonable to assume that flooding of taxable property in Broward County will also result in financial losses.

Broward County has a total of 868,151 homes, the median value of which is higher than the state average. In Broward County census tracts, the average home value is approximately half a million dollars, with the highest average home values (over \$1.6 million) in East Fort Lauderdale, less than half a mile from the coast. Here, along the ICW and North Fork New River Canal, the worst case modeling scenario would result in most of the census tract being inundated (3 to 12 feet) during peak depths in 2085. Even under less drastic scenarios, repeated inundation would likely result in loss of real estate from the county's highest priced area under the No Action Alternative. Similar levels of flooding are predicted in other census tracts along the ICW, with similar impacts to high-value residences.

The Broward County census tract with the lowest average home value is located at the junction of Florida Turnpike South and North State Road 7 in Tamarac City. Peak depths under a worst case modeling scenario in the No Action Alternative for this area are projected to be less than 1 foot. These scenarios underscore how under the No Action Alternative, market demand for housing is likely to shift to address the needs of those who are most able to afford desirable property.

Labor Force and Employment

The labor force participation rate in Broward County is higher than that of the state of Florida and the United States average. Palm Beach County has a lower labor force participation rate than other counties in the state but is on par with its unemployment rate. In Broward and Palm Beach counties, overall positive job growth (totaled across all industries) is expected through 2032. Despite net positive growth, Broward County projects a decrease in certain industry sectors by 2032, including construction and government. Palm Beach County projects a decrease in agriculture, forestry, fishing, hunting, and mining

within the same time frame. These decreases are likely to be exacerbated further in the future by natural hazards that make it difficult to produce product output due to potential lack of habitable construction areas and fishable water. Other sectors, such as health care, have the potential to see an increase in profitability and job growth attributed to increasing health hazards of extreme weather conditions and events (Bloetscher et al. 2016). Finance and insurance sectors may also experience growth as the demand for weather-related insurance increases.

Income

Census tracts within the Study Area were evaluated for their per capita income (**Section B.1.20**). Data indicate a non-proportional per capita income growth rate and a widening income margin between areas. If this trend continues, the gap between those areas with the highest and lowest per capita incomes will continue to grow. This can have direct results on an area's ability to recover from weather-related events. The disparity between incomes could be further exacerbated by additional costs related to such events including as property damage, flood insurance, and lost wages from funding cuts and loss of job opportunities. This could potentially lead to more individuals falling below the national poverty level.

National Risk Index for Natural Hazards

The National Risk Index for Natural Hazards calculates the expected annual loss from natural hazards in Broward County to be very high compared to the rest of the United States. Under current conditions county-wide, coastal flooding is calculated to result in expected annual losses of \$473,690; riverine flooding is expected to result in annual losses of \$5,439,354; and hurricanes are expected to incur annual losses of \$894,835,315. This annual loss is expected to compound over time under the No Action Alternative due to increased flooding, storm surge, and hurricanes. As the frequency of these disasters increases, the expected annual economic losses will increase as well.

B.3.20.2 Alternative A

Population and Demographics

Population growth is expected to be the same under each of the alternatives as the No Action Alternative. Population density under Alternative A may see less fluctuation in areas along waterways and canals compared to the No Action Alternative, since Alternative A would provide some reduction in flooding and inundation.

Housing and Land Use

The long-term economic impact of extreme weather conditions in Florida are likely to affect the housing market similar to the No Action Alternative. However, these effects under Alternative A could be less severe compared with the No Action Alternative since Alternative A would provide some reduction in flooding and inundation. In Alternative A, under the worst case scenario by 2085, the loss of taxable property would be similar the No Action Alternative. However, the project is expected to generate revenue through its construction. Land acquisition and easements may also benefit the local economy by generating revenue for property owners, including local municipalities (see **Section B.3.16 Land Use and Real Estate** and **Appendix F, Real Estate Plan**).

Labor Force and Employment

The distribution of labor force participation is likely to be similar across all alternatives, including the No Action Alternative. However, under Alternative A, there may be less potential loss of taxable property due to flood resiliency improvements, and therefore less financial impact on the services that receive funding through property taxes. Financial and insurance sectors are still likely to experience growth as the demand for flood insurance continues with the rise of weather-related events. Construction employment may benefit from a short-term increase with the implementation of Alternative A, which would support employment opportunities during the period of construction.

Income

Income growth is expected to be similar across all alternatives, including the No Action Alternative. The non-proportional per capita growth rates and widening income margins between areas are likely to continue without the added effects from weather-related events. However, under Alternative A, improved flood management would result in less property damage and therefore less income spent on repairs and replacement. Additionally, as noted above, construction of Alternative A would contribute to employment income in the region. Alternative A is likely to ease some of the negative financial effects felt by those in lower income brackets when compared with the effects of the No Action Alternative.

National Risk Index for Natural Hazards

Estimates of extreme weather events under the National Risk Index for Natural Hazards are expected to be the same under all alternatives, including the No Action Alternative. However, under Alternative A, new and improved WCS and other structural improvements would mitigate some level of economic losses through improved FRM.

B.3.20.3 *Alternative B***Population and Demographics**

Under Alternative B, population density may fluctuate less in areas along waterways and canals compared to Alternative A and the No Action Alternative, since Alternative B would provide additional reduction in flooding and inundation.

Housing and Land Use

Alternative B is expected to have similar effects on housing and land use as Alternative A. Revenue would be generated through construction of the various Alternative B features, and land acquisition and easements may benefit the local economy by generating revenue. Both outcomes would be beneficial as compared to the No Action Alternative.

Labor Force and Employment

Alternative B would be expected to result in less potential loss of taxable property than Alternative A and the No Action Alternative due to the construction and operation of additional flood resiliency improvements, and therefore less financial impact on the services that receive funding through property taxes. However, such differences are expected to be minor. Like Alternative A, the construction of

Alternative B would support local employment opportunities. Such local employment opportunities would not be realized under the No Action Alternative.

Income

Alternative B would result in less property damage and therefore less income spent on repairs and replacement than Alternative A. Construction would contribute to employment income in the region under Alternative B, which would not occur under the No Action Alternative.

National Risk Index for Natural Hazards

Estimates of extreme weather events under the National Risk Index for Natural Hazards are expected to be the same under all alternatives, including the No Action Alternative. However, under Alternative B, new and improved WCS and other structural improvements would mitigate some level of economic losses through improved FRM.

*B.3.20.4 Alternative C***Population and Demographics**

Population density may fluctuate less in areas along waterways and canals under Alternative C as compared to the No Action Alternative. Alternative C would provide additional reduction in flooding and inundation compared to Alternatives A and B.

Housing and Land Use

Alternative C is expected to have similar effects on housing and land use as Alternatives A and B by generating construction revenue and revenue from land acquisition and easements. Both outcomes would be beneficial as compared to the No Action Alternative.

Labor Force and Employment

Alternative C would be expected to result in less potential loss of taxable property than Alternatives A and B and the No Action Alternative due to the construction and operation of additional flood resiliency improvements, and therefore less financial impact on the services that receive funding through property taxes. However, such differences are expected to be minor. Like Alternatives A and B, the construction of Alternative C would support local employment opportunities. Local employment opportunities would not be realized under the No Action Alternative.

Income

Alternative C would result in less property damage and therefore less income spent on repairs and replacement than Alternatives A and B. Like Alternatives A and B, construction would contribute to employment income in the region under Alternative C, which would not occur under the No Action Alternative.

National Risk Index for Natural Hazards

Estimates of extreme weather events under the National Risk Index for Natural Hazards are expected to be the same under all alternatives, including the No Action Alternative. However, like Alternatives A and B, structural improvements and nature-based features under Alternative C would further mitigate economic losses through improved FRM.

B.3.20.5 Alternative RO**Population and Demographics**

Population growth is expected to be the same under Alternative RO as the No Action Alternative. Population density under Alternative RO may see less fluctuation in areas along waterways and canals compared to the No Action Alternative, since Alternative RO would provide some reduction in flooding and inundation.

Housing and Land Use

Alternative RO expected to have similar effects on housing and land use as Alternatives A and B by generating construction revenue and revenue from land acquisition and easements. Both outcomes would be beneficial as compared to the No Action Alternative.

Labor Force and Employment

The distribution of labor force participation is likely to be similar between Alternative RO and No Action Alternative. Alternative RO would be expected to result in less potential loss of taxable property than the No Action Alternative due to the construction and operation of flood resiliency improvements, and therefore, less financial impact on the services that receive funding through property taxes. However, such differences are expected to be minor. Construction employment may benefit from a short-term increase with the implementation of Alternative RO, which would support employment opportunities during the period of construction.

Income

Alternative RO would result in less property damage and therefore less income spent on repairs and replacement than Alternative A and the No Action Alternative. As with Alternatives A, B, and C, construction of Alternative RO would contribute to employment income in the region.

National Risk Index for Natural Hazards

Estimates of extreme weather events under the National Risk Index for Natural Hazards are expected to be the same under all alternatives, including the No Action Alternative. However, structural improvements under Alternative RO would further mitigate economic losses through improved FRM.

B.3.21 Cultural Resources

There are 7,944 recorded cultural resources present within the Study Area. These cultural resources include historic buildings, structures, cemeteries, and archaeological sites and range in origin from the Early Archaic Period to the twentieth century. Of the cultural resources present within the Study Area,

183 are NRHP-eligible, 20 are potentially eligible, 5,654 have not been evaluated or require additional information to determine eligibility for the NRHP, and 2,087 are ineligible for listing. Thirteen recorded cultural resources are within the Study Area would be expected to be affected by the proposed WCS updates under Alternative A. Under Alternatives B, C, and RO, 20 recorded cultural resources within the Study Area would be expected to be affected by the proposed WCS updates. Additional recorded cultural resources could be indirectly impacted by the proposed WCS construction. The following is a discussion of the expected consequences of each proposed alternative for this project.

B.3.21.1 Future Without Project Conditions (No Action Alternative)

The No Action Alternative is expected to have adverse effects on cultural resources, including historic properties, within the Study Area. As there is no construction associated with the No Action Alternative, no short-term impacts to cultural resources due to construction are expected. The expected adverse effects to cultural resources associated with this alternative are related to the long-term impacts of flooding, storm surges, and sea level rise. SFWMD provided hydrological data for 7,934 of the cultural resources within the Study Area (**Table B.3-81**). Under the 25-year intermediate H&H scenario, 2,238 cultural resources would be predicted to not be impacted from flooding under the No Action Alternative. Under the 100-year maximum H&H scenario, 1,236 cultural resources would be predicted to not be impacted by flooding under the No Action Alternative. The increased risk of flooding or storm surges in areas with cultural resources increases the chances of damages that threaten the integrity of cultural resources that are listed, eligible, or have not been evaluated for the NRHP.

Table B.3-81. Summary of Hydrological Data in Association with Cultural Resources within the Study Area.

Depth of Predicted Flooding in Feet	Number of Cultural Resources Affected Intermediate 25 Year Storm Surge				Number of Cultural Resources Affected: Maximum 100 Year Storm Surge			
	No Action	Alternative A	Alternative B	Alternative C	No Action	Alternative A	Alternative B	Alternative C
0.000	2238	2289	2293	2280	1236	1268	1269	1268
0.001-0.500	3261	3306	3302	3295	1256	1272	1269	1271
0.501-1.000	1508	1467	1472	1479	937	921	918	911
1.001-1.500	503	467	462	474	504	529	524	509
1.501-2.000	210	195	195	195	565	574	545	527
2.001-2.500	100	98	98	98	674	625	654	641
2.501-3.000	30	26	27	27	689	671	672	653
3.001-3.500	10	13	12	13	611	595	600	623
3.501-4.000	9	9	9	9	379	391	391	421
4.001-4.500	11	11	11	11	227	229	230	237
4.501-5.000	6	5	5	5	161	162	165	170
5.001-5.500	6	7	7	7	140	131	138	143
5.501-6.000	7	7	6	6	188	202	195	194
6.001-6.500	10	9	11	9	170	166	166	168
6.501-7.000	21	21	20	22	77	80	80	79
7.001-7.500	4	4	4	4	56	55	55	56
7.501-8.000	-	-	-	-	10	10	8	8
8.001-8.500	-	-	-	-	4	3	5	5
8.501-9.000	-	-	-	-	3	3	3	3
9.001-9.500	-	-	-	-	6	7	6	4
9.501-10.000	-	-	-	-	11	12	11	12
10.001-10.500	-	-	-	-	8	6	8	9
10.501-11.000	-	-	-	-	7	7	7	7
11.001-11.500	-	-	-	-	11	11	11	11
11.501-12.000	-	-	-	-	4	4	4	4

B.3.21.2 Alternative A

The proposed updates to seven WCS under Alternative A are expected to result in short- and long-term impacts that would adversely affect cultural resources as compared to the No Action Alternative, specifically resources that are listed or are eligible for listing on the NRHP or have yet to be reviewed by the Florida SHPO. Of the 13 cultural resources (9 linear resources, 1 bridge, and 3 structures) associated with this alternative, 1 (Lock No. 1) is listed on the NRHP, 8 (G-08 [Hillsboro] Canal, Dixie Highway, Florida East Coast [FEC] Railway Tracks, FEC Bridge, G-15 [North New River] Canal, C-11 [South New River] Canal, Deerfield Lock, and S-13 Pump Station and Gated Spillway) are eligible for NRHP, and 4 (E-3 Canal, C-14 [Cypress Creek] Canal, C-13 [Middle River] Canal, and C-12 [Plantation] Canal) are ineligible.

Short-Term Impacts

Under Alternative A, the proposed updates for the G-56 Gated Spillway would be centered around the current structure. The hardening and resiliency improvements proposed for the WCS include replacing it with taller gates, new concrete caps over existing caps on top of the existing wingwalls, raising of the service bridge, and the addition of riprap around the spillway. As the updates to the WCS are centered around the existing spillway, all ground-disturbing activities, including staging, construction, installation of riprap, are expected to occur within the area previously disturbed during the 1991 construction of the G-56 Gated Spillway. Therefore, the proposed updates are not expected to have a direct effect to historic properties, specifically the G-08 (Hillsboro) Canal and Deerfield Lock.

The proposed hardening and resiliency improvements to the G-57 Gated Spillway under Alternative A are the same as for the G-56 Gated Spillway. In addition, two 10-foot culverts would be constructed. The ground-disturbing activities for these proposed updates consist of staging, construction, installation of riprap, and excavation of the culverts. The proposed alterations to the current spillways are expected to occur within the area previously disturbed during the 1987 construction of the spillway. The excavations of the culverts under the historic FEC railway tracks and Dixie Highway would create temporary ground disturbance at these historic properties, but will not adversely affect the integrity of these resources. The updates to the G-57 Gated Spillway are not expected to directly affect historic properties associated with the spillway.

Under Alternative A, the current S-37A Gated Spillway would be demolished and replaced with a longer, wider gated spillway. The proposed updates to the spillway call for demolition, staging, construction, shoreline expansion, and repaving. These ground-disturbing activities would likely extend outside the area previously disturbed during the 1959 construction of the spillway. The updates to the S-37A Gated Spillway would directly affect a historic property as a portion of the FEC railway track would need to be temporarily removed to pave the concrete railroad passing. While the construction efforts would temporarily affect the FEC railway tracks, the construction and repairs to the tracks would not adversely affect the historic property as the overall resource would retain its integrity.

Similarly, Alternative A calls for a longer, wider gated spillway to replace the current S-36 Gated Spillway; however, construction is not expected to directly affect any historic properties as the C-13 (Middle River) Canal is not eligible for the NRHP.

The proposed updates to the S-33 Gated Spillway under Alternative A include the construction of a new gated spillway and pump station 100 feet west of the existing structure and replacing the existing box culvert. The updates to the WCS would include demolition, shoreline expansion, construction, and staging. The updates are not expected to directly affect any historic structures, since the C-12 (Plantation) Canal is ineligible for the NRHP.

Under Alternative A, the proposed hardening and resiliency improvements to the G-54 Gated Spillway are the same as for the G-56 Gated Spillway and would be centered around the current structure. Staging, construction, and installation of riprap would result in ground disturbances; however, the area was previously disturbed by the 1992 construction of the current spillway. Therefore, the proposed updates to the G-54 Gated Spillway are not anticipated directly affect any historic properties, specifically the G-15 (North New River) Canal and Lock No. 1.

Under Alternative A, the S-13 Pump Station and Gated Spillway would be replaced by a new structure and a portion of the current bypass channel would be partially backfilled with soil. These updates call for demolition, shoreline expansion, soil replacement, construction, and staging that would result in ground disturbances throughout the construction area. As the new spillway structure would be located 250 feet west of the current structure, the proposed construction area is only partially associated with areas that were previously disturbed during the 1955 construction of the S-13 Pump Station and Gated Spillway. The proposed updates to the WCS are expected to have a direct effect to the C-11 (South New River) Canal, a historic property; however, these effects would be expected to be temporary as excavated materials would be backfilled, and the new structure would be reminiscent of those already present on the canal. Therefore, under Alternative A, there would be temporary impacts to the C-11 Canal, but these impacts would not result in adverse effects. The proposed updates would also have a direct effect to the S-13 Pump Station and Gated Spillway, the demolition of which would be an adverse effect as the structure has been determined eligible for listing in the NRHP as a contributing component of the NRHP-eligible South New River Canal (8BD4153).

Long-Term Impacts

The updates to seven WCS proposed in Alternative A are expected to indirectly impact historic properties within the Study Area as compared to the No Action Alternative. Over time, the increased pumping capacity of WCS with pump stations may result in changes in hydrology and material weathering that could adversely affect historic properties including the G-08 (Hillsboro) Canal, Deerfield Lock, G-15 (North New River) Canal, and C-11 (South New River) Canals, the FEC Bridge, and Lock No. 1.

Under the intermediate, 25-year H&H scenario, 2,289 cultural resources within the Study Area would be expected to not be impacted by flooding under Alternative A (**Table B.3-81**). This model shows that 51 additional cultural resources (or a 0.6428 percent increase) would not be expected to be impacted by the predicted intermediate 25-year storm surges. Under the maximum 100-year H&H scenario, 1,268 cultural within the Study Area would be expected to not be impacted by flooding under Alternative A. The 100-year maximum H&H model reveals an additional 32 cultural resources (or a 0.4034 percent increase) would be expected to not be impacted by flooding under Alternative A than the FWOP. A Benefits Analysis for the Study Area (**Appendix D**) further indicates that Alternative A is predicted to reduce the inundation impact to cultural resources in the Hillsboro Canal Basin, North New River Canal West Basin, and C-11 East Basin when compared to the FWOP. The changes to WCS proposed in

Alternative A would help to mitigate the long-term threat to cultural resources throughout the Study Area.

B.3.21.3 Alternative B

The proposed improvements under Alternative B are expected to result in short- and long-term impacts that are similar to those under Alternative A but would affect additional cultural resources as compared to the No Action Alternative. Of the 20 cultural resources (13 linear resources, 2 bridges, 2 archaeological sites, and 3 structures) associated with this Alternative, 1 is listed on the NRHP (Lock No. 1), 9 are NRHP-eligible (G-08 [Hillsboro] Canal, Dixie Highway, FEC Railway Tracks, FEC Bridge, G-15 [North New River] Canal, C-11 [South New River] Canal, Deerfield Lock, S-13 Pump Station and Gated Spillway, and the Seaboard Air Line Railroad), 6 are ineligible for the NRHP (E-1 Canal, E-3 Canal, C-14 [Cypress Creek] Canal, C-13 [Middle River] Canal, C-12 [Plantation] Canal, , and the Military Trail), and 4 are not evaluated (Hillsboro Canal Bridge, E-2 Canal, Site 8BD182, and Site 8BD183).

Short-Term Impacts

Under Alternative B, the G-56 Gated Spillway would be replaced by a new gated spillway 400 feet east of the existing structure and include 5.5 linear miles of canal dredging to improve water conveyance. These updates call for demolition, shoreline expansion, construction, dredging, and staging that would result in ground disturbances over the entire construction and dredging area. While the construction area only intersects with the G-08 (Hillsboro) Canal, the proposed dredging intersects with the canal in addition to the Deerfield Lock, Seaboard Air Line Railroad, and Hillsboro Canal Bridge. As the proposed spillway would be in a different location than the current structure, the construction footprint is expected to only partially occur within areas previously disturbed by the construction of the current G-56 Gated Spillway. The construction activities associated with the proposed spillway would have a direct effect on the G-08 (Hillsboro) Canal. In addition, the proposed dredging of over 5.5 linear miles would directly affect the G-08 (Hillsboro) Canal and the E-2 Canal. Dredging of the G-08 (Hillsboro) Canal would have a temporary impact on these resources because the excavated materials would be compacted, graded, and sodded within the existing canal. These impacts would not result in adverse effects as the overall character of the canal would be maintained. The proposed dredging would also directly affect the Deerfield Lock as the proposed action would intersect with the structure. The dredging in relation to the Deerfield Lock would not result in an adverse effect as the lock is ineligible for the NRHP as an individual structure. In contrast, the proposed dredging would not be expected to directly affect the Seaboard Air Line Railroad or Hillsboro Canal Bridge because all dredging activities would occur under both resources within the canal.

The proposed updates to the G-57 Gated Spillway under Alternative B include a new spillway approximately 150 feet northwest of the existing structure and the same culvert expansion that is proposed under Alternative A. The proposed improvements would not be expected to have any direct effects on historic properties as the C-14 (Cypress Creek) Canal is ineligible for the NRHP and all excavations for the culverts would occur beneath the Dixie Highway and FEC railway tracks.

Under Alternative B, the existing S-37B Gated Spillway would be replaced by a new gated spillway 215 feet north of the current structure and would include 1.2 linear miles of dredging in the C-14 (Cypress

Creek) Canal. There are no expected direct effects to historic properties associated with the proposed updates as the C-14 (Cypress Creek) Canal is not eligible for the NRHP.

Improvements for the current S-37A Gated Spillway are similar to those proposed under Alternative A. These updates would directly affect a historic property as a portion of the FEC railway track would need to be temporarily removed to pave the concrete railroad passing. While the construction efforts would temporarily affect the FEC railway tracks, the construction and repairs to the tracks would not adversely affect the historic property as the overall resource would retain its integrity.

Proposed updates to the S-36 Gated Spillway under Alternative B are similar to those proposed under Alternative A. Ground disturbances during construction are not expected to directly affect any historic properties, as the C-13 (Middle River) Canal is ineligible for the NRHP.

Like Alternative A, under Alternative B, the S-33 Gated Spillway would be replaced by a new gated spillway and pump station but the number of roller gates would increase and the existing box culvert would be removed. Construction would not result in direct effects to historic properties under Alternative B, as the C-12 (Plantation) Canal is not eligible for the NRHP.

Under Alternative B, the current G-54 Gated Spillway would be replaced by a new gated spillway 30 feet west of the existing structure. Some construction would occur in areas that were previously undisturbed. Therefore, the proposed improvements under Alternative B are expected to have a direct effect on the G-15 (North New River) Canal but are not expected to have a direct effect on the Lock No. 1 structure as construction and demolition are planned around the spillways and ancillary structures. The proposed dredging to the canal would have a temporary impact as the excavated materials would be compacted, graded, and sodded within the existing canal. These proposed changes to the canal would not result in an adverse effect as the overall character of the canal would remain the same.

Proposed updates to the S-13 Pump Station and Gated Spillway under Alternative B are the same as those proposed under Alternative A, with greater capacity pumps. The proposed updates to the WCS are expected to have a direct effect to cultural resources, specifically the C-11 (South New River) Canal and S-13 Pump Station and Gated Spillway. The proposed updates to the canal would be expected to have a temporary impact as excavated materials would be compacted, graded and sodded within the existing canal, and the new structure would be reminiscent of those already present on the canal. These impacts would not result in adverse effects as the overall character of the canal would be maintained. The proposed updates would also have a direct effect to the S-13 Pump Station and Gated Spillway; the demolition of the spillway would be an adverse effect since the structure has been determined eligible for listing in the NRHP, as a contributing component of the NRHP-eligible South New River Canal (8BD4153).

Additionally, 8.4 linear miles of canal improvements are proposed on the C-11 (South New River) Canal under Alternative B. The proposed dredging is expected to have a direct impact on a historic property. The proposed updates to the canal would be expected to be a temporary impact as excavated materials would be compacted, graded, and sodded within the existing canal. These impacts would not result in adverse effects.

The proposed construction of the Markham Park Stormwater Storage Capacity Improvement Project under Alternative B would include the construction of a new pump station and gate and upgrading

existing culverts. Ground-disturbing activities, including construction and staging, would result in potential adverse effects to the G-15 (North New River) Canal.

Long-Term Impacts

The proposed updates under Alternative B are expected to have a direct effect on cultural resources within the Study Area as compared to the No Action Alternative. While the construction of new WCS would not directly affect the FEC Bridge, Hillsboro Canal Bridge, FEC railway tracks, Seaboard Air Line Railroad, Dixie Highway, and Lock No. 1, the proposed updates would have indirect effects on these resources. There would also be expected indirect effects to the Deerfield Lock structure. The long-term impacts of construction, soil removal, and an increase in pump capacity of the spillways has the potential to change the hydrology of canals and increase material weathering, which would then threaten the integrity of the resources. In addition, the proposed pumping of stormwater from the G-15 (North New River) Canal to the Markham Park lake system associated with the new stormwater storage area is expected to adversely affect Sites 8BD182 and 8BD183, both burial mound sites, over time due to expected increased erosional activity resulting from the increased waterflow through the lake system.

Under the 25-year intermediate H&H scenario, 2,293 cultural resources would be expected to not be impacted by flooding under Alternative B (**Table B.3-81**). This model indicates that 55 additional cultural resources (or a 0.6932 percent increase) would be expected to not be impacted by intermediate flooding under Alternative B when compared to the No Action Alternative. Under the 100-year maximum H&H scenario, 1,269 cultural resources would be expected to not be impacted by flooding under Alternative B. The 100-year maximum model suggests that 33 more cultural resources (or a 0.416 percent increase) would not be expected to be impacted by flooding under Alternative B versus the No Action Alternative. A Benefits Analysis for the Study Area (**Appendix D**) further indicates that Alternative B is predicted to reduce the inundation impact to cultural resources in the Hillsboro Canal Basin, North New River Canal West Basin, and C-11 East Basin when compared to the No Action Alternative. Therefore, the changes proposed in Alternative B would help to mitigate the long-term threat to historic properties throughout the entire Study Area.

B.3.21.4 Alternative C

The proposed improvements under Alternative C are expected to result in short- and long-term impacts as compared to the No Action Alternative that are similar to those under Alternative B and would affect the same 20 cultural resources identified under Alternative B.

Short-Term Impacts

Improvements to the G-56 Gated Spillway under Alternative C are similar to those under Alternative B except a new pump station would also be constructed. The effects to historic properties are the same as under Alternative B.

Updates to the G-57 Gated spillway under Alternative C are similar to those under Alternative B except a new pump station would be constructed. No direct effect on historic properties is expected.

Improvements to the S-37A Gated Spillway under Alternative C are similar to those under Alternative B except the spillway would have additional gates and the pump station would have additional capacity.

This alternative includes 6.8 linear miles of dredging in the C-14 Canal. However, there are no historic properties associated with the construction area.

Updates to the S-36 Gated Spillway are similar to those proposed under Alternatives A and B. Three segments (approximately 0.1, 1.6, and 2.6 linear miles) of the C-13 (Middle River) Canal would be dredged to improve water conveyance. No historic properties are expected to be directly affected by these proposed actions as the C-13 (Middle River) Canal is not eligible for the NRHP and all dredging activities would occur under the Seaboard Air Line Railroad.

Under Alternative C, updates to the S-33 Gated Spillway are the same as under Alternative B except the pump station would have greater capacity. There would be no effect to historic properties.

The proposed improvements to the G-54 Gated Spillway under Alternative C are similar to those under Alternative B except a pump station would also be constructed and 13.9 linear miles of the G-15 (North New River) Canal would be dredged for improved water conveyance. The proposed actions would directly affect historic properties as Lock No. 1 would be demolished. The demolition of Lock No. 1 would adversely affect the historic property. The proposed dredging of the G-15 (North New River) Canal would temporarily impact the canal, but the resource would not be adversely affected as the overall character of the canal would be retained.

Updates to the S-13 Pump Station and Gated Spillway under Alternative C are the same as those proposed under Alternatives A and B but with greater capacity pumps. The proposed updates to the WCS are expected to have a direct effect to historic properties, specifically the C-11 (South New River) Canal and the S-13 Pump Station and Gated Spillway. The proposed updates to the canal would be expected to be a temporary impact as excavated materials would be compacted, graded, and sodded within the existing canal, and the new structure would be reminiscent of those already present on the canal. These impacts would not result in adverse effects as the overall character of the canal would be maintained. The proposed updates would also have a direct effect to the S-13 Pump Station and Gated Spillway; the demolition of the spillway would be an adverse effect as the structure has been determined eligible for listing in the NRHP as a contributing component of the NRHP-eligible South New River Canal (8BD4153).

Canal conveyance improvements under Alternative C in the C-14 (Cypress Creek) Canal are not expected to directly affect any historic properties as the C-14 (Cypress Creek) Canal is not eligible for the NRHP. However, the proposed 8.4 linear miles of dredging on the C-11 (South New River) Canal would have a direct impact. The proposed updates to the canal would be expected to be a temporary impact as excavated materials would be compacted, graded, and sodded within the existing canal.

Effects from the proposed Markham Park Stormwater Storage Capacity Improvement Project are the same as under Alternative B, with potential adverse effects to the G-15 (North New River) Canal.

The construction of the Hillsboro Watershed Stormwater Storage Capacity Improvement Project under Alternative C would include the construction of two pump stations, a perimeter levee and seepage canal, an overflow weir structure, and a gated outflow structure that interacts with the G-08 (Hillsboro) Canal. The proposed action would require construction and staging that would result in ground disturbances throughout the proposed construction area. The proposed new structures would not result

in an adverse effect to the G-08 (Hillsboro) Canal because the new structures would be reminiscent of those already present on the canal.

Long-Term Impacts

Effects to historic properties under Alternative C are similar to those under Alternative B. While the construction of new WCS would not directly affect the FEC Bridge, Hillsboro Canal Bridge, FEC railway tracks, Seaboard Air Line Railroad, and Dixie Highway, the proposed updates would have indirect effects on these resources. There would also be expected indirect effects to the Deerfield Lock structure. The long-term impacts of construction, soil removal, and increase in pump capacity of the spillways has the potential to change the hydrology and increase material weathering, which would then threaten the integrity of the resources. In addition, changes in hydrology over time would further threaten the integrity of the G-08 (Hillsboro) Canal, G-15 (North New River) Canal, and C-11 (South New River) Canal. In addition, the proposed pumping of stormwater from the G-15 (North New River) Canal to the Markham Park lake system associated with the new stormwater storage area is expected to adversely affect Sites 8BD182 and 8BD183, both burial mound sites, over time due to expected increased erosional activity resulting from the increased waterflow through the lake system.

Under the 25-year intermediate H&H scenario, 2,280 cultural resources would be expected to not be impacted by flooding under Alternative C. This model suggests that an additional 42 cultural resources (or a 0.5264 percent increase) would not be expected to be at risk of flooding due to storm surges when compared to the FWOP. Under the 100-maximum H&H scenario, 1268 cultural resources would be expected to not be impacted by flooding due to storm surges. The additional 32 expected to not experience flood inundation is a 0.4034 percent increase when compared to the FWOP. A Benefits Analysis (**Appendix D**) further shows that Alternative C is predicted to provide the highest reduction of inundation to the Hillsboro Canal Basin, North New River Canal West Basin, and C-11 East Basin when compared to Alternatives A and B and the FWOP. However, the Benefit Analysis also found that while Alternative C would be expected to provide the highest reduction in inundation of cultural resources, the expected reductions associated with Alternatives A and B were close to that of Alternative C. The changes proposed in Alternative C are expected to help mitigate the long-term threat the historic properties throughout the entire Study Area when compared to the FWOP.

B.3.21.5 Alternative RO

The proposed improvements under Alternative RO are expected to result in short- and long-term impacts as compared to the No Action Alternative. Of the 20 cultural resources (13 linear resources, 2 bridges, 2 archaeological sites, and 3 structures) associated with Alternative RO, 1 is listed on the NRHP (Lock No. 1), 9 are NRHP-eligible (G-08 [Hillsboro] Canal, Dixie Highway, FEC Railway Tracks, FEC Bridge, G-15 [North New River] Canal, C-11 [South New River] Canal, Deerfield Lock, S-13 Pump Station and Gated Spillway, and the Seaboard Air Line Railroad), 6 are ineligible for the NRHP (E-1 Canal, E-3 Canal, C-14 [Cypress Creek] Canal, C-13 [Middle River] Canal, C-12 [Plantation] Canal, , and the Military Trail), and 4 are not evaluated (Hillsboro Canal Bridge, E-2 Canal, , Site 8BD182, and Site 8BD183).

Short-Term Impacts

Under Alternative RO, the G-56 Gated Spillway would be replaced by a new gated spillway 400 feet east of the existing structure and include 1.1 linear miles of canal dredging to improve water conveyance. These updates call for demolition, shoreline expansion, construction, dredging, and staging that would result in ground disturbances over the entire construction and dredging area. While the construction area only intersects with the G-08 (Hillsboro) Canal, the proposed dredging intersects with the canal in addition to the Deerfield Lock, Seaboard Air Line Railroad, and Hillsboro Canal Bridge. As the proposed spillway would be in a different location than the current structure, the construction footprint is expected to only partially occur within areas previously disturbed by the construction of the current G-56 Gated Spillway. The construction activities associated with the proposed spillway would have a direct effect on the G-08 (Hillsboro) Canal. In addition, the proposed dredging of over 1.1 linear miles would directly affect the G-08 (Hillsboro) Canal and the E-2 Canal. Dredging of the G-08 (Hillsboro) Canal would have a temporary impact on these resources because the excavated materials would be compacted, graded and sodded within the existing canal. These impacts would not result in adverse effects as the overall character of the canals would be maintained. The proposed dredging would also directly affect the Deerfield Lock as the proposed action would come intersect with the structure. The dredging in relation with the Deerfield Lock would not result in an adverse effect as the lock is ineligible for the NRHP as an individual structure. In contrast, the proposed dredging would not be expected to directly affect the Seaboard Air Line Railroad or Hillsboro Canal Bridge because all dredging activities would occur under both resources within the canal.

The proposed updates to the G-57 Gated Spillway under this alternative include a new spillway approximately 150 feet northwest of the existing structure and expansion of culverts. The proposed improvements would not be expected to have any direct effects on historic properties as the C-14 (Cypress Creek) Canal is ineligible for the NRHP and all excavations for the culverts would occur beneath the Dixie Highway and FEC railway tracks.

Under Alternative RO, the existing S-37B Gated Spillway would be replaced by a new gated spillway 215 feet north of the current structure and would include 1.2 linear miles of dredging in the C-14 (Cypress Creek) Canal. There are no expected direct effects to historic properties associated with the proposed updates as the C-14 (Cypress Creek) Canal is not eligible for the NRHP.

The proposed alternative calls for the current S-37A Gated Spillway to be demolished and replaced with a longer, wider gated spillway. The proposed updates to the spillway call for demolition, staging, construction, shoreline expansion, and repaving. These ground-disturbing activities would likely extend outside the area previously disturbed during the 1959 construction of the spillway. The updates to the S-37A Gated Spillway would directly affect a historic property as a portion of the FEC Railway track would need to be temporarily removed to pave the concrete railroad passing. While the construction efforts would temporarily affect the FEC railway tracks, the construction and repairs to the tracks would not adversely affect the historic property as the overall resource would retain its integrity. Construction would not be expected to affect the FEC bridge.

Under Alternative RO, the updates to the S-36 Gated Spillway would include a longer, wider gated spillway to replace the current structure. Construction, however, is not expected to directly affect any historic properties as the C-13 (Middle River) Canal is not eligible for the NRHP. Ground disturbances

during construction are not expected to directly affect any historic properties, as the C-13 (Middle River) Canal is ineligible for the NRHP.

For Alternative RO, the S-33 Gated Spillway would be replaced by a new gated spillway and pump station with the construction of roller gates and the existing box culvert being removed. Construction would not result in direct effects to historic properties under this plan, as the C-12 (Plantation) Canal is not eligible for the NRHP.

Under Alternative RO, the current G-54 Gated Spillway would be replaced by a new gated spillway 30 feet west of the existing structure that includes the construction of a new pump station. Some construction would occur in areas that were previously undisturbed. The proposed actions would directly affect historic properties as Lock No. 1 would be demolished. The remaining structure at Lock #1 is too close to the proposed new G-54 Pump Station, and the required canal excavation and retaining wall construction cannot be completed without removing it. Demolition would ensure that the pump station can be built and function properly within the canal ROW. As a result, under Alternative RO, Lock No. 1 would be adversely affected. Dredging of the G-15 (North New River) Canal would result in a temporary impact on the resource as all dredged material would be compacted, graded, and sodded within the canal. These impacts would not adversely affect the G-15 Canal as the overall character of the resource would be retained.

Under Alternative RO, the updates for the S-13 Pump Station and Gated Spillway would be the same as those proposed under Alternative B. The proposed updates to the WCS are expected to have a direct effect to historic properties, specifically the C-11 (South New River) Canal and S-13 Pump Station and Gated Spillway. The proposed updates to the canal would be expected to have a temporary impact as excavated materials would be compacted, graded and sodded within the existing canal, and the new structure would be reminiscent of those already present on the canal. The proposed updates would also have a direct effect to the S-13 Pump Station and Gated Spillway; the demolition of the spillway would be an adverse effect as the structure has been determined eligible for listing in the NRHP as a contributing component of the NRHP-eligible South New River Canal (8BD4153).

Additionally, 2.0 linear miles of canal improvements are proposed on the C-11 (South New River) Canal under Alternative RO. The proposed dredging is expected to have a direct impact on a historic property. The proposed updates to the canal would be expected to be a temporary impact as excavated materials would be compacted, graded and sodded within the existing canal.

Long-Term Impacts

The proposed updates under Alternative RO are expected to have additional indirect effects on historic properties and cultural resources within the Study Area. While the construction of new WCS would not directly affect the FEC Bridge, Hillsboro Canal Bridge, FEC railway tracks, Seaboard Air Line Railroad, and Dixie Highway, the proposed updates would have a long-term impact on these resources. There would also be expected indirect effects to the Deerfield Lock structure. The long-term impacts of construction, soil removal, and an increase in pump capacity of the spillways has the potential to change the hydrology of canals and increase material weathering, which would then threaten the integrity of the resources.

Quantitative data from the 25-year intermediate H&H scenario and 100-year maximum H&H scenario show that Alternatives A, B, and C resulted in an increase in the number of cultural resources that would not be impacted by water inundation when compared to the FWOP. In addition, a Benefits Analysis for cultural resources (**Appendix D**) found that Alternative RO would ultimately yield comparable or greater reduction of inundation to cultural resources across the two modeled flooding scenarios when compared to Alternatives A, B, and C. The hybrid model proposed for Alternative RO is likely to result in an expected reduction of water inundation to cultural resources when compared to the FWOP. Alternative RO also has the potential to reduce the number of cultural resources that would experience inundation when compared to Alternatives A, B, and C.

B.3.21.6 Summary of Environmental Consequences and Cumulative Effects

An analysis of the cultural resources within the Study Area indicates each of the action alternatives has short- and long-term impacts that could adversely affect historic properties. The predictive models of peak sea level rise elevations when compared to the presence of cultural resources demonstrates the alternatives would have mitigating effects to some cultural resources threats. There would be no mitigating effects under the No Action Alternative.

B.4 Environmental Compliance

The National Environmental Policy Act (NEPA) of 1969, as amended (42 U.S.C. 4321 *et seq.*; 85 Federal Register [FR] 43304) mandates that federal agencies evaluate the environmental effects of proposed actions as part of their decision-making process. USACE prepared this environmental assessment in compliance with USACE NEPA regulations outlined in 33 Code of Federal Regulations (CFR) Part 230 and the *Department of Defense National Environmental Policy Act Implementing Procedures* (90 FR 27857, June 30, 2025). As part of this process, USACE has also reviewed the applicability of other relevant federal laws, regulations, and executive orders. Where applicable, USACE has conducted the necessary consultations and coordination to ensure compliance with these statutes.

B.4.1 Environmental Laws

The following federal laws were considered when preparing this environmental assessment.

B.4.1.1 Abandoned Shipwreck Act of 1987 (43 United States Code (U.S.C.) §§ 2101-2106)

The Abandoned Shipwreck Act protects historic shipwrecks in U.S. waters from treasure hunters and unauthorized salvage by establishing federal government ownership over most abandoned shipwrecks in U.S. rivers and lakes, and in oceans from shore to 3 miles.

B.4.1.2 American Indian Religious Freedom Act (42 U.S.C § 1996 and 1996a)

The American Indian Religious Freedom Act protects and preserves their inherent right of American Indians to believe, express, and exercise their traditional religions, including but not limited to accessing sites, use and possession of sacred objects, and worship through ceremonials and traditional rites.

B.4.1.3 Anadromous Fish Conservation Act of 1965 (16 U.S.C. § 757a et seq.)

The Anadromous Fish Conservation Act authorizes a cooperative, intergovernmental program to conserve, develop and enhance runs of anadromous fish species that migrate from saltwater into freshwater to spawn.

B.4.1.4 Antiquities Act of 1906 (54 U.S.C. §§ 320301-320303)

The Antiquities Act provides protection of natural and cultural resources and treasures on federal lands. It authorizes proclamation of national monuments, historic and prehistoric structures or objects of historic or scientific interest on federal lands; protects natural and historic features; and provides for investigation of the sites.

B.4.1.5 Archaeological and Historic Preservation Act of 1974 (54 U.S.C. §§ 312501-312508)

The Archaeological and Historic Preservation Act mandates that federal agencies take steps to recover and preserve significant archaeological and historic information threatened by federal activities, ensuring that valuable cultural resources are not lost without documentation.

B.4.1.6 Archaeological Resources Protection Act of 1979, as amended (16 U.S.C. §§ 470aa – 470mm)

The Archaeological Resources Protection Act of 1979 protects archaeological resources on public and Indian lands by requiring permits for excavation or removal and by establishing criminal and civil penalties for unauthorized activities such as looting or trafficking. It also safeguards sensitive site information, establishes federal ownership and curation requirements for recovered materials, and provides uniform enforcement authority across federal land-managing agencies.

B.4.1.7 Bald Eagle and Golden Eagle Protection Act of 1940, as amended (16 U.S.C. §§ 668-668d)

The Bald and Golden Eagle Protection Act safeguards eagle species by prohibiting unauthorized take or disturbance and enabling regulated, responsible use and management through a federal permitting system.

B.4.1.8 Clean Air Act of 1972, as amended (42 U.S.C. § 7401 et seq.)

The Clean Air Act is a comprehensive law designed to regulate air emissions from stationary and mobile sources to protect public health and the environment. The Act authorizes the EPA to establish National Ambient Air Quality Standards to regulate emissions of hazardous air pollutants.

B.4.1.9 Clean Water Act of 1972, as amended (33 U.S.C. § 1251 et seq.)

Section 401 and 404 of the Clean Water Act, and 33 CFR 336(c)(4) and 33 CFR 320.4(b), require the USACE to avoid, minimize, and mitigate impacts to wetlands.

B.4.1.10 Coastal Barrier Resources Act (P.L. 97-348 and 16 U.S.C. § 3501 et seq.) and Coastal Barrier Improvement Act of 1990

Congress passed the Coastal Barrier Resources Act, which established the Coastal Barrier Resources System “to minimize the loss of human life, wasteful expenditure of Federal revenues, and the damage to fish, wildlife, and other natural resources associated with coastal barriers.” The Coastal Barrier Resources System is composed of parts of coastal areas along the Atlantic Ocean, Gulf of America, Great Lakes, Puerto Rico, and U.S. Virgin Islands.

B.4.1.11 Coastal Zone Management Act of 1972, as amended (16 U.S.C. § 1451 et seq.)

The Coastal Zone Management Act governs how states and territories plan for, protect, and responsibly develop their coastal resources. It established a voluntary partnership under which coastal states and territories can receive federal financial and technical assistance to create and implement Coastal Zone Management Programs that address ecological protection, hazard mitigation, public access, and sustainable development.

B.4.1.12 Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986 (42 U.S.C. § 9601 et seq.)

The Comprehensive Environmental Response, Compensation, and Liability Act provides federal authority to respond to releases or threatened releases of hazardous substances that may endanger the public or environment.

B.4.1.13 Deepwater Port Act of 1974, as amended (33 U.S.C. § 1501)

The Deepwater Port Act establishes a planning and licensing system for import and export of oil and natural gas deepwater port structures located beyond the U.S. territorial sea, including minimizing adverse impacts on the marine environment.

B.4.1.14 Emergency Wetlands Resources Act (16 U.S.C. §§ 3901-3932)

The Emergency Wetlands Resources Act provides for fee collections that may be used for refuge operations and maintenance, a national wetlands priority conservation plan, and completing NWI maps.

B.4.1.15 Endangered Species Act of 1973 (16 U.S.C. § 1531)

The ESA establishes protections for fish, wildlife, and plants that are listed as threatened or endangered; provides for adding species to and removing them from the list of threatened and endangered species, and for preparing and implementing plans for their recovery; and provides for interagency cooperation to avoid take of listed species and for issuing permits for otherwise prohibited activities.

B.4.1.16 Estuary Protection Act (16 U.S.C. 1221-1226)

This Act promotes a coordinated Federal approach to estuary habitat restoration activities, provides for a national estuary habitat restoration strategy, encourages estuary habitat restoration partnerships and establishes the Estuary Habitat Restoration Council.

B.4.1.17 Estuary Restoration Act (P.L. 106–457)

The Estuary Restoration Act addresses accelerating wetland losses and ongoing damage from development, silting, and contamination. The Estuary Restoration Act promotes a coordinated federal approach to estuary habitat restoration; encourages public and private sector partnerships; assists estuary habitat restoration projects, including monitoring and research; and supports estuary restoration projects.

B.4.1.18 Farmland Protection Act of 1981 (7 U.S.C. § 4201 et seq.)

The Farmland Protection Act is aimed at minimizing the unnecessary conversion of productive farmland to non-agricultural uses, especially when federal actions are involved.

B.4.1.19 Federal Water Project Recreation Act of 1965 (16 U.S.C. § 460l-12 et seq)

The Federal Water Project Recreation Act ensures the inclusion and development of recreational facilities and opportunities at federal water resource projects, such as dams, reservoirs, and flood control structures.

B.4.1.20 Fish and Wildlife Coordination Act of 1958, as amended (16 U.S.C. §§ 661-666e)

The Fish and Wildlife Coordination Act requires the consideration and protection of fish and wildlife resources in the planning and execution of water resource development projects.

B.4.1.21 Historic, Archeologic, or Prehistoric Items and Antiquities (18 U.S.C. § 1866(b))

This statute criminalizes appropriating, excavating, injuring, or destroying antiquities when those objects or ruins are “situated on land owned or controlled by the Federal Government.”

B.4.1.22 Land and Water Conservation Act of 1965 (16 U.S.C. § 460)

The Land and Water Conservation Act ensures availability of outdoor recreation opportunities for the public. It supports planning, acquisition, and development of land and water recreation resources.

B.4.1.23 Magnuson-Stevens Fishery Conservation and Management Act, as amended (16 U.S.C. § 1801 et seq.)

The Magnuson-Stevens Fishery Conservation and Management Act reflects the Secretary of Commerce’s and Fishery Management Councils’ authority and responsibilities for the protection of EFH. Federal agencies that fund, permit, or carry out activities that may adversely impact EFH are required to consult with the NMFS regarding the potential effects of their actions on EFH.

B.4.1.24 Marine Mammal Protection Act of 1972, as amended (16 U.S.C. § 1361 et seq.)

The Marine Mammal Protection Act conserves marine mammal populations and protects them from extinction or depletion due to human activities, and ensures marine mammals remain “a significant functioning element in the ecosystem” and at “optimum sustainable populations” to maximize productivity.

B.4.1.25 Marine Protection, Research, and Sanctuaries Act of 1972 (33 U.S.C. § 1401 et seq.)

Also known as the Ocean Dumping Act, the Marine Protection, Research, and Sanctuaries Act regulates the disposition of material into oceans, including dumping of materials that would degrade or endanger human health, welfare, or amenities, the marine environment, ecological systems, or economic potential. The act bans the disposal of radiological, chemical, and biological warfare agents, high-level radioactive wastes, medical wastes, sewage sludge, and industrial wastes.

B.4.1.26 Migratory Bird Conservation Act of 1928, as amended (16 U.S.C. § 715)

The Migratory Bird Conservation Act authorizes the Secretary of the Interior to conduct investigations and publish documents related to North American birds, and establishes a Migratory Bird Conservation Commission to approve areas recommended by the Secretary for acquisition. The Migratory Bird

Conservation Commission also approves wetlands conservation projects recommended by the North American Wetlands Conservation Council under the North American Wetlands Conservation Act.

B.4.1.27 Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. §§ 703-712)

The Migratory Bird Treaty Act protects migratory birds by prohibiting unauthorized take and trade, implementing international treaties, and enabling regulated use through a permitting system.

B.4.1.28 National Environmental Policy Act of 1969, as amended (42 U.S.C. § 4321 et seq.)

The National Environmental Policy Act requires that all federal agencies integrate and assess the environmental effects of their proposed actions. An environmental impact statement must be prepared for any major federal action likely to have a significant effect on the quality of the human environment. For federal actions that do not have significant impacts and are not eligible for a categorical exclusion, an environmental assessment is required. National Environmental Policy Act regulations include a scoping process designed to determine the scope and importance of environmental issues related to a project. This process helps identify and exclude issues that are not significant from further detailed analysis.

B.4.1.29 National Historic Preservation Act of 1966, as amended (54 U.S.C. § 300101 et seq.)

Section 106 of the National Historic Preservation Act requires federal agencies to consider the effects of their undertakings on historic properties and afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on such undertakings. Section 101(d)(6)(B) of the Act requires consultation with any Indian Tribe or Native Hawaiian organization that attaches religious and cultural significance to historic properties that may be affected by an undertaking. Section 106 seeks ways to avoid, minimize, or mitigate any adverse effects on historic properties and to accommodate historic preservation concerns with the needs of federal undertakings.

B.4.1.30 Native American Graves Protection and Repatriation Act of 1990, as amended (25 U.S.C. § 3001 et seq.)

The Native American Graves Protection and Repatriation Act recognizes the rights of lineal descendants, Indian Tribes, and Native Hawaiian organizations with regard to Native American human remains, funerary objects, sacred objects, and objects of cultural patrimony. The act provides systematic processes to protect Native American human remains, funerary objects, sacred objects, and objects of cultural patrimony; restore Native American human remains, funerary objects, sacred objects, and objects of cultural patrimony to lineal descendants, Indian Tribes, and Native Hawaiian organizations; requires consultation with lineal descendants, Indian Tribes, and Native Hawaiian organizations; and requires deference to the Native American traditional knowledge of lineal descendants, Indian Tribes, and Native Hawaiian organizations. Federal agencies must inventory all Native American human remains and funerary objects in their possession and control, attempt to identify the affiliated Tribe(s), and repatriate the items to the appropriate group including inadvertent discoveries.

B.4.1.31 Noise Control Act of 1972, as amended (42 U.S.C. § 4901 et seq.)

The Noise Control Act regulates noise pollution to protect public health and welfare by establishing and enforcing noise emission standards for various sources of noise, including machinery, vehicles, and industrial equipment. Its primary goal is an environment free from excessive noise that can harm human health or interfere with quality of life.

B.4.1.32 Protect and Restore America's Estuaries Act (P.L. 116-337)

The Protect and Restore America's Estuaries Act addresses effect of recurring extreme weather events on estuaries including identifying and assess vulnerabilities and developing and implementing adaptation strategies.

B.4.1.33 Resource Conservation and Recovery Act, as amended by the Hazardous and Soils Waste Amendments of 1984 (42 U.S.C. § 6901 et seq.)

The Resource Conservation and Recovery Act controls generation, transportation, treatment, storage and disposal of hazardous waste through regulation of management and cleanup of solid and hazardous waste and encouraging waste reduction and beneficial reuse.

B.4.1.34 Rivers and Harbors Act of 1899, as amended (33 U.S.C. §§ 401 et seq.)

The Rivers and Harbors Act protects navigation, considers the public interest, and protects and utilizes the nation's waters by balancing favorable effects of actions within U.S. waters against detrimental effects. Section 9 prohibits construction of any bridge, dam, dike, or causeway crossing over or in navigable waters. Section 10 prohibits unauthorized obstruction or alteration of including construction of any structure in or over a navigable water, excavating or depositing material in navigable waters, or affecting a navigable water's course, location, condition, or capacity. Section 11 establishes harbor lines channelward of which no piers, wharves, bulkheads, or other works may be extended or deposits made without a Department of Army permit issued pursuant to Section 404 of the Clean Water Act.

B.4.1.35 Safe Drinking Water Act of 1974, as amended (42 U.S.C. §§ 300f-300j)

The Safe Drinking Water Act protects public health by regulating the nation's public drinking water supply. It authorizes the EPA to set national standards for drinking water quality and oversees states, localities, and water suppliers to ensure that these standards are met.

B.4.1.36 Submerged Lands Act of 1953 (43 U.S.C. § 1301)

The Submerged Lands Act transferred ownership and jurisdiction over submerged lands and natural resources from the federal government to the coastal states. In Florida, submerged lands within state boundaries are governed by the State of Florida through the Board of Trustees of the Internal Improvement Trust Fund and managed primarily by the Florida Department of Environmental Protection. These entities oversee leasing, permitting, conservation, and public use consistently with the act and state laws.

B.4.1.37 Toxic Substances Control Act of 1976 (15 U.S.C. § 2601 et seq.)

The Toxic Substances Control Act requires reporting, record-keeping, testing requirements and restrictions related to chemical substances and/or mixtures, their manufacture, processing or distribution.

B.4.1.38 Uniform Relocation and Assistance and Real Property Acquisition Policies Act (42 U.S.C. § 4601 et seq.)

The Uniform Relocation and Assistance and Real Property Acquisition Policies Act ensures fair and equitable treatment of persons and businesses displaced or whose property is acquired by the government for federal or federally-assisted projects. The act ensures that people and businesses displaced by federal or federally-assisted projects receive fair compensation and appropriate relocation assistance, promoting equitable treatment and minimizing hardship during government property acquisitions.

B.4.1.39 Wild and Scenic Rivers Act of 1968, as amended (16 U.S.C. §§ 1271-1287)

The Wild and Scenic Rivers Act establishes a national wild and scenic rivers system to preserve and safeguard rivers with natural, cultural, and recreational values as free-flowing.

Table B.4-1 provides a summary of how the C&SF Section 203 Study's Recommended Plan is in compliance with each applicable federal law.

Table B.4-1. Recommended Plan Compliance with Environmental Laws.

Law (Citation)	Compliance Status
Abandoned Shipwreck Act of 1987 (43 U.S.C. §§ 2101-2106)	Not Applicable No abandoned shipwrecks have been identified in the project area.
American Indian Religious Freedom Act (432 U.S.C. § 1996 and 1996a)	Not applicable No sites of traditional religious significance are located within the area of potential effects nor does the proposed action interfere with freedom of worship.
Anadromous Fish Conservation Act of 1965 (16 U.S.C. § 757a et seq.)	In Compliance No adverse effects to anadromous fish species have been identified.
Antiquities Act of 1906 (154 U.S.C. §§ 320301-320303)	Not applicable No federal lands are affected by this action.
Archaeological and Historic Preservation Act(54 U.S.C. §§ 312501-312508)	Not Applicable: The Recommended Plan does not occur on Federally or Tribally owned lands.
Archaeological Resources Protection Act of 1979 , as amended (16 U.S.C. §§ 470aa – 470mm)	In Compliance: There are no archaeological resources affected within the Recommended Plan.
Bald and Golden Eagle Protection Act of 1940, as amended (16 U.S.C. §§ 668-668d)	In Compliance Six known bald eagle nests are located in the C&SF Section 203 Study Area. The nests are located more than 660 feet from areas where construction would occur under the Recommended Plan.
Clean Air Act of 1972, as amended (42 U.S.C. § 7401 et seq.)	In Compliance The Study Area is within National Ambient Air Quality Standards attainment at the time of this document. New air emissions sources that might result from construction or operation of the

Law (Citation)	Compliance Status
	Recommended Plan will be permitted as required. The need for air permitting will be assessed on completion of Preconstruction Engineering and Design and if required, obtained before beginning operations.
Clean Water Act of 1972, as amended (33 U.S.C. § 1251 <i>et seq.</i>)	In Compliance The Florida Department of Environmental Protection (FDEP) stated through email from the Florida State Clearinghouse (March 13, 2026) that FDEP reviewed the project and concluded it should not compromise state water quality standards if all permitting requirements are met. Section 404 permits, Section 401 water quality certifications, with a Section 402 National Pollutant Discharge Elimination System permit if appropriate, will be obtained prior to construction activities.
Coastal Barrier Resources Act (P.L. 97-348 and 16 U.S.C. § 3501 <i>et seq.</i>) and Coastal Improvement Act of 1990 (P.L. 101-591)	Not Applicable Coastal Barrier Resources System maps indicate the proposed Recommended Plan features are not within a designated Coastal Barrier Resources Act area.
Coastal Zone Management Act of 1972, as amended (16 U.S.C. § 1451 <i>et seq.</i>)	In Compliance The Coastal Zone Management Act consistency determination has been prepared for the Recommended Plan. Refer to Section B.4.4 . USACE received concurrence from FDEP on March 13, 2026, that the project is consistent with the Florida Coastal Management Program.
Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986 (42 U.S.C. § 9601 <i>et seq.</i>)	Not Applicable There are no Superfund sites in the Project Area. The Florida Department of Environmental Protection will be engaged if materials regulated under this act are identified in any Recommended Plan construction locations.
Deepwater Port Act of 1974, as amended (33 U.S.C. § 1501)	Not Applicable No deepwater ports are located in the Study Area.
Emergency Wetlands Resources Act (16 U.S.C. §§ 3901-3932)	Not Applicable Provisions for wetlands acquisition, conservation, and mapping, and migratory birds and their habitat, are not applicable to the C&SF Section 203 Study.
Endangered Species Act of 1973 (16 U.S.C. § 1531)	In Compliance USACE completed informal Endangered Species Act Section 7 consultation with USFWS on February 26, 2026, in which USFWS concurred with USACE's "May Affect Not Likely to Adversely Affect" determinations for federally listed species and "No Adverse Modification" determination for proposed critical habitat in the Study Area. USACE completed informal Endangered Species Act Section 7 consultation with NMFS on March 9, 2026, in which NMFS concurred with USACE's "No Effect" and "May Affect Not Likely to Adversely Affect" determinations for federally listed species and "No Adverse Modification" determination for proposed critical habitat in the Study Area.
Estuary Protection Act of 1978 (16 U.S.C. 1221-1226)	Not Applicable Hydrologic and hydraulic modeling analysis demonstrates operational changes in water management will largely be observed as changes in discharge timing. There would be minimal expected change in the overall variability of the flow regime experienced by downstream systems. WCS discharges are sent into downstream canals and the ICW rather than ecologically sensitive bays or lagoons. These receiving bodies are adapted to salinity, water quality, and temperature conditions created by WCS discharges. The Comprehensive Everglades Restoration Program has not

Law (Citation)	Compliance Status
	identified ecosystem-based flow targets for seagrasses, spawning areas, or salinity transition zones for any of Broward County's canal downstream areas. Given the nature of these receiving water bodies, there would not be any adverse operational effects to estuaries as a result of operation of the Recommended Plan.
Estuary Restoration Act of 2000 (P.L. 106-457)	Not Applicable No estuaries will be directly affected by the Recommended Plan.
Farmland Protection Policy Act of 1981 (7 U.S.C. § 4201 <i>et seq.</i>)	Not Applicable No conversion of farmland to non-agricultural uses proposed under the Recommended Plan.
Federal Water Project Recreation Act of 1965 (16 U.S.C. § 460I-12 <i>et seq.</i>)	In Compliance Construction may temporarily adversely affect recreational opportunities in small portions of the Study Area, where Recommended Plan features will be constructed. Recreation opportunities will return to pre-project conditions upon completion of construction.
Fish and Wildlife Coordination Act of 1958, as amended (16 U.S.C. §§ 661-666e)	In Compliance On February 4, 2026, a Memorandum For The Record was issued to document an informal understanding between the USACE and USFWS agreeing to utilize the NEPA review process to complete coordination responsibilities under the FWCA. The USFWS would include comments relevant to the FWCA in the USFWS review and response to the Draft IFS/EA.
Historic, Archeologic, or Prehistoric Items and Antiquities (18 U.S.C. § 1866(b))	Not Applicable No federal lands are affected by this action.
Land and Water Conservation Act of 1970 (16 U.S.C. § 460)	Not Applicable The Recommended Plan will not affect recreational opportunities upon completion of construction or during operations.
Magnuson-Stevens Fishery Conservation and Management Act, as amended (16 U.S.C. § 1801 <i>et seq.</i>)	In Compliance An Essential Fish Habitat (EFH) Assessment, which is integrated into this Feasibility Study and Environmental Assessment, evaluates the potential effects of constructing and operating the Recommended Plan on EFH and came to a "No Adverse Effect" determination. USACE sent a Notice of Availability to NMFS on January 21, 2026. NMFS provided EFH conservation recommendations to USACE on March 16, 2026. USACE responded to the EFH conservation recommendations on April 8, 2026, completing Magnuson-Stevens Fishery Conservation and Management Act coordination. NMFS EFH correspondence and a comment-response matrix that includes USACE responses to NMFS are provided in Appendix J .
Marine Mammal Protection Act of 1972, as amended (P.L. 92-522 and 16 U.S.C. § 1361 <i>et seq.</i>)	In Compliance Manatee best management practices will be implemented during construction and operations. Effects to the manatee are expected to be de minimis or discountable.
Marine Protection, Research, and Sanctuaries Act of 1972 (33 U.S.C. § 1401 <i>et seq.</i>)	Not Applicable Ocean disposal is not a component of the Recommended Plan.
Migratory Bird Conservation Act of 1928, as amended (16 U.S.C. § 715)	In Compliance Effects on migratory birds from the construction and operation of the Recommended Plan are expected to be negligible to minor and include beneficial and adverse effects. Migratory bird surveys will be conducted prior to construction to confirm presence and effects to migratory birds.
Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. §§ 703-712)	In Compliance

Law (Citation)	Compliance Status
	Effects on migratory birds from the construction and operation of the Recommended Plan are negligible to minor and include beneficial and adverse effects. Migratory bird surveys will be conducted prior to construction to confirm presence and effects to migratory birds.
National Environmental Policy Act of 1969, as amended (42 U.S.C. § 4321 <i>et seq.</i>)	In Compliance This environmental assessment has been prepared for the C&SF Section 203 Study and has resulted in a Finding of No Significant Impact (FONSI).
National Historic Preservation Act of 1966, as amended (54 U.S.C. § 300101 <i>et seq.</i>)	In Compliance Consultation with the Florida SHPO, Seminole Tribe of Florida, Miccosukee Tribe of Indians, Thlopthlocco Tribal Town, Seminole Nation of Oklahoma, and Muscogee Nation was initiated on December 18, 2024. The Study Area has been assessed for the presence historic properties. Alternative RO will have an adverse effect on NRHP-listed historic property Lock 1 (8BD58) and the S-13 Spillway, which is a contributing element to NRHP-eligible historic property, the South New River Canal (8BD4153). Under Section 106 of the National Historic Preservation Act, consultation with the Florida State Historic Preservation Office (SHPO) and the appropriate federally recognized tribes on these determinations resulted in the development of a Memorandum of Agreement (MOA) to mitigate for adverse effects prior to impact. An MOA among the USACE, SFWMD, and Florida SHPO was executed on April 20, 2026.
Native American Graves and Protection and Repatriation Act of 1966, as amended (25 U.S.C. § 3001 <i>et seq.</i>)	Not applicable The Recommended Plan will not occur on federal lands.
Noise Control Act of 1972, as amended (42 U.S.C. § 4901 <i>et seq.</i>)	In Compliance Construction of the Recommended Plan may generate temporary and short-term noise disturbance that is in keeping with an urban environment. Best management practices will minimize construction noise impacts. Operational noise, primarily associated with pump operations, is expected to be insignificant, and would be short-term, infrequent, and localized. Mitigating measures will reduce noise effects.
Protect and Restore America's Estuaries Act (P.L. 116-337)	Not applicable The area of proposed effects does not include estuaries.
Resource Conservation and Recovery Act of 1976, as amended by the Hazardous and Solid Waste Amendments of 1984 (42 U.S.C. § 6901 <i>et seq.</i>)	In Compliance All constituents identified in site soils at Recommended Plan construction locations are below Industrial/Commercial Direct Exposure Soil Cleanup Target Levels. Additional testing will be conducted if excavated contaminated soils or sediments are to be reused or disposed offsite. Potentially contaminated soils will be controlled to preclude runoff or contaminant migration. Contaminant concentrations at these sites do not pose an unacceptable risk, but workers will be notified of soil and sediment contamination and appropriate safety protocols will be implemented.
Rivers and Harbors Act of 1899, as amended (33 U.S.C. §§ 401 <i>et seq.</i>)	Compliance Activities The Recommended Plan includes construction of new or replacement water control structures in canals within the Study Area, portions of which could be defined as navigable waters of the United States. If constructed by the non-federal sponsor, Section 10 permit(s) will be obtained prior to construction activities.
Safe Drinking Water Act of 1974, as amended	In Compliance

Law (Citation)	Compliance Status
(42 U.S.C. §§ 300f-300j)	The Recommended Plan will not affect drinking water sources or quality, including the Biscayne Aquifer.
Submerged Lands Act of 1953 (43 U.S.C. § 1301)	Compliance Activities Any required permit(s) would be obtained from the FDEP prior to construction activities on submerged lands.
Toxic Substances Control Act of 1976 (15 U.S.C. § 2601 <i>et seq.</i>)	Not applicable The Recommended Plan will not mix, manufacture, process or distribute chemical substances. Post-manufactured substances may be applied or used as directed by instructions or guidelines as part of constructing and operating the Recommended Plan.
Uniform Relocation and Assistance and Real Property Acquisition Policies Act (42 U.S.C. § 4601 <i>et seq.</i>)	Compliance Activities The Recommended Plan will adhere to the required procedures and protections outlined in the act. Relocated people or businesses will receive fair compensation, appropriate relocation assistance, equitable treatment and every effort will be made to minimize hardship.
Wild and Scenic River Act of 1968, as amended (16 U.S.C. § 1271-1287)	Not applicable No designated wild and scenic rivers are located within the Study Area.

Notes: U.S.C. = United States Code; P.L. = Public Law

B.4.2 Executive Orders

The following executive orders (EO) were considered when preparing this environmental assessment.

B.4.2.1 EO 11514, Protection and Enhancement of Environmental Quality

EO 11514 directs federal agencies to protect and enhance the Nation's environmental quality to sustain and enrich human life, including "initiate measures needed to direct their policies, plans, and programs so as to meet national environmental goals."

B.4.2.2 EO 11593, Protection and Enhancement of Cultural Environment

EO 11593 directs federal agencies to preserve, restore, and maintain the historic and cultural environment of the nation, including identifying, evaluating, and protecting historic properties and cultural resources under their jurisdiction or control. Federal executive branch agencies shall (1) administer the cultural properties under their control in a spirit of stewardship and trusteeship for future generations; (2) initiate measures necessary to direct their policies, plans and programs in such a way that federally owned sites, structures, and objects of historical, architectural or archaeological significance are preserved, restored, and maintained for the inspiration and benefit of the people; and, (3) in consultation with the Advisory Council on Historic Preservation, institute procedures to assure that federal plans and programs contribute to the preservation and enhancement of non-federally owned sites, structures and objects of historical, architectural or archaeological significance.

B.4.2.3 EO 11988, Floodplain Management

EO 11988 directs federal agencies to avoid, to the extent possible, the short- and long-term adverse impacts associated with occupancy and modification of floodplains and avoid direct or indirect support of floodplain development wherever there is a practicable alternative.

B.4.2.4 EO 11990, Protection of Wetlands

EO 11990 directs federal agencies to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands in the conduct of an agency's responsibilities.

B.4.2.5 EO 12088, Federal Compliance with Pollution Control Standards

EO 12088 requires federal agencies to comply with applicable pollution control standards and to ensure that their activities do not violate environmental laws. The EO directs agencies to establish pollution prevention programs and to report on their environmental compliance efforts.

B.4.2.6 EO 12777, Implementation of § 311 of the Federal Water Pollution Control Act of 1972, as amended, and the Oil Pollution Act

This EO implements the Oil Pollution Act of 1990 by outlining emergency response procedures for managing spills of oil and hazardous materials into the waters inside U.S. jurisdiction. EPA, the U.S. Coast Guard, and the Departments of Defense, Interior, Agriculture, Commerce, and Energy participate in contingency planning.

B.4.2.7 EO 12856, Federal Compliance with Right-To-Know Laws and Pollution Prevention Requirements

EO 12856, in keeping with the Emergency Planning and Community Right-to-Know Act of 1986, establishes programs to provide the public with important information on the hazardous and toxic chemicals in their communities, and emergency planning and notification requirements to protect the public in the event of a release of extremely hazardous substances.

B.4.2.8 EO 12962, Recreational Fisheries, as amended

EO 12962 requires federal agencies to conserve, restore, and enhance aquatic systems to provide increased, sustainable recreational fishing opportunities, and requires the evaluation of federally funded, permitted, or authorized actions on aquatic systems and recreational fisheries.

B.4.2.9 EO 13007, Indian Sacred Sites

This EO addresses the accommodation of sacred sites. Each executive branch agency with statutory or administrative responsibility for the management of federal lands is required, to the extent practicable, permitted by law, and not clearly inconsistent with agency functions, to accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners. They shall also avoid adversely affecting the physical integrity of the sacred sites. Where appropriate, agencies will maintain the confidentiality of sacred sites.

B.4.2.10 EO 13045, Protection of Children from Environmental Health Risks and Safety Risks

EO 13045 acknowledges children may disproportionately suffer from environmental health and safety risks. It prioritizes identification and assessment of environmental health and safety risks to children and ensures that all federal actions address the unique vulnerabilities of children.

B.4.2.11 *EO 13089, Coral Reef Protection*

EO 13089 seeks to preserve and protect the biodiversity, health, heritage, and social and economic value of U.S. coral reef ecosystems and the marine environment. Agencies will identify actions that may affect U.S. coral reef ecosystems, and protect, enhance, and avoid degrading them.

B.4.2.12 *EO 13112, Invasive Species, as amended*

EO 13112 addresses the prevention of the introduction of invasive species and provides for their control and minimization of the economic, ecological, and human health impacts the invasive species cause. The EO establishes the National Invasive Species Council and Invasive Species Advisory Committee, which are responsible for the preparation and issuance of the National Invasive Species Management Plan. The National Invasive Species Management Plan details and recommends performance-oriented goals and objectives and specific measures of success for federal agencies.

B.4.2.13 *EO 13175, Consultation and Coordination with Indian Tribal Governments*

EO 13175 establishes the framework for federal agencies to engage in meaningful consultation and collaboration with federally recognized Indian Tribes. The EO also sets forth policymaking criteria to which agencies must adhere to the extent permitted by law.

B.4.2.14 *EO 13186, Responsibilities of Federal Agencies to Protect Migratory Birds*

EO 13186 directs federal agencies to take active measures to protect migratory bird populations as part of their environmental responsibilities.

B.4.2.15 *EO 13352, Facilitation of Cooperative Conservation*

EO 13352 promotes collaboration among federal, state, local, and Tribal governments, as well as private landowners and other stakeholders, to address natural resource and environmental issues.

B.4.2.16 *Memorandum of Government-to-Government Relations with Native American Tribal Governments*

This Presidential Memorandum directs the federal government to operate within a government-to-government relationship with federally recognized Native American Tribes. Each executive department and agency shall apply the requirements of EO 12875 (Enhancing the Intergovernmental Partnership) and EO 12866 (Regulatory Planning and Review) to design solutions and tailor federal programs, in appropriate circumstances, to address specific or unique needs of Tribal communities.

Table B.4-2 provides a summary of how the C&SF Section 203 Study's Recommended Plan is in compliance with each applicable executive order.

Table B.4-2. Recommended Plan Compliance with Executive Orders.

Executive Order	Compliance Status
Protection and Enhancement of Environmental Quality (EO 11514)	Compliance Activities USACE is adhering to the NEPA process to identify and address environmental and decision-making considerations that may affect environmental quality in this Integrated Feasibility Study and Environmental Assessment (IFS/EA). Compliance with

Executive Order	Compliance Status
	EO 11514 will be achieved through the NEPA process and during design and construction.
Protection and Enhancement of Cultural Environment (EO 11593)	Not Applicable EO 11593 applies to historic properties owned or controlled by the federal government. Because this project does not involve properties under federal ownership, USACE will instead comply with National Historic Preservation Act and Archaeological and Historic Preservation Act requirements for federally funded activities on non-federal land.
Floodplain Management (EO 11988)	Compliance Activities The proposed action takes place within a floodplain but is not expected to induce development in the floodplain. Section 5.0 of this IFS and EA addresses effects of construction and operation of proposed structures on resources within the action area, including floodplain wetlands. Negligible, direct, short-term, adverse effects on wetlands are expected due to construction of the proposed action, while negligible, direct, long-term benefits are anticipated for OMRR&R. Section 3.0 and Section 4.0 includes information on alternatives considered, and Section 6.0 provides justification for the selection of the Recommended Plan. Comments submitted during the review of the Draft EA have been responded to in this Final IFS and EA, as applicable. The preferred plan is the most responsive to all project objectives and the most consistent with this EO. The C&SF Section 203 Study's purpose is to develop and evaluate continued and improved flood risk management and resiliency solutions that align with the Federal Objective, as defined in Section 2031 of the Water Resources Development Act of 2007. The Federal Objective specifies that water resources planning shall reflect national priorities, encourage economic development, and protect the environment by seeking to maximize sustainable economic development, avoiding the unwise use of floodplains, and protecting and restoring natural ecosystems. The planning process informs an implementable suite of measures to address flood risk damages and involves parallel efforts across managed watershed basins, primary canals, and water control structures. The Recommended Plan complies with the goals of this EO.
Protection of Wetlands (EO 11990)	Compliance Activities The proposed Recommended Plan avoids wetlands to the maximum extent practicable. A Clean Water Act (404)(b)(1) evaluation has been prepared and is included in this IFS/EA and will be updated during design. USACE will continue efforts to avoid, reduce and/or mitigate wetland impacts in compliance with applicable state and federal laws, regulations, and requirements. Final impact figures will be determined following wetland delineation and further refinement during the Preconstruction Engineering and Design phase. If mitigation is necessary, USACE will provide appropriate mitigation.
Federal Compliance with Pollution Control Standards (EO 12088)	In compliance The Recommended Plan will meet applicable requirements under state and federal laws, and regulations.
EO 12777, Implementation of § 311 of the Federal Water Pollution Control Act of 1972, as amended, and the Oil Pollution Act	Compliance Activities Best management practices will be implemented to prevent runoff of oil and other pollutants. The construction contractor will be responsible for controlling and remediating any inadvertent oil releases.
Federal Compliance with Right-to-Know Laws and Pollution Prevention (EO 12856)	Not Applicable The C&SF Section 203 Study does not include hazardous and toxic chemicals or emergency planning and notification requirements to protect the public in the event of release of extremely hazardous substances.
Recreational Fisheries, as amended (EO 12962)	In compliance Short-term effects to recreational fishing activities and aquatic systems could occur during Recommended Plan construction activities. However, it is expected that the after construction has been completed, there will be no net loss of aquatic systems with continued public access to recreational opportunities.
Indian Sacred Sites	Not Applicable

Executive Order	Compliance Status
(EO 13007)	Consultation with the Florida SHPO, Seminole Tribe of Florida, Miccosukee Tribe of Indians, Thlopthlocco Tribal Town, Seminole Nation of Oklahoma, and Muscogee Nation has not identified any Indian sacred sites in the C&SF Section 203 Study Area.
Protection of Children from Environmental Health Risks and safety Risks (EO 13045)	In compliance The Recommended Plan is not expected to have environmental health or safety risks affecting children. The Phase 1 Environmental Site Assessments did not identify materials or wastes at response levels, there are minimal exposure pathways, and children will not be permitted onsite during Recommended Plan construction or other high exposure activities. Asbestos-containing material, lead-based paint, or polychlorinated biphenyls identified during design or construction will be managed and disposed in accordance with the Resource Conservation and Recovery Act and all other applicable laws.
Coral Reef Protection (EO 13089)	Not Applicable No coral reefs will be affected by the C&SF Section 203 Study or construction of the Recommended Plan.
Invasive Species, as amended (EO 13112)	Compliance Activities Best management practices will be followed to prevent or reduce introduction of or establishment of invasive and non-invasive species within the Recommended Plan construction locations. Measures to reduce the spread of exotic and/or invasive species will be included in Recommended Plan contract specifications. The C&SF Section 203 Study complies with this EO.
Consultation and Coordination with Indian Tribal Governments (EO 13175)	In compliance Consultation with the Miccosukee Tribe of Indians, Seminole Tribe of Florida, Muscogee (Creek) Nation, Seminole Nation of Oklahoma, and Thlopthlocco Tribal Town was initiated in December 2024. Consultation is ongoing and will continue throughout final design.
Responsibilities of Federal Agencies to Protect Migratory Birds (EO 13186)	Compliance Activities The Recommended Plan is not expected to adversely affect migratory birds. Migratory bird surveys would be conducted prior to construction and measures to avoid and minimize impacts to migratory birds will be in place throughout the construction phase. USACE will be in full compliance with the EO at the time of construction.
Facilitation of Cooperative Conservation (EO 13352)	Compliance Activities The public and agencies have been fully engaged on the C&SF Section 203 Study via the NEPA process. USACE will continue to consult and collaborate with stakeholders and with local, state, and federal agencies on the Recommended Plan. The proposed Project complies with this EO.
Memorandum on Government-to-Government Relations with Native American Tribal Governments (Federal Register Vol. 59, No. 85)	Compliance Activities Consultation with the Miccosukee Tribe of Indians, Seminole Tribe of Florida, Muscogee (Creek) Nation, Seminole Nation of Oklahoma, and Thlopthlocco Tribal Town was initiated in December 2024. Consultation is ongoing and will continue throughout final design.

B.4.3 Clean Water Act Section 404(b)(1) Evaluation

The Section 404(b)(1) evaluation addresses, at a general level, the potential environmental effects of the wetland alterations expected from dredge and fill and construction of the proposed project. For the purposes of this Section 404(b)(1) evaluation, “project” means implementation of the C&SF Section 203 Study Recommended Plan. Subsequent, site-specific, Section 404(b)(1) evaluations will be completed for individual project components, or groups thereof.

B.4.3.1 Location

The Study Area (**Figure B.4-1**) for the proposed Project encompasses approximately 420 square miles within the eastern portion of Broward County and a small portion of southern Palm Beach County. The

C&SF Section 203 Study Area comprises the nine upstream watersheds and six downstream watersheds that are exposed or vulnerable to flooding, located between the eastern side of the East Coast Protective Levee and the coastal water control structures. The Study Area delineation is based on existing watersheds, contiguous urban areas, and previous studies (SFWMD's Flood Protection Level of Service [SFWMD 2021b] and USACE's South Atlantic Coastal Study [USACE 2021]).

The C&SF Section 203 Study Area is highly urbanized, focused on areas of extensive development and canals that have been extensively altered and includes coastal water control structures (**Table B.4-3**) directly managed by the C&SF system and is the area of emphasis for evaluating improvements to the water control structures' functionality and reducing flood damages.

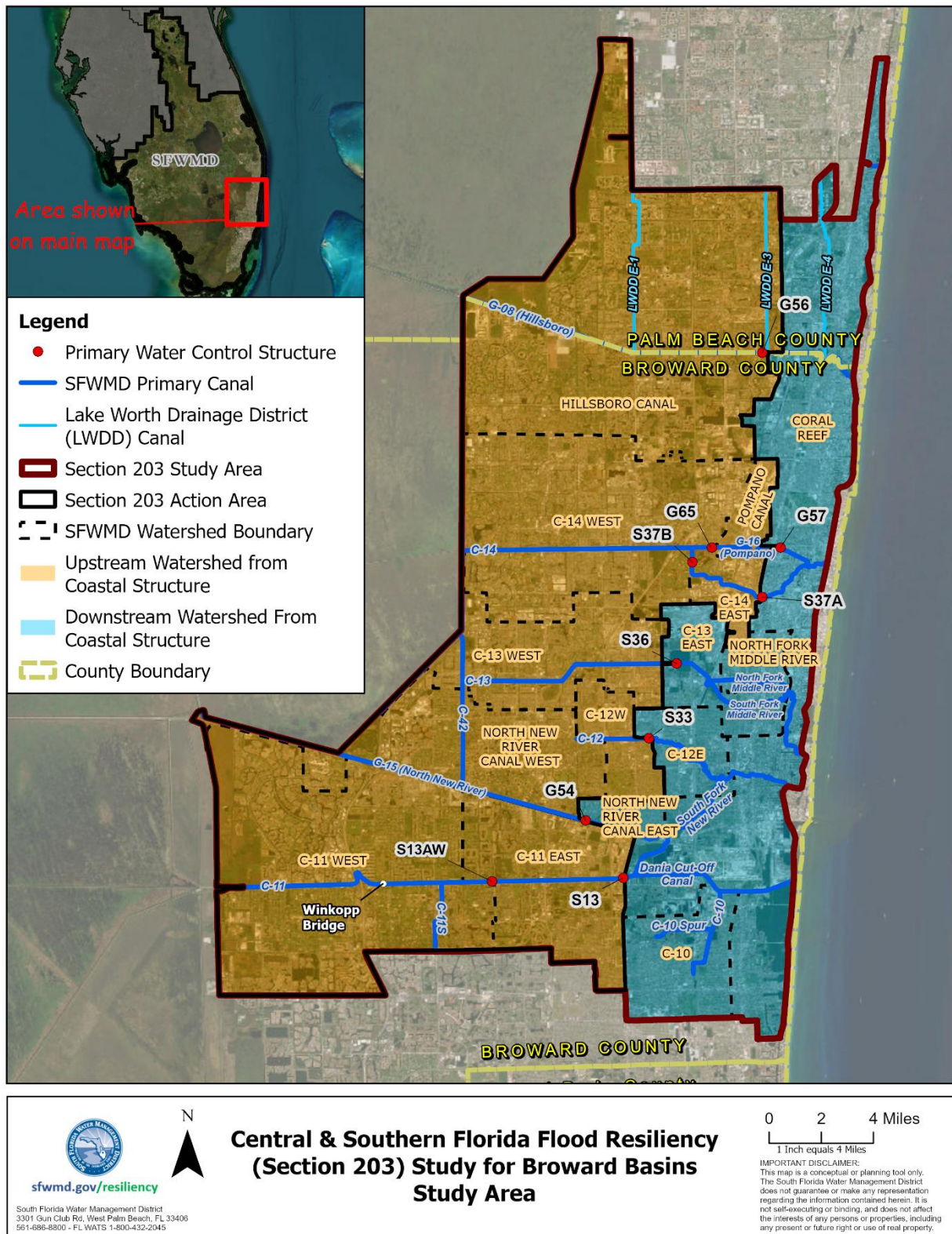


Figure B.4-1. C&SF Section 203 Study Area.

Table B.4-3. C&SF Section 203 Study Area—Managed Watershed Basins, Primary Canals, and Water Control Structures.

Managed Upstream Watershed Basin	Primary Canal	Primary Water Control Structure	Downstream Watershed Basin
Hillsboro Canal Basin	G-08 (Hillsboro) Canal	G-56 Gated Spillway	Coral Reef Basin
Pompano Canal Basin	G-16 (Pompano) Canal	G-57 Gated Spillway	Coral Reef Basin
C-14 West Basin	C-14 (Cypress Creek) Canal	S-37B Gated Spillway ^{a/}	C-14 East Basin
C-14 East Basin	C-14 (Cypress Creek) Canal	S-37A Gated Spillway	Coral Reef Basin
C-13 West Basin	C-13 (Middle River) Canal	S-36 Gated Spillway	C-13 East, North Fork Middle River, and Coral Reef Basins
C-12 West Basin	C-12 (Plantation) Canal	S-33 Gated Spillway	C-12 East and Coral Reef Basins
North New River Canal West Basin	G-15 (North New River) Canal	G-54 Gated Spillway	North New River Canal East and Coral Reef Basins
C-11 West Basin	C-11 (South New River) Canal	S-13AW Gated Culvert ^{a/}	C-11 East Basin
C-11 East Basin	C-11 (South New River) Canal	S-13 Pump Station and Gated Spillway	Coral Reef and C-10 Basins

Notes: C = canal; G = gate; S = structure

a/ The S-37B Gated Spillway and S-13AW Gated Culvert are non-coastal structures; all others are coastal structures

Urbanized Broward County is one of six counties within the Atlantic Coastal Ridge, also referred to as the Lower East Coast. The Lower East Coast is the most densely populated area in Florida and includes the West Palm Beach, Fort Lauderdale, and Miami population centers. Water levels in this area are tightly controlled near the shoreline to prevent over-drainage and manage saltwater intrusion. The area depends on the operation of the C&SF Project for flood control, water supply, and other purposes.

Broward County covers approximately 1,323 square miles, with a heavily developed landscape that includes urban, suburban, and few rural areas. It is home to more than 1.9 million residents, making it the second most populous county in the state (second to Miami-Dade County). Broward County is characterized by its extensive coastline along the Atlantic Ocean and a complex system of canals, lakes, and wetlands, which play a crucial role in water management and flood mitigation (Broward County 2024c). Similarly, southern Palm Beach County is characterized by densely populated urban development with a mix of land uses including residential, commercial, and industrial. This is interspersed with water control structures (e.g., canals, pumps) that provide flood control and water supply.

B.4.3.2 Recommended Plan Description

A Recommended Plan was selected from a suite of alternatives (**Figure B.4-2**). The Recommended Plan includes various structural measures to achieve improved flood risk management. Structural measures such as upgrades, replacement, and/or expansion of existing WCS would be constructed. Pump stations' finished floor elevations and the top of spillway gates in the closed position will be above the 2085 100-year surge and 100-year rainfall event under high sea level rise conditions. Where possible, access roads, parking areas, and similar infrastructure will be constructed at locations and elevations to preclude backflow when at the 2085 100-year surge and 100-year rainfall event under high sea level rise conditions. Riprap or revetment will armor canals against erosion adjacent to WCS.

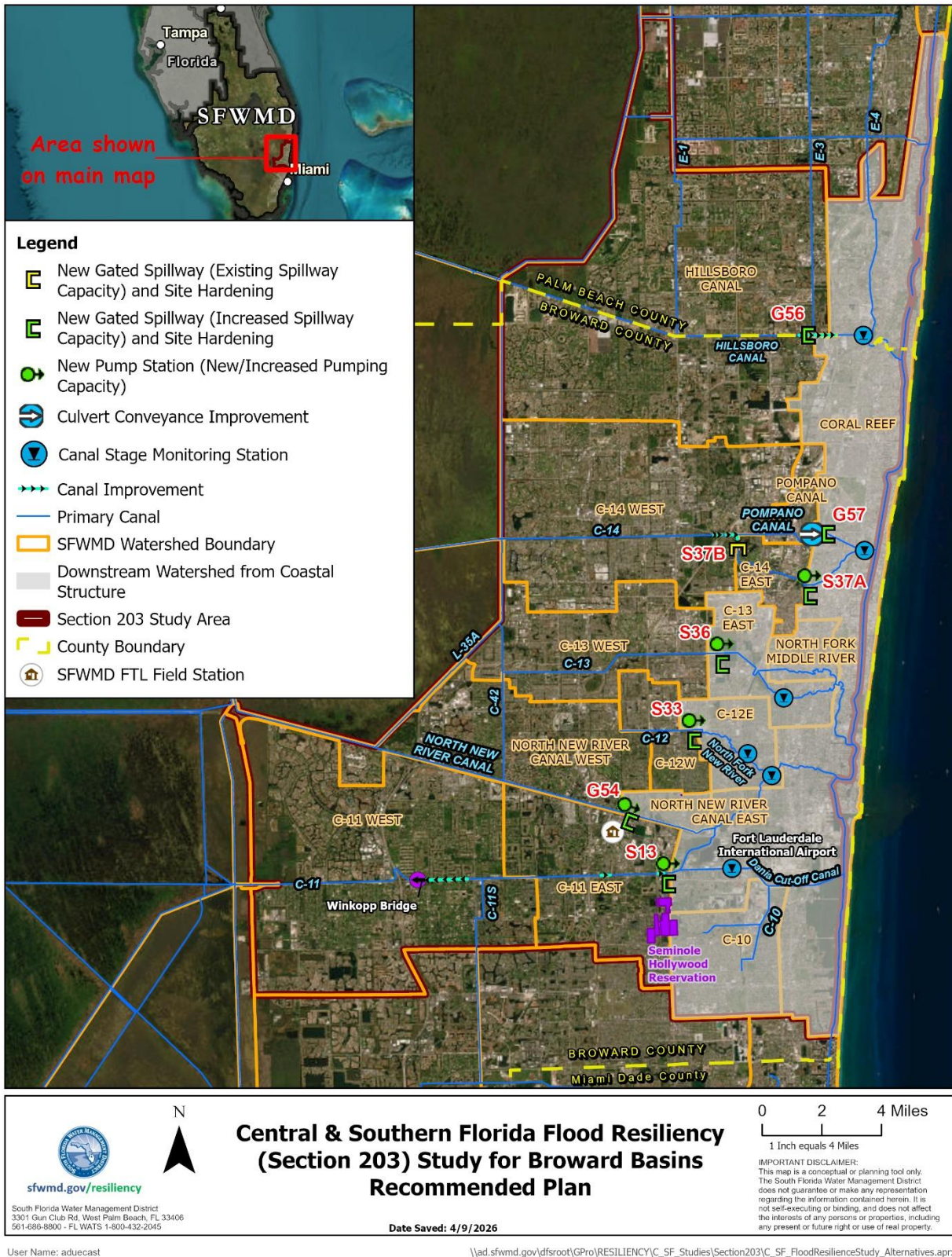


Figure B.4-2. Features of the C&SF Section 203 Study Recommended Plan.

The Recommended Plan also includes canal conveyance improvements. Where required to increase flow capacity, the cross-sectional area of canals will be excavated to improve water flow. Generally, excavation will involve deepening these canal segments while not impacting existing side slope stability. All excavation will be within the canal's ROW. Excavated materials will be placed and compacted within the canal's ROW or disposed of at an offsite landfill.

The proposed Recommended Plan features are described below (**Table B.4-4**). Additional details for the Recommended Plan improvements are provided in **Section A.1 of Appendix A**. A dewatering system will be in operation during canal excavation to ensure water content of dredged material is as low as possible. This will ease handling and reduce dewatering requirements.

Hillsboro Canal Basin, G-08 (Hillsboro) Canals

The Hillsboro Canal Basin watershed is primarily controlled by the G-56 Gated Spillway (26.327972°N, 80.131583°W) on the G-08 (Hillsboro) Canal. The G-56 Gated Spillway consists of three 20-foot-wide gates. The Recommended Plan structural measures would include construction of a new, replacement gated spillway with four 25-foot-wide roller gates approximately 75 feet west (upstream) of the current G-56 Gated Spillway and demolition of the old spillway. Approximately 17,278 neat cubic yards of soil excavation would be required to construct the new WCS and connect the WCS intake and discharge bays to the existing canal.

Additionally, an approximately 1.1-linear-mile section of the G-08 (Hillsboro) Canal would be excavated (i.e., dredged) to enlarge the canal cross section, improving water conveyance. Approximately 0.2 miles of canal, beginning approximately 500 feet west of the existing G-56 Gated Spillway and proceeding west, would be excavated to a maximum depth of 5 feet below the existing canal bottom, removing an estimated 23,868 neat cubic yards of soil. Additionally, approximately 0.9 miles of canal beginning on the east side of the spillway would be similarly dredged to a depth not exceeding 5 feet below the existing canal bottom, with 25,485 neat cubic yards of soil excavated. Dredged material from all areas would be placed, compacted, graded, and sodded within the existing access corridors along the canal ROW, with any excess soil disposed of at permitted landfills or other SFWMD-approved sites. All work would occur within the existing canal ROW and proposed perpetual easement.

Pompano Canal Basin, G-16 (Pompano) Canal

The Pompano Canal Basin watershed is primarily controlled by the G-57 Gated Spillway (26.230850°N, 80.121525°W) on the G-16 (Pompano) Canal. The G-57 Gated Spillway consists of two 14-foot-wide gates. A 1,400-foot long, 10-foot-diameter culvert is located approximately 350 feet northwest (upstream) of the existing structure, parallel to Atlantic Boulevard (State Road 814), between South Dixie Highway (State Road 811) and Cypress Road, for the purpose of stormwater conveyance.

Table B.4-4. Proposed Recommended Plan Features.

Canal	WCS	Demolition of Existing Structures	New Pump Station		New Gated Structure			Canal Excavation		Manatee Protection Requirements
			Design Pumping Capacity (cfs)	Mix of Pumps	Number and Width of Spillway Bays/Gates	Weir Type for Each Spillway Bay	Weir Crest Elevation for Each Spillway Bay (ft NAVD88)	Net Cubic Yards	Linear Miles	
G-08 (Hillsboro) Canal	G-56 Gated Spillway	G-56 & ancillary structure	N/A	N/A	Gated Spillway w/ (4) 25-ft-wide roller gates	Ogee	-5.10	49,353	1.1	Manatee protection system gate controller w/ sensor for each discharge bay
G-16 (Pompano) Canal ^{a/}	G-57 Gated Spillway	G-57 & ancillary structures	N/A	N/A	Gated Spillway w/ (2) 21-ft-wide roller gates	Trapezoidal	-2.50	N/A	N/A	Manatee protection system gate controller w/ sensor for each discharge bay
C-14 (Cypress Creek) Canal	S-37B Gated Spillway	S-37B & ancillary structures	N/A	N/A	Gated Spillway w/ (2) 25-ft-wide roller gates	Ogee	-1.60	26,631	1.2	N/A S-37B not accessible to manatees ^{b/}
C-14 (Cypress Creek) Canal	S-37A Gated Spillway	S-37A & ancillary structures	1,200	(3) 400-cfs pumps (1) 400-cfs auxiliary pump	Gated Spillway w/ (3) 25-ft-wide roller gates	Ogee	-9.30	N/A	N/A	Manatee protection system gate controller w/ sensor for each discharge bay
C-13 (Middle River) Canal	S-36 Gated Spillway	S-36 & ancillary structures	510	(3) 170-cfs pumps	Gated Spillway w/ (2) 16-ft-wide roller gates	Trapezoidal	-8.60	N/A	N/A	Manatee protection system gate controller w/ sensor for each discharge bay
C-12 (Plantation) Canal	S-33 Gated Spillway	S-33 & ancillary structures	510	(3) 170-cfs pumps (1) 170-cfs auxiliary pump	Gated Spillway w/ (2) 20-ft-wide roller gates	Trapezoidal	-3.60	N/A	N/A	Manatee protection system gate controller w/ sensor for each discharge bay
G-15 (North New River) Canal	G-54 Gated Spillway	G-54 & ancillary structures	810	(3) 270-cfs pumps	Gated Spillway w/ (4) 20-ft-wide roller gates	Trapezoidal	-5.60	N/A	N/A	Manatee protection system gate controller w/ sensor for each discharge bay

Canal	WCS	Demolition of Existing Structures	New Pump Station		New Gated Structure			Canal Excavation		Manatee Protection Requirements
			Design Pumping Capacity (cfs)	Mix of Pumps	Number and Width of Spillway Bays/Gates	Weir Type for Each Spillway Bay	Weir Crest Elevation for Each Spillway Bay (ft NAVD88)	Net Cubic Yards	Linear Miles	
C-11 (South New River) Canal	S-13AW Gated Culvert	N/A	N/A	N/A	N/A	N/A	N/A	85,039	1.5	N/A No WCS improvements proposed
C-11 (South New River) Canal	S-13 Pump Station and Gated Spillway	S-13 & ancillary structures	1,080	(2) 180-cfs pumps (2) 360-cfs pumps (1) 360-cfs auxiliary pump	Gated Spillway w/ (2) 14-ft-wide roller gates and trash rakes on HW side	Ogee	-9.60	29,179	0.5	Manatee protection system gate controller w/ sensor for each discharge bay

a/ Improvements in the G-16 (Pompano) Canal would also include two new, 10-foot-diameter culverts (or a double 10-foot-span by 9-foot-rise concrete box culvert) constructed parallel to and on the south side of the existing 10-foot diameter culvert, upstream of the proposed G-57 Gated Spillway and Pump Station.

b/ Per USFWS C&SF Project Manatee Accessibility Map (September 2006)

The Recommended Plan structural measures would include construction of a new, replacement gated spillway with two 21-foot-wide roller gates approximately 250 feet northwest (upstream) of the current G-57 Gated Spillway and demolition of the old spillway. Approximately 6,511 neat cubic yards of soil excavation would be required to construct the new WCS and connect the WCS intake and discharge bays to the existing canal. Dredged material would be placed, compacted, graded, and sodded within the existing access corridors along the canal ROW, with any excess soil disposed of at permitted landfills or other SFWMD-approved sites. All work would occur within the existing canal ROW, and proposed fee estate acquisition, perpetual easements, and temporary easements.

In addition, two new, 10-foot-diameter culverts (or a double 10-foot-span by 9-foot-rise concrete box culvert) would be constructed parallel to and on the south side of the existing 10-foot diameter culvert. The existing culvert would remain to maintain flow during construction of the new culvert(s). New concrete support walls would be built at both ends of the site to support installation of the new parallel culverts. Construction of the new culverts would most likely occur by jack-and-bore method or similar trenchless installation methods under South Dixie Highway (SR 811), the Florida East Coast Railroad, SW 1st Avenue and Cypress Road, and via trenching in the remaining areas.

C-14 West Basin, C-14 (Cypress Creek) Canal

The C-14 West Basin watershed is primarily controlled by the S-37B Gated Spillway (26.223689°N, 80.170163°W) located on the C-14 (Cypress Creek) Canal. The S-37B Gated Spillway consists of two 25-foot-wide gates. The Recommended Plan structural measures would include construction of a new, replacement gated spillway with two 25-foot-wide roller gates approximately 215 feet north (upstream) of the current S-37B Gated Spillway and demolition of the old spillway. Approximately 4,311 neat cubic yards of soil excavation would be required to construct the new WCS and connect the WCS intake and discharge bays to the existing canal.

The Recommended Plan also includes conveyance improvements by excavating and enlarging the canal cross section of 1.2-linear miles of the C-14 (Cypress Creek) Canal, extending north and then west of the S-37B Gated Spillway. Approximately 1.2 miles of canal north of the S-37B Gated Spillway would be excavated to a maximum depth of 5 feet below the existing canal bottom, removing an estimated 26,631 neat cubic yards of sediment. All dredged material would be placed, compacted, graded, and sodded within the existing access corridors along the canal ROW, with any excess soil disposed of at permitted landfills or other SFWMD-approved sites. All work would occur within the existing canal ROW.

C-14 East Basin, C-14 (Cypress Creek) Canal

The C-14 East Basin watershed is primarily controlled by the S-37A Gated Spillway (26.206246°N, 80.131641°W) located on the C-14 (Cypress Creek) Canal. The S-37A Gated Spillway consists of two 25-foot-wide gates. The Recommended Plan structural measures would include building a new gated spillway with three 25-foot-wide roller gates and demolition of the old spillway. A new pump station would be constructed adjacent to the new gated spillway, which would house three 400-cfs pumps and one 400-cfs auxiliary pump, for a total design discharge capacity of 1,200 cfs. Although the new WCS would be in the same location as the existing one, it would encompass a larger footprint to accommodate the new pump station. Approximately 85,456 neat cubic yards of soil excavation would be required to construct the new gated spillway and pump station and connect the WCS intake and

discharge bays to the existing canal. Dredged material would be placed, compacted, graded, and sodded within the existing access corridors along the canal ROW, with any excess soil disposed of at permitted landfills or other SFWMD-approved sites. All work would occur within the existing canal ROW and proposed fee estate acquisition and temporary easement.

C-13 West Basin, C-13 (Middle River) Canal

The C-13 West Basin watershed is primarily controlled by the S-36 Gated Spillway (26.173183°N, 80.179122°W) located on the C-13 (Middle River) Canal. The S-36 Gated Spillway consists of one 25-foot-wide gate. The Recommended Plan structural measures would include building a new gated spillway with two 16-foot-wide roller gates to replace the current S-36 Gated Spillway and demolition of the old spillway. Although the new WCS would be in the same location as the existing spillway, it would encompass a larger footprint to accommodate the new gates and would meet current SFWMD design standards. A new pump station would be constructed adjacent to the new gated spillway, which would house three 170-cfs pumps for a total design discharge capacity of 510 cfs. Approximately 43,305 neat cubic yards of soil excavation would be required to construct the new gated spillway and pump station and connect the WCS intake and discharge bays to the existing canal. Dredged material would be placed, compacted, graded, and sodded within the existing access corridors along the canal ROW, with any excess soil disposed of at permitted landfills or other SFWMD-approved sites. All work would occur within the existing canal ROW and proposed fee estate acquisitions and temporary easement.

C-12 West Basin, C-12 (Plantation) Canal

The C-12 West Basin watershed is primarily controlled by the S-33 Gated Spillway (26.135942°N, 80.194494°W) located on the C-12 (Plantation) Canal. The S-33 Gated Spillway consists of one 20-foot-wide gate. The Recommended Plan structural measures would include construction of a new gated spillway with two 20-foot-wide roller gates and demolition of the old spillway. A new pump station would also be constructed, which would house three 170-cfs pumps and one 170-cfs auxiliary pump, for a total design discharge capacity of 510 cfs. The width of the new WCS would necessitate excavation of the south canal bank and the existing box culvert downstream of the current WCS. Approximately 53,706 neat cubic yards of soil excavation would be required to construct the new gated spillway and pump station and connect the WCS intake and discharge bays to the existing canal. Dredged material would be placed, compacted, graded, and sodded within the existing access corridors along the canal ROW, with any excess soil disposed of at permitted landfills or other SFWMD-approved sites. All work would occur within the existing canal ROW.

North New River Canal West Basin, G-15 (North New River) Canal

The North New River Canal West Basin watershed is primarily controlled by the G-54 Gated Spillway (26.095082°N, 80.229682°W) located on the G-15 (North New River) Canal. The G-54 Gated Spillway consists of three 16-foot-wide gates. The Recommended Plan structural measures would include construction of a new gated spillway with four 20-foot-wide roller gates approximately 30 feet west northwest (upstream) of the current G-54 Gated Spillway and demolition of the old spillway. A new pump station would be constructed adjacent to the new gated spillway. The pump station would house three 270-cfs pumps for a total design pumping capacity of 810 cfs. Approximately 42,064 neat cubic yards of soil excavation would be required to construct the new gated spillway and pump station and connect the WCS intake and discharge bays to the existing canal. Dredged material would be placed,

compacted, graded, and sodded within the existing access corridors along the canal ROW, with any excess soil disposed of at permitted landfills or other SFWMD-approved sites. The abandoned boat lock downstream of the existing WCS would be demolished. All work would occur within the existing canal ROW.

C-11 West Basin, C-11 (South New River) Canal

The C-11 West Basin watershed is primarily controlled by the S-13AW Gated Culvert (26.064633°N, 80.281512°W) located on the C-11 (South New River) Canal. The S-13AW Gated Culvert consists of two 10-foot-wide gates. The Recommended Plan structural measures include the excavation of a 1.5 miles of the C-11 (South New River) Canal in the C-11 West Basin watershed to improve conveyance. Excavation would begin approximately 50 feet east of the east side of the Winkopp Bridge and proceed east along the canal. Excavation would occur to a maximum depth of 5 feet below the existing canal bottom, removing an estimated 85,039 neat cubic yards of soil. Dredged material would be placed, compacted, graded, and sodded within the existing access corridors along the canal ROW, with any excess soil disposed of at permitted landfills or other SFWMD-approved sites. The excavated north and south side slopes of this 1.5-mile canal section would be stabilized with riprap (approximately 66,124 neat cubic yards) underlaid by bedding stone (approximately 16,762 neat cubic yards) and filter fabric. All work would occur within the existing canal ROW.

C-11 East Basin, C-11 (South New River) Canal

The C-11 East Basin watershed is primarily controlled by the S-13 Pump Station and Gated Spillway (26.066360°N, 80.208858°W) located on the C-11 (South New River) Canal. The S-13 Pump Station and Gated Spillway consists of a single 16-foot-wide spillway gate with a pump station with three 180-cfs pumps for a total design discharge capacity of 540 cfs. The Recommended Plan structural measures would include construction of a new gated spillway approximately 200 feet west (upstream) of the current S-13 Pump Station and Gated Spillway and demolition of the old spillway. A new gated spillway with two 14-foot-wide roller gates would be constructed. A new pump station with four main pumps (including two 180-cfs pumps and two 360-cfs pumps) and one 360-cfs auxiliary pump would be constructed, which would increase the total design discharge capacity via pumping for the WCS from 540 cfs to 1,080 cfs. Approximately 64,687 neat cubic yards of soil excavation would be required to construct the new gated spillway and pump station and connect the WCS intake and discharge bays to the existing canal. Dredged material would be placed, compacted, graded, and sodded within the existing access corridors along the canal ROW, with any excess soil disposed of at permitted landfills or other SFWMD-approved sites.

An approximately 13,000-square-foot portion of the remnant bypass channel located southeast of the existing WCS would be partially backfilled with soil, and a smaller channel would be left in place to maintain existing drainage flows from State Road 7 (US 441) and the stormwater system for the residential community south of the S-13 site. Upland soil material from the new S-13 Pump Station and Gated Spillway excavation would be used as backfill for the remnant channel; excavated material would be tested for compliance prior to use as backfill. The material would be properly graded and stabilized and would incorporate a small pilot channel to carry existing drainage.

In addition, 0.5 miles of the C-11 (South New River) Canal in the C-11 East Basin watershed would be excavated in two places to improve conveyance. First, approximately 0.3 miles of canal excavation,

beginning at the centerline of SW 74th Avenue and proceeding east along the canal, would occur to depths not exceeding 5 feet below the existing canal bottom and would result in approximately 17,752 neat cubic yards of soil removal. Then, approximately 0.2 miles of canal excavation, beginning 50 feet east of the east side of the Florida Turnpike northbound offramp bridge and proceeding east along the canal, would occur to depths not exceeding 5 feet below the existing canal bottom and would result in approximately 11,427 neat cubic yards of soil removal. Dredged material would be placed, compacted, graded, and sodded within the existing access corridors along the canal ROW, with any excess soil disposed of at permitted landfills or other SFWMD-approved sites.

Downstream Monitoring Stations

The Recommended Plan includes the installation of six canal stage monitoring stations (each consisting of a pile-supported steel platform, steel stilling well pipe, solar powered remote data logger and staff gauge) within the downstream watersheds in the Study Area. The downstream monitoring stations would be in addition to monitoring stations that would be installed approximately 150 to 200 feet downstream of each new WCS. The downstream monitoring stations are further described in **Section A.1.12 of Appendix A**.

B.4.3.3 Authority and Purpose

The purpose of the C&SF Section 203 Study is to develop and evaluate continued and improved flood risk management and resilience solutions that align with Section 2031 of the Water Resources Development Act of 2007, reflect national priorities, encourage economic development, and protect the environment by seeking to maximize sustainable economic development, avoiding the unwise use of floodplains, and protecting and restoring natural ecosystems. The planning process developed an implementable suite of measures to address flood risk damage across managed watershed basins, primary canals, and water control structures.

The need for this project is driven by significant physical, hydrological, climatological, demographic, and economic changes; increasing flood risks; and maintaining quality of life and community resiliency in the Study Area. There is a critical need to improve upon the existing USACE federally authorized and constructed C&SF Project.

The recommended plan maximizes flood resiliency and flood risk management benefits for the population, property, and critical infrastructure within the Action Area. Specifically, the effort advances the feasibility assessment and initial engineering designs for adapting water/flood control structures in areas of Broward County and a small portion of southern Palm Beach County most vulnerable to flood risk.

B.4.3.4 General Description of Dredged or Fill Material

Several project features are expected to include dredging, however releases of dredged or fill material into wetlands, navigable waters or other aquatic resources is not expected. Additional Section 404(b)(1) documentation will be completed for individual features when project level design, including dredged and fill material needs, are completed for construction and Clean Water Act permitting requirements are defined. General characteristics are discussed below. Specific characteristics, quantities, and sources of dredged or upland fill material will be refined during planning and design activities for each component of the proposed project.

B.4.3.5 General Characteristics of Material

The Project Area's surficial geology features two key formations, the young Everglades Geomorphic District and the Atlantic Coastal Ridge Province, both underlain by porous Miami Limestone (Pleistocene-era) that forms the Biscayne Aquifer. The region has stable geologic conditions with minimal seismic activity and gradual sinkhole formation. Soil is predominantly sandy, poorly drained, and unsuitable for prime farmland. These conditions complicate drainage and flood mitigation efforts.

Quantity of Material

The total volume of material dredged from canal bottoms is estimated to be 190,201 neat cubic yards. Specifics of the material are described in **Table B.4-5**. An additional 317,318 neat cubic yards are anticipated to be excavated in association with constructing and improving WCS. Excavation associated with WCS improvements and construction will primarily be uplands but may include small volumes of material from surface water interface or previously disturbed canal bottoms.

Dredged material resulting from canal excavation would be placed and compacted in previously developed canal upland ROWs located in the vicinity of the excavation. Where there is insufficient ROW for placement, materials will be disposed in a landfill. No material will be used for fill in wetlands, navigable waters, or other aquatic resources.

Source of Material

Material is expected to be excavated in dewatered areas with long-reach excavators from canal banks and barges. The material will be from existing canal bottoms and banks where canals are excavated to facilitate water conveyance. The material will be placed in permanent, bermed disposal areas adjacent to the canals within existing ROWs in the area of the excavation.

Table B.4-5. Recommended Plan Canal Excavation Dredged Materials Use, Volumes, and Characteristics.

Canal / Watershed	WCS	Excavation Length (linear miles)	Excavation Maximum Depth (feet below existing canal bottom)	Total Volume of Dredged Material (neat cubic yards)	Use Onsite or Disposal	Type of Material
G-08 (Hillsboro) Canal / Hillsboro Canal Basin	G-56 Gated Spillway	1.1	5	49,353	49,353 neat cubic yards used onsite	Sand
C-14 (Cypress Creek) Canal / C-14 West Basin	S-37B Gated Spillway	1.2	5	26,631	26,631 neat cubic yards used onsite	Sand
C-11 (South New River) Canal / C-11 West and East Basins	S-13AW Gated Culvert; S-13 Pump Station and Gated Spillway	1.5 (C-11 West Basin) 0.5 (C-11 East Basin)	5	114,218	31,541 neat cubic yards used onsite; 82,677 neat cubic yards disposed of offsite	Sand Sand with Limestone Fragments Limestone (medium-hard) Limestone (hard)

Note: WCS = water control structure

B.4.3.6 Description of the Proposed Discharge Site

Location

G-08 (Hillsboro) Canal

Dredged material will be placed, compacted, graded and sodded within designated permanent dredged material disposal areas within the G-08 (Hillsboro) Canal ROW where there is a low concentration of trees and/or a need to raise the canal bank for flood protection (**Figure B.4-3**).

Dredged material will be placed, compacted, graded and sodded within designated permanent dredged material disposal areas within the C-14 (Cypress Creek) Canal ROW where there is a low concentration of trees and/or a need to raise the canal bank for flood protection (**Figure B.4-4**).

C-11 (South New River) Canal

Dredged material will be placed, compacted, graded and sodded within designated permanent dredged material disposal areas within the C-11 (South New River) Canal ROW where there is a low concentration of trees and/or a need to raise the canal bank for flood protection (**Figure B.4-5** and **Figure B.4-6**). Excess dredged material that cannot be utilized within the canal ROW will be trucked to the nearest landfill.

One and one-half miles of the C-11 (South New River) Canal, in the C-11 West Basin, will be stabilized with continuous riprap revetment along canal side slopes. Sixteen thousand seven hundred and sixty-two neat cubic yards of riprap bedding stone will be laid atop geotextile filter fabric. The bedding stone riprap will be stabilized with 66,124 neat cubic yards of riprap.

Approximately 13,000-square-feet of the remnant bypass channel located southeast of the existing S-13 Pump Station and Gated Spillway would be partially backfilled with soil. A small pilot channel will be left in place to carry existing drainage. Upland soil material from the new S-13 Pump Station and Gated Spillway excavation would be used as remnant channel backfill. This excavated material would be tested for contaminants prior to use as backfill. The material would be properly graded and stabilized.

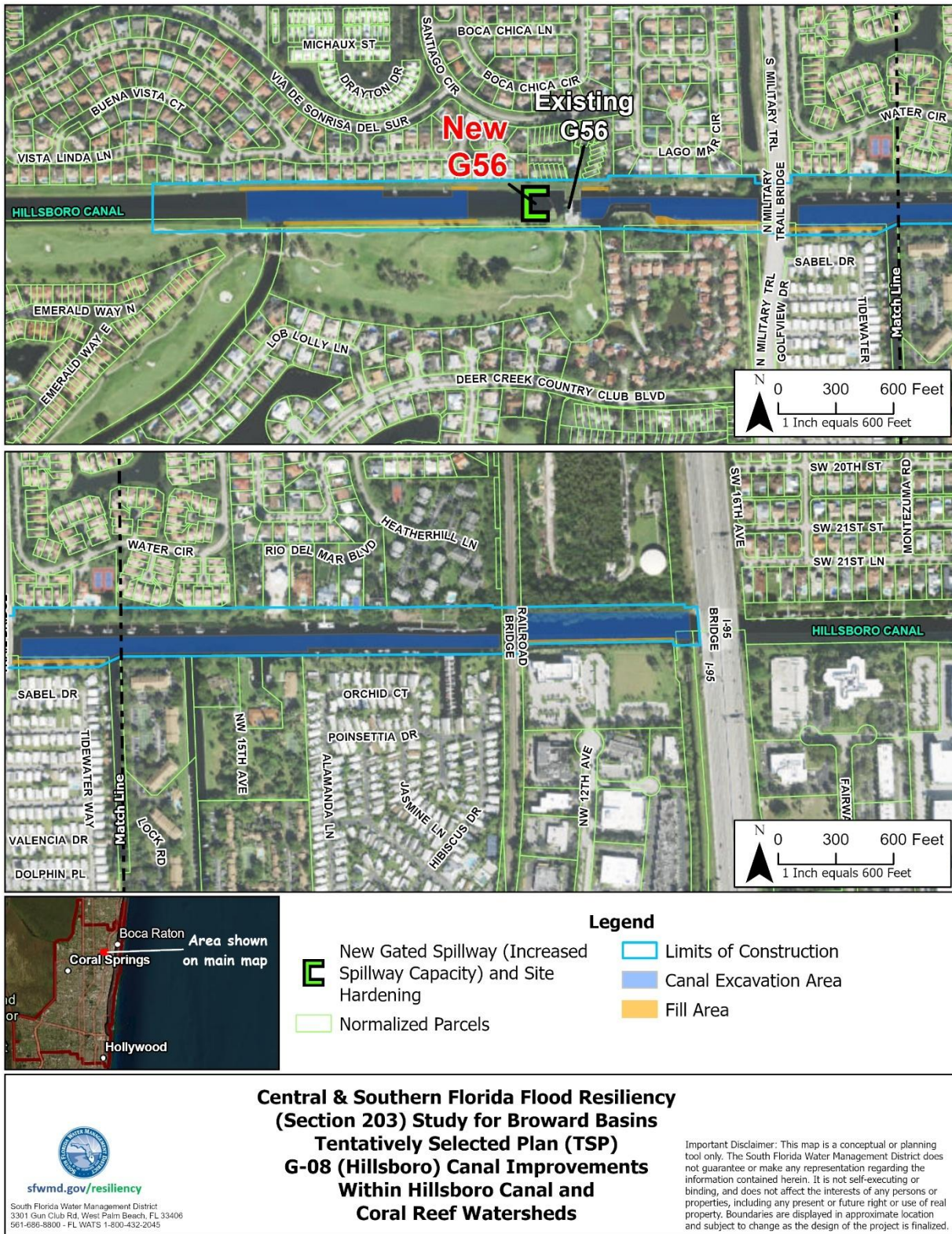


Figure B.4-3. G-08 (Hillsboro) Canal Improvements Excavation and Fill Areas.



Figure B.4-4. C-14 (Cypress Creek) Canal Improvements Excavation and Fill Areas.

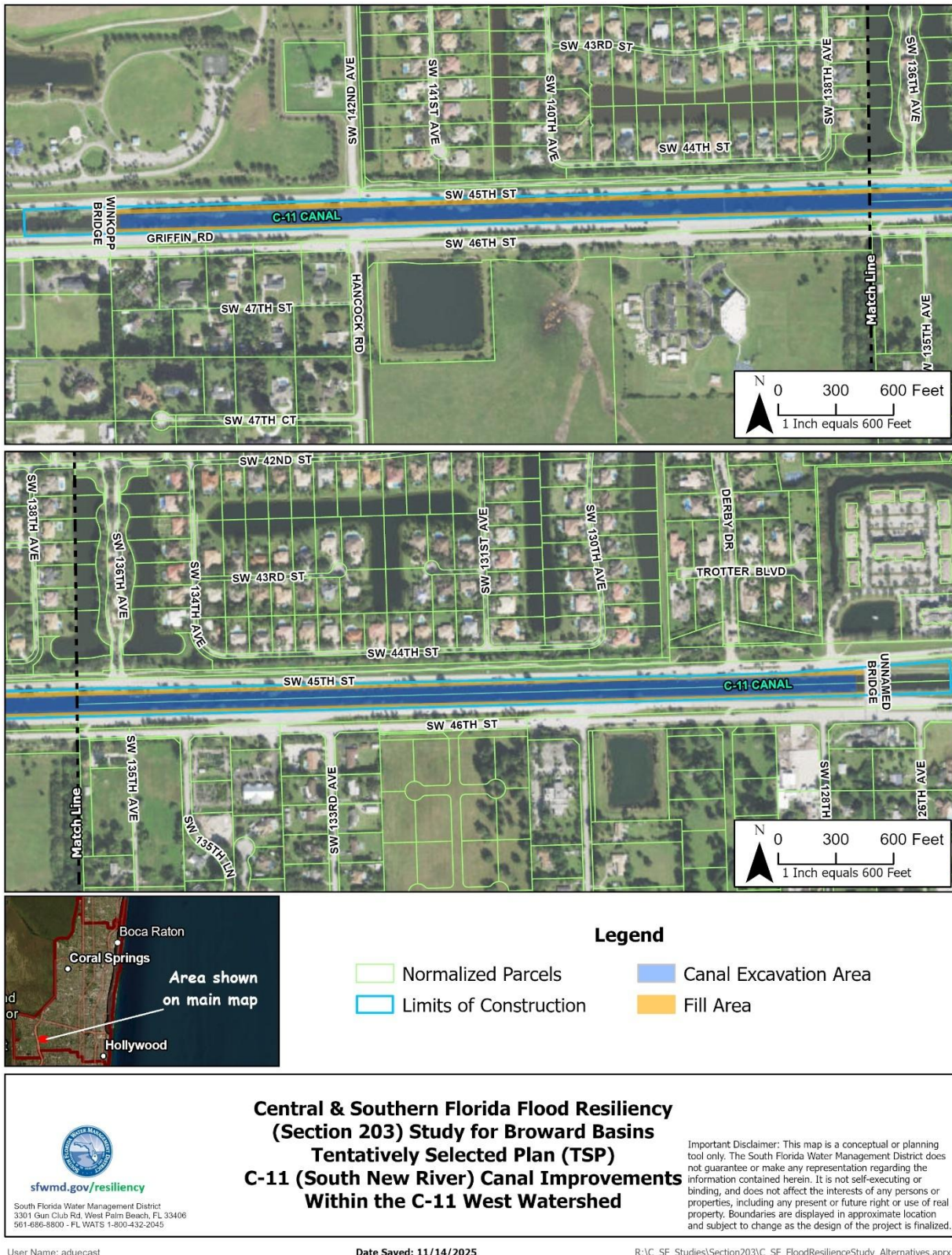


Figure B.4-5. C-11 (South New River) Canal (C-11 West Basin) Improvements Excavation and Fill Areas.

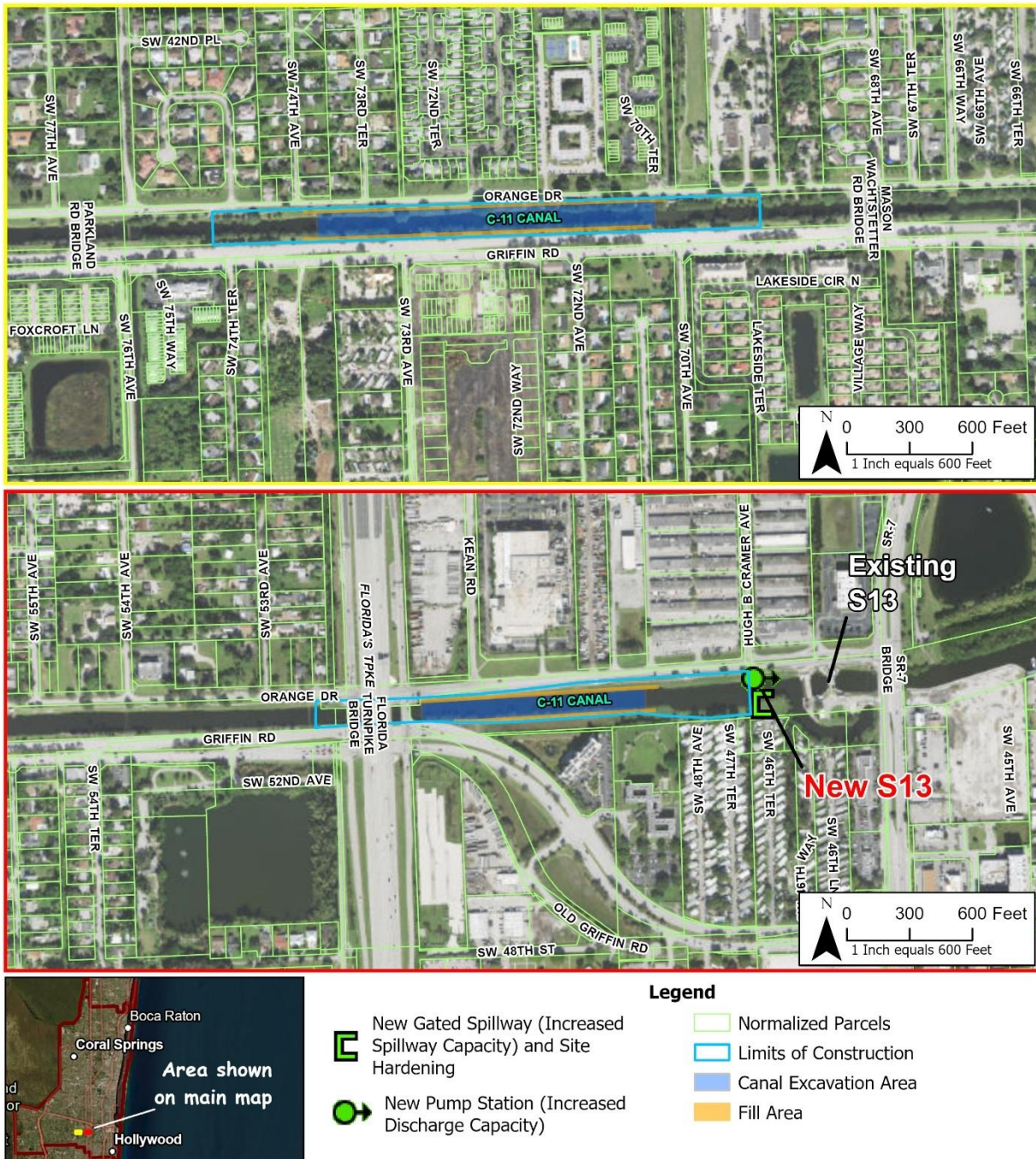


Figure B.4-6. C-11 (South New River) Canal (C-11 East Basin) Improvements Excavation and Fill Areas.

Size

The size of dredged material placement sites will be finalized during the Preconstruction Engineering and Design phase. Estimated size of excavated material disposal sites are:

Hillsboro Canal: 15 acres

C-14 Canal (C-14 West Watershed): 12 acres

C-11 Canal: 16 acres

Site

Upland, confined sites within the construction footprint and/or canal right of way would be used. Materials that could not be placed within the construction footprint or canal right of way would be disposed at landfills.

Habitat

All excavated material would be placed in a developed, urban landscape (**Figure B.4-6**).

Timing and Duration of Discharge

Construction date and timing and duration of dredging and disposal activities has yet to be determined. Estimates of construction period are shown in **Table B.4-6**. It is assumed that any excavation and disposal of dredged material would occur within this estimated construction period. Dredging and discharge timing and durations will be further defined during the Preconstruction Engineering and Design phase.

Table B.4-6. Estimated Period of Construction.

Canal	WCS	Estimated Construction Period (years)
G-08 (Hillsboro) Canal	G-56	2
G-16 (Pompano) Canal	G-57	2.5
C-14 (Cypress Creek) Canal, West Basin	S-37B	2.5
C-14 (Cypress Creek) Canal, East Basin	S-37A	6.5
C-13 (Middle River) Canal	S-36	5
C-12 (Plantation) Canal, West Basin	S-33	5
G-15 (North New River) Canal, West Basin	G-54	2.5
C-11 (South New River) Canal, East Basin	S-13	6.5

Note: WCS = water control structure

B.4.3.7 Description of Placement Method

Dewatered sediment would be mechanically removed by a land-based or barge-mounted long reach excavator. The excavated material will be mechanically placed on the construction site (**Table B.4-5**), trucked to placement or staging stockpile areas for holding prior to mechanical placement, or trucked to a landfill for disposal.

B.4.3.8 Factual Determinations

Physical Substrate Determinations

Substrate Elevation and Type

The natural topography of the area is nearly flat, with slopes less than 2 percent, except for manmade features such as canals.

Sediment Type

The substrate at the reservoir site is expected to be calcium carbonate limestone rock overlain with sandy soils.

Dredge/Fill Material Movement

Movement of dredged/fill material will be limited to its removal from G-08 (Hillsboro) Canal, C-14 (Cypress Creek) Canal, and C-11 (South New River) Canal and some suspended sediments associated with removal. Placement of the dredged material in contained dredged material disposal sites or at offsite landfills will preclude its movement. BMPs during construction will control movement of sediment into undisturbed areas and areas outside the construction footprint.

Physical Effects on Benthos

Benthic organisms in the dredged material removal footprint will be adversely affected. These adverse effects to benthic organisms will include habitat disruption and removal or displacement of organisms. These adverse effects will be limited to the area and time of canal water bottom dredging. It is anticipated the adverse effects will subside when canal water bottom activities are complete.

Water Circulation, Fluctuation, and Salinity Determination

Deepening of the canals to a maximum depth of 5 feet below the existing canal bottom should not significantly alter water circulation, fluctuation, or salinity. Replacement/upgrade of WCS and adding new pumps offer greater flood risk management capabilities but may change localized currents and redistribute sediments. These effects will subside. Significant effects are not expected (**Table B.4-7**).

Table B.4-7. Physical Effects on Surface Water Quality.

Site	Watershed / Canal	Physical Effects on Surface Water Quality
G-56 Gated Spillway	Hillsboro Canal Basin / G-08 (Hillsboro) Canal	Demolishing existing WCS may cause minimal to negligible increases in sediment loads or turbidity during construction. Effects on water quality from canal excavation are expected to be negligible. Construction activities can lead to increased erosion and sediment wash off into the canal during high rainfall events. This impact is expected to be minimal to negligible. Effects on water quality from the canal enlargement are expected to be negligible.
G-57 Gated Spillway	Pompano Canal Basin / G-16 (Pompano) Canal	Demolishing existing WCS may cause minimal to negligible increases in sediment loads or turbidity during construction. Construction activities can lead to increased erosion and sediment wash off into the canal during high rainfall events. This impact is expected to be minimal to negligible. Effects on water quality from the addition of the two culverts are expected to be negligible.

Site	Watershed / Canal	Physical Effects on Surface Water Quality
S-37B Gated Spillway	C-14 West Basin / C-14 (Cypress Creek) Canal	Demolishing existing WCS may cause minimal to negligible increases in sediment loads or turbidity during construction. Effects on water quality from canal excavation are expected to be negligible. Construction activities can lead to increased erosion and sediment wash off into the canal during high rainfall events. This impact is expected to be minimal to negligible. Effects on water quality from the canal enlargement are expected to be negligible.
S-37A Gated Spillway	C-14 East Basin / C-14 (Cypress Creek) Canal	Demolishing existing WCS may cause minimal to negligible increases in sediment loads or turbidity during construction. Construction activities can lead to increased erosion and sediment wash off into the canal during high rainfall events. This impact is expected to be minimal to negligible. During OMRR&R, the operation of three new main pumps and one auxiliary pump could alter water quality by managing sediment transport, thereby reducing the buildup of sediment at the gated spillway. Pumps may also create localized currents, resulting in sediment resuspension and thereby increasing turbidity. These effects during the OMRR&R phase are expected to be negligible.
S-36 Gated Spillway	C-13 West Basin / C-13 (Middle River) Canal	Demolishing existing WCS may cause minimal to negligible increases in sediment loads or turbidity during construction. Construction activities can lead to increased erosion and sediment wash off into the canal during high rainfall events. This impact is expected to be minimal to negligible. Three new main pumps and one auxiliary pump can alter water quality by reducing sediment buildup of at the gated spillway. Pumps can create currents resulting in sediment resuspension, increasing turbidity. These effects during the OMRR&R phase are expected to be negligible.
S-33 Gated Spillway	C-12 West Basin / C-12 (Plantation) Canal	Demolishing existing WCS may cause minimal to negligible increases in sediment loads or turbidity during construction. Construction activities can lead to increased erosion and sediment wash off into the canal during high rainfall events. This impact is expected to be minimal to negligible. During OMRR&R, operation of three new main pumps and one auxiliary pump could alter water quality by reducing the buildup of sediment at the gated spillway. Pumps can create currents, resulting in sediment resuspension, increasing turbidity. These effects during the OMRR&R phase are expected to be negligible.
G-54 Gated Spillway	North New River Canal West Basin / G-15 (North New River) Canal	Demolishing existing WCS may cause minimal to negligible increases in sediment loads or turbidity during construction. Construction activities can lead to increased erosion and sediment wash off into the canal during high rainfall events. This impact is expected to be minimal to negligible. During OMRR&R, operation of three new main pumps could alter water quality by reducing the buildup of sediment at the gated spillway. Pumps can create currents, resulting in sediment resuspension, increasing turbidity. These effects during the OMRR&R phase are expected to be negligible.
S-13 AW Gated Culvert	C-11 West Basin / C-11 (South New River) Canal	Effects on water quality from canal excavation are expected to be negligible.
S-13 Pump Station and Gated Spillway	C-11 East Basin / C-11 (South New River) Canal	Demolishing existing spillway may cause minimal to negligible increases in sediment loads or turbidity during construction. Effects on water quality from canal excavation are expected to be negligible. Construction activities can lead to increased erosion and sediment wash off into the canal during high rainfall events. This impact is expected to be minimal to negligible. During OMRR&R, operation of four new main pumps and one auxiliary pump could alter water quality by reducing the buildup of sediment at the gated spillway. Pumps may also create localized currents thereby increasing turbidity. These effects during the OMRR&R phase are expected to be negligible.

Suspended Particulate/Turbidity Determinations

Short-term, localized increases in suspended particulates and turbidity associated with dredging, demolishing existing WCSs, temporary access roads, and project construction activities are expected. These increases would be ameliorated by construction sequencing, BMPs to control erosion, sediment transfer and contain turbidity, and monitoring. These would subside upon construction completion. Longer-term water quality effects associated with project operations are not expected and any that might occur would be similar to current water quality challenges. These would be addressed through operational monitoring and adaptive management, if potentially adverse effects are observed or predicted.

Effects on Chemical and Physical Properties of the Water Column

It is expected that effects on chemical and physical properties of the water column will be similar for all sites and in keeping with existing properties.

Light Penetration

During construction operations, there would be a temporary insignificant reduction in light penetration in the canals in the immediate vicinity of the activity. Once construction is complete, light penetration is expected to return to preconstruction levels.

Dissolved Oxygen

During construction operations, there would be a temporary reduction in the dissolved oxygen (O₂) content in the water column due to organic sediment oxygen demand from the disturbed soils in the immediate vicinity of the activity. Once construction is complete, dissolved oxygen is expected to return to preconstruction levels.

Toxic Metals, Organics, and Pathogens

Generally, no toxic metals, anthropogenic organics, or pathogens are anticipated to be released by Project construction. Additional discussion on these items would be provided during further planning and design of Project components.

Aesthetics of the Water Column

During construction, visual aesthetics would be negatively affected. After completion, aesthetics would be similar to those existing prior to construction.

Effects on Biota

Primary Productivity and Photosynthesis

Placement of excavated materials in permanent, upland disposal areas during construction would temporarily adversely affect productivity and photosynthesis in the immediate vicinity of construction by destroying vegetation and smothering biota. It is estimated that as much as 34 acres of fringe wetlands within the construction footprint may be permanently removed as part of canal widening.

Wetlands presence and potential effects would be further quantified after PED as part of permitting actions. This represents a minor effect on primary productivity and photosynthesis.

Suspension/Filter Feeders

Suspension and/or filter feeders have not been identified in the project area. However, should these species be in the vicinity, during construction operations there would be a temporary increase in turbidity and possibly a decrease in suspension/filter feeders due to construction activities. This temporary increase in turbidity would be short term and should not have any long-term negative impact on these highly fecund organisms.

Sight Feeders

During construction operations, there would be a temporary increase in turbidity and possibly a decrease in sight feeders due to construction activities. No significant impacts on these organisms are expected as most sight feeders are highly mobile and can move outside the affected area. When the Project is operational, sight feeders will return to the area and minimal effects are expected.

Contamination Determinations

The canals of the Study Area have been subjected to various pollutants for more than 70 years from both point and non-point sources. Many chemical constituents do not degrade over that time and may persist in canal sediments. Sampling and testing was conducted in Phase I and II Environmental Site Assessments (ESA). The full reports of the Phase I and II ESAs sampling methodologies and analyses are included in **Appendix I**. Constituents of interest found in sediments tested in the Recommended Plan vicinity are described in **Table B.4-8**.

Table B.4-8. Hazardous, Toxic, and Radioactive Constituents of Interest.

Location	Constituents of Interest
G-08 (Hillsboro) Canal	Arsenic, Chromium
G-16 (Pompano) Canal	Chromium
C-14W (Cypress Creek) Canal	Barium, Chromium
C-14E (Cypress Creek) Canal	Chromium, Selenium, 4,4-DDE
C-13W (Middle River) Canal	Arsenic, Chromium
C-12W (Plantation) Canal	Arsenic, Chromium, Silver
G-15 (North New River West) Canal	Arsenic, Chromium, Selenium
C-11W (South New River) Canal	Arsenic, Chromium

During PED and before construction, additional testing and analysis would be performed on the project area as needed to determine if remedial actions are warranted and what constitutes appropriate disposal of excess dredged materials. All structural features would be constructed with appropriate sediment and erosion control plans, spill control plans and BMPs specific to handling potentially contaminated material. Areas being dredged would be de-watered before materials are removed, handled appropriately and placed in contained areas to prevent erosion and potential contaminant migration. If analysis indicates it is appropriate, materials will be re-used in construction, placed within

the canal right of way or disposed of in a landfill. Contaminated soils would be disposed of in keeping with RCRA requirements.

Aquatic Ecosystem and Organism Determinations

No long-term adverse impacts on the aquatic ecosystem and its organisms are anticipated. A study of south Florida canals evaluating biological traits found habitat and benthic macroinvertebrate communities (stream condition index) to be poor (Payne 2019) indicating a lack of richness in the system.

The proposed project is not expected to cause or contribute to violations of state water quality standards, jeopardize the existence of any federally threatened or endangered species or critical habitat. No significant degradation is expected, and all appropriate and practicable steps will be taken to minimize impacts.

Effects on Plankton

No adverse impacts to plankton are anticipated.

Effects on Benthos

No adverse impacts to benthic organisms are anticipated other than displacement of those organisms in the construction footprint of the proposed project.

Effects on Nekton

Design features to reduce risks to larval fish will be considered during the PED phase. There should be no adverse impacts to freshwater swimming aquatic organisms, including fishes, during construction. Additionally, no adverse impacts are expected downstream in the waters of the adjacent coastline.

Effects on Aquatic Food Web

Periphyton forms the base of the food web within the project area. Implementation of the project is not expected to affect periphyton mat biomass or productivity, or freshwater diatoms. No adverse impacts to the aquatic food web are anticipated other than minor temporary impacts within the construction footprint.

Effects on Special Aquatic Sites

Hardground and Coral Reef Communities

Coral and Hardbottom EFH occurs in the easternmost fringes of the Study Area near ocean inlets, but low salinity prevents Coral and Hardbottom EFH upstream of the ICW. Therefore, the Recommended Plan will have no effect on hardground and coral reef communities.

Sanctuaries and Refuges

There are no sanctuaries or refuges within the Recommended Plan footprint, and none would be impacted by implementation of the Recommended Plan.

Wetlands

The dominant wetlands community in the project area is freshwater non-forested consisting of marshes, mixed scrub-shrub, floating/emergent aquatics, and freshwater forested consisting of cypress/tupelo, mixed hardwood-coniferous swamps, and wet flatwoods/hydric pine flatwoods. These small, fragmented freshwater wetlands are scattered throughout the project area and are unlikely to be affected by Recommended Plan implementation. The Study Area also includes estuarine wetlands, but none are at risk of being effected by the Recommended Plan.

During PED, the construction sites will be evaluated for the presence of wetlands. Any required environmental permit will be sought before construction. Any impacts to wetlands resulting from implementation of a project component will be avoided, minimized, and mitigated, as appropriate.

Mud Flats

There are no mud flats within the construction footprint or areas impacted by the proposed project.

Vegetated Shallows

No submerged aquatic vegetation was identified in the project study area. No portions of the study area meet the definition for a Habitat Area of Particular Concern.

Riffle and Pool Complexes

There are no riffle or pool complexes within the project footprint, and none should be impacted by the proposed project.

Effect on Threatened and Endangered Species

A Biological Assessment that evaluates the effects of constructing and operating the Recommended Plan on federally listed species and their critical habitat that are under the purview of the USFWS came to “No Effect” and “May Affect Not Likely to Adversely Affect” determinations for 10 federally listed species in the Study Area. USACE completed the informal Endangered Species Act Section 7 consultation with USFWS on February 26, 2026.

An informal consultation letter that evaluates the potential effects of constructing and operating the Recommended Plan on federally listed species and their critical that are under the purview of the National Oceanic and Atmospheric Administration came to a “No Effect” and “May Affect Not Likely to Adversely Affect” determinations for federally listed species in the Study Area. USACE completed the informal Endangered Species Act Section 7 consultation with the National Oceanic and Atmospheric Administration on March 9, 2026. .

Proposed Disposal (Placement) Site Determinations

Excavated material would be placed and compacted in uplands on the sides of canals adjacent to berm toes or in the canal ROW. Any excess material not used in construction would be disposed in a landfill. There would be no long-term adverse impacts to the project area resources because of excavated material placement.

Mixing Zone Determination

The dredged material would not cause unacceptable changes in the mixing zone water quality requirements, as specified by the State of Florida's WQC permit procedures. No adverse impacts related to depth, current velocity, direction and variability, degree of turbulence, stratification, or ambient concentrations of constituents are expected from implementation of the project.

Determination of Compliance with Applicable Water Quality Standards

Urban development heavily influences water quality in the Study Area. Extensive levees and canals have disrupted natural drainage patterns, further degrading water quality. Nutrient pollution contributes to water quality impairment. To address nutrient pollution, FDEP has identified impaired waters, established numeric nutrient criteria and developed TMDLs that set pollutant reduction targets. These targets are implemented through Basin Management Action Plans and regulatory programs including the National Pollutant Discharge Elimination System (NPDES) to regulate point source discharges and ensure compliance with water quality standards. All seven primary canals and several additional canals in the Study Area are subject to state-adopted and EPA-approved TMDLs.

Construction and operation of the proposed activities will improve drainage, will not contribute nutrient pollution, does not include point source discharges except as might occur subject to a Construction General permit, and will not violate state-adopted and EPA-approved TMDLs. Any negative effects to water quality will be minor, temporary, and will subside upon completion of construction.

Potential Effects on Human Use Characteristics

Municipal and Private Water Supply

Southeast Florida's flat, low-lying terrain, permeable Biscayne Aquifer, and strong surface-groundwater interactions—combined with canals and levees—define its hydrology. The urbanized eastern regions of Broward County rely on primary canals and WCS for flood control, water supply, and aquifer recharge. Water control operations prevent flooding and impede saltwater intrusion while recharging the aquifer. However, hydrologic modeling of nine watershed basins reveals uneven flood protection levels of service. Infrastructure gaps contribute to urban flooding, especially in vulnerable basins during extreme rainfall.

The proposed project's enhanced flood risk and water management will positively affect water supply in the area.

Recreational and Commercial Fisheries

There will be no effect on recreational fishing when project construction is complete.

Water-related Recreation

There will be no effect on water-related recreation when project construction is complete.

Aesthetics

There will be no effect on aesthetics when project construction is complete.

Parks, National and Historical Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves

There will be no effect on parks, national and historical monuments, national seashores, wilderness areas, research sites, and similar preserves.

Essential Fish Habitat

Seven square miles (1.7 percent) of the 420-square-mile study area is tidal. The tidal portions of canals in the study area include Essential Fish Habitat (EFH) for Snapper-Grouper Complex, Spiny Lobster, Penaeid Shrimp, and Coastal Migratory Pelagics. A fragment of Atlantic Highly Migratory Species EFH (restricted to blacktip, bull, lemon, nurse, spinner, and tiger sharks) occurs in the easternmost fringe of the study area at Port Everglades (5.8 miles downstream of the nearest project control structure [S-33 Gated Spillway]).

The proposed construction features would have a minimal footprint of earthworks in highly altered, low-quality tidal waters, representing a negligible fraction of the total EFH within the study area. BMPs will be employed during construction to protect water quality, prevent erosion, and protect manatees. As a result, there will not be any adverse effects to EFH. An EFH Assessment that evaluates the potential effects of constructing and operating the Recommended Plan on EFH came to a “No Adverse Effect” determination. USACE consultation with the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS) for EFH concluded when responses to NMFS’s March 16, 2026 EFH conservation recommendations were transmitted to NMFS on April 8, 2026.

Assessment of Effects on Plankton

No adverse impacts to plankton are anticipated.

Assessment of Effects on Benthos

Adverse impacts to benthic organisms can be expected in areas where canal water bottom dredging will occur. These adverse effects will be temporary and the canal bottoms can be expected to recolonize.

Assessment of Effects on Nekton

Design features to reduce risks to larval fish will be considered during the PED phase. There should be no adverse impacts to freshwater swimming aquatic organisms, including fishes, during construction. Additionally, no adverse impacts are expected downstream in the waters of the adjacent coastline.

Determination of Effects on Essential Fish Habitat

The project will have no adverse effects on EFH.

Determination of Cumulative Effects on the Aquatic Ecosystem

The overall benefit to the regional system is expected to be far greater than the localized adverse effects. The effects on the remaining natural environment and environmental resources in the area are expected to be minor. The effects on the physical, social, and economic environments are expected to be profoundly positive. The project will improve resilience to rising water levels and storm surge, give

greater protection to infrastructure and help maintain critical services. These beneficial effects are expected to substantially outweigh any cumulative adverse effects produced by the aquatic ecosystem alterations that may be necessary to construct some of the project features.

Determination of Secondary Effects on the Aquatic Ecosystem

No adverse secondary impacts on the aquatic ecosystem will occur due to construction or operation. Environmental commitments will ensure construction sites are contained, erosion would be controlled by appropriate erosion control techniques, and sedimentation would be prevented during construction. An ecological and water-quality monitoring plan will be implemented during and after construction. Specific environmental commitments, engineering and design commitments, permitting commitments and operational commitments will be incorporated to avoid, minimize, and/or mitigate for adverse effects.

Findings of Compliance or Non-compliance with the Restrictions on Discharge

No significant adaptations of the guidelines were made relative to this evaluation.

At this time, no practicable alternatives exist that have less adverse impact on the aquatic ecosystem. The Recommended Plan is the Least Environmentally Damaging Practicable Alternative (LEDPA).

The discharge of fill materials is not anticipated to cause or contribute to violations of any applicable state water quality standards. The discharge operation is not anticipated to violate the Toxic Effluent Standards of Section 307 of the CWA.

The placement of fill materials in the project area is not anticipated to jeopardize the continued existence of any threatened and endangered species or result in the likelihood of destruction or adverse modification of any critical habitat, as specified by the ESA, as amended.

The placement of fill material is not anticipated to result in significant adverse effects on human health and welfare, including municipal and private water supplies, recreational and commercial fishing, plankton, fish, shellfish, wildlife, and special aquatic sites. The life stages of aquatic species and other wildlife are not anticipated to be adversely affected. Significant adverse effects on aquatic ecosystem diversity, productivity and stability, and recreational, aesthetic, and economic values are not anticipated.

Based on the guidelines, the proposed discharge site for the discharge of fill and/or dredged material is specified as complying with the requirements of these guidelines.

B.4.4 Coastal Zone Management Act Consistency Statement**Florida Coastal Management Program****Federal Consistency Evaluation Procedures****Central and Southern Florida (C&SF) Flood Resiliency (Section 203) Study for Broward Basins****Broward County, Florida**

Enforceable Policy. Florida State Statutes considered “Enforceable policy” under the Coastal Zone Management Act ([24 Florida Statutes of the Florida Coastal Management Program | Florida Department of Environmental Protection](#)).

Applicability of the Coastal Zone Management Act. Table B.4-9. There are separate requirements for activities on the Outer Continental Shelf (subpart E) and for “assistance to an applicant agency” (subpart F).

B.4.4.1 Coastal Zone Consistency Statement by Statute/Enforceable Policy**Florida Statute (F.S.) Parts I and II, Chapter 161, Dennis L. Jones Beach and Shore Preservation Act**

Coastal areas are among the state’s most valuable natural, aesthetic, and economic resources, and they provide habitat for a variety of plant and animal life. The state is required to protect coastal areas from imprudent activities that could jeopardize the stability of the beach-dune system, accelerate erosion, provide inadequate protection to upland structures, endanger adjacent properties, or interfere with public beach access. Coastal areas used, or likely to be used, by sea turtles are designated for nesting, and the removal of vegetative cover that binds sand is prohibited. This statute provides policy for the regulations of construction, reconstruction, and other physical activities related to the beaches and shores of the state. Additionally, this statute requires the restoration and maintenance of critically eroding beaches.

Response: The Recommended Plan will have no direct or indirect impacts on any Broward County beaches or shorelines; no beach nourishment, erosion-control structures, or other shore-protection measures are proposed or required. The Recommended Plan complies with this act.

F.S. Part II, Chapter 163, Intergovernmental Programs: Growth Policy, County and Municipal Planning; Land Development Regulation

The purpose of this statute is to provide for the implementation of comprehensive planning programs to guide and control future development in the state. The comprehensive planning process encourages units of local government to preserve, promote, protect, and improve the public health, safety, comfort, good order, appearance, convenience, law enforcement and fire prevention, and general welfare; prevent the overcrowding of land and avoid undue concentration of population; facilitate the adequate and efficient provision of public facilities and services; and conserve, develop, utilize, and protect natural resources within their jurisdictions.

RESPONSE: The Recommended Plan is designed to safeguard Broward County’s existing critical infrastructure, along with its residential and commercial buildings. It will not increase future

development in the state. Coordination with federal, state, and local agencies, federally recognized Native American Tribes, and other stakeholders were initiated early in the planning phase and will continue under NEPA requirements. The Recommended Plan complies fully with the provisions of this chapter

F.S. Chapter 186, State and Regional Planning

The state comprehensive plan provides basic policy direction to all levels of government regarding the orderly social, economic, and physical growth of the state. The goals, objectives, and policies of the state comprehensive plan are statewide in scope and are consistent and compatible with each other. The statute provides direction for the delivery of governmental services, a means for defining and achieving the specific goals of the state, and a method for evaluating the accomplishment of those goals.

RESPONSE: Pursuant to NEPA, the Integrated Feasibility Study and Environmental Assessment was developed through a collaborative process with federal, state, and local agencies, federally recognized Native American Tribes, and other stakeholders during this study and would continue during subsequent phases of the project. The Recommended Plan would increase Broward County's resilience to storm surge events. The Recommended Plan meets the goals of the State Comprehensive Plan, as described in detail in the Integrated Feasibility Study and Environmental Assessment and is consistent with the goals of this chapter.

F.S. Chapter 252, Emergency Management Act

The state of Florida is vulnerable to a wide range of emergencies, including natural, technological, and manmade disasters. This vulnerability is exacerbated by the tremendous growth in the state's population. This statute directs the state to reduce the vulnerability of its people and property to natural and manmade disasters; prepare for, respond to and reduce the impacts of disasters; and decrease the time and resources needed to recover from disasters.

Disaster mitigation is necessary to ensure the common defense of Floridians' lives and to protect the public peace, health, and safety. The policies provide the means to assist in the prevention or mitigation of emergencies that may be caused or aggravated by the inadequate planning or regulation. State agencies are directed to keep land uses and facility construction under continuing study and identify areas that are particularly susceptible to natural or manmade catastrophic occurrences.

RESPONSE: The purpose of the Recommended Plan focuses on enhancing the resiliency of the water control structures and adjacent primary canals in Broward Basins for continued and improved flood risk management (FRM) from storm surge flooding events to residents, industries, businesses, and infrastructure all of which are critical to the economy. The Recommended Plan will contribute to Broward County's efforts towards building resilience to coastal storms. Through comprehensive planning, hazard mitigation, coordinated operations, public outreach, continuity safeguards, and strict financial control, the Recommended Plan fully satisfies the mandates of this chapter.

F.S. Chapter 253, State Lands

The Board of Trustees of the Internal Improvement Trust Fund (Trustees) is vested and charged with the acquisition, administration, management, control, supervision, conservation, protection, and disposition

of all lands owned by the state. Lands acquired for preservation, conservation and recreation serve the public interest by contributing to public health, welfare and economy. In carrying out the requirements of this statute, the Trustees are directed to take necessary action to fully: conserve and protect state lands; maintain natural conditions; protect and enhance natural areas and ecosystems; prevent damage and depredation; and preserve archaeological and historical resources.

All submerged lands are considered single-use lands to be maintained in natural condition for the propagation of fish and wildlife and public recreation. Where multiple uses are permitted, ecosystem integrity, recreational benefits and wildlife values are conserved and protected.

RESPONSE: USACE is currently coordinating the Recommended Plan with the State of Florida through the Federal Consistency Determination (FCD) review, and the review process of the Integrated Feasibility Study and Environmental Assessment. Environmental protection measures will be implemented to minimize adverse effects to wildlife resources, threatened and endangered species, and other environmental resources. Please refer to the Integrated Feasibility Study and Environmental Assessment for a more thorough description of the potential resources impacted by the Recommended Plan and for a list of Environmental Commitments. The proposed project is consistent with the goals of this chapter.

F.S. Chapter 258, State Parks and Preserves

The statute addresses the state's administration of state parks, aquatic preserves, and recreation areas, which are acquired to emblemize the state's natural values and to ensure that these values are conserved for all time. Parks and preserves are managed for the non-depleting use, enjoyment, and benefit of Floridians and visitors and to contribute to the state's tourist appeal.

Aquatic Preserves are recognized as having exceptional biological, aesthetic, and scientific value and are set aside for the benefit of future generations. Disruptive physical activities and polluting discharges are highly restricted in aquatic preserves. State managed wild and scenic rivers possess exceptionally remarkable and unique ecological, fish and wildlife, and recreational values. These rivers are also designated for permanent preservation and enhancement for both the present and future.

RESPONSE: Pursuant to NEPA, the EA was coordinated with federal, state, federally recognized Native American tribes, local agencies, and other interested parties, during this study. Environmental protection measures, as described in detail in the Integrated Feasibility Study and Environmental Assessment, will be implemented to minimize adverse effects to the maximum extent practicable to fish and other wildlife resources, threatened and endangered species, water quality, air quality, or other environmental resources. During the Preconstruction Engineering and Design (PED) phase, USACE will re-coordinate the project with the State of Florida for the issuance of a water quality certification (WQC), and a final FCD review. Coordination will also continue with the FDEP's Division of Parks and Recreation during the PED phase. The proposed plans and information will be submitted to the state in compliance with this chapter once finalized. The Recommended Plan complies with the goals of this chapter.

F.S. Chapter 259, Land Acquisition for Conservation or Recreation

The statute addresses public ownership of natural areas for purposes of maintaining the state's unique natural resources; protecting air, land, and water quality; promoting water resource development to meet the needs of natural systems and citizens of this state; promoting restoration activities on public lands; and providing lands for natural resource-based recreation. Lands are managed to protect or restore their natural resource values, and provide the greatest benefit, including public access, to the citizens of this state.

RESPONSE: The Recommended Plan is designed to improve the resiliency of existing water-control structures and their adjacent primary canals in the Broward basins, ensuring continued and enhanced flood-risk management against storm surge events. All proposed land purchases are strictly limited to tracts required for the construction, operation, and maintenance of the identified water-control infrastructure; no acreage is being acquired for conservation or recreational use. Any persons or businesses displaced by these acquisitions will be treated in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act and F.S. Chapter 259, receiving fair market compensation, relocation assistance, equitable treatment, and every effort to minimize hardship. Upon completion of design, all plans, appraisals, title commitments, and environmental documentation will be submitted to the FDEP. By limiting acquisitions to those parcels essential for authorized flood-risk infrastructure and adhering to the statute's appraisal, public-notice, funding, and recording requirements, the Recommended Plan fully complies with the goals and procedural safeguards of this Chapter.

F.S Chapter 260, Florida Greenways and Trails Act

A statewide system of greenways and trails is established in order to conserve, develop, and use the natural resources of Florida for healthful and recreational purposes. These greenways and trails provide open space benefiting environmentally sensitive lands and wildlife and provide people with access to healthful outdoor activities. The greenways and trails serve to implement the concepts of ecosystem management while providing recreational opportunities such as horseback riding, hiking, bicycling, canoeing, jogging, and historical and archaeological interpretation. As of August 29th, 2016, Chapter 260, F.S., does not contain any enforceable policies for federal consistency purposes.

RESPONSE: The Recommended Plan will not directly impact Florida greenways or trails. A segment of the Great Florida Birding and Wildlife Trail lies roughly 200 feet from the C-14 (Cypress Creek) Canal improvements; however, the construction/operational alignment avoids all direct encroachment. USACE will coordinate with FDEP's Division of Parks and Recreation throughout design and permitting, and will submit final plans and supporting documentation to the state in full compliance with the chapter. By preserving existing corridor continuity, restoring riparian buffers along the canal, and avoiding any trail realignments, the Recommended Plan fulfills the goals and mandates of the Florida Greenways and Trails Act.

F.S. Chapter 267, Historical Resources

The management and preservation of the state's archaeological and historical resources are addressed by this statute. This statute recognizes the state's rich and unique heritage of historic properties and

directs the state to locate, acquire, protect, preserve, operate and interpret historic and archeological resources for the benefit of current and future generations of Floridians.

Objects or artifacts with intrinsic historic or archeological value located on, or abandoned on, state-owned lands or state-owned submerged lands belong to the citizens of the state. The state historic preservation program operates in conjunction with the National Historic Preservation Act of 1966 to require state and federal agencies to consider the effect of their direct or indirect actions on historic and archeological resources. These resources cannot be destroyed or altered unless no prudent alternative exists. Unavoidable impacts must be mitigated.

RESPONSE: USACE assessed for the presence of cultural and historic properties. Consultation with the Florida SHPO, Seminole Tribe of Florida, Miccosukee Tribe of Indians, Thlopthlocco Tribal Town, Seminole Nation of Oklahoma, and Muscogee Nation was initiated on December 5, 2024. USACE is additionally consulting with the Florida SHPO and the Advisory Council on Historic Preservation to ensure there are no adverse effects to historic properties as a result of the Recommended Plan, and, as needed, will identify appropriate mitigation measures. Construction will not begin until consultation is completed; therefore, the Recommended Plan will be consistent with the goals of this chapter.

F.S. Chapter 288, Commercial Development and Capital Improvement

The framework to promote and develop general business, trade, and tourism components of the state economy are established in this statute. The statute includes requirements to protect and promote the natural, coastal, historical, and cultural tourism assets of the state; foster the development of nature-based tourism and recreation; and upgrade the image of Florida as a quality destination. Natural resource-based tourism and recreational activities are critical sectors of Florida's economy. The needs of the environment must be balanced with the need for growth and economic development.

RESPONSE: The Recommended Plan will strengthen Broward County's resilience to storm surge events and accelerate community recovery in the aftermath of a storm. Upgrading water-control structures will deliver socioeconomic benefits by bolstering facility reliability and enabling them to return to normal operations more quickly following a storm event. In addition, the construction work will provide temporary, localized economic gains. The Recommended Plan aligns with the objectives of this chapter and complies with the economic development and job-creation provisions of this chapter.

F.S. Chapter 334, Transportation Administration

The statute addresses the state's policy concerning transportation administration. It establishes the responsibilities of the state, the counties, and the municipalities in the planning and development of the transportation systems; and the development of an integrated, balanced statewide transportation system. This is necessary for the protection of public safety and general welfare and for the preservation of all transportation facilities in the state. As of October 9th, 2017, Chapter 334, F.S., does not contain any enforceable policies for federal consistency purposes.

RESPONSE: Public transportation systems will not be affected by the Recommended Plan, and therefore, will be consistent with the goals of this chapter.

F.S Chapter 339, Transportation Finance and Planning

The statute addresses the finance and planning needs of the state's transportation system.

RESPONSE: Public transportation systems will not be affected by the Recommended Plan, and therefore, will be consistent with the goals of this chapter.

F.S. Chapter 373, Water Resources

The waters in the state of Florida are managed and protected to conserve and preserve water resources, water quality, and environmental quality. This statute addresses sustainable water management; the conservation of surface and ground waters for full beneficial use; the preservation of natural resources, fish, and wildlife; protecting public land; and promoting the health and general welfare of Floridians. The state manages and conserves water and related natural resources by determining whether activities will unreasonably consume water; degrade water quality; or adversely affect environmental values such as protected species habitat, recreational pursuits, and marine productivity.

Specifically, under Part IV of Chapter 373, the Department of Environmental Protection, water management districts, and delegated local governments review and take agency action on wetland resource, environmental resource, and stormwater permit applications. These permits address the construction, alteration, operation, maintenance, abandonment, and removal of any stormwater management system, dam, impoundment, reservoir, or appurtenant work or works (including dredging, filling and construction activities in, on, and over wetlands and other surface waters).

RESPONSE: Early and ongoing inter-agency coordination with the SFWMD, FDEP, USACE, USFWS, tribal governments, local governments, and other stakeholders are being conducted to ensure consistency with regional water resource objectives. Prior to construction, the project will obtain all required Environmental Resource Permits under Part IV of Chapter 373 and any necessary Consumptive Use Permits under Part II of Chapter 373. Surface-water discharges, stormwater treatment systems, and any wetland alterations will be engineered to meet or exceed the State's water-quality standards and the SFWMD established level-of-service requirements. Best Management Practices and compensatory mitigation will be applied to avoid, minimize, or offset impacts to natural surface- and groundwater flows, wetlands, wildlife habitat, and threatened or endangered species. The Recommended Plan will be consistent with this act.

F.S. Chapter 375, Outdoor Recreation and Conservation Lands

The statute addresses the development of a comprehensive outdoor recreation plan. The purpose of the plan is to document recreational supply and demand, describe current recreational opportunities, estimate the need for additional recreational opportunities, and propose the means to meet the identified needs.

RESPONSE: The Recommended Plan would have no impacts to conservation lands or existing recreational areas. The Recommended Plan complies with the goals of this chapter.

F.S Chapter 376, Pollutant Discharge Prevention and Removal

Regulating the transfer, storage, and transportation of pollutants, and the cleanup of pollutant discharges is essential for maintaining coastal resources (specifically the coastal waters, estuaries, tidal flats, beaches, and public lands adjoining the seacoast) in as close to a pristine condition as possible. The preservation of the seacoast as a source of public and private recreation, along with the preservation of water and certain lands are matters of the highest urgency and priority. This statute provides a framework for the protection of the state's coastline from spills, discharges, and releases of pollutants. The discharge of pollutants into or upon any coastal waters, estuaries, tidal flats, beaches, and lands adjoining the seacoast of the state is prohibited. The statute provides for hazards and threats of danger and damages resulting from any pollutant discharge to be evaluated; requires the prompt containment and removal of pollution; provides penalties for violations; and ensures the prompt payment of reasonable damages from a discharge. Portions of Chapter 376, F.S., serve as a complement to the national contingency plan portions of the federal Water Pollution Control Act.

RESPONSE: Petroleum products, hazardous materials and wastes would be handled and disposed of in accordance with state and federal requirements. All wastes would be disposed of at certified waste disposal facilities. The contract specifications will be written to prohibit the contractor from dumping oil, fuel, or hazardous wastes in the work area and will include conditions on how to handle inadvertent spills of pollutants, such as vehicle fuels. A spill prevention and control plan will be required of the contractor and would be developed prior to project implementation. The Recommended Plan is consistent with the goals of this chapter.

F.S Chapter 377, Energy Resources

The statute addresses the regulation, planning, and development of the energy resources of the state. The statute provides policy to conserve and control the oil and gas resources in the state, including products made therefrom and to safeguard the health, property and welfare of Floridians. The Department of Environmental Protection (DEP) is authorized to regulate all phases of exploration, drilling, and production of oil, gas, and other petroleum products in the state.

The statute describes the permitting requirements and criteria necessary to drill and develop for oil and gas. DEP rules ensure that all precautions are taken to prevent the spillage of oil or any other pollutant in all phases of extraction and transportation. The state explicitly prohibits pollution resulting from drilling and production activities. No person drilling for or producing oil, gas, or other petroleum products may pollute land or water; damage aquatic or marine life, wildlife, birds, or public or private property; or allow any extraneous matter to enter or damage any mineral or freshwater-bearing formation.

Penalties for violations of any provisions of this chapter are detailed.

RESPONSE: This chapter does not apply. The Recommended Plan does not involve exploration, drilling, or production of gas, oil, or petroleum products.

F.S. Chapter 379, Fish and Wildlife Conservation

The framework for the management and protection of the state of Florida's wide diversity of fish and wildlife resources are established in this statute. It is the policy of the state to conserve and wisely manage these resources. Particular attention is given to those species defined as being endangered or threatened. This includes the acquisition or management of lands important to the conservation of fish and wildlife.

This statute contains specific provisions for the conservation and management of marine fisheries resources. These conservation and management measures permit reasonable means and quantities of annual harvest (consistent with maximum practicable sustainable stock abundance) as well as ensure the proper quality control of marine resources that enter commerce.

Additionally, this statute supports and promotes hunting, fishing and the taking of game opportunities in the State. Hunting, fishing, and the taking of game are considered an important part in the state's economy and in the conservation, preservation, and management of the state's natural areas and resources.

RESPONSE: The Recommended Plan is in compliance with Section 7 of the ESA. A Biological Assessment addressing impacts on federally listed species and critical habitat under the USFWS's purview (Appendix G) concluded "No Effect" or "May Affect, Not Likely to Adversely Affect" for 10 listed species. USACE completed informal Endangered Species Act Section 7 consultation with USFWS on February 26, 2026 with "No Effect" and "May Affect Not Likely to Adversely Affect" determinations for federally listed species in the Study Area. USACE completed informal Endangered Species Act Section 7 consultation with NMFS on March 9, 2026 with "No Effect" and "May Affect Not Likely to Adversely Affect" determinations for federally listed species in the Study Area. The Florida Fish and Wildlife Conservation Commission (FWC) reviewed potential impacts to state-listed species and their habitats as part of the State of Florida Clearinghouse review. USACE responded to FWC comments with commitment to minimize effects to native species; refer to Appendix J for USACE's response to FWC comments.

Best Management Practices and compensatory mitigation measures will be applied to avoid, minimize, or offset impacts to wildlife resources, wetlands, and upland habitats, as well as state and federally listed species. The Recommended Plan will secure all state and federal wildlife authorizations prior to ground-disturbing activities.

F.S. Chapter 380, Land and Water Management

Land and water management policies are established to protect natural resources and the environment; and to guide and coordinate local decisions relating to growth and development. The statute provides that state land and water management policies be implemented by local governments through existing processes for the guidance of growth and development. The statute also provides that all the existing rights of private property be preserved in accord with constitutions of this state and of the United States.

The chapter establishes the Areas of Critical State Concern designation, the Florida Communities Trust as well as the Florida Coastal Management Act. The Florida Coastal Management Act provides the basis

for the Florida Coastal Management Program which seeks to protect the natural, commercial, recreational, ecological, industrial, and aesthetic resources of Florida's coast.

RESPONSE: The Recommended Plan is designed to improve the resiliency of existing water-control structures and their adjacent primary canals in the Broward basins, ensuring continued and enhanced flood-risk management against storm surge events. Interagency coordination was initiated early in the planning process and is being continued with Broward County ensuring the Recommended Plan objectives are consistent with the County's Comprehensive Plan policies for stormwater management and coastal storm resilience. Any required development orders or permits will be obtained through the local review process, with all conditions documented prior to construction. Stormwater drainage improvements under the Recommended Plan will meet the County's level-of-service standards and will be accommodated within the existing or committed capacity of the stormwater management system. Concurrency determinations for drainage, roads for construction access, and related public facilities will be secured before any ground-disturbing activities commence. The Recommended Plan would contribute to Broward County's efforts towards resilience to coastal storms, and therefore, will be consistent with the goals of this chapter.

F.S. Chapter 381, Public Health: General Provisions

The statute establishes public policy concerning the state's public health system, which is designated to promote, protect, and improve the health of all people in the state.

RESPONSE: The Recommended Plan would not affect the state's public health system, and therefore, this chapter is not applicable.

F.S. Chapter 388, Mosquito Control

Mosquito control efforts of the state are to achieve and maintain such levels of arthropod control as will protect human health and safety; promote the economic development of the state; and facilitate the enjoyment of its natural attractions by reducing the number of pestiferous and disease-carrying arthropods.

It is the policy of the state to conduct arthropod control in a manner consistent with protection of the environmental and ecological integrity of all lands and waters throughout the state.

RESPONSE: The Recommended Plan will not further the propagation of mosquitoes or other pest arthropods. The Recommended Plan complies with the chapter.

F.S. Chapter 403, Environmental Control

Environmental control policies conserve state waters; protect and improve water quality; and maintain air quality. This statute provides wide-ranging authority to address various environmental control concerns, including air and water pollution; electrical power plant and transmission line siting; the Interstate Environmental Control Compact; resource recovery and management; solid and hazardous waste management; drinking water protection; pollution prevention; ecosystem management; and natural gas transmission pipeline siting.

RESPONSE: The Recommended Plan will obtain all required state environmental permits and implement best management practices to minimize adverse effects to the maximum extent practicable to water quality, wildlife resources, threatened and endangered species, and other natural resources. The Recommended Plan is consistent with the goals of this chapter.

F.S. Chapter 553, Building Construction Standards

The statute addresses building construction standards and provides for a unified Florida Building Code.

RESPONSE: The Recommended Plan does not include new building construction. The Recommended Plan would have no impact to the Florida Building Code.

F.S. Chapter 582, Soil and Water Conservation

It is the state's policy to preserve natural resources; control and prevent soil erosion, prevent floodwater and sediment damages; and to further the conservation, development and use of soil and water resources. Farm, forest, and grazing lands are among the basic assets of the state; and the preservation of these lands is necessary to protect and promote the health, safety, and general welfare of its people. These measures help to preserve state and private lands, control floods, maintain water quality, prevent impairment of dams and reservoirs, assist in maintaining the navigability of rivers and harbors, preserve wildlife and protect wildlife habitat, protect the tax base, protect public lands, and protect and promote the health, safety, and general welfare of the people of this state.

RESPONSE: The Recommended Plan is not located on or near agricultural lands and would not impact any agricultural lands. Sediment and erosion control plans and measures would be implemented in accordance with state and federal regulations. The Recommended Plan is consistent with the goals of this chapter.

F.S. Chapter 597, Aquaculture

The statute establishes public policy concerning the cultivation of aquatic organisms in the state. The intent is to enhance the growth of aquaculture, while protecting Florida's environment. This includes a requirement for a state aquaculture plan which provides for: the coordination and prioritization of state aquaculture efforts; the conservation and enhancement of aquatic resources; and mechanisms for increasing aquaculture production.

RESPONSE: The Recommended Plan does not include aquaculture.

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